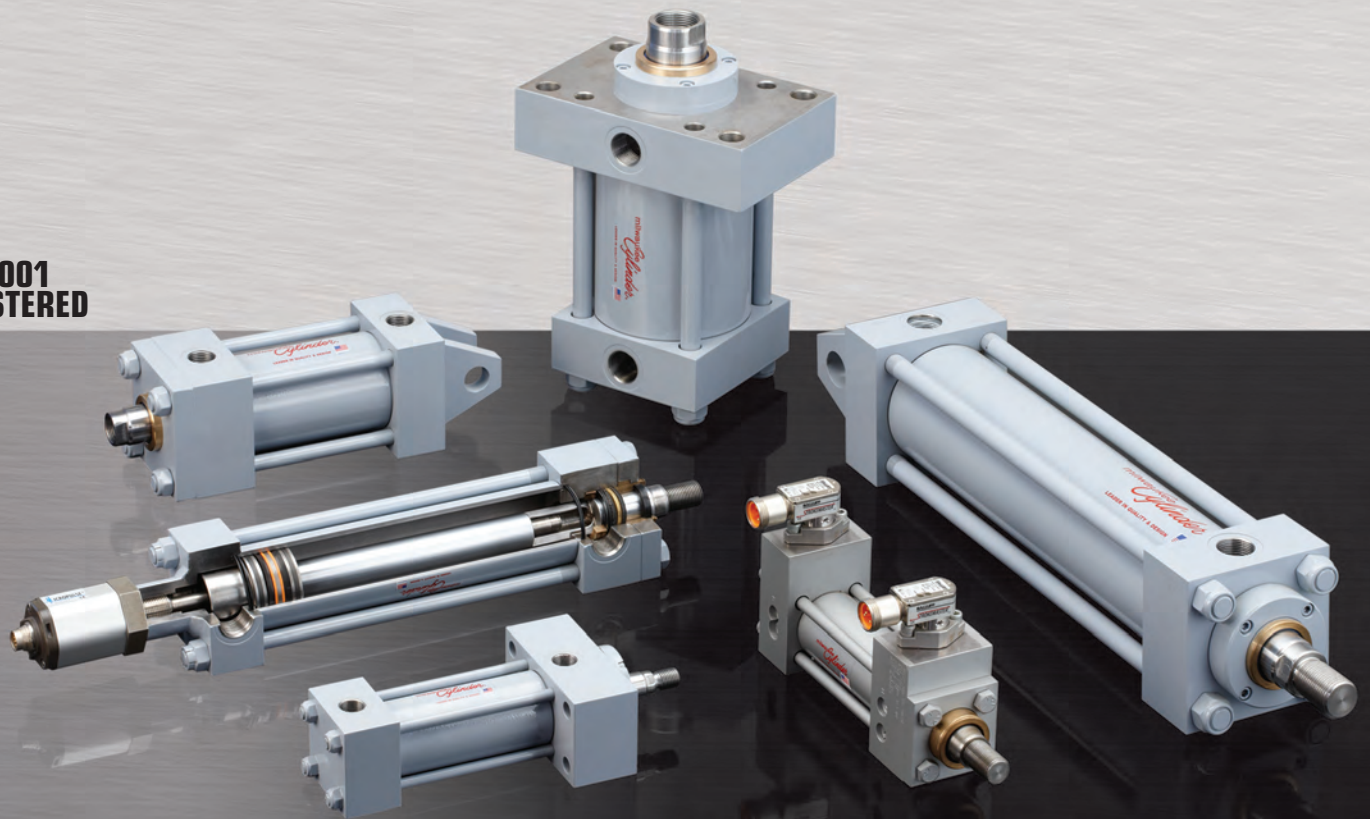


milwaukee *Cylinder*



 ISO 9001
REGISTERED

MC105R2

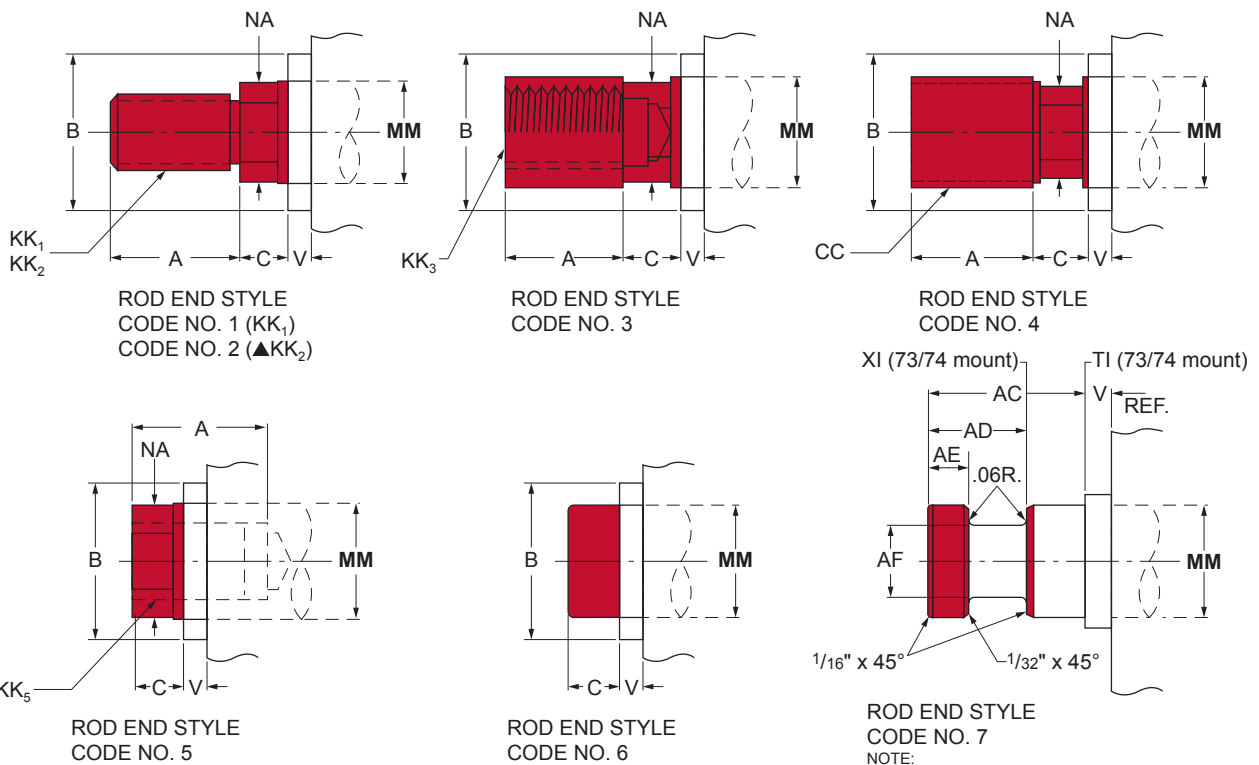
Specials are Our Standard

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

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

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

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



NOTE:
 1.) AC = 1 5/8" FOR 1 1/2" BORE CYL.
 2.) AC = 3 3/4" FOR 7" BORE CYL.

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

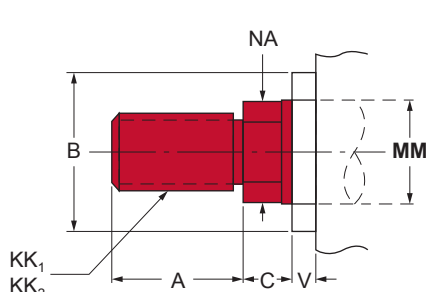
METRIC Piston Rod End Styles (Series MH)

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

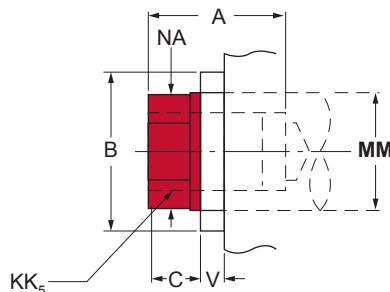
* Distance across wrench flats.

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

Note: Other rod sizes available. Consult factory.



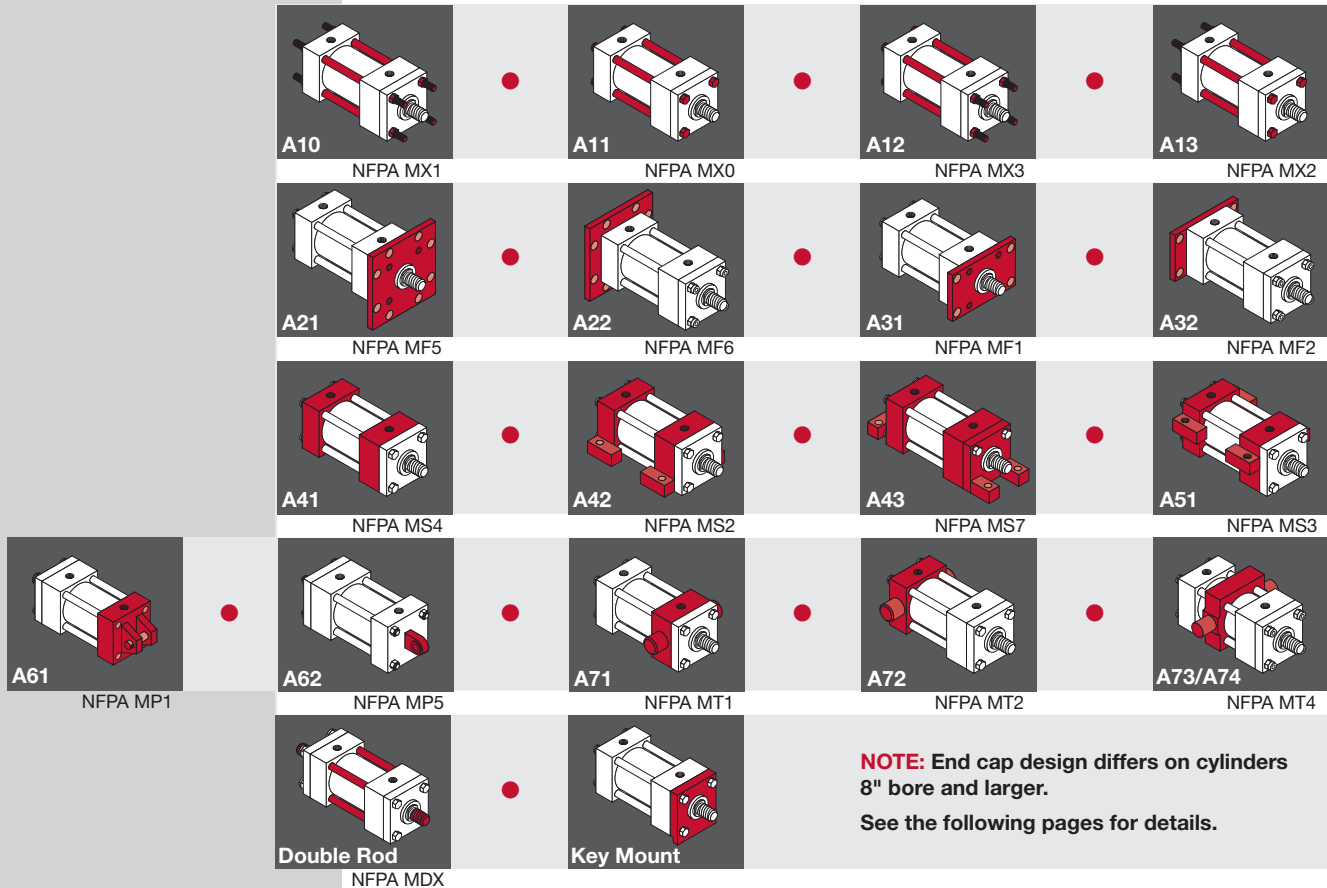
ROD END STYLE
CODE NO. 1 (KK₁)
CODE NO. 2 (KK₂)



ROD END STYLE
CODE NO. 5 (KK₅)

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Series A



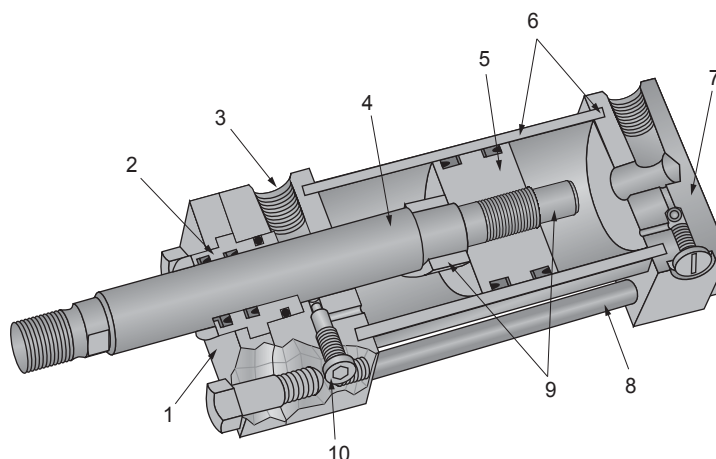
NOTE: End cap design differs on cylinders 8" bore and larger.
See the following pages for details.

Milwaukee Cylinder Series A Pneumatic Cylinders are built to perform on the toughest applications. This heavy-duty air cylinder is designed for 250 psi operation at temperatures between -20° F and +200° F, but can be used at higher temperatures with special seals. *Milwaukee Cylinder's* advanced engineering and quality workmanship ensure you years of maintenance-free service life.

		Page
General	<i>TABLE 3 - Piston Rod End Styles</i>	<i>Inside Cover, page ii</i>
	<i>Standard Specifications and Features</i>	74
	<i>Performance Tested Design Features</i>	75
Mounting Specifications	<i>Tie Rod Mount</i>	76-79
	<i>Flange Mount</i>	80-81
	<i>Solid End Cap Mount</i>	82-83
	<i>Side Mount and Lug Mount</i>	84-87
	<i>Pin Mount and Trunnion Mount</i>	88-91
	<i>Double Rod End Cylinders</i> <i>Key Mount</i>	92 93
Additional Information	<i>Design Options</i>	94-95
	<i>Stop Tubes / Cylinder Sizing</i>	96-97
	<i>Ordering Information / Replacement Parts</i>	98-99
	<i>Installation / Trouble Shooting / Maintenance</i>	100-101
Accessories	<i>Clevis / Brackets / Pins / Rod Eyes Dimensional Data</i>	<i>Inside Back Cover</i>

STANDARD SPECIFICATIONS

- Standard construction – square head – tie rod design
- Nominal pressure – 250 psi air service
- Standard fluid-filtered air
- Standard temperature – -20° F to +200° F
- Standard bore sizes – 1½" to 16"
- Standard piston rod diameters ⅝" thru 5½"
- Standard mounting styles – 17 standard styles plus 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, plus 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.



MilCad Cylinder Configurator

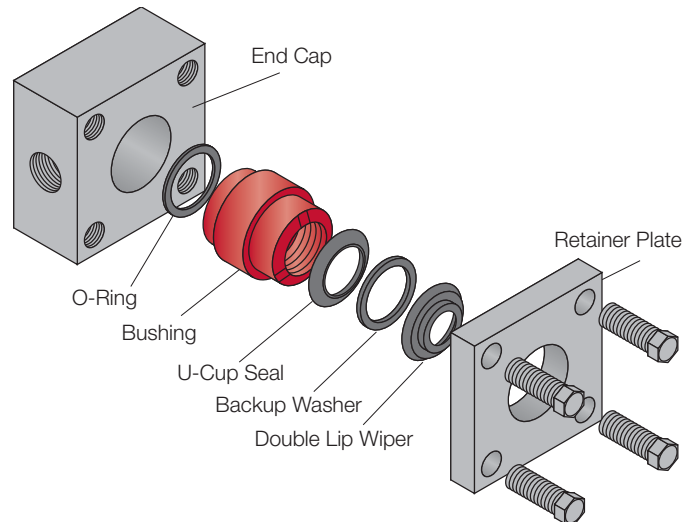
Visit milwaukeecylinder.com to configure and download CAD files of your cylinders.

STANDARD FEATURES

- 1. Removable Retainer Plate**
 The retainer plate and rod bushing are externally removable. On most models, total disassembly of the cylinder is not necessary. Four capscrews securely hold and lock the retainer plate in place.
- 2. Rod Bushing and Seals**
 The rod bushing is accurately machined from solid bearing bronze. It is piloted and retained in the end cap to provide positive rod support, and designed for maximum bearing area.
 Buna-N seals are supplied as standard with *Milwaukee Cylinder Series A* cylinder. They are suitable for use with air or petroleum base fluids up to a temperature of 200°F. For high temperature or synthetic petroleum base fluids, seals of Viton and Teflon are also available.
- 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**
 An iron piston is precision machined from fine grained iron alloy. The piston is pilot fitted and threaded to the rod.
- 6. Cylinder Barrel**
 The barrel is honed and hard chrome plated. This provides superior sealing power, with the minimum of friction, to assure long seal life. Composite barrel is standard for 10" diameter and larger.
- 7. End Caps**
 End caps and mountings are of high quality steel, precision machined for accurate mounting.
- 8. Tie-Rods**
 The tie-rods are constructed from a high quality medium carbon steel. The threads are accurately rolled for rigid engagement of the nuts.
- 9. Cushions**
 Cushions are machined to close tolerance to provide positive, smooth deceleration at the end of stroke. On all bore sizes, we provide the longest cushion possible, based on the rod size and blind end caps. Longer cushions are available; for further information, consult factory.
- 10. Cushion Needle Adjustment and Ball Check**
 The cushion needle adjustment valve and cushion-check ball retainer screw are specifically designed to provide full cushion adjustment.

Combination Rod Seal Design...

The *Milwaukee Cylinder Series A* Cylinder combines a u-cup seal with a double lip wiper as a secondary seal. It is piloted and retained in the end cap to provide positive rod support and maximum bearing area.

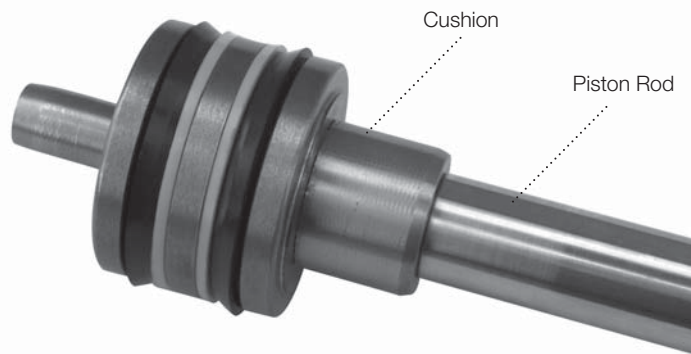


Simple Maintenance...

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.

Piston...

The *Milwaukee Cylinder Series A* cylinder uses two u-cup seals with back-up rings and a fine grained iron alloy piston. This proven piston seal design combines low friction and smooth break away with the near zero leakage of the u-cup seals.



Cushions...

The cushion is of a high grade alloy, precision machined and specially tapered to provide smooth deceleration of the piston at the end of stroke. The rod end cushion bushing is floated with an O-ring to compensate for minor misalignments during normal operation. This is to assure that our customers receive the total quality of performance that is designed into a *Milwaukee Cylinder* cylinder.

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.



MilCad Cylinder Configurator

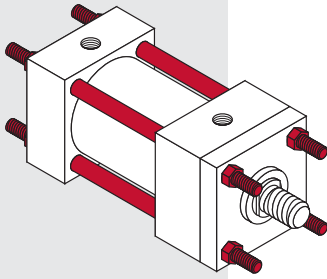
Visit milwaukeeecylinder.com to configure and download CAD files of your cylinders.

For Package and Mounting

Dimension see
Tables 1A and 2A.

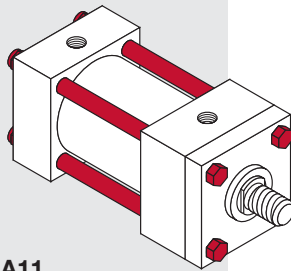
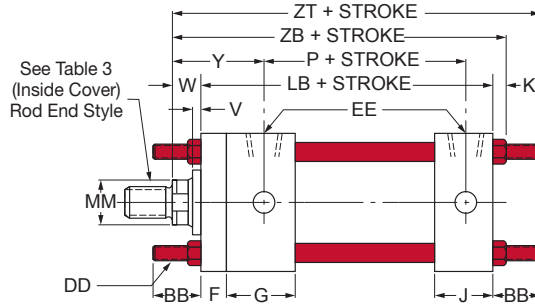
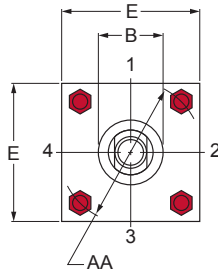
TIE ROD MOUNTED CYLINDERS

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.



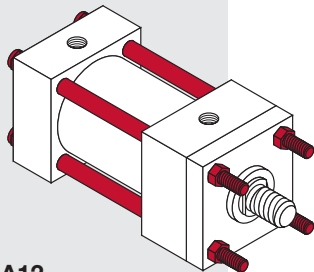
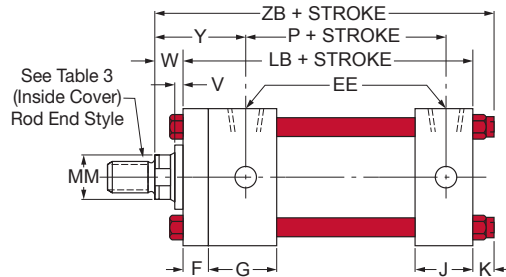
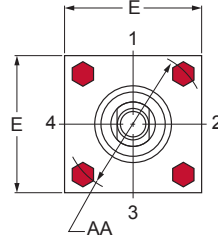
**MODEL A10
NFA STYLE MX1**

TIE RODS EXTENDED BOTH ENDS



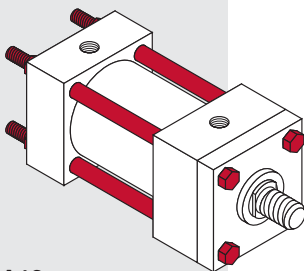
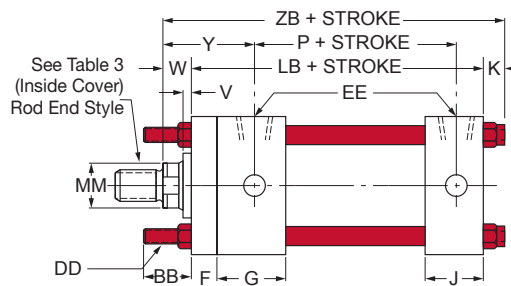
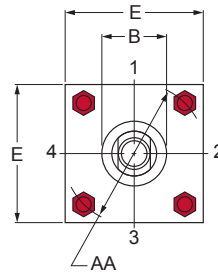
**MODEL A11
NFA STYLE MX0**

NO TIE ROD EXTENSION



**MODEL A12
NFA STYLE MX3**

TIE RODS EXTENDED ROD END



**MODEL A13
NFA STYLE MX2**

TIE RODS EXTENDED BLIND END

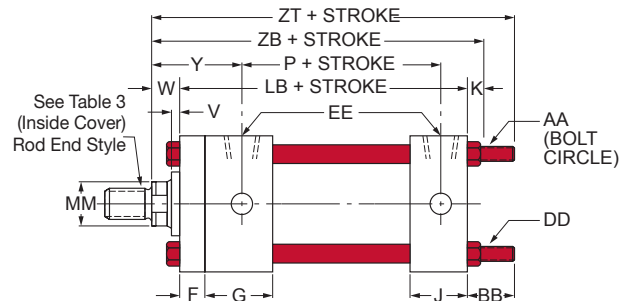
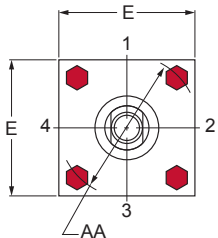


TABLE 1A

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

Bore Ø	Rod MM	Cylinder Code	B	LB	P	V	W	Y	ZB	ZT
1½	5/8	A0011	1 1/8	4	2 1/4	1/4	5/8	1 15/16	4 7/8	5 5/8
	•1	A0012	1 1/2			1/2	1	2 5/16	5 1/4	6
2	5/8	A0110	1 1/8	4	2 1/4	1/4	5/8	1 15/16	4 15/16	5 3/4
	1	A0111	1 1/2			1/2	1	2 5/16	5 5/16	6 1/8
	•1 3/8	A0112	2			5/8	1 1/4	2 5/16	5 5/16	6 3/8
2½	5/8	A0120	1 1/8	4 1/8	2 3/8	1/4	5/8	1 15/16	5 1/16	5 7/8
	1	A0121	1 1/2			1/2	1	2 5/16	5 7/16	6 1/4
	1 3/8	A0122	2			5/8	1 1/4	2 5/16	5 11/16	6 1/2
	•1 3/4	A0123	2 3/8			3/4	1 1/2	2 13/16	5 15/16	6 3/4
3¼	1	A0130	1 1/2	4 7/8	2 5/8	1/4	3/4	2 7/16	6	7
	1 3/8	A0131	2			3/8	1	2 11/16	6 1/4	7 1/4
	1 3/4	A0132	2 3/8			1/2	1 1/4	2 15/16	6 1/2	7 1/2
	2	A0133	2 5/8			1/2	1 3/8	3 1/16	6 5/8	7 5/8
4	1	A0140	1 1/2	4 7/8	2 5/8	1/4	3/4	2 7/16	6	7
	1 3/8	A0141	2			3/8	1	2 11/16	6 1/4	7 1/4
	1 3/4	A0142	2 3/8			1/2	1 1/4	2 15/16	6 1/2	7 1/2
	2	A0143	2 5/8			1/2	1 3/8	3 1/16	6 5/8	7 5/8
	2 1/2	A0144	3 1/8			5/8	1 5/8	3 5/16	6 7/8	7 7/8
5	1	A1X50	1 1/2	5 1/8	2 7/8	1/4	3/4	2 7/16	6 5/16	7 11/16
	1 3/8	A1X51	2			3/8	1	2 11/16	6 9/16	7 15/16
	1 3/4	A1X52	2 3/8			1/2	1 1/4	2 15/16	6 13/16	8 3/16
	2	A0153	2 5/8			1/2	1 3/8	3 1/16	6 15/16	8 5/16
	2 1/2	A0154	3 1/8			5/8	1 5/8	3 5/16	7 3/16	8 9/16
	3	A0155	3 3/4			5/8	1 5/8	3 5/16	7 3/16	8 9/16
6	3 1/2	A0156	4 1/4	5 3/4	3 1/8	5/8	1 5/8	3 5/16	7 3/16	8 9/16
	1 3/8	A0160	2			1/4	7/8	2 13/16	7 1/16	8 7/16
	1 3/4	A0161	2 3/8			3/8	1 1/8	3 1/16	7 5/16	8 11/16
	2	A0162	2 5/8			3/8	1 1/4	3 3/16	7 7/16	8 13/16
	2 1/2	A0163	3 1/8			1/2	1 1/2	3 7/16	7 11/16	9 1/16
	3	A0164	3 3/4			1/2	1 1/2	3 7/16	7 11/16	9 1/16
	3 1/2	A0165	4 1/4			1/2	1 1/2	3 7/16	7 11/16	9 1/16
4	A0166	4 3/4	1/2	1 1/2	3 7/16	7 11/16	9 1/16			

For bore diameter sizes 8" to 16" see next page.

HOW TO ORDER

For ordering information refer to page 98.

NOTES:

- ◆ For double rod end cylinders add prefix letter "D" to cylinder code. Example: DA0011. (Refer to page 92.)
- Available with fixed-non-adjustable cushions on rod end and standard adjustable cushions on the blind end only.

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

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

TABLE 2A

The dimensions are constant regardless of rod diameter or stroke.

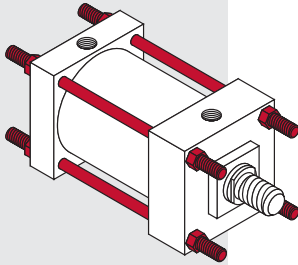
Bore Ø	AA	BB	DD	E	EE	F	G	J	K
1½	2.02	1	1/4-28	2	3/8	3/8	1 1/2	1	1/4
2	2.60	1 1/8	5/16-24	2 1/2	3/8	3/8	1 1/2	1	5/16
2½	3.10	1 1/8	5/16-24	3	3/8	3/8	1 1/2	1	5/16
3¼	3.90	1 3/8	3/8-24	3 3/4	1/2	5/8	1 3/4	1 1/4	3/8
4	4.70	1 3/8	3/8-24	4 1/2	1/2	5/8	1 3/4	1 1/4	3/8
5	5.80	1 13/16	1/2-20	5 1/2	1/2	5/8	1 3/4	1 1/4	7/16
6	6.90	1 13/16	1/2-20	6 1/2	3/4	3/4	2	1 1/2	7/16

For Package and Mounting

Dimension see
Tables 1A and 2A.

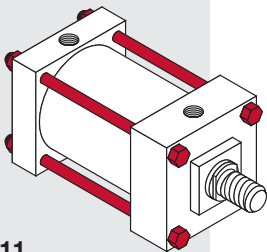
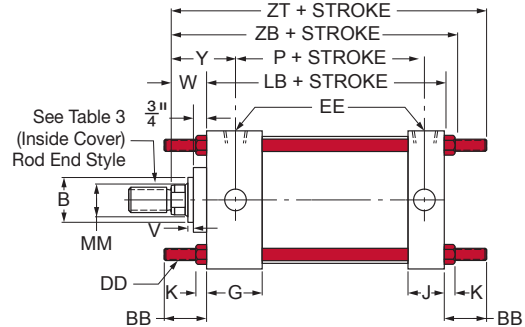
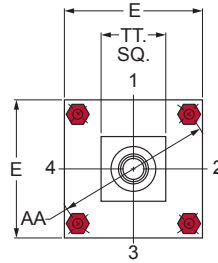
TIE ROD MOUNTED CYLINDERS

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



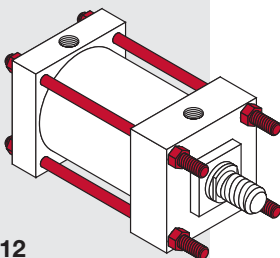
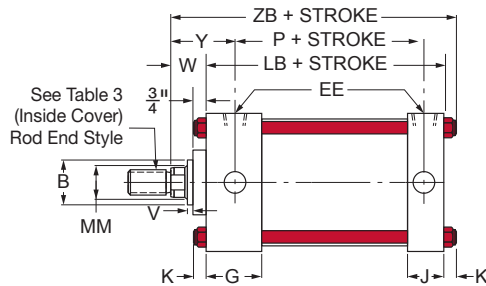
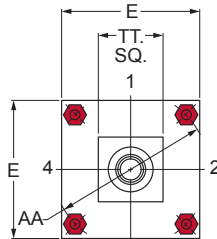
MODEL A10
NFA STYLE MX1

TIE RODS EXTENDED BOTH ENDS



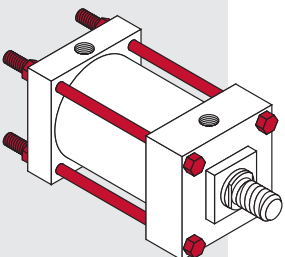
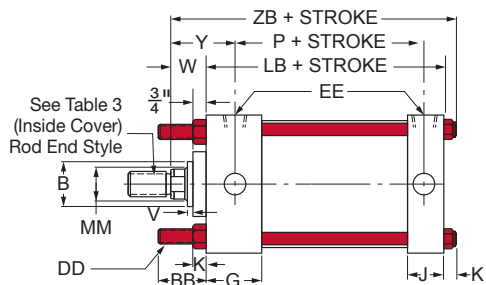
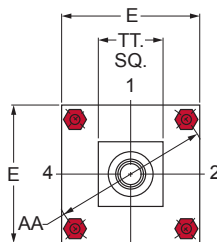
MODEL A11
NFA STYLE MX

NO TIE ROD EXTENSION



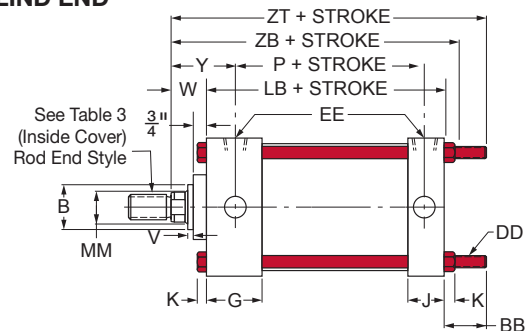
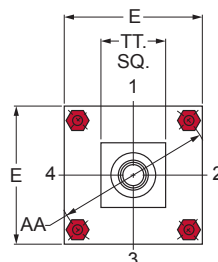
MODEL A12
NFA STYLE MX3

TIE RODS EXTENDED ROD END



MODEL A13
NFA STYLE MX2

TIE RODS EXTENDED BLIND END



▼ **TABLE 1A**

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	TT	V	W	Y	ZB	ZT
8	1 3/8	A0180	2	5 1/8	3 1/4	4	1/4	1 5/8	2 13/16	7 5/16	9 1/16
	1 3/4	A0181	2 3/8			4	3/8	1 7/8	3 1/16	7 9/16	9 5/16
	2	A0182	2 5/8			4	3/8	2	3 3/16	7 1 1/16	9 7/16
	2 1/2	A0183	3 1/8			4					
	3	A0184	3 3/4			5 1/2					
	3 1/2	A0185	4 1/4			5 1/2					
	4	A0186	4 3/4			5 1/2	1/2	2 1/4	3 7/16	7 15/16	9 11/16
	4 1/2	A0187	5 1/4			7					
5	A0188	5 3/4	7								
5 1/2	A0189	6 1/4	7								
10	1 3/4	A1100	2 3/8	6 3/8	4 1/8	4	3/8	1 7/8	3 1/8	8 15/16	10 15/16
	2	A1101	2 5/8			4	3/8	2	3 1/4	9 1/16	11 1/16
	2 1/2	A1102	3 1/8			4					
	3	A1103	3 3/4			5 1/2					
	3 1/2	A1104	4 1/4			5 1/2					
	4	A1105	4 3/4			5 1/2	1/2	2 1/4	3 1/2	9 5/16	11 5/16
	4 1/2	A1106	5 1/4			7					
	5	A1107	5 3/4			7					
5 1/2	A1108	6 1/4	7								
12	2	A1120	2 5/8	6 7/8	4 5/8	4	3/8	2	3 1/4	9 9/16	11 9/16
	2 1/2	A1121	3 1/8			4					
	3	A1122	3 3/4			5 1/2					
	3 1/2	A1123	4 1/4			5 1/2					
	4	A1124	4 3/4			5 1/2	1/2	2 1/4	3 1/2	9 13/16	11 13/16
	4 1/2	A1125	5 1/4			7					
	5	A1126	5 3/4			7					
5 1/2	A1127	6 1/4	7								
14	2 1/2	A1140	3 1/8	8 1/8	5 1/2	4					
	3	A1141	3 3/4			5 1/2					
	3 1/2	A1142	4 1/4			5 1/2					
	4	A1143	4 3/4			5 1/2	1/2	2 1/4	3 13/16	11 3/16	13 3/16
	4 1/2	A1144	5 1/4			7					
	5	A1145	5 3/4			7					
5 1/2	A1146	6 1/4	7								
16	2 1/2	A1160	3 1/8	8 1/8	5 5/8	4					
	3	A1161	3 3/4			5 1/2					
	3 1/2	A1162	4 1/4			5 1/2					
	4	A1163	4 3/4			5 1/2	1/2	2 1/4	3 3/4	11 3/16	13 3/16
	4 1/2	A1164	5 1/4			7					
	5	A1165	5 3/4			7					
5 1/2	A1166	6 1/4	7								

▼ **TABLE 2A**

The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	AA	BB	DD	E	EE	G	J	K
8	9.10	2 5/16	5/8-18	8 1/2	3/4	2	1 1/2	9/16
10	11.20	2 11/16	3/4-16	10 5/8	1	2 1/4	2	1 1/16
12	13.30	2 11/16	3/4-16	12 3/4	1	2 1/4	2	1 1/16
14	15.40	3 3/16	7/8-14	14 3/4	1 1/4	2 3/4	2 1/4	1 3/16
16	17.90	3 3/16	7/8-14	17	1 1/4	2 3/4	2 1/4	1 3/16

HOW TO ORDER

For ordering information refer to page 98.

NOTES:

- ◆ For double rod end cylinders add prefix letter "D" to cylinder code. Example: DA0180. (Refer to page 92.)

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

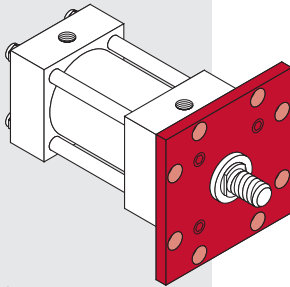
MilCad Cylinder Configurator
 Visit milwaukeecylinder.com to configure and download CAD files of your cylinders.

For Package and Mounting

Dimension see
Tables 1A and 2A.

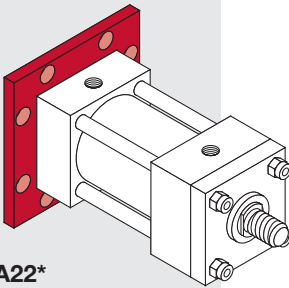
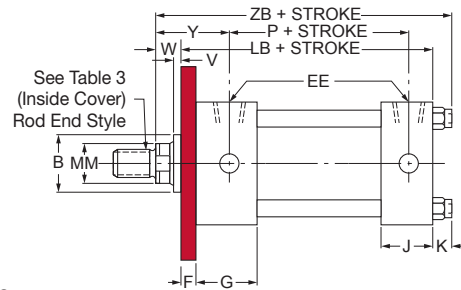
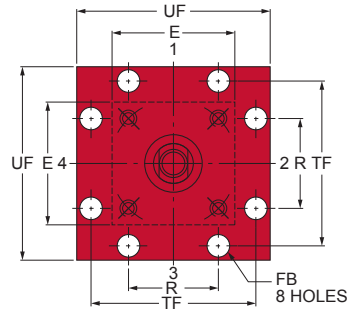
FLANGE MOUNTED CYLINDERS

The flange mount is one of the strongest, most rigid methods of mounting. With this type of mount there is little allowance for misalignment, though when long strokes are required, the free end opposite the mounting should be supported to prevent sagging and possible binding of the cylinder. The best use of a blind end flange is in a thrust load application (rod in compression). Rod end flange mounts are best used in tension applications. When a less rigid mount can be used and the cylinder can be attached to a panel or bulkhead, an extended tie-rod mounting could be considered.



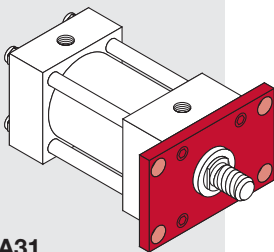
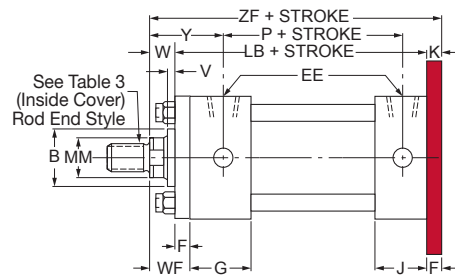
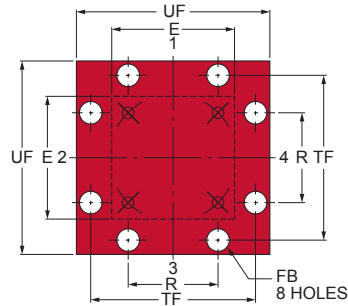
**MODEL A21
NFPA STYLE MF5**

ROD SQUARE FLANGE MOUNTING



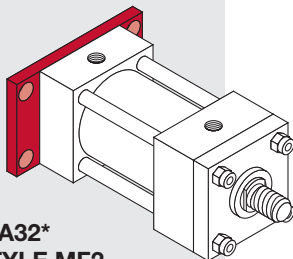
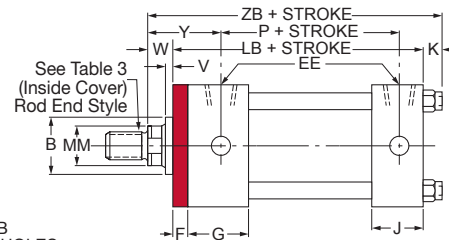
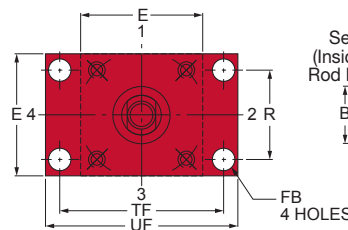
**MODEL A22*
NFPA STYLE MF6**

BLIND SQUARE FLANGE MOUNTING



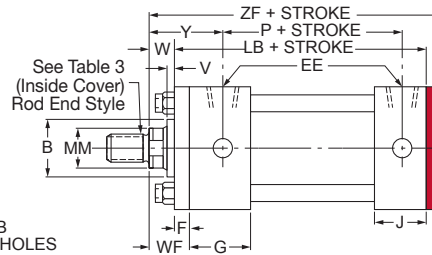
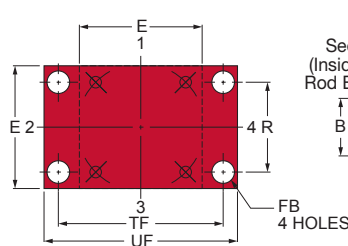
**MODEL A31
NFPA STYLE MF1**

ROD RECTANGULAR FLANGE MOUNTING



**MODEL A32*
NFPA STYLE MF2**

BLIND RECTANGULAR FLANGE MOUNTING



▼ **TABLE 1A**

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

Bore Ø	Rod MM	Cylinder Code ♦	B	LB	P	V	W	Y	ZB	ZF
1½	⅝	A0011	1⅛	4	2¼	¼	⅝	1 ¹⁵ / ₁₆	4 ⁷ / ₈	5
	•1*	A0012	1½			½	1	2 ⁵ / ₁₆	5¼	5 ³ / ₈
2	⅝	A0110	1⅛	4	2¼	¼	⅝	1 ¹⁵ / ₁₆	4 ¹⁵ / ₁₆	5
	1	A0111	1½			½	1	2 ⁵ / ₁₆	5 ⁵ / ₁₆	5 ³ / ₈
	•1⅜*	A0112	2			⅝	1¼	2 ⁵ / ₁₆	5 ⁵ / ₁₆	5 ⁵ / ₈
2½	⅝	A0120	1⅛	4⅞	2⅜	¼	⅝	1 ¹⁵ / ₁₆	5 ¹ / ₁₆	5⅞
	1	A0121	1½			½	1	2 ⁵ / ₁₆	5 ⁷ / ₁₆	5½
	1⅜	A0122	2			⅝	1¼	2 ⁵ / ₁₆	5 ¹ / ₁₆	5¾
	•1¾*	A0123	2⅜			¾	1½	2 ¹³ / ₁₆	5 ¹⁵ / ₁₆	6
3¼	1	A0130	1½	4⅞	2 ⁵ / ₈	¼	¾	2 ⁷ / ₁₆	6	6¼
	1⅜	A0131	2			⅜	1	2 ¹¹ / ₁₆	6¼	6½
	1¾	A0132	2⅜			½	1¼	2 ¹⁵ / ₁₆	6½	6¾
	2*	A0133	2 ⁵ / ₈			½	1⅜	3 ¹ / ₁₆	6 ⁵ / ₈	6 ⁷ / ₈
4	1	A0140	1½	4⅞	2 ⁵ / ₈	¼	¾	2 ⁷ / ₁₆	6	6¼
	1⅜	A0141	2			⅜	1	2 ¹¹ / ₁₆	6¼	6½
	1¾	A0142	2⅜			½	1¼	2 ¹⁵ / ₁₆	6½	6¾
	2	A0143	2 ⁵ / ₈			½	1⅜	3 ¹ / ₁₆	6 ⁵ / ₈	6 ⁷ / ₈
	2½*	A0144	3⅞			⅝	1⅝	3 ⁵ / ₁₆	6 ⁷ / ₈	7⅞
5	1	A1x50	1½	5⅞	2 ⁷ / ₈	¼	¾	2 ⁷ / ₁₆	6 ⁵ / ₁₆	6½
	1⅜	A1x51	2			⅜	1	2 ¹¹ / ₁₆	6 ⁹ / ₁₆	6¾
	1¾	A1x52	2⅜			½	1¼	2 ¹⁵ / ₁₆	6 ¹³ / ₁₆	7
	2	A0153	2 ⁵ / ₈			½	1⅜	3 ¹ / ₁₆	6 ¹⁵ / ₁₆	7⅞
	2½	A0154	3⅞			⅝	1⅝	3 ⁵ / ₁₆	7 ³ / ₁₆	7 ³ / ₈
	3	A0155	3¾			⅝	1⅝	3 ⁵ / ₁₆	7 ³ / ₁₆	7 ³ / ₈
6	1¾	A0160	2	5¾	3⅞	¼	7 ⁸ / ₁₆	2 ¹³ / ₁₆	7 ¹ / ₁₆	7 ³ / ₈
	1¾	A0161	2⅜			⅜	1⅞	3 ¹ / ₁₆	7 ⁵ / ₁₆	7 ⁵ / ₈
	2	A0162	2 ⁵ / ₈			⅜	1¼	3 ³ / ₁₆	7 ⁷ / ₁₆	7 ³ / ₄
	2½	A0163	3⅞			½	1½	3 ⁷ / ₁₆	7 ¹¹ / ₁₆	8
	3	A0164	3¾			½	1½	3 ⁷ / ₁₆	7 ¹¹ / ₁₆	8
	3½	A0165	4¼			½	1½	3 ⁷ / ₁₆	7 ¹¹ / ₁₆	8
	4	A0166	4¾			½	1½	3 ⁷ / ₁₆	7 ¹¹ / ₁₆	8

For bore diameter sizes 8" to 16" see next page.

HOW TO ORDER

For ordering information refer to Page 98.

NOTES:

- ♦ For double rod end cylinders add prefix letter "D" to cylinder code. Example: DA0011. (Refer to page 92.)
- 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 A22 and A32 mounting styles.

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

MilCad Cylinder Configurator
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▼ **TABLE 2A**

The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	E	EE	F	FB	G	J	K	R	TF	UF
1½	2	⅜	⅜	5 ¹⁶ / ₁₆	1½	1	¼	1.43	2¾	3⅜
2	2½	⅜	⅜	⅜	1½	1	5 ¹⁶ / ₁₆	1.84	3⅜	4⅞
2½	3	⅜	⅜	⅜	1½	1	5 ¹⁶ / ₁₆	2.19	3⅞	4 ⁵ / ₈
3¼	3¾	½	⅝	7 ¹⁶ / ₁₆	1¾	1¼	⅜	2.76	4 ¹¹ / ₁₆	5½
4	4½	½	⅝	7 ¹⁶ / ₁₆	1¾	1¼	⅜	3.32	5 ⁷ / ₁₆	6¼
5	5½	½	⅝	9 ¹⁶ / ₁₆	1¾	1¼	7 ¹⁶ / ₁₆	4.10	6 ⁵ / ₈	7 ⁵ / ₈
6	6½	¾	¾	9 ¹⁶ / ₁₆	2	1½	7 ¹⁶ / ₁₆	4.88	7 ⁵ / ₈	8 ⁵ / ₈

Series H

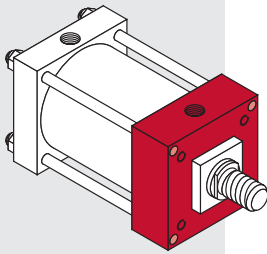
Series MH

Series LH

Series A

For Package and Mounting

Dimension see
Tables 1A and 2A.

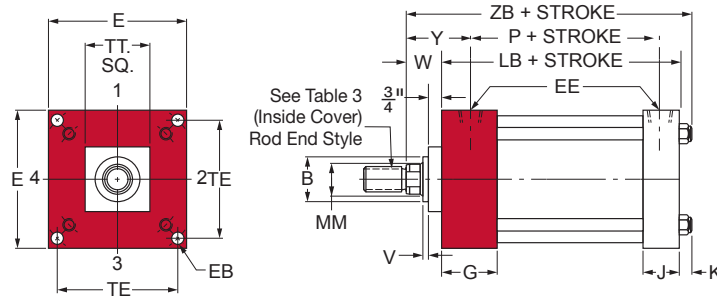


**MODEL A21
NFPA STYLE ME3**

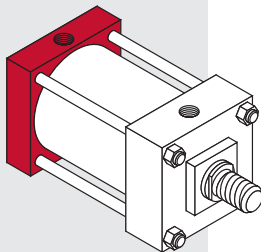
SOLID ROD END CAP MOUNTED CYLINDERS

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



SOLID BLIND END CAP SQUARE MOUNTING



**MODEL A22
NFPA STYLE ME4**

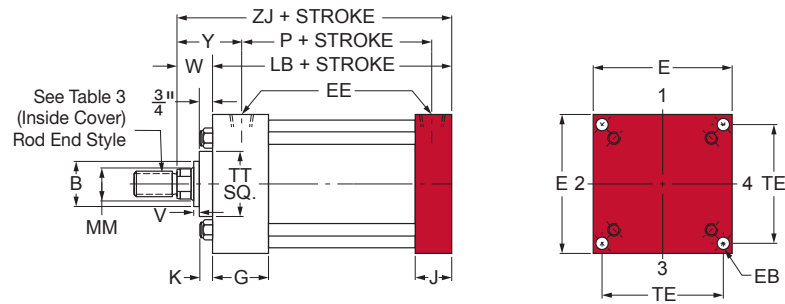


TABLE 1A

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	TT	V	W	Y	ZB	ZJ
8	1 3/8	A0180	2	5 1/8	3 1/4	4	1/4	1 5/8	2 13/16	7 5/16	6 3/4
	1 3/4	A0181	2 3/8			4	3/8	1 7/8	3 1/16	7 9/16	7
	2	A0182	2 5/8			4	3/8	2	3 3/16	7 11/16	7 1/8
	2 1/2	A0183	3 1/8			4					
	3	A0184	3 3/4			5 1/2					
	3 1/2	A0185	4 1/4			5 1/2					
	4	A0186	4 3/4			5 1/2	1/2	2 1/4	3 7/16	7 15/16	7 3/8
	4 1/2	A0187	5 1/4			7					
5	A0188	5 3/4	7								
5 1/2	A0189	6 1/4	7								
10	1 3/4	A1100	2 3/8	6 3/8	4 1/8	4	3/8	1 7/8	3 1/8	8 15/16	8 1/4
	2	A1101	2 5/8			4	3/8	2	3 1/4	9 1/16	8 3/8
	2 1/2	A1102	3 1/8			4					
	3	A1103	3 3/4			5 1/2					
	3 1/2	A1104	4 1/4			5 1/2					
	4	A1105	4 3/4			5 1/2	1/2	2 1/4	3 1/2	9 5/16	8 5/8
	4 1/2	A1106	5 1/4			7					
	5	A1107	5 3/4			7					
5 1/2	A1108	6 1/4	7								
12	2	A1120	2 5/8	6 7/8	4 5/8	4	3/8	2	3 1/4	9 9/16	8 7/8
	2 1/2	A1121	3 1/8			4					
	3	A1122	3 3/4			5 1/2					
	3 1/2	A1123	4 1/4			5 1/2					
	4	A1124	4 3/4			5 1/2	1/2	2 1/4	3 1/2	9 13/16	9 1/8
	4 1/2	A1125	5 1/4			7					
	5	A1126	5 3/4			7					
5 1/2	A1127	6 1/4	7								
14	2 1/2	A1140	3 1/8	8 1/8	5 1/2	4					
	3	A1141	3 3/4			5 1/2					
	3 1/2	A1142	4 1/4			5 1/2					
	4	A1143	4 3/4			5 1/2	1/2	2 1/4	3 13/16	11 3/16	10 3/8
	4 1/2	A1144	5 1/4			7					
	5	A1145	5 3/4			7					
5 1/2	A1146	6 1/4	7								
16	2 1/2	A1160	3 1/8	8 1/8	5 5/8	4					
	3	A1161	3 3/4			5 1/2					
	3 1/2	A1162	4 1/4			5 1/2					
	4	A1163	4 3/4			5 1/2	1/2	2 1/4	3 3/4	11 3/16	10 3/8
	4 1/2	A1164	5 1/4			7					
	5	A1165	5 3/4			7					
5 1/2	A1166	6 1/4	7								

TABLE 2A

The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	E	EB	EE	R	G	J	K	R	TE
8	8 1/2	1 1/16	3/4	-	2	1 1/2	9/16	6.44	7.57
10	10 5/8	1 3/16	1	-	2 1/4	2	1 1/16	7.92	9.40
12	12 3/4	1 3/16	1	-	2 1/4	2	1 1/16	9.40	11.10
14	14 3/4	1 5/16	1 1/4	-	2 3/4	2 1/4	1 3/16	10.90	12.87
16	17	1 1/16	1 1/4	-	2 3/4	2 1/4	1 3/16	12.65	14.85

HOW TO ORDER

For ordering information refer to page 98.

NOTES:

- ◆ For double rod end cylinders add prefix letter "D" to cylinder code. Example: DA0180. (Refer to page 92.)

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

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

Series H

Series MH

Series LH

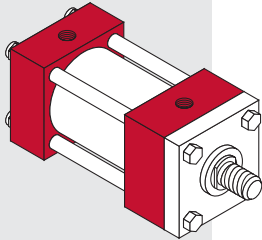
Series A

For Package and Mounting

Dimension see
Tables 1A and 2A.

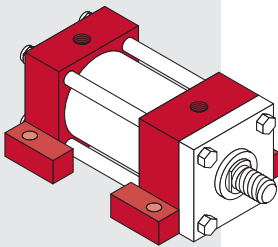
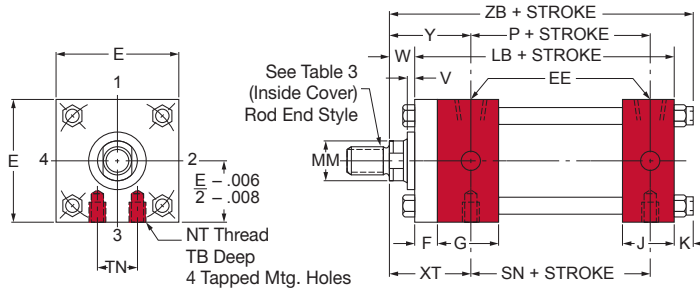
SIDE OR LUG MOUNTED CYLINDERS

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.



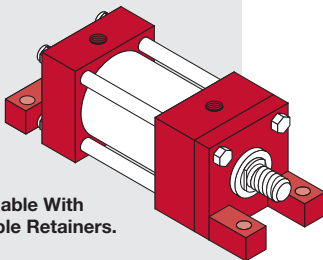
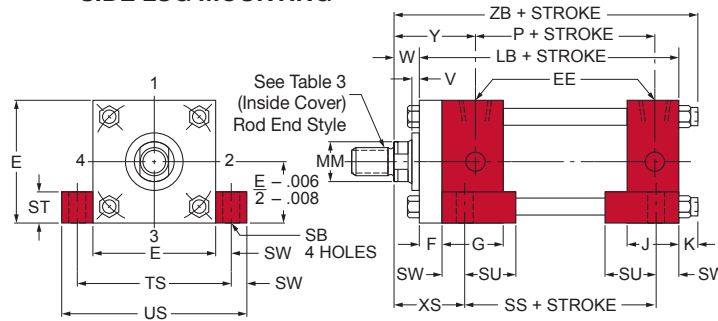
**MODEL A41
NFPA STYLE MS4**

TAPPED HOLES IN CAPS FLUSH MOUNTING



**MODEL A42
NFPA STYLE MS2**

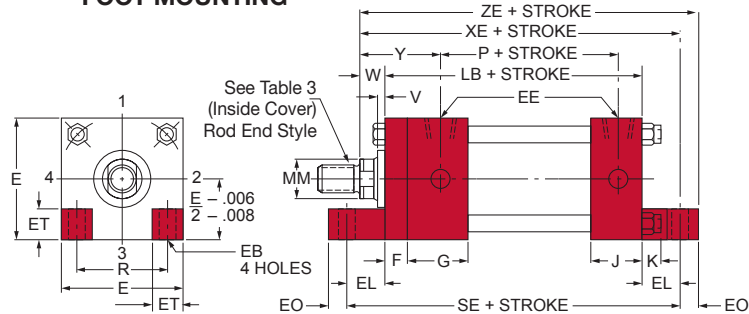
SIDE LUG MOUNTING



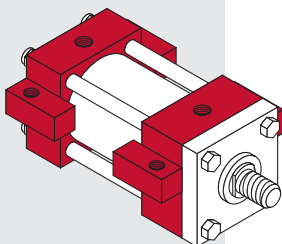
Not Available With
Removable Retainers.

**MODEL A43
NFPA STYLE MS7**

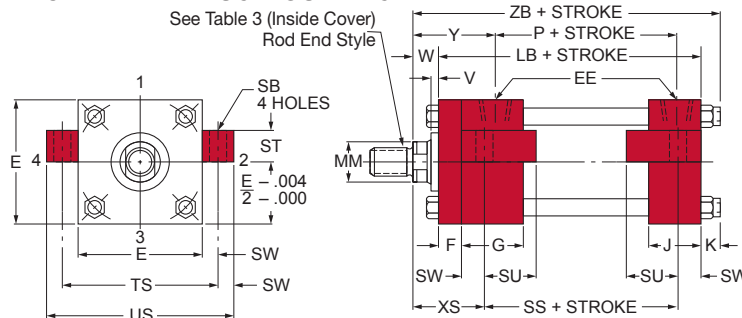
FOOT MOUNTING



CENTERLINE LUG MOUNTING



**MODEL A51
NFPA STYLE MS3**



▼ **TABLE 1A**

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

Bore Ø	Rod MM	Cylinder Code ♦	LB	P	SE ▲	SN	SS ■	V	W	XE	XS	XT	Y	ZB	ZE
1½	5/8	A0011	4	2¼	5½	2¼	27/8	¼	5/8	53/8	13/8	115/16	115/16	47/8	53/8
	•1*	A0012						½	1	5¾	1¾	25/16	25/16	5¼	6
2	5/8	A0110	4	2¼	57/8	2¼	27/8	¼	5/8	59/16	13/8	115/16	115/16	415/16	57/8
	†1*	A0111						½	1	515/16	1¾	25/16	25/16	55/16	6¼
	•13/8*	A0112						5/8	1¼	63/16	2	29/16	29/16	59/16	6½
2½	5/8	A0120	4½	23/8	6¼	23/8	3	¼	5/8	513/16	13/8	115/16	115/16	51/16	61/8
	1	A0121						½	1	63/16	1¾	25/16	25/16	57/16	6½
	†13/8*	A0122						5/8	1¼	67/16	2	29/16	29/16	511/16	6¾
	•1¾*	A0123						¾	1½	611/16	2¼	213/16	213/16	615/16	7
3¼	1	A0130	47/8	25/8	65/8	25/8	3¼	¼	¾	6½	17/8	27/16	27/16	6	67/8
	13/8	A0131						¾	1	6¾	21/8	211/16	211/16	6¼	71/8
	1¾*	A0132						½	1¼	7	23/8	215/16	215/16	6½	73/8
	2*	A0133						½	13/8	71/8	2½	31/16	31/16	65/8	7½
4	1	A0140	47/8	25/8	67/8	25/8	3¼	¼	¾	65/8	17/8	27/16	27/16	6	7
	13/8	A0141						¾	1	67/8	21/8	211/16	211/16	6¼	7¼
	1¾	A0142						½	1¼	71/8	23/8	215/16	215/16	6½	7½
	2	A0143						½	13/8	7¼	2½	31/16	31/16	65/8	75/8
	2½*	A0144						5/8	15/8	7½	2¾	35/16	35/16	67/8	77/8
5	1	A1x50	5½	27/8	7¼	27/8	3½	¼	¾	615/16	21/16	27/16	27/16	65/16	77/16
	13/8	A1x51						¾	1	73/16	25/16	211/16	211/16	69/16	711/16
	1¾	A1x52						½	1¼	77/16	29/16	215/16	215/16	613/16	715/16
	2	A0153						½	13/8	79/16	211/16	31/16	31/16	615/16	81/16
	2½	A0154						5/8	15/8	713/16	215/16	35/16	35/16	73/16	85/16
	3	A0155						5/8	15/8	713/16	215/16	35/16	35/16	73/16	85/16
6	13/8	A0160	5¾	31/8	7¾	31/8	35/8	¼	7/8	75/8	25/16	213/16	213/16	71/16	81/8
	1¾	A0161						¾	11/8	77/8	29/16	31/16	31/16	75/16	83/8
	2	A0162						¾	1¼	8	211/16	33/16	33/16	77/16	8½
	2½	A0163						½	1½	8¼	215/16	37/16	37/16	711/16	8¾
	3	A0164						½	1½	8¼	215/16	37/16	37/16	711/16	8¾
	3½	A0165						½	1½	8¼	215/16	37/16	37/16	711/16	8¾
	4*	A0166						½	1½	8¼	215/16	37/16	37/16	711/16	8¾

For bore diameter sizes 8" to 16" see next page.

HOW TO ORDER

For ordering information refer to Page 98.

NOTES:

♦ For double rod end cylinders add prefix letter "D" to cylinder code. Example: DA0011. (Refer to page 92.)


* Tapped holes on A41 rod end cap have a shallower TB depth in these sizes.

† The standard rod eye or rod clevis will interfere with foot lugs on Model A43. When these rod end accessories are required, use additional rod extension.

▲ For double rod end cylinders from 1½" thru 6" bore, add ½ + F to this dimension.

■ For double rod end cylinders from 1½" thru 6" bore, add ½ to this dimension.

• Available with fixed non-adjustable cushions on rod end and standard adjustable cushions on the blind end only.



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

Page ii

▼ **TABLE 2A**

The dimensions are constant regardless of rod diameter or stroke.

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

Series H
Series MH
Series LH
Series A

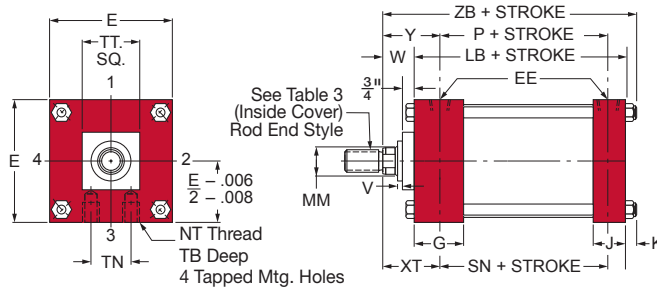
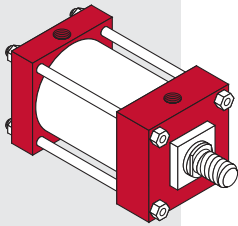
For Package and Mounting

Dimension see
Tables 1A and 2A.

SIDE OR LUG MOUNTED CYLINDERS

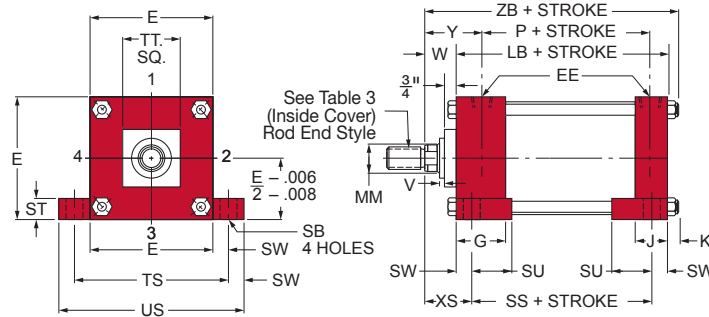
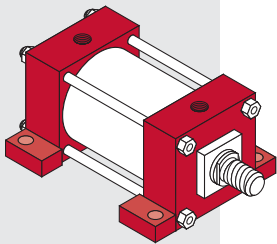
The side or lug mounted cylinder provides a fairly rigid mount. These types of cylinders can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves toward the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder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

TAPPED HOLES IN CAPS FLUSH MOUNTING



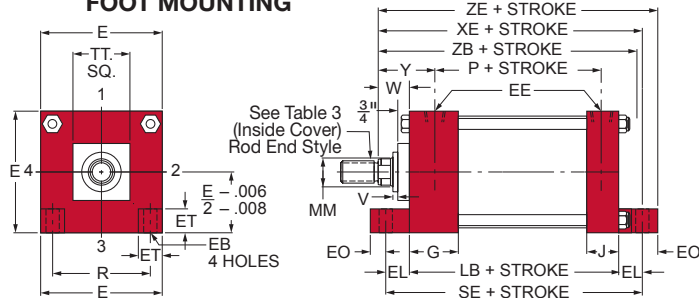
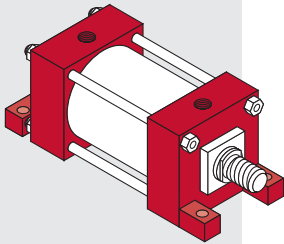
MODEL A41
NFPA STYLE MS4

SIDE LUG MOUNTING



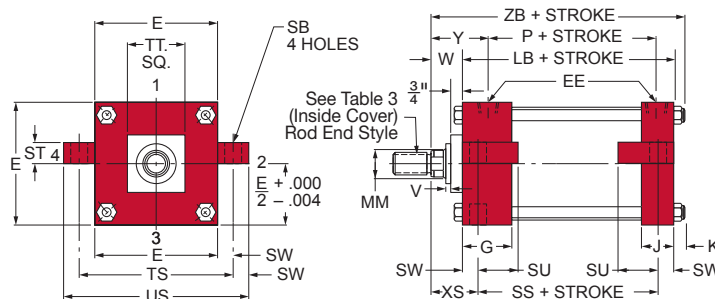
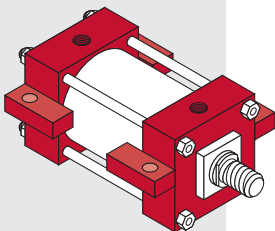
MODEL A42
NFPA STYLE MS2

FOOT MOUNTING



MODEL A43
NFPA STYLE MS7

CENTERLINE LUG MOUNTING



MODEL A51
NFPA STYLE MS3

TABLE 1A

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

Bore Ø	Rod MM	Cylinder Code	LB	P	SE	SN	SS	TT	V	W	XE	XS	XT	Y	ZB	ZE
8	1 3/8	A0180						4	1/4	1 5/8	7 7/8	2 5/16	2 13/16	2 13/16	7 5/16	8 1/2
	1 3/4	A0181						4	3/8	1 7/8	8 1/8	2 9/16	3 1/16	3 1/16	7 9/16	8 3/4
	2	A0182						4	3/8	2	8 1/4	2 11/16	3 3/16	3 3/16	7 11/16	8 7/8
	2 1/2	A0183						4								
	3*	A0184	5 1/8	3 1/4	7 3/8	3 1/4	3 3/4	5 1/2								
	3 1/2*	A0185						5 1/2								
	4*	A0186						5 1/2	1/2	2 1/4	8 1/2	2 15/16	3 7/16	3 7/16	7 15/16	9 1/8
	4 1/2*	A0187						7								
	5*	A0188						7								
5 1/2*	A0189						7									
10	1 3/4	A1100						4	3/8	1 7/8	9 9/16	2 3/4	3 1/8	3 1/8	8 15/16	10 3/16
	2	A1101						4	3/8	2	9 11/16	2 7/8	3 1/4	3 1/4	9 1/16	10 5/16
	2 1/2	A1102						4								
	3*	A1103						5 1/2								
	3 1/2*	A1104	6 3/8	4 1/8	9	4 1/8	4 5/8	5 1/2								
	4*	A1105						5 1/2	1/2	2 1/4	9 15/16	3 1/8	3 1/2	3 1/2	9 5/16	10 9/16
	4 1/2*	A1106						7								
	5*	A1107						7								
5 1/2*	A1108						7									
12	2	A1120						4	3/8	2	10 3/16	2 7/8	3 1/4	3 1/4	9 9/16	10 13/16
	2 1/2	A1121						4								
	3	A1122						5 1/2								
	3 1/2	A1123						5 1/2								
	4	A1124	6 7/8	4 5/8	9 1/2	4 5/8	5 1/8	5 1/2	1/2	2 1/4	10 7/16	3 1/8	3 1/2	3 1/2	9 13/16	11 1/16
	4 1/2*	A1125						7								
	5*	A1126						7								
5 1/2*	A1127						7									
14	2 1/2*	A1140						4								
	3*	A1141						5 1/2								
	3 1/2*	A1142						5 1/2								
	4*	A1143	8 1/8	5 1/2	11 1/8	5 1/2	5 7/8	5 1/2	1/2	2 1/4	11 7/16	3 3/8	3 13/16	3 13/16	11 3/16	13 5/8
	4 1/2*	A1144						7								
	5*	A1145						7								
5 1/2*	A1146						7									
16	2 1/2*	A1160						4								
	3*	A1161						5 1/2								
	3 1/2*	A1162						5 1/2								
	4*	A1163	8 1/8	5 5/8	12 1/8	5 1/2	5 7/8	5 1/2	1/2	2 1/4	11 7/16	3 3/8	3 13/16	3 3/4	11 3/16	13 1/2
	4 1/2*	A1164						7								
	5*	A1165						7								
5 1/2*	A1166						7									

HOW TO ORDER

For ordering information refer to page 98.

NOTES:

- ◆ For double rod end cylinders add prefix letter "D" to cylinder code. Example: DA0180. (Refer to page 92.)
- * Model A43 is not available in these sizes.
- For double rod end cylinders from 8" thru 16" bore, add 1/2" to this dimension (except 10" and 12"; add 1/4").

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

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

TABLE 2A

The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	E	EB	EE	EL	EO	ET	F	G	J	K	NT	R	SB	ST	SU	SW	TB	TN	TS	US
8	8 1/2	1 1/16	3/4	1 1/8	5/8	2	-	2	1 1/2	9/16	3/4-10	6.44	1 1/16	1	1 9/16	1 1/16	1 1/8	4 1/2	9 7/8	11 1/4
10	10 5/8	1 3/16	1	1 5/16	5/8	2 5/8	-	2 1/4	2	1 1/16	1-8	7.92	1 1/16	1 1/4	2	7/8	1 5/8	5 1/2	12 3/8	14 1/8
12	12 3/4	1 3/16	1	1 5/16	5/8	3 9/32	-	2 1/4	2	1 1/16	1-8	9.40	1 1/16	1 1/4	2	7/8	1 5/8	7 1/4	14 1/2	16 1/4
14	14 3/4	1 5/16	1 1/4	1 1/2	3/4	3 25/32	-	2 3/4	2 1/4	1 3/16	1 1/4-7	10.90	1 5/16	1 1/2	2 1/2	1 1/8	2 1/4	8 3/8	17	19 1/4
16	17	1 1/16	1 1/4	2	1 1/8	3 5/8	-	2 3/4	2 1/4	1 3/16	1 3/8-6	12.65	1 5/16	1 1/2	2 1/2	1 1/8	2 1/2	9 3/4	19 1/4	21 1/2

Series H

Series MH

Series LH

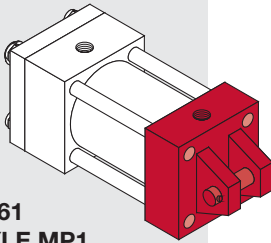
Series A

For Package and Mounting

Dimension see
Tables 1A and 2A.

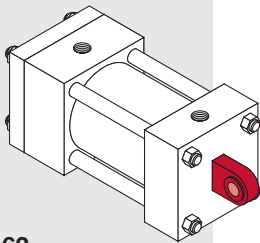
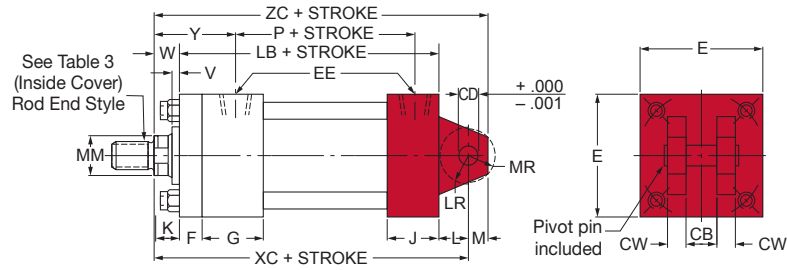
PIN AND TRUNNION MOUNTED CYLINDERS

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.



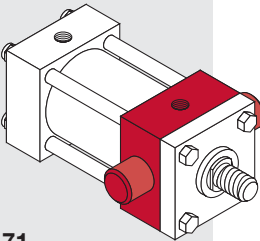
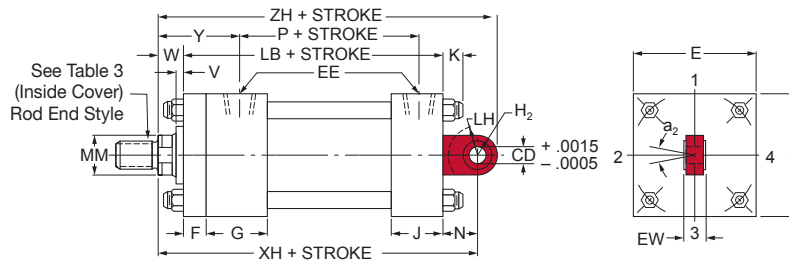
MODEL A61
NFPA STYLE MP1

CLEVIS MOUNT



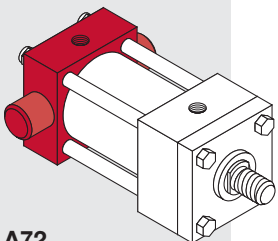
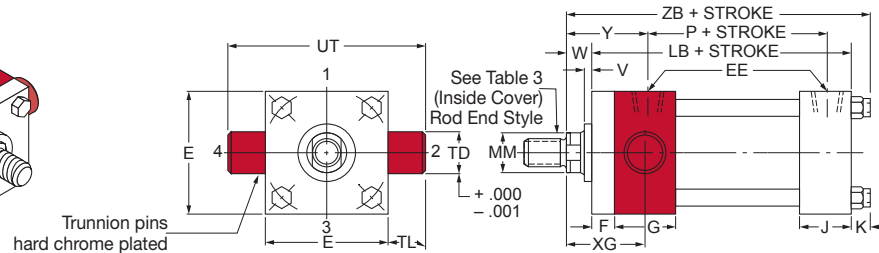
MODEL A62
NFPA STYLE MP5

SPHERICAL EYE MOUNT



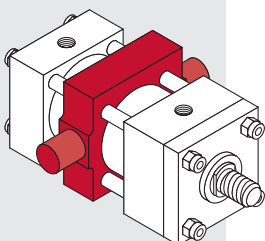
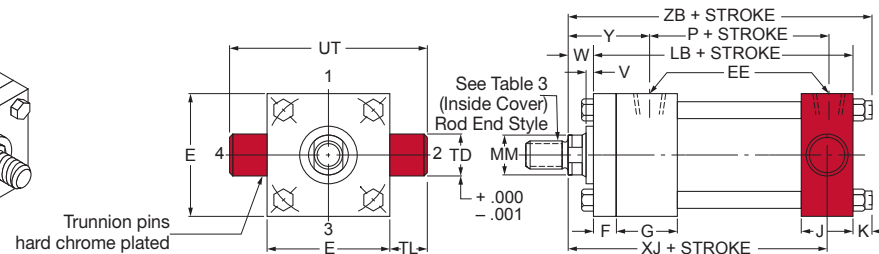
MODEL A71
NFPA STYLE MT1

ROD END TRUNNION MOUNT



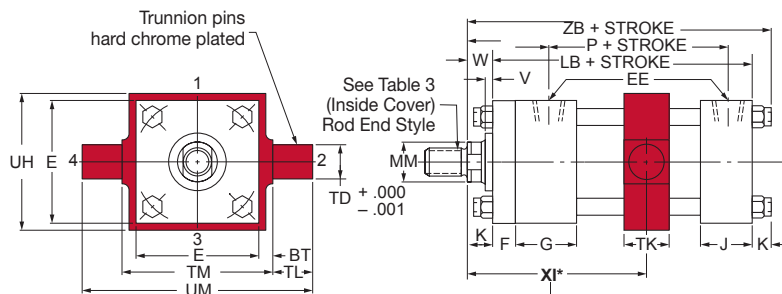
MODEL A72
NFPA STYLE MT2

BLIND END TRUNNION MOUNT



MODEL A73/A74
NFPA STYLE MT4

CENTER TRUNNION MOUNT



* Customer to specify XI dimension.

A73 is an exclusive Milwaukee Cylinder design.
A74 is the Industry "Standard" design.

▼ **TABLE 1A**

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

Bore Ø	Rod MM	Cylinder Code ♦	LB	P	V	W	XC	XG	XH	XJ	Y	ZB	ZC	ZH
1½	5/8	A0011	4	2¼	¼	5/8	5¾	1¾	5½	4½	115/16	47/8	57/8	6¼
	•1*	A0012			½	1	5¾	2½	57/8	4½	25/16	5¼	6¼	65/8
2	5/8	A0110	4	2¼	¼	5/8	5¾	1¾	5½	4½	115/16	415/16	57/8	6¼
	1*	A0111			½	1	5¾	2½	57/8	4½	25/16	55/16	6¼	65/8
	•1¾*	A0112			5/8	1¼	6	2¾	6½	4¾	29/16	59/16	6½	67/8
2½	5/8	A0120	4½	2¾	¼	5/8	5½	1¾	55/8	4¼	115/16	51/16	6	63/8
	1	A0121			½	1	57/8	2½	6	4¾	25/16	57/16	63/8	6¾
	1¾	A0122			5/8	1¼	6½	2¾	6¼	47/8	29/16	511/16	65/8	7
	•1¾*	A0123			¾	1½	6¾	25/8	6¾	5½	213/16	515/16	67/8	71/8
3¼	1	A0130	47/8	25/8	¼	¾	67/8	2¼	67/8	5	27/16	6	7¾	8½
	1¾	A0131			¾	1	7½	2½	7½	5¼	211/16	6¼	77/8	8¾
	1¾	A0132			½	1¼	7¾	2¾	7¾	5½	215/16	6½	8½	85/8
	2*	A0133			½	1¾	7½	27/8	7½	55/8	31/16	65/8	8¼	8¾
4	1	A0140	47/8	25/8	¼	¾	67/8	2¼	67/8	5	27/16	6	7¾	8½
	1¾	A0141			¾	1	7½	2½	7½	5¼	211/16	6¼	77/8	8¾
	1¾	A0142			½	1¼	7¾	2¾	7¾	5½	215/16	6½	8½	85/8
	2	A0143			½	1¾	7½	27/8	7½	55/8	31/16	65/8	8¼	8¾
	2½*	A0144			5/8	15/8	7¾	3½	7¾	57/8	35/16	67/8	8½	9
5	1	A1x50	5½	27/8	¼	¾	7½	2¼	7½	5¼	27/16	65/16	77/8	8¾
	1¾	A1x51			¾	1	7¾	2½	7¾	5½	211/16	69/16	8½	85/8
	1¾	A1x52			½	1¼	7¾	2¾	7¾	5¾	215/16	613/16	8¾	87/8
	2	A0153			½	1¾	7¾	27/8	7¾	57/8	31/16	615/16	8½	9
	2½	A0154			5/8	15/8	8	3½	8	6½	35/16	73/16	8¾	9¼
	3	A0155			5/8	15/8	8	3½	8	6½	35/16	73/16	8¾	9¼
6	1¾	A0160	5¾	3½	¼	7/8	8½	25/8	8¼	57/8	213/16	71/16	9½	10
	1¾	A0161			¾	1½	8¾	27/8	8½	6½	31/16	75/16	9¾	10¼
	2	A0162			¾	1¼	8½	3	85/8	6¼	33/16	77/16	9½	10¾
	2½	A0163			½	1½	8¾	3¼	87/8	6½	37/16	711/16	9¾	105/8
	3	A0164			½	1½	8¾	3¼	87/8	6½	37/16	711/16	9¾	105/8
	3½	A0165			½	1½	8¾	3¼	87/8	6½	37/16	711/16	9¾	105/8
4	A0166	½	1½	8¾	3¼	87/8	6½	37/16	711/16	9¾	105/8			

For bore diameter sizes 8" to 16" see next page.


HOW TO ORDER

For ordering information refer to page 98.

NOTES:


- ♦ For double rod end cylinders add prefix letter "D" to cylinder code. Example: DA0011. (Refer to page 92.) Double rod ends are not available on clevis mount Series A 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: A61 and A73 mounting styles.



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

Page ii



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

▼ **TABLE 2A**

The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	a ₂	BT	CB	CD	CW	E	EE	EW	F	G	H ₂	J	K	L	LH	LR	M	MR	N	TD	TL	A73				A74				UT
																						TK	TM	UH	UM	TK	TM	UH	UM	
1½	13°	¾	¾	½	½	2	¾	5/8	¾	1½	13/16	1	¼	¾	5/8	5/8	½	21/32	7/8	1	1	11/8	3½	2¾	5½	1¼	2½	2½	4½	4
2	13°	¾	¾	½	½	2½	¾	5/8	¾	1½	13/16	1	5/16	¾	5/8	5/8	½	11/16	7/8	1	1	11/8	4	27/8	6	1½	3	3	5	4½
2½	13°	¾	¾	½	½	3	¾	5/8	¾	1½	13/16	1	5/16	¾	5/8	5/8	½	11/16	7/8	1	1	11/8	4½	3¾	6½	1½	3½	3½	5½	5
3¼	14°	¾	1¼	¾	5/8	3¾	½	7/8	5/8	1¾	1¼	1¼	¾	1¼	1	11/16	¾	15/16	1¼	1	1	1¼	5¼	4½	7¼	2	4½	4¼	6½	5¾
4	14°	¾	1¼	¾	5/8	4½	½	7/8	5/8	1¾	1¼	1¼	¾	1¼	1	11/16	¾	15/16	1¼	1	1	1¼	6	5	8	2	5¼	5	7¼	6½
5	14°	¾	1¼	¾	5/8	5½	½	7/8	5/8	1¾	1¼	1¼	7/16	1¼	1	11/16	¾	15/16	1¼	1	1	1¼	7	6	9	2	6¼	6	8¼	7½
6	12½°	1	1½	1	¾	6½	¾	1¾	¾	2	1¾	1½	7/16	1½	1¼	1¼	1	13/16	15/8	1¾	1¾	1½	8½	7	11¼	2½	7¾	7	105/8	9¼

Series H

Series MH

Series LH

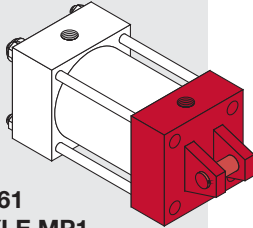
Series A

For Package and Mounting

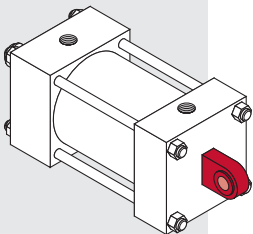
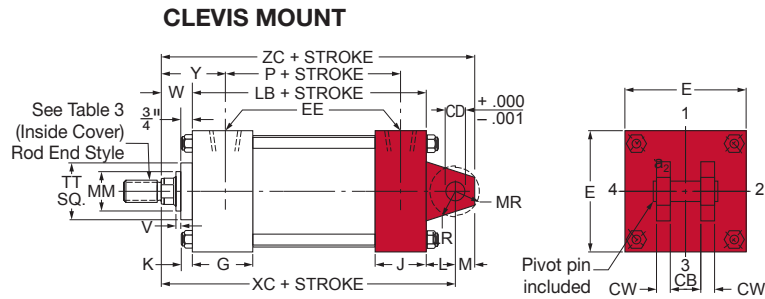
Dimension see
Tables 1A and 2A.

PIN AND TRUNNION CYLINDERS

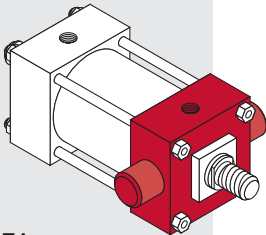
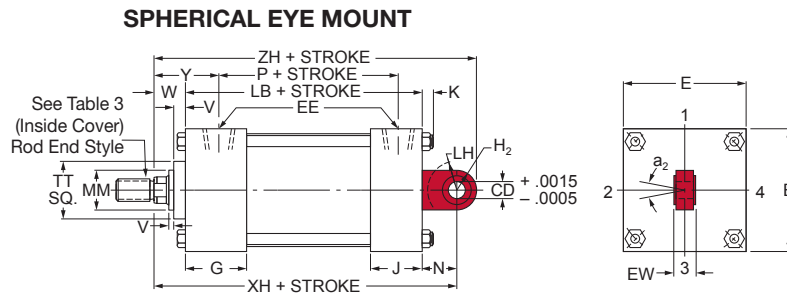
All pin and trunnion cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.



MODEL A61
NFPA STYLE MP1

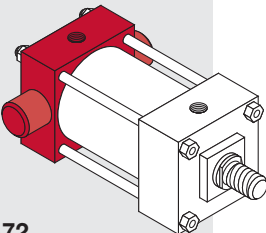
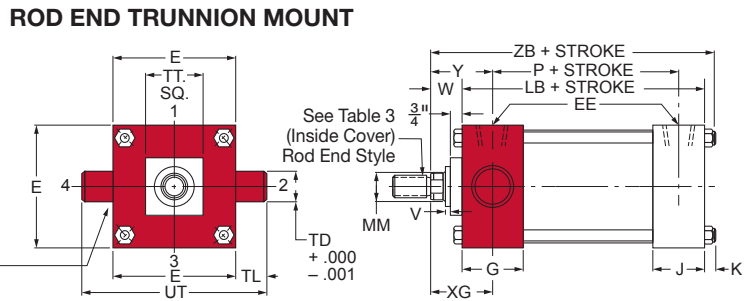


MODEL A62



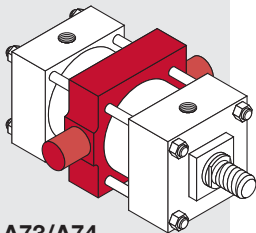
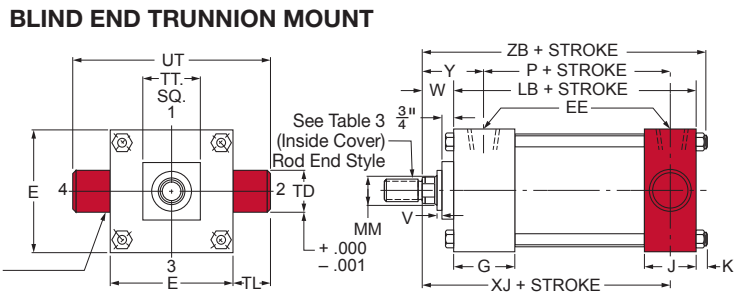
MODEL A71
NFPA STYLE MT1

Trunnion pins
hard chrome plated



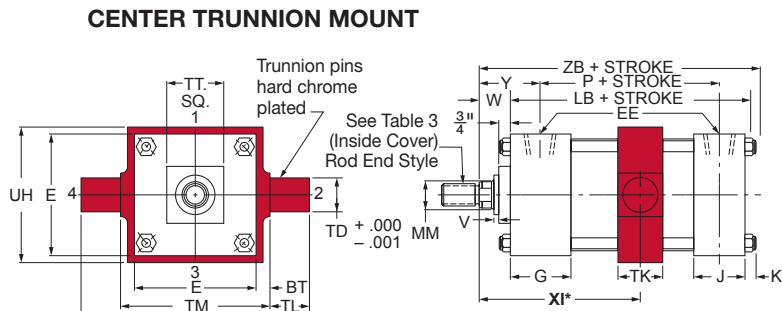
MODEL A72
NFPA STYLE MT2

Trunnion pins
hard chrome plated



MODEL A73/A74
NFPA STYLE MT4

A73 is an exclusive Milwaukee Cylinder design.
A74 is the Industry "Standard" design.



* Customer to specify XI dimension.

▼ **TABLE 1A**

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

Bore Ø	Rod MM	Cylinder Code ♦	LB	P	TT	V	W	XC	XG	XH	XJ	Y	ZB	ZC	ZH
8	1 3/8	A0180	5 1/8	3 1/4	4	1/4	1 5/8	8 1/4	2 5/8	8 3/8	6	2 13/16	7 5/16	9 1/4	10 1/8
	1 3/4	A0181			4	3/8	1 7/8	8 1/2	2 7/8	8 5/8	6 1/4	3 1/16	7 9/16	9 1/2	10 3/8
	2	A0182			4	3/8	2	8 5/8	3	8 3/4	6 3/8	3 3/16	7 11/16	9 5/8	10 1/2
	2 1/2	A0183			4										
	3	A0184			5 1/2										
	3 1/2	A0185			5 1/2										
	4	A0186			5 1/2	1/2	2 1/4	8 7/8	3 1/4	9	6 5/8	3 7/16	7 15/16	9 7/8	10 3/4
	4 1/2	A0187			7										
5	A0188	7													
5 1/2	A0189	7													
10	1 3/4	A1100	6 3/8	4 1/8	4	3/8	1 7/8	10 3/8	3	-	7 1/4	3 3/8	8 15/16	11 3/4	-
	2	A1101			4	3/8	2	10 1/2	3 1/8	-	7 3/8	3 1/4	9 1/16	11 7/8	-
	2 1/2	A1102			4										
	3	A1103			5 1/2										
	3 1/2	A1104			5 1/2										
	4	A1105			5 1/2	1/2	2 1/4	10 3/4	3 3/8	-	7 5/8	3 1/2	9 5/16	12 1/8	-
	4 1/2	A1106			7										
	5	A1107			7										
5 1/2	A1108	7													
12	2	A1120	6 7/8	4 5/8	4	3/8	2	11 1/8	3 1/8	-	7 7/8	3 3/4	9 9/16	12 7/8	-
	2 1/2	A1121			4										
	3	A1122			5 1/2										
	3 1/2	A1123			5 1/2										
	4	A1124			5 1/2	1/2	2 1/4	11 3/8	3 3/8	-	8 1/8	3 1/2	9 13/16	13 1/8	-
	4 1/2	A1125			7										
	5	A1126			7										
5 1/2	A1127	7													
14	2 1/2	A1140	8 1/8	5 1/2	4										
	3	A1141			5 1/2										
	3 1/2	A1142			5 1/2										
	4	A1143			5 1/2	1/2	2 1/4	12 7/8	3 5/8	-	9 1/4	3 13/16	11 3/16	14 7/8	-
	4 1/2	A1144			7										
	5	A1145			7										
5 1/2	A1146	7													
16	2 1/2	A1160	8 1/8	5 5/8	4										
	3	A1161			5 1/2										
	3 1/2	A1162			5 1/2										
	4	A1163			5 1/2	1/2	2 1/4	14 3/8	3 5/8	-	9 1/4	3 3/4	11 3/16	16 7/8	-
	4 1/2	A1164			7										
	5	A1165			7										
5 1/2	A1166	7													

HOW TO ORDER

For ordering information refer to page 98.

NOTES:

- ♦ For double rod end cylinders add prefix letter "D" to cylinder code. Example: DA0180. (Refer to page 92.) Double rod ends are not available on clevis mount Series A cylinders.

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

MilCad Cylinder Configurator
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▼ **TABLE 2A**

The dimensions are constant regardless of rod diameter or stroke.

Bore Ø	a ₂	BT	CB	CD	CW	E	EE	EW	G	H ₂	J	K	L	LH	LR	M	MR	N	TD	TL	A73				A74				UT
																					TK	TM	UH	UM	TK	TM	UH	UM	
8	12 1/2°	1	1 1/2	1	3/4	8 1/2	3/4	1 3/8	2	1 3/4	1 1/2	9/16	1 1/2	1 1/4	1 1/4	1	1 3/16	1 5/8	1 3/8	1 3/8	1 1/2	10 1/2	9	13 1/4	2 1/2	9 3/4	9 1/2	12 1/2	11 1/4
10	-	1 1/4	2	1 3/8	1	10 5/8	1	-	2 1/4	-	2	1 1/16	2 1/8	-	2 7/8	1 3/8	1 3/8	-	1 3/4	1 3/4	2	13 1/8	11	16 5/8	3	12	11 3/4	15 1/2	14 1/8
12	-	1 1/4	2 1/2	1 3/4	1 1/4	12 3/4	1	-	2 1/4	-	2	1 1/16	2 1/4	-	2	1 3/4	1 3/4	-	1 3/4	1 3/4	2	15 1/4	13 3/8	18 3/4	3	14	17 1/2	18 3/4	16 1/4
14	-	1 1/2	2 1/2	2	1 1/4	14 3/4	1 1/4	-	2 3/4	-	2 1/4	1 3/16	2 1/2	-	2 1/4	2	2	-	2	2	2 1/4	17 3/4	15 3/8	21 3/4	3 1/2	16 1/4	16	20 1/4	18 3/4
16	-	1 1/2	3	2	1 1/4	17	1 1/4	-	2 3/4	-	2 1/4	1 3/16	4	-	3 5/8	2 1/2	3	-	2	2	2 1/4	20	18	24	-	-	-	-	-

Series H

Series MH

Series LH

Series A

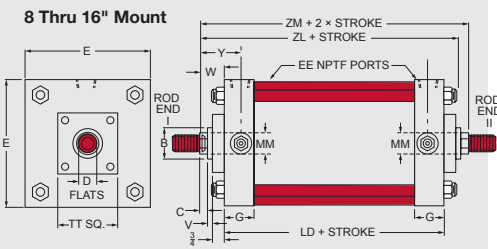
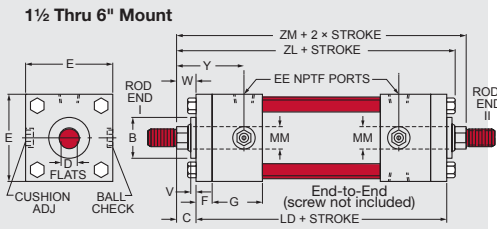
DOUBLE ROD END CYLINDERS

Milwaukee Cylinder's Double Rod End Cylinders are available with all the standard types of mountings, except 61 and 62.

To obtain dimensioning 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 on the right. These added dimensions differ from, or are in addition to, those shown on the preceding pages and provide the additional information needed to completely dimension a double rod end cylinder model.

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

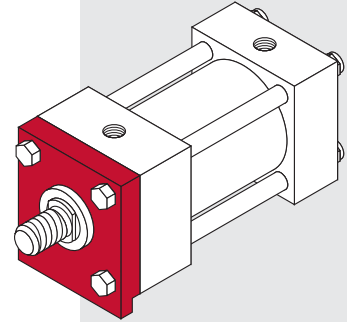
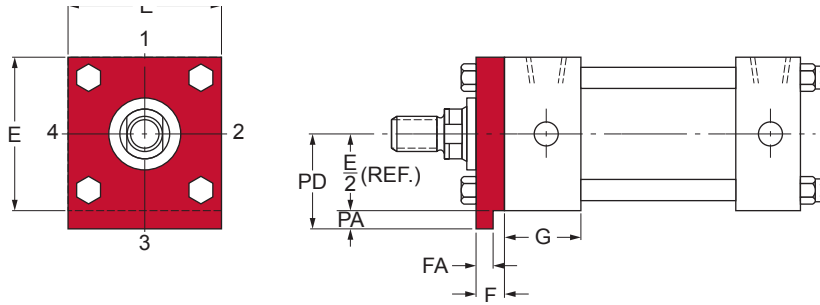


Bore Ø	Rod MM	Cylinder Code	LD*	SE*	SS*	ZL	ZM				
1½	5/8	DA0011	4 7/8	6 3/8	3 3/8	5 3/4	6 1/8				
	1	DA0012				6 1/8	6 7/8				
2	5/8	DA0110	4 7/8	6 3/4	3 3/8	5 13/16	6 1/8				
	1	DA0111				6 3/16	6 7/8				
	1 1/8	DA0112				6 7/16	7 3/8				
2½	5/8	DA0120	5	7 1/8	3 1/2	5 15/16	6 1/4				
	1	DA0121				6 5/16	7				
	1 3/8	DA0122				6 9/16	7 1/2				
	1 3/4	DA0123				6 13/16	8				
3¼	1	DA0130	6	7 3/4	3 3/4	7 1/8	7 1/2				
	1 3/8	DA0131				7 3/8	8				
	1 3/4	DA0132				7 3/8	8 1/2				
	2	DA0133				7 3/4	8 3/4				
4	1	DA0140	6	8	3 3/4	7 1/8	7 1/2				
	1 3/8	DA0141				7 3/8	8				
	1 3/4	DA0142				7 3/8	8 1/2				
	2	DA0143				7 3/4	8 3/4				
	2 1/2	DA0144				8	9 1/4				
5	1	DA1x50	6 1/4	8 3/8	3 5/8	7 7/16	7 3/4				
	1 3/8	DA1x51				7 11/16	8 1/4				
	1 3/4	DA1x52				7 15/16	8 3/4				
	2	DA0153				8 1/16	9				
	2 1/2	DA0154				8 5/16	9 1/2				
	3	DA0155									
3 1/2	DA0156										
6	1 3/8	DA0160	7	8 7/8	4 1/8	8 5/16	8 3/4				
	1 3/4	DA0161				8 3/16	9 1/4				
	2	DA0162				8 11/16	9 1/2				
	2 1/2	DA0163				8 15/16	10				
	3	DA0164									
	3 1/2	DA0165									
4	DA0166										
8	1 3/8	DA0180	5 5/8	7 7/8	4 1/4	7 13/16	8 7/8				
	1 3/4	DA0181				8 1/16	9 3/8				
	2	DA0182				8 3/16	9 5/8				
	2 1/2	DA0183				8 7/16	10 1/8				
	3	DA0184									
	3 1/2	DA0185									
	4	DA0186				9 1/16	10 5/8				
	4 1/2	DA0187									
	5	DA0188									
5 1/2	DA0189										
1 3/4	DA1100	6 5/8	9 1/4	4 7/8	9 3/16			10 3/8			
2	DA1101				9 5/16	10 5/8					
2 1/2	DA1102				9 9/16	11 1/8					
3	DA1103										
3 1/2	DA1104										
4	DA1105				9 9/16	11 1/8					
4 1/2	DA1106										
5	DA1107										
5 1/2	DA1108										
2	DA1120	7 1/8	9 3/4	5 3/8			9 3/16	11 1/8			
2 1/2	DA1121				10 1/16	11 3/8					
3	DA1122										
3 1/2	DA1123										
4	DA1124										
4 1/2	DA1125										
5	DA1126	8 5/8	11 5/8	6 1/8	11 11/16	13 3/8					
5 1/2	DA1127										
2 1/2	DA1140						8 5/8	11 3/4	6 1/8	11 11/16	13 3/8
3	DA1141										
3 1/2	DA1142										
4	DA1143										
4 1/2	DA1144										
5	DA1145										
5 1/2	DA1146	8 5/8	11 3/4	6 1/8	11 11/16	13 3/8					
2 1/2	DA1160										
3	DA1161										
3 1/2	DA1162										
4	DA1163										
4 1/2	DA1164										
5	DA1165										
5 1/2	DA1166										

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

KEY MOUNT CYLINDERS

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



HOW TO ORDER

For ordering information refer to page 98.

▼ **KEY MOUNT CYLINDERS**

Bore Ø	E	F	FA	G	PA	PD
1½	2	⅜	.312/.310	1½	⅜	1⅜
2	2½	⅜	.312/.310	1½	⅜	1⅞
2½	3	⅜	.312/.310	1½	⅜	1⅞
3¼	3¾	⅝	.562/.560	1¼	⅝	2¾
4	4½	⅝	.562/.560	1¼	⅝	2⅞
5	5½	⅝	.562/.560	1¼	⅝	3⅞
6	6½	¾	.687/.684	2	¾	3⅝

Series H

Series MH

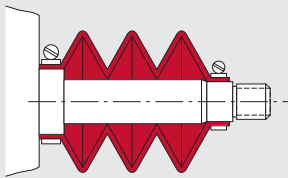
Series LH

Series A

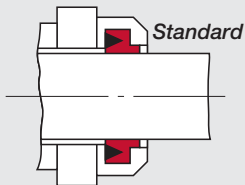


Oversize Port
Welded Boss

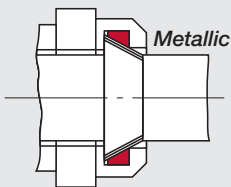
SAE Straight Thread
O-ring Port



Rod Boots



Standard



Metallic

Metallic Rod Wipers



**MilCad Cylinder
Configurator**

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

DESIGN OPTIONS

Standard Ports

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

Oversize Ports

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

Straight Thread Ports

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

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

Rod Boots

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

Metallic Rod Wipers

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

▼ PORT SIZES

Bore Ø	Standard NPTF Port EE	Oversized NPTF Port EE ₁	SAE Straight O-Ring Port EE ₂	SAE Standard Thread Series
1½	¾	½	#6	¾-18
2	¾	½	#6	¾-18
2½	¾	½	#6	¾-18
3¼	½	¾	#10	7/8-14
4	½	¾	#10	7/8-14
5	½	¾	#10	7/8-14
6	¾	1	#12	1½-12
8	¾	1	#12	1½-12
10	1	1¼	#16	1½-12
12	1	1¼	#16	1½-12
14	1¼	1½	#20	1½-12
16	1¼	1½	#20	1½-12

DESIGN OPTIONS FOR SPECIAL CYLINDERS

Special Rod Ends

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

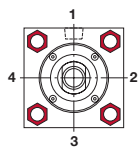
Special Assemblies from Standard Parts

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

Cushion Adjustment Locations

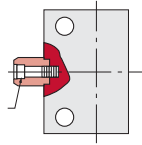
A ball check is supplied as standard in position #2 and a cushion adjustment needle is supplied **as standard in position #2 on most models**. The cushion needle and ball check are interchangeable as far as location and may be put in any side not occupied by a port or mounting.

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 A71 and A72. They can be used on all bore and rod combinations, except on the largest oversize rods offered with each bore size on all model A71 cylinders.

Single-Acting Cylinders

The *Milwaukee Cylinder Series A* Cylinders are designed for either single- or double action. When used as a single-acting cylinder, pneumatic 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.

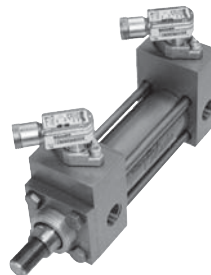
Single-Acting Spring Cylinders

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.

Proximity Switches

End of Stroke Limit Switches:

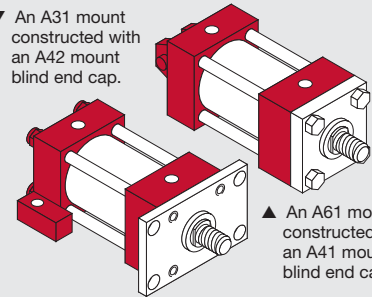
We provide inductive proximity switches for end of stroke sensing. These non-contact switches detect the presence of the spud/cushion bushing. See page 185 for more information.



Combined Mountings

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

▼ An A31 mount constructed with an A42 mount blind end cap.

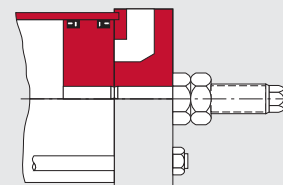


▲ An A61 mount constructed with an A41 mount blind end cap.

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

Adjustable Stroke Cylinders

When a cylinder application requires stroke adjustment, *Milwaukee Cylinder* offers a number of designs. This particular design is externally adjustable, incorporating a threaded rod (of piston rod quality) with a seal nut. This provides a proven-effective, high and low pressure seal, affording maximum sealing on the stroke adjustment rod.

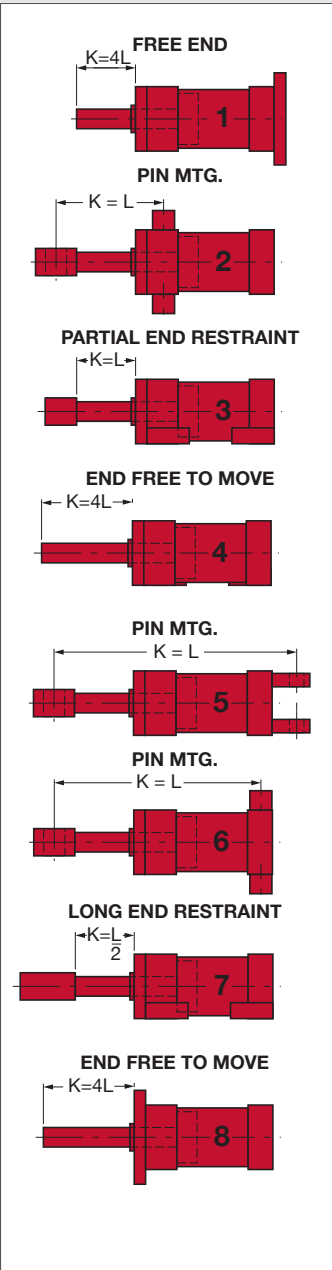


Further information concerning design limitations, cushioning or alternate designs can be obtained by contacting *Milwaukee Cylinder*.

i CAUTION!

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

▼ FIGURE 1



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

STOP TUBES

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

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

Depending on the type of air cylinder you require, *Milwaukee Cylinder* offers two stop tube designs. When an air cylinder cushioned on the rod end requires stop tube, an additional piston and spacer is used (refer to Figure A). If an air cylinder requiring stop tube is not cushioned, only a spacer is used (refer to Figure B).

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 Figure 1)

*Note: W = the rod stick out
(refer to pages 74-93)

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

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 88 or 90

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 88 or 90

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 88 or 90

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.

Figure A

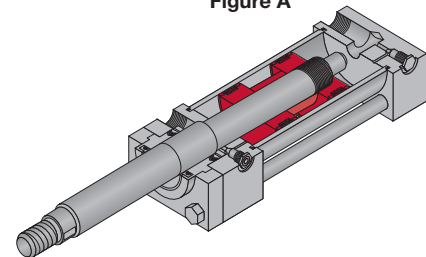
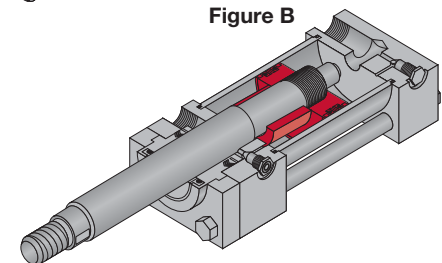


Figure B



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

▼ **TABLE 1 - VALUE OF "K" IN INCHES**

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

▼ **TABLE 2 - DEDUCTIONS FOR PULL STROKE FORCE & DISPLACEMENT**

Bore Ø	Piston Rod Area	Piston Rod Force in Pounds for Various Pressures								Displacement per inch of Stroke	
		30 psi	50 psi	80 psi	100 psi	125 psi	150 psi	200 psi	250 psi	Pressure Air Cubic Ft. Displaced	Free Air Cubic Ft. @ 80 psi
5/8	.307	9	15	25	31	38	46	62	77	.00018	.00116
1	.785	23	39	63	79	98	118	158	197	.00045	.00290
1 1/8	1.4895	44	74	119	149	186	223	298	372	.00086	.00554
1 1/4	2.405	72	120	192	241	300	261	482	601	.00139	.00895
2	3.142	94	157	251	314	392	471	628	785	.00182	.01172
2 1/2	4.909	147	245	393	491	613	736	982	1227	.00284	.01829
3	7.069	212	353	566	707	883	1060	1414	1767	.00409	.02635
3 1/2	9.621	288	481	770	962	1202	1443	1924	2405	.00557	.03588
4	12.566	377	628	1006	1257	1571	1885	2514	3142	.00727	.04683
4 1/2	15.904	477	795	1272	1590	1987	2385	3180	3975	.00920	.05926
5	19.635	589	982	1571	1964	2455	2946	3928	4910	.01137	.07324
5 1/2	23.758	712	1188	1901	2376	2970	3564	4752	5940	.01375	.08857

▼ **TABLE 3 - THRUST FORCE AND DISPLACEMENT**

Piston Ø	Piston Rod Area	Cylinder Force in Pounds for Various Pressures								Displacement per inch of Stroke	
		30 psi	50 psi	80 psi	100 psi	125 psi	150 psi	200 psi	250 psi	Pressure Air Cubic Ft. Displaced	Free Air Cubic Ft. @ 80 psi
1 1/2	1.77	53	88	141	177	221	265	354	442	.00102	.00657
2	3.14	94	157	251	314	392	471	628	785	.00182	.01185
2 1/2	4.91	147	245	393	491	613	736	982	1227	.00284	.01829
3 1/4	8.30	249	415	664	830	1037	1245	1660	2075	.00480	.03091
4	12.57	377	628	1006	1257	1571	1885	2514	3142	.00727	.04682
5	19.64	589	982	1571	1964	2455	2946	3928	4910	.01137	.07324
6	28.27	848	1413	2262	2827	3533	4240	5654	7067	.01636	.10538
8	50.27	1508	2513	4022	5027	6283	7540	10054	12567	.02909	.18740
10	78.54	2356	3927	6283	7854	9817	11781	15708	19635	.04545	.29279
12	113.10	3393	5655	9048	11310	14137	16965	22620	28275	.06545	.42160
14	153.90	4617	7695	12312	15390	19237	23085	30780	38475	.08906	.57367
16	201.10	6030	10050	16080	20100	25125	30150	40200	50250	.11620	.74900

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 96.
3. Based on the distance between mounting points ("L"), determine the value of "K" as shown on Figure 1, page 96.
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.

Series H

Series MH

Series LH

Series A

Feature	Description	Page Number	Code Number	Example
Double Rod End		92	D	A143 - 31 - 1 4 - 7 × 14 ³ / ₄
Cylinder Code	Refer to TABLE 1A	77, 79, 81, 83, 85, 87, 89, 91	—	
Mounting Style	Model Number Only	76, 78, 80, 82, 84, 86, 88, 90	—	
Rod End Style	Code Number	inside front cover (ii)	—	
Cushions	None Rod End Blind End Both Ends	— — — —	1 2 3 4	
Cylinder Modifications	Special		S	If Standard Leave Blank
Seals	Buna-N (-20° to 200° F) Viton (-15° to 350° F) Special		7 8 S	*If Special Describe Requirements
Stroke	Specify in Inches Including Fractional Requirements		—	



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.

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

EXAMPLE: The code for a pneumatic cylinder 4" bore, rod end rectangular flange mounting, 1³/₄" rod, Style No. 1 rod end, cushion both ends, standard seals with a 14³/₄" stroke is **A142-31-14-7x14³/₄**.

HOW TO ORDER

Series A Cylinders

Standard Series A 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

(covered by the cylinder code)

1. Bore & Rod Size or the Cylinder Code: (refer to pages 76-93)
2. Mounting Style: (refer to page 76-93)
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 94.
2. **Operating Fluid or Medium:** Series A Cylinders are equipped with seals for use with shop air or petroleum base fluids. Specify on your order if any other type of operating medium is to be used.
3. **Temperature Range:** Series A pneumatic 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 A Cylinders are rated for 250 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 84 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:

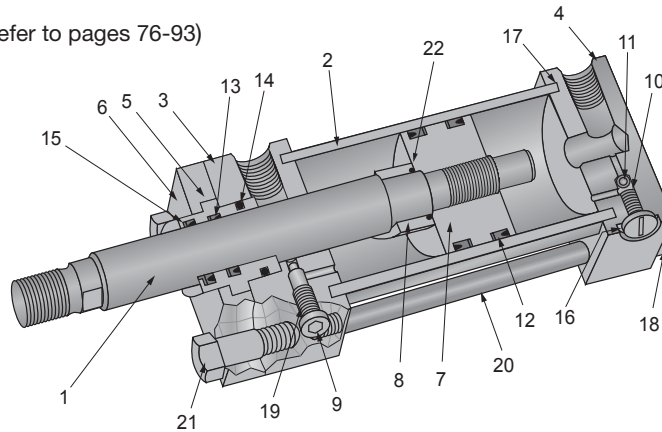
Example:

Buna-N Kit No. XXXXX-7-50

- cylinder code number (refer to pages 76-93)

Viton Kit No. XXXXX-8-50

- cylinder code number (refer to pages 76-93)



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. Needle
10	Ball Check Retainer
11	Ball Check
12	U-Cup Seal & Backup Washer for Piston
13	Rod Seal & Backup Washer for Rod Bushing
14	O-Ring Seal for Rod Bushing
15	Rod Wiper
16	O-Ring Seal for Ball Check Retainer
17	Gasket
18	Tie Rod Nut
19	O-Ring Seal for Cushion Adj. Needle
20	Tie Rod
21	Self-Locking Cap Screw
22	O-Ring for Floating Cushion

www.milwaukeeecylinder.com

Retainer Plate Cap Screw Torques

▼ For Square Retainers

Bore Ø	Torque (Ft-lbs)
1½	10
2	20
2½	20
3¼	30
4	30
5	50
6	50

Tie-rod Nut Torques

▼ Nut Torque Specifications

Bore Ø	Torque (Ft-lbs)	
	Steel	Composite
1½	5	3
2-2½	12	6
3¼-4	30	15
5-6	50	25
8	100	50
10	160	95
12	160	135
14	250	220
16	250	250

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 A**General Information****Cleanliness**

Cleanliness is 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 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.

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

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 99.

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.

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.

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.

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.

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.

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.

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

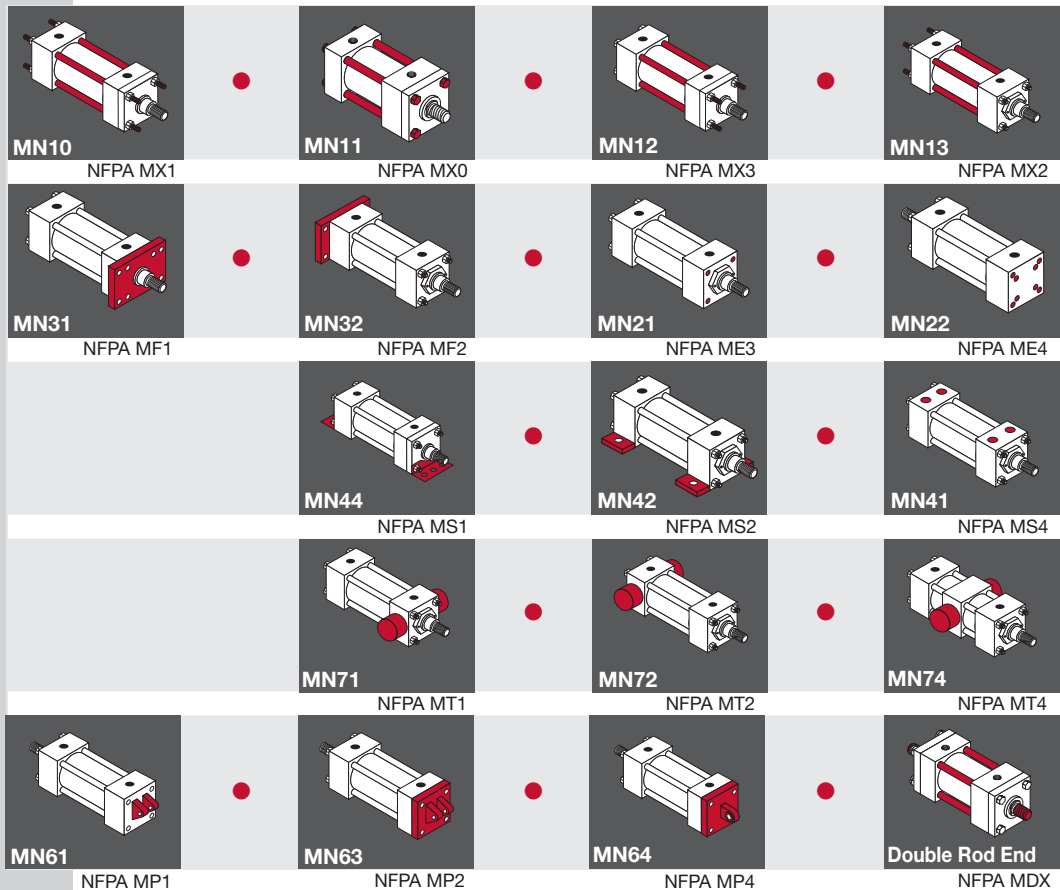
When changing piston seals, extend the piston rod 3" or more if possible, being sure to support the piston rod and the piston at all times. *Remove the tie-rod nuts, blind end cap, the barrel and then the piston seals. A light grease, compatible with the system fluid, should be used on the rings and u-cup seals for smooth assembly. Install the u-cup 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 u-cup seal is to the edge of the barrel, use a thin rounded blade to start the lip of the u-cup, 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 is a gasket which is layed into the end cap tube groove first. Then 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 gasket did not move and then finish assembling the cylinder.

Series MN



Milwaukee Cylinder Series MN Aluminum Cylinders are of heavy duty construction in ten bore sizes (1-1/2" up to 12"). Pneumatic operation up to 250 PSI is standard, and 400 PSI hydraulic non-shock operation is available. These high-alloy aluminum pneumatic cylinders are made to order, allowing you to meet the needs of your custom application. Series MN Cylinders are recognized for their durability and long-lasting performance.

General	<i>Standard Specifications and Features</i>	104
	<i>Series MN Piston Rod End Styles & Base Cylinder Dimensions</i>	105
Mounting Specifications	<i>Tie-Rod Mount</i>	106
	<i>Flange Mount</i>	107
	<i>Side Mount and Lug Mount</i>	108-109
	<i>Trunnion Mount</i>	110
	<i>Clevis and Eye Mount</i>	111
	<i>Double Rod End Cylinders</i>	112
Basic Options	<i>Basic Option Index</i>	113
	<i>Basic Options</i>	114-123
Accessories	<i>Clevis, Pins and Mounts</i>	124-125
	<i>Stainless Steel Clevis, Pins and Mounts</i>	126
	<i>Switches</i>	127-129
	<i>Switches and Brackets</i>	130
	<i>Switch Mounting</i>	131
	<i>Switches Hysterises and Band Width</i>	132
Additional Information	<i>Switch Ordering Instructions</i>	133
	<i>Series MN Ordering Information</i>	134

Max. Operating Pressure:

250 psi

Operating Temperature, **Buna-N:**

-20° F to 200° F

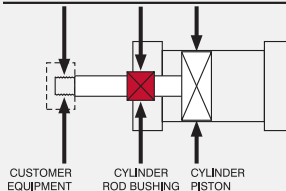
Operating Temperature, **Viton:**

-15° F to 350° F

FLOATING ROD BUSHING

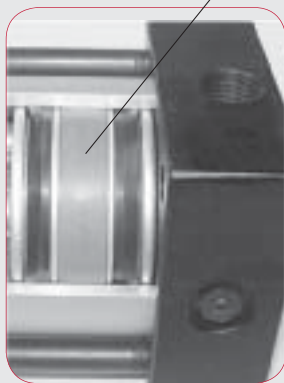
Self Alignment Feature

Rod Bushing is designed to float .002", improving bearing surface alignment.



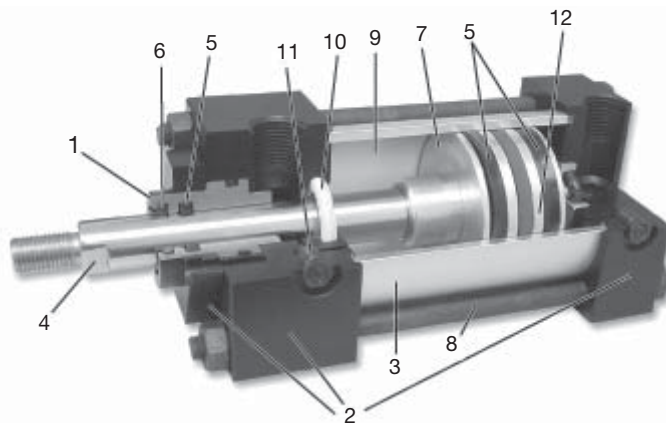
- Reduces cylinder drag and erratic operation
- Reduces cylinder wear
- Provides a minimum of 25% longer life than "fixed" Rod Bushing designs

Piston Wear Band



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STANDARD FEATURES

1. **Floating Rod Bushing**
Precision machined from 150,000 psi rated graphite filled cast iron and PTFE coated to reduce friction and extend cycle life. Bushing design "traps" lubrication in effective bearing area.
2. **Head, Cap & Retainer**
Precision machined from high strength 6061-T6 aluminum alloy. Black anodized for corrosion resistance.
3. **Cylinder Tube**
Precision machined from 6063-T6832 high tensile aluminum alloy and hard coat to 60 Rc for wear resistance and extended cycle life.
4. **Piston Rod**
Precision machined from high yield, polished and hard chrome plated steel.
5. **Piston & Rod Seals**
Heavy lip design Buna-N Nitrile construction. Seals are pressure activated and wear compensating with PTFE piston wear band for long life. (Self lubricating material).
6. **Rod Wiper**
Abrasion resistant urethane provides aggressive wiping action in all environments. External lip design prevents debris from entering cylinder.
7. **Piston**
Precision machined from 6061-T651 alloy aluminum, provides an excellent bearing surface for extended cylinder life.
8. **Tie Rods**
Prestressed high carbon steel tie rod construction eliminates axial loading of cylinder tube and maintains compression on tube and end seals.
9. **Permanent Lubrication**
Permanently lubricated with PTFE based grease on all internal components. This is a non-migratory type high performance grease providing outstanding service life. No additional lubrication is required.
10. **Cushions**
(Options H & C) Floating cushion seal designed for maximum cushion performance, quick return stroke break-away and extended life.
11. **Cushion Adjustment Needle**
Adjustable steel needle design has fine thread metering and is positively captured to prevent needle ejection during adjustment.
12. **Piston Magnet**
(Option MPR/MPH - see page 120) for *Milwaukee Cylinder* magnetically operated Reed and Solid State switches (refer to pages 127-133).

PERFORMANCE OPTIONS

ST – Stop Tubes are used to reduce rod bearing and piston stress (refer to page 108 for cylinder design guidance).

MA – Micro-Adjust provides a precision adjustment on the cylinder extend stroke, providing quick and accurate cylinder positioning, reducing set-up time.

SSA – Stainless Steel Piston Rod, Tie Rods, Nuts, and Fasteners provide corrosion resistance in outdoor applications and wet environments.

LF – Low Friction Seals reduce breakaway and running friction. Effective at all operating pressures.

NR – Non-Rotating option incorporates (2) internal guide rods preventing rod rotation (NFPA dimensions).

ABOUT ROD END STYLES

Style KK1 Male Rod End is STANDARD. (If no rod style is specified, it will be supplied with KK1). Other NFPA Styles can be specified (See Chart).

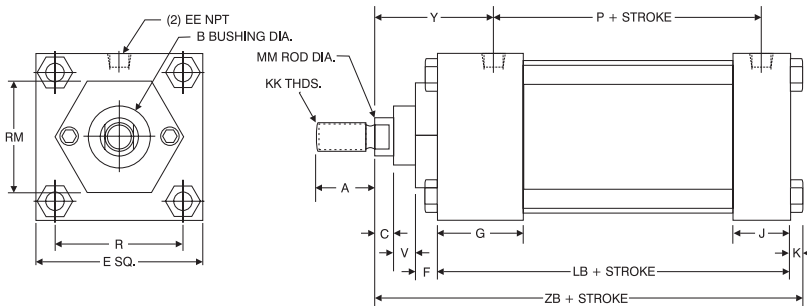
Need a rod end not listed? NO PROBLEM! Each Piston Rod is made to order and does not delay shipment. Coarse (UNC) threads, metric threads or just plain rod ends are common. Thread lengths are also made to order (Specify: "A"= Length).

NEED SOMETHING NOT LISTED? Contact the factory to discuss your custom requirements.

BORE	ROD MM	STANDARD		OPTIONAL		OPTIONAL		OPTIONAL		OPTIONAL		C	V
		KK1	A	KK2	A	KK3	A	KK4	A	KK5			
1½, 2, 2½	5/8	7/16-20	3/4	1/2-20	3/4	7/16-20	3/4	5/8-18	3/4	No Threads	3/8	1/4	
	1	3/4-16	1 1/8	7/8-14	1 1/8	3/4-16	1 1/8	1-14	1 1/8	No Threads	1/2	1/2	
3¼, 4, 5	1	3/4-16	1 1/8	7/8-14	1 1/8	3/4-16	1 1/8	1-14	1 1/8	No Threads	1/2	1/4	
	1 3/8	1-14	1 5/8	1 1/4-12	1 5/8	1-14	1 5/8	1 3/8-12	1 5/8	No Threads	5/8	3/8	
6 & 8	1 3/8	1-14	1 5/8	1 1/4-12	1 5/8	1-14	1 5/8	1 3/8-12	1 5/8	No Threads	5/8	3/8	
	1 3/4	1 1/4-12	2	1 1/2-12	2	1 1/4-12	2	1 3/4-12	2	No Threads	3/4	1/2	
10	1 3/4	1 1/4-12	2	1 1/2-12	2	1 1/4-12	2	1 3/4-12	2	No Threads	3/4	1/2	
	2	1 1/2-12	2 1/4	1 3/4-12	2 1/4	1 1/2-12	2 1/4	2-12	2 1/4	No Threads	7/8	3/8	
12	2	1 1/2-12	2 1/4	1 3/4-12	2 1/4	1 1/2-12	2 1/4	2-12	2 1/4	No Threads	7/8	3/8	
	2 1/2	1 7/8-12	3	2 1/4-12	3	1 7/8-12	3	2 1/2-12	3	No Threads	1	1/2	

BASIC CYLINDER

MODEL MN11
NFPA STYLE MX0 (No mount)



Bore Ø	Rod MM	Cylinder Code	A	B	C	E	EE	F	G	J	K	KK	LB	P	R	RM	V	Y	ZB
1½	5/8	MN00611	3/4	1 1/8	3/8	2	3/8	3/8	1 1/2	1	1/4	7/16-20	3 5/8	2 3/8	1.43	2 Sq.	1/4	1 7/8	4 7/8
	1	MN00612	1 1/8	1 1/2	1/2	2	3/8	3/8	1 1/2	1	1/4	3/4-16	3 5/8	2 3/8	1.43	2 Sq.	1/2	2 1/4	5 1/4
2	5/8	MN06110	3/4	1 1/8	3/8	2 1/2	3/8	3/8	1 1/2	1	5/16	7/16-20	3 5/8	2 3/8	1.84	1 1/4 Hex	1/4	1 7/8	4 15/16
	1	MN06111	1 1/8	1 1/2	1/2	2 1/2	3/8	3/8	1 1/2	1	5/16	3/4-16	3 5/8	2 3/8	1.84	2 1/2 Sq.	1/2	2 1/4	5 5/16
2½	5/8	MN06120	3/4	1 1/8	3/8	3	3/8	3/8	1 1/2	1	5/16	7/16-20	3 3/4	2 1/2	2.19	1 1/4 Hex	1/4	1 7/8	5 1/16
	1	MN06121	1 1/8	1 1/2	1/2	3	3/8	3/8	1 1/2	1	5/16	3/4-16	3 3/4	2 1/2	2.19	3 Sq.	1/2	2 1/4	5 7/16
3¼	1	MN06130	1 1/8	1 1/2	1/2	3 3/4	1/2	5/8	1 3/4	1 1/4	3/8	3/4-16	4 1/4	2 3/4	2.76	2 3/4 Dia.	1/4	2 3/8	6
	1 3/8	MN06131	1 5/8	2	5/8	3 3/4	1/2	5/8	1 3/4	1 1/4	3/8	1-14	4 1/4	2 3/4	2.76	3 3/4 Sq.	3/8	2 5/8	6 1/4
4	1	MN06140	1 1/8	1 1/2	1/2	4 1/2	1/2	5/8	1 3/4	1 1/4	3/8	3/4-16	4 1/4	2 3/4	3.32	2 3/4 Dia.	1/4	2 3/8	6
	1 3/8	MN06141	1 5/8	2	5/8	4 1/2	1/2	5/8	1 3/4	1 1/4	3/8	1-14	4 1/4	2 3/4	3.32	3 1/2 Dia.	3/8	2 5/8	6 1/4
5	1	MN06150	1 1/8	1 1/2	1/2	5 1/2	1/2	5/8	1 3/4	1 1/4	7/16	3/4-16	4 1/2	3	4.10	2 3/4 Dia.	1/4	2 3/8	6 5/16
	1 3/8	MN06151	1 5/8	2	5/8	5 1/2	1/2	5/8	1 3/4	1 1/4	7/16	1-14	4 1/2	3	4.10	3 1/2 Dia.	3/8	2 5/8	6 9/16
6	1 3/8	MN06160	1 5/8	2	5/8	6 1/2	3/4	5/8	2	1 1/2	7/16	1-14	5	3 1/4	4.88	3 1/2 Dia.	3/8	2 3/4	7 1/16
	1 3/4	MN06161	2	2 3/8	3/4	6 1/2	3/4	5/8	2	1 1/2	7/16	1 1/4-12	5	3 1/4	4.88	3 1/2 Dia.	1/2	3	7 5/16
8	1 3/8	MN06180	1 5/8	2	5/8	8 1/2	3/4	5/8	2	1 1/2	9/16	1-14	5 1/8	3 3/8	6.44	3 1/2 Dia.	3/8	2 3/4	7 5/16
	1 3/4	MN06181	2	2 3/8	3/4	8 1/2	3/4	5/8	2	1 1/2	9/16	1 1/4-12	5 1/8	3 3/8	6.44	3 1/2 Dia.	1/2	3	7 9/16
10	1 3/4	MN61100	2	2 3/8	3/4	10 5/8	1	5/8	2 1/4	2	1 1/16	1 1/4-12	6 3/8	4 5/16	7.92	3 1/2 Dia.	1/2	3 1/16	8 15/16
	2	MN61101	2 1/4	2 5/8	7/8	10 5/8	1	3/4	2 1/4	2	1 1/16	1 1/2-12	6 3/8	4 5/16	7.92	5 Dia.	3/8	3 3/16	9 1/16
12	2	MN61200	2 1/4	2 5/8	7/8	12 3/4	1	3/4	2 1/4	2	1 1/16	1 1/2-12	6 7/8	4 13/16	9.40	5 Dia.	3/8	3 3/16	9 9/16
	2 1/2	MN61201	3	3 3/8	1	12 3/4	1	3/4	2 1/4	2	1 1/16	1 7/8-12	6 7/8	4 13/16	9.40	5 Dia.	1/2	3 7/16	9 13/16

Series H

Series MH

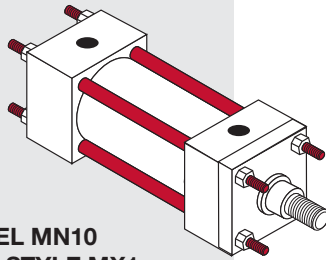
Series LH

Series A

Series MN

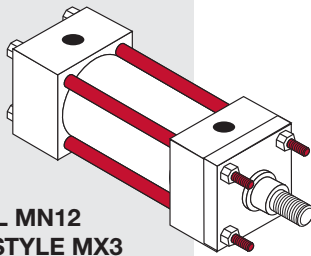
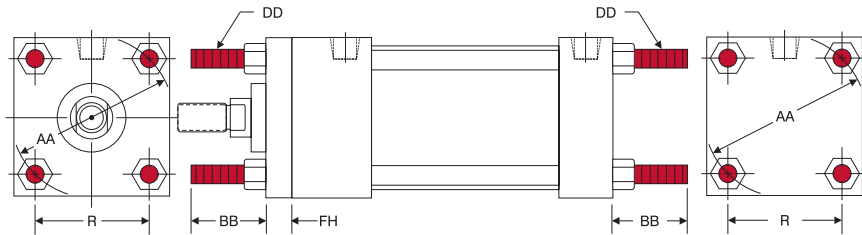
TIE ROD MOUNTED CYLINDERS

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.



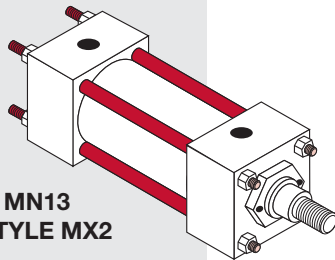
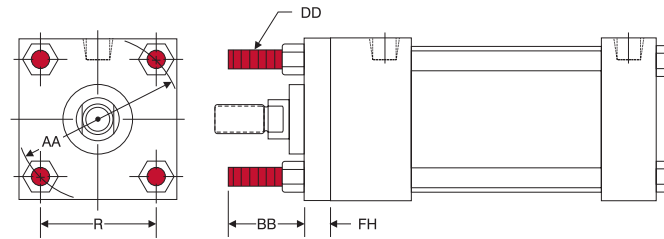
MODEL MN10
NFPA STYLE MX1

TIE RODS EXTENDED BOTH END



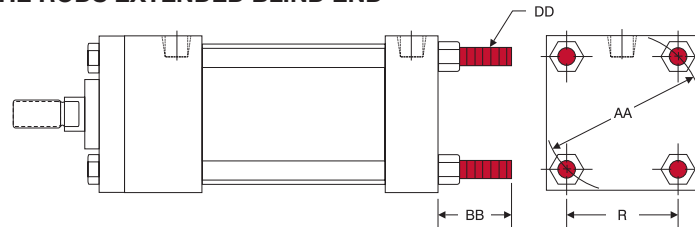
MODEL MN12
NFPA STYLE MX3

TIE RODS EXTENDED ROD END



MODEL MN13
NFPA STYLE MX2

TIE RODS EXTENDED BLIND END



HOW TO ORDER

For ordering information refer to Page 134.

NOTES:

- For double rod end cylinders, add prefix letter D to cylinder code. Example: DMN00611. (Refer to page 112.)

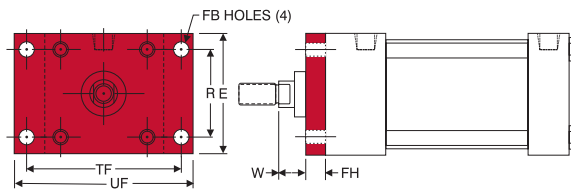
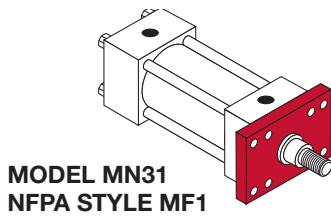
Rod End Styles and Dimensions
For rod end styles and dimensions see:
Page 105

MilCad Cylinder Configurator
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TIE ROD EXTENDED 'MN10', 'MN12', 'MN13' MOUNT DIMENSIONS							
Bore Ø	Rod MM	Cylinder Code ↓	AA	BB	DD	FH	R
1½	5/8	MN00611	2.02	1	¼-28	3/8	1.43
	1	MN00612					
2	5/8	MN06110	2.6	1½	5/16-24	3/8	1.84
	1	MN06111					
2½	5/8	MN06120	3.1	1½	5/16-24	3/8	2.19
	1	MN06121					
3¼	1	MN06130	3.9	1¾	¾-24	5/8	2.76
	1¾	MN06131					
4	1	MN06140	4.7	1¾	¾-24	5/8	3.32
	1¾	MN06141					
5	1	MN06150	5.8	1¾ ¹⁶	½-20	5/8	4.10
	1¾	MN06151					
6	1¾	MN06160	6.9	1¾ ¹⁶	½-20	¾	4.88
	1¾	MN06161					
8	1¾	MN06180	9.1	**2 ⁵ / ₁₆	5/8-18	*5/8	6.44
	1¾	MN06181					
10	1¾	MN61100	11.2	**2 ¹¹ / ₁₆	¾-16	*5/8	7.92
	2	MN61101					
12	2	MN61200	13.3	**2 ¹¹ / ₁₆	¾-16	*¾	9.40
	2½	MN61201					

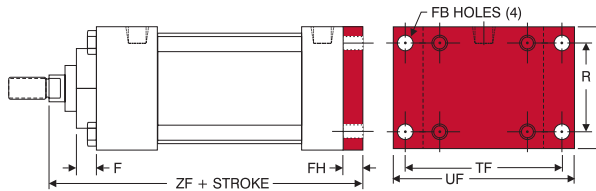
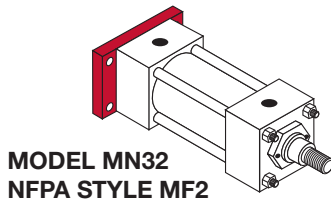
* MX1 and MX3 have full square bushing retainer on 1½" - 6" bores, round retainers on 8"-12" bores.
** BB dimensions from face of head. For dimensions not shown, see page 105.

ROD RECTANGULAR FLANGE MOUNTING (1½" - 6" bore only)



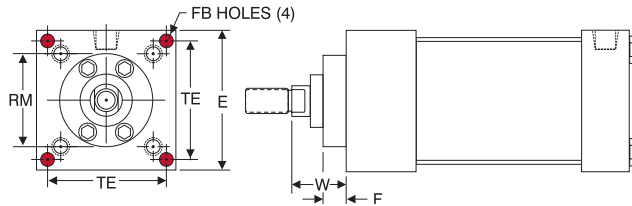
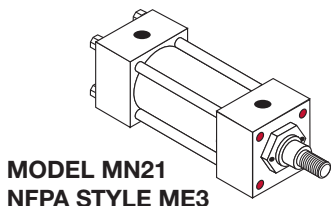
MODEL MN31
NFFA STYLE MF1

BLIND RECTANGULAR FLANGE MOUNTING (1½" - 6" bore only)



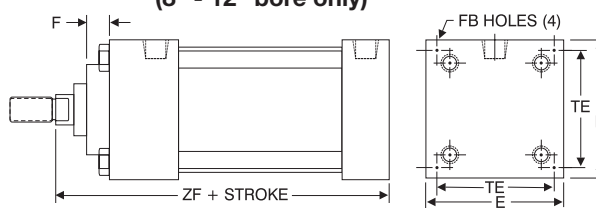
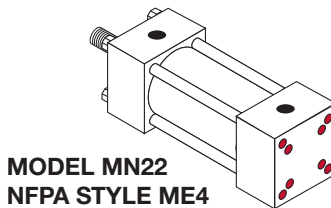
MODEL MN32
NFFA STYLE MF2

ROD SQUARE FLANGE MOUNTING (8" - 12" bore only)



MODEL MN21
NFFA STYLE ME3

BLIND SQUARE FLANGE MOUNTING (8" - 12" bore only)



MODEL MN22
NFFA STYLE ME4

'MN31', 'MN32' FLANGE MOUNT & 'MN21', 'MN22' CAP MOUNT DIMENSIONS

Bore Ø	Rod MM	Cylinder Code ↓	E	F	FB	FH	R	RM	TE	TF	UF	W	ZF
1½	5/8**	MN00611	2	3/8	5/16	3/8	1.43	—	—	2¾	3¾	5/8	5
	1**	MN00612										1	5¾
2	5/8**	MN06110	2½	3/8	3/8	3/8	1.84	—	—	3¾	4½	5/8	5
	1**	MN06111										1	5¾
2½	5/8**	MN06120	3	3/8	3/8	3/8	2.19	—	—	3¾	4¾	5/8	5½
	1**	MN06121										1	5½
¾	1**	MN06130	3¾	5/8	7/16	5/8	2.76	—	—	4 11/16	5½	¾	6¼
	1 3/8**	MN06131										1	6½
4	1**	MN06140	4½	5/8	7/16	5/8	3.32	—	—	5 7/16	6¼	¾	6¼
	1 3/8**	MN06141										1	6½
5	1**	MN06150	5½	5/8	9/16	5/8	4.10	—	—	6 5/8	7 5/8	¾	6½
	1 3/8**	MN06151										1	6¾
6	1 3/8**	MN06160	6½	5/8	9/16	¾	4.88	—	—	7 5/8	8 5/8	7/8	7 3/8
	1 ¾**	MN06161										1 1/8	7 5/8
8	1 3/8*	MN06180	8½	5/8	1 1/16	N/A	N/A	3 1/2	7.57	N/A	N/A	1 5/8	6 3/4
	1 ¾*	MN06181										1 7/8	7
10	1 ¾*	MN61100	10 5/8	5/8	1 9/16	N/A	N/A	3 1/2	9.40	N/A	N/A	1 7/8	8 1/4
	2*	MN61101										2	8 3/8
12	2*	MN61200	12 3/4	¾	1 9/16	N/A	N/A	5	11.1	N/A	N/A	2	8 7/8
	2 1/2*	MN61201										2 1/4	9 1/8

For dimensions not shown, see page 105.

FLANGE MOUNTED CYLINDERS

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

Rod end flange mounts are best used in tension applications.

When a less rigid mount can be used and the cylinder can be attached to a panel or bulkhead, an extended tie-rod mounting could be considered.

HOW TO ORDER

For ordering information refer to Page 134.

NOTES:

◆ For double rod end cylinders, add prefix letter D to cylinder code. Example: DMN00611. (Refer to page 112.)

* Models MN31 and MN32 not available in these sizes.

** Models MN21 and MN22 not available in these sizes.

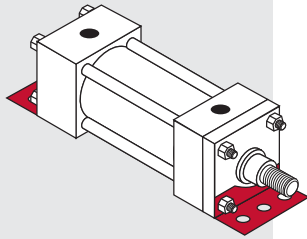
Rod End Styles and Dimensions
For rod end styles and dimensions see:

HOW TO ORDER

For ordering information refer to Page 134.

NOTES:

- ◆ For double rod end cylinders, add prefix letter D to cylinder code. Example: DMN00611. (Refer to page 112.)

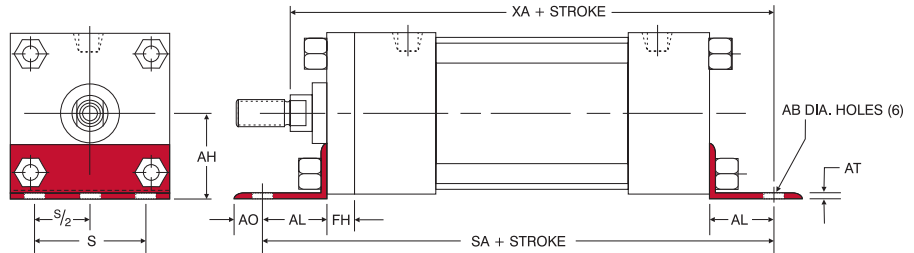


**MODEL MN44
NFA STYLE MS1**

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.

ANGLE MOUNTING



'MN44' ANGLE MOUNT DIMENSIONS

Bore Ø	Rod MM	Cylinder Code ◆	AB	AH	AL	AO	AT	FH	S	Add Stroke	
										SA▲	XA
1½	5/8	MN00611	7/16	13/16	1	3/8	1/8	3/8	1¼	6	55/8
	1	MN00612									6
2	5/8	MN06110	7/16	17/16	1	3/8	1/8	3/8	1¾	6	55/8
	1	MN06111									6
2½	5/8	MN06120	7/16	15/8	1	3/8	1/8	3/8	2¼	6½	5¾
	1	MN06121									6½
3¼	1	MN06130	9/16	115/16	1¼	½	1/8	5/8	2¾	73/8	67/8
	13/8	MN06131									71/8
4	1	MN06140	9/16	2¼	1¼	½	1/8	5/8	3½	73/8	67/8
	13/8	MN06141									71/8
5	1	MN06150	11/16	2¾	13/8	5/8	3/16	5/8	4¼	77/8	7¼
	13/8	MN06151									7½
6	13/8	MN06160	13/16	3¼	13/8	5/8	3/16	3/4	5¼	8½	8
	1¾	MN06161									8¼
8	13/8	MN06180	13/16	4¼	113/16	11/16	¼	5/8*	71/8	8¾	89/16
	1¾	MN06181									813/16

*3½" diameter round retainer on 8" bore. (MA1 bracket bolted directly to head)
For dimensions not shown, see page 105.

▲ For Double Rod End, add 1/2" + FH to this dimension.



Rod End Styles and Dimensions

For rod end styles
and dimensions
see:

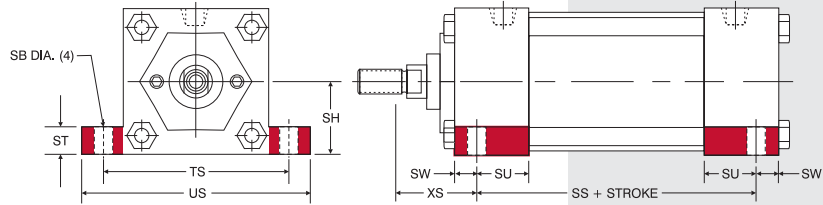
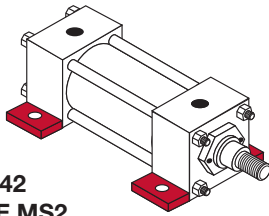
Page 105



MilCad Cylinder Configurator

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

SIDE LUG MOUNTING



**MODEL MN42
NFFA STYLE MS2**

'MN42' SIDE LUG MOUNT DIMENSIONS												
Bore Ø	Rod MM	Cylinder Code ♦	SB	SH	ST	SU	SW	SZ	TS	US	XS	Add Stroke SS*
1½	5/8	MN00611	7/16	1	½	1 1/8	3/8	5/8	2 3/4	3 1/2	1 3/8	2 7/8
	1	MN00612									1 1/4	
2	5/8	MN06110	7/16	1 1/4	½	1 1/8	3/8	5/8	3 1/4	4	1 3/8	2 7/8
	1	MN06111									1 3/4	
2½	5/8	MN06120	7/16	1 1/2	½	1 1/8	3/8	5/8	3 3/4	4 1/2	1 3/8	3
	1	MN06121									1 3/4	
3¼	1	MN06130	9/16	1 7/8	¾	1 1/4	½	¾	4 3/4	5 3/4	1 7/8	3 1/4
	1 3/8	MN06131									2 1/8	
4	1	MN06140	9/16	2 1/4	¾	1 1/4	½	¾	5 1/2	6 1/2	1 7/8	3 1/4
	1 3/8	MN06141									2 1/8	
5	1	MN06150	1 3/16	2 3/4	1	1 1/16	1 1/16	9/16	6 7/8	8 1/4	2 1/16	3 1/8
	1 3/8	MN06151									2 5/16	
6	1 3/8	MN06160	1 3/16	3 1/4	1	1 5/16	1 1/16	1 3/16	7 7/8	9 1/4	2 5/16	3 5/8
	1 3/4	MN06161									2 9/16	
8	1 3/8	MN06180	1 3/16	4 1/4	1	1 5/16	1 1/16	1 3/16	9 7/8	11 1/4	2 5/16	3 3/4
	1 3/4	MN06181									2 9/16	

For dimensions not shown, see page 105.

HOW TO ORDER

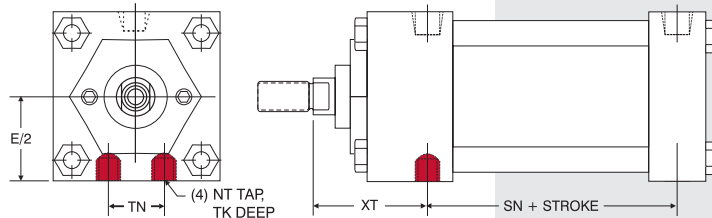
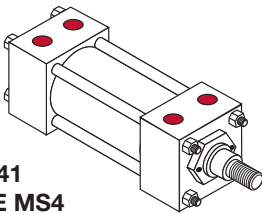
For ordering information refer to Page 134.

NOTES:

♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DMN00611. (Refer to page 112.) Double rod ends are not available on clevis mount Series MN cylinders.

* For Double Rod End Cylinders add 1/2" to this dimension.

TAPPED HOLES IN CAPS FLUSH MOUNTING



**MODEL MN41
NFFA STYLE MS4**

'MN41' TAPPED HOLE MOUNT DIMENSIONS								
Bore Ø	Rod MM	Cylinder Code ♦	E/2	NT	TK	TN	XT	Add Stroke SN
1½	5/8	MN00611	1	¼-20	3/8	5/8	1 15/16	2 1/4
	1	MN00612					2 5/16	
2	5/8	MN06110	1 1/4	5/16-18	½	7/8	1 15/16	2 1/4
	1	MN06111					2 5/16	
2½	5/8	MN06120	1 1/2	3/8-16	5/8	1 1/4	1 15/16	2 3/8
	1	MN06121					2 5/16	
3¼	1	MN06130	1 7/8	½-13	¾	1 1/2	2 7/16	2 5/8
	1 3/8	MN06131					2 11/16	
4	1	MN06140	2 1/4	½-13	¾	2 1/16	2 7/16	2 5/8
	1 3/8	MN06141					2 11/16	
5	1	MN06150	2 3/4	5/8-11	1	2 11/16	2 7/16	2 7/8
	1 3/8	MN06151					2 11/16	
6	1 3/8	MN06160	3 1/4	¾-10	1 1/8	3 1/4	2 13/16	3 1/8
	1 3/4	MN06161					3 1/16	
8	1 3/8	MN06180	4 1/4	¾-10	1 1/8	4 1/2	2 13/16	3 1/4
	1 3/4	MN06181					3 1/16	
10	1 3/4	MN61100	5 5/16	1-8	1 1/2	5 1/2	3 1/8	4 1/8
	2	MN61101					3 1/4	
12	2	MN61200	6 3/8	1-8	1 1/2	7 1/4	3 1/4	4 5/8
	2 1/2	MN61201					3 1/2	

For dimensions not shown, see page 105.

Info
Rod End Styles and Dimensions
For rod end styles and dimensions see:
Page 105

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

Series MN
Hyd-Pneu Devices
Cyl Accessories
Manifolds
Power Units/Valves
Design Guide

Series H

Series MH

Series LH

Series A

Series MN

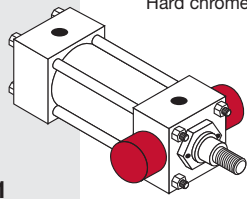
NOTE:

MT1 and MT2 trunnions are bolt on, non-removable design.

TRUNNION CYLINDERS

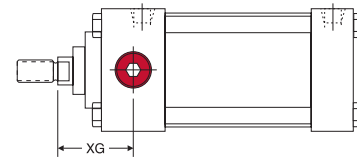
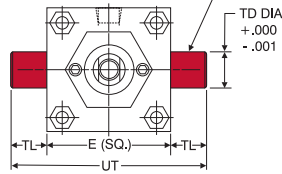
All trunnion cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.

**MODEL MN71
NFPA STYLE MT1**

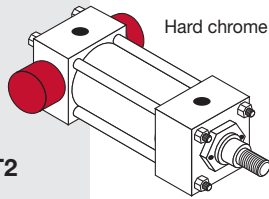


ROD END TRUNNION MOUNT

Hard chrome plated O.D. wear surface on trunnions

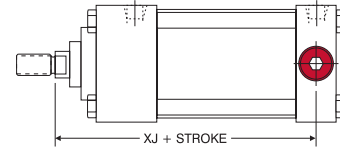
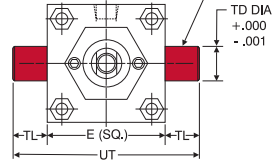


**MODEL MN72
NFPA STYLE MT2**



BLIND END TRUNNION MOUNT

Hard chrome plated O.D. wear surface on trunnions

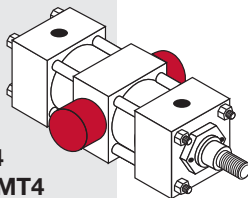


'MN71' AND 'MN72' TRUNNION MOUNT DIMENSIONS									ACCESSORIES (see pages 110-111 for dimensions)		
Bore Ø	Rod MM	Cylinder Code ♦	E	TD	TL	UT	XG	Add Stroke XJ	Rod Clevis	Rod Eye	Clevis Pin
1½*	5/8	MN00611	2	1	1	4	1¼	4½	RC437	RE437	CP500
	1	MN00612					N/A*	4½	RC750	RE750	CP750
2	5/8	MN06110	2½	1	1	4½	1¼	4½	RC437	RE437	CP500
	1	MN06111					2½	4½	RC750	RE750	CP750
2½	5/8	MN06120	3	1	1	5	1¼	4¼	RC437	RE437	CP500
	1	MN06121					2½	4½	RC750	RE750	CP750
¾	1	MN06130	¾	1	1	5¾	2¼	5	RC750	RE750	CP750
	1¾	MN06131					2½	5¼	RC1000	RE1000	CP1000
4	1	MN06140	4½	1	1	6½	2¼	5	RC750	RE750	CP750
	1¾	MN06141					2½	5¼	RC1000	RE1000	CP1000
5	1	MN06150	5½	1	1	7½	2¼	5¼	RC750	RE750	CP750
	1¾	MN06151					2½	5½	RC1000	RE1000	CP1000
6	1¾	MN06160	6½	1¾	1¾	9¼	2⅝	5⅞	RC1000	RE1000	CP1000
	¾	MN06161					2⅞	6⅞	RC1250	RE1250	CP1375
8	1¾	MN06180	8½	1¾	1¾	11¼	2⅝	6	RC1000	RE1000	CP1000
	¾	MN06181					2⅞	6¼	RC12505	RE1250	CP1375

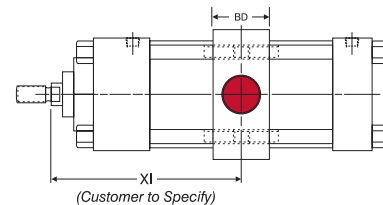
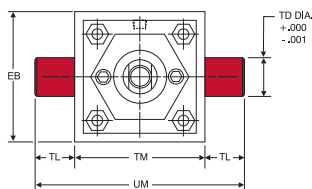
*No oversize rod available on 1½" bore MT1. For dimensions not shown, see page 105.

NOTE: MT4 Trunnions and Intermediate section are one-piece steel construction.

**MODEL MN74
NFPA STYLE MT4**



CENTER TRUNNION MOUNT



HOW TO ORDER

For ordering information refer to Page 134.

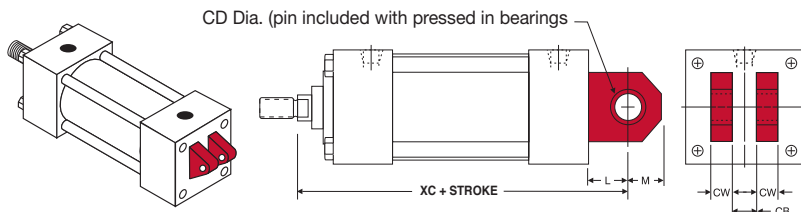
NOTES:

- ♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DMN00611. (Refer to page 112.)

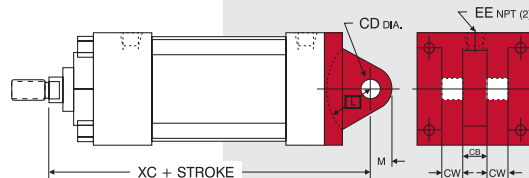
'MN74' CENTER TRUNNION MOUNT DIMENSIONS							
Bore Ø	BD	EB	TD	TL	TM	UM	X1
1½	1¼	2½	1	1	2½	4½	CUSTOMER TO SPECIFY
2	1½	3	1	1	3	5	
2½	1½	3½	1	1	3½	5½	
¾	2	4¼	1	1	4½	6½	
4	2	5	1	1	5¼	7¼	
5	2	6	1	1	6¼	8¼	
6	2	7	1¾	1¾	7⅞	10⅞	
8	2½	9½	1¾	1¾	9¾	12½	

CLEVIS MOUNT

Extruded MP1 Mount
(Extruded: 1½" - 8" Bores, Weldment: 10" & 12" Bores)



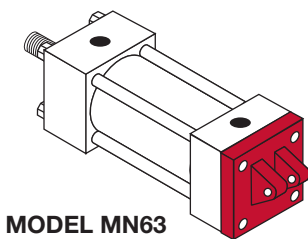
Iron Casting MP1 Mount
(Optional)**



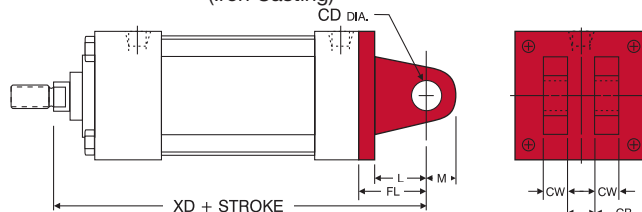
MODEL MN61
NFPA STYLE MP1

REMOVABLE CLEVIS MOUNT

MP2 Mount
(Iron Casting)



MODEL MN63
NFPA STYLE MP2



HOW TO ORDER

For ordering information refer to Page 134.

NOTES:

- ◆ For double rod end cylinders, add prefix letter D to cylinder code. Example: DMN00611. (Refer to page 112.)

Info **Rod End Styles and Dimensions**
For rod end styles and dimensions see:
Page 105

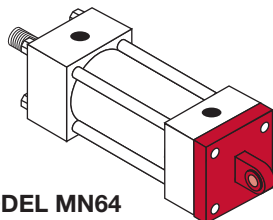
MilCad **Cylinder Configurator**
Visit milwaukeekeecylinder.com to configure and download CAD files of your cylinders.

See pages 124-125 for dimensions.

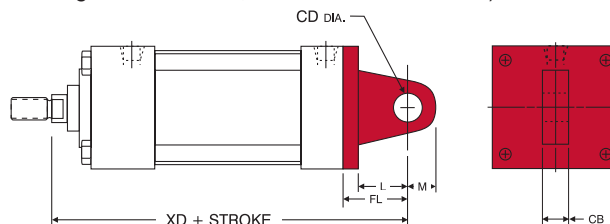
REMOVABLE FIXED EYE MOUNT

MP4 Mount

(Iron Casting: 1½" - 4" Bores, Weldment: 5" & 6" Bores)



MODEL MN64
NFPA STYLE MP4



'MN61', 'MN63' CLEVIS AND 'MN64' EYE MOUNT DIMENSIONS (in)										ACCESSORIES (see pages 110-111 for dimensions)					
Bore Ø	Rod MM	Cylinder Code ◆	CB	CD	CW	FL	L	M	XC	XD	Rod Clevis	Rod Eye	Clevis Pin	Eye Bracket (for MP1)	Clevis Bracket (for MP4)
1½	5/8	MN00611	3/4	1/2	1/2	1 1/8	3/4	5/8	5 3/8	5 3/4	RC437	RE437	CP500		
	1	MN00612							5 3/4	6 1/8	RC750	RE750	CP750		
2	5/8	MN06110	3/4	1/2	1/2	1 1/8	3/4	5/8	5 3/8	5 3/4	RC437	RE437	CP500	EB500	CB500
	1	MN06111							5 3/4	6 1/8	RC750	RE750	CP750		
2½	5/8	MN06120	3/4	1/2	1/2	1 1/8	3/4	5/8	5 1/2	5 7/8	RC437	RE437	CP500		
	1	MN06121							5 7/8	6 1/4	RC750	RE750	CP750		
3¼	1	MN06130	1 1/4	3/4	5/8	1 7/8	1 1/4	7/8	6 7/8	7 1/2	RC750	RE750	CP750		
	1 3/8	MN06131							7 1/8	7 3/4	RC1000	RE1000	CP1000		
4	1	MN06140	1 1/4	3/4	5/8	1 7/8	1 1/4	7/8	6 7/8	7 1/2	RC750	RE750	CP750	EB750	CB750
	1 3/8	MN06141							7 1/8	7 3/4	RC1000	RE1000	CP1000		
5	1	MN06150	1 1/4	3/4	5/8	1 7/8	1 1/4	7/8	7 1/8	7 3/4	RC750	RE750	CP750		
	1 3/8	MN06151							7 3/8	8	RC1000	RE1000	CP1000		
6	1 3/8	MN06160	1 1/2	1	3/4	2 1/4	1 1/2	1	8 1/8	8 7/8	RC1000	RE1000	CP1000	EB1000	CB1000
	1 3/4	MN06161							8 3/8	9 1/8	RC1250	RE1250	CP1375		
8	1 3/8	MN06180	1 1/2	1	3/4	N/A	1 1/2	1	8 1/4	N/A	RC1000	RE1000	CP1000		
	1 3/4	MN06181							8 1/2	N/A	RC1250	RE1250	CP1375		
10	1 3/4	MN61100	2	1 3/8	1	N/A	2 1/8	1 3/8	10 3/8	N/A	RC1250	RE1250	CP1375	EB1375	CB1375
	2	MN61101							10 1/2	N/A	RC1500	RE1500	CP1750		
12	2	MN61200	2 1/2	1 3/4	1 1/4	N/A	2 1/4	1 3/4	11 1/8	N/A	RC1500	RE1500	CP1750	EB1750	CB1750
	2 1/2	MN61201							11 3/8	N/A	RC1875	N/A	CP2000		

Clevis pins are provided with pivot mounts. For dimensions not shown, see page 105.

**Extruded MP1 mounts are standard (1½" - 8" bores). Cast Iron removable mounts are optional, and must be requested when ordering (1½" - 6" bores). Specify "CAST MP1" when ordering.

Series H

Series MH

Series LH

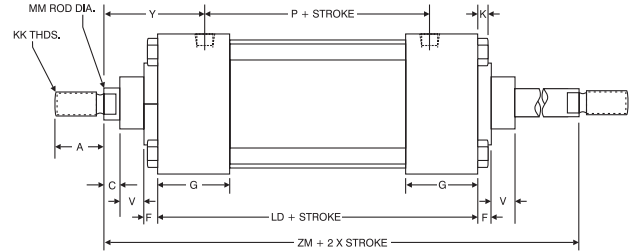
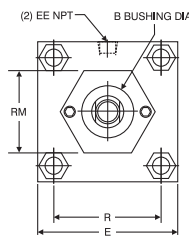
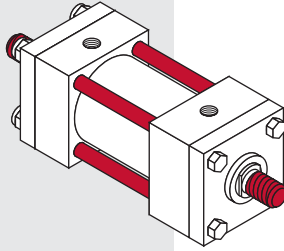
Series A

Series MN

Rod End Styles and Dimensions
For rod end styles and dimensions see:
Page 105

DOUBLE ROD END CYLINDERS

- Standard and oversize piston rods available
- Full range of standard options
- Durable design. Full rod bearing at each end of cylinder
- Can be provided with hollow piston rods (gun-drilled through, to your size requirements)
- Can be used in adjustable extend stroke applications (by adding a stop collar on one rod end, or option "MA" - Refer to page 119).



Bore Ø	Rod MM	Cylinder Code	A	B	C	E	EE	F	G	K	KK	LD	P	R	RM	V	Y	ZM
1½	5/8	DMN00611	¾	1 1/8	¾	2	¾	¾	1 1/2	¼	7/16-20	4 1/8	2 3/8	1.43	2 Sq.	¼	1 7/8	6 1/8
	1	DMN00612	1 1/8	1 1/2	1/2						¾-16					1/2	2 1/4	6 7/8
2	5/8	DMN06110	¾	1 1/8	¾	2 1/2	¾	¾	1 1/2	5/16	7/16-20	4 1/8	2 3/8	1.84	1 3/4 Hex	¼	1 7/8	6 1/8
	1	DMN06111	1 1/8	1 1/2	1/2						¾-16					1/2	2 1/4	6 7/8
2½	5/8	DMN06120	¾	1 1/8	¾	3	¾	¾	1 1/2	5/16	7/16-20	4 1/4	2 1/2	2.19	1 3/4 Hex	¼	1 7/8	6 1/4
	1	DMN06121	1 1/8	1 1/2	1/2						¾-16					1/2	2 1/4	7
3¼	1	DMN06130	1 1/8	1 1/2	1/2	3 3/4	1/2	5/8	1 3/4	¾	¾-16	4 3/4	2 3/4	2.76	2 3/4 Dia.	¼	2 3/8	7 1/2
	1 1/8	DMN06131	1 5/8	2	5/8						1-14					3/8	2 5/8	8
4	1	DMN06140	1 1/8	1 1/2	1/2	4 1/2	1/2	5/8	1 3/4	¾	¾-16	4 3/4	2 3/4	3.32	2 3/4 Dia.	¼	2 3/8	7 1/2
	1 3/8	DMN06141	1 5/8	2	5/8						1-14					3/8	2 5/8	8
5	1	DMN06150	1 1/8	1 1/2	1/2	5 1/2	1/2	5/8	1 3/4	7/16	¾-16	5	3	4.10	2 3/4 Dia.	¼	2 3/8	7 3/4
	1 3/8	DMN06151	1 5/8	2	5/8						1-14					3/8	2 5/8	8 1/4
6	1 3/8	DMN06160	1 5/8	2	5/8	6 1/2	¾	5/8	2	7/16	1-14	5 1/2	3 1/4	4.88	3 1/2 Dia.	3/8	2 3/4	8 3/4
	1 3/4	DMN06161	2	2 3/8	¾						1 1/4-12					1/2	3	9 1/4
8	1 3/8	DMN06180	1 5/8	2	5/8	8 1/2	¾	5/8	2	9/16	1-14	5 5/8	3 3/8	6.44	3 1/2 Dia.	3/8	2 3/4	8 7/8
	1 3/4	DMN06181	2	2 3/8	¾						1 1/4-12					1/2	3	9 3/8
10	1 3/4	DMN61100	2	2 3/8	¾	10 5/8	1	5/8	2 1/4	1 1/16	1 1/4-12	6 5/8	4 5/16	7.92	3 1/2 Dia.	1/2	3 1/16	10 3/8
	2	DMN61101	2 1/4	2 5/8	7/8			¾			1 1/2-12					3/8	3 3/16	10 5/8
12	2	DMN61200	2 1/4	2 5/8	7/8	12 3/4	1	¾	2 1/4	1 1/16	1 1/2-12	7 1/8	4 1 3/16	9.40	5 Dia.	3/8	3 3/16	11 1/8
	2 1/2	DMN61201	3	3 1/8	1						1 7/8-12					1/2	3 7/16	11 5/8

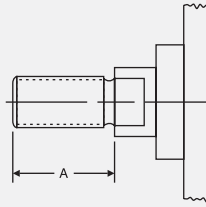
▼ Double Rod End Stroke Adders

Bore Ø	Rod MM	MS1D		MS2D
		SAD	XAD	SSD
1½	5/8	6 7/8	6 1/2	3 3/8
	1		6 7/8	
2	5/8	6 7/8	6 1/2	3 3/8
	1		6 7/8	
2½	5/8	7	6 5/8	3 1/2
	1		7	
3¼	1	8 1/2	8	3 3/4
	1 3/8		8 1/4	
4	1	8 1/2	8	3 3/4
	1 3/8		8 1/4	
5	1	9	8 3/8	3 5/8
	1 3/8		8 5/8	
6	1 3/8	9 3/4	9 1/4	4 1/8
	1 3/4		9 1/2	
8	1 3/8	9 1/4	9 1/16	4 1/4
	1 3/4		9 5/16	

INDEX TO BASIC OPTIONS

CODE	DESCRIPTION	
A=	EXTENDED PISTON ROD THREAD	114
A/O	AIR/OIL PISTON	114
AS	ADJUSTABLE STROKE (RETRACT)	114
B, BC, BH	BUMPERS	114
BP	BUMPER PISTON SEALS	115
H, C, LH, LC, ELH, ELC	CUSHIONS	116
ELH, ELC	DIMENSIONS FOR EXTRA LONG CUSHIONS	117
	CUSTOM LENGTH CUSHIONS	117
BSPT/BSPP	BRITISH STANDARD PIPE THREADS.	118
C=	EXTENDED PISTON ROD	118
EN	ELECTROLESS NICKEL	118
KK3S	STUDDED PISTON ROD	118
LF	LOW FRICTION	118
MA	MIXCRO-ADJUST	119
MAB	MICRO-ADJUST WITH URETHANE BUMPER	119
MPR, MPH	MAGNETIC PISTON	120
MS	METALLIC ROD SCRAPER	120
NR	NON-ROTATING (NFPA) CYLINDERS	120
OP	OPTIONAL PORT LOCATION	121
	OPTIONAL PORT & CUSHION AT SAME LOCATION	121
OS	OVERSIZE ROD	121
SAE	SAE "O-RING" BOSS PORTS	121
SSA	STAINLESS STEEL "ALL"	122
SSF	STAINLESS STEEL FASTENERS	122
SSR	STAINLESS STEEL PISTON ROD	122
SST	STAINLESS STEEL TIE RODS & NUTS	122
ST	STOP TUBE	122
TH	400 PSI HYDRAULIC (NON SHOCK)	123
VS	VITON	123

A=



EXTENDED PISTON ROD THREAD

"A=" Refers to the length of piston rod thread
 Shorter than standard lengths can be furnished at no charge. Longer than standard lengths can be furnished at nominal price adder.
Special length threads available.

A/O

AIR/OIL PISTON

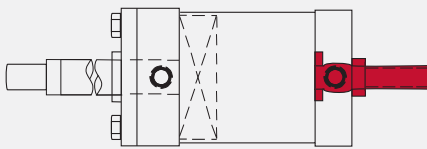
Air/Oil pistons allow for the combination of pneumatic supply air with the precise control of oil.

The basic A/O piston is designed for oil on the cylinder cap end, and a "meter out" flow control (not provided) for precise return stroke control.

For applications that require the oil to be on the cylinder rod end, specify the TH option.

NOTE: Due to the nature of oil to remain in the tubing finish recesses, a condition called "collaring" will allow oil to seep past the A/O seal over time, escaping in the air valve exhaust.

AS

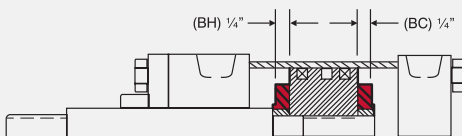


ADJUSTABLE STROKE (RETRACT)

Consists of a threaded rod in the cylinder cap, non-removable. Provides an adjustable positive stop on the cylinder retract.

To order, specify "AS" and length of adjustment (Example: AS=3").

B, BC, BH



BUMPERS

Urethane impact dampening bumpers, used when cylinder speeds do not allow for standard cushions.

BC = Cap Bumper **BH** = Head Bumper **B** = Head and Cap Bumper
 (NOTE: Each bumper adds 1/4" to cylinder length).

BP

BUMPER PISTON SEALS

Milwaukee Cylinder's Bumper Piston Seal, when used with our advanced cushion design, decelerates the cylinder at end of stroke — reducing noise and extending cylinder life.



1½" Bore Shown



Available on 1½" - 8" Bore

BENEFITS

- **Reduces cycle rates**
Higher piston velocities can be achieved due to rapid deceleration feature increasing productivity
- **Provides maximum impact dampening**
Reduces machine vibration
- **Reduces cylinder end-of-stroke noise**
- **Available in Viton Seals**
(1½" to 8" bore)

DESIGN TIPS

- Use cushions to achieve quick performance on longer strokes (Options HC & BP)
- Use the BP Seals without cushions on short strokes requiring fast cycles
- Due to compressibility, BP Seals are not recommended for applications that require 100% repeatable stroke increments

Bumper Piston Seals will shorten the cylinder stroke when operated at less than 90 PSI supply air. The charts below show the approximate (average) stroke reduction, at various pressure (for new cylinders). As the cylinders are cycled, the seals will take a slight set. Tests have shown that after 1,500,000 cycles, the seals will have between .001" and .008" compression set per seal. After that, there is no noticeable compression set.

TOTAL STROKE REDUCTION ("A" Dimension X 2) (in inches)						
Bore Ø	0 PSI	10 PSI	30 PSI	50 PSI	70 PSI	90 PSI
1½	.10	.09	.07	.06	.04	.00
2	.14	.11	.07	.04	.01	.00
2½	.18	.14	.08	.05	.02	.00
3¼	.14	.12	.08	.04	.01	.00
4	.17	.14	.09	.05	.02	.00
5	.18	.14	.07	.03	.01	.00
6	.23	.18	.10	.05	.01	.00
8	.31	.26	.15	.07	.03	.00

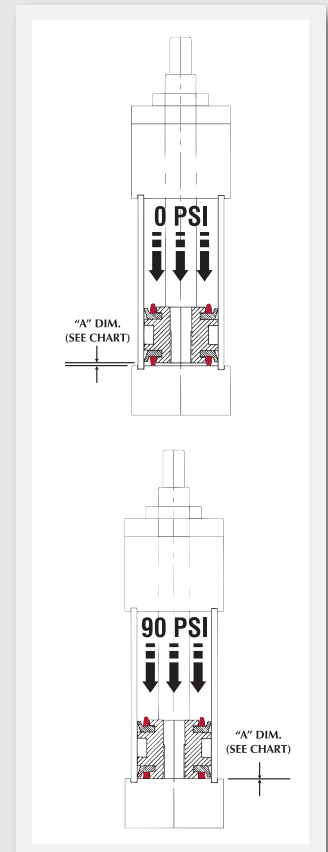
PER END STROKE REDUCTION ("A" Dimension) (in inches)						
Bore Ø	0 PSI	10 PSI	30 PSI	50 PSI	70 PSI	90 PSI
1½	.048	.043	.035	.028	.021	.00
2	.069	.056	.037	.020	.010	.00
2½	.091	.070	.042	.024	.008	.00
3¼	.071	.059	.039	.020	.002	.00
4	.087	.069	.045	.026	.009	.00
5	.092	.072	.036	.013	.005	.00
6	.113	.091	.051	.023	.003	.00
8	.154	.132	.076	.037	.016	.00

Standard Material: Buna-N
Optional Material: Viton

Operating Temperature:
-20° F to 200° F

Operating Temperature:
-150° F to 350° F

Operating Pressure:
250 PSI Air



Series H

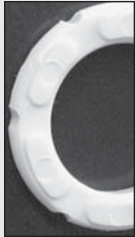
Series MH

Series LH

Series A

Series MN

Seal Design



Front Side



Back Side

HEAD AND CAP CUSHIONS

Milwaukee Cylinder's advanced cushion design features a unique, one piece seal that is allowed to float in a precision machined groove.

This type of seal design provides consistent cushion performance and maximum seal life.

Oversized flow paths molded in the periphery of the seal provide "full flow" on the return stroke without the use of ball checks.

HEAD CUSHIONS

H STANDARD LENGTH HEAD CUSHION

LH LONG HEAD CUSHION

ELH EXTRA LONG HEAD CUSHION*

* Extra Long Head add length to cylinder.
Refer to page 117 for details.*

CAP CUSHIONS

C STANDARD LENGTH CAP CUSHION

LC LONG CAP CUSHION

ELC EXTRA LONG CAP CUSHION*

* Extra Long Head add length to cylinder.
Refer to page 117 for details.*

HOW TO SIZE CUSHIONS FOR YOUR APPLICATION

Cylinders with air cushions provide a possible solution to destructive energies. The air cushion traps a small amount of exhaust air at the end of stroke, providing an air pocket that decelerates the load. This reduces the potentially destructive energy being transmitted to the cylinder and other components. The following is a brief explanation on how to determine the energy level of your application and determine if an air cushion can provide adequate energy absorption. Air cushions do not build heat since the heat generated is dissipated with the exhausted air flow.

- STEP 1:** Determine the total load to be stopped by the cylinder. Include the piston rod weight (see piston rod weight chart below).
- STEP 2:** Determine the velocity (in feet per second) at which the load impacts the cylinder end caps.
- STEP 3:** Use the following formula to calculate the energy the cylinder generates.
- STEP 4:** Using the table below, select the proper cushion length. Note: You can choose a larger bore size to increase cushion capacities.

CUSHION SIZING FORMULA

Milwaukee Cylinder's advanced cushion design features a unique, one piece seal that is allowed to float in a precision machined groove.

$$\text{energy} = \frac{(w \times v^2) + (p \times k)}{64}$$

W = Total weight of load in pounds (including piston rod)

V = Velocity (in feet per second)

P = Driving pressure in PSI (usually the air line pressure)

K = Bore constant value (see chart below for "K" values)

Sizing Example:

How to figure the energy for a 2½" bore cylinder, 10" stroke, 5/8" piston rod, moving a 25 lb. load at 6 feet per second with 80 psi air.

$$P = 80 \text{ psi} \quad W = 26.25 \text{ lbs.} \quad V = 6 \text{ FPS.} \quad K = .17$$

$$\text{Energy} = (26.25/64) \times (62) \text{ or } (36) + (80 \times .17)$$

$$\text{Energy} = 28.36 \text{ ft/lbs.}$$

The Maximum Energy Data Chart indicates that the "Long" Cushion at 38.6 maximum energy value would be the right choice for this application.

Design Tips



- Cushions Adjustment screws can be ordered on same side as ports. Refer to page 121 for details.

Refer to page 121 for details.

- BP Seals provide additional impact dampening and noise reduction. (Refer to page 145 for details).

Piston Rod Weight Chart

Rod MM	Piston Rod Weight*
5/8	.35 lb. + .09 lb/in of stroke
1	1.1 lb. + .22 lb/in of stroke
1 1/8	2.3 lb. + .42 lb/in of stroke
1 3/4	5.0 lb. + .68 lb/in of stroke
2	6.1 lb. + .88 lb/in of stroke
2 1/2	10.4 lb. + 1.39 lb/in of stroke

* Double weight for double rod end cylinders.

MAXIMUM ENERGY DATA

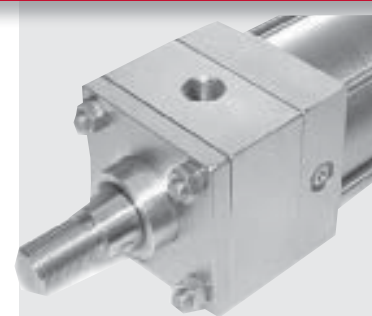
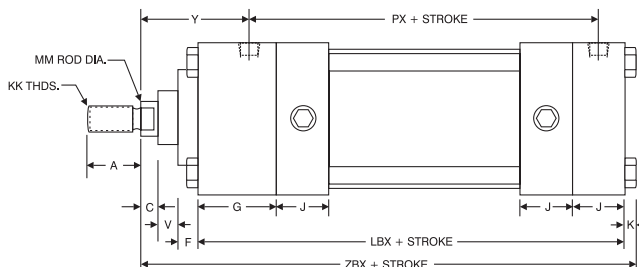
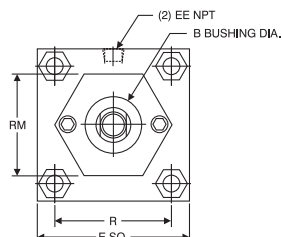
Bore Ø	K	H OR C Standard Cushion Series Max Energy (ft-lbs)	LH OR LC Long Cushion Series Max Energy (ft-lbs)	ELH OR ELC Extra-Long Cushion Series Max Energy (ft-lbs)
1½	.06	8.2	12.8	26.9
2	.11	13.8	21.7	45.8
2½	.17	24.6	38.6	81.5
3¼	.25	45.7	83.6	172.2
4	.38	57.3	137.1	282.6
5	.59	94.6	226.0	465.8
6	1.37	225.5	334.4	767.6
8	2.43	411.3	609.8	1399.8
10	3.79	379.4	621.4	1620.9
12	5.47	554.8	908.8	2370.6

EXTRA LONG CUSHIONS

Milwaukee Cylinder's "ELH" Extra-Long Head Cushions and "ELC" Extra-Long Cap Cushions add length to the cylinder. Refer to the chart for dimensions.

ELH EXTRA LONG HEAD CUSHION

ELC EXTRA LONG CAP CUSHION



(MN41-1 1/2" X 6" ELH - EN) Shown

Bore Ø	Rod MM	Cylinder Code	A	B	C	E	EE	F	G	J	K	KK	LBX	PX	R	RM	V	Y	ZBX
1 1/2	5/8	DMN00611	3/4	1 1/8	3/8	2	3/8	3/8	1 1/2	1	1/4	7/16-20	5 5/8	4 3/8	1.43	2 Sq.	1/4	1 7/8	6 7/8
	N/A	DMN00612	N/A	N/A	N/A							N/A					N/A	N/A	N/A
2	5/8	DMN06110	3/4	1 1/8	3/8	2 1/2	3/8	3/8	1 1/2	1	5/16	7/16-20	5 5/8	4 3/8	1.84	1 3/4 Hex	1/4	1 7/8	6 15/16
	1	DMN06111	1 1/8	1 1/2	1/2							3/4-16				2 1/2 Sq.	1/2	2 1/4	7 5/16
2 1/2	5/8	DMN06120	3/4	1 1/8	3/8	3	3/8	3/8	1 1/2	1	5/16	7/16-20	5 3/4	4 1/2	2.19	1 3/4 Hex	1/4	1 7/8	7 1/16
	1	DMN06121	1 1/8	1 1/2	1/2							3/4-16				3 Sq.	1/2	2 1/4	7 7/16
3 1/4	1	DMN06130	1 1/8	1 1/2	1/2	3 3/4	1/2	5/8	1 3/4	1 1/4	3/8	3/4-16	6 3/4	5 1/4	2.76	2 3/4 Dia.	1/4	2 3/8	8 1/2
	1 3/8	DMN06131	1 5/8	2	5/8							1-14				3 3/4 Sq.	3/8	2 5/8	8 3/4
4	1	DMN06140	1 1/8	1 1/2	1/2	4 1/2	1/2	5/8	1 3/4	1 1/4	3/8	3/4-16	6 3/4	5 1/4	3.32	2 3/4 Dia.	1/4	2 3/8	8 1/2
	1 3/8	DMN06141	1 5/8	2	5/8							1-14				3 1/2 Dia.	3/8	2 5/8	8 3/4
5	1	DMN06150	1 1/8	1 1/2	1/2	5 1/2	1/2	5/8	1 3/4	1 1/4	7/16	3/4-16	7	5 1/2	4.10	2 3/4 Dia.	1/4	2 3/8	8 13/16
	1 3/8	DMN06151	1 5/8	2	5/8							1-14				3 1/2 Dia.	3/8	2 5/8	9 1/16
6	1 3/8	DMN06160	1 5/8	2	5/8	6 1/2	3/4	5/8	2	1 1/2	7/16	1-14	8	6 1/4	4.88	3 1/2 Dia.	3/8	2 3/4	10 1/16
	1 3/4	DMN06161	2	2 3/8	3/4							1 1/4-12					1/2	3	10 5/16
8	1 3/8	DMN06180	1 5/8	2	5/8	8 1/2	3/4	5/8	2	1 1/2	9/16	1-14	8 1/8	6 3/8	6.44	3 1/2 Dia.	3/8	2 3/4	10 5/16
	1 3/4	DMN06181	2	2 3/8	3/4							1 1/4-12					1/2	3	10 5/16
10	1 3/4	DMN61100	2	2 3/8	3/4	10 5/8	1	5/8	2 1/4	2	1 1/16	1 1/4-12	10 3/8	8 5/16	7.92	3 1/2 Dia.	1/2	3 1/16	12 15/16
	2	DMN61101	2 1/4	2 5/8	7/8							1 1/2-12					3/8	3 3/16	13 1/16
12	2	DMN61200	2 1/4	2 5/8	7/8	12 3/4	1	3/4	2 1/4	2	1 1/16	1 1/2-12	10 7/8	8 13/16	9.40	5 Dia.	3/8	3 3/16	13 9/16
	2 1/2	DMN61201	3	3 3/8	1							1 7/8-12					1/2	3 7/16	10 13/16

EXTRA LONG CUSHIONS

Custom length cushions can be designed for your application. Contact Milwaukee Cylinder for details!

Example: An OEM manufacturer of industrial equipment needed a cylinder to shuttle a 125 lb. rolling (and guided) fixture 36" of travel, at low airline pressure to avoid operator injury. A 3 1/2" long head and cap cushion was designed to meet the operating specifications.



BSPT

BRITISH STANDARD PIPE TAPER

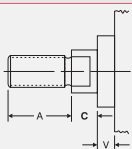
British Standard Pipe Taper (**BSPT**) threads have the same taper as American NPT tapered threads, but use a 55° Whitworth thread form and different diameters. *(Not interchangeable with NPT)*

BSPP

BRITISH STANDARD PIPE PARALLEL

British Standard Pipe Parallel (**BSPP**) also referred to as BSP "Straight" Thread. *(Not interchangeable with NPT)*

C=



EXTENDED PISTON ROD

"C=" is commonly referred to as Piston Rod Extension. Piston rods can be extended to any length up to 120" total piston rod length, including stroke portion. Cylinders with long "C" lengths can be mounted away from obstacles or outside hazardous environments.

EN

ELECTROLESS NICKEL

"EN" or Electroless Nickel plating was invented in 1946, and has gained worldwide commercial usage since 1964. Common usages include aircraft landing gear, automotive brake cylinder and components, fuel injector parts, gas turbine parts, spray nozzles for chemical applications and many electronic devices including hard drives.

The properties of Electroless Nickel contribute to the multitude of uses. The coating provides an attractive finish, while exhibiting high abrasion and corrosion resistance. Its ability to uniformly coat blind holes, threads, internal surfaces and sharp edges contributes to its effectiveness. It has a very high bonding strength to the base metal (100,000-200,000 psi), so much so that gas turbines use electroless nickel plating as a base to braze broken blades to.

COMMON USAGES:

- **FOOD PROCESSING** — EN plating has been used to handle such diverse products as sodium hydroxide, food grade acids and fish oils. Excellent resistance to mild sanitizing caustics, chlorine, and chlorides in general. The natural smooth finish ensures cleanliness in food processing equipment.
- **PETROLEUM AND CHEMICAL** — The petroleum and chemical industry are large users of electroless nickel plating for corrosion protection. Design tip: Submit the list of chemicals and concentration levels to *Milwaukee Cylinder* for evaluation and recommendations. In some instances, Stainless Steel cylinders provide the best value and long cylinder life.
- **MEDICAL AND PHARMACEUTICAL** — The medical industry uses EN plated cylinders in clean-rooms, on equipment used to make plasma or IV bags, since it is critical that cylinder components need to be sterilized and particle "flake free". The pharmaceutical industry typically can be harsh on equipment, even abusive – but the equipment must remain completely reliable. EN cylinders provide the most reliable and cost effective choice.

EN CYLINDER SPECIFICATIONS

En Plated Parts:

Tube, Head, Cap, Bushing Retainer, Mounts (excluding MT1/MT2 which is hard chrome plated stainless steel).

Other Components:

303/304 Stainless Steel: Tie Rods & Nuts, Retainer Screws, Piston Rod (hard chrome plated), Rod Bushing with PTFE Wear Band and Rod Wiper. (Optional: SAE 660 Bronze Rod Bushing)

EN PLATING SPECIFICATIONS:

High Phosphorus (highest corrosion resistant Electroless Nickel plating available)

Composition: 87-90% Nickel, 10-13% Phosphorus

Hardness: Rc 46-48

Thickness: .0005"-.0007"

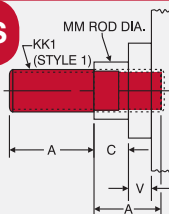
Lubricity: Excellent (Similar to chrome)

Coefficient Of Friction: Low

Finish: Bright and very smooth

Other types of EN plating are available. Contact *Milwaukee Cylinder* with your specifications for a prompt quote.

KK35



STUDED PISTON ROD

KK35 option combines the KK3 female threaded rod end design and a stud, with permanent Loctite. When assembled, the KK35 has the same dimensions as a KK1 rod end.

This option is useful in applications that typically break standard KK1 rod ends due to high load impacting.

LF

LOW FRICTION

Material: Carboxylated Nitrile
Operating Temp.: -20°F to 200°F
Operating Pressure: 250 psi Air

"LF" Low Friction option incorporates the use of round-lip, extremely low friction carboxylated nitrile seals. Round-lip seals "hydroplane" on opposed sealing surfaces, and have a lower running and break-away friction. • **Material:** Carboxylated Nitrile • **Operating Temperature:** -20°F to 200°F (-25°C to 90°C) • **Operating Pressure:** 250 psi air (17 bar)

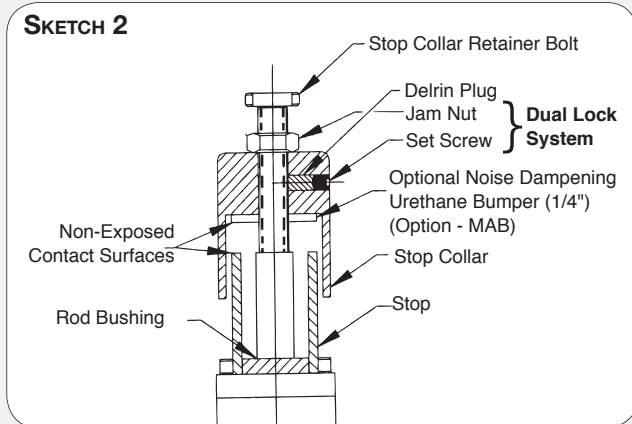
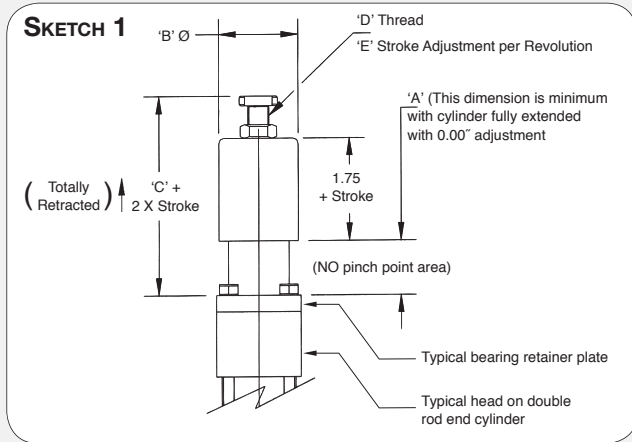
MA



MICRO-ADJUST

- Allows precise adjustment of cylinder extend stroke
- Easy to read precision scale (.001" calibration)
- Enclosed, no "pinch point" design
- Available on all cylinder models with "D" Double Rod End option
- Up to 6" stroke and adjustment*

* Note: The adjustment range is throughout entire stroke. Consult factory for longer stroke requirements or modifications not listed.



- MICRO-ADJUST Set-up Instructions**
- 1) Set actuator to desired stroke
 - 2) Turn stop collar until it makes contact with stop
 - 3) Tighten set screw
 - 4) Tighten jam nut for positive lock of stop collar

MICRO-ADJUST DIMENSIONS					
Bore Ø	A	B	C	D	E
1½	1.00	1.88	3.71	½-20	.050
2	1.00	1.88	3.71	½-20	.050
2½	1.00	1.88	3.71	½-20	.050
3¼	1.00	2.81	3.71	¾-16	.063
4	.75	2.81	3.47	¾-16	.063
5	.75	2.81	3.47	¾-16	.063
6	.75	3.75	3.47	¾-16	.063
8	.75	3.75	3.47	¾-16	.063

MAB

MICRO-ADJUST WITH URETHANE BUMPER

A noise dampening urethane bumper is added between the metal contact points, minimizing noise. See Sketch 2 above.

Series H

Series MH

Series LH

Series A

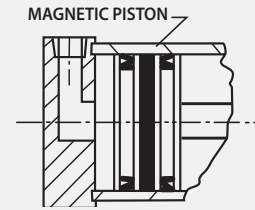
Series MN

MPR/MPH

MAGNETIC PISTON

MPR Magnetic Pistons are used in conjunction with Milwaukee Cylinder's R10, R10P, RAC Reed and MSS Solid State Switches. (See pages 127-133 for switches)

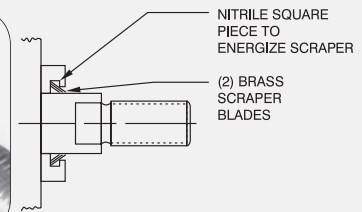
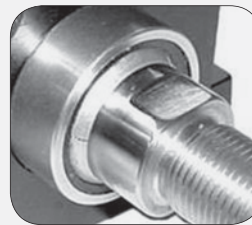
MPH Magnetic Pistons are used with Milwaukee Cylinder's "Old Style" HE011, HE03SK and HE04SC Hall Effect Switches.



MS

METALLIC ROD SCRAPER

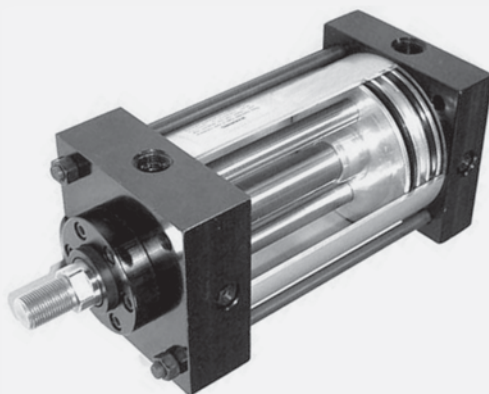
Aggressively scrapes the piston rod, removing foreign material such as spatter, sprays and powders. (Brass construction)



NR

NON-ROTATING (NFPA) CYLINDERS

2" through 12" bore 200 psi air, 400 psi hydraulic (non-shock)



Benefits:

- Two internal guide rods throughout stroke
- High repeatability at each end of stroke (+/- 1 degree)
- All external dimensions are the same as standard cylinder (no additional length or width required)
- Standard Diameter Guide Rod Seals & Bronze Bearings for long life and reliable operation
- Available in Double Rod End Models

Advantages

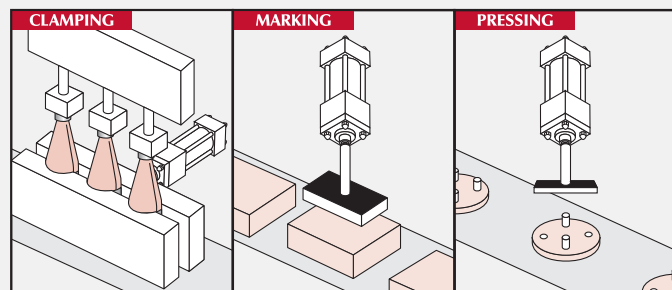
- Eliminates the need for external guide shafts in many positioning applications
- Guide rods are internal, self-cleaning, not subjected to harsh cleaners
- Compact design saves space, no larger than standard NFPA cylinders!
- Durable, self-contained construction

Note: "NR" option not available in combination with "BP" bumper piston seal option.

'NR' GUIDE ROD SIZES AND MAX. STROKE

Bore Ø	Rod MM	Cushions	Guide Rod Ø	Max. Stroke (inches)
2	5/8	Cap only	0.250	10
2½	5/8	Cap only	0.312	12
	1	N/A	0.312	12
3¼	1	Available	0.375	18
	1⅜	Cap only	0.375	18
4	1	Available	0.625	30
	1⅜	Available	0.625	30
5	1	Available	0.625	30
	1⅜	Available	0.625	30
6	1⅜	Available	0.625	30
	1¾	Available	0.625	30
8	1⅜	Available	1.000	40
	1¾	Available	1.000	40
10	1¾	Available	1.000	40
	2	Available	1.000	40
12	2	Available	1.000	40
	2½	Available	1.000	40

APPLICATION POSSIBILITIES:



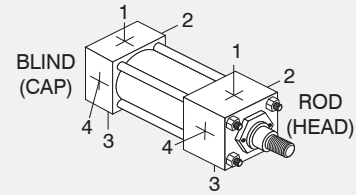
OP

OPTIONAL PORT LOCATION

Optional port locations can be ordered simply by calling out the location numbers:

Note: When optional port locations are ordered, specify **both** port locations, even if one port is in the standard location.

- Standard port positions at 1
- Standard cushion positions at 2
- Specify non-standard locations when ordering



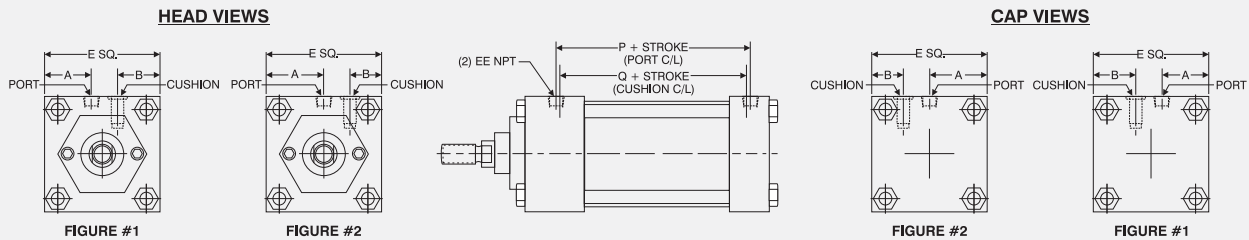
OPTIONAL PORT AND CUSHION AT SAME LOCATION

Now available, the ability to specify Ports and Cushions on the same cylinder side!

Note: When optional port and cushion locations are ordered, specify both port and cushion locations, even if a port or cushion is in the standard location.



BASIC DIMENSIONS:

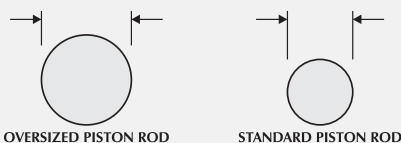


Bore Ø	Rod MM	Figure	A	B	E	EE	P	Q
1½	5/8	1	3/4	5/8	2	1/4	2¾	2½
	1	N/A	N/A	N/A	N/A			
2	5/8	1	7/8	15/16	2½	3/8	2¾	2½
	1	1	1	¾	2½			
2½	5/8	1	1½	1½	3	3/8	2½	2¼
	1	1	1½	1	3			
3¼	1	1	1½	1¾	3¾	½	2¾	2½
	1¾	2	1¾	1	3¾			
4	1	2	2¼	1¼	4½	½	2¾	2½
	1¾	2	2¼	1½	4½			
5	1	2	2¾	1¾	5½	½	3	3
	1¾	2	2¾	1¾	5½			
6	1¾	2	3¼	1¾	6½	¾	3¼	3
	1¾	2	3¼	1¾	6½			
8	1¾	2	4¼	2¾	8½	¾	3¾	3½
	1¾	2	4¼	2¾	8½			
10	1¾	2	5½	3½	10½	1	4½	4½
	2	2	5½	3½	10½			
12	2	2	6¾	4¾	12¾	1	4¾	4½
	2½	2	6¾	4¾	12¾			

OS

OVERSIZE ROD

Applications requiring long strokes may require oversize piston rod diameters to prevent sagging or buckling. To determine the recommended rod diameter, refer to Chart 3 on page 122.



SAE

SAE "O"-RING BOSS PORTS (SAE J514)

SAE ports can be ordered in place of NPT ports. Order by SAE number. (Example SAE#10)

Recommended SAE Port Size by Cylinder Bore			
Bore Ø	SAE#	Bore Ø	SAE#
1½	#4 (7/16-20)	5	#6 (9/16-18)
2	#4 (7/16-20)	6	#8 (3/4-16)
2½	#4 (7/16-20)	8	#8 (3/4-16)
3¼	#6 (9/16-18)	10	#10 (7/8-14)
4	#6 (9/16-18)	12	#10 (7/8-14)

STAINLESS STEEL

Stainless Steel, when used in conjunction with Anodized Aluminum Heads, Caps and Tube, provide corrosion resistance in outdoor applications and wet environments.

Customize your cylinder by choosing from Stainless Steel Fasteners, Piston Rod, or Tie Rods and Nuts.

SSA

STAINLESS STEEL "ALL"

Stainless Steel Piston Rod (Hard-Chrome Plated), Stainless Steel Fasteners, Stainless Steel Tie Rods and Nuts

SSF

STAINLESS STEEL FASTENERS

Stainless Steel Fasteners (Bushing Retainer Screws)

SSR

STAINLESS STEEL PISTON ROD

Stainless Steel Piston Rod (Hard-Chrome Plated)

SST

STAINLESS STEEL TIE RODS & NUTS

Stainless Steel Tie Rods and Nuts

ST

STOP TUBE

Stop Tubes are designed to reduce the piston rod bushing stress to within the designed range of the bearing material. This will insure proper cylinder performance, in any given application. Stop Tubes lower the cylinder bearing stress by adding length to the piston, which increases the overall length of the cylinder. (Note: Milwaukee Cylinder uses a double piston design for 2-inch and longer stop tubes.)

Stop Tube Selection

To determine the proper amount of stop tube for your application, you must first find the value of "D", which represents the "stroke, adjusted for mounting condition". Each mounting condition creates different levels of bushing stress, which have direct impact on the amount of stop tube required. (See Chart 1)

Once the value of "D" is known, refer to Chart 2 for the recommended amount of stop tube.

To order a Stop Tube, add the stop tube prefix "ST=" and the length, to the end of your cylinder model number.

As noted, the working stroke must be included when ordering.

Chart 1

Find the value of "D" for your application

"D" = Stroke, adjusted for mounting condition "T" = Axial thrust (refer to Chart 3)
 "S" = Actual cylinder stroke

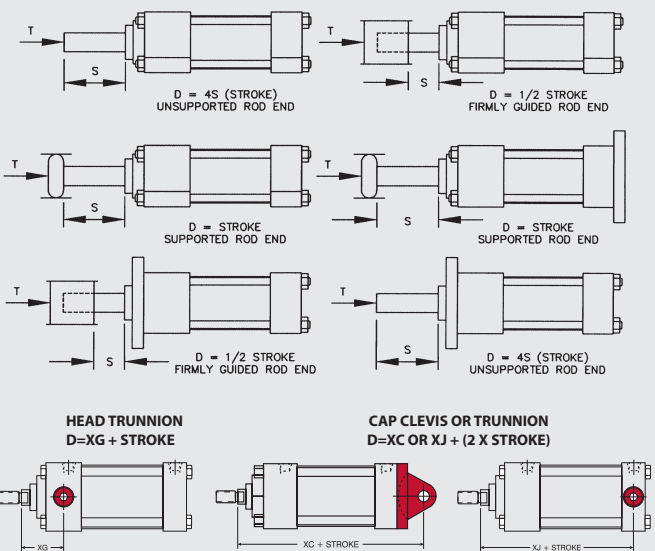


Chart 2

Using the value of "D", find the recommended amount of stop tube

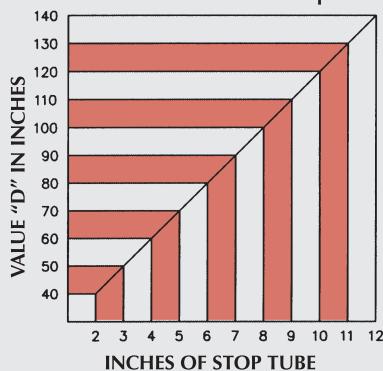
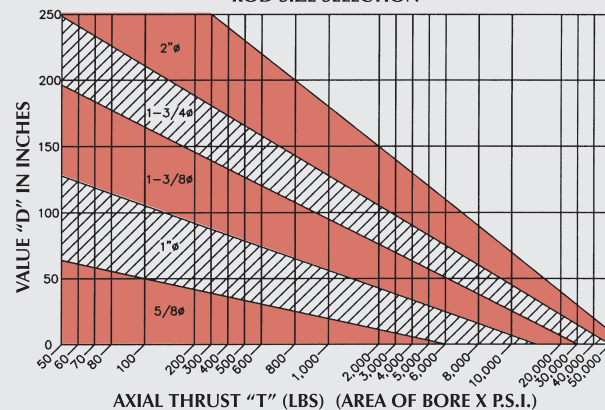


Chart 3

ROD SIZE SELECTION



TH

400 PSI HYDRAULIC (NON-SHOCK)

"MN" Series can be ordered with the "TH" option.

RATING: 400 PSI Hydraulic, Non-Shock

SEALS:

- Piston Seals - (1) POLY-PAK, (1) square-lip
- Rod Seal - POLY-PAK

VS

VITON SEALS

Benefits of VITON Seals:

- Higher temperature performance (0° F to 350° F [-20° C to 200° C])
- Higher chemical resistance (Resists most wash down solutions)

Many other seal materials are available. Contact *Milwaukee Cylinder* for proper seal material selection in tough applications or environments

Series H

Series MH

Series LH

Series A

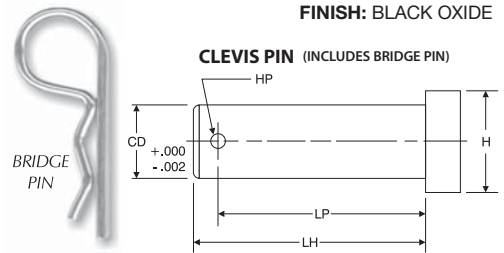
Series MN

▼ ACCESSORIES CROSS REFERENCE CHART

CYLINDER MODEL				ACCESSORIES				
Bore Ø	Rod MM	Rod Style (KK)	Rod Thread	Rod Clevis	Rod Eye	Clevis Pin	Clevis Bracket	Eye Bracket
1½, 2, 2½	5/8	(Standard) KK1	7/16-20	RC437	RE437	CP500	CB500	EB500
		KK2	1/2-20	RC500	RE500	CP500		
	1	(Standard-Oversized) KK1	¾-16	RC750	RE750	CP750		
		KK4	1-14	RC1000	RE1000	CP1000		
3¼, 4, 5	1	(Standard) KK1	¾-16	RC750	RE750	CP750	CB750	EB750
		KK4	1-14	RC1000	RE1000	CP1000		
	1¾	(Standard-Oversized) KK1	1-14	RC1000	RE1000	CP1000		
		KK2	1¼-12	RC1250	N/A	CP1375		
6 and 8	1¾	(Standard) KK1	1-14	RC1000	RE1000	CP1000	CB1000	EB1000
		KK2	1¼-12	RC1250	N/A	CP1375		
	1¾	(Standard-Oversized) KK1	1¼-12	RC1250	N/A	CP1375		
		KK2	1½-12	RC1500	N/A	CP1750		
10	1¾	(Standard) KK1	1¼-12	RC1250	RE1250	CP1375	CB1375	EB1375
		KK2	1½-12	RC1500	RE1500	CP1750	CB1750	EB1750
12	2	(Standard) KK1	1½-12	RC1500	RE1500	CP1750	CB1750	EB1750
		KK1	1½-12	RC1500	RE1500	CP1750	CB1750	EB1750

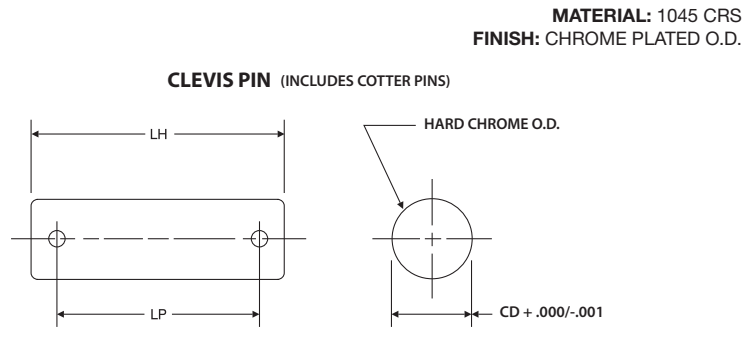
CLEVIS PIN (with Bridge Pin - Standard)

Part No.	CD	H	HP	LH	LP
CP500	½	5/8	5/32	2¼	2¾/32
CP750	¾	15/16	5/32	3	2 ²⁷ /32
CP1000	1	1¾	13/64	3½	3 ⁵ /16
CP1375	1¾	1¾	¼	5	4½
CP1750	1¾	2 ⁹ /64	¼	6	5½



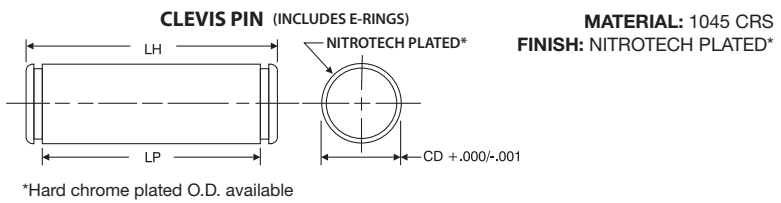
CLEVIS PIN (with Cotter Pin)

Part No.	CD	LH	LP
CP500C	½	2¼	1 ¹⁵ /16
CP750C	¾	3	2 ²³ /32
CP1000C	1	3½	3 ⁷ /32
CP1375C	1¾	5	4¼
CP1750C	1¾	6	5½
CP2000C	2	6	5½



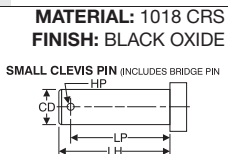
CLEVIS PIN (with E-Ring)

Part No.	CD	LH	LP
CP500E	½	2½	1 ⁷ /8
CP750E	¾	2 ¹⁵ /16	2 ⁵ /8
CP1000E	1	3 ⁷ /16	3½



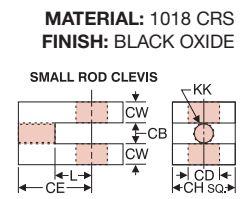
SMALL CLEVIS PIN (with Bridge Pin)

Part No.	CD	HP	LH	LP
CP500CCS	½	5/32	1¾	1¼
CP750CCS	¾	5/32	2	1 ⁷ /8



SMALL ROD CLEVIS

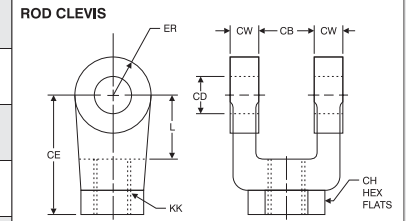
Part No.	CB	CD	CE	CH	CW	KK1	KK2	L
RC437CCS	½	½	1¾	1	¼	7/16-20	—	¾
RC500CCS	½	½	1¾	1	¼	—	1/2-20	¾
RC750CCS	¾	¾	1¾	1½	¾	¾-16	—	1



MN Accessories: Clevis, Pins & Mounts

ROD CLEVIS								
Part No.	CB	CD	CE	CH	CW	ER	KK	L
RC437	3/4	1/2	1 1/2	1	1/2	1/2	7/16-20	3/4
RC500	3/4	1/2	1 1/2	1	1/2	1/2	1/2-20	3/4
RC750	1 1/4	3/4	2 3/8	1 1/4	5/8	3/4	3/4-16	1 1/4
RC1000	1 1/2	1	3 1/8	1 1/2	3/4	1	1-14	1 1/2
RC1250	2	1 3/8	4 1/8	2	1	1 3/8	1 1/4-12	2 1/8
RC1375	2	1 3/8	4 1/8	2	1	1 3/8	1 3/8-12	2 1/8
RC1500	2 1/2	1 3/4	4 1/2	2 3/8	1 1/4	1 3/4	1 1/2-12	2 1/4
RC1750	2 1/2	1 3/4	4 1/2	2 3/8	1 1/4	1 3/4	1 3/4-12	2 1/4
RC1875	2 1/2	2	5 1/2	3	1 1/4	2	1 7/8-12	2 1/2

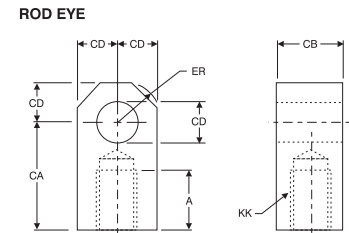
MATERIAL: CAST STEEL
FINISH: BLACK OXIDE



(Clevis Pins sold separately from Rod Clevises)

ROD EYE						
Part No.	A	CA	CB	CD	ER	KK
RE437	3/4	1 1/2	3/4	1/2	5/8	7/16-20
RE500	3/4	1 1/2	3/4	1/2	5/8	1/2-20
RE750	1 1/8	2 1/16	1 1/4	3/4	7/8	3/4-16
RE1000	1 5/8	2 13/16	1 1/2	1	1 3/16	1-14
RE1250	2	3 7/16	2	1 3/8	1 9/16	1 1/4-12
RE1500	2 1/4	4	2 1/2	1 3/4	2	1 1/2-12

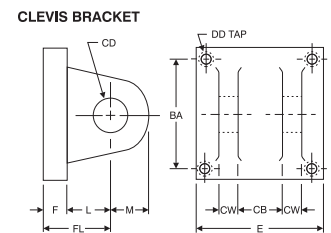
MATERIAL: 1018 CRS
FINISH: BLACK OXIDE



(Clevis Pins sold separately from Rod Eyes)

CLEVIS BRACKET										
Part No.	BA	CB	CD	CW	DD	E	F	FL	L	M
CB500	1 5/8	3/4	1/2	1/2	3/8-24	2 1/2	3/8	1 1/8	3/4	5/8
CB750	2 9/16	1 1/4	3/4	5/8	1/2-20	3 1/2	5/8	1 7/8	1 1/4	3/4
CB1000	3 1/4	1 1/2	1	3/4	5/8-18	4 1/2	3/4	2 1/4	1 1/2	1
CB1375	3 13/16	2	1 3/8	1	5/8-18	5	7/8	3	2 1/8	1 3/8
CB1750	4 15/16	2 1/2	1 3/4	1 1/4	7/8-14	6 1/2	7/8	3 1/8	2 1/4	1 3/4

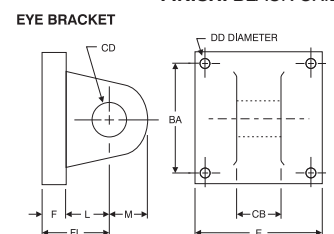
MATERIAL: CAST STEEL
FINISH: BLACK OXIDE



(Clevis Pins sold separately from Clevis Brackets)

EYE BRACKET										
Part No.	BA	CB	CD	DD	E	F	FL	L	M	
EB500	1 5/8	3/4	1/2	13/32	2 1/2	3/8	1 1/8	3/4	1/2	
EB750	2 9/16	1 1/4	3/4	17/32	3 1/2	5/8	1 7/8	1 1/4	3/4	
EB1000	3 1/4	1 1/2	1	2 1/32	4 1/2	3/4	2 1/4	1 1/2	1	
EB1375	3 13/16	2	1 3/8	2 1/32	5	7/8	3	2 1/8	1 3/8	
EB1750	4.95	2 1/2	1 3/4	29/32	6 1/2	7/8	3 3/8	2 1/4	1 3/4	

MATERIAL: CAST STEEL
FINISH: BLACK OXIDE



(Clevis Pins sold separately from Eye Brackets)

Series H

Series MH

Series LH

Series A

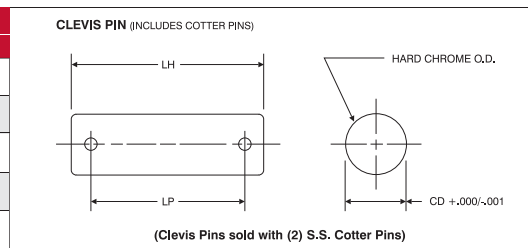
Series MN

▼ STAINLESS STEEL ACCESSORIES CROSS REFERENCE CHART

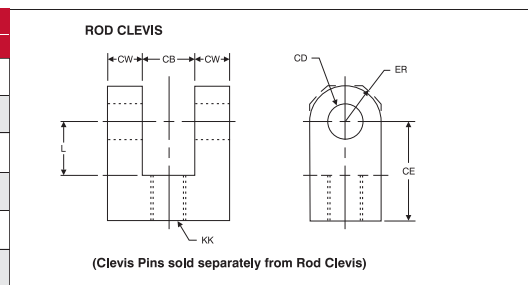
CYLINDER MODEL				ACCESSORIES				
Bore Ø	Rod MM	Rod Style (KK)	Rod Thread	Rod Clevis	Rod Eye	Clevis Pin	Clevis Bracket	Eye Bracket
1½, 2, 2½	5/8	(Standard)	KK1 7/16-20	SS-RC437	SS-RE437	SS-CP500	SS-CB500	SS-EB500
			KK2 ½-20	SS-RC500	SS-RE500	SS-CP500		
	1	(Standard-Oversized)	KK1 ¾-16	SS-RC750	SS-RE750	SS-CP750		
			KK4 1-14	SS-RC1000	SS-RE1000	SS-CP1000		
3¼, 4, 5	1	(Standard)	KK1 ¾-16	SS-RC750	SS-RE750	SS-CP750	SS-CB750	SS-EB750
			KK4 1-14	SS-RC1000	SS-RE1000	SS-CP1000		
	1¾	(Standard-Oversized)	KK1 1-14	SS-RC1000	SS-RE1000	SS-CP1000		
			KK2 1¼-12	SS-RC1250	N/A	SS-CP1375		
6 and 8	1¾	(Standard)	KK1 1-14	SS-RC1000	SS-RE1000	SS-CP1000	SS-CB1000	SS-EB1000
			KK2 1¼-12	SS-RC1250	N/A	SS-CP1375		
	1¾	(Standard-Oversized)	KK1 1¼-12	SS-RC1250	N/A	SS-CP1375		
			KK2 1½-12	SS-RC1500	N/A	SS-CP1750		

▼ ACCESSORIES (303 Stainless Steel)

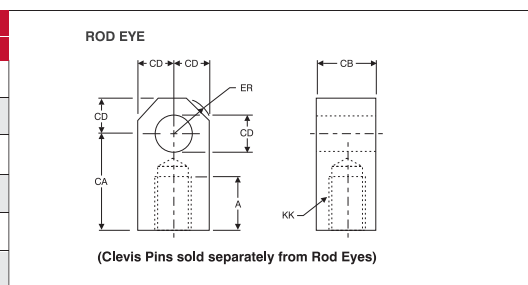
CLEVIS PIN (with Cotter Pins)			
Part No.	CD	LH	LP
SS-CP500	½	2¼	1 ¹⁵ / ₁₆
SS-CP750	¾	3	2 ²³ / ₃₂
SS-CP1000	1	3½	3 ⁷ / ₃₂
SS-CP1375	1¾	5	4¼
SS-CP1750	1¾	6	5½



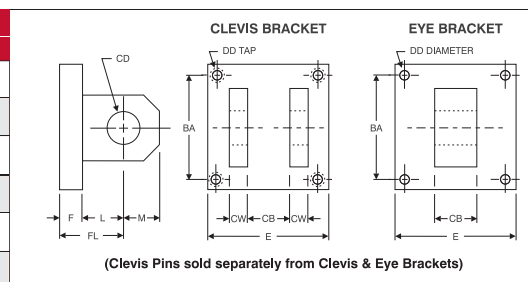
ROD CLEVIS							
Part No.	CB	CD	CE	CW	ER	KK	L
SS-RC437	¾	½	1½	½	½	7/16-20	¾
SS-RC500	¾	½	1½	½	½	½-20	¾
SS-RC750	1¼	¾	2¾	5/8	¾	¾-16	1¼
SS-RC1000	1½	1	3½	¼	1	1-14	1½
SS-RC1250	2	1¾	4½	1	1¾	1¼-12	2½
SS-RC1500	2½	1¾	4½	1¼	1¾	1½-12	2¼



ROD EYE						
Part No.	A	CA	CB	CD	ER	KK
SS-RE437	¾	1½	¾	½	5/8	7/16-20
SS-RE500	¾	1½	¾	½	5/8	½-20
SS-RE750	1½	2 ¹ / ₁₆	1¼	¾	7/8	¾-16
SS-RE1000	1½	2 ¹³ / ₁₆	1½	1	1 ³ / ₁₆	1-14
SS-RE1250	2	3 ⁷ / ₁₆	2	1¾	1 ⁹ / ₁₆	1¼-12
SS-RE1500	2¼	4	2½	1¾	2	1½-12

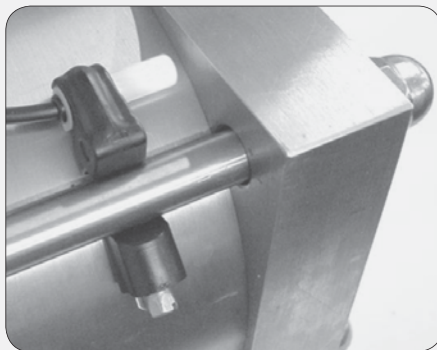


CLEVIS BRACKETS AND EYE BRACKETS											
	Part No.	BA	CB	CD	CW	DD	E	F	FL	L	M
CLEVIS BRACKETS	SS-CB500	1 ⁵ / ₈	¾	½	½	3/8-24	2½	3/8	1½	¾	5/8
	SS-CB750	2 ⁹ / ₁₆	1¼	¾	5/8	½-20	3½	5/8	1 ⁷ / ₈	1¼	¾
	SS-CB1000	3¼	1½	1	¾	5/8-18	4½	¾	2¼	1½	1
EYE BRACKETS	SS-EB500	1 ⁵ / ₈	¾	½		1 ³ / ₃₂	2½	3/8	1½	¾	½
	SS-EB750	2 ⁹ / ₁₆	1¼	¾	N/A	1 ⁷ / ₃₂	3½	5/8	1 ⁷ / ₈	1¼	¾
	SS-EB1000	3¼	1½	1		2 ¹ / ₃₂	4½	¾	2¼	1½	1



MN Accessories: R10, R10P, RAC, MSS Switches

Milwaukee Cylinder offers Reed, High Power AC Reed, DC Solid State and Reed Switches with built-in circuit protection to meet a wide variety of customer needs.



SWITCHES

- Miniature AC/DC Reed
- High Power AC Reed
- CE RoHS
- Miniature AC/DC Reed with built-in Circuit Protection
- Extended Temperature Range Reed
- Miniature DC Solid State

Advantages:

- Compact low profile switch/bracket assembly
- Switches and brackets are nylon and stainless steel hardware construction – suitable for wash down or corrosive environments (IP67)
- Quick, simple set-up: Requires standard (slotted) screw driver only
- High visibility LED can be seen up to 20 feet
- Optional quick connect threaded coupling on low current model
- Magnetically operated, can be located anywhere in the actuator stroke range
- Can be used with the MN Series Milwaukee Cylinder aluminum actuators, electroless nickel plated series, and stainless steel

(Note: Specify “MPR” option when ordering actuator)

- Suitable for all bore sizes (1½" to 12")
- One magnet (MPR) for all switch models

Benefits of REED Switch:

- Internal circuit protection
- Lower cost
- Low or high current models available, AC or DC, and TRIAC type switch for inductive loads
- High visibility red LED (on low current models)
- Choice of lead lengths available on all models
- Optional quick connect threaded coupling on low current model

Benefits of SOLID STATE Switch:

- Faster signal speeds
- Solid State Reliability – No moving parts means long life, no contact bounce or wear
- Reverse Polarity and Over Voltage Protection
- High Visibility Red LED (all models)
- Choice of lead lengths available or Quick Connect Threaded Coupling

R10

Miniature REED Switch

- 5-120 Volts AC, 5-110 Volts DC, 400 mA current rating (max.)
- Cable options include 24" or 120" plain cable leads, and 8mm threaded quick connect
- High visibility LED

R10P

Miniature AC/DC REED Switch with built-in Circuit Protection

- 5-120 Volts AC, 5-110 Volts DC, 150 mA current rating (max.)
- Cable options include 24" or 120" plain cable leads
- High visibility LED
- Circuit protection consisting of varistor/choke arrangement that will protect switch from transients, voltage spikes and inrush currents usually associated with long cable runs (particularly at higher voltages) and unprotected inductive loads such as relays, solenoids, motors, and motor starters and some PLC's

MSS

Miniature SOLID STATE Switch

- 10-30 Volts DC, 4-300 mA current rating
- Can be wired current sinking (NPN) or current sourcing (PNP)
- Cable options include 24" or 120" plain cable leads, and 8mm threaded quick connect
- High visibility LED

RAC

High Power AC REED Switch

- 12-240 Volts AC, 800 mA current rating, TRIAC output
- Cable options include 24" or 120" plain cable leads

▼ SWITCH APPLICATION SELECTION GUIDE For selecting the right switch for your application

Switch Model	Programmable Controllers	Relays	Solenoids	Indicator Lights		Motors	Time Counters
				Bulbs	Solid State		
R10 Reed	Yes	<10VA*	<10VA*	<10VA*	Yes	<10VA*	<10VA*
RAC High Powered Reed**	No	Yes	Yes	Yes	No	Yes	Yes
R10P Reed	Yes	<10VA	<10VA	<10VA	No	<10VA	<10VA
MSS Solid State	Yes	<300mA	No	<300mA	Yes	No	<300mA

*Use resistor-capacitor protection

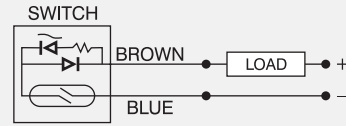
**Minimum current = 80mA

Series H

R10 / R10X

MINIATURE REED SWITCH, CABLE TYPE, (Two Wire Switch)

R10: Miniature Reed Switch, 24" Plain Cable Lead, (2 wire Switch)
R10X: Miniature Reed Switch, 120" Plain Cable Lead, (2 wire Switch)
Contacts: SPST Form A (Normally Open)
Contact Rating: 10 Watts Max.
Input Voltage: 5-120 Volts Max. AC, 5-110 Volts Max. DC
Maximum Load Current: 400 mA Max. (Resistive) @ 25° C (77° F)
 150 mA Max. (Resistive) @ 70° C (158° F)
Actuating Time Average: 1.0 millisecond
LED Indicator: High Luminescence Housing
Temperature Range: -20° C to 70° C (-4° F to 158° F)
Protection Rating: IP67



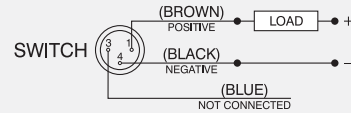
Input Voltage: 110 Volts Max. DC, 120 Volts Max. AC
Maximum Load Current: 400 mA Max. (Resistive) @ 25° C (77° F)
 150 mA Max. (Resistive) @ 70° C (158° F)

Series MH

R10Q

MINIATURE REED SWITCH, 8mm MALE QUICK CONNECT, (Two Wire Switch)

R10Q: Miniature Reed Switch, 8mm Male Quick Connect, (2 wire Switch)
Contacts: SPST Form A (Normally Open)
Contact Rating: 10 Watts Max.
Input Voltage: 60 Volts Max. AC or DC
Maximum Load Current: 400 mA Max. (Resistive) @ 25° C (77° F)
 150 mA Max. (Resistive) @ 70° C (158° F)
Actuating Time Average: 1.0 millisecond
LED Indicator: High Luminescence Housing
Temperature Range: -20° C to 70° C (-4° F to 158° F)
Protection Rating: IP67



Input Voltage: 60 Volts Max. AC or DC
Maximum Load Current: 400 mA Max. (Resistive) @ 25° C (77° F)
 150 mA Max. (Resistive) @ 70° C (158° F)

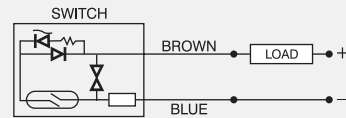
Series LH

Series A

R10P/R10PX

MINIATURE REED SWITCH, 24" PLAIN CABLE LEAD, CIRCUIT PROTECTION, (Two Wire Switch)

R10P: Miniature Reed Switch, 24" Plain Cable Lead, Circuit Protection (2 wire Switch)
R10PX: Miniature Reed Switch, 120" Plain Cable Lead, Circuit Protection (2 wire Switch)
Contacts: SPST Form A (Normally Open)
Contact Rating: 10 Watts Max.
Input Voltage: 5-120 Volts Max. AC, 110 Volts Max. DC
Maximum Load Current: 150 mA Max. (Resistive)
Actuating Time Average: 1.0 millisecond
LED Indicator: High Luminescence Housing
Temperature Range: -20° C to 70° C (-4° F to 158° F)
Protection Rating: IP67



Input Voltage: 120 Volts Max. AC, 110 Volts Max. DC
Maximum Load Current: 150 mA Max.

Circuit Protection

Varistor: 138 Volts
Choke: 680 μH

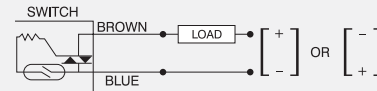
Note: The circuit protection consists of a Varistor and Choke arrangement. The Varistor will take transient and voltage spikes out of the line and is mounted in parallel with the switch. The Choke will disperse inrush currents (normally caused by long cable runs) and is mounted in series with the switch.

Series MN

RAC / RACX

HIGH POWER AC REED SWITCH, CABLE TYPE, (Two Wire Switch)

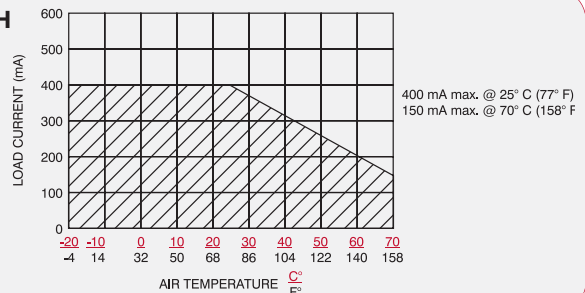
RAC: High Power AC Reed Switch, 24" Plain Cable Lead, (2 wire Switch)
RACX: High Power AC Reed Switch, 120" Plain Cable Lead, (2 wire Switch)
Contacts: TRIAC Output
Contact Rating: 200 Watts Max.
Input Voltage: 12 to 240 Volts (AC only)
Minimum Load Current: 80 mA
Maximum Load Current: 800 mA
Actuating Time Average: 2.0 milliseconds
LED Indicator: Not Available
Temperature Range: -20° C to 70° C (-4° F to 158° F)
Protection Rating: IP67



Contact Rating: 200 Watts Max.
Input Voltage: 12 to 240 Volts (AC only)
Minimum Load Current: 80 mA
Maximum Load Current: 800 mA

LOAD CURRENT DE-RATING GRAPH

R10 / R10X / R10Q
(R10PX: 150 mA MAX., -20°C to 70°C)



MSS / MSSX

MINIATURE SOLID STATE SWITCH, CABLE TYPE, (Two Wire Switch)

MSS:	Miniature Solid State Switch, 24" Plain Cable Lead, (2 wire Switch)
MSSX:	Miniature Solid State Switch, 120" Plain Cable Lead, (2 wire Switch)
*Output Type:	Current Sinking or Current Sourcing
Input Voltage:	10 to 30 Volts DC
Current Consumption (not sensing):	1mA
Minimum Load Current:	4 mA
Maximum Load Current:	300 mA
"ON" Voltage Drop:	3 Volts @ 4 mA 4 Volts @ 300 mA
LED Indicator:	High Luminescence Housing
Temperature Range:	-20° C to 70° C (-4° F to 158° F)
Actuating Time Average:	2.0 Microseconds
Protection Rating:	IP67
Reverse Polarity Protected:	Yes
Transient (over voltage) Protected:	Yes



Typical Current Sourcing (PNP) Configuration



Typical Current Sinking (NPN) Configuration

***NOTE:** This is a (2) wire switch used in series with the load. Therefore, this switch can be used with devices requiring either a current sinking (NPN) output or a current sourcing (PNP) output from the solid state switch.

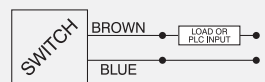
MSSQ

MINIATURE SOLID STATE SWITCH, 8mm MALE QUICK CONNECT, (Two Wire Switch)

MSSQ:	Miniature Solid State Switch, 8mm Male Quick Connect (2 wire Switch)
*Output Type:	Current Sinking or Current Sourcing
Input Voltage:	10 to 30 Volts DC
Current Consumption (not sensing):	1mA
Minimum Load Current:	4 mA
Maximum Load Current:	300 mA
"ON" Voltage Drop:	3 Volts @ 4 mA 4 Volts @ 300 mA
LED Indicator:	High Luminescence Housing
Temperature Range:	-20° C to 70° C (-4° F to 158° F)
Actuating Time Average:	2.0 Microseconds
Protection Rating:	IP67
Reverse Polarity Protected:	Yes
Transient (over voltage) Protected:	Yes



Typical Current Sourcing (PNP) Configuration



Typical Current Sinking (NPN) Configuration

***NOTE:** This is a (2) wire switch used in series with the load. Therefore, this switch can be used with devices requiring either a current sinking (NPN) output or a current sourcing (PNP) output from the solid state switch.

Series H

Series MH

Series LH

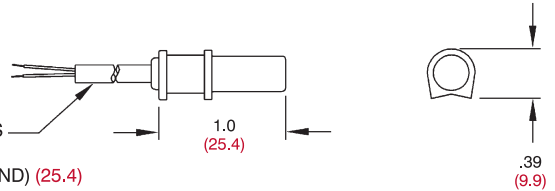
Series A

Series MN

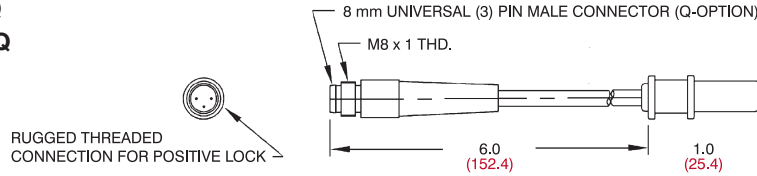
SWITCHES

R10 / R10X MSS / MSSX

PLAIN CABLE LEADS
R10 / MSS = 24" (0.6m) JACKETED LEADS
R10X / MSSX = 120" (3.0m)
(JACKET CUT BACK 1" ON END) (25.4)

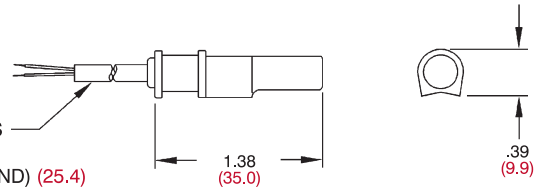


R10Q MSSQ



RAC / RACX R10P / R10PX

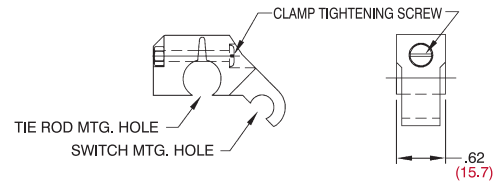
PLAIN CABLE LEADS
R10P / RAC = 24" (0.6m) JACKETED LEADS
R10PX / RACX = 120" (3.0m)
(JACKET CUT BACK 1" ON END) (25.4)



SWITCH BRACKETS

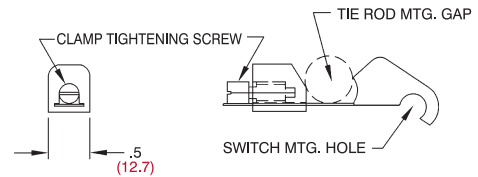
SB15 (For 1½" Through 2½" Bore Cylinders)

Bracket Construction:
Molded Nylon 6 (Black) and
Stainless Steel Hardware



SB32 (For 3¼" Through 12" Bore Cylinders)

Bracket Construction:
Molded Nylon 6 (Black) and
Stainless Steel Hardware

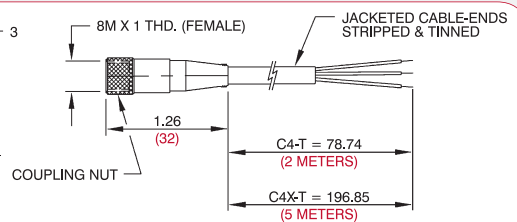


QUICK CONNECT CORD SET

(Used with "Q" Type Switch Leads)

FOR CABLES:
C4-T (2 METER CABLE LENGTH)
C4X-T (5 METER CABLE LENGTH)

CONDUCTOR COLORS:
1. BROWN
3. BLUE
4. BLACK

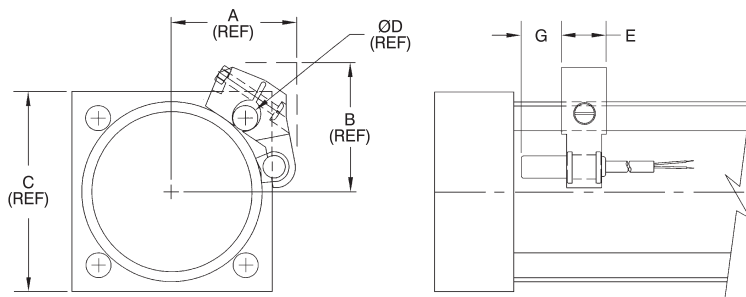


All dimensions are in inches (metric in parentheses)

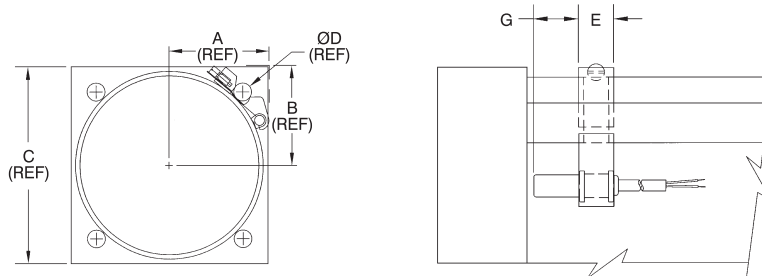
MN Accessories: Switch Mounting

SB15 / SB32

SB15



SB32



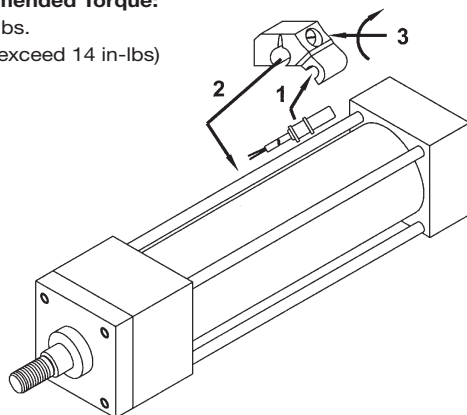
▼ SWITCH BORE DIMENSIONAL TABLE

Part #	Bore Ø	A	B	C	D	E	G
SB15	1½	1¾	1 ¹³ / ₃₂	2	¼	5⁄8	½
	2	1 ⁵ / ₈	1 ²¹ / ₃₂	2½	5⁄16	5⁄8	½
	2½	1 ⁷ / ₈	1 ⁷ / ₈	3	5⁄16	5⁄8	½
SB32	3¼	2 ¹ / ₈	2 ¹ / ₈	3¾	3⁄8	½	9⁄16
	4	2 ⁷ / ₁₆	2 ³ / ₈	4½	3⁄8	½	9⁄16
	5	2 ⁷ / ₈	2 ³ / ₄ *	5½	½	½	9⁄16
	6	3¼*	3¼*	6½	½	½	9⁄16
	8	4¼*	4¼*	8½	5⁄8	½	9⁄16
	10	5 ⁵ / ₁₆ *	5 ⁵ / ₁₆ *	10 ⁵ / ₈	¾	½	9⁄16
12	6 ³ / ₈ *	6 ³ / ₈ *	12¾	¾	½	9⁄16	

* These dimensions are 1/2 of the 'C' dimension. The switch bracket **does not** protrude beyond standard head/cap.

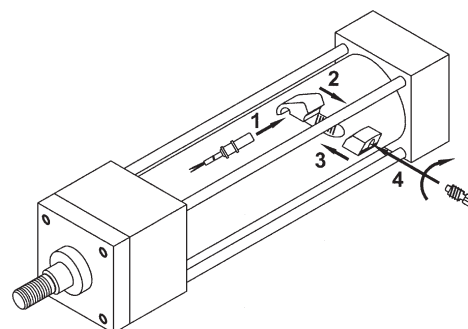
▼ HOW TO ASSEMBLE SWITCH AND BRACKETS

Recommended Torque:
6-10 in-lbs.
(Do not exceed 14 in-lbs)



**SB15 SWITCH BRACKET
(MOUNTING ILLUSTRATION)**

Recommended Torque:
8-12 in-lbs.
(Do not exceed 14 in-lbs)



**SB32 SWITCH BRACKET
(MOUNTING ILLUSTRATION)**

Series H

Series MH

Series LH

Series A

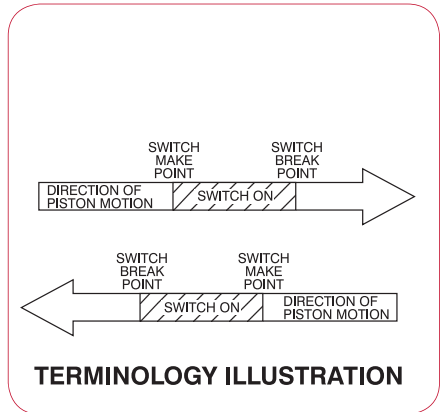
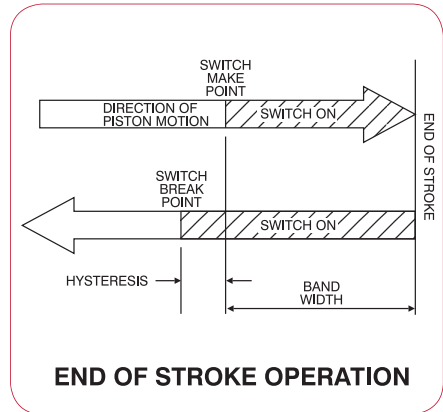
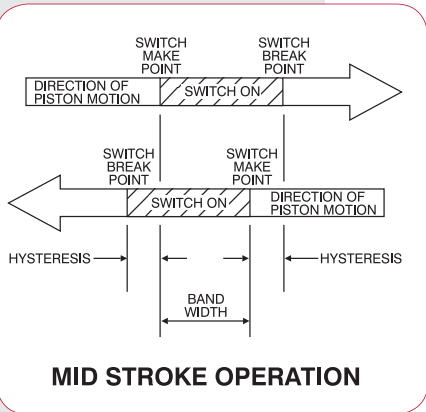
Series MN

HYSTERESIS:

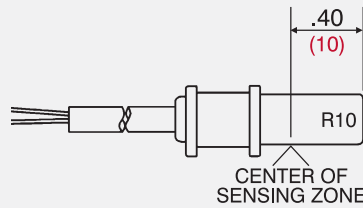
The distance between the switch break point moving in one direction, and the switch make point moving in the opposite direction.

BAND WIDTH:

Distance the piston moves while the switch is made (in either direction), less the hysteresis.

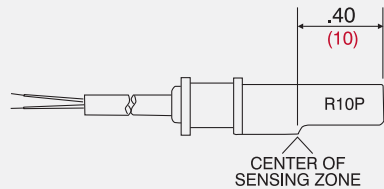


R10 / R10X / R10Q



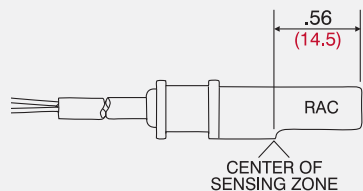
Repeatability	Hysteresis (Maximum)	Band Width (Minimum)
±.010" (±0,25 mm)	.040" (1 mm)	.200" (5 mm)

R10P / R10PX



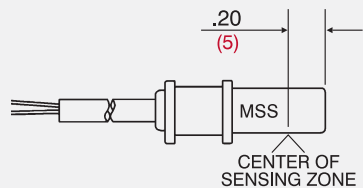
Repeatability	Hysteresis (Maximum)	Band Width (Minimum)
±.010" (±0,25 mm)	.040" (1 mm)	.200" (5 mm)

RAC / RACX



Repeatability	Hysteresis (Maximum)	Band Width (Minimum)
±.010" (±0,25 mm)	.085" (2,1 mm)	.345" (8,8 mm)

MSS / MSSX / MSSQ



Repeatability	Hysteresis (Maximum)	Band Width (Minimum)
±.010" (±0,25 mm)	.075" (1,9 mm)	.315" (8 mm)

NOTE: Dimensions are in inches, (metric in parentheses). Results are based upon Milwaukee Cylinder's piston and magnet assemblies. Results may vary if used with other manufacturers cylinder products.

MN Accessories: Switch Ordering Instructions

▼ CONFIGURE YOUR SWITCH PART NUMBER

TO ORDER, SPECIFY:

Switch Model, Lead Type,
and Bracket Size



Switch Model	
R10	= AC/DC Reed
RAC	= High Power AC Reed
MSS	= Solid State
R10P	= AC/DC Reed with Circuit Protection

Switch Lead Type	
(leave blank)	= 24" Plain Cable
X	= 120" Plain Cable
Q	= 8mm Quick Connect (not available on RAC or R10P)

Switch Bracket Size	
SB15	= 1½" to 2½" Bore
SB32	= 3¼" to 12" Bore
(leave blank)	for switch only

▼ SWITCH ACCESSORIES

Quick Connect Cord Sets	
Model	Description
C4-T	8mm Straight Quick Connect Cord X 2 Meter (78")
C4X-T	8mm Straight Quick Connect Cord X 5 Meter (196")

ABOUT OUR SWITCHES

Our switches are different! The most common complaint in the market is the unreliability of magnetically operated switches. Most cylinder piston magnets have about 10-30% more power than required to operate the switch. This results in erratic operation, a nuisance for maintenance and lowering overall plant productivity.

Milwaukee Cylinder's magnets have 50-100% more power than required to operate our switch! The combination of *Milwaukee Cylinder's* R10, R10P, RAC and MSS Switches and our Cylinders, raises the reliability of switch operation comparable to that of many mechanically operated limit switches.

APPLICATION RECOMMENDATIONS AND PRECAUTIONS

- Noise suppression — Motors and valve solenoids will produce high pulses throughout an electrical system. Therefore, primary and control circuit wiring should not be mixed in the same conduit. Separate power supplies for both logic level signals (Microprocessor, P.C., CPU, Input Devices) and Output Field Devices (Motors, Valve Solenoids) is recommended.
- Never connect R10, R10P or MSS type switches without a load present. The switch will be destroyed.
- Some electrical loads may be capacitive. Capacitive loading may occur due to distributed capacity in cable runs over 25 feet. Use switch model RAC whenever capacitive loading may occur.
- To obtain optimum performance and long life, switches should not be subjected to strong magnetic fields, extreme temperatures (outside of specifications), or excessive ferrous filings or chip buildup.
- Improper wiring may damage or destroy the switch. Therefore, the wiring diagrams along with the listed power ratings, should be carefully observed before connecting power to the switch.

Following these tips can save time and provide trouble free installations!

Other switches available:

- 12mm Quick Connect
- Pulse Extension Switch
- Special Length Cable
- Change Over Switch (SPDT)
- Weld Immune Switch
- High Temp. Switch

(Consult factory for details.)

▼ CONFIGURE YOUR CYLINDER (Series MN cylinder)

1 2 3 4 5 6 7

MN06130 - 31 - HC - KK2 - 7 X 14³/₄

1 Double Rod End add "D"
2 Cylinder Code
3 NFPA Mounts
4 Cushions
5 Options
6 Seals
7 Stroke

Part Number System

Example: A 3¹/₄" Bore, 1" rod, MF1 mount, cushion both ends, Style KK2 rod end, standard seals with a 14³/₄" stroke.

Part Number:
MN06130-31-HC-KK2-7 x 14³/₄

2 CYLINDER CODE		
Bore Ø	Rod Ø	Cylinder Code
1½	5/8	MN00611
	1	MN00612
2	5/8	MN06110
	1	MN06111
2½	5/8	MN06120
	1	MN06121
3¼	1	MN06130
	1 1/8	MN06131
4	1	MN06140
	1 1/8	MN06141
5	1	MN06150
	1 1/8	MN06151
6	1 1/8	MN06160
	1 1/4	MN06161
8	1 1/8	MN06180
	1 1/4	MN06181
10	1 1/4	MN61100
	2	MN61101
12	2	MN61200
	2 1/2	MN61201

3 NFPA MOUNTS		
	Description	
31	MF1	Front Flange (1½"-6" Bore)
32	MF2	Rear Flange (1½"-6" Bore)
21	ME3	Front Mounting Holes (8"-12" Bore)
22	ME4	Rear Mounting Holes (8"-12" Bore)
61	MP1	Rear Pivot Clevis (1½"-12" Bore)
63	MP2	Rear Pivot Clevis, Removable (1½"-6" Bore)
64	MP4	Rear Fixed Eye Mount, Removable (1½"-6" Bore)
44	MS1	Front & Rear End Angle (1½"-8" Bore)
42	MS2	Side Lug (1½"-8" Bore)
41	MS4	Bottom Tapped Holes (1½"-12" Bore)
71	MT1	Front Trunnion (1½"-8" Bore)
72	MT2	Rear Trunnion (1½"-8" Bore)
74	MT4	Intermediate Trunnion (1½"-8" Bore)
11	MX0	No Mount (1½"-12" Bore)
10	MX1	Extended Tie Rods - Head & Cap (1½"-12" Bore)
13	MX2	Extended Tie Rods (Cap) (1½"-12" Bore)
12	MX3	Extended Tie Rods (Head) (1½"-12" Bore)

4 CUSHIONS	
	Description
H	Head Cushion Position 2 is Standard Specify for Positions: 1, 3 & 4
LH	Long Head Cushion Position 2 is Standard Specify For Positions: 1, 3 & 4
* ELH	Extra Long Head Cushion Position 2 is Standard Specify for Positions: 1, 3 & 4
C	Cap Cushion Position 2 is Standard Specify for Positions: 1, 3 & 4
LC	Long Cap Cushion Position 2 is Standard Specify for Positions: 1, 3 & 4
* ELC	Extra Long Cap Cushion Position 2 is Standard Specify for Positions: 1, 3 & 4
NC	No Cushion

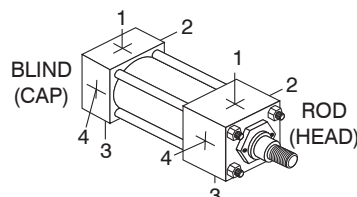
6 SEALS	
7	BUNA (-30° to 250° F)
8	VITON (-15° to 350° F)
S	SPECIAL

7 STROKE	
0" to 120" / Made to order.	

5 OPTIONS	
Add length to cylinder - See "Option Length Adder" Chart Below	
KK1	Standard
A	Extended piston rod thread (Example: A = 2")
AS	Adjustable stroke - retract (specify length, example: AS = 4")
A/O	Air / oil piston
*B	¼" Urethane bumper both ends
*BC	¼" Urethane bumper cap only
*BH	¼" Urethane bumper head only
BP	Bumper piston seals (1½" - 8" bore)
BSPP	BSPP ports (specify size, example: BSPP = ¼")
BSPT	BSPT ports (specify size, example: BSPT = ¼")
C	Extended piston rod (example: C = 3")
EN	Electroless nickel plated (see page 118 for specifications)
KK2	Large male rod thread
KK3	Female rod thread
KK3S	Studded piston rod (KK3 with stud, loctite in place)
KK4	Full diameter male rod thread
KK5	Blank rod end (no threads, "A" = 0")
LF	Low friction seals (see page 118 for specifications)
MA	Micro-adjust (6" max. stroke) available on double rod end models
MAB	Micro-adjust with sound dampening bumper (6" max. stroke)
MPR	Magnetic piston for Reed or Solid State switches R10, RAC, and MSS (see pages 127-133 for selection)
MPH	Magnetic piston for hall switches
MS	Metallic rod scraper (brass construction)
NR	Non-rotating (see page 120 for specifications)
OP	Optional port location (example: ports at 2 and 3)
OS	Oversize rod diameter (specify size, example: OS = 1 1/8")
SAE	Sae ports (specify size, example: SAE #10)
SE	Spring extend (1½, 2, 2½ inch bore)
SR	Spring return (1½, 2, 2½ inch bore)
SSA	Stainless steel piston rod, tie rods & nuts, and fasteners
SSF	Stainless steel fasteners
SSR	Stainless steel piston rod
SST	Stainless steel tie rods & nuts
*ST	Stop tube (specify stop tube length and effective stroke) (example: MN MS4 2 x 24" effective stroke-ST=3)
Steel tube	Steel cylinder tube, black epoxy paint finish
TH	400 psi hydraulic non-shock (see page 123 for specifications)
XX	Special variation (specify)

* Add length to cylinder - See "Options Length Adder" chart below

OPTIONS LENGTH ADDER						
(add to catalog basic overall length dimensions.)						
Bore Ø	OPTION					ST* (Stop Tube) Example: ST=2
	B	BC	BH	ELC	ELH	
1½	1/2	1/4	1/4	1	1	2
2	1/2	1/4	1/4	1	1	2
2½	1/2	1/4	1/4	1	1	2
3¼	1/2	1/4	1/4	1 1/4	1 1/4	2
4	1/2	1/4	1/4	1 1/4	1 1/4	2
5	1/2	1/4	1/4	1 1/4	1 1/4	2
6	1/2	1/4	1/4	1 1/2	1 1/2	2
8	1/2	1/4	1/4	1 1/2	1 1/2	2
10	1/2	1/4	1/4	2	2	2
12	1/2	1/4	1/4	2	2	2



Standard Port and Cushion Adjustment Positions

- Ports - Position 1
- Cushion adjustment - Position 2
- Specify non-standard positions when ordering