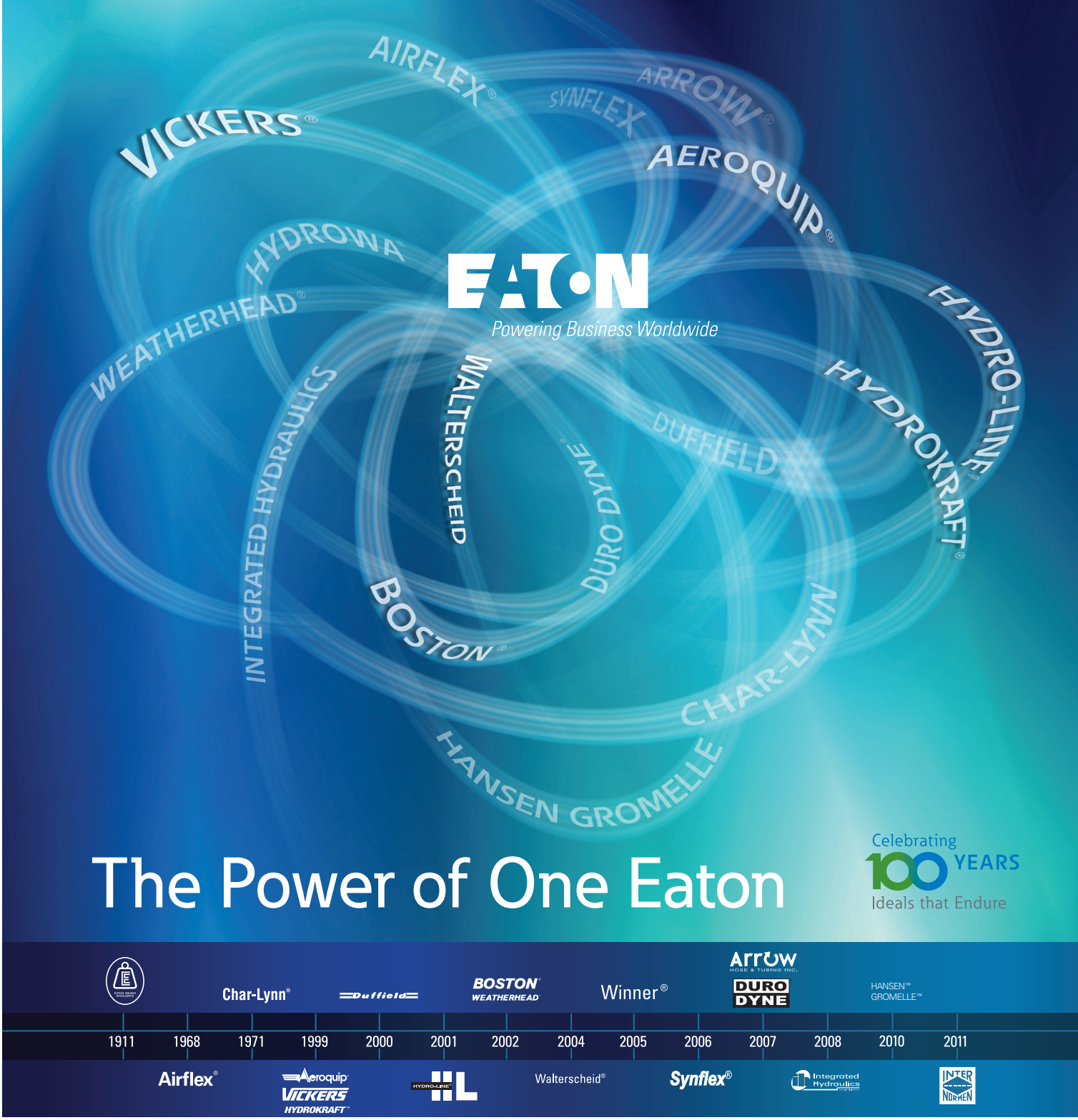
Vickers Industrial Welded Cylinders

Technical Manual

Series WH

Powering Business Worldwide



EATON
Powering Business Worldwide

There's a certain energy at Eaton. It's the power of integrating the competencies of some of the world's most respected names to build a brand you can trust to meet every power management need. The energy created supports our commitment to powering business worldwide.

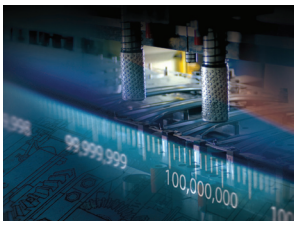
As the world's demand for high-efficiency hydraulic systems for mobile and stationary applications increase, Eaton is helping to solve these challenges more reliably, efficiently, and sustainably. Our goal is simple; to provide unique solutions across a wide range of markets that keep businesses on the leading edge of change. Visit Eaton.com/hydraulics/fusion.

That's the power of One Eaton.

Serving eight key segments - sharing one focus

Alternative Energy

Making energy sources technically practical and economically sound requires the kind of control made possible by high-quality components. When Eaton is on the inside, you will experience the reliable, consistent performance to create and capture energy—making renewable energy an every-day energy.



Discrete Manufacturing

Produce at peak efficiency with the superior precision and repeatability of Eaton products. Eaton hydraulic components provide the precise control and consistent operation required for virtually every step in your manufacturing operation. With Eaton, we'll help you redefine the meaning of raw productivity.

Oil & Gas

As the oil & gas industry continues to face further globalization and consolidation, large-scale organizations that can meet your needs in every corner of the world are more difficult to find. At Eaton, our portfolio of products is only surpassed by our tremendous reach.

Processing

Whatever your industry, no matter which processes you manage, Eaton parts and systems help keep you up and running. Our components make equipment more efficient and easier to use, so you get optimal machine performance and maximum productivity.

Agriculture & Forestry

There's a reason farming and forestry are called "working the land." These segments involve some of the hardest work and longest hours of any sector in the economy. Your productivity and profitability depend on the way you manage time and tasks.

Commercial Vehicles

Eaton technologies can make your driving operation more successful. Greater comfort and productivity help increase driver retention, while reduced emissions, leaks, and noise improve environmental performance. Increased efficiencies overall mean lower costs and higher net revenue.

Material Handling

Eaton hydraulic systems provide the precise control and consistent operation required for material handling and utility work. With a broad selection of products and solutions built in, Eaton helps make you a master of your domain.

Construction & Mining

When you work on a large scale, even the details are big. You need to trust every part of the equipment that lets you handle construction and mining jobs. For reliable components that deliver consistent performance in extreme conditions, turn to Eaton.

Eaton is a leading diversified power management company

Eaton provides reliable, efficient and safe power management for a growing number of industries.

Understanding and helping our customers succeed

- Listening and understanding to requirements and business drivers
- Delivering solutions with value propositions to solve the critical business needs

Knowing what's important to our customers and integrating that knowledge into the fabric of our business

- ...to deliver innovative, quality products
- ...to respond fast
- ...to provide dedicated customer service and support around the globe

Our strength is global reach with local responsiveness and support

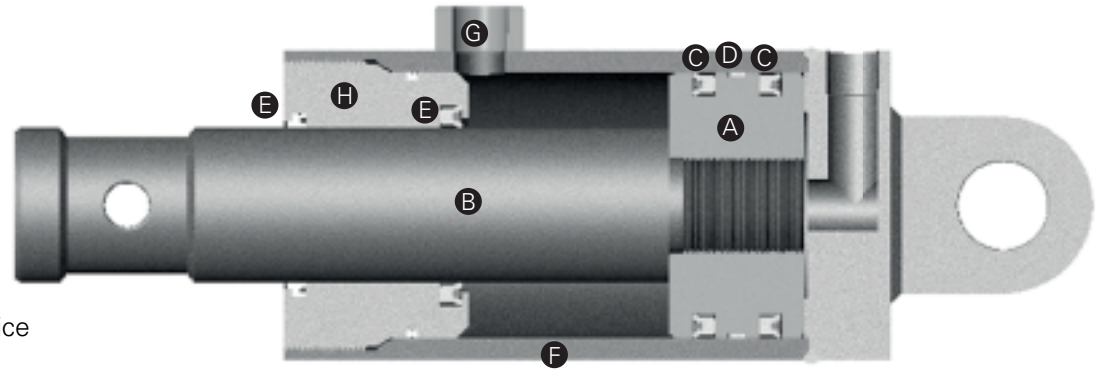
- Customers served in more than 150 countries
- Diverse channels ensure reliable availability and support
- Design and engineering teams provide support for standard products and custom solutions
- Eaton experts offer efficient product and application training

Table of Contents

Design Features and Specifications

Specifications

Bore Sizes: 4″ - 12″
Pressure Ratings:
3,000 psi Hydraulic Service



A Piloted Ductile Iron Piston

- One-piece, ductile iron piston, piloted to ensure concentricity.
- Secured to the rod by threadlocker in bores up to 6″ and set screws in 7″ bores and up to insure a positive connection.

B Piston Rod

- Piston rod is machined from high yield, turned, ground and polished C-1045/50 micro alloy steel.
- Piston Rods are hard chrome plated a minimum of .001″ diametrically, to insure superior cylinder operation and life.
- Heavy plating, stainless steel, or chrome over nickel plating are available options.

C Piston Seals

- Specially designed, mechanically loaded piston seals minimize piston bypass.
- Bi-directional piston seal with outboard wear bands is standard on 9″ and above.
- Bi-directional piston seal is optional for smaller bore sizes.

D Piston Wear Band

- Nonmetallic wear band provides side load protection.

E Rod Seal/Wiper

- Specially designed, high duro-meter, mechanically loaded rod seal virtually eliminates rod seal leakage.
- Urethane rod wiper is abrasion resistant and provides exclusion protection.

F High Yield Steel Tubing

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

G Steel Port Boss

- Steel port boss insures a full thread, pressure-tight porting connection.

H Iron Rod Gland

- Standard gland is constructed of high strength ductile iron.
- Optional SAE 660 bronze material or wear bands are available to provide additional side load protection.
- All welded cylinders have a precision fit body seal and backup on the gland O.D.

How to Order
Series WH Cylinders

W	H	1	0	H	M	5	N	3	K	A	1	0	8	0	0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

1 2 Series designation

WH – Welded Hydraulic Cylinder

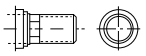
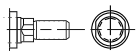
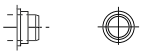
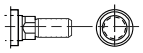
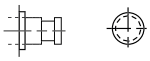
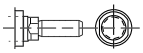
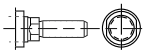
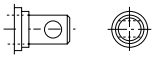
3 4 Mounting Style

Code		Mounting Style
08	–	Head Flange
10	–	Cap Clevis
47	–	Cap Fixed Eye

5 6 Bore and Rod Diameter

Code	Bore	Rod
HL	4	1-3/4
HM	4	2
HP	4	2-1/2
KU	5	3
KV	5	3-1/2
LV	6	3-1/2
LW	6	4
MW	7	4
MZ	7	5
NZ	8	5
N1	8	5-1/2
R1	10	5-1/2
R4	10	7
S4	12	7
S7	12	9

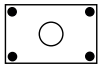
7 Rod End Type

Code	Rod End Style	
2	Short Female UN Thread	
4	Full Male UN Thread	
5	Small Male UN Thread	
6	Plain- No Attachment	
9	Intermediate Male UN Thread	
G	Grooved End	
K	Extended Small Male UN Thread	
M	Extended Int. Male UN Thread	
P	Pin Hole	

8 Seals

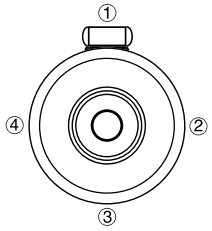
Code	Application Type
N	Normal
L	Low Friction
T	High Temperature
D	Dirty/ Dusty Environment

9 Ports

Code	Port Style
1 NPTF	
3 SAE/UN O-ring	
6 SAE 4-bolt Manifold	

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

11 Cushions

Code	
A	Noncushioned (both ends)

12 13 14 Cylinder Stroke

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

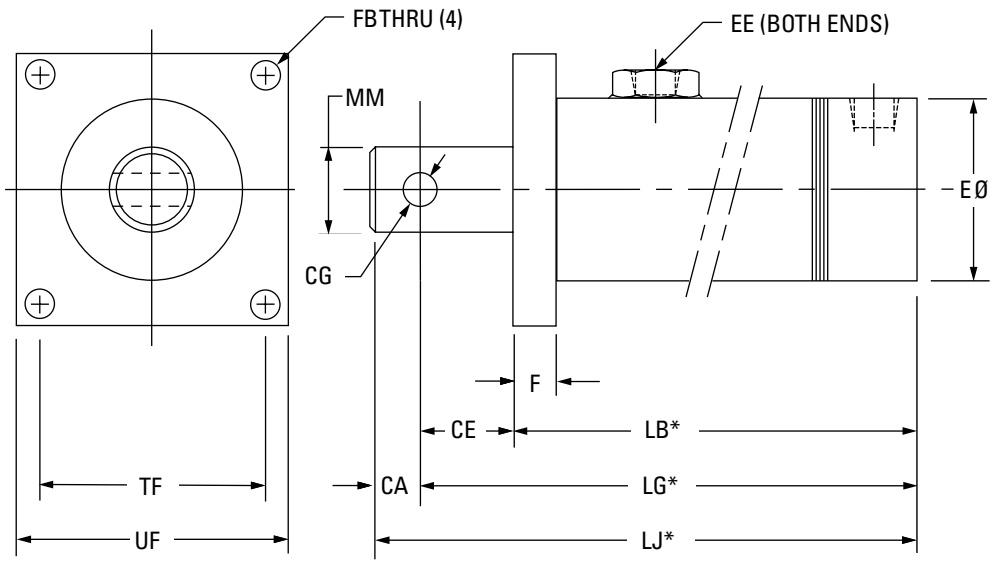
15 16 Extra Rod Projection

("C" dimension)

Item 15 indicates inches from 0 through 9.

Item 16 indicates fractions of an inch per codes shown for item 14 above.

Mounting Dimensions - WH08 Head Square Flange Mounts

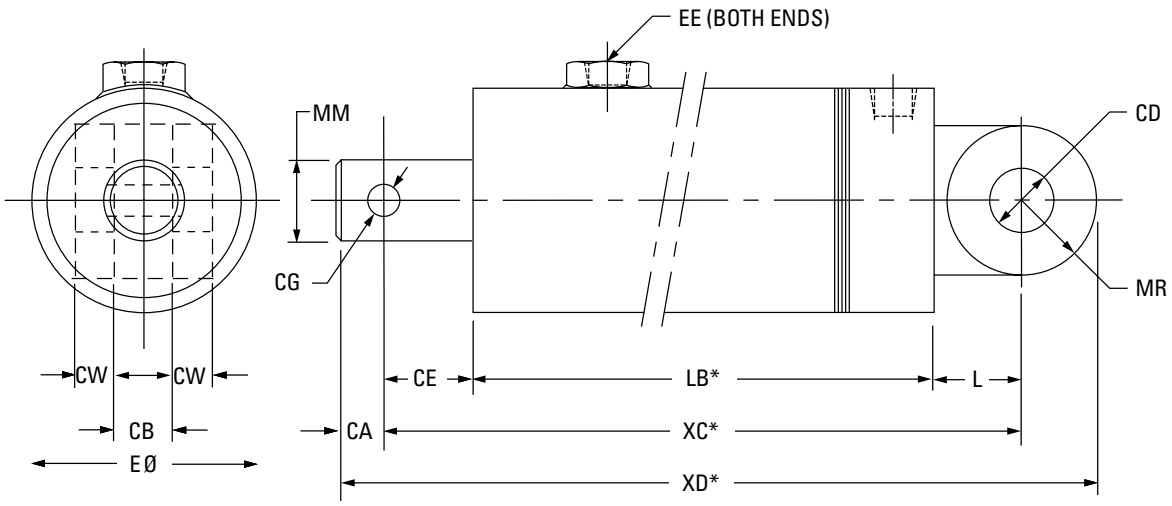


BORE SIZE	ROD DIA (MM)	CA	CE	CG	E	EE (NPTF)	EE (SAE)	F	FB	LB*	LG*	LJ*	TF	UF
4″	1.75	2.50	3.00	.75	4.62	.75	#12	.88	.56	6.25	9.25	11.75	6.38	7.62
4″	2	2.50	3.00	1.00	4.62	.75	#12	.88	.56	6.25	9.25	11.75	6.38	7.62
4″	2.5	2.50	3.00	1.00	4.62	.75	#12	.88	.56	6.25	9.25	11.75	6.38	7.62
5″	3	2.50	3.12	1.00	6.00	.75	#12	1.00	.81	7.50	10.62	13.12	10.00	12.00
5″	3.5	2.50	3.50	1.50	6.00	.75	#12	1.00	.81	7.50	11.00	13.75	10.00	12.00
6″	3.5	2.50	3.50	1.00	7.00	1.00	#16	1.50	.81	7.62	11.12	13.62	10.00	12.00
6″	4	2.50	3.50	1.50	7.00	1.00	#16	1.50	.81	8.12	11.62	14.12	10.00	12.00
7″	4	2.50	3.63	1.50	8.00	1.25	#20	1.50	1.03	9.00	12.88	15.38	14.25	18.00
7″	5	2.50	3.88	1.50	8.00	1.25	#20	1.50	1.03	9.00	12.88	15.38	14.25	18.00
8″	5	2.50	3.63	1.50	9.25	1.25	#20	2.50	1.03	10.50	14.12	16.62	14.25	18.00
8″	5.5	2.50	3.63	1.50	9.25	1.25	#20	2.50	1.03	10.50	14.12	16.62	14.25	18.00
10″	5.5	2.50	3.50	1.50	11.75	2.00	#32	3.50	1.81	14.44	17.94	20.44	18.38	22.00
10″	7	3.00	3.75	3.00	11.75	2.00	#32	3.50	1.81	14.69	18.44	21.44	18.38	22.00
12″	7	3.00	3.75	3.00	14.00	2.00	#32	3.50	2.06	15.63	19.38	22.38	18.38	22.00
12″	9	3.00	4.63	3.00	14.00	2.00	#32	3.50	2.06	15.63	20.25	23.25	18.38	22.00

Dimensions shown are mounting dimensions.
* Add stroke to all starred dimensions.

NOTE: Rod sleeve available, specify I.D. x O.D. x Total Length

Mounting Dimensions - WH10 Cap Clevis Mounts

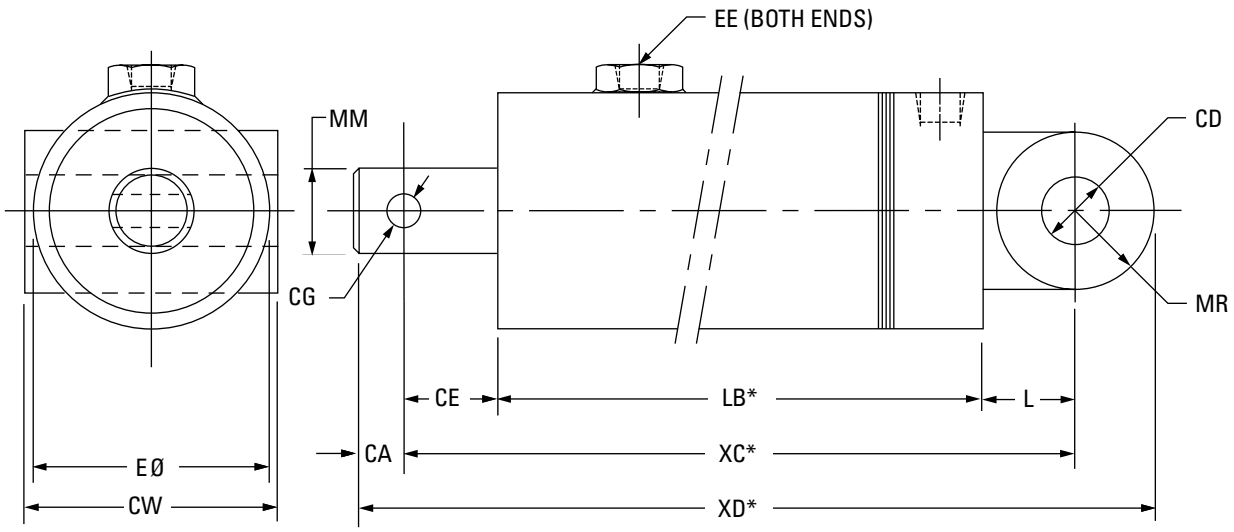


BORE SIZE	ROD DIA (MM)	CA	CB	CD	CE	CG	CW	E	EE (NPTF)	EE (SAE)	L	LB*	MR	XC*	XD*
4″	1.75	2.50	2.12	1.375	3.00	.75	1.00	4.63	.75	#12	1.88	6.25	1.38	11.12	15.00
4″	2	2.50	2.12	1.375	3.00	1.00	1.00	4.63	.75	#12	2.12	6.25	1.38	11.38	15.25
4″	2.5	2.50	2.12	1.375	3.00	1.00	1.00	4.63	.75	#12	2.00	6.25	1.38	11.38	15.25
5″	3	2.50	2.25	1.500	3.12	1.00	1.12	6.00	.75	#12	2.00	7.50	1.50	12.62	16.62
5″	3.5	2.50	2.25	1.500	3.50	1.50	1.12	6.00	.75	#12	2.25	7.50	1.50	13.25	17.25
6″	3.5	2.50	2.62	2.000	3.50	1.00	1.25	7.00	1.00	#16	2.50	7.62	2.00	13.62	18.12
6″	4	2.50	2.62	2.000	3.50	1.50	1.25	7.00	1.00	#16	2.50	8.12	2.00	14.12	18.62
7″	4	2.50	3.12	2.500	3.62	1.50	1.50	8.00	1.25	#20	3.12	9.00	2.50	16.00	21.00
7″	5	2.50	3.12	2.500	3.88	1.50	1.50	8.00	1.25	#20	3.12	9.00	2.50	16.00	21.00
8″	5	2.50	3.12	3.000	3.62	1.50	1.50	9.25	1.25	#20	2.88	10.50	3.00	17.00	22.50
8″	5.5	2.50	3.12	3.000	3.62	1.50	1.50	9.25	1.25	#20	2.88	10.50	3.00	17.00	22.50
10″	5.5	2.50	4.25	3.500	3.50	1.50	2.00	11.75	2.00	#32	4.00	14.44	3.50	21.94	27.94
10″	7	3.00	4.25	3.500	3.75	3.00	2.00	11.75	2.00	#32	4.00	14.69	3.50	22.44	28.94
12″	7	3.00	4.62	4.000	3.75	3.00	2.25	14.00	2.00	#32	4.50	15.62	4.00	23.88	30.88
12″	9	3.00	4.62	4.000	4.62	3.00	2.25	14.00	2.00	#32	6.19	15.62	4.00	26.44	33.44

Dimensions shown are mounting dimensions.
* Add stroke to all starred dimensions.

NOTE: Rod sleeve available, specify I.D. x O.D. x Total Length

Mounting Dimensions - WH47 Cap Eye Mounts



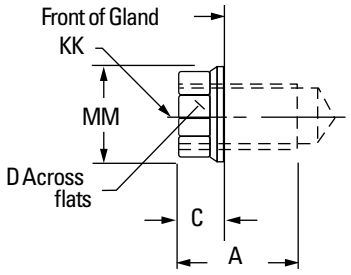
BORE SIZE	ROD DIA (MM)	CA	CD	CE	CG	CW	E	EE (NPT)	EE (SAE)	L	LB*	MR	XC*	XD*
4″	1.75	2.50	1.390	3.00	.75	5.00	4.63	.75	#12	1.19	6.25	1.19	10.44	14.13
4″	2	2.50	1.390	3.00	1.00	5.00	4.63	.75	#12	1.19	6.25	1.19	10.44	14.13
4″	2.5	2.50	1.390	3.00	1.00	5.00	4.63	.75	#12	1.19	6.25	1.19	10.44	14.13
5″	3	2.50	1.515	3.12	1.00	6.00	6.00	.75	#12	1.25	7.50	1.25	11.88	15.62
5″	3.5	2.50	1.515	3.50	1.50	6.00	6.00	.75	#12	1.25	7.50	1.25	12.25	16.00
6″	3.5	2.50	1.515	3.50	1.00	7.00	7.00	1.00	#16	1.25	7.50	1.25	12.38	16.12
6″	4	2.50	1.515	3.50	1.50	7.00	7.00	1.00	#16	1.25	8.12	1.25	12.88	16.62
7″	4	2.50	2.015	3.62	1.50	8.00	8.00	1.25	#20	1.88	9.00	1.88	14.50	18.88
7″	5	2.50	2.015	3.88	1.50	8.00	8.00	1.25	#20	1.88	9.00	1.88	14.75	19.12
8″	5	2.50	2.515	3.62	1.50	9.00	9.25	1.25	#20	2.25	10.50	2.25	16.38	21.12
8″	5.5	2.50	2.515	3.62	1.50	9.00	9.25	1.25	#20	2.25	10.50	2.25	16.38	21.12
10″	5.5	2.50	3.515	3.50	1.50	11.75	11.75	2.00	#32	2.75	14.44	2.75	20.69	25.94
10″	7	3.00	3.515	3.75	3.00	11.75	11.75	2.00	#32	2.75	14.69	2.75	21.19	26.94
12″	7	3.00	4.015	3.75	3.00	14.00	14.00	2.00	#32	3.00	15.62	3.00	22.38	28.38
12″	9	3.00	4.015	4.62	3.00	14.00	14.00	2.00	#32	3.00	15.62	3.00	23.25	29.25

Dimensions shown are mounting dimensions.
* Add stroke to all starred dimensions.

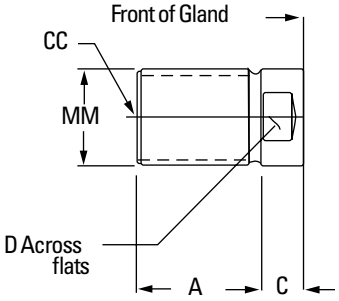
NOTE: Rod sleeve available, specify I.D. x O.D. x Total Length

Series WH Rod End Selection

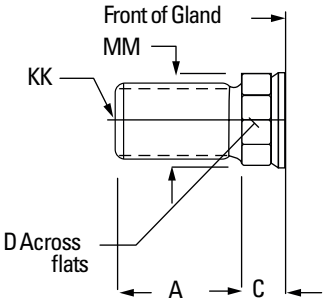
Rod End Style 2



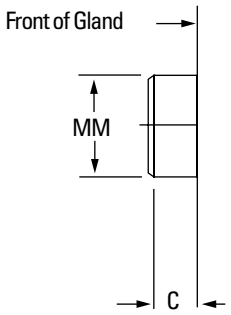
Rod End Style 4



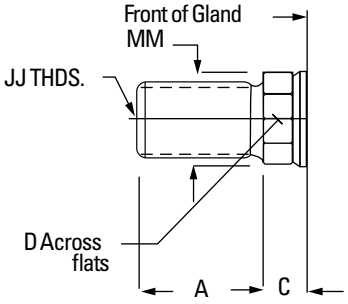
Rod End Style 5



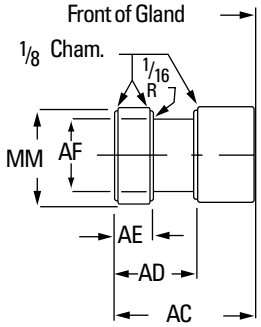
Rod End Style 6



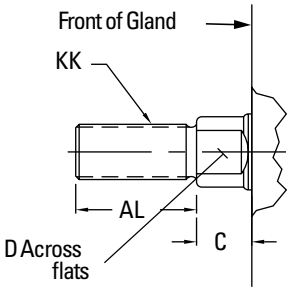
Rod End Style 9



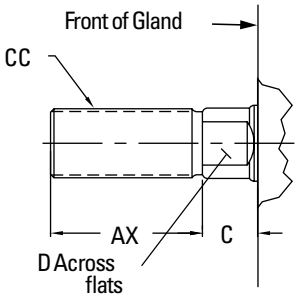
Rod End Style G



Rod End Style K



Rod End Style M



ROD DIA. (MM)	A	C	D	CC THREAD	JJ THREAD	KK THREAD	AC	AD	AE	AF	AL	AX
1.75	2.00	.75	1.50	1.750-12	1.500-12	1.250-12	1.75	1.31	.50	1.13	2.75	3.12
2	2.25	.88	1.69	2.000-12	1.750-12	1.500-12	2.63	1.69	.63	1.38	3.12	4.12
2.5	3.00	1.00	2.06	2.500-12	2.250-12	1.875-12	3.25	1.94	.75	1.75	4.12	4.75
3	3.50	1.00	2.63	3.000-12	2.750-12	2.250-12	3.63	2.44	.88	2.25	4.75	5.50
3.5	3.50	1.00	3.00	3.500-12	3.250-12	2.500-12	4.38	2.69	1.00	2.50	5.00	6.38
4	4.00	1.00	3.38	4.000-12	3.750-12	3.000-12	4.50	2.69	1.00	3.00	5.62	6.56
5	5.00	1.00	4.25	5.000-12	4.750-12	3.500-12	5.38	3.19	1.50	3.88	7.00	7.56
5.5	5.50	1.00	4.63	5.500-12	5.250-12	4.000-12	6.25	3.94	1.88	4.38	7.75	9.56
7	7.00	1.00	6.00	7.000-12	6.500-12	5.500-12	6.50	4.06	2.00	5.75	10.00	10.50
9	9.00	1.00	8.00	9.000-12	8.500-12	6.500-12	6.75	4.13	2.00	7.25	12.50	13.50

All dimensions in inches

***NOTE:** For Rod End Pin Hole dimensions, see cylinder mounting dimension drawings on pages 7-9.

Technical Data - Rod Size and Stop Tube Selection

Rod Size Selection

Standard rod sizes are normally suitable for all applications except for long stroke or high thrust applications. Proper selection of minimum rod size may be determined by the following steps:

1. With knowledge of bore size and operating pressure, thrust (T) may be determined. Refer to the graph in the next column.
2. Select from illustrations to the right the type of mounting to be used and determine the length of L with the piston rod in the fully extended position.
3. Find the value of L at the bottom of the graph and follow its line vertically until it intercepts the horizontal line representing the maximum push thrust that will be applied to your cylinder. The intersection of these two lines will fall within a stripe representing the minimum recommended piston rod diameter for your application.

Stop Tubes

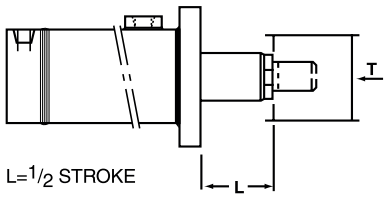
Stop tubes are located between the piston and the rod shoulder on the head end of the cylinder. Bearing loading is reduced by separating the piston and the rod bushing. Bearing wear and tendency to buckle is reduced.

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

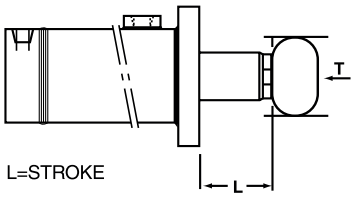
Determine the value of L with the piston rod in the fully extended position. If the value of L is under 40 inches, no stop tube is needed. If L is greater than 40 inches, one inch of stop tube is recommended for each 10 inches or fraction thereof beyond 40.

Special Note: When specifying stroke and stop tube lengths, please include net working stroke plus the stop tube length.

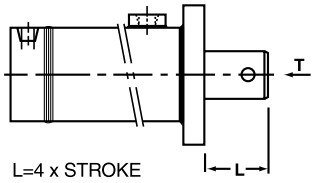
Firmly Guided Rod End



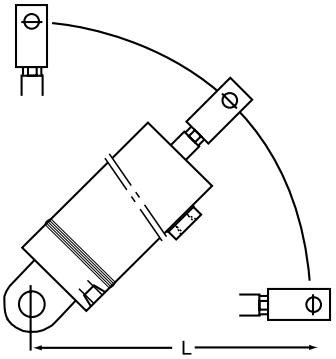
Supported Rod End



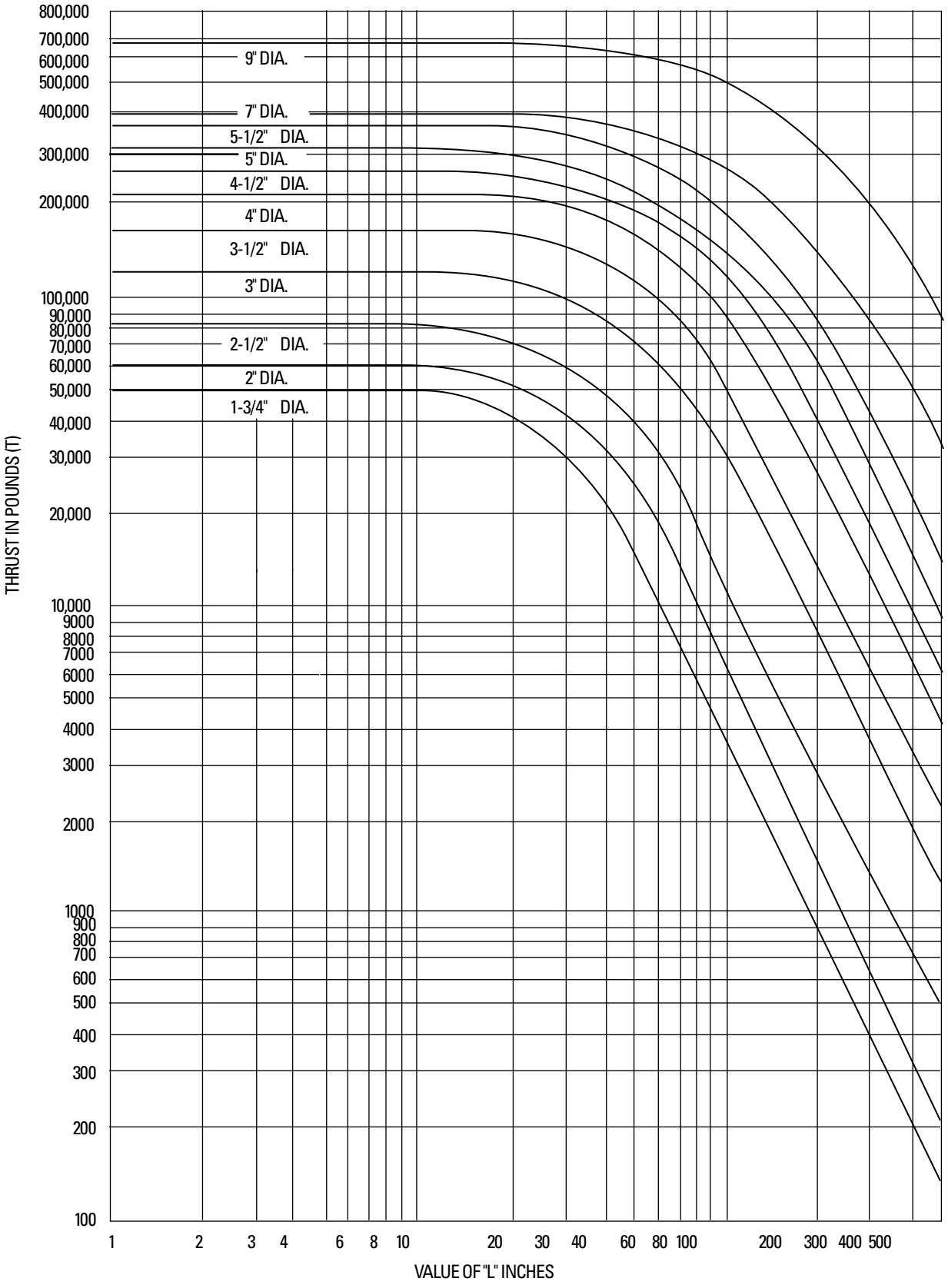
Unsupported Rod End



Clevis Mount



Stop Tube Graph



Notes

Notes

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