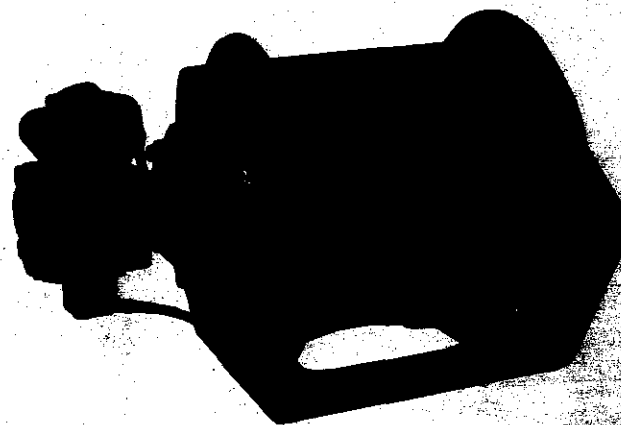


BRADEN

SERIES

PD12C 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 918-251-8511.

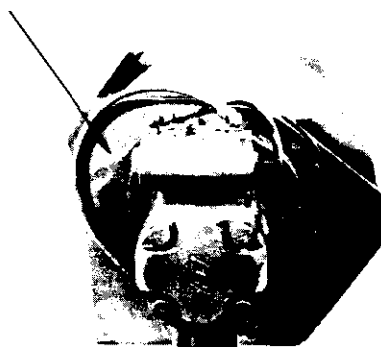
The minimum service intervals specified are for operating hours of the prime mover.

The following service instructions have been prepared to provide assembly, disassembly and maintenance information for the BRADEN Model PD12C 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.

Continuing product improvement may cause changes in your winch which are not included in this manual. Whenever a question arises regarding your BRADEN Winch or this manual, 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
T	T	T		T	T		T
POWER	MAX.	DESIGN		GEAR	MOTOR		DRUM
DRUM	RATING	MODEL		RATIO	SIZE		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

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GENERAL SAFETY RECOMMENDATIONS

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. Refer to "Warm-up Procedure" listed in the "Preventive Maintenance" section of this manual.
7. Do not exceed the maximum pressure (PSI) or flow (GPM) stated in the winch specifications.
8. Operate winch line speeds to match job conditions.
9. Leather gloves should be used when handling wire rope.
10. Never attempt to handle wire rope when the hook end is not free.
11. 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.
12. Never use wire rope with broken strands. Replace wire rope.
13. Do not weld on any part of the winch.
14. Use recommended hydraulic oil and gear lubricant.
15. Keep hydraulic system clean and free from contamination at all times.
16. Use correct anchor for wire rope and pocket in drum.
17. Do not use knots to secure or attach wire rope.
18. The BRADEN designed wire rope anchors are capable of supporting the rated load when installed properly. For additional safety, **ALWAYS** maintain a minimum of five (5) wraps of wire rope on the drum.

Safety and informational callouts used in this manual include:

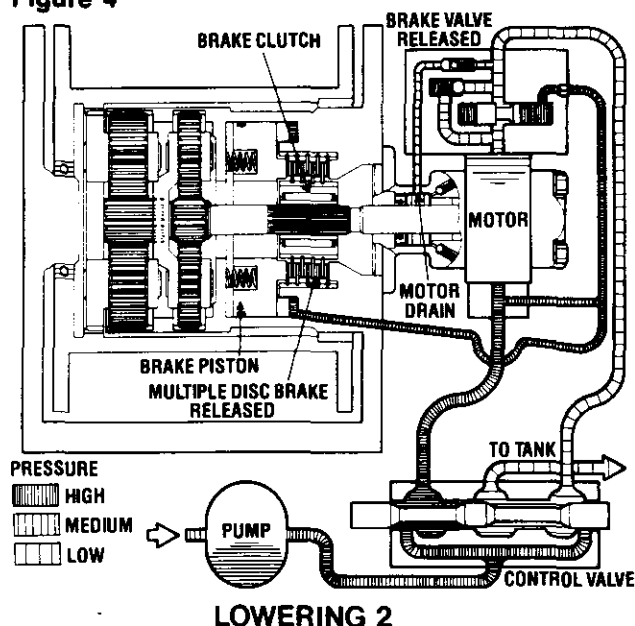
WARNING

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.

Figure 4



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

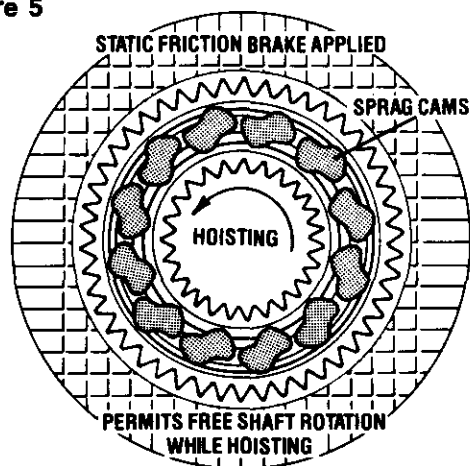
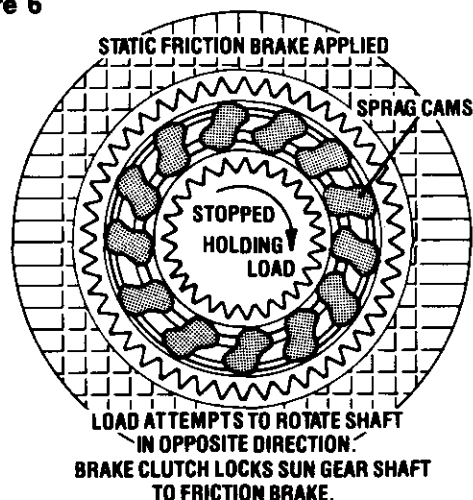
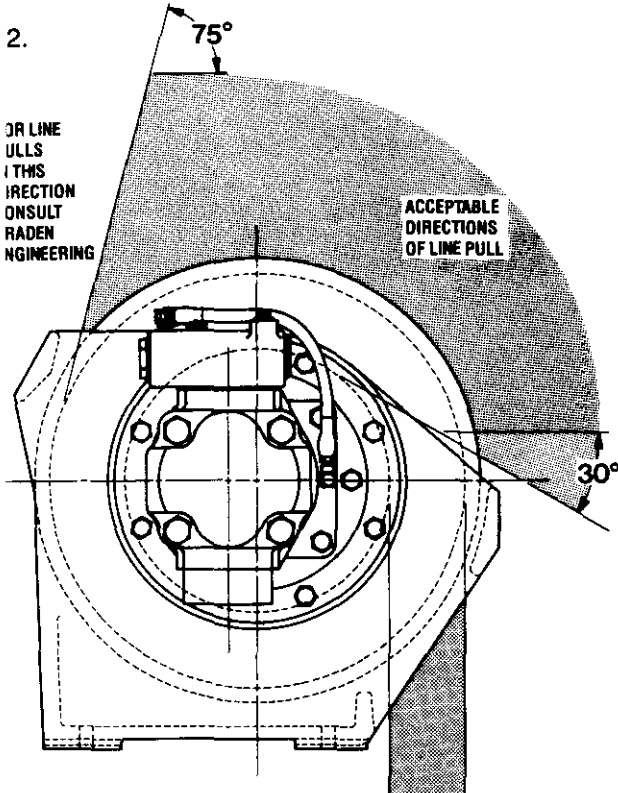


Figure 6

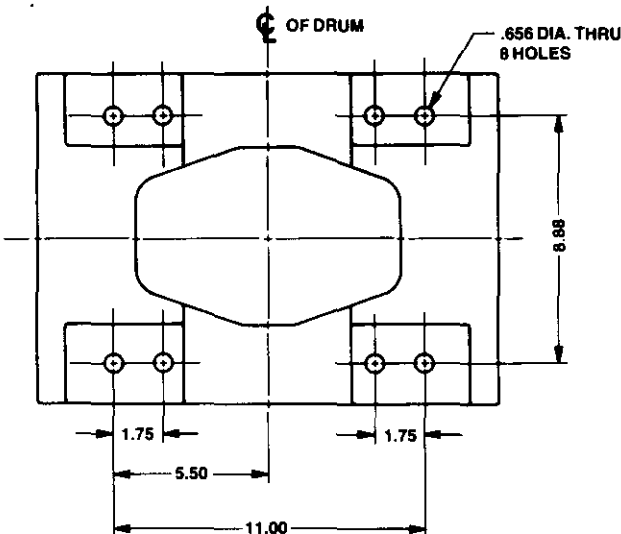


WINCH INSTALLATION

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.



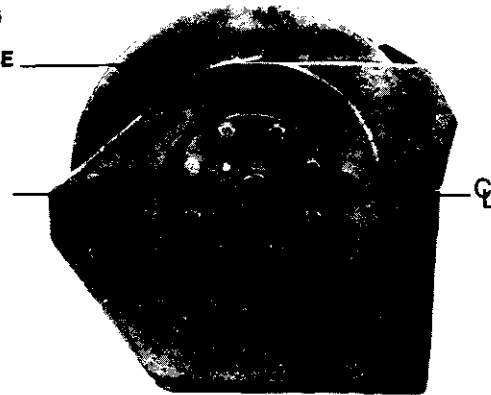
Because of the design of the mounting base, the direction of line pull should only be as shown in the above illustration. Line pulls in any other direction must be approved by BRADEN Engineering.



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 an even surface. If necessary, use shim stock to insure even mounting. The mounting surface should be flat within + or - .020 inches.

VENT PLUG
ABOVE
CENTERLINE



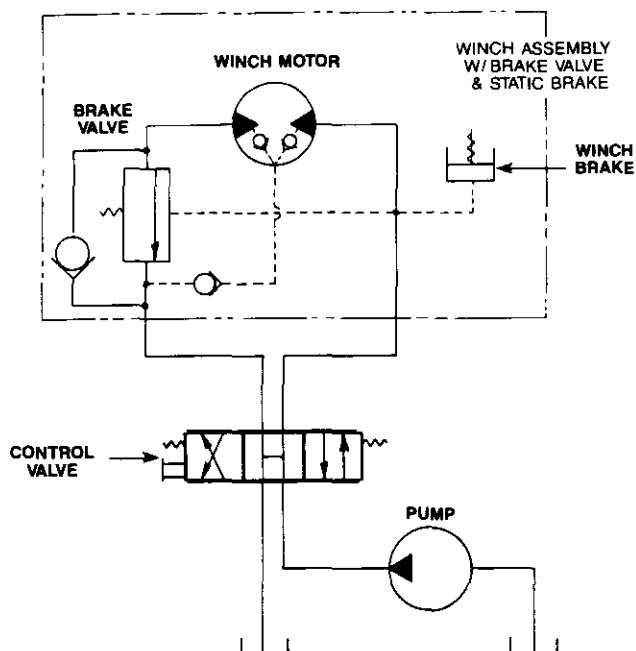
4. The vent plug must always be located above the horizontal centerline. If the winch is mounted on a pivoting surface, be sure vent plug remains above the centerline in all positions. If necessary, reposition bearing support and vent plug as follows:

- 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 exceed 100 psi for optimum motor seal life. 150 psi is the maximum allowable back pressure. The standard winch is supplied with the motor internally drained. If high back pressures are encountered, the motor may be externally drained directly to tank to improve motor seal life. For back pressures exceeding 150 psi consult BRADEN Service Department.

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 $1\frac{1}{2}$ 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 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. 120° – 140°F is generally considered optimum.

In general terms; for continuous operation at ambient temperatures between 50 and 110°F use SAE 20W; for continuous operation between 10 and 90°F, use SAE 10W; for applications colder than 10°F, 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 BOLT 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.

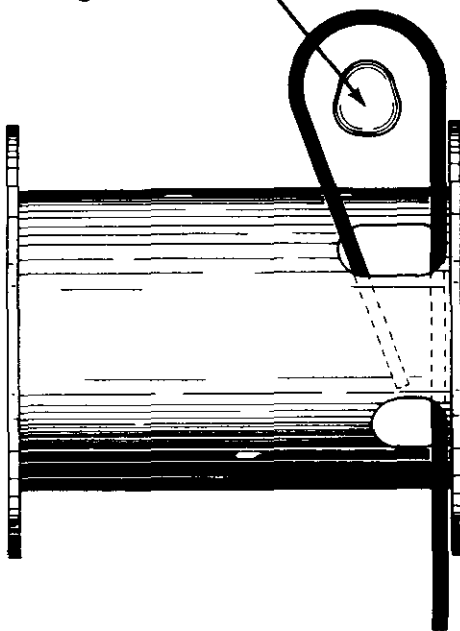
BOLT DIA. INCHES	THD PER INCH	TORQUE LB-FT.	
		DRY	LUBED
1/4	20 28	9	6
5/16	18 24	18	13
3/8	16 24	31	23
7/16	14 20	50	37
1/2	13 20	75	55
9/16	12 18	110	80
5/8	11 18	150	115

BOLT DIA. INCHES	THD PER INCH	TORQUE LB-FT.	
		DRY	LUBED
3/4	10 16	265	200
7/8	9 14	420	325
1	8 14	640	485
1 1/8	7 12	790	590
1 1/4	7 12	1110	835
1 3/8	6 12	1460	1095
1 1/2	6 12	1940	1455

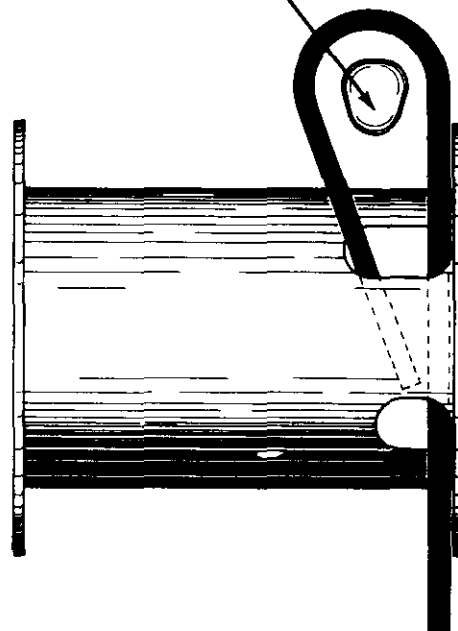
WIRE AND BRAIDED ROPE INSTALLATION

ANCHORING WIRE ROPE

$\frac{7}{16}$ and $\frac{1}{2}$ wire rope.
Insert large end first.



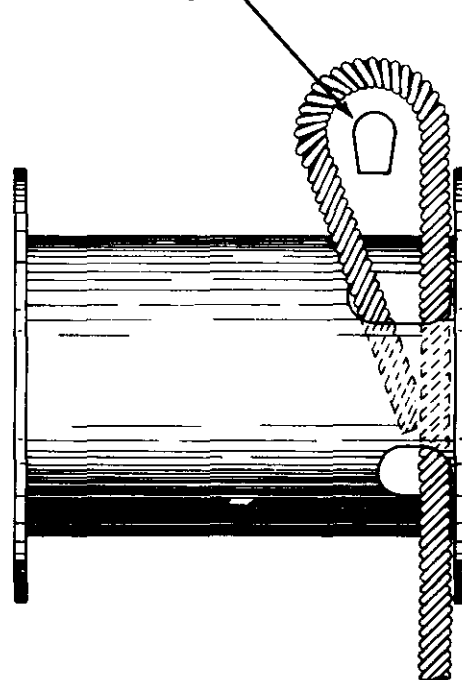
$\frac{9}{16}$ and $\frac{5}{8}$ wire rope.
Insert small end first.



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 $\frac{3}{4}$ 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 $\frac{7}{16}$ " and $\frac{1}{2}$ " wire rope by inserting the wedge, large end first. $\frac{9}{16}$ " and $\frac{5}{8}$ " wire rope may be anchored by inserting the wedge, small end first.

ANCHORING BRAIDED ROPE

1" & 1 $\frac{1}{8}$ " braided rope



A special wedge is used to anchor 1" and 1 $\frac{1}{8}$ " braided rope. The installation procedure is the same as for anchoring wire rope.

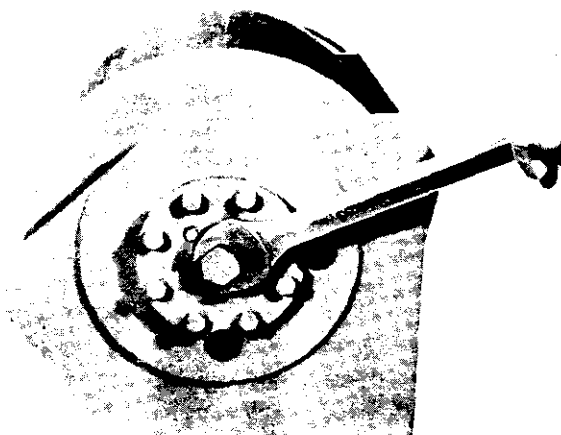
PREVENTIVE MAINTENANCE

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.

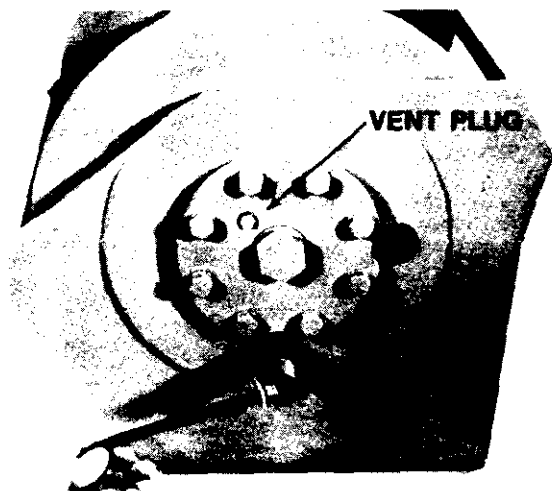
- **Regular Gear Oil Changes** — every 1000 hours or six (6) months
- **Use of Proper Gear Oil** — recommended type for prevailing ambient temperature
- **Annual Disassembly and Inspection of All Wear Items** — in compliance with American National Standards Institute (ANSI) specification B30.5c 1987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

treme 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.

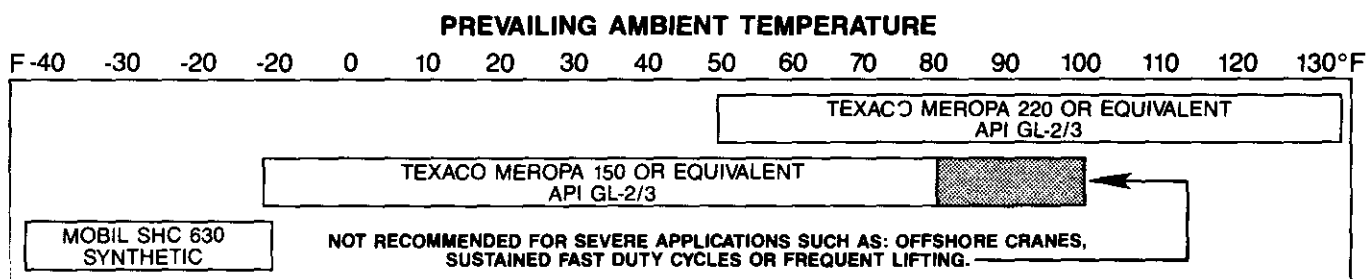
BRADEN planetary winches are factory filled with Texaco Meropa 150 or equivalent API GL-2/3 gear oil.

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



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
<p>A</p> <p>The winch will not lower the load or not lower the load smoothly.</p>	<p>1. The problem could be a plugged or loose pilot orifice. The pilot orifice is a small pipe plug with a hole drilled through it, located behind the pilot port fitting on the brake valve. If it becomes plugged, it will prevent the pilot pressure, from the manifold, from opening the brake valve. If it becomes loose, it will allow an unregulated amount of oil in to operate the brake valve which causes erratic brake valve operation.</p> <p>2. The friction brake may not be releasing as a result of a defective brake cylinder seal.</p> <p>NOTE: If the brake cylinder seal is defective you will usually find oil leaking from the winch vent plug.</p> <p>3. Friction brake will not release as a result of damaged brake discs.</p>	<div data-bbox="1094 548 1533 1075" data-label="Image"> </div> <p>Remove the pilot hose and fitting from the brake valve, then use a $\frac{5}{32}$ 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.</p> <p>Check brake cylinder seal as follows:</p> <p>A. Disconnect the swivel tee from the brake release port. Connect a hand pump with accurate 0-2000 psi gauge and shut-off valve to the - 4 J.I.C. fitting in the brake release port.</p> <p>B. Apply 1000 psi to the brake. Close shut-off valve and let stand for five (5) minutes.</p> <p>C. If there is any loss of pressure in five (5) minutes, the brake cylinder should be disassembled for inspection of the sealing surfaces and replacement of the seals. Refer to "Motor Support-Brake Cylinder Service."</p> <p>Dissassemble brake to inspect brake discs. Check stack-up height as described in "Motor Support-Brake Cylinder Service".</p>

TROUBLE	PROBABLE CAUSE	REMEDY
<p>B</p> <p>Oil leaks from vent plug.</p>	<p>1. Same as A2.</p> <p>2. Motor seal may be defective as a result of high system back pressure or contaminated oil.</p>	<p>Same as A2.</p> <p>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.</p> <p>Oil analysis may indicate contamination has worn motor shaft and seal. Thoroughly flush entire hydraulic system and install new filters and oil. Install new motor seal.</p>
<p>C</p> <p>The brake will not hold a load with the control lever in neutral.</p>	<p>1. Excessive system back pressure acting on the brake release port.</p> <p>2. Friction brake will not hold due to worn or damaged brake discs.</p> <p>3. Brake clutch is slipping.</p>	<p>The same as remedy 2 of Trouble B2.</p> <p>Same as Remedy 3 of Trouble A3.</p> <p>Improper planetary gear oil may cause the brake clutch to slip. Drain old gear oil and flush winch with solvent. Thoroughly drain solvent and refill winch with recommended planetary gear oil listed in "Preventive Maintenance".</p> <p>Brake clutch may be damaged or worn. Disassemble and inspect brake clutch as described in "Brake Clutch Service".</p>
<p>D</p> <p>The winch will not hoist the rated load.</p>	<p>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.</p> <p>2. System relief valve may be set too low. Relief valve needs adjustment or repair.</p>	<p>Reinforce mounting surface.</p> <p>If necessary, use shim stock to level winch. Refer to "Winch Installation".</p> <p>First loosen, then evenly retighten all winch mounting bolts to recommended torque.</p> <p>Check relief pressure as follows:</p> <p>A. Install an accurate 0-4000 psi gauge into the inlet port of the brake valve.</p>

TROUBLE "D" CONTINUED ON NEXT PAGE

TROUBLE	PROBABLE CAUSE	REMEDY
TROUBLE "D" CONTINUED FROM PREVIOUS PAGE	<p>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.</p> <p>4. Winch line pull rating is based on 1st layer of wire rope.</p> <p>5. Rigging and sheaves not operating efficiently.</p>	<p>B. Apply a stall pull load on the winch while monitoring pressure.</p> <p>C. Compare gauge reading to winch specifications. Adjust relief valve as required.</p> <p>NOTE: If pressure does not increase in proportion to adjustment, relief valve may be contaminated or worn out. In either case, the relief valve may require disassembly or replacement.</p> <p>Same as remedies for Trouble D1 & D2.</p> <p>Same as remedies for Trouble E2.</p> <p>Refer to winch performance charts for additional information.</p> <p>Perform rigging service as recommended by crane manufacturer.</p>
<p>E</p> <p>The winch runs hot.</p>	<p>1. Same as D1.</p> <p>2. Be certain that the hydraulic system temperature is not more than 180 degrees. F. Excessive hydraulic oil temperatures may be caused by:</p> <p>A. Plugged heat exchanger.</p> <p>B. Too low or too high oil level in hydraulic reservoir.</p> <p>C. Same as D2.</p> <p>D. Hydraulic pump not operating efficiently.</p> <p>3. Excessively worn or damaged internal winch parts.</p>	<p>Same as remedies for Trouble D1.</p> <p>Thoroughly clean exterior and flush interior.</p> <p>Fill/drain to proper level.</p> <p>Same as remedies for Trouble D2.</p> <p>Prime mover low on horsepower or R.P.M. Tune/adjust prime mover.</p> <p>Check suction line for damage.</p> <p>If pump is belt driven, belts are slipping. Replace/tighten belts.</p> <p>Pump worn. Replace pump.</p> <p>Disassemble winch to inspect/replace worn parts.</p>

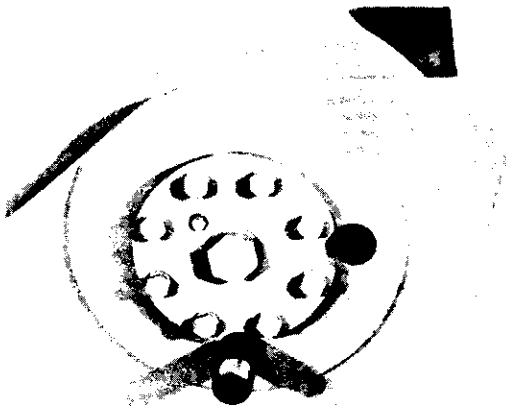
TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;">F</p> <p>Winch "chatters" while raising rated load.</p>	<ol style="list-style-type: none"> 1. Same as D2. 2. Hydraulic oil flow to motor may be too low. 3. Controls being operated too quickly. 	<p>Same as remedies for Trouble D2.</p> <p>Same as remedies for Trouble E2.</p> <p>Conduct operator training as required.</p>
<p style="text-align: center;">G</p> <p>The wire rope does not spool smoothly on the drum.</p>	<ol style="list-style-type: none"> 1. The winch may be mounted too close to the main sheave, causing the fleet angle to be more than 1½ degrees. 2. The winch may not be mounted perpendicular to an imaginary line between the center of the cable drum and the first sheave. 3. Could possibly be using the wrong lay rope. There is a distinct advantage in applying rope of the proper direction of lay. When the load is slacked off, the several 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. 4. The winch may have been overloaded, causing permanent set in the wire rope. 	<p>Check mounting distance and fleet angle. Reposition winch as required.</p> <p>Refer to "Winch Installation".</p> <p>Consult wire rope manufacturer for recommendation of wire rope that best suits your application.</p> <p>Replace wire rope and conduct operator/rigger training as required.</p>

DISASSEMBLY OF WINCH

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 non-flammable 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.

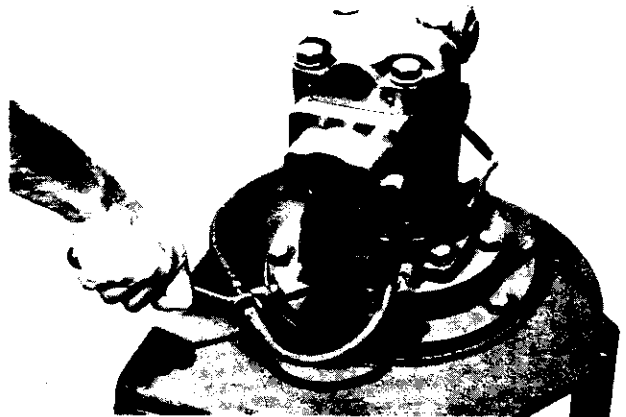


1. Remove the wire rope from the winch drum and align the drain hole in the drum with a hole in the support side plate before removing the hoses and mounting bolts. After the winch is removed from its mounting, thoroughly clean the outside surfaces. To drain the oil, install a short piece of 1 inch pipe 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 $\frac{5}{16}$ inch Allen wrench to remove the drain plug through the pipe.

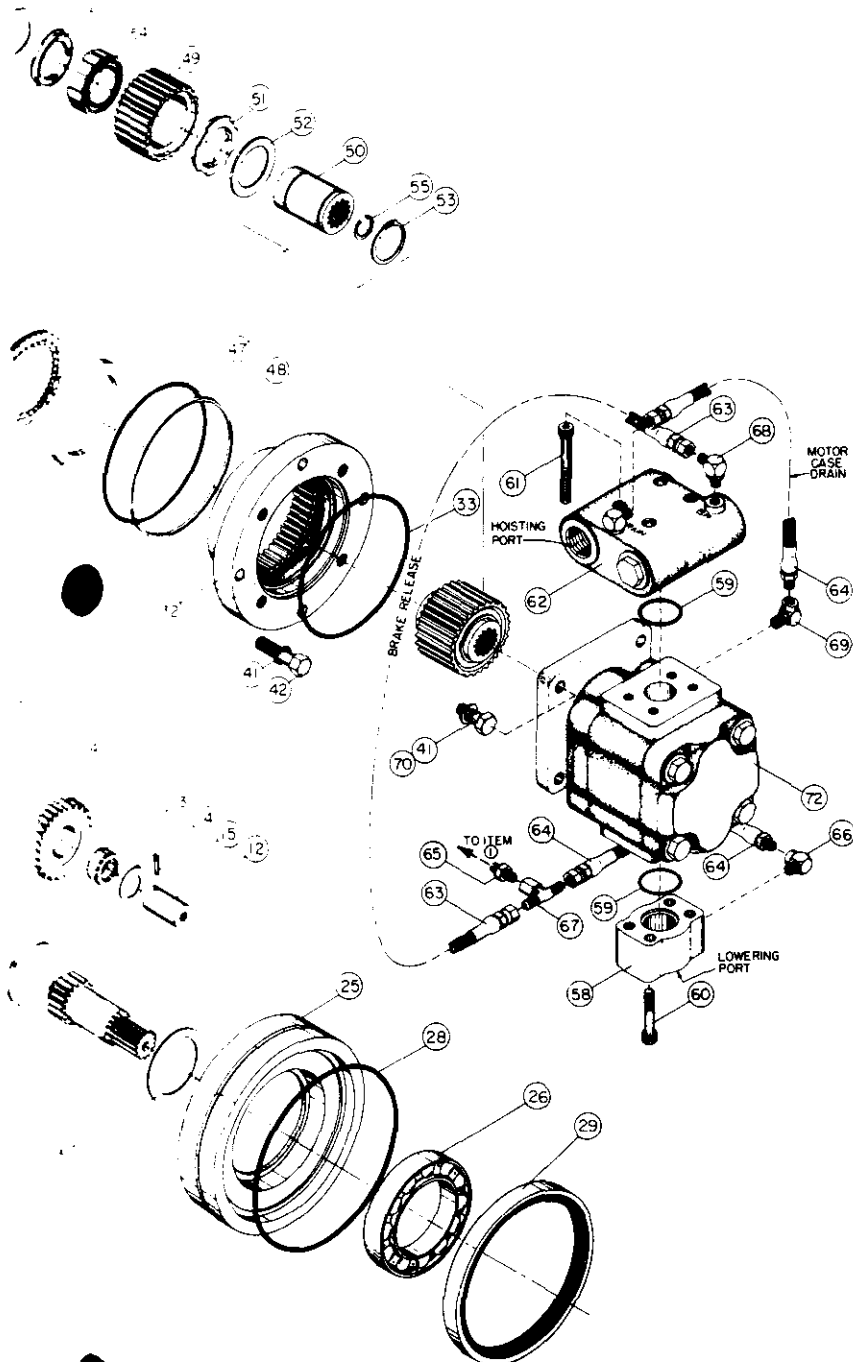


3. Begin disassembly by removing the oil level plug and standing the winch on the bearing support end. Tag and remove the hydraulic hoses that connect the brake valve and manifold to the brake cylinder.



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.

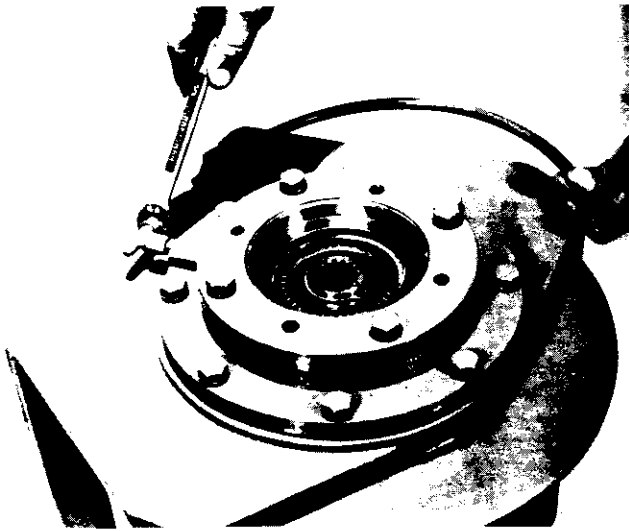
This exploded view diagram illustrates the assembly of a mechanical component, likely a pump or motor housing. The main housing (22) is shown at the bottom left. A central shaft (24) is positioned horizontally. To the right, a gear assembly is shown, including a large gear (17) and a smaller gear (21). Various other components, such as seals (3, 4, 7), bearings (36), and fasteners (10, 19, 20, 34, 37, 38, 40, 41, 43, 44, 45, 46), are shown in their relative positions for assembly. The diagram is labeled with numbers 1 through 57, corresponding to the parts list on the right.



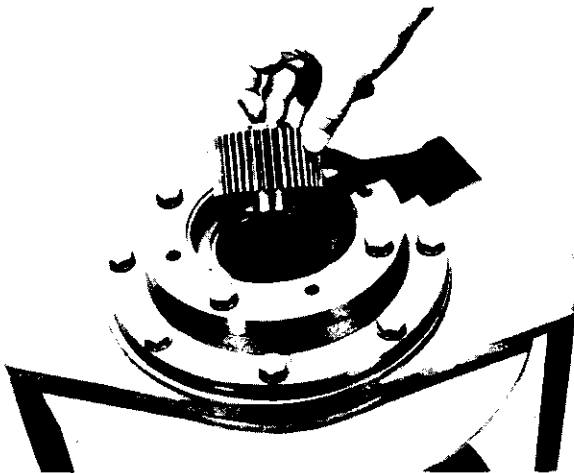
PD12C PARTS KEY

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	Spiral Pin
18	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	Capcrew
41	24	Lockwasher
42	4	Capcrew
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	Capcrew — Socket Head
61	4	Capcrew — 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	Capcrew
72	1	Hydraulic Motor

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



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



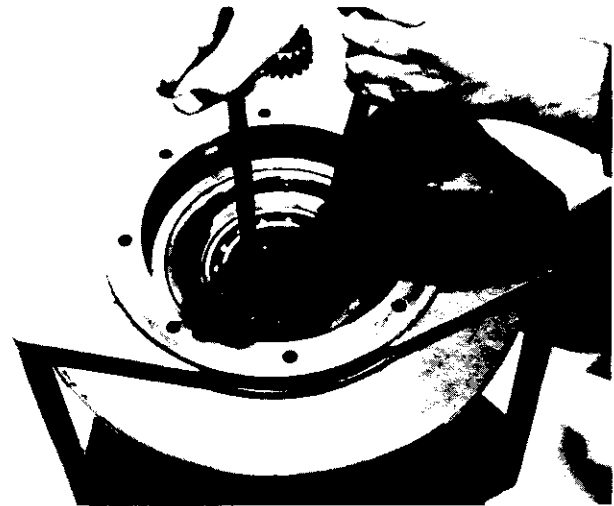
6. Remove the brake clutch assembly from the motor support. Refer to "Brake Clutch Service" for additional information.



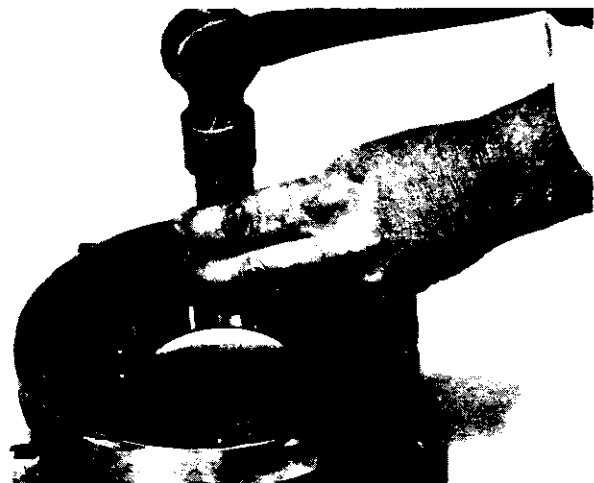
7. Remove the motor support capscrews and install

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.

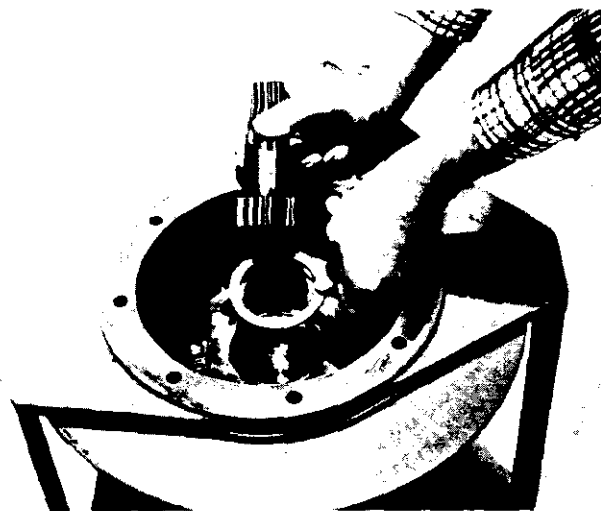
8. Remove the brake cylinder capscrews and install two (2) capscrews and a short piece of chain into the motor support mounting bolt holes. Using the chain as a handle, lift the brake cylinder out of the drum and base, being careful to avoid damaging the sealing or bearing surfaces. Refer to "Motor Support-Brake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



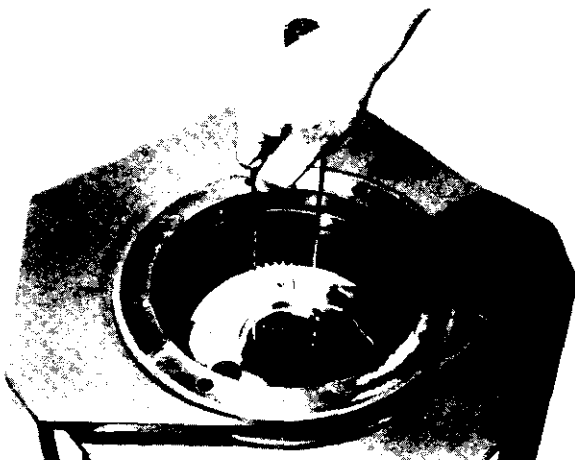
9. Remove the drum closure. Remove and discard the O-ring from the outside of the drum closure.



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



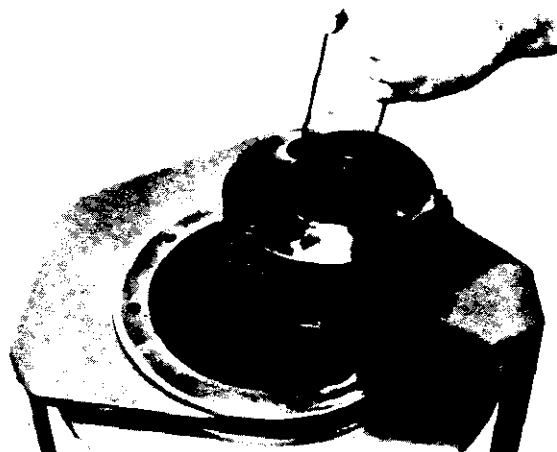
11. Remove the primary sun gear and thrust washer from the primary planet carrier.



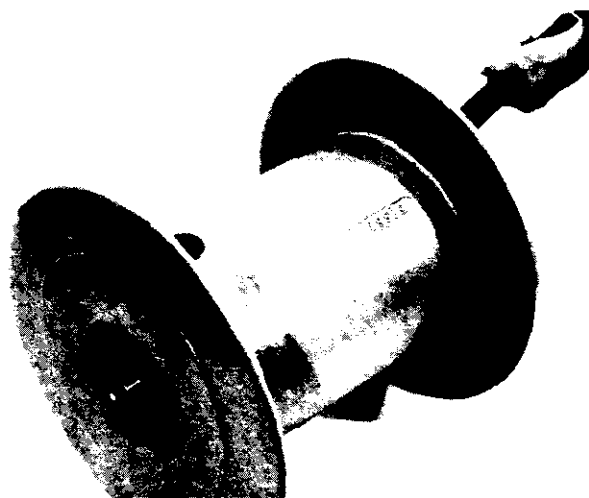
12. Remove the primary planet carrier from the drum. Refer to "Planet Carrier Service" for additional information.



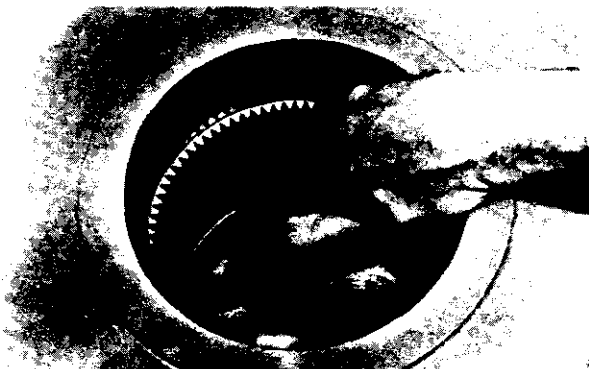
13. Remove the output sun gear and thrust washer from the output planet carrier.



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 cap-screws 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.

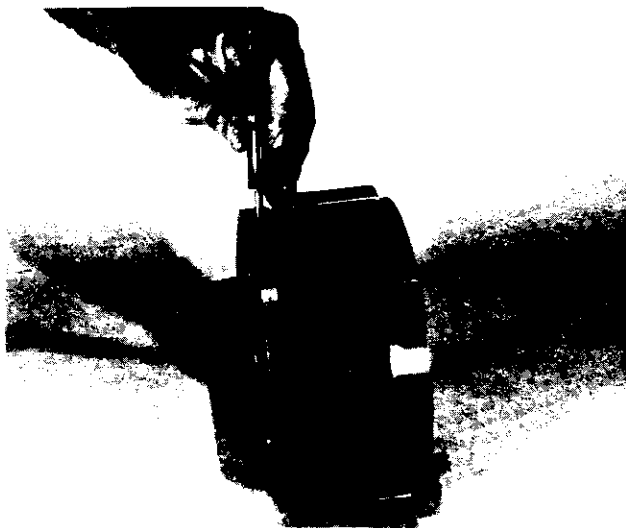


17. Thoroughly clean and inspect drum and base. Check ring gear (machined into inside surface of drum) teeth for nicks, spalling or excessive wear. Replace if wear is greater than 0.015" when compared to unworn area of teeth.

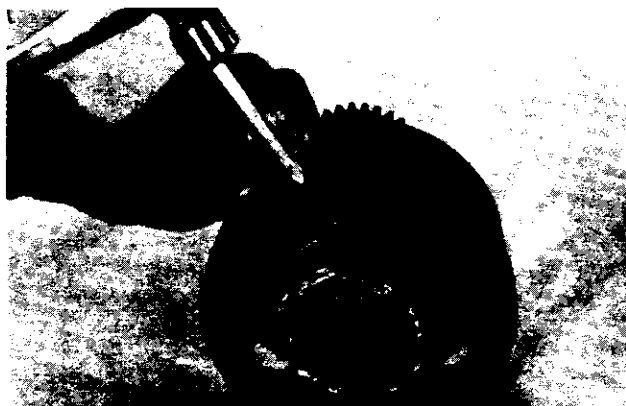
PLANET CARRIER SERVICE

OUTPUT PLANET CARRIER

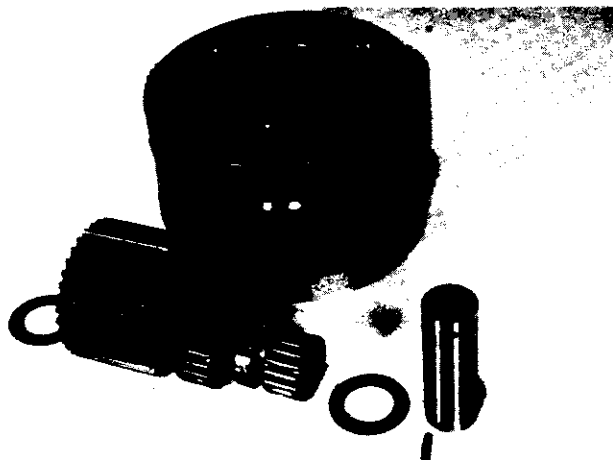
DISASSEMBLY



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



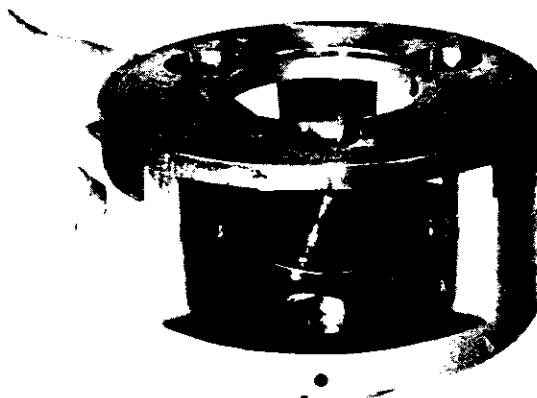
2. Use a punch to drive the roll pins from the planet shafts. Do not reuse the roll pins.



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



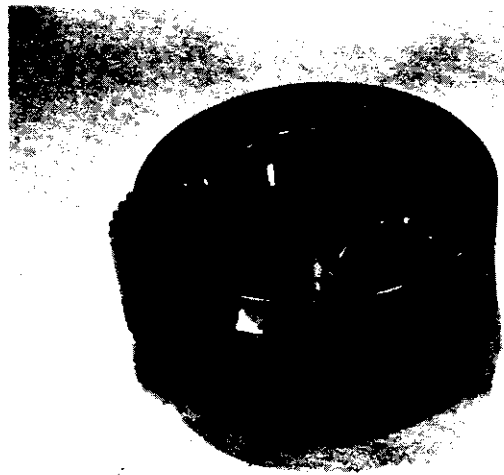
1. Place the output planet carrier on workbench with splined coupling side down. Install output thrust plate in center of carrier.



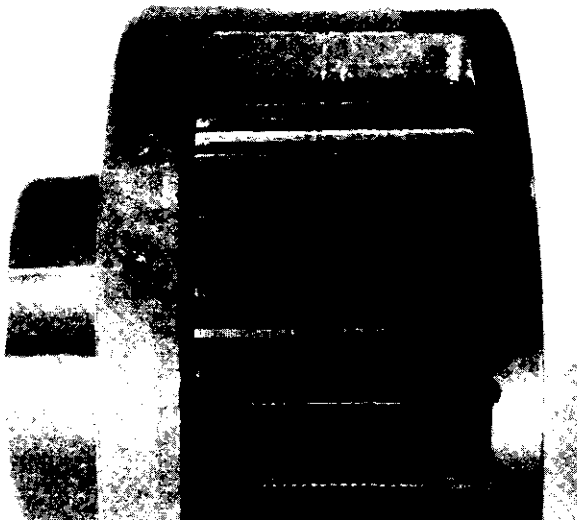
2. Insert two (2) bearings and a bearing spacer into a gear with the spacer between the bearings. Place a thrust washer on each side of the gear and position in a carrier opening. Slide the shaft through the carrier, thrust washer, bearing-gear sub-assembly and remaining thrust washer.



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.

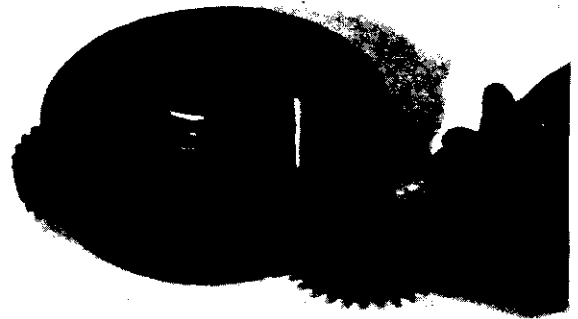


5. Completed output planet carrier.



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.

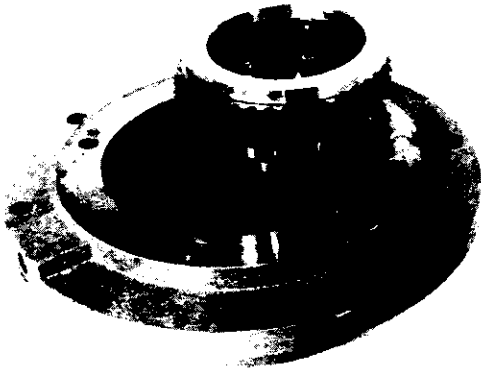
PRIMARY PLANET CARRIER



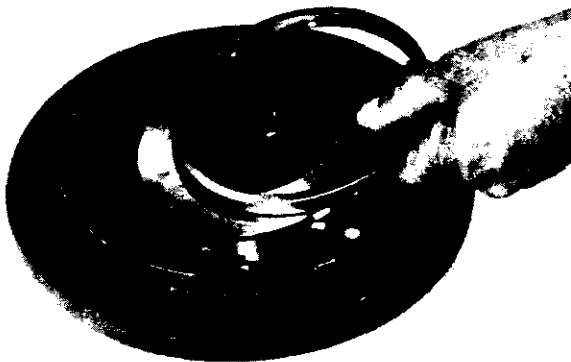
1. To service the primary planet carrier, the steps are the same as for the output carrier except there is only one bearing for each gear and no bearing spacer.

MOTOR SUPPORT-BRAKE CYLINDER SERVICE

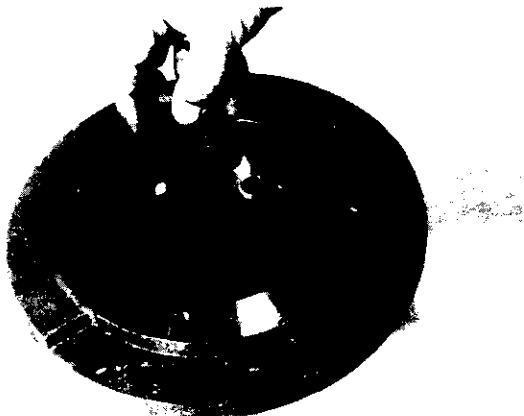
DISASSEMBLY



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.

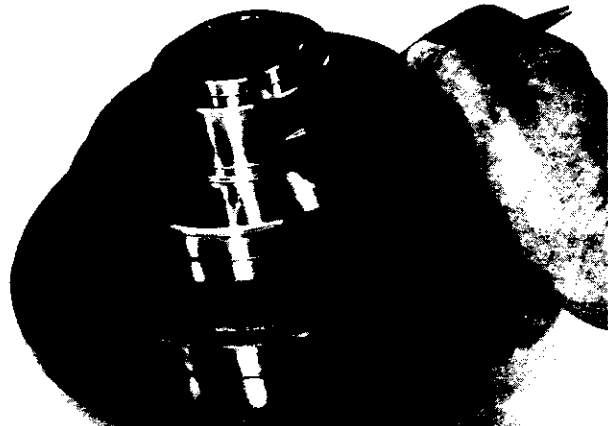


3. Remove the brake springs.

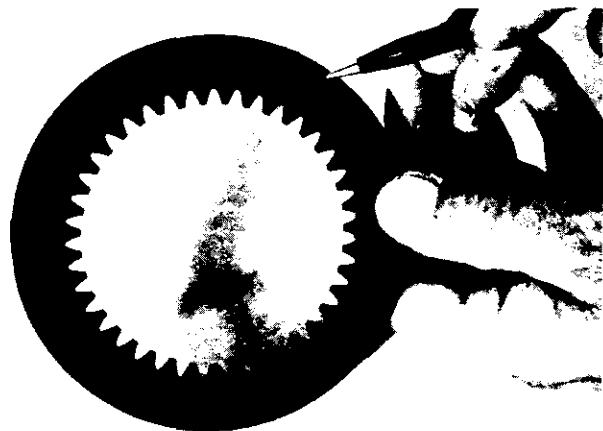
CLEAN AND INSPECT



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.

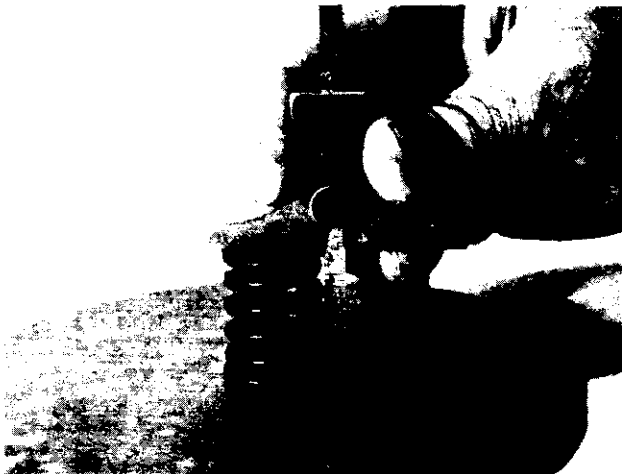


3. Place friction brake disc on flat surface and check for distortion with a straight edge. Friction material

should appear even across entire surface with groove pattern visible. Replace friction disc if splines are worn to a point, disc is distorted or friction material is worn unevenly.



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 $1\frac{3}{16}$ inches. 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.

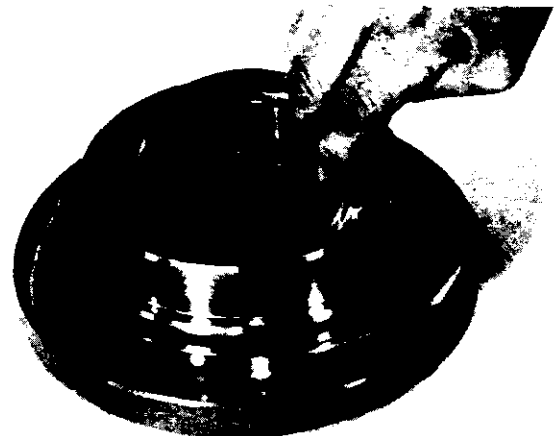
⚠ CAUTION

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

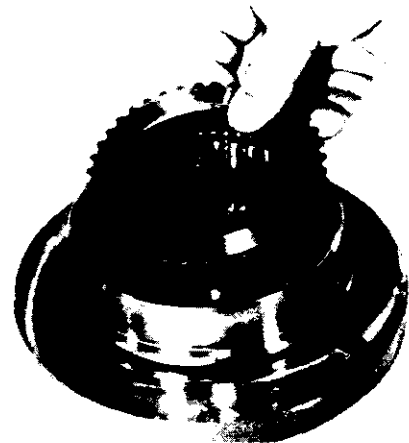
ASSEMBLY



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

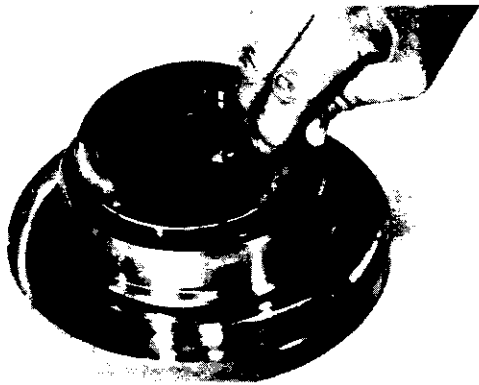


2. Install a brake spacer into the motor support.

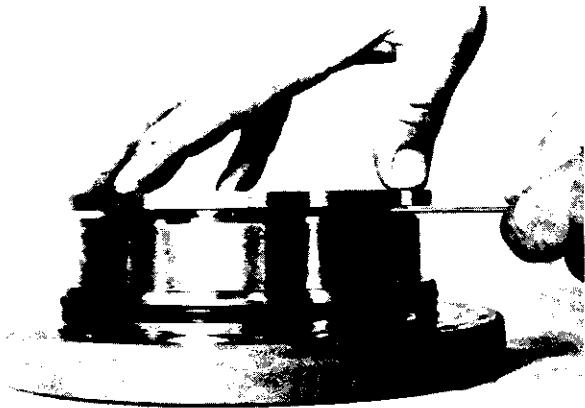


3. Insert first, a steel brake disc against the spacer followed by a friction brake disc then alternate steel and friction discs until seven (7) friction and eight (8) steel discs have been installed. Finish with a steel brake disc on top.

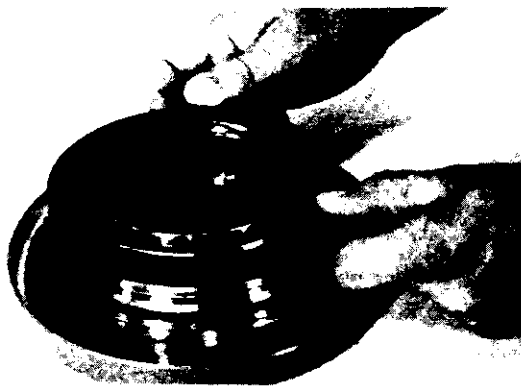
NOTE: It is good practice to pre-lubricate the discs in light motor oil prior to assembly.



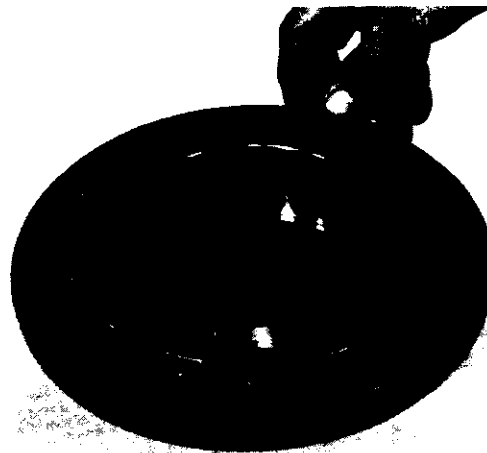
4. Install the remaining brake spacer on top of the last steel brake disc.



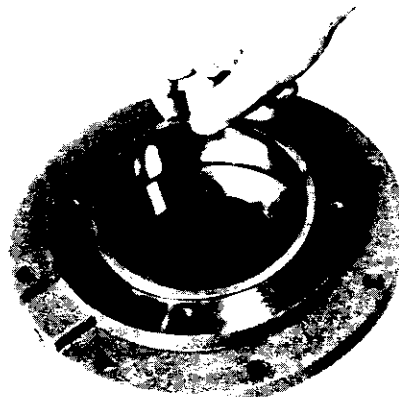
5. To check brake stack height, place pressure plate on top of brake spacer. Hold pressure plate down firmly by hand and measure clearance in three places between motor support and pressure plate. Average gap must measure between .153 inches maximum and .080 inches minimum. If the gap exceeds the maximum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



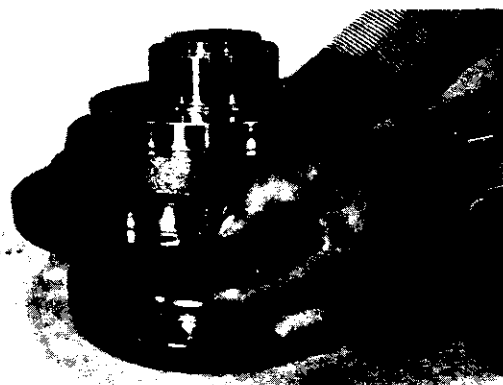
6. Lubricate the brake piston seal and motor support sealing surface with petroleum jelly or hydraulic oil. Install new piston seal to motor support, seal lip down.



7. Install brake springs into brake cylinder.



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.

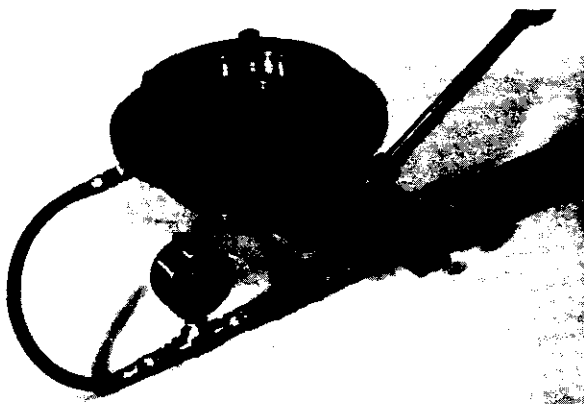


9. Apply petroleum jelly to the entire sealing surface of the brake cylinder and to the piston seal. Install the brake cylinder over the motor support being careful to avoid damaging the piston seal or motor support O-ring. (A press may be necessary to avoid cocking the brake cylinder during installation.)



10. Install motor support cap screws and evenly tighten to recommended torque.

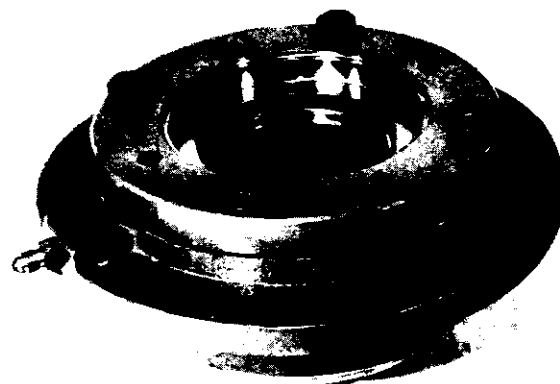
BRAKE CYLINDER PRESSURE TEST



1. Install the -4 J.I.C. fitting into the brake release port. Connect a hand pump with accurate 0-2000 psi gauge and shut-off valve to this fitting. Apply 1000 psi 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 seal.



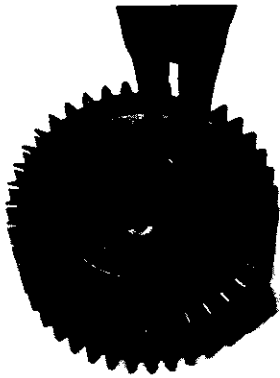
2. WHILE PRESSURE IS APPLIED AND THE BRAKE RELEASED, install the brake clutch assembly in the brake pack, short end of the inner race toward motor. Turn the clutch back and forth as you align the outer race splines with the brake disc splines.



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.

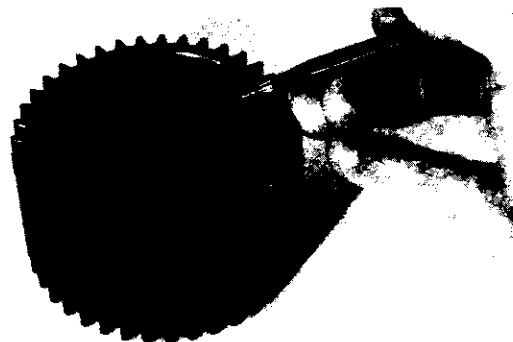


4. Next, slide the sprag clutch out, inspect the sprag clutch closely for abnormal wear, cracks, pitting, or corrosion. Check small clips for breakage or bright spots; the signs of excessive wear. Unless the outer race or remaining sprag bushing is damaged or shows excessive wear, there is no need for 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 could result in property damage, severe personal injury or death. It is generally recommended to replace the entire brake clutch assembly if any component is defective.

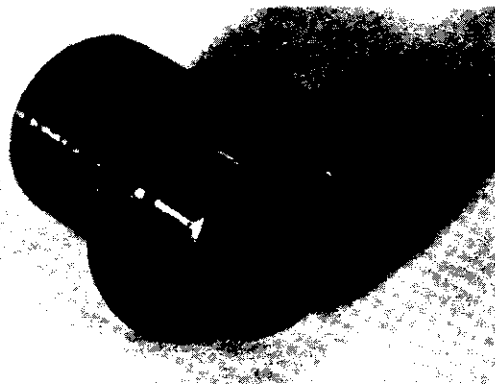
ASSEMBLY



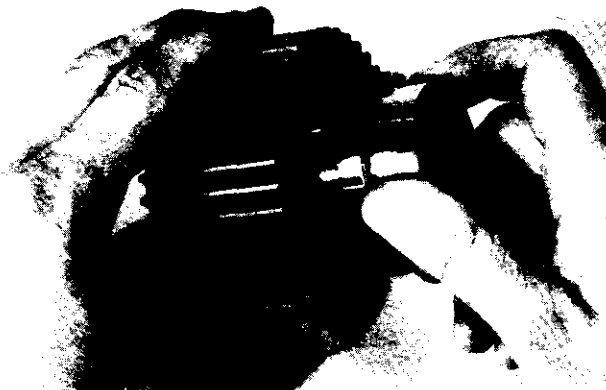
1. Press a sprag bushing into the outer race, using a mechanical or hydraulic press. A flat plate of approximately the same diameter as the bushing flange outside diameter should be placed between the press and bushing during assembly to protect the bushing. Be certain the bushing flange is against the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



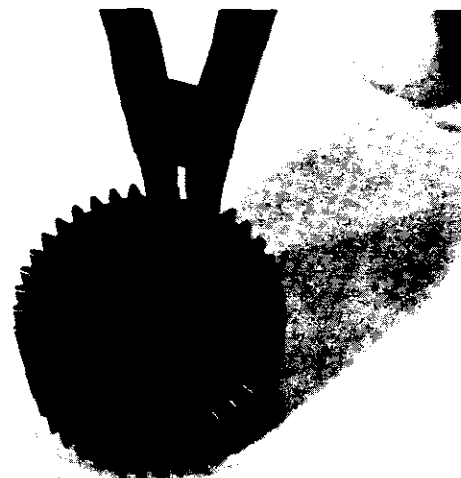
2. Turn the assembly over and install the sprag clutch in the bore of the outer race.
3. Press the remaining bushing into the race. Again, make sure the bushing is against the shoulder.



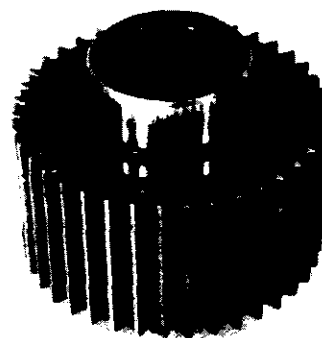
4. Next, install a sprag bushing retainer, then a snap ring on the inner race. Be sure the snap ring is seated in the snap ring groove.



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.



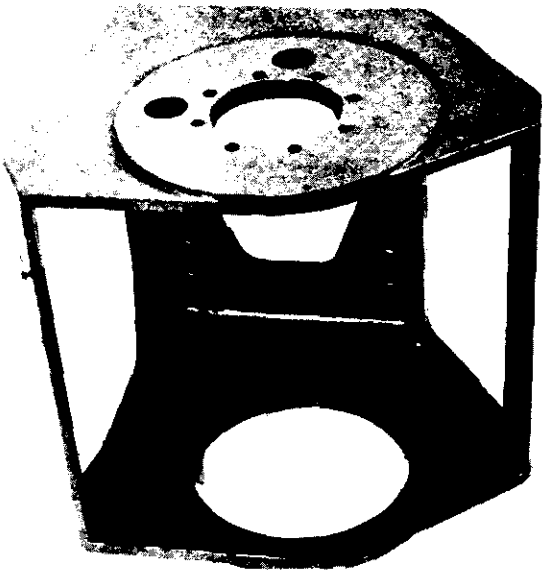
7. This is a completed brake clutch assembly.



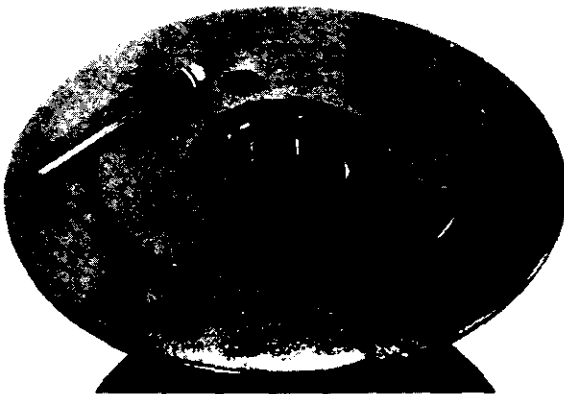
⚠ WARNING

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



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



2. Install a new bearing in the drum if replacement is necessary. Use a good grade of sealant on the outside diameter of the new seal. Turn 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.



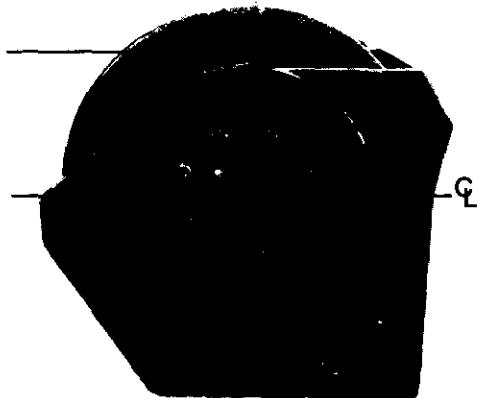
3. Center the drum in the opening of the base. Lubricate the bearing support with petroleum jelly or gear oil and install in base and drum.



⚠ CAUTION

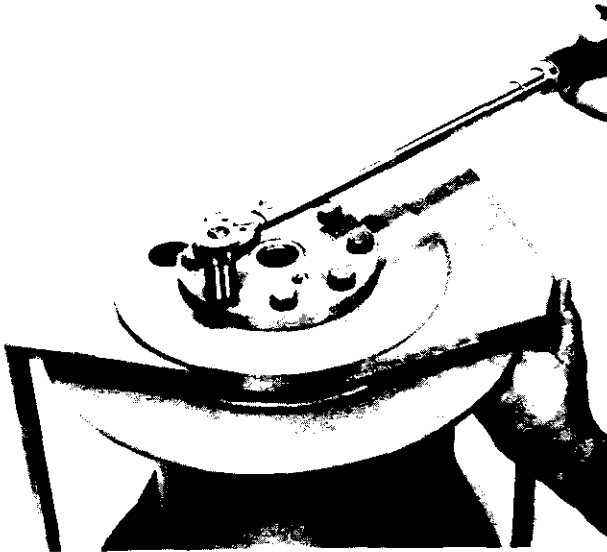
Make certain the snap ring is installed on the bearing support. This snap ring will keep the output planet carrier correctly positioned in the winch. Gear train damage may occur if this snap ring is omitted.

VENT PLUG
ABOVE
CENTERLINE

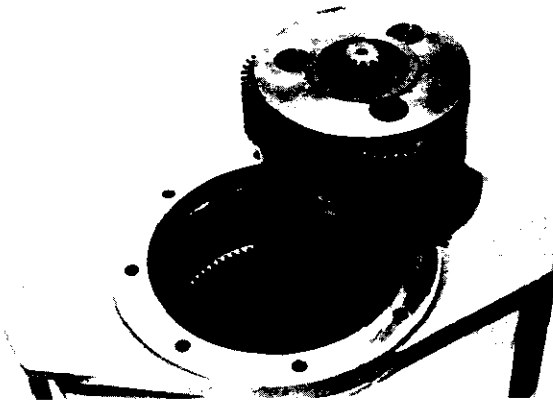


⚠ CAUTION

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



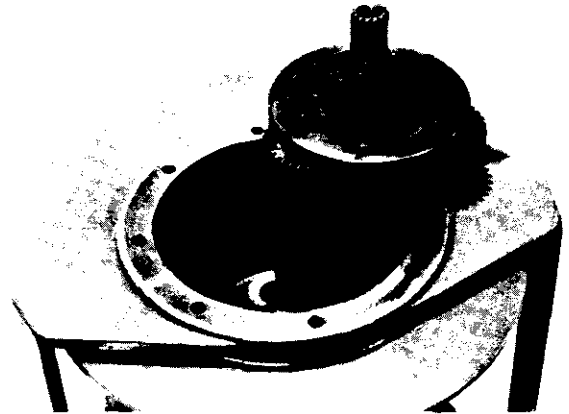
4. Tighten the bearing support capscrews to the recommended torque.



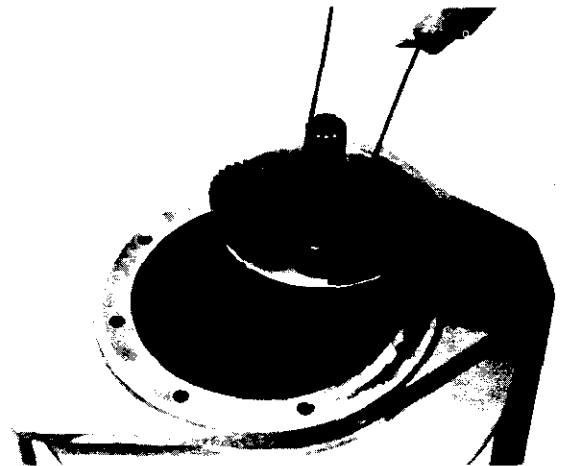
5. Stand winch on bearing support end. Install the output sun gear and thrust washer into output planet carrier.



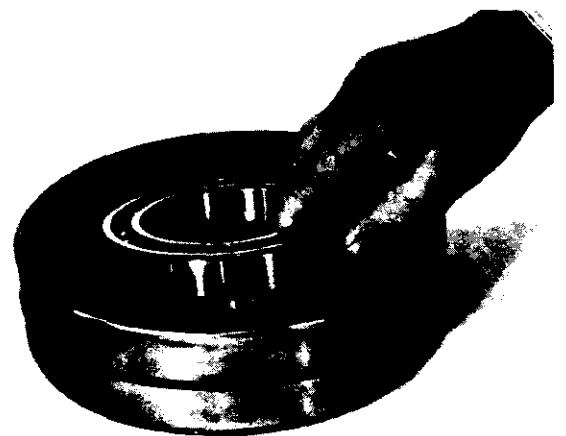
6. Install the output planet carrier into the drum while meshing the planet gears with the ring gear and the planet housing with the bearing support.



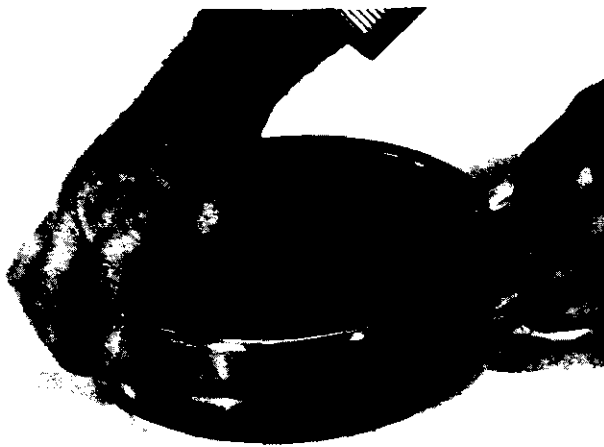
7. Install the primary sun gear and thrust washer into the primary planet carrier.



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.



10. Install a new O-ring on the drum closure.

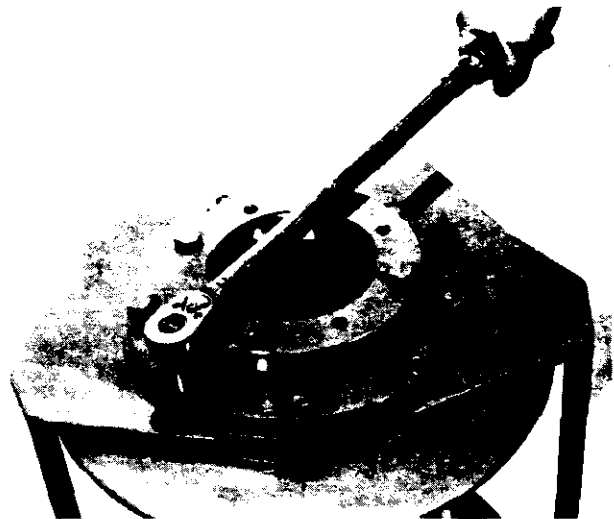


11. Lubricate the O-ring and drum opening with petroleum jelly or gear oil and install the drum closure into the drum.



12. 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.



13. Tighten brake cylinder capscrews to recommended torque.



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

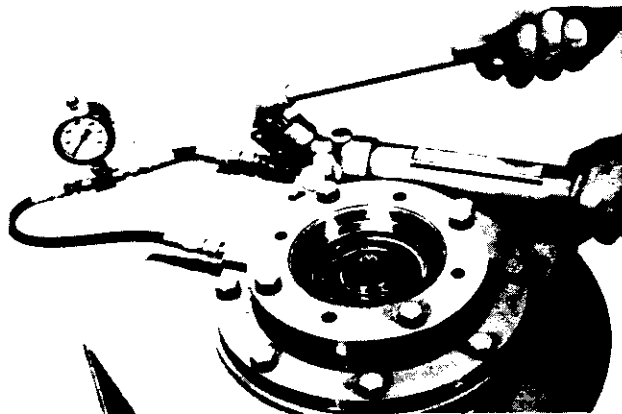
When installed correctly, the inner race should turn freely in the opposite direction the drum turns to pull wire rope in. An easy way to check the rotation is to hold the outer race in one hand, and rotate the inner race.

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

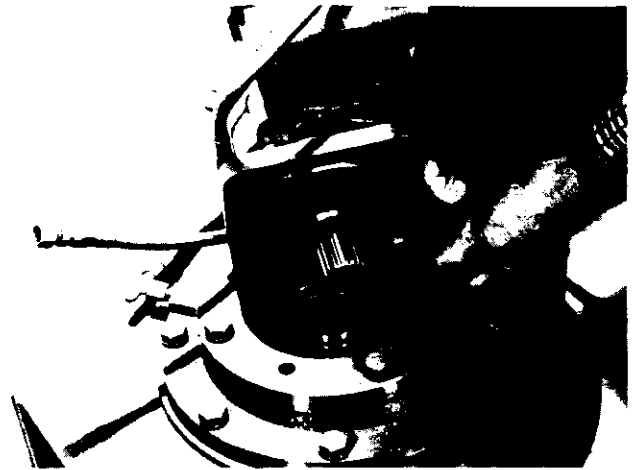
Be certain the snap ring is seated in the groove in the splined bore of the inner race. This snap ring will keep the brake clutch assembly correctly positioned in the center of the friction brake pack. Binding of the brake or brake failure may occur if this snap ring is omitted.



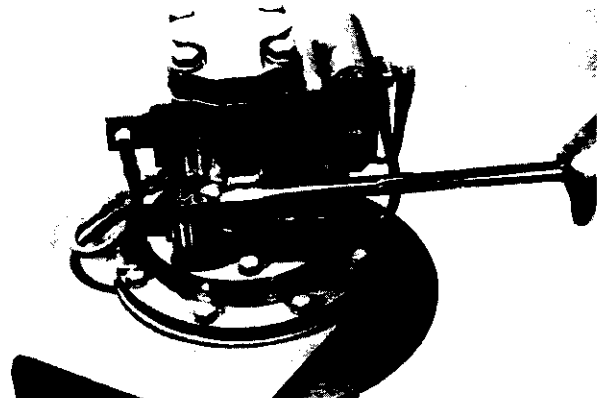
15. If the brake discs are misaligned, preventing the installation of the clutch, then with a hand pump, apply 750-1000 psi to the brake release port. The brake discs will move freely with the brake released, permitting alignment of the discs, brake clutch and input sun gear.



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



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



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



19. Install the hoses that connect the manifold and brake valve to the brake cylinder.
20. 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.

PREVENTIVE MAINTENANCE LOG

IN SERVICE RECORD DATE - - - HRS.	PRIME MOVER HRS.	3 MOS. OR 500 HRS.	6 MOS. OR 1000 HRS.	9 MOS. OR 1500 HRS.	12 MOS. OR 2000 HRS.	15 MOS. OR 2500 HRS.	18 MOS. OR 3000 HRS.	21 MOS. OR 3500 HRS.	24 MOS. OR 4000 HRS.
CHECK GEAR OIL LEVEL	DATE								
CHANGE HYD SYSTEM FLTR	HRS.								
CHANGE GEAR OIL	DATE	X		X		X		X	
CLEAN VENT PLUG	HRS.	X		X		X		X	
CHECK/TIGHTEN MOUNTING BOLTS		X		X		X		X	
DISASSEMBLY & INSPECTION	DATE	X	X	X		X	X	X	
	HRS.	X	X	X		X	X	X	

PREVENTIVE MAINTENANCE LOG

IN SERVICE RECORD DATE - - - HRS.	PRIME MOVER HRS.	27 MOS. OR 4500 HRS.	30 MOS. OR 5000 HRS.	33 MOS. OR 5500 HRS.	36 MOS. OR 6000 HRS.	39 MOS. OR 6500 HRS.	42 MOS. OR 7000 HRS.	45 MOS. OR 7500 HRS.	48 MOS. OR 8000 HRS.
CHECK GEAR OIL LEVEL	DATE								
CHANGE HYD SYSTEM FLTR	HRS.								
CHANGE GEAR OIL	DATE	X		X		X		X	
CLEAN VENT PLUG	HRS.	X		X		X		X	
CHECK/TIGHTEN MOUNTING BOLTS		X		X		X		X	
DISASSEMBLY & INSPECTION	DATE	X	X	X		X	X	X	
	HRS.	X	X	X		X	X	X	

REPEAT MAINTENANCE SCHEDULE AFTER REACHING 48 MONTHS OR 8000 HOURS.

