



**HYBRODYNAMICS**

## Hy-P Technology

PNEUMATICALLY POWERED HYDRAULICALLY  
REGULATED ACTUATION

CATALOG 8-1

Series **LO**

Basic Cylinders with Permanent Dampening

THE PRODUCTS IN THIS CATALOG ARE PROTECTED UNDER ONE OR MORE OF THE  
FOLLOWING PATENTS: US 6 481 335, US 6 606 936, US 6 675 698.



**Made in the U.S.A.**

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Effective April 2005

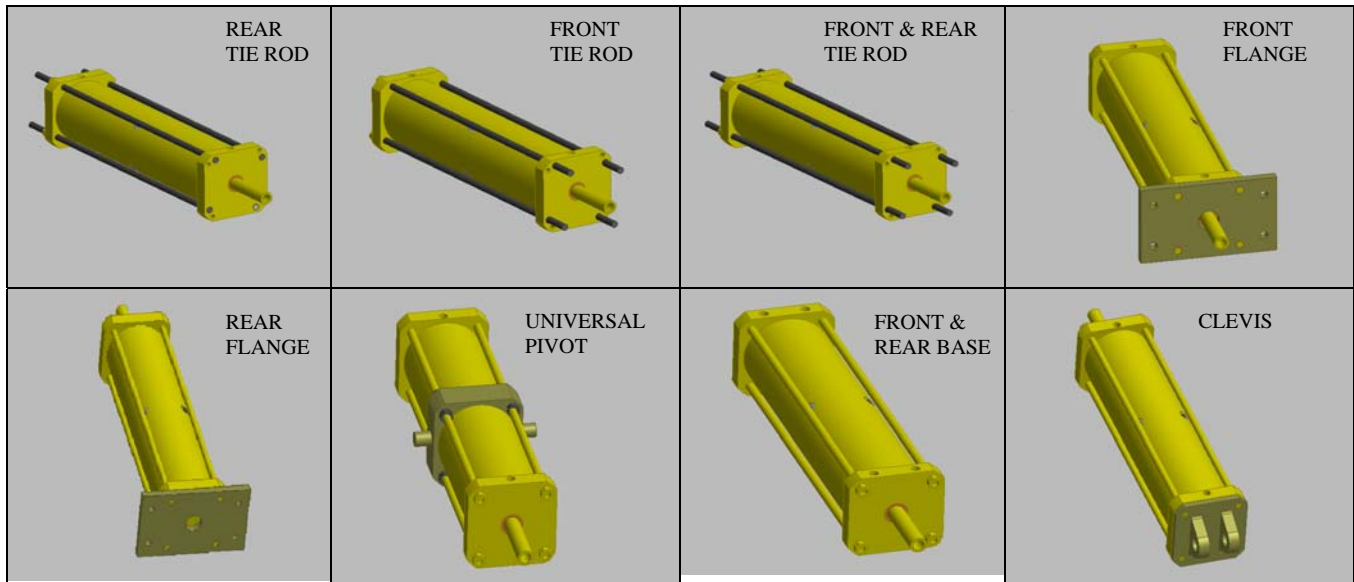
## INTRODUCTION

Hy-P actuation is a unique hybrid form of fluid powered actuation in which air powered movement is combined with self-contained hydraulic dampening. The hydraulic dampening of Hy-P actuators (cylinders in particular) is passive and arranged internally. Due to the internal arrangement of dampening, Hy-P cylinders are compact, have the geometry of conventional cylinders and are easy to integrate into conventional systems. Hy-P cylinders can be powered by any conventional source of compressed air and controlled by standard pneumatic logic components. The dampening allows: **instant stops; indefinite positioning** in any desired point between terminal positional stops; **smooth motion** free of spontaneous spring-like displacements, creeping and chatter. Beyond that, Hy-P cylinders can **operate at up to 300PSI** of pressure.

## Hy-P Cylinders Series Lo

Hy-P cylinders series **Lo** have factory-set permanent dampening rate. **Lo** cylinders are designed for pneumatic systems demanding smooth motion, multiple stops and control beyond the level that cannot be achieved with conventional air cylinders.

## Standard Mounting Options



## Standard, Customized and Custom Mounting

Standard mounting options allow practically unlimited variety of custom modifications, including modifications to the cylinders' end-caps. Consult with the factory if customized standard or custom mounting is required.

## Rod End Options

Standard rod end

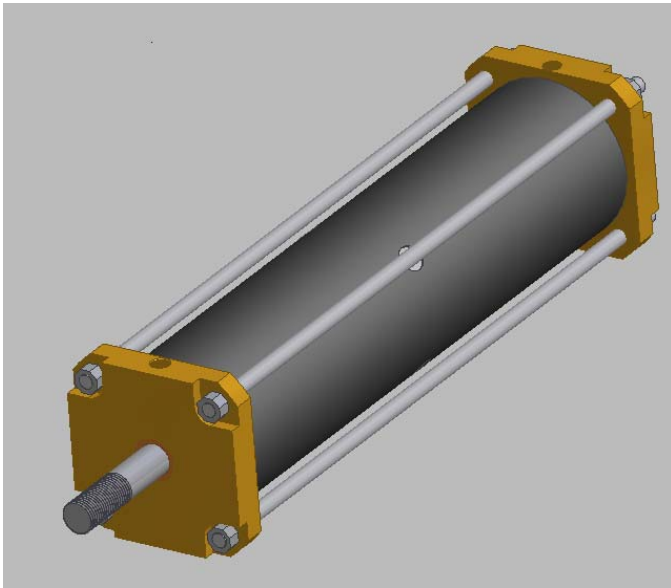


Customized rod end options



Consult the factory about custom rod end design and geometry

# SERIES LO, STANDARD CONFIGURATIONS



## General Construction

**END CAPS & CYLINDER** – Anodized aluminum.

**TIE RODS** – Stainless steel 18-8.

**ROD** – Stainless steel 303.

## General Specification

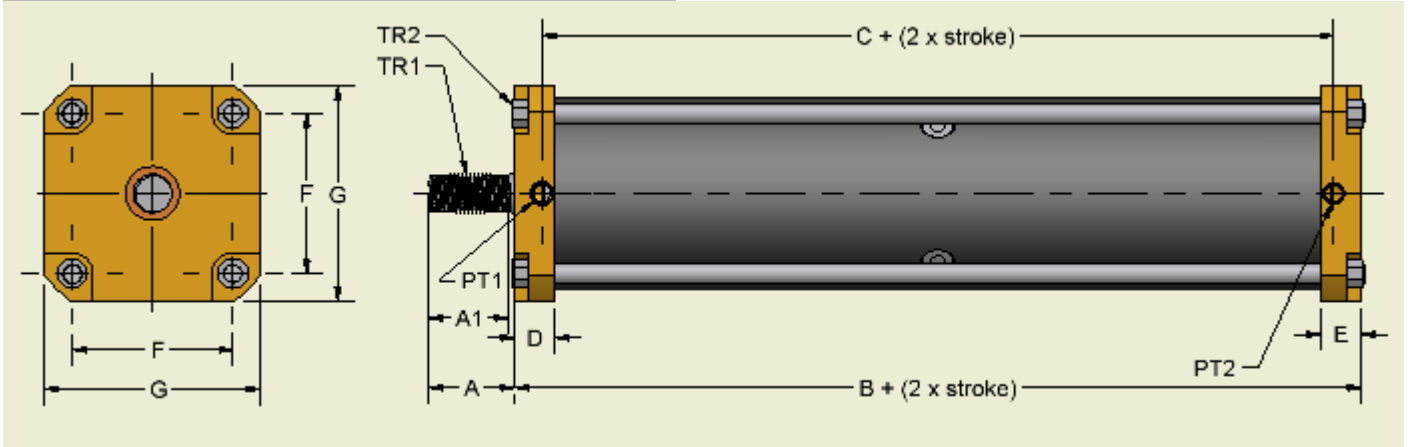
**OPERATION** Double-acting  
**OPERATING PRESSURE** 30 - 300psi (non-shock operation)

**Definition:** Non-shock operation is defined as operation in which all stops and movements occur via pneumatic or internal hydraulic control and not via mechanical limits at terminal positions or external forces.

**OPERATING TEMPERATURE** 20 - 180°F

**DISPLACEMENT VELOCITY at ZERO LOAD** 0.1 - 12in/sec @ 100psi

**CONTINUOUS NON-STOP CYCLING AT MAXIMUM VELOCITY WITHOUT OVERHEATING.**



BORE	*MAX STANDARD STROKE	A	A'	B	C	D	E	F	G	TR1	TR2	PT1	PT2
1 1/8	23	0.80	0.75	1.27	1.11	0.32	0.32	1.34	1.72	7/16-20UNF	10-32UNC	1/16 NPT	1/16 NPT
3 1/4	21.5	1.13	1.05	2.42	1.70	1.05	1.05	3.50	4.50	1 1/4-14UN	1/2-20UNF	1/4 NPT	1/4 NPT
4	21	1.13	1.05	2.88	2.17	1.05	1.05	4.15	5.55	1 1/4-14UN	1/2-20UNF	1/4 NPT	1/4 NPT
6	20	2.13	2.00	7.88	6.64	1.76	1.76	5.80	7.00	1 3/4-12UN	5/8-18UNF	3/4 NPT	3/4 NPT

NOTE: ALL LINEAR DIMENSIONS ARE IN INCHES

\* FOR LONG STROKE MODELS REFERENCE Pg.5, PARAGRAPH "EXTENDED STROKE CYLINDERS"

BORE	FORCE FACTOR		STATIC FORCE [LB]										VOLUMETRIC DISPLACEMENT [FT <sup>3</sup> /IN STROKE]	
	FORWARD	REVERSE	@60psi		@80psi		@100psi		@200psi		@300psi		FORWARD	REVERSE
			FRWD	RVRS	FRWD	RVRS	FRWD	RVRS	FRWD	RVRS	FRWD	RVRS		
1 1/8	0.99	0.85	59.4	51	79.2	68	99	85	198	170	297	255	0.000575	0.000489
3 1/4	8.3	7.5	498	450	664	600	830	750	1660	1500	2490	2250	0.00480	0.00450
4	12.6	11.8	756	708	1008	944	1260	1180	2520	2360	3780	3540	0.00727	0.00682
6	28.3	25.9	1698	1554	2264	2072	2830	2590	5660	5180	8490	7770	0.0164	0.0150

## DISPLACEMENT VELOCITY CONSIDERATIONS

### Standard Displacement Velocity Settings

The range of displacement velocity outlined in the **General Specification** is given for zero load and 100psi conditions. Displacement velocity is generally proportional to the cylinder's operating pressure within 60 - 300psi of range, provided that the operating temperature is constant. In Hy-P cylinders series **Lo**, the displacement velocity is determined by three permanent factory settings. For standard cylinders series **Lo**, the three settings are standard and divide the entire displacement velocity range into three sub-ranges: 0.1 - 4in/sec, 3 - 7in/sec and 6 - 12in/sec. The desired nominal displacement velocity and range shall be specified at the time of ordering.

### Displacement Velocity Adjustments

Cylinders series **Lo** also allow adjustments of velocity using standard means of pneumatic control (for instance-pneumatic needle valves) to meter either incoming or exhaust airflow, or both. Unlike conventional cylinders, Hy-P cylinders series **Lo** do not exhibit chatter at low airflow and the velocity control quality is much better than that achievable with conventional air cylinders.

## SERIES LO, CUSTOMIZED CONFIGURATIONS

### Stainless Steel Construction

Hy-P cylinders series **Lo** listed in standard configurations but made for environments typical for **chemical, petrochemical** and other specific industries can be constructed with:

<b>Cylinder</b>	- 304 stainless steel.
<b>Rod</b>	- 303 stainless steel.
<b>Tie Rods</b>	- 18-8 stainless steel.
<b>Nuts</b>	- 18-8 stainless steel.
<b>Bushings</b>	- chemically inert polymer (FDA approved if required).
<b>Seals</b>	- chemically inert polymer (FDA approved if required).
<b>Dampening fluid</b>	- chemically inert synthetic oil (FDA approved if required).

Cylinders for **extremely aggressive environments, aggressive environments** with **operating temperature above 200°F, seawater applications**, and for **food, pharmaceutical and medical industries** can be constructed with:

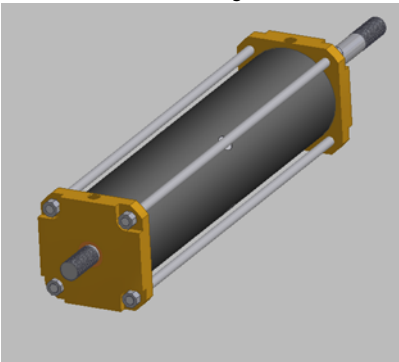
<b>Cylinder</b>	- 316 stainless steel.
<b>Rod</b>	- 316 stainless steel.
<b>Tie Rods</b>	- 316 stainless steel.
<b>Nuts</b>	- 316 stainless steel.
<b>Bushings</b>	- chemically inert FDA approved polymer.
<b>Seals</b>	- chemically inert FDA approved polymer.
<b>Dampening fluid</b>	- chemically inert FDA approved synthetic oil.

### Other Types of Construction

Hy-P cylinders series **Lo** can be constructed of different carbon steel alloys or other unconventional materials and their combinations to best accommodate specific applications. Metal parts can be electrochemically plated or painted externally. Consult with the factory about details related to specific applications.

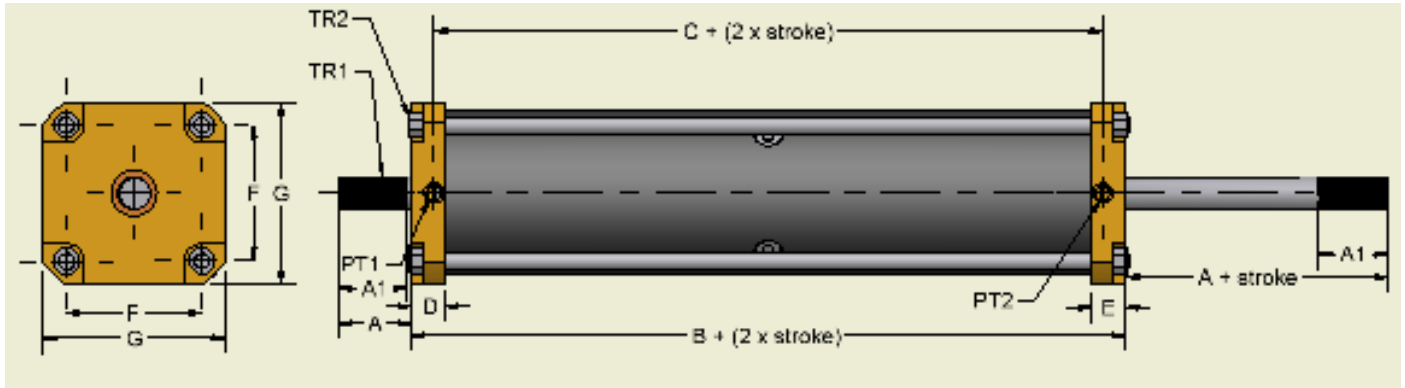
### Custom Specification Cylinders

#### a. Double Rod Cylinders



All Hy-P cylinders series **Lo** listed in standard configurations are available in sub-standard **Double Rod** version. **Double Rod** cylinders are not considered as standard. The main differences between standard **Single Rod** and sub-standard **Double Rod** cylinders are force factors and linear dimensions.

BORE	FORCE FACTOR	STATIC FORCE [LB]					VOLUMETRIC DISPLACEMENT [FT <sup>3</sup> /IN STROKE]
		@60psi	@80psi	±100ps	±200ps	±300ps	
<b>1 1/8</b>	0.85	51	68	85	170	255	0.000489
<b>3 1/4</b>	7.5	450	600	750	1500	2250	0.00450
<b>4</b>	11.8	708	944	1180	2360	3540	0.00682
<b>6</b>	25.9	1554	2072	2590	5180	7770	0.0150



b. High and Special Performance Cylinders

Custom configurations also include cylinders with special performance features or specifications that exceed the specifications of standard models. High and special performance include:

**High Operating Pressure** (600psi and higher)

**Broad Operating Temperature Range** (-30°F to +250°F with possibility for expansion)

**High Displacement Velocity** (36in/sec and higher)

**Magnetic Position Detection Feature**

**Non-Rotating Feature**

**Submerged Deep Sea Operation**

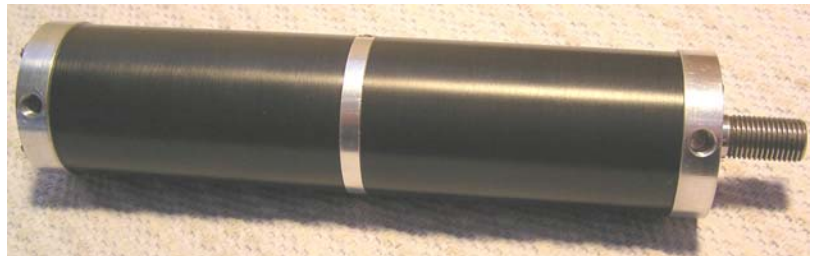
**Vacuum Operation**

c. Extended Stroke Cylinders

Custom cylinders are available with strokes exceeding the strokes of standard cylinders up to two times. Extended stroke cylinders might have side load and axial load capacity lower than the standard models. Consult with the factory about the possible load limitations or if longer stroke increase is required.

d. Custom-Shaped and Discontinued Models

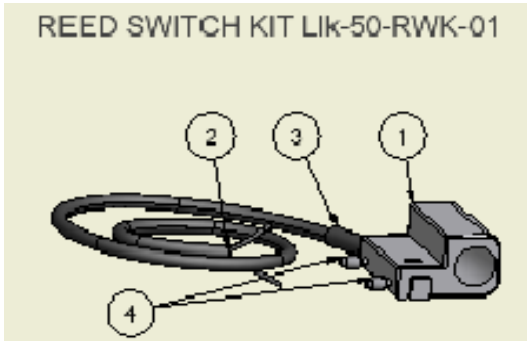
Cylinder models offered in prior catalogs and currently discontinued (except for the “Doublet” actuators) are available by special order. Cylinders with custom-shaped exteriors, locations and types of ports, etc. are also available by special order.



## MAGNETIC SENSORS AND ACCESSORIES

RBHydrodynamics, Inc. offers Hy-P cylinders with magnetic position detection feature. Models equipped with this feature have magnets mounted on the cylinder piston. Magnetic sensors mounted on the cylinder surface detect the magnetic signature of the magnets as the piston moving inside the cylinder passes the sensors. The sensors can be multiple and can be installed anywhere along the stroke of the piston.

RBHydrodynamics, Inc. offers the reed switch as a part of the standard reed switch kit. The kit is designed for mounting magnetic sensors on **Standard** and **Double Rod** cylinders with 6in bore (ref. pg.4 and pg.5) by attaching the reed switch holding bracket to the cylinder tie rod.



Part Name	Part Number	QTY	Part Description
1. Reed Switch Bracket	Llk-50-RSB-01	1	Anodized Aluminum
2. Reed Switch	00045-01	1	Input: 10 - 30VDC, Load: 200mA max with LED indicator
3. Reed Switch Tubing	Llk-50-RST-01	1	Polymer Sleeve
4. Slotted Nylon Set Screw		2	10-32x1/4
5. Hex Nut	00003-20	2	5/8-18 (not shown)

**NOTE:** Reed Switch kits for other standard bore sizes are available by special order

**NOTE:** Reed Switch Brackets adjustably slide on tie rods with Hex Nuts used for securing them in position. The Reed Switch Brackets and Hex Nuts are not detachable parts and are installed at the factory. Specify the number of Reed Switch Brackets and the tie rods on which they shall be installed at the time of order.

## SERVICES

RBHydrodynamics, Inc. offers the following services:

- Application Engineering Consultations
- Custom Design and Material Selection
- Custom Hardware and Accessories Design
- Documented Design Proposals
- Finite Analysis and Testing
- Troubleshooting and Technical Support
- Quality Assurance
- Expedited Delivery

## SPECIAL ORDERS vs. STANDARD

### CONFIGURATIONS

Hy-P cylinder configurations that deviate from the standards are defined as special order items. Depending on the degree of deviations, special order items can be qualified as either customized or custom. For instance, double rod cylinders require minimum modification of materials and manufacturing processes compared to standard single rod cylinders. They also need zero R&D and thus qualify as customized products. Production of extended stroke and custom-shaped cylinders, on the other hand, demands special engineering and manufacturing efforts, and is associated with additional material expenses, and qualifies as custom. Customized and custom cylinders have longer lead-times and are more expensive proportionally to the level of uniqueness, novelty, and manufacturing and R&D efforts. RBHydrodynamics, Inc. has a goal of expanding the number of standard products in order to make its products more affordable and to minimize the lead-time. To achieve this goal, the company encourages the customers to consider the use of custom configuration cylinders in their products having continuous reoccurring and/or growing demand. In such cases, RBHydrodynamics, Inc. can often offer custom cylinders at the price of standard cylinders and reduce the lead-time to the level typical for standard units.

RBHydrodynamics, Inc. constantly conducts new product development in the direction of promising fields where the R&D efforts have the highest justifiable probability to yield new products that can be qualified as standard configurations.

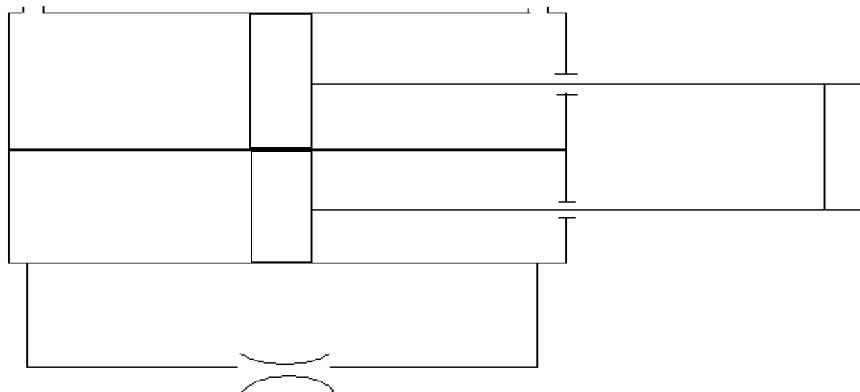
## ORDERING INSTRUCTIONS

When ordering, define basic specification parameters including:

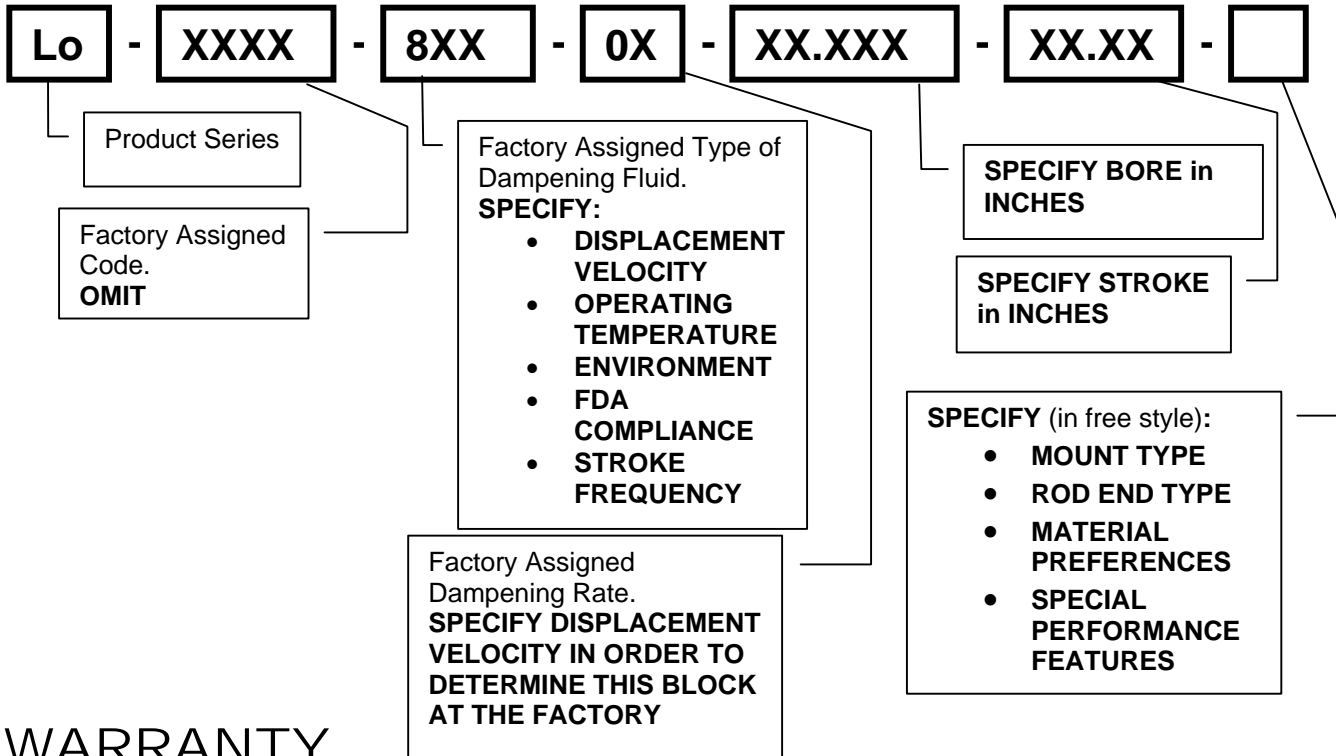
- **Bore**
- **Stroke**
- **Operating Pressure**
- **Displacement Velocity**
- **Operating Temperature**
- **Mount Type**
- **Rod End Type**
- **Material Preferences**
- **Special Performance Features, such as:**
  - ✓ **Magnetic Position Detection**
  - ✓ **Non-Rotating**
  - ✓ **Aggressive Environment**
  - ✓ **Submerged Deep Sea Operation**
  - ✓ **Vacuum Operation**
  - ✓ **FDA Compliance**
  - ✓ **Extended Stroke**
  - ✓ **Custom-Shaped**
  - ✓ **Etc.**
  
- **Quantity**

Consult with the factory to select the model of correct nomenclature or select the correct model using basic principles of nomenclature.

## SERIES LO SYMBOL



## BASIC PRINCIPLES of NOMENCLATURE



## WARRANTY

All products are warranted against defects in workmanship and material under normal conditions and usage for a total of  $1 \times 10^6$  inches of linear displacement or for a period of 2 years from the date of shipment, whichever is earlier in time. The exclusive remedy in the event of such defect is repair, replacement, or refund, at RBHybrodynamics, Inc.'s option. This warranty does not cover products that have been subject to misuse, negligence, accidents, misapplication or tampering in a way so as to affect normal performance. ALL WARRANTIES, EXPRESS OR IMPLIED OTHER THAN THE WARRANTY SPECIFIED ABOVE, ARE EXCLUDED INCLUDING BUT NOT LIMITED TO ANY WARRANTY AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AS SOLD, DESCRIPTION, AND QUALITY.

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