

INSTRUCTION AND PARTS MANUAL  
**PL5 FREE FALL**  
PLANETARY HYDRAULIC WINCH

 **PULL**  **MASTER**

A  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 8/1/2008  
SUPERSEDES ALL PRIOR WARRANTIES

Seller warrants that each article (whether Gear Drive Products, Brake Products and/or Winch Products, all of which are covered hereunder) 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. Buyer acknowledges that Buyer is knowledgeable concerning the articles covered by this Warranty and sold in connection therewith which are being purchased, that Buyer has reviewed this Warranty and that the remedies provided hereunder are adequate and acceptable to Buyer.

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 Buyer'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, incorrect installation, overloading, or employment for other than normal and ordinary use and service. This Warranty shall not apply to any article which has been repaired, altered or disassembled, or assembled by personnel other than those of Seller. This Warranty shall not apply to any article upon which repairs or alterations have been made (unless authorized in writing and in advance by Seller). 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.

Buyer expressly agrees that Seller is not responsible to perform any work or investigation related in any way to tensional vibration issues and is not responsible for the detection or remedy of Natural Frequency Vibration of the mechanical system in which the unit is installed. Buyer acknowledges, understands and agrees that this Warranty does not cover failures of the unit which result in any manner from the operation of the machine or unit at vibration frequencies at or near the natural frequency vibration of the machine in such a way that damage may result. Buyer expressly agrees that Seller is not responsible for failure damage or accelerated wear caused by machine or ambient vibration. Further, Buyer acknowledges and agrees that Buyer is always solely responsible for determination and final approval of the "application factor" which may be used in Seller's calculations, and this application factor is 1.0 unless otherwise stated in Seller's quotation specifications.

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. If a party who had purchased articles from Buyer, or from persons in privity with Buyer, brings any action or proceeding against Seller for remedies other than those set forth in this Warranty, Buyer agrees to defend Seller against the claims asserted in such action or proceeding at Buyer's expense, including the payment of attorneys' fees and costs, and indemnify Seller and hold Seller harmless of, from and against all such claims, actions, proceedings or judgments therein. Buyer also agrees to defend and indemnify Seller of, from and against any loss, cost, damage, claim, debt or expenses, including attorneys' fees, resulting from any claims by Buyer or third parties to property or injury to persons resulting from faulty installation, repair or modification of the article and misuse or negligent operation or use of the article, whether or not such damage to property or injury to persons may be caused by defective material, workmanship, or construction. **ADVISORY:** *Winches and hoists are not approved for lifting or handling personnel or persons unless specifically approved in writing from Seller for the specific intended application.*

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. Buyer's purchase of any article(s) covered by this Warranty shall constitute acceptance of the terms and conditions hereof and shall be binding upon Buyer and Buyer's representatives, heirs and assigns. The laws of the Province of British Columbia shall govern Buyer's rights and responsibilities in regard to this Warranty and the transaction(s) subject thereto, and the Province of British Columbia shall be the exclusive forum and jurisdiction for any action or proceedings brought by Buyer in connection herewith or any dispute hereunder. If any of the terms and conditions contained within this Warranty are void, the remaining provisions thereof are and shall remain valid and enforceable.

**Note:** *Prices and specifications contained in this price book 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.

PULLMASTER planetary hydraulic winches are made for hoisting and lowering loads and are 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 WINCH CORPORATION. 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 WINCH CORPORATION.

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 90 dBA 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 PL5 WITH FREE FALL

## GENERAL DESCRIPTION:

The PULLMASTER Model PL5 with free fall is a planetary hydraulic winch having equal speed in both directions and the ability to lower a load FAST. The main components of this unit are:

- + hydraulic gear motor
- + multi disc brake with static and dynamic function
- + over-running clutch
- + primary planet reduction
- + final planet reduction
- + brake housing
- + cable drum
- + free fall end housing
- + free fall clutch assembly

## FUNCTION IN FORWARD ROTATION (HOISTING):

In forward rotation, the output torque and rpm of the hydraulic motor are transmitted to the sun gear of the primary planet reduction. The output of the primary reduction is transferred to the final sun gear, 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 sun gear, without effecting the brake. Pressure required to rotate the drum at full speed without load may vary up to 300 psi (21 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 a load, pressure from 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 release the brake is 300 - 500 psi (21 - 34 bar) depending upon load. 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 paying out speed can be achieved in a stepless operation by modulation of the winch control valve handle. When the control valve handle is returned to neutral position, pressure drops 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 the lowering operation 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 through the hydraulic motor. This circulation flow is internally drained to the return line flow through a check valve arrangement inside the hydraulic motor. The circulation flow is supplied automatically by the hydraulic motor when a load is lowered. If the pressure inside the brake housing is kept at or below 100 psi, generally there is no need for a brake circulation return line. (See TYPICAL HYDRAULIC CIRCUITS.)

**IMPORTANT:** Pressure in the brake housing must never exceed 100 psi (7 bar). Excessive brake housing pressure will cause the safety valve, located on top of the motor, to leak. Brake housing pressure can be gauged at the safety valve port.

# DESCRIPTION OF THE MODEL PL5 WITH FREE FALL



## WARNING

**ALWAYS ENSURE COMPLIANCE WITH ANY NATIONAL OR LOCAL SAFETY CODES AND REGULATIONS REGARDING THE USE OF FREE FALL WINCHES PRIOR TO OPERATION OF THIS UNIT.**

### 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 PULLMASTER Model PL5 planetary winch with free fall. Upon activating the emergency free fall function the load will drop and 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 PULLMASTER Model PL5 planetary winch with free fall is actuated for emergency free fall, hydraulic pressure is supplied to the clutch piston, compressing a series of springs to release the multi-disc clutch. This effectively disconnects the cable drum from the gear train of the winch to drop the suspended load. Minimum load 100 lbs (45 kg) is required to overcome the resistance in free fall mode.

### IMPORTANT:

Pressure in the free fall end housing must never exceed 10 psi (.7 bar). Free fall end housing pressure can be gauged at the circulation inlet port.

# EXPLANATION OF MODEL CODING

**PL 5 X - XX - XX - XX D - XXXX**

**BASIC UNIT SERIES** \_\_\_\_\_

**SIZE OF UNIT** \_\_\_\_\_

**REDUCTION RATIO** \_\_\_\_\_

Only used for non-standard reduction ratios

**TYPE OF BRAKE** \_\_\_\_\_

- 12 Automatic brake, counterclockwise hoisting, intravent
- 13 Automatic brake, external brake release, counterclockwise hoisting, intravent
- 14 Automatic brake, external brake release, clockwise hoisting intravent
- 15 Automatic brake, clockwise hoisting, intravent

**HYDRAULIC MOTOR** \_\_\_\_\_

- 210 Gear motor, 2.0 cubic inch displacement  
(For optional motors refer to APPENDIX A)

**DRUM SIZE** \_\_\_\_\_

- 1 7.38 inch drum diameter x 11.00 inch flange diameter x 6.56 inch length (STANDARD)  
(For optional drum sizes refer to APPENDIX A)

**OPTIONS** \_\_\_\_\_

- D** Emergency free fall

**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

## **CLOCKWISE ROTATION:**

The drum rotation of the standard PULLMASTER Model PL5 planetary winch with free fall is counterclockwise for hoisting, when looking at the hydraulic motor of the winch. Drum rotation for clockwise hoisting direction 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 BRAKE RELEASE OPTION  
MUST BE CONNECTED ACCORDING TO "TYPICAL HYDRAULIC CIRCUITS".**

## **CABLE DRUM SIZES:**

Aside from the standard drum sizes listed in APPENDIX A, the PULLMASTER Model PL5 planetary winch with free fall can be supplied with optional drums to accommodate large wire rope storage capacity.

## **DRUM GROOVING:**

Cable drums for the PULLMASTER Model PL5 planetary winch with free fall 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 standard PULLMASTER Model PL5 planetary winch with free fall may be changed by using a different displacement motor.  
(See APPENDIX A for performance information.)

## **HYDRAULIC MOTORS FOR HIGH PRESSURE HYDRAULIC SYSTEMS:**

The operating pressure of the PULLMASTER Model PL5 planetary winch with free fall and standard gear motor is limited to 2100 psi (145 bar). For hydraulic systems operating with higher 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 7/16 inch diameter wire rope. See APPENDIX A for performance of available options.

## CABLE DRUM DIMENSIONS (STANDARD DRUM):

Barrel Diameter	7.38 in	187 mm
Flange Diameter	11.00 in	279 mm
Barrel Length	6.56 in	167 mm

## CABLE STORAGE CAPACITY:

Size of wire rope	1/4 in	348 ft	106 m
	5/16 in	218 ft	67 m
	3/8 in	157 ft	48 m
	7/16 in	110 ft	34 m
	1/2 in	100 ft	31 m

**MAXIMUM OPERATING PRESSURE:** 2100 psi 145 bar

**MAXIMUM OPERATING VOLUME:** 24 (US) gpm 91 l/min

**MINIMUM OPERATING VOLUME:** 6 (US) gpm 23 l/min

**DRUM TORQUE AT MAXIMUM PRESSURE:** 17,578 lb-in 1986 Nm

**DRUM RPM AT MAXIMUM VOLUME:** 66 rpm

## LINE PULL AT MAXIMUM PRESSURE:

Bare drum	4500 lb	20.0 kN
Full drum	3328 lb	14.8 kN

## LINE SPEED AT MAXIMUM VOLUME:

Bare drum	135 fpm	41 m/min
Full drum	183 fpm	56 m/min

## PERMISSIBLE SYSTEM BACK PRESSURE AT MOTOR RETURN PORT:

65 psi 4.5 bar

## PERMISSIBLE PRESSURE IN BRAKE HOUSING (GAUGED AT SAFETY VALVE PORT):

100 psi 7 bar

## PERMISSIBLE PRESSURE

### AT FREE FALL CIRCULATION SUPPLY PORT:

10 psi 0.7 bar

## LUBRICATING OIL:

Volume required (-1 drum):	0.3 (US) gal	(1.1 litre)
Volume required (-6 drum):	0.5 (US) gal	(1.9 litre)

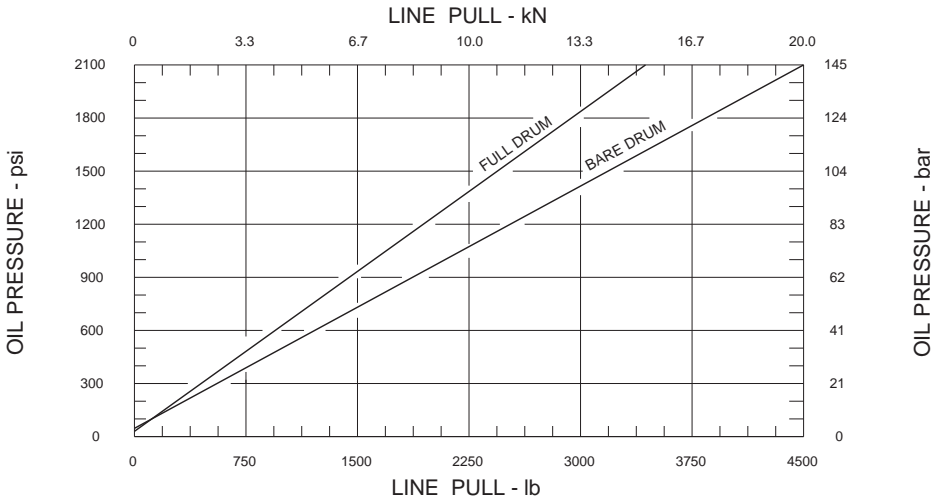
Refer to RECOMMENDATIONS for viscosity and instructions.



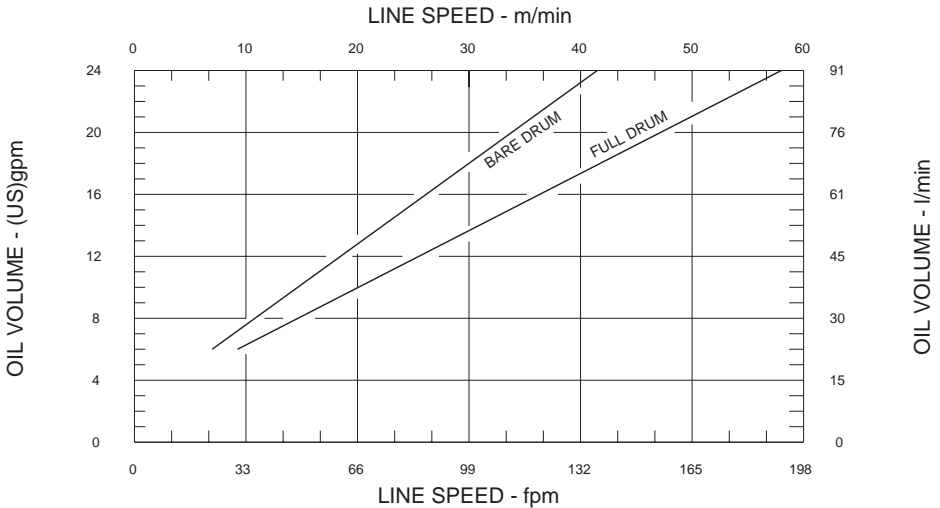
# PERFORMANCE GRAPHS

## LINE PULL VS. OIL PRESSURE:

PG-PL5-C



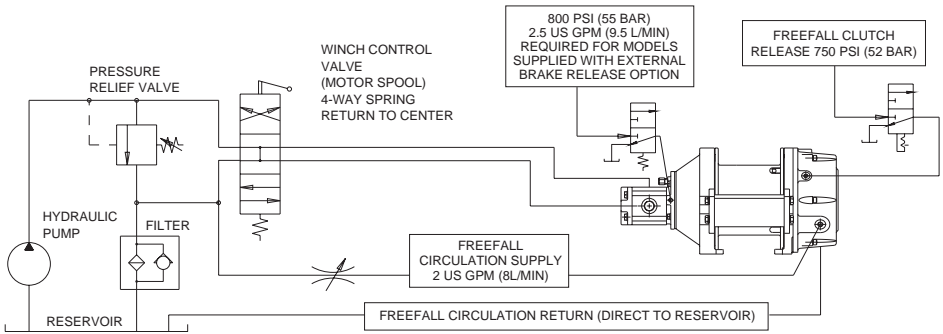
## LINE SPEED VS. OIL VOLUME:



Performance graphs are based on standard hydraulic motor, gear ratio and cable drum with 7/16 inch diameter rope.

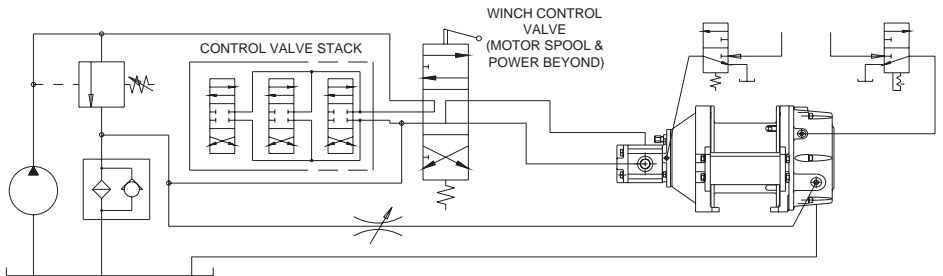
# TYPICAL HYDRAULIC CIRCUITS

HC-PL5-D-S1-A



## 1. TYPICAL HYDRAULIC CIRCUIT - STANDARD CONTROL VALVE

Refer to above hydraulic circuit for installations where the winch is controlled by an individual control valve. Note that the valve must have a **motor spool** (both winch ports open to tank in neutral position). A brake circulation return line is not required.

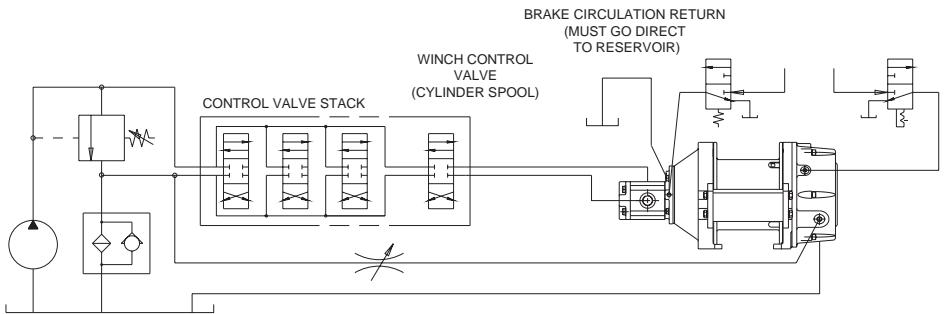


## 2. TYPICAL HYDRAULIC CIRCUIT - POWER BEYOND CONTROL VALVE

Refer to above hydraulic circuit when the winch control valve is used in a circuit containing stacked valves controlling other functions, as occurs on hydraulic cranes and loaders. The winch control valve must have a **motor spool** and **power beyond** feature. The winch valve is shown upstream of the stacked control valves. If the winch control valve is located downstream of the stacked control valves, the valve stack must have the **power beyond** feature. A brake circulation return line is not required.

# TYPICAL HYDRAULIC CIRCUITS

HC-PL5-D-S1-A



### 3. TYPICAL HYDRAULIC CIRCUIT - STACKED CONTROL VALVE

Refer to above hydraulic circuit when the winch control valve is one of several stacked control valves and has a **cylinder spool** (winch ports blocked in neutral position). In this configuration, the safety valve must be replaced with a circulation return line plumbed directly to the reservoir. The brake circulation return line cannot be connected to a common return line.

**IMPORTANT:** For proper function of the winch in any circuit, the return line back pressure measured at the motor return port, the brake housing pressure measured at the safety valve and the free fall end housing pressure measured at the circulation inlet port must not exceed pressures per SPECIFICATIONS.

# 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.

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

## LUBRICATION:

The winch gear train requires oil bath lubrication. The winch is shipped from the factory without lubricating oil.

**IMPORTANT:** ADD LUBRICATING OIL THROUGH THE CABLE DRUM FILL PORT BEFORE RUNNING WINCH.

Refer to INSTALLATION DIMENSIONS for location of lubricating oil fill port. For normal operating temperature use SAE 90 lubricating oil in the cable drum: 0.3 gallon (1.2 liters) for -1 drum and 0.5 gallon (2 liters) for -6 drum. Consult lubricating oil supplier or factory for temperatures beyond normal operating range.

## 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.

## EMERGENCY FREE FALL CONTROL VALVE:

A two-position, three-way, detented valve is required to actuate emergency free fall. Emergency free fall is used to fully release a load up to the maximum capacity of the winch. The valve is not required to meter oil supply. In neutral position, the free fall clutch release port must be vented to reservoir.



**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.**

## HYDRAULIC CONTROL VALVE:

A standard control valve used for operating PULLMASTER planetary winches 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 FILTER:

Consult hydraulic component manufacturer for recommendation. Generally, 5 to 10 micron filters are acceptable. In order to prevent accidental stoppage of the return line flow, the filter should have a by-pass feature.

## HYDRAULIC HOSES:

The following hydraulic hose with suitable fittings is recommended for the PULLMASTER Model PL5 planetary winch with free fall.

Pressure lines:	SAE 100R2-14 or better
Circulation return line:	SAE 100R6-8 or better
Circulation supply line:	SAE 100R6-4 or better
Free fall release line:	SAE 100R2-4 or better

## 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 operators control panel. The E stop has to be designed and placed in line with EN 60204 and EN 418.

# 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 DIMENSIONS.
  - 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 as per BOLT TORQUE CHART at back of manual.
- 4) Fill the drum with lubricating oil. Refer to RECOMMENDATIONS (page 10) for oil volume required. Refer to INSTALLATION DIMENSIONS for location of fill port.
- 5) Use recommended circuit components and hydraulic hoses.
- 6) The circulation return line of the free fall housing should be plumbed in such a manner that the free fall housing remains full of oil at all time. Connect the return line directly to reservoir. Do not connect to a common return line.
- 7) When required, the winch drain line must be connected directly to the reservoir. Do not connect to a common return line.

**IMPORTANT:** Excessive pressure at brake housing will damage the winch motor or oil seals. Never plug safety valve port.

- 8) Before operating the winch with a load, verify that approximately 1.5 (US) gpm (6 l/min) hydraulic fluid is circulating through the brake assembly by removing the safety valve and checking flow when the winch is run in the lowering direction. Verify that hydraulic fluid is circulating through the free fall clutch assembly by checking the flow at the circulation return line.
- 9) 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.

# 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.

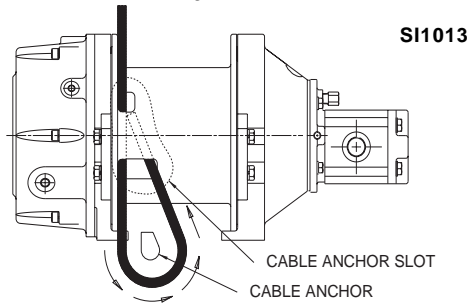
**IMPORTANT:** Refer to manufacturer's handling, inspection and maintenance recommendations to avoid potential accidents. For selection of ropes, etc. please check following product standards: DIN 15020, prEN818-1/9, prEN 1492-1/2, prEN 1677-1/3 and other relevant product standards.

- 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 counterclockwise 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

Counterclockwise hoisting winch shown. (Use cable anchor slot on opposite side of drum for clockwise 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 and long side nearest the drum flange. Pull rope tight to wedge rope in slot.



- 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 minimum of 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 systems. 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 shaft.

# OPERATING INSTRUCTIONS

- 7) Shift the emergency free fall control valve to pressurize the free fall clutch release port, effectively disconnecting the cable drum from the gear train and dropping the load. Free fall speed depends on size of the load. The minimum load that will overcome the resistance in free fall mode is approximately 100 lb (45 kg).



**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.**

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 for 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 can be analysed. If this condition exists, install a flow meter into the hydraulic circuit to check the volume of oil 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 pulling capacity of the winch.**

If the winch will not produce the specified maximum line pull, install a pressure gauge in 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 hydraulic pump is driven by V-belts, check for belt slippage. When checking oil pressure and volume in the hydraulic circuit, make sure that the hydraulic reservoir is filled to the top level and the hydraulic pump is running at maximum operating rpm.

Only after 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
<b>Winch will not produce line pull at maximum pressure as listed in SPECIFICATIONS.</b>	<ul style="list-style-type: none"> <li>a) Winch is mounted to an uneven surface. (See INSTALLATION INSTRUCTIONS.)</li> <li>b) Cable sheaves or block purchase operated with the winch are not turning freely.</li> <li>c) Damage or wear in the hydraulic motor.</li> <li>d) The relief valve pressure may be set too low. (See SPECIFICATIONS for maximum operating pressure.)</li> <li>e) Excessive back pressure in the hydraulic system.</li> </ul>
<b>Winch will not produce line speed at maximum volume as listed in SPECIFICATIONS.</b>	<ul style="list-style-type: none"> <li>a) Winch is mounted to an uneven surface. (See INSTALLATION INSTRUCTIONS.)</li> <li>b) Cable sheaves or block purchase operated with the winch are not turning freely.</li> <li>c) Damage or wear in the hydraulic motor.</li> <li>d) Excessive back pressure in the hydraulic system.</li> </ul>
<b>Winch will not reverse.</b>	<ul style="list-style-type: none"> <li>a) Leakage out of the brake piston prevents the disc brake from being released against the brake springs. This is caused by damage to the O-rings on the brake piston or connecting tube.</li> <li>b) Insufficient hydraulic pressure. (See SPECIFICATIONS for minimum operating pressure.)</li> <li>c) Winch is mounted to an uneven surface. (See INSTALLATION INSTRUCTIONS.)</li> <li>d) Hydraulic pressure is not reaching the brake piston due to plugged brake release passage.</li> </ul>



# TROUBLE SHOOTING CONTINUED

FAILURE	PROBABLE CAUSE
<b>Brake will not hold.</b>	<ul style="list-style-type: none"> <li>a) Brake plates or divider plates have been damaged by contamination in the hydraulic fluid or lack of circulation flow in the brake housing.</li> <li>b) Brake piston or clutch piston seize because of contamination in the hydraulic fluid.</li> <li>c) Excessive back pressure in the return line of the hydraulic system causes the brake to release.</li> <li>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.</li> <li>e) Wire rope is fastened to the incorrect cable anchor slot.</li> <li>f) Over-running clutch is damaged or surface where over-running clutch engages on motor drive shaft is worn or indented.</li> <li>g) Failure to vent free fall clutch or optional external brake release may cause winch load to slip.</li> </ul>
<b>Brake vibrates when lowering a load.</b>	<ul style="list-style-type: none"> <li>a) Pump does not supply sufficient flow. Pump rpm must be maintained at normal operating speed when a load is lowered.</li> <li>b) Brake is running too hot. This is caused by a complete lack of, or insufficient, circulation flow.</li> <li>c) Control valve for the winch operation has poor metering characteristics.</li> <li>d) Damaged brake plates or divider plates.</li> <li>e) Over-running clutch is damaged or surface where over-running clutch engages on motor drive shaft is worn or indented.</li> <li>f) Air has mixed with hydraulic oil resulting in foamy oil.</li> </ul>
<b>Free fall clutch cannot be disengaged.</b>	<ul style="list-style-type: none"> <li>a) Insufficient pressure or flow supplied to free fall port. Check TYPICAL HYDRAULIC CIRCUITS for pressure and volume requirements.</li> <li>b) O-ring seals in clutch piston are damaged.</li> <li>c) Insufficient load on the wire rope. A minimum of 100 lb (45 kg) is required to drop a load in free fall.</li> </ul>
<b>Oil leaks.</b>	<ul style="list-style-type: none"> <li>a) Oil leaks from the motor adaptor are caused by a damaged O-ring seal on the motor adaptor.</li> <li>b) Oil leaks occurring between the cable drum flange and free fall housing is caused by excessive pressure in the free fall housing or brake housing. Oil leak occurring between the cable drum flange and brake housing is caused by excessive pressure in the brake housing.</li> </ul>

Refer to the SERVICE INSTRUCTIONS if it becomes necessary to disassemble the Model PL5 winch with free fall.

# SERVICE INSTRUCTIONS

## GENERAL:

Before disassembling the PULLMASTER Model PL5 planetary winch with free fall, read and understand the following instructions.

Replace expendable parts such as O-rings and oil seals when reassembling the winch. Have a winch seal kit (Part No. 23418) on hand before the unit is disassembled. If motor is to be serviced, have on a hand motor seal kit (Part No. 24227).

**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.

Disconnect all hydraulic hoses, remove the winch from its mounting and relocate to a clean working area, similar to one used for service work on any other hydraulic component. Special tools are not required to service the winch. Adjustments and calibrations are not required.

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.

The following SERVICE INSTRUCTIONS refer to part descriptions and item numbers which appear in the group drawings.

## DISASSEMBLY

### REMOVAL OF FREE FALL ASSEMBLY:

If the brake, primary or final drives require service, or if a general inspection overhaul is required, proceed to REMOVAL OF HYDRAULIC MOTOR ASSEMBLY. If specific service is required to correct a malfunction at the free fall end, remove the free fall assembly as follows:

- 1) Remove pipe plug, item 101, from free fall end housing, item 240, to drain lubricating oil from free fall end housing.
- 2) With winch sitting flat on its mounting pads, remove four capscrews, item 555, and lockwashers, item 553, which connect free fall housing, item 200, to tie bars, item 556.
- 3) Support cable drum, item 500, and withdraw free fall end housing, item 240, until spline of connecting shaft, item 220, is clear of cable drum.
- 4) Remove pipe plug, item 101, from free fall end housing, item 240, to drain oil from free fall assembly interior.
- 5) Stand free fall assembly on its end, with connecting shaft, item 220, vertical.
- 6) Proceed to DISASSEMBLY OF FREE FALL ASSEMBLY.

### REMOVAL OF HYDRAULIC MOTOR ASSEMBLY:

- 1) Before removing hydraulic motor, refer to page 22 drawing # SI1043 and tick mark the position of the hydraulic motor to facilitate reassembly.
- 2) Remove four capscrews, item 931, and lockwashers, item 933, from the motor adaptor, item 900. Brake springs, item 752, apply pressure against inside of motor adaptor, therefore it is recommended that capscrews are unscrewed, one turn at a time, until spring pressure has been released. The complete motor assembly, including motor adaptor, can now be removed from brake housing assembly.
- 3) Remove and discard two O-rings, item 801 and item 707. (O-ring, item 801, seals pressure transfer hole for automatic brake release and is situated on flange of brake housing.)

### DISASSEMBLY OF HYDRAULIC MOTOR ASSEMBLY:

If service or repair work requires access to interior of brake housing, hydraulic motor should not be disassembled. If problem has been analysed to be in hydraulic motor, proceed with disassembly as follows:

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

# SERVICE INSTRUCTIONS CONTINUED

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

- 2) Remove port end cover, item 871, from gear housing, item 860.
- 3) Remove gear set, item 881 and item 882 and thrust blocks, item 885.
- 4) Remove and discard channel seals, item 887 and item 888 and backup seals, item 897.
- 5) Carefully pry gear housing, item 860, off of motor adaptor, item 900. Dowel pins, item 865, may stay in gear housing.
- 6) Discard section seals, item 869.

Section seals, channel seals and backup seals in hydraulic motor assembly are not part of winch seal kit. Seal kit for hydraulic motor can be ordered from factory under Part No. 24227.

## DISASSEMBLY OF BRAKE HOUSING ASSEMBLY:

Disassemble brake housing assembly as follows:

- 1) Remove ten brake springs, item 752. Examine springs for damage and measure overall length. Overall spring length should be 1.25 inch. Springs measuring less than 1.19 inch should be replaced.
- 2) Pull brake piston, item 750, out of brake housing, item 700.
- 3) Remove and discard O-rings, item 751 and 753.
- 4) Thoroughly inspect brake piston outer diameters and brake housing inner bores for scoring caused by hydraulic fluid contamination. Minor surface damage may be repaired by polishing with a fine emery cloth.
- 5) Remove circlip, item 727, from primary sungear, item 440. Remove brake hub, item 720, sprag clutch, item 723, and sprag clutch aligners, item 722, from primary sungear.



**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.**

- 6) Remove five friction plates, item 716, and 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 (winches may contain optional metallic friction plates).
- 7) Remove brake spacer, item 712.

## DISASSEMBLY OF PRIMARY DRIVE:

If the primary drive requires service or repair, disassemble as follows:

- 1) Remove pipe plug, item 503, from cable drum, item 500, to drain lubricating oil from the winch interior.
- 2) Remove four remaining capscrews, item 555, and lockwashers, item 553. Remove two tie bars, item 556. Stand winch upright.
- 3) Remove six capscrews, item 537, and lockwashers, item 541, through access opening in brake housing. Lift brake housing with bearing flange out of cable drum, item 500 (bearing flange may stay in the cable drum). Remove and discard O-ring, item 539.
- 4) Remove circlip, item 719, from primary sungear, item 440.
- 5) Remove primary sungear, item 440, from brake housing, item 700.

# SERVICE INSTRUCTIONS CONTINUED



## DANGER

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

- 6) Thoroughly inspect primary sungear, item 440, and brake hub, item 720, particularly surfaces where sprag clutch, item 723, engages.
- 7) If any indentation or surface damage is detected, replace brake hub, sprag clutch and primary sungear as a set.
- 8) Remove two thrust washers, item 737, and thrust bearing, item 739. Inspect parts and replace if damaged.
- 9) Remove and discard oil seal, item 711, and backup washer, item 710.
- 10) Remove primary planet hub assembly with final sungear, item 340, from cable drum.
- 11) Inspect planet hub stopper, item 402, for damage or wear and replace if less than .09 inch thick.
- 12) Inspect three primary planet gears, item 420, for damage or wear. If it is necessary to remove planet gears, remove circlip, item 411, and press planet pin, item 410, out of planet hub, item 400. Inspect needle bearing, item 423, and two thrust washers, item 421, and replace if damaged or worn.
- 13) Remove final sungear, item 340, with circlip, item 341, and sungear stopper, item 344. Inspect stopper for damage or wear. If stopper is worn more than .03 inch below face of sungear, stopper should be replaced.
- 14) Inspect planet hub stopper, item 704, for damage or wear and replace if less than .09 inch thick.
- 15) Pull bearing flange, item 530, and ball bearing, item 533, off of brake housing.
- 16) Remove circlip, item 535. Push ball bearing, item 533, out of bearing flange. Inspect and replace if damaged.
- 17) Remove and discard oil seal, item 531.

### DISASSEMBLY OF FINAL DRIVE:

If final drive requires service or repair, disassemble as follows:

- 1) Remove final planet hub assembly from cable drum.
- 2) Inspect three final planet gears, item 320, for damage or wear. If it is necessary to remove planet gears, remove circlip, item 311, and press planet pin, item 310, out of final planet hub, item 300. Inspect 20 loose rollers, item 323, and two thrust washers, item 321, and replace if damaged.

### Winches with optional -6 drum only:

- 2a) Remove coupling, item 520, from connecting shaft spline, item 220.
- 3) Remove cable drum, item 500, from connecting shaft, item 220.
- 4) Remove circlip, item 513. Push ball bearing, item 507, out of cable drum. Inspect and replace if damaged.
- 5) Remove and discard oil seal, item 505.
- 6) Inspect cable drum gear teeth for damage or wear.

### DISASSEMBLY OF FREE FALL ASSEMBLY:

If service or repair is required on free fall assembly, disassemble as follows:

- 1) Allow free fall springs, item 232, to expand safely by unscrewing capscrews, item 209, one turn at a time.
- 2) Remove free fall housing, item 200, together with connecting shaft, item 220.
- 3) Remove circlip, item 228, and pull connecting shaft, item 220, out of free fall housing bearing, item 507.
- 4) Remove and discard O-ring, item 213.
- 5) Remove circlip, item 513. Push ball bearing, item 507, out of free fall housing. Inspect and replace if damaged.

# SERVICE INSTRUCTIONS CONTINUED

- 6) Remove and discard oil seal, item 505.
- 7) Remove 22 free fall springs, item 232. Examine springs for damage and measure overall length. Overall spring length should be 1.79 inch. Springs measuring less than 1.73 inch should be replaced.
- 8) Pull free fall clutch piston, item 230, from free fall end housing, item 240, using two 3/8 NC threaded puller holes.
- 9) Remove and discard O-ring, item 231 and 233.
- 10) Thoroughly inspect free fall clutch piston outer diameters and free fall end housing inner bores for scoring caused by hydraulic fluid contamination. Minor surface damage may be repaired by polishing with a fine emery cloth.
- 11) Pull clutch hub, item 226, out of free fall end housing.



**DANGER**

**DAMAGED FRICTION OR DIVIDER PLATES WILL REDUCE CLUTCHING 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.**

- 12) Remove nine divider plates, item 204, and eight friction plates, item 206, 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.
- 13) Remove clutch spacer, item 202.
- 14) Pull ball bearing, item 215, out of free fall end housing. Inspect and replace if damaged.

## REASSEMBLY

Thoroughly clean all parts. Use only new, well-greased O-rings and oil seals. Unless otherwise specified, torque fasteners per BOLT TORQUE CHART.

### REASSEMBLY OF FREE FALL ASSEMBLY:

Reassemble free fall assembly by reversing the disassembly procedure.

- 1) Press ball bearing, item 215, into free fall end housing, item 240.
- 2) Install clutch hub, item 226, into free fall end housing.



**DANGER**

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

- 3) Install clutch spacer, item 202, into free fall end housing. Starting and finishing with a divider plate, alternately install nine divider plates, item 204, and eight friction plates, item 206.
- 4) Install new, well greased O-rings, items 231 and 233, into clutch piston glands, item 230. Carefully install clutch piston into free fall end housing.
- 5) Install 22 free fall springs, item 232.
- 6) Press new, well-greased oil seal, item 505, into free fall housing, item 200.
- 7) Press ball bearing, item 507, into free fall housing and secure with circlip, item 513.
- 8) Push connecting shaft, item 220, through free fall housing bearing. Install circlip, item 228.

# SERVICE INSTRUCTIONS CONTINUED

- 9) Install new, well-greased O-ring, item 213, into free fall housing groove.
- 10) Position free fall housing, item 200, over free fall end housing, item 240. Tighten six capscrews, item 209, with lockwashers, item 211, one turn at a time to evenly compress springs.
- 11) If a specific malfunction at the free fall end has been serviced and the rest of the winch is intact, proceed to REPLACEMENT OF FREE FALL ASSEMBLY. If the winch has been disassembled, proceed to REASSEMBLY OF FINAL DRIVE.

## REASSEMBLY OF FINAL DRIVE:

Reassemble final drive by reversing the disassembly procedure.

- 1) Press new, well-greased oil seal, item 505, into cable drum, item 500.
- 2) Press ball bearing, item 507, into cable drum and secure with circlip, item 513.
- 3) Install cable drum, item 500, onto connecting shaft, item 220.

## Winches with optional -6 drum only:

- 3a) Replace coupling, item 520, on connecting shaft spline.
- 4) Reassemble final planet hub assembly. Use grease to temporarily hold 20 loose rollers, item 323, in bore of planet gear, item 320. Position thrust washers, item 321, on either side of planet gear and press planet pin, item 310, into final planet hub, item 300. Retain with circlip, item 311.
- 5) Insert final planet hub assembly into cable drum. Ensure that planet hub spline is fully engaged.

## REASSEMBLY OF PRIMARY DRIVE:

Reassemble primary drive by reversing the disassembly procedure.

- 1) Press new, well-greased oil seal, item 531, into bearing flange, item 530. Press ball bearing, item 533, into bearing flange and secure with circlip, item 535. Press bearing flange assembly onto brake housing hub.
- 2) Verify planet hub stopper, item 704, is installed on brake housing hub.
- 3) Verify sungear stopper, item 344, and circlip, item 341, are installed on final sungear, item 340.
- 4) Install final sungear into primary planet hub, item 400.
- 5) Reassemble primary planet hub assembly. Press needle bearing, item 423, into planet gear, item 420. Position thrust washer, item 421, on either side of planet gear and press planet pin, item 410, into primary planet hub, item 400. Retain with circlip, item 411.
- 6) Verify planet hub stopper, item 402, is installed on planet hub.
- 7) Insert primary planet hub assembly into cable drum. Ensure that final sungear, item 340, is fully engaged with final planet gears, item 320.
- 8) Press new, well-greased oil seal, item 711, and backup washer, item 710, into brake housing bore, item 700.
- 9) Install thrust bearing, item 739, (with thrust washer, item 737, on either side) against oil seal, item 711.
- 10) Insert primary sungear, item 440, through brake housing bore, item 700, and fasten with circlip, item 719.
- 11) Install new, well-greased O-ring, item 539, onto bearing flange, item 530. Insert bearing flange into cable drum opening and fasten with six capscrews, item 537, and lockwashers, item 541. Slide brake housing, item 700, into bearing flange, turning primary sungear, item 440, to engage primary planet gears, item 420.
- 12) Use eight capscrews, item 555, and lockwashers, item 553, to secure tie bars, item 556.
- 13) Install pipe plug, item 503, into cable drum.

## REASSEMBLY OF BRAKE HOUSING ASSEMBLY:

Reassemble brake housing assembly by reversing the disassembly procedure.

- 1) Install sprag clutch, item 723, into bore of brake hub, item 720, and position sprag clutch aligners, item 722, on either side of brake hub. Carefully slide brake hub assembly onto primary sungear, item 440. Secure with circlip, item 727.

# SERVICE INSTRUCTIONS CONTINUED

**IMPORTANT:** For proper brake function, verify that brake hub rotation is correct. When viewed from the motor end, the primary sun gear of a counterclockwise hoisting winch must turn freely clockwise and lock in the counterclockwise direction.



## 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.**

- 2) Install brake spacer, item 712, into brake housing, item 700.

**NOTE: For PL5 free fall with -213 motor: Refer to 3a)**

- 3) Starting and finishing with a divider plate, alternately install six divider plates, item 713, and five friction plates, item 716.
- 3a) Starting with two divider plates, item 713, two friction plates, item 716, repeat two divider plates, two friction plates, one divider plate, one friction plate ending with one divider plate, item 713.
- 4) Install new, well-greased O-rings, items 751 and 753, into piston, item 750. Carefully install brake piston in brake housing, item 700.
- 5) Install ten brake springs, item 752.

### REASSEMBLY OF HYDRAULIC MOTOR:

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

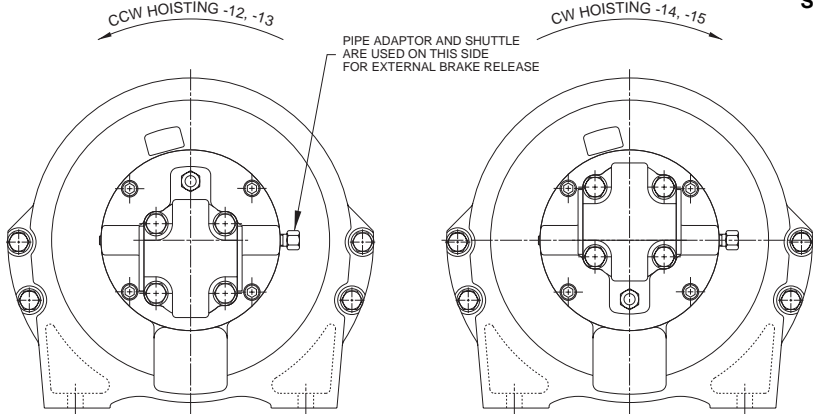
- 1) Clean all parts thoroughly before reassembly and apply grease liberally to all seals. Use only new seals (seal kit Part No. 24227) for hydraulic motor.
- 2) Install new, well-greased rubber channel seal, item 887 and item 888 into thrust block, item 885, so that protrusions in seal match recesses in block. Install new backup seal, item 897, over top of channel seal, leaving flat side of backup seal flush with surface of thrust block. Insert thrust block, item 885, into the gear housing, making sure seals are facing away from gear set.
- 3) Install well-greased section seal, item 869, on gear housing, item 860. Install gear housing together with seal section, onto motor adaptor, item 900, lined up on two dowel pins. Tap on tight using a soft headed hammer.
- 4) Install gear set, item 881 and item 882 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 a well-greased seal section, item 869, on gear housing.
- 6) Install port end cover, item 870, onto gear housing and lightly torque four hex capscrews, item 951, and lockwashers, item 953, to approximately 10 ft-lb (14 Nm).

### REPLACE HYDRAULIC MOTOR ASSEMBLY:

- 1) Install new O-ring, item 707, onto motor adaptor pilot. Use grease to temporarily hold two O-rings, item 801, into recesses on flange of motor adaptor, item 900.
- 2) Position motor assembly with brake release pressure transfer holes of motor adaptor and brake housing aligned, as per drawing # S11043 on page 22. Tighten four capscrews, item 931, and lockwashers, item 933, one turn at a time to evenly compress springs.

# SERVICE INSTRUCTIONS CONTINUED

S11043



## REPLACEMENT OF FREE FALL ASSEMBLY:

- 1) Carefully rest free fall assembly on its side.
- 2) Install pipe plug, item 101, into free fall end housing, item 240.
- 3) Support cable drum, item 500, and insert free fall assembly until spline of connecting shaft, item 220, engages final planet hub, item 300.
- 4) Use four capscrews, item 555, and lockwashers, item 553, to secure free fall housing, item 200, to tie bars, item 556.
- 5) Install pipe plug, item 503, into cable drum, item 500.

**IMPORTANT:** Before operating the winch, add lubricating oil through cable drum oil fill port. Refer to INSTALLATION INSTRUCTIONS for location of fill port. Required volume of oil is 0.3 (US) gallon (1.1 litre) for -1 drum, 0.5 (US) gallon (1.9 litre) for -6 drum.

Plumb winch assembly to a hydraulic supply and torque motor capscrews according to following procedure:

- Ensure that circulation supply flow is being supplied to the free fall and brake housing.
- Run the winch, with no load, in the hoisting direction at reduced speed (approximately 30% of permissible hydraulic volume).
- With winch running, evenly tighten four capscrews, item 951, to 45 ft-lb (61 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

Winch gear train lubricating oil should be changed after the initial six months or 50 hours of operation, whichever comes first. Lubricating oil should then be changed every 12 months or 500 operating hours, whichever comes first.

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 PL5 planetary winch with free fall, always quote the complete model and serial number of the unit.

**MODEL #** \_\_\_\_\_

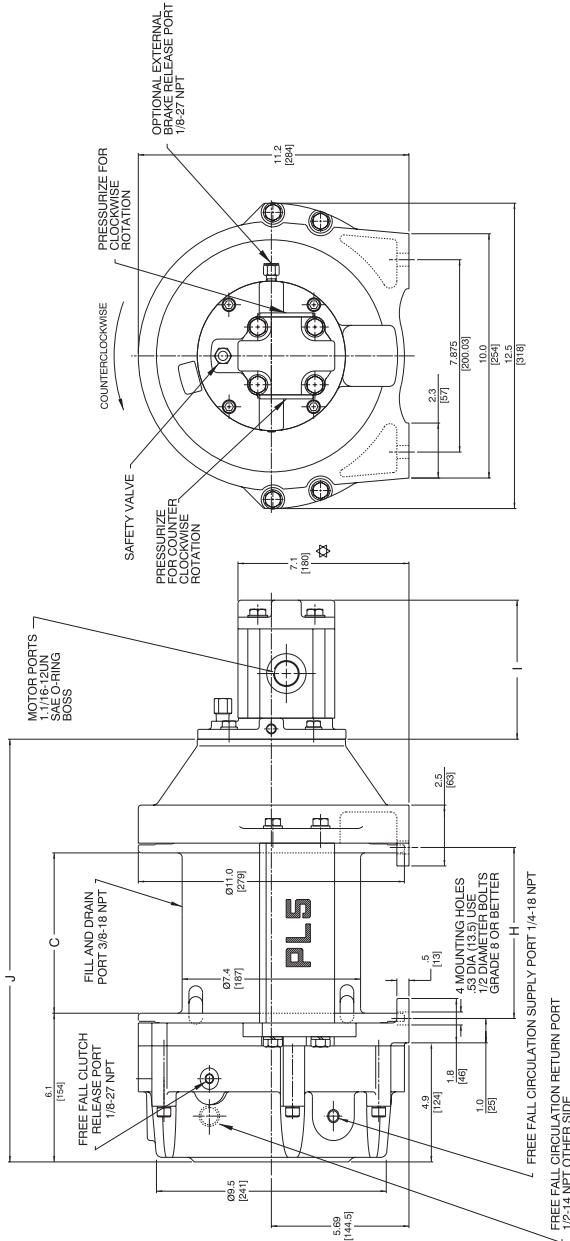
**SERIAL #** \_\_\_\_\_

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.

# INSTALLATION DIMENSIONS

11124

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



✧ This is for models with counterclockwise hoisting. For models with clockwise hoisting, add 1.2 inch (30 mm).

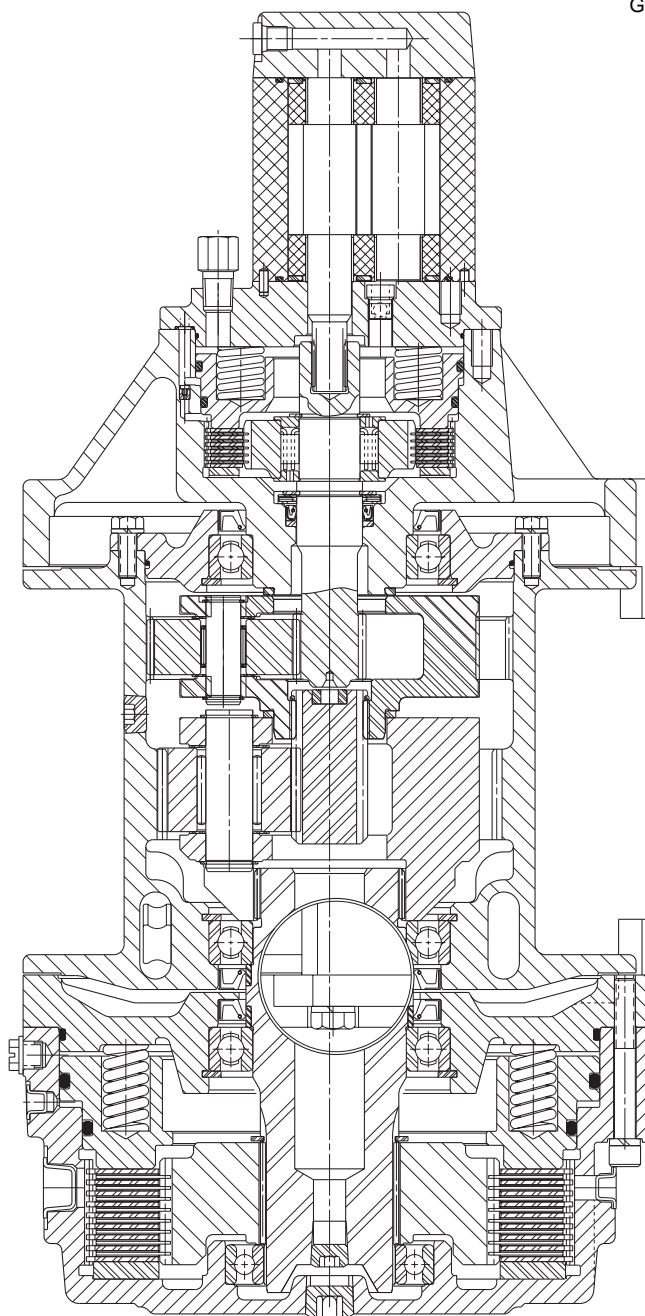
MOTOR CODE	DISPLACEMENT CC / REV	l (in)	l (mm)
-210	33	5.7	145
-211	27	5.3	135
-212	23	5.1	129
-213	14	4.6	116

DRUM CODE	C	H	J	UNITS
-1	6.6 167	7.000 177.80	17.3 439	in mm
-6	10.0 254	10.435 265.04	20.7 526	in mm

# ASSEMBLY DRAWING

G1283 & G1197

**NOTE:** For brake stack-up with -213 motor refer to BRAKE GROUP on PAGE 28.



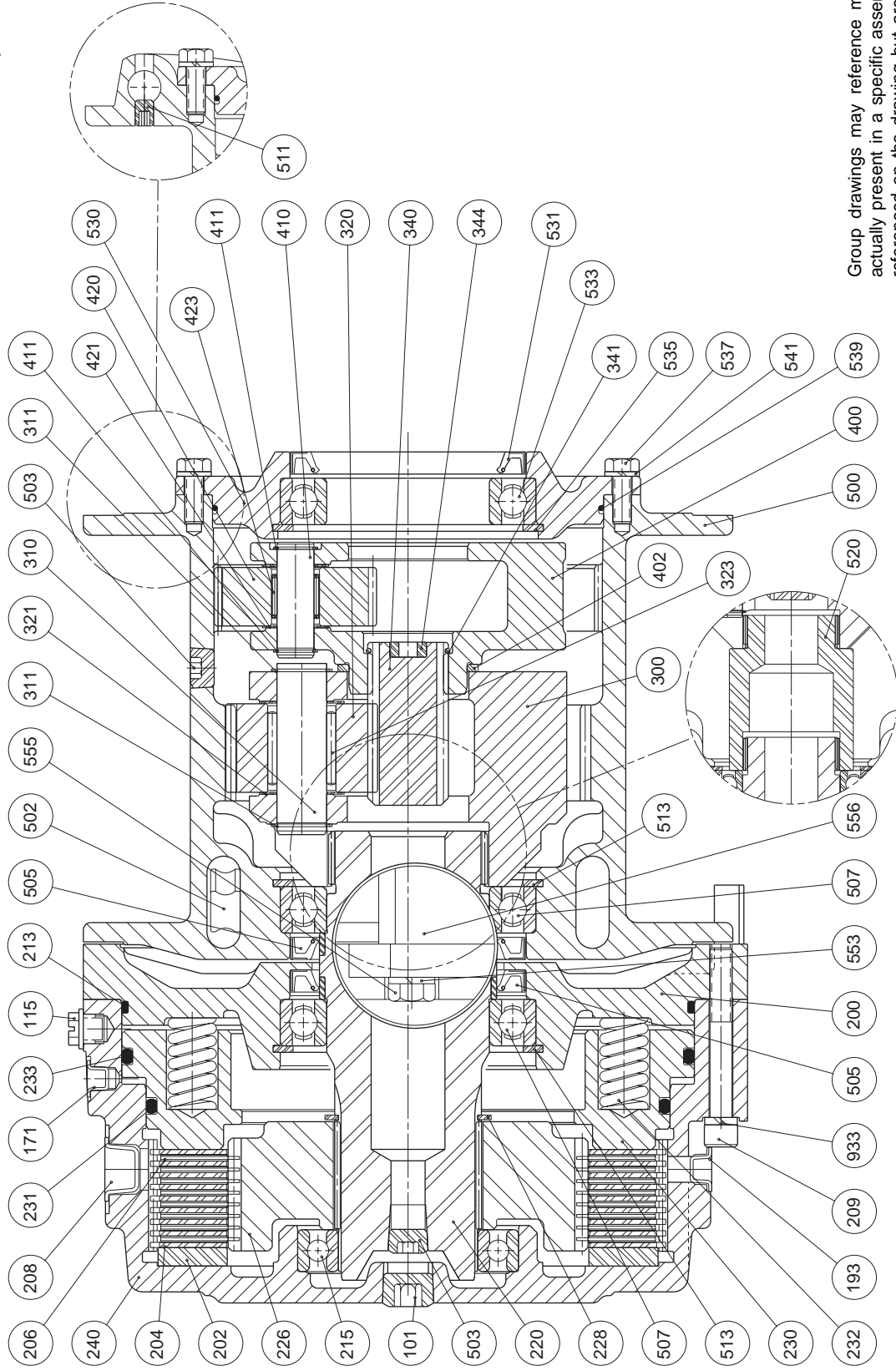
# PARTS REFERENCE - DRUM GROUP

ITEM NO.	QTY.	PART NO.	DESCRIPTION
101	1	25032	PIPE PLUG 1/2" - 14 NPT
115	1	26042	PLASTIC CAPPLUG 1/2"-13NC THR'D
171	1	25374	PLASTIC CAPPLUG 1/8" NPT
193	1	25395	PLASTIC CAPPLUG 1/4" NPT
200	1	23403	FREE FALL HOUSING
202	1	22283	CLUTCHSPACER
204	9	25953	DIVIDER PLATE
206	8	26230	FRICTION PLATE
208	1	25388	PLASTIC CAPPLUG 1/2" NPT
209	6	25949	CAPSCREW - SOCKET HEAD 3/8" - 16NC X 3.5" GRADE 8
213	1	25033	O-RING -271 9-1/4"ID 1/8"CS
215	1	26039	BALL BEARING
220	1	23226	CONNECTING SHAFT
226	1	23339	CLUTCH HUB
228	1	25555	CIRCLIP ROTOR CLIP SH-250
230	1	23402	CLUTCH PISTON
231	1	26518	O-RING -90DURO -371 8-1/2"ID 3/16"CS
232	22	22751	BRAKE SPRING
233	1	26519	O-RING -90DURO -374 9-1/4"ID 3/16"CS
240	1	23401	FREE FALL END HOUSING
300	1	20367	FINAL PLANET HUB
310	3	20369	FINAL PLANET PIN
311	6	25091	CIRCLIP ROTOR CLIP SH-87
320	3	20370	FINAL PLANET GEAR
321	6	25068	THRUST WASHER TORRINGTON# TRA 1423
323	60	25270	LOOSE ROLLER 5/32" X 1.25" TOR. # E151-Q
340	1	20366	FINAL SUNGEAR
341	1	25273	CIRCLIP ANDERTON# A1000-137
344	1	20082	SUNGEAR STOPPER
400	1	*	PRIMARY PLANET HUB
402	1	20372	PLANET HUB STOPPER
410	3	*	PRIMARY PLANET PIN
411	6	25119	CIRCLIP ROTOR CLIP SH-62
420	3	*	PRIMARY PLANET GEAR
421	6	25064	THRUST WASHER TORRINGTON# TRA 1018
423	3	25063	NEEDLE BEARING TORRINGTON# B1012
500	1	*	CABLE DRUM
502	1	20085	CABLE ANCHOR
503	2	25085	PIPE PLUG 3/8" - 18 NPT
505	2	25008	OIL SEAL
507	2	25007	BALL BEARING # 6014
511	1	*	SET SCREW 5/16" - 18NC X 7/16"
513	2	25006	CIRCLIP ROTOR CLIP HO-433
520	1	*	COUPLING
530	1	20363	BEARING FLANGE
531	1	25008	OIL SEAL
533	1	25007	BALL BEARING # 6014
535	1	25006	CIRCLIP ROTOR CLIP HO-433
537	6	25171	CAPSCREW - HEX HEAD 5/16" - 18NC X 7/8" GRADE 5
539	1	25276	O-RING -164 6-1/4" ID 3/32" CS
541	6	25025	LOCKWASHER 5/16"
553	8	25328	LOCKWASHER 7/16"
555	8	25265	CAPSCREW - HEX HEAD 7/16" - 14NC X 1.25" GRADE 5
556	2	*	TIE BAR
		*	These parts vary. Refer to APPENDIX B.

# DRUM GROUP

G1197

**Item 511**  
Used only in winches with -6 drum.



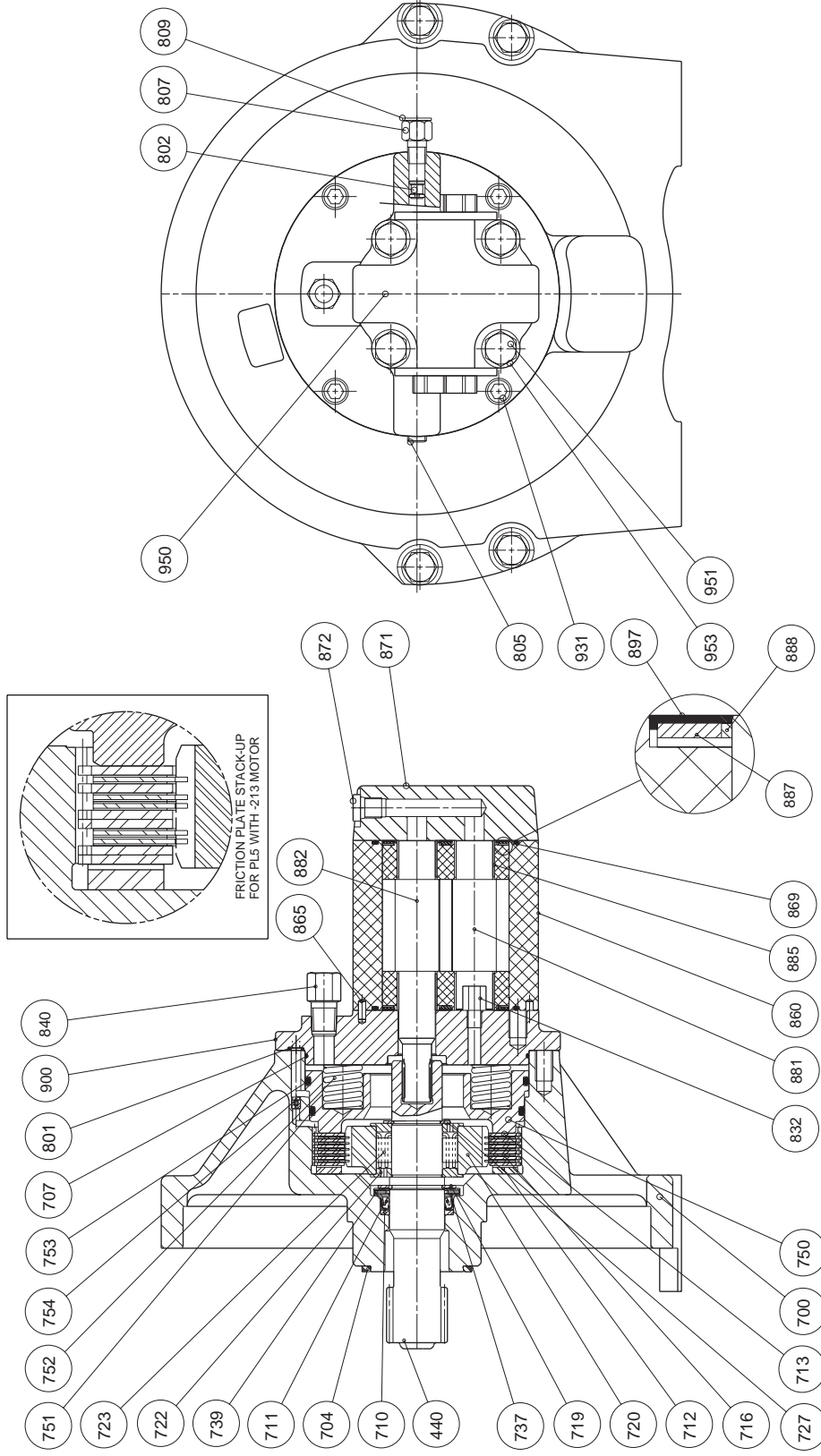
Group drawings may reference more parts than are actually present in a specific assembly. Parts that are referenced on the drawing but are not on the PARTS REFERENCE list should be ignored.

**Item 520**  
Used only in winches with-6 drum.

Refer to PAGE 25 for ASSEMBLY DRAWING and PAGE 29 for winch seal kit.

# BRAKE GROUP

G1283



Refer to PAGE 25 for ASSEMBLY DRAWING and PAGE 29 for winch seal kit.

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
440	1	**	SUNGEAR
700	1	23033	BRAKE HOUSING
704	1	20372	PLANET HUB STOPPER
707	1	25015	O-RING -0474-1/2" ID 1/16"CS
710	1	20714	BACK UP WASHER FOR OIL SEAL #25278
711	1	25278	OIL SEAL
712	1	21902	BRAKE SPACER
713	6	25024	DIVIDER PLATE
716	5	20034	FRICITION PLATE (OPTIONAL - METALLIC PLATES #26362)
719	1	25539	CIRCLIP ROTOR CLIP SE-118
720	1	22881	BRAKE HUB
722	2	20183	SPRAG CLUTCH ALIGNER
723	1	25187	SPRAG CLUTCH
727	1	25492	CIRCLIP ROTOR CLIP SH-106
737	2	25483	THRUST WASHER INA # AS 3047
739	1	25537	THRUST BEARING INA # AXK 3047
750	1	23034	PISTON
751	1	25528	O-RING -90 DURO -245 4-3/8" ID 1/8"CS
752	10	20340	BRAKE SPRING
753	1	25261	O-RING -90 DURO -246 4-1/2" ID 1/8"CS
754	1	23044	ORIFICE PLUG
759	1	*	STEEL BALL 5/32" DIA
801	2	25792	O-RING -009 7/32" ID 1/16"CS
802	1	*	SHUTTLE
805	2	25040	PIPE PLUG 1/8" - 27 NPT
807	1	*	*
832	2	26785	CHECK VALVE
840	1	20870	SAFETY VALVE
860	1	**	GEAR HOUSING
865	2	26371	DOWEL PIN
869	2	26373	SECTION SEAL
871	1	26378	PORT END COVER
872	1	26379	PLUG - ORB #4
881	1	**	GEAR DRIVEN
882	1	**	GEAR DRIVE
885	4	26788	THRUST BLOCK
887	4	26789	CHANNEL SEAL
888	4	26790	CHANNEL SEAL
897	2	26786	BACKUP SEAL
900	1	24154	MOTOR ADAPTOR
931	4	25772	CAPSCREW
933	4	25298	LOCKWASHER 3/8" HIGH COLLAR
950	1	*	MOTOR
951	4	**	CAPSCREW - HEX HEAD
953	4	26369	WASHER
955	2	25536	PLASTIC CAPLUG 1.0625" -12 THREADED
		23418	WINCH SEAL KIT, CONTAINS ITEMS: 213, 231, 233, 505, 539, 707, 710, 711, 751, 753 AND 801.
		24227	MOTOR SEAL KIT, CONSISTING OF ITEMS: 869, 887, 888 AND 897.
			ITEM 950, MOTOR SUB-ASSY, CONSISTS OF ITEMS: 800, 802, 805, 807, 809, 832, 860, 865, 869, 871, 872, 881, 882, 885, 887, 888, 897, 951 AND 953.

\* These parts vary.  
Refer to BRAKE CODE CHART below.  
\*\* Refer to APPENDIX B.

## BRAKE CODE CHART

## BRAKE CODE

ITEM	PART DESCRIPTION	-12	-13	-14	-15
		PART NUMBERS			
802	SHUTTLE	N/A	20849	20849	N/A
807	PIPE PLUG 1/8 - 27 NPT	25040	N/A	N/A	25040
807	PIPE ADAPTOR 1/8 - 27 NPT	N/A	25622	25622	N/A
809	CAPLUG 1/8 NPT	N/A	25374	25374	N/A
950	MOTOR -210	24146	24210	24210	24146
950	MOTOR -211	24147	24211	24211	24147
950	MOTOR -212	24148	24212	24212	24148
950	MOTOR -213	24149	24213	24213	24149

# APPENDIX A

## PERFORMANCE DATA

Model Number	Hydraulic Requirement		Drum Torque	Drum RPM	Bare Drum		Full Drum	
	Flow	Pressure			Line Pull	Line Speed	Line Pull	Line Speed
PL5-XX-210-1D	24 (US) gpm 91 l/min	2100psi 145bar	17,578lb-in 1986Nm	66	4500lb 20.0kN	135fpm 41 m/min	3328lb 14.8kN	183fpm 56 m/min
PL5-XX-211-1D	11 (US) gpm 42 l/min	2250psi 155bar	15,625lb-in 1765Nm	35	4000lb 17.8kN	72fpm 22 m/min	3098lb 13.8kN	92fpm 28 m/min
PL5A-XX-212-1D	11 (US) gpm 42 l/min	2400psi 165bar	19,532lb-in 2207Nm	29.5	5000lb 22.2kN	60fpm 18 m/min	3698lb 16.4kN	82fpm 25 m/min
PL5-XX-213-1D	11 (US) gpm 42 l/min	2250psi 155bar	7,813lb-in 883Nm	69	2000lb 8.9kN	141fpm 43 m/min	1479lb 6.6kN	191fpm 58 m/min

## CABLE STORAGE

CABLE STORAGE	BARREL DIAMETER	FLANGE DIAMETER	LENGTH	WIRE ROPE DIAMETER				
				1/4"	5/16"	3/8"	7/16"	1/2"
-6	7.38" 187mm	11.00" 279mm	10.00" 254mm	531ft 162m	333ft 101m	239ft 73m	168ft 51m	153ft 47m

Performance specifications are based on 7/16 inch diameter wire rope.

Performance data (line pull and line speed) for models with -6 drum is same as equivalent model with -1 drum.



# APPENDIX B

## ITEM NUMBERS

400	410	420	440	500	511	520	556
-----	-----	-----	-----	-----	-----	-----	-----

## PART DESCRIPTION

PLANET HUB	PLANET PIN	PLANET GEAR	SUNGEAR	CABLE DRUM	SET SCREW	COUPLING	TIE BAR
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## DRUM CODE

## STANDARD REDUCTION RATIO PART NUMBERS

-1	23022	20776	23023	23028	20361	-	-	23042
-6	23022	20776	23023	23028	22123	25526	21745	23076

## DRUM CODE

## 'A' REDUCTION RATIO PART NUMBERS

-1	20373	20080	20371	23078	20361	-	-	23042
-6	20373	20080	20371	23078	22123	25526	21745	23076

## MOTOR PARTS

MOTOR CODE	ITEM			
	GEAR HOUSING	GEAR DRIVEN	GEAR DRIVE	CAPSCREW HEX HEAD
-210	26793	26791	26792	26370
-211	26797	26795	26796	26794
-212	26798	26799	26800	26801
-213	26802	26803	26804	26399

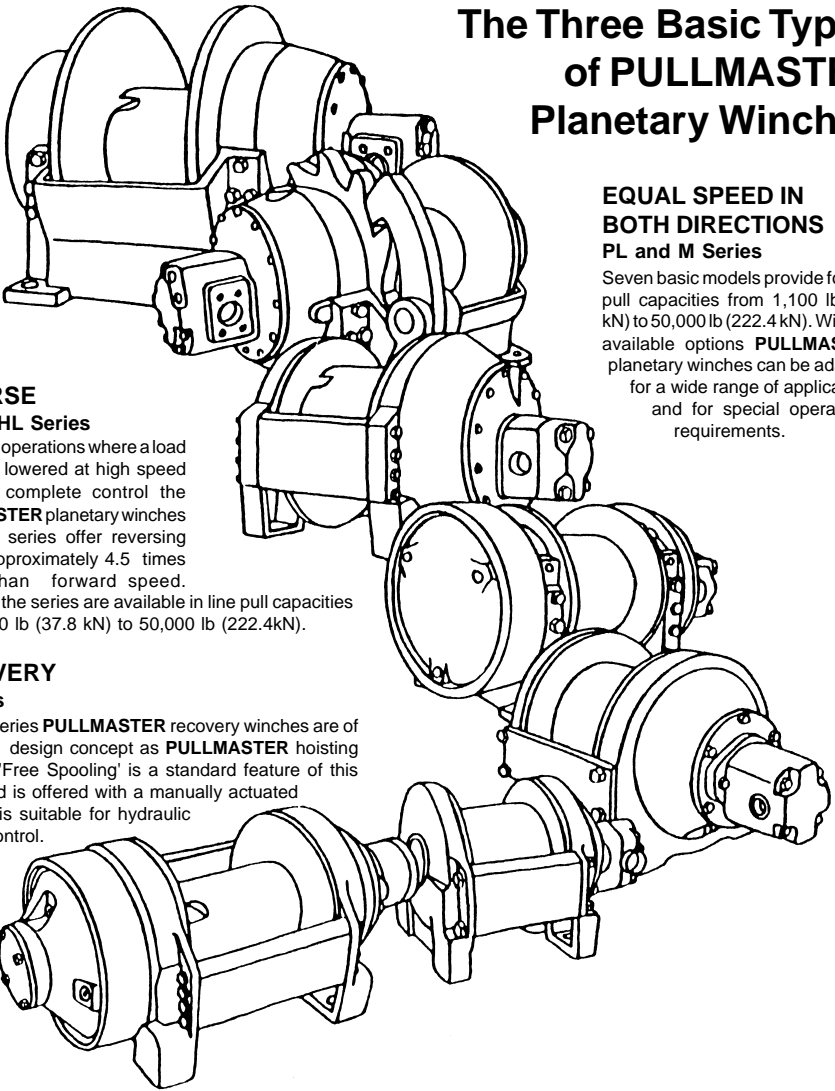
# BOLT TORQUE CHART

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

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



# The Three Basic Types of PULLMASTER Planetary Winches



## RAPID REVERSE

### HL and HL Series

For winch operations where a load has to be lowered at high speed and with complete control the **PULLMASTER** planetary winches in the 'H' series offer reversing speeds approximately 4.5 times faster than forward speed. Models in the series are available in line pull capacities from 8,500 lb (37.8 kN) to 50,000 lb (222.4kN).

## RECOVERY

### R Series

The 'R' Series **PULLMASTER** recovery winches are of the same design concept as **PULLMASTER** hoisting winches. 'Free Spooling' is a standard feature of this model and is offered with a manually actuated clutch or is suitable for hydraulic remote control.

## EQUAL SPEED IN BOTH DIRECTIONS PL and M Series

Seven basic models provide for line pull capacities from 1,100 lb (4.9 kN) to 50,000 lb (222.4 kN). With the available options **PULLMASTER** planetary winches can be adapted for a wide range of applications and for special operational requirements.

Service for **PULLMASTER** planetary winches can be obtained through a worldwide network of **PULLMASTER** Distributors. For the Distributor nearest to you contact the factory.

Use only authentic **PULLMASTER** replacement parts in the repair of a **PULLMASTER** planetary winch.

Purchased items such as bearings, seals, O-rings, etc., can be supplied from the factory. However, a cross reference list for such parts is shown in the PARTS REFERENCE of this manual.

When in doubt about proper function, installation or repair of a **PULLMASTER** planetary winch please contact your nearest **PULLMASTER** Distributor or the factory.

**PULLMASTER**

A DOVER COMPANY

**THE LOGICAL  
CHOICE**