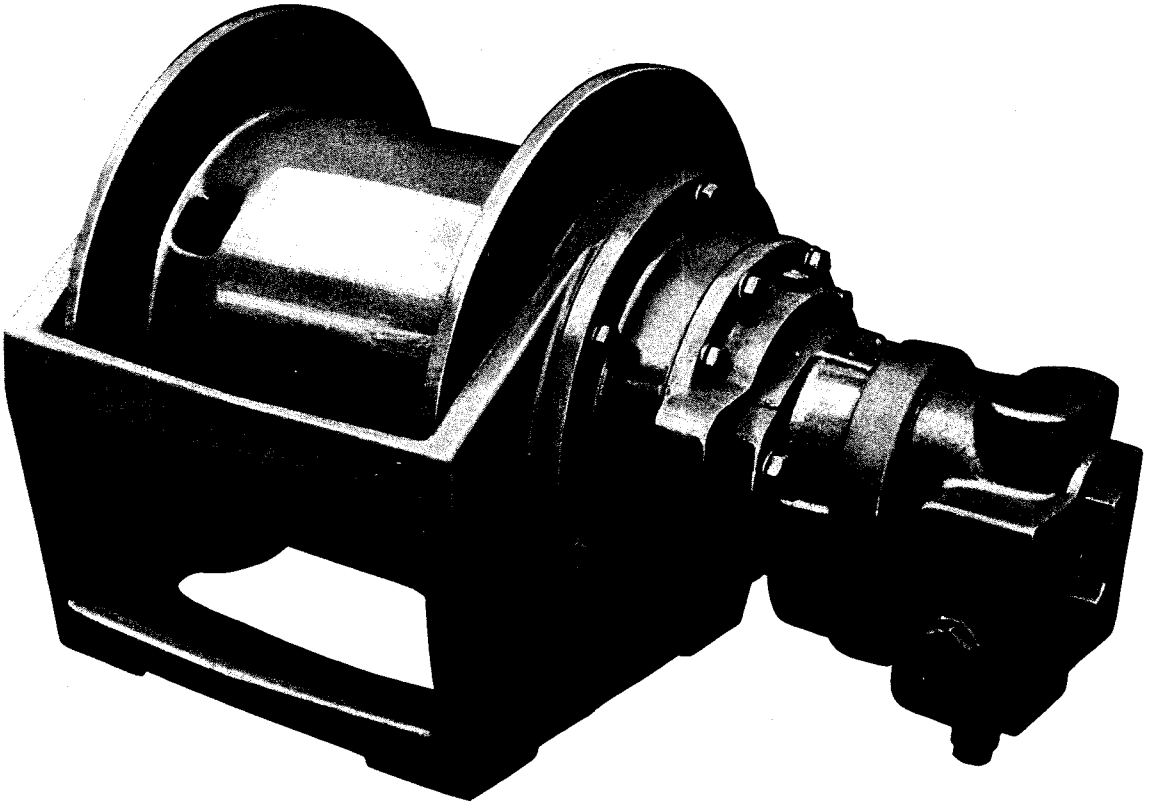
BRADEN®
Gearmatic®

BG6
HYDRAULIC WINCH

This manual also provides service information for the BRADEN PD5 and GEARMATIC GH5 winches.



INSTALLATION, MAINTENANCE PARTS AND SERVICE

BG-101
8/91
Printed in U.S.A.

PACCAR WINCH DIVISIONS
P.O. BOX 547 • BROKEN ARROW, OK U.S.A. 74013
PHONE (918) 251-8511 • FAX (918) 258-4822

FOREWORD

Read and understand this entire manual before operating or servicing your BRADEN/GEARMATIC winch. Retain this manual for future reference.

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

The following service instructions have been prepared to provide assembly, disassembly and maintenance information for the Model BG6 series winch. It is suggested that before doing any work on these units, all assembly and disassembly instructions should be read and understood.

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

Continuing product improvement may cause changes in your winch which may not be included in this manual. When a question arises regarding your winch or this manual, contact your nearest BRADEN/GEARMATIC dealer or the factory Service Department at 918-251-8511, Monday - Friday, 8:00 a.m. to 4:30 p.m. CST, or by FAX at 918-258-4822. Provide the complete winch model and serial number when making inquiries. The model and serial numbers are stamped into the data plate attached to the base, to the left of the hydraulic motor.

PARTS AND SERVICE

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

OTHER MODELS

This manual also applies to the Braden PD5 and Gearmatic GH5 winches.

EXPLANATION OF MODEL NUMBER

BG6 — 67 010 - 01

OVERALL RATIO

67 — 67.

29 — 29.00:1

MOTOR

010 — 1.05 CU. IN. (17 cm^3) DISPLACEMENT

012 — 1.20 CU. IN. (20 cm^3) DISPLACEMENT

020 — 1.96 CU. IN. (32 cm^3) DISPLACEMENT

029 — 2.94 CU. IN. (48 cm^3) DISPLACEMENT

DRUM

01 — 7.5 IN. (191 mm) BARREL DIAMETER

11.13 IN. (283 mm) FLANGE DIAMETER

7.28 IN. (185 mm) BETWEEN FLANGES

TABLE OF CONTENTS

GENERAL SAFETY RECOMMENDATIONS

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

⚠ WARNING

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

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

Safety informational callouts used in this manual include:

⚠ WARNING

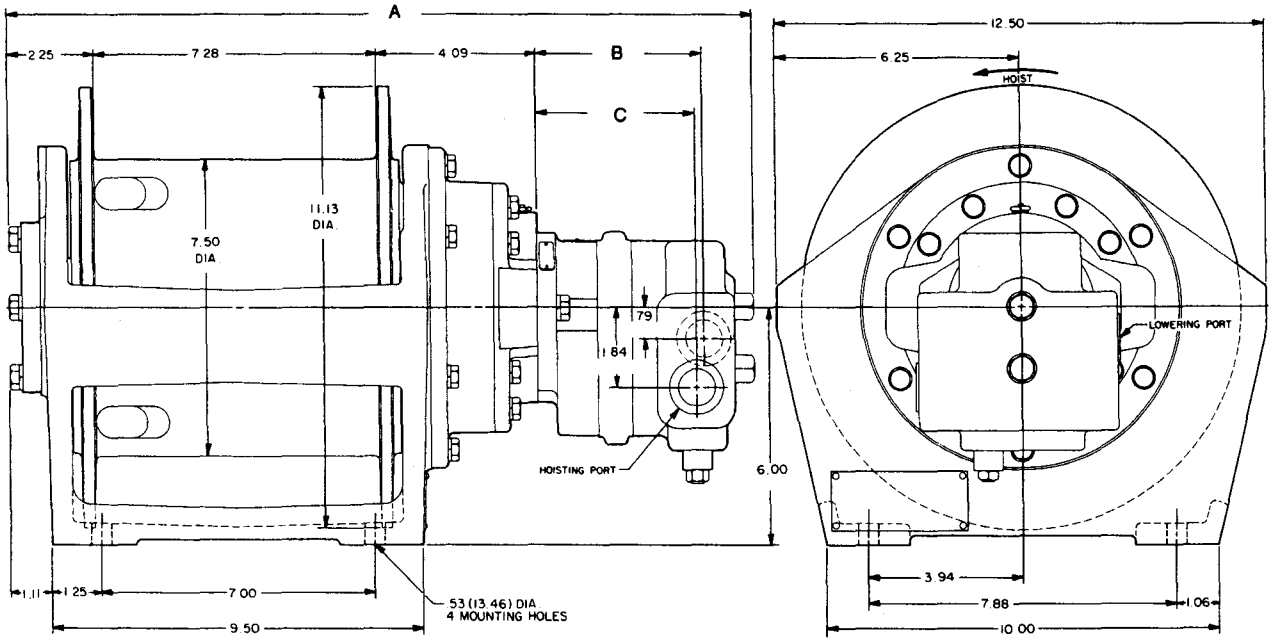
WARNING — This emblem is used to warn against hazards and unsafe practice which could result in severe personal injury or death if proper procedures are not followed.

⚠ CAUTION

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

DIMENSIONAL DATA

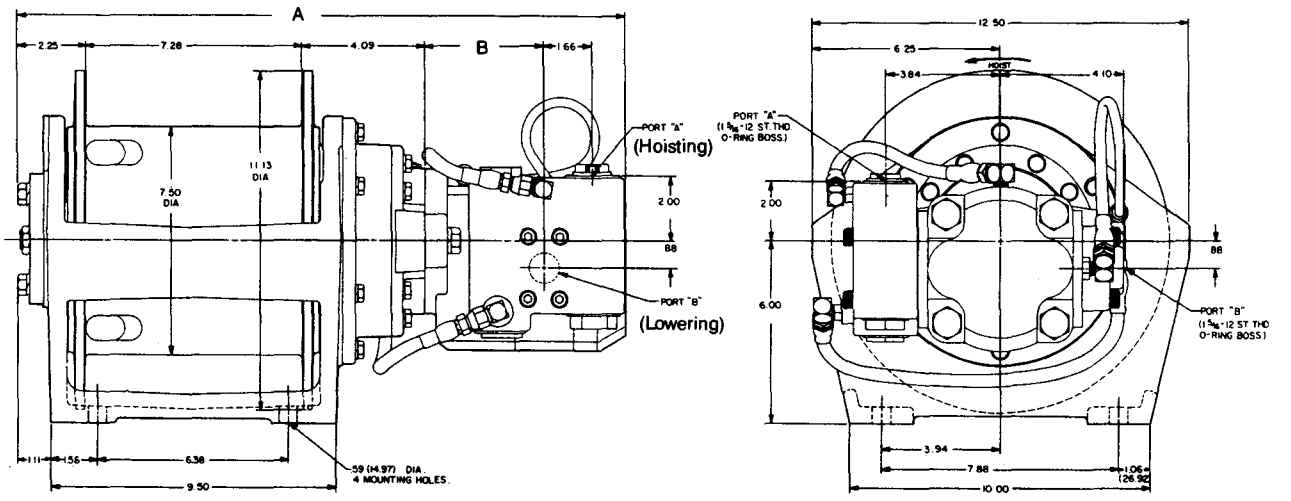
MOTORS 010 & 012



MOTOR	A	B	C
010	19.19	4.25	4.07
012	19.32	4.38	4.19

HOISTING AND LOWERING PORTS ARE 7/8-14 SAE.

MOTORS 020 & 029



MOTOR	A	B
020	20.06	3.81
029	20.56	4.06

BG6 PERFORMANCE

67.06:1 RATIO

ROPE SIZE (IN.)	LAYER	012 MOTOR 1.20 CU. IN. DISP. 2200 PSI @ 18 GPM		010 MOTOR 1.05 CU. IN. DISP. 2500 PSI @ 15 GPM		ROPE CAPACITY (FT.)	LAYER
		LINE PULL (LBS.)	LINE SPEED (FPM)	LINE PULL (LBS.)	LINE SPEED (FPM)	01 DRUM	
3/8 .375	1	5,000	88	5,000	81	40	1
	2	4,570	97	4,570	88	83	2
	3	4,200	105	4,200	96	130	3
	4*	3,890	114	3,890	104	181	4
7/16 .438	1	5,000	89	5,000	81	34	1
	2	4,510	99	4,510	90	72	2
	3	4,100	109	4,100	99	114	3
	4*	3,760	119	3,760	114	160	4
1/2 .500	1	5,000	90	5,000	82	30	1
	2	4,450	101	4,450	92	64	2
	3*	4,000	112	4,000	103	102	3

67.06:1 RATIO (METRIC)

ROPE SIZE (MM)	LAYER	012 MOTOR 20 cm³ DISP. 155 kg/cm² @ 68 l/min		010 MOTOR 17 cm³ DISP. 176 kg/cm² @ 57 l/min		ROPE CAPACITY (M)
		LINE PULL (KG)	LINE SPEED (MPM)	LINE PULL (KG)	LINE SPEED (MPM)	
10	1	2,268	27	2,268	25	12.2
	2	2,073	30	2,073	27	25.3
	3	1,905	32	1,905	29	39.6
	4*	1,765	35	1,765	32	55.2
11	1	2,268	27	2,268	25	10.4
	2	2,046	30	2,046	27	21.9
	3	1,860	33	1,860	30	34.7
	4*	1,706	36	1,706	35	48.8
13	1	2,268	27	2,268	25	9.1
	2	2,019	31	2,019	28	19.5
	3*	1,814	34	1,814	31	31.1

*This layer does not comply with ANSI Spec. B30.5C 5-1.3.2c for ½" exposed flange.

29.00:1 RATIO

ROPE SIZE (IN.)	LAYER	012 MOTOR 1.20 CU. IN. DISP. 2500 PSI @ 18 GPM		020 MOTOR 1.96 CU. IN. DISP. 2750 PSI @ 25 GPM		029 MOTOR** 2.94 CU. IN. DISP. 2650 PSI @ 21 GPM		ROPE CAPACITY (FT.)
		LINE PULL (LBS.)	LINE SPEED (FPM)	LINE PULL (LBS.)	LINE SPEED (FPM)	LINE PULL (LBS.)	LINE SPEED (FPM)	01 DRUM
3/8 .375	1	2,500	205	4,000	175	6,000	93	40
	2	2,280	224	3,650	192	5,480	102	83
	3	2,100	244	3,360	209	5,040	111	130
	4*	1,940	263	3.110	226	4,670	120	181
7/16 .438	1	2,500	206	4,000	177	6,000	94	34
	2	2,250	229	3,600	196	5,400	105	72
	3	2,050	252	3,280	216	4,920	115	114
	4*	1,880	275	3,010	236	4,510	125	160
1/2 .500	1	2,500	208	4,000	178	6,000	95	30
	2	2,220	234	3,560	201	5,330	107	64
	3*	2,000	260	3,200	223	4,800	119	102

29.00:1 RATIO (METRIC)

ROPE SIZE (MM)	LAYER	012 MOTOR 20 cm³ DISP. 176 kg/cm² @ 68 l/min		020 MOTOR 32 cm³ DISP. 193 kg/cm² @ 95 l/min		029 MOTOR** 48 cm³ DISP. 186 kg/cm² @ 79 l/min		ROPE CAPACITY (M)
		LINE PULL (KG)	LINE SPEED (MPM)	LINE PULL (KG)	LINE SPEED (MPM)	LINE PULL (KG)	LINE SPEED (MPM)	
10	1	1,134	62	1,814	53	2,722	28	12.2
	2	1,034	68	1,656	59	2,486	31	25.3
	3	953	74	1,524	64	2,286	34	39.6
	4*	880	80	1,406	69	2,118	37	55.2
11	1	1,134	63	1,814	54	2,722	29	10.4
	2	1,021	70	1,633	60	2,449	32	21.9
	3	930	77	1,488	66	2,232	35	34.7
	4*	853	84	1,365	72	2,046	38	48.8
13	1	1,134	63	1,814	54	2,722	29	9.1
	2	1,007	71	1,615	61	2,418	33	19.5
	3	907	79	1,452	68	2,177	36	31.1

*This layer does not comply with ANSI Spec. B30.5C 5-1.3.2c for ½" exposed flange.

**This model is approved for intermittent applications only. Do not exceed hydraulic pressure or flow indicated. Contact factory for details.

THEORY OF OPERATION

DESCRIPTION OF WINCH

The winch has three basic assemblies:

1. Hydraulic motor assembly and brake valve
2. Cable drum assembly
3. Brake cylinder and motor adapter

The hydraulic motor is bolted to the motor adapter which in turn is bolted to the brake cylinder and the winch base. The cable drum assembly is supported by anti-friction bearings which are located by the brake housing at one end and the bearing support at the other end. The ring gear for both planetary sets is machined on the inside surface of the cable drum.

PLANETARY GEAR TRAIN

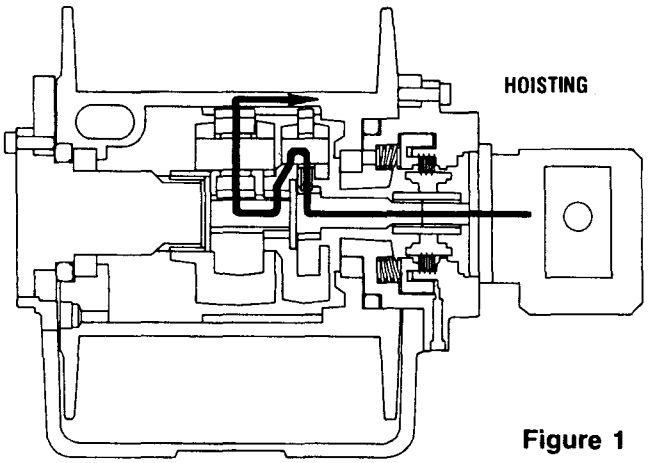


Figure 1

The hydraulic motor shaft is directly coupled to the inner brake hub which is connected to the input shaft which acts as the sun gear for the primary planetary set. When driven by the input shaft, the primary planet gears walk around the ring gear machined in the cable drum and drive the primary planet carrier.

The primary planet carrier drives the output sun gear which drives the output planet gears. The output planet carrier is splined to the bearing support and cannot rotate. As the output planet gears are driven by the output sun gear, they drive the ring gear/cable drum.

DUAL BRAKE SYSTEM

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

The dynamic brake system has two basic components.

1. Brake valve assembly
2. Hydraulic motor

The brake valve is basically a counter balance valve. The counter balance valve is contained within the hydraulic motor end bracket on units with motor code 010 and 012. Units with motor code 020 or 029 utilize a brake valve mounted externally on the hoist port of the motor. It contains a check valve to allow free flow of oil to the motor in the haul-in direction and a pilot operated, spring-loaded spool valve that blocks the flow of oil out of the motor when the control valve is placed in neutral. When the control valve is placed in the pay-out position, the spool valve remains closed until sufficient pilot pressure is applied to the end of the spool to shift it against spring pressure and open a passage. After the spool valve cracks open, the pilot pressure becomes flow-dependent and modulates the spool valve opening which controls the pay-out speed.

The static brake system has three basic components:

1. Spring applied, multiply friction disk brake pack
2. Over-running brake clutch assembly
3. Hydraulic brake cylinder and spring plate

The static brake consists of alternately stacked friction and steel brake disks. The steel brake disks are externally splined to the motor adapter and cannot rotate. The friction disks are internally splined to the outer brake hub of the over-running brake clutch. When compressed by spring force, the brake pack locks the over-running brake clutch outer brake hub to the motor adapter.

The static brake is released by the pilot pressure at a pressure lower than that required to open the pilot operated brake 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 primarily a load holding brake and will provide dynamic braking only during extremely slow operation when there is insufficient flow to open the brake valve.

The sprag type over-running brake clutch is installed between the inner brake race and the outer brake hub. The over-running brake clutch allows the inner brake race and input shaft to turn freely in the direction to haul in cable and locks up to force the friction brake disks to turn with the inner brake race and input shaft to pay out cable. The brake pack remains fully applied when hauling in cable and must be released by pilot pressure to allow the brake disks to turn freely and pay out cable.

DUAL BRAKE SYSTEM – OPERATION

When hoisting or pulling a load, the brake clutch allows free rotation of the inner brake race and input shaft. The sprag cams lay over and permit the inner brake race

to turn free of the outer brake hub. Figure 2. The friction brake remains fully engaged. The winch is not affected by any braking action during haul-in.

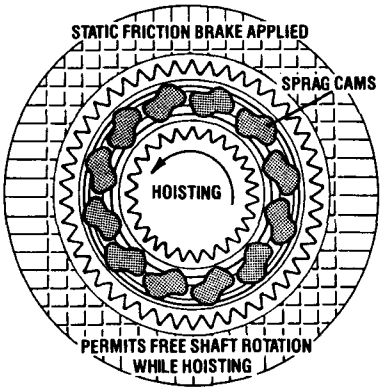


Figure 2

When the haul-in operation is stopped, the load attempts to turn the input shaft in the opposite direction. This reversed input causes the sprag cams to instantly engage and firmly lock the inner brake race to the outer brake hub. Reference Figure 3.

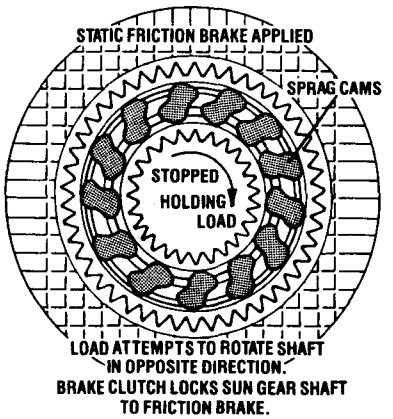


Figure 3

When the winch is powered in reverse, to pay out cable, the motor and gear train will not rotate until sufficient pilot presure is suppied to open the brake valve. 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.

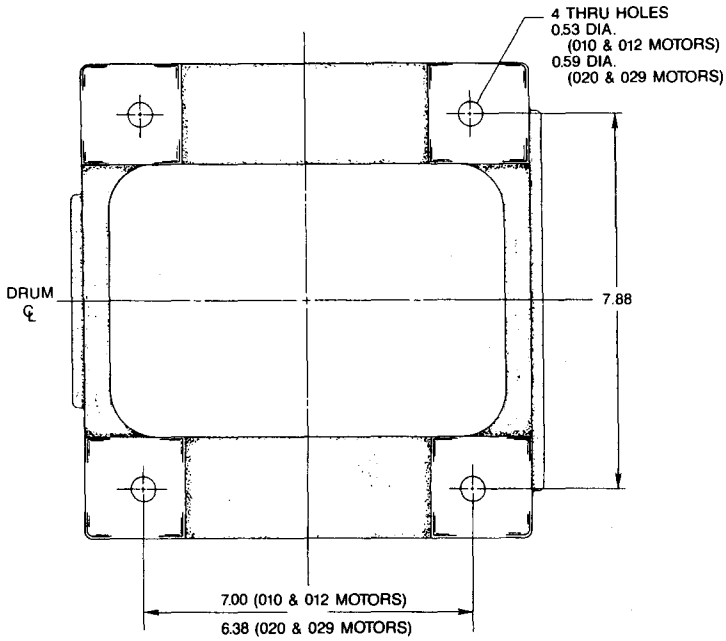
When the control valve is returned to neutral or "hold", the pilot pressure will drop and the brake valve will close, stopping the load. The friction brake will engage and hold the load after the brake valve has closed.

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 friction brake will release sufficiently to allow the load to rotate the motor through its own internal leakage. This feature results in a very slow speed and extremely accurate positioning.

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.

WINCH AND WIRE ROPE INSTALLATION

1. The winch should be mounted with the centerline of the cable drum in a horizontal position. The mounting plane of the winch may be rotated in any position around this centerline providing the vent port in the motor adapter is correctly positioned. Refer to additional instructions in this section.



2. When mounting the winch, use all four (4) mounting holes and grade eight (8) bolts and nuts. Evenly tighten nuts to 80 lb. ft. torque, lubricated with 30W motor oil.

   It is important that the winch is mounted on a surface that will not flex when the winch is in use, and cause binding of the gear train. Binding in the gear train will result in accelerated wear and heat. Also, the mounting surface should be flat within + or − .020 inches. If necessary, install shims under winch mounting pads to achieve even mounting.

3. The hydraulic lines and components that operate the winch should be of sufficient size to assure minimum back pressure at the winch. The motor manufacturer recommends that the back pressure not exceed 100 psi for optimum motor seal life.

   If high back pressures are encountered, the motor may be externally drained to tank to improve motor seal life. On the 010 and 012 motors, the external drain port is a 7/16 in. -20 O-ring boss port located on the top of the motor near the mounting flange. On the 020 and 029 motors the motor case drain line can be run directly to tank, and the connection on the brake valve plugged. (Refer to component drawing on page 12).

   The winch directional control valve must be a three position four way valve with a motor spool such that when the valve is in the center position both work ports are open to tank (open center, open port).

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

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

   Maximum cold weather start-up viscosity should not exceed 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/GEARMATIC Service Department. The use of multi-viscosity oils is generally not recommended. Refer to "Recommended Planetary Gear Oil" in the "Preventive Maintenance" section for additional information.

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

6. The vent plug in the motor adapter must be located as close to top dead center as possible. If the winch is mounted on a pivoting surface, be sure vent plug remains above the centerline in all positions. If necessary reposition motor adapter and vent plug as follows:

   A. Remove brake cylinder capscrews (34).

   B. Rotate brake cylinder assembly (22) and reinstall capscrews (34).

   C. Evenly tighten capscrews to recommended torque

7. Install hydraulic hoses to motor in the following manner:

   Motor Codes 010 & 012

   To hoist a load, pressurize the motor port at the nine (9) o'clock position, when viewed from the motor end (port nearest counter-balance valve cartridge).

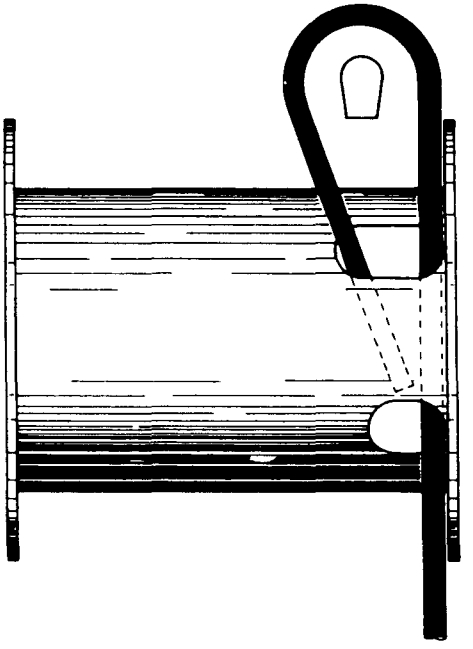
   To lower a load, pressurize the motor port at the three (3) o'clock position.

   Motor Code 020 & 029

   To hoist a load, pressurize the inlet port on the brake valve.

To lower a load, pressurize the manifold port on the side of motor opposite the brake valve.

Hoisting and lowering ports are also identified on the exploded view drawing at the center of this manual.



WIRE ROPE INSTALLATION

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 three-fourths of the way back through the pocket. Install the cable anchor (55) with the small end toward the drum, then pull the slack out of the wire rope. The cable anchor will slip into the pocket and secure the wire rope into the drum.

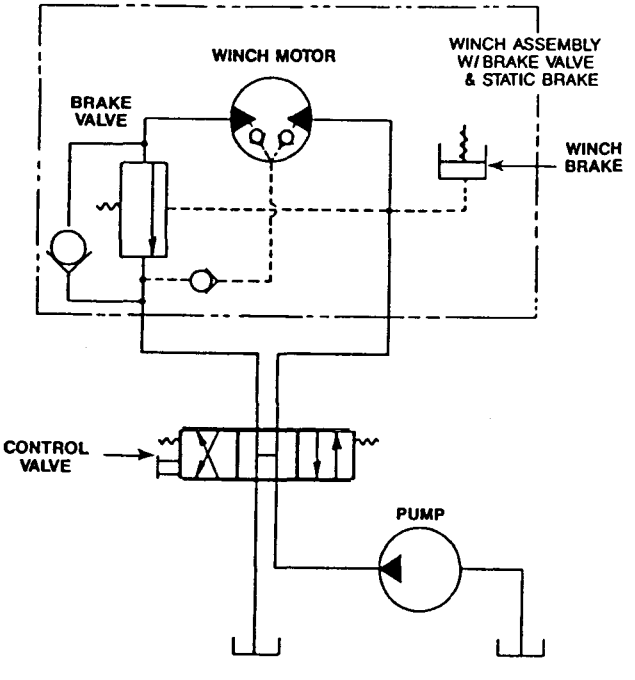
Use cable anchor 26095 for $\frac{5}{16}$ to $\frac{1}{2}$ dia. wire rope.

Use cable anchor 28779 for $\frac{1}{4}$ in. dia. wire or poly rope.

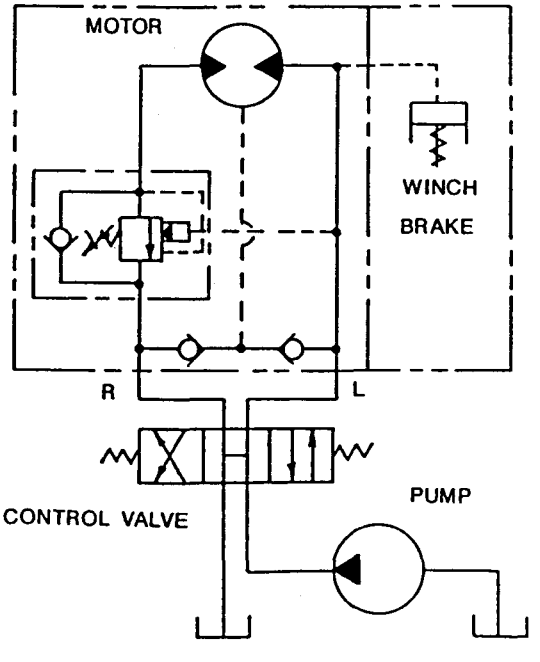
Standard drum rotation, to haul-in wire rope, is counter-clockwise when viewed from motor end.

HYDRAULIC CIRCUITS

MOTOR CODE 020 & 029



MOTOR CODE 010 & 012



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 ever 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 every 1,000 operating hours or six (6) months, whichever occurs first. The gear oil must be changed to remove wear particles that impede the reliable and safe operation of the brake clutch and erode bearings, gears and seals. Failure to change gear oil at these suggested minimum intervals may contribute to intermittent brake slippage which could result in property damage, severe personal injury or death.

   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 motor adapter. 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**

   Inspected entire length of wire rope according to wire rope manufacturer's recommendations.

6. **Mounting bolts**

   Tighten all winch base mounting bolts to recommended torque after the first one hundred (100) hours of operation, then every 1000 operating hours or six (6) months, whichever occurs first.

7. **Warm-up 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, we have listed one (1) readily available product in each temperature range which has been tested and found to meet our specifications. This is not to say that other lubricant brands would not perform equally as well.

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

BG6 planetary winches are factory filled with Texaco Meropa 150 or equivalent API GL-2 gear oil.

9. Inspection

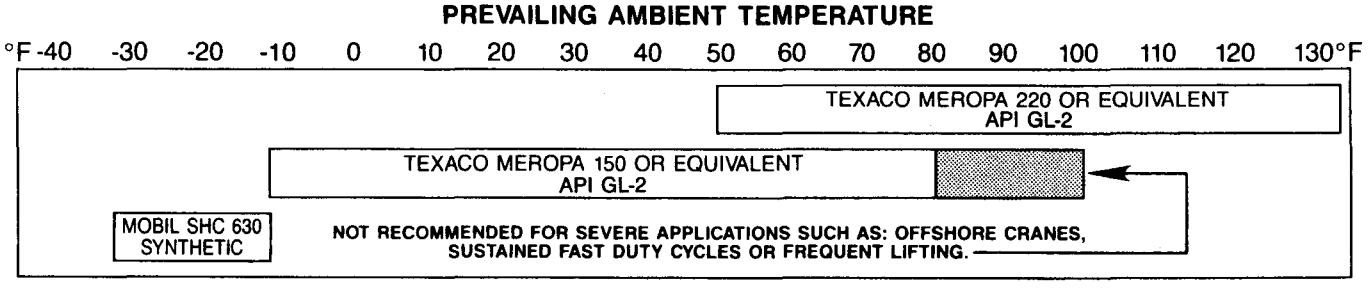
In compliance with ANSI specification number B30.5c1987 and API Recommended Practice RP 2D section 3, we recommend that the winch be disassembled for a thorough inspection of all wear items every 2,000 hours of operation or twelve (12) months, whichever occurs first.

A. Bearings and Gears – Refer to MOTOR ADAPTER – BRAKE HOUSING ASSEMBLY SERVICE, Clean and Inspect, items 5 and 8 on page 18; CABLE DRUM AND END BRACKET SERVICE, Clean and inspect, items 4, 5 & 6 on page 19; PLANET CARRIER SERVICE, Clean and inspect, items 2, 3 & 4 on page 20.

B. Brake Cylinder – Refer to MOTOR ADAPTER – BRAKE HOUSING ASSEMBLY SERVICE, Clean and inspect, items 6, 7, 9 and 10 on page 18.

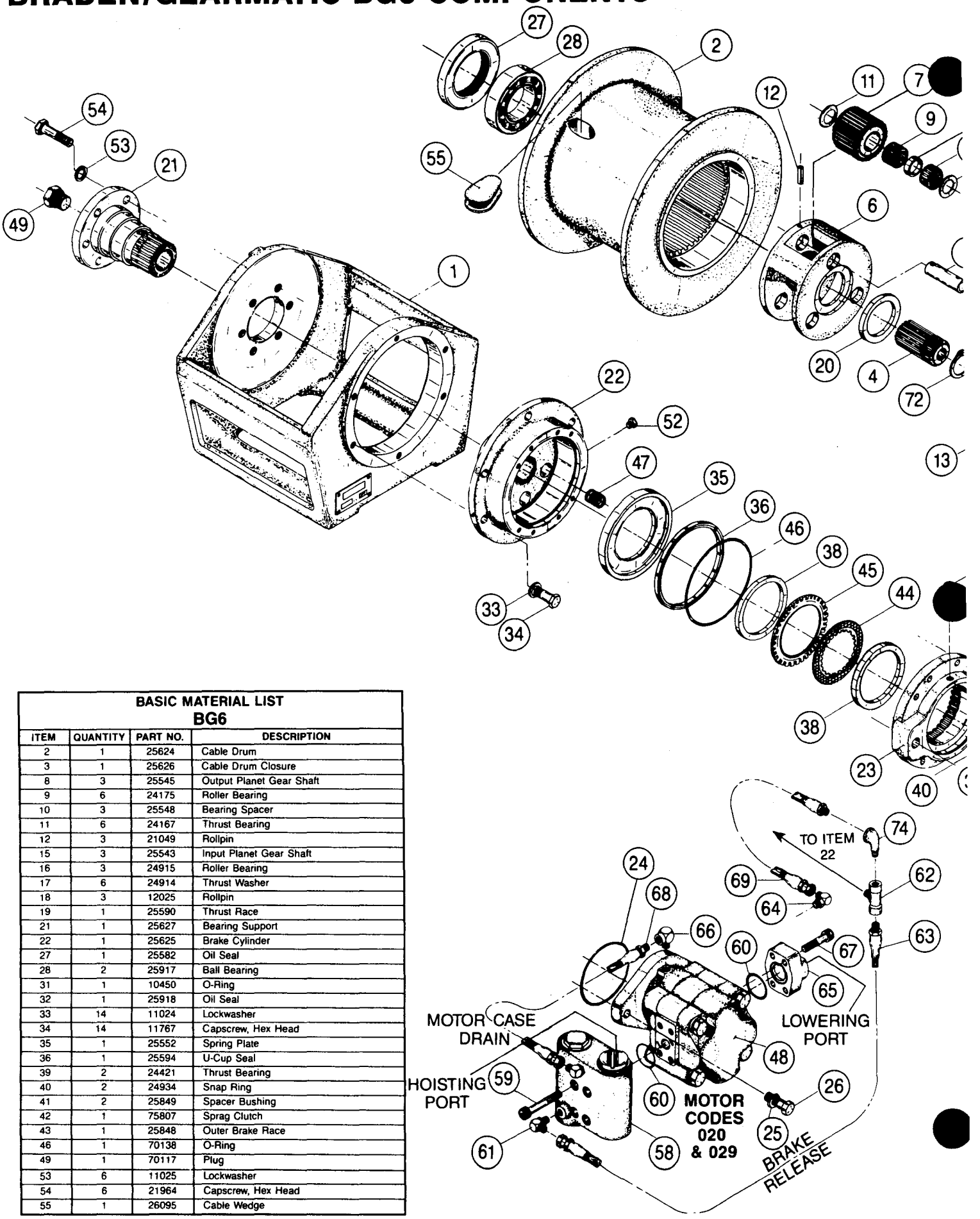
C. Brake Clutch – Refer to MOTOR ADAPTER – BRAKE HOUSING ASSEMBLY SERVICE, Clean and inspect, item 4 on page 17.

RECOMMENDED GEAR OIL

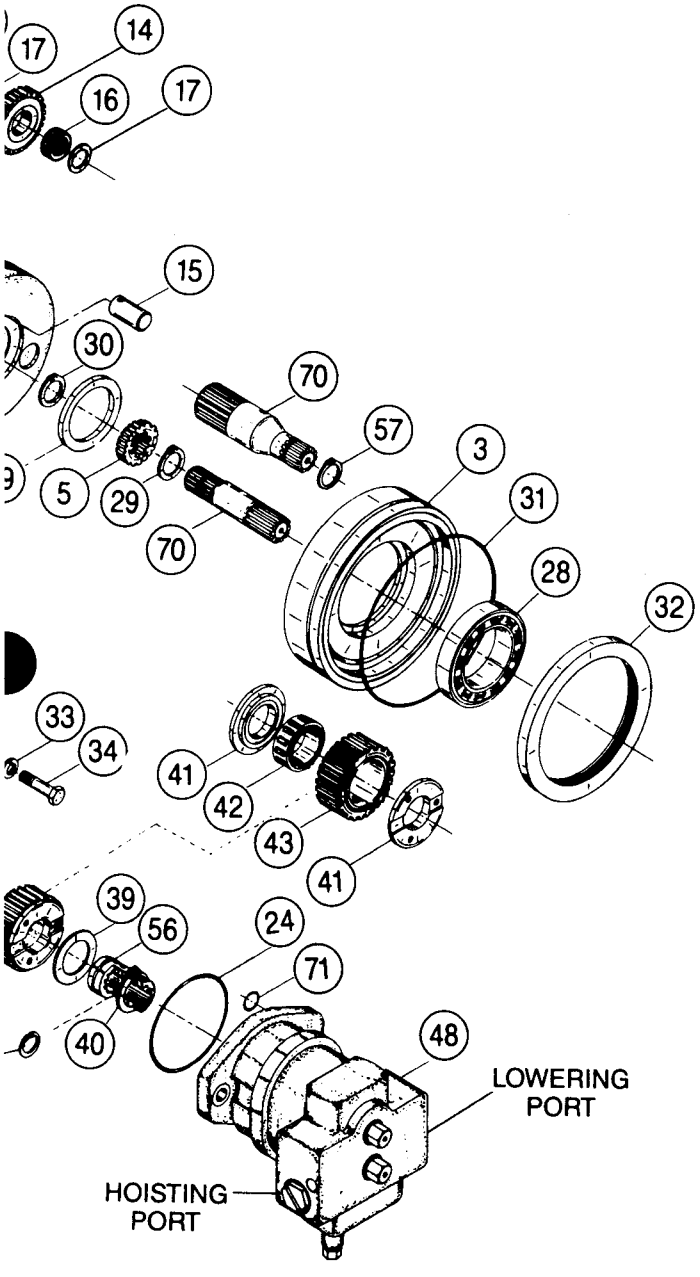


BG6 winches are factory filled with Texaco Meropa 150 or equivalent API GL-2 gear oil. Oil capacity is 2 pints.

BRADEN/GEARMATIC BG6 COMPONENTS



BASIC MATERIAL LIST BG6			
ITEM	QUANTITY	PART NO.	DESCRIPTION
2	1	25624	Cable Drum
3	1	25626	Cable Drum Closure
8	3	25545	Output Planet Gear Shaft
9	6	24175	Roller Bearing
10	3	25548	Bearing Spacer
11	6	24167	Thrust Bearing
12	3	21049	Rollpin
15	3	25543	Input Planet Gear Shaft
16	3	24915	Roller Bearing
17	6	24914	Thrust Washer
18	3	12025	Rollpin
19	1	25590	Thrust Race
21	1	25627	Bearing Support
22	1	25625	Brake Cylinder
27	1	25582	Oil Seal
28	2	25917	Ball Bearing
31	1	10450	O-Ring
32	1	25918	Oil Seal
33	14	11024	Lockwasher
34	14	11767	Capscrew, Hex Head
35	1	25552	Spring Plate
36	1	25594	U-Cup Seal
39	2	24421	Thrust Bearing
40	2	24934	Snap Ring
41	2	25849	Spacer Bushing
42	1	75807	Sprag Clutch
43	1	25848	Outer Brake Race
46	1	70138	O-Ring
49	1	70117	Plug
53	6	11025	Lockwasher
54	6	21964	Capscrew, Hex Head
55	1	26095	Cable Wedge



MOTOR CODES 010 & 012

MATERIAL LIST VARIABLES

ITEM	QTY.	67.06:1 RATIO 010 & 012 MOTORS PART NO.	29.00:1 RATIO 020 & 029 MOTORS PART NO.	29.00:1 RATIO 012 MOTOR PART NO.	DESCRIPTION
0	1	81790	81915	81915	Primary Planet Carrier Assembly (w/Item 4)
0	1	81791	81917	81917	Output Planet Carrier Assembly
4	1	25634	25544	25544	Output Sun Gear
5	1	—	25547	25547	Primary Sun Gear
6	1	25630	25532	25532	Output Planet Carrier
7	3	25632	25546	25546	Output Planet Gear
13	1	25629	25531	25531	Primary Planet Carrier
14	3	25631	25556	25556	Primary Planet Gear
20	1	13680	25590	25590	Thrust Race
23	1	25919	26091	25919	Motor Adapter
24	1	25727	21063	25727	O-Ring
25	2	18003	11026	18003	Lockwasher
26	2	21961	13413	21961	Capscrew, Hex Head
29	1	—	25589	25589	Snap Ring
30	1	11953	13023	13023	Snap Ring
37	1	18062	10074	10074	Relief Valve
38	3	25550	—	—	Brake Plate Spacer
38	2	—	25550	25550	Brake Plate Spacer
44	5	25541	—	—	Friction Disc
44	7	—	25541	25541	Friction Disc
45	6	25540	—	—	Brake Disc
45	8	—	25540	25540	Brake Disc
47	6	24916	26094	26094	Brake Spring
48	1	27126	—	—	Hydraulic Motor Code 010
48	1	27127	—	27127	Hydraulic Motor Code 012
48	1	—	25386	—	Hydraulic Motor Code 020
48	1	—	25385	—	Hydraulic Motor Code 029
52	1	25663	—	25563	Hex Head Plug
56	1	26287	26093	26287	Inner Brake Race
57	1	25589	—	25589	Snap Ring
58	1	—	81715	—	Brake Valve Assembly
59	4	—	25622	—	Capscrew, Socket Head
60	2	—	25366	—	O-Ring
61	1	—	25302	—	Elbow Fitting
62	1	—	22934	—	Tee — Male Branch
63	1	—	13706	—	Hose Assembly, 16 Inch
64	1	—	25131	—	Elbow w/O-Ring
65	1	—	25539	—	Split Flange Adapter
66	1	—	24236	—	Reducer Elbow
67	4	—	13544	—	Capscrew, Socket Head
68	1	—	13711	—	Hose Assembly, 10 Inch
69	1	—	13710	—	Hose Assembly, 8 Inch
70	1	26288	26092	26524	Input Shaft
71	1	24520	—	24520	O-Ring
72	1	11953	25588	25588	Snap Ring
73	1	—	32115	—	Retaining Ring
74	1	—	13708	—	Elbow, Street
1	1	25623	26643	25623	Base

BG6
O-RING AND SEAL KIT
PART NUMBER 61774

ITEM	QUANTITY	PART NO.	DESCRIPTION
24	1	25727	O-Ring (Motor Codes 010 & 012)
24	1	21063	O-Ring (Motor Code 020)
27	1	25582	Oil Seal
71	1	24520	O-Ring (Motor Codes 010 & 012)
31	1	10450	O-Ring
32	1	25918	Oil Seal
36	1	25594	U-Cup Seal
46	1	70138	O-Ring
49	1	70117	Oil Level Plug w/O-Ring
52	1	25663	Hex Head Plug w/O-Ring (Motor Codes 010 & 012)
60	2	25366	O-Ring

Counter Balance Valve Seal Kit for Motor Codes 010 & 012 — Part No. 26559

Motor Shaft Seal Only for Motor Codes 010 & 012 — Part No. 26531

TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
A. Winch will not pull maximum load.	1. System relief valve may be set too low.	Install a pressure gauge in the haul-in port and apply a stall pull on the winch. If pressure is low, increase relief valve setting until recommended pressure is obtained. 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.
	2. If this trouble occurs suddenly after working at a maximum pull, a particle of dirt may be lodged under the system relief valve, holding it partially open. If this is the cause, a considerable loss in line speed may be noticed as the load on the cable is increased.	Remove relief valve, disassemble and clean parts thoroughly in a suitable solvent. Reassemble and install relief valve. Reset pressure according to specifications.
	3. If the pump is belt driven, the belts may be slipping.	Check belts when pump is at full PSI (kg/cm²) (stall pull on winch). Tighten belts if they are found to be slipping.
	4. The oil level in the reservoir may be too low. The suction line may be restricted or have an air leak causing cavitation at the inlet port. This will cause the pump to make a whining noise.	Check oil level in the reservoir. Check the suction line for damage, externally and internally. Replace suction line if necessary.
	5. 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 generate the rated line pull and cause heat.	Reinforce mounting surface. If necessary, use steel shim stock to level winch. First loosen, then evenly retighten all winch mounting bolts to recommended torque.
	6. 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 remedy for A-5. Same as remedy for B-4.
	7. Winch line pull rating is based on 1st layer of wire rope. Expected line pull may be in excess of winch rating.	Refer to winch performance charts for additional information.
	8. After all the causes listed above have been investigated and it is found that the winch will stall at maximum pressure without developing the maximum pull on the bare drum, the trouble may be in the winch.	Install a pressure gauge in the motor haul-in port and apply a stall pull on the winch. If the pressure is up to maximum and the bare drum line pull is less than the specified line pull, the trouble will be in the winch. Disassemble winch according to disassembly instructions and check that gear train turns freely. If gear train is found to be satisfactory, inspect the hydraulic motor, according to the service instructions for the hydraulic motor.
	9. Rigging and sheaves not operating efficiently.	Perform rigging and sheave service as recommended by manufacturer.

TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
B. Considerable reduction in line speed.	1. Same as A-2.	Same as remedy for A-2.
	2. Same as A-4.	Same as remedy for A-4.
	3. Same as A-6.	Same as remedy for A-5 & B-4.
	4. If this trouble has increased gradually, the hydraulic pump or winch motor may be worn.	Remove and inspect pump. If satisfactory, consult the disassembly instructions for the winch and remove and inspect the motor according to the service instructions for the hydraulic motor.
C. Reverse speed is slower than forward speed.	1. Control valve may be restricted in its travel.	Check the travel of the control valve spool. The spool travel should be the same in both directions.
	2. Same as A-1.	Same as remedy for A-1.
	3. Oil may be too thick causing a high resistance to rotation at the brake plates and causing the relief valve to by-pass.	Follow warm-up procedure in "Preventive Maintenance" section.
	4. Same as F-1.	Same as remedy for F-1.
D. Brake will not hold when control valve is returned to neutral after lifting a load.	1. Excessive system back pressure acting on the brake release port.	Install a pressure gauge at the "pay-out" port of the hydraulic motor. Operate the pump at full throttle and monitor pressure in "neutral" and haul-in positions. If the pressure is greater than 50 PSI, check for restrictions in the return line from the winch to the control valve and the control valve to the reservoir.
	2. Friction brake will not hold due to worn or damaged brake disks.	Disassemble winch to inspect/replace worn parts.
	3. Brake clutch is slipping.	Improper gear oil may cause the brake clutch to slip. Replace brake parts, drain and flush gear oil then refill with recommended gear oil.
		Brake clutch may be damaged or worn. Disassemble and inspect brake clutch.
E. Brake will not control or stop the load when lowering.	1. Same as D-1, 2, or 3.	Same as remedies for D-1, 2, or 3.
	2. Winch is being overloaded.	Install a pressure gauge at the haul-in port and apply a stall pull on the winch. If the pressure is higher than the maximum specified PSI, reduce the pressure.
	3. After the causes listed above have been investigated and found to be satisfactory, the trouble may be in the winch.	Disassemble the brake clutch assembly according to the disassembly instructions. Inspect the brake springs, brake plates and brake hub assembly. Check that the brake hub assembly will "lock up" in the required direction of rotation.

TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
F. The winch will not lower the load or not lower the load smoothly.	1. The friction brake may not be releasing as a result of a defective brake cylinder seal. NOTE: If the brake cylinder seal is defective you will usually notice oil leaking from the winch vent plug.	Disassemble and inspect the brake cylinder seal.
	2. Friction brake will not release as a result of damaged brake disks.	Disassemble brake to inspect brake disks.
	3. Same as B-4.	Same as remedy for B-4.
	4. Same as A-3.	Same as remedy for A-3.
	5. Same as A-5.	Same as remedy for A-5.
	6. Control valve handle being operated too quickly.	Operate control valve smoothly when starting and stopping a load. Conduct operator training as required.
	7. Insufficient gear oil in cable drum.	Remove oil level plug and check oil level. Fill to proper level.
	8. Control valve does not have good metering characteristics.	See "Winch Installation" section for control valve specifications.
G. The winch runs hot.	1. Same as A-5.	Same as remedy for A-5.
	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 A-1.	Same as remedy for A-1.
	D. Hydraulic pump not operating efficiently.	Remove and inspect pump. Check suction line for damage. If pump is belt driven, belts may be slipping. Replace/tighten belts.
	3. Excessively worn or damaged internal winch parts.	Disassemble winch to inspect/replace worn parts.
	4. Same as F-7.	Same as remedy for F-7.
H. Winch "chatters" while raising rated load.	1. Same as A-1.	Same as remedy for A-1.
	2. Same as B-4.	Same as remedy for B-4.
	3. Hydraulic oil flow to motor may be too low.	Increase pump rpm.
	4. Same as F-6.	Same as remedy for F-6.

WINCH SERVICE

FOREWORD TO WINCH SERVICE

- 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/GEARMATIC 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.

⚠ WARNING

DO NOT CLEAN BRAKE FRICTION DISKS IN SOLVENT. SOLVENT MAY CAUSE DAMAGE TO FRICTION MATERIAL WHICH MAY RESULT IN BRAKE FAILURE AND LOAD DROP.

- Perform all applicable trouble shooting operations BEFORE disassembling winch.

MOTOR ADAPTER – BRAKE HOUSING ASSEMBLY SERVICE

DISASSEMBLY

1. Disconnect all hoses and fittings from the hydraulic motor, brake valve and brake cylinder.
2. Remove the capscrews (26) and lockwashers (25) which secure the motor (48) and slide motor out of motor adapter (23). Allow gear oil to drain into a suitable container. Remove and discard the o-ring (24) installed on the pilot of the motor.
3. Remove the capscrews (34) and lockwashers (33) which secure the motor adapter (23) to the brake cylinder (22).

⚠ CAUTION

Each capscrew (34) must be slackened one turn at a time progressively around the motor adapter (23) until the spring compression has been relaxed.

4. Remove the over-running brake clutch assembly (40-43) and input shaft (70).
5. Remove the friction (44) and steel brake disks (45) and brake plate spacer (38) from the motor adapter (23). Remove the spring plate (35), 'U' cup seal (36) and brake springs (47) from the brake cylinder (22).
6. If the over-running brake clutch assembly requires service, remove snap ring (40) from the inner brake race (56) and slide thrust bearing (39), spacer bushings (41), sprag clutch (42) and outer brake hub (43) from the inner brake race.

CLEAN AND INSPECT

1. Discard the motor adapter o-ring (46), brake port o-ring (71), motor pilot o-ring (24) and brake 'U' cup seal (36).
2. Wash all parts in suitable solvent and dry thoroughly. Do not wash over-running brake clutch assembly unless it will be disassembled.

⚠ WARNING

DO NOT WASH BRAKE FRICTION DISKS IN SOLVENT. SOLVENT MAY CAUSE DAMAGE TO FRICTION MATERIAL WHICH MAY RESULT IN BRAKE FAILURE AND LOAD DROP.

3. Remove vent plug (37) from motor adapter (23) and clean.
4. Carefully inspect the polished surfaces of the outer brake hub (43), inner brake race (56) and the sprag clutch (42) for abnormal wear, cracks, pitting, corrosion, scoring or scuffing. Check the sprag clutch cage and small clips for breakage or bright spots; the signs of excessive wear. Check component dimensions:

Maximim outer brake hub I.D.	1.9065 in.
Minimum inner brake race O.D.	1.2498 in.
Maximum spacer bushing I.D.	1.2540 in.

⚠ 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.

5. Check wear on over-running brake clutch spacer bushings (41) at surface where spacer bushing makes contact with thrust bearing (39) and outer brake hub (43). If contact area is worn more than .020", replace spacer bushings.

6. Place friction brake disk (44) 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 disk if splines are worn to a point, disk is distorted or friction material is worn unevenly.

7. Place steel brake disk (45) on flat surface and check for distortion with a straight edge. Check surface for signs of material transfer or heat. Replace steel disk if splines are worn to a point, disk is distorted or heat discolored.

8. Inspect spline gear teeth (machined into inside surface of motor adapter [23]) for nicks, spalling or excessive wear. Replace motor adapter if teeth are worn to a point or are grooved in a manner which would restrict free movement of the steel brake disks (45).

9. Check brake 'U' cup sealing surfaces on motor adapter (23) and in brake cylinder (22). Be sure brake release oil passage in motor adapter is free of contamination.

10. Check brake spring (47) free length; minimum free length is 1.00 inch. Check springs for any sign of cracking or distortion. 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. Assemble a snap ring (40) in one of the grooves provided on the outside diameter of the inner brake race (56). Install a thrust bearing (39) followed by spacer bushing (41) onto the inner brake race (56). Then install the over-running sprag clutch (42) into the outer brake race (43). Using a rotating motion, install the assembled sprag clutch and outer brake race on the inner brake race. Install the remaining spacer (41) and thrust bearing (39) then secure with snap ring (40). When installed correctly, the inner brake race should turn freely in the same direction the drum turns to pull cable in with the outer brake race held in hand.

1a. 29:1 ratio winch.
Install snap ring (73) in groove provided in inner brake race (56).

2. 67.06:1 ratio winch.
Set the winch in a vertical position with the brake cylinder up. Install snap ring (57) on the input shaft (70) then install in the winch ensuring gear teeth mesh with the primary planet gears.

2a. 29:1 ratio winch.
Set the winch in a vertical position with the brake cylinder up. Install snap ring (29) on input shaft (70) then install in winch ensuring spline teeth locate in bore of primary sun gear (5).

3. Install a brake spring (47) in each hole in the brake cylinder (22). Install spring plate (35) in bore of brake cylinder so that shoulder is toward motor.

4. Install over-running brake clutch assembly on input shaft (70). Install 'U' cup seal (36) in bore of brake cylinder (22).

5. 67.06:1 ratio winch.
Install two brake plate spacers (38), one steel brake disk (45) followed by a friction brake disk (44) then alternate steel and friction disks until five (5) friction and six (6) steel disks have been installed. Finish with a steel brake disk then a brake plate spacer (38) to the outside. The splined bore of the friction brake disks will locate on the outer brake hub (43).

5a. 29:1 ratio winch.
Install a brake plate spacer (38), one steel brake disk (45) followed by a friction brake disk (44) then alternate steel and friction disks until seven (7) friction and eight (8) steel disks have been installed. Finish with a steel brake disk then a brake plate spacer (38) to the outside. The splined bore of the friction brake disks will locate on the outer brake hub (43).

NOTE: It is a good practice to pre-lubricate the disks with gear oil prior to installation.

6. Align the teeth of the steel brake disks, then install a new o-ring (46) onto the motor adapter. Lubricate the o-ring with light general purpose grease or hydraulic oil and carefully install motor adapter (23) into the brake cylinder (22). Be sure motor adapter is installed with vent plug at the twelve o'clock position. Do not use force to engage the motor adapter with the teeth of the steel brake disks. Secure in position with capscrews (34) and lockwashers (33).

⚠ CAUTION

Tighten capscrews (34) one turn at a time progressively around the motor adapter until fully seated.

7. Install a new o-ring (24) on the motor pilot and o-ring (71) in brake pilot hole then install motor (48) onto motor adapter. Tighten capscrews to recommended torque.

CABLE DRUM AND END BRACKET SERVICE

DISASSEMBLY

1. Disassemble motor adapter and brake cylinder assembly.
2. Set winch in a vertical position with the brake cylinder up. Remove capscrews (34) and lockwashers (33) from brake cylinder (22).
3. Remove the brake cylinder (22).
4. Remove drum closure (3) complete with bearing (28) and oil seal (32) from cable drum (2) through opening in winch base.
5. Lift out primary and secondary planet carrier assemblies.
6. Place winch in a horizontal position and remove capscrews (54) and lockwashers (53) from bearing support (21). Remove bearing support.
7. Lift cable drum (2) from winch base (1).

CLEAN AND INSPECT

1. Wash all parts in solvent and dry thoroughly. Do not wash primary and output planet assemblies unless they will be disassembled.
2. Inspect sealing surface in cable drum (2), bearing support (21) and brake cylinder (22) for wear. Light scoring may be polished with fine emery cloth.
3. Remove and discard oil seals (27) and (32) from cable drum (2) and cable drum closure (3).
4. Carefully inspect bearings (28) for smooth rotation. Replace bearings if there are any defects such as pitting, spalling, or heat discoloration.
5. Inspect thrust races (19) and (20) for pitting or distortion and replace if either condition exists.
6. Inspect ring gear teeth (machined into inside surface of drum [2]) for nicks, spalling or excessive wear. Replace drum if wear is greater than .015″ when compared to unworn area of teeth.

ASSEMBLY

1. Apply non-hardening sealant to outside diameter of oil seal (32). Install in drum closure (3) with spring side of seal toward bearing (28), using a flat plate 5¾″ diameter to avoid distortion.
2. Install bearing (28) in drum closure (3) using a press and a flat plate, 4″ diameter, to avoid damage to bearing (28). Lubricate and install o-ring (31) on outside diameter of drum closure.
3. Install bearing (28) in cable drum bore using a 3½″ diameter plate to avoid damage to the bearing. Coat outside diameter of oil seal (27) with non-hardening sealant and install in cable drum using a 3⅝″ diameter plate. The lip of the oil seal must face the bearing (28).
4. Stand winch base (1) on end with large bore end down. Position cable drum (2) in winch base and install bearing support (21) so it locates in winch base and with drum bearing (28) and oil seal (27). Secure in position with capscrews (54) and lockwashers (53). Torque capscrews to specifications.
5. Reverse position of winch so large bore end of winch base is up. Install the output planet carrier assembly into the cable drum (2) while meshing the planet gears with the internal ring gear and the internal planet hub spline with the bearing support (21).
6. Install the output sun gear (4) in the splined bore of the primary planet carrier assembly and locate with snap rings (30) and (72).
7. Install a thrust race (20) in the output planet carrier recess, then position the primary planet carrier assembly into the cable drum (2) while meshing the planet gears with the internal ring gear and the output sun gear (4) with the output planet carrier gears.
8. Install thrust race (19) in recess of primary planet hub assembly. Install drum closure assembly being careful not to damage o-ring (31).

8a. 29:1 ratio winch.
Ensure primary planet carrier assembly sun gear (5) is installed and meshes with primary planet carrier gears (14).

9. Install and secure brake cylinder (22) to winch base (1) with capscrews (34) and lockwashers (33) and torque to specifications.

PLANET CARRIER SERVICE

OUTPUT PLANET CARRIER

DISASSEMBLY

1. Remove the planet gears by driving the roll pins into the center of the planet gear shafts.
2. Now you can remove the planet gear shafts, bearings, spacer, thrust washers and gears.
3. Use a punch to drive the roll pins from the planet gear shafts. Do not reuse the roll pins.

CLEAN AND INSPECT

1. Thoroughly clean all parts and inspect for damage and wear.
2. 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.
3. The thrust washer contact areas should be free from any surface irregularities that may cause abrasions or friction.
4. The gears and shafts should be inspected for abnormal wear or pitting. Replace if necessary.

ASSEMBLY

1. Place the output planet carrier (6) on a workbench with splined coupling side up. Insert two bearings (9) with a bearing spacer (10) between the bearings in the bore of the planet gear (7). Place a thrust washer (11) on each side of the gear and position in a carrier opening. Slide the shaft (8) through the carrier, thrust washer, bearing-gear sub assembly and remaining thrust washer.
2. Carefully align the pin hole in the carrier (6) with the hole in the planet gear shaft (8) and drive the roll pin (12) into place. Always use NEW roll pins.
3. Note that the roll pin (2) is slightly recessed in the carrier when properly installed. Repeat these steps for each of the three planet gears.

PRIMARY PLANET CARRIER

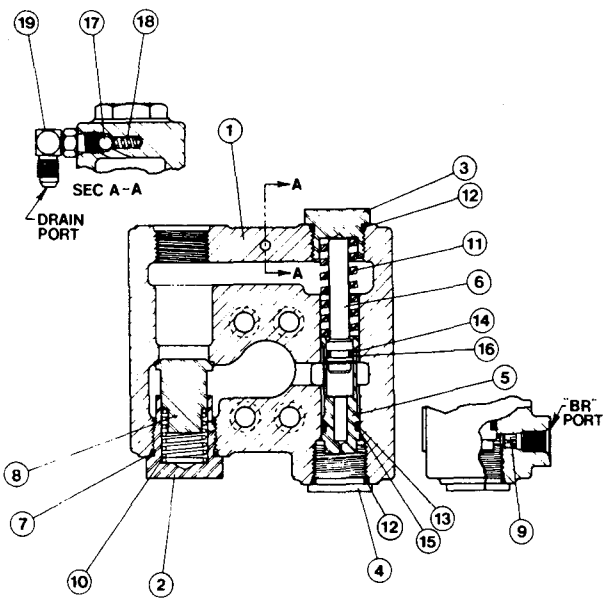
1. Remove snap ring (30) from primary planet hub and slide out the output sun gear (4).
2. To service the primary planet carrier, the steps are the same as for the output carrier except there is only one bearing for each gear and no bearing spacer.

BRAKE VALVE SERVICE

The 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.



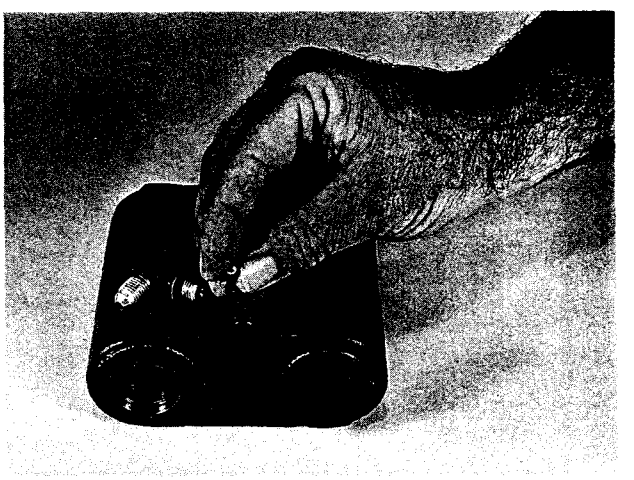
BRAKE VALVE ASSEMBLY NO. 81715			
ITEM	QUANTITY	PART NO.	DESCRIPTION
1	1	NSS	VALVE HOUSING
2	1	NSS	SPRING RETAINER
3	1	NSS	SPRING RETAINER
4	1	NSS	PLUG
5	1	NSS	SPOOL
6	1	NSS	DAMPER PISTON
7*	1	24186	O-RING
8	1	NSS	CHECK VALVE POPPET
9	1	24200	PILOT ORIFICE
10	1	24190	CHECK VALVE SPRING
11	1	24192	SPOOL SPRING
12*	2	23601	O-RING
13*	1	24193	O-RING
14*	1	24194	O-RING
15*	1	24195	BACK-UP RING
16*	1	24196	BACK-UP RING
17	1	21158	CHECK BALL (1/4")
18	1	25480	CHECK BALL SPRING
19	1	25302	ELBOW FITTING

NSS — NOT SERVICED SEPARATELY. ORDER COMPLETE VALVE ASSEMBLY.

*These items included in Seal Kit 61567.

DISASSEMBLY

1. Remove the pilot orifice from the brake release (BR) port using a $\frac{5}{32}$ inch Allen wrench.

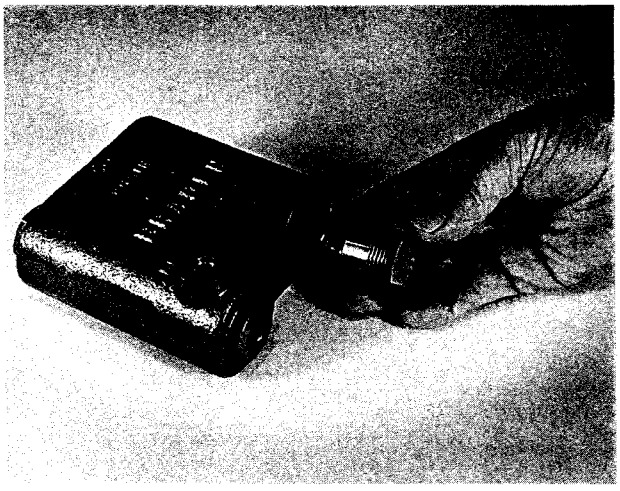


2. Remove the elbow fitting, motor drain check ball and spring.

3. Remove the spool spring retainer and spool spring. Check spring free length. Replace spring if less than $1\frac{15}{16}$ inches 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 inches long.

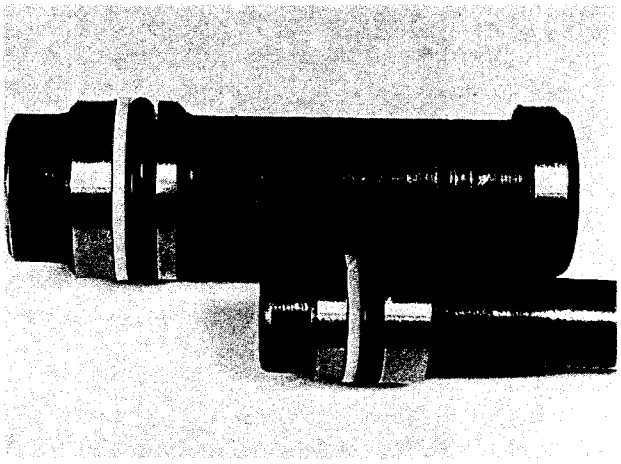
CLEAN AND INSPECT

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.

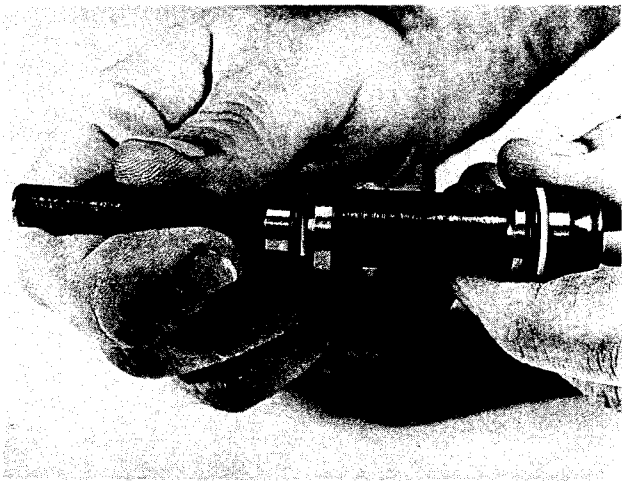
ASSEMBLY

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.

PD5 & GH5 UPDATES

All 67:1 ratio winches with serial numbers prior to 87-03126 were built with an input shaft having an integral brake race. This shaft has been replaced by the following parts:

Item 70	Input Shaft	Part Number 26288
Item 40	Snap Ring	Part Number 24934 (1 only)
Item 56	Inner Brake Race	Part Number 26287
Item 57	Snap Ring	Part Number 25589

Note: All drawings in this manual reflect current production.

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. (Kg/m) DRY	LUBED
1/4	20 28	9 (1.25)	6 (.83)
5/16	18 24	18 (2.5)	13 (1.8)
3/8	16 24	31 (4.3)	23 (3.2)
7/16	14 20	50 (6.9)	37 (5.1)
1/2	13 20	75 (10.4)	55 (7.6)
9/16	12 18	110 (15)	80 (11)
5/8	11 18	150 (21)	115 (16)

BOLT DIA. INCHES	THD PER INCH	TORQUE LB-FT. (Kg/m) DRY	LUBED
3/4	10 16	265 (37)	200 (28)
7/8	9 14	420 (58)	325 (45)
1	8 14	640 (89)	485 (67)
1 1/8	7 12	790 (109)	590 (82)
1 1/4	7 12	1110 (1534)	835 (116)
1 3/8	6 12	1460 (202)	1095 (151)
1 1/2	6 12	1940 (268)	1455 (201)

To convert lb. ft. to Nms, multiply lb. ft. value by 1.356.

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 (qts.)	× 0.94635	= liters (l)	× 1.0567	= quarts (qts.)	
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	= liters³ (l3)	× 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 (lbs.)	
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(in.-lbs.)	× 0.11298	= newton-meters (Nm)	× 8.851	= pound-inches (in.lb.)	
pound-feet (ft.-lbs.)	× 1.3558	= newton-meters (Nm)	× 0.7376	= pound-feet (ft.-lb.)	
pound-feet (ft.-lbs.)	× .1383	= kilograms/meter(kg/m)	× 7.233	= pound-feet (ft.-lb.)	
		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/sec.)	× 3.281	= feet/sec. (ft/sec.)	
feet/min. (ft/min.)	× .3048	= meters/min. (m/m)	× 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)	= 0.000,000	or 10^{-6}