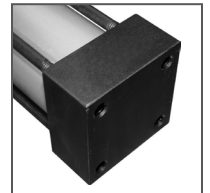


FM Series Flush Mount Cylinders

Flush Mount (FM) Series actuators provide immense flexibility within the NFPA pneumatics market. Four tapped holes at each end and a flush sleeve nut construction on the head allow for simple interchange with other applications — simply change the mounts and you're ready to go!



Benefits

- Same construction as TA series with the added benefit of sleeve nut construction.
- Four tapped holes in Head and Cap Faces Standard. Optional four (4) additional tapped holes in base (MS4 Mount).
- No exposed tie rods or nuts at head and cap provides a clean design.
- Interchanges with many older style NFPA manufacturers' cylinders out in the field.
- Can easily add a multitude of NFPA Mounts by simply bolting in place (refer to page 47 for mount selection).
- Available in Single & Double Rod End models.

Performance Options

- **LF** – Low Friction Seals reduce breakaway and running friction. Effective at all operating pressures.
- **Extended Cushion Lengths** – Longer cushions increase the capacity of air cushions, eliminating costly hydraulic shock absorbers in some cases. Choose from three different cushion lengths for maximum performance.
- **MPR** – Magnetic Piston (for position sensing switches).
- **SSA** – Stainless steel piston rod, tie rods, nuts and fasteners provide corrosion resistance. Refer to Series 'SS' for a complete stainless steel solution.
- **MA** – Micro-Adjust provides a precision adjustment on the cylinder extend stroke, providing quick and accurate cylinder positioning, reducing set-up time.
- **AS** – Adjustable Retract Stroke allows for accurate adjustment on the cylinder return stroke.
- **BSP or SAE Ports** – Special ports are available and do not increase delivery time.
- **NR** – Non-Rotating option incorporates two (2) internal guide rods preventing rod rotation (NFPA dimensions held).

Self-Lubricating Cylinder Design

PTFE coated cast iron bushing, PTFE Wear Band, Hard-Chrome Plated Piston Rod, Hard-Coated Aluminum Tube and PTFE based grease provide permanent lubrication and long cylinder life.

Standard Port Sizes

One Size Less Than TA Series

Additional Port Sizes Available

Bore	1.50	2.00	2.50	3.25	4.00	5.00	6.00	8.00*
Port Size	0.250 NPT	0.250 NPT	0.250 NPT	0.375 NPT	0.375 NPT	0.375 NPT	0.500 NPT	0.750 NPT

*Same as TA Series.

Operating Pressure

250 PSI air (17 BAR)

Operating Temperature

Carboxylated Nitrile: -20°F to 200°F (-29°C to 93°C)
Fluorocarbon: 0°F to 400°F (-18°C to 204°C)

FM - MS4 - 2.5 x 10 - HC - MPR

Series	Substitute
250 PSI Air	FM
NFPA Mounts	Substitute
Front Flange (1.50" - 6.00" Bore)	MF1
Rear Flange (1.50" - 6.00" Bore)	MF2
Rear Pivot Clevis (1.50" - 6.00" Bore)	MP1
Rear Pivot Clevis (1.50" - 6.00" Bore)	MP2
Rear Pivot Eye (1.50" - 4.00" Bore)	MP4
Front & Rear End Angle (1.50" - 8.00" Bore)	MS1
Side Lug (1.50" - 8.00" Bore)	MS2
Bottom Tapped Holes (1.50" - 8.00" Bore)	MS4
Front Trunnion (1.50" - 8.00" Bore)	MT1
Rear Trunnion (1.50" - 8.00" Bore)	MT2
No Mount (1.50" - 8.00" Bore)	MX0
Non-NFPA (1.50" - 4.00" Bore)	Basebar
Style	Substitute
Single Rod	(Blank)
Double Rod End	D
Bore	Substitute
1.50"	1.5
2.00"	2
2.50"	2.5
3.25"	3.25
4.00"	4
5.00"	5
6.00"	6
8.00"	8
Stroke	Substitute
0" to 120" Made to order	

Options	Substitute
Extended Piston Rod Thread (Example: A = 2")	A
Adjustable Stroke - Retract (Specify Length, Example: AS = 4")	AS
Air / Oil Piston	AO
.250" Urethane Bumper Both Ends	B»
.250" Urethane Bumper Cap Only	BC»
.250" Urethane Bumper Head Only	BH»
Bumper Piston Seals (1.50" - 8" Bore)	BP
British Standard Pipe Taper (Specify Size, Example: BSP = 1/4)	BSPP
British Standard Pipe Parallel (Specify Size, Example: BSP = 1/4)	BSPT
Extended Piston Rod (Example: If C = 0.50", Then 1" Rod Extension Is C = 1.50")	C
Large Male Rod Thread	KK2
Female Rod Thread	KK3
Studded Piston Rod (KK3 With Stud, Loctite In Place)	KK3S
Full Diameter Male Rod Thread	KK4
Blank Rod End (No Threads, "A" = 0")	KK5
Low Friction Seals	LF
Low Temperature Seals (LT)	LT
Low Temperature Extreme Seals (LTE)	LTE
Micro-Adjust (12" Max Stroke)	MA
Available On Double Rod End Models	
Micro-Adjust W/ Sound Dampening Bumper (12" Max Stroke)	MAB
Magnetic Piston for Reed or Solid State Switches (R10, R10P, RAC, RHT & MSS)	MPR
Metallic Rod Scraper (Brass Construction)	MS
Non-Rotating	NR
Optional Port Location (Example: OP=3,7)	OP
Oversize Rod Diameter (Specify Size, Example: OS = 1.375")	OS
SAE Ports (Specify Size, Example: SAE#10)	SAE
Spring Extend (1.50, 2.00, 2.50 Bore)	SE»
Spring Return (1.50, 2.00, 2.50 Bore)	SR»
Stainless Steel Piston Rod, Tie Rods, Sleeve Nuts & Fasteners	SSA
Stainless Steel Fasteners	SSF
Stainless Steel Tie Rod Sleeve Nuts	SSN
Stainless Steel Piston Rod	SSR
Stainless Steel Tie Rods & Sleeve Nuts	SST
Stop Tube - Specify Stop Tube Length (In Inches)	
Specify Stroke as ES (Effective Stroke) (Example: TA-MS4-2X24ES-ST=3)	ST»
Steel Cylinder Tube, Black Epoxy Paint Finish	TMS
Stainless Steel Cylinder Tube	TMSS
400 PSI Hydraulic Non-Shock	TH
Fluorocarbon Seals	VS
Special Variation (Specify)	XX
Cushions	Substitute
Adjustable Head Cushion Position 2 Is Standard	H
Specify For Positions: 1, 3 & 4	
Adjustable Long Head Cushion Position 2 Is Standard Specify For Positions: 1, 3 & 4	LH
Adjustable Extra Long Head Cushion	
Position 2 Is Standard Specify For Positions: 1, 3 & 4	ELH»»
Adjustable Cap Cushion	
Position 6 Is Standard Specify For Positions: 5, 7 & 8	C
Adjustable Long Cap Cushion	
Position 6 Is Standard Specify For Positions: 5, 7 & 8	LC
Adjustable Extra Long Cap Cushion	
Position 6 Is Standard Specify For Positions: 5, 7 & 8	ELC»»
Fixed Cushions	Substitute
Fixed Head Cushion (Non-Adjustable, No Adjustment Needle)	FCH
Fixed Cap Cushion (Non-Adjustable, No Adjustment Needle)	FCC
Fixed Head and Cap Cushion (Non-Adjustable, No Adjustment Needle)	FC

Note: Refer to Options for specifications

* Steel tubes do not work with MPR magnetic pistons. Refer to Balluff end of stroke sensors within Switches.

» Refer to Option Length Adder

Ordering example for adjustable cushions in non-standard locations: H3C7

Refer to Options for assistance with cushion length selection.

Cushions can be ordered on same side as ports.

"L" and "EL" cushion options can be ordered as fixed cushions. Example: FCLH, FCELH

About our Part Number System

- Simple, easy to understand
- No excessive codes!
- Eliminates mistakes when ordering

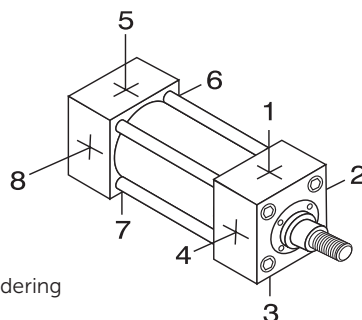
Example: A 2.5" Bore by 10" Stroke NFPA cylinder, Bottom Tap Mount, Head & Cap Cushions, and Magnetic Piston for Switches.

Part Number:

FM-MS4-2.5 x 10-HC-MPR

Standard Port and Cushion Adjustment Positions

- Ports - Positions 1 and 5
- Cushion Adjustment - Positions 2 and 6
- Specify Non-Standard Positions When Ordering

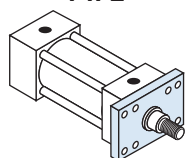


Option Length Adder (Add To Catalog Basic Overall Length Dimensions)								
Option								
Bore	B	BC	BH	ELC	ELH	SE	SR	ST ¹ (Stop Tube) Example: ST=2
1.50	0.500	0.250	0.250	1.000	1.000	Refer to Options for length adders and available bore sizes and strokes		2
2.00	0.500	0.250	0.250	1.000	1.000			2
2.50	0.500	0.250	0.250	1.000	1.000			2
3.25	0.500	0.250	0.250	1.250	1.250			2
4.00	0.500	0.250	0.250	1.250	1.250			2
5.00	0.500	0.250	0.250	1.250	1.250			2
6.00	0.500	0.250	0.250	1.500	1.500			2
8.00	0.500	0.250	0.250	1.500	1.500			2

1 The desired stop tube length adds directly to the overall cylinder length.

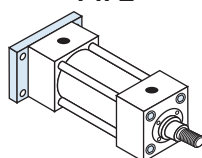
NFPA Mounts

MF1



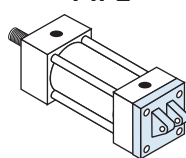
1.50"-6.00"
Bores

MF2



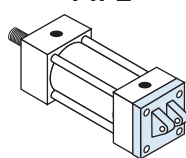
1.50"-6.00"
Bores

MP1



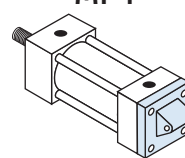
1.50"-6.00"
Bores

MP2



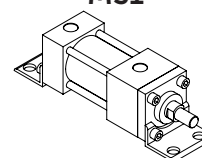
1.50"-6.00"
Bores

MP4



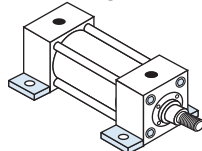
1.50"-4.00"
Bores

MS1



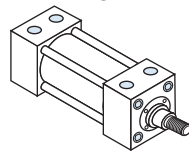
1.50"-8.00"
Bores

MS2



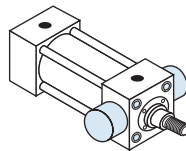
1.50"-8.00"
Bores

MS4



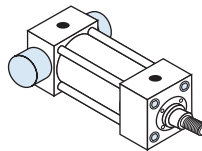
1.50"-8.00"
Bores

MT1



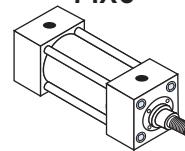
1.50"-8.00"
Bores

MT2



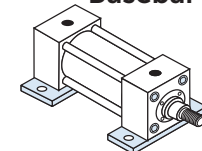
1.50"-8.00"
Bores

MX0



1.50"-8.00"
Bores

Basebar



1.50"-4.00"
Bores

About Rod End Styles

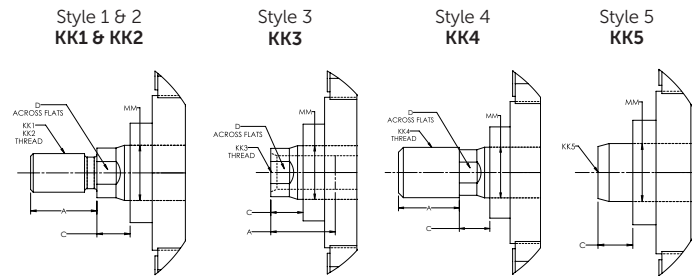
Style 1 Male Rod End is Standard

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).

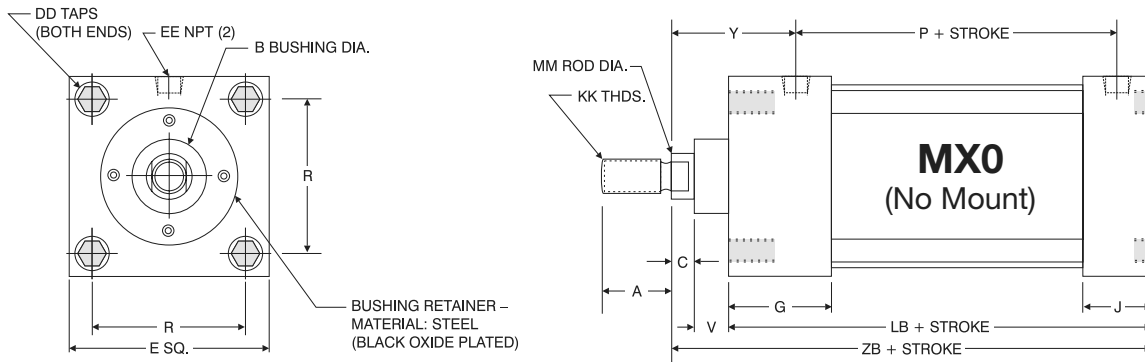
Need something not listed? Just send us a sketch. In most cases, quotes are turned around in one day!

Piston Rod End Styles



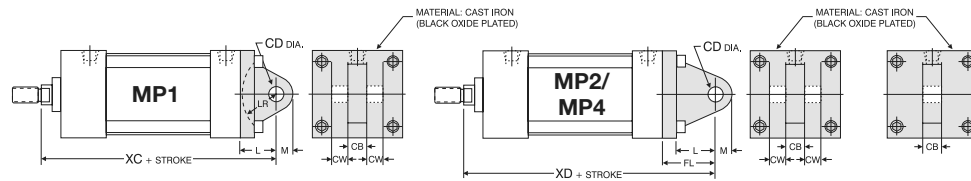
Bore	Rod Diameter (MM)	Standard				Optional							C	D
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male		Style 5 - Blank				
		KK1	A	KK2	A	KK3	A	KK4	A	KK5				
1.50, 2.00, 2.50	0.625 Standard	7/16-20	0.750	1/2-20	0.750	7/16-20	0.750	5/8-18	0.750	No Threads	0.375	0.500		
	1.000 Oversize	3/4-16	1.125	7/8-14	1.125	3/4-16	1.125	1-14	1.125	No Threads	0.500	0.875		
3.25, 4.00, 5.00	1.000 Standard	3/4-16	1.125	7/8-14	1.125	3/4-16	1.125	1-14	1.125	No Threads	0.500	0.875		
	1.375 Oversize	1-14	1.625	1 1/4-12	1.625	1-14	1.625	1 3/8-12	1.625	No Threads	0.625	1.125		
6.00 & 8.00	1.375 Standard	1-14	1.625	1 1/4-12	1.625	1-14	1.625	1 3/8-12	1.625	No Threads	0.625	1.125		
	1.750 Oversize	1 1/4-12	2.000	1 1/2-12	2.000	1 1/4-12	2.000	1 3/4-12	2.000	No Threads	0.750	1.500		

Basic Dimensions: MX0 (No Mount) - Standard Rod



FM Series Basic Dimensions MX0																
Bore	A	B	C	DD	EE	G	J	KK	LB	MM	P	R	V	Y	ZB	
1.50	0.750	1.125	0.375	1/4-28	2.000	0.250	1.500	1.000	7/16-20	3.625	0.625	2.375	1.438	0.625	1.875	4.625
2.00	0.750	1.125	0.375	5/16-24	2.500	0.250	1.500	1.000	7/16-20	3.625	0.625	2.375	1.843	0.625	1.875	4.625
2.50	0.750	1.125	0.375	5/16-24	3.000	0.250	1.500	1.000	7/16-20	3.750	0.625	2.500	2.188	0.625	1.875	4.750
3.25	1.125	1.500	0.500	3/8-24	3.750	0.375	1.750	1.250	3/4-16	4.250	1.000	2.750	2.760	0.875	2.375	5.625
4.00	1.125	1.500	0.500	3/8-24	4.500	0.375	1.750	1.250	3/4-16	4.250	1.000	2.750	3.320	0.875	2.375	5.625
5.00	1.125	1.500	0.500	1/2-20	5.500	0.375	1.750	1.250	3/4-16	4.500	1.000	3.000	4.100	0.875	2.375	5.875
6.00	1.625	2.000	0.625	1/2-20	6.500	0.500	2.000	1.500	1-14	5.000	1.375	3.250	4.875	1.000	2.750	6.625
8.00	1.625	2.000	0.625	5/8-18	8.500	0.750	2.000	1.500	1-14	5.125	1.375	3.375	6.438	1.000	2.750	7.313

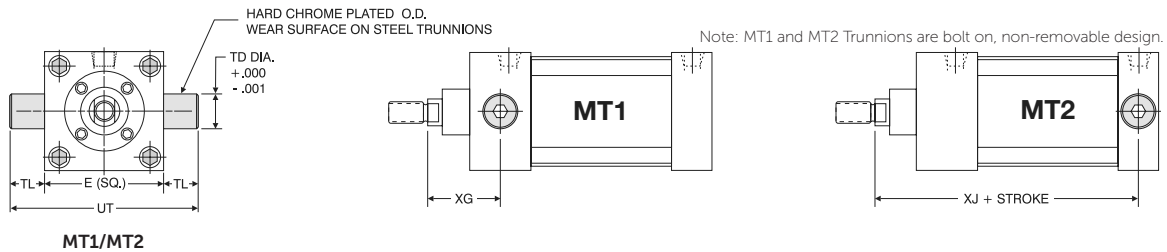
Pivot Mounts – Flush Mount (With Sleeve Nut Construction)



FM Series MP1 & MP2 Clevis and MP4 Rod Eye Mount Dimensions

Bore	Rod Diameter	CB	CD	CW	FL	L	LR	M	XC	Add Stroke XD
1.50	0.625 Standard 1.000 Oversize	0.750	0.500	0.500	1.125	0.750	0.750	0.625	5.375 5.750	5.750 6.125
2.00	0.625 Standard 1.000 Oversize	0.750	0.500	0.500	1.125	0.750	0.750	0.625	5.375 5.750	5.750 6.125
2.50	0.625 Standard 1.000 Oversize	0.750	0.500	0.500	1.125	0.750	0.750	0.625	5.500 5.875	5.875 6.250
3.25	1.000 Standard 1.375 Oversize	1.250	0.750	0.625	1.875	1.250	1.250	0.875	6.875 7.125	7.500 7.750
4.00	1.000 Standard 1.375 Oversize	1.250	0.750	0.625	1.875	1.250	1.250	0.875	6.875 7.125	7.500 7.750
5.00	1.000 Standard 1.375 Oversize	1.250	0.750	0.625	1.875	1.250	1.250	0.875	7.125 7.375	7.750 8.000
6.00	1.375 Standard 1.750 Oversize	1.500	1.000	0.750	2.250	1.500	1.500	1.000	8.125 8.375	8.875 9.125

For dimensions not shown, see page 38. Clevis pins are provided with pivot mounts.



MT1/MT2

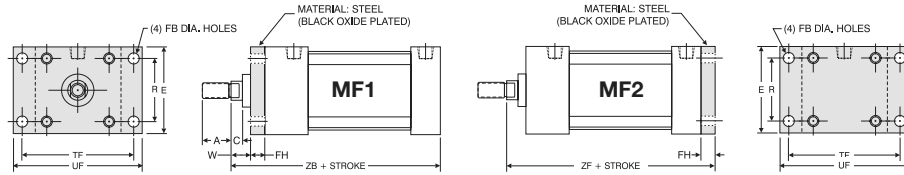
Note: MT1 standard cushion locations at 3 and 6
MT2 standard cushion locations at 2 and 7

FM Series MT1 Head Trunnion and MT2 Cap Trunnion Mount Dimensions

Bore	Rod Diameter	E	TD	TL	UT	XG	Add Stroke XJ
1.50	0.625 Standard 1.000 Oversize	2.000	1.000	1.000	4.000	1.750 N/A*	4.125 4.500
2.00	0.625 Standard 1.000 Oversize	2.500	1.000	1.000	4.500	1.750 2.125	4.125 4.500
2.50	0.625 Standard 1.000 Oversize	3.000	1.000	1.000	5.000	1.750 2.125	4.250 4.625
3.25	1.000 Standard 1.375 Oversize	3.750	1.000	1.000	5.750	2.250 2.500	5.000 5.250
4.00	1.000 Standard 1.375 Oversize	4.500	1.000	1.000	6.500	2.250 2.500	5.000 5.250
5.00	1.000 Standard 1.375 Oversize	5.500	1.000	1.000	7.500	2.250 2.500	5.250 5.500
6.00	1.375 Standard 1.750 Oversize	6.500	1.375	1.375	9.250	2.625 2.875	5.875 6.125
8.00	1.375 Standard 1.750 Oversize	8.500	1.375	1.375	11.250	2.625 2.875	6.000 6.250

*No oversize rod available on 1.50" bore MT1.
For dimensions not shown, see page 38.

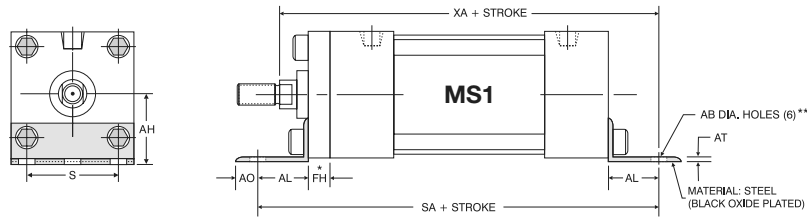
Flange Mounts – Flush Mount (With Sleeve Nut Construction)



FM Series MF1 and MF2 Flange Mount Dimensions												
Bore	Rod Diameter	A	C	E	FB	FH	R	TF	UF	W	ZB	ZF
1.50	0.625 Standard	0.750	0.375	2.000	0.313	0.375	1.430	2.750	3.375	0.625	4.625	5.000
	1.000 Oversize	1.125	0.500							1.000	5.000	5.375
2.00	0.625 Standard	0.750	0.375	2.500	0.375	0.375	1.840	3.375	4.125	0.625	4.625	5.000
	1.000 Oversize	1.125	0.500							1.000	5.000	5.375
2.50	0.625 Standard	0.750	0.375	3.000	0.375	0.375	2.188	3.875	4.625	0.625	4.750	5.125
	1.000 Oversize	1.125	0.500							1.000	5.125	5.500
3.25	1.000 Standard	1.125	0.500	3.750	0.438	0.625	2.760	4.688	5.500	0.750	5.625	6.250
	1.375 Oversize	1.625	0.625							1.000	5.875	6.500
4.00	1.000 Standard	1.125	0.500	4.500	0.438	0.625	3.320	5.438	6.250	0.750	5.625	6.250
	1.375 Oversize	1.625	0.625							1.000	5.875	6.500
5.00	1.000 Standard	1.125	0.500	5.500	0.563	0.625	4.100	6.625	7.625	0.750	5.875	6.500
	1.375 Oversize	1.625	0.625							1.000	6.125	6.750
6.00	1.375 Standard	1.625	0.625	6.500	0.563	0.750	4.875	7.625	8.625	0.875	6.625	7.375
	1.750 Oversize	2.000	0.750							1.125	6.875	7.625

For dimensions not shown, see page 38.

Base Mounts – Flush Mount (With Sleeve Nut Construction)



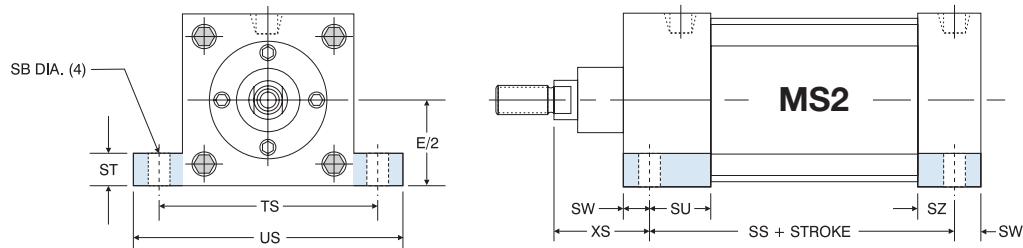
FM Series MS1 Angle Mount Dimensions										
Bore	Rod Diameter	AB	AH	AL	AO	AT	FH	S	Add Stroke SA	XA
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.125	0.375	1.250	6.000	5.625
	1.000 Oversize									6.000
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.125	0.375	1.750	6.000	5.625
	1.000 Oversize									6.000
2.50	0.625 Standard	0.438	1.625	1.000	0.375	0.125	0.375	2.250	6.125	5.750
	1.000 Oversize									6.125
3.25	1.000 Standard	0.563	1.938	1.250	0.500	0.125	0.625	2.750	7.375	6.875
	1.375 Oversize									7.125
4.00	1.000 Standard	0.563	2.250	1.250	0.500	0.125	0.625	3.500	7.375	6.875
	1.375 Oversize									7.125
5.00	1.000 Standard	0.688	2.750	1.375	0.625	0.188	0.625	4.250	7.875	7.250
	1.375 Oversize									7.500
6.00	1.375 Standard	0.813	3.250	1.375	0.625	0.188	0.750	5.250	8.500	8.000
	1.750 Oversize									8.250
8.00	1.375 Standard	0.813	4.250	1.813	0.688	0.250	0.625*	7.125	8.750	8.563
	1.750 Oversize									8.813

*3.50" diameter round retainer on 8.00" bore (MS1 bracket bolted directly to head).

**1.50" bore has four (4) "AB" holes on "S" dimension.

For dimensions not shown, see page 38.

Base Mounts – Flush Mount (With Sleeve Nut Construction)

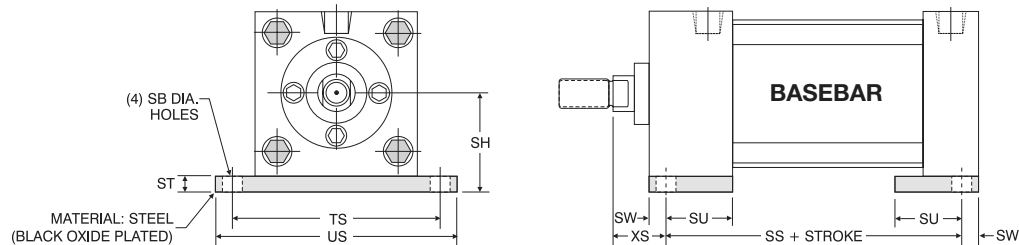


FM Series MS2 Side Lug Mount Dimensions

Bore	Rod Diameter	SB	E/2	ST	SU	SW	SZ	TS	US	XS	Add Stroke SS
1.50	0.625 Standard 1.000 Oversize	0.438	1.000	0.500	1.125	0.375	0.625	2.750	3.500	1.375 1.750	2.875
2.00	0.625 Standard 1.000 Oversize	0.438	1.250	0.500	1.125	0.375	0.625	3.250	4.000	1.375 1.750	2.875
2.50	0.625 Standard 1.000 Oversize	0.438	1.500	0.500	1.125	0.375	0.625	3.750	4.500	1.375 1.750	3.000
3.25	1.000 Standard 1.375 Oversize	0.563	1.875	0.750	1.250	0.500	0.750	4.750	5.750	1.875 2.125	3.250
4.00	1.000 Standard 1.375 Oversize	0.563	2.250	0.750	1.250	0.500	0.750	5.500	6.500	1.875 2.125	3.250
5.00	1.000 Standard 1.375 Oversize	0.813	2.750	1.000	1.063	0.688	0.563	6.875	8.250	2.063 2.313	3.125
6.00	1.375 Standard 1.750 Oversize	0.813	3.250	1.000	1.313	0.688	0.813	7.875	9.250	2.313 2.563	3.625
8.00	1.375 Standard 1.750 Oversize	0.813	4.250	1.000	1.313	0.688	0.813	9.875	11.250	2.313 2.563	3.750

For dimensions not shown, see page 38.

FM-Basebar (Non-NFPA)



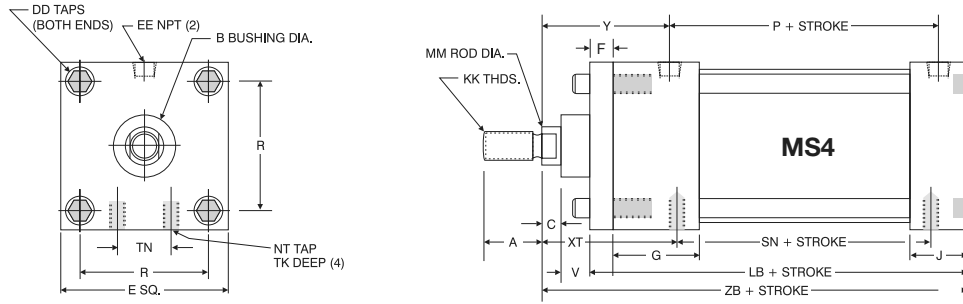
FM Series Basebar Mount (Non-NFPA) Dimensions

Bore	Rod Diameter	SB	SH	ST	SU	SW	TS	US	XS	Add Stroke SS
1.50	0.625 Standard 1.000 Oversize	0.438	1.250	0.250	1.125	0.375	2.750	3.500	1.375 1.750	2.875
2.00	0.625 Standard 1.000 Oversize	0.438	1.500	0.250	1.125	0.375	3.250	4.000	1.375 1.750	2.875
2.50	0.625 Standard 1.000 Oversize	0.438	1.875	0.375	1.125	0.375	3.750	4.500	1.375 1.750	3.000
3.25	1.000 Standard 1.375 Oversize	0.563	2.375	0.500	1.250	0.500	4.750	5.750	1.875 2.125	3.250
4.00	1.000 Standard 1.375 Oversize	0.563	2.750	0.500	1.250	0.500	5.500	6.500	1.875 2.125	3.250

Note: 1.50" to 3.25" oversized rods have full front retainer.

For dimensions not shown, see page 38.

Base Mounts – Flush Mount (With Sleeve Nut Construction)

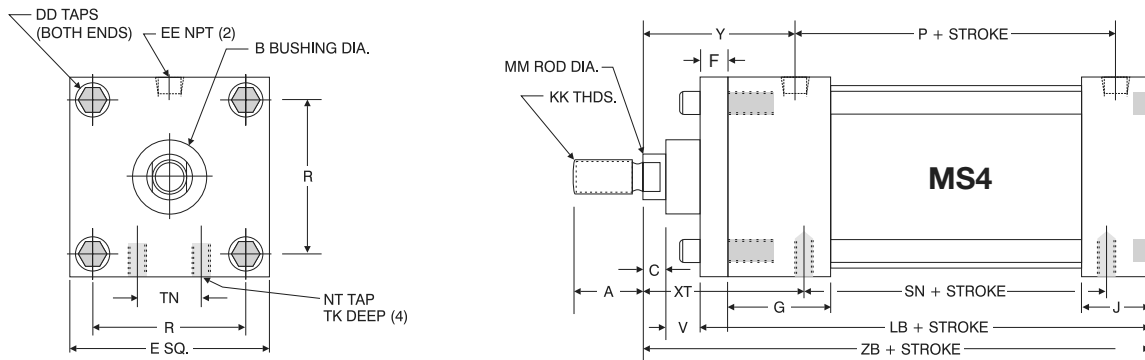


FM Series MS4 Flush Mount Dimensions

Bore	A	B	C	DD	E	EE	G	J	KK	LB	Rod Diameter (MM)	NT	P	R	SN	TK	TN	V	XT	Y	ZB
1.50	0.750	1.125	0.375	1/4-28	2.000	0.250	1.500	1.000	7/16-20	3.625	0.625	1/4-20	2.375	1.425	2.250	0.375	0.625	0.625	1.938	1.875	4.625
2.00	0.750	1.125	0.375	5/16-24	2.500	0.250	1.500	1.000	7/16-20	3.625	0.625	5/16-18	2.375	1.844	2.250	0.500	0.875	0.625	1.938	1.875	4.625
2.50	0.750	1.125	0.357	5/16-24	3.000	0.250	1.500	1.000	7/16-20	3.750	0.625	3/8-16	2.500	2.188	2.375	0.625	1.250	0.625	1.938	1.875	4.750
3.25	1.125	1.500	0.500	3/8-24	3.750	0.375	1.750	1.250	3/4-16	4.250	1.000	1/2-13	2.750	2.760	2.625	0.750	1.500	0.875	2.438	2.375	5.625
4.00	1.125	1.500	0.500	3/8-24	4.500	0.375	1.750	1.250	3/4-16	4.250	1.000	1/2-13	2.750	3.320	2.625	0.750	2.063	0.875	2.438	2.375	5.625
	1.625	2.000	0.625						1-14		1.375							1.000	2.688	2.625	5.875
5.00	1.125	1.500	0.500	1/2-20	5.500	0.375	1.750	1.250	3/4-16	4.500	1.000	5/8-11	3.000	4.100	2.875	1.000	2.688	0.875	2.438	2.375	5.875
	1.625	2.000	0.625						1-14		1.375							1.000	2.688	2.625	6.125
6.00	1.625	2.000	0.625	1/2-20	6.500	0.500	2.000	1.500	1 1/4-12	5.000	1.750	3/4-10	3.250	4.875	3.125	1.125	3.250	1.125	3.063	3.000	6.875
	2.000	2.375	0.750						1-14		1.375							1.000	2.813	2.750	7.313
8.00	1.625	2.000	0.625	5/8-18	8.500	0.750	2.000	1.500	1 1/4-12	5.125	1.750	3/4-10	3.375	6.438	3.250	1.125	4.500	1.125	3.063	3.000	7.563
	2.000	2.375	0.750																		

For dimensions not shown, see page 38.

FM-MS4: Oversize Rod Diameter (1.50" Bore¹ to 3.25" Bore)



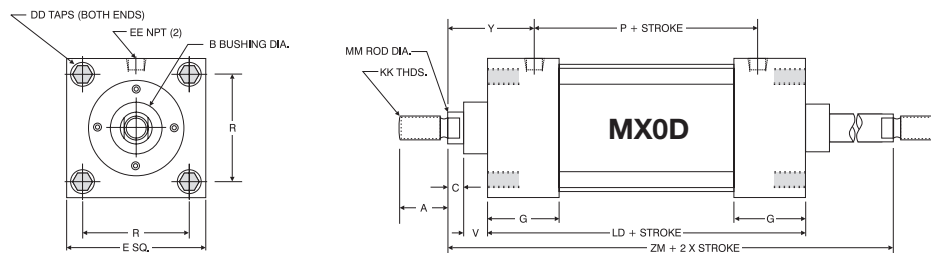
FM Series Oversize Rod MS4 Flush Mount Dimensions

Bore	A	B	C	DD	E	EE	F	G	J	KK	LB	Rod Diameter (MM)	NT	P	R	SN	TK	TN	V	XT	Y	ZB
1.50	1.125	1.500	0.500	1/4-28	2.000	0.250	0.375	1.500	1.000	3/4-16	3.625	1.000	1/4-20	2.375	1.438	2.250	0.375	0.625	0.500	2.313	2.250	5.000
2.00	1.125	1.500	0.500	5/16-24	2.500	0.250	0.375	1.500	1.000	3/4-16	3.625	1.000	5/16-18	2.375	1.844	2.250	0.500	0.875	0.500	2.313	2.250	5.000
2.50	1.125	1.500	0.500	5/16-24	3.000	0.250	0.375	1.500	1.000	3/4-16	3.750	1.000	3/8-16	2.500	2.188	2.375	0.625	1.250	0.500	2.313	2.250	5.125
3.25	1.625	2.000	0.625	3/8-24	3.750	0.375	0.625	1.750	1.250	1-14	4.250	1.375	1/2-13	2.750	2.760	2.625	0.750	1.500	0.375	2.688	2.625	5.875

1. 1.50" oversize needs a full square retainer and retaining bolts.

For dimensions not shown, see page 38.

Double Rod End (No Mount) – Flush Mount (With Sleeve Nut Construction)

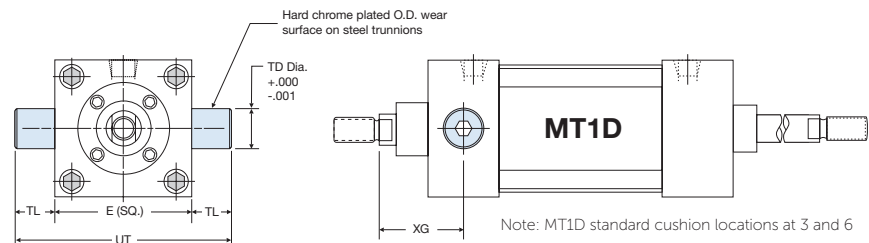


FM Series Double Rod End Basic Dimensions MX0D

Bore	A	B	C	DD	E	EE	G	KK	LD	MM	P	R	V	Y	ZM
1.50	0.750	1.125	0.375	1/4-28	2.000	0.250	1.500	7/16-20	4.125	0.625	2.375	1.438	0.625	1.875	6.125
2.00	0.750	1.125	0.375	5/16-24	2.500	0.250	1.500	7/16-20	4.125	0.625	2.375	1.844	0.625	1.875	6.125
2.50	0.750	1.125	0.375	5/16-24	3.000	0.250	1.500	7/16-20	4.250	0.625	2.500	2.188	0.625	1.875	6.250
3.25	1.125	1.500	0.500	3/8-24	3.750	0.375	1.750	3/4-16	4.750	1.000	2.750	2.760	0.875	2.375	7.500
4.00	1.125	1.500	0.500	3/8-24	4.500	0.375	1.750	3/4-16	4.750	1.000	2.750	3.320	0.875	2.375	7.500
5.00	1.125	1.500	0.500	1/2-20	5.500	0.375	1.750	3/4-16	5.000	1.000	3.000	4.100	0.875	2.375	7.750
6.00	1.625	2.000	0.625	1/2-20	6.500	0.500	2.000	1-14	5.500	1.375	3.250	4.875	1.000	2.750	8.750
8.00	1.625	2.000	0.625	5/8-18	8.500	0.750	2.000	1-14	5.625	1.375	3.375	6.438	1.000	2.750	8.875

For oversize rod dimensions, refer to page 36.

Double Rod End Pivot Mount



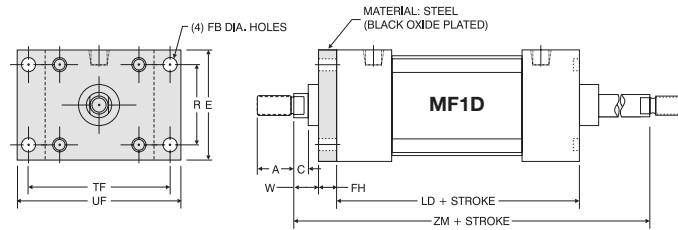
FM Series Double Rod End MT1D Head Trunnion Mount Dimensions

Bore	Rod Diameter	E	TD	TL	UT	XG
1.50*	0.625 Standard	2.000	1.000	1.000	4.000	1.750
2.00	0.625 Standard 1.000 Oversize	2.500	1.000	1.000	4.500	1.750 2.125
2.50	0.625 Standard 1.000 Oversize	3.000	1.000	1.000	5.000	1.750 2.125
3.25	1.000 Standard 1.375 Oversize	3.750	1.000	1.000	5.750	2.250 2.500
4.00	1.000 Standard 1.375 Oversize	4.500	1.000	1.000	6.500	2.250 2.500
5.00	1.000 Standard 1.375 Oversize	5.500	1.000	1.000	7.500	2.250 2.500
6.00	1.375 Standard 1.750 Oversize	6.500	1.375	1.375	9.250	2.625 2.875
8.00	1.375 Standard 1.750 Oversize	8.500	1.375	1.375	11.250	2.625 2.875

*No oversize rod available on 1.50" bore MT1D.

For dimensions not shown, see chart above.

Double Rod End Flange Mount – Flush Mount (With Sleeve Nut Construction)



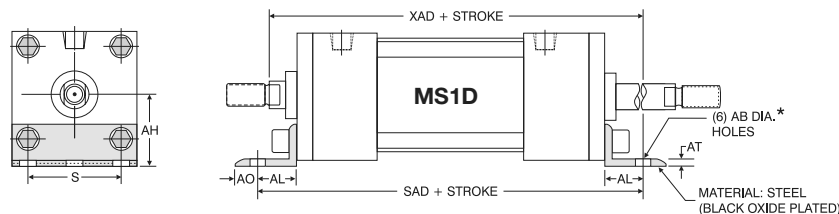
FM Series Double Rod End MF1D Flange Mount Dimensions

Bore	Rod Diameter	A	C	E	FB	FH	R	TF	UF	W	Add Stroke LD	ZM
1.50	0.625 Standard	0.750	0.375	2.000	0.313	0.375	1.438	2.750	3.375	0.625	4.125	6.125
	1.000 Oversize	1.125	0.500							1.000		6.875
2.00	0.625 Standard	0.750	0.375	2.500	0.375	0.375	1.844	3.375	4.125	0.625	4.125	6.125
	1.000 Oversize	1.125	0.500							1.000		6.875
2.50	0.625 Standard	0.750	0.375	3.000	0.375	0.375	2.188	3.875	4.625	0.625	4.250	6.250
	1.000 Oversize	1.125	0.500							1.000		7.000
3.25	1.000 Standard	1.125	0.500	3.750	0.438	0.625	2.760	4.688	5.500	0.750	4.750	7.500
	1.375 Oversize	1.625	0.625							1.000		8.000
4.00	1.000 Standard	1.125	0.500	4.500	0.438	0.625	3.320	5.438	6.250	0.750	4.750	7.500
	1.375 Oversize	1.625	0.625							1.000		8.000
5.00	1.000 Standard	1.125	0.500	5.500	0.563	0.625	4.100	6.625	7.625	0.750	5.000	7.750
	1.375 Oversize	1.625	0.625							1.000		8.250
6.00	1.375 Standard	1.625	0.625	6.500	0.563	0.750	4.875	7.625	8.625	0.875	5.500	8.750
	1.750 Oversize	2.000	0.750							1.125		9.250

Note: 1.50" to 3.25" oversized rods use full retainers.

For dimensions not shown, see page 38.

Double Rod End Base Mounts – Flush Mount (With Sleeve Nut Construction)



FM Series Double Rod End MS1D Angle Mount Dimensions

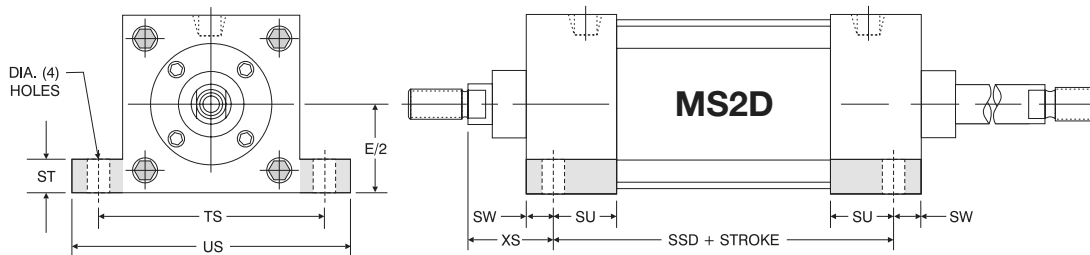
Bore	Rod Diameter	AB	AH	AL	AO	AT	S	SAD	Add Stroke XAD
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.125	1.250	6.875	6.500
	1.000 Oversize								6.875
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.125	1.750	6.875	6.500
	1.000 Oversize								6.875
2.50	0.625 Standard	0.438	1.625	1.000	0.375	0.125	2.250	7.000	6.625
	1.000 Oversize								7.000
3.25	1.000 Standard	0.563	1.938	1.250	0.500	0.125	2.750	8.500	8.000
	1.375 Oversize								8.250
4.00	1.000 Standard	0.563	2.250	1.250	0.500	0.125	3.500	8.500	8.000
	1.375 Oversize								8.250
5.00	1.000 Standard	0.688	2.750	1.375	0.625	0.188	4.250	9.000	8.375
	1.375 Oversize								8.625
6.00	1.375 Standard	0.813	3.250	1.375	0.625	0.188	5.250	9.750	9.250
	1.750 Oversize								9.500
8.00	1.375 Standard	0.813	4.250	1.813	0.688	0.250	7.125	9.250	9.063
	1.750 Oversize								9.313

*1.50" bore has four (4) "AB" holes on "S" dimension.

Note: Flush retainer on 8.00" bore (MS1 bracket bolted directly to head).

For dimensions not shown, see page 38.

Double Rod End Base Mounts – Flush Mount (With Sleeve Nut Construction)



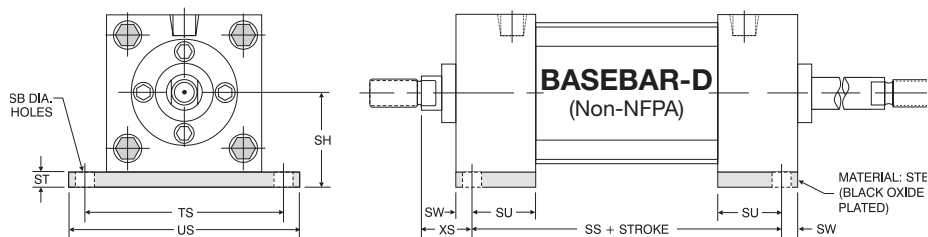
FM Series Double Rod End MS2D Side Lug Mount Dimensions

Bore	Rod Diameter	SB	E/2	ST	SU	SW	TS	US	XS	Add Stroke SSD
1.50	0.625 Standard 1.000 Oversize	0.438	1.000	0.500	1.125	0.375	2.750	3.500	1.375 1.750	3.375
2.00	0.625 Standard 1.000 Oversize	0.438	1.250	0.500	1.125	0.375	3.250	4.000	1.375 1.750	3.375
2.50	0.625 Standard 1.000 Oversize	0.438	1.500	0.500	1.125	0.375	3.750	4.500	1.375 1.750	3.500
3.25	1.000 Standard 1.375 Oversize	0.563	1.875	0.750	1.250	0.500	4.750	5.750	1.875 2.125	3.750
4.00	1.000 Standard 1.375 Oversize	0.563	2.250	0.750	1.250	0.500	5.500	6.500	1.875 2.125	3.750
5.00	1.000 Standard 1.375 Oversize	0.813	2.750	1.000	1.063	0.688	6.875	8.250	2.063 2.313	3.625
6.00	1.375 Standard 1.750 Oversize	0.813	3.250	1.000	1.313	0.688	7.875	9.250	2.313 2.563	4.125
8.00	1.375 Standard 1.750 Oversize	0.813	4.250	1.000	1.563	0.688	9.875	11.250	2.313 2.563	4.250

Note: 1.50" to 3.25" oversized rods use full retainers.

For dimensions not shown, see page 38.

FM-Basebar-D (Non-NFPA)

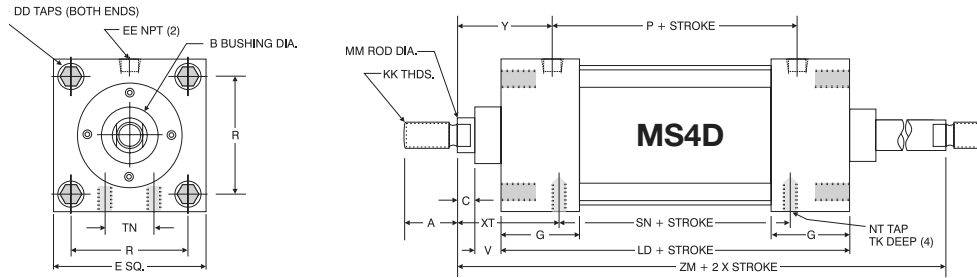


FM Series Double Rod End Basebar Mount (Non-NFPA) Dimensions

Bore	Rod Diameter	SB	SH	Add Stroke SS	ST	SU	SW	TS	US	XS
1.50	0.625 Standard 1.000 Oversize	0.438	1.250	3.375	0.250	1.125	0.375	2.750	3.500	1.375 1.750
2.00	0.625 Standard 1.000 Oversize	0.438	1.500	3.375	0.250	1.125	0.375	3.250	4.000	1.375 1.750
2.50	0.625 Standard 1.000 Oversize	0.438	1.875	3.500	0.375	1.125	0.357	3.750	4.500	1.375 1.750
3.25	1.000 Standard 1.375 Oversize	0.563	2.375	3.750	0.500	1.250	0.500	4.750	5.750	1.875 2.125
4.00	1.000 Standard 1.375 Oversize	0.563	2.750	3.750	0.500	1.250	0.500	5.500	6.500	1.875 2.125

For dimensions not shown, see page 38.

FM-MS4D: Standard Rod Diameter



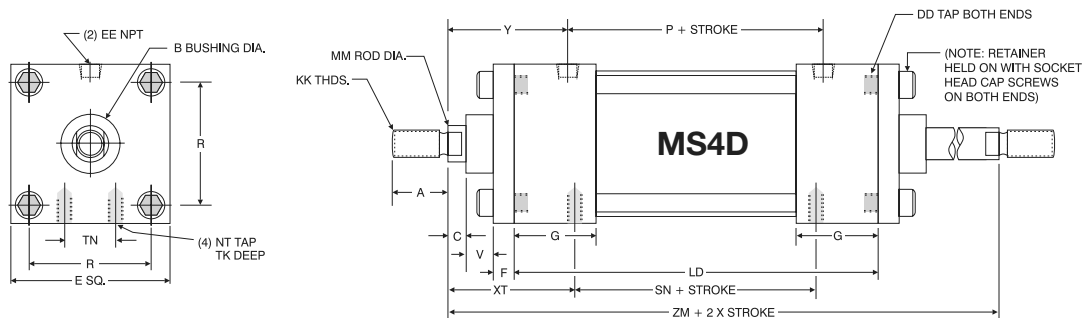
FM Series Double Rod End MS4D Flush Mount Dimensions

Bore	A	B	C	DD	E	EE	G	KK	LD	MM	P	R	V	Y	NT	TK	TN	SN	XT	ZM
1.50	0.750	1.125	0.375	1/4-28	2.000	0.250	1.500	7/16-20	4.125	0.625	2.375	1.438	0.625	1.875	1/4-20	0.375	0.625	2.250	1.938	6.125
2.00	0.750	1.125	0.375	5/16-24	2.500	0.250	1.500	7/16-20	4.125	0.625	2.375	1.844	0.625	1.875	5/16-18	0.500	0.875	2.250	1.938	6.125
2.50	0.750	1.125	0.375	5/16-24	3.000	0.250	1.500	7/16-20	4.250	0.625	2.500	2.188	0.625	1.875	3/8-16	0.625	1.250	2.375	1.938	6.250
3.25	1.125	1.500	0.500	3/8-24	3.750	0.375	1.750	3/4-16	4.750	1.000	2.750	2.760	0.875	2.375	1/2-13	0.750	1.500	2.625	2.438	7.500
4.00	1.125	1.500	0.500	3/8-24	4.500	0.375	1.750	3/4-16	4.750	1.000	2.750	3.320	0.875	2.375	1/2-13	0.750	2.063	2.625	2.438	7.500
5.00	1.125	1.500	0.500	1/2-20	5.500	0.375	1.750	3/4-16	5.000	1.000	3.000	4.100	0.875	2.375	5/8-11	1.000	2.688	2.875	2.438	7.750
6.00	1.625	2.000	0.625	1/2-20	6.500	0.500	2.000	1-14	5.500	1.375	3.250	4.875	1.000	2.750	3/4-10	1.125	3.250	3.125	2.813	8.750
8.00	1.625	2.000	0.625	5/8-18	8.500	0.750	2.000	1-14	5.625	1.375	3.375	6.438	1.000	2.750	3/4-10	1.125	4.500	3.250	2.813	8.875

Note: 1.50" to 3.25" oversized rods use full retainers.

For dimensions not shown, see page 38.

FM-MS4D: Oversize Rod Diameter



FM Series Double Rod End Oversize Rod MS4D Flush Mount Dimensions

Bore	A	B	C	DD	E	EE	F	G	KK	LD	MM	P	R	V	Y	NT	TK	TN	SN	XT	ZM
1.50	1.125	1.500	0.500	1/4-28	2.000	0.250	0.375	1.500	3/4-16	4.125	1.000	2.375	1.438	0.500	2.250	1/4-20	0.375	0.625	2.250	2.313	6.875
2.00	1.125	1.500	0.500	5/16-24	2.500	0.250	0.375	1.500	3/4-16	4.125	1.000	2.375	1.845	0.500	2.250	5/16-18	0.500	0.875	2.250	2.313	6.875
2.50	1.125	1.500	0.500	5/16-24	3.000	0.250	0.375	1.500	3/4-16	4.250	1.000	2.500	2.188	0.500	2.250	3/8-16	0.625	1.250	2.375	2.313	7.000
3.25	1.625	2.000	0.625	3/8-24	3.750	0.375	0.625	1.750	1-14	4.750	1.375	2.750	2.760	0.375	2.625	1/2-13	0.750	1.500	2.625	2.688	8.000
4.00	1.625	2.000	0.625	3/8-24	4.500	0.375	0.625	1.750	1-14	4.750	1.375	2.750	3.320	0.375	2.625	1/2-13	0.750	2.063	2.625	2.688	8.000
5.00	1.625	2.000	0.625	1/2-20	5.500	0.375	0.625	1.750	1-14	5.000	1.375	3.000	4.100	0.375	2.625	5/8-11	1.000	2.688	2.875	2.688	8.250
6.00	2.000	2.375	0.750	1/2-20	6.500	0.500	0.750	2.000	1 1/4-12	5.500	1.750	3.250	4.875	0.500	3.125	3/4-10	1.125	3.250	3.125	3.063	9.250
8.00	2.000	2.375	0.750	5/8-18	8.500	0.750	0.625	2.000	1 1/4-12	5.625	1.750	3.375	6.438	1.125	3.000	3/4-10	1.125	4.500	3.250	3.063	9.375

Note: Flush retainer on 4.00" to 8.00" bore.

Mounting Kits

Most FM Series cylinders are shipped ready to accept any FM Series mounting kits. FM cylinders can be used in different applications simply by changing the mount. In addition, the FM Flush Mount feature can be used for mounting—just use the four (4) tapped holes in head or cap to mount cylinder. The FM Series is one of the most versatile cylinders on the market. Choose from six (6) mounting kits. Each kit comes complete with fasteners; pins are ordered separately.



Series FM Mounting Kits

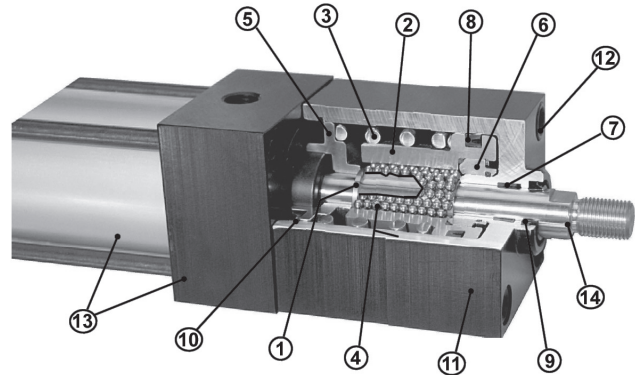
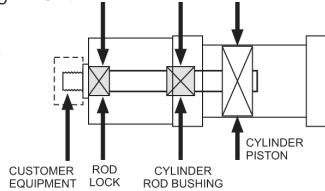
Bore	MP1	MP2	MP4	MF1	MF1 OS Rod	MF2	MS1	MS1 OS Rod	Basebar
1.50	FM-MP1-15-KIT	FM-MP2-15-KIT	FM-MP4-15-KIT	FM-MF1-15-KIT	FM-MF1-15-OS-KIT	FM-MF2-15-KIT	FM-MS1-15-KIT	N/A	FM-BASEBAR-15-KIT
2.00	FM-MP1-20-KIT	FM-MP2-20-KIT	FM-MP4-20-KIT	FM-MF1-20-KIT	FM-MF1-20-OS-KIT	FM-MF2-20-KIT	FM-MS1-20-KIT	N/A	FM-BASEBAR-20-KIT
2.50	FM-MP1-25-KIT	FM-MP2-25-KIT	FM-MP4-25-KIT	FM-MF1-25-KIT	FM-MF1-25-OS-KIT	FM-MF2-25-KIT	FM-MS1-25-KIT	N/A	FM-BASEBAR-25-KIT
3.25	FM-MP1-32-KIT	FM-MP2-32-KIT	FM-MP4-32-KIT	FM-MF1-32-KIT	FM-MF1-32-OS-KIT	FM-MF2-32-KIT	FM-MS1-32-KIT	N/A	FM-BASEBAR-32-KIT
4.00	FM-MP1-40-KIT	FM-MP2-40-KIT	FM-MP4-40-KIT	FM-MF1-40-KIT	FM-MF1-40-OS-KIT	FM-MF2-40-KIT	FM-MS1-40-KIT	N/A	FM-BASEBAR-40-KIT
5.00	FM-MP1-50-KIT	FM-MP2-50-KIT	N/A	FM-MF1-50-KIT	FM-MF1-50-OS-KIT	FM-MF2-50-KIT	FM-MS1-50-KIT	N/A	N/A
6.00	FM-MP1-60-KIT	FM-MP2-60-KIT	N/A	FM-MF1-60-KIT	FM-MF1-60-OS-KIT	FM-MF2-60-KIT	FM-MS1-60-KIT	N/A	N/A
8.00	N/A	N/A	N/A	N/A	N/A	N/A	FM-MS1-80-KIT	FM-MS1-80-OS-KIT	N/A

Note: Basebar "SH" dimension is not NFPA (refer to pages 41 & 45). All other dimensions are NFPA.

Floating Rod Bushing

Self Alignment Feature: Rod Bushing is designed to float .002" to improve bearing surface alignment.

- Reduces cylinder drag and erratic operation
- Reduces cylinder wear
- Provides a minimum of 25% longer life than fixed rod bushing designs



Heavy-Duty Design for Reliable, Consistent Operation

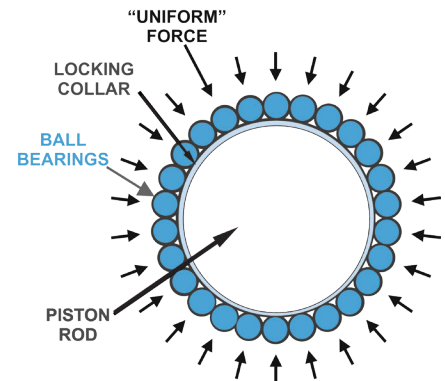
- 1. Locking Collar** – Hardened specialized tool steel, precision ground, multi-split collar design provides 4,000,000-5,000,000 cycles without fatigue or fracture.
- 2. Piston-Outer Lock Housing** – Hardened tool steel, precision ground design also serves as a spring guide for uniform clamp force distribution with virtually no wear.
- 3. Spring** – Oversized for maximum power, heavy-duty coil spring (low fatigue) will provide millions of consistent rod lock actuations at full rated load.
- 4. Ball Bearings** – Hardened, precision ground (high grade) steel ball bearings provide total transfer of spring force to locking collar.
- 5. Rod Lock Guide (Steel)** – Centers Rod Lock to cylinder rod bushing and maintains perfect alignment eliminating binding or rod scraping or reduced locking force due to misalignment.
- 6. Piston Guide** – Hardened and ground steel guide that centers the piston-outer lock housing and provides bearing surface for piston/spring assembly
- 7. Rod Guide Bearing** – High-load wear strip (PTFE based), self lubricating.
- 8. Piston Seal** – Heavy lip design Carboxylated Nitrile construction. Seal is pressure activated and wear compensating for extended life (self lubricating material).
- 9. Rod Wiper** – Urethane
- 10. Retainer Ring (Steel)** – Retains coil spring compression (under very high spring force) and internal lock components (NOTE: Do not remove).
- 11. Housing** – Precision machined from 6061-T6 aluminum, black anodized for corrosion resistance.
- 12. Sleeve Nut (Steel)** – Provides four (4) tapped holes for mounting unit or MF1 flange.
- 13. FM Series Cylinder** – Refer to catalog pages 28-36 for specifications and options.
- 14. Cylinder Piston Rod** – Hard chrome plated steel.
- 15. Permanent Lubrication** – Permanently lubricated with Magnalube-G PTFE based grease on all internal components. No additional lubrication is required.

100% Fill Ball Bearing Design

The cavity between the Locking Collar and Outer Lock Housing is 100% filled with ball bearings, providing UNIFORM distribution of Locking (Clamp/Holding) Force.

Design Advantages

- **Low Metal Fatigue** – On all clamping components.
- **Superior Locking Forces** – Highest locking forces in the industry.
- **Non Wearing** – Low component fatigue eliminates wear and extends life to 4,000,000-5,000,000 cycles at full rated load.



The Bimba Difference

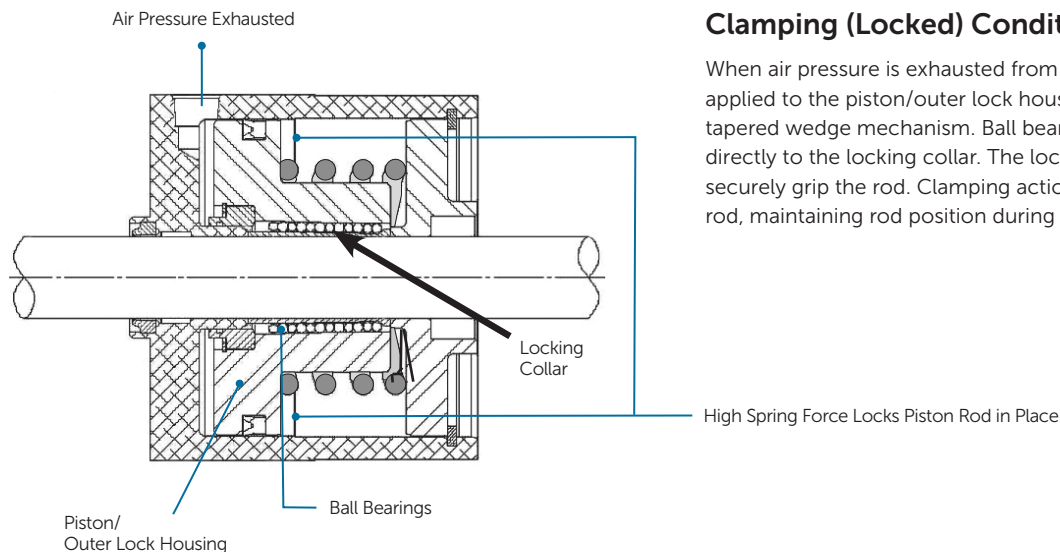
Bimba's floating rod bushing design and 'RL' Series Rod Lock = OPTIMIZED RESULTS and SUPERIOR PERFORMANCE.

For rod locks to achieve the rated holding force and maximize cycle life, good alignment must be maintained between the locking mechanism and cylinder rod. Bimba's Floating Rod Bushing design and accurate rod lock alignment ensure superior performance and trouble-free operation.

Rod Locks are used to hold linear cylinder loads stationary in any mounting orientation. Units will lock in both directions to rated holding force. They are not designed to withstand rotational loads or to brake the load in dynamic applications. Units are commonly used in work holding applications and for locking tools or fixtures in the event of air pressure loss. They are very common in positioning systems since they will hold the cylinder position very rigidly. Units are also common in emergency stop (E-Stop) applications.

Refer to safety information on page 70 for proper application..

Operating Principle



Clamping (Locked) Condition

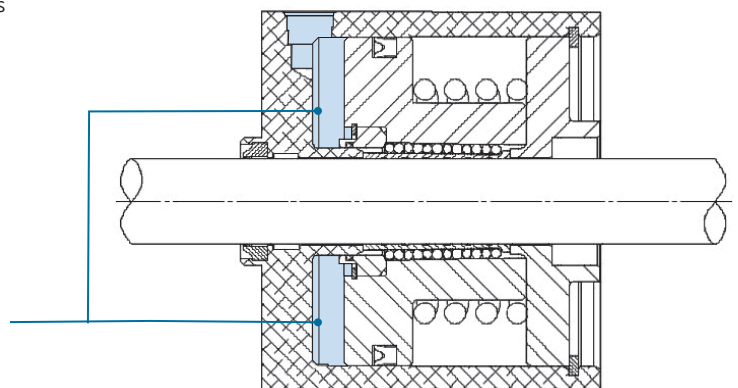
When air pressure is exhausted from rod lock, high spring force is applied to the piston/outer lock housing, which utilizes an ultra-fine tapered wedge mechanism. Ball bearings transfer the spring force directly to the locking collar. The locking collar is designed to flex and securely grip the rod. Clamping action does not move or disturb the rod, maintaining rod position during actuation.

Unclamped Condition (Free Moving Piston Rod):

When air pressure is applied to rod lock, the air pressure overcomes the spring force, moving Piston/Outer Locking Housing. This movement provides clearance in the tapered mechanism allowing the Locking Collar to relax and provide free rod movement.

Air Pressure Moves Piston, Compressing Spring, Which Eliminates Locking Force

60-150 PSI Air Pressure



Operating Pressure

Cylinder: 0 to 250 PSI Air
Rod Lock: 60 to 150 PSI Air

Operating Temperature

Standard Seals: 10°F to 180°F (-12°C to 82°C)
Fluorocarbon Seals: 0°F to 400°F (-18°C to 204°C)

Axial Movement (Clamped)*

Standard: .001" to .008"

Close Tol. (Optional): .001" to .003"

*Represents clearance within the rod lock unit, .000" movement due to actuation.

Rod Material Requirements

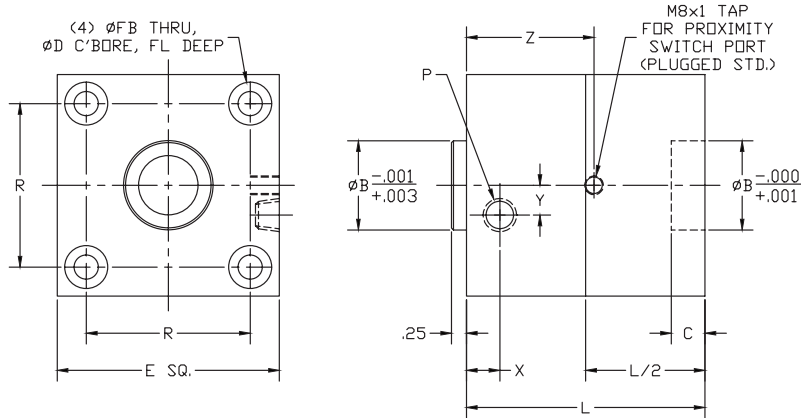
Diameter: +.000" to -.002" Nominal Diameter

Hardened Shaft: .0005" Minimum hard chrome

Unhardened Shaft: .001" Minimum hard chrome

Finish: 6 to 10 Ra

Rod Lock Dimensions & Rated Holding Force



Rod Lock Dimensions																
Bore	Rod Diameter*	Part No. Rod Lock Only	Axial Holding Force	B	C	D	FL	E	FB	L	P	R	X	Y	Z	Weight (Lbs.)
1.50	0.625 Standard	RL-063150-1	200	1.125	0.375	0.422	0.896	1.975	0.281	3.000	1/8 NPT	1.430	0.310	0.250	1.529	3.0
	0.625 Standard	RL-063200-1	500	1.125	0.375					3.000			0.310		1.196	4.0
2.00	1.000 Standard	RL-100200-1	350	1.500	0.563	0.515	1.031	2.475	0.343	3.750	1/8 NPT	1.840	0.500	0.380	1.869	3.5
	1.000 Standard	RL-100250-1	650	1.500	0.563	0.515	1.031	2.975	0.343	3.750	1/8 NPT	2.190	0.500	0.500	1.857	5.0
2.50	1.000 Standard	RL-100325-1	1000	1.500	0.563	0.719	1.281	3.725	0.406	4.000	1/4 NPT	2.760	0.560	0.000	2.140	8.0
	1.375 Standard	RL-138325-1	1000	2.000	0.625	0.719	1.281	4.475	0.406	4.000	1/4 NPT	3.320	0.560	0.000	1.782	14.0
3.25	1.000 Standard	RL-100400-1	1550	1.500	0.563	0.844	1.500	5.475	0.531	4.000	1/4 NPT	4.100	0.625	0.750	1.941	19.0
	1.375 Standard	RL-138400-1	1550	2.000	0.625	0.844	1.500	6.475	0.531	4.500	1/4 NPT	4.880	0.820	0.000	2.055	16.0
4.00	1.000 Standard	RL-100500-1	2150	1.500	0.563	0.844	1.500	6.475	0.531	4.500	1/4 NPT	4.880	0.820	0.000	2.055	16.0
	1.375 Standard	RL-138500-1	2150	2.000	0.625	0.844	1.500	6.475	0.531	4.500	1/4 NPT	4.880	0.820	0.000	2.055	16.0
5.00	1.000 Standard	RL-100500-1	2150	1.500	0.563	0.844	1.500	6.475	0.531	4.500	1/4 NPT	4.880	0.820	0.000	2.055	16.0
	1.375 Standard	RL-138500-1	2150	2.000	0.625	0.844	1.500	6.475	0.531	4.500	1/4 NPT	4.880	0.820	0.000	2.055	16.0
6.00	1.375 Standard	RL-138600-1	2850	2.000	0.625	0.844	1.500	6.475	0.531	4.500	1/4 NPT	4.880	0.820	0.000	2.055	16.0
	1.750 Standard	RL-175600-1	2850	2.375	0.750	0.844	1.500	6.475	0.531	4.500	1/4 NPT	4.880	0.820	0.000	2.055	16.0

Basic Cylinder Force Chart

Bore	Rod Diameter	Stroke Type	Effective Piston Area	Pounds Of Force At:		
				60 PSI	80 PSI	100 PSI
1.50	All	Push	1.767	106	142	177
	0.625	Pull	1.460	88	117	146
2.00	All	Push	3.142	188	251	314
	0.625	Pull	2.835	170	227	284
	1.000	Pull	2.357	141	189	236
2.50	All	Push	4.909	295	393	491
	0.625	Pull	4.602	276	368	460
	1.000	Pull	4.124	247	330	412
3.25	All	Push	8.296	498	664	830
	1.000	Pull	7.511	451	601	751
	1.375	Pull	6.811	409	545	681
4.00	All	Push	12.566	754	1005	1257
	1.000	Pull	11.781	707	942	1178
	1.375	Pull	11.081	665	886	1108
5.00	All	Push	19.635	1178	1571	1964
	1.000	Pull	18.850	1131	1508	1885
	1.375	Pull	18.150	1089	1452	1815
6.00	All	Push	28.274	1696	2262	2827
	1.375	Pull	26.789	1607	2144	2679
	1.750	Pull	25.869	1552	2070	2587

*Required Rod Diameter: Nominal size +000/-002.

Rated Holding Force

Bore	Rod Diameter	Rod Lock Model	Holding Force*
1.50	0.625	RL-063150	200
2.00	0.625	RL-063200	500
	1.000	RL-100200	350
2.50	0.625	RL-063250	650
	1.000	RL-100250	650
3.25	1.000	RL-100325	1000
	1.375	RL-138325	1000
4.00	1.000	RL-100400	1550
	1.375	RL-138400	1550
5.00	1.000	RL-100500	2150
	1.375	RL-138500	2150
6.00	1.375	RL-138600	2850
	1.750	RL-175600	2850

*Holding force is the minimum rating on clean and dry rods over the entire life of the unit. Add the load weight to the basic cylinder force when sizing rod lock.

Rod locks are 100% tested to assure that each unit exceeds the published rated holding force. When properly applied, rod locks will maintain the published holding force over the life of the unit.

FM - MS4 - 2.5 x 10 - HC - RL - 063 250 - MPR

Series	Substitute	Options	Substitute
250 PSI Air	FM	Extended Piston Rod Thread (Example: A = 2")	A
NFPA Mounts	Substitute	Adjustable Stroke - Retract (Specify Length, Example: AS = 4")	AS
Front Flange (1.50" - 6.00" Bore)	MF1	Air / Oil Piston	AO
Rear Flange (1.50" - 6.00" Bore)	MF2	.250" Urethane Bumper Both Ends	B»
Rear Pivot Clevis (1.50" - 6.00" Bore)	MP1	.250" Urethane Bumper Cap Only	BC»
Rear Pivot Clevis (1.50" - 6.00" Bore)	MP2	.250" Urethane Bumper Head Only	BH»
Rear Pivot Eye (1.50" - 4.00" Bore)	MP4	Bumper Piston Seals (1.50" - 6.00" Bore)	BP
Front & Rear End Angle (1.50" - 6.00" Bore)	MS1	British Standard Pipe Taper (Specify Size, Example: BSPP = 1/4)	BSPP
Side Lug (1.50" - 6.00" Bore)	MS2	British Standard Pipe Parallel (Specify Size, Example: BSPT = 1/4)	BSPT
Bottom Tapped Holes (1.50" - 6.00" Bore)	MS4	Large Male Rod Thread	KK2
Front Trunnion (1.50" - 6.00" Bore)	MT1	Female Rod Thread	KK3
Rear Trunnion (1.50" - 6.00" Bore)	MT2	Studded Piston Rod (KK3 With Stud, Loctite In Place)	KK3S
No Mount (1.50" - 6.00" Bore)	MX0	Full Diameter Male Rod Thread	KK4
Non-NFPA (1.50" - 4.00" Bore)	Basebar	Blank Rod End (No Threads, "A" = 0")	KK5
Style	Substitute	Low Friction Seals	LF
Single Rod	(Blank)	Low Temperature Seals	LT
Double Rod End	D	Low Temperature Extreme Seals	LTE
Bore	Substitute	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models	MA
1.50"	1.5	Micro-Adjust W/ Sound Dampening Bumper (12" Max Stroke)	MAB
2.00"	2	Magnetic Piston For Reed Or Solid State Switches - Models: R10, R10P, RAC, RHT & MSS	MPR
2.50"	2.5	Non-Rotating	NR
3.25"	3.25	Optional Port Location (Example: OP=3,7)	OP
4.00"	4	Oversize Rod Diameter (Specify Size, Example: OS = 1.375")	OS
5.00"	5	Proximity Switch (1.50" - 6.00" Bore)	P
6.00"	6	Shipped Unassembled	
Stroke		Extended Piston Rod (Example: If RLC= 0.50", Then 1" Rod Extension Is RLC= 1.50")	RLC
0" to 120" Made to order		SAE Ports (Specify Size, Example: SAE#10)	SAE
Cushions	Substitute	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners	SSA
Adjustable Head Cushion Position 2 Is Standard Specify For Positions: 1, 3 & 4	H	Stainless Steel Fasteners	SSF
Adjustable Long Head Cushion Position 2 Is Standard Specify For Positions: 1, 3 & 4	LH	Stainless Steel Sleeve Nuts	SSN
Adjustable Extra Long Head Cushion Position 2 Is Standard Specify For Positions: 1, 3 & 4	ELH»	Stainless Steel Piston Rod	SSR
Adjustable Cap Cushion Position 6 Is Standard Specify For Positions: 5, 7 & 8	C	Stainless Steel Tie Rods & Sleeve Nuts	SST
Adjustable Long Cap Cushion Position 6 Is Standard Specify For Positions: 5, 7 & 8	LC	Stop Tube - Specify Stop Tube Length (In Inches) Specify Stroke as ES (Effective Stroke) (Example: FM-MS4-2x24ES-ST=3)	ST»
Adjustable Extra Long Cap Cushion Position 6 Is Standard Specify For Positions: 5, 7 & 8	ELC»	Steel Cylinder Tube, Black Epoxy Paint Finish	TMS
Fixed Cushions	Substitute	Stainless Steel Cylinder Tube	TMSS
Fixed Head Cushion (Non-Adjustable, No Adjustment Needle)	FCH	400 PSI Hydraulic Non-Shock	TH
Fixed Cap Cushion (Non-Adjustable, No Adjustment Needle)	FCC	Fluorocarbon Rod Lock Seals	V
Fixed Head and Cap Cushion (Non-Adjustable, No Adjustment Needle)	FC	Fluorocarbon Seals	VS
		Special Variation (Specify)	XX
		Bore	Substitute
		1.5"	150
		2"	200
		2.5"	250
		3.25"	325
		4"	400
		5"	500
		6"	600
		Rod Size	Substitute
		0.625"	063
		1.000"	100
		1.375"	138
		1.750"	175
		Rod Lock	
		RL	

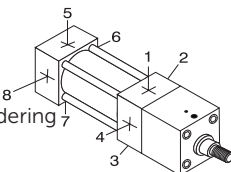
Notes:

- 1) Ordering example for adjustable cushions in non-standard locations: H3C7
- 2) Refer to Options for assistance with cushion length selection.
- 3) Cushions can be ordered on same side as ports.

Note: Refer to Options for specifications
» Refer to Option Length Adder

Standard Port and Cushion Adjustment Positions

- Ports - Positions 1 and 5
- Cushion Adjustment - Positions 2 and 6
- Rod lock port follows head port
- Specify Non-Standard Positions When Ordering



Special Rod Lock Modifications

Common rod lock modifications include metallic rod scraper, close tolerance axial movement, fluorocarbon seals, electroless nickel plating or stainless steel housing.

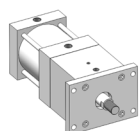
Consult your local distributor or Bimba line customer service for more information and delivery.

Option Length Adder (Add To Catalog Basic Overall Length Dimensions)						
Bore	B	BC	BH	Option		ST ¹ (Stop Tube) Example: ST=2
1.50	0.500	0.250	0.250	1.000	1.000	2.000
2.00	0.500	0.250	0.250	1.000	1.000	2.000
2.50	0.500	0.250	0.250	1.000	1.000	2.000
3.25	0.500	0.250	0.250	1.250	1.250	2.000
4.00	0.500	0.250	0.250	1.250	1.250	2.000
5.00	0.500	0.250	0.250	1.250	1.250	2.000
6.00	0.500	0.250	0.250	1.500	1.500	2.000

1 The desired stop tube length adds directly to the overall cylinder length.

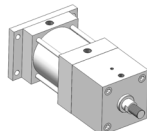
FM NFPA Mounts with Rod Lock

MF1



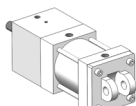
1.50" - 6.00" bores

MF2



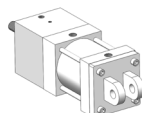
1.50" - 6.00" bores

MP1



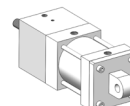
1.50" - 6.00" bores

MP2



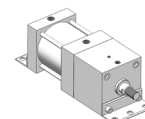
1.50" - 6.00" bores

MP4



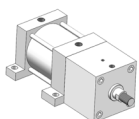
1.50" - 4.00" bores

MS1



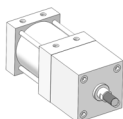
1.50" - 6.00"

MS2



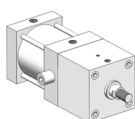
1.50" - 6.00" bores

MS4



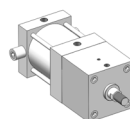
1.50" - 6.00" bores

MT1



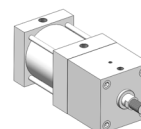
1.50" - 6.00" bores

MT2



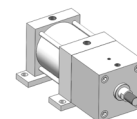
1.50" - 6.00" bores

MX0



1.50" - 6.00" bores

Basebar



1.50" - 4.00" bores

Basic Cylinder (MX0 Mount) Flush Mount (With Sleeve Nut Construction)

About Rod End Styles

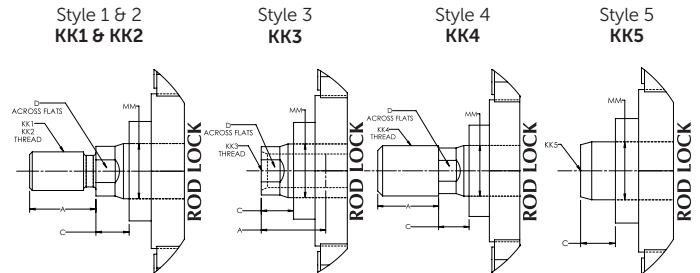
Style 1 Male Rod End is Standard

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).

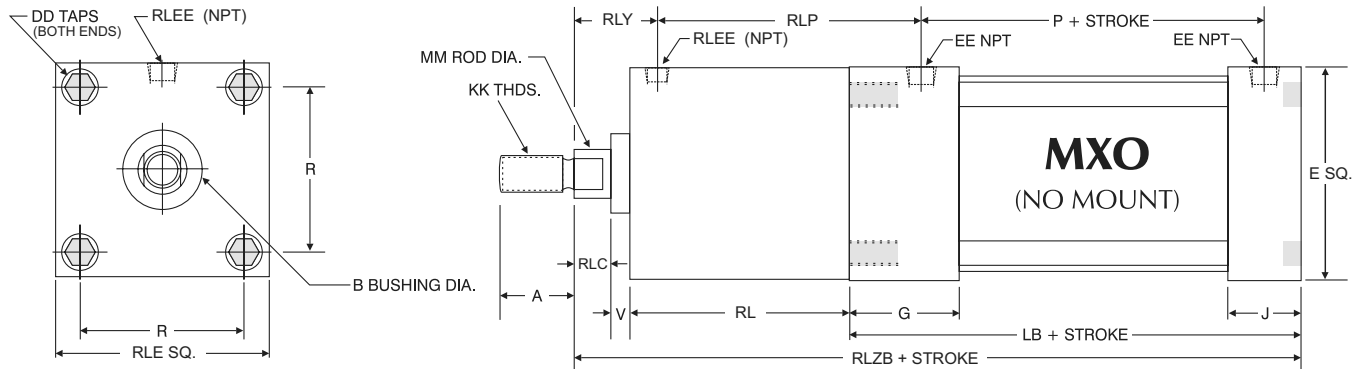
Need something not listed? Just send us a sketch. In most cases, quotes are turned around in one day!

Piston Rod End Styles



Bore	Rod Diameter (MM)	Standard				Optional						RLC	D
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male		Style 5 - Blank			
		KK1	A	KK2	A	KK3	A	KK4	A	KK5			
1.50, 2.00, 2.50	0.625	7/16-20	0.750	1/2-20	0.750	7/16-20	0.750	5/8-18	0.750	No Threads	0.375	0.500	
3.25, 4.00, 5.00	1.000	3/4-16	1.125	7/8-14	1.125	3/4-16	1.125	1-14	1.125	No Threads	0.500	0.875	
6.00	1.375	1-14	1.625	1 1/4-12	1.625	1-14	1.625	1 3/8-12	1.625	No Threads	0.625	1.125	

MX0 (No Mount): Standard Rod with Rod Lock Mounted



FM Series Basic Dimensions MX0 (Standard Rod)														Rod Lock Basic Dimensions						
Bore	A	B	DD	E	EE	G	J	KK	LB	MM	P	R	RL	RLC	RLE	RLEE	RLP	RLY	V	RLZB
1.50	0.750	1.125	1/4-28	2.000	1/4 NPT	1.500	1.000	7/16-20	3.625	0.625	2.375	1.430	3.000	0.375	1.980	1/8 NPT	3.563	0.940	0.250	7.250
2.00	0.750	1.125	5/16-24	2.500	1/4 NPT	1.500	1.000	7/16-20	3.625	0.625	2.375	1.840	3.000	0.375	2.480	1/8 NPT	3.563	0.940	0.250	7.250
2.50	0.750	1.125	5/16-24	3.000	1/4 NPT	1.500	1.000	7/16-20	3.750	0.625	2.500	2.190	3.250	0.375	2.980	1/8 NPT	3.750	1.000	0.250	7.625
3.25	1.125	1.500	3/8-24	3.750	3/8 NPT	1.750	1.250	3/4-16	4.250	1.000	2.750	2.760	4.000	0.500	3.730	1/4 NPT	4.438	1.313	0.250	9.000
4.00	1.125	1.500	3/8-24	4.500	3/8 NPT	1.750	1.250	3/4-16	4.250	1.000	2.750	3.320	4.000	0.500	4.480	1/4 NPT	4.438	1.313	0.250	9.000
5.00	1.125	1.500	1/2-20	5.500	3/8 NPT	1.750	1.250	3/4-16	4.500	1.000	3.000	4.100	4.000	0.500	5.480	1/4 NPT	4.438	1.313	0.250	9.250
6.00	1.625	2.000	1/2-20	6.500	1/2 NPT	2.000	1.500	1-14	5.000	1.375	3.250	4.880	4.500	0.625	6.480	1/4 NPT	5.060	1.440	0.250	10.375

Basic Cylinder (MX0 Mount) Flush Mount (With Sleeve Nut Construction): Oversized Rod

About Rod End Styles

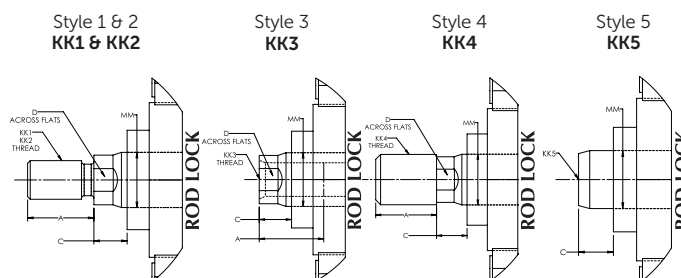
Style 1 Male Rod End is Standard

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).

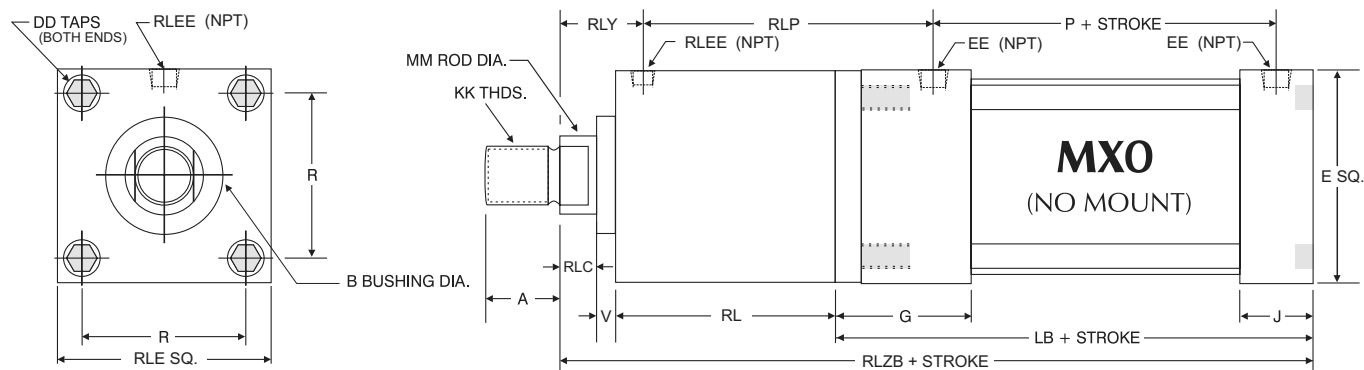
Need something not listed? Just send us a sketch. In most cases, quotes are turned around in one day!

Piston Rod End Styles



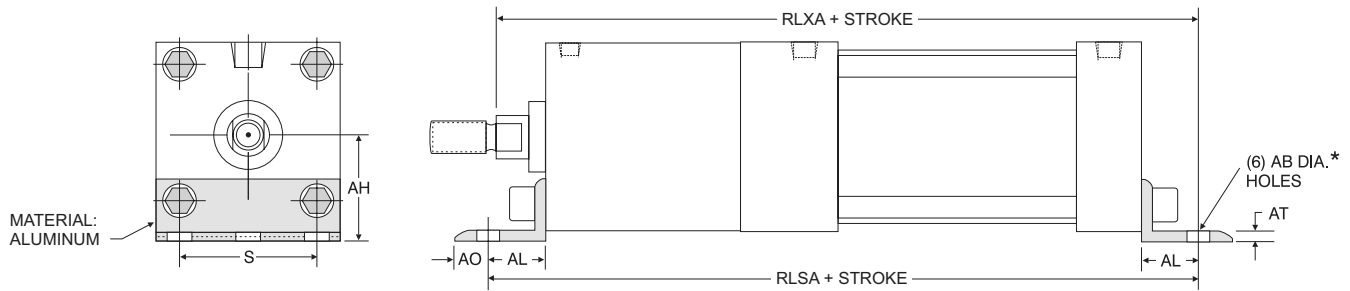
Bore	Rod Diameter (MM)	Standard				Optional						
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male		Style 5 - Blank	RLC	V
		KK1	A	KK2	A	KK3	A	KK4	A	KK5		
2.00, 2.50	1.000	3/4-16	1.125	7/8-14	1.125	3/4-16	1.125	1-14	1.125	No Threads	0.500	0.250
3.25, 4.00, 5.00	1.375	1-14	1.625	1 1/4-12	1.625	1-14	1.625	1 3/8 -12	1.625	No Threads	0.625	0.250
6.00	1.750	1 1/4-12	2.000	1 1/2-12	2.000	1 1/4-12	2.000	1 3/4-12	2.000	No Threads	0.750	0.250

MX0 (No Mount): Oversized Rod with Rod Lock Mounted



FM Series Basic Dimensions MX0 (Oversized Rod)															Rod Lock Basic Dimensions						
Bore	A	B	DD	E	EE	FH	G	J	KK	LB	MM	P	R	RL	RLC	RLE	RLEE	RLP	RLY	V	RLZB
2.00	1.125	1.500	5/16-24	2.500	1/4 NPT	0.375	1.500	1.000	3/4-16	3.625	1.000	2.375	1.840	3.750	0.500	2.480	1/8 NPT	4.500	1.250	0.250	8.500
2.50	1.125	1.500	5/16-24	3.000	1/4 NPT	0.375	1.500	1.000	3/4-16	3.750	1.000	2.500	2.190	3.750	0.500	2.980	1/8 NPT	4.500	1.250	0.250	8.625
3.25	1.625	2.000	3/8-24	3.750	3/8 NPT	0.625	1.750	1.250	1-14	4.250	1.375	2.750	2.760	4.000	0.625	3.730	1/4 NPT	5.063	1.438	0.250	9.750
4.00	1.625	2.000	3/8-24	4.500	3/8 NPT	0.625	1.750	1.250	1-14	4.250	1.375	2.750	3.320	4.000	0.625	4.480	1/4 NPT	5.063	1.438	0.250	9.750
5.00	1.625	2.000	1/2-20	5.500	3/8 NPT	0.625	1.750	1.250	1-14	4.500	1.375	3.000	4.100	4.125	0.625	5.480	1/4 NPT	5.188	1.438	0.250	10.125
6.00	2.000	2.375	1/2-20	6.500	1/2 NPT	0.750	2.000	1.500	1 1/4-12	5.000	1.750	3.250	4.875	4.500	0.750	6.480	1/4 NPT	5.820	1.563	0.250	11.250

MS1 (Head & Cap End Angle): Standard Rod with Rod Lock Mounted



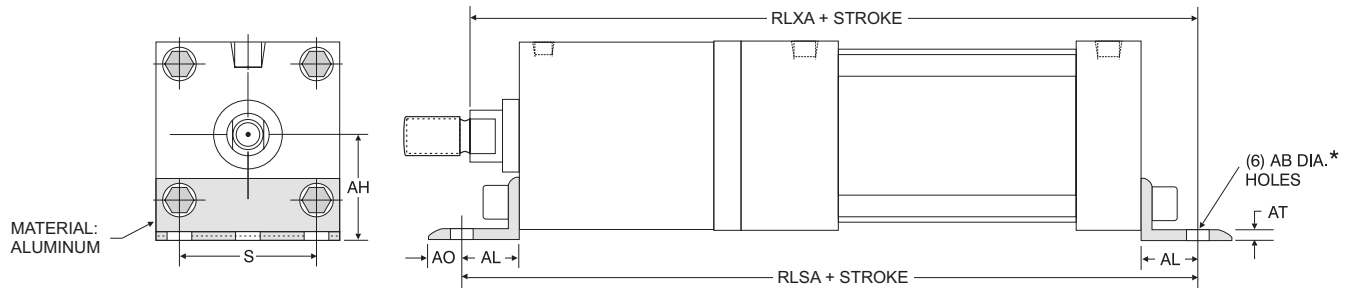
FM Series MS1 Angle Mount Dimensions

Bore	Rod Diameter	AB	AH	AL	AO	AT	S	Add Stroke RLSA	RLXA
1.50	0.625	0.438	1.188	1.000	0.375	0.125	1.250	8.625	8.250
2.00	0.625	0.438	1.438	1.000	0.375	0.125	1.750	8.625	8.250
2.50	0.625	0.438	1.625	1.000	0.375	0.125	2.250	9.000	8.625
3.25	1.000	0.563	1.938	1.250	0.500	0.125	2.750	10.750	10.250
4.00	1.000	0.563	2.250	1.250	0.500	0.125	3.500	10.750	10.250
5.00	1.000	0.688	2.750	1.375	0.625	0.188	4.250	11.250	10.625
6.00	1.375	0.813	3.250	1.375	0.625	0.188	5.250	12.250	11.750

*Note: 1.50" bore has four (4) "AB" holes on "S" dimension.

For dimensions not shown, see page 55.

MS1 (Head & Cap End Angle): Oversized Rod with Rod Lock Mounted



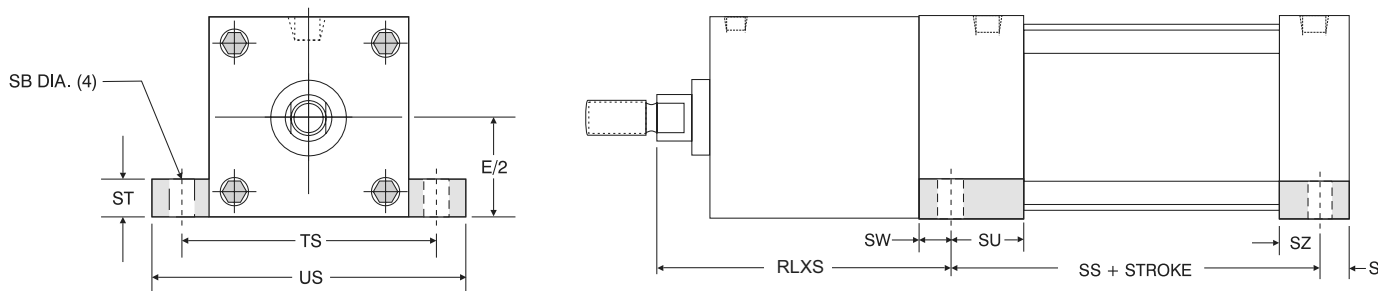
FM Series MS1 Angle Mount Dimensions

Bore	Rod Diameter	AB	AH	AL	AO	AT	S	Add Stroke RLSA	RLXA
2.00	1.000	0.438	1.438	1.000	0.375	0.125	1.750	9.750	9.500
2.50	1.000	0.438	1.625	1.000	0.375	0.125	2.250	9.875	9.625
3.25	1.375	0.563	1.938	1.250	0.500	0.125	2.750	11.375	11.000
4.00	1.375	0.563	2.250	1.250	0.500	0.125	3.500	11.375	11.000
5.00	1.375	0.688	2.750	1.375	0.625	0.188	4.250	12.000	11.500
6.00	1.750	0.813	3.250	1.375	0.625	0.188	5.250	13.000	12.625

*Note: 1.50" bore has four (4) "AB" holes on "S" dimension.

For dimensions not shown, see page 55.

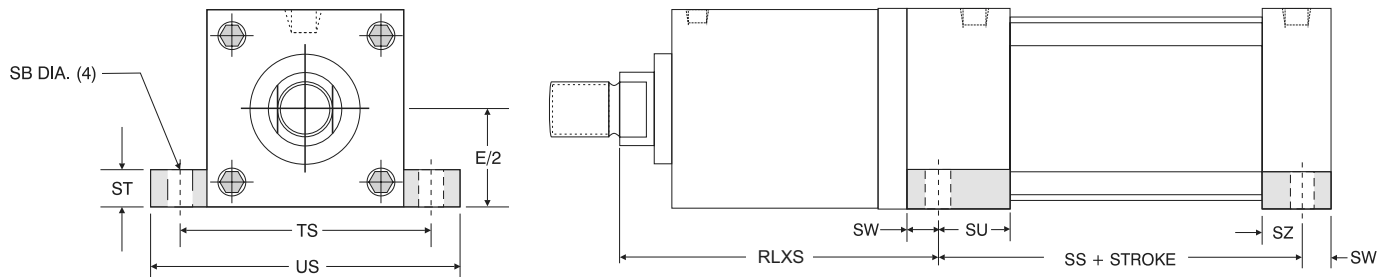
MS2 (Side Lug): Standard Rod With Rod Lock Mounted



FM Series MS2 Side Lug Mount Dimensions											
Bore	Rod Diameter	SB	E/2	ST	SU	SW	SZ	TS	US	RLXS	Add Stroke SS
1.50	0.625	0.438	1.000	0.500	1.125	0.375	0.625	2.750	3.500	4.000	2.875
2.00	0.625	0.438	1.250	0.500	1.125	0.375	0.625	3.250	4.000	4.000	2.875
2.50	0.625	0.438	1.500	0.500	1.125	0.375	0.625	3.750	4.500	4.250	3.000
3.25	1.000	0.563	1.875	0.750	1.250	0.500	0.750	4.750	5.750	5.250	3.250
4.00	1.000	0.563	2.250	0.750	1.250	0.500	0.750	5.500	6.500	5.250	3.250
5.00	1.000	0.813	2.750	1.000	1.063	0.688	0.563	6.875	8.250	5.438	3.125
6.00	1.375	0.813	3.250	1.000	1.313	0.688	0.813	7.875	9.250	6.070	3.625

For dimensions not shown, see page 55.

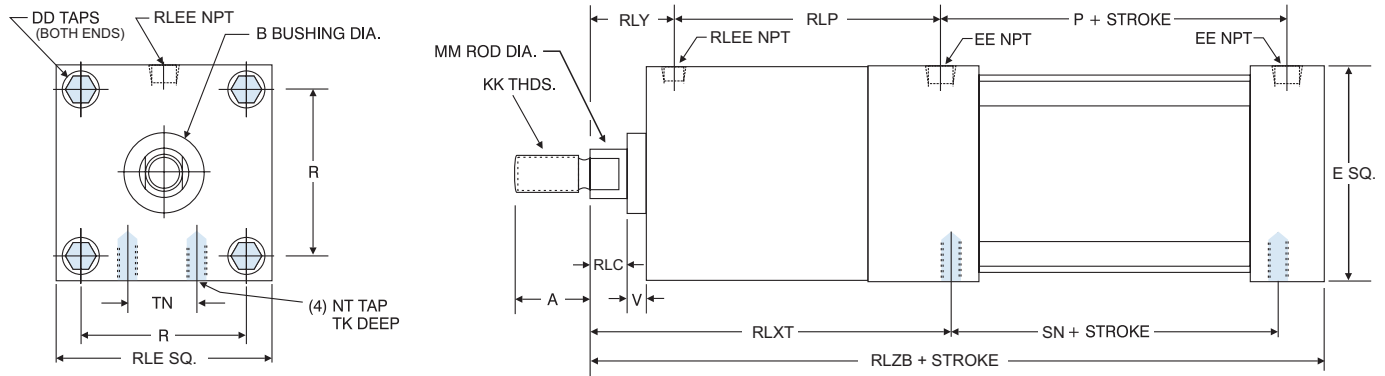
MS2 (Side Lug): Oversized Rod With Rod Lock Mounted



FM Series MS2 Side Lug Mount Dimensions											
Bore	Rod Diameter	SB	E/2	ST	SU	SW	SZ	TS	US	RLXS	Add Stroke SS
2.00	1.000	0.438	1.250	0.500	1.125	0.375	0.625	3.250	4.000	5.250	2.875
2.50	1.000	0.438	1.500	0.500	1.125	0.375	0.625	3.750	4.500	5.250	3.000
3.25	1.375	0.563	1.875	0.750	1.250	0.500	0.750	4.750	5.750	6.000	3.250
4.00	1.375	0.563	2.250	0.750	1.250	0.500	0.750	5.500	6.500	6.000	3.250
5.00	1.375	0.813	2.750	1.000	1.063	0.688	0.531	6.875	8.250	6.313	3.125
6.00	1.750	0.813	3.250	1.000	1.313	0.688	0.813	7.875	9.250	6.938	3.625

For dimensions not shown, see page 55.

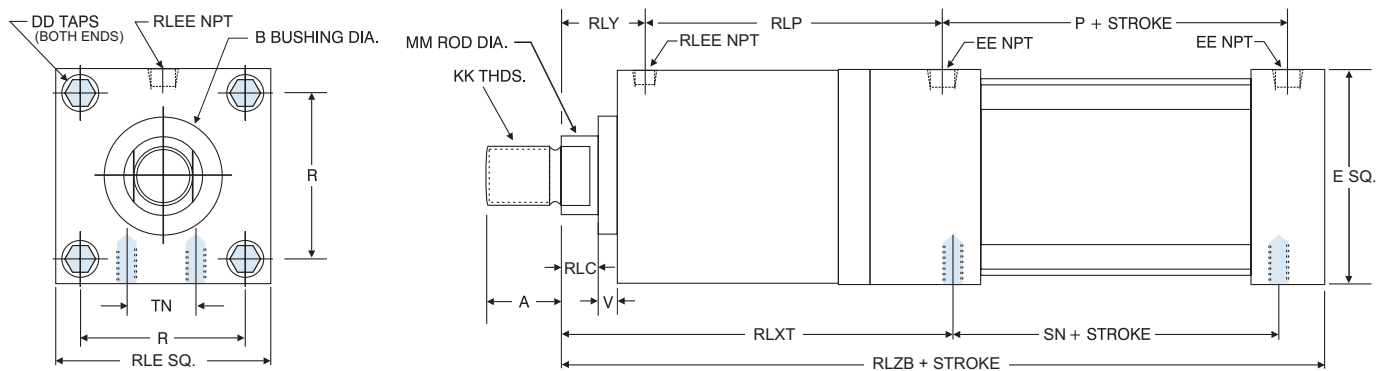
MS4 (Bottom Tapped Holes): Standard Rod With Rod Lock Mounted



FM Series MS4 Flush Mount Dimensions														Rod Lock Basic Dimensions							
Bore	A	B	DD	E	EE	KK	MM	NT	P	R	SN	TK	TN	RLC	RLE	RLEE	RLP	RLXT	RLY	RLZB	V
1.50	0.750	1.125	1/4-28	2.000	1/4 NPT	7/16-20	0.625	1/4-20	2.375	1.438	2.250	0.375	0.625	0.375	1.984	1/8 NPT	3.563	4.570	0.938	7.250	0.250
2.00	0.750	1.125	5/16-24	2.500	1/4 NPT	7/16-20	0.625	5/16-18	2.375	1.844	2.250	0.500	0.875	0.375	2.484	1/8 NPT	3.563	4.570	0.938	7.250	0.250
2.50	0.750	1.125	5/16-24	3.000	1/4 NPT	7/16-20	0.625	3/4-16	2.500	2.188	2.375	0.625	1.250	0.375	2.984	1/8 NPT	3.750	4.820	1.000	7.625	0.250
3.25	1.125	1.500	3/8-24	3.750	3/8 NPT	3/4-16	1.000	1/2-13	2.750	2.760	2.625	0.750	1.500	0.500	3.734	1/4 NPT	4.438	5.820	1.313	9.000	0.250
4.00	1.125	1.500	3/8-24	4.500	3/8 NPT	3/4-16	1.000	1/2-13	2.750	3.320	2.625	0.750	2.063	0.500	4.484	1/4 NPT	4.438	5.820	1.313	9.000	0.250
5.00	1.125	1.500	1/2-20	5.500	3/8 NPT	3/4-16	1.000	5/8-11	3.000	4.100	2.875	1.000	2.688	0.500	5.484	1/4 NPT	4.438	5.820	1.313	9.250	0.250
6.00	1.625	2.000	1/2-20	6.500	1/2 NPT	1-14	1.375	3/4-10	3.250	4.875	3.125	1.125	3.250	0.625	6.484	1/4 NPT	5.063	6.560	1.438	10.375	0.250

For dimensions not shown, see page 55.

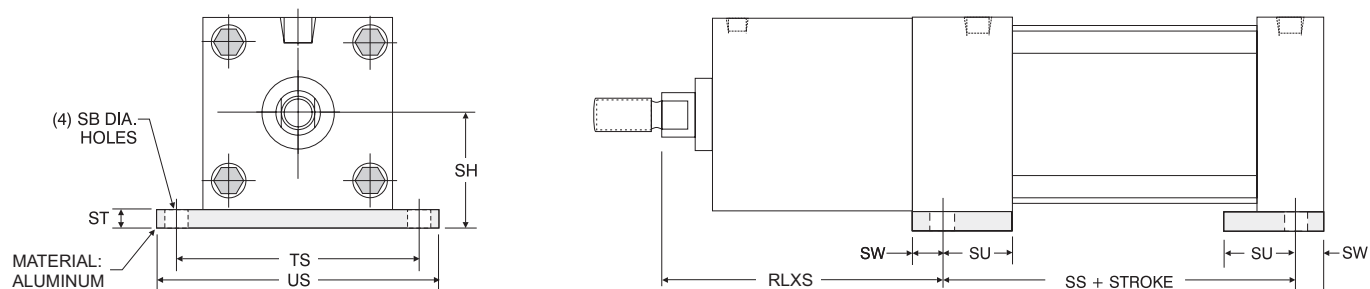
MS4 (Bottom Tapped Holes): Oversized Rod With Rod Lock Mounted



FM Series Oversize Rod MS4 Flush Mount Dimensions														Rod Lock Basic Dimensions							
Bore	A	B	DD	E	EE	KK	MM	NT	P	R	SN	TK	TN	RLC	RLE	RLEE	RLP	RLXT	RLY	RLZB	V
2.00	1.125	1.500	5/16-24	2.500	1/4 NPT	3/4-16	1.000	5/16-18	2.375	1.844	2.250	0.500	0.875	0.500	2.484	1/8 NPT	4.500	5.813	1.250	8.500	0.250
2.50	1.125	1.500	5/16-24	3.000	1/4 NPT	3/4-16	1.000	3/4-16	2.500	2.188	2.375	0.625	1.250	0.500	2.984	1/8 NPT	4.500	5.813	1.250	8.625	0.250
3.25	1.625	2.000	3/8-24	3.750	3/8 NPT	1-14	1.375	1/2-13	2.750	2.760	2.625	0.750	1.500	0.625	3.734	1/4 NPT	5.063	6.570	1.438	9.750	0.250
4.00	1.625	2.000	3/8-24	4.500	3/8 NPT	1-14	1.375	1/2-13	2.750	3.320	2.625	0.750	2.063	0.625	4.484	1/4 NPT	5.063	6.570	1.438	9.750	0.250
5.00	1.625	2.000	1/2-20	5.500	3/8 NPT	1-14	1.375	5/8-11	3.000	4.100	2.875	1.000	2.688	0.625	5.484	1/4 NPT	5.188	6.688	1.438	10.125	0.250
6.00	2.000	2.375	1/2-20	6.500	1/2 NPT	1 1/4-12	1.750	3/4-10	3.250	4.875	3.125	1.125	3.250	0.750	6.484	1/4 NPT	5.820	7.438	1.563	11.250	0.250

For dimensions not shown, see page 55.

Basebar (Non-NFPA): Standard Rod With Rod Lock Mounted

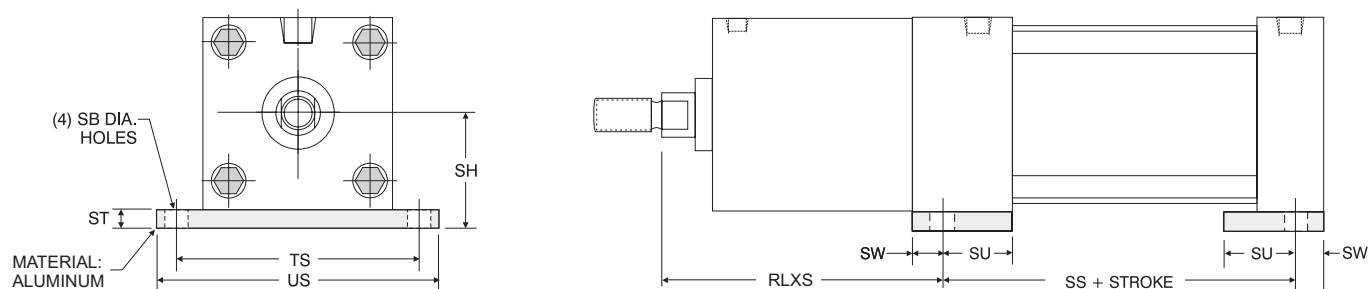


FM Series Basebar Mount (Non-NFPA) Dimensions

Bore	Rod Diameter	SB	SH	ST	SU	SW	TS	US	RLXS	Add Stroke SS
1.50	0.625	0.438	1.250	0.250	1.125	0.375	2.750	3.500	4.000	2.875
2.00	0.625	0.438	1.500	0.250	1.125	0.375	3.250	4.000	4.000	2.875
2.50	0.625	0.438	1.875	0.375	1.125	0.375	3.750	4.500	4.250	3.000
3.25	1.000	0.563	2.375	0.500	1.250	0.500	4.750	5.750	5.250	3.250
4.00	1.000	0.563	2.750	0.500	1.250	0.500	5.500	6.500	5.250	3.250

For dimensions not shown, see page 55.

Basebar (Non-NFPA): Oversized Rod With Rod Lock Mounted

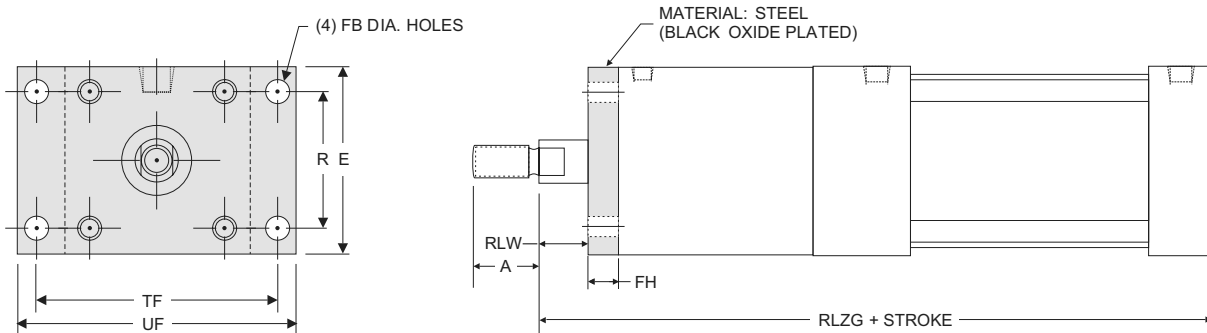


FM Series Basebar Mount (Non-NFPA) Dimensions

Bore	Rod Diameter	SB	SH	ST	SU	SW	TS	US	RLXS	Add Stroke SS
2.00	1.000	0.438	1.500	0.250	1.125	0.375	3.250	4.000	5.250	2.875
2.50	1.000	0.438	1.875	0.375	1.125	0.375	3.750	4.500	5.250	3.000
3.25	1.375	0.563	2.375	0.500	1.250	0.500	4.750	5.750	6.000	3.250
4.00	1.375	0.563	2.750	0.500	1.250	0.500	5.500	6.500	6.000	3.250

For dimensions not shown, see page 55.

MF1 (Head Flange): Standard Rod With Rod Lock Mounted

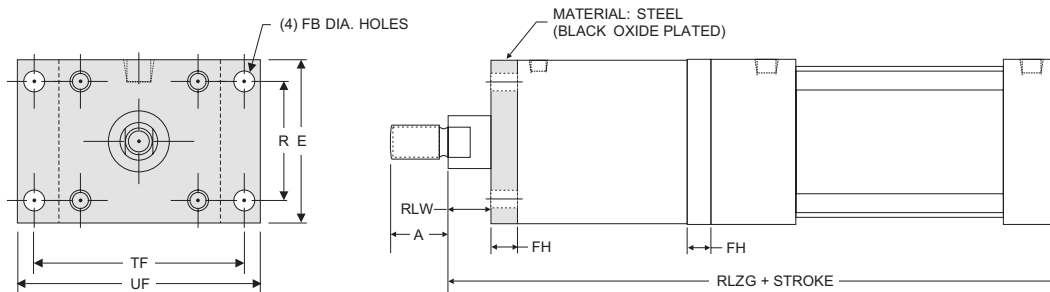


FM Series MF1 Flange Mount Dimensions

Bore	Rod Diameter	A	E	FB	FH	R	RLW	TF	UF	RLZG
1.50	0.625	0.750	2.000	0.313	0.375	1.438	0.625	2.750	3.375	7.625
2.00	0.625	0.750	2.500	0.375	0.375	1.844	0.625	3.375	4.125	7.625
2.50	0.625	0.750	3.000	0.375	0.375	2.188	0.625	3.875	4.625	8.000
3.25	1.000	1.125	3.750	0.438	0.625	2.760	0.750	4.688	5.500	9.625
4.00	1.000	1.125	4.500	0.438	0.625	3.320	0.750	5.438	6.250	9.625
5.00	1.000	1.125	5.500	0.563	0.625	4.100	0.750	6.625	7.625	9.875
6.00	1.375	1.625	6.500	0.563	0.750	4.875	0.875	7.625	8.625	11.125

For dimensions not shown, see page 55.

MF1 (Head Flange): Oversized Rod With Rod Lock Mounted

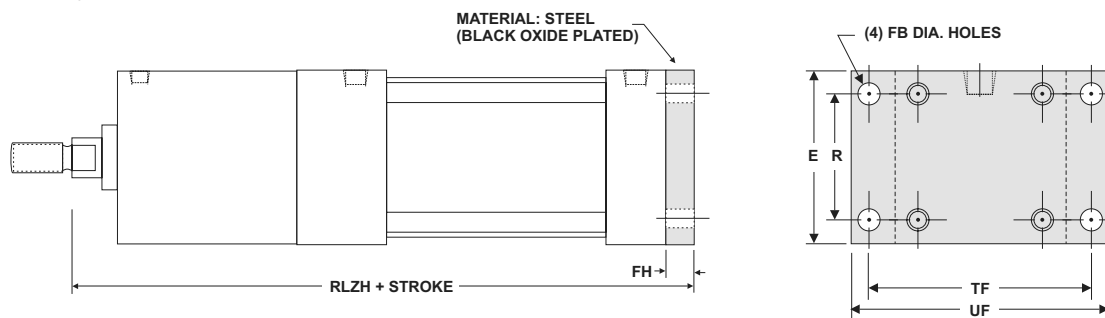


FM Series MF2 Flange Mount Dimensions

Bore	Rod Diameter	A	E	FB	FH	R	RLW	TF	UF	RLZG
2.00	1.000	1.125	2.500	0.375	0.375	1.844	1.000	3.375	4.125	9.125
2.50	1.000	1.125	3.000	0.375	0.375	2.188	1.000	3.875	4.625	9.250
3.25	1.375	1.625	3.750	0.438	0.625	2.760	1.000	4.688	5.500	10.500
4.00	1.375	1.625	4.500	0.438	0.625	3.320	1.000	5.438	6.250	10.500
5.00	1.375	1.625	5.500	0.563	0.625	4.100	1.000	6.625	7.625	10.875
6.00	1.750	2.000	6.500	0.563	0.750	4.875	1.125	7.625	8.625	12.125

For dimensions not shown, see page 55.

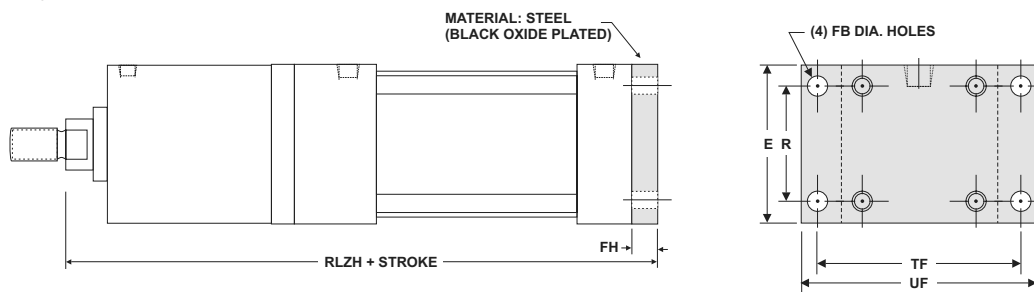
MF2 (Cap Flange): Standard Rod With Rod Lock Mounted



FM Series MF2 Flange Mount Dimensions								
Bore	Rod Diameter	E	FB	FH	R	TF	UF	RLZH
1.50	0.625	2.000	0.313	0.375	1.438	2.750	3.375	7.625
2.00	0.625	2.500	0.375	0.375	1.844	3.375	4.125	7.625
2.50	0.625	3.000	0.375	0.375	2.188	3.875	4.625	8.000
3.25	1.000	3.750	0.438	0.625	2.760	4.688	5.500	9.625
4.00	1.000	4.500	0.438	0.625	3.320	5.438	6.250	9.625
5.00	1.000	5.500	0.563	0.625	4.100	6.625	7.625	9.875
6.00	1.375	6.500	0.563	0.750	4.875	7.625	8.625	11.125

For dimensions not shown, see page 55.

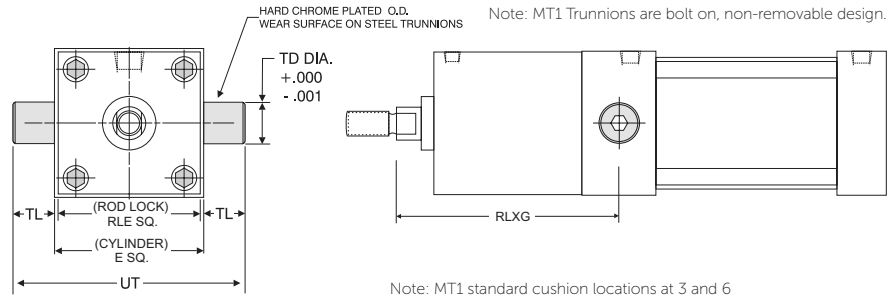
MF2 (Cap Flange): Oversized Rod With Rod Lock Mounted



FM Series MF2 Flange Mount Dimensions								
Bore	Rod Diameter	E	FB	FH	R	TF	UF	RLZH
2.00	1.000	2.500	0.375	0.375	1.844	3.375	4.125	8.875
2.50	1.000	3.000	0.375	0.375	2.188	3.875	4.625	9.000
3.25	1.375	3.750	0.438	0.625	2.760	4.688	5.500	10.375
4.00	1.375	4.500	0.438	0.625	3.320	5.438	6.250	10.375
5.00	1.375	5.500	0.563	0.625	4.100	6.625	7.625	10.750
6.00	1.750	6.500	0.563	0.750	4.875	7.625	8.625	12.000

For dimensions not shown, see page 55.

MT1 (Head Trunnion): Standard Rod With Rod Lock Mounted

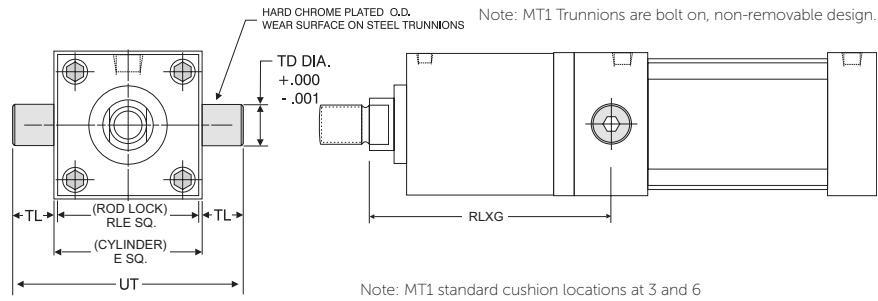


FM Series MT1 Head Trunnion and MT2 Cap Trunnion Mount Dimensions

Bore	Rod Diameter	E	RLE	TD	TL	UT	RLXG
1.50	0.625	2.000	1.984	1.000	1.000	4.000	4.375
2.00	0.625	2.500	2.484	1.000	1.000	4.500	4.375
2.50	0.625	3.000	2.984	1.000	1.000	5.000	4.625
3.25	1.000	3.750	3.734	1.000	1.000	5.750	5.625
4.00	1.000	4.500	4.484	1.000	1.000	6.500	5.625
5.00	1.000	5.500	5.484	1.000	1.000	7.500	5.625
6.00	1.375	6.500	6.484	1.375	1.375	9.250	6.375

For dimensions not shown, see page 55.

MT1 (Head Trunnion): Oversized Rod With Rod Lock Mounted

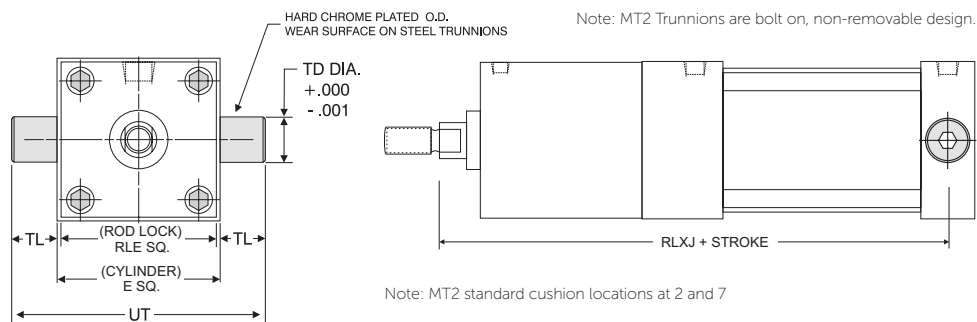


FM Series MT1 Head Trunnion and MT2 Cap Trunnion Mount Dimensions

Bore	Rod Diameter	E	RLE	TD	TL	UT	RLXG
2.00	1.000	2.500	2.484	1.000	1.000	4.500	5.625
2.50	1.000	3.000	2.984	1.000	1.000	5.000	5.625
3.25	1.375	3.750	3.734	1.000	1.000	5.750	6.375
4.00	1.375	4.500	4.484	1.000	1.000	6.500	6.375
5.00	1.375	5.500	5.484	1.000	1.000	7.500	6.500
6.00	1.750	6.500	6.484	1.375	1.375	9.250	7.250

For dimensions not shown, see page 55.

MT2 (Cap Trunnion): Standard Rod With Rod Lock Mounted

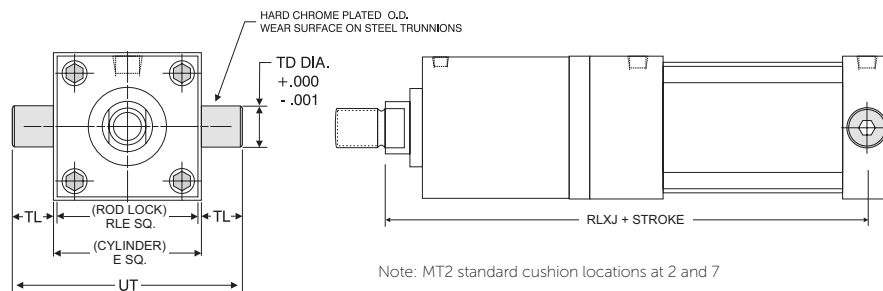


FM Series MT1 Head Trunnion and MT2 Cap Trunnion Mount Dimensions

Bore	Rod Diameter	E	RLE	TD	TL	UT	Add Stroke RLXJ
1.50	0.625	2.000	1.984	1.000	1.000	4.000	6.750
2.00	0.625	2.500	2.484	1.000	1.000	4.500	6.750
2.50	0.625	3.000	2.984	1.000	1.000	5.000	7.125
3.25	1.000	3.750	3.734	1.000	1.000	5.750	8.375
4.00	1.000	4.500	4.484	1.000	1.000	6.500	8.375
5.00	1.000	5.500	5.484	1.000	1.000	7.500	8.625
6.00	1.375	6.500	6.484	1.375	1.375	9.250	9.625

For dimensions not shown, see page 55.

MT2 (Cap Trunnion): Oversized Rod With Rod Lock Mounted

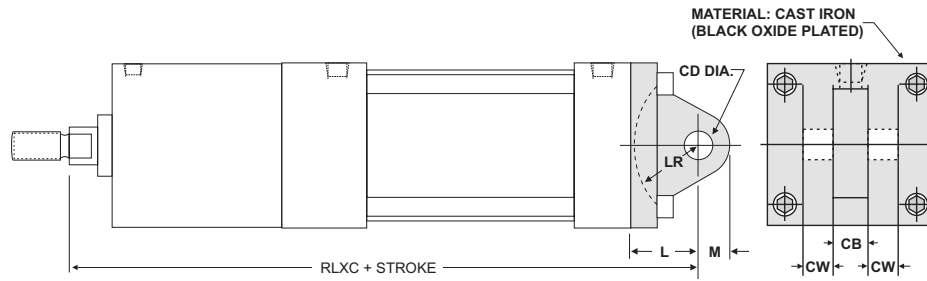


FM Series MT1 Head Trunnion and MT2 Cap Trunnion Mount Dimensions

Bore	Rod Diameter	E	RLE	TD	TL	UT	Add Stroke RLXJ
2.00	1.000	2.500	2.484	1.000	1.000	4.500	8.000
2.50	1.000	3.000	2.984	1.000	1.000	5.000	8.125
3.25	1.375	3.750	3.734	1.000	1.000	5.750	9.125
4.00	1.375	4.500	4.484	1.000	1.000	6.500	9.125
5.00	1.375	5.500	5.484	1.000	1.000	7.500	9.375
6.00	1.750	6.500	6.484	1.375	1.375	9.250	10.500

For dimensions not shown, see page 55.

MP1 (Detachable Cap Pivot Clevis): Standard Rod With Rod Lock Mounted



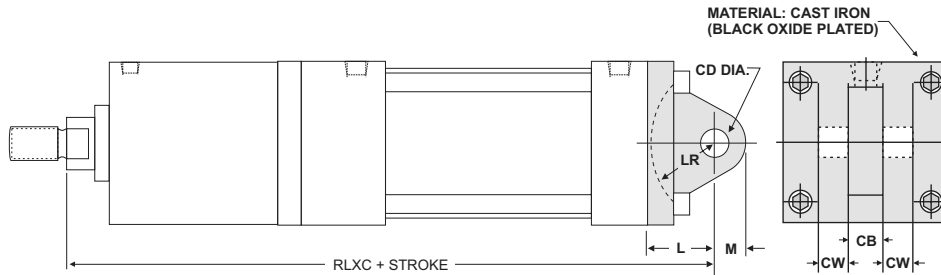
FM Series MP1 Clevis Mount Dimensions

Bore	Rod Diameter	CB	CD	CW	L	LR	M	Add Stroke RLXC
1.50	0.625	0.750	0.500	0.500	0.750	0.750	0.625	8.000
2.00	0.625	0.750	0.500	0.500	0.750	0.750	0.625	8.000
2.50	0.625	0.750	0.500	0.500	0.750	0.750	0.625	8.375
3.25	1.000	1.250	0.750	0.625	1.250	1.250	0.875	10.250
4.00	1.000	1.250	0.750	0.625	1.250	1.250	0.875	10.250
5.00	1.000	1.250	0.750	0.625	1.250	1.250	0.875	10.500
6.00	1.375	1.500	1.000	0.750	1.500	1.500	1.000	11.875

For dimensions not shown, see page 55.

Clevis pins are provided with pivot mounts.

MP1 (Detachable Cap Pivot Clevis): Oversized Rod With Rod Lock Mounted



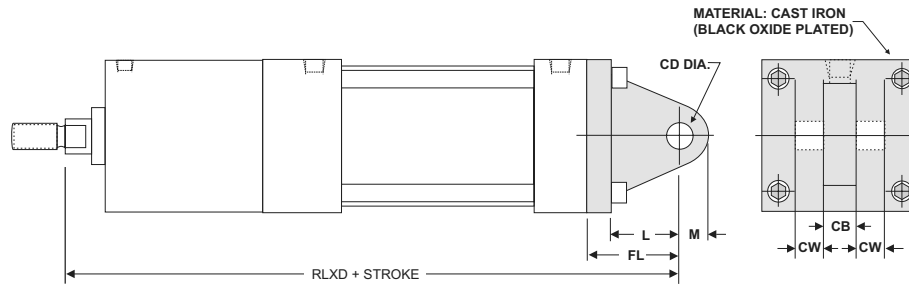
FM Series MP1 Clevis Mount Dimensions

Bore	Rod Diameter	CB	CD	CW	L	LR	M	Add Stroke RLXC
2.00	1.000	0.750	0.500	0.500	0.750	0.750	0.625	9.250
2.50	1.000	0.750	0.500	0.500	0.750	0.750	0.625	9.375
3.25	1.375	1.250	0.750	0.625	1.250	1.250	0.875	11.000
4.00	1.375	1.250	0.750	0.625	1.250	1.250	0.875	11.000
5.00	1.375	1.250	0.750	0.625	1.250	1.250	0.875	11.375
6.00	1.750	1.500	1.000	0.750	1.500	1.500	1.000	12.750

For dimensions not shown, see page 55.

Clevis pins are provided with pivot mounts.

MP2 (Detachable Cap Pivot Clevis): Standard Rod With Rod Lock Mounted



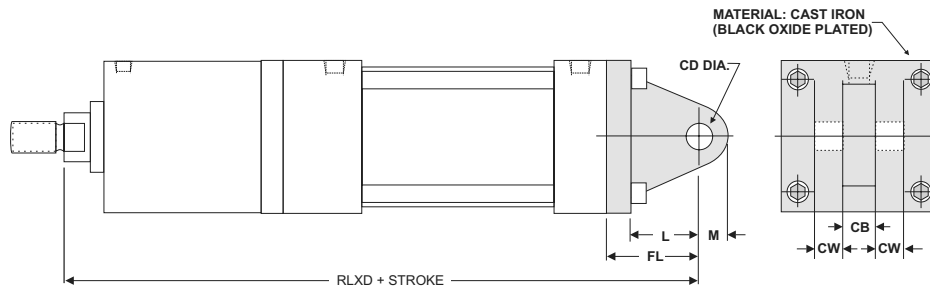
FM Series MP2 Clevis Mount Dimensions

Bore	Rod Diameter	CB	CD	CW	FL	L	M	Add Stroke RLXD
1.50	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.375
2.00	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.375
2.50	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.750
3.25	1.000	1.250	0.750	0.625	1.875	1.250	0.875	10.875
4.00	1.000	1.250	0.750	0.625	1.875	1.250	0.875	10.875
5.00	1.000	1.250	0.750	0.625	1.875	1.250	0.875	11.125
6.00	1.375	1.500	1.000	0.750	2.250	1.500	1.000	12.625

For dimensions not shown, see page 55.

Clevis pins are provided with pivot mounts.

MP2 (Detachable Cap Pivot Clevis): Oversized Rod With Rod Lock Mounted



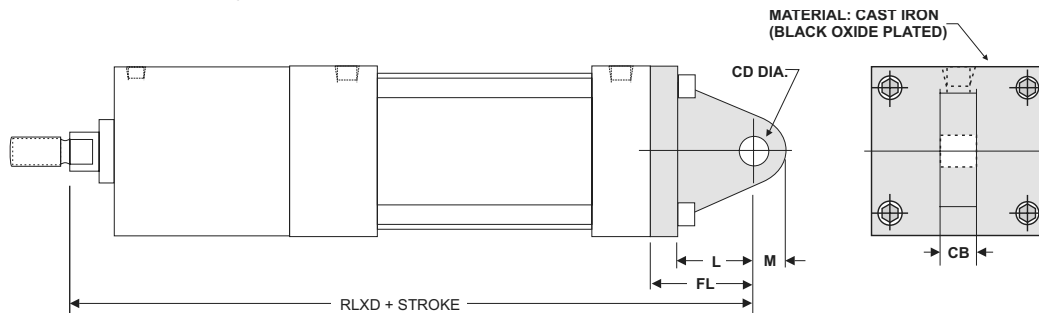
FM Series MP2 Clevis Mount Dimensions

Bore	Rod Diameter	CB	CD	CW	FL	L	M	Add Stroke RLXD
2.00	1.000	0.750	0.500	0.500	1.125	0.750	0.625	9.625
2.50	1.000	0.750	0.500	0.500	1.125	0.750	0.625	9.750
3.25	1.375	1.250	0.750	0.625	1.875	1.250	0.875	11.625
4.00	1.375	1.250	0.750	0.625	1.875	1.250	0.875	11.625
5.00	1.375	1.250	0.750	0.625	1.875	1.250	0.875	12.000
6.00	1.750	1.500	1.000	0.750	2.250	1.500	1.000	13.500

For dimensions not shown, see page 55.

Clevis pins are provided with pivot mounts.

MP4 (Detachable Cap Pivot Eye): Standard Rod With Rod Lock Mounted

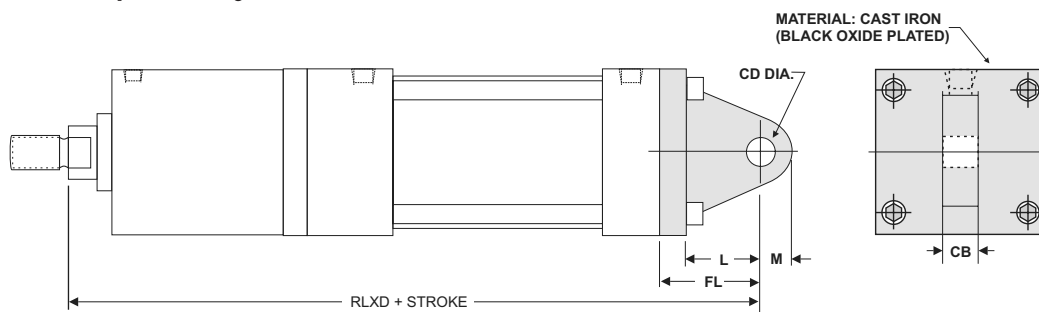


FM Series MP4 Rod Eye Mount Dimensions

Bore	Rod Diameter	CB	CD	CW	FL	L	M	Add Stroke RLXD
1.50	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.375
2.00	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.375
2.50	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.750
3.25	1.000	1.250	0.750	0.625	1.875	1.250	0.875	10.875
4.00	1.000	1.250	0.750	0.625	1.875	1.250	0.875	10.875

For dimensions not shown, see page 55. Clevis pins are provided with pivot mounts.

MP4 (Detachable Cap Pivot Eye): Oversized Rod With Rod Lock Mounted



FM Series MP4 Rod Eye Mount Dimensions

Bore	Rod Diameter	CB	CD	CW	FL	L	M	Add Stroke RLXD
2.00	1.000	0.750	0.500	0.500	1.125	0.750	0.625	9.625
2.50	1.000	0.750	0.500	0.500	1.125	0.750	0.625	9.750
3.25	1.375	1.250	0.750	0.625	1.875	1.250	0.875	11.625
4.00	1.375	1.250	0.750	0.625	1.875	1.250	0.875	11.625

For dimensions not shown, see page 55. Clevis pins are provided with pivot mounts.

Technical Data: Rod Lock Air Controls

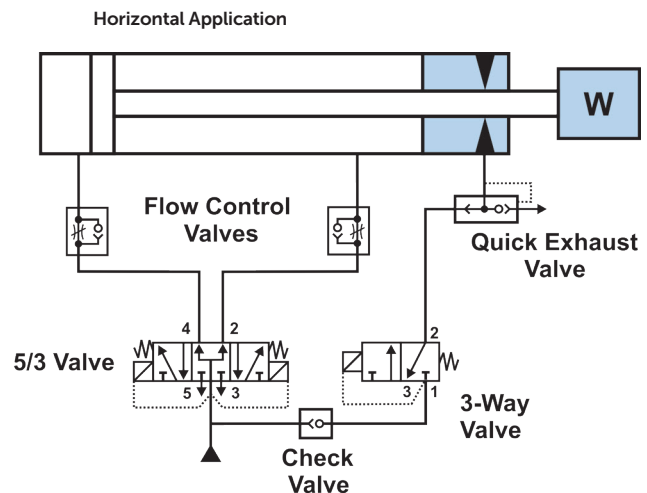
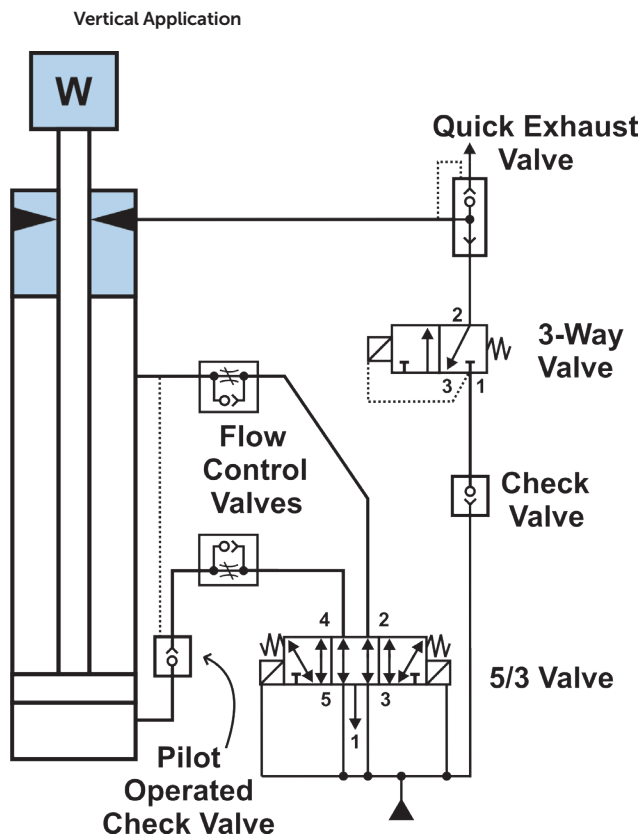
Rod Locks can be used in a wide range of general purpose applications. They are designed to mechanically lock the cylinder piston rod when the air supply (60-150 PSI) is removed. Rod Locks are designed for millions of trouble-free actuations if properly applied. Avoid designs or situations where the rod lock is frequently engaged while the piston rod is in motion. Since Rod Locks have a high degree of rigidity, they can be used in positioning systems. Total Rod Lock play (under loaded conditions) is very low (.000" to .008").

1. **Cylinder Control** – Use a 5/3 valve to extend and retract cylinder with rod lock. A four-way valve or closed center valve can cause the cylinder to lunge before the rod lock is fully released, causing damage to the rod lock or piston rod.
2. **Rod Lock Control** – Use a four-way NC valve to supply 60 - 150 PSI to engage and disengage the rod lock.

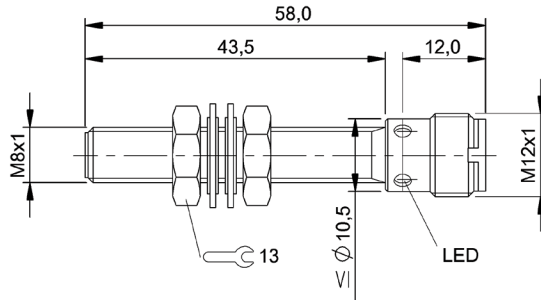
3. **Check Valve** – Can be used to isolate three-way valve from drop in supply air during cylinder operation.
4. **Air Regulator** – Can be used in vertical applications to offset the cylinder displacement differential between the rod end and cap end. They can also be used to help balance or counter the effects of gravity on the load.
5. **Quick Exhaust Valve** – Can be used to accelerate the rod lock response time for maximum performance. Typical rod lock response time is 200ms.
6. **E-Stop** – Rod locks can be used in E-Stop applications provided the design calls for infrequent actuation of rod lock while the cylinder rods are in motion.
7. **Manual Override** – A three-way valve can be added to the control circuits below to act as a manual override for tooling set-up or

For dimensions not shown, see page 55. Clevis pins are provided with pivot mounts.

Consult your local distributor (or fluid power specialist) for proper air circuit design. Avoid situations where the cylinder can lunge on power up or cycling.



Rod Lock Proximity Switch: Option P



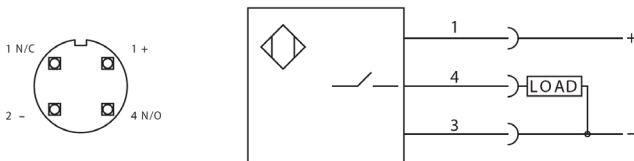
An inductive proximity switch (with M12x1 thread) can be used to sense the rod lock unclamped condition. Jam nuts are included and the switch is shipped unassembled (unthreaded) from the rod lock.

Balluff Model: BES M08EH-PSC15B-S04G

Electrical Data	Substitute
Connection type:	Connector
Effective operating current I _e :	200 mA
Effective operating voltage U _e DC:	24.0 V
Electrical version:	DC, direct current
Load capacitance max. (at U _e):	0.500 µF
Max. no-load cur. lo undamped:	3.0 mA
Minimum operating current I _m :	0 mA
No-load current lo damped max.:	9.0 mA
Operating voltage U _B max. DC [V]:	30.0 V
Operating voltage U _B min. DC [V]:	10.0 V
Rated insulation voltage U _i :	250 VAC
Rated short circuit current:	100 A
Ripple max. (% of U _e):	15%
Switching freq. f max. (at U _e):	3000 Hz
Switching function:	Normally open (NO)
Switching output:	PNP
Voltage drop static max.:	2.5 V

Mechanical Data	Substitute
Ambient temperature T _a max.	70°C
Ambient temperature T _a min.	-25°C
Assured operating distance S _a	1.20 mm
Connector type	M12x1-S04
Depth	58.0 mm
Diameter d1	M08x1
Effective operating distance S _r	1.50 mm
Housing material	Stainless steel
Mech. Installation condition	Flush (shielded)
Mounting length	43.0 mm
Rated operating distance S _n [mm]	1.50 mm
Sensing face material	PBT
Tightening torque	8 Nm (6 FT-Lbs)
Function indicator	Yes
Function display	LED
Polarity reversal protected	Yes
Short circuit protected	Yes

Wiring Connections: PNP Normally Open



Proximity Switch Setting Instructions

1. Set the rod lock to the unclamped "pressure applied" position.
2. Screw the proximity switch (with jam nuts) into the designated M8x1 proximity switch hole until it contacts the position flange.
3. Unscrew (back off) the proximity switch approximately 3/4 turn. While holding the proximity switch in the set position, tighten the locking nut using 6 ft/lbs of torque. Final adjustment may be necessary to achieve desired results.
4. With the electrical power in the "off" position, connect the electrical wiring per the wiring diagram supplied with the switch. After the electrical power has been turned on, the proximity switch should indicate that the rod lock is in the unclamped position.

Notes: Ensure that the electrical power has been turned off before making adjustments. The locking nut should be tightened to a maximum of 15 ft/lbs of torque to prevent damage to the internal components of the switch. If sealing the unit for food or chemical service, make sure to include optional sealing ring.

Rod Lock Installation Instructions

1. Apply constant air supply to rod lock port (60-150 PSI).
2. Remove shipping arbor from inside rod lock. Save for future use.
3. Remove excess grease and dirt from cylinder piston rod. Slide rod lock onto piston rod, using care not to damage seals or bearings.
4. Align rod lock to cylinder so that unit is square and flush. Make sure that the cylinder is at least 1/2" extended.
5. Remove 60-150 PSI air supply to rod lock.
6. Fasten rod lock to cylinder using four (4) sleeve nuts & rods. Tighten sleeve nuts a little at a time, in a clockwise rotation, finishing with the proper torque specification.
7. Cycle Rod Lock by applying 60-150 PSI to rod lock port, then removing 60-150 PSI pressure; cycle several times in this manner.
8. Apply constant 60-150 PSI air supply to rod lock, then hand cycle the cylinder piston rod to check for proper alignment.
9. If cylinder piston rod does not move freely, remove rod lock and repeat Installation Instructions. If the piston rod still drags or is difficult to move, check the squareness of the Rod Lock to the cylinder.



Note: Faulty alignment will cause rod damage, cylinder failure and may drastically reduce holding force.

Sleeve Nut Torque Specs	
Bore	Torque (Ft/Lbs)
1.50	5 - 7
2.00	12 - 14
2.50	12 - 14
3.25	30
4.00	35
5.00	45
6.00	50

WARNING

UNIT CONTAINS HIGH SPRING FORCE

DO NOT DISASSEMBLE – INJURY MAY OCCUR

Return to Bimba for service

Refer to Rod Lock Catalog or visit www.bimba.com for complete instructions on proper use of rod lock.

DO NOT REMOVE 60-150 PSI AIR SUPPLY TO ROD LOCK WHEN DISASSEMBLED FROM CYLINDER. PERMANENT DAMAGE MAY OCCUR.

Safety Information

DANGER

IF PERSONAL SAFETY IS REQUIRED, AN UNRELATED, REDUNDANT SAFETY SYSTEM IS REQUIRED TO PREVENT BODILY INJURY

WARNING

DO NOT DISASSEMBLE ROD LOCK-UNIT CONTAINS HIGH SPRING FORCE.

Return to Bimba for service.

WARNING

ROD LOCKS SHOULD BE INSTALLED, OPERATED AND MAINTAINED BY QUALIFIED PERSONNEL ONLY.
UNITS SHOULD BE CHECKED PERIODICALLY FOR PROPER HOLDING FORCE.

General Information

One (or more rod locks) can be used on the same shaft or cylinder. Two units when combined will double the holding force. Steel cylinders should be considered in all high-load applications.

Rod locks are designed for static applications (rod not moving while engaging rod lock) and are suitable for infrequent dynamic braking (E-Stop) when used with proper shafting materials. Repeated dynamic stops may cause rod and seal damage and/or rod lock wear resulting in reduced life or holding force.

Filtered and dry air is important for proper rod lock functioning. Debris or moisture inside the rod lock may inhibit performance and/or shorten the life of the unit. Rod locks are pre-lubricated for life, no additional air lubrication is required.

The rod which the rod lock engages (clamps) must be kept clean and dry for optimum holding force.



The rod lock requires a minimum of 60 PSI to fully release. A low PSI condition (below 60 PSI) may cause the rod lock to drag on the rod, causing damage to the rod. Care should be taken to eliminate low PSI conditions.

Rod locks are intended for use with industrial compressed air systems within the operation specifications.

Operating Pressure

Cylinder:	0 to 250 PSI AIR
Rod Lock:	60 to 150 PSI AIR

Operating Temperature

Standard Seals:	10°F to 180°F (-12°C to 82°C)
Fluorocarbon Seals:	0°F to 400°F (-18°C to 204°C)

Axial Movement (Clamped)*

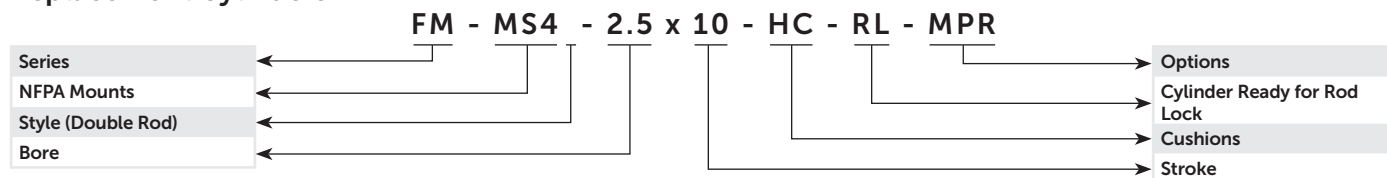
Standard:	.001" to .008"
Close Tol. (Optional):	.001" to .003"

Represents clearance within the rod lock unit, .000" movement due to actuation.

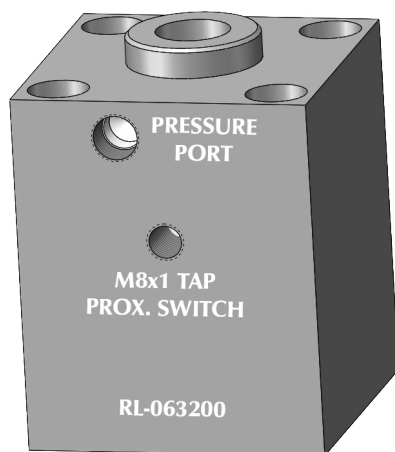
Rod Material Requirements

Diameter:	+.000" to -.002" Nominal Diameter
Hardened Shaft:	.0005" Minimum hard chrome
Unhardened Shaft:	.001" Minimum hard chrome
Finish:	6 to 10 Ra

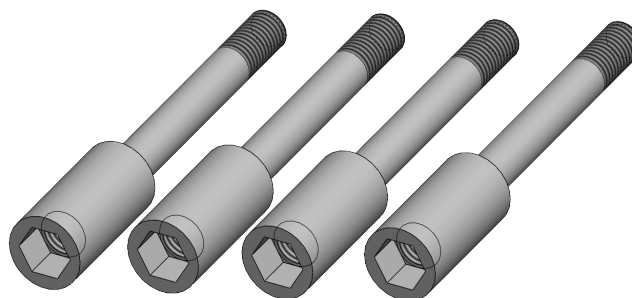
Replacement Cylinders



Note: Cylinders will ship with standard rod end (KK1) and standard rod extension (RLC dimension) unless otherwise noted by customer.



Rod Lock



Mounting Kit

Rod Lock Part List					
Bore	Rod Diameter	Rod Lock Model (Rod Lock & Mounting Kit)	Rated Holding Force (Lbs.)	Rod Lock Only	Mounting Kit Only
1.50	0.625	RL-063150	200	RL-063150-1	MK-063150
	1.000	RL-063200	350	RL-100200-1	MK-100200
2.00	0.625	RL-063250	650	RL-063250-1	MK-063250
	1.000	RL-100250	650	RL-100250-1	MK-100250
2.50	0.625	RL-100325	1000	RL-100325-1	MK-100325
	1.000	RL-138325	1000	RL-138325-1	MK-138325
3.25	1.000	RL-100400	1550	RL-100400-1	MK-100400
	1.375	RL-138400	1550	RL-138400-1	MK-138400
4.00	1.000	RL-100500	2150	RL-100500-1	MK-100500
	1.375	RL-138500	2150	RL-138500-1	MK-138500
5.00	1.375	RL-138600	2850	RL-138600-1	MK-138600
	1.750	RL-175600	2850	RL-175600-1	MK-175600

Notes: Holding Force – The minimum rating over the entire life of the rod lock.

Initial actual holding forces are higher.

DO NOT disassemble rod lock – UNIT CONTAINS HIGH SPRING FORCE. Return to Bimba for service.

Replacement Rod Locks are shipped with a steel shaft. DO NOT remove 60-150 PSI supply air to Rod Lock without steel shaft or cylinder rod in place – permanent damage to Rod Lock may occur.