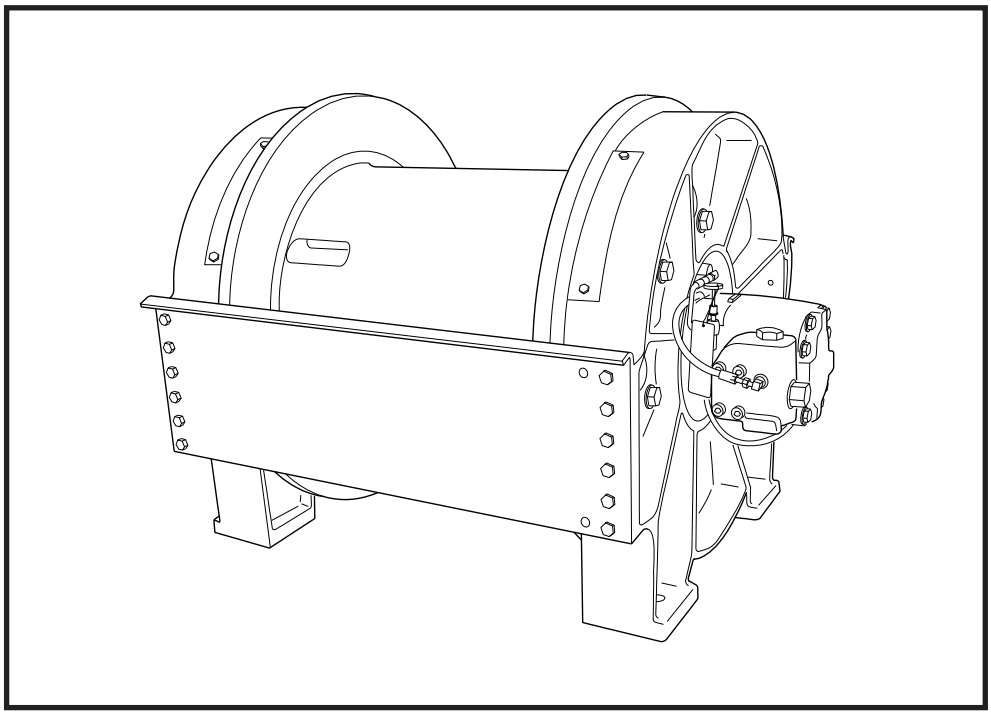
BRADEN

CH330/CH400
HYDRAULIC WINCH



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.

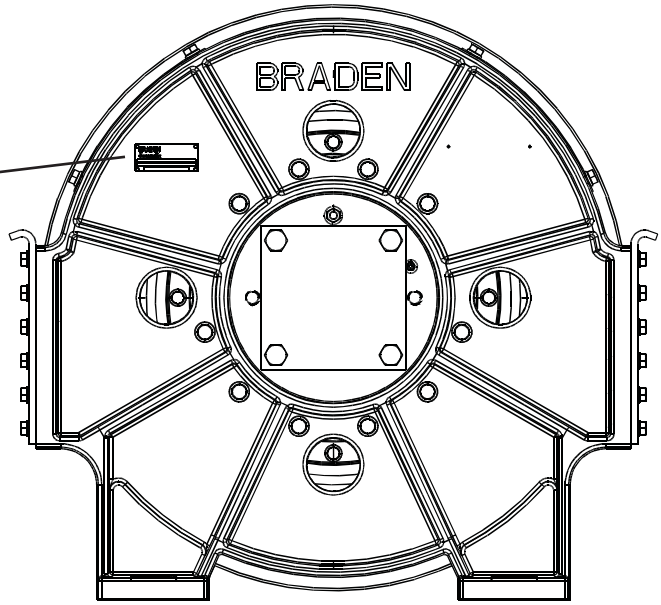
The following service instructions have been prepared to provide assembly, disassembly and maintenance information for the BRADEN Model CH330/400A series winch. Before doing any work on these units, all assembly and disassembly instructions should be read and understood.

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 in appearance.

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

Telephone- 1-918-251-8511

Serial Numbers and Model Number stamped into the motor end bracket as shown at right. Always refer to the Serial Number and Model Number when requesting information or service parts.



EXPLANATION OF SERIAL NUMBER

CH	330	A	69	120	-	01	-	G	-	1
CONSTRUCTION HOIST	MAX RATING	DESIGN RATING	GEAR RATIO	MOTOR SIZE		DRUM SIZE		DRUM OPTION		OPTION

CH DESIGNATES CONSTRUCTION HOIST
330 DESIGNATES 33,000 LB DESIGN FIRST LAYER LINE PULL
A DESIGNATES THE MODEL SERIES RELATING TO DESIGN CHANGES
69 DESIGNATES TOTAL GEAR REDUCTION
120 DESIGNATES HYDRAULIC MOTOR DISPLACEMENT IN CU IN/REV (120 = 12.0 CU IN REV)
01 DESIGNATES THE DRUM OPTION
G DESIGNATES OTHER DRUM OPTIONS (G = GROOVED; M = MACHINED; P = RATCHET AND PAWL U = UNDERWOUND)
1 PERMITS TESTING AND INSPECTION PER API 2C FOR OFFSHORE CRANES

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 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.

⚠ WARNING ⚠

FAILURE TO OBEY THE FOLLOWING SAFETY RECOMMENDATIONS MAY RESULT IN PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH.

1. Read all warning tag information and become familiar with all controls before operating winch.
2. Never attempt to clean, oil or perform any maintenance on a machine with the engine running, unless instructed to do so in the service manual.
3. Never operate winch controls unless you are properly seated at the operators station on the prime mover and you are sure personnel are clear of the work area.
4. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
5. Ground personnel should stay in view of the prime mover operator and clear of winch drum. Do not allow ground personnel near winch line under tension. A safe distance of at least 1½ times the length of the cable should be maintained.
6. On machines having hydraulically, mechanically and/or cable controlled equipment, be certain the equipment is either lowered to the ground or blocked securely before servicing, adjusting and/or repairing the winch. Always apply the prime mover parking brakes and lower equipment before dismounting the prime mover.
7. Inspect rigging, winch and hydraulic hoses at the beginning of each work shift. Defects should be corrected immediately.
8. Keep equipment in good operating condition. Perform scheduled servicing and adjustments listed in the "Preventive Maintenance" section of this manual.
9. An equipment warm-up procedure is recommended for all start-ups and is essential at ambient temperatures below +40°F (4°C). Refer to "Warm-Up Procedure" listed in the "Preventive Maintenance" section of this manual.
10. Be sure of equipment stability before operating winch.
11. The winches described herein are neither designed nor intended for use or application to equipment used in the lifting or moving of persons.
12. Do not exceed the maximum pressure (PSI or kPa) or flow (GPM or LPM) stated in the winch specifications.
13. Operate winch line speeds to match job conditions.
14. Leather gloves should be used when handling winch cable.
15. Never attempt to handle winch cable when the hook end is not free.
16. When winding winch cable on the winch drum, never attempt to maintain tension by allowing winch cable to slip through hands. Always use "hand-over-hand" technique.
17. Never use winch cable with broken strands. Replace winch cable.
18. Do not weld on any part of the winch.
19. Do not use knots to secure or attach winch cable.
20. Use recommended hydraulic oil and gear lubricant.
21. Keep hydraulic system clean and free from contamination at all times.
22. Use correct size cable anchor for cable and pocket in winch drum.
23. The BRADEN wire rope anchors are capable of supporting the rated load when installed properly. For additional safety, ALWAYS maintain a minimum of five (5) wraps of wire rope on the drum.

Safety Informational callouts used in this manual include:

⚠ WARNING ⚠

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 ⚠

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

THEORY OF OPERATION

DESCRIPTION OF WINCH

The winch is made up of the following sub-assemblies and parts:

1. Hydraulic motor, brake valve and motor adapter
2. Drum and drum support assembly
3. Motor end support
4. Tie plates
5. Brake clutch assembly
6. Drive assembly with multiple disc parking brake and internal gearing

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 haul-in direction and a pilot operated, spring loaded spool valve that blocks the flow of oil out of the motor when the control valve is placed in neutral. When the control valve is placed in the pay-out 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. See figures 1, 2 and 3.

Figure 1

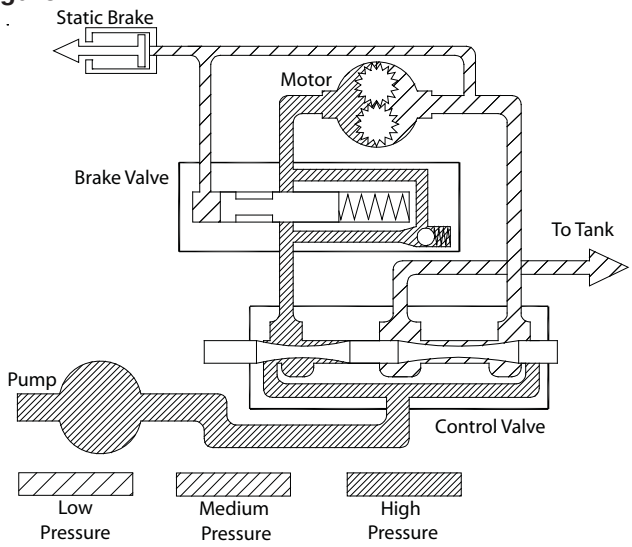


Figure 2

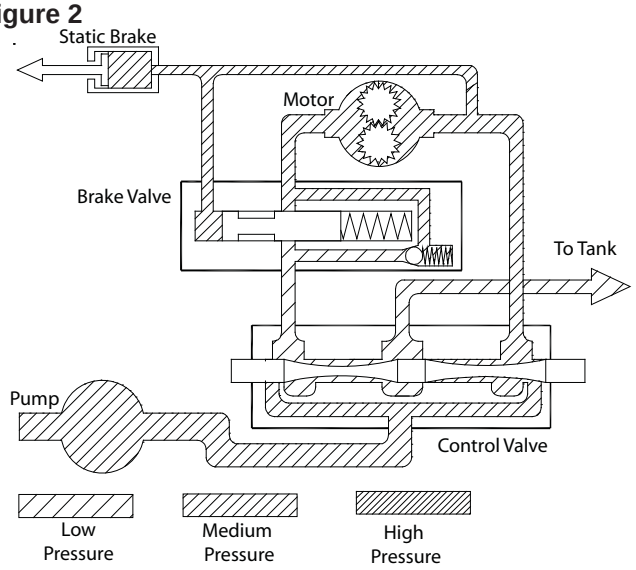
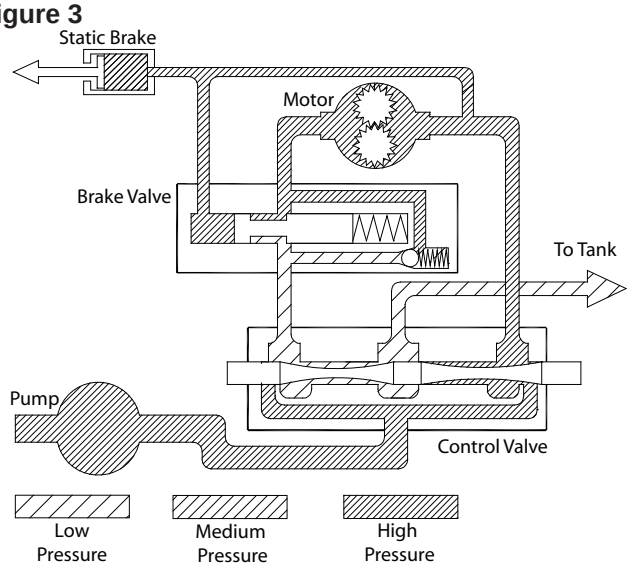


Figure 3



The static brake system has three operating components:

1. Spring applied, hydraulically released multiple friction disc brake pack
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 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 inner race of the brake clutch is a splined coupling between the motor and the primary sun gear. The outer race is splined to the friction discs in the brake pack, while steel separator plates are splined to the stationary housing. The brake clutch allows this shaft to turn freely

Figure 4

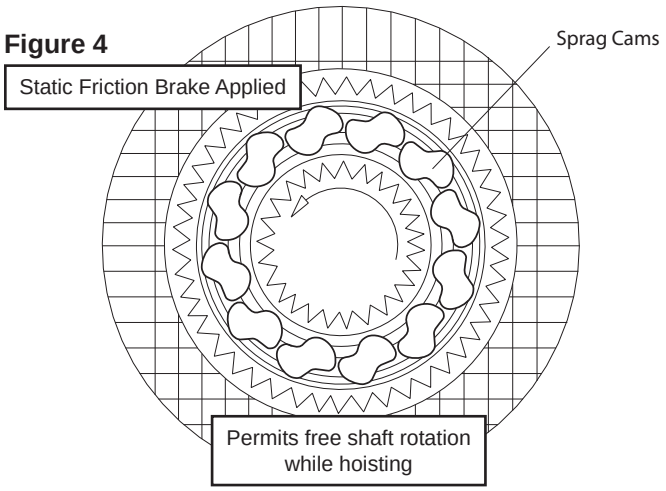
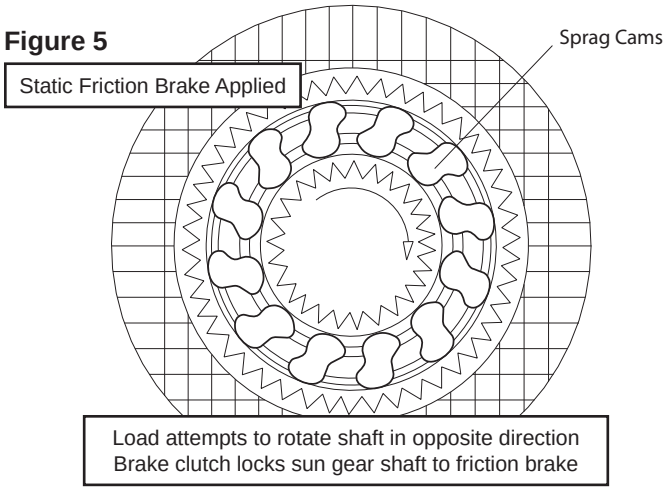


Figure 5



in the haul-in direction, and locks up to force the brake discs to turn with the shaft in the pay-out direction. See figures 4 and 5.

Spring pressure prevents the brake discs from turning until the hydraulic cylinder and piston are pressurized, releasing the brake.

OPERATION

When hauling-in cable, or hoisting a load, the motor shaft and winch gear train turn freely as the sprag cams lay over between the inner and outer races of the brake clutch. See figure 4.

The multiple disc friction brake remains fully engaged and the winch is not affected by any braking action. See figure 1.

When the operation is stopped, the load tries to turn the winch drum, gear train and primary sun gear in the reverse direction. This reversed input to the inner race of the brake clutch causes the sprag cams to instantly roll upward and lock the shaft to the fully engaged friction brake. See figure 5.

When the winch is powered in the pay-out or lowering direction, the motor cannot rotate until sufficient pilot pressure is present to release the brake and open the brake valve. See figures 2 and 3. The friction brake will completely release at a pressure lower than that required to open the brake valve. The extent to which the brake valve opens determines the amount of oil that can flow through the motor, which is directly related to the drum speed of the winch. Increasing the flow of oil to the winch motor causes the pilot pressure to rise which increases the opening in the brake valve, allowing more oil to flow through the motor and increasing the drum speed. Decreasing this oil flow causes the pilot pressure to drop, reducing the opening in the brake valve which slows the motor and winch speed.

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

When the control valve is shifted to neutral, pilot pressure drops closing the brake valve spool, stopping the motor and the load. The friction brake then engages and holds the load after the brake valve has closed.

When lowering a load very slowly for precise positioning, no oil flow actually occurs through the pilot operated spool in the brake valve. Pressure builds up to a point where the friction 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.

WINCH OPERATION

The input section of the drive assembly is bolted to the motor end support and cannot rotate. The drive housing is the output member of the gear set and is bolted to the winch drum. The motor shaft is directly coupled to the primary sun gear through the inner race of the brake clutch. The motor turns the primary sun gear which drives three successive planetary gear sets, turning the drive housing and the winch drum.

In the haul-in direction, hydraulic oil flows through a large check valve in the brake valve and turns the motor in the free rotating direction of the brake clutch, driving the gear train and winch drum. The friction brake remains fully engaged.

In the pay-out direction, oil flow through the motor is initially blocked by a spool in the brake valve. Oil pressure supplied to the motor through the control valve is piloted to the friction brake and the brake valve spool. The friction brake is released at a lower pressure than that required to shift the brake valve spool. When pressure is sufficient to shift the brake valve spool, oil is allowed to flow through the motor, rotating the winch gear train and drum.

WINCH AND WIRE ROPE INSTALLATION

1. The winch should be mounted with the centerline of the cable drum in a horizontal position. The mounting plane of the winch may be rotated in any position around this centerline providing the vent in the motor adapter is above the centerline of the cable drum. The vent should be as close to top dead center as possible.

2. When mounting the winch, use all four (4) mounting holes and grade eight (8) bolts and nuts. Evenly tighten the nuts to the torque in the "Recommended Fastener Torque" chart. Make certain the winch drum is centered behind the first sheave and the fleet angle does not exceed 1½ degrees. The winch should also be mounted perpendicular to an imaginary line from the center of the drum to the first sheave to ensure even spooling.

Refer to "Dimensional Drawing" for bolt hole size and pattern.

It is important that the winch is mounted on a surface that will not flex when the winch is in use, and cause binding of the gear train. Binding in the gear train will result in accelerated wear and heat. Also, the mounting surface should be flat with +/- 0.020 inches. If necessary, install shims under the winch mounting pads to achieve even mounting.

3. The hydraulic lines and components that operate the winch should be of sufficient size to assure minimum back pressure at the winch. The back pressure at the motor must not exceed 100 psi (690 kPa) to maintain full brake system design factor and optimum motor seal life.

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 (open center, open port).

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

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

Maximum cold weather start-up viscosity should not exceed 5,000 SUS with a pour point at least 20°F (11° C) lower than the minimum ambient temperature.

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

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

For winch gear oil, refer to "Lubricant Specifications" in the "Preventive Maintenance and Specifications" section.

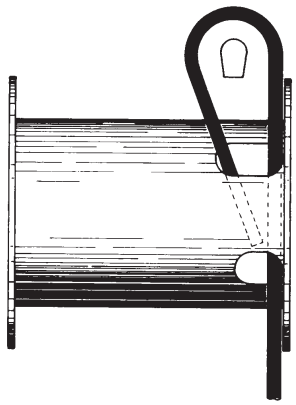
5..The hydraulic oil filter should have a 10 micron nominal rating and be full flow type.

6. The vent plug in the motor adapter must be located as close to top dead center as possible. If the winch is mounted on a pivoting surface, the vent plug must remain above the centerline of the cable drum to prevent gear oil leakage.

7. Refer to "Dimensional Drawing" for relationship between drum rotation and which port is pressurized.

WIRE ROPE INSTALLATION 03 and 04 DRUM

Take the free end of the wire rope and insert it through the small opening of the anchor pocket you are going to use. Loop the wire rope and push the free end about three-fourths of the way back through the pocket. Install the cable anchor with the small end toward the drum, then pull the slack out of the wire rope. The cable anchor will slip into the pocket and secure the wire rope to the drum. A minimum of five (5) wraps of wire rope should remain on the cable drum at all times. Refer to "General Safety Recommendations" for additional information.



01 and 02 DRUM – ANCHOR

Remove both sheet metal covers from the end bracket of the winch. Pull the end of the cable through the opening in the drum flange and out through the end bracket as shown in figure 1. Form the cable around part 1 of the wedge as shown in figure 2, and pull the assembly into the anchor pocket (part 2 and the nut are not attached to part 1 at this time). Access the threaded rod attached to part 1 through the other opening in the end bracket and install part 2 and the nut. On large diameter cable, it may be necessary to hammer on the cable looped around part 1 in order to force it far enough into the anchor pocket to attach part 2. It is important for the "dead" end of the cable to extend beyond the end of part 2, as shown in figure 2, but not far enough to come in contact with the end bracket when the winch is operating. A load should be applied to the "live" end of the cable to properly seat the anchor. After the initial load is applied, check the tightness of the nut holding part 2 in place and tighten it if required. A minimum of five (5) wraps of wire rope should remain on the cable drum at all times. Refer to "General Safety Recommendations" for additional information.

Figure 1

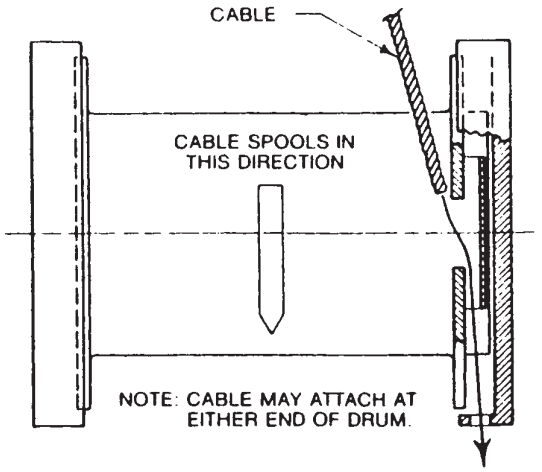
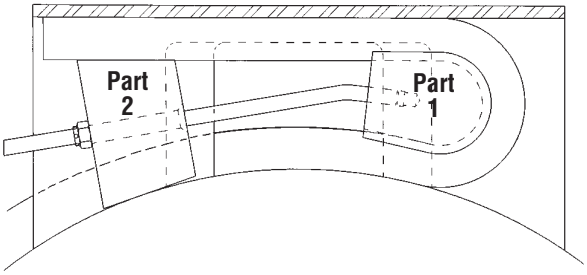
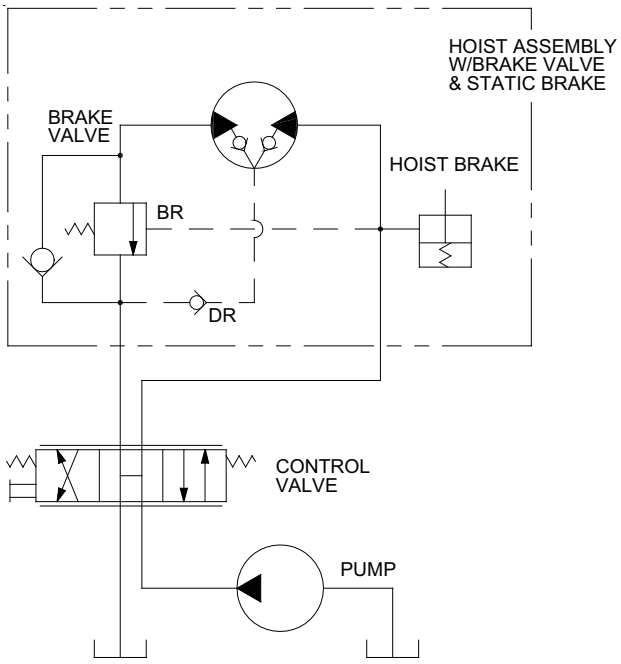


Figure 2

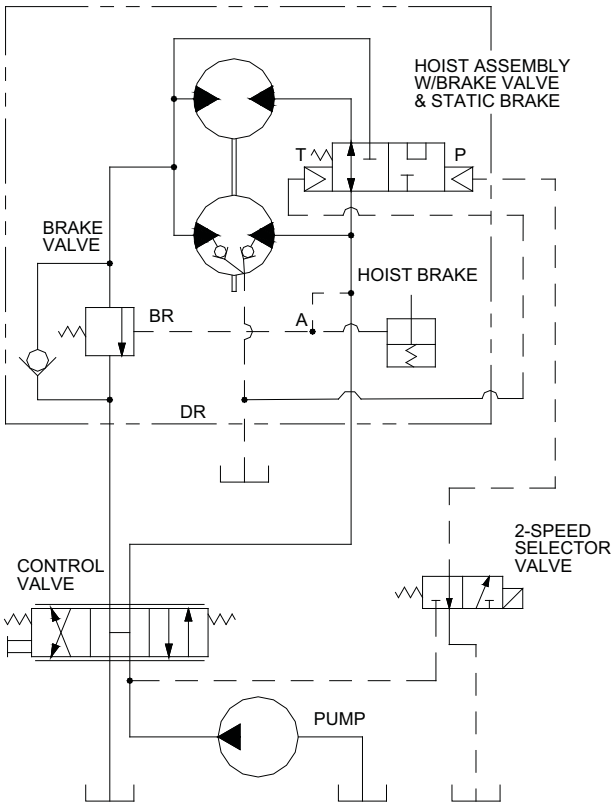


HYDRAULIC CIRCUITS

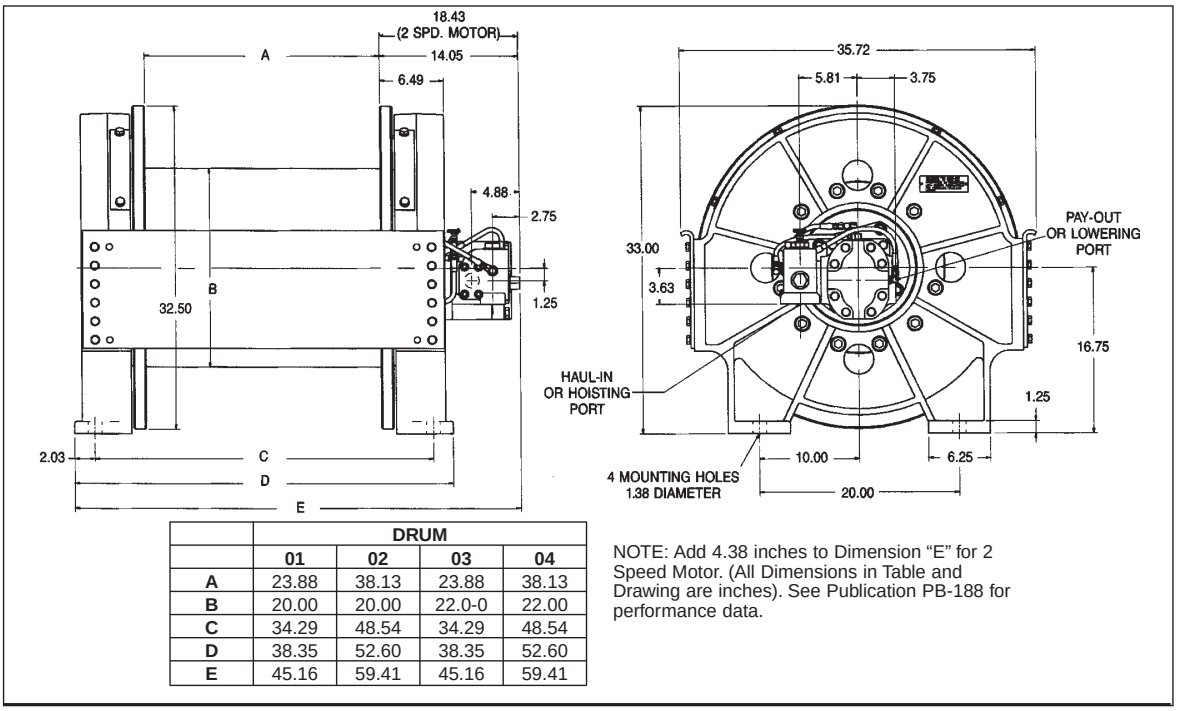
SINGLE SPEED CIRCUIT



2-SPEED SPEED CIRCUIT



DIMENSIONAL



	DRUM			
	01	02	03	04
A	23.88	38.13	23.88	38.13
B	20.00	20.00	22.0-0	22.00
C	34.29	48.54	34.29	48.54
D	38.35	52.60	38.35	52.60
E	45.16	59.41	45.16	59.41

NOTE: Add 4.38 inches to Dimension "E" for 2 Speed Motor. (All Dimensions in Table and Drawing are inches). See Publication PB-188 for performance data.

PREVENTIVE MAINTENANCE

A regular program of preventive maintenance for your planetary winch is strongly recommended to minimize the need for emergency servicing and promote safe, reliable winch operation.

Field experience, supported by engineering tests, indicates the three (3) service procedures listed below are the MOST critical to safe, reliable winch operation and must be observed.

- **Regular Gear Oil Changes** – every 1000 hours or six (6) months
- **Use of Proper Gear Oil** – recommended type for prevailing ambient temperature
- **Annual Disassembly and Inspection of All Wear Items** – in compliance with American National Standards Institute (ANSI) specification B30.5c 1987 and American Petroleum Institute (API) recommended practice RP 2D section 3.

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

1. Oil Level

The gear oil level should be checked every 500 operating hours or three (3) months, whichever occurs first. Oil level should be even with the centerline of the winch drum. Rotate the winch drum until the level plug can be seen in one of the two access holes on either side of the drum support and remove the plug. The oil should be level with the bottom of this opening. If additional oil in needed, refer to "Recommended Planetary Gear Oil".

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. 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.

Rotate the drum until the –8 drain plug is aligned with the lowest opening in the drum end support plate. Install a short piece of 1 inch pipe through the end plate. Reach through the pipe with a 5/16 hex Allen wrench and remove the –8 plug to drain the oil. Install the –8 plug and remove the 1 inch pipe when all the oil has been drained from the drum. Gear oil circulates between the drive and the drum through holes in the primary ring gear, you must also remove the plug in the rotating part of the winch drive to drain any trapped oil in the drive. This is done by aligning the plug with the opening in the support bracket directly below the winch motor.

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. Make certain that the gear oil viscosity used in your winch is correct for your prevailing ambient temperature. Failure to use

the proper type and viscosity of planetary gear oil may contribute to brake slippage which could result in property damage, severe personal injury or death. Refer to “Recommended Planetary Gear Oil” for additional information.

3. Vent Plug

The vent plug is located directly above the winch motor near the brake release port. 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 1000 operating hours or six (6) months, whichever occurs first.

7. Warm-up Procedures

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 and obtaining long gear train life.

⚠ 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.

For simplicity, we have 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.

CH330/CH400 planetary winches are factory filled with Texaco Meropa 150 or equivalent.

9. Inspection

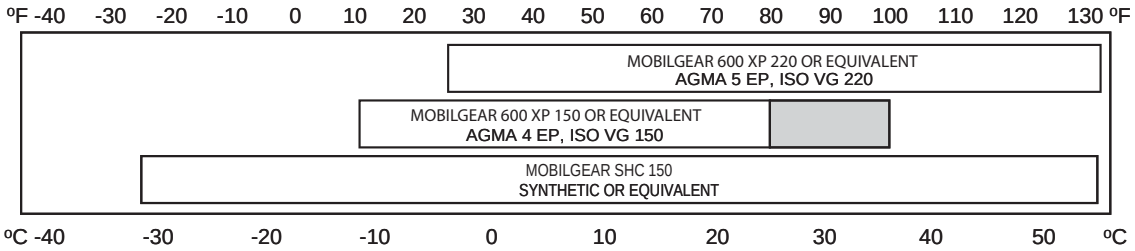
In compliance with ANSI specification number B30.5c1987 and API Recommended Practice RP 2D section 3, we recommend that the winch be disassembled for a thorough inspection of all wear items every 2,000 hours of operation or twelve (12) months, whichever occurs first.

⚠ 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 contain large amounts of EP (extreme pressure) and anti-friction additives which may contribute to brake slippage and damage to brake friction discs or seals. Oil viscosity with regard to ambient temperature is also critical to reliable brake operation. Our tests indicate that excessively heavy or thick gear oil may contribute to intermittent brake slippage. Make certain that the gear oil viscosity used in your winch is correct for your prevailing ambient temperature.

RECOMMENDED PLANETARY GEAR OIL

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.*

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

Mobil	Shell	Chevron	Texaco
Mobilgear 600 XP 150	Omala 150	Gear Compounds EP 150	Meropa 150
Mobilgear 600 XP 220	Omala 220	Gear Compounds EP 220	Meropa 220

WEIGHTS, OIL CAPACITIES AND SPECIAL TOOLS

SPECIAL TOOLS

2 each 5/16-18NC eye bolt
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.*

a.) 1 inch diameter bar approximately 36 inches long and various sized small steel blocks (key stock).
b.) 3 each 7/8-9NC x 6 inch long capscrews
c.) 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.

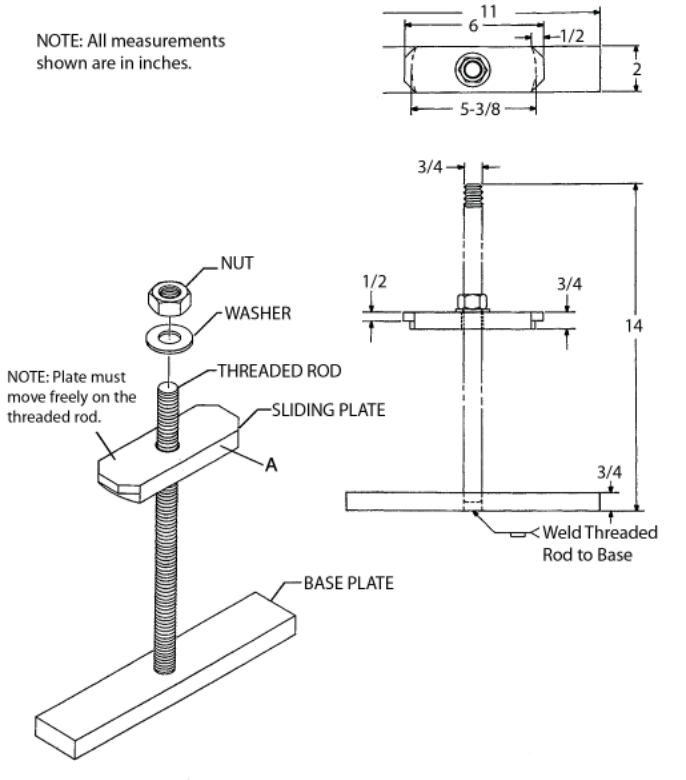
NOTE: *If a press is available (with at least 5 inches of travel), only part (A) shown below is required (center hole not required). If a press is not available, all parts shown and listed below are required.*

a.) 1 each ¾-16NF threaded rod, 4 inches long
b.) 1 each ¾-16NF nuts
c.) 1 each ¾ inch plain washer

Ferry capscrew sockets ¾" drive 12 point
5/8" Proto P/N – J07510T
Snap-On P/N – IMD202A

¾" Proto P/N J07512T
Snap-On P/N IMD242A

DRUM	APPROXIMATE WEIGHT (LBS/KG)	APPROXIMATE OIL CAPACITY (QT
01	2700/1225	40/38
02	3370/1530	65/61.5
21	3800/1725	90/85



TROUBLESHOOTING

⚠ WARNING ⚠

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

TROUBLE	PROBABLE CAUSE	REMEDY
A The winch will not lower the load or not lower the load smoothly.	1. The friction brake may not be releasing as a result of a defective brake cylinder seal. NOTE: If the brake cylinder seal is defective you will usually find oil leaking from the winch vent plug. 2. Friction brake will not release as a result of damaged brake discs.	Check brake cylinder seal as follows: A. Disconnect the swivel tee from the brake release port. Connect a hand pump with accurate 0-2000 psi (0-13,000 kPa) gauge and shut-off valve to the –4 J.I.C. fitting in the brake release port. B. Apply 1000 psi (6,900 kPa) to the brake. Close shut-off valve and let stand for five (5) minutes. C. If there is any loss of pressure in five (5) minutes, the brake cylinder should be disassembled for inspection of the sealing surfaces and replacement of the seals. Refer to “Motor Support-Brake Cylinder Service”. Disassemble brake to inspect brake discs.
B Oil leaks from vent plug.	1. Same as A1. 2. Motor seal may be defective as a result of high system back pressure or contaminated oil.	Same as A1. System back pressure must not exceed 150 psi (1,030 kPa) for gear motor. 30 psi for piston motor. Inspect hydraulic system for a restriction in the return line from the control valve to the reservoir. Be sure control valve and plumbing is properly sized to winch motor. Oil analysis may indicate contamination has worn motor shaft and seal. Thoroughly flush entire hydraulic system and install new filters and oil. Install new motor seal.

TROUBLE	PROBABLE CAUSE	REMEDY
C The brake will not hold a load with the control lever in neutral.	1. Excessive system back pressure acting on the brake release port.	Same as remedy for Trouble B2.
	2. Friction brake will not hold due to worn or damaged brake discs.	Same as remedy for Trouble A2.
	3. Brake clutch is slipping.	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”. Brake clutch may be damaged or worn. Disassemble and inspect brake clutch as described in “Brake Clutch Service”.
D The winch will not hoist the rated load.	1. The winch may be mounted on an uneven or flexible surface which causes distortion of the winch base and binding of the gear train. Binding in the gear train will absorb horsepower needed to hoist the rated load and cause heat.	Reinforce mounting surface. If necessary, use shim stock to level winch. Refer to “Winch Installation”. First loosen, then evenly retighten all winch mounting bolts to recommended torque.
	2. System relief valve may be set too low. Relief valve needs adjustment or repair.	Check relief pressure as follows: A. Install an accurate 0-4000 psi (28,000 kPa) gauge into the inlet port of the brake valve. B. Apply a stall pull load on the winch while monitoring pressure. C. Compare gauge reading to winch specifications. Adjust relief valve as required. NOTE: If pressure does not increase in proportion to adjustment, relief valve may be contaminated or worn out. In either case, the relief valve may require disassembly or replacement.
	3. Be certain hydraulic system temperature is not more than 180°F (82° C). Excessive hydraulic oil temperatures increase motor internal leakage and reduce motor performance.	Same as remedies for Trouble D1 & D2. Same as remedies for Trouble E2.
	4. Winch line pull rating is based on 1st layer of wire rope.	Refer to winch performance charts for additional information.
	5. Rigging and sheaves not operating efficiently.	Perform rigging service as recommended by crane manufacturer.

TROUBLE	PROBABLE CAUSE	REMEDY
E The winch runs hot.	1. Same as D1.	Same as remedies for Trouble D1.
	2. Be certain that the hydraulic system temperature is not more than 180°F (82°C). Excessive hydraulic oil temperatures may be caused by:	
	A. Plugged heat exchanger.	Thoroughly clean exterior and flush interior.
	B. Too low or too high oil level in hydraulic reservoir.	Fill/drain to proper level.
	C. Same as D2.	Same as remedies for Trouble D2.
	D. Hydraulic pump not operating efficiently.	Prime mover low on horsepower or R.P.M. Tune/adjust prime mover.
		Check suction line for damage.
		If pump is belt driven, belts are slipping. Replace/tighten belts.
		Pump worn. Replace pump.
	3. Excessively worn or damaged internal winch parts.	Disassemble winch to inspect/replace worn parts.
F Winch “chatters” while raising rated load.	1. Same as D2.	Same as remedies for Trouble D2.
	2. Hydraulic oil flow to motor may be too low.	Same as remedies for Trouble E2.
	3. Controls being operated too quickly.	Conduct operator training as required.
G The wire rope does not spool smoothly on the drum.	1. The winch may be mounted too close to the main sheave, causing the fleet angle to be more than 1½ degrees.	Check mounting distance and fleet angle. Reposition winch as required.
	2. The winch may not be mounted perpendicular to an imaginary line between the center of the cable drum and the first sheave.	Refer to “Winch Installation”.
	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.	Consult wire rope manufacturer for recommendation of wire rope that best suits your application.
	4. The winch may have been overloaded, causing permanent set in the wire rope.	Replace wire rope and conduct operator/rigger training as required.

SERVICE PRECAUTIONS

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

Work in a clean, dust free area as cleanliness is of utmost importance when servicing hydraulic equipment.

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

Use only genuine BRADEN replacement parts for optimum results. Never re-use expendable parts such as O-rings and oil seals.

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

Lubricate all O-rings and oil seals with gear oil prior to installation.
Lubricate all bearings with an oil soluble grease prior to assembly.

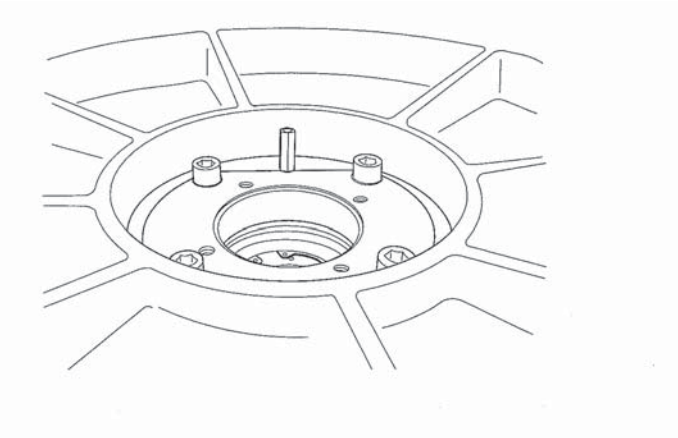
Use a sealing compound on the outside surface of oil seals and a light coat of thread sealing compound on pipe threads. Avoid getting sealing compound inside parts or passages which conduct oil.

Before beginning to disassemble the winch or drive gearbox, remove the wire rope, drain the oil and clean the outside surfaces to avoid contaminating gears and bearings.

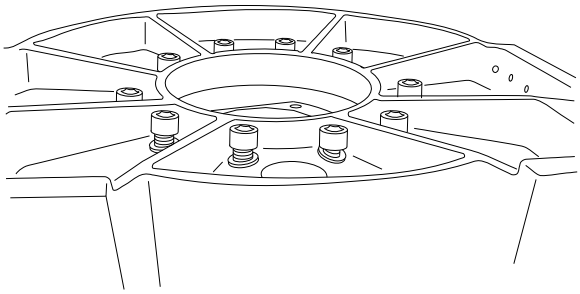
Item numbers shown in service procedures are referenced to the exploded view drawing in the center of this manual.

WINCH DISASSEMBLY

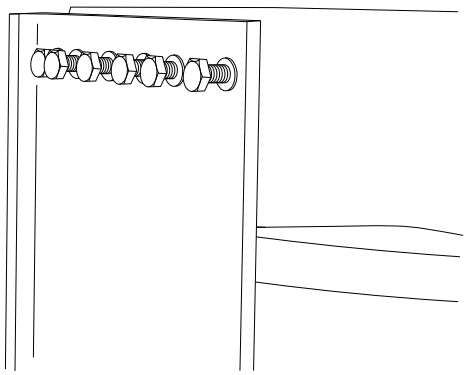
1. Stand the winch of the end opposite the motor. Remove the hydraulic hose that connects the brake valve and motor to the brake release port. Remove the four (4) capscrews securing the motor to the winch and lift off the motor/brake valve assembly. Remove and discard the O-ring installed on the outside of the motor pilot.



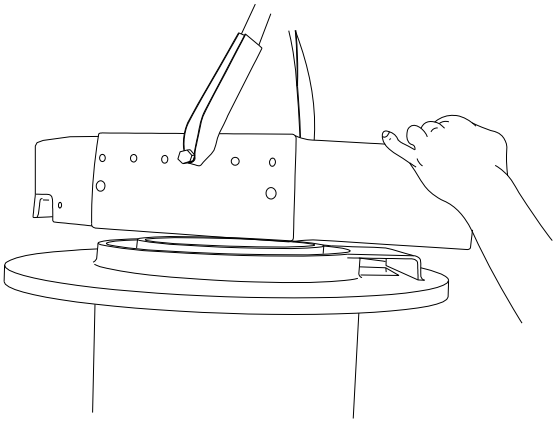
2. Remove the four (4) capscrews from the motor adapter and remove the motor adapter (item 27) from the drive gearbox. Remove and discard the O-ring (item 26) from the motor adapter.



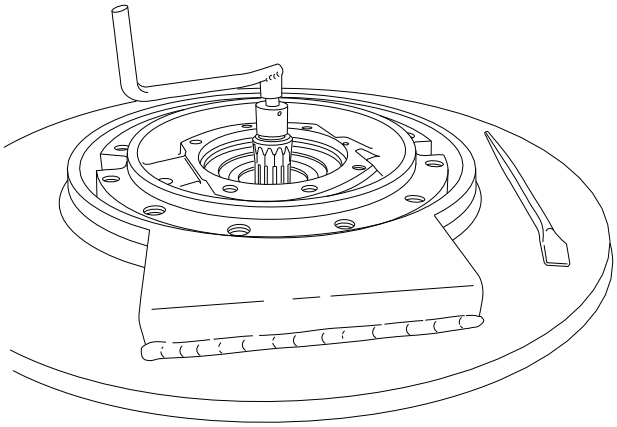
3. Remove the ten (10) capscrews and lockwashers securing the end bracket (item 25) to the gearbox.



4. Remove the twenty four (24) capscrews and lockwashers securing the tie plates (item 1) to both end brackets and remove the tie plates. The tie plates have two dowel pins in each end and may have to be lightly tapped or pried from the end brackets. Install four large c-clamps around the drum support end bracket (item 2) and the drum flange. This will prevent the end bracket and drum from separating when the motor end bracket and winch drive are removed.

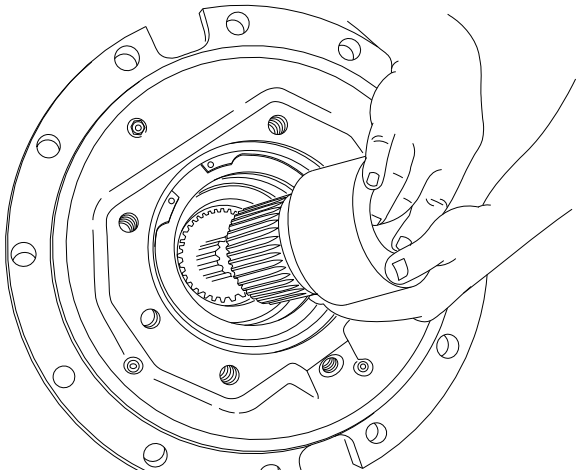


5. Lift the motor end bracket (item 25) from the drum/drive assembly.



6. There are two large notches in the end of the drive gearbox. These must be rotated to gain access to the capscrews and lockwashers (items 4 & 5) that secure the gearbox to the winch drum. This is done by rotating the motor coupling while keeping the drum from turning. Continue this procedure and remove all capscrews and lockwashers (items 4 & 5).

   NOTE: To obtain relative movement between the two sections of the gearbox, the input shaft must be rotated in the same direction as the motor turns to haul-in cable. Rotating the shaft in the opposite direction results in the entire gearbox and drum turning as a single unit.

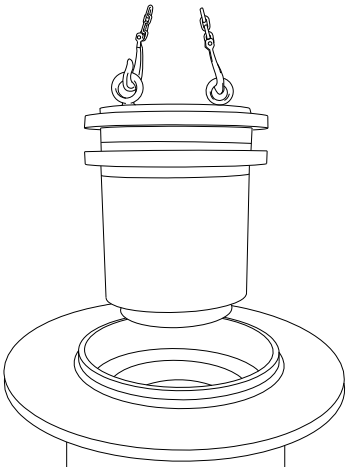


7. The brake clutch assembly and motor coupling should now be removed from the gearbox.

   NOTE: The sun gear will remain in the gearbox and cannot be removed from this end.

⚠ WARNING ⚠

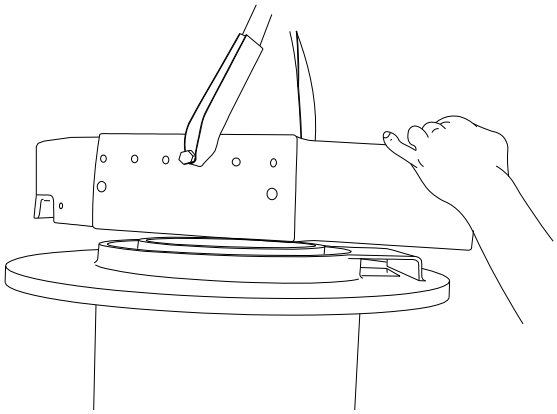
DO NOT attempt to remove the large retaining ring at this time. It is holding the static brake spring in compression. Removing this retaining ring at this time could result in property damage, personal injury, or death.



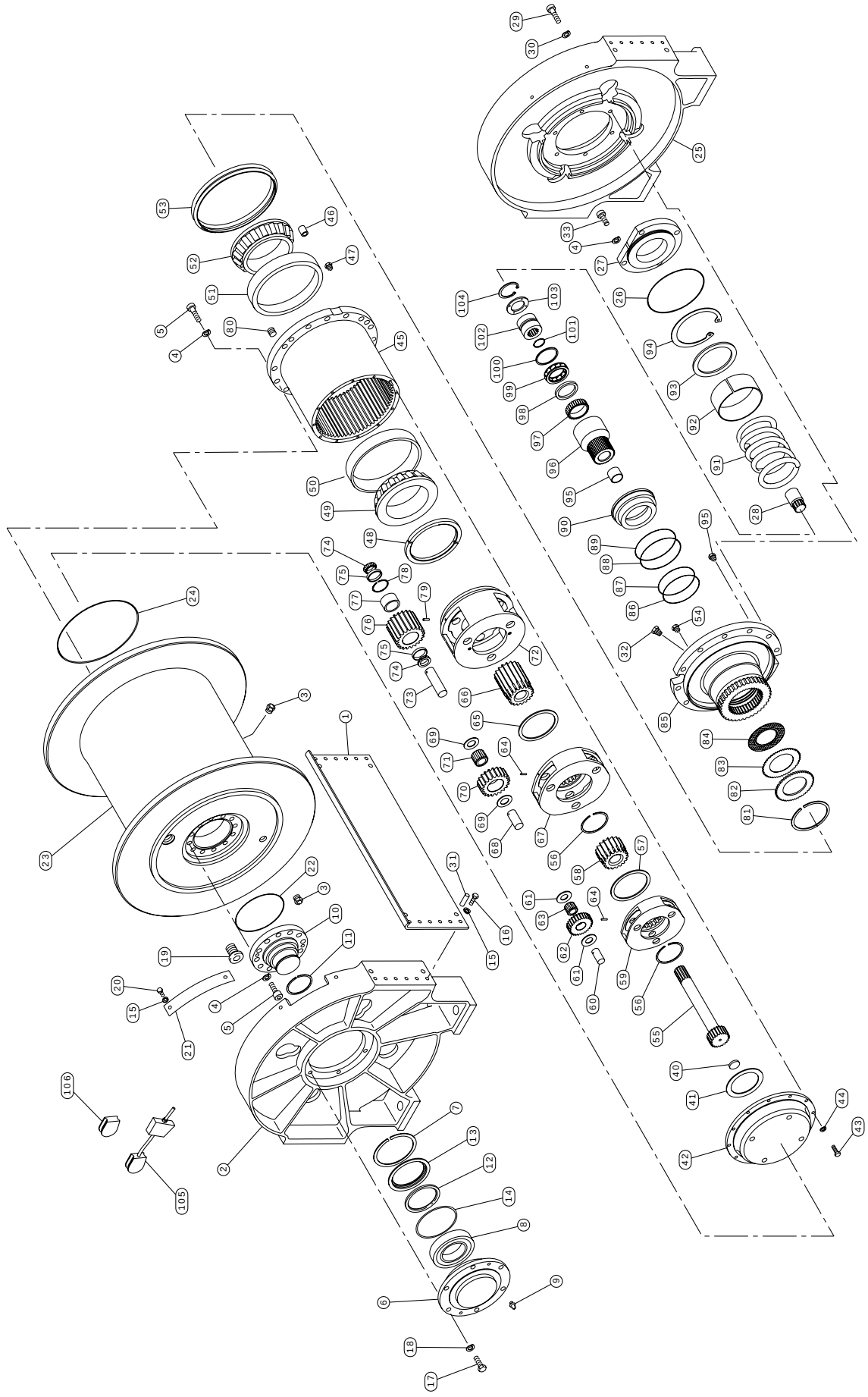
8. Lift the winch drive gearbox out of the drum using two (2) 7/8 NC eye bolts spaced 180° apart as lifting lugs. Refer to Winch Drive/Gearbox Service section for further disassembly of winch drive.

DRUM SUPPORT END BRACKET SERVICE

If the winch disassembly procedure has been followed to this point, remove the c-clamps installed in step 4. If only this end of the winch is being serviced, support the winch on the motor end bracket and remove the twelve (12) capscrews and lockwashers securing the end of both tie plates (item 1), to the drum support end bracket (item 2). Loosen the twelve (12) capscrews on the other end of both tie plates just enough to allow the tie plates to be pried free of the dowel pins in the drum support end bracket.



1. Lift the support end bracket from the drum. NOTE: If the winch disassembly procedure was followed and the drum is on top of the end bracket, lift the drum from the support end bracket.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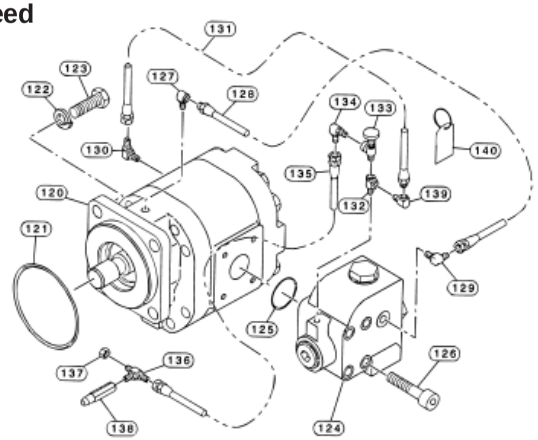
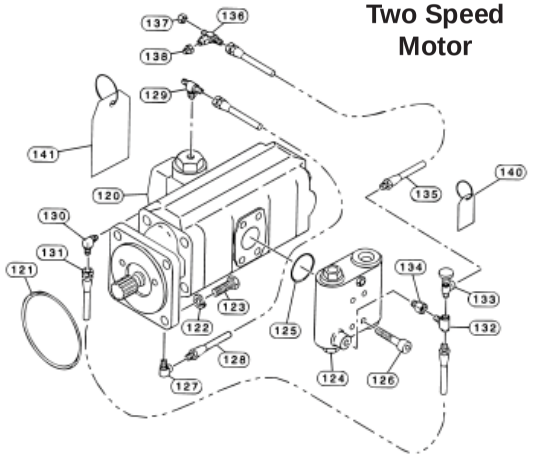
Single Speed Motor



Two Speed Motor

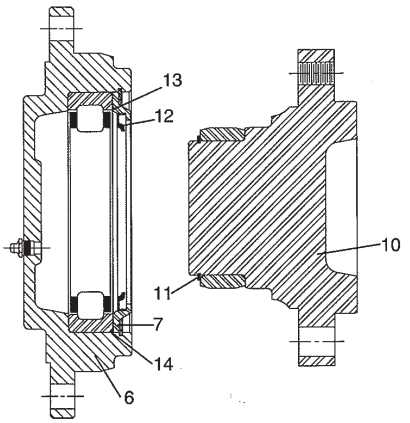


ITEM NUMBER	DESCRIPTION
1	Tie Plate
2	Support End Plate
3	O-Ring Flush Plug
4	Lockwasher
5	Capscrew
6	Outer Bearing Hub
7	Internal Retaining Ring
8	Roller Bearing
9	Grease Fitting
10	Inner Bearing Hub
11	External Retaining Ring
12	Seal
13	Seal Carrier
14	O-Ring
15	Lockwasher
16	Capscrew
17	Capscrew
18	Lockwasher
19	Sight Gauge
20	Capscrew
21	Cover Plate
22	O-Ring
23	Cable Drum
24	O-Ring
25	Motor End Plate
26	O-Ring
27	Motor Adapter
28	Motor Coupling
29	Capscrew
30	Lockwasher

ITEM NUMBER	DESCRIPTION
31	Dowel Pin
32	Pipe Plug
33	Capscrew
40	Thrust Washer
41	Thrust Washer
42	Primary Ring Gear/End Cover
43	Capscrew
44	Lockwasher
45	Ring Gear
46	Drain Tube
47	Plug
48	Split Ring
49	Bearing Cone
50	Bearing Cup
51	Bearing Cup
52	Bearing Cone
53	Metal Face Seal
54	Vent Plug
55	Primary Sun Gear
56	External Retaining Ring
57	Thrust Washer
58	Second Stage Sun Gear
59	Primary Planet Carrier
60	Planet Pin
61	Thrust Washer
62	Primary Planet Gear
63	Loose Rollers
64	Rollpin
65	Thrust Washer
66	Output Sun Gear

ITEM NUMBER	DESCRIPTION
67	Second Stage Planet Carrier
68	Planet Pin
69	Thrust Washer
70	Second Stage Planet Gear
71	Loose Rollers
72	Output Planet Carrier
73	Planet Pin
74	Bearing Cone
75	Bearing Cup
76	Output Planet Gear
77	Bearing Spacer
78	Internal Retaining Ring
79	Rollpin
80	Plug
81	Internal Retaining Ring
82	Brake Spacer/Support Plate
83	Steel Brake Disk
84	Friction Brake Disk
85	Motor Support/Brake Cylinder
86	Back-Up Ring
87	O-Ring
88	O-Ring
89	Back-Up Ring
90	Brake Piston
91	Brake Spring
92	Brake Piston Stop
93	Spring Stop
94	Internal Retaining Ring
95	Bushing
96	Sprag Clutch Outer Race

ITEM NUMBER	DESCRIPTION
97	Roller Bearing
98	Spacer
99	Sprag Clutch Assembly
100	Spacer
101	Internal Retaining Ring
102	Sprag Clutch Inner Race
103	Spacer
104	Internal Retaining Ring
105	Cable Wedge (01 & 02 Drum)
106	Cable Wedge (03 & 04 Drum)
120	Hydraulic Motor
121	O-Ring
122	Lockwasher
123	Capscrew
124	Brake Valve
125	O-Ring
126	Capscrew
127	Reducer Elbow
128	Hydraulic Hose
129	Elbow Fitting
130	Elbow Fitting
131	Hydraulic Hose
132	Tee Fitting
133	Needle Valve
134	Elbow Fitting
135	Hydraulic Hose
136	Male Branch Tee Fitting
137	Cap Nut
138	Nipple
139	Elbow Fitting
140	Warning Tag



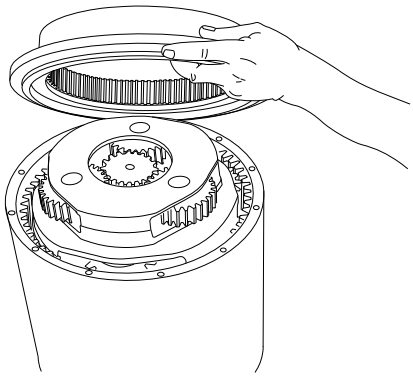
2. The bearing carrier/end cap (item 6) is in the end bracket, and the bearing support (item 10) is in the drum. Remove the retaining ring (item 7) and the seal carrier and seal (items 13 & 12). Remove and discard O-ring (item 14). Remove the seal from the seal carrier and discard.

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.

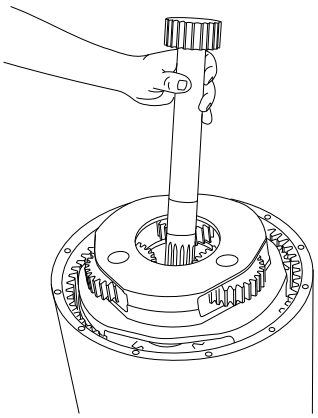
Apply a non-hardening sealant to the outside diameter of a new seal. Install the seal into the seal carrier as shown above. Install a new O-ring against the outer race of the bearing and install the seal carrier into the bearing carrier/end cap. Install a new retaining ring into the groove in the end cap. Liberally pack the bearing and end cap with grease. The end bracket can now be placed on the drum, or the drum placed on the end bracket, depending on your method of assembly.

WINCH DRIVE/GEARBOX SERVICE

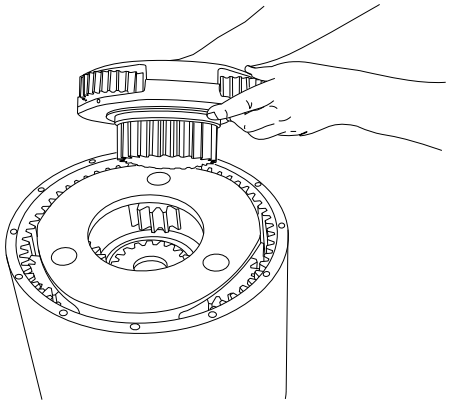
DISASSEMBLY



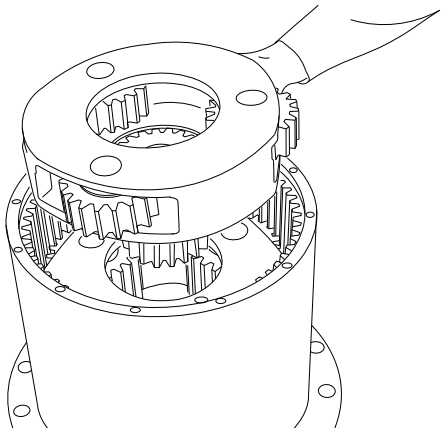
1. Stand the drive on the input end and remove the twelve (12) capscrews and lockwashers (items 43 & 44) securing the end cover/primary ring gear to the drive assembly and remove the cover from the drive.



2. Remove the primary sun gear (item 55).

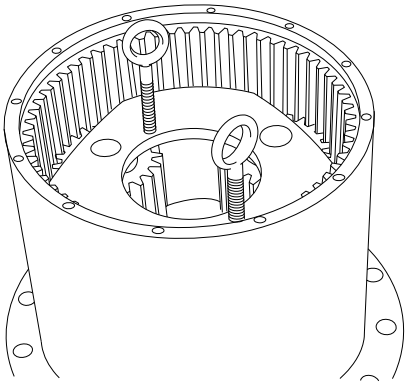


3. Remove the primary planet assembly. The second stage sun gear (item 58) will come out with the planet assembly. If the thrust washer (item 57) between the primary and second stage planet assemblies stayed in the gearbox, remove it and set it aside with the primary planet assembly.



4. Remove the second stage planet assembly. The output sun gear (item 66) will come out with the planet assembly. If the thrust washer (item 65) between the second

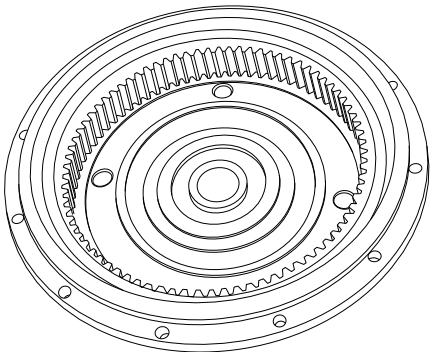
stage and output planet assemblies stayed in the gearbox, remove it and set it aside with the second stage planet assembly.



5. The output planet carrier has two (2) tapped holes (1/2 – 13) which can be used to lift the assembly out of the ring gear. Install 2 eye bolts into these holes and use them to lift the output planet assembly out of the ring gear. Due to the weight of the assembly, it may be advisable to use a small hoist for this operation.
6. Using a long bar or blunt chisel, separate the ends of the split ring (item 48) and remove both halves of the split ring from the motor support. Turn the assembly over so the motor support is facing up. Since the bearing cone (item 49) will fall the length of the ring gear in the next step, the assembly should be setting on a wooden board or put several rags in the bottom of the ring gear to prevent damage to the bearing.
7. Install three (3) 7/8 – 9x6 inch long capscrews equally spaced around the motor support (item 85) until they contact the ring gear (item 45). Alternately tighten each capscrew ½ to 1 turn at a time to lift the motor support out of the ring gear. When the two pieces have been separated, you will hear the bearing cone (item 49) drop to the bottom of the ring gear.
8. Install two (2) ¾ - 10 eye bolts in 2 of the motor mounting holes and use them to lift the motor support/brake assembly out of the ring gear.

SUB-ASSEMBLY SERVICE

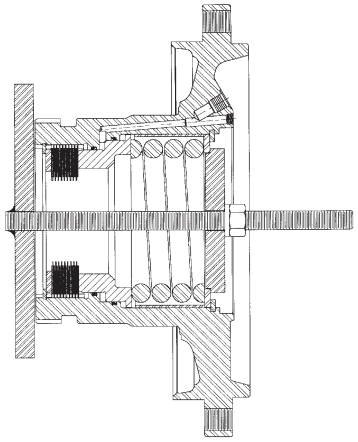
PRIMARY RING GEAR/END COVER



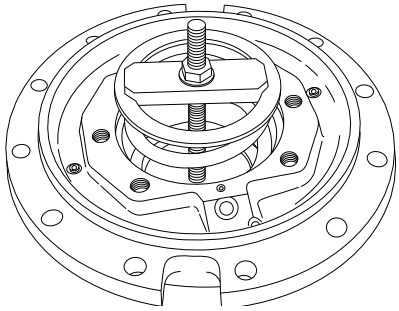
1. Thoroughly clean and inspect the cover/ring gear. Check the ring gear teeth for nicks, spalling or excessive wear. Replace if wear is greater than 0.015 in. (0.4 mm) when compared to unworn area of teeth. The only serviceable parts in the ring gear/cover are the two thrust washers (items 40 & 41). Inspect them for signs of abnormal wear or damage and replace as required. Inspect the inside of the cover for signs of contact with the primary sun gear and/or primary planet carrier. If signs of contact are seen, replace both thrust washers.

BRAKE ASSEMBLY

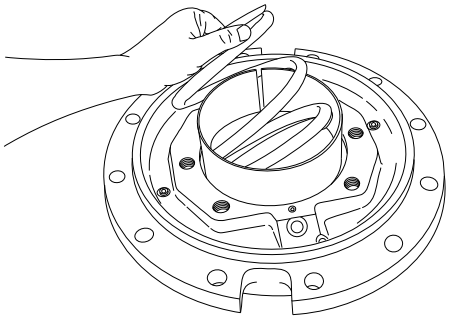
DISASSEMBLY



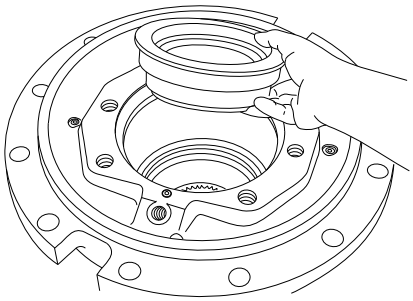
1. Install the spring compressor tool as show. If a hydraulic press is available, only part “A” of the tool is required. Tighten the nut above part “A” or apply hydraulic pressure to slightly compress the spring and relieve load on the retaining ring (item 94). Carefully remove the retaining ring.



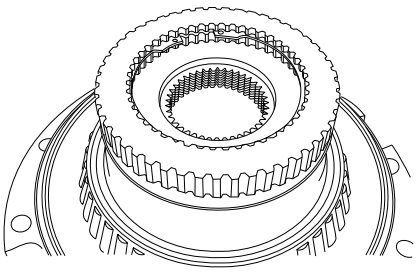
2. Slowly and carefully unscrew the nut above part “A” until spring pressure is completely released (spring travel is approximately 4 inches [10 cm]). Remove the compressor tool.



3. Remove the spring stop (item 93), spring (item 91) and piston stop (item 92) from the brake cylinder.



4. Remove the brake piston (item 90). Remove and discard both sets of piston O-rings and backup rings (items 86, 87, 88 & 89).



5. Turn the assembly over to access the brake plates. Remove the retaining ring (item 81). Remove the spacer plate (item 82), steel separator discs (item 83) and friction discs (item 84).

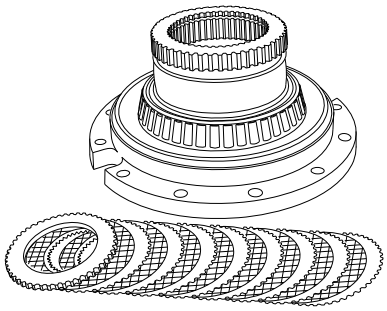
Thoroughly clean and inspect all parts, paying close attention to the sealing surfaces of the brake piston. Place each friction disc on a flat surface and check for distortion with a straight edge. Friction material should appear even across the entire surface and the groove pattern should be visible. 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.

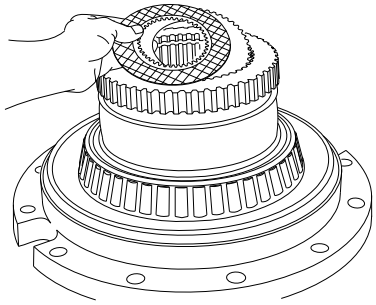
Inspect both sets of large tapered roller bearings (items 49, 50, 51 & 52) for signs of damage or excessive wear. The bearing rollers should not exhibit any irregularities. If the rollers show any sign of spalling, corrosion, discoloration, material displacement or abnormal wear, the bearing should be 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.

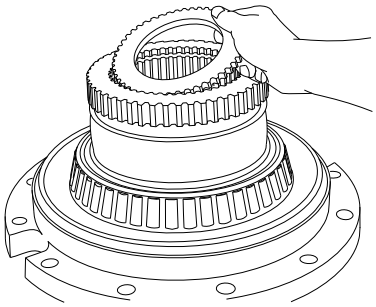
ASSEMBLY



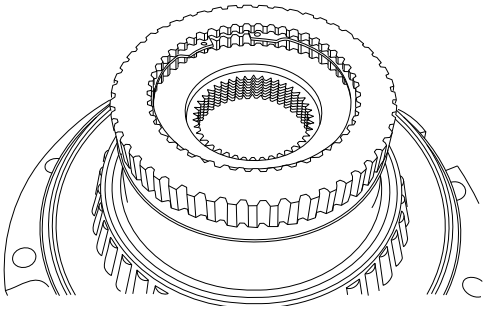
1. Set the motor support/brake cylinder on a bench with the motor end down.



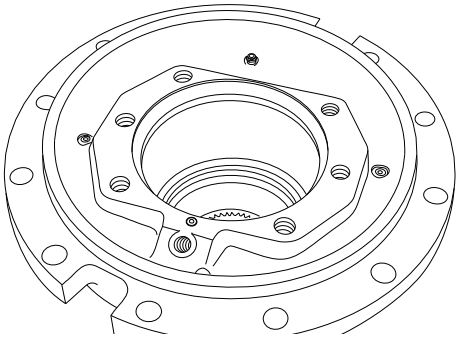
2. Starting with a steel disc, alternately install a steel then a friction disc until nine (9) of each type disc have been installed (ending with a friction disc). It is advisable to lightly lubricate the brake discs with oil that will be used in the winch prior to assembly.

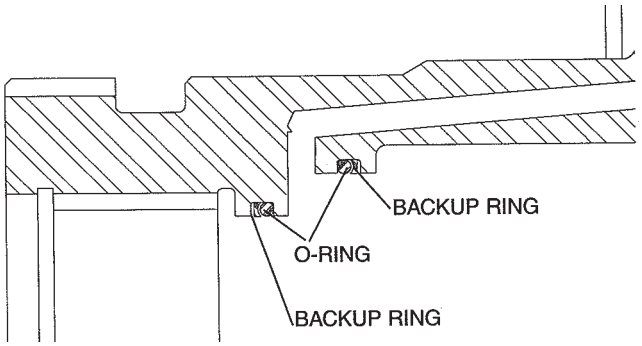


3. Install the spacer plate (item 82) on top of the last friction disc.

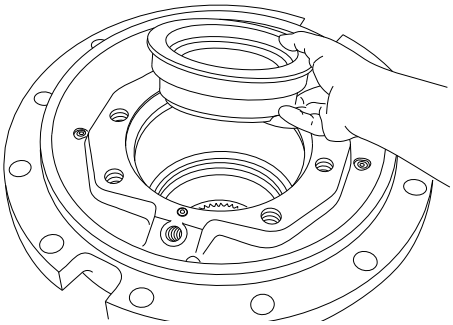


4. Install the retaining ring (item 81). Turn the assembly over with the motor end up and be sure all brake plates are stacked squarely against the spacer plate.

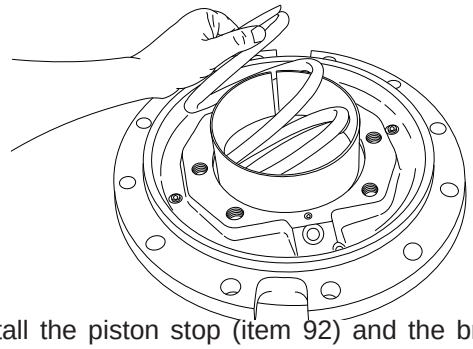




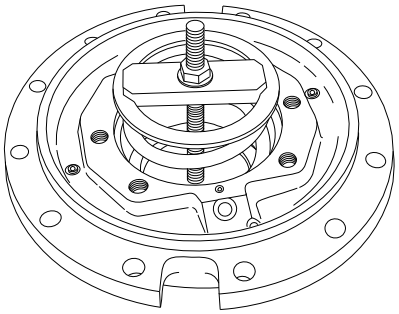
5. Install new O-rings and backup rings (items 86 & 87, 88 & 89) into the brake cylinder as shown. It is VERY important to position the O-rings and backup rings as shown above to prevent brake cylinder leakage.



6. Lightly lubricate the sealing surfaces of the brake piston (item 90) and install it into the brake cylinder until it touches the brake discs.



7. Install the piston stop (item 92) and the brake spring (item 91).



8. Set the spring stop (item 93) 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 motor support. Install the retaining ring (item 94). **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 sprag clutch assembly. Rotate the clutch back and forth to align the splines in all brake discs. When the sprag clutch has engaged all the discs, release the pressure on the brake cylinder and remove the sprag clutch.

Sprag Clutch Assembly

Before disassembling the sprag clutch, make note of the freewheeling direction of the inner brake race (item 102). Hold the outer race (item 96) 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 (item 104). All other internal parts can now be removed, including the sprag assembly (item 99) and the roller bearing (item 97).
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.

⚠ 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.

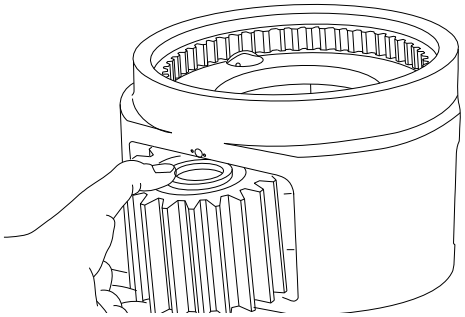
3. Apply a light coat of gear box lubricant to all components as they are assembled. Install the roller bearing (item 97) into the outer race (item 96). Install spacer (item 98) on top of roller bearing. Install the sprag clutch assembly (item 99). **NOTE:** The sprag assembly consists of three parts; 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 pressing it into the outer race.

Before installing the inner race (item 102), be sure the internal retaining ring (item 101) 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 (items 100 & 103), and retaining ring (item 104).

PLANET CARRIER SERVICE

OUTPUT PLANET CARRIER

1. The preferred method of removing the planet pin (item 73), is to first remove the roll pin (item 79). 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 (item 72). 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 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.

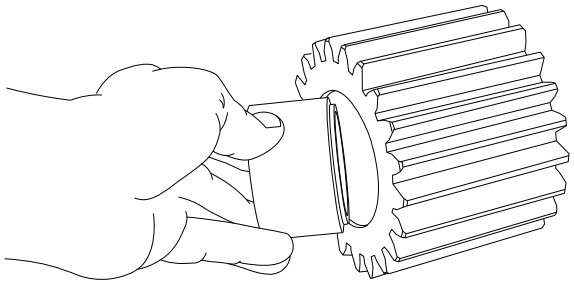
3. If the bearings need to be replaced, remove the bearing cups, spacer and internal retaining ring from the bore of the planet gear.

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.

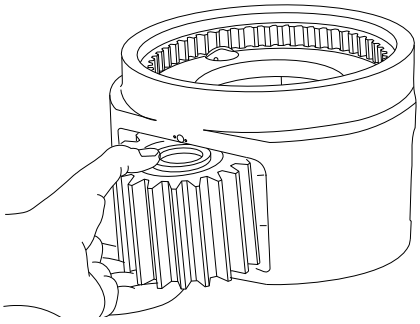
5. Install a retaining ring (item 78) in the bore of a planet gear. Be sure it is completely seated in the groove.



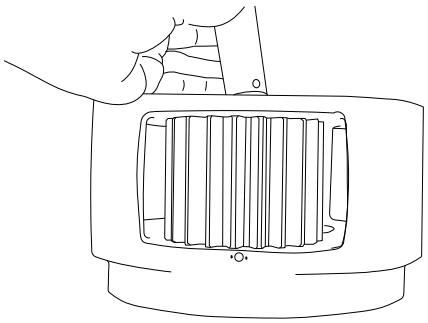
6. Install a bearing spacer (item 77) into the bore of the planet gear. Be sure the step on the spacer is toward the retaining ring.

7. Install a bearing cup (item 75) into each end of the gear. The cups should firmly contact the spacer.

8. Repeat steps 5, 6 and 7 for each planet gear.

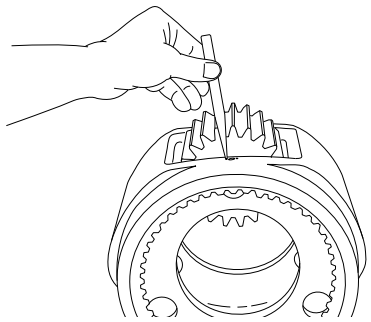


9. Install a bearing cone (item 74) into each end of a planet gear and slide the gear and bearings into the planet carrier, aligning the bearing bores with the planet pin bore.



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 (item 79) 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.

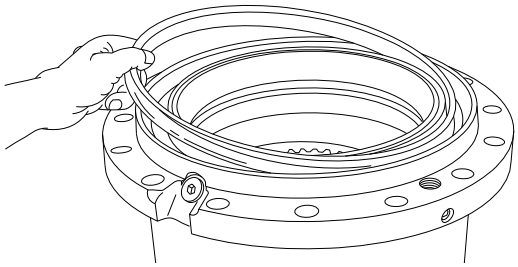
NOTE: Always use **NEW** pins.

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.

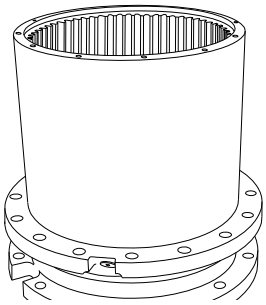
UNIT ASSEMBLY

The following procedure should be used to assemble a complete winch and drive gearbox. It assumes all sub-assemblies have been properly serviced as described in previous sections of this manual.

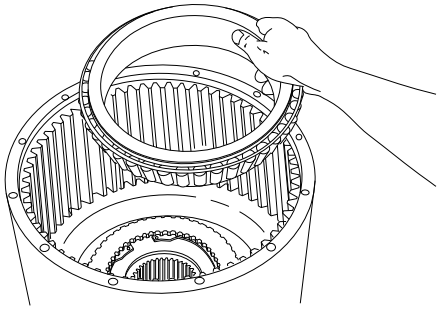


1. If the metal seal (item 53) is being replaced, install one half of the seal in the motor support and the other half in the ring gear. The old seal is simply pried out of its seat. Clean the seal seat area in both the motor support and ring gear. NOTE: Handle the new seals with care. The metal contact areas must remain perfectly flat and free of nicks or dents for the seal to operate leak free.

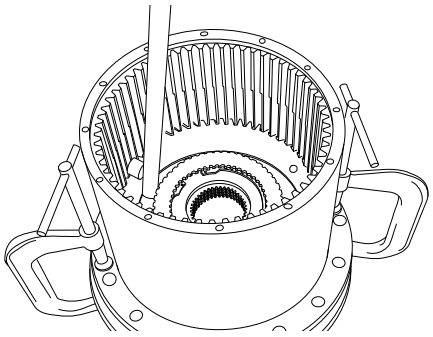
   Apply a liberal coat of oil soluble grease to the new seal O-rings and install one O-ring on each seal half. Each seal half can then be gently worked into its seat in the motor support and ring gear.



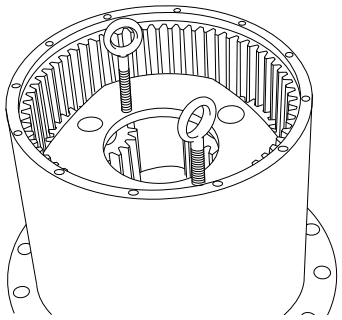
2. If the tapered roller bearings (items 49, 50, 51 & 52) are being replaced, install bearing cone (item 52) onto the motor support. Install both bearing cups (items 50 & 51) into the ring gear. Set the motor support on your workbench with the motor end down. Apply a light coat of oil to the mating surfaces of the metal seal, and set the ring gear down onto the motor support. Mating surfaces of the seal should be in contact with each other and the ring gear should rotate smoothly.



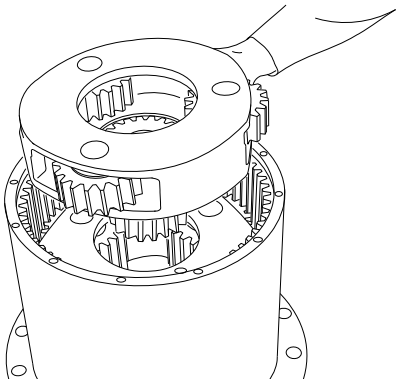
3. Install the bearing cone (item 49) onto the motor support. Use a bar or flat ended punch to fully seat the bearing. Again check that the ring gear rotates freely.



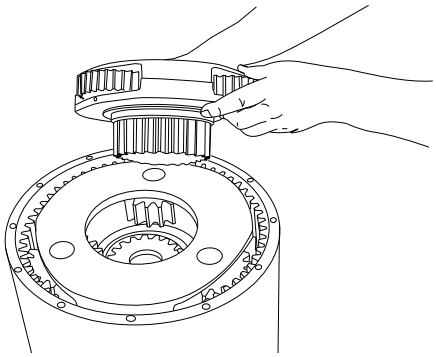
4. Install two large c-clamps between the flanges of the motor support and ring gear. Tighten the c-clamps firmly and again fully seat the bearing installed in step 3. Install both halves of the split ring (item 48) into the groove on the motor support. A 1 inch diameter bar and various sizes of steel blocks or key stock can be used, if necessary, to force the split ring halves into the groove. Be careful to avoid damaging the ring gear teeth while installing the split ring. Remove the two c-clamps.



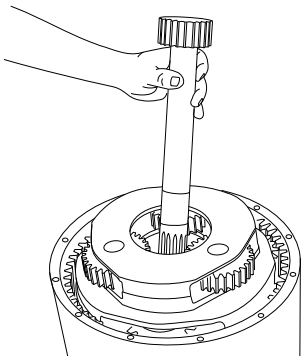
5. Install 2 each ½ - 13 eye bolts into the output planet carrier and use them to set the planet assembly into the ring gear. Rotate the planet carrier to engage the splines on the motor support. In addition to engaging the splines, the planet carrier must drop down over the split ring halves, holding them in position.



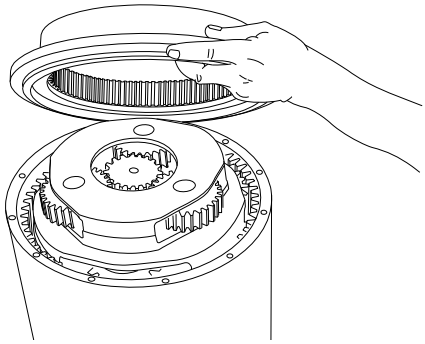
6. Install thrust washer (item 65), onto the second stage planet assembly (with output sun gear). A light coat of oil soluble grease should be used to hold it in place during assembly. Slide the planet assembly into the ring gear and engage the output sun gear with the output planet gears. The second stage planet gears should now be at least 1/8 inch (3 mm) below the top of the teeth cut into the ring gear. If they are above the ring gear teeth, the unit is not properly assembled to this point. Either the thrust washer (item 65) is improperly positioned, or the output planet carrier is not fully engaged onto the motor support (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 (item 57) 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.



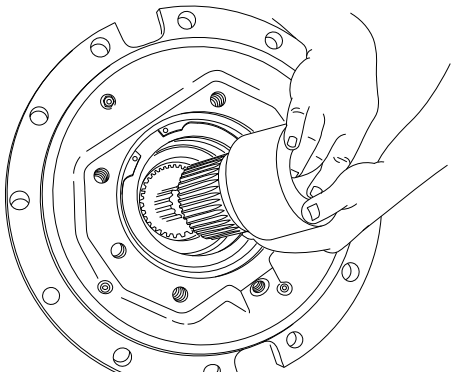
8. Install the primary sun gear (item 55) through the center of the primary planet assembly.



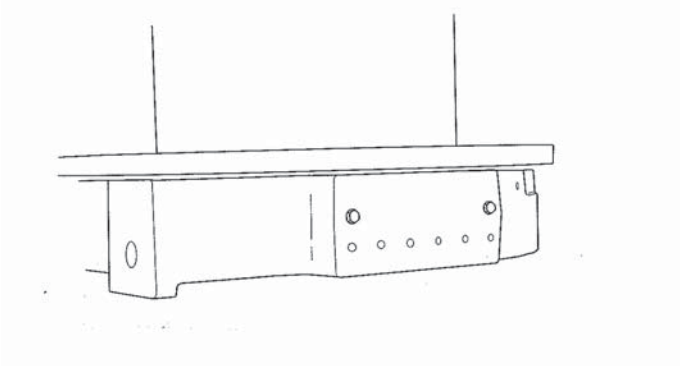
⚠ CAUTION ⚠

In the following step, the primary ring/cover may suddenly drop on the main ring gear when all primary sun gear teeth are aligned with those in the cover. DO NOT work with your fingers between the cover and the main ring gear.

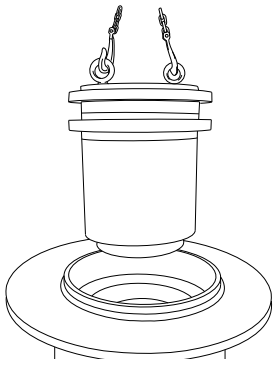
9. Carefully set the cover (item 42) onto the main ring gear, engaging the primary planet gears with the gear teeth machined into the cover. Turn the cover to align the bolt holes with those in the main ring gear and install all twelve (12) capscrews and lockwashers (items 43 & 44).



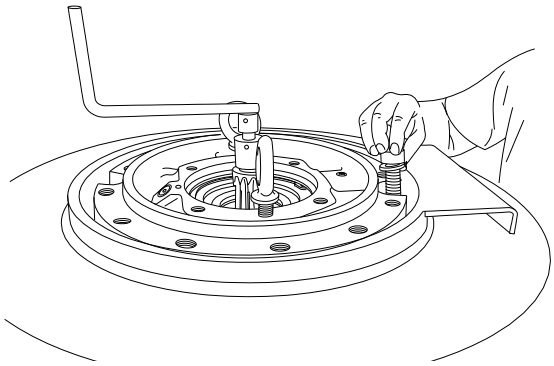
10. Turn the unit over and visually check to see if all internal teeth on the brake discs are aligned. If they are not aligned, connect a hand operated hydraulic pump to the brake release port and apply 500 psi (3,450 kPa). This will allow the brake plates to be rotated and aligned as the sprag clutch assembly is installed. Install the sprag clutch assembly. The top of the sprag assembly should be just below the spring stop (item 93) when installed completely. If a hand pump was used, release the pressure and remove the pump.



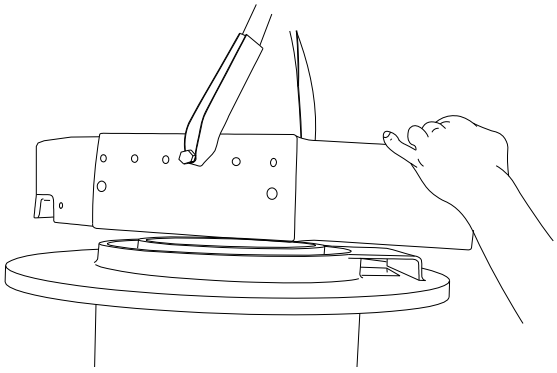
11. Carefully set the cable drum onto the support end bracket (item 2). Pay careful attention that the bearing is not damaged and engages properly.



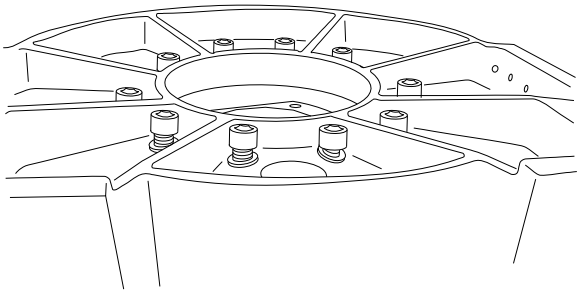
12. Install 2 eye bolts into the winch drive assembly and use them to lift the drive. While the drive is suspended, install a new O-ring (item 24) under the lower flange of the drive. Carefully set the drive into the winch drum, aligning the holes in the drum with those in the bottom flange of the drive.



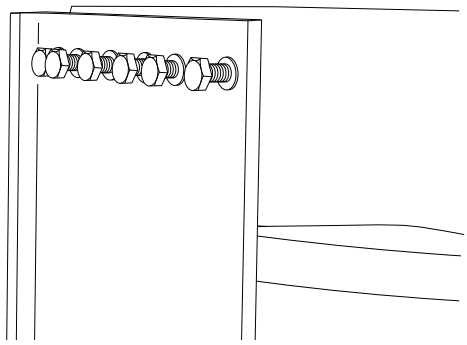
13. There are two large notches in the end of the drive gearbox. These must be rotated to install the capscrews and lockwashers (items 4 & 5) that secure the gearbox to the winch drum. This is done by rotating the motor coupling while keeping the drum from turning. Continue this procedure and install all capscrews and lockwashers (items 4 & 5). **NOTE:** To obtain relative movement between the two sections of the gearbox, the input shaft must be rotated in the same direction as the motor turns to haul-in cable. Rotating the shaft in the opposite direction results in the entire gearbox and drum turning as a single unit.



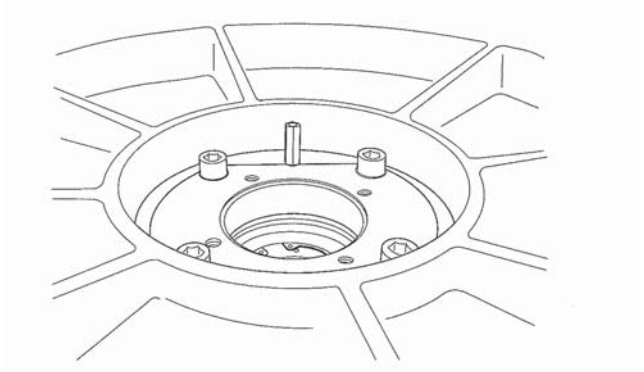
14. Install the motor end bracket (item 25) onto the winch drive. Be sure to orient the end bracket so the vent plug will be as close as possible to the 12:00 o'clock position when the winch is installed.



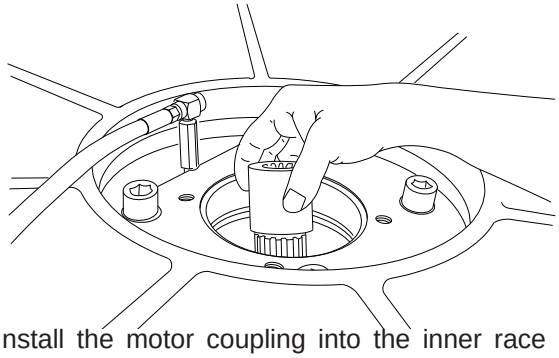
15. Install the ten (10) capscrews and lockwashers (items 29 & 30) securing the end bracket to the winch drive. If necessary, rotate the motor end bracket until it is aligned with the support end bracket.



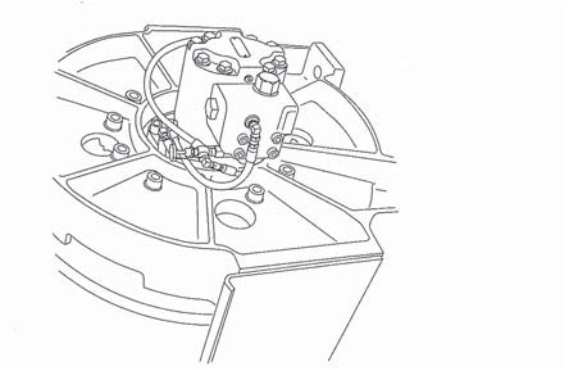
16. Install the two tie plates between the two end brackets, using the dowels in the end brackets to align and position them. Install all twenty four (24) capscrews and lockwashers (items 15 & 16) securing the tie plates to the end brackets.



17. Install a new O-ring (item 26) onto the motor adapter. Install the motor adapter into the winch drive using four (4) capscrews and lockwashers (items 33 & 4).



18. Install the motor coupling into the inner race of the sprag clutch.



19. Install a new O-ring (item 121) onto the pilot of the hydraulic motor. Install the hydraulic motor into the motor adapter, engaging the motor splines with the motor coupling. Install the four (4) capscrews and lockwashers (items 122 & 123), securing the motor to the motor adapter. Connect the brake release hose to the brake release port on the winch drive.

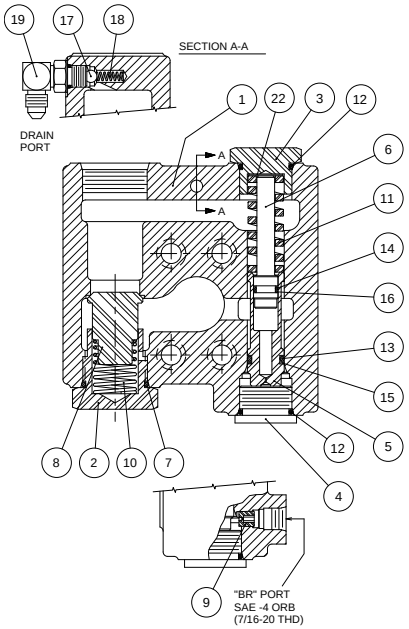
BRAKE VALVE SERVICE

Braden CH330 and CH400 winches are supplied with one of two brake valves, depending on the hydraulic motor used. Both are reliable hydraulic valves with internal components manufactured to close tolerances. Due to these close tolerances, several individual parts are not available as replacement parts and are noted in the following parts list as NSS (not serviced separately).

Before disassembling the brake valve, be sure you have conducted all applicable troubleshooting operations and are certain the brake valve is causing the malfunction.

Thoroughly clean the outside surfaces of the valve and work in a clean dust free area, as cleanliness is of utmost importance when servicing hydraulic components.

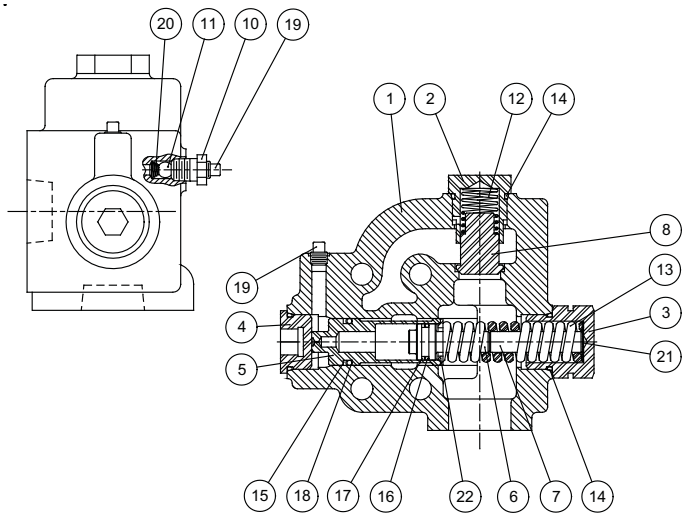
1¼ INCH BRAKE VALVE



1-1/4 INCH BRAKE VALVE ASSEMBLY		
ITEM	QUANTITY	DESCRIPTION
1	1	VALVE HOUSING (NSS)
2	1	SPRING RETAINER (NSS)
3	1	SPRING RETAINER (NSS)
4	1	PLUG (NSS)
5	1	SPOOL (NSS)
6	1	DAMPER PISTON (NSS)
7	1	O-RING
8	1	CHECK VALVE POPPET (NSS)
9	1	PILOT ORIFICE
10	1	CHECK VALVE SPRING
11	1	SPOOL SPRING
12	2	O-RING
13	1	O-RING
14	1	O-RING
15	1	BACK-UP RING
16	1	BACK-UP RING
17	1	CHECK BALL (1-1/4")
18	1	CHECK BALL SPRING
19	1	ELBOW FITTING

1½ INCH BRAKE VALVE

.



1-1/2 INCH BRAKE VALVE ASSEMBLY		
ITEM	QUANTITY	DESCRIPTION
1	1	VALVE HOUSING (NSS)
2	1	SPRING RETAINER (NSS)
3	1	SPRING RETAINER (NSS)
4	1	PLUG (NSS)
5	1	SPOOL (NSS)
6	1	DAMPER PISTON (NSS)
7	1	DAMPER PISTON EXTENSION
8	1	CHECK VALVE POPPET (NSS)
9	1	PILOT ORIFICE
10	1	REDUCER
11	1	CHECK BALL
12	1	CHECK VALVE SPRING
13	1	SPOOL SPRING
14	2	O-RING
15	1	BACK-UP RING
16	1	O-RING
17	1	BACK-UP RING
18	1	O-RING
19	2	PIPE PLUG
20	1	CHECK BALL SPRING
21	as req'd	SHIM
22	1	SPRING SEAT

NSS - NOT SERVICED SEPARATELY.
ORDER COMPLETE VALVE ASSEMBLY.

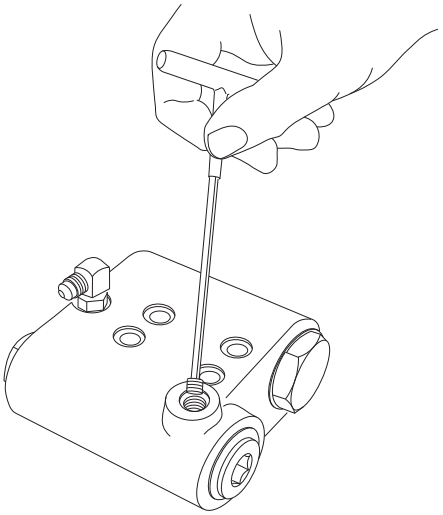
1½ inch brake valves built after mid-March 1997 contain a spring seat (item 22 above) between the spool spring and the spool. This provides a slightly larger, more uniform area for the spring to seat against the spool. The result is increased spring service life and improved repeatability of the pressure/flow modulation over the full compression range of the spring.

The spring retainer has been modified to allow for the additional thickness of the spring seat and a groove machined into the hex end cap serves as a visual indicator that the valve contains the new spring seat. The spring seat improvement may be added to early brake valves by installing kit (Part No. 62805). Items 3, 7, 13, 14 & 22

shown above are included in the kit. We recommend that this kit be installed whenever the brake valve is removed for inspection or service.

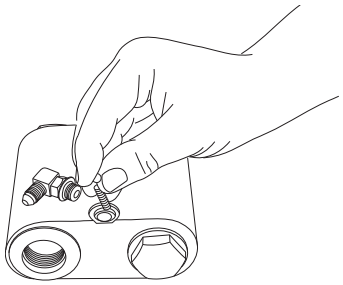
It is always a good practice to check the initial opening or “cracking” pressure of the brake valve whenever the hoist is serviced or inspected. Refer to Braden Service Bulletin number 527 for complete brake valve test and adjustment procedures.

DISASSEMBLY

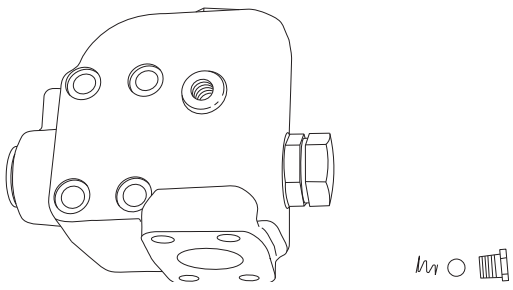


1. On the 1¼ in. valve only, remove the pilot orifice from the brake release (BR) port using a 5/32 in. Allen wrench.

1¼ in. Valve

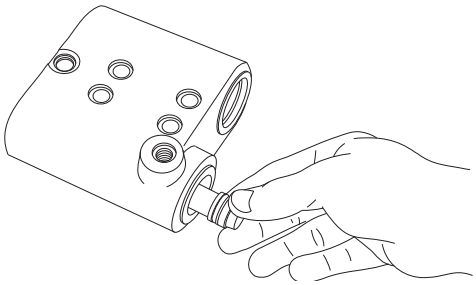


1½ in. Valve

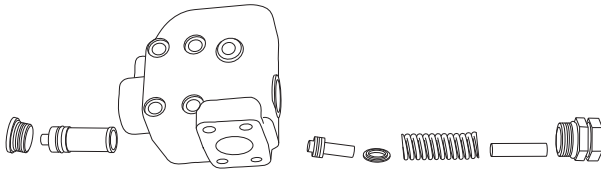


2. Remove the fitting, motor drain check ball and spring.

1¼ in. Valve

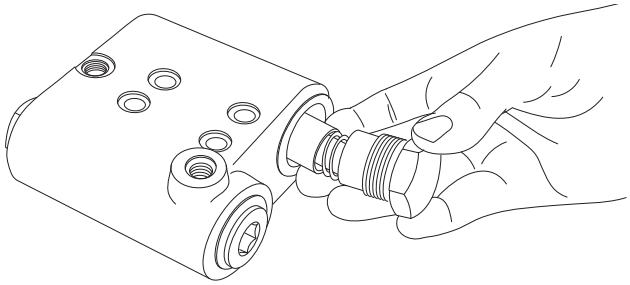


1½ in. Valve

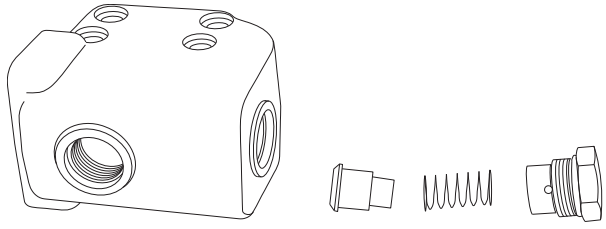


3. Remove the spool spring retainer and spool spring. Remove the spool plug and carefully remove the spool assembly. Remove the damper piston from the spool. The piston will come out of the spool slowly, because of a partial vacuum formed between the two. Use extreme care to avoid damaging the polished surfaces of either piece.

1¼ in. Valve



1½ in. Valve



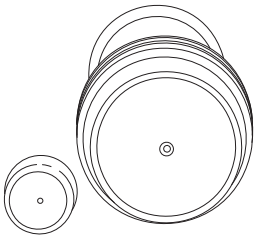
4. Remove the check valve spring retainer, spring and check valve poppet.

CLEAN AND INSPECT

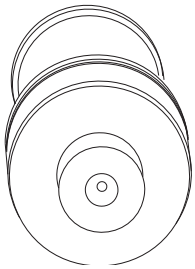
1. Discard all O-rings and back-up rings. Clean all parts in solvent and blow dry. Inspect polished surfaces of spool and damper piston for damage that may cause

binding or leakage. Inspect spool bore in valve housing for damage or scoring. Inspect check valve seat in valve housing and check valve poppet. If the spools, bores or valves are damaged, the entire valve must be replaced as these parts are not serviced separately. Check the free length of the main piston spring. For the 1¼ inch valve, replace if less than 1 15/16 inches (49.2 mm) long. For the 1½ inch valve, replace if less than 3 7/16 inches (87.3 mm) long. Check the free length of the check valve spring. Replace if less than 1½ inches (38.1 mm) long.

¼ in. Valve



1½ in. Valve

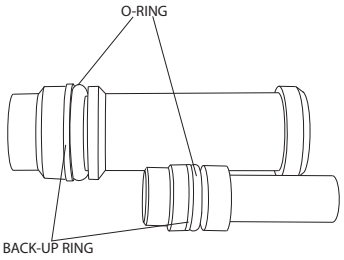


2. Inspect the 0.020 inch (0.5 mm) orifice in the end of the spool to be certain it is open. On the 1¼ in. valve, also inspect the pilot orifice to be certain it is open.

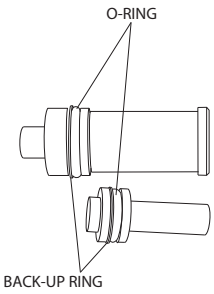
ASSEMBLY

1. Install new O-rings on the plug and spool retainers.

1¼ in. Valve

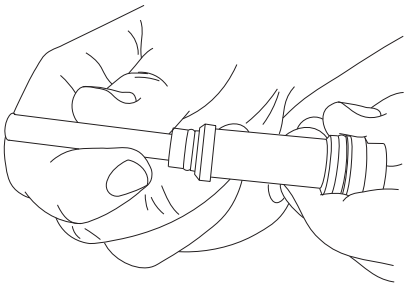


1½ in. Valve

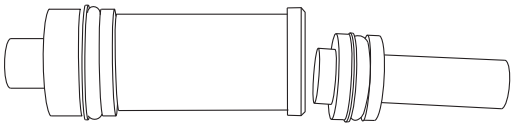


2. Install new O-rings and back-up rings on the spool and damper pistons as shown. It is important that each back-up ring is on the correct side of its O-ring. Take care not to cut the O-rings during assembly. Let the spool and piston set for ten minutes before installing them in their respective bores. This will allow the O-rings to return to their original size after being stretched.

1¼ in. Valve



1½ in. Valve



3. Lubricate the spool and damper piston O-rings with hydraulic oil. Carefully install the damper piston into the spool. Carefully install the spool into the valve housing. On either valve, always install the spool into the valve body so the O-ring enters the bore first, or the plug end of the valve body. Install the plug. On the 1¼ in. valve, install the spool spring and spring retainer. On the 1½ in. valve, install the spring seat, spool spring, damper piston extension and spring retainer.

4. Install the check valve poppet, spring and check valve spring retainer.

5. Install the motor drain check ball, spring and fitting.

6. On the 1¼ in. valve only, install the pilot orifice into the BR port on the valve housing.

7. The brake valve is now complete and ready to be installed on the winch motor.

RECOMMENDED FASTENER TORQUE

The general purpose torque shown in the chart applies to SAE Grade 5 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 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.

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

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

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

METRIC CONVERSION TABLE

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

TEMPERATURE

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

COMMON METRIC PREFIXES

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