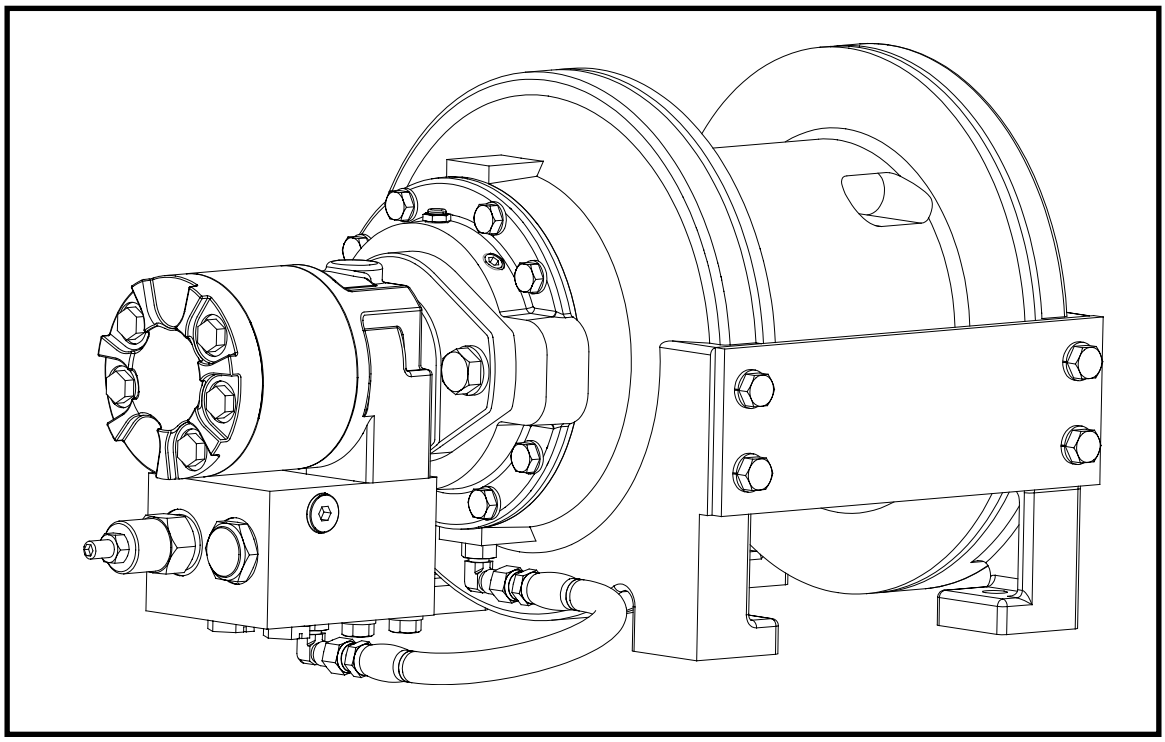
BRADEN
Gearmatic

BG4A & BG4B
HYDRAULIC HOIST



INSTALLATION, MAINTENANCE AND SERVICE MANUAL

LIT2193 R4
3/2008
Printed in U.S.A.

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FOREWORD

Read and understand this entire publication **BEFORE** operating or servicing your BRADEN hoist. Retain this manual 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 Model BG4 series hoist. It is suggested that before doing any work on these units, all assembly and disassembly instructions should be read and understood.

Some illustrations in this manual may show details or attachments which may be different from your hoist. Also, some components may be removed for illustrative purposes.

Continuing product improvement may cause changes in your hoist which may not be included in this manual. When a question arises regarding your hoist or this manual, contact your nearest BRADEN dealer or the factory Service Department. Provide the complete hoist model number and serial number when making inquiries. The model and serial numbers are stamped into the data plate attached to the tie plate as shown below.

Braden Technical Support Department

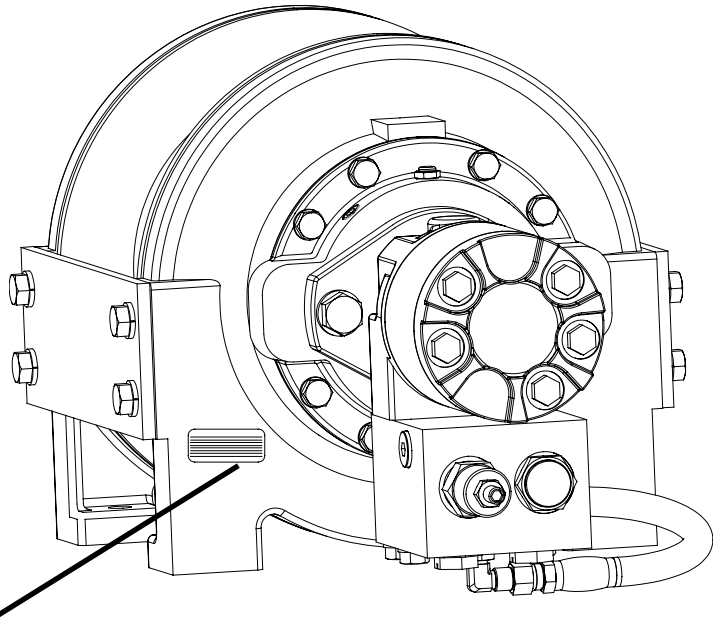
Phone: (918) 251-8511
08:00 to 16:30 CST
Monday thru Friday

Fax: (918) 259-1575

Internet: hoist.service@paccar.com

PARTS AND SERVICE

BRADEN provides parts and service through a network of authorized dealers. Parts and service are not available directly from the factory. For the name of your nearest dealer, consult your local phone directory or call us at the phone number shown above.



Serial Number and Model Number are stamped into the data plate located on left lower corner the motor support when viewing hoist from motor end. Always refer to the Serial Number and Model Number when requesting information or service parts.

EXPLANATION OF MODEL NUMBER

BG	4	B	05	119	01	H
BRADEN GEARMATIC	MAX RATING	DESIGN MODEL	GEAR RATIO	MOTOR SIZE	DRUM SIZE	OPTIONAL HIGH LINE PULL

BG DESIGNATES BRADEN GEARMATIC

4 DESIGNATES 4,000 lb (1,810 kg) FIRST LAYER LINE PULL

B DESIGNATES THE MODEL SERIES RELATING TO DESIGN CHANGES

05 DESIGNATES TOTAL GEAR REDUCTION

119 DESIGNATES HYDRAULIC MOTOR DISPLACEMENT IN cu in./rev
DECIMAL POINT ELIMINATED (119 = 11.9 cu in./rev [195 cu cm])

01 DESIGNATES THE DRUM

H DESIGNATES 5,000 lb. (2,270 kg) FIRST LAYER LINE PULL OPTION

GENERAL SAFETY RECOMMENDATIONS

Safety for operators and ground personnel is of prime concern. Always take the necessary precautions to ensure safety to others as well as yourself. To ensure safety, the prime mover and hoist must be operated with care and concern 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.

Safety informational callout's used in this manual include:

⚠ WARNING ⚠

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

⚠ CAUTION ⚠

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

1. Read all warning tag information and become familiar with all controls **BEFORE** operating hoist.
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 hoist 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 hoist drum. **DO NOT** allow ground personnel near hoist line under tension. A safe distance of at least 1½ times the length of the cable should be maintained. **NEVER** allow anyone to stand beneath a suspended load
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 hoist. Always apply the prime mover parking brakes and lower equipment before dismounting the prime mover.
7. Inspect rigging, hoist 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 +40ºF (14°C.) Refer to "Warm-up Procedure" listed in the "Preventive Maintenance" section of this manual.
10. Be sure of equipment stability before operating hoist.
11. The hoists 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 flow (GPM) stated in the hoist specifications.
13. Operate hoist line speeds to match job conditions.
14. Leather gloves should be used when handling hoist cable.
15. **NEVER** attempt to handle hoist cable when the hook end is not free.
16. When winding hoist cable on the hoist drum, NEVER attempt to maintain tension by allowing hoist cable to slip through hands. Always use "hand-over-hand" technique.
17. **NEVER** use hoist cable with broken strands. Replace hoist cable.
18. **DO NOT** weld on any part of the hoist.
19. **DO NOT** use knots to secure or attach hoist 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 cable drum.
23. The BRADEN wire rope anchors are capable of supporting the rated load only when installed properly. For additional safety, **ALWAYS** maintain a minimum of five (5) wraps of wire rope on the drum.

⚠ WARNING ⚠

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

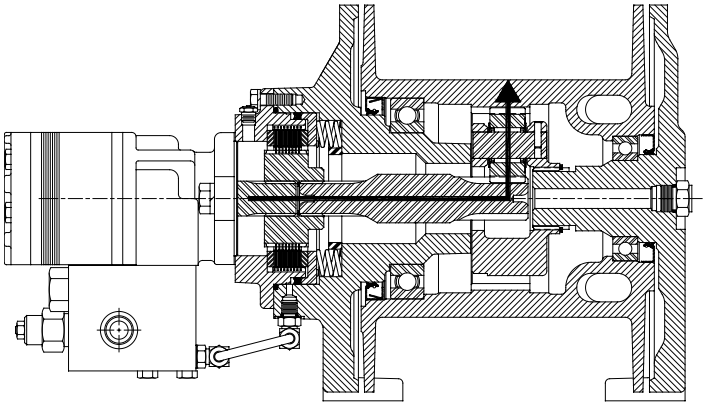
THEORY OF OPERATION

DESCRIPTION OF HOIST

The hoist has three basic assemblies:

1. Hydraulic motor, brake valve block and counterbalance cartridges.
2. Static brake assembly.
3. Cable drum assembly.

The hydraulic motor is bolted to the motor adapter which in turn is bolted to the brake cylinder end plate of the hoist. The cable drum assembly is supported on the motor end by a bronze bushing and on the support end by a roller bearing. The ring gear for the single planetary reduction set is machined into the inside of the cable drum. The cable drum features two anchor pockets for winding cable on the drum in either direction.



PLANETARY GEAR TRAIN

The hydraulic motor shaft is directly splined to the brake coupling which is connected to the sun gear of the planetary reduction set. The planet carrier is splined to the bearing support end plate and cannot rotate. The hydraulic motor rotates the brake coupling and sun gear, driving the planet gears which in turn drive the ring gear/cable drum.

DUAL BRAKE SYSTEM

DYNAMIC BRAKE

The dynamic brake consists of two basic components:

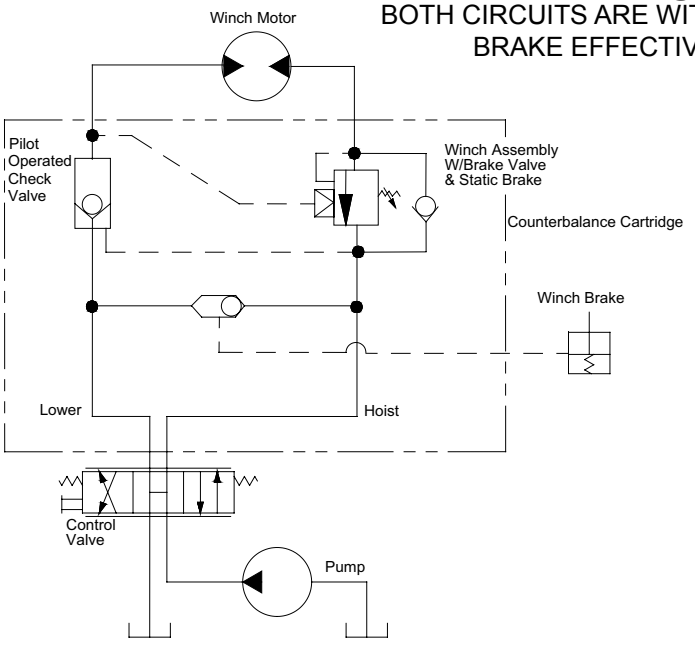
1. Brake Valve block and cartridges;
2. Hydraulic motor.

The brake valve contains a counterbalance cartridge valve, pilot-operated check valve and a shuttle valve. The check valve opens at approximately 30 PSI (207 kPa) to allow the hoist to rotate in the raising direction. During lowering, oil is sent to the counterbalance cartridge which blocks the flow of oil out of the motor until the valve cracks opens at approximately 750 PSI (5,170 kPa) with no load. After the valve cracks open, the pilot pressure becomes flow dependent modulating the cartridge valve to control the lowering speed. The shuttle valve directs oil to the internal brake from both directions, releasing the brake during both raising and lowering operations.

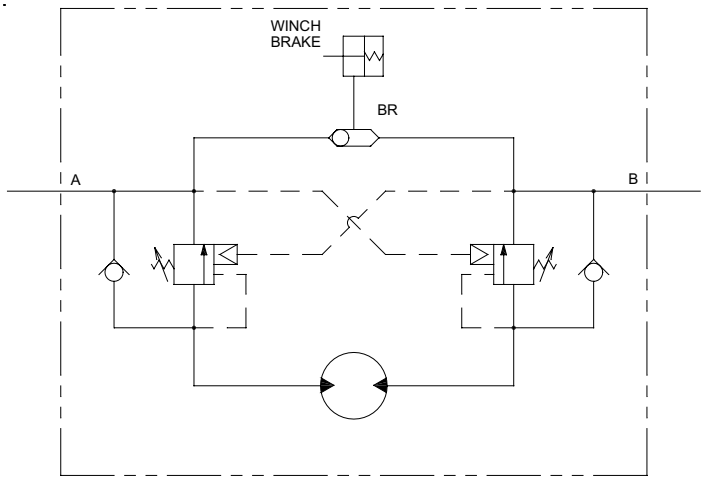
Note: Early BG4A hoists included (2) counterbalance cartridges in the valve block. When servicing, one cartridge may be replaced with the check valve cartridge currently in use.

HYDRAULIC CIRCUITS

BOTH CIRCUITS ARE WITH A SINGLE SPEED MOTOR,
BRAKE EFFECTIVE BOTH DIRECTIONS



1 COUNTERBALANCE CARTRIDGE
1 PILOT OPER. CHECK VALVE



2 COUNTERBALANCE CARTRIDGES
(Early BG4A Hoists)

STATIC BRAKE

The static brake consists of three basic components.

1. Spring applied, multiple friction disk brake pack.
2. Solid brake coupling.
3. Hydraulic brake cylinder and spring plate.

The brake pack consists of alternatively stacked friction and steel brake disks. The steel brake disks are externally splined to the motor adapter and cannot rotate. The friction disks are internally splined to the brake coupling. When the hoist is not being operated, spring force compresses the brake pack and locks the brake coupling to the motor adapter, preventing the gear train or cable drum from rotating in either direction. The solid brake coupling makes the static brake "effective both directions". This means the static brake must be released before the hoist can operate in either the raise or lower direction.

The static brake is released by pilot pressure applied to the brake cylinder. It releases at a pressure lower than that required to open the pilot operated counterbalance cartridge, typically approx. 600 PSI (4,140 Kpa.) This sequence assures that dynamic braking is done by the counterbalance cartridge and that little, if any, heat is absorbed by the friction brake.

The static or friction brake is primarily a load holding brake and will provide dynamic braking only during extremely slow operation when there is insufficient flow and pressure to open the counterbalance cartridge.

OPERATION

Since the static brake on this hoist is "effective both directions", the brake must be hydraulically released to operate the hoist in either the hoist or lower direction.

When the hoist is powered in either direction, the motor cannot rotate until sufficient pilot pressure is present to open the counterbalance cartridge or check valve. The friction brake will completely release at a pressure lower than required to open the counterbalance cartridge during lowering. The extent to which the cartridge opens will determine the amount of oil that can flow through it and the speed at which the cable drum will turn. Increasing the flow of oil to the hoist motor will cause the pressure to rise and the opening in the cartridge to enlarge, speeding up the cable drum. Decreasing the flow causes the pressure to drop and the opening in the cartridge to decrease, slowing down the cable drum.

During raising operations, the check valve recieves a pilot signal from the motor inlet port opening the check valve to allow free flow of oil through the motor. When the control valve is returned to the neutral or center position, pressure will rapidly drop and the counterbalance cartridge will close, stopping the load. The friction brake will engage and hold the load after the cartridge is closed.

HOIST AND WIRE ROPE INSTALLATION

1. The hoist should be mounted with the centerline of the cable drum in a horizontal position. The mounting plane of the hoist 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 hoist, use all four (4) mounting holes and Grade 8 bolts and nuts. Evenly tighten the nuts to the torque in the "Recommended Torque" chart. Refer to "Dimensional Drawing" for bolt hole size and pattern.

It is important that the hoist is mounted on a sur face that will not flex when the hoist 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 hoist mounting pads to achieve even mounting.

3. The hydraulic lines and components that operate the hoist should be of sufficient size to assure minimum back pressure at the hoist. 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 hoist 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 having 150 to 330 SUS viscosity at 100°F (38°C) and viscosity index of 100 or greater will give good results under normal temperature conditions. The use of an oil having a high viscosity index will minimize cold start trouble and reduce the length of warm-up periods. A high viscosity index will minimize changes in viscosity with corresponding changes in temperature.

Maximum cold weather start-up viscosity should not exceed 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 180ºF (82°C). 120-140°F (49-60°C) is generally considered optimum.

In general terms:

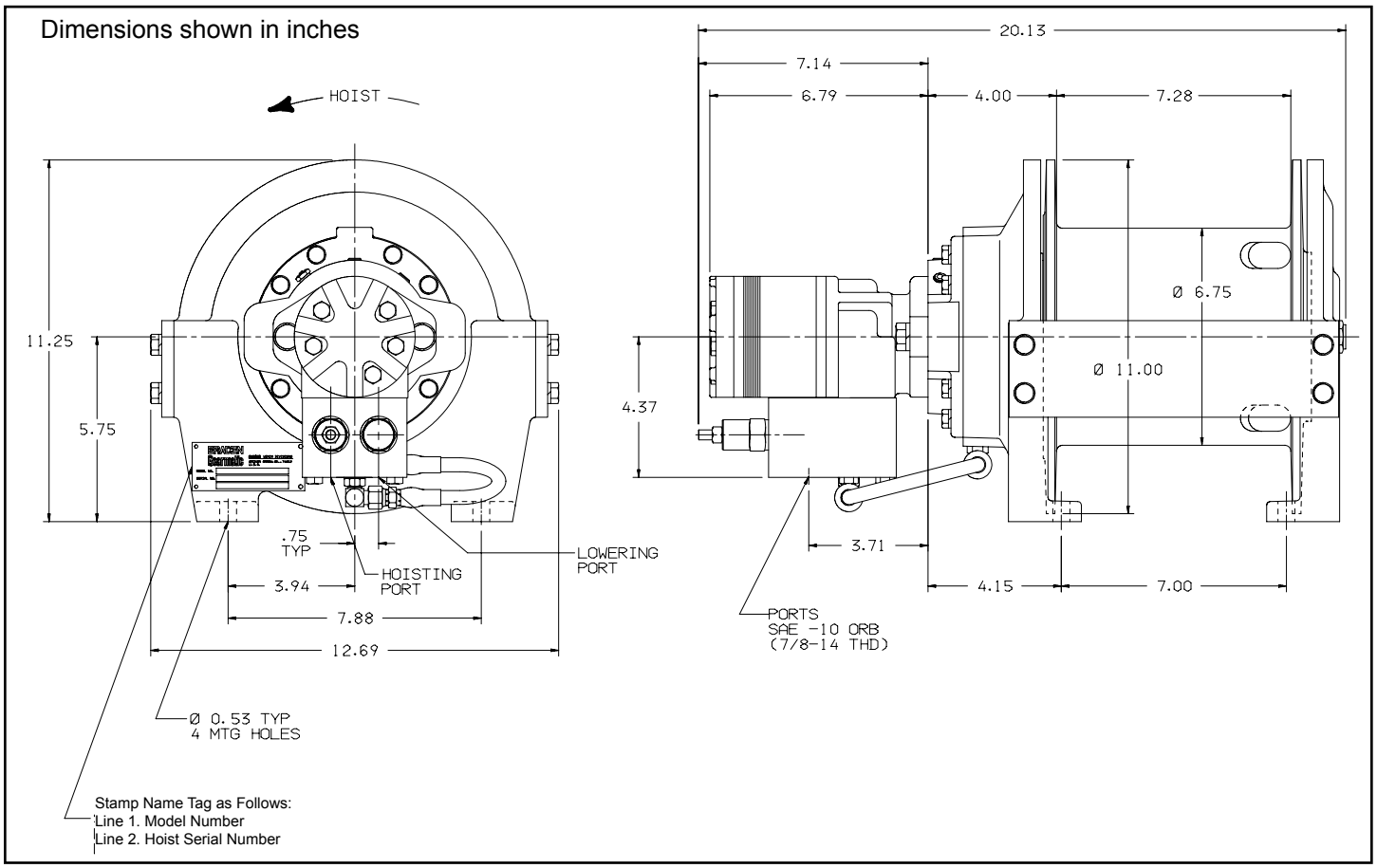
For continuous operation at ambient temperatures between 50 and 110°F (10-43°C) use ISO VG 46 – 68 (SAE20); for continuous operation between 10 and 90°F (-12 and 32°C) use ISO VG 32 (SAE10W); for applications colder than 10°F (-12°C), contact the BRADEN Product Support Department. The use of multi-viscosity oils is generally not recommend-

ed.

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 hoist 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
(ONE PIECE CABLE WEDGE)

⚠ WARNING ⚠

THE CABLE ANCHORS ALONE ON HOISTS ARE NOT INTENDED TO HOLD RATED LOADS.

Hoist loads applied directly to the wire rope anchor may cause the wire rope to pull free and result in the sudden loss of load control and cause property damage, personal injury or death. A minimum of 5 wraps of wire rope must be left on the drum barrel to achieve rated load.

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

Take the free end of the wire rope and insert it through the small opening on the cable drum. Loop the wire rope and push the free end about 3/4 of the way back through the pocket. Install the wedge as shown in figure 1, then pull the slack out of the wire rope. The “dead” end of the rope needs to extend slightly beyond the end of the wedge as shown in figure 2.

Using a hammer and brass drift, drive the wedge as deep into the pocket as possible to ensure it is fully seated and no further movement is detected. Applying a load on the wire rope will also help seat the wedge in the pocket.
Check to ensure the wedge does not protrude from either end of the pocket, causing it to interfere with proper spooling of wire rope onto the drum (see figures 3 & 4).

If there is interference or the wedge does not seat firmly, contact the BRADEN Product Support Department at 1-918-251-8511 to determine the proper wedge size.

It is important that the wire rope have the proper tensioning when it is installed on the drum. When the wire rope is first installed, you should operate the hoist, with light to moderate loads, with reeving that let’s you place these loads on the block and the drum with all the rope off the drum except for the last five wraps.

Correct Installations

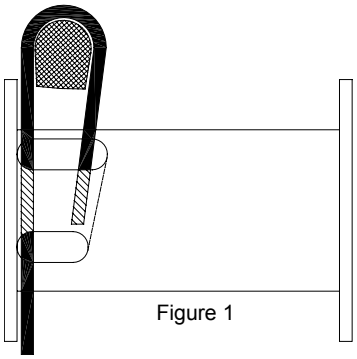


Figure 1

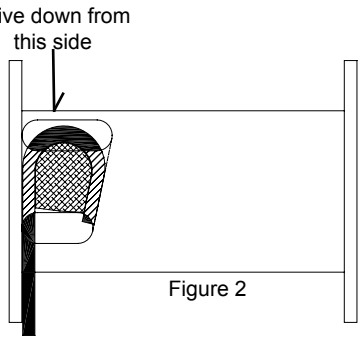
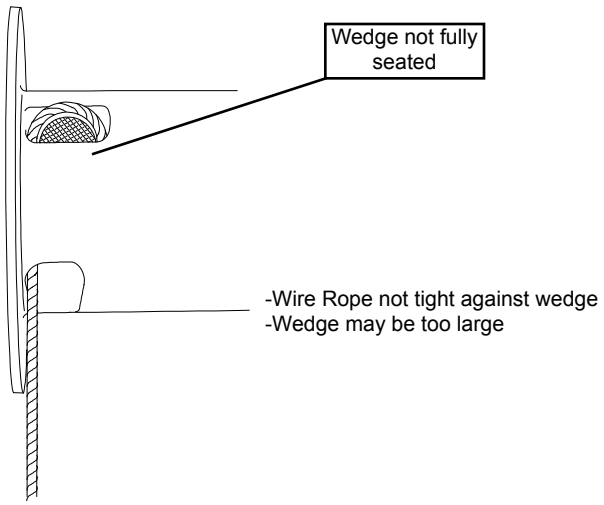
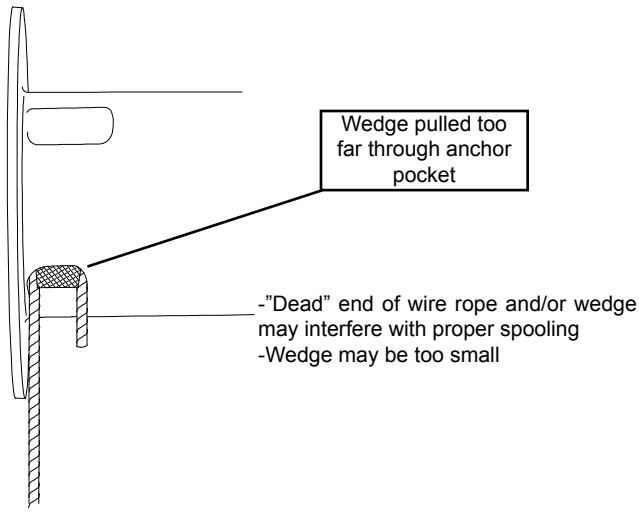


Figure 2

Wedge and wire rope fully seated in pocket

Incorrect Installations





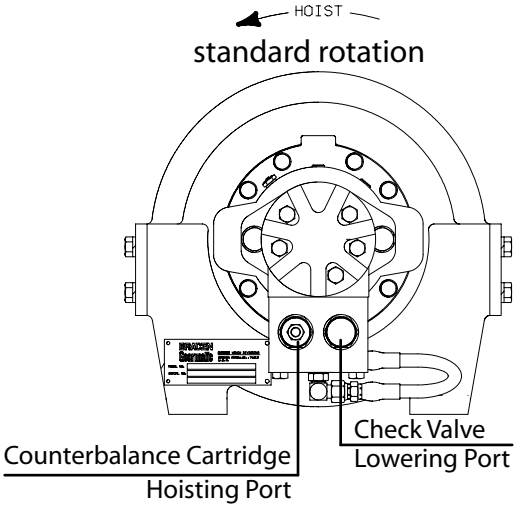
REVERSING DIRECTION OF DRUM ROTATION

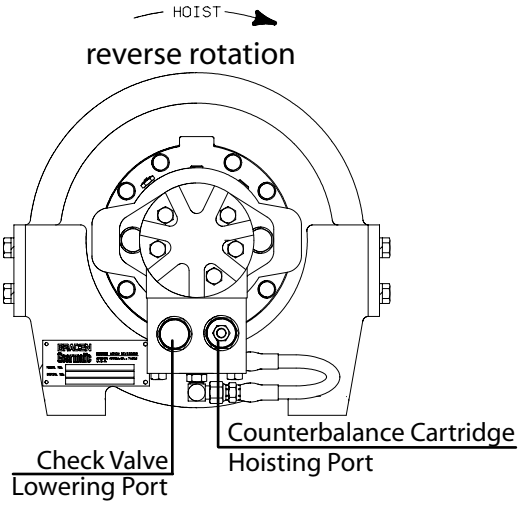
For standard rotation when hoisting, the cable drum rotates counter clock-wise (CCW) when viewed from the motor end.

In order to reverse the direction of rotation of the cable drum, two changes must be made on the motor end of the hoist.

1. Remove and reverse the positions of the counterbalance and check valve cartridges in the brake valve block. For standard rotation, the counterbalance cartridge is installed in the left hand (LH) port when looking at the motor end of the hoist. For opposite, or reversed, rotation, the counterbalance cartridge must be installed in the right hand (RH) port. NOTE: On early units with dual counterbalance cartridges, skip this step.

2. Remove and reverse the positions of the hydraulic motor lines connected to the brake valve. The line for powering the motor in the hoisting direction must be installed in the port that is in-line with the counterbalance cartridge.





PREVENTIVE MAINTENANCE

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

The user of BRADEN hoist products is responsible for hoist inspection, testing, operator training and maintenance noted below with the frequency dependent on the hoist duty cycle and the thoroughness of the preventive maintenance program. Field experience, supported by engineering testing, indicates the three (3) service procedures listed below are the MOST critical to safe, reliable hoist operation and **MUST** be observed.

• **Regular Gear Oil Changes** – every 1000 hours, or six (6) months.

• **Use of Proper Gear Oil** – recommended type and viscosity for prevailing ambient temperatures.

• **Periodic Disassembly and Inspection of All Wear Components** – for recommendations, refer to Bulletin PB-308.

Crane inspection records, as well as records of hoist preventive maintenance, repairs and modifications, must be available for a minimum of five (5) years. These records should include, but not be limited to, hoist model and serial number, name and employer of repair technician, date of work and description of work performed.

1. **Oil Level**

The gear oil level should be checked every 500 operating hours, three (3) months, or whenever an oil leak is detected; whichever occurs first. To check the oil level, remove the large plug located in the center of the bearing support endplate. The oil should be level with the bottom of this opening. If additional oil is needed, refer to “Recommended Planetary Gear Oil” for correct oil type.

Hoist gear oil capacity is approx. 2 pints (1 liter.)

2. **Oil Change**

The gear oil should be changed after the first 100 operating hours or three (3) months, whichever occurs first. The gear oil should then be changed once every 1,000 operating hours or every 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.

⚠ WARNING ⚠

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

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 operation. Make certain that the gear oil viscosity used in your hoist 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 in the motor adapter. It is very important to keep this vent clean and unobstructed. Whenever gear oil is changed remove the 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 hoist base mounting bolts to recommended torque after the first 100 hours of operation, then every 1000 operating hours or six (6) months, whichever occurs first.

7. **Warm-up Procedure**

A warm-up procedure is recommended at each start-up and is essential at ambient temperatures below +40°F (4°C). The prime mover should be run at its lowest recommended RPM with the hydraulic hoist control valve in neutral allowing sufficient time to warm up the system. The hoist 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.

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

⚠ WARNING ⚠

Failure to properly warm up the hoist, 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

Oil Change

To change the gear oil, the hoist must be removed from the platform. Remove the wire rope from the cable drum to aid handling the hoist during oil changes. Stand the hoist on a stable surface with the motor end up. Remove the motor and brake valve assembly, brake release line and brake coupling. Turn the hoist over and drain the oil through the brake opening.

Stand the hoist with the motor end up and refill through the brake opening with two (2) pints (.95 L) of the recommended gear oil. Reinstall the brake coupling, hydraulic motor and brake valve and brake release line as defined in the “Hoist Assembly” section of this manual.

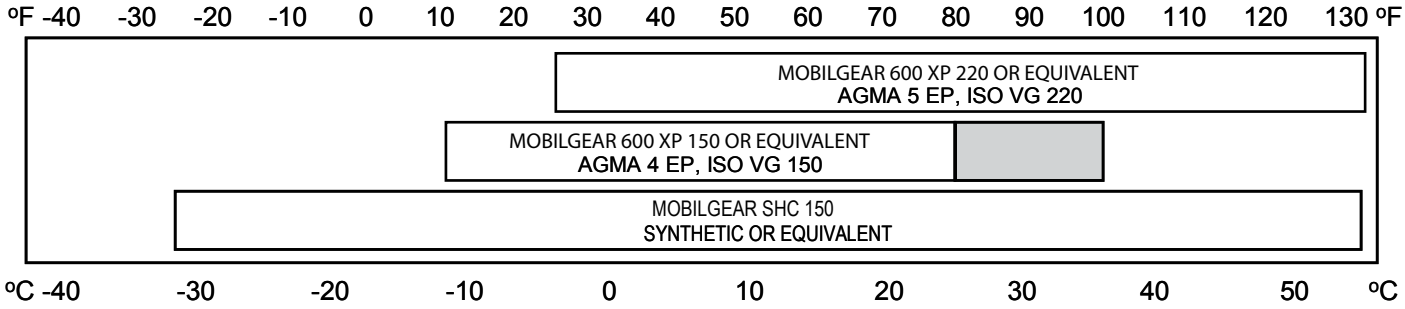
Position the hoist on its mounting feet and let stand for a short time. Check the oil level as defined in “Oil Change” (above).

⚠ WARNING ⚠

Failure to use the proper type and viscosity of planetary gear oil may contribute to intermittent brake 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 temperatures 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 hoist is correct for your prevailing ambient temperature.

RECOMMENDED PLANETARY GEAR OIL

PREVAILING AMBIENT TEMPERATURE

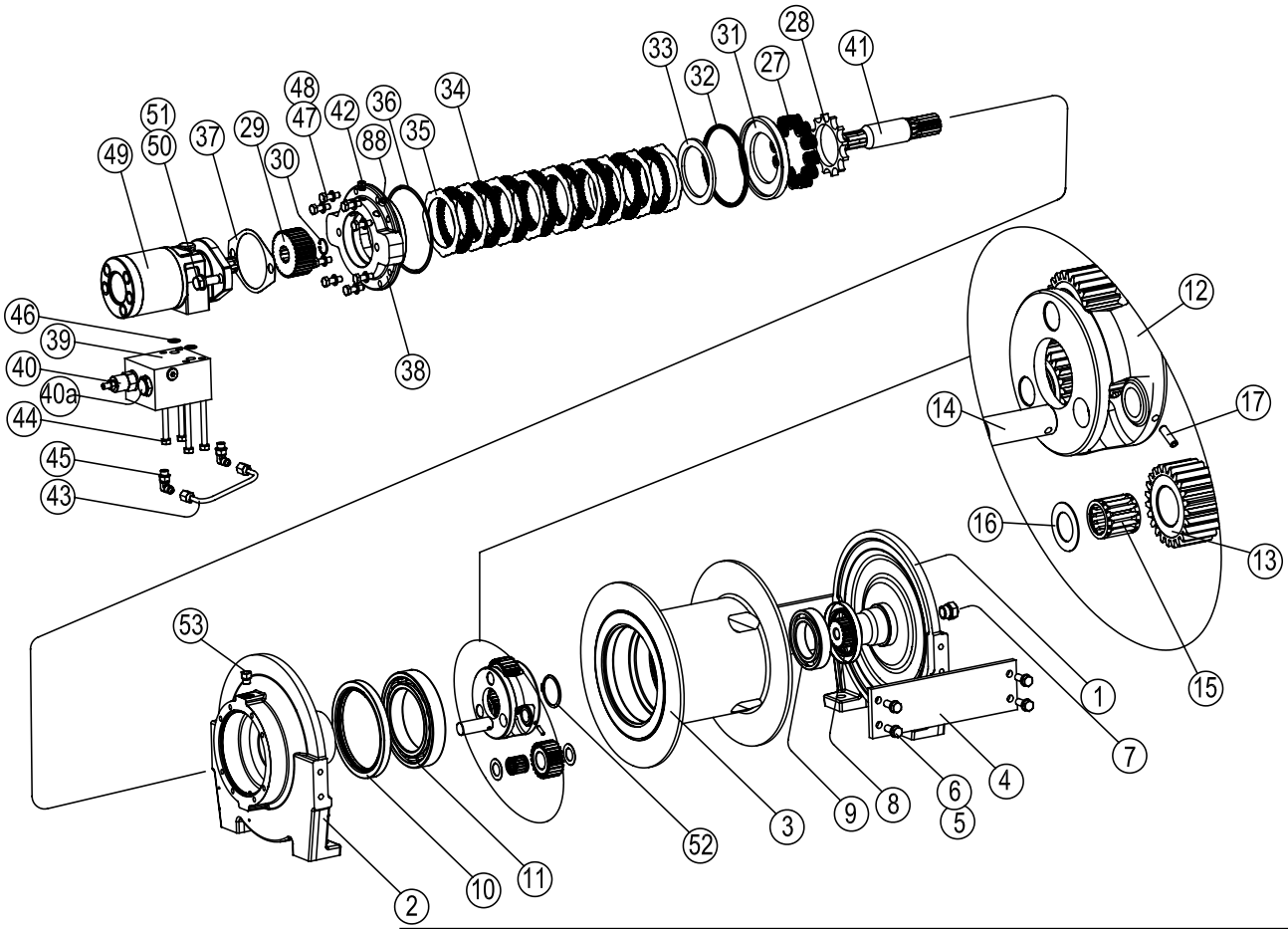


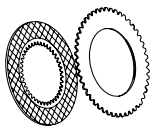
NOTE: *SHADED TEMPERATURE RANGE IN THE CHART ABOVE NOT RECOMMENDED FOR SEVERE APPLICATIONS SUCH AS: OFFSHORE CRANES, SUSTAINED FAST DUTY CYCLES OR FREQUENT LIFTING.*

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**

BG4 Components





NOTE: BG4 version "A" features splined brake discs, pictured left. The "B" version features lobed discs as shown in explosion above. Additionally spring count and brake disc count (items 27, 34, & 36) may vary from depiction above; consult the appropriate Material List for your particualr hoist model for accurate brake spring and brake disc quantities.

ITEM #	DESCRIPTION	QTY
1	Bearing Support Endplate	1
2	Brake Cylinder Endplate	1
3	Cable Drum	1
4	Tie Plate	2
5	Capscrew (3/8-16 x 1 GD8)	8
6	Lockwasher (3/8)	8
7	Sight Gauge	1
8	Oil Seal	1
9	Ball Bearing	1
10	Oil Seal	1
11	Ball Bearing	1
12	Output Planet Carrier	1
13	Ouptut Planet Gear	3
14	Output Planet Carrier Shaft	3
15	Roller Bearing	3
16	Thrust Race	6
17	Rollpin	3
27	Spring	8
28	Spring Locator	1
29	Brake Coupling	1
30	Retaining Ring	1
31	Spring Plate	1
32	Brake Piston Seal	1

ITEM #	DESCRIPTION	QTY
33	Brake Plate Spacer	1
34	Friction Disc	8
35	Steel Disc	9
36	O-Ring	1
37	Gasket	1
38	Motor Adaptor	1
39	Brake Valve Block	1
40	Counterbalance Cartridge	1
40A	Check Valve Cartridge	1
41	Sun Gear	1
42	Vent Plug	1
43	Tube Assembly	1
44	Capscrew (5/16-18 x 3 GD8)	4
45	Elbow Fitting	2
46	O-Ring	2
47	Capscrew (5/16-18 x 1 GD8)	8
48	Lockwasher (5/16)	8
49	Hydraulic Motor	1
50	Capscrew (1/2-13 x 1 1/4)	2
51	Lockwasher (1/2)	2
52	Retaining Ring	1
53	Plug, Brake Cylinder Endplate	1
88	Allen Head Plug Brake Cylinder	2

TROUBLESHOOTING

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

⚠ WARNING ⚠

If a hoist exhibits any sign of:

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

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

TROUBLE	PROBABLE CAUSE	REMEDY
A		
The hoist will not lower the load or not lower the load smoothly.	1. The counterbalance valve cartridge may be plugged, damaged, or out of adjustment	Remove the counterbalance cartridge from the valve block and inspect. Clean and reseal as required. Cartridges are supplied pre-set to the pressure required for proper hoist operation. Further adjustment should not be required
	2. 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 hoist vent plug.*	Check brake cylinder seal as follows: A. Disconnect the brake release tube from the brake release port. Connect a hand pump with accurate 0-2000 psi (13,800 kPa) gauge and shut-off valve to the fitting in the brake release port. 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 “Brake Cylinder Service” section of this manual.
	3. Friction brake will not release as a result of damaged brake discs.	Disassemble brake to inspect brake discs. Refer to “Brake Cylinder Service” section of this manual.

TROUBLE	PROBABLE CAUSE	REMEDY
B Oil leaks from vent plug	1. Same as A2.	Same as A2.
	2. Motor seal may be defective as a result of high back pressure in the motor case drain circuit or contaminated oil. Contamination will usually cause the seal to wear a groove in the motor shaft.	Hydraulic System back pressure must not exceed 100 psi (690 kPa.) Inspect hydraulic system for a restriction in the return line to the reservoir. 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.
C The brake will not hold a load with the control lever in neutral	1. Excessive system back pressure acting on the brake release port.	The pressure at the motor lowering port is also transmitted to the brake release pilot circuit. Inspect hydraulic circuit for restrictions, plugged filters or control valves not centering.
	2. Friction brake will not hold due to worn or damaged brake discs.	Same as Remedy of Trouble A3.
D The hoist will not hoist the rated load	1. The hoist may be mounted on an uneven or flexible surface which causes distortion of the hoist base and binding of the gear train. Binding in the gear train will absorb horsepower needed to hoist the rated load and cause heat.	Reinforce mounting surface. If necessary, use shim stock to level hoist. Refer to “Hoist Installation”. First loosen, then evenly retighten all hoist 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 0-5000 psi (34,500 kPa) gauge into the inlet port of the brake valve. B. Apply a stall pull load on the hoist while monitoring pressure. C. Compare gauge reading to hoist 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.*

TROUBLE	PROBABLE CAUSE	REMEDY
Trouble "D" Continued From Previous Page	3. Check valve or counterbalance valve may be clogged or stuck. BG4 hoists use a check valve which requires the brake to be released while hoisting or pulling wire rope.	Remove the counterbalance or check valve cartridge and clean for inspection. Reseal or replace as required.
	4. Be certain hydraulic system temperature is not more than 180°F (82°C). Excessive hydraulic oil temperatures increase motor internal leakage and reduces motor performance.	Same as remedies for Trouble D1 & D2. Same as remedies for Trouble E2.
	5. Hoist line pull rating is based on 1st layer of wire rope.	Refer to hoist performance charts for additional information.
	6. Rigging and sheaves not operating efficiently.	Perform rigging service as recommended by crane manufacturer.
E The hoist 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.	Engine low on horsepower or R.P.M. Tune/adjust engine. Check suction line for damage. Pump worn. Replace pump.
	E. Hydraulic oil is wrong viscosity for operating conditions.	Use correct hydraulic oil.
	3. Excessively worn or damaged internal hoist parts.	Disassemble hoist to inspect/ replace worn parts.

TROUBLE	PROBABLE CAUSE	REMEDY
F		
Hoist “chatters” or surges while raising rated load.	1. Same as D2.	Same as remedies for Trouble D2.
	2. Same as D3	Same as remedies for Trouble D3
	3. Hydraulic oil flow to motor may be too low.	Same as remedies for Trouble E2.
	4. Controls being operated too quickly.	Conduct operator training as required.
G		
The wire rope does not spool smoothly on the drum.	1. The hoist 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 hoist as required to achieve ½ to 1½ degree fleet angle.
	2. The hoist may not be mounted perpendicular to an imaginary line between the center of the cable drum and the first sheave.	Refer to “Hoist 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 wraps on the drum will stay closer together and maintain an even layer. If rope of improper lay is used, the coils will spread apart each time the load is removed. Then, when hoisting is resumed, the rope has a tendency to criss-cross and overlap on the drum. The result is likely to be a flattened and crushed rope.	Consult wire rope manufacturer for recommendation of wire rope that best suits your application.
	4. The hoist may have been overloaded, causing permanent set in the wire rope.	Replace wire rope and conduct operator/rigger training as required.

HOIST SERVICE

FOREWORD TO HOIST SERVICE

Before any part is removed from the hoist, 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.

Remove wire rope prior to removing hoist from crane.

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

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

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.

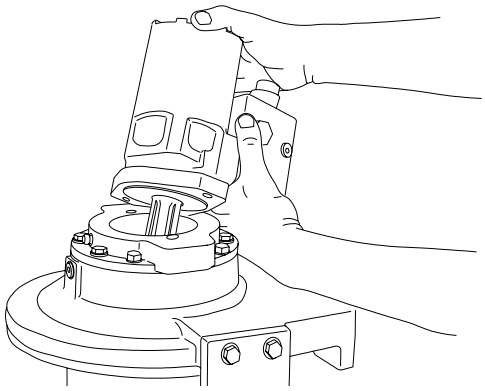
Use a sealing compound on the outside surface of oil seals and a light coat of thread sealing compound on pipe threads. Avoid getting thread compound inside parts or passages which conduct oil.

Thoroughly clean all parts in a good grade of non-flammable safety solvent. Wear protective clothing as required.

Refer to exploded view drawing for item numbers used in service procedures.

• Perform all applicable trouble shooting operations **BEFORE** disassembling hoist. To identify specific parts by part number, refer to BG4 material list.

HOIST DISASSEMBLY

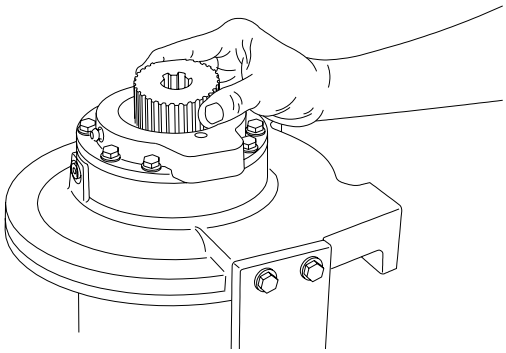


1. Disconnect all hoses and fittings from the motor.

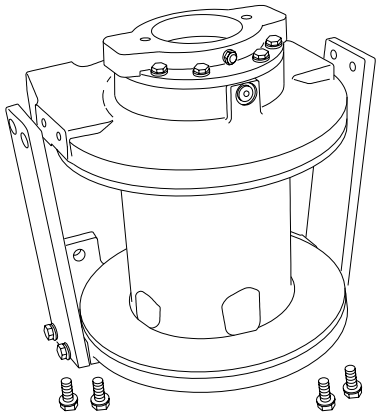
⚠ WARNING ⚠

DO NOT clean brake friction disks in solvent. Solvent may cause damage to friction material which may result in brake failure and loss of load control.

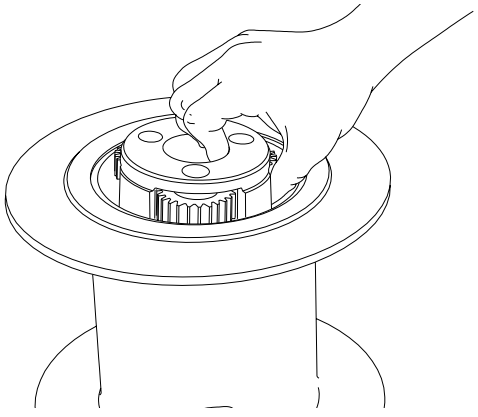
2. Stand the hoist on the bearing support plate. Remove the brake release tube assembly (42) between the brake valve block and the brake cylinder end plate. Remove the capscrews (47) and lockwashers (48) which secure the motor (49) to the motor adapter (38), and lift the motor out of the motor adapter. Remove and discard the gasket installed on the pilot of the motor.



3. Remove the brake coupling (29) and sun gear (41) from the hoist.



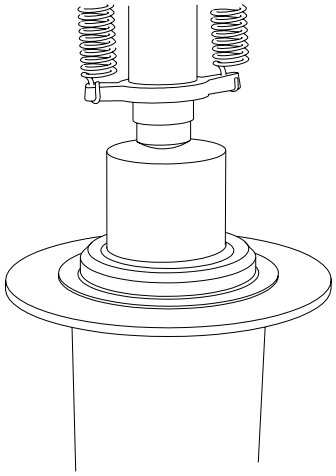
4. Remove the four capscrews (5) and lockwashers (6) holding the tieplates (4) to the brake cylinder endplate. The drum is supported on the endplate by a large bushing. Carefully separate the endplate assembly from the drum. The endplate assembly includes the static brake cylinder. Remove the brake cylinder endplate from the drum.



5. Remove the other four capscrews and lockwashers holding the tieplates to the bearing support endplate. Remove the planet assembly from the drum and separate the drum from the bearing support endplate.

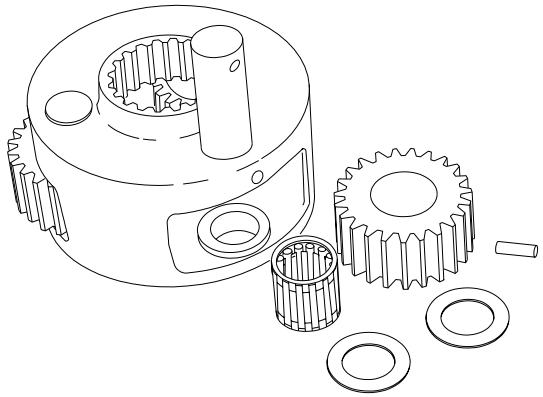
DRUM ASSEMBLY SERVICE

1. Remove the bearing and seal from each end of the drum. Check the ring gear teeth (machined into the inside surface of the drum) for nicks, spalling or excessive wear. Replace the drum if wear is greater than 0.015 in. (0.4 mm) when compared to unworn area of teeth.



2. Install new bearings in the drum if replacement is necessary. Apply a non-hardening sealant on the outside diameter of each new seal and press the seals into the drum, using a flat plate to avoid distortion.

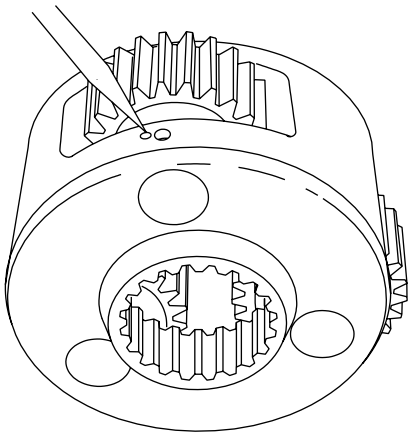
PLANET CARRIER SERVICE



1. First drive the rollpins (17) into the center of the planet shafts (14). Now you can remove the planet shaft (14), two thrust races (16), planet gear (13) and roller bearing (15). Repeat this procedure for the other two planet gears. Thoroughly clean all parts and inspect for damage and wear. The bearing rollers should not exhibit any irregularities. If the rollers show any sign of spalling, corrosion, discoloration, material displacement or abnormal wear, the bearing should be replaced.

Likewise, the cage should be inspected for unusual wear or deformation, particularly the cage bars. If there is any damage that will impair the cage's ability to separate, retain and guide the rollers properly, the bearing should be replaced. The thrust washer contact areas should be free from any surface irregularities that may cause abrasions or friction. The gears and shafts should be inspected for abnormal wear or pitting. Replace if necessary.

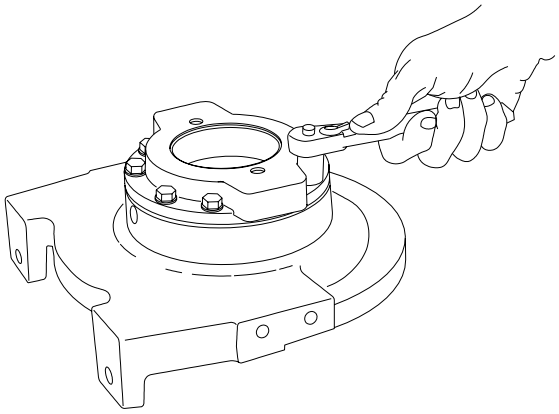
2. Insert a bearing into a planet gear and place a thrust race on each side of the gear. Position this assembly in the planet carrier and slide the planet gear shaft through the carrier. Align the pin hole in the shaft with the hole in the carrier and drive a NEW rollpin into place. **ALWAYS USE NEW ROLLPINS.** When properly positioned, the rollpin will be slightly below the surface of the carrier.



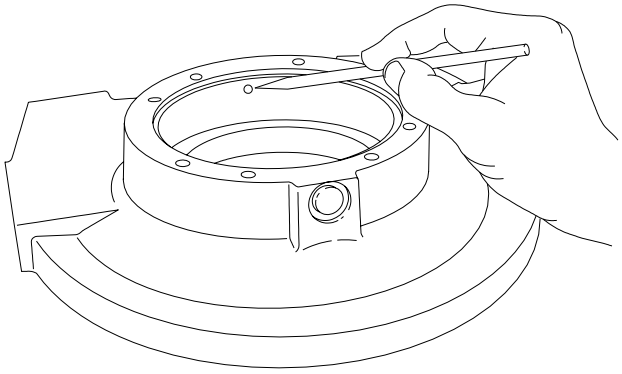
3. With a center punch, stake the carrier next to the pin hole as shown. This will distort the hole so the pin will not back out when in service. Repeat these steps for each of the three planet gears.

BRAKE CYLINDER ENDPLATE SERVICE

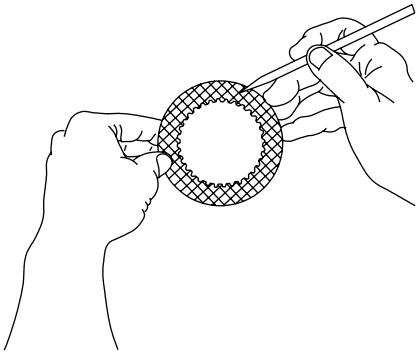
DISASSEMBLY AND INSPECTION.



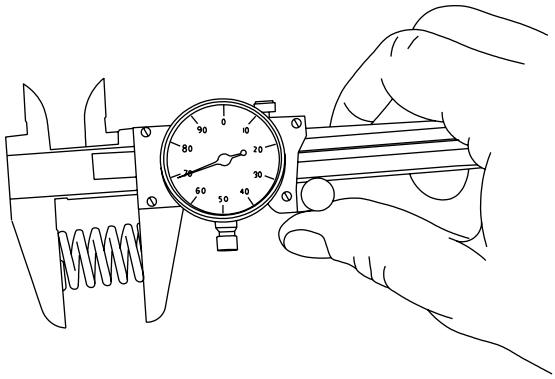
1. NOTE: The capscrews in the motor adapter should be evenly removed in 1 or 2 turn increments since the motor adapter is under spring tension. Remove the capscrews (47) and lockwashers (48) holding the motor adapter (38) to the endplate (2). Install 2 capscrews and a short piece of chain or two 1/2-13 eyebolts into the motor mounting holes. Using the chain as a handle, lift the motor adapter out of the endplate. Remove and discard the O-ring (36) from the motor adapter. Remove and discard the brake piston seal (32). Remove brake plate spacers (33), steel discs (35), friction discs (34), spring plate (31), springs (27) and spring spacer (28).



2. Thoroughly clean and inspect all parts at this time. Check brake piston sealing surfaces on motor adapter and brake cylinder endplate. The sealing surfaces must be smooth. Light scoring from contaminants in the gear oil may be smoothed with an extra-fine abrasive cloth. Be sure the brake release port in the endplate (shown above) is free of contamination. Remove the vent plug (42) from the motor adapter, clean in solvent and reinstall. **DO NOT** paint over the vent or replace it with a solid plug.



3. Place each friction disc on a flat surface and check for distortion with a straight edge. Friction material should appear even across entire surface with groove pattern visible. Replace friction disc if splines are worn to a point, disc is distorted, friction material is worn unevenly or groove pattern is worn away. Place each steel disc on a flat surface and check for distortion with a straight edge. Check surface for signs of material transfer or heat. Replace steel disc if splines are worn to a point, disc is distorted or heat discolored.

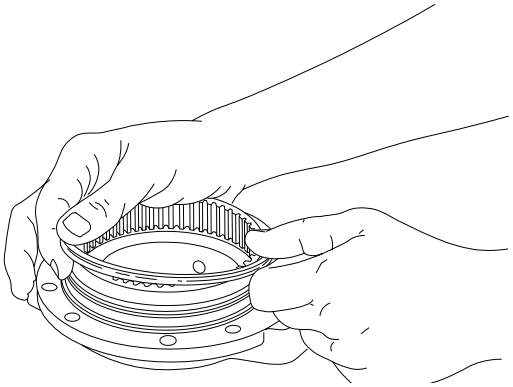


4. Check free length of each brake spring. Minimum free length is 15/16 inch (23.8 mm). Check springs for any signs of cracking or failure. If a brake spring must be replaced for any reason, then **ALL** brake springs must be replaced.

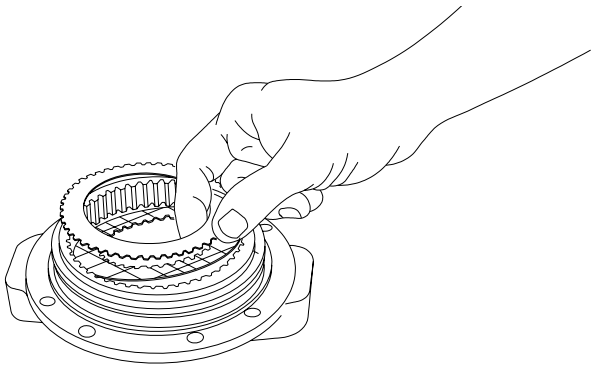
⚠ CAUTION ⚠

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

HOIST ASSEMBLY



1. Place the motor adapter on workbench with the motor mounting surface down. Install a new O-ring (36). Lubricate the brake piston seal with petroleum jelly or hydraulic oil and install on the motor support with the seal lip down, as shown above.

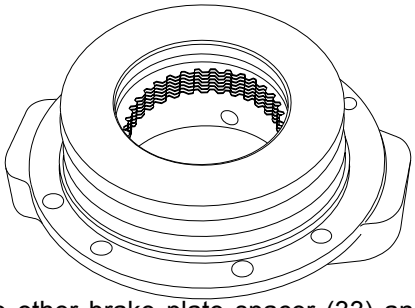


2. BG4B (current) units with “lobed” brake discs:
Install a steel brake disc (35) into the motor support, followed by a friction disc (34). Alternately install steel and friction discs until eight (8) friction and nine (9) steel discs have been installed. Finish with a steel disc on top.

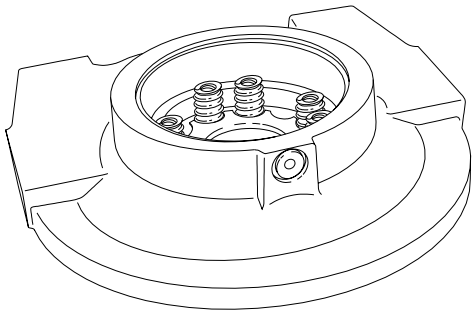
BG4A units with splined discs: Install a brake spacer (33) into the motor support. Insert a steel disc (35) against the spacer, followed by a friction disc (34). Alternately install steel and friction discs until eight (8) friction discs and nine (9) steel discs have been installed. Finish with a steel disc on top.

NOTE: If motor adapter replacement for a BG4A (early design) is required for any reason, use the BG4B motor adapter and “lobed” brake discs, and remove the brake plate spacer (33) located at the motor end of the motor adapter.

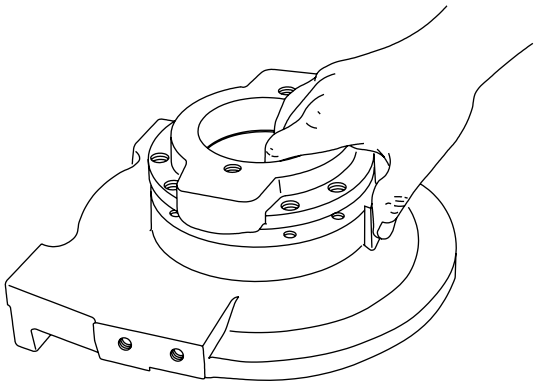
NOTE: It is good practice to lubricate the discs in gear oil prior to assembly.



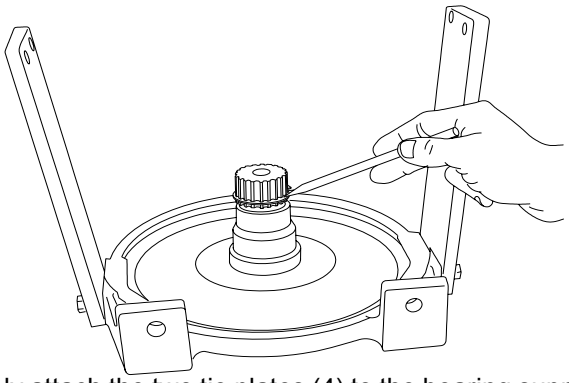
3. Install the other brake plate spacer (33) and the spring plate (31) as shown.



4. Install the spring locator (28) and the eight (8) springs (27) into the brake cylinder end plate (2).



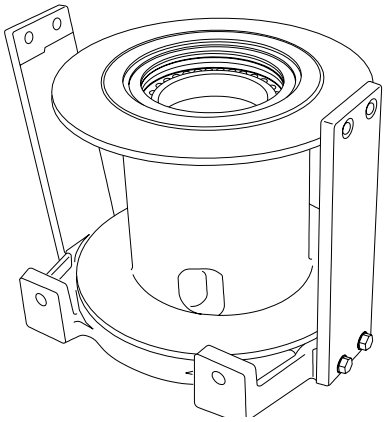
5. While holding the motor adapter and brake assembly together, turn it over and install into the brake cylinder endplate. Install the eight (8) capscrews (47) and lockwashers (48) but do not tighten them completely at the same time.



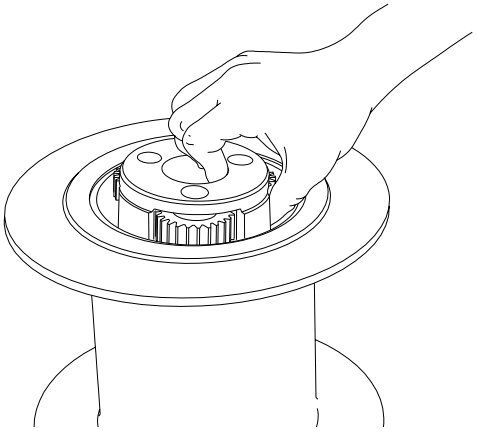
6. Loosely attach the two tie plates (4) to the bearing support end plate using capscrews (4) and lockwashers (6.)

⚠ CAUTION ⚠

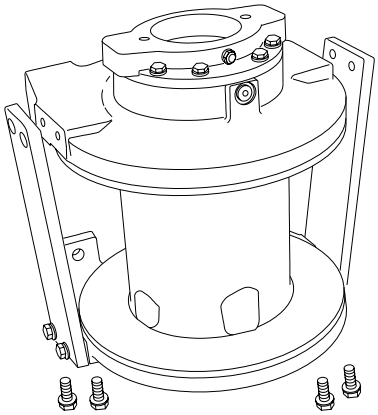
Make certain the snap ring is installed on the bearing support. This snap ring will keep the planet carrier correctly positioned in the hoist. Gear train damage will occur if this snap ring is omitted.



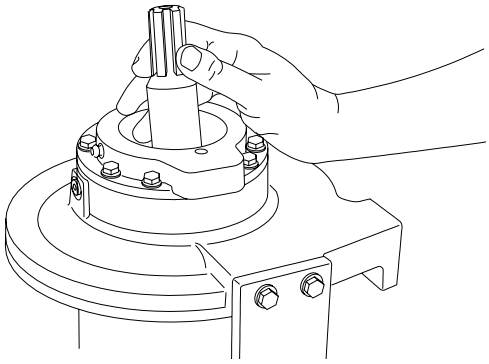
7. Lubricate the bearing support and sealing surface with petroleum jelly or gear oil and place the cable drum (3) on the bearing support endplate. Check that the drum rotates freely on the bearing.



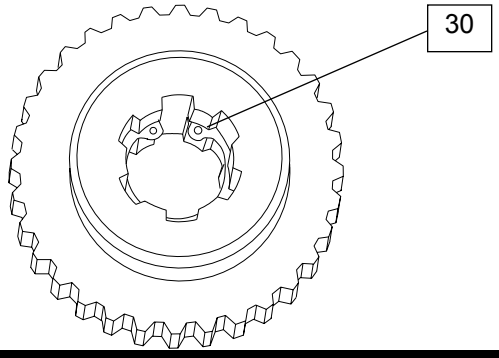
8. Install the planet carrier assembly into the drum while meshing the planet gears with ring gear and the planet carrier with the bearing support.



9. Lubricate the bearing support and sealing surface on the brake cylinder endplate and install the endplate assembly onto the drum.

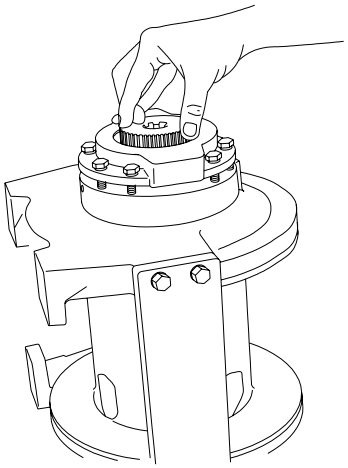


10. Fasten the two tie plates to the endplate with capscrews (5) and lockwashers (6), and torque all eight (8) tie plate capscrews to their proper value. Check that the drum turns freely in both directions without binding or any interference. Install the sun gear (41), meshing with the teeth on the planet gears in the drum.



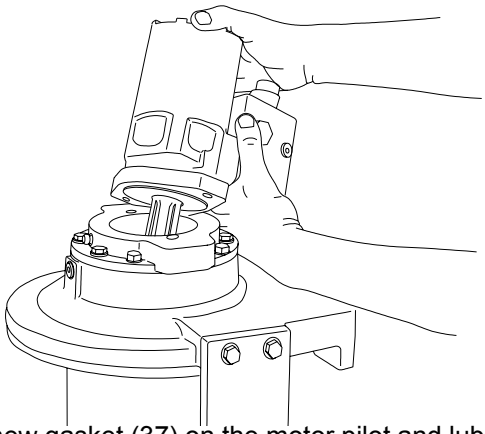
⚠ WARNING ⚠

Be certain the snap ring (30) is seated in the groove in the splined bore of the brake coupling (29). This snap ring will keep the brake coupling correctly positioned in the center of the friction brake pack. Binding of the brake or brake failure may occur if this snap ring is omitted.

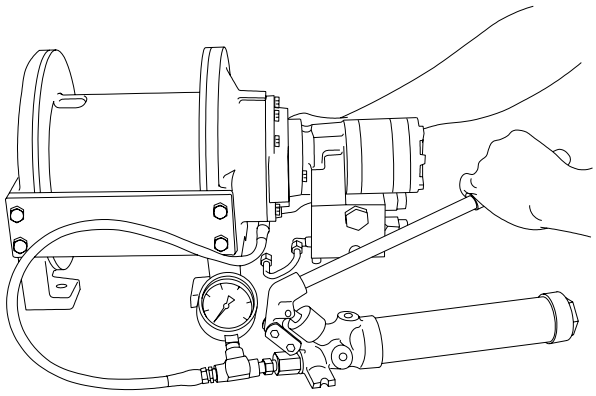


11. Install the brake coupling into the brake pack with the flat end of the coupling toward the motor. Turn the coupling back and forth to align the outer splines with the brake disc splines. The coupling must engage all the brake discs and the snap ring in its center must rest on the sun gear. Evenly tighten the eight (8) capscrews around the motor adapter one turn at a time until the motor adapter is firmly seated to the endplate. Torque the capscrews to their proper value.

Pour two pints (1 Liter) of recommended gear oil into the open motor adapter. Refer to “recommended Planetary Gear Oil” section of this manual.



12. Install a new gasket (37) on the motor pilot and lubricate with petroleum jelly or gear oil. Install the motor onto the motor adapter with two (2) capscrews (50) and lockwashers (51). Torque the capscrews to their proper value.



13. Install a hand pump with an accurate 0-2,000 psi (0-13,800 kPa) gauge and shut-off valve to the brake release port. Apply 1,000 psi (6,900 kPa) to the brake and close the shut-off valve. Let the brake stand for five (5) minutes. If there is any loss of pressure, the brake pack should be disassembled for inspection of the brake seals and sealing surfaces. Release the pressure, remove the hand pump and install the brake release tube (43) between the brake valve block (39) and the brake release port.

RECOMMEND 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.

RECOMMENDED FASTENER TORQUE

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

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

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 $_2$O (60 °F)	X 0.2488	= kilopascals (kPa)	kilopascals (kPa)	X 4.0193	= inches H $_2$O (60 °F)
bars	X 100	= kilopascals (kPa)	kilopascals (kPa)	X 0.01	= bars
POWER					
horsepower (hp)	X 0.746	= kilowatts (kW)	kilowatts (kW)	X 1.34	= horsepower (hp)
ft.-lbs./min.	X 0.0226	= watts (W)	watts (W)	X 44.25	= ft.-lbs./min.
TORQUE					
pound-inches (in.-lbs.)	X 0.11298	= newton-meters (N-m)	newton-meters (N-m)	X 8.851	= pound-inches (in.lbs.)
pound-feet (ft.-lbs.)	X 1.3558	= newton-meters (N-m)	newton-meters (N-m)	X 0.7376	= pound-feet (ft.-lbs.)
pound-feet (ft.-lbs.)	X .1383	= kilograms/meter (kg-m)	kilogram/meter (kg-m)	X 7.233	= pound-feet (ft.-lbs.)
VELOCITY					
miles/hour (m/h)	X 0.11298	= kilometers/hour (km/hr)	kilometers/hour (km/hr)	X 0.6214	= miles/hour (m/h)
feet/second (ft./sec.)	X 0.3048	= meter/second (m/s)	meters/second (m/s)	X 3.281	= feet/second (ft./sec.)
feet/minute (ft./min.)	X 0.3048	= meter/minute (m/min)	meters/minute (m/min)	X 3.281	= feet/minute (ft./min.)

TEMPERATURE

°Celsius = 0.556 (°F - 32) °Fahrenheit = (1.8 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	(m)	= 0.000.001 or 10 $^{-6}$