

# OWNER'S MANUAL



## MARINE CRANE

MODEL NUMBER: \_\_\_\_\_ MPH1.25-20KMX \_\_\_\_\_

SERIAL NUMBER: \_\_\_\_\_

MONTH/YEAR BUILT: \_\_\_\_\_

PHONE: (206) 352-6869

FAX: (206) 352-6750

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# **SECTION 1**

## CRANE INSTALLATION

- Step 1: Clean pedestal flange and bearing surfaces. Mix 1/2 container of Devcon 10110 Plastic Steel (bedding compound) and apply an even, 1/8-inch thick layer on the pedestal flange. Use care to avoid filling the bolt holes.
- Step 2: Lift the crane and place on the pedestal. Install the swing bearing bolts and torque to \_\_\_\_\_70\_\_\_\_\_ft-lbs. Remove lifting slings. Allow 24 hours curing time for the bedding compound.
- Step 3: Torque the swing bearing bolts to a final value of \_\_\_\_\_183\_\_\_\_\_ft-lbs using a criss-crossing pattern.
- Step 4: Conduct the Crane Start-up Procedures and Load Test. The load test and ongoing operation of the crane should be performed only by authorized persons having read and understood this Owner's Manual.
- Step 5: After approximately 50 hours of operation, recheck the swing bearing bolts for proper torque. Refer to Section 4, Swing Bearing Bolt Maintenance, for additional periodic checks of the swing bearing bolt torques during crane service life.

## CRANE START-UP PROCEDURE

Step 1: If new piping was installed as part of crane circuit, ensure it is flushed to a cleanliness level of ISO 16/14 prior to connection of crane or directional valve.

Step 2: Install hydraulic hoses from the directional control valve to the crane functions (or hydraulic swivel) as specified on the tags. Connect pressure and return hoses to the directional control valve. Connect case drain hose to reservoir.

**Note:** If the new MPH crane is connecting to existing customer supplied hydraulic power unit, skip steps 3, 4 and 5.

Step 3: Ensure the hydraulic reservoir is filled with suitable hydraulic fluid.

Step 4: Ensure suction valve is open. Flooded suction - bleed air from the hydraulic pump at the pressure port. Non-flooded suction – fill pump with clean oil at pressure port.

Step 5: Adjust directional control valve relief and/or pump compensator (if applicable) to minimum setting (full counter-clockwise.) Start/stop the electric motor and confirm that direction of rotation is correct as indicated on pump casing.

Step 6: Start system and check for leaks at all connections. Monitor the reservoir oil level and filter elements. Add oil as required. Change elements if filter is in bypass condition with oil at 80 degrees F or higher.

Step 7: Adjust directional control valve relief and/or pump compensator (if applicable) to approximately 1200 psi. For open center systems, engage a cylinder function at full extent of travel (i.e.- boom down) to allow setting of relief.

Step 8: Operate all crane functions. Check for leaks at all connections. Check that functions operate in the desired direction compared to handle movement. Swap hoses on any function that is backwards of desired function direction compared to handle movement.

Step 9: Ensure all cylinder functions are operated to full extent of travel in both directions a minimum of three times to remove air. Lift a light load (<25% of SWL) with the hoist. Check for leaks at all connections.

Step 10: Adjust directional control valve relief and/or pump compensator (if applicable) to the pressure listed in technical specifications. Perform Crane Load Test as described in this section. Check for leaks at all connections.

Step 11: Conduct operator and maintenance person training prior to operation.

## CRANE LOAD TEST

The crane should be load tested after successful completion of the installation and start-up procedures.

**Note:** Place the boom in a fully lowered position prior to start of the load test. This will ensure test load is lifted at the maximum crane radius.

Conduct test with a weight of 125% of the rated SWL, calculated as follows:

$$\begin{array}{r} \text{_____} 1250 \text{_____ lbs SWL} \times 1.25 = \\ \text{_____} 1563 \text{_____ lbs @ _____} 20 \text{_____ foot radius (maximum radius)} \end{array}$$

**Note:** An increase the system operating pressure may be required to achieve a lift of 125% of the rated SWL. Increase pressure slowly only until test load can be lifted. Ensure pressure is returned to the correct setting listed in the technical specifications upon completion of load testing.

**Note:** If desired, counterbalance valves can be adjusted for maximum efficiency as follows: During load test at maximum radius, adjust boom cylinder counterbalance clockwise until movement of cylinder is noted, then immediately adjust counter-clockwise until movement stops. Adjust counter-clockwise  $\frac{1}{2}$  additional turn. Repeat procedure for knuckle cylinder counterbalance closest to base end of cylinder.

# **SECTION 2**

## CRANE TECHNICAL SPECIFICATIONS

### General

**Note: This crane is NOT certified for lifting personnel.**

SWL (safe working load) at 20' radius	1,250 lbs
SWL (safe working load) at 25' radius	850 lbs
Maximum radius (manual pull out retracted)	20 ft
Maximum radius (manual pull out extended)	25 ft

**NOTE: Capacity with manual pull out extended is 850 lbs ALL RADIUS. Do not lift more than 850 lbs with the manual pull out extended.**

Minimum radius with manual pull out retracted	3 ft.
Boom Angle	0-87 degrees
Design pressure	2,200 psi
Design flow	7.7 gpm (maximum)
Design hydraulic fluid	Shell AW32 or equivalent
Crane weight	1,600 lbs
Pedestal Weight	250 lbs

### Hoist

Main winch type	Pullmaster PL2, planetary, hydraulic-driven
Main winch line speed (bare drum)	81 fpm
Main winch line pull (bare drum)	2,200 lbs
Operating pressure/flow	2,200 psi/7.7 gpm

### Boom Cylinder

Type	Double-acting, single counterbalance valve
Displacement	4" bore x 30" stroke x 2.25" rod
Operating pressure/flow	2,200 psi/7.7 gpm maximum

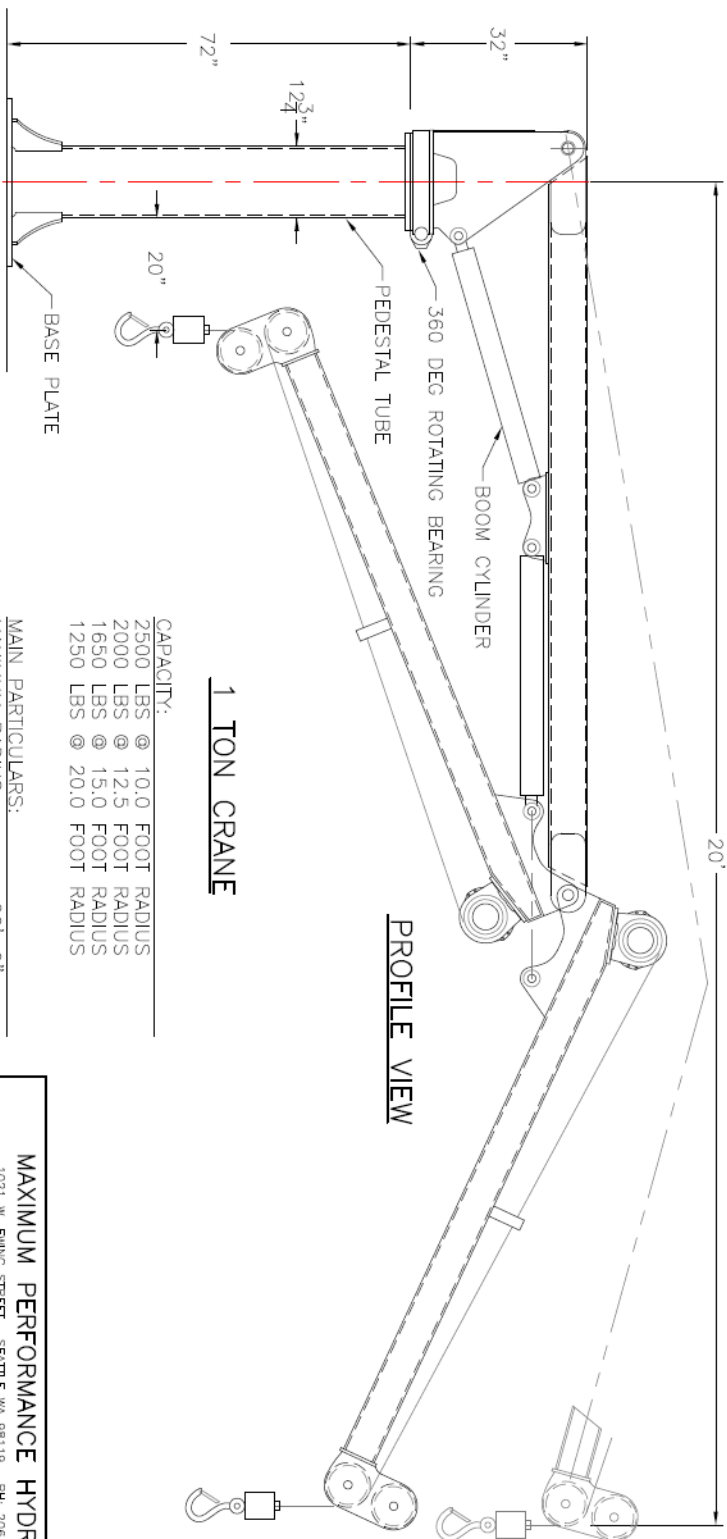
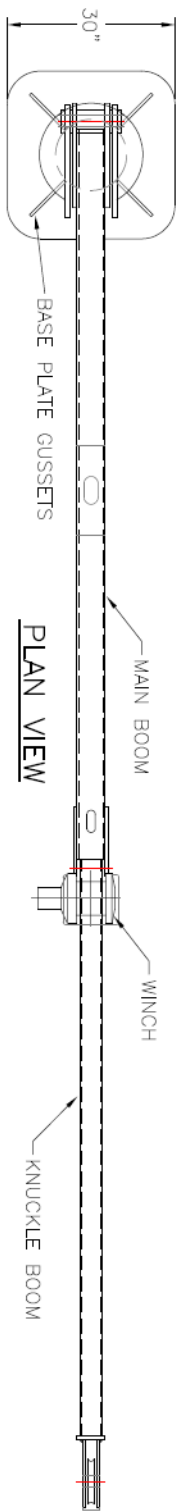
### Knuckle Cylinder

Type	Double-acting, double counterbalance valve
Displacement	4" bore x 30" stroke x 2.25" rod
Operating pressure/flow	2,200 psi/7.7 gpm maximum

### Swing Drive

Type	IMO 343 worm gear drive, hydraulic-driven, self-locking w/cylinder spool
Speed	0-1.5 rpm
Swing travel	360 degree, non-continuous
Operating pressure/flow	2,200 psi/7.7 gpm maximum





**1 TON CRANE**

**CAPACITY:**

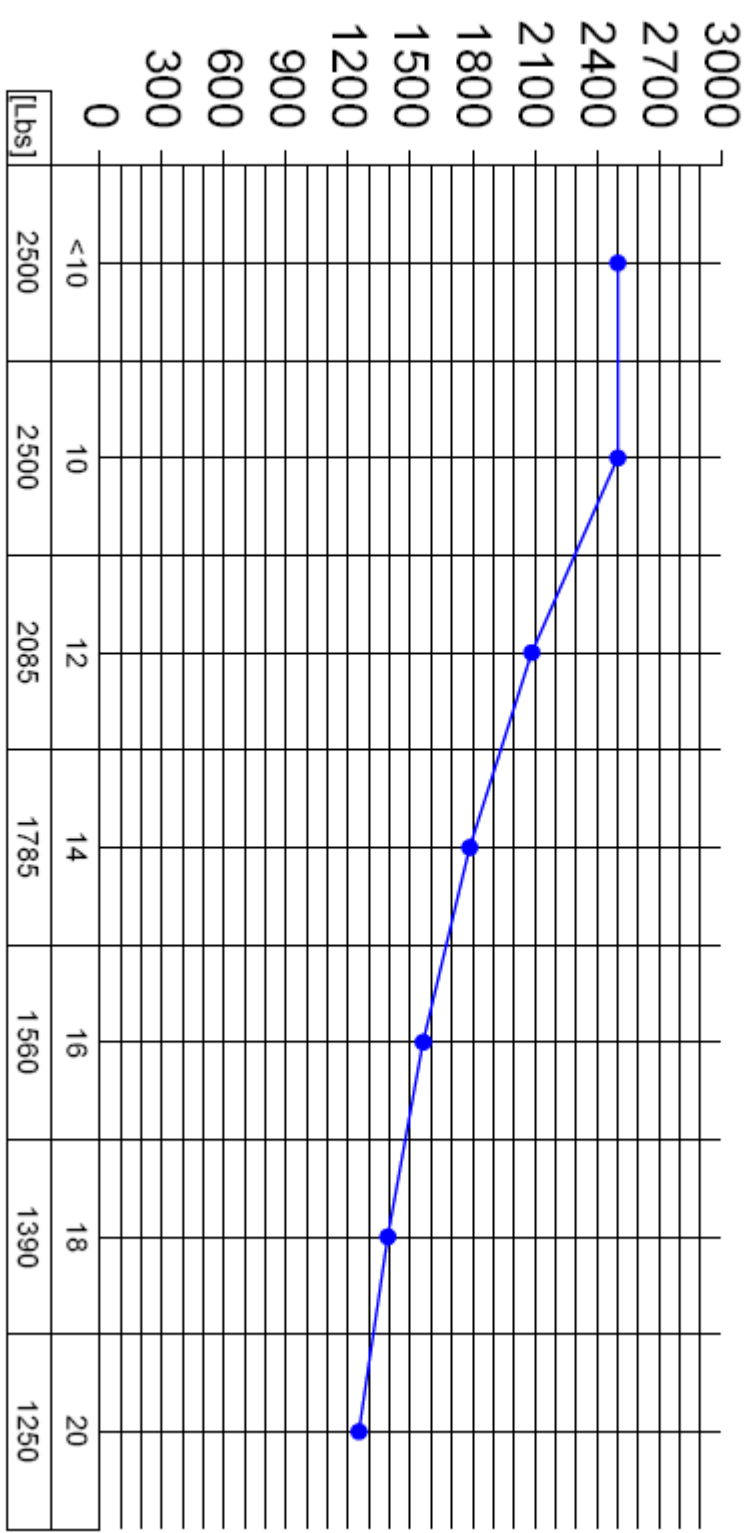
2500 LBS	@	10.0 FOOT RADIUS
2000 LBS	@	12.5 FOOT RADIUS
1650 LBS	@	15.0 FOOT RADIUS
1250 LBS	@	20.0 FOOT RADIUS

**MAIN PARTICULARS:**

MAXIMUM RADIUS:	20'-0"
MINIMUM RADIUS:	1'-8"
OPERATIONAL WEIGHT:	1800 LBS

<b>MAXIMUM PERFORMANCE HYDRAULICS</b>	
1021 W. EWING STREET, SEATTLE WA 98119, PH: 206-352-6869	
<b>1 TON KNUCKLE CRANE</b>	
<b>MPH1-20K</b>	
DATE: 09/25/2006	SCALE: N/A
DWG. BY: CO	REV: -

# MPH1-20K KNUCKLE BOOM CRANE LOAD CHART



**RADIUS IN FEET (FROM PEDESTAL CENTERLINE)**

# MODEL **PL2** PLANETARY HYDRAULIC WINCH

## DESCRIPTION

The **PULLMASTER** Model PL2 is a high performance, high efficiency planetary winch, having equal speed in both directions of rotation. The cable drum of this unit conforms with OSHA recommendations, making this winch especially suitable for applications where a load is raised or lowered.

The **PULLMASTER** Model PL2 is powered by a hydraulic gear motor and a reduction ratio of 40.5:1 is established by two planetary stages. The automatic multi-disc brake is "Spring Applied - Pressure Released". An over-running clutch, between the motor drive shaft and the brake assembly, permits free rotation in the "Hoisting" direction without affecting the brake. During "Lowering" operation the over-running clutch locks, causing the brake discs to rotate between a series of divider discs. Dynamic braking is then achieved by modulation of the winch control valve handle. When the control is returned to neutral position the brake applies automatically. During lowering of a load, temperature generated by the disc brake is dissipated by a flow of hydraulic fluid supplied from the hydraulic motor. This circulation flow is vented internally and therefore, there is no need for an external vent line. A counter-balance valve is not required for smooth and positive "Down" control of the **PULLMASTER** Model PL2 planetary winch.

All moving parts of the **PULLMASTER** Model PL2 planetary winch are totally enclosed and run in an oil bath. Anti-friction bearings are used on all turning components, assuring long, trouble free service with a minimum requirement for maintenance.

## PERFORMANCE

- Maximum operating volume = 7.7 (US) gpm (29 l/min)
- Maximum operating pressure = 2200 psi (152 bar)
- Drum rpm at maximum volume = 49
- Drum torque at maximum pressure = 7095 lb-in (802 Nm)

MODEL NUMBER	BARE DRUM		MEAN DRUM (THEORETICAL)		FULL DRUM	
	LINE PULL	LINE SPEED	LINE PULL	LINE SPEED	LINE PULL	LINE SPEED
PL2-221-1	2204 lb	83 fpm	1925 lb	96 fpm	1633 lb	111 fpm
	9.8 kN	25 m/min	8.6 kN	29 m/min	7.3 kN	34 m/min

When the **PULLMASTER** Model PL2 is installed in an existing hydraulic circuit with a lesser volume or pressure the performance will change. Maximum pressure and maximum hydraulic volume must not be exceeded. Performance graphs for line pull vs. oil pressure and line speed vs. oil volume, are available upon request.

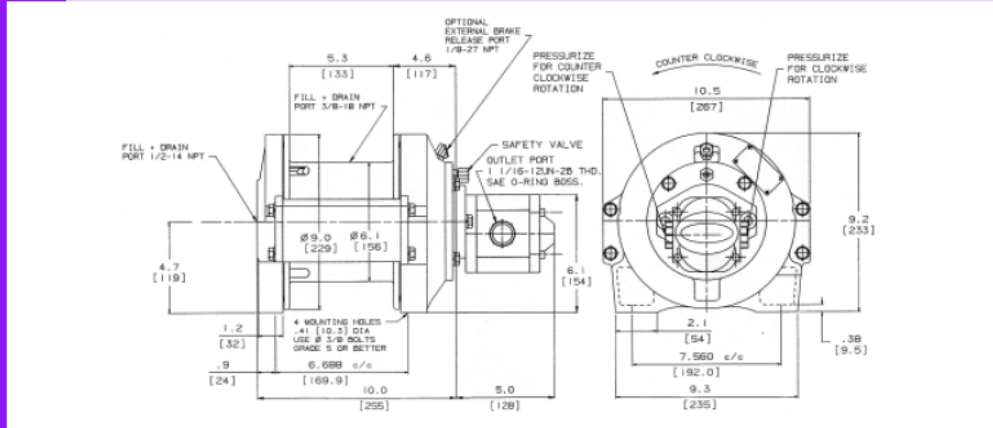
## CABLE STORAGE

### CABLE STORAGE CAPACITY FOR WIRE ROPE

MODEL NUMBER	DRUM SIZE			WIRE ROPE DIAMETER*				
	BARREL	FLANGE	LENGTH	1/8 in	3/16 in	1/4 in	5/16 in	3/8 in
PL2-221-1	6 1/8 in	9 in	5 1/4 in	745 ft	318 ft	172 ft	122 ft	84 ft
	156 mm	229 mm	133 mm	227 m	97 m	52 m	37 m	25 m

\* Standard cable anchor is suitable for 1/4 - 3/8 inch diameter wire rope. For safety, 5 wraps of wire rope must be maintained at all times.

## DIMENSIONS



**PULLMASTER** planetary winches are covered by a liberal warranty. Parts and repair service are available from authorized **PULLMASTER** distributors throughout Canada, the United States and most overseas areas.

### IMPORTANT

**PULLMASTER** planetary winches are neither designed nor intended for installation on equipment used in lifting or moving of personnel.

**PULLMASTER** planetary winches are available for larger line pull capacities. Options are provided on some models for "Rapid Reverse", "Freespooling", "External Brake Release" and different drum sizes.

## DISTRIBUTOR



For more information write to:

**PULLMASTER WINCH CORPORATION**  
8247- 130 STREET, SURREY, B.C. CANADA V3W 7X4  
TELEPHONE: (604) 594-4444 • FAX: (604) 591-7332

# **SECTION 3**

## **SAFETY PRECAUTIONS**

1. Only authorized and trained personnel should operate the crane.
2. The crane should be operated only after the complete Installation, Start-up and Load Test procedures outlined in this Owner's Manual have been successfully performed.
3. The crane should only be operated within the load ratings outlined in this Owner's Manual.
4. The crane should only be operated after the required periodic maintenance has been performed according to this Owner's Manual and the included manual for the hoist(s).
5. **This crane is NOT certified for lifting personnel.**
6. The crane should only be used for lifting and lowering loads vertically.
7. Do not allow the crane or the lifted load to contact any obstruction during operation.
8. The crane should not be operated if the crane or rigging is damaged in any way.
9. The crane should not be used in areas where it may be swung within fifteen (15) feet of high voltage power lines.
10. Loads should never be lifted over the heads of personnel.

**NOTE: Refer also to the safety precautions outlined in the Hoist Manual included in Section 4.**

## OPERATING INSTRUCTIONS

Refer to the Crane Installation and Start-up section for steps required prior to operation of the crane.

Refer to additional operating instructions in the Hoist Manual(s) included in Section 4.

The following steps should be taken **before each use of the crane**:













1. Fully inspect the crane for damage or hydraulic fluid leaks.
2. Fully inspect the rigging for damage and proper arrangement.
3. Verify adequate hydraulic fluid supply.
4. Confirm that all periodic maintenance has been performed according to this Owner's Manual and the included equipment manuals.
5. Confirm that the work area is free from obstructions.
6. Notify personnel in the work area of pending crane operation.

The crane should only be operated according to the following rules:

1. All of the safety precautions outlined in the previous section should be followed at all times.
2. Always verify that the weight of the load to be lifted, and the planned movement, are within the crane rating.
3. When moving a control handle to and from the neutral position, do so slowly to execute the crane function smoothly. This smooth operation will increase the service life of the crane.
4. Always remove any slack in the hoist line(s) and rigging slowly to avoid any jerking of the crane and its components. This will prevent damage and increase the service life of the crane.

When the crane is not in use, always stow the boom in a boom rest and/or secure properly to prevent its movement while underway.

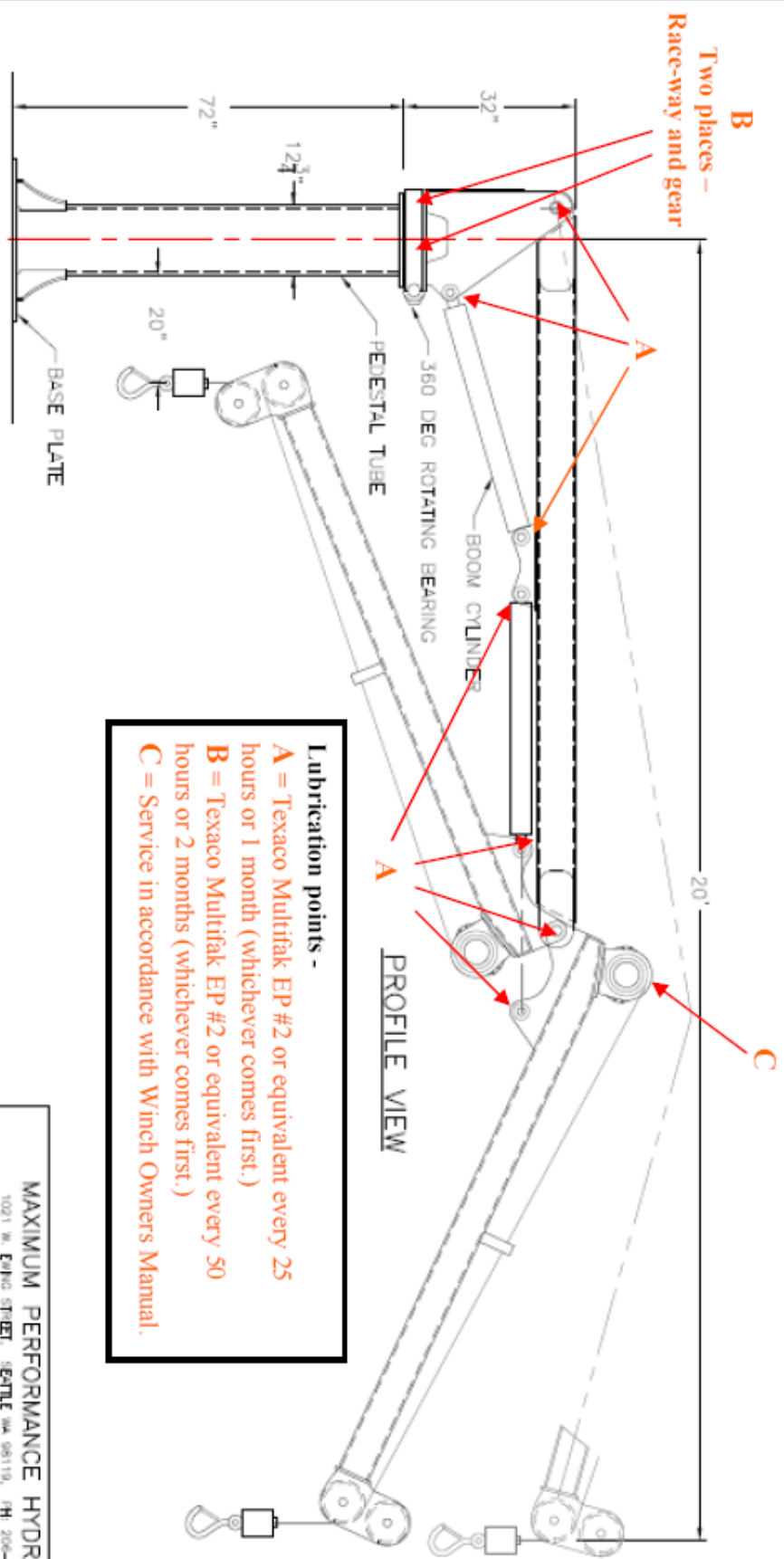
# HAND SIGNALS FOR HOISTING OPERATIONS

<p><b>Load Up</b></p>  <p>1</p>	<p><b>Load Down</b></p>  <p>2</p>	<p><b>Load Up Slowly</b></p>  <p>3</p>
<p><b>Load Down Slowly</b></p>  <p>4</p>	<p><b>Boom Up</b></p>  <p>5</p>	<p><b>Boom Down</b></p>  <p>6</p>
<p><b>Boom Up Slowly</b></p>  <p>7</p>	<p><b>Boom Down Slowly</b></p>  <p>8</p>	<p><b>Boom Up Load Down</b></p>  <p>9</p>
<p><b>Boom Down Load Up</b></p>  <p>10</p>	<p><b>Everything Slowly</b></p>  <p>11</p>	<p><b>Use Whip Line</b></p>  <p>12</p>

# **SECTION 4**



# Lubrication Chart



**Lubrication points -**

- A** = Texaco Multifak EP #2 or equivalent every 25 hours or 1 month (whichever comes first.)
- B** = Texaco Multifak EP #2 or equivalent every 50 hours or 2 months (whichever comes first.)
- C** = Service in accordance with Winch Owners Manual.

<b>MAXIMUM PERFORMANCE HYDRAULICS</b>			
1021 W. ELMING STREET    SUITE 404 98119, PH. 206-352-6869			
<b>1 TON KNUCKLE CRANE</b>			
<b>MPH1-20K</b>			
DATE: 09/25/2006	SCALE: N/A	DWG. BY: GD	REV: -

## CRANE SWING BEARING BOLT MAINTENANCE

Safe crane operation and the service life of the Swing Bearing depend on maintaining proper torque in the Swing Bearing Bolts.

The required bolt torque is \_\_\_\_\_ 183 \_\_\_\_\_ ft-lbs. This value is based on the threads being lubricated with lubricant or anti-seize.

Periodically check the torque of the bolts as follows:

### After crane installation:

Re-check the bolts for proper torque after approximately 50 hours of operation.

### During the crane service life:

After the 50-hour post-installation check, check the bolts for proper torque after each 300 hours of operation.

# CRANE TROUBLESHOOTING

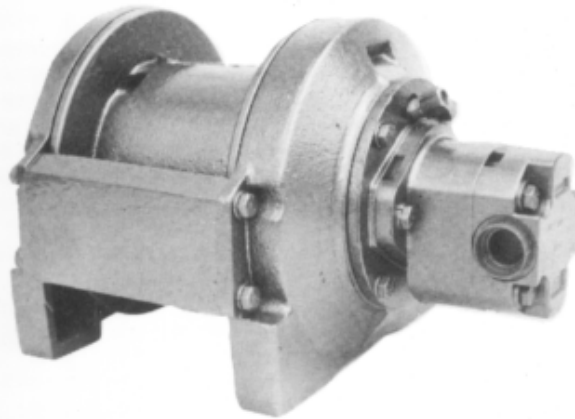
<u>Problem</u>	<u>Possible Cause</u>	<u>Solution</u>
No response to controls.	<p>Electrical problem (electrically actuated valves only.)</p> <p>Suction valve closed or suction strainer clogged (if applicable.)</p> <p>Hydraulic fluid level low.</p> <p>Relief valve setting low or defective relief valve.</p> <p>Defective hydraulic pump.</p>	<p>Ensure electrical signal is reaching directional valve.</p> <p>Open valve or clean suction strainer. <b>Note:</b> check pump for internal damage.</p> <p>Replenish fluid. <b>Note:</b> check pump for internal damage.</p> <p>Adjust, repair or replace as required.</p> <p>Repair or replace as required.</p>
Slow crane movement, especially when operating near maximum loads.	<p>Relief valve setting low or defective relief valve.</p> <p>Defective hydraulic pump.</p>	<p>Adjust, repair or replace as required.</p> <p>Repair or replace as required.</p>
Boom drops when control handle is centered.	<p>Counterbalance setting low or defective counterbalance valve.</p> <p>Cylinder piston seals worn or damaged.</p>	<p>Adjust or replace as required.</p> <p>Repair or replace cylinder as required.</p>
<p>Load drops when control handle is centered.</p> <p><b>Note:</b> Additional troubleshooting information for the winch is available in section 4.</p>	<p>Excessive back pressure in tank line.</p> <p>Winch brake worn or damaged.</p>	<p>Change return filter element or check for other source of back pressure in tank line.</p> <p>Repair or replace winch as required.</p>
External leak of hydraulic fluid from cylinder.	Worn or damaged seal(s) or cylinder rod	Repair or replace cylinder as required.
Excessive heat in hydraulic system.	<p>Relief valve setting low or defective relief valve.</p> <p>Heat exchanger not functioning (if applicable.)</p> <p>Excessive ambient temperature or operation beyond duty cycle.</p>	<p>Adjust, repair or replace as required.</p> <p>Check for proper operation. Repair or replace as required.</p> <p>Stop operation of crane to allow cooling of system.</p>
Excessive noise from crane during operation	Insufficient lubrication of pins, bushings and/or bearings.	Lubricate crane according to owners manual.

# PL2

THE INTRAVENT

## PLANETARY HYDRAULIC WINCH

DESIGN REVISION EFFECTIVE FROM SERIAL # 76061



DESIGN REVISION 'B'

## INSTRUCTION AND PARTS MANUAL

EQUAL SPEED  
EQUAL SPEED  
EQUAL SPEED



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.

 **PULL MASTER** ★  
A **DOVER** COMPANY

**THE LOGICAL  
CHOICE**

# 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 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 PL2

## GENERAL DESCRIPTION:

The PULLMASTER Model PL2 is a planetary hydraulic winch having equal speed in both directions. 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
- + End housing
- + Cable drum

## 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 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 450 psi (31 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, 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 200 - 500 psi (14 - 34 bar) depending upon load and from 550 - 1075 psi (38 - 74 bar) without 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 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 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 vented to the return line flow through a check valve arrangement inside the hydraulic motor. The circulation flow is supplied only when a load is lowered. A separate vent line connecting the PULLMASTER Model PL2 with the hydraulic reservoir is not normally required.

(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.

# EXPLANATION OF MODEL CODING

**PL 2 X - XX - XX - XX X - B 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
- 16 Automatic brake, counterclockwise hoisting, intravent, external brake release
- 17 Automatic brake, effective in both directions, external brake release, external circulation, external drain port
- 18 Automatic brake, effective in both directions, intravent
- 19 Automatic brake, external brake release, zero leakage, counterclockwise hoisting, intravent
- 20 Automatic brake, external brake release, zero leakage, clockwise hoisting, intravent

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

- 221 Gear motor (.81 cubic inch displacement)  
(Other motors are optional)

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

- 1 6.13 inch drum diameter x 9.00 inch flange diameter x 5.25 inch length - STANDARD  
(For other drum sizes refer to APPENDIX A)

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

**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.

**DESIGN REVISION EFFECTIVE FROM SERIAL # 76061**



# OPTIONS

## **CLOCKWISE ROTATION:**

The drum rotation of the standard PULLMASTER Model PL2 planetary winch 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 CIRCUIT".**

## **CABLE DRUM SIZES:**

Aside from the standard drum sizes listed in APPENDIX A, the PULLMASTER Model PL2 planetary winch can be supplied with optional drums to accommodate large wire rope storage capacity.

## **DRUM GROOVING:**

Cable drums for the PULLMASTER Model PL2 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 standard PULLMASTER Model PL2 planetary winch may be changed by using a different displacement motor.

(Contact the factory for performance information.)

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

The operating pressure of the PULLMASTER Model PL2 planetary winch is limited to 2200 psi (152 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 5/16 inch diameter wire rope. For other cable drums and gear ratios refer to APPENDIX A. Performance specifications for winches supplied with optional motors are provided in attached supplement.

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

Barrel diameter	6.13 in	156 mm
Flange diameter	9.00 in	229 mm
Barrel length	5.25 in	133 mm

**CABLE STORAGE CAPACITY:**

Size of wire rope	1/4 in	172 ft	52 m
	5/16 in	122 ft	37 m
	3/8 in	84 ft	25 m

**MAXIMUM OPERATING PRESSURE:** 2200 psi 152 bar

**MAXIMUM OPERATING VOLUME:** 7.7 (US) gpm 29 l/min

**MINIMUM OPERATING VOLUME:** 2.5 (US) gpm 9 l/min

**DRUM TORQUE AT MAXIMUM PRESSURE:** 7095 lb-in 802 Nm

**DRUM RPM AT MAXIMUM VOLUME:** 49 rpm

**LINE PULL AT MAXIMUM PRESSURE:**

Bare drum	2204 lb	9.8 kN
Full drum	1633 lb	7.3 kN

**LINE SPEED AT MAXIMUM VOLUME:**

Bare drum	83 fpm	25 m/min
Full drum	111 fpm	34 m/min

**PERMISSIBLE SYSTEM BACK PRESSURE AT MOTOR RETURN PORT:** 65 psi 4.5 bar

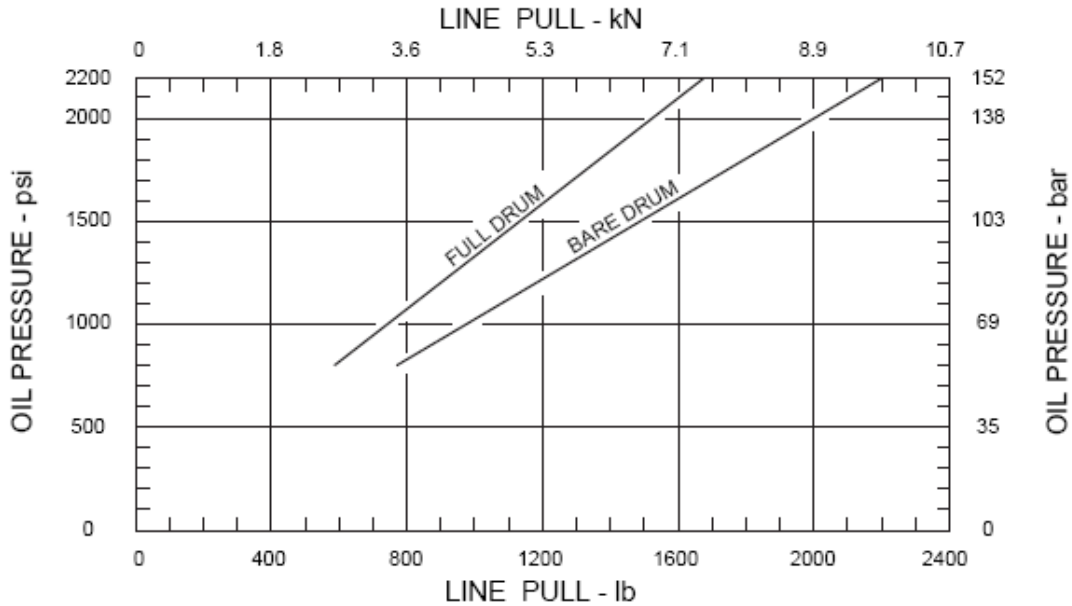
**PERMISSIBLE PRESSURE AT BRAKE HOUSING SAFETY VALVE:** 100 psi 7 bar

**LUBRICATING OIL:** Refer to RECOMMENDATIONS for viscosity and instructions.  
Refer to APPENDIX A for oil volume required.

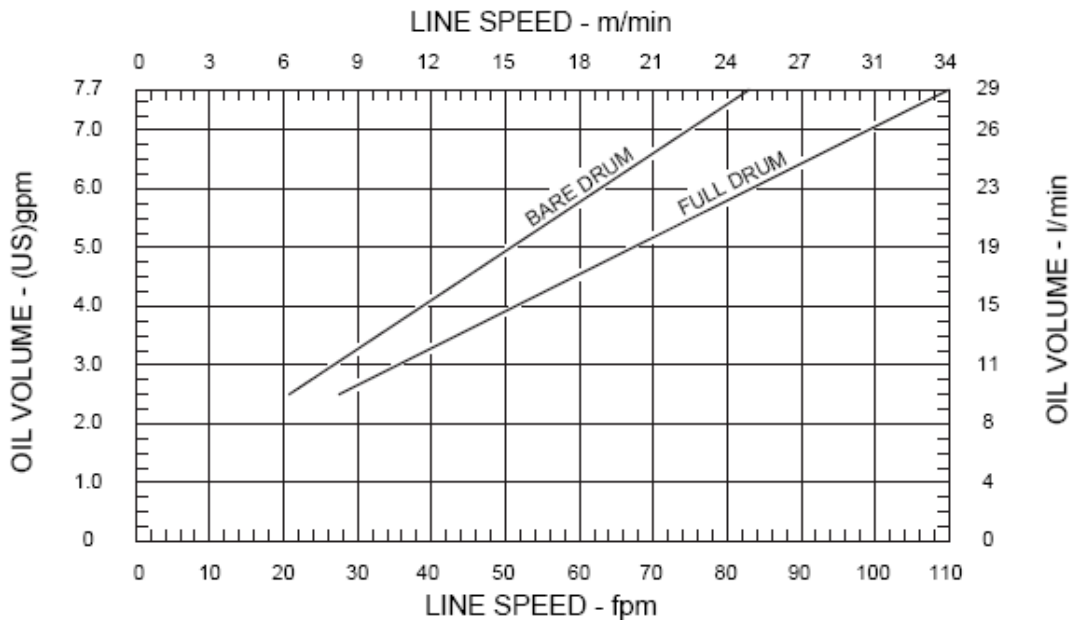
# PERFORMANCE GRAPHS

PG-PL2-B

## LINE PULL VS. OIL PRESSURE



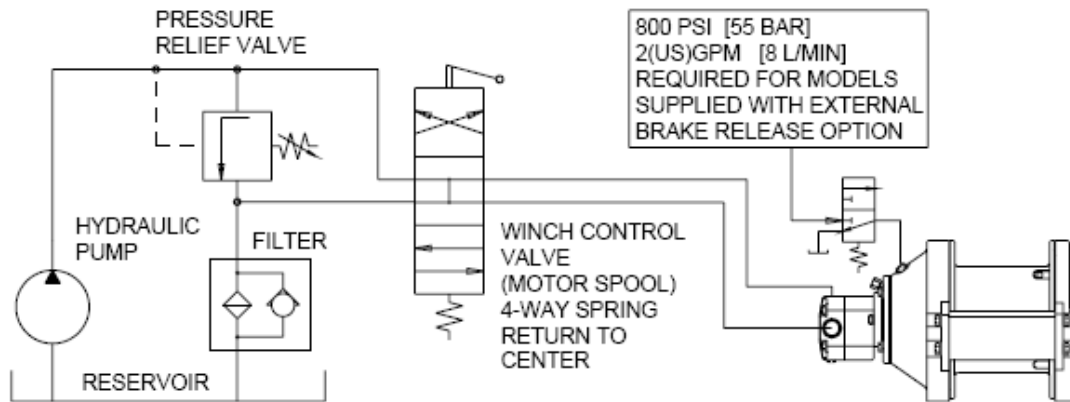
## LINE SPEED VS. OIL VOLUME



Performance graphs are based on standard hydraulic motor, gear ratio and cable drum with 1/4 inch diameter rope.

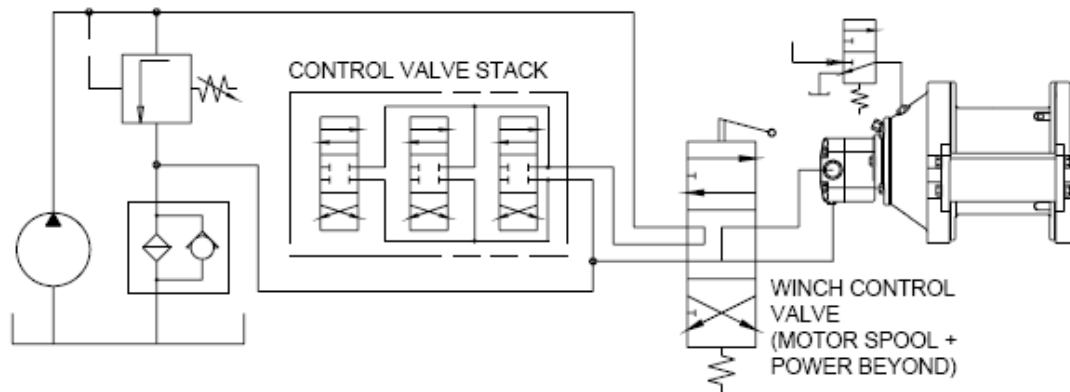
# TYPICAL HYDRAULIC CIRCUITS

HC-PL2-S1



## 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 motor drain line is not required.

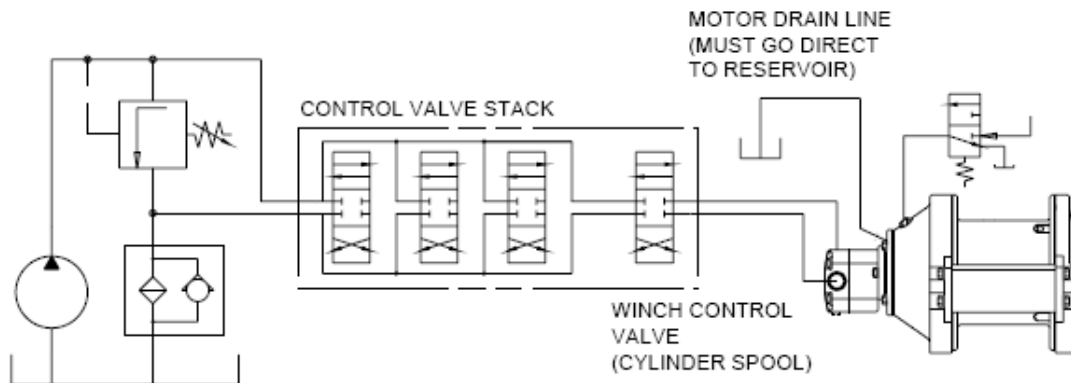


## 2. TYPICAL HYDRAULIC CIRCUIT - POWER BEYOND CONTROL VALVE

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 motor drain line is not required.

# TYPICAL HYDRAULIC CIRCUITS CONTINUED

HC-PL2-S1



### 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 drain line plumbed directly to the reservoir. The drain 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 and the brake housing pressure measured at the safety valve 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 winch 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 UP TO THE LEVEL OF THE END HOUSING OIL FILL PORT BEFORE RUNNING WINCH.**

Refer to **INSTALLATION DIMENSIONS** for location of lubricating oil fill port. Refer to **APPENDIX A** for quantity of oil required. SAE 90 lubricating oil is recommended. Consult lubricating oil supplier or factory for temperature 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**.

## HYDRAULIC CONTROL VALVE:

The 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 PL2 planetary winch.

Pressure lines:	SAE 100R2-8 or better
Motor drain line (when required):	SAE 100R6-4 or better

It is recommended that larger hydraulic hose be installed where pressure lines are excessively long.

## 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.

# 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 torque chart at back of manual.
- 4) Fill the winch with lubricating oil. See APPENDIX A for oil volume required.
- 5) Use recommended circuit components and hydraulic hoses.
- 6) When required, the winch motor 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. Higher pressure inside the brake housing requires higher brake release pressure to rotate the drum in the lowering direction.

- 7) Before operating the winch with a load, verify that 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. Flow should measure 3/4 - 1 gpm (3 - 4 l/min).

**NOTE:** Pressure required to rotate the drum in forward direction at full speed without load may vary up to 450 psi (31 bar).

Pressure required to rotate the drum in reverse direction at full speed may vary from 200 - 500 psi (14 - 34 bar) depending upon load and from 550 - 1075 psi (38 - 74 bar) without load.

# 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.

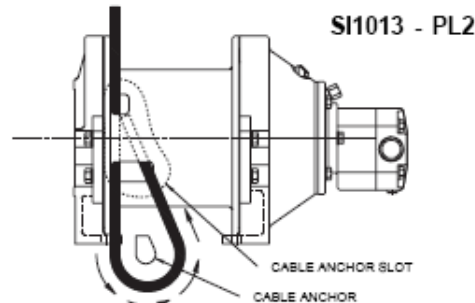
**IMPORTANT:** The ropes, chains, slings, etc. are not part of the winch and are not covered by this manual. Refer to manufacturer's handling, inspection and maintenance recommendations to avoid potential accidents. For selection of ropes, etc. please check following product standards: DIN 15020, prEN818-1/9,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

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, verify 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
Winch will not produce line pull at maximum pressure as listed in SPECIFICATIONS.	<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 circuit</li> </ul>
Winch will not produce line speed at maximum volume as listed in SPECIFICATIONS.	<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 circuit.</li> </ul>
Winch will not reverse.	<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 connecting tube.</li> </ul>

## TROUBLE SHOOTING CONTINUED

FAILURE	PROBABLE CAUSE
<p>Brake will not hold.</p>	<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 is seized in the brake housing because of contamination in the hydraulic fluid.</li> <li>c) Excessive back pressure in the return line of the hydraulic circuit 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) Winch supplied with external brake release option is not plumbed per TYPICAL HYDRAULIC CIRCUITS. Failure to vent external brake release port to reservoir may trap pressure and cause winch brake to slip.</li> </ul>
<p>Brake vibrates when lowering a load.</p>	<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>
<p>Oil leaks.</p>	<ul style="list-style-type: none"> <li>a) Oil leaks from the motor flange are caused by a damaged O-ring seal on the motor flange.</li> <li>b) Oil leaks occurring between the cable drum flanges and housings are caused by excessive pressure in the brake housing. Excessive pressure in the brake housing will damage the oil seal between the brake housing and cable drum interior.</li> </ul>

Refer to the SERVICE INSTRUCTIONS if it becomes necessary to disassemble the Model PL2 winch.

# SERVICE INSTRUCTIONS

## GENERAL:

Before disassembling the PULLMASTER Model PL2 planetary winch, read and understand the following instructions.

Replace expendable parts such as O-rings and oil seals when reassembling the winch. Have a seal kit (Part No. 23111) on hand before the unit is disassembled.

**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 HYDRAULIC MOTOR ASSEMBLY:

The motor is not user serviceable and must be replaced if not functioning properly. Contact your nearest PULLMASTER WINCH CORPORATION distributor for a replacement. Remove the motor assembly as follows:

- 1) Remove two capscrews, item 935, and lockwashers, item 937. Pull the hydraulic motor, item 950, out of the winch assembly.
- 2) Remove and discard O-ring, item 811.
- 3) Connecting tube, item 830, will either be in motor or in motor adaptor. Note and mark which brake release port this part is from (required for reassembly) then remove. Remove motor plug, item 888, from other brake release port. These parts must be reinstalled properly for winch brake to function correctly. Remove and discard three O-rings, item 831.

### DISASSEMBLY OF BRAKE HOUSING ASSEMBLY:

The majority of service and repair work is done on the brake housing assembly which is accessed by removing the hydraulic motor assembly. Disassemble brake housing assembly as follows:

- 1) Remove motor adaptor, item 800, by removing four capscrews, item 931, and lockwashers, item 933. Allow brake springs, item 752, to expand safely by unscrewing capscrews one turn at a time.
- 2) Remove and discard O-ring, item 707.
- 3) Remove six 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.
- 4) Pull the brake piston, item 750, out of the brake housing, item 700. Remove pipe plug, item 757. Verify hole in orifice plug, item 754, is clear and unobstructed.
- 5) Remove and discard O-rings, items 751 and 753.
- 6) Thoroughly inspect the 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.

#### Winches with standard reduction ratio only:

- 7) Pull the primary sun gear, item 440, with brake hub, item 720, sprag clutch, item 723, and clutch aligners, items 722 and 724, from the brake housing. Proceed to step 8.

#### Winches with optional 'A' reduction ratio only:

- 7A) Design of the 'A' reduction primary sun gear, item 440, prevents its removal from the motor side of the brake housing. Disassemble brake inside the brake housing by following steps 8 through 12.

## SERVICE INSTRUCTIONS CONTINUED

- 8) Remove circlip, item 727 and clutch aligner, item 724.
- 9) Remove brake hub, item 720, and sprag clutch, item 723.
- 10) Remove clutch aligner, item 722. Inspect both clutch aligners and replace if damaged.



### 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.

- 11) Remove three friction plates, item 716, and four 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.
- 12) Remove brake spacer, item 712.

#### Winches with standard reduction ratio only:

- 13) Remove thrust bearing, item 739, two thrust washers, item 737, and thrust washer, item 736. Inspect bearing and washers and replace if damaged or worn.
- 14) Remove and discard oil seal, item 711, and backup washer, item 710.



### DANGER

MINOR SURFACE DEFECTS WHERE THE OVER-RUNNING CLUTCH ENGAGES THE SUNGEAR 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 SUNGEAR AND BRAKE HUB ASSEMBLY AS A SET.

- 15) Thoroughly inspect sungear, item 440, particularly surface where over-running clutch, item 723, engages. If any indentation or surface damage is detected, replace sungear, brake hub and sprag clutch as a set. Proceed to DISASSEMBLY OF PRIMARY DRIVE.

#### Winches with optional 'A' reduction ratio only:

- 13A) Remove circlip, item 719. Remove thrust bearing, item 739, two thrust washers, item 737, and thrust washer, item 736. Inspect bearing and washers and replace if damaged or worn. To remove primary sungear, item 440. Proceed to DISASSEMBLY OF PRIMARY DRIVE.

#### 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 eight capscrews, item 555, and lockwashers, item 553. Remove two tie bars, item 556. Stand the winch upright on its end housing.
- 3) Lift the brake housing with loose needle rollers, item 701, and needle retainer, item 702, out of the cable drum, item 500.

# SERVICE INSTRUCTIONS CONTINUED

## Winches with standard reduction ratio only:

- 4) The standard reduction primary sungear, item 440, was removed from the motor side of the brake housing. Proceed to step 5.

## Winches with optional 'A' reduction ratio only:

- 4A) Remove primary sungear, item 440, from the drum side of the brake housing. Refer to the warning preceding step 15 of DISASSEMBLY OF BRAKE HOUSING ASSEMBLY and thoroughly inspect the sungear, particularly where the over-running clutch, item 723, engages. If any indentation or surface damage is detected, replace sungear, brake hub and sprag clutch as a set.
- 4B) Remove and discard oil seal, item 711, and backup washer, item 710. Proceed to step 5.
- 5) Remove the primary planet hub assembly from the cable drum.
- 6) Inspect planet hub stopper, item 402, for damage or wear and replace if less than .09 inch thick.
- 7) 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 the planet hub, item 400. Inspect needle bearing, item 423, and two thrust washers, item 421, and replace if damaged or worn.
- 8) Remove final sungear, item 340, with circlip, item 341, and sungear stopper, item 344. Inspect stopper for damage or wear. If stopper is worn to within .06 inch of the sungear face, stopper should be replaced.
- 9) Inspect planet hub stopper, item 704, for damage or wear and replace if less than .09 inch thick.
- 10) Inspect loose rollers, item 701, and needle retainer, item 702, and replace if damaged or worn.
- 11) Remove and discard oil seal, 515.

## DISASSEMBLY OF FINAL DRIVE:

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

- 1) Remove final planet hub assembly from the 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 the final planet hub, item 300. Inspect needle bearing, item 323, and two thrust washers, item 321, and replace if damaged.

## Winches with optional -5 drum only:

- 2A) Remove coupling, item 520, from end housing spline. Proceed to step 3.
- 3) Remove circlip, item 109. Pull end housing, item 100, out of the cable drum ball bearing, item 507.
- 4) Remove circlip, item 513. Push ball bearing, item 507, out of the 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.

## 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.

## REASSEMBLY OF FINAL DRIVE:

Reassemble final drive by reversing the disassembly procedure.

- 1) Press a 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) Press end housing, item 100, into the cable drum ball bearing, item 507. Secure with circlip, item 109.

## Winches with optional -5 drum only:

- 3A) Replace coupling, item 520, on end housing spline. Proceed to step 4.

## SERVICE INSTRUCTIONS CONTINUED

- 4) Reassemble final planet hub assembly. Press needle bearing, item 323, in the bore of the planet gear, item 320. Position thrust washers, item 321, on either side of the planet gear and press planet pin, item 310, into the final planet hub, item 300. Retain with circlip, item 311.
- 5) Insert final planet hub assembly into the cable drum. Ensure that the planet hub spline is fully engaged.

### REASSEMBLY OF PRIMARY DRIVE:

Reassemble primary drive by reversing the disassembly procedure.

- 1) Press a new, well-greased oil seal, item 515, into the cable drum, item 500.
- 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 the 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 the cable drum. Ensure that the final sungear, item 340, is fully engaged with the final planet gears, item 320.
- 8) Press a new, well-greased oil seal, item 711, and backup washer, item 710, into brake housing bore, item 700.

#### Winches with standard reduction ratio only:

- 9) Lower the brake housing, item 700, into the cable drum. Proceed to step 10.

#### Winches with optional 'A' reduction ratio only:

- 9A) The design of the 'A' reduction primary sungear dictates that it be installed from the drum side of the brake housing. Carefully twist the shoulder of the sungear through the oil seal, item 711. Ensure that the oil seal is not damaged as the sungear is installed.
- 9B) Install thrust bearing, item 739, with a thrust washer, item 737, on either side. Install thrust washer, item 736, with circlip, item 719.
- 9C) Lower the brake housing, item 700, into the cable drum. Proceed to step 10.
- 10) Use eight capscrews, item 555, and lockwashers, item 553, to secure tie bars, item 556.
- 11) Install pipe plug, item 503, into the cable drum.

### REASSEMBLY OF BRAKE HOUSING ASSEMBLY:

Reassemble brake housing assembly by reversing the disassembly procedure.

- 1) Verify circlip, item 719, is in place.
- 2) Position sprag clutch aligners, items 722 and 724, on either side of the sprag clutch, item 723, inside the brake hub, item 720. Carefully install brake hub and sprag clutch aligners on the primary sungear, item 440. Secure with circlip, item 727.

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

#### Winches with standard reduction ratio only:

- 3) Install thrust bearing, item 739, with a thrust washer, item 737, on either side.
- 4) Install the primary sungear assembly, carefully twisting the shoulder of the sungear through the oil seal, item 711. Ensure that the oil seal is not damaged as the sungear is installed. Proceed to step 5.

#### Winches with optional 'A' reduction ratio only:

- 3A) Verify that the primary sungear assembly is properly installed and retained in the brake housing. Proceed to step 5.

# SERVICE INSTRUCTIONS CONTINUED

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



**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) Starting and finishing with divider plate, alternately install four divider plates, item 713, and three friction plates, item 716.
- 7) Install pipe plug, item 757, in brake piston, item 750. Install new, well-greased O-rings, items 751 and 753, into piston glands. Carefully install brake piston in brake housing. Rotate piston to align connecting tube hole with corresponding hole in motor adaptor.
- 8) Install six brake springs, item 752.
- 9) Install new, well-greased O-ring, item 707, onto motor adaptor pilot, item 800.
- 10) Position motor adaptor with hydraulic motor mounting holes horizontal and connecting tube holes of piston and adaptor aligned. Tighten four capscrews, item 931, and lockwashers, item 933, one turn at a time to evenly compress springs.

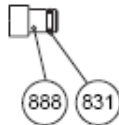
## REPLACEMENT OF HYDRAULIC MOTOR ASSEMBLY:

Replace the hydraulic motor assembly by reversing the removal procedure.

**IMPORTANT:** Before installing motor, determine brake code of winch. Install motor plug as indicated below.

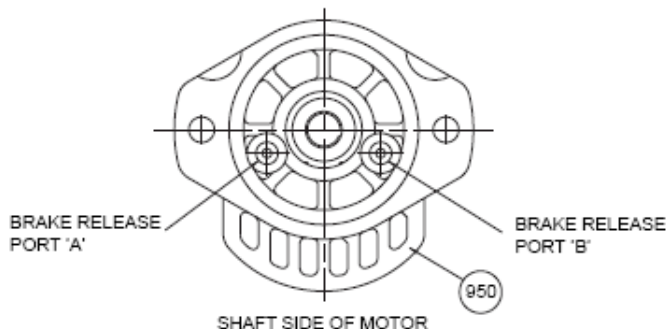
(May not be exactly as illustrated) SI-1029

MOTOR PLUG  
WITH O-RING



**NOTE:** Insert motor plug, O-ring end, into Port A or B as per Brake Code chart below.

BRAKE CODE	PLUG PORT
-12 or -13	B
-14 or -15	A



- 1) Install three new, well-greased O-rings, item 831; two onto connecting tube, item 830, and one onto motor plug, item 888. Install connecting tube and motor plug into motor, item 950. Verify that holes are same as parts were removed from.
- 2) Install new, well-greased O-ring, item 811, onto motor pilot, item 950.
- 3) Fasten motor to motor adaptor using two capscrews, item 935, and lockwashers, item 937.

**IMPORTANT:** Before operating the winch, add lubricating oil up to the level of the end housing oil fill port. (Refer to INSTALLATION INSTRUCTIONS for location of fill port. Refer to APPENDIX A for oil volume required.) To ensure proper reassembly, run the winch in both directions without load.



**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:

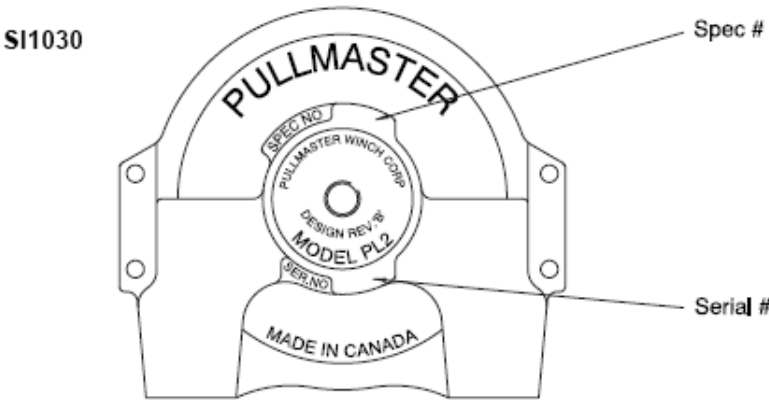
- 1) Disconnect all hydraulic hoses and remove the winch from its mounting.
- 2) Disassemble the winch as per instructions.
- 3) Discard and replace all O-rings and oil seals.
- 4) Clean all parts and inspect for wear and damage as per instructions. Replace worn or damaged parts as required.
- 5) Reassemble the winch as per instructions.
- 6) Follow INSTALLATION and OPERATING INSTRUCTIONS when returning winch to its mounting.

When ordering parts for the PULLMASTER Model PL2 planetary winch, always quote the complete model number, serial number and specification (spec) number (if applicable) of the unit.

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

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

**SPEC #** \_\_\_\_\_

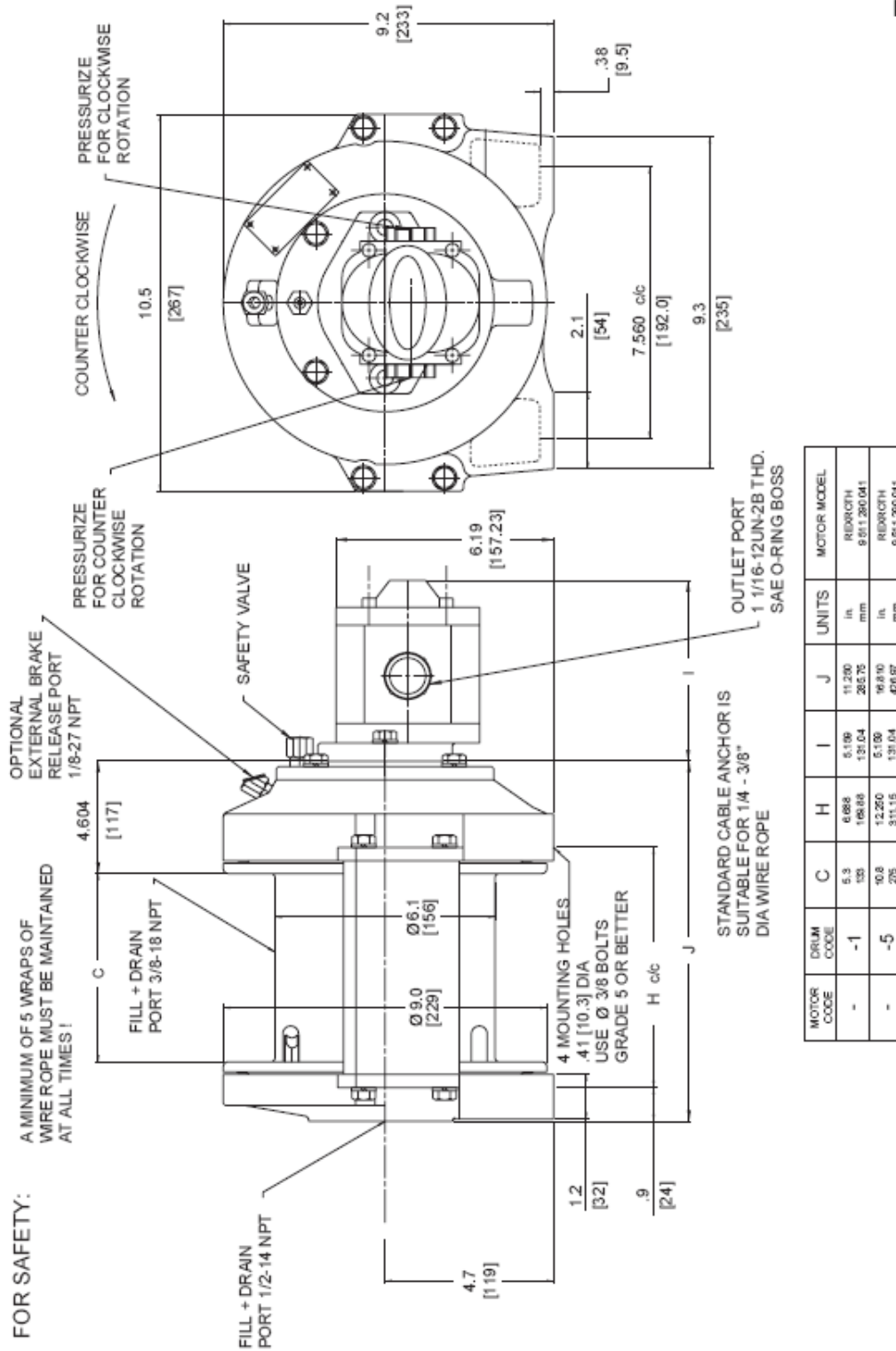


PULLMASTER WINCH CORPORATION reserves the right to change specifications and the design of PULLMASTER planetary winches at any time without prior notice and without incurring any obligations.



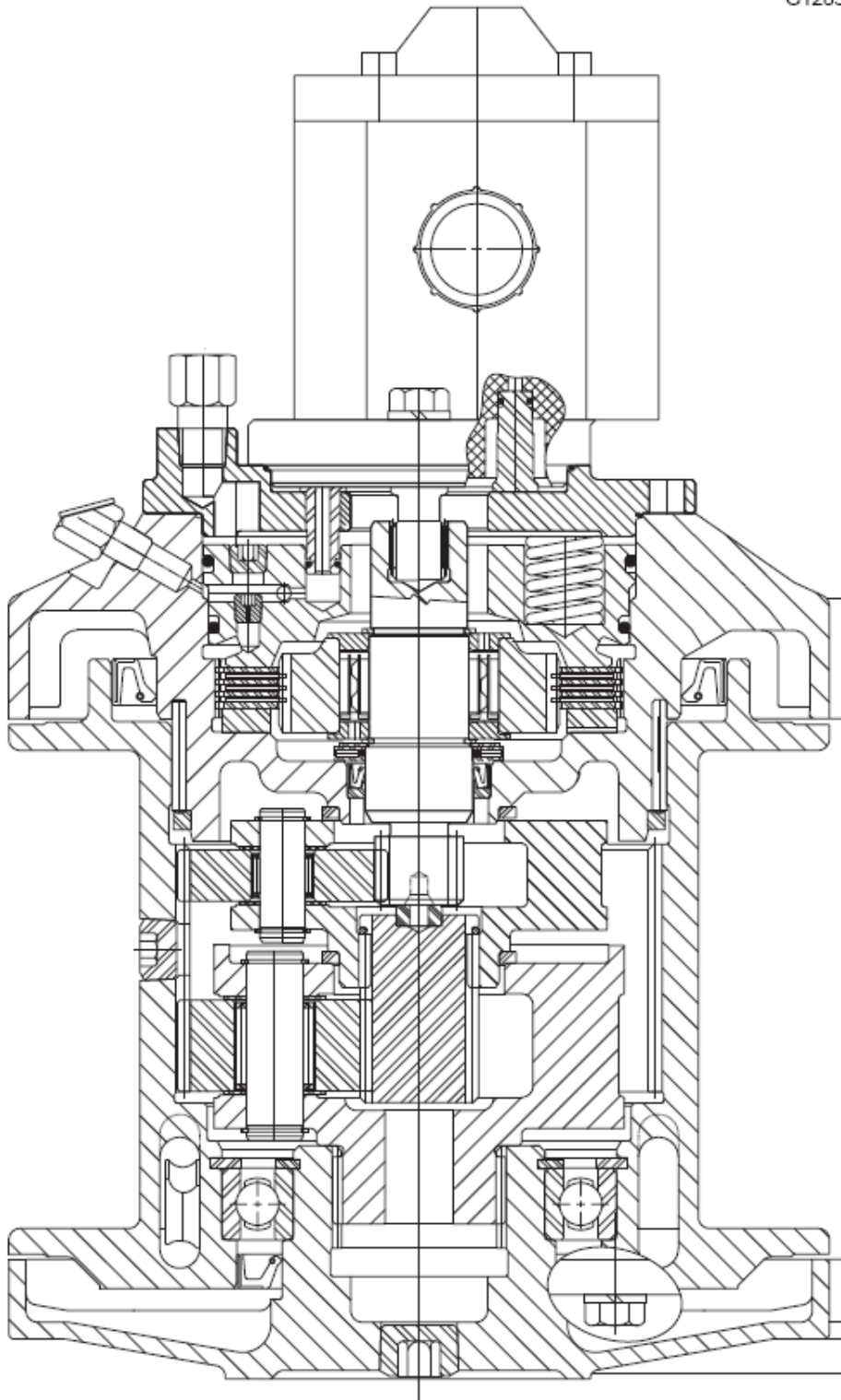
# INSTALLATION DIMENSIONS

11121



# ASSEMBLY DRAWING

G1285 & G1146



# PARTS REFERENCE - DRUM GROUP

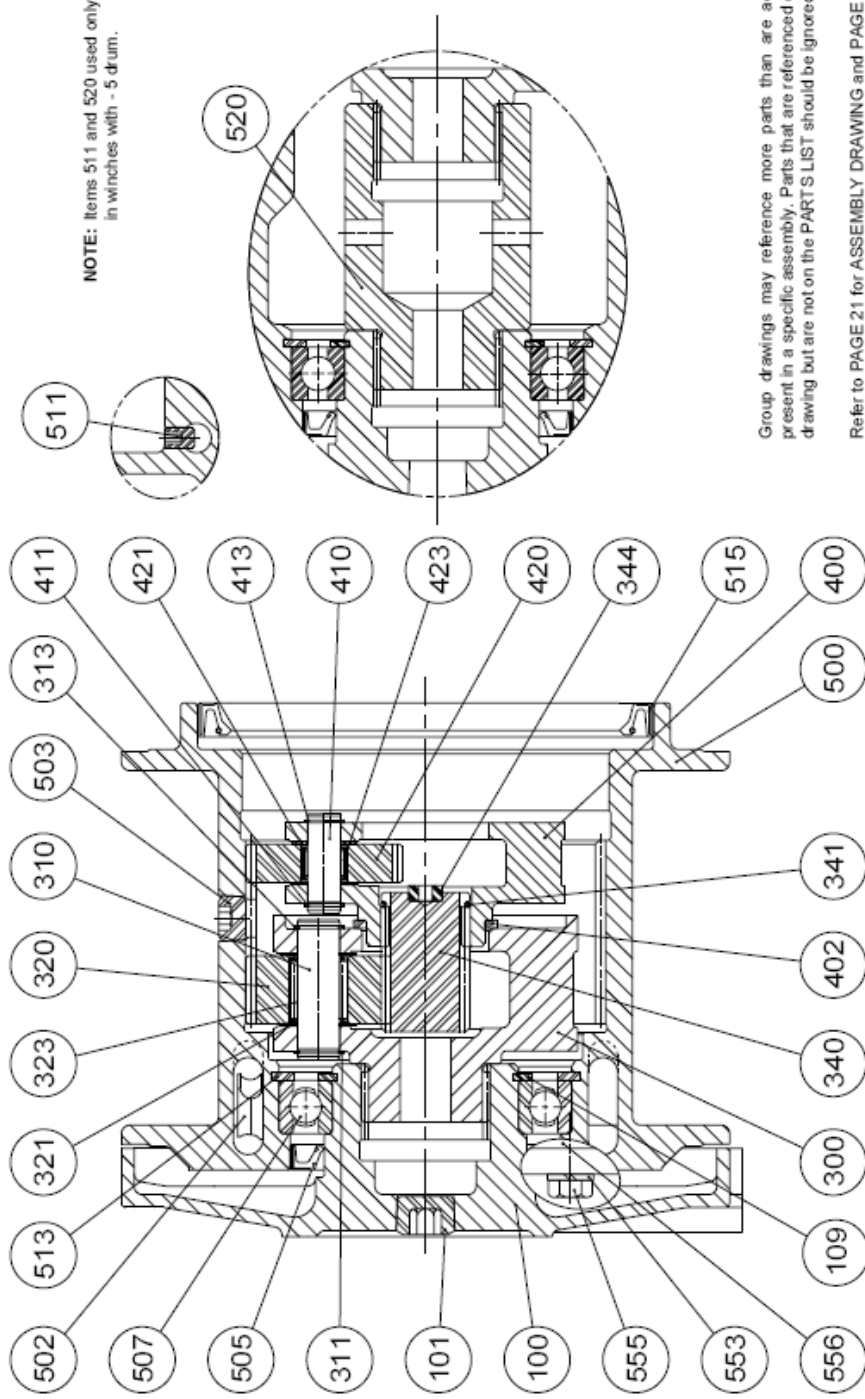
ITEM NO	QTY.	PART NO.**	DESCRIPTION
100	1	20701	END HOUSING
101	1	25032	PIPE PLUG 1/2 - 14 NPT
109	1	25012	CIRCLIP ROTOR CLIP SH-275
300	1	20703	PLANET HUB
310	3	20080	PLANET PIN
311	3	25080	CIRCLIP ROTOR CLIP C-82
313	3	25119	CIRCLIP ROTOR CLIP SH-82
320	3	20708	PLANET GEAR
321	6	25084	THRUST WASHER TORRINGTON # TRA 1018
323	3	25289	NEEDLE BEARING TORRINGTON #BH1016
340	1	20709	SUNGEAR
341	1	25527	CIRCLIP ANDERTON # A1000 - 0125
344	1	20713	SUNGEAR STOPPER
400	1	*	PLANET HUB
402	1	20712	PLANET HUB STOPPER
410	3	20710	PLANET PIN
411	3	25525	CIRCLIP ROTOR CLIP SH-50
413	3	25525	CIRCLIP ROTOR CLIP SH-50
420	3	*	PLANET GEAR
421	6	25524	THRUST WASHER TORRINGTON # TRA 815
423	3	25523	NEEDLE BEARING TORRINGTON # B88
500	1	*	CABLE DRUM
502	1	*	CABLE ANCHOR
503	1	25085	PIPE PLUG 3/8 - 18 NPT
506	1	25008	OIL SEAL
507	1	25007	BALL BEARING # 8014
511	2	*	SET SCREW 5/16 - 18 NC X .43
513	1	25008	CIRCLIP ROTOR CLIP HO-433
515	1	25151	OIL SEAL
520	1	*	COUPLING
553	8	25037	LOCKWASHER 3/8"
555	8	25284	CAPSCREW HEX HEAD 3/8 - 18NC X 1.00 GRADE 5
558	2	*	TIE BAR

\* These parts vary.  
Refer to APPENDIX B.  
\*\* Effective Serial # 46884.

# DRUM GROUP

Design Revision 'B' - Effective from Serial # 46684

G1146



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 LIST should be ignored.

Refer to PAGE 21 for ASSEMBLY DRAWING and PAGE 25 for winch seal kit.



# PARTS REFERENCE - BRAKE GROUP

ITEM NO.	QTY.	PART NO. **	DESCRIPTION
440	1	****	SUNGEAR
700	1	*	BRAKE HOUSING (INCLUDES ITEMS 701 AND 702)
701	106	25270	LOOSE ROLLER 5/32 X 1.25 TOR. #E151-Q (INCLUDED IN ITEM 700)
702	1	20717	NEEDLE RETAINER (INCLUDED IN ITEM 700)
704	1	20712	PLANET HUB STOPPER
707	1	25275	O-RING -048 4 3/4" ID 1/16" CS
708	1	*	CHECK VALVE
709	1	*	PLASTIC CAPPLUG 1/8 NPT
710	1	20714	BACK UP WASHER FOR OIL SEAL #25278
711	1	25278	*** OIL SEAL
712	1	20107	BRAKE SPACER
713	4	25024	DIVIDER PLATE
716	3	20034	FRICITION PLATE
719	1	25492	CIRCLIP ROTOR CLIP SH-106
720	1	22881	BRAKE HUB
722	1	20183	SPRAG CLUTCH ALIGNER
723	1	25187	SPRAG CLUTCH
724	1	20183	SPRAG CLUTCH ALIGNER
727	1	25492	CIRCLIP ROTOR CLIP SH-106
736	1	26310	THRUST WASHER TORRINGTON # TRA 1828
737	2	25483	THRUST WASHER INA # AS 3047
739	1	25537	THRUST BEARING INA # AXK 3047
750	1	*	PISTON ASSEMBLY (INCLUDES ITEMS: 754, 757 AND 759)
751	1	25528	O-RING -245 4 3/8" ID 1/8" CS, 90 DURO
752	6	20340	BRAKE SPRING
753	1	25261	O-RING -246 4 1/2" ID 1/8" CS, 90 DURO
754	1	20732	ORIFICE PLUG
757	1	25040	PIPE PLUG 1/8 - 27 NPT
759	1	*	STEEL BALL 5/32 DIA
800	1	21079	MOTOR ADAPTOR
811	1	25016	O-RING -042 3 1/4" ID 1/16" CS
830	1	20519	CONNECTING TUBE
831	3	25018	O-RING -010 1/4" ID 1/16" CS
840	1	20870	SAFETY VALVE
888	1	22962	MOTOR PLUG
931	4	25264	CAPSCREW - HEX HEAD 3/8 - 16 NC X 1.00 GRADE 5
933	4	25037	LOCKWASHER 3/8"
935	2	25264	CAPSCREW - HEX HEAD 3/8 - 16 NC X 1.00 GRADE 5
937	2	25037	LOCKWASHER 3/8"
950	1	26829	*** MOTOR
955	2	25536	PLASTIC CAPPLUG 1.0625" -12 THREADED
		23111	WINCH SEAL KIT, CONSISTS OF ITEMS: 505, 515, 707, 710, 711, 751, 753, 811 AND 831.

\* These parts vary.  
Refer to BRAKE CODE CHART.  
\*\* Effective Serial # 48884.  
\*\*\* Do not substitute.  
Available from PULLMASTER  
or Authorized Dealer only.  
\*\*\*\* Refer to APPENDIX B.

## BRAKE CODE CHART

## BRAKE CODE

ITEM NO.	PART DESCRIPTION	PART NUMBERS				
		-12	-13	-14	-15	
708	CHECK VALVE	N/A	21530	21530	N/A	
709	1/8 NPT CAPPLUG	N/A	25374	25374	N/A	
750	PISTON ASSEMBLY	21571	21531	21531	21571	
759	5/32 DIA STEEL BALL	N/A	25533	25533	N/A	
<b>REDUCTION RATIO</b>						
700	BRAKE HOUSING	STANDARD	22464	22467	22467	22464
700	BRAKE HOUSING	'A'	22469	22470	22470	22469

# APPENDIX A

DRUM CODE	CABLE DRUM SIZES INCHES (MILLIMETERS)			WIRE ROPE STORAGE FEET (METERS)			LINE PULL AT MAXIMUM PRESSURE*		LINE SPEED AT MAXIMUM VOLUME*		LUBRICATING OIL VOLUME REQUIRED  U.S. GALLONS (LITERS)
	BARREL	FLANGE	LENGTH	3/8 INCH	5/16 INCH	1/4 INCH	BARE DRUM	FULL DRUM	BARE DRUM	FULL DRUM	

### STANDARD REDUCTION RATIO

-1	6.13 (156)	9.0 (229)	5.25 (133)	84 (25)	122 (37)	172 (52)	2204 (9.8)	1633 (7.3)	83 (25)	108 (33)	.13 (.5)
-5	6.13 (156)	9.0 (229)	10.81 (275)	172 (53)	251 (76)	354 (108)	2204 (9.8)	1633 (7.3)	83 (25)	108 (33)	.27 (1.0)

### 'A' REDUCTION RATIO

-1	6.13 (156)	9.0 (229)	5.25 (133)	84 (25)	122 (37)	172 (52)	1285 (5.7)	952 (4.2)	142 (43)	189 (58)	.13 (.5)
-5	6.13 (156)	9.0 (229)	10.81 (275)	172 (53)	251 (76)	354 (108)	1285 (5.7)	952 (4.2)	142 (43)	189 (58)	.27 (1.0)

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

# APPENDIX B

## ITEM NUMBERS

400	420	440	500	502	511	520	556
-----	-----	-----	-----	-----	-----	-----	-----

## PART DESCRIPTION

<i>PRIMARY</i>			CABLE DRUM	CABLE ANCHOR	SET SCREW	COUPLING	TIE BAR
PLANET HUB	PLANET GEAR	SUNGEAR					

DRUM  
CODE

## STANDARD REDUCTION RATIO

PART NUMBERS

-1	20705	20707	22896	21830	21882	-	-	20706
-5	20705	20707	22896	22227	-	25526	21620	21621

DRUM  
CODE

## 'A' REDUCTION RATIO

PART NUMBERS

-1	20912	20911	22912	21830	21882	-	-	20706
-5	20912	20911	22912	22227	-	25526	21620	21621



# 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.

## Installation and Maintenance Instructions for Slewing Rings

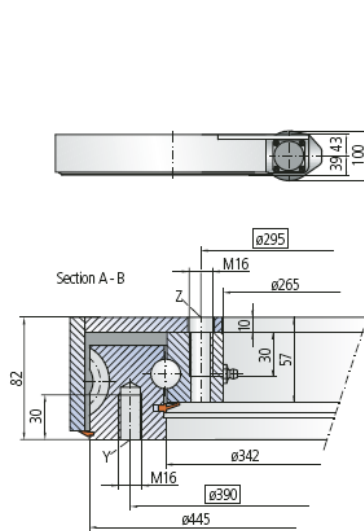


**EW DV**  
Rev. 6.02

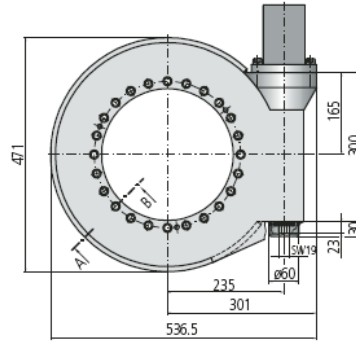


# WD-L Series

## Size 0343 / single row



Note, mounting face against upper surface shall be within the limits of 343 and 349



### Mounting holes

Y = 18 Holes M16-30 deep, equally spaced  
Z = 24 Holes 18-10 deep / M16-30 deep, equally spaced

### Lubrication ports

2 Taper type grease nipples on the internal diameter  
2 Taper type grease nipples on the outside of the housing  
Slew Drive supplied pre-lubricated

### Limiting load diagram for 'compressive' load

Drawing reference number WD-L 0343/3-04557			
Module	m	[mm]	5
Number of starts of the worm		[-]	1
Gear ratio	i	[-]	86
Self-locking gears			no**
Maximum torque $SF_5 = 1$	$M_{d \max}$	[Nm]	12905
Nom. torque $SF = 1$ at $n = 1$ rpm	$M_{d \text{ nom}}$	[Nm]	10150
Maximum holding torque*	$M_h$	[Nm]	12905
Static load rating, radial	$C_{o \text{ rad}}$	[kN]	338
Static load rating, axial	$C_{o \text{ ax}}$	[kN]	905
Dynamic load rating, radial	$C_{\text{rad}}$	[kN]	157
Dynamic load rating, axial	$C_{\text{ax}}$	[kN]	183
Weight		[kg]	72

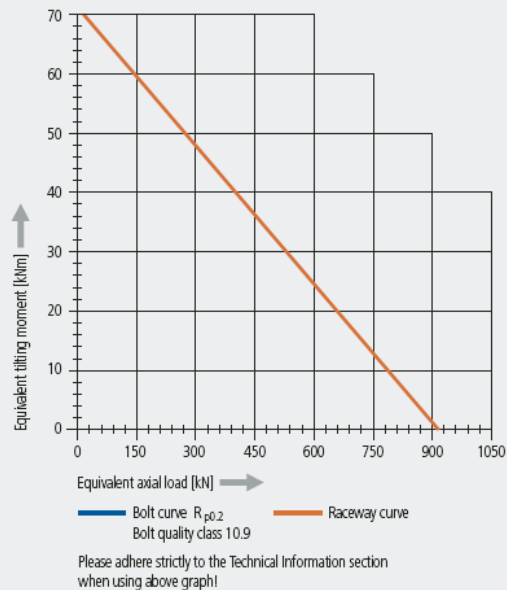
\*Optional with brake

\*\*Self-locking with mounted permanent brake or with mounted hydraulic motor and oil return stop

The selection of the hydraulic / electric motor depends on actual customer requirements and specifications.

Selection example: performance data with hydraulic motor H-160

Pressure differential	$\Delta p$	[bar]	145
Oil flow	Q	[l/min]	18
Output speed	n	[rpm]	1
Maximum achievable torque	$M_d$	[Nm]	12905



## Installation and Maintenance Instructions for Slewing Rings (EW DV Rev. 6.02)

### Preface

The following instructions give you all the information you need to be able to correctly install and maintain an IMO Slewing Ring.

All instructions are provided with a revision number. Installation and Maintenance Instructions with preceding revision numbers are invalid. The latest version is published on our homepage and can be downloaded from there in numerous languages ([www.griimo.com](http://www.griimo.com)). Please always check that you are working with the latest revision!

These instructions shall be attached to your product or to the final product or to the installation and Maintenance Instructions. All work steps listed here are to be executed by suitably qualified personnel. Please do not hesitate to contact our Engineering Department for any further assistance.

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Please do not hesitate to contact our Engineering Department for any further assistance.

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Only the German version is legally binding.

IMO accepts no liability for:

1. Non-compliance with Installation and Maintenance Instructions.
2. Failure to pass on content to third party.

### Notice

The following text includes special notices and procedures that shall be observed. The technical properties of Slewing Rings are to be found in our product catalogue or in the technical offer.

### Contents

0. Transport, handling and storage provisions
  - 0.1 Transport, handling and storage
    - 0.1.1 Transport, handling and storage
1. Installation
  - 1.1 Preparation for installation
    - 1.1.1 Cleaning the Slewing Ring and the mounting structure
    - 1.1.2 Determining permissible deviations and deformations of mounting structure
    - 1.1.3 Lubricating of the Slewing Ring
    - 1.1.4 Choice of mounting bolts
    - 1.1.5 Choice of tightening torques
    - 1.1.6 Tightening the bolts with a hydraulic tightening device
  - 1.2 Installing the Slewing Ring
    - 1.2.1 Positioning the Slewing Ring
    - 1.2.2 Securing the Slewing Ring with bolts
    - 1.2.3 Determining the existing tilting clearance
    - 1.2.4 Setting the backlash
    - 1.2.5 Operating test
2. Maintenance / safety checks and lubrication
  - 2.1 Checking the mounting bolts
  - 2.2 Checking the tilting clearance
  - 2.3 Relubrication
  - 2.4 Relubrication intervals
  - 2.5 Lubricants
  - 2.6 Dismantling the bearing

### 0. Transport, handling and storage provisions

#### 0.1 Transport, handling and storage

Transport only in horizontal position. Impacts shall be avoided.

Wear work gloves when handling the Slewing Rings. Slewing rings are generally provided with threaded holes in which eye-bolts can be fixed. This enables safe handling on a hoisting device. Please observe the relevant legal regulations when doing this.

Slewing Rings must be transported with the hoisting device connected to three uniformly distributed lifting points around the perimeter. Internal factory transport and installation shall only take place in a horizontal position. Transport crosses must be left in the Slewing Ring until it is properly installed.

Store only in horizontal position in closed rooms. If stacked there must be a stable intermediate layer. The corrosion protection coating has a shelf-life of approx. 3 months in closed packaging. Longer storage periods require special protective measures. If in doubt, please contact IMO.

#### 1. Installation

##### 1.1 Preparation for installation

##### 1.1.1 Cleaning the Slewing Ring and the mounting structure

1. Remove extraneous material from supporting surfaces (including paint residues, welding beads, burr formation).
2. Clear corrosion protection coating from supporting surfaces of the Slewing Ring.

In doing this, ensure that:

- Clearing material does not penetrate into the Slewing Ring.
- Applicable provisions are observed (e.g. manufacturer's provisions, protection of workers, environmental protection etc.).
- Clearing material that attacks the sealing material is not used.

Applicable cleaning materials:

- Cold solvents (e.g. white spirit, diesel oil, Kaltryl KEV).

##### 1.1.2 Determining permissible flatness deviation $\Delta_p$ perpendicularity deviation $\Delta_w$ and permissible deformation $\Delta_d$ of the mounting surface of the supporting structure

Table 1: Permissible flatness and perpendicularity deviations for standard Slewing Rings  
Use the values of Roller Slewing Rings for preloaded Ball Slewing Rings

Roller Slewing Rings	250	500	750	1000	1250
Flatness perpendicularity deviation per supporting surface (mm)	0.08	0.10	0.13	0.15	0.18
Perpendicularity deviation per supporting surface (mm)	0.06	0.08	0.09	0.10	0.11
Ball Slewing Rings	1500	1750	2000	2500	3000
Flatness perpendicularity deviation per supporting surface (mm)	0.10	0.13	0.15	0.17	0.20
Perpendicularity deviation per supporting surface (mm)	0.08	0.10	0.11	0.12	0.13
Preloaded Ball Slewing Rings	3500	4000	4500	5000	5500
Flatness perpendicularity deviation per supporting surface (mm)	0.40	0.45	0.50	0.55	0.60
Perpendicularity deviation per supporting surface (mm)	0.23	0.25	0.26	0.30	0.33

Table 2: Permissible deformation of mounting structure under maximum load for standard Slewing Rings

Roller Slewing Rings	250	500	750	1000	1250
Flatness perpendicularity deviation per supporting surface (mm)	0.71	0.27	0.35	0.40	0.46
Perpendicularity deviation per supporting surface (mm)	0.16	0.21	0.24	0.27	0.29
Ball Slewing Rings	1500	1750	2000	2500	3000
Flatness perpendicularity deviation per supporting surface (mm)	0.50	0.61	0.67	0.80	0.93
Perpendicularity deviation per supporting surface (mm)	0.25	0.27	0.40	0.45	0.48
Preloaded Ball Slewing Rings	3500	4000	4500	5000	5500
Flatness perpendicularity deviation per supporting surface (mm)	1.06	1.20	1.33	1.46	1.59
Perpendicularity deviation per supporting surface (mm)	0.60	0.66	0.73	0.79	0.86

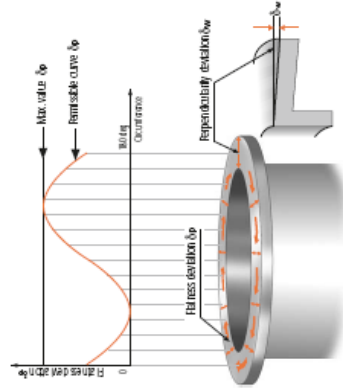
For Slewing Rings between the specified sizes the closest smaller value shall be taken. For Slewing Rings larger than the largest diameter, the value for the largest diameter given shall be used. The size of the raceway diameter  $D_r$  can be taken from our identity number.



Permissible perpendicularity deviation  $\Delta_w$  (tilting) is based on the actual flange width and may only amount to one half of the values in Table 1.

The maximum residual value for flatness deviation  $\Delta_p$  (waviness) along the circumference may total to only once per 180 deg. The form must resemble a sine curve that gradually rises and falls.

Sketch: Nominal curve of flatness deviation of the mounting structure and flatness and perpendicularity deviations on the mounting structure



Installation and Maintenance Instructions for Slewing Rings (EW DV Rev. 6.02)

1.1.3 Lubricating the Slewing Ring

Slewing Rings are supplied fully lubricated. They shall be greased again prior to initial operation. It is essential to use the greases specified on the delivery drawing. Suitable grease types for normal cases are listed on Table 9.

- **!** Inject grease into all grease nipples one after the other, while rotating the Slewing Ring, until a bead of grease forms at least on one sealing lip.

1.1.4 Choice of mounting bolts

Prescribed sizes, number and quality grades shall be used

- Grip ratio (grip length to diameter of bolt) shall be observed from minimum  $s=5$  to maximum  $s=10$ .
- The function and lifespan as well as the durability of the bolt connection are affected in the case of non-compliance.
- If the permissible interfacial pressure is exceeded, use suitable washers of appropriate size and strength.
- Do not reuse bolts, nuts and washers.

Table 3: Permissible interfacial pressure for different materials

Material	Max. surface pressure in MPa
S50 / C60 / A2-70 / A2-70 / A2-70	420
A6-38 / A3-20 / A3-20	700

1.1.5 Choice of tightening torques

Mounting bolts are in normal cases adequately secured by correct preloading.

- Mounting bolts can be secured by Loctite. Nord-Lock boltlock washers may be necessary in case of shock or vibration.
- Use of split rings, split washers etc. is not permissible.
- If washers are used ensure that they are of the correct strength class.

Table 4: Tightening torque and bolt tension forces for regular metric threads according to DIN13

Mounting bolt diameter	Bolt cross-section A <sub>1</sub> [mm <sup>2</sup> ]	Concession A <sub>2</sub> [mm <sup>2</sup> ]	Tightening torque M <sub>0.2</sub> [Nm]	Max. surface pressure p <sub>0.2</sub> [N/mm <sup>2</sup> ]	Mounting bolt pre-load F <sub>0.2</sub> [kN]	Permissible tilting strength F <sub>0.2</sub> [kN]		
M4	8.23	7.75	2.25	3.31	3.07	0.8	10.9	12.9
M5	14.2	12.7	4.61	6.71	7.02	6.05	15.6	18.6
M6	20.1	17.9	7.80	11.5	11.4	9.25	23.7	28.1
M8	35.6	31.8	19.1	28.0	29.2	17.5	55.3	65.5
M10	58.0	52.3	38.0	58.8	63.3	27.3	90.2	107.0
M12	84.3	76.2	65.5	97.7	114	39.9	125.5	148.5
M14	115	105	107	156	165	54.7	180.4	214
M16	157	144	168	246	258	75.3	241	287
M18	192	175	209	326	344	91.6	284	341
M20	246	225	274	420	442	118	361	430
M22	309	282	350	520	547	147	450	537
M24	385	354	435	660	692	187	569	676
M27	493	457	561	840	882	239	729	873
M30	639	593	714	1070	1120	306	944	1120
M36	910	854	1000	1470	1530	420	1280	1520
M42	1230	1160	1330	1960	2030	560	1710	2030
M48	1610	1520	1720	2580	2660	740	2280	2730
M56	2100	1990	2210	3450	3550	990	3010	3600
M64	2730	2600	2820	4500	4620	1310	3940	4710
M72	3420	3270	3510	5750	5880	1720	5040	6030
M80	4290	4110	4350	7250	7390	2240	6340	7610
M90	5370	5160	5430	9150	9300	2900	8000	9600

<sup>1)</sup> M<sub>0.2</sub> according to DIN 9139 table 23.01 (reference 2.06) (M<sub>0.2</sub> = 0.0846F<sub>0.2</sub>)  
<sup>2)</sup> F<sub>0.2</sub> according to DIN 9139 table 23.01 (reference 2.03) (F<sub>0.2</sub> = 0.12)

1.1.6 Tightening the bolts with a hydraulic tightening device

We recommend the use of a hydraulic tightening device for mounting bolts a above M30.

Table 5: Bolt tension forces for using a hydraulic tightening device on regular metric threads according to DIN 13.

Mounting bolt diameter	Tension concession A <sub>1</sub> [mm <sup>2</sup> ]	Concession A <sub>2</sub> [mm <sup>2</sup> ]	Mounting bolt pre-load F <sub>0.2</sub> [kN]	Permissible tilting strength F <sub>0.2</sub> [kN]	
M24	35.3	32.4	191	242	328
M27	45.9	42.7	252	320	422
M30	56.1	51.9	314	446	515
M33	69.4	64.7	389	554	637
M36	81.7	76.9	458	653	750
M39	95.9	91.3	547	780	896
M42	121	115.5	679	885	1029
M45	136	128	753	983	1159
M48	163	157	876	1177	1372
M52	198	188	1058	1405	1641
M56	240	229	1298	1718	2004
M60	282	270	1555	1957	2285
M64	326	313	1831	2228	2617
M68	385	370	2134	2611	3041

<sup>1)</sup> F<sub>0.2</sub> for hydraulic tightening device with pre-load of 5% of load limit

1.2 Installing the Slewing Ring

1.2.1 Positioning the Slewing Ring

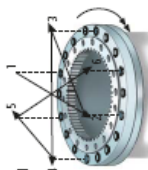
1. Determine the main-load-carrying zone.
2. For all Slewing Rings the soft spot of the Slewing Ring raceway shall be placed at a 90 deg point to the maximum load zone. The soft spot is designated with a filling plug or a punched "S" mark.
3. With a gauge, check whether the supporting surface of the Slewing Rings is fully supported by the mounting structure.

1.2.2 Securing the Slewing Ring with bolts

The Slewing Ring shall be mounted in the unloaded condition. First the toothless bearing rings is attached and then the gear bearing ring.

- The following procedure shall be followed in order to avoid deviations between the bolt tightening forces.

1. Lightly lubricate bolt threads in order to ensure uniform frictional resistance does not apply to bolt locking devices with adhesives.
2. Preload the bolts, including washers, if required, in 3 steps with 30%, 80%, 100% of the tightening torque or the hydraulically applied pre-tension force.
3. Thereby rotate the unbolted ring several times. Repeat the procedure for the bearing ring which has not yet been bolted.

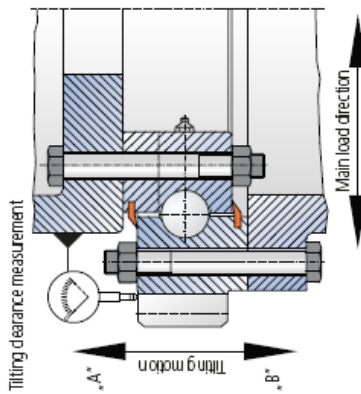


When applying a hydraulic fastening device, the tightening forces for preloading shall not exceed 90% of yield stress. The values given in Table 5 correspond with 85% of yield stress.

1.2.3 Determining the existing tilting clearance

- **!** The tilting clearance increases with raceway wear. To determine the increase in tilting clearance, it is necessary to take basic measurements after installation prior to putting the Slewing Ring into operation for the first time.
- Permanently designate the measuring point in the main load direction.
- Record all measured values.

Procedure



1. Determine and mark the measuring point, if possible in the main load direction, on all bearing rings.
2. Attach the dial gauge – see sketch.
3. Apply the defined filling torque, minimum 50% of the maximum operational load in "A" direction.
4. Set the dial gauge to zero.
5. Apply the defined filling torque, minimum 50% of the maximum operational load in "B" direction.
6. The measured value displayed corresponds to the tilting clearance and serves as a basis for comparison for later inspections.

- All subsequent measurements are performed at the same measuring point, with the same load, at the same position of the bearing rings relative to one another and in the same sequence.
- All the measured values are to be recorded.
- For purely axial or radial loads, tilting clearance is inspected by applying an additional tilting load.

1.2.4 Setting the backlash



In the case of geared Slewing Rings the backlash shall be set during the mounting procedure. The narrowest point of the gearing is marked in green for this purpose.

The set value is:  $b_r = 0.03$  to  $0.04 \times m$



A gauge shall be used to measure the backlash. If deviations from the specified values are established the axis spacing shall be corrected by moving the pinion. Afterwards the Slewing Ring shall be rotated by one complete turn making sure that no narrow points occur.

Table 6: Permissible backlash

Module in mm	4	5	6	8	10
Permissible backlash in mm	0.12-0.16	0.15-0.20	0.18-0.24	0.24-0.32	0.30-0.40
Module in mm	12	14	16	18	20
Permissible backlash in mm	0.36-0.48	0.42-0.56	0.48-0.64	0.54-0.72	0.60-0.80
Module in mm	22	24	25	26	30
Permissible backlash in mm	0.66-0.88	0.72-0.96	0.75-1.00	0.84-1.12	0.90-1.20

1.2.5 Operating test

If the mounting bolts are properly tightened, then the Slewing Ring shall rotate uniformly. Deviations of the mounting structure and the effect of external loads can strongly impact the friction torque.

1. Rotate the mounted Slewing Ring several times.
2. Check whether the Slewing Ring runs smoothly without jumping.
3. Perform further test runs under full load.

After the operating test, recheck the tightening torques of the mounting bolts.

Installation and Maintenance Instructions for Slewing Rings (EW DV Rev. 6.02)

2. Maintenance / safety checks and lubrication

2.1 Checking mounting bolts

To compensate for possible settling, it is necessary to retighten the bolts to the prescribed torque. This shall be done after no more than 100 hours of operation and without external load applied to the bolt connection.

The inspection shall be repeated after every 700 hours in operation or at least every 6 months. The inspection period shall be reduced under special operating conditions. In case of loose bolts, nuts and washers, replace all bolts, nuts and washers with new ones.

2.2 Checking the tilting clearance

Raceway wear leads to increased tilting clearance. It is therefore necessary to check the tilting clearance after 700 operating hours, or at the latest after 6 months.

Checking the increase in tilting clearance  $k_t$  directly on the Slewing Ring

For the procedure to check increase in the tilting clearance,

The value  $m_1$  determined after installation of the Slewing Ring is considered as the base value and is deducted from the measured value  $m_2$ . The difference between  $m_2$  and  $m_1$  may not exceed 0,05 mm.

$$k_t = m_2 - m_1 \leq k_t \text{ perm}$$

$k_t \text{ perm}$  = according to Table 7

Checking the increase in tilting clearance  $k_t$  not directly on Slewing Ring

The increase in tilting clearances is to be converted proportionally for each measurement (after the installation measurement) and compared with  $k_t$  permissible.

For both checks:

- Reduce the inspection intervals to 200 operating hours if the measured increase in tilting clearance amounts to approx. 75% of the maximum permissible increase in tilting clearance.
- Reduce the inspection intervals once again after further increase in tilting clearance (to 50 – 100 operating hours).
- Replace the Slewing Ring if the maximum permissible increase in tilting clearance is reached.

The limits for  $k_t$  permissible are given in the following table at which the Slewing Ring must always be exchanged.

Table 7: Supporting clearance

Rolling element diameter (mm)	12	16	20	25	32	40
Ball supporting clearance $k_{t1}$ (mm)	1,02	1,16	1,30	1,46	1,72	2,00
Roller supporting clearance $k_{t2}$ (mm)	0,18	0,25	0,32	0,40	0,52	0,65
Rolling element diameter (mm)	45	50	60	70	80	100
Ball supporting clearance $k_{t1}$ (mm)	2,18	2,35	2,70	3,05	3,40	4,10
Roller supporting clearance $k_{t2}$ (mm)	0,24	0,32	0,39	0,46	0,53	0,67

2.3 Relubrication of Slewing Ring

Grease types specified in the delivery drawing shall be used. Substitute lubricants which can be mixed together can be found in Tables 9 & 10.

Legal and manufacturer provisions about handling the respective lubricants must be observed.

2.3.1 Raceway system

1. Inject grease into all cleaned grease nipples one after the other while rotating the Slewing Ring, until a bead of fresh grease forms at least on one sealing lip or at the bearing gap.
2. Ensure that old grease can flow out of the Slewing Ring freely.
3. If possible continue to rotate the Slewing Ring.

2.3.2 Gear

1. Apply grease to the teeth of the Slewing Ring with a clean brush. Instead of a brush, the grease can also be sprayed on, or applied by means of a suitable lubricating device (e.g., a lubricating phion).
2. Remove excess and used grease. Adhesive lubricants have proved to be particularly effective in open gearing.

2.4 Relubrication intervals

Relubrication intervals depend mainly on the prevailing operating and environmental conditions as well as the position of the Slewing Ring. Exact lubrication intervals can only be determined by tests under operating conditions. In case no comparative results are available, the following table can be used for reference values.

Table 8: Lubricating intervals

Work conditions	Lubrication intervals
Operational workshop/lubricates/ repair, etc.)	approx. every 200 operating hours, or once every 6 months
Without continuous open ground (crane / ballroom, etc.)	every 1000/2000 operating hours or once every 2 months
Aggressive conditions: solvent/ AWC, make very dry, environment / more than 70 operating hours per week	every 500 operating hours or once every 2 months
Extreme conditions (mineral / synthetic / water / turbines)	Continuous lubricability-central lubrication system or lubricator

The specified values given are valid for the following conditions:

- Operating temperature on Slewing Ring in the range from -25°C to 70°C
- Circumferential velocity in the permissible ranges
- Low to medium loads

The table can never replace values established through experience; the most frequent cause of failure of Slewing Rings is insufficient lubrication!

Slewing Rings shall generally be relubricated:

- after every cleaning, e.g. spraying off with water, washing system etc, before and after long inactive periods, e.g. for cranes and construction machines during winter months.

Cleaning the Slewing Ring with a steam jet or high-pressure cleaner is not permissible!

2.5 Lubricants

Lubricants for the raceway system

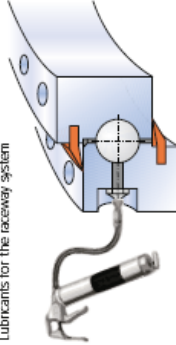


Table 9: Lubricants for the raceway

Supplier	Product name	Applicable temperature range
Aral	Araslip 2	-30°C to +120°C
Rechem	High-Load EP	-20°C to +120°C
BP	EnergySaver EP2	-20°C to +120°C
BP	Spindel 2	-30°C to +120°C
Indumol	Indumol SHC 160	-30°C to +130°C
Klüber	Conceptor 2 EP	-20°C to +120°C
Renus	Rollith MDP 2	-30°C to +120°C
Stal	Aluma EP 112	-25°C to +120°C

Lubricants for the gear



Table 10: Lubricants for the gear

Supplier	Product name	Applicable temperature range
Aral	Araslip EP 1	-20°C to +120°C
Rechem	Rechem CA 100	-20°C to +120°C
BP	Energy WNL	-20°C to +120°C
BP	Carbil 23	-19°C to +120°C
Indumol	Indumol S1	-20°C to +120°C
Klüber	Klüber CA 90	-20°C to +120°C
Renus	Rollith AUS 0	-20°C to +120°C
Stal	Araslip Grease 14	-54°C to +93°C
Stal	Araslip Compa 200E	-40°C to +120°C

2.6 Checking the seals

Within the course of maintenance work it is also essential to check the seals. Damaged seals must be exchanged. To obtain replacement seals please contact IMO and have the complete drawing number ready. The replacement seals can be cut to the required length and installed with simple tools.

2.7 Dismantling the bearing

If it is found that the limits of filling clearance have been exceeded during an inspection according to 2.2, the Slewing Ring must be exchanged. It is thereby necessary to proceed in the general sense in the reverse order to that for installation.

Slewing Rings shall be disposed of according to the materials of the individual components and are not taken back by the manufacturer. The corresponding environmental regulations shall be strictly observed during their disposal.

Rotate the bearing rings during regreasing. Follow the accident prevention regulations while doing this.



## HYDRAULIC MOTORS HP



### APPLICATION

- Conveyors
- Feeding mechanism of robots and manipulators
- Metal working machines
- Textile machines
- Machines for agriculture
- Food industries
- Grass cutting machinery etc.



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### OPTIONS

- Model- Spool valve, gerotor
- Flange mount
- Side ports
- Shafts- straight, splined and tapered
- SAE, Metric and BSPP ports
- Speed sensing
- Other special features

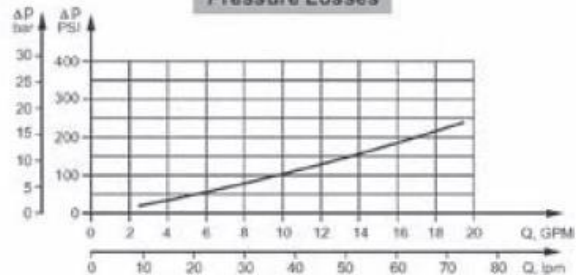
### GENERAL

Displacement,	in <sup>3</sup> /rev [cm <sup>3</sup> /rev.]	1.52+24.16 [25-396]
Max. Speed,	[RPM]	150+1600
Max. Torque,	in-lb [daNm]	290+3060 [3,3+34,6]
Max. Output,	HP [kW]	5+11.5 [3,7+8,5]
Max. Pressure Drop,	PSI [bar]	945+1815 [65+125]
Max. Oil Flow,	GPM [lpm]	10.5+16 [40+60,8]
Min. Speed,	[RPM]	10
Pressure fluid	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)	
Temperature range,	°F [°C]	-22+194 [-30+90]
Optimal Viscosity range, SUS [mm <sup>2</sup> /s]	98+347 [20+75]	
Filtration	ISO code 20/16 (Min. recommended fluid filtration of 25 micron)	

#### Oil flow in drain line

Pressure drop PSI [bar]	Viscosity SUS [mm <sup>2</sup> /s]	Oil flow in drain line GPM [lpm]
1450 [100]	98 [20]	.660 [2,5]
	164 [35]	.476 [1,8]
2030 [140]	98 [20]	.925 [3,5]
	164 [35]	.740 [2,8]

#### Pressure Losses



**SPECIFICATION DATA**

Type	HP 25	HP 32	HP 40	HP 50	HP 80	HP 100	
<b>Displacement, in.<sup>3</sup>/rev. [cm.<sup>3</sup>/rev.]</b>	1.52 [25]	1.95 [32]	2.44 [40]	3.02 [49.5]	4.83 [79.2]	6.04 [99.0]	
<b>Max. Speed, [RPM]</b>	Cont.	1600	1560	1515	1210	605	
	Int.*	1815	1720	1760	1515	755	
<b>Max. Torque in-lb [daNm]</b>	Cont.	290 [3,3]	380 [4,3]	550 [6,2]	725 [8,2]	1210 [13,7]	1500 [17,0]
	Int.*	415 [4,7]	540 [6,1]	730 [8,2]	1050 [11,9]	1725 [19,5]	2100 [23,7]
<b>Max. Output HP [kW]</b>	Cont.	6.0 [4,5]	7.8 [5,8]	11.4 [8,5]	11.7 [8,7]	11.7 [8,7]	11.9 [8,9]
	Int.*	8.2 [6,1]	10.5 [7,8]	15.5 [11,6]	18.8 [14]	19.7 [14,7]	19.4 [14,5]
<b>Max. Pressure Drop PSI [bar]</b>	Cont.	1450 [100]	1450 [100]	1750 [120]	1815 [125]	1815 [125]	1815 [125]
	Int.*	2030 [140]	2030 [140]	2250 [155]	2540 [175]	2540 [175]	2540 [175]
<b>Max. Oil Flow GPM [lpm]</b>	Cont.	10.5 [40]	13.2 [50]	16 [60,6]	16 [60,6]	16 [60,6]	16 [60,6]
	Int.*	12 [45,4]	14.5 [55]	18.5 [70]	20 [75,7]	20 [75,7]	20 [75,7]
<b>Max. Inlet Pressure PSI [bar]</b>	Cont.	2030 [140]	2030 [140]	2030 [140]	2030 [140]	2030 [140]	2030 [140]
	Int.*	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]
	Peak**	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]
<b>Max. Return Pressure without Drain Line or Max. Pressure in Drain Line, PSI [bar]</b>	Cont. 0-100 RPM	2200 [150]	2200 [150]	2200 [150]	2200 [150]	2200 [150]	2200 [150]
	Cont. 100-300 RPM	1100 [75]	1100 [75]	1100 [75]	1100 [75]	1100 [75]	1100 [75]
	Cont. 300-600 RPM	725 [50]	725 [50]	725 [50]	725 [50]	725 [50]	725 [50]
	Cont. >600 RPM	300 [20]	300 [20]	300 [20]	365 [25]	365 [25]	365 [25]
Int.* 0-max. RPM	2200 [150]	2200 [150]	2200 [150]	1800 [124]	1800 [124]	1800 [124]	
<b>Max. Return Pressure with Drain Line, PSI [bar]</b>	Cont.	2030 [140]	2030 [140]	2030 [140]	2030 [140]	2030 [140]	2030 [140]
	Int.*	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]	2540 [175]
	Peak**	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]	2900 [200]
<b>Max. Starting Pressure with Unloaded Shaft, PSI [bar]</b>	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	145 [10]	
<b>Min. Starting Torque in-lb [daNm]</b>	At max.press. drop Cont.	265 [3,0]	355 [4,0]	480 [5,4]	610 [6,9]	1040 [11,7]	1310 [14,8]
	At max.press. drop Int.*	370 [4,2]	500 [5,6]	600 [6,8]	885 [10]	1490 [16,8]	1860 [21]
<b>Min. Speed***, [RPM]</b>		20	15	10	10	10	
<b>Weight, lb [kg]</b>	HP	12.3 [5,6]	12.4 [5,6]	12.6 [5,7]	12.3 [5,6]	12.6 [5,7]	13.0 [5,9]
	HPQ				11.00 [5,0]	11.25 [5,1]	11.69 [5,3]

\* Intermittent operation: the permissible values may occur for max. 10% of every minute.

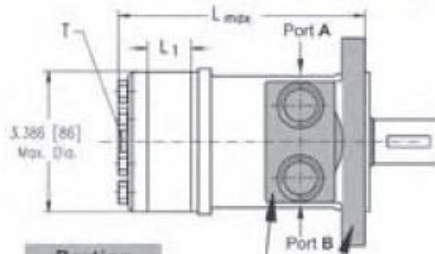
\*\* Peak load: the permissible values may occur for max. 1% of every minute.

\*\*\* For speeds of 10 RPM or lower, consult factory or your regional manager.

- Intermittent speed and intermittent pressure drop must not occur simultaneously.
- Recommended filtration is per ISO cleanliness code 20/16. A nominal filtration of 25 micron or better.
- Recommend using a premium quality, anti-wear type mineral based hydraulic oil HLP(DIN51524) or HM (ISO 6743/4). If using synthetic fluids consult the factory for alternative seal materials.
- Recommended minimum oil viscosity 70 SUS [13 mms/s] at 122°F [50°C].
- Recommended maximum system operating temperature is 180°F [82°C].
- To assure optimum motor life fill with fluid prior to loading and run at moderate load and speed for 10-15 minutes.

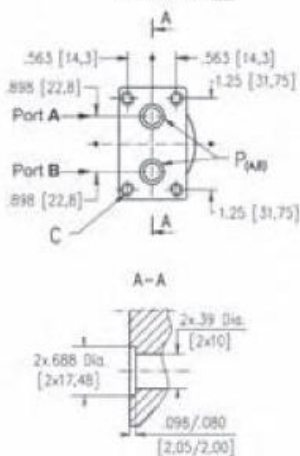


**DIMENSIONS AND MOUNTING DATA FOR HP**



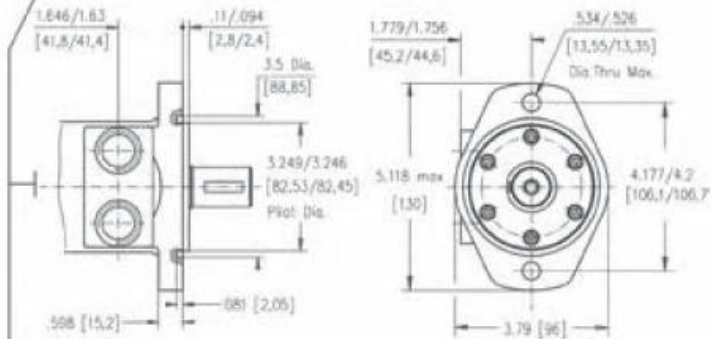
**Porting**

Side Ports  
Version 1

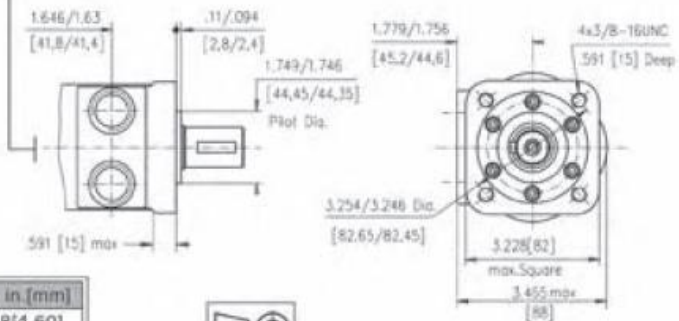


**Mounting**

SAE A Flange



Q Square Flange



**Standard Rotation**

Viewed from Shaft End  
Port A Pressurized - CW  
Port B Pressurized - CCW

**Reverse Rotation**

Viewed from Shaft End  
Port A Pressurized - CCW  
Port B Pressurized - CW

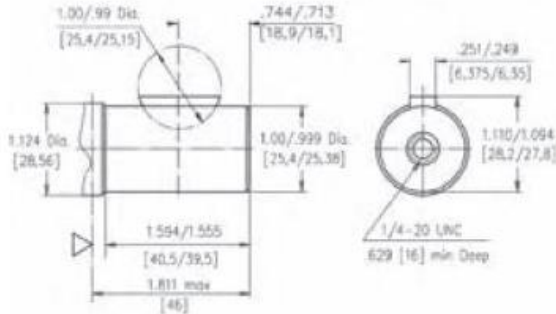
Type	L <sub>max</sub> , in. [mm]	L <sub>1</sub> , in. [mm]
HP(Q) 25	5.24 [133,1]	.18[4,60]
HP(Q) 32	5.29 [134,4]	.23[5,90]
HP(Q) 40	5.35 [135,9]	.29[7,40]
HP(Q) 50	5.32 [135,17]	.26[6,67]
HP(Q) 80	5.48 [139,17]	.42[10,67]
HP(Q) 100	5.58 [141,83]	.52[13,33]
HP(Q) 125	5.72 [145,17]	.66[16,67]
HP(Q) 160	5.90 [149,83]	.84[21,33]
HP(Q) 200	6.11 [155,17]	1.05[26,67]
HP(Q) 250	6.37 [161,83]	1.31[33,33]
HP(Q) 315	6.74 [171,17]	1.68[42,67]
HP(Q) 400	7.16 [181,83]	2.10[53,33]

Versions			
	1	4	5
<b>C</b>	4x 1/8-18UNC	-	-
<b>P<sub>max</sub></b>	2x.39 Dia. [2x10]	2x 1/4-14UNF	2xQ-14NPTF
<b>T</b>	1/4 -20UNF	1/4 -20UNF	1/4 -20UNF

**SHAFT EXTENSIONS FOR HP AND HR MOTORS**

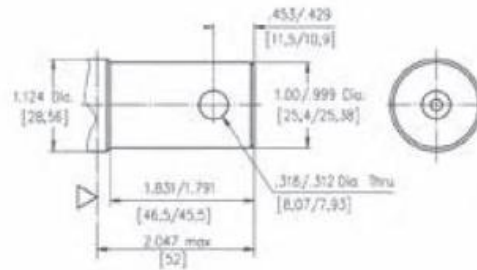
**C**

1" [25,4] straight, Woodruff key  $3/8$ "x1" SAE J502  
Max. Torque 3900 in-lb [44 daNm]



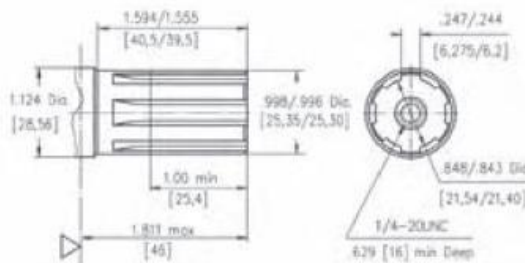
**H**

1" [25,4] straight, w/ .315 [8] Crosshole  
Max. Torque 3900 in-lb [44 daNm]



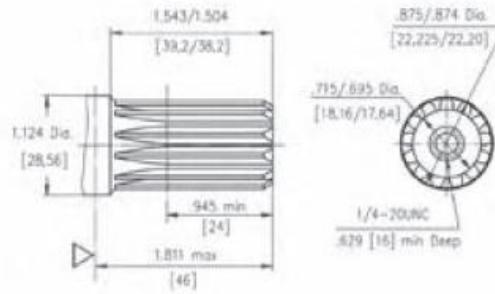
**G**

1" [25,4], SAE 6B Splined  
Max. Torque 3900 in-lb [44 daNm]



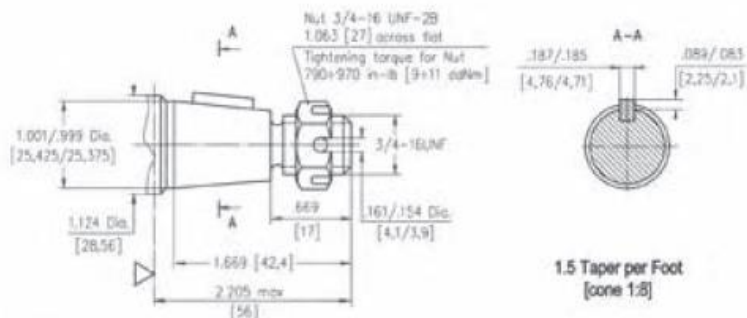
**S**

13T Splined,  $1/8$ " [22,2], ANS B 92.1-1976  
Max. Torque 3200 in-lb [38 daNm]



**I**

1" [25,4], SAE J501 Tapered  
Parallel key  $3/8$ "x $3/8$ "x $1$ "  
Max. Torque 3900 in-lb [44 daNm]

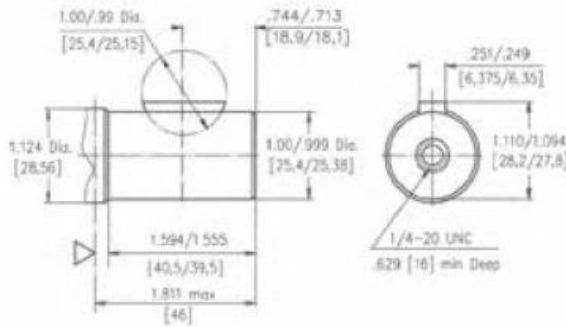


V - Motor Mounting Surface  
Requirement max. Torque must be not exceeded.

**SHAFT EXTENSIONS FOR HP AND HR MOTORS**

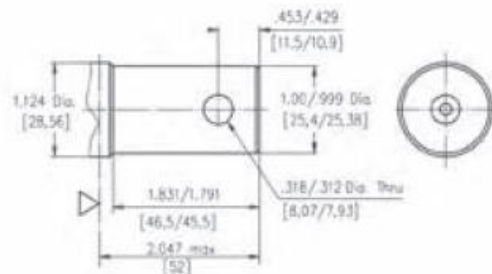
**C**

1" [25,4] straight, Woodruff key  $9^{\circ} \times 1^{\circ}$  SAE J502  
Max. Torque 3900 in-lb [44 daNm]



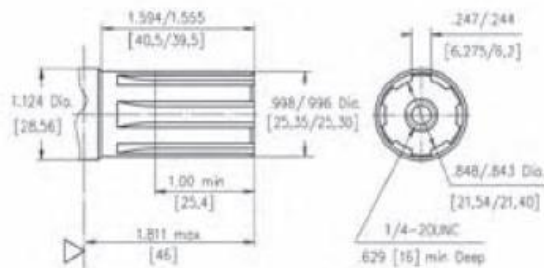
**H**

1" [25,4] straight, w/ .315 [8] Crosshole  
Max. Torque 3900 in-lb [44 daNm]



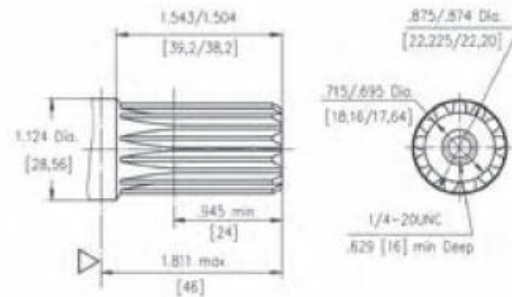
**G**

1" [25,4], SAE 6B Splined  
Max. Torque 3900 in-lb [44 daNm]



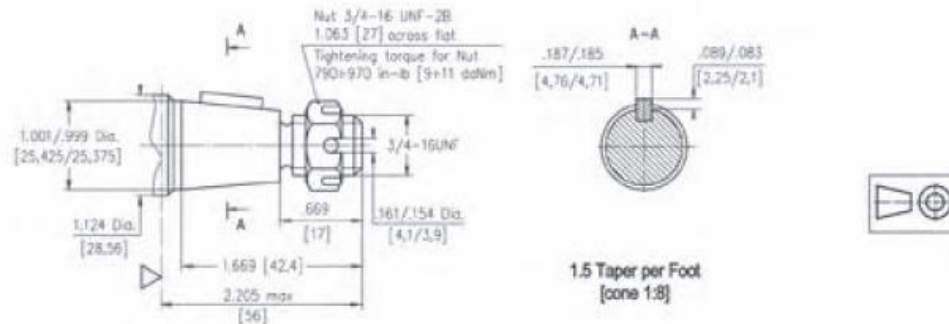
**S**

13T Splined,  $7/8^{\circ}$  [22,2], ANS B 92.1-1976  
Max. Torque 3200 in-lb [36 daNm]



**T**

1" [25,4], SAE J501 Tapered  
Parallel key  $3/4^{\circ} \times 3/4^{\circ} \times .6^{\circ}$   
Max. Torque 3900 in-lb [44 daNm]



V- Motor Mounting Surface  
Requirement max. Torque must be not exceeded.

**ORDER CODE**

	1	2	3	4	5	6	7	8	9
<b>HP</b>									

**Pos. 1 - Mounting Flange**

omit - SAE A, two holes

**Q** - Square, four bolts

**Pos. 2 - Displacement code** [performance data see pages 19/25]

<b>25</b>	- 1.52 [ 25,0] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]
<b>32</b>	- 1.95 [ 32,0] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]
<b>40</b>	- 2.44 [ 40,0] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]
<b>50</b>	- 3.02 [ 49,5] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]
<b>80</b>	- 4.83 [ 79,2] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]
<b>100</b>	- 6.04 [ 99,0] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]
<b>125</b>	- 9.66 [123,8] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]
<b>160</b>	- 9.74 [158,4] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]
<b>200</b>	- 12.10 [198,0] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]
<b>250</b>	- 15.10 [247,5] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]
<b>315</b>	- 19.30 [316,8] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]
<b>400</b>	- 24.16 [396,0] in. <sup>3</sup> /rev. [cm. <sup>3</sup> /rev.]

**Pos. 3 - Shaft Extensions\*** [see page 38]

<b>C</b>	- 1" [25,4] straight, Woodruff key
<b>G</b>	- 1" [25,4] SAE 6B Splined
<b>H</b>	- 1" [25,4] straight, w/.315 [8] Crosshole
<b>S</b>	- 7/8" [22,2] 13T Splined
<b>T</b>	- 1" [25,4] SAE J501 Tapered

**Pos. 4 - Port Size/Type** [standard manifold to each]

**1** - side ports, Manifold [5/16-18 UNC Mounting Threads], 7/16-20 UNF

**4** - side ports, 2x7/8-14 UNF, O-ring, 7/16-20 UNF

**5** - side ports, 2x1/2-14 NPTF, 7/16-20 UNF

**Pos. 5 - Speed Monitoring**

omit - none

**RS-P** - with speed sensor (PNP pull-down resistor)

**RS-N** - with speed sensor (NPN pull-up resistor)

**Pos. 6 - Special Features** [see Specification data-page 18]

omit - none

**LL** - Low Leakage

**LSV** - Low Speed Valve

**FR** - Free Running

**Pos. 7 - Rotation**

omit - Standard Rotation

**R** - Reverse Rotation

**Pos. 8 - Option [Paint]\*\***

omit - no Paint

**P** - Painted

**PC** - Corrosion Protected Paint

**Pos. 9 - Design Series**

omit - Factory specified

Notes : \* The permissible output torque for shafts must be not exceeded!

\*\* Color at customer's request.

The hydraulic motors are mangano phosphatized as standard.

## CRANE REMOVAL/INSTALLATION

### Removal

Step 1: Tag and remove the hoses.

Step 2: Attach lifting slings to the boom and rig for a level pick.

Step 3: Apply tension to the rigging and remove the swing bearing bolts which attach the bearing to the pedestal.

Step 4: Lift crane and bearing from the pedestal and place on suitable supports.

**Note:** Do not allow hydraulic swivel (if equipped) to contact the ground as damage will occur.

### Installation

Step 1a: If bedding compound was damaged during crane removal, remove all old bedding compound from both surfaces and apply new compound as described in Section 1, Crane Installation, step 1 and 2.

Step 1b: If bedding compound is intact, install the swing bearing bolts and torque to \_\_\_\_\_70\_\_\_\_\_ft-lbs. Remove the lifting slings.

Step 2: Torque the swing bearing bolts to a final value of \_\_\_\_\_183\_\_\_\_\_ft-lbs using a criss-crossing pattern.

Step 3: Install the hydraulic hoses as specified on the tags.

Step 4: Conduct hydraulic system start-up procedures from Section 1, Crane Start-Up Procedure (as applicable.)

Step 5: After approximately 50 hours of operation, recheck the swing bearing bolts for proper torque.