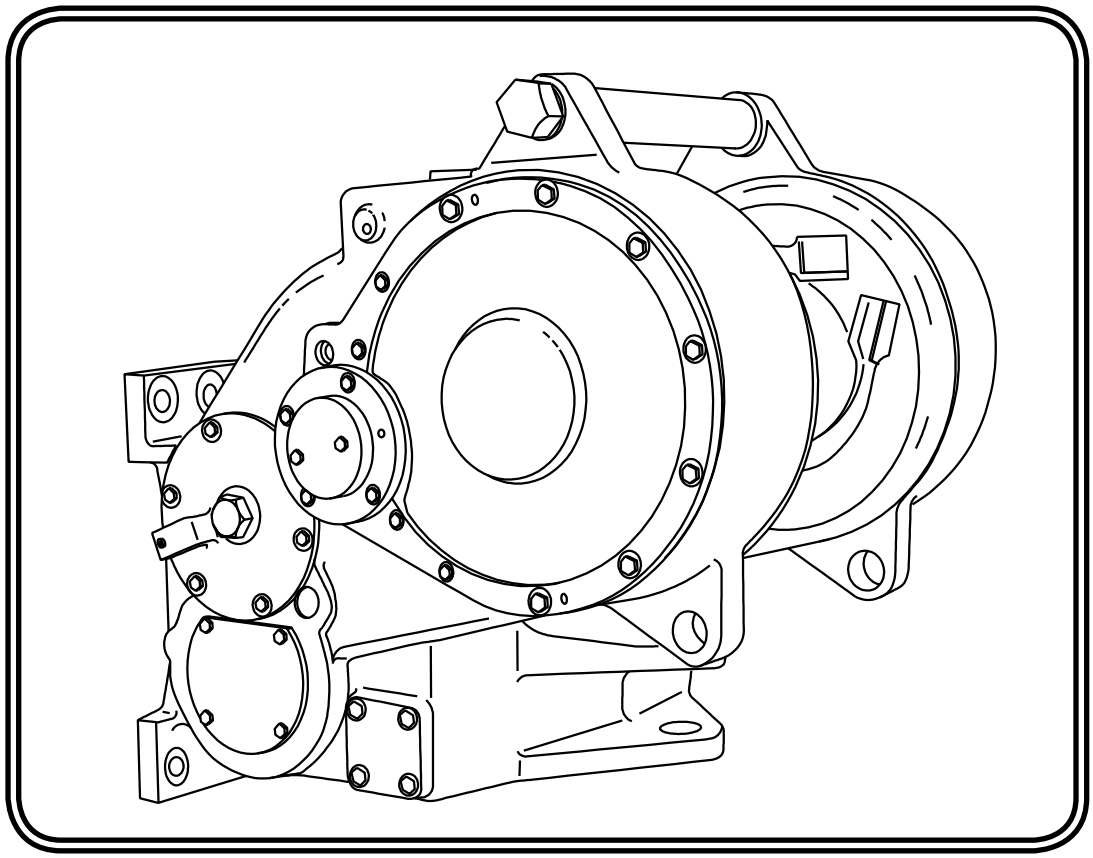
SERVICE MANUAL
PA WINCH MODELS WITH TIER 4 ELECTRONIC CONTROLS
PA55 FOR D6N TRACTORS
PA56 FOR D6T TRACTORS



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FOREWORD

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

This manual contains instructions for the service and repair of PACCAR Models PA55 and PA56 power shift winches with electronic controls.

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 PACCAR winch or this publication, please contact the PACCAR Winch 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. Provide the complete winch MODEL NUMBER and SERIAL NUMBER when making inquiries. Refer to MODEL DESCRIPTION section for location of model and serial number.

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*

TABLE OF CONTENTS

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.

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 PACCAR parts. Do not use parts from other winch manufacturers on your PACCAR winch. Do not use PACCAR 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 PACCAR winches are designed and intended for use on specific models of crawler tractors. Changing winches between tractors is not possible in some cases because of differences in tractor models. Some changes cannot be

approved by PACCAR because of safety limitations. Call a PACCAR dealer or the PACCAR factory prior to attempting winch modifications or before mounting on a different tractor.

11. PACCAR power shift winches are equipped with hydraulic accumulators. Discharge the accumulator stored oil supply before removing any hydraulic lines or fittings or servicing winch. Personal injury may result from the sudden release of oil pressure. To discharge the accumulator, stop the engine, turn the key switch "on" then slowly cycle the joystick control handle into full Reel-In then Reel-Out positions a minimum of 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.

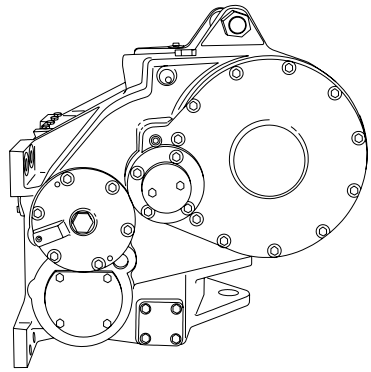
15. Keep equipment in good operating condition. Perform the scheduled servicing and adjustments defined in the "Preventive Maintenance" section of this manual. Use of proper lubricants is crucial to reliable operation of winch.

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.

MODEL DESCRIPTION

The PACCAR PA55 and PA56 Series Power Shift Winches are a single drum unit which mounts on the rear of a crawler tractor. It is driven by engine power through the tractor PTO (Power Take-Off). The winch may be operated independently or with the tractor transmission engaged. When operated properly, it is capable of utilizing maximum engine horsepower. The winch has equal speed gearing, power-in and power-out, using multiple-disc oil actuated friction clutches and a spring applied hydraulically released multiple-disc oil brake.

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



PA55, 3-Shaft, Standard PTO shown

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

The Model PA55 may have either a 3-shaft or 4-shaft gear train configuration depending upon the tractor horsepower, PTO speed and line speed requirements of the winch application. All PA56 series winches are 4-shaft configuration.

The standard Power Shift (PS) Winch is primarily used in logging, land clearing and general utility applications. The standard speed model has gear ratios which match the cable drum rotation in Reel-In (forward) to reverse track speeds for optimum advantage in tractor recovery.

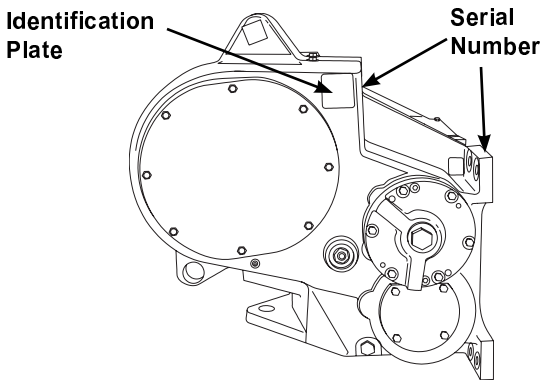
The slow speed configuration is similar to the standard speed but uses slow speed gearing for greater load control. The slow speed configuration is well suited to oil and gas field, mining and pipeline applications.

Optional features increase the winches ability to meet specific application requirements. Options available for the PA55 & PA56 series winches include:

- Gear Ratios
- Three or Four Roller Fairleads

The winch model number is an important reference as to what optional components were used when the winch was manufactured. The winch identification plate is located on the right hand side of the winch case. The serial number is also stamped into the upper right hand mounting pad.

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



Record the information below for future reference. Always include the model and serial numbers when inquiring or ordering parts.

Model No._____

Serial No._____

In-Service Date_____

The winch model number contains the following configuration data:

MODEL

C 0 0 0 0 0 E

- **PA55 PA56**
- **Bevel Gear Ratio**
  A - 1:1
  B - 1.27:1
  C - 1.64:1
  D - 2.11:1
  E - 2.79:1
- 0 - Overwind
  1 - Underwind
- 0 - Standard Brake
- 0 - Without Freespool
  1 - With Freespool
- 0 - Four Shaft winch
  1 - Three Shaft winch
- 0 - No Fairlead
  3 - Three Roller Fairlead
  4 - Four Roller Fairlead
- E - Electronic Controls

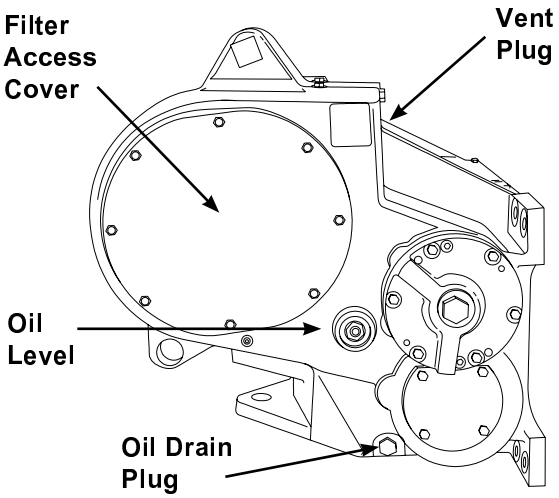
PREVENTIVE MAINTENANCE & SPECIFICATIONS

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

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

⚠ WARNING ⚠

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from sudden release of oil under pressure. To discharge the accumulator, stop engine, turn key switch on slowly cycle joystick into full Reel-In position then full Reel-Out position, a minimum of five (5) times.

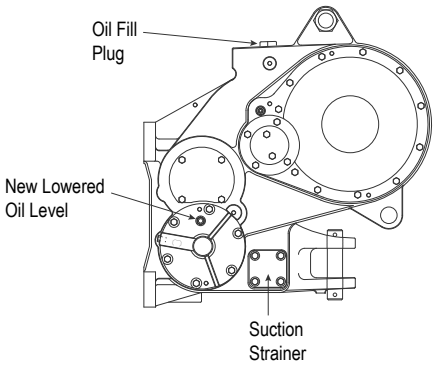


STANDARD PTO WINCH CASE

1.Oil Level

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

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



LOW PTO WINCH CASE

Lowered Winch Oil Level for Low-PTO Winches (PA56 for D6H, D6R and D6T)

A small reduction in winch case oil level will reduce oil temperature in LOW PTO winches that are installed on tractors used in high cyclic, high travel speed applications. These applications include landfill compaction, road-building, coal plant waste compaction and mine reclamation.

All LOW PTO PA56 winches built since November, 2007, serial number 0704876 and later have a lowered oil level.

To produce the lowered oil level, the traditional oil level sight glass on the right hand side of the winch case is removed and replaced with solid plug P/N 9S-8008 (-12 ORB flush plug). The clutch shaft left hand bearing carrier P/N 118-6951 is replaced by P/N 332-2447 that has a new port to accept a small oil level sight glass P/N 270-5244 (-8 ORB).

The original oil volume was 16.5 US gal. or 66 qt. (63 l). The lowered oil level volume is 11.5 US gal. or 46 qt. (43.5 l).

The winch pump will continue to draw oil from the sump at 45 degree forward or backward slope.

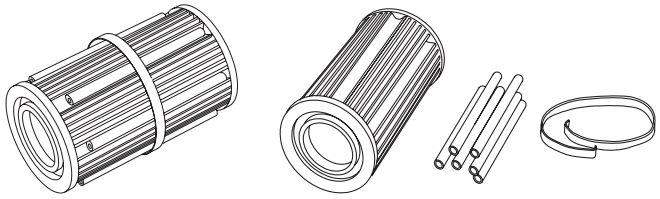
2. Oil Change, Filter and Strainer Service

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

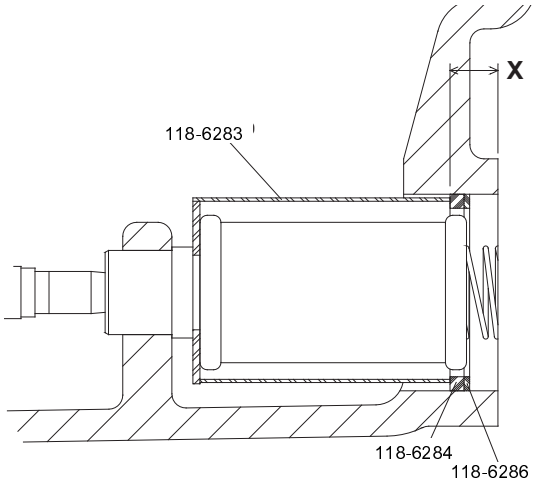
⚠ WARNING ⚠

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

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



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



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

1. Install shield. Part Number 118-6283, between connector and strainer as shown above, with open side facing downward.

2. Measure distance “X”, from shield to strainer cover mounting surface.

3. If “X” dimension is between 0.720 in. and 0.783 in. (18.3 – 19.9 mm), add one seal, 118-6286, outboard of seal 118-6284.

4. If “X” dimension is greater than 0.783 in. (19.9 mm), add two seals, 118-6286, outboard of seal 118-6284.

   Seal 118-6284 is .25 in. (6.4 mm) thick
   Seal 118-6286 is .06 in. (1.5 mm) thick

Refill winch to proper level with recommended oil.

⚠ CAUTION ⚠

To prevent serious damage to the winch, DO NOT run engine while oil is drained from the winch.

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

Lubricate the filter gasket and adapter threads with winch oil and install new filter element onto filter head. Tighten ½ - ¾ turn after seal ring makes contact with filter head. Start tractor and operate engine at low idle. Correct any leaks.

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

3. Vent Plug

The vent is located next to the electrical connector. It is very important to keep this vent clean and unobstructed. Whenever the oil is changed, remove vent plug, clean in safety solvent and reinstall. Do not replace with a solid plug.

4. Winch Cable (wire rope)

Inspect entire length of wire rope, chokers and hooks according to wire rope and rigging manufacturers recommendations.

5. Mounting Fasteners

Check/tighten all winch mounting fasteners to recommended torque after the first 100-250 hours of operation, then every 1000 operating hours or six (6) months, whichever occurs first.

6. Warm-Up Procedure

Start tractor engine and operate at low idle for five minutes.

⚠ WARNING ⚠

A warm-up procedure is recommended at each start-up and is essential at ambient temperatures below +40°F (4°C). Failure to warm-up winch hydraulic system may result in erratic clutch/brake operation which may result in property damage, injury or death.

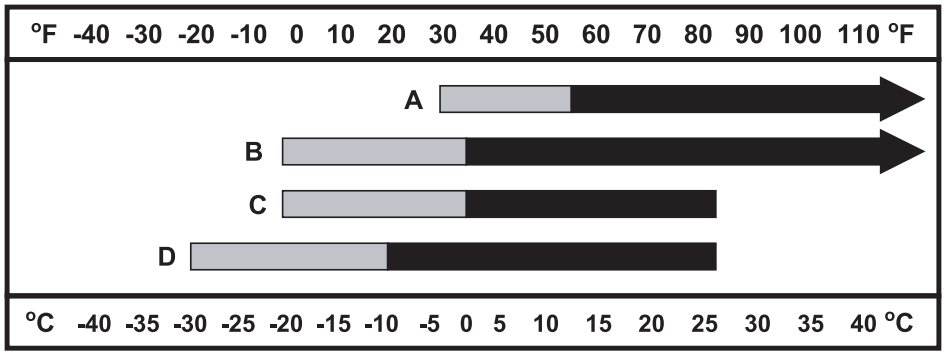
⚠ CAUTION ⚠

Do not shift Freespool lever and attempt to engage cable drum while the cable drum or gear train is rotating. Winch gear train damage may result.

RECOMMENDED OIL

We have published the following specifications to help you determine which lubricant is best suited to your application. Your lubricant supplier should assure you his product meets this specification. If there is any doubt as to the suitability of a lubricant, contact the Paccar Winch Service Department, providing a detailed copy of the product specifications.

Prevailing Ambient Temperature



A - CAT TO4 SAE30
B - CAT TO4 SAE 10W30
C - CAT TO4 SAE 10W
D - CAT TO4 SAE 5W20 spc.

⚠ 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.

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 corrosion protection, good dispersant and detergent characteristics, anti-wear additives and remain compatible with nitrile base seals.

SPECIFICATIONS

Unit weight (without oil, cable or specific tractor adapters) ..... 2,400 lbs (1090 kg)

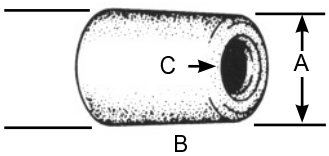
Gear Ratio Available

Bevel Gear Ratio	**1.27:1**	**2.11:1**	**2.78:1**
Overall Ratio (3-Shaft Gear Train)		47.0:1	
Overall Ratio (4-Shaft Gear Train)	51.4:1		112.8:1

Cable Drum Dimensions	
Barrel Diameter	10 in. (254 mm)
Flange Diameter	19-7/8 in. (504 mm)
Barrel Length	12-3/8 in. (314 mm)
Throat Clearance	approx. 9 in. (229 mm)

Cable Storage Capacity	
3/4 in. (19 mm)	319 ft (97 m)
7/8 in. (22 mm)	226 ft (69 m)
1 in. (25 mm)	154 ft (47 m)

Cable Ferrule Part Numbers	
3/4 in. (19 mm)	118-6273
7/8 in. (22 mm)	118-6275
1 in. (25 mm)	118-6276



Cable Ferrule Dimensions
A - 2.12 in. (54 mm)
B - 2.56 in. (65 mm)
C - To match cable diameter

Hydraulic System

Oil Capacity (Standard PTO)..... 78 qt (74 L)
Oil Capacity (Low PTO)..... 46 qt (44 L)
Operating Pressure.....390-410 psi (2,690-2,830 kPa)
Stand-By Pressure.....290-340 psi (2000-2345 kPa)
Typical Operating Oil Temperature..... Up to Ambient Plus 80°F (26.7°C)

RECOMMENDED FASTENER TORQUE

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

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

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

		Torque (LB-FT)			
Bolt Dia.	Thds Per	Grade 5		Grade 8	
Inches	Inch	Dry	Lubed	Dry	Lubed
1/4	20 28	8	6	12	9
5/16	18 24	17	13	24	18
3/8	16 24	31	23	45	35
7/16	14 20	50	35	70	50
1/2	13 20	75	55	110	80
9/16	12 18	110	80	150	110
5/8	11 18	150	115	210	160

		Torque (LB-FT)			
Bolt Dia.	Thds Per	Grade 5		Grade 8	
Inches	Inch	Dry	Lubed	Dry	Lubed
3/4	10 16	265	200	380	280
7/8	9 14	420	325	600	450
1	8 14	640	485	910	680
1 1/8	7 12	790	590	1290	970
1 1/4	7 12	1120	835	1820	1360
1 3/8	6 12	1460	1095	2385	1790
1 1/2	6 12	1940	1460	3160	2370

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

CONTROL SYSTEM OPERATION AND TROUBLESHOOTING

BASIC OPERATION

The winch contains an independent, internal hydraulic system. The winch case serves as a reservoir and stores filtered oil for the internally mounted hydraulic pump. The pump is driven by a gear pressed onto the bevel pinion gear, and supplies oil as long as the tractor PTO shaft is turning. Oil from the pump is then routed through a pressure filter then directed to the control valve where a stand-by system pressure is maintained at 290-340 PSI (2000-2340 kPa).

The system oil pressure is routed through the control valve body to the solenoid actuated valve cartridges. When energized by the electronic control system, the solenoids direct oil to apply the Reel-In and Reel-Out clutches, release the spring-applied brake and shift the spring-engaged freespool mechanism. The electronic winch control system includes a sealed, solid-state joystick control lever and a sealed, solid-state control module, an electric solenoid operated control valve installed within the winch case, with a wiring harness connected between them.

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

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

The solid-state joystick control lever has no contact points to wear out or need adjustment, aside from the small push-button switch on the top of the lever. This button MUST be depressed to enable the electronic control system to perform any winch function. This feature prevents accidental or unwanted winch actuation.

The joystick produces a signal by a magnetically induced voltage as the control lever is moved near the sensing devices on the circuit board beneath the lever. The small, induced voltage is transmitted to the control module. The job of the control module is to receive 24V DC power from the tractor, filter this power supply to protect the electronics, then produce the correct combination of 24V DC signals to energize the appropriate solenoid cartridges in the control valve. The control valve is mounted inside the winch case behind the large access cover on the RH side. When energized by the control module, the solenoids send control oil pressure to perform the specific winch functions based on the position of the joystick lever. A small red indicator light, installed next to the joystick, will illuminate to indicate that the hydraulic oil filter is beginning to bypass and should be serviced if the light remains on.

A small volume of oil is stored in the spring-type accumulator at control system pressure. This stand-by pressure ensures quick response to the operator's commands, regardless of engine speed or winch load. The stand-by pressure is maintained by the joint operation of a pressure switch and a main pressure control solenoid valve. The pressure switch will be closed and send current to the main pressure solenoid until stand-by pressure reaches 340 PSI (2345 kPa). When the cutout pressure is reached, the pressure switch de-energizes the solenoid valve. The stand-by pressure is contained in the control valve housing by a check valve, and slowly decreases to 290 PSI (2000 kPa), where it will close the pressure switch contacts and start the charging process again.

When the operator selects a winch function, the pressure switch is not used and the control module activates the main pressure solenoid. A relief valve limits the main system pressure to approximately 400 PSI (2760 kPa) during clutch and brake actuation.

The wiring harness provides the vital connection between the control module and the control valve. The connecting pins and sockets are numbered for identification and trouble-shooting. The pin and socket numbers are referenced in the following descriptions of winch functions.

CONTROL OPERATION

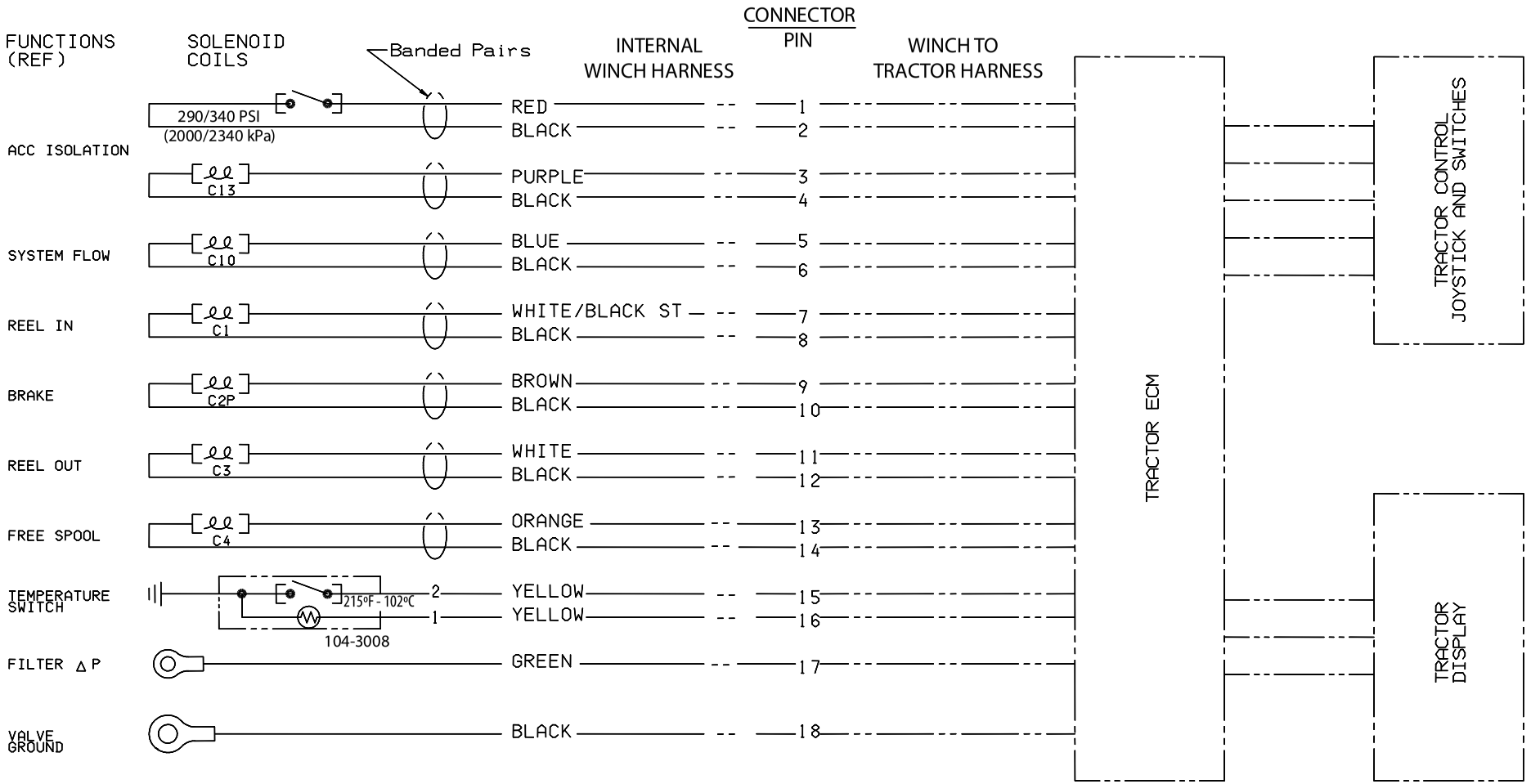
A thorough understanding of the control system is needed before any trouble-shooting is begun. Please review the following descriptions of the control system to become familiar with the interaction of all of the control circuit components.

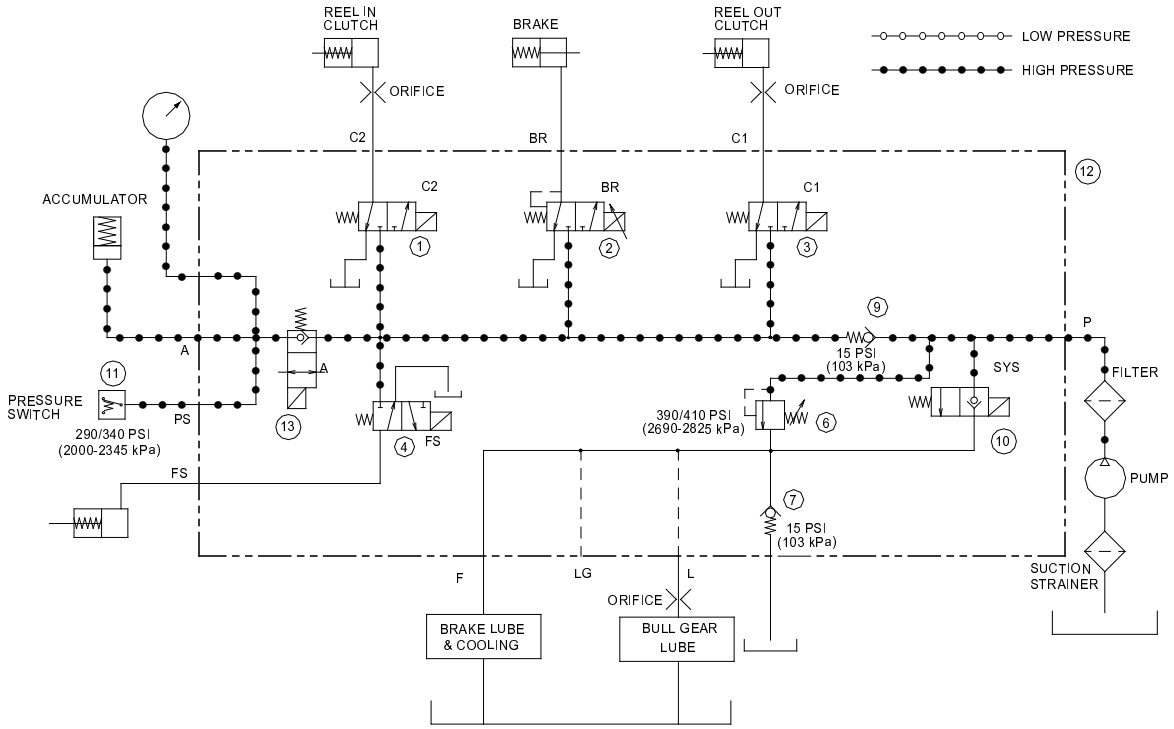
All control diagnostic tests should be performed with an accurate 0-600 PSI (0-7000 kPa) hydraulic pressure gauge and an accurate digital or analog multi-meter. The main hydraulic test port is located on the RH side of the winch case next to the wiring harness connector. A female quick disconnect coupler is required for using the gauge.

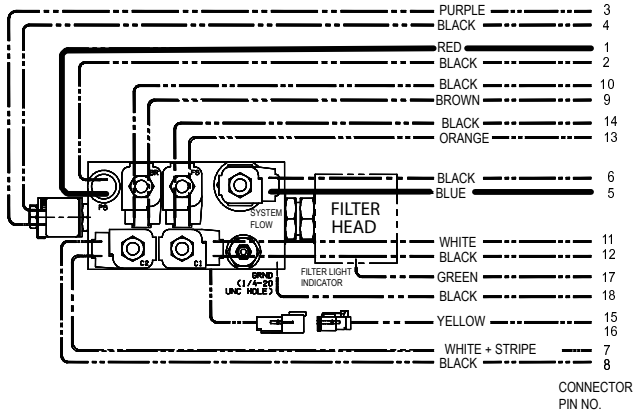
⚠ WARNING ⚠

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from sudden release of oil pressure. To discharge the accumulator, stop the engine, turn the key switch on, then slowly cycle the joystick lever into full REEL-IN and REEL-OUT positions a minimum of five (5) times. **NOTE: The tractor electrical system must be ON.**

WIRING HARNESS
(D6T - Tier 4)
(D6N - Series - Tier 4)







CONTROL VALVE

BREAK-ON (NEUTRAL) “CHARGING”

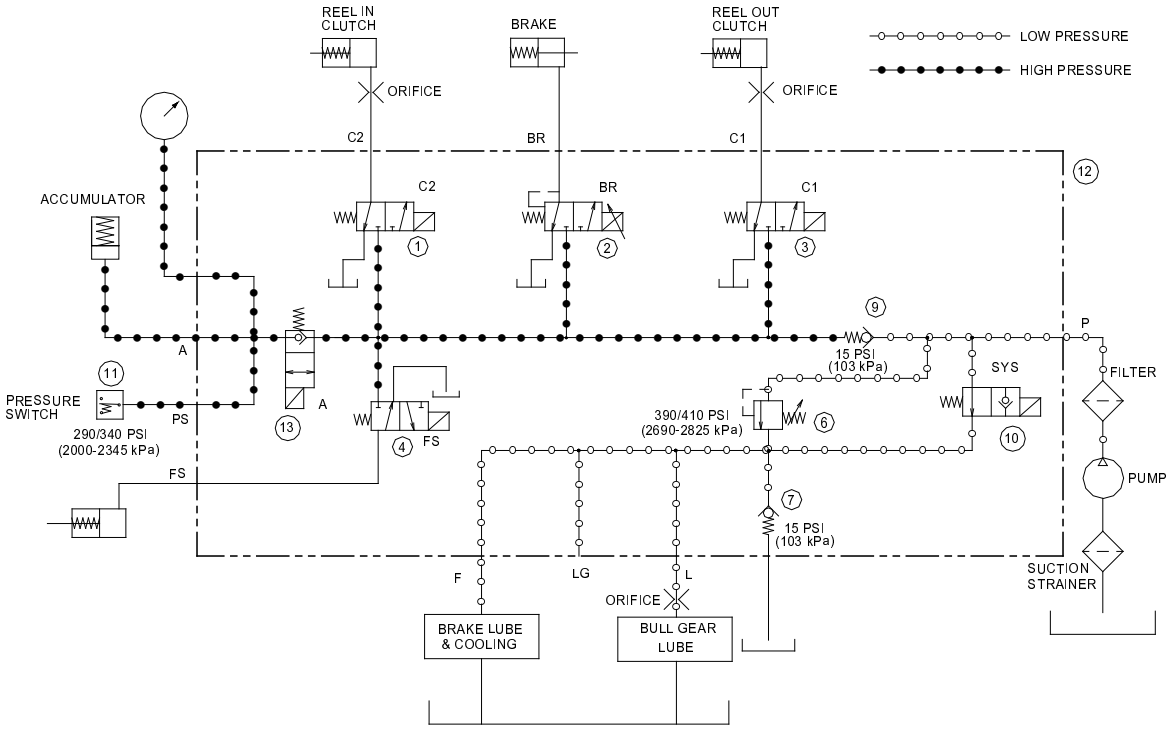
When “charging”, 24 volts DC will be seen at the red and blue wire within the winch case. The blue wire will be de-energized when the circuit is “unloaded”.

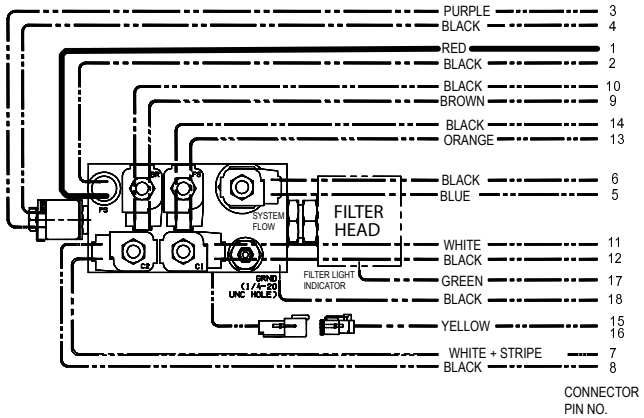
The pressure maintenance system operates continuously to maintain a stand-by supply of oil pressure for the control system. The pressure maintenance system consists of the following components:

Item 9 - Check Valve
Item 10 - Main Pressure Solenoid Valve
Item 11 - Stand-by System Pressure Switch
Item 13 - Accumulator Holding Cartridge
Item A - Accumulator

Oil from the pump passes through the filter and enters the valve housing, passing through the check valve (9) and holding cartridge (13) on its way to the accumulator (A). When charging first occurs, the pressure switch (11) contacts are closed producing a signal to energize the main pressure solenoid (10) to block the flow of oil to the lubrication circuit. At this time, all of the oil from the pump is directed to fill the accumulator and the pressure gallery in the control valve.

BREAK ON “UNLOADED”





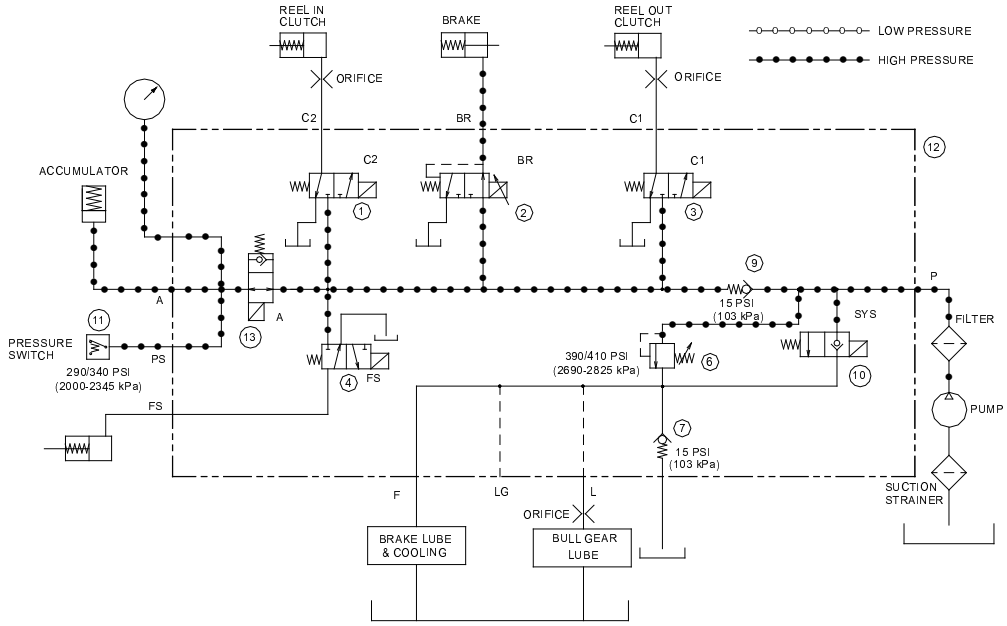
CONTROL VALVE

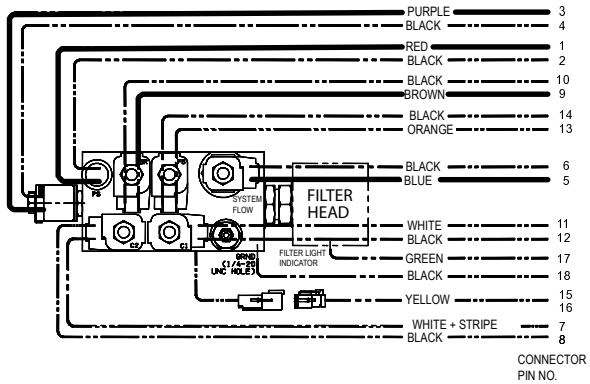
BREAK ON “UNLOADED”

When the pressure at the pressure switch (11) reaches approximately 340 PSI (2345 kPa), the pressure switch opens and the main pressure solenoid (10) is de-energized. In the de-energized position, the main pressure solenoid valve (10) allows pump oil to flow through the lube circuit and return to the winch sump. The oil stored in the accumulator is trapped by the check valve (9) and the accumulator holding cartridge (13). This oil is available for clutch application and brake release.

When the pressure at the pressure switch (11) decreases to approximately 290 PSI (2000 kPa), either through system demand or internal system leakage, the pressure switch (11) contacts will close producing a signal to energize the main pressure solenoid valve (10). When energized, the main pressure solenoid valve (10) blocks the flow of oil to the lube circuit and the pump will refill the accumulator to approximately 340 PSI (2345 kPa).

In the “unloaded” mode, the main pressure solenoid is de-energized and the oil from the pump is flowing back to sump through the lube circuit. There is very little load on the winch pump at this time, thus reducing wear and heat.





CONTROL VALVE

BRAKE-OFF

During BRAKE-OFF, 24 volts DC will be seen at the red and blue wires within the winch case. As the joystick lever moves from the BRAKE-ON position into the full BRAKE-OFF position, the voltage at the brown wire increase proportionally from 0 to 24 volts DC.

To release the spring-applied brake requires the following components:

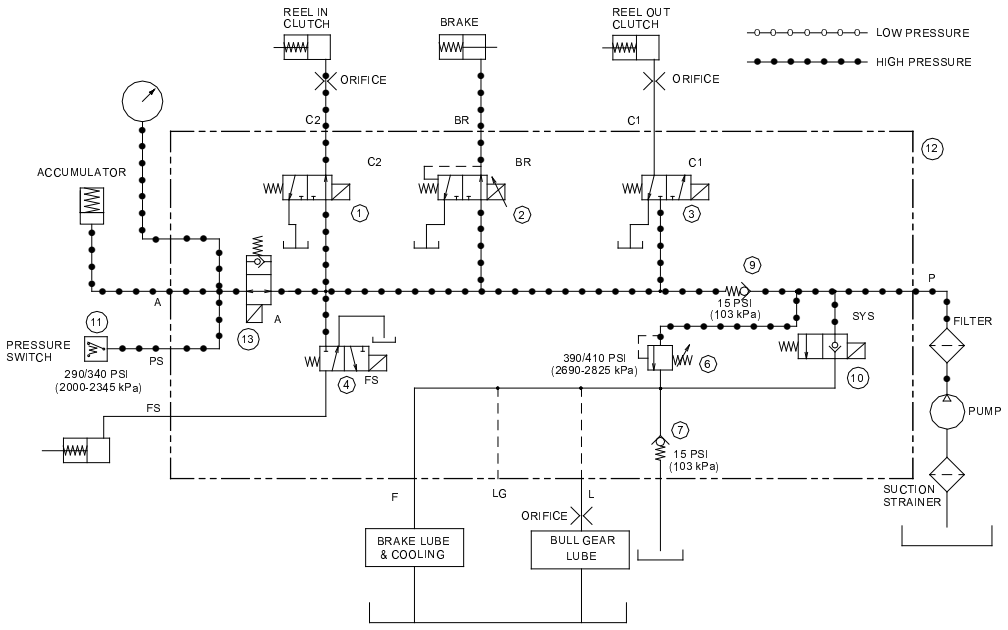
Item 2 - Brake Control Solenoid
Item 6 - Relief Valve
Item 10 - Main Pressure Solenoid Valve
Item 13 - Accumulator Holding Valve
Item A - Accumulator

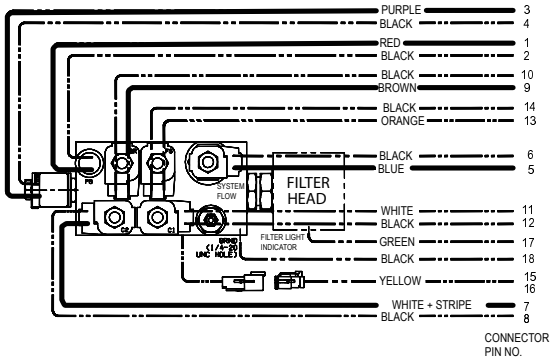
In BRAKE-OFF, only the brake is released; the directional clutches are not affected. The brake circuit is unique in that the brake release oil pressure is proportional to the movement of the joystick lever into the BRAKE-OFF position. All other winch functions receive full control pressure, 400 PSI (2760kPa) and full 24 volts DC to the solenoid valves. The main pressure solenoid valve (10) and the accumulator holding valve (13) receives 24 volts DC through the blue and purple wire within the winch case. The full flow of the pump is directed to the oil pressure gallery in the control valve. The pressure switch (11) is not used to control the maximum control system oil pressure when a winch function is selected. Instead of the pressure switch (11), the relief valve (6) limits the maximum pressure in the control circuit to approximately 400 PSI (2760 kPa).

After first pressing the enable switch, the movement of the joystick lever toward the BRAKE-OFF position will cause an increase in the voltage sent to the brake control solenoid (2) through the brown wire. As voltage increases, the valve opens further to send higher control pressure to release the spring-applied brake. When the joystick lever is placed in the full BRAKE-OFF position, full 24 volt DC current is sent to the control valve and full 400 PSI (2760 kPa) oil pressure is sent to fully release the brake.

When the joystick lever is released, the electrical signal to the solenoids is lost, the solenoid valves exhaust the control oil pressure to the winch sump, and the spring-applied brake reapplies to hold the load. The control valve returns to the BRAKE-ON mode and the pressure maintenance system begins slowly cycling to maintain a stand-by supply of control oil pressure.

REEL-IN





CONTROL VALVE

REEL-IN

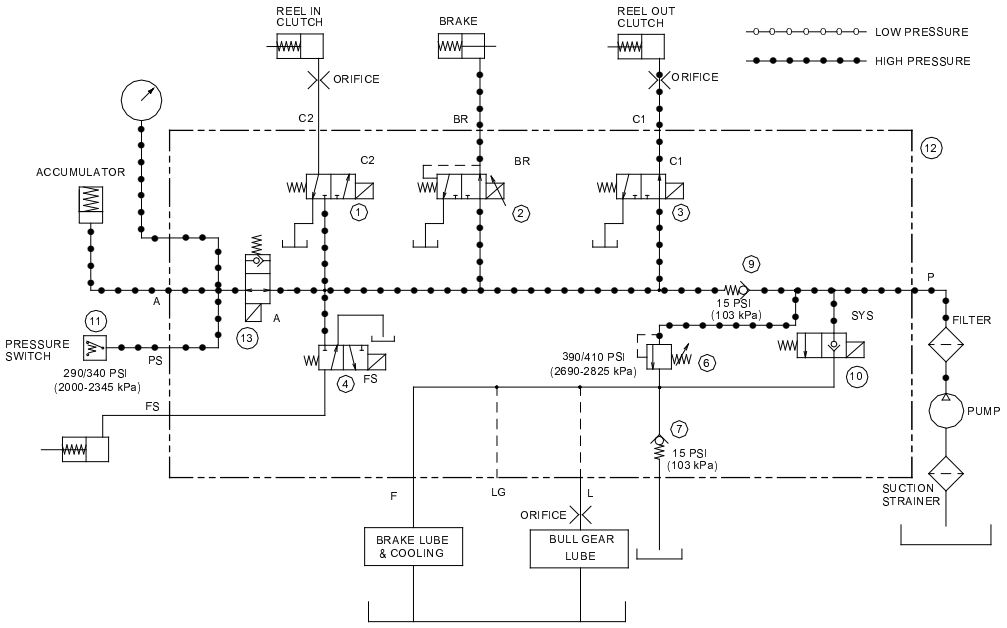
During REEL-IN, 24 volts DC will be seen at the red, blue, purple, brown and white with black stripe wires within the winch case.

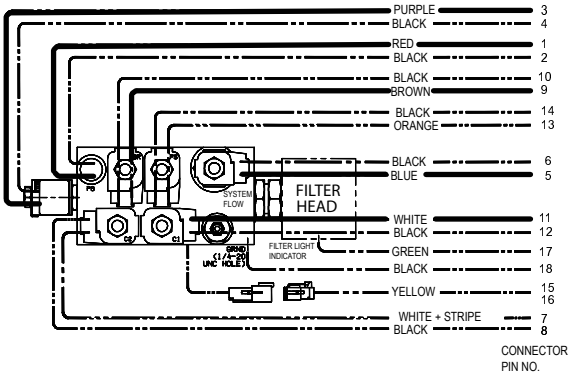
To apply the REEL-IN clutch and release the spring-applied brake requires the following components:

Item 1 - C2 Clutch Control Solenoid
Item 2 - Brake Control Solenoid
Item 6 - Relief Valve
Item 10 - Main Pressure Solenoid
Item 13 - Accumulator Holding Valve
Item A - Accumulator

With the enable button pressed and the joystick lever moved to the REEL-IN position, a signal is sent to the control module to initiate a sequence of 24 volt DC signals to energize the proper solenoids of the control valve within the winch case. The main pressure solenoid valve (10) is energized to bring the control system oil pressure from stand-by pressure up to full pressure, 400 PSI (2760 kPa), by blocking the path to the lube circuit. The control system pressure is limited by the relief valve (6). The accumulator holding solenoid valve (13) is opened to allow the stored oil in the accumulator to enter the pressure gallery of the control valve. This action improves the response time and consistency of the REEL-IN clutch. The brake control solenoid (2) will be energized to begin the release of the brake as the C2 clutch control solenoid (1) is energized to begin the application of the REEL-IN clutch. The timing of the brake release and clutch application is electronically controlled to provide a shift with a minimal amount of load “fall-back” for good load control while minimizing clutch/brake disc scrubbing due to overlap.

When the joystick lever is released and returned to BRAKE-ON, the signal to the control module is cleared and the 24-volt DC signals to energize the solenoids are switched off. The clutch releases as the brake applies to hold the load. The pressure maintenance system will return to slowly cycling to maintain a stand-by supply of control oil pressure.





CONTROL VALVE

REEL-OUT

For REEL-OUT, 24 volts DC will be present at the red, blue, purple, brown and white wires within the winch case.

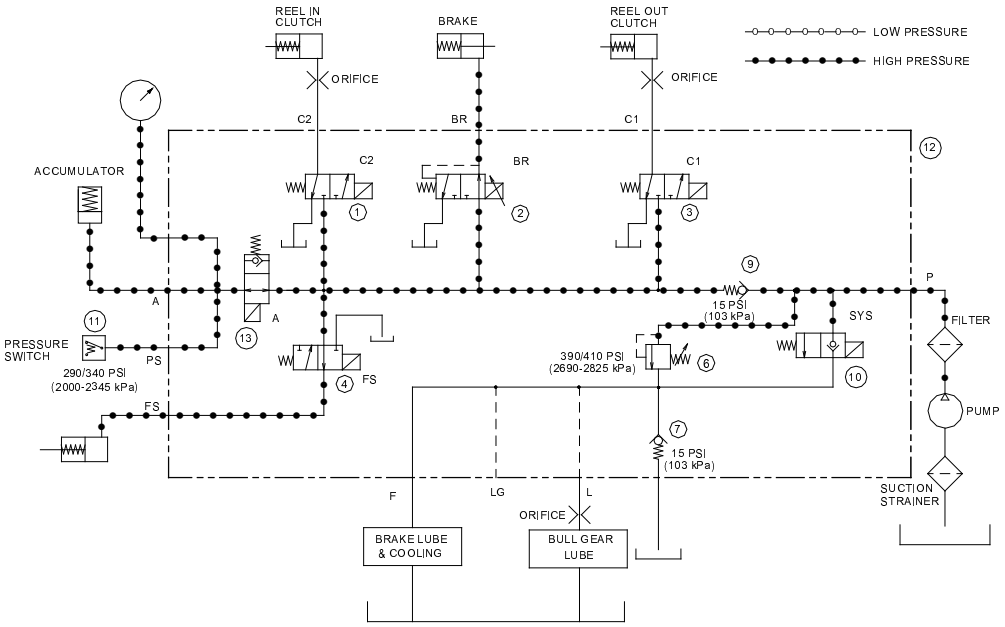
To apply the REEL-OUT clutch and release the spring-applied brake requires the following components:

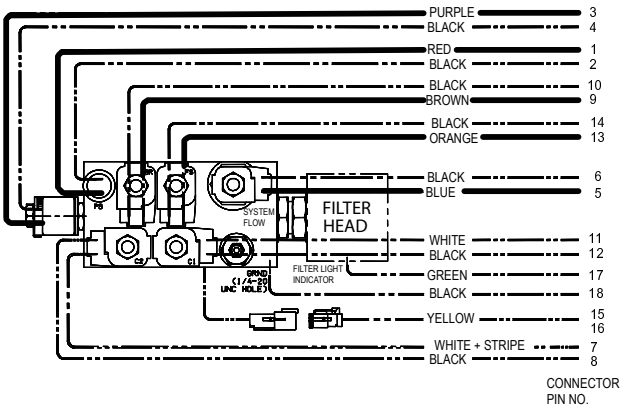
Item 2 - Brake Control Solenoid
Item 3 - C1 Clutch Control Solenoid
Item 6 - Relief Valve
Item 10 - Main Pressure Solenoid
Item 13 - Accumulator Holding Valve
Item A - Accumulator

With the enable button pressed and the joystick lever moved to the REEL-OUT position, a signal is sent to the control module to initiate a sequence of 24 volt DC signals to energize the proper solenoids of the control valve within the winch case. The main pressure solenoid valve (10) is energized to bring the control system oil pressure from stand-by pressure up to full pressure, 400 PSI (2760 kPa), by blocking the path to the lube circuit. The control system pressure is limited by the relief valve (6). The accumulator holding solenoid valve (13) is opened to allow the stored oil in the accumulator to enter the pressure gallery of the control valve. This action improves the response time and consistency of the REEL-OUT clutch. The brake control solenoid (2) will be energized to begin the release of the brake as the C1 clutch control solenoid (1) is energized to begin the application of the REEL-OUT clutch. The timing of the brake release and clutch application is electronically controlled to provide a shift with a minimal amount of load “fall-back” for good load control while minimizing clutch/brake disc scrubbing due to overlap.

When the joystick lever is released and returned to BRAKE-ON, the signal to the control module is cleared and the 24-volt DC signals to energize the solenoids are switched off. The clutch releases as the brake applies to hold the load. The pressure maintenance system will return to slowly cycling to maintain a stand-by supply of control oil pressure.

FREESPOOL





CONTROL VALVE

FREESPOOL

For FREESPOOL, 24 volts DC will be present at the red, blue, purple, brown and orange wires within the winch case. To operate the winch in FREESPOOL, the following components are required:

Item 2 - Brake Control Solenoid
Item 4 - Freespool Cylinder Control Solenoid
Item 6 - Relief Valve
Item 10 - Main Pressure Solenoid
Item 13 - Accumulator Holding Valve
Item A - Accumulator

With the enable button pressed and the joystick lever moved to the FREESPOOL position, a signal is sent to the control module to initiate a sequence of 24 volt DC signals to energize the proper solenoids of the control valve within the winch case.

The main pressure solenoid valve (10) is energized to bring the control system oil pressure from stand-by pressure up to full pressure, 400 PSI (2760 kPa), by blocking the path to the lube circuit. The control system pressure is limited by the relief valve (6). The accumulator holding solenoid valve(13) is opened to allow the stored oil in the accumulator to enter the pressure gallery of the control valve. The brake control solenoid (2) will be energized to release the brake. Once the brake is released and any load applied to the gear train has been relieved, the freespool cylinder solenoid (4) is energized. The solenoid actuates the cartridge to send oil to the freespool cylinder, which is installed in the LH side of the winch case. The cylinder is fitted with a shift yoke that moves a sliding collar gear into and out of engagement with the first reduction gear and second reduction pinion. The cylinder is spring-loaded to the “engaged” position keeping the cable drum load connected to the winch gear train and load holding brake. When disengaged, cable may be pulled from the cable drum by hand.

⚠ WARNING ⚠

FREESPOOL is used for pulling wire rope (cable) off of the cable drum BY HAND ONLY. NEVER attempt to release a load with freespool, or re-engage the gear train while the cable drum is rotating or while the tractor is in motion. Always remove the load from the wire rope with BRAKE-OFF or REEL-OUT before selecting FREESPOOL. Gear train damage may result which could lead to loss of load control, property damage, injury or death.

When the freespool operation is completed and the cable drum is stopped, the control lever may then be moved back into the BRAKE ON position. This will clear the signal from the joystick to the control module, which will call for the release of oil pressure from the freespool cylinder. The freespool cylinder springs will push the shift yoke and sliding collar gear back into engagement with the first reduction gear and second reduction pinion. This occurs first to ensure that the gear train is fully engaged before the brake control solenoid is de-energized to exhaust oil from the spring-applied brake. The pressure maintenance system of the control valve will return to slowly cycling to maintain a stand-by supply of control oil pressure, ready for the next command.

TROUBLESHOOTING

If the winch does not operate correctly, remove it from service immediately to avoid possible damage or injury from malfunctioning equipment.

Begin troubleshooting with a visual inspection of obvious faults, such as oil leaks, or loose or damaged parts. If the cause for the trouble is not readily apparent, check the operation of the winch in a secured test area.

ELECTRONIC SYSTEM TESTS

This section provides a quick reference guide to testing the electronic control components. An accurate multiple test meter is recommended, but a simple test light may be used on the solenoids. A small pocket screwdriver or similar light tool will easily sense the magnetism on energized solenoid coils. With the winch service access cover removed, place the small steel tool near the top of the solenoid coil. When energized, the tool will be drawn to the coil indicating the entire electrical side of the specific control circuit is operating.

The control valve solenoid coil resistance may be tested by unplugging the wires from the two spade connectors and attaching the test leads from an accurate Ohm meter to the solenoid coil spade connectors.

At approximately 70°F (21°C), the main system flow solenoid coil (10) resistance is 41.7 Ohms. The resistance for all the other solenoid coils is 20.6 Ohms.

Test the wiring harness for continuity. Check from the spade connectors on the solenoids in the winch to the 24-pin connector on the front of the winch, then check the main harness from the 24-pin connector to the connector on the ECM. Refer to the wiring harness diagram on page 10 for wire and pin identification.

HYDRAULIC SYSTEM TESTS

In addition to the main pressure tap on the front of the winch case, there are individual circuit test ports on the brake housing cover / bearing carrier and on the clutch shaft bearing carrier cover. The brake cover has test ports for B - BRAKE-OFF pressure, C - clutch pressure and F - flush / lube oil pressure. The clutch shaft bearing carrier has a C - clutch pressure tap.

A quick indicator of general hydraulic system operation is accumulator rod extension. With the winch service access cover removed, you can view the extended length of the accumulator rod. Approximately 1.57 in. (40 mm) is equal to 400 PSI (2760 kPa). The rod must be extended or the pressure is too low to fully apply a clutch and release the brake.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
A		
Brake does not hold. Cable Drum may also be slowly turning while in “BRAKE ON”.	1. Brake assembly worn, damaged or improperly assembled.	1. Remove and disassemble brake assembly to check for worn parts or improper assembly.
	2. Brake solenoid may be stuck open.	2. Install a pressure gauge at port “B” on the brake housing. Pressure should be 0 PSI in neutral (BRAKE-ON). If oil pressure is present, brake solenoid (item 2) should be cleaned or replaced.
	3. Frequent lowering of loads by slipping through the brake generates excessive heat. This can destroy friction disc material and warp steel plates. Lower loads by placing the joystick in the REEL-OUT or reverse position.	3. Remove the brake assembly, disassemble and replace friction discs if oil grooves are no longer visible. Replace steel discs if warped or scored. Instruct operator to use REEL-OUT for lowering loads.
B		
Winch continues to REEL-IN / REEL-OUT cable with the control in “BRAKE ON”.	1. Brake discs worn and/or damaged. Directional clutch discs warped.	1. See corrective action for A2. Also disassemble clutch assembly to check for worn parts. Determine the root cause of failure.
C		
Tractor torque converter stalls out when attempting to REEL-IN or REEL-OUT.	1. Brake not releasing as clutch is applied due to low hydraulic pressure. A minimum system pressure of 190-235 PSI (1310-1620 kPa) is required to release the brake.	1a. See corrective action for D. 1b. Control valve leakage, perform electronic and hydraulic tests.
	2. Brake not releasing due to damaged components or worn brake piston seals.	2. See corrective action for A2. 2a. Replace brake piston seals.
D		
No or very low oil pressure.	1. Low oil level.	1. Fill winch to proper level with the recommended oil.
	2. Tractor torque converter stalls when operating the winch.	2. Operate tractor engine at the proper speed to match the winch load requirement. Minimum PTO shaft speed for reliable winch operation is 650 RPM. Use sheave blocks and multi-part line if excessive line pulls are encountered.
	3. Clogged pressure filter or suction strainer.	3. Drain oil, change pressure filter and clean suction strainer. Fill with new recommended oil. While cleaning the suction strainer, identify any contamination and take corrective action as required

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
D (continued)	4. Main pressure solenoid valve (item 10) stuck in the "unload" position, or the signal to "charge" is not present.	4a. Pressure switch (item 6) in the control valve may be stuck in the "open" position allowing all oil to flow continuously into the lubrication circuit. Disconnect the wires from the pressure switch and check for resistance across the terminals. The switch should be closed with the pressure drained from the circuit. The pressure switch should open at 340 PSI (2345 kPa). If the switch is stuck open, the pressure will decay to 0 PSI. Inspect and replace as required. 4b. The main pressure solenoid (item 10) in the control valve may not be energizing, or may be mechanically stuck by contamination. Use a volt meter to check for 24 Volts DC at the blue wire on the solenoid. If no voltage present, check the pressure switch. (Refer to corrective action F2b) If voltage is present, the solenoid may be stuck and need to be replaced. The coil may be tested with an Ohm-meter across the terminals. A reading of more than 41.7 Ohms at 70°F (21°C) is normal. The resistance should increase with increased temperature.
	5. Suction hose/tube loose causing pump cavitation.	5. Drain oil, remove small side inspection covers to permit access to the pump suction hose/tube. Inspect and repair / replace as required. Be sure hose clamps and adapters are properly tightened.
	6. Pump defective.	6. Check pump flow as described in the "Hydraulic Pump" service section of this manual. If defective, identify the cause for the pump failure and take corrective action prior to new pump installation.
	7. Loose pressure filter.	7. Tighten or replace filter as required.
E Clutch damaged or defective	1. Friction discs worn and steel discs warped.	1. Replace clutch discs and plates. Adjust system relief pressure to 390-410 PSI (2690-2830 kPa) at low idle.
	2. Clutch piston return springs weak or broken.	2. Replace springs as required. Always replace springs in complete sets.
	3. Clutch piston seized or O-rings defective. Clutch housing check ball held off its seat by contamination.	3. Clean and replace components as required.
	4. Clutch assembled with excessive clutch piston travel.	4. Rebuild clutch as outlined in the "Clutch Assembly" section of this manual.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
E (continued)	5. Control valve defective.	5. Perform electronic and hydraulic tests.
	6. Accumulator piston seals leaking.	6. Observe the hole near the rod end of the accumulator body during winch operation. Oil exiting the hole indicates leakage past the piston seals. The accumulator should be rebuilt or replaced. Refer to the "Accumulator Service" section of this manual for test procedures.
F Winch runs hot; above 180°F (82°C).	1. Improper oil level. Too high or too low oil level can cause aeration and overheating.	1a. Fill or drain oil as needed to achieve the proper level, using the recommended oil. 1b. Make certain oil is not transferring to/ from the winch and tractor transmission case. Replace PTO / bevel pinion carrier seals as required.
	2. Control valve cycling rapidly (once every 15 seconds or less) causing overheating.	2a. Accumulator seals leaking (refer to corrective action E6). 2b. The pressure switch (item 6) in the control valve may be defective. Install a gauge at the pressure tap on the front of the winch and record the pressure. The pressure should increase to approximately 340 PSI (2345 kPa), then fall slowly back to approximately 290 PSI (2000 kPa). If the pressure falls back faster than 15 seconds, the accumulator seals may need to be replaced (refer to corrective action E6), or there may be a leak in the control valve. If the pressure does not fall back rapidly, but the pressure switch cycles on/off, the pressure switch is defective. To avoid opening the relief valve in error, and causing rapid overheating, the pressure switch MUST cycle off (unload) at a pressure no higher than 370 PSI (2550 kPa). 2c. Solenoids 1, 2, 3, and/or 4 may be leaking. Leakage may be observed at the corresponding gauge ports on the control valve. In the BRAKE ON position, there should be no oil flowing out the gauge ports FSG, C2G, BG and C1G. If oil continues leaking out any of these ports, the corresponding solenoid is not sealing tightly and should be serviced or replaced.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
F (continued)		2d. The check valve (item 9) in the control valve housing may be worn and leaking. Remove the check valve and inspect the valve seat. 2e. If leakage continues and you have verified it is not caused by any of the components listed above, the problem may be caused by a leaking accumulator holding solenoid valve (item 13). Install a gauge into port AG to verify accumulator pressure. Service or replace as needed.
	3. The pressure maintenance system does not cycle to unload the pump and makes the pump develop and hold 400 PSI (2760 kPa) against the relief valve.	3. Test the pressure switch (item 6) for proper operation. (Refer to corrective action D4a) Test for a stuck main pressure solenoid valve (item 10). (Refer to corrective action D4b)
G Winch runs noisy.	1. Improper bevel gear/pinion backlash. 2. Defective gear train bearing(s) and/or gear(s).	1. Establish clutch shaft end play of .005-.010 in. (.13-.25 mm), and bevel gear / pinion backlash of .004-.012 (.10-.31 mm). 2. Replace components. Operate the winch within its stated limits, using sheave blocks and multi-part line when excessive line pulls are encountered.
H Winch gear train bearing and/or gear failure.	1. Defective bearing(s) and/or gear(s). 2. Gear train overloaded or shock loaded.	Replace necessary components. Review application. Operate the winch within its stated limits, using sheave blocks and multi-part line when excessive line pulls are encountered.
I REEL-IN and REEL-OUT functions reversed.	1. C1 and C2 clutch pressure hoses reversed at control valve. **NOTE:** *If winch will be used in an "underwind" configuration, the clutch pressure hoses must be reversed at the control valve.*	1. Remove the RH access cover and locate the control valve. Remove the hoses at ports C1 and C2 and reinstall in the opposite ports or reverse white and white with black stripe wires on C1 and C2 clutch control solenoids.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
J FREESPOOL will not engage or disengage.	1. Control system malfunction. 2. Problem with freespool cylinder assembly or pressure supply hose. 3. Freespool shift rail out of adjustment. 4. Winch load is applied to gear train, preventing shift by freespool cylinder. 5. Freespool solenoid not energizing or defective.	1. Perform electronic and hydraulic tests. 2. Inspect the freespool cylinder assembly components and hose. Repair or replace as required. 3. Adjust the position of the shift rail. Refer to the “Idler Shaft Group” section of this manual. 4. Conduct operator training. Instruct operator to release load with BRAKE-OFF or REEL-OUT function BEFORE attempting FREESPOOL. 5. Test electronic circuits and/or repair or replace solenoid valve.
K Winch will not REEL-IN or REEL-OUT. All other functions appear normal.	1. If engine speed is not “pulled down” when applying either clutch, then C2 (REEL-IN) or C1 (REEL-OUT) clutch solenoid valve is not receiving 24 VDC, or the solenoid valve is stuck.	1a. Check the blue, brown, white, and white w/ black stripe wires for 24 VDC. Replace solenoid(s) or correct electronic control system as required. Check the resistance of the coil(s). If the resistance across the terminals of the coil(s), with the wires removed, is less than 20.6 Ohms at 70°F (2°C), then the coil is defective. Resistance will increase at higher temperatures. If in doubt, remove the clutch pressure hose from port “C2” and install a pressure gauge. Start the tractor and place the winch control lever in the REEL-IN position. If the solenoid opens, pressure should be 400 PSI (2760 kPa). A quick check of the wiring AND solenoid may be made by testing the magnetism of the energized coil with a small screwdriver, placed near the top of the solenoid. 1b. If engine speed “pulls down” when winch operation is attempted, then C1 clutch solenoid is applying the REEL-IN clutch but the brake is not releasing. Check the wires as mentioned in corrective action K1. Check the brake control solenoid valve (item 2) for actuation and replace as required.
L No response to movement of joystick.	1. Power is “ON” at pin 1. 2. Power is “OFF” at pin 1.	1. Operator MUST press enable button. Electronic problem - joystick, control module, harness. Mechanical problem - loose filter, bad pump, stuck solenoid valve cartridge(s). 2. Electrical problem - blown fuse, open circuit in harness.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
M		
Filter bypass indicator light remains on.	1. Filter plugged, remaining in bypass mode.	1. Replace filter, change oil, clean suction strainer. Cut open pressure filter element if necessary to determine origin of contamination and take corrective action as required.
	2. Cold, thick winch oil causing filter to bypass.	2. Use the proper viscosity oil for your ambient temperature.
	3. Defective indicator sending switch, or chaffed/grounded sending switch wire (green wire / # 9 at harness plug).	3. The indicator light is a ground seeking circuit. The light will be on if the wire has chaffed and shorted to ground or if the switch is stuck in the “bypass” position. Replace the sending switch as required.
N		
Brake will not release fully in BRAKE-OFF. All other function OK.	1. Low brake release pressure, pressure drops when winch is hot.	1. Install a gauge at the “B” port on the brake housing. Place the control lever in the BRAKE-OFF position. The gauge pressure should rise proportionally to the amount of lever movement toward full BRAKE-OFF. Gauge pressure should be the same as the main system pressure, less no more than 15 PSI (100 kPa). If the pressure is more than 15 PSI (100 kPa) below main system pressure, the proportional solenoid valve (BR - item 2) is sticking and should be replaced.
	2. Brake piston seals leaking.	2. Disassemble brake to replace seals and inspect condition of discs.

WINCH REMOVAL AND INSTALLATION

Before starting any repair procedures, be sure to thoroughly clean the parts to be removed and adjacent areas on the tractor 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 not to damage gaskets, shims, seals and o-rings that are to be reused. Replace any such parts that are damaged or otherwise defective. Certain o-rings and seals specified in the replacement instructions must not be reused. In general, seals and o-rings that work under operating hydraulic pressures, or that require extensive disassembly to replace, should be replaced with new parts at time of reassembly.

During assembly, use a suitable thread sealing compound on all capscrews 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 winch case. Hydraulic components should be rebuilt under the cleanest possible conditions.

WINCH REMOVAL

⚠ WARNING ⚠

Discharge the accumulator oil supply BEFORE removing any hydraulic lines or servicing winch. Personal injury may result from sudden release of oil pressure. To discharge the accumulator, stop the engine, turn the tractor switch ON, then slowly cycle the joystick lever into full REEL-IN and REEL-OUT positions a minimum of five (5) times. The tractor electrical system **MUST** be ON during this procedure.

Place tractor and winch in level position and drain oil from winch into a suitable container. Install drain plug securely after oil has been completely drained. Recycle or dispose of used oil in an enviromentally responsible manner.

⚠ CAUTION ⚠

To prevent serious damage to the winch, do not run the tractor engine without oil in the winch.

Disconnect the wire harness from the winch electrical connector.

⚠ WARNING ⚠

The winch weighs approximately 2,400 lbs (1,090 kg) without wire rope or mounting adapters. Make certain your hoist and all lifting equipment has adequate lifting capacity.

Two (2) 1 in. - 7 UNC threaded holes are provided in the top of the winch case for installing lifting eyebolts. Make certain eyebolt has a minimum of 1.25 in. (32 mm) of thread engagement.

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

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

WINCH INSTALLATION

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

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

Remove the winch top cover to gain access to the bevel gears.

Carefully install the winch onto the tractor while guiding the winch PTO pilot into tractor and slightly rotating the winch bevel gears by hand to properly align the PTO shaft splines. Apply Loctite 271 or equivalent to clean, dry threads of all fasteners. Install the fasteners and tighten to the recommended torque.

Install the winch top access cover plate and fill the winch to proper level with recommended oil.

⚠ CAUTION ⚠

To prevent serious damage to the winch, do not run the tractor engine without oil in the winch.

Connect the wiring harness to the winch electrical connector.

Start the tractor and test all functions before placing the unit into service.

WELDING PROCEDURE

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

Preparation:

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

Procedure:

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

Materials:

Flux coated “stick” electrode

Composition –	Ni	43.75%	Mn	11.00%
	C	1.50%	Fe	43.75%

Mechanical properties -	tensile strength	65,000 – 84,000 psi (448,000 – 579,000 kPa)
	yield strength	45,000 – 65,000 psi (310,000 – 448, 000 kPa)
	elongation	15-25%

Flux cored wire

Composition -	Ni	50.00%	Fe	44.00%
	C	1.00%	Si	0.60%
	Mn	4.20%		

Mechanical properties -	tensile strength	64,000 – 74,000 psi (441,000 – 510,230 kPa)
	yield strength	43,000 – 50,000 psi (297,000 – 345,000 kPa)
	elongation	15-25%

WIRE ROPE INSTALLATION

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

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

Maximum warrantable wire rope diameter:

PA55 =7/8 in. (22 mm)

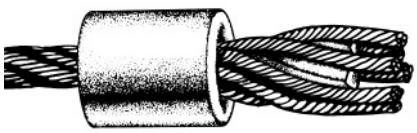
PA56 = 1 in. (25 mm)

⚠ WARNING ⚠

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

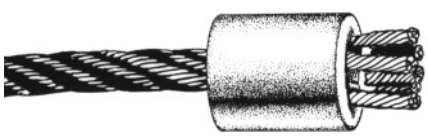
INSTALLATION OF SPIRAL FERRULES

Re-usable, field-installed spiral ferrules are not supplied with all Paccar winches. These ferrules are for use with standard six-strand, IWRC (Independent Wire Rope Core) type wire rope. Refer to ferrule selection chart in the “Specifications” section of this manual.



Step One

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



Step Two

Tap wedges and cable into the ferrule leaving approximately 3/8 in. (10 mm) extending from the top. The first load will seat cable and wedges securely in the ferrule.

BEVEL PINION AND HYDRAULIC PUMP SERVICE

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

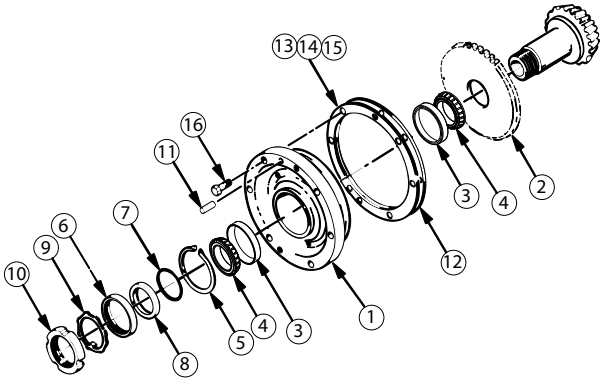
The bevel pinion and hydraulic pump share common carrier housing. The carrier is mounted in the front face of the winch case and will be located in the upper bore for standard PTO winches and in the lower case bore of low PTO winches.

An improvement was made to the design of the bevel pinion carrier with regards to the dual tapered bearing support of the pinion. For more than 25 years, Carco used a Timken “set-right” matched bearing set with cup and cone spacers. The .005 - .010 in. (.13 - .25 mm) typical end-play that was always present in the “set-right” bearing set could at times make setting bevel gear back-lash difficult. The bearing cups were arranged with the thick ends (small ID) against a matched shoulder spacer held in position by a retaining ring in the carrier bore. The bearing cones were separated by a spacer ground to a pre-determined thickness. When the bearing lock-nut was tightened to 150 lb-ft (203.4 N-m) torque, the bearing cones were firmly clamped against the spacer. The end-play mentioned above resulted from the retaining ring-to-groove clearance and the shoulder spacer-to-retaining ring clearance.

The new bevel pinion carrier contains a shoulder machined in the bore that locates and separates the bearing cups. The bearing cones no longer use a cone spacer between them. The bearings are adjusted by carefully tightening the bearing lock-nut to produce a 10 lb-in (1.3 N-m) rolling torque. The bevel pinion has no end-play so the bevel gear back-lash and contact adjustments are easier and more accurate. The bearing cone close to the pinion head supports the axial thrust of the bevel gear set and the bearing cone toward the tractor can resist thrust that may be induced by the tractor PTO shaft.

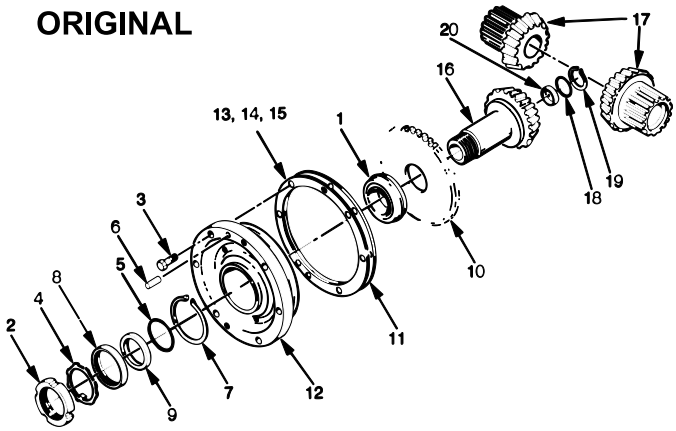
The original design carrier housing is no longer available and is fully serviced by the new “rolling torque” bevel pinion carrier. In the following text, the original Timken “Set Right” bearing arrangement will be identified with the note (original). The new bevel pinion carrier that uses separate pairs of cups and cones is the current design.

CURRENT



ITEM	DESCRIPTION	QTY
1	BEVEL PINION CARRIER	1
2	PUMP PINION	1
3	TAPER ROLLER BEARING CUP	2
4	TAPER ROLLER BEARING CONE	2
5	RETAINING RING	1
6	OIL SEAL	1
7	O-RING	1
8	SEAL SPACER	1
9	LOCKWASHER	1
10	BEARING LOCKNUT	1
11	DOWEL PIN	1
12	SHIM, GASKET	1
13	SHIM .005 in. (.13 mm)	2
14	SHIM .007 in. (.18 mm)	2
15	SHIM .020 in. (.51 mm)	2
16	CAPSCREW, HEX HD (1/2 - 13 X 1-1/4 GD8 Z)	6

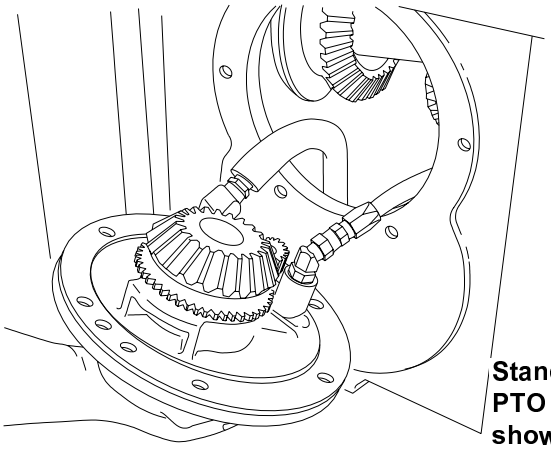
ORIGINAL



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

BEVEL PINION CARRIER REMOVAL

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



Standard PTO shown

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

BEVEL PINION REMOVAL

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

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

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

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

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

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

Thoroughly clean and inspect all parts at this time.

All components of the bearing assembly are a matched set with the bearing adjustment controlled by the inner and outer set spacers. If the bearing cone or cup is worn or damaged, the entire bearing assembly (1) must be replaced. (Original)

BEVEL PINION ASSEMBLY

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

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

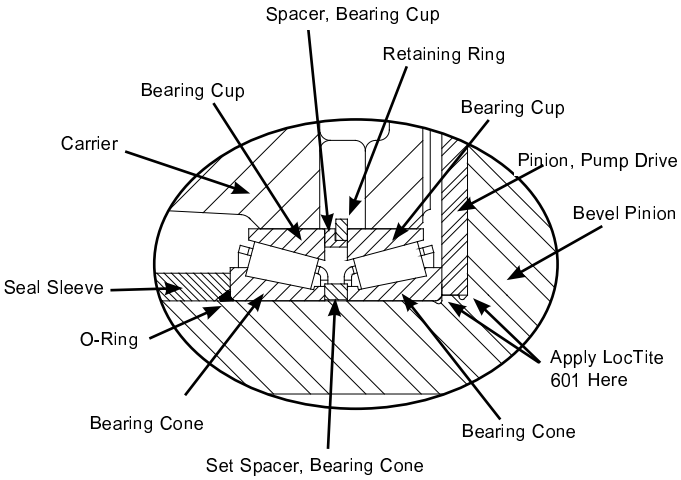
Clean and dry bore of pump drive pinion (10) and mating surface on bevel pinion (16) with Loc-tite cleaner 7070 or equivalent.

Apply Loc-tite 609 or equivalent to pump drive pinion bore and mating bevel pinion surface. Press pump drive pinion onto bevel pinion and seat securely against bevel pinion shoulder. Allow Loc-tite to harden.

ORIGINAL

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

ORIGINAL



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

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

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

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

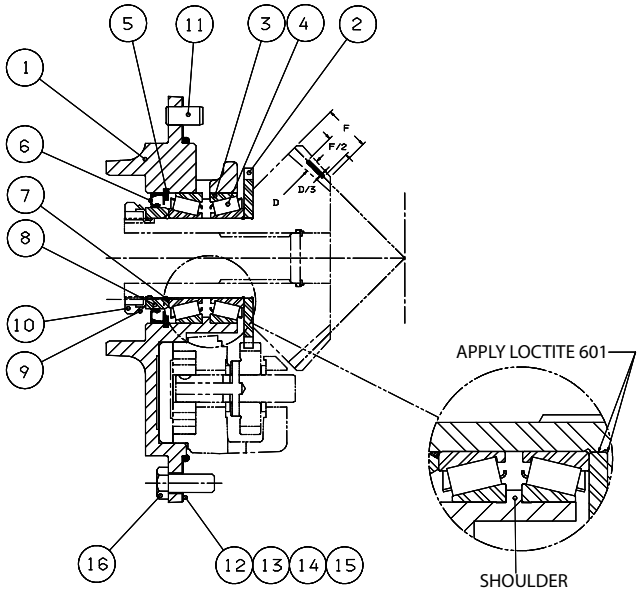
Press the remaining bearing cone securely onto the bevel pinion, seating into the bearing cup.

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

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

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

CURRENT



Clean preservative oil off of bearing cups and cones. Press bearing cone (4) onto bevel pinion and fully seat against pump drive pinion as shown. Install bearing cups (3) into bevel pinion carrier (1) with thick edge; small inside diameter against the shoulder. Install the bevel pinion sub-assembly into the carrier. Install the remaining bearing cone onto the bevel pinion. Install o-ring (7) onto pinion against the outer bearing cone. Install retaining ring (5) into bevel pinion carrier bore. Apply Permatex Aviation Form-A-Gasket liquid sealant to the outside surface of seal (6) and press into carrier bore with the open spring side of the seal facing the bearings. Apply light grease to the inside and outside surface of seal spacer (8) and install with inside diameter chamfer for o-ring (7) toward the bearings.

Install bearing lockwasher (9) and bearing locknut (10) onto pinion. Clamp pinion gear in workshop vise equipped with aluminum or bronze jaw protectors. Rotate bevel pinion carrier to align bearing cone rollers as you slowly tighten the bearing lock nut. When a slight drag is noticed as the bevel pinion carrier is rotated, remove carrier from vise and wrap nylon cord around the bevel pinion and slowly pull the cord at a steady rate and measure the resistance with a “fish scale”. At the pump drive pinion diameter, the rolling torque should be approximately 3 pounds (1.4 kg).

If a dial-type torque wrench is available, install the PTO adapter shaft into the bevel pinion or use a Timken 11N socket that fits the torque wrench/meter and can turn the bevel pinion. The rolling torque should be 8-10 lb.-in. (1.1 N-m). Bend bearing lockwasher tang up to lock nut in correct position.

BEVEL PINION CARRIER INSTALLATION

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

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

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

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

Apply approximately .20 in. (5 mm) continuous bead of Dow RTV 732 or equivalent silastic sealant to carrier pilot .

Clean dowel pin (11) with Loctite Cleaner 7070 and apply Loctite 242 or 243 to dowel pin and install into winch case.

Install suction and pressure hoses to pump. Install completed bevel pinion carrier assembly into winch case. Clean capscrews (16) with Loctite Cleaner 7070. Apply Loctite 242 or 243 to capscrews and evenly tighten to 80 lb.-ft. (108 N-m) torque.

Refill winch to proper level with recommended lubricant.

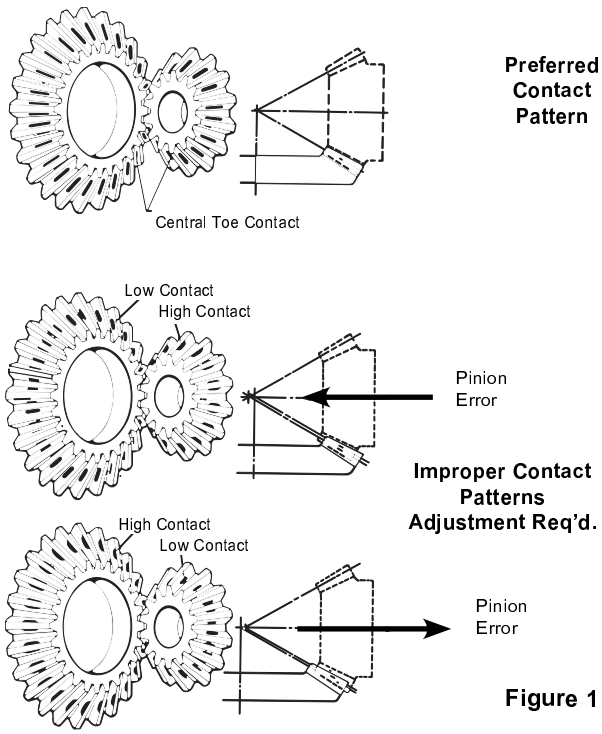


Figure 1

HYDRAULIC PUMP SERVICE

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

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

- Gate valve – ½ NPT port minimum, 1,000 psi (6,895 kPa) rating, minimum.
- ½ NPT schedule 80 pipe tee with a –8JIC hose adapter on one run.
- Accurate 0-600 psi (0-4,137 kPa) gauge

Attach ½ NPT run end of tee to gate valve with –8JIC adapter on opposite run. Install gauge to branch of tee.

TEST PROCEDURE

1. Operate tractor and winch long enough to bring oil up to operating temperature 100-120 F (38-49 C). Stop engine.
2. Remove access cover on right hand side of winch and locate pump port on control valve labeled “P”. Remove –8JIC pump line from the tee in the pump port of the control valve.
3. Attach pump line to the gauge side of the gate valve or flow meter. Direct the open end of the gate valve/flow meter back into the winch case.
4. With gate valve/flow meter fully open, operate engine at 650-700 RPM and measure oil flow by directing oil into a container for 15 seconds.
5. Gradually close gate valve/flow meter until you have applied 350 psi (2413 kPa) load to the pump. Again record the flow for 15 seconds.

⚠ CAUTION ⚠

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

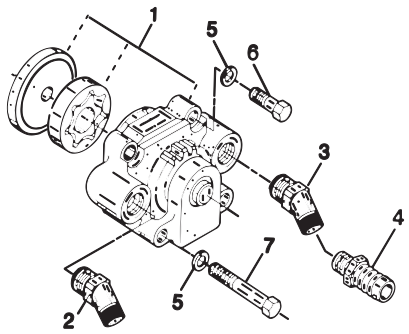
The minimum acceptable pump flow is 2 gpm (US) (7.6 lpm) at 650-700 RPM PTO speed and 350 psi (2413 kPa). Two quarts (2 liters) per 15 seconds equals 2 gpm.

If pump flow is below minimum:

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

HYDRAULIC PUMP REMOVAL

Remove the ½ in. capscrews which secure the bevel gear inspection cover to the top of the winch case. Remove the inspection plate. Remove the pump suction tube and pressure hose from the pump. In most applications, the pump may be removed from the bevel pinion carrier through the top of the winch case. If this is not practical in your application, then remove the bevel pinion carrier from the winch case as described in the “Bevel Pinion Carrier Service” section of this manual.



ITEM	DESCRIPTION	QTY.
1	Pump Assembly	1
2	Elbow, 45 degree -8 (pressure side)	1
3	Elbow, 45 degree (STD PTO suction side)	1
	Elbow, 45 degree 1/2 NPT adapter (LOW PTO)	1
4	Barbed Hose Adapter (LOW PTO)	1
5	Lockwasher (1/4 in.)	4
6	Capscrew, Hex Head (1/4 - 20 X 1-1/2 G8)	2
7	Capscrew, Hex Head (1/4 - 20 X 3 G8)	2

ALL UNITS

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

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

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

PUMP INSTALLATION

Lubricate entire pump assembly with recommended oil.

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

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

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

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

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

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

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

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

CLUTCH SHAFT SERVICE

DESCRIPTION

The clutch shaft assembly contains or supports the two bevel gears, the Reel-In and Reel-Out clutches, the brake hub and the first reduction pinion gear. Refer to illustration on page 32.

OPERATION

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

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

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

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

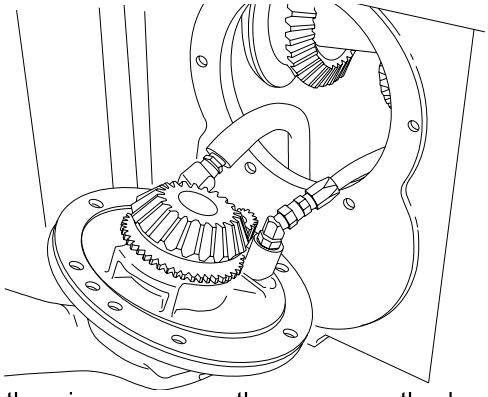
The brake is spring applied and hydraulically released. The clutch shaft and the entire winch gear train is held firm by the brake until hydraulic oil pressure overcomes the spring force to relieve the compression of the discs. When released, the clutch shaft and brake hub can turn as the brake friction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

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

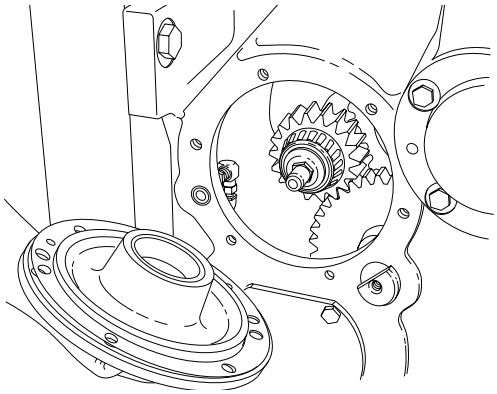
The clutches are supplied with application oil pressure from passages drilled through the center of the shaft. Clutch application oil travels from the control valve to the clutch shaft bearing carriers where the oil passes through a rotary seal shaft installed in the drilled passages at the ends of the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

REMOVAL

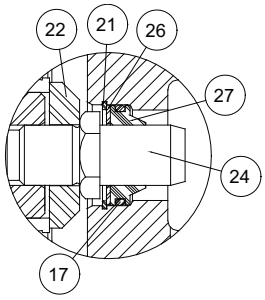
Drain oil and remove winch from tractor as described in the “Winch Removal and Installation” section of this manual. Remove only the winch, leaving the mounting blocks attached to the tractor.



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



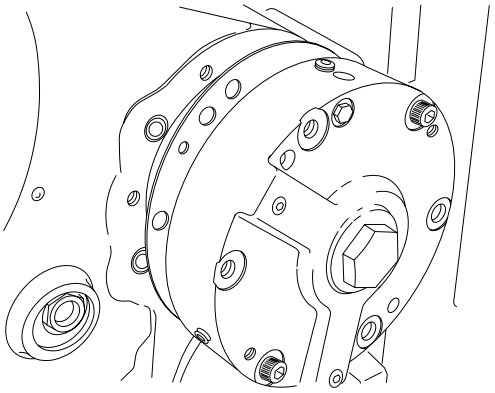
Remove the six capscrews (10) then remove the left hand clutch shaft bearing carrier (35). Retain the shim set for reassembly. Inspect the bearing cup (4) in the bearing carrier and replace as required.



ITEM	DESCRIPTION	QTY.
17	O-Ring	2
21	Retaining Ring	2
22	Bearing Retainer	2
24	Rotary Seal Shaft	2
26	Back-Up Washer	2
27	Rotary Seal	2
40	Orifice Plug	2

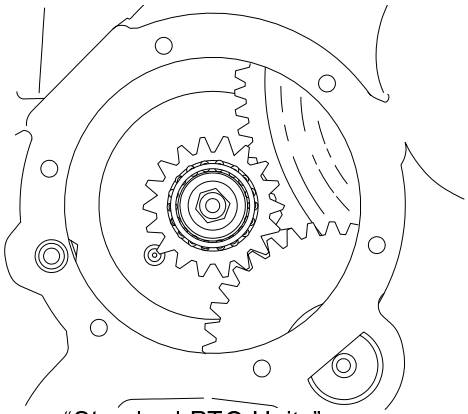
Remove the retaining ring (21) from the bore of the bearing carrier, then remove the rotary seal assembly (17, 26, 27).

Remove the six ½ in. capscrews securing the brake assembly to the winch case. DO NOT remove the two 3/8 in. capscrews securing the outer bearing carrier cover to the brake housing at this time. Refer to “Brake Assembly Service” for additional information.



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

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



"Standard PTO Units"

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

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

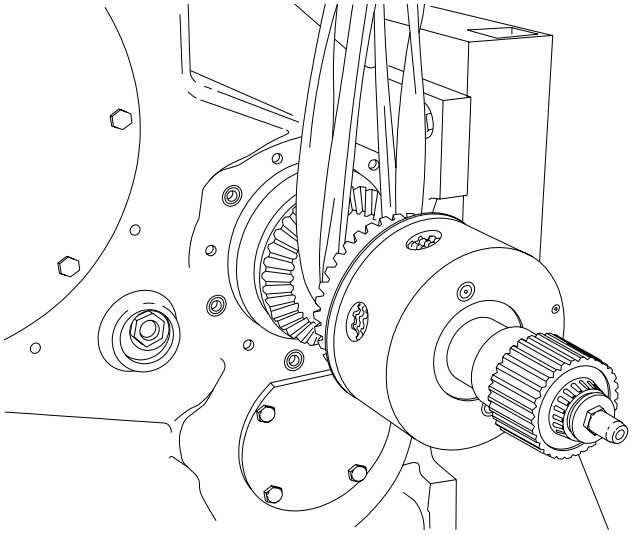
or

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

⚠CAUTION⚠

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

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



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

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

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

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

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

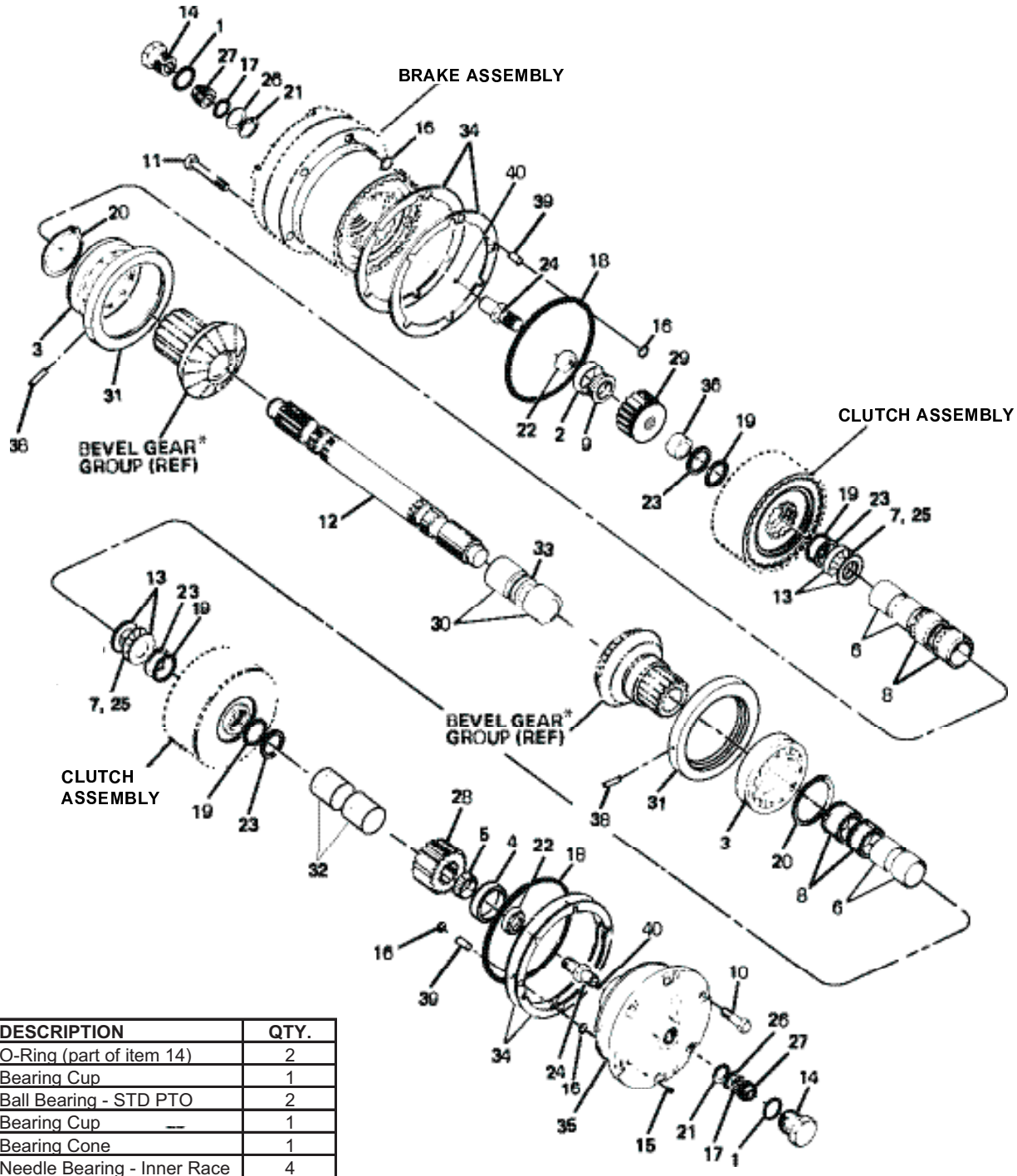
Slide each clutch assembly off of the shaft. Refer to "Clutch Assembly Service" for additional information.

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

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

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

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



ITEM	DESCRIPTION	QTY.
1	O-Ring (part of item 14)	2
2	Bearing Cup	1
3	Ball Bearing - STD PTO	2
4	Bearing Cup	1
5	Bearing Cone	1
6	Needle Bearing - Inner Race	4
7	Thrust Bearing	2
8	Needle Bearing - Inner Race	4
9	Bearing Cone	1
10	Capscrew, Hex Head	6
11	Capscrew, Hex Head	6
12	Clutch Shaft	1
13	Thrust Bearing Race	2
14	Plug (contains item 1)	2
15	Plug (contains item 1)	1
16	O-Ring	8
17	O-Ring	2
18	O-Ring	2
19	O-Ring	4
20	Retaining Ring	2
21	Retaining Ring	2
22	Bearing Retainer	2
23	Back-up Ring	4
24	Rotatry Seal Shaft	2

ITEM	DESCRIPTION	QTY.
25	Thrust Bearing, Shoulder Spacer	2
26	Back-up Washer	2
27	Rotary Seal	2
28	Pinion Gear	1
29	Brake Hub	1
30	Bevel Gear Spacer	2
31	Bearing Carrier	2
32	Pinion Spacer	1
33	Shim Set	1
34	Shims (.005, .007, .020 in.)	AR
35	Clutch Shaft Bearing Carrier	1
36	Brake Hub Spacer	1
37	Spring (not shown)	1
38	Roll Pin - Ref. SB93	2
39	Sleeve	4
40	Orifice Plug (electronic controls only)	2

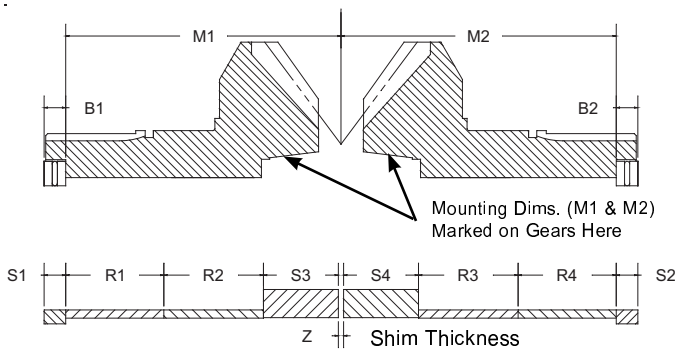
ASSEMBLY

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

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

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

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



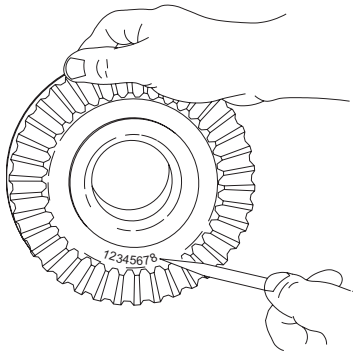
Due to machine tolerances, the thickness of the shim pack must be determined individually for each winch. The same parts which have been used for measuring must be used together.

ITEM	QTY	DESCRIPTION
B1, B2	2	Thrust Bearing Assembly (Thrust bearing (7) and 2 thrust bearing races (13).
S1, S2	2	Thrust Bearing Shoulder Spacer (25)
S3, S4	2	Bevel Gear Spacer (30)
R1 thru R4	4	Needle Bearing Inner Race (6)
M1, M2	2	Bevel Gear

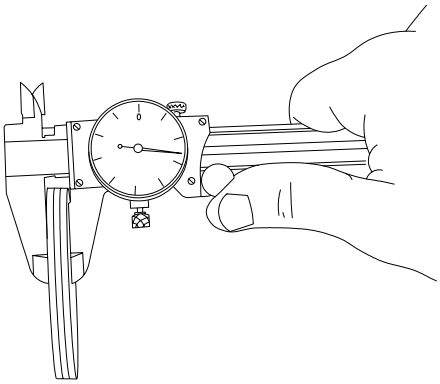
Shim Pack Thickness:

Z = B1 + B2 + M1 + M2 – S1 – S2 – S3 – S4 – R1 – R2 – R3 – R4

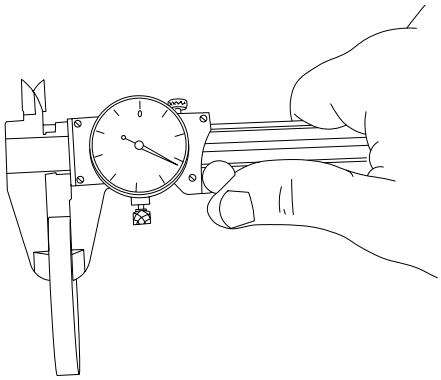
The basic shim pack supplied through Service Parts is .120 in. (3.05 mm) thick.



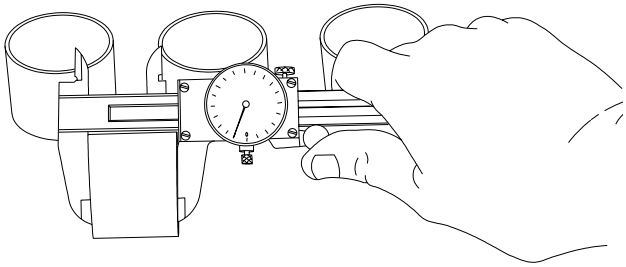
Record dimensions M1 and M2, bevel gear mounting distance. The mounting distance has been etched into the inside surface of the bevel gears.



Measure and record dimension B1 and B2, thrust bearing assembly. Each thrust bearing assembly includes: one thrust bearing (7) and two thrust bearing races (13).



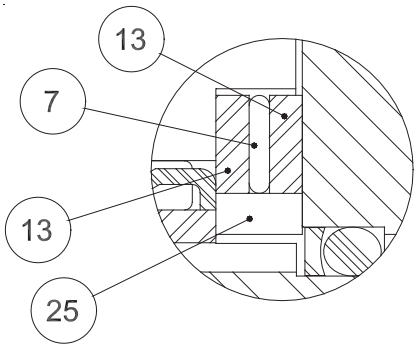
Measure and record dimension S1 and S2, thrust bearing spacer thickness (25) and S3 and S4 bevel gear spacer thickness (30).



Measure and record dimension R1, R2, R3 and R4 bevel gear bearing inner race (6) thickness.

The shim pack thickness, Z, to use in re-assembly of the clutch shaft is the total mounting distance of the bevel gears M1 and M2 plus the total thickness of the thrust bearing assemblies B1 and B2 less the total thickness of the bevel gear spacers S3 and S4, inner bearing races R1, R2, R3, R4 and thrust bearing spacers S1 and S2.

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



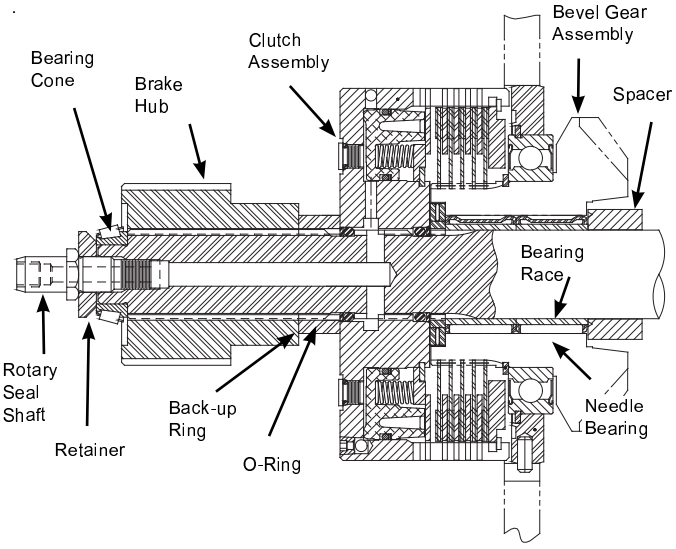
ITEM	DESCRIPTION	QTY.
7	Thrust Bearing	2
13	Thrust Bearing Race	4
25	Thrust Bearing Spacer	2

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

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

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

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



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

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

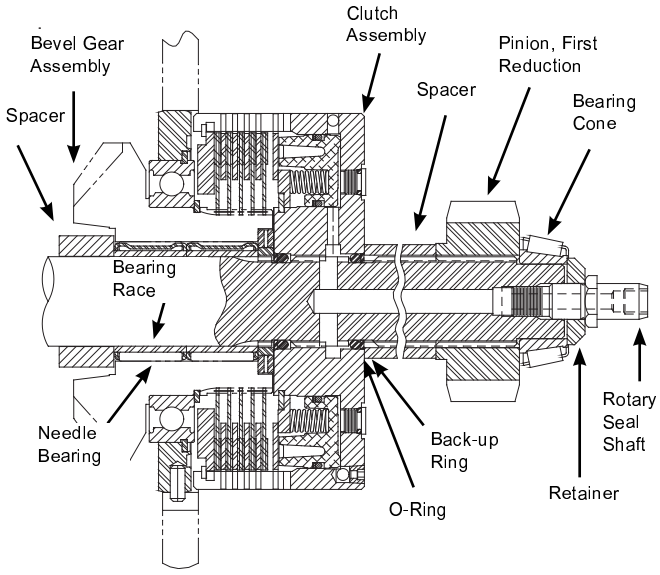
Install a clutch assembly onto the shaft aligning the splines of the clutch friction discs with the splines of the bevel gear. Seat the clutch over the o-ring and back-up ring installed on the clutch shaft.

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

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

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

Install rotary seal shaft (24) and retainer (22) onto the clutch shaft. Install the bearing retainer with the small diameter (chamfered) side toward the bearing cone. Apply Loc-tite 271 or equivalent to the threads and pilot shoulder of the shaft and tighten 130 lb•ft (175 N•m) torque.



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

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

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

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

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

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

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

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

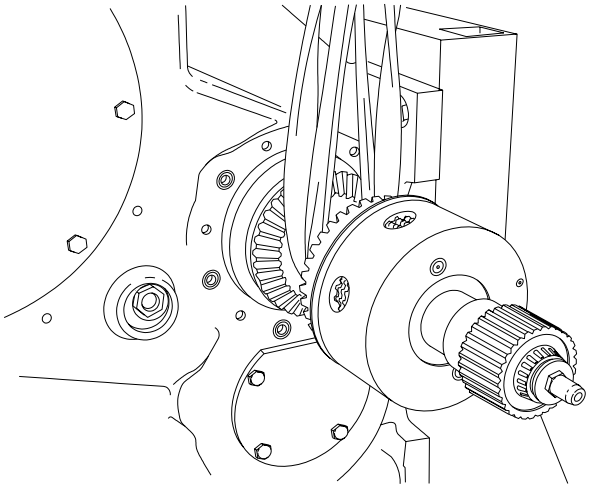
Install spacer (32) over the clutch shaft, next to the clutch assembly. The spacer will hold the o-ring and back-up ring into the clutch housing.

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

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

Install the rotary seal shaft (24) and retainer (22) into the end of the clutch shaft. Install the bearing retainer with the large diameter (flat) side toward the bearing cone. Apply Loc-tite 271 or equivalent to the threads and pilot shoulder of the shaft and tighten to 130 lb•ft (175 N•m) torque.

INSTALLATION



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

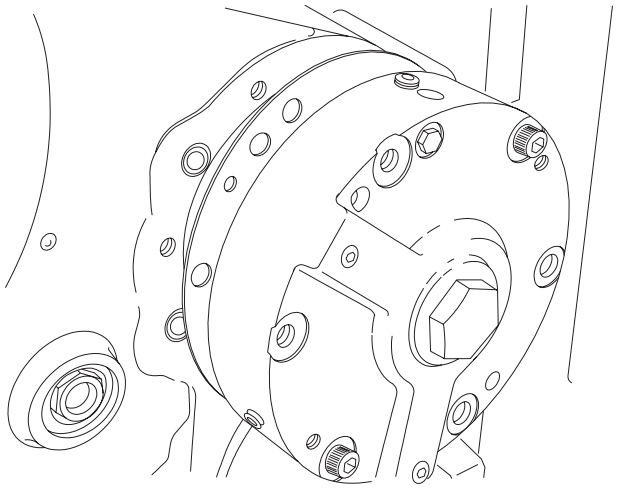
All PA55 & PA56 winches are fitted with a rollpin (38) driven into outside surface of the bevel gear bearing carriers (31). These rollpins must be aligned with grooves machined in the inner case bores.

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

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

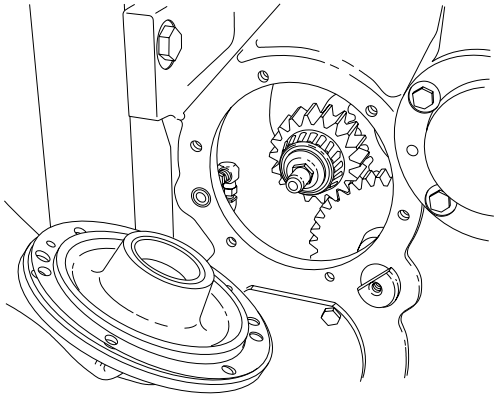
Use the shim set (34) removed during disassembly or a new shim set of the same thickness. Position shim set over the brake housing, aligning oil ports.

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



Install the brake housing and shim set into the winch case carefully aligning the oil ports. Make certain that all of the brake friction discs have engaged the brake hub (29) before installing capscrews.

Tighten to 75 lb•ft (102 N•m) torque.



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

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

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

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

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

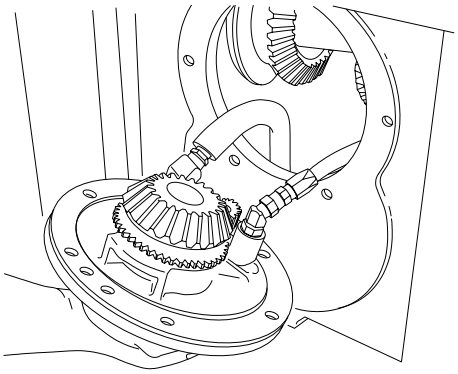
Tighten to 75 lb•ft (102 N•m) torque.

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

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

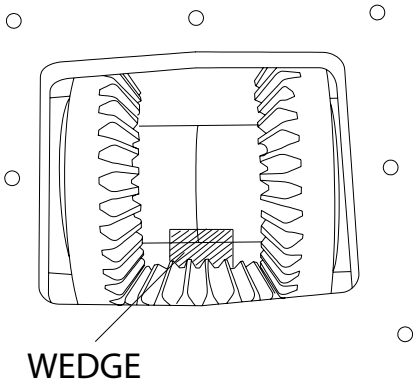
Remove left hand bearing carrier cover and add or remove shims (34) as required to obtain correct end play.

Install plug (14) into bearing carrier cover.



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

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



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

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

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

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

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

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

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

Make certain pump suction and pressure hoses and all capscrews are properly tightened.

Refill winch to proper level with recommended oil.

CLUTCH ASSEMBLY SERVICE

Two identical clutch assemblies are mounted on the clutch shaft: One is used to Reel-In, the other for Reel-Out. Each clutch contains five friction discs (12) splined to the bevel gears and five steel discs (13) with tangs to engage the slotted clutch housing. The clutch housing is splined to the clutch shaft.

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

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

REMOVAL

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

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

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

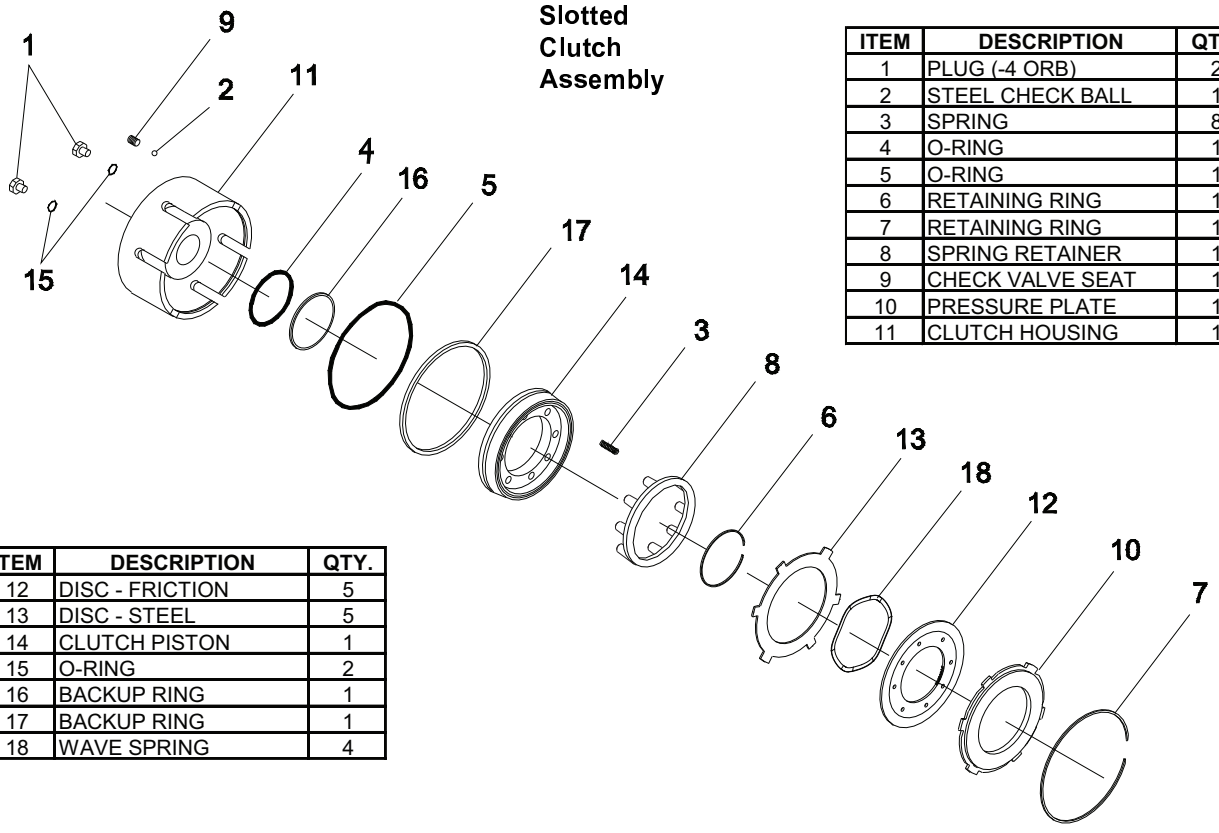
DISASSEMBLY

Remove the pressure plate retaining ring(s) (7) using slight pressure to compress the wave springs, if so equipped.

Remove the pressure plate (10), clutch friction discs (12), steel discs (13), and the wave springs (18) as required.

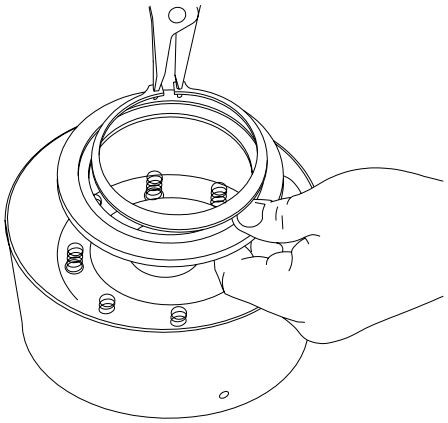
Inspect friction discs for wear and flatness. Original disc thickness is .138-.148 in. (3.5-3.8 mm). Oil groove depth on new discs is .015 in. (.38 mm) minimum. Replace friction discs if the oil groove is .005 in. (.13 mm) or less, disc is not flat, or friction material is worn unevenly.

Inspect steel discs for scoring and warpage. New PA55/PA56 discs are flat and .093 in. (2.36 mm) thick. Replace steel discs if they are not flat beyond .015 in. (.4 mm), heat discolored, or show signs of friction material transfer.



ITEM	DESCRIPTION	QTY.
1	PLUG (-4 ORB)	2
2	STEEL CHECK BALL	1
3	SPRING	8
4	O-RING	1
5	O-RING	1
6	RETAINING RING	1
7	RETAINING RING	1
8	SPRING RETAINER	1
9	CHECK VALVE SEAT	1
10	PRESSURE PLATE	1
11	CLUTCH HOUSING	1

ITEM	DESCRIPTION	QTY.
12	DISC - FRICTION	5
13	DISC - STEEL	5
14	CLUTCH PISTON	1
15	O-RING	2
16	BACKUP RING	1
17	BACKUP RING	1
18	WAVE SPRING	4

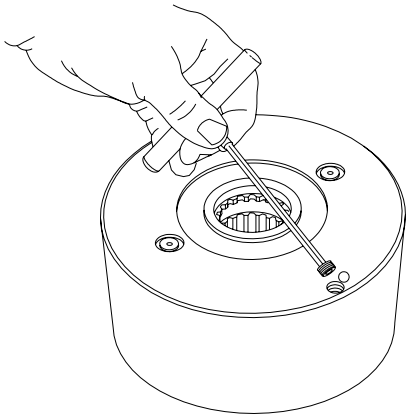


Using a suitable press or two C-clamps, depress spring retainer (8) and remove retaining ring (6) and clutch spring retainer (8).

Remove the eight clutch piston return springs (3). During the rebuild of clutch assemblies, it is recommended to replace all eight springs. Minimum spring free length is 1.16 in. (29.5 mm) for springs in slotted housings.

Turn the clutch housing over and tap on bench top to remove clutch piston (14). Remove two plugs (1) to aid piston removal. Inspect piston for wear or damage.

Remove O-Rings and back-up rings from the piston. Replace O-Rings and/or back-up rings upon reassembly.



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

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

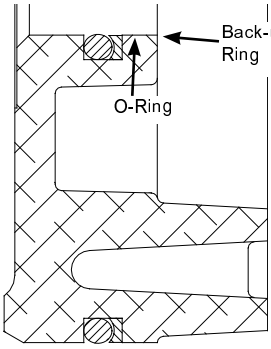
ASSEMBLY

Thoroughly clean and inspect all components prior to assembly.

Install the steel check-ball (2) into the back side of clutch housing (11). Lightly coat threads of check valve seat (9) with Loc-tite 242 and install flush with the surface of the clutch housing. Make certain that the steel ball moves freely and no thread locking compound is in seat area.

Install back-up rings (16 & 17) into grooves in clutch piston. Lubricate O-Rings (4 & 5) with hydraulic oil and install them in the grooves with the back-up rings.

NOTE: *The concave (cupped) side of the back-up ring MUST always face the O-Ring. Back-up rings are toward the side of the piston that pushes against the clutch discs, as shown.*



Lubricate the piston O-Ring sealing surface with hydraulic oil then push piston (14) into bottom of clutch housing (11).

Install spring retainer (8) over springs.

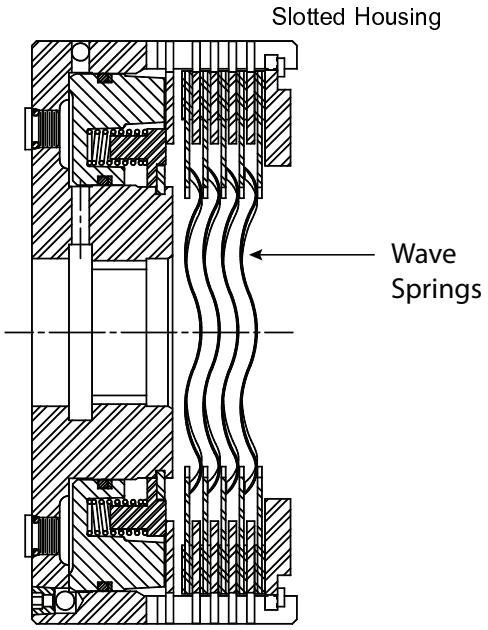
Using a suitable press against spring retainer (8) compress springs to expose the retaining ring groove. Install retaining ring (6) with the sharp edge of the inner diameter of the retaining ring facing away from the clutch springs.

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

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

Install the discs by starting with a steel separator disc (13) (lugs on outside diameter) next to the piston and alternate with a friction disc (12) (teeth on inside diameter) until a total of five friction discs and five steel discs have been installed. Install a wave spring (18) between each set of friction discs centered around the steel plates.

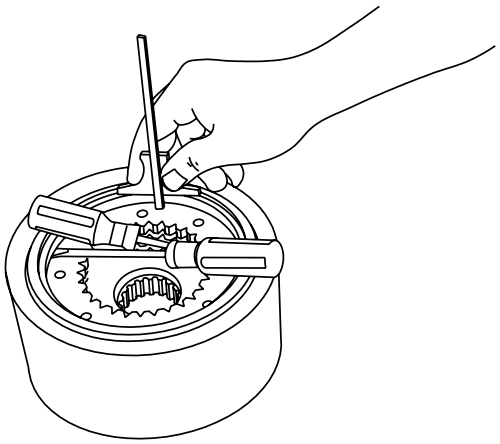
Install the pressure plate (10) and retaining ring (7).



Clutch Assembly

The assembled clutch must have .090-.140 in. (2.3-3.6 mm) clearance between the pressure plate and the top friction disc with new clutch discs. If the clutch pack

clearance exceeds .140 in. (3.6 mm), this indicates some wear of the discs. The friction discs are completely worn out and must be replaced if the clearance exceeds .200 in. (5.1 mm). If the clearance is less than .090 in (2.3 mm), this indicates that the clutch piston may not be fully retracted or some distortion of the discs may be consuming the clearance. Closely inspect and repair or replace components as required.



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

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

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

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

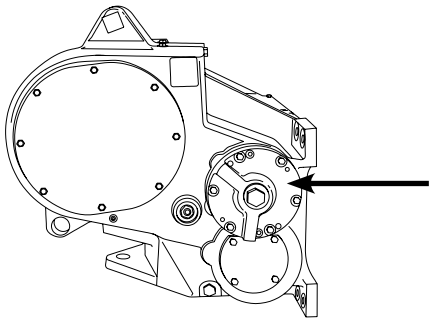
⚠ CAUTION ⚠

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

BRAKE ASSEMBLY SERVICE

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

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



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

The winch gear train is connected to the brake assembly by the brake hub, attached to the end of the clutch shaft. The brake hub is splined to eight friction discs (11). The friction discs are alternately stacked between steel discs (12), which are splined to the brake housing (15), which is anchored to the winch case.

Two large disc type springs (13) exert a tremendous force against the brake piston (4) and retainer (3) to hold the brake disc pack compressed, locking the winch gear train to the winch case.

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

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

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

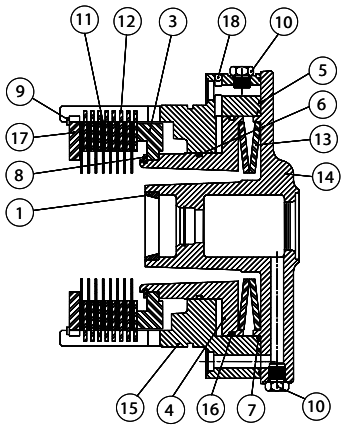
BRAKE ASSEMBLY REMOVAL

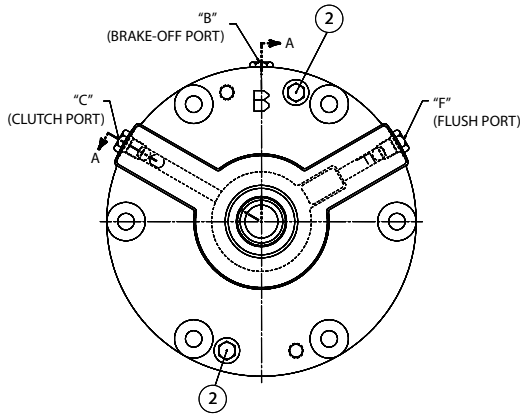
Drain oil from the winch into a suitable container and recycle or dispose of used oil in an environmentally responsible manner.

Remove the six ½ in. capscrews securing the brake assembly to the winch case. Do not remove the two 3/8-in. capscrews (2) which secure the bearing carrier to the brake housing at this time.

The brake may be removed from the winch case by carefully using a pry bar between the brake housing and winch case. Be careful not to damage the shim set.

Remove the brake assembly from the winch case. The brake assembly weighs approximately 80 lbs (36 kg). Retain the shim set for reassembly.





ITEM	DESCRIPTION	QTY
1	BEARING CUP	1
2	CAPSCREW (3/8 - 16 X 1 G8 Z)	2
3	PRESSURE PLATE	1
4	BRAKE PISTON	1
5	O-RING	3
6	O-RING	1
7	O-RING	1
8	RETAINER RING	1
9	RETAINING RING	1
10	PLUG	3
11	FRICTION DISC	8
12	BRAKE PLATE	8
13	BRAKE SPRING	2
14	CARRIER MACH RH	1
15	BRAKE HOUSING	1
16	O-RING	1
17	BRAKE RETAINER PLATE	1
18	STEEL BALL	1

DISASSEMBLY

Place the brake assembly onto a work bench with the disc end down. Remove the two 3/8 in. capscrews (2) securing the bearing carrier (14) to the brake housing (15) and remove the carrier. Remove the retaining ring from inside of the carrier and remove the rotary seal and O-Ring assembly; replace as required. Inspect the bearing cup (1) in the bearing carrier; replace as required.

Remove and discard the three O-Rings (5) from the oil port grooves in the brake housing. Remove the two brake springs (13). Note the position of the springs for reassembly.

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

Remove retaining ring (9) and pressure plate (17).

Remove the friction discs and steel discs (11 & 12).

Inspect the friction discs for wear and flatness. Original friction disc thickness is .138-.144 in. (3.5-3.8 mm). The oil groove depth of a new disc is .015 in. (.38 mm) minimum. Replace friction discs if oil groove is .005 in. (.13 mm) or less, the disc is not flat or friction material is worn unevenly.

Inspect the steel discs (12) for scoring and warping. Replace steel discs if they are not flat beyond .015 in. (.4 mm), heat discolored, or show signs of friction material transfer.

Remove retaining ring (8) and piston retainer (3). Push brake piston (4) free of brake housing. Remove and discard o-rings (6 & 16) from the grooves of the brake piston.

ASSEMBLY

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

Install brake piston O-Rings (6,16) into grooves of brake piston. Lubricate O-Rings after installation with winch oil or light general purpose grease.

Lubricate brake piston sealing surfaces and install brake piston (4) into the brake housing until fully seated.

Install piston retainer (3) over piston hub with the large diameter end facing up. Secure in place with retaining ring (8).

The PA55 and PA56 brake pack requires no adjustment. Position the brake housing with the disc end of the housing facing up.

Install the inner steel disc (12) into the brake housing against the piston retainer.

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

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

Install a friction disc (11) and alternate with a steel disc (12) until a total of eight friction and eight steel discs have been installed.

Install the outer pressure plate (17) and secure in place with a retaining ring (9).

BRAKE SPRING INSTALLATION

Position the brake housing with the disc end facing down.

Install the two brake springs (13) into the housing against the brake piston with the dished (concave) side of the springs facing away from each other.

⚠ WARNING ⚠

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

Install three O-Rings (5) into the oil port grooves on the outer end of the brake housing.

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

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

Install O-Ring (7) into the groove on the pilot of the bearing carrier.

Install the bearing carrier (18) onto the brake housing while aligning the oil ports between the two housings. Install the two 3/8 in. capscrews (2) and tighten to 31 lb•ft (42 N•m) torque.

BRAKE ASSEMBLY TEST PROCEDURE

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

Lubricate and install an O-Ring (5) into the grooved brake housing port labeled with a “B” cast onto the bearing carrier.

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

Locate the external brake release port next to the “B” cast into the bearing carrier. The port is -6 ORB on current units. Attach a hand pump with an accurate 0-500 psi (0-3450 kPa) gauge teed into the line.

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

The brake should be fully released at approximately 230 - 250 psi (1590 - 1720 kPa).

Continue to increase pressure to 350 psi (2410 kPa). Close the hand pump valve and let stand for five minutes. If there is any loss of pressure in five minutes, the brake cylinder should be disassembled for inspection of the seals and sealing surfaces.

While pressure is applied and the brake is released, align the friction discs. If the clutch shaft group has been disassembled, use the brake hub to align the splines of the discs.

INSTALLATION

Refer to “Clutch Shaft Service” for additional information.

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

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

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

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

Install the six capscrews which secure the brake housing to the winch case. Tighten to 75 lb•ft (102 N•m) torque.

Refill winch to proper level with recommended oil.

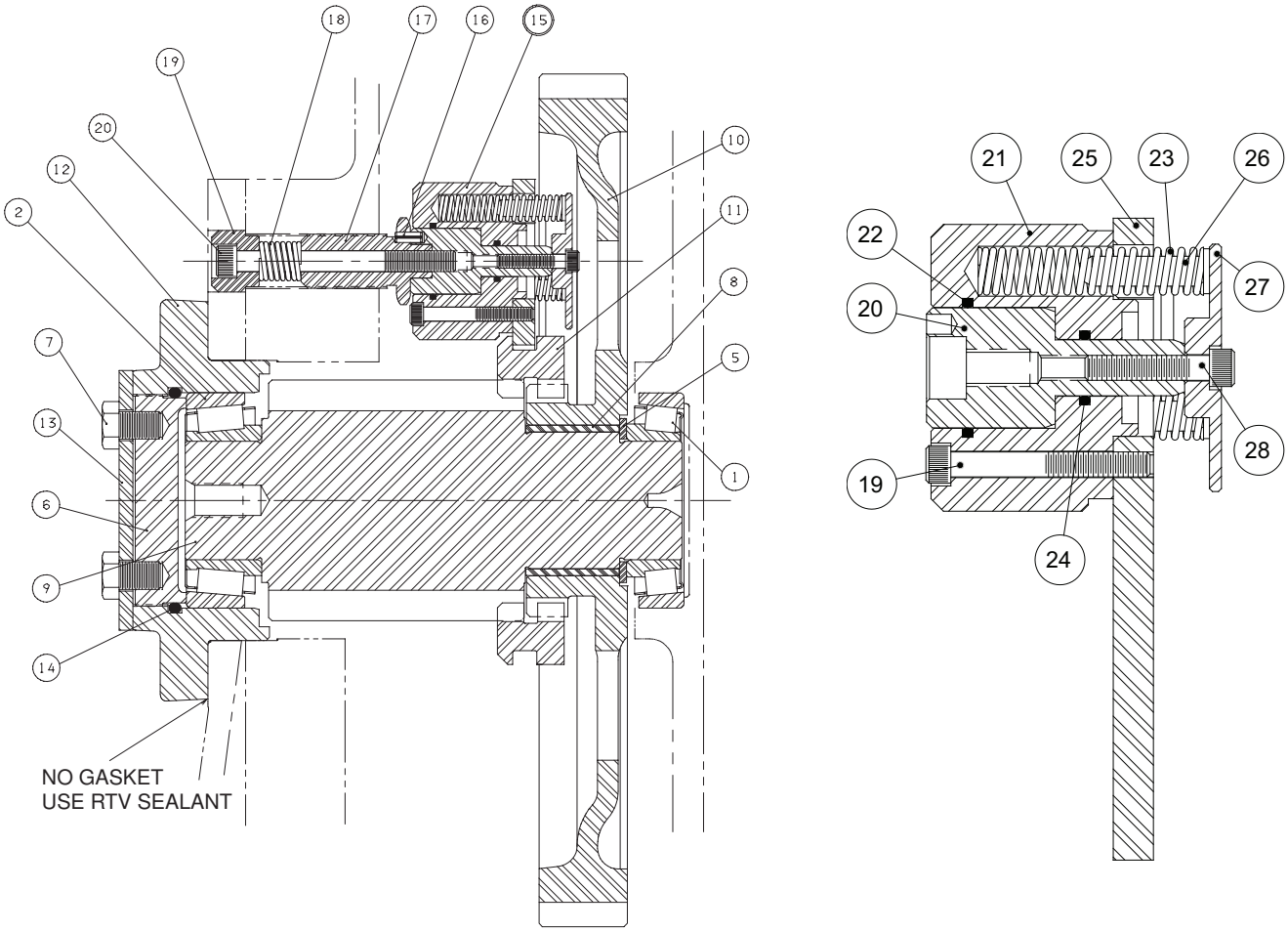
Installation When Clutch Shaft Group has NOT been Disassembled: Refer to parts illustration on page 32.

Do not install brake springs and bearing carrier on to brake housing until brake housing is installed in winch case. Install three o-rings (16) into oil tube grooves in the brake housing and three grooves in the winch case ports. Install the original shim set (34) onto the brake housing followed by the brake housing o-ring (18). Install the brake housing assembly into the winch case and align the brake friction discs with the splines on the brake hub (28). Since the brake springs are not yet installed, the brake discs are easy to move and align with the hub. Make certain the brake housing is fully against the winch case and all eight brake friction discs are on the brake hub.

Apply a small amount of general purpose grease to the outside diameter of the inner brake spring and install into the recess in the brake piston. Apply a small amount of grease to the outer brake spring and install into the recess in the bearing carrier (cover). Install the three port o-rings into the outer surface of the brake housing. Install the large o-ring onto the pilot of the bearing carrier (cover) then apply a small amount of general purpose grease to the o-rings. Install the bearing carrier onto the brake housing being careful to keep the brake springs confined in the recesses of the brake piston and bearing carrier. Install the two 3/8 inch capscrews and hand tighten.

Install the six, long ½ inch capscrews that secure the brake assembly to the winch case and tighten to 75 lb.-ft. (102 N-m) torque. Tighten the two 3/8 inch capscrews to 311 lb.-ft. (42 N-m) torque.

IDLER SHAFT GROUP



ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	BEARING	1	15	FREESPOOL CYLINDER ASSEMBLY	1
2	BEARING	1	16	ROLL PIN	1
3	CAPSCREW (1/2 - 13 X 1-1/4 G8 Z)	1	17	CYLINDER STUD	1
4	CAPSCREW (1/2 - 13 X 2 G8 Z)	1	18	SPRING	1
5	THRUST BEARING	2	19	CAPSCREW (1/4 NC X 2 SOC. HEAD)	3
6	ADJUSTER	1	20	CYLINDER ROD	1
7	CAPSCREW (1/2 - 13 X 3/4 G8 Z)	1	21	CYLINDER	1
8	BUSHING	1	22	O-RING	1
9	PINION	1	23	SPRING	1
10	FIRST REDUCTION GEAR	1	24	O-RING	3
11	CLUTCH COLLAR	1	25	YOKE	1
12	BEARING CARRIER	1	26	SPRING GUIDE	3
13	LOCK PLATE	1	27	CYLINDER RETAINER	1
14	O-RING	1	28	CAPSCREW (1/4 NC X 1-1/4 SPECIAL)	1

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

REMOVAL

Drain the oil from the winch as described in the “Preventive Maintenance” section if this manual.

Remove two capscrews (7) and the lock plate (13) from the idler shaft bearing carrier (12) and adjuster assembly.

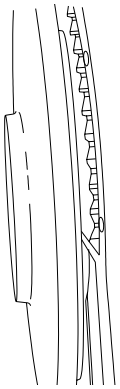
Remove the four capscrews securing the idler shaft bearing carrier and adjuster assembly to the winch. Use two (2) of these capscrews as jackscrews, and remove the carrier and adjuster assembly. (Use 1/2 - 13 tap to clean paint from jackscrew holes.)

Note the location of the two long capscrews.

Inspect the bearing cup and cone. Replaced as required.

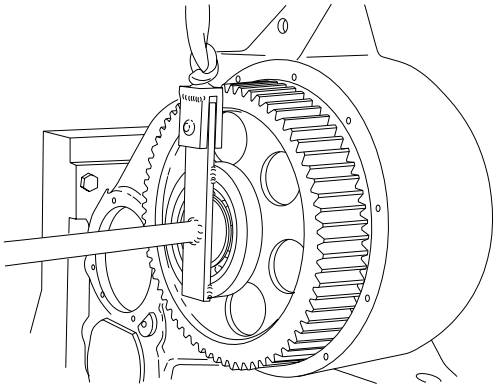
Turn the adjuster (6) counter-clockwise (CCW) and remove it from the bearing carrier. Remove and discard the O-ring (14) from the carrier.

Remove the capscrews from the large diameter second reduction shaft bearing carrier cover, and carefully remove the cover. There are two jackscrew holes in the cover.



⚠ WARNING ⚠

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



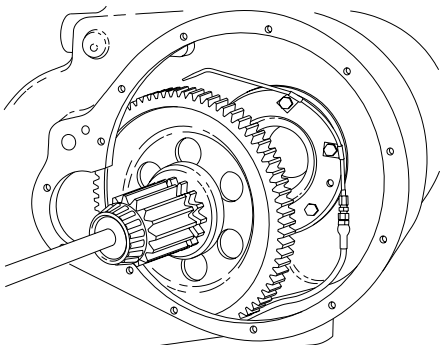
With a suitable lifting fixture or sling, remove the second reduction drum drive gear and shaft assembly from the winch case. The gear and shaft assembly weight is approximately 155 lb. (70 kg).

Remove the freespool hose from the cylinder.

Remove the cylinder rod capscrew (20), spring (18) and retainer washer (19) from the winch case.

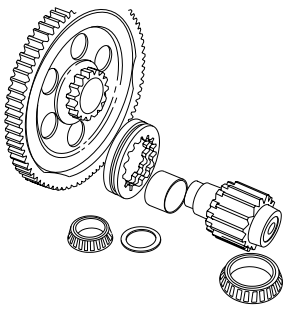
Rotate the cylinder assembly (15) around the clutch collar (11) toward the case wall opening and remove it from the winch case.

You may remove the cylinder stud (17) from the winch case, as required.



Together, remove the second reduction pinion (9) and first reduction gear (10) from the winch case. Press the pinion from the gear and bearings.

Inspect the bushing (8) in the first reduction gear for scoring or excessive wear. The bushing should fit freely over the pinion.



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

FREESPOOL CYLINDER ASSEMBLY SERVICE

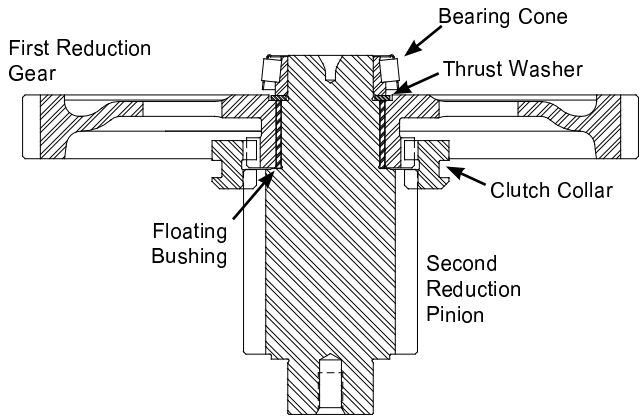
Remove the capscrew (20), retainer washer (27), springs (23) and spring guides (26).

Remove the cylinder rod (20) from the cylinder (21).

Inspect the sealing surfaces for scoring or other abnormal wear and replace components as required. Use new O-rings (24, 24) when reassembling.

Apply Loctite 242, or equivalent, to clean, dry threads of the capscrews during reassembly.

ASSEMBLY



Place the second reduction pinion on a flat surface with the small diameter end facing upward.

Lubricate the bushing and mating surfaces of the second reduction pinion with new winch oil, and install the bushing over the pinion.

Install the freespool clutch collar over the first reduction gear with the beveled side of the collar facing down toward the large end of the pinion.

Lubricate the outside diameter of the bushing and the first reduction gear bore with new winch oil. Install the first reduction gear and clutch collar assembly over the bushing, aligning the second reduction pinion teeth with the splined collar teeth. The clutch collar MUST be installed with the chamfered edge toward the pinion.

Install the thrust washer (5) over the second reduction pinion and into the recess of the first reduction gear.

Press the inner bearing cone over the end of the second reduction pinion, until the bearing cone is resting firmly against the thrust washer.

Press the outer bearing cone over the end of the second reduction pinion, until the bearing cone is resting firmly against the pinion shoulder.

If required, lubricate and install the bearing cup into bore in the inner wall of the winch case.

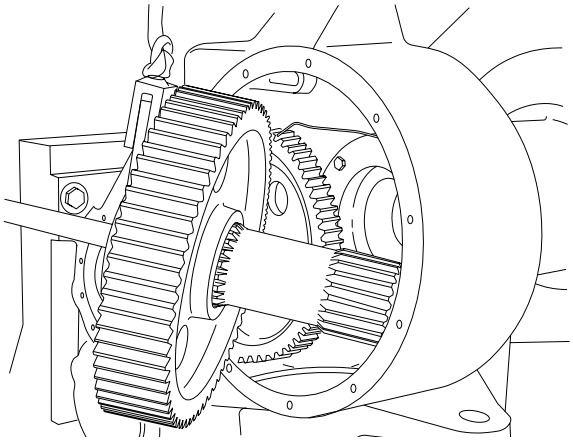
Place the first reduction gear and second reduction pinion assembly into the winch case opening, aligning the inner bearing cone within the bearing cup.

If required, install the cylinder stud into the winch case. Use Loctite 242, or equivalent, on clean, dry threads.

Install the freespool cylinder assembly into the winch case. Engage the clutch collar with the yoke. Rotate the cylinder assembly into alignment with the cylinder stud. BE SURE the roll pin in the stud engages the hole in the cylinder assembly.

Install the capscrew, spring and retainer. Apply Loctite 242, or equivalent, and torque to 45 lb•ft (61 N•m).

Temporarily install the idler shaft bearing carrier subassembly (bearing carrier, adjuster and O-ring) into the winch case to support the outer end of the second reduction pinion. Apply shop air pressure, approximately 100 PSI (69 kPa), to the freespool cylinder. Adjust the freespool cylinder stud into the winch case wall as required to allow the clutch collar to clear the edge of the pinion teeth, but still maintain maximum tooth contact while engaged. Install the hydraulic hose onto the freespool cylinder.



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

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

⚠ WARNING ⚠

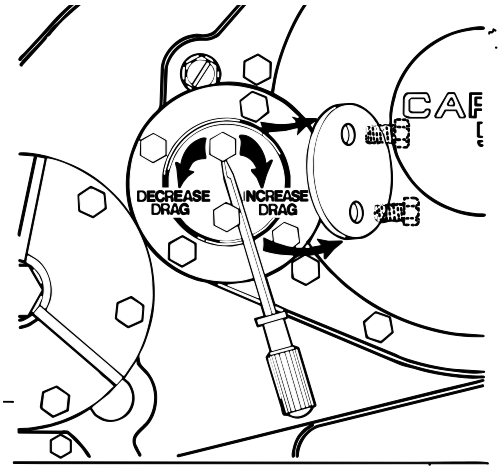
The second reduction drum drive gear and drum drive shaft assembly weighs approximately 155 lb. (70 kg). Use a suitable lifting fixture or sling and take proper precautions when lifting this assembly to prevent possible personal injury. If the gear and shaft assembly is not seated fully into the cable drum as defined, it could become dislodged and fall from the winch case causing personal injury.

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

Lubricate and install the O-ring (14) into the groove in the bearing carrier. Install the threaded adjuster (16) into the bearing carrier until it is lightly seated against the bearing cup.

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

Install the bearing carrier to the winch case. Apply thread sealant to the capscrews and torque evenly to 75 lb•ft (102 N•m). Evenly tighten the large cover capscrews in a cross pattern to 75 lb.-ft. (102 N-m) torque.



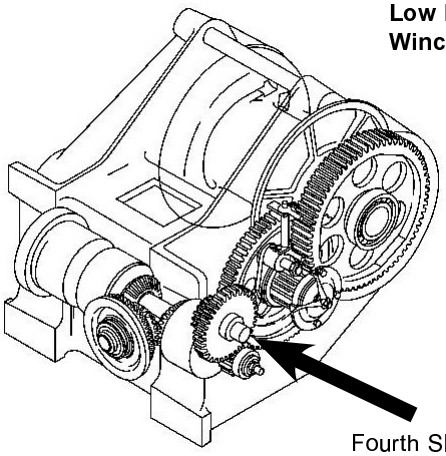
Using a pry bar or a screwdriver approximately 18 in. (460 mm) in length, turn the threaded adjuster clockwise (CW) until tight. Tap the adjuster with a hammer to seat the bearing and continue turning the adjuster, then tapping with the hammer, until it can no longer be tightened. Back the adjuster out, by turning counter-clockwise (CCW), 1/16 turn maximum (22.5°) and secure in place with the lockplate and capscrews. Torque the lock plate capscrews to 75 lb•ft (102 N•m).

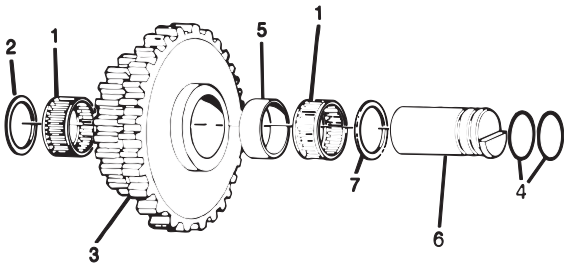
NOTE: *Tightening the threaded adjuster pushes the bearing cup (outer race) into heavier contact with the bearing cone, increasing the bearing drag; much like tightening a wheel bearing nut in an automobile or truck. The snug fitting bearing cup will not move outward with the threaded adjuster when the adjuster is loosened. The winch MUST be operated under load for a brief period to allow the gear train load to push the bearing cup outward against the adjuster before a reduction in bearing drag is noticed.*

⚠ CAUTION ⚠

DO NOT back the adjuster out more than 1/16 turn (22.5°) as this allows excessive shaft endplay. Excessive endplay may cause gear train misalignment, excessive noise and accelerated wear.

FOURTH SHAFT GROUP



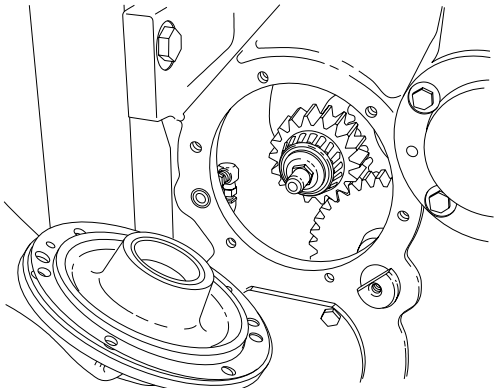


ITEM	DESCRIPTION	QTY.
1	Roller Bearing	2
2	Thrust Washer - 0.062 in. (1.58 mm)	2
3	Cluster Gear	1
4	O-Ring	1
5	Spacer	1
6	Countershaft Pin	1
7	Thrust Washer - 0.217 in. (5.5 mm)	1

Model PA56 winches are equipped with the “Fourth Shaft Group”. This group contains a cluster gear which provides additional reduction in the gear train. Most PA55 winches are of the 3-shaft configuration.

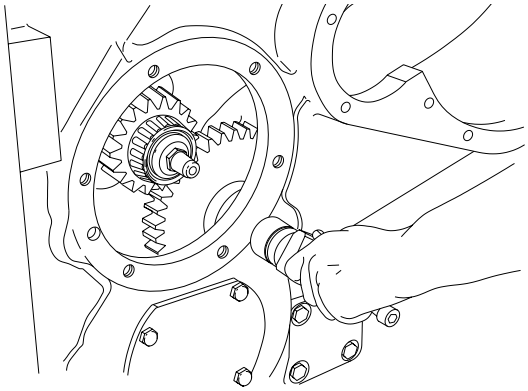
DISASSEMBLY

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



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

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



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

⚠ CAUTION ⚠

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

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

ASSEMBLY

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

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

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

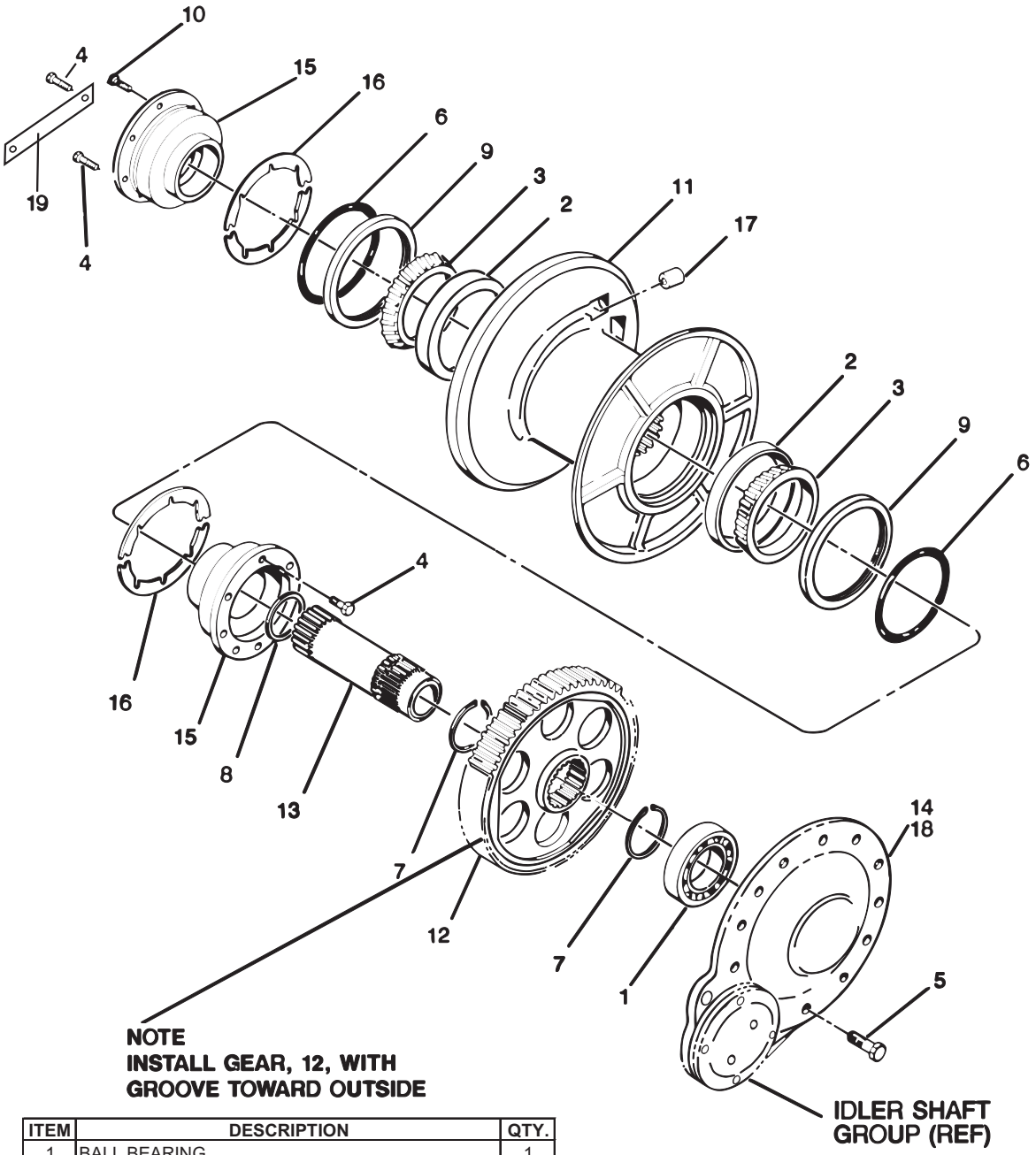
Rotate the countershaft pin so that the slotted end is properly positioned to permit clutch shaft bearing carrier installation.

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

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

Refill winch to the proper level with recommended oil.

CABLE DRUM GROUP



ITEM	DESCRIPTION	QTY.
1	BALL BEARING	1
2	BEARING CUP	2
3	BEARING CONE	2
4	CAPSCREW, HEX HEAD (1/2 - 13 X 1 G5 SS)	12
5	CAPSCREW, HEX HEAD (1/2 - 13 X 1 1/4 G5)	11
6	O-RING	2
7	RETAINING RING, EXTERNAL	2
8	RETAINING RING, INTERNAL	1
9	OIL SEAL	2
10	CAPSCREW, SOCKET HEAD (1/2 - 13 X 1 G8 SS)	1
11	CABLE DRUM	1
12	SECOND REDUCTION GEAR	1
13	SECOND REDUCTION GEAR SHAFT	1
14	BEARING CARRIER, COVER	1
15	BEARING CARRIER, DRUM	1
16	SHIM SET (2 pair each, .005, .007, .020 in.	2
17	FERRULE - 3/4 IN. (19 mm) WIRE ROPE	1
	FERRULE - 7/8 IN. (22 mm) WIRE ROPE	1
	FERRULE - 1 IN. (25 mm) WIRE ROPE	1
18	NO GASKET, Use RTV 730 or equivalent	--
19	VALVE MOUNTING PLATE	1

SS - SELF SEALING

DISASSEMBLY

⚠ WARNING ⚠

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from sudden release of oil pressure. To discharge the accumulator, stop engine, turn key switch on slowly cycle joystick into full Reel-In then Reel-Out positions a minimum of five (5) times.

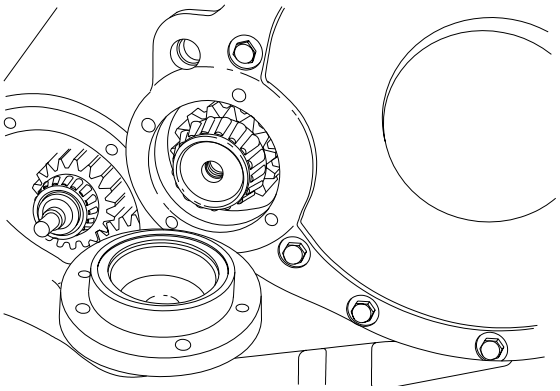
⚠ WARNING ⚠

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.

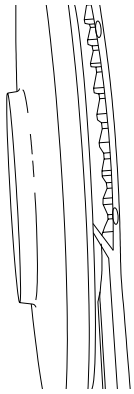
Remove the right hand winch housing cover.

Remove the two long capscrews securing the control valve to the mounting plate. Remove the spin-on filter and lower the control valve in the winch case.

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



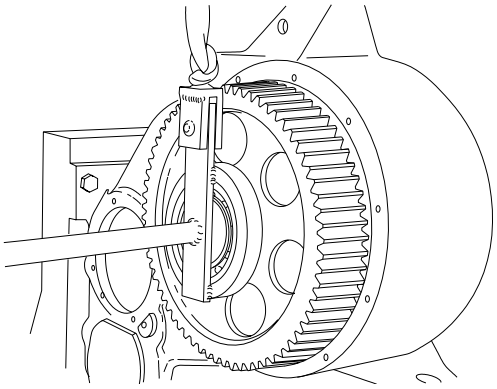
Remove the four capscrews securing the idler shaft bearing carrier and adjuster to the winch. Use two capscrews as jackscrews to remove the carrier from the winch.



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

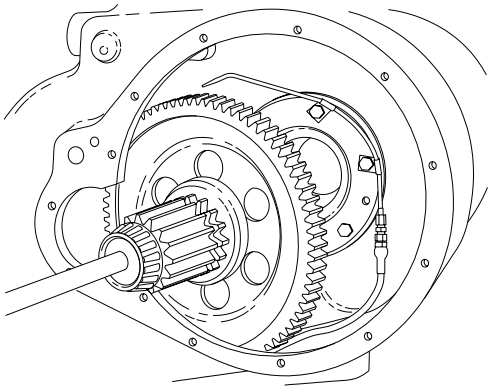
⚠ CAUTION ⚠

Use a pry bar between the bearing carrier cover and the second reduction drum drive gear to unseat the ball bearing from cover. Do not allow the cable drum drive gear to slide free of the winch case. The gear assembly may fall from the cover and cause personal injury. Gear and shaft weigh approximately 155 lb (70 kg).



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

Remove the freespool cylinder and yoke assembly from the first reduction gear.



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

Support the cable drum with a nylon sling and remove capscrews (4) from the right hand drum bearing carrier (15). Using jackscrews, remove the drum bearing carrier.

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

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

Inspect bearing cones (3) and replace as required.

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

Remove cable drum oil seals (9).

Inspect bearing cups (2) and replace as required.

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

ASSEMBLY

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

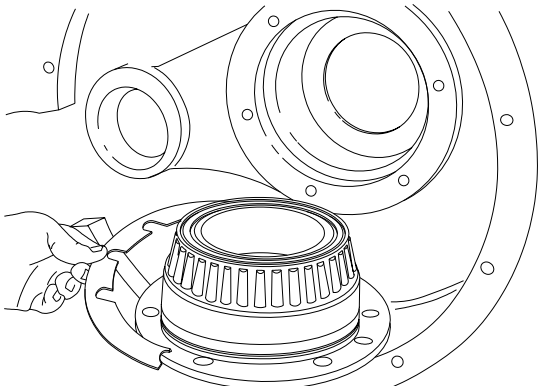
Install oil seals (9) into the cable drum with the spring side of the seal facing toward the cable drum.

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

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

Lightly lubricate bearing cones (3) with multi-purpose bearing grease and install onto the bearing carriers.

Suspend the cable drum in the winch case with the cable ferrule pocket on the right hand side. Lubricate the bearing cups (2) and oil seals (9) with general purpose grease. Install the right hand bearing carrier into the winch case and cable drum using the original shim set (16), if available. Apply non-hardening thread sealant to the capscrews and tighten to 75 lb•ft (102 N•m) torque.



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

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

NOTE: *It is best to keep the drum end play close to the minimum value given above.*

Install the first reduction gear and pinion assembly into the winch. Install the freespool cylinder and yoke. Refer to the “Idler Shaft Group” section of this manual for additional information.

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

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

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

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

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

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

Place the control valve into position and install capscrew and tighten to 75 lb•ft (102 N•m) torque.

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

Refill winch with recommended lubricant.

CONTROL VALVE SERVICE

Make certain that all applicable troubleshooting procedures have been completed BEFORE removing or disassembling the control valve. Refer to the “Control System Operation and Troubleshooting” section of this manual for more information. All repairs to the control valve must be performed in a clean work environment.

CONTROL VALVE REMOVAL AND DISASSEMBLY

1. Stop the tractor engine. With the key switch in ON position, discharge the accumulator stored oil supply by slowly cycling the joystick control lever into full REEL-IN then REEL-OUT positions as a minimum of (5) times.

⚠ WARNING ⚠

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from sudden release of oil pressure. To discharge the accumulator, stop the engine, turn the key switch on, then slowly cycle the joystick lever into full REEL-IN and REEL-OUT positions a minimum of five (5) times. **NOTE: The tractor electrical system must be ON.**

2. Remove the filter and valve access cover from the RH side of the winch case.

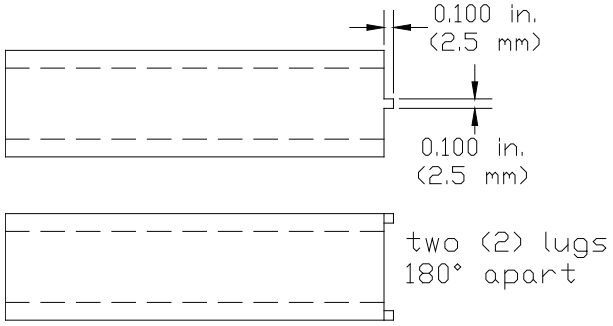
3. Remove the filter element from the filter head. Carefully tag all hoses to aid assembly then remove all of the hoses from the control valve. Disconnect the wiring harness from the solenoids at all connections. The wires are color keyed. Refer to the “Control System Operation and Troubleshooting” section of this manual for wire color/function and connection point information.

4. Remove the pump supply hose from the filter head. Remove the two (2) capscrews that secure the valve to the mounting bracket and remove the valve assembly from the winch case.

5. Place the valve on a clean work surface and remove the filter head assembly from the valve.

6. The solenoid valves may be removed from the valve housing by first removing the solenoid coil from the valve cartridge.
   a.Carefully bend the lock tab down and away from the retaining nut.
   b. Remove the retainer nut from the top of the solenoid and lift the coil off of the cartridge.
   c. Remove the solenoid valve cartridge from the valve housing.

7. Remove the two (2) check valve assemblies from the valve housing through the front, or forward, face of the valve. Build the special spanner socket, defined below, for use in removing the check valves.

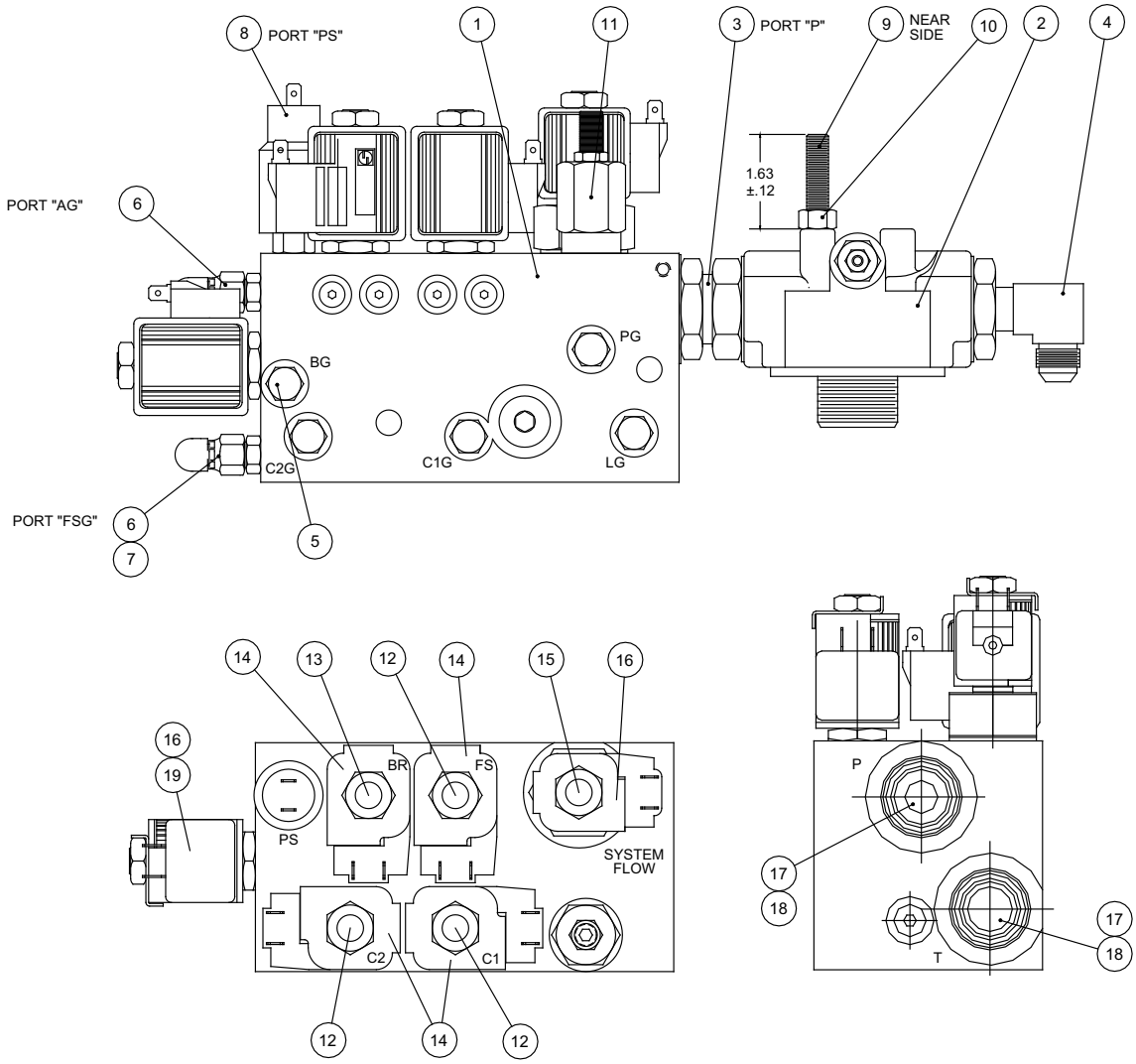


8. Thoroughly clean and inspect all parts of the control valve. Replace the check valve assembly if there is any damage to the sealing surfaces of the stem and the housing.

ASSEMBLY AND INSTALLATION

1. Install new O-rings and back-up rings on the solenoid valves before installation. Seal kits are available for all of the valve cartridges. Lubricate the seals with new winch oil prior to assembling.

2. Unless you are installing new components, carefully install the solenoid valve cartridges back into the valve housing bores they were originally removed from. Tighten the valve cartridges to the torque values listed in the chart on page 55.



ITEM NO.	DESCRIPTION	QTY.	TORQUE VALUE	
			lb·ft	N·m
1	CONTROL VALVE HOUSING	1	--	--
2	FILTER HEAD	1	--	--
3	UNION	1	--	--
4	ELBOW	1	15	20
5	PLUG, HEX HD	5	5.5	7
6	ELBOW	2	5.5	7
7	CAP	1	--	--
8	PRESSURE SWITCH	1	5.5	7
9	STUD	1	--	--
10	NUT	2	--	--
11	RELIEF VALVE	1	25	35
12	SOLENOID VALVE (C1, C2, F/S)	3	50	70
13	SOLENOID VALVE (BRAKE)	1	22	30
14	COIL, SOLENOID (C1, C2, F/S, BRAKE)	4	3	4
15	SOLENOID VALVE (MAIN PRESSURE)	1	80	110
16	COIL, SOLENOID (MAIN PRESSURE, ACCUMULATOR)	2	3	4
17	CHECK VALVE	2	--	--
18	CHECK VALVE RETAINER	2	60	80
19	SOLENOID VALVE (ACCUMULATOR)	1	50	70

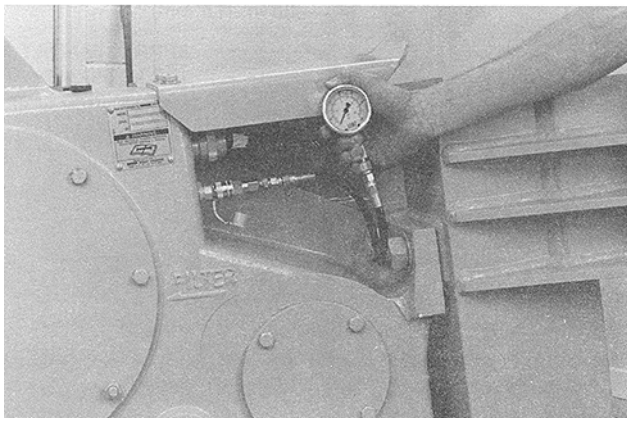
3. Install the filter head assembly into the valve housing, after all solenoids have been installed.

4. Install the valve/filter sub-assembly into the winch case. Install the two (2) capscrews that secure the valve to the mounting bracket. Evenly tighten the capscrews to 35 lb•ft (47 N•m). Install the pump supply hose onto the filter head assembly.

5. Lubricate the seal and install the filter element onto the filter head. Tighten the filter ¾ turn, by hand, after the seal makes contact with the filter head. Attach the wiring harness leads to the proper solenoid and pressure switch contact points. Refer to the wiring diagram on page 10 of this manual. Attach the grounding terminal (black wire) to the upper RH corner of the valve housing with the machine screw. Install all of the hydraulic hoses onto the valve assembly, then fill the winch to the proper level with the recommended oil.

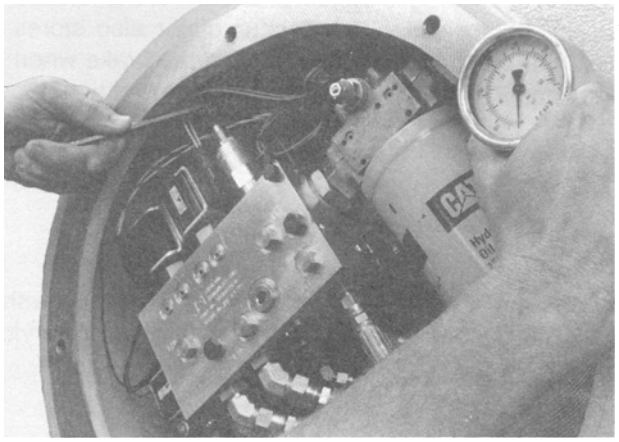
PRESSURE ADJUSTMENT

1.



Install an accurate 0-600 PSI (0-4140 kPa) pressure gauge to the main pressure tap on the front of the winch. Start the tractor engine and operate approximately 800 RPM for about five (5) minutes to purge the air from the hydraulic lines. The standby oil pressure should charge up to 340 PSI (2345 kPa), then slowly fall back to 290 PSI (2000 kPa). This pressure is controlled by the pressure switch signaling the main pressure solenoid, and is not adjustable.

2.



Place the control lever into the BRAKE-OFF position and record the pressure. When a winch function is selected, the main pressure, controlled by the relief valve, should be 390-410 PSI (2690-2830 kPa) at low idle. If the main pressure is not within this range, loosen the jam nut on the relief valve and turn the adjusting screw. A ¼ in. Allen wrench is required for this adjustment. After making adjustments, retighten the jam nut. Shut the tractor engine off, turn the tractor key switch to the ON position, and discharge the accumulator stored oil supply by slowly cycling the control lever between REEL-IN and REEL-OUT five (5) times.

⚠ WARNING ⚠

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from sudden release of oil pressure. To discharge the accumulator, stop the engine, turn the key switch on, then slowly cycle the joystick lever into full REEL-IN and REEL-OUT positions a minimum of five (5) times. **NOTE: The tractor electrical system must be ON.**

3. Remove the pressure gauge from the main pressure tap then install the filter / valve access cover with a new gasket as required. Tighten the cover fasteners to 75 lb•ft (100 N•m).

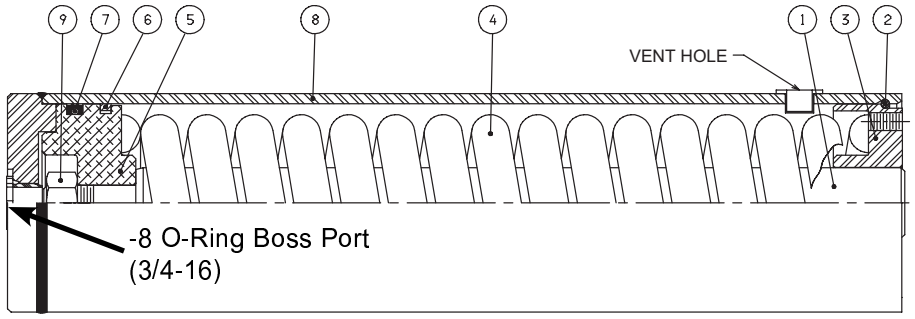
ACCUMULATOR SERVICE

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

⚠ WARNING ⚠

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

The spring-type accumulator DOES NOT require any periodic recharging or servicing.



Rod extension at no pressure is 0.06 in. (1.5 mm).

Rod extension at 400 psi (2760 kPa) is approximately 1.57 in. (40 mm)

⚠ WARNING ⚠

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

ITEM	DESCRIPTION	QTY.
1	Rod	1
2	Retaining Ring	1
3	Rod Guide	1
4	Spring	1
5	Piston	1
6	Cast Iron Piston Ring	1
7	Seal Assembly	1
8	Tube Assembly	1
9	Nut	1

PISTON SEAL TEST PROCEDURE

1. If the accumulator is installed in the winch case, remove the accumulator hose from the “A” port of the control valve. The accumulator may then be tested in the winch case.
2. Connect a hand pump with accurate 0-600 psi (0-4137 kPa) gauge and shut-off valve to the accumulator. Apply 400 psi (2758 kPa) to the accumulator. Close shut-off valve securely. Measure rod extension beyond rod guide. If rod extension decreases more than 1/8 in. (3 mm) in one minute, the accumulator should be disassembled and new seals installed.

⚠ WARNING ⚠

2,000 lb (900 kg) spring preload! ALWAYS use a press for disassembly per service instructions given below. If rod guide removal is attempted without using a press, property damage, injury or death may result.

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

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

3. Slowly release pressure on the press and remove rod guide (3), spring (4) and piston/rod assembly.

TIP: *The cast iron piston ring (6) will attempt to expand into the retaining ring groove when the piston is removed from the tube. To reduce the chances of this happening, pack the groove with heavy grease and withdraw the piston rod assembly quickly past the groove.*

4. Replace piston seals (6 & 7). While the accumulator is disassembled, check the piston retaining nut (9). It should be tightened to 120 lb•ft (163 N•m) torque.
5. Lubricate tube and piston seals with winch lubricant. Install an automotive type piston ring compressor around the piston making certain the step cut piston ring is properly compressed.
6. Press piston into tube and push to bottom of tube. Install spring and rod guide.
7. With the tube secured in a press, press rod guide into tube approximately ½ in. (13 mm) below the outer edge of the tube. Install a **new** retaining ring (2) securely into the groove in the tube.
8. Slowly release pressure on the press. Observe that the rod guide has fully seated the retaining ring into the groove.
9. Retest piston seals to make certain seals were not damaged during installation.