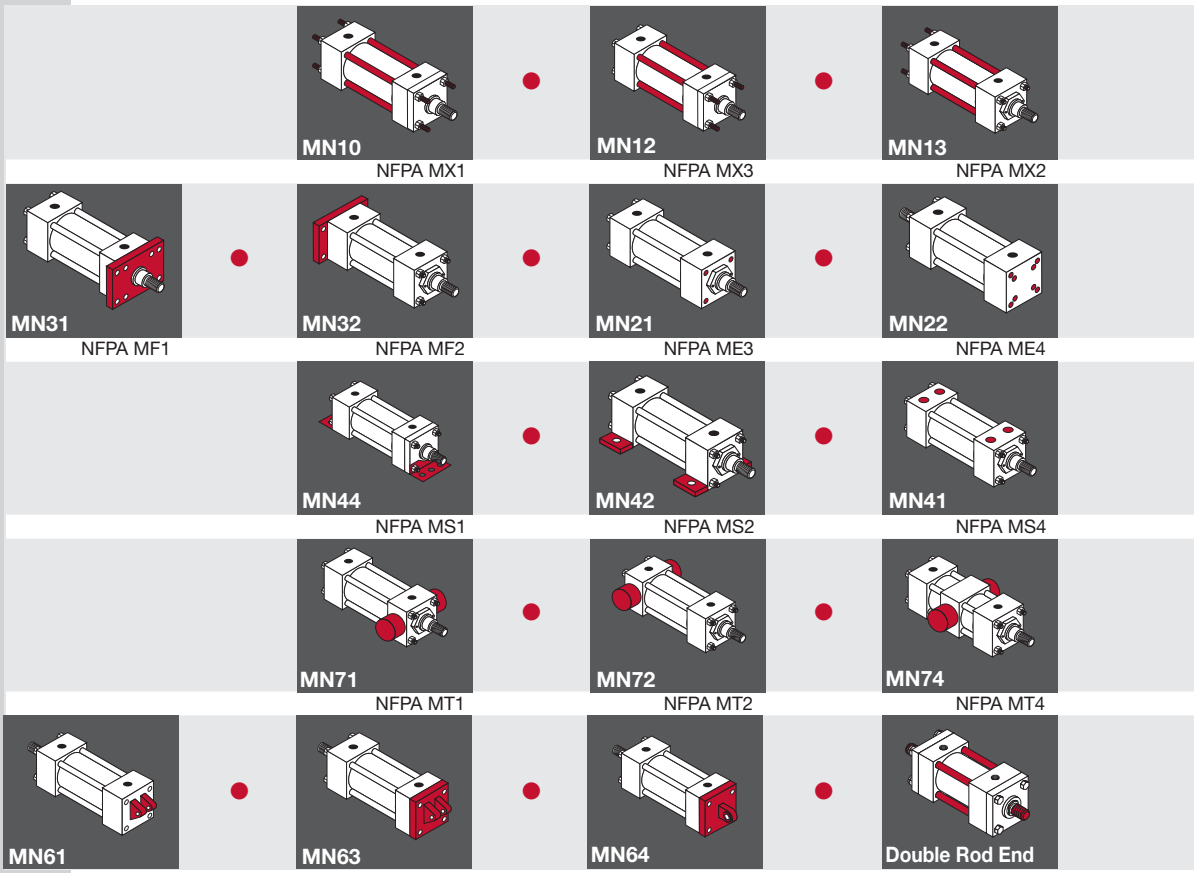
milwaukee *Cylinder*

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.

Max. Operating Pressure:
250 psi

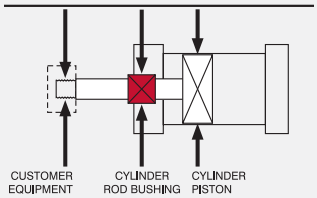
Operating Temperature, **Buna-N**:
-20° F to 200° F

Operating Temperature, **Viton**:
-15° F to 350° F

FLOATING ROD BUSHING

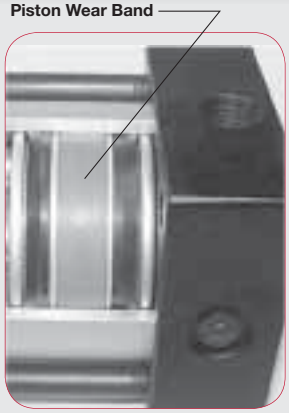
Self Alignment Feature

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



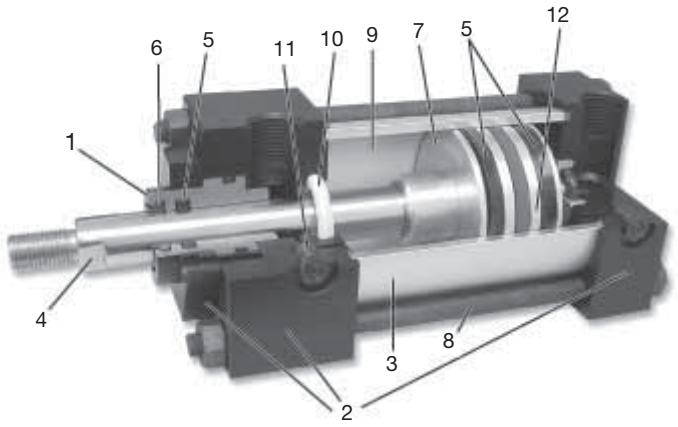
- Reduces cylinder drag and erractic operation
- Reduces cylinder wear
- Provides a minimum of 25% longer life than "fixed" Rod Bushing designs

Piston Wear Band



***MilCad* Cylinder Configuator**

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



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. **Cushions**
    (Option MPR) 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).

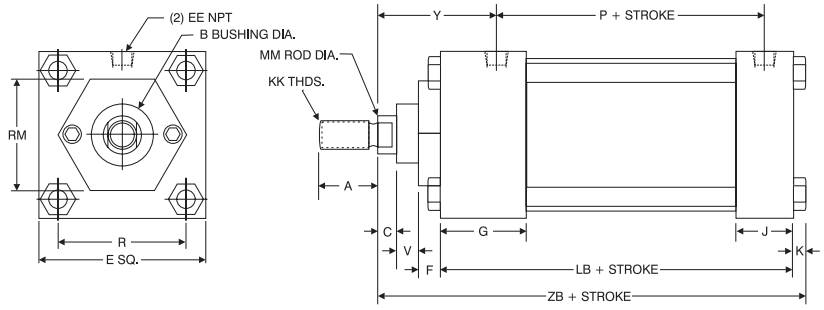
Need a rod end not listed? NO PROBLEM! Each Piston Rod is made to order and does not delay shipment. Coarse (UNC) threads, metric threads or just plain rod ends are common. Thread lengths are also made to order (Specify: "A"= Length).

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

BORE	ROD MM	STANDARD KK1	A	OPTIONAL KK2	A	OPTIONAL KK3	A	OPTIONAL KK4	A	OPTIONAL KK5	C	V
1½, 2, 2½	⅝ 1	7/16-20 ¾-16	¾ 1⅛	½-20 ⅞-14	¾ 1⅛	7/16-20 ¾-16	¾ 1⅛	⅝-18 1-14	¾ 1⅛	No Threads	⅜ ½	¼ ½
3¼, 4, 5	1 1⅜	¾-16 1-14	1⅛ 1⅝	⅞-14 1¼-12	1⅛ 1⅝	¾-16 1-14	1⅛ 1⅝	1-14 1⅜-12	1⅛ 1⅝	No Threads	½ ⅝	¼ ⅜
6 & 8	1⅜ 1¾	1-14 1¼-12	1⅝ 2	1¼-12 1½-12	1⅝ 2	1-14 1¼-12	1⅝ 2	1⅜-12 1¾-12	1⅝ 2	No Threads	⅝ ¾	⅜ ½
10	1¾ 2	1¼-12 1½-12	2 2¼	1½-12 1¾-12	2 2¼	1¼-12 1½-12	2 2¼	1¾-12 2-12	2 2¼	No Threads	¾ ⅞	½ ⅜
12	2 2½	1½-12 1⅞-12	2¼ 3	1¾-12 2¼-12	2¼ 3	1½-12 1⅞-12	2¼ 3	2-12 2½-12	2¼ 3	No Threads	⅞ 1	⅜ ½

BASIC CYLINDER

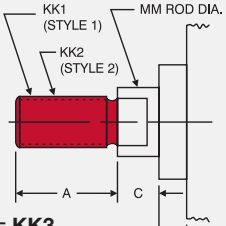
MODEL MN11
NFPA STYLE MXO (No mount)



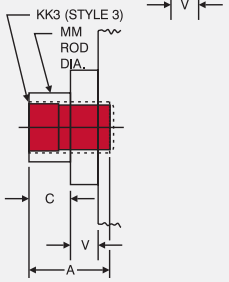
Bore Ø	Rod MM	Cylinder Code	A	B	C	E	EE	F	G	J	K	KK	LB	P	R	RM	V	Y	ZB
1½	⅝	MN00611	¾	1⅛	⅜	2	⅜	⅜	1½	1	¼	7/16-20	3⅝	2⅜	1.43	2 Sq.	¼	1⅞	4⅞
	1	MN00612	1⅛	1½	½							¾-16					½	2¼	5¼
2	⅝	MN06110	¾	1⅛	⅜	2½	⅜	⅜	1½	1	5/16	7/16-20	3⅝	2⅜	1.84	1¾ Hex	¼	1⅞	4 15/16
	1	MN06111	1⅛	1½	½							¾-16				2½ Sq.	½	2¼	5 5/16
2½	⅝	MN06120	¾	1⅛	⅜	3	⅜	⅜	1½	1	5/16	7/16-20	3¾	2½	2.19	1¾ Hex	¼	1⅞	5 1/16
	1	MN06121	1⅛	1½	½							¾-16				3 Sq.	½	2¼	5 7/16
3¼	1	MN06130	1⅛	1½	½	3¾	½	⅝	1¾	1¼	⅜	¾-16	4¼	2¾	2.76	2¾ Dia.	¼	2⅜	6
	1⅜	MN06131	1⅝	2	⅝							1-14				3¾ Sq.	⅜	2⅝	6¼
4	1	MN06140	1⅛	1½	½	4½	½	⅝	1¾	1¼	⅜	¾-16	4¼	2¾	3.32	2¾ Dia.	¼	2⅜	6
	1⅜	MN06141	1⅝	2	⅝							1-14				3½ Dia.	⅜	2⅝	6¼
5	1	MN06150	1⅛	1½	½	5½	½	⅝	1¾	1¼	7/16	¾-16	4½	3	4.10	2¾ Dia.	¼	2⅜	6 5/16
	1⅜	MN06151	1⅝	2	⅝							1-14				3½ Dia.	⅜	2⅝	6 9/16
6	1⅜	MN06160	1⅝	2	⅝	6½	¾	⅝	2	1½	7/16	1-14	5	3¼	4.88	3½ Dia.	⅜	2¾	7 1/16
	1¾	MN06161	2	2⅜	¾							1¼-12					½	3	7 5/16
8	1⅜	MN06180	1⅝	2	⅝	8½	¾	⅝	2	1½	9/16	1-14	5⅛	3⅜	6.44	3½ Dia.	⅜	2¾	7 5/16
	1¾	MN06181	2	2⅜	¾							1¼-12					½	3	7 9/16
10	1¾	MN61100	2	2⅜	¾	10⅝	1	⅝	2¼	2	11/16	1¼-12	6⅜	4 5/16	7.92	3½ Dia.	½	3 1/16	8 15/16
	2	MN61101	2¼	2⅝	⅞			¾				1½-12				5 Dia.	⅜	3 3/16	9 1/16
12	2	MN61200	2¼	2⅝	⅞	12¾	1	¾	2¼	2	11/16	1½-12	6⅞	4 13/16	9.40	5 Dia.	⅜	3 3/16	9 9/16
	2½	MN61201	3	3⅛	1							1⅞-12					½	3 7/16	9 13/16

PISTON ROD END STYLES

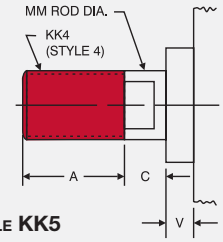
STYLE KK1 & KK2



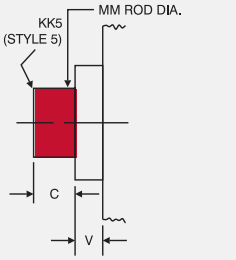
STYLE KK3



STYLE KK4



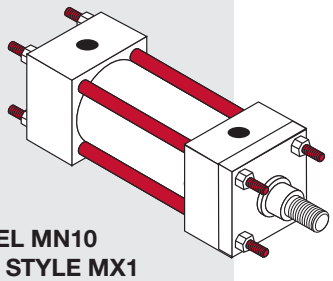
STYLE KK5



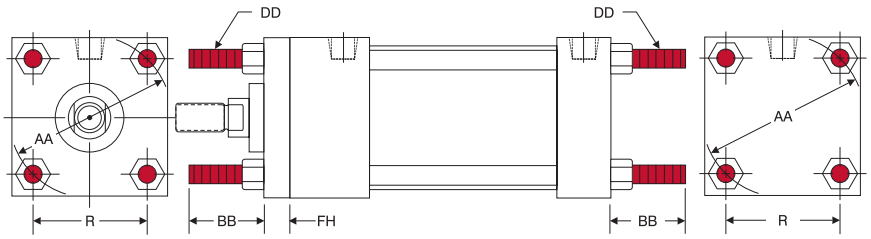
TIE ROD MOUNTED CYLINDERS

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

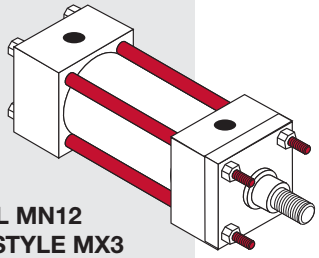
TIE RODS EXTENDED BOTH END



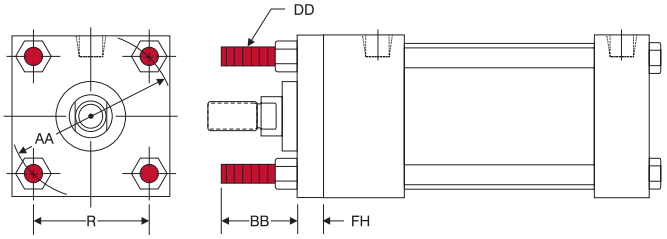
MODEL MN10
NFPA STYLE MX1



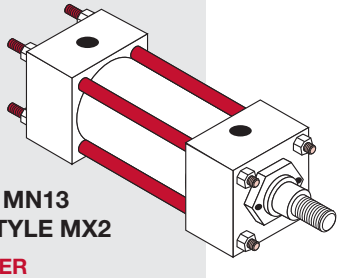
TIE RODS EXTENDED ROD END



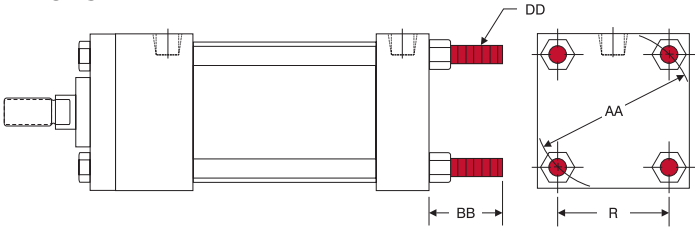
MODEL MN12
NFPA STYLE MX3



TIE RODS EXTENDED BLIND END



MODEL MN13
NFPA STYLE MX2



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

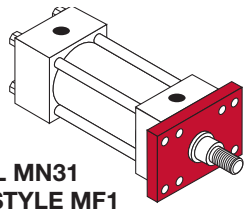
***MilCad* Cylinder Configuator**

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

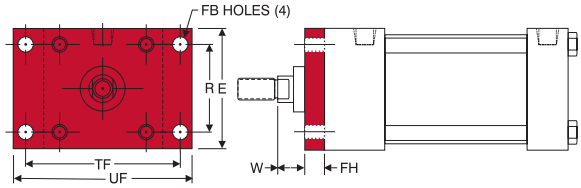
TIE ROD EXTENDED 'MN10', 'MN12, 'MN13' MOUNT DIMENSIONS							
Bore Ø	Rod MM	Cylinder Code ♦	AA	BB	DD	FH	FH
1½	⅝	MN00611	2.02	1	¼-28	⅜	1.43
	1	MN00612					
2	⅝	MN06110	2.6	1⅛	5/16-24	⅜	1.84
	1	MN06111					
2½	⅝	MN06120	3.1	1⅛	5/16-24	⅜	2.19
	1	MN06121					
3¼	1	MN06130	3.9	1⅜	⅜-24	⅝	2.76
	1⅜	MN06131					
4	1	MN06140	4.7	1⅜	⅜-24	⅝	3.32
	1⅜	MN06141					
5	1	MN06150	5.8	1 13/16	½-20	⅝	4.10
	1⅜	MN06151					
6	1⅜	MN06160	6.9	1 13/16	½-20	¾	4.88
	1¾	MN06161					
8	1⅜	MN06180	9.1	**2 5/16	⅝-18	*⅝	6.44
	1¾	MN06181					
10	1¾	MN61100	11.2	**2 11/16	¾-16	*⅝	7.92
	2	MN61101				*¾	
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.

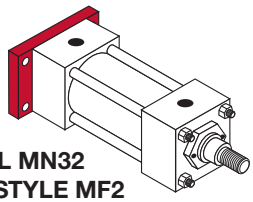
ROD RECTANGULAR FLANGE MOUNTING
(1½" - 6" bore only)



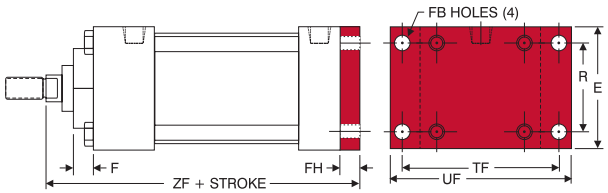
MODEL MN31
NFPA STYLE MF1



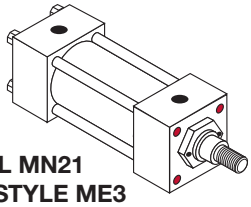
BLIND RECTANGULAR FLANGE MOUNTING
(1½" - 6" bore only)



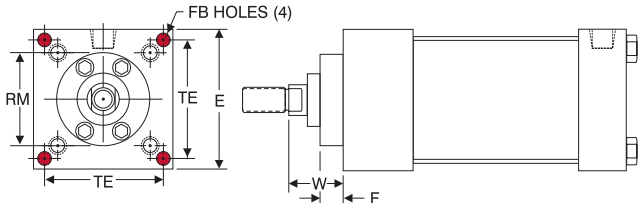
MODEL MN32
NFPA STYLE MF2



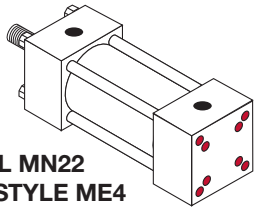
ROD SQUARE FLANGE MOUNTING
(8" - 12" bore only)



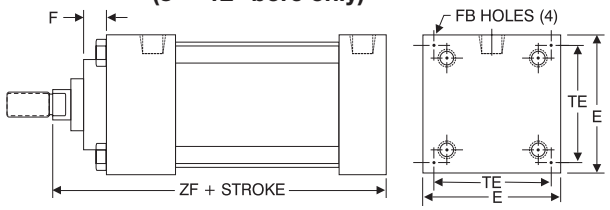
MODEL MN21
NFPA STYLE ME3



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



MODEL MN22
NFPA 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	—	—	2 3/4	3 3/8	5/8	5
	1**	MN00612										1	5 3/8
2	5/8**	MN06110	2 1/2	3/8	3/8	3/8	1.84	—	—	3 3/8	4 1/8	5/8	5
	1**	MN06111										1	5 3/8
2½	5/8**	MN06120	3	3/8	3/8	3/8	2.19	—	—	3 7/8	4 5/8	5/8	5 1/8
	1**	MN06121										1	5 1/2
3¼	1**	MN06130	3 3/4	5/8	7/16	5/8	2.76	—	—	4 11/16	5 1/2	3/4	6 1/4
	1 3/8**	MN06131										1	6 1/2
4	1**	MN06140	4 1/2	5/8	7/16	5/8	3.32	—	—	5 7/16	6 1/4	3/4	6 1/4
	1 3/8**	MN06141										1	6 1/2
5	1**	MN06150	5 1/2	5/8	9/16	5/8	4.10	—	—	6 5/8	7 5/8	3/4	6 1/2
	1 3/8**	MN06151										1	6 3/4
6	1 3/8**	MN06160	6 1/2	5/8	9/16	3/4	4.88	—	—	7 5/8	8 5/8	7/8	7 3/8
	1 3/4**	MN06161										1 1/8	7 5/8
8	1 3/8*	MN06180	8 1/2	5/8	11/16	N/A	N/A	3 1/2	7.57	N/A	N/A	1 5/8	6 3/4
	1 3/4*	MN06181										1 7/8	7
10	1 3/4*	MN61100	10 5/8	5/8	13/16	N/A	N/A	3 1/2	9.40	N/A	N/A	1 7/8	8 1/4
	2*	MN61101		3/4				5				2	8 3/8
12	2*	MN61200	12 3/4	3/4	13/16	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 AND CAP 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 bulkheard, 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.

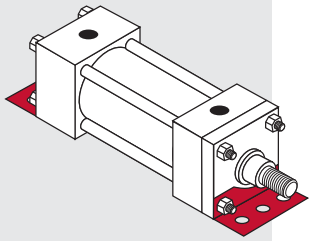
Rod End Styles and Dimensions
For rod end styles and dimensions see:
Page 105

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.)

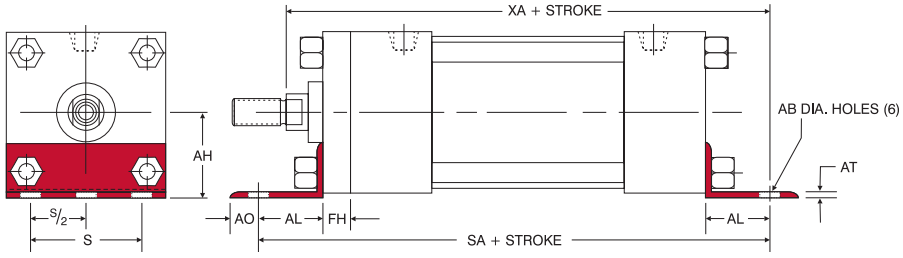


MODEL MN44
NFPA STYLE MS1

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' SIDE AND LUG MOUNT DIMENSIONS

Bore Ø	Rod MM	Cylinder Code ♦	AB	AH	AL	AO	AT	FH	S	Add Stroke SA▲	Add Stroke XA
1½	5/8	MN00611	7/16	1 3/16	1	3/8	1/8	3/8	1 1/4	6	5 5/8
	1	MN00612									6
2	5/8	MN06110	7/16	1 7/16	1	3/8	1/8	3/8	1 3/4	6	5 5/8
	1	MN06111									6
2½	5/8	MN06120	7/16	1 5/8	1	3/8	1/8	3/8	2 1/4	6 1/8	5 3/4
	1	MN06121									6 1/8
3¼	1	MN06130	9/16	1 15/16	1 1/4	1/2	1/8	5/8	2 3/4	7 3/8	6 7/8
	1 3/8	MN06131									7 1/8
4	1	MN06140	9/16	2 1/4	1 1/4	1/2	1/8	5/8	3 1/2	7 3/8	6 7/8
	1 3/8	MN06141									7 1/8
5	1	MN06150	11/16	2 3/4	1 3/8	5/8	3/16	5/8	4 1/4	7 7/8	7 1/4
	1 3/8	MN06151									7 1/2
6	1 3/8	MN06160	13/16	3 1/4	1 3/8	5/8	3/16	3/4	5 1/4	8 1/2	8
	1 3/4	MN06161									8 1/4
8	1 3/8	MN06180	13/16	4 1/4	1 13/16	11/16	1/4	5/8*	7 1/8	8 3/4	8 9/16
	1 3/4	MN06181									8 13/16

*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

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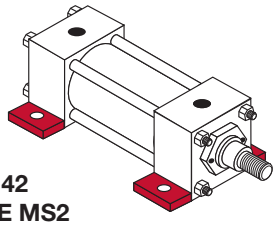
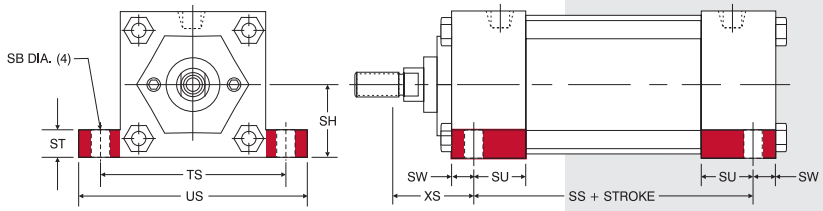
SIDE LUG MOUNTING



MODEL MN42
NFPA 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	⅝	MN00611	7/16	1	½	1⅛	⅜	⅝	2¾	3½	1⅜	2⅞
	1	MN00612									1¾	
2	⅝	MN06110	7/16	1¼	½	1⅛	⅜	⅝	3¼	4	1⅜	2⅞
	1	MN06111									1¾	
2½	⅝	MN06120	7/16	1½	½	1⅛	⅜	⅝	3¾	4½	1⅜	3
	1	MN06121									1¾	
3¼	1	MN06130	9/16	1⅞	¾	1¼	½	¾	4¾	5¾	1⅞	3¼
	1⅜	MN06131									2⅛	
4	1	MN06140	9/16	2¼	¾	1¼	½	¾	5½	6½	1⅞	3¼
	1⅜	MN06141									2⅛	
5	1	MN06150	13/16	2¾	1	1 1/16	1 1/16	9/16	6⅞	8¼	2 1/16	3⅛
	1⅜	MN06151									2 5/16	
6	1⅜	MN06160	13/16	3¼	1	1 5/16	1 1/16	13/16	7⅞	9¼	2 5/16	3⅝
	1¾	MN06161									2 9/16	
8	1⅜	MN06180	13/16	4¼	1	1 5/16	1 1/16	13/16	9⅞	11¼	2 5/16	3¾
	1¾	MN06181									2 9/16	

For dimensions not shown, see page 105.

HOW TO ORDER

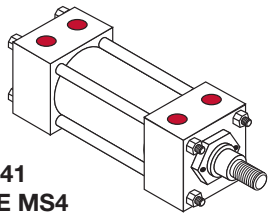
For ordering information refer to Page 134.

NOTES:

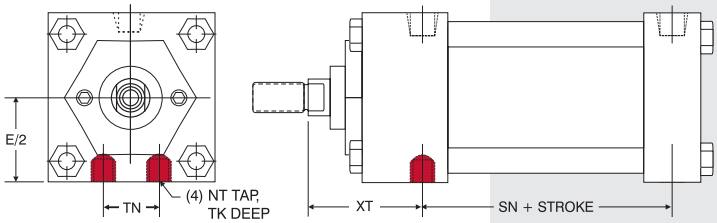
♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DMN00611. (Refer to page 112.)

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

TAPPED HOLES IN CAPS FLUSH MOUNTING



MODEL MN41
NFPA STYLE MS4



'MN41' SIDE LUG MOUNT DIMENSIONS								
Bore Ø	Rod MM	Cylinder Code ♦	E/2	NT	TK	TN	XT	Add Stroke SN
1½	⅝	MN00611	1	¼-20	⅜	⅝	1 15/16	2¼
	1	MN00612					2 5/16	
2	⅝	MN06110	1¼	5/16-18	½	⅞	1 15/16	2¼
	1	MN06111					2 5/16	
2½	⅝	MN06120	1½	⅜-16	⅝	1¼	1 15/16	2⅜
	1	MN06121					2 5/16	
3¼	1	MN06130	1⅞	½-13	¾	1½	2 7/16	2⅝
	1⅜	MN06131					2 11/16	
4	1	MN06140	2¼	½-13	¾	2 1/16	2 7/16	2⅝
	1⅜	MN06141					2 11/16	
5	1	MN06150	2¾	⅝-11	1	2 11/16	2 7/16	2⅞
	1⅜	MN06151					2 11/16	
6	1⅜	MN06160	3¼	¾-10	1⅛	3¼	2 13/16	3⅛
	1¾	MN06161					3 1/16	
8	1⅜	MN06180	4¼	¾-10	1⅛	4½	2 13/16	3¼
	1¾	MN06181					3 1/16	
10	1¾	MN61100	5 5/16	1-8	1½	5½	3⅛	4⅛
	2	MN61101					3¼	
12	2	MN61200	6⅜	1-8	1½	7¼	3¼	4⅝
	2½	MN61201					3½	

For dimensions not shown, see page 105.

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

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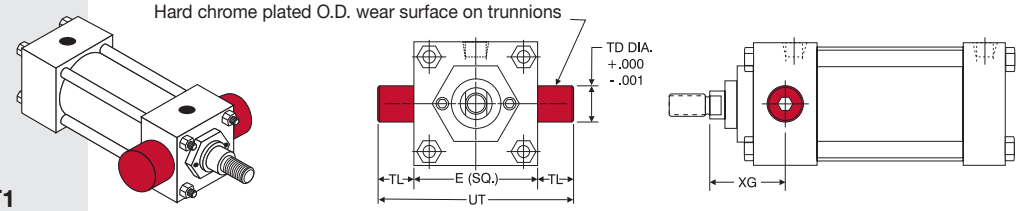
NOTE:
MT1 and MT2 trunnions are bolt on, non-removable design.

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.

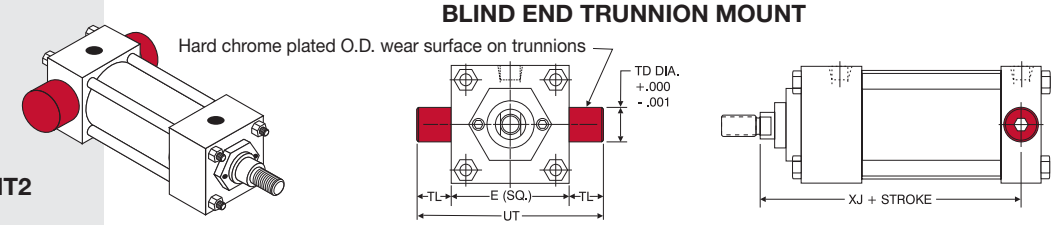
ROD END TRUNNION MOUNT

MODEL MN71
NFPA STYLE MT1



BLIND END TRUNNION MOUNT

MODEL MN72
NFPA STYLE MT2



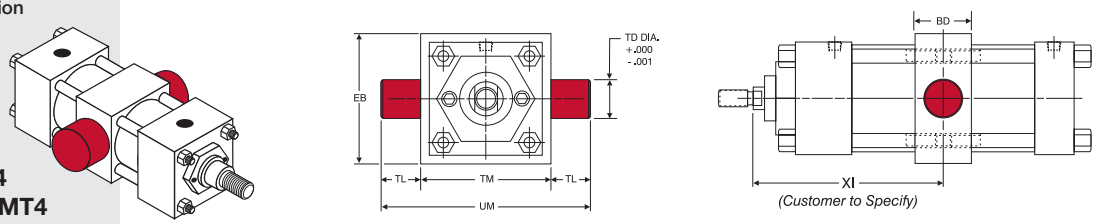
'MN71' AND 'MN72' TRUNNION MOUNT DIMENSIONS									ACCESSORIES (see pages 110-111 for dimensions)		
Bore Ø	Rod MM	Cylinder Code ♦	E	TD	TL	UT	XG	Add Stroke XJ	Rod Clevis	Rod Eye	Clevis Pin
1½	⅝	MN00611	2	1	1	4	1¾	4⅛	RC437	RE437	CP500
	1	MN00612					N/A*	4½	RC750	RE750	CP750
2	⅝	MN06110	2½	1	1	4½	1¾	4⅛	RC437	RE437	CP500
	1	MN06111					2⅛	4½	RC750	RE750	CP750
2½	⅝	MN06120	3	1	1	5	1¾	4¼	RC437	RE437	CP500
	1	MN06121					2⅛	4⅝	RC750	RE750	CP750
3¼	1	MN06130	3¾	1	1	5¾	2¼	5	RC750	RE750	CP750
	1⅜	MN06131					2½	5¼	RC1000	RE1000	CP1000
4	1	MN06140	4½	1	1	6½	2¼	5	RC750	RE750	CP750
	1⅜	MN06141					2½	5¼	RC1000	RE1000	CP1000
5	1	MN06150	5½	1	1	7½	2¼	5¼	RC750	RE750	CP750
	1⅜	MN06151					2½	5½	RC1000	RE1000	CP1000
6	1⅜	MN06160	6½	1⅜	1⅜	9¼	2⅝	5⅞	RC1000	RE1000	CP1000
	1¾	MN06161					2⅞	6⅛	RC1250	RE1250	CP1375
8	1⅜	MN06180	8½	1⅜	1⅜	11¼	2⅝	6	RC1000	RE1000	CP1000
	1¾	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.

CENTER TRUNNION MOUNT

MODEL MN74
NFPA STYLE MT4



'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	
3¼	2	4¼	1	1	4½	6½	
4	2	5	1	1	5¼	7¼	
5	2	6	1	1	6¼	8¼	
6	2	7	1⅜	1⅜	7⅝	10⅜	
8	2½	9½	1⅜	1⅜	9¾	12½	

HOW TO ORDER

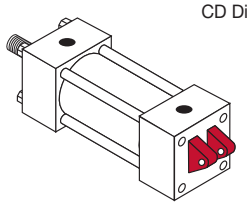
For ordering information refer to Page 134.

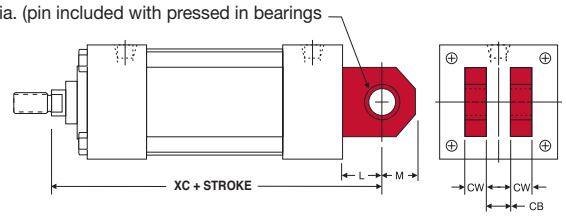
NOTES:

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

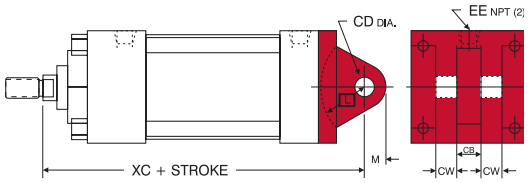
CLEVIS MOUNT

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





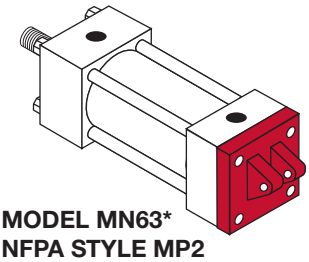
Iron Casting MP1 Mount
(Optional)**

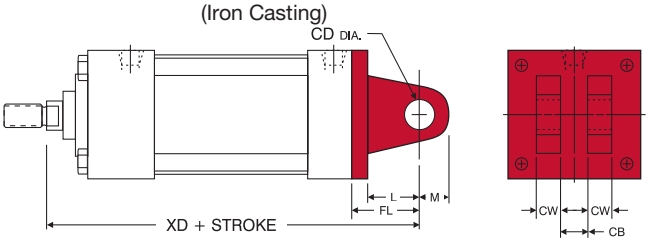


MODEL MN61
NFPA STYLE MP1

REMOVABLE CLEVIS MOUNT

MP2 Mount
(Iron Casting)



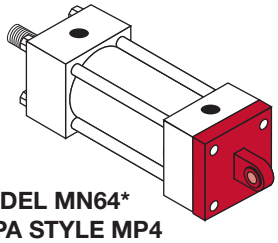


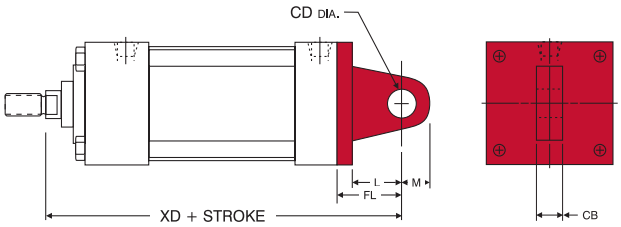
MODEL MN63*
NFPA STYLE MP2

FIXED EYE MOUNT

MP4 Mount
(Iron Casting: 1½" - 4" Bores, Weldment: 5" & 6" Bores*)

See pages 124-125 for dimensions.





MODEL MN64*
NFPA STYLE MP4

HOW TO ORDER

For ordering information refer to Page134.

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

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'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	⅝	MN00611	¾	½	½	1⅛	¾	⅝	5⅜	5¾	RC437	RE437	CP500	EB500	CB500
	1	MN00612							5¾	6⅛	RC750	RE750	CP750		
2	⅝	MN06110	¾	½	½	1⅛	¾	⅝	5⅜	5¾	RC437	RE437	CP500		
	1	MN06111							5¾	6⅛	RC750	RE750	CP750		
2½	⅝	MN06120	¾	½	½	1⅛	¾	⅝	5½	5⅞	RC437	RE437	CP500		
	1	MN06121							5⅞	6¼	RC750	RE750	CP750		
3¼	1	MN06130	1¼	¾	⅝	1⅞	1¼	⅞	6⅞	7½	RC750	RE750	CP750	EB750	CB750
	1⅜	MN06131							7⅛	7¾	RC1000	RE1000	CP1000		
4	1	MN06140	1¼	¾	⅝	1⅞	1¼	⅞	6⅞	7½	RC750	RE750	CP750		
	1⅜	MN06141							7⅛	7¾	RC1000	RE1000	CP1000		
5	1	MN06150	1¼	¾	⅝	1⅞	1¼	⅞	7⅛	7¾	RC750	RE750	CP750		
	1⅜	MN06151							7⅜	8	RC1000	RE1000	CP1000		
6	1⅜	MN06160	1½	1	¾	2¼	1½	1	8⅛	8⅞	RC1000	RE1000	CP1000	EB1000	CB1000
	1¾	MN06161							8⅜	9⅛	RC1250	RE1250	CP1375		
8	1⅜*	MN06180	1½	1	¾	N/A	1½	1	8¼	N/A	RC1000	RE1000	CP1000		
	1¾*	MN06181							8½		RC1250	RE1250	CP1375		
10	1¾*	MN61100	2	1⅜	1	N/A	2⅛	1⅜	10⅜	N/A	RC1250	RE1250	CP1375	EB1375	CB1375
	2*	MN61101							10½		RC1500	RE1500	CP1750	EB1750	CB1750
12	2*	MN61200	2½	1¾	1¼	N/A	2¼	1¾	11⅛	N/A	RC1500	RE1500	CP1750		
	2½*	MN61201							11⅜		RC1875	N/A	CP2000		

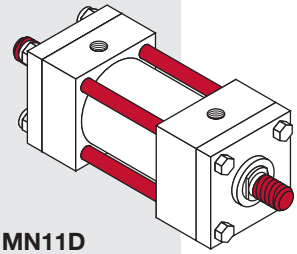
Clevis pins are provided with pivot mounts.
For dimensions not shown, see page 105.

**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.

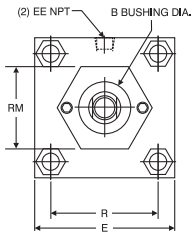
Rod End Styles and Dimensions
For rod end styles and dimensions see:
Page 105

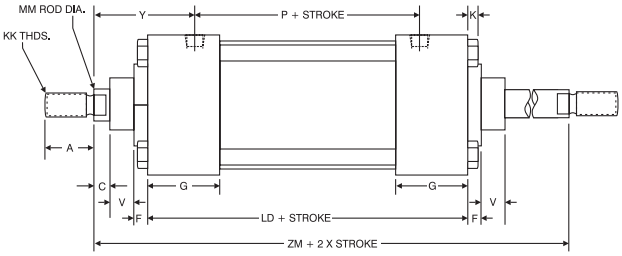
DOUBLE ROD END CYLINDERS

- 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).



MODEL MN11D
NFPA STYLE MXOD (No Mount)





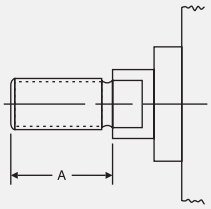
Bore Ø	Rod MM	Cylinder Code ♦	A	B	C	E	EE	F	G	K	KK	LD	P	R	RM	V	Y	ZM
1½	⅝	DMN00611	¾	1⅛	⅜	2	⅜	⅜	1½	¼	7/16-20	4⅛	2⅜	1.43	2 Sq.	¼	1⅞	6⅛
	1	DMN00612	1⅛	1½	½						¾-16					½	2¼	6⅞
2	⅝	DMN06110	¾	1⅛	⅜	2½	⅜	⅜	1½	5/16	7/16-20	4⅛	2⅜	1.84	1¾ Hex	¼	1⅞	6⅛
	1	DMN06111	1⅛	1½	½						¾-16				2½ Sq.	½	2¼	6⅞
2½	⅝	DMN06120	¾	1⅛	⅜	3	⅜	⅜	1½	5/16	7/16-20	4¼	2½	2.19	1¾ Hex	¼	1⅞	6¼
	1	DMN06121	1⅛	1½	½						¾-16				3 Sq.	½	2¼	7
3¼	1	DMN06130	1⅛	1½	½	3¾	½	⅝	1¾	⅜	¾-16	4¾	2¾	2.76	2¾ Dia.	¼	2⅜	7½
	1⅜	DMN06131	1⅝	2	⅝						1-14				3¾ Sq.	⅜	2⅝	8
4	1	DMN06140	1⅛	1½	½	4½	½	⅝	1¾	⅜	¾-16	4¾	2¾	3.32	2¾ Dia.	¼	2⅜	7½
	1⅜	DMN06141	1⅝	2	⅝						1-14				3½ Dia.	⅜	2⅝	8
5	1	DMN06150	1⅛	1½	½	5½	½	⅝	1¾	7/16	¾-16	5	3	4.10	2¾ Dia.	¼	2⅜	7¾
	1⅜	DMN06151	1⅝	2	⅝						1-14				3½ Dia.	⅜	2⅝	8¼
6	1⅜	DMN06160	1⅝	2	⅝	6½	¾	⅝	2	7/16	1-14	5½	3¼	4.88	3½ Dia.	⅜	2¾	8¾
	1¾	DMN06161	2	2⅜	¾						1¼-12					½	3	9¼
8	1⅜	DMN06180	1⅝	2	⅝	8½	¾	⅝	2	9/16	1-14	5⅝	3⅜	6.44	3½ Dia.	⅜	2¾	8⅞
	1¾	DMN06181	2	2⅜	¾						1¼-12					½	3	9⅜
10	1¾	DMN61100	2	2⅜	¾	10⅝	1	⅝	2¼	11/16	1¼-12	6⅝	4⅝16	7.92	3½ Dia.	½	3 1/16	10⅜
	2	DMN61101	2¼	2⅝	⅞			¾			1½-12				5 Dia.	⅜	3 3/16	10⅝
12	2	DMN61200	2¼	2⅝	⅞	12¾	1	¾	2¼	11/16	1½-12	7⅛	4 13/16	9.40	5 Dia.	⅜	3 3/16	11⅛
	2½	DMN61201	3	3⅛	1						1⅞-12					½	3 7/16	11⅝

▼ Double Rod End Stroke Adders

Bore Ø	Rod MM	MS1D SAD	MS1D XAD	MS2D SSD
1½	⅝	6⅞	6½	3⅜
	1		6⅞	
2	⅝	6⅞	6½	3⅜
	1		6⅞	
2½	⅝	7	6⅝	3½
	1		7	
3¼	1	8½	8	3¾
	1⅜		8¼	
4	1	8½	8	3¾
	1⅜		8¼	
5	1	9	8⅜	3⅝
	1⅜		8⅝	
6	1⅜	9¾	9¼	4⅛
	1¾		9½	
8	1⅜	9¼	9 1/16	4¼
	1¾		9 5/16	

Index to Basic Options

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

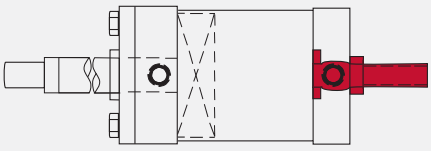
Air/Oil pistons allow for the combination of pneumatic supply air with the precise control of oil.

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

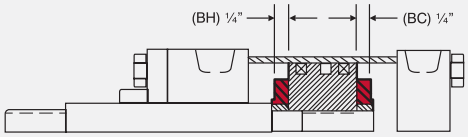


ADJUSTABLE STROKE (RETRACT)

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 impacf 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 performace 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

Standard Material: Buna-N

Operating Temperature:
-20° F to 200° F

***Optional Material: Viton**

Operating Temperature:
-150° F to 350° F

*Available in 1½" bores

Operating Pressure:
250 PSI Air

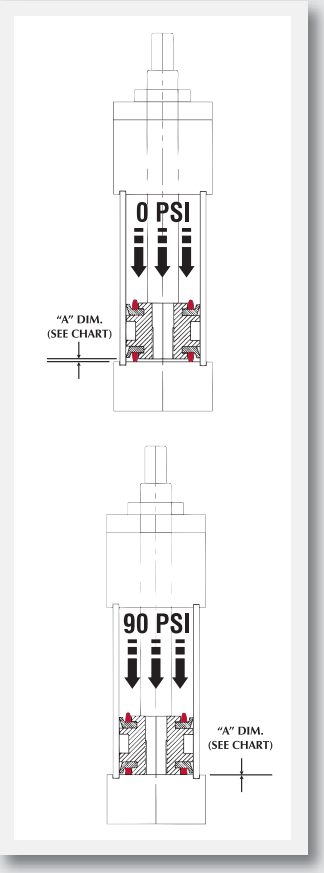
Bumper Piston Seals will shorten the cylinder stroke when operated at less than 90 PSI supply air. The charts below show the approximate (average) stroke reduction, at various pressure (for new cylinders). As the cylinders are cycled, the seals will take a slight set. Tests have shown that after 1,500,000 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



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.

Design Tips

- **Cushions Adjustment screws can be ordered on same side as ports.** Refer to page 121 for details.
- **BP** Seals provide additional impact dampening and noise reduction. (Refer to page 145 for details).

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.

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

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 psi W = 26.25 lbs. V = 6 FPS. K = .17

Energy = (26.25/64) X (62) or (36) + (80 X .17)
Energy = 28.36 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.

Piston Rod Weight Chart

Rod MM	Piston Rod Weight*
⅝	.35 lb. + .09 lb/in of stroke
1	1.1 lb. + .22 lb/in of stroke
1⅜	2.3 lb. + .42 lb/in of stroke
1¾	5.0 lb. + .68 lb/in of stroke
2	6.1 lb. + .88 lb/in of stroke
2½	10.4 lb. + 1.39 lb/in of stroke

* Double weight for double rod end cylinders.

MAXIMUM ENERGY DATA

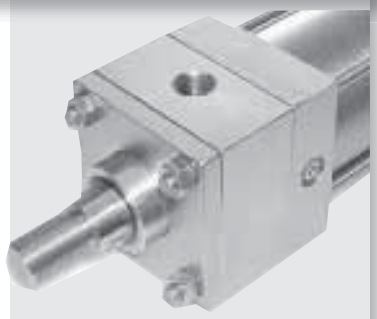
Bore Ø	K	H OR C Standard Cushion Series Max Energy (ft-lbs)	LH OR LC Long Cushion Series Max Energy (ft-lbs)	ELH OR ELC Extra-Long Cushion Series Max Energy (ft-lbs)
1½	.06	8.2	12.8	26.9
2	.11	13.8	21.7	45.8
2½	.17	24.6	38.6	81.5
3¼	.25	45.7	83.6	172.2
4	.38	57.3	137.1	282.6
5	.59	94.6	226.0	465.8
6	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

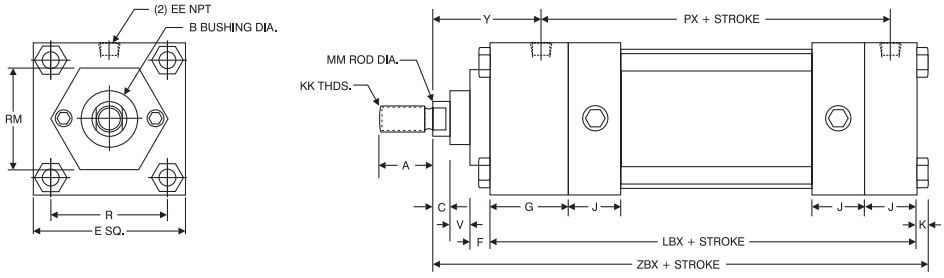
Milwaukee Cylinder's "ELH" Extra-Long Head Cushions and "ELC" Extra-Long Cap Cushions add length to the cylinder. Refer to the chart for dimensions.

ELH EXTRA LONG HEAD CUSHION

ELC EXTRA LONG CAP CUSHION



(MN41-1½" X 6" ELH - EN) Shown

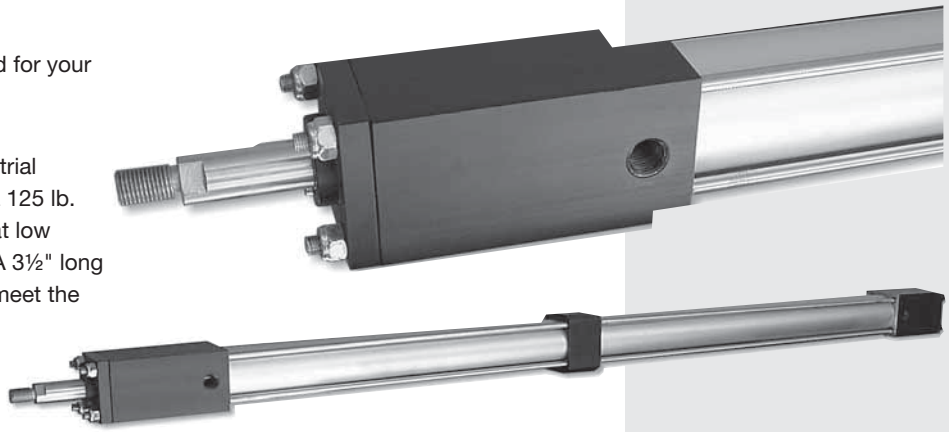


Bore Ø	Rod MM	Cylinder Code	A	B	C	E	EE	F	G	J	K	KK	LBX	PX	R	RM	V	Y	ZBX
1½	⅝	DMN00611	¾	1⅛	⅜	2	⅜	⅜	1½	1	¼	7/16-20	5⅝	4⅜	1.43	2 Sq.	¼	1⅞	6⅞
	N/A	DMN00612	N/A	N/A	N/A							N/A					N/A	N/A	N/A
2	⅝	DMN06110	¾	1⅛	⅜	2½	⅜	⅜	1½	1	5/16	7/16-20	5⅝	4⅜	1.84	1¾ Hex	¼	1⅞	6 15/16
	1	DMN06111	1⅛	1½	½							¾-16				2½ Sq.	½	2¼	7 5/16
2½	⅝	DMN06120	¾	1⅛	⅜	3	⅜	⅜	1½	1	5/16	7/16-20	5¾	4½	2.19	1¾ Hex	¼	1⅞	7 1/16
	1	DMN06121	1⅛	1½	½							¾-16				3 Sq.	½	2¼	7 7/16
3¼	1	DMN06130	1⅛	1½	½	3¾	½	⅝	1¾	1¼	⅜	¾-16	6¾	5¼	2.76	2¾ Dia.	¼	2⅜	8½
	1⅜	DMN06131	1⅝	2	⅝							1-14				3¾ Sq.	⅜	2⅝	8¾
4	1	DMN06140	1⅛	1½	½	4½	½	⅝	1¾	1¼	⅜	¾-16	6¾	5¼	3.32	2¾ Dia.	¼	2⅜	8½
	1⅜	DMN06141	1⅝	2	⅝							1-14				3½ Dia.	⅜	2⅝	8¾
5	1	DMN06150	1⅛	1½	½	5½	½	⅝	1¾	1¼	7/16	¾-16	7	5½	4.10	2¾ Dia.	¼	2⅜	8 13/16
	1⅜	DMN06151	1⅝	2	⅝							1-14				3½ Dia.	⅜	2⅝	9 1/16
6	1⅜	DMN06160	1⅝	2	⅝	6½	¾	⅝	2	1½	7/16	1-14	8	6¼	4.88	3½ Dia.	⅜	2¾	10 1/16
	1¾	DMN06161	2	2⅜	¾							1¼-12					½	3	10 5/16
8	1⅜	DMN06180	1⅝	2	⅝	8½	¾	⅝	2	1½	9/16	1-14	8⅛	6⅜	6.44	3½ Dia.	⅜	2¾	10 5/16
	1¾	DMN06181	2	2⅜	¾							1¼-12					½	3	10 9/16
10	1¾	DMN61100	2	2⅜	¾	10⅝	1	⅝	2¼	2	11/16	1¼-12	10⅜	8 5/16	7.92	3½ Dia.	½	3 1/16	12 15/16
	2	DMN61101	2¼	2⅝	⅞			¾				1½-12				5 Dia.	⅜	3 3/16	13 1/16
12	2	DMN61200	2¼	2⅝	⅞	12¾	1	¾	2¼	2	11/16	1½-12	10⅞	8 13/16	9.40	5 Dia.	⅜	3 3/16	13 9/16
	2½	DMN61201	3	3⅛	1							1⅞-12					½	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 3½" long head and cap cushion was designed to meet the operating specifications.



MN Basic Options: BSPT, BSPP, C=, EN, KK35, LF

milwaukee Cylinder

BSPT

BRITISH STANDARD PIPE TAPER

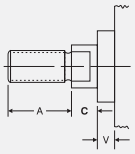
British Standard Pipe Taper (**BSPT**) threads have the same taper as American NPT tapered threads, but use a 55° Whitworth thread form and different diameters. *(Not interchangeable with NPT)*

BSPP

BRITISH STANDARD PIPE PARALLEL

British Standard Pipe Parallel (**BSPP**) also refered 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

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)

Coefficent 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.

ELECTROLESS NICKEL

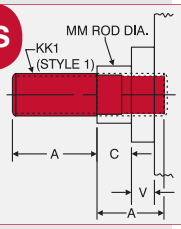
"**EN"** or Electroless Nickel plating was invented in 1946, and has gained worldwide commercial usage since 1964. Common usages include aircraft landing gear, automotive brake cylinder and components, fuel injector parts, gas turbine parts, spray nozzles for chemical applications and many electronic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

KK3S



STUDDED PISTON ROD

KK3S option combines the KK3 female threaded rod end design and a stud, with permanent Loctite. When assembled, the KK3S 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

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

LOW FRICTION

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

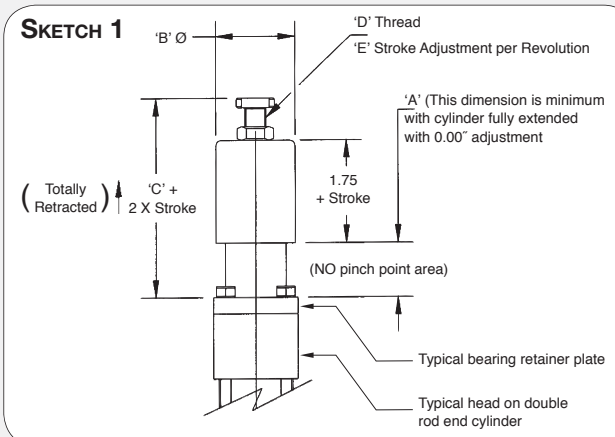
MA

MICRO-ADJUST

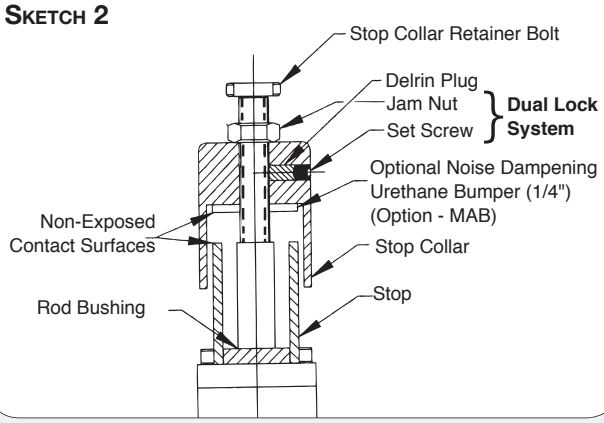
- Allows precise adjustment of cylinder extend stroke
- Easy to read precision scale (.001" calibration)
- Enclosed, no "pinch point" design
- Available on all cylinder models with "D" Double Rod End option
- Up to 6" stroke and adjustment*

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

SKETCH 1



SKETCH 2



MICRO-ADJUST Set-up Instructions

1) Set actuator to desired stroke
2) Turn stop ollar 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

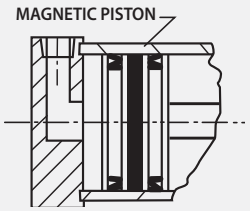
A noise dampening urethane bumper is added between the metal contact points, minimizing noise. See Sketch 2 above.

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)*

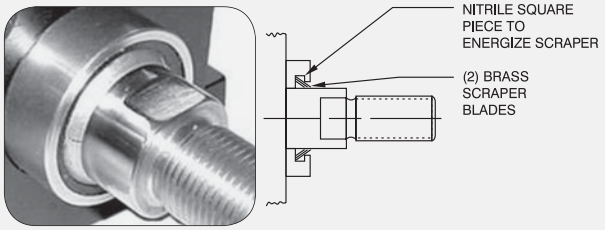
MPH Magnetic Pistons are used with *Milwaukee Cylinder's* "Old Style" HE011, HE03SK and HE04SC Hall Effect Switches.



MS

METALLIC ROD SCRAPER

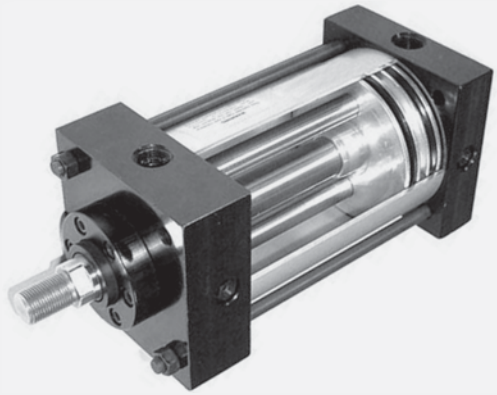
Aggressively scrapes the piston rod, removing foreign material such as spatter, sprays and powders. *(Brass contruction)*



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

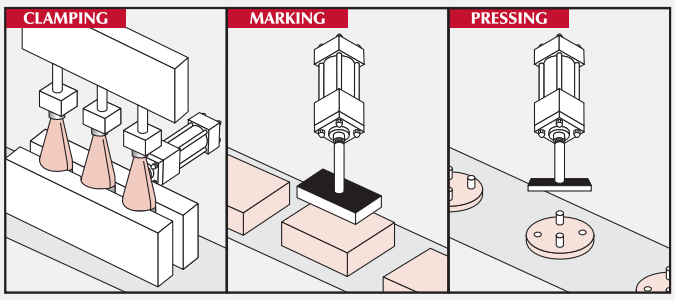
- Eliminates the need for external guide shafts in many positioning applications
- Guide rods are internal, self-cleaning, not subjected to harsh cleaners
- Compact design saves space, no larger than standard NFPA cylinders!
- Durable, self-contained construction

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	⅝	Cap only	0.250	10
2½	⅝	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		0.625	30
5	1	Available	0.625	30
	1⅜		0.625	30
6	1⅜	Available	0.625	30
	1¾		0.625	30
8	1⅜	Available	1.000	40
	1¾		1.000	40
10	1¾	Available	1.000	40
	2		1.000	40
12	2	Available	1.000	40
	2½		1.000	40

APPLICATION POSSIBILITIES:



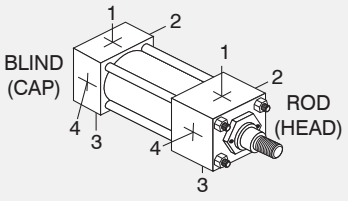
OP

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:

HEAD VIEWS **CAP VIEWS**

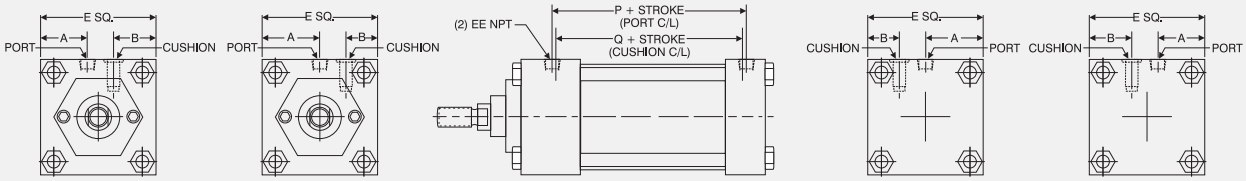


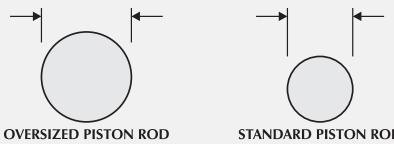
FIGURE #1 FIGURE #2 FIGURE #2 FIGURE #1

Bore Ø	Rod MM	Figure	A	B	E	EE	P	Q
1½	⅝	1	¾	⅝	2	¼	2⅜	2⅛
	1	N/A	N/A	N/A	N/A			
2	⅝	1	⅞	15⁄16	2½	⅜	2⅜	2⅛
	1	1	1	¾	2½			
2½	⅝	1	1⅛	1⅛	3	⅜	2½	2¼
	1	1	1⅛	1	3			
3¼	1	1	1½	1⅜	3¾	½	2¾	2½
	1⅜	2	1⅞	1	3¾			
4	1	2	2¼	1¼	4½	½	2¾	2½
	1⅜	2	2¼	1⅛	4½			
5	1	2	2¾	1¾	5½	½	3	3
	1⅜	2	2¾	1⅝	5½			
6	1⅜	2	3¼	1⅞	6½	¾	3¼	3
	1¾	2	3¼	1⅞	6½			
8	1⅜	2	4¼	2¾	8½	¾	3⅜	3⅛
	1¾	2	4¼	2¾	8½			
10	1¾	2	5 5⁄16	3 11⁄16	10⅝	1	4 5⁄16	4⅛
	2	2	5 5⁄16	3 11⁄16	10⅝			
12	2	2	6⅜	4¾	12¾	1	4 13⁄16	4⅝
	2½	2	6⅜	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 (¾-16)
2½	#4 (7⁄16-20)	8	#8 (¾-16)
3¼	#6 (9⁄16-18)	10	#10 (⅞-14)
4	#6 (9⁄16-18)	12	#10 (⅞-14)

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

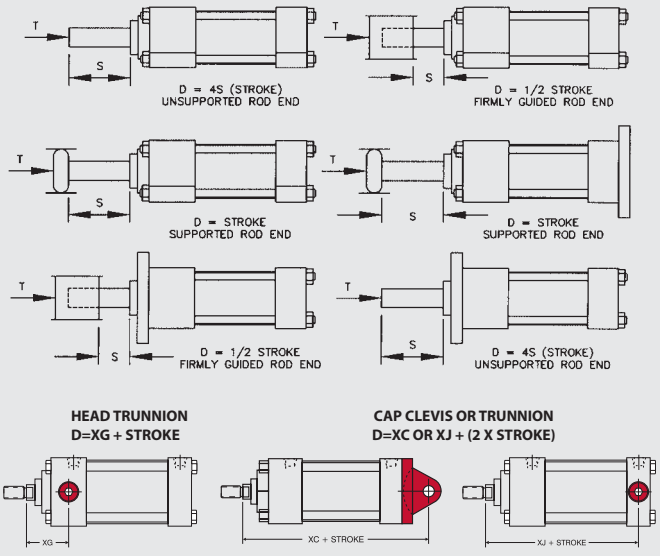


Chart 2

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

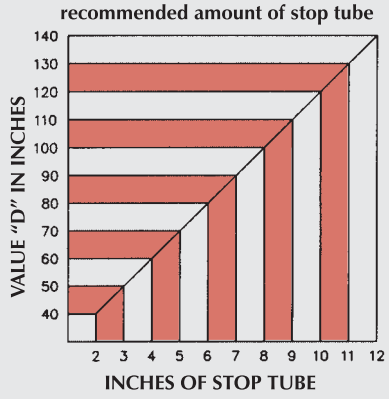
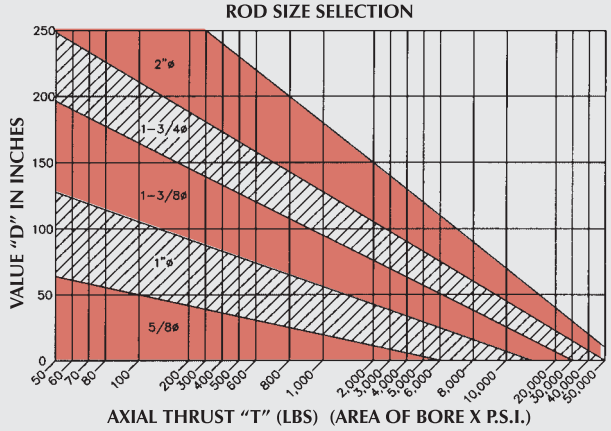


Chart 3

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

MN Accessories: Clevis, Pins & Mounts

milwaukee Cylinder

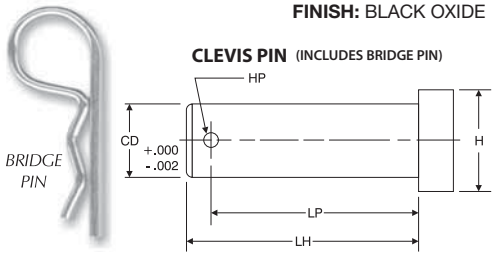
▼ ACCESSORIES CROSS REFERENCE CHART

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	⅝	(Standard)	KK1	7/16-20	RC437	RE437	CP500	CB500	EB500
			KK2	½-20	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		
	1⅜	(Standard-Oversized)	KK1	1-14	RC1000	RE1000	CP1000		
			KK2	1¼-12	RC1250	N/A	CP1375		
6 and 8	1⅜	(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
	2	(Standard)	KK1	1½-12	RC1500	RE1500	CP1750	CB1750	EB1750
12	2	(Standard)	KK1	1½-12	RC1500	RE1500	CP1750	CB1750	EB1750

CLEVIS PIN (with Bridge Pin - Standard)

Part No.	CD	H	HP	LH	LP
CP500	½	⅝	5/32	2¼	2 3/32
CP750	¾	15/16	5/32	3	2 27/32
CP1000	1	1 3/16	13/64	3½	3 5/16
CP1375	1⅜	1¾	¼	5	4½
CP1750	1¾	2 9/64	¼	6	5½

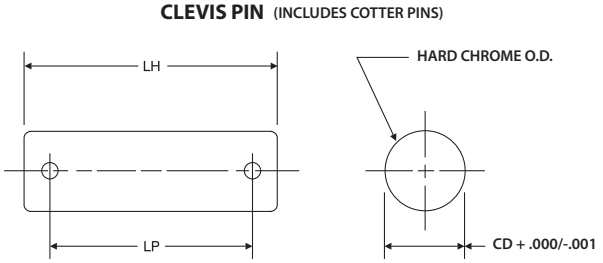
MATERIAL: 1018 CRS
FINISH: BLACK OXIDE



CLEVIS PIN (with Cotter Pin)

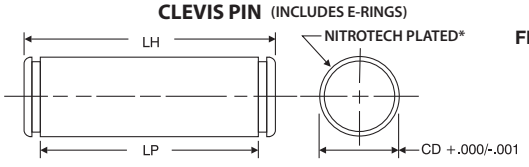
Part No.	CD	LH	LP
CP500C	½	2¼	1 15/16
CP750C	¾	3	2 23/32
CP1000C	1	3½	3 7/32
CP1375C	1⅜	5	4¼
CP1750C	1¾	6	5½
CP2000C	2	6	5½

MATERIAL: 1045 CRS
FINISH: CHROME PLATED O.D.



CLEVIS PIN (with Cotter Pin)

Part No.	CD	LH	LP
CP500E	½	2⅛	1⅞
CP750E	¾	2 15/16	2⅝
CP1000E	1	3 7/16	3⅛

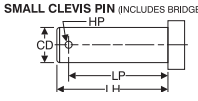


*Hard chrome plated O.D. available

MATERIAL: 1045 CRS
FINISH: NITROTECH PLATED*

SMALL CLEVIS PIN (with Bridge Pin)

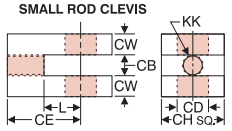
Part No.	CD	HP	LH	LP
CP500CCS	½	5/32	1⅜	1¼
CP750CCS	¾	5/32	2	1⅞



MATERIAL: 1018 CRS
FINISH: BLACK OXIDE

SMALL ROD CLEVIS

Part No.	CB	CD	CE	CH	CW	KK1	KK2	L
RC437CCS	½	½	1⅜	1	¼	7/16-20	—	¾
RC500CCS	½	½	1⅜	1	¼	—	½-20	¾
RC750CCS	¾	¾	1¾	1½	⅜	¾-16	—	1



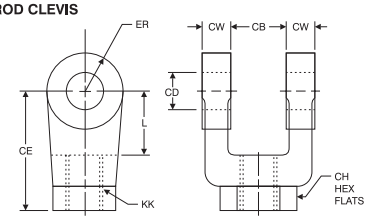
MATERIAL: 1018 CRS
FINISH: BLACK OXIDE

ROD CLEVIS

Part No.	CB	CD	CE	CH	CW	ER	KK	L
RC437	¾	½	1½	1	½	½	7/16-20	¾
RC500	¾	½	1½	1	½	½	½-20	¾
RC750	1¼	¾	2⅜	1¼	⅝	¾	¾-16	1¼
RC1000	1½	1	3⅛	1½	¾	1	1-14	1½
RC1250	2	1⅜	4⅛	2	1	1⅜	1¼-12	2⅛
RC1375	2	1⅜	4⅛	2	1	1⅜	1⅜-12	2⅛
RC1500	2½	1¾	4½	2⅜	1¼	1¾	1½-12	2¼
RC1750	2½	1¾	4½	2⅜	1¼	1¾	1¾-12	2¼
RC1875	2½	2	5½	3	1¼	2	1⅞-12	2½

MATERIAL: CAST STEEL
FINISH: BLACK OXIDE

ROD CLEVIS



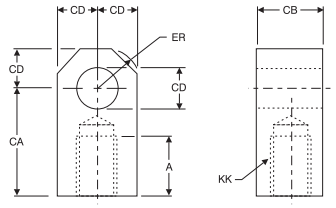
(Clevis Pins sold separately from Rod Clevises)

ROD EYE

Part No.	A	CA	CB	CD	ER	KK
RE437	¾	1½	¾	½	⅝	7/16-20
RE500	¾	1½	¾	½	⅝	½-20
RE750	1⅛	2 1/16	1¼	¾	⅞	¾-16
RE1000	1⅝	2 13/16	1½	1	1 3/16	1-14
RE1250	2	3 7/16	2	1⅜	1 9/16	1¼-12
RE1500	2¼	4	2½	1¾	2	1½-12

MATERIAL: 1018 CRS
FINISH: BLACK OXIDE

ROD EYE



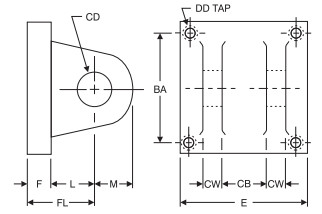
(Clevis Pins sold separately from Rod Eyes)

CLEVIS BRACKET

Part No.	BA	CB	CD	CW	DD	E	F	FL	L	M
CB500	1⅝	¾	½	½	⅜-24	2½	⅜	1⅛	¾	⅝
CB750	2 9/16	1¼	¾	⅝	½-20	3½	⅝	1⅞	1¼	¾
CB1000	3¼	1½	1	¾	⅝-18	4½	¾	2¼	1½	1
CB1375	3 13/16	2	1⅜	1	⅝-18	5	⅞	3	2⅛	1⅜
CB1750	4 15/16	2½	1¾	1¼	⅞-14	6½	⅞	3⅛	2¼	1¾

MATERIAL: CAST STEEL
FINISH: BLACK OXIDE

CLEVIS BRACKET



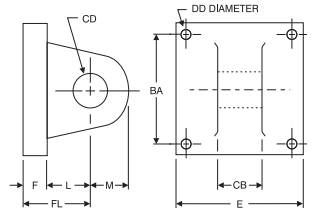
(Clevis Pins sold separately from Clevis Brackets)

EYE BRACKET

Part No.	BA	CB	CD	DD	E	F	FL	L	M
EB500	1⅝	¾	½	13/32	2½	⅜	1⅛	¾	½
EB750	2 9/16	1¼	¾	17/32	3½	⅝	1⅞	1¼	¾
EB1000	3¼	1½	1	21/32	4½	¾	2¼	1½	1
EB1375	3 13/16	2	1⅜	21/32	5	⅞	3	2⅛	1⅜
EB1750	4.95	2½	1¾	29/32	6½	⅞	3⅛	2¼	1¾

MATERIAL: CAST STEEL
FINISH: BLACK OXIDE

EYE BRACKET



(Clevis Pins sold separately from Eye Brackets)

▼ STAINLESS STEEL ACCESSORIES CROSS REFERENCE CHART

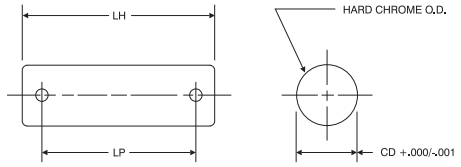
CYLINDER MODEL					ACCESSORIES				
Bore Ø	Rod MM	Rod Style (KK)		Rod Thread	Rod Clevis	Rod Eye	Clevis Pin	Clevis Bracket	Eye Bracket
1½, 2, 2½	⅝	(Standard)	KK1	7/16-20	SS-RC437	SS-RE437	SS-CP500	SS-CB500	SS-EB500
			KK2	½-20	SS-RC500	SS-RE500	SS-CP500		
	1	(Standard-Oversized)	KK1	¾-16	SS-RC750	SS-RE750	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		
	1⅜	(Standard-Oversized)	KK1	1-14	SS-RC1000	SS-RE1000	SS-CP1000		
			KK2	1¼-12	SS-RC1250	N/A	SS-CP1375		
6 and 8	1⅜	(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	1⅜	5	4¼
SS-CP1750	1¾	6	5½

CLEVIS PIN (INCLUDES COTTER PINS)

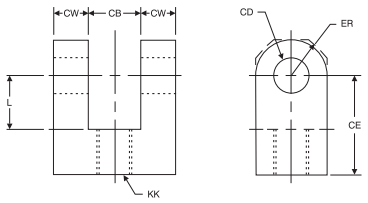


(Clevis Pins sold with (2) S.S. Cotter Pins)

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	2⅜	⅝	¾	¾-16	1¼
SS-RC1000	1½	1	3⅛	¼	1	1-14	1½
SS-RC1250	2	1⅜	4⅛	1	1⅜	1¼-12	2⅛
SS-RC1500	2½	1¾	4½	1¼	1¾	1½-12	2¼

ROD CLEVIS

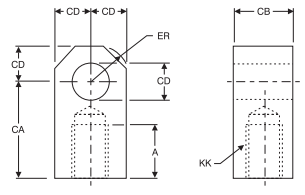


(Clevis Pins sold separately from Rod Clevis)

ROD EYE

Part No.	A	CA	CB	CD	ER	KK
SS-RE437	¾	1½	¾	½	⅝	7/16-20
SS-RE500	¾	1½	¾	½	⅝	½-20
SS-RE750	1⅛	2 1/16	1¼	¾	⅞	¾-16
SS-RE1000	1⅝	2 13/16	1½	1	1 3/16	1-14
SS-RE1250	2	3 7/16	2	1⅜	1 9/16	1¼-12
SS-RE1500	2¼	4	2½	1¾	2	1½-12

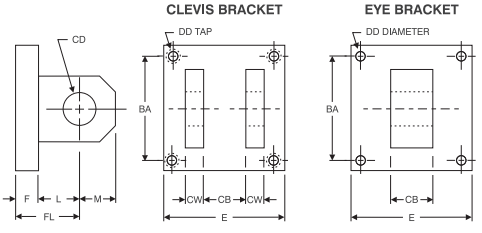
ROD EYE



(Clevis Pins sold separately from Rod Eyes)

CLEVIS BRACKETS AND EYE BRACKETS

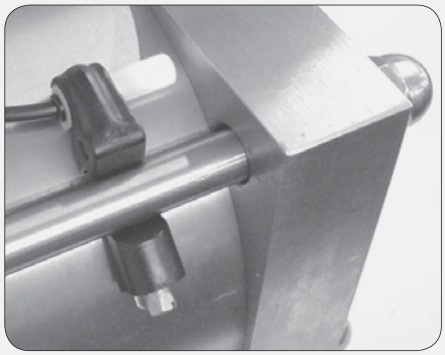
	Part No.	BA	CB	CD	CW	DD	E	F	FL	L	M
Clevis Brackets	SS-CB500	1⅝	¾	½	½	⅜-24	2½	⅜	1⅛	¾	⅝
	SS-CB750	2 9/16	1¼	¾	⅝	½-20	3½	⅝	1⅞	1¼	¾
	SS-CB1000	3¼	1½	1	¾	⅝-18	4½	¾	2¼	1½	1
Eye Brackets	SS-EB500	1⅝	¾	½	N/A	13/32	2½	⅜	1⅛	¾	½
	SS-EB750	2 9/16	1¼	¾		17/32	3½	⅝	1⅞	1¼	¾
	SS-EB1000	3¼	1½	1		21/32	4½	¾	2¼	1½	1



(Clevis Pins sold separately from Clevis & Eye Brackets)

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 Minature 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

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

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 Minature 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

▼ 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

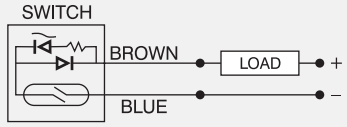
**Minimum current = 80mA

R10 / R10X

MINATURE 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



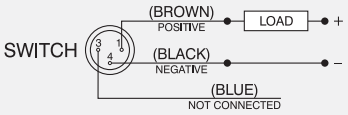
Input Voltage:	110 Volts Max. DC, 120 Volts Max. AC
Maximum Load Current:	400 mA Max. (Resistive) @ 25° C (77° F) 150 mA Max. (Resistive) @ 70° C (158° F)

R10Q

MINATURE 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



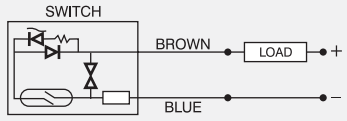
Input Voltage:	60 Volts Max. AC or DC
Maximum Load Current:	400 mA Max. (Resistive) @ 25° C (77° F) 150 mA Max. (Resistive) @ 70° C (158° F)

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

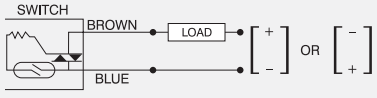
Note: The circuit protection consists of a Varistor and Choke arrangement. The Varistor will take transient and voltage spikes out of the line and is mounted in parallel with the switch. The Choke will disperse inrush currents (normally caused by long cable runs) and is mounted in series with the switch.

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)

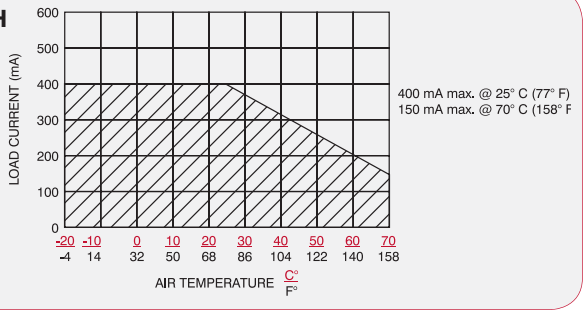
Contacts:	TRIAC Output
Contact Rating:	200 Watts Max.
Input Voltage:	12 to 240 Volts (AC only)
Minimum Load Current:	80 mA
Maximum Load Current:	800 mA
Actuating Time Average:	2.0 milliseconds
LED Indicator:	Not Available
Temperature Range:	-20° C to 70° C (-4° F to 158° F)
Protection Rating:	IP67



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)

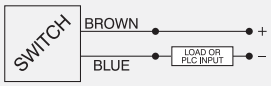


MSS / MSSX

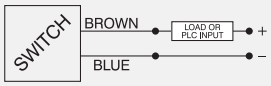
MINATURE SOLID STATE SWITCH, CABLE TYPE, (Two Wire Switch)

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

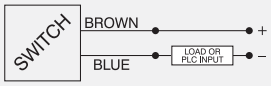
***NOTE:** This is a (2) wire switch used in series with the load. Therefore, this switch can be used with devices requiring either a current sinking (NPN) output or a current sourcing (PNP) output from the solid state switch.

MSSQ

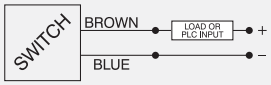
MINIATURE SOLID STATE SWITCH, 8mm MALE QUICK CONNECT, (Two Wire Switch)

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



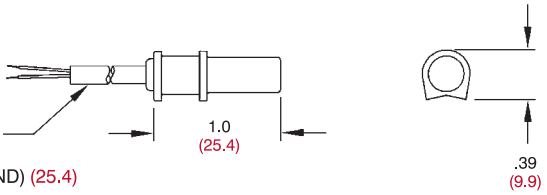
Typical Current Sinking (NPN) Configuration

***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.

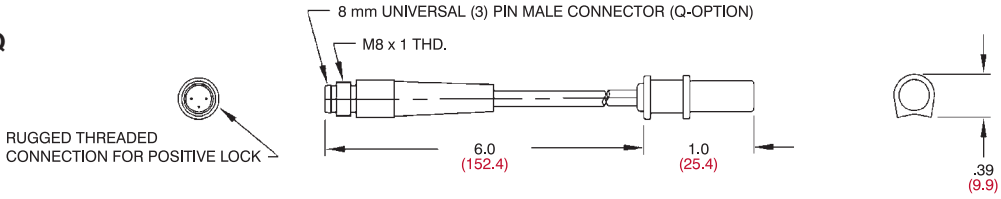
SWITCHES

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)

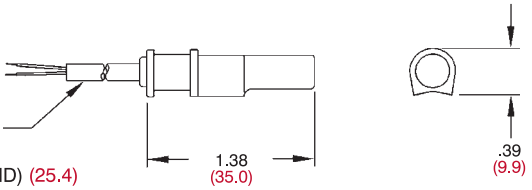


R10Q
MSSQ



RAC / RACX
R10P / R10PX

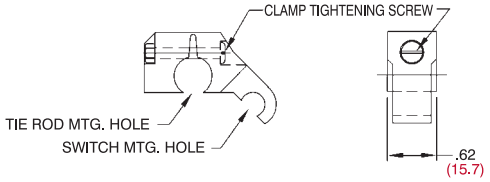
PLAIN CABLE LEADS
R10P / RAC = 24" (0.6m) JACKETED LEADS
R10PX / RACX = 120" (3.0m)
(JACKET CUT BACK 1" ON END) (25.4)



SWITCH BRACKETS

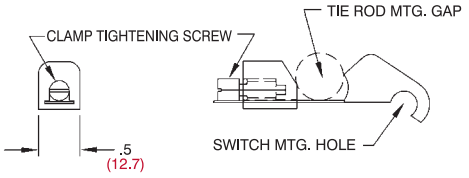
SB15 (For 1½ " Through 2½" Bore Cylinders)

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



SB32 (For 3¼ " Through 12" Bore Cylinders)

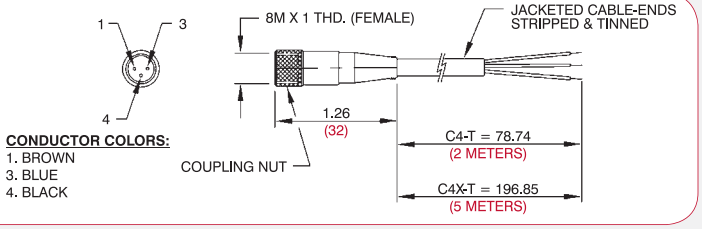
Bracket Construction:
Molded Nylon 6 (Black) and
Stainless Steel Hardware



QUICK CONNECT CORD SET

(Used with "Q" Type Switch Leads)

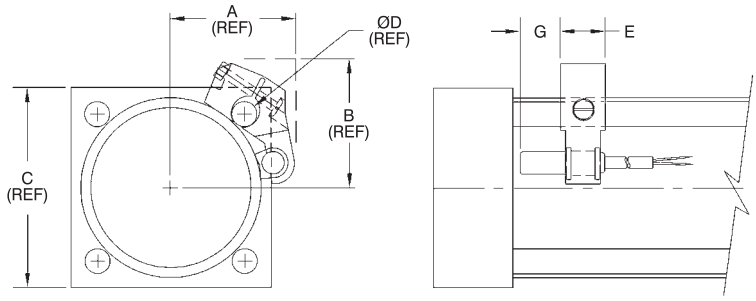
FOR CABLES:
C4-T (2 METER CABLE LENGTH)
C4X-T (5 METER CABLE LENGTH)



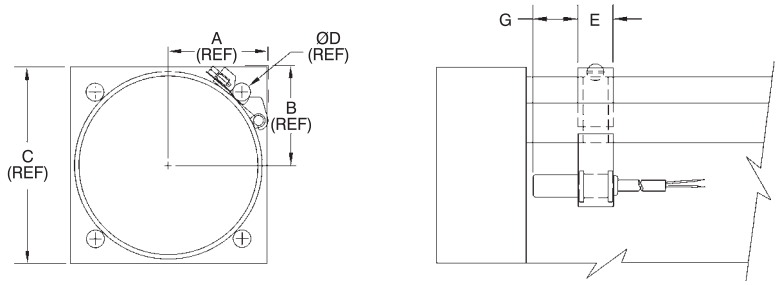
All dimensions are in inches (metric in parentheses)

SB15 / SB32

SB15



SB32



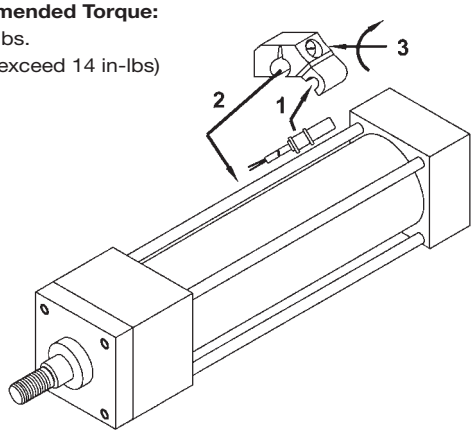
▼ SWITCH BORE DIMENSIONAL TABLE

Part #	Bore Ø	A	B	C	D	E	G
SB15	1½	1⅜	1 13/32	2	¼	⅝	½
	2	1⅝	1 21/32	2½	5/16	⅝	½
	2½	1⅞	1⅞	3	5/16	⅝	½
SB32	3¼	2⅛	2⅛	3¾	⅜	½	9/16
	4	2 7/16	2⅜	4½	⅜	½	9/16
	5	2⅞	2¾*	5½	½	½	9/16
	6	3¼*	3¼*	6½	½	½	9/16
	8	4¼*	4¼*	8½	⅝	½	9/16
	10	5 5/16*	5 5/16*	10⅝	¾	½	9/16
	12	6⅜*	6⅜*	12¾	¾	½	9/16

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

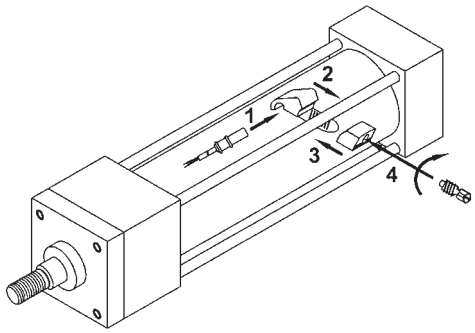
▼ HOW TO ASSEMBLE SWITCH AND BRACKETS

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)



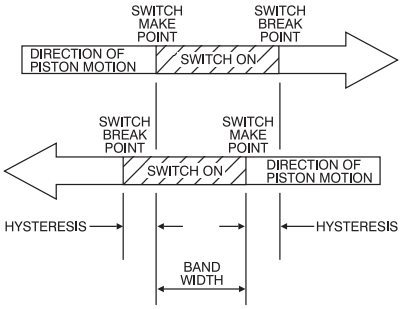
SB32 SWITCH BRACKET (MOUNTING ILLUSTRATION)

HYSTERESIS:

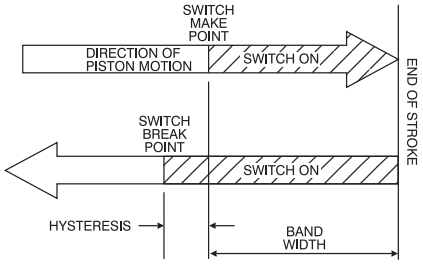
The distance between the switch break point moving in one direction, and the switch make point moving in the opposite direction.

BAND WIDTH:

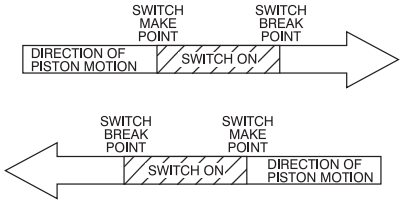
Distance the piston moves while the switch is made (in either direction), less the hysteresis.



MID STROKE OPERATION

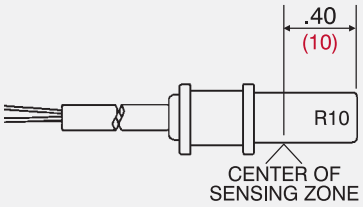


END OF STROKE OPERATION



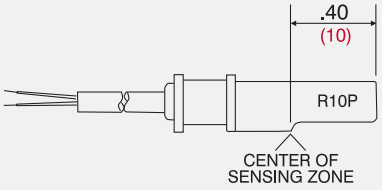
TERMINOLOGY ILLUSTRATION

R10 / R10X / R10Q



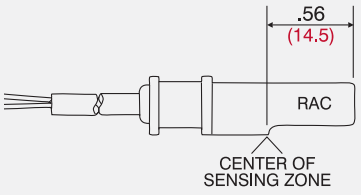
Repeatability	Hysteresis (Maximum)	Band Width (Minimum)
±.010" (±,25 mm)	.040" (1 mm)	.200" (5 mm)

R10P / R10PX



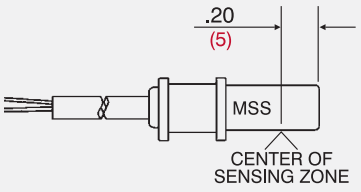
Repeatability	Hysteresis (Maximum)	Band Width (Minimum)
±.010" (±0,25 mm)	.040" (1 mm)	.200" (5 mm)

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

R10 (Switch Model) **X** (Switch Lead Type) **-** **SB15** (Switch 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 erractic 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 performace 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)

Part Number System
Example: A 3¼" Bore, 1" rod, MF1 mount, cushion both ends, Style KK2 rod end, standard seals with a 14¾" stroke.
Part Number:
MN06130-31-HC-KK2-7 x 14¾

	-	MN06130	-	31	-	HC	-	KK2	-	7	x	14¾
1 Double Rod End add "D"		2 Cylinder Code		3 NFPA Mounts		4 Cushions		5 Options		6 Seals		7 Stroke

2 CYLINDER CODE

Bore Ø	Rod Ø	Cylinder Code
1½	⅝	MN00611
	1	MN00612
2	⅝	MN06110
	1	MN06111
2½	⅝	MN06120
	1	MN06121
3¼	1	MN06130
	1⅜	MN06131
4	1	MN06140
	1⅜	MN06141
5	1	MN06150
	1⅜	MN06151
6	1⅜	MN06160
	1¾	MN06161
8	1⅜	MN06180
	1¾	MN06181
10	1¾	MN61100
	2	MN61101
12	2	MN61200
	2½	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 (1½"-6" Bore)
62	MP4	Rear Pivot Eye (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

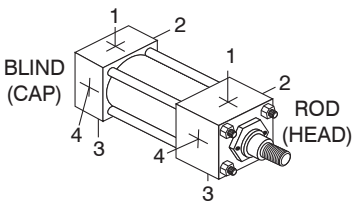
	Description
H	Head Cushion Position 2 is Standard Specify for Positions: 1, 3 & 4
LH	**Long** Head Cushion Position 2 is Standard Specify For Positions: 1, 3 & 4
* ELH	**Extra Long** Head Cushion Position 2 is Standard Specify for Positions: 1, 3 & 4
C	**Cap** Cushion Position 2 is Standard Specify for 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)
BSP	BSP ports (specify size, example: BSP = 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 page120 for specifications)
OP	Optional port location (example: ports at 2 and 3)
OS	Oversize rod diameter (specify size, example: OS = 1⅜")
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)
VS	Viton seals
WB	Piston wear band
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	½	¼	¼	1	1	2
2	½	¼	¼	1	1	2
2½	½	¼	¼	1	1	2
3¼	½	¼	¼	1¼	1¼	2
4	½	¼	¼	1¼	1¼	2
5	½	¼	¼	1¼	1¼	2
6	½	¼	¼	1½	1½	2
8	½	¼	¼	1½	1½	2
10	½	¼	¼	2	2	2
12	½	¼	¼	2	2	2

Standard Port and Cushion Adjustment Positions

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