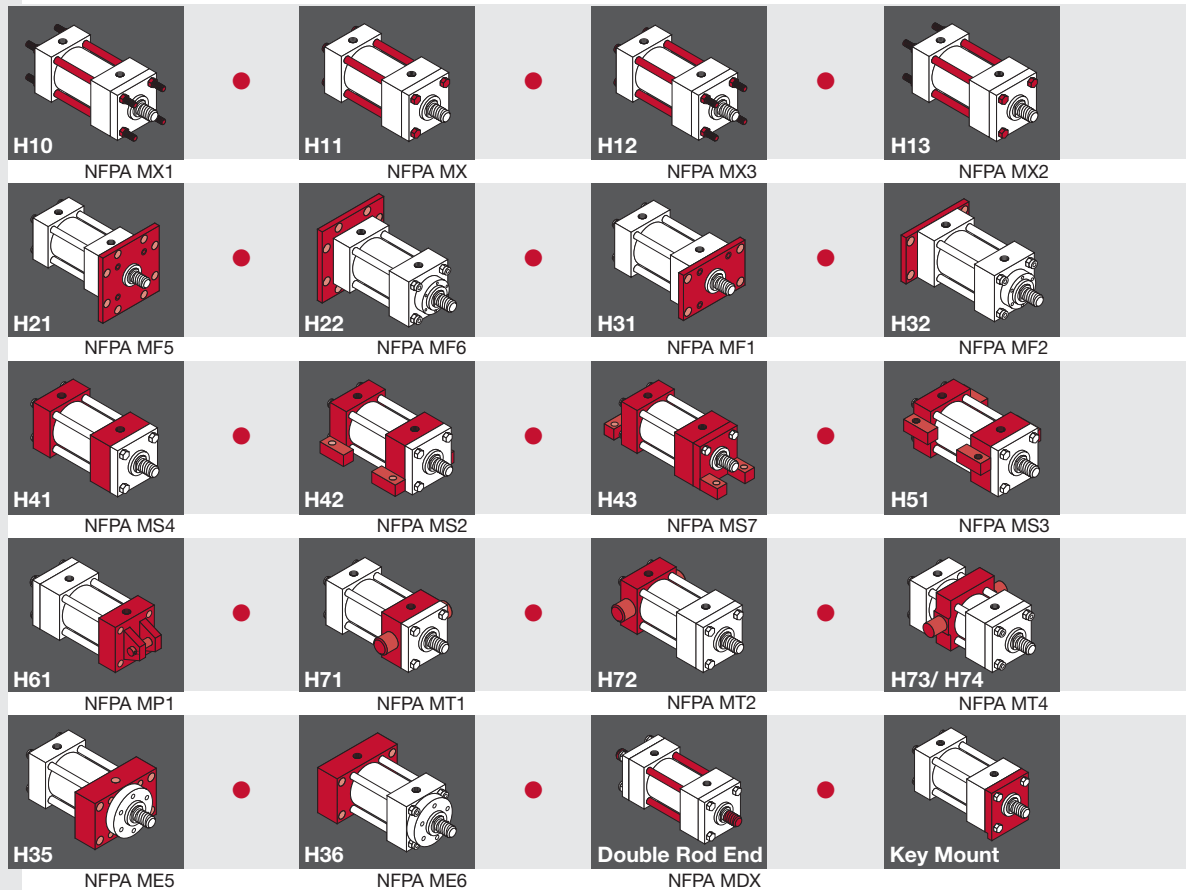


Series H



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.

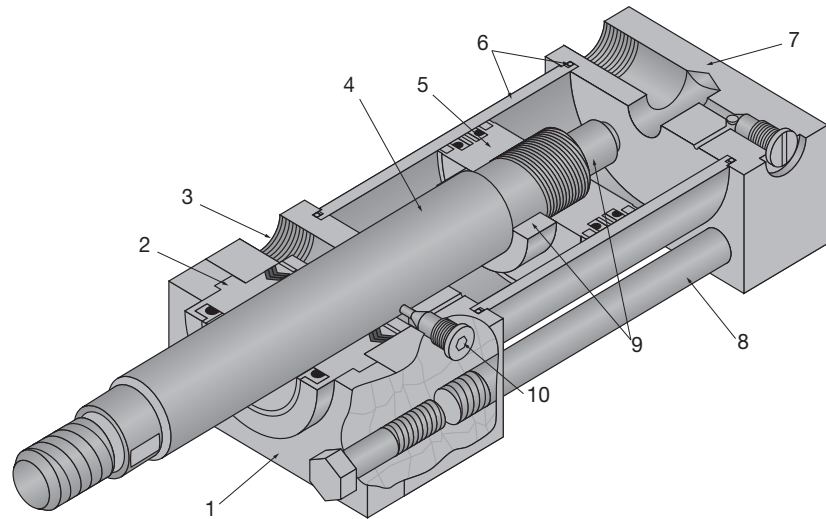
General
*TABLE 3 - Piston Rod End Styles**Standard Specifications and Features**Performance Tested Design Features**Tie Rod Mount**Flange Mount***Mounting Specifications***Side Mount and Lug Mount**Pin Mount and Trunnion Mount**Solid End Cap Mount*
Double Rod End Cylinders
*Key Mount***Additional Information***Design Options**Stop Tubes / Cylinder Sizing**Ordering Information / Replacement Parts**Installation / Trouble Shooting / Maintenance***Accessories***Clevis / Brackets / Pins / Rod Eyes Dimensional Data*

STANDARD SPECIFICATIONS

- Standard construction – square head – tie-rod design
- Nominal pressure – 3000 psi (5000 psi non-shock); see info box below
- Standard fluid-hydraulic oil
- Standard temperature – -20° F to +200° F
- Standard bore sizes – 1½" To 18"
- Standard piston rod diameters ⅝" 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 ⅝" and 1" diameter rods. Studded rod end style is available for all rod sizes

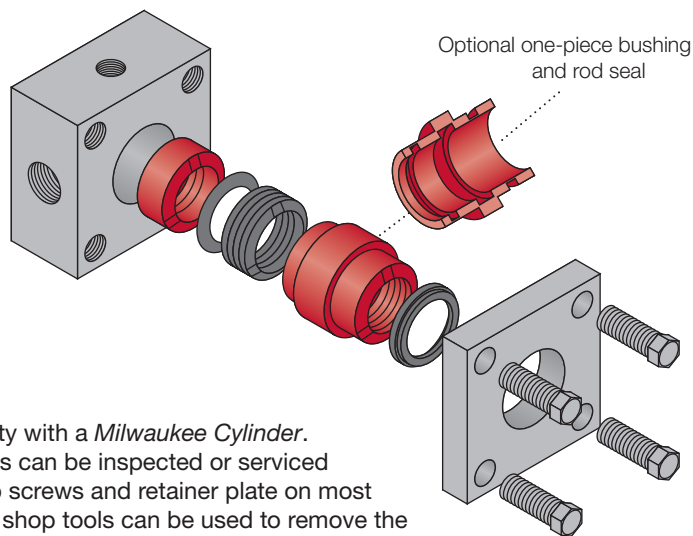
i If your hydraulic operating pressure exceeds 3000 psi, send your application data for engineering evaluation and design recommendations.

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



STANDARD FEATURES

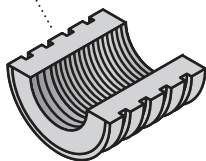
- 1. Removable Retainer Plate**
 The retainer plate and rod bushing are externally removable without disassembling the cylinder on most standard models. Four capscrews securely hold and lock the retainer plate in place.
- 2. Rod Bushing and Seals**
 A combination of spring loaded multiple lip vee rings 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.

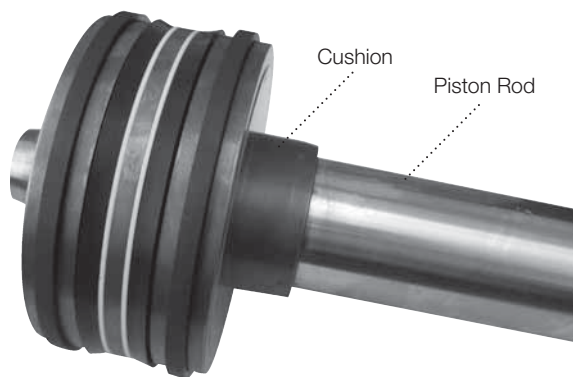
Optional piston design with four cast iron rings



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

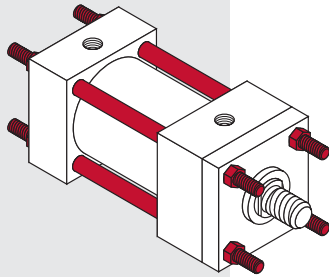
The Series H Cylinder combines two bi-directional sealing cast iron piston rings, with u-cup seals with back-up rings and a fine grained alloy iron piston. This proven piston seal design is effective at both high and low pressures. The design gives the wear and shock absorbing quantities of cast iron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

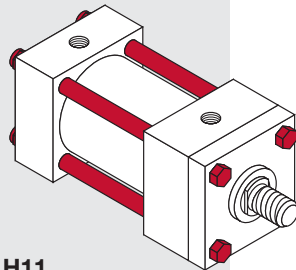
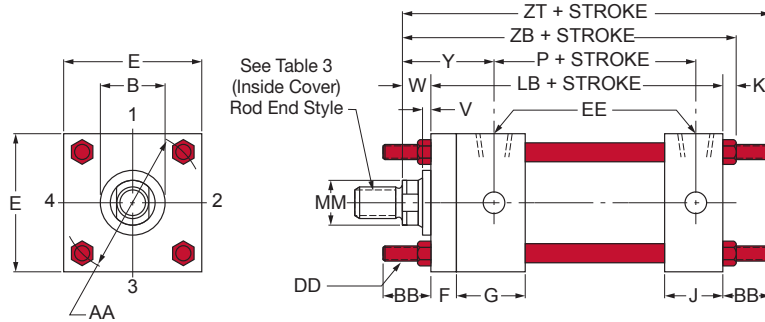
TIE-ROD MOUNTED CYLINDERS

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.



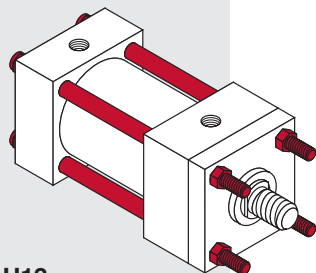
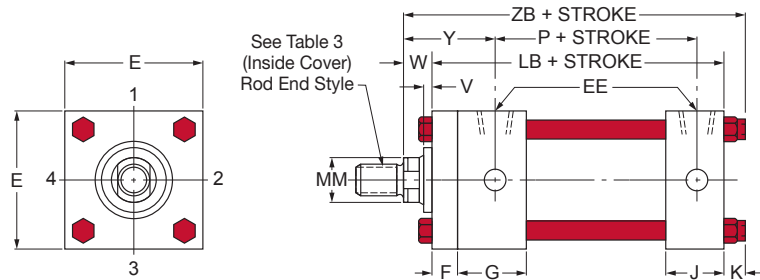
MODEL H10
NFA STYLE MX1

TIE RODS EXTENDED BOTH ENDS



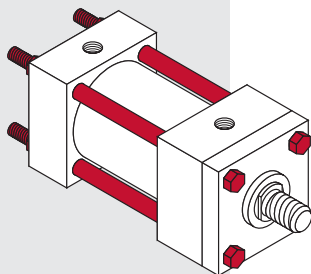
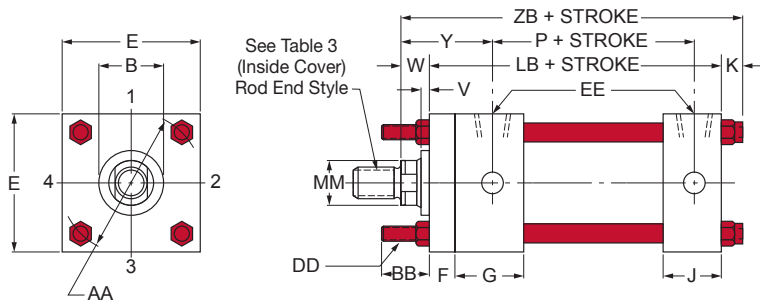
MODEL H11
NFA STYLE MX

NO TIE ROD EXTENSION



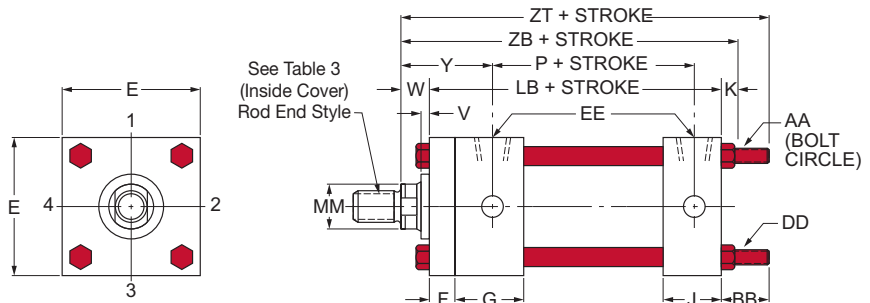
MODEL H12
NFA STYLE MX3

TIE RODS EXTENDED ROD END



MODEL H13
NFA 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	⅝	H00151	1⅛	5	2⅞	¼	⅝	2	6⅛	7
	•1	H00152	1½			½	1	2⅜	6½	7⅜
2	1	H01510	1½	5¼	2⅞	¼	¾	2⅜	6⅝	7⅜ ¹⁶
	•1⅜	H01511	2			⅜	1	2⅝	6⅞	8¼ ¹⁶
2½	1	H01520	1½			¼	¾	2⅜	6¾	7⅝ ¹⁶
	1⅜	H01521	2	5⅜	3	⅜	1	2⅝	7	8¾ ¹⁶
	•1¾	H01522	2⅜			½	1¼	2⅞	7¼	8⅞ ¹⁶
3¼	1⅜	H01530	2			¼	⅞	2 ²³ / ₃₂	7⅞	9 ⁷ / ₁₆
	1¾	H01531	2⅜	6¼	3 ¹⁹ / ₃₂	⅜	1⅛	2 ³¹ / ₃₂	8⅛	9 ¹¹ / ₁₆
	2	H01532	2⅝			⅜	1¼	3 ³ / ₃₂	8¼	9 ¹³ / ₁₆
4	1¾	H01540	2⅜			¼	1	2 ¹⁵ / ₁₆	8⅜	9 ¹⁵ / ₁₆
	2	H01541	2⅝	6⅝	3⅞	¼	1⅛	3 ¹ / ₁₆	8½	10 ¹ / ₁₆
	2½	H01542	3⅛			⅜	1⅜	3 ⁵ / ₁₆	8¾	10 ⁵ / ₁₆
5	2	H01550	2⅝			¼	1⅛	3 ¹ / ₁₆	9¼	11 ⁷ / ₁₆
	2½	H01551	3⅛	7⅞	4⅜	⅜	1⅜	3 ⁵ / ₁₆	9½	11 ¹¹ / ₁₆
	3	H01552	3¾			⅜	1⅜	3 ⁵ / ₁₆	9½	11 ¹¹ / ₁₆
	3½	H01553	4¼			⅜	1⅜	3 ⁵ / ₁₆	9½	11 ¹¹ / ₁₆
6	2½	H01560	3⅛							
	3	H01561	3¾	8⅜	5	¼	1¼	3 ⁷ / ₁₆	10¾	13¼
	3½	H01562	4¼							
	4	H01563	4¾							
7	3	H01570	3¾							
	3½	H01571	4¼	9½	5½	¼	1¼	3¾	12	14 ⁷ / ₈
	4	H01572	4¾							
	4½	H01573	5¼							
8	5	H01574	5¾							
	3½	H01580	4¼							
	4	H01581	4¾	10½	6¼	¼	1¼	3⅞	13¼	16¼
	4½	H01582	5¼							
10	5	H01583	5¾							
	5½	H01584	6¼							
	4½	H15100	5¼			¼	1¼	4¾	16 ¹¹ / ₁₆	21 ¹ / ₁₆
12	5	H15101	5¾	13 ¹³ / ₁₆	8½	½	1½	5	16 ¹⁵ / ₁₆	21 ⁵ / ₁₆
	5½	H15102	6¼			½	1½	5	16 ¹⁵ / ₁₆	21 ⁵ / ₁₆
12	5½	H15120	6¼			¼	1¼	5½	19 ⁹ / ₁₆	24 ¹¹ / ₁₆
	7	H15121	8	16 ⁷ / ₁₆	9⅞					

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	1⅜	⅜-24	2½	½	#10	⅜	1¾	1½	½
2	2.9	1 ¹³ / ₁₆	½-20	3	½	#10	⅝	1¾	1½	⅝
2½	3.6	1 ¹³ / ₁₆	½-20	3½	½	#10	⅝	1¾	1½	⅝
3¼	4.6	2 ⁵ / ₁₆	⅝-18	4½	¾	#12	¾	2	1¾	¾
4	5.4	2 ⁵ / ₁₆	⅝-18	5	¾	#12	⅞	2	1¾	¾
5	7.0	3 ³ / ₁₆	7 ¹⁶ / ₁₆ -14	6½	¾	#12	⅞	2	1¾	1
6	8.1	3⅝	1-14	7½	1	#16	1	2¼	2¼	1⅞
7	9.3	4⅞	1⅞-12	8½	1¼	#20	1	2¾	2¾	1¼
8	10.6	4½	1¼-12	9½	1½	#24	1	3	3	1½
10	13.62	6	1¾-12	12⅝	2	#24	1 ¹¹ / ₁₆	3 ¹¹ / ₁₆	3 ¹¹ / ₁₆	1⅝
12	16.25	7	2-12	14⅞	2½	#32	1 ¹⁵ / ₁₆	4 ⁷ / ₁₆	4 ⁷ / ₁₆	1⅞


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.)

- 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 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.

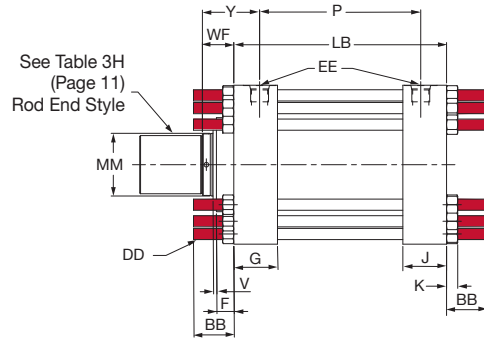
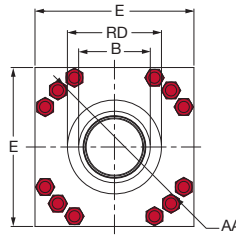
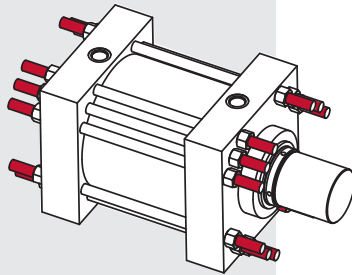
Series H
Series MH
Series LH
Series A
Series MN
Hyd-Pne Devices
Cyl Accessories
Manipulators
Power Units/Valves
Design Guide

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

TIE ROD MOUNTED CYLINDERS

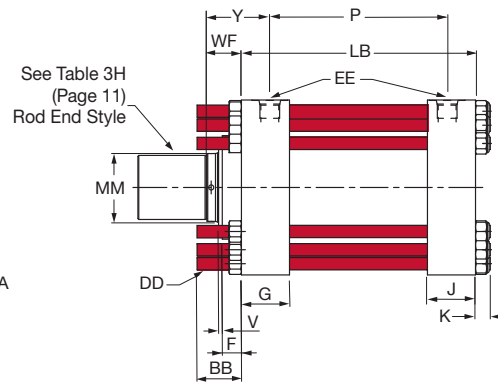
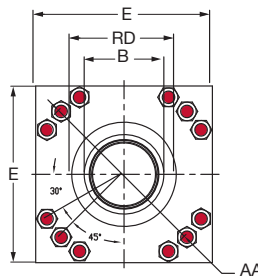
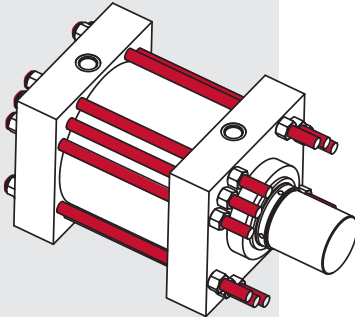
Tie rod mounts are suited for many applications and are similar to flange mounts, but tie-rod mounts are not as rigid as the flange type of mounting. The best use of tie rods extended on the blind end is in a thrust load application. When using tie rod extended on the rod end, the best application is 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



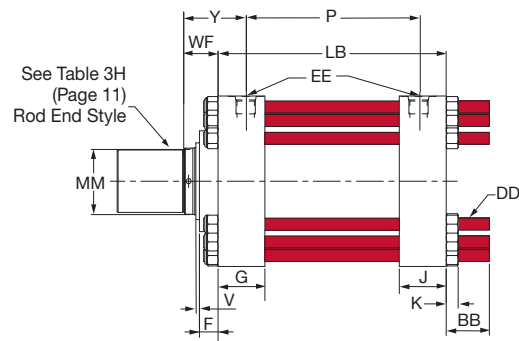
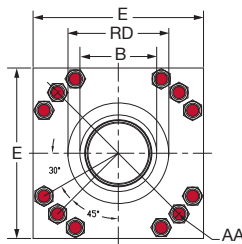
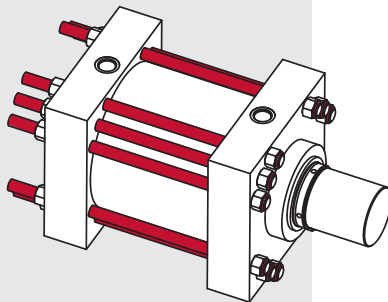
MODEL HM10

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	15 ⁵ / ₈	10 ⁵ / ₈	1/4	3 1/2	6	10 1/2
	8	HM15141	9			1/4	4	6 1/2	11 1/2
	10	HM15142	-			-	6	8 1/2	14 1/2
16	8	HM15160	9	18 ⁵ / ₈	11 ⁷ / ₈	1/4	4	7 ³ / ₈	11 1/2
	9	HM15161	-			-	5 ⁵ / ₈	9	13 ³ / ₈
	10	HM15162	-			-	6	9 ³ / ₈	14 1/2
18	9	HM15180	-	22	13 ³ / ₄	-	5 ⁵ / ₈	9 ³ / ₄	13 ³ / ₈
	10	HM15181	-			-	6	10 ¹ / ₈	14 1/2

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	4 1/2	1 1/4-12	17 ³ / ₄	#24	4 ⁷ / ₈	4 ⁷ / ₈	1 1/2
16	20.25	5	1 ³ / ₈ -12	20 ¹ / ₄	#24	5 ⁷ / ₈	5 ⁷ / ₈	1 ⁵ / ₈
18	22.63	5 1/2	1 1/2-12	22 ¹ / ₄	#24	6 ⁷ / ₈	6 ⁷ / ₈	1 ⁷ / ₈

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.

NOTES:

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

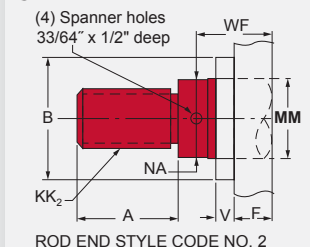


MilCad Cylinder Configurator

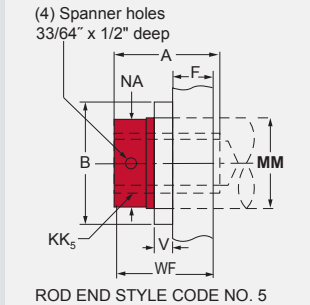
Visit milwaukeeecylinder.com to configure and download CAD files of your cylinders.

PISTON ROD END STYLES

STYLE KK2



STYLE KK5

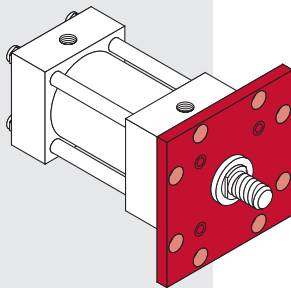


For Package and Mounting Dimension see Tables 1H and 2H.

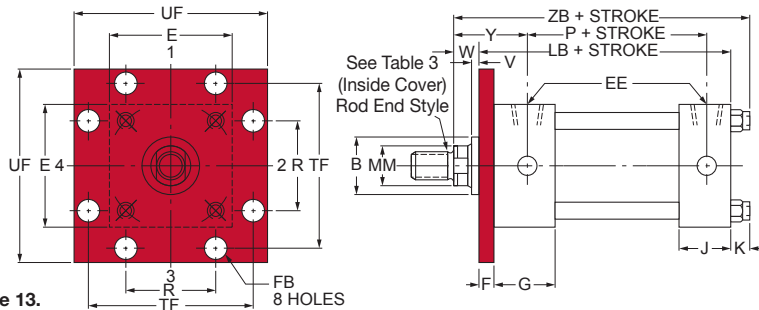
FLANGE MOUNTED CYLINDERS

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.



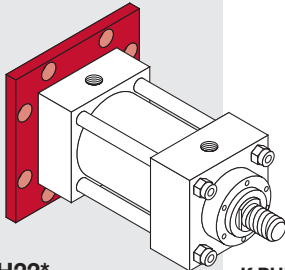
ROD SQUARE FLANGE MOUNTING



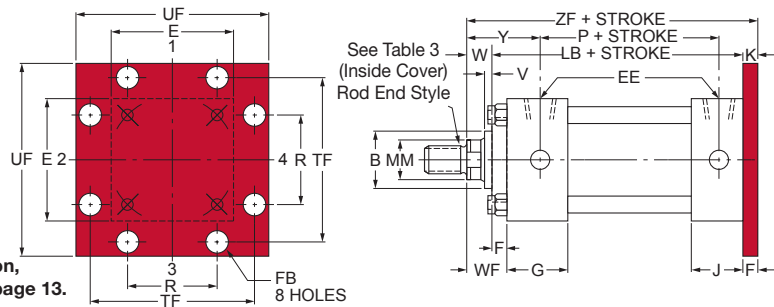
MODEL H21
NFPA STYLE MF5

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

Shown with circular retainer. Retainer is square <math>< 3/4''</math> bore.

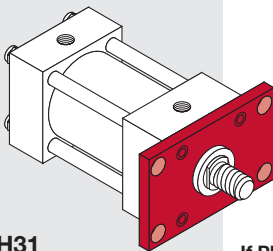


BLIND SQUARE FLANGE MOUNTING

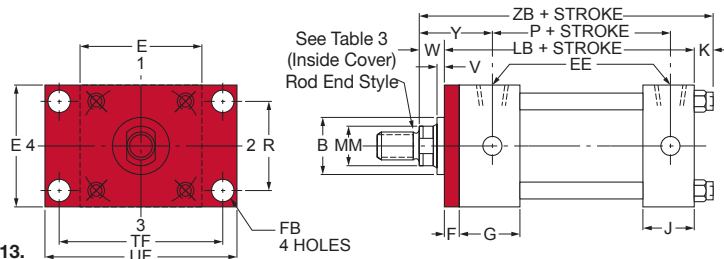


MODEL H22*
NFPA STYLE MF6

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

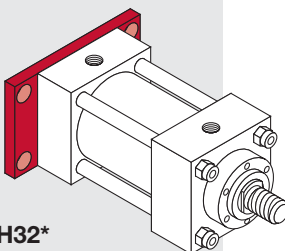


ROD RECTANGULAR FLANGE MOUNTING

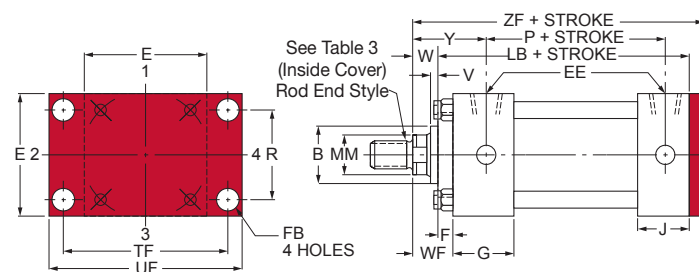


MODEL H31
NFPA STYLE MF1

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



BLIND RECTANGULAR FLANGE MOUNTING



MODEL H32*
NFPA STYLE MF2

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

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	1⅞	5	2⅞	¼	⅝	—	2	6⅞	6
	•1*	H00152	1½			½	1	—	2⅝	6½	6⅝
2	1	H01510	1½	5¼	2⅞	¼	¾	—	2⅝	6⅝	6⅝
	•1⅜*	H01511	2			⅜	1	—	2⅝	6⅞	6⅞
2½	1	H01520	1½			¼	¾	—	2⅝	6¾	6¾
	1⅜	H01521	2	5⅝	3	⅜	1	—	2⅝	7	7
	•1¾*	H01522	2⅝			½	1¼	—	2⅞	7¼	7¼
3¼	1⅜	H01530	2			¼	⅞	1⅝	2 ²³ / ₃₂	7⅞	7⅞
	1¾	H01531	2⅝	6¼	3 ¹⁹ / ₃₂	⅜	1⅞	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	8⅞	8½
	2	H01541	2⅝	6⅝	3⅞	¼	1⅞	2	3 ¹ / ₁₆	8½	8⅝
	2½	H01542	3⅞			⅜	1⅜	2¼	3 ⁵ / ₁₆	8¾	8⅞
5	2	H01550	2⅝			¼	1⅞	2	3 ¹ / ₁₆	9¼	9⅞
	2½	H01551	3⅞	7⅞	4⅜	⅜	1⅞	2¼	3 ⁵ / ₁₆	9½	9⅝
	3	H01552	3¾			⅜	1⅞	2¼	3 ⁵ / ₁₆	9½	9⅝
	3½	H01553	4¼			⅜	1⅞	2¼	3 ⁵ / ₁₆	9½	9⅝
6	2½	H01560	3⅞								
	3	H01561	3¾	8⅞	5	¼	1¼	2¼	3 ⁷ / ₁₆	10¼	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								
8	5	H01574	5¾								
	3½	H01580	4¼								
	4	H01581	4¾								
	4½	H01582	5¼	10½	6¼	¼	1¼	2¼	3⅞	13¼	12¾
10	5	H01583	5¾								
	5½	H01584	6¼								
	4½	H15100	5¼			¼	1¼	—	4¾	16 ¹¹ / ₁₆	16¾
12	5	H15101	5¾	13 ¹⁹ / ₁₆	8½	½	1½	—	5	16 ¹⁵ / ₁₆	17
	5½	H15102	6¼			½	1½	—	5	16 ¹⁵ / ₁₆	17
12	5½	H15120	6¼			¼	1¼	—	5½	19 ⁹ / ₁₆	19⅝
	7	H15121	8	16 ⁷ / ₁₆	9⅞			—			

For bore diameter sizes 14" to 18" see pages 24 and 25.

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	⅞	1¼	1½	½	1.63	3 ⁷ / ₁₆	4¼
2	3	½	#10	⅝	⅞	1¼	1½	⅝	2.05	4⅞	5⅞
2½	3½	½	#10	⅝	⅞	1¼	1½	⅝	2.55	4⅞	5⅞
3¼	4½	¾	#12	¾	1 ¹ / ₁₆	2	1¾	¾	3.25	5⅞	7⅞
4	5	¾	#12	⅞	1 ¹ / ₁₆	2	1¾	¾	3.82	6⅞	7⅞
5	6½	¾	#12	⅞	1 ⁵ / ₁₆	2	1¾	1	4.95	8 ³ / ₁₆	9¾
6	7½	1	#16	1	1 ¹ / ₁₆	2¼	2¼	1⅞	5.73	9 ⁷ / ₁₆	11¼
7	8½	1¼	#20	1	1 ³ / ₁₆	2¾	2¾	1¼	6.58	10⅞	12⅝
8	9½	1½	#24	1	1 ⁵ / 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.)

- 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 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



MilCad Cylinder Configurator

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

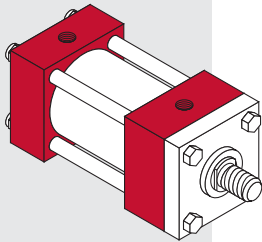
Series H
Series MH
Series LH
Series A
Series MN
Hyd-Pne Devices
Cyl Accessories
Manipulators
Power Units/Valves
Design Guide

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

SIDE OR LUG MOUNTED CYLINDERS

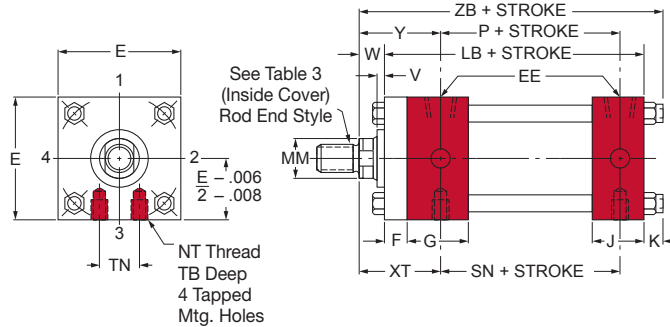
The side or lug mounted cylinder provides a fairly rigid mount. These types of cylinders can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves toward the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder 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.

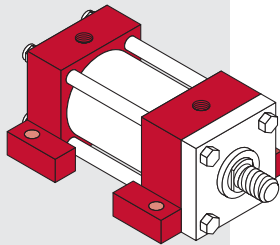


MODEL H41
NFA STYLE MS4

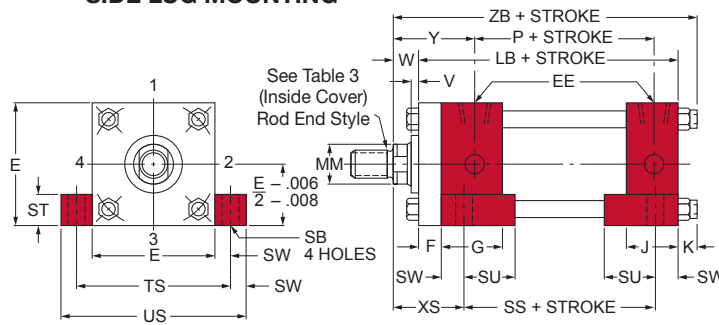
TAPPED HOLES IN CAPS FLUSH MOUNTING



SIDE LUG MOUNTING

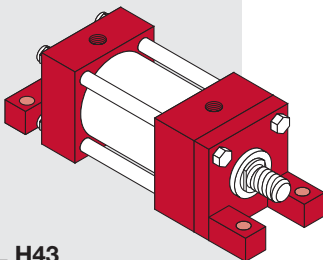


MODEL H42
NFA STYLE MS2

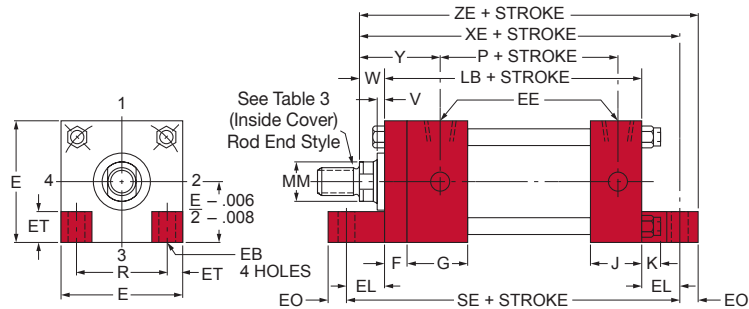


Not Available With
Removable Retainers.

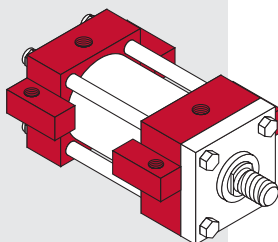
FOOT MOUNTING



MODEL H43
NFA STYLE MS7



CENTERLINE LUG MOUNTING



MODEL H51
NFA STYLE MS3

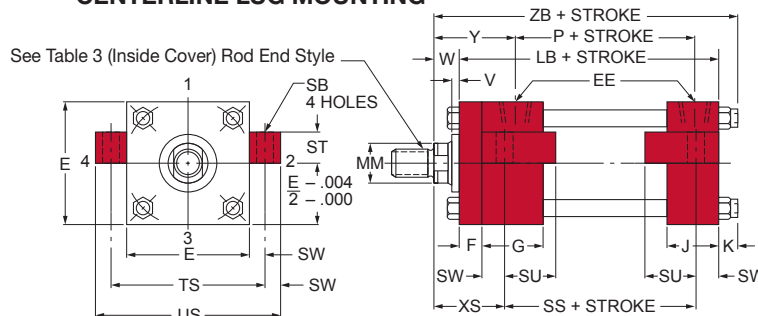


TABLE 1H

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	67/8	77/16					
	•†1¾*	H01511						¾	1	73/16	21/8	25/8	25/8	67/8	711/16					
2½	1	H01520	3	5¾	7¼	3	33/8	¼	¾	71/16	21/16	2¾	2¾	6¾	79/16					
	13/8*	H01521						¾	1	715/16	25/16	25/8	25/8	7	713/16					
3¼	13/8*	H01522	319/32	6¼	8½	3½	41/8	½	1¼	79/16	29/16	27/8	27/8	7¼	81/16					
	•†1¾*	H01530						¾	1	8¼	25/16	2¾	223/32	77/8	87/8					
4	1¾	H01531	37/8	6½	87/8	3¾	4	¾	1½	8½	2¾	3	215/16	83/8	93/8					
	2*	H01541						¾	1½	87/8	27/8	31/8	31/16	8½	9½					
	2½*	H01542						¾	1¾	91/8	31/8	37/8	35/16	8¾	9¾					
5	2	H01550	43/8	7½	10½	43/8	4½	¾	1½	9¾	27/8	31/8	31/16	9¼	10½					
	2½	H01551						¾	1¾	10	31/8	33/8	35/16	9½	10¾					
	3	H01552						¾	1¾	10	31/8	33/8	35/16	9½	10¾					
6	3½*	H01553	5	8¾	10¾	5	5½	¾	1¾	115/16	33/8	3½	37/16	10¾	1213/16					
	2½	H01560						5½	9½	13½	5½	5¾	¾	1¼	129/16	35/8	319/16	3¾	12	13½
	3	H01561																		
7	3½	H01562	6¼	10½	14½	6¼	6¾	¾	1¼	13¾	35/8	315/16	37/8	13¼	147/8					
	4	H01570																		
	4½*	H01571																		
8	5*	H01572	8½	1313/16	-	8½	87/8	½	1½	-	49/16	5	4¾	1611/16	-					
	3	H01573						½	1½	-	419/16	5¼	5	1615/16	-					
	4	H01574						½	1½	-	419/16	5¼	5	1615/16	-					
10	5½*	H01580	97/8	167/16	-	10½	10½	¾	1¼	-	59/16	5¾	5½	199/16	-					
	4	H01581																		
	5	H01582																		
12	5½	H01583	97/8	167/16	-	10½	10½	¾	1¼	-	59/16	5¾	5½	199/16	-					
	4	H01584																		
	5	H01585																		
12	7	H15100	97/8	167/16	-	10½	10½	¾	1¼	-	59/16	5¾	5½	199/16	-					
	5	H15101																		
	5½	H15102																		
12	7	H15120	97/8	167/16	-	10½	10½	¾	1¼	-	59/16	5¾	5½	199/16	-					
	7	H15121																		
	7	H15122																		

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.)

* Model H41 is not available 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.

• 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 Table 3 in the inside cover of catalog.

Page ii

MilCad Cylinder Configurator

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TABLE 2H

The dimensions are constant regardless of rod diameter or stroke.

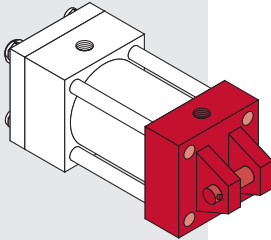
Bore Ø	E	EB	EE NPT	EE SAE	EL	EO	ET	F	G	J	K	NT	R	SB	ST	SU	SW	TB	TN	TS	US
1½	2½	7/16	½	#10	7/8	¾	¾	¾	1¾	1½	½	¾-16	1.63	7/16	½	15/16	¾	9/16	¾	3¼	4
2	3	9/16	½	#10	15/16	½	7/8	5/8	1¾	1½	5/8	½-13	2.05	9/16	¾	1¼	½	5/8	15/16	4	5
2½	3½	9/16	½	#10	15/16	½	7/8	5/8	1¾	1½	5/8	5/8-11	2.55	13/16	1	19/16	11/16	7/8	15/16	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	1¾	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	1½	1¼-7	5.73	19/16	1½	2½	1½	1¾	39/16	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	1¾	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	1¾	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.

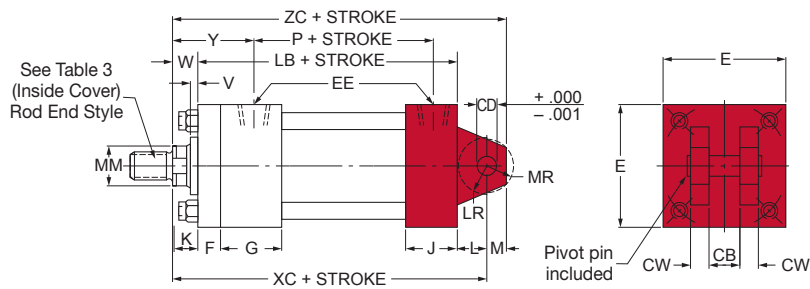
PIN AND TRUNNION MOUNTED CYLINDERS

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.

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



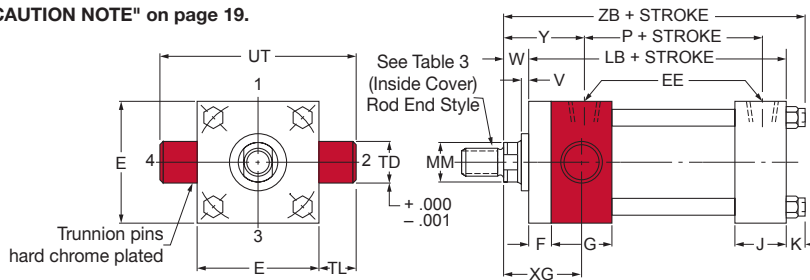
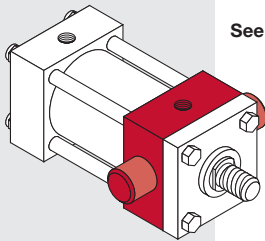
CLEVIS MOUNT



MODEL H61
NFA STYLE MP1

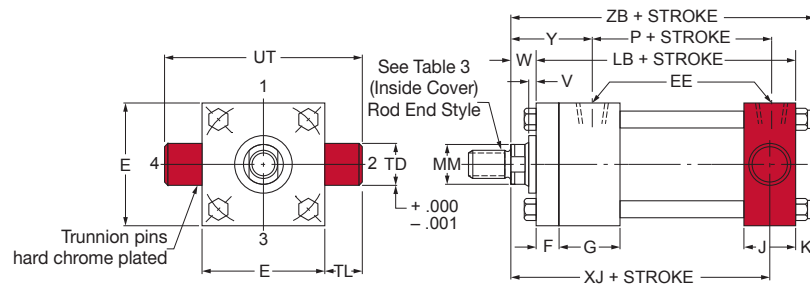
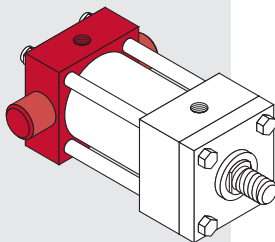
ROD END TRUNNION MOUNT

See "CAUTION NOTE" on page 19.



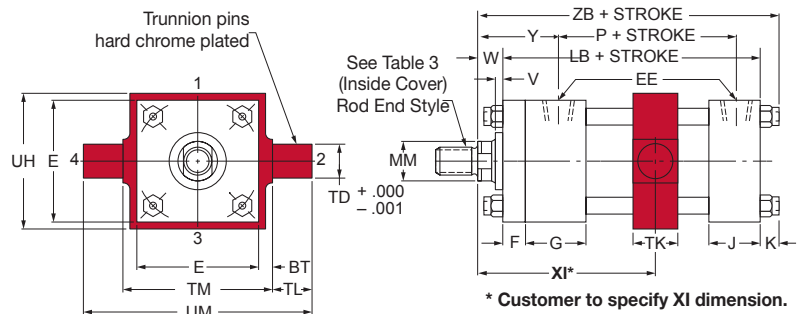
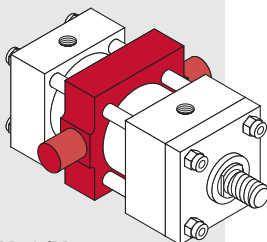
MODEL H71
NFA STYLE MT1

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	5/8	H00151	27/8	5	¼	5/8	63/8	17/8	47/8	2	61/8	67/8
	•1*	H00152			½	1	63/4	21/4	51/4	23/8	61/2	71/4
2	1	H01510	27/8	5¼	¼	¾	7¼	2¼	5¼	23/8	65/8	8
	•1¾*	H01511			3/8	1	7½	2½	5½	25/8	67/8	8¼
2½	1	H01520	3	53/8	¼	¾	73/8	2¼	53/8	23/8	63/4	81/8
	13/8	H01521			3/8	1	75/8	2½	55/8	25/8	7	83/8
3¼	•1¾*	H01522	319/32	6¼	½	1¼	77/8	2¾	57/8	27/8	7¼	85/8
	13/8	H01530			¼	7/8	85/8	25/8	6¼	223/32	77/8	95/8
4	1¾	H01531	37/8	65/8	3/8	1½	87/8	27/8	6½	231/32	81/8	97/8
	2	H01532			3/8	1¼	9	3	65/8	33/32	8¼	10
	1¾	H01540			¼	1	9¾	27/8	6¾	215/16	83/8	111/8
5	2	H01541	43/8	71/8	¼	11/8	97/8	3	67/8	31/16	8½	11¼
	2½	H01542			3/8	13/8	101/8	3¼	71/8	35/16	8¾	11½
	2	H01550			¼	11/8	10½	3	73/8	31/16	9¼	121/8
6	2½	H01551	5	83/8	3/8	13/8	10¾	3¼	75/8	35/16	9½	123/8
	3	H01552			3/8	13/8	10¾	3¼	75/8	35/16	9½	123/8
	3½	H01553			3/8	13/8	10¾	3¼	75/8	35/16	9½	123/8
7	2½	H01560	5½	9½	¼	1¼	121/8	33/8	83/8	37/16	10¾	141/8
	3	H01561										
	3½	H01562										
	4	H01563										
8	3	H01570	6¼	10½	¼	1¼	15	3¾	10¼	37/8	13¼	17¾
	3½	H01571										
	4	H01572										
	4½	H01573										
10	4½	H01574	8½	1319/16	½	1½	195/16	5	13½	5	1615/16	2213/16
	3	H01580										
	4	H01581										
	4½	H01582										
12	5	H01583	97/8	167/16	¼	1¼	223/16	53/8	15½	5½	199/16	263/16
	5½	H01584										
	4½	H15100										
	5	H15101										
12	5½	H15102	97/8	167/16	¼	1¼	223/16	53/8	15½	5½	199/16	263/16
	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				UT
																	TK	TM	UH	UM	TK	TM	UH	UM	
1½	¾	½	½	2½	½	#10	3/8	1¾	1½	½	¾	5/8	½	21/32	1	1	1½	4	2½	6	1½	3	3	5	4½
2	1¼	¾	5/8	3	½	#10	5/8	1¾	1½	5/8	1¼	11/8	¾	15/16	13/8	13/8	2	5	33/8	7¾	1¾	3½	3½	6¼	5¾
2½	1¼	¾	5/8	3½	½	#10	5/8	1¾	1½	5/8	1¼	11/8	¾	15/16	13/8	13/8	2	5½	41/8	8¼	1¾	4	4	6¾	6¼
3¼	1½	1	¾	4½	¾	#12	¾	2	1¾	¾	1½	1¼	1	13/16	1¾	1¾	2½	7	5	10½	2¼	5	5	8½	8
4	2	13/8	1	5	¾	#12	7/8	2	1¾	¾	21/8	17/8	13/8	13/8	1¾	1¾	2½	7½	6½	11	2¼	5½	6½	9	8½
5	2½	1¾	1¼	6½	¾	#12	7/8	2	1¾	1	2¼	2	15/8	15/8	1¾	1¾	3	9	7½	12½	3	7	7¼	10½	10
6	2½	2	1¼	7½	1	#16	1	2¼	2¼	11/8	2½	21/16	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	25/8	23/8	23/8	2½	2½	4	12	10	17	3½	9¾	10	14¾	13½
8	3	3	1½	9½	1½	#24	1	3	3	1½	3¼	27/8	2¾	2¾	3	3	4½	13	11	19	4	11	11¾	17	15½
10	4	3½	2	125/8	2	#24	11/16	311/16	311/16	15/8	4	3½	3½	3½	3½	3½	5	17½	15¼	24½	5	14	15¼	21	195/8
12	4½	4	2¼	147/8	2½	#32	15/16	47/16	47/16	17/8	4½	4	4	4	4	4	5½	207/8	19¼	287/8	8½	16½	19¼	24½	227/8

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.
- 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: H61 and H73/H74 mounting styles.

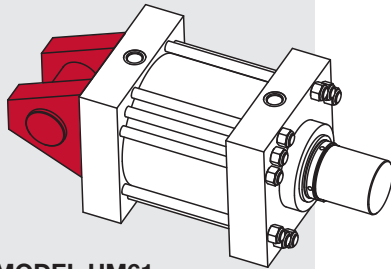
Rod End Styles and Dimensions
For rod end styles and dimensions see Table 3 in the inside cover of catalog.
Page ii

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

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

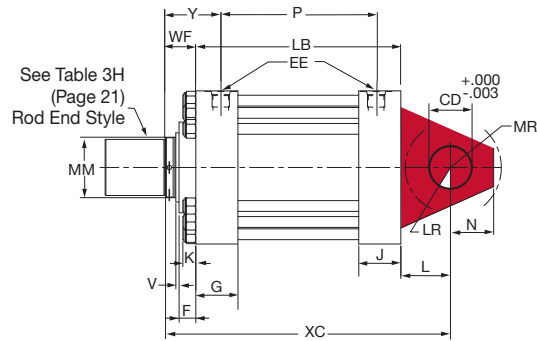
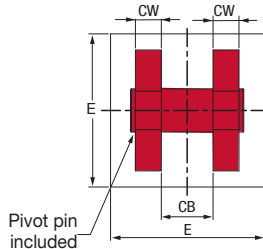
PIN AND TRUNNION MOUNTED CYLINDERS

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.



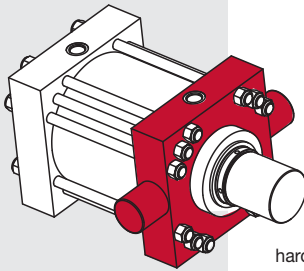
MODEL HM61

CLEVIS MOUNT

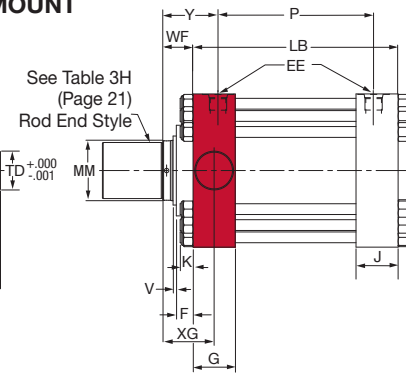
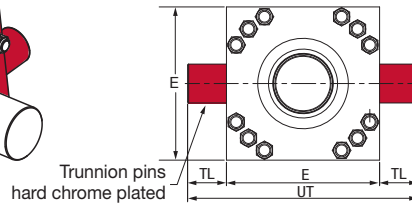


See "CAUTION NOTE" on page 21.

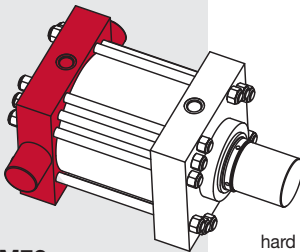
ROD END TRUNNION MOUNT



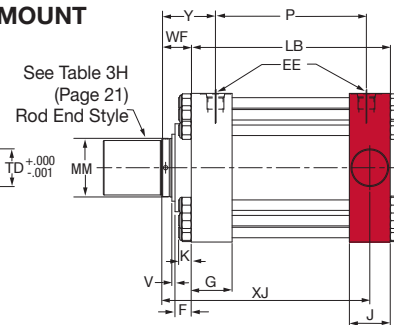
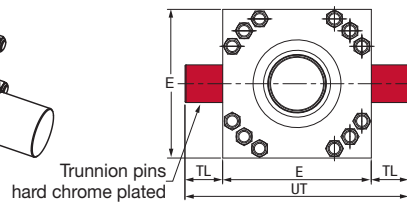
MODEL HM71



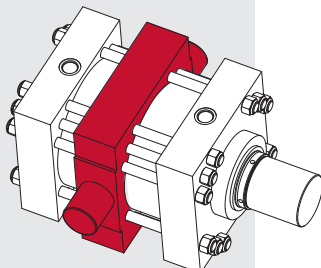
BLIND END TRUNNION MOUNT



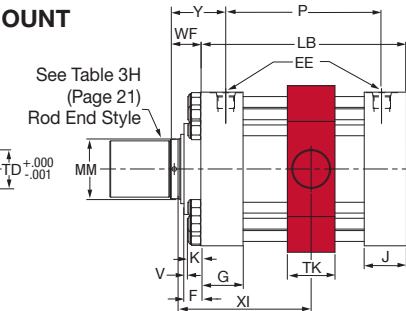
MODEL HM72



CENTER TRUNNION MOUNT



MODEL HM73/HM74



HM73 is an exclusive Milwaukee Cylinder design.
HM74 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	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 1 1/16
	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	-			-	5 5/8	9 3/4	35 1/4	-	-
	10	HM15181	-	22	13 3/4	-	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.)

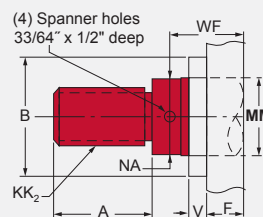


MilCad Cylinder Configurator

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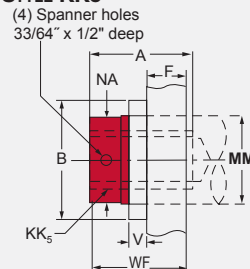
PISTON ROD END STYLES

STYLE KK2



ROD END STYLE CODE NO. 2

STYLE KK5



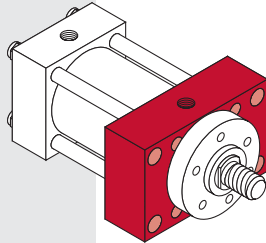
ROD END STYLE CODE NO. 5

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

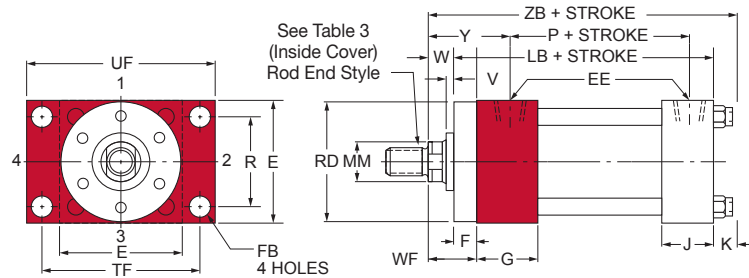
SOLID ROD END CAP MOUNTED CYLINDERS

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.



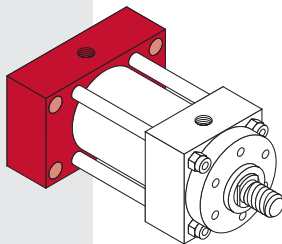
MODEL H35
NFPA STYLE ME5



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

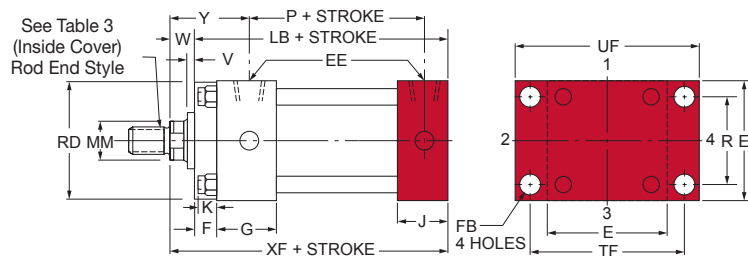


TABLE 1H

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

Bore Ø	Rod MM	Cylinder Code ♦	P	LB	RD	V	W	WF	XF	Y	ZB
1½	⅝	H00151	2⅞	5	2.38	¼	⅝	1	5⅝	2	6⅞
	•1*	H00152			2.50	½	1	1⅜	6	2⅝	6½
2	1	H01510	2⅞	5¼	3.00	¼	¾	1⅜	6	2⅝	6⅝
	•1⅜*	H01511			3.00	⅜	1	1⅝	6¼	2⅝	6⅞
2½	1	H01520	3	5⅝	3.00	¼	¾	1⅜	6⅞	2⅝	6¾
	1⅜	H01521			3.00	⅜	1	1⅝	6⅜	2⅝	7
	•1¾*	H01522			3.50	½	1¼	1⅞	6⅝	2⅞	7¼
3¼	1⅜	H01530	3⅞	6¼	3.50	¼	⅞	1⅝	7⅞	2 ²³ / ₃₂	7⅞
	1¾	H01531			3.50	⅜	1⅞	1⅞	7⅞	2 ³¹ / ₃₂	8⅞
	2	H01532			4.00	⅜	1¼	2	7½	3 ³ / ₃₂	8¼
4	1¾	H01540	3⅞	6⅝	3.50	¼	1	1⅞	7⅞	2 ¹⁵ / ₁₆	8⅝
	2	H01541			4.00	¼	1⅞	2	7¾	3 ¹ / ₁₆	8½
	2½	H01542			4.50	⅜	1⅜	2¼	8	3 ⁵ / ₁₆	8¾
5	2	H01550	4⅜	7⅞	4.00	¼	1⅞	2	8¼	3 ¹ / ₁₆	9¼
	2½	H01551			4.50	⅜	1⅞	2¼	8½	3 ⁵ / ₁₆	9½
	3	H01552			5.12	⅜	1⅞	2¼	8½	3 ⁵ / ₁₆	9½
	3½	H01553			5.50	⅜	1⅞	2¼	8½	3 ⁵ / ₁₆	9½
6	2½	H01560	5	8⅝	4.50						
	3	H01561			5.50	¼	1¼	2¼	9⅞	3 ⁷ / ₁₆	10¾
	3½	H01562			5.88						
	4	H01563			6.38						
7	3	H01570	5½	9½	5.50						
	3½	H01571			5.88	¼	1¼	2¼	10¾	3¾	12
	4	H01572			6.38						
	4½	H01573			6.88						
	5	H01574			7.31						
8	3½	H01580	6¼	10½	5.88						
	4	H01581			6.38	¼	1¼	2¼	11¾	3⅞	13¼
	4½	H01582			6.88						
	5	H01583			7.31						
	5½	H01584			8.43						
10	4½	H15100	8½	13 ¹³ / ₁₆	6.88	¼	1¼	2 ¹⁵ / ₁₆	15 ¹ / ₁₆	4¾	16 ¹¹ / ₁₆
	5	H15101			7.31	½	1½	3 ³ / ₁₆	15 ⁵ / ₁₆	5	16 ¹⁵ / ₁₆
	5½	H15102			8.43	½	1½	3 ³ / ₁₆	15 ⁵ / ₁₆	5	16 ¹⁵ / ₁₆
12	5½	H15120	9⅞	16 ⁷ / ₁₆	8.43						
	7	H15121			10.50	¼	1¼	3 ¹ / ₁₆	17 ¹ / ₁₆	5½	19 ⁹ / 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	E	EE NPT	EE SAE	F	FB	G	J	K	PA	PD	R	TF	UF
1½	2½	½	#10	⅜	7/16	1¼	1½	½	⅜	1 ¹ / ₁₆	1.63	3 ⁷ / ₁₆	4¼
2	3	½	#10	⅝	9/16	1¼	1½	⅝	5/16	1 ¹³ / ₁₆	2.05	4⅞	5⅞
2½	3½	½	#10	⅝	9/16	1¼	1½	⅝	5/16	2 ¹ / ₁₆	2.55	4⅝	5⅝
3¼	4½	¾	#12	¾	1 ¹ / ₁₆	2	1¾	¾	¾	2⅝	3.25	5⅞	7⅞
4	5	¾	#12	⅞	1 ¹ / ₁₆	2	1¾	¾	7/16	2 ¹⁵ / ₁₆	3.82	6⅝	7⅝
5	6½	¾	#12	⅞	1 ⁵ / ₁₆	2	1¾	1	7/16	3 ¹¹ / ₁₆	4.95	8 ³ / ₁₆	9¾
6	7½	1	#16	1	1 ¹ / ₁₆	2¼	2¼	1⅞	½	4¼	5.73	9 ⁷ / ₁₆	11¼
7	8½	1¼	#20	1	1 ³ / ₁₆	2¾	2¾	1¼	½	4¾	6.58	10 ⁵ / ₁₆	12⅝
8	9½	1½	#24	1	1 ⁵ / ₁₆	3	3	1½	½	5¼	7.50	11 ¹³ / ₁₆	14
10	12⅝	2	#24	1 ¹¹ / ₁₆	1 ¹³ / ₁₆	3 ¹¹ / ₁₆	3 ¹¹ / ₁₆	1⅝	1 ³ / ₁₆	7⅞	9.62	15 ⁷ / ₁₆	19
12	14⅞	2½	#32	1 ¹⁵ / ₁₆	2 ¹ / ₁₆	4 ⁷ / ₁₆	4 ⁷ / ₁₆	1⅞	1 ⁵ / ₁₆	8⅝	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.)

- 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 Table 3 in the inside cover of catalog.

Page ii



MilCad Cylinder Configurator

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

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

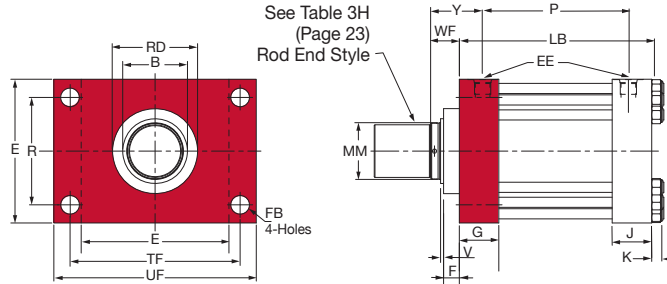
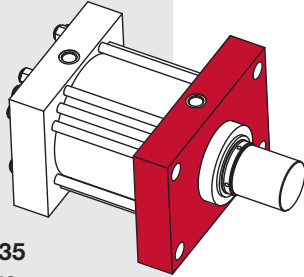
SOLID END CAP MOUNTED CYLINDERS

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.

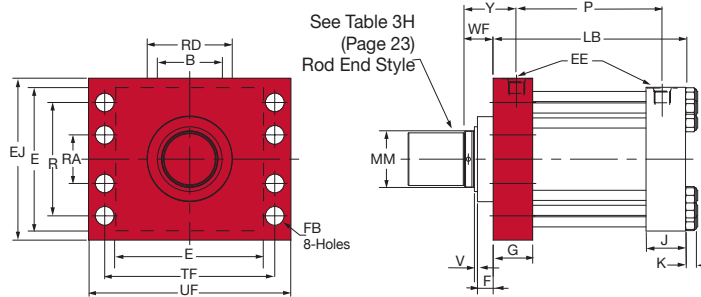
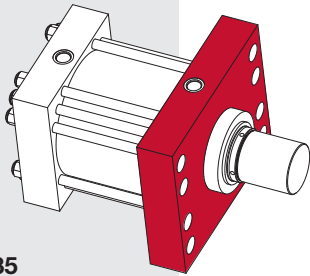
SOLID ROD END CAP MOUNT (14" Bore)

MODEL HM35
14" Bore Size



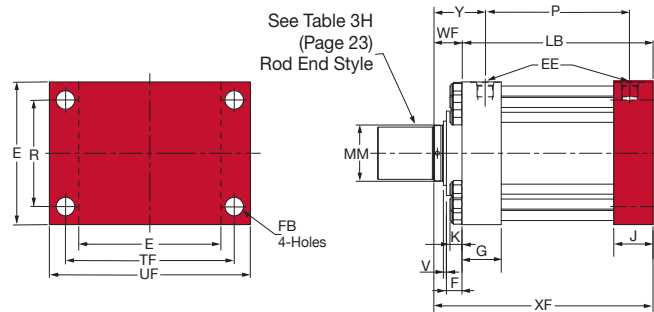
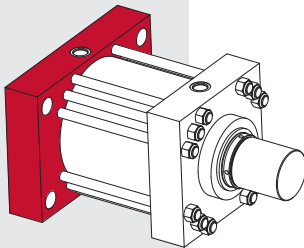
SOLID ROD END CAP MOUNT (16" and 18" Bore)

MODEL HM35
16" and 18" Bore Sizes



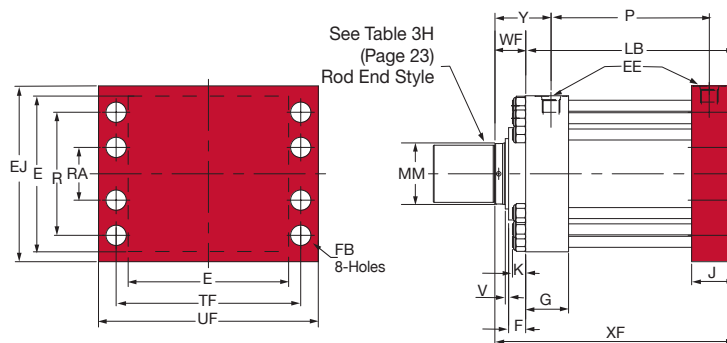
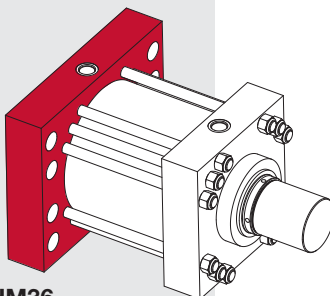
SOLID BLIND END CAP MOUNT (14" BORE)

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%	9%	13%	27%
	10	HM15181	-	22	13¾	-	6	10%	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 ⁹ / 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.)

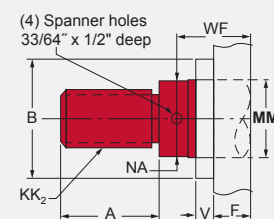


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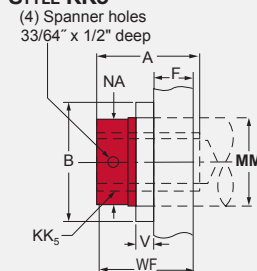
PISTON ROD END STYLES

STYLE KK2



ROD END STYLE CODE NO. 2

STYLE KK5



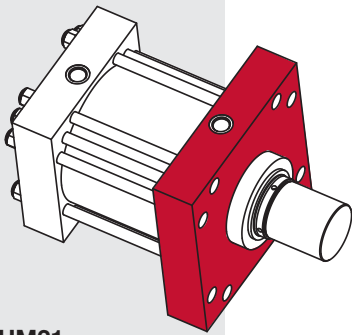
ROD END STYLE CODE NO. 5

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

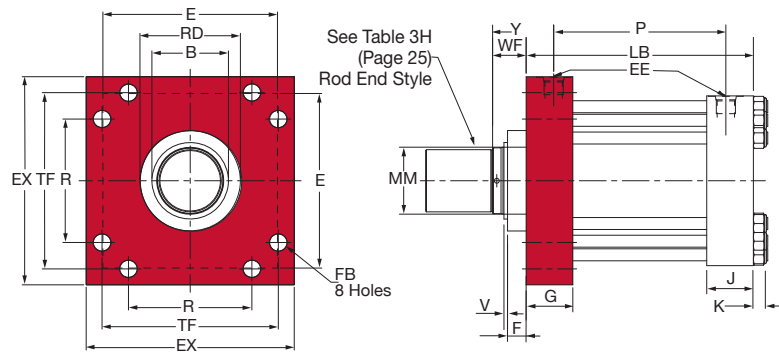
SOLID END CAP MOUNTED CYLINDERS

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.

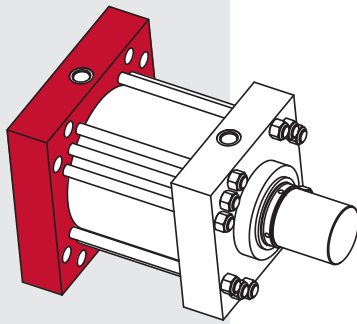
SOLID ROD END CAP SQUARE MOUNTING



MODEL HM21



SOLID BLIND END CAP SQUARE MOUNTING



MODEL HM22

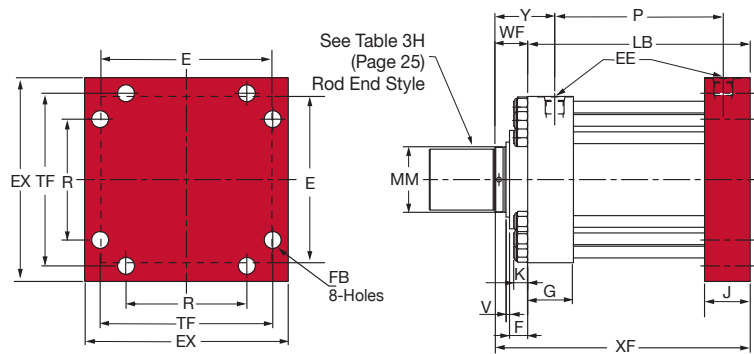


TABLE 1H The dimensions given on this table are affected by the piston rod diameter and the stroke.

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%	9%	13%	27%
	10	HM15181	-	22	13¾	-	6	10%	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	1 ¹³ / ₁₆	4 ⁷ / ₈	4 ⁷ / ₈	1½	12.90	18.43
16	20¼	#24	24½	1 ¹³ / ₁₆	5 ⁷ / ₈	5 ⁷ / ₈	1%	15.28	21.03
18	22¼	#24	26½	2 ¹ / ₁₆	6 ⁷ / ₈	6 ⁷ / ₈	1 ⁷ / ₈	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	1 ¹⁵ / ₁₆	6%	¼	3½
	8	5¾-12	8	9	1 ¹⁵ / ₁₆	7%	¼	4
	10	7¼-12	10	-	3½	9%	-	6
16	8	5¾-12	8	9	1 ¹⁵ / ₁₆	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.)

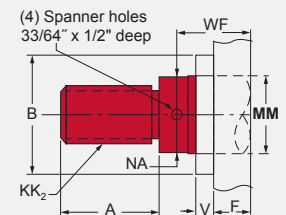


MilCad Cylinder Configurator

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

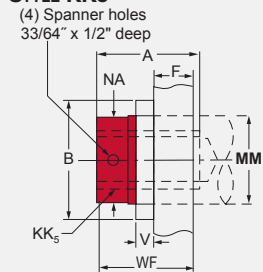
PISTON ROD END STYLES

STYLE KK2



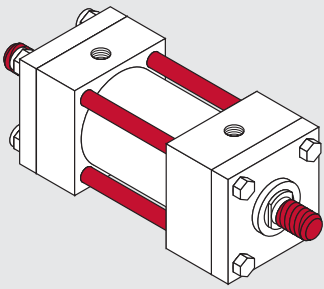
ROD END STYLE CODE NO. 2

STYLE KK5

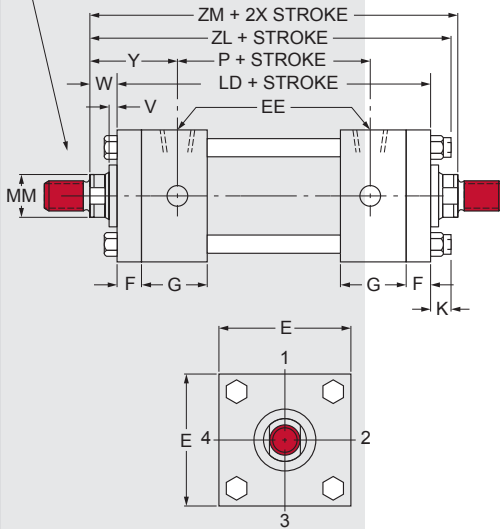


ROD END STYLE CODE NO. 5

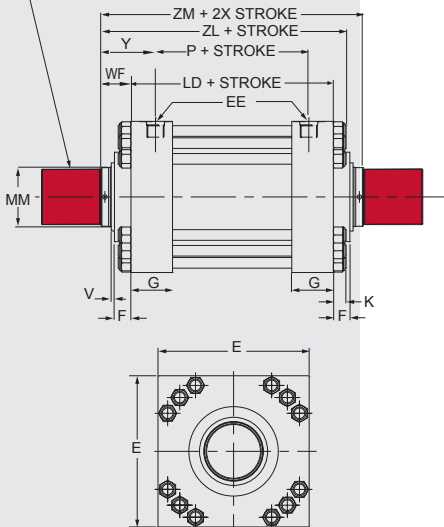
Series H



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

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.

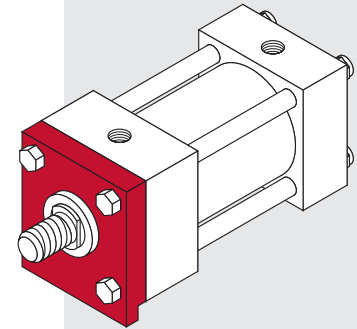
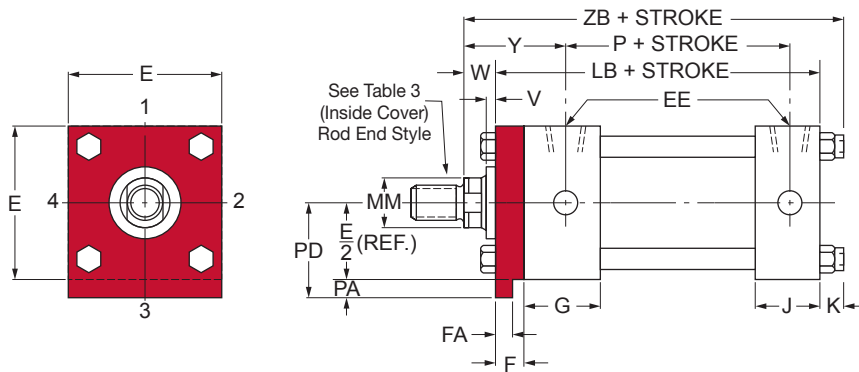
DOUBLE ROD END CYLINDERS

Bore Ø	Rod MM	Cylinder Code	LD*	SE*	SS*	ZL	ZM
1	5/8	DH00151	5%	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 7/8	7 1/2	7 3/8
	•1 3/8*	DH01511		8	3 7/8	7 3/4	8 1/8
2 1/2	1	DH01520	6 1/4	8 1/8	3 3/8	7 5/8	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
3 1/4	1 3/4	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 3/8	5 3/4	13	13
	3 1/2	DH01571		13 3/8	5 3/4		
	4	DH01572		13 3/8	5 3/4		
	4 1/2	DH01573		13 3/8	5 3/4		
	5	DH01574		13 3/8	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 5/8	—	—	24 1/4	26 3/8
	9	DHM15161		—	—	25 7/8	29 3/8
	10	DHM15162		—	—	26 1/4	30 3/8
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	1¾	¾/16	17/16
2	3	5/8	.562/.560	1¾	5/16	113/16
2½	3½	5/8	.562/.560	1¾	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	8¾

Key Mount is not available on larger bore cylinders.

HOW TO ORDER

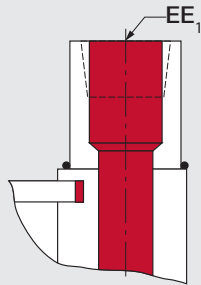
For ordering information refer to Page 32.



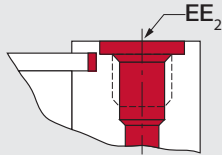
MilCad Cylinder Configurator

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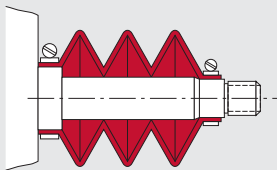
Port Locations



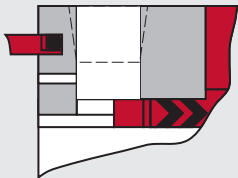
Enlarge Port Welded Boss



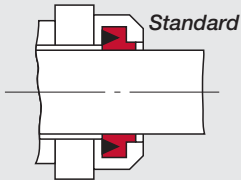
SAE Straight Thread O-ring Port



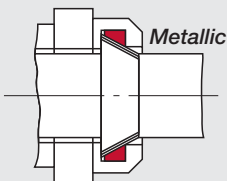
Rod Boots



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
	35.00	1.25
	4.00	1.25
	4.50	1.25
	5.00	1.25
8	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

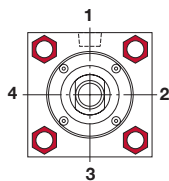
Each style of the various standard cylinder mountings is illustrated, using the commonly recognized cylinder dimensional symbols of the National Fluid Power Association. Each side of the end views are numbered to aid in communication when referring to the relationship between the ports and the mountings. 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

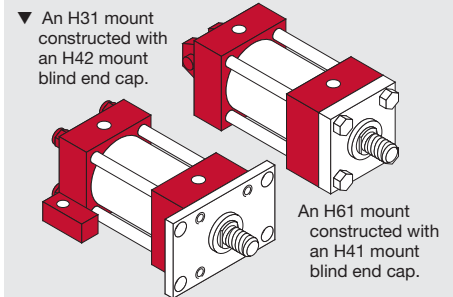
End of Stroke Limit Switches:

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:



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.

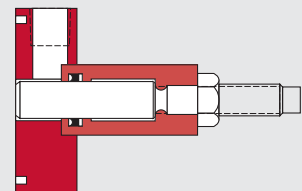
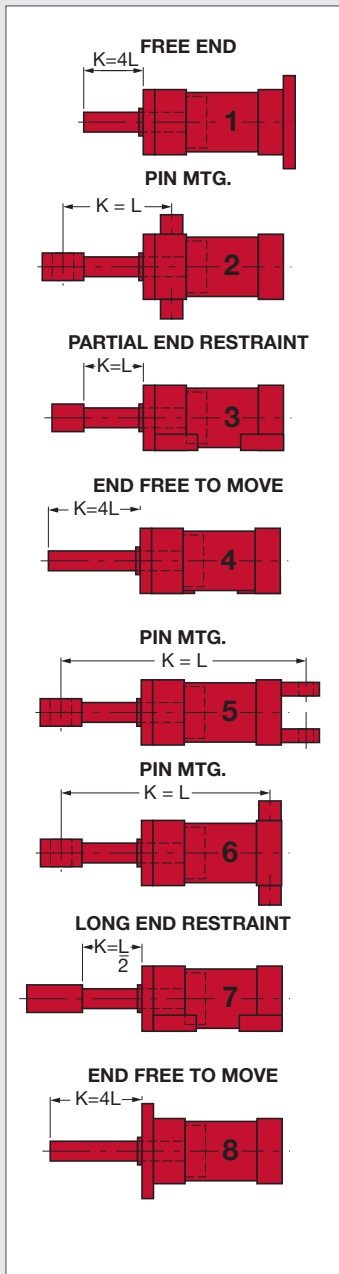


FIGURE 1



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:

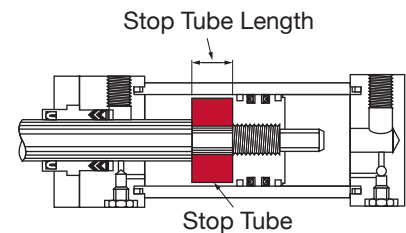
CA = rod eye dimension (back inside cover)
 CE = rod clevis dimension (back inside cover)
 XJ = mounting dimension page 18

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	219	350	421	-	-
200,000	-	-	-	-	-	-	-	65	98	131	160	260	330	402	-	-
250,000	-	-	-	-	-	-	-	-	72	109	143	236	301	375	-	-
300,000	-	-	-	-	-	-	-	-	-	85	120	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 × 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 milwaukeeecylinder.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:

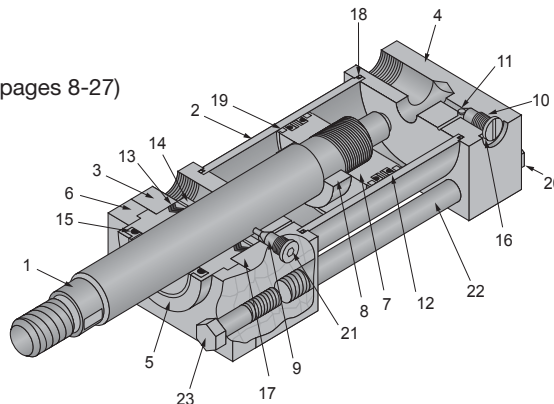
Example:

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, 1⅜	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.