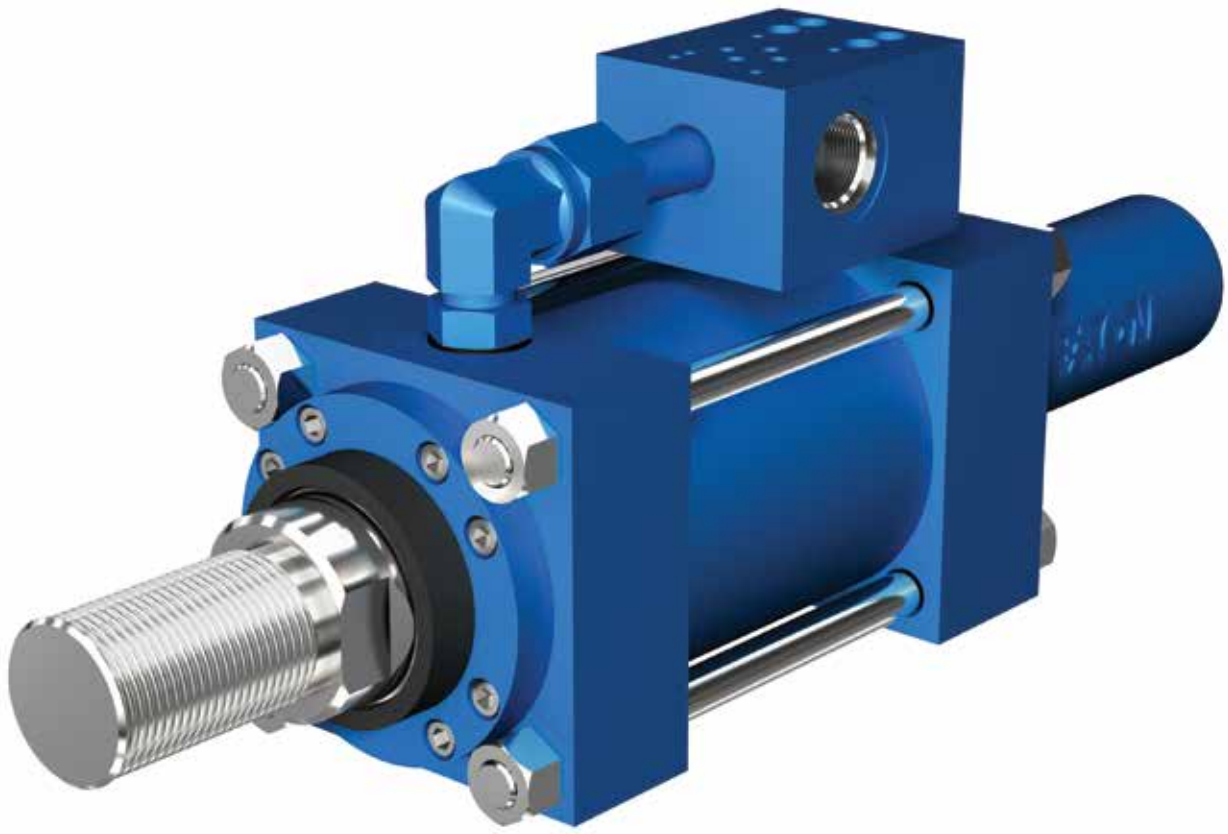
Eaton Electro-Hydraulic Cylinder Catalog



Powering Business Worldwide

Table of Content

Introduction

Features

Machined manifold

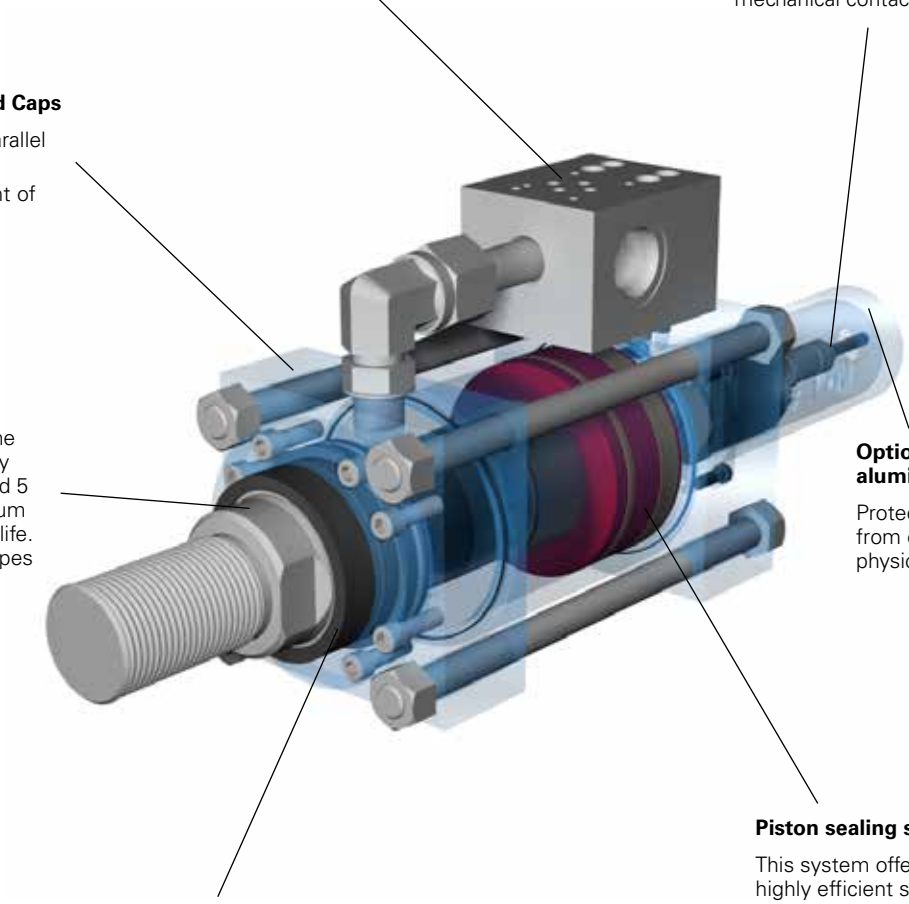
Allows mounting of valve directly on cylinder cap. This eliminates leaks and piping problems and provides for simplified installation and maintenance

Precision solid state position transducer

Generates digital or analog output feedback. Magnetostrictive design eliminates mechanical contact in operation.

Precision Steel Heads and Caps

- Provides truly flat and parallel mounting surfaces
- Insures correct alignment of tubing and rod cartridge



Piston Rod

Case hardened, hard chrome plated piston rod in a variety of diameters between 1 and 5 1/2 inches provides maximum durability and extends seal life. Several different rod end types are available.

Optional cast aluminum cover

Protects transducer head from environmental and physical damage

Piston sealing system

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

Rod Cartridge Assembly

Machined to maximum bearing support and wear resistance.Unitized, threadless assembly is pilot-fitted into the head on a precision bored diameter to assure true concentricity. Rod wearband prevents metal to metal contact and extends rod seal life.

Standard Cylinders

Eaton has created an easy system for ordering EH Series cylinders, developed to improve our service to you. The standard model code consists of twenty two alpha-numeric digits which fully describe the most common standard options offered on EH cylinders.

To specify your EH cylinder, review the following pages for a full description of each option available and select the desired code.

This model code system

will:

Simplify the re-order process.

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

Improve identification.

Every EH cylinder has a twenty two 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 Eaton sales engineer to identify and service your Eaton cylinder.

NOTE

See pages 6 and 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.

When specifying such an option, enter an "X" for the appropriate position in the twenty two digit model code, then describe your requirements.For example, if you have an application which requires a custom thread on the end of the piston rod, enter an "X" for position 7. Then add a full description at the end of the model code, such as "With 3.25 inch total rod projection and M22 x 1,5 thread 1.375 inches long." The cylinder will then be given a unique seven digit design number on receipt of order (as explained below).

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)

Replacement Cylinders

Every custom Eaton cylinder is assigned a unique design number. A custom cylinder will have 30 digits vs. 22 used for the standard cylinder. The design number is contained in the last seven digits of the model code, and position 24 is always an alpha character. In other words, the design number begins at position 24. When ordering a replacement cylinder, simply give the model code or the seven digit design number to your local Eaton 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 Eaton replacement parts.

WARNING

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

Model code

EH	09	KM	5	L	5	K	A	99A	09	-	B	A	A	0	0
1, 2	3, 4	5, 6	7	8	9	10	11	12, 13, 14	15, 16	17	18	19	20	21	22

1, 2 Series

EH – 3000 PSI Electro Hydraulic Cylinders

3, 4 Mounting Styles

01 – Side Lug
08 – Head Square Flange
09 – Head Rectangular
10 – Cap Clevis Mount
15 – Intermediate Trunnion
16 – Cap Trunnion
17 – Head Trunnion

5, 6 Bore and Rod Size Combinations

Code	Bore	Rod
CE	1.50	1.00
DE	2.00	1.00
DH	2.00	1.38
EE	2.50	1.00
EH	2.50	1.38
EL	2.50	1.75
GH	3.25	1.38
GL	3.25	1.75
GM	3.25	2.00
HL	4.00	1.75
HM	4.00	2.00
HP	4.00	2.50
KM	5.00	2.00
KP	5.00	2.50
KU	5.00	3.00
KV	5.00	3.50
LP	6.00	2.50
LU	6.00	3.00
LV	6.00	3.50
LW	6.00	4.00
MU	7.00	3.00
MV	7.00	3.50
MW	7.00	4.00
MY	7.00	4.50
MZ	7.00	5.00
NV	8.00	3.50
NW	8.00	4.00
NY	8.00	4.50
NZ	8.00	5.00
N1	8.00	5.50

7 Rod End Type

5 – Small Male UN Thread
2 – Short Female UN thread

8 Seal Options

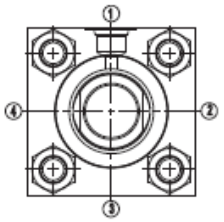
N – Normal
L – Low Friction Sealing

9 Port Options

5 – SAE/UN O-ring
P – With Manifold & Piping

10 Port Location

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



11 Cushion location

Cushions are located as shown in Rod end type section when viewing cylinder from head end (mounting end)

Code	Head	Cap
A	-	-
F	1	-
G	2	-
H	3	-
J	4	-

12, 13, 14 Cylinder stroke

Items 12 and 13 indicate stroke length from 00 inches through 99 inches.
Item 14 indicates fraction of an inch per the following codes:

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 Special features

Extra Rod projection

- Item 15 indicates inches from 0 through 9
- Item 16 indicates fraction of an inch per the codes shown for digit 14

Gland drain/position

Code	Head	Cap
GF	1	-
GG	2	-
GH	3	-
GJ	4	-

EH	09	KM	5	L	5	K	A	99A	09	-	B	A	A	0	0
1, 2	3, 4	5, 6	7	8	9	10	11	12, 13, 14	15, 16	17	18	19	20	21	22

15, 16 Special features

Airbleed/Position

Code	Head	Cap
HB	-	1
HC	-	2
HD	-	3
HE	-	4
HF	1	-
HG	2	-
HH	3	-
HJ	4	-
HK	1	1
HL	1	2
HM	1	3
HN	1	4
HP	2	1
HR	2	2
HS	2	3
HT	2	4
HU	3	1
HV	3	2
HW	3	3
HY	3	4
H1	4	1
H2	4	2
H3	4	3
H4	4	4

15, 16 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

15, 16 Special features

Flats	No of A/C
Code	**Flat***
F4	4
F6	6

* Only upto 3.5" rod

17 Separator

18 Sensor type

Sensor type

Code	Type
0	No Transducer
B	Balluff Analog
D	Balluff Digital
S	Temposonics GH
T	Tempsonics RH
X	Special

19 Output

Output

Code	Sensor output
0	No Transducer MTS Magnet Supplied
1	No Transducer Balluff Magnet Supplied
A	0 ~ 10 VDC
B	10 ~ 0 VDC
C	4 ~ 20 mA
D	20 ~ 4 mA
E	0 ~ 20 mA
F	20 ~ 0 mA
G	-10 ~ 10 VDC
H	10 ~ -10 VDC
J	-5 ~ 5 VDC
K	5 ~ -5 VDC

Below applicable only for Sensor options D/T, except for R and S

L	SSI output

* Applicable only for Sensor options D/S

R	Start/Stop Leading edge active*
S	Start/Stop Trailing edge active*
T	EtherNet/IP
U	EtherCAT
V	CANOpen
W	DeviceNet
Y	Profinet
Z	Profibus

20 Cable

Code	Cable option
0	No Cable
A	Standard Connector - 5 ft
B	Standard Connector - 10 ft
C	Standard Connector - 15 ft
D	Right Angle Connector - 5 ft
E	Right Angle Connector - 10 ft
F	Right Angle Connector - 15 ft
G	Cable Out - 5 ft
H	Cable Out - 10 ft
K	Cable Out - 15 ft
M	Standard Male Connector

21 Cover

Code	Cover option
0	No Cover
C	Standard Cover

22 Valve pattern

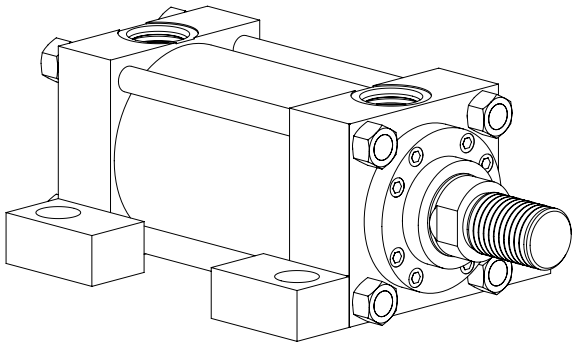
Code	Pattern style
0	No Manifold
A	Ø.875 Bolt Circle (SM4-20)
B	Ø1.750 Bolt Circle (SM4-40)
C	CETOP 3
D	CETOP 5
G	CETOP 8
X	Special

Mounting types and Application guide

01: Side lug mount

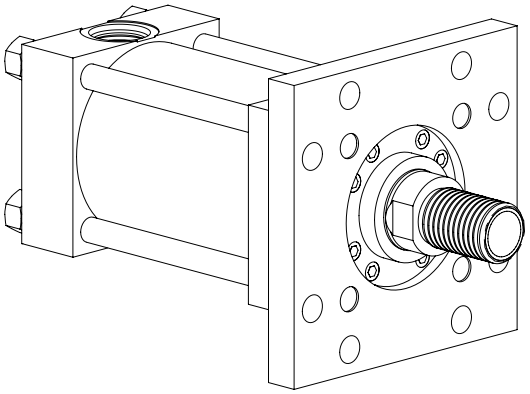
Side Lug Mounting styles are for moving loads along a flat guided surface, as in a carriage along rails. The mounting surface should be flat and parallel to the center line of the piston rod. The load should be guided to traverse along the center line of the piston rod. With unsupported loads, the bearing must absorb more force. For these applications, the larger alternate rod is recommended and stop tubes should be considered.

The frame on which the cylinder is mounted must be rigid to resist the bending moments. Use high tensile socket head cap screws or hex head bolts tightened to the manufacturers recommended torque. The mounting bolts should not be subjected to shear load, use of keys is recommended.



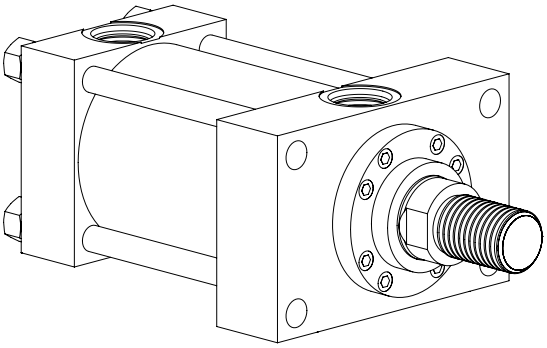
08: Head square flange mount

These mounts are ideal for straight line force transfer applications in which the cylinder is used in tension (pulling). The mounting surface should be flat, and the rod end cartridge should be piloted into it.The frame on which the cylinder is mounted must be sufficiently rigid to resist bending moments. The force of the load should be perpendicular to the mounting surface and parallel to the centerline of the piston rod. For eccentric loads, the larger of the two available rods in each bore size is recommended. Stop tubes should also be considered.



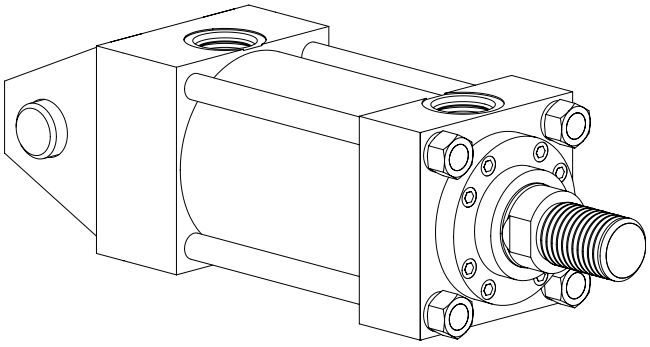
09: Head rectangular mount

These mounts are ideal for straight line force transfer applications in which the cylinder is used in tension(pulling). The mounting surface should be flat, and the rod end cartridge should be piloted into it. The frame on which the cylinder is mounted must be sufficiently rigid to resist bending moments. The force of the load should be perpendicular to the mounting surface and parallel to the centerline of the piston rod. For eccentric loads,the larger of the two available rods in each bore size is recommended. Stop tubes should also be considered.



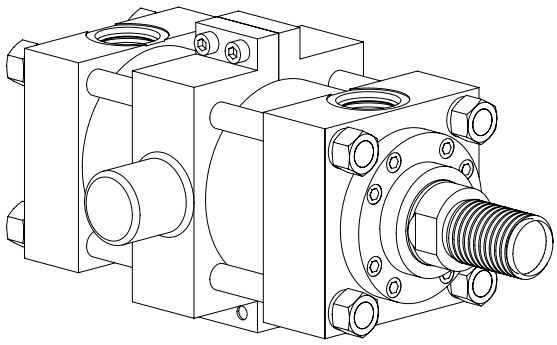
10: Clevis mount

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.



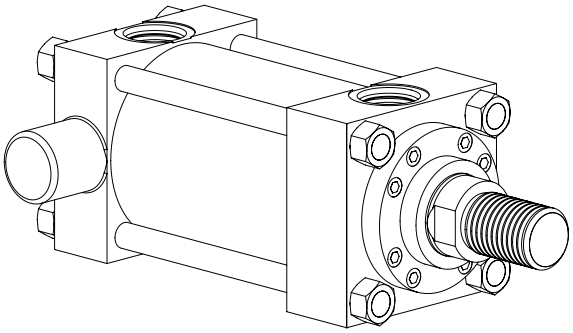
15: Intermediate trunnion mount

The Intermediate Trunnion mount is for longer stroke applications in which the machine member travels in a curved path in one plane. On special orders, the trunnion can be located anywhere along the body.This mount can be used both in compression (push) and tension (pull) applications.It is recommended that rigidly mounted pillow blocks with bearings at least as long as the trunnion pins be used.The pillow blocks should be installed as close to the shoulder of the trunnion as possible.



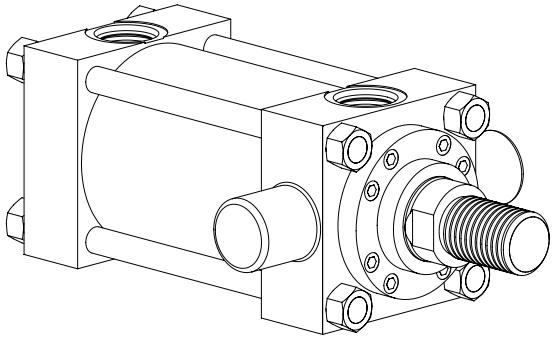
16: Cap trunnion mount

These mounts are for applications in which the machine member travels in a curved path in one plane.Either mount can be used both in compression (push) and tension (pull) applications.When used in compression applications, head trunnion mounts provide a longer maximum stroke than cap trunnion mounts.The trunnion pins are an integral part of the cap and can be sleeved to provide an extremely tight fit to the mating machine member and permit curvilinear motion.It is recommended that rigidly mounted pillow blocks with bearings at least as long as the trunnion pins be used.The pillow blocks should be installed as close to the shoulder of the trunnion as possible.

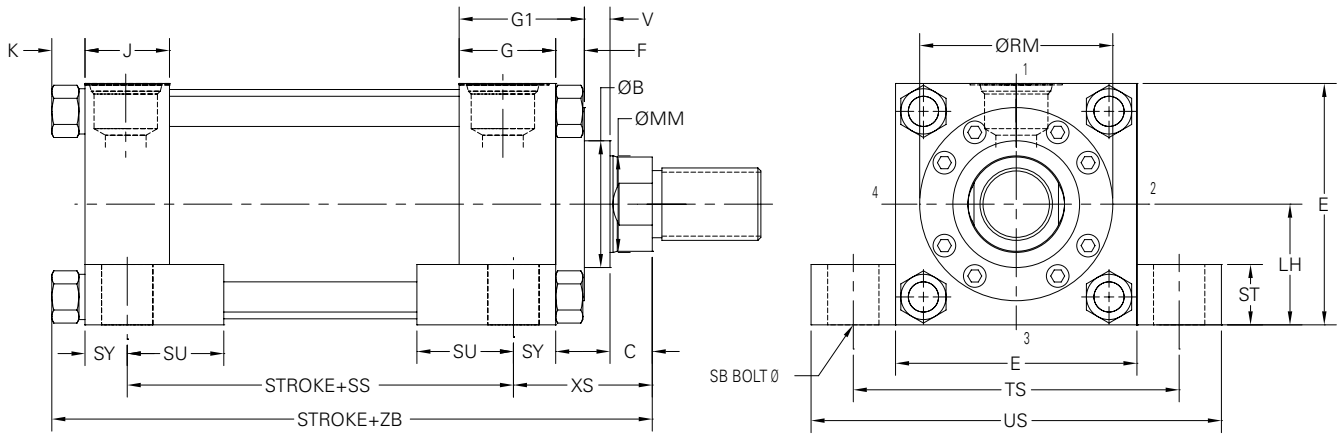


17: Head trunnion mount

These mounts are for applications in which the machine member travels in a curved path in one plane.Either mount can be used both in compression (push) and tension (pull) applications.When used in compression applications, head trunnion mounts provide a longer maximum stroke than cap trunnion mounts.The trunnion pins are an integral part of the cap and can be sleeved to provide an extremely tight fit to the mating machine member and permit curvilinear motion.It is recommended that rigidly mounted pillow blocks with bearings at least as long as the trunnion pins be used.The pillow blocks should be installed as close to the shoulder of the trunnion as possible.



EH01 - Side lug mount

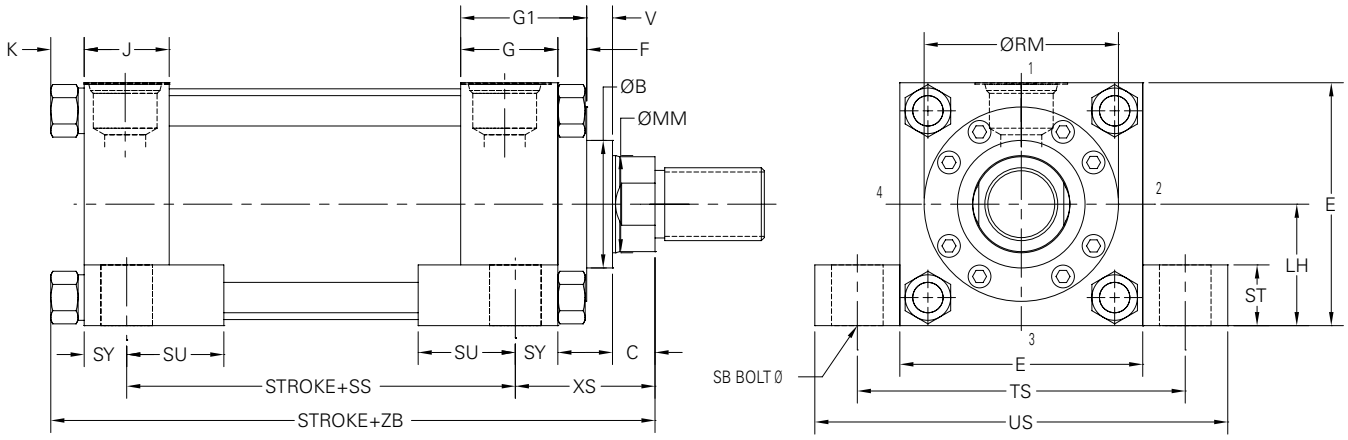


Bore	Rod (MM)	B +.000/ -.002	C**	E	G	F	V	RM	LH ±.002	SB	ST	SU Head	SU CAP	SY Head	SY CAP
1 1/2	1	1.499	0.50	2.50	1.75	0.38	0.50	-	1.243	0.38	0.50	0.94	0.94	0.38	0.63
2	1	1.499	0.50	3.00	1.75	0.63	0.25	-	1.493	0.50	0.75	1.25	1.00	0.50	0.75
	1 3/8	1.999	0.63	3.00	1.75	0.63	0.38	-	1.493	0.50	0.75	1.25	1.00	0.50	0.75
2 1/2	1	1.499	0.50	3.50	1.75	0.50	0.38	2.63	1.743	0.75	1.00	1.56	1.31	0.69	0.94
	1 3/8	1.999	0.63	3.50	1.75	0.63	0.38	-	1.743	0.75	1.00	1.56	1.31	0.69	0.94
	1 3/4	2.374	0.75	3.50	1.75	0.63	0.50	-	1.743	0.75	1.00	1.56	1.31	0.69	0.94
3 1/4	1 3/8	1.999	0.63	4.50	2.00	0.59	0.41	3.25	2.243	0.75	1.00	1.56	1.56	0.69	0.69
	1 3/4	2.374	0.75	4.50	2.00	0.75	0.38	-	2.243	0.75	1.00	1.56	1.56	0.69	0.69
	2	2.624	0.88	4.50	2.00	0.75	0.38	-	2.243	0.75	1.00	1.56	1.56	0.69	0.69
4	1 3/4	2.374	0.75	5.00	2.00	0.59	0.53	3.88	2.493	1.00	1.25	2.00	2.00	0.88	0.88
	2	2.624	0.88	5.00	2.00	0.59	0.53	4.00	2.493	1.00	1.25	2.00	2.00	0.88	0.88
	2 1/2	3.124	1.00	5.00	2.00	0.59	0.66	4.44	2.493	1.00	1.25	2.00	2.00	0.88	0.88
5	2	2.624	0.88	6.50	2.00	0.59	0.53	4.00	3.243	1.00	1.25	2.00	2.00	0.88	0.88
	2 1/2	3.124	1.00	6.50	2.00	0.59	0.66	4.44	3.243	1.00	1.25	2.00	2.00	0.88	0.88
	3	3.749	1.00	6.50	2.00	0.72	0.53	5.25	3.243	1.00	1.25	2.00	2.00	0.88	0.88
	3 1/2	4.249	1.00	6.50	2.00	0.72	0.53	5.63	3.243	1.00	1.25	2.00	2.00	0.88	0.88
6	2 1/2	3.124	1.00	7.50	2.25	0.59	0.66	4.44	3.743	1.25	1.50	2.50	2.50	1.13	1.13
	3	3.749	1.00	7.50	2.25	0.72	0.53	5.25	3.743	1.25	1.50	2.50	2.50	1.13	1.13
	3 1/2	4.249	1.00	7.50	2.25	0.72	0.53	5.63	3.743	1.25	1.50	2.50	2.50	1.13	1.13
	4	4.749	1.00	7.50	2.25	0.88	0.38	6.44	3.743	1.25	1.50	2.50	2.50	1.13	1.13
7	3	3.749	1.00	8.50	2.75	0.72	0.53	5.25	4.243	1.50	1.75	2.88	2.88	1.38	1.38
	3 1/2	4.249	1.00	8.50	2.75	0.72	0.53	5.63	4.243	1.50	1.75	2.88	2.88	1.38	1.38
	4	4.749	1.00	8.50	2.75	0.88	0.38	6.44	4.243	1.50	1.75	2.88	2.88	1.38	1.38
	4 1/2	5.249	1.00	8.50	2.75	0.88	0.38	7.13	4.243	1.50	1.75	2.88	2.88	1.38	1.38
	5	5.749	1.00	8.50	2.75	0.88	0.38	7.56	4.243	1.50	1.75	2.88	2.88	1.38	1.38
8	3 1/2	4.249	1.00	9.50	3.00	0.72	0.53	5.63	4.743	1.50	1.75	2.88	2.88	1.38	1.38
	4	4.749	1.00	9.50	3.00	0.88	0.38	6.44	4.743	1.50	1.75	2.88	2.88	1.38	1.38
	4 1/2	5.249	1.00	9.50	3.00	0.88	0.38	7.13	4.743	1.50	1.75	2.88	2.88	1.38	1.38
	5	5.749	1.00	9.50	3.00	0.88	0.38	7.56	4.743	1.50	1.75	2.88	2.88	1.38	1.38
	5 1/2	6.249	1.00	9.50	3.00	0.88	0.38	8.38	4.743	1.50	1.75	2.88	2.88	1.38	1.38

+ Plus Stroke

** Style 2 rod ends may require additional rod length.The dimensions C,XS,ZB+Max would increase by additional ERP dimension (wherever applicable)

EH01 - Side lug mount

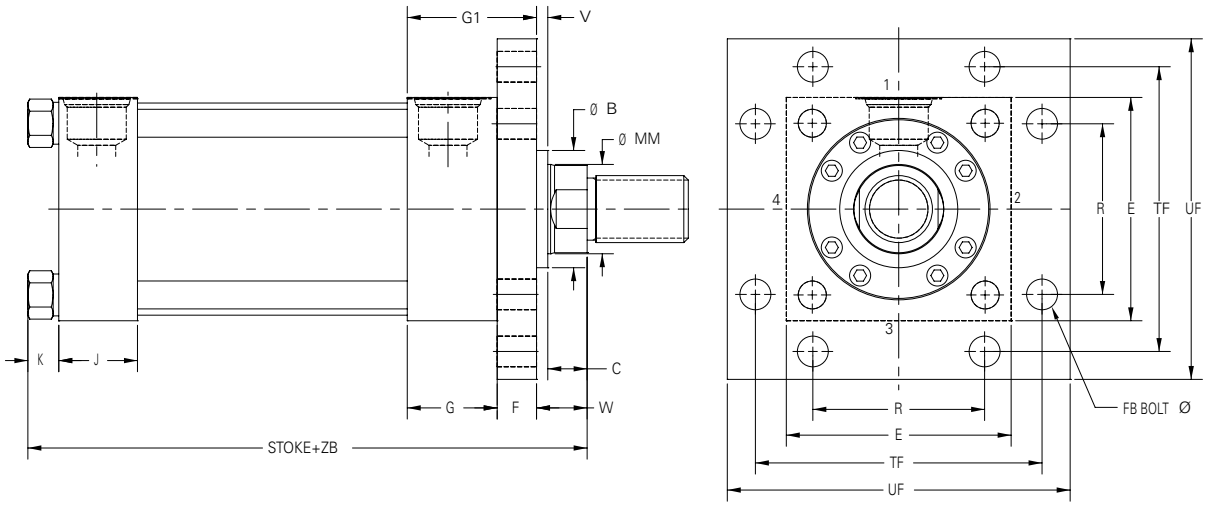


Bore	Rod (MM)	TS	US	XS**	K	J	SS+ *	ZB+Max (*/**)	Piston Thickness	ERP**
1 1/2	1	3.25	4.00	1.75	0.41	1.75	4.75	7.54	2.25	-
2	1	4.00	5.00	1.88	0.55	1.75	4.50	7.68	2.25	-
	1 3/8	4.00	5.00	2.13	0.55	1.75	3.63	7.05	1.38	0.75
2 1/2	1	4.88	6.25	2.06	0.55	1.75	4.25	7.80	2.38	-
	1 3/8	4.88	6.25	2.31	0.55	1.75	3.37	7.18	1.50	0.63
	1 3/4	4.88	6.25	2.56	0.55	1.75	3.37	7.43	1.50	1.13
3 1/4	1 3/8	5.88	7.25	2.31	0.67	1.75	4.12	7.79	1.75	-
	1 3/4	5.88	7.25	2.56	0.67	1.75	4.12	8.05	1.75	0.63
	2	5.88	7.25	2.69	0.67	1.75	4.12	8.17	1.75	0.81
4	1 3/4	6.75	8.50	2.75	0.67	1.75	4.00	8.30	2.00	0.38
	2	6.75	8.50	2.88	0.67	1.75	4.00	8.43	2.00	0.50
	2 1/2	6.75	8.50	3.13	0.67	1.75	4.00	8.67	2.00	1.19
5	2	8.25	9.96	2.88	0.92	1.75	4.50	9.18	2.50	-
	2 1/2	8.25	9.96	3.13	0.92	1.75	4.50	9.42	2.50	0.69
	3	8.25	9.96	3.13	0.92	1.75	4.50	9.42	2.50	0.69
	3 1/2	8.25	9.96	3.13	0.92	1.75	4.50	9.42	2.50	0.69
6	2 1/2	9.75	12.00	3.38	1.03	2.25	5.13	10.66	2.88	-
	3	9.75	12.00	3.38	1.03	2.25	5.13	10.66	2.88	-
	3 1/2	9.75	12.00	3.38	1.03	2.25	5.13	10.66	2.88	-
	4	9.75	12.00	3.38	1.03	2.25	5.13	10.66	2.88	-
7	3	11.25	13.50	3.63	1.17	2.75	5.75	11.92	3.00	-
	3 1/2	11.25	13.50	3.63	1.17	2.75	5.75	11.92	3.00	-
	4	11.25	13.50	3.63	1.17	2.75	5.75	11.92	3.00	-
	4 1/2	11.25	13.50	3.63	1.17	2.75	5.75	11.92	3.00	-
	5	11.25	13.50	3.63	1.17	2.75	5.75	11.92	3.00	-
8	3 1/2	12.25	14.50	3.63	1.26	3.00	6.75	13.01	3.50	-
	4	12.25	14.50	3.63	1.26	3.00	6.75	13.01	3.50	-
	4 1/2	12.25	14.50	3.63	1.26	3.00	6.75	13.01	3.50	-
	5	12.25	14.50	3.63	1.26	3.00	6.75	13.01	3.50	-
	5 1/2	12.25	14.50	3.63	1.26	3.00	6.75	13.01	3.50	-

+ Plus Stroke

** Style 2 rod ends may require additional rod length.The dimensions C,XS,ZB+Max would increase by additional ERP dimension (wherever applicable)

EH08 - Head Square flange mount

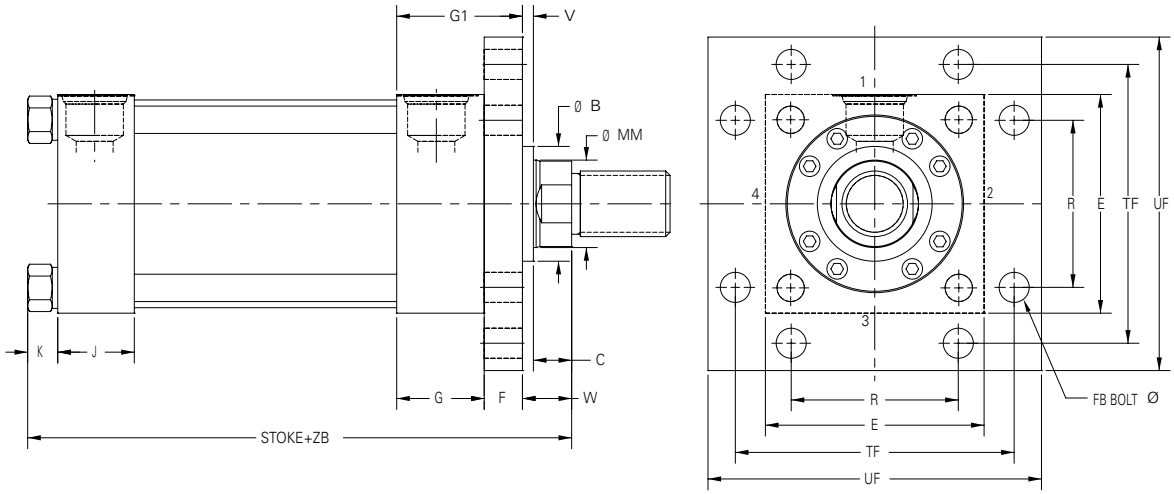


Bore	Rod (MM)	B +.000/ -.002	C**	E	G	F	V	W**	FB	R	TF	UF
1 1/2	1	1.499	0.50	2.50	1.75	0.38	0.50	1.00	0.38	1.63	3.44	4.25
2	1	1.499	0.50	3.00	1.75	0.63	0.25	0.75	0.50	2.05	4.13	5.13
	1 3/8	1.999	0.63	3.00	1.75	0.63	0.38	1.00	0.50	2.05	4.13	5.13
2 1/2	1	1.499	0.50	3.50	1.75	0.63	0.25	0.75	0.50	2.55	4.63	5.63
	1 3/8	1.999	0.63	3.50	1.75	0.63	0.38	1.00	0.50	2.55	4.63	5.63
	1 3/4	2.374	0.75	3.50	1.75	0.63	0.50	1.25	0.50	2.55	4.63	5.63
3 1/4	1 3/8	1.999	0.63	4.50	2.00	0.75	0.25	0.88	0.63	3.25	5.88	7.13
	1 3/4	2.374	0.75	4.50	2.00	0.75	0.38	1.13	0.63	3.25	5.88	7.13
	2	2.624	0.88	4.50	2.00	0.75	0.38	1.25	0.63	3.25	5.88	7.13
4	1 3/4	2.374	0.75	5.00	2.00	0.88	0.25	1.00	0.63	3.82	6.38	7.63
	2	2.624	0.88	5.00	2.00	0.88	0.25	1.13	0.63	3.82	6.38	7.63
	2 1/2	3.124	1.00	5.00	2.00	0.88	0.38	1.38	0.63	3.82	6.38	7.63
5	2	2.624	0.88	6.50	2.00	0.88	0.25	1.13	0.88	4.95	8.19	9.75
	2 1/2	3.124	1.00	6.50	2.00	0.88	0.38	1.38	0.88	4.95	8.19	9.75
	3	3.749	1.00	6.50	2.00	0.88	0.38	1.38	0.88	4.95	8.19	9.75
	3 1/2	4.249	1.00	6.50	2.00	0.88	0.38	1.38	0.88	4.95	8.19	9.75
6	2 1/2	3.124	1.00	7.50	2.25	1.00	0.25	1.25	1.00	5.73	9.44	11.25
	3	3.749	1.00	7.50	2.25	1.00	0.25	1.25	1.00	5.73	9.44	11.25
	3 1/2	4.249	1.00	7.50	2.25	1.00	0.25	1.25	1.00	5.73	9.44	11.25
	4	4.749	1.00	7.50	2.25	1.00	0.25	1.25	1.00	5.73	9.44	11.25
7	3	3.749	1.00	8.50	2.75	1.00	0.25	1.25	1.13	6.58	10.63	12.63
	3 1/2	4.249	1.00	8.50	2.75	1.00	0.25	1.25	1.13	6.58	10.63	12.63
	4	4.749	1.00	8.50	2.75	1.00	0.25	1.25	1.13	6.58	10.63	12.63
	4 1/2	5.249	1.00	8.50	2.75	1.00	0.25	1.25	1.13	6.58	10.63	12.63
	5	5.749	1.00	8.50	2.75	1.00	0.25	1.25	1.13	6.58	10.63	12.63
8	3 1/2	4.249	1.00	9.50	3.00	1.00	0.25	1.25	1.25	7.50	11.81	14.00
	4	4.749	1.00	9.50	3.00	1.00	0.25	1.25	1.25	7.50	11.81	14.00
	4 1/2	5.249	1.00	9.50	3.00	1.00	0.25	1.25	1.25	7.50	11.81	14.00
	5	5.749	1.00	9.50	3.00	1.00	0.25	1.25	1.25	7.50	11.81	14.00
	5.50	6.249	1.00	9.50	3.00	1.00	0.25	1.25	1.25	7.50	11.81	14.00

+ Plus Stroke

** Style 2 rod ends may require additional rod length.The dimensions C,W,ZB+Max would increase by additional ERP dimension (wherever applicable)

EH08 - Head Square flange mount

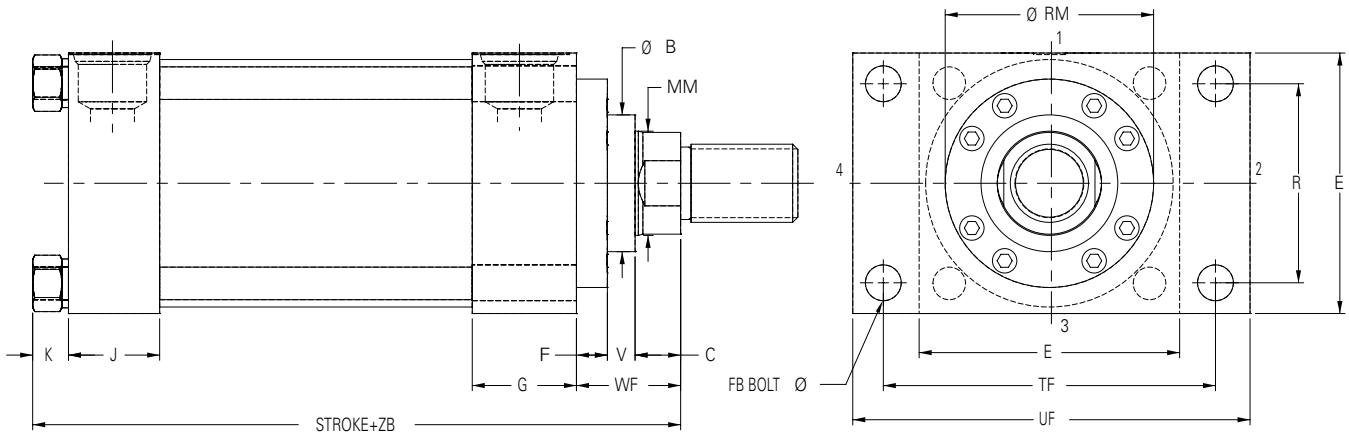


Bore	Rod (MM)	K	J	ZB+Max(*/**)	Piston thickness	ERP**
1 1/2	1	0.41	1.75	7.54	2.25	-
2	1	0.55	1.75	7.68	2.25	-
	1 3/8	0.55	1.75	7.06	1.38	0.75
2 1/2	1	0.55	1.75	7.81	2.38	-
	1 3/8	0.55	1.75	7.18	1.50	0.63
	1 3/4	0.55	1.75	7.43	1.50	1.13
3 1/4	1 3/8	0.67	1.75	7.80	1.75	-
	1 3/4	0.67	1.75	8.05	1.75	0.63
	2	0.67	1.75	8.17	1.75	0.81
4	1 3/4	0.67	1.75	8.30	2.00	0.38
	2	0.67	1.75	8.43	2.00	0.50
	2 1/2	0.67	1.75	8.67	2.00	1.19
5	2	0.92	1.75	9.18	2.50	-
	2 1/2	0.92	1.75	9.42	2.50	0.69
	3	0.92	1.75	9.42	2.50	0.69
	3 1/2	0.92	1.75	9.42	2.50	0.69
6	2 1/2	1.03	2.25	10.66	2.88	-
	3	1.03	2.25	10.66	2.88	-
	3 1/2	1.03	2.25	10.66	2.88	-
	4	1.03	2.25	10.66	2.88	-
7	3	1.17	2.75	11.92	3.00	-
	3 1/2	1.17	2.75	11.92	3.00	-
	4	1.17	2.75	11.92	3.00	-
	4 1/2	1.17	2.75	11.92	3.00	-
	5	1.17	2.75	11.92	3.00	-
8	3 1/2	1.26	3.00	13.01	3.50	-
	4	1.26	3.00	13.01	3.50	-
	4 1/2	1.26	3.00	13.01	3.50	-
	5	1.26	3.00	13.01	3.50	-
	5.50	1.26	3.00	13.01	3.50	-

+ Plus Stroke

** Style 2 rod ends may require additional rod length.The dimensions C,W,ZB+Max would increase by additional ERP dimension (wherever applicable)

EH09 - Head rectangular mount

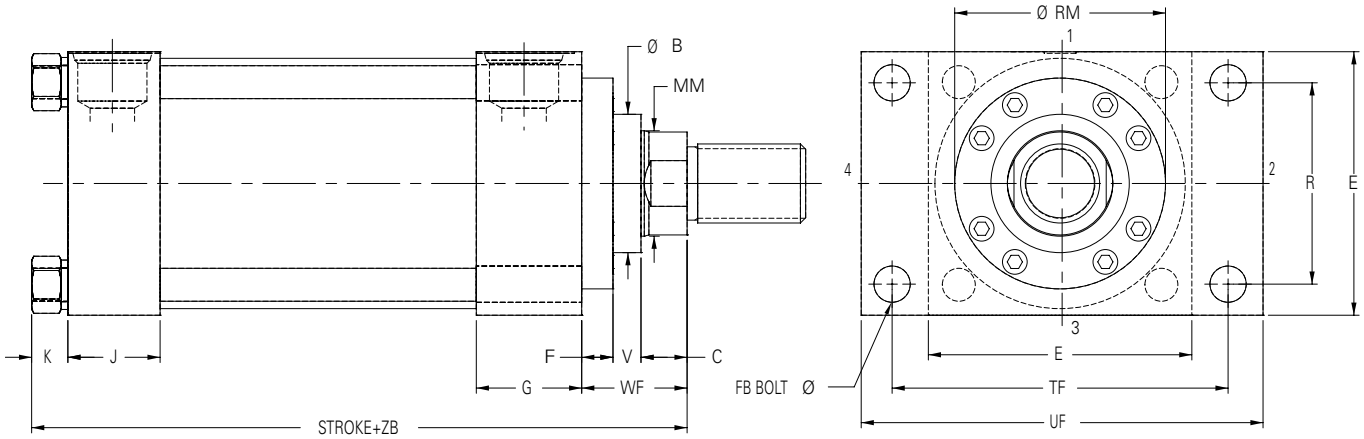


Bore	Rod (MM)	B +.000/ -.002	C**	E	G	F	V	WF**	RM	FB	R	TF	UF
1 1/2	1	1.499	0.50	2.50	1.75	0.50	0.38	1.38	2.63	0.38	1.63	3.44	4.25
2	1	1.499	0.50	3.00	1.75	0.50	0.38	1.38	2.63	0.50	2.05	4.13	5.13
	1 3/8	1.999	0.63	3.00	1.75	0.59	0.41	1.63	3.25	0.50	2.05	4.13	5.13
2 1/2	1	1.499	0.50	3.50	1.75	0.50	0.38	1.38	2.63	0.50	2.55	4.63	5.63
	1 3/8	1.999	0.63	3.50	1.75	0.59	0.41	1.63	3.25	0.50	2.55	4.63	5.63
	1 3/4	2.374	0.75	3.50	1.75	0.59	0.54	1.88	3.88	0.50	2.55	4.63	5.63
3 1/4	1 3/8	1.999	0.63	4.50	2.00	0.59	0.41	1.63	3.25	0.63	3.25	5.88	7.13
	1 3/4	2.374	0.75	4.50	2.00	0.59	0.54	1.88	3.88	0.63	3.25	5.88	7.13
	2	2.624	0.88	4.50	2.00	0.59	0.53	2.00	4.00	0.63	3.25	5.88	7.13
4	1 3/4	2.374	0.75	5.00	2.00	0.59	0.54	1.88	3.88	0.63	3.82	6.38	7.63
	2	2.624	0.88	5.00	2.00	0.59	0.53	2.00	4.00	0.63	3.82	6.38	7.63
	2 1/2	3.124	1.00	5.00	2.00	0.59	0.66	2.25	4.44	0.63	3.82	6.38	7.63
5	2	2.624	0.88	6.50	2.00	0.59	0.53	2.00	4.00	0.88	4.95	8.19	9.75
	2 1/2	3.124	1.00	6.50	2.00	0.59	0.66	2.25	4.44	0.88	4.95	8.19	9.75
	3	3.749	1.00	6.50	2.00	0.72	0.53	2.25	5.25	0.88	4.95	8.19	9.75
	3 1/2	4.249	1.00	6.50	2.00	0.72	0.53	2.25	5.63	0.88	4.95	8.19	9.75
6	2 1/2	3.124	1.00	7.50	2.25	0.59	0.66	2.25	4.44	1.00	5.73	9.44	11.25
	3	3.749	1.00	1.00	2.25	0.72	0.53	2.25	5.25	1.00	5.73	9.44	11.25
	3 1/2	4.249	1.00	1.00	2.25	0.72	0.53	2.25	5.63	1.00	5.73	9.44	11.25
	4	4.749	1.00	1.00	2.25	0.88	0.38	2.26	6.44	1.00	5.73	9.44	11.25
7	3	3.749	1.00	8.50	2.75	0.72	0.53	2.25	5.25	1.13	6.58	10.63	12.63
	3 1/2	4.249	1.00	1.00	2.75	0.72	0.53	2.25	5.63	1.13	6.58	10.63	12.63
	4	4.749	1.00	1.00	2.75	0.88	0.38	2.25	6.44	1.13	6.58	10.63	12.63
	4 1/2	5.249	1.00	1.00	2.75	0.88	0.38	2.25	7.13	1.13	6.58	10.63	12.63
	5	5.749	1.00	1.00	2.75	0.88	0.38	2.25	7.56	1.13	6.58	10.63	12.63
8	3 1/2	4.249	1.00	9.50	3.00	0.72	0.53	2.25	5.63	1.25	7.50	11.81	14.00
	4	4.749	1.00	1.00	3.00	0.88	0.38	2.25	6.44	1.25	7.50	11.81	14.00
	4 1/2	5.249	1.00	1.00	3.00	0.88	0.38	2.25	7.13	1.25	7.50	11.81	14.00
	5	5.749	1.00	1.00	3.00	0.88	0.38	2.25	7.56	1.25	7.50	11.81	14.00
	5.50	6.249	1.00	1.00	3.00	0.88	0.38	2.25	8.38	1.25	7.50	11.81	14.00

+ Plus Stroke

** Style 2 rod ends may require additional rod length.The dimensions C,WF,ZB+Max would increase by additional ERP dimension (wherever applicable)

EH09 - Head rectangular mount

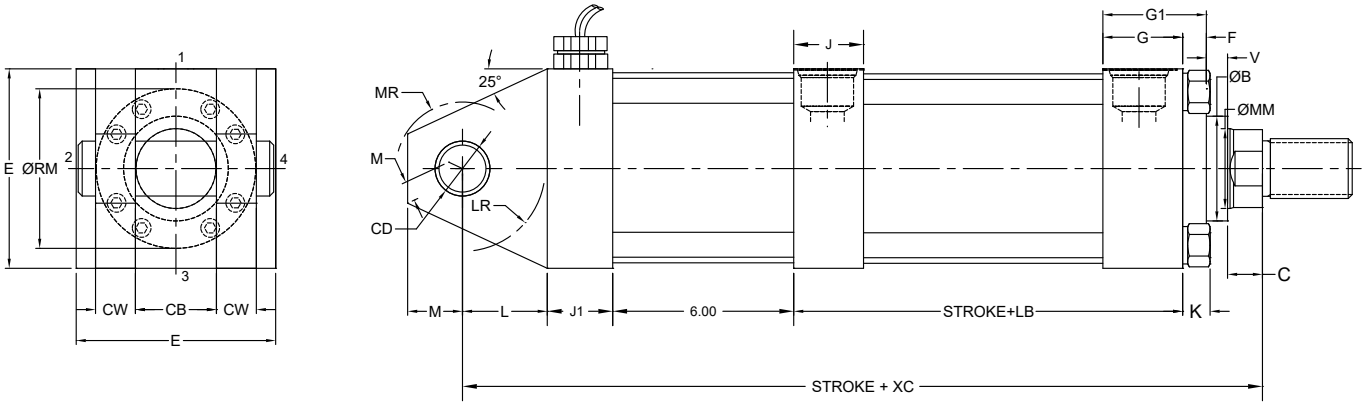


Bore	Rod (MM)	K	J	ZB+Max(*/**)	Piston Thickness	ERP**
1 1/2	1	0.41	1.75	7.54	2.25	-
2	1	0.55	1.75	7.68	2.25	-
	1 3/8	0.55	1.75	7.06	1.38	0.75
2 1/2	1	0.55	1.75	7.80	2.38	-
	1 3/8	0.55	1.75	7.18	1.50	0.63
	1 3/4	0.55	1.75	7.43	1.50	1.13
3 1/4	1 3/8	0.67	1.75	7.80	1.75	-
	1 3/4	0.67	1.75	8.05	1.75	0.63
	2	0.67	1.75	8.17	1.75	0.81
4	1 3/4	0.67	1.75	8.30	2.00	0.38
	2	0.67	1.75	8.42	2.00	0.50
	2 1/2	0.67	1.75	8.67	2.00	1.19
5	2	0.92	1.75	9.17	2.50	-
	2 1/2	0.92	1.75	9.42	2.50	0.69
	3	0.92	1.75	9.42	2.50	0.69
	3 1/2	0.92	1.75	9.42	2.50	0.69
6	2 1/2	1.03	2.25	10.66	2.88	-
	3	1.03	2.25	10.66	2.88	-
	3 1/2	1.03	2.25	10.66	2.88	-
	4	1.03	2.25	10.67	2.88	-
7	3	1.17	2.75	11.92	3.00	-
	3 1/2	1.17	2.75	11.92	3.00	-
	4	1.17	2.75	11.92	3.00	-
	4 1/2	1.17	2.75	11.92	3.00	-
	5	1.17	2.75	11.92	3.00	-
8	3 1/2	1.26	3.00	13.01	3.50	-
	4	1.26	3.00	13.01	3.50	-
	4 1/2	1.26	3.00	13.01	3.50	-
	5	1.26	3.00	13.01	3.50	-
	5.50	1.26	3.00	13.01	3.50	-

+ Plus Strok

** Style 2 rod ends may require additional rod length.The dimensions C,WF,ZB+Max would increase by additional ERP dimension (wherever applicable)

EH10 - Clevis mount

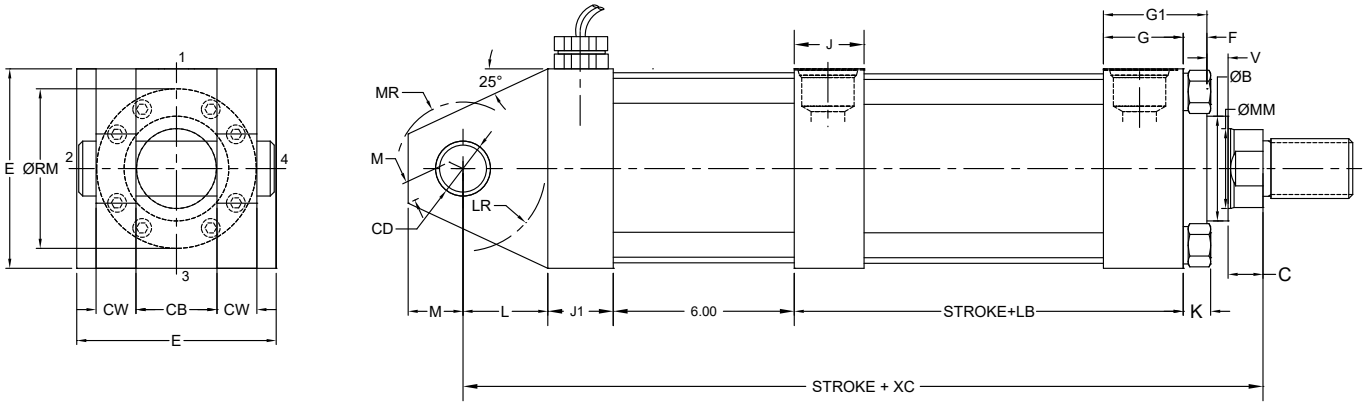


Bore	Rod (MM)	B +.000/ -.002	C**	E	G	F	V	RM	FH	L	M	CB	CD+.000/- .002
2	1	1.499	0.50	3.00	1.75	0.63	0.25	-	0.63	1.25	0.75	1.25	0.750
	1 3/8	1.999	0.63	3.00	1.75	0.63	0.38	-	0.63	1.25	0.75	1.25	0.750
2 1/2	1	1.499	0.50	3.50	1.75	0.50	0.38	2.63	0.63	1.25	0.75	1.25	0.750
	1 3/8	1.999	0.63	3.50	1.75	0.63	0.38	-	0.63	1.25	0.75	1.25	0.750
	1 3/4	2.374	0.75	3.50	1.75	0.63	0.50	-	0.63	1.25	0.75	1.25	0.750
3 1/4	1 3/8	1.999	0.63	4.50	2.00	0.59	0.41	3.25	0.75	1.50	1.00	1.50	1.000
	1 3/4	2.374	0.75	4.50	2.00	0.75	0.38	-	0.75	1.50	1.00	1.50	1.000
	2	2.624	0.88	4.50	2.00	0.75	0.38	-	0.75	1.50	1.00	1.50	1.000
4	1 3/4	2.374	0.75	5.00	2.00	0.59	0.53	3.88	0.88	2.13	1.38	2.00	1.375
	2	2.624	0.88	5.00	2.00	0.59	0.53	4.00	0.88	2.13	1.38	2.00	1.375
	2 1/2	3.124	1.00	5.00	2.00	0.59	0.66	4.44	0.88	2.13	1.38	2.00	1.375
5	2	2.624	0.88	6.50	2.00	0.59	0.53	4.00	0.88	2.25	1.75	2.50	1.750
	2 1/2	3.124	1.00	6.50	2.00	0.59	0.66	4.44	0.88	2.25	1.75	2.50	1.750
	3	3.749	1.00	6.50	2.00	0.72	0.53	5.25	0.88	2.25	1.75	2.50	1.750
	3 1/2	4.249	1.00	6.50	2.00	0.72	0.53	5.63	0.88	2.25	1.75	2.50	1.750
6	2 1/2	3.124	1.00	7.50	2.25	0.59	0.66	4.44	1.00	2.50	2.00	2.50	2.000
	3	3.749	1.00	7.50	2.25	0.72	0.53	5.25	1.00	2.50	2.00	2.50	2.000
	3 1/2	4.249	1.00	7.50	2.25	0.72	0.53	5.63	1.00	2.50	2.00	2.50	2.000
	4	4.749	1.00	7.50	2.25	0.88	0.38	6.44	1.00	2.50	2.00	2.50	2.000
7	3	3.749	1.00	8.50	2.75	0.72	0.53	5.25	1.00	3.00	2.50	3.00	2.500
	3 1/2	4.249	1.00	8.50	2.75	0.72	0.53	5.63	1.00	3.00	2.50	3.00	2.500
	4	4.749	1.00	8.50	2.75	0.88	0.38	6.44	1.00	3.00	2.50	3.00	2.500
	4 1/2	5.249	1.00	8.50	2.75	0.88	0.38	7.13	1.00	3.00	2.50	3.00	2.500
	5	5.749	1.00	8.50	2.75	0.88	0.38	7.56	1.00	3.00	2.50	3.00	2.500
8	3 1/2	4.249	1.00	9.50	3.00	0.72	0.53	5.63	1.00	3.25	2.75	3.00	3.000
	4	4.749	1.00	9.50	3.00	0.88	0.38	6.44	1.00	3.25	2.75	3.00	3.000
	4 1/2	5.249	1.00	9.50	3.00	0.88	0.38	7.13	1.00	3.25	2.75	3.00	3.000
	5	5.749	1.00	9.50	3.00	0.88	0.38	7.56	1.00	3.25	2.75	3.00	3.000
	5 1/2	6.249	1.00	9.50	3.00	0.88	0.38	8.38	1.00	3.25	2.75	3.00	3.000

+ Plus Stroke

** Style 2 rod ends may require additional rod length.The dimensions C,XD+ would increase by additional ERP dimension (wherever applicable)

EH10 - Clevis mount

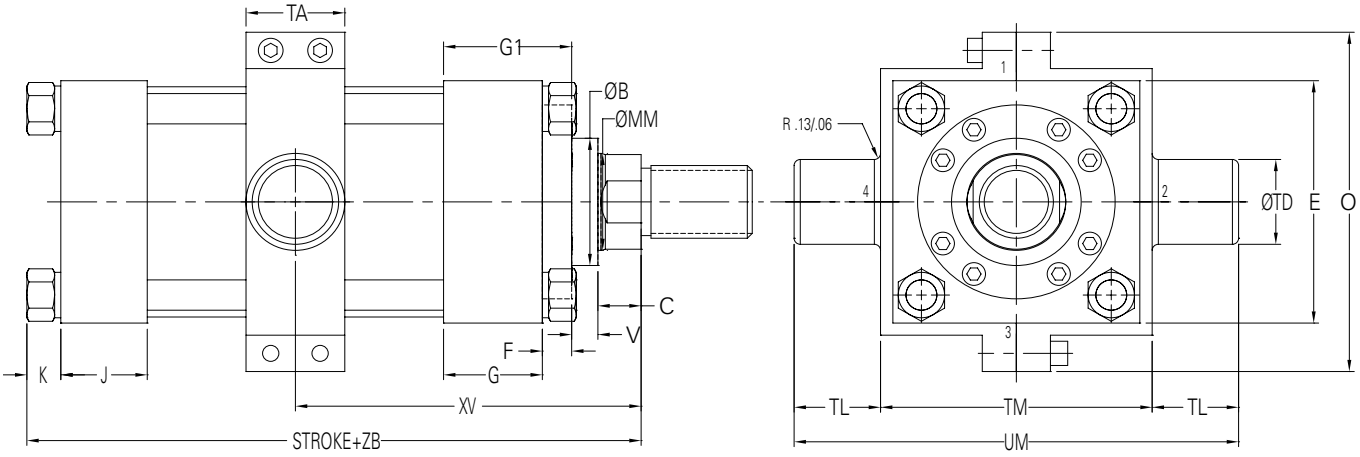


Bore	Rod (MM)	CW	LR	MR	K	J1	XC+(*/**)	J
2	1	0.63	1.06	1.06	0.55	1.50	15.88	1.75
	1 3/8	0.63	1.06	1.06	0.55	1.50	15.26	1.75
2 1/2	1	0.63	1.06	1.06	0.55	1.75	16.25	1.75
	1 3/8	0.63	1.06	1.06	0.55	1.75	15.63	1.75
	1 3/4	0.63	1.06	1.06	0.55	1.75	15.88	1.75
3 1/4	1 3/8	0.75	1.25	1.13	0.67	1.75	16.38	1.75
	1 3/4	0.75	1.25	1.13	0.67	1.75	16.63	1.75
	2	0.75	1.25	1.13	0.67	1.75	16.76	1.75
4	1 3/4	1.00	1.88	1.75	0.67	1.75	17.51	1.75
	2	1.00	1.88	1.75	0.67	1.75	17.64	1.75
	2 1/2	1.00	1.88	1.75	0.67	1.75	17.88	1.75
5	2	1.25	1.94	1.88	0.92	1.75	18.26	1.75
	2 1/2	1.25	1.94	1.88	0.92	1.75	18.50	1.75
	3	1.25	1.94	1.88	0.92	1.75	18.50	1.75
	3 1/2	1.25	1.94	1.88	0.92	1.75	18.50	1.75
6	2 1/2	1.25	2.06	2.13	1.03	2.25	20.38	2.25
	3	1.25	2.06	2.13	1.03	2.25	20.38	2.25
	3 1/2	1.25	2.06	2.13	1.03	2.25	20.38	2.25
	4	1.25	2.06	2.13	1.03	2.25	20.38	2.25
7	3	1.50	2.56	2.50	1.17	2.75	22.50	2.75
	3 1/2	1.50	2.56	2.50	1.17	2.75	22.50	2.75
	4	1.50	2.56	2.50	1.17	2.75	22.50	2.75
	4 1/2	1.50	2.56	2.50	1.17	2.75	22.50	2.75
	5	1.50	2.56	2.50	1.17	2.75	22.50	2.75
8	3 1/2	1.50	2.69	2.75	1.26	3.00	24.00	3.00
	4	1.50	2.69	2.75	1.26	3.00	24.00	3.00
	4 1/2	1.50	2.69	2.75	1.26	3.00	24.00	3.00
	5	1.50	2.69	2.75	1.26	3.00	24.00	3.00
	5 1/2	1.50	2.69	2.75	1.26	3.00	24.00	3.00

+ Plus Stroke

** Style 2 rod ends may require additional rod length.The dimensions C,XD+ would increase by additional ERP dimension (wherever applicable)

EH15 - Intermediate trunnion mount



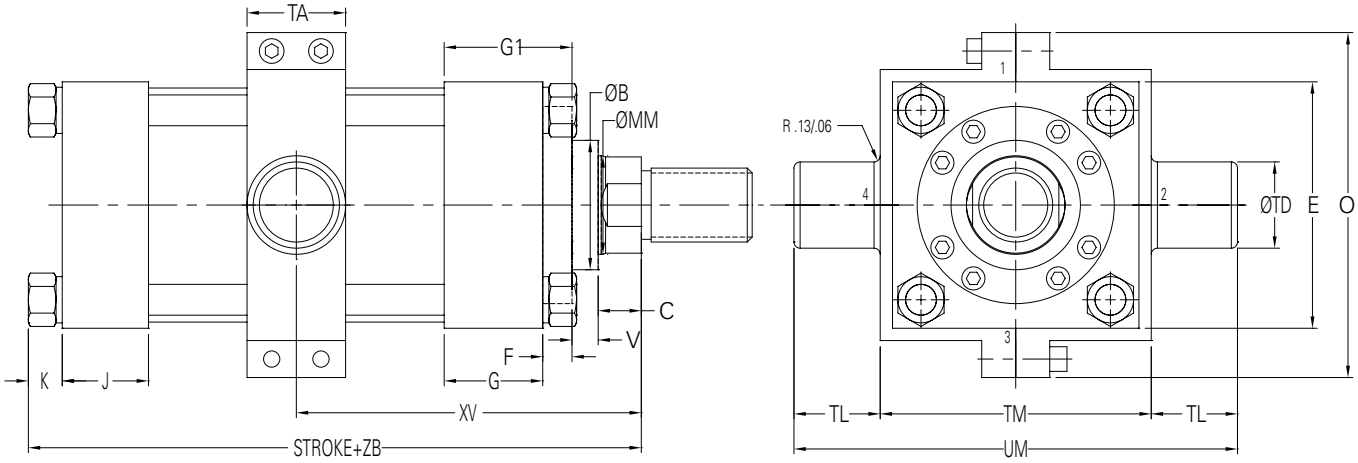
Bore	Rod (MM)	B +.000/ -.002	C**	E	G	F	V	RM	TD +.000/.001	TL	UM	TM	TA
1 1/2	1	1.499	0.50	2.50	1.75	0.38	0.50	-	1.000	1.00	5.00	3.00	1.50
2	1	1.499	0.50	3.00	1.75	0.63	0.25	-	1.375	1.38	6.25	3.50	1.50
	1 3/8	1.999	0.63	3.00	1.75	0.63	0.38	-	1.375	1.38	6.25	3.50	1.50
2 1/2	1	1.499	0.50	3.50	1.75	0.50	0.38	2.63	1.375	1.38	6.75	4.00	1.50
	1 3/8	1.999	0.63	3.50	1.75	0.63	0.38	-	1.375	1.38	6.75	4.00	1.50
	1 3/4	2.374	0.75	3.50	1.75	0.63	0.50	-	1.375	1.38	6.75	4.00	1.50
3 1/4	1 3/8	1.999	0.63	4.50	2.00	0.59	0.41	3.25	1.750	1.75	8.50	5.00	2.00
	1 3/4	2.374	0.75	4.50	2.00	0.75	0.38	-	1.750	1.75	8.50	5.00	2.00
	2	2.624	0.88	4.50	2.00	0.75	0.38	-	1.750	1.75	8.50	5.00	2.00
4	1 3/4	2.374	0.75	5.00	2.00	0.59	0.53	3.88	1.750	1.75	9.00	5.50	2.00
	2	2.624	0.88	5.00	2.00	0.59	0.53	4.00	1.750	1.75	9.00	5.50	2.00
	2 1/2	3.124	1.00	5.00	2.00	0.59	0.66	4.44	1.750	1.75	9.00	5.50	2.00
5	2	2.624	0.88	6.50	2.00	0.59	0.53	4.00	1.750	1.75	10.50	7.00	2.50
	2 1/2	3.124	1.00	6.50	2.00	0.59	0.66	4.44	1.750	1.75	10.50	7.00	2.50
	3	3.749	1.00	6.50	2.00	0.72	0.53	5.25	1.750	1.75	10.50	7.00	2.50
	3 1/2	4.249	1.00	6.50	2.00	0.72	0.53	5.63	1.750	1.75	10.50	7.00	2.50
6	2 1/2	3.124	1.00	7.50	2.25	0.59	0.66	4.44	2.000	2.00	12.50	8.50	3.00
	3	3.749	1.00	7.50	2.25	0.72	0.53	5.25	2.000	2.00	12.50	8.50	3.00
	3 1/2	4.249	1.00	7.50	2.25	0.72	0.53	5.63	2.000	2.00	12.50	8.50	3.00
	4	4.749	1.00	7.50	2.25	0.88	0.38	6.44	2.000	2.00	12.50	8.50	3.00
7	3	3.749	1.00	8.50	2.75	0.72	0.53	5.25	2.500	2.50	14.75	9.75	3.00
	3 1/2	4.249	1.00	8.50	2.75	0.72	0.53	5.63	2.500	2.50	14.75	9.75	3.00
	4	4.749	1.00	8.50	2.75	0.88	0.38	6.44	2.500	2.50	14.75	9.75	3.00
	4 1/2	5.249	1.00	8.50	2.75	0.88	0.38	7.13	2.500	2.50	14.75	9.75	3.00
	5	5.749	1.00	8.50	2.75	0.88	0.38	7.56	2.500	2.50	14.75	9.75	3.00
8	3 1/2	4.249	1.00	9.50	3.00	0.72	0.53	5.63	3.000	3.00	17.00	11.00	3.50
	4	4.749	1.00	9.50	3.00	0.88	0.38	6.44	3.000	3.00	17.00	11.00	3.50
	4 1/2	5.249	1.00	9.50	3.00	0.88	0.38	7.13	3.000	3.00	17.00	11.00	3.50
	5	5.749	1.00	9.50	3.00	0.88	0.38	7.56	3.000	3.00	17.00	11.00	3.50
	5 1/2	6.249	1.00	9.50	3.00	0.88	0.38	8.38	3.000	3.00	17.00	11.00	3.50

+ Plus Stroke

*XV= XV Std+ 1/2 Stroke"

** Style 2 rod ends may require additional rod length.The dimensions C,XV,ZB+Max would increase by additional ERP dimension (wherever applicable)

EH15 - Intermediate trunnion mount



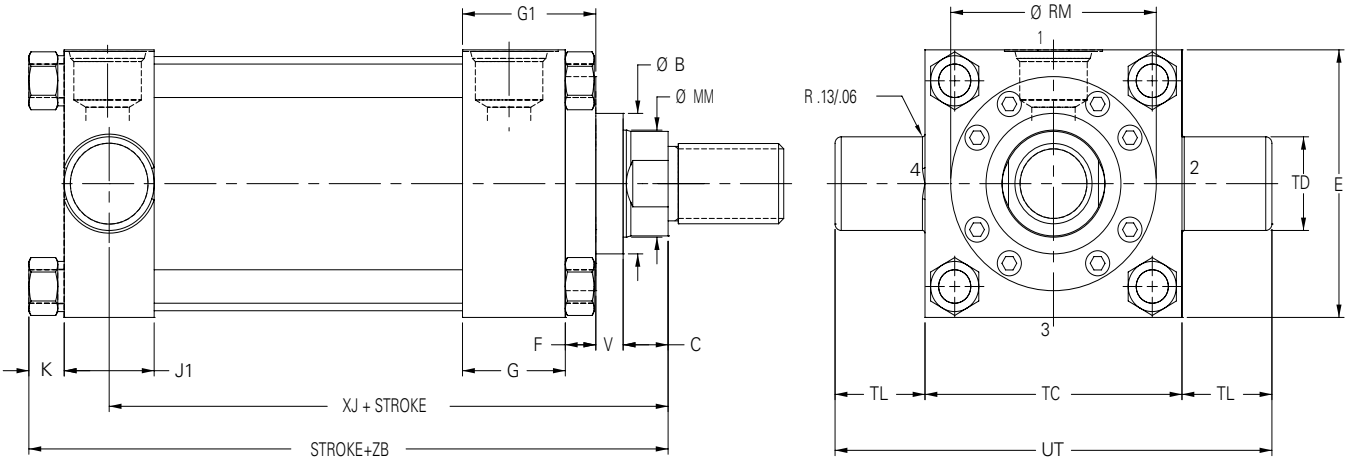
Bore	Rod (MM)	Max.0	K	XV Std(*/**)	J	ZB+Max(*/**)	Piston Thickness	ERP**
1 1/2	1	-	0.41	3.81	1.75	7.54	2.25	-
2	1	-	0.55	3.81	1.75	7.68	2.25	-
	1 3/8	-	0.55	4.19	1.75	7.05	1.38	0.75
2 1/2	1	-	0.55	3.88	1.75	7.80	2.38	-
	1 3/8	-	0.55	4.14	1.75	7.18	1.50	0.63
	1 3/4	-	0.55	4.38	1.75	7.43	1.50	1.13
3 1/4	1 3/8	-	0.67	4.50	1.75	7.79	1.75	-
	1 3/4	-	0.67	4.76	1.75	8.05	1.75	0.63
	2	-	0.67	4.89	1.75	8.17	1.75	0.81
4	1 3/4	-	0.67	4.88	1.75	8.30	2.00	0.38
	2	-	0.67	5.00	1.75	8.43	2.00	0.50
	2 1/2	-	0.67	5.25	1.75	8.67	2.00	1.19
5	2	-	0.92	5.25	1.75	9.18	2.50	-
	2 1/2	-	0.92	5.50	1.75	9.42	2.50	0.69
	3	-	0.92	5.50	1.75	9.42	2.50	0.69
	3 1/2	-	0.92	5.50	1.75	9.42	2.50	0.69
6	2 1/2	9.50	1.03	5.94	2.25	10.66	2.88	-
	3	9.50	1.03	5.94	2.25	10.66	2.88	-
	3 1/2	9.50	1.03	5.94	2.25	10.66	2.88	-
	4	9.50	1.03	5.94	2.25	10.66	2.88	-
7	3	11.50	1.17	6.50	2.75	11.92	3.00	-
	3 1/2	11.50	1.17	6.50	2.75	11.92	3.00	-
	4	11.50	1.17	6.50	2.75	11.92	3.00	-
	4 1/2	11.50	1.17	6.50	2.75	11.92	3.00	-
	5	11.50	1.17	6.50	2.75	11.92	3.00	-
8	3 1/2	13.25	1.26	7.13	3.00	13.01	3.50	-
	4	13.25	1.26	7.13	3.00	13.01	3.50	-
	4 1/2	13.25	1.26	7.13	3.00	13.01	3.50	-
	5	13.25	1.26	7.13	3.00	13.01	3.50	-
	5 1/2	13.25	1.26	7.13	3.00	13.01	3.50	-

+ Plus Stroke

*XV= XV Std+ 1/2 Stroke"

** Style 2 rod ends may require additional rod length.The dimensions C,XV,ZB+Max would increase by additional ERP dimension (wherever applicable)

EH16 - Cap trunnion mount

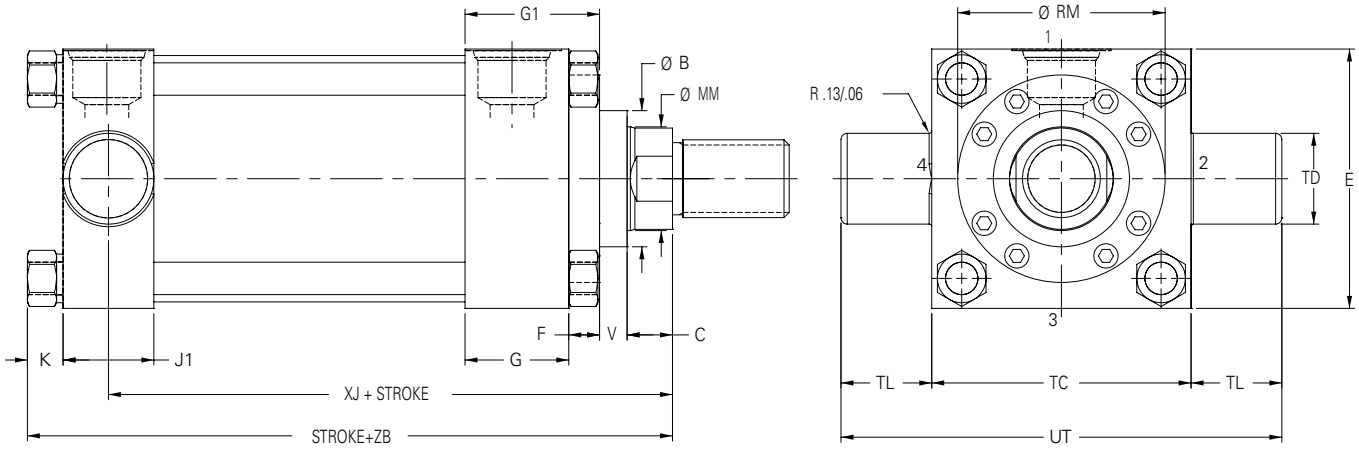


Bore	Rod (MM)	B +.000/ -.002	C**	E	G	F	V	RM	TD +.000/.001	TL	TC	UT	K
1 1/2	1	1.499	0.50	2.50	1.75	0.38	0.50	-	1.000	1.00	2.50	4.50	0.41
2	1	1.499	0.50	3.00	1.75	0.63	0.25	-	1.375	1.38	3.00	5.75	0.55
	1 3/8	1.999	0.63	3.00	1.75	0.63	0.38	-	1.375	1.38	3.00	5.75	0.55
2 1/2	1	1.499	0.50	3.50	1.75	0.50	0.38	2.63	1.375	1.38	3.50	6.25	0.55
	1 3/8	1.999	0.63	3.50	1.75	0.63	0.38	-	1.375	1.38	3.50	6.25	0.55
	1 3/4	2.374	0.75	3.50	1.75	0.63	0.50	-	1.375	1.38	3.50	6.25	0.55
3 1/4	1 3/8	1.999	0.63	4.50	2.00	0.59	0.41	3.25	1.750	1.75	4.50	8.00	0.67
	1 3/4	2.374	0.75	4.50	2.00	0.75	0.38	-	1.750	1.75	4.50	8.00	0.67
	2	2.624	0.88	4.50	2.00	0.75	0.38	-	1.750	1.75	4.50	8.00	0.67
4	1 3/4	2.374	0.75	5.00	2.00	0.59	0.53	3.88	1.750	1.75	5.00	8.50	0.67
	2	2.624	0.88	5.00	2.00	0.59	0.53	4.00	1.750	1.75	5.00	8.50	0.67
	2 1/2	3.124	1.00	5.00	2.00	0.59	0.66	4.44	1.750	1.75	5.00	8.50	0.67
5	2	2.624	0.88	6.50	2.00	0.59	0.53	4.00	1.750	1.75	6.50	10.00	0.92
	2 1/2	3.124	1.00	6.50	2.00	0.59	0.66	4.44	1.750	1.75	6.50	10.00	0.92
	3	3.749	1.00	6.50	2.00	0.72	0.53	5.25	1.750	1.75	6.50	10.00	0.92
	3 1/2	4.249	1.00	6.50	2.00	0.72	0.53	5.63	1.750	1.75	6.50	10.00	0.92
6	2 1/2	3.124	1.00	7.50	2.25	0.59	0.66	4.44	2.000	2.00	7.50	11.50	1.03
	3	3.749	1.00	7.50	2.25	0.72	0.53	5.25	2.000	2.00	7.50	11.50	1.03
	3 1/2	4.249	1.00	7.50	2.25	0.72	0.53	5.63	2.000	2.00	7.50	11.50	1.03
	4	4.749	1.00	7.50	2.25	0.88	0.38	6.44	2.000	2.00	7.50	11.50	1.03
7	3	3.749	1.00	8.50	2.75	0.72	0.53	5.25	2.500	2.50	8.50	13.50	1.17
	3 1/2	4.249	1.00	8.50	2.75	0.72	0.53	5.63	2.500	2.50	8.50	13.50	1.17
	4	4.749	1.00	8.50	2.75	0.88	0.38	6.44	2.500	2.50	8.50	13.50	1.17
	4 1/2	5.249	1.00	8.50	2.75	0.88	0.38	7.13	2.500	2.50	8.50	13.50	1.17
	5	5.749	1.00	8.50	2.75	0.88	0.38	7.56	2.500	2.50	8.50	13.50	1.17
8	3 1/2	4.249	1.00	9.50	3.00	0.72	0.53	5.63	3.000	3.00	9.50	15.50	1.26
	4	4.749	1.00	9.50	3.00	0.88	0.38	6.44	3.000	3.00	9.50	15.50	1.26
	4 1/2	5.249	1.00	9.50	3.00	0.88	0.38	7.13	3.000	3.00	9.50	15.50	1.26
	5	5.749	1.00	9.50	3.00	0.88	0.38	7.56	3.000	3.00	9.50	15.50	1.26
	5 1/2	6.249	1.00	9.50	3.00	0.88	0.38	8.38	3.000	3.00	9.50	15.50	1.26

+ Plus Stroke

** Style 2 rod ends may require additional rod length.The dimensions C,XJ,ZB+Max would increase by additional ERP dimension (wherever applicable)

EH16 - Cap trunnion mount

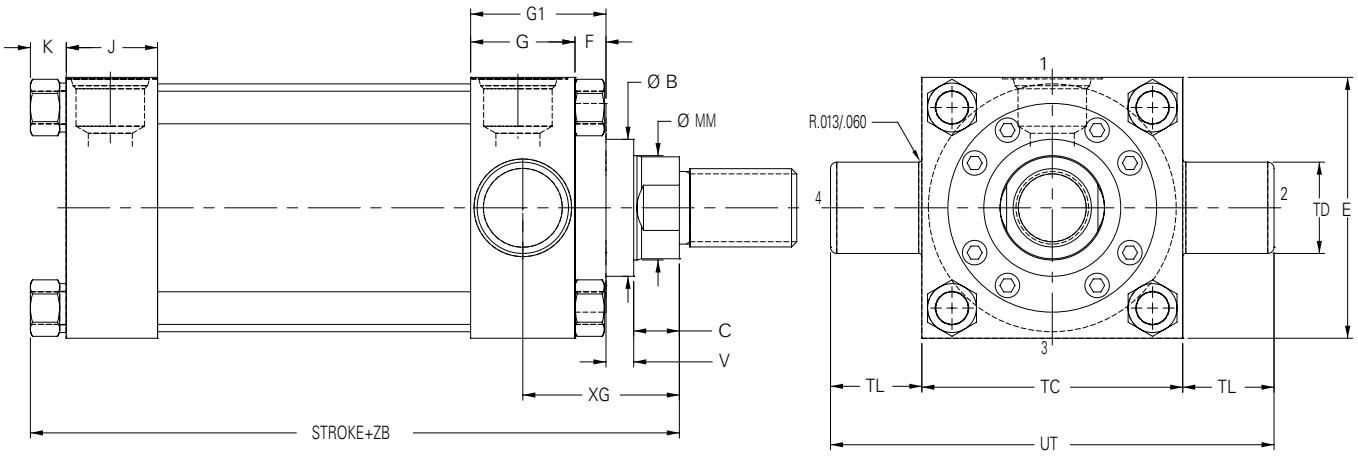


Bore	Rod (MM)	J1	ZB+Max(*/**)	XJ+(*/**)	Piston Thickness	ERP**
1 1/2	1	1.75	7.54	6.13	2.25	-
2	1	1.75	7.68	6.13	2.25	-
	1 3/8	1.75	7.05	5.50	1.38	0.75
2 1/2	1	1.75	7.80	6.25	2.38	-
	1 3/8	1.75	7.18	5.63	1.50	0.63
	1 3/4	1.75	7.43	5.88	1.50	1.13
3 1/4	1 3/8	1.75	7.79	6.25	1.75	-
	1 3/4	1.75	8.05	6.50	1.75	0.63
	2	1.75	8.17	6.63	1.75	0.81
4	1 3/4	1.75	8.30	6.75	2.00	0.38
	2	1.75	8.43	6.88	2.00	0.50
	2 1/2	1.75	8.67	7.12	2.00	1.19
5	2	1.75	9.18	7.38	2.50	-
	2 1/2	1.75	9.42	7.63	2.50	0.69
	3	1.75	9.42	7.63	2.50	0.69
	3 1/2	1.75	9.42	7.63	2.50	0.69
6	2 1/2	2.25	10.66	8.38	2.88	-
	3	2.25	10.66	8.38	2.88	-
	3 1/2	2.25	10.66	8.38	2.88	-
	4	2.25	10.66	8.38	2.88	-
7	3	2.75	11.92	9.38	3.00	-
	3 1/2	2.75	11.92	9.38	3.00	-
	4	2.75	11.92	9.38	3.00	-
	4 1/2	2.75	11.92	9.38	3.00	-
	5	2.75	11.92	9.38	3.00	-
8	3 1/2	3.05	13.06	10.27	3.50	-
	4	3.05	13.06	10.27	3.50	-
	4 1/2	3.05	13.06	10.27	3.50	-
	5	3.05	13.06	10.27	3.50	-
	5 1/2	3.05	13.06	10.27	3.50	-

+ Plus Stroke

** Style 2 rod ends may require additional rod length.The dimensions C,XJ,ZB+Max would increase by additional ERP dimension (wherever applicable)

EH17 - Head trunnion

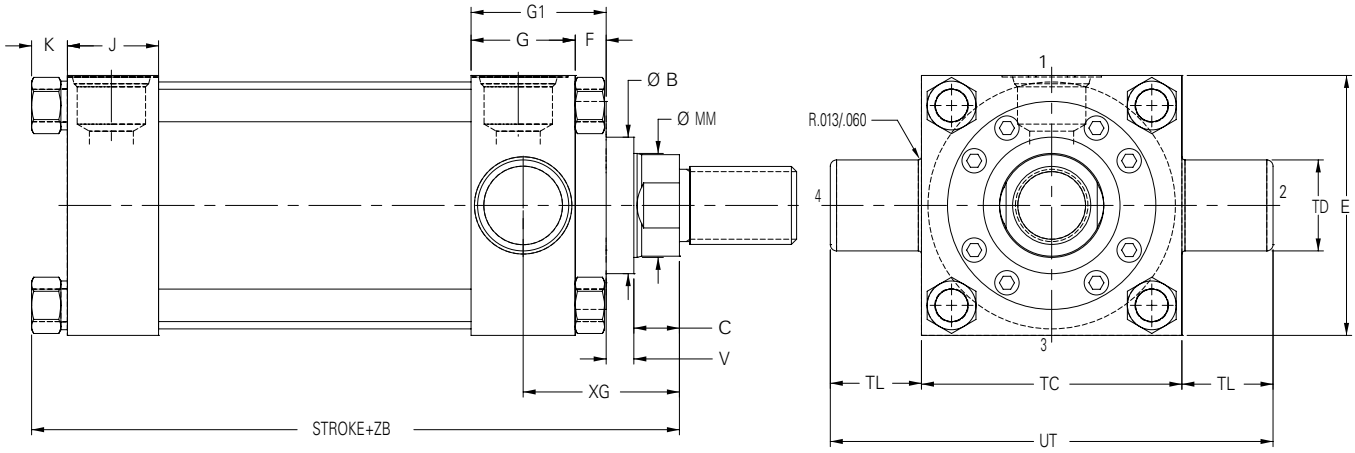


Bore	Rod (MM)	B +.000/ -.002	C**	E	G	F	V	RM	TD +.000/.001	TL	TC	UT	XG+**
1 1/2	1	1.499	0.50	2.50	1.75	0.38	0.50	-	1.000	1.00	2.50	4.50	2.25
2	1	1.499	0.50	3.00	1.75	0.63	0.25	-	1.375	1.38	3.00	5.75	2.25
	1 3/8	1.999	0.63	3.00	1.75	0.63	0.38	-	1.375	1.38	3.00	5.75	2.50
2 1/2	1	1.499	0.50	3.50	1.75	0.50	0.38	2.63	1.375	1.38	3.50	6.25	2.25
	1 3/8	1.999	0.63	3.50	1.75	0.63	0.38	-	1.375	1.38	3.50	6.25	2.50
	1 3/4	2.374	0.75	3.50	1.75	0.63	0.50	-	1.375	1.38	3.50	6.25	2.75
3 1/4	1 3/8	1.999	0.63	4.50	2.00	0.59	0.41	3.25	1.750	1.75	4.50	8.00	2.63
	1 3/4	2.374	0.75	4.50	2.00	0.75	0.38	-	1.750	1.75	4.50	8.00	2.88
	2	2.624	0.88	4.50	2.00	0.75	0.38	-	1.750	1.75	4.50	8.00	3.00
4	1 3/4	2.374	0.75	5.00	2.00	0.59	0.53	3.88	1.750	1.75	5.00	8.50	2.88
	2	2.624	0.88	5.00	2.00	0.59	0.53	4.00	1.750	1.75	5.00	8.50	3.00
	2 1/2	3.124	1.00	5.00	2.00	0.59	0.66	4.44	1.750	1.75	5.00	8.50	3.25
5	2	2.624	0.88	6.50	2.00	0.59	0.53	4.00	1.750	1.75	6.50	10.00	3.25
	2 1/2	3.124	1.00	6.50	2.00	0.59	0.66	4.44	1.750	1.75	6.50	10.00	3.25
	3	3.749	1.00	6.50	2.00	0.72	0.53	5.25	1.750	1.75	6.50	10.00	3.25
	3 1/2	4.249	1.00	6.50	2.00	0.72	0.53	5.63	1.750	1.75	6.50	10.00	3.25
6	2 1/2	3.124	1.00	7.50	2.25	0.59	0.66	4.44	2.000	2.00	7.50	11.50	3.38
	3	3.749	1.00	7.50	2.25	0.72	0.53	5.25	2.000	2.00	7.50	11.50	3.38
	3 1/2	4.249	1.00	7.50	2.25	0.72	0.53	5.63	2.000	2.00	7.50	11.50	3.38
	4	4.749	1.00	7.50	2.25	0.88	0.38	6.44	2.000	2.00	7.50	11.50	3.38
7	3	3.749	1.00	8.50	2.75	0.72	0.53	5.25	2.500	2.50	8.50	13.50	3.63
	3 1/2	4.249	1.00	8.50	2.75	0.72	0.53	5.63	2.500	2.50	8.50	13.50	3.63
	4	4.749	1.00	8.50	2.75	0.88	0.38	6.44	2.500	2.50	8.50	13.50	3.63
	4 1/2	5.249	1.00	8.50	2.75	0.88	0.38	7.13	2.500	2.50	8.50	13.50	3.63
	5	5.749	1.00	8.50	2.75	0.88	0.38	7.56	2.500	2.50	8.50	13.50	3.63
8	3 1/2	4.249	1.00	9.50	3.00	0.72	0.53	5.63	3.000	3.00	9.50	15.50	3.75
	4	4.749	1.00	9.50	3.00	0.88	0.38	6.44	3.000	3.00	9.50	15.50	3.75
	4 1/2	5.249	1.00	9.50	3.00	0.88	0.38	7.13	3.000	3.00	9.50	15.50	3.75
	5	5.749	1.00	9.50	3.00	0.88	0.38	7.56	3.000	3.00	9.50	15.50	3.75
	5 1/2	6.249	1.00	9.50	3.00	0.88	0.38	8.38	3.000	3.00	9.50	15.50	3.75

+ Plus Stroke

** Style 2 rod ends may require additional rod length.The dimensions C,XG+,ZB+Max would increase by additional ERP dimension (wherever applicable)

EH17 - Head trunnion



Bore	Rod (MM)	K	J	ZB+Max(*/**)	Piston Thickness	ERP**
1 1/2	1	0.41	1.75	7.54	2.25	-
2	1	0.55	1.75	7.68	2.25	-
	1 3/8	0.55	1.75	7.05	1.38	0.75
2 1/2	1	0.55	1.75	7.80	2.38	-
	1 3/8	0.55	1.75	7.18	1.50	0.63
	1 3/4	0.55	1.75	7.43	1.50	1.13
3 1/4	1 3/8	0.67	1.75	7.79	1.75	-
	1 3/4	0.67	1.75	8.05	1.75	0.63
	2	0.67	1.75	8.17	1.75	0.81
4	1 3/4	0.67	1.75	8.30	2.00	0.38
	2	0.67	1.75	8.43	2.00	0.50
	2 1/2	0.67	1.75	8.67	2.00	1.19
5	2	0.92	1.75	9.18	2.50	-
	2 1/2	0.92	1.75	9.42	2.50	0.69
	3	0.92	1.75	9.42	2.50	0.69
	3 1/2	0.92	1.75	9.42	2.50	0.69
6	2 1/2	1.03	2.25	10.66	2.88	-
	3	1.03	2.25	10.66	2.88	-
	3 1/2	1.03	2.25	10.66	2.88	-
	4	1.03	2.25	10.66	2.88	-
7	3	1.17	2.75	11.92	3.00	-
	3 1/2	1.17	2.75	11.92	3.00	-
	4	1.17	2.75	11.92	3.00	-
	4 1/2	1.17	2.75	11.92	3.00	-
	5	1.17	2.75	11.92	3.00	-
8	3 1/2	1.26	3.00	13.01	3.50	-
	4	1.26	3.00	13.01	3.50	-
	4 1/2	1.26	3.00	13.01	3.50	-
	5	1.26	3.00	13.01	3.50	-
	5 1/2	1.26	3.00	13.01	3.50	-

+ Plus Stroke

** Style 2 rod ends may require additional rod length.The dimensions C,XG+,ZB+Max would increase by additional ERP dimension (wherever applicable)

WARNING

All rod accessories must be torqued against the rod shoulder.

Mounting brackets, rod clevises, and rod eyes for all EH cylinders are available from Eaton. These accessories are detailed below showing part numbers and all pertinent dimensional data. Make sure the rod end type selected has threads that match the threads of any required accessory. Dimensions are in inches unless otherwise noted. When ordering, please specify the part name and part number. It is user's responsibility to select the correct accessory.

WARNING

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

WARNING

It is the user's responsibility to select the correct accessory.

WARNINGS – Piston Rods

Cylinder users must always make sure that the piston rod is securely attached to the machine member.

Piston rods are not normally designed to absorb bending moments or loads which are perpendicular to the axis of piston rod motion. These additional loads can cause the piston rod end to fail. If these types of additional loads are expected to be imposed on the piston rods, their magnitude should be made known to our Engineering Department so they may be properly addressed.

On occasion, cylinders are ordered with double rods. In some cases, a stop is threaded onto one of the piston rods and used as an external stroke adjuster. This type of usage may result in a potential safety hazard and can also lead to premature piston rod failure. The external stop will create a pinch point. As a result, the cylinder user must use guards.

Furthermore, if an external stop is not parallel to the final contact surface, it will place a bending moment on the piston rod. An external stop will also negate the effect of a cushion and will subject the piston rod to an impact loading. These two conditions can cause premature piston rod failure. The use of external stroke adjusters should be reviewed with our Engineering Department.

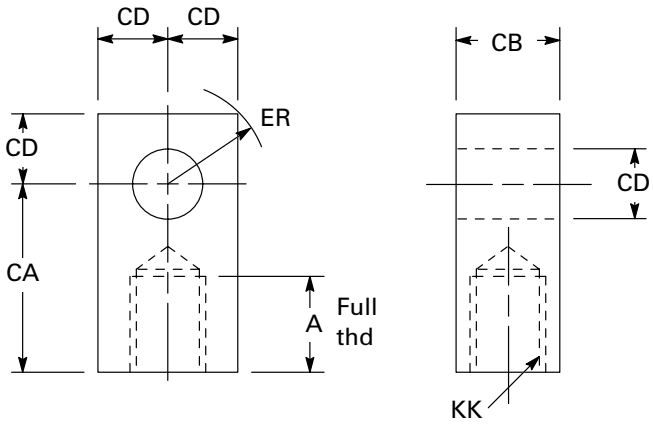
WARNINGS – Mounting & Accessories

The cylinder user should avoid severe vibration and high impact load. Severe vibration can cause joints to become loose. A high impact load can reduce the fatigue life of the piston rod, rod end, accessories and other components. Consult the Eaton Engineering Department if there is severe vibration or a high impact load.

Proper selection and installation of the mounting style options and accessories will improve cylinder performance and extend service life. Cylinders are capable of generating a very high force, so proper selection and maintenance is necessary. It is the user's responsibility to ensure proper selection and installation.

The failure to select the correct mounting options and accessories, the failure to mount the cylinder correctly and/or the failure to install the piston rod, rod ends, accessories and other components correctly may cause or result in death, bodily injury and/or property damage.

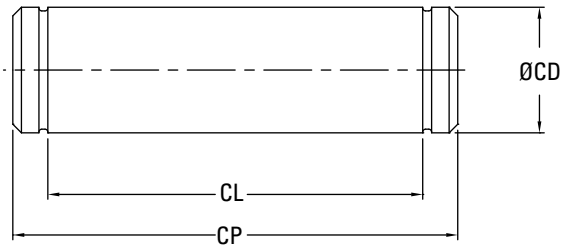
Rod Eye



* Recommended torque values using MoS_2 lubricant with 0.12 co-efficient of friction.

Bore	KK	Torque* (ft-lb)	Part Number	Weight (lbs)	A	CA	CB	CD	ER
1.50	7/16–20 UNF–2B	36	FRE-0437	0.38	0.75	1.50	0.75	0.50	0.63
2.00	3/4–16 UNF–2B	125	FRE-0750	1.25	1.13	2.06	1.25	0.75	0.88
2.50	3/4–16 UNF–2B	125	FRE-0750	1.25	1.13	2.06	1.25	0.75	0.88
3.25	1–14 NS–2B	250	FRE-1000	2.5	1.63	2.81	1.50	1.00	1.18
4.00	1 1/4–12 UNF–2B	460	FRE-1250	5.94	2.00	3.44	2.00	1.38	1.56
5.00	1 1/2–12 UNF–2B	663	FRE-1500	11.4	2.25	4.00	2.50	1.75	2.00
6.00	1 7/8–12 UNF–2B	944	FRE-1875	15.1	3.00	5.00	2.50	2.00	2.25
7.00	2 1/4–12 UNF–2B	1315	FRE-2250	27	3.50	5.81	3.00	2.50	2.81
8.00	2 1/2–12 UNF–2B	5050	FRE-2500	35	3.50	6.12	3.00	3.00	3.25

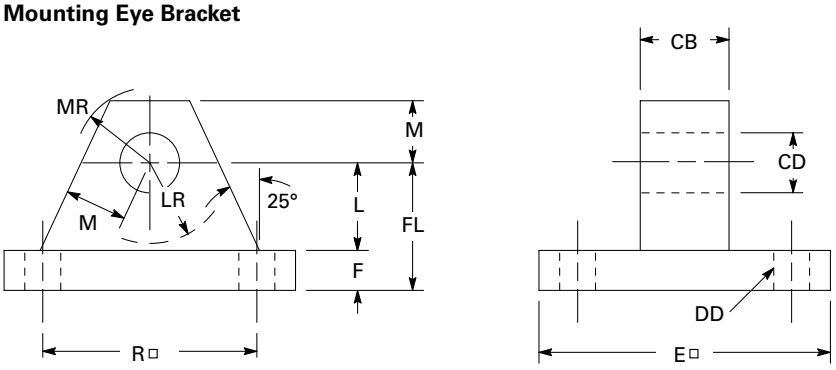
Pivot Pin



Bore	Part Number	CD	CL	CP
1.50	SVPIN-050-10	0.500	1.88	2.10
2.00	SVPIN-075-10	0.750	2.63	2.89
2.50	SVPIN-075-10	0.750	2.63	2.89
3.25	SVPIN-100-10	1.000	3.13	3.39
4.00	SVPIN-138-10	1.375	4.16	4.47
5.00	SVPIN-175-10	1.750	5.16	5.56
6.00	SVPIN-200-10	2.000	5.16	5.56
7.00	SVPIN-250-10	2.500	6.16	6.64
8.00	SVPIN-300-10	3.000	6.19	6.77

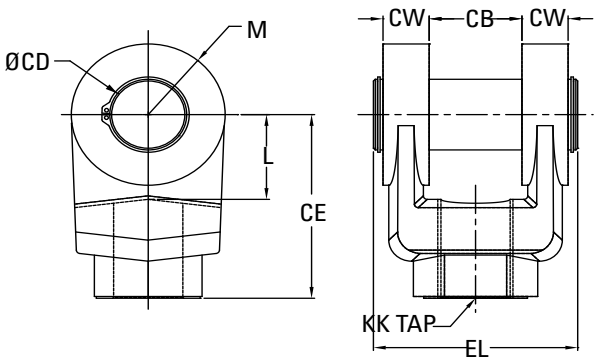
1. Pivot pins are furnished with clevis mounted cylinders.
2. Pivot pins supplied with retainer clips.

Mounting Eye Bracket



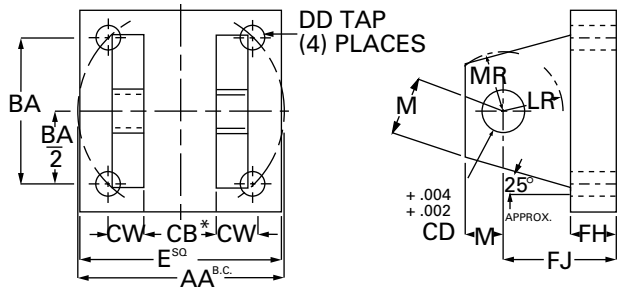
Bore	Part Number	Weight (lbs)	E	F	L	M	R	CB	CD	DD	FL	LR	MR
1.50	SEB-0500	0.94	2.50	0.38	0.75	0.50	1.63	0.75	0.50	0.38	1.13	0.50	0.56
2.00	SEB-0750	3.19	3.50	0.63	1.25	0.75	2.55	1.25	0.75	0.50	1.88	1.00	1.06
2.50	SEB-0750	3.19	3.50	0.63	1.25	0.75	2.55	1.25	0.75	0.50	1.88	1.00	1.06
3.25	SEB-1000	7.17	4.50	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

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	2.38
2.00	3/4–16 UNF–2B	FRC-0750-10	1.56	1.25	0.75	1.25	0.75	2.38	0.63	3.13
2.50	3/4–16 UNF–2B	FRC-0750-10	1.56	1.25	0.75	1.25	0.75	2.38	0.63	3.13
3.25	1–14 NS–2B	FRC-1000-10	3.31	1.50	1.00	1.50	1.00	3.13	0.75	3.75
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	4.75
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	6.03
6.00	1 7/8–12 UNF–2B	FRC-1875-10	21	2.50	2.00	2.50	2.00	5.50	1.25	6.03
7.00	2 1/4–12 UNF–2B	FRC-2250-10	36	3.00	2.50	3.00	2.50	6.50	1.50	7.03
8.00	2 1/2–12 UNF–2B	FRC-2500-10	43	3.25	2.75	3.00	3.00	6.75	1.50	7.13

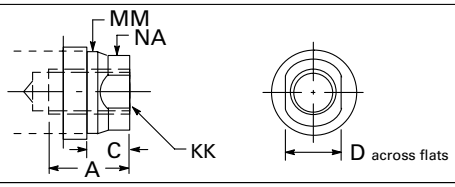
Clevis Bracket



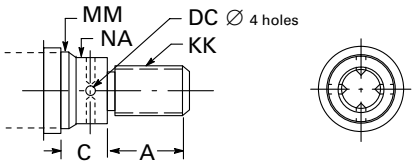
Bore	Part No.	AA	BA	CB	CD	CW	DD	E	FH	FJ	LR	M	MR
1.50	ECB-0500	2.30	1.63	0.78	0.500	0.50	3/8-24	2.50	0.38	1.38	0.50	0.50	0.56
2.00	ECB-0750	2.90	2.06	0.59	0.750	0.63	1/2-20	3.00	0.63	1.88	1.00	0.75	0.69
2.50	ECB-0750A	3.60	2.56	0.59	0.750	0.63	1/2-20	3.50	0.63	1.88	1.06	0.75	0.69
3.25	ECB-1000	4.60	3.25	1.53	1.000	0.75	5/8-18	4.50	0.75	2.25	1.25	1.00	1.13
4.00	ECB-1380	5.40	3.81	2.03	1.375	1.00	5/8-18	5.00	0.88	3.00	1.88	1.38	1.75
5.00	ECB-1750	7.00	4.94	2.53	1.750	1.25	7/8-14	6.50	0.88	3.13	2.00	1.75	1.88
6.00	ECB-2000	8.10	5.75	2.53	2.000	1.25	1-14	7.50	1.00	3.50	2.13	2.00	2.13
7.00	ECB-2500	9.30	6.59	3.03	2.500	1.50	1 1/8-12	8.50	1.00	4.00	2.63	2.50	2.50
8.00	ECB-3000	10.60	7.50	3.03	3.000	1.50	1 1/4-12	9.50	1.00	4.25	2.88	2.75	2.75

Inch Rod Ends

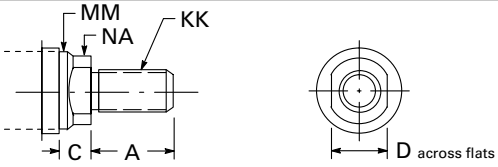
Code 2



For rod sizes 4" thru $5^1/_2$"



Code 5



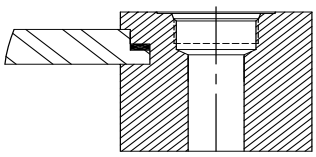
						UN(F) Thread
Rod dia(MM)	**A**	**C**	**D**	**DC**	**NA**	**KK**
0.625	0.75	0.38	0.50	-	0.585	7/16-20
1.000	1.13	0.50	0.88	-	0.968	3/4-16
1.375	1.63	0.63	1.13	-	1.343	1-14
1.750	2.00	0.75	1.50	-	1.718	1 1/4-12
2.000	2.25	0.88	1.75	-	1.953	1 1/2-12
2.500	3.00	1.00	2.13	-	2.437	1 7/8-12
3.000	3.50	1.00	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.

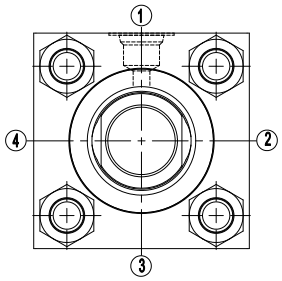
Port selection

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

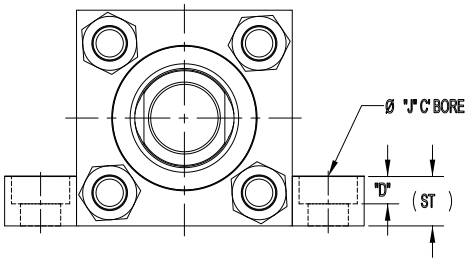


Bore	Rod (MM)	SAE NFPA	Fluid Required per Inch of Stroke		Fluid Required per Inch of Stroke		Flow (gpm)	Piston Velocity (inch/sec)	
			Head (gal)	Cap (gal)	Head (gal)	Cap (gal)		Head	Cap
1 1/2	1	#8	0.004	0.008	0.982	1.767	6.0	23.5	13.1
2	1	#8	0.010	0.014	2.356	3.142	6.0	9.8	7.4
	1 3/8	#8	0.007	0.014	1.657	3.142	6.0	13.9	7.4
2 1/2	1	#8	0.018	0.021	4.123	4.909	6.0	5.6	4.7
	1 3/8	#8	0.015	0.021	3.424	4.909	6.0	6.7	4.7
	1 3/4	#8	0.011	0.021	2.503	4.909	6.0	9.2	4.7
3 1/4	1 3/8	#12	0.029	0.036	6.811	8.296	14.5	8.2	6.7
	1 3/4	#12	0.026	0.036	5.891	8.296	14.5	9.5	6.7
	2	#12	0.022	0.036	5.154	8.296	14.5	10.8	6.7
4	1 3/4	#12	0.044	0.054	10.161	12.566	14.5	5.5	4.4
	2	#12	0.041	0.054	9.425	12.566	14.5	5.9	4.4
	2 1/2	#12	0.033	0.054	7.658	12.566	14.5	7.3	4.4
5	2	#12	0.071	0.085	16.493	19.635	14.5	3.4	2.8
	2 1/2	#12	0.064	0.085	14.726	19.635	14.5	3.8	2.8
	3	#12	0.054	0.085	12.566	19.635	14.5	4.4	2.8
	3 1/2	#12	0.043	0.085	10.014	19.635	14.5	5.6	2.8
6	2 1/2	#16	0.101	0.122	23.366	28.274	27.9	4.6	3.8
	3	#16	0.092	0.122	21.206	28.274	27.9	5.1	3.8
	3 1/2	#16	0.081	0.122	18.653	28.274	27.9	5.8	3.8
	4	#16	0.068	0.122	15.708	28.274	27.9	6.8	3.8
7	3	#20	0.136	0.167	31.416	38.485	45.5	5.6	4.6
	3 1/2	#20	0.125	0.167	28.863	38.485	45.5	6.1	4.6
	4	#20	0.112	0.167	25.918	38.485	45.5	6.8	4.6
	4 1/2	#20	0.098	0.167	22.58	38.485	45.5	7.8	4.6
	5	#20	0.082	0.167	18.85	38.485	45.5	9.3	4.6
8	3 1/2	#24	0.176	0.218	40.644	50.266	67.4	6.4	5.2
	4	#24	0.163	0.218	37.699	50.266	67.4	6.9	5.2
	4 1/2	#24	0.149	0.218	34.361	50.266	67.4	7.6	5.2
	5	#24	0.133	0.218	30.631	50.266	67.4	8.5	5.2
	5 1/2	#24	0.115	0.218	26.507	50.266	67.4	9.8	5.2

Port locations are identified by viewing the cylinder from the head end (or from the mounting end of double rod cylinders).The location numbers are shown here.



Certain Port locations cannot be specified with some mounting styles. The table below indicates which of the head and cap port locations are available for each EH Series mounting style.



Bore	J	D
1.50	0.625	0.22
2.00	0.812	0.38
2.50	1.188	0.7
3.25	1.188	0.44
4.00	1.562	0.66
5.00	1.562	0.062
6.00	2.00	-
7.00	2.312	0.31
8.00	2.312	-

Port location		Head location				Cap location			
Mounting style code	Description	1	2	3	4	1	2	3	4
01	Side lug mount	A	W	A	W	A	W	A	W
08	Head square flange mount	W	W	W	W	A	A	A	A
09	Head rectangular mount	A	A	A	A	A	A	A	A
15	Intermediate trunnion mount	A	A	A	A	A	A	A	A
16	Cap trunnion mount	A	A	A	A	A	N	A	N
17	Head trunnion mount	A	N	A	N	A	A	A	A
50	Cap detachable clevis mount	A	A	A	A	A	A	A	A

Cushion location		Head location			
Mounting style code	Description	1	2	3	4
01	Side lug mount	A	A	A	A
08	Head square flange mount	A	A	A	A
09	Head rectangular mount	A	A	A	A
15	Intermediate trunnion mount	A	A	A	A
16	Cap trunnion mount	A	A	A	A
17	Head trunnion mount	A	N	A	N
50	Cap detachable clevis mount	A	A	A	A

A- Available

N- Not available

W- Port is available without Port boss only

Sealing system

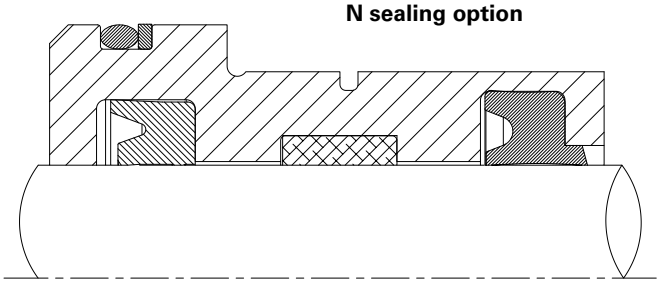
Two different sealing systems are available in EH series cylinders

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

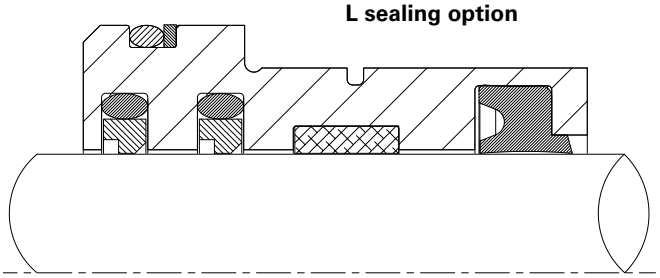
Code	Fluid	Temperature (°F)	Max. Speed (ft/s)	Application
N	Mineral oil, petroleum base	–31 to 176	2.25	Normal, typical industrial
	Automotive transmission fluid			
L	Mineral oil	–31 to 248	15	Low friction servo

Rod Seal Configuration

N sealing option

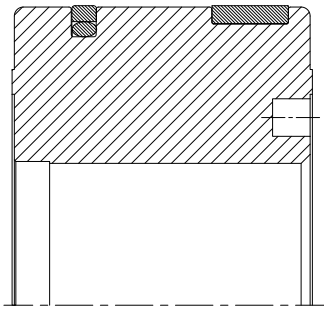


L sealing option



Piston Seal Configuration

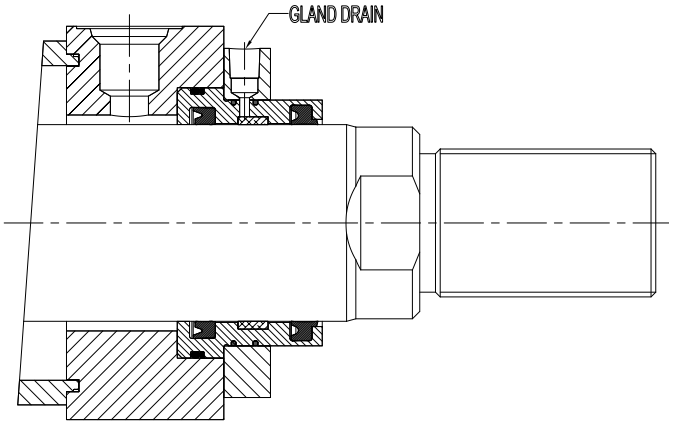
N and L Seal option



Gland Drain Option

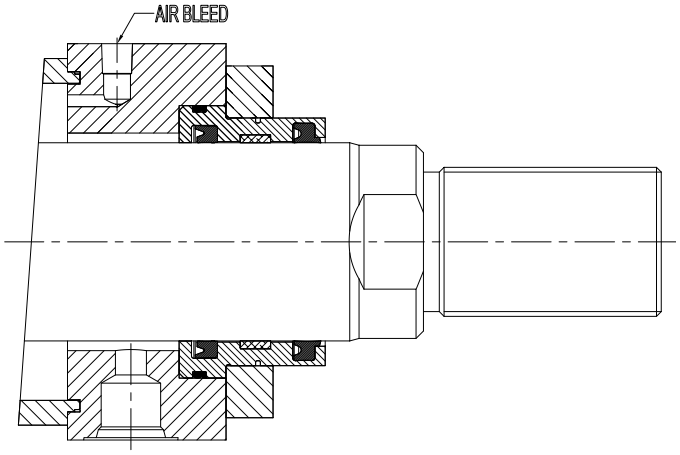
Gland drains are primarily used for long stroke cylinders (over 30 inches) and when extended speed exceeds retract speed.

The gland drain is used to return any accumulated fluid, between the rod seal and wiper, to tank. This is used in servo applications, for ultra-low leakage requirements, or for remote visual monitoring of rod seal leakage for preventive maintenance purposes.



Air Bleed Option

Usually cylinders will bleed themselves of air when ports are vertical, on top. Bleed ports are often desirable to remove entrapped air, when the ports are on the bottom. High performance and high speed or heavy load applications are a few examples where air bleeds are desirable.



Stop tubes

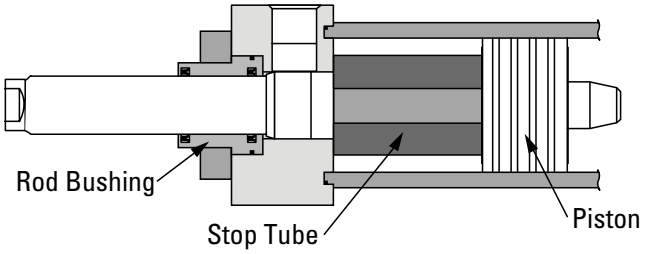
Stop tubes are located between the piston and the rod shoulder on the head end of the cylinder. Bearing loading is reduced by separating the piston and the rod bushing. Bearing wear and tendency to buckle is reduced.
To determine if a stop tube is required and the length of stop tube needed, use the following procedure:

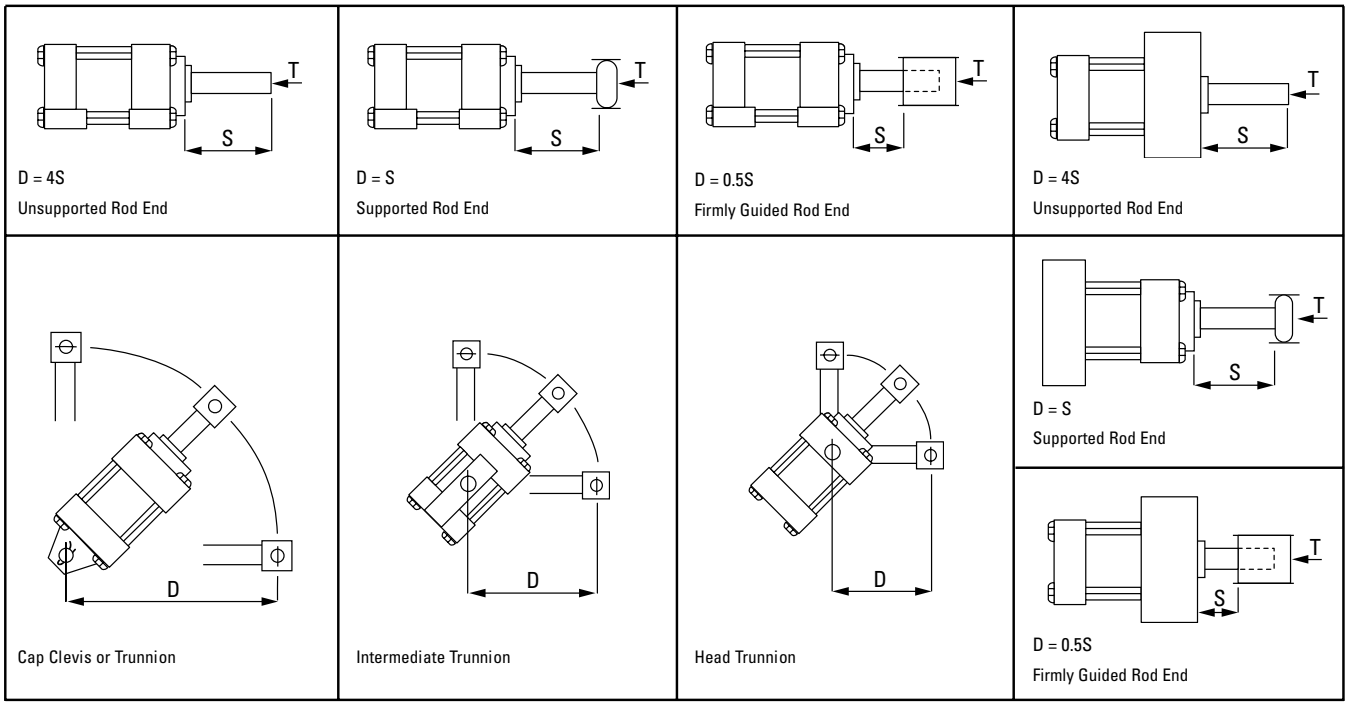
Determine the value of D with the piston rod in the fully extended position. If the value of D is under 40", no stop tube is needed.

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

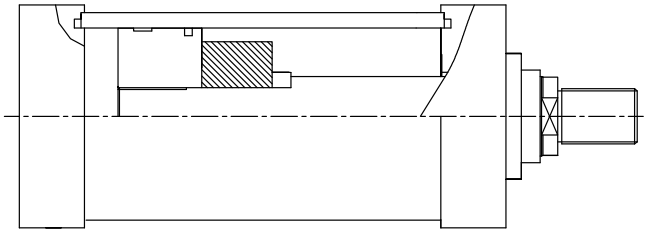
There are two stop tube designs depending on the length required.

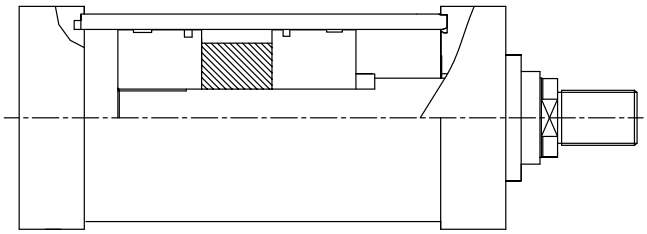
Design A

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.





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 derieved 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 f in	Rod f in	Work Area (in^2)	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
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
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
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

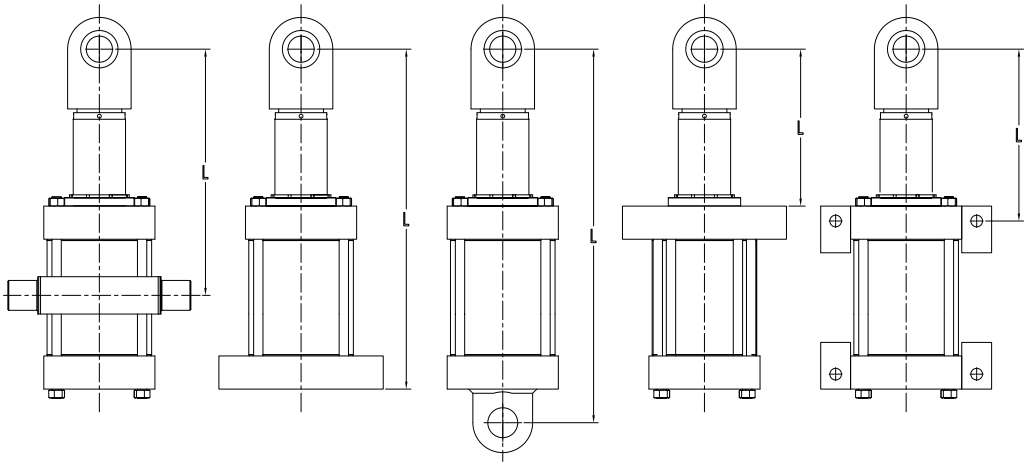
Maximum allowable push stroke (Recomended "L")

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 spelling analysis only and does not consider side loading, stop tube requirments or oter cylinder stroke limitations.

For pressure above 3000 PSI consult your local Eaton representative.



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

Bore f in	Rod f in	Rigid Mount (01,02,04,05,07,08,09,12, 13,14,19,21,22,23,24)							Swivel Mount (10,11,15,16,17,47,48,50)						
		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

End conditions for above chart

Mount	Condition
Rigid Mounts	Fixed-Guided
Swivel Mounts	Pin-Pin

Calculation according to Euler

$$P = \frac{C\pi^2 EI}{FL^2} \qquad \frac{L}{k} \triangleright \left[\frac{2C\pi^2 E}{S_y}\right]$$

Calculation according to Jb Johnson

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

Safety factor,
Critical load, Lb
Modulus of elasticity, 30000000 psi
Length, in
Moment of inertia, in^4
End condition
Fixed-Guided 2
Fixed-Fixed 4
Pin-Pin 1
Rod area, in²
Radius of gyration, in

Cushions are recommended when piston speed is in excess of 20-25 feet per minute. Cushions decelerate the piston and rod assembly at the end of the stroke, lessening the noise and shock and increasing cylinder life. Heavy loads attached to the piston and rod assembly should be stopped by external means, such as shock absorbers, springs, decelerating valves, etc.

Use the information below, along with the examples on page 36 to determine if standard cushioning is sufficient for your application.

Force factor chart

Force Factors (a = v2 x .001294)

Piston	Velocity
ips	a
1	0.001
2	0.005
3	0.012
4	0.021
5	0.032
6	0.047
7	0.063
8	0.083
9	0.105
10	0.129
11	0.157
12	0.186
13	0.219
14	0.254
15	0.291
16	0.331
17	0.374
18	0.419
19	0.467
20	0.518
21	0.571
22	0.626
23	0.685
24	0.745
25	0.809

General formulas

Horizontal motion	F_{acc} or $F_{dec} = W \times {}^{a}/_{s}$
Vertical motion, decelerating downward or accelerating upward	F_{acc} or $F_{dec} = (W \times {}^{a}/_{s}) + W$
Vertical motion, decelerating upward or accelerating downward	F_{acc} or $F_{dec} = (W \times {}^{a}/_{s}) - W$
Frictional force	$F_f = u \times W$
Total cushioning force (+ F_f if load accelerating, — F_f if load decelerating)	$F_t = F_{acc}$ or $F_{dec} + F_p \pm F_f$
Contained pressure	$P_c = F_t/A_{cc}$ or F_t/A_{hc}

Force factor terminology

Terms Used"	Explanation	Units
W	Weight	pounds
Ab	Bore area	square inches
Ah	Ab less rod area	square inches
Acc	Ab less cap plunger cross- sectional area	square inches
Ahc	Ab less head plunger cross- sectional area	square inches
a	Force factor	-
s	Acceleration or deceleration distance	inches
u	Coefficient of friction of load motions	Horizontal = .15 Vertical = 0
v	Velocity	"inches per second (ips)"
Facc	Force needed to accelerate a weight	pounds
Fdec	Force needed to decelerate a weight	pounds
Ff	Friction force due to load motion	pounds
Fp	Driving pressure force	pounds
Ft	Total cushioning force	pounds
Pp	Pump pressure	"inches per second (ips)"
Pc	Contained cushioning pressure	"inches per second (ips)"

Acceleration and Deceleration Forces

The a force factors shown are used to determine the forces required to accelerate or decelerate a weight through a given distance, s (Refer to **Force Factor Chart).**

- If the motion of the load is horizontal, use the genera formula F_{acc} or $F_{dec} = W \times {}^{a}/_{s}$.
- If the motion of the load is vertical and is being decelerated downward or accelerated upward, use the general formula F_{acc} or $F_{dec} = (W \times {}^{a}/_{s}) + W$.
- If the motion of the load is vertical and is being decelerated upward or accelerated downward, use the general formula F_{acc} or $F_{dec} = (W \times {}^{a}/_{s}) - W$.
- Friction due to load motion affects F_t. Add F_f to F_t if the load is accelerating. Subtract F_f from F_t if the load is decelerating.
- Cylinder friction is negligible.

Note

The contained cushioning pressure must not exceed 5000 psi. If the standard cushion results in a too high pressure, then a longer cushion spud must be specified.

Technical data
How to calculate cushion requirements

Hydraulic examples

Example A

Horizontal deceleration

EH series cylinder, 3 1/4" bore, 1 3/8" rod (standard), cushioning at cap.

A weight of 3000 lbs., moving at 25 ips, and driven by a pump pressure of 1000 psi should stopped in 1 1/4". Assume the coefficient of friction to be .15.

1. F_f = **u x W**
   = .15 x 3000 lbs.
   F_f = 450 lbs.
2. F_p = A_h x P_p
   A_h = A_b – rod area
   = 8.45 sq. in.–
   1.49 sq. in.
   A_h = 6.96 sq. in.
   F_p = 6.96 sq. in. x
   1000 psi
   F_p = 6960 lbs.
3. F_{dec} = **W x** $^a/_s$
   = 3000 lbs. x
   .809/1.25 in.
   F_{dec} = 1942 lbs.
4. F_t = F_{dec} + F_p – F_f
   = 1942 + 6960 – 450
   F_t = 8452 lbs.
5. P_c = F_t / **Acc**
   = 8452 lbs./7.85 sq.in.
   P_c = 1077 psi

This figure does not exceed the pressure capability of the cylinder, therefore, the standard cushion is acceptable.

Example B

Horizontal deceleration

EH series cylinder, 6" bore, 2 1/2" rod (standard), cushioning at head. The cylinder is mounted vertical rod down, with a 2000 lb. load attached to the rod end. Pump pressure is 750 psi, the load is moving at 40 ips, and must be stopped in 1 3/8" There is no load friction.

1. F_p = P_p x A_b
   = 750 psi x
   28.56 sq. in.
   F_p = 21,420 lbs.
2. F_{dec} = **(W x** $^a/_s$**) + W**
   = (2000 lbs. x
   2.07/1.375 in.)
   + 2000 lbs.
   F_{dec} = 5011 lbs.
3. F_t = F_p + F_{dec}
   = 21,420 + 5011 lbs.
   F_t = 26,431 lbs.
4. P_c = F_t / A_{hc}
   = 26,431 lbs.
   /22.07 sq. in.
   P_c = 1198 psi

This does not exceed the pressure capability of the cylinder, therefore, the standard cushion is acceptable.

Note

If your calculations show you need a longer cushion than standard, longer cushions are available in 1/4 inch increments.

Bore Size	Rod Dia	Cushion Length (in.)		Effective Cushion Area (in.²)	
		Head	Cap	Head (A_{hc})	Cap (A_{cc})
1.50	0.63	1.13	1.81	1.24	1.70
	1.00	1.13	1.81	0.73	1.70
2.00	1.00	1.13	1.13	2.13	2.91
	1.38	1.13	1.13	1.17	2.90
2.50	1.00	1.13	1.13	3.92	4.77
	1.38	1.13	1.13	2.96	4.77
	1.75	1.13	1.13	1.89	4.77
3.25	1.38	1.38	1.25	6.38	7.85
	1.75	1.38	1.25	5.31	7.85
	2.00	1.38	1.25	4.02	7.85
4.00	1.75	1.38	1.25	9.62	12.16
	2.00	1.38	1.25	8.33	12.16
	2.50	1.38	1.25	6.27	12.16
5.00	2.00	1.38	1.25	15.44	18.64
	2.50	1.38	1.25	13.38	18.64
	3.00	1.31	1.25	10.93	18.64
	3.50	1.31	1.25	8.08	18.64
6.00	2.50	1.38	1.50	22.07	26.16
	3.00	1.31	1.50	19.62	26.16
	3.50	1.31	1.50	16.77	26.16
	4.00	1.50	1.50	15.20	26.16
7.00	3.00	2.00	2.00	29.88	36.42
	3.50	2.00	2.00	27.03	36.42
	4.00	2.00	2.00	25.46	36.42
	4.50	2.00	2.00	19.29	36.42
	5.00	2.00	2.00	17.70	36.42
8.00	3.50	2.00	2.00	38.85	48.24
	4.00	2.00	2.00	37.28	48.24
	4.50	2.00	2.00	31.11	48.24
	5.00	2.00	2.00	29.52	48.24
	5.50	2.00	2.00	29.52	48.24

EH series offers standard Bolt on Manifold with piping. Special options are available, including regeneration mode, reverse mounting and operation, drainback and straddle block design, oversize special porting or special patterns. Manifolds may be mounted on head or cap end depending on the application with 5 standard valve patterns available.

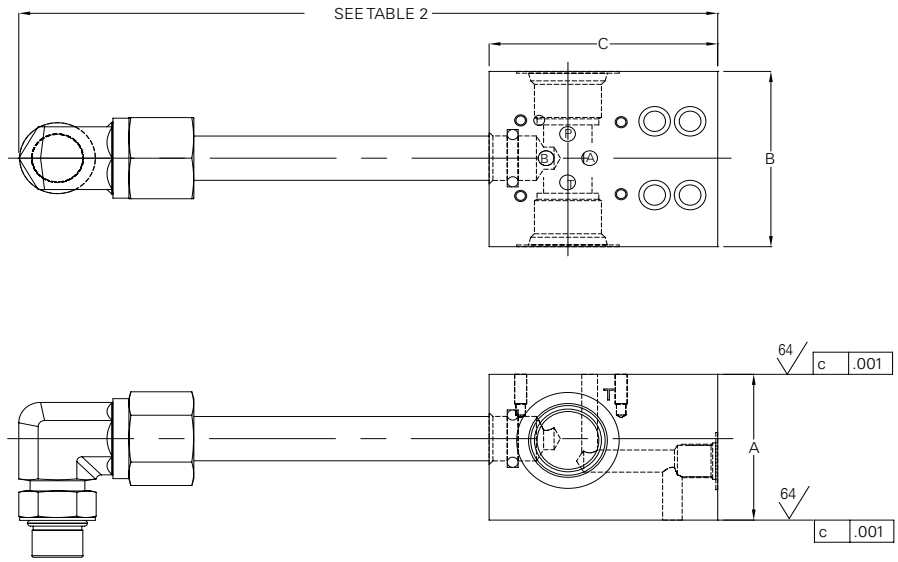


Table 1 - Standard manifold patterns available

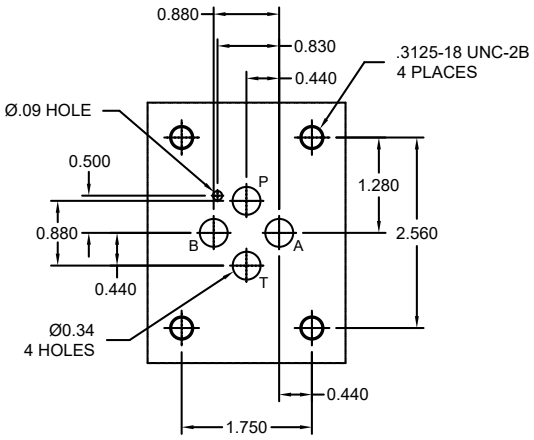
Control valve series	A	B	C
Ø.875 Bolt Circle (SM4-20)	2.7	3.12	4
Ø1.750 Bolt Circle (SM4-40)	2.88	4.00	6.00
CETOP 3	1.50	3.25	3.75
CETOP 5	2.00	5.00	5.00
CETOP 8	3.50	5.50	7.88

Table 2

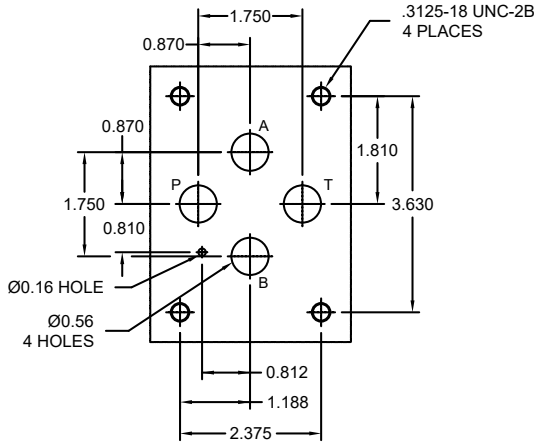
Bore diameter	"Minimum Stroke Requirements Bore for Manifold Block Applications"
1.50	3.00
2.00	3.00
2.50	3.00
3.25	2.50
4.00	2.00
5.00	2.00
6.00	1.50
7.00	1.00
8.00	0.50

Valve pattern

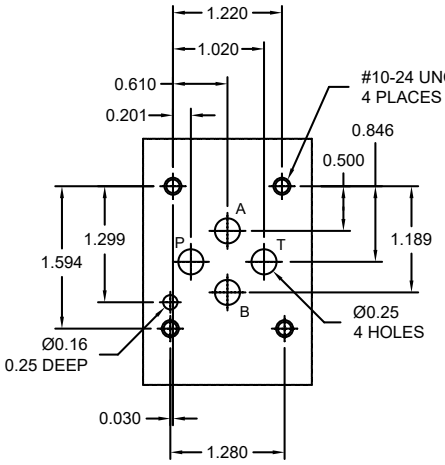
Ø.875 Bolt Circle (SM4-20)



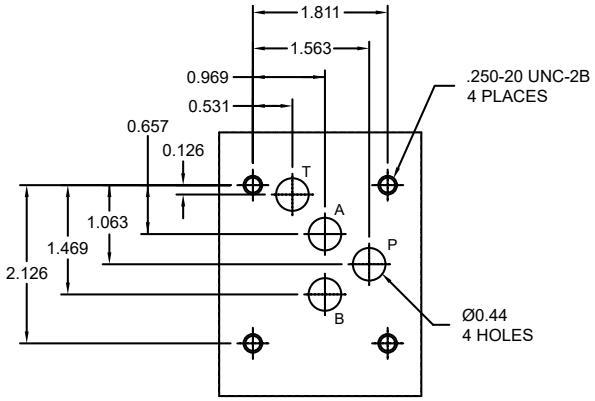
Ø1.750 Bolt Circle (SM4-40)



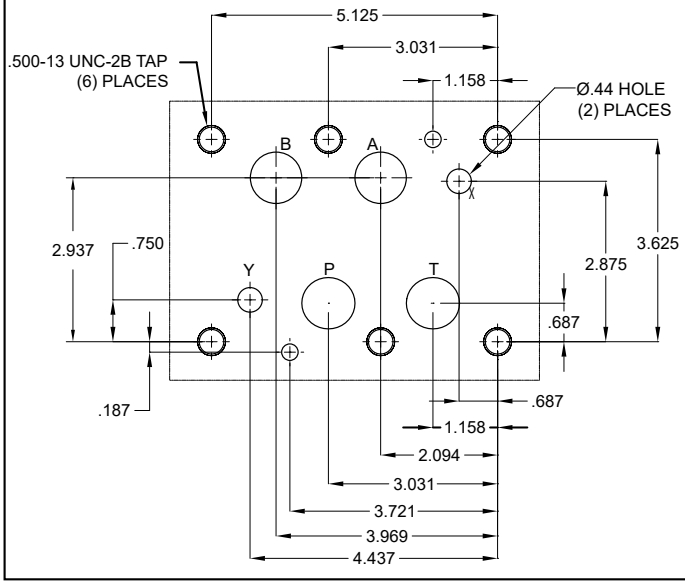
CETOP 3 VALVE PATTERN



CETOP 5 VALVE PATTERN

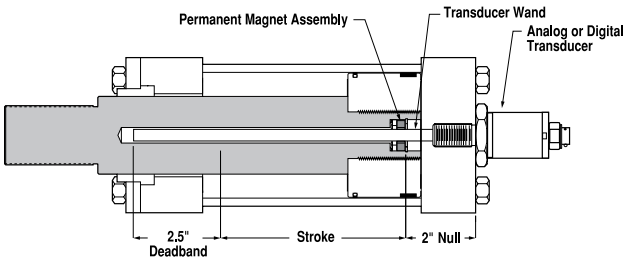


CETOP 8 VALVE PATTERN



Noncontact transducer

Eaton utilizes a magnetostriction device for feedback.Selection of feedback should be matched to the control systems to ensure optimum performance of the positioning system.



Specifications

Characteristic	Description/Specification
Operating Voltage	+24 Vdc nominal
Null Space	Null space is 2 in. unless otherwise noted
Setpoints	Setpoint adjustment (Null/Span): 100% of electrical stroke length, 50 mm (2 in.) min. distance between setpoints.
Dead band	"2.5 in. For stroke lengths of 2 - 197 in. 2.6 in. For stroke lengths of 197.1 - 300 in."
Displacement range	"Analog: 2 to 100 in. (50 to 2540 mm) Digital: 2 to 300 in. (50 to 7620 mm)"
Head Enclosure	"Aluminum housing with diagnostic LED display (LEDs located beside connector/cable exit)"
Sealing	IP 67(with connector attached) or IP 68 for integral cable models
Sensor Rod	304L stainless steel
Linearity Deviation	< ± 0.02%full stroke (minimum ± 50 µm)
Repeatability	< ± 0.001% full stroke (minimum ± 2.5 µm)
Hysteresis	< 4 µm
Resolution	"Analog: Infinite (restricted by output ripple) Digital Pulse: 0.1, 0.01 and 0.005 mm (controller dependent)"
EMC Test	"Emissions: IEC/EN 61000-6-3 Immunity: IEC/EN 61000-6-2 IEC/EN 61000-4-2/3/4/5/6/8,level 3/4 criterium A, CE qualified"
Operating Temperature	"-40 °C (-40 °F) to 80 °C (176 °F) 85 °C (185 °F) max."
Operating Pressure**	5000 psi static, 10,000 psi peak (350 bar static, 690 bar peak)
Shock Rating	100 g (single hit) / IEC standard 68-2-27 (survivability)
Update times	"Analog: < 1 ms (typical) Digital (Controller dependent, design reference = (null + stroke+ dead zone) inches x 10.0 µsec/in. x (number of circulations)"
Analog outputs	"Voltage (Fully adjustable): 0 to 10, 10 to 0, -10 to +10, +10 to -10 Vdc (minimum controller load > 5k ohms) Current (Fully Adjustable): 4(0) to 20 mA, 20 to 4(0) mA (Minimum/maximum load, 0/500 ohms)"
Digital-Pulse Outputs:	Start/Stop or Pulse Width Modulation (PWM)
Vibration Rating	15 g (30 g with HVR option)/10 to 2000 Hz,IEC standard 68-2-6 (operational)
Maximum Cable length	Analog and digital: 100 ft.***
Wiring	6-pin male D60 (M16) connector or integral cable
Mounting	Threaded flange 3/4 - 16 UNF-3A
Typical mounting torque:	45 N-m (33 ft. - lbs.)

** Compare these specifications to cylinder specifications. Use the proper limiting specification

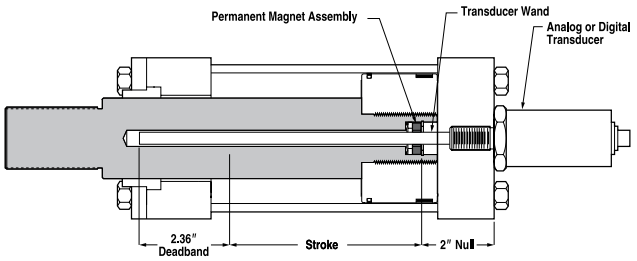
*** 1) Maximum cable length is dependent on the output selected, contact factory.

2) Recommended maximum integral cable length to be 10 meters (33 ft.). Cables greater than 10 m (33 ft.) in length are available, however, proper care must be taken during handling and installation.

Transducer specifications – Balluff BTL 5/7

Noncontact transducer

Eaton utilizes magnetostriction device for feedback. Balluff offers a transducer design for rugged industrial environments wherever linear motion must be controlled. Two standard types of feedback outputs are available: analog and digital Selection of feedback output should be matched to the control systems to ensure optimum performance of the positioning system.

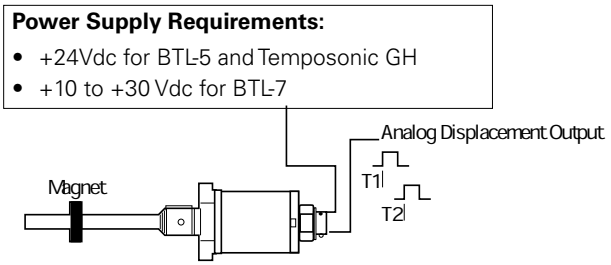


Specifications

Characteristic	Description/Specification BTL-5	Description/Specification BTL-7
Operating Voltage	24Vdc ± 20%	+10 to +30 Vdc
Current Draw	"Digital outputs: <150 mA (at 1K Hz sampling rate) CANopen: <100 mA Profibus: <120 mA SSI: <80mA Quadrature: <80mA"	For Analog outputs (BTL-7): ≤ 150 mA @ +24 Vdc
Mounting	Threaded flange 3/4 - 16 UNF-3A	
Null Space	For 3/4-16 UNF-3A mounting: 50.8 mm (2 in.)	
Dead band	Dead band is 2.36 in. (60mm) from tip of transducer	
Displacement range	Digital: 2 to 156 in. (51 to 3962 mm)	Analog : 2 to 300 in. (51 to 7620 mm)
Head Enclosure	Anodized aluminum body, stainless investment cast flange (DIN 1.3952)	
Sealing	IP 67 (with connector attached) or IP 68 for integral cable models	
Sensor Rod	316 stainless steel tube	
Non-Linearity	"Digital O/P Stroke length ≤ 500 mm: ±100µm Stroke length > 500 mm: 0.02% of full-scale"	"Analog O/P Stroke length ≤ 500 mm: ±50µm Stroke length > 500 mm, ≤ 5500 mm: ±0.01% of full-scale Stroke length > 5500 mm: 0.02% of full-scale"
	CANopen, Profibus O/P: ±30µm at 5µm resolution	N/A
	SSI O/P:±30µm or ±2LSBs, whichever is greater	N/A
	"Quadrature O/P Stroke length ≤ 500 mm: ±100µm Stroke length > 500 mm: 0.02% of full-scale"	N/A
Repeatability	Resolution/ min 2µm	
	CANopen, Profibus, SSI O/P ±1 digit	N/A
	Quadrature O/P: Resolution + (±2 x resolution or 5µm, whichever is greater)	N/A
Hysteresis	Digital O/P ≤5µm	BTL-7: Analog O/P ≤5µm
	CANopen, Profibus, SSI O/P ±1 digit	N/A
	Quadrature O/P : ±2 x resolution or 5µm, whichever is greater	N/A
Resolution	Digital O/P-Controller dependent	"BTL-7: Analog O/P Voltage: ≤ 0.33 mV Current: ≤ 0.66 µA"
	CANopen: Position 5µm, Velocity 0.1mm/s increments(selectable)	N/A
	"Profibus: Position 5µm (configurable) Velocity 0.1mm/s increments (configurable)"	N/A
	SSI: 1, 5, 10, 20 or 40µm	N/A
	Quadrature: 1, 2, 5 10µm, 0.001" or 0.0001"(switch selectable)	N/A
	N/A	Analog ≤ 30ppm/K
Temperature Coefficient	Digital: [0.6 µA/°C + (10 ppm/°C*P*V/NL)] * ΔT	
	CANopen, Profibus, SSI and quadrature : (6µm + 5ppm x L)/°C	
Operating Temperature	-40 °C (-40 °F) to 85 °C (185 °F)	
Operating Pressure**	8700 psi max.	
Sampling rate	N/A	Length dependent max 4KHz
	CANopen, Profibus:1kHz	N/A
	SSI : 2KHz	N/A
	"Quadrature: Free-running: 1ms, 2ms, 4ms Synchronous: 500µS to 10ms"	N/A
Shock Rating	100g for 6ms (100g for 2ms continuous) per IEC 68 2-27	150g/6 ms per IEC 60068-2-27
Vibration Rating	12g, 10 to 2000 Hz per IEC 68-2-6	20g, 10 to 2000 Hz per EN 60068-2-6
Maximum Cable length	50 feet Voltage output; 500 feet Current output; 1500 feet Pulse output	
Analog outputs	Analog voltage 0 to 10 Vdc / 10 to 0 Vdc	
Number of outputs	"Voltage version: 2, rising and falling (not independently scalable) Current version: 1"	
Digital outputs	Start/Stop or Pulse-widthmodulated (RS422/RS485), CANopen, Profibus, SSI and Quadrature only for BTL-5	N/A
Wiring	8-pin male (M16) connector or integral cable	

Analog Output Options

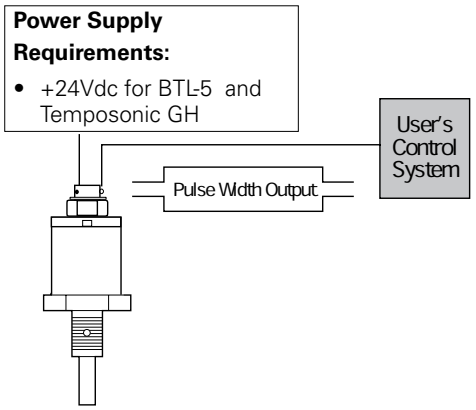
Analog Systems include a Linear Displacement Transducer, a magnet and the cable between the sensor and the customer electronics. The sensor generates the interrogation pulse, senses the return pulse and develops the analog output displacement signal (voltage or current).



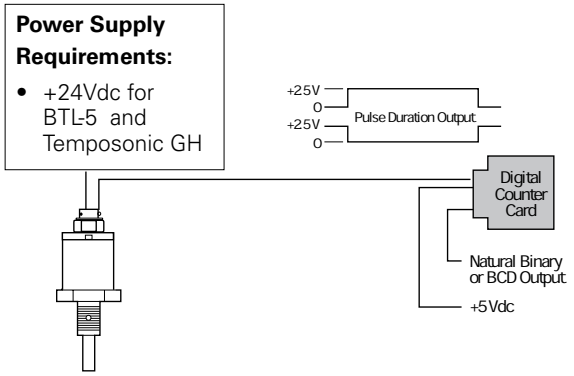
Digital Output Options

Following are the digital output options available. Each provides a different type of digital output,either pulse width modulation binary (natural binary or binary coded decimal) or an RS422 Start/ Stop pulse output

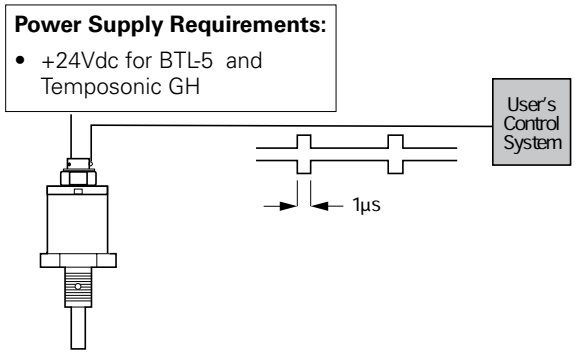
1. The digital PWM electronics are self contained in the transducer. The interrogation electronics provide a pulse width modulated TTL level output (no external signal conditioning required).



2. The PWM output, in conjunction with an externally mounted digital counter card, provides natural binary (18 bits) or BCD (41/4 digits) output (using two counter cards would provided the capability to achieve 22 bit natural binary and 6 BCD outputs).



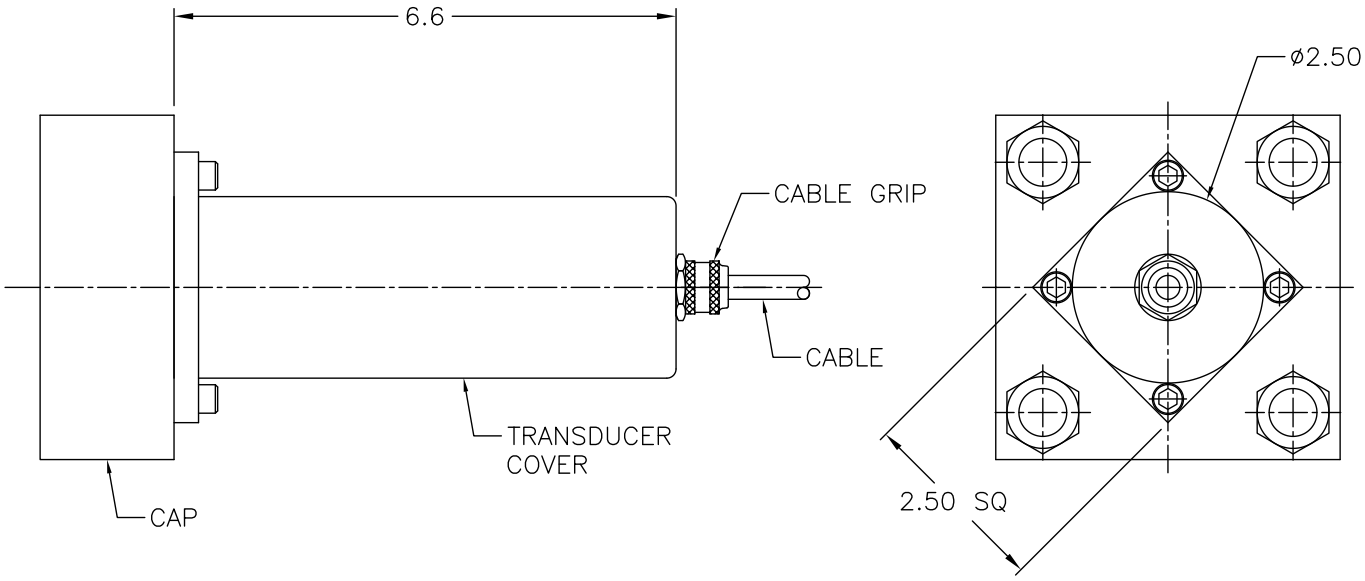
3. The RS422 output electronics are self contained in the transducer. A customer supplied 1 KHz square wave signal is required with this output option to produce an RS422 Start/ Stop output.



Temposonics GH and Balluff BTL-5 Clearance requirements

Transducer and Connector with Cover Option

Aluminum cover option provides additional protection to the electronics selected for the application.



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

Eaton Cylinder Application Data Sheet

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

ext = cylinder extends ret = cylinder retracts

Eaton valving options

Eaton valves below can be mounted on to the configured cylinder and adjusted to customer specification. Fill out the Valve Application Data Sheet on the next page and forward it to your local Eaton sales engineer along with the cylinder request.

Proportional valves

For reliable, high performance cylinder control, Eaton offers a comprehensive line of proportional, directional control valves with and without on-board electronics

Servo valves:

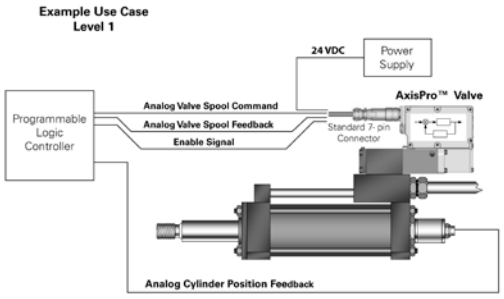
Eaton's SM4 /SX4 servo valve provide closed loop control with exact positional accuracy, repeatable velocity profiles and predictable force or Torque regulation.

Directional Control valves:

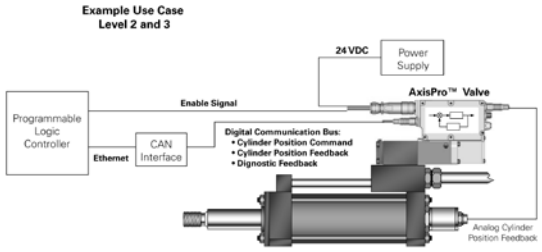
Eaton directional valves provide three- or four-way directional control for cylinder or hydraulic motors. They can be actuated by solenoid, hydraulic or pneumatic pilot, lever, or mechanically, making them an ideal fit for a wide variety of industrial applications

Axis Pro valves:

AxisPro is a game changing machine control valve. Its embedded intelligence simplifies traditionally complex control practices and its ability to predict potential maintenance issues increases machine reliability.



"AxisPro level 1 valves can be used to control machine motions in open loop or closed loop control applications.The valve receives its analog command input onthe 7-pin,main,connector from an external axis control device.



"AxisPro level 2 valves can be used to control machine motion in open or closed loop control applications.The valve can receive its analog command input on the 7-pin connector from an external axis control device or,with the available on-board motion control feature activated (via Eaton Pro-FX Configure),can close the external control loop around the actuator on the valve (taking feedback signal from cylinder or motor) – eliminating the separate motion controller. In this case the AxisPro valve receives a position,speed or force command and will create its own valve command needed to comply with the requested machine motion. In addition,digital communications over the CANopen bus is available for machine control or monitoring purposes.

Valve Application Data Sheet

Customer Name:

Customer P/N:	Rev:	Machine:	Function:
Contact:	Phone:	Fax:	Mail:

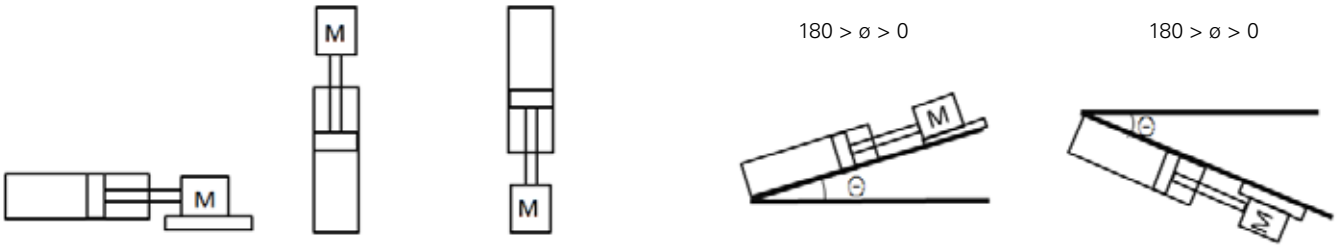
Cylinder

Bore diameter (in).....	Rod diameter (in).....	Stroke (Extend) (in).....	Stroke (Retract) (in).....
		Max speed (Extend) (in/sec).....	Max speed (Retract) (in/sec).....
		Acceleration time (Extend)(sec).....	Acceleration time (Retract)(sec).....

Load characteristics

Effective load weight (lbs).....	External force type (Extend) ☐ Resistive/Positive ☐ Overrunning/Negative	External force type (Retract) ☐ Resistive/Positive ☐ Overrunning/Negative
	External Force magnitude (Extend)…….. Lbs	External Force magnitude (Retract)…….. Lbs

How is Cylinder mounted?



☐ Horizontal	☐ Vertical-rod up	☐ Vertical-rod down	☐ Orientation Rod up	☐ Orientation Rod down
			Ø……Degrees	Ø……Degrees

Does the load slide against a second body? ☐ Yes ☐ No Is the surface lubricated? ☐ Yes ☐ No

System

Supply pressure.....PSI	Tank Pressure.....PSI

Control Parameter

☐ Position	☐ Velocity	☐ Pressure	☐ Transitional (Dual mode)

Specify accuracy requirement for the desired control parameter (if applicable)

Valve

☐ Proportional	☐ Servo	☐ No preference	Minimum command signal (if applicable).....%

Proportional Valves

Spool Metering type	Spool Center type	Electronics	Performance
☐ Symmetric Meter-In & Meter-Out	☐ Closed centre	☐ With Onboard	☐ Standard
☐ Asymmetric Meter-In & Meter-Out	☐ A & B Bleed to T	electronics	☐ High
☐ Meter-Out only	☐ A & B Bleed to P	☐ Without Onboard	☐ Servo
☐ Meter-In only	☐ Zero Lap	electronics	
☐ 2-Gain Symmetric	☐ A - T, B - P		

Environmental Conditions

☐ Standard factory	☐ Very Dirty	☐ Outdoors	Other
Application sketch		Special requirements	

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