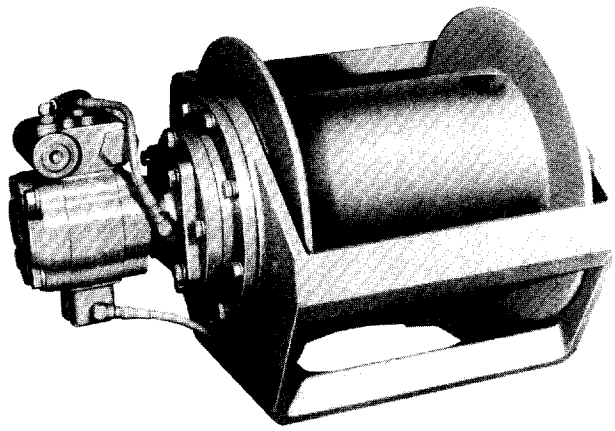
BRADEN

SERIES
PD12C
PD15B HYDRAULIC WINCH



INSTALLATION, MAINTENANCE AND SERVICE MANUAL

PACCAR WINCH DIVISIONS

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FOREWORD

Read this entire publication and retain it for future reference.
If you have any questions regarding your Braden Planetary Winch or this publication, call the Braden Service Department at 1-918-251-8511, 08:00-16:30 hours, CT, Monday through Friday.

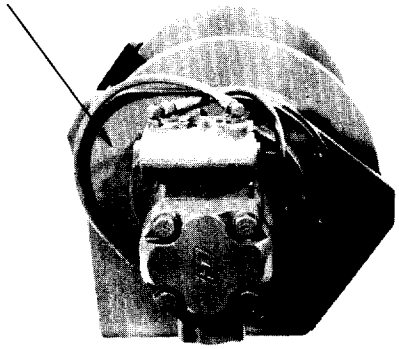
The minimum service intervals specified are for operating hours of the prime mover.

The following service instructions have been prepared to provide assembly, disassembly and maintenance information for the BRADEN Model PD12C/PD15B series winch. It is suggested that before doing any work on these units, all assembly and disassembly instructions should be read and understood.

Some pictures in this manual may show details or attachments that are different from your winch. Also, some components have been removed for illustrative purposes. Illustrations and pictures in this manual are of a "typical" unit sold through our distribution channels. Some winches, particularly those sold directly to original equipment manufacturers, may differ slightly in appearance.

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

Serial Numbers and Model Numbers are located to the left hand side of the hydraulic motor, stamped into the base. Always refer to the Serial Number and Model Number when requesting information or service parts.



EXPLANATION OF MODEL NUMBER

PD	12	C	-	29	064	-	02	-	U	L	-	1
POWER DRUM	MAX. RATING	DESIGN MODEL		GEAR RATIO	MOTOR SIZE		DRUM OPTION		ROTATION	BASE		OPTION

PD DESIGNATES POWER DRUM
12 DESIGNATES 12,000 LB. APPROXIMATE FIRST LAYER LINE PULL
C DESIGNATES THE MODEL SERIES RELATING TO DESIGN CHANGES
29 DESIGNATES TOTAL GEAR REDUCTION
064 DESIGNATES HYDRAULIC MOTOR DISPLACEMENT IN CU IN/REV
(DECIMAL POINT ELIMINATED. EXAMPLE 064 = 6.4 CU IN/REV)
02 DESIGNATES THE DRUM OPTION
U DESIGNATES UNDERGROUND CABLE DRUM – OPTIONAL
L DESIGNATES LEFT HAND BASE – OPTIONAL
1 PERMITS TESTING AND INSPECTION PER API 2C FOR OFFSHORE CRANES

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GENERAL SAFETY RECOMMENDATIONS

Safety and informational callouts used in this manual include:

⚠ WARNING

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

⚠ CAUTION

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

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

1. Be certain equipment (boom, sheave blocks, pendants, etc.) is either lowered to the ground or blocked securely before servicing, adjusting, or repairing winch.
2. Be sure personnel are clear of work area BEFORE operating winch.
3. Read all warning and caution tag information provided for safe operation and service of winch.
4. Inspect rigging and winch at the beginning of each work shift. Defects should be corrected immediately
5. Keep equipment in good operating condition. Perform scheduled servicing and adjustments listed in the "Preventive Maintenance" section of this manual.
6. An equipment warm-up procedure is recommended for all start-ups and essential at ambient temperatures below +40°F (4°C). Refer to "Warm-up Procedure" listed in the "Preventive Maintenance" section of this manual.
7. Operate winch line speeds to match job conditions.
8. Leather gloves should be used when handling wire rope.
9. Never attempt to handle wire rope when the hook end is not free. Keep all parts of body and clothing clear of cable rollers, cable entry area of fairleads and winch drum.
10. When winding wire rope on the winch drum, never attempt to maintain tension by allowing wire rope to slip through hands. Always use "Hand-Over-Hand" technique.
11. Never use wire rope with broken strands. Replace wire rope.
12. Do not weld on any part of the winch.
13. Use recommended hydraulic oil and gear lubricant.
14. Keep hydraulic system clean and free from contamination at all times.
15. Use correct anchor for wire rope and pocket in drum.
16. Do not use knots to secure or attach wire rope.
17. The BRADEN designed 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.
18. Never attempt to clean, oil or perform any maintenance on a machine with the engine or prime mover running, unless instructed to do so in this manual.
19. Never operate winch controls unless you are properly positioned at the operators station and you are sure personnel are clear of the work area.
20. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
21. Ground personnel should stay in view of the operator and clear of winch drum. Do not allow ground personnel near winch line under tension. A safe distance of at least 1-1/2 times the length of the cable should be maintained.
22. Do not exceed the maximum pressure, PSI (kPa), or flow, GPM (LPM), stated in the winch specifications for hydraulically driven winches.
23. Install guarding to prevent personnel from getting any part of body or clothing caught at a point where the cable is wrapped onto the drum or drawn through guide rollers.
24. "Deadman" controls, which automatically shut off power to the winch whenever the operator leaves his station, should be installed whenever practicable.
25. Never allow anyone to stand under a suspended load.
26. Avoid sudden "shock" loads or attempting to "jerk" load free. This type of operation may cause heavy loads, in excess of rated capacity, which may result in failure of cable and winch.

THEORY OF OPERATION

DESCRIPTION OF WINCH

The winch has four basic component parts:

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

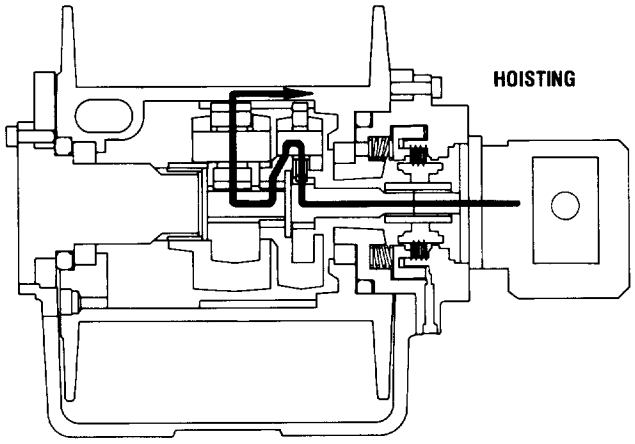
The drum assembly consists of three basic assemblies:

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

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

WINCH OPERATION

Planetary gearing: Figure 1



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

The primary planet carrier drives the output planet sun gear which, in turn drives the output planet gears. The output planet carrier is splined to the bearing support and can not rotate. Therefore, as the output planet gears are driven by the sun gear, they will drive the ring gear/drum.

Dual Brake System — Description

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

The dynamic brake system has two operating components:

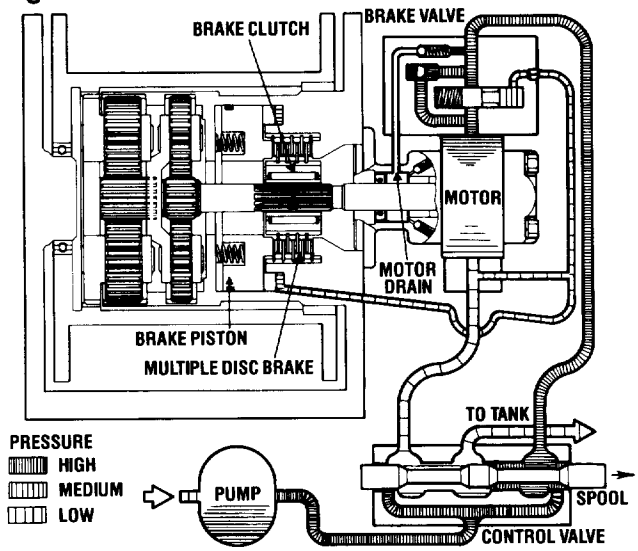
1. Brake valve assembly
2. Hydraulic motor

The brake valve is basically a counter balance valve. It contains a check valve to allow free flow of oil to the motor in the hoisting direction and a pilot operated, spring-loaded spool valve that blocks the flow of oil out of the motor when the control valve is placed in neutral. When the control valve is placed in the lowering position, the spool valve remains closed until sufficient pilot pressure is applied to the end of the spool to shift it against spring pressure and open a passage. After the spool valve cracks open, the pilot pressure becomes flow-dependent and modulates the spool valve opening which controls the lowering speed. Figures 2, 3 and 4.

The static brake system has three operating components:

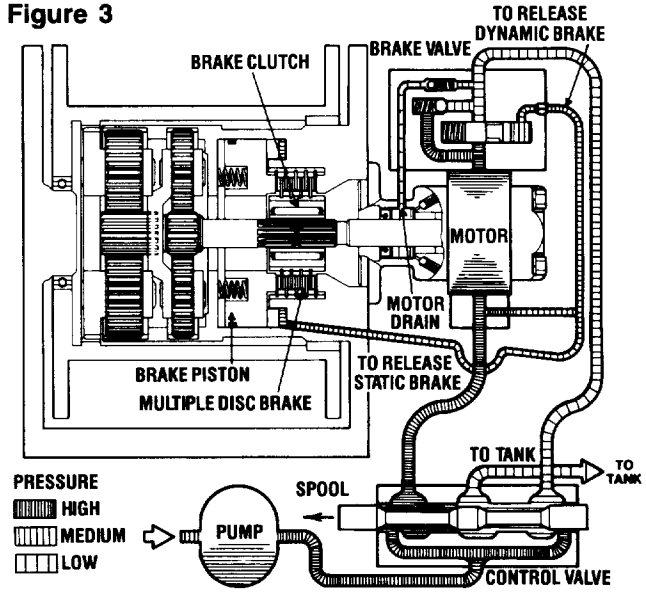
1. Spring Applied, Multiple Friction Disc Static Brake
2. Brake Clutch Assembly
3. Hydraulic Piston and Cylinder

Figure 2



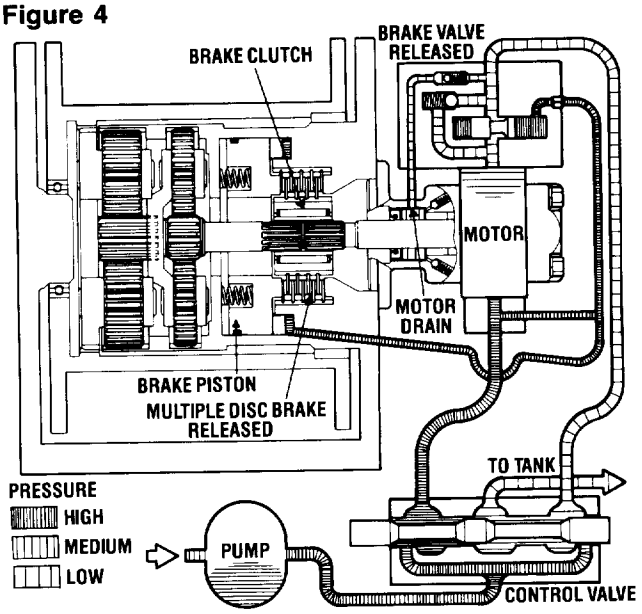
HOISTING

Figure 3



LOWERING 1

Figure 4



LOWERING 2

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

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

The brake clutch is splined to the primary sun gear shaft between the motor and the primary sun gear. It will allow this shaft to turn freely in the direction to raise a load and lock up to force the brake discs to turn with the shaft in the direction to lower a load. Figures 5 and 6.

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

Dual Brake System — Operation

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

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

When the winch is powered in reverse, to lower the load, the motor can not rotate until sufficient pilot pressure is present to open the brake valve. Figures 3 & 4. The friction brake within the winch will completely release at a pressure lower than that required to open the brake valve. The extent to which the brake valve opens will determine the amount of oil that can flow through it and the speed at which the load will be lowered. Increasing the flow of oil to the winch motor will cause the pressure to rise and the opening in the brake valve to enlarge, speeding up the descent of the load. Decreasing this flow causes the pressure to lower and the opening in the brake valve to decrease thus slowing the descent of the load.

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

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

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

Figure 5

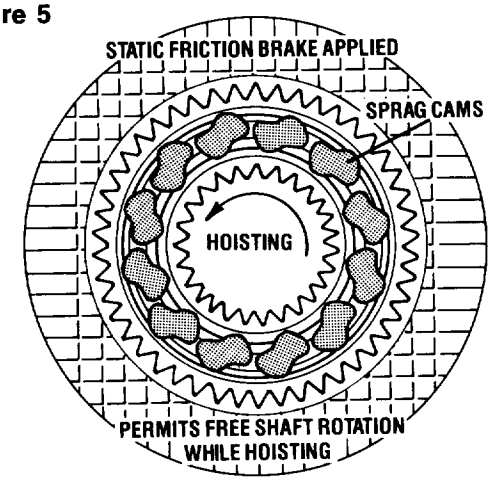
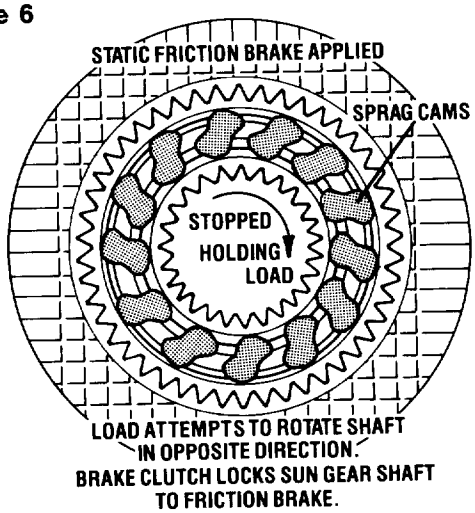


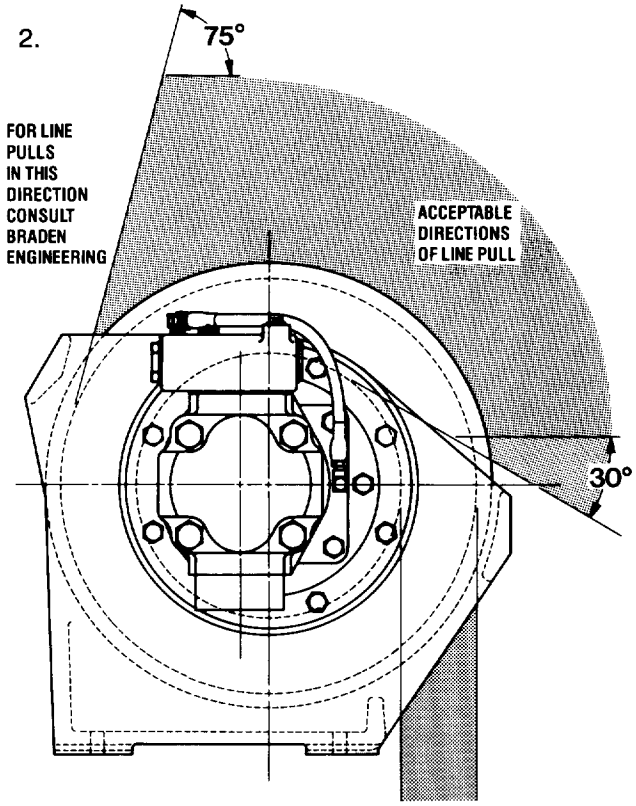
Figure 6



WINCH INSTALLATION

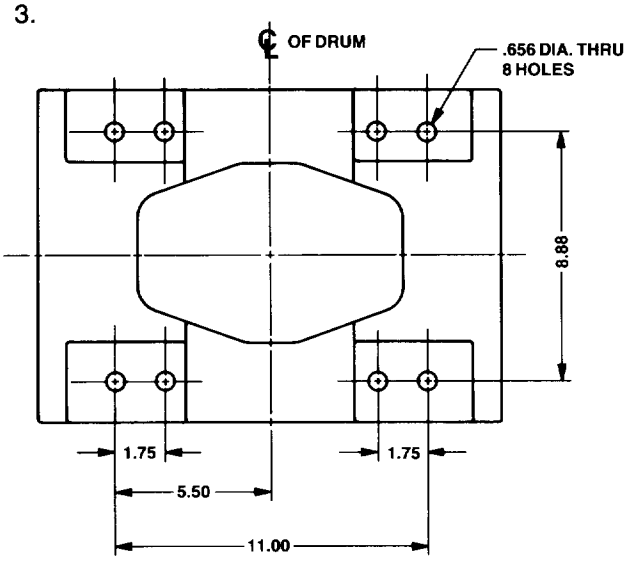
1. The winch should be mounted with the centerline of the drum in a horizontal position. The mounting plane of the base may be rotated in any position around this centerline.

2.



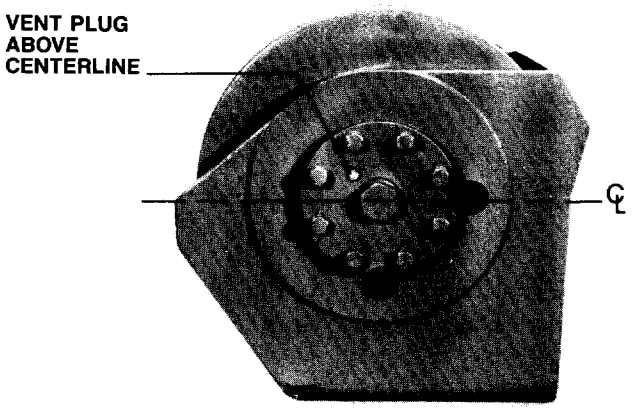
Because of the design of the mounting base, the direction of line pull should only be as shown in the above illustration. Line pulls in any other direction must be approved by BRADEN Engineering.

3.



When mounting the winch, use all eight (8) mounting holes and grade 5 or better bolts and nuts. Tighten to recommended torque.

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, be sure the winch is mounted on a flat surface. If necessary, use shim stock to insure the mounting surface is flat within 0.020 in. (0.5 mm).

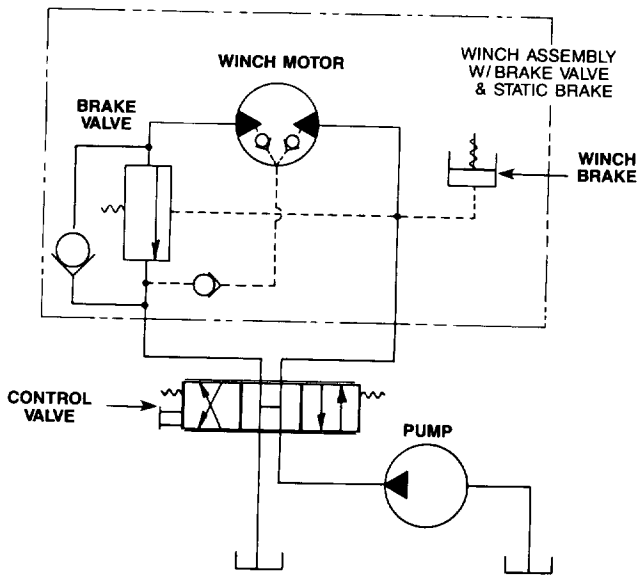


4. The vent plug must always be located above the horizontal centerline. If the winch is mounted on a pivoting surface, be sure vent plug remains above the centerline in all positions. If necessary, reposition bearing support and vent plug as follows:
   A. Remove bearing support bolts.
   B. Rotate bearing support until vent plug is positioned correctly and bolt holes are aligned.
   C. Evenly tighten bolts to recommended torque.

5. Hydraulic lines and components that operate the winch should be of sufficient size to assure minimum back pressure at the winch. The motor manufacturer recommends that the back pressure not to exceed 100 psi (690 kPa) for optimum motor seal life. 150 psi (1,030 kPa) is the maximum allowable back pressure. The standard winch is supplied with the motor internally drained. If high back pressures are encountered, the motor may be externally drained directly to tank to improve motor seal life. For back pressures exceeding 150 psi (1,030 kPa) consult BRADEN Service Department.

6. The winch should be mounted perpendicular to an imaginary line from the center of the drum to the first sheave to insure even spooling. Make certain the fleet angle does not exceed 1½ degrees.

7.



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).

8. 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 warmup periods. A high viscosity index will minimize changes in viscosity with corresponding changes in temperature.

Maximum cold weather start-up viscosity should not exceed 5000 SUS with a pour point at least 20°F (11°C) lower than the minimum temperature.

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

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

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

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.

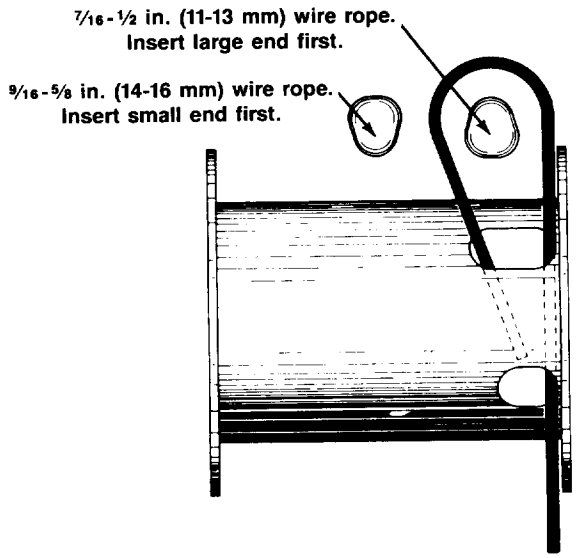
BOLT DIA. INCHES	THD PER INCH	TORQUE LB-FT. (N•m) DRY	LUBED
1/4	20 28	9 (12)	6 (8)
5/16	18 24	18 (24)	13 (18)
3/8	16 24	31 (42)	23 (31)
7/16	14 20	50 (68)	37 (50)
1/2	13 20	75 (102)	55 (75)
9/16	12 18	110 (149)	80 (109)
5/8	11 18	150 (203)	115 (156)

BOLT DIA. INCHES	THD PER INCH	TORQUE LB-FT. (N•m) DRY	LUBED
3/4	10 16	265 (359)	200 (271)
7/8	9 14	420 (569)	325 (441)
1	8 14	640 (868)	485 (658)
1 1/8	7 12	790 (1071)	590 (800)
1 1/4	7 12	1110 (1505)	835 (1132)
1 3/8	6 12	1460 (1980)	1095 (1485)
1 1/2	6 12	1940 (2630)	1455 (1973)

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

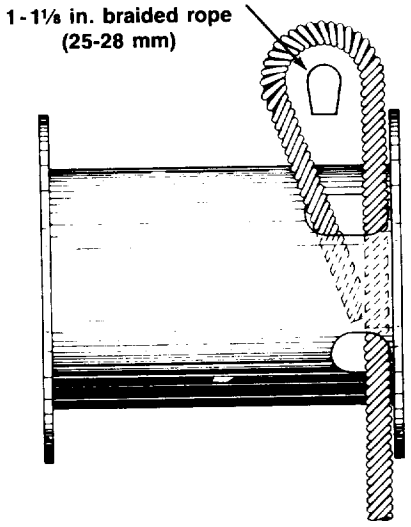
WIRE AND BRAIDED ROPE INSTALLATION

ANCHORING WIRE ROPE



Take the free end of the wire rope and insert it through the small opening of the anchor pocket. Loop the wire rope and push the free end about 3/4 of the way back through the pocket. Install the wedge, then pull the slack out of the wire rope. The wedge will slip into the pocket and secure the wire rope into the drum. The anchor is designed to accommodate several different sizes of wire rope. You may anchor 7/16 and 1/2 in. (11 & 13 mm) wire rope by inserting the wedge, large end first. Anchor 9/16 and 5/8 in. (14 & 16 mm) wire rope by inserting the wedge, small end first.

ANCHORING BRAIDED ROPE



A special wedge is used to anchor 1 and 1 1/8 in. (25 & 28 m) braided rope. The installation procedure is the same as for anchoring wire rope.

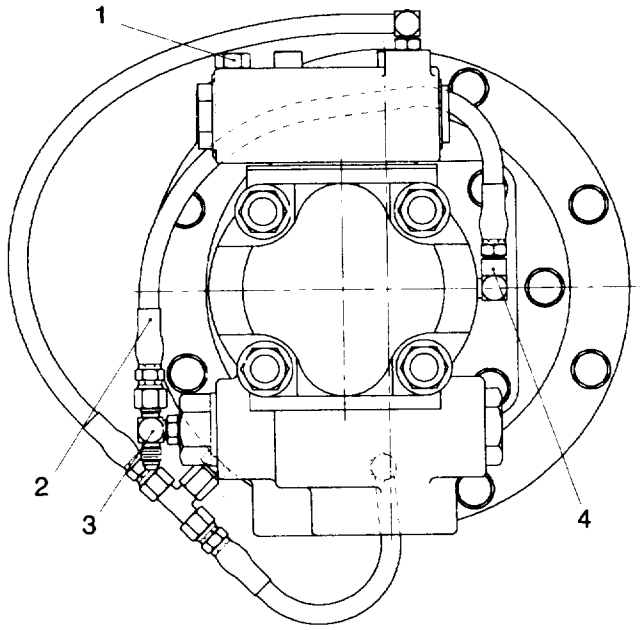
TWO SPEED MOTOR CASE DRAIN PLUMBING

Winches built prior to 1991 with two speed motor, Part No. 26182, have the motor case drain connected to the drain port of the brake valve. This may result in accelerated motor shaft wear and leakage. The following modification should be made to the motor hydraulic piping to prevent this type of seal damage.

1. Remove the motor case drain hose from the brake valve drain port and install plug, Item 1, into the valve port. Remove the hose from the case drain port elbow, Item 4.
2. Install a new case drain hose, Item 2, onto the motor case drain elbow, Item 4.
3. Install the tee adapter, Item 3, into the two-speed motor shift valve drain port (identified by long end cap).
4. Install the new motor case drain hose, item 2, onto the tee adapter.
5. Install a case drain hose from the tee directly to the reservoir. Minimum hose size is -6, 3/8 in. (9.5 mm). Maximum drain line back pressure is 100 PSI (7 Kg/cm^2) measured at the motor case drain port.

Parts needed for modification:

Item	Qty	P/N	Description
1	1	25663	Plug -4 (Aeroquip 900598-4S)
2	1	13707	Hose 17 in. OAL (-4 JIC Fml Svl/-4 Hose / 1/8 NPT ml)
3	1	29078	Tee -4 (Aeroquip 203003-4-4S)



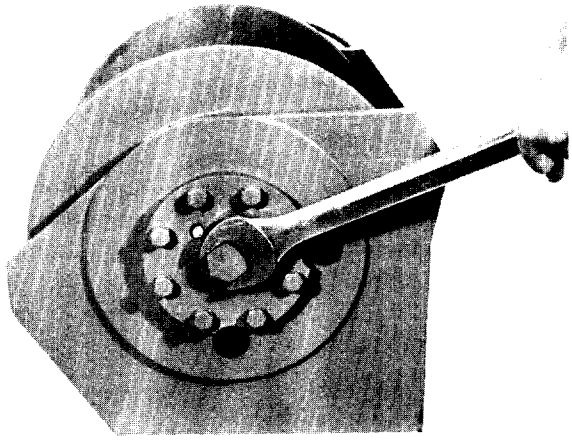
PREVENTIVE MAINTENANCE

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.

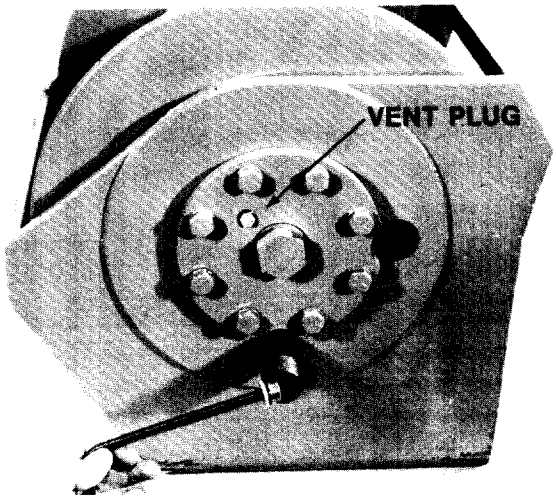
- **Regular Gear Oil Changes** — every 1000 hours or six (6) months
- **Use of Proper Gear Oil** — recommended type for prevailing ambient temperature
- **Annual Disassembly and Inspection of All Wear Items** — in compliance with American National Standards Institute (ANSI) specification B30.5c 1987 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. To check the oil level, remove the large plug located in the center of the drum support. The oil should be level with the bottom of this opening. If additional oil is 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 ever 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.

The gear oil should also be changed whenever the ambient temperature changes significantly and an oil from a different temperature range would be more appropriate. Oil viscosity with regard to ambient temperature is critical to reliable brake clutch operation. Our tests indicate that excessively heavy or thick gear oil may contribute to intermittent brake clutch slippage. Make certain that the gear oil viscosity 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 clutch 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 drum support as shown. 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 manufacturers 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 procedure

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

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

⚠ 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.

8. Recommended Planetary Gear Oil

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

⚠ WARNING

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

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

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

BRADEN planetary winches are factory filled with Texaco Meropa 150 or equivalent AGMA No. 4EP gear oil.

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.

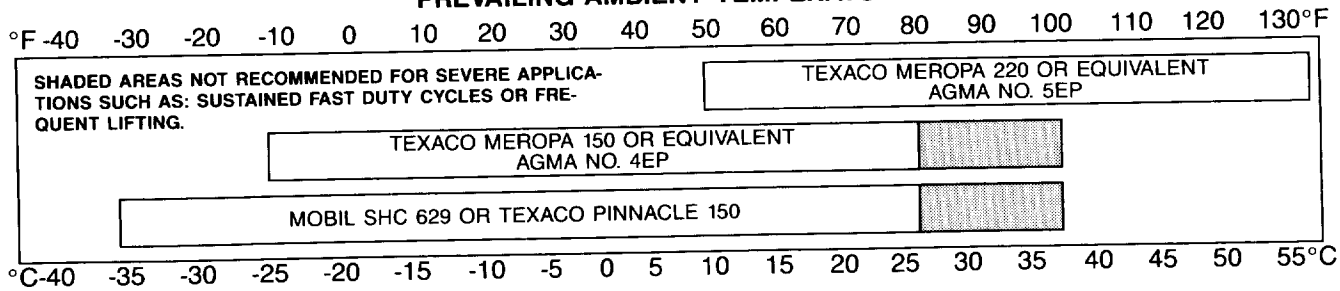
A. Bearings and Gears — Refer to DISASSEMBLY OF WINCH, item 17 on page 19; and PLANET CARRIER SERVICE, item 3 on page 20.

B. Brake Cylinder — Refer to MOTOR SUPPORT - BRAKE CYLINDER SERVICE, Clean and Inspect, pages 22 and 23.

C. Brake Clutch — Refer to BRAKE CLUTCH SERVICE, item 4 on page 26.

RECOMMENDED GEAR OIL

PREVAILING AMBIENT TEMPERATURE

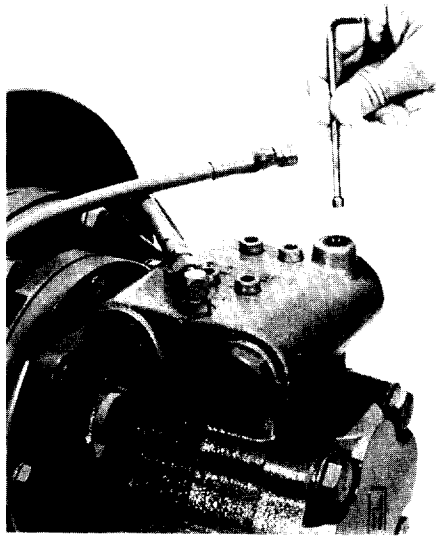


OIL CAPACITY

02 & 05 DRUM - 6 PINTS 04 DRUM - 7 PINTS

TROUBLE SHOOTING

⚠ WARNING If a winch ever exhibits any sign of erratic operation, or load control difficulties (i.e. load creeping or chattering) appropriate trouble shooting 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 problem could be a plugged or loose pilot orifice. The pilot orifice is a small pipe plug with a hole drilled through it, located behind the pilot port fitting on the brake valve. If it becomes plugged, it will prevent the pilot pressure, from the manifold, from opening the brake valve. If it becomes loose, it will allow an unregulated amount of oil in to operate the brake valve which causes eratic brake valve operation.	 Remove the pilot hose and fitting from the brake valve, then use a 5/32 inch Allen wrench to remove the pilot orifice. The diameter of the orifice is approximately .020 inches. Clean and install the pilot orifice tightly in the brake valve.
	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 winch vent plug.	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 gauge and shut-off valve to the – 4 J.I.C. fitting in the brake release port. B. Apply 1000 psi 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."
	3. Friction brake will not release as a result of damaged brake discs.	Dissassemble brake to inspect brake discs. Check stack-up height as described in "Motor Support-Brake Cylinder Service".

TROUBLE	PROBABLE CAUSE	REMEDY
B Oil leaks from vent plug.	1. Same as A2. 2. Motor seal may be defective as a result of high system back pressure or contaminated oil.	Same as A2. System back pressure must not exceed 150 psi. 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.
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. 2. Friction brake will not hold due to worn or damaged brake discs. 3. Brake clutch is slipping.	The same as remedy 2 of Trouble B2. Same as Remedy 3 of Trouble A3. 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. 2. System relief valve may be set too low. Relief valve needs adjustment or repair.	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. Check relief pressure as follows: A. Install an accurate 0-4000 psi (27,580 kPa) gauge into the inlet port of the brake valve.

TROUBLE "D" CONTINUED ON NEXT PAGE

TROUBLE	PROBABLE CAUSE	REMEDY
TROUBLE "D" CONTINUED FROM PREVIOUS PAGE		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 degrees F. 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.
E		
The winch runs hot.	1. Same as D1.	Same as remedies for Trouble D1.
	2. Be certain that the hydraulic system temperature is not more than 180 degrees. F. Excessive hydraulic oil temperatures may be caused by:	
	A. Plugged heat exchanger.	Thoroughly clean exterior and flush interior.
	B. Too low or too high oil level in hydraulic reservoir.	Fill/drain to proper level.
	C. Same as D2.	Same as remedies for Trouble D2.
	D. Hydraulic pump not operating efficiently.	Prime mover low on horsepower or R.P.M. Tune/adjust prime mover. Check suction line for damage. If pump is belt driven, belts are slipping. Replace/tighten belts. Pump worn. Replace pump.
	3. Excessively worn or damaged internal winch parts.	Disassemble winch to inspect/replace worn parts.

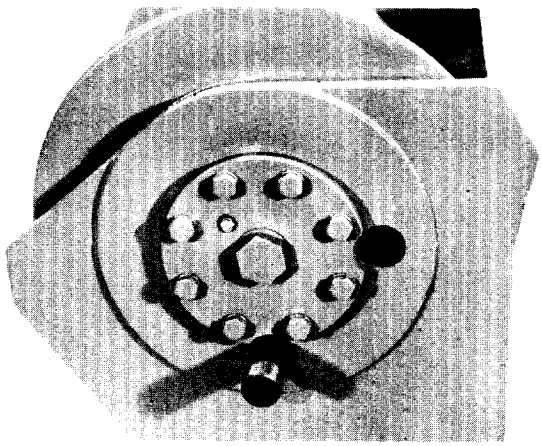
TROUBLE	PROBABLE CAUSE	REMEDY
F		
Winch "chatters" while raising rated load.	1. Same as D2.	Same as remedies for Trouble D2.
	2. Hydraulic oil flow to motor may be too low.	Same as remedies for Trouble E2.
	3. Controls being operated too quickly.	Conduct operator training as required.
G		
The wire rope 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.

DISASSEMBLY OF WINCH

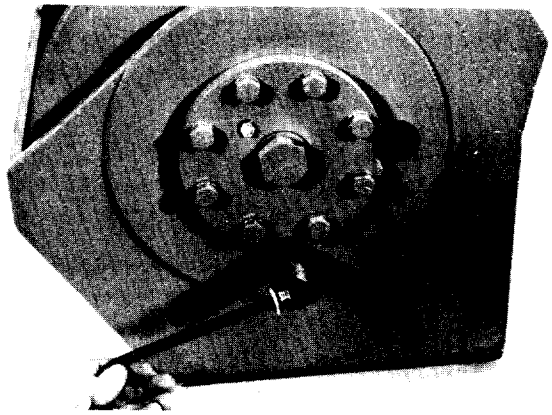
SERVICE PRECAUTIONS

- Before any part is removed from the winch, 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 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 nonflammable safety solvent. Wear protective clothing as required.

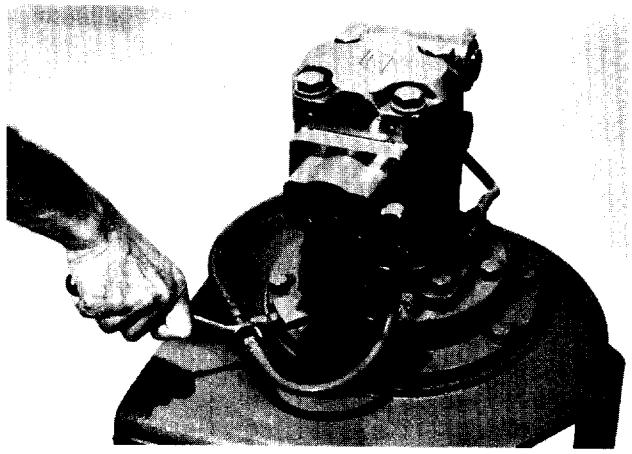
After trouble shooting the winch and its hydraulic system as covered in the "Trouble Shooting" section, and the problem is determined to be in the winch, use the following procedure to disassemble the winch.



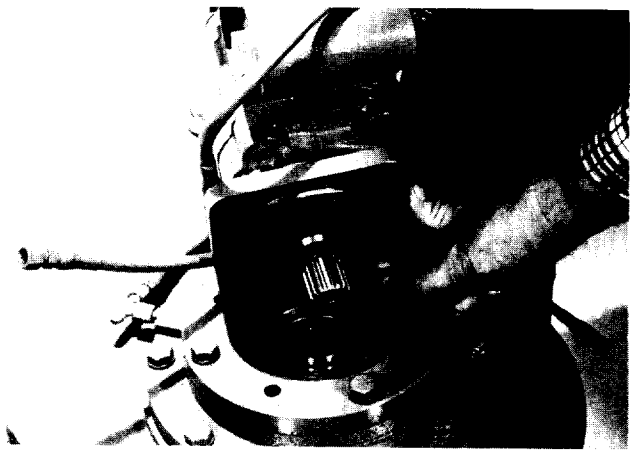
1. Remove the wire rope from the winch drum and align the drain hole in the drum with a hole in the support side plate before removing the hoses and mounting bolts. After the winch is removed from its mounting, thoroughly clean the outside surfaces. To drain the oil, install a short piece of 1 inch pipe in the larger threads of the drain hole. If necessary, insert a bar into the anchor pocket and manually rotate the drum in the direction to hoist a load until the drain holes are aligned.



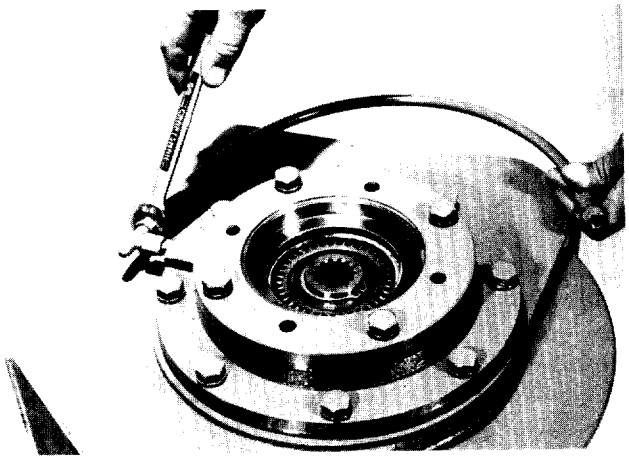
2. Use a 5/16 inch Allen wrench to remove the drain plug through the pipe.



3. Begin disassembly by removing the oil level plug and standing the winch on the bearing support end. Tag and remove the hydraulic hoses that connect the brake valve and manifold to the brake cylinder.



4. Remove the capscrews securing the motor, and lift the motor off the winch. Remove and discard the O-ring installed on the pilot of the motor.



5. Tag and remove the hoses and fittings from the brake cylinder release port.

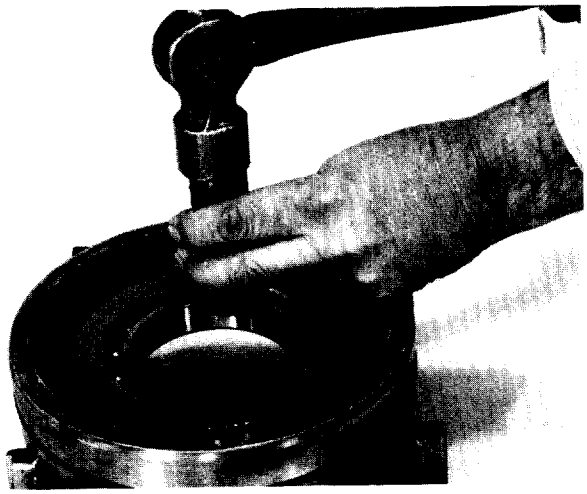
6. Remove the brake clutch assembly from the motor support. Refer to "Brake Clutch Service" for additional information.

7. Remove the motor support capscrews and install two (2) capscrews and a short piece of chain into the motor mounting bolt holes. Using the chain as a handle, lift the motor support out of the brake cylinder being careful to avoid damaging the sealing surfaces. Remove and discard the O-ring and back-up ring from the motor support. Refer to "Motor Support-Brake Cylinder Service" for additional information.

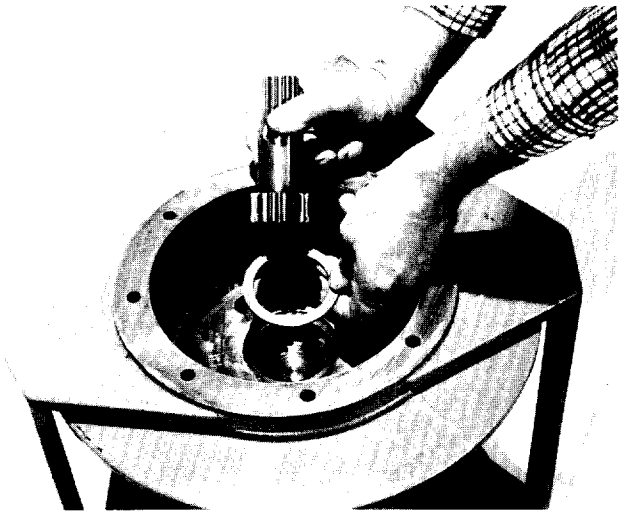
8. Remove the brake cylinder capscrews and install two (2) capscrews and a short piece of chain into the motor support mounting bolt holes. Using the chain as a handle, lift the brake cylinder out of the drum and base, being careful to avoid damaging the sealing or bearing surfaces. Refer to "Motor Support-Brake Cylinder Service" for additional information.

   For PD15B winches, the drum closure cannot be removed through the opening in the base. If your winch has a cast base, remove the bearing support, as described in step 15, and remove the drum from the base. Then proceed with steps 9 thru 14. If your winch has a three piece base, remove the motor end side plate and continue with step 9.

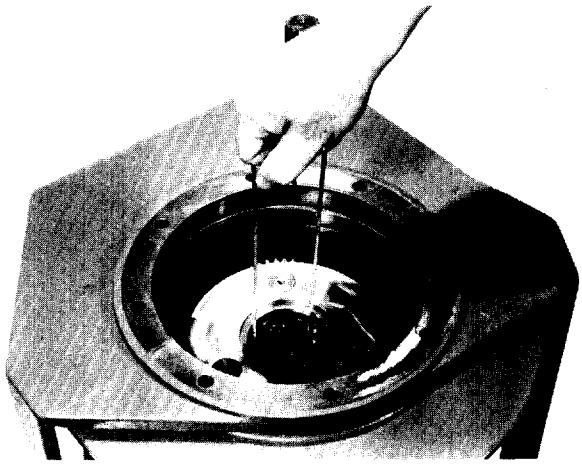
9. Using two heel type pry bars placed between the primary planet carrier and the drum closure, pry upward to remove the drum closure. Remove and discard the O-ring from the outside of the drum closure.



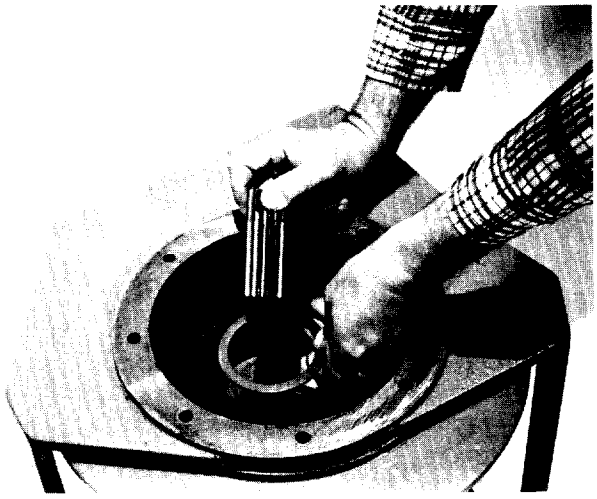
10. Remove the seal and bearing from inside of closure.



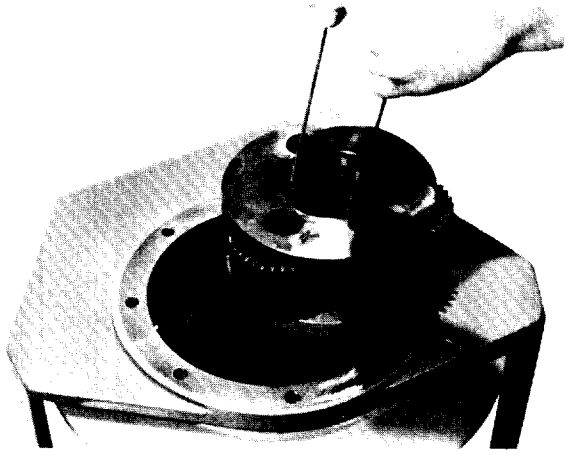
11. Remove the primary sun gear and thrust washer from the primary planet carrier.



12. Remove the primary planet carrier from the drum. Refer to "Planet Carrier Service" for additional information.

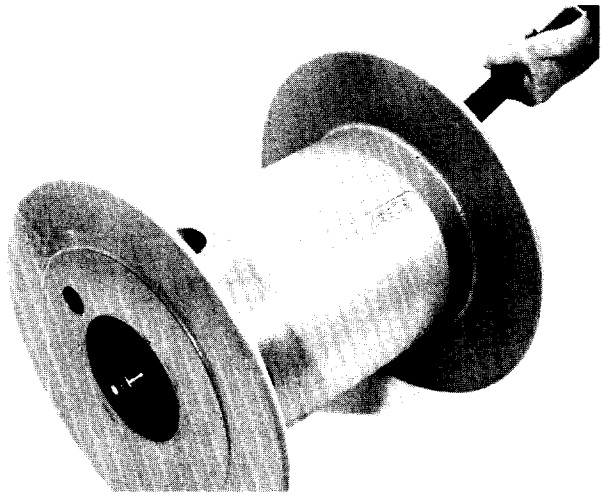


13. Remove the output sun gear and thrust washer from the output planet carrier.

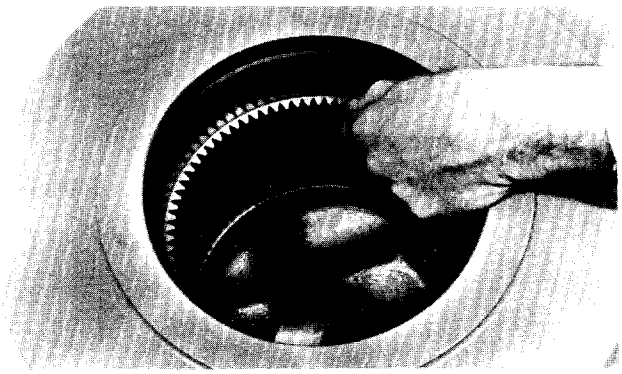


14. Remove the output planet carrier from the drum. Refer to "Planet Carrier Service" for additional information.

15. Stand winch on motor end with bearing support up; then remove eight (8) bearing support capscrews and bearing support being careful to avoid damaging the sealing or bearing surfaces.

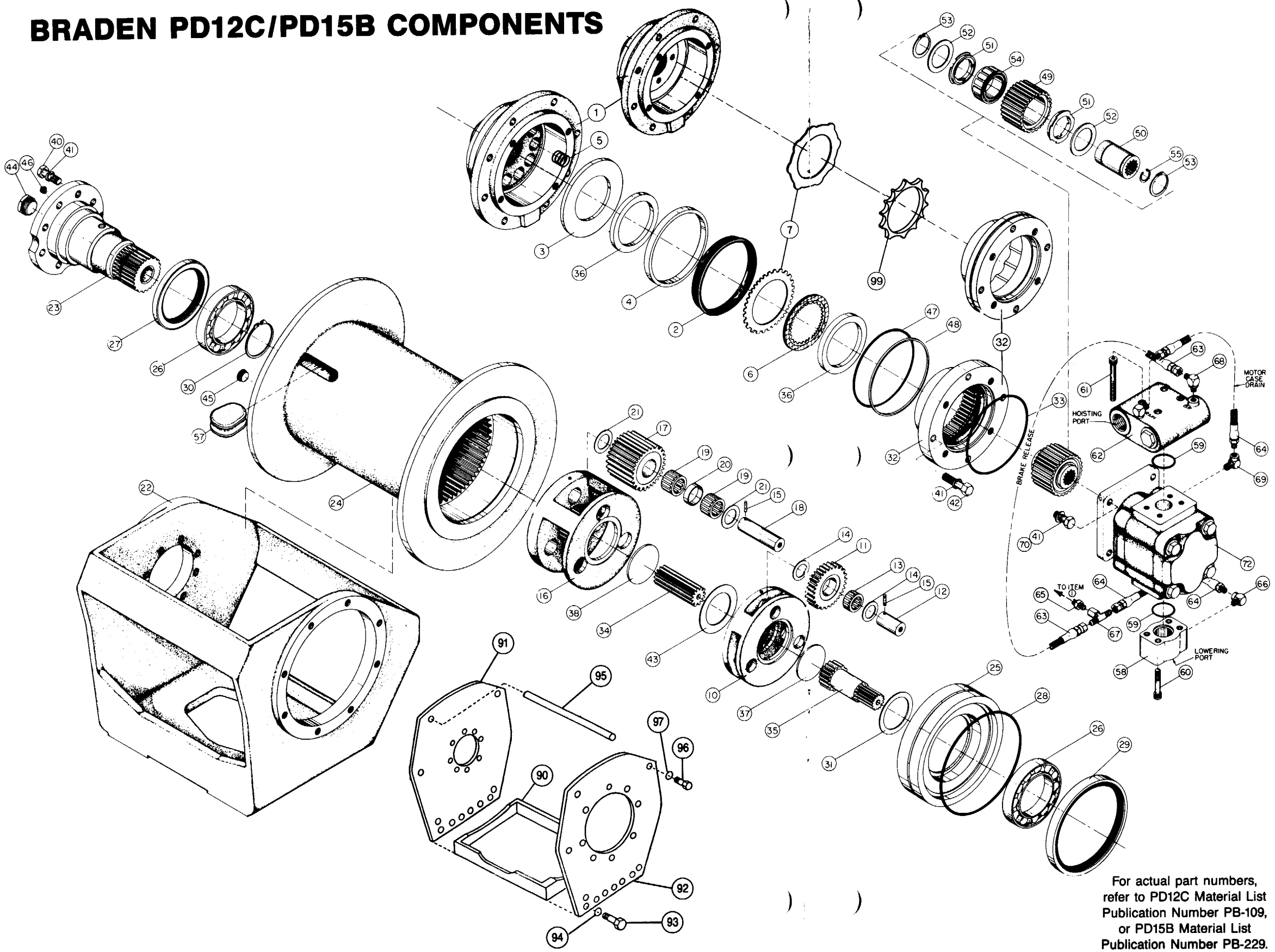


16. Slide drum out of base onto a work bench and remove seal and bearing from support end.



17. Thoroughly clean and inspect drum and base. Check ring gear (machined into inside surface of drum) 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.

BRADEN PD12C/PD15B COMPONENTS



For actual part numbers, refer to PD12C Material List Publication Number PB-109, or PD15B Material List Publication Number PB-229.

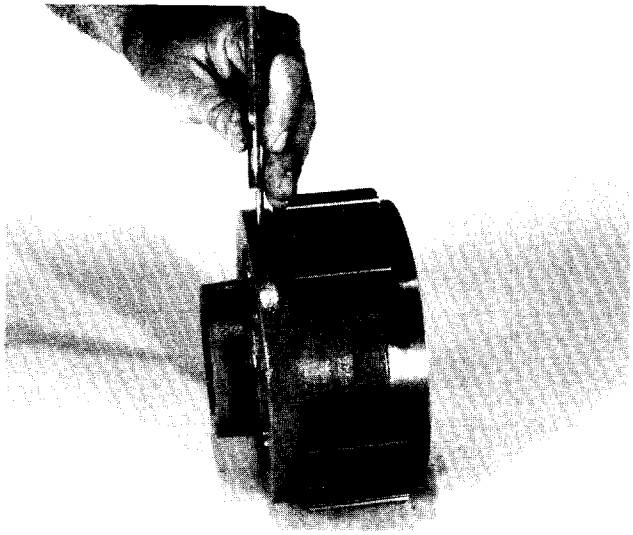
PD12C/PD15B PARTS KEY

ITEM	QUANTITY	DESCRIPTION
1	1	Brake Cylinder
2	1	Piston Seal
3	1	Pressure Plate
4	1	Piston Back-up Ring
5	12	Spring
6	7	Disc-friction
7	8	Disc-brake
10	1	Primary Planet Carrier
11	3	Primary Planet Gear
12	3	Primary Planet Gear Shaft
13	3	Roller Bearing
14	6	Thrust Washer
15	6	Spirol Pin
16	1	Output Planet Carrier
17	3	Output Planet Gear
18	3	Output Planet Gear Shaft
19	6	Roller Bearing
20	3	Bearing Spacer
21	6	Thrust Washer
22	1	Base
23	1	Bearing Support
24	1	Cable Drum
25	1	Cable Drum Closure
26	2	Ball Bearing
27	1	Oil Seal
28	1	O-Ring
29	1	Oil Seal
30	1	Retaining Ring
31	1	Thrust Washer
32	1	Motor Support
33	1	O-ring
34	1	Output Sun Gear
35	1	Primary Sun Gear
36	2	Spacer
37	1	Primary Thrust Plate
38	1	Output Thrust Plate
40	16	Capscrew
41	24	Lockwasher
42	4	Capscrew
43	1	Thrust Washer
44	1	Plug — Hex. Head
45	1	Plug — Flush
46	1	Vent Plug
47	1	O-ring
48	1	Back-up Ring
49	1	Brake Race — Outer
50	1	Brake Race — Inner
51	2	Sprag Bushing
52	2	Sprag Bushing Retainer
53	2	Retaining Ring
54	1	Sprag Clutch
55	1	Retaining Ring
57	1	Cable Clamp
58	1	Manifold
59	2	O-ring
60	4	Capscrew — Socket Head
61	4	Capscrew — Socket Head
62	1	Brake Valve
63	1	Hose Assembly
64	2	Hose Assembly — 12 In.
65	1	Adapter — Straight
66	1	Elbow
67	1	Swivel Tee
68	1	Elbow
69	1	Reducer Elbow
70	4	Capscrew
72	1	Hydraulic Motor
90	1	Base Plate
91	1	Side Plate (bearing support end)
92	1	Side Plate (motor end)
93	16	Capscrew (special)
94	16	Washer
95	1/2	Tie Bar
96	2/4	Capscrew
97	2/4	Lockwasher
99	1	Spring Spacer

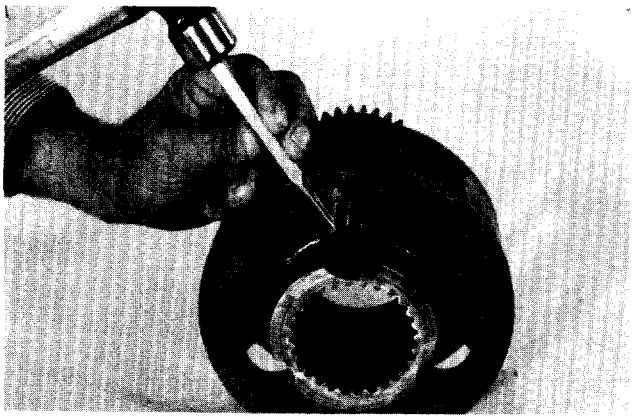
PLANET CARRIER SERVICE

OUTPUT PLANET CARRIER

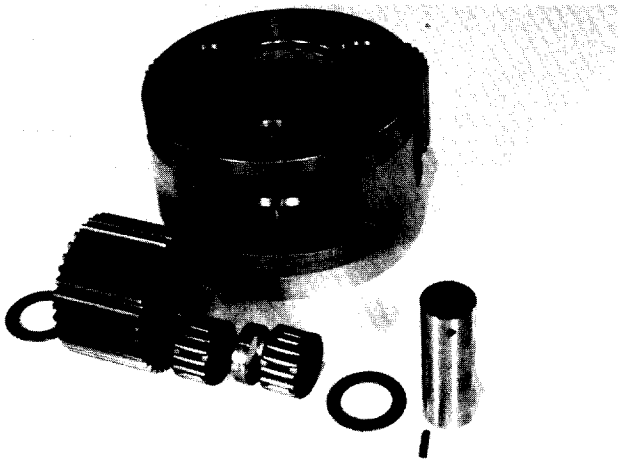
DISASSEMBLY



1. Remove the planet gears by driving the roll pins into the center of the planet shafts.

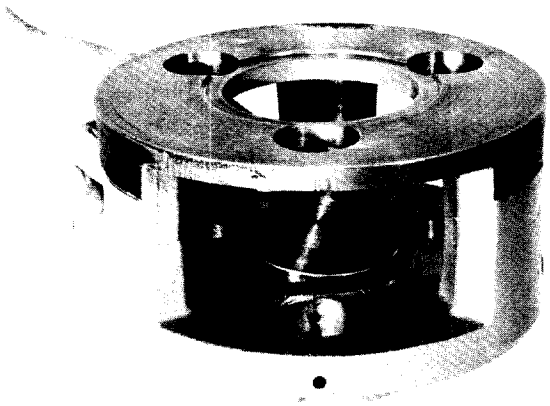


2. Use a punch to drive the roll pins from the planet shafts. Do not reuse the roll pins.

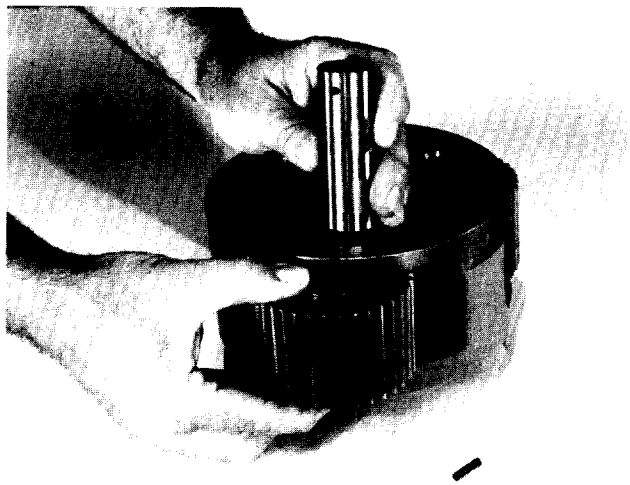


3. Now you can remove the planet shafts, bearings, spacer, thrust washers and gears. Thoroughly clean all parts and inspect for damage and wear. The bearing rollers should not exhibit any irregularities. If the rollers show any sign of spalling, corrosion, discoloration, material displacement or abnormal wear, the bearing should be replaced. Likewise, the cage should be inspected for unusual wear or deformation, particularly the cage bars. If there is any damage that will impair the cage's ability to separate, retain and guide the rollers properly, the bearing should be replaced. The thrust washer contact areas should be free from any surface irregularities that may cause abrasions or friction. The gears and shafts should be inspected for abnormal wear or pitting. Replace if necessary.

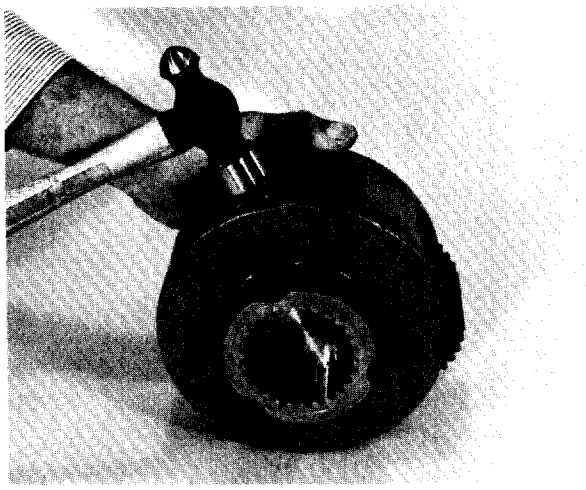
ASSEMBLY



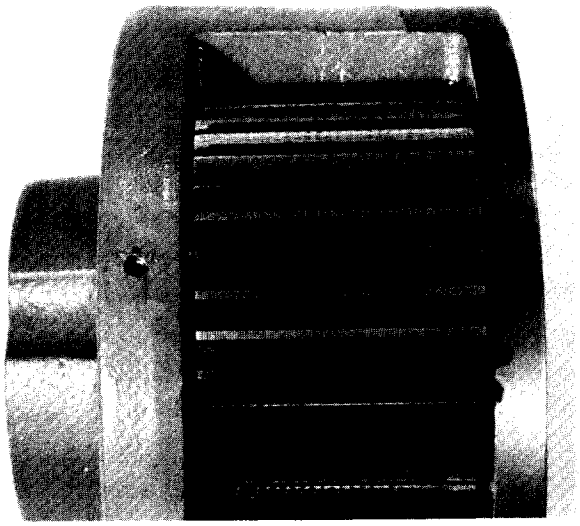
1. Place the output planet carrier on workbench with splined coupling side down. Install output thrust plate in center of carrier.



2. Insert two (2) bearings and a bearing spacer into a gear with the spacer between the bearings. Place a thrust washer on each side of the gear and position in a carrier opening. Slide the shaft through the carrier, thrust washer, bearing-gear sub-assembly and remaining thrust washer.



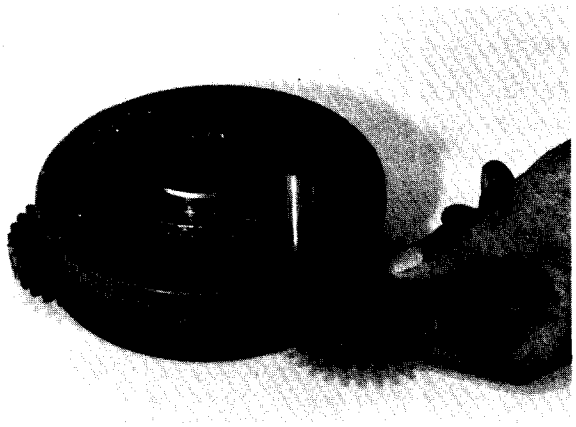
3. Carefully align the pin hole in the carrier with the hole in the planet gear shaft and drive the roll pin into place. Always use *NEW* roll pins. When properly positioned, 50% of the rollpin will engage the planet gear shaft and 50% will remain in the planet carrier.



4. Note that the roll pin is slightly recessed in the carrier when properly installed. 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. Repeat these steps for each of the three planet gears.

5. Completed output planet carrier.

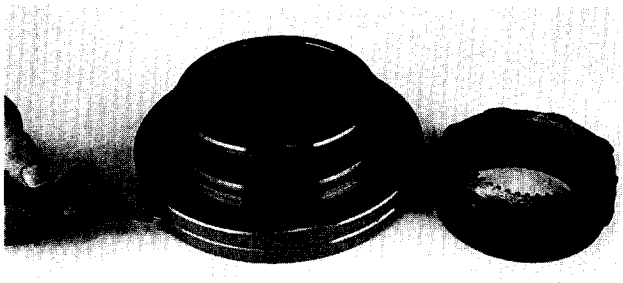
PRIMARY PLANET CARRIER



1. To service the primary planet carrier, the steps are the same as for the output carrier except there is only one bearing for each gear and no bearing spacer.

MOTOR SUPPORT-BRAKE CYLINDER SERVICE

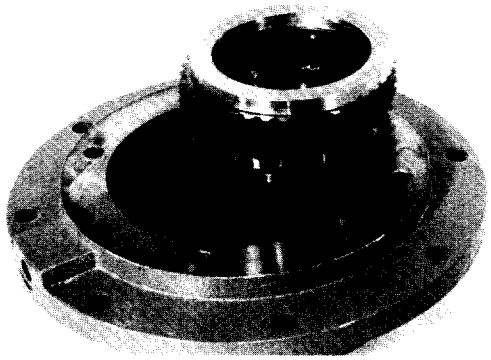
NOTE: Starting mid-year 1996, Braden changed the steel brake separator discs from a splined tooth design to a lobed design. This required a change to the motor support and brake cylinder, and the addition of a spring spacer. A winch with the lobed discs can be identified by a machined groove on the outside diameter of the motor support. When replacing steel brake discs, the motor support or brake cylinder, care must be taken to properly identify the correct parts. Splined discs, and their mating motor support and brake cylinder will remain available as spare parts.



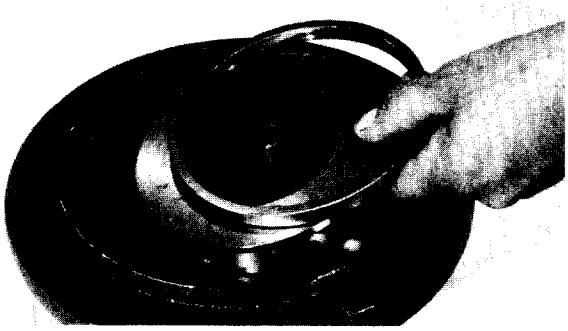
New lobed steel brake separator plates and motor support. Note groove on outside diameter of motor support.

Although most photos in this section show splined discs, all procedures are the same except where specifically noted.

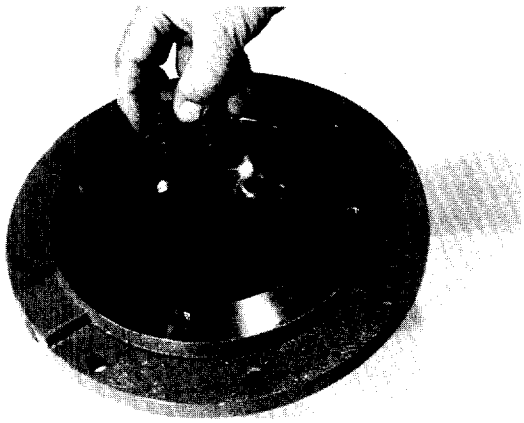
DISASSEMBLY



1. After removing the motor support and brake clutch assembly, continue brake cylinder disassembly by removing the spacers, friction brake discs, and steel brake discs.



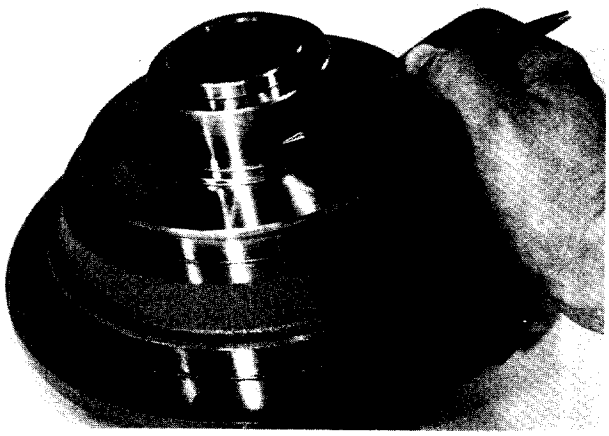
2. Remove the piston back-up ring and pressure plate.



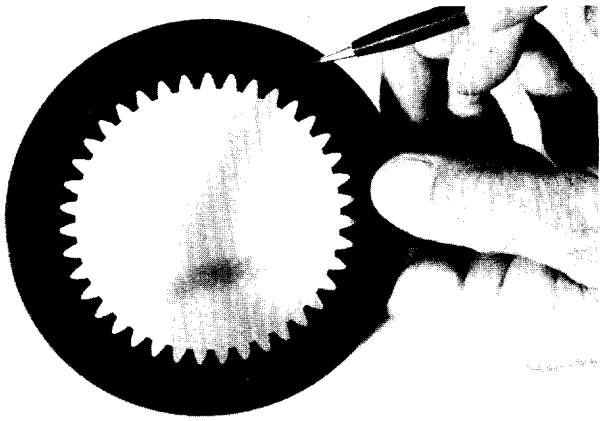
3. Remove the brake springs.

CLEAN AND INSPECT

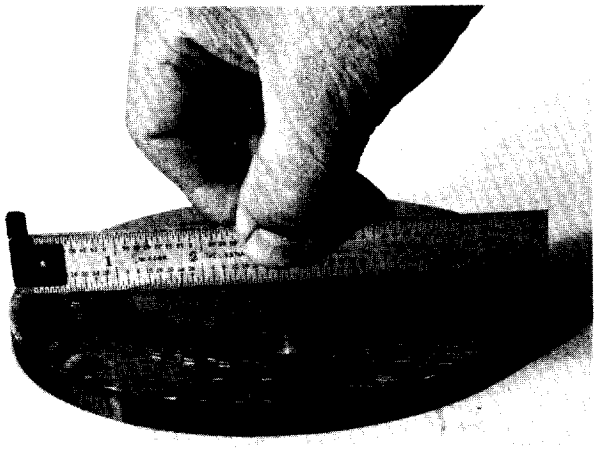
1. Thoroughly clean and inspect all parts at this time. Check brake piston sealing surfaces on brake cylinder and motor support. Be sure brake release port is free of contamination.



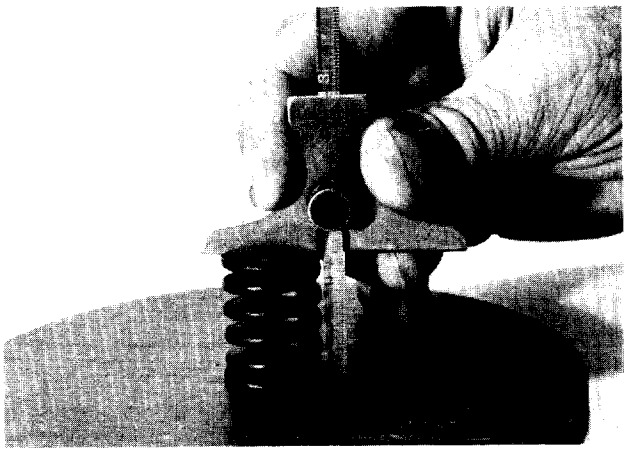
2. Check oil seal and bearing surfaces on brake cylinder for damage or wear.



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



4. Place steel brake disc on 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.



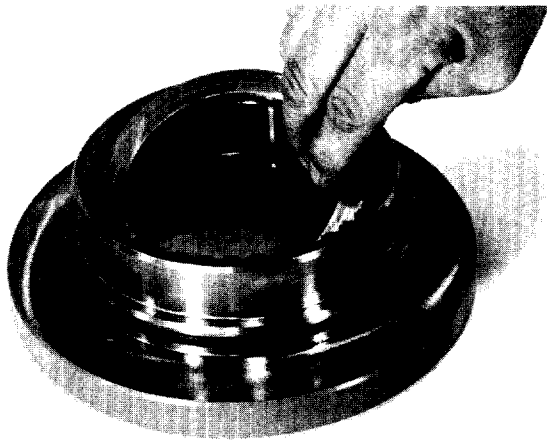
5. Check brake spring free length; minimum free length is 1 3/16 in. (30.2 mm). Check springs for any sign of cracking or failure. If a brake spring must be replaced for any reason, then *ALL* brake springs must be replaced.

⚠ CAUTION

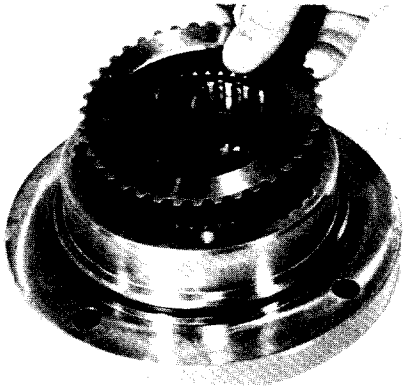
Failure to replace brake springs as a set may result in uneven brake application pressure and repeated brake spring failure.

ASSEMBLY

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

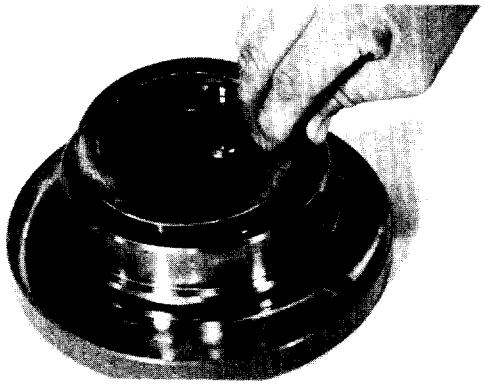


2. Install a brake spacer into the motor support. (Not required with lobed discs)

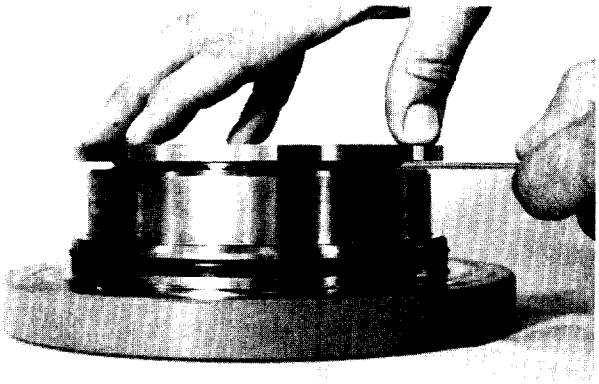


3. Insert first, a steel brake disc against the spacer followed by a friction brake disc then alternate steel and friction discs until seven (7) friction and eight (8) steel discs have been installed. Finish with a steel brake disc on top.

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

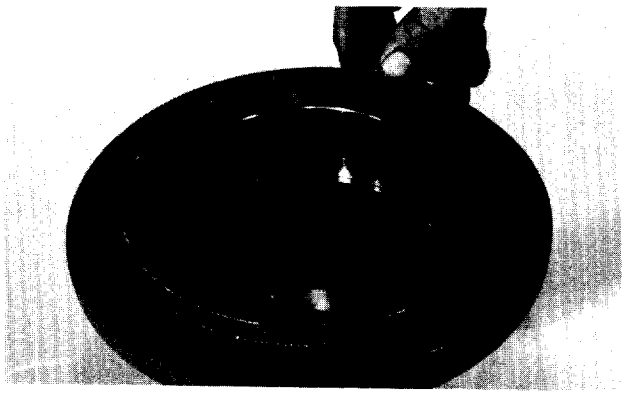


4. Install the remaining brake spacer on top of the last steel brake disc. (This is the only spacer used with lobed discs.)



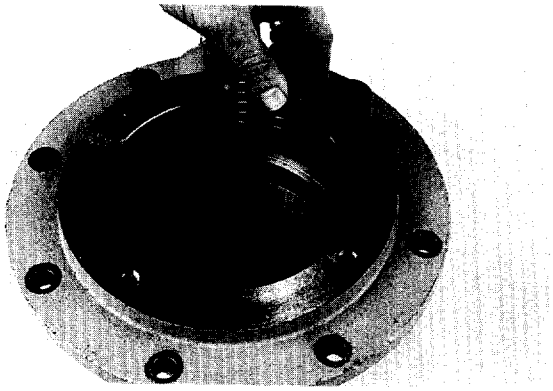
5. To check brake stack height, place pressure plate on top of brake spacer. Hold pressure plate down firmly by hand and measure clearance in three places between motor support and pressure plate. Average gap must measure between .153 in. (4 mm) maximum and .080 in. (2 mm) minimum. If the gap exceeds the maximum limit, there are too many brake discs in stack-up or the discs are distorted. If the gap is less than the minimum, there are two few discs in stack-up or the discs are worn out. When stack height is correct remove pressure plate and continue assembly.

6. Lubricate the brake piston seal and motor support sealing surface with petroleum jelly or hydraulic oil. Install new piston seal to motor support, seal lip down.



OLDER STYLE BRAKE CYLINDER

7. Install brake springs into brake cylinder.

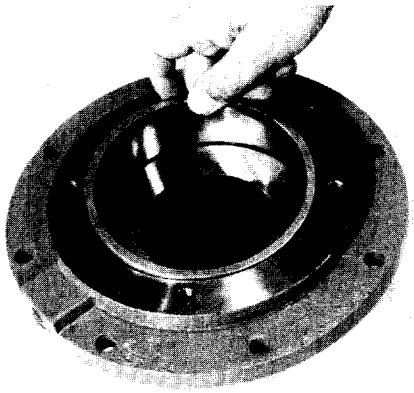


NEW STYLE BRAKE CYLINDER

7A. When using the new style brake cylinder wtihout milled spring pockets, install the spring spacer, then the brake springs.

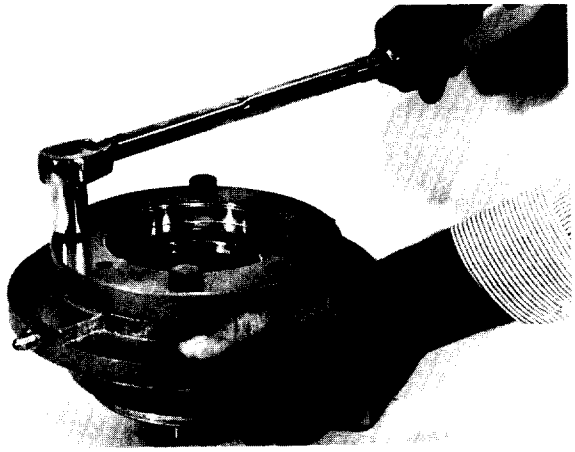
⚠ WARNING

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



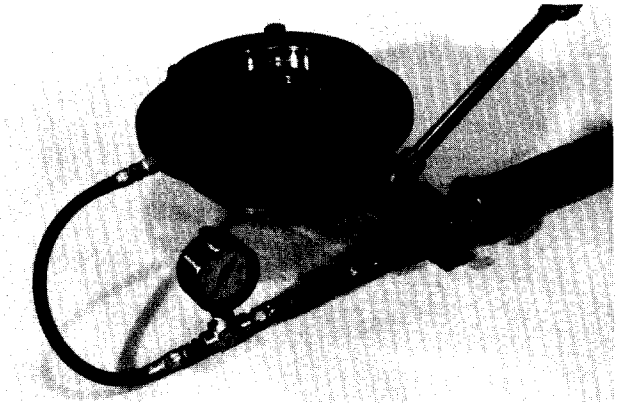
8. Install pressure plate into brake cylinder followed by the piston back-up ring. The close-fitting piston back-up ring may be depressed slightly to one side to lodge the back-up ring in the brake cylinder bore and temporarily hold the pressure plate and springs in place while you lower the brake cylinder over the motor support.

9. Apply petroleum jelly to the entire sealing surface of the brake cylinder and to the piston seal. Install the brake cylinder over the motor support being careful to avoid damaging the piston seal or motor support O-ring. (A press may be necessary to avoid cocking the brake cylinder during installation.)

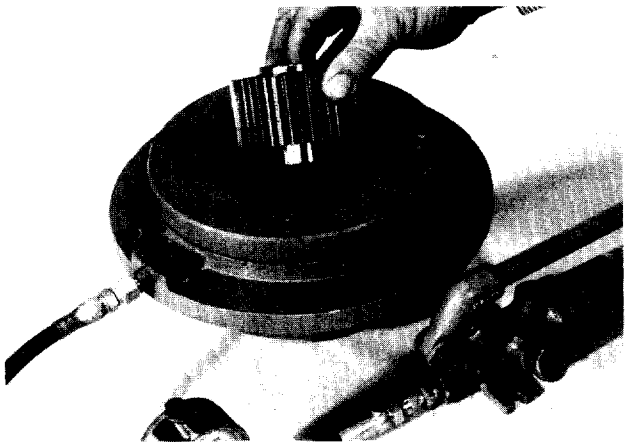


10. Install motor support capscrews and evenly tighten to recommended torque.

BRAKE CYLINDER PRESSURE TEST



1. Install the −4 J.I.C. fitting into the brake release port. Connect a hand pump with accurate 0-2000 psi (0-13,800 kPa) gauge and shut-off valve to this fitting. Apply 1000 psi (6,900 kPa) to the brake. Close shut-off valve and let stand for five (5) minutes. If there is any loss of pressure in five (5) minutes, the brake cylinder should be disassembled for inspection of the sealing surfaces and brake piston.

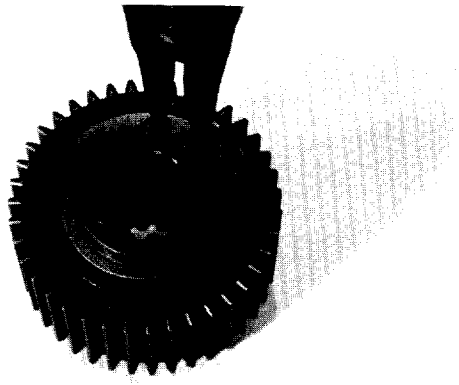


2. WHILE PRESSURE IS APPLIED AND THE BRAKE RELEASED, install the brake clutch assembly in the brake pack, short end of the inner race toward motor. Turn the clutch back and forth as you align the outer race splines with the brake disc splines.

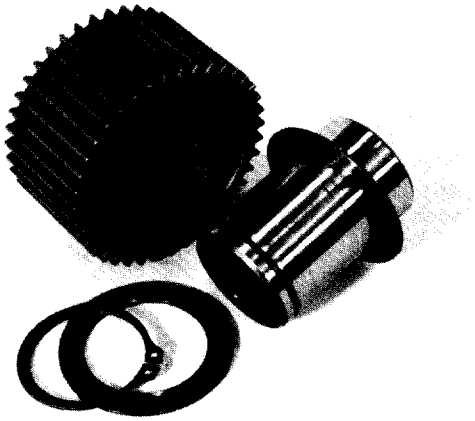
3. Release the pressure on the brake cylinder then remove the brake clutch assembly. The brake cylinder assembly is now complete and ready to be installed in the winch.

BRAKE CLUTCH SERVICE

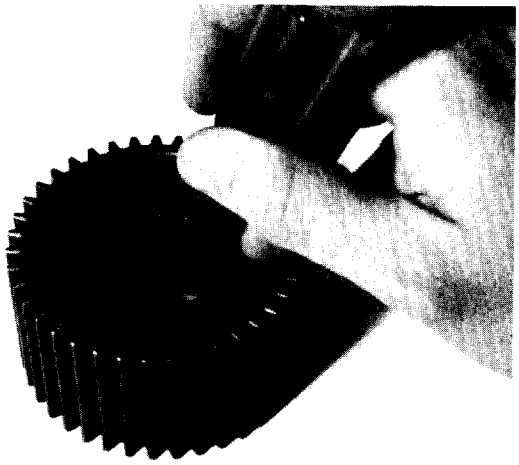
DISASSEMBLY



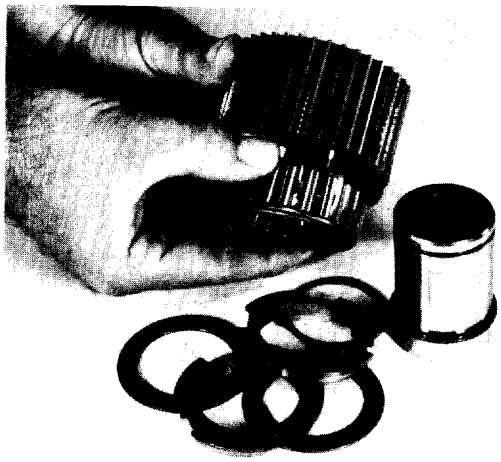
1. Remove the snap ring and sprag bushing retainer from one end only.



2. Pull the inner race out. Examine the race for scoring, wear or indentations caused by the sprag cams. Replace the race if necessary.



3. Use a screwdriver and mallet to remove the sprag bushing from one end of the outer race. There are four special cut-outs in the bushing for this purpose. Be careful not to damage the bushing inside surface. If a bushing's inside surface is damaged or shows wear, replace it.

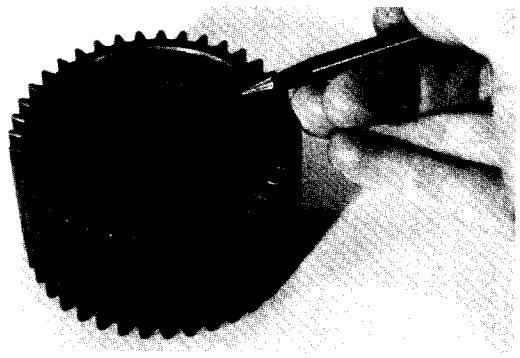


4. Next, slide the sprag clutch out, inspect the sprag clutch closely for abnormal wear, cracks, pitting, or corrosion. Check small clips for breakage or bright spots; the signs of excessive wear. Unless the outer race or remaining sprag bushing is damaged or shows excessive wear, there is no need for further disassembly. If disassembly is necessary, remove the bushing according to the procedure covered in Step No. Three (3). All brake clutch assembly parts should be thoroughly cleaned and inspected before assembly.

⚠ WARNING

The polished surfaces of the races and sprag cams must be perfectly smooth to insure positive engagement of the clutch. The slightest defect may reduce brake clutch effectiveness, which may lead to loss of load control and result in property damage, personal injury or death. It is generally recommended to replace the entire brake clutch assembly if any component is defective.

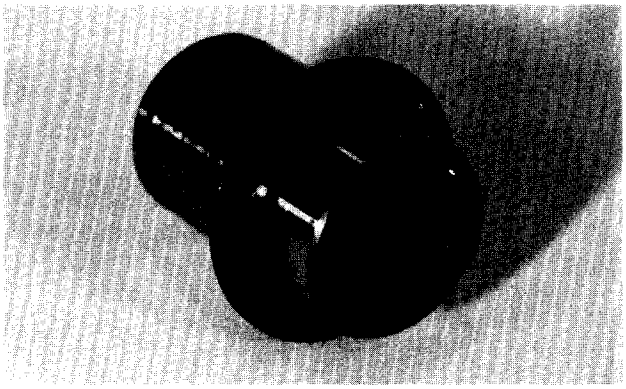
ASSEMBLY



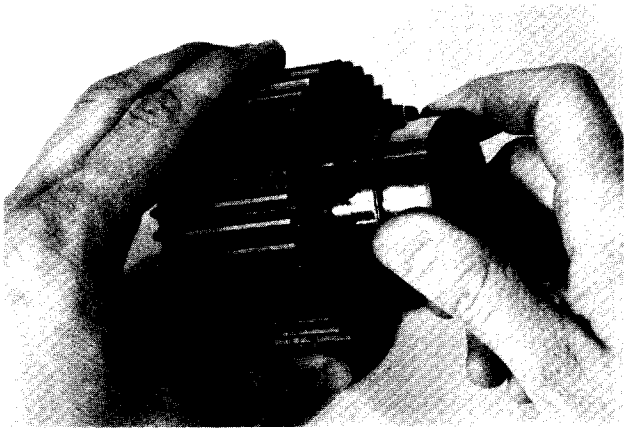
1. Press a sprag bushing into the outer race, using a mechanical or hydraulic press. A flat plate of approximately the same diameter as the bushing flange outside diameter should be placed between the press and bushing during assembly to protect the bushing. Be certain the bushing flange is against the shoulder in the outer race.

2. Turn the assembly over and install the sprag clutch in the bore of the outer race.

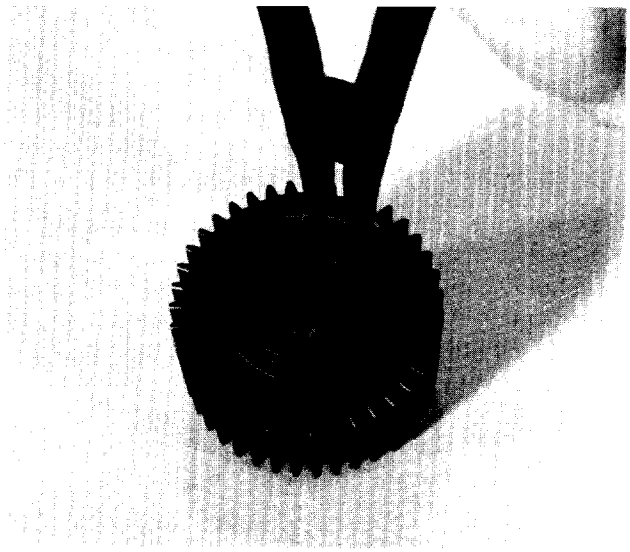
3. Press the remaining bushing into the race. Again, make sure the bushing is against the shoulder.



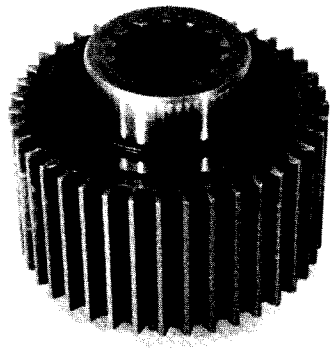
4. Next, install a sprag bushing retainer, then a snap ring on the inner race. Be sure the snap ring is seated in the snap ring groove.



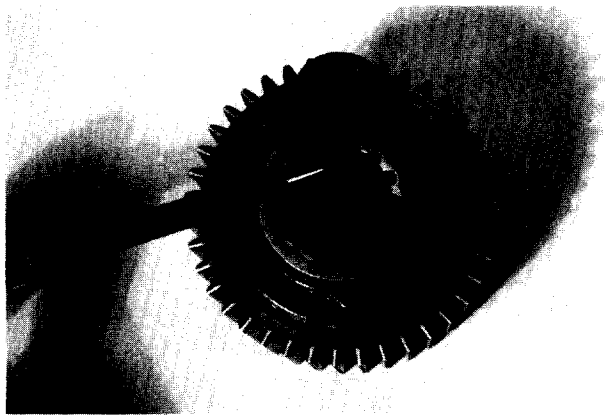
5. Slide the inner race through the bushings and sprag clutch (the race will have to be rotated in the free-wheeling direction to start it through the sprag clutch). If the inner race will not go through the bushings, the bushings have probably been damaged and should be replaced.



6. Turn the assembly over with the snap ring down. Install the second retainer and snap ring. Make certain the snap ring is seated in the groove properly.



7. This is a completed brake clutch assembly.



⚠ WARNING

Be certain the snap ring is seated in the groove in the splined bore of the inner race. This snap ring will keep the brake clutch assembly 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.

WINCH ASSEMBLY

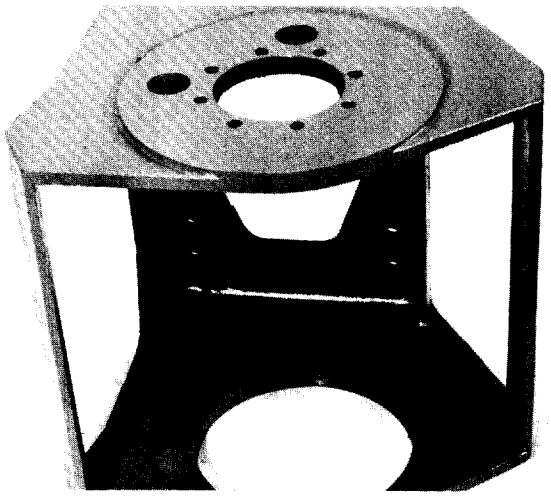
NOTE: PD15B winches ONLY

The drum closure will not fit through the opening in the base. For winches with a three piece base, first assemble the bearing support side plate (91) to the base plate (90). Go to step 1 and follow the assembly procedure. Install the motor end side plate and tie bar(s) after installing the drum closure in step 10.

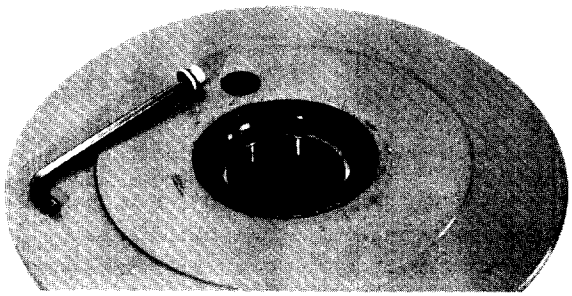
For winches with a one piece cast base, use the following assembly procedure. With the drum horizontal, install the output planet carrier assembly, output sun gear (34), thrust washer (43), primary planet carrier assembly, thrust washer (31) and drum closure. (Apply a light coat of grease to the thrust washers to hold them in position.) Position the drum in the base and install the bearing support. (Refer to step 3 for two caution statements.) You may have to rotate the bearing support or planet gears to engage the bearing support with the output planet carrier. Install and hand tighten the bearing support capscrews. Stand winch on bearing support end and visually check to verify the primary thrust plate is properly positioned. (Refer to caution and drawings in step 16.) Install the primary sun gear and proceed to step 11 to complete winch assembly. Tighten bearing support capscrews to recommended torque after motor is installed.

⚠ CAUTION

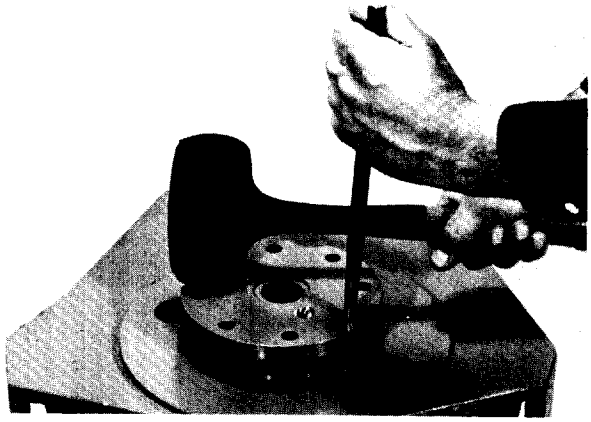
Winches with a three piece fabricated base use special shoulder capscrews to fasten side plates to the base plate. **DO NOT** use standard capscrews in their place.



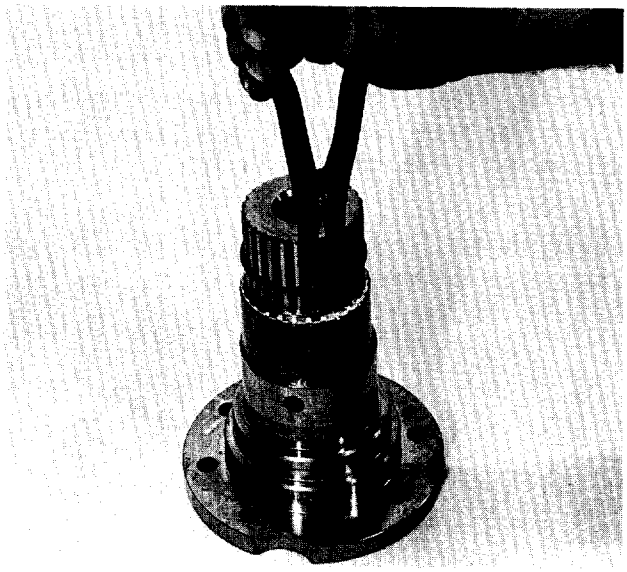
1. Place winch base on side with bearing support end up.



2. Install a new bearing in the drum if replacement is necessary. Apply a non-hardening sealant on the outside diameter of the new seal. Install the spring side of the seal next to the bearing, then press into the drum, using a flat plate to avoid distortion. Be sure drain plug is installed securely.



3. Center the drum in the opening of the base. Lubricate the bearing support with petroleum jelly or gear oil and install in base and drum.

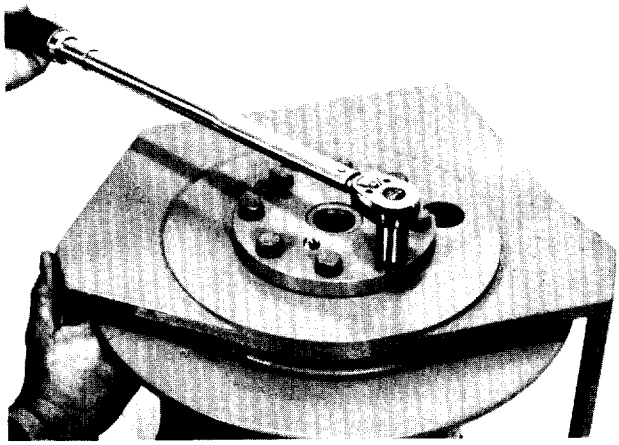


⚠ CAUTION

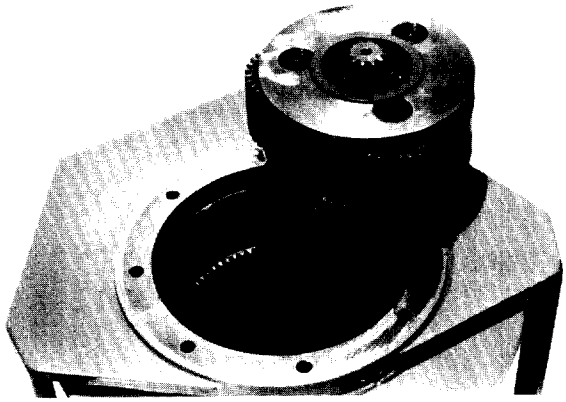
Make certain the snap ring is installed on the bearing support. This snap ring will keep the output planet carrier correctly positioned in the winch. Gear train damage may occur if this snap ring is omitted.

⚠ CAUTION

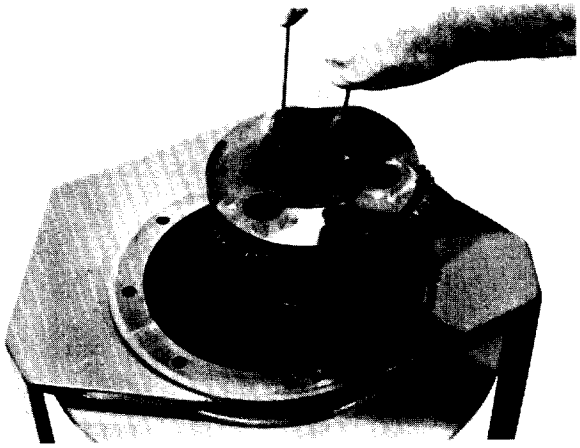
Be sure the vent plug is located above the horizontal centerline for the intended application. Oil leakage may occur if vent is positioned incorrectly.



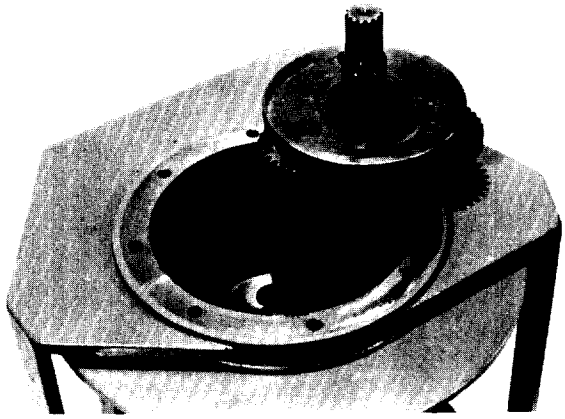
4. Tighten the bearing support capscrews to the recommended torque.



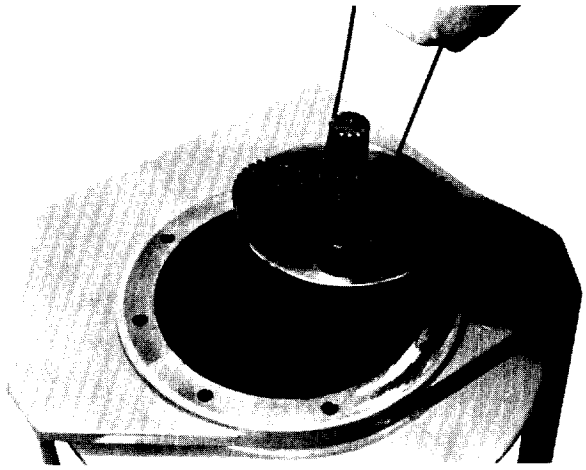
5. Stand winch on bearing support end. Install the output sun gear and thrust washer into output planet carrier.



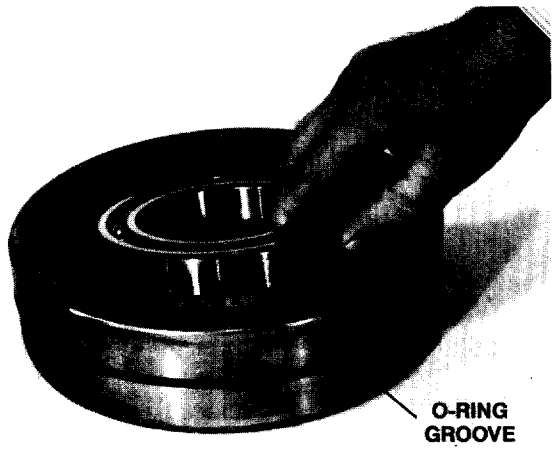
6. Install the output planet carrier into the drum while meshing the planet gears with the ring gear and the planet housing with the bearing support.



7. Install the primary sun gear and thrust washer into the primary planet carrier.



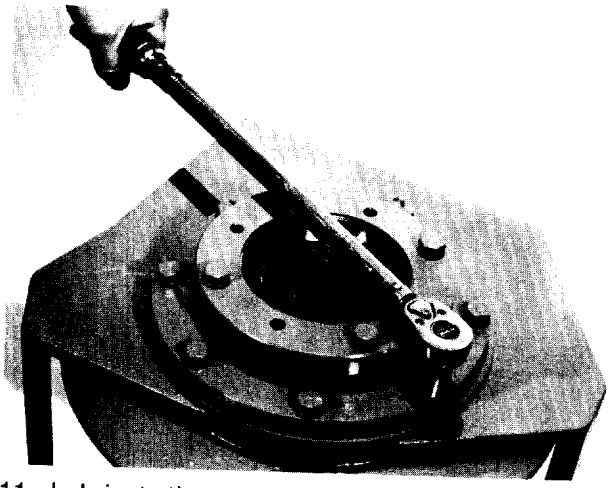
8. Install the primary planet carrier, meshing the planet gears with the ring gear and the planet housing with the output sun gear.



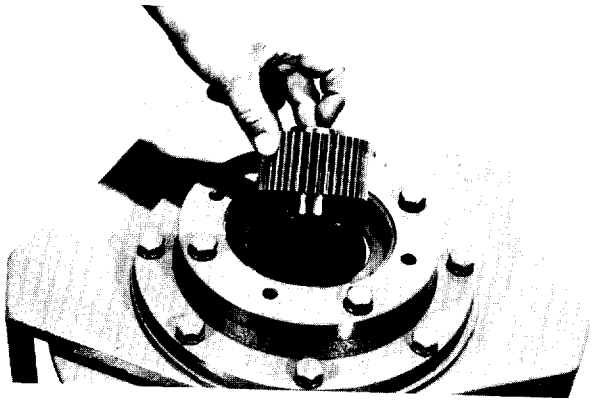
9. Install a new bearing in the drum closure as required. Use sealant on the outside surface of the oil seal. Install with spring side of the seal toward bearing, using a flat plate to avoid distortion.

   Install a new o-ring in the groove on the O.D. of the drum closure.

10. Lubricate the O-ring and drum opening with petroleum jelly or gear oil and install the drum closure into the drum.



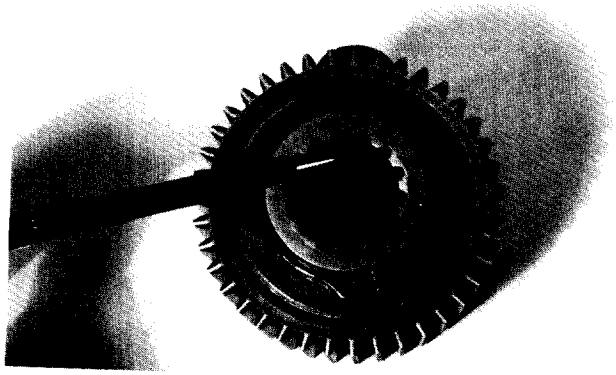
11. Lubricate the pilot, oil seal and bearing surfaces of the brake cylinder and carefully install brake cylinder into base and drum. Locate the brake release port toward the lower rear corner of the base. Tighten brake cylinder capscrews to recommended torque.



12. Install the brake clutch assembly with the short end of the inner race toward motor.

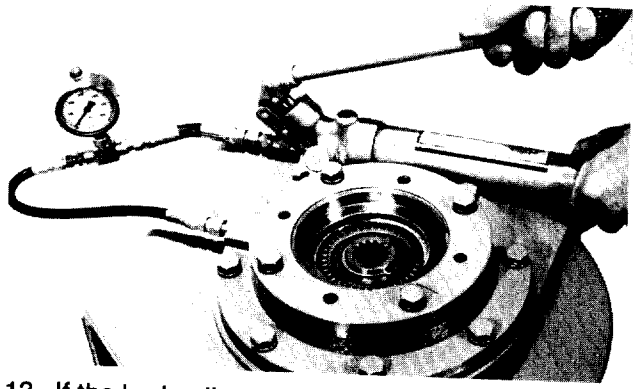
    When installed correctly, the inner race should turn freely in the opposite direction the drum turns to pull wire rope in. An easy way to check the rotation is to hold the outer race in one hand, and rotate the inner race.

If the clutch free wheels in the wrong direction, disassemble the clutch and reverse the inner race. Refer to "Brake Clutch Service" for additional information.

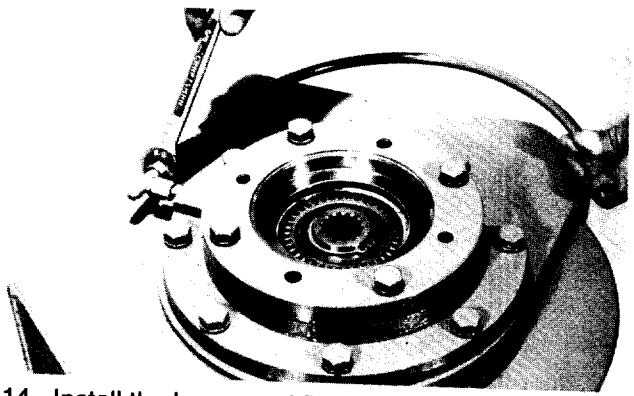


⚠ WARNING

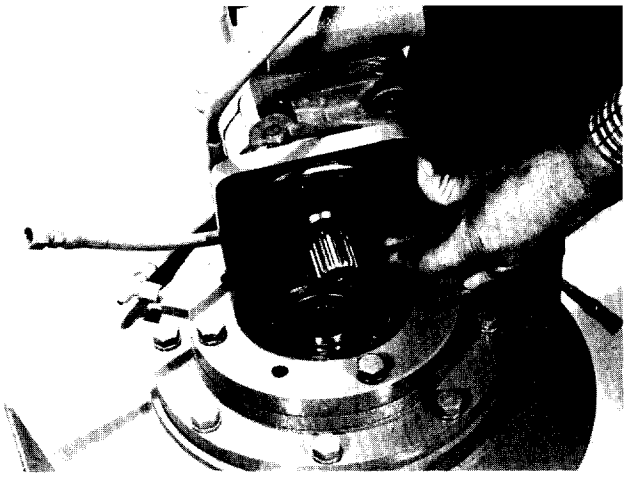
Be certain the snap ring is seated in the groove in the splined bore of the inner race. This snap ring will keep the brake clutch assembly correctly positioned in the center of the friction brake pack. Binding of the brake or brake failure may occur if this snap ring is omitted.



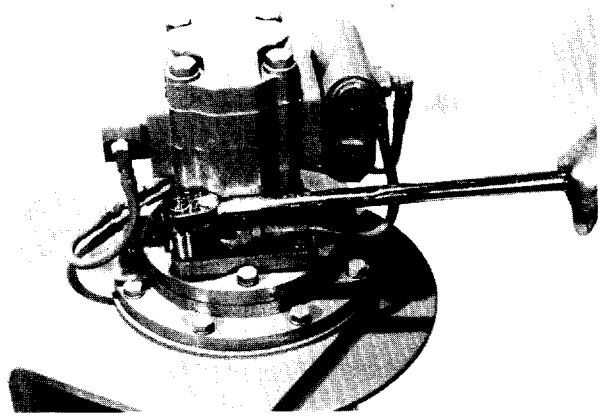
13. If the brake discs are misaligned, preventing the installation of the clutch, then with a hand pump, apply 750-1000 psi to the brake release port. The brake discs will move freely with the brake released, permitting alignment of the discs, brake clutch and input sun gear.



14. Install the hoses and fittings to the brake cylinder release port.



15. Install a new O-ring on the motor pilot then lubricate with petroleum jelly or gear oil.

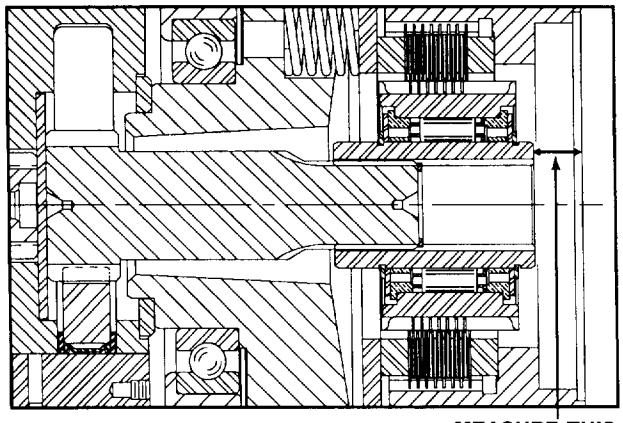


16. Engage the motor shaft with the brake clutch inner race and lower motor into place. Tighten capscrews to recommended torque.

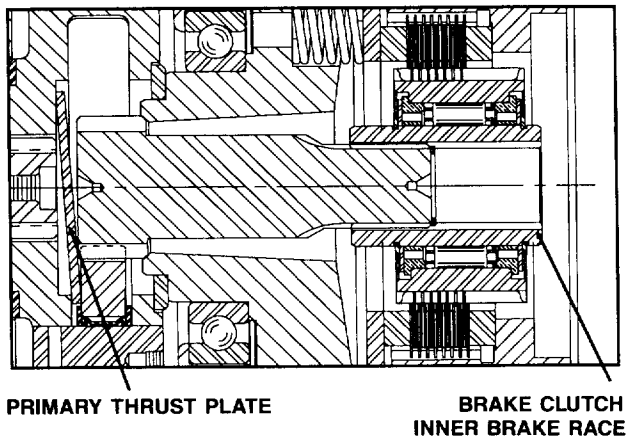
⚠ CAUTION

Care must be taken to assure the primary thrust plate remains properly located in its counterbore when the motor is installed for the first time, or is being re-installed on the winch. It is possible for the primary thrust plate to drop out of its counterbore and become wedged between the planet gears and the planet carrier. If the winch is operated with the primary thrust plate wedged between the primary gears and the planet carrier, or with a thrust washer out of position, severe damage to internal winch components could result.

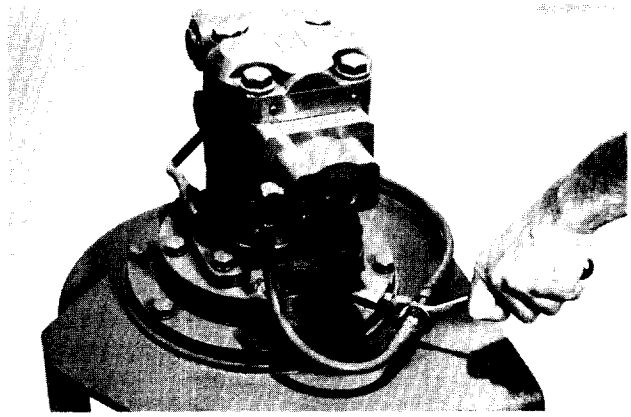
Measure the distance from the motor mounting surface to the inner brake race. With all components properly installed, this distance should be 11/16 in. (17.5 mm) to



3/4 in. (19.1 mm). If this distance is less than 9/16 in. (14.3 mm), the primary spacer may be positioned as shown below and should be checked.



The Primary Thrust Plate is shown wedged between the planet gears and the planet carrier. Note that the Primary Sun Gear and the entire Brake Clutch Assembly have moved to the right (toward the hydraulic motor).



17. Install the hoses that connect the manifold and brake valve to the brake cylinder.

18. After the winch assembly is complete, check all capscrews and fittings to make certain they have been tightened correctly.

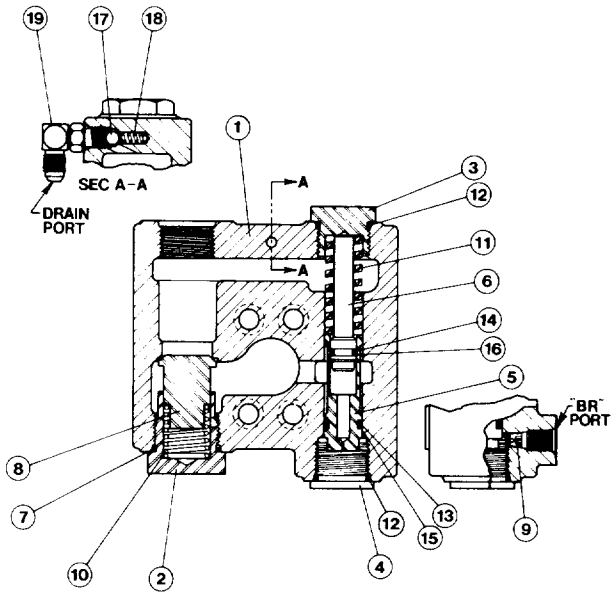
    Refill the winch with the recommended oil listed under "Preventive Maintenance", and install the oil level plug.

BRAKE VALVE SERVICE

The BRADEN brake valve is a reliable hydraulic valve with internal components manufactured to close tolerances. Due to the close tolerances and mating of components, the valve housing, spool, piston and check poppet are not available as replacement parts.

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

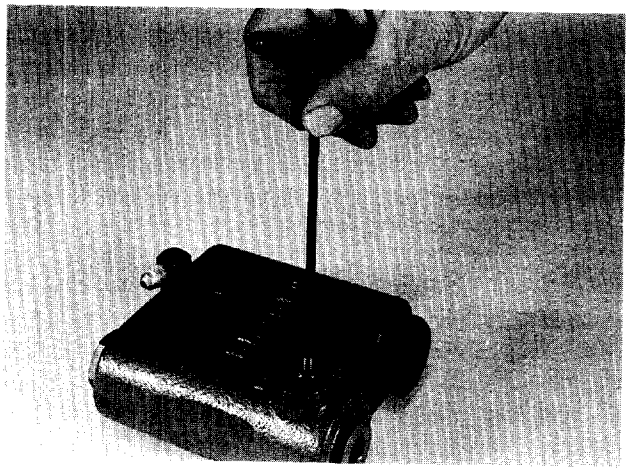
Thoroughly clean the outside surfaces of the valve and work in a clean dust free area, as cleanliness is of utmost importance when servicing hydraulic components.



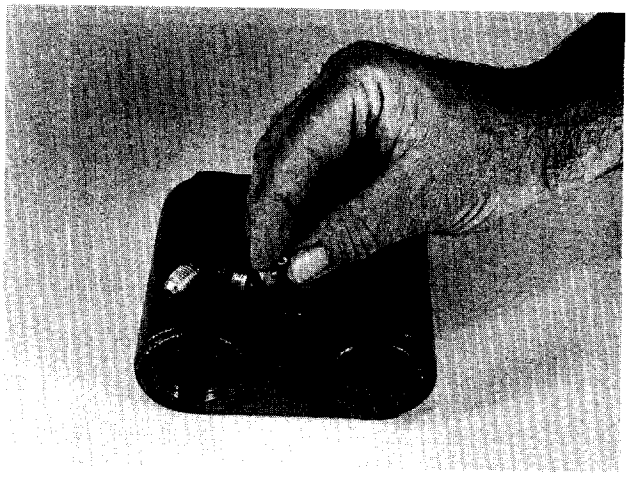
BRAKE VALVE ASSEMBLY		
ITEM	QUANTITY	DESCRIPTION
1	1	VALVE HOUSING (NSS)
2	1	SPRING RETAINER (NSS)
3	1	SPRING RETAINER (NSS)
4	1	PLUG (NSS)
5	1	SPOOL (NSS)
6	1	DAMPER PISTON (NSS)
7	1	O-RING
8	1	CHECK VALVE POPPET (NSS)
9	1	PILOT ORIFICE
10	1	CHECK VALVE SPRING
11	1	SPOOL SPRING
12	2	O-RING
13	1	O-RING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

NSS — NOT SERVICED SEPARATELY. ORDER COMPLETE VALVE ASSEMBLY.

DISASSEMBLY



1. Remove the pilot orifice from the brake release (BR) port using a 5/32 in. Allen wrench.

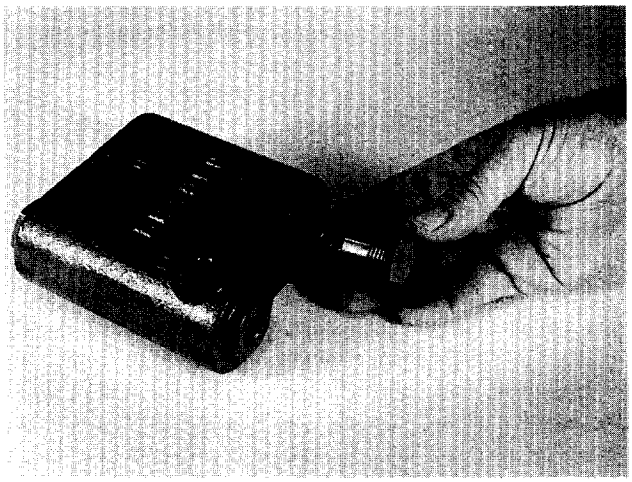


2. Remove the elbow fitting, motor drain check ball and spring.

3. Remove the spool spring retainer and spool spring. Check spring free length. Replace spring if less than 1 15/16 in. (49.2 mm) long.

4. Remove spool plug and *carefully* remove spool assembly.

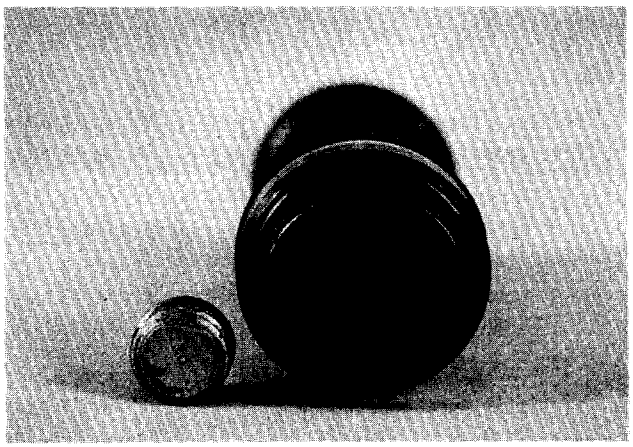
5. Remove the damper piston from the spool. The piston will come out slowly, because of a partial vacuum formed as it is removed. Use extreme care to avoid damaging the polished surfaces of the piston or spool.



6. Remove the check valve spring retainer, spring and check valve poppet. Check spring free length. Replace spring if less than 1½ in. (38.1 mm) long.

CLEAN AND INSPECT

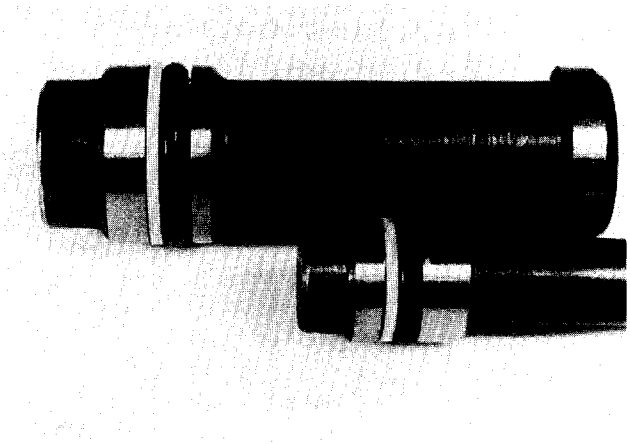
1. Discard all O-rings and back-up rings. Clean all parts in solvent and blow dry. Inspect polished surfaces of spool and damper piston for damage that may cause binding or leakage. Inspect spool bore in valve housing for damage or scoring. Inspect check valve seat in valve housing and check valve poppet. If the spools, bores or valves are damaged, the entire valve must be replaced as these parts are not serviced separately.



2. Inspect the .020 inch orifice in the end of the spool and the pilot orifice to be certain they are open.

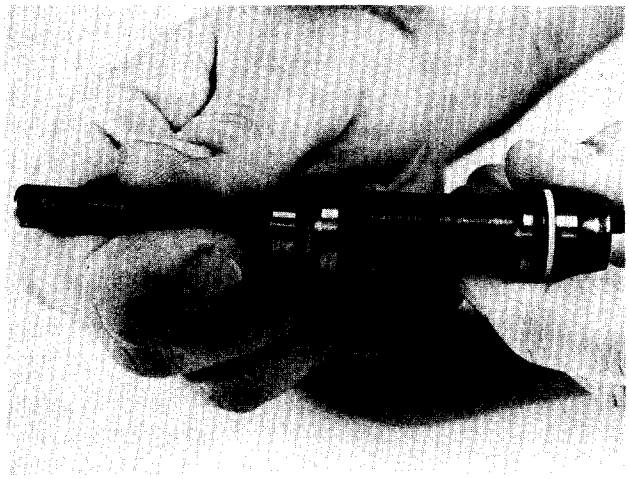
ASSEMBLY

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



2. Install new O-rings and back-up rings on the spool and damper piston 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 damper 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.

3. Lubricate the spool and damper piston O-rings with hydraulic oil. Carefully install the damper piston into the spool.



4. Lubricate the spool bore and spool O-rings with hydraulic oil. Carefully install the spool into the valve housing. Always install the spool from the plug end as shown to minimize the possibility of damaging the O-ring. Install the plug, spool spring and spring retainer.

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

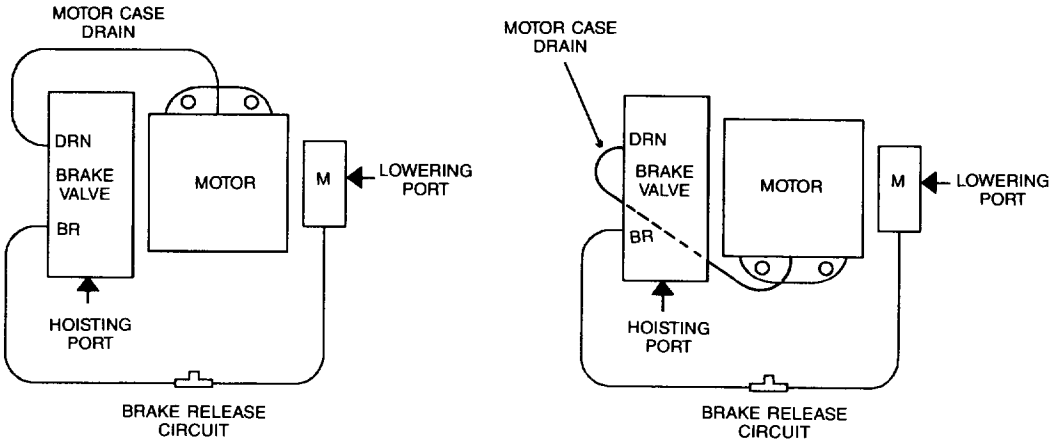
6. Install the motor drain check ball, spring and elbow fitting.

7. Install the pilot orifice into the valve housing.

8. The brake valve is complete and ready to be installed on winch motor.

REVERSING DIRECTION OF DRUM ROTATION

(029, 034, 039, 051, 064 & 049/024 motors ONLY)

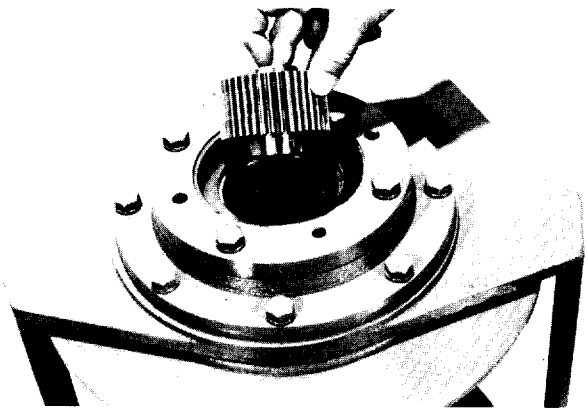


"A" M = MANIFOLD BLOCK "B"

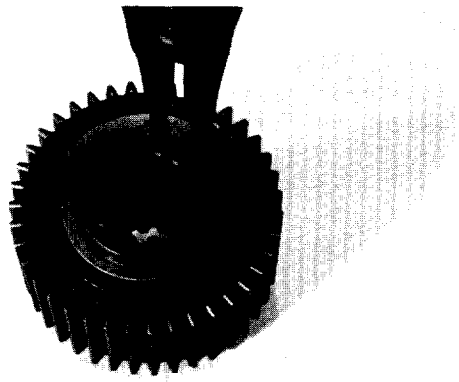
In order to change the direction of rotation, 2 things must be changed on the winch. First, the motor must be made to rotate in the opposite direction. This is done by exchanging positions of the brake valve and manifold block on the motor. Secondly, the brake clutch assembly must be made effective for the opposite direction of rotation. This is done by reversing the inner race of the brake clutch assembly.

Figures "A" and "B" above show typical PD12C motor installations. Note that the only difference between the two drawings is the motor is rotated 180° (the "belly" of the motor moves to the opposite side). If the motor shaft rotates clockwise in figure "A" when the hoisting port is pressurized, it will rotate counterclockwise in figure "B".

1. Remove the four capscrews securing the brake valve to the motor. Remove the four capscrews securing the manifold block to the motor. Disconnect the motor case drain hose at the motor. **NOTE:** Some installations have the brake release hose connected directly to the motor, instead of to the manifold block. In this case, disconnect the brake release hose at the motor port. Stand winch up on drum support with the motor end up and secure in this position.
2. Before removing the motor, it is a good idea to note or mark the position of the motor in relation to the winch, since it will be rotated 180° when re-installed. Remove the capscrews securing the motor to the winch and carefully remove the motor.

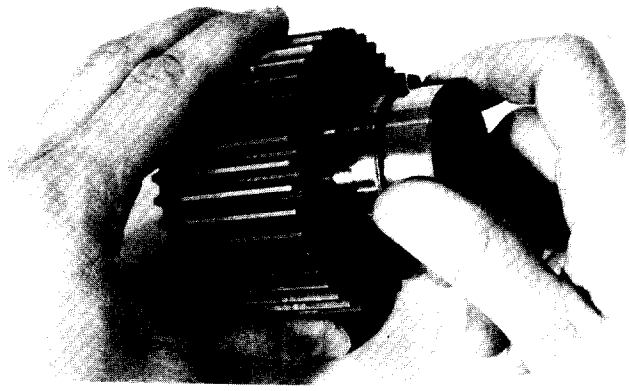


3. Remove the brake clutch assembly from the motor support.

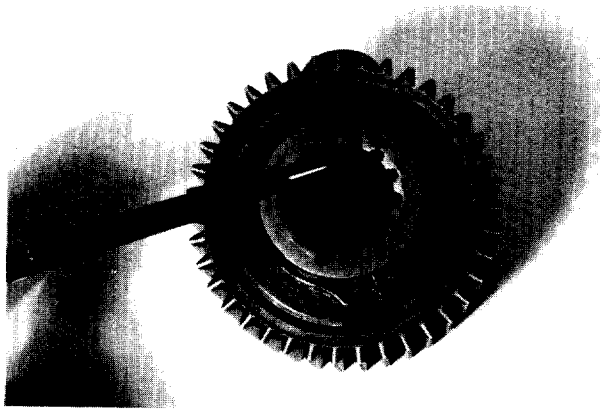


4. Remove the snap ring and sprag bushing retainer from one end only of the brake clutch assembly.

5. Pull the inner race out. Examine the race for scoring, wear or indentations caused by the sprag cams. If the inner race is not completely smooth, the assembly should be replaced.

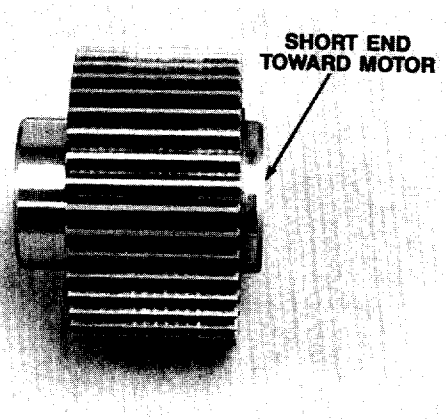


6. Turn the sprag assembly around and slide the inner race (with 1 snap ring and bushing retainer) through the bushings and sprag clutch (the race will have to be rotated in the free-wheeling direction to start it through the sprag clutch). Install the remaining bushing retainer and snap ring. Make certain the snap ring is properly seated in the groove.



⚠ WARNING

Be certain the snap ring is seated in the groove in the splined bore of the inner race. This snap ring will keep the brake clutch assembly 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.



7. Before installing the brake clutch, be sure the inner race turns free in the opposite direction the drum will turn to haul-in wire rope. An easy way to check the rotation is to hold the outer race in one hand and rotate the inner race. Install the brake clutch with the short end of the inner race toward the motor.
8. Install a new O-ring on the motor pilot. Rotate the motor 180° from its original position and install it onto the winch. Install and tighten motor capscrews to recommended torque.
9. Install new O-rings in the brake valve and manifold block. Attach the brake valve and manifold block to the motor using the original capscrews and tighten to recommended torque.
10. Connect the motor case drain hose to the motor case drain port. **NOTE:** On two speed motors, the case drain and shift drain should be connected directly to tank. **DO NOT** use the drain connection on the brake valve. See "TWO SPEED MOTOR CASE DRAIN PLUMBING" for additional information.
11. If your winch had the brake release hose connected directly to the motor, the original motor port must be plugged and the hose connected to the motor pressure port near the manifold block (lowering port).
12. Operate the winch slowly in both directions and check for oil leaks and/or unusual sounds from the winch. The winch should operate smoothly in both directions. Refer to "WIRE AND BRAIDED ROPE INSTALLATION" and properly install rope onto the winch drum.
13. Before returning the winch to full service, a light load should be lifted and held a few feet off the ground to be sure the static brake is functioning properly. The winch should also be able to slowly lower the load in a smooth and controlled manner. If the winch does not perform either of these functions, refer to "TROUBLE SHOOTING" for additional information.

METRIC CONVERSION TABLE

MULTIPLY:	BY:	TO GET:	MULTIPLY:	BY:	TO GET:
		LINEAR			
inches (in.)	× 25.4	= millimeters (mm)	× 0.03937		= inches (in.)
feet (ft)	× 0.3048	= meters (m)	× 3.281		= feet (ft)
miles (mi)	× 1.6093	= kilometers (km)	× 0.6214		= miles (mi)
		AREA			
inches² (sq in.)	× 645.15	= millimeters² (mm^2)	× 0.000155		= inches² (sq in.)
feet² (sq ft)	× 0.0929	= meters² (m^2)	× 10.764		= feet² (sq ft)
		VOLUME			
inches³ (cu in.)	× 0.01639	= liters (l)	× 61.024		= inches³ (cu in.)
quarts (qt)	× 0.94635	= liters (l)	× 1.0567		= quarts (qt)
gallons (gal)	× 3.7854	= liters (l)	× 0.2642		= gallons (gal)
inches³ (cu in.)	× 16.39	= centimeters³ (cc)	× .06102		= inches³ (cu in.)
feet³ (cu ft)	× 28.317	= liters	× 0.03531		= feet³ (cu ft)
feet³ (cu ft)	× 0.02832	= meters³ (m^3)	× 35.315		= feet³ (cu ft)
fluid oz (fl oz)	× 29.57	= milliliters (ml)	× 0.03381		= fluid oz. (fl oz)
		MASS			
ounces (oz)	× 28.35	= grams (g)	× 0.03527		= ounces (oz)
pounds (lbs)	× 0.4536	= kilograms (kg)	× 2.2046		= pounds (lb)
tons (2000 lb)	× 907.18	= kilograms (kg)	× 0.001102		= tons (2000 lb)
tons (2000 lb)	× 0.90718	= metric tons (t)	× 1.1023		= tons (2000) lb)
tons (long) (2240 lb)	× 1016.05	= kilograms (kg)	× 0.000984		= tons (lg) (2240 lb)
		PRESSURE			
inches Hg (60°F)	× 3600	= kilopascals (kPa)	× 0.2961		= inches Hg
pounds/sq.in. (psi)	× 6.895	= kilopascals (kPa)	× 0.145		= pounds/sq.in. (psi)
pounds/sq.in. (psi)	× .0703	= kilograms/sq.cm (kg/cm^2)	× 14.22		= pounds/sq.in. (psi)
pounds/sq.in. (psi)	× .069	= bars	× 14.50		= pounds/sq.in. (psi)
inches H_2O (60°F)	× 0.2488	= kilopascals (kPa)	× 4.0193		= inches H_2O
bars	× 100	= kilopascals (kPa)	× 0.01		= bars
		POWER			
horsepower (hp)	× 0.746	= kilowatts (kW)	× 1.34		= horsepower (hp)
ft.-lbs./min	× 0.0226	= watts (W)	× 44.25		= ft.-lbs./min.
		TORQUE			
pound-inches (lb•in)	× 0.11298	= newton-meters (N•m)	× 8.851		= pound-inches (lb•in.)
pound-feet (lb•ft)	× 1.3558	= newton-meters (N•m)	× 0.7376		= pound-feet (lb•ft)
pound-feet (lb•ft)	× .1383	= kilograms/meter(kg•m)	× 7.233		= pound-feet (lb•ft)
		VELOCITY			
miles/hour (m/h)	× 1.6093	= kilometers/hour (km/hr)	× 0.6214		= miles/hour (m/h)
feet/sec. (ft./sec.)	× 0.3048	= meter/sec. (m/s)	× 3.281		= feet/sec. (ft/sec.)
feet/min. (ft/min.)	× .3048	= meters/min. (m/min)	× 3.281		= feet/min. (ft/min)

TEMPERATURE °Celsius = 0.556 (°F − 32) °F = (1.8°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}

FOR BEST RESULTS,
ALWAYS USE GENUINE BRADEN PARTS.

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