INSTRUCTION AND PARTS MANUAL

# MODEL M50

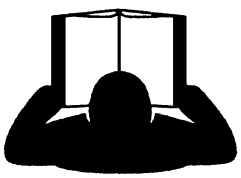
## FREE FALL

## PLANETARY HYDRAULIC WINCH

Pull MASTER

A DOVER COMPANY

THE LOGICAL CHOICE



**READ THIS MANUAL BEFORE INSTALLING, OPERATING OR SERVICING THIS PRODUCT. THIS MANUAL CONTAINS IMPORTANT INFORMATION. MAKE THIS MANUAL AVAILABLE TO ALL PERSONS RESPONSIBLE FOR THE OPERATION, INSTALLATION, SERVICING AND MAINTENANCE OF THIS PRODUCT.**

# PULLMASTER LIMITED WARRANTY

Effective 1/1/2002

*SUPERSEDES ALL PRIOR WARRANTIES*

Seller warrants that each article sold under this order shall at the time of shipment (i) conform to applicable specifications, and (ii) be free from defects in material and workmanship during normal and ordinary use and service (the "Warranty").

Buyer's exclusive remedy and Seller's sole obligation under this Warranty shall be, at Seller's option, to repair or replace any article or part thereof which has proven to be defective, or to refund the purchase price of such article or part thereof.

This Warranty shall expire one (1) year from the date the article is first shipped by Seller. Notice of claimed breach of this Warranty must be given by Buyer to Seller within the applicable period. Such notice shall include an explanation of the claimed warranty defect and proof of date of purchase of the article or part thereof for which warranty coverage is sought. No allowances shall be made by Seller for any transportation, labor charges, parts, "in and out" costs, adjustments or repairs, or any other work, unless such items are authorized in writing and in advance by Seller. Nor shall Seller have any obligation to repair or replace items which by their nature are expendable.

If an article is claimed to be defective in material or workmanship, or not to conform to the applicable specifications, Seller will either examine the article at Seller's site or issue shipping instructions for return to Seller. This Warranty shall not extend to any articles or parts thereof which have been installed, used, or serviced otherwise than in conformity with Seller's applicable specifications, manuals, bulletins, or instructions, or which shall have been subjected to improper installation, operation, or usage, misapplication, neglect, overloading, or employment for other than normal and ordinary use and service.

This Warranty shall not apply to any articles or parts thereof furnished by Seller to Buyer's specifications and/or furnished by Buyer or acquired from others at Buyer's request.

SELLER MAKES NO EXPRESS WARRANTIES AND NO IMPLIED WARRANTIES OF ANY KIND, OTHER THAN THE WARRANTY EXPRESSLY SET FORTH ABOVE. SUCH WARRANTY IS EXCLUSIVE AND IS MADE AND ACCEPTED IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

The remedies for this Warranty shall be only those expressly set forth above, to the exclusion of any and all other remedies of whatsoever kind. The limited remedies set forth above shall be deemed exclusive, even though they may fail their essential purpose. No agreement varying or extending the foregoing Warranty, remedies, exclusions, or limitations shall be effective unless in a writing signed by an executive officer of Seller and Buyer. This Warranty is non-transferable.

Under no circumstances shall Seller be liable (i) for any damage or loss to any property other than the warranted article or part thereof, or (ii) for any special, indirect, incidental, or consequential damage or loss, even though such expenses, damages, or losses may be foreseeable.

The foregoing limitations on Seller's liability in the event of breach of warranty shall also be the absolute limit of Seller's liability in the event of Seller's negligence in manufacture, installation, or otherwise, with regard to the articles covered by this Warranty, and at the expiration of the Warranty period as above stated, all such liabilities shall terminate.


## WARNING

**PULLMASTER** planetary winches/drives are not designed for operations involving lifting or moving personnel. The **PULLMASTER WINCH CORPORATION** cannot be held liable or responsible for any accident resulting from such use of **PULLMASTER** planetary winches/drives.

***Note:*** *Specifications contained in this Instruction and Parts Manual are subject to change without notice.*

# SAFETY RECOMMENDATIONS

## DANGER

**FAILURE TO COMPLY WITH THE FOLLOWING SAFETY RECOMMENDATIONS AND LOCAL RULES AND REGULATIONS WILL RESULT IN PROPERTY DAMAGE, SEVERE INJURY OR DEATH.**

Definition: **Caution** indicates a potentially hazardous situation which, if not avoided may result in minor or moderate injury.

Definition: **Warning** indicates a potentially hazardous situation which, if not avoided could result in death or serious injury.

Definition: **Danger** indicates a potentially hazardous situation which, if not avoided will result in death or serious injury.

The planetary hydraulic winches are made for hoisting and lowering loads and to be operated by trained and professional personnel. They are not designed for operations involving lifting or moving personnel. The winches are powered by hydraulic power. The ropes / cables for hoisting operations are not supplied by PULLMASTER. The winches are always assembled in an application, they do not function as an independent machine and it is not allowed to use them as such.

The winches are to be used within the specifications as listed in the manual under “SPECIFICATIONS”. Other use as foreseen in the functional description of the hydraulic winch is not allowed without written permission from PULLMASTER.

1. Do not install, operate or service winch before reading and understanding manufacturer's instructions.
2. The winch described herein is not designed for operations involving lifting or moving personnel.
3. Do not lift or carry loads over people.
4. Do not exceed recommended operating pressure (psi) and operating volume (gpm).
5. Do not jerk the winch. Always smoothly accelerate and decelerate load.
6. Do not operate a damaged, noisy or malfunctioning winch.
7. Do not leave a load suspended for any extended period of time.
8. Never leave a suspended load unattended.
9. Winch should be maintained and operated by qualified personnel.
10. Inspect winch, rigging, mounting bolts and hoses before each shift.
11. Warm-up equipment before operating winch, particularly at low ambient temperatures.
12. Verify winch function by raising and lowering a full test load to a safe height before each shift.
13. Do not weld any part of the winch.
14. Verify gear lubrication and brake circulation supply and return before operating winch.
15. Be sure of equipment stability before operating winch.
16. Wear proper clothing to avoid entanglement in rotating machinery.
17. Always stand clear of the load.
18. Use only recommended hydraulic oil and gear lubricant.
19. Keep hydraulic system clean and free from contamination at all times.
20. Maintain winch and equipment in good operating condition. Perform scheduled maintenance regularly.
21. Keep hands clear when winding wire rope onto the winch drum.
22. Do not use the wire rope as a ground for welding.
23. Rig the winch carefully. Ensure that the wire rope is properly anchored to the correct cable anchor slot at the cable drum.
24. Do not lift a load with a twisted, kinked or damaged wire rope.
25. Consult wire rope manufacturer for size, type and maintenance of wire rope.
26. Maintain five wraps of wire rope on the cable drum at all times.
27. In case of a power failure or breakdown leading to an unexpected stop of the hydraulic power circuit, stand clear of the area and the load being hoisted, take the necessary precautions to prevent access to area where the load is halted.
28. The noise level of the winch is 89dBA measured on a distance of 1.00 meter, 1.60 meters high. The measuring equipment used was: Realistic #42-3019.
29. Clean up any oil spillage immediately.
30. Wear proper clothing and personal protection equipment such as, footwear, safety goggles and a hard hat. Read manual first.

# DESCRIPTION OF THE MODEL M50 FREE FALL

## GENERAL DESCRIPTION:

The PULLMASTER Model M50 free fall is a planetary hydraulic winch having equal speed in both directions and the ability to lower a load FAST. The free fall option comes in three variations: **emergency free fall**, **controlled free fall**, or with **both combined**. The main components of this unit are:

- Hydraulic gear motor
- Multi disc brake with static and dynamic function
- Over-running clutch
- Hydraulic gear motor
- Primary planet reduction
- Final planet reduction
- Brake housing
- Cable drum
- Free fall housing
- Free fall clutch assembly
- Metering pump assembly (for controlled free fall)

## FUNCTION IN FORWARD ROTATION (HOISTING):

In forward rotation, the output torque and rpm of the hydraulic motor are transmitted to the sungear of the primary planet reduction. The output of the primary reduction is transferred to the final sungear, which is splined to the primary planet hub. The final planet assembly is locked in place by the free fall clutch and does not rotate, so the rotation is transmitted to the cable drum by the final drive planet gears. In forward rotation, or when a load is lifted, an over-running clutch, which connects the motor drive shaft to the automatic brake assembly, permits free rotation of the sungear, without effecting the brake. The pressure required to rotate the drum without load at full speed may vary up to 350 psi (24 bar). When the winch rotation is stopped, the load on the cable drum causes the over-running clutch to lock and the maximum load is held safely by the disc brake.

## FUNCTION IN REVERSE ROTATION (LOWERING):

In reverse rotation, or when the winch is pressurized for lowering of a load, hydraulic pressure from the reverse side of the hydraulic motor is channelled to the brake piston, causing the brake piston to release the multi-disc brake against a number of brake springs. The pressure required to rotate the drum at full speed may vary from 250 to 550 psi (17 to 38 bar) depending upon the load and without load from 500 to 1000 psi (34 to 69 bar). The over-running clutch, connecting the motor drive shaft to the brake assembly, locks, causing the brake discs to rotate between divider plates, which are engaged into the brake housing. If the load on the cable drum tends to effect the lowering speed, the resulting pressure drop in the brake piston causes friction between the brake discs and the divider plates. In this way, a completely smooth pay out speed can be achieved in a stepless operation by modulation of the winch control handle. When the control handle is returned to neutral position, rotation stops and the disc brake applies automatically. A hydraulic counter-balance valve or holding valve is not required for smooth and positive operation of the automatic brake.

During lowering operations of the winch, the friction created by the brake discs results in heat. This heat is dissipated by the circulation of hydraulic fluid through the brake housing, supplied internally from the motor, or externally, depending on the brake code of the winch. For efficient cooling of the automatic brake, models with external circulation should be adjusted to supply 5 (US) gpm - 19 l/min. This flow must be returned directly to the reservoir with a permissible back pressure of 30 psi (2 bar).

**IMPORTANT:** Under no circumstances must the pressure in the brake housing be permitted to exceed 30 psi (2 bar). Excessive pressure in the brake housing will damage the oil seal separating the brake housing from the drum interior. Damage to this seal will cause the drum to fill up with hydraulic fluid.


**WARNING**

**PRIOR TO OPERATION OF THIS UNIT, VERIFY COMPLIANCE WITH ALL NATIONAL AND LOCAL SAFETY CODES AND REGULATIONS REGARDING THE USE OF FREE FALL WINCHES.**

# DESCRIPTION OF THE MODEL M50 FREE FALL

CONTINUED

## EMERGENCY FREE FALL:

The **emergency free fall** is used for a full release of a suspended load up to the maximum load capacity of the Model M50 planetary winch. Upon activating the **emergency free fall** function, the load will drop and it must be allowed to fall to its end travel without re-engagement.

**DANGER**

**RE-ENGAGING FREE FALL CLUTCH WHILE LOAD IS DROPPING CAUSES SHOCK LOADS AND WILL LEAD TO CABLE FAILURE, PROPERTY DAMAGE, SEVERE INJURY OR DEATH. INTERLOCK HYDRAULIC CONTROL TO PREVENT RE-ENGAGING FREE FALL CLUTCH WHILE LOAD IS DROPPING.**

## FUNCTION OF THE EMERGENCY FREE FALL:

When the Model M50 planetary winch is actuated for **emergency free fall**, hydraulic pressure is channelled to the clutch piston, causing the clutch piston to press against a series of springs and release the multi-disc clutch. This effectively disconnects the cable drum from the gear train of the winch and the suspended load will drop. The minimum load required to establish **emergency free fall** mode is 1,000 lb (554 kg).

## CONTROLLED FREE FALL:

The **controlled free fall** offers positive down control of a load at selected speeds and can be stopped anywhere on the way down. The **controlled free fall** is not designed, nor intended to lower the maximum load in a **controlled free fall.** The permissible load is 30% of the maximum line pull capacity of the winch. Since the clutch release pressure of the **controlled free fall** varies in accordance with the size of the load, a metering pump is utilized to compensate for clutch release pressure variations.

## FUNCTION OF CONTROLLED FREE FALL:

The **controlled free fall** has the same basic function as the **emergency free fall** with the addition of a metering pump which regulates the different clutch pressure requirements during a **controlled free fall**. When the **controlled free fall** is actuated, hydraulic pressure is channelled into the clutch piston, causing the clutch piston to press against a series of springs and release the multi-disc clutch. When the clutch has been released, the final planet assembly rotates with the cable drum, around a stationary sungear. A small hydraulic gear pump is splined to the final planet hub. This hydraulic pump displaces hydraulic oil flow out of the free fall control circuit to compensate for the difference in the clutch release pressure, which varies according to the actual lowering speed. The faster the load is lowered with the free fall control, the faster the planet hub will cause the pump to turn, increasing the displacement volume drawn out of the control circuit. When the free fall control is returned to neutral, the hydraulic pressure in the clutch piston is vented and the free fall clutch is re-engaged by spring pressure.

## COMBINED EMERGENCY AND CONTROLLED FREE FALL:

The **emergency** and **controlled free fall** can be combined for installations where both of these options are required. Two separate controls must be used for this option and the operating criteria for both functions must be adhered to.

**IMPORTANT:** Under no circumstances must the pressure in the free fall housing be permitted to exceed 10 psi (.7 bar). Excessive pressure will damage the main drum seals. Damage to these oil seals will cause oil to leak between drum flange of brake housing or free fall housing.

# EXPLANATION OF MODEL CODING

**M 50 X - XX - XX - XX X - X XXXX**

**BASIC UNIT SERIES**
M = Equal speed in both directions

**SIZE OF UNIT**

**REDUCTION RATIO**
Only used for non standard reduction ratios

**TYPE OF BRAKE**

-3 Automatic brake, clockwise drum rotation, internal circulation flow

-4 Automatic brake, external brake release, clockwise drum rotation, internal circulation flow

-5 Automatic brake, external brake release, counterclockwise drum rotation, internal circulation flow

-6 Automatic brake, counterclockwise drum rotation, internal circulation flow

-7 Automatic brake, clockwise drum rotation, external circulation flow

-8 Automatic brake, external brake release, clockwise drum rotation, external circulation flow

-9 Automatic brake, external brake release, counterclockwise drum rotation, external circulation flow

-10 Automatic brake, counterclockwise drum rotation, external circulation flow

**HYDRAULIC MOTOR**
- 86 Hydraulic motor, 3 inch gear section (12.3 cubic inch displacement) (Other gear sections for this motor are optional)

**DRUM SIZE**
-1 14 inch drum diameter X 23.75 inch flange diameter X 14 inch length - STANDARD
(For other drum sizes refer to APPENDIX A)

**OPTIONS**
- C Controlled free fall
- D Emergency free fall
- G Combined emergency and controlled free fall

**DESIGN REVISION**

**SPECIFICATION NUMBER**
Describes features not identified by preceding codes

**NOTE:** Clockwise and counterclockwise drum rotation is the direction of rotation for pulling or hoisting, established by looking at the hydraulic motor.

# OPTIONS

## COUNTERCLOCKWISE ROTATION:

The drum rotation of the standard PULLMASTER Model M50 free fall planetary winch is clockwise for hoisting when looking at the hydraulic motor of the winch. Drum rotation for counterclockwise hoisting direction is available as an option.

## INTERNAL CIRCULATION:

The PULLMASTER Model M50 free fall has an external circulation flow supply line to cool the brake. Internal circulation is available as an option.

## EXTERNAL BRAKE RELEASE:

PULLMASTER planetary winches can be supplied with an **external brake release** which permits release of the automatic disc brake from an external pressure source.

**DANGER**

**FAILURE TO PROPERLY VENT EXTERNAL BRAKE RELEASE PORT WILL TRAP BRAKE PRESSURE AND ALLOW THE LOAD TO DROP, CAUSING PROPERTY DAMAGE, SEVERE INJURY OR DEATH. WINCHES SUPPLIED WITH EXTERNAL RELEASE OPTION MUST BE CONNECTED ACCORDING TO "TYPICAL HYDRAULIC CIRCUIT".**

## CABLE DRUM SIZES:

Aside from the standard drum sizes listed in APPENDIX A, the PULLMASTER Model M50 free fall planetary winch can be supplied with optional drums to accommodate large wire rope storage capacity.

## DRUM GROOVING:

Cable drums for the PULLMASTER Model M50 free fall planetary winch can be grooved. Where this option is a requirement, it is necessary to state the size of wire rope which is to be used with the winch.

## OPTIONAL GEAR SECTION FOR THE HYDRAULIC MOTOR:

The performance of the PULLMASTER Model M50 free fall planetary winch can be changed by using a different displacement motor. (Contact the factory for performance information of different gear sections.)

## HYDRAULIC MOTORS FOR HIGH PRESSURE HYDRAULIC SYSTEMS:

The operating pressure of the PULLMASTER Model M50 free fall planetary winch is limited to 2500 psi (172 bar). For hydraulic systems operating with a higher range of hydraulic pressure, the winch can be supplied with a hydraulic piston motor, which will provide for the same basic performance in terms of line pull and line speed capacity. (Contact the factory for this requirement.)

The PULLMASTER WINCH CORPORATION will consider other options for quantity requirements.

# SPECIFICATIONS

Performance specifications are based on standard hydraulic motor, gear ratio and cable drum with 1.25 inch diameter wire rope. For other cable drums and reductions refer to APPENDIX A. For other motors, refer to supplement inside back cover. Performance specifications for winches supplied with optional motors are provided in attached supplement.

**CABLE DRUM DIMENSIONS (STANDARD DRUM):**

| | | |
|---|---|---|
| Barrel diameter | 14.00 in | 356 mm |
| Flange diameter | 23.75 in | 603 mm |
| Barrel length | 14.00 in | 356 mm |

**CABLE STORAGE CAPACITY:**

| **(Size of wire rope)** | | |
|---|---|---|
| 9/16 in | 854 ft | 260 m |
| 5/8 in | 691 ft | 211 m |
| 3/4 in | 519 ft | 158 m |
| 7/8 in | 375 ft | 114 m |
| 1 in | 276 ft | 84 m |
| 1 1/8 in | 195 ft | 60 m |
| 1 1/4 in | 177 ft | 54 m |

| | | |
|---|---|---|
| **MAXIMUM OPERATING PRESSURE:** | 2500 psi | 172 bar |
| **MAXIMUM OPERATING VOLUME:** | 115 (US) gpm | 435 l/min |
| **MINIMUM OPERATING VOLUME:** | 30 (US) gpm | 114 l/min |
| **DRUM TORQUE AT MAXIMUM PRESSURE:** | 381,250 lb-in | 43,075 Nm |
| **DRUM RPM AT MAXIMUM VOLUME:** | Hoisting | 17.4 rpm |

**HOISTING LINE PULL AT MAXIMUM PRESSURE:**

| | | |
|---|---|---|
| Bare drum | 50,000 lb | 222.4 kN |
| Full drum | 33,889 lb | 150.7 kN |

**PERMISSIBLE CONTROLLED FREE FALL LOAD:**

| | | |
|---|---|---|
| Bare drum | 15,000 lb | 66.7 kN |
| Full drum | 10,520 lb | 46.8 kN |

**HOISTING LINE SPEED AT MAXIMUM VOLUME:**

| | | |
|---|---|---|
| Bare drum | 69 fpm | 21 m/min |
| Full drum | 102 fpm | 31 m/min |

**PERMISSIBLE SYSTEM BACK PRESSURE AT MOTOR RETURN PORT:**

| | |
|---|---|
| 65 psi | 4.5 bar |

**PERMISSIBLE PRESSURE AT CIRCULATION SUPPLY PORT:**

| | | |
|---|---|---|
| Brake housing | 30 psi | 2 bar |
| Free fall housing | 10 psi | .7 bar |

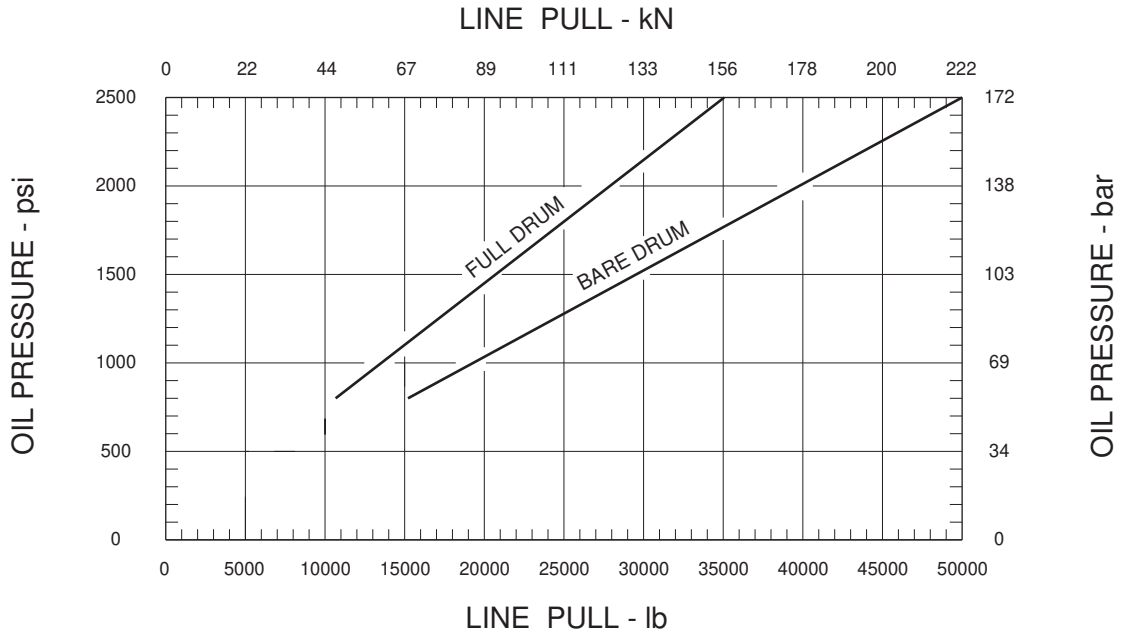
**LUBRICATING OIL:** Refer to RECOMMENDATIONS for instructions.

# PERFORMANCE GRAPHS

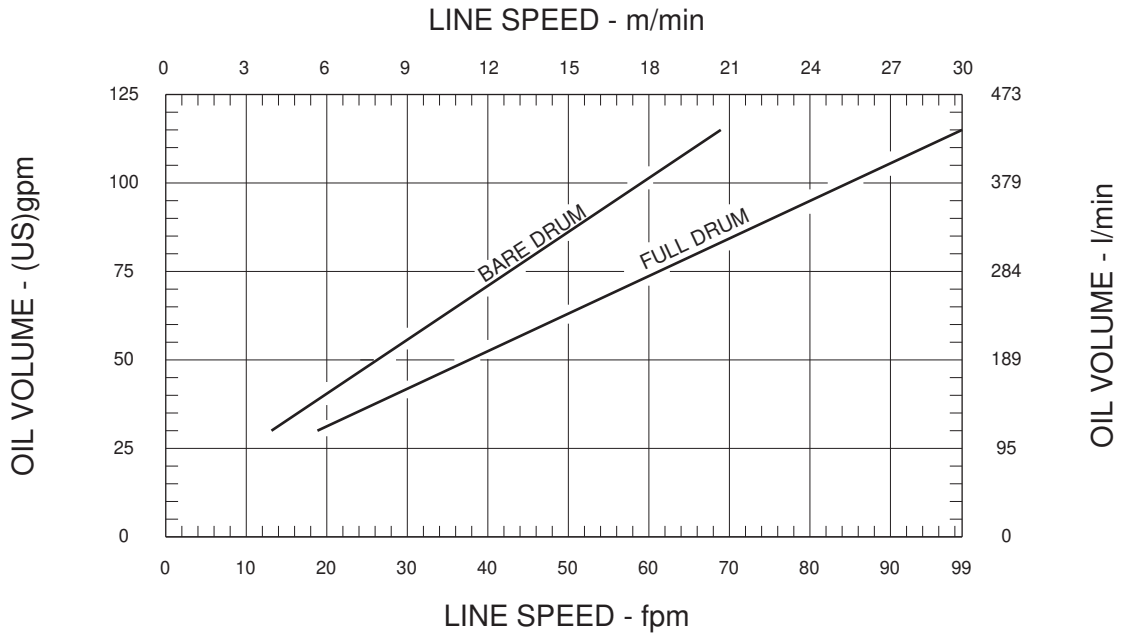
PG-M50-A

## LINE PULL VS. OIL PRESSURE

| MAXIMUM ALLOWABLE LINE PULL WHEN USING CONTROLLED FREE FALL: | | |
|---|---|---|
| Bare drum | 15,000 lb | 66.7 kN |
| Full drum | 10,520 lb | 46.8 kN |



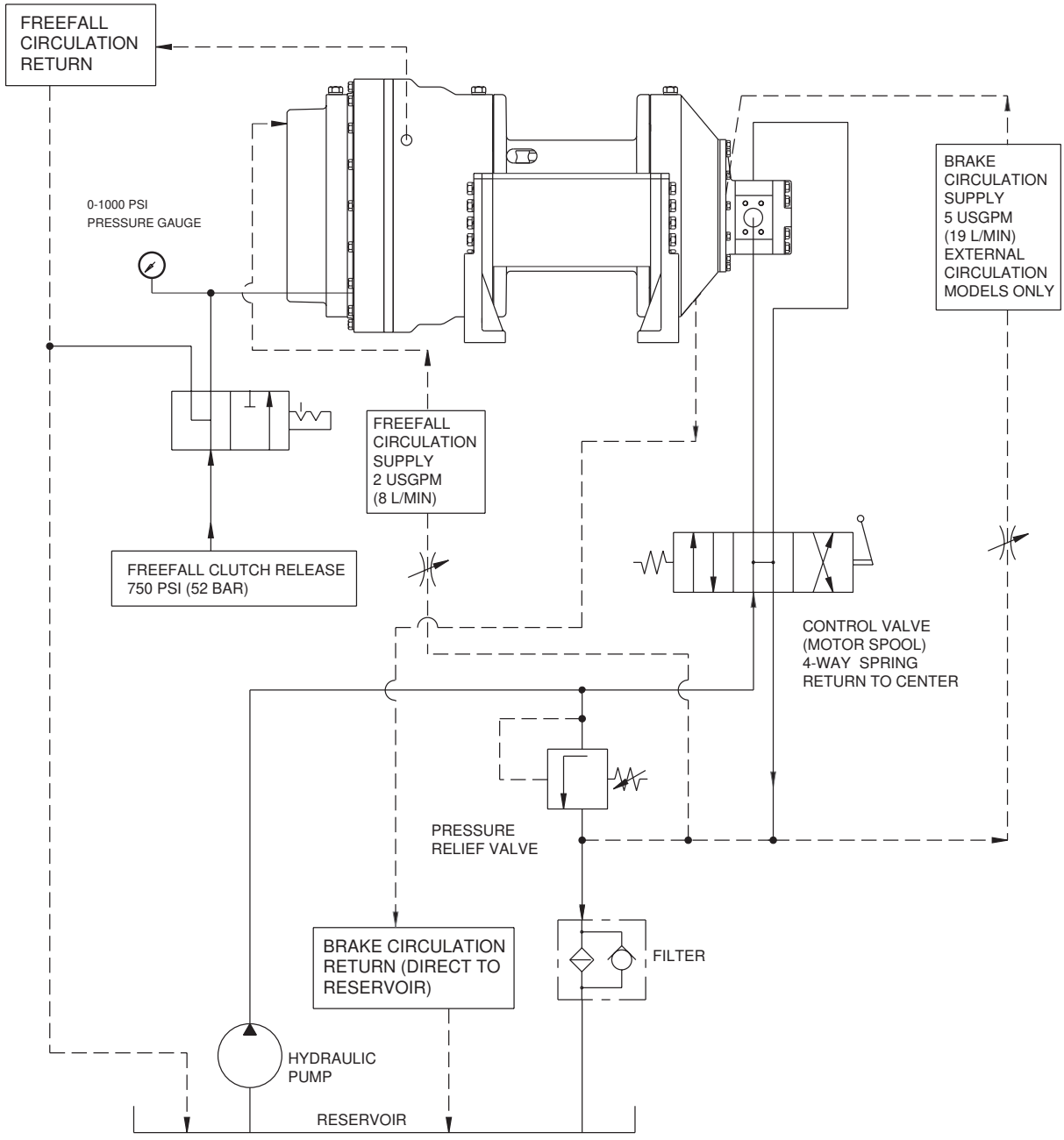

## LINE SPEED VS. OIL VOLUME




Performance graphs are based on standard hydraulic motor, gear ratio and cable drum with 1.25 inch diameter wire rope.

# TYPICAL HYDRAULIC CIRCUIT

**EMERGENCY FREE FALL:** HC-M50-X-86-XD-B

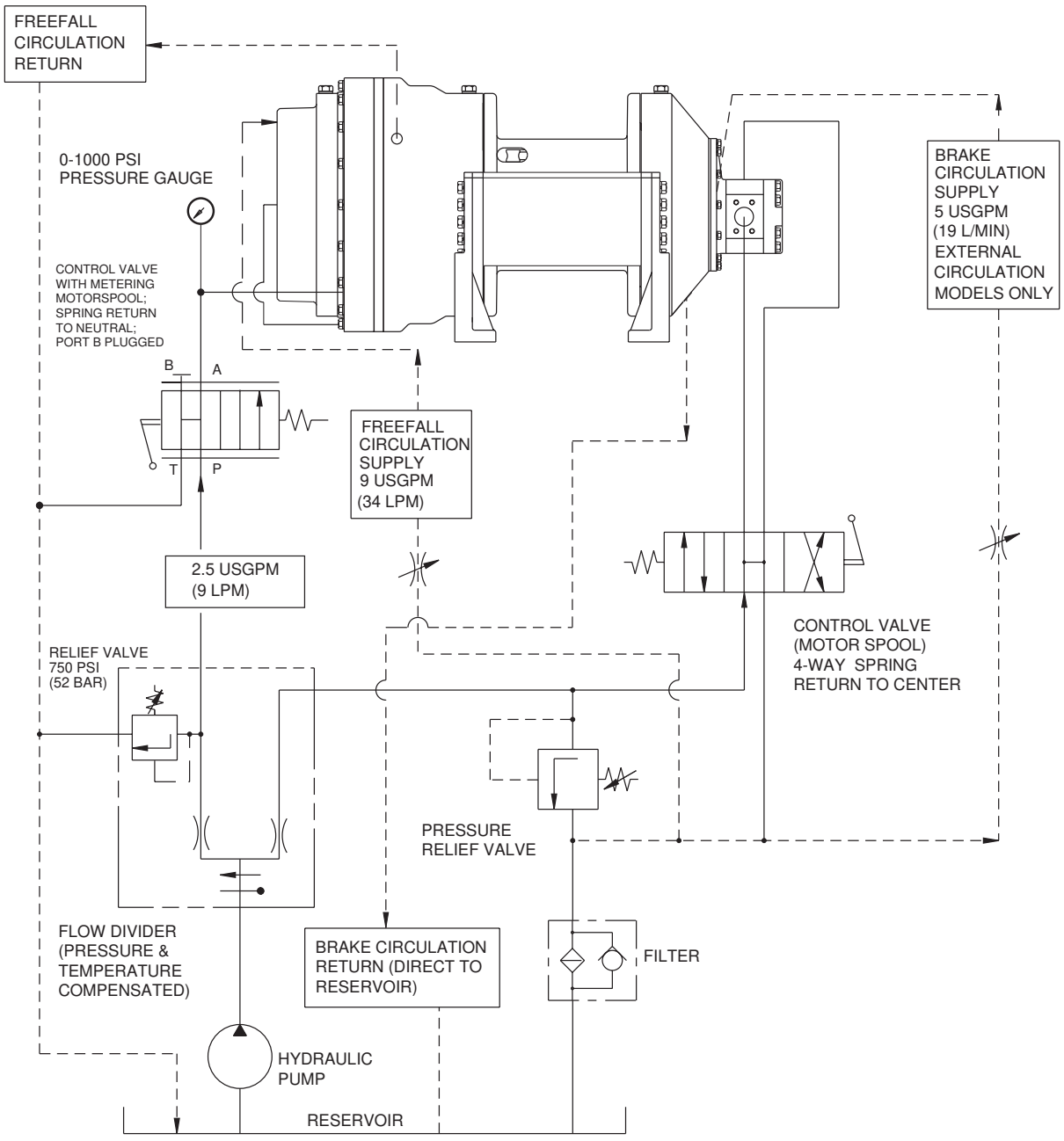



**DANGER**

**RE-ENGAGING FREE FALL CLUTCH WHILE LOAD IS DROPPING CAUSES SHOCK LOADS AND WILL LEAD TO CABLE FAILURE, PROPERTY DAMAGE, SEVER INJURY OR DEATH. INTERLOCK HYDRAULIC CONTROL TO PREVENT RE-ENGAGING FREE FALL CLUTCH WHILE LOAD IS DROPPING.**

# TYPICAL HYDRAULIC CIRCUIT

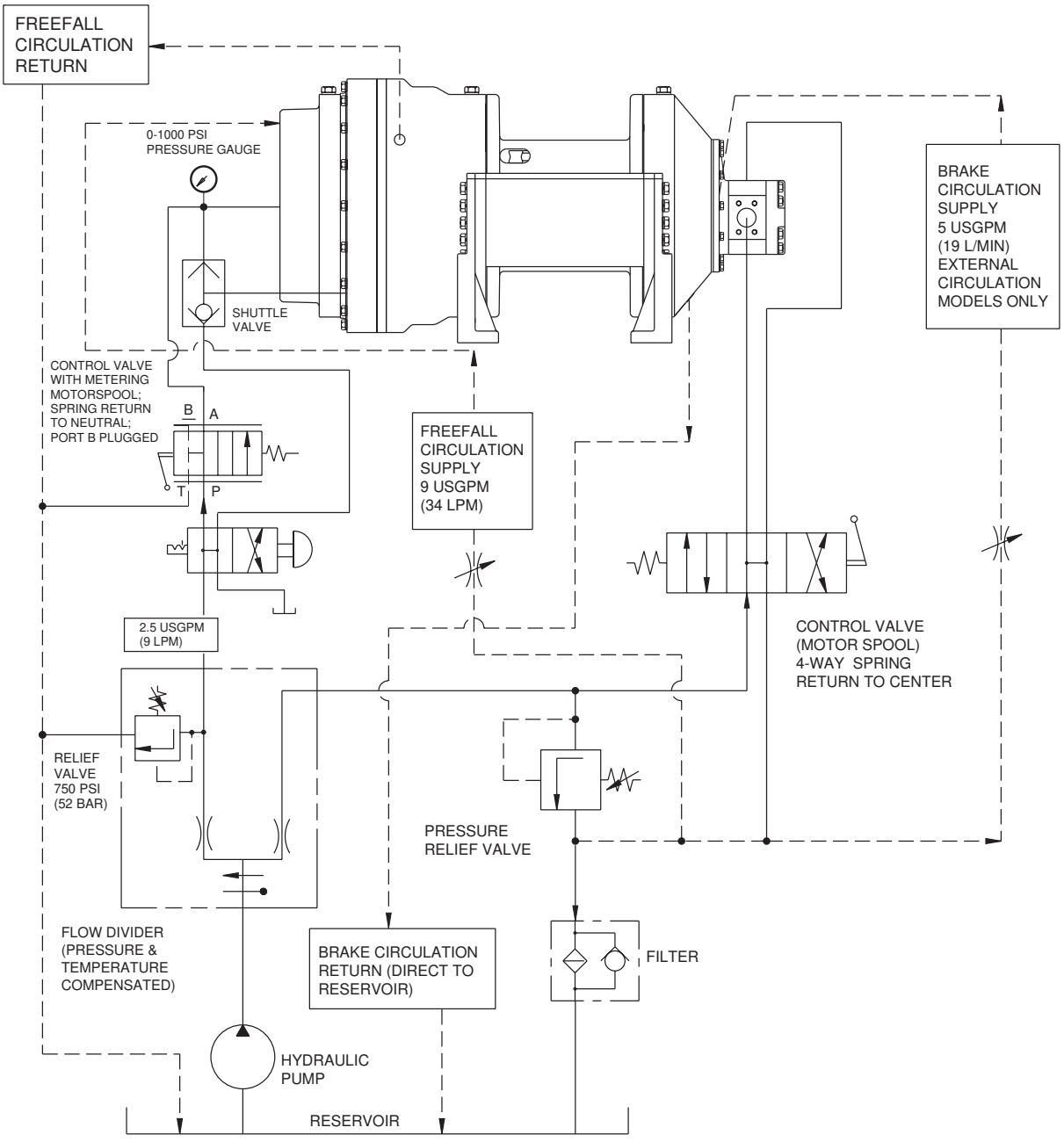
**CONTROLLED FREE FALL:** HC-M50-X-86-XC-B



# TYPICAL HYDRAULIC CIRCUIT

HC-M50-X-86-XG-B

**COMBINED EMERGENCY & CONTROLLED FREE FALL:**



# RECOMMENDATIONS

## HYDRAULIC FLUID:

The hydraulic fluid selected for use with PULLMASTER planetary winches should be a high grade, petroleum based fluid, with rust, oxidation and wear resistance. Fluid cleanliness and operating viscosity are critical to winch reliability, efficiency and service life.

For optimum performance, the recommended viscosity range at operating temperature is 81 - 167 SUS (16 - 36 CS). For extreme operating conditions of short duration, the maximum viscosity range of 58 - 4635 SUS (10 - 1000 CS) should not be exceeded.

For optimum performance, the winch recommended hydraulic fluid temperature operating range is 80 - 150F (27 - 66 C). For extreme operating conditions of short duration, the maximum temperature range of -5 - 180F (-21 - 82 C) should not be exceeded.

## LUBRICATION:

The winch gear train is lubricated by hydraulic oil circulated through the free fall end cover.

**IMPORTANT**: VERIFY FREE FALL CIRCULATION SUPPLY FLOW BEFORE RUNNING WINCH.

Refer to INSTALLATION DRAWING for location of free fall circulation supply and return ports.

## HYDRAULIC PUMP:

For maximum performance of the PULLMASTER planetary winch, the hydraulic pump must supply the maximum flow of hydraulic fluid at the hydraulic pressure stated in SPECIFICATIONS.

## HYDRAULIC WINCH CONTROL VALVE:

The standard control valve used for operation of the PULLMASTER planetary winch must have a four-way, spring return to neutral feature, which provides for open flow from the pressure ports of the winch to the reservoir in neutral position of the control (motor spool). It is important to point out that good speed control, especially when lowering a load, depends on the “metering” characteristics of the control valve. The better the oil flow is “metered” the better will be the speed control.

## HYDRAULIC PRESSURE RELIEF:

The hydraulic circuit for the PULLMASTER planetary winch requires a pressure relief set at the operating pressure (see SPECIFICATIONS). Usually, a pressure relief is part of the hydraulic control valve. Where this is not the case, a separate pressure relief valve must be installed and set at the recommended maximum pressure.

## HYDRAULIC RESERVOIR:

It is recommended that the hydraulic reservoir has sufficient capacity to provide good heat dissipation in order to prevent over-heating of the hydraulic fluid. The hydraulic reservoir should be made from clean and scale-free material to prevent contamination of the hydraulic fluid. In order to prevent air from being mixed with the hydraulic fluid, the reservoir should have an over-flow baffle separating the return lines from the suction line and all return lines should enter the reservoir below the fluid level. The reservoir should be mounted close to and above the hydraulic pump in a location which provides for free air circulation around the reservoir.

## HYDRAULIC HOSES:

The following hydraulic hoses are recommended for maximum efficiency of the PULLMASTER Model M50 planetary winch with free fall:

| | |
|---|---|
| Pressure lines: | Equivalent to SAE 100R 12-32 |
| Circulation return line: | Equivalent to SAE 100R 4-16 |
| Circulation supply line: | Equivalent to SAE 100R 6-6 |
| Free fall release line: | Equivalent to SAE 100R 3-4 |

It is recommended that a larger size of hydraulic hose is installed where the pressure lines or the circulation lines are excessively long.

## HYDRAULIC FILTER:

Hydraulic filter recommendations for the hydraulic circuit of the PULLMASTER planetary winch, based on a return line filter, are given as follows:

| | |
|---|---|
| Average Atmosphere: | 10 microns |
| Dusty Atmosphere: | 5 microns |

In order to prevent accidental stoppage of the return line flow, the oil filter should have a by-pass feature.

# RECOMMENDATIONS CONTINUED

## EMERGENCY FREE FALL CONTROL VALVE:

The **emergency free fall** requires a two position, three-way valve. The pressure port must be open to the reservoir when the emergency free fall is not actuated and must pressurize the free fall release port on the winch when the free fall control button is pressed. A selector valve with two detent positions is best suited. If the **emergency free fall** is combined with **controlled free fall**, a standard two position, four-way selector valve with two detents should be used. (Refer to TYPICAL HYDRAULIC CIRCUIT.)

## CONTROLLED FREE FALL CONTROL VALVE:

For positive speed control, the valve used for the **controlled free fall** must be a “spring return”, two position selector valve, which has good metering characteristics and on which the pressure port is open to the reservoir when the **controlled free fall** is not operating.

## USE OF AN E STOP:

**(FOR EUROPEAN MACHINERY DIRECTIVE APPLICATIONS)**

The use of an E stop (emergency) is mandatory in the controls circuit. The E stop is to be placed in the operator's control panel. The E stop must be designed and placed in line with EN 60204 and EN 418.

## PRESSURE GAUGE:

To monitor free fall release port pressure install a 1000 psi (69 bar) pressure gauge between the free fall control valve and the release port.

**IMPORTANT:**

The circulation return lines must go direct to reservoir. Pressure in the free fall housing must not be permitted to exceed 10 psi (0.7 bar).

# INSTALLATION INSTRUCTIONS

**DANGER**

**FAILURE TO FOLLOW INSTALLATION INSTRUCTIONS WILL RESULT IN PROPERTY DAMAGE, SEVERE INJURY OR DEATH.**

The initial installation or mounting of a PULLMASTER planetary winch is critically important for proper operation and performance. If the winch is mounted to an uneven surface, the centre line of the unit can be distorted to a point where the winch will not operate in either direction. It is therefore very important that the following instructions are observed when a PULLMASTER planetary winch is installed:

1) Make certain that the mounting platform is sufficiently strong in order to avoid deflection when a load is lifted.

2) Set the winch on the mounting platform and check for surface contact on all mounting pads of the winch.

3) If there is a space between the mounting surface and one of the mounting pads, the mounting surface is not even and the space below the mounting pad must be shimmed. If this condition exists, proceed as follows:

   a) Install mounting bolts snug tight on the three mounting pads which are in contact with the mounting surface. (For mounting bolt size and grade see INSTALLATION DRAWING.)

   b) Measure the space underneath the fourth mounting pad with a feeler gauge and use shim stock of equivalent thickness in the space between the mounting pad and the mounting surface.

   c) Only after this procedure should the fourth mounting bolt be installed. Tighten all four bolts per BOLT TORQUE CHART.

4) Use recommended circuit components and hydraulic hoses.

5) The circulation return line of the winch should be plumbed in such a manner that the brake housing and free fall housing remain full of oil at all times. Connect the return lines directly to reservoir. Do not connect to a common return line.

6) Bleed the air out of the free fall control circuit by loosening the connection at the free fall release port on the winch. With no load on the cable drum, operate the free fall control valve, letting all air escape, then re-tighten the connection at the release port.

7) Before operating the winch with a load, verify adequate circulation flow through the circulation return line as stated in TYPICAL HYDRAULIC CIRCUIT. Verify that pressure measured at the circulation supply port does not exceed the permissible pressure stated in SPECIFICATIONS. Winches equipped with the internal circulation option will supply circulation flow only when the winch is run in the lowering direction.

# OPERATING INSTRUCTIONS

## DANGER

**FAILURE TO FOLLOW OPERATING INSTRUCTIONS WILL RESULT IN PROPERTY DAMAGE, SEVERE INJURY OR DEATH.**

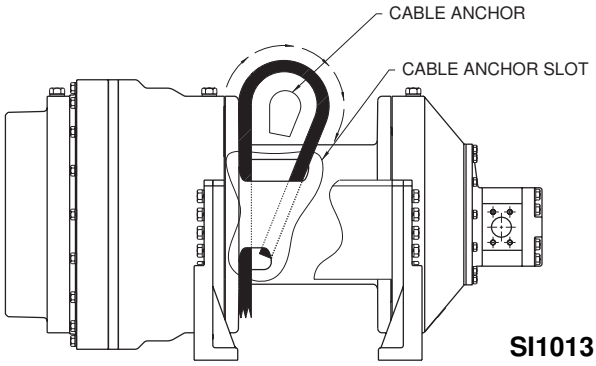
After the PULLMASTER planetary winch has been installed in accordance with the INSTALLATION INSTRUCTIONS, the wire rope can be fastened to the cable drum.

**IMPORTANT:** The ropes, chains, slings, etc. are not part of the winch and are not covered by this manual. Refer to manufacturer's handling, inspection and maintenance recommendations to avoid potential accidents. For selection of ropes, etc. please check following product standards: DIN 15020, prEN818-1/9, prEN 1492-1/2, prEN 1677-1/3 and other relevant product standards.

1) The cable drum of the PULLMASTER planetary winch has two cable anchor slots, one for clockwise and one for counterclockwise hoisting. Standard rotation for hoisting is clockwise when looking at the hydraulic motor of the unit. It is critical to select the cable anchor slot which will permit winding of the wire rope on the drum in the correct direction of rotation. If the wire rope is wound on the cable drum in the wrong direction of rotation, the winch will have no braking capacity. Each winch is shipped from the factory with a label on the drum indicating the correct cable anchor slot.

**WIRE ROPE INSTALLATION**
Clockwise hoisting winch shown.
(Use cable anchor slot on opposite side of drum for counterclockwise hoisting winch.)

Feed the wire rope through the cable anchor slot. Loop rope back into slot as shown. Insert cable anchor into slot, small end first. Pull rope tight to wedge rope in slot.




**SI1013 - M50FF**

2) On wire rope installation, care must be taken that the wire rope is wrapped completely around the cable anchor and properly pulled into the cable anchor slot in the cable drum. The cable drum requires 5 wraps of wire rope for safety.

3) The winch operation is controlled by a single control valve lever which has a **forward**, a **reverse** and a **neutral** position. Speed control in either direction is obtained by modulation of the control valve lever. Maximum line speed in either direction is obtained when the control valve lever is moved as far as it can go. The disc brake of the winch will come on automatically when the winch control lever is returned to **neutral**.

4) Always warm up equipment prior to operating winch, particularly in low ambient temperature. Circulate hydraulic oil through the winch control valve for several minutes to warm the hydraulic system. To prime the winch with warm oil, operate the winch at slow speed, forward and reverse, several times.

5) Prevent corrosion damage to winch interior. If not used regularly, run winch up and down at least once every two weeks.

6) To ensure proper winch installation and function, raise and lower a full test load to a safe height before using winch for regular operation at the start of each shift.

# OPERATING INSTRUCTIONS CONTINUED

## EMERGENCY FREE FALL:

To actuate the **emergency free fall**, push the emergency free fall control to disconnect the cable drum from the gear train of the winch. The load (minimum 1000 lb - 454 kg) will drop. The speed of the free fall will depend on the size of the load on the wire rope.

**DANGER**

**RE-ENGAGING FREE FALL CLUTCH WHILE LOAD IS DROPPING CAUSES SHOCK LOADS AND WILL LEAD TO CABLE FAILURE, PROPERTY DAMAGE, SEVER INJURY OR DEATH. INTERLOCK HYDRAULIC CONTROL TO PREVENT RE-ENGAGING FREE FALL CLUTCH WHILE LOAD IS DROPPING.**

## CONTROLLED FREE FALL:

To operate the **controlled free fall**, open the free fall control lever gradually to obtain smooth acceleration of the lowering speed of the winch. The lowering speed is in direct proportion with the movement of the free fall control lever. To decelerate or slow down the load, slowly return the control lever back to its neutral position. Sudden stops of an accelerating load and erratic operation of the free fall control lever should be avoided. For better modulation of the free fall control, a long handle should be used on the free fall control valve.

**IMPORTANT:** The **controlled free fall** is not designed nor intended to lower the maximum load in a controlled free fall. The permissible load of the PULLMASTER Model M50 **controlled free fall** operation is 30% of the maximum line pull capacity of the winch.

If, after a new installation, the winch does not function properly, refer to the TROUBLESHOOTING section of this manual.

# TROUBLE SHOOTING

## GENERAL:

In most cases, when the hydraulic winch does not perform satisfactorily, the cause of malfunction is found somewhere in the hydraulic circuit. Before the winch is removed from its mounting and disassembled, all of the hydraulic circuit components should be checked for proper function.

**IMPORTANT:**

**The hydraulic oil volume relates to the line speed or rpm of the winch.**

Therefore, if the winch does not produce the specified maximum rated line speed or drum rpm, a loss of hydraulic flow somewhere in the hydraulic circuit system can be analysed. If this condition exists, install a flow meter into the hydraulic circuit to check the volume supplied to the pressure port of the hydraulic winch motor when the winch control is completely opened. The flow meter should indicate the maximum operating volume. If this test indicates a loss of hydraulic flow, check the hydraulic pump, the relief valve and the control valve. If the pump is driven by V-belts, check for belt slippage.

**The hydraulic pressure relates to the line pull or lifting capacity of the winch.**

If the winch will not lift the specified maximum line pull, install a pressure gauge into the pressure line leading to the hoisting port on the hydraulic winch motor. Stall the winch to prevent rotation of the drum and then open the control valve. Check the hydraulic pressure reading of the installed pressure gauge. If the pressure reads below the specified maximum operating pressure, look for trouble in the hydraulic pump, the relief valve and the control valve. If the pump is driven by V-belts, check for belt slippage. When checking oil pressure and volume in the hydraulic circuit, make certain that the hydraulic reservoir is filled to the top level and the hydraulic pump is running at maximum operating rpm.

Only if the hydraulic system has been checked and found to be in order, use the following indications for probable causes of failure in the winch:

| FAILURE | PROBABLE CAUSE |
|---|---|
| **Winch will not produce line pull at maximum pressure as listed in SPECIFICATIONS.** | a) Winch is mounted to an uneven surface. (See INSTALLATION INSTRUCTIONS.)<br>b) Cable sheaves or block purchase operated with the winch are not turning freely.<br>c) Damage or wear in the hydraulic motor.<br>d) Excessive back pressure in the hydraulic system.<br>e) Relief valve may be set too low. (See SPECIFICATIONS for maximum operating pressure.)<br>f) Clutch release valve may be in release position. |
| **Winch will not produce line speed at maximum volume as listed in SPECIFICATIONS.** | a) Winch is mounted to an uneven surface. (See INSTALLATION INSTRUCTIONS.)<br>b) Cable sheaves or block purchase operated with the winch are not turning freely.<br>c) Damage or wear in the hydraulic motor.<br>d) Excessive back pressure in the hydraulic circuit. |
| **Winch will not reverse.** | a) Leakage out of the brake piston prevents the brake from being released against the brake springs. This is caused by damaged O-ring seals on the brake piston.<br>b) The O-ring seals, on the brake release channel between the motor adaptor and the brake housing is damaged. If this failure occurs there will be substantial leakage from between the motor adaptor and brake housing.<br>c) Insufficient hydraulic pressure. (See SPECIFICATIONS for minimum operating pressure.)<br>d) Winch is mounted to an uneven surface. (See INSTALLATION INSTRUCTIONS.)<br>e) Hydraulic pressure is not reaching the brake piston (plugged brake release orifice in the brake housing). |

# TROUBLESHOOTING CONTINUED

| FAILURE | PROBABLE CAUSE |
|---|---|
| **Brake will not hold.** | a) Brake plates or divider plates have been damaged by contamination in the hydraulic fluid, or lack of circulation flow in the brake housing.<br>b) Brake piston is seized in the brake housing because of contamination in the hydraulic fluid.<br>c) Excessive back pressure in the return line causes the brake to be released.<br>d) Control valve has incorrect spool, which traps hydraulic pressure in the brake piston when the control valve handle is returned to neutral position. For proper function of the automatic brake, both pressure ports of the winch must be open to the reservoir in neutral position of the control valve.<br>e) Hydraulic pressure is trapped in the clutch piston, preventing total engagement. This is caused by using an incorrect control valve. The free fall control valve must leave the free fall release port open to reservoir when not activated.<br>f) Wire rope is fastened to the incorrect cable anchor slot.<br>g) Sprag clutch is damaged or surfaces where sprag clutch engages on motor drive shaft or brake hub are worn or indented.<br>h) Winch supplied with external brake release option is not plumbed per TYPICAL HYDRAULIC CIRCUIT. Failure to vent external brake release port to reservoir may trap pressure and cause winch brake to slip. |
| **Brake vibrates when powering down a load.** | a) Pump does not supply sufficient flow. Pump rpm must be maintained at normal operating speed when a load is lowered.<br>b) Brake is running too hot. This is caused by insufficient circulation flow. To check the circulation, observe the flow of oil from the circulation return line of the winch (approx. 5 (US) gpm - 19 l/min when the winch is reversed).<br>c) Control valve for the winch operation has poor 'metering' characteristics.<br>d) Damaged brake plates or divider plates.<br>e) The over-running clutch, which connects the motor shaft with the brake assembly, is damaged.<br>f) Air mixed with hydraulic oil (foamy oil). |
| **Free fall clutch cannot be disengaged.** | a) Insufficient pressure or flow supplied to free fall release port (refer to TYPICAL HYDRAULIC CIRCUIT).<br>b) O-ring seals in clutch piston are damaged.<br>c) Insufficient load on the wire rope. A minimum of 1000 lb (454 kg) on a standard -1 drum is required to drop a load in free fall. |

Refer to the SERVICE INSTRUCTIONS if it becomes necessary to disassemble the Model M50 free fall winch.

# TROUBLESHOOTING CONTINUED

| FAILURE | PROBABLE CAUSE |
|---|---|
| **Free fall cannot be controlled.** | a) Emergency free fall is non-controllable.<br>b) Piping circuit or control valve is incorrect. Check hydraulic circuit.<br>c) Control valve used has poor metering characteristics. The control valve should have a flow capacity of 3 - 6 gpm maximum. If a large volume control valve is used, it may not provide good metering of the hydraulic oil, resulting in poor speed control.<br>d) Hydraulic metering pump, installed in the end housing, is damaged. |
| **Oil leaks.** | a) Oil leaks from the motor flange are caused by a damaged O-ring seal on the motor flange.<br>b) Oil leaks occurring between cable drum flanges and housings are caused by excessive pressure in free fall housing or brake housing. If pressure in free fall end exceeds 10 psi (0.7 bar) check for restrictions in free fall circulation return line. If pressure in brake housing exceeds 30 psi (2 bar) check for damage to oil seal, item 607, and restrictions in brake circulation return line. Both circulation return lines must go directly back to reservoir.<br>c) Oil leaking out of the free fall housing on either side of the spring retainer is caused by a damaged O-ring seal, item 213. |

# SERVICE INSTRUCTIONS

## GENERAL:

Before attempting disassembly of the PULLMASTER Model M50 free fall planetary winch, the following instrctions for disassembly and reassembly should be read and understood:

It is suggested that all expendable parts, such as O-rings and oil seals, are not reused on reassembly. It is therefore important to have a seal kit (Part No. 23191) and, providing the hydraulic motor has to be serviced, a seal kit (Part No. 23117) on hand before the unit is taken apart. Two new roller bearings item 875, may also be required (Part No. 25352).

**NOTE:** Backup washers may be included with seal kit. Install with oil seals as per instructions. If not present in seal kit, the oil seals supplied do not require backup washers.

A clean working area is of prime importance, similar to conditions used for service work on any other hydraulic component.

All parts, as they are removed from the winch assembly, should be inspected for wear and damage. Worn or damaged parts must be replaced. Thoroughly clean parts before reassembly. Do not use solvent to clean the brake friction plates.

During reassembly, lubricate all O-rings and oil seals with grease before installation.

In the following service instructions, reference to parts is made by numbers and shown on the applicable group drawings.

# DISASSEMBLY

For the majority of required service or repair work, disassembly is required only on the brake housing of the PULLMASTER Model M50 free fall planetary winch. There are no special tools needed for the service or repair work and no adjustments or calibrations are necessary. Proceed with the disassembly as follows:

## DISASSEMBLY OF HYDRAULIC MOTOR ASSEMBLY:

If the analysed service or repair work requires access to the interior of the brake housing, the hydraulic motor should not be disassembled. In this case, the hydraulic motor should be removed together with the motor adaptor as a complete assembly. If a problem has been analysed to be in the hydraulic motor, proceed with the disassembly as follows:

1) Remove eight hex capscrews item 951, together with lockwashers item 953, from motor assembly.

**IMPORTANT:** Failure to exercise care when removing the motor port end cover or gear housing could permanently damage the machined surfaces of these motor components. Take care not to damage machined surfaces of motor components at disassembly.

2) Remove (pry loose if necessary) port end cover item 870, together with bearings item 875, and ring seal item 877. Thrust plate item 885, and dowel pins item 865, may stay in gear housing.
3) If thrust plate comes off with end cover, carefully pry it off of the bearings item 875, and discard teflon seals item 887.
4) Remove gear set item 881, which consists of two gears which are a matched set.
5) Carefully pry gear housing item 861, off of motor adaptor item 800. Thrust plate item 885, and dowel pins item 865, may stay in gear housing.
6) If thrust plate stays on the motor adaptor, carefully pry it off of bearings item 875, and discard teflon seals item 887.
7) Discard gasket seals item 869. It is also advisable to replace ring seals item 877, at this time. Bearings item 875, have to be removed to allow access to ring seals.

Teflon seals, gasket seals and ring seals in the hydraulic motor assembly are not part of the winch seal kit. The seal kit for the hydraulic motor can be ordered from the factory under Part No. 23117. All parts of the hydraulic motor, with the exception of the motor adaptor item 800, and the port end cover item 870, are standard parts of the hydraulic motor, having a 3 inch gear section. All of these parts can be ordered from PULLMASTER or Authorized Distributors / Dealers in Canada, the United States and in most overseas areas.

# SERVICE INSTRUCTIONS CONTINUED

## REMOVAL OF HYDRAULIC MOTOR ASSEMBLY:

If disassembly of the hydraulic motor is not necessary, proceed as follows:

1) Remove 12 hex head capscrews item 537, with lockwashers item 541, from motor adaptor item 800. (Since brake springs item 752, apply pressure against the inside of motor adaptor, it is recommended that hex capscrews are unscrewed, one turn at a time, until spring pressure has been released.) Complete motor assembly, including motor adaptor, can now be removed from brake housing assembly.

2) Remove and discard three O-rings item 801, and O-ring item 707. (O-rings item 801, seal pressure transfer hole for automatic brake release and are situated on flange of brake housing.)

## DISASSEMBLY OF BRAKE HOUSING ASSEMBLY:

1) After motor assembly has been removed, all parts of brake assembly are accessible. Remove 14 brake springs item 752. Thoroughly examine springs for damage and measure overall length. Overall spring length should be 2.27 inch. If any spring measures less than 2.21 inch, replace all springs as a set.

2) Pull motor drive shaft item 730, and complete brake hub assembly from brake housing.

3) Disassemble brake hub assembly by removing circlip item 727, from motor drive shaft. Remove motor drive shaft from brake hub item 720. Remove sprag clutch aligners items 722 and 724, and sprag clutch item 723, from brake hub.

**DANGER**

**MINOR SURFACE DEFECTS WHERE THE SPRAG CLUTCH ENGAGES THE MOTOR DRIVE SHAFT AND BRAKE HUB, WILL RESULT IN BRAKE FAILURE AND ALLOW THE LOAD TO DROP, CAUSING PROPERTY DAMAGE, SEVERE INJURY OR DEATH. THOROUGHLY INSPECT THESE AREAS AND, IF NECESSARY, REPLACE MOTOR DRIVE SHAFT, SPRAG CLUTCH AND BRAKE HUB AS A SET.**

4) Thoroughly inspect motor drive shaft item 730, and brake hub item 720, particularly surfaces where sprag clutch item 723, engages. If any indentation or surface damage is detected, replace brake hub, sprag clutch and motor drive shaft as a set.

5) Pull brake piston item 750, out of brake housing using two 5/8-11NC bolts screwed into two puller holes in piston and discard O-rings item 751 and item 753.

6) Thoroughly examine inner bores of brake housing and outer diameters of brake piston for scoring caused by hydraulic fluid contamination. Minor surface damage may be repaired by polishing with a fine emery cloth.

**DANGER**

**DAMAGED FRICTION OR DIVIDER PLATES WILL REDUCE BRAKING CAPACITY AND ALLOW THE LOAD TO DROP, CAUSING PROPERTY DAMAGE, SEVERE INJURY OR DEATH. SOLVENT MAY DAMAGE THE FRICTION PLATES. DO NOT USE SOLVENT TO CLEAN THE FRICTION PLATES. PERFORM THOROUGH INSPECTION AND, IF NECESSARY, REPLACE FRICTION AND DIVIDER PLATES AS A SET.**

7) Remove five friction plates item 715, together with six divider plates item 713, and inspect for damage or wear. Plates should be flat and smooth. Plates should not show heat discoloration. Paper material on friction plates should be intact and grooved. If any damage is detected, replace friction and divider plates as a set.

8) Remove brake spacer item 712.

9) Oil seal item 607, and backup washer item 606, which seals brake housing from cable drum interior, can now be removed and discarded.

All parts have now been removed from the brake housing and there is no need for further disassembly, unless a failure has been analysed in the remaining winch assembly.

## DISASSEMBLY OF FREE FALL ASSEMBLY:

**NOTE:** All instructions which refer to controlled free fall also apply to combined free fall.

If a failure occurs in free fall section of the winch, proceed as follows:

1) Remove drain plug item 503, from end cover item 240, and drain lubricating oil from free fall housing and end cover. The oil will drain quicker if the filler plug item 503, is removed from cable drum item 500.

2) If controlled free fall model, winch includes metering pump at back of free fall end cover item 240. If a failure has occurred in metering pump, pump can be serviced without disassembling remainder of free fall assembly. If not servicing pump, proceed to 3).

## DISASSEMBLY OF METERING PUMP:

The metering pump can be replaced as a sub-assembly or serviced. If replacing as a sub-assembly, proceed to *h)*. If servicing, be sure to have a pump seal kit on hand (Part No. 23031). Proceed as follows:

*a)* Remove metering tube assembly item 216, from port end cover item 180, and free fall end cover item 240.

*b)* Remove four hex capscrews item 197, and lockwashers item 199, from metering pump assembly.

**IMPORTANT:** Failure to exercise care when removing port end cover or gear housing could permanently damage machined surfaces of pump components. Take care not to damage machined surfaces of pump components at disassembly.

*c)* Remove port end cover item 180, from gear housing item 242.

*d)* Remove gear set item 224, and thrust blocks item 235.

*e)* Remove and discard channel seals item 225, and backup seals item 184.

*f)* Carefully pry gear housing item 242, off metering pump adaptor item 246. Dowel pins item 191, may stay in gear housing.

*g)* Discard section seals item 205.

Section seals, channel seals and backup seals in metering pump are not part of winch seal kit. Seal kit for metering pump can be ordered from factory under Part No. 23031.

*h)* To remove metering pump adaptor item 246, along with stopper item 140, unscrew four capscrews item 209, and lockwashers item 211. Remove and discard O-ring item 241.

*i)* Remove metering pump shaft item 190.

3) Remove 18 hex head capscrews item 239, with lockwashers item 237, and separate free fall clutch assembly from free fall housing item 200.

**IMPORTANT:** Internal gear item 330, may come off of planet gears at this time. If this occurs, care must be taken to ensure the part does not slide out of ball bearing item 103, and drop.

4) Remove internal gear item 330.

5) **EMERGENCY FREE FALL:**

5a) Inspect sungear stopper item 344, for excessive wear. Replace if less than 1.54 inch thick.

**CONTROLLED FREE FALL:**

5a) Inspect hub stopper item 126, for excessive wear. Replace if less than 0.50 inch thick.

5b) Remove metering pump connector item 248.

5c) Inspect sungear stopper item 344, for excessive wear. Replace if less than 0.22 inch thick.

6) Pull final planet assembly off of cable drum hub item 500, and inspect for wear or damage. (Free fall end cover capscrews item 239, can be screwed into two tapped pulling holes in planet hub to assist with removal of final planet hub assembly.)

7) Inspect three final planet gears, item 320, for damage or wear. If it is necessary to remove final planet gears,

remove circlip item 311, and press planet pin item 310, out of planet hub item 300. Inspect loose rollers item 323, bearing spacers item 322, and two thrust washers item 321, and replace if necessary.

8) Pull final sungear item 340, out of cable drum item 500.

9) Remove 8 socket head capscrews item 207, along with lockwashers item 217, from spring retainer item 212.

**CAUTION:** Since 99 springs apply pressure behind spring retainer, socket head capscrews should be loosened one turn at a time, until spring pressure has been relieved.

10) Pull spring retainer item 212, out of end cover item 240. Remove and discard two O-rings item 213, from spring retainer.

11) Remove 99 springs item 232, from clutch piston item 230.

12) Pull clutch piston item 230, out of free fall housing item 200. (Use two long 5/8-11NC capscrews screwed into piston to assist removal. Alternatively, compressed air may be carefully applied to free fall release port to assist removal of clutch piston.)

13) Remove and discard O-rings items 231 and 213, from clutch piston.

14) Check clutch piston outside diameters and inside diameters of end cover for surface scratches due to contamination resulting from particles in the hydraulic fluid. If there is any evidence of surface damage, polish with fine emery cloth.

15) Pull clutch connecting shaft item 220, out of end cover, along with bearing item 221.

**DANGER**

**DAMAGED FRICTION OR DIVIDER PLATES WILL REDUCE BRAKING CAPACITY AND ALLOW THE LOAD TO DROP, CAUSING PROPERTY DAMAGE, SEVERE INJURY OR DEATH. SOLVENT MAY DAMAGE THE FRICTION PLATES. DO NOT USE SOLVENT TO CLEAN THE FRICTION PLATES. PERFORM THROUGH INSPECTION AND, IF NECESSARY, REPLACE FRICTION AND DIVIDER PLATES AS A SET.**

16) Remove 10 friction plates item 206, together with 11 divider plates item 204, and inspect for damage or wear. Plates should be flat and smooth. Plates should not show heat discoloration. Paper material on friction plates should be intact and grooved. If any damage is detected, replace friction and divider plates as a set.

17) Remove clutch spacer item 202.

## DISASSEMBLY OF PRIMARY DRIVE AND SECONDARY DRIVE:

For ease of working on the unit, set winch upright on final drive housing.

1) Remove five hex capscrews item 555, with lockwashers item 553, from each side of both tie bars item 556, and remove tie bars from assembly.

2) Remove 12 hex capscrews item 537, along with lockwashers item 541, from secondary housing item 456, by rotating brake housing until access hole is over top of hex capscrews. Brake housing, together with primary and secondary planet hub assemblies, can now be lifted out of cable drum item 500. Discard O-ring item 539.

3) To disassemble secondary drive assembly, remove internal retaining ring item 481. Secondary planet hub assembly can now be pulled out of secondary planet housing item 456.

4) Remove secondary sungear item 490, from between planet gears item 470. Inspect secondary planet hub stopper item 494, for wear. Replace if less than 0.16 inch thick.

5) If secondary planet hub stopper needs to be replaced, or if secondary planet gears item 470, must be removed, remove circlips item 461. Secondary planet pins item 460, can now be pressed out of secondary planet hub item 450. Remove secondary planet gears item 470, along with thrust washers item 471. Inspect needle bearings item 473, and replace if damaged.

6) Primary assembly may now be slid out of internal gear and inspected for wear or damage. If primary planet gears item 420, must be removed, remove circlip item 411, from planet pin item 410, and press planet pin

out of primary planet hub item 400. Remove primary planet gear item 420, together with loose rollers item 423, and thrust washers item 421.

7) Remove primary sungear item 440, from centre of connecting shaft item 600.
8) Remove circlip item 431, from end of connecting shaft and slide internal gear item 430, along with bearing stopper item 532, off of connecting shaft spline.
9) Connecting shaft item 600, may now be pulled out of brake housing, and O-ring item 601, discarded. Inspect needle bearing item 603, and replace if necessary.
10) To separate secondary housing item 456, and brake housing item 700, use a standard bearing puller or insert two heel bars into slot between secondary housing and brake housing and pry brake housing out of spherical roller bearing item 533.
11) Remove internal retaining ring item 534, to remove spherical roller bearing item 533. Remove and discard oil seal item 531.
12) To separate final drive housing item 100, and cable drum item 500, first remove external circlip item 513, off end of cable drum, then insert two heel bars into slot between final drive housing and cable drum and pry out of ball bearing item 103.
13) Remove internal retaining ring item 104, to remove ball bearing item 103. Remove and discard oil seal item 105.

# REASSEMBLY

Thoroughly clean all parts. Use only new, well-greased O-rings and oil seals. Unless otherwise specified, torque fasteners per BOLT TORQUE CHART at back of manual. If the entire winch was disassembled, start by reassembling the free fall end first.

## REASSEMBLY OF FREE FALL ASSEMBLY:

Reassemble free fall end of winch as follows:

1) If free fall housing was removed, press in new oil seal item 105, and bearing item 103, if removed. Re-install retaining ring item 109.
2) Press free fall housing item 200, onto splined end of cable drum, and install circlip item 513.
3) Set end cover item 240, with opening facing up.
4) Install clutch connecting shaft item 220, into end cover.
5) Set clutch spacer item 202, into end cover, and place a divider plate item 204, against it, lining up teeth with those inside of end cover.

**DANGER**

**INCORRECT ASSEMBLY OF THE FRICTION PLATE AND DIVIDER PLATE STACK WILL REDUCE BRAKING CAPACITY AND ALLOW THE LOAD TO DROP, CAUSING PROPERTY DAMAGE, SEVERE INJURY OR DEATH. REASSEMBLE PER INSTRUCTIONS.**

6) Place brake plate item 206, against divider plate, lining up teeth onto teeth of clutch connecting shaft item 220. Alternate remaining divider and brake plates, finishing stack with a divider plate.
7) Install new, well-greased O-rings item 231 and item 213, onto clutch piston item 230.
8) Carefully press clutch piston item 230, into end cover item 240. If a hoist is available, piston can be supported using two 5/8 -11NC eyebolts.
9) Place 99 springs item 232, into holes in clutch piston.
10) Install two new, well-greased O-rings item 213, into grooves on flanges of spring retainer item 212.
11) Fasten spring retainer to end cover using 8 socket head capscrews item 207, along with 8 high collar

lockwashers item 217. Fasten capscrews, one turn at a time, to compress 99 springs.

12) Reassemble final planet hub assembly. Use grease to temporarily hold 30 loose rollers item 323, in bore of planet gear item 320. Position bearing spacers item 322, and thrust washers item 321, on either side of planet gear. Press planet pin item 310, into final planet hub item 300, and retain with circlip item 311.
13) Insert final planet hub assembly into free fall housing item 200. Ensure that final planet hub spline is fully engaged with cable drum item 500.
14) Install final sungear item 340, through centre of three final planet gears and into cable drum item 500.
15) **EMERGENCY FREE FALL:**

    15a) Install internal gear item 330, with sungear stopper item 344, over top of planet gears item 320.

    **CONTROLLED FREE FALL:**

    15a) Insert metering pump connector item 248, with sungear stopper item 344, and planet hub stopper item 126, into final planet hub item 300.

    15b) Install internal gear item 330, over top of planet gears item 320.
16) Install end cover item 240, and spring retainer assembly, into free fall housing and secure with 18 capscrews item 239 and lockwashers item 237.

If controlled free fall model, metering pump is assembled and/or installed after brake housing and tie bars are re-installed.

## REASSEMBLY OF PRIMARY DRIVE AND SECONDARY DRIVE:

Turn winch over, resting on end housing with cable drum opening facing upward. Reassemble primary drive as follows:

1) Press new, well-greased oil seal item 531, into secondary planet housing item 456. Press spherical roller bearing item 533, into secondary housing and secure with retaining ring item 534.
2) Press secondary housing assembly onto brake housing item 700, and install new, well-greased O-ring item 539.
3) Press needle bearing item 603, into connecting shaft item 600.
4) Install new, well greased oil seal item 607, with backup washer item 606 (if included with seal kit), into connecting shaft.
5) Install new, well greased O-ring item 601, onto connecting shaft item 600, and insert connecting shaft into brake housing item 700.
6) Slide internal gear item 430, along with bearing stopper item 532, onto end of connecting shaft and fasten in place with circlip item 431.
7) Reassemble primary planet hub assembly. Use grease to temporarily hold 20 loose rollers item 423, in bore of planet gear item 420. Verify placement of sungear stopper item 444. Position thrust washers item 421, on either side of planet gear and press planet pin item 410, into final planet hub item 400. Retain with circlip item 411.
8) Insert primary sungear item 440, between three planet gears and insert sungear shaft into connecting shaft, engaging planet gears with internal gear. Fasten with retaining ring item 431.
9) Reassemble secondary planet hub assembly. If removed, press needle bearing item 473, into planet gear item 470. Verify placement of planet hub stopper item 494. Position thrust washers item 471, on either side of planet gear and press planet pin item 460, into secondary planet hub item 450. Retain with circlip item 461.
10) Insert secondary sungear item 490, between three planet gears item 470. Slide assembly into secondary planet housing item 456, engaging sungear spline with primary planet hub item 400, and planet gears with secondary planet housing. Insert retaining ring item 481.
11) Lower brake housing assembly onto cable drum, while engaging spline of final sungear item 340, with secondary planet hub item 450. Line up mounting holes of secondary housing item 456, with those in cable drum.
12) Rotate brake housing to line up access holes and fasten secondary housing using 12 capscrews item 537, and lockwashers item 541.

13) Attach tie bars item 556, using 20 capscrews item 555, and lockwashers item 553. Stand winch horizontally on feet.

## REASSEMBLY OF FREE FALL METERING PUMP:

If metering pump was disassembled, the following procedure should be followed for reassembly:

1) Clean all parts thoroughly before reassembly and apply grease to all seals. Use only new seals (seal kit part No. 23031) for metering pump.
2) Install new, well-greased rubber channel seal item 225, into thrust block item 235, so that protrusions in seal match recesses in block. Install new backup seal item 184, over top of channel seal, leaving flat side of backup seal flush with surface of thrust block. Insert thrust block item 235, into gear housing, making sure seals are facing away from gear set.
3) Install new, well-greased section seal item 205, on gear housing item 242. Install gear housing together with seal section, onto metering pump adaptor item 246, lined up on two dowel pins. Tap on tights using soft-headed hammer.
4) Install gear set item 224, in gear housing. (External spline end of gear goes into bore of motor adaptor.)
5) Insert other thrust block, complete with backup and channel seals, making sure seals are facing away from gear set. Install new, well-greased seal section item 205, on gear housing.
6) Install port end cover item 180, onto gear housing and fasten with four hex capscrews item 197, and lockwashers item 199.

## REPLACE METERING PUMP:

Install metering pump onto winch as follows:

1) Insert metering pump shaft item 190, into free fall end cover and engage external spline with that of metering pump connector item 248.
2) Install new, well-greased O-ring item 241, onto metering pump adaptor. Verify stopper item 140, is installed on metering pump adaptor. Insert metering pump into free fall housing opening, engaging spline of metering pump shaft.
3) Fasten with four socket head capscrews item 209, and lockwashers item 211.

## REASSEMBLY OF BRAKE HOUSING ASSEMBLY:

Reassemble brake housing assembly as follows:

1) Install sprag clutch item 723, into bore of brake hub item 720. Position sprag clutch aligners item 722 and item 724, on either side of brake hub. Carefully slide motor drive shaft item 730, into brake hub assembly and secure with circlip item 719. Verify that circlips item 727 and item 731, are installed on motor drive shaft.
2) Carefully slide motor drive shaft item 730, with brake hub assembly, into connecting shaft until it engages spline of primary sungear item 440.

**IMPORTANT:** For proper brake function, verify that the sprag clutch is installed correctly. When viewed from the motor end, the motor drive shaft of a clockwise hoisting winch must turn freely clockwise and lock in the counterclockwise direction.

3) Install brake spacer item 712, into brake housing.

**DANGER**

**INCORRECT ASSEMBLY OF THE FRICTION PLATE AND DIVIDER PLATE STACK WILL REDUCE BRAKING CAPACITY AND ALLOW THE LOAD TO DROP, CAUSING PROPERTY DAMAGE, SEVERE INJURY OR DEATH. REASSEMBLE PER INSTRUCTIONS.**

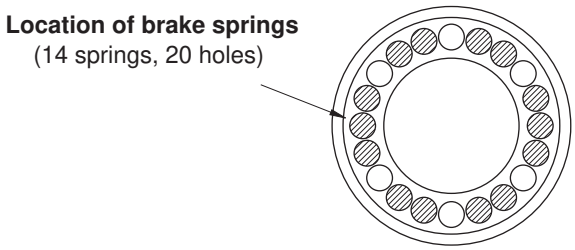
4) Starting and finishing with divider plate, alternately install six divider plates item 713, and five friction plates item 715.
5) Liberally grease O-ring item 751, and O-ring item 753, and install on brake piston item 750.

6) Slide brake piston into brake housing with hoes for brake springs facing out of brake housing assembly.

7) Install 14 brake springs item 752, in brake piston using hole pattern shown.

## HOLE PATTERN FOR BRAKE SPRING INSTALLATION:

**SI1007 - M50**




8) Liberally grease three new O-rings item 801, and install in to recesses on motor adaptor item 800. Install new, well-greased O-ring item 707, on flange of motor adaptor.

9) Slide hydraulic motor assembly on splined end of motor drive shaft item 730, and line up pressure transfer holes of brake housing and motor adaptor. Install 12 capscrews item 537, and lockwashers item 541. Tighten one turn at a time to evenly compress springs.

## REASSEMBLY OF HYDRAULIC MOTOR:

If hydraulic motor was disassembled, the following procedure should be followed for reassembly:

1) Clean all parts thoroughly before reassembly and apply grease liberally to all seals. Use only new seals (seal kit Part No. 23117) for hydraulic motor.

2) Install two new teflon seals item 887, on each thrust plate item 885. Press one of the thrust plates, together with two teflon seals, onto bearings item 875, installed in motor adaptor item 800.

3) Install new, well-greased gasket seal item 869, on each side of gear housing item 861. Slide gear housing together with gasket seals, onto motor adaptor, lined up on two dowel pins. Tap on tight using a soft-headed hammer.

4) Install gear set item 881, in gear housing (the longer gear with the internal spline goes into the top position).

5) Press other thrust plate, complete with two new teflon seals, onto bearings installed in port end cover.

6) Install port end cover item 870, together with two bearings item 875, and new ring seal item 877, onto gear housing, lined up on two dowel pins item 865. Tap on tight using a soft-headed hammer. Install and lightly torque eight hex capscrews item 951, and lockwashers item 953, to approximately 50 ft-lb (70 Nm).

7) Plumb winch assembly to a hydraulic supply and torque motor capscrews according to the following procedure:
   - Ensure that circulation supply flow is being supplied to both the brake housing and the end cover.
   - Run the winch, with no load, in the hoisting direction at reduced speed (approximately 30% of maximum hydraulic volume).
   - With winch running, evenly tighten eight capscrews item 951, to 200 ft-lb (270 Nm).
   - Test motor operation by running winch at full speed in both directions.

To ensure proper reassembly, run the winch in both directions without load.

**DANGER**

**LIFTING A LOAD WITH A NEWLY SERVICED WINCH WILL ENABLE AN INSTALLATION OR SERVICE PROBLEM TO GO UNDETECTED AND ALLOW THE LOAD TO DROP CAUSING PROPERTY DAMAGE, SEVERE INJURY OR DEATH. TO ENSURE PROPER REINSTALLATION, REFER TO PROCEDURES AND TESTS DESCRIBED IN "INSTALLATION" AND "OPERATING INSTRUCTIONS".**

# RECOMMENDED MAINTENANCE

Hydraulic system fluid should be changed at least once every 12 months.

For optimum performance over an extended period of time, the following preventive maintenance service should be done every 12 months or 500 operating hours (whichever comes first):

1) Disconnect all hydraulic hoses and remove the winch from its mounting.

2) Disassemble the winch as per instructions.

3) Discard and replace all O-rings and oil seals.

4) Clean all parts and inspect for wear and damage as per instructions. Replace worn or damaged parts as required.

5) Reassemble the winch as per instructions.

6) Follow INSTALLATION and OPERATING INSTRUCTIONS when returning winch to its mounting.

When ordering parts for the PULLMASTER Model M50 free fall planetary winch, always quote the complete model and serial number of the unit.

**MODEL #** _____

**SERIAL #** _____

PULLMASTER WINCH CORPORATION reserves the right to change specifications and the design of PULLMASTER planetary winches at any time without prior notice and without incurring any obligations.

# PARTS REFERENCE - FREE FALL

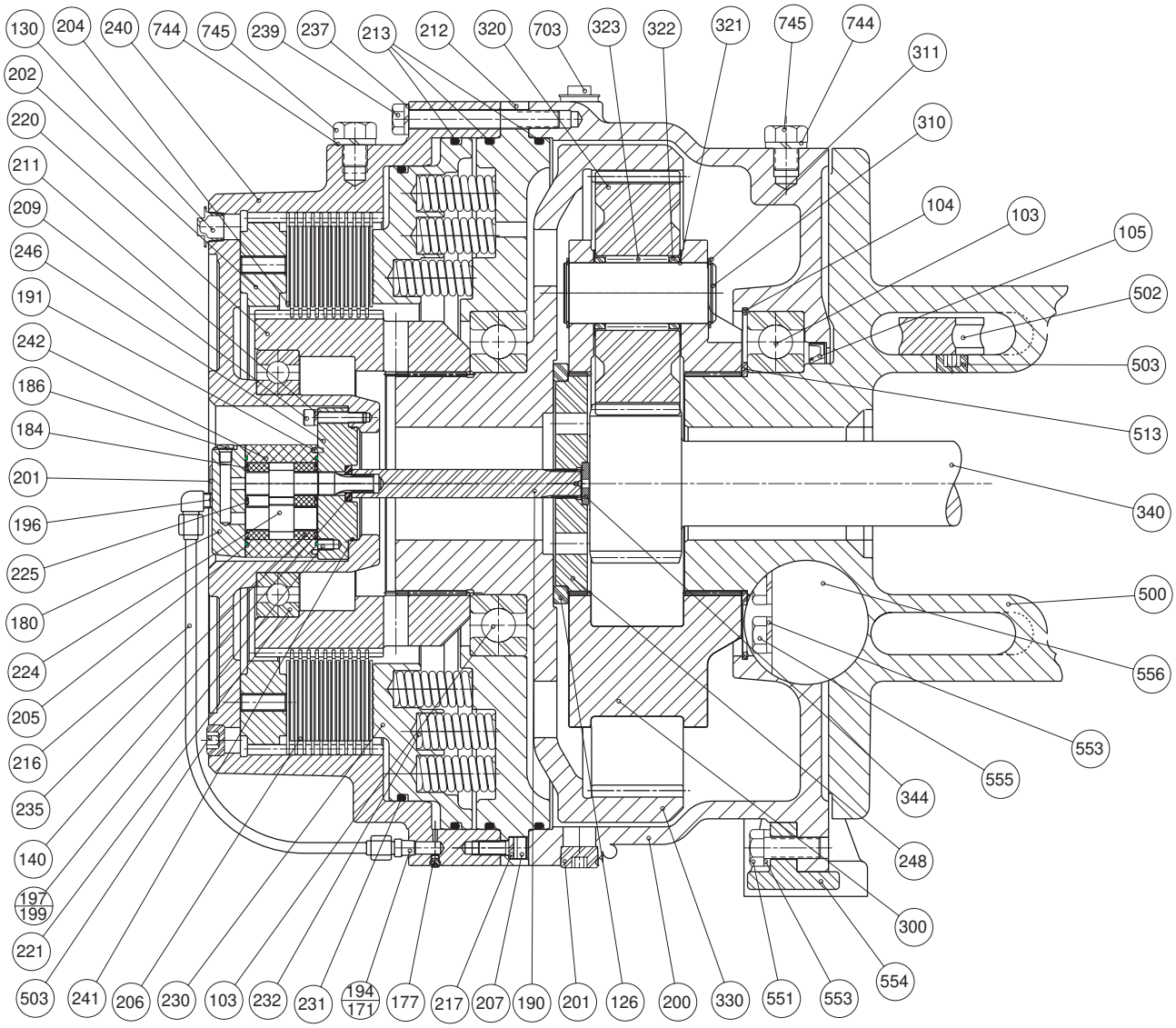
| ITEM NO. | QTY. | PART NO. | DESCRIPTION |
|---|---|---|---|
| 103 | 2 | 25669 | BALL BEARING #6040 |
| 104 | 1 | 21035 | RETAINING RING |
| 105 | 1 | 25670 | OIL SEAL |
| 126 | 1 | *** | PLANET HUB STOPPER |
| 130 | 1 | 25331 | PLASTIC CAPLUG 3/4 NPT |
| 140 | 1 | *** | STOPPER |
| 171 | 1 | 26278 | PLASTIC CAPLUG 1/4 NPT |
| 177 | 4 | 25370 | PIPE PLUG 1/16 NPT |
| 180 ✣ | 1 | 23298 | PORT END COVER |
| 184 ✣ | 2 | 26372 | BACKUP SEAL |
| 186 ✣ | 1 | 26379 | PLUG -ORB #4 |
| 190 | 1 | *** | METERING PUMP SHAFT |
| 191 ✣ | 2 | 26371 | DOWEL PIN |
| 194 | *** | 25031 | PIPE PLUG 1/4 NPT |
| 196 ✣ | 1 | 25031 | PIPE PLUG 1/4 NPT |
| 197 ✣ | 4 | 26399 | CAPSCREW |
| 199 ✣ | 4 | 26369 | WASHER |
| 200 | 1 | * | FREE FALL HOUSING |
| 201 | *** | 25481 | PIPE PLUG 1" NPT |
| 202 | 1 | 23064 | CLUTCH SPACER |
| 204 | 11 | 26382 | DIVIDER PLATE |
| 205 ✣ | 2 | 26373 | SECTION SEAL |
| 206 | 10 | 26381 | FRICTION PLATE |
| 207 | 8 | 26392 | CAPSCREW - SOC HEAD 1/2-13NC X 1.25 GRADE 5 |
| 209 | 4 | *** | CAPSCREW - SOC HEAD 3/8-16NC X 1.75 GRADE 5 |
| 211 | 4 | *** | LOCKWASHER 3/8" HIGH COLLAR |
| 212 | 1 | 23058 | SPRING RETAINER |
| 213 | 3 | 26393 | O-RING -90 DURO -473 23-15/16" ID 1/4" CS |
| 216 | 1 | *** | METERING TUBE ASSEMBLY |
| 217 | 8 | 25161 | LOCKWASHER 1/2" HI COLLAR |
| 220 | 1 | 23305 | CLUTCH CONNECTING SHAFT |
| 221 | 1 | 26481 | BALL BEARING #6032 |
| 224 ✣ | 1 | 26398 | GEAR SET |
| 225 ✣ | 2 | 26375 | CHANNEL SEAL |
| 230 | 1 | 23054 | FREE FALL PISTON |
| 231 | 1 | 26580 | O-RING -90 DURO -470 21" ID 1/4" CS |
| 232 | 99 | 23065 | FREE FALL SPRING |
| 235 ✣ | 2 | 26374 | THRUST BLOCK |
| 237 | 18 | 25359 | LOCKWASHER 5/8" |
| 239 | 18 | 25821 | CAPSCREW - HEX HEAD 5/8 - 11NC X 5.50 GRADE 5 |
| 240 | 1 | *** | FREE FALL END COVER |
| 241 | 1 | *** | O-RING -044 3-3/4" ID 1/16" CS |
| 242 ✣ | 1 | 26397 | GEAR HOUSING |
| 242 ✣ | 2 | 26107 | SAE PLUG |
| 246 ✣ | 1 | 23294 | METERING PUMP ADAPTOR |
| 248 | 1 | *** | PLANET / SUNGEAR STOPPER |
| 300 | 1 | *** | PLANET HUB |
| 310 | 3 | 21027 | PLANET PIN |
| 311 | 6 | 25678 | CIRCLIP ROTOR CLIP SH-215 |
| 320 | 3 | ** | PLANET GEAR |
| 321 | 6 | 25677 | THRUST WASHER INA #AS 5578 |
| 322 | 6 | 21058 | BEARING SPACER |
| 323 | 90 | 25297 | LOOSE ROLLER TORRINGTON #G613 - Q |
| 330 | 1 | 23063 | INTERNAL GEAR |
| 340 | 1 | * | SUNGEAR |
| 344 | 1 | 19036 | SUNGEAR STOPPER |
| 500 | 1 | * | CABLE DRUM |
| 502 | 1 | 21005 | CABLE ANCHOR |
| 503 | 2 | 25237 | PIPE PLUG 3/4 - 14 NPT |
| 513 | 1 | 25679 | CIRCLIP ROTOR CLIP SH-800 |
| 541 | 12 | 25014 | LOCKWASHER 1/2" |
| 551 | 14 | 25564 | CAPSCREW - HEX HEAD 3/4 - 10NC X 2.00 GRADE 5 |
| 553 | * | * | LOCKWASHER 3/4" |
| 554 | * | * | BASE PLATE |
| 555 | * | * | CAPSCREW - HEX HEAD 3/4-10NC GRADE 5 |
| 556 | * | * | TIE BAR |
| 703 | 1 | 25347 | PLASTIC CAPLUG 1" NPT |
| 744 | 2 | 25890 | LOCKWASHER 7/8" |
| 745 | 2 | 22613 | CAPSCREW - HEX HEAD 7/8 - 9NC X 1 GRADE 5 |

* These part numbers and quantities vary according to drum code. Refer to APPENDIX B.
** Refer to APPENDIX C.
*** Refer to APPENDIX D.
✣ These are components of metering pump sub-assembly, item 242. Refer to APPENDIX D.

Refer to PAGE 30 for winch seal kit and PAGE 36 for ASSEMBLY DRAWING.

# FREE FALL GROUP

G1185-B




Group drawings may reference more parts than are actually present in a specific assembly. Parts that are referenced on the drawing but are not on the PARTS REFERENCE list should be ignored.

# PARTS REFERENCE - BRAKE GROUP

| ITEM NO. | QTY. | PART NO. | DESCRIPTION |
|---|---|---|---|
| 343 | 1 | 20172 | RETAINING RING |
| 400 | 1 | ** | PLANET HUB |
| 410 | 3 | 20369 | PLANET PIN |
| 411 | 3 | 25004 | CIRCLIP ROTOR CLIP C-87 |
| 413 | 3 | 25091 | CIRCLIP ROTOR CLIP SH-87 |
| 420 | 3 | ** | PLANET GEAR |
| 421 | 6 | 25068 | THRUST WASHER #TRA 1423 |
| 423 | 60 | 25270 | LOOSE ROLLER 5/32 X 1.25 TOR. #E151 - Q |
| 430 | 1 | ** | ** |
| 431 | 1 | 25338 | CIRCLIP ROTOR CLIP SH-300 |
| 440 | 1 | ** | SUNGEAR |
| 444 | 1 | 20419 | SUNGEAR STOPPER |
| 450 | 1 | ** | PLANET HUB |
| 456 | 1 | ** | SECONDARY HOUSING |
| 460 | 3 | 20162 | PLANET PIN |
| 461 | 3 | 25122 | CIRCLIP ROTOR CLIP C-100 |
| 463 | 3 | 25411 | CIRCLIP ROTOR CLIP SH-100 |
| 470 | 3 | ** | PLANET GEAR |
| 471 | 6 | 25098 | THRUST WASHER TORRINGTON #TRA 1625 |
| 473 | 3 | 25097 | NEEDLE BEARING TORRINGTON #BH 1620 |
| 481 | 1 | 21034 | RETAINING RING |
| 490 | 1 | ** | SUNGEAR |
| 494 | 1 | ** | PLANET HUB STOPPER |
| 531 | 1 | 25672 | OIL SEAL |
| 532 | 1 | 21033 | BEARING STOPPER |
| 533 | 1 | 25671 | BEARING - SPHERICAL ROLLER SKF #23021 CC |
| 534 | 1 | 21070 | RETAINING RING |
| 537 | 12 | 25081 | CAPSCREW - HEX HEAD 1/2 - 13NC X 1.50 GRADE 5 |
| 539 | 1 | 25286 | O-RING -277 11 1/2" ID 1/8" CS |
| 541 | 12 | 25014 | LOCKWASHER 1/2" |
| 600 | 1 | 21032 | CONNECTING SHAFT |
| 601 | 1 | 25341 | O-RING -239 3-5/8" ID 1/8" CS |
| 603 | 1 | 25334 | NEEDLE BEARING TORRINGTON #B2812 |
| 606 | 1 | 21086 | BACKUP WASHER |
| 607 | 1 | 25345 | OIL SEAL |
| 700 | 1 | * | BRAKE HOUSING |
| 703 | 1 | 25347 | PLASTIC CAPLUG 1 NPT THR' D |
| 707 | 1 | 25339 | O-RING -278 12" ID 1/8" CS |
| 712 | 1 | 20451 | BRAKE SPACER |
| 713 | 6 | 25305 | DIVIDER PLATE |
| 715 | 5 | 25304 | FRICTION PLATE |
| 719 | 1 | 25336 | CIRCLIP ROTOR CLIP SH-187 |
| 720 | 1 | 20446 | BRAKE HUB |
| 722 | 1 | 20455 | SPRAG CLUTCH ALIGNER |
| 723 | 1 | 25303 | SPRAG CLUTCH |
| 724 | 1 | 20421 | SPRAG CLUTCH ALIGNER |
| 727 | 1 | 25335 | CIRCLIP ROTOR CLIP SH-196 |
| 744 | 1 | 25890 | LOCKWASHER 7/8" |
| 745 | 1 | 22613 | CAPSCREW - HEX HEAD 7/8 - 9NC X 1.00 GRADE 5 |
| 750 | 1 | 20397 | PISTON |
| 751 | 1 | 25343 | O-RING -90 DURO -451 11" ID 1/4" CS |
| 752 | 14 | 20413 | BRAKE SPRING |
| 753 | 1 | 25342 | O-RING -90 DURO -452 11-1/2" ID 1/4" CS |
| | | 23191 | WINCH SEAL KIT, CONSISTS OF ITEMS: 105, 213, 235, 531, 539, 601,606, 607, 707, 735, 751, 753 AND 801. |

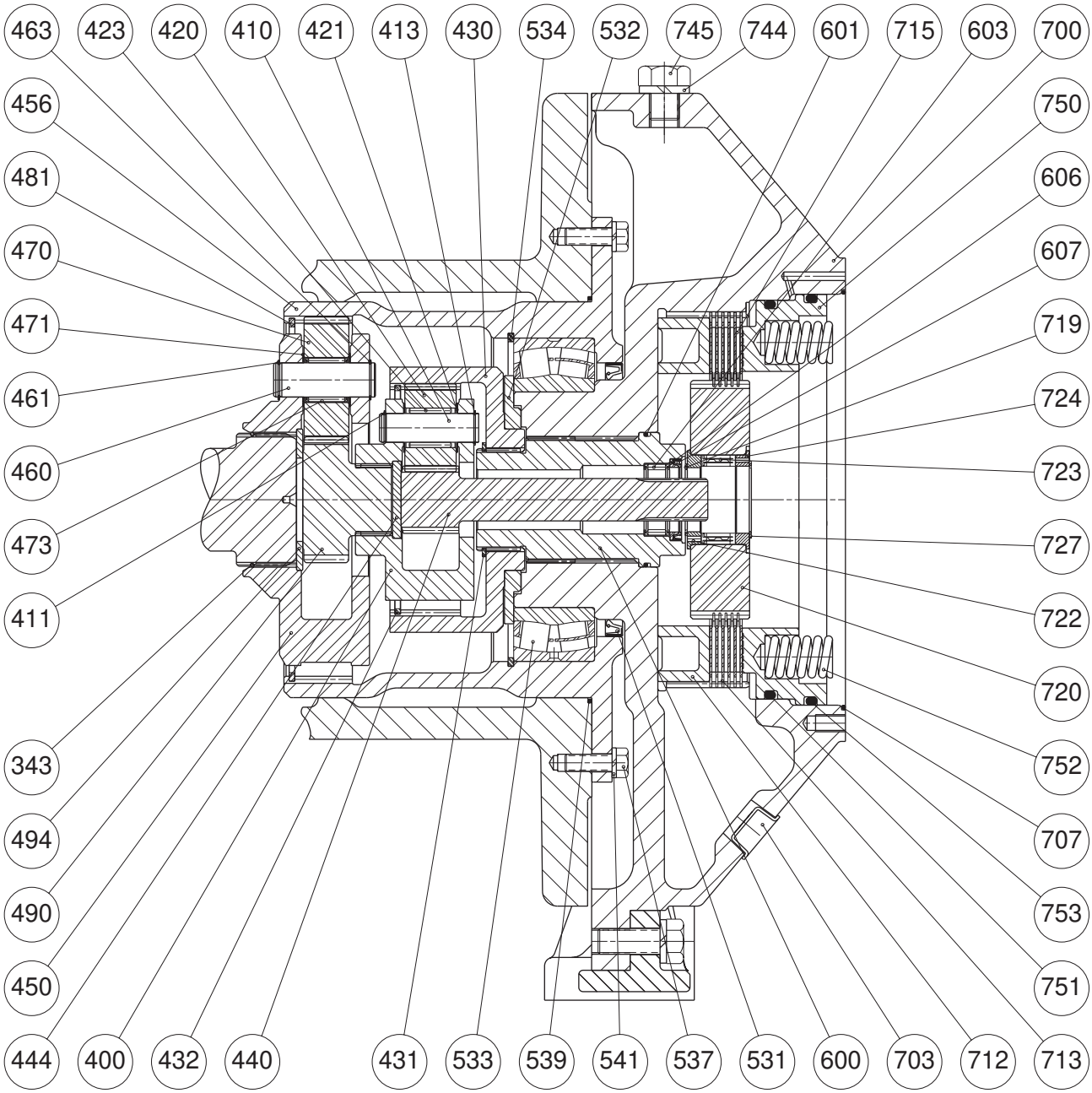
* This part varies according to drum code. Refer to APPENDIX B.

** This part varies according to reduction code. Refer to APPENDIX C.

Refer to PAGE 36 for ASSEMBLY DRAWING.

# BRAKE GROUP

G1065-B




Group drawings may reference more parts than are actually present in a specific assembly. Parts that are referenced on the drawing but are not on the PARTS REFERENCE list should be ignored.

# PARTS REFERENCE - MOTOR GROUP

| ITEM NO. | QTY. | PART NO. | DESCRIPTION |
|---|---|---|---|
| 537 | 12 | 25081 | CAPSCREW - HEX HEAD 1/2-13NC X 1.5 GRADE 5 |
| 541 | 12 | 25014 | LOCKWASHER 1/2" |
| 730 | 1 | 20415 | MOTOR DRIVE SHAFT |
| 731 | 1 | 25288 | CIRCLIP ROTOR CLIP C-112 |
| 800 | 1 | 20401 | MOTOR ADAPTOR |
| 801 | 3 | 25127 | O-RING -013 7/16" ID 1/16" CS |
| 802 | 1 | * | * |
| 805 | 2 | 25040 | PIPE PLUG 1/8 - 27 NPT |
| 806 | 1 | * | * |
| 807 | 1 | * | * |
| 809 | 1 | * | * |
| 813 | 1 | 25031 | PIPE PLUG 1/4 - 18 NPT |
| 861 | 1 | 25350 | GEAR HOUSING |
| 865 | 4 | 25356 | DOWEL PIN |
| 869 | 2 | 25348 | SEAL - GASKET |
| 870 | 1 | 21761 | PORT END COVER |
| 875 | 4 | 25352 | BEARING - ROLLER |
| 877 | 2 | 25646 | RING SEAL |
| 881 | 1 | 25645 | GEAR SET |
| 885 | 2 | 25644 | THRUST PLATE |
| 887 | 4 | 25647 | TEFLON SEAL |
| 899 | 2 | 25031 | PIPE PLUG 1/4 - 18 NPT |
| 929 | 1 | * | * |
| 950** | 1 | * | SUB - ASSY MOTOR -086 |
| 951 | 8 | 25357 | CAPSCREW - HEX HEAD 5/8 X 6.75 GRADE 5 |
| 953 | 8 | 25325 | WASHER |
| 955 | 2 | 25559 | PLASTIC CAPLUG 2.0" |
| | | 23117 | MOTOR SEAL KIT, CONTAINS ITEMS: 869, 877 AND 887. |

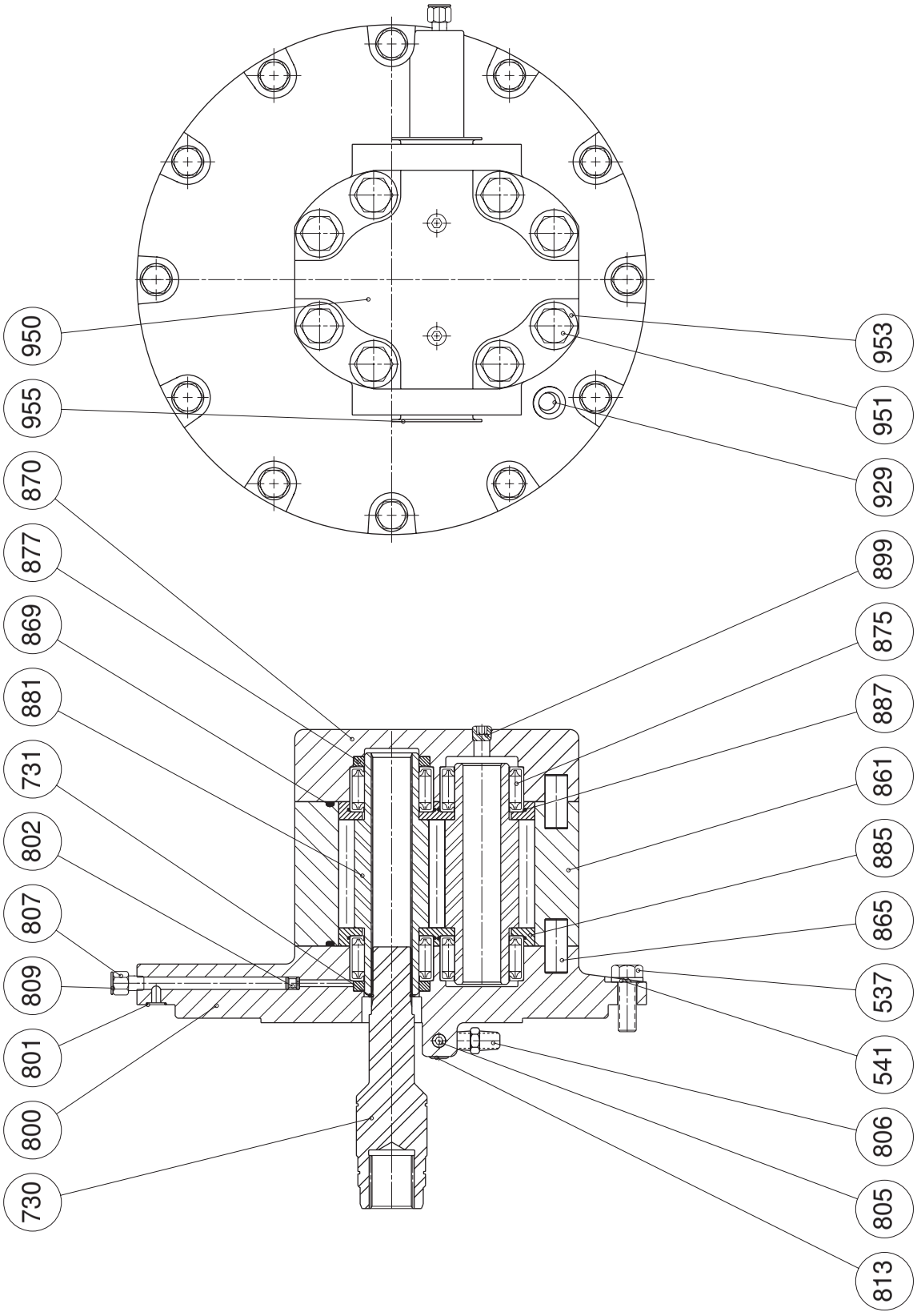
* These part numbers and descriptions vary according to brake code. Refer to APPENDIX E.

** Item 950, MOTOR SUB-ASSY, consists of items: 800, 802, 803, 804, 805, 807, 809, 861, 865, 869, 870, 875, 877, 881, 885, 887, 899, 929, 951, 953 AND 955.

Refer to PAGE 30 for winch seal kit and PAGE 36 for ASSEMBLY DRAWING.

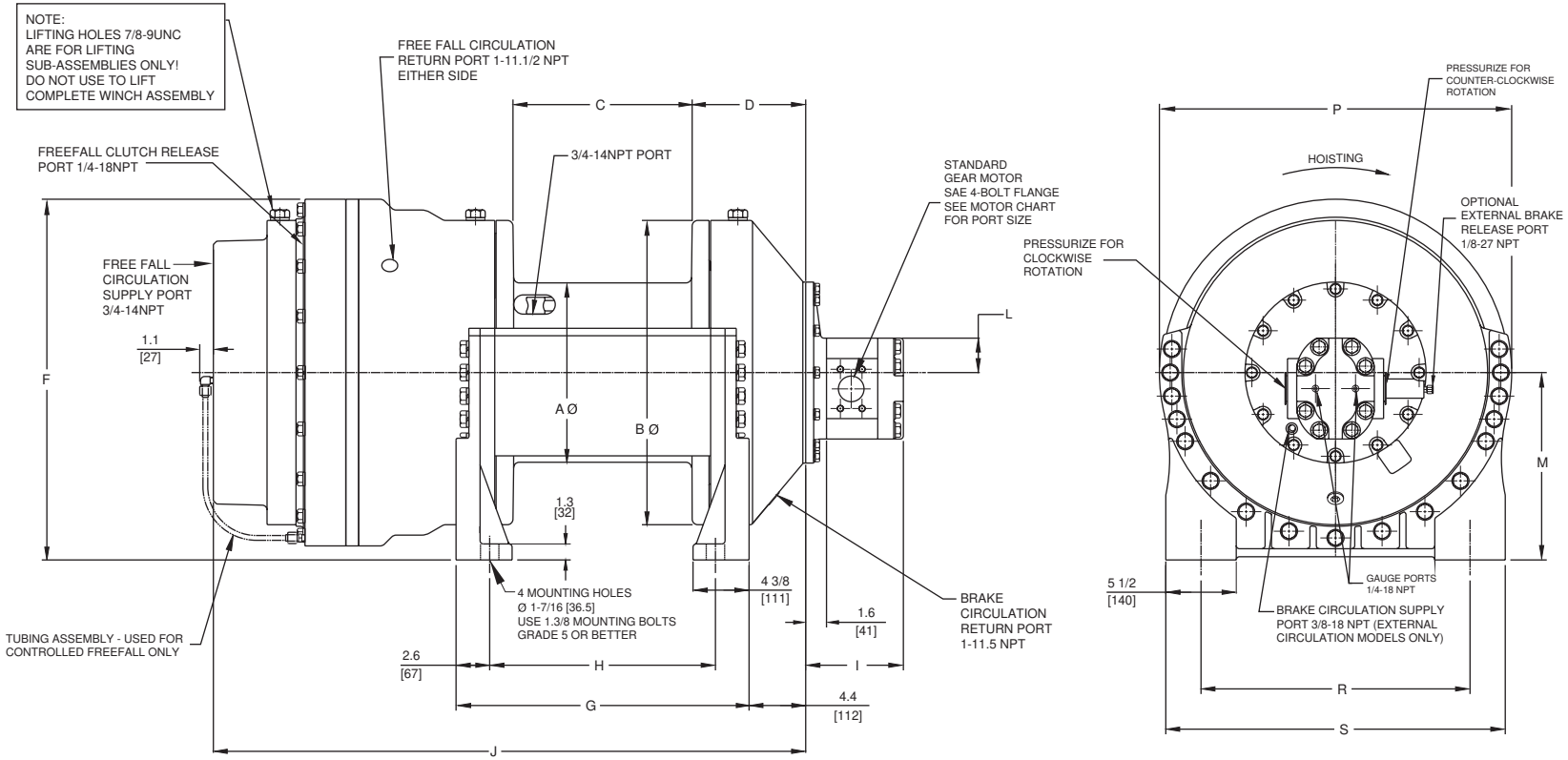
# MOTOR GROUP

G1002-D




Group drawings may reference more parts than are actually present in a specific assembly. Parts that are referenced on the drawing but are not on the PARTS REFERENCE list should be ignored.

**FOR SAFETY:** A minimum of 5 wraps of wire rope must be maintained at all times!




Standard cable anchor is suitable for 3/4" to 1 1/4" diameter wire rope.

# INSTALLATION DIMENSIONS

I1077-2

**Dimensions in inch**
**(Dimensions in millimeters)**

| DRUM CODE | A | B | C | D | F | G | H | J | M | P | R | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - 1 | 14.0 (356) | 23.8 (603) | 14.0 (356) | 8.9 (225) | 26.8 (681) | 28.2 (715) | 17.625 (447.68) | 46.3 (1176) | 14.63 (371.5) | 27.5 (699) | 21.000 (533.40) | 26.5 (673) |
| - 2 | 18.0 (457) | 30.0 (762) | 22.0 (559) | 8.9 (225) | 30.5 (775) | 30.9 (784) | 25.625 (650.88) | 54.3 (1379) | 15.50 (393.7) | 33.1 (841) | 24.000 (609.60) | 30.0 (762) |
| - 13 | 14.0 (356) | 36.0 (914) | 36.0 (914) | 9.5 (241) | 36.5 (927) | 46.0 (1169) | 40.768 (1035.49) | 68.9 (1750) | 18.50 (469.9) | 39.1 (994) | 30.000 (762.00) | 36.0 (914) |

**Dimensions in inches**
**(Dimensions in millimeters)**

HYDRAULIC MOTORS

*COMMERCIAL WM76 SERIES*

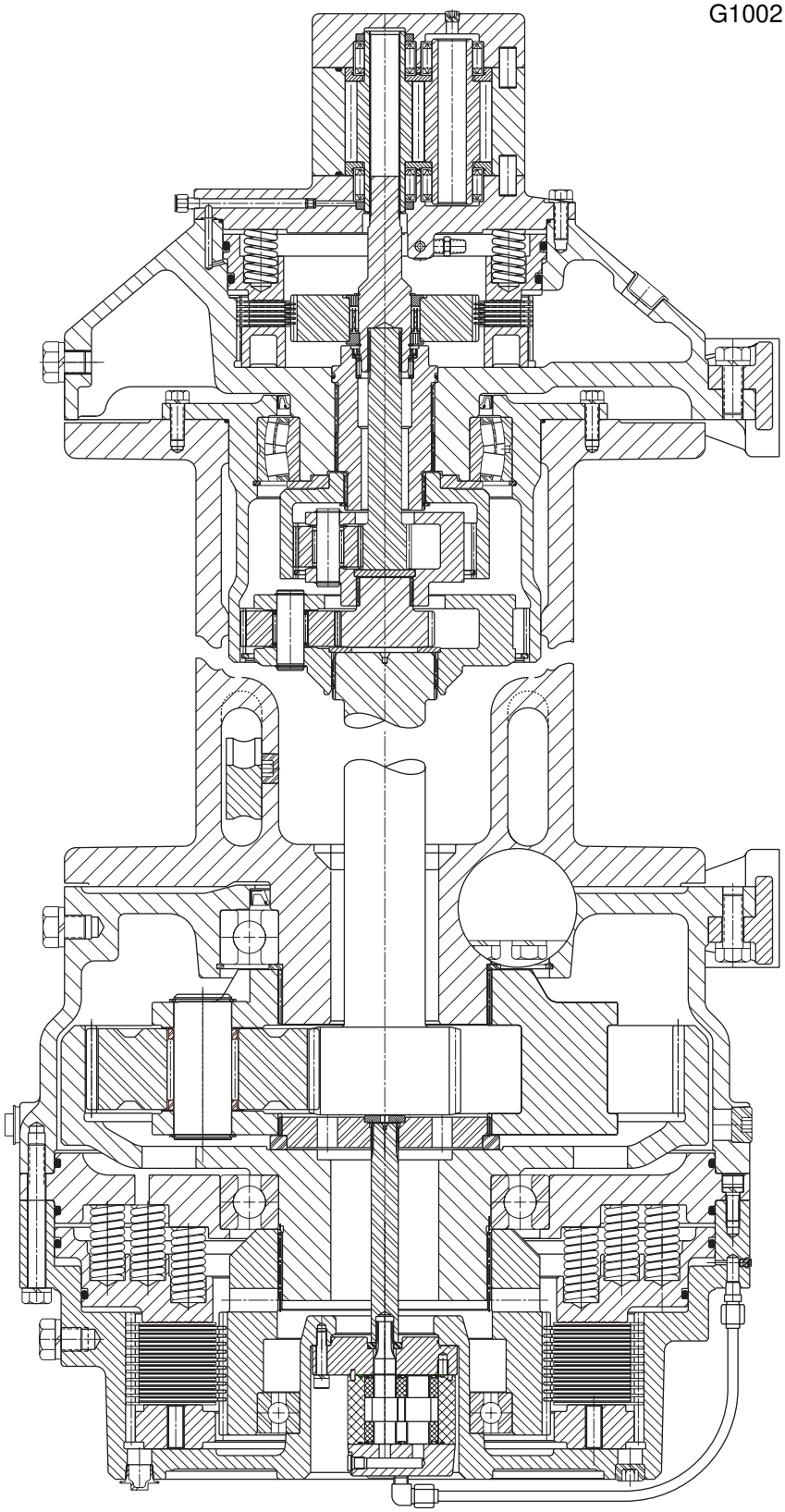
| MOTOR CODE | GEAR WIDTH | MOTOR PORT SIZE SAE 4-BOLT FLANGE | I | L |
|---|---|---|---|---|
| - 86 | 3.00 (76.2) | 2.0 CODE 61 | 7.6 (194) | 2.7 (68) |
| - 87 | 2.75 (69.9) | | 7.4 (187) | 2.7 (68) |
| - 88 | 2.50 (63.5) | 1.5 CODE 61 | 7.1 (181) | 2.7 (68) |
| - 89 | 2.25 (57.2) | | 6.9 (175) | 2.7 (68) |
| - 90 | 2.00 (50.8) | | 6.6 (168) | 2.7 (68) |
| - 91 | 1.75 (44.5) | 1.25 CODE 61 | 6.4 (162) | 2.7 (68) |
| - 92 | 1.50 (38.1) | | 6.1 (156) | 2.7 (68) |
| - 93 | 1.25 (31.8) | | 5.9 (149) | 2.7 (68) |
| - 94 | 1.00 (25.4) | 1.00 CODE 61 | 5.6 (143) | 2.7 (68) |

*COMMERCIAL M365 SERIES*

| MOTOR CODE | GEAR WIDTH | MOTOR PORT SIZE SAE 4-BOLT FLANGE | I | L |
|---|---|---|---|---|
| - 42 | 2.50 (63.5) | 1.5 CODE 61 | 8.0 (203) | 2.5 (64) |
| - 101 | 2.25 (57.2) | | 7.8 (197) | 2.5 (64) |
| - 102 | 2.00 (50.8) | | 7.5 (191) | 2.5 (64) |

# ASSEMBLY DRAWING

G1002 & G1065 & G1185



# APPENDIX A

| DRUM CODE | CABLE DRUM SIZES INCHES (MILLIMETERS) | | | WIRE ROPE STORAGE FEET (METERS) | | | LINE PULL AT MAXIMUM PRESSURE* POUNDS (KILONEWTONS) | | LINE SPEED AT MAXIMUM VOLUME* FEET/MINUTE (METERS/MINUTE) | | MAXIMUM ALLOWABLE LOAD FOR CONTROLLED OR COMBINED FREE FALL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | BARREL | FLANGE | LENGTH | 1 1/4 inch | 1 1/8 inch | 1 inch | BARE DRUM | FULL DRUM | BARE DRUM | FULL DRUM | |
| M50-1 | 14.0 (356) | 23.8 (605) | 14.0 (356) | 177 (54) | 195 (60) | 276 (84) | 50000 (222) | 33889 (150) | 69 (21) | 102 (31) | 30% OF MAXIMUM PERMISSIBLE LINE PULL |
| M50-2 | 18.0 (457) | 30.0 (762) | 22.0 (559) | 440 (134) | 605 (184) | 654 (199) | 39610 (176) | 26522 (118) | 87 (27) | 131 (40) | |
| M50-13 | 14.0 (356) | 36.0 (914) | 36.0 (914) | 1503 (458) | 1858 (566) | 2221 (677) | 50000 (222) | 21942 (98) | 69 (21) | 158 (48) | |
| M50A-1 | 14.0 (356) | 23.8 (605) | 14.0 (356) | 177 (54) | 195 (60) | 276 (84) | 50000 (222) | 31890 (142) | 49 (15) | 71 (22) | |
| M50A-2 | 18.0 (457) | 30.0 (762) | 22.0 (559) | 440 (134) | 605 (184) | 654 (199) | 39610 (176) | 27320 (122) | 62 (19) | 91 (28) | |
| M50A-13 | 14.0 (356) | 36.0 (914) | 36.0 (914) | 1503 (458) | 1858 (566) | 2221 (677) | 50000 (222) | 21951 (98) | 49 (15) | 113 (34) | |
| M50C-1 | 14.0 (356) | 23.8 (605) | 14.0 (356) | 177 (54) | 195 (60) | 276 (84) | 36281 (161) | 24593 (109) | 95 (29) | 141 (43) | |
| M50C-2 | 18.0 (457) | 30.0 (762) | 22.0 (559) | 440 (134) | 605 (184) | 654 (199) | 28742 (128) | 19247 (86) | 120 (37) | 181 (55) | |
| M50C-13 | 14.0 (356) | 36.0 (914) | 36.0 (914) | 1503 (458) | 1858 (566) | 2221 (677) | 36281 (161) | 15929 (71) | 95 (29) | 216 (66) | |

* Performance specifications are based on standard hydraulic motor with 1 1/4 inch diameter rope.

Consult factory for specifications of Model M50D.

# APPENDIX B

| ITEM NO. | PART DESCRIPTION | DRUM CODE - 1 | DRUM CODE - 2 | DRUM CODE - 13 |
|---|---|---|---|---|
| | | PART NUMBER (QUANTITY) | | |
| 200 | FREE FALL HOUSING | 23565 ( 1 ) | 23053 ( 1 ) | 23053 ( 1 ) |
| 340 | FINAL SUNGEAR *Standard Reduction* | 21030 ( 1 ) | 21031 ( 1 ) | 22134 ( 1 ) |
| 340 | FINAL SUNGEAR *"C" Reduction* | 23351 (1) | 22238 (1) | 23352 (1) |
| 500 | CABLE DRUM | 20999 ( 1 ) | 21014 ( 1 ) | 21515 ( 1 ) |
| 553 | LOCKWASHER | 25299 ( 34 ) | 25299 ( 54 ) | 25299 ( 54 ) |
| 554 | BASE PLATE | 21007 ( 2 ) | 21045 ( 2 ) | 21517 ( 2 ) |
| 555 | CAPSCREW | 25682 ( 20 ) | 25564 ( 40 ) | 25564 ( 40 ) |
| 556 | TIE BAR | 21013 ( 2 ) | 21049 ( 2 ) | 21516 ( 2 ) |
| 700 | BRAKE HOUSING | 20997 ( 1 ) | 20998 ( 1 ) | 20998 ( 1 ) |

# APPENDIX C

| ITEM NO. | PART DESCRIPTION | MODEL REDUCTION CODE | | | |
|---|---|---|---|---|---|
| | | M50 | M50A | M50C | M50D |
| | | PART NO. | | | |
| 320 | FINAL PLANET GEAR | 21010 | 21010 | 22239 | 21010 |
| 400 | PRIMARY PLANET HUB | 20404 | 20546 | 20404 | 20404 |
| 420 | PRIMARY PLANET GEAR | 20370 | 20545 | 20370 | 20370 |
| 430 | PRIMARY INTERNAL GEAR | 21061 | 21061 | 21061 | 21061 |
| 440 | PRIMARY SUNGEAR | 21036 | 21380 | 21036 | 21036 |
| 450 | SECONDARY PLANET HUB | 21011 | 21011 | 21011 | 23158 |
| 456 | SECONDARY HOUSING | 21006 | 21006 | 23089 | 23089 |
| 470 | SECONDARY PLANET GEAR | 21009 | 21009 | 21009 | 23160 |
| 490 | SECONDARY SUNGEAR | 21062 | 21062 | 21062 | 23159 |
| 494 | SECONDARY SUNGEAR STOPPER | 21067 | 21067 | 21067 | 21067 |

# APPENDIX D

| ITEM NO. | PART DESCRIPTION | TYPE OF FREE FALL | |
|---|---|---|---|
| | | *CONTROLLED (C)* | *EMERGENCY (D)* |
| | | | |
| 126 | PLANET HUB STOPPER | 23314 | N/A |
| 140 | STOPPER | 23316 | N/A |
| 190 | METERING PUMP SHAFT | 23311 | N/A |
| 194 | PIPE PLUG 1/4 NPT | 25031 x 2 | 25031 x 3 |
| 201 | PIPE PLUG 1 NPT | 25481 x 1 | 25481 x 2 |
| 209 | SOC HEAD CAPSCREW | 26495 | N/A |
| 211 | HIGH COLLAR LOCKWASHER | 25298 | N/A |
| 216 | METERING TUBE ASSEMBLY | 22611 | N/A |
| 240 | FREE FALL END COVER | 23289 | 23055 |
| 241 | O-RING | 26494 | N/A |
| 242 | METERING PUMP SUB-ASSEMBLY | SEE APPENDIX E | N/A |
| 248 | METERING PUMP CONNECTOR | 23309 | N/A |
| 300 | FINAL PLANET HUB<br>*STANDARD REDUCTION* | 23350 | 21026 |
| 300 | FINAL PLANET HUB<br>*'C' REDUCTION* | 23315 | 22237 |

# APPENDIX E

| ITEM NO. | PART DESCRIPTION | BRAKE CODE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | -3 | -4 | -5 | -6 | -7 | -8 | -9 | -10 |
| | | PART NO. | | | | | | | |
| 242 | METERING PUMP SUB-ASSEMBLY | 23357 | 23357 | 23304 | 23304 | 23357 | 23357 | 23304 | 23304 |
| 802 | SHUTTLE | N/A | 20849 | 20849 | N/A | N/A | 20849 | 20849 | N/A |
| 806 | CIRCULATION VALVE | 20456 | 20456 | 20456 | 20456 | N/A | N/A | N/A | N/A |
| 806 | 1/4-18 NPT PIPE PLUG | N/A | N/A | N/A | N/A | 25031 | 25031 | 25031 | 25031 |
| 807 | 1/8-27 NPT PIPE PLUG | 25040 | N/A | N/A | 25040 | 25040 | N/A | N/A | 25040 |
| 807 | 1/8 NPT PIPE ADAPTOR | N/A | 25622 | 25622 | N/A | N/A | 25622 | 25622 | N/A |
| 809 | 1/8 NPT CAPLUG | N/A | 25374 | 25374 | N/A | N/A | 25374 | 25374 | N/A |
| 929 | 3/8 NPT CAPLUG | N/A | N/A | N/A | N/A | 26276 | 26276 | 26276 | 26276 |
| 929 | 3/8-18 NPT PIPE PLUG | 25085 | 25085 | 25085 | 25085 | N/A | N/A | N/A | N/A |
| 950 | MOTOR (-86) | 20504 | 22011 | 22012 | 20804 | 20505 | 21977 | 22013 | 20805 |

# BOLT TORQUE CHART

| BOLT DIAMETER Inches | TORQUE Lb-ft | TORQUE Nm |
|---|---|---|
| 1/4 | 9 | 12 |
| 5/16 | 18 | 24 |
| 3/8 | 32 | 43 |
| 7/16 | 50 | 68 |
| 1/2 | 75 | 102 |
| 9/16 | 110 | 149 |
| 5/8 | 150 | 203 |
| 3/4 | 265 | 359 |
| 7/8 | 420 | 569 |
| 1 | 640 | 868 |
| 1 1/8 | 800 | 1085 |
| 1 1/4 | 1000 | 1356 |
| 1 3/8 | 1200 | 1627 |
| 1 1/2 | 1500 | 2034 |

**NOTE:** Unless otherwise specified, torque bolts per above chart.