

ENGINEERING  
TOMORROW

*Danfoss*

Product Catalog

# Vickers® by Danfoss Industrial Welded Cylinders



**VICKERS**  
by Danfoss

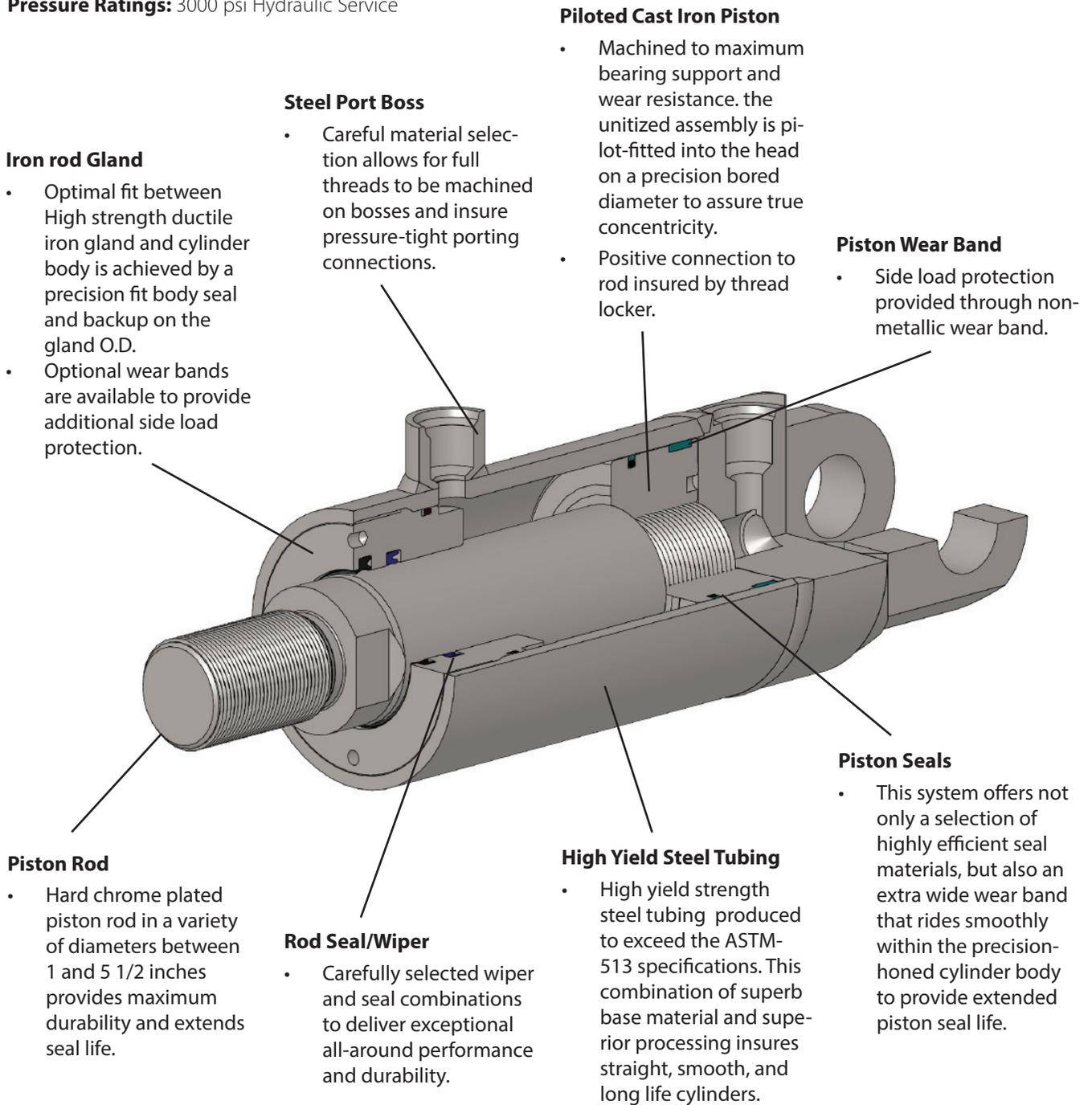
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# Design Features and Specifications

**Bore Sizes:** 1.5" - 8"

**Pressure Ratings:** 3000 psi Hydraulic Service



**Iron rod Gland**

- Optimal fit between High strength ductile iron gland and cylinder body is achieved by a precision fit body seal and backup on the gland O.D.
- Optional wear bands are available to provide additional side load protection.

**Steel Port Boss**

- Careful material selection allows for full threads to be machined on bosses and insure pressure-tight porting connections.

**Piston Rod**

- Hard chrome plated piston rod in a variety of diameters between 1 and 5 1/2 inches provides maximum durability and extends seal life.

**Rod Seal/Wiper**

- Carefully selected wiper and seal combinations to deliver exceptional all-around performance and durability.

**Piloted Cast Iron Piston**

- Machined to maximum bearing support and wear resistance. the unitized assembly is pilot-fitted into the head on a precision bored diameter to assure true concentricity.
- Positive connection to rod insured by thread locker.

**Piston Wear Band**

- Side load protection provided through non-metallic wear band.

**High Yield Steel Tubing**

- High yield strength steel tubing produced to exceed the ASTM-513 specifications. This combination of superb base material and superior processing insures straight, smooth, and long life cylinders.

**Piston Seals**

- This system offers not only a selection of highly efficient seal materials, but also an extra wide wear band that rides smoothly within the precision-honed cylinder body to provide extended piston seal life.

# Product Specifications

## General Specifications

- Heavy duty service
- Standard construction - threaded head, welded cap
- Bore diameters - 1.50" through 8.00"
- Strokes - available in any practical stroke length (see pg 16 for limitations)
- Piston rod diameters -0.625" through 5.500" (based on bore size)
- Rod end styles - 2 standard, specials available
- Single rod end
- Mounting styles - 5 standard styles. Additional mounting styles offered for custom cylinders.
- Nominal pressure - 3,000 psi<sup>1</sup> (207 Bar)
- Standard fluid media - Filtered hydraulic oil (Seals for different applications and temperatures are listed under Sealing System)

<sup>1</sup> - If hydraulic pressure exceeds 3,000 psi (207 Bar), send application data for engineering evaluation and recommendation.

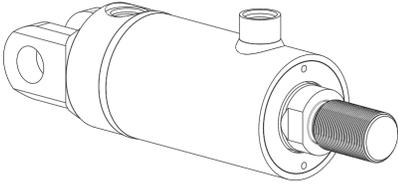
## Material Specifications - Standard Temperatures and Applications

<b>Head</b>	High strength ductile iron	<b>Piston seal</b>	Glass-filled PTFE
<b>Cap</b>	Carbon steel	<b>Piston seal energizer</b>	Nitrile
<b>Cylinder body</b>	Carbon steel	<b>Piston bearing</b>	Bronze-filled PTFE
<b>Piston rod</b>	High Yield C1045/50 micro alloy steel	<b>End seal o-ring</b>	Nitrile
<b>Rod seal</b>	Polyurethane	<b>Backup ring</b>	PTFE
<b>Rod wiper seal</b>	Nitrile		
<b>Piston</b>	Cast iron		

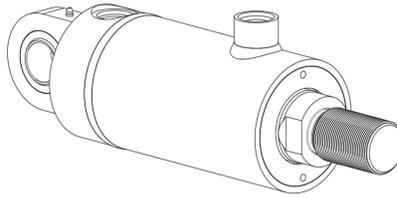
*Specifications in this catalog are subject to change.*

# Available Mounting Styles

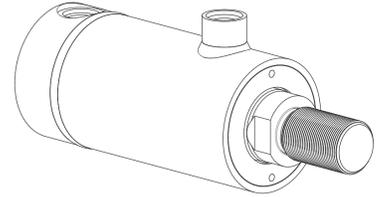
WH10: Cap Fixed Clevis Mount



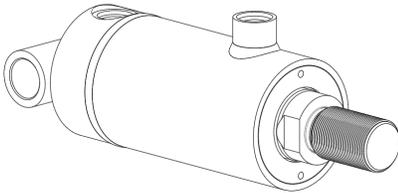
WH11: Cap Spherical Bearing Mount



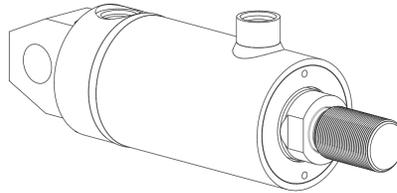
WH24: No Mount



WH46: Cross Tube Mount



WH47: Cap Fixed Eye Mount



## Custom Options and Modifications

- Additional Mounts and Rod End Types
- Special Heads, Caps, Pistons and Mounts
- Mount/Port Relocation
- Oversize/Undersize Ports
- Port Thread Styles
- Port Blocks/Valve Manifold and Flow Tubing (at either end)
- Multiple Ports
- Cartridge Valves
- Air Bleeds
- Double Rod End
- Oversize/Undersize Rod Diameters
- Extra Thick Chrome Plated Piston Rod
- Rod Materials (stainless steels, alloy steels, etc.)
- Rod Coatings
- Nitrided Rod
- Pinned Rod to Piston
- Welded Rod to Piston
- Welded Rod End Accessory
- Extra Wrench Flats
- Rod Boot
- Metallic Rod Wiper
- Seal Materials (additional compounds)
- PolyPak Seals
- Stop Tube
- Stroke Adjuster (No Mount only)
- Proximity Switch
- Linear Displacement Transducer
- Fixed Cushions
- High Pressure Service (>3,000 PSI)
- Pneumatic Service
- Water Submersible Design
- Chrome Plated Bore
- Nickel Plated Assembly
- Application-Specific Paint
- Stainless Steel Construction (derated operating pressure)
- Metric Rod and Bore Diameters

# How to Order

## Standard Cylinders

Danfoss has created an easy system for ordering Welded Series cylinders, developed to improve our service to you. The standard model code consists of sixteen alpha-numeric digits which fully describe the most common standard options offered on welded cylinders. To specify your welded cylinder, review the following pages for a full description of each option available and select the desired code. Feature options are focused to provide you with an optimal cylinder and short lead times.

## Simplify the re-order process.

Each welded series cylinder is assigned a sixteen digit model code. That code is unique to a particular cylinder description. That way, when you re-order your Welded cylinder, you're assured of exactly the same top quality cylinder design.

## Improve identification

Every welded cylinder has a sixteen digit model code clearly marked on the product and impression stamped in the metal head or cap. The code completely describes a specific cylinder. This allows seals and replacement components to be easily identified in the field.

## Facilitate communications

This fully descriptive model code system allows you to work directly with your local Danfoss sales engineer to identify and service your cylinder.

## NOTE

See page 7 for a summary of model code options.

## Custom Cylinders New Cylinders

Although the model code has been arranged to cover the vast majority of available options, there will be occasions when you require an option which cannot be coded.

If more than one of the available options represented in position 15 and 16 are required, add the appropriate codes as a suffix. The cylinder will then be given a unique seven digit design number on receipt of order (as explained below).

Get in contact with our team if the features you are looking for are not available.

## Replacement Cylinders

Every custom cylinder is assigned a unique design number. A Custom cylinder will have 22 digits vs. 16 for the standard cylinder. The design number is contained in the last six digits of the model code, and position 17 is always an alpha character. In other words, the design number begins after position 16. When ordering a replacement cylinder, simply give the model code or the six digit design number to your local Danfoss Cylinder Sales representative.

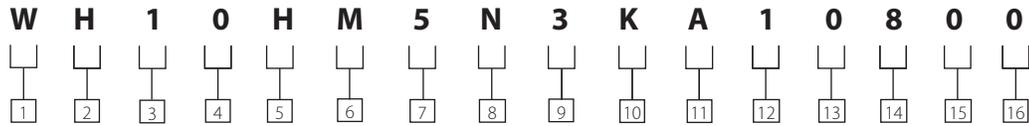
## Replacement Parts

Each design number is stored in a quick retrieval computerized storage system. This gives our field sales representatives rapid access to assist you in identifying and specifying genuine Danfoss replacement parts.

## WARNING

It is the user's responsibility to select the correct system, product or components.

# Model Code Selection



## 1,2 Series Designation

WH – Welded Hydraulic Cylinder

## 3,4 Mounting Style

10 – Cap Fixed Clevis  
11 – Spherical Bushing  
24 – No Mount  
46 – Cross Tube End  
47 – Cap Fixed Eye

## 5,6 Bore & Rod Diameter

Code	Bore	Rod
CC	1-1/2	5/8
CE	1-1/2	1
DE	2	1
DH	2	1-3/8
EE	2-1/2	1
EH	2-1/2	1-3/8
EL	2-1/2	1-3/4
GH	3-1/4	1-3/8
GL	3-1/4	1-3/4
GM	3-1/4	2
HL	4	1-3/4
HM	4	2
HP	4	2-1/2
KM	5	2
KP	5	2-1/2
KU	5	3
KV	5	3-1/2
LP	6	2-1/2
LU	6	3
LV	6	3-1/2
LW	6	4
MU	7	3
MV	7	3-1/2
MW	7	4
MY	7	4-1/2
MZ	7	5
NV	8	3-1/2
NW	8	4
NY	8	4-1/2
NZ	8	5
N1	8	5-1/2

## 7 Rod End Type

Code	Rod End Style
2	Short Female UN Thread
5	Small Male UN Thread

## 8 Seals

Code Application Type

N Normal  
L Low Friction  
T High Temperature

## 9 Ports

Code Port Style

1 NPTF



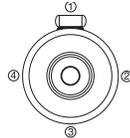
3 SAE/UN



## 10 Port Location

Ports are located as shown below when viewing cylinder from head end.

BF = Back Face center of cap



Code Head Cap\*

K	1	1
L	1	2
M	1	3
N	1	4
P	2	1
R	2	2
S	2	3
T	2	4
U	3	1
V	3	2
W	3	3
Y	3	4
1	4	1
2	4	2
3	4	3
4	4	4
5**	1	BF
6**	2	BF
7**	3	BF
8**	4	BF

\* - Cap Position 2, 3, 4 not available if 46 - Cross Tube Cap End is selected

\*\* - Only available with no mount

## 11 Cushions Code

A Noncushioned (both ends)

## 12,13,14 Cylinder Strokes

Items 12 & 13 indicate total cylinder stroke length from 00 through 99 inches, body text.

Item 14 indicates fraction of an inch as follows:

Code	Fraction	Code	Fraction
0	0	8	1/2
1	1/16	9	9/16
2	1/8	A	5/8
3	3/16	B	11/16
4	1/4	C	3/4
5	5/16	D	13/16
6	3/8	E	7/8
7	7/16	F	15/16

## 15,16 Extra Rod Projection

Item 15 indicates inches from 0 thru 9.

Item 16 indicates fraction of an inch per the following codes:

----- OR -----

Flats / Stop Tube / Keyed Piston / Rod material

Code No. of A/C Flat\*

F4	4
F6	6

\* Only upto 3.5" Rod.

## Keyed Piston to Rod

Code	Type
KG	Grub Screw
KS	Weld Piston to rod

## Rod Material Options

Code	Type
* RP	Thick Chrome Plate
RS	Stainless Steel 17-4.
** RT	Stainless Steel 303

\* .002 Chrome thickness

\*\* Consult factory for pressure Rating

## Stop tube

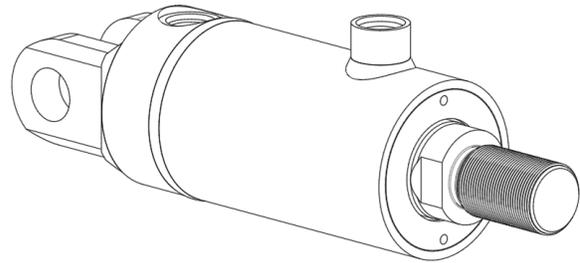
Code Length in inches

S1	1
S2	2
S3	3
S4	4
S5	5
S6	6
S7	7
S8	8
S9	9
SA	10
SB	11
SC	12
SD	13
SE	14
SF	15
SG	16
SH	17
SJ	18
SK	19
SL	20

# Mounting Types and Application Guide

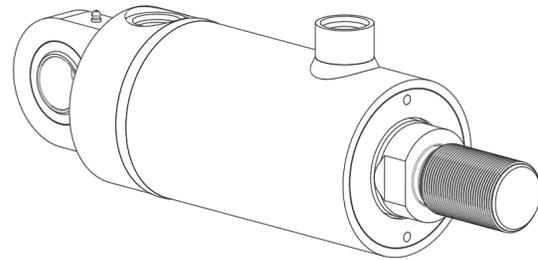
## WH10: Cap Fixed Clevis Mount

This mount is for applications in which the machine member travels in a curved path within one plane. This mount can be used both in compression (push) and tension (pull). The center line of the machine member that attaches to the swivel pin must be perpendicular to the center-line of the piston rod and the curved path must be in one plane only. Any misalignment will cause excess side loading on the bearing and piston. This will lead to premature failure.



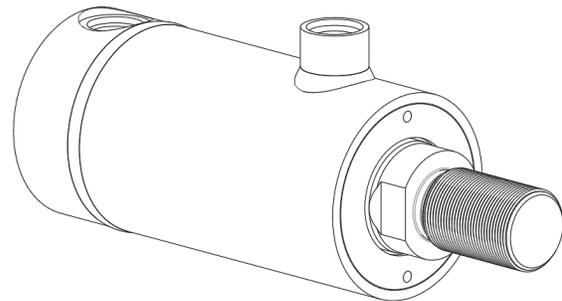
## WH11: Spherical Bearing Mount

This mount is for applications in which the machine member travels in a curved path in one plane where some misalignment is unavoidable. The amount of allowable misalignment can be calculated. This mount can be used both in compression (push) and tension (pull) applications. Maximum operating pressure as shown in the table on page 11.



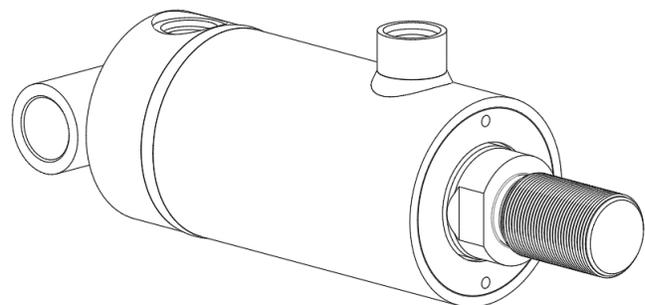
## WH24: No Mount

No mounts are for moving loads on a flat guided surface such as carriage rails. Mounting surface should be flat and parallel to centerline of the piston rod. The load should be guided to traverse along the centerline of the piston rod. The frame on which the cylinder is mounted must be sufficiently rigid to resist bending moments. With unsupported loads, the bearing must absorb more force. For these applications, the larger available rod is recommended, and stop tubes should be considered. External clamping mechanism on head and cap is required to hold cylinder in place during operation. Use high tensile socket head cap screws or hex head bolts tightened to the manufacturer's recommended torque in clamping. For high shock applications, dowel pins or shear keys should be incorporated in the mounting design. For severe side load applications, consult your local Danfoss sales engineer.



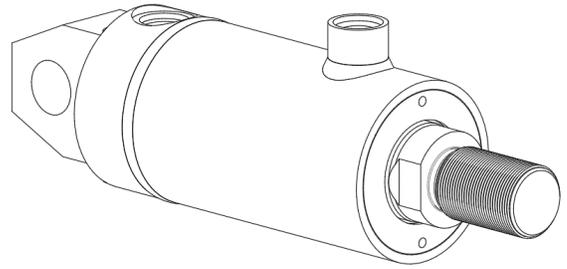
## WH46: Cross Tube Mount

These mounts are for applications in which the machine member travels in a curved path within one plane. These mounts can be used both in compression (push) and tension (pull). The centerline of the machine member that attaches to the swivel pin must be perpendicular to the centerline of the piston rod and the curved path must be in one plane only. Any misalignment will cause excess side loading on the bearing and piston. This will lead to premature failure. For applications with small amounts of misalignment, consider the spherical bearing mount WH11.



### **W47: Cap Fixed Eye Mount**

These mounts are for applications in which the machine member travels in a curved path within one plane. These mounts can be used both in compression (push) and tension (pull). The centerline of the machine member that attaches to the swivel pin must be perpendicular to the centerline of the piston rod and the curved path must be in one plane only. Any misalignment will cause excess side loading on the bearing and piston. This will lead to premature failure. For applications with small amounts of misalignment, consider the spherical bearing mount WH11.



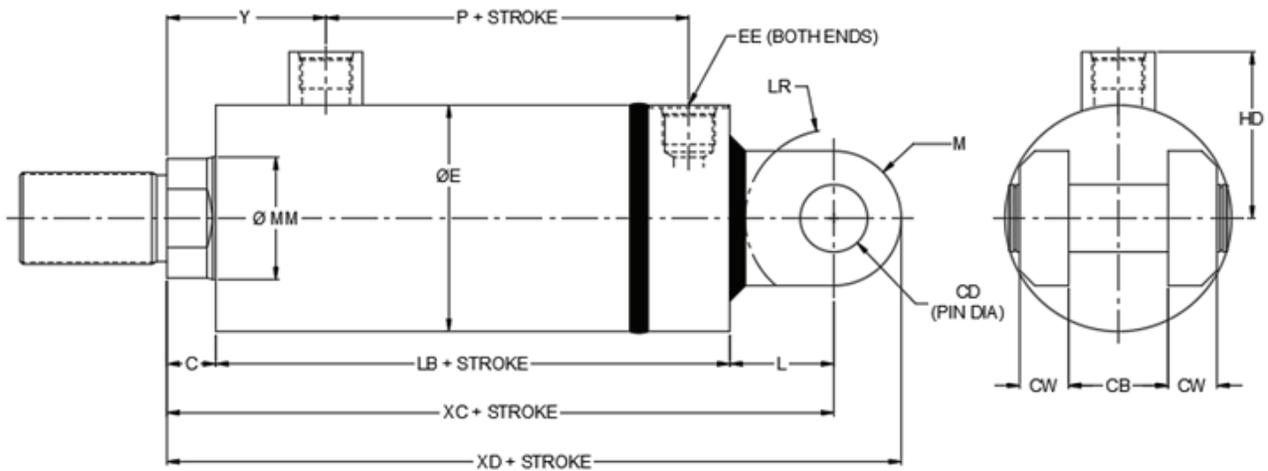
### **WARNING**

Failure to mount the cylinder correctly on the frame may result in death, bodily injury and/or property damage.

NOTE: Care must be exercised to prevent rod buckling in compression applications with long strokes. See page 16 for stroke limitations. Stop tube may be required depending on the stroke length required. Please refer to page 17.

# Mounting Style and Installation Dimensions

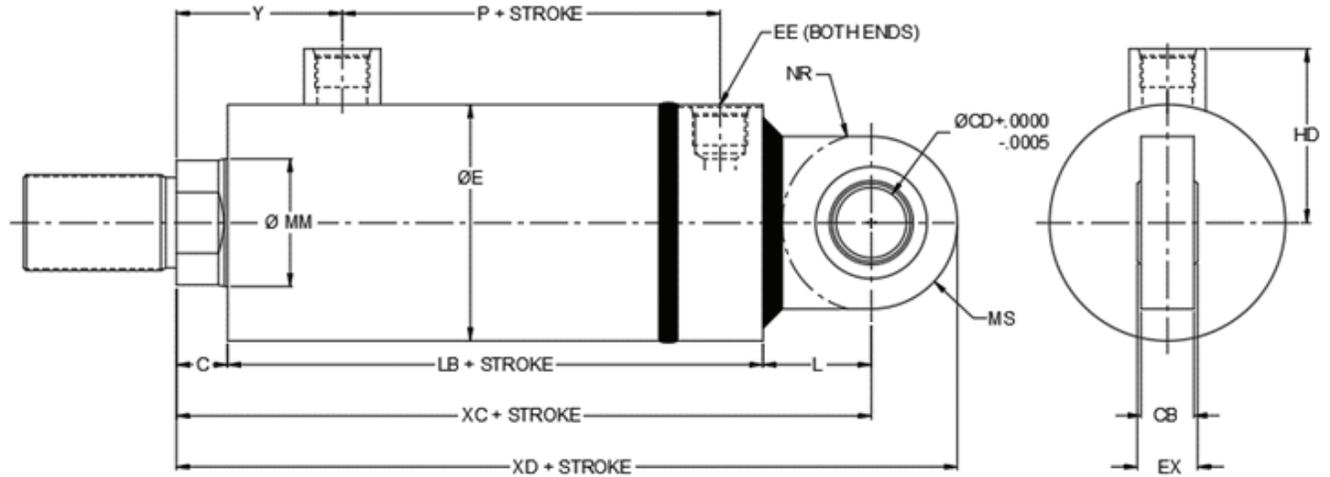
## WH10 Cap Fixed Clevis Mount



Bore	Rod Dia	C	E	EE (NPTF)	EE (SAE)	Y	P	HD	LB	L	XC	LR (RAD.)	M (RAD.)	CD	CB	CW	XD
1.50	0.63	0.38	1.88	0.38	#6	1.59	2.38	1.94	4.13	0.75	5.25	0.56	0.50	0.50	0.78	0.50	5.75
	1.00	0.50	1.88	0.38	#6	1.72	2.38	1.94	4.13	0.75	5.38	0.56	0.50	0.50	0.78	0.50	5.88
2.00	1.00	0.50	2.38	0.50	#8	2.66	2.50	2.38	5.25	1.25	7.00	1.00	0.75	0.75	1.09	0.50	7.75
	1.38	0.63	2.38	0.50	#8	2.78	2.50	2.38	5.25	1.25	7.13	1.00	0.75	0.75	1.09	0.50	7.88
2.50	1.00	0.50	3.00	0.50	#8	2.63	2.66	2.69	5.38	1.25	7.13	1.06	0.75	0.75	1.28	0.63	7.88
	1.38	0.63	3.00	0.50	#8	2.75	2.66	2.69	5.38	1.25	7.25	1.06	0.75	0.75	1.28	0.63	8.00
	1.75	0.75	3.00	0.50	#8	2.88	2.66	2.69	5.38	1.25	7.38	1.06	0.75	0.75	1.28	0.63	8.13
3.25	1.38	0.63	3.88	0.75	#12	2.75	3.28	3.13	6.25	1.50	8.38	1.25	1.00	1.00	1.53	0.75	9.38
	1.75	0.75	3.88	0.75	#12	2.88	3.28	3.13	6.25	1.50	8.50	1.25	1.00	1.00	1.53	0.75	9.50
	2.00	0.88	3.88	0.75	#12	3.00	3.28	3.13	6.25	1.50	8.63	1.25	1.00	1.00	1.53	0.75	9.63
4.00	1.75	0.75	4.63	0.75	#12	3.00	3.41	3.50	6.50	2.13	9.38	1.81	1.38	1.38	2.03	1.00	10.75
	2.00	0.88	4.63	0.75	#12	3.13	3.41	3.50	6.50	2.13	9.50	1.81	1.38	1.38	2.03	1.00	10.88
	2.50	1.00	4.63	0.75	#12	3.25	3.41	3.50	6.50	2.13	9.63	1.81	1.38	1.38	2.03	1.00	11.00
5.00	2.00	0.88	6.00	0.75	#12	3.31	4.09	4.19	7.38	2.25	10.50	1.88	1.75	1.75	2.53	1.25	12.25
	2.50	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	2.25	10.63	1.88	1.75	1.75	2.53	1.25	12.38
	3.00	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	2.25	10.63	1.88	1.75	1.75	2.53	1.25	12.38
	3.50	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	2.25	10.63	1.88	1.75	1.75	2.53	1.25	12.38
6.00	2.50	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.50	12.13	2.13	2.00	2.00	2.53	1.25	14.13
	3.00	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.50	12.13	2.13	2.00	2.00	2.53	1.25	14.13
	3.50	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.50	12.13	2.13	2.00	2.00	2.53	1.25	14.13
	4.00	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.50	12.13	2.13	2.00	2.00	2.53	1.25	14.13
7.00	3.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	3.00	13.50	2.63	2.50	2.50	3.03	1.50	16.00
	3.50	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	3.00	13.50	2.63	2.50	2.50	3.03	1.50	16.00
	4.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	3.00	13.50	2.63	2.50	2.50	3.03	1.50	16.00
	4.50	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	3.00	13.50	2.63	2.50	2.50	3.03	1.50	16.00
	5.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	3.00	13.50	2.63	2.50	2.50	3.03	1.50	16.00
8.00	3.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	3.25	14.25	3.25	2.75	3.00	3.03	1.50	17.00
	4.00	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	3.25	14.25	3.25	2.75	3.00	3.03	1.50	17.00
	4.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	3.25	14.25	3.25	2.75	3.00	3.03	1.50	17.00
	5.00	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	3.25	14.25	3.25	2.75	3.00	3.03	1.50	17.00
	5.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	3.25	14.25	3.25	2.75	3.00	3.03	1.50	17.00

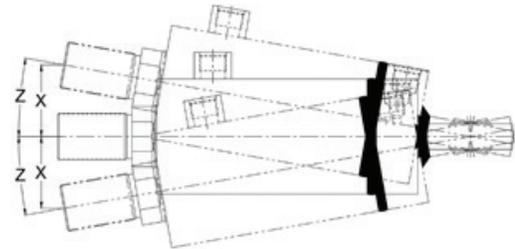
# Mounting Style and Installation Dimensions

## WH11 Spherical Bushing Mount



Bore	PSI*	Angle Z	Tangent of Z
1.50	1650	1.5	0.026
2.00	2000	2	0.035
2.50	1400	2	0.035
3.25	1500	2	0.035
4.00	1750	2	0.035
5.00	1900	2.5	0.044
6.00	1700	2.5	0.044

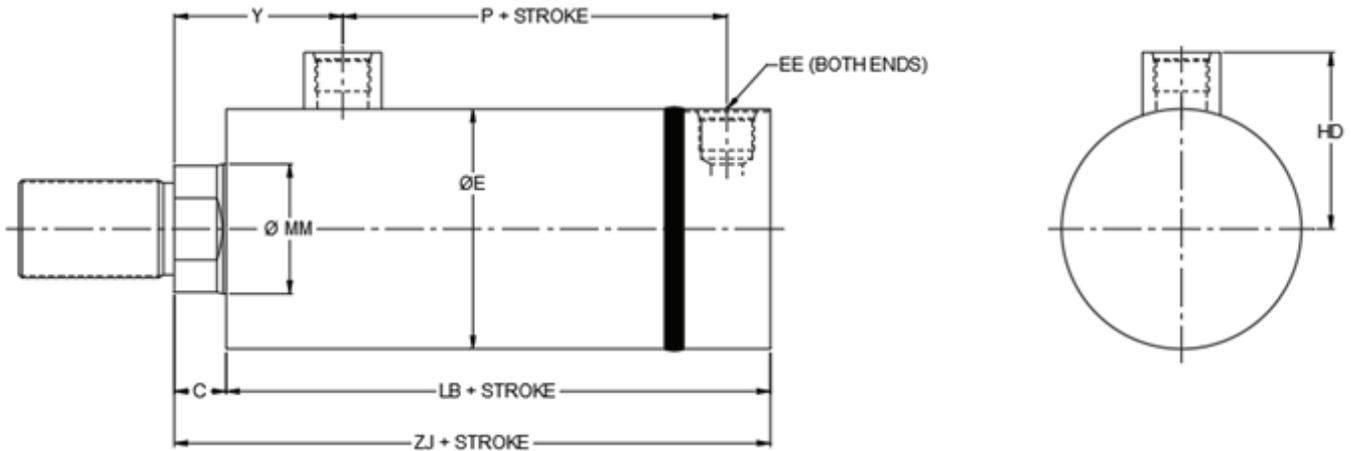
\* Maximum Operating Pressure



Angle Z is the recommended maximum angle of misalignment. To find the maximum recommended X distance, multiply the distance between pivot mounting holes by the tangent of angle Z.

Bore	Rod Dia	C	E	EE (NPTF)	EE (SAE)	Y	P	HD	LB	L	XC	NR (RAD.)	MS (RAD.)	CD	CB	EX	XD
1.50	0.63	0.38	1.88	0.38	#6	1.59	2.38	1.94	4.13	0.88	5.38	0.75	0.63	0.50	0.38	0.44	6.00
	1.00	0.50	1.88	0.38	#6	1.72	2.38	1.94	4.13	0.88	5.50	0.75	0.63	0.50	0.38	0.44	6.13
2.00	1.00	0.50	2.38	0.50	#8	2.66	2.50	2.38	5.25	1.25	7.00	1.06	1.00	0.75	0.56	0.66	8.00
	1.38	0.63	2.38	0.50	#8	2.78	2.50	2.38	5.25	1.25	7.13	1.06	1.00	0.75	0.56	0.66	8.13
2.50	1.00	0.50	3.00	0.50	#8	2.63	2.66	2.69	5.38	1.25	7.13	1.06	1.00	0.75	0.56	0.66	8.13
	1.38	0.63	3.00	0.50	#8	2.75	2.66	2.69	5.38	1.25	7.25	1.06	1.00	0.75	0.56	0.66	8.25
	1.75	0.75	3.00	0.50	#8	2.88	2.66	2.69	5.38	1.25	7.38	1.06	1.00	0.75	0.56	0.66	8.38
3.25	1.38	0.63	3.88	0.75	#12	2.75	3.28	3.13	6.25	1.63	8.50	1.38	1.31	1.00	0.75	0.88	9.81
	1.75	0.75	3.88	0.75	#12	2.88	3.28	3.13	6.25	1.63	8.63	1.38	1.31	1.00	0.75	0.88	9.94
	2.00	0.88	3.88	0.75	#12	3.00	3.28	3.13	6.25	1.63	8.75	1.38	1.31	1.00	0.75	0.88	10.06
4.00	1.75	0.75	4.63	0.75	#12	3.00	3.41	3.50	6.50	2.13	9.38	1.81	1.69	1.38	1.03	1.19	11.06
	2.00	0.88	4.63	0.75	#12	3.13	3.41	3.50	6.50	2.13	9.50	1.81	1.69	1.38	1.03	1.19	11.19
	2.50	1.00	4.63	0.75	#12	3.25	3.41	3.50	6.50	2.13	9.63	1.81	1.69	1.38	1.03	1.19	11.31
5.00	2.00	0.88	6.00	0.75	#12	3.31	4.09	4.19	7.38	2.38	10.63	2.06	2.13	1.75	1.31	1.53	12.75
	2.50	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	2.38	10.75	2.06	2.13	1.75	1.31	1.53	12.88
	3.00	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	2.38	10.75	2.06	2.13	1.75	1.31	1.53	12.88
	3.50	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	2.38	10.75	2.06	2.13	1.75	1.31	1.53	12.88
6.00	2.50	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.63	12.25	2.31	2.44	2.00	1.50	1.75	14.69
	3.00	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.63	12.25	2.31	2.44	2.00	1.50	1.75	14.69
	3.50	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.63	12.25	2.31	2.44	2.00	1.50	1.75	14.69
	4.00	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.63	12.25	2.31	2.44	2.00	1.50	1.75	14.69

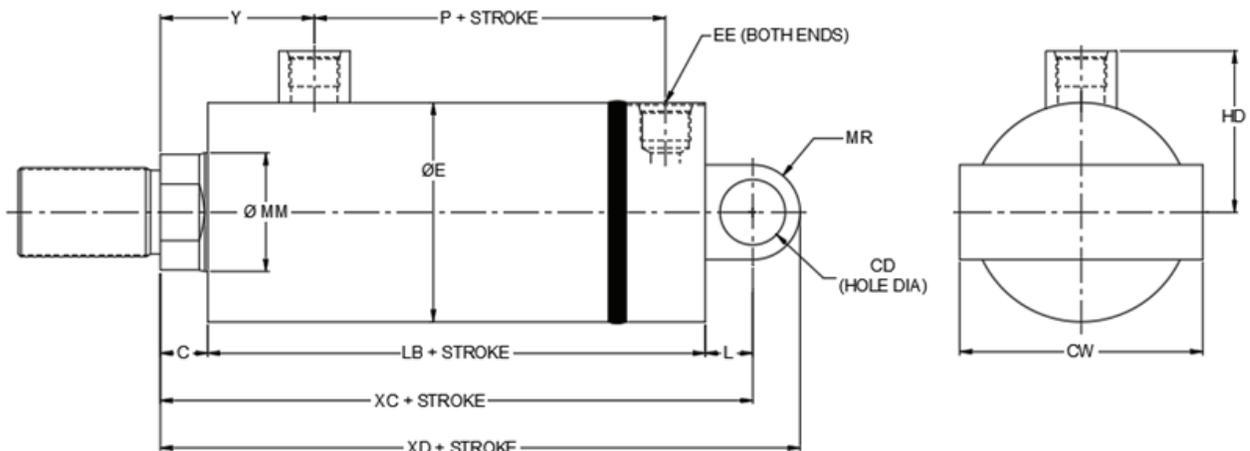
# Mounting Style and Installation Dimensions WH24 No Mount



Bore	Rod Dia	C	E	EE (NPTF)	EE (SAE)	Y	P	HD	LB	ZJ
1.50	0.63	0.38	1.88	0.38	#6	1.59	2.38	1.94	4.13	4.50
	1.00	0.50	1.88	0.38	#6	1.72	2.38	1.94	4.13	4.63
2.00	1.00	0.50	2.38	0.50	#8	2.66	2.50	2.38	5.25	5.75
	1.38	0.63	2.38	0.50	#8	2.78	2.50	2.38	5.25	5.88
2.50	1.00	0.50	3.00	0.50	#8	2.63	2.66	2.69	5.38	5.88
	1.38	0.63	3.00	0.50	#8	2.75	2.66	2.69	5.38	6.00
	1.75	0.75	3.00	0.50	#8	2.88	2.66	2.69	5.38	6.13
3.25	1.38	0.63	3.88	0.75	#12	2.75	3.28	3.13	6.25	6.88
	1.75	0.75	3.88	0.75	#12	2.88	3.28	3.13	6.25	7.00
	2.00	0.88	3.88	0.75	#12	3.00	3.28	3.13	6.25	7.13
4.00	1.75	0.75	4.63	0.75	#12	3.00	3.41	3.50	6.50	7.25
	2.00	0.88	4.63	0.75	#12	3.13	3.41	3.50	6.50	7.38
	2.50	1.00	4.63	0.75	#12	3.25	3.41	3.50	6.50	7.50
5.00	2.00	0.88	6.00	0.75	#12	3.31	4.09	4.19	7.38	8.25
	2.50	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	8.38
	3.00	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	8.38
	3.50	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	8.38
6.00	2.50	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	9.63
	3.00	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	9.63
	3.50	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	9.63
	4.00	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	9.63
7.00	3.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	10.50
	3.50	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	10.50
	4.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	10.50
	4.50	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	10.50
	5.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	10.50
8.00	3.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	11.00
	4.00	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	11.00
	4.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	11.00
	5.00	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	11.00
	5.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	11.00

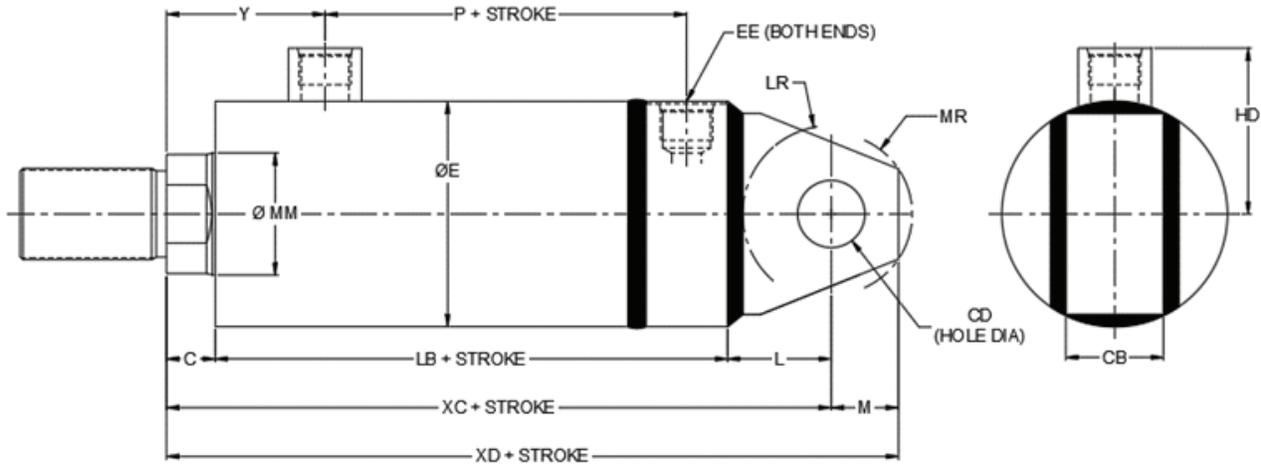
# Mounting Style and Installation Dimensions

## WH46 Cross Tube Mount



Bore	Rod Dia	C	E	EE (NPTF)	EE (SAE)	Y	P	HD	LB	L	MR (RAD.)	XC	CD+0.002 -0.000	CW	XD
1.50	0.63	0.38	1.88	0.38	#6	1.59	2.38	1.94	4.13	0.63	0.63	5.13	0.752	2.38	5.75
	1.00	0.50	1.88	0.38	#6	1.72	2.38	1.94	4.13	0.63	0.63	5.25	0.752	2.38	5.88
2.00	1.00	0.50	2.38	0.50	#8	2.66	2.50	2.38	5.25	0.63	0.63	6.38	0.752	2.88	7.00
	1.38	0.63	2.38	0.50	#8	2.78	2.50	2.38	5.25	0.63	0.63	6.50	0.752	2.88	7.13
2.50	1.00	0.50	3.00	0.50	#8	2.63	2.66	2.69	5.38	0.75	0.75	6.63	1.002	3.50	7.38
	1.38	0.63	3.00	0.50	#8	2.75	2.66	2.69	5.38	0.75	0.75	6.75	1.002	3.50	7.50
	1.75	0.75	3.00	0.50	#8	2.88	2.66	2.69	5.38	0.75	0.75	6.88	1.002	3.50	7.63
3.25	1.38	0.63	3.88	0.75	#12	2.75	3.28	3.13	6.25	0.94	0.94	7.81	1.252	4.38	8.75
	1.75	0.75	3.88	0.75	#12	2.88	3.28	3.13	6.25	0.94	0.94	7.94	1.252	4.38	8.88
	2.00	0.88	3.88	0.75	#12	3.00	3.28	3.13	6.25	0.94	0.94	8.06	1.252	4.38	9.00
4.00	1.75	0.75	4.63	0.75	#12	3.00	3.41	3.50	6.50	1.00	1.00	8.25	1.377	5.13	9.25
	2.00	0.88	4.63	0.75	#12	3.13	3.41	3.50	6.50	1.00	1.00	8.38	1.377	5.13	9.38
	2.50	1.00	4.63	0.75	#12	3.25	3.41	3.50	6.50	1.00	1.00	8.50	1.377	5.13	9.50
5.00	2.00	0.88	6.00	0.75	#12	3.31	4.09	4.19	7.38	1.38	1.38	9.63	1.752	6.25	11.00
	2.50	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	1.38	1.38	9.75	1.752	6.25	11.13
	3.00	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	1.38	1.38	9.75	1.752	6.25	11.13
	3.50	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	1.38	1.38	9.75	1.752	6.25	11.13
6.00	2.50	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	1.50	1.50	11.13	2.002	7.50	12.63
	3.00	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	1.50	1.50	11.13	2.002	7.50	12.63
	3.50	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	1.50	1.50	11.13	2.002	7.50	12.63
	4.00	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	1.50	1.50	11.13	2.002	7.50	12.63
7.00	3.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	1.88	1.88	12.38	2.502	8.50	14.25
	3.50	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	1.88	1.88	12.38	2.502	8.50	14.25
	4.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	1.88	1.88	12.38	2.502	8.50	14.25
	4.50	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	1.88	1.88	12.38	2.502	8.50	14.25
	5.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	1.88	1.88	12.38	2.502	8.50	14.25
8.00	3.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	2.00	2.00	13.00	3.002	9.75	15.00
	4.00	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	2.00	2.00	13.00	3.002	9.75	15.00
	4.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	2.00	2.00	13.00	3.002	9.75	15.00
	5.00	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	2.00	2.00	13.00	3.002	9.75	15.00
	5.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	2.00	2.00	13.00	3.002	9.75	15.00

# Mounting Style and Installation Dimensions WH47 Cap Fixed Eye Mount



Bore	Rod Dia	C	E	EE (NPTF)	EE (SAE)	Y	P	HD	LB	L	M	XC	LR (RAD.)	MR (RAD.)	CD+0.002 -0.000	CB	XD
1.50	0.63	0.38	1.88	0.38	#6	1.59	2.38	1.94	4.13	0.75	0.50	5.25	0.56	0.56	0.502	0.75	5.75
	1.00	0.50	1.88	0.38	#6	1.72	2.38	1.94	4.13	0.75	0.50	5.38	0.56	0.56	0.502	0.75	5.88
2.00	1.00	0.50	2.38	0.50	#8	2.66	2.50	2.38	5.25	1.25	0.75	7.00	1.06	0.94	0.752	1.25	7.75
	1.38	0.63	2.38	0.50	#8	2.78	2.50	2.38	5.25	1.25	0.75	7.13	1.06	0.94	0.752	1.25	7.88
2.50	1.00	0.50	3.00	0.50	#8	2.63	2.66	2.69	5.38	1.25	0.75	7.13	1.00	0.94	0.752	1.25	7.88
	1.38	0.63	3.00	0.50	#8	2.75	2.66	2.69	5.38	1.25	0.75	7.25	1.00	0.94	0.752	1.25	8.00
	1.75	0.75	3.00	0.50	#8	2.88	2.66	2.69	5.38	1.25	0.75	7.38	1.00	0.94	0.752	1.25	8.13
3.25	1.38	0.63	3.88	0.75	#12	2.75	3.28	3.13	6.25	1.50	1.00	8.38	1.19	1.21	1.002	1.50	9.38
	1.75	0.75	3.88	0.75	#12	2.88	3.28	3.13	6.25	1.50	1.00	8.50	1.19	1.21	1.002	1.50	9.50
	2.00	0.88	3.88	0.75	#12	3.00	3.28	3.13	6.25	1.50	1.00	8.63	1.19	1.21	1.002	1.50	9.63
4.00	1.75	0.75	4.63	0.75	#12	3.00	3.41	3.50	6.50	2.13	1.38	9.38	1.81	1.63	1.377	2.00	10.75
	2.00	0.88	4.63	0.75	#12	3.13	3.41	3.50	6.50	2.13	1.38	9.50	1.81	1.63	1.377	2.00	10.88
	2.50	1.00	4.63	0.75	#12	3.25	3.41	3.50	6.50	2.13	1.38	9.63	1.81	1.63	1.377	2.00	11.00
5.00	2.00	0.88	6.00	0.75	#12	3.31	4.09	4.19	7.38	2.25	1.75	10.50	1.88	1.89	1.752	2.50	12.25
	2.50	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	2.25	1.75	10.63	1.88	1.89	1.752	2.50	12.38
	3.00	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	2.25	1.75	10.63	1.88	1.89	1.752	2.50	12.38
	3.50	1.00	6.00	0.75	#12	3.44	4.09	4.19	7.38	2.25	1.75	10.63	1.88	1.89	1.752	2.50	12.38
6.00	2.50	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.50	2.00	12.13	2.00	2.19	2.002	2.50	14.13
	3.00	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.50	2.00	12.13	2.00	2.19	2.002	2.50	14.13
	3.50	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.50	2.00	12.13	2.00	2.19	2.002	2.50	14.13
	4.00	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.50	2.00	12.13	2.00	2.19	2.002	2.50	14.13
	4.00	1.00	7.00	1.00	#16	3.88	4.63	4.88	8.63	2.50	2.00	12.13	2.00	2.19	2.002	2.50	14.13
7.00	3.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	3.00	2.50	13.50	2.50	2.69	2.502	3.00	16.00
	3.50	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	3.00	2.50	13.50	2.50	2.69	2.502	3.00	16.00
	4.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	3.00	2.50	13.50	2.50	2.69	2.502	3.00	16.00
	4.50	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	3.00	2.50	13.50	2.50	2.69	2.502	3.00	16.00
	5.00	1.00	8.00	1.25	#20	4.00	5.13	5.44	9.50	3.00	2.50	13.50	2.50	2.69	2.502	3.00	16.00
8.00	3.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	3.25	2.75	14.25	2.63	2.94	3.002	3.00	17.00
	4.00	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	3.25	2.75	14.25	2.63	2.94	3.002	3.00	17.00
	4.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	3.25	2.75	14.25	2.63	2.94	3.002	3.00	17.00
	5.00	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	3.25	2.75	14.25	2.63	2.94	3.002	3.00	17.00
	5.50	1.00	9.25	1.25	#20	4.00	5.63	6.07	10.00	3.25	2.75	14.25	2.63	2.94	3.002	3.00	17.00

# Bore and Rod Diameter – Cylinder Size Selection

To choose the proper size of cylinder for your application, first determine the maximum push or pull force required to do the job. Then use the below table to select the cylinder that will provide that force.

Remember that force capabilities derived from charts and formulas may be therotically correct, but other factor must be considered. Be sure to allow for pressure drop between pump outlet and cylinder port. Also some of a cylinder force is used up overcoming seal friction and lesser extent the inertia of the piston itself.

## WARNING

It is the user's responsibility to select the correct cylinder size.

Bore Dia in	Rod Dia in	Work Area (in <sup>2</sup> )	Maximum Force (lbf) At working pressure(psi)					
			500 (psi)	750 (psi)	1000 (psi)	1500 (psi)	2000 (psi)	3000 (psi)
1.50	-	1.767	884	1325	1767	2651	3534	5301
	0.625	1.460	730	1095	1460	2191	2921	4381
	1	0.982	491	736	982	1473	1964	2945
2.00	-	3.142	1571	2356	3142	4712	6283	9425
	1	2.356	1178	1767	2356	3534	4712	7069
	1.375	1.657	828	1243	1657	2485	3313	4970
2.50	-	4.909	2454	3682	4909	7363	9817	14726
	1	4.123	2062	3093	4123	6185	8247	12370
	1.375	3.424	1712	2568	3424	5136	6848	10272
	1.75	2.503	1252	1878	2503	3755	5007	7510
3.25	-	8.296	4148	6222	8296	12444	16592	24887
	1.375	6.811	3405	5108	6811	10216	13622	20433
	1.75	5.891	2945	4418	5891	8836	11781	17672
	2	5.154	2577	3866	5154	7731	10308	15463
4.00	-	12.566	6283	9425	12566	18850	25133	37699
	1.75	10.161	5081	7621	10161	15242	20322	30483
	2	9.425	4712	7069	9425	14137	18850	28274
	2.5	7.658	3829	5743	7658	11486	15315	22973
5.00	-	19.635	9817	14726	19635	29452	39270	58905
	2	16.493	8247	12370	16493	24740	32987	49480
	2.5	14.726	7363	11045	14726	22089	29453	44179
	3	12.566	6283	9425	12566	18850	25133	37699
	3.5	10.014	5007	7510	10014	15021	20028	30042
	4	8.296	4148	6222	8296	12444	16592	24887
6.00	-	28.274	14137	21206	28274	42412	56549	84823
	2.5	23.366	11683	17524	23366	35048	46731	70097
	3	21.206	10603	15904	21206	31809	42412	63617
	3.5	18.653	9327	13990	18653	27980	37307	55960
	4	15.708	7854	11781	15708	23562	31416	47124
	4.5	14.137	7069	10603	14137	21206	28274	42412
7.00	-	38.485	19242	28863	38485	57727	76969	115454
	3	31.416	15708	23562	31416	47124	62832	94248
	3.5	28.863	14432	21648	28863	43295	57727	86590
	4	25.918	12959	19439	25918	38877	51836	77755
	4.5	22.580	11290	16935	22580	33870	45161	67741
	5	18.850	9425	14137	18850	28274	37699	56549
	5.5	16.493	8247	12370	16493	24740	32987	49480
8.00	-	50.266	25133	37699	50266	75398	100531	150797
	3.5	40.644	20322	30483	40644	60967	81289	121933
	4	37.699	18850	28274	37699	56549	75398	113098
	4.5	34.361	17181	25771	34361	51542	68723	103084
	5	30.631	15315	22973	30631	45946	61261	91892
	5.5	26.507	13254	19880	26507	39761	53015	79522

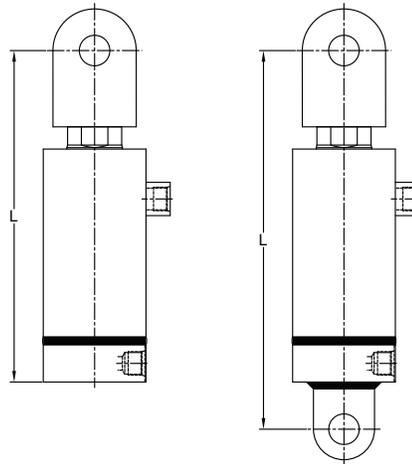
# Maximum Allowable Push Stroke (Recommended "L")

In push application, a cylinder acts as loaded column.

To use the side table first go to section for your mounting style. Then locate the column which is closest to, but not below, your application's operating pressure. The intersection of operating pressure and bore /rod size represents the allowable length (L) in full extended condition.

The maximum allowable length "L" is based on column loading analysis only and does not consider side loading, stop tube requirements or other cylinder stroke limitations.

For pressure above 3000 PSI consult your local Danfoss representative.



Maximum Length L (in) at Working Pressure (psi) { Length L in full extend condition}

Bore Dia in	Rod Dia in	Rigid Mount (24)								Swivel Mount (10,11,46,47)							
		3000 psi	2000 psi	1500 psi	1000 psi	750 psi	500 psi	250 psi	3000 psi	2000 psi	1500 psi	1000 psi	750 psi	500 psi	250 psi		
1.50	0.63	14	19	22	27	31	38	54	10	13	15	19	22	27	38		
	1.00	40	48	56	69	79	97	137	28	34	40	48	56	69	97		
2.00	1.00	30	36	42	51	59	73	103	21	26	30	36	42	51	73		
	1.38	56	69	79	97	112	137	194	40	49	56	69	79	97	137		
2.50	1.00	20	19	34	41	47	58	82	14	19	24	29	34	41	58		
	1.38	45	55	63	78	90	110	156	32	39	45	55	63	78	110		
	1.75	73	89	103	126	145	178	252	51	63	73	89	103	126	178		
3.25	1.38	32	42	49	60	69	85	120	23	30	35	42	49	60	85		
	1.75	56	69	79	97	112	137	194	40	48	56	69	79	97	137		
	2.00	73	89	103	127	146	179	253	52	63	73	89	103	127	179		
4.00	1.75	43	56	64	79	91	111	157	31	39	45	56	64	79	111		
	2.00	59	73	84	103	119	145	206	42	51	59	73	84	103	145		
	2.50	93	114	131	161	186	227	321	66	80	93	114	131	161	227		
5.00	2.00	40	38	67	82	95	116	165	28	27	47	58	67	82	116		
	2.50	74	91	105	129	148	182	257	52	64	74	91	105	129	182		
	3.00	107	131	151	185	214	262	370	76	93	107	131	151	185	262		
	3.50	145	178	206	252	291	356	504	103	126	145	178	206	252	356		
6.00	2.50	56	76	87	107	124	151	214	40	54	62	76	87	107	151		
	3.00	89	109	126	154	178	218	308	63	77	89	109	126	154	218		
	3.50	121	148	171	210	242	297	420	86	105	121	148	171	210	297		
	4.00	158	194	224	274	317	388	548	112	137	158	194	224	274	388		
7.00	3.00	72	93	108	132	153	187	264	51	66	76	93	108	132	187		
	3.50	104	127	147	180	208	254	360	73	90	104	127	147	180	254		
	4.00	136	166	192	235	271	332	470	96	118	136	166	192	235	332		
	4.50	172	210	243	297	344	421	595	121	149	172	210	243	297	421		
	5.00	212	260	300	367	424	519	735	150	184	212	260	300	367	519		
8.00	3.50	87	111	129	157	182	223	315	62	79	91	111	129	157	223		
	4.00	119	145	168	206	237	291	411	84	103	119	145	168	206	291		
	4.50	150	184	213	260	301	368	521	106	130	150	184	213	260	368		
	5.00	186	227	262	321	371	454	643	131	161	186	227	262	321	454		
	5.50	224	275	317	389	449	550	778	159	194	224	275	317	389	550		

Calculation according to Euler

$$P = \frac{C\pi^2 EI}{FL^2}$$

$$\frac{L}{k} > \left[ \frac{2C\pi^2 E}{S_y} \right]$$

Calculation according to Jb Johnson

$$P = \frac{AS_y}{F} \left[ 1 - \frac{S_y L^2}{4C\pi^2 E k^2} \right]$$

$$\frac{L}{k} \leq \left[ \frac{2C\pi^2 E}{S_y} \right]$$

- F Safety factor,
- P Critical load, Lb
- E Modulus of elasticity, 30000000 psi
- L Length, in
- I Moment of inertia, in<sup>4</sup>
- C End condition
  - Fixed-Guided 2
  - Fixed-Fixed 4
  - Pin-Pin 1
- A Rod area, in<sup>2</sup>
- k Radius of gyration, in

End conditions for above chart  
 Mount Condition  
 Rigid Mounts Fixed-Guided  
 Swivel Mounts Pin-Pin

# Stop Tube Selection

Stop tubes are located between the piston and the rod shoulder on the head end of the cylinder. Bearing loading is reduced by separating the piston and the rod bushing. Bearing wear and tendency to buckle is reduced.

To determine if a stop tube is required and the length of stop tube needed, use the following procedure:

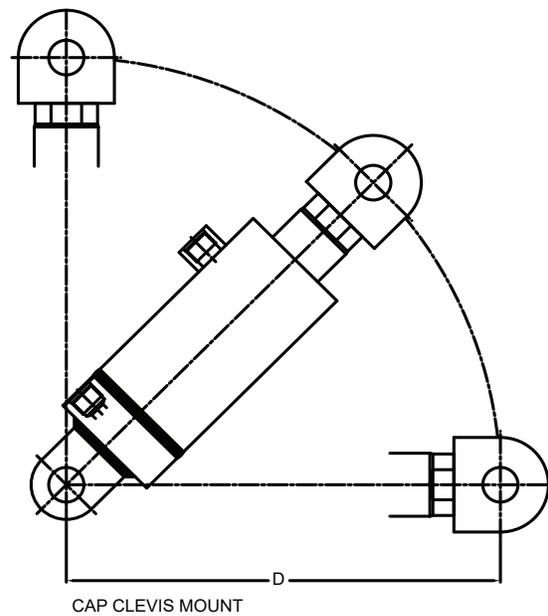
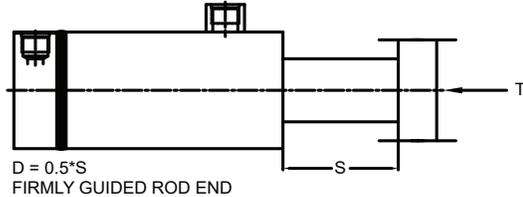
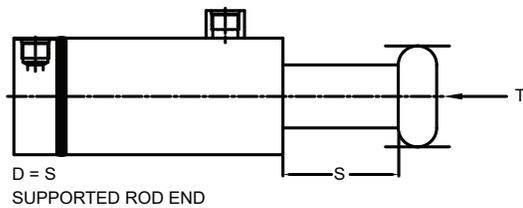
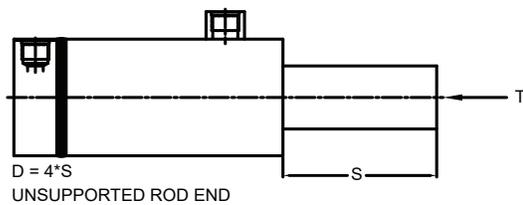
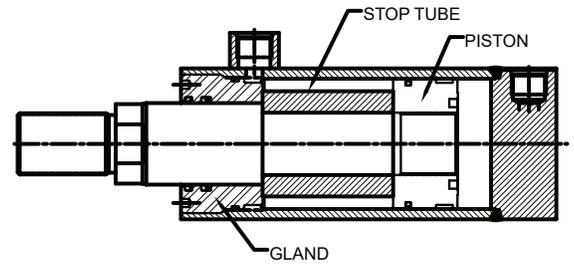
Determine the value of D with the piston rod in the fully extended position. If the value

of D is under 40", no stop tube is needed.

If D is greater than 40", one inch of stop tube is recommended for each 10", or fraction thereof, beyond 40".

### SPECIAL NOTE

When specifying stroke and stop tube lengths, please include net working stroke plus stop tube length.

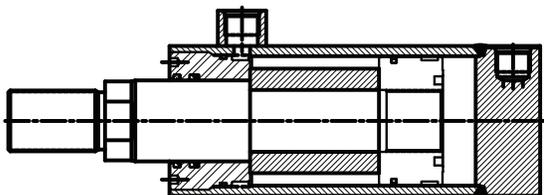


### STOP TUBES

There are two stop tube designs depending on the length required. A stop tube will increase the overall cylinder length.

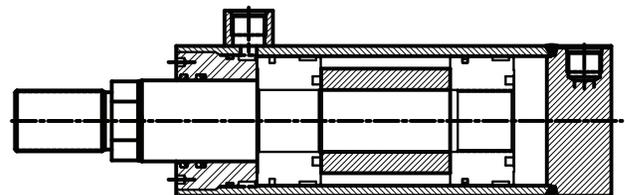
#### DESIGN A

The standard stop tube design for lengths under 10".



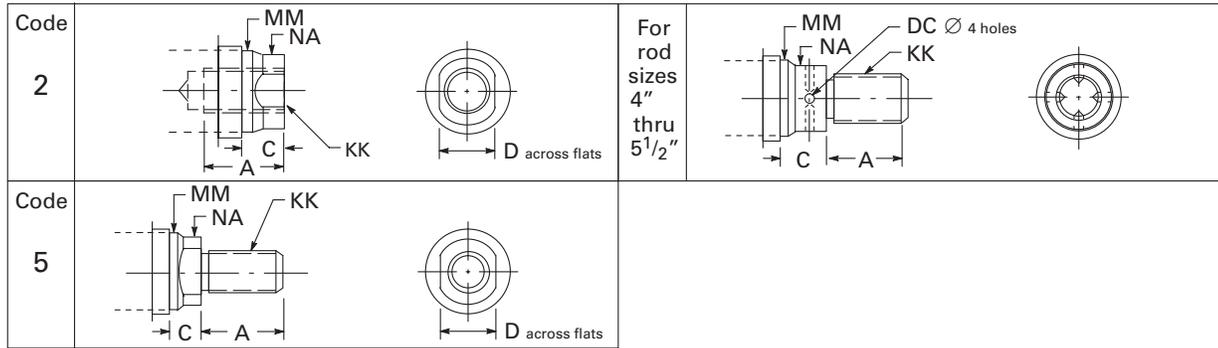
#### DESIGN B

The standard stop tube design for lengths over 10". Note that the piston's effective bearing area is doubled, in addition to gaining the normal increased minimum distance between bearing points.



# Rod End Type Selection\*

## Inch Rod Ends



Rod dia(MM)	A	C	D	DC	NA	UN(F) Thread
						KK
0.625	0.75	0.38	0.53	-	0.585	7/16-20
1.000	1.13	0.50	0.88	-	0.968	3/4-16
1.375	1.63	0.63	1.13	-	1.343	1-14
1.750	2.00	0.75	1.50	-	1.718	1 1/4-12
2.000	2.25	0.88	1.75	-	1.953	1 1/2-12
2.500	3.00	1.00	2.13	-	2.437	1 7/8-12
3.000	3.50	1.00	2.63	-	2.937	2 1/4-12
3.500	3.50	1.00	3.00	-	3.437	2 1/2-12
4.000	4.00	1.00	-	0.50	3.906	3-12
4.500	4.50	1.00	-	0.50	4.406	3 1/4-12
5.000	5.00	1.00	-	0.50	4.906	3 1/2-12
5.500	5.50	1.00	-	0.50	5.406	4-12

\* For ordering other rod end types, call out "X" in place of Rod end style code and define the rod type specs.  
 .625 rod dia is not available for Cylinders with Transducer.

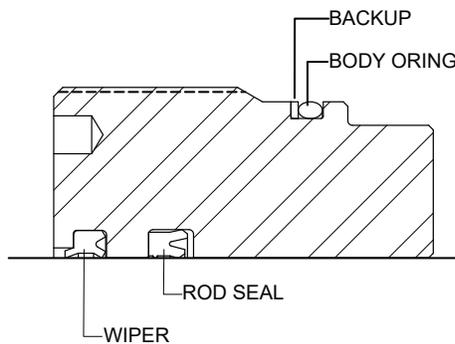
# Sealing System

Three different sealing systems are available in Series WH cylinders.

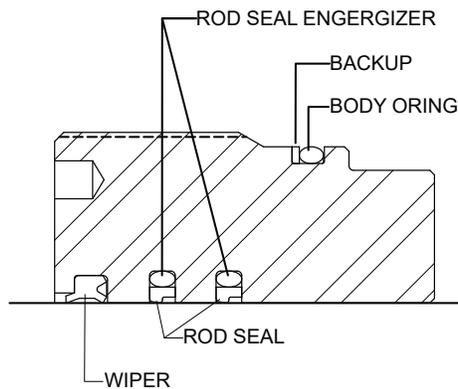
Determine the correct seal code for your application, then enter it as position 8 in the model code.

Code	Fluid	Temperature (°F)	Max. Speed (ft/s)	Application
N	Mineral oil, petroleum base	-31 to 176	2.25	Normal, typical industrial
	Automotive transmission fluid			
L	Mineral oil	-31 to 248	15	Low friction servo
	Water glycol (HFC)	50 to 158	3	Fire retardant fluids
	Oil-in-water emulsions (HFA) Water-in-oil emulsions (HFB)			
T	Mineral oil	-13 to 392	15	High temperature
	Phosphate esters, petroleum oil blends	32 to 392	15	Fire retardant fluids
	Fyrquel 220, 550, 1000			
	Hought-O-Safe 1340 Pydraul 200, 230C, 280, 312C, 540C, A200			

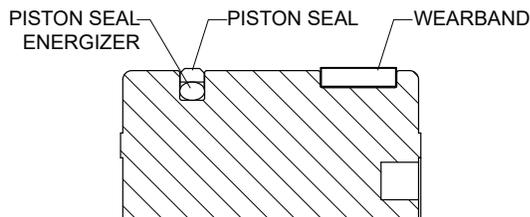
## ROD SEALING CONFIGURATION



NORMAL SEALING (N)



LOW FRICTION AND HIGH TEMP SEALING ( L AND T)



## PISTON SEALING CONFIGURATION

NORMAL, LOW FRICTION AND HIGH TEMP SEALING ( N, L AND T)

# Port Type and Size

## Available Ports

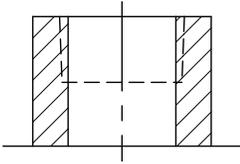
Series WH cylinders are available with SAE straight thread O-ring ports and the alternate ports listed below. The table below

lists the port types and sizes available for each bore diameter. The table on the next page lists the maximum piston velocities

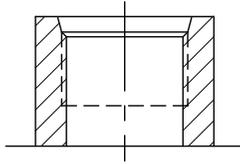
obtainable with each bore diameter and port type combination.

Where a port or port boss interferes with cylinder

mounting, mounting should take precedence.



PORT CODE 1



PORT CODE 3

## Port Code

Bore	Rod Dia	1 (NPTF) †	3 (SAE J1926)
1.50	0.63	0.38	#6
	1.00	0.38	#6
2.00	1.00	0.50	#8
	1.38	0.50	#8
2.50	1.00	0.50	#8
	1.38	0.50	#8
	1.75	0.50	#8
3.25	1.38	0.75	#12
	1.75	0.75	#12
	2.00	0.75	#12
4.00	1.75	0.75	#12
	2.00	0.75	#12
	2.50	0.75	#12
5.00	2.00	0.75	#12
	2.50	0.75	#12
	3.00	0.75	#12
	3.50	0.75	#12
6.00	2.50	1.00	#16
	3.00	1.00	#16
	3.50	1.00	#16
	4.00	1.00	#16
7.00	3.00	1.25	#20
	3.50	1.25	#20
	4.00	1.25	#20
	4.50	1.25	#20
	5.00	1.25	#20
8.00	3.50	1.25	#20
	4.00	1.25	#20
	4.50	1.25	#20
	5.00	1.25	#20
	5.50	1.25	#20

† NPTF ports are not recommended for maximum reliability on new application

# Port Selection

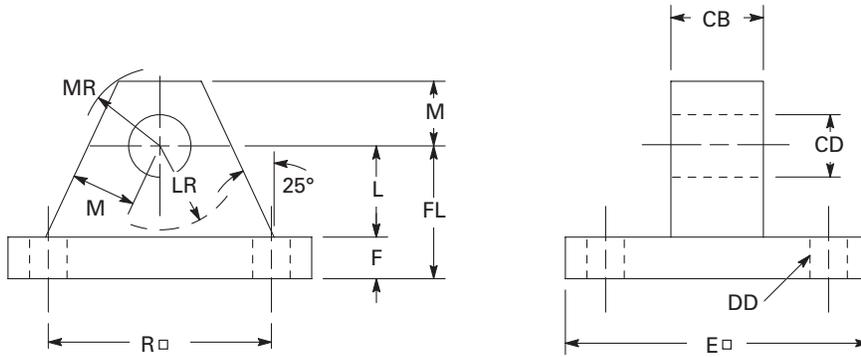
Use this table to determine which bore diameter, rod diameter and port combination will provide the piston velocity required for your application.

Bore Dia In	Rod Dia in	Fluid Required per Inch of stroke (gal) (in <sup>3</sup> )		Port Code 1		Port Code 3		
				Flow (gpm)	Piston Velocity (In/sec)	Flow (gpm)	Piston Velocity (In/sec)	
1.50	Cap	0.008	1.767	6.0	13.1	6.0	13.1	
	0.63	0.006	1.460	6.0	15.8	6.0	15.8	
	1.00	0.004	0.982	6.0	23.5	6.0	23.5	
2.00	Cap	0.014	3.142	6.0	7.4	6.0	7.4	
	1.00	0.010	2.356	6.0	9.8	6.0	9.8	
	1.38	0.007	1.657	6.0	13.9	6.0	13.9	
2.50	Cap	0.021	4.909	6.0	4.7	6.0	4.7	
	1.00	0.018	4.123	6.0	5.6	6.0	5.6	
	1.38	0.015	3.424	6.0	6.7	6.0	6.7	
	1.75	0.011	2.503	6.0	9.2	6.0	9.2	
3.25	Cap	0.036	8.296	14.5	6.7	14.5	6.7	
	1.38	0.029	6.811	14.5	8.2	14.5	8.2	
	1.75	0.026	5.891	14.5	9.5	14.5	9.5	
	2.00	0.022	5.154	14.5	10.8	14.5	10.8	
4.00	Cap	0.054	12.566	14.5	4.4	14.5	4.4	
	1.75	0.044	10.161	14.5	5.5	14.5	5.5	
	2.00	0.041	9.425	14.5	5.9	14.5	5.9	
	2.50	0.033	7.658	14.5	7.3	14.5	7.3	
	5.00	Cap	0.085	19.635	14.5	2.8	14.5	2.8
5.00	2.00	0.071	16.493	14.5	3.4	14.5	3.4	
	2.50	0.064	14.726	14.5	3.8	14.5	3.8	
	3.00	0.054	12.566	14.5	4.4	14.5	4.4	
	3.50	0.043	10.014	14.5	5.6	14.5	5.6	
	6.00	Cap	0.122	28.274	27.9	3.8	27.9	3.8
	2.50	0.101	23.366	27.9	4.6	27.9	4.6	
6.00	3.00	0.092	21.206	27.9	5.1	27.9	5.1	
	3.50	0.081	18.653	27.9	5.8	27.9	5.8	
	4.00	0.068	15.708	27.9	6.8	27.9	6.8	
	7.00	Cap	0.167	38.485	45.5	4.6	45.5	4.6
	3.00	0.136	31.416	45.5	5.6	45.5	5.6	
	3.50	0.125	28.863	45.5	6.1	45.5	6.1	
	4.00	0.112	25.918	45.5	6.8	45.5	6.8	
7.00	4.50	0.098	22.580	45.5	7.8	45.5	7.8	
	5.00	0.082	18.850	45.5	9.3	45.5	9.3	
	8.00	Cap	0.218	50.266	67.4	5.2	45.5	3.5
	3.50	0.176	40.644	67.4	6.4	45.5	4.3	
	4.00	0.163	37.699	67.4	6.9	45.5	4.6	
	4.50	0.149	34.361	67.4	7.6	45.5	5.1	
	5.00	0.133	30.631	67.4	8.5	45.5	5.7	
5.50	0.115	26.507	67.4	9.8	45.5	6.6		



# Accessories

## Mounting Eye Bracket\*

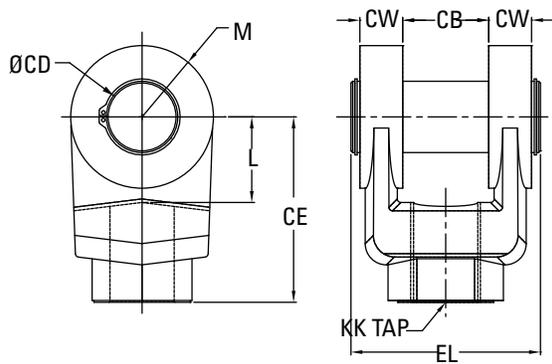


Bore	Part Number	Weight (lbs)	E	F	L	M	R	CB	CD	DD	FL	LR	MR
1.50	SEB-0500	0.94	2.50	0.38	0.75	0.50	1.63	0.75	0.50	0.38	1.13	0.50	0.56
2.00	WHSEB-0750**	3.00	3.50	0.63	1.25	0.75	2.55	1.06	0.75	0.50	1.88	1.06	1.06
2.50	SEB-0750	3.19	3.50	0.63	1.25	0.75	2.55	1.25	0.75	0.50	1.88	1.00	1.06
3.25	SEB-1000	7.17	4.50	0.88	1.50	1.00	3.25	1.50	1.00	0.63	2.38	1.00	1.13
4.00	SEB-1375	11.7	5.00	0.88	2.13	1.38	3.82	2.00	1.38	0.63	3.00	1.13	1.75
5.00	SEB-1750A	22	6.50	1.13	2.25	1.75	4.95	2.50	1.75	0.88	3.38	1.75	1.88
6.00	SEB-2000A	34.5	7.50	1.50	2.50	2.00	5.73	2.50	2.00	1.00	4.00	2.00	2.13
7.00	SEB-2500A	55.4	8.50	1.75	3.00	2.50	6.58	3.00	2.50	1.13	4.75	2.50	2.50
8.00	SEB-3000	72.5	9.50	2.00	3.25	2.75	7.50	3.00	3.00	1.25	5.25	2.75	2.75

\* Will work with 10- Clevis mount and FRC-XXXX rod clevis

\*\* WHSEB-0750 will only work on cap end of WH10

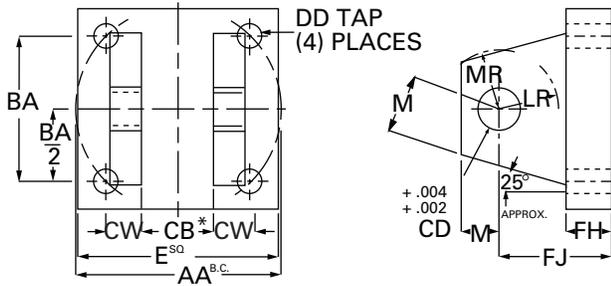
## Rod Clevis



Bore	KK	Part Number	Weight (lbs)	L	M	CB	CD	CE	CW	EL
1.50	7/16-20 UNF-2B	FRC-0437-10	0.56	0.75	0.50	0.75	0.50	1.50	0.50	2.10
2.00	3/4-16 UNF-2B	FRC-0750-10	1.56	1.25	0.75	1.25	0.75	2.38	0.63	2.89
2.50	3/4-16 UNF-2B	FRC-0750-10	1.56	1.25	0.75	1.25	0.75	2.38	0.63	2.89
3.25	1-14 UNS-2B	FRC-1000-10	3.31	1.50	1.00	1.50	1.00	3.13	0.75	3.39
4.00	1 1/4-12 UNF-2B	FRC-1250-10	9.25	2.13	1.38	2.00	1.38	4.13	1.00	4.47
5.00	1 1/2-12 UNF-2B	FRC-1500-10	14.62	2.25	1.75	2.50	1.75	4.50	1.25	5.56
6.00	1 7/8-12 UN-2B	FRC-1875-10	21	2.50	2.00	2.50	2.00	5.50	1.25	5.56
7.00	2 1/4-12 UN-2B	FRC-2250-10	36	3.00	2.50	3.00	2.50	6.50	1.50	6.64
8.00	2 1/2-12 UN-2B	FRC-2500-10	43	3.25	2.75	3.00	3.00	6.75	1.50	6.77

# Accessories

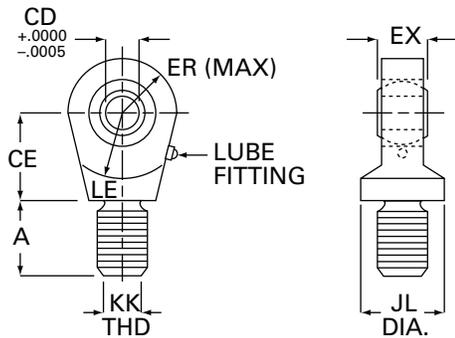
## Clevis Bracket\*



Bore	Part No.	AA	BA	CB	CD	CW	DD	E	FH	FJ	LR	M	MR
1.50	ECB-0500	2.31	1.63	0.781	0.500	0.50	3/8-24	2.50	0.38	1.13	0.50	0.50	0.56
2.00	ECB-0750	2.91	2.06	1.281	0.750	0.63	1/2-20	3.00	0.63	1.88	1.00	0.75	1.06
2.50	ECB-0750A	3.62	2.56	1.281	0.750	0.63	1/2-20	3.50	0.63	1.88	1.06	0.75	1.06
3.25	ECB-1000	4.60	3.25	1.531	1.000	0.75	5/8-18	4.50	0.75	2.25	1.25	1.00	1.13
4.00	ECB-1380	5.39	3.81	2.031	1.375	1.00	5/8-18	5.00	0.88	3.00	1.88	1.38	1.75
5.00	ECB-1750	6.99	4.94	2.531	1.750	1.25	7/8-14	6.50	0.88	3.13	2.00	1.75	1.88
6.00	ECB-2000	8.13	5.75	2.531	2.000	1.25	1-14	7.50	1.00	3.50	2.13	2.00	2.13
7.00	ECB-2500	9.32	6.59	3.031	2.500	1.50	1 1/8-12	8.50	1.00	4.00	2.63	2.50	2.50
8.00	ECB-3000	10.61	7.50	3.031	3.000	1.50	1 1/4-12	9.50	1.00	4.25	2.88	2.75	2.75

\* Will work with 47-mono clevis, eye mount and FRE-XXXX rod eye

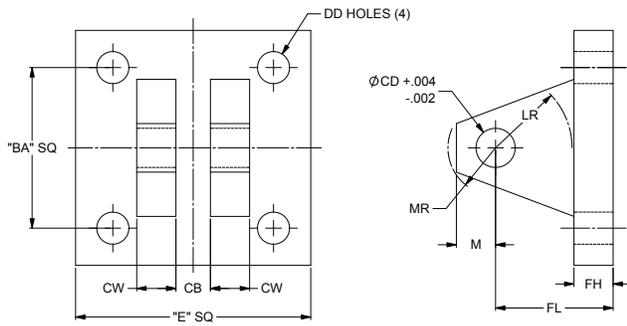
## Spherical Rod Eye



Bore	KK	Part No.	A	CD +.0000 -.0005	CE	EX	ER	JL	LE	Load Capacity (lbs)
1.50	7/16-20 UNF	BRE-0437	0.69	0.5000	0.88	0.44	0.88	0.88	0.75	2600
2.00	3/4-16 UNF	BRE-0750	1.00	0.7500	1.25	0.66	1.25	1.31	1.06	9400
2.50	3/4-16 UNF	BRE-0750	1.00	0.7500	1.25	0.66	1.25	1.31	1.06	9400
3.25	1-14 UNS-2A	BRE-1000	1.50	1.0000	1.88	0.88	1.38	1.50	1.44	16800
4.00	1 1/4-12 UNF-2A	BRE-1250	2.00	1.3750	2.13	1.19	1.81	2.00	1.88	28600
5.00	1 1/2-12 UNF-2A	BRE-1500	2.13	1.7500	2.50	1.53	2.19	2.25	2.13	43000
6.00	1 7/8-12 UN-2A	BRE-1875	2.88	2.0000	2.75	1.75	2.63	2.75	2.50	70000

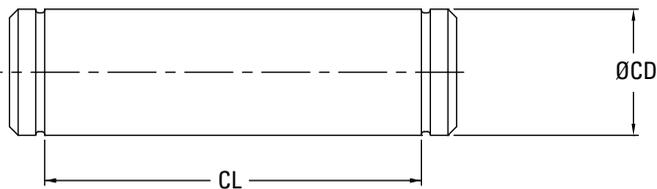
# Accessories for WH11 Spherical Bushing Mount

## Spherical Clevis Bracket



Bore	Part No.	BA	CB	CD	CW	DD	E	FH	FL	LR	M	MR
1.50	SCB-0500	2.05	0.44	0.500	0.50	0.41	3.00	0.50	1.50	0.94	0.50	0.62
2.00	SCB-0750	2.76	0.66	0.750	0.62	0.53	3.75	0.62	2.00	1.38	0.88	1.00
2.50	SCB-0750	2.76	0.66	0.750	0.62	0.53	3.75	0.62	2.00	1.38	0.88	1.00
3.25	SCB-1000	4.10	0.88	1.000	0.75	0.53	5.50	0.75	2.50	1.69	1.00	1.19
4.00	SCB-1380	4.95	1.19	1.375	1.00	0.66	6.50	0.88	3.50	2.44	1.38	1.62
5.00	SCB-1750	6.58	1.53	1.750	1.25	0.91	8.50	1.25	4.50	2.88	1.75	2.06
6.00	SCB-2000	7.92	1.75	2.000	1.50	0.91	10.62	1.50	5.00	3.31	2.00	2.38

## Pivot Pin - for Spherical Bearing



Bore	Part No.	CD	CL
1.50	SBPIN-050-10	0.500	1.56
2.00	SBPIN-075-10	0.750	2.03
2.50	SBPIN-075-10	0.750	2.03
3.25	SBPIN-100-10	1.000	2.50
4.00	SBPIN-138-10	1.375	3.31
5.00	SBPIN-175-10	1.750	4.22
6.00	SBPIN-200-10	2.000	4.94

1. Pivot pins supplied with retainer clips.

# Proximity Switches and Transducers

A wide variety of precision cylinder position sensing and feedback devices are available. These packaged cylinder systems can handle virtually any application requiring feedback throughout the cylinder stroke with or without velocity monitoring and with resolutions of  $\pm 0.001$  or better. Cylinder can be manufactured prepared for transducer or with transducer

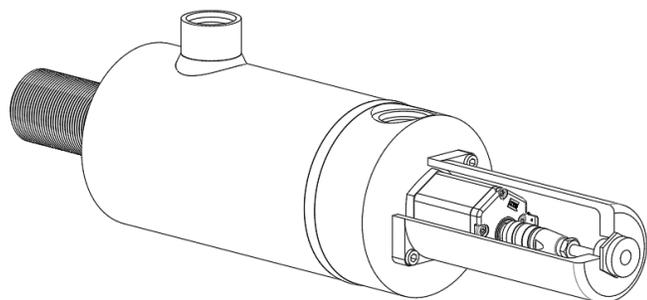
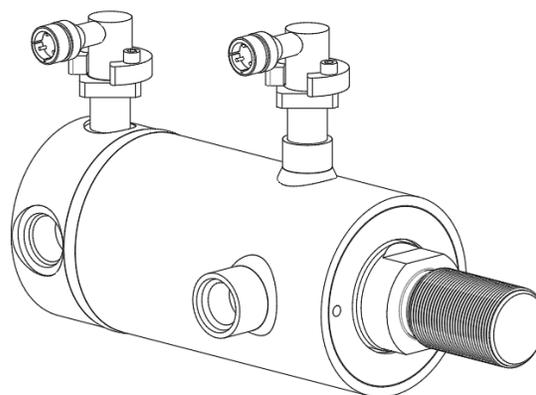
already installed. Proximity switches are inductive type switches with sensing probe that "looks" at the cushion collar or button to provide extended or retracted indication. Since the probe is inside the cylinder. Harsh external environments don't affect sensing. The 2-wire circuit will operate on AC or

DC and works as reliably as a programmable controller. Proximity switches will meet UL requirements for 3000-psi (210 bar) hydraulic cylinder. Switch will allow 304° rotations. Short Circuit protection is standard feature on proximity switches. SCP protects the switch from shorts in load or line. Upon sensing short condition, the switch assumes a non-

conducting mode. The fault condition must be removed and power turned off in order to reset the switch. This feature prevents unintended automatic restarts. The switch indicated when it is in SCP mode by flashing both leads.

Series PS 200 2-wire AC / DC Proximity Switch

Pressure	3000 PSI
Sensing Range	0.08 in $\pm$ 10 %
Sensing distance from End of stroke	0.25" - 0.38" stroke to go
Operating temperature range	-13° to +158° F
Repeatability	0.001 in
Switching differential	$\leq$ 15%
Supply Voltage	20 - 250 V AC / DC
Voltage drop	$\leq$ 6 V
Load Current capacity @ 25° C	5-400 mA
Inrush current	$\leq$ 3A (t $\leq$ 20ms)
Indicating LED's (Standard)	1 lit: Power on non-conducting 2 lit: Target present (both flashing = SCP mode)



Different protective cover options are available for rugged environments to protect the electronics. Casting cover options protect the transducer from minor wear and tear, yet is easily removable to service the transducer.

Linear displacement transducers are precise, durable, cost-effective measurement devices. Well protected within the core of the cylinder, the transducer measures the position of the moving elements of the cylinder, but also remains untouched, and unaffected by even the harshest elements. Innovative encapsulated design and engineering along with the rugged construction guarantee the best reliability, precision and

durability in even the toughest industrial environment.

From the common mangetostrictive type transducers and proximity switches to solid state transducers, Danfoss can provide a solution for your feedback needs regardless of application or condition. Danfoss can also provide a cylinder "prepared" for a transducer if you prefer to provide your own feedback. Please contact your Danfoss representative with your requirements and we can provide a cylinder solution.

# Cylinder Application Data Sheet

All other types of cylinders (Mill Duty, Tie Rod, Threaded) can be configured with different transducer, manifold, and mounting options upon request. Submit below form for a custom WH cylinder design to your local Danfoss sales engineer.

<b>Customer Name:</b>				
Customer P/N	Rev	Machine	Function	
Contact	Ph	Fax	e-mail	
<b>Cylinder Description</b>				
Series	Mtg Style	Bore	Rod	Stroke
Cushions: None <input type="checkbox"/> Rod End <input type="checkbox"/> Pos: Blind End <input type="checkbox"/> Pos:				
Weight Connected to Rod (lbs):				
<b>How is Cylinder Mounted</b>				
Horizontal <input type="checkbox"/>	Vertical Rod Up <input type="checkbox"/> Rod Down <input type="checkbox"/>		Angle <input type="checkbox"/> Degrees Vertical	
Rod End Connection	Firmly Guided <input type="checkbox"/> Supported <input type="checkbox"/> Unsupported <input type="checkbox"/> Know Side Load(lbs)			
<b>How is Cylinder Used</b>				
Operating Fluid:			Fluid Temp @ Cylinder: °F	
Pressure Setting Extend:		Pressure Setting Retract:		
Stop Internal Ext <input type="checkbox"/>	Stop Internal Ret <input type="checkbox"/>	Stop External Ext <input type="checkbox"/>	Stop External Ret <input type="checkbox"/>	
Force Ext lb f	Force Ret lb f	Velocity Ext:	Velocity Ret:	
Cycle Rate:	Cycle Life of Cylinder:	Cycle Life Seals:		
<b>Environmental Conditions</b>				
Standard Factory <input type="checkbox"/> Very Dirty <input type="checkbox"/> Outdoors <input type="checkbox"/> Other:				
Application Sketch			Special Requirements	
Prepared By	Date	Reviewed By	Date	

ext = cylinder extends    ret = cylinder retracts



ENGINEERING  
TOMORROW

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Printed in USA  
Document No. BC431180704757en-000101  
September 2022