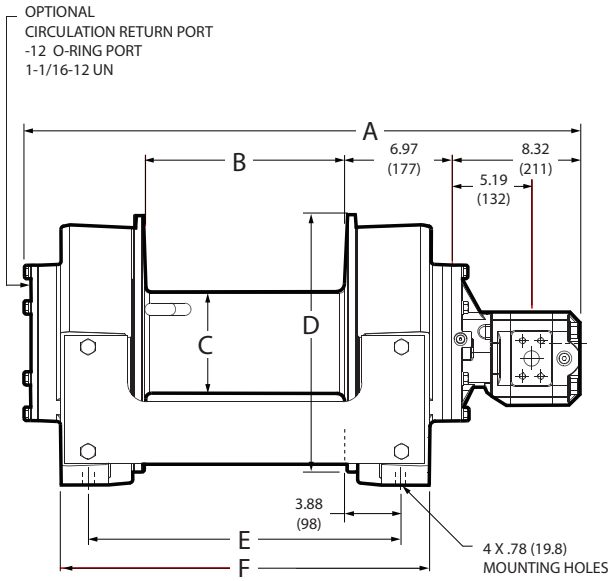
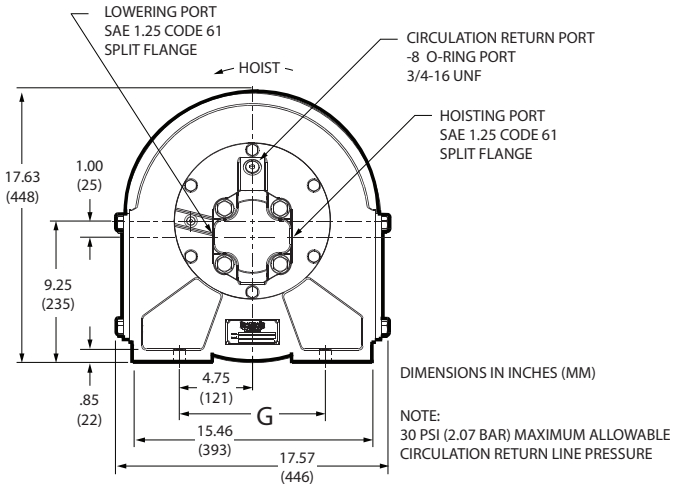
Gearmatic

Model GH15C

High Speed Reverse

Up To 15,000-Pound LinePull





Specifications

GH15C-34/8051-01, -02

5.1 cu in. Gear Motor (84cc)
2600 PSI (179 bar) @ 60 gpm (227 lpm)
Wire Rope Diameter: .75 in. (19 mm)

Layer	Line Pull		Hoisting Line Speed		High Speed Reverse Line Speed	
	LB	KG	FPM	MPM	FPM	MPM
1	15,000	6,818	138	42	610	186
2	12,430	5,650	166	51	736	224
3	10,610	4,823	195	59	862	263
4	9,250	4,205	224	68	988	301
5	8,210	3,732	252	77	1115	340
6	7,370	3,350	281	86	1241	378

GH15C-34/8051-04

5.1 cu in. Gear Motor (84cc)
2750 PSI (190 bar) @ 60 gpm (227 lpm)
Wire Rope Diameter: .75 in. (19 mm)

Layer	Line Pull		Hoisting Line Speed		High Speed Reverse Line Speed	
	LB	KG	FPM	MPM	FPM	MPM
1	10,000	4,545	216	66	955	291
2	8,830	4,014	245	75	1,081	329
3	7,910	3,595	273	83	1,207	368
4	7,160	3,255	302	92	1,333	406

Wire Rope Capacity

Layer	-01 Drum		-02 Drum		-04 Drum	
	FT	M	FT	M	FT	M
1	20	6	32	10	51	16
2	44	13	71	22	109	33
3	72	22	117	36	174	53
4	104	32	170	52	245	75
5	141	43	230	70		
6	182	55	296	90		

Dimension Variables

	A	B	C	D	E	F	G
-01 Drum	31.16 (791)	8.00 (203)	6.50 (165)	16.75 (425)	15.75 (400)	18.73 (476)	9.50 (241)
-01 Drum Universal 11x17 (279x432) Bolt Pattern	31.16 (791)	8.00 (203)	6.50 (165)	16.75 (425)	17.00 (432)	19.00 (483)	11.00 (279)
-02 Drum	36.16 (918)	13.00 (330)	6.50 (165)	16.75 (425)	20.75 (527)	24.00 (610)	9.50 (241)
-04 Drum	36.16 (918)	13.00 (330)	10.60 (269)	16.75 (425)	20.75 (527)	24.00 (610)	9.50 (241)

* Rope capacity based on 90% theoretical
** Reverse (lowering) line speed is 4.4 times faster than forward (hoisting) speed. The maximum load can be lowered at a line speed equal to the hoisting line speed. When lowering loads at maximum speed the load must be reduced to 23% of maximum capacity.

LIT2553 R2
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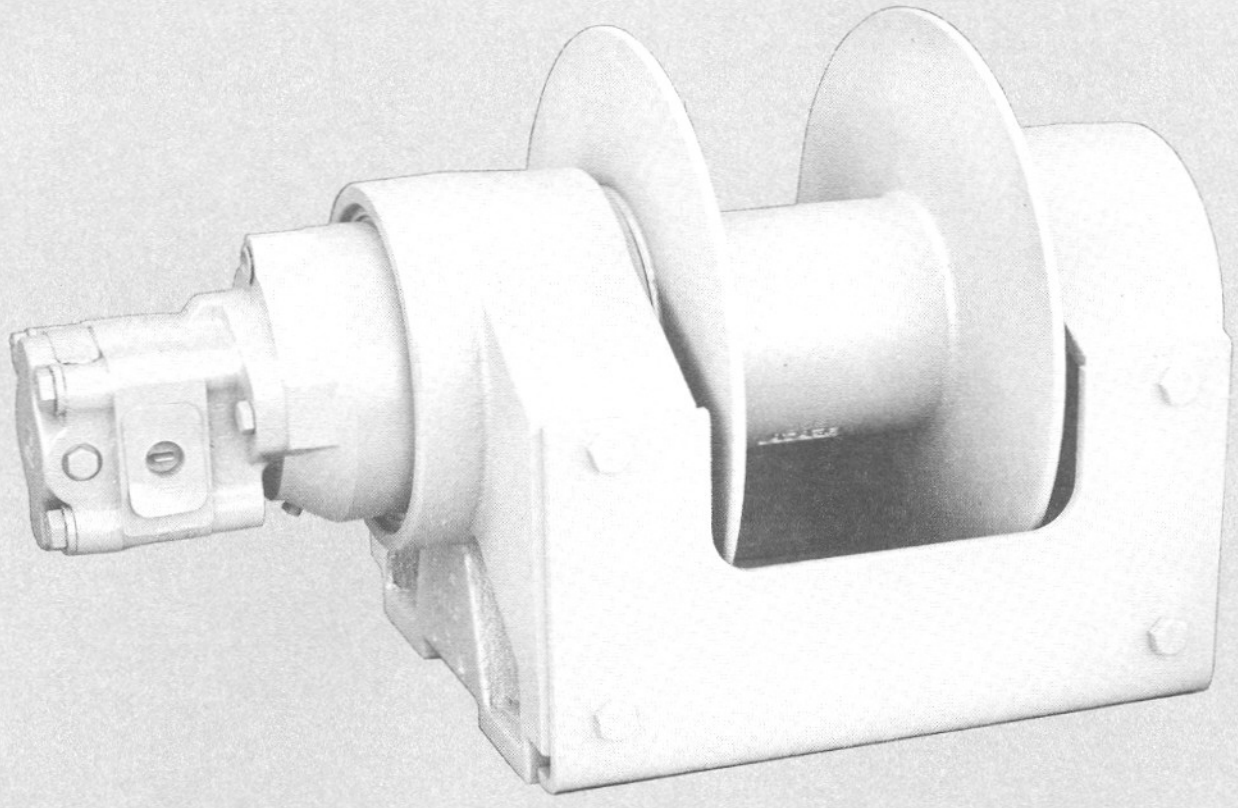
Gearmatic®

GH15 HIGH SPEED REVERSE HYDRAULIC WINCH

PARTS SERVICE & MAINTENANCE MANUAL



PACCAR WINCH DIVISIONS

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PG-110
2/97
Printed in U.S.A.

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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 winch must be operated with care and concern for the equipment and the operator should have a thorough knowledge of the machine's performance capabilities. The following recommendations are offered only as a guide for the operator. Local rules and regulations will also apply.

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.

!WARNING!

ON MACHINES HAVING HYDRAULICALLY, MECHANICALLY AND/OR CABLE CONTROLLED EQUIPMENT, BE CERTAIN THE EQUIPMENT (BOOM, SHEAVE BLOCKS, PENDANTS, ETC.) IS EITHER LOWERED TO THE GROUND OR BLOCKED SECURELY BEFORE SERVICING, ADJUSTING AND/OR REPAIRING THE WINCH.

3. Before starting engine be certain all controls move freely and are placed in the neutral position.
4. Never operate winch controls unless you are sure personnel are clear of work area.
5. Operate winch line speeds to match job conditions.
6. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
7. Never attempt to handle wire rope when the hook end is not free.
8. Leather gloves should be used when handling wire rope.
9. Ground personnel should stay in view of winch operator and clear of work area. Do not allow ground personnel near wire rope under tension. A safe distance of at least 1½ times the length of the cable in use should be maintained.
10. When winding cable on the winch drum, never attempt to maintain tension by allowing cable to slip through hands. Always use "hand-over-hand" method.
11. Use correct size cable anchor for cable and pocket in winch drum. Never use a knot to secure or attach cable.
12. Inspect rigging, winch and hoses at the beginning of each work shift. Any wire rope with broken strands; or rigging worn; or damaged hoses should be replaced immediately.
13. Be sure of equipment stability before operating winch.
14. Do not weld to any part of the winch.
15. Keep equipment in good operating condition. Perform scheduled servicing and adjustments listed in the "Preventive Maintenance" section of this manual. Keep hydraulic systems clean and free from contamination at all times.
16. 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.
17. Do not exceed the maximum pressure (PSI) or flow (GPM) stated in the winch specifications.
18. The GEARMATIC designed wire rope anchors are capable of supporting the rated load when installed properly. For additional safety, ALWAYS maintain a minimum of three (3) wraps of wire rope on the drum.

Safety and informational callouts in this manual include:

!WARNING!

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

!CAUTION!

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

HIGH SPEED REVERSE SPECIFICATIONS
EXPLANATION OF MODEL NUMBER
GH15 — 75/22 029 — 01

OVERALL RATIO

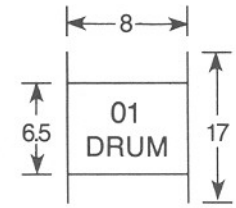
75/22 – High Speed Reverse
75.44:1 Hoisting
22.00:1 Lowering
Other Ratios Available on Special Order Basis

MOTOR

020 – 1.96 CU. IN. DISPLACEMENT
029 – 2.94 CU. IN. DISPLACEMENT
039 – 3.92 CU. IN. DISPLACEMENT
Other Displacements Available

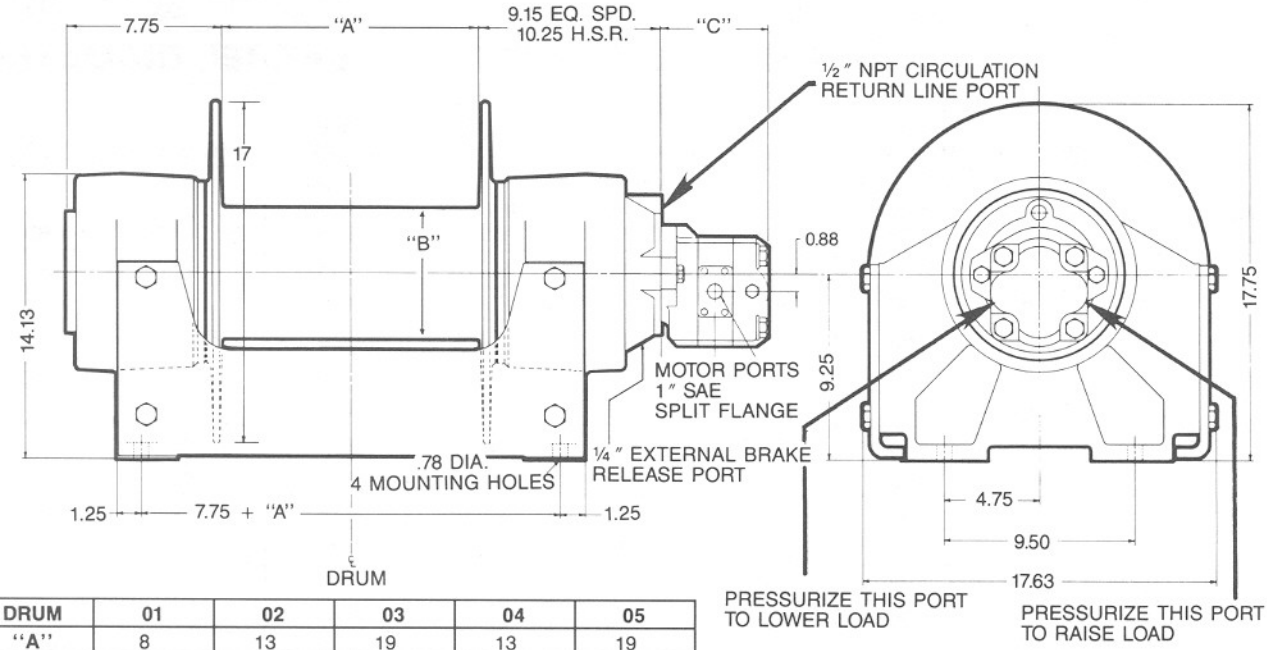
DRUM

01 – 6.5 × 17 × 8
02 – 6.5 × 17 × 13
03 – 6.5 × 17 × 19
04 – 10.6 × 17 × 13
05 – 10.6 × 17 × 19



NOTE: The GH15 High Speed Reverse Winch lowers the load 3.42 times faster than the hoisting speed. It is capable of lowering the maximum rated load at maximum speed on an intermittent basis only. For continuous maximum line speed lowering, the line pull should be no more than 50% of the rated load. For applications exceeding these limits, consult the factory.

DIMENSIONAL DATA



DRUM	01	02	03	04	05
"A"	8	13	19	13	19
"B"	6.5	6.5	6.5	10.6	10.6

MOTOR	020	029	039
"C"	5.3125	5.81	6.31

GH15 HIGH SPEED REVERSE PERFORMANCE

75.44:1 HOISTING
22.01:1 LOWERING

01, 02 & 03 DRUMS WITH 6.5″ BARREL DIAMETER

ROPE SIZE (IN.)	LAYER	039 MOTOR 3.92 CU. IN. DISP. 1550 PSI @ 75 GPM		029 MOTOR 2.94 CU. IN. DISP. 2100 PSI @ 56 GPM		020 MOTOR 1.96 CU. IN. DISP. 3000 PSI @ 40 GPM		ROPE CAPACITY (FT)		
		LINE PULL (LBS.)	LINE SPEED (FPM) HOISTING ‡	LINE PULL (LBS.)	LINE SPEED (FPM) HOISTING ‡	LINE PULL (LBS.)	LINE SPEED (FPM) HOISTING ‡	DRUM 01	DRUM 02	DRUM 03
9/16	1	15,000	87	15,000	86	14,660	92	24	41	61
	2	13,160	100	13,370	99	12,730	106	53	88	130
	3	11,630	113	11,820	112	11,520	120	84	141	209
	4	10,420	126	10,590	125	10,080	134	120	201	297
	5	9,440	139	9,590	138	9,130	148	159	266	395
	6	8,620	152	8,760	152	8,350	162	202	338	501
	7	7,940	165	8,070	165	7,680	176	249	416	617
	8	7,360	178	7,470	178	7,120	190	299	500	742
	9*	6,850	192	6,960	191	6,630	204	353	591	876
5/8	1	15,000	87	15,000	87	14,530	93	22	37	55
	2	12,870	102	13,080	102	12,450	109	48	80	119
	3	11,260	117	11,440	116	10,900	124	77	129	192
	4	10,010	131	10,170	131	9,690	140	110	185	274
	5	9,010	146	9,150	145	8,720	156	147	246	366
	6	8,190	160	8,320	160	7,930	171	187	314	466
	7	7,510	175	7,630	174	7,270	187	231	388	576
	8*	6,930	189	7,040	189	6,710	202	279	468	695
3/4	1	14,760	89	14,990	89	14,280	95	18	31	46
	2	12,330	106	12,530	106	11,930	114	40	68	101
	3	10,590	124	10,760	123	10,250	132	66	111	166
	4	9,280	141	9,430	141	8,980	151	95	161	239
	5	8,260	159	8,390	158	7,990	170	128	216	322
	6	7,440	176	7,560	176	7,202	188	164	277	413
	7*	6,770	194	6,880	193	6,552	207	204	345	514

04 & 05 DRUMS WITH 10.6″ BARREL DIAMETER

ROPE SIZE (IN.)	LAYER	039 MOTOR 3.92 CU. IN. DISP. 1620 PSI @ 75 GPM		029 MOTOR 2.94 CU. IN. DISP. 2160 PSI @ 56 GPM		020 MOTOR 1.96 CU. IN. DISP. 3000 PSI @ 40 GPM		ROPE CAPACITY (FT)	
		LINE PULL (LBS.)	LINE SPEED (FPM) HOISTING ‡	LINE PULL (LBS.)	LINE SPEED (FPM) HOISTING ‡	LINE PULL (LBS.)	LINE SPEED (FPM) HOISTING ‡	04 DRUM	05 DRUM
9/16	1	10,000	137	10,000	136	9,270	146	65	96
	2	9,125	150	9,125	149	8,460	160	135	201
	3	8,390	163	8,390	162	7,780	174	212	315
	4	7,770	176	7,770	176	7,210	188	296	438
	5	7,230	189	7,230	189	6,710	202	385	571
5/8	1	9,945	138	9,945	137	9,220	147	58	86
	2	8,995	152	8,995	152	8,340	163	123	182
	3	8,205	167	8,205	166	7,610	178	193	287
	4	7,550	181	7,550	181	7,000	194	270	400
	5*	6,985	196	6,985	195	6,480	209	352	523
3/4	1	9,835	139	9,835	139	9,120	149	49	72
	2	8,735	157	8,735	156	8,100	167	103	154
	3	7,860	174	7,860	173	7,290	186	164	244
	4*	7,145	192	7,145	191	6,630	205	231	344

*This layer does not comply with ANSI Spec. 5-132a2c for ½″ exposed flange.

‡For line speed while lowering, multiply hoisting line speed by 3.42.

THEORY OF OPERATION

DESCRIPTION OF WINCH

The winch has three basic assemblies

1. Primary planetary end bracket and motor assembly
2. Output planetary end bracket assembly
3. Drum assembly

The hydraulic motor is bolted to the motor support retained in the primary end bracket. The drum assembly is supported by both end bracket assemblies which receive additional support from the side plates.

PLANETARY GEAR TRAIN

The hydraulic motor shaft is directly coupled to the input shaft for the high speed reverse planet assembly. The planet carrier is driven as the planet gears walk around their ring gear, which is kept from rotating by the spring applied brake. The high speed reverse planet carrier drives the primary sun gear which also acts as the inner race of the over-running brake clutch. When driven by the sun gear, the primary planet gears walk around the ring gear machined in the primary end bracket and drive the primary planet carrier.

The primary planet carrier drives the sun gear shaft which passes through the drum and drives the output planet gears. As the output planet gears are driven by the sun gear shaft, the planet gears walk around the ring gear machined in the output end bracket and drive the output planet carrier. As the output planet carrier rotates, it drives the drum through a splined coupling. When hoisting or hauling in cable, all three planetary gear sets are operating. When lowering or paying out cable, the high speed reverse planetary set is locked out of the drive train resulting in a faster drum speed.

BRAKE SYSTEM

The brake system contains three basic components:

1. Spring applied, multiple friction disc brake pack
2. Over-running brake clutch assembly
3. Hydraulic piston and cylinder

The friction disc brake pack consists of alternately stacked friction and steel brake discs. The steel brake discs are externally splined to the primary end bracket and can not rotate. The friction discs are internally splined to the high speed reverse ring gear, which is also the outer clutch hub of the over-running brake clutch. When compressed by spring force, the brake pack locks the high speed reverse ring gear and the over-running brake clutch outer hub to the primary end bracket.

The sprag type over-running brake clutch is installed between the primary sun gear and the high speed reverse ring gear. In the hoisting or haul in direction, the sprag clutch allows the primary sun gear to be driven by the high speed reverse planet carrier, while the ring gear is prevented from turning by the brake discs.

When lowering or paying out cable, the sprag clutch locks up to force the friction discs to turn with the primary sun gear. This also locks together the high speed reverse ring gear and planet carrier, eliminating that gear sets reduction and producing a faster drum speed. The brake pack remains fully applied when hauling in cable and must be released by pilot pressure to pay out cable.

When hoisting or pulling a load, the brake clutch allows free rotation of the primary sun gear. The sprag cams lay over and permit the primary sun gear to turn free of the outer clutch hub. Figure 1. The friction brake remains fully engaged. The winch is not affected by any braking action when hauling in.

When the haul in 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 engage and firmly lock the primary sun gear to the outer brake clutch hub. Reference figure 2.

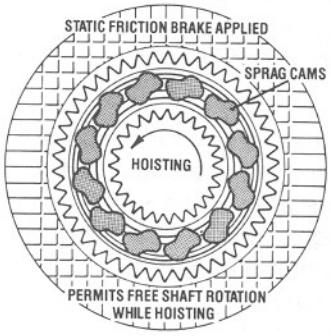


Figure 1

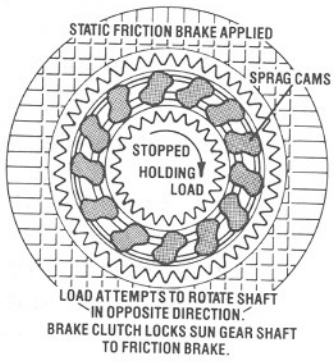


Figure 2

When the winch is powered in reverse, to pay out cable, the motor and gear train will not rotate until sufficient pilot pressure is supplied to the brake release piston to overcome the brake spring force. With no load on the winch, approximately 500 PSI is required to compress the brake springs and allow the friction brake discs, splined to the outer brake clutch hub, to turn free of the steel brake discs. As pilot pressure increases, the brake is gradually released allowing the motor to drive the gear train in reverse to pay out cable.

When the control valve is returned to neutral or "hold", the pilot pressure will drop and the brake will apply to hold the load.

If the load on the drum barrel tries to drive the motor faster than the supply of oil will permit (i.e. if the motor tries to act as a pump), the hydraulic pressure acting on the brake piston will decrease, causing an increase in the effective spring load, resulting in an increase in braking effort. In this way, a balanced pressure is supplied to the motor and brake release piston according to the load on the winch drum.

The speed of the winch in reverse and forward is purely dependent on the volume of oil supplied to the motor through the control valve.

WINCH AND WIRE ROPE INSTALLATION

1. The winch should be mounted with the centerline of the drum in a horizontal position. The mounting plane of the winch may be rotated in any position around this centerline providing the oil circulating port in the motor support is correctly aligned at the twelve o'clock position. Refer to "Output Planetary End Bracket Service" and "Primary Planetary End Bracket Service" for installation instructions.

2. When mounting the winch, use all four (4) mounting holes and grade eight (8) bolts and nuts. Evenly tighten nuts to 320 lb. ft. torque, lubricated with 30W motor oil, in approximately 40 lb. ft. increments.

   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 ± .020 inches.

   As a final installation test, check clearance between the drum and end brackets at three (3) evenly spaced locations around the winch. The clearance should be equal within .020″. Repeat test for each side of winch. Left and right hand sides need not equal each other. If necessary, install steel 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. Maximum return line pressure must not exceed 140 psi, measured at the winch motor ports.

   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 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.

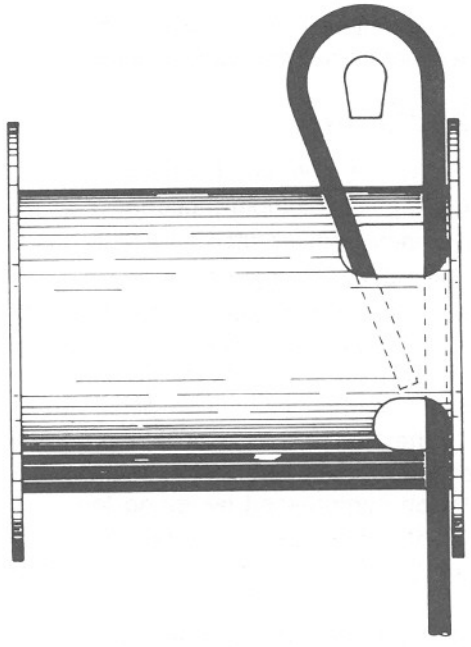
   Under continuous operating conditions the temperature of the oil at any point in the system must not exceed 180°F. 120° – 140°F is generally considered optimum.

   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 GEARMATIC Service Department. The use of multi-viscosity oils is generally not recommended.

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

WIRE ROPE INSTALLATION

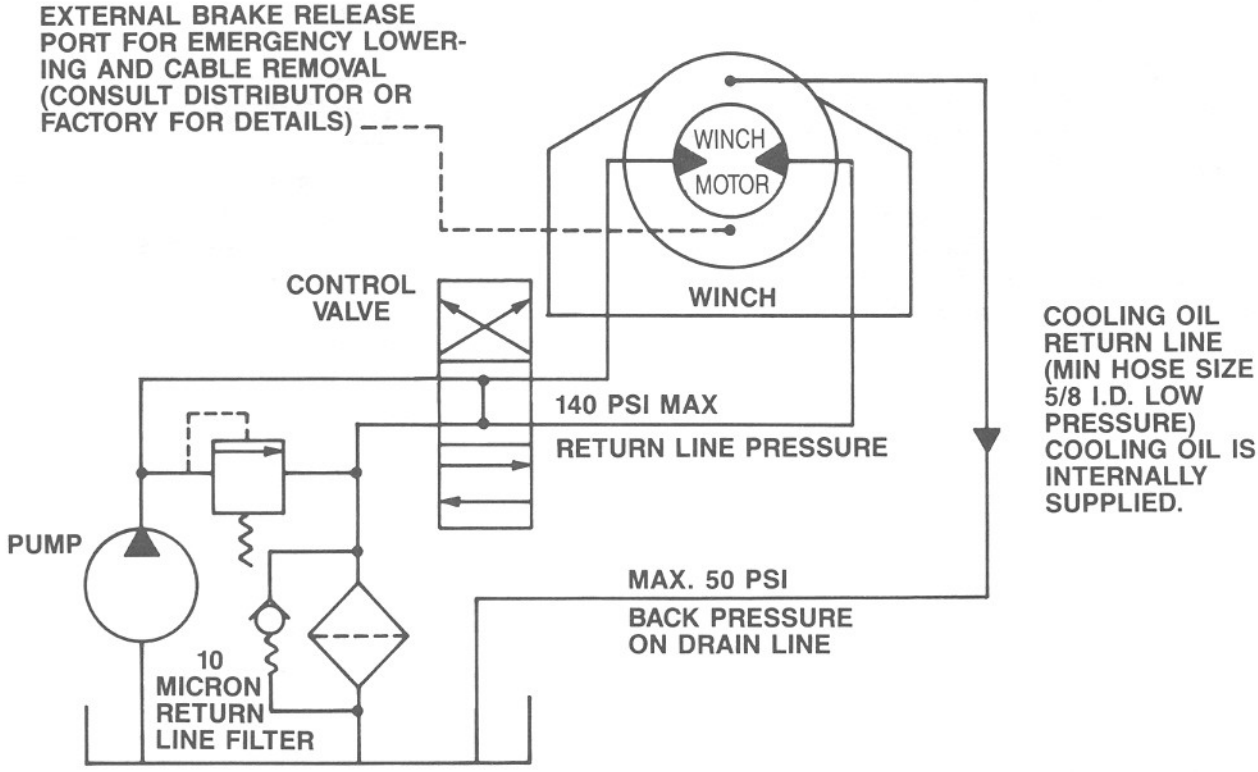
Take the free end of the wire rope and insert it through the small opening of the anchor pocket. Loop the wire rope and push the free end about three-fourths of the way back through the pocket. Install the cable anchor with the small end toward the drum, then pull the slack out of the wire rope. The cable anchor will slip into the pocket and secure the wire rope into the drum.



Use cable anchor 76281 for ¾ dia. wire rope.
Use cable anchor 76285 for 9/16 or ⅝ dia. wire rope.

Standard drum rotation, to haul-in cable, is counterclockwise when viewed from the motor end.

HYDRAULIC CIRCUIT



During winch lowering or pay-out operation hydraulic oil is circulated through the winch to provide cooling for the brake and lubricate gearing. The circulation oil is automatically provided by way of an internal orifice located in the brake piston.

The cooling oil return line must be connected to the vent port on the motor mounting housing and should be connected directly to the reservoir. The vent port must always be positioned as close to top dead center as possible.

!CAUTION!

The pressure in the winch due to circulation must never exceed 50 psi. Excessive pressures will damage seals.

Upon initial start-up or following winch repair, fill the winch housing with oil by placing the winch control valve in the "lower" position with only sufficient flow to cause the drum to creep. Maintain this operation for approximately 60 seconds to force lubricating oil into the housing and force air out through the case drain line. After this has been done, follow recommendations for "Warm-up Procedure" in the "Preventive Maintenance" section.

PREVENTIVE MAINTENANCE

A regular program of preventive maintenance for your planetary winch will minimize the need for emergency servicing and help provide extended component life.

NOTE: All service intervals are specified for equipment operating hours.

1. Every 1000 hours or twelve (12) months, whichever occurs first, drain the hydraulic oil from the winch by removing the snap ring retaining the end cover of the output planetary end bracket. With two flat blade screwdrivers, pry the cover out, allowing the oil to drain into a suitable container. Inspect the o-ring and replace as required. After the oil has drained inspect bearings and gear teeth wear then replace end cover in the end bracket and install the snap ring.
2. Every twelve (12) months or 1000 hours, whichever occurs first, remove the motor and motor support assembly to inspect the brake discs and sprag clutch assembly following the instructions for those sections.
3. 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.
4. WIRE ROPE.
   Inspect entire length of wire rope according to wire rope manufacturer's recommendations.
5. MOUNTING BOLTS.
   Tighten all winch base mounting bolts to recom-

mended torque after the first one hundred (100) hours of operation, then every 500 operating hours or six (6) months, whichever occurs first.

6. 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 hydraulic oil through the planetary gear sets and brake.

!CAUTION!

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, or may cause excessive pressure build-up in the winch housing causing premature seal failures.

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.

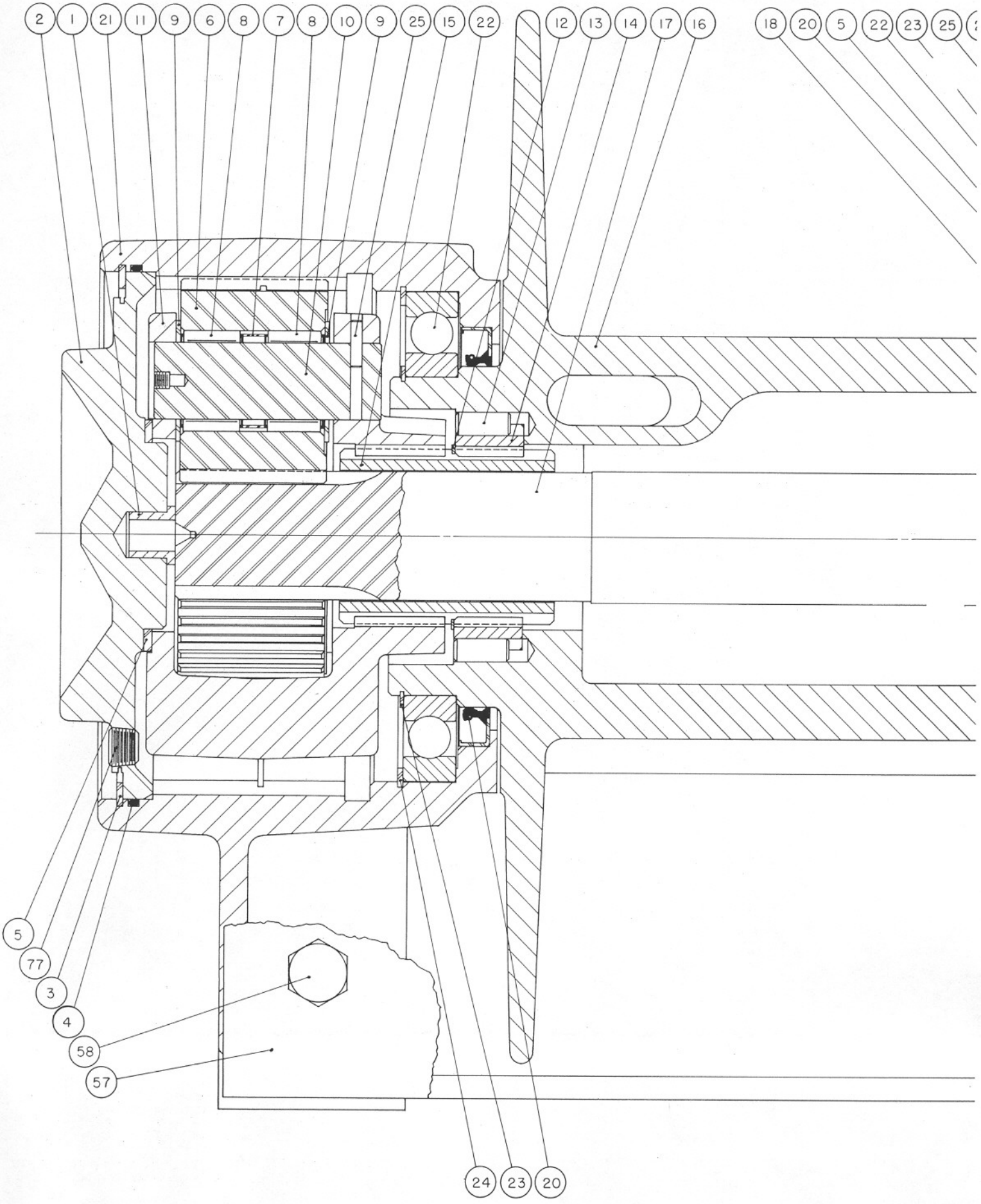
Lubricated Torque values based on use of SAE 30W engine oil applied to threads and face of bolt or nut.

BOLT DIA. INCHES	THD PER INCH	TORQUE LB-FT. DRY	TORQUE LB-FT. 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	TORQUE LB-FT. 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

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/cm^2) (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.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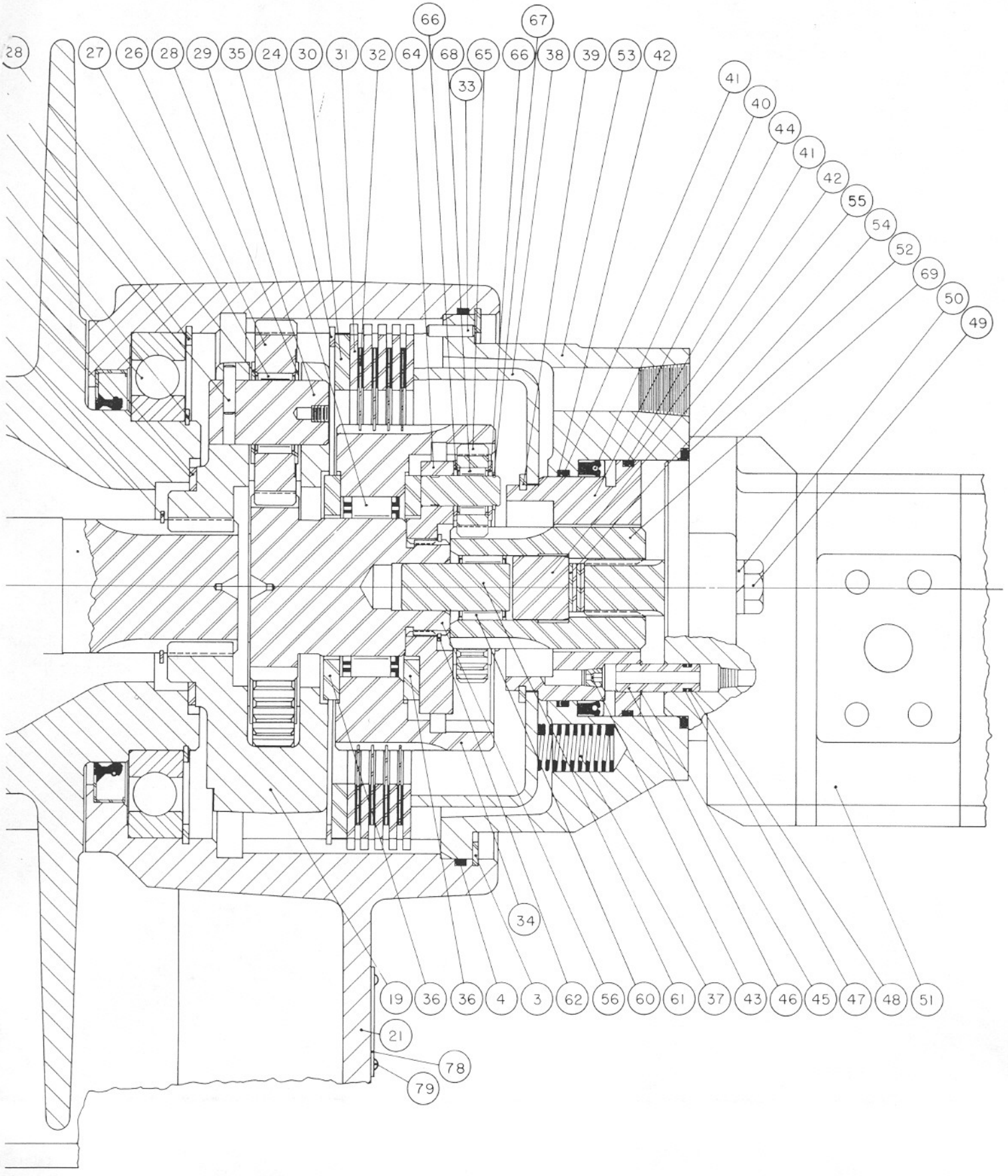


GH15 HIGH SPEED REVERSE CROSS-SECTION

(See Page 20 for Bill of Material)

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. Winch will not reverse at high 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 discs.	Disassemble winch to inspect/replace worn parts.
	3. Brake clutch is slipping.	Improper hydraulic oil may cause the brake clutch to slip. Replace brake parts and refill reservoir with recommended hydraulic 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 primary drive 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 excessive oil flow from the winch vent line.	Check brake cylinder seal.
	2. Friction brake will not release as a result of damaged brake discs.	Disassemble brake to inspect brake discs.
	3. Hydraulic system flow too low for smooth operation of winch motor and brake release.	Operate pump at maximum RPM.
	4. Same as B-4.	Same as remedy for B-4.
	5. Same as A-3.	Same as remedy for A-3.
	6. Same as A-5.	Same as remedy for A-5.
	7. Control valve handle being operated too quickly	Operate control valve smoothly when starting and stopping a load. Conduct operator training as required.
	8. No oil circulating through the winch.	Remove motor and inspect oil circulation orifice hole in brake release piston.
	9. Control valve does not have good metering characteristics.	See "Winch Installation" sections 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 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. Circulation oil orifice may be plugged.	Remove motor and inspect orifice in brake release piston.
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. Same as F-3.	Same as remedy for F-3.
	4. Same as F-7.	Same as remedy for F-7.

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 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 light general purpose grease or hydraulic 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 compounds 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.

!WARNING!

DO NOT CLEAN BRAKE FRICTION DISCS 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.

OUTPUT PLANETARY END BRACKET SERVICE

NOTE: Although the primary and output end brackets are the same, it is **not** recommended that they be interchanged, since each end develops it's own gear tooth wear pattern.

DISASSEMBLY

1. Drain hydraulic oil by first removing the snap ring (3) retaining the end cover (2) of the output planetary end bracket. Using two flat blade screwdrivers, pry the cover out, allowing the hydraulic oil to drain into a suitable container.
2. With the output planetary end cover removed, remove the output planet carrier assembly (11). Refer to "Planet Carrier Service" for additional information.
3. Remove the drum drive connector (15) from the cable drum.
4. If necessary, the sun gear shaft (17) may be removed at this time.

CLEAN AND INSPECT

1. Remove and discard the end cover o-ring (4).
2. Wash all parts in suitable solvent and dry thoroughly. Do not wash the final planet assembly unless it will be disassembled.
3. Check end cover snap ring (3) for flatness and that it forms a true circle. Replace snap ring if it is bent or damaged.
4. Check sun gear thrust bushing (1) in center of end cover (2) for excessive wear. Replace thrust bushing if shoulder thickness is less than $\frac{1}{16}$ inch.
5. Inspect ring gear teeth (machined into inside surface of end bracket) for nicks, spalling or excessive wear. Replace end bracket if wear is greater than .015″ when compared to unworn area of teeth.

ASSEMBLY

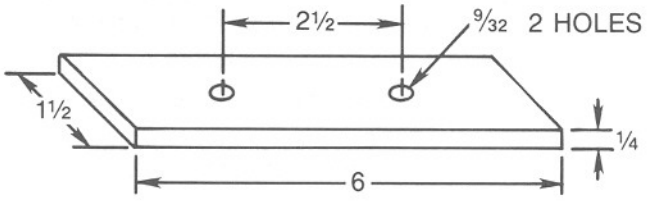
1. Insure that snap ring (18) is in position on the sun gear shaft (17) then install the sun gear shaft, being careful to fully engage it with the primary planet carrier (19).
2. Install the drum drive connector (15) into the cable drum.
3. Install the output planet carrier assembly (11) into the end bracket while meshing the planet gears with the ring gear and sun gear shaft (17), and the planet carrier with the drum drive connector (15).
4. Install sun gear thrust bushing (1) and planet carrier thrust washer (5) into end cover.
5. Install a new end cover o-ring (4) into the end bracket. Lubricate o-ring with light general purpose grease or hydraulic oil and carefully install end cover (2) into the end bracket. Ensure thrust washer (5) does not fall out of position during installation of the end cover.
6. Install end cover snap ring (3).

PRIMARY PLANETARY END BRACKET SERVICE

DISASSEMBLY

1. Remove the capscrews (49) securing the motor (51) and slide motor out of motor support (53). Allow hydraulic oil to drain into a suitable container. Remove and discard the o-ring (52) installed on the pilot of the motor.
2. Remove and discard the o-ring and backup washer (47, 48) from the brake piston oil tube (46). The oil tube has been installed in the brake piston (44) with Loc-Tite and should not be removed unless damaged or severely worn.
3. To remove the snap ring (2) which retains the motor support (53) in the primary planetary end bracket, the brake piston (44) must be retracted to relieve the spring tension against the snap ring.
   A. Connect a hand pump with accurate 0-2000 psi gauge and shut-off valve to the external brake release port. Apply approximately 500 PSI to the brake port to retract the brake piston.
   B. With the brake piston retracted, remove the snap ring (3) retaining the motor support (53) in the primary planetary end bracket and remove the motor support assembly from the end bracket. When the motor support assembly has been removed, release the brake release pressure.

      NOTE: If a hand pump is not available, the brake piston may be retracted by fabricating the compressor plate shown below.



   a) With puller bar across motor support opening, install two ¼ – 20 × 2½ long threaded studs with nuts into the brake piston.
   b) Evenly tighten nuts on studs against bar to retract piston and permit removal of housing snap ring and motor support assembly.

Refer to "Motor Support – Brake Cylinder Service" for additional information.

4. Remove the input shaft assembly (69).
5. Remove the high speed reverse planetary gear set, sprag clutch and primary sun gear as an assembly.
6. Remove the friction (32) and steel (31) brake discs and back-up plate (30) from the end bracket. Remove the snap ring (24) from the ring gear, machined into inside surface of end bracket.
7. Remove the primary planet carrier assembly (19) from the end bracket. Refer to "Planet Carrier Service" for additional information.
8. Remove the sun gear shaft (17).

CLEAN AND INSPECT

1. Remove and discard the motor support assembly o-ring (4).
2. Wash all parts in suitable solvent and dry thoroughly. Do not wash primary planet assembly unless it will be disassembled.

!WARNING!

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

3. Check motor support assembly snap ring (3) for flatness and that it forms a true circle. Replace snap ring if it is bent or damaged.
4. Remove the retaining ring (62) holding the high speed reverse planet carrier to the input sun gear (56) and remove the planet carrier and gears.
5. Remove the over-running brake clutch (35) and outer clutch hub/high speed reverse ring gear (34) from the primary sun gear (56). The polished surfaces of the races and the cams must be perfectly smooth and free of scoring, heat discoloration or material transfer. The slightest defect may reduce brake clutch effectiveness. Check component dimensions as follows:

Maximum outer clutch hub (34) I.D.	2.8043″
Minimum sun gear (56) O.D.	2.1481″
Maximum thrust washer (36) I.D.	2.153″

   NOTE: If the outer clutch hub (34), sun gear (56) or over-running clutch (35) require replacement, it is recommended that all three (3) components be replaced.

6. Check wear on over-running brake clutch thrust washers (36) at surface where thrust washer makes contact with primary sun gear (56) and primary planet carrier (19). If contact area is worn more than .030″, replace thrust washer or turn over washer and install in such a manner to place an unworn area in contact with the wear surfaces.
7. Place friction brake disc (32) 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.

8. Place steel brake disc (31) 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.

9. Inspect ring gear teeth (machined into inside surface of end bracket (21)) for nicks, spalling or excessive wear. Replace end bracket if wear is greater than .015″ when compared to unworn area of teeth.

10. Inspect high speed reverse ring gear for nicks, spalling or excessive wear. Replace the ring gear/outer clutch race if wear is greater than 0.015″ when compared to unworn area of teeth.

ASSEMBLY

1. Insure that snap ring (18) is in position on the sun gear shaft (17). Install the sun gear shaft, being careful to engage the output planet assembly (11).

2. Install the thrust washer (5) onto the pilot of the primary planet carrier (19). Install the primary planet carrier assembly into the end bracket while meshing the planet gears with the ring gear and the planet carrier with the sun gear shaft (17).

3. Install an over-running brake clutch thrust washer (36) onto the primary sun gear (56). Then, install the over-running sprag clutch assembly (35) and outer clutch hub/high speed reverse ring gear (34) so large counter bored side of hub locates over thrust washer. Install the remaining thrust washer (36). When installed correctly, the primary sun gear should turn freely in the same direction the drum turns to pull cable in with the outer clutch hub held in hand. Install the high speed reverse planet carrier (64) while meshing the planet gears with the ring gear (34) and the planet carrier with the sun gear (56). Install the retaining ring (62) which holds the high speed reverse planet carrier to the sun gear. Set this assembly aside for installation in step 5. NOTE: Steps 4 through 7 are best performed with the winch stood on end and adequately supported.

4. Install the snap ring (24) into the groove in the ring gear of the end bracket (21). Against the snap ring, install the steel back-up plate (30), one steel brake disc (31) followed by a friction brake disc (32), then alternate steel and friction discs until four (4) friction and five (5) steel discs have been installed. Finish with a steel brake disc to the outside. Center the friction discs and align the gear teeth best as possible.

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

5. Install the primary sun gear/sprag clutch/high speed reverse planetary assembly from step 3, meshing the friction disc (32) gear teeth with the external gear on the hub (34), and the primary gear (56) with the primary planet gears (26).

6. Install the input shaft assembly (55, 60 and 69), meshing the high speed reverse planet gears (65) with the input shaft (69).

7. Install a new motor support o-ring (3) into the end bracket. Lubricate the o-ring with light general purpose grease or hydraulic oil. With a hand pump, apply approximately 500 PSI to the external brake port to fully retract the brake piston (44). Install the motor support-brake cylinder assembly into the end bracket. Be sure motor support (53) is installed with locating pin (33) at the twelve o-clock position. Install snap ring (3) into end bracket, making certain snap ring is fully seated into groove in end bracket.

8. The proper number of motor shaft shims (54) must be installed in the input shaft (69) to minimize end play of the primary and high speed reverse planet carriers and over-running brake clutch assembly. Install shims as follows:

   A. Install six (6) shims (54), into the input shaft.

   B. Retract brake piston (44) with hand pump.

   C. Rotate brake piston (44) until oil tube (46) locates in brake release port of motor pilot.

   D. With o-rings (47, 48, 52) removed from oil tube and motor pilot, install hydraulic motor (51) onto motor support. Hold in place by hand. DO NOT install or tighten capscrews! Note gap between motor (51) and motor support (53).

   E. Remove shims (54) one (1) at a time until motor fits flush against face of motor support with no visible clearance under flange.

   F. Remove motor and install a new o-ring (52) on the motor pilot.

9. Lubricate and install o-ring and back-up ring (47, 48) on the brake piston oil tube (46) with the o-ring nearest the outer end.

10. Lubricate brake release port in motor pilot and motor pilot o-ring (52). Install the motor (51) onto the motor support being careful to avoid damage to the oil tube seals. Tighten capcrews (49) to recommended torque.

DRUM AND END BRACKET SERVICE

The following procedure may be used after the primary and output end bracket assemblies have been disassembled. Refer to "Primary End Bracket Service" and "Output Planetary End Bracket Service" sections.

DISASSEMBLY

1. Remove side plate capscrews (58) and side plates (57).
2. Support cable drum (16) with hoist and remove snap ring (23) which retains bearing onto drum.
3. Support weight of end bracket (21) and remove from drum (16) using two (2) pry bars placed between end bracket and drum.
4. Remove snap ring (24) which retains bearing in end bracket and press bearing (22) and oil seal (20) from end bracket (21).

CLEAN AND INSPECT

1. Wash all parts in solvent and dry thoroughly.
2. Inspect sealing surface on drum for wear. Light scoring may be polished with fine emery cloth.
3. Carefully inspect drum bearings for smooth rotation. Replace bearing if there are any defects such as pitting, spalling, or heat discoloration.

ASSEMBLY

1. Apply non-hardening sealant to outside diameter of oil seal (20). Install seal in end bracket (21) with spring side of seal toward bearing (22), using a flat plate 7″ to 7¼″ diameter to avoid distortion.
2. Install bearing (22) in end bracket (21) using a press and a flat plate, 7½″ diameter, to avoid damage to bearing. Install snap ring (24) which retains the bearing in the end bracket.
3. Lubricate drum seal and bearing surfaces with light general purpose grease or hydraulic oil. Install end bracket (21) onto drum (16) being careful to avoid damaging seal and bearing. Use a press with a 5¼″ – 5½″ I.D. drive ring to apply force only to inner race to avoid bearing damage. Install snap ring (23) which retains bearing onto drum.
4. Place winch on flat surface and install side plates (57). Lube all capscrews (58) with 30W motor oil and install finger tight. In approximately 25 lb. ft. increments, evenly tighten capscrews to 115 lb. ft. torque.
5. Install output and/or primary planetary assemblies as described in "Output Planetary End Bracket Service" or "Primary Planetary End Bracket Service".

NOTE: Although the primary and output end brackets are the same, it is **not** recommended that they be interchanged, since each end develops it's own gear tooth wear pattern.

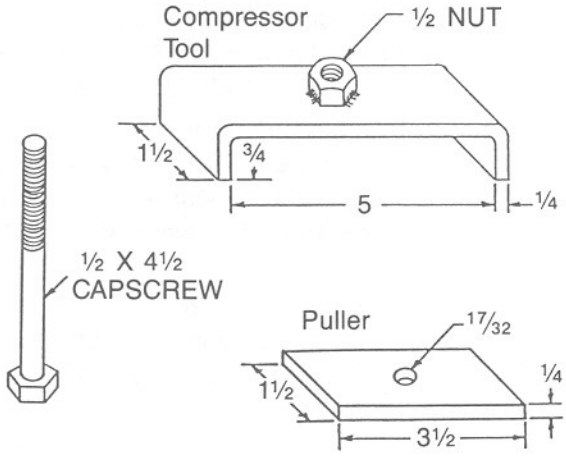
MOTOR SUPPORT — BRAKE CYLINDER SERVICE

DISASSEMBLY

1. To remove the snap ring (39) which retains the pressure plate (38) onto the brake piston (44) the pressure plate must be clamped against the shoulder of the brake piston to unload the brake spring force and permit removal of the snap ring.

   With a press, apply only enough force on the pressure plate (38) to unload the brake spring force and permit removal of the snap ring (39).

   NOTE: If a press is not available, the pressure plate may be retained by fabricating the spring compressor shown below:



   A. Place compressor tool across pressure plate (38) and puller bar across brake piston (44).

   B. Tighten capscrew enough to unload brake spring force and permit removal of snap ring (39).

   C. With the snap ring removed, carefully loosen spring compressor capscrew until brake spring tension is completely relieved.

2. Remove the brake springs (37) then slide the brake piston (44) out of the motor support.

   Remove the piston seal and back-up ring (40) and the o-ring and back-up ring (41, 42) from the brake cylinder.

CLEAN AND INSPECT

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

2. Check brake spring (37) free length; minimum free length is $1\frac{15}{16}$ inches. 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.

3. Inspect pressure plate snap ring (39) for flatness and that it forms a true circle. Replace snap ring if it is bent or damaged.
4. Inspect brake piston orifice to ensure hole is unobstructed.

ASSEMBLY

1. Install new o-rings and back-up rings (41, 42) on brake piston and in motor support. O-rings should be installed on inside toward brake release port with back-up rings installed toward outer edges of motor support.
2. Lubricate the brake piston seal, back-up ring (40) and brake piston sealing surface with light general purpose grease or hydraulic oil. The back-up ring expands the piston seal and improves its sealing ability. The new back-up ring MUST be installed with the smooth, flat side toward the large end of the piston. Install a new piston seal with the sealing lip toward the back-up ring. The piston sealing lip should mate with the grooved surface of the back-up ring.
3. Lubricate the brake piston seals and motor support sealing surfaces with light general purpose grease or hydraulic oil. Install the brake piston (44) into the motor support (53) being careful to avoid damaging the piston seals.
4. Install the brake springs (37) into the motor support.
5. Using either a press or the spring compressor tool described earlier, compress the brake springs (37) and pressure plate (38) onto brake piston (44) and secure in place with snap ring (39).
6. To insure brake seals have been properly installed, pressure test motor support – brake cylinder as follows:

   A. Connect a hand pump with an accurate 0-1000 PSI gauge and shut off valve to the brake release port.

   B. Apply 500 PSI to the brake. Close shut-off valve and let stand for 30 seconds then open valve. Repeat three (3) times to purge air from cylinder.

   C. With air purged from cylinder, apply 500 PSI to 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 seals.

7. If the pressure tests are satisfactory, the motor support – brake cylinder assembly is complete and ready for installation.

PLANET CARRIER SERVICE

DISASSEMBLY

(OUTPUT PLANET CARRIER)

1. Remove the planet gears (6) by driving the roll pins (25) into the center of the planet gear shafts (10).
2. Now you can remove the planet gear shafts (10), bearings (8), spacer (7), thrust washers (9) and gears (6).
3. Use a punch to drive the roll pins from the planet gear shafts. Do not reuse the roll pins.

(PRIMARY PLANET CARRIER)

1. Remove the planet gears (26) by driving the roll pins (25) into the center of the planet gear shafts (29).
2. Now you can remove the planet gear shafts (29), bearings (27), thrust washers (28) and gears (26).
3. Use a punch to drive the roll pins from the planet gear shafts. Do not reuse the roll pins.

(HIGH SPEED REVERSE PLANET CARRIER)

1. Remove the snap rings (67) from the planet gear shafts.
2. Remove the thrust washers (66), planet gears (65) and bearings (68).

CLEAN AND INSPECT

1. Thoroughly clean all parts and inspect for damage and wear.
2. The bearing rollers (8, 27 or 68) 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 (9, 28 or 66) contact areas on the gears or carrier 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

(OUTPUT PLANET CARRIER)

1. Place the output planet carrier (11) on workbench with splined coupling side up. Insert two (2) bearings (8) with a bearing spacer (7) between the bearings in the bore of the planet gear. Place a thrust washer (9) on each side of the gear (6) and position in a carrier opening. Slide the shaft (10) through the carrier, thrust washer, bearing-gear sub assembly and remaining thrust washer.
2. Carefully align the pin hole in the carrier with the hole in the planet gear shaft and drive the roll pin (25) into place. Always use NEW roll pins.
3. Note that the roll pin is slightly recessed in the carrier when properly installed. Repeat these steps for each of the three planet gears.

(PRIMARY PLANET CARRIER)

1. Place the planet carrier (19) on workbench with splined coupling side up. Insert a bearing (27) in the bore of the planet gear (26). Place a thrust washer (28) on each side of the gear and position in the carrier opening. Slide the shaft (29) through the carrier, thrust washer, bearing-gear sub assembly and remaining thrust washer.
2. Carefully align the pin hole in the carrier with the hole in the planet gear shaft and drive a new roll pin (25) into place. Always use NEW roll pins.
3. Note that the roll pin is slightly recessed in the carrier when properly installed. Repeat these steps for each of the three planet gears.

(HIGH SPEED REVERSE PLANET CARRIER)

1. Place the planet carrier (64) on workbench with planet gear shafts up.
2. Place a thrust washer (66) on the planet gear shaft.
3. Insert a bearing (68) into the bore of the planet gear (65) and place the planet gear/bearing on the planet gear shaft.
4. Place another thrust washer (66) on the planet gear shaft and install a snap ring (67) to hold the gear in place.
5. Repeat steps 2, 3 and 4 for the other two planet gears.

GH15 HSR HYDRAULIC WINCH BILL OF MATERIAL

ITEM	PART NO.	QTY	DESCRIPTION
0	76281	1	CABLE WEDGE 3/4
0	76285	1	CABLE WEDGE 9/16 - 5/8
1	73184	1	BUSHING
2	76270	1	END COVER
3	76408	2	RETAINING RING
3	100606	2	RETAINING RING w/HOOK LOCK
4	76208	2	O-RING
5	11890	2	THRUST WASHER
6	26279	3	PLANET GEAR
7	25443	3	BEARING SPACER
8	25292	6	BEARING
9	24306	6	THRUST WASHER
10	25613	3	OUTPUT PLANET GEAR SHAFT
11	25602	1	OUTPUT PLANET CARRIER
12	76209	1	SNAP RING
13	76258	8	DOWEL PIN (EARLY PRODUCTION, NOT CURRENTLY USED)
14	25913	1	CONNECTING RING (EARLY PRODUCTION, NOT CURRENTLY USED)
15	25811	1	CONNECTOR
16	81745	1	CABLE DRUM/01 (6.5 DIA X 17 DIA X 8 LG)
16	76240	1	CABLE DRUM/02 (6.5 DIA X 17 DIA X 13 LG)
16	76241	1	CABLE DRUM/03 (6.5 DIA X 17 DIA X 19 LG)
16	76242	1	CABLE DRUM/04 (10.6 DIA X 17 DIA X 13 LG)
16	76243	1	CABLE DRUM/05 (10.6 DIA X 17 DIA X 19 LG)
17	25858	1	SUN GEAR SHAFT (8 IN. DRUM)
17	76254	1	SUN GEAR SHAFT (13 IN. DRUM)
17	76255	1	SUN GEAR SHAFT (19 IN. DRUM)
18	76322	1	SNAP RING
19	25715	1	PRIMARY PLANET CARRIER
20	76211	2	OIL SEAL
21	76365	2	END BRACKET
22	76212	2	BEARING
23	76213	2	SNAP RING
24	76214	3	SNAP RING
25	23584	6	PIN
26	26280	3	PLANET GEAR
27	24175	3	BEARING
28	25361	6	THRUST WASHER
29	25614	3	PRIMARY PLANET GEAR SHAFT
30			BRAKE BACK-UP PLATE (NOT CURRENTLY USED)
31	25808	7	BRAKE DISC, STEEL
32	25809	4	BRAKE DISC, FRICTION
33	76215	1	DOWEL PIN
34	25841	1	OUTER CLUTCH HUB/HSR RING GEAR
35	76216	1	SPRAG CLUTCH
36	25815	2	THRUST WASHER
37	75811	12	SPRING
38	25860	1	PRESSURE PLATE
39	32093	1	RETAINING RING
40	76218	1	SEAL
41	23422	2	O-RING
42	76219	2	BACK-UP WASHER
43	76314	1	ORIFICE PLUG (0.081)
44	76274	1	BRAKE RELEASE PISTON (EARLY PRODUCTION)
44	76395	1	BRAKE RELEASE PISTON (CURRENT PRODUCTION)
45	76170	1	SNAP RING (EARLY PRODUCTION, NOT CURRENTLY USED)
46	25816	1	OIL TUBE (EARLY PRODUCTION)
46	76397	1	BRAKE RELEASE TUBE (CURRENT PRODUCTION)
47	24520	1	O-RING
48	76168	1	BACK-UP WASHER
49	13938	2	CAPSCREW
50	11026	2	LOCKWASHER
51	76259	1	HYDRAULIC MOTOR - CODE 029
51	76324	1	HYDRAULIC MOTOR - CODE 039
51	76261	1	HYDRAULIC MOTOR - CODE 020

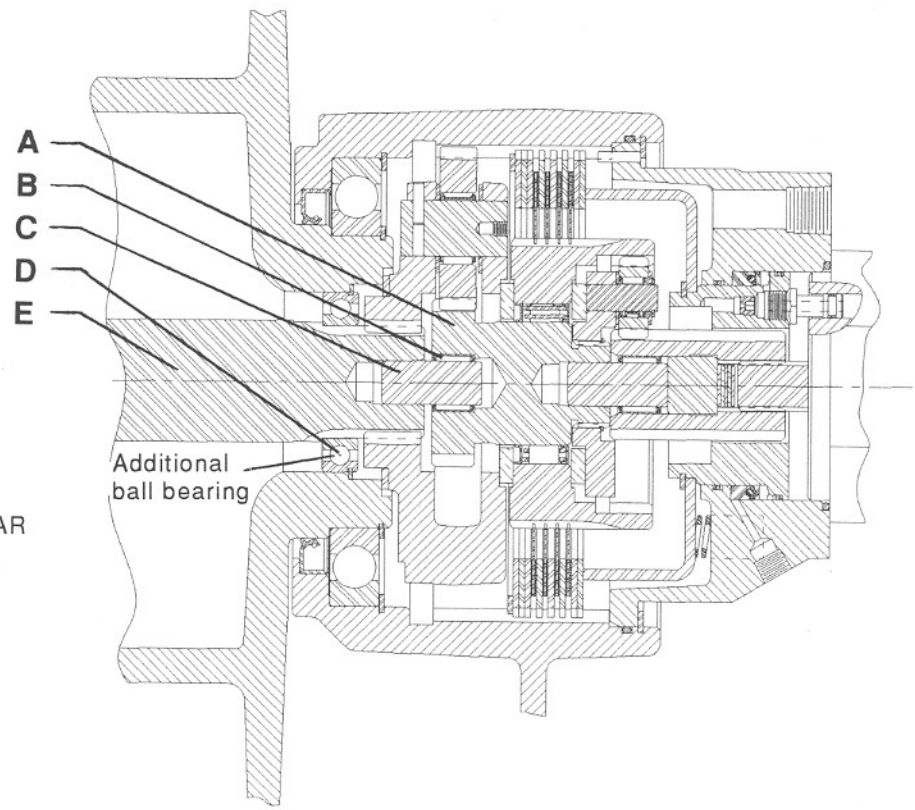
52	21063	1	O-RING
53	25752	1	MOTOR SUPPORT
54	76174	6	SHIM
55		1	SPACER PLUG (NOT SOLD SEPARATELY)
56	76495	1	PRIMARY SUN GEAR (INCLUDES ITEM 61)
57	25905	2	SIDE PLATE (8 IN. LG DRUM)
57	76256	2	SIDE PLATE (13 IN. LG DRUM)
57	76257	2	SIDE PLATE (19 IN. DRUM)
58	25119	8	CAPSCREW
60	11875	1	BEARING
61	76283	1	PIN
62	76264	1	SNAP RING
64	76262	1	HIGH SPEED REV. PLANET CARRIER
65	25903	3	PLANET GEAR
66	76265	6	THRUST WASHER
67	76266	3	SNAP RING (early production, 2 piece, for shaft groove width of 0.041 in.)
67	29808	3	SNAP RING (mid '93 & later production, 1 piece, for shaft groove width of 0.048 in.)
68	76267	3	BEARING
69	76366	1	INPUT SHAFT (INCLUDES ITEM 55)

SEAL KIT #76275

ITEM	PART NO.	QTY	DESCRIPTION
3	100606	2	RETAINING RING
4	76208	2	O-RING
20	76211	2	OIL SEAL
39	32093	1	RETAINING RING
40	76218	1	SEAL
41	23422	2	O-RING
42	76219	2	BACK-UP WASHER
47	24520	1	O-RING
48	76168	1	BACK-UP WASHER
52	21063	1	O-RING
54	76174	6	SHIM

Some special purpose GH15HSR models are built with a ball bearing on the inside of the primary end of the cable drum. These units have 5 unique parts as shown at right and listed below.

(These 5 parts are also available as a conversion kit, part number 62416)



A P.N. 29796 PRIMARY SUN GEAR
B P.N. 11875 NEEDLE BEARING
C P.N. 76283 PIN
D P.N. 72251 BALL BEARING
E P.N. 29798 SUN GEAR SHAFT