

PD18C BUMPER WINCH SYSTEM



Record serial number below:

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First 2 numbers indicate year of manufacture
(for serial number location, see page 4).

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.

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Safety and informational call outs used in this manual include:



WARNING – This emblem is used to warn against hazards and 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.

FOREWORD

Read and understand this entire publication before operating or servicing your BRADEN winch. Retain this manual for future reference.

If you have any questions regarding your BRADEN Planetary Winch or this publication, call the BRADEN Service Department at 1-918-251-8511, 08:00-16:30 hours, CT, Monday through Friday.

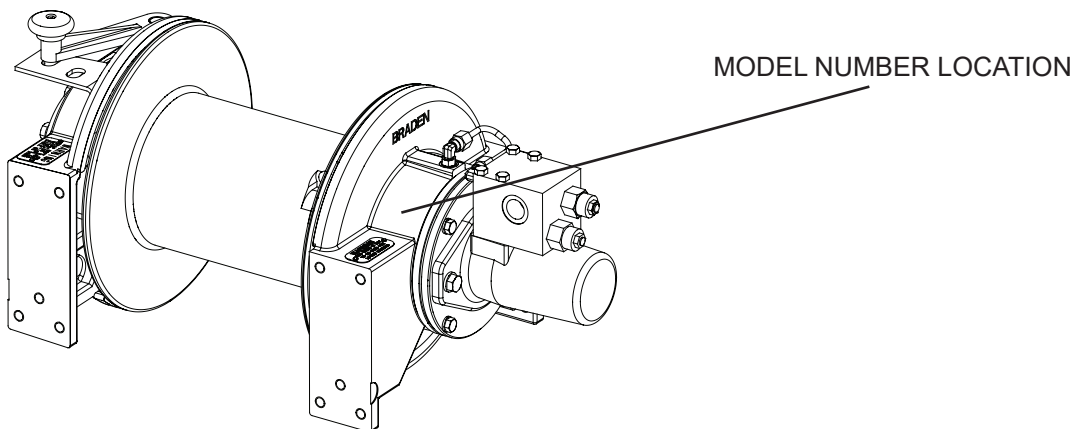
The minimum service intervals specified are for operating hours of the prime mover.

The following service instructions have been prepared to provide assembly, disassembly and maintenance information for the BRADEN Model PD18C 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 have been removed for illustrative purposes. Illustrations and pictures in this manual are of a "typical" unit sold through our distribution channels. Some winches, particularly those sold directly to original equipment manufacturers, may differ slightly in appearance.

Whenever a question arises regarding your BRADEN winch, please contact BRADEN Service Department for the latest available information.

Serial Numbers and Model Numbers are stamped into the motor support at the location shown. Always refer to the Serial Number and Model Number when requesting information or service.



EXPLANATION OF MODEL NUMBER

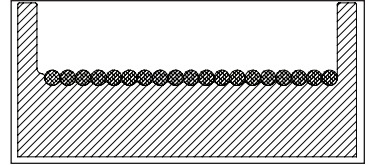


- PD** DESIGNATES POWER DRUM
- 18** DESIGNATES 18,000 LB. APPROXIMATE FIRST LAYER LINE PULL
- C** DESIGNATES THE MODEL SERIES RELATING TO DESIGN CHANGES
- 11** DESIGNATES APPROXIMATE DISTANCE BETWEEN FLANGES
- DB** DESIGNATES DUAL OR DOUBLE-ACTING PARKING BRAKE
- F** DESIGNATES FRONT MOUNT
- EB** DESIGNATES EXTENSION SHAFT OUTBOARD BEARING LEG

GLOSSARY OF TERMS

Brake Valve - A hydraulic counterbalance valve is usually bolted to the hoist port of the hydraulic motor. It allows oil to flow freely through the motor in the hoisting direction. When oil pressure tries to rotate the motor in the lowering direction, the brake valve blocks the flow of oil out of the motor until the internal static brake is released. It then controls lowering 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 Over-Running Clutch - A mechanical one-way clutch on the input shaft of the hoist, 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 (i.e. lift a load), then immediately locks the hoist gear train to the mechanical brake when the hoist is stopped, holding the load in place.

Static, Mechanical, or Load-Holding Brake - A multi-disc, spring applied, hydraulically released brake that works together with the sprag clutch to hold a suspended load. This brake is not designed to stop a load being lowered, but holds the load in place when the hoist is not being operated.

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 hoist 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.

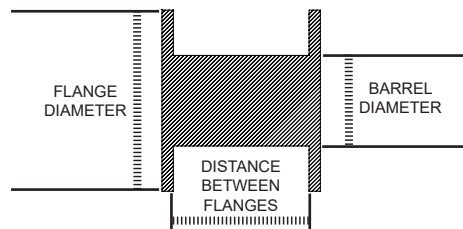
D/d Ratio - The ratio of cable drum barrel diameter (D) to wire rope diameter (d). Current ANSI standards require a minimum of 17:1.

EXAMPLES:

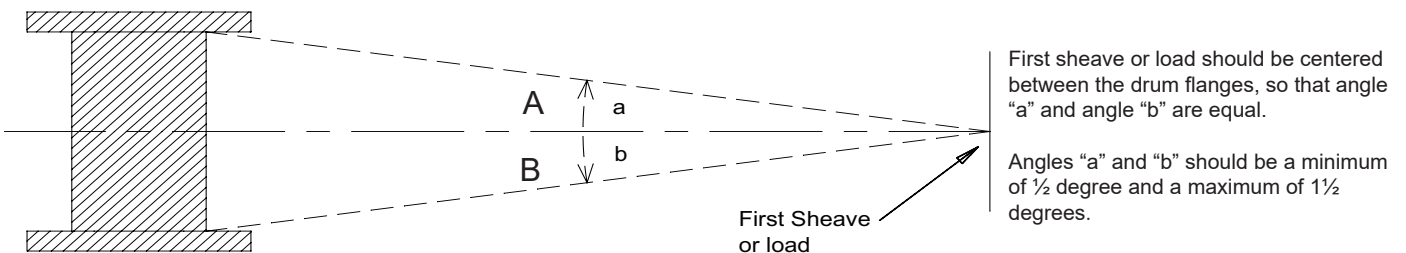
If you know the cable diameter you want to use, multiply it by 17 to get the **MINIMUM** cable drum barrel diameter (i.e. ½ inch wire rope X 17 = 8.5 inches - this is the minimum hoist barrel diameter).

If you know the barrel diameter, divide it by 17 to get the **MAXIMUM** wire rope diameter (i.e. 10 inch barrel diameter / 17 = 0.588, or 9/16 inch - this is the maximum wire rope diameter).

Cable Drum Dimensions -



Fleet Angle - The angle between the wire rope's 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.



Wrap - A single coil of wire rope wound on a drum.

Layer - All wraps of wire rope on the same level between drum flanges.

Freeboard - The amount of drum flange that is exposed radially past the last layer of wire rope. Minimum freeboard varies with the regulatory organization. ASME B30.5 requires ½ in. minimum freeboard.

GENERAL SAFETY RECOMMENDATIONS

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

1. Be certain equipment (boom, sheave blocks, pendants, etc.) is either lowered to the ground or blocked securely before servicing, adjusting, or repairing hoist.
2. Be sure personnel are clear of work area BEFORE operating hoist.
3. Read all warning and caution tags provided for safe operation and service of the hoist and become familiar with the operation and function of all controls before operating the hoist.
4. Inspect rigging and hoist at the beginning of each work shift. Defects should be corrected immediately. Do not operate a hoist with defects.
5. Keep equipment in good operating condition. Perform scheduled servicing and adjustments listed in the "Preventive Maintenance" section of this manual.
6. An equipment warm-up procedure is recommended for all start-ups and essential at ambient temperatures below +40°F (+4°C). Refer to "Warm-up Procedure" listed in the "Preventive Maintenance" section of this manual.
7. Do not exceed the maximum pressure (PSI, kPa) or flow (GPM, lpm) stated in the hoist specifications found in the specific sales brochure.
8. Operate hoist line speeds to match job conditions.
9. Protective gloves should be used when handling wire rope.
10. Never attempt to handle wire rope when the hook end is not free. Keep all parts of body and clothing clear of cable rollers, cable entry area of fairleads, sheaves and hoist drum.
11. When winding wire rope on the hoist drum, never attempt to maintain tension by allowing wire rope to slip through hands. Always use "Hand-Over-Hand" technique.
12. Never use wire rope with broken strands. Replace wire rope that is damaged. Refer to rope supplier manual.
13. Do not weld on any part of the hoist without approval from PACCAR Winch Engineering.
14. Use recommended hydraulic oil and gear lubricant.
15. Keep hydraulic system clean and free from contamination at all times.
16. Use correct anchor for wire rope and pocket in drum.
17. Do not use knots to secure or attach wire rope.
18. The BRADEN designed wire rope anchors are not intended to support the rated load. ALWAYS maintain a minimum of three (3) wraps of wire rope on the drum. It is recommended that the last three (3) wraps of wire rope be painted bright red to serve as a visual reminder.
19. Never attempt to clean, oil or perform any maintenance on a machine with the engine or prime mover running, unless instructed to do so in this manual.
20. Never operate hoist controls unless you are properly positioned at the operators station and you are sure personnel are clear of the work area.
21. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
22. Ground personnel should stay in view of the operator and clear of the hoist drum. Do not allow ground personnel near wire rope under tension. A safe distance of 1½ times the working length of the wire rope should be maintained.
23. 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 guide rollers or potential "pinch points".
24. Install switches or valves that will shut off power to the hoist, in locations where they can be reached by anyone entangled in the wire rope before being drawn into the hoist or any "pinch point".
25. "Deadman" controls, which automatically shut off power to the hoist whenever the operator leaves his station or releases the hoist control lever, should be installed whenever practical.
26. Never allow anyone to position any part of body under a suspended load.
27. Avoid sudden "shock" loads or attempting to "jerk" a load free. This type of operation may cause heavy loads, in excess of rated capacity, which may result in failure of wire rope, hoist or crane structure.
28. Whenever possible, install the hoist in a location that is not immediately adjacent to a "normal" operator's station.
29. All hoist controls shall be located within easy reach of the operator. The controls shall be installed in such a location that the operator is removed from the

electrical path to ground if the load, rigging, or wire rope come in contact with or within proximity to an electrically energized conductor.

30. Before operating the hoist, be sure ALL safety procedures for the equipment or vehicle the hoist is mounted on are properly followed and/or in place.
31. The PD18C Bumper Winch fairlead is designed to withstand up to 15 degrees of fleet angle at a maximum load of 20,000 pounds (9072 kg). When pulling at fleet angles greater than 1.5 degrees, ensure the winch rope stack up does not exceed the drum flange. Respooling of the rope may be required during high fleet angle pulls.

If there is any question regarding the preceding safety recommendations, or the safe operation of your hoist, please contact the BRADEN Product Support Department at 1-918-251-8511, Monday through Friday from 0800 to 1630 hours, CST, by fax at 1-918-259-1575, or via the internet at www.paccarwinch.com for the latest available information.

THEORY OF OPERATION

DESCRIPTION OF WINCH

The winch has five basic component parts:

1. Hydraulic motor and brake valve
2. Brake cylinder and motor support
3. Clutch housing and manual clutch
4. Cable roller assembly and tie plates
5. Drum assembly

The drum assembly consists of four basic assemblies:

1. Cable drum
2. Primary planetary gear set
3. Output planetary gear set
4. Ring gear

The hydraulic motor is bolted to the motor support which in turn is bolted to the brake cylinder which forms the winch mounting base.

The motor end of the drum, running on a ball bearing, is supported by the brake cylinder. The other end of the drum is supported by the final planet carrier through a large bushing.

The output shaft is supported through two bushings in the bearing support. The bearing support is secured to the clutch housing with six capscrews.

Lip type oil seals are used to prevent oil leakage at both ends of the drum and the output shaft.

WINCH OPERATION – PLANETARY GEARING

The hydraulic motor drives the sun gear of the primary planetary gear set through the splined inner race of the brake clutch. When driven by the sun gear, the primary planet gears walk around the ring gear assembly, which is splined to the brake cylinder, and drive the primary planetary carrier.

The primary planet carrier drives the output sun gear and output shaft. The output planet gears walk around the ring

gear assembly, splined to the brake cylinder, and drive the output planet carrier.

Torque from the output planet carrier is transmitted to the cable drum through the splined jaw clutch.

The output shaft turns any time the motor is running. The output shaft speed will be over 4 times greater than the drum speed.

STANDARD BRAKE SYSTEM – DESCRIPTION

The standard brake system is brake effective one direction and 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 cartridge valve. The brake valve cartridge contains a poppet valve which allows free oil flow to the motor in the haul-in direction. A full-floating, spring loaded, pilot assisted, two-diameter differential area sleeve blocks the flow of oil out of the motor when the control valve is placed in the neutral position. When the control valve is placed in the pay-out position, the differential sleeve remains closed until sufficient pilot pressure shifts the sleeve, allowing a return passage through the motor to tank.

After the differential sleeve opens, the pilot pressure becomes flow dependent and modulates the floating sleeve, which in turn controls the lowering speed. Figures 4 and 5.

The static brake system has three operating components:

1. Multiple friction disc, spring applied brake

2. Brake clutch assembly
3. Hydraulic piston and cylinder

The static brake is released by brake release pilot pressure. The brake release pressure is lower than the pilot pressure required to shift the brake valve sleeve. This sequence assures that dynamic braking takes place in the brake valve and little, if any, heat is absorbed by the static or friction brake.

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

The brake clutch is splined to the primary sun gear shaft between the motor and the primary sun gear. It will allow this shaft to turn freely in the direction to haul-in cable or raise a load and lock up to force the brake discs to turn with the shaft in the direction to lower a load. Figures 1 and 2. The hydraulic cylinder, when pressurized, will release the spring pressure on the brake discs, allowing the brake discs to turn freely.

When hauling in cable, the brake clutch which connects the motor shaft to the primary sun gear, allows rotation. Figure 1. The friction brake remains fully engaged. The

STANDARD BRAKE SYSTEM – OPERATION

winch, when hauling in cable, is not affected by any brake action. Figure 3.

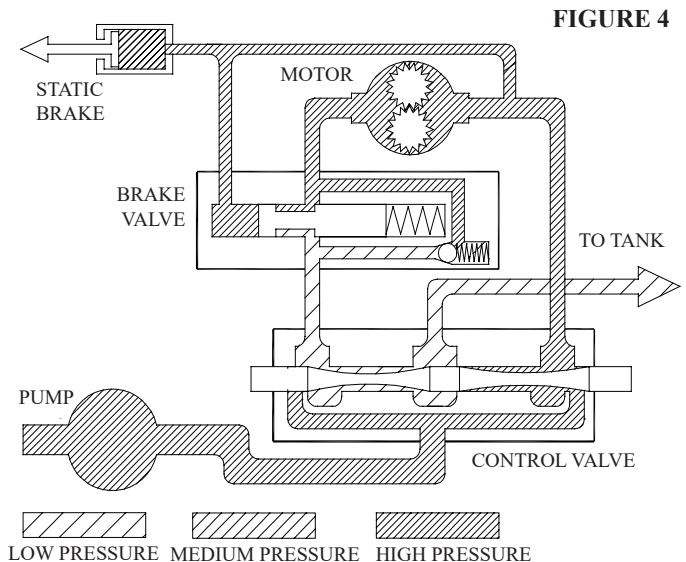
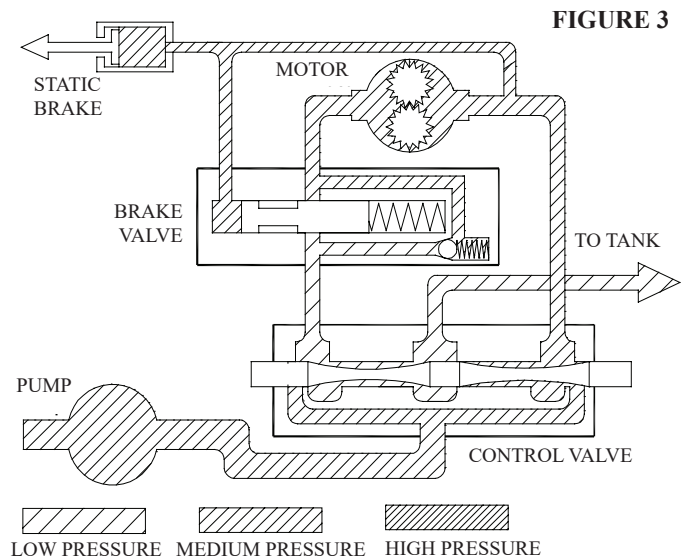
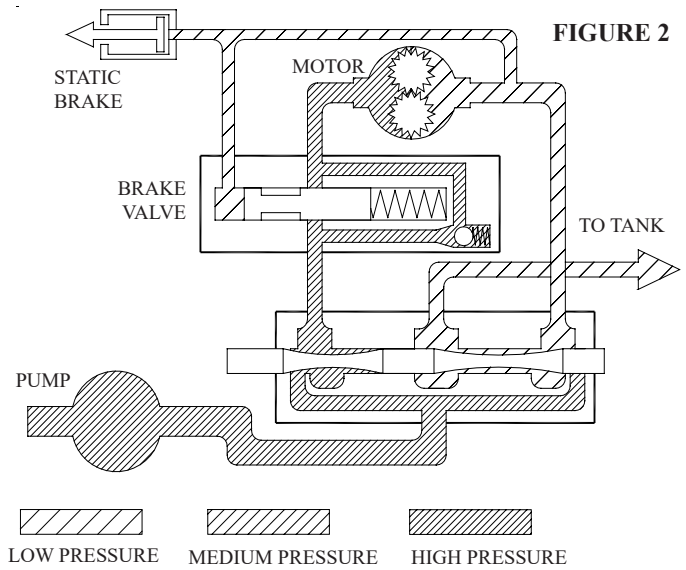
When the haul-in operation is stopped, the load attempts to turn the primary sun gear in the opposite direction.

When the winch is powered in reverse, to pay-out cable, the motor cannot rotate until sufficient pilot pressure is present to open the brake valve. Figures 4 and 5. The friction brake within the winch will completely release at a pressure lower than that required to open the brake valve. The extent to which the brake valve opens will determine the amount of oil that can flow through it and the speed at which the cable drum will turn. Increasing the flow of oil to the winch motor will cause the pressure to rise and the opening in the brake valve to enlarge, speeding up the cable drum. Decreasing this flow causes the pressure to lower and the opening in the brake valve to decrease thus slowing down the cable drum.

When the control valve is shifted to neutral, the pressure will drop and the brake valve will close, stopping the drum. The friction brake will engage and hold the drum after the brake valve has closed.

When paying out cable very slowly for precise positioning, no oil flow actually occurs through the winch motor. The pressure will build up to a point where the brake will release sufficiently to allow the load to rotate the motor through its own internal leakage. This feature results in a very slow speed and extremely accurate positioning.

The friction brake receives very little wear in the pay-out or lowering operation. All of the heat generated by paying-out cable and stopping a load is absorbed by the hydraulic oil where it can be readily dissipated.



Disc brake (static parking brake) releases at approx. 390 psi (2,690 kPa) at no load. Single cartridge counter-balance valve opens at approx. 670 psi (4,620 kPa) at no load.

NOTE: Pressures shown above are ΔP across the motor. (Refer to page 34 for dual counter-balance cartridge with brake effective both directions)

MANUAL CLUTCH INSTRUCTIONS

WARNING

Visually check that clutch is fully engaged, shift handle locked in detent, before operating the winch drum under load.

Do not attempt to move the clutch shift handle with a load on the cable.

Do not use “cheaters” to extend the shift handle length or other means to apply undue force on the shift handle. A partially engaged drum clutch may “jump out” of engagement causing a sudden loss of load control which may result in property damage, severe personal injury or death.

PROCEDURE FOR SHIFTING CLUTCH

A. To Engage Clutch

1. Ensure winch motor is not running and the cable drum is not loaded. The prime mover is stopped in neutral with parking brake set.
2. Lift lock knob on shift handle to disengage lock detent. Move handle inboard, towards drum, to engage clutch. If shift handle lock knob will not engage detent hole, the clutch is not fully engaged. At this point it may be necessary to manually rotate the cable drum slightly in either direction to align clutch lugs while holding slight pressure on shift handle.

B. To Disengage Clutch

1. Ensure winch motor is not running and the cable drum is not loaded. The prime mover is stopped in neutral with parking brake set.
2. Lift lock knob on shift handle to disengage lock detent. Move shift handle outboard, away from drum, to disengage clutch. If shift handle has resistance to shift, cable drum may be manually rotated in the direction to payout cable relieving the self-energized load and allowing the shift.

PROCEDURE FOR DETERMINING CONDITION OF CLUTCH LUGS

There is a 7½° angle on the load bearing faces of the clutch lugs and final planet carrier recesses to prevent disengagement of the clutch under load. Since these surfaces cannot be visually inspected without disassembling the winch, the following procedure was devised to insure that their condition is such that the clutch cannot disengage under load.

1. Fully engage clutch (See “A, To Engage Clutch” above).
2. Power about 4 feet of cable off the drum.
3. Power in slowly while holding 5-10 lb. of tension on the cable. This tension must be maintained throughout the balance of this procedure. The purpose of this step is to take up the slack in the power train and maintain a no-slack condition.
4. Stop the winch, leaving the clutch engaged.
5. Mark one line on or near the outside diameter of the drum flange and another on the clutch housing side frame adjacent to the first line.
6. Disengage the clutch slowly while observing the lines. The drum flange should move 1/16 in. to 6/16 in. in the direction that spools cable onto the drum. If less than 1/16 in. travel occurs, or if the travel is in the opposite direction, winch should be disassembled and the clutch visually inspected for wear and/or damage and replaced if necessary.

The clutch should be inspected periodically using the above procedure.

WINCH INSTALLATION

1. The winch should be mounted with the center-line of the drum in a horizontal position, with the clutch shifter at the top of the winch.
2. Hydraulic lines and components that operate the winch should be of sufficient size to assure minimum back pressure at the winch. The motor manufacturer recommends that the back pressure not exceed 100 psi for optimum motor seal life. 150 psi is the maximum allowable back pressure. The standard winch is supplied with the motor internally drained. If high back pressures are encountered, the motor may be externally drained directly to tank to improve motor seal life. For back pressures exceeding 150 psi, consult BRADEN Service Department.
3. High quality hydraulic oil is essential for satisfactory performance and long hydraulic system component life.

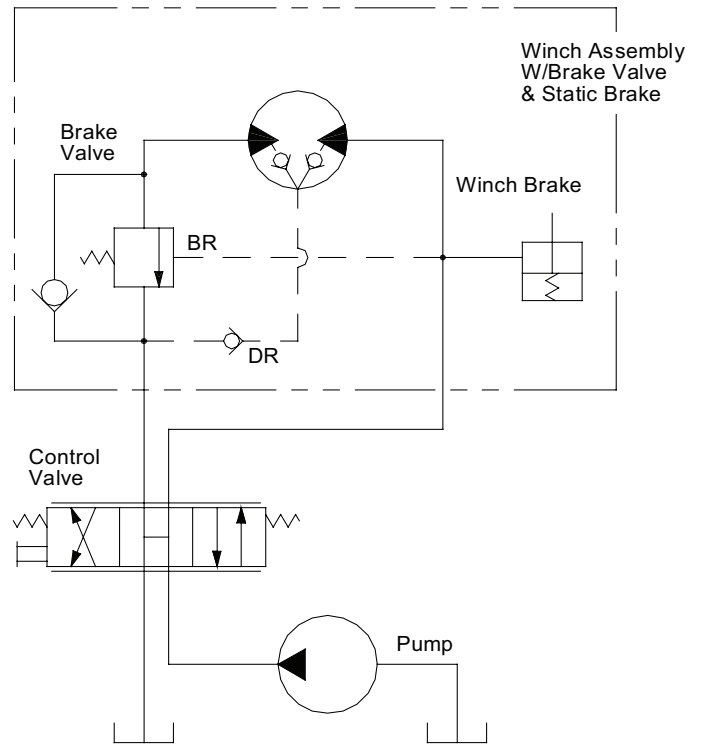
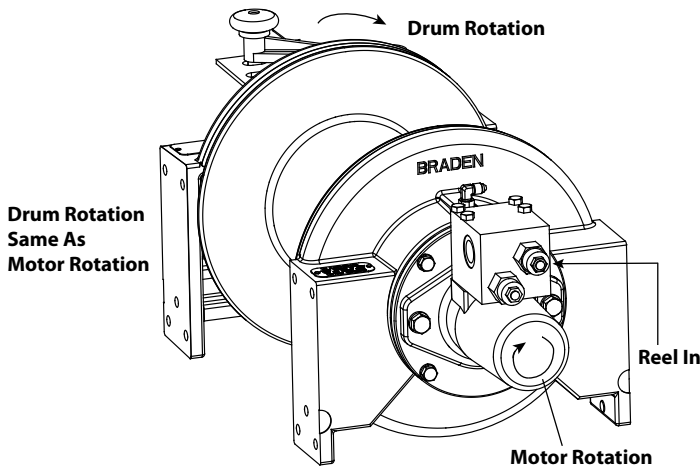
Oil having 150 to 330 SUS viscosity at 100°F (38°C) and viscosity index of 100 or greater will give good results under normal temperature conditions. The use of oil having a high viscosity index will minimize cold-start trouble and reduce the length of warm-up periods. A high viscosity index will minimize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

Maximum cold weather start-up viscosity should not exceed 5,000 SUS with a pour point at least 20°F (11°C) 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° to 140°F (49° to 60°C) is generally considered optimum.

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

4. The hydraulic oil filter should have a 10 micron nominal rating and be full flow type.

REFERENCE MOTOR CONNECTIONS



WIRE ROPE INSTALLATION

WARNING

Cable can be wound onto the drum in either direction. The standard static brake, however, is effective in only one direction. The winch is able to hold a load only if the cable or rope is wound in the correct direction on the drum or capstan. Spooling cable onto the drum in the wrong direction, or wrapping rope on the capstan in the wrong direction may cause loss of load control, which may result in property damage, severe personal injury or death.

PROCEDURE FOR DETERMINING CABLE WRAP DIRECTION

1. Install a 0-3,000 psi pressure gauge in each winch motor supply port.
2. Operate the winch in both directions and record the pressure on the supply side of the motor.
3. At a given load and pump RPM, the supply pressure will be approximately 650 psi lower when the drum is turning in the correct direction to haul-in cable.

NOTE: *Front mounted winches (PD18C-11F & FEB series) with serial number 9303989 and higher have a cast cable drum with a different cable anchoring system than the fabricated drum.*

WARNING

Cable anchors are NOT designed to hold rated loads. Winch loads applied directly to the cable anchor may cause the cable to pull free and result in the sudden loss of load control and cause property damage, personal injury or death. A minimum of three (3) wraps of cable must be left on the drum barrel to achieve rated load. Do not use knots to secure or attach winch cable. We suggest that the last three (3) wraps of cable be painted bright red to serve as a visual warning.

PROCEDURE FOR INSTALLING CABLE ANCHOR (FABRICATED DRUM)

1. Slip the anchor 22842 onto the cable. If cable to be used is 5/8 inch, the existing cable hole will require drilling out to 11/16 inch diameter.
2. If cable to be used is 1/2 inch, slip bushing 22488 onto cable next to anchor. Use of 9/16 and 5/8 inch cable do not require bushing.
3. Separate cable strands to form a flair or bell in the end of the cable. Size the flair so no more than 1/4 inch of cable protrudes beyond the end of the cable bushing or clamp. Clean the flared end of the cable to remove any lubricant. Braze weld flared end of cable to form a ball or knot.
4. Determine the direction of drum rotation to haul-in cable, as outlined below, and install cable anchor into appropriate drum flange. Install the cable clamp stop.

PROCEDURE FOR INSTALLING CABLE (CAST DRUM)

A cast-in, pass-through hole with two setscrews is used to secure the cable to the drum. The anchoring system is designed for 1/2 inch through 5/8 inch (12 mm through 16 mm) diameter cable.

First determine the proper direction to wrap cable onto the drum. Insert the cable into the anchor hole until it is even with the other end of the hole. Tighten the two cable anchor setscrews and wind cable onto the drum.

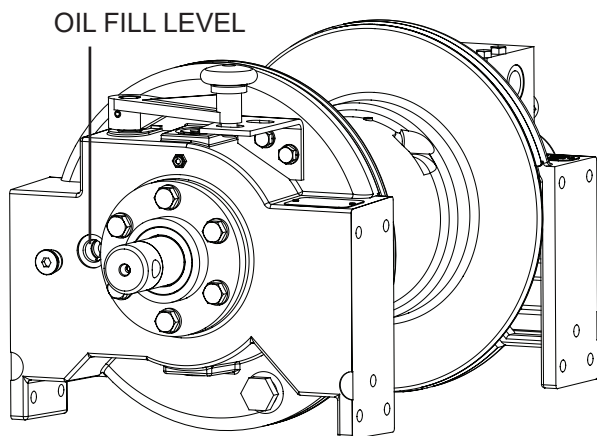
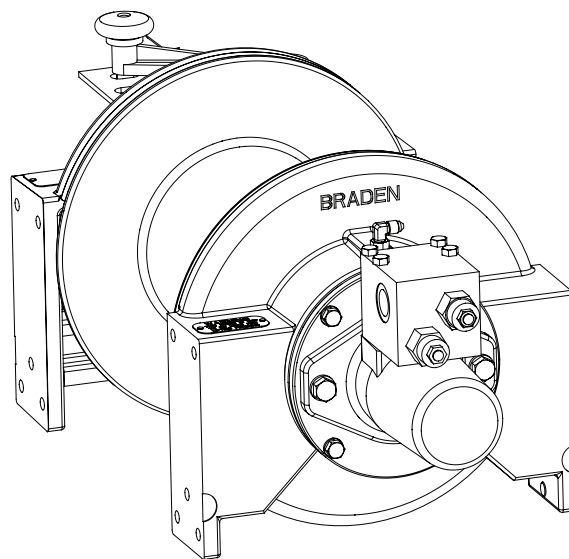
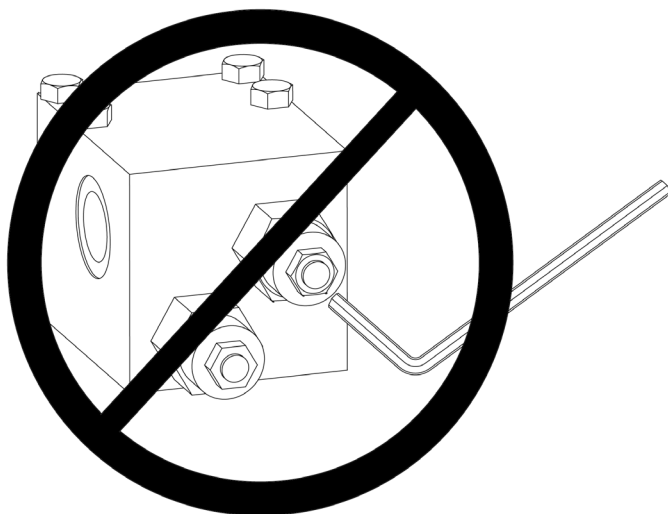
PREVENTATIVE MAINTENANCE

⚠ WARNING ⚠

The brake valve cartridge is factory set and normally requires no further adjustment. The brake valve can be manually piloted open by its adjusting screw. Manually opening brake valve could cause internal winch damage and may cause loss of load control during lowering operations which may result in property damage, severe personal injury or death.

The brake valve cartridge may be unique in that turning the adjustment screw in, clockwise, lowers the brake release pressure. In the event it has been determined a brake valve adjustment is required, the entire brake valve cartridge should be replaced.

The brake valve cartridge is easily removed from the brake valve block for cleaning, inspection or replacement, but is not designed to be disassembled in the field. In the event it has been determined the brake valve should be disassembled, the entire brake valve cartridge should be replaced.



1. Oil Level

The gear oil level should be checked every 500 operating hours or three (3) months, whichever occurs first. To check the oil level, remove the large -8 plug located in the center of the clutch housing. The oil should be level with the bottom of this opening. If additional oil is needed, refer to "Recommended Planetary Gear Oil".

⚠ WARNING ⚠

Failure to change gear oil at these suggested minimum intervals may contribute to intermittent brake slippage which could result in property damage, severe personal injury or death.

2. Oil Change

The gear oil should be changed after the first one hundred (100) hours of operation, then every 1,000 operating hours or six (6) months, whichever occurs first. The gear oil must be changed to remove wear particles that impede the reliable and safe operation of the brake clutch and erode bearings, gears and seals.

The gear oil should also be changed whenever the ambient temperature changes significantly and an oil from a different temperature range would be more appropriate. Oil viscosity with regard to ambient temperature is critical to reliable brake clutch operation. Our tests indicate that excessively heavy or thick gear oil may contribute to intermittent brake clutch slippage. Make certain that the gear oil viscosity is correct for your prevailing ambient temperature. Refer to "Recommended Planetary Gear Oil" for additional information.

3. Vent Plug

The vent plug is located in the clutch housing as shown in the previous illustration. It is very important to keep this vent clean and unobstructed. Whenever gear oil is changed, remove vent plug, clean in solvent and reinstall.

Do not paint over the vent or replace with a solid plug.

4. Hydraulic System

The original filter element should be replaced after the first fifty (50) hours of operation, then every 500 operating hours or three (3) months, or in accordance with the equipment manufacturer's recommendations.

5. Wire Rope

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

6. 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.

⚠ WARNING ⚠

Failure to use the proper type and viscosity of planetary gear oil may contribute to intermittent brake clutch slippage which could result in property damage, severe personal injury or death. Some gear lubricants (such as API GL5 automotive gear lube) contain large amounts of EP (extreme pressure) and anti-friction additives which may contribute to brake clutch slippage and damage to brake friction discs or seals. Oil viscosity with regard to ambient temperature is also critical to reliable brake clutch operation. Our tests indicate that excessively heavy or thick gear oil may contribute to intermittent brake clutch slippage. Make certain that the gear oil viscosity used in your winch is correct for your prevailing ambient temperature.

⚠ 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, severe personal injury or death.

7. Warm-Up Procedure

A warm-up procedure is recommended at each start-up and is essential 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.

8. 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 brake clutch 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 as well.

If the following lubricant brands are not available in your area, make certain your lubricant vendor supplies you with oil that is equivalent to those products listed below.

BRADEN planetary winches are factory filled with Texaco Meropa 150 gear oil or equivalent industrial grade gear lubricant meeting AGMA 4EP with ISO viscosity grade 150.

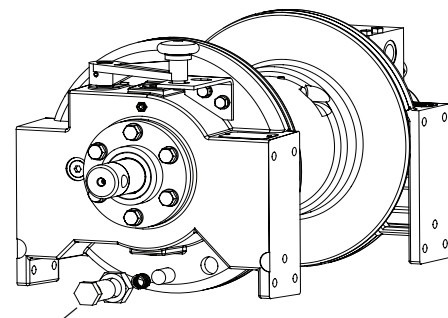
9. Drum Drag Brake

Front mount winches (PD18C-11F & FEB series) with serial number 9303663 and higher have a drag brake in the clutch end housing to control drum over-spin or "birdnest."

To adjust the drag brake, first disengage the manual clutch (see page 10). Loosen the jam nut and back out the spring housing until the winch drum turns freely. Tighten the spring housing ONLY until the desired amount of drum drag is obtained. Hold the spring housing from turning and tighten the jam nut. Excessive drag will accelerate wear on the brake disc and result in additional force being required to pull cable off the drum by hand. After adjustment, observe the position of the spring housing in relation to the jam nut. If no threads on the spring housing are exposed above the jam nut, the disc is worn beyond its service limit and should be replaced. When replacing the disc, also measure the spring free length. If the spring free length is 1-1/8 inch (28.6 mm) or less, the spring should also be replaced.

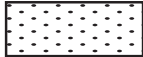
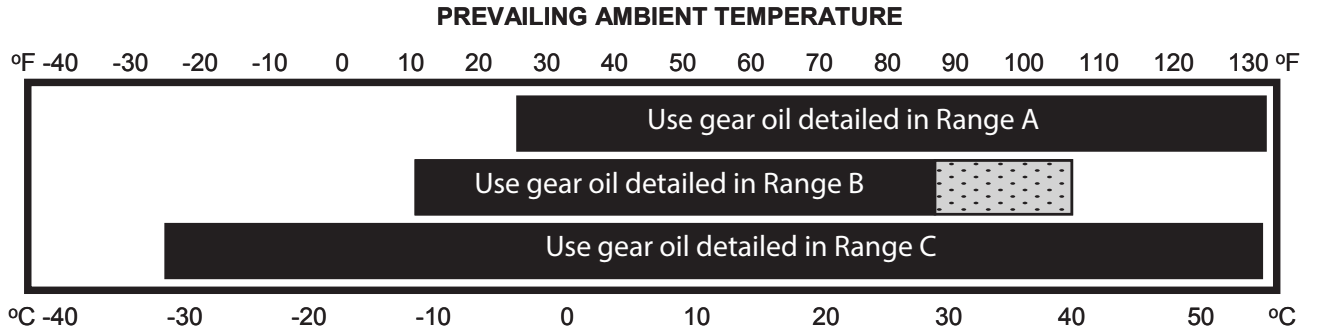
⚠ WARNING ⚠

The drum drag brake is NOT intended to hold or control the winch load. The multi-disc spring applied parking brake is designed to hold the winch load. Attempting to hold a load with the drag brake may cause a loss of load control, which could result in property damage, injury or death.



DRUM DRAG BRAKE

RECOMMENDED GEAR OIL



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.

	Mobil	Shell	Chevron	Texaco
Range A	Mobilgear 600 XP 220	Omala S2 G 220	Gear Compounds EP 220	Meropa 220
Range B	Mobilgear 600 XP 150	Omala S2 G 150	Gear Compounds EP 150	Meropa 150
Range C	Mobilgear SHC 150	Omala S4 GX 150		

TROUBLESHOOTING

The following troubleshooting section is provided as a general guide. You may also need to contact the Original Equipment Manufacturer (OEM) for additional information.

⚠ WARNING ⚠

If a hoist exhibits any sign of:

- Erratic operation such as poor load control, load creeping down or chattering.
- Unusual noise.
- Gear oil leaks
- A sudden rise in wear particles from oil analysis

The hoist **MUST** be removed from service until the problem has been corrected. If a hoist has been subjected to a sudden heavy load (shock-load) or overload, the hoist must be removed from service, disassembled and all internal components thoroughly inspected for damage. Continued operation with a defect may result in loss of load control, property damage, injury or death.

TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;">A</p> <p>The winch will not lower the load or not lower the load smoothly.</p>	<p>1. The problem could be a plugged or loose pilot orifice. The pilot orifice is a small pipe plug with a hole drilled through it, located behind the pilot port fitting on the brake valve. If it becomes plugged, it will prevent the pilot pressure, from the manifold, from opening the brake valve. If it becomes loose, it will allow an unregulated amount of oil in to operate the brake valve causing erratic brake valve operation.</p> <p><i>NOTE: Some brake valves do not use a separate pilot orifice plug.</i></p> <p>2. The friction brake may not be releasing as a result of a defective brake cylinder seal.</p> <p><i>NOTE: If the brake cylinder seal is defective you will usually find oil leaking from the hoist vent plug.</i></p> <p>3. Friction brake will not release as a result of damaged brake discs.</p>	<p>Remove the pilot hose and fitting from the brake valve, then use a 5/32 inch Allen wrench to remove the pilot orifice. The diameter of the orifice is approximately .020 inches (.5 mm). Clean and install the pilot orifice tightly in the brake valve.</p> <p>Check brake cylinder seal as follows:</p> <p>A. Disconnect the swivel tee from the brake release port. Connect a hand pump with accurate 0-2000 psi (13,800 kPa) gauge and shut-off valve to the fitting in the brake release port.</p> <p>B. Apply 1000 psi (6,900 kPa) to the brake. Close shut-off valve and let stand for five (5) minutes.</p> <p>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 "Brake Cylinder Service" section of this manual.</p> <p>Disassemble brake to inspect brake discs. Check stack-up height as described in "Brake Cylinder Service" section of this manual.</p>

TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;">B</p> <p>Oil leaks from vent plug</p>	<p>1. Same as A2.</p> <p>2. Motor seal may be defective as a result of high back pressure in the motor case drain circuit or contaminated oil. Contamination will usually cause the seal to wear a groove in the motor shaft.</p>	<p>Same as A2.</p> <p>Case drain back pressure must not exceed 100 psi (690 kPa) for gear motors and 44 psi (304 kPa) for piston motors. Inspect hydraulic system for a restriction in the return line to the reservoir.</p> <p>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.</p>
<p style="text-align: center;">C</p> <p>The brake will not hold a load with the control lever in neutral</p>	<p>1. Excessive system back pressure acting on the brake release port.</p> <p>2. Friction brake will not hold due to worn or damaged brake discs.</p> <p>3. Brake clutch is slipping.</p>	<p>The pressure at the motor lowering port is also transmitted to the brake release pilot circuit. Inspect hydraulic circuit for restrictions, plugged filters or control valves not centering.</p> <p>Same as Remedy of Trouble A3.</p> <p>Improper planetary gear oil may cause the brake clutch to slip. Drain old gear oil and flush winch with solvent. Thoroughly drain solvent and refill hoist with recommended planetary gear oil listed in "Preventive Maintenance".</p> <p>Brake clutch may be damaged or worn. Disassemble and inspect brake clutch as described in "Over-running Clutch Service".</p>
<p style="text-align: center;">D</p> <p>The hoist will not hoist the rated load</p>	<p>1. The hoist may be mounted on an uneven or flexible surface which causes distortion of the hoist base and binding of the gear train. Binding in the gear train will absorb horsepower needed to hoist the rated load and cause heat.</p> <p>2. System relief valve may be set too low. Relief valve needs adjustment or repair.</p>	<p>Reinforce mounting surface.</p> <p>If necessary, use shim stock to level hoist. Refer to "Hoist Installation".</p> <p>First loosen, then evenly retighten all hoist mounting bolts to recommended torque.</p> <p>Check relief pressure as follows:</p> <p>A. Install an accurate 0-5000 psi (34,500 kPa) gauge into the inlet port of the brake valve.</p>

TROUBLE	PROBABLE CAUSE	REMEDY
<p>Trouble "D" Continued From Previous Page</p>	<p>3. Be certain hydraulic system temperature is not more than 180°F (82°C). Excessive hydraulic oil temperatures increase motor internal leakage and reduces motor performance.</p> <p>4. Hoist line pull rating is based on 1st layer of wire rope.</p> <p>5. Rigging and sheaves not operating efficiently.</p>	<p>B. Apply a stall pull load on the hoist while monitoring pressure.</p> <p>C. Compare gauge reading to hoist specifications. Adjust relief valve as required.</p> <p>NOTE: <i>If pressure does not increase in proportion to adjustment, relief valve may be contaminated or worn out. In either case, the relief valve may require disassembly or replacement.</i></p> <p>Same as remedies for Trouble D1 & D2.</p> <p>Same as remedies for Trouble E2. Refer to hoist performance charts for additional information.</p> <p>Perform rigging service as recommended by crane manufacturer.</p>
<p>E</p> <p>The winch runs hot</p>	<p>1. Same as D1.</p> <p>2. Be certain that the hydraulic system temperature is not more than 180°F (82°C). Excessive hydraulic oil temperatures may be caused by:</p> <p>A. Plugged heat exchanger.</p> <p>B. Too low or too high oil level in hydraulic reservoir.</p> <p>C. Same as D2</p> <p>D. Hydraulic pump not operating efficiently.</p> <p>E. Hydraulic oil is wrong viscosity for operating conditions.</p> <p>3. Excessively worn or damaged internal winch parts.</p>	<p>Same as remedies for Trouble D1.</p> <p>Thoroughly clean exterior and flush interior.</p> <p>Fill/drain to proper level.</p> <p>Same as remedies for Trouble D2.</p> <p>Engine low on horsepower or rpm. Tune/adjust engine.</p> <p>Check suction line for damage.</p> <p>Pump worn. Replace pump.</p> <p>Use correct hydraulic oil.</p> <p>Disassemble hoist to inspect/replace worn parts.</p>

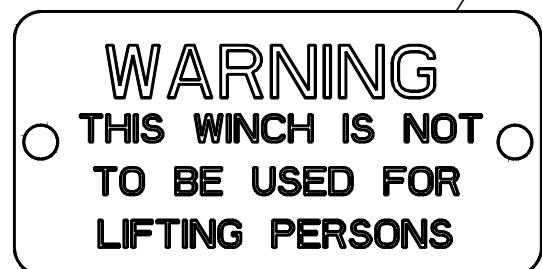
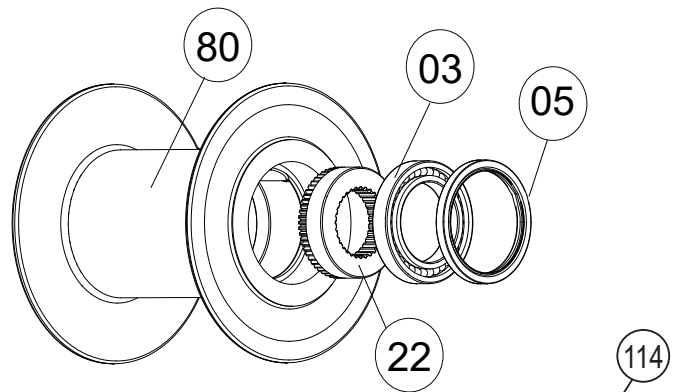
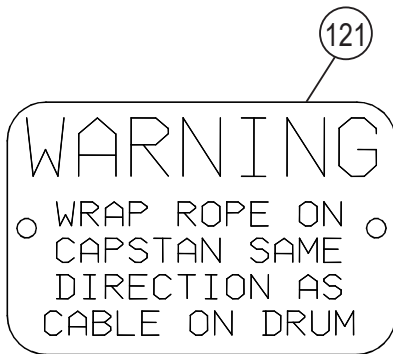
TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;">F</p> <p>Hoist “chatters” or surges while raising rated load.</p>	<ol style="list-style-type: none"> 1. Same as D2. 2. Hydraulic oil flow to motor may be too low. 3. Controls being operated too quickly. 	<p>Same as remedies for Trouble D2.</p> <p>Same as remedies for Trouble E2.</p> <p>Conduct operator training as required.</p>
<p style="text-align: center;">G</p> <p>The wire rope does not spool smoothly on the drum.</p>	<ol style="list-style-type: none"> 1. The hoist may be mounted too close to the main sheave, causing the fleet angle to be more than 1½ degrees. 2. The hoist may not be mounted perpendicular to an imaginary line between the center of the cable drum and the first sheave. 3. Could possibly 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 wraps 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. Then, when hoisting is resumed, the rope has a tendency to criss-cross and overlap on the drum. The result is apt to be a flattened and crushed rope. 4. The hoist may have been overloaded, causing permanent set in the wire rope. 	<p>Check mounting distance and fleet angle. Reposition hoist as required to achieve ½ to 1½ degree fleet angle.</p> <p>Refer to “Hoist Installation”.</p> <p>Consult wire rope manufacturer for recommendation of wire rope that best suits your application.</p> <p>Replace wire rope and conduct operator/rigger training as required.</p>

PD18C BUMPER WINCH SYSTEM PARTS LIST

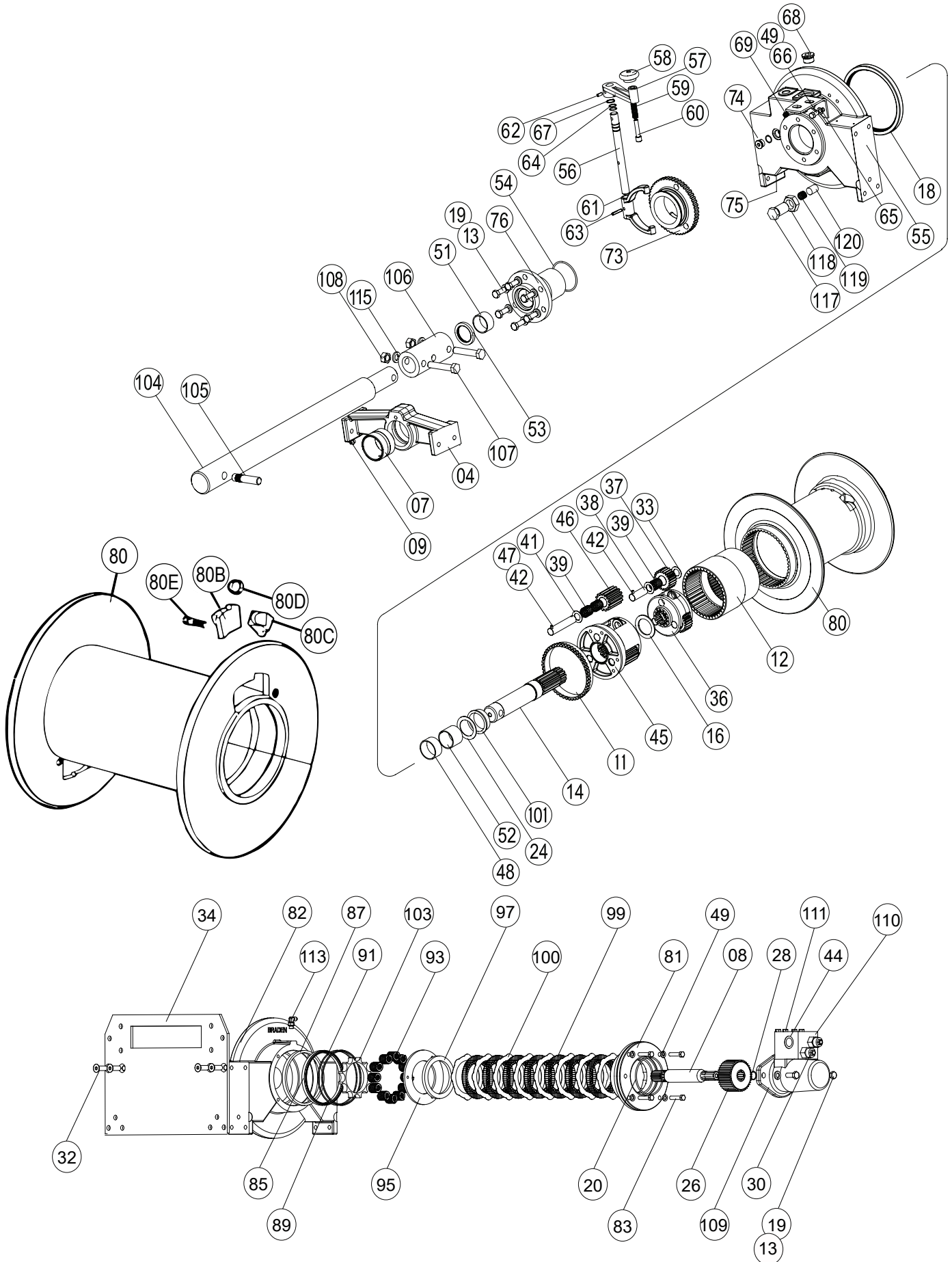
ITEM	DESCRIPTION	PART NO.	QTY.
4	BEARING LEG ASSEMBLY	83214	1
7	BUSHING	22853	1
9	GREASE FITTING	18047	8
11	DRUM BUSHING	23532	1
12	RING GEAR	22795	1
13	CAPSCREW (1/2 - 13 X 1 1/4 GD8 Z)	104174	6
14	OUTPUT SUN GEAR	26982	1
16	THRUST RACE	13680	1
18	SEAL-OIL	22818	1
19	LOCKWASHER (1/2)	11026	6
24	THRUST BEARING	24581	1
33	THRUST RACE	27718	6
36	PRIMARY PLANET CARRIER	26772	1
37	PLANET GEAR	100001	3
38	PRIMARY PLANET GEAR SHAFT	26993	3
39	ROLLER BEARING	27717	9
41	THRUST RACE	24913	6
42	ROLLPIN	22824	6
45	OUTPUT PLANET CARRIER	26780	1
46	OUTPUT PLANET GEAR	26774	3
47	OUTPUT PLANET GEAR SHAFT	26771	3
48	PLANET CARRIER BUSHING	23107	1
49	LOCKWASHER	27152	2
51	BEARING	26995	1
52	OUTPUT SHAFT BUSHING	22817	1
53	LIP SEAL	27000	1
54	O-RING	69858	1
55	CLUTCH HOUSING	104498	1
56	SHIFTER SHAFT	26989	1
57	SHIFTER HANDLE	26976	1
58	SHIFTER HANDLE KNOB	18022	1
59	SHIFTER HANDLE SPRING	11310	1
60	HANDLE STEM	11309	1

ITEM	DESCRIPTION	PART NO.	QTY.
61	SHIFTER FORK	26979	1
62	ROLLPIN	12028	1
63	PIN (1/4 X 1-1/4)	27002	1
64	O-RING	22452	2
65	SHIFTER BRACKET	27124	1
66	CAPSCREW (3/8 - 16 X 3/4 GD8 Z)	104135	2
67	SNAP RING	25589	1
68	FILL PLUG	22450	2
69	VENT RELIEF VALVE	18062	1
73	CLUTCH	26836	1
74	LEVEL PLUG	32411	1
75	EXP PLUG	12767	1
76	BEARING SUPPORT	26835	1
80	CABLE DRUM (-11)	29709	1
	CABLE DRUM (-11/14)	29535	1
80A	SETSCREW (5/16 SOCKET HD)	12206	2
80B	CABLE CLAMP	22842	1
80C	CABLE CLAMP STOP	23795	1
80D	CABLE BUSHING	22488	1
80E	CAPSCREW (3/8-16 X 1" BUTTON HD)	23630	1
101	BEARING	27004	1
104	EXTENSION SHAFT	27012	1
105	CAPSTAN PIN	11980	1
106	COUPLING	27013	1
107	CAPSCREW (5/8 - 18 x 3 1/4 GD8 Z)	23578	2
108	JAM NUT	23577	2
115	WASHER (5/8)	13449	2
117	SPRING HOUSING	29891	1
118	NUT	24849	1
119	SPRING	29892	1
120	DRAG BRAKE DISC	27321	1
121	WARNING LABEL	23227	1
	DRIVE SCREW (NS)	11842	2

* INCLUDED IN SEAL KIT P/N 62333, SEE PAGE 6

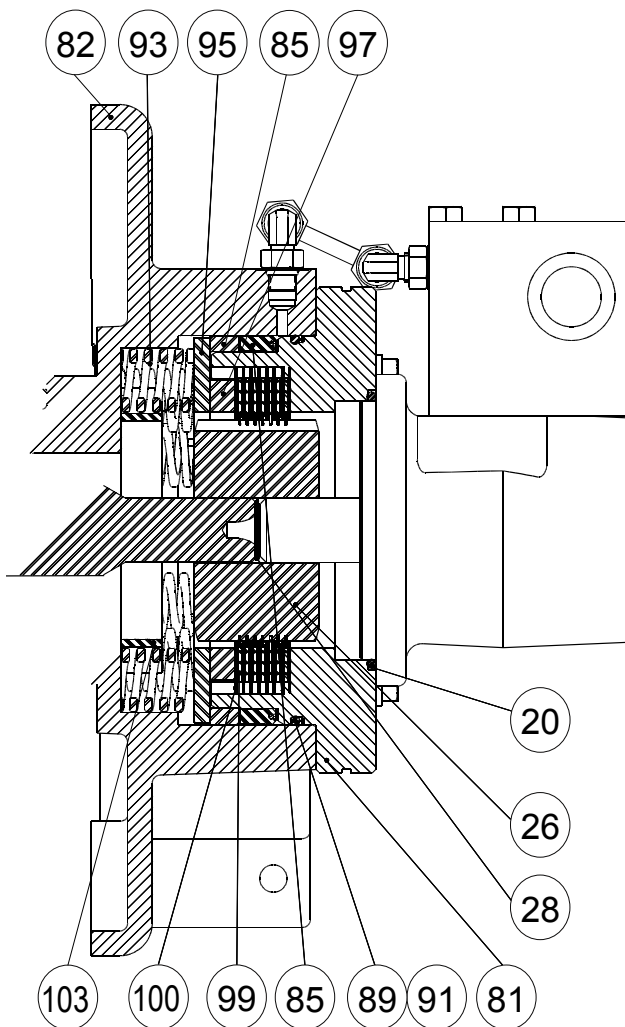


PD18C BUMPER WINCH SYSTEM PARTS LIST



PD18C BUMPER WINCH SYSTEM PARTS LIST

CROSS-SECTION & PARTS LIST



ITEM	DESCRIPTION	PART NO.	QTY.
3	BALL BEARING	26998	1
5	OIL SEAL *	25918	1
8	INPUT SUN GEAR	26983	1
13	CAPSCREW (1/2 - 13 X 1 1/4 GD8 Z)	104174	2
19	LOCKWASHER (1/2)	11026	2
20	O-RING *	21063	1
22	RING GEAR ADAPTER	27123	1
26	BRAKE COUPLING	29255	1
28	RETAINING RING	27535	1
30	COUNTERBALANCE VALVE	27258	2
32	CAPSCREW, FLAT HEAD (1/2 - 13 X 1 1/4)	25096	4
34	TIE PLATE	104120	1
44	SHIPPING PLUG (NS)	29965	2
49	LOCKWASHER (3/8)	27152	4
80	CABLE DRUM (SHOWN ON PAGES 4 & 5)	29709	1
81	MOTOR SUPPORT	102933	1
82	BRAKE CYLINDER HOUSING	104499	1
83	CAPSCREW (3/8 - 16 X 1 3/4 GD8 Z)	104311	4
85	BRAKE PISTON SEAL (RUBBER) *	25642	1
87	PISTON BACKUP RING (METAL)	25636	1
89	O-RING *	24981	1
91	BACK-UP RING *	25643	1
93	DIE SPRING	25644	12
95	PRESSURE PLATE	25635	1
97	SPACER	25637	1
99	DISC-FRICTION	21036	7
100	BRAKE DISK	100027	8
103	SPRING SPACER	100200	1
109	HYDRAULIC MOTOR	104089	1
110	BRAKE VALVE BLOCK	40045	1
111	CAPSCREW (5/16 - 18 X 3 1/2 GD8 Z)	27622	4
112	TUBE ASSEMBLY (NS)	104116	1
113	ELBOW FITTING	25302	2
114	WARNING PLATE	23310	2
115	WARNING DECAL	23312	1
	DRIVE SCREW (NS)	11842	1

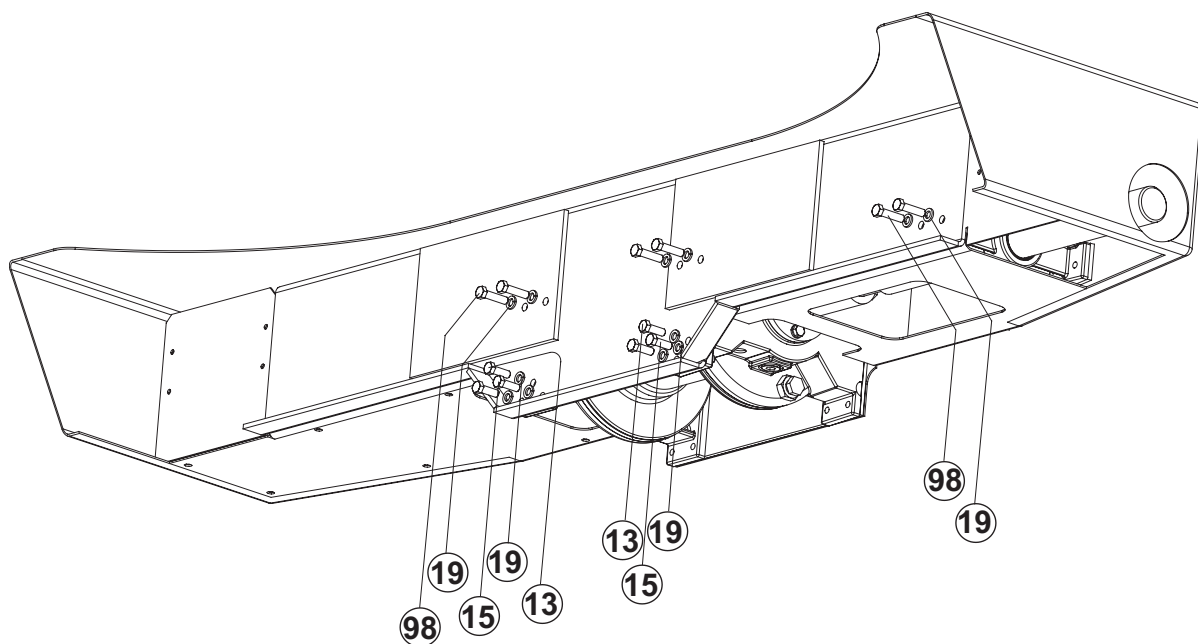
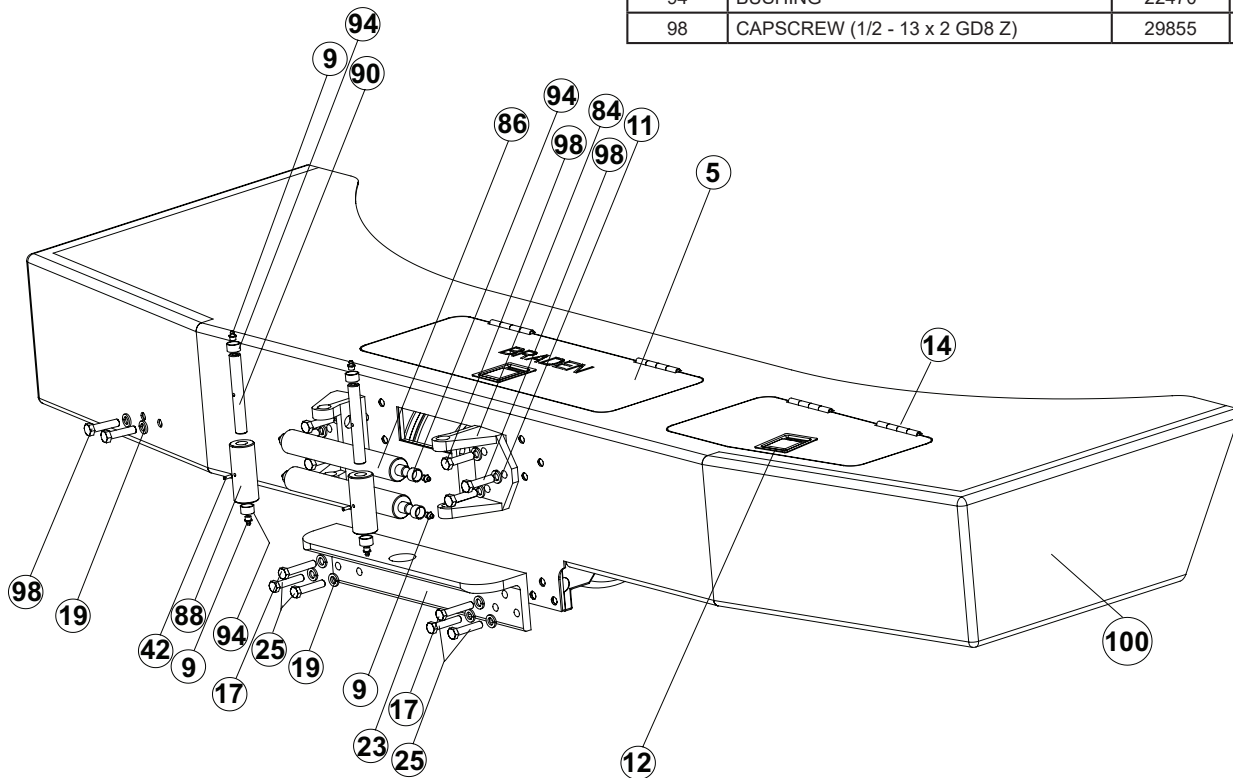
* INCLUDED IN SEAL KIT P/N 62333, SEE PAGE BELOW

Seal Kit P/N 62333		
Item	Description	Part No.
85	BRAKE PISTON SEAL	25642
89	O-RING	24981
91	BACK-UP RING	25643
20	O-RING	21063
5	OIL SEAL	25918
53	LIP SEAL	27000
54	O-RING	69858
64	O-RING	22452
18	SEAL-OIL	22818

PD18C BUMPER WINCH SYSTEM PARTS LIST

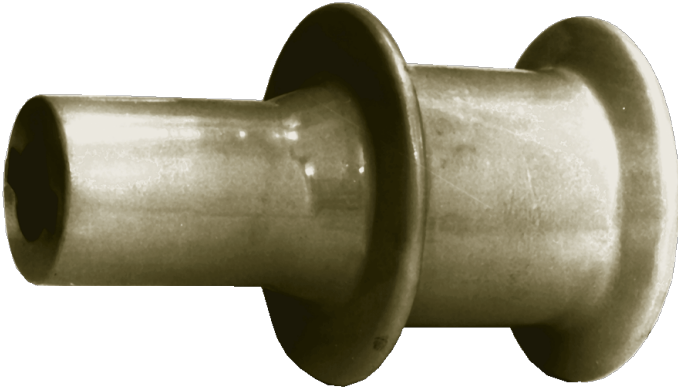
ITEM NO.	DESCRIPTION	PART NO.	QTY.
100	BUMPER SHELL ASSEMBLY (INCLUDES ITEMS 5, 11, 12, 14)	83308	1
5	WINCH DOOR	104529	1
9	GREASE FITTINGS	18047	8
11	TOOLBOX DOOR	104801	1
12	LATCH	29270	2
13	CAPSCREW (1/2 - 13 X 1 1/2 GD8 Z SPL)	103314	2
14	HINGE	100669	4
15	CAPSCREW (1/2 - 13 X 1 1/2 GD8 Z)	104322	4

17	CAPSCREW (1/2 - 13 X 2 1/2 GD8 Z)	104131	2
19	LOCKWASHER (1/2)	11026	26
21	NUT, HEX (1/2) (NS)	101439	6
23	TIE BAR	103548	1
25	CAPSCREW (1/2 - 13 X 2 1/4 GD8 Z)	104137	4
31	MOUNTING BRACKET (NOT SHOWN)	29225	2
42	ROLLPIN	22824	2
84	ROLLER BRACKET	100161	2
86	HORIZONTAL CABLE ROLLER	27009	2
88	VERTICAL CABLE ROLLER	27010	2
90	CABLE ROLLER PIN	27011	2
94	BUSHING	22470	8
98	CAPSCREW (1/2 - 13 x 2 GD8 Z)	29855	14



PD18C BUMPER WINCH SYSTEM PARTS LIST

CAPSTAN OPTIONS

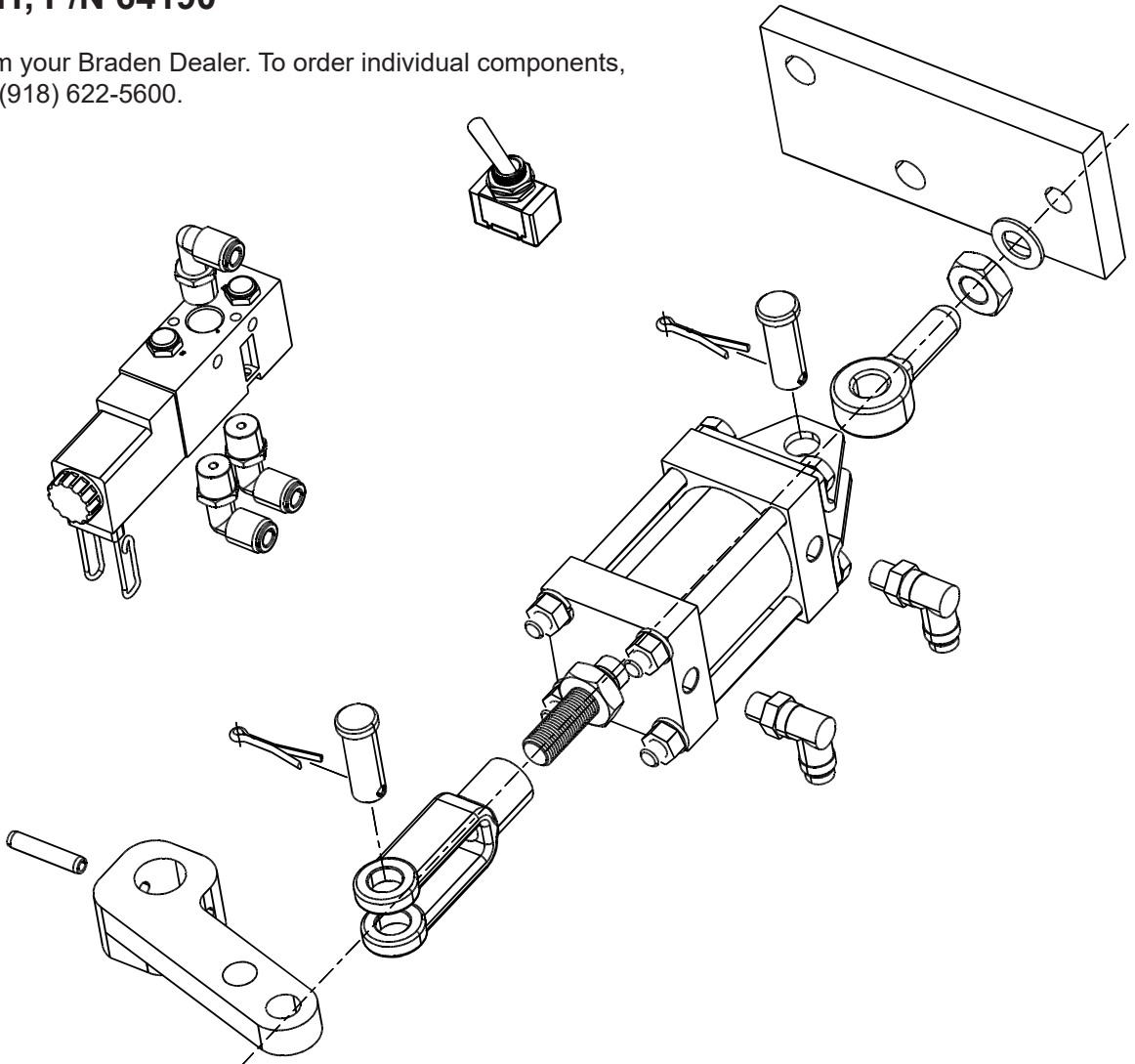


Ductile Iron, P/N 81239, 6,000 lb. capacity, 46 lbs. weight. For use with wire rope or synthetic.

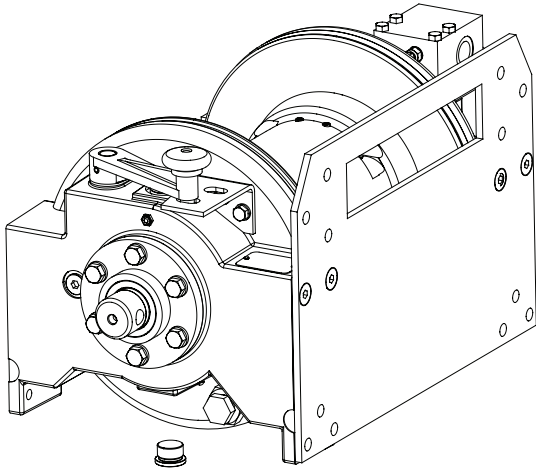
Aluminum, P/N 82598, 3,000 lb. capacity, 27 lbs. weight. For use with synthetic rope only.

AIR SHIFT KIT, P/N 64190

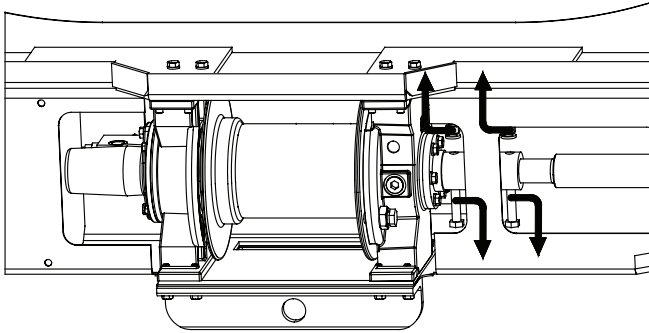
Order entire kit from your Braden Dealer. To order individual components, contact APSCO at (918) 622-5600.



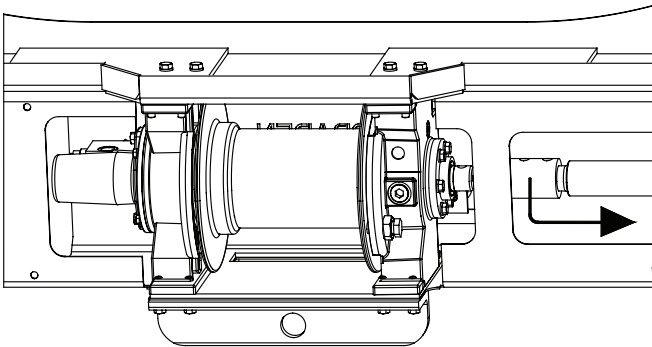
WINCH DISASSEMBLY



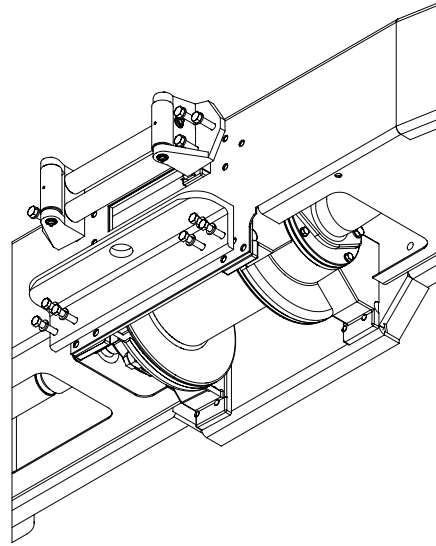
1. Remove drain plug and drain lube oil. **NOTE:** Winch is shown removed from bumper at this step for illustrative purposes only.



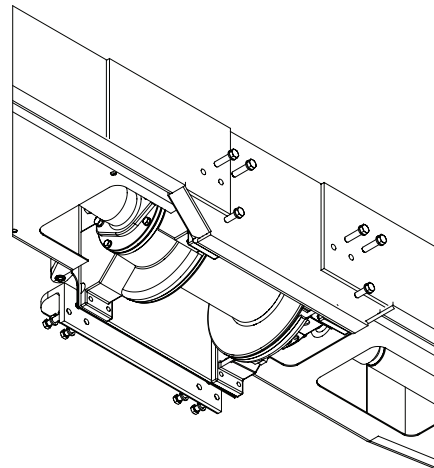
2. Remove capscrews, lock washers, and nuts which secure the capstan drive coupling to the output sun gear and capstan drive shaft.



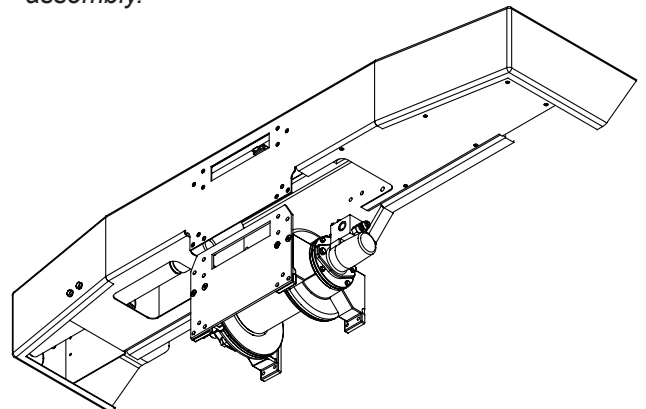
3. Slide the capstan drive coupling outboard to release the capstan drive from the winch.



4. Remove capscrews securing the roller assembly and tow bar. These capscrews serve to attach the tow bar and roller assembly to the winch while passing through the bumper assembly.

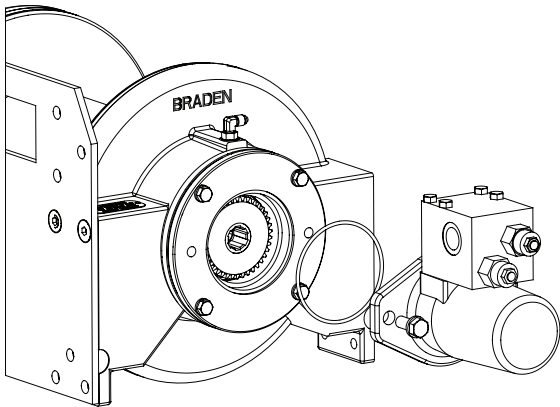


5. Remove capscrews from the backside of the bumper assembly. **NOTE:** The winch is now not attached to the bumper unit; use proper lifting equipment to ensure the winch is gently lowered from the bumper assembly.

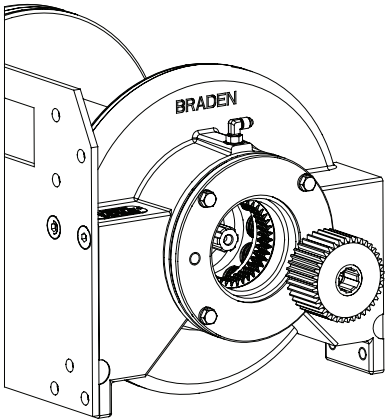


WINCH DISASSEMBLY

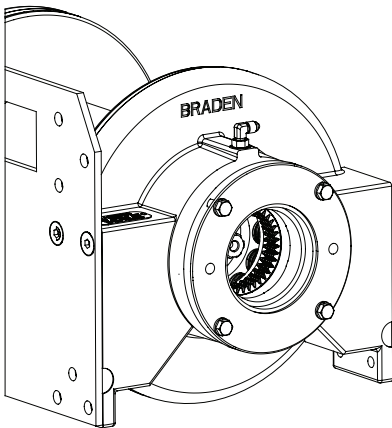
6. Remove brake supply transfer tube assembly from brake valve (82) and brake cylinder housing (110).



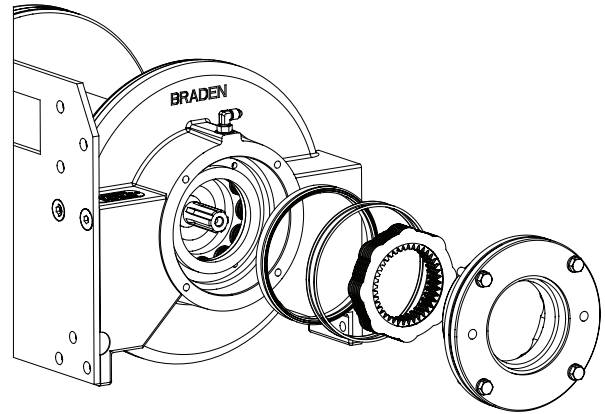
7. Remove hydraulic motor attachment capscrews and remove motor and brake valve as an assembly.



8. Remove brake coupling. Remove input sun gear.

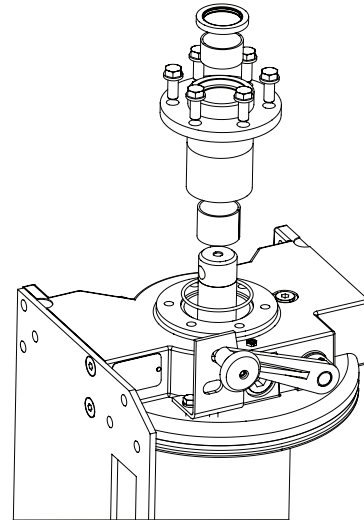


9. Equally "back off" motor support attachment capscrews (83) relieving brake pack spring load. Spring load will be relieved before capscrews disengage motor support.

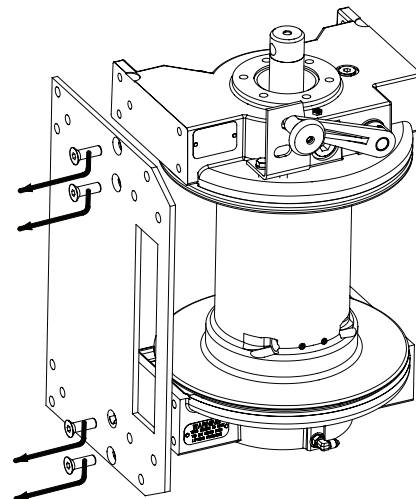


10. Remove motor support, seal, spacers, pressure plate, springs and brake pack (friction and steel discs).

11. Stand winch assembly on motor end, supporting with blocks to prevent tipping.

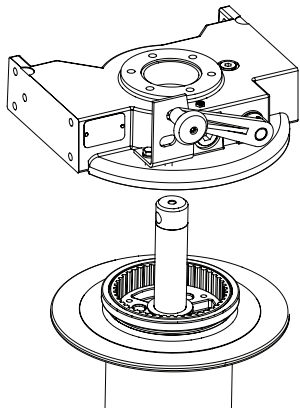


12. Remove bearing support attachment capscrews and bearing support.

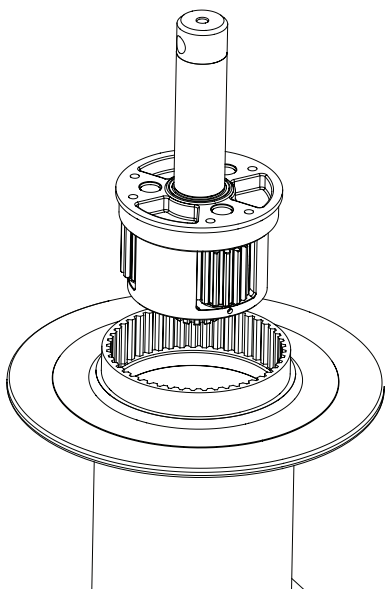


13. Remove rear tie plate attachment capscrews and tie plate.

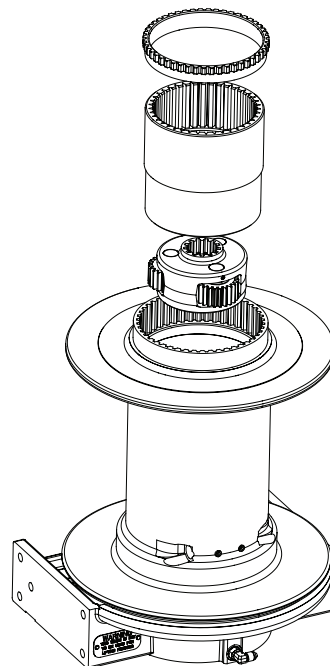
WINCH DISASSEMBLY



14. Remove clutch housing with shift fork and clutch.



15. Remove output sun gear, thrust bearing, and output planetary assembly from cable drum.

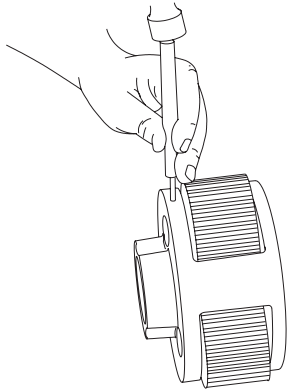


16. Remove drum bushing from cable drum. Remove planetary ring gear assembly from cable drum. The ring gear adapter may remain attached to the planetary ring gear assembly in which case the primary planetary assembly and thrust race will be removed with ring gear assembly. Once removed from the drum, the ring gear adapter may be driven from the ring gear assembly with a wooden block, if required.

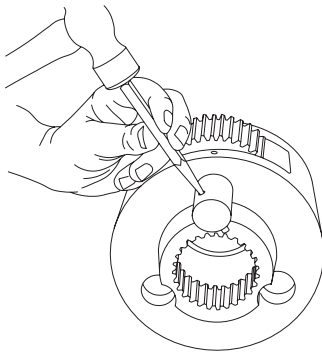
17. Attach suitable lifting hoist to cable drum and hoist drum from brake cylinder housing.

PLANET CARRIER SERVICE

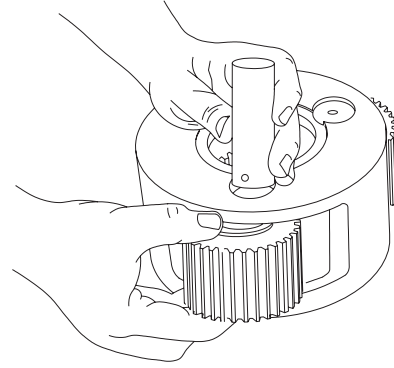
OUTPUT PLANET CARRIER



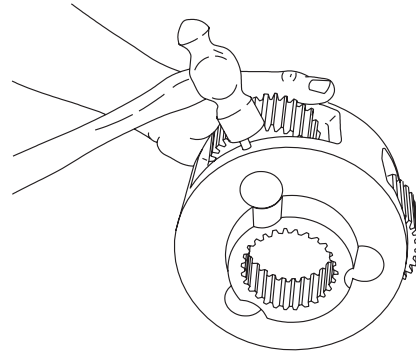
1. Remove the planet gears by driving the roll pins into the center of the planet shafts. The planet shafts, bearings, spacers thrust washers and gears can now be removed. Roll pins may then be removed from the planet shafts.



2. 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.
3. Clean and inspect output shaft bushing and clutch drive surfaces in the carrier. Bushing should be replaced if it exhibits an excessive wear pattern, scoring or metal displacement. Replace the carrier if clutch driving surfaces show any sign of abnormal wear or rounded engagement surface corners.



4. To reassemble carrier, replace any worn bearings, thrust washers, or gears. Carefully place bearings, washers, and any spacers inside gear and replace in carrier and drive gear shaft through assembly.



5. When properly installed, the roll pin is slightly recessed into the carrier. The roll pin should also be staked into the carrier with a center punch next to the pin hole, to prevent the roll pin from backing out.



CAUTION

When reassembling the planet carrier, ALWAYS use NEW roll pins. NEVER re-use roll pins. Used roll pins may loosen and back out of the hole, which may cause serious damage to internal winch components.

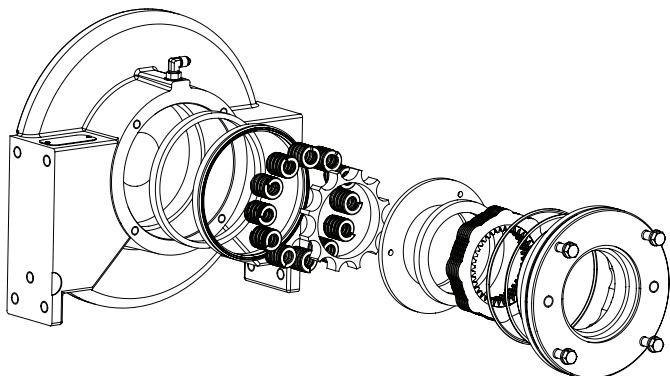
PRIMARY PLANET CARRIER

To service the primary planet carrier, follow the same procedure as the output planet carrier. The only difference is the primary planet carrier has only one bearing for each gear and does not have a shaft bushing.

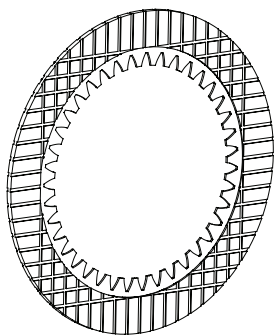
MOTOR SUPPORT / BRAKE SERVICE

DISASSEMBLY

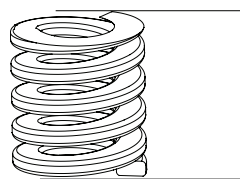
NOTE: PD18C winches use a new style lobed steel brake disc. This required a change to the motor support and brake cylinder and the addition of a spring spacer. A winch with lobed discs can be identified by a machined groove on the outside diameter of the motor support. When replacing steel brake discs, the motor support or brake cylinder, care must be taken to correctly identify the parts.



1. After removing the motor support from the brake cylinder housing, remove all brake components from both the motor support and brake cylinder housing. Check the brake piston sealing surfaces on the motor support and brake cylinder housing. 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 or friction material is worn unevenly.
3. Place steel disc on flat surface and check for distortion with a straight edge. Check surface for signs of material transfer or heat damage. Replace steel disc if splines are worn to a point, disc is distorted or heat discolored.



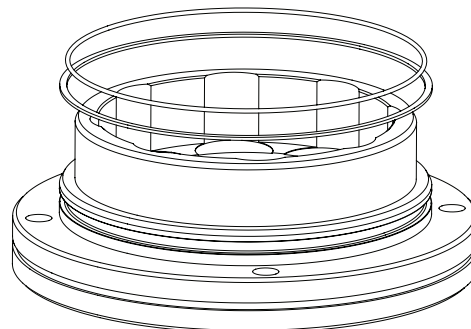
Minimum Free Length

4. Check brake spring free length; minimum free length is 1-3/16 inches. Check springs for any sign of cracking or failure. If a brake spring must be replaced for any reason, than ALL brake springs must be replaced.

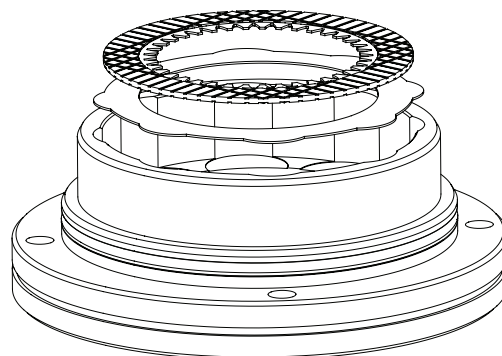
CAUTION

Brake springs **MUST** be replaced as a set. Mixing new and old springs causes uneven support of the pressure plate and uneven spring loading. Failure to replace brake springs as a set may result in uneven brake application and repeated spring failure.

ASSEMBLY



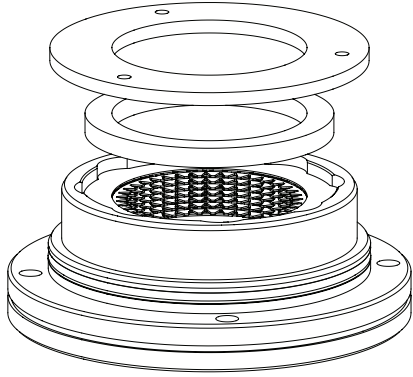
1. Begin assembly by placing motor support on workbench with motor mounting surface down. Install new o-ring and back-up ring as shown.



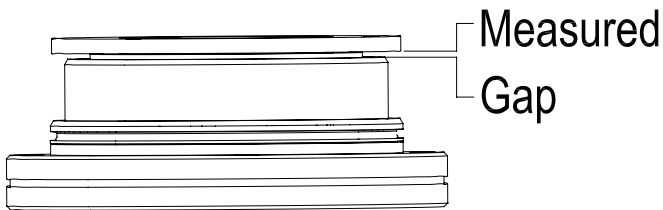
2. Insert first, a steel brake disc against the spacer followed by a friction brake disc then alternate steel and friction discs until all friction and all steel discs have been installed. Finish with a steel disc on top.

NOTE: It is a good practice to pre-lubricate the discs with light motor oil prior to assembly.

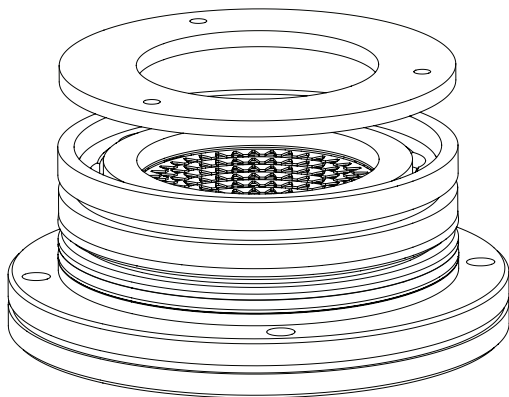
MOTOR SUPPORT / BRAKE SERVICE



3. Install the remaining brake spacer on top of the last steel brake disc.



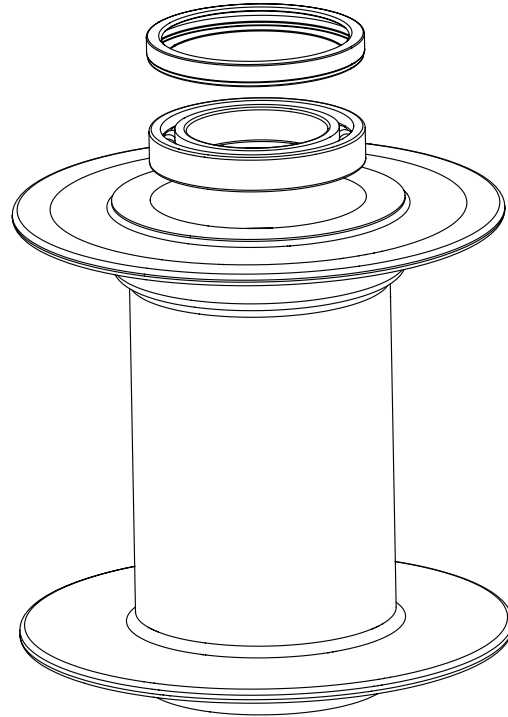
4. To check brake stack height, place pressure plate on top of brake spacer, Hold pressure plate down firmly by hand and measure clearance in three places between motor support and pressure plate. Average gap must measure between 0.153 in. (3.89 mm) maximum and 0.060 in. (1.52 mm) minimum. If the gap exceeds the maximum limit, there are too many brake discs in the stack-up or the discs are distorted. If the gap is less than the minimum, there are too few discs in the stack-up or the discs are worn out. When stack height is within the above limits, remove pressure plate and continue assembly.



5. Lubricate the brake piston seal and motor support sealing surface with petroleum jelly or hydraulic oil. Install new piston seal onto motor support, with the seal lip down. Install piston back-up ring onto motor support, on top of piston seal.

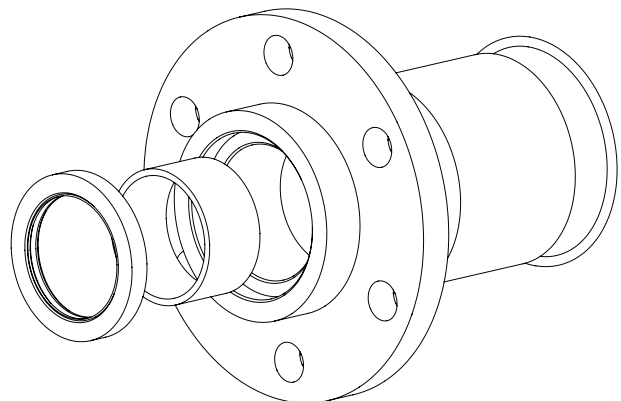
The motor support/brake assembly is now complete and ready for installation into the brake cylinder housing. Refer to "WINCH ASSEMBLY" for complete instructions.

DRUM AND BEARING SUPPORT



1. The motor end of the drum contains a bearing and seal that should be cleaned and inspected for signs of damage or wear.
2. The drum seal and bearing should be replaced as required.

NOTE: *The opposite end of the drum contains a bushing that supports the output planet carrier. This bushing should be cleaned and inspected for signs of damage or wear and replaced if required.*

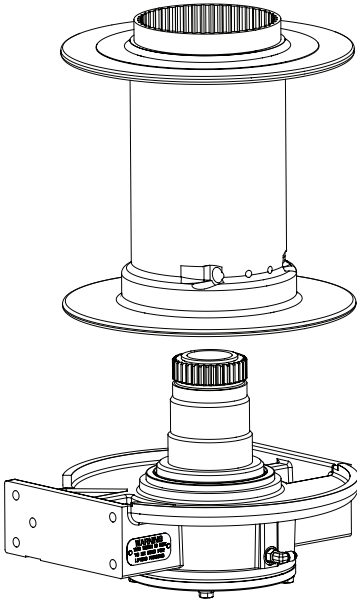


3. The bearing support contains a seal and two bushings that seal and support the output sun gear shaft. Thoroughly clean and inspect the seal and bushings for signs of damage or wear and replace if required.

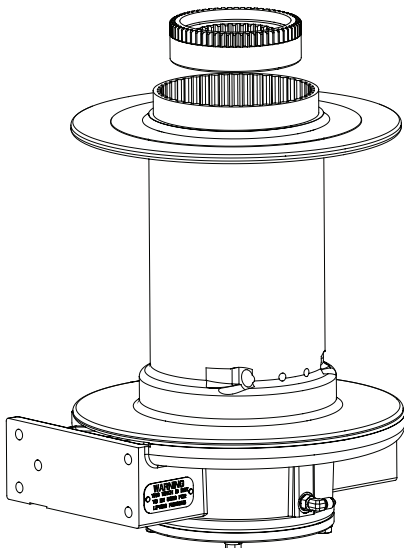
WINCH ASSEMBLY

(When an assembly instruction calls for lubrication of a part, use winch gear oil unless specifically instructed otherwise.)

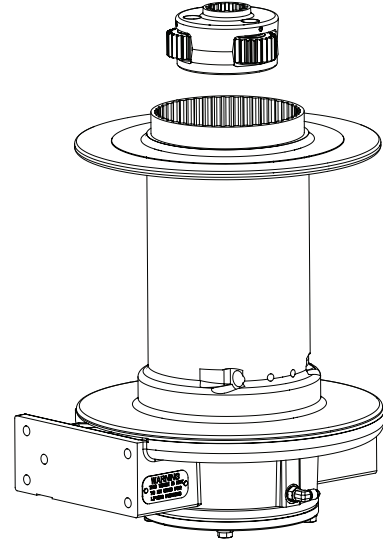
Refer to Recommended Bolt Torque Chart on page 35 for torque values unless specifically instructed otherwise.



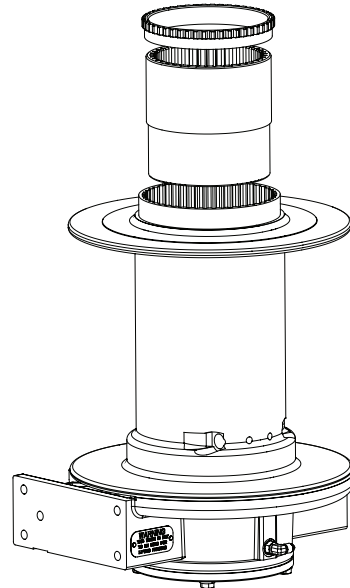
1. Stand brake cylinder housing, motor end down, on suitable work surface and support with blocks to prevent tipping. If not previously completed, install primary planet thrust bushing into brake cylinder housing.
2. Lubricate bearing and sealing surfaces of brake cylinder housing. Attach suitable lifting hoist to cable drum and position drum assembly, bearing end down, onto brake cylinder housing.



3. Position ring gear adapter with external splines facing outboard and install onto brake cylinder housing.

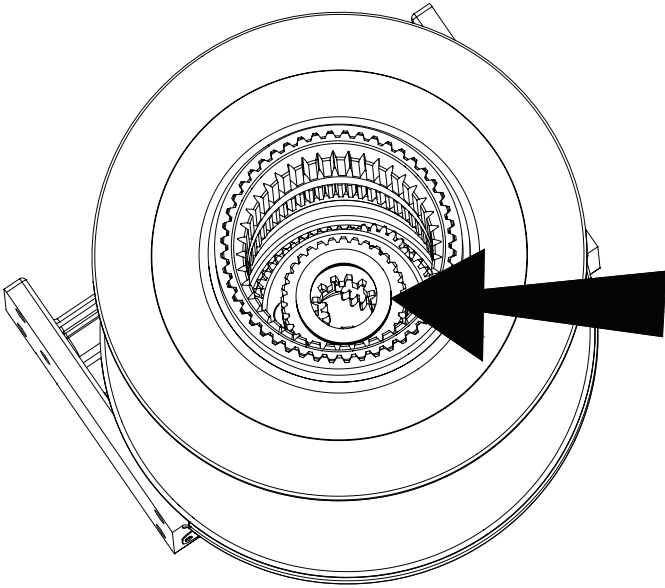


4. Position primary planetary assembly with hub extension facing outboard (up) onto face of bushing in brake cylinder housing.

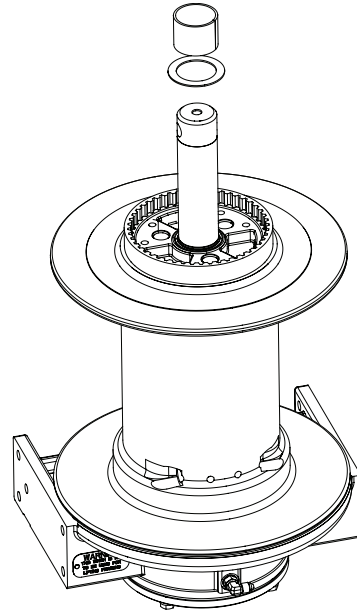


5. Position ring gear assembly with smaller outside diameter inboard and install into cable drum, engaging the primary planet gear and ring gear adapter.
6. Position drum bushing with the teeth outboard and install into cable drum .

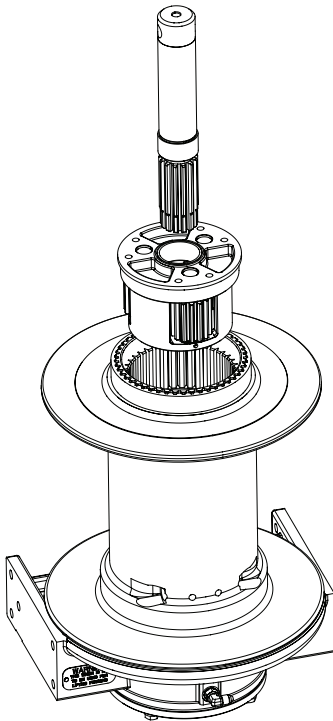
WINCH ASSEMBLY



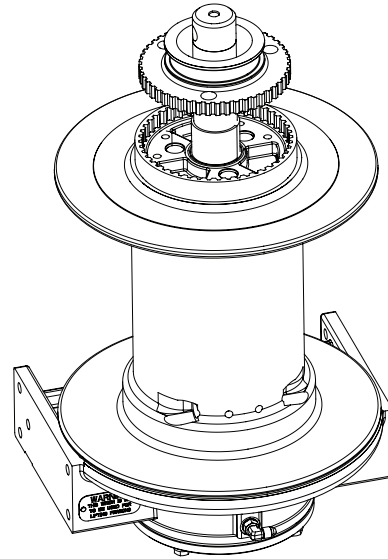
7. Lubricate and position thrust race onto the hub extension of primary planet carrier.



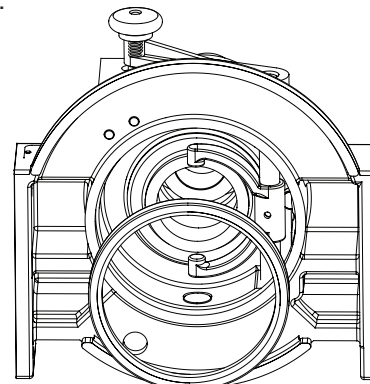
9. Lubricate and install thrust bearing onto output sun gear.



8. Position output planetary assembly with clutch engagement surface outboard and install into ring gear assembly. Install output sun gear into output planetary.

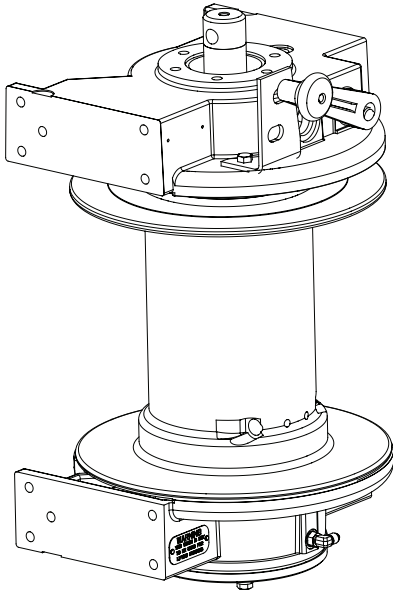


10. Position clutch with shift fork groove outboard (up), over output sun gear, and onto face of output planetary. Index clutch on output planetary in the disengaged position.

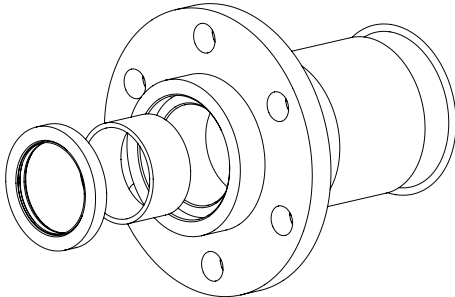


11. If not previously completed, install drum seal into clutch housing assembly with seal lip facing inboard.

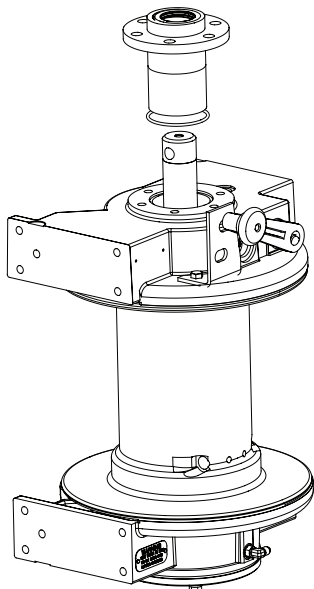
WINCH ASSEMBLY



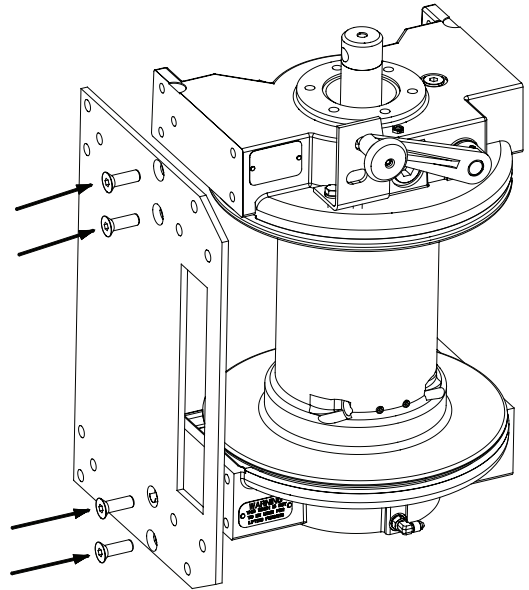
12. Position clutch housing assembly, with clutch shift lever in the engaged position, over output sun gear while engaging shifter fork into clutch. As clutch housing is lowered into position, clutch shift lever will need to be shifted from the engaged to disengaged position.



13. If not previously completed, install oil seal into bearing support with seal lip toward flange. Install o-ring on bearing support.



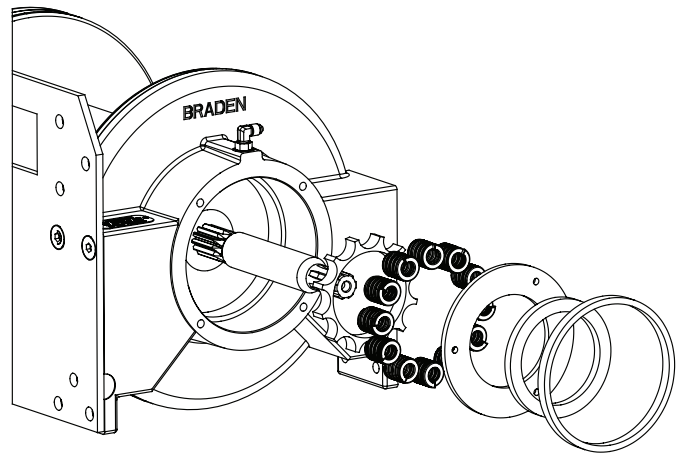
14. Lubricate bushings with lubricant and install bearing support over output sun gear and into clutch housing and install capscrews.



15. Install front tie plate with capscrews. Do not tighten capscrews at this time.

Attach suitable lifting device and relocate power drum assembly into a horizontal position.

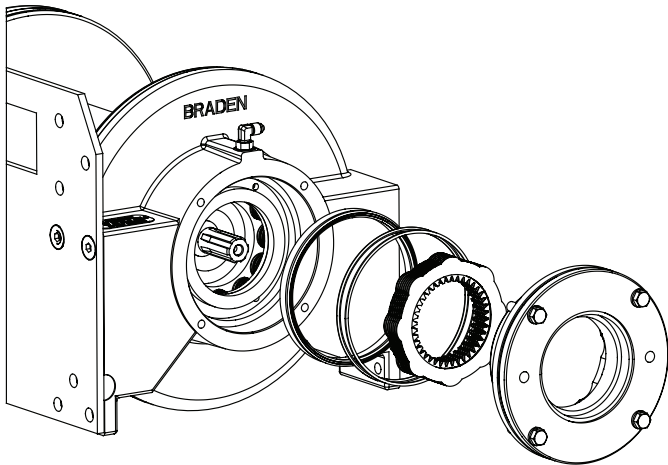
Rotate cable drum to engage clutch with output planet carrier. Torque capscrews on bearing support and front tie plate to correct value.



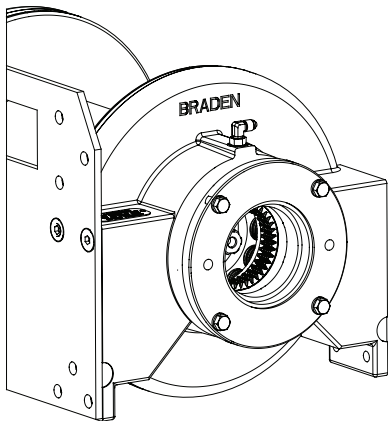
16. Install brake springs into brake cylinder housing using petroleum jelly or oil soluble grease to temporarily hold them in place.

17. Install pressure plate and seals into brake cylinder housing.

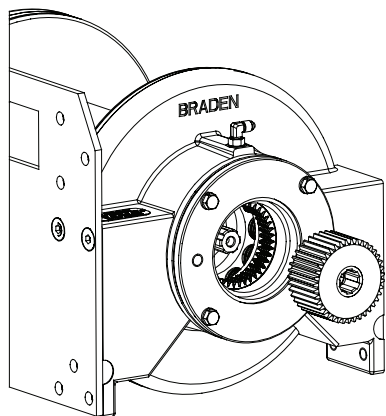
WINCH ASSEMBLY



18. Install input sun gear, engaging the primary planet gears. Install brake plates, with a steel disc on both ends of the brake plate stack.



19. Using four (4) 3/8 x 2 inch NC capscrews (1/2 inch longer than standard), align previously assembled motor support with brake cylinder housing. Finger tighten capscrews evenly until piston seal begins to compress into brake cylinder housing. Using hand tools continue to alternately tighten capscrews in 1/2 turn increments until piston seal completely engages the cylinder.



20. Remove the longer capscrews and install proper capscrews and lock washers. Install the brake clutch

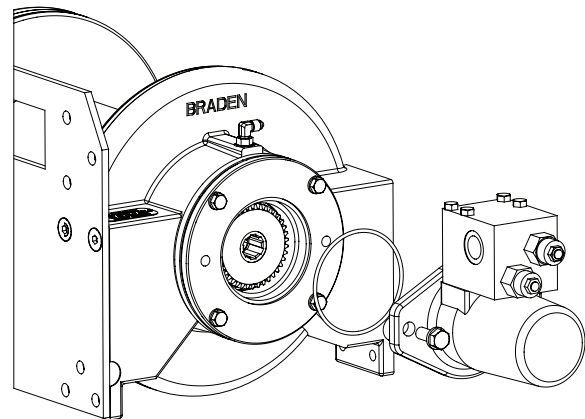
assembly with the short end of the brake coupling toward the motor.

21. Alternately and evenly hand tighten capscrews compressing brake springs and seating motor support. Torque capscrews to correct value.

⚠ WARNING ⚠

Be certain the snap ring is seated in the groove in the splined bore of the brake coupling. This snap ring will keep the brake coupling correctly positioned in the center of the friction brake pack. Binding of the brake or brake failure may occur if this snap ring is omitted.

22. Connect a hand pump with an accurate 0–2,000 psi (0–141 kg/cm²) gauge and shut-off valve to the brake release fitting. Apply 1,000 psi (70 kg/cm²) to the brake cylinder. Close the shut-off valve and let stand for 5 minutes. If there is any loss of pressure in 5 minutes, the brake cylinder should be disassembled for inspection of the sealing surfaces and brake piston seal.



23. Install motor o-ring onto motor assembly and install motor onto motor support. Torque motor mounting capscrews to correct value.
24. If the brake valve manifold was removed from the motor, it should be installed now, using two new o-rings. Install the brake release transfer tube onto the manifold assembly to complete winch assembly.

NOTE: Disc brake (static parking brake) releases at approx. 390 psi (2,690 kPa) at no load.

Dual cartridge counterbalance valve opens at approx. 960 psi (6,620 kPa) at 15 gpm (15 lpm).

Dual cartridge counterbalance valve opens at approx. 1,580 psi (10,890 kPa) at 30 gpm (114 Lpm).

NOTE: Pressures shown above are ΔP across the motor.

RECOMMENDED BOLT TORQUE

The general purpose torque shown in the chart applies to SAE grade 5 and 8 bolts, studs, and standard steel full, thick, and high nuts. Higher or lower torques for special applications will be specified such as the use of spanner nuts, nuts on shaft ends, jam nuts, and where distortion of parts or gaskets is critical. Lubricated torque values based on use of SAE 30W engine oil applied to threads and face of bolt or nut.

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

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

