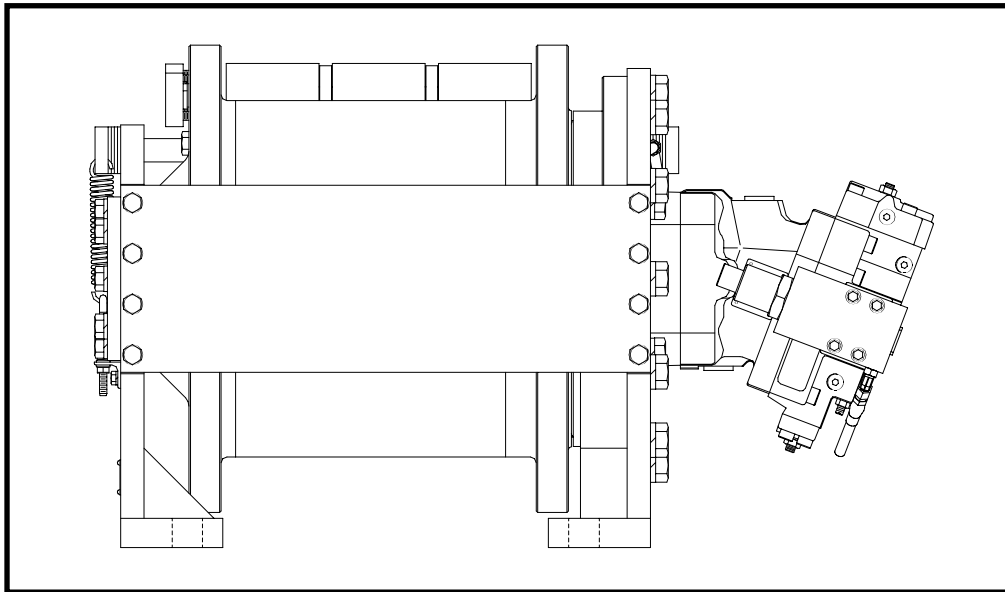


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# BRADEN

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## RW300A



## INSTALLATION, MAINTENANCE AND SERVICE MANUAL

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# FOREWORD

Read this entire publication and retain it for future reference.

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

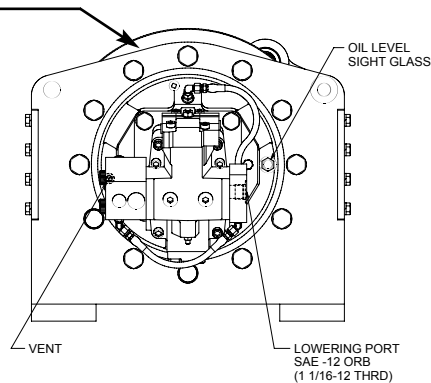
The following service instructions have been prepared to provide assembly, disassembly and maintenance information for the Braden Model RW300A. It is suggested that before doing any work on this unit, all assembly and disassembly instructions should be read and understood.

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

Whenever a question arises regarding your winch or this manual, please contact the Braden Technical Support Department via phone at (918)-251-8511, from 08:00 to 16:30 hours, CT, Monday through Friday, via fax at (918)-259-1575, or via email at [winch.service@paccar.com](mailto:winch.service@paccar.com), for the latest available information.

**Model Number**

**Serial Number**



The winch serial number and model number are stamped into a data plate located on the drum bearing support end bracket. The serial number is steel stamped into the top of the motor end support plate. Always refer to the serial number and model number when requesting information or service parts.

## EXPLANATION OF MODEL NUMBER

<b>RW</b>	<b>300</b>	<b>A</b>	<b>- 69 -</b>	<b>V</b>	<b>086/050</b>	<b>- B</b>	<b>S</b>
WINCH	MAX RATING	DESIGN MODEL	GEAR RATIO	PISTON MOTOR	MOTOR SIZE	BRAKE	OPTION

RW	REDUCER DRIVE / WINCH
300	DESIGNATES APPROXIMATE PEAK TORQUE X 1000 lb.-in.
A	DESIGNATES DESIGN SERIES
69	DESIGNATES GEAR REDUCTION RATIO :1
V	DESIGNATES PISTON MOTOR VARIABLE DISPLACEMENT
086/050	DESIGNATES MOTOR DISPLACEMENT IN CUBIC INCH/REVOLUTION; LOW RANGE/HIGH RANGE
B	DESIGNATES UNIT EQUIPPED WITH INTERNAL BRAKE
S	DESIGNATES SPECIAL

# GENERAL SAFETY RECOMMENDATIONS

Safety and informational callouts used in this manual include:

## **WARNING**

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

## **CAUTION**

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

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 winch must be operated with care and concern by the operator for the equipment and a thorough knowledge of the machine's performance capabilities. The following recommendations are offered as a general safety guide. Local rules and regulations will also apply.

1. Be certain equipment (boom, mast, sheave blocks, pendants, etc.) is either lowered to the ground or blocked securely before servicing, adjusting, or repairing winch.
2. Be sure personnel are clear of work area BEFORE operating winch.
3. Read all warning and caution tag information provided for safe operation and service of winch.
4. Inspect rigging and winch at the beginning of each work shift. Defects should be corrected immediately.
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. Operate winch line speeds to match job conditions.
8. Leather gloves should be used when handling wire rope.
9. 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 winch drum.
10. 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.
11. Never use wire rope with broken strands. Replace wire rope.
12. Do not weld on any part of the winch.
13. Use recommended hydraulic oil and gear lubricant.
14. Keep hydraulic system clean and free from contamination at all times.
15. Use correct anchor method for wire rope and pocket in drum. Do not use knots to secure or attach wire rope. For additional safety, ALWAYS maintain a minimum of five (5) wraps of wire rope on the drum.
16. 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.
17. Never operate winch controls unless you are properly positioned at the operators station and you are sure personnel are clear of the work area.
18. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
19. Ground personnel should stay in view of the operator and clear of winch drum. Do not allow ground personnel near winch line under tension.
20. Do not exceed the maximum pressure, PSI (kPa), or flow, GPM (LPM), stated in the winch specifications.
21. 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.
22. "Deadman" controls, which automatically shut off power to the winch whenever the operator leaves his station, should be installed whenever practicable.
23. Never allow anyone to stand under a suspended load.
24. Avoid sudden "shock" loads or attempting to "jerk" load free. This type of operation may cause heavy loads, in excess of rated capacity, which may result in failure of cable and winch.

# THEORY OF OPERATION

## DESCRIPTION OF WINCH

The winch has four basic component parts:

1. Winch base
2. Hydraulic motor and brake valve
3. Brake cylinder and motor support
4. Drum assembly

The drum assembly consists of four basic assemblies:

1. Drum with integral ring gear
2. Output planetary gear set
3. Secondary planetary gear set
4. Primary planetary gear set

The hydraulic motor is bolted to the brake cylinder and the base. The motor end of the drum, running on dual tapered bearings, is supported by the brake cylinder. The other end of the drum runs on a spherical bearing on the support bolted to the base. The ring gear for the planetary sets is machined into the drum's inside surface.

## WINCH OPERATION

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 in the drum and drive the primary planet carrier.

The primary planet carrier drives the secondary sun gear. The secondary planet gears drive the secondary planet carrier, which drives the output sun gear. The output planet carrier is splined to the brake cylinder and cannot rotate. Therefore, as the output planet gears are driven by the sun gear, they will drive the ring gear/drum.

## DUAL BRAKE SYSTEM – DESCRIPTION

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

The dynamic brake system has two operating components:

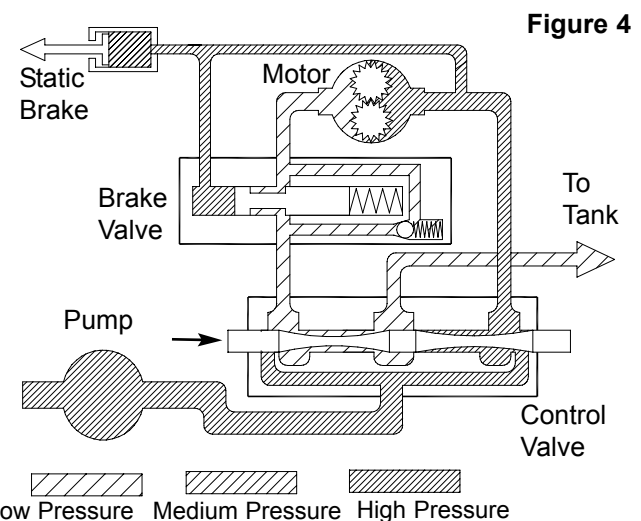
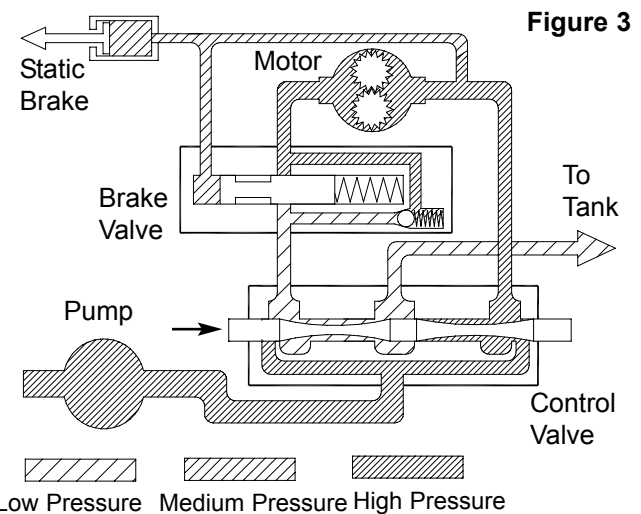
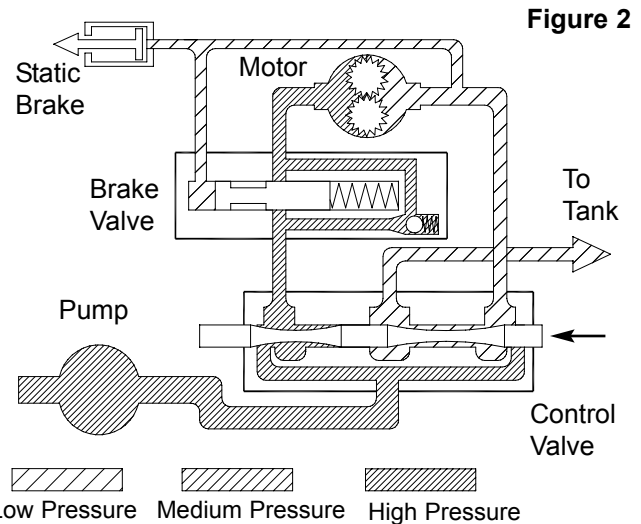
1. Brake valve assembly
2. Hydraulic motor

The brake valve is basically a counterbalance valve. It contains a check valve to allow free flow of oil to the motor in the hoisting 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. When the control valve is placed in the lowering position, the spool valve remains closed until sufficient pilot pressure is applied to the end of the spool to shift it against spring pressure and open a passage. After the spool valve cracks open, the pilot pressure becomes flow-dependent and modulates the spool valve opening which controls the lowering speed.

Figures 2, 3 & 4 show a simplified version of the brake valve for illustrative purposes.

The static brake system has three operating components:

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



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 assures that dynamic braking takes place in the brake valve and that little, if any, heat is absorbed by the 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 raise a load and lock up to force the brake discs to turn with the shaft in the direction to lower a load. Figures 5 and 6.

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

## DUAL BRAKE SYSTEM – OPERATION

When hoisting a load, the brake clutch which connects the motor shaft to the primary sun gear, allows free rotation. The sprag cams lay over and permit the inner race to turn free of the outer race. Figure 5. The friction brake remains fully engaged. The winch, in raising a load, is not affected by any braking action. Figure 2.

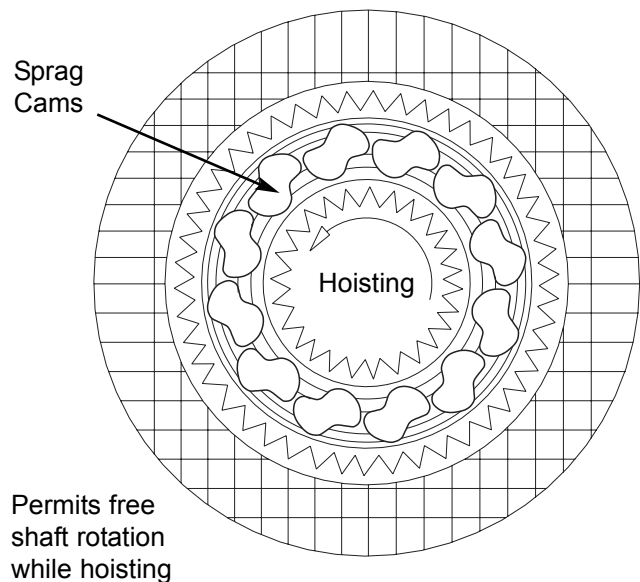
When the lifting operation is stopped, the load attempts to turn the primary sun gear in the opposite direction. This reversed input causes the sprag cams to instantly roll upward and firmly lock the shaft to the fully engaged friction brake. Figure 6.

When the winch is powered in reverse, to lower the load, the motor cannot rotate until sufficient pilot pressure is present to open the brake valve. Figures 3 & 4. 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 load will be lowered. 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 descent of the load. Decreasing this flow causes the pressure to lower and the opening in the brake valve to decrease thus slowing the descent of the load.

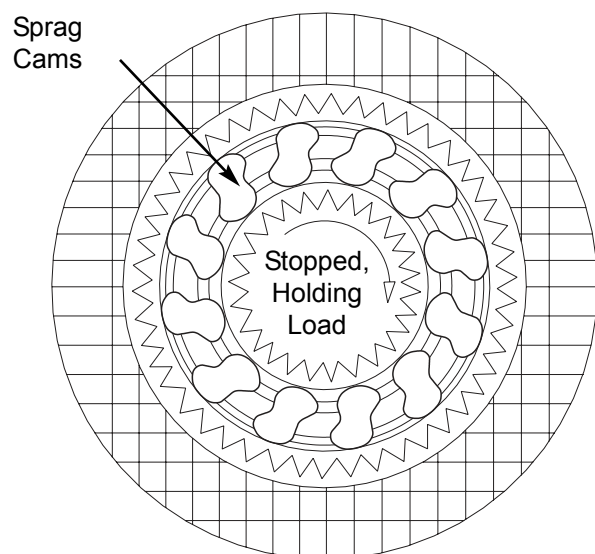
When the control valve is shifted to neutral, the pressure will drop and the brake valve will close, stopping the load. The friction brake will engage and hold the load after the brake valve has closed.

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

**Figure 5** Static Friction Brake Applied

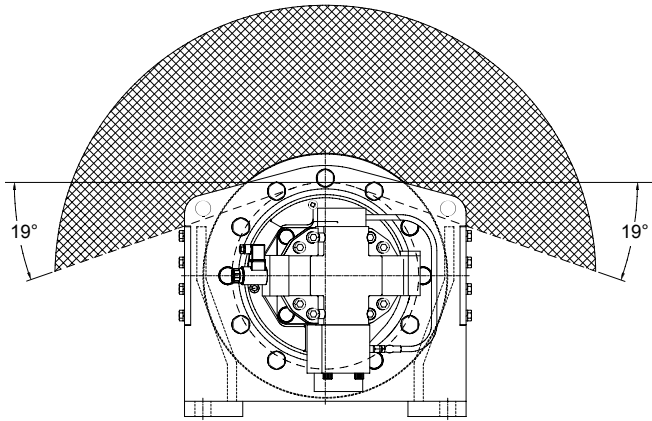


**Figure 6** Static Friction Brake Applied

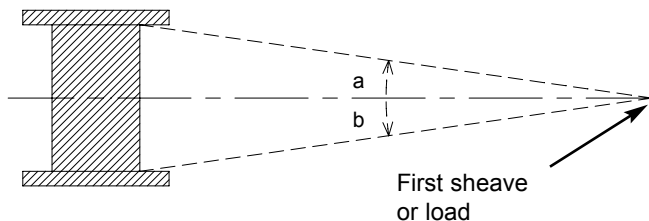


Load attempts to rotate shaft in opposite direction. Brake clutch locks sun gear shaft to friction brake.

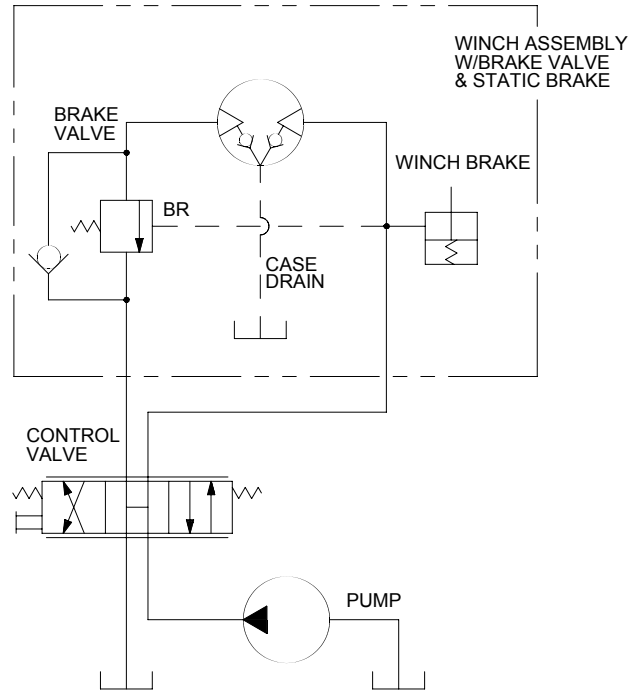
# WINCH INSTALLATION



1. The winch must be mounted with the centerline of the drum in a horizontal position. Due to the design of the winch base group, the cable departure angle must only be in the shaded area as shown. When mounting the winch, use all four mounting holes with 1.25 in. grade 8 capscrews, hardened washers and nuts tightened to recommended torque.
2. The winch must be mounted to a flat, rigid surface that will not flex when the winch is in use, causing binding in the gear train. Binding in the winch gear train will result in accelerated wear of internal components, reduced hoisting capacity and heat. If necessary, use shim stock under the winch mounting pads to ensure the surface is flat within 0.020 in. (0.5 mm).
3. The vent plug, installed in the brake cylinder, must always be located above the horizontal centerline. If the winch is mounted on a pivoting surface, be sure the vent plug remains above centerline.
4. Hydraulic lines and components that operate the winch should be of sufficient size to assure minimum back pressure at the winch. The motor must be externally drained directly to the reservoir to avoid motor shaft seal failure.



5. The winch must be mounted perpendicular to an imaginary line from the center of the winch to the first sheave to ensure even spooling. Make certain the fleet angle is between  $\frac{1}{2}$  and  $1 \frac{1}{2}$  degrees.



6. The winch directional control valve must be a three position, four way valve with a motor spool such that when the valve is in the center position, both work ports are open to tank (often called open center, open port).
7. High quality hydraulic oil is essential for satisfactory performance and long hydraulic component life. Make certain the hydraulic oil used is the proper viscosity for your starting ambient temperature. Typically, the maximum cold weather start-up viscosity should not exceed 5000 SUS with a pour point  $20^{\circ}\text{F}$  ( $11^{\circ}\text{C}$ ) lower than the minimum anticipated temperature.

Under continuous operating conditions, the oil temperature should not exceed  $180^{\circ}\text{F}$  ( $82^{\circ}\text{C}$ ). Optimum oil temperature is  $120\text{-}140^{\circ}\text{F}$  ( $49\text{-}60^{\circ}\text{C}$ ). Unless otherwise specified by the vehicle manufacturer, the hydraulic oil filter should have a 10 micron rating.

## SPECIFICATIONS

Unit weight without wire rope, approximate .....1370 lb. (621 kg)

Gear Ratio .....69:1

Cable Drum Dimensions:	
Barrel Diameter	15.25 in. (387 mm)
Flange Diameter	20.0 in. (508 mm)
Barrel Length	13.5 in. (343 mm)

Cable Storage Capacity		
Layer	1	2
7/8 in. (22 mm)	65 ft. (19.8 m)	137 ft. (41.8 m)

Gear Oil Capacity .....15 pints (7.1 liters)

## RECOMMENDED FASTENER TORQUE

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

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

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

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

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



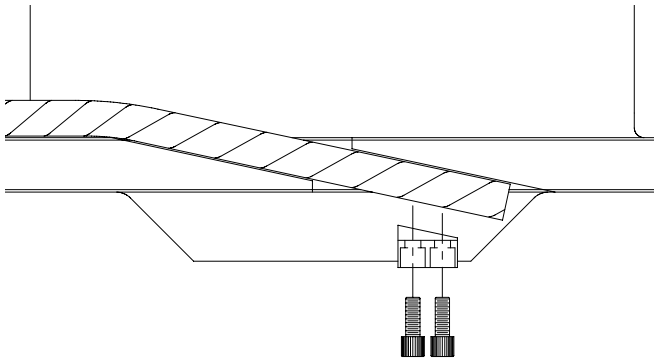
# WIRE ROPE INSTALLATION

Prepare the end of the wire rope as recommended by the wire rope manufacturer. Insert the free end of the wire rope through the opening in the drum flange. Push the wire rope into the anchor pocket until the end of the wire rope is even with the outer edge of the pocket. Install the clamp plate onto the drum flange with the thin end of the clamp wedge toward the dead end of the wire rope. Apply a light load of approximately 500 lb. (227 kg) to the wire rope as the new wire rope is wound onto the cable drum.

The anchor system is designed for use only with 7/8 in. (22mm) wire rope.

## ⚠ WARNING ⚠

The clamp plate wire rope anchor system is not capable of supporting the rated load. Always MAINTAIN a minimum of five wraps of wire rope on the cable drum. If the wire rope is fully reeled out, the wire rope may slip out of the drum causing a loss of load control which may result in property damage, injury or death. We suggest that the last 5-6 wraps of wire rope be painted bright red to serve as a visual warning.



# PREVENTIVE MAINTENANCE

A regular program of preventive maintenance for your planetary hoist is strongly recommended to minimize the need for emergency servicing and promote safe, reliable hoist operation. The user of Braden products is responsible for hoist inspection, testing and maintenance with frequency dependent upon the severity of the hoist duty cycle and thoroughness of the preventive maintenance program in effect.

## **⚠ WARNING ⚠**

Any time a hoist exhibits erratic operation and/or unusual noise, the hoist must be taken out of service until it is inspected and serviced by a qualified technician. Continued operation of a hoist with a defect in a critical component may lead to loss of load control, property damage, injury or death.

A record of written, dated and signed inspections, load tests, maintenance and repairs or modifications must be kept readily available in an appropriate location for a minimum of five years.

Inspection procedures for hoists are divided into five general categories based upon the hoist usage or duty cycle, which in turn determines different, appropriate intervals for inspections. The usage categories must be assigned by the hoist user/owner on a consistent unit-by-unit basis. The five hoist usage categories are as follows:

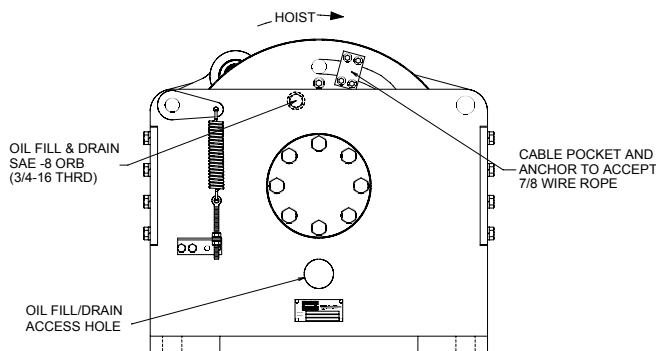
**Idled:** - The hoist has not been used for three months.  
**Infrequent Usage** - The hoist is used less than ten hours per month based on a three month average.  
**Moderate Usage** - Hoist used 10-50 hours per month based on a three month average.  
**Heavy Usage** - Hoist used 50-200 hours per month.  
**Severe Duty** - Hoist is operated more than 200 hours per month OR where 50% of the lifts exceed 75% of the Braden rated capacity for the hoist.

The following chart lists the inspections that are required for each type of usage category.

<b>INSPECTION USAGE CATEGORY</b>	<b>PRE-USE DAILY INSPECTION</b>	<b>SEMI-ANNUAL INSPECTION</b>	<b>ANNUAL INSPECTION</b>	<b>TEAR-DOWN INSPECTION</b>
<b>IDLED</b> Not used for 3 months	REQUIRED BEFORE PLACED IN SERVICE	REQUIRED BEFORE PLACED IN SERVICE	--	REQUIRED IF MAINTENANCE & REPAIR HISTORY UNKNOWN
<b>INFREQUENT USAGE</b> less than ten hours per month	REQUIRED	REQUIRED	REQUIRED	5 YEARS 3 YEARS IF NOT SUBJECT TO FULL INSPECTION PROGRAM
<b>MODERATE USAGE</b> 10-50 hours per month	REQUIRED	REQUIRED	REQUIRED	4 YEARS 2 YEARS IF NOT SUBJECT TO FULL INSPECTION PROGRAM
<b>HEAVY USAGE</b> 50-200 hours per month	REQUIRED	REQUIRED	REQUIRED SEMI-ANNUALLY (6 months)	3 YEARS 1.5 YEARS IF NOT SUBJECT TO FULL INSPECTION PROGRAM
<b>SEVERE USAGE</b> 200+ hours per month or 50% of lifts exceed 75% rated capacity	REQUIRED	REQUIRED QUARTERLY (3 months)	REQUIRED SEMI-ANNUALLY (6 months)	1 YEAR

## Pre-Use or Daily Inspection:

Must include but is not limited to the following inspections that will be performed prior to placing the hoist into service and then as necessary during extended operation. This inspection must be performed by a qualified technician.



1. Check for external oil leaks and repair as necessary. This is extremely important due to the accelerated wear that will result from insufficient lubricating oil in the hoist. Check the oil level monthly if no external oil leaks are detected.
2. Check the hydraulic fittings and hoses for leaks, chaffing, deterioration or excessive corrosion and repair as required.
3. Visually inspect for corroded, loose or missing fasteners and tighten or replace as required.
4. Inspect the entire length of wire rope and rigging as recommended by the wire rope and rigging manufacturer.
5. Inspect all safety devices such as anti-two-blocking switches and limit switches and repair as required.
6. A warm-up procedure is recommended at each start-up and is essential at ambient temperatures below 40°F (4°C). The engine should be run at low RPM with the hoist control valve in neutral allowing sufficient time to warm up the hydraulic system. The hoist should then be operated without a load, at low speeds, raise then lower several times to prime all lines with warm hydraulic oil and to circulate gear lubricant through the planetary gear train.

## Semi-Annual Inspection (every six months):

Must include but is not limited to the following inspections performed by a qualified technician.

1. Perform the Pre-Use inspection.
2. Take a lubricant sample as described later in this section and analyze it for wear metals content, correct viscosity, lubricant deterioration, moisture and other contaminants. If the oil sample contains a high amount of metallic particles, the hoist must be taken out of service to undergo a tear-down inspection.  
**Note:** *Oil analysis cannot detect nor warn against a fatigue failure.*
3. Perform a brake test as described later in this section.
4. Inspect/tighten all hoist mounting fasteners to recommended torque.
5. Service the hydraulic system oil and filters as recommended by the vehicle manufacturer.

## Annual Inspection:

Must include but not limited to the following inspections that must be performed by a qualified technician.

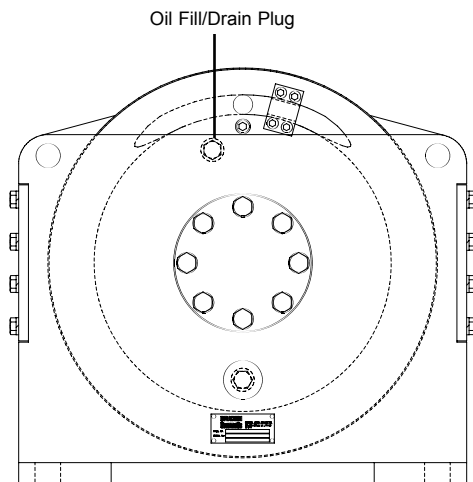
1. Perform the Pre-Use and Semi-Annual inspections.
2. Change hoist gear cavity lubricating oil after an oil sample has been taken as described later in this section. Refill the hoist to the proper level with recommended lubricant. Refer to "Recommended Planetary Hoist Gear Oil" later in this section for more information.

On new hoists, change gear oil after the first 50 operating hours then every 500-1000 operating hours or annually depending upon hoist usage as shown on Page 9.

## ⚠ WARNING ⚠

Failure to properly warm up the hoist, particularly under low ambient conditions, may result in temporary brake slippage due to thick gear oil in the brake clutch assembly or hydraulic system back-pressure attempting to release the brake, which could result in property damage, injury or death.

## Oil change instructions:

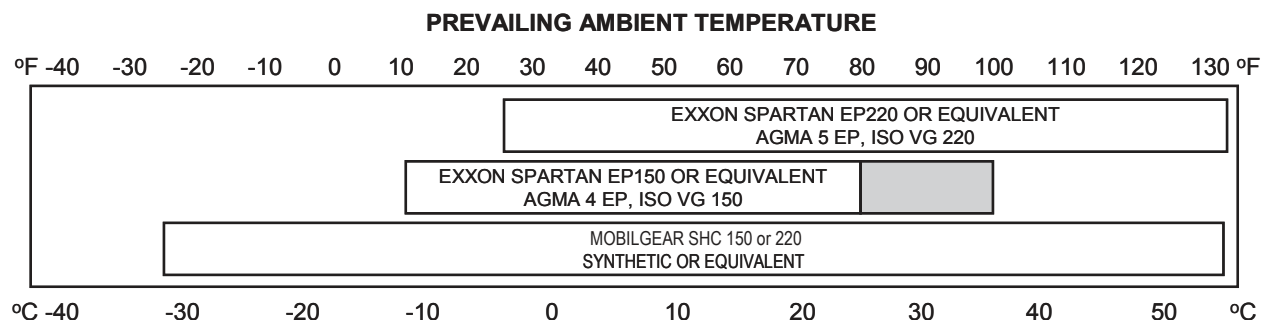


1. The fill/drain plug is located on the end of the drum flange, away from the motor. Rotate drum barrel to place the fill/drain plug at the bottom, 6 o'clock position. Remove the plug and capture the gear oil in a suitable container. Recycle or dispose of used oil in an environmentally responsible manner. While the oil is draining, collect oil from mid-stream for oil analysis.
2. Rotate drum to place the drain/fill plug at the 3 o'clock position. Fill with recommended oil. Oil fill capacity is 15 pints (7.1 liters). Install plug securely after refilling gear cavity.
3. Remove the vent relief plug located in the brake cylinder above the motor. Clean the vent relief plug in solvent and reinstall. Do not paint over the plug. Drum seal leaks will result if the relief vent hole is restricted.

## RECOMMENDED PLANETARY HOIST GEAR OIL

### ⚠ 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 contain large amounts of EP (extreme pressure) and anti-friction additives which may contribute to brake clutch slippage or 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 hoist is correct for your prevailing ambient temperature.



**NOTE:** SHADED TEMPERATURE RANGE IN THE CHART ABOVE NOT RECOMMENDED FOR SEVERE APPLICATIONS SUCH AS: OFFSHORE CRANES, SUSTAINED FAST DUTY CYCLES OR FREQUENT LIFTING.

Texaco Meropa 150, previously used as factory fill, may no longer be widely available due to current market conditions. As of mid-year 2002, planetary hoists are factory filled with Exxon Spartan EP150, or equivalent. The chart below relates the Texaco products to 4 currently available oils. Consult your oil supplier for other equivalent oils if required.

Texaco	Exxon	Mobil	Shell	Chevron
Meropa 150	Spartan EP 150	Mobilgear 629	Omala 150	Gear Compounds EP 150
Meropa 220	Spartan EP 220	Mobilgear 630	Omala 220	Gear Compounds EP 220

# SPECIAL TOOLS

2 each ½-13NC eye bolt  
2 each ¾-10NC eye bolt:

**NOTE:** The first two items below are required only if the motor support is separated from the ring gear. The other tools are required to service the brake assembly.

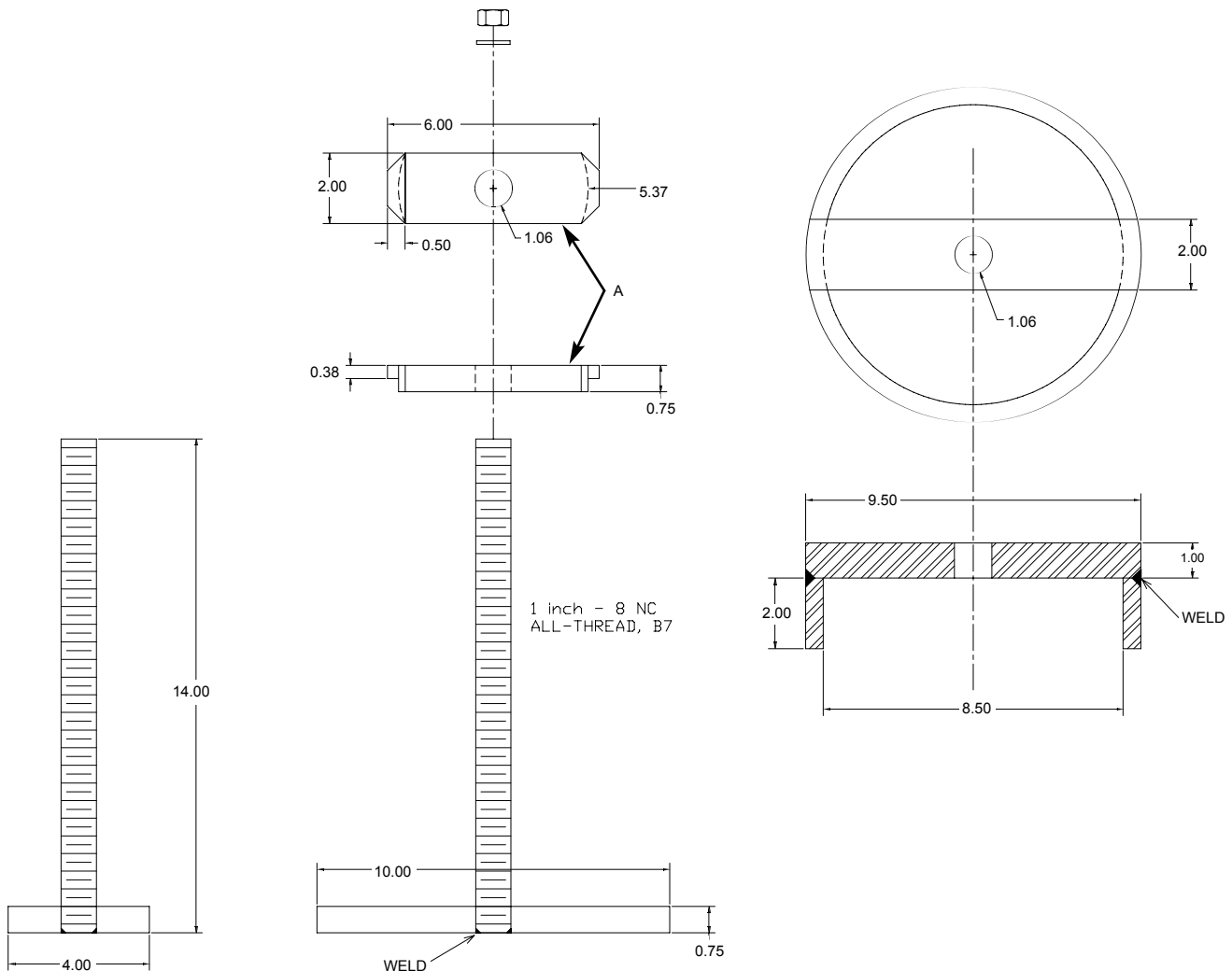
3 each 7/8 - 9NC x 6 inch long capscrews

A ratcheting internal snap ring pliers capable of handling an N5000 700 snap ring.

All units use a single coil spring to apply the internal brake. The following spring compressor must be fabricated and is strongly recommended.

**NOTE:** If a press is available (with at least 5 inches of travel), only part (A) shown below is required (center hole not required). If a press is not available, all parts shown and listed below are required.

1 each 1 - 8 NC threaded rod, 14 inches long  
1 each 1 - 8 NC nuts  
1 each 1 inch plain washer



# TROUBLESHOOTING

## ⚠ WARNING ⚠

If a hoist ever exhibits any sign of erratic operation, or load control difficulties (load creeping down or chattering) appropriate troubleshooting tests and repairs must be performed immediately. Continued operation of a hoist with a defect may result in property damage, injury or death.

TROUBLE	PROBABLE CAUSE	REMEDY
<b>A</b> <p>The hoist will not lower the load or not lower the load smoothly.</p>	<p>1. The problem could be a plugged internal orifice or leaking cartridge body seal ring on the counter-balance valve. If a small piece of contamination entered the counter-balance (CB) valve cartridge, it may be restricting the hydraulic signal to open the valve. The pressure may be going too high or the smooth action of the CB valve may be impaired.</p> <p>If the cartridge body seals are leaking, the pilot signal pressure may be lost or the oil flow that the CB valve is modulating is able to return to tank without the proper control allowing the load to lower too early or too quickly.</p> <p>2. The friction brake may not be releasing as a result of a defective brake cylinder seal.</p> <p>NOTE: If the brake cylinder seal is defective you will usually find oil leaking from the winch vent plug.</p> <p>3. Friction brake will not release as a result of damaged brake discs.</p>	<p>Remove the counter-balance cartridge from the valve body and inspect condition of body seal rings. Disassemble valve body and flush with clean solvent to remove contamination. Assemble valve using new seal rings on CB valve cartridge. Install an accurate 0-1000 PSI (0-6900 kPa) test gauge in the brake release hose. With no load on the hoist, slowly move the control lever into the lowering position and record the pressure when the drum begins to turn in the lowering direction. The static brake will release at approximately 300 PSI (2070 kPa) and the CB valve should open at approximately 1050 PSI (7240 kPa).</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 gauge and shut-off valve to the -4 J.I.C. fitting in the brake release port.</p> <p>B. Apply 1000 psi 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 "Motor Support-Brake Cylinder Service".</p> <p>Disassemble brake to inspect brake discs. Check stack-up height as described in "Motor Support-Brake Cylinder Service".</p>
<b>B</b> <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 or contaminated oil.</p>	<p>Same as A2.</p> <p>Motor case drain back pressure must not exceed 40 psi (275 kPa). Inspect hydraulic system for a restriction in the return line to the reservoir. Be sure plumbing is properly sized to winch motor.</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>

TROUBLE	PROBABLE CAUSE	REMEDY
<p><b>C</b></p> <p>The brake will not hold a load with the control lever in neutral.</p>	<ol style="list-style-type: none"> <li>1. Excessive system back pressure acting on the brake release port.</li> <li>2. Friction brake will not hold due to worn or damaged brake discs.</li> <li>3. Brake clutch is slipping.</li> </ol>	<p>System back-pressure must not exceed 100 psi (690 kPa). Inspect hydraulic system for restriction in the circuit from the motor to the reservoir.</p> <p>Same as Remedy 3 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 winch 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 "Brake Clutch Service".</p>
<p><b>D</b></p> <p>The winch will not hoist the rated load.</p>	<ol style="list-style-type: none"> <li>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 hoist the rated load and cause heat.</li> <li>2. System relief valve may be set too low. Relief valve needs adjustment or repair.</li> <li>3. Be certain hydraulic system temperature is not more than 180°F (82°C). Excessive hydraulic oil temperatures increase motor and pump internal leakage and reduce performance.</li> <li>4. Winch line pull rating is based on 1st layer of wire rope.</li> <li>5. Rigging and sheaves not operating efficiently.</li> </ol>	<p>Reinforce mounting surface.</p> <p>If necessary, use shim stock to level winch. Refer to "Winch Installation".</p> <p>First loosen, then evenly retighten all winch mounting bolts to recommended torque.</p> <p>Check relief pressure as follows:</p> <p>A. Install an accurate gauge into the inlet port of the brake valve.</p> <p>B. Apply a stall pull load on the winch while monitoring pressure.</p> <p>C. Compare gauge reading to winch specifications. Adjust relief valve as required.</p> <p>NOTE: 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.</p> <p>Same as remedies for Trouble D1 &amp; D2.</p> <p>Same as remedies for Trouble E2.</p> <p>Refer to winch performance charts for additional information.</p> <p>Perform rigging service as recommended by rig manufacturer.</p>

TROUBLE	PROBABLE CAUSE	REMEDY
<p><b>E</b></p> <p>The winch runs hot.</p>	<ol style="list-style-type: none"> <li>1. Same as D1.</li> <li>2. Be certain that the hydraulic system temperature is not more than 180°F (82°C). Excessive hydraulic oil temperatures may be caused by:               <ol style="list-style-type: none"> <li>A. Plugged heat exchanger.</li> <li>B. Too low or too high oil level in hydraulic reservoir.</li> <li>C. Same as D2.</li> <li>D. Hydraulic pump not operating efficiently.</li> </ol> </li> <li>3. Excessively worn or damaged internal winch parts.</li> </ol>	<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 R.P.M. Tune/adjust prime mover.</p> <p>Check suction line for damage.</p> <p>Pump worn. Replace pump.</p> <p>Disassemble winch to inspect/replace worn parts.</p>
<p><b>F</b></p> <p>Winch “chatters” while raising rated load.</p>	<ol style="list-style-type: none"> <li>1. Same as D2.</li> <li>2. Hydraulic oil flow to motor may be too low.</li> <li>3. Controls being operated too quickly.</li> </ol>	<p>Same as remedies for Trouble D2.</p> <p>Same as remedies for Trouble E2.</p> <p>Conduct operator training as required.</p>
<p><b>G</b></p> <p>The wire rope does not spool smoothly on the drum.</p>	<ol style="list-style-type: none"> <li>1. The winch may be mounted too close to the main sheave, causing the fleet angle to be more than 1-1/2 degrees.</li> <li>2. The winch may not be mounted perpendicular to an imaginary line between the center of the cable drum and the first sheave.</li> <li>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 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. Then, when winding 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.</li> <li>4. The winch may have been overloaded, causing permanent set in the wire rope.</li> </ol>	<p>Check mounting distance and fleet angle. Reposition winch as required.</p> <p>Refer to “Winch 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>



# DISASSEMBLY OF WINCH

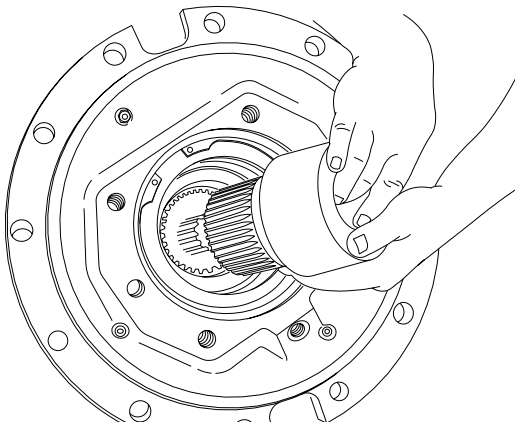
See cross-section illustration on page 26 and parts key for reference.

1. Remove the wire rope from the cable drum and rotate the drum until the fill/drain plug is at the bottom, six o'clock position. Remove the drain plug and capture the gear oil in a suitable container. Recycle or dispose of used oil in an environmentally responsible manner. Install the drain plug.
2. Label the hydraulic hoses as they are removed from the hoist motor. Install plugs in the open hoses and motor ports to reduce entrainment of dirt in the open port.

## ⚠ CAUTION ⚠

The RW300 hoist weighs approximately 1370 lbs. (621 kg). Use adequate lifting equipment.

3. Remove the hoist mounting fasteners and lift the hoist from the mount. Begin disassembly by placing the hoist on a stable work surface with the motor end facing up. Secure the hoist in this position to prevent it from falling and causing injury.
4. Remove the hose that connects the brake valve to the brake release port. Remove the fasteners securing the motor to the brake cylinder assembly. Lift the motor straight up to disengage the motor shaft from the brake clutch assembly.

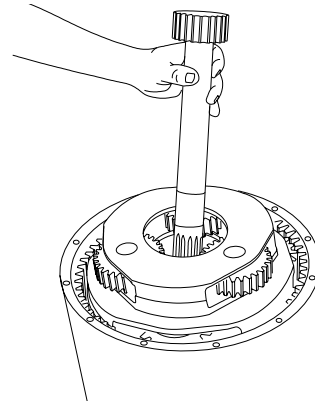


5. Remove the brake clutch assembly/brake hub (42) from the brake cylinder. The input sun gear (2) can not be removed at this time.

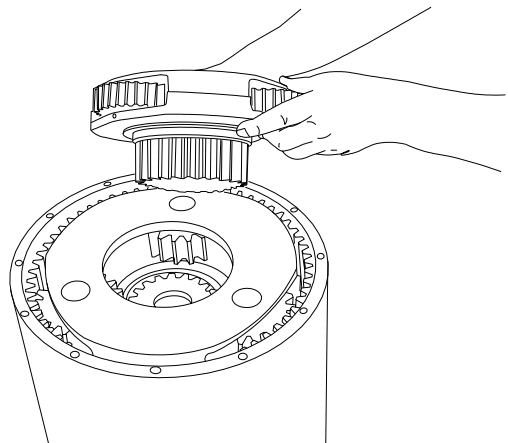
## ⚠ WARNING ⚠

**DO NOT** attempt to remove the large retaining ring at this time. It is holding the static brake spring in compression. Removing this retaining ring at this time could result in property damage, personal injury or death.

6. Remove the brake release hose adapter from the brake release port to prevent damage. Remove the motor pilot adapter (40) from the brake cylinder.
7. With a suitable hoist, turn the hoist over with the motor end down. Remove the capscrews and lock-washers (99,100) that retain the tie-plates (101) to the end-brackets (96, 97). Remove the drum bearing support and end-bracket assembly from the cable drum.
8. Remove the 16 socket head capscrews and lock-washers (12, 13) from the drum flange end (5). With a plastic face mallet, unseat the drum flange end (5) from the drum ring gear (60). Remove the drum flange end from the drum ring gear.

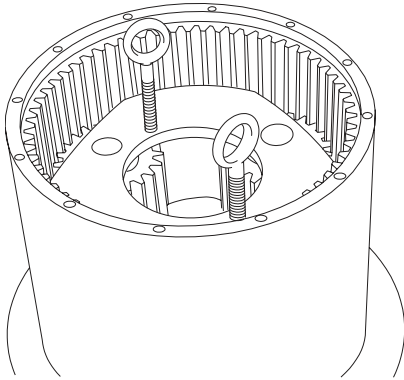


9. Remove the primary sun gear (2) from the primary planet carrier assembly (71).



10. Remove the primary planet carrier (71) and secondary sun gear assembly from the drum ring gear. If the thrust washer (70) between the primary and secondary planet carriers stayed on the secondary planet carrier, remove it and set it aside with the primary planet carrier.

11. Remove the secondary planet carrier assembly (68) from the drum ring gear. The output sun gear (64) will come out with the secondary sun gear. If the thrust washer (66) stayed on the output planet carrier remove it and set aside with the secondary planet carrier.



12. Install two  $\frac{1}{2}$ -13 thread eyebolts into the two tapped holes in the output planet carrier (63). The output planet carrier weighs approximately 125 lb. (57 kg). With a hoist, lift the output planet carrier out of the drum ring gear.
13. Use a long pry bar or chisel to separate the ends of the split ring (65) then remove both halves from the brake cylinder. The bearing cone (57) is a snug fit on the brake cylinder and will have to be pressed off. Place a stack of shop towels onto the work bench to provide padding when the bearing drops off of the brake cylinder. Turn the drum ring gear assembly over with the motor end up and centered over the stack of shop towels.

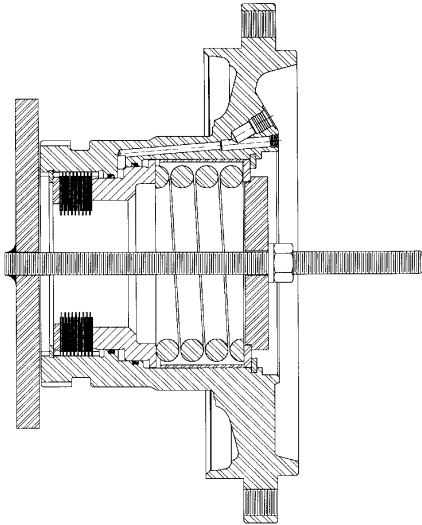
14. Remove the twelve capscrews and lockwashers (82, 83) that secure the motor end-bracket (96) to the brake cylinder (34). Install three  $\frac{7}{8}$  - 9 jack-screws, 6 inches long, evenly spaced into the end-bracket mounting bolt holes. Apply general purpose grease to the threads to reduce friction. Evenly tighten the jack-screws against the drum ring gear flange to push the brake cylinder out of the drum ring gear and separate the bearings. When the two pieces have separated, you will hear the bearing cone drop off the brake cylinder journal onto the pile of shop towels.

15. Install two  $\frac{3}{4}$  - 10 eye bolts into the brake cylinder motor mounting holes and lift the brake cylinder out of the drum ring gear. Be very careful to avoid damaging the drum seals. One half of the lapped metal surface seal is installed on the brake cylinder; the other half is on the drum ring gear. This seal is very durable and will last many years and may often be reused if the mating surfaces are still smooth with no scoring.
16. Inspect the ring gear teeth for pitting and wear. If the wear is greater than .015 in. (.4 mm) when compared to the unworn area of teeth, the ring gear should be replaced. Inspect the thrust washers for scoring and wear. Replace the thrust washers if scoring appears excessive.

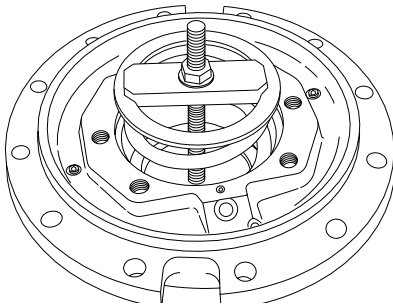
# BRAKE CYLINDER SERVICE

Fabricate the spring compressor tool as illustrated in the "Tools" section of this manual.

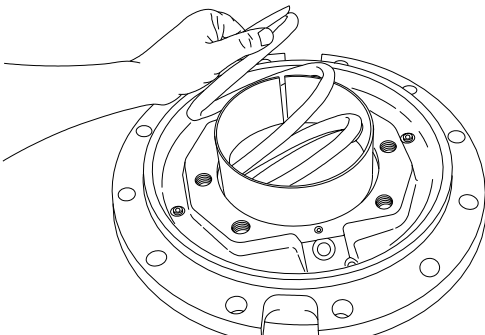
## DISASSEMBLY



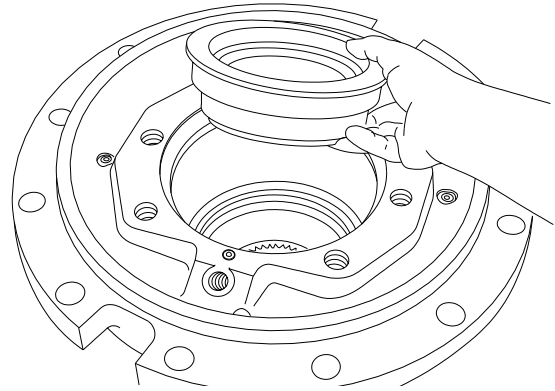
1. Install the spring compressor tool as show. If a hydraulic press is available, only part "A" of the tool is required. Tighten the nut above part "A" or apply hydraulic pressure to slightly compress the spring and relieve load on the retaining ring (53). Carefully remove the retaining ring.



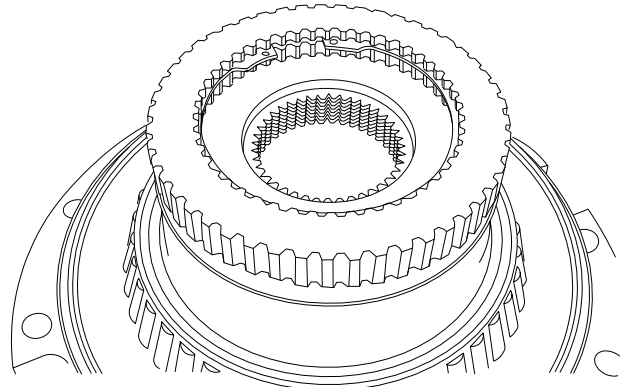
2. Slowly and carefully unscrew the nut above part "A" until spring pressure is completely released (spring travel is approximately 4 inches [10 cm]). Remove the compressor tool.



3. Remove the spring stop (52), spring (55) and piston stop (32) from the brake cylinder.



4. Remove the brake piston (59). Remove and discard both sets of piston O-rings and backup rings (27, 28, 30, 31).



5. Turn the assembly over to access the brake plates. Remove the retaining ring (62). Remove the spacer plate (61), steel separator discs and friction discs (25, 26).

Thoroughly clean and inspect all parts, paying close attention to the sealing surfaces of the brake piston. Place each friction disc on a flat surface and check for distortion with a straight edge. Friction material should appear even across the entire surface and the groove pattern should be visible. Replace friction discs if splines are worn to a point, disc is distorted, friction material is worn unevenly or groove pattern is no longer visible. Place each steel brake plate on a flat surface and check for distortion with a straight edge. Check surface for signs of material transfer or heat. Replace steel discs if splines are worn to a point, disc is distorted or heat discolored.

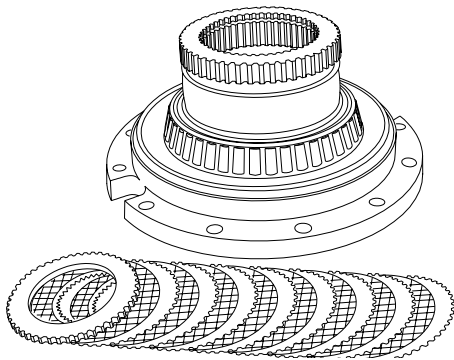
Check the brake release passage to be sure it is clean and completely open.

Inspect both sets of large tapered roller bearings (35, 36, 56, 57) for signs of damage or excessive wear. The bearing rollers should not exhibit any

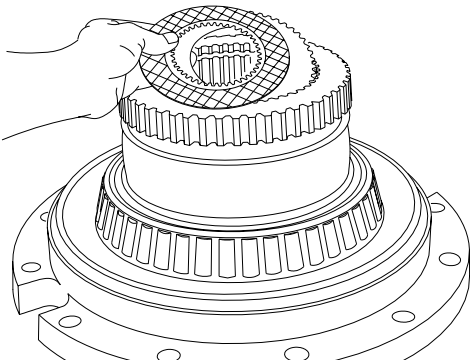
irregularities. If the rollers show any sign of spalling, corrosion, discoloration, material displacement or abnormal wear, the bearing should be replaced. Likewise, the cage should be inspected for wear or deformation. If there is any damage that would impair the cage's ability to separate, retain and guide the rollers properly, the bearing should be replaced.

Carefully inspect both halves of the metal face seal between the motor support/brake cylinder and the ring gear. If the metal contact faces show signs of excessive wear or mechanical damage, or the rubber rings are brittle or damaged, the seal should be replaced.

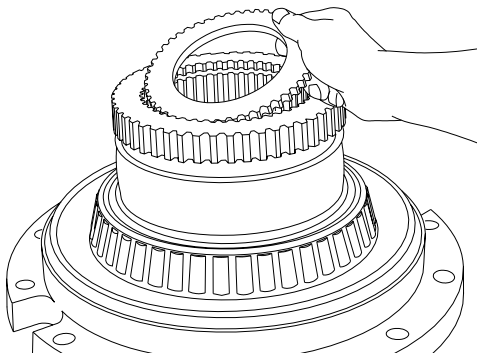
## ASSEMBLY



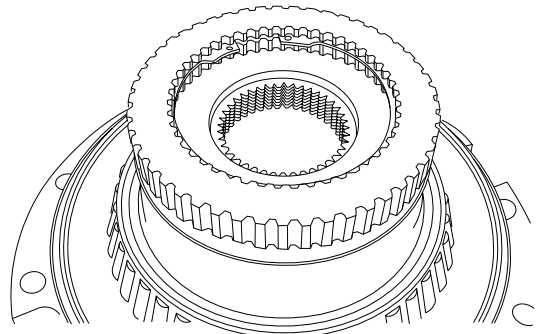
1. Set the motor support/brake cylinder on a bench with the motor end down.



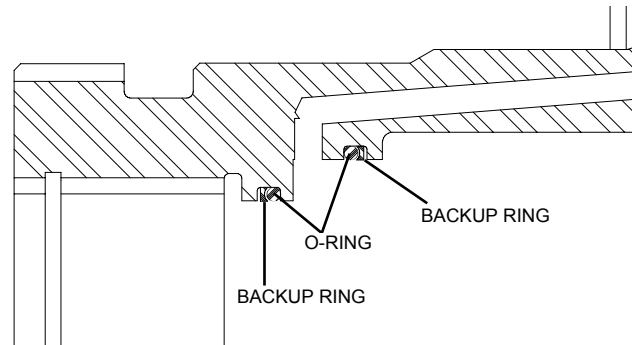
2. Starting with a steel disc, alternately install a steel then a friction disc until eight (8) of each type disc have been installed (ending with a friction disc). It is advisable to lightly lubricate the brake discs with oil that will be used in the winch prior to assembly.



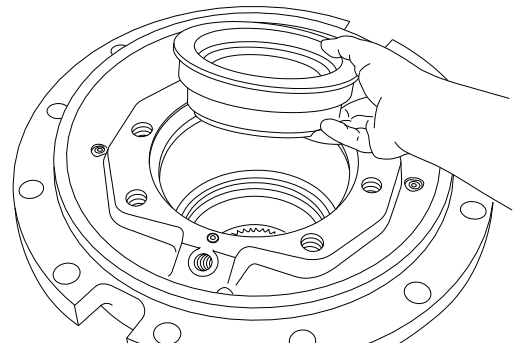
3. Install the spacer plate (61) on top of the last friction disc.



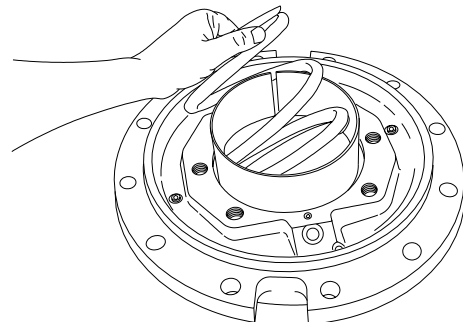
4. Install the retaining ring (62). Turn the assembly over with the motor end up and be sure all brake plates are stacked squarely against the spacer plate.



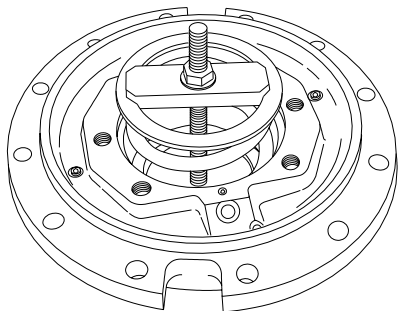
5. Install new O-rings and backup rings (27, 28, 30, 31) into the brake cylinder as shown. It is VERY important to position the O-rings and backup rings as shown above to prevent brake cylinder leakage.



6. Lightly lubricate the sealing surfaces of the brake piston (59) and install it into the brake cylinder until it touches the brake discs.



7. Install the piston stop (32) and the brake spring (55).



8. Set the spring stop (52) on the spring and install the spring compressor tool, or move the assembly to a press. Be sure the step on the compressor tool is squarely seated on the spring stop.

### ⚠ CAUTION ⚠

The brake spring must be compressed approximately 4 inches (10 cm) and has a compressed force of approximately 1,500 lb (680 kg). Extreme care should be observed while completing this step to avoid sudden release of the spring. **DO NOT** stand directly in front of the spring while it is being compressed.

9. Slowly compress the spring until the spring stop is slightly below the retaining ring groove in the brake cylinder. Install the retaining ring (57). **NOTE:** The holes in the ends of the retaining ring are slightly tapered. The smaller end of the hole **MUST** be installed away from the spring stop, or toward the motor, to prevent the ring from slipping off the pliers when installed or removed. Be sure the retaining ring is completely seated in its groove, and slowly release the spring compressor until the force of the spring is held by the retaining ring. Remove the spring compressor tool.

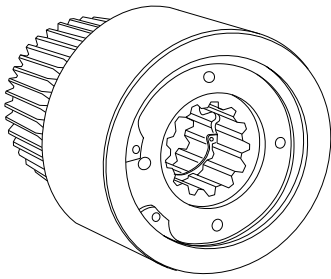
## Brake Cylinder Pressure Test

1. Connect a hydraulic hand pump with an accurate gauge and shut-off valve to the brake release port of the motor support. Apply 500 psi (3,450 kPa) to the brake. Close the shut-off valve and let stand for five (5) minutes. If there is any loss of pressure, the brake cylinder should be disassembled for inspection of the sealing surfaces and O-rings.

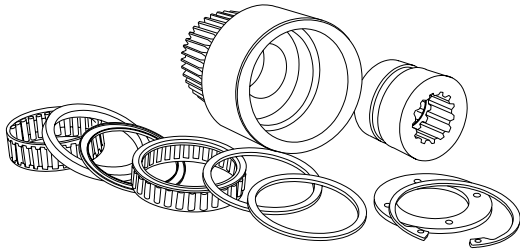
WHILE PRESSURE IS APPLIED AND THE BRAKE IS RELEASED, install the brake clutch assembly/ brake hub. Rotate the clutch back and forth to align the splines in all brake discs. When the brake clutch has engaged all the discs, release the pressure on the brake cylinder and remove the brake clutch.

# BRAKE CLUTCH ASSEMBLY SERVICE

Before disassembling the brake clutch, make note of the freewheeling direction of the inner brake race (50). Hold the outer race (42) and try to turn the inner race in both directions. It should turn free of the outer race in one direction only. If the inner race will not turn freely in either direction, or turns freely in both directions, the sprag clutch assembly has been damaged and must be replaced.



1. Remove the retaining ring (43). All other internal parts can now be removed, including the sprag assembly (46) and the roller bearing (58).



2. Thoroughly clean all parts in solvent and inspect for signs of wear and/or damage. Inspect the sprag clutch and roller bearing closely for abnormal wear, cracks, pitting or corrosion. Check small clips for breakage or bright spots; the signs of excessive wear.

3. Apply a light coat of winch lubricant to all components as they are assembled. Install the roller bearing (58) into the outer race (42). Install spacer (47) on top of roller bearing. Install the sprag clutch assembly (46). **NOTE:** The sprag assembly consists of three parts; two u-shaped bronze spacers and a cam assembly. The bronze spacers are installed with their open end toward the cam assembly, one spacer on each side. Rotate the cam assembly while gently pushing it into the outer race.

Before installing the inner race (50), be sure the internal retaining ring (49) is installed and fully seated. Slide the inner race through the sprag clutch (the race will have to be rotated in the freewheeling direction to start it into the clutch). Be sure the inner race turns freely in the same direction determined before the unit was disassembled. If it turns freely in the opposite direction, the sprag clutch has been installed backwards and must be reversed. Install spacers (44, 45), and retaining ring (43).

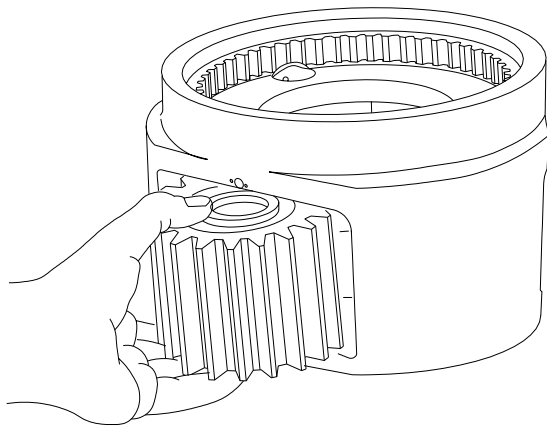
## ⚠ WARNING ⚠

The polished surfaces of the inner and outer races must be perfectly smooth to insure positive engagement of the clutch. The slightest defect may reduce sprag clutch effectiveness, which could result in property damage, personal injury or death. The entire sprag clutch assembly must be replaced if any component is defective.

# PLANET CARRIER SERVICE

## OUTPUT PLANET CARRIER

1. The preferred method of removing the planet pin (18), is to first remove the roll pin (24). This can usually be done by using a punch or small pry bar to drive or push the roll pin out of the planet carrier (63). Access to the roll pin is gained through a drilled hole in the end of the planet pin. If this method is not successful, the roll pin must be sheared by driving or pressing the planet pin out of the carrier. A piece of pipe or tubing long enough to hold the planet pin may be used to support the carrier while each pin is removed. Adequately support the assembly and drive or press out one planet pin, shearing the roll pin.

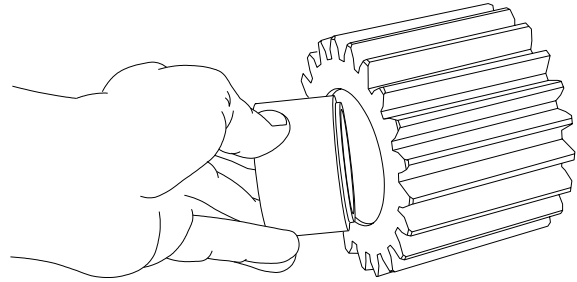


2. Slide the planet gear (19) out of the carrier and remove the bearing cones. Clean and inspect the bearing cups in each end of the gear. If they are determined to be in serviceable condition, no further disassembly is required.
3. If the bearings need to be replaced, remove the bearing cups, spacer and internal retaining ring from the bore of the planet gear.
4. Repeat steps 1, 2 and 3 for each planet gear.

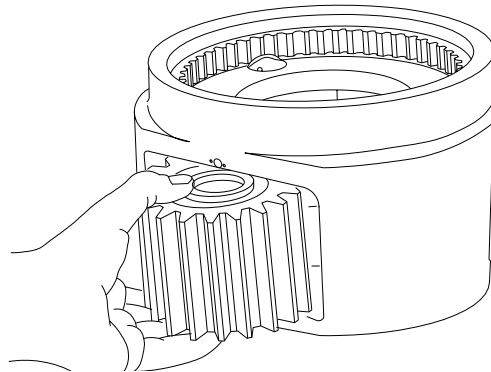
Thoroughly clean all parts and inspect for damage and wear. The bearings should be examined for any signs of spalling, corrosion, discoloration, material displacement or abnormal wear. The bearing cages should be inspected for wear or deformation. If any of these conditions are found, the bearing should be replaced. Gears should be inspected for abnormal wear or pitting and replaced as necessary. Inspect all machined surfaces and bearing bores for signs of damage or excessive wear.

**NOTE:** Steps 5 through 8 are necessary only if the planet gear bearings are being replaced.

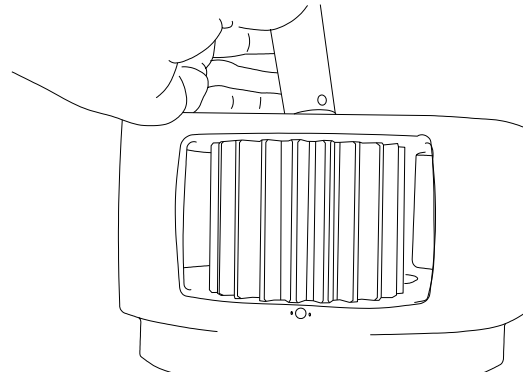
5. Install a retaining ring (21) in the bore of a planet gear. Be sure it is completely seated in the groove.



6. Install a bearing spacer (20) into the bore of the planet gear. Be sure the step on the spacer is toward the retaining ring.
7. Install a bearing cup (22) into each end of the gear. The cups should firmly contact the spacer.
8. Repeat steps 5, 6 and 7 for each planet gear.

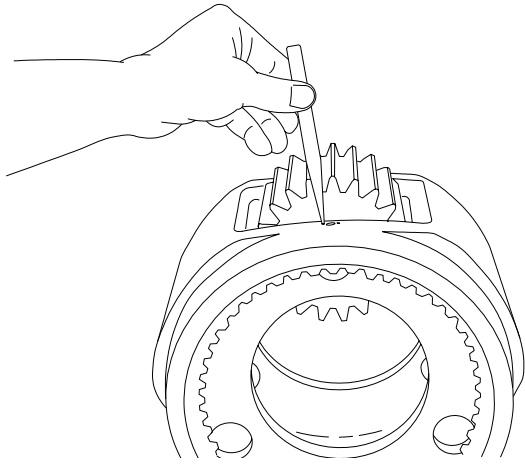


9. Install a bearing cone (23) into each end of a planet gear and slide the gear and bearings into the planet carrier, aligning the bearing bores with the planet pin bore.



10. Install a planet pin through the planet carrier and bearings, aligning the hole in the pin with the roll pin hole in the carrier. Drive a new roll pin (24) into place in the carrier.

**NOTE:** Always use NEW roll pins.



11. The roll pin should be slightly recessed in the carrier when properly installed. Use a punch to stake the carrier next to the pin hole so the pin will not back out when the unit is in operation.

12. Repeat steps 9, 10 and 11 for each planet gear.

## PRIMARY AND SECOND STAGE PLANET CARRIERS

1. The preferred method of removing the planet pin, is to first remove the roll pin. This can usually be done by using a punch or small pry bar to drive or push the roll pin out of the planet carrier. Access to the roll pin is gained through a drilled hole in the end of the planet pin. If this method is not successful, the roll pin must be sheared by driving or pressing the planet pin out of the carrier. A piece of pipe or tubing long enough to hold the planet pin may be used to support the carrier while each pin is removed. Adequately support the assembly and drive or press out one planet pin, shearing the roll pin.

2. Slide the planet gear out of the carrier and remove the thrust washers and loose roller bearings.

3. Repeat steps 1 and 2 for each planet gear.

4. Remove the retaining ring holding the sun gear in the planet carrier and remove the sun gear.

Thoroughly clean all parts and inspect for damage and wear. The bearing rollers should be examined for any signs of spalling, corrosion, discoloration, material displacement or abnormal wear. If any of these conditions are found, the rollers should be replaced. Gears should be inspected for abnormal wear or pitting and replaced as necessary. Inspect all machined surfaces and bearing bores for signs of damage or excessive wear.

5. Engage the sun gear with the splines on the planet carrier and install the retaining onto the sun gear.

6. Liberally coat the bore of a planet gear with a good grade of oil soluble grease.

7. Set a thrust washer on a clean flat work surface. Set the planet gear on the thrust washer with the bore in the gear centered over the washer. Install a row of loose rollers around the bore of the gear, using additional grease as required to hold them in place.

8. Set another thrust washer on top of the rollers and slide the gear and bearing assembly into place in the planet carrier. Align the gear with one of the planet pin bores in the carrier and install a planet pin. Align the hole in the pin with the hole in the carrier and install a new roll pin.

**NOTE:** Always use **NEW** pins.

9. The roll pin should be slightly recessed in the carrier when properly installed. Use a punch to stake the carrier next to the pin hole so the pin will not back out when the unit is in operation.

10. Repeat steps 5 through 9 for the remaining planet gears.



# WINCH ASSEMBLY

The following procedure should be used to assemble the complete winch. It assumes all the sub-assemblies have been properly serviced as described earlier in this manual.

1. Install the motor end-bracket (96) onto the fully assembled brake cylinder. Install the 12 capscrews and lockwashers (82, 83) only snug at this time. They will be tightened to recommended torque after both end-brackets have been installed. If the lapped metal face seal assembly (33) is being replaced, install one half of the seal in the brake cylinder and the other half in the drum ring gear. The old seal is simply pried out of position. Thoroughly clean the seal seat areas.

**Note:** Handle the new seals with great care. The smooth metal contact surfaces must remain perfectly flat and free of dents or nicks for the seal to operate leak free. Alcohol acts as a lubricant for rubber. If alcohol is not available, a light coating of oil may be used.

Apply denatured alcohol to the large o-rings and place them in the seal seat in the housings. Apply denatured alcohol to the o-ring again and evenly push the lapped metal face seal into the o-ring. You may need the assistance of another technician to help push the metal face seal into place. Do not use punches or metal tools directly on the seal surface as the lapped surface is easily damaged.

2. Install bearing cone (36) onto the brake cylinder and new bearing cups (35, 56) into the drum ring gear. Place the brake cylinder on the workbench with the motor side down. Apply a light coat of oil to the metal face seals and to the bearing cones and cups. Place the drum ring gear onto the brake cylinder. The face seals will hold the two components slightly apart.
3. Install bearing cone (57) onto the brake cylinder. Use a brass punch to gently start the bearing onto the brake cylinder journal.

**Note:** Fabricate the bearing compression tool shown in the "Tools" section of this manual.

4. Using the bearing compression tool, or large frame hydraulic press, press the bearing cone down into the bearing cup. Make certain the bearing cone is fully seated in the cup. Remove any burrs or nicks from the split rings and install the split rings into the groove in the brake cylinder. The two halves of the split ring must be centered in the groove. The count-

er-bore in the output planet carrier holds the split rings in the groove. The split rings must be centered for the planet carrier to install over the brake cylinder splines.

5. Install two ½-13 eye bolts into the output planet carrier. With a hoist, install the output planet carrier into the drum ring gear. Rotate each gear to align the teeth as you lower the carrier. Rotate the carrier to align the carrier with the brake cylinder splines. When aligned, the carrier will drop down onto the splines and capture the split rings.
6. Install thrust washer (66), onto the second stage planet assembly (with output sun gear). A light coat of oil soluble grease should be used to hold it in place during assembly. Slide the planet assembly into the ring gear and engage the output sun gear with the output planet gears. The second stage planet gears should now be at least 1/8 inch (3 mm) below the top of the teeth cut into the drum ring gear. If they are above the ring gear teeth, the unit is not properly assembled to this point. Either the thrust washer (66) is improperly positioned, or the output planet carrier is not fully engaged onto the brake cylinder (possibly caused by the split ring not being fully seated). Remove the second stage planet assembly and/or the output planet assembly to determine and correct the cause of the problem before proceeding.
7. Install thrust washer (70) onto the primary planet assembly (with second stage sun gear). A light coat of oil soluble grease should be used to hold it in place during assembly. Install the primary planet assembly onto the second stage planet assembly, engaging the second stage sun gear with the second stage planet gears. Visually check to be sure the thrust washer is properly positioned.
8. Install the primary sun gear (2) through the center of the primary planet assembly.
9. Press a new bearing (88) if required, into the drum flange. Use a flat steel plate that is slightly smaller OD than the drum bearing as a pressure plate to press the new drum bearing into the drum flange bore until it is fully seated at the bottom. Apply non-hardening sealant to the outside diameter of a new drum seal then install the new seal into the drum flange. Use a flat steel plate as a driver and press the new seal into the drum flange until it is even with the outside edge of the drum flange.

## **CAUTION**

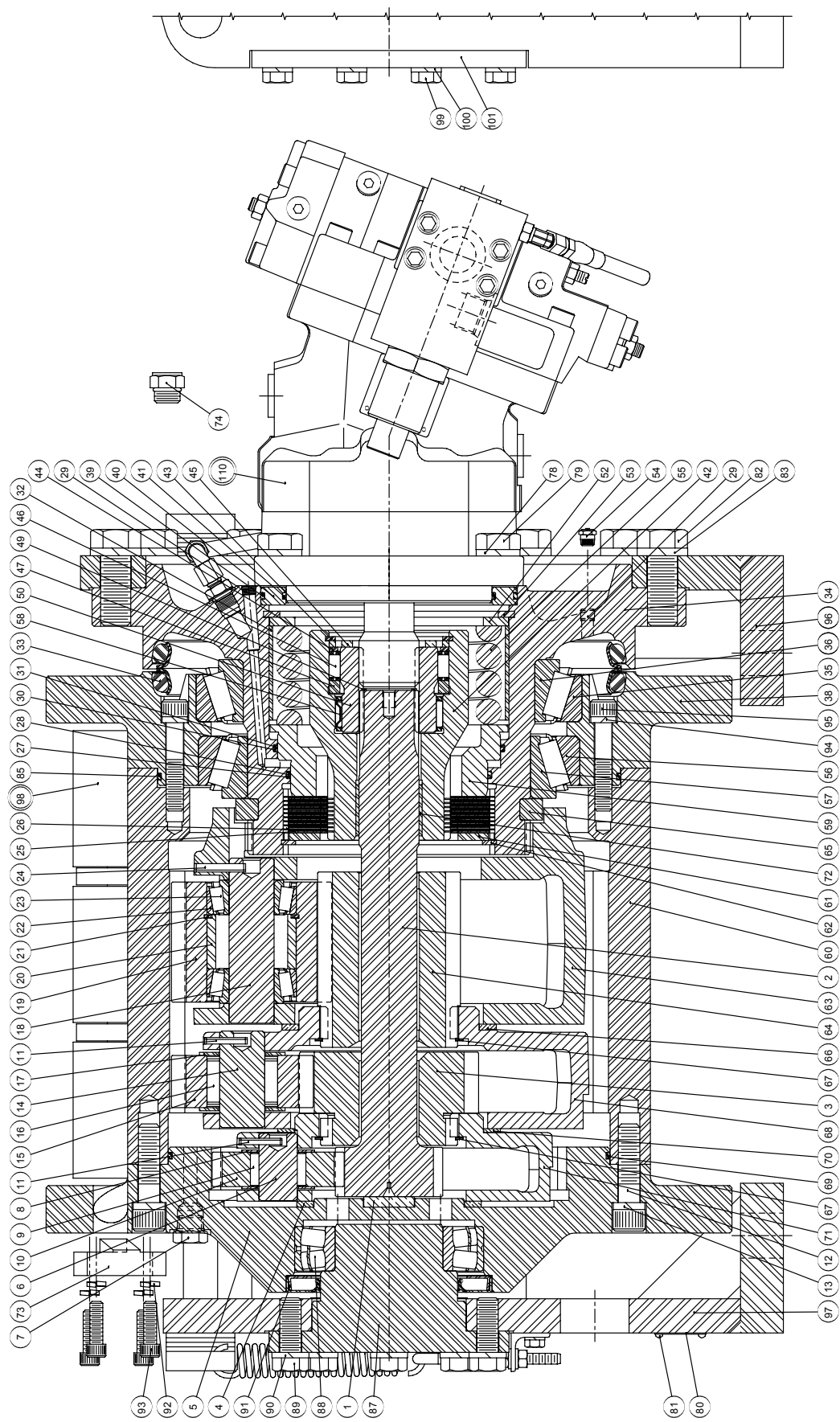
In the following step, the drum flange/primary ring gear may suddenly drop onto the drum ring gear when all primary planet gear teeth are aligned with those in the flange. DO NOT work with your fingers between the drum flange and the drum ring gear.

10. Carefully set the drum flange (5) onto the drum ring gear, engaging the primary planet gears with the ring gear teeth machined into the inside surface. Turn the drum flange to align the bolt holes with those in the drum ring gear and install the 16 capscrews and lockwashers (12, 13). Tighten the capscrews (12) to 210 lb.-ft. (285 N-m) torque in an alternating cross-over pattern.
11. Install the drum bearing support/end-bracket assembly onto the drum assembly. For added safety, remove two of the drum bearing support capscrews (89) and replace them with two 5/8 - 11 eye bolts so that a hoist may be used to lift the drum flange. After the end-bracket is installed, remove the eye bolts and install the drum bearing support capscrews (89) snugly at this time.
12. Install the tie plates (101) onto the end-brackets with capscrews and lockwashers (99, 100). Only hand tighten the capscrews at this time.
13. Place assembled winch onto a flat surface and evenly tighten the tie plate capscrews (99) to 105 lb.-ft. (142 N-m) torque. Tighten the motor end-bracket capscrews (82) to 600 lb.-ft. (814 N-m) torque in an alternating cross-over pattern. Tighten the drum bearing support capscrews (89) to 210 lb.-ft. (285 N-m) torque.
14. Turn the winch up on end with the motor end up. Secure the winch in this position so that it does not fall over. Install the brake release hose adapter into the brake release port. Attach a hand-pump to the adapter and apply approximately 500 PSI (3450 kPa) to release the brake.
15. Install the brake clutch assembly/brake hub into the brake cylinder. You must align all of the brake discs and the input sun gear splines. The brake clutch assembly should bottom out with the input sun gear against the snap ring in the inside diameter of the inner brake race. After the brake clutch assembly is fully seated, release the pressure from the hand-pump then remove the hand pump.
16. Install new o-rings onto the motor pilot adapter (39, 40, 41) and install the adapter into the brake cylinder. Install the motor sub-assembly onto the winch. Install and tighten capscrews and lockwashers (78, 79) to 380 lb.-ft. (515 N-m) torque. Install the brake release signal hose from the lowering port of the motor to the brake release port on the brake cylinder.
17. Fill winch to the oil level port or the centerline of the assembly with recommended gear oil. Refer to "Recommended Gear Oil" in the "Specifications" section of this manual.

**Note:** Whenever a winch has been repaired, it should be tested on a test tower or tested on the original equipment. The following test procedure is offered as a suggestion only; equipment specifications will dictate the test required.

1. Install the winch as recommended in the "Installation" section of this manual.
2. Install wire rope as recommended by the wire rope supplier. If unknown, make certain first layer, the most important, is tightly packed onto the cable drum and maintain approximately 500 lb. (226 kg) tension load on all layers of wire rope.
3. Rope off a secure test area for test lift. Make certain no personnel will be under a suspended load. Lift a test load of approximately 2500 pounds (1134 kg) approximately 3 feet (1 meter) and return the controls to neutral/hold. If the load is held firmly, raise then lower the test load the full height of the boom/mast as available. Increase the load and repeat the test. If no problems are found, the winch may be placed into service. If any malfunction is detected, the winch must be removed from service until the problem is corrected and the winch passes the lift tests. Make a permanent record of the winch repairs that include the date of repair, what was wrong before the repair, what was done, what parts were used, the test performed and the name of the technician(s).

RW300A COMPONENTS

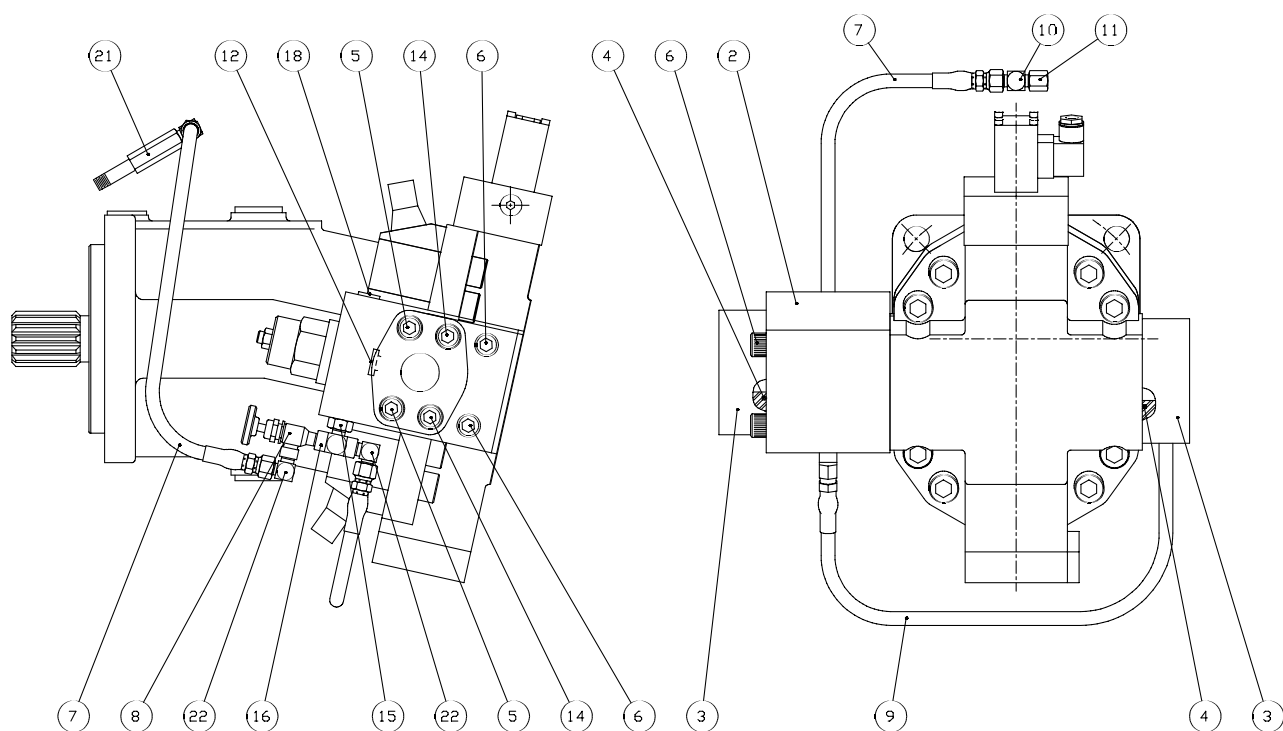


## RW300A (04893, 05051 & 05435) PARTS KEY

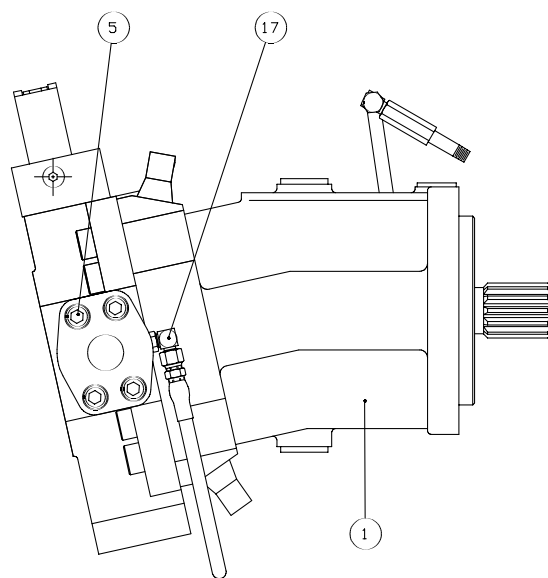
Item	Description	Qty.
1	WASHER, THRUST	1
2	GEAR, PRIMARY SUN	1
3	GEAR, SECONDARY SUN	1
4	WASHER, THRUST	1
5	FLANGE, PRIMARY RING	1
6	PIN, PRIMARY PLANET	3
7	PLUG	1
8	WASHER, THRUST	6
9	ROLLER	51
10	GEAR, PRIMARY PLANET	3
11	SPIROL PIN	6
12	CAPSCREW	16
13	LOCKWASHER, H1-COLLAR	16
14	PIN, SECONDARY PLANET	3
15	GEAR, SECONDARY PLANET	3
16	ROLLER	42
17	WASHER, THRUST	6
18	PIN, PLANET	3
19	GEAR, FINAL PLANET	3
20	BEARING SPACER	3
21	RING, INTERNAL RETAINING	3
22	BEARING, CUP	6
23	BEARING, CONE	6
24	ROLLPIN	3
25	FRICION DISC	9
26	BRAKE DISC	9
27	BACK-UP RING	1
28	O-RING	1
29	PIPE PLUG	3
30	O-RING	1
31	BACK-UP, O-RING	1
32	PISTON STOP	1
33	SEAL	1
34	SUPPORT, MOTOR	1
35	BEARING, CUP	1
36	BEARING, CONE	1
38	FLANGE, BEARING CARRIER	1
39	O-RING	1
40	ADAPTER, MOTOR	1
41	O-RING	1
42	BRAKE RACE, OUTER	1
43	RING, INTERNAL RETAINING	1
44	SPACER	1
45	SPACER	1
46	51729 SPRAG ASSEMBLY	1
47	SPACER	1
49	RING, INTERNAL RETAINING	1
50	BRAKE RACE, INNER	1
52	SPRING, STOP	1
53	RING, INTERNAL RETAINING	1
54	RELIEF VALVE	1
55	SPRING	1
56	BEARING, CUP	1
57	BEARING, CONE	1
58	BEARING, ROLLER	1
59	PISTON	1
60	GEAR, RING	1
61	RETAINER, BRAKE	1
62	RING, INTERNAL RETAINING	1
63	CARRIER, FINAL PLANET	1
64	GEAR, FINAL SUN	1
65	RING, SPLIT	1
66	WASHER, THRUST	1
67	RING, EXTERNAL RETAINING	2
68	CARRIER, SECONDARY PLANET	1
69	O-RING	1

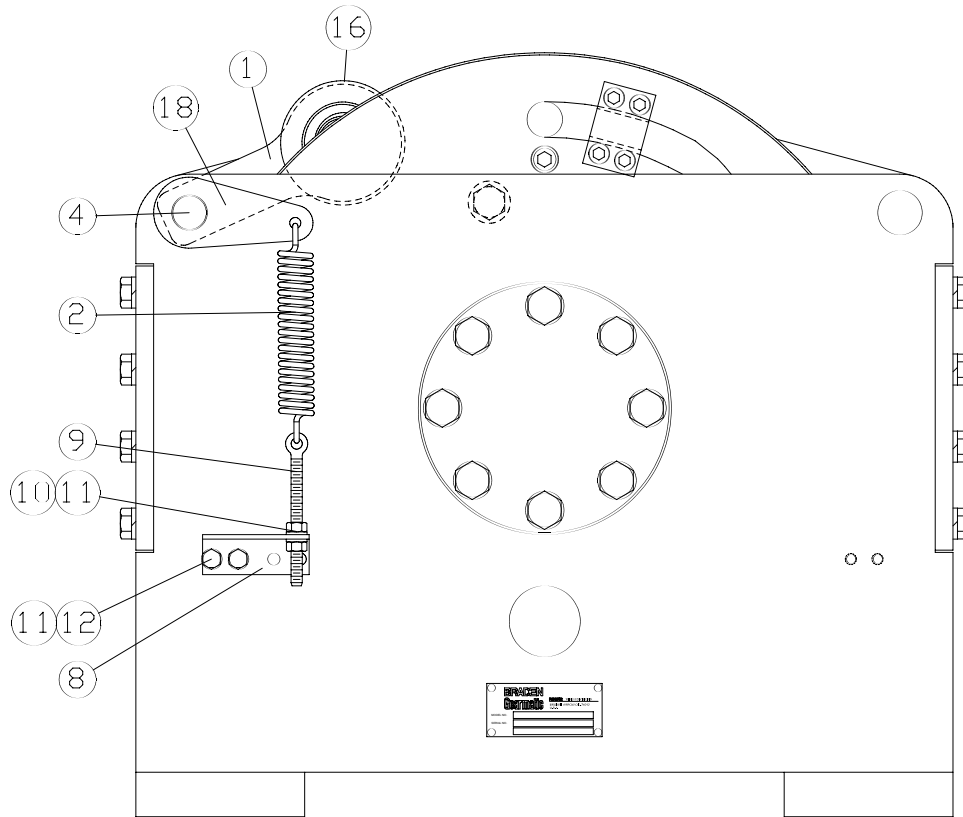
Item	Description	Qty.
70	WASHER, THRUST	1
71	CARRIER, PRIMARY PLANET	1
72	BEARING	1
73	ANCHOR, CABLE	1
74	SIGHT GAUGE	1
78	LOCKWASHER (3/4 Z)	4
79	CAPSCREW (3/4 NC X 2 G8 Z)	4
80	NAMEPLATE	1
81	DRIVE SCREW	4
82	CAPSCREW (7/8 NC X 2-1/4 G8 Z)	12
83	LOCKWASHER (7/8 Z)	12
85	O-RING	1
87	SUPPORT, BEARING	1
88	SPH ROLLER BRG	1
89	CAPSCREW (5/8 NC X 1-1/4 G8 Z)	8
90	LOCKWASHER (5/8 Z)	8
91	OILSEAL	1
92	LOCKWASHER (3/8 HI COLLAR Z)	4
93	CAPSCREW (3/8 NC X 1-1/4 G8)	4
94	LOCKWASHER (1/2 HI COLLAR Z)	16
95	CAPSCREW (1/2 NC X 2-3/4 G8)	16
96	SIDE PLATE, MOTOR	1
97	SIDE PLATE, SUPPORT	1
98	TENSION ROLLER ASSY (04893 WINCH)	1
99	CAPSCREW (1/2 X 1-1/2 G8 SPECIAL)	16
100	LOCKWASHER (1/2)	16
101	TIE PLATE	2

110	HYDRAULIC MOTOR SUB-ASSEMBLY (FOR WINCH ASSEMBLY 04893 & 05051)	
111	MOTOR, HYDRAULIC (05051 WINCH)	1
	MOTOR, HYDRAULIC (04893 WINCH)	
112	BRAKE VALVE	1
113	MANIFOLD	1
114	O-RING	1
115	CAPSCREW (7/16 NC X 1-1/2 SOC HD)	4
116	CAPSCREW (7/16 NC X 3-3/4 SOC HD)	4
117	HOSE ASSY (-4 JIC X 20 IN.) 05051 WINCH	1
118	ELBOW (45° ORB TO JIC -4/-4)	2
119	ADAPTER (-4 JIC / -4 ORB) 04893 WINCH	1
	ELBOW (-4 JIC / -4 ORB) 05051 WINCH	1
120	SWIVEL NUT ELBOW (90°)	1
121	HOSE ASSEMBLY (-4 JIC X 14 IN.)	1
122	ADAPTER (JIC TO ORB -4/-6)	1
123	PLUG (-4 ORB)	1



110	<b>HYDRAULIC MOTOR SUB-ASSEMBLY (FOR WINCH ASSEMBLY 05435)</b>	
1	MOTOR, HYDRAULIC (05051 WINCH)	1
2	BRAKE VALVE	1
3	ADAPTER	2
4	O-RING	2
5	CAPSCREW (1/2 NC X 1-1/2 G8 Z)	6
6	CAPSCREW (1/2 NC X 4-1/2 G8 Z)	2
7	HOSE ASSEMBLY (-4 JIC X 17 IN.)	1
8	NEEDLE VALVE	1
9	HOSE ASSEMBLY (-4 JIC X 20 IN.)	1
10	TEE, MALE BRANCH	1
11	CAP NUT	1
12	PLUG (-4 ORB)	1
14	CAPSCREW (1/2 NC X 5-1/2 G8)	2
15	ADAPTER	1
16	TEE, MALE BRANCH	1
17	ELBOW FITTING	1
18	PLUG	1
21	NIPPLE	1
22	ELBOW	2





98	<b>TENSION ROLLER ASSEMBLY</b> (04893 WINCH ONLY) (NOT ALL PARTS ARE SHOWN)	1
1	TENSION ROLLER ARM	2
2	TENSION SPRING	1
3	TENSION ROLLER SHAFT	1
4	TENSION ARM SHAFT	1
5	SETSCREW	2
6	WASHER (1 INCH)	8
7	ROLLER BUSHING	2
8	SPRING ANCHOR	1
9	ROLLER ROD END	1
10	HEX NUT (5/16)	2
11	LOCKWASHER (5/16)	4
12	CAPSCREW (5/16 NC X 3/4 G5)	2
13	ROLLPIN	3
14	RETAINING RING	2
15	THRUST WASHER	2
16	ROLLER	3
17	ROLLPIN	2
18	LEVER ARM	1
19	COLLAR	1

# METRIC CONVERSION TABLE

English to Metric

Metric to English

English to Metric			Metric to English		
LINEAR					
inches (in.)	X 25.4	= millimeters (mm)	millimeters (mm)	X 0.3937	= inches (in.)
feet (ft.)	X 0.3048	= meters (m)	meters (m)	X 3.281	= feet (ft.)
miles (mi.)	X 1.6093	= kilometers (km)	kilometers (km)	X 0.6214	= miles (mi.)
AREA					
inches <sup>2</sup> (sq.in.)	X 645.15	= millimeters <sup>2</sup> (mm <sup>2</sup> )	millimeters <sup>2</sup> (mm <sup>2</sup> )	X 0.000155	= inches <sup>2</sup> (sq.in.)
feet <sup>2</sup> (sq.ft.)	X 0.0929	= meters <sup>2</sup> (m <sup>2</sup> )	meters <sup>2</sup> (m <sup>2</sup> )	X 10.764	= feet <sup>2</sup> (sq.ft.)
VOLUME					
inches <sup>3</sup> (cu.in.)	X 0.01639	= liters (l)	liters (l)	X 61.024	= inches <sup>3</sup> (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 <sup>3</sup> (cu.in.)	X 16.39	= centimeters <sup>3</sup> (cc)	centimeters3 (cc)	X 0.06102	= inches <sup>3</sup> (cu.in.)
feet <sup>3</sup> (cu.ft.)	X 28.317	= liters (l)	liters (l)	X 0.03531	= feet <sup>3</sup> (cu.ft.)
feet <sup>3</sup> (cu.ft.)	X 0.02832	= meters <sup>3</sup> (m <sup>3</sup> )	meters3 (m3)	X 35.315	= feet <sup>3</sup> (cu.ft.)
fluid ounce (fl.oz.)	X 29.57	= milliliters (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 <sup>2</sup> )	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 <sub>2</sub> O (60°F)	X 0.2488	= kilopascals (kPa)	kilopascals (kPa)	X 4.0193	= inches H <sub>2</sub> 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 X °C) + 32		
COMMON METRIC PREFIXES					
mega	(M)	= 1,000,000 or 10 <sup>6</sup>	deci	(d)	= 0.1 or 10 <sup>-1</sup>
kilo	(k)	= 1,000 or 10 <sup>3</sup>	centi	(c)	= 0.01 or 10 <sup>-2</sup>
hecto	(h)	= 100 or 10 <sup>2</sup>	milli	(m)	= 0.001 or 10 <sup>-3</sup>
deka	(da)	= 10 or 10 <sup>1</sup>	micro	(μ)	= 0.000.001 or 10 <sup>-6</sup>