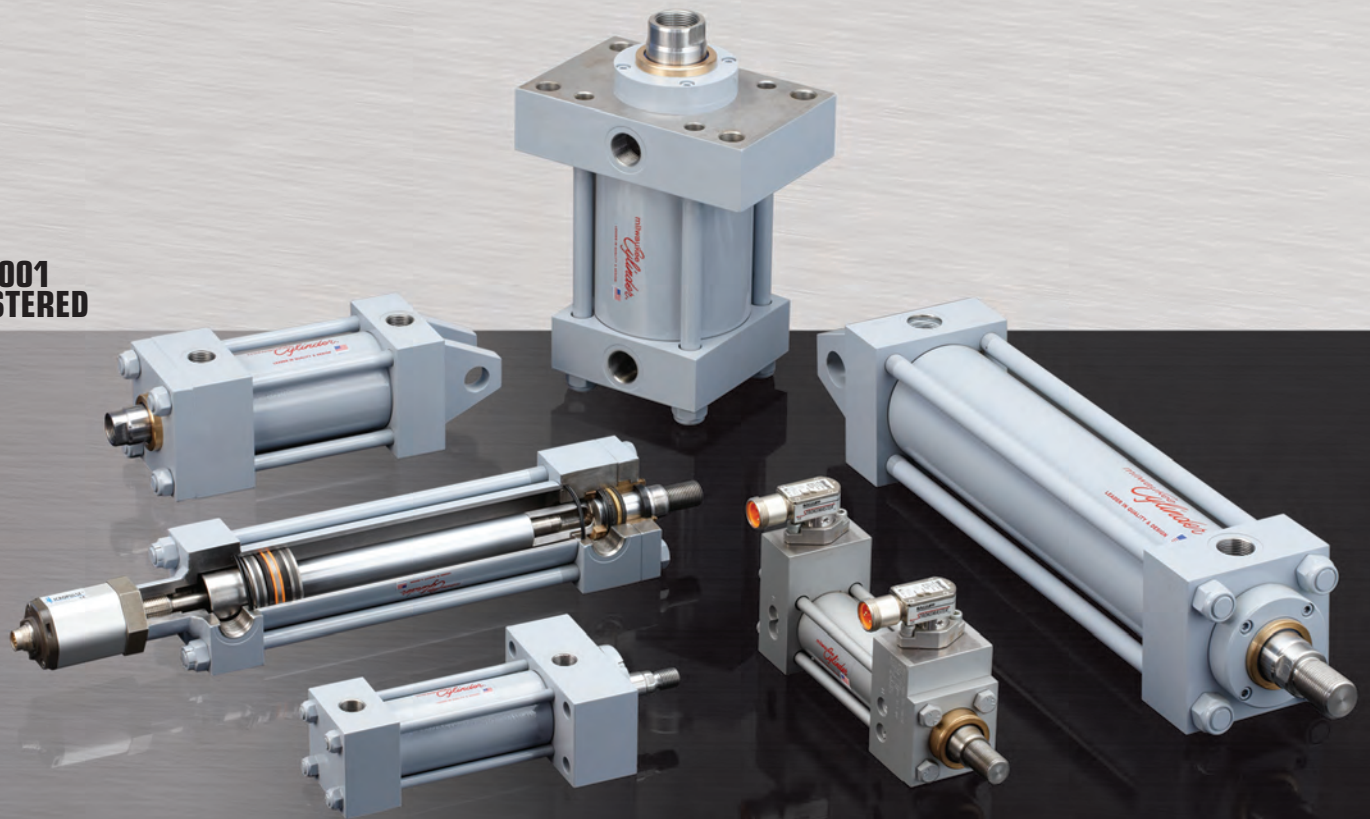


milwaukee *Cylinder*



 ISO 9001
REGISTERED

MC105R2

Specials are Our Standard

milwaukee *Cylinder*

...engineered solutions for hydraulic and pneumatic applications

A long established and recognized supplier of highly engineered cylinder solutions and a manufacturer of a standard range of steel and aluminum NFPA tie-rod cylinders for both hydraulic and pneumatic applications.

Milwaukee Cylinder, a leader and innovator in the hydraulic and pneumatic actuation field since 1956, is now ISO 9001:2008 certified.

Our broad product line offers a solution for virtually every possible cylinder application. We offer our customers years of experience in the design and manufacture of fluid power products with special operating and design requirements.

By working directly with our customers, Milwaukee Cylinder has developed a world-wide reputation for engineering expertise in the manufacture of specialty cylinders. Over the last 50 years, Milwaukee Cylinder has become known as the company where specials are our standard.

At Milwaukee Cylinder, we operate with a spirit of innovation and creativity, dedicated to meeting the needs and challenges of today's most demanding applications. We take pride in being a producer of High-Quality Performance-Tested hydraulic and pneumatic products. Products that have been proven and tested by the world's leading manufacturers in the harshest environments.

With our on-going commitment to research and development, as well as our worldwide sales and distribution network, we will continue to meet and exceed demanding customer requirements and provide world-class customer service. From initial design to after-sale support, we maintain the same high level of quality that our customers have come to recognize from Milwaukee Cylinder.

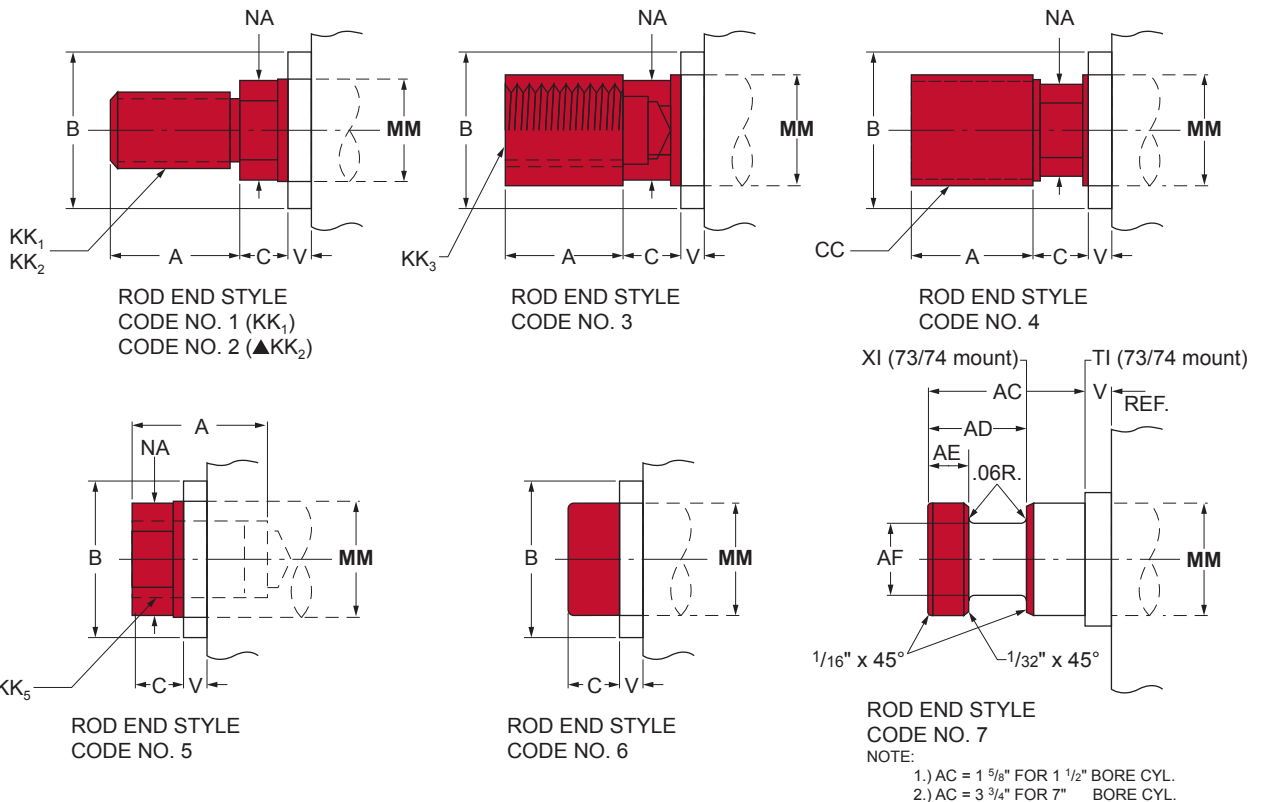


Table 3 Piston Rod End Styles (Series H, LH and A) See page 105 for Series MN

ROD MM	A	B	$-.001$ $-.003$	C	CC	*D	KK ₁	KK _{2 3 5}	NA	AD	AE	$+.001$ $-.002$	AF diameter	AC
5/8	3/4	1 1/8		3/8	5/8-18	1/2	1/2-20	7/16-20	19/32	5/8	1/4		3/8	1 1/8
1	1 1/8	1 1/2		1/2	1-14	7/8	7/8-14	3/4-16	31/32	15/16	3/8		1 1/16	1 1/2 (#1)
1 3/8	1 5/8	2		5/8	1 3/8-12	1 1/8	1 1/4-12	1-14	1 11/32	1 1/16	3/8		7/8	1 3/4
1 3/4	2	2 3/8		3/4	1 3/4-12	1 1/2	1 1/2-12	1 1/4-12	1 45/64	1 5/16	1/2		1 1/8	2
2	2 1/4	2 5/8		7/8	2-12	1 11/16	1 3/4-12	1 1/2-12	1 61/64	1 11/16	5/8		1 3/8	2 5/8
2 1/2	3	3 1/8		1	2 1/2-12	2 1/16	2 1/4-12	1 7/8-12	2 29/64	1 15/16	3/4		1 3/4	3 1/4
3	3 1/2	3 3/4		1	3-12	2 5/8	2 3/4-12	2 1/4-12	2 15/16	2 7/16	7/8		2 1/4	3 5/8 (#2)
3 1/2	3 1/2	4 1/4		1	3 1/2-12	3	3 1/4-12	2 1/2-12	3 7/16	2 11/16	1		2 1/2	4 3/8
4	4	4 3/4		1	4-12	3 3/8	3 3/4-12	3-12	3 15/16	2 11/16	1		3	4 1/2
4 1/2	4 1/2	5 1/4		1	4 1/2-12	**	4 1/4-12	3 1/4-12	4 27/64	3 3/16	1 1/2		3 1/2	5 1/4
5	5	5 3/4		1	5-12	**	4 3/4-12	3 1/2-12	4 59/64	3 3/16	1 1/2		3 7/8	5 3/8
5 1/2	5 1/2	6 1/4		1	5 1/2-12	**	5 1/4-12	4-12	5 27/64	3 15/16	1 7/8		4 3/8	6 1/4
7	7	8		1	7-12	**	6 1/2-12	5 1/2-12	6 57/64	4 1/16	2		5 3/4	6 1/2

* Distance across wrench flats.
 ** (4) Spanner holes 33/64" x 1/2" deep.
 Note: Other rod sizes available. Consult factory.

▲ Rod end style KK₂ is studded as standard for 5/8" and 1" diameter rods.
 Studded rod end style is available for all rod sizes.
 ■ See page 105 for Series MN piston rod end styles.



CAUTION: When ordering replacement cylinders for competitive brands, our Style #1 rod ends may not be interchangeable with other manufacturers' Style #1. Our Style #2 should be used if this applies to your application.

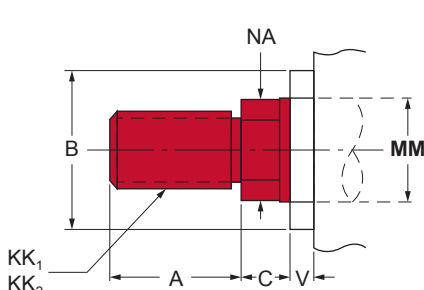
METRIC Piston Rod End Styles (Series MH)

Bore Ø	Rod MM						Rod End Styles					
		B	V	C	*D	NA	KK ₁	A	KK ₂	A	KK ₅	A
25	12	24	6	9	10	11	M10 X 1.25	14	—	—	M8 X 1	14
	18	30			15	17	M14 X 1.5	18	M10 X 1.25	14	M12 X 1.25	18
32	14	26	12	13	12	13	M12 X 1.25	16	—	—	M10 X 1.25	16
	22	34			18	21	M16 X 1.5	22	M12 X 1.25	16	M16 X 1.5	22
40	18	30	6	19	15	17	M14 X 1.5	18	—	—	M12 X 1.25	18
	28	42			22	26	M20 X 1.5	28	M14 X 1.5	18	M20 X 1.5	28
50	22	34	6	19	18	21	M16 X 1.5	22	—	—	M16 X 1.5	22
	28	42			22	16	M20 X 1.5	28	M16 X 1.5	22	M20 X 1.5	28
	36	50			30	34	M27 X 2	36	M16 X 1.5	22	M27 X 2	36
63	28	42	6	26	22	26	M20 X 1.5	28	—	—	M20 X 1.5	28
	36	50			30	34	M27 X 2	36	M20 X 1.5	28	M27 X 2	36
	45	60			39	43	M33 X 2	45	M20 X 1.5	28	M33 X 2	45
80	36	50	5	26	30	34	M27 X 2	36	—	—	M27 X 2	36
	45	60			39	43	M33 X 2	45	M27 X 2	36	M33 X 2	45
	56	72	9	22	48	54	M42 X 2	56	M27 X 2	36	M42 X 2	56
100	45	60	7	28	39	43	M33 X 2	45	—	—	M33 X 2	45
	56	72			48	54	M42 X 2	56	M33 X 2	45	M42 X 2	56
	70	88	10	25	62	68	M48 X 2	63	M33 X 2	45	M48 X 2	63
125	56	72	7	28	48	54	M42 X 2	56	—	—	M42 X 2	56
	70	88			62	68	M48 X 2	63	M42 X 2	56	M48 X 2	63
	90	108	10	25	80	88	M64 X 3	85	M42 X 2	56	M64 X 3	85
160	70	88	7	25	62	68	M48 X 2	63	—	—	M48 X 2	63
	90	108			80	88	M64 X 3	85	M48 X 2	63	M64 X 3	85
	110	133			**	108	M80 X 3	95	M48 X 2	63	M80 X 3	95
200	90	108	7	25	80	88	M64 X 3	85	—	—	M64 X 3	85
	110	133			**	108	M80 X 3	95	M64 X 3	85	M80 X 3	95
	140	163			**	138	M100 X 3	112	M64 X 3	85	M100 X 3	112

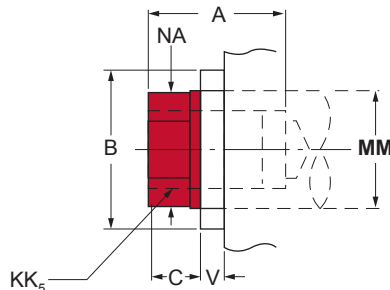
* Distance across wrench flats.

** (4) Spanner holes 13mm x 13mm deep.

Note: Other rod sizes available. Consult factory.



ROD END STYLE
CODE NO. 1 (KK₁)
CODE NO. 2 (KK₂)



ROD END STYLE
CODE NO. 5 (KK₅)

milwaukee *Cylinder*

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NEW PRODUCTS

METRIC HYDRAULIC CYLINDERS

Series "MH" ISO Metric Tie Rod Cylinders

- ISO standard 6020/2 - 160 bar series
- Working pressure up to 210 bar
- Temperature range 20° C to 150° C
- Cushions available at either or both ends
- Single and Double rod end design

See pages 36-49 for details!



POWER UNITS

- Gear (3000 psi) or Vane (2000 psi) Pump designs
- Vertical, JIC, Low Height or L-shaped reservoirs available
- Available in a wide range of standard and custom configurations

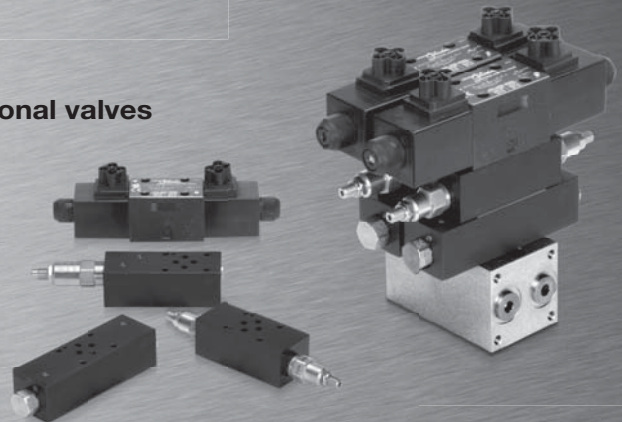
See pages 160-166 for details!



VALVES

- D03 and D05 spool type directional valves in multiple flow paths
- Working pressure up to 3000 psi (210 bar)
- Temperature range 20° C to 150° C

See pages 167-176 for details!



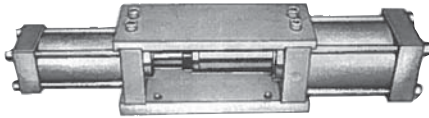
CUSTOM PRODUCTS



WHEN IT COMES TO SPECIAL CYLINDERS, *Milwaukee Cylinder* is not limited to tie rod constructed cylinders. This cylinder, which incorporated a number of special features, was designed for use on farm equipment. It features a threaded rod bushing for easy removal of the rod and piston seals, a modified NFPA mount MF1 to suit the design requirement of the customer, welded construction and welded half coupling ports were required so that this cylinder would be interchangeable with equipment already in the field.



WE ARE PROUD OF OUR ROLE as a quality supplier of cylinders to many different areas of industry. This cylinder was designed for a foundry application that required a special mounting because of clearance problems with existing equipment. *Milwaukee Cylinder* satisfied the customer's requirements with round end caps to provide the required clearance, multiple tie rods for added strength, and a special mounting to the customer's specifications.



IF STANDARD CYLINDERS WON'T DO THE JOB, we're specialists in engineering cylinders that will perform the functions that you require. This special pumping unit used on marine vessels was designed to separate the shipboard and mast hydraulic fluid systems. Cylinders used on a marine vessel to raise and lower the mast are subject to salt water contamination. To prevent contamination of the shipboard system, an independent hydraulic system is required for the mast. This cylinder acts as a pump operated off of the shipboard system, to provide hydraulic pressure for the mast system on the marine vessel.

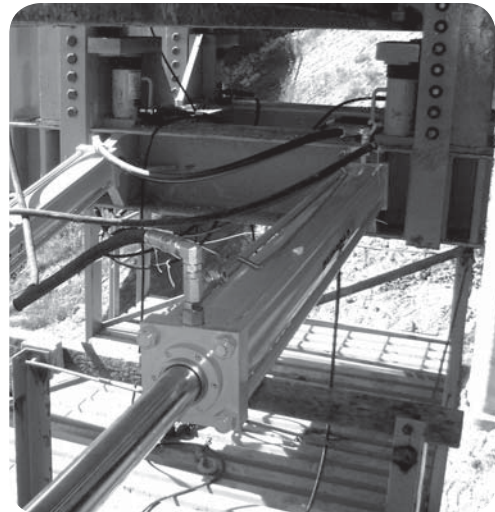
SYSTEM SOLUTIONS

***Milwaukee Cylinder* wants to solve your problem!**

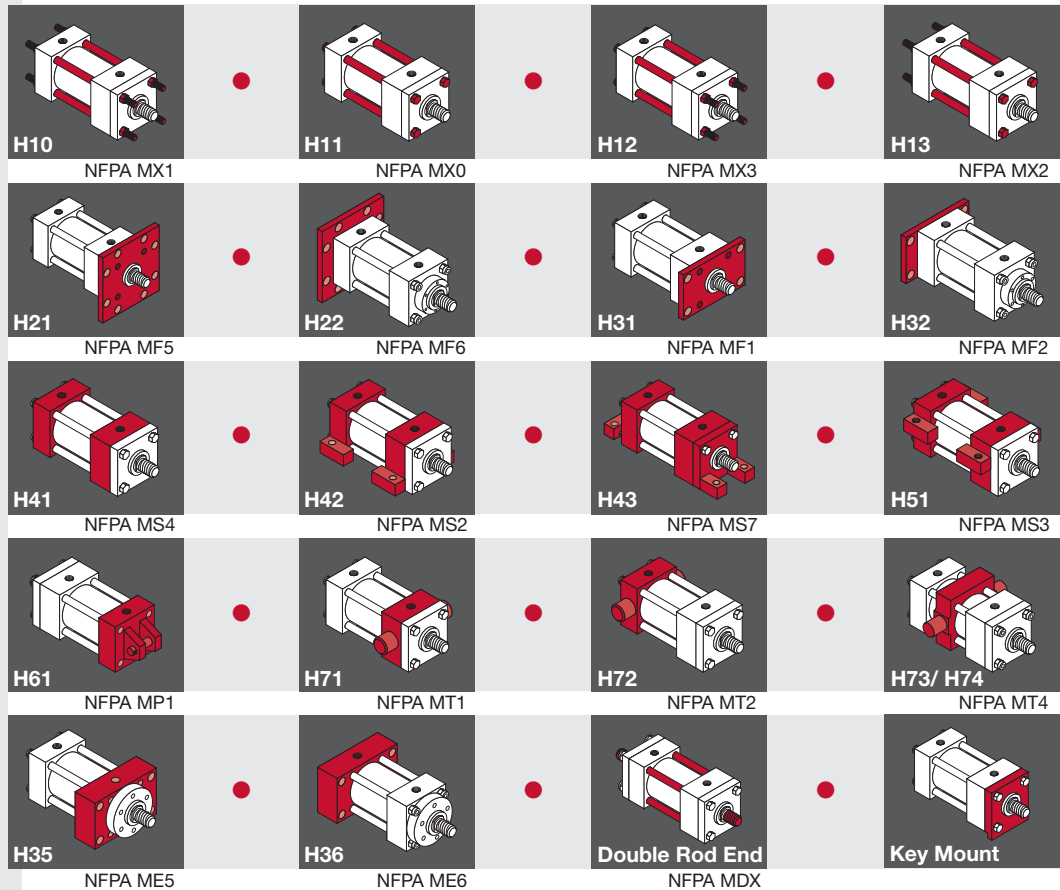
We provide many complete solutions to both our OEM customers and end users.

In addition to custom cylinders we often provide plumbing, fittings, valves, mounting hardware, and other accessories to allow a quicker and easier solution.

Ask us to help!



Series H



Milwaukee Cylinder Series H Hydraulic Cylinders are built to perform on the toughest applications. Series H is a complete line of NFPA standard hydraulic tie rod cylinders, with maximum operating pressures up to 3000 psi on all standard bore sizes. If your application requires higher operating pressures, consult our engineers. Incorporating a variety of *Milwaukee Cylinder* exclusive advanced features proven through the years, these cylinders will provide a long, maintenance-free service life.

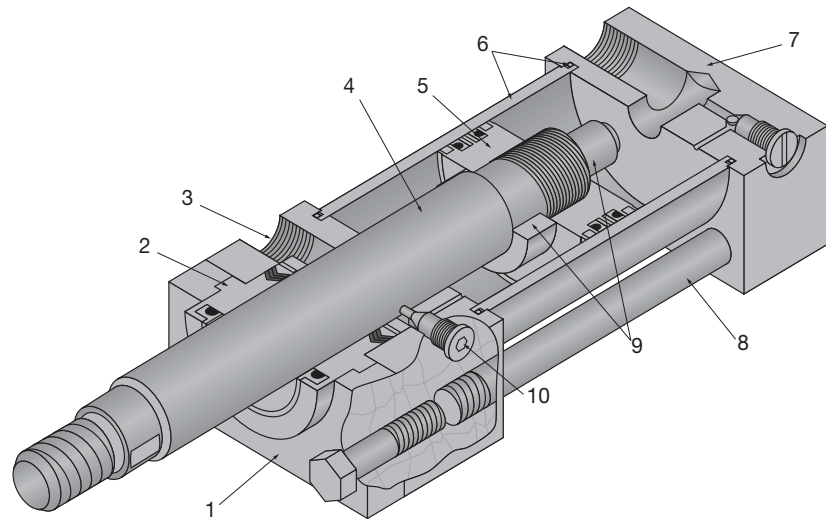
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STANDARD SPECIFICATIONS

- Standard construction – square head – tie-rod design
- Nominal pressure – 3000 psi (See info box below for pressures higher than 3000 psi)
- Standard fluid-hydraulic oil
- Standard temperature – -20° F to +200° F
- Standard bore sizes – 1½" To 18"
- Standard piston rod diameters 5/8" thru 7"
- Standard mounting styles– 18 standard styles and custom designs to suit your needs
- Strokes – available in any practical stroke length
- Cushions – available at either end or both ends of stroke
- Standard 7 rod end styles and specials designed to order
- Rod end style KK₂ is studded as standard for 5/8" and 1" diameter rods. Studded rod end style is available for all rod sizes

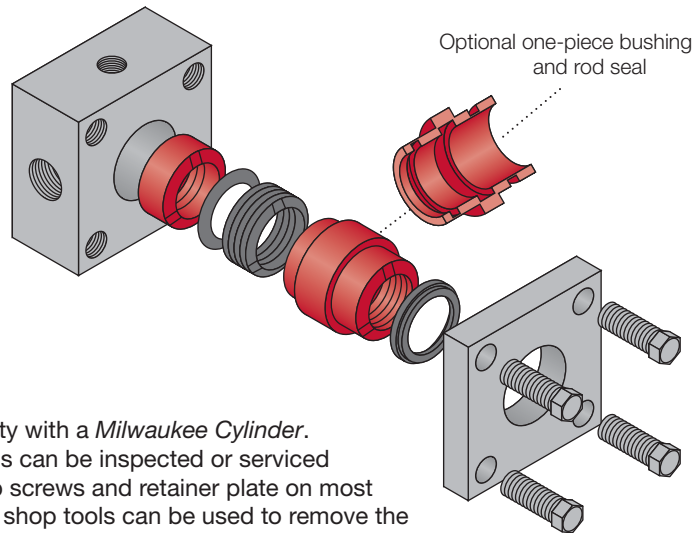
i If your hydraulic operating pressure exceeds 3000 psi, send your application data for engineering evaluation and design recommendations.

MilCad Cylinder Configurator
Visit milwaukeeecylinder.com to configure and download CAD files of your cylinders.



STANDARD FEATURES

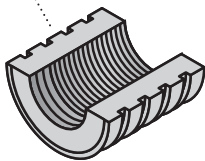
- 1. Removable Retainer Plate**
 The retainer plate and rod bushing are externally removable without disassembling the cylinder on most standard models. Four capscrews securely hold and lock the retainer plate in place.
- 2. Rod Bushing and Seals**
 A combination of spring loaded multiple lip vee rings with a supporting bronze bushing is standard in *Milwaukee Cylinder Series H* Cylinders.
- 3. Ports**
 Large NPTF cylinder ports are standard and can be located to customer requirements. SAE ports optional.
- 4. Piston Rod**
 The piston rod is of high strength steel, hardened and plated to resist scoring and corrosion, assuring maximum life.
- 5. Piston**
 The piston is of fine grained alloy iron, incorporating a combination of u-cup seals and cast iron rings, ensuring non-leak Hi-Lo pressure performance. The piston is pilot fitted and threaded to the rod.
- 6. Cylinder Barrel and Seals**
 The barrel is of steel tubing, honed to a fine finish to assure superior sealing, minimum friction and maximum seal life. It is step cut on the O.D. of both ends for an O-Ring and molded back-up washer. *Milwaukee Cylinder's* unique non-extrusion barrel seal design provides a positive leak tight seal.
- 7. End Caps**
 End caps and mountings are of high quality steel, precision machined for accurate mounting.
- 8. Tie-Rods and Nuts**
 The tie-rods are constructed from a high quality medium carbon steel. On most sizes the threads are rolled for rigid engagement of the self-locking nuts.
- 9. Cushions**
 Cushions are machined to close tolerance to provide positive, smooth deceleration at the end of stroke. On all bore sizes, we provide the longest cushion possible based on the rod size and blind end caps. Longer cushions are available; for further information, consult factory.
- 10. Cushion Needle Adjustment and Ball Check**
 The cushion needle adjustment valve and cushion-check ball retainer screw are specifically designed to provide full cushion adjustment.



Simple Maintenance...

Simple maintenance is reality with a *Milwaukee Cylinder*. The rod bushing or rod seals can be inspected or serviced by merely removing the cap screws and retainer plate on most models. Standard available shop tools can be used to remove the rod bushing and seals without disturbing the torque on the tie-rods, assuring performance quality with maintenance ease.

Optional piston design with four cast iron rings



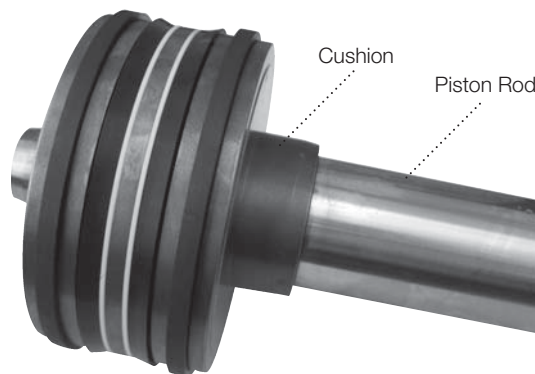
Cushions...

The cushion is of a high-grade alloy, precision machined and specially tapered to provide smooth deceleration of the piston at the end of stroke.

A standard manufacturing process at *Milwaukee Cylinder* is to assemble the piston, cushion, and the piston rod; placing the assembly between centers and checking the critical diameters for concentricity.

Piston Rod...

The piston rod is hardened, plated high strength steel, machined and processed to resist scoring and corrosion, assuring maximum life. *Milwaukee Cylinder* offers seven rod end styles as standard. **The style #2 rod end with two wrench flats is furnished as standard** unless otherwise specified. Special rod ends and extra wrench flats are also available. They must be specified at the time of order, giving the dimensional requirements and the location of additional wrench flats.



COMBINATION ROD SEAL DESIGN...

The Series H cylinder combines spring loaded multiple lip vee rings with a supporting bronze bearing ring bushing and a double lip wiper as a secondary seal. This proven rod seal design combination is effective at both high and low pressures. It affords maximum sealing and an extra long bearing support.

As an optional design, a one-piece rod bushing with a double lip u-cup rod seal and a double lip wiper is available. Metallic rod scrapers may be supplied on request, in place of the double lip wiper with either rod bushing design.

COMBINATION SEALING ROD

The Series H Cylinder combines two bi-directional sealing cast iron piston rings, with u-cup seals with back-up rings and a fine grained alloy iron piston. This proven piston seal design is effective at both high and low pressures. The design gives the wear and shock absorbing quantities of cast iron and the near zero leakage of the u-cup seals.

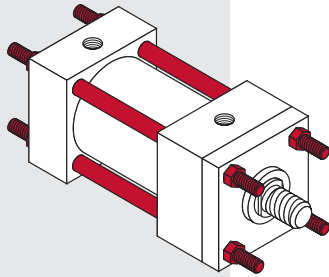
As an optional design, a piston using four low friction cast iron rings is available.

For Package and Mounting

Dimension see
Tables 1H and 2H.

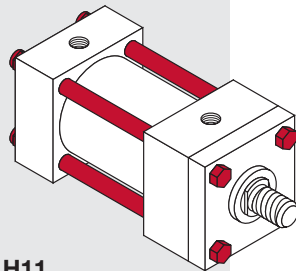
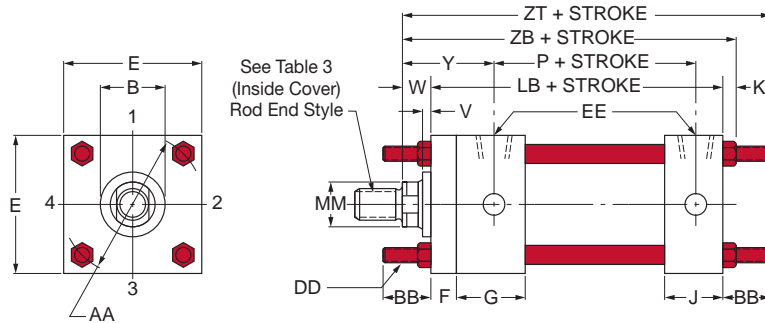
TIE-ROD MOUNTED CYLINDERS

Tie-rod mounts are suited for many applications and are similar to flange mounts, but tie-rod mounts are not as rigid as the flange type of mounting. The best use of tie rods extended on the blind end is in a thrust load application. When using tie rods extended on the rod end, the best application is a tension load. When long strokes are required, the free end should be supported to prevent misalignment, sagging or possible binding of the cylinder.



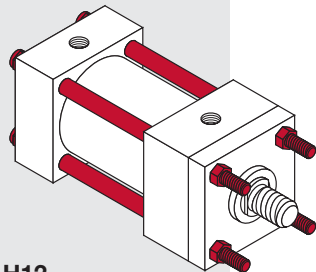
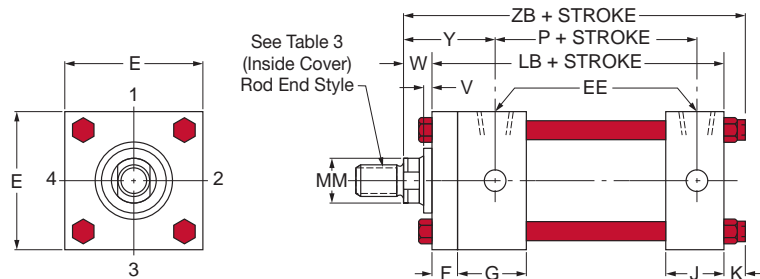
**MODEL H10
NFPA STYLE MX1**

TIE RODS EXTENDED BOTH ENDS



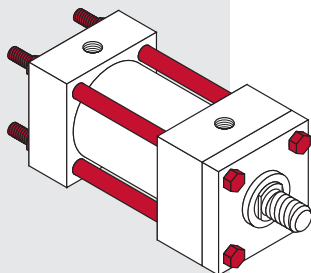
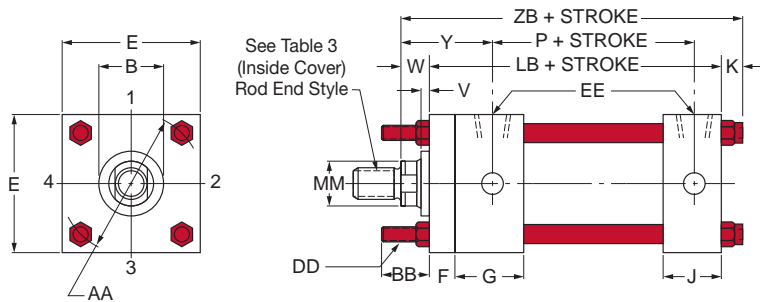
**MODEL H11
NFPA STYLE MX0**

NO TIE ROD EXTENSION



**MODEL H12
NFPA STYLE MX3**

TIE RODS EXTENDED ROD END



**MODEL H13
NFPA STYLE MX2**

TIE RODS EXTENDED BLIND END

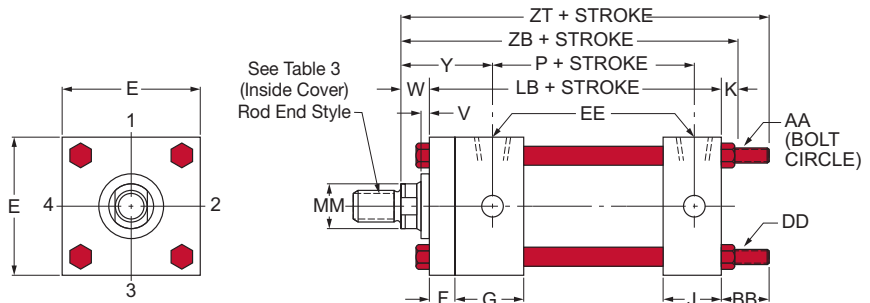


TABLE 1H

The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ♦	B	LB	P	V	W	Y	ZB	ZT
1½	5/8	H00151	1 1/8	5	2 7/8	1/4	5/8	2	6 1/8	7
	1	H00152	1 1/2			1/2	1	2 3/8	6 1/2	7 3/8
2	1	H01510	1 1/2	5 1/4	2 7/8	1/4	3/4	2 3/8	6 5/8	7 13/16
	1 3/8	H01511	2			3/8	1	2 5/8	6 7/8	8 1/16
2½	1	H01520	1 1/2			1/4	3/4	2 3/8	6 3/4	7 15/16
	1 3/8	H01521	2	5 3/8	3	3/8	1	2 5/8	7	8 3/16
	1 3/4	H01522	2 3/8			1/2	1 1/4	2 7/8	7 1/4	8 7/16
3¼	1 3/8	H01530	2			1/4	7/8	2 23/32	7 7/8	9 7/16
	1 3/4	H01531	2 3/8	6 1/4	3 19/32	3/8	1 1/8	2 31/32	8 1/8	9 11/16
	2	H01532	2 5/8			3/8	1 1/4	3 3/32	8 1/4	9 13/16
4	1 3/4	H01540	2 3/8			1/4	1	2 15/16	8 3/8	9 15/16
	2	H01541	2 5/8	6 5/8	3 7/8	1/4	1 1/8	3 1/16	8 1/2	10 1/16
	2 1/2	H01542	3 1/8			3/8	1 3/8	3 5/16	8 3/4	10 5/16
5	2	H01550	2 5/8			1/4	1 1/8	3 1/16	9 1/4	11 7/16
	2 1/2	H01551	3 1/8	7 1/8	4 3/8	3/8	1 3/8	3 5/16	9 1/2	11 11/16
	3	H01552	3 3/4			3/8	1 3/8	3 5/16	9 1/2	11 11/16
	3 1/2	H01553	4 1/4			3/8	1 3/8	3 5/16	9 1/2	11 11/16
6	2 1/2	H01560	3 1/8							
	3	H01561	3 3/4	8 3/8	5	1/4	1 1/4	3 7/16	10 3/4	13 1/4
	3 1/2	H01562	4 1/4							
	4	H01563	4 3/4							
7	3	H01570	3 3/4							
	3 1/2	H01571	4 1/4	9 1/2	5 1/2	1/4	1 1/4	3 3/4	12	14 7/8
	4	H01572	4 3/4							
	4 1/2	H01573	5 1/4							
8	5	H01574	5 3/4							
	3 1/2	H01580	4 1/4							
	4	H01581	4 3/4	10 1/2	6 1/4	1/4	1 1/4	3 7/8	13 1/4	16 1/4
	4 1/2	H01582	5 1/4							
10	5	H01583	5 3/4							
	5 1/2	H01584	6 1/4							
	4 1/2	H15100	5 1/4			1/4	1 1/4	4 3/4	16 11/16	21 1/16
	5	H15101	5 3/4	13 13/16	8 1/2	1/2	1 1/2	5	16 15/16	21 5/16
12	5 1/2	H15102	6 1/4			1/2	1 1/2	5	16 15/16	21 5/16
	7	H15120	6 1/4							
7	H15121	8	16 7/16	9 7/8	1/4	1 1/4	5 1/2	19 9/16	24 11/16	

For bore diameter sizes 14" to 18" see next page.

TABLE 2H

The dimensions are constant regardless of rod diameter or stroke.


Bore Ø	AA	BB	DD	E	EE NPT	EE SAE	F	G	J	K
1½	2.3	1 3/8	3/8-24	2 1/2	1/2	#10	3/8	1 3/4	1 1/2	1/2
2	2.9	1 13/16	1/2-20	3	1/2	#10	5/8	1 3/4	1 1/2	5/8
2½	3.6	1 13/16	1/2-20	3 1/2	1/2	#10	5/8	1 3/4	1 1/2	5/8
3¼	4.6	2 5/16	5/8-18	4 1/2	3/4	#12	3/4	2	1 3/4	3/4
4	5.4	2 5/16	5/8-18	5	3/4	#12	7/8	2	1 3/4	3/4
5	7.0	3 3/16	7/8-14	6 1/2	3/4	#12	7/8	2	1 3/4	1
6	8.1	3 5/8	1-14	7 1/2	1	#16	1	2 1/4	2 1/4	1 1/8
7	9.3	4 1/8	1 1/8-12	8 1/2	1 1/4	#20	1	2 3/4	2 3/4	1 1/4
8	10.6	4 1/2	1 1/4-12	9 1/2	1 1/2	#24	1	3	3	1 1/2
10	13.62	6	1 3/4-12	12 5/8	2	#24	1 11/16	3 11/16	3 11/16	1 5/8
12	16.25	7	2-12	14 7/8	2 1/2	#32	1 15/16	4 7/16	4 7/16	1 7/8

HOW TO ORDER

For ordering information refer to Page 32.

NOTES:

- ♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DH00151. (Refer to page 26.)



Rod End Styles and Dimensions
For rod end styles and dimensions see Table 3 in the inside cover of catalog.
Page ii



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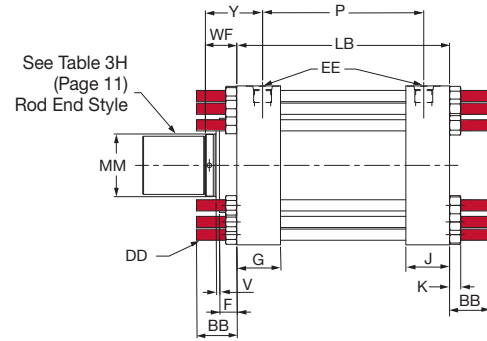
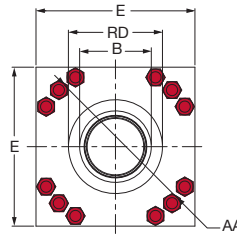
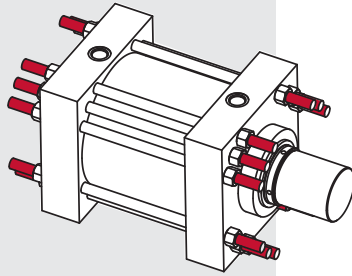
For Package and Mounting

Dimension see
Tables 1H and 2H.

TIE ROD MOUNTED CYLINDERS

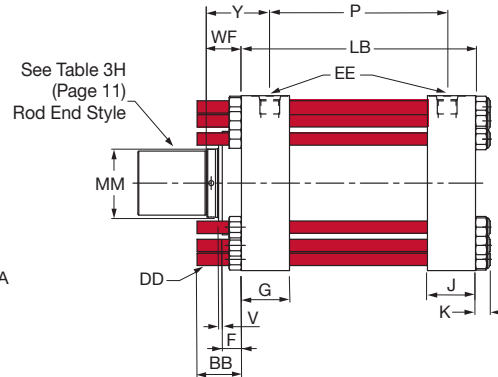
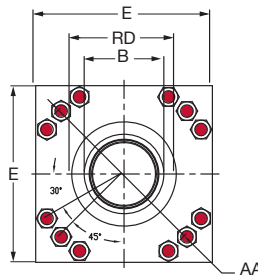
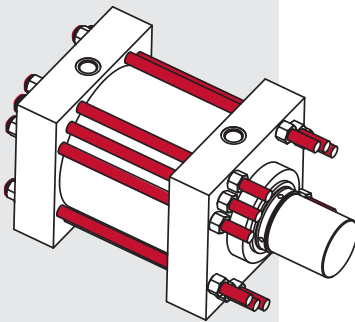
Tie rod mounts are suited for many applications and are similar to flange mounts, but tie-rod mounts are not as rigid as the flange type of mounting. The best use of tie rods extended on the blind end is in a thrust load application. When using tie rod extended on the rod end, the best application is a tension load. When long strokes are required, the free end should be supported to prevent misalignment, sagging or possible binding of the cylinder.

TIE RODS EXTENDED BOTH ENDS



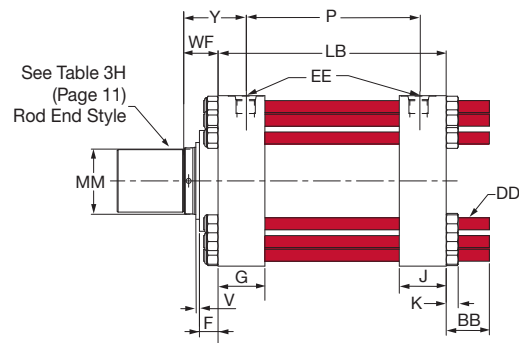
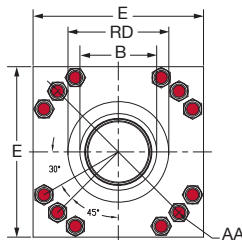
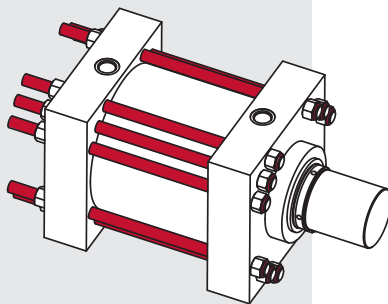
MODEL HM10

TIE RODS EXTENDED ROD END



MODEL HM12

TIE RODS EXTENDED BLIND END



MODEL HM13

▼ **TABLE 1H**

The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ↓	B	LB	P	V	WF	Y	RD
14	7	HM15140	8			¼	3½	6	10½
	8	HM15141	9	15⅝	10⅝	¼	4	6½	11½
	10	HM15142	-			-	6	8½	14½
16	8	HM15160	9	18⅝	11⅞	¼	4	7⅞	11½
	9	HM15161	-			-	5⅝	9	13⅞
	10	HM15162	-			-	6	9⅞	14½
18	9	HM15180	-	22	13¾	-	5⅝	9¾	13⅞
	10	HM15181	-			-	6	10⅞	14½

▼ **TABLE 2H**

The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	AA	BB	DD	E	EE SAE	G	J	K
14	17.88	4½	1¼-12	17¾	#24	4⅞	4⅞	1½
16	20.25	5	1⅝-12	20¼	#24	5⅞	5⅞	1⅝
18	22.63	5½	1½-12	22¼	#24	6⅞	6⅞	1⅞

LARGE BORE CYLINDERS

NOTE: Large bore Series H cylinders (14", 16" and 18") must use Table 3H for accurate piston rod end dimensions.

▼ **TABLE 3H - Piston Rod Ends**

Bore Ø	Rod MM	Thread KK	A	B +.000 - .005	F	NA	V	WF
14	7	5½-12	7	8	1⅞	6⅞	¼	3½
	8	5¾-12	8	9	1⅞	7⅞	¼	4
	10	7¼-12	10	-	3½	9⅞	-	6
16	8	5¾-12	8	9	1⅞	7⅞	¼	4
	9	6½-12	9	-	3⅞	8⅞	-	5⅝
	10	7¼-12	10	-	3½	9⅞	-	6
18	9	6½-12	9	-	3⅞	8⅞	-	5⅝
	10	7¼-12	10	-	3½	9⅞	-	6

HOW TO ORDER

For ordering information refer to Page 32.

NOTES:

- ◆ For double rod end cylinders, add prefix letter D to cylinder code. Example: DHM15140. (Refer to page 26.)

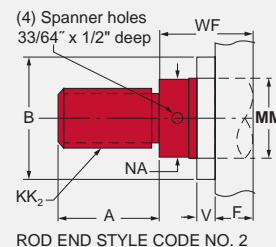


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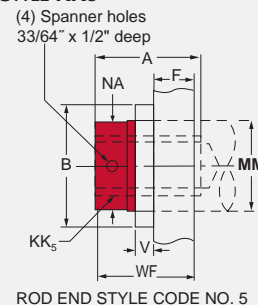
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PISTON ROD END STYLES

STYLE KK2



STYLE KK5



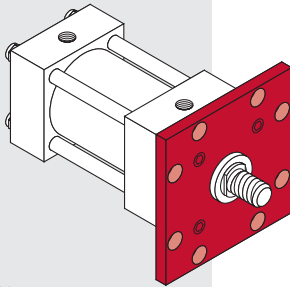
For Package and Mounting

Dimension see
Tables 1H and 2H.

FLANGE MOUNTED CYLINDERS

The flange mount is one of the strongest, most rigid methods of mounting. With this type of mount there is little allowance for misalignment, though when long strokes are required, the free end opposite the mounting should be supported to prevent sagging and possible binding of the cylinder. The best use of a blind end flange is in a thrust load application (rod in compression).

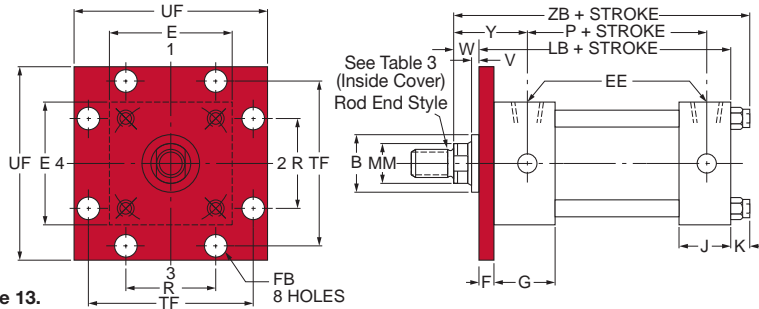
Rod end flange mounts are best used in tension applications. If an application exceeds the rectangular flange rating, requiring an extra heavy flange, a solid flange style end cap mount is available for all bore sizes (refer to page 22). When a less rigid mount can be used and the cylinder can be attached to a panel or bulkhead, an extended tie-rod mounting could be considered.



MODEL H21
NFPA STYLE MF5

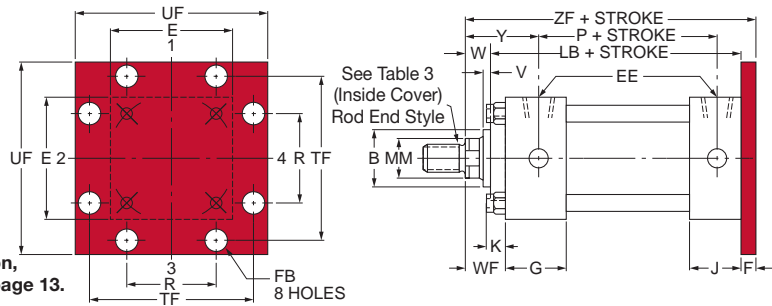
Shown with circular retainer.
Retainer is square <math><3/4\text{ inch}</math> bore.

ROD SQUARE FLANGE MOUNTING

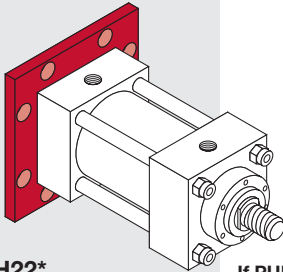


If PUSH application,
see Table 3H on page 13.

BLIND SQUARE FLANGE MOUNTING

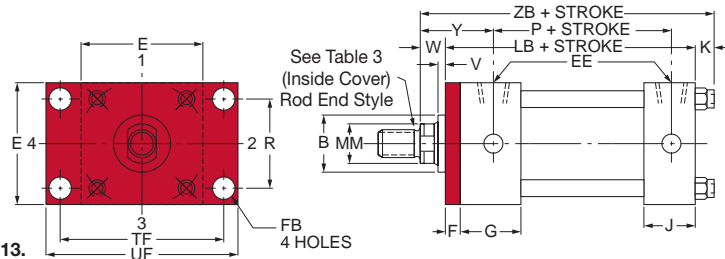


If PULL application,
see Table 3H on page 13.

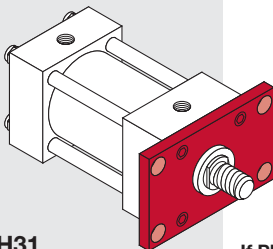


MODEL H22*
NFPA STYLE MF6

ROD RECTANGULAR FLANGE MOUNTING

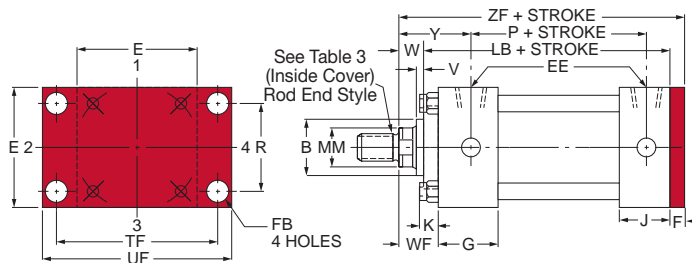


If PUSH application,
see Table 3H on page 13.

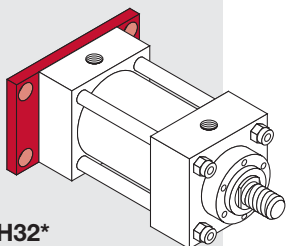


MODEL H31
NFPA STYLE MF1

BLIND RECTANGULAR FLANGE MOUNTING



If PULL application,
see Table 3H on page 13.



MODEL H32*
NFPA STYLE MF2

▼ **TABLE 1H**

The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ↓	B	LB	P	V	W	WF	Y	ZB	ZF
1½	⅝	H00151	1⅛	5	2⅞	¼	⅝	—	2	6⅛	6
	1*	H00152	1½			½	1	—	2⅝	6½	6⅜
2	1	H01510	1½	5¼	2⅞	¼	¾	—	2⅝	6⅝	6⅝
	1⅝*	H01511	2			⅜	1	—	2⅝	6⅞	6⅞
2½	1	H01520	1½			¼	¾	—	2⅝	6¾	6¾
	1⅝	H01521	2	5⅝	3	⅜	1	—	2⅝	7	7
	1¾*	H01522	2⅝			½	1¼	—	2⅞	7¼	7¼
3¼	1⅝	H01530	2			¼	⅞	1⅝	2 ²³ / ₃₂	7⅞	7⅞
	1¾	H01531	2⅝	6¼	3 ¹⁹ / ₃₂	⅜	1⅝	1⅞	2 ³¹ / ₃₂	8⅞	8⅞
	2	H01532	2⅝			⅜	1¼	2	3 ³ / ₃₂	8¼	8¼
4	1¾	H01540	2⅝			¼	1	1⅞	2 ¹⁵ / ₁₆	8⅝	8½
	2	H01541	2⅝	6⅝	3⅞	¼	1⅝	2	3 ¹ / ₁₆	8½	8⅝
	2½	H01542	3⅝			⅜	1⅝	2¼	3 ⁵ / ₁₆	8¾	8⅞
5	2	H01550	2⅝			¼	1⅝	2	3 ¹ / ₁₆	9¼	9⅝
	2½	H01551	3⅝	7⅞	4⅜	⅜	1⅝	2¼	3 ⁵ / ₁₆	9½	9⅝
	3	H01552	3¾			⅜	1⅝	2¼	3 ⁵ / ₁₆	9½	9⅝
	3½	H01553	4¼			⅜	1⅝	2¼	3 ⁵ / ₁₆	9½	9⅝
6	2½	H01560	3⅝								
	3	H01561	3¾	8⅝	5	¼	1¼	2¼	3 ⁷ / ₁₆	10¾	10⅝
	3½	H01562	4¼								
	4	H01563	4¾								
7	3	H01570	3¾								
	3½	H01571	4¼								
	4	H01572	4¾	9½	5½	¼	1¼	2¼	3¾	12	11¾
	4½	H01573	5¼								
	5	H01574	5¾								
8	3½	H01580	4¼								
	4	H01581	4¾								
	4½	H01582	5¼	10½	6¼	¼	1¼	2¼	3⅞	13¼	12¾
	5	H01583	5¾								
	5½	H01584	6¼								
10	4½	H15100	5¼			¼	1¼	—	4¾	16 ¹ / ₁₆	16¾
	5	H15101	5¾	13 ¹³ / ₁₆	8½	½	1½	—	5	16 ¹⁵ / ₁₆	17
	5½	H15102	6¼			½	1½	—	5	16 ¹⁵ / ₁₆	17
12	5½	H15120	6¼								
	7	H15121	8	16 ⁷ / ₁₆	9⅞	¼	1¼	—	5½	19 ⁹ / ₁₆	19⅝

For bore diameter sizes 14" to 18" see pages 24 and 25 (solid end cap mount).

▼ **TABLE 2H**

The dimensions are constant regardless of rod diameter or stroke.


Bore Ø	E	EE NPT	EE SAE	F	FB	G	J	K	R	TF	UF
1½	2½	½	#10	⅜	7/16	1¾	1½	½	1.63	3/16	4¼
2	3	½	#10	⅝	9/16	1¾	1½	⅝	2.05	4/8	5⅝
2½	3½	½	#10	⅝	9/16	1¾	1½	⅝	2.55	4⅝	5⅝
3¼	4½	¾	#12	¾	11/16	2	1¾	¾	3.25	5⅞	7⅞
4	5	¾	#12	7/8	11/16	2	1¾	¾	3.82	6⅝	7⅞
5	6½	¾	#12	7/8	15/16	2	1¾	1	4.95	83/16	9¾
6	7½	1	#16	1	11/16	2¼	2¼	1⅝	5.73	9/16	11¼
7	8½	1¼	#20	1	13/16	2¾	2¾	1¼	6.58	10⅝	12⅝
8	9½	1½	#24	1	15/16	3	3	1½	7.50	11 ¹³ / ₁₆	14
10	12⅝	2	#24	1 ¹¹ / ₁₆	1 ¹³ / ₁₆	3 ¹¹ / ₁₆	3 ¹¹ / ₁₆	1⅝	9.62	15⅞	19
12	14⅞	2½	#32	1 ¹⁵ / ₁₆	2 ¹ / ₁₆	4 ⁷ / ₁₆	4 ⁷ / ₁₆	1⅞	11.45	18½	22

HOW TO ORDER

For ordering information refer to Page 32.

NOTES:

- ◆ For double rod end cylinders, add prefix letter D to cylinder code. Example: DH00151. (Refer to page 26.)
- * Removable retainer not available for these bore and rod combinations in the H22 and H32 mounting styles.



Rod End Styles and Dimensions
For rod end styles and dimensions see Table 3 in the inside cover of catalog.

Page ii

▼ **TABLE 3H**

Recommended Pressure Rating

Bore Ø	Standard Flange PSI Rating	3000 PSI Required Flange Thickness
1½-4	3000	Standard
5	2200	1
6	1500	1½
7	1100	1¾
8	800	2
10	1300	2½
12	1000	3



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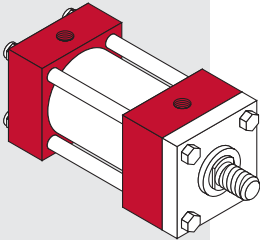
For Package and Mounting

Dimension see
Tables 1H and 2H.

SIDE OR LUG MOUNTED CYLINDERS

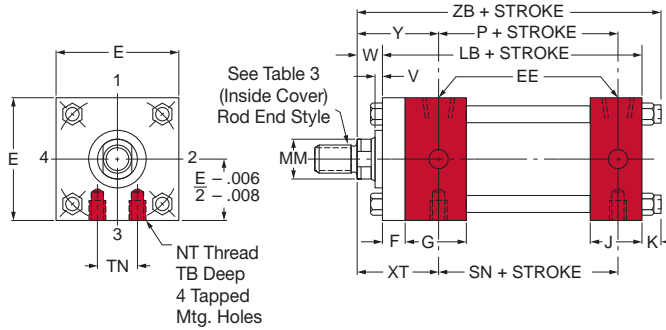
The side or lug mounted cylinder provides a fairly rigid mount. These types of cylinders can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves toward the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder is used properly (without misalignment), the mounting bolts are either in simple shear or tension without any compound stresses.

Shown with square retainer.
Retainer is circular on bore size
3/4" and larger.

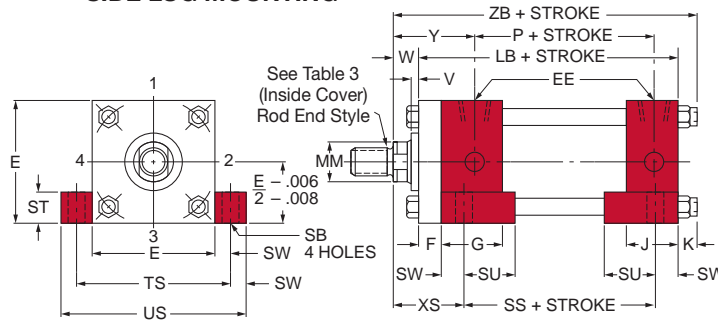


MODEL H41
NFA STYLE MS4

TAPPED HOLES IN CAPS FLUSH MOUNTING



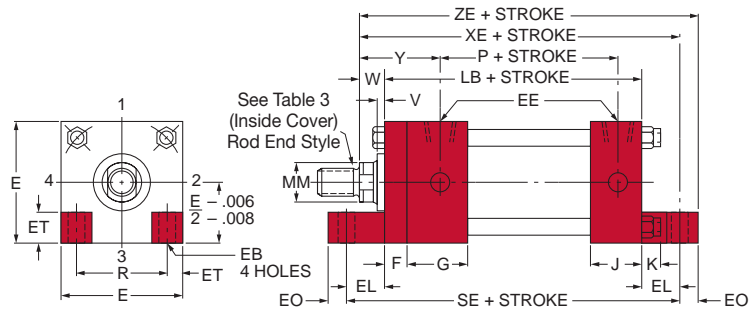
SIDE LUG MOUNTING



MODEL H42
NFA STYLE MS2

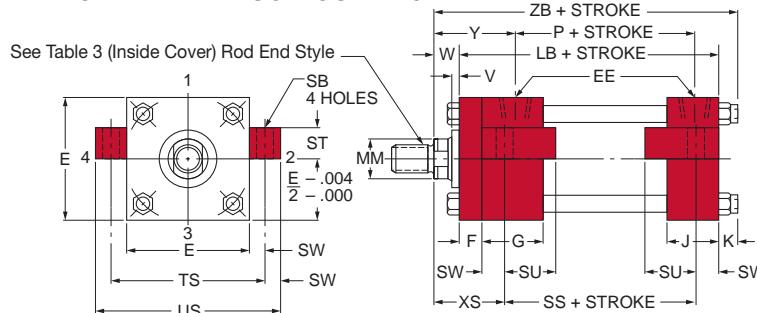
Not Available With
Removable Retainers.

FOOT MOUNTING



MODEL H43
NFA STYLE MS7

CENTERLINE LUG MOUNTING



MODEL H51
NFA STYLE MS3

TABLE 1H

The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ♦	P	LB	SE ▲	SN	SS ■	V	W	XE	XS	XT	Y	ZB	ZE	
1½	5/8	H00151	27/8	5	6¾	27/8	37/8	¼	5/8	6½	1¾	2	2	6½	67/8	
	†1*	H00152						½	1	67/8	1¾	2¾	2¾	6½	7¼	
2	1	H01510	27/8	5¼	7½	27/8	35/8	¼	¾	615/16	17/8	2¾	2¾	65/8	77/16	
	†1¾*	H01511						¾	1	73/16	2½	25/8	25/8	67/8	711/16	
2½	1	H01520	3	55/8	7¼	3	33/8	¼	¾	71/16	21/16	25/8	25/8	6¾	79/16	
	13/8*	H01521						¾	1	715/16	25/16	25/8	25/8	7	713/16	
	†1¾*	H01522						½	1¼	79/16	29/16	27/8	25/8	7¼	81/16	
3¼	13/8	H01530	319/32	6¼	8½	3½	41/8	¼	7/8	8¼	25/16	2¾	223/32	77/8	87/8	
	1¾	H01531						¾	11/8	8½	29/16	3	231/32	8½	9½	
	†2*	H01532						¾	1¼	85/8	211/16	3½	33/32	8¼	9¼	
4	1¾	H01540	37/8	65/8	87/8	3¾	4	¼	1	8¾	2¾	3	215/16	85/8	93/8	
	2*	H01541						¼	11/8	87/8	27/8	3½	31/16	8½	9½	
	2½*	H01542						¾	13/8	9½	3½	37/8	35/16	8¾	9¾	
5	2	H01550	43/8	7½	10½	43/8	4½	¼	11/8	9¾	27/8	3½	31/16	9¼	10½	
	2½	H01551						¾	13/8	10	3½	33/8	35/16	9½	10¾	
	3	H01552						¾	13/8	10	3½	33/8	35/16	9½	10¾	
	3½*	H01553						¾	13/8	10	3½	33/8	35/16	9½	10¾	
6	2½	H01560	5	83/8	10¾	5	5½	¼	1¼	115/16	33/8	3½	37/16	10¾	1213/16	
	3	H01561														
	3½	H01562														
	4*	H01563														
7	3	H01570	5½	9½	13½	5½	5¾	¼	1¼	129/16	35/8	319/16	3¾	12	13½	
	3½	H01571														
	4	H01572														
	4½*	H01573														
	5*	H01574														
8	3½	H01580	6¼	10½	14½	6¼	6¾	¼	1¼	13¾	35/8	319/16	37/8	13¼	147/8	
	4	H01581														
	4½	H01582														
	5	H01583														
	5½*	H01584														
10	4½	H15100	8½	1313/16	-	8½	87/8	¼	1¼	-	49/16	5	4¾	1611/16	-	
	5	H15101						½	1½	-	413/16	5¼	5	1615/16	-	
	5½	H15102						½	1½	-	413/16	5¼	5	1615/16	-	
12	5½	H15120	97/8	167/16	-	10½	10½	¼	1¼	-	53/16	5¾	5½	199/16	-	
	7	H15121														

HOW TO ORDER

For ordering information refer to page 32.

NOTES:


♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DH00151. (Refer to page 26.)

* Tapped holes on H41 rod end cap have a shallower TB depth in these sizes.

† The standard rod eye or rod clevis will interfere with foot lugs on Model H43. When these rod end accessories are required, use additional rod extension.

▲ For double rod end cylinders from 1½" thru 5" bore, add ¼ + F to this dimension.

■ For double rod end cylinders from 1½" thru 5" bore, add ¼ to this dimension.



Rod End Styles and Dimensions
For rod end styles and dimensions see Table 3 in the inside cover of catalog.

Page ii



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TABLE 2H

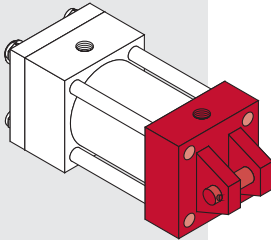
The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	E	EB	EE NPT	EE SAE	EL	EO	ET	F	G	J	K	NT	R	SB	ST	SU	SW	TB	TN	TS	US
1½	2½	7/16	½	#10	7/8	¾	¾	¾	1¾	1½	½	¾-16	1.63	7/16	½	15/16	¾	9/16	¾	3¼	4
2	3	9/16	½	#10	15/16	½	7/8	5/8	1¾	1½	5/8	½-13	2.05	9/16	¾	1¼	½	5/8	15/16	4	5
2½	3½	9/16	½	#10	15/16	½	7/8	5/8	1¾	1½	5/8	5/8-11	2.55	13/16	1	19/16	11/16	7/8	15/16	47/8	6¼
3¼	4½	11/16	¾	#12	11/8	5/8	11/8	¾	2	1¾	¾	¾-10	3.25	13/16	1	19/16	11/16	1	1½	57/8	7¼
4	5	11/16	¾	#12	11/8	5/8	11/8	7/8	2	1¾	¾	1-8	3.82	11/16	1¼	2	7/8	13/8	21/16	6¾	8½
5	6½	15/16	¾	#12	1½	¾	1½	7/8	2	1¾	1	1-8	4.95	11/16	1¼	2	7/8	1½	215/16	8¼	10
6	7½	11/16	1	#16	111/16	13/16	19/8	1	2¼	2¼	11/8	1¼-7	5.73	19/16	1½	2½	11/8	1¾	35/16	9¾	12
7	8½	13/16	1¼	#20	113/16	15/16	1¾	1	2¾	2¾	1¼	1½-6	6.58	19/16	1¾	27/8	13/8	17/8	3¾	11¼	14
8	9½	15/16	1½	#24	2	11/8	2	1	3	3	1½	1½-6	7.50	19/16	1¾	27/8	13/8	17/8	4¼	12¼	15
10	125/8	-	2	#24	-	-	-	111/16	311/16	311/16	15/8	1½-6	9.62	19/16	2¼	3½	15/8	2¼	5¾	157/8	19¾
12	147/8	-	2½	#32	-	-	-	115/16	47/16	47/16	17/8	1½-6	11.45	19/16	3	4¼	2	2¼	7¼	187/8	227/8

For Package and Mounting

Dimension see
Tables 1H and 2H.

Shown with square retainer.
Retainer is circular on bore sizes of
3/4" and larger.

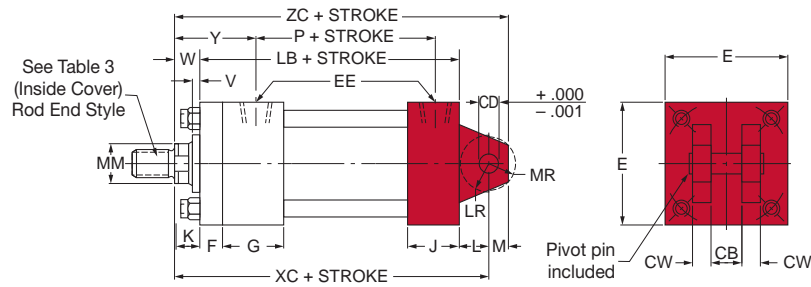


MODEL H61
NFA STYLE MP1

PIN AND TRUNNION MOUNTED CYLINDERS

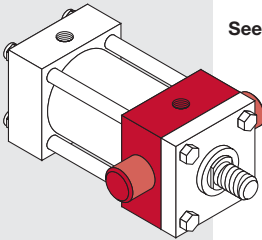
All pin and trunnion cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.

CLEVIS MOUNT

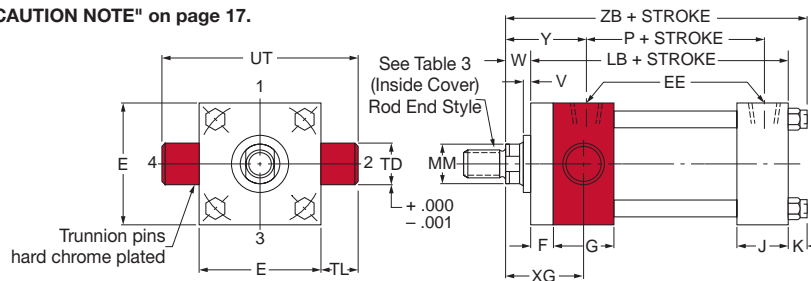


ROD END TRUNNION MOUNT

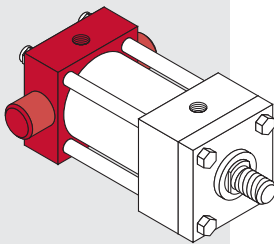
See "CAUTION NOTE" on page 17.



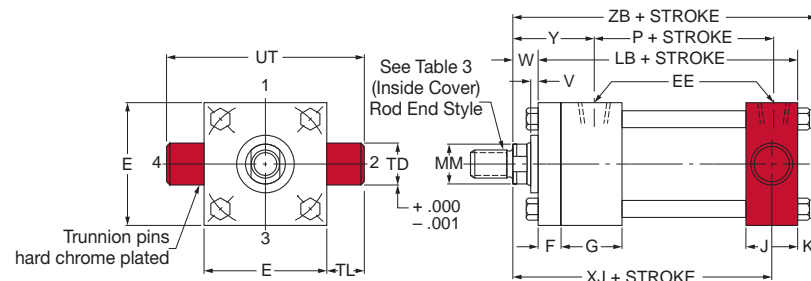
MODEL H71
NFA STYLE MT1



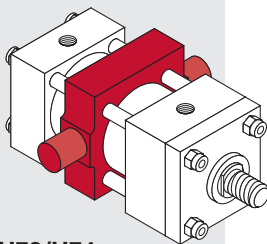
BLIND END TRUNNION MOUNT



MODEL H72
NFA STYLE MT2



CENTER TRUNNION MOUNT



MODEL H73/H74
NFA STYLE MT4

H73 is an exclusive Milwaukee Cylinder design.
H74 is the Industry "Standard" design.

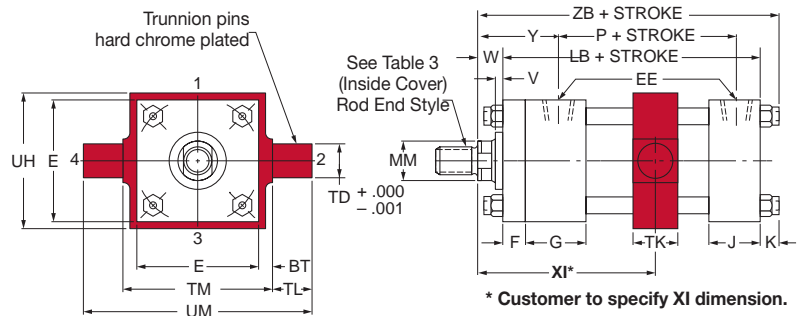


TABLE 1H

The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ↓	P	LB	V	W	XC	XG	XJ	Y	ZB	ZC
1½	⅝	H00151	2⅞	5	¼	⅝	6⅜	1⅞	4⅞	2	6⅞	6⅞
	1*	H00152			½	1	6¾	2¼	5¼	2⅜	6½	7¼
2	1	H01510	2⅞	5¼	¼	¾	7¼	2¼	5¼	2⅜	6⅝	8
	1⅝*	H01511			⅜	1	7½	2½	5½	2⅝	6⅞	8¼
2½	1	H01520	3	5⅝	¼	¾	7⅝	2¼	5⅝	2⅜	6¾	8⅞
	1⅝	H01521			⅜	1	7⅝	2½	5⅝	2⅝	7	8⅝
	1¾*	H01522			½	1¼	7⅞	2¾	5⅞	2⅞	7¼	8⅝
3¼	1⅝	H01530	3 ¹⁹ / ₃₂	6¼	¼	⅞	8⅝	2⅝	6¼	2 ²³ / ₃₂	7⅞	9⅝
	1¾	H01531			⅜	1⅞	8⅞	2⅞	6½	2 ³¹ / ₃₂	8⅞	9⅞
	2	H01532			⅜	1¼	9	3	6⅝	3 ³ / ₃₂	8¼	10
4	1¾	H01540	3⅞	6⅝	¼	1	9¾	2⅞	6¾	2 ¹⁵ / ₁₆	8⅝	11⅞
	2	H01541			¼	1⅞	9⅞	3	6⅞	3 ¹ / ₁₆	8½	11¼
	2½	H01542			⅜	1⅝	10⅞	3¼	7⅞	3 ⁵ / ₁₆	8¾	11½
5	2	H01550	4⅜	7⅞	¼	1⅞	10½	3	7⅞	3 ¹ / ₁₆	9¼	12⅞
	2½	H01551			⅜	1⅝	10¾	3¼	7⅞	3 ⁵ / ₁₆	9½	12⅜
	3	H01552			⅜	1⅝	10¾	3¼	7⅞	3 ⁵ / ₁₆	9½	12⅜
	3½	H01553			⅜	1⅝	10¾	3¼	7⅞	3 ⁵ / ₁₆	9½	12⅜
6	2½	H01560	5	8⅝	¼	1¼	12⅞	3⅝	8⅝	3 ⁷ / ₁₆	10¾	14⅞
	3	H01561										
	3½	H01562										
	4	H01563										
7	3	H01570	5½	9½	¼	1¼	13¾	3⅝	9⅝	3¾	12	16⅞
	3½	H01571										
	4	H01572										
	4½	H01573										
	5	H01574										
8	3½	H01580	6¼	10½	¼	1¼	15	3¾	10¼	3⅞	13¼	17¾
	4	H01581										
	4½	H01582										
	5	H01583										
	5½	H01584										
10	4½	H15100	8½	13 ¹³ / ₁₆	¼	1¼	19 ¹ / ₁₆	4¾	13¼	4¾	16 ¹ / ₁₆	22 ⁹ / ₁₆
	5	H15101			½	1½	19 ⁵ / ₁₆	5	13½	5	16 ¹⁵ / ₁₆	22 ¹³ / ₁₆
	5½	H15102			½	1½	19 ⁵ / ₁₆	5	13 ¹ / ₂	5	16 ¹⁵ / ₁₆	22 ¹³ / ₁₆
12	5½	H15120	9⅞	16 ⁷ / ₁₆	¼	1¼	22 ³ / ₁₆	5⅝	15½	5½	19 ⁹ / ₁₆	26 ³ / ₁₆
	7	H15121										

For bore diameter sizes 14" to 18" see next page.

TABLE 2H

The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	CB	CD	CW	E	EE NPT	EE SAE	F	G	J	K	L	LR	M	MR	TD	TL	H73				H74				
																	TK	TM	UH	UM	TK	TM	UH	UM	UT
1½	¾	½	½	2½	½	#10	⅝	1¾	1½	½	¾	⅝	½	2 ¹ / ₃₂	1	1	1½	4	2½	6	1½	3	3	5	4½
2	1¼	¾	⅝	3	½	#10	⅝	1¾	1½	⅝	1¼	1⅞	¾	1 ⁵ / ₁₆	1⅞	1⅞	2	5	3⅞	7¾	1¼	3½	3½	6¼	5¾
2½	1¼	¾	⅝	3½	½	#10	⅝	1¾	1½	⅝	1¼	1⅞	¾	1 ⁵ / ₁₆	1⅞	1⅞	2	5½	4⅞	8¼	1¼	4	4	6¾	6¼
3¼	1½	1	¾	4½	¾	#12	⅞	2	1¾	¾	1½	1¼	1	1 ¹ / ₁₆	1¾	1¾	2½	7	5	10½	2¼	5	5	8½	8
4	2	1⅝	1	5	¾	#12	⅞	2	1¾	¾	2⅞	1⅞	1⅞	1⅞	1¾	1¾	2½	7½	6½	11	2¼	5½	6½	9	8½
5	2½	1¾	1¼	6½	¾	#12	⅞	2	1¾	1	2¼	2	1⅝	1⅞	1¾	1¾	3	9	7½	12½	3	7	7¼	10½	10
6	2½	2	1¼	7½	1	#16	1	2¼	2¼	1⅞	2½	2 ¹ / ₁₆	2	2	2	2	3½	10½	8¾	14½	3¼	8½	8¾	12½	11½
7	3	2½	1½	8½	1¼	#20	1	2¾	2¾	1¼	3	2⅝	2⅝	2⅝	2½	2½	4	12	10	17	3½	9¾	10	14¾	13½
8	3	3	1½	9½	1½	#24	1	3	3	1½	3¼	2⅞	2¾	2¾	3	3	4½	13	11	19	4	11	11¾	17	15½
10	4	3½	2	12⅝	2	#24	1 ¹ / ₁₆	3 ¹ / ₁₆	3 ¹ / ₁₆	1⅞	4	3½	3½	3½	3½	3½	5	17⅞	15¼	24⅞	5	14	15¼	21	19⅞
12	4½	4	2¼	14⅞	2½	#32	1 ⁵ / ₁₆	4 ⁷ / ₁₆	4 ⁷ / ₁₆	1⅞	4½	4	4	4	4	4	5½	20⅞	19¼	28⅞	5½	16½	19¼	24½	22⅞

HOW TO ORDER

For ordering information refer to Page 32.

CAUTION NOTES:

Rod end trunnion mount cylinders in bore sizes 5" through 8" with oversize piston rods, and bore sizes 10" through 18" with all piston rod diameters should not be used over 1500 PSI. If your application requires higher pressure, consult the factory.

NOTES:

◆ For double rod end cylinders, add prefix letter D to cylinder code. Example: DHM00151. (Refer to page 26.) Double rod ends are not available on clevis mount Series H cylinders.

* Removable retainer not available for these bore and rod combinations: H61 and H73/H74 mounting styles.

Rod End Styles and Dimensions
For rod end styles and dimensions see Table 3 in the inside cover of catalog.
Page ii

MilCad Cylinder Configurator
Visit milwaukeekeeylinder.com to configure and download CAD files of your cylinders.

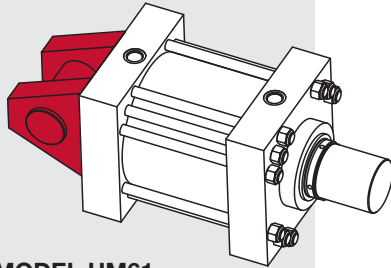
Series H
Series MH
Series LH
Series A
Series MN
Hyd-Pneu Devices
Cyl Accessories
Manipulators
Power Units/Valves
Design Guide

For Package and Mounting

Dimension see
Tables 1H and 2H.

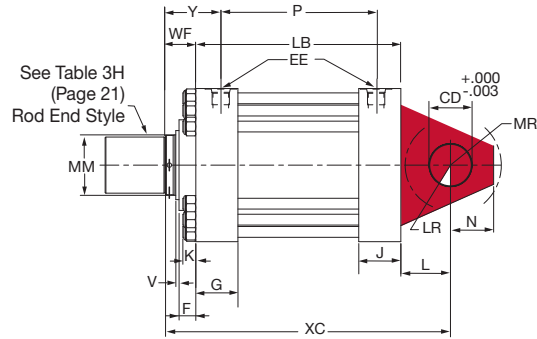
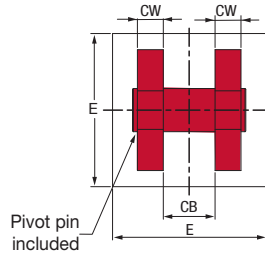
PIN AND TRUNNION MOUNTED CYLINDERS

All pin and trunnion cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.

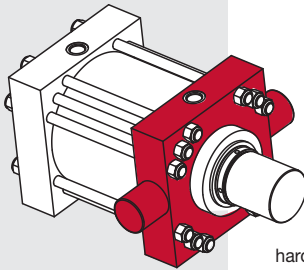


MODEL HM61

CLEVIS MOUNT

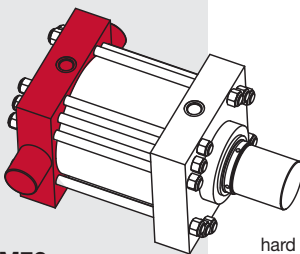
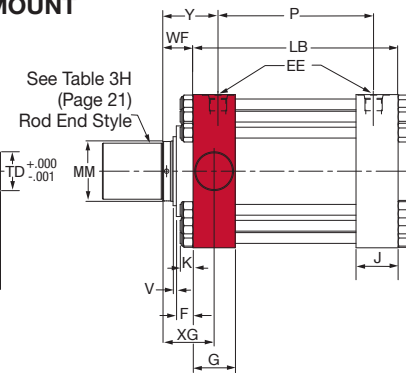
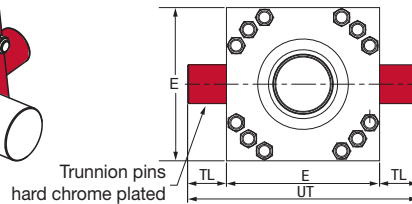


See "CAUTION NOTE" on page 19.



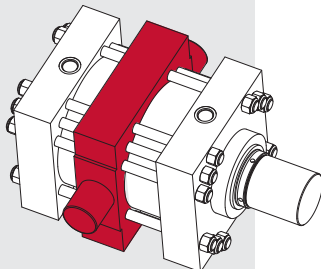
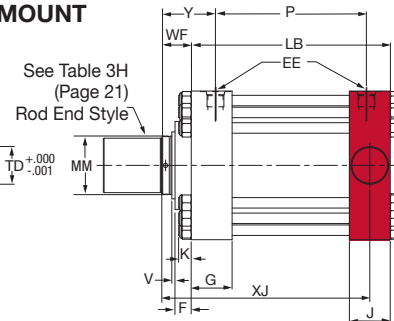
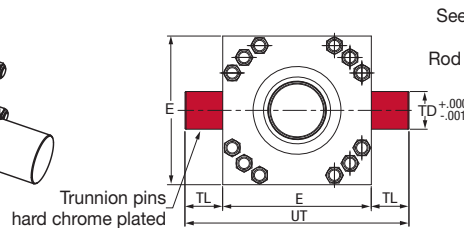
MODEL HM71

ROD END TRUNNION MOUNT



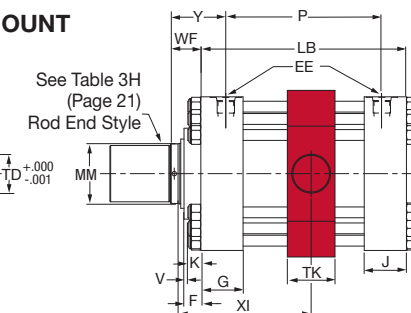
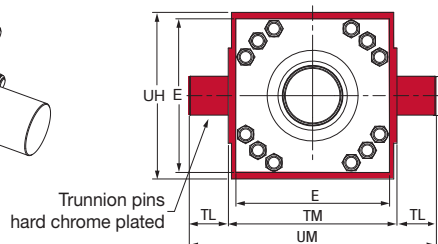
MODEL HM72

BLIND END TRUNNION MOUNT



MODEL HM74

CENTER TRUNNION MOUNT



▼ TABLE 1H The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ↓	B	LB	P	V	WF	Y	XC	XG	XJ
14	7	HM15140	8			1/4	3 1/2	6	24 7/8	5 15/16	16 11/16
	8	HM15141	9	15 5/8	10 5/8	1/4	4	6 1/2	25 3/8	6 7/16	17 3/16
	10	HM15142	-			-	6	8 1/2	27 3/8	8 7/16	19 3/16
16	8	HM15160	9			1/4	4	7 3/8	29 5/8	-	-
	9	HM15161	-	18 5/8	11 7/8	-	5 5/8	9	31 1/4	-	-
	10	HM15162	-			-	6	9 3/8	31 5/8	-	-
18	9	HM15180	-	22	13 3/4	-	5 5/8	9 3/4	35 1/4	-	-
	10	HM15181	-			-	6	10 1/8	35 5/8	-	-

▼ TABLE 2H The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	CB	CD	CW	E	EE SAE	G	J	K	L	LR	M	MR	TD	TL	TK	TM	UH	UM	UT
14	6	5	3	17 3/4	#24	4 7/8	4 7/8	1 1/2	5 3/4	4 1/8	5	5 15/32	4 1/2	4 1/2	5 1/2	19 1/2	19 1/4	28 1/2	26 1/8
16	7	6	3 1/2	20 1/4	#24	5 7/8	5 7/8	1 5/8	7	6 1/4	6	6	-	-	-	-	-	-	-
18	8	6 1/2	4	22 1/4	#24	6 7/8	6 7/8	1 7/8	7 5/8	6 3/4	6 1/2	6 1/2	-	-	-	-	-	-	-

LARGE BORE CYLINDERS

NOTE: Large bore Series H cylinders (14", 16" and 18") must use Table 3H for accurate piston rod end dimensions.

▼ TABLE 3H - Piston Rod Ends

Bore Ø	Rod MM	Thread KK	A	B +.000 - .005	F	NA	V	WF
14	7	5 1/2-12	7	8	1 15/16	6 7/8	1/4	3 1/2
	8	5 3/4-12	8	9	1 15/16	7 7/8	1/4	4
	10	7 1/4-12	10	-	3 1/2	9 7/8	-	6
16	8	5 3/4-12	8	9	1 15/16	7 7/8	1/4	4
	9	6 1/2-12	9	-	3 3/8	8 7/8	-	5 5/8
	10	7 1/4-12	10	-	3 1/2	9 7/8	-	6
18	9	6 1/2-12	9	-	3 3/8	8 7/8	-	5 5/8
	10	7 1/4-12	10	-	3 1/2	9 7/8	-	6

HOW TO ORDER

For ordering information refer to Page 32.

CAUTION NOTES:

Rod end trunnion mount cylinders in bore sizes 5" through 8" with oversize piston rods, and bore sizes 10" through 18" with all piston rod diameters should not be used over 1500 PSI. If your application requires higher pressure, consult the factory.

NOTES:

- ◆ For double rod end cylinders, add prefix letter D to cylinder code. Example: DHM15140. (Refer to page 26.) Double rod ends are not available on clevis mount Series H cylinders.

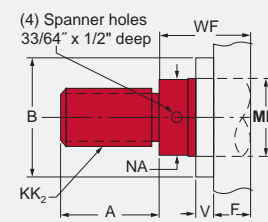


MilCad Cylinder Configurator

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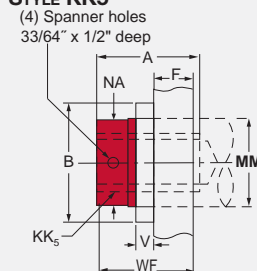
PISTON ROD END STYLES

STYLE KK2



ROD END STYLE CODE NO. 2

STYLE KK5



ROD END STYLE CODE NO. 5

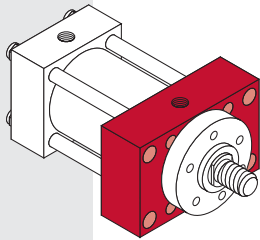
For Package and Mounting

Dimension see
Tables 1H and 2H.

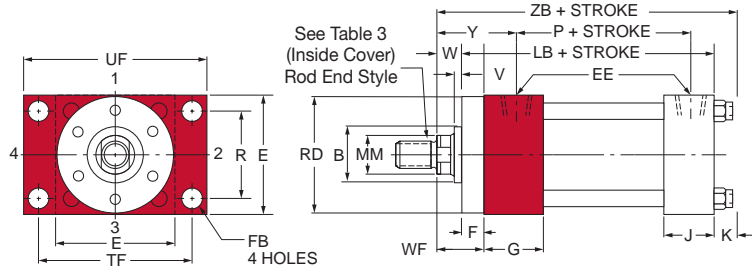
SOLID ROD END CAP MOUNTED CYLINDERS

Milwaukee Cylinder's solid rod end cap mount is one of the strongest, most rigid methods of mounting. This type of mounting is best in a tension application.

Flange rated for 3,000 PSI operation.



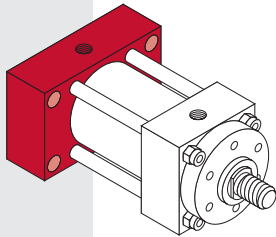
MODEL H35
NFPA STYLE ME5



SOLID BLIND END CAP MOUNTED CYLINDERS

Milwaukee Cylinder's solid blind end cap mount is one of the strongest, most rigid methods of mounting. This type of mounting is best in a thrust load application.

Flange rated for 3,000 PSI operation.



MODEL H36
NFPA STYLE ME6

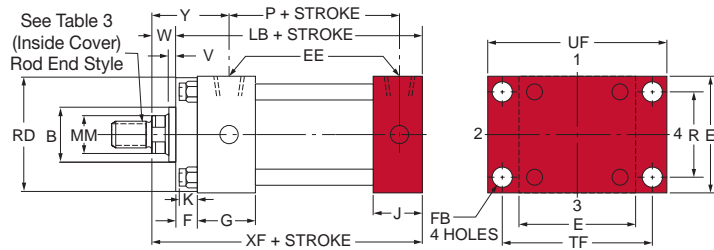


TABLE 1H

The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ♦	B	P	LB	RD	V	W	WF	XF	Y	ZB
1½	5/8	H00151	1 1/8	2 7/8	5	2.38	1/4	5/8	1	5 5/8	2	6 1/8
	1	H00152	1 1/2			2.50	1/2	1	1 3/8	6	2 3/8	6 1/2
2	1	H01510	1 1/2	2 7/8	5 1/4	3.00	1/4	3/4	1 3/8	6	2 3/8	6 5/8
	1 3/8	H01511	2			3.00	3/8	1	1 5/8	6 1/4	2 5/8	6 7/8
2½	1	H01520	1 1/2	3	5 3/8	3.00	1/4	3/4	1 3/8	6 1/8	2 3/8	6 3/4
	1 3/8	H01521	2			3.00	3/8	1	1 5/8	6 3/8	2 5/8	7
	1 3/4	H01522	2 3/8			3.50	1/2	1 1/4	1 7/8	6 5/8	2 7/8	7 1/4
3¼	1 3/8	H01530	2	3 19/32	6 1/4	3.50	1/4	7/8	1 5/8	7 1/8	2 23/32	7 7/8
	1 3/4	H01531	2 3/8			3.50	3/8	1 1/8	1 7/8	7 3/8	2 31/32	8 1/8
	2	H01532	2 5/8			4.00	3/8	1 1/4	2	7 1/2	3 3/32	8 1/4
4	1 3/4	H01540	2 3/8	3 7/8	6 5/8	3.50	1/4	1	1 7/8	7 5/8	2 15/16	8 3/8
	2	H01541	2 5/8			4.00	1/4	1 1/8	2	7 3/4	3 1/16	8 1/2
	2 1/2	H01542	3 1/8			4.50	3/8	1 3/8	2 1/4	8	3 5/16	8 3/4
5	2	H01550	2 5/8	4 3/8	7 1/8	4.00	1/4	1 1/8	2	8 1/4	3 1/16	9 1/4
	2 1/2	H01551	3 1/8			4.50	3/8	1 3/8	2 1/4	8 1/2	3 5/16	9 1/2
	3	H01552	3 3/4			5.12	3/8	1 3/8	2 1/4	8 1/2	3 5/16	9 1/2
	3 1/2	H01553	4 1/4			5.50	3/8	1 3/8	2 1/4	8 1/2	3 5/16	9 1/2
6	2 1/2	H01560	3 1/8	5	8 3/8	4.50	1/4	1 1/4	2 1/4	9 5/8	3 7/16	10 3/4
	3	H01561	3 3/4			5.50						
	3 1/2	H01562	4 1/4			5.88						
	4	H01563	4 3/4			6.38						
7	3	H01570	3 3/4	5 1/2	9 1/2	5.50	1/4	1 1/4	2 1/4	10 3/4	3 3/4	12
	3 1/2	H01571	4 1/4			5.88						
	4	H01572	4 3/4			6.38						
	4 1/2	H01573	5 1/4			6.88						
	5	H01574	5 3/4			7.31						
8	3 1/2	H01580	4 1/4	6 1/4	10 1/2	5.88	1/4	1 1/4	2 1/4	11 3/4	3 7/8	13 1/4
	4	H01581	4 3/4			6.38						
	4 1/2	H01582	5 1/4			6.88						
	5	H01583	5 3/4			7.31						
	5 1/2	H01584	6 1/4			8.43						
10	4 1/2	H15100	5 1/4	8 1/2	13 13/16	6.88	1/4	1 1/4	2 15/16	15 1/16	4 3/4	16 11/16
	5	H15101	5 3/4			7.31	1/2	1 1/2	3 3/16	15 5/16	5	16 15/16
	5 1/2	H15102	6 1/4			8.43	1/2	1 1/2	3 3/16	15 5/16	5	16 15/16
12	5 1/2	H15120	6 1/4	9 7/8	16 7/16	8.43	1/4	1 1/4	3 3/16	17 11/16	5 1/2	19 9/16
	7	H15121	8			10.50						

For bore diameter sizes 14" to 18" see next page.

TABLE 2H

The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	E	EE NPT	EE SAE	F	FB	G	J	K	PA	PD	R	TF	UF
1½	2 1/2	1/2	#10	3/8	7/16	1 3/4	1 1/2	1/2	3/16	1 7/16	1.63	3 7/16	4 1/4
2	3	1/2	#10	5/8	9/16	1 3/4	1 1/2	5/8	5/16	1 13/16	2.05	4 1/8	5 1/8
2½	3 1/2	1/2	#10	5/8	9/16	1 3/4	1 1/2	5/8	5/16	2 1/16	2.55	4 5/8	5 5/8
3¼	4 1/2	3/4	#12	3/4	1 1/16	2	1 3/4	3/4	3/8	2 5/8	3.25	5 7/8	7 1/8
4	5	3/4	#12	7/8	1 1/16	2	1 3/4	3/4	7/16	2 15/16	3.82	6 3/8	7 5/8
5	6 1/2	3/4	#12	7/8	1 5/16	2	1 3/4	1	7/16	3 11/16	4.95	8 3/16	9 3/4
6	7 1/2	1	#16	1	1 1/16	2 1/4	2 1/4	1 1/8	1/2	4 1/4	5.73	9 7/16	11 1/4
7	8 1/2	1 1/4	#20	1	1 3/16	2 3/4	2 3/4	1 1/4	1/2	4 3/4	6.58	10 3/8	12 5/8
8	9 1/2	1 1/2	#24	1	1 5/16	3	3	1 1/2	1/2	5 1/4	7.50	11 13/16	14
10	12 5/8	2	#24	1 11/16	1 13/16	3 11/16	3 11/16	1 5/8	13/16	7 1/8	9.62	15 7/8	19
12	14 7/8	2 1/2	#32	1 15/16	2 1/16	4 7/16	4 7/16	1 7/8	15/16	8 3/8	11.45	18 1/2	22

HOW TO ORDER

For ordering information refer to Page 32.

NOTES:

- ♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DH00151. (Refer to page 26.)

i Rod End Styles and Dimensions
For rod end styles and dimensions see Table 3 in the inside cover of catalog.
Page ii

MilCad Cylinder Configurator
Visit milwaukeekeeylinder.com to configure and download CAD files of your cylinders.

For Package and Mounting

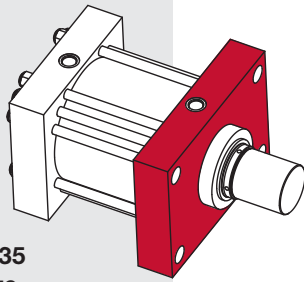
Dimension see
Tables 1H and 2H.

SOLID END CAP MOUNTED CYLINDERS

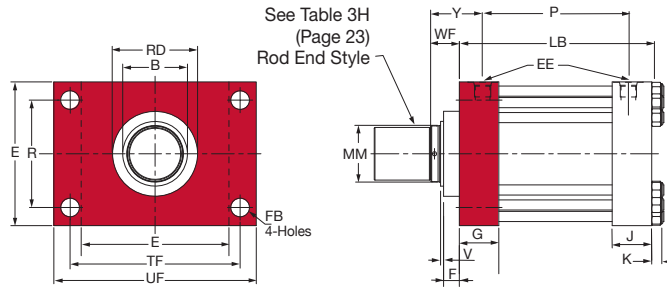
Milwaukee Cylinder's solid end cap mount is one of the strongest, most rigid methods of mounting. This type of rod end cap mounting is best in a tension application. A solid blind end cap mounting is best in a thrust application.

Flange rated for 3,000 PSI operation.

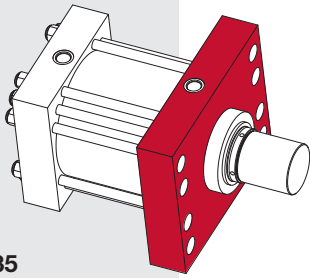
SOLID ROD END CAP MOUNT (14" Bore)



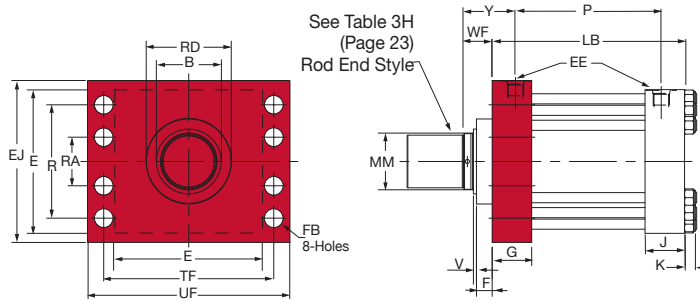
MODEL HM35
14" Bore Size



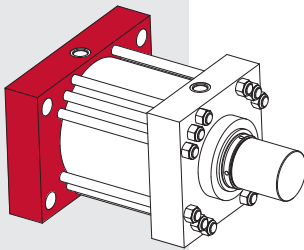
SOLID ROD END CAP MOUNT (16" and 18" Bore)



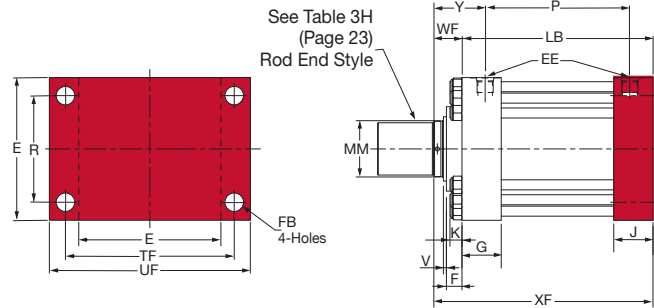
MODEL HM35
16" and 18" Bore Sizes



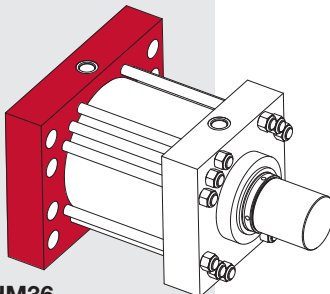
SOLID BLIND END CAP MOUNT (14" BORE)



MODEL HM36
14" Bore Size



SOLID BLIND END CAP MOUNT (16" AND 18" BORE)



MODEL HM36
16" and 18" Bore Sizes

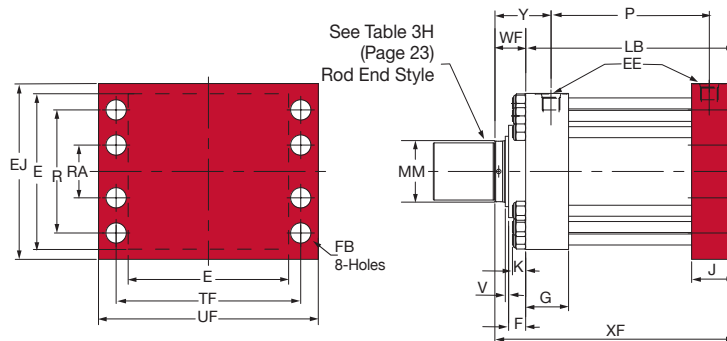


TABLE 1H The dimensions given on this table are affected by the piston rod diameter and the stroke. (H21, H22)

Bore Ø	Rod MM	Cylinder Code	B	LB	P	V	WF	Y	RD	XF
14	7	HM15140	8			¼	3½	6	10½	19½
	8	HM15141	9	15%	10%	¼	4	6½	11½	19%
	10	HM15142	-			-	6	8½	14½	21%
16	8	HM15160	9			¼	4	7%	11½	22%
	9	HM15161	-	18%	11%	-	5%	9	13%	24¼
	10	HM15162	-			-	6	9%	14½	24%
18	9	HM15180	-			-	5%	9¾	13¾	27%
	10	HM15181	-	22	13¾	-	6	10½	14½	28

TABLE 2H The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	E	EE SAE	EJ	FB	G	J	K	R	RA	TF	UF
14	17¾	#24	-	2 ⁵ / ₁₆	4 ⁷ / ₈	4 ⁷ / ₈	1½	13.26	-	21.00	25
16	20¼	#24	20	1 ¹³ / ₁₆	5 ⁷ / ₈	5 ⁷ / ₈	1 ⁵ / ₈	15.50	8	21.00	24½
18	22¼	#24	23	2 ¹ / ₁₆	6 ⁷ / ₈	6 ⁷ / ₈	1 ⁷ / ₈	18.00	7¼	24.25	28¼

LARGE BORE CYLINDERS

NOTE: Large bore Series H cylinders (14", 16" and 18") must use Table 3H for accurate piston rod end dimensions.

TABLE 3H - Piston Rod Ends

Bore Ø	Rod MM	Thread KK	A	B +.000 - .005	F	NA	V	WF
14	7	5½-12	7	8	1 ¹⁵ / ₁₆	6 ⁷ / ₈	¼	3½
	8	5¾-12	8	9	1 ¹⁵ / ₁₆	7 ⁷ / ₈	¼	4
	10	7¼-12	10	-	3½	9 ⁷ / ₈	-	6
16	8	5¾-12	8	9	1 ¹⁵ / ₁₆	7 ⁷ / ₈	¼	4
	9	6½-12	9	-	3 ³ / ₈	8 ⁷ / ₈	-	5%
	10	7¼-12	10	-	3½	9 ⁷ / ₈	-	6
18	9	6½-12	9	-	3 ³ / ₈	8 ⁷ / ₈	-	5%
	10	7¼-12	10	-	3½	9 ⁷ / ₈	-	6

HOW TO ORDER

For ordering information refer to Page 32.

NOTES:

- ◆ For double rod end cylinders, add prefix letter D to cylinder code. Example: DHM15140. (Refer to page 26.)

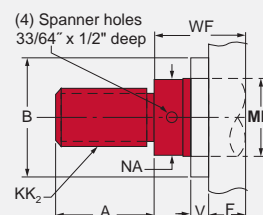


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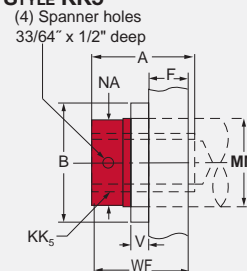
PISTON ROD END STYLES

STYLE KK2



ROD END STYLE CODE NO. 2

STYLE KK5



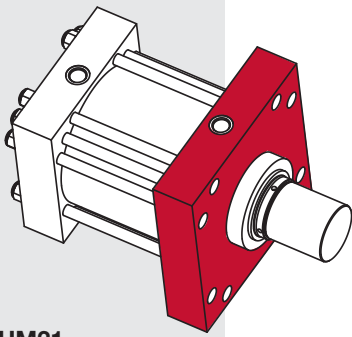
ROD END STYLE CODE NO. 5

For Package and Mounting
Dimension see
Tables 1H and 2H.

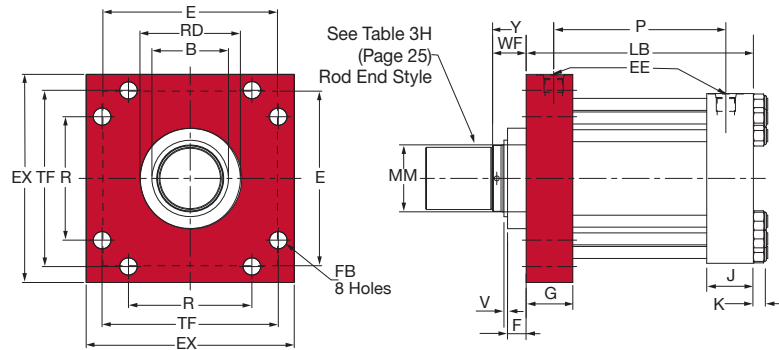
SOLID END CAP MOUNTED CYLINDERS

Milwaukee Cylinder's solid end cap mount is one of the strongest, most rigid methods of mounting. This type of rod end cap mounting is best in a tension application. A solid blind end cap mounting is best in a thrust application.

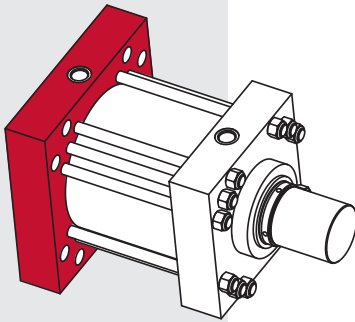
SOLID ROD END CAP SQUARE MOUNTING



MODEL HM21



SOLID BLIND END CAP SQUARE MOUNTING



MODEL HM22

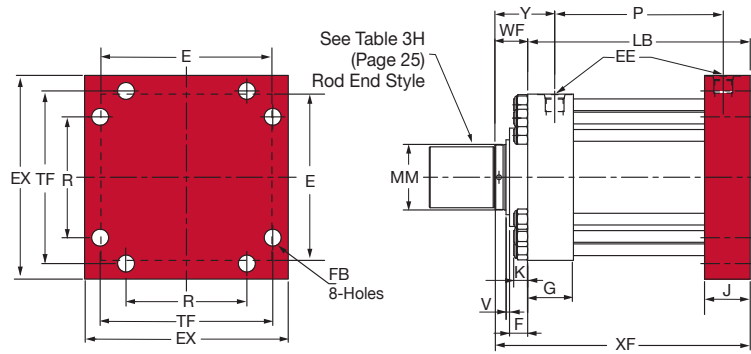


TABLE 1H The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code	B	LB	P	V	WF	Y	RD	XF
14	7	HM15140	8			¼	3½	6	10½	19½
	8	HM15141	9	15%	10%	¼	4	6½	11½	19%
	10	HM15142	-			-	6	8½	14½	21%
16	8	HM15160	-			-	4	7%	11½	22%
	9	HM15161	-	18%	11%	-	5%	9	13%	24¼
	10	HM15162	-			-	6	9%	14½	24%
18	9	HM15180	-			-	5%	9¾	13¾	27%
	10	HM15181	-	22	13¾	-	6	10½	14½	28

TABLE 2H The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	E	EE SAE	EX	FB	G	J	K	R	TF
14	17¾	#24	21¾	1¼	4¾	4¾	1½	12.90	18.43
16	20¼	#24	24½	1¼	5¾	5¾	1%	15.28	21.03
18	22¼	#24	26½	2¼	6¾	6¾	1%	16.45	22.65

LARGE BORE CYLINDERS

NOTE: Large bore Series H cylinders (14", 16" and 18") must use Table 3H for accurate piston rod end dimensions.

TABLE 3H - Piston Rod Ends

Bore Ø	Rod MM	Thread KK	A	B +.000 - .005	F	NA	V	WF
14	7	5½-12	7	8	1¼	6%	¼	3½
	8	5¾-12	8	9	1¼	7%	¼	4
	10	7¼-12	10	-	3½	9%	-	6
16	8	5¾-12	8	9	1¼	7%	¼	4
	9	6½-12	9	-	3¾	8%	-	5%
	10	7¼-12	10	-	3½	9%	-	6
18	9	6½-12	9	-	3¾	8%	-	5%
	10	7¼-12	10	-	3½	9%	-	6

HOW TO ORDER

For ordering information refer to Page 32.

NOTES:

- For double rod end cylinders, add prefix letter D to cylinder code. Example: DHM15140. (Refer to page 26.)

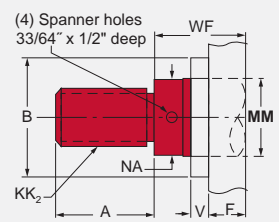


MilCad Cylinder Configurator

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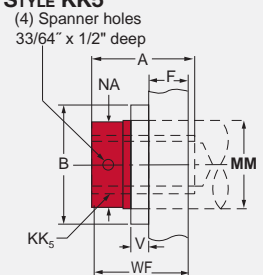
PISTON ROD END STYLES

STYLE KK2



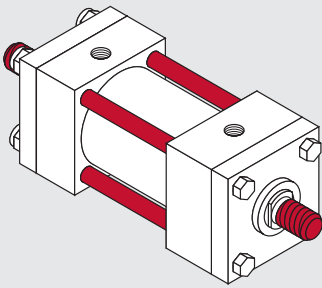
ROD END STYLE CODE NO. 2

STYLE KK5



ROD END STYLE CODE NO. 5

Series H



DOUBLE ROD END CYLINDERS

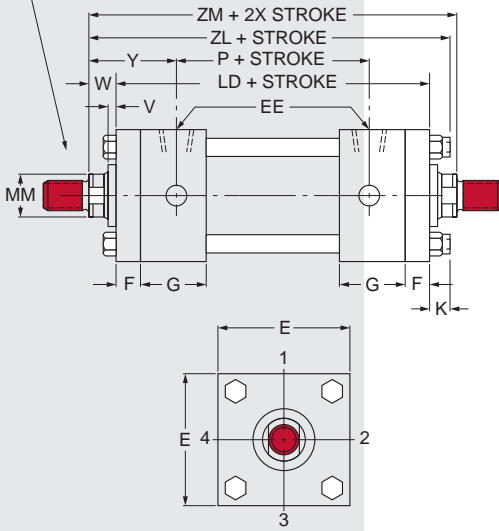
Milwaukee Cylinder's Double Rod End Cylinders are available with all the standard types of Series H mountings, except the clevis mount (H61).

To obtain dimensional information on a double rod end cylinder, first select the desired mounting style and refer to the corresponding single rod end cylinder model shown on the preceding pages. After you have determined all necessary dimensions from the previous page covering the desired mounting, turn back to this page. Supplement those dimensions with additional ones from the drawings below and the table at the right. These added dimensions differ from, or are in addition to, those shown on the preceding pages and provide the additional information needed to completely dimension a double rod end cylinder model.

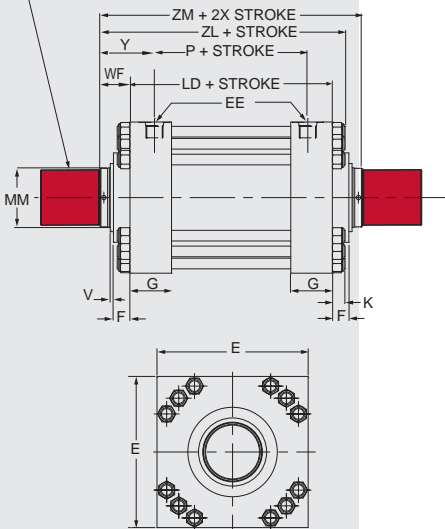
On a double rod end cylinder where two different rod ends are required, or two different rod sizes are required, or cushions on one end are required, be sure to state clearly which rod is to go at which end of the cylinder. When two types of mounting styles are required, be sure to specify their relationship to the piston rods, if they are not the same.

BORE SIZES 1" to 12".

See Table 3 (Inside cover)
Rod End Styles.



BORE SIZES 14" to 18". See
Table 3H (on previous page)
Rod End Styles.



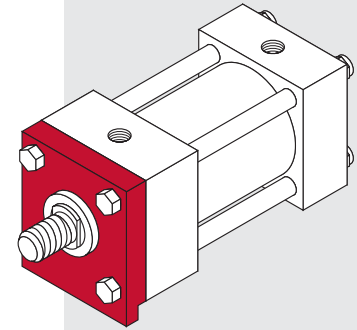
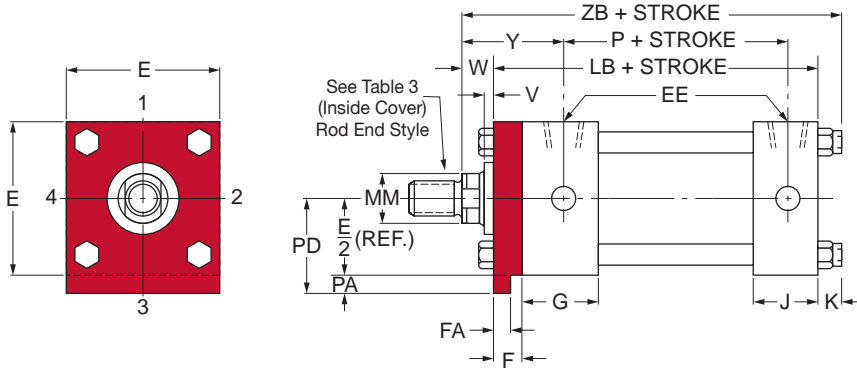
DOUBLE ROD END CYLINDERS

Bore Ø	Rod MM	Cylinder Code	LD*	SE*	SS*	ZL	ZM
1½	5/8	DH00151	5 5/8	7 3/8	4 1/8	6 3/4	6 7/8
	1*	DH00152		7 3/8	4 1/8	7 1/8	7 3/8
2	1	DH01510	6 1/8	8	3 3/8	7 1/2	7 3/8
	1 3/8*	DH01511		8	3 3/8	7 3/4	8 1/8
2½	1	DH01520	6 1/4	8 1/8	3 3/8	7 3/8	7 3/4
	1 3/8	DH01521		8 1/8	3 3/8	7 7/8	8 1/4
	1 3/4*	DH01522		8 1/8	3 3/8	8 1/8	8 3/4
3¼	1 3/8	DH01530	7 1/4	9 1/2	4 3/8	8 7/8	9
	1 3/4	DH01531		9 1/2	4 3/8	9 1/8	9 1/2
	2	DH01532		9 1/2	4 3/8	9 1/4	9 3/4
4	1 3/4	DH01540	7 3/4	10	4 1/4	9 1/2	9 3/4
	2	DH01541		10	4 1/4	9 5/8	10
	2 1/2	DH01542		10	4 1/4	9 7/8	10 1/2
5	2	DH01550	8 1/4	11 1/4	4 3/4	10 3/8	10 1/2
	2 1/2	DH01551		11 1/4	4 3/4	10 5/8	11 8
	3	DH01552		11 1/4	4 3/4	10 5/8	11
	3 1/2	DH01553		11 1/4	4 3/4	10 5/8	11
6	2 1/2	DH01560	9 3/8	11 3/4	5 1/8	11 3/4	11 7/8
	3	DH01561		11 3/4	5 1/8		
	3 1/2	DH01562		11 3/4	5 1/8		
	4	DH01563		11 3/4	5 1/8		
7	3	DH01570	10 1/2	13 1/8	5 3/4	13	13
	3 1/2	DH01571		13 1/8	5 3/4		
	4	DH01572		13 1/8	5 3/4		
	4 1/2	DH01573		13 1/8	5 3/4		
	5	DH01574		13 1/8	5 3/4		
8	3 1/2	DH01580	11 1/2	14 1/2	6 3/4	14 1/4	14
	4	DH01581		14 1/2	6 3/4		
	4 1/2	DH01582		14 1/2	6 3/4		
	5	DH01583		14 1/2	6 3/4		
	5 1/2	DH01584		14 1/2	6 3/4		
10	4 1/2	DH15100	15 1/2	—	8 7/8	18 3/8	18
	5	DH15101		—	8 7/8	18 3/8	18 1/2
	5 1/2	DH15102		—	8 7/8	18 3/8	18 1/2
12	5 1/2	DH15120	18 3/8	—	10 1/2	21 1/4	20 7/8
	7	DH15121		—	10 1/2	21 1/4	20 7/8
14	7	DHM15140	15 5/8	—	—	20 5/8	22 5/8
	8	DHM15141		—	—	21 1/8	23 3/8
	10	DHM15142		—	—	23 3/8	27 3/8
16	8	DHM15160	18 3/8	—	—	24 1/4	26 5/8
	9	DHM15161		—	—	25 7/8	29 7/8
	10	DHM15162		—	—	26 1/4	30 5/8
18	9	DHM15180	22	—	—	29 1/2	33 1/4
	10	DHM15181		—	—	29 7/8	34

*Note: These dimensions are to be substituted for the related mounting dimensions given on the preceding pages. All dimensions given on this table are plus stroke.

KEY MOUNT CYLINDERS

The *Milwaukee Cylinder* Key Mount retainer plate is a mounting option designed to add rugged stability to foot and side mount cylinders. The retainer plate is extended below the mounting surface of the cylinder. This extension may be fitted into a milled keyway in your mounting pad, eliminating the need for welded keys or locator pins.



KEY MOUNT CYLINDERS

Bore Ø	E	F	FA	G	PA	PD
1½	2½	¾	.312/.310	1¼	¾	17/16
2	3	¾	.562/.560	1¼	5/16	113/16
2½	3½	¾	.562/.560	1¼	5/16	21/16
3¼	4½	¾	.687/.684	2	¾	25/8
4	5	7/8	.812/.809	2	7/16	215/16
5	6½	7/8	.812/.809	2	7/16	311/16
6	7½	1	.937/.934	2¼	½	4¼
7	8½	1	.937/.934	2¾	½	4¾
8	9½	1	.937/.934	3	½	5¼
10	125/8	111/16	1.625/1.620	311/16	13/16	71/8
12	147/8	115/16	1.875/1.870	47/16	13/16	83/8

Key Mount is not available on larger bore cylinders.

HOW TO ORDER

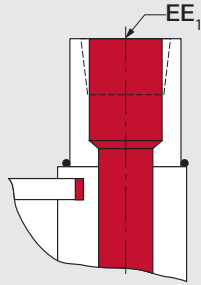
For ordering information refer to Page 32.



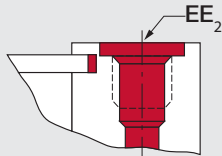
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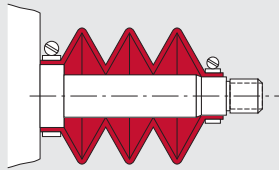
Port Locations



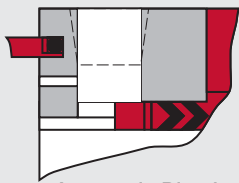
Enlarge Port Welded Boss



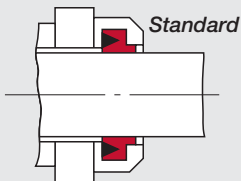
SAE Straight Thread O-ring Port



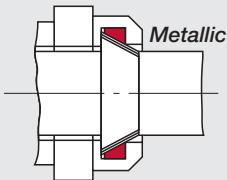
Rod Boots



Automatic Bleed



Standard



Metallic

Metallic Rod Wipers

DESIGN OPTIONS

Standard Ports

The Milwaukee Cylinder Series H cylinders are manufactured as standard, with the largest possible NPTF tapered thread ports that will fit in both the rod and blind ends of a given bore size. Upon request, extra ports can be provided on the sides of the end caps not occupied by mountings or cushion adjusters.

Enlarge Ports

On most bore sizes, welded bosses may be provided for enlarge NPTF ports. These bosses protrude from the sides of the end caps. For information as to the boss height in relation to your bore and port requirements, contact the factory. Also, special heavier end caps can be provided to accommodate enlarge ports without the use of a welded boss.

Straight Thread Ports

On request, an SAE straight thread O-Ring port can be used on the Series H cylinders. In addition to the standard enlarge NPTF ports, welded bosses may also be used for enlarge SAE straight thread O-Ring ports. For further information contact the factory.

Note: Flange and manifold style ports are available.

Bleeder Ports

Bleeder ports are not regularly furnished with Series H cylinders. Automatic air bleeds are standard on non-cushion cylinders. Bleeder ports are available upon request. They will be placed on either end cap or on the tube.

4-Bolt Flange Ports

Heavy-duty Hydraulic Cylinders

Bore Ø	Rod Ø	Nominal Flange Size (in)
3¼	1.38	.75
	1.75	.75
	2.00	.75
4	1.75	.75
	2.00	.75
	2.50	.75
5	2.00	.75
	2.50	.75
	3.00	.75
	3.50	.75
6	2.50	1.00
	3.00	1.00
	3.50	1.00
	4.00	1.00
7	3.00	1.25
	3.50	1.25
	4.00	1.25
	4.50	1.25
8	5.00	1.25
	3.50	1.50
	4.00	1.50
	4.50	1.50
	5.00	1.50
	5.50	1.50

NOTE: Some flange overhang will occur on heads or caps in most cylinder designs. Overhang may interfere with some end mountings.

Rod Boots

When cylinders are used in areas of high contamination or where contaminants have an air hardening property, the exposed piston rod should be covered with a rod boot to protect the rod bearing and seals. A rod boot is simply a collapsible cover. It is of sewn construction made from a neoprene coated fabric. The rod boots are impervious to oil, grease and water.

They will operate effectively from 0° F to +200° F without cracking. For additional details on Rod Boots, please see page 186.

Metallic Rod Wipers

If requested metallic rod wipers will be supplied in place of the standard synthetic rubber wiper. This type of seal is recommended for applications where contaminants would tend to cling to the rod and damage a standard synthetic rubber rod wiper.

PORT SIZES

Bore Ø	Standard NPTF Port EE	Enlarged NPTF Port EE ₁	SAE Straight O-Ring Port EE ₂	SAE Standard Thread Series
1½	½	¾	#10	7/8-14
2	½	¾	#10	7/8-14
2½	½	¾	#10	7/8-14
3¼	¾	1	#12	1¼-12
4	¾	1	#12	1¼-12
5	¾	1	#12	1¼-12
6	1	1¼	#16	1¾-12
7	1¼	1½	#20	1¾-12
8	1½	2	#24	1¾-12
10	2	2½	#24	1¾-12
12	2½	3	#32	2½-12

DESIGN OPTIONS FOR SPECIAL CYLINDERS

Special Rod Ends

Modifications of standard or entirely special rod ends are available from *Milwaukee Cylinder*. When your requirements call for a special rod end style, your order should include a sketch if it is to be an entirely special rod end or note reference as to which letter dimensions you wish to have modified (see inside cover).

Special Assemblies from Standard Parts

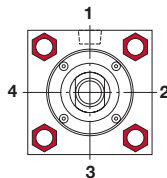
Each style of the various standard cylinder mountings is illustrated, using the commonly recognized cylinder dimensional symbols of the National Fluid Power Association. Each side of the end views are numbered to aid in communication when referring to the relationship between the ports and the mountings. When requesting information or placing an order that requires a dimension other than standard, always make reference to the given dimensional symbol in the catalog and then give your requirements.

Cushion Adjustment Locations

A ball check and a cushion adjustment needle are supplied as standard in position #2 on most models. The cushion needle and ball check are interchangeable as far as location and may be put in any side not occupied by a port or mounting.

Port Locations

Ports are located in position #1 as standard unless otherwise specified. By using the position numbers given with the end views in the dimensional data section of this catalog, ports can be arranged in any one of four 90° positions in relation to the cylinder mounting. When ports are relocated on a cushioned cylinder, the cushion needle and ball check are automatically relocated to hold their relationship to the port as on a standard cylinder, unless otherwise specified at the time of the order.



Removable Trunnion Pins

Removable trunnion pins are available on models H71 and H72 at a nominal extra charge. They can be used on all bore

and rod combinations, except on the largest oversize rods offered with each bore size on all model H71 cylinders.

Single-Acting Cylinders

Series H cylinders are designed for either single or double action. When used as a single acting cylinder, hydraulic power drives the piston in one direction, only relying on either the load or an external force to return the piston after the pressure is exhausted.

Single-Acting Spring Cylinders

Single-acting spring return cylinders normally have a spring inside of the cylinder to return the piston to its original position. The application load and friction conditions must be specified when placing an order to properly size the spring. Also specify whether the spring is to return or advance the piston. A spring return cylinder is designed with a stop tube to act as spring guide, which prevents binding of the cylinder due to misalignment of the spring. To accurately determine the cylinder length and mounting dimensions for your application, contact your local *Milwaukee Cylinder* representative or the factory.

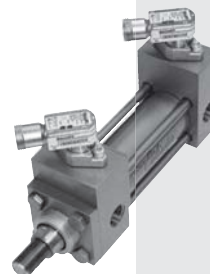
Water Service Cylinders

Series H cylinders can be used with water as an operating fluid with some standard modifications to the types of material and the manufacturing processes used. These modifications will include, at some additional cost, bronze piston, nickel plated end caps, a hard chrome plated cylinder barrel and a chrome plated piston or stainless steel piston rod at extra cost. Due to the increased factors of corrosion, electrolysis and mineral deposits acting within a water fitted cylinder, *Milwaukee Cylinder* cannot warrant or make any guarantees other than a water service cylinder will be free of defects in workmanship or materials.

Proximity Switches

End of Stroke Limit Switches:

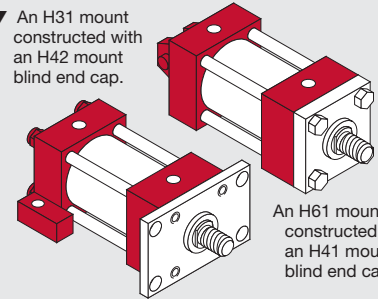
We provide inductive proximity switches for end of stroke sensing. These non-contact switches detect the presence of the spud/cushion bushing. See page 185 for more information.



Combined Mountings

Standard mountings may be combined when specified by the customer. Some examples of this are:

▼ An H31 mount constructed with an H42 mount blind end cap.



An H61 mount constructed with an H41 mount blind end cap.

These and other combinations can be readily made from standard parts. If you are unsure of a possible combination or if it will suit your particular needs, consult with your local *Milwaukee Cylinder* representative or contact the factory.

Adjustable Stroke Cylinders

When a cylinder application requires stroke adjustment, *Milwaukee Cylinder* offers a number of designs, the most common of which is illustrated below. This particular design is externally adjustable, incorporating a threaded rod (of piston rod quality) with the standard hydraulic rod end multiple lip vee seal and bushing design. This provides a proven-effective high and low pressure seal, affording maximum sealing on the stroke adjustment rod.

Further information concerning design limitations, cushioning or alternate designs can be obtained by contacting the factory.

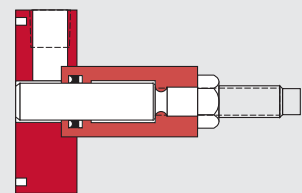
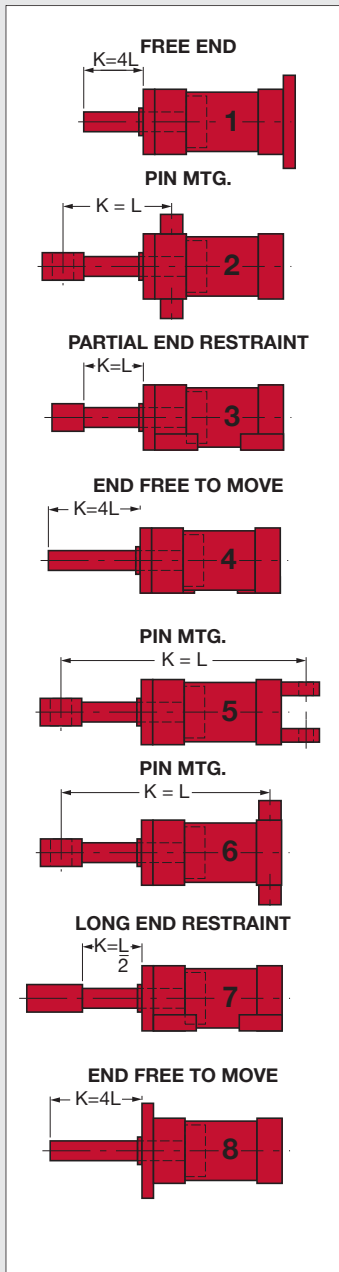


FIGURE 1



i Stop Tubes
 For more information on Stop Tubes, see page 181 in the Design Engineer's Guide.

STOP TUBES

Stop tubes are used to maintain bearing pressure within acceptable limits and are recommended on cylinders with long strokes or poorly guided rods.

The stop tube is a spacer between the rod end cap and the piston, which provides separation between the piston and the rod bearing. This separation reduces the moment forces developed between the rod bearing and piston when the rod is extended.

To determine if stop tube is necessary for your cylinder requirements, you have to solve for "K" (refer to Figure 1). If your required cylinder has a "K" dimension in excess of 40 inches, stop tube is required. For each 10 inch increment or fraction thereof in excess of 40 inches, one inch of stop tube is recommended. When stop tube is required, the overall length of the cylinder will be increased by the length of the stop tube to be used.

To determine "K" (see to Figure 1)

*Note: W = the rod stick out
 (refer to pages 8-27)

Cylinder #1, #4, #8 – see Figure 1

$$K = 4L = 4 (\text{stroke} + W^*)$$

Cylinder #2 - see Figure 1

$$K = L = (CA \text{ or } CE) + XG + \text{Stroke}$$

Note:

CA = rod eye dimension (back inside cover)

CE = rod clevis dimension (back inside cover)

XG = mounting dimension page 18

Cylinder #3 – see Figure 1

$$K = L = W^* + \text{Stroke}$$

Cylinder #5 – see Figure 1

$$K = L = (CA \text{ or } CE) + XC + (2 \times \text{Stroke})$$

Note:

CA = rod eye dimension (back inside cover)

CE = rod clevis dimension (back inside cover)

XC = mounting dimension page 18

Cylinder #6 – see Figure 1

$$K = L = (CA \text{ or } CE) + XJ + (2 \times \text{Stroke})$$

Note:

CA = rod eye dimension (back inside cover)

CE = rod clevis dimension (back inside cover)

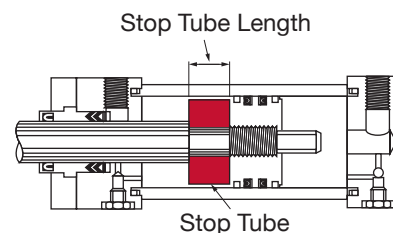
XJ = mounting dimension page 18

Cylinder #7 – see Figure 1

$$K = L/2 = (W^* + \text{Stroke})/2$$

When mounting long stroke cylinders, care should be taken to assure cylinder alignment over the entire length of stroke. The use of external guides or swivel bushings is recommended to reduce side load conditions and prolong the cylinder's service life.

Note: Stop tube length must be added to "K" factor before making final selection of rod size. This is primarily true in No. 5 long stroke applications.



The stop tube is located between the piston and the rod end cap. It limits the extended stroke of the cylinder, providing additional strength for less cost and reduced weight than the use of an oversize rod.

▼ TABLE 1 - VALUE OF "K" IN INCHES

Thrust Force (in-lbs)	Piston Rod Diameter (in)															
	5/8	1	1 1/8	1 1/4	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	7	8	9	10
400	35	84	134	-	-	-	-	-	-	-	-	-	-	-	-	-
700	30	68	119	-	-	-	-	-	-	-	-	-	-	-	-	-
1,000	26	60	105	156	190	-	-	-	-	-	-	-	-	-	-	-
1,400	24	54	93	144	175	244	308	-	-	-	-	-	-	-	-	-
1,800	23	48	84	127	160	230	294	366	-	-	-	-	-	-	-	-
2,400	18	45	75	114	145	214	281	347	-	-	-	-	-	-	-	-
3,200	16	40	68	103	131	196	262	329	398	-	-	-	-	-	-	-
4,000	12	38	63	93	119	174	240	310	373	446	-	-	-	-	-	-
5,000	9	36	60	87	112	163	225	289	359	426	-	-	-	-	-	-
6,000	-	30	56	82	102	152	209	274	342	411	476	-	-	-	-	-
8,000	-	25	51	76	93	136	186	244	310	375	448	-	-	-	-	-
10,000	-	21	45	70	89	125	172	221	279	349	412	-	-	-	-	-
12,000	-	17	41	64	85	117	155	210	270	326	388	455	-	-	-	-
16,000	-	-	35	57	75	110	141	188	233	291	350	421	-	-	-	-
20,000	-	-	28	52	66	103	136	173	218	270	325	385	-	-	-	-
30,000	-	-	-	39	56	87	120	156	190	232	285	330	-	-	-	-
40,000	-	-	-	24	43	75	108	142	177	210	248	293	-	-	-	-
50,000	-	-	-	-	30	66	97	131	165	201	234	268	408	-	-	-
60,000	-	-	-	-	-	57	88	119	154	190	226	256	384	-	-	-
80,000	-	-	-	-	-	36	71	104	136	170	204	240	336	-	-	-
100,000	-	-	-	-	-	-	56	91	120	154	199	224	324	400	-	-
120,000	-	-	-	-	-	-	45	76	108	146	174	207	313	377	-	-
140,000	-	-	-	-	-	-	-	64	98	129	162	194	301	365	-	-
160,000	-	-	-	-	-	-	-	47	87	118	149	182	279	350	421	-
200,000	-	-	-	-	-	-	-	-	65	98	131	160	260	330	402	-
250,000	-	-	-	-	-	-	-	-	-	72	109	143	236	301	375	-
300,000	-	-	-	-	-	-	-	-	-	85	120	152	212	281	351	420
350,000	-	-	-	-	-	-	-	-	-	53	100	195	261	328	396	-
400,000	-	-	-	-	-	-	-	-	-	-	72	182	241	309	374	-
500,000	-	-	-	-	-	-	-	-	-	-	-	152	212	274	341	-
600,000	-	-	-	-	-	-	-	-	-	-	-	-	114	183	247	310
700,000	-	-	-	-	-	-	-	-	-	-	-	-	70	162	221	280

▼ TABLE 2 - DEDUCTIONS FOR PULL STROKE FORCE & DISPLACEMENT

Piston Rod Ø	Piston Rod Area	Cylinder Force in Pounds for Various Pressures							Displacement /in of Stroke	
		500 psi	750 psi	1000 psi	1250 psi	1500 psi	2000 psi	3000 psi	Gallons Oil Displaced	
5/8	.307	154	230	307	384	461	614	921	.00133	
1	.785	393	589	785	981	1178	1570	2355	.00340	
1 1/8	1.485	743	1114	1485	1856	2228	2970	4455	.00643	
1 1/4	2.405	1203	1804	2405	3006	3608	4810	7215	.01041	
2	3.142	1571	2357	3142	3928	4713	6284	9426	.01360	
2 1/2	4.909	2455	3682	4909	6137	7364	9818	14730	.02125	
3	7.069	3535	5302	7069	8836	10600	14140	21210	.03060	
3 1/2	9.621	4811	7216	9621	12026	14430	19240	28860	.04165	
4	12.57	6285	9428	12570	15708	18860	25140	37710	.05442	
4 1/2	15.90	7950	11920	15900	19880	23850	31800	47700	.06883	
5	19.64	9818	14726	19635	24544	29452	39270	58905	.08500	
5 1/2	23.76	11880	17820	23760	29698	35640	47520	71280	.10286	
7	38.48	19240	28860	38480	-	57720	76920	115400	.1668	
8	50.27	25135	37700	50270	-	75400	100500	150810	.2177	
9	63.62	31810	47720	63620	-	95430	127200	190860	.2753	
10	78.54	39270	58900	78540	-	117810	157100	235620	.3396	

▼ TABLE 3 - THRUST FORCE AND DISPLACEMENT

Cylinder Bore Ø	Piston Area	Cylinder Force in Pounds for Various Pressures							Displacement /in of Stroke	
		500 psi	750 psi	1000 psi	1250 psi	1500 psi	2000 psi	3000 psi	Gallons Oil Displaced	
1 1/2	1.767	884	1325	1767	2209	2651	3534	5301	.00765	
2	3.142	1571	2357	3142	3928	4713	6284	9426	.01360	
2 1/2	4.909	2455	3682	4909	6137	7364	9818	14730	.02125	
3 1/4	8.296	4148	6222	8296	10370	12440	16590	24890	.03591	
4	12.57	6285	9428	12570	15708	18860	25140	37710	.05442	
5	19.64	9820	14730	19640	24544	29460	39280	58920	.08502	
6	28.27	14140	21200	28270	35342	42400	56540	84810	.12230	
7	38.49	19240	28870	38490	48106	57740	76980	115500	.16660	
8	50.27	25140	37700	50270	62832	75400	100500	150800	.21760	
10	78.54	39270	58900	78540	98175	117800	157100	235600	.34000	
12	113.1	56550	84820	113100	141375	169600	226200	339300	.48960	
14	153.9	76950	115400	153900	-	230800	307800	461700	.66620	
16	201.1	100600	150800	201100	-	301600	402200	603300	.8706	
18	254.5	127200	190900	254500	-	381800	509000	763500	1.102	
20	314.2	157100	235600	314200	-	471300	628400	942600	1.306	

CYLINDER SIZING

The selection of the correct rod size is one of the most important factors in sizing a cylinder. The standard rod for each bore size that *Milwaukee Cylinder* manufactures is sufficient to handle the maximum tension force that the cylinder is capable of producing. It is primarily in compression and long stroke, high thrust applications that the column strength needs to be considered.

The following steps should be used to determine the proper rod size for an application:

1. Select the cylinder bore size required from Table 3 based on the required cylinder thrust force and the operating line pressure at the cylinder.
2. Determine the length between mounting points or "L" as shown on Figure 1, page 30.
3. Based on the distance between mounting points ("L"), determine the value of "K" as shown on Figure 1, page 30.
4. Using the thrust force and the developed "K" dimension, refer to Table 1 to select the proper rod size.
5. If an oversized rod is required, re-check the overall length dimension ("K") in Step 1 and confirm your previous rod size selection.

To determine the cylinder pull (tension), stroke force, or displacement, deduct the force or displacement corresponding to the rod size in Table 2 from the force or displacement corresponding to the bore size shown in Table 3.

Feature	Description	Page Number	Code Number	Example
Double Rod End		26	D	<p>H01541 - 31 - 1 4 - 7 x 14³/₄</p>
Cylinder Code	Refer to Table 1H	9, 11, 13, 15, 17 19, 21, 23, 25	—	
Mounting Style	Model Number Only	8, 10, 12, 14, 16 18, 20, 22, 24	—	
Rod End Style	Code Number	inside front cover	—	
Cushions	None	—	1	
	Rod End	—	2	
	Blind End	—	3	
	Both Ends	—	4	
Cylinder Modifications	Special		S	
Seals	BUNA-N (-20° to 200° F)		7	
	Viton (-15° to 350° F)		8	
	Special		S	
Stroke	Specify in Inches Including Fractional Requirements		—	

***NOTE:** Use "S" if any special design features or seals are required, describe in detail on your order.

EXAMPLE: The code for a hydraulic cylinder 4" bore, 2" rod, rod end rectangular flange mounting, Style No. 1 rod end, cushion both ends, standard seals with a 14³/₄" stroke is: **H01541-31-14-7x14³/₄**.



DUPLICATE CYLINDERS

Duplicate cylinders can be ordered by giving the serial number from the nameplate of the original cylinder. Factory records supply a quick, positive identification.



MilCad Cylinder Configurator

Visit milwaukeekecylinder.com to configure and download CAD files of your cylinders.

HOW TO ORDER

Series H Cylinders

Standard Series H Cylinders can be completely and accurately described by a model number. If your requirements are completely standard, select the alphanumeric codes from above that represent your cylinder and place them in the sequence indicated by the example. Use of the cylinder model number will eliminate untimely delays in handling your order.

General Order Data

1. Bore & Rod Size or the Cylinder Code: (refer to pages 8-27)
2. Mounting Style: (refer to page 8-27)
3. Rod End Style: (refer to inside cover, page ii)
4. Cushion Requirements
5. Length of Stroke

Application Data

1. **Port Requirements:** refer to page 28.
2. **Operating Fluid or Medium:** Series H Cylinders are equipped with seals for use with hydraulic oil. If other than a quality grade hydraulic oil will be used, specify the type of fluid in your order. See page 184 for more details.
3. **Temperature Range:** Series H Hydraulic Cylinders contain seals of Nitrile (Buna-N) suitable to -20° F to +200° F. Specify your operating temperature if your application does not fall within this temperature range.
4. **Operating Pressure:** Series H Cylinders are rated for 3000 PSI. If your requirements are in excess of the rated pressure, describe your application in your order.
5. **Accessories:** Specify any accessories you require, using the part numbers given on the inside back cover.
6. **Special Requirements:** If you require special seals, rod material, stop tube, center support, adjustable stroke or any other special requirements not covered, specify in detail on your order.

REPLACEMENT SEALS OR CYLINDER PARTS

For replacement seals or cylinder parts, the serial number of your cylinder, the cylinder model number and the item number of the part you require (below) should appear on your order. To order entire seal kits for your cylinder, simply specify the serial number and the cylinder model number from page 32 on your request for service parts.

HOW TO ORDER COMPLETE SEAL KITS

When ordering complete seal kits, specify the following information on your order:

1. The serial number of the cylinder the seals will be used on.
2. The bore and rod size.
3. If the cylinder is cushioned.

To eliminate untimely delays in the handling of your order, please use the seal kit code as shown in the example below:

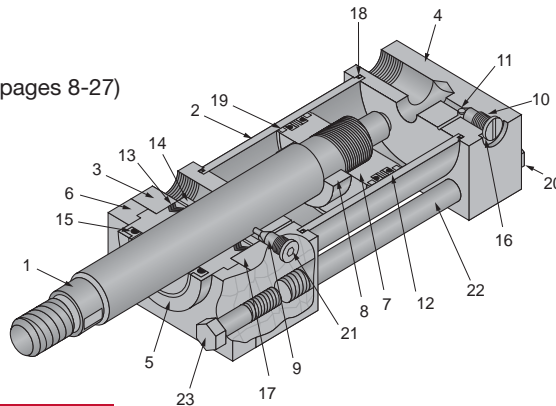
Example:

Buna-N Kit No. XXXXX-7-40

- cylinder code number (refer to pages 8-27)

Viton Kit No. XXXXX-8-40

- cylinder code number (refer to pages 8-27)



STANDARD PARTS LIST

Item No.	Description
1	Piston Rod
2	Cylinder Barrel
3	Head End Cap
4	Cap End Cap
5	Rod Bushing
6	Retainer Plate
7	Piston
8	Cushion Plunger
9	Cushion Adj. Plunger
10	Ball Check Retainer
11	Ball Check
12	U-Cup Seal & Backup Washer for Piston
13	Rod Vee Ring Set
14	Rear Bearing Ring
15	Rod Wiper
16	O-Ring Seal for Ball Check Retainer
17	Wave Spring
18	Cylinder Barrel O-Ring & Backup Washer
19	Cast Iron Piston Ring, Standard
20	Tie Rod Flex Lock Nut
21	O-Ring Seal for Cushion Adj. Needle
22	Tie Rod
23	Self-Locking Cap Screw

Retainer Plate Cap Screw Torques

▼ For Square Retainers

Bore Ø	Torque (Ft-lbs)
1½	10
2	20
2½	20
3¼	40
4	40
5	75
6	100

▼ For Circular Retainers

Bore Ø	Rod	Torque (Ft-lbs)
1½	All	3
2	All	6
2½	1, 1⅝	6
	1¾	10
3¼	All	10
4	All	10
5	All	10
6	2½	10
	3, 3½, 4	30
7	All	30
8	3½ - 5	30
	5½	50
10	4½ - 5	30
	5½	50
12	5½	50
	All	50

Tie-rod Nut Torques

▼ Nut Torque Specifications

Bore Ø	Torque (Ft-lbs)
1½	25
2	45
2½	45
3¼	125
4	125
5	300
6	400
7	600
8	900
10	2500
12	3700

When it is necessary to remove the tie-rod nuts on a cylinder, they must be reassembled to the torque specifications given above. To prevent the tie-rods from twisting when tightened, use a vice grip or locking clamp. Note that the torque specification is based on lubricated threads.

INSTALLATION FOR SERIES H

General Information

Cleanliness

The most important consideration when installing the cylinder. When cylinders are shipped from *Milwaukee Cylinder*, the ports are securely plugged with plastic plugs which should not be removed until the piping is to be installed. All piping should be thoroughly clean, to include the removal of all threading and flaring burrs or chips, before making the connection to the cylinder ports. One chip can cause premature failure of the cylinder or other hydraulic system components.

Alignment

Improper alignment will result in excessive cylinder wear. Check to assure rod alignment between the cylinder and its mating component on your machine in both the extended and retracted positions.

Environment

Cylinders operating in areas where there is weld splatter, fast drying chemicals, paint, excessive heat or other hazardous conditions, should have covers or shields to prevent damage to the rod and rod seals.

Bleeding

Air within the cylinder or system will cause erratic operation of the cylinder. *Milwaukee Cylinders* generally do not require bleed ports if the cylinder ports are mounted in an upright position. Several full strokes of the cylinder will purge air from the cylinder into the circuit piping, where it can be bled off. Bleeder ports are available for applications where the cylinder is the high point of the circuit or where the cylinder does not complete a full stroke during its normal cycle.

MOUNTING RECOMMENDATIONS

Foot Mounted Cylinders

The use of high strength alloy steel mounting bolts 1/16" smaller than the hole size is recommended. After final alignment, foot mounted cylinders should be dowel pinned in place.

Trunnion Mounted Cylinders

Lubricated pillow blocks designed for close tolerance applications should be used. It is important to rigidly mount and align the pillow blocks so that the trunnion pins will not be subjected to any extreme bending moments. The rod end should be pivoted with the pivot pin in line and parallel to the axis of the trunnion pins.

Flush Mount Cylinders

The use of high strength alloy steel mounting bolts is recommended. Shear keys should be used to reduce the stress on the mounting bolts created by the normal push and pull forces created by the cylinder cycle.

Flange Mount Cylinders

The controlled diameter rod bushing extension can be used as a pilot to locate the flange mount. Dowel pins should be used after the cylinder is mounted and aligned to prevent shifting.

Clevis Mount Cylinders

This type of cylinder must be pivoted at both ends and the pins must be in line and parallel to each other. After the cylinder is mounted, the customer should check to assure that the cylinder is free to swing through its working arc without interference from other machined parts.

STORAGE

Often times, cylinders are delivered before a customer is prepared to install them and must be stored for a period of time. When storage is required:

1. Select an area indoors for storage, which has dry and non-corrosive atmosphere. Take caution to protect the cylinder from both internal and external corrosion.
2. Cylinders to be stored should be kept in a vertical position (piston rod up) whenever possible.
3. Port protector plugs should be kept in the cylinder ports until the time of installation.

CYLINDER TROUBLE SHOOTING

1. External leakage

If leaking occurs between the end cap and barrel, check tie-rod torque. Do not over torque. If the torque is correct, then replace the barrel seal. When leakage occurs in the rod bushing area, replace the rod seals. If leakage continues or reoccurs in short period of operation, check items 2 thru 5, page 33.

2. Cylinder misalignment

Side load is a common problem which occurs when the cylinder application does not allow the piston rod to work in line during the extend and retract motions of the cylinder. Evidence of this is excessive seal failure, bushing wear or galling of the piston rod. Often, bending of the piston rod or complete failure (breakage) of the rod occurs.

3. Contamination on the piston rod

Dirt and other material is often picked up when the piston rod is extended. When the rod is retracted in an excessive dirty application, it often carries the dirt back into the rod seal cavity of the cylinder, causing damage to the seals. With a slight modification of the cylinder rod end, a rod boot can be added to protect the rod bushing and seals for most applications.

4. Bad mountings

Due to wear of pivot pins or mounting bolts working loose, a cylinder may have side load, even though the rod was in line when the cylinder was first installed. All cylinder mountings should be checked periodically.

5. Damaged piston rod

An extended piston rod can be damaged by the impact of a hard object which could burr the rod. If this occurs, the rod should be checked immediately to prevent seal damage.

6. Internal leakage

Inside the cylinder, leakage past the piston seals can cause sluggish movement or settling of the cylinder under load conditions. This occurs due to leakage of worn piston seals or rings.

7. Creeping cylinder

When a cylinder is stopped in midstroke and it creeps, check for internal leakage. Creeping can also be caused by a worn control valve and this should be checked, even if the cylinder is found to have internal leakage.

8. Erratic operation

When a cylinder is erratic or sluggish in operation, this may be caused by a number of problems. The most common cause of sluggish operation is air in the system. Internal leakage could also be a

cause. If the system starts out sluggishly and, as it warms, speeds up, the oil may be of too high viscosity. The whole system should be checked for worn components if after these checks, the cylinder is still operating in a sluggish manner.

CYLINDER MAINTENANCE

Rod Seal Replacement

When changing rod seals, extend the piston rod 3" or more if possible, being sure to support the rod at all times. Remove the retainer plate screws (if tie-rod nuts have to be removed, refer to the nut torque specification on this page when reassembling the cylinder), retainer plate and outer bushing. Using an eye hook or thin screwdriver, pry the vees from the end cap cavity (if low pressure air is applied to the rod end port, this will help to force the vees from the cavity). The new set of vees should be assembled into the cavity separately and lubed with the soft vee in the center. Replace the rod wiper in the bushing and reassemble the cylinder.

Piston Seal Replacement

When changing piston seals, extend the piston rod 3" or more if possible, being sure to support the piston rod and the piston at all times. *Remove the tie-rod nuts, blind end cap, the barrel and then the piston seals. A light grease, compatible with the system fluid, should be used on the rings and block vee seals for smooth assembly. Install the block vee piston seals, scarf cutting on only the back-up washers. Then install the cast iron rings with the joints in opposite directions. To reassemble, start the piston into the tube, compressing the cast iron rings using twine or a ring compressor. When the piston block vee seal is to the edge of the barrel, use a thin rounded blade to start the lip of the block vee, making sure the entire lip is started before moving the piston further into the tube.

***Note:** When a cylinder has been disassembled this far, the barrel seals should at least be inspected, if not replaced.

Barrel Seal Replacement

When replacing barrel seals, use the same method of disassembling the cylinder as used when replacing piston seals. The barrel seal consists of a backup washer and O-Ring, which is assembled on the first step of both ends of the tube, with the backup washer going on first. The outer diameter of the tube groove on the end caps must be checked for nicks or burrs and then greased. Position the end caps squarely on the tube (check to make sure port location is correct) and firmly force or tap the end cap over the tube until it bottoms. Check to make sure the O-Ring did not shear and then finish assembling the cylinder.

Nut Torque Specifications

Cylinder Bore	Torque (Ft-lbs)
1½	25
2 - 2½	45
3¼ - 4	125
5	300
6	400
8	900
10	2500
12	3700

When it is necessary to remove the tie-rod nuts on a cylinder, they must be reassembled to the torque specifications given above. To prevent the tie-rods from twisting when tightened, use a vice grip or locking clamp. Note that the torque specification is based on lubricated threads.

Series H

Series MH

Series LH

Series A

Series MN

Hyd-Pneum Devices

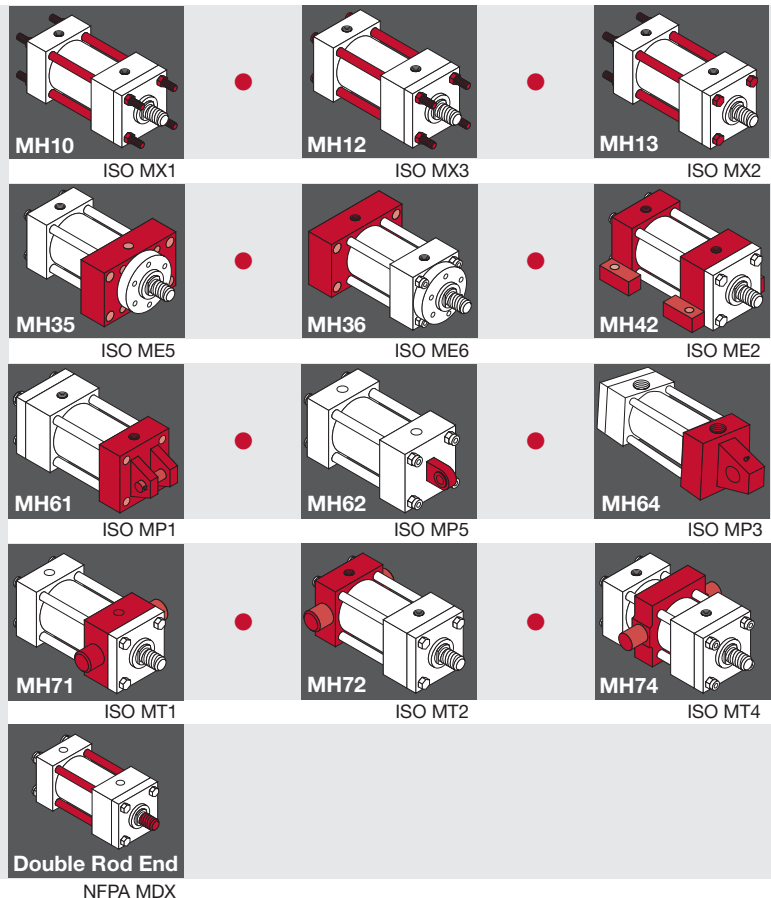
Cyl Accessories

Manipulators

Power Units/Valves

Design Guide

Series MH



Milwaukee Cylinder Series MH ISO Metric Hydraulic Cylinders are built to perform on the toughest applications. Series MH tiered cylinders are built to ISO spec 6020-2, with maximum operating pressures up to 210 bar on all standard bore sizes. If your application requires higher operating pressures, consult our engineers. *Milwaukee Cylinder* helps you solve even more application needs with our expanded ISO Metric Cylinder product line.

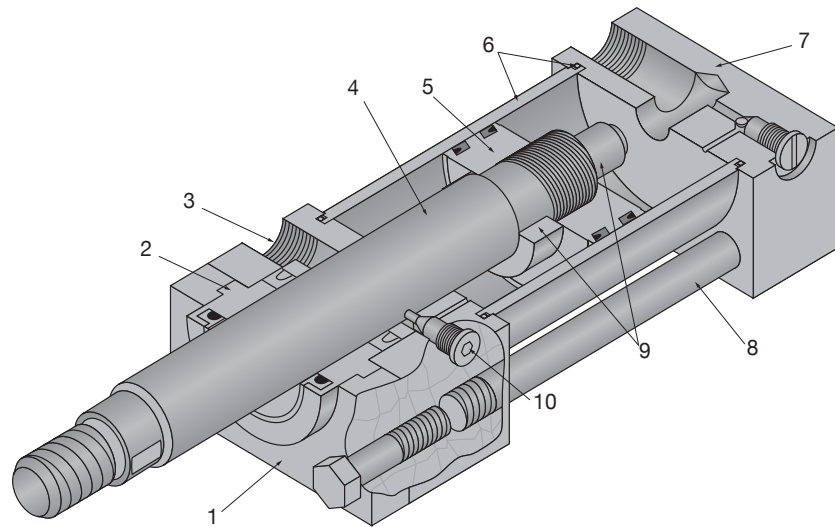
		Page
General	<i>METRIC Cylinder Piston Rod End</i>	<i>Inside Cover page iii</i>
	<i>Standard Specifications and Features</i>	38
	<i>Performance Tested Design Features</i>	39
Mounting Specifications	<i>Tie Rod Mount</i>	40-41
	<i>Solid End Cap and Side Lug Mount</i>	42-43
	<i>Pin Mount</i>	44-45
	<i>Trunnion Mount</i>	46-47
	<i>Double Rod End Cylinders</i>	48
Additional Information	<i>Ordering Information</i>	49

STANDARD SPECIFICATIONS

- Standard construction – square head – tie-rod design
- ISO 6020-2
- Nominal pressure – 210 bar; see info box below
- Standard fluid-hydraulic oil
- Standard temperature – -20° C to +105° C
- Standard bore sizes – 25 mm thru 200 mm
- Standard piston rod diameters 12 mm thru 140 mm
- Standard mounting styles– 12 standard styles and custom designs to suit your needs
- Strokes – available in any practical stroke length
- Cushions – available at either end or both ends of stroke
- Three standard rod end styles and specials designed to order

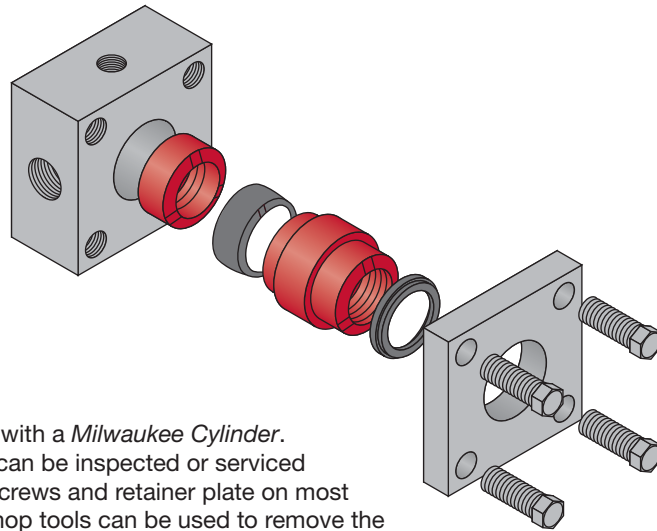
i If your hydraulic operating pressure exceeds 210 bar, send your application data for engineering evaluation and design recommendations.

MilCad Cylinder Configurator
Visit milwaukeeecylinder.com to configure and download CAD files of your cylinders.



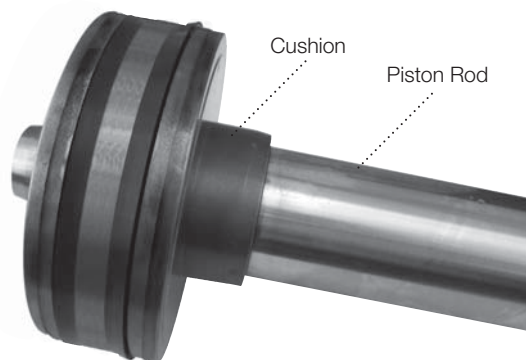
STANDARD FEATURES

- 1. Removable Retainer Plate**
The retainer plate and rod bushing are externally removable without disassembling the cylinder on most standard models. Four capscrews securely hold and lock the retainer plate in place.
- 2. Rod Bushing and Seals**
A U-cup Rod Seal with a supporting bronze bushing is standard in *Milwaukee Cylinder Series MH* Cylinders.
- 3. Ports**
BSPP/G (ISO 1179-1) cylinder ports are standard and can be located to customer requirements. ISO 6149-1 ports optional.
- 4. Piston Rod**
The piston rod is of high strength steel, hardened and plated to resist scoring and corrosion, assuring maximum life.
- 5. Piston**
The piston is of fine grained alloy iron, incorporating u-cup seals, ensuring non-leak Hi-Lo pressure performance. The piston is pilot fitted and threaded to the rod.
- 6. Cylinder Barrel and Seals**
The barrel is of steel tubing, honed to a fine finish to assure superior sealing, minimum friction and maximum seal life.
- 7. End Caps**
End caps and mountings are of high quality steel, precision machined for accurate mounting.
- 8. Tie-Rods and Nuts**
The tie-rods are constructed from a high quality medium carbon steel. On most sizes the threads are rolled for rigid engagement of the self-locking nuts.
- 9. Cushions**
Cushions are machined to close tolerance to provide positive, smooth deceleration at the end of stroke. On all bore sizes, we provide the longest cushion possible based on the rod size and blind end caps. Longer cushions are available; for further information, consult factory.
- 10. Cushion Needle Adjustment and Ball Check**
The cushion needle adjustment valve and cushion-check ball retainer screw are specifically designed to provide full cushion adjustment.



Simple Maintenance...

Simple maintenance is reality with a *Milwaukee Cylinder*. The rod bushing or rod seals can be inspected or serviced by merely removing the cap screws and retainer plate on most models. Standard available shop tools can be used to remove the rod bushing and seals without disturbing the torque on the tie-rods, assuring performance quality with maintenance ease.



Cushions...

The cushion is of a high-grade alloy, precision machined and specially tapered to provide smooth deceleration of the piston at the end of stroke.

A standard manufacturing process at *Milwaukee Cylinder* is to assemble the piston, cushion, and the piston rod; placing the assembly between centers and checking the critical diameters for concentricity.

Piston Rod...

The piston rod is hardened, plated high strength steel, machined and processed to resist scoring and corrosion, assuring maximum life. *Milwaukee Cylinder* offers three rod end styles as standard. **The style #2 rod end with two wrench flats is furnished as standard** unless otherwise specified. Special rod ends and extra wrench flats are also available. They must be specified at the time of order, giving the dimensional requirements and the location of additional wrench flats.

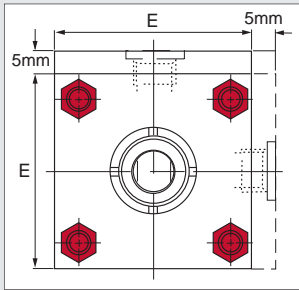
COMBINATION ROD SEAL DESIGN...

The Series MH cylinder design is a one-piece rod bushing with a double lip u-cup rod seal, a supporting bearing ring, and a double lip wiper.

COMBINATION SEALING ROD

The Series MH cylinder combines two bi-directional sealing u-cup seals and a fine grained alloy iron piston. This proven piston seal design is effective at both high and low pressures. The design gives the wear and shock absorbing qualities of cast iron and the near zero leakage of the u-cup seals.

25 & 32mm Bore Cylinders

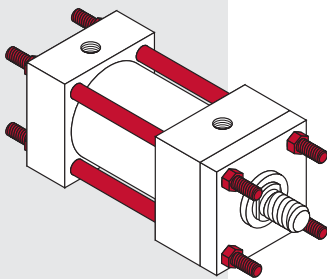


5mm extra height applies to port face at the rod end caps only.

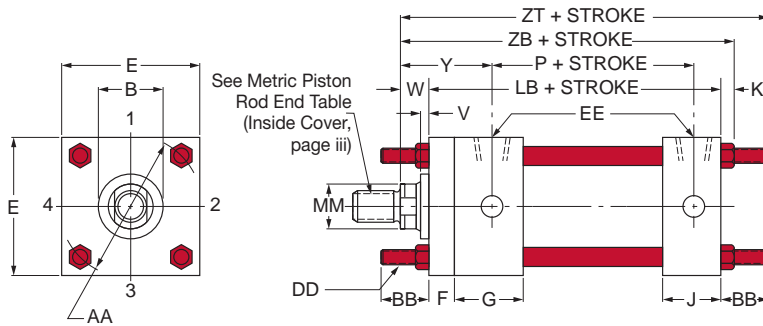
TIE ROD MOUNTED CYLINDERS

The flange and tie-rod mounts are basically the same, except that the cylinder tie-rods are extended and used to mount the cylinder. To prevent misalignment, sagging, or possible binding of the cylinder, when long strokes are required, the free end should be supported. The best use of tie-rods when extending on the blind end is in a thrust load application. When using tie-rods extended on the rod end, the best application is a tension load. Tie rod mounts are suited for many applications, but it should be noted that they are not as rigid as the flange type of mounting.

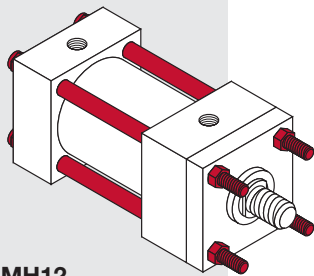
TIE RODS EXTENDED BOTH ENDS



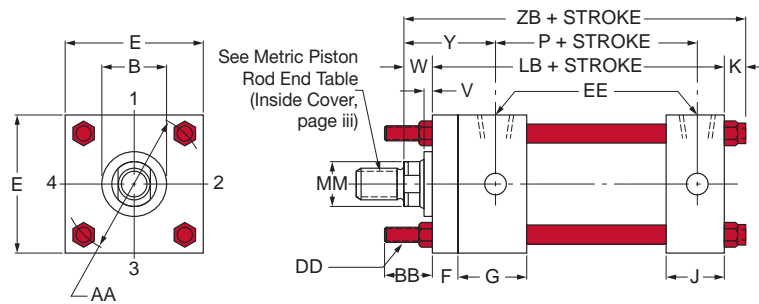
MODEL MH10
ISO STYLE MX1



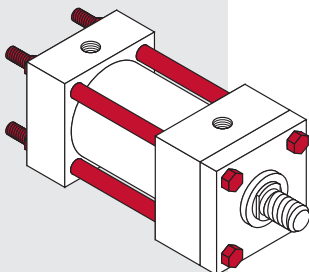
TIE RODS EXTENDED ROD END



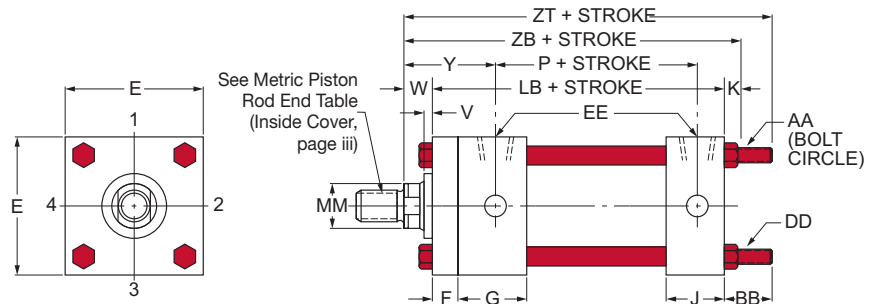
MODEL MH12
ISO STYLE MX3



TIE RODS EXTENDED BLIND END



MODEL MH13
ISO STYLE MX2



▼ TABLE 1MH The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ♦	B	LB	P	V	W	Y	ZB	ZT
25	12	MH0151	24	99	53	6	15	50	121	133
	18△	MH0152	30							
32	14	MH1510	26	103	56	12	25	60	137	152
	22†	MH1511	34							
40	18	MH1520	30	128	73	6	25	62	163	188
	28†	MH1521	42							
50	22	MH1530	34	134	74	6	25	67	174	205
	28	MH1531	42			9				
	36†	MH1532	50			6				
63	28	MH1540	42	136	80	6	32	71	183	214
	36	MH1541	50			9				
	45	MH1542	60			13				
80	36	MH1550	50	159	93	5	31	77	209	249
	45	MH1551	60			9				
	56	MH1552	72			7				
100	45	MH1560	60	168	101	7	35	82	222	262
	56	MH1561	72			10				
	70	MH1562	88			10				
125	56	MH1570	72	197	117	10	35	86	258	313
	70	MH1571	88							
	90	MH1572	108							
160	70	MH1580	88	213	130	7	32	86	273	337
	90	MH1581	108							
	110	MH1582	133							
200	90	MH1590	108	267	165	7	32	98	330	414
	110	MH1591	133							
	140	MH1592	163							

△ Cushions not available on rod end.

† Available with fixed nonadjustable cushions on rod end and standard adjustable cushions on the blind end only.

▼ TABLE 2MH The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	AA	BB	DD	E	EE BSPP	F	G	J	K
25	40	19	M5 X 0.8	40	¼	10	40	25	7
32	47	24	M6 X 1	45	¼	10	40	25	9
40	59	35	M8 X 1	63	¾	10	45	38	10
50	74	46	M12 X 1.25	75	½	16	45	38	15
63	91	46	M12 X 1.25	90	½	16	45	38	15
80	117	59	M16 X 1.5	115	¾	20	50	45	19
100	137	59	M16 X 1.5	130	¾	22	50	45	19
125	178	81	M22 X 1.5	165	1	22	58	58	26
160	219	92	M27 X 2	205	1	25	58	58	28
200	269	115	M30 X 2	245	1¼	25	76	76	31

HOW TO ORDER

For ordering information refer to page 49.

CAUTION NOTES:

NOTES:

- ♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DMH0151. (Refer to page 48.)



Rod End Styles and Dimensions

For rod end styles and dimensions see the table in the inside cover of the brochure "METRIC Piston Rod End Styles".

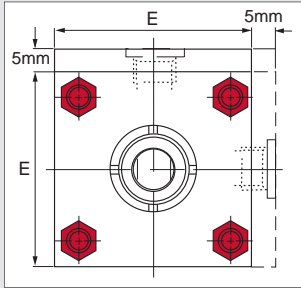
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MilCad Cylinder Configurator

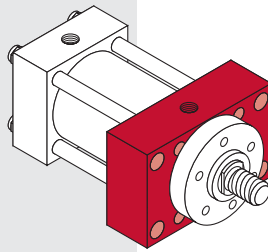
Visit milwaukeekeeylinder.com to configure and download CAD files of your cylinders.

25 & 32mm Bore Cylinders



5mm extra height applies to port face at the rod end caps only.

Flange rated for 210 bar operation.

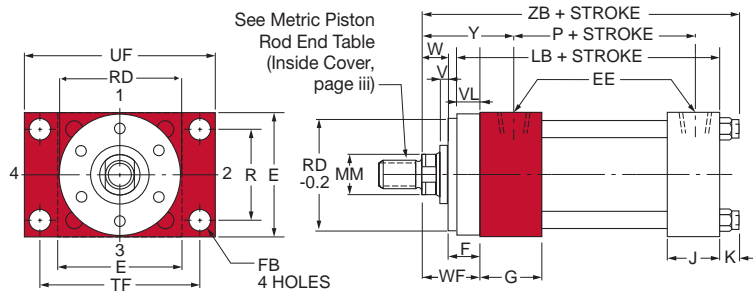


MODEL MH35*
ISO STYLE ME5

SOLID END CAP MOUNTED CYLINDERS

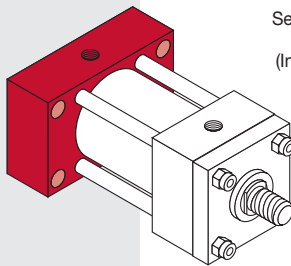
Milwaukee Cylinder's solid end cap mount is one of the strongest, most rigid methods of mounting. This type of rod end cap mounting is best in a tension application. A solid blind end cap mounting is best in a thrust application.

SOLID ROD END CAP MOUNT

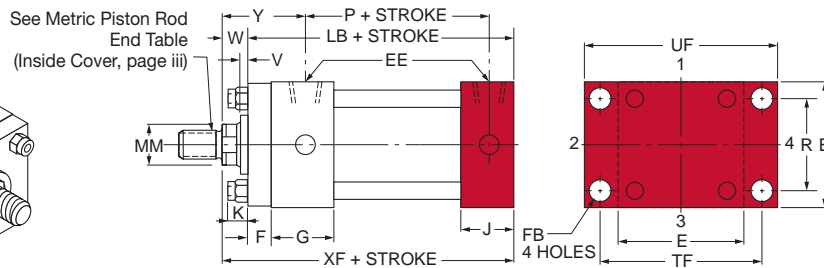


SOLID BLIND END CAP MOUNT

Flange rated for 210 bar operation.



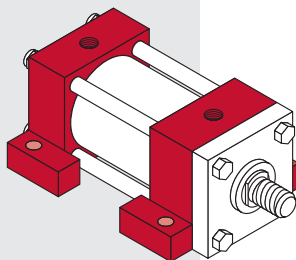
MODEL MH36
ISO STYLE ME6



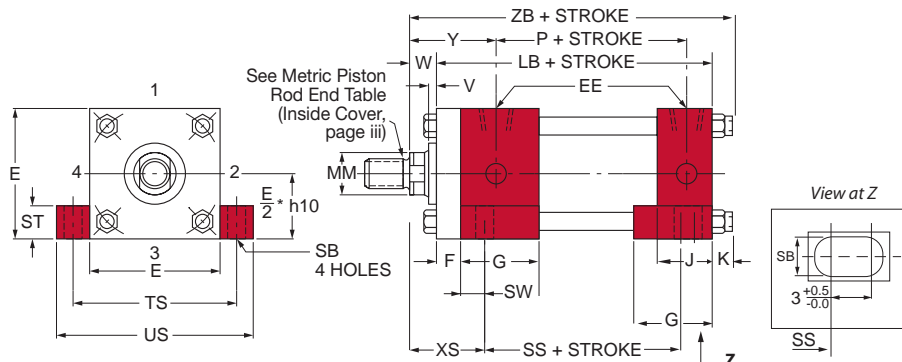
SIDE OR LUG MOUNTED CYLINDERS

The side or lug mounted cylinder provides a fairly rigid mount. These types of cylinders can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves toward the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder is used properly (without misalignment), the mounting bolts are either in simple shear or tension without any compound stresses.

25 mm and 35 mm port at Rod End available in Position #1 only.



MODEL MH42
ISO STYLE MS2



▼ TABLE 1MH The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ♦	B	LB	P	RD f8	SS	V	VL min.	W	WF	XF	XS	Y	ZB
25	12	MH0151	24	99	53	38	72	6	3	15	25	114	33	50	121
	18△	MH0152	30												
32	14	MH1510	26	103	56	42	72	12	3	25	35	128	45	60	137
	22†	MH1511	34												
40	18	MH1520	30	128	73	62	97	6	3	25	35	153	45	62	163
	28†	MH1521	42					12							
50	22	MH1530	34	134	74	74	91	6	4	25	41	159	54	67	174
	28	MH1531	42					9							
	36†	MH1532	50					9							
63	28	MH1540	42	136	80	75	85	6	4	32	48	168	65	71	183
	36	MH1541	50			82		9							
	45	MH1542	60			88		13							
80	36	MH1550	50	159	93	82	104	5	4	31	51	190	68	77	209
	45	MH1551	60			88		9							
	56	MH1552	72			105		9							
100	45	MH1560	60	168	101	92	101	7	5	35	57	203	79	82	222
	56	MH1561	72			105		10							
	70	MH1562	88			125		10							
125	56	MH1570	72	197	117	105	130	7	5	35	57	232	79	86	258
	70	MH1571	88			150		10							
	90	MH1572	108			150		10							
160	70	MH1580	88	213	130	125	129	7	5	32	57	245	86	86	273
	90	MH1581	108			170		7							
	110	MH1582	133			170		7							
200	90	MH1590	108	267	165	150	171	7	5	32	57	299	92	98	330
	110	MH1591	133			210		7							
	140	MH1592	163			210		7							

△ Cushions not available on rod end.

† Available with fixed nonadjustable cushions on rod end and standard adjustable cushions on the blind end only.

▼ TABLE 2MH The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	E	EE BSP	F	FB	G	J	K	R	SB	ST	SW	TS	TF	UF	US
25	40*	¼	10	5.5	40	25	7	27	6.6	8.5	8	54	51	65	72
32	45*	¼	10	6.5	40	25	9	33	9	12.5	10	63	58	70	84
40	63	⅜	10	11	45	38	10	41	11	12.5	10	83	87	110	103
50	75	½	16	14	45	38	15	52	14	19	13	102	105	130	127
63	90	½	16	14	45	38	15	65	18	26	17	124	117	145	161
80	115	¾	20	18	50	45	19	83	18	26	17	149	149	180	186
100	130	¾	22	18	50	45	19	97	26	32	22	172	162	200	216
125	165	1	22	22	58	58	26	126	26	32	22	210	208	250	254
160	205	1	25	26	58	58	28	155	33	38	29	260	253	300	318
200	245	1¼	25	33	76	76	31	190	39	44	35	311	300	360	381


* 25 mm and 35 mm port at rod end available in position #1 only (MH42 only).

HOW TO ORDER

For ordering information refer to page 49.

NOTES:


- ♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DMH0151. (Refer to page 48.) Double rod ends are not available on clevis mount Series MH cylinders



Rod End Styles and Dimensions

For rod end styles and dimensions see the table in the inside cover of the brochure "METRIC Piston Rod End Styles".

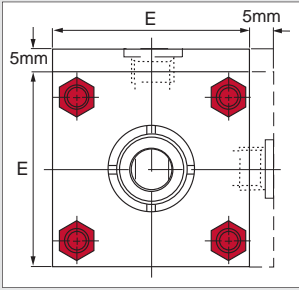
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MilCad Cylinder Configurator

Visit milwaukeekeeylinder.com to configure and download CAD files of your cylinders.

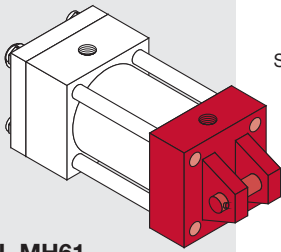
25 & 32mm Bore Cylinders



5mm extra height applies to port face at the rod end caps only.

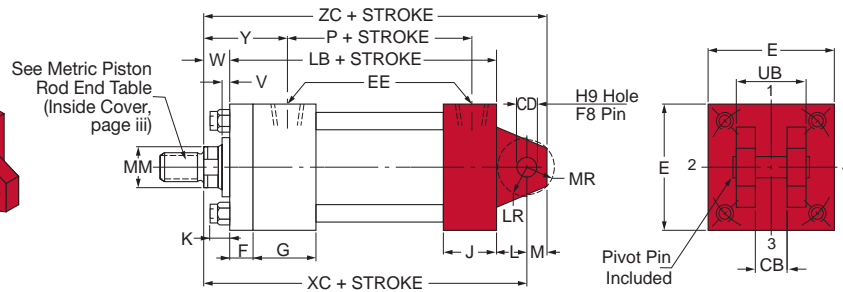
PIN MOUNTED CYLINDERS

All pin cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.

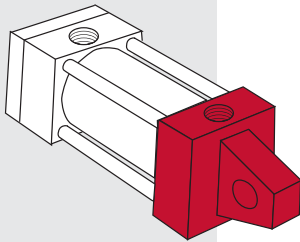


**MODEL MH61
ISO STYLE MP1**

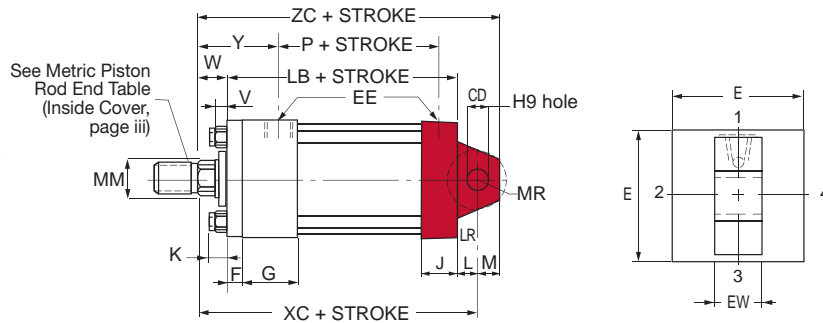
CLEVIS MOUNT



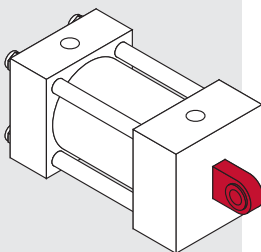
FIXED EYE MOUNT



**MODEL MH64
ISO STYLE MP3**



SPHERICAL EYE MOUNT



**MODEL MH62
ISO STYLE MP5**

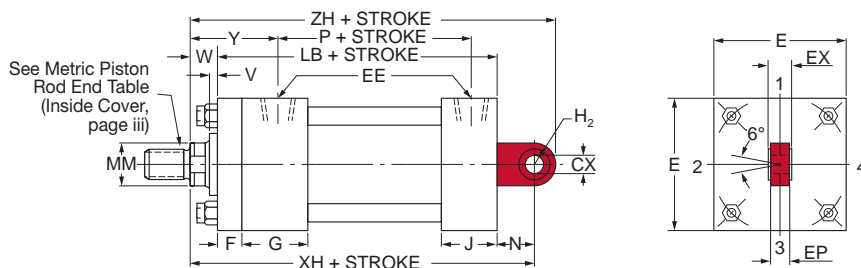


TABLE 1MH The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ♦	B	LB	P	V	W	XC	XH	Y	ZC	ZH
25	12	MH0151	24	99	53	6	15	127	130	50	137	150
	18△	MH0152	30									
32	14	MH1510	26	103	56	12	25	147	148	60	159	170.5
	22†	MH1511	34									
40	18	MH1520	30	128	73	6	25	172	178	62	186	207
	28†	MH1521	42			12						
50	22	MH1530	34	134	74	6	25	191	190	67	211	223
	28	MH1531	42			9						
	36†	MH1532	50			9						
63	28	MH1540	42	136	80	6	32	200	206	71	220	246
	36	MH1541	50			9						
	45	MH1542	60			13						
80	36	MH1550	50	159	93	5	31	229	238	77	257	288
	45	MH1551	60			9						
	56	MH1552	72			9						
100	45	MH1560	60	168	101	7	35	257	261	82	295	323
	56	MH1561	72			10						
	70	MH1562	88			10						
125	56	MH1570	72	197	117	7	35	289	304	86	334	384
	70	MH1571	88			10						
	90	MH1572	108			10						
160	70	MH1580	88	213	130	7	32	308	337	86	367	437
	90	MH1581	108			7						
	110	MH1582	133			7						
200	90	MH1590	108	267	165	7	32	381	415	98	451	535
	110	MH1591	133			7						
	140	MH1592	163			7						

△ Cushions not available on rod end.

† Available with fixed nonadjustable cushions on rod end and standard adjustable cushions on the blind end only.

HOW TO ORDER

For ordering information refer to page 49.

NOTES:

♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DMH0151. (Refer to page 48.) Double rod ends are not available on clevis mount Series MH cylinders.



Rod End Styles and Dimensions

For rod end styles and dimensions see the table

in the inside cover of the brochure "METRIC Piston Rod End Styles".

Page iii



MilCad Cylinder Configurator

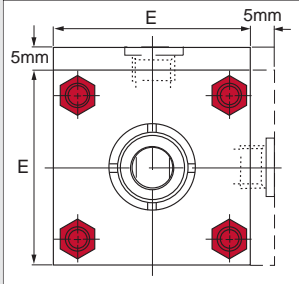
Visit milwaukeeecylinder.com to configure and download CAD files of your cylinders.

TABLE 2MH The dimensions are constant regardless of rod diameter or stroke.

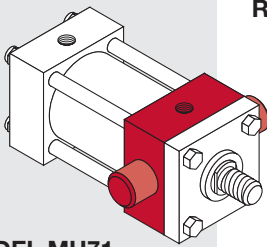
Bore Ø	CB A16	CD	CX	E	EE BSPP	EP	EW h14	EX	F	G	H2 max.	J	K	L	LR	M	MR	N	UB max.
25	12	10	12-0.008	40	¼	8	12	10	10	40	20	25	7	13	12	10	12	16	24
32	16	12	16-0.008	45	¼	11	16	14	10	40	22.5	25	9	19	17	12	15	20	32
40	20	14	20-0.012	63	⅜	13	20	16	10	45	29	38	10	19	17	14	16	25	40
50	30	20	25-0.012	75	½	17	30	20	16	45	33	38	15	32	29	20	25	31	60
63	30	20	30-0.012	90	½	19	30	22	16	45	40	38	15	32	29	20	25	38	60
80	40	28	40-0.012	115	¾	23	40	28	20	50	50	45	19	39	34	28	34	48	80
100	50	36	50-0.012	130	¾	30	50	35	22	50	62	45	19	54	50	36	44	58	100
125	60	45	60-0.015	165	1	38	60	44	22	58	80	58	26	57	53	45	53	72	120
160	70	56	80-0.015	205	1	47	70	55	25	58	100	58	28	63	59	59	59	92	140
200	80	70	100-0.020	245	1¼	57	80	70	25	76	120	76	31	82	78	70	76	116	160

For Package and Mounting Dimension see Tables 1MH and 2MH.

25 & 32mm Bore Cylinders



5mm extra height applies to port face at the rod end caps only.



MODEL MH71
ISO STYLE MT1

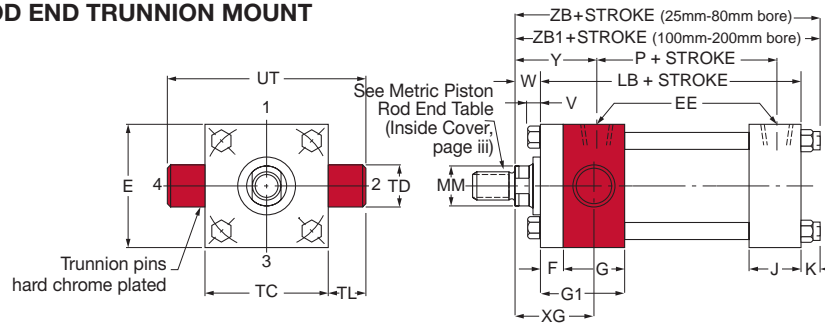
TRUNNION MOUNTED CYLINDERS

All trunnion cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.



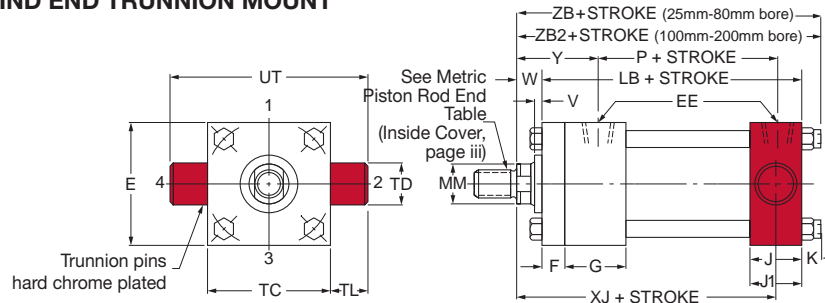
See "CAUTION NOTE on page 47.

ROD END TRUNNION MOUNT

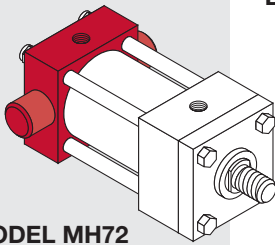


MH71 mount cylinders with bore sized 100mm through 200mm DO NOT have bolts on the rod end. Tie rods are threaded into the rod end cap. Use **ZB1** and **G1** for this bore size range.

BLIND END TRUNNION MOUNT

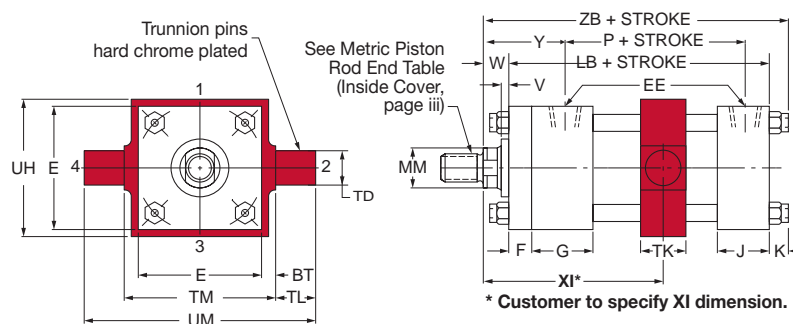


MH72 mount cylinders with bore sized 100mm through 200mm DO NOT have nuts on the blind end. Tie rods are threaded into the blind end cap, and secured with nuts (K) on the rod end. Use **ZB2** and **J1** for this bore size range.

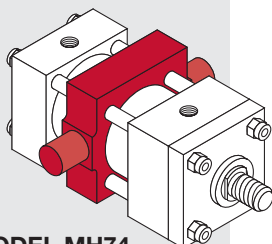


MODEL MH72
ISO STYLE MT2

CENTER TRUNNION MOUNT



* Customer to specify XI dimension.



MODEL MH74
ISO STYLE MT4

▼ TABLE 1MH The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ♦	B	LB	P	V	W	XG	XJ	Y	ZB	ZB1	ZB2
25	12	MH0151	24	99	53	6	15	44	101	50	121	-	-
	18△	MH0152	30										
32	14	MH1510	26	103	56	12	25	54	115	60	137	-	-
	22†	MH1511	34										
40	18	MH1520	30	128	73	6	25	57	134	62	163	-	-
	28†	MH1521	42			12							
50	22	MH1530	34	134	74	6	25	64	140	67	174	-	-
	28	MH1531	42			9							
63	28	MH1540	42	136	80	6	32	70	149	71	183	-	-
	36	MH1541	50			9							
80	45	MH1551	60	159	93	9	31	76	168	77	209	-	-
	56	MH1552	72			5							
100	45	MH1560	60	168	101	7	35	71	187	82	222	222*	216**
	56	MH1561	72			10							
125	56	MH1570	72	197	117	7	35	75	209	86	258	258*	246**
	70	MH1571	88			10							
160	70	MH1580	88	213	130	7	32	75	230	86	273	278*)	275**
	90	MH1581	108			7							
200	90	MH1590	108	267	165	7	32	85	276	98	330	337*)	331**
	110	MH1591	133			7							
	140	MH1592	163										

△ Cushions not available on rod end.

† Available with fixed nonadjustable cushions on rod end and standard adjustable cushions on the blind end only.

* Use this dimension for MH71 mount cylinders with bore sizes 100mm through 200mm.

** Use this dimension for MH72 mount cylinders with bore sizes 100mm through 200mm.

HOW TO ORDER


For ordering information refer to Page 49.

CAUTION NOTES:

› Rod end trunnion mount cylinders in 160mm bore (all rod sizes) and 200mm bore, (110 and 140 sizes) should not be used over 100 bar. If your application requires higher pressure, consult the factory.


NOTES:

♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DMH0151. (Refer to page 48.) Double rod ends are not available on clevis mount Series MH cylinders.



Rod End Styles and Dimensions
For rod end styles and dimensions see the table in the inside cover of the brochure "METRIC Piston Rod End Styles".

Page iii



MilCad Cylinder Configurator

Visit milwaukeeecylinder.com to configure and download CAD files of your cylinders.

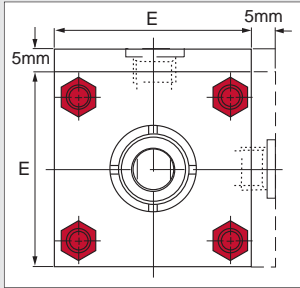
▼ TABLE 2MH The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	BT	E	EE BSPP	F	G	G1	J	J1	K	TD f8	TC h14	TL	TM h14	TK	UH	UM	UT
25	9	40	¼	10	40	-	25	-	7	12	38	10	48	20	45	68	58
32	11	45	¼	10	40	-	25	-	9	16	44	12	55	25	54	79	68
40	14.5	63	⅜	10	45	-	38	-	10	20	63	16	76	30	76	108	95
50	17	75	½	16	45	-	38	-	15	25	76	20	89	40	89	129	116
63	17.5	90	½	16	45	-	38	-	15	32	89	25	100	40	95	150	139
80	22	115	¾	20	50	-	45	-	19	40	114	32	127	50	127	191	178
100	25	130	¾	22	50	72	45	58	19	50	127	40	140	60	140	220	207
125	31.5	165	1	22	58	80	58	72	26	63	165	50	178	73	178	278	265
160	36.5	205	1	25	58	88	58	88	28	80	203	63	215	90	216	341	329
200	57	245	1¼	25	76	108	76	108	31	100	241	80	279	110	280	439	401

* Use this dimension for MH71 mount cylinders with bore sizes 100mm through 200mm.

** Use this dimension for MH72 mount cylinders with bore sizes 100mm through 200mm.

25 & 32mm Bore Cylinders



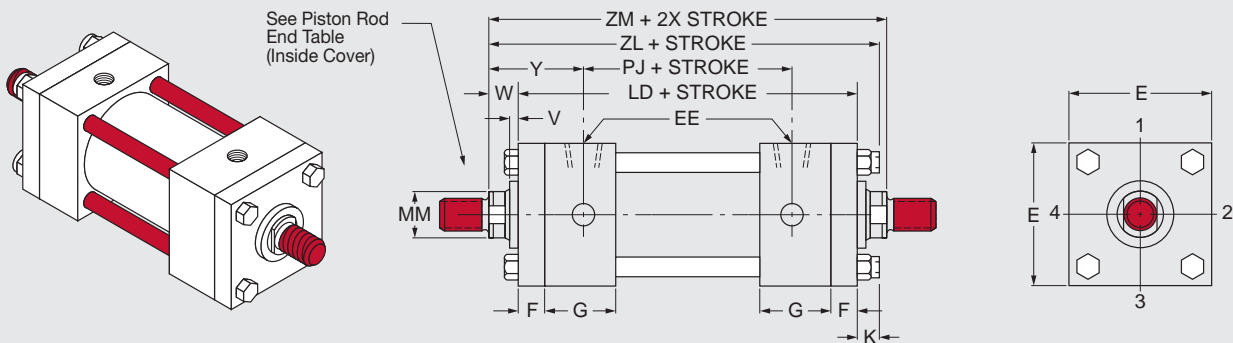
5mm extra height applies to port face at the rod end caps only.

DOUBLE ROD END CYLINDERS

Double rod end styles are available in every mounting style except clevis. On double rod end cylinders where the rod ends are not the same, be sure to specify clearly which rod end is to go at which end of the cylinder in relation to your mounting requirements.

To obtain dimensional information on a double rod end cylinder, first select the desired mounting style and refer to the corresponding single rod end cylinder model shown on the preceding pages. After you have determined all necessary dimensions from the previous page covering the desired mounting, turn back to this page. Supplement those dimensions with additional ones from the drawing below and the table at the right. These added dimensions differ from, or are in addition to, those shown on the preceding pages and provide the additional information needed to completely dimension a double rod end cylinder model.

On a double rod end cylinder where two different rod ends are required, or two different rod sizes are required, or cushions on one end are required, be sure to state clearly which rod is to go at which end of the cylinder. When two types of mounting styles are required, be sure to specify their relationship to the piston rods, if they are not the same.



▼ TABLE 2MH

The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	E	F	G	K	EE BSPP
25	40	10	40	7	¼
32	45	10	40	9	¼
40	63	10	45	10	⅜
50	75	16	45	15	½
63	90	16	45	15	½
80	115	20	50	19	¾
100	130	22	50	19	¾
125	165	22	58	26	1
160	205	25	58	28	1
200	245	25	76	31	1¼

▼ DOUBLE ROD END CYLINDERS

Bore Ø	Rod MM	Cylinder Code	B	LD	PJ	V	W	Y	ZL	ZM
25	12	DMH0151	24	124	54	6	15	50	146	154
	18	DMH0152	30							
32	14	DMH1510	26	128	58	12	25	60	162	178
	22	DMH1511	34							
40	18	DMH1520	30	145	71	6	25	62	180	195
	28	DMH1521	42			12				
50	22	DMH1530	34	157	73	6	25	67	197	207
	28	DMH1531	42			6				
	36	DMH1532	50			9				
63	28	DMH1540	42	159	81	6	32	71	206	223
	36	DMH1541	50			9				
	45	DMH1542	60			13				
						5				
80	36	DMH1550	50	184	92	5	31	77	234	246
	45	DMH1551	60			9				
	56	DMH1552	72							
100	45	DMH1560	60	195	101	7	35	82	249	265
	56	DMH1561	72			10				
	70	DMH1562	88							
125	56	DMH1570	72	219	117	7	35	86	280	289
	70	DMH1571	88			10				
	90	DMH1572	108							
160	70	DMH1580	88	238	130	7	32	86	298	302
	90	DMH1581	108							
	110	DMH1582	133							
200	90	DMH1590	108	292	160	7	32	98	355	488
	110	DMH1591	133							
	140	DMH1592	163							

▼ CONFIGURE YOUR CYLINDER (Series MH Metric Cylinder Nomenclature)

1
 MH1552 -
 61 -
 2
 4
 6 -
 9 X
 425

1 Double Rod End
 2 Cylinder Code (Refer to Table 1MH)
 3 Mounting Style
 4 Rod End Style
 5 Cushions
 6 Cylinder Modifications (If standard leave blank)
 7 Seal
 8 Stroke

Note:

Use "S" if any special design features are required, describe in detail on your order.

Example:

The code for a MP1 mount metric hydraulic cylinder with an 80mm bore, 56mm rod, Style No. 2 rod end, cushion both ends, standard seals with a 425mm stroke is MH1552-61-24-9 x 425

	Feature	Description	Page No.	Code No.
1	Double Rod End		—	D
2	Cylinder Code	Refer to Table 1MH	7, 9, 11, 13	—
3	Mounting Style	Model Number Only	6, 8, 10, 12	—
4	Rod End Style	Code Number	Inside front cover (iii)	—
5	Cushions	None Rod End Blind End Both Ends	— — — —	1 2 3 4
6	Cylinder Modifications	Special	—	S
7	Seal	Polyurethane (-20° to 200° F)	—	9
8	Stroke	Specify in millimeters	—	—

Series MH

Series LH

Series A

Series MN

Hyd-Pneum Devices

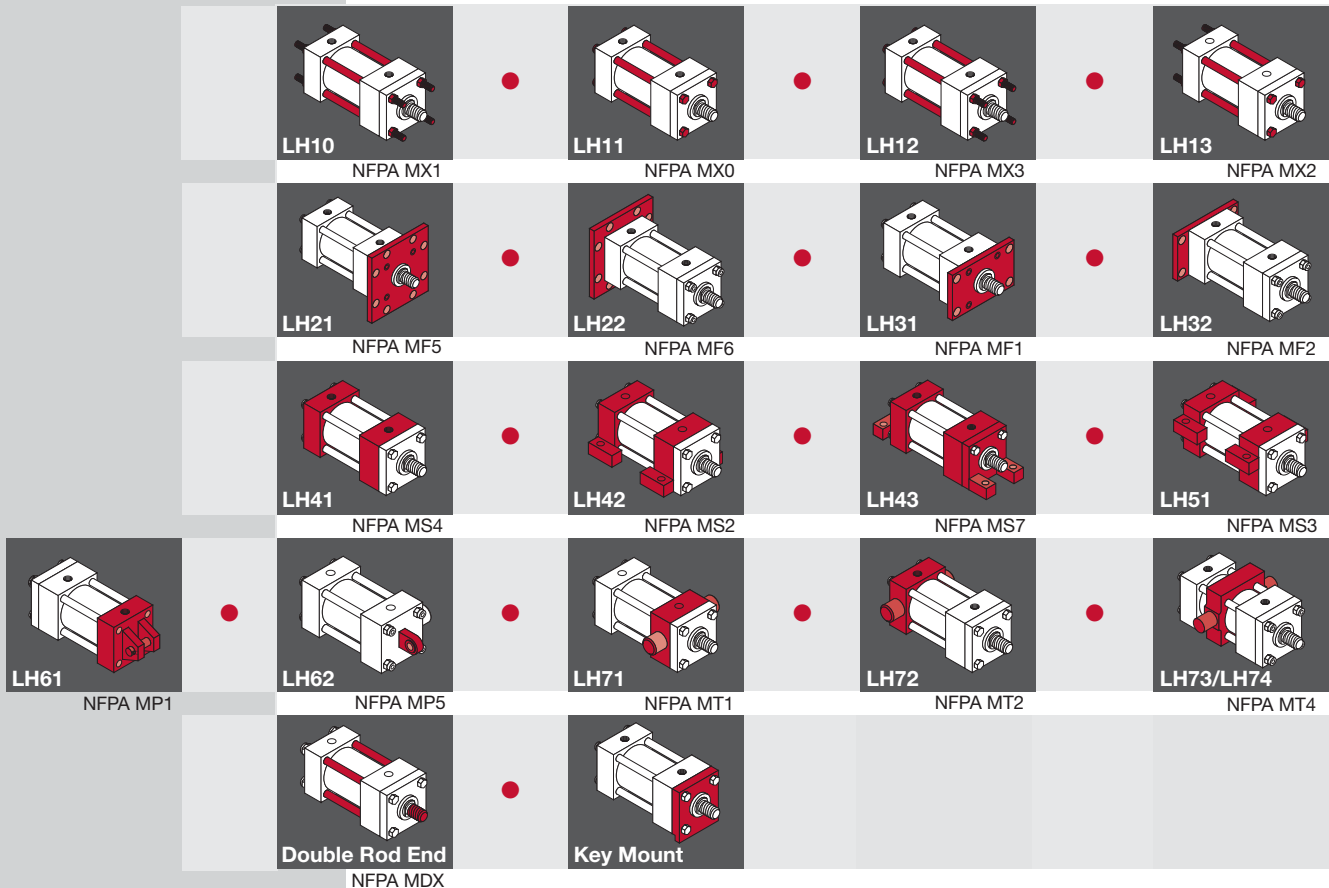
Cyl Accessories

Manipulators

Power Units/Valves

Design Guide

Series LH

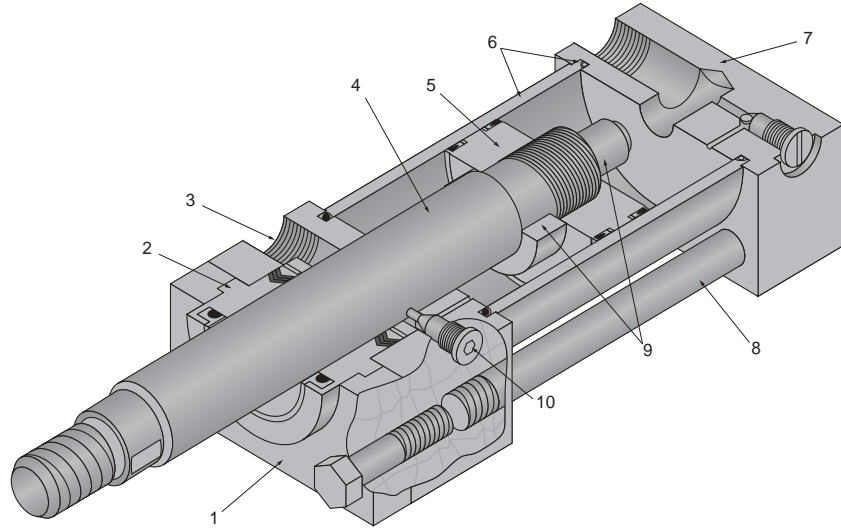


Milwaukee Cylinder Series LH Low Pressure Hydraulic Cylinders are built to perform on the toughest applications. The nominal pressure for Series LH ranges from 750 psi to 1500 psi, depending on bore size. Advanced engineering, combined with quality materials and expert workmanship, contribute to the making of a rugged, top quality low-pressure hydraulic cylinder that will provide a long, maintenance-free service life.

		Page
General	<i>TABLE 3 - Piston Rod End Styles</i>	<i>Inside Cover, page ii</i>
	<i>Standard Specifications and Features</i>	52
	<i>Performance Tested Design Features</i>	53
Mounting Specifications	<i>Tie Rod Mount</i>	54-55
	<i>Flange Mount</i>	56-57
	<i>Side Mount and Lug Mount</i>	58-59
	<i>Pin Mount and Trunnion Mount</i>	60-61
	<i>Double Rod End Cylinders Key Mount</i>	62 63
Additional Information	<i>Design Options</i>	64-65
	<i>Stop Tubes / Cylinder Sizing</i>	66-67
	<i>Ordering Information / Replacement Parts</i>	68-69
	<i>Installation / Trouble Shooting / Maintenance</i>	70-71
Accessories	<i>Clevis / Brackets / Pins / Rod Eyes Dimensional Data</i>	<i>Inside Back Cover</i>

STANDARD SPECIFICATIONS

- Standard construction – square head – tie rod design
- Nominal pressure – 750 psi to 1500 psi (range varies by bore size)
- Standard fluid-hydraulic oil
- Standard temperature – -20° F to +200° F
- Standard bore sizes – 1½" to 6"
- Standard piston rod diameters 5/8" thru 4"
- Standard mounting styles – 17 standard styles plus custom designs to suit your needs
- Strokes – available in any practical stroke length
- Cushions – available at either or both ends of stroke
- Standard 7 rod end styles, plus specials designed to order
- Rod end style KK₂ - is studded as standard for 5/8" and 1" diameter rods. Studded rod end style is available for all rod sizes.



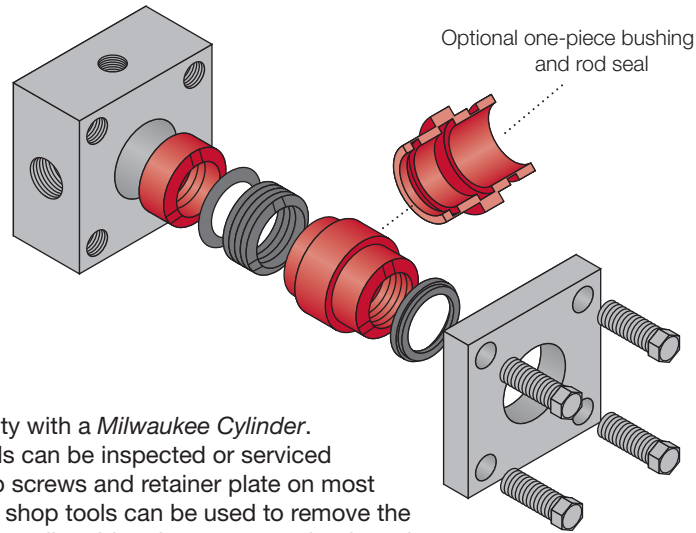
STANDARD FEATURES

- 1. Removable Retainer Plate**
 The retainer plate and rod bushing are externally removable without disassembling the cylinder on most standard models. Four capscrews securely hold and lock the retainer plate in place.
- 2. Rod Bushing and Seals**
 A combination of spring loaded multiple lip vee rings with a supporting bronze bushing is standard in *Milwaukee Cylinder Series LH Cylinders*.
- 3. Ports**
 Large NPTF cylinder ports are standard and can be located to customer requirements. SAE ports available upon request.
- 4. Piston Rod**
 The piston rod is of high strength steel, hardened and plated to resist scoring and corrosion to assure maximum seal life.
- 5. Piston**
 The Series LH piston is precision machined from fine grained iron alloy. It is pilot fitted and threaded to the piston rod.
- 6. Cylinder Barrel and Seals**
 The barrel is of chrome plated steel tubing, honed to a fine finish to assure superior sealing, minimum friction and maximum seal life. It is step cut on the I.D. of both ends for O-ring seals.
- 7. End Caps**
 End caps and mountings are of high quality steel, precision machined for accurate mounting.
- 8. Tie-Rods**
 The tie rods are constructed from a high quality medium carbon steel. The threads are accurately rolled for rigid engagement of the nuts.
- 9. Cushions**
 Cushions are machined to close tolerance to provide positive, smooth deceleration at the end of stroke. On all bore sizes we provide the longest cushion possible, based on the rod size and blind end caps. Longer cushions are available; for further information, consult factory.
- 10. Cushion Needle Adjustment and Ball Check**
 The cushion needle adjustment valve and cushion-check ball retainer screw are specifically designed to provide full cushion adjustment.



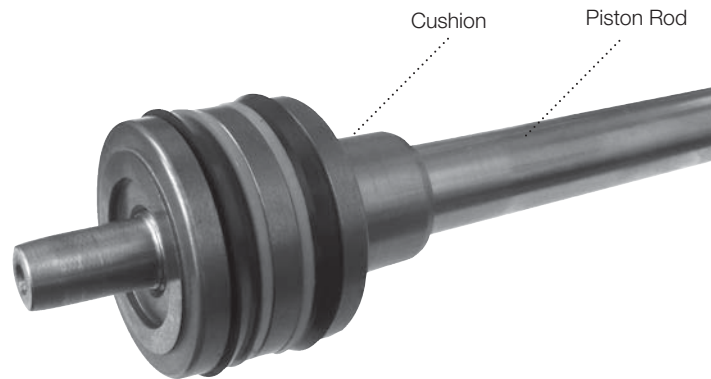
MilCad Cylinder Configurator

Visit milwaukee-cylinder.com to configure and download CAD files of your cylinders.



Simple Maintenance...

Simple maintenance is reality with a *Milwaukee Cylinder*. The rod bushing or rod seals can be inspected or serviced by merely removing the cap screws and retainer plate on most models. Standard available shop tools can be used to remove the rod bushing and seals without disturbing the torque on the tie-rods, assuring performance quality with maintenance ease.



Cushions...

The cushion is of a high grade alloy, precision machined and specially tapered to provide smooth deceleration of the piston at the end of stroke. The rod end cushion bushing is floated with an O-ring to compensate for minor misalignments during normal operation.

Piston Rod...

The piston rod is hardened, plated high strength steel, machined and processed to resist scoring and corrosion, assuring maximum life. *Milwaukee Cylinder* offers seven rod end styles as standard. **The style #2 rod end with two wrench flats is furnished as standard** unless otherwise specified. Special rod ends and extra wrench flats are also available. They must be specified at the time of order, giving the dimensional requirements and the location of additional wrench flats.

COMBINATION ROD SEAL DESIGN...

The *Milwaukee Cylinder* Series LH cylinder combines spring loaded multiple lip vee rings with a supporting bronze bushing and a double lip wiper as a secondary seal. This proven rod seal design combination is effective at both high and low pressures. It affords maximum sealing and an extra long bearing support.

As an optional design, a one-piece rod bushing with a double lip rod seal and a double lip wiper is available. Metallic rod scrapers may be supplied on request, in place of the double lip wiper with either rod bushing design.

The unique versatility of the *Milwaukee Cylinder* Series LH design makes available a selection of seals to meet all types of service conditions.

PISTON AND SEAL COMBINATION

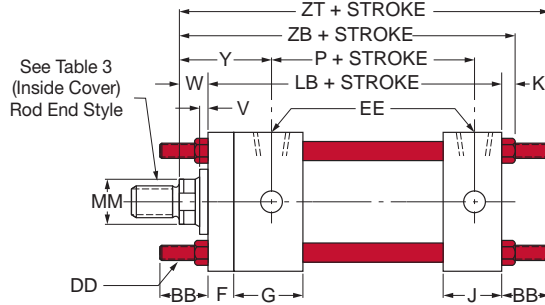
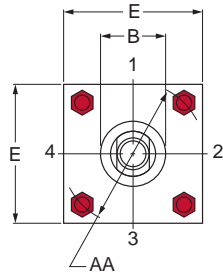
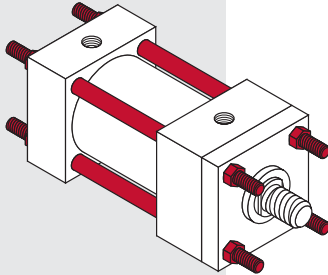
The *Milwaukee Cylinder* Series LH cylinder combines two u-cup seals and a fine grained iron alloy. This proven design combines low friction and smooth break away with the near zero leakage of the block vee seal.

For Package and Mounting
Dimension see
Tables 1LH and 2LH.

TIE ROD MOUNTED CYLINDERS

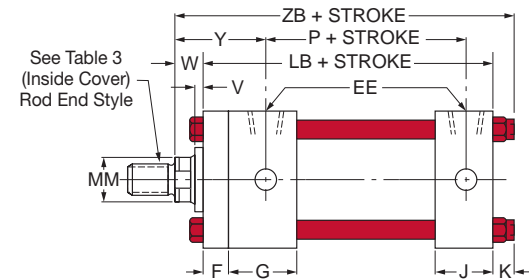
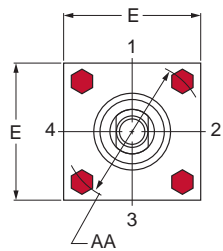
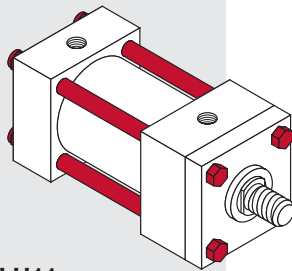
Tie-rod mounts are suited for many applications and are similar to flange mounts, but tie-rod mounts are not as rigid as the flange type of mounting. The best use of tie-rods extended on the blind end is in a thrust load application. When using tie-rods extended on the rod end, the best application is a tension load. When long strokes are required, the free end should be supported to prevent misalignment, sagging or possible binding of the cylinder.

TIE RODS EXTENDED BOTH ENDS



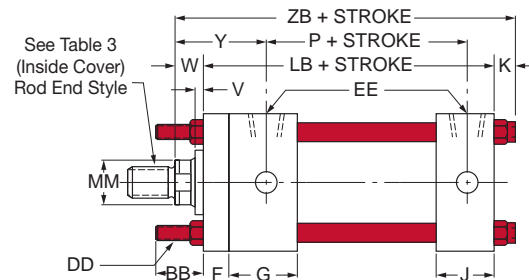
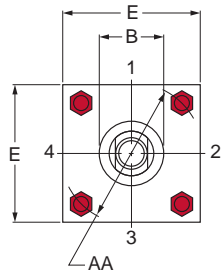
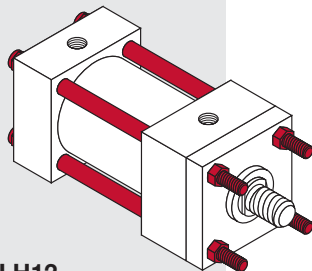
MODEL LH10
NFA STYLE MX1

NO TIE ROD EXTENSION



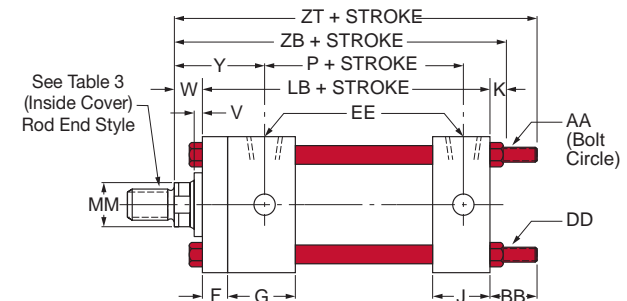
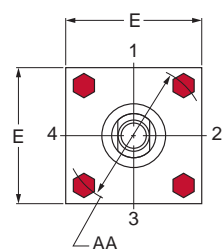
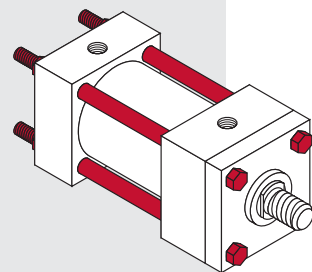
MODEL LH11
NFA STYLE MX0

TIE RODS EXTENDED ROD END



MODEL LH12
NFA STYLE MX3

TIE RODS EXTENDED BLIND END



MODEL LH13
NFA STYLE MX2

TABLE 1LH The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ↓	B	LB	P	V	W	Y	ZB	ZT
1½	⅝	LH0051	1⅛	4	2¼	¼	⅝	1 ¹⁵ / ₁₆	5	5⅝
	•1	LH0052	1½			½	1	2 ⁹ / ₁₆	5⅜	6
2	⅝	LH0510	1⅛	4	2¼	¼	⅝	1 ¹⁵ / ₁₆	5 ¹ / ₁₆	5¾
	1	LH0511	1½			½	1	2 ⁹ / ₁₆	5 ⁷ / ₁₆	6⅞
	•1⅜	LH0512	2			⅝	1¼	2 ⁹ / ₁₆	5 ¹ / ₁₆	6⅜
2½	⅝	LH0520	1⅛	4⅞	2⅜	¼	⅝	1 ¹⁵ / ₁₆	5 ³ / ₁₆	5⅞
	1	LH0521	1½			½	1	2 ⁹ / ₁₆	5 ⁹ / ₁₆	6¼
	1⅜	LH0522	2			⅝	1¼	2 ⁹ / ₁₆	5 ¹³ / ₁₆	6½
	•1¾	LH0523	2⅜			¾	1½	2 ¹³ / ₁₆	6 ¹ / ₁₆	6¾
3¼	1	LH0530	1½	4⅞	2⅝	¼	¾	2 ⁷ / ₁₆	6⅞	7
	1⅜	LH0531	2			⅜	1	2 ¹¹ / ₁₆	6⅜	7¼
	1¾	LH0532	2⅜			½	1¼	2 ¹⁵ / ₁₆	6⅝	7½
	2	LH0533	2⅝			½	1⅜	3 ¹ / ₁₆	6¾	7⅝
4	1	LH0540	1½	4⅞	2⅝	¼	¾	2 ⁷ / ₁₆	6⅞	7
	1⅜	LH0541	2			⅜	1	2 ¹¹ / ₁₆	6⅜	7¼
	1¾	LH0542	2⅜			½	1¼	2 ¹⁵ / ₁₆	6⅝	7½
	2	LH0543	2⅝			½	1⅜	3 ¹ / ₁₆	6¾	7⅝
	2½	LH0544	3⅞			⅝	1⅝	3 ⁵ / ₁₆	7	7⅞
5	1	LH0550	1½	5⅞	2⅞	¼	¾	2 ⁷ / ₁₆	6 ⁷ / ₁₆	7 ¹ / ₁₆
	1⅜	LH0551	2			⅜	1	2 ¹¹ / ₁₆	6 ¹¹ / ₁₆	7 ¹⁵ / ₁₆
	1¾	LH0552	2⅜			½	1¼	2 ¹⁵ / ₁₆	6 ¹⁵ / ₁₆	8 ³ / ₁₆
	2	LH0553	2⅝			½	1⅜	3 ¹ / ₁₆	7 ¹ / ₁₆	8 ⁵ / ₁₆
	2½	LH0554	3⅞			⅝	1⅝	3 ⁵ / ₁₆	7 ⁵ / ₁₆	8 ⁹ / ₁₆
	3	LH0555	3¾			⅝	1⅝	3 ⁵ / ₁₆	7 ⁵ / ₁₆	8 ⁹ / ₁₆
	3½	LH0556	4¼			⅝	1⅝	3 ⁵ / ₁₆	7 ⁵ / ₁₆	8 ⁹ / ₁₆
6	1⅜	LH0560	2	5¾	3⅞	¼	7 ⁸ / ₁₆	2 ¹³ / ₁₆	7 ³ / ₁₆	8 ⁷ / ₁₆
	1¾	LH0561	2⅜			⅜	1⅞	3 ¹ / ₁₆	7 ⁷ / ₁₆	8 ¹¹ / ₁₆
	2	LH0562	2⅝			⅜	1¼	3 ³ / ₁₆	7 ⁹ / ₁₆	8 ¹³ / ₁₆
	2½	LH0563	3⅞			½	1½	3 ⁷ / ₁₆	7 ¹³ / ₁₆	9 ¹ / ₁₆
	3	LH0564	3¾			½	1½	3 ⁷ / ₁₆	7 ¹³ / ₁₆	9 ¹ / ₁₆
	3½	LH0565	4¼			½	1½	3 ⁷ / ₁₆	7 ¹³ / ₁₆	9 ¹ / ₁₆
	4	LH0566	4¾			½	1½	3 ⁷ / ₁₆	7 ¹³ / ₁₆	9 ¹ / ₁₆

HOW TO ORDER

For ordering information refer to Page 68.

NOTES:

- ◆ For double rod end cylinders, add prefix letter D to cylinder code. Example: DLH0051 (Refer to page 62.)
- Available with fixed-non-adjustable cushions on rod end and standard adjustable cushions on the blind end only.

Rod End Styles and Dimensions
For rod end styles and dimensions see the Table 3 in the inside cover of the catalog.

Page ii

MilCad Cylinder Configurator

Visit milwaukeekeecylinder.com to configure and download CAD files of your cylinders.

Recommended Pressure Rating

Bore Ø	Pressure Rating (psi)
1½	1500
2	1500
2½	1500*
3¼	1500
4	1000
5	1000*
6	750

***NOTE:**

2½" Bore, ⅝" Rod, Rating 1000 psi
5" Bore, 1" Rod, Rating 750 psi

TABLE 2LH The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	AA	BB	DD	E	EE NPT	EE SAE	F	G	J	K
1½	2.02	1	¼-28	2	⅜	#6	⅜	1½	1	⅜
2	2.60	1⅞	⅝-24	2½	⅜	#6	⅜	1½	1	7 ¹ / ₁₆
2½	3.10	1⅞	⅝-24	3	⅜	#6	⅜	1½	1	7 ¹ / ₁₆
3¼	3.90	1⅞	⅝-24	3¾	½	#10	⅝	1¾	1¼	½
4	4.70	1⅞	⅝-24	4½	½	#10	⅝	1¾	1¼	½
5	5.80	1 ¹³ / ₁₆	½-20	5½	½	#10	⅝	1¾	1¼	9 ¹ / ₁₆
6	6.90	1 ¹³ / ₁₆	½-20	6½	¾	#12	¾	2	1½	9 ¹ / ₁₆

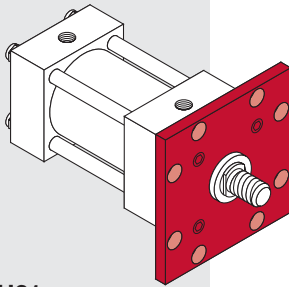
For Package and Mounting Dimension see Tables 1LH and 2LH.

FLANGE MOUNTED CYLINDERS

The flange mount is one of the strongest, most rigid methods of mounting. With this type of mount there is little allowance for misalignment, though when long strokes are required, the free end opposite the mounting should be supported to prevent sagging and possible binding of the cylinder.

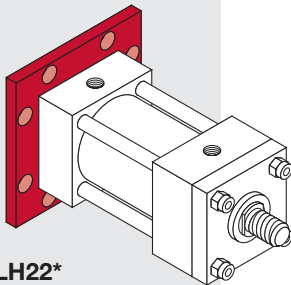
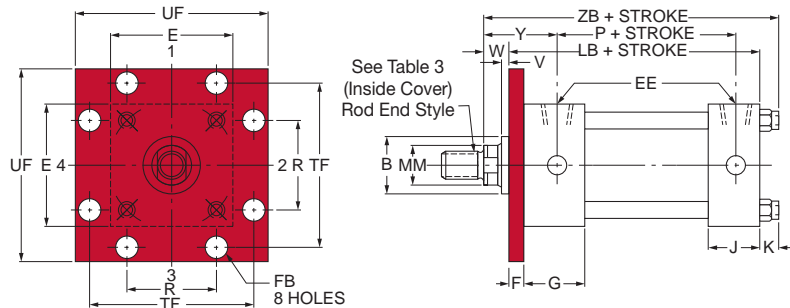
The best use of a blind end flange is in a thrust load application (rod in compression).

Rod end flange mounts are best used in tension applications. When a less rigid mount can be used and the cylinder can be attached to a panel or bulkhead, an extended tie-rod mounting could be considered.



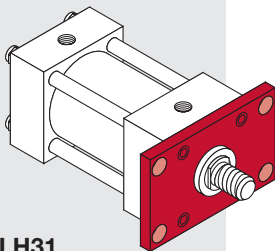
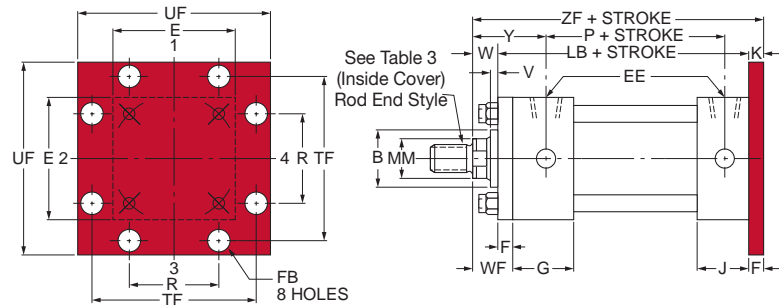
MODEL LH21
NFPA STYLE MF5

ROD SQUARE FLANGE MOUNTING



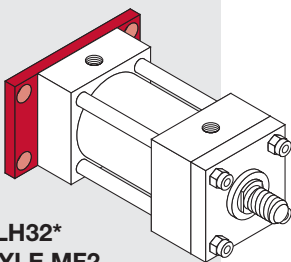
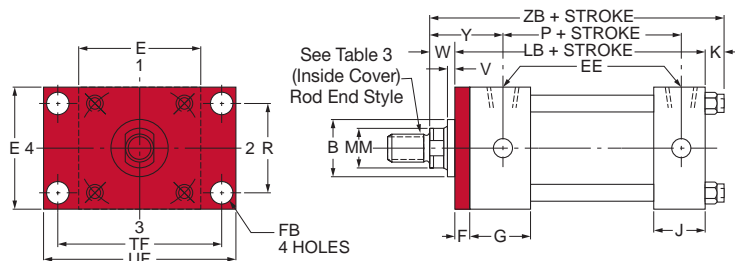
MODEL LH22*
NFPA STYLE MF6

BLIND SQUARE FLANGE MOUNTING



MODEL LH31
NFPA STYLE MF1

ROD RECTANGULAR FLANGE MOUNTING



MODEL LH32*
NFPA STYLE MF2

BLIND RECTANGULAR FLANGE MOUNTING

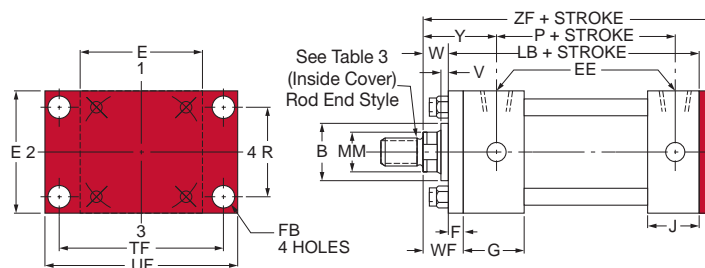


TABLE 1LH The dimensions given on this table are affected by the piston rod diameter and the stroke.

Bore Ø	Rod MM	Cylinder Code ↓	B	LB	P	V	W	Y	ZB	ZF
1½	⅝	LH0051	1⅛	4	2¼	¼	⅝	1¹⁵⁄₁₆	5	5
	•1*	LH0052	1½			½	1	2⁹⁄₁₆	5⅜	5⅜
2	⅝	LH0510	1⅛	4	2¼	¼	⅝	1¹⁵⁄₁₆	5¹⁄₁₆	5
	1	LH0511	1½			½	1	2⁹⁄₁₆	5⁷⁄₁₆	5⅜
	•1⅜*	LH0512	2			⅝	1¼	2⁹⁄₁₆	5¹¹⁄₁₆	5⅝
2½	⅝	LH0520	1⅛	4⅞	2⅜	¼	⅝	1¹⁵⁄₁₆	5⅜	5⅞
	1	LH0521	1½			½	1	2⁹⁄₁₆	5⁹⁄₁₆	5½
	1⅜	LH0522	2			⅝	1¼	2⁹⁄₁₆	5¹³⁄₁₆	5¾
	•1¼*	LH0523	2⅜			¾	1½	2¹³⁄₁₆	6¹⁄₁₆	6
3¼	1	LH0530	1½	4⅞	2⅝	¼	¾	2⁷⁄₁₆	6⅞	6¼
	1⅜	LH0531	2			⅜	1	2¹¹⁄₁₆	6⅜	6½
	1¾	LH0532	2⅜			½	1¼	2¹⁵⁄₁₆	6⅝	6¾
	2*	LH0533	2⅝			½	1⅜	3¹⁄₁₆	6¾	6⅞
4	1	LH0540	1½	4⅞	2⅝	¼	¾	2⁷⁄₁₆	6⅞	6¼
	1⅜	LH0541	2			⅜	1	2¹¹⁄₁₆	6⅜	6½
	1¾	LH0542	2⅜			½	1¼	2¹⁵⁄₁₆	6⅝	6¾
	2	LH0543	2⅝			½	1⅜	3¹⁄₁₆	6¾	6⅞
	2½*	LH0544	3⅞			⅝	1⅝	3⁵⁄₁₆	7	7⅞
5	1	LH0550	1½	5⅞	2⅞	¼	¾	2⁷⁄₁₆	6⁷⁄₁₆	6½
	1⅜	LH0551	2			⅜	1	2¹¹⁄₁₆	6¹¹⁄₁₆	6¾
	1¾	LH0552	2⅜			½	1¼	2¹⁵⁄₁₆	6¹⁵⁄₁₆	7
	2	LH0553	2⅝			½	1⅜	3¹⁄₁₆	7¹⁄₁₆	7⅞
	2½	LH0554	3⅞			⅝	1⅝	3⁵⁄₁₆	7⁵⁄₁₆	7⅝
	3	LH0555	3¾			⅝	1⅝	3⁵⁄₁₆	7⁵⁄₁₆	7⅝
	3½*	LH0556	4¼			⅝	1⅝	3⁵⁄₁₆	7⁵⁄₁₆	7⅝
6	1⅜	LH0560	2	5¾	3⅞	¼	⅞	2¹³⁄₁₆	7³⁄₁₆	7⅝
	1¾	LH0561	2⅜			⅜	1⅞	3¹⁄₁₆	7⁷⁄₁₆	7⅝
	2	LH0562	2⅝			⅜	1¼	3⁹⁄₁₆	7⁹⁄₁₆	7¾
	2½	LH0563	3⅞			½	1½	3⁷⁄₁₆	7¹³⁄₁₆	8
	3	LH0564	3¾			½	1½	3⁷⁄₁₆	7¹³⁄₁₆	8
	3½	LH0565	4¼			½	1½	3⁷⁄₁₆	7¹³⁄₁₆	8
	4	LH0566	4¾			½	1½	3⁷⁄₁₆	7¹³⁄₁₆	8

HOW TO ORDER

For ordering information refer to Page 68.

NOTES:

- ◆ For double rod end cylinders, add prefix letter D to cylinder code. Example: DLH0051 (Refer to page 62.)
- Available with fixed-non-adjustable cushions on rod end and standard adjustable cushions on the blind end only.
- * Removable retainer not available for these bore and rod combinations in the LH22 and LH32 mounting styles.

i **Rod End Styles and Dimensions**
For rod end styles and dimensions see the Table 3 in the inside cover of the catalog.

Page ii

MilCad Cylinder Configurator

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Recommended Pressure Rating

Bore Ø	Pressure Rating (psi)
1½	1500
2	1500
2½	1500*
3¼	1500
4	1000
5	1000*
6	750

***NOTE:**

2½" Bore, ⅝" Rod, Rating 1000 psi
5" Bore, 1" Rod, Rating 750 psi

TABLE 2LH The dimensions are constant regardless of rod diameter or stroke.

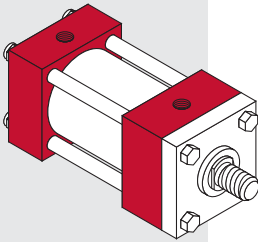
Bore Ø	E	EE NPT	EE SAE	F	FB	G	J	K	R	TF	UF
1½	2	⅜	#6	⅜	⅝	1½	1	⅜	1.43	2¾	3⅜
2	2½	⅜	#6	⅜	⅜	1½	1	⁷⁄₁₆	1.84	3⅜	4⅞
2½	3	⅜	#6	⅜	⅜	1½	1	⁷⁄₁₆	2.19	3⅞	4⅝
3¼	3¾	½	#10	⅝	⁷⁄₁₆	1¾	1¼	½	2.76	4¹¹⁄₁₆	5½
4	4½	½	#10	⅝	⁷⁄₁₆	1¾	1¼	½	3.32	5⁷⁄₁₆	6¼
5	5½	½	#10	⅝	⁹⁄₁₆	1¾	1¼	⁹⁄₁₆	4.10	6⅝	7⅝
6	6½	¾	#12	¾	⁹⁄₁₆	2	1½	⁹⁄₁₆	4.88	7⅝	8⅝

For Package and Mounting
Dimension see
Tables 1LH and 2LH.

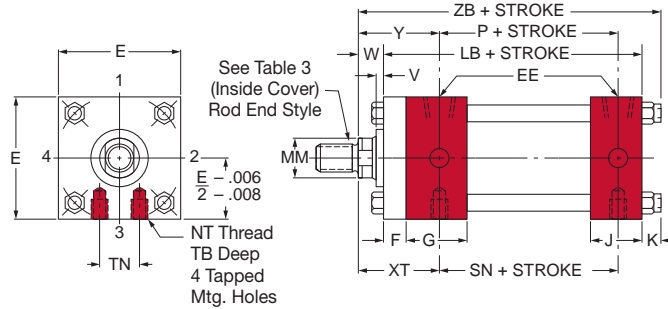
SIDE OR LUG MOUNTED CYLINDERS

The side or lug mounted cylinder provides a fairly rigid mount. These types of cylinders can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves toward the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder is used properly (without misalignment), the mounting bolts are either in simple shear or tension without any compound stresses.

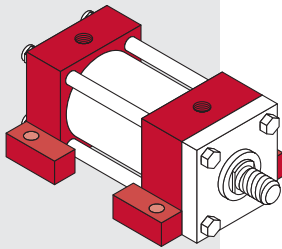
TAPPED HOLES IN CAPS FLUSH MOUNTING



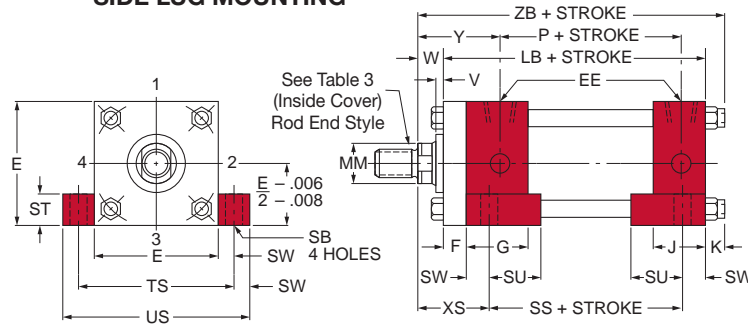
MODEL LH41
NFWA STYLE MS4



SIDE LUG MOUNTING

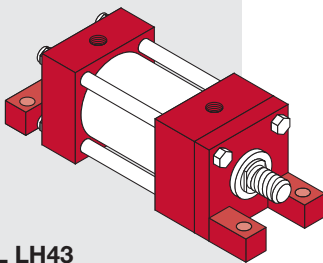


MODEL LH42
NFWA STYLE MS2

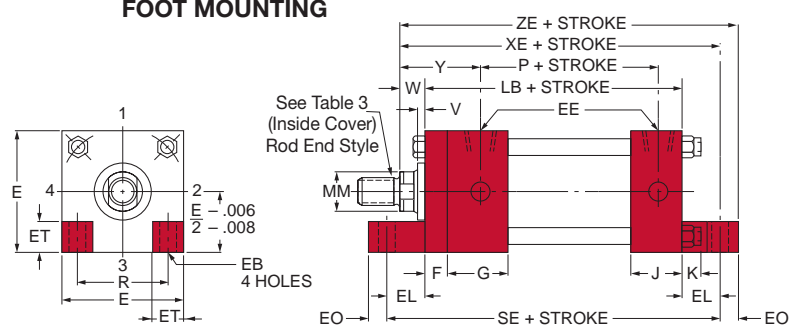


Not Available With
Removable Retainers.

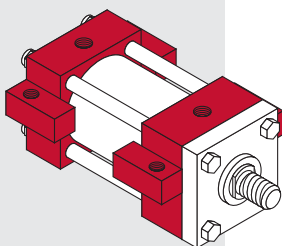
FOOT MOUNTING



MODEL LH43
NFWA STYLE MS7



CENTERLINE LUG MOUNTING



MODEL LH51
NFWA STYLE MS3

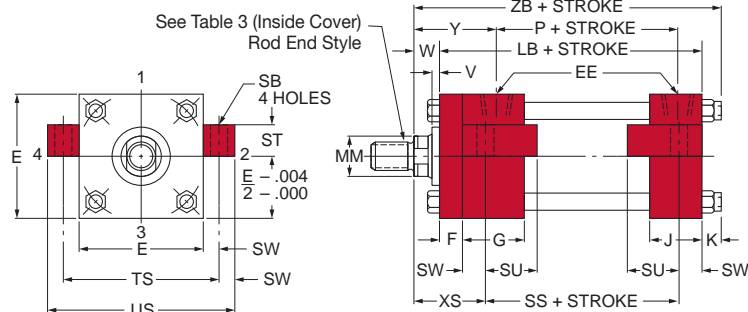


TABLE 1LH The dimensions given on this table are affected by the piston rod diameter and the stroke.


Bore Ø	Rod MM	Cylinder Code ♦	LB	P	SE ▲	SN	SS ■	V	W	XE	XS	XT	Y	ZB	ZE
1½	5/8	LH0051	4	2¼	5½	2¼	27/8	¼	5/8	53/8	13/8	115/16	115/16	5	53/8
	•1*	LH0052						½	1	5¾	1¾	25/16	25/16	53/8	6
2	5/8	LH0510	4	2¼	57/8	2¼	27/8	¼	5/8	59/16	13/8	115/16	115/16	51/16	57/8
	†1*	LH0511						½	1	515/16	1¾	25/16	25/16	57/16	6¼
2½	5/8	LH0520	4½	23/8	6¼	23/8	3	¼	5/8	513/16	13/8	115/16	115/16	53/16	61/8
	1	LH0521						½	1	63/16	1¾	25/16	25/16	59/16	6½
	†13/8*	LH0522						5/8	1¼	67/16	2	29/16	29/16	513/16	6¾
3¼	1	LH0530	47/8	25/8	65/8	25/8	3¼	¼	¾	6½	17/8	27/16	27/16	61/8	67/8
	13/8	LH0531						¾	1	6¾	21/8	211/16	211/16	63/8	71/8
	1¾*	LH0532						½	1¼	7	23/8	215/16	215/16	65/8	73/8
	2*	LH0533						½	13/8	71/8	2½	31/16	31/16	6¾	7½
4	1	LH0540	47/8	25/8	67/8	25/8	3¼	¼	¾	65/8	17/8	27/16	27/16	61/8	7
	13/8	LH0541						¾	1	67/8	21/8	211/16	211/16	63/8	7¼
	1¾	LH0542						½	1¼	71/8	23/8	215/16	215/16	65/8	7½
	2	LH0543						½	13/8	7¼	2½	31/16	31/16	6¾	75/8
5	2½*	LH0544	5½	27/8	7¼	27/8	3½	5/8	15/8	7½	2¾	35/16	35/16	7	77/8
	1	LH0550						¼	¾	615/16	21/16	27/16	27/16	67/16	77/16
	13/8	LH0551						¾	1	73/16	25/16	211/16	211/16	611/16	711/16
	1¾	LH0552						½	1¼	77/16	29/16	215/16	215/16	615/16	715/16
	2	LH0553						½	13/8	79/16	211/16	31/16	31/16	71/16	81/16
6	2½	LH0554	5¾	31/8	7¾	31/8	35/8	5/8	15/8	713/16	215/16	35/16	35/16	75/16	85/16
	3	LH0555						5/8	15/8	713/16	215/16	35/16	35/16	75/16	85/16
	3½*	LH0556						5/8	15/8	713/16	215/16	35/16	35/16	75/16	85/16
	13/8	LH0560						¼	7/8	75/8	25/16	213/16	213/16	73/16	81/8
	1¾	LH0561						¾	11/8	77/8	29/16	31/16	31/16	77/16	83/8
6	2	LH0562	5¾	31/8	7¾	31/8	35/8	¾	1¼	8	211/16	33/16	33/16	79/16	8½
	2½	LH0563						½	1½	8¼	215/16	37/16	37/16	713/16	8¾
	3	LH0564						½	1½	8¼	215/16	37/16	37/16	713/16	8¾
	3½	LH0565						½	1½	8¼	215/16	37/16	37/16	713/16	8¾
	4*	LH0566						½	1½	8¼	215/16	37/16	37/16	713/16	8¾

HOW TO ORDER

For ordering information refer to Page 68.

NOTES:

- ♦ For double rod end cylinders, add prefix letter D to cylinder code. (Example: DLH0051 (Refer to page 62.))
- * Tapped holes on LH41 rod end cap have a shallower TB depth in these sizes.
- † The standard rod eye or rod clevis will interfere with foot lugs on Model LH43. When these rod end accessories are required, use additional rod extension.
- ▲ For double rod end cylinders from 1½" thru 6" bore, add ½ + F to this dimension.
- For double rod end cylinders from 1½" thru 6" bore, add ½ to this dimension.
- Available with fixed non-adjustable cushions on rod end and standard adjustable cushions on the blind end only.



Rod End Styles and Dimensions

For rod end styles and dimensions see the Table 3 in the inside cover of the catalog.

Page ii

Recommended Pressure Rating

Bore Ø	Pressure Rating (psi)
1½	1500
2	1500
2½	1500*
3¼	1500
4	1000
5	1000*
6	750

***NOTE:**

2½" Bore, 5/8" Rod, Rating 1000 psi
5" Bore, 1" Rod, Rating 750 psi

TABLE 2LH The dimensions are constant regardless of rod diameter or stroke.

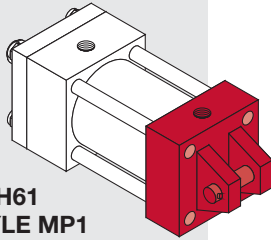
Bore Ø	E	EB	EE NPT	EE SAE	EL	EO	ET	F	G	J	K	NT	R	SB	ST	SU	SW	TB	TN	TS	US
1½	2	5/16	3/8	#6	¾	¼	½	3/8	1½	1	3/8	¼-20	1.43	7/16	½	15/16	3/8	3/8	5/8	2¾	3½
2	2½	3/8	3/8	#6	15/16	5/16	19/32	3/8	1½	1	7/16	5/16-18	1.84	7/16	½	15/16	3/8	9/16	7/8	3¼	4
2½	3	3/8	3/8	#6	11/16	5/16	¾	3/8	1½	1	7/16	3/8-16	2.19	7/16	½	15/16	3/8	5/8	1¼	3¾	4½
3¼	3¾	7/16	½	#10	7/8	3/8	29/32	5/8	1¾	1¼	½	½-13	2.76	9/16	¾	1¼	½	¾	1½	4¾	5¾
4	4½	7/16	½	#10	1	3/8	11/8	5/8	1¾	1¼	½	½-13	3.32	9/16	¾	1¼	½	1	21/16	5½	6½
5	5½	9/16	½	#10	11/16	½	111/32	5/8	1¾	1¼	9/16	5/8-11	4.10	13/16	1	19/16	11/16	1	211/16	67/8	8¼
6	6½	9/16	¾	#12	1	½	19/16	¾	2	1½	9/16	¾-10	4.88	13/16	1	19/16	11/16	11/8	3¼	77/8	9¼

Series LH Series A Series MN Hyd-Pneum Devices Cyl Accessories Manipulators Power Units/Valves Design Guide

For Package and Mounting Dimension see Tables 1LH and 2LH.

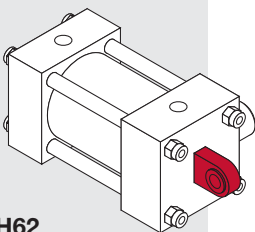
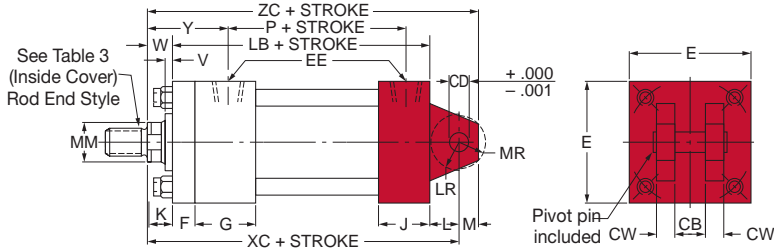
PIN AND TRUNNION MOUNTED CYLINDERS

All pin and trunnion cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.



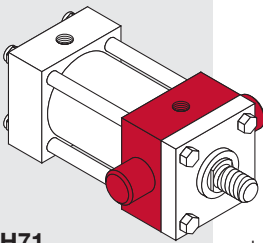
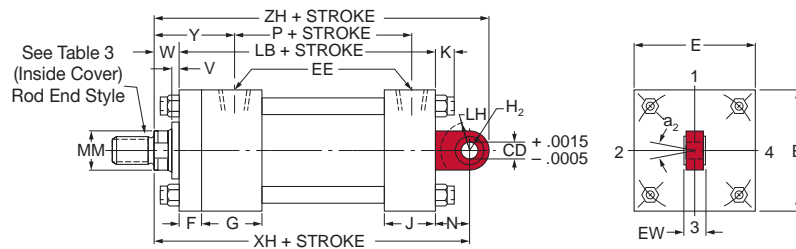
**MODEL LH61
NFPA STYLE MP1**

CLEVIS MOUNT



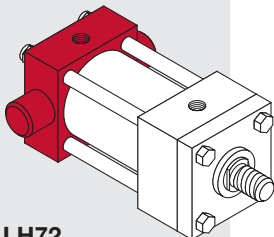
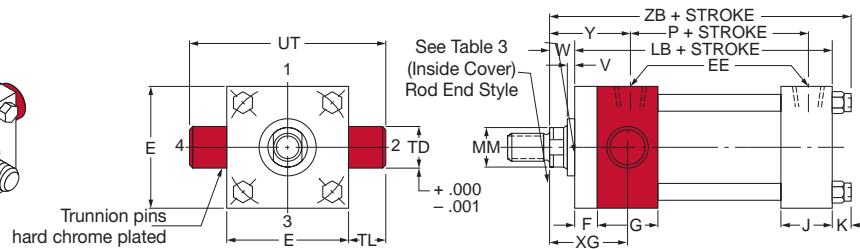
**MODEL LH62
NFPA STYLE MP5**

SPHERICAL EYE MOUNT



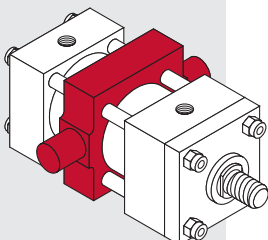
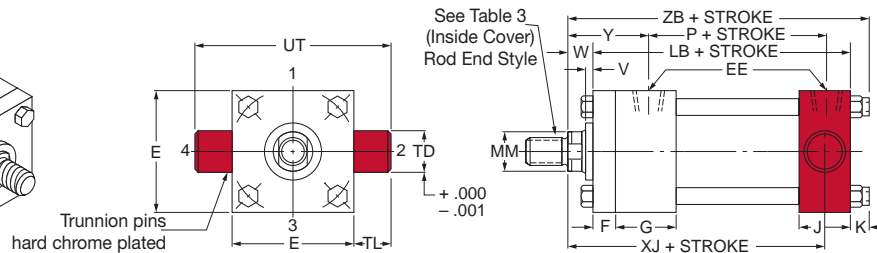
**MODEL LH71
NFPA STYLE MT1**

ROD END TRUNNION MOUNT



**MODEL LH72
NFPA STYLE MT2**

BLIND END TRUNNION MOUNT



**MODEL LH73/LH74
NFPA STYLE MT4**

LH73 is an exclusive Milwaukee Cylinder design.
LH74 is the Industry "Standard" design.

CENTER TRUNNION MOUNT

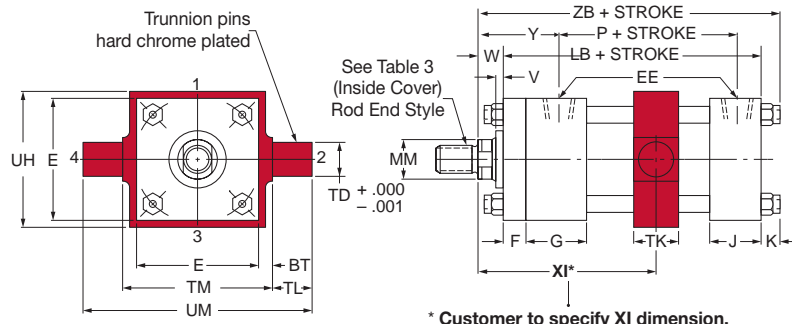


TABLE 1LH The dimensions given on this table are affected by the piston rod diameter and the stroke.


Bore Ø	Rod MM	Cylinder Code ↓	LB	P	V	W	XC	XG	XH	XJ	Y	ZB	ZC	ZH
1½	5/8	LH0051	4	2¼	¼	5/8	5¾	1¾	5½	4½	115/16	5	5½	6¼
	•1*	LH0052			½	1	5¾	2½	5½	4½	25/16	5¾	6¼	6½
2	5/8	LH0510	4	2¼	¼	5/8	5¾	1¾	5½	4½	115/16	5½	5½	6¼
	1*	LH0511			½	1	5¾	2½	5½	4½	25/16	5½	6¼	6½
2½	•1¾*	LH0512	4½	2¾	5/8	1¼	6	2¾	6½	4¾	29/16	5½	6½	6½
	5/8	LH0520			¼	5/8	5½	1¾	5½	4¼	115/16	5¾	6	6¾
	1	LH0521			½	1	5½	2½	6	4½	25/16	5¾	6¾	6¾
3¼	1¾	LH0522	4¾	25/8	5/8	1¼	6½	2¾	6¼	4¾	29/16	5½	6½	7
	•1¾*	LH0523			¾	1½	6¾	2¾	6¾	5½	213/16	6½	6½	7½
	1	LH0530			¼	¾	6¾	2¼	6¾	5	27/16	6½	7¾	8½
	1¾	LH0531			¾	1	7½	2½	7½	5¼	211/16	6¾	7¾	8¾
4	1¾	LH0532	4¾	25/8	½	1¼	7¾	2¾	7¾	5½	215/16	6¾	8½	8½
	2*	LH0533			½	1¾	7½	2¾	7½	5¾	31/16	6¾	8¼	8¾
	1	LH0540			¼	¾	6¾	2¼	6¾	5	27/16	6½	7¾	8½
	1¾	LH0541			¾	1	7½	2½	7½	5¼	211/16	6¾	7¾	8¾
5	1¾	LH0542	5½	27/8	½	1¼	7¾	2¾	7¾	5½	215/16	6¾	8½	8½
	2	LH0543			½	1¾	7½	2¾	7½	5¾	31/16	6¾	8¼	8¾
	2½*	LH0544			5/8	15/8	7¾	3½	7¾	5¾	35/16	7	8½	9
	1	LH0550			¼	¾	7½	2¼	7½	5¼	27/16	6½	7¾	8¾
	1¾	LH0551			¾	1	7¾	2½	7¾	5½	211/16	6½	8½	8¾
6	1¾	LH0552	5¾	3½	½	1¼	7¾	2¾	7¾	5¾	215/16	6½	8½	8¾
	2	LH0553			½	1¾	7¾	2¾	7¾	5¾	31/16	7½	8½	9
	2½	LH0554			5/8	15/8	8	3½	8	6½	35/16	7½	8¾	9¼
	3	LH0555			5/8	15/8	8	3½	8	6½	35/16	7½	8¾	9¼
	3½*	LH0556			5/8	15/8	8	3½	8	6½	35/16	7½	8¾	9¼
	1¾	LH0560			¼	7/8	8½	25/8	8¼	5¾	213/16	7¾	9½	10
6	1¾	LH0561	5¾	3½	¾	1½	8¾	2¾	8½	6½	31/16	7½	9¾	10¼
	2	LH0562			¾	1¼	8½	3	8½	6¼	33/16	7¾	9½	10¾
	2½	LH0563			½	1½	8¾	3¼	8¾	6½	37/16	7¾	9¾	10¾
	3	LH0564			½	1½	8¾	3¼	8¾	6½	37/16	7¾	9¾	10¾
	3½	LH0565			½	1½	8¾	3¼	8¾	6½	37/16	7¾	9¾	10¾
	4	LH0566			½	1½	8¾	3¼	8¾	6½	37/16	7¾	9¾	10¾

HOW TO ORDER

For ordering information refer to Page 68.

NOTES:

- ♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DLH0051 (Refer to page 62.) Double rod ends are not available on LH61 or LH62 mount styles of Series LH cylinders.
- Available with fixed non-adjustable cushions on rod end and standard adjustable cushions on the blind end only.
- * Removable retainer not available for these bore and rod combinations: LH61 and LH73/LH74 mounting styles.



Rod End Styles and Dimensions

For rod end styles and dimensions see the Table 3 in the inside cover of the catalog.

Page ii



MilCad Cylinder Configurator

Visit milwaukeeecylinder.com to configure and download CAD files of your cylinders.

Recommended Pressure Rating

Bore Ø	Pressure Rating (psi)
1½	1500
2	1500
2½	1500*
3¼	1500
4	1000
5	1000*
6	750

***NOTE:**

2½" Bore, 5/8" Rod, Rating 1000 psi
5" Bore, 1" Rod, Rating 750 psi

TABLE 2LH The dimensions are constant regardless of rod diameter or stroke.

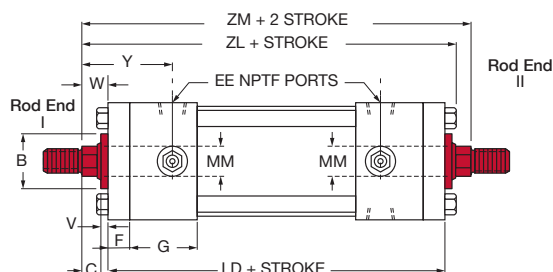
Bore Ø	a ₂	BT	CB	CD	CW	E	EE	EE	EW	F	G	H ₂	J	K	L	LH	LR	M	MR	N	TD	TL	LH73				LH74				
																							TK	TM	UH	UM	TK	TM	UH	UM	UT
1½	13°	¾	¾	½	½	2	¾	#6	5/8	¾	1½	13/16	1	¾	¾	5/8	½	21/32	7/8	1	1	1½	3½	2¾	5½	1¼	2½	2½	4½	4	
2	13°	¾	¾	½	½	2½	¾	#6	5/8	¾	1½	13/16	1	7/16	¾	5/8	½	11/16	7/8	1	1	1½	4	2¾	6	1½	3	3	5	4½	
2½	13°	¾	¾	½	½	3	¾	#6	5/8	¾	1½	13/16	1	7/16	¾	5/8	½	11/16	7/8	1	1	1½	4½	3¾	6½	1½	3½	3½	5½	5	
3¼	13°	¾	1¼	¾	5/8	3¾	½	#10	7/8	5/8	1¾	1¼	1¼	½	1¼	1	11/16	¾	15/16	1¼	1	1	1¼	5¼	4½	7¼	2	4½	4¼	6½	5¾
4	13°	¾	1¼	¾	5/8	4½	½	#10	7/8	5/8	1¾	1¼	1¼	½	1¼	1	11/16	¾	15/16	1¼	1	1	1¼	6	5	8	2	5¼	5	7¼	6½
5	13°	¾	1¼	¾	5/8	5½	½	#10	7/8	5/8	1¾	1¼	1¼	9/16	1¼	1	11/16	¾	15/16	1¼	1	1	1¼	7	6	9	2	6¼	6	8¼	7½
6	12½°	1	1½	1	¾	6½	¾	#12	1¾	¾	2	1¾	1½	9/16	1½	1¼	1¼	1	13/16	15/8	1¾	1¾	1½	8½	7	11¼	2½	7½	7	10¾	9¼

DOUBLE ROD END CYLINDERS

Milwaukee Cylinder's Double Rod End Cylinders are available with all the standard types of mountings, except LH61 and LH62 mount styles of Series LH cylinders.

To obtain dimensional information on a double rod end cylinder, first select the desired mounting style and refer to the corresponding single rod end cylinder model shown on the preceding pages. After you have determined all necessary dimensions from the previous page covering the desired mounting, turn back to this page. Supplement those dimensions with additional ones from the drawings below and the table at the right. These added dimensions differ from, or are in addition to, those shown on the preceding pages and provide the additional information needed to completely dimension a double rod end cylinder model.

On a double rod end cylinder where two different rod ends are required, or two different rod sizes are required, or cushions on one end are required, be sure to state clearly which rod is to go at which end of the cylinder. When two types of mounting styles are required, be sure to specify their relationship to the piston rods, if they are not the same.



▼ DOUBLE ROD END CYLINDERS

Bore Ø	Rod MM	Cylinder Code	LD*	SE*	SS*	ZL	ZM
1½	5/8	DLH051	4 7/8	6 3/8	3 3/8	5 7/8	6 1/8
	1	DLH052				6 1/4	6 7/8
2	5/8	DLH510	4 7/8	6 3/4	3 3/8	5 15/16	6 1/8
	1	DLH511				6 5/16	6 7/8
	1 3/8	DLH512				6 9/16	7 3/8
2½	5/8	DLH520	5	7 1/8	3 1/2	6 1/16	6 1/4
	1	DLH521				6 7/16	7
	1 3/8	DLH522				6 11/16	7 1/2
3¼	1	DLH530	6	7 3/4	3 3/4	7 1/4	7 1/2
	1 3/8	DLH531				7 1/2	8
	1 3/4	DLH532				7 3/4	8 1/2
4	2	DLH533	6	8	3 3/4	7 7/8	8 3/4
	1	DLH540				7 1/4	7 1/2
	1 3/8	DLH541				7 1/2	8
	1 3/4	DLH542				7 3/4	8 1/2
5	2	DLH543	6 1/4	8 3/8	3 5/8	7 7/8	8 3/4
	2 1/2	DLH544				8 1/8	9 1/4
	1	DLH550				7 9/16	7 3/4
	1 3/8	DLH551				7 13/16	8 1/4
	1 3/4	DLH552				8 1/16	8 3/4
6	2	DLH553	7	8 7/8	4 1/8	8 3/16	9
	2 1/2	DLH554				8 7/16	9 1/2
	3	DLH555				8 7/16	9 1/4
	3 1/2	DLH556					
	1 3/8	DLH560					
	1 3/4	DLH561					
2	DLH562	8 13/16	9 1/2				
2 1/2	DLH563						
3	DLH564						
3 1/2	DLH565						
4	DLH566		10				

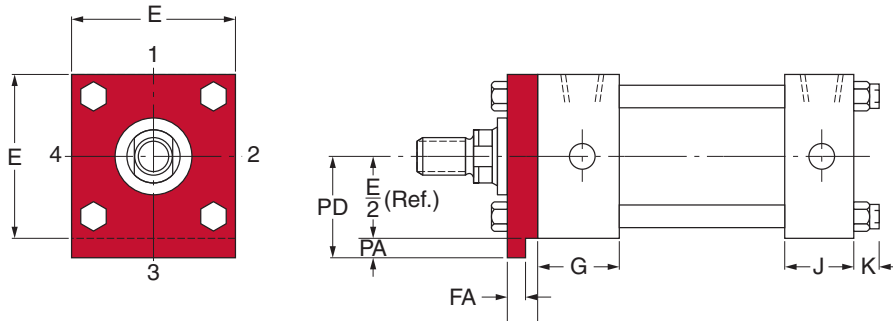
* NOTE: These dimensions are to be substituted for the related mounting dimensions given on the preceding pages. All dimensions given on this table are plus stroke.

KEY MOUNT CYLINDERS

The *Milwaukee Cylinder* Key Mount retainer plate is a mounting option designed to add rugged stability to foot and side mount cylinders. The retainer plate is extended below the mounting surface of the cylinder. This extension may be fitted into a milled keyway in your mounting pad, eliminating the need for welded keys or locator pins.

HOW TO ORDER

For ordering information refer to Page 68.



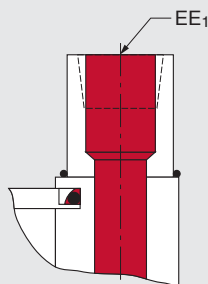
▼ KEY MOUNT CYLINDERS

Bore Ø	E	F	FA	G	PA	PD
1½	2	¾	.312/.310	1½	¾/16	1¾/16
2	2½	¾	.312/.310	1½	¾/16	17/16
2½	3	¾	.312/.310	1½	¾/16	11¹/16
3¼	3¾	¾	.562/.560	1¾	5/16	2¾/16
4	4½	¾	.562/.560	1¾	5/16	29/16
5	5½	¾	.562/.560	1¾	5/16	3¹/16
6	6½	¾	.687/.684	2	¾	3¾

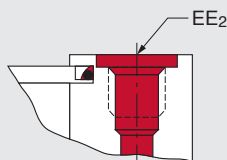


MilCad Cylinder Configurator

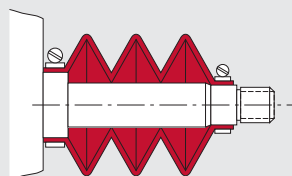
Visit milwaukeeecylinder.com to configure and download CAD files of your cylinders.



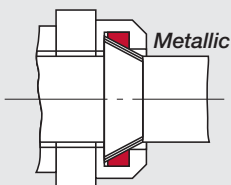
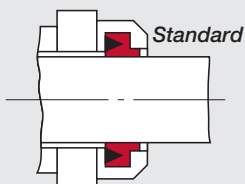
Oversize Port
Welded Boss



SAE Straight Thread
O-ring Port



Rod Boots



Metallic Rod Wipers



**MilCad Cylinder
Configurator**

Visit milwaukeecylinder.com
to configure and download
CAD files of your cylinders.

STANDARD DESIGN OPTIONS

Standard Ports

The *Milwaukee Cylinder* Series LH Cylinders are manufactured as standard, with the largest NPTF tapered thread ports that will fit in both the rod and blind ends of a given bore size. Upon request, extra ports can be provided on the sides of the end caps not occupied by mountings or cushion adjusters.

Oversize Ports

On most bore sizes, welded bosses may be provided for oversize NPTF ports. These bosses protrude from the sides of the end caps. For information as to the boss height in relation to your bore and port requirements, contact your local *Milwaukee Cylinder* Representative. Also, special heavier end caps can be provided so that oversize ports can be accommodated without the use of a welded boss.

Straight Thread Ports

On request, *Milwaukee Cylinder* will furnish an SAE straight thread O-Ring port on the Series LH Cylinders. In addition to the standard oversize NPTF ports, welded bosses may also be used for oversize SAE straight thread O-Ring ports. For further information on oversize SAE ports, contact the factory.

Note:

Flange and manifold style ports are available from *Milwaukee Cylinder*.

Rod Boots

When cylinders are used in areas of high contamination or where contaminants have an air hardening property, the exposed piston rod should be covered with a rod boot to protect the rod bearing and seals. A rod boot is simply a collapsible cover. It is of sewn construction made from a neoprene coated fabric. The rod boots are impervious to oil, grease and water. They will operate effectively from 0° F to +200° F without cracking. For additional details on Rod Boots, please see page 186.

Metallic Rod Wipers

If requested, metallic rod wipers will be supplied in place of the standard synthetic rubber wiper. This type of seal is recommended for applications where contaminants would tend to cling to the rod and damage a standard synthetic rubber rod wiper.

▼ PORT SIZES

Bore Ø	Standard		SAE Straight O-Ring Port	
	NPTF Port EE	Oversized NPTF Port EE ₁	EE ₂	SAE Standard Thread Series
1½	⅜	½	#6	⅝-18
2	⅜	½	#6	⅝-18
2½	⅜	½	#6	⅝-18
3¼	½	¾	#10	7/8-14
4	½	¾	#10	7/8-14
5	½	¾	#10	7/8-14
6	¾	1	#12	1½-12

DESIGN OPTIONS FOR SPECIAL CYLINDERS

Special Rod Ends

Modifications of standard or entirely special rod ends are available from *Milwaukee Cylinder*. When your requirements call for a special rod end style, your order should include a sketch if it is to be an entirely special rod end or note reference as to which letter dimensions you wish to have modified (see inside front cover).

Special Assemblies from Standard Parts

Each style of the various standard cylinder mountings is illustrated, using the commonly recognized cylinder dimensional symbols of the National Fluid Power Association. Each side of the end views are numbered to aid in communication when referring to the relationship between the ports and the mountings. When requesting information or placing an order that requires a dimension other than standard, always make reference to the given dimensional symbol in the catalog and then give your requirements.

Cushion Adjustment Locations

A ball check and a cushion adjustment needle are supplied as standard in position #2 on most models. The cushion needle and ball check are interchangeable as far as location and may be put in any side not occupied by a port or mounting.

Port Locations

Ports are located in position #1 as standard unless otherwise specified. By using the position numbers given with the end views in the dimensional data section of this catalog, ports can be arranged in any one of four 90° positions in relation to the cylinder mounting. When ports are relocated on a cushioned cylinder, the cushion needle and ball check are automatically relocated to hold their relationship to the port as on a standard cylinder, unless otherwise specified at the time of the order.

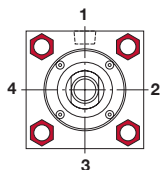
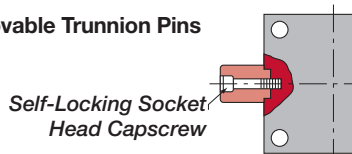


Figure 1

Removable Trunnion Pins



Removable trunnion pins are available on models LH71 and LH72. They can be

used on all bore and rod combinations, except on the largest oversize rods offered with each bore size on all model LH71 cylinders.

Single-Acting Cylinders

The *Milwaukee Cylinder's* Series LH cylinders are designed for either single or double action. When used as a single acting cylinder, hydraulic power drives the piston in one direction, only relying on either the load or an external force to return the piston after the pressure is exhausted.

Single-Acting Spring Cylinders

Single-acting spring return cylinders normally have a spring inside of the cylinder to return the piston to its original position. The application load and friction conditions must be specified when placing an order to properly size the spring. Also specify whether the spring is to return or advance the piston. A spring return cylinder is designed with a stop tube to act as spring guide, which prevents binding of the cylinder due to misalignment of the spring. To accurately determine the cylinder length and mounting dimensions for your application, contact your local *Milwaukee Cylinder* representative or the factory.

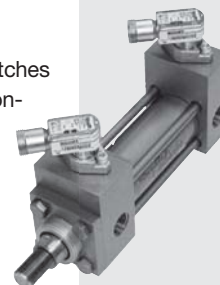
Water Service Cylinders

Milwaukee Cylinder's Series LH Cylinders can be used with water as an operating fluid with some standard modifications to the types of material and the manufacturing processes used. These modifications will include, at some additional cost, bronze piston, nickel plated end caps, a hard chrome plated cylinder barrel and a chrome plated piston or stainless steel piston rod at extra cost. Due to the increased factors of corrosion, electrolysis and mineral deposits acting within a water fitted cylinder, *Milwaukee Cylinder* cannot warrant or make any guarantees other than a water service cylinder will be free of defects in workmanship or materials.

Proximity Switches

End of Stroke Limit Switches:

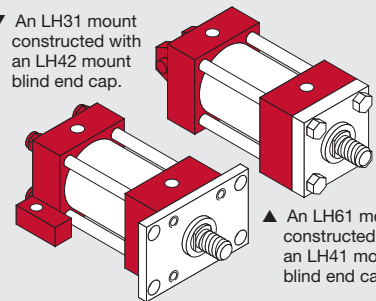
We provide inductive proximity switches for end of stroke sensing. These non-contact switches detect the presence of the spud/cushion bushing. See page 185 for more information.



Combined Mountings

Standard mountings may be combined when specified by the customer. Some examples of this are:

▼ An LH31 mount constructed with an LH42 mount blind end cap.

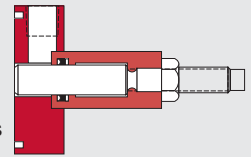


▲ An LH61 mount constructed with an LH41 mount blind end cap.

These and other combinations can be readily made from standard parts. If you are unsure of a possible combination or if it will suit your particular needs, consult with your local *Milwaukee Cylinder* representative or contact the factory.

Adjustable Stroke Cylinders

When a cylinder application requires stroke adjustment, *Milwaukee Cylinder* offers a number of designs, the most common of which is illustrated below. This particular design is externally adjustable, incorporating a threaded rod (of piston rod quality) with the standard hydraulic rod end multiple lip vee seal and bushing design. This provides a proven-effective high and low pressure seal, affording maximum sealing on the stroke adjustment rod.



Further information concerning design limitations, cushioning or alternate designs can be obtained by contacting the factory.

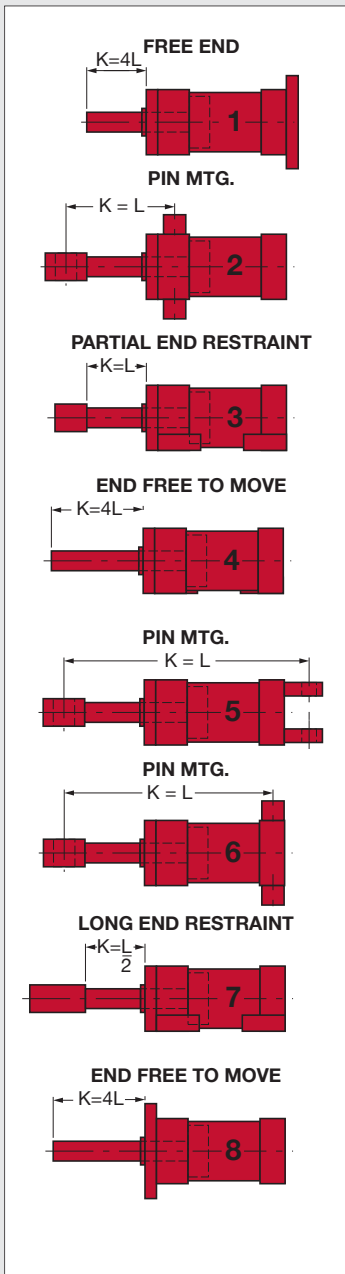


CAUTION!

Cylinders with removable trunnion pins will have a reduced pressure rating.

Consult the factory.

▼ FIGURE 1



Stop Tubes

For more information on Stop Tubes, see page 181 in the Design Engineer's Guide.

STOP TUBES

Stop tubes are used to maintain bearing pressure within acceptable limits and are recommended on cylinders with long strokes or poorly guided rods.

The stop tube is a spacer between the rod end cap and the piston, which provides separation between the piston and the rod bearing. This separation reduces the moment forces developed between the rod bearing and piston when the rod is extended.

To determine if stop tube is necessary for your cylinder requirements, you have to solve for "K" (refer to Figure 1). If your required cylinder has a "K" dimension in excess of 40 inches, stop tube is required. For each 10 inch increment or fraction thereof in excess of 40 inches, one inch of stop tube is recommended. When stop tube is required, the overall length of the cylinder will be increased by the length of the stop tube to be used.

To determine "K" (see to Figure 1)

*Note: W = the rod stick out (refer to pages 54-63)

Cylinder #1, #4, #8 – see Figure 1

$$K = 4L = 4(\text{stroke} + W^*)$$

Cylinder #2 - see Figure 1

$$K = L = (CA \text{ or } CE) + XG + \text{Stroke}$$

Note:

CA = rod eye dimension (back inside cover)

CE = rod clevis dimension (back inside cover)

XG = mounting dimension page 60

Cylinder #3 – see Figure 1

$$K = L = W^* + \text{Stroke}$$

Cylinder #5 – see Figure 1

$$K = L = (CA \text{ or } CE) + XC + (2 \times \text{Stroke})$$

Note:

CA = rod eye dimension (back inside cover)

CE = rod clevis dimension (back inside cover)

XC = mounting dimension page 60

Cylinder #6 – see Figure 1

$$K = L = (CA \text{ or } CE) + XJ + (2 \times \text{Stroke})$$

Note:

CA = rod eye dimension (back inside cover)

CE = rod clevis dimension (back inside cover)

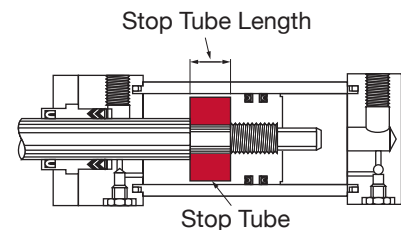
XJ = mounting dimension page 60

Cylinder #7 – see Figure 1

$$K = L/2 = (W^* + \text{Stroke})/2$$

When mounting long stroke cylinders, care should be taken to assure cylinder alignment over the entire length of stroke. The use of external guides or swivel bushings is recommended to reduce side load conditions and prolong the cylinder's service life.

Note: Stop tube length must be added to "K" factor before making final selection of rod size. This is primarily true in No. 5 long stroke applications.



The stop tube is located between the piston and the rod end cap. It limits the extended stroke of the cylinder, providing additional strength for less cost and reduced weight than the use of an oversize rod.

▼ TABLE 1 - VALUE OF "K" IN INCHES

Thrust Force (in-lbs)	Piston Rod Diameter (in)													
	5/8	1	1 1/8	1 1/4	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	7	
400	35	84	134	-	-	-	-	-	-	-	-	-	-	-
700	30	68	119	-	-	-	-	-	-	-	-	-	-	-
1,000	26	60	105	156	190	-	-	-	-	-	-	-	-	-
1,400	24	54	93	144	175	244	308	-	-	-	-	-	-	-
1,800	23	48	84	127	160	230	294	366	-	-	-	-	-	-
2,400	18	45	75	114	145	214	281	347	-	-	-	-	-	-
3,200	16	40	68	103	131	196	262	329	398	-	-	-	-	-
4,000	12	38	63	93	119	174	240	310	373	446	-	-	-	-
5,000	9	36	60	87	112	163	225	289	359	426	-	-	-	-
6,000	-	30	56	82	102	152	209	274	342	411	476	-	-	-
8,000	-	25	51	76	93	136	186	244	310	375	448	-	-	-
10,000	-	21	45	70	89	125	172	221	279	349	412	-	-	-
12,000	-	17	41	64	85	117	155	210	270	326	388	455	-	-
16,000	-	-	35	57	75	110	141	188	233	291	350	421	-	-
20,000	-	-	28	52	66	103	136	173	218	270	325	385	-	-
30,000	-	-	-	39	56	87	120	156	190	232	285	330	-	-
40,000	-	-	-	24	43	75	108	142	177	210	248	293	-	-
50,000	-	-	-	-	30	66	97	131	165	201	234	268	408	-
60,000	-	-	-	-	-	57	88	119	154	190	226	256	384	-
80,000	-	-	-	-	-	36	71	104	136	170	204	240	336	-
100,000	-	-	-	-	-	-	56	91	120	154	199	224	324	-
120,000	-	-	-	-	-	-	45	76	108	146	174	207	313	-
140,000	-	-	-	-	-	-	-	64	98	129	162	194	301	-
160,000	-	-	-	-	-	-	-	47	87	118	149	182	279	-
200,000	-	-	-	-	-	-	-	-	65	98	131	160	260	-
250,000	-	-	-	-	-	-	-	-	-	72	109	143	236	-
300,000	-	-	-	-	-	-	-	-	-	-	85	120	212	-
350,000	-	-	-	-	-	-	-	-	-	-	53	100	195	-
400,000	-	-	-	-	-	-	-	-	-	-	-	72	182	-
500,000	-	-	-	-	-	-	-	-	-	-	-	-	152	-
600,000	-	-	-	-	-	-	-	-	-	-	-	-	-	114
700,000	-	-	-	-	-	-	-	-	-	-	-	-	-	70

▼ TABLE 2 - DEDUCTIONS FOR PULL STROKE FORCE & DISPLACEMENT

Piston Rod Ø	Piston Rod Area	Cylinder Force in Pounds for Various Pressures								Displacement /in of Stroke	
		100 psi	200 psi	250 psi	500 psi	750 psi	1000 psi	1250 psi	1500 psi	Gallons Oil Displaced	
5/8	.307	31	61	77	154	230	307	384	461	.00133	
1	.785	79	157	196	393	589	785	981	1178	.00340	
1 1/8	1.485	149	297	371	743	1114	1485	1856	2228	.00643	
1 1/4	2.405	241	481	601	1203	1804	2405	3006	3608	.01041	
2	3.142	314	628	786	1571	2357	3142	3928	4713	.01360	
2 1/2	4.909	491	982	1227	2455	3682	4909	6137	7364	.02125	
3	7.069	707	1414	1767	3535	5302	7069	8836	10600	.03060	
3 1/2	9.621	962	1924	2405	4811	7216	9621	12026	14430	.04165	
4	12.57	1257	2514	3143	6285	9428	12570	15708	18860	.05442	

▼ TABLE 3 - THRUST FORCE AND DISPLACEMENT

Cylinder Bore Ø	Piston Area	Cylinder Force in Pounds for Various Pressures								Displacement /in of Stroke	
		100 psi	200 psi	250 psi	500 psi	750 psi	1000 psi	1250 psi	1500 psi	Gallons Oil Displaced	
1 1/2	1.767	177	353	442	884	1325	1767	2209	2651	.00765	
2	3.142	314	628	786	1571	2357	3142	3928	4713	.01360	
2 1/2	4.909	491	982	1227	2455	3682	4909	6137	7364	.02125	
3 1/4	8.296	830	1659	2074	4148	6222	8296	10370	12440	.03591	
4	12.57	1257	2514	3143	6285	9428	12570	15708	18860	.05442	
5	19.64	1964	3928	4910	9820	14730	19640	24544	29460	.08502	
6	28.27	2827	5654	7068	14140	21200	28270	35342	42400	.12230	

CYLINDER SIZING

The selection of the correct rod size is one of the most important factors in sizing a cylinder. The standard rod for each bore size that *Milwaukee Cylinder* manufactures is sufficient to handle the maximum tension force that the cylinder is capable of producing. It is primarily in compression and long stroke, high thrust applications that the column strength needs to be considered.

The following steps should be used to determine the proper rod size for an application:

1. Select the cylinder bore size required from Table 3 based on the required cylinder thrust force and the operating line pressure at the cylinder.
2. Determine the length between mounting points or "L" as shown on Figure 1, page 66.
3. Based on the distance between mounting points ("L"), determine the value of "K" as shown on Figure 1, page 66.
4. Using the thrust force and the developed "K" dimension, refer to Table 1 to select the proper rod size.
5. If an oversized rod is required, re-check the overall length dimension ("K") in Step 1 and confirm your previous rod size selection.

To determine the cylinder pull (tension), stroke force, or displacement, deduct the force or displacement corresponding to the rod size in Table 2 from the force or displacement corresponding to the bore size shown in Table 3.