

# FM Series NFPA FLUSH MOUNT

## Aluminum Cylinders 1.50" to 8.00" Bore

**Single Rod End**

**Page 26**



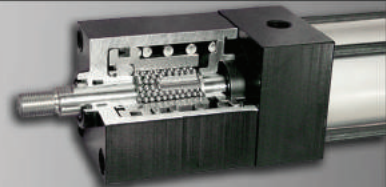
**Double Rod End**

**Page 33**



**Rod Lock**

**Page 38**



**95% OF OUR CYLINDERS SHIP IN 2-3 DAYS!  
ONE DAY RUSH SERVICE AVAILABLE ON ALL CATALOGED CYLINDER MODELS!**

# SERIES 'FM': FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)



## Benefits

- Same construction as 'TA' series with the added benefit of sleeve nut construction.
- Four tapped holes in Head and Cap-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 multiple of NFPA Mounts by simply bolting in place (refer to page 37 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).
- **EN** – Electroless Nickel Plated and Stainless Steel Fasteners provide corrosion resistance.
- **SSA** – Stainless Steel Piston Rod, Tie Rods, Sleeve Nuts and Fasteners provide corrosion resistance in outdoor applications and wet environments.
- **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).

## 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)

(Optional Port Sizes Available - Refer to page 27 for ordering instructions)

BORE	1.50	2.00	2.50	3.25	4.00	5.00	6.00
PORT SIZE	0.250 NPT	0.250 NPT	0.250 NPT	0.375 NPT	0.375 NPT	0.375 NPT	0.500 NPT

### OPERATING PRESSURE

250 PSI AIR (17 BAR)

### OPERATING TEMPERATURE

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

# HOW TO ORDER: SERIES 'FM' (FLUSH MOUNT)

**FM - MS4 - 2.50 x 10 - HC - MPR**

SERIES	
FM	250 PSI AIR

NFFPA MOUNTS	
MF1	FRONT FLANGE (1.50"- 6.00" BORE)
MF2	REAR FLANGE (1.50"- 6.00" BORE)
MP1	REAR PIVOT CLEVIS (1.50"- 6.00" BORE)
MP2	REAR PIVOT CLEVIS (1.50"- 6.00" BORE)
MP4	REAR PIVOT EYE (1.50"- 4.00" BORE)
MS1	FRONT & REAR END ANGLE (1.50"- 8.00" BORE)
MS2	SIDE LUG (1.50"- 8.00" BORE)
MS4	BOTTOM TAPPED HOLES (1.50"- 8.00" BORE)
MT1	FRONT TRUNNION (1.50"- 8.00" BORE)
MT2	REAR TRUNNION (1.50"- 8.00" BORE)
MX0	NO MOUNT (1.50"- 8.00" BORE)
BASE BAR	NON-NFFPA (1.50"- 4.00" BORE)

BORE	
1.50	2.00
2.50	3.25
4.00	5.00
6.00	8.00

STROKE	
0" to 120" MADE-TO-ORDER	

CUSHIONS	
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 6 IS STANDARD SPECIFY FOR POSITIONS: 1, 3 & 4
C	CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8
LC	LONG CAP CUSHION POSITION 2 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8
ELC	EXTRA LONG CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8
<b>FIXED CUSHIONS</b>	
FCH	FIXED HEAD CUSHION (NON-ADJUSTABLE, NO ADJUSTMENT NEEDLE)
FCC	FIXED CAP CUSHION (NON-ADJUSTABLE, NO ADJUSTMENT NEEDLE)
FC	FIXED HEAD AND CAP CUSHION (NON-ADJUSTABLE, NO ADJUSTMENT NEEDLE)

STYLE	
SINGLE ROD (LEAVE BLANK)	
D = DOUBLE ROD END	

OPTIONS	
ADDS LENGTH TO CYLINDER - SEE "OPTION LENGTH ADDER" CHART BELOW.	
A=	EXTENDED PISTON ROD THREAD (Example: A= 2")
AS	ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, Example: AS = 4")
A/O	AIR / OIL PISTON
B	.25" URETHANE BUMPER BOTH ENDS
BC	.25" URETHANE BUMPER CAP ONLY
BH	.25" URETHANE BUMPER HEAD ONLY
BP	BUMPER PISTON SEALS (1.50" - 6.00" BORE)
BSP	BSP PORTS (SPECIFY SIZE, EXAMPLE: BSP = .25")
C=	EXTENDED PISTON ROD (EXAMPLE: IF C= 0.50", THEN 1" ROD EXTENSION IS C= 1.50")
EN	ELECTROLESS NICKEL PLATED
KK2	LARGE MALE ROD THREAD
KK3	FEMALE ROD THREAD
KK3S	STUDD 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
MA	MICRO-ADJUST (12" MAX STROKE) AVAILABLE ON DOUBLE ROD END MODELS
MAB	MICRO-ADJUST W/ SOUND DAMPENING BUMPER (12" MAX STROKE)
MPR	MAGNETIC PISTON FOR REED OR SOLID STATE SWITCHES - MODELS: R10, R10P, RAC, RHT & MSS
MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
NR	NON-ROTATING
OP	OPTIONAL PORT LOCATION OR SIZE (EXAMPLE: Ports @ 3 & 7)
OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, EXAMPLE: OS = 1.375")
SAE	SAE PORTS (SPECIFY SIZE, EXAMPLE: SAE #10)
SE	SPRING EXTEND (1.50", 2.00", 2.50" BORE)
SR	SPRING RETURN (1.50", 2.00", 2.50" BORE)
SSA	STAINLESS STEEL PISTON ROD, TIE RODS & NUTS & FASTENERS
SSF	STAINLESS STEEL FASTENERS
SSN	STAINLESS STEEL TIE ROD NUTS
SSR	STAINLESS STEEL PISTON ROD
SST	STAINLESS STEEL TIE RODS
ST	STOP TUBE - SPECIFY STOP TUBE LENGTH (IN INCHES) SPECIFY STROKE AS ES (EFFECTIVE STROKE) (EXAMPLE: FM MS4 2 X 24ES-ST=3)
TMS	STEEL CYLINDER TUBE, BLACK EPOXY PAINT FINISH
TH	400 PSI HYDRAULIC NON-SHOCK
VS	FLUOROCARBON SEALS
XX	SPECIAL VARIATION (SPECIFY)

**About our Part Number System**

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

**Example:** A 2.50" Bore by 10" Stroke NFFPA cylinder, Bottom Tap Mount, Head & Cap Cushions, and Magnetic Piston for Switches.

**Part Number:** FM-MS4-2.5 x 10-HC-MPR

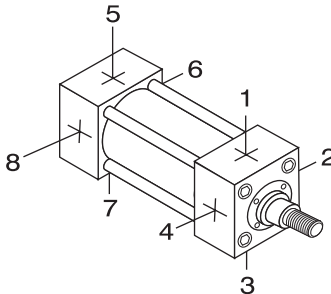
**Note:** "L" and "EL" CUSHION OPTIONS CAN BE ORDERED AS FIXED CUSHIONS.

**Example:** FCLH, FCELH

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

## STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

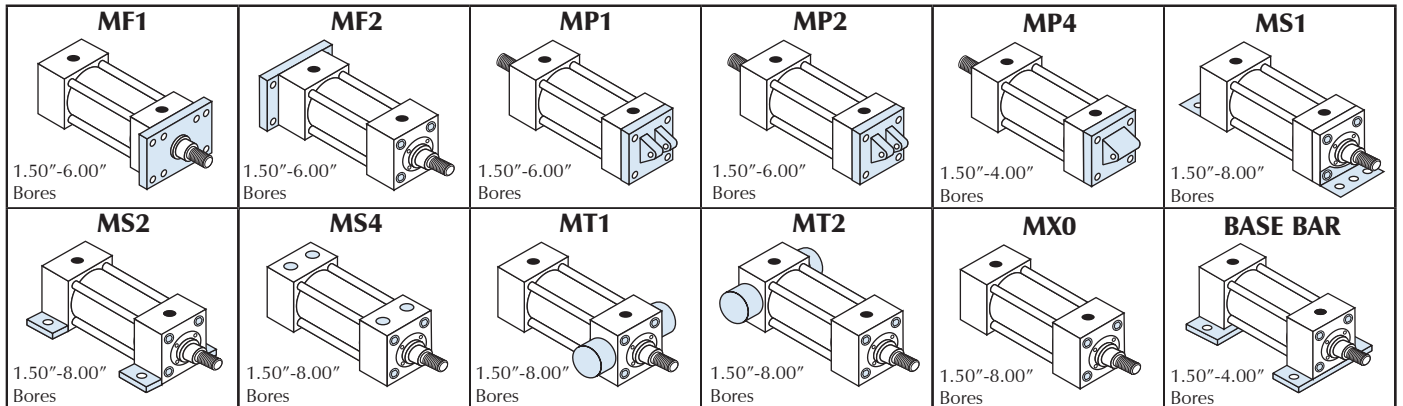
- Ports - Positions 1 and 5
- Cushion Adjustment - Positions 2 and 6
- Specify Non-Standard Positions When Ordering



OPTION LENGTH ADDER							
(ADD TO CATALOG BASIC OVERALL LENGTH DIMENSIONS)							
BORE	OPTION						
	B	BC	BH	ELC	ELH	SE	SR
1.50	0.500	0.250	0.250	1.000	1.000	REFER TO PAGE 92 FOR LENGTH ADDERS	ST* (STOP TUBE) EXAMPLE: ST=2
2.00	0.500	0.250	0.250	1.000	1.000	REFER TO PAGE 92 FOR LENGTH ADDERS	2
2.50	0.500	0.250	0.250	1.000	1.000	REFER TO PAGE 92 FOR LENGTH ADDERS	2
3.25	0.500	0.250	0.250	1.250	1.250	REFER TO PAGE 92 FOR LENGTH ADDERS	2
4.00	0.500	0.250	0.250	1.250	1.250	REFER TO PAGE 92 FOR LENGTH ADDERS	2
5.00	0.500	0.250	0.250	1.250	1.250	REFER TO PAGE 92 FOR LENGTH ADDERS	2
6.00	0.500	0.250	0.250	1.500	1.500	REFER TO PAGE 92 FOR LENGTH ADDERS	2

\*The desired Stop Tube length adds directly to the overall cylinder length.

## 'FM' NFFPA MOUNTS



# SERIES 'FM' DIMENSIONS: BASIC CYLINDER (MX0 MOUNT) FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)

EASY FLIP OUT PAGE FOR REFERENCE

## About Rod End Styles

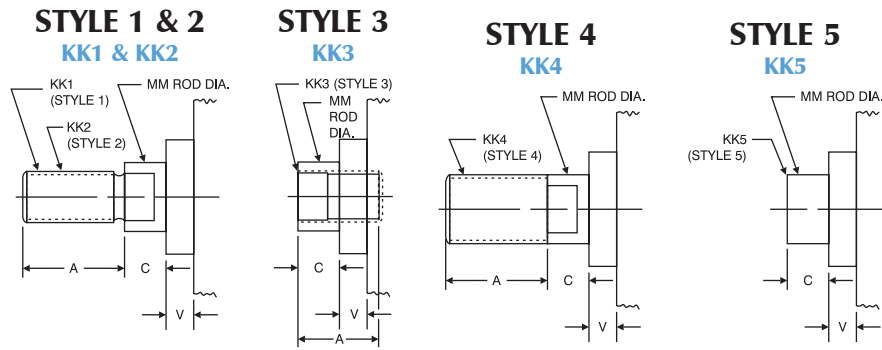
Style 1 Male Rod End is STANDARD

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).

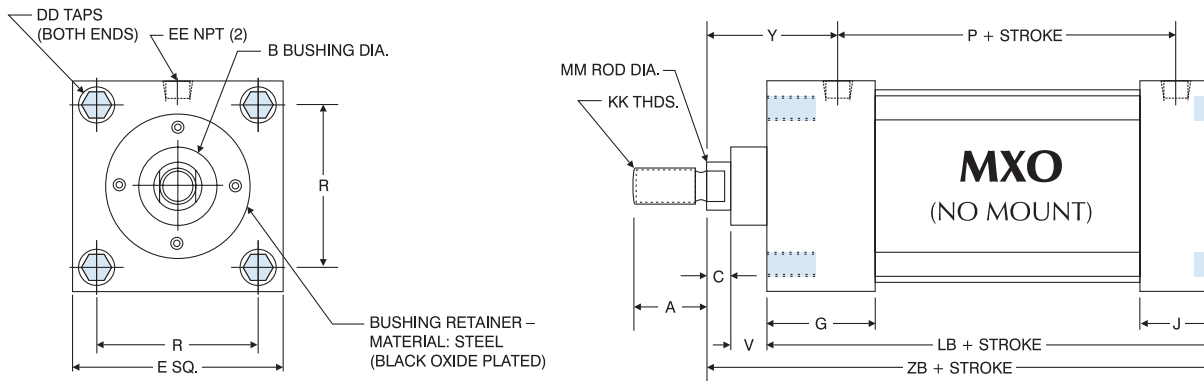
NEED SOMETHING NOT LISTED? Just send us a sketch. In most cases, quotes are turned around in one day!

## PISTON ROD END STYLES



BORE	MM ROD DIAMETER	STANDARD		OPTIONAL							C	V
		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	0.625
	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	0.500
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	1.000
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	1.000
	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	1.125

## BASIC DIMENSIONS: 'MX0' (NO MOUNT) - STANDARD ROD



'FM' SERIES BASIC DIMENSIONS 'MX0'																
BORE	A	B	C	DD	E	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

For oversize rod dimensions, see page 32.

# SERIES 'FM' DIMENSIONS: BASIC CYLINDER (MX0 MOUNT) FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)

## About Rod End Styles

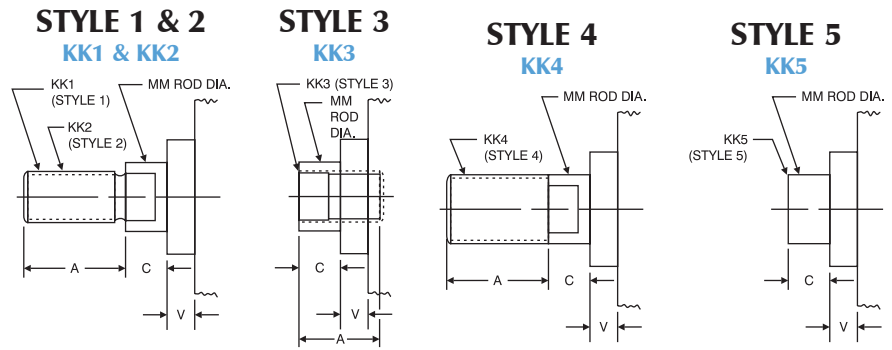
Style 1 Male Rod End is STANDARD

Other NFPA Styles can be specified (see chart).

Need a rod end not listed?  
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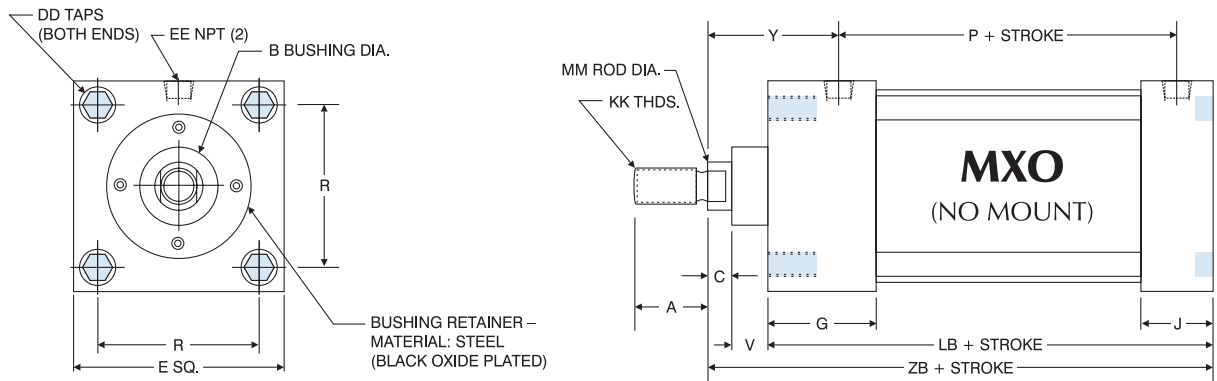
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## PISTON ROD END STYLES



BORE	MM ROD DIAMETER	STANDARD		OPTIONAL							C	V
		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	0.625
	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	0.500
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	1.000
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	1.000
	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	1.125

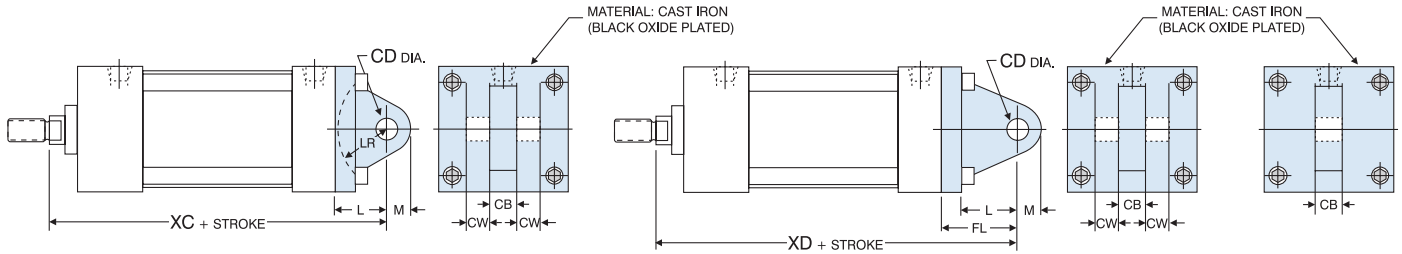
## BASIC DIMENSIONS: 'MX0' (NO MOUNT) - STANDARD ROD



'FM' SERIES BASIC DIMENSIONS 'MX0'																
BORE	A	B	C	DD	E	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

For oversize rod dimensions, see page 32.

# SERIES 'FM' DIMENSIONS: PIVOT MOUNTS FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)



**FM-MP1**

**FM-MP2**

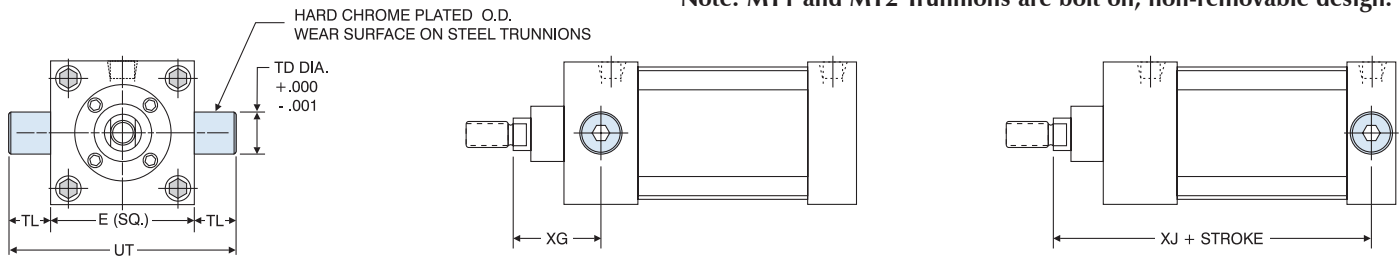
**FM-MP4**

(1.50" - 4.00" bore)

'FM' SERIES 'MP1' & 'MP2' CLEVIS AND 'MP4' ROD EYE MOUNT DIMENSIONS										
BORE	ROD DIAMETER	CB	CD	CW	FL	L	LR	M	ADD STROKE	
									XC	XD
1.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.750	0.625	5.375	5.750
	1.000 Oversize								5.750	6.125
2.00	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.750	0.625	5.375	5.750
	1.000 Oversize								5.750	6.125
2.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.750	0.625	5.500	5.875
	1.000 Oversize								5.875	6.250
3.25	1.000 Standard	1.250	0.750	0.625	1.875	1.250	1.250	0.875	6.875	7.500
	1.375 Oversize								7.125	7.750
4.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	1.250	0.875	6.875	7.500
	1.375 Oversize								7.125	7.750
5.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	1.250	0.875	7.125	7.750
	1.375 Oversize								7.375	8.000
6.00	1.375 Standard	1.500	1.000	0.750	2.250	1.500	1.500	1.000	8.125	8.875
	1.750 Oversize								8.375	9.125

For dimensions not shown, see page 28.

Note: MT1 and MT2 Trunnions are bolt on, non-removable design.



**FM-MT1 / MT2**

**FM-MT1**

**FM-MT2**

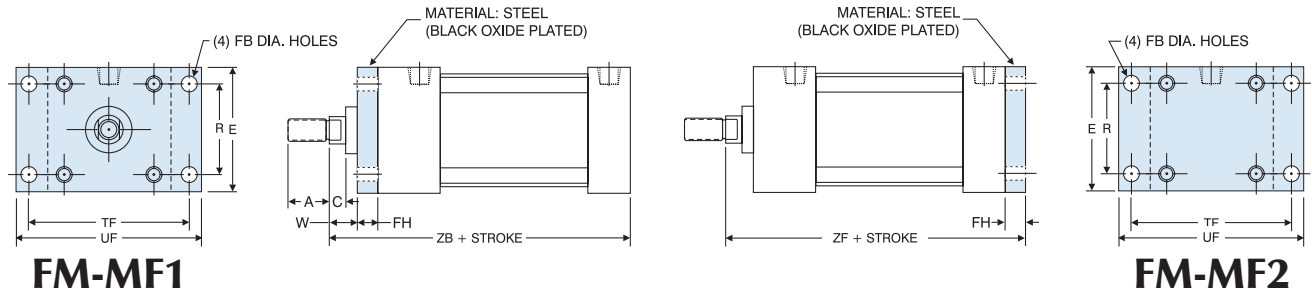
Note: MT1 standard cushion locations at 3 and 6  
MT2 standard cushion locations at 2 and 7

'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	2.000	1.000	1.000	4.000	1.750	4.125	
	1.000 Oversize					N/A*	4.500	
2.00	0.625 Standard	2.500	1.000	1.000	4.500	1.750	4.125	
	1.000 Oversize					2.125	4.500	
2.50	0.625 Standard	3.000	1.000	1.000	5.000	1.750	4.250	
	1.000 Oversize					2.125	4.625	
3.25	1.000 Standard	3.750	1.000	1.000	5.750	2.250	5.000	
	1.375 Oversize					2.500	5.250	
4.00	1.000 Standard	4.500	1.000	1.000	6.500	2.250	5.000	
	1.375 Oversize					2.500	5.250	
5.00	1.000 Standard	5.500	1.000	1.000	7.500	2.250	5.250	
	1.375 Oversize					2.500	5.500	
6.00	1.375 Standard	6.500	1.375	1.375	9.250	2.625	5.875	
	1.750 Oversize					2.875	6.125	
8.00	1.375 Standard	8.500	1.375	1.375	11.250	2.625	6.000	
	1.750 Oversize					2.875	6.250	

\*No oversize rod available on 1.50" bore MT1.  
For dimensions not shown, see page 28.

# SERIES 'FM' DIMENSIONS: FLANGE MOUNTS

## FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)



**FM-MF1**

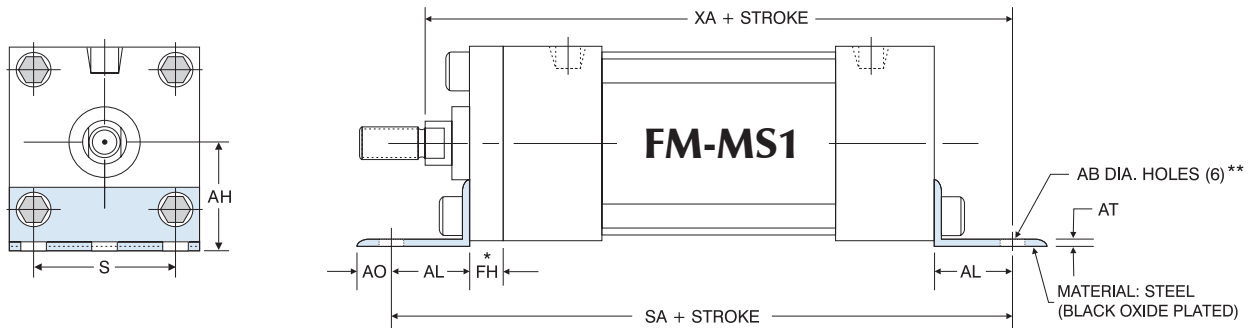
**FM-MF2**

'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 28.

# SERIES 'FM' DIMENSIONS: 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

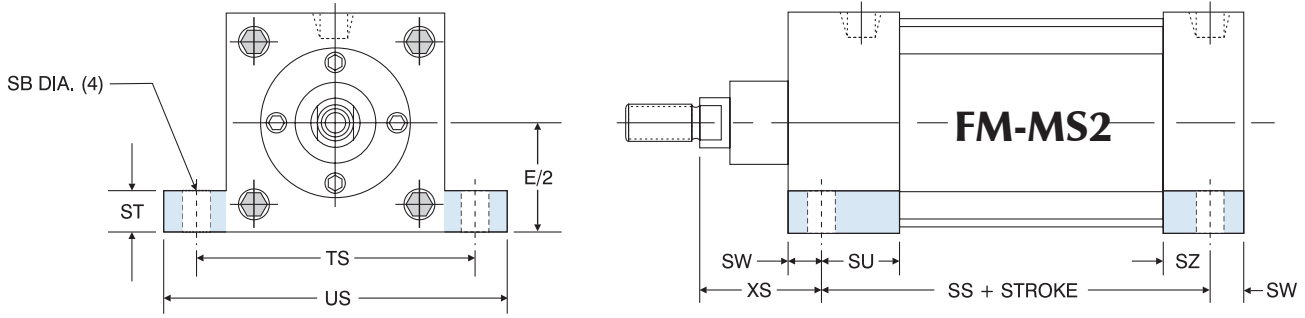
\*3.50" diameter round retainer on 8.00" bore (MS1 BRACKET BOLTED DIRECTLY TO HEAD).

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

For dimensions not shown, see page 28.

# SERIES 'FM' DIMENSIONS: BASE MOUNTS

## FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)

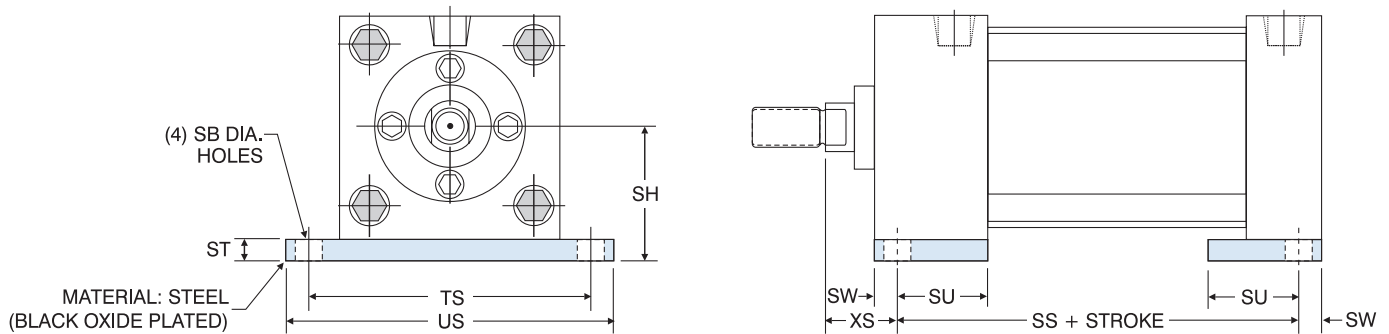


'FM' SERIES 'MS2' SIDE LUG MOUNT DIMENSIONS

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

Note: 1.50" to 3.25" oversized rods have full front retainer.  
For dimensions not shown, see page 28.

## FM-BASE BAR (Non-NFPA)



'FM' SERIES BASE BAR MOUNT (Non-NFPA) DIMENSIONS

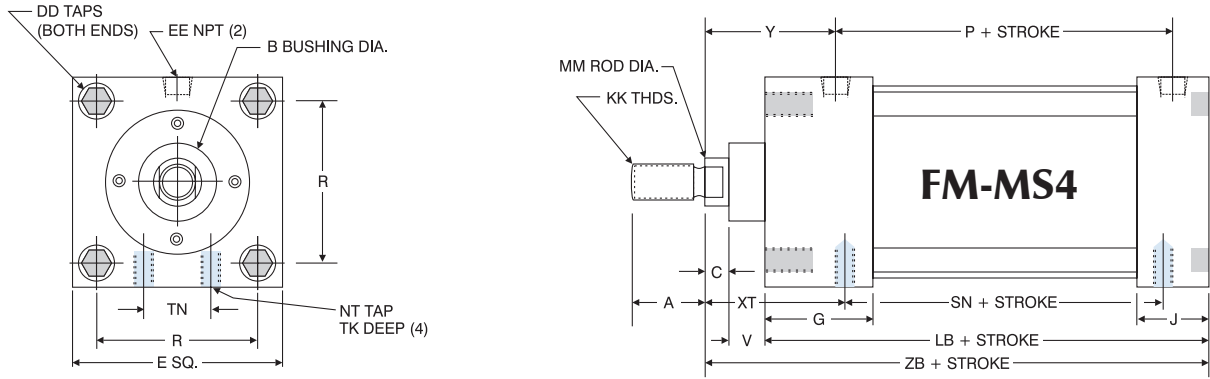
BORE	ROD DIAMETER	SB	SH	ST	SU	SW	TS	US	XS	ADD STROKE
										SS
1.50	0.625 Standard	0.438	1.250	0.250	1.125	0.375	2.750	3.500	1.375	2.875
	1.000 Oversize									
2.00	0.625 Standard	0.438	1.500	0.250	1.125	0.375	3.250	4.000	1.375	2.875
	1.000 Oversize									
2.50	0.625 Standard	0.438	1.875	0.375	1.125	0.375	3.750	4.500	1.375	3.000
	1.000 Oversize									
3.25	1.000 Standard	0.563	2.375	0.500	1.250	0.500	4.750	5.750	1.875	3.250
	1.375 Oversize								2.125	
4.00	1.000 Standard	0.563	2.750	0.500	1.250	0.500	5.500	6.500	1.875	3.250
	1.375 Oversize								2.125	

Note: 1.50" to 3.25" oversized rods have full front retainer.  
For dimensions not shown, see page 28.



# SERIES 'FM' DIMENSIONS: BASE MOUNTS

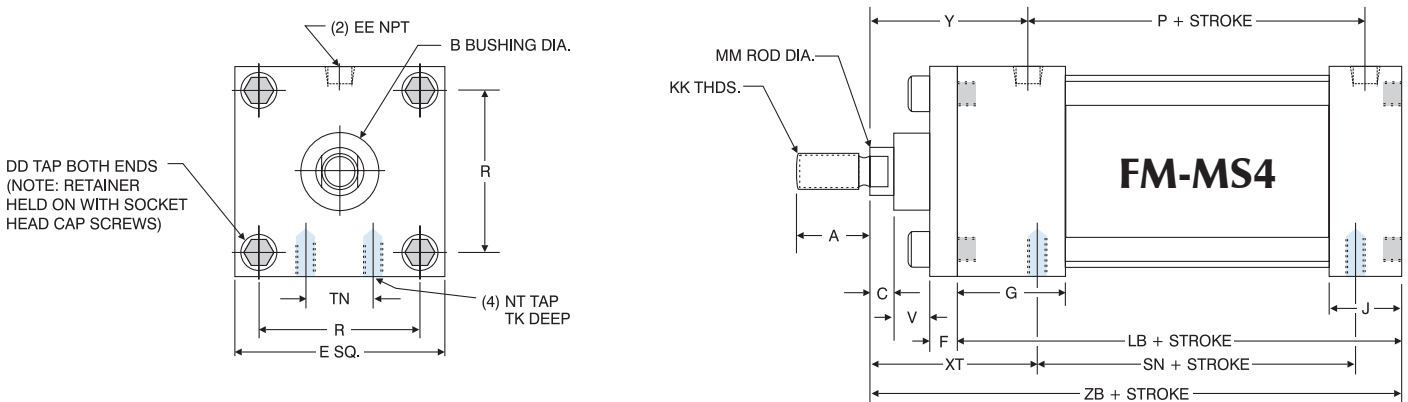
## FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)



'FM' SERIES 'MS4' FLUSH MOUNT DIMENSIONS																					
BORE	MM	A	B	C	DD	E	EE	G	J	KK	LB	P	R	V	Y	NT	TK	TN	SN	XT	ZB
1.50	0.625	0.750	1.125	0.375	1/4-28	2.000	0.250	1.500	1.000	7/16-20	3.625	2.375	1.425	0.625	1.875	1/4-20	0.375	0.625	2.250	1.938	4.625
2.00	0.625	0.750	1.125	0.375	5/16-24	2.500	0.250	1.500	1.000	7/16-20	3.625	2.375	1.844	0.625	1.875	5/16-18	0.500	0.875	2.250	1.938	4.625
2.50	0.625	0.750	1.125	0.357	5/16-24	3.000	0.250	1.500	1.000	7/16-20	3.750	2.500	2.188	0.625	1.875	3/8-16	0.625	1.250	2.375	1.938	4.750
3.25	1.000	1.125	1.500	0.500	3/8-24	3.750	0.375	1.750	1.250	3/4-16	4.250	2.750	2.760	0.875	2.375	1/2-13	0.750	1.500	2.625	2.438	5.625
4.00	1.000	1.125	1.500	0.500	3/8-24	4.500	0.375	1.750	1.250	3/4-16	4.250	2.750	3.320	0.875	2.375	1/2-13	0.750	2.063	2.625	2.438	5.625
	1.375	1.625	2.000	0.625						1-14				1.000	2.625						
5.00	1.000	1.125	1.500	0.500	1/2-20	5.500	0.375	1.750	1.250	3/4-16	4.500	3.000	4.100	0.875	2.375	5/8-11	1.000	2.688	2.875	2.438	5.875
	1.375	1.625	2.000	0.625						1-14				1.000	2.625						
6.00	1.375	1.625	2.000	0.625	1/2-20	6.500	0.500	2.000	1.500	1-14	5.000	3.250	4.875	1.000	2.750	3/4-10	1.125	3.250	3.125	2.813	6.625
	1.750	2.000	2.375	0.750						1 1/4-12				1.125	3.000						
8.00	1.375	1.625	2.000	0.625	5/8-18	8.500	0.750	2.000	1.500	1-14	5.125	3.375	6.438	1.000	2.750	3/4-10	1.125	4.500	3.250	2.813	7.313
	1.750	2.000	2.375	0.750						1 1/4-12				1.125	3.000						

For dimensions not shown, see page 28.

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

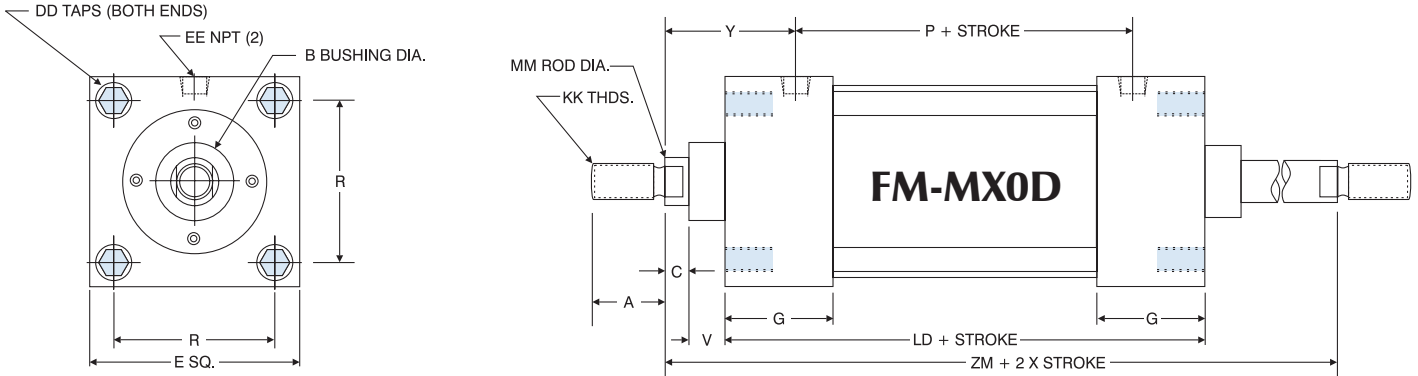


'FM' SERIES OVERSIZE ROD 'MS4' FLUSH MOUNT DIMENSIONS																						
BORE	MM	A	B	C	DD	E	EE	F	G	J	KK	LB	P	R	V	Y	NT	TK	TN	SN	XT	ZB
1.50	1.000	1.125	1.500	0.500	1/4-28	2.000	0.250	0.375	1.500	1.000	3/4-16	3.625	2.375	1.438	0.500	2.250	1/4-20	0.375	0.625	2.250	2.313	5.000
2.00	1.000	1.125	1.500	0.500	5/16-24	2.500	0.250	0.375	1.500	1.000	3/4-16	3.625	2.375	1.844	0.500	2.250	5/16-18	0.500	0.875	2.250	2.313	5.000
2.50	1.000	1.125	1.500	0.500	5/16-24	3.000	0.250	0.375	1.500	1.000	3/4-16	3.750	2.500	2.188	0.500	2.250	3/8-16	0.625	1.250	2.375	2.313	5.125
3.25	1.375	1.625	2.000	0.625	3/8-24	3.750	0.375	0.625	1.750	1.250	1-14	4.250	2.750	2.760	0.375	2.625	1/2-13	0.750	1.500	2.625	2.688	5.875

For dimensions not shown, see page 28.

# SERIES 'FM' DIMENSIONS: DOUBLE ROD END (NO MOUNT) FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)

## BASIC DIMENSIONS: DOUBLE ROD END 'MX0D' (NO MOUNT)

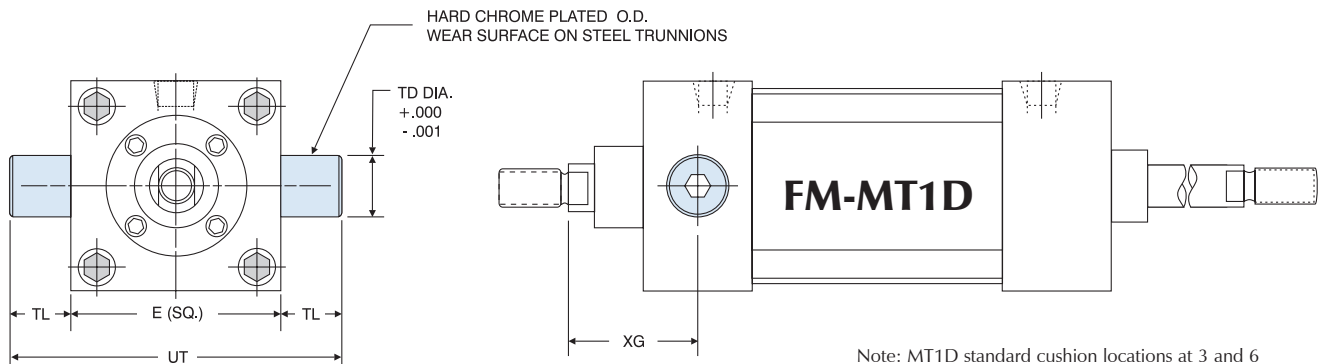


'FM' SERIES DOUBLE ROD END BASIC DIMENSIONS 'MX0D'

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.

## SERIES 'FM' DIMENSIONS: DOUBLE ROD END PIVOT MOUNT



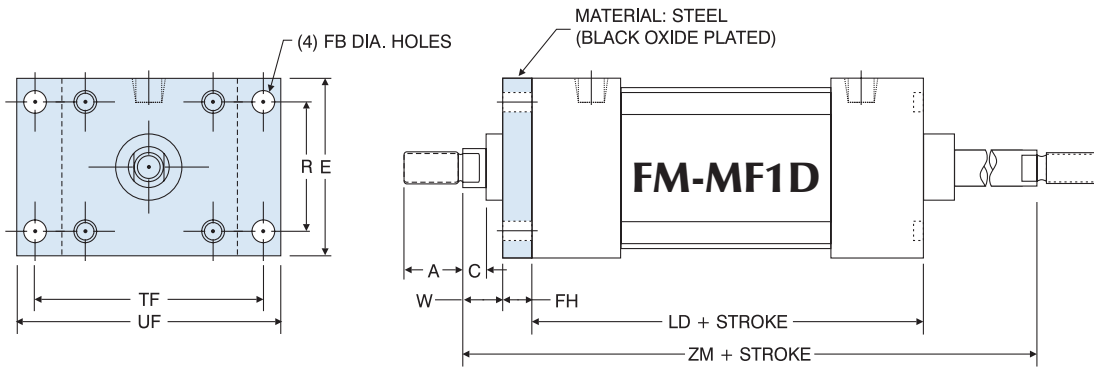
Note: MT1D standard cushion locations at 3 and 6

'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	2.500	1.000	1.000	4.500	1.750
	1.000 Oversize					2.125
2.50	0.625 Standard	3.000	1.000	1.000	5.000	1.750
	1.000 Oversize					2.125
3.25	1.000 Standard	3.750	1.000	1.000	5.750	2.250
	1.375 Oversize					2.500
4.00	1.000 Standard	4.500	1.000	1.000	6.500	2.250
	1.375 Oversize					2.500
5.00	1.000 Standard	5.500	1.000	1.000	7.500	2.250
	1.375 Oversize					2.500
6.00	1.375 Standard	6.500	1.375	1.375	9.250	2.625
	1.750 Oversize					2.875
8.00	1.375 Standard	8.500	1.375	1.375	11.250	2.625
	1.750 Oversize					2.875

\*No oversize rod available on 1.50" bore MT1D.  
For dimensions not shown, see chart above.

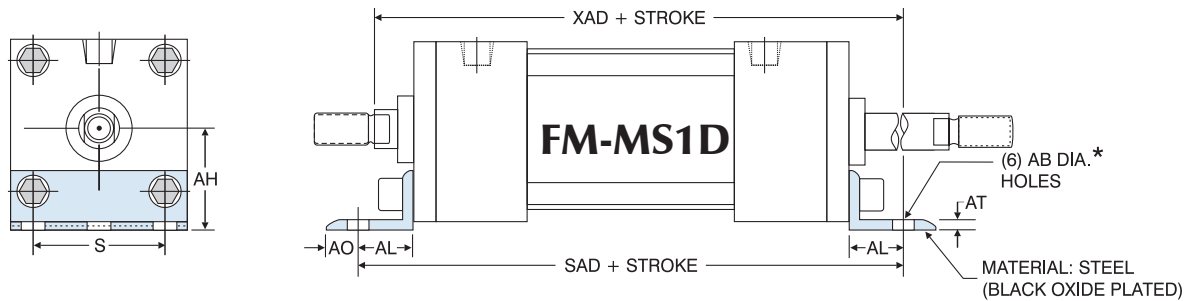
# SERIES 'FM' DIMENSIONS: DOUBLE ROD END FLANGE MOUNT FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)



'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	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	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	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	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	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	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	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 33.

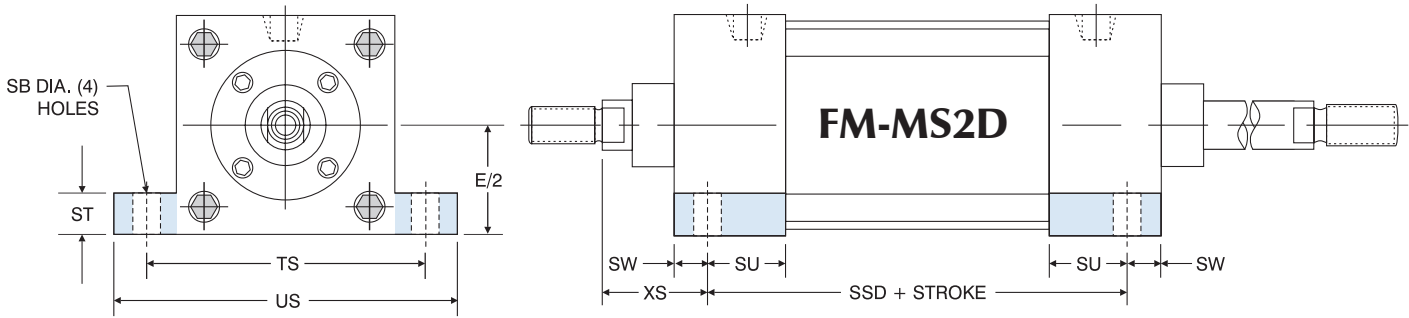
# SERIES 'FM' DIMENSIONS: DOUBLE ROD END BASE MOUNTS FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)



'FM' SERIES DOUBLE ROD END 'MS1D' ANGLE MOUNT DIMENSIONS									
BORE	ROD DIAMETER	AB	AH	AL	AO	AT	S	ADD STROKE	
								SAD	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 33.

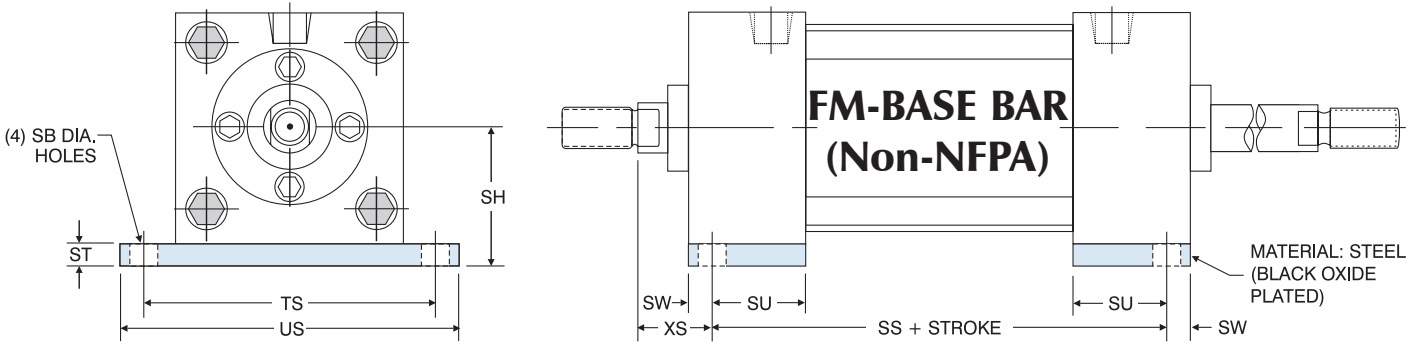
# SERIES 'FM' DIMENSIONS: DOUBLE ROD END BASE MOUNTS FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)



'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	0.438	1.000	0.500	1.125	0.375	2.750	3.500	1.375	3.375
	1.000 Oversize									
2.00	0.625 Standard	0.438	1.250	0.500	1.125	0.375	3.250	4.000	1.375	3.375
	1.000 Oversize									
2.50	0.625 Standard	0.438	1.500	0.500	1.125	0.375	3.750	4.500	1.375	3.500
	1.000 Oversize									
3.25	1.000 Standard	0.563	1.875	0.750	1.250	0.500	4.750	5.750	1.875	3.750
	1.375 Oversize									
4.00	1.000 Standard	0.563	2.250	0.750	1.250	0.500	5.500	6.500	1.875	3.750
	1.375 Oversize									
5.00	1.000 Standard	0.813	2.750	1.000	1.063	0.688	6.875	8.250	2.063	3.625
	1.375 Oversize									
6.00	1.375 Standard	0.813	3.250	1.000	1.313	0.688	7.875	9.250	2.313	4.125
	1.750 Oversize									
8.00	1.375 Standard	0.813	4.250	1.000	1.563	0.688	9.875	11.250	2.313	4.250
	1.750 Oversize									

Note: 1.50" to 3.25" oversized rods use full retainers.  
For dimensions not shown, see page 33.



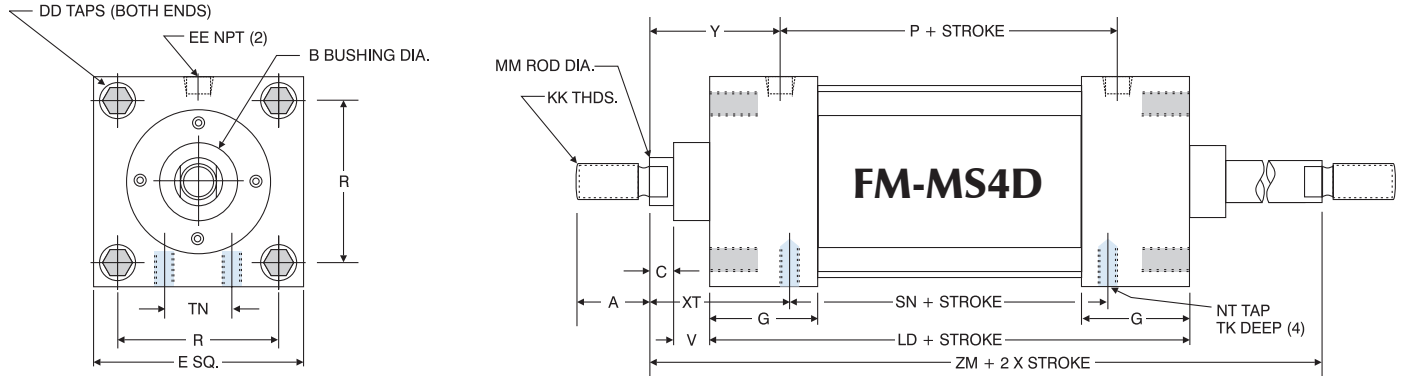
'FM' SERIES DOUBLE ROD END BASE BAR MOUNT (Non-NFPA) DIMENSIONS

BORE	ROD DIAMETER	SB	SH	ADD STROKE	ST	SU	SW	TS	US	XS
				SS						
1.50	0.625 Standard	0.438	1.250	3.375	0.250	1.125	0.375	2.750	3.500	1.375
	1.000 Oversize									
2.00	0.625 Standard	0.438	1.500	3.375	0.250	1.125	0.375	3.250	4.000	1.375
	1.000 Oversize									
2.50	0.625 Standard	0.438	1.875	3.500	0.375	1.125	0.357	3.750	4.500	1.375
	1.000 Oversize									
3.25	1.000 Standard	0.563	2.375	3.750	0.500	1.250	0.500	4.750	5.750	1.875
	1.375 Oversize									
4.00	1.000 Standard	0.563	2.750	3.750	0.500	1.250	0.500	5.500	6.500	1.875
	1.375 Oversize									

For dimensions not shown, see page 33.

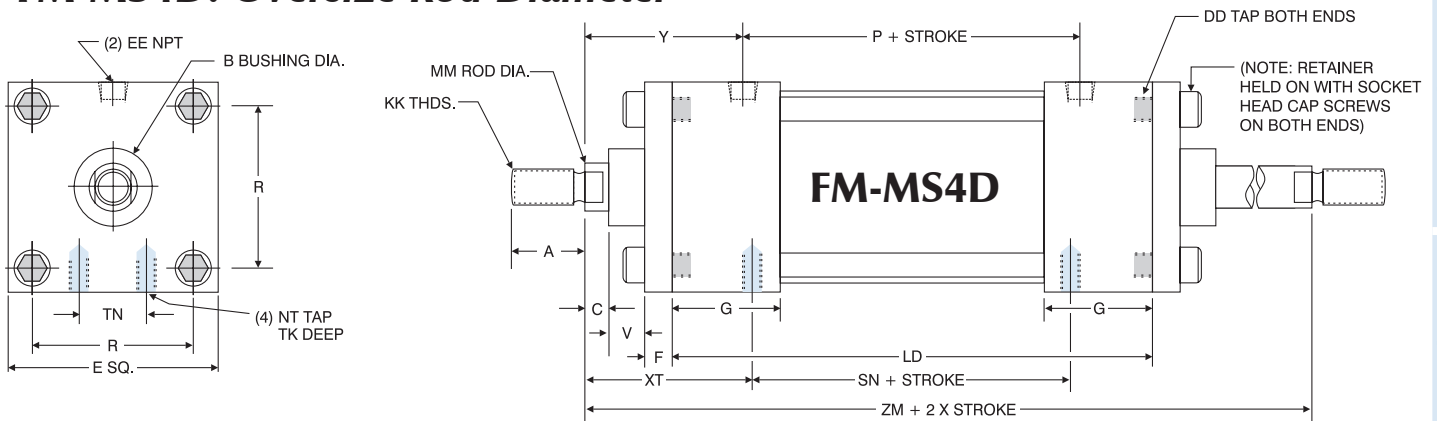
# SERIES 'FM' DIMENSIONS: DOUBLE ROD END BASE MOUNT FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)

## 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

## FM-MS4D: Oversize Rod Diameter

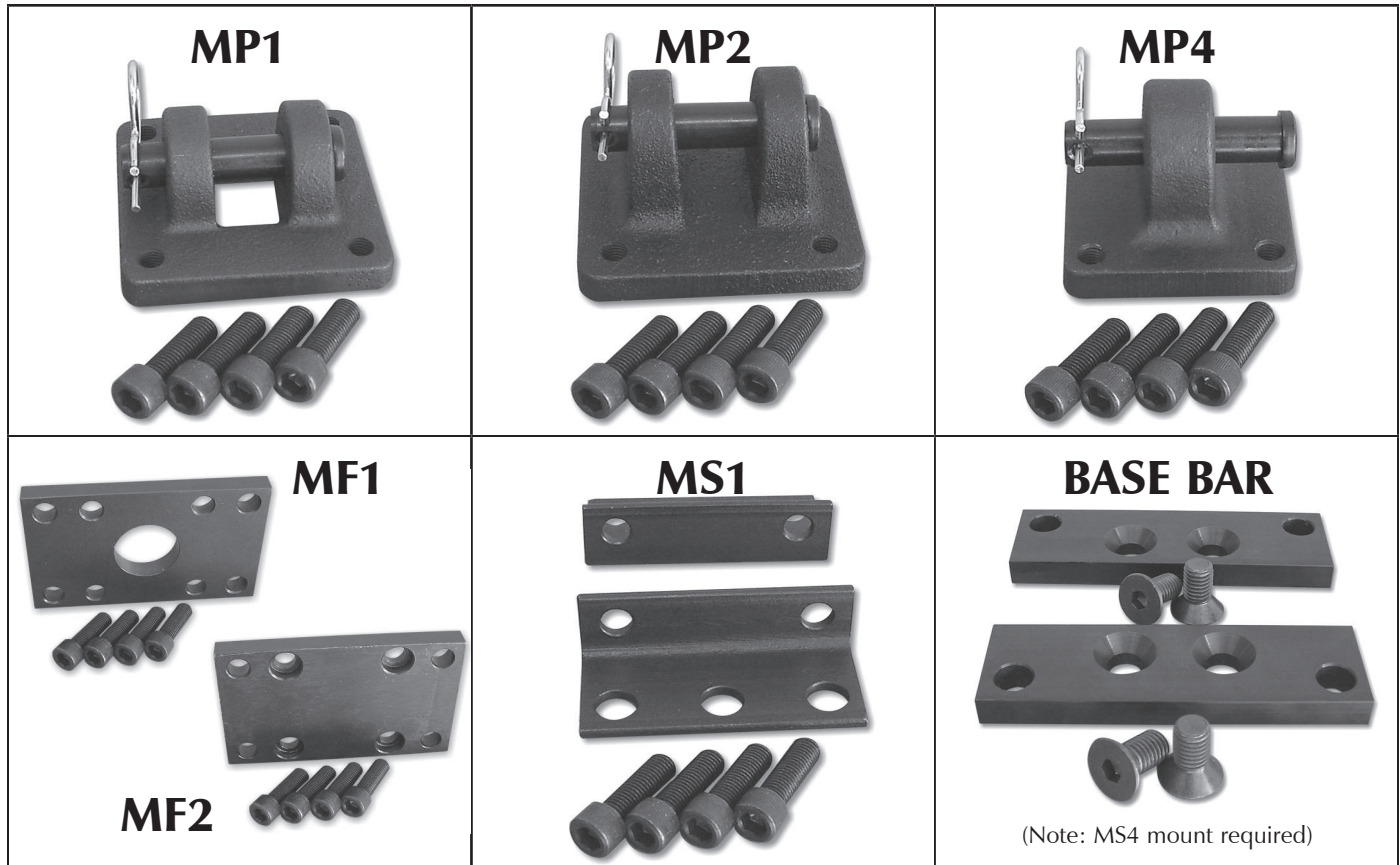


'FM' SERIES DOUBLE ROD END OVERSIZE ROD 'MS4D' FLUSH MOUNT DIMENSIONS																					
BORE	A	B	C	DD	E	EE	F	G	KK	LD	MM	P	R	V	Y	NT	TK	TN	SN	XT	ZM
1.50	1.125	1.500	0.500	1/4-28	2.000	0.250	0.375	1.500	3/4-16	4.125	1.000	2.375	1.438	0.500	2.250	1/4-20	0.375	0.625	2.250	2.313	6.875
2.00	1.125	1.500	0.500	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.

# SERIES 'FM' FLUSH MOUNT: MOUNTING KITS

Most 'FM' 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

	MP1	MP2	MP4	MF1	MF1 OS ROD	MF2	MS1	Base Bar
BORE	PART NUMBER	PART NUMBER	PART NUMBER	PART NUMBER	PART NUMBER	PART NUMBER	PART NUMBER	PART NUMBER
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	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	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	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	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	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
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

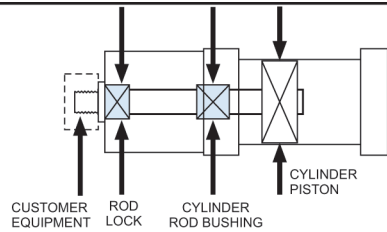
\*Base Bar "SH" dimension is not NFPA. Refer to pages 31 & 35. All other dimensions are NFPA.

# SERIES 'FM' (NFPA) CYLINDER WITH ROD LOCK

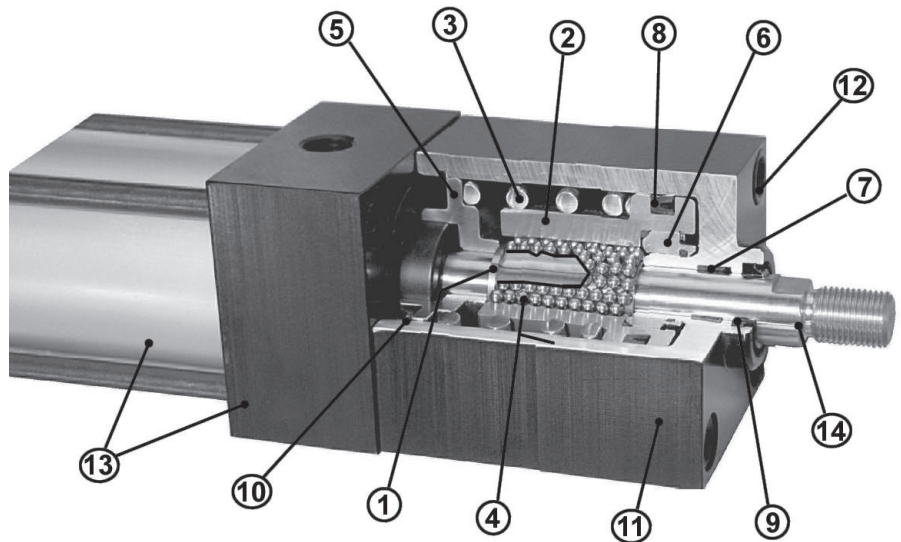
## Floating Rod Bushing

### 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

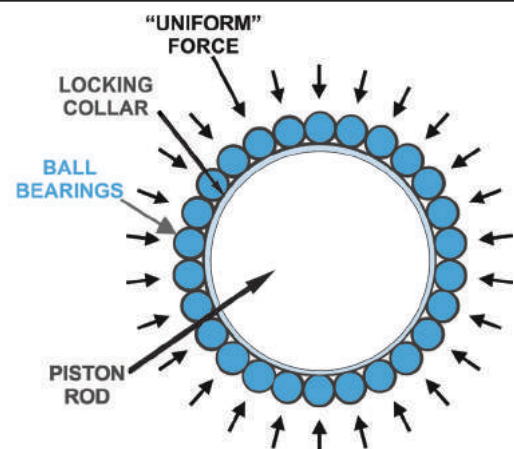
- ① **LOCKING COLLAR** – Hardened specialized tool steel, precision ground, multi-split collar design provides 4,000,000-5,000,000 cycles without fatigue or fracture.
  - ② **PISTON-OUTER LOCK HOUSING** – Hardened tool steel, precision ground design also serves as a spring guide for uniform clamp force 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 TRD catalog pages 28-36 for specifications and options.
  - ⑭ **CYLINDER PISTON ROD** – Hard chrome plated steel.
- 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.

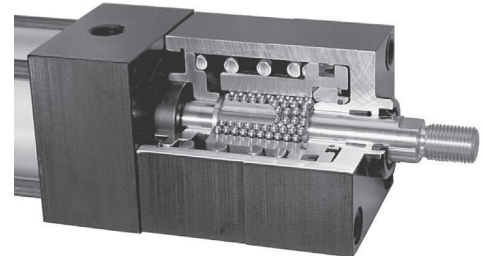


# The TRD difference...

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

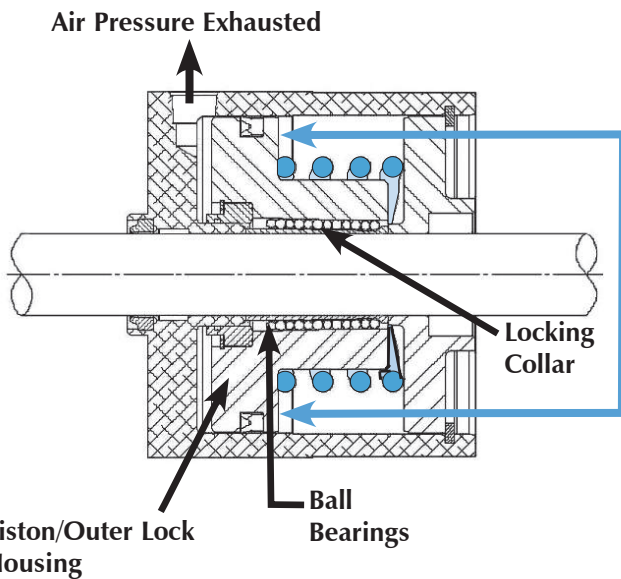
For rod locks to achieve the rated holding force and maximize cycle life, good alignment must be maintained between the locking mechanism and cylinder rod. TRD's Floating Rod Bushing design and accurate rod lock alignment ensure superior performance and trouble-free operation.

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 59 for proper application.

## OPERATING PRINCIPAL



### 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.

**HIGH SPRING FORCE  
LOCKS PISTON ROD  
IN PLACE**

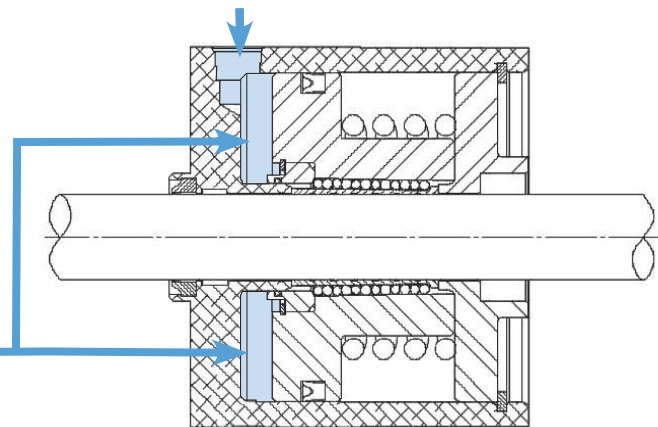
### UNCLAMPED CONDITION

#### (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"

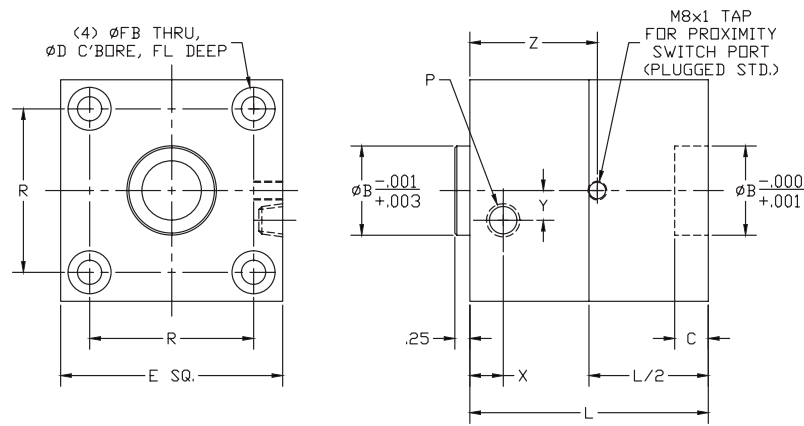
### ROD MATERIAL REQUIREMENTS

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

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



# 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
2.00	0.625 Standard	RL-063200-1	500	1.125	0.375	0.515	1.031	2.475	0.343	3.000	1/8 NPT	1.840	0.310	0.380	1.196	4.0
	1.000 Oversize	RL-100200-1	350	1.500	0.563					3.750			0.500		1.869	3.5
2.50	0.625 Standard	RL-063250-1	650	1.125	0.375	0.515	1.031	2.975	0.343	3.250	1/8 NPT	2.190	0.380	0.500	1.490	5.0
	1.000 Oversize	RL-100250-1	650	1.500	0.563					3.750			0.500		1.857	5.0
3.25	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 Oversize	RL-138325-1	1000	2.000	0.625					4.000			0.500		2.000	9.0
4.00	1.000 Standard	RL-100400-1	1550	1.500	0.563	0.719	1.281	4.475	0.406	4.000	1/4 NPT	3.320	0.560	0.000	1.782	14.0
	1.375 Oversize	RL-138400-1	1550	2.000	0.625					4.000			0.500		1.811	13.0
5.00	1.000 Standard	RL-100500-1	2150	1.500	0.563	0.844	1.500	5.475	0.531	4.000	1/4 NPT	4.100	0.560	0.750	1.810	18.0
	1.375 Oversize	RL-138500-1	2150	2.000	0.625					4.125			0.625		1.941	19.0
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 Oversize	RL-175600-1	2850	2.375	0.750					4.500			0.560		1.923	14.0

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

## BASIC CYLINDER FORCE CHART

BORE	ROD DIA.	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
2.50	1.000	PULL	2.357	141	189	236
	ALL	PUSH	4.909	295	393	491
2.50	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
3.25	1.375	PULL	6.811	409	545	681
	ALL	PUSH	12.566	754	1005	1257
4.00	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
5.00	1.375	PULL	18.150	1089	1452	1815
	ALL	PUSH	28.274	1696	2262	2827
6.00	1.375	PULL	26.789	1607	2144	2679
	1.750	PULL	25.869	1552	2070	2587

## RATED HOLDING FORCE

BORE	ROD DIA.	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.