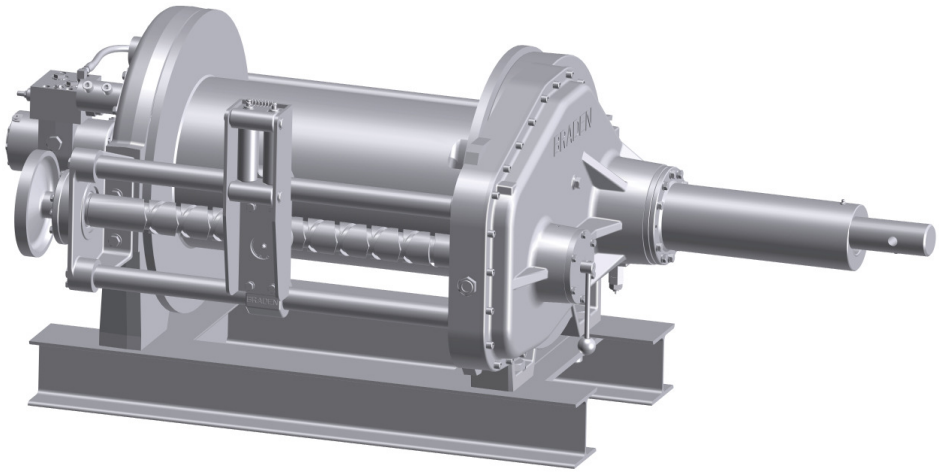
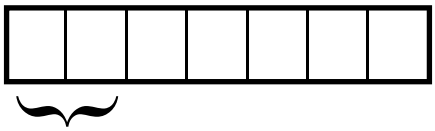
BRADEN
A PACCAR COMPANY

BP200C
HYDRAULIC PLANETARY UNDERGROUND PULLING WINCH
INSTALLATION, MAINTENANCE AND SERVICE MANUAL



Record serial number below:



First 2 numbers indicate year of manufacture
(for serial number location, see page 3).

Visit www.paccarwinch.com for the most up-to-date product and service information.
Technical publications for most PACCAR Winch products are available for download.

800 East Dallas | Broken Arrow, OK 74012
www.paccarwinch.com | 918.251.8511
LIT2893 PB303_5-2022 (CPR) ©2022 PACCAR Inc

MADE IN THE USA

Table of Contents

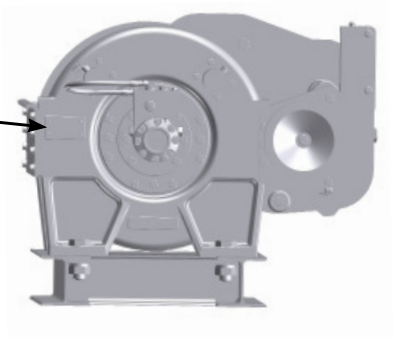
FOREWORD

The following service instructions have been prepared to provide assembly, disassembly and maintenance information for the BRADEN Model BP200C series winch. It is suggested that before doing any work on these units, all assembly and disassembly instructions should be read and understood.

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

Continuing product improvement may cause changes in your winch, which are not included in this manual. Whenever a question arises regarding your BRADEN Winch or this manual, please contact BRADEN Service Department for the latest available information.

Model Number
Serial Number



The model and serial numbers of BRADEN BP200C winches are located on the left side of the hydraulic motor. ***Always*** reference both of these numbers when ordering replacement parts. Our goal is to ship the correct parts, the first time.

EXPLANATION OF MODEL NUMBER

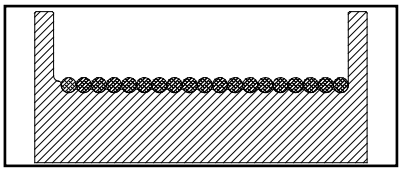
BP200 C - 23 212/106 - 1/2 - 46 H

BP200	DESIGNATES MODEL BP200 (20,000 Lb FIRST LAYER LINE PULL)
C	DESIGNATES THE MODEL SERIES RELATING TO DESIGN CHANGES
23	DESIGNATES TOTAL GEAR REDUCTION
212/106	DESIGNATES HYDRAULIC MOTOR DISPLACEMENT IN CU IN./REV (212/106 = 2 SPEED MOTOR 21.2/10.6 CU IN./REV)
1/2	DESIGNATES THE INITIAL LEVEL WIND SETTING (1/2 = 0.5 INCH WIRE ROPE) (AVAILABLE SIZES ARE 7/16 IN., 1/2 IN., AND 9/16 IN.)
46	DESIGNATES EXTENSION SHAFT LENGTH (CENTERLINE OF DRUM TO END OF SHAFT) (00 = NO EXTENSION SHAFT) (AVAILABLE LENGTHS ARE 46 IN., 47 IN., AND 50 IN.) (EXTENSION SHAFT LENGTH CAN BE INCREASED BY 2 INCHES IN THE FIELD)
H	DESIGNATES HYDRAULIC CLUTCH AND DRAG BRAKE CONTROLS (BLANK = AIR [STANDARD])

GLOSSARY

Brake Valve — A hydraulic counterbalance valve should be connected to the reel-in port of the hydraulic motor. It allows oil to flow freely through the motor in the winching direction. When oil pressure tries to rotate the motor in the reel-out direction, the brake valve blocks the flow of oil out of the motor until the internal static brake is released. It then controls reel-out speed based on the load and flow of oil to the motor. All the heat generated by controlling the speed of the load is dissipated by the hydraulic system, not by the internal static brake.

Grooved Drum — A cable drum with grooves on the barrel to ensure the first layer of cable spools properly onto the drum. The grooves can be cast or machined into the drum, or cast or machined into separate pieces that are mechanically fastened to the drum.
NOTE: Only one size cable can be used on a grooved drum.



Sprag or Overrunning Clutch — A mechanical one-way clutch on the input shaft of the winch, between the input shaft and the static mechanical brake. The clutch allows the input shaft to turn freely in the direction required to spool cable onto the drum, then immediately locks the winch gear train to the mechanical brake when the winch is stopped, holding the load in place.

Static, Mechanical, or Load-holding Brake — A multidisc, spring-applied, hydraulically released brake that works together with the sprag clutch to hold a load. This brake is not designed to stop a load being lowered, but holds the load in place when the winch is not in operation.

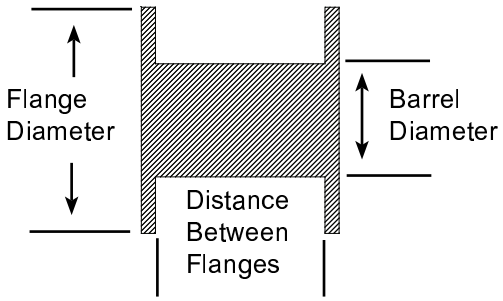
First-layer Line-pull Rating — The maximum rated line pull (in pounds or kilograms) on the first layer of cable. The maximum rating for any particular winch is based on maintaining an acceptable structural design factor and service life. Certain combinations of drum, gear ratio, motor and hydraulic pressure, may reduce this rating.

First-layer Line-speed Rating — The maximum rated line speed (in feet or meters per minute) on the first layer of cable. Certain combinations of drum, gear ratio, motor, and hydraulic flow may reduce or increase this rating.

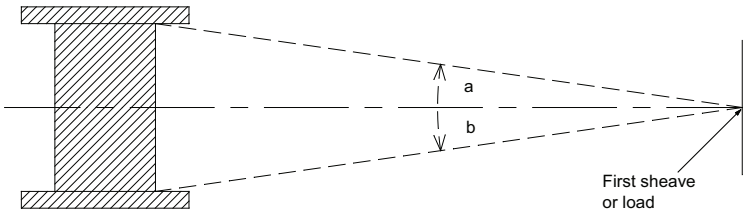
D/d Ratio — The ratio of cable drum barrel diameter (D) to wire/synthetic rope diameter (d). Current SAE standards require a minimum of 8:1.

EXAMPLES:
If you know the cable diameter you want to use, multiply it by 8 to get the MINIMUM cable drum barrel diameter (such as 1/2-inch wire rope X 8 = 4 inches — this is the minimum winch barrel diameter).
If you know the barrel diameter, divide it by 8 to get the MAXIMUM wire/synthetic rope diameter.
(such as 8-inch barrel diameter / 8 = 1 — this is the maximum wire/synthetic rope diameter)

Cable Drum Dimensions —



Fleet Angle — The angle between the wire/synthetic rope position at the extreme end wrap on a drum, and a line drawn perpendicular to the axis of the drum, through the center of the nearest fixed sheave or load attachment point.



First sheave or load should be centered between the drum flanges, so that angles A and B are equal.

Angles A and B should be a minimum of 1/2 degree and a maximum of 1-1/2 degrees.

Wrap — A single coil of wire/synthetic rope wound on a drum.
Layer — All wraps of wire/synthetic rope on the same level between drum flanges.
Freeboard — Amount of drum flange that is exposed radially past the last layer of wire/synthetic rope. Minimum freeboard varies with the regulatory organization. ASME B30.5 requires 1/2-inch minimum freeboard. SAE J706 requires minimum freeboard of 0.7d, where d is rope diameter.

GENERAL SAFETY RECOMMENDATIONS

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

1. The BRADEN BP200C is neither designed nor intended for use or application to equipment used in the lifting or moving of persons.
2. Inspect rigging and winch at the beginning of each work shift. Defects should be corrected immediately.
3. Keep equipment in good operating condition. Perform scheduled servicing and adjustments listed in the "Preventive Maintenance" section of this manual.
4. An equipment warm-up procedure is recommended for all start-ups and essential at ambient temperatures below +40°F (+5°C). Refer to "Warm-up Procedure" listed in the "Preventive Maintenance" section of this manual.
5. Be certain any equipment attached to the cable is either lowered to the ground or blocked securely (i.e. NO LOAD on the cable drum) before servicing, adjusting or repairing the winch.
6. Before operating the winch, be sure ALL safety procedures and equipment for the vehicle the winch is mounted in are properly followed and/or in place.
7. Be sure personnel are clear of the work area BEFORE operating the winch.
8. Read all warning and caution tags provided for safe operation and service of the winch and become familiar with the operation and function of all controls before operating the winch.
9. Never operate winch controls unless you are properly positioned at the operators station and you are sure personnel are clear of the work area.
10. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
11. Ground personnel should stay in view of the operator and clear of the winch drum. Do not allow anyone near a winch line under tension. A safe distance of at least one and one-half (1-1/2) times the length of the unspooled wire rope should be maintained.
12. The winch clutch may disengage and drop or lose control of a load if it is not fully engaged at the beginning of a lift or pull. The winch operator must visually determine that the clutch is fully engaged before lifting or pulling a load. Check the "Winch Engaged" indicator light to make sure it is illuminated before beginning a lift or pull. The clutch must be in its fully engaged position before this light will illuminate.
13. Never attempt to handle wire rope when the hook end is not free. Keep all parts of body and clothing clear of the cable rollers, cable entry area of fair-leads and winch drum.
14. Install guarding to prevent personnel from getting any part of body or clothing caught at a point where the cable is wrapped onto the drum or drawn through the guide rollers, or where any rotating shaft is exposed.
15. Install switches or valves that will shut off power to the winch, in locations where they can be reached by anyone entangled in the wire rope before being drawn into the winch or any "pinch point".
16. "Deadman" controls which automatically shut off power to the winch whenever the operator leaves his station, should be installed whenever practical.
17. Do not exceed the maximum pressure, psi (kPa) or flow, gpm (lpm) stated in the winch specifications.
18. Operate the winch line speeds to match job conditions.
19. Leather gloves should be used when handling wire rope.
20. Never attempt to handle wire rope when the hook end is not free.
21. When winding wire rope on the winch drum, never attempt to maintain tension by allowing wire rope to slip through hands. Always use "Hand-Over-Hand" technique.
22. Never use wire rope with broken strands. Replace wire rope.
23. Do not weld on any part of the winch.
24. Use recommended hydraulic oil and gear lubricant.
25. Keep hydraulic system clean and free from contaminants at all times.
26. Use correct anchor for the wire rope size being installed.
27. Do not use knots to secure or attach wire rope.
28. Never allow anyone to stand under a suspended load.
29. Avoid sudden "shock" loads or attempt to "jerk" a load free. This type of operation may cause heavy loads in excess of rated capacity, which may result in failure of the wire rope and/or winch.

Safety and informational callouts used in this manual include:

⚠ WARNING ⚠

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

⚠ CAUTION ⚠

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

BASIC OPERATION

DESCRIPTION OF WINCH

The BRADEN BP200C winch consists of the following sub-assemblies:

1. Motor and brake valve block with cartridges
2. Load holding friction brake assembly
3. Drum drag brake
4. Two stage planetary gear set
5. Cable drum, closure and bearings
6. Level wind system
7. Extension shaft
8. Drum clutch

The BP200C winch is supplied with provisions for either air or hydraulically operated drum drag and drum clutch controls. Refer to the "EXPLANATION OF MODEL NUMBER" to determine the type of control for your winch. Refer to "WINCH INSTALLATION" for control circuits.

NOTE: A winch built for air control CANNOT be operated hydraulically, or vice-versa, without changing the clutch spring. Consult the BRADEN Service Department for details.

THEORY OF OPERATION

When the winch is "at rest" with no hydraulic or air pressure applied, the load holding brake is fully applied by spring pressure, preventing the drum, drive train gears and motor from rotating. The drum clutch is fully engaged by spring pressure, and the drum drag brake is not applied.

BASIC WINCH OPERATION

The primary sun gear is directly coupled to the hydraulic motor by the inner race of the brake clutch assembly. The primary sun gear shaft goes through the drum and drives the primary planet gears on the support end of the winch. As the motor shaft turns in the haul-in direction, the planetary assemblies reduce the speed input by the motor to rotate the cable drum. In the haul-in direction, the static brake remains fully applied and the input shaft rotates freely through the sprag clutch. When the motor is stopped, the load attempts to rotate the winch gear train in the opposite direction locking the brake clutch to the input shaft, allowing the fully applied static brake to hold the load firm.

DUAL BRAKE SYSTEM

The dual brake system consists of a dynamic brake system and a static brake system.

The dynamic brake system has two operating components:

1. Brake Valve Assembly
2. Hydraulic Motor

The brake valve is basically a counterbalance valve with better metering characteristics for load control. It contains a check valve to allow free oil flow to the motor in the haul-in direction, and a pilot operated, spring-loaded spool valve that blocks the flow of oil out of the motor when the control valve is placed in neutral. With the control valve lever moved toward the pay-out direction, the spool valve remains closed until sufficient pilot pressure is applied to the end of the spool to shift it against the spring pressure and open a passage. After the spool valve cracks open, the pilot pressure becomes flow dependent and modulates the spool valve opening, controlling the pay-out speed of the winch. See Figures 1, 2, and 3.

The winch brake system has three main components for all winches:

1. Spring-Applied, Multiple Friction Disc Static Brake
2. Hydraulic Piston and Cylinder
3. Brake Clutch Assembly

The static brake is released by the brake valve pilot pressure at a pressure lower than that required to open the pilot operated spool valve. This sequence ensures that dynamic braking takes place within the brake valve, and that little, if any, heat is absorbed by the static, friction brake.

The static friction brake is load holding brake only, and has nothing to do with dynamic braking or the rate of descent of a load.

The brake clutch assembly is splined to the primary sun gear shaft between the hydraulic motor and primary sun gear. It will allow this shaft to turn freely in the direction to haul-in a load, and locks up to force the brake discs to turn with the shaft in the pay-out direction. See Figures 4 and 5.

The hydraulic brake cylinder, when pressurized, will release the spring pressure on the brake discs, allowing the discs to turn freely.

DRUM CLUTCH

The drum clutch is spring applied, and air or hydraulically released. The release mechanism is a mechanical disengagement of the drum from the drive train. The winch is equipped with an electrical switch that will light the red "WINCH DISENGAGED" lamp on the freespool panel whenever the drum is disengaged from the drive train. In this position, wire rope can be pulled from the drum by hand, provided the drum drag brake is not activated. The extension shaft/capstan drive can also be operated in this mode without the cable drum rotating. To disengage the drum, the winch should be stopped and there should be no load on the cable drum. To engage the clutch, the drum may have to be rotated slightly by hand to align the internal splines. When the clutch is fully engaged, the green "WINCH ENGAGED" lamp on the freespool panel will be lit.

DRUM DRAG BRAKE

The BP200C has two (2) drag brake cylinders. These can be either air or hydraulically operated. Their purpose is to control drum movement when the winch is in freespool mode with the drum disconnected from the drive train. They are not designed nor intended to hold a load. The amount of drag they provide can be easily adjusted using one of the circuits shown in the "INSTALLATION" section of this manual. All hardware for these control circuits is customer provided.

LEVEL WIND

The BP200C winch is equipped with a level wind system to ensure smooth even spooling of wire rope onto the drum. The speed of the tension roller assembly in relation to the cable drum speed is specific to each size wire rope. In order to change wire rope size, the chain and sprockets driving the level wind diamond screw must be changed. Refer to "LEVEL WIND DRIVE GROUP CONVERSION PARTS" for additional information. The system is provided with a manual disconnect and hand wheel on the diamond screw. The disconnect lever is located on the side of the winch opposite the motor. With the lever pointing down in a vertical position, the diamond screw is engaged. Rotating the lever 90° toward the front of the winch disengages the screw and allows it to be rotated using the hand wheel on the opposite end, near the motor. This feature is used to properly align the tension roller assembly with the wire rope on the drum. It may be necessary to perform this alignment occasionally to compensate for normal wire rope stretch and/or wear, or when new wire rope is installed.

INSTALLATION

GENERAL REQUIREMENTS

The winch should be mounted with the centerline of the drum in a horizontal position. Typically, the base will be fastened directly to the frame of the vehicle.

When mounting the winch, the method of attachment must be capable of withstanding the full 20,000 pound line pull.

It is important that the winch be mounted on a surface that will not flex when the winch is in use, since this could bind the working parts of the winch. Also, be sure the winch is mounted on a flat surface. If necessary, use shim stock to ensure proper mounting. The mounting surface should be flat within + or -.020 inches (.5 mm).

Hydraulic lines and components that operate the winch should be of sufficient size to assure minimum back pressure at the winch. Back pressure should not exceed 100 psi (690 kPa) for maximum motor seal life. A motor case drain from the shaft end drain port to tank is required.

The winch directional control valve must be a three-position, four-way valve with a motor spool having both work ports open directly to tank, when the valve is in the center position.

The extension shaft must be attached to the end of the winch opposite the motor. The shaft may be connected to the coupling in one of two positions, allowing a 2 inch adjustment in length.
The hydraulic oil filter should have a 10 micron nominal rating and be a full-flow type.

High quality hydraulic oil is essential for satisfactory performance and long hydraulic system component life.

Oil having 150 to 330 SUS viscosity at 100°F (38°C) and viscosity index of 100 or greater will give good results under normal temperature conditions. The use of an oil having a high viscosity index will minimize cold-start trouble and reduce the length of warm-up periods. A high viscosity index will minimize changes in viscosity with corresponding changes in temperature.

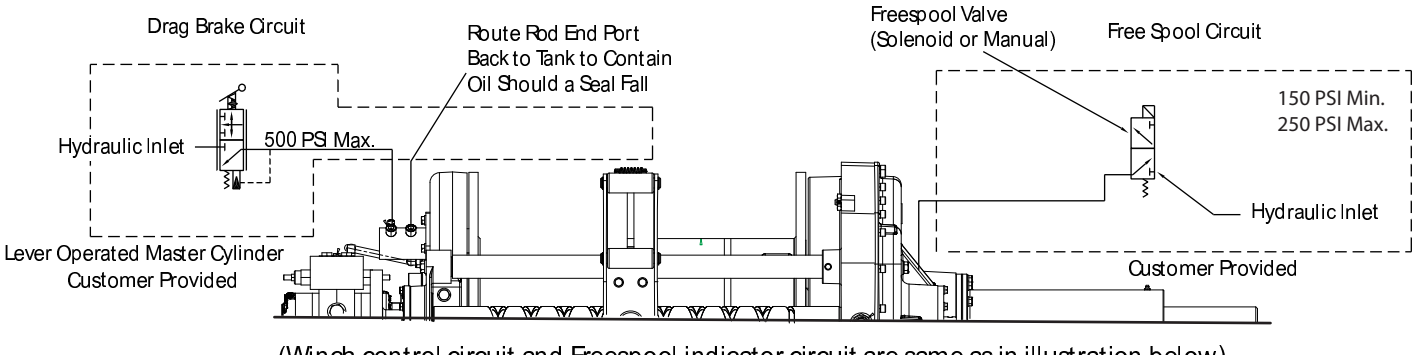
Maximum cold weather start-up viscosity should not exceed 5000 SUS with a pour point at least 20°F lower than the minimum temperature.

Under continuous operating conditions the temperature of the oil at any point in the system must not exceed 180°F (82°C). 120-140°F (49- 60°C) is generally considered optimum.

In general terms; for continuous operation at ambient temperatures between 50 and 110°F (10 to 43°C), use SAE 20W; for continuous operation between 10 and 90°F (-12 to 32°C), use SAE 10W; for applications colder than 10°F, contact the BRADEN Service Department. The use of multi-viscosity oils is generally not recommended.

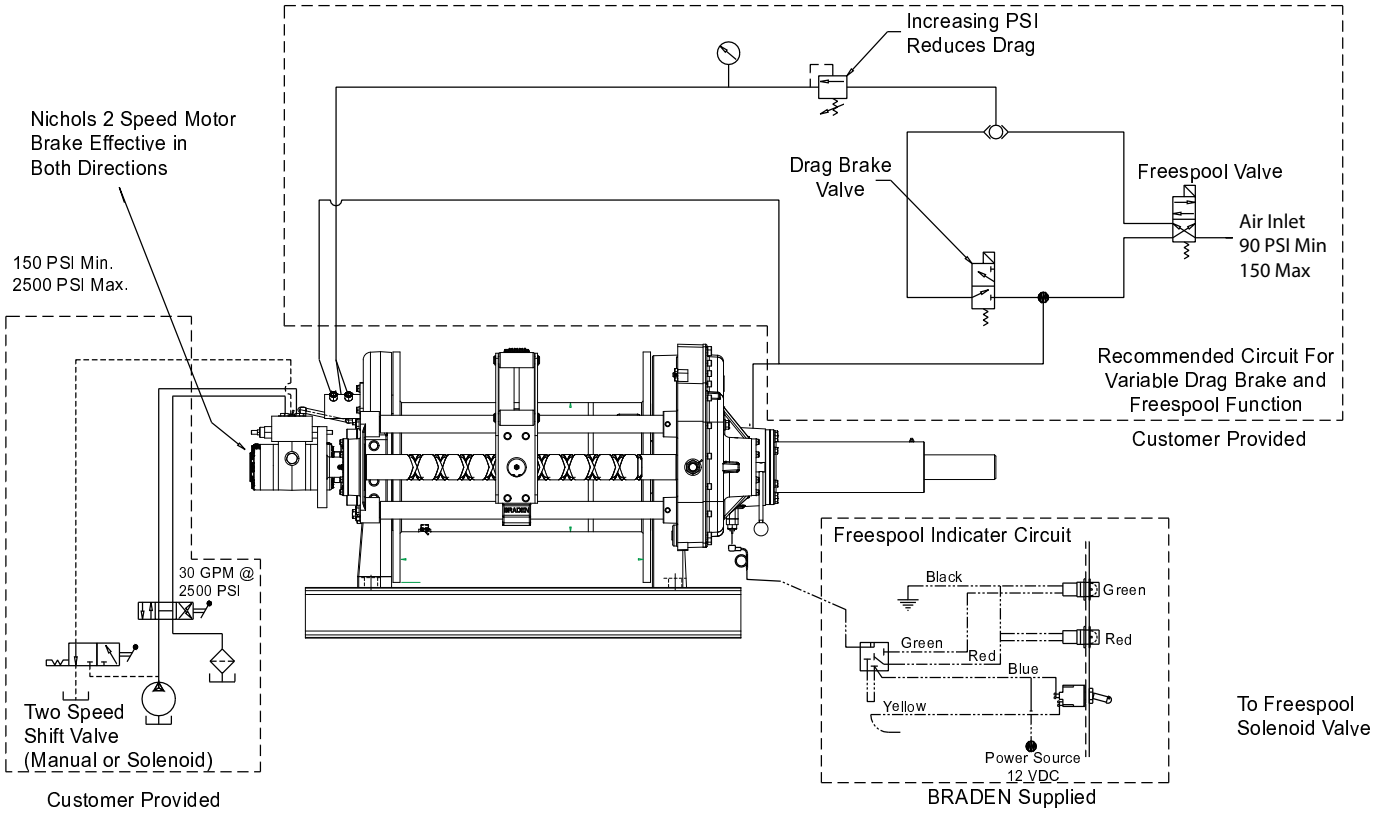
Refer to the following drawings for winch control circuit, drag brake circuit and freespool circuit.
NOTE: *Continuous operation at high speeds and loads may require the use of an oil cooler in the hydraulic system to maintain acceptable oil temperature.*

HYDRAULIC CONTROLS



(Winch control circuit and Freespool indicator circuit are same as in illustration below)

AIR OPERATED CONTROLS



*NOTE: A winch built for hydraulic controls **CANNOT** be operated with air controls, and a winch built for air controls **CANNOT** be operated with hydraulic controls. The freespool piston return spring is different for each type of control. See page 2 of this manual for location and explanation of Model Number to determine control type for your winch.*

WIRE ROPE INSTALLATION

⚠ WARNING ⚠

THE CABLE ANCHORS ALONE ON HOISTS ARE NOT DESIGNED TO HOLD RATED LOADS. Winch loads applied directly to the wire rope anchor may cause the wire rope 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 wire rope must be left on the drum barrel to achieve rated load.

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

Using larger cable will not always increase the 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 for your application.

The wedge and anchor pocket must be clean and dry. The end of the wire rope being anchored to the drum must be clean and dry and not frayed. Anything on the end of the wire rope to keep it from fraying (i.e. tape or wire) must not be in contact with the wedge when the installation is complete. Consult the wire rope manufacturer on the proper treatment of the dead end of the wire rope. Some rope manufacturers recommend when using rotation resistant wire rope, that the rope end be seized, welded or brazed before inserting the wire rope into the wedge socket to prevent core slippage or loss of rope lay.

Take the free end of the wire rope and insert it through the small opening on the cable drum. Loop the wire rope and push the free end about 3/4 of the way back through the pocket. Install the wedge as shown in figure 7, then pull the slack out of the wire rope. The “dead” end of the rope needs to extend slightly beyond the end of the wedge as shown in figure 8.

Using a hammer and brass drift, drive the wedge as deep into the pocket as possible to ensure it is fully seated and no further movement is detected. Applying a load on the wire rope will also help seat the wedge in the pocket. Check to ensure the wedge does not protrude from either end of the pocket, causing it to interfere with proper spooling of wire rope onto the drum (see figures 9 & 10). If there is interference or the wedge does not seat firmly, contact the BRADEN Product Support Department at 918-251-8511 to determine the proper wedge size. The wedge shipped from the factory will properly anchor 7/16, 1/2 and 9/16 inch wire rope.

Before installing the wire rope, the levelwind roller bracket must be aligned with the correct rope pocket. Rotate the drum until the correct cable pocket is on top at the 12:00 position. The correct pocket will have the smaller opening toward the diamond screw. Disengage the diamond screw

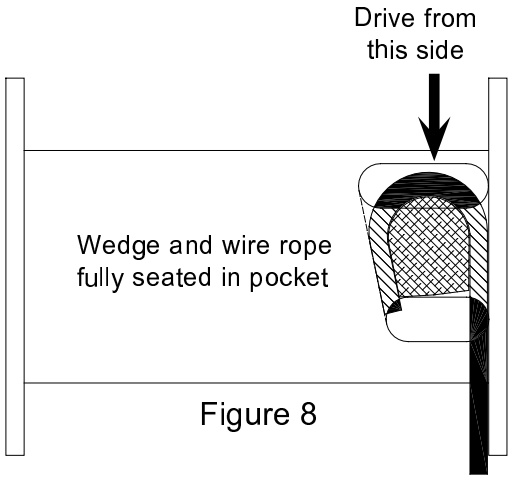


Figure 8

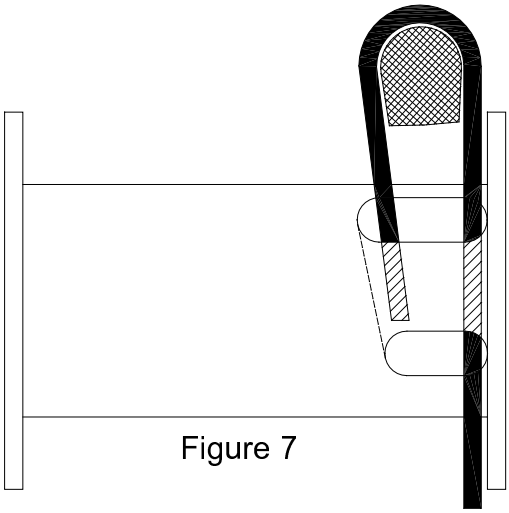


Figure 7

Incorrect Installations

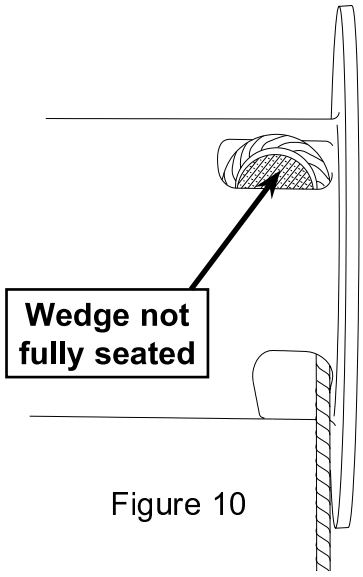


Figure 10

- Wire rope not tight against wedge
- Wedge may be too large

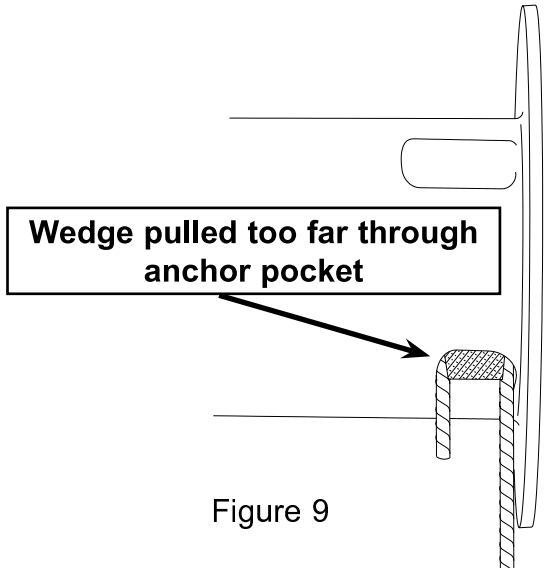
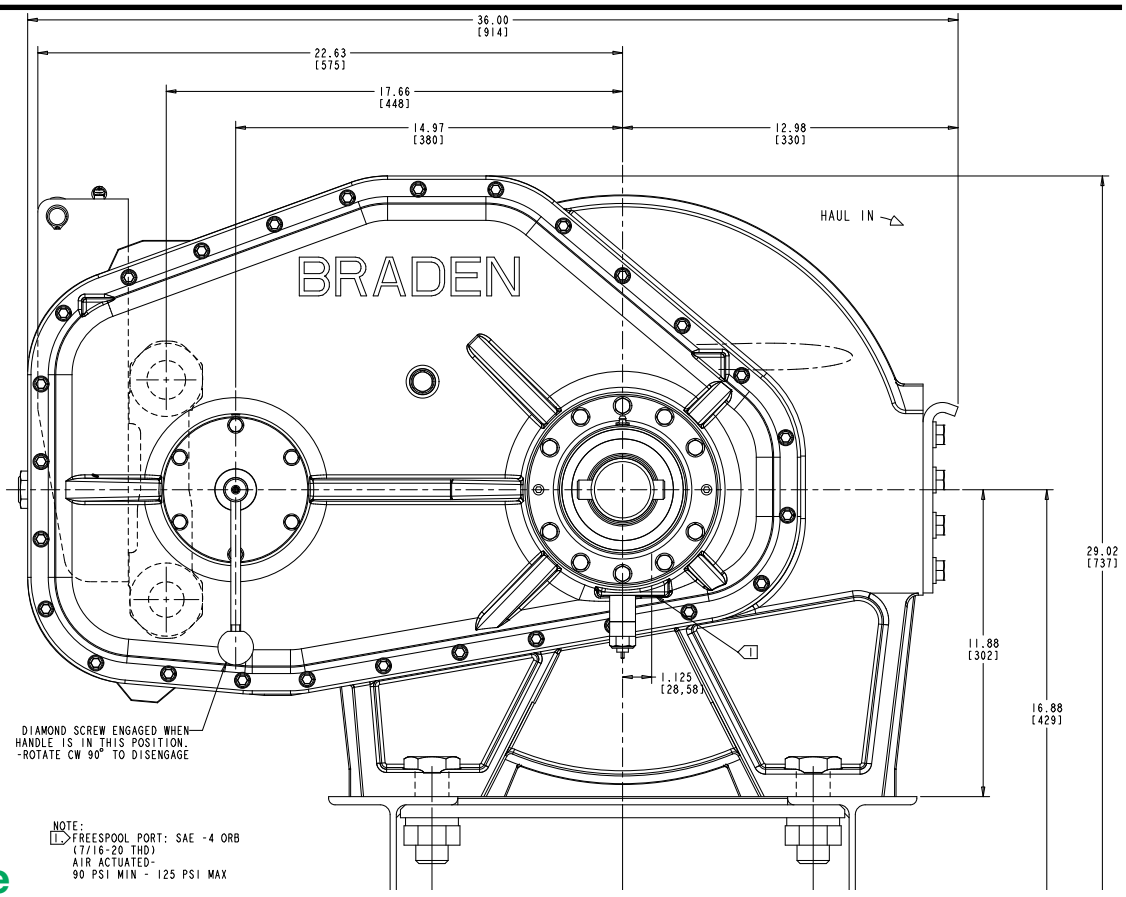


Figure 9

- “Dead” end of wire rope and/or wedge may interfere with proper spooling
- Wedge may be too small

by rotating the lever on the chain case, 90° toward the front of the winch. Using the handwheel on the motor end of the winch, turn the diamond screw in the same direction as the winch hauls in cable until the roller bracket is at the flange where the cable will be anchored. The pawl should be just starting to enter the turnaround area of the screw. Re-engage the diamond screw. Thread the wire rope through the spring loaded rollers and anchor it to the winch drum. Refer to the figures on the previous page for additional information. When spooling cable onto the drum, the roller bracket should lag behind where the rope is laying onto the drum by 1/2 of a rope diameter. Re-adjust the position of the roller assembly, if needed, after beginning to spool wire rope onto the drum. The diamond screw levelwind alone does not assure smooth even spooling of cable onto the drum. A light load (approx. 200 to 400 LB, 90 to 180 kg) should be maintained on the cable to assist even spooling.

DIMENSIONAL DRAWINGS AND SPECIFICATIONS



Performance

Low Speed Winching (BP200C-36176/088-9/16-46)				
	Layer 1	**Layer 2**	**Layer 3**	**Layer 4**
Line Pull*	20,000 lb (9,072 kg)	18,440 lb (8,364 kg)	17,100 lb (7,756 kg)	15,950 lb (7,235 kg)
Line Speed*	34 fpm (10 mpm)	37 fpm (11 mpm)	40 fpm (12 mpm)	43 fpm (13 mpm)

High Speed Winching (BP200C-36176/088-9/16-46)				
	Layer 1	**Layer 2**	**Layer 3**	**Layer 4**
Line Pull*	9,900 lb (4,491 kg)	9,120 lb (4,137 kg)	8,460 lb (3,837 kg)	7,890 lb (3,579 kg)
Line Speed*	45 fpm (14 mpm)	49 fpm (15 mpm)	53 fpm (16 mpm)	57 fpm (17mpm)

Based on max pressure of 2,500 psi, 30 gpm, 36:1 gear ratio and 9/16" (14 mm) rope. Performance will vary dependent on hydraulic system, motor, drum and cable sizes.

Minimum 150 psi (1,030 kPa), above motor outlet pressure, required to shift motor to high speed

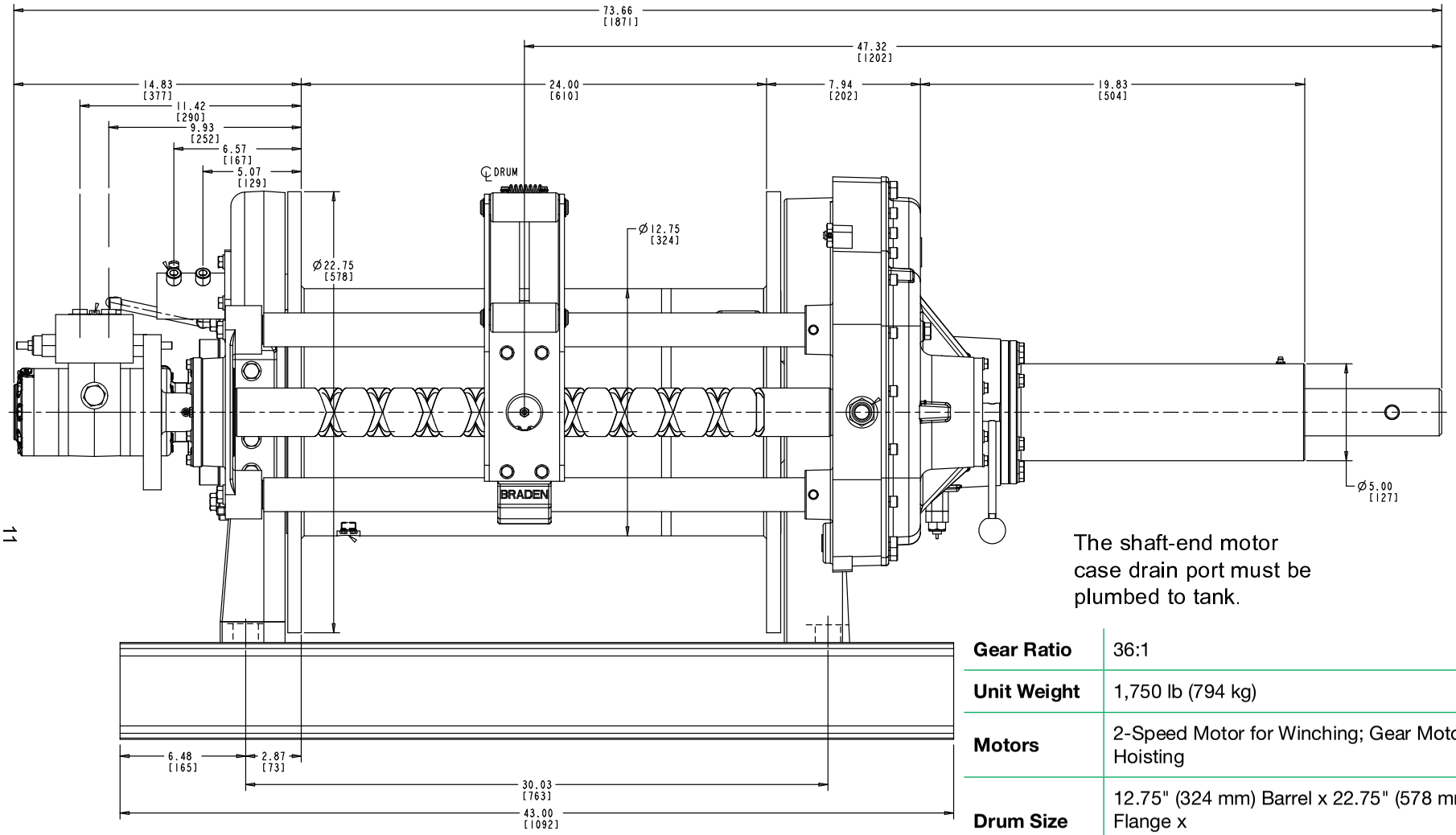
Maximum allowable pressure at motor shift port - 2,500 psi (17,200 kPa)

Shaft end motor case drain must be drained to tank

2 speed motor displacement is 17.6/8.8 cu in. (288/173 cu cm).

Performance based on:
2,500 psi (17,200 kPa) at 30 gpm (114 LPM)

NOTE: *Continuous operation at high speeds and loads may require the use of an oil cooler in the hydraulic system to maintain acceptable oil temperature.*



The shaft-end motor case drain port must be plumbed to tank.

Gear Ratio	36:1
Unit Weight	1,750 lb (794 kg)
Motors	2-Speed Motor for Winching; Gear Motor for Hoisting
Drum Size	12.75" (324 mm) Barrel x 22.75" (578 mm) Flange x 24" (610 mm) Between Flanges
Rope Diameters	3/8" (10 mm), 7/16" (11 mm), 1/2" (13 mm), 9/16" (14 mm), 5/8" (16 mm)
Rope Storage	1,537 ft (468 m) for 9/16" (14 mm) Rope

Other Rope Capacities
1/2 in. - 2,226 ft (678 M)
7/16 in. - 2,769 ft (844 M)

WINCH OPERATION

The following warnings are basic to safe winch operation. Please read them completely and follow them each time your BP200C winch is operated.

⚠ WARNING ⚠

A partially engaged drum clutch may "jump out" of engagement causing a sudden loss of load control which may result in property damage, personal injury or death. Before operating the winch, be sure the drum clutch is **fully** engaged by observing the green light on the freespool panel. The green light will only be lit if the drum clutch is fully engaged. **DO NOT** attempt to disengage the clutch when there is tension on the wire rope.

When possible, position the winch such that the centerline of the drum is perpendicular to the load. The angle the winch must pull from (fleet angle) must not exceed 5°. If the fleet angle exceeds 5°, the cable will not spool correctly resulting in damaged cable and prematurely worn winch components.

Disengage the drum clutch and apply the drum drag brake to control drum over-spin or "birdnesting". You can now pull cable off the drum by hand.

Securely attach the end of the cable to the load in such a manner to avoid damage to the load or cable. Fully engage the drum clutch.

△ CAUTION △

Be sure the drum clutch is fully engaged by observing the green light on the freespool control panel. DO NOT operate the winch to pull in a load unless this light is on.

⚠ WARNING ⚠

Ground personnel must stay in view of the operator and clear of the load and winch drum. Do not allow personnel near the winch line under tension. Do not allow personnel to be in line with winch load. A safe distance of at least 1 and 1/2 times the working length of the cable should be maintained by ground personnel. A broken cable and/or lost load may cause property damage, personal injury or death.

Operate the winch control valve smoothly to avoid "jerking" the load. The winch should be operated at the slowest practical speed for your application to maintain maximum load control. If necessary, secure the load in position and pay-out enough cable to remove all tension on the cable and drum.

Disconnect the winch cable from the load. Wind the cable back onto the winch drum. Be careful to maintain a minimum fleet angle, and sufficient tension to cause the cable to spool properly onto the drum.

△ CAUTION △

If maintaining tension on the cable by hand, always wear leather gloves and never attempt to maintain tension by allowing winch cable to slip through hands. Always use "hand-over-hand" technique, being careful to keep hands and clothing away from winch drum and level wind rollers.

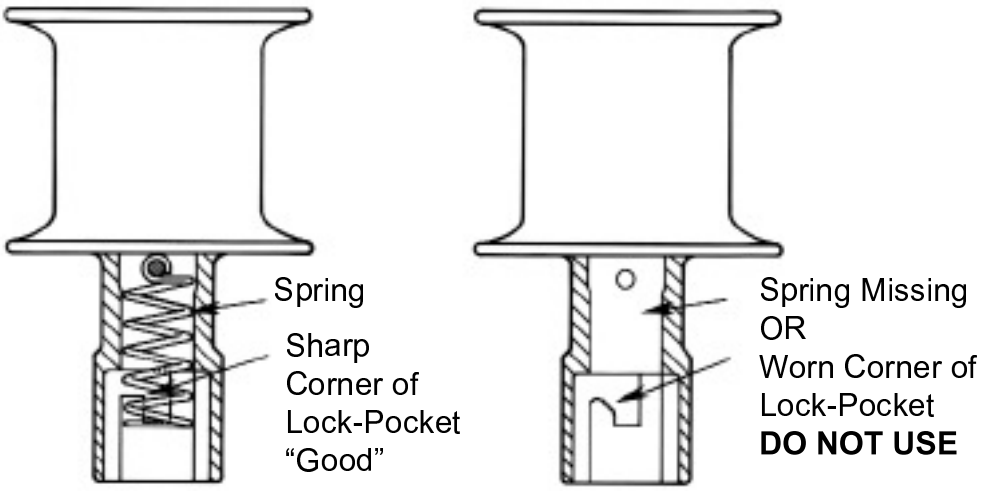
CAPSTAN USE

BRADEN has two types of capstans available. One is a quick disconnect bayonet type, the other is a bolt-on style.

⚠ WARNING ⚠

- Before installing a bayonet type capstan, make certain the spring is properly located in the bore. The spring holds the capstan in the lock position on the extension shaft. If the spring is omitted, the capstan may come off the extension shaft and cause a sudden loss of load control which may result in property damage, personal injury or death. Also, closely inspect the edges of the lock pocket to make certain they are still sharp and not rounded from extensive use. A badly worn lock pocket may prevent the capstan from locking securely to the extension shaft which could allow the capstan to come off the extension shaft and cause a sudden loss of load control which may result in property damage, personal injury or death.
- When installing a bolt-on capstan, make sure that a 3/4 in. X 5 1/4 in. long (19 X 133 mm) Grade 8 capscrew and self-locking nut are used. A soft bolt or pin may shear off and cause a sudden loss of load control which may result in property damage, personal injury or death.
- Make certain that the vehicle is positioned such that the capstan load line and hand line are perpendicular to the center of the capstan barrel. Do not allow rope to pull against the flange of the capstan as rope may get damaged or may “jump” over the flange and cause a sudden loss of load control which may result in property damage, personal injury or death.
- Before operating the capstan, be sure the drum clutch is disengaged. The red “winch disengaged” light on the freespool panel will be lit.

To install the bayonet type capstan, push the capstan onto the extension shaft, against spring tension, then turn counter-clockwise (viewed from the outside) to the stop. Release the capstan and verify that the spring has pushed the capstan outward into the lock position.



⚠ WARNING ⚠

Exposed areas of extension shafts and/or capstan shafts are dangerous. Clothing and other items may become tangled and wrapped around the shaft when it is rotating. Appropriate guarding should be installed to prevent any part of the body or clothing from contacting the shaft when it is rotating. Failure to provide appropriate guarding could result in property damage, personal injury or death.

PREVENTIVE MAINTENANCE

A regular program of preventive maintenance for your BRADEN BP200C winch will minimize the need for emergency servicing and promote long 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 ⚠

- Never attempt to service a winch while the prime mover engine is running. Accidental engagement of the winch may result in property damage, personal injury or death.
- Make certain all load is removed from the winch cable and cable drum before servicing the winch. A cable under tension may rapidly unspool resulting in property damage, personal injury or death.

Daily when winch is in regular use:

- Inspect the cable and rigging for broken wires or other damage as recommended by the wire rope and rigging manufacturer.
- Visually inspect the winch and drum clutch controls for signs of damage or oil leakage. Shift the winch into freespool. Be sure the red “winch disengaged” light is on and the drum can be turned by hand. Re-engage the drum clutch and be sure the green “winch engaged” light is on.

Weekly

- Perform all daily inspections.
- Check winch gear oil level at the sight glass in the chain case. If necessary, fill to the center of the sight glass with the recommended gear oil. Over filling may result in leaks and/or overheating. Operating the winch at a low oil level may result in rapid wear of the internal components and gears.
- Lubricate the grease fittings on the diamond screw, pawl and extension shaft. Use a high quality moly type grease with a rating of NLGI-2 or better.
- Inspect and retighten as required, all winch mounting fasteners. Inspect and repair as required, all winch mounting brackets and welds.
- Wipe off any accumulated dust and apply a light coat of rust preventive oil to diamond screw and guide bars.

Monthly

- Check and adjust as required, the hydraulic system relief valve to ensure proper performance and component protection.
- Service the hydraulic system filters/strainers as recommended by the equipment manufacturer.

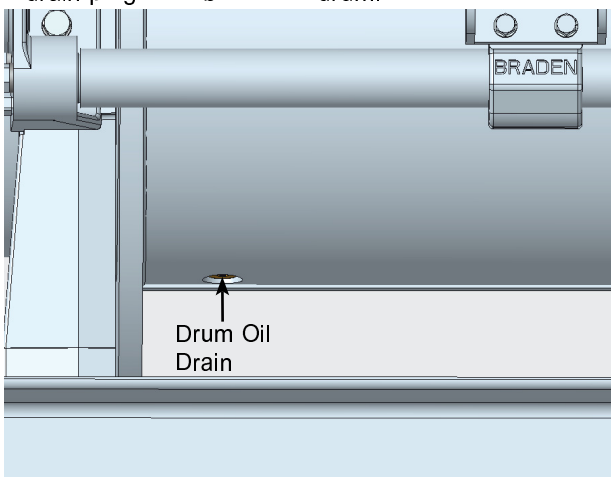
Yearly

- Change winch gear oil. Oil should preferably be changed soon after operating the winch, while the oil is warm.

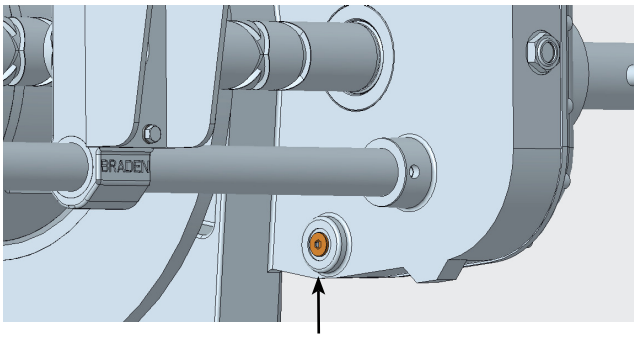
Oil Change Proceedure

Place winch in a level position. Remove cable from drum. Slowly rotate the cable drum until the drain plug in the drum is at the bottom, at the 6:00 position. Stop the hydraulic system prime mover so the winch cannot be accidentally operated while changing oil.

Place a suitable contain under the drum and remove the oil drain plug from bottom of drum.



Place a suitable container under the chain case drain and remove the drain plug.



While the oil is draining, remove the vent plug and bushing and clean them in safety solvent. It is very important to keep the vent clean and unobstructed. **DO NOT** paint over the vent or replace it with a solid plug.

Rotate the drum to align the oil hole with the hole in the end bracket at the 3:00 position. Fill the drum with oil to the bottom of the hole and replace the drain plug. Install the drain plug in the chain case and fill the case to the center of the sight glass. Install the bushing and vent plug. The drum and chain case use the same oil. Refer to "Recommended Gear Oil" on next page.

Wire Rope

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

Mounting Bolts

Tighten all winch base mounting bolts to recommended torque after the first one hundred (100) hours of operation, then every 1,000 operating hours, or six (6) months, whichever occurs first.

Warm-up Procedures

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

The prime mover should be run at its lowest recommended RPM with the hydraulic winch control valve in neutral allowing sufficient time to warm up the system. The winch should then be operated at low speeds, forward and reverse, several times to prime all lines with warm hydraulic oil, and to circulate gear lubricant through the planetary gear sets.

⚠ WARNING ⚠

Failure to properly warm up the winch, particularly under low ambient temperature conditions, may result in temporary brake slippage due to high back pressures attempting to release the brake, which could result in property damage, personal injury or death.

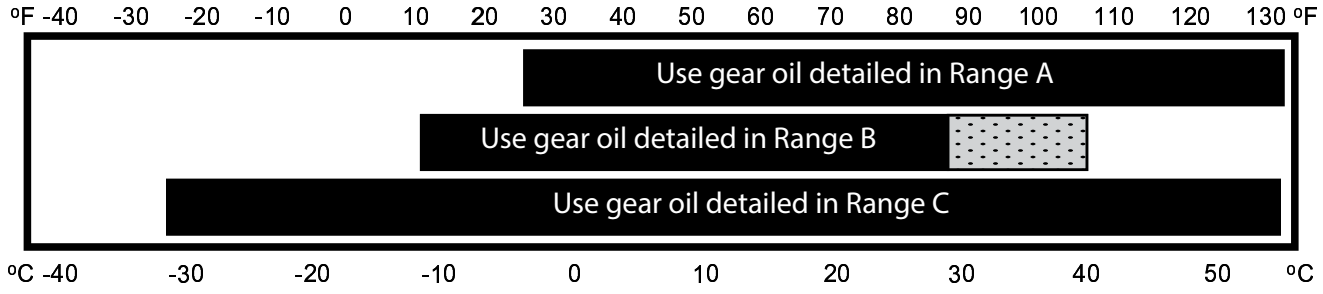
Recommended Planetary Gear Oil

Field experience, supported by extensive engineering tests, indicates the use of the proper planetary gear oil is essential to reliable and safe operation of the winch brake and obtaining long gear train life.

For simplicity, BRADEN has listed one (1) readily available product in each temperature range which has been tested and found to meet our specifications. This is not to say that other lubricant brands would not perform equally

RECOMMENDED GEAR OIL

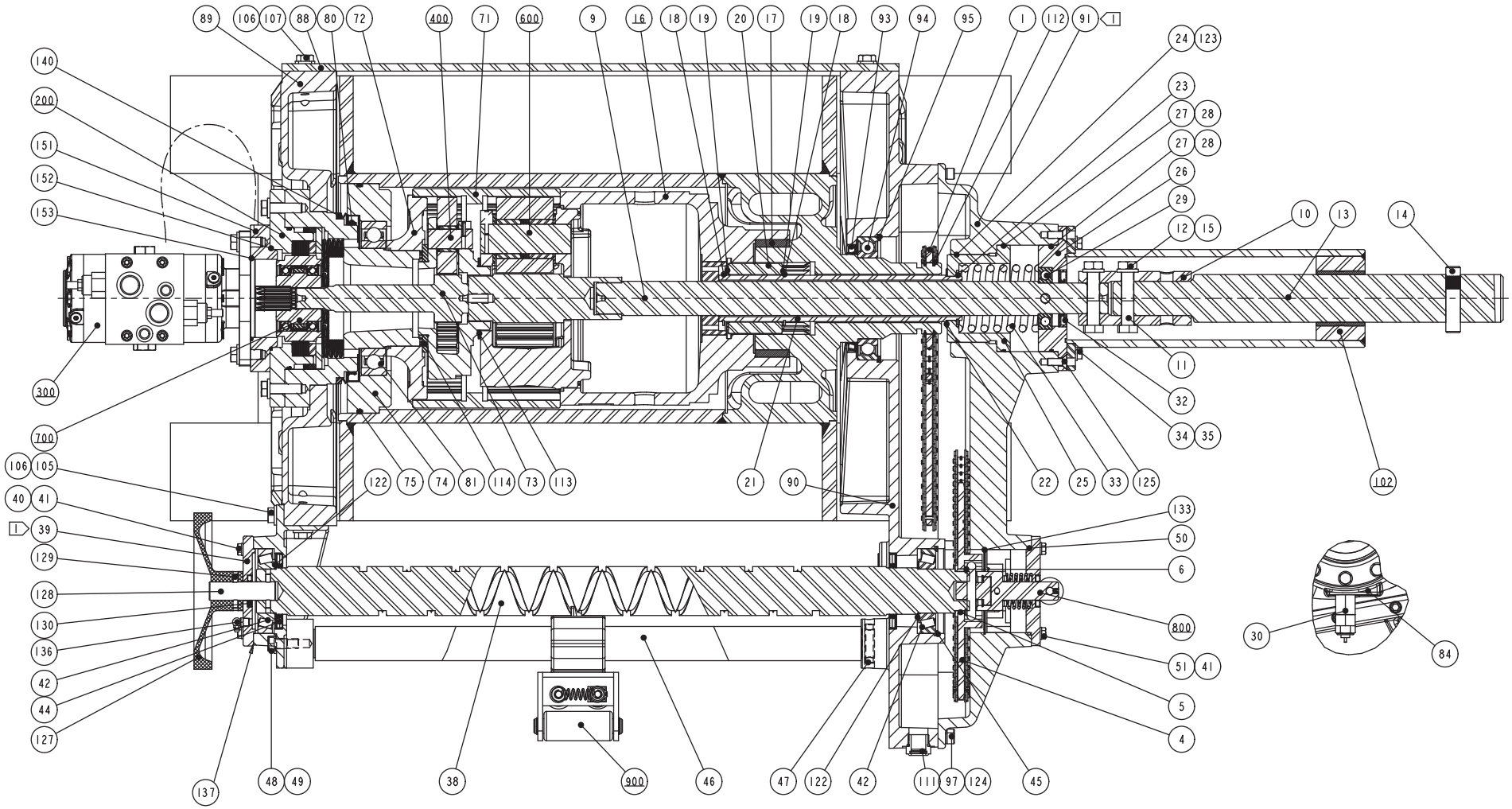
PREVAILING AMBIENT TEMPERATURE



SHADED TEMPERATURE RANGE IN THE CHART ABOVE NOT RECOMMENDED FOR SEVERE APPLICATIONS SUCH AS SUSTAINED FAST DUTY CYCLES OR FREQUENT WINCHING.

Winches are factory filled with Mobilgear 600 XP 150 or equivalent. Consult your oil supplier for other equivalent oils if required.

MAIN COMPONENTS



SHIM SET 29625,
SEE NOTE FOR
SETTING INSTRUCTIONS

NOTES:

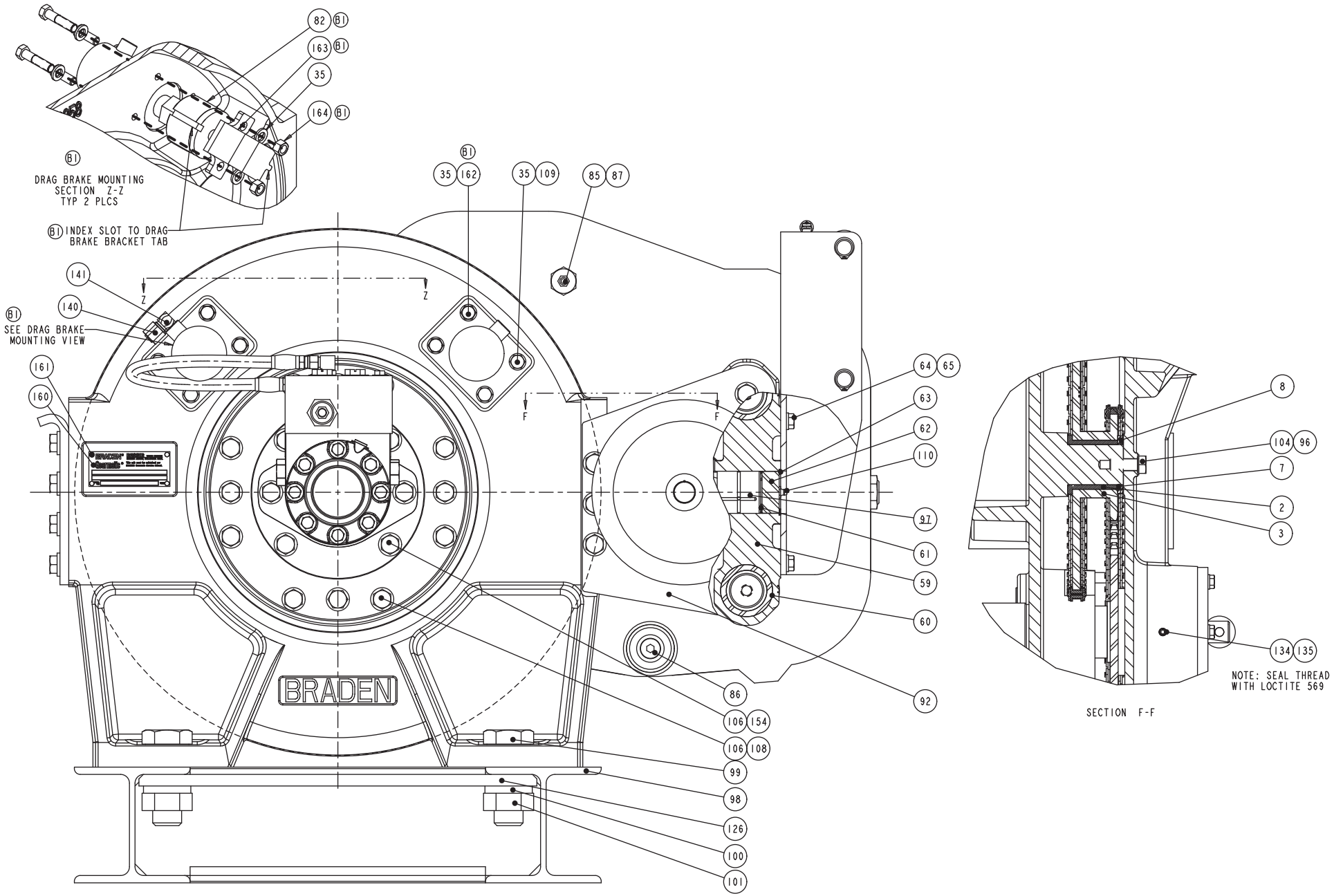
1. APPLY SILASTIC SEALANT - DOW 732 OR EQUIVALENT - TO FLANGE OF CHAINCASE COVER ITEM 108 AND DIAMOND SCREW COVER ITEM 33 PRIOR TO ASSY
2. 0.010/0.015 END PLAY REQUIRED ON DIAMOND SCREW SHAFT.

Item	Description	Qty.
MAJOR PARTS GROUPS:		
200	BRAKE CYLINDER ASSEMBLY - SEE PAGE 38	1
300	HYDRAULIC MOTOR ASSEMBLY - SEE PAGE 45	1
400	PRIMARY PLANET CARRIER ASSEMBLY - SEE PAGE 42	1
600	OUTPUT PLANET CARRIER ASSEMBLY - SEE PAGE 42	1
700	OVERRUNNING CLUTCH ASSEMBLY (SPRAG) - SEE PAGE 40	1
800	DIAMOND SCREW DISCONNECT ASSEMBLY - SEE PAGE 43	1
900	ROLLER ASSEMBLY - SEE PAGE 41	1
001	DRIVE SPROCKET - SEE PAGE 19	1
002	BUSHING	1
003	DUAL SPROCKET- SEE PAGE 19	1
004	DRIVEN SPROCKET - SEE PAGE 19	1
N/A	OFFSET LINK	2
005	BUSHING	1
006	SNAP RING	1
007	RACE-THRUST	1
008	THRUST RACE	1
009	EXTENSION SHAFT	1
010	COUPLING - BP200	1
011	CAPSCREW H063-325 NF GD8 Z	2
012	NUT-JAM	2
013	CAPSTAN SHAFT - SEE PAGE 18	1
014	20-272P CAPSTAN PIN	1
015	WASHER-SHAKEPROOF L063 Z EXT	2
016	CARRIER EXTENSION ASSY	1
017	BUSHING	1
018	SNAP RING	2
019	THRUST WASHER	2
020	FREESPOOL COUPLING	1
021	PULL TUBE	1
022	THRUST WASHER	1
023	SNAP RING	1
024	O-RING	1
025	FREESPOOL PISTON	1
026	END COVER	1
027	O-RING	1
028	BACKUP-RING	1
029	BEARING	1
030	INDICATOR SWITCH CARRIER ASS	1
032	OIL SEAL	1
033	RETURN SPRING - SEE PAGE 19	1

Item	Description	Qty.
034	CAPSCREW H038-150 NC GD8 Z	10
035	LOCKWASHER	10
035	WASHER, HARD	8
038	DIAMOND SCREW	1
039	COVER, BP200B	1
040	CAPSCREW H031-100 NC GD8 Z	6
041	LOCKWASHER L031 Z SPLIT	12
042	TAPERED ROLLER BEARING SET	2
044	SEAL, LIP	2
045	RETAINING RING	1
046	GUIDE BAR	2
047	ROLL PIN	2
048	CAPSCREW H050-125 NC GD8 Z	2
049	LOCKWASHER L050 Z SPLIT	2
050	O-RING	1
051	CAPSCREW H031-088 NC GD8 Z	6
058	PAWL	1
071	RING GEAR	1
072	RING GEAR ADAPTER	1
073	SUN GEAR	1
074	CABLE DRUM CLOSURE	1
075	O-RING	1
080	SEAL	1
081	BALL BEARING	1
082	CYLINDER	2
083	DRAG BRAKE PAD, BP200B	2
084	4 PLUG ORB (FLUSH) -4	1
085	RELIEF VALVE 1-5 PSI	1
086	PLUG,O-RING FLUSH -8	1
087	BUSHING-REDUCER PIPE -12-2	1
088	TIE PLATE	1
088	ZERK	1
089	MOTOR END PLATE	1
090	CHAINCASE ENDPLATE	1
091	CHAIN CASE COVER, BP200B	1
092	GUIDEBAR BRACKET	1
093	LIPSEAL	1
094	BEARING, BALL	1
095	SNAP RING	1
096	WASHER, SEALING S050	1
097	CAPSCREW S038-100 NC ASTM A574	27
098	H-BEAM FRAME	1
099	CAPSCREW H125-350 NC GD8 Z	4
100	LOCKWASHER L125 Z SPLIT	4

Item	Description	Qty.
101	HEX NUT	4
102	TORQUE TUBE ASSY	1
104	CAPSCREW H050-125 NC GD8 Z	1
105	CAPSCREW H050-150 NC GD8 Z	7
105	CAPSCREW H050-150 NC GD8 Z	8
106	WASHER P050 HRD Z	45
107	CAPSCREW H050-150 NC GD8 Z SPL	8
108	CAPSCREW H050-300 NC GD8 Z	8
109	CAPSCREW H038-088 NC GD8 Z	8
111	SIGHT GAUGE	1
112	SNAP RING	2
113	THRUST WASHER	1
114	THRUST WASHER	1
122	THRUST WASHER	2
123	BACKUP RING	1
124	LOCKWASHER	27
125	CAPSCREW F038-100 NC ASTM F835	2
126	SUPPORT PLATE	2
127	HANDWHEEL, BP200B	1
128	STUB SHAFT, BP200B	1
129	ROLLPIN	2
130	SEAL, LIP	1
133	RETAINING RING, BP200B	1
134	ROLLPIN	1
135	SETSCREW	1
136	GREASE ZERK FITTING	1
137	SHIM SET	1
140	CAP JIC -4	1
140	V-RING SEAL	1
141	ELBOW TUBE FITTING	1
151	MOTOR ADAPTER	1
152	O-RING	1
153	O-RING	1
154	CAPSCREW H050-175 NC GD8 Z	4
160	NAMEPLATE	1
161	DRIVE SCREW	4
ITEMS NOT SHOWN:		
N/A	REDUCTION CHAIN- SEE PAGE 24	1
N/A	REDUCTION CHAIN- SEE PAGE 24	1
N/A	OFFSET LINK	2
N/A	CABLE WEDGE (1/2-3/4 WIRE ROPE)	1
N/A	DRUM OIL DRAIN PLUG ORB -4	1

MAIN COMPONENTS



Item	Description	Qty.
MAJOR PARTS GROUPS:		
200	BRAKE CYLINDER ASSEMBLY - SEE PAGE 38	1
300	HYDRAULIC MOTOR ASSEMBLY - SEE PAGE 45	1
400	PRIMARY PLANET CARRIER ASSEMBLY - SEE PAGE 42	1
600	OUTPUT PLANET CARRIER ASSEMBLY - SEE PAGE 42	1
700	OVERRUNNING CLUTCH ASSEMBLY (SPRAG) - SEE PAGE 40	1
800	DIAMOND SCREW DISCONNECT ASSEMBLY - SEE PAGE 43	1
900	ROLLER ASSEMBLY - SEE PAGE 41	1
001	DRIVE SPROCKET - SEE PAGE 19	1
002	BUSHING	1
003	DUAL SPROCKET- SEE PAGE 19	1
004	DRIVEN SPROCKET - SEE PAGE 19	1
N/A	OFFSET LINK	2
005	BUSHING	1
006	SNAP RING	1
007	RACE-THRUST	1
008	THRUST RACE	1
009	EXTENSION SHAFT	1
010	COUPLING - BP200	1
011	CAPSCREW H063-325 NF GD8 Z	2
012	NUT-JAM	2
013	CAPSTAN SHAFT - SEE PAGE 18	1
014	20-272P CAPSTAN PIN	1
015	WASHER-SHAKEPROOF L063 Z EXT	2
016	CARRIER EXTENSION ASSY	1
017	BUSHING	1
018	SNAP RING	2
019	THRUST WASHER	2
020	FREESPOOL COUPLING	1
021	PULL TUBE	1
022	THRUST WASHER	1
023	SNAP RING	1
024	O-RING	1
025	FREESPOOL PISTON	1
026	END COVER	1
027	O-RING	1
028	BACKUP-RING	1
029	BEARING	1
030	INDICATOR SWITCH CARRIER ASS	1
032	OIL SEAL	1
033	RETURN SPRING - SEE PAGE 19	1

Item	Description	Qty.
034	CAPSCREW H038-150 NC GD8 Z	10
035	LOCKWASHER	10
035	WASHER, HARD	8
038	DIAMOND SCREW	1
039	COVER, BP200B	1
040	CAPSCREW H031-100 NC GD8 Z	6
041	LOCKWASHER L031 Z SPLIT	12
042	TAPERED ROLLER BEARING SET	2
044	SEAL, LIP	2
045	RETAINING RING	1
046	GUIDE BAR	2
047	ROLL PIN	2
048	CAPSCREW H050-125 NC GD8 Z	2
049	LOCKWASHER L050 Z SPLIT	2
050	O-RING	1
051	CAPSCREW H031-088 NC GD8 Z	6
058	PAWL	1
071	RING GEAR	1
072	RING GEAR ADAPTER	1
073	SUN GEAR	1
074	CABLE DRUM CLOSURE	1
075	O-RING	1
080	SEAL	1
081	BALL BEARING	1
082	CYLINDER	2
083	DRAG BRAKE PAD, BP200B	2
084	4 PLUG ORB (FLUSH) -4	1
085	RELIEF VALVE 1-5 PSI	1
086	PLUG,O-RING FLUSH -8	1
087	BUSHING-REDUCER PIPE -12-2	1
088	TIE PLATE	1
088	ZERK	1
089	MOTOR END PLATE	1
090	CHAINCASE ENDPLATE	1
091	CHAIN CASE COVER, BP200B	1
092	GUIDEBAR BRACKET	1
093	LIPSEAL	1
094	BEARING, BALL	1
095	SNAP RING	1
096	WASHER, SEALING S050	1
097	CAPSCREW S038-100 NC ASTM A574	27
098	H-BEAM FRAME	1
099	CAPSCREW H125-350 NC GD8 Z	4
100	LOCKWASHER L125 Z SPLIT	4

Item	Description	Qty.
101	HEX NUT	4
102	TORQUE TUBE ASSY	1
104	CAPSCREW H050-125 NC GD8 Z	1
105	CAPSCREW H050-150 NC GD8 Z	7
105	CAPSCREW H050-150 NC GD8 Z	8
106	WASHER P050 HRD Z	45
107	CAPSCREW H050-150 NC GD8 Z SPL	8
108	CAPSCREW H050-300 NC GD8 Z	8
109	CAPSCREW H038-088 NC GD8 Z	8
111	SIGHT GAUGE	1
112	SNAP RING	2
113	THRUST WASHER	1
114	THRUST WASHER	1
122	THRUST WASHER	2
123	BACKUP RING	1
124	LOCKWASHER	27
125	CAPSCREW F038-100 NC ASTM F835	2
126	SUPPORT PLATE	2
127	HANDWHEEL, BP200B	1
128	STUB SHAFT, BP200B	1
129	ROLLPIN	2
130	SEAL, LIP	1
133	RETAINING RING, BP200B	1
134	ROLLPIN	1
135	SETSCREW	1
136	GREASE ZERK FITTING	1
137	SHIM SET	1
140	CAP JIC -4	1
140	V-RING SEAL	1
141	ELBOW TUBE FITTING	1
151	MOTOR ADAPTER	1
152	O-RING	1
153	O-RING	1
154	CAPSCREW H050-175 NC GD8 Z	4
160	NAMEPLATE	1
161	DRIVE SCREW	4
ITEMS NOT SHOWN:		
N/A	REDUCTION CHAIN- SEE PAGE 24	1
N/A	REDUCTION CHAIN- SEE PAGE 24	1
N/A	OFFSET LINK	2
N/A	CABLE WEDGE (1/2-3/4 WIRE ROPE)	1
N/A	DRUM OIL DRAIN PLUG ORB -4	1

TROUBLESHOOTING

⚠ WARNING ⚠

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

TROUBLE	PROBABLE CAUSE	REMEDY
A The winch will not pay-out or haul-in the load smoothly.	1. The friction brake may not be releasing as a result of a defective brake cylinder seal. NOTE: If the brake cylinder seal is defective the winch drum will fill with hydraulic oil and slowly fill the chain case. A fast leak may cause oil to leak around the motor end drum seal. A slower leak may fill the chain case and leak oil from the vent. 2. Friction brake will not release as a result of damaged brake discs.	Check brake cylinder seal as follows: A. Disconnect the hose from the brake valve block. Connect a hand pump with accurate 0-2,000 psi (13,800 kPa) gauge and shut-off valve to the hose (–4 J.I.C. fitting). B. Apply 1,000 psi (6,900 kPa) to the brake. Close shut-off valve and let stand for five (5) minutes. C. If there is any loss of pressure in five (5) minutes, the brake cylinder should be disassembled for inspection of the sealing surfaces and replacement of the seals. Refer to “Motor Support- Brake Cylinder Service”. Disassemble brake to inspect brake discs.
B Oil leaks from vent plug.	1. Same as A1. 2. Motor seal may be defective as a result of high system back pressure or contaminated oil.	Same as A1. Peak intermittent system back pressure must not exceed 150 psi (1,030 kPa). Inspect hydraulic system for a restriction in the return line from the control valve and/or from the motor case drain to the reservoir. Be sure control valve and plumbing is properly sized to winch motor. Oil analysis may indicate contamination has worn motor shaft and seal. Thoroughly flush entire hydraulic system and install new filters and oil. Install new motor seal.

TROUBLE	PROBABLE CAUSE	REMEDY
C		
The brake will not hold a load with the control lever in neutral.	1. Excessive system back pressure acting on the brake release port.	The same as B2.
	2. Friction brake will not hold due to worn or damaged brake discs.	Same as A2.
D		
The winch will not pull the rated load.	1. The winch may be mounted on an uneven or flexible surface which causes distortion of the winch base and binding of the gear train. Binding in the gear train will absorb horsepower needed to pull the rated load and cause heat.	Reinforce mounting surface. If necessary, use shim stock to level winch. Refer to “Winch Installation”. First loosen, then evenly retighten all winch mounting bolts to recommended torque.
	2. System relief valve may be set too low. Relief valve needs adjustment or repair.	Check relief pressure as follows: A. Install an accurate 0-4000 psi gauge into the inlet port of the brake valve. B. Apply a stall pull load on the winch while monitoring pressure. C. Compare gauge reading to winch specifications. Adjust relief valve as required. NOTE: If pressure does not increase in proportion to adjustment, relief valve or pump may be contaminated or worn out. In either case, the relief valve may require disassembly or replacement.
	3. Be certain hydraulic system temperature is not more than 180°F (82°C). Excessive hydraulic oil temperatures increase motor internal leakage and reduce motor performance.	Same as remedies for Trouble D1 & D2. Same as remedies for Trouble E2.
	4. Winch line pull rating is based on 1st layer of wire rope.	Refer to winch performance charts for additional information.
	5. Rigging and sheaves not operating efficiently.	Perform rigging service as recommended by vehicle manufacturer.

TROUBLE	PROBABLE CAUSE	REMEDY
E		
The winch runs hot.	1. Same as D1.	Same as remedies for Trouble D1.
	2. Be certain that the hydraulic system temperature is not more than 180 degrees F. Excessive hydraulic oil temperatures may be caused by:	
	A. Plugged heat exchanger.	Thoroughly clean exterior and flush interior.
	B. Too low or too high oil level in hydraulic reservoir.	Fill/drain to proper level.
	C. Same as D2.	Same as remedies for Trouble D2.
	D. Hydraulic pump not operating efficiently.	Prime mover low on horsepower or R.P.M. Tune/adjust prime mover. Check suction line for damage. If pump is belt driven, belts are slipping. Replace/tighten belts. Pump worn. Replace pump.
	3. Excessively worn or damaged internal winch parts.	Disassemble winch to inspect and/or replace worn parts.
F		
The wire rope does not spool smoothly on the drum.	1. Could be using the wrong lay rope. There is a distinct advantage in applying rope of the proper direction of lay. When the load is slacked off, the several coils on the drum will stay closer together and maintain an even layer. If rope of improper lay is used, the coils will spread apart each time the load is removed. When winding is resumed, the rope has a tendency to criss-cross and overlap on the drum. The result is often flattened and crushed rope.	Consult wire rope manufacturer for recommendation of wire rope that best suits your application.
	2. The winch may have been overloaded, causing permanent set in the wire rope.	Replace wire rope and conduct operator/rigger training as required.

TROUBLE	PROBABLE CAUSE	REMEDY
F Continued	3. Levelwind roller assembly may be out of adjustment	Roller assembly should lag behind where the rope is laying onto the drum by 1/2 a rope diameter. Adjust as required.
	4. The levelwind ratio does not match the cable being used.	Verify levelwind ratio is correct for the size cable being used.
G When winch is shifted into free-spool, winch continues to operate normally.	1. Insufficient pressure at the freespool pressure port.	Check pressure at freespool port. Refer to page 8 for air and hydraulic pressure ranges.
	2. Damaged O-ring seals in free-spool piston.	Replace piston O-ring seals.
	3. There may be a load on the drum and gear train.	Be sure there is no tension on the wire rope when shifting to freespool.
	4. A winch built for hydraulic controls cannot be shifted with air.	Check winch model number and verify type of control circuit required.
H When winch is shifted into free-spool, red light on console does not come on.	1. Faulty solenoid.	Check solenoid and replace as required. (Terminals 30 and 87a are connected with coil de-energized. Terminals 30 and 87 are connected with coil energized. Coil is between terminals 85 and 86.
	2. Burned out bulb.	Check bulb and replace as required.
	3. Faulty freespool switch on winch.	Check switch and replace as required. (Switch is normally open, closed when plunger is pushed in)
I Winch will not remain in freespool mode. (winch drum re-engages to winch drive train)	1. Leaking seals on the freespool piston.	Replace the O-rings and backup rings on the freespool piston.

CHANGING EXTENSION SHAFT LENGTH

Extension shafts are available as 46 in., 47 in., and 50 in. lengths. (from centerline of drum to end of shaft). The extension shaft is connected to the winch with a coupling that has two (2) sets of holes in it, 2 inches apart. This allows the 46 in. shaft to be extended to 48 in., the 47 in. shaft to 49 in. and the 50 in. shaft to 52 in. Follow the steps below to change the effective length of the extension shaft.

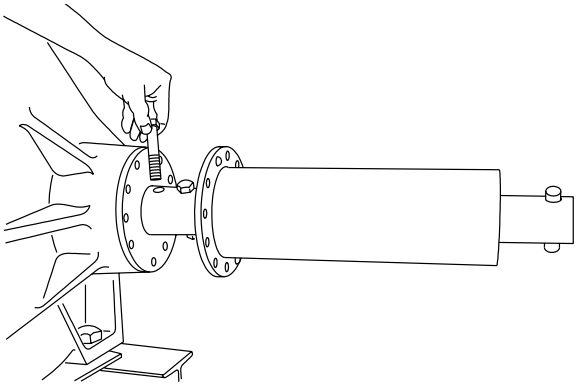
⚠ CAUTION ⚠

The torque tube and extension shaft weigh approximately 65 Lb (29 kg). The entire assembly may easily become disengaged from the coupling during this procedure, resulting in personal injury. If necessary, provide support for the torque tube and extension shaft as it is slid outward.

⚠ WARNING ⚠

The capscrews used in the coupling are Grade 8. DO NOT replace either of them with a soft bolt or pin. A soft bolt or pin may shear off and cause a sudden loss of load control which may result in property damage, personal injury or death.

Remove the twelve (12) capscrews and lockwashers securing the torque tube to the chain case, and slide the torque tube toward the end of the extension shaft, exposing the coupling. Remove the nut, washer and capscrew that are furthest from the winch. Carefully slide the extension shaft outward until the hole in the shaft aligns with the outer hole in the coupling. Replace the capscrew, washer and nut and torque to the correct value. Slide the torque tube back against the chain case and replace the capscrews and washers, and torque to the correct value. Be sure the grease fitting in the torque tube remains at the 12:00 o'clock position.



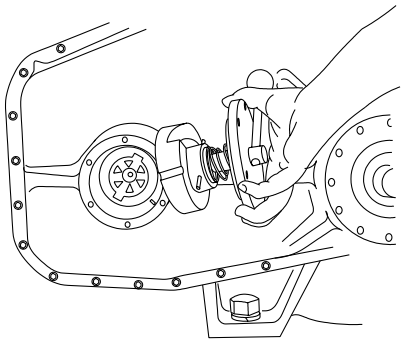
LEVEL WIND DRIVE CONVERSION

The level wind mechanism on the BP200C winch operates at a speed specific to the size of wire rope being used. Whenever wire rope size is changed, some sprockets and chains will have to be changed for the level wind mechanism to operate at the correct speed. The following table shows the correct sprockets and chains required for each size wire rope.

		Wire Rope Size		
		7/16	1/2	9/16
Item	Description	Part No.	Part No.	Part No.
004	DRIVEN SPROCKET	29209 54T	29209 54T	29209 54T
003	DUAL SPROCKET	29616	29617	29636
001	DRIVE SPROCKET	29211 24T	29211 24T	29211 24T
N/A	DRIVE CHAIN - 5/8 P *	29433 65P	29641 63P	29641 63P
N/A	DRIVE CHAIN - 5/8 P *	29632 70P	29433 65P	29433 65P
N.S. **	OFFSET LINK - 5/8 P	29434	29434	29434

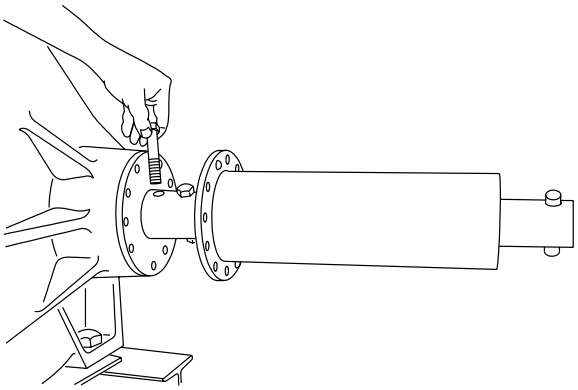
* Includes connecting link
(for replacement connecting link, order Part No. 29435)
** N.S. - Not Shown on drawing

The following steps outline the procedure for changing the sprockets and chain to enable the level wind drive to operate with a different size wire rope.



Place a suitable container under the chain case drain plug and remove the plug to drain the oil. Remove the vent and reducer bushing from the chain case and clean them in safety solvent. It is very important to keep the vent clean and unobstructed. **DO NOT** paint over the vent or replace it with a solid plug.

The cover removed in this step is under spring tension. The capscrews should be loosened evenly in a crosspattern to relieve spring tension. Remove the six (6) capscrews and lockwashers holding the diamond screw disconnect lever assembly to the chain case. Remove the entire assembly and O-ring under the cover.

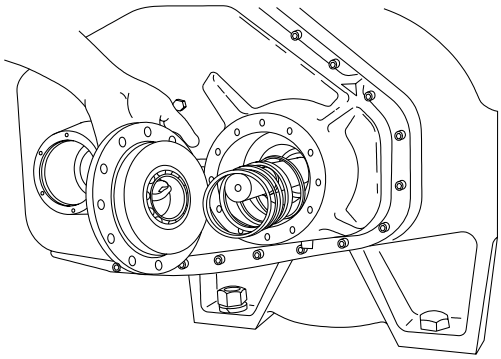


Remove the twelve (12) capscrews and lockwashers securing the torque tube to the chain case, and slide the torque tube toward the end of the extension shaft, exposing the coupling. Remove the nut, washer and capscrew that are closest to the winch. Carefully remove the extension shaft and torque tube from the winch.

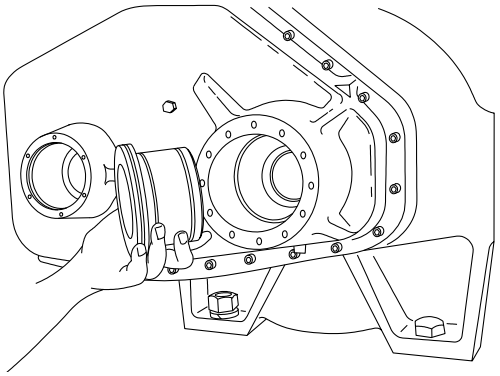
△ CAUTION △

The torque tube and extension shaft weigh approximately 65 Lb (29 kg). If necessary, provide support for the torque tube and extension shaft as it is removed from the winch.

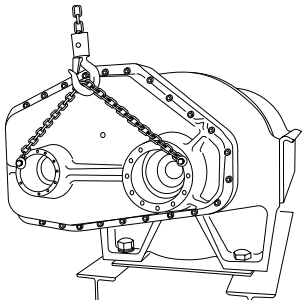
Remove the two (2) socket head capscrews from the bearing/seal carrier and remove the carrier from the winch. Remove the freespool spring. The shaft can now be pulled out of the winch. Some additional oil in the drum may now drain from the winch.



Remove the external retaining ring at the bottom of the freespool piston. Remove the freespool piston and carefully inspect the O-rings, backup rings and sealing surfaces. Replace the O-rings and backup rings on the piston if required.

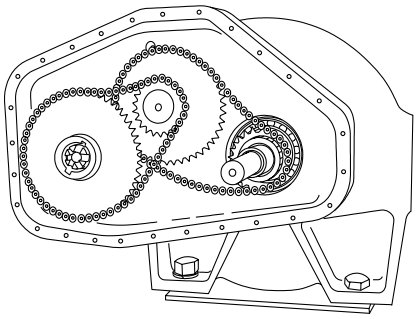


Disconnect the wire from the freespool indicator switch. Adequately support the chain case cover and remove all the capscrews and lockwashers from the cover. Note that there is one capscrew in the center of the cover. Carefully remove the cover.



△ CAUTION △

The chain case cover weighs approximately 110 Lb (50 kg). Provide adequate support as it is removed from the winch.

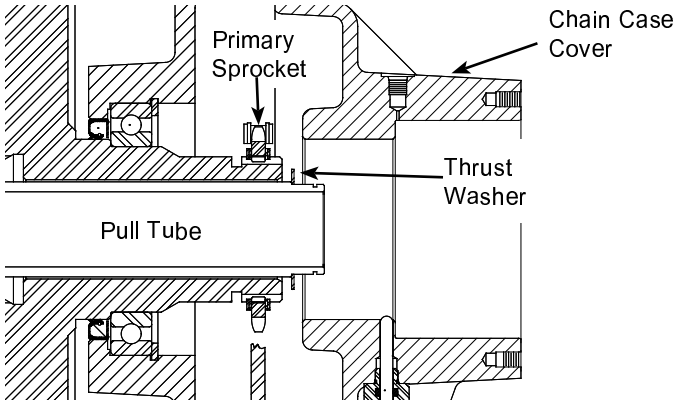


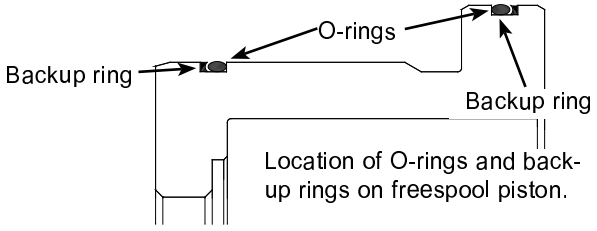
Remove all three sprockets and chains. Thoroughly clean and inspect any parts that will be re-used for signs of damage and/or excessive wear. Replace worn parts as required.

Install new sprockets and chain. When installing intermediate and final drive sprockets, make sure they turn smooth and freely on their bushings. Be sure the retaining ring for the primary sprocket is fully seated in its groove. Install the two spacers onto shaft of the intermediate sprocket. Apply a coating of oil soluble grease to hold them in place until the cover is installed.

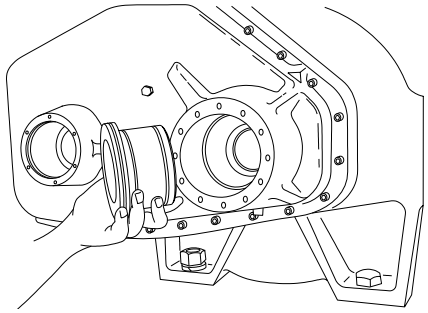
Before installing the cover, pull out the pull tube as far as it can go, and rotate the drum slightly. This will hold the pull tube in its extended position, making it much easier to install the retaining ring after the piston is installed later.

Thoroughly clean the mating surfaces on the chain case and cover. Apply a small, even bead (approx. 3/16 in.) of Dow 732 or equivalent silastic sealant to the flange of the cover and install the cover onto the chain case. Install all capscrews and lockwashers in the flange of the case and evenly torque them. Install the remaining capscrew and lockwasher in the center of the cover.

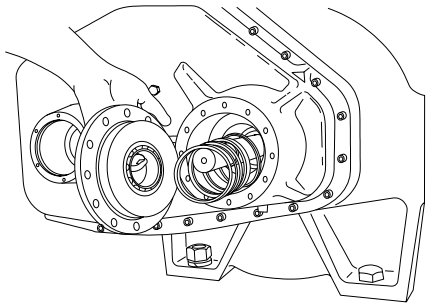




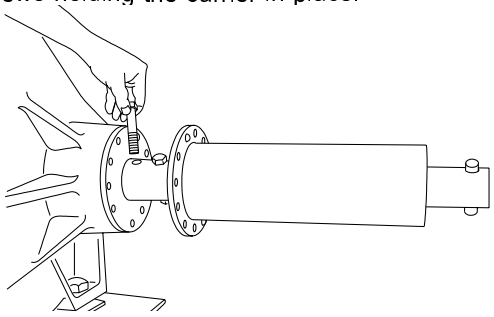
Be sure the thrust washer is in place on the freespool “pull tube”.



Apply a light coat of winch oil to the outside of the freespool piston and install it into the chain case cover. Install the retaining ring into the groove in the end of the “pull tube”, securing the piston to the tube. Rotate the drum slightly and push the pull tube into the winch, engaging the drum. The drum is now engaged with the winch gear train and will not be able to rotate.



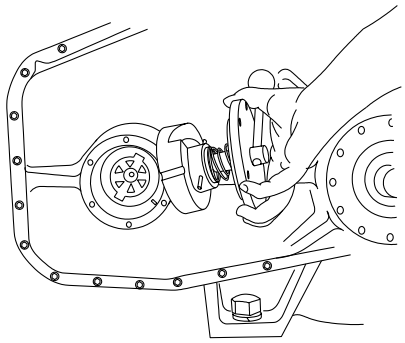
Insert the long drive shaft through the “pull tube” and engage the internal splines. When completely engaged, the driveshaft will extend 1 3/4 in. (44 mm) past the cover. Install the freespool spring and the bearing/seal carrier into the cover. Install the two countersunk socket head capscrews holding the carrier in place.



Install The extension shaft/torque tube assembly and fasten the coupling to the drive shaft. Install the capscrews and lockwashers securing the torque tube to the cover and torque to the correct value.

⚠ WARNING ⚠

The capscrews used in the coupling are Grade 8. DO NOT replace either of them with a soft bolt or pin. A soft bolt or pin may shear off and cause a sudden loss of load control which may result in property damage, personal injury or death.



Install the diamond screw disconnect lever assembly into the cover. Be sure to engage the slot on the outside of the cam with the pin in the bore of the cover. Install the capscrews and lockwashers and torque to the correct value. Install the freespool switch. The freespool mechanism and switch can now be tested. Attach an ohmmeter between the terminal on the switch to the chain case. The meter should read “0”, indicating an open circuit. If your winch is air controlled, connect an air source to the freespool pressure port next to the switch. If your winch is hydraulically controlled, connect a hydraulic hand pump with an accurate gauge to the pressure port. Apply 90 - 150 psi (621 - 1,030 kPa) of air, or 150 - 250 psi (1,030 - 1,720 kPa) of hydraulic pressure. The ohmmeter should indicate continuity and you should be able to rotate the drum by hand. Maintain pressure for several minutes to be sure piston seals are not leaking. If there are any signs indicating pressure is leaking past the seals, disassemble the piston and correct the cause of the leak before returning the winch to service. Slowly rotate the drum while releasing pressure to re-engage the gear train.

Install the drain plug and fill the chain case with oil to the middle of the sight glass. Install the bushing and vent plug.

SERVICING THE DIAMOND SCREW LEVEL WIND

Routine preventive maintenance will greatly extend the life of components of the levelwind system.

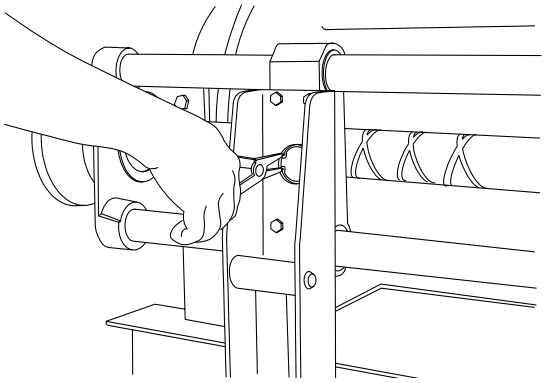
It is important to keep the two smooth slide bars clean and rust free. They should be wiped clean and lightly oiled before and after each use.

The diamond screw should also be cleaned and lightly oiled before and after each use.

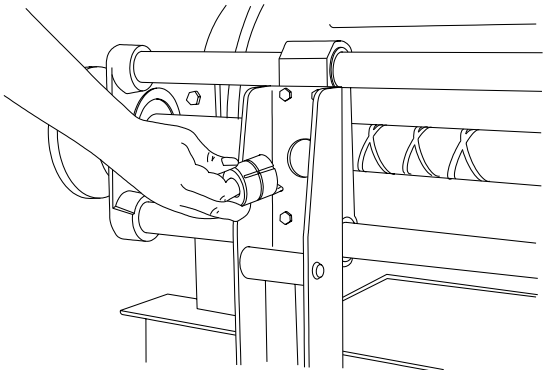
There is a grease fitting on the roller assembly carrier that lubricates the pawl riding in the diamond screw. Apply grease, before each time the winch is used, until a small amount pushes out around the pawl. Use a high quality type 12-hydroxy stearate lithium based product, which contains an EP additive, such as Moly, and meets or exceeds an NGLI Grade 2 specification.

There is also a grease fitting for the bearing at the handwheel end of the diamond screw. Apply a small amount of grease every six (6) months.

Replacing the Level Wind Carrier Pawl

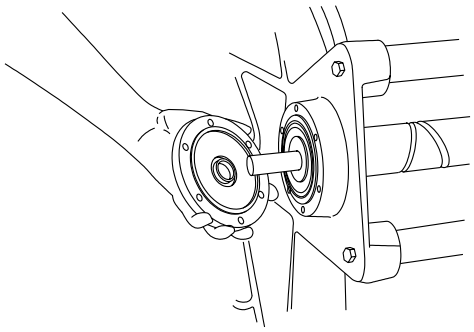


First remove the retaining ring from the carrier.



Remove the grease fitting and spacer, the thrust washer, and the pawl. Thoroughly clean and dry the bore in the carrier. Apply a light coat of grease to the new pawl and install it into the carrier. Rotate the pawl until it engages the groove in the diamond screw. Install the thrust washer against the pawl, the spacer with grease fitting, then the retaining ring. Apply grease through the fitting until a small amount is pushed out around the pawl.

Servicing the Diamond Screw, Bearings and Slide Bars

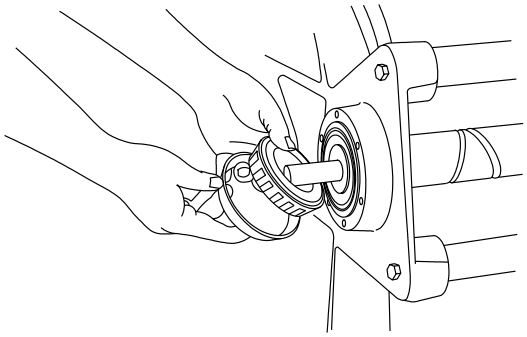


Disengage the diamond screw and use the handwheel to move the level wind carrier assembly to the end of the diamond screw, next to the handwheel.

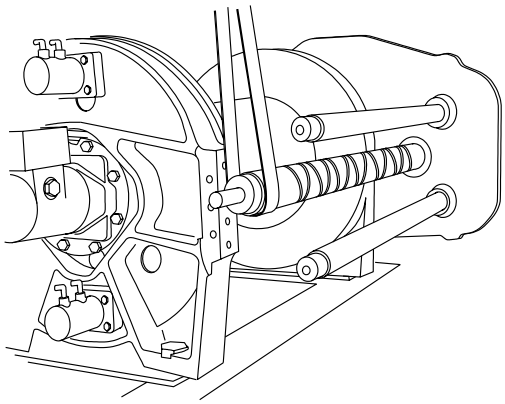
Remove the handwheel by driving out the rollpin on the back of the handwheel. Remove the six (6) capscrews and lockwashers holding the cover plate to the bracket and remove the cover and any shims.

NOTE: *Shims are used under this cover to set the end play of the diamond screw.*

Inspect and replace the seal in the cover as required.

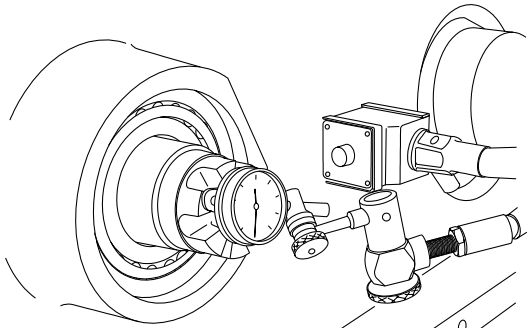


Remove the bearing cup, cone and spacer washer.



Support the diamond screw and remove the level wind support bracket from the winch and slide the carrier assembly off of the slide bars. The slide bars can now be removed, if required, by driving out the rollpin at the chain case end. If the bearing or seal on the chain case end of the diamond screw need to be replaced, the chain case cover must be removed. Refer to “Level Wind Drive Conversion” on page 24. With the chain case cover removed, remove the chain, sprocket and bushing from the diamond screw. Remove the retaining ring from the diamond screw bearing. Support the diamond screw and gently tap the diamond screw out of the end bracket. The bearing and seal can now be replaced. Install the diamond screw, bearing and retaining ring. Thoroughly clean and inspect the support bracket for signs of damage. Inspect and replace the seal in the bracket if required. Thoroughly clean and inspect the bearing, and replace if required.

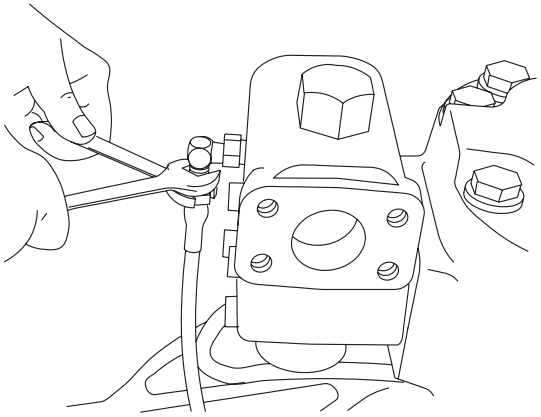
Clean the diamond screw and slide tubes and lightly lubricate their entire lengths. Slide the carrier assembly onto the slide bars and engage the pawl with the diamond screw. Lightly lubricate the sealing surfaces of the diamond screw and the handwheel shaft. Install the support bracket onto the winch, being careful not to damage the seal as it engages the diamond screw. Install all capscrews and lockwashers and torque to their correct values. Apply a liberal coating of grease to the bearing cup and cone. Install the spacer washer, bearing cup and cone, and the cover and shims.



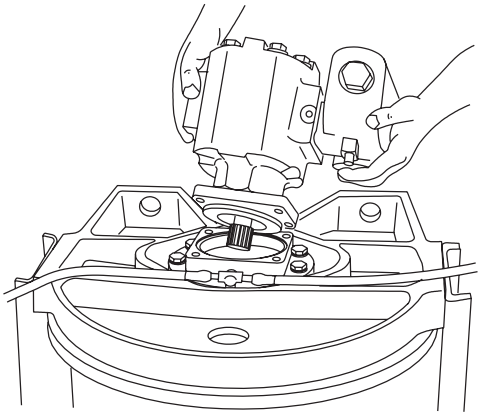
Check diamond screw end play with a dial indicator. End play should be between 0.010 and 0.015 in. (0.25 - 0.38 mm). Adjust end play with shims under the handwheel cover. Apply grease through the grease fitting to fill the bearing cavity. Install the handwheel and rollpin. Disengage the diamond screw and rotate the handwheel to be sure the diamond screw and carriage operate smoothly. Install the bushing, sprocket and chain onto the end of the diamond screw. Install the chain case cover as described in “Level Wind Drive Conversion” on page 26.

BP200C DISASSEMBLY

1. Remove the wire rope from the hoist drum and align the drain plug in the drum with the lowest hole in the support end plate before removing the hoses and mounting bolts. After the hoist is removed from its mounting, clean the outside surfaces.



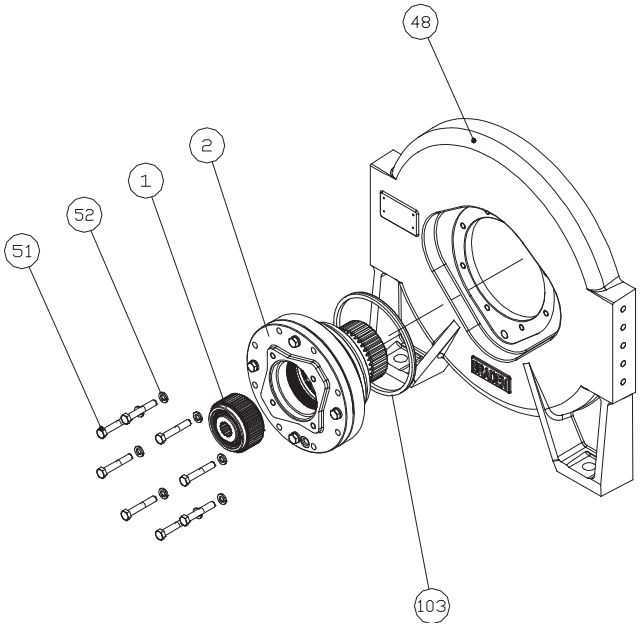
2. Begin the disassembly by standing the hoist on the end opposite the motor. Tag and remove the hydraulic hoses that connect the brake valve to the brake release port.



3. Remove the 2 capscrews and lockwashers securing the motor and lift the motor off the hoist. Remove and discard the O-ring installed on the outside of the motor pilot.

4. Remove the 8 capscrews and lockwashers from the two tie plates, and remove the plates.

5. Remove the overrunning clutch assembly (Item 1) from the center of the brake cylinder assembly. Refer to Overrunning Clutch Assembly Service section in this manual for additional information. Remove the eight capscrews (Item 51) and lockwashers (Item 52) from the motor adapter, and remove the brake cylinder assembly. Remove and discard the V-ring seal (Item 103) that was under the brake cylinder. Do not remove the four capscrews holding the motor adapter to the brake cylinder at this time. Refer to Brake Cylinder Service section of manual.

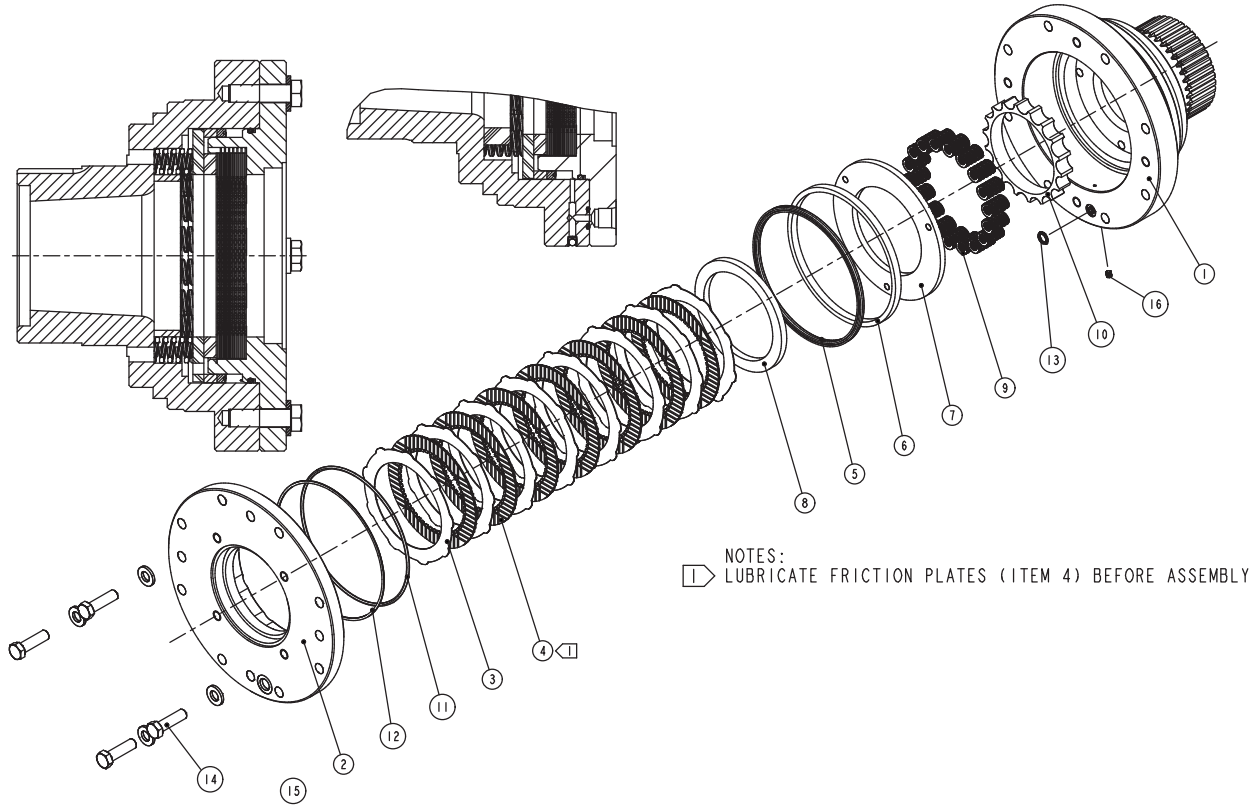


6. There are two 1/2-inch NC tapped holes in the drum closure (Item 56). Install two capscrews or threaded eyebolts to aid in removing the closure from the cable drum. Remove and discard the O-ring (Item 68) from the OD of the drum closure.

7. Install two eyebolts into top end of ring gear. Lift ring gear out of drum. Remove planet gear sets from drum.

8. Lift the cable drum (Item 59) off of the drum support assembly (Item 5).

9. Thoroughly clean and inspect all disassembled components at this time. Inspect bearings in the drum closure and cable drum (Items 64 and 65), and replace as required. Inspect sealing surfaces on the drum support and brake cylinder and repair any damaged areas if possible, or replace components as required. During a complete hoist teardown, drum seals (Items 69 and 70) and V-ring seals (Items 103 and 104) should always be replaced. Inspect thrust washers (Items 66 and 67) for signs of excessive wear, heat damage or metal transfer and replace as necessary. Inspect the ring gear teeth for nicks, spalling, or excessive wear. Replace if wear in contact areas is greater than 0.015 inch (0.4 mm) when compared to unworn area of teeth.



Disassembly

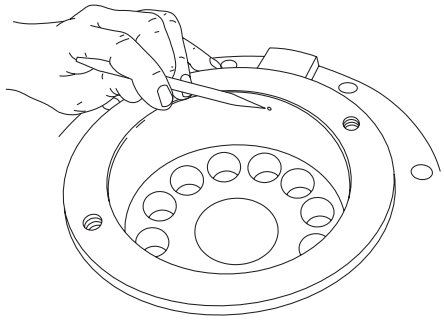
1. Stand the brake assembly on the splined end, with the motor adapter upward. Remove the four capscrews (Item 14) and lockwashers (Item 15). Use a crisscross pattern and loosen each capscrew one turn at a time until spring tension is released.

> **⚠ CAUTION ⚠**
>
> The motor adapter is under spring tension from the brake springs. Loosen each of the capscrews one turn at a time until spring tension is released.

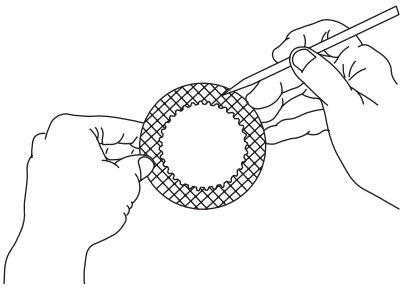
2. Remove the motor adapter (Item 2). Lift out all the brake discs (Item 3), friction discs (Item 40) and the spacer (Item 8).
3. Remove and discard the O-ring and backup ring (Items 11 and 12) from the motor adapter. Remove and discard the seal (Item 5) from the brake cylinder. Remove the steel backup ring (Item 6).
4. Remove the pressure plate (Item 7) and the springs and spacer (Items 9 and 10) from the brake cylinder.

Clean and Inspect

1. Thoroughly clean and inspect all parts at this time. Check sealing surfaces on both the motor adapter and brake cylinder. Be sure the brake release port is open and free of contamination.



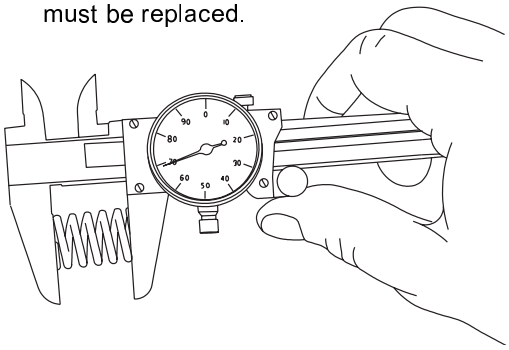
2. Place friction brake disc on flat surface and check for distortion with a straight edge. Friction material should appear even across entire surface with groove pattern visible. Replace friction disc if splines are worn to a point, disc is distorted, friction material is burned or worn unevenly, or groove depth is less than 0.003 inch (0.08 mm).
3. Place steel disc on flat surface and check for distortion with a straight edge. Check surface for signs of material transfer or excessive heat. Replace steel disc if distorted, heat discolored, or mechanically damaged.



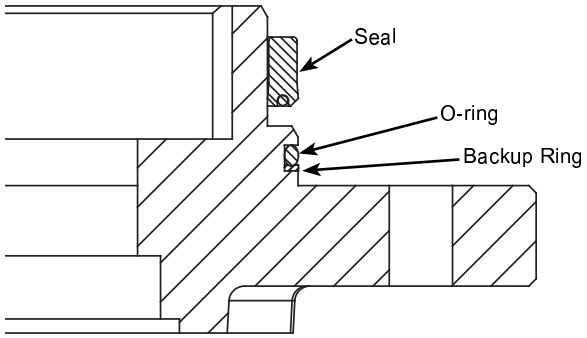
CAUTION

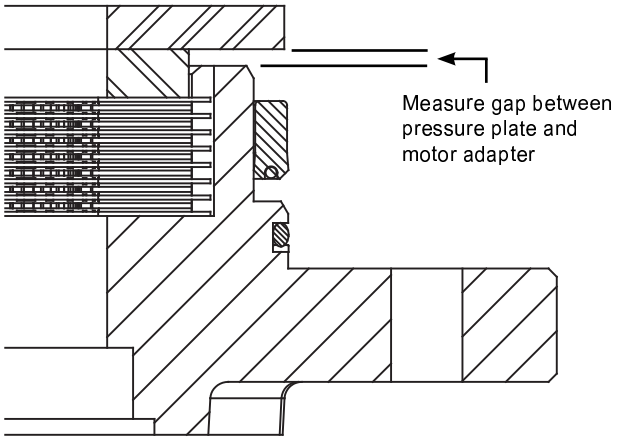
Failure to replace brake springs as a set may result in uneven brake application pressure and repeated brake spring failure.

4. Check brake spring free length. Minimum free length is 1-7/16 inch (36.5 mm). Check springs for any signs of cracking or failure. If a brake spring must be replaced for any reason, then **ALL** brake springs must be replaced.



Assembly





1. Place the motor adapter on a clean work surface with the motor-mounting surface down. Apply a light coat of oil to a new backup ring (Item 12) and O-ring (Item 11) and install them into the groove on the motor adapter. Backup rings are always placed on the low pressure side of the O-ring. In this case, the backup ring is toward the motor-mounting surface. Lightly oil the brake cylinder seal (Item 5) and install it onto the motor adapter with the seal lip down.
2. Install a steel brake disc (Item 3) into the motor adapter, followed by a friction disc (Item 4). Continue to alternately install steel and friction discs. A steel disc will be on top.
3. Install the brake plate spacer (Item 8) on top of the last steel disc.
4. To check brake stack height, place pressure plate (Item 7) on top of brake spacer. Hold pressure plate down firmly by hand and measure gap (in three places) between motor adapter and pressure plate. Average gap must measure between 0.160 inch (4 mm) maximum and 0.080 inch (2.0 mm) minimum. If the gap exceeds the maximum limit, there may be too many discs in the stack-up or the discs are distorted. If the gap is less than the minimum, there may be too few discs or the discs are worn beyond their serviceable limit and should be replaced. When the gap is within the minimum and maximum values, remove the pressure plate and all brake discs. Lubricate all friction discs with the same oil to be used in the hoist. Install all brake discs and brake plate spacer as described in steps 2 and 3.

5. Place the brake cylinder on a clean work surface with the splined end down. Install the spring spacer (Item 10), then the springs (Item 9).

⚠ WARNING ⚠

Always use the molded spring spacer to properly position the springs in the brake cylinder. Failure to install the spring spacer may allow the springs to contact each other and become damaged. This could result in loss of load control, property damage, injury, or death.

6. Install the pressure plate (Item 7) into the brake cylinder. Be careful that none of the springs fall over. Install the steel backup ring (Item 6). Apply petroleum jelly or an oil soluble grease to a new O-ring (Item 13) and install it in the brake cylinder.

   NOTE: The close fitting backup ring may be depressed slightly to one side to lodge it in the brake cylinder bore and temporarily hold the pressure plate and springs in place while the brake cylinder is inverted and lowered over the motor adapter.

   As an alternate, the motor adapter and brake plates can be turned over and installed into the brake cylinder, holding the brake plates and spacer in place through the center opening. Be careful to not pinch your fingers between the spacer plate and the pressure plate.

7. Apply petroleum jelly or an oil soluble grease to the sealing surface of the brake cylinder and the piston seal. Turn the brake cylinder over and lower it onto the motor adapter, being careful not to damage the piston seal or O-ring on the adapter. Be careful the O-ring (Item 13) does not fall out of place, and the oil passages are aligned. The alternate assembly method above could also be used.

8. Turn the entire assembly over and install the four capscrews and lockwashers. After the capscrews make contact with the motor adapter, evenly tighten them one turn at a time until the motor adapter is drawn tight against the brake cylinder, then torque to the recommended value.

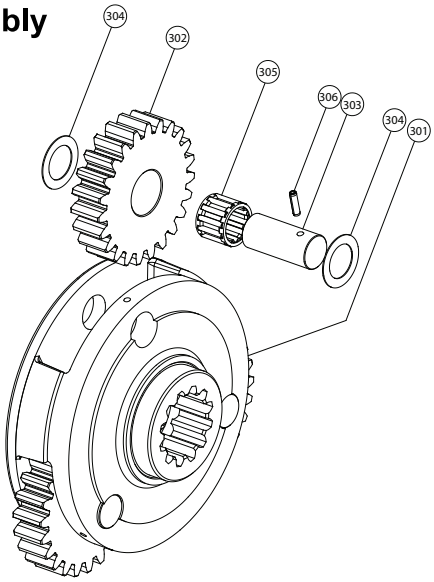
BRAKE CYLINDER PRESSURE TEST

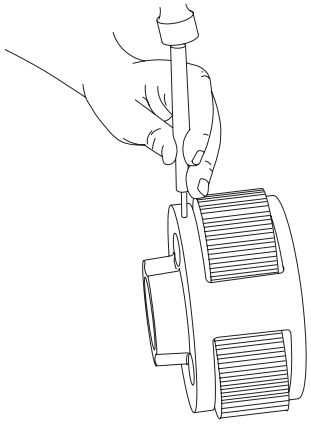
1. Install a -6 ORB fitting into the brake release port on the motor adapter. Connect a hand pump with an accurate 0-2,000 PSI (0-138 bar) gauge and shut-off valve to this fitting. Apply 1,000 PSI (69 bar) to the brake and close the shut-off valve. Let the unit stand for five minutes. If there is any loss of pressure, the brake cylinder should be disassembled for inspection of the sealing surfaces, seal and O-ring. When the source of the pressure leak has been determined and corrected, reassemble the brake cylinder and repeat the test.

2. WHILE PRESSURE IS APPLIED AND THE BRAKE IS RELEASED, install the overrunning clutch assembly into the brake pack. Turn the clutch back and forth to align the splines on all the friction discs. Release the pressure on the brake cylinder and remove the clutch assembly. The brake cylinder is now complete and ready to be installed in the hoist.

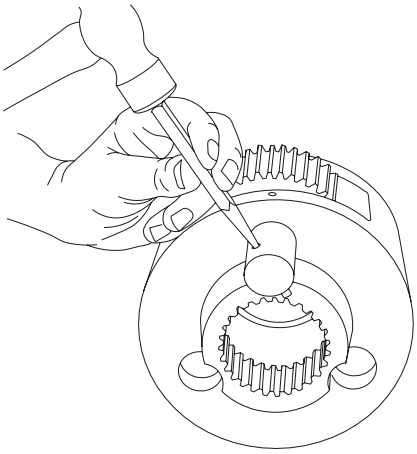
PRIMARY PLANET CARRIER

Disassembly





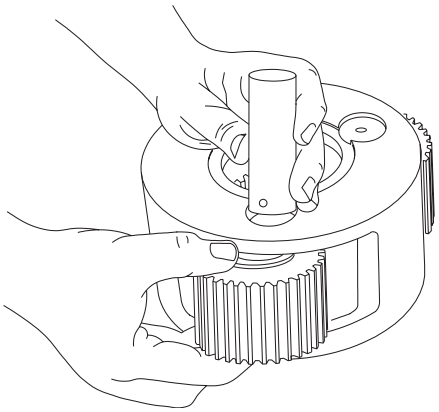
1. Remove the planet gears by first driving the roll pins (Item 31) into the center of the planet gear shafts (Item 28).



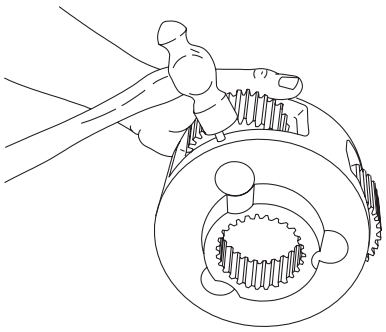
2. Use a punch to drive the roll pins from the planet gear shafts. **DO NOT** reuse the roll pins.

3. Now you can remove the planet shafts, bearings, thrust washers and gears. 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 shafts should be inspected for abnormal wear or pitting. Replace if necessary.

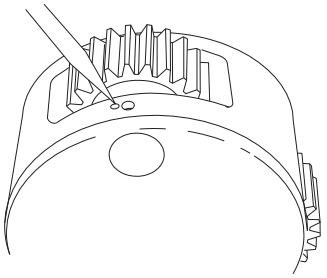
Assembly



1. Install a bearing into a planet gear and place a thrust washer on each side of the gear. Position this assembly into an opening in the carrier. Slide a planet gear shaft through the carrier, thrust washer, bearing and remaining thrust washer.



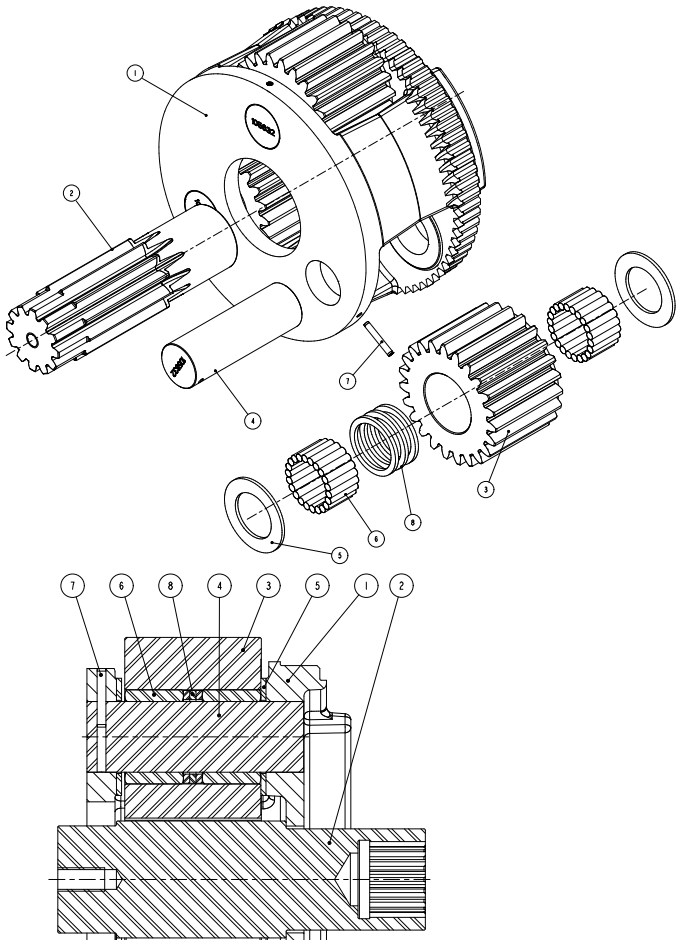
2. Carefully align the pin hole in the carrier with the hole in the shaft and drive a new roll pin into place. **ALWAYS** use **NEW** roll pins. When properly positioned, 50% of the roll pin will engage the planet gear shaft and 50% will remain in the carrier.



3. Note that the roll pin is slightly recessed into the carrier when properly installed. With a center punch, stake the carrier next to the pin hole as shown. This will distort the hole and prevent the pin from backing out in operation. Repeat these steps for each of the three planet gears.

OUTPUT PLANET CARRIER

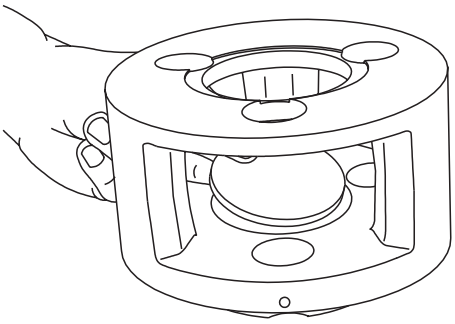
Disassembly



1. Follow steps 1 and 2 of the Primary Planet Carrier disassembly procedure to remove the roll pins from the planet gear shafts.

2. Now you can remove the planet shafts, bearings, spacers, thrust washers and gears. 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, they should be replaced. The thrust washer contact areas should be free from any surface irregularities that may cause abrasions or friction. Inspect gears and shafts for abnormal wear or pitting and replace if necessary.

Assembly



1. Place the output carrier on a clean work surface with the drive pins down. Install the output thrust plate (Item 102) into the center of the carrier.

2. Apply a liberal coat of oil soluble grease to a thrust washer and center it on one side of a planet gear. Place the planet gear on a clean work surface with the thrust washer down. Apply a liberal coat of oil soluble grease to the bore of the gear. Stack a row of loose roller bearings into the planet gear, using the grease to hold them in position. There are 22 rollers in each row. Install a bearing spacer. Stack a second row of loose roller bearings on top of the bearing spacer. Place a second thrust washer on the planet gear. Carefully slide the planet gear, bearings and thrust washers into the carrier. Install a planet gear shaft into the carrier and through the planet gear bearings.

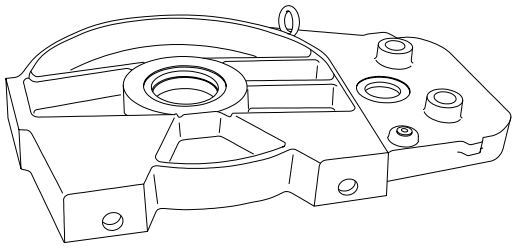
3. Follow steps 2 and 3 of the Primary Planet Carrier assembly procedure to install and stake a **NEW** roll pin in the carrier.

Repeat this procedure for each of the planet gears.

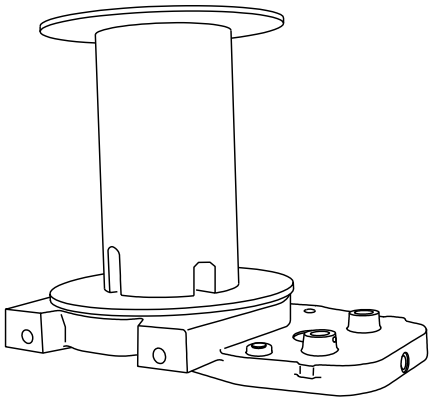
ASSEMBLING THE WINCH GEAR TRAIN, BRAKE AND DRUM

Before beginning to assemble the winch, all bearings should be cleaned, inspected and replaced as required. All seals should be replaced. Use a good grade non-hardening sealing compound on the outside diameter of seals and a light coat of thread sealing compound or sealing tape on pipe fittings and plugs. Be careful not to get these materials inside parts and passages which conduct oil.

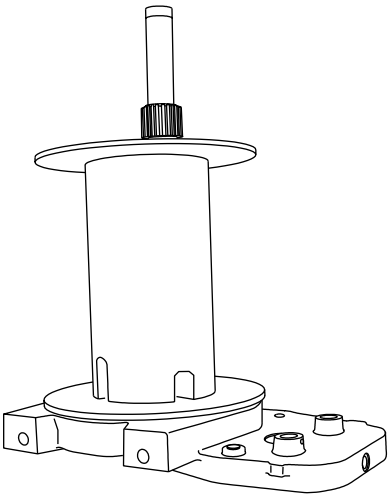
Planet carrier assemblies and brake cylinder should be serviced as required. New O-rings, backup rings and motor gasket should be on hand. All bushings and thrust washers should be inspected and replaced as required.



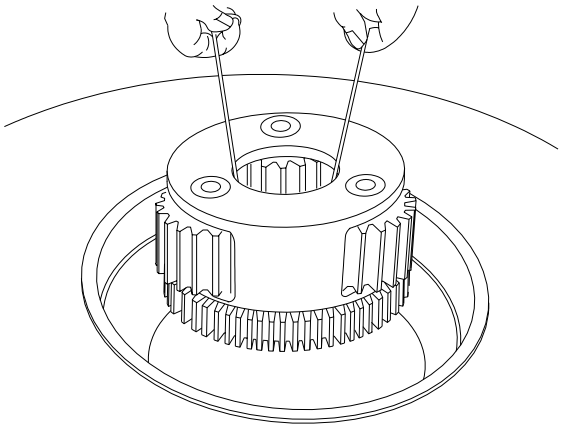
Place the chain case end support bracket on a clean work surface. Use wooden blocks to level and raise the bracket approximately 4 to 6 inches since the end of the drum and the pull tube will extend approximately 1-1/2 inches past the bracket when installed. The drum bearing, retaining ring and seal should already be installed. The diamond screw bearing and seal should also be installed.



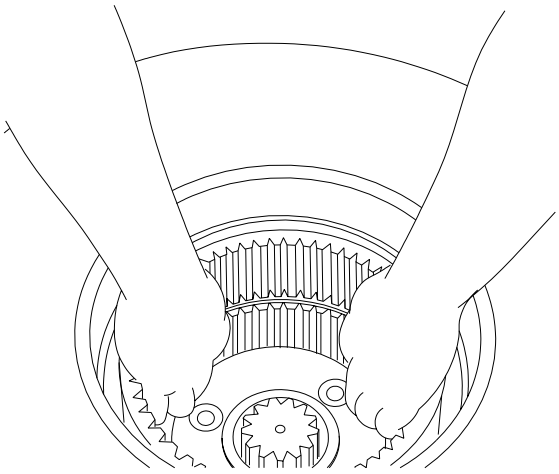
Set the drum onto the support bracket, being careful not to damage the seal.



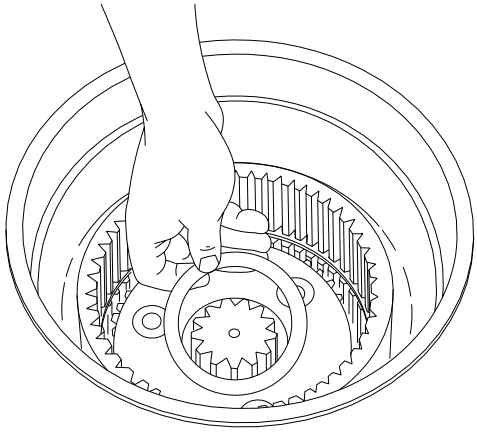
Install the pull tube and freespool gear assembly into the drum. Install the drum bushing (Item 17) onto the pilot hub inside the drum. Install the planet carrier extension (Item 16) into the drum. The end of the extension will fit over the drum bushing.



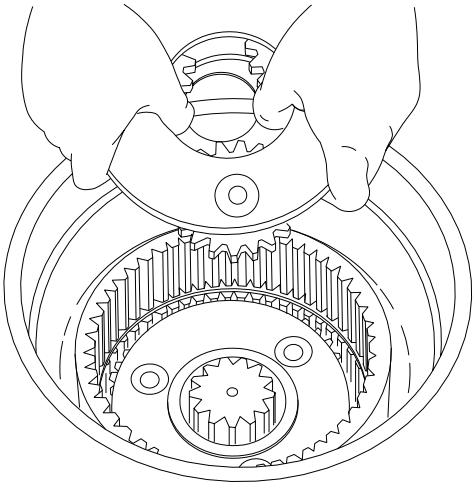
Lower the output planet carrier assembly into the drum, making certain that the teeth on the end of the carrier mesh with the teeth on the carrier extension.

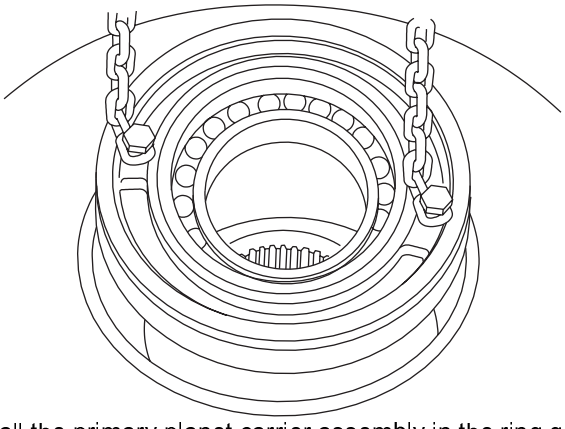


Install the ring gear with the beveled end down, toward the carrier extension. The ring gear teeth must mesh with the output planet gears.



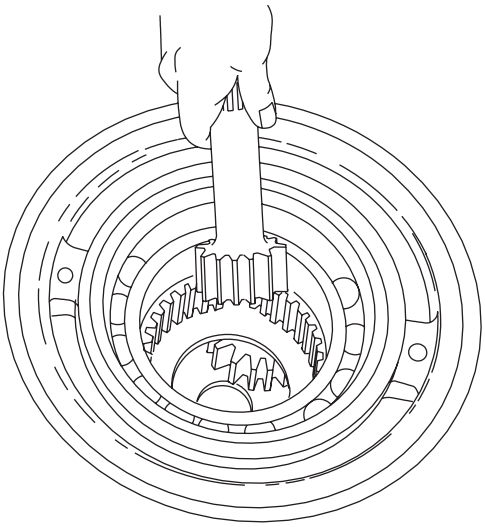
Install the output sun gear and the thrust washer. Center the thrust washer on the output carrier so the primary carrier pilot can be installed through it.





Install the primary planet carrier assembly in the ring gear, meshing the planet gears with the ring gear. The hub goes down, engaging the output sun gear. Be sure the pilot enters the thrust washer.

Install a new bearing in the drum closure if replacement is necessary, making certain to press it against the shoulder in the bottom of the bearing bore. Coat the outside diameter of the new seal with a good grade of sealant. Turn the spring side of the seal toward the bearing, and press the seal into the seal bore, leaving it flush with the end of the bore. Lubricate a new O-ring and install it on the drum closure. Lubricate the large diameter on the closure and install the closure in the drum.



Install the primary sun gear, meshing its teeth with the primary planet gears.

Install the motor end support bracket and the tie plate between the two end brackets. Install all capscrews and lockwashers, but do not fully tighten them at this time.

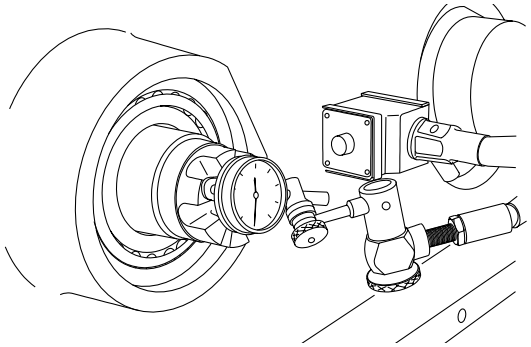
Lubricate the O-ring and install it on the outside of the brake cylinder.

If the slide bars were removed, install them using two new roll pins. Install the diamond screw into its bearing in the chain case support bracket, being careful not to damage the seal. Install the slider bracket onto the slide bars and engage the pawl into the diamond screw. Install the level wind support bracket over the diamond screw and slide bars, being careful not to damage the seal. Tighten all capscrews in the bracket and the tie plate to their correct torque values.

Refer to “SERVICING THE DIAMOND SCREW LEVEL WIND” for additional information and install the bearing and cover plate.

Turn the winch onto its mounting feet, and raise the chain case end up approximately 2 to 3 in. (51 to 76 mm).

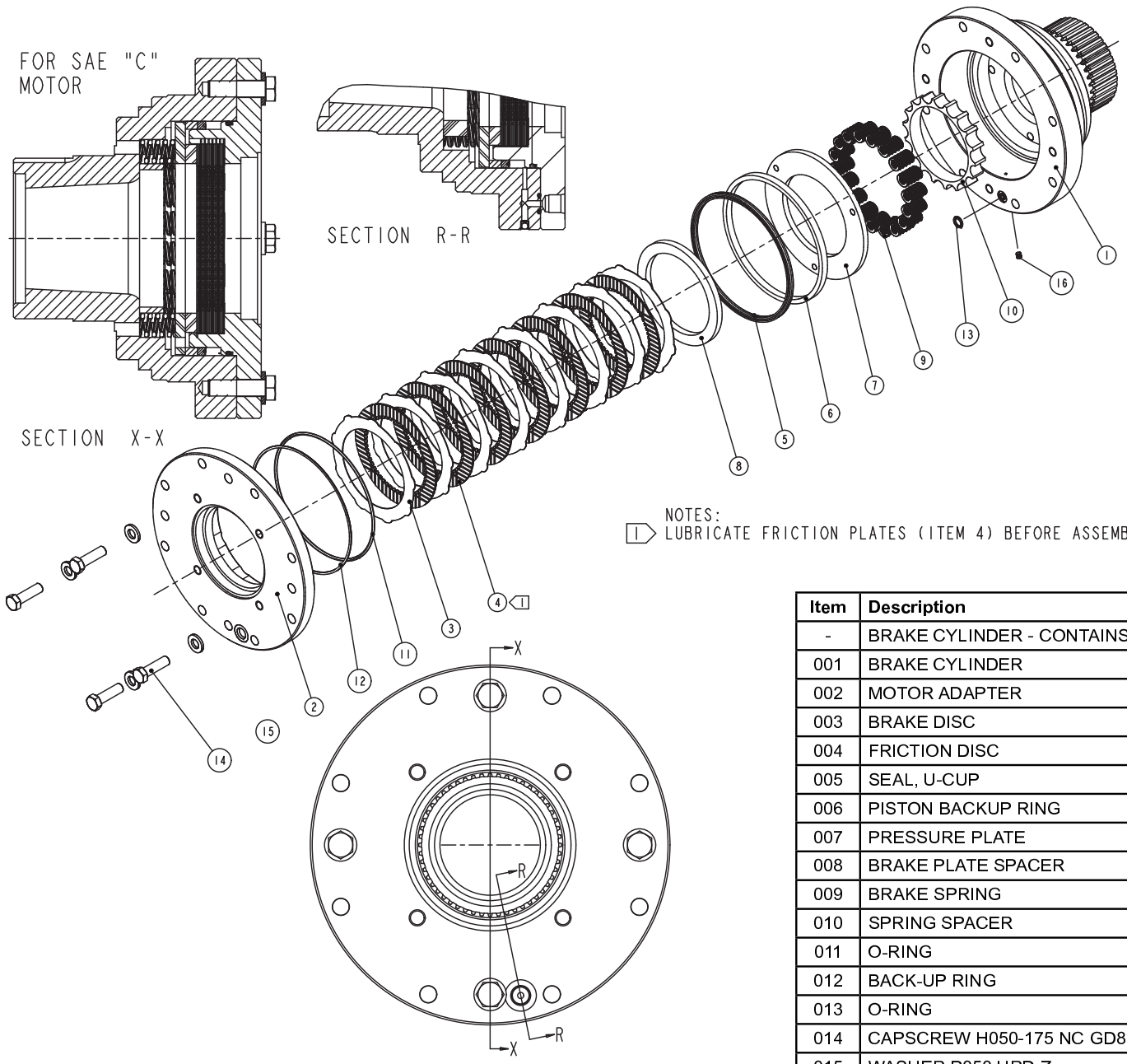
Check the diamond screw end play with a dial indicator as shown. End play should be 0.010 to 0.015 in. (0.25 to 0.38 mm). Adjust end play by adding or removing shims under the cover plate at the opposite end of the diamond screw. When proper end play is achieved, install the diamond screw handwheel.



Add 5 quarts (4.73 L) of oil to the winch drum through the pull tube. Refer to “CONVERSION PARTS FOR LEVEL WIND DRIVE” and install the sprockets, chain, freespool parts, extension shaft and diamond screw disconnect lever. Return the winch to a level position and fill the chain case to the center of the sight glass (approx. 9 quarts - 8.5L).

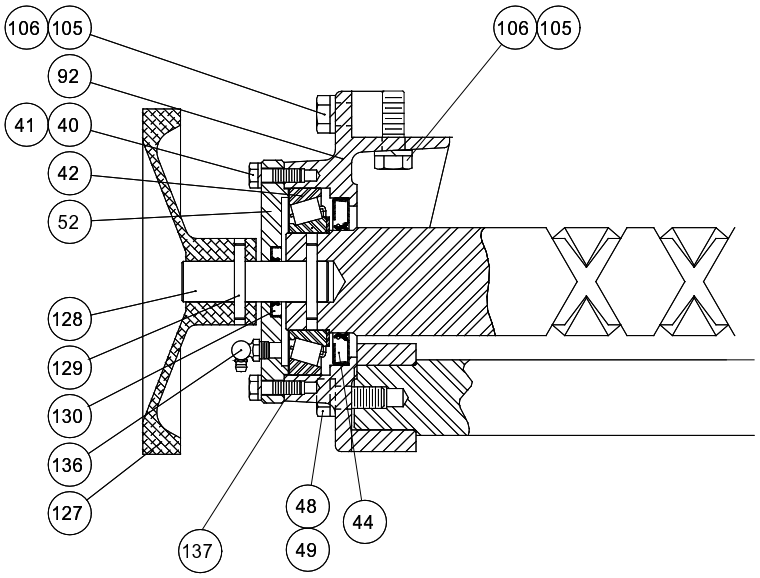
After the winch is installed, be sure the drum rotates in the correct direction to pay-out and haul-in cable as indicated at the operators station. Be sure the freespool mechanism and the indicator lights are operating correctly.

BRAKE CYLINDER ASSEMBLY



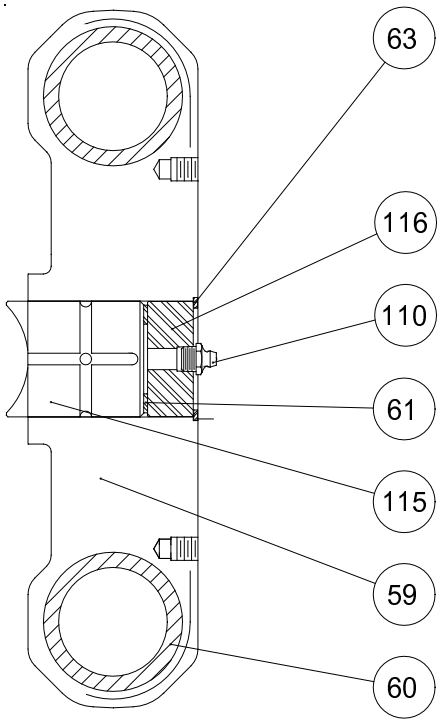
Item	Description	Qty.
-	BRAKE CYLINDER - CONTAINS ALL PARTS BELOW	1
001	BRAKE CYLINDER	1
002	MOTOR ADAPTER	1
003	BRAKE DISC	8
004	FRICTION DISC	7
005	SEAL, U-CUP	1
006	PISTON BACKUP RING	1
007	PRESSURE PLATE	1
008	BRAKE PLATE SPACER	1
009	BRAKE SPRING	18
010	SPRING SPACER	1
011	O-RING	1
012	BACK-UP RING	1
013	O-RING	1
014	CAPSCREW H050-175 NC GD8 Z	4
015	WASHER P050 HRD Z	4
016	EXPANSION PLUG	1

HANDWHEEL DETAIL



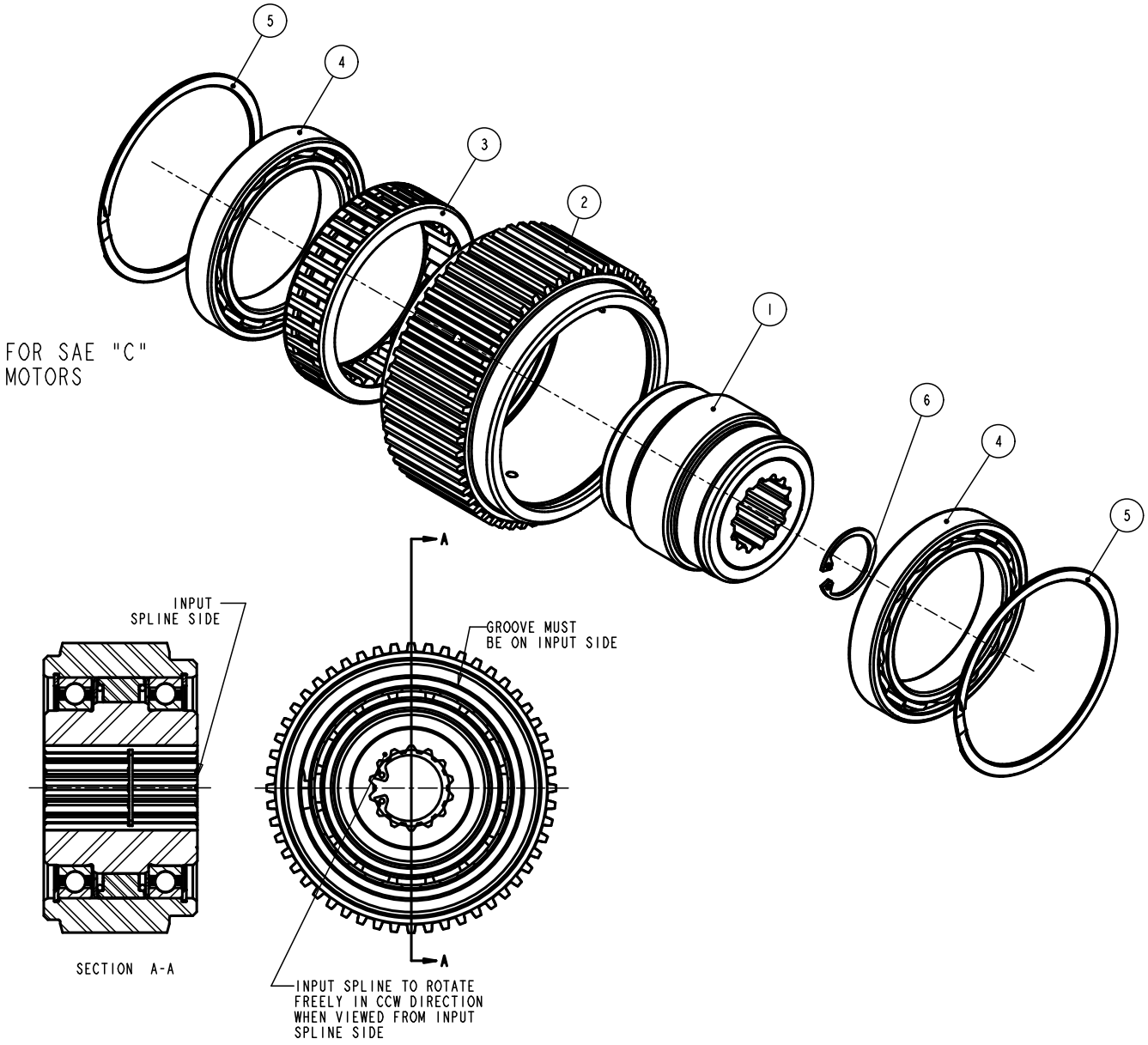
Item	Description	Qty.
40	CAPSCREW (5/16 - 18 X 1 G8 Z)	6
41	LOCKWASHER (5/16)	6
42	TAPERED ROLLER BEARING SET	1
44	SEAL	1
48	CAPSCREW (1/2 - 13 X 1-1/4 G8 Z)	2
49	LOCKWASHER (1/2)	2
52	COVER	1
92	LEVEL WIND SUPPORT BRACKET	1
105	CAPSCREW (1/2 - 13 X 1-1/2 G8 Z)	7
106	LOCKWASHER (1/2)	7
127	HANDWHEEL	1
128	STUB SHAFT	1
129	ROLLPIN	2
130	SEAL	1
136	GREASE FITTING	1
137	SHIM SET	1

CARRIAGE ASSEMBLY



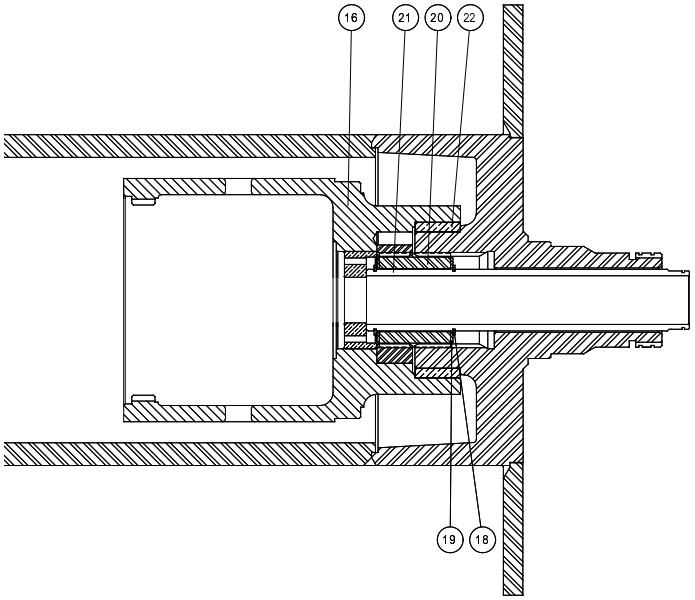
Item	Description	Qty.
-	CARRIAGE ASSEMBLY - INCLUDES ALL ITEMS BELOW	1
59	CARRIAGE	1
60	BUSHING	2
61	THRUST WASHER	1
63	RETAINING RING	1
110	GREASE FITTING	1
115	PAWL	1
116	SPACER	1

OVERRUNNING CLUTCH (SPRAG)



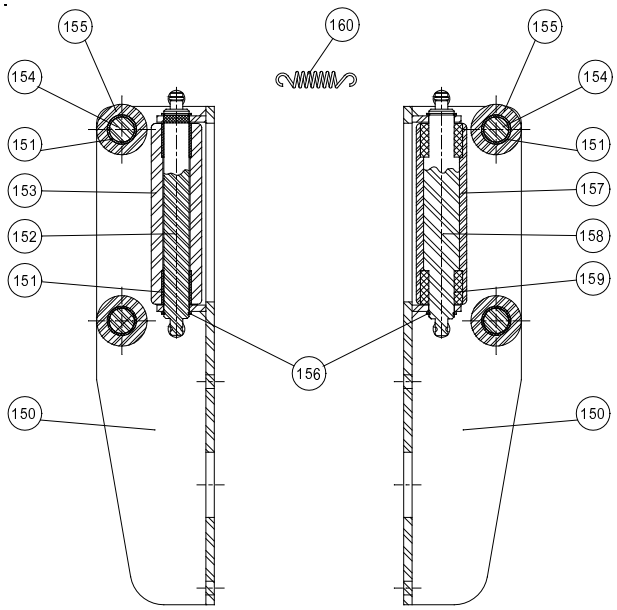
Item	Description	Qty.
-	OVERRUNNING CLUTCH (SPRAG) - CONTAINS ALL PARTS BELOW	1
001	INNER BRAKE RACE	1
002	OUTER RACE	1
003	OVERRUNNING CLUTCH	1
004	BALL BEARING	2
005	RETAINING RING	2
006	RETAINING RING	1
NSS - NOT SOLD SEPARATELY		

FREESPOOL GEAR ASSEMBLY



Item	Description	Qty.
16	CARRIER EXTENSION	1
18	RETAINING RING	2
19	THRUST WASHER	2
20	FREESPOOL COUPLING	1
21	PULL TUBE	1
22	BUSHING	1

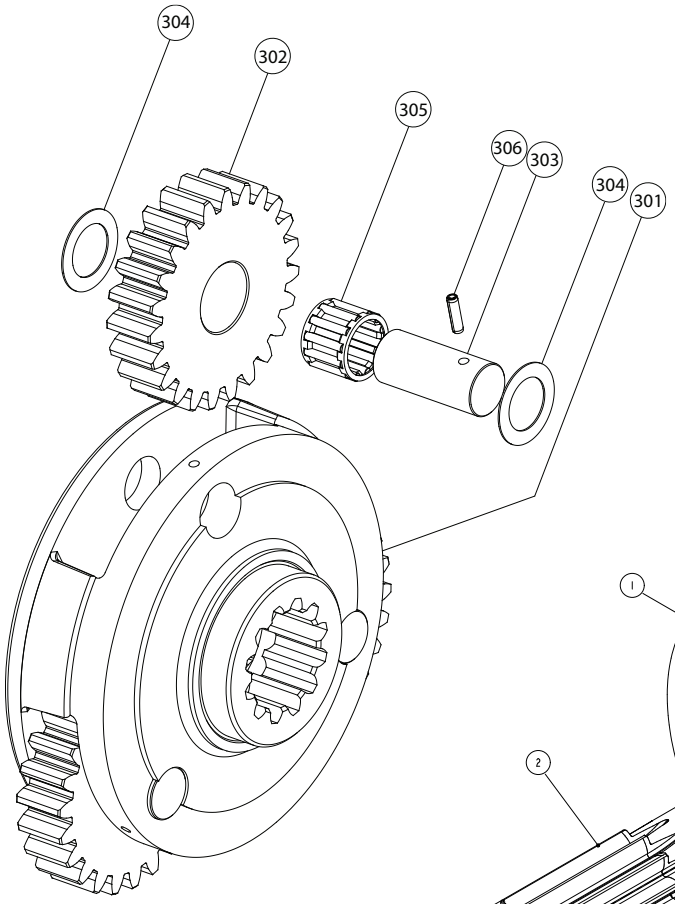
ROLLER ASSEMBLY



Fixed Roller **Moving Roller**

Item	Description	Qty.
-	Roller Assembly - contains all parts below	1
150	Roller Bracket	1
151	Bushing	6
152	Fixed Roller Shaft	1
153	Fixed Roller	1
154	Horizontal Roller Shaft	2
155	Horizontal Roller	2
156	Retaining Ring	8
157	Moving Roller	1
158	Moving Roller Shaft	1
159	Bushing	2
160	Roller Tension Spring	2
N.S.	Capscrew (3/8 - 16 X 3/4 G8 Z)	4
	Lockwasher (3/8)	4

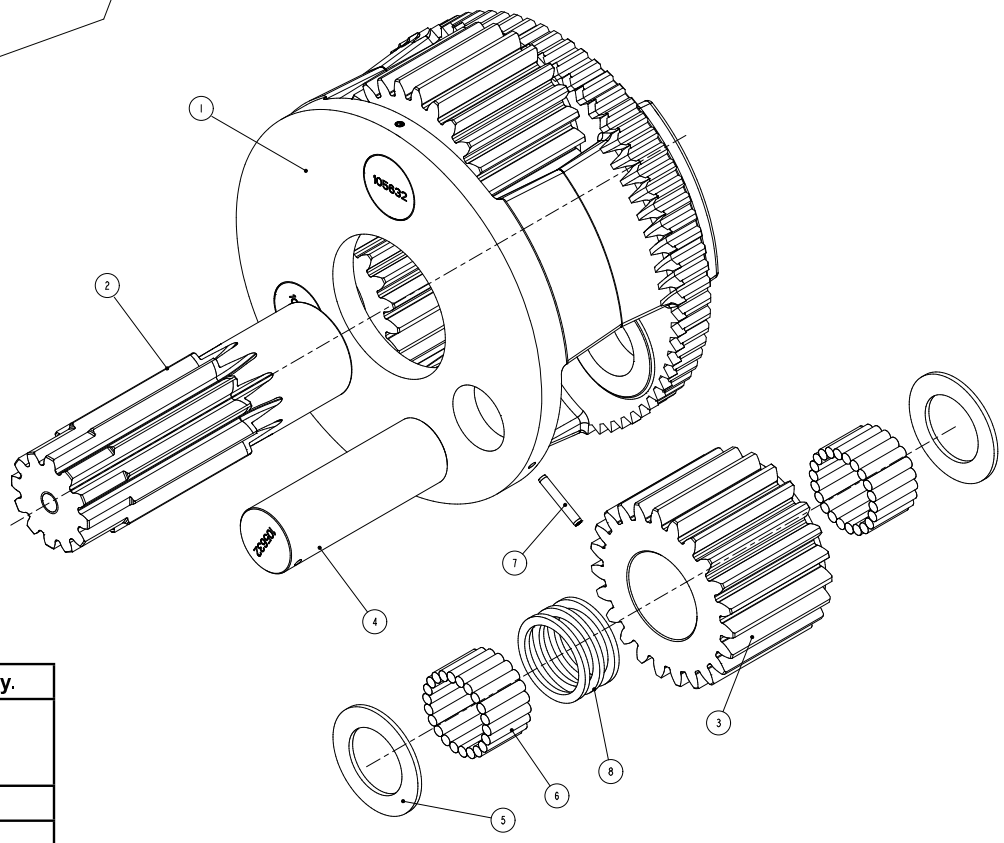
PLANET GEAR ASSEMBLIES



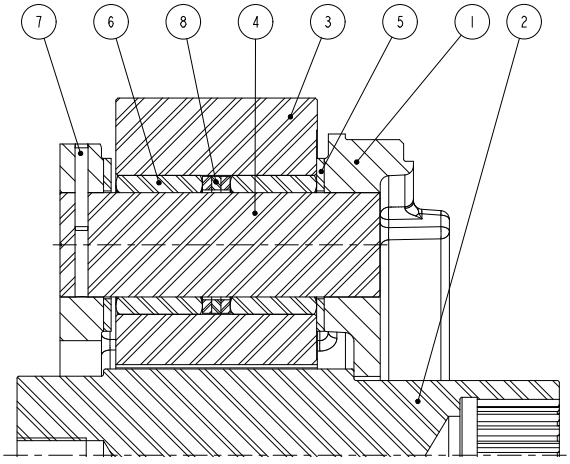
PRIMARY PLANET CARRIER

Item	Description	Qty.
-	PRIMARY PLANET CARRIER ASSEMBLY - CONTAINS ALL PARTS BELOW	1
001	PRIMARY PLANET CARRIER	1
002	PRIMARY PLANET GEAR	3
003	PRIMARY PLANET GEAR SHAFT	3
004	THRUST BEARING	6
005	ROLLER BEARING	3
006	SPIROL PIN	3

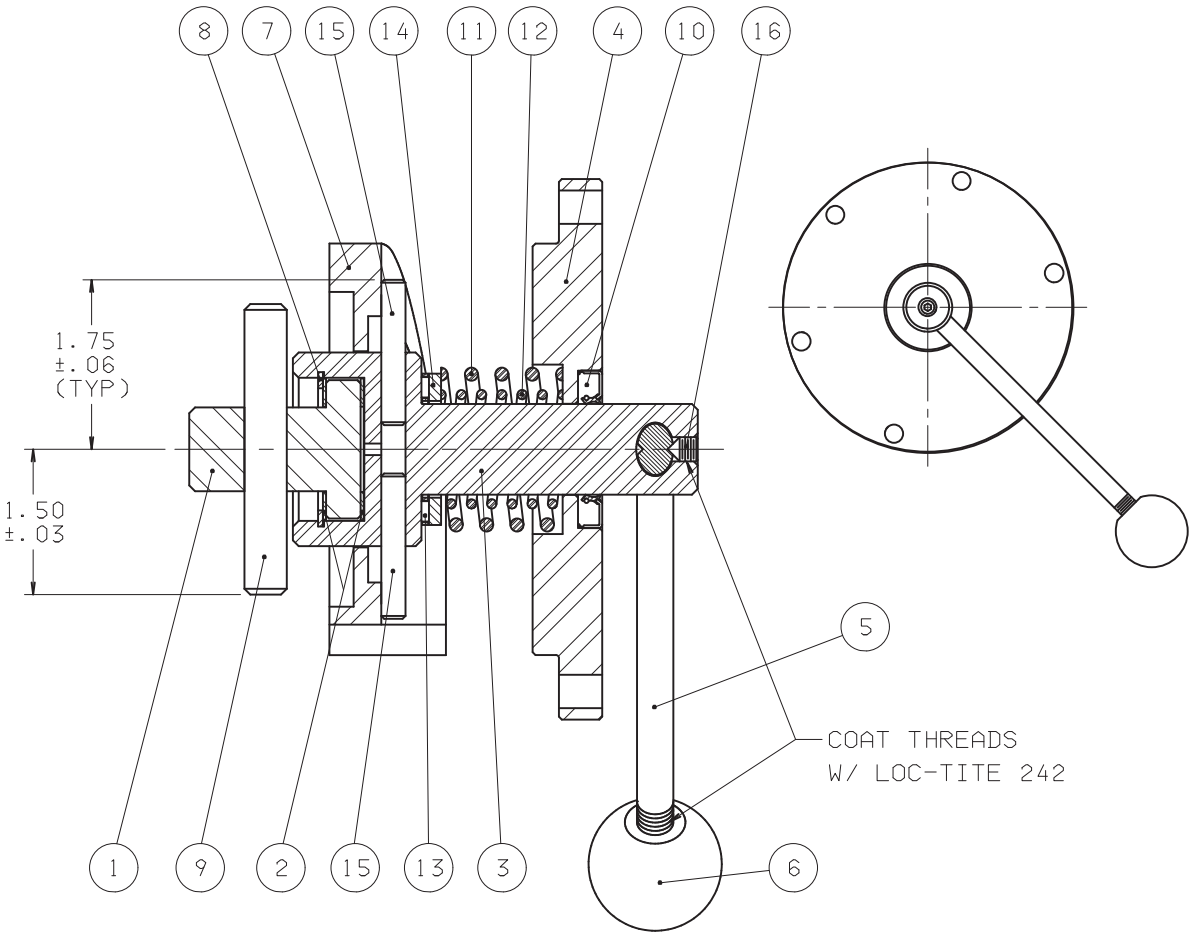
OUTPUT PLANET CARRIER



Item	Description	Qty.
-	OUTPUT CARRIER ASSEMBLY - CONTAINS ALL PARTS BELOW	1
001	OUTPUT CARRIER	1
002	GEAR, PLANET	3
003	OUTPUT SUN GEAR	1
004	OUTPUT PLANET SHAFT	3
005	THRUST WASHER	6
006	ROLLER	120
007	SPIROL PIN	3
008	SPACER, BEARING	9

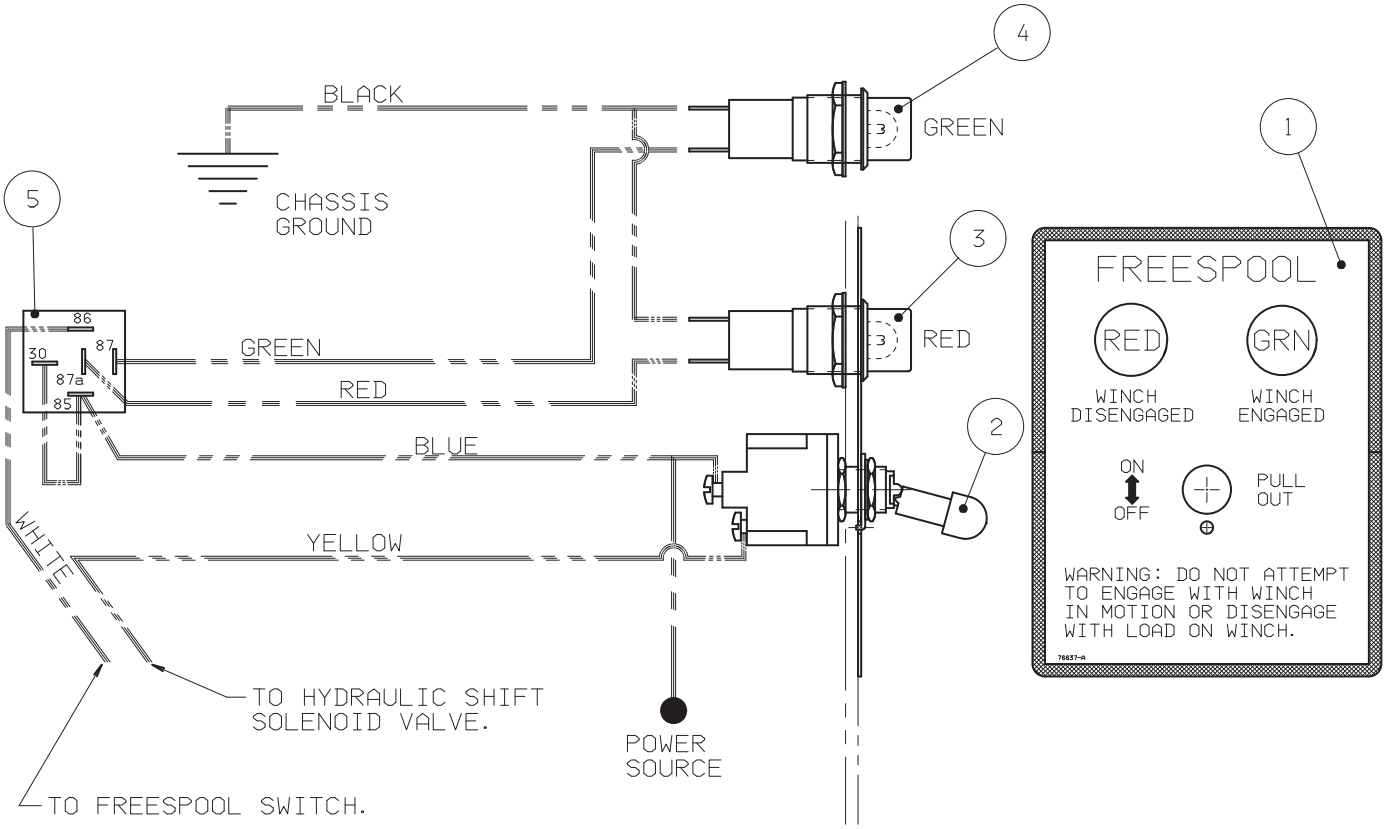


DIAMOND SCREW DISCONNECT



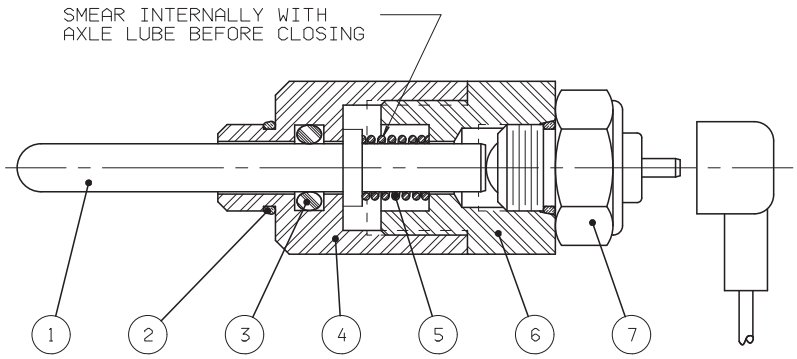
Item	Description	Qty.
001	DISCONNECT SHAFT	1
002	THRUST RACE	2
003	DISCONNECT RETAINER, BP200B	1
004	END COVER, BP200B	1
005	HANDLE, BP200B	1
008	RING, RETAINING INTERNAL	1
009	PIN	1
010	SEAL, LIP	1
011	SPRING, BP200B	1
012	SPRING, BP200B	1
013	THRUST BEARING, BP200B	1
014	THRUST WASHER, BP200B	1
015	DOWELL PIN, BP200B	2
007	CAM, BP200B	1
016	SETSCREW	1
006	KNOB, BP200B	1

LAMP AND SWITCH ASSEMBLY



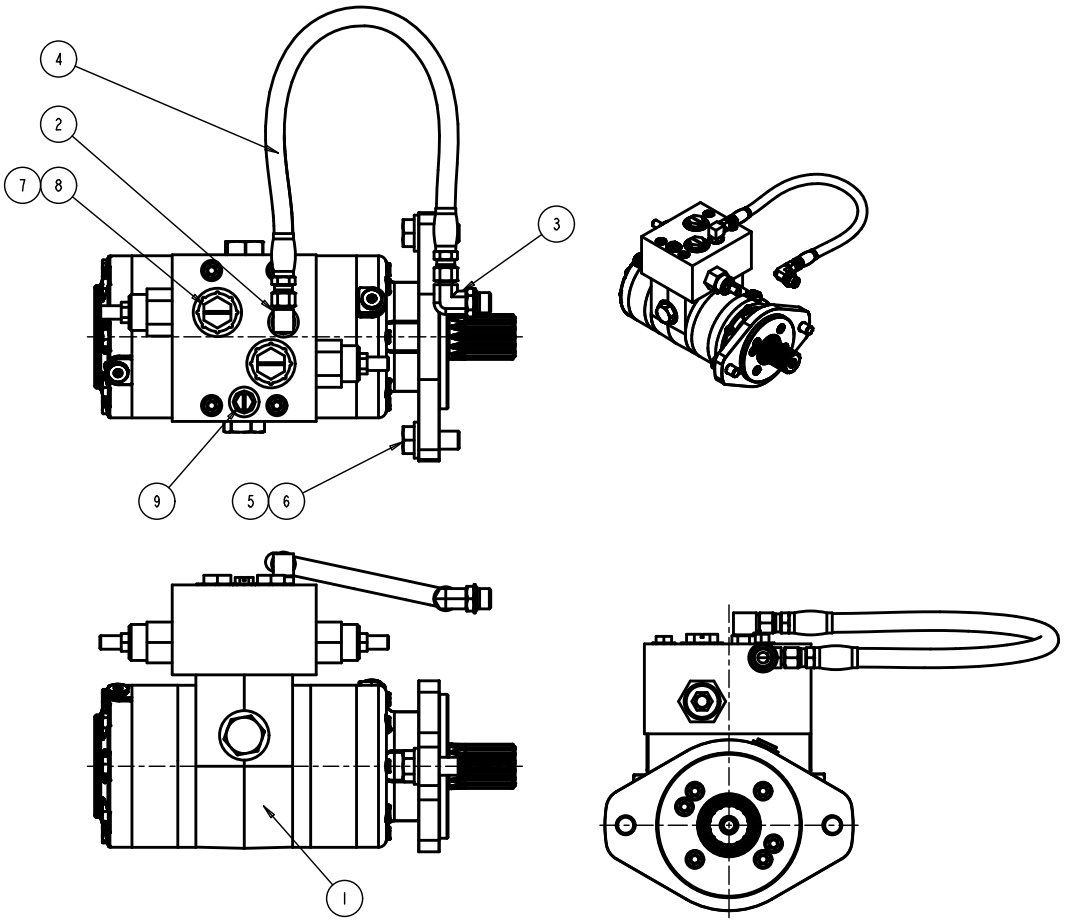
Item	Description	Qty.
-	LAMP & SWITCH ASSY - CONTAINS ALL LITEMS BELOW	1
003	INDICATOR LIGHT ASSY, RED	1
_	LENS, RED	1
_	LAMP BODY	1
004	INDICATOR LIGHT ASSY, GREEN	1
-	LENS, GREEN	1
_	LAMP BODY	1
006	LAMP/12V	2
002	TOGGLE SWITCH	1
001	TEMPLATE, FREESPOOL WARNING	1
005	RELAY, 12VDC, SPDT	1

FREESPOOL SWITCH ASSEMBLY



Item	Description	Qty.
-	FREESPOOL WINCH ASEMBLY - CONTAINS ALL PARTS BELOW	1
250	SWITCH PIN	1
251	O-RING	1
252	O-RING	1
253	SWITCH CARRIER ADAPTER	1
254	SPRING	1
255	SWITCH CARRIER ADAPTER	1
256	SWITCH W/O-RING & CONNECTOR	1
257	O-RING	1

MOTOR ASSEMBLY



Item	Description	Qty.
-	HYDRAULIC MOTOR ASSEMBLY - CONTAINS ALL ITEMS BELOW:	1
001	HYDRAULIC MOTOR	1
002	ELBOW FITTING	1
003	ELBOW/O-RING	1
004	HOSE ASSY	1
005	WASHER P050 HRD Z	2
006	CAPSCREW H050-125 NC GD8 Z	2
007	SHIPPING PLUG	2

VARIABLE ITEMS

		Wire Rope Size		
		7/16	1/2	9/16
Item	Description	Part No.	Part No.	Part No.
004	DRIVEN SPROCKET	29209 54T	29209 54T	29209 54T
003	DUAL SPROCKET	29616	29617	29636
001	DRIVE SPROCKET	29211 24T	29211 24T	29211 24T
N/A	DRIVE CHAIN - 5/8 P *	29433 65P	29641 63P	29641 63P
N/A	DRIVE CHAIN - 5/8 P *	29632 70P	29433 65P	29433 65P
N.S. **	OFFSET LINK - 5/8 P	29434	29434	29434

* Includes connecting link
(for replacement connecting link, order Part No. 29435)
** N.S. - Not Shown on drawing

EXTENSION SHAFTS		
Item	Length	Part No.
013	46	29208
	47	29619
	50	29622

FREESPOOL SPRING		
Item	Control	Part No.
033	Pneum.	29239
	Hydr.	29963

RECOMMENDED BOLT TORQUE

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

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

RECOMMENDED FASTENER TORQUE

Bolt Diam. Inches	Thread per inch	Torque LB-FT (N.m)			
		Grade 5		Grade 8	
		Dry	Lubed	Dry	Lubed
1/4	20 28	8 (11)	6 (8)	12 (16)	9 (12)
5/16	18 24	17 (23)	13 (17)	24 (33)	18 (24)
3/8	16 24	31 (42)	23 (31)	45 (61)	35 (47)
7/16	14 20	50 (68)	35 (47)	70 (95)	50 (68)
1/2	13 20	75 (102)	55 (75)	110 (149)	80 (108)
9/16	12 18	110 (149)	80 (108)	150 (203)	110 (149)
5/8	11 18	150 (203)	115 (156)	210 (285)	160 (217)

Bolt Diam. Inches	Thread per inch	Torque LB-FT (N.m)			
		Grade 5		Grade 8	
		Dry	Lubed	Dry	Lubed
3/4	10 16	265 (359)	200 (271)	380 (515)	280 (380)
7/8	9 14	420 (569)	325 (441)	600 (813)	450 (610)
1	8 14	640 (868)	485 (658)	910 (1234)	680 (922)
1 1/8	7 12	790 (1071)	590 (800)	1290 (1749)	970 (1315)
1 1/4	7 12	1120 (1518)	835 (1132)	1820 (2468)	1360 (1817)
1 3/8	6 12	1460 (1979)	1095 (1485)	2385 (3234)	1790 (2427)
1 1/2	6 12	1940 (2360)	1460 (1979)	3160 (4284)	.2370 (3214)

To convert LB-FT to Kg-m, multiply LB-FT value by 0.1383

8-2008

METRIC CONVERSION TABLE

English to Metric			Metric to English		
LINEAR					
inches (in.)	X 25.4	= millimeters (mm)	millimeters (mm)	X 0. 03937	= inches (in.)
feet (ft.)	X 0.3048	= meters (m)	meters (m)	X 3.281	= feet (ft.)
miles (mi.)	X 1.6093	= kilometers (km)	kilometers (km)	X 0.6214	= miles (mi.)
AREA					
inches ^{2} (sq.in.)	X 645.15	= millimeters ^{2} (mm ^{2})	millimeters ^{2} (mm ^{2})	X 0.000155	= inches ^{2} (sq.in.)
feet ^{2} (sq.ft.)	X 0.0929	= meters ^{2} (m ^{2})	meters ^{2} (m ^{2})	X 10.764	= feet ^{2} (sq.ft.)
VOLUME					
inches ^{3} (cu.in.)	X 0.01639	= liters (l)	liters (l)	X 61.024	= inches ^{3} (cu.in.)
quarts (qts.)	X 0.94635	= liters (l)	liters (l)	X 1.0567	= quarts (qts.)
gallons (gal.)	X 3.7854	= liters (l)	liters (l)	X 0.2642	= gallon (gal.)
inches ^{3} (cu.in.)	X 16.39	= centimeters ^{3} (cc)	centimeters3 (cc)	X 0.06102	= inches ^{3} (cu.in.)
feet ^{3} (cu.ft.)	X 28.317	= liters (l)	liters (l)	X 0.03531	= feet ^{3} (cu.ft.)
feet ^{3} (cu.ft.)	X 0.02832	= meters ^{3} (m ^{3})	meters3 (m3)	X 35.315	= feet ^{3} (cu.ft.)
fluid ounce (fl.oz.)	X 29.57	= millileters (ml)	milliliters (ml)	X 0.03381	= fluid ounce (fl.oz.)
MASS					
ounces (oz.)	X 28.35	= grams (g)	grams (g)	X 0.03527	= ounces (oz.)
pounds (lbs.)	X 0.4536	= kilograms (kg)	kilograms (kg)	X 2.2046	= pounds (lbs.)
tons (2000 lbs.)	X 907.18	= kilograms (kg)	kilograms (kg)	X 0.001102	= tons (2000 lbs.)
tons (2000 lbs.)	X 0.90718	= metric tons (t)	metric tons (t)	X 1.1023	= tons (2000 lbs.)
tons (long) (2240 lbs.)	X 1013.05	= kilograms (kg)	kilograms (kg)	X 0.000984	= tons (long) (2240 lbs.)
PRESSURE					
inches Hg (60 °F)	X 3600	= kilopascals (kPa)	kilopascals (kPa)	X 0.2961	= inches Hg (60 °F)
pounds/sq.in. (PSI)	X 6.895	= kilopascals (kPa)	kilopascals (kPa)	X 0.145	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.0703	= kilograms/sq.cm. (kg/cm ^{2})	kilograms/sq.cm. (kg/cm2)	X 14.22	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.069	= bars	bars	X 14.5	= pounds/sq.in. (PSI)
inches H $_2$O (60 °F)	X 0.2488	= kilopascals (kPa)	kilopascals (kPa)	X 4.0193	= inches H $_2$O (60 °F)
bars	X 100	= kilopascals (kPa)	kilopascals (kPa)	X 0.01	= bars
POWER					
horsepower (hp)	X 0.746	= kilowatts (kW)	kilowatts (kW)	X 1.34	= horsepower (hp)
ft.-lbs./min.	X 0.0226	= watts (W)	watts (W)	X 44.25	= ft.-lbs./min.
TORQUE					
pound-inches (in.-lbs.)	X 0.11298	= newton-meters (N-m)	newton-meters (N-m)	X 8.851	= pound-inches (in.lbs.)
pound-feet (ft.-lbs.)	X 1.3558	= newton-meters (N-m)	newton-meters (N-m)	X 0.7376	= pound-feet (ft.-lbs.)
pound-feet (ft.-lbs.)	X .1383	= kilograms/meter (kg-m)	kilogram/meter (kg-m)	X 7.233	= pound-feet (ft.-lbs.)
VELOCITY					
miles/hour (m/h)	X 0.11298	= kilometers/hour (km/hr)	kilometers/hour (km/hr)	X 0.6214	= miles/hour (m/h)
feet/second (ft./sec.)	X 0.3048	= meter/second (m/s)	meters/second (m/s)	X 3.281	= feet/second (ft./sec.)
feet/minute (ft./min.)	X 0.3048	= meter/minute (m/min)	meters/minute (m/min)	X 3.281	= feet/minute (ft./min.)

TEMPERATURE

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

COMMON METRIC PREFIXES

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

BP200C

Service Manual

BRADEN®
A PACCAR COMPANY

BRADEN CARCO Gearmatic | PACCAR WINCH

800 East Dallas | Broken Arrow, OK 74012
www.paccarwinch.com | 918.251.8511
LIT2893 PB303_4-2022 (CPR) ©2022 PACCAR Inc

MADE IN THE USA