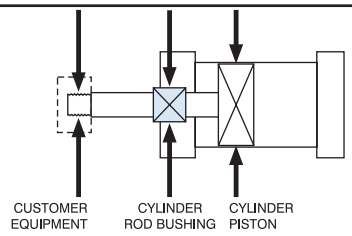
SERIES 'TA' (NFPA) CYLINDER

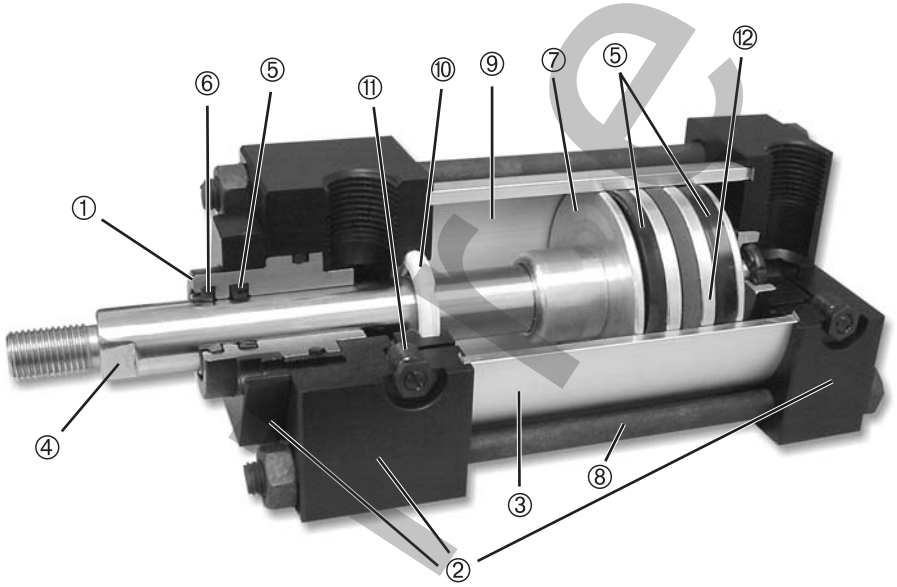
Floating Rod Bushing

SELF ALIGNMENT FEATURE

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



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



HEAVY-DUTY DESIGN FOR RELIABLE, CONSISTENT OPERATION

① ***FLOATING ROD BUSHING*** – Precision machined from 150,000 PSI rated graphite filled cast iron and PTFE coated to reduce friction and extend cycle life. Bushing design "traps" lubrication in effective bearing area.

② ***HEAD, CAP & RETAINER*** – Precision machined from high strength 6061-T6 aluminum alloy. Black anodized for corrosion resistance.

③ ***CYLINDER TUBE*** – Precision machined from 6063-T6832 high tensile aluminum alloy and hard coat to 60 Rc for wear resistance and extended cycle life.

④ ***PISTON ROD*** – Precision machined from high yield, polished and hard chrome plated steel.

⑤ ***PISTON & ROD SEALS*** – Heavy lip design Carboxilated Nitrile construction. Seals are pressure activated and wear compensating for long life. (Self lubricating material).

⑥ ***ROD WIPER*** – Abrasion resistant urethane provides aggressive wiping action in all environments. External lip design prevents debris from entering cylinder.

⑦ ***PISTON*** – Precision machined from 6061-T651 alloy aluminum, provides an excellent bearing surface for extended cylinder life.

⑧ ***TIE RODS*** – Prestressed high carbon steel tie rod construction eliminates axial loading of cylinder tube and maintains compression on tube and end seals.

⑨ ***PERMANENT LUBRICATION*** – Permanently lubricated with Magna-Lube G PTFE based grease on all internal components. This is a non-migratory type high performance grease providing outstanding service life. No additional lubrication is required.

⑩ ***CUSHIONS*** – (Options H & C) Floating cushion seal designed for maximum cushion performance, quick return stroke break-away and extended life.

⑪ ***CUSHION ADJUSTMENT NEEDLE*** – Adjustable steel needle design has fine thread metering and is positively captured to prevent needle ejection during adjustment.

⑫ ***PISTON MAGNET*** – (Option MPR) for TRD magnetically operated reed and solid state switches (refer to pages 105-111).

OPERATING PRESSURE	250 PSI AIR (17 BAR)

OPERATING TEMPERATURE	Carboxilated Nitrile: -20°F to 200°F (-25°C to 90°C) Fluorocarbon: 0°F to 400°F (-20°C to 200°C)

Performance options:

- ***WB*** – PTFE piston wear band, recommended for pivot mounted, long strokes or cylinders that may see side loads.
- ***ST*** – Stop tubes are used to reduce rod bearing and piston stress (refer to page 89 for cylinder design guidance).
- ***MA*** – Micro-Adjust provides a precision adjustment on the cylinder extend stroke, providing quick and accurate cylinder positioning, reducing set-up time.
- ***SSA*** – Stainless Steel Piston Rod, Tie Rods, Nuts, and Fasteners provide corrosion resistance in outdoor applications and wet environments.
- ***LF*** – Low Friction seals reduce breakaway and running friction. Effective at all operating pressures.
- ***NR*** – Non-Rotating option incorporates (2) internal guide rods preventing rod rotation (NFPA dimensions).

Preliminary

HOW TO ORDER: Series 'TA'

TA - MF1 ___ - 2½ x 10 - HC - MPR

SERIES	
TA	250 PSI AIR

NFPA MOUNTS	
MF1	FRONT FLANGE (1 1/2"-6" Bore)
MF2	REAR FLANGE (1 1/2"-6" Bore)
ME3	FRONT MOUNTING HOLES (8"-12" Bore)
ME4	REAR MOUNTING HOLES (8"-12" Bore)
MP1	REAR PIVOT CLEVIS (1 1/2"-12" Bore)
MP2	REAR PIVOT CLEVIS (1 1/2"-6" Bore)
MP4	REAR PIVOT EYE (1 1/2"-6" Bore)
MS1	FRONT & REAR END ANGLE (1 1/2"-8" Bore)
MS2	SIDE LUG (1 1/2"-8" Bore)
MS4	BOTTOM TAPPED HOLES (1 1/2"-12" Bore)
MT1	FRONT TRUNNION (1 1/2"-8" Bore)
MT2	REAR TRUNNION (1 1/2"-8" Bore)
MT4	INTERMEDIATE TRUNNION (1 1/2"-8" Bore)
MXO	NO MOUNT (1 1/2"-12" Bore)
MX1	EXTENDED TIE RODS - HEAD & CAP (1 1/2"-12" Bore)
MX2	EXTENDED TIE RODS (CAP) (1 1/2"-12" Bore)
MX3	EXTENDED TIE RODS (HEAD) (1 1/2"-12" Bore)

BORE	
1 1/2	2
2 1/2	3 1/4
4	5
6	8
10	12

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

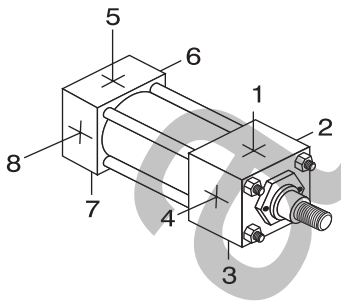
STROKE
0" to 120" Made to Order

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 2 IS *STANDARD* *SPECIFY* FOR POSITIONS: 1, 3 & 4	X
C	CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	
LC	**LONG** CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	
ELC	**EXTRA LONG** CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	X

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
X	B	1/4" URETHANE BUMPER BOTH ENDS
X	BC	1/4" URETHANE BUMPER CAP ONLY
X	BH	1/4" URETHANE BUMPER HEAD ONLY
	BP	BUMPER PISTON SEALS (1 1/2" - 8" Bore)
	BSP	BSP PORTS (SPECIFY SIZE, Example: BSP = 1/4")
	C =	EXTENDED PISTON ROD (Example: C = 3")
	EN	**ELECTROLESS NICKEL PLATED** *(Refer to page 84 for specifications)*
	KK2	LARGE MALE ROD THREAD
	KK3	FEMALE ROD THREAD
	KK3S	STUDDED PISTON ROD (KK3 with Stud, Loctite in place)
	KK4	FULL DIAMETER MALE ROD THREAD
	KK5	BLANK ROD END (NO THREADS, "A" = 0")
	LF	**LOW FRICTION SEALS** *(Refer to page 84 for specifications)*
	MA	MICRO-ADJUST (6" MAX. STROKE) *Available on Double Rod End Models*
	MAB	MICRO-ADJUST WITH SOUND DAMPENING BUMPER (6" MAX. STROKE)
	MPR	MAGNETIC PISTON FOR REED OR SOLID STATE SWITCHES - TRD MODELS: R10, RAC, AND MSS *(Refer to pages 105-111 for selection)*
	MPH	MAGNETIC PISTON FOR HALL SWITCHES
	MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
	NR	**NON-ROTATING** *(Refer to page 86 for specifications)*
	OP	OPTIONAL PORT LOCATION (Example: Ports @ 3 & 7)
	OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, Example: OS = 1 3/8")
	SAE	SAE PORTS (SPECIFY SIZE, Example: SAE #10)
X	SE	SPRING EXTEND (1 1/2, 2, 2 1/2 bore)
X	SR	SPRING RETURN (1 1/2, 2, 2 1/2 bore)
	SSA	STAINLESS STEEL PISTON ROD, TIE RODS & NUTS, AND FASTENERS
	SSF	STAINLESS STEEL FASTENERS
	SSR	STAINLESS STEEL PISTON ROD
	SST	STAINLESS STEEL TIE RODS & NUTS
X	ST	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) (Example: TA MS4 2 X 24" EFFECTIVE STROKE-ST=3)
	STEEL TUBE	STEEL CYLINDER TUBE, BLACK EPOXY PAINT FINISH
	TH	**400 PSI HYDRAULIC NON-SHOCK** *(Refer to page 90 for specifications)*
	VS	FLUOROCARBON SEALS
	WB	PISTON WEAR BAND
	XX	SPECIAL VARIATION (SPECIFY)

STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

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



About our Part Number System

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

Example: A 2½" Bore by 10" Stroke NFPA cylinder, Front Flange Mount, Head & Cap Cushions, Magnetic Piston for Switches.

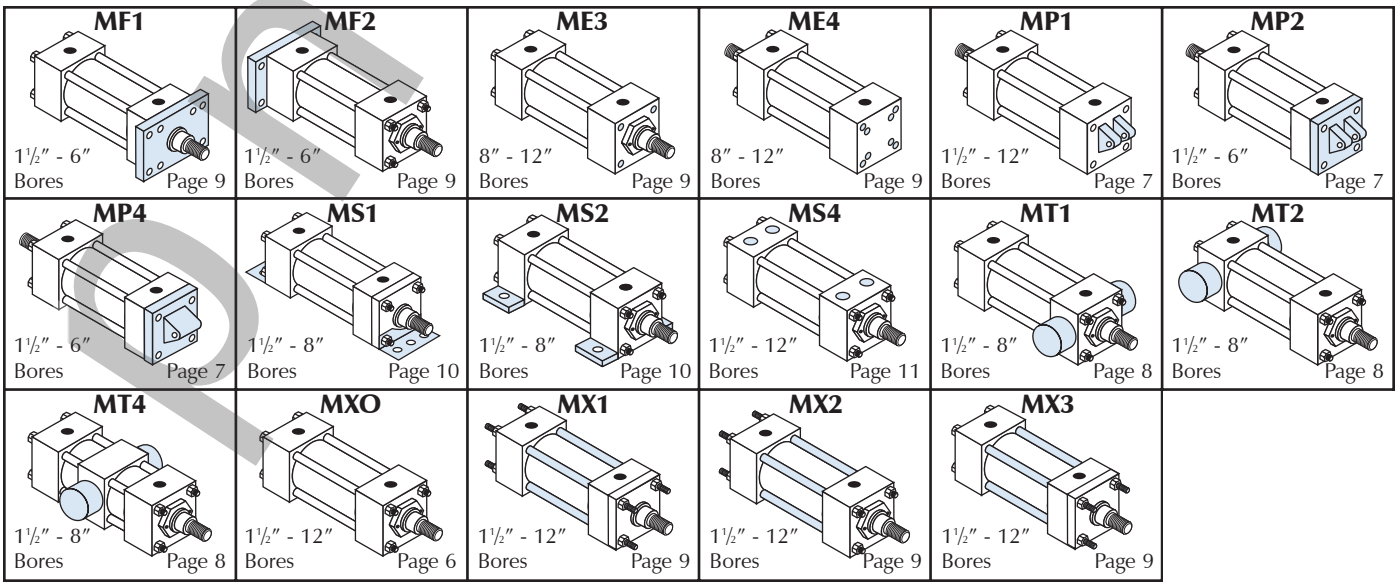
Part Number: TA-MF1-2½ x 10-HC-MPR

OPTION LENGTH ADDER
(ADD TO CATALOG BASIC OVERALL LENGTH DIMENSIONS)

BORE	OPTION							
	B	BC	BH	ELC	ELH	SE	SR	ST* (STOP TUBE) Example: ST=2
1 1/2	1/2	1/4	1/4	1	1	Refer to page 88 for length adders and available bore sizes and strokes		2
2	1/2	1/4	1/4	1	1			2
2 1/2	1/2	1/4	1/4	1	1			2
3 1/4	1/2	1/4	1/4	1 1/4	1 1/4			2
4	1/2	1/4	1/4	1 1/4	1 1/4			2
5	1/2	1/4	1/4	1 1/4	1 1/4			2
6	1/2	1/4	1/4	1 1/2	1 1/2			2
8	1/2	1/4	1/4	1 1/2	1 1/2			2
10	1/2	1/4	1/4	2	2			2
12	1/2	1/4	1/4	2	2			2

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

NFPA MOUNTS



Pneu & Line

SERIES 'TA' DIMENSIONS: BASIC CYLINDER (NO MOUNT)

EASY FLIP OUT PAGE FOR REFERENCE

About Rod End Styles

Style 1 Male Rod End is STANDARD

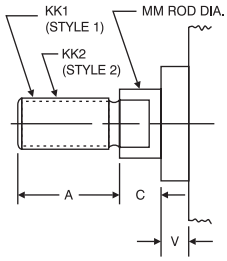
Other NFPA Styles can be specified (See Chart).

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).

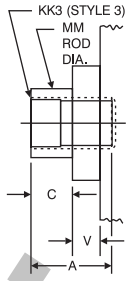
NEED SOMETHING NOT LISTED?
Just send us a sketch.
In most cases, quotes are turned around in one day!

PISTON ROD END STYLES

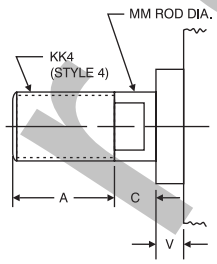
STYLE 1 & 2 — KK1 & KK2



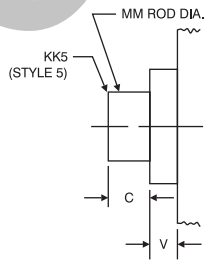
STYLE 3 — KK3



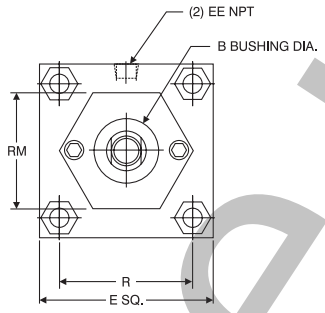
STYLE 4 — KK4

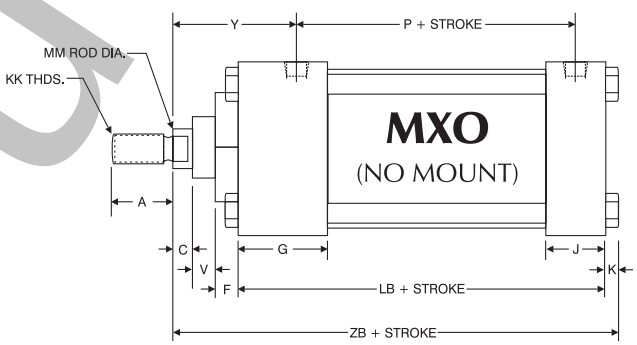


STYLE 5 — KK5



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



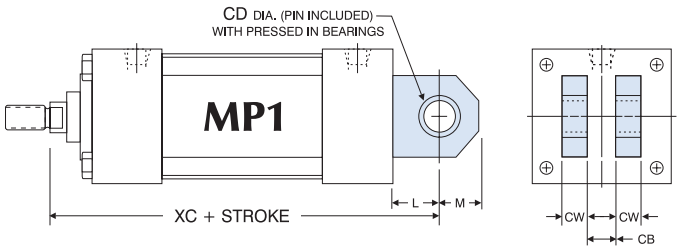


BASIC DIMENSIONS 'MXO' STANDARD & OVERSIZE RODS

BORE	ROD DIAMETER	A	B	C	E	EE	F	G	J	K	KK	LB	MM	P	R	RM	V	Y	ZB
1½	⅝ Standard	¾	1⅛	⅜	2	⅜	⅜	1½	1	¼	7/16-20	3⅝	⅝	2⅜	1.43	2 SQ.	¼	1⅞	4⅞
	1 Oversize	1⅛	1½	½							¾-16		1				½	2¼	5¼
2	⅝ Standard	¾	1⅛	⅜	2½	⅜	⅜	1½	1	5/16	7/16-20	3⅝	⅝	2⅜	1.84	1¾ HEX	¼	1⅞	4 15/16
	1 Oversize	1⅛	1½	½							¾-16		1			2½ SQ.	½	2¼	5 5/16
2½	⅝ Standard	¾	1⅛	⅜	3	⅜	⅜	1½	1	5/16	7/16-20	3¾	⅝	2½	2.19	1¾ HEX	¼	1⅞	5 1/16
	1 Oversize	1⅛	1½	½							¾-16		1			3 SQ.	½	2¼	5 7/16
3¼	1 Standard	1⅛	1½	½	3¾	½	⅝	1¾	1¼	⅜	¾-16	4¼	1	2¾	2.76	2¾ DIA.	¼	2⅜	6
	1⅜ Oversize	1⅝	2	⅝							1-14		1⅜			3¾ SQ.	⅜	2⅝	6¼
4	1 Standard	1⅛	1½	½	4½	½	⅝	1¾	1¼	⅜	¾-16	4¼	1	2¾	3.32	2¾ DIA.	¼	2⅜	6
	1⅜ Oversize	1⅝	2	⅝							1-14		1⅜			3½ DIA.	⅜	2⅝	6¼
5	1 Standard	1⅛	1½	½	5½	½	⅝	1¾	1¼	7/16	¾-16	4½	1	3	4.10	2¾ DIA.	¼	2⅜	6 5/16
	1⅜ Oversize	1⅝	2	⅝							1-14		1⅜			3½ DIA.	⅜	2⅝	6 9/16
6	1⅜ Standard	1⅝	2	⅝	6½	¾	⅝	2	1½	7/16	1-14	5	1⅜	3¼	4.88	3½ DIA.	⅜	2¾	7 1/16
	1¾ Oversize	2	2⅜	¾							1¼-12		1¾				½	3	7 5/16
8	1⅜ Standard	1⅝	2	⅝	8½	¾	⅝	2	1½	9/16	1-14	5⅛	1⅜	3⅜	6.44	3½ DIA.	⅜	2¾	7 5/16
	1¾ Oversize	2	2⅜	¾							1¼-12		1¾				½	3	7 9/16
10	1¾ Standard	2	2⅜	¾	10⅝	1	⅝	2¼	2	11/16	1¼-12	6⅜	1¾	4 5/16	7.92	3½ DIA.	½	3 1/16	8 15/16
	2 Oversize	2¼	2⅝	⅞			¾				1½-12		2			5 DIA.	⅜	3 3/16	9 1/16
12	2 Standard	2¼	2⅝	⅞	12¾	1	¾	2¼	2	11/16	1½-12	6⅞	2	4 13/16	9.40	5 DIA.	⅜	3 3/16	9 9/16
	2½ Oversize	3	3⅛	1							1⅞-12		2½				½	3 7/16	9 13/16

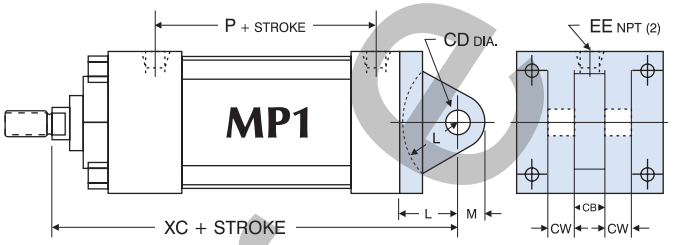
online

SERIES 'TA' DIMENSIONS: PIVOT MOUNTS



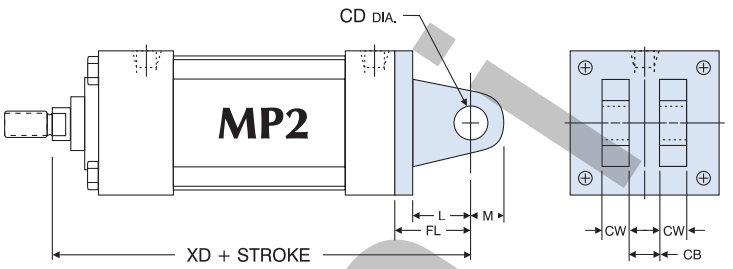
EXTRUDED MP1 MOUNT

(EXTRUDED: 1½" - 8" BORES, WELDMENT: 10" & 12" BORES)



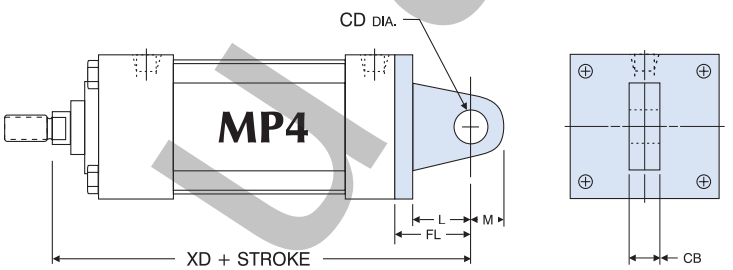
IRON CASTING MP1 MOUNT

*(OPTIONAL)***



MP2 MOUNT

(IRON CASTING)



MP4 MOUNT

(IRON CASTING: 1½" - 4" BORES, WELDMENT: 5" - 6" BORES)*

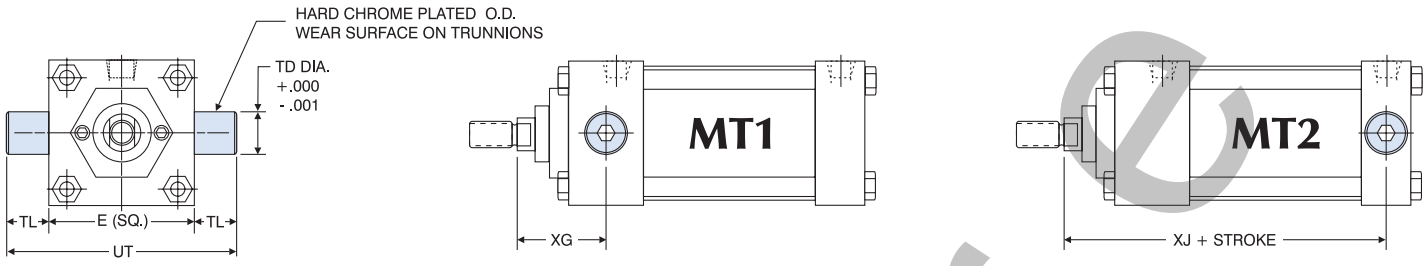
'MP1', 'MP2' CLEVIS AND 'MP4' EYE MOUNT DIMENSIONS										ACCESSORIES *(SEE PAGES 101-102 FOR DIMENSIONS)*				
BORE	ROD DIAMETER	CB	CD	CW	FL	L	M	XC	XD	ROD CLEVIS	ROD EYE	CLEVIS PIN	EYE BRACKET *(FOR MP1)*	CLEVIS BRKT *(FOR MP4)*
1½	⅝ Standard	¾	½	½	1⅛	¾	⅝	5⅜	5¾	RC437	RE437	CP500	EB500	CB500
	1 Oversize							5¾	6⅛	RC750	RE750	CP750		
2	⅝ Standard	¾	½	½	1⅛	¾	⅝	5⅜	5¾	RC437	RE437	CP500		
	1 Oversize							5¾	6⅛	RC750	RE750	CP750		
2½	⅝ Standard	¾	½	½	1⅛	¾	⅝	5½	5⅞	RC437	RE437	CP500		
	1 Oversize							5⅞	6¼	RC750	RE750	CP750		
3¼	1 Standard	1¼	¾	⅝	1⅞	1¼	⅞	6⅞	7½	RC750	RE750	CP750	EB750	CB750
	1⅜ Oversize							7⅛	7¾	RC1000	RE1000	CP1000		
4	1 Standard	1¼	¾	⅝	1⅞	1¼	⅞	6⅞	7½	RC750	RE750	CP750		
	1⅜ Oversize							7⅛	7¾	RC1000	RE1000	CP1000		
5*	1 Standard	1¼	¾	⅝	1⅞	1¼	⅞	7⅛	7¾	RC750	RE750	CP750		
	1⅜ Oversize							7⅜	8	RC1000	RE1000	CP1000		
6*	1⅜ Standard	1½	1	¾	2¼	1½	1	8⅛	8⅞	RC1000	RE1000	CP1000	EB1000	CB1000
	1¾ Oversize							8⅜	9⅛	RC1250	RE1250	CP1375		
8	1⅜ Standard	1½	1	¾	N/A	1½	1	8¼	N/A	RC1000	RE1000	CP1000		
	1¾ Oversize							8½		RC1250	RE1250	CP1375		
10	1¾ Standard	2	1⅜	1	N/A	2⅛	1⅜	10⅜	N/A	RC1250	RE1250	CP1375	EB1375	CB1375
	2 Oversize							10½		RC1500	RE1500	CP1750	EB1750	CB1750
12	2 Standard	2½	1¾	1¼	N/A	2¼	1¾	11⅛	N/A	RC1500	RE1500	CP1750		
	2½ Oversize							11⅜		RC1875	N/A	CP2000		

Clevis pins are provided with pivot mounts.
*MP4 5"-6" bores are 5-7 day delivery.
For dimensions not shown, see page 6.

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

Preliminary

SERIES 'TA' DIMENSIONS: PIVOT MOUNTS

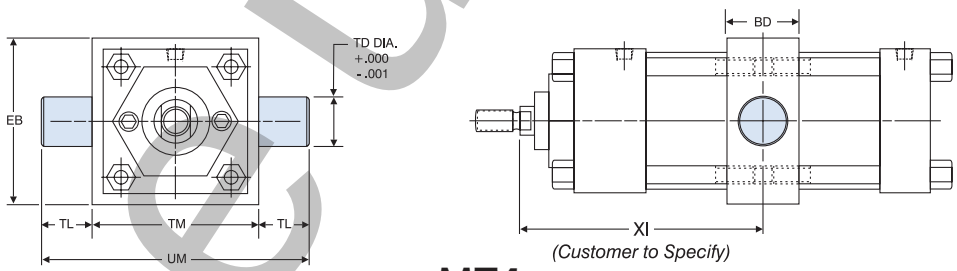


MT1 / MT2

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

'MT1' HEAD TRUNNION AND 'MT2' CAP TRUNNION MOUNT DIMENSIONS								ACCESSORIES *(SEE PAGES 101-102 FOR DIMENSIONS)*		
BORE	ROD DIAMETER	E	TD	TL	UT	XG	ADD STROKE XJ	ROD CLEVIS	ROD EYE	CLEVIS PIN
1½	⅝ Standard	2	1	1	4	1¾	4⅛	RC437	RE437	CP500
	1 Oversize					N/A*	4½	RC750	RE750	CP750
2	⅝ Standard	2½	1	1	4½	1¾	4⅛	RC437	RE437	CP500
	1 Oversize					2⅛	4½	RC750	RE750	CP750
2½	⅝ Standard	3	1	1	5	1¾	4¼	RC437	RE437	CP500
	1 Oversize					2⅛	4⅝	RC750	RE750	CP750
3¼	1 Standard	3¾	1	1	5¾	2¼	5	RC750	RE750	CP750
	1⅜ Oversize					2½	5¼	RC1000	RE1000	CP1000
4	1 Standard	4½	1	1	6½	2¼	5	RC750	RE750	CP750
	1⅜ Oversize					2½	5¼	RC1000	RE1000	CP1000
5	1 Standard	5½	1	1	7½	2¼	5¼	RC750	RE750	CP750
	1⅜ Oversize					2½	5½	RC1000	RE1000	CP1000
6	1⅜ Standard	6½	1⅜	1⅜	9¼	2⅝	5⅞	RC1000	RE1000	CP1000
	1¾ Oversize					2⅞	6⅛	RC1250	RE1250	CP1375
8	1⅜ Standard	8½	1⅜	1⅜	11¼	2⅝	6	RC1000	RE1000	CP1000
	1¾ Oversize					2⅞	6¼	RC1250	RE1250	CP1375

*No oversize rod available on 1½" bore MT1.
For dimensions not shown, see page 6.



MT4

Note: MT4 Trunnions and Intermediate Section are one-piece steel construction.

'MT4' INTERMEDIATE TRUNNION MOUNT DIMENSIONS							
BORE	BD	EB	TD	TL	TM	UM	XI
1½	1¼	2½	1	1	2½	4½	CUSTOMER TO SPECIFY
2	1½	3	1	1	3	5	
2½	1½	3½	1	1	3½	5½	
3¼	2	4¼	1	1	4½	6½	
4	2	5	1	1	5¼	7¼	
5	2	6	1	1	6¼	8¼	
6	2	7	1⅜	1⅜	7⅝	10⅜	
8	2½	9½	1⅜	1⅜	9¾	12½	

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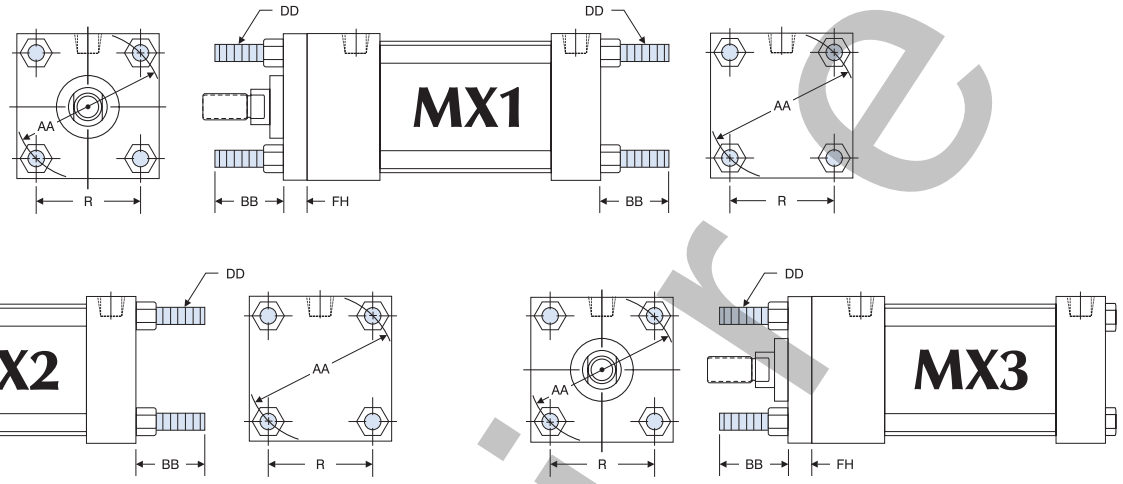
SERIES 'TA' DIMENSIONS: TIE ROD & FLANGE MOUNTS



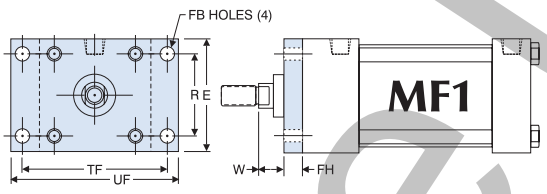
TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS

BORE	ROD DIAMETER	AA	BB	DD	FH	R
1½	⅝ Standard	2.02	1	¼-28	⅜	1.43
	1 Oversize					
2	⅝ Standard	2.6	1⅛	5/16-24	⅜	1.84
	1 Oversize					
2½	⅝ Standard	3.1	1⅛	5/16-24	⅜	2.19
	1 Oversize					
3¼	1 Standard	3.9	1⅜	⅜-24	⅝	2.76
	1⅜ Oversize					
4	1 Standard	4.7	1⅜	⅜-24	⅝	3.32
	1⅜ Oversize					

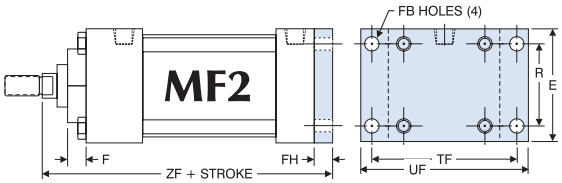
TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS

BORE	ROD DIAMETER	AA	BB	DD	FH	R
5	1 Standard	5.8	1 13/16	½-20	⅝	4.10
	1⅜ Oversize					
6	1⅜ Standard	6.9	1 13/16	½-20	¾	4.88
	1¾ Oversize					
8	1⅜ Standard	9.1	**2 5/16	⅝-18	*⅝	6.44
	1¾ Oversize					
10	1¾ Oversize	11.2	**2 11/16	¾-16	*⅝	7.92
	2 Oversize				*¾	
12	2 Standard	13.3	**2 11/16	¾-16	*¾	9.40
	2½ Oversize					

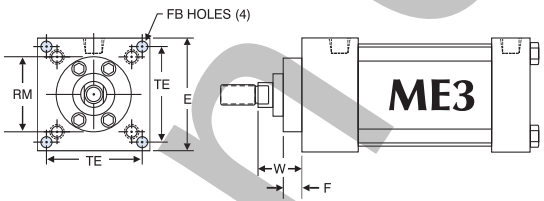
*MX1 & MX3 have full square bushing retainer on 1½" - 6" bores, round retainers on 8" - 12" bores.
**BB dimension from face of head.
For dimensions not shown, see page 6.



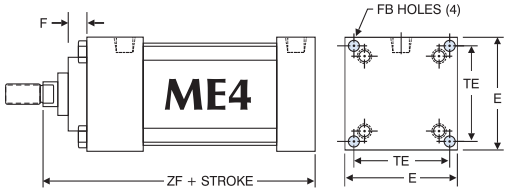
1½" - 6" BORES



1½" - 6" BORES



8" - 12" BORES



8" -12" BORES

'MF1', 'MF2' FLANGE & 'ME3', 'ME4' CAP MOUNT DIMENSIONS

BORE	ROD DIAMETER	E	F	FB	FH	R	RM	TE	TF	UF	W	ZF
1½	⅝ Standard	2	⅜	5/16	⅜	1.43	—	—	2¾	3⅜	⅝	5
	1 Oversize										1	5⅜
2	⅝ Standard	2½	⅜	⅜	⅜	1.84	—	—	3⅜	4⅛	⅝	5
	1 Oversize										1	5⅜
2½	⅝ Standard	3	⅜	⅜	⅜	2.19	—	—	3⅞	4⅝	⅝	5⅛
	1 Oversize										1	5½
3¼	1 Standard	3¾	⅝	7/16	⅝	2.76	—	—	4 11/16	5½	¾	6¼
	1⅜ Oversize										1	6½
4	1 Standard	4½	⅝	7/16	⅝	3.32	—	—	5 7/16	6¼	¾	6¼
	1⅜ Oversize										1	6½

'MF1', 'MF2' FLANGE & 'ME3', 'ME4' CAP MOUNT DIMENSIONS

BORE	ROD DIAMETER	E	F	FB	FH	R	RM	TE	TF	UF	W	ZF
5	1 Standard	5½	⅝	9/16	⅝	4.10	—	—	6⅝	7⅝	¾	6½
	1⅜ Oversize										1	6¾
6	1⅜ Standard	6½	⅝	9/16	¾	4.88	—	—	7⅝	8⅝	⅞	7⅜
	1¾ Oversize										1⅛	7⅝
8	1⅜ Standard	8½	⅝	11/16	N/A	N/A	3½	7.57	N/A	N/A	1⅝	6¾
	1¾ Oversize										1⅞	7
10	1¾ Standard	10⅝	⅝	13/16	N/A	N/A	3½	9.40	N/A	N/A	1⅞	8¼
	2 Oversize		¾				5				2	8⅜
12	2 Standard	12¾	¾	13/16	N/A	N/A	5	11.11	N/A	N/A	2	8⅞
	2½ Oversize										2¼	9⅛

For dimensions not shown, see page 6.

Preliminary

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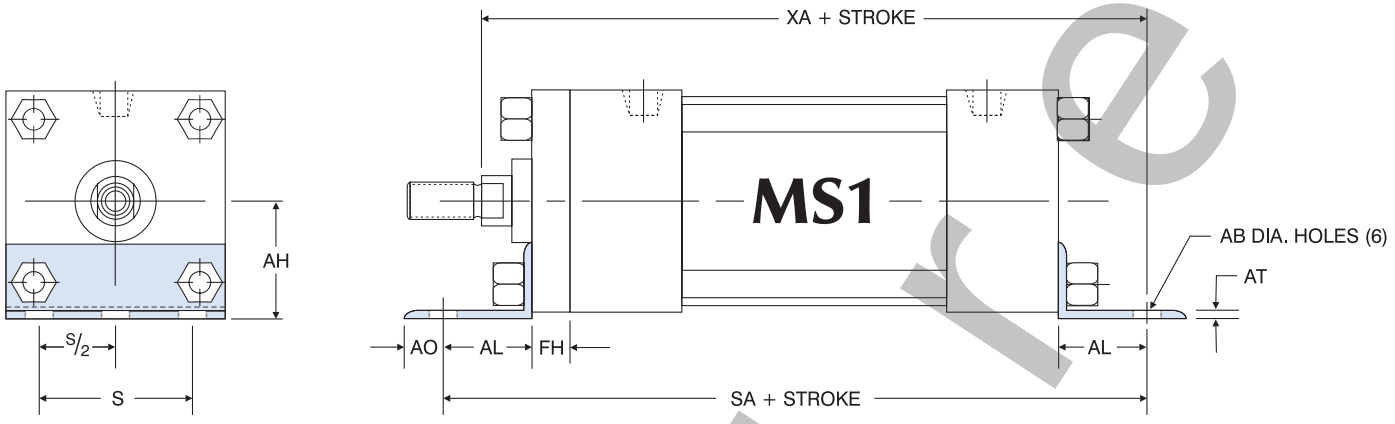
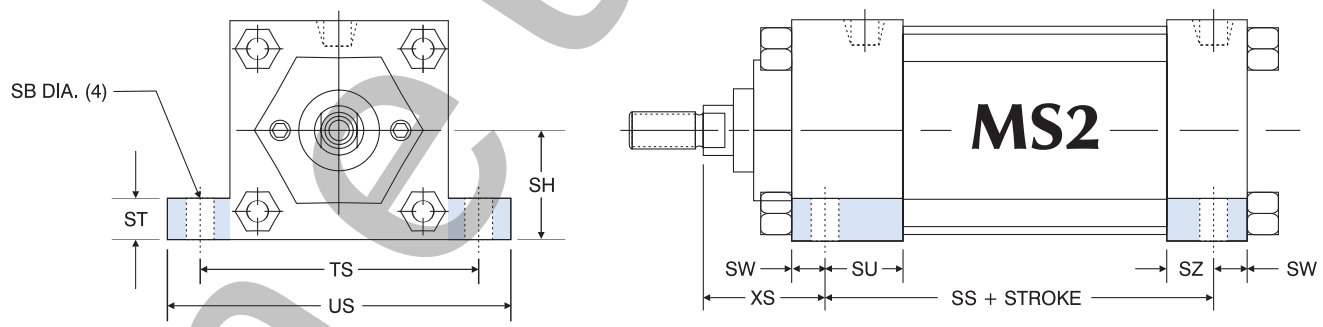
SERIES 'TA' DIMENSIONS: BASE MOUNTS



'MS1' ANGLE MOUNT DIMENSIONS										
BORE	ROD DIAMETER	AB	AH	AL	AO	AT	FH	S	ADD STROKE SA	ADD STROKE XA
1½	⅝ Standard	7/16	1 3/16	1	⅜	⅛	⅜	1¼	6	5⅝
	1 Oversize									6
2	⅝ Standard	7/16	1 7/16	1	⅜	⅛	⅜	1¾	6	5⅝
	1 Oversize									6
2½	⅝ Standard	7/16	1⅝	1	⅜	⅛	⅜	2¼	6⅛	5¾
	1 Oversize									6⅛
3¼	1 Standard	9/16	1 15/16	1¼	½	⅛	⅝	2¾	7⅜	6⅞
	1⅜ Oversize									7⅛
4	1 Standard	9/16	2¼	1¼	½	⅛	⅝	3½	7⅜	6⅞
	1⅜ Oversize									7⅛
5	1 Standard	11/16	2¾	1⅜	⅝	3/16	⅝	4¼	7⅞	7¼
	1⅜ Oversize									7½
6	1⅜ Standard	13/16	3¼	1⅜	⅝	3/16	¾	5¼	8½	8
	1¾ Oversize									8¼
8	1⅜ Standard	13/16	4¼	1 13/16	11/16	¼	⅝*	7⅛	8¾	8 9/16
	1¾ Oversize									8 13/16

*3½" diameter round retainer on 8" bore. (MS1 BRACKET BOLTED DIRECTLY TO HEAD)



'MS2' SIDE LUG MOUNT DIMENSIONS											
BORE	ROD DIAMETER	SB	SH	ST	SU	SW	SZ	TS	US	XS	ADD STROKE SS
1½	⅝ Standard	7/16	1	½	1⅛	⅜	⅝	2¾	3½	1⅜	2⅞
	1 Oversize									1¾	
2	⅝ Standard	7/16	1¼	½	1⅛	⅜	⅝	3¼	4	1⅜	2⅞
	1 Oversize									1¾	
2½	⅝ Standard	7/16	1½	½	1⅛	⅜	⅝	3¾	4½	1⅜	3
	1 Oversize									1¾	
3¼	1 Standard	9/16	1⅞	¾	1¼	½	¾	4¾	5¾	1⅞	3¼
	1⅜ Oversize									2⅛	
4	1 Standard	9/16	2¼	¾	1¼	½	¾	5½	6½	1⅞	3¼
	1⅜ Oversize									2⅛	
5	1 Standard	13/16	2¾	1	1 1/16	11/16	9/16	6⅞	8¼	2 1/16	3⅛
	1⅜ Oversize									2 5/16	
6	1⅜ Standard	13/16	3¼	1	1 5/16	11/16	13/16	7⅞	9¼	2 5/16	3⅝
	1¾ Oversize									2 9/16	
8	1⅜ Standard	13/16	4¼	1	1 5/16	11/16	13/16	9⅞	11¼	2 5/16	3¾
	1¾ Oversize									2 9/16	

For dimensions not shown, see page 6.

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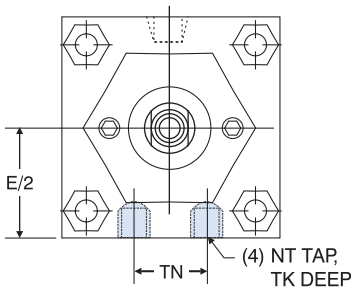
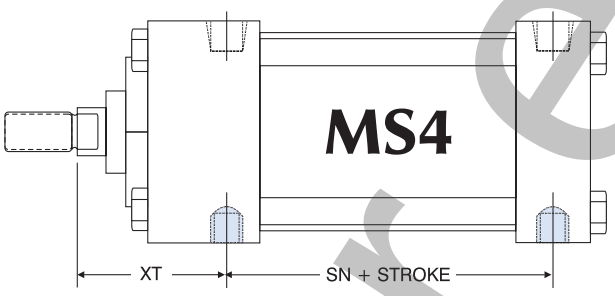
SERIES 'TA' DIMENSIONS: BASE MOUNTS





'MS4' BOTTOM TAPPED MOUNT DIMENSIONS							
BORE	ROD DIAMETER	E/2	NT	TK	TN	XT	ADD STROKE SN
1 1/2	5/8 Standard	1	1/4-20	3/8	5/8	1 15/16	2 1/4
	1 Oversize					2 5/16	
2	5/8 Standard	1 1/4	5/16-18	1/2	7/8	1 15/16	2 1/4
	1 Oversize					2 5/16	
2 1/2	5/8 Standard	1 1/2	3/8-16	5/8	1 1/4	1 15/16	2 3/8
	1 Oversize					2 5/16	
3 1/4	1 Standard	1 7/8	1/2-13	3/4	1 1/2	2 7/16	2 5/8
	1 3/8 Oversize					2 11/16	
4	1 Standard	2 1/4	1/2-13	3/4	2 1/16	2 7/16	2 5/8
	1 3/8 Oversize					2 11/16	
5	1 Standard	2 3/4	5/8-11	1	2 11/16	2 7/16	2 7/8
	1 3/8 Oversize					2 11/16	
6	1 3/8 Standard	3 1/4	3/4-10	1 1/8	3 1/4	2 13/16	3 1/8
	1 3/4 Oversize					3 1/16	
8	1 3/8 Standard	4 1/4	3/4-10	1 1/8	4 1/2	2 13/16	3 1/4
	1 3/4 Oversize					3 1/16	
10	1 3/4 Standard	5 5/16	1-8	1 1/2	5 1/2	3 1/8	4 1/8
	2 Oversize					3 1/4	
12	2 Standard	6 3/8	1-8	1 1/2	7 1/4	3 1/4	4 5/8
	2 1/2 Oversize					3 1/2	

For dimensions not shown, see page 6.

COMBINATION MOUNTS

Cylinders can be ordered with a combination of mounts for added design flexibility.

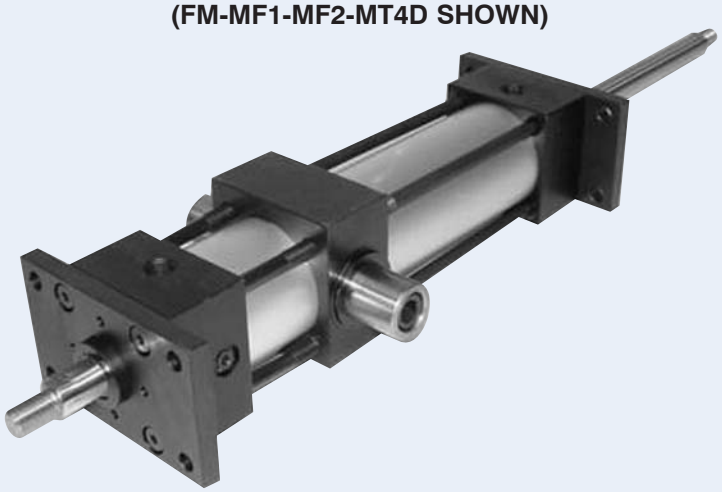
How to Order:

Combination mount part numbers can be constructed by adding a dash (-) in between the desired mounts in the part number.

Example:
5" Bore 'TA' Series cylinder with 12" Stroke, Head and Cap Cushions, Magnetic Piston for Reed Switches and having an MS4 and MF1 Mount:

Part Number:
TA-MS4-MF1-5 X 12-HC-MPR

(FM-MF1-MF2-MT4D SHOWN)



Pneumatic

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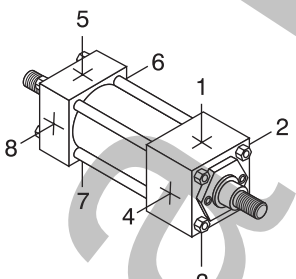
SERIES 'TA' DIMENSIONS: DOUBLE ROD END

Benefits

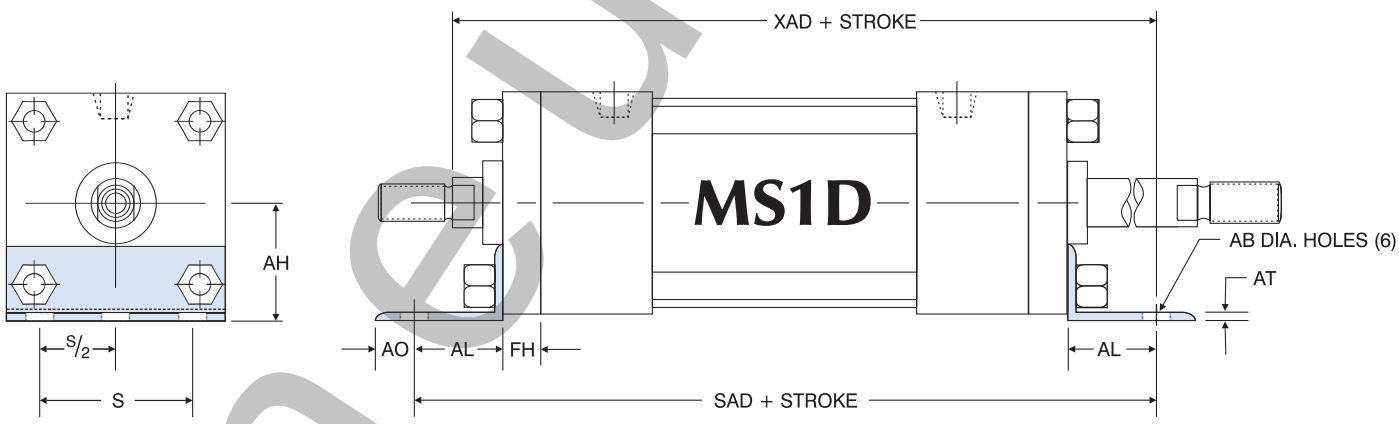
- Standard and Oversize Piston Rods available.
- Full range of Standard Options.
- Durable design. Full Rod Bearing at each end of cylinder.
- Can be provided with Hollow Piston Rods (gun-drilled through, to your size requirements).
- Can be used in adjustable extend stroke applications (by adding a stop collar on one rod end, or option "MA" - *Refer to page 85*).



STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

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

SERIES 'TA' DIMENSIONS: DOUBLE ROD END BASE MOUNTS



'MS1D' ANGLE MOUNT DIMENSIONS										
BORE	ROD DIAMETER	AB	AH	AL	AO	AT	FH	S	ADD STROKE SAD	ADD STROKE XAD
1½	⅝ Standard	7/16	1 3/16	1	3/8	1/8	3/8	1¼	6⅞	6½
	1 Oversize									6⅞
2	⅝ Standard	7/16	1 7/16	1	3/8	1/8	3/8	1¾	6⅞	6½
	1 Oversize									6⅞
2½	⅝ Standard	7/16	1⅝	1	3/8	1/8	3/8	2¼	7	6⅝
	1 Oversize									7
3¼	1 Standard	9/16	1 15/16	1¼	½	1/8	⅝	2¾	8½	8
	1⅜ Oversize									8¼
4	1 Standard	9/16	2¼	1¼	½	1/8	⅝	3½	8½	8
	1⅜ Oversize									8¼
5	1 Standard	11/16	2¾	1⅜	⅝	3/16	⅝	4¼	9	8⅜
	1⅜ Oversize									8⅝
6	1⅜ Standard	13/16	3¼	1⅜	⅝	3/16	¾	5¼	9¾	9¼
	1¾ Oversize									9½
8	1⅜ Standard	13/16	4¼	1 13/16	11/16	¼	⅝*	7⅛	9¼	9 1/16
	1¾ Oversize									9⅝

*3½ diameter round retainer on 8" bore. (MS1 BRACKETS BOLTED DIRECTLY TO HEAD)

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SERIES 'TA' DIMENSIONS: DOUBLE ROD END

EASY FLIP OUT PAGE FOR REFERENCE

About Rod End Styles

Style 1 Male Rod End is STANDARD

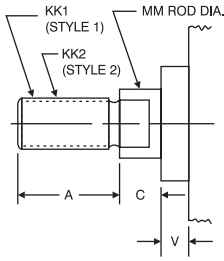
Other NFPA Styles can be specified (See Chart).

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).

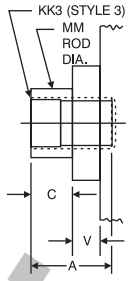
NEED SOMETHING NOT LISTED?
Just send us a sketch.
In most cases, quotes are turned around in one day!

PISTON ROD END STYLES

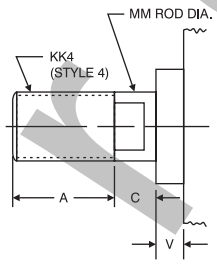
STYLE 1 & 2 — KK1 & KK2



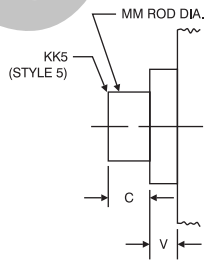
STYLE 3 — KK3



STYLE 4 — KK4

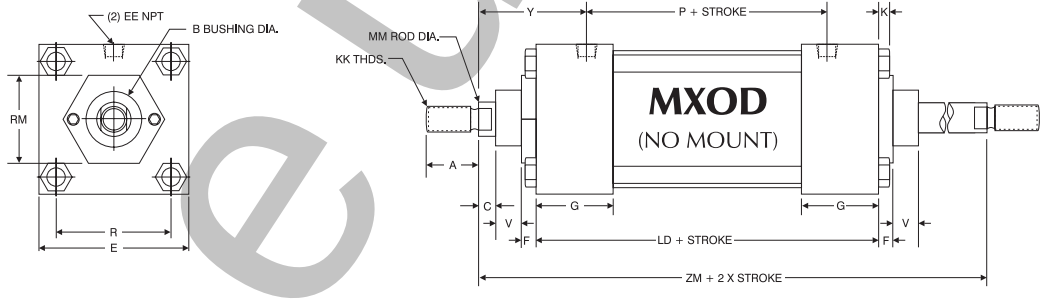


STYLE 5 — KK5



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

DOUBLE ROD END DIMENSIONS: *'MXOD' (NO MOUNT)*



DOUBLE ROD END BASIC DIMENSIONS 'MXOD' STANDARD & OVERSIZE RODS

BORE	ROD DIAMETER	A	B	C	E	EE	F	G	K	KK	LD	MM	P	R	RM	V	Y	ZM
1½	⅝ Standard	¾	1⅛	⅜	2	⅜	⅜	1½	¼	7/16-20	4⅛	⅝	2⅜	1.43	2 SQ.	¼	1⅞	6⅛
	1 Oversize	1⅛	1½	½						¾-16		1				½	2¼	6⅞
2	⅝ Standard	¾	1⅛	⅜	2½	⅜	⅜	1½	5/16	7/16-20	4⅛	⅝	2⅜	1.84	1¾ HEX	¼	1⅞	6⅛
	1 Oversize	1⅛	1½	½						¾-16		1			2½ SQ.	½	2¼	6⅞
2½	⅝ Standard	¾	1⅛	⅜	3	⅜	⅜	1½	5/16	7/16-20	4¼	⅝	2½	2.19	1¾ HEX	¼	1⅞	6¼
	1 Oversize	1⅛	1½	½						¾-16		1			3 SQ.	½	2¼	7
3¼	1 Standard	1⅛	1½	½	3¾	½	⅝	1¾	⅜	¾-16	4¾	1	2¾	2.76	2¾ DIA.	¼	2⅜	7½
	1⅜ Oversize	1⅝	2	⅝						1-14		1⅜			3¾ SQ.	⅜	2⅝	8
4	1 Standard	1⅛	1½	½	4½	½	⅝	1¾	⅜	¾-16	4¾	1	2¾	3.32	2¾ DIA.	¼	2⅜	7½
	1⅜ Oversize	1⅝	2	⅝						1-14		1⅜			3½ DIA.	⅜	2⅝	8
5	1 Standard	1⅛	1½	½	5½	½	⅝	1¾	7/16	¾-16	5	1	3	4.10	2¾ DIA.	¼	2⅜	7¾
	1⅜ Oversize	1⅝	2	⅝						1-14		1⅜			3½ DIA.	⅜	2⅝	8¼
6	1⅜ Standard	1⅝	2	⅝	6½	¾	⅝	2	7/16	1-14	5½	1⅜	3¼	4.88	3½ DIA.	⅜	2¾	8¾
	1¾ Oversize	2	2⅜	¾						1¼-12		1¾				½	3	9¼
8	1⅜ Standard	1⅝	2	⅝	8½	¾	⅝	2	9/16	1-14	5⅝	1⅜	3⅜	6.44	3½ DIA.	⅜	2¾	8⅞
	1¾ Oversize	2	2⅜	¾						1¼-12		1¾				½	3	9⅜
10	1¾ Standard	2	2⅜	¾	10⅝	1	⅝	2¼	11/16	1¼-12	6⅝	1¾	4⅝	7.92	3½ DIA.	½	3 1/16	10⅜
	2 Oversize	2¼	2⅝	⅞			¾			1½-12		2			5 DIA.	⅜	3 3/16	10⅝
12	2 Standard	2¼	2⅝	⅞	12¾	1	¾	2¼	11/16	1½-12	7⅛	2	4 13/16	9.40	5 DIA.	⅜	3 3/16	11⅛
	2½ Oversize	3	3⅛	1						1⅞-12		2½				½	3 7/16	11⅝

Preview

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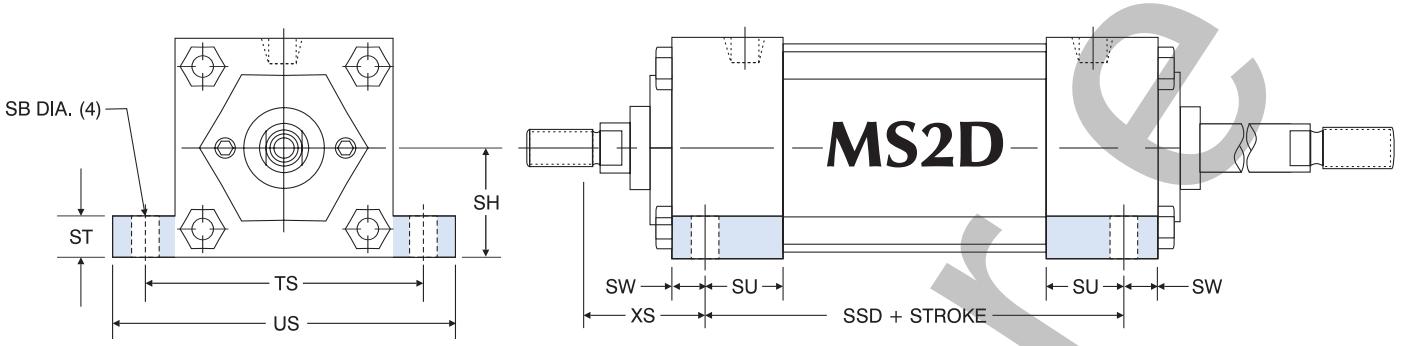
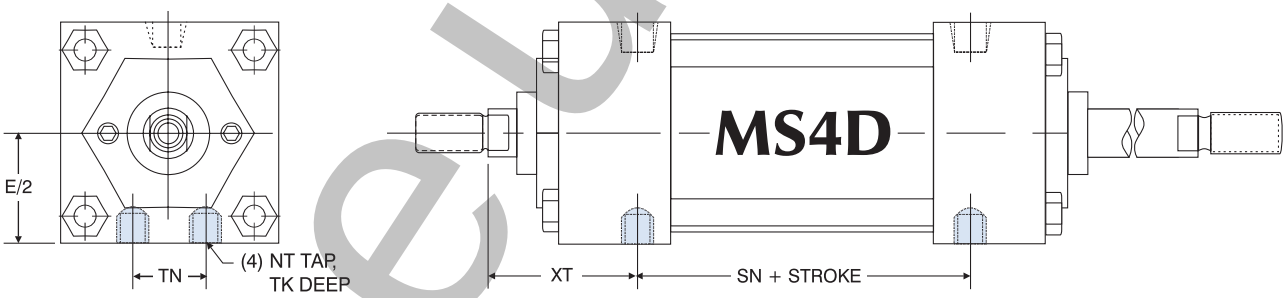
SERIES 'TA' DIMENSIONS: DOUBLE ROD END BASE MOUNTS



DOUBLE ROD END 'MS2D' SIDE LUG MOUNT DIMENSIONS										
BORE	ROD DIAMETER	SB	SH	ST	SU	SW	TS	US	XS	ADD STROKE SSD
1 1/2	5/8 Standard	7/16	1	1/2	1 1/8	3/8	2 3/4	3 1/2	1 3/8	3 3/8
	1 Oversize								1 3/4	
2	5/8 Standard	7/16	1 1/4	1/2	1 1/8	3/8	3 1/4	4	1 3/8	3 3/8
	1 Oversize								1 3/4	
2 1/2	5/8 Standard	7/16	1 1/2	1/2	1 1/8	3/8	3 3/4	4 1/2	1 3/8	3 1/2
	1 Oversize								1 3/4	
3 1/4	1 Standard	9/16	1 7/8	3/4	1 1/4	1/2	4 3/4	5 3/4	1 7/8	3 3/4
	1 3/8 Oversize								2 1/8	
4	1 Standard	9/16	2 1/4	3/4	1 1/4	1/2	5 1/2	6 1/2	1 7/8	3 3/4
	1 3/8 Oversize								2 1/8	
5	1 Standard	13/16	2 3/4	1	1 1/16	11/16	6 7/8	8 1/4	2 1/16	3 5/8
	1 3/8 Oversize								2 5/16	
6	1 3/8 Standard	13/16	3 1/4	1	1 5/16	11/16	7 7/8	9 1/4	2 5/16	4 1/8
	1 3/4 Oversize								2 9/16	
8	1 3/8 Standard	13/16	4 1/4	1	1 9/16	11/16	9 7/8	11 1/4	2 5/16	4 1/4
	1 3/4 Oversize								2 9/16	

For dimensions not shown, see page 13.



DOUBLE ROD END 'MS4D' BOTTOM TAPPED MOUNT DIMENSIONS							
BORE	ROD DIAMETER	E/2	NT	TK	TN	XT	ADD STROKE SN
1 1/2	5/8 Standard	1	1/4-20	3/8	5/8	1 15/16	2 1/4
	1 Oversize					2 5/16	
2	5/8 Standard	1 1/4	5/16-18	1/2	7/8	1 15/16	2 1/4
	1 Oversize					2 5/16	
2 1/2	5/8 Standard	1 1/2	3/8-16	5/8	1 1/4	1 15/16	2 3/8
	1 Oversize					2 5/16	
3 1/4	1 Standard	1 7/8	1/2-13	3/4	1 1/2	2 7/16	2 5/8
	1 3/8 Oversize					2 11/16	
4	1 Standard	2 1/4	1/2-13	3/4	2 1/16	2 7/16	2 5/8
	1 3/8 Oversize					2 11/16	
5	1 Standard	2 3/4	5/8-11	1	2 11/16	2 7/16	2 7/8
	1 3/8 Oversize					2 11/16	
6	1 3/8 Standard	3 1/4	3/4-10	1 1/8	3 1/4	2 13/16	3 1/8
	1 3/4 Oversize					3 1/16	
8	1 3/8 Standard	4 1/4	3/4-10	1 1/8	4 1/2	2 13/16	3 1/4
	1 3/4 Oversize					3 1/16	
10	1 3/4 Standard	5 5/16	1-8	1 1/2	5 1/2	3 1/8	4 1/8
	2 Oversize					3 1/4	
12	2 Standard	6 3/8	1-8	1 1/2	7 1/4	3 1/4	4 5/8
	2 1/2 Oversize					3 1/2	

For dimensions not shown, see page 13.

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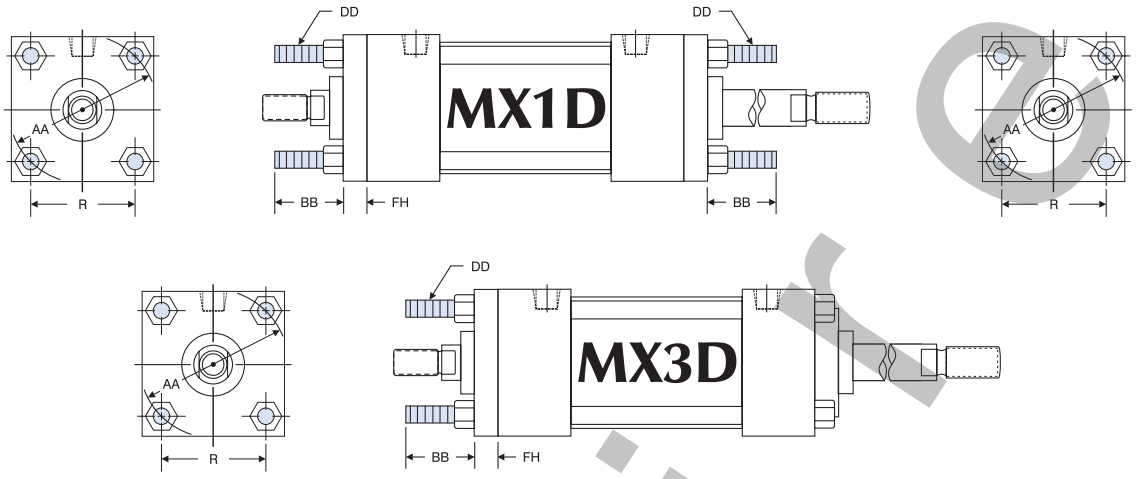
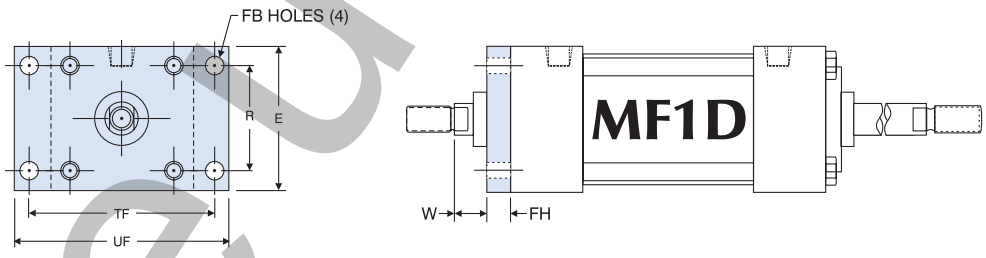
SERIES 'TA' DIMENSIONS: DOUBLE ROD END TIE ROD & FLANGE MOUNTS



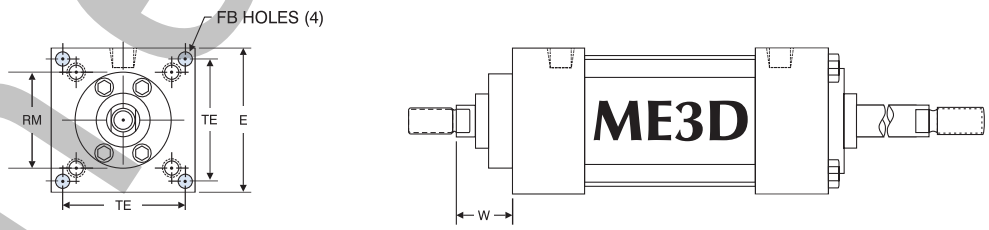
TIE ROD EXTENDED 'MX1D' & 'MX3D' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
1½	⅝ Standard 1 Oversize	2.02	1	¼-28	⅜	1.43
2	⅝ Standard 1 Oversize	2.6	1⅛	5/16-24	⅜	1.84
2½	⅝ Standard 1 Oversize	3.1	1⅛	5/16-24	⅜	2.19
3¼	1 Standard 1⅜ Oversize	3.9	1⅜	⅜-24	⅝	2.76
4	1 Standard 1⅜ Oversize	4.7	1⅜	⅜-24	⅝	3.32

TIE ROD EXTENDED 'MX1D' & 'MX3D' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
5	1 Standard 1⅜ Oversize	5.8	1 13/16	½-20	⅝	4.10
6	1⅜ Standard 1¾ Oversize	6.9	1 13/16	½-20	¾	4.88
8	1⅜ Standard 1¾ Oversize	9.1	**2 5/16	⅝-18	*⅝	6.44
10	1¾ Oversize 2 Oversize	11.2	**2 11/16	¾-16	*⅝ *¾	7.92
12	2 Standard 2½ Oversize	13.3	**2 11/16	¾-16	*¾	9.40

*Full square bushing retainer on 1½" - 6" bores, round retainers on 8" - 12" bores.
**"BB" dimension from head on 8", 10" & 12" bores.



1½" - 6" BORES



8" - 12" BORES ONLY

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS										
BORE	ROD DIAMETER	E	FB	FH	R	RM	TE	TF	UF	W
1½	⅝ Standard 1 Oversize	2	5/16	⅜	1.43	—	—	2¾	3⅜	⅝ 1
2	⅝ Standard 1 Oversize	2½	⅜	⅜	1.84	—	—	3⅜	4⅛	⅝ 1
2½	⅝ Standard 1 Oversize	3	⅜	⅜	2.19	—	—	3⅞	4⅝	⅝ 1
3¼	1 Standard 1⅜ Oversize	3¾	7/16	⅝	2.76	—	—	4 11/16	5½	¾ 1
4	1 Standard 1⅜ Oversize	4½	7/16	⅝	3.32	—	—	5 7/16	6¼	¾ 1

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS										
BORE	ROD DIAMETER	E	FB	FH	R	RM	TE	TF	UF	W
5	1 Standard 1⅜ Oversize	5½	9/16	⅝	4.10	—	—	6⅝	7⅝	¾ 1
6	1⅜ Standard 1¾ Oversize	6½	9/16	¾	4.88	—	—	7⅝	8⅝	⅞ 1⅛
8	1⅜ Standard 1¾ Oversize	8½	11/16	N/A	N/A	3½	7.57	N/A	N/A	1⅝ 1⅞
10	1¾ Standard 2 Oversize	10⅝	13/16	N/A	N/A	3½ 5	9.40	N/A	N/A	1⅞ 2
12	2 Standard 2½ Oversize	12¾	13/16	N/A	N/A	5	11.1	N/A	N/A	2 2¼

For dimensions not shown, see page 13.

repair

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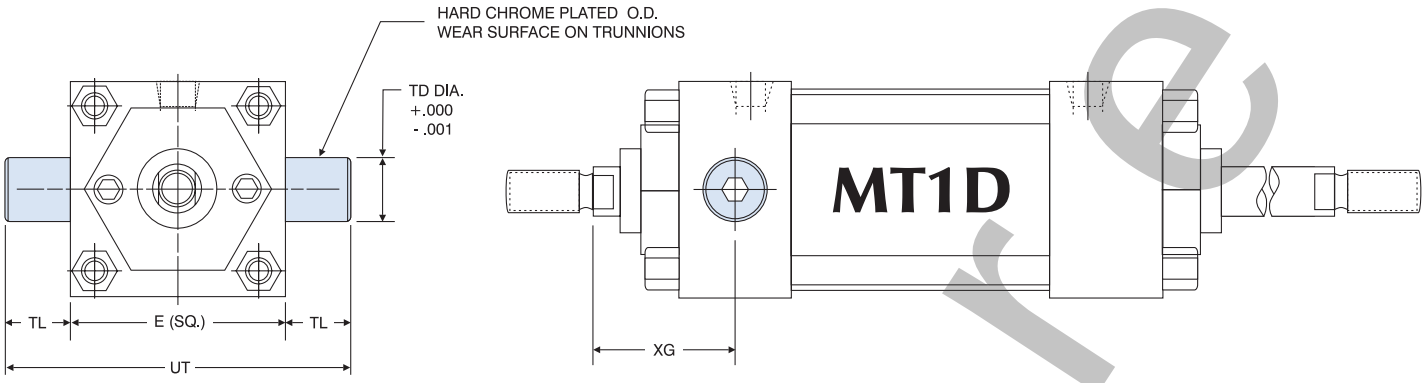
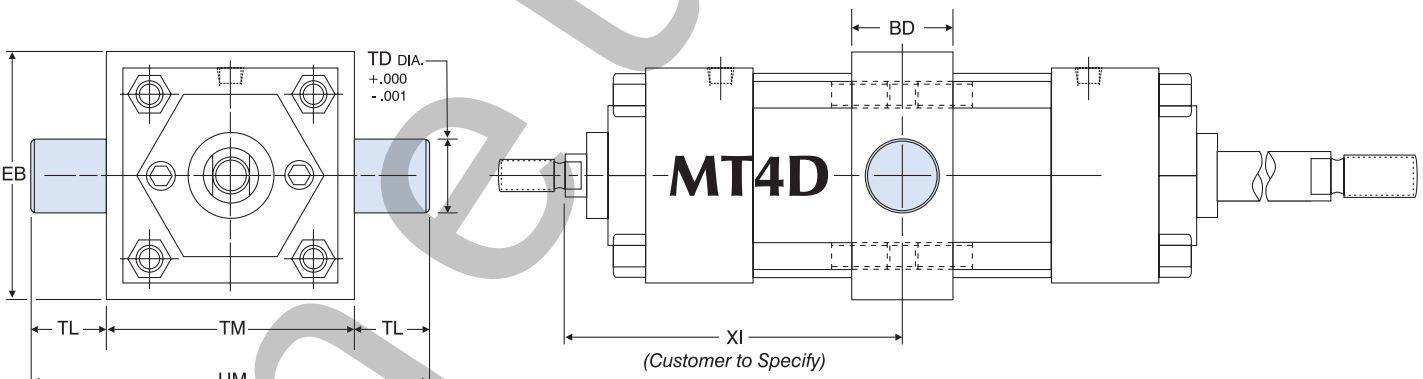
SERIES 'TA' DIMENSIONS: DOUBLE ROD END PIVOT MOUNTS



Note: MT1D Trunnions are bolt on, non-removable design.

DOUBLE ROD END 'MT1D' HEAD TRUNNION MOUNT DIMENSIONS						
BORE	ROD DIAMETER	E	TD	TL	UT	XG
1½	⅝ Standard	2	1	1	4	1¾
	N/A*					N/A
2	⅝ Standard	2½	1	1	4½	1¾
	1 Oversize					2⅛
2½	⅝ Standard	3	1	1	5	1¾
	1 Oversize					2⅛
3¼	1 Standard	3¾	1	1	5¾	2¼
	1⅜ Oversize					2½
4	1 Standard	4½	1	1	6½	2¼
	1⅜ Oversize					2½
5	1 Standard	5½	1	1	7½	2¼
	1⅜ Oversize					2½
6	1⅜ Standard	6½	1⅜	1⅜	9¼	2⅝
	1¾ Oversize					2⅞
8	1⅜ Standard	8½	1⅜	1⅜	11¼	2⅝
	1¾ Oversize					2⅞

*No oversize rod available on 1½" bore MT1D.
For dimensions not shown, see page 13.



Note: MT4D Trunnions and Intermediate Section are one-piece steel construction.

DOUBLE ROD END 'MT4D' INTERMEDIATE TRUNNION MOUNT DIMENSIONS							
BORE	BD	EB	TD	TL	TM	UM	XI
1½	1¼	2½	1	1	2½	4½	CUSTOMER TO SPECIFY
2	1½	3	1	1	3	5	
2½	1½	3½	1	1	3½	5½	
3¼	2	4¼	1	1	4½	6½	
4	2	5	1	1	5¼	7¼	
5	2	6	1	1	6¼	8¼	
6	2	7	1⅜	1⅜	7⅝	10⅜	
8	2½	9½	1⅜	1⅜	9¾	12½	

pneumatic

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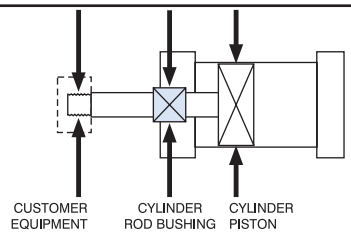
SERIES 'TD' TOUGH-DUTY

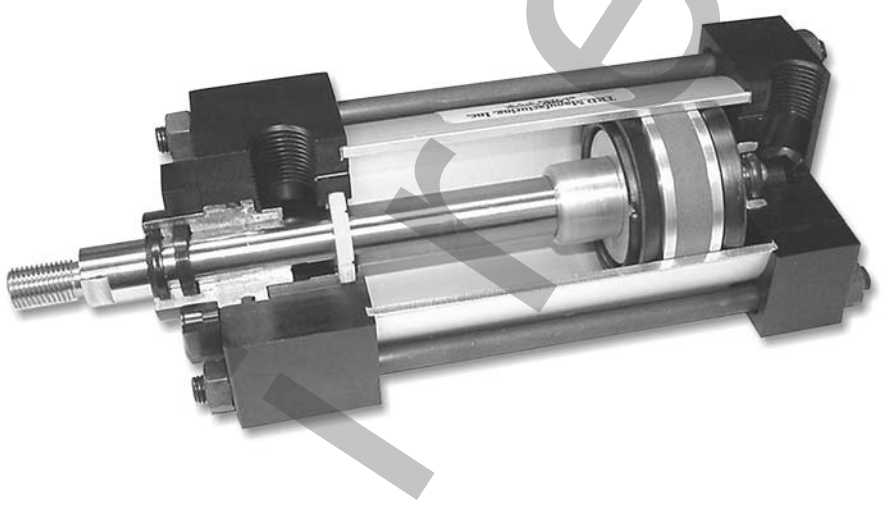
Floating Rod Bushing

SELF ALIGNMENT FEATURE

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



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



TOUGH-DUTY DESIGN - Same construction as 'TA' Series with these performance features, STANDARD:

- ***Impact Dampening Piston Seals*** – "BP" Seals are designed to reduce machine vibration and noise. Higher piston velocities can be achieved due to the rapid deceleration feature, increasing productivity. Bumper Seals are rated for tough-duty, yet offer quieter operation than standard cylinder designs. (Refer to page 81 in options section, "BP" Seals for performance considerations).
- ***Fixed Cushions*** - Head and Cap Cushions are *standard*. The "fixed" design utilizes an internal orifice for a predetermined flow rate, eliminating the need for adjustments. The "fixed" cushion design provides tamper-free operation and guarantees a cushion function at each end of full stroke.
- ***PTFE Piston Wear Band*** - 90% Virgin PTFE with performance additives to increase Compressive Modulus to 65,000 PSI. Wear Band material is designed to provide low-friction, long life operation even in the most demanding applications.

Performance options *(Refer to pages 80-91 for details):*

- ***H or C*** - Adjustable Cushions allow the cylinder to be adjusted to each application, providing the optimum cushion performance and harmonious motion.
- ***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.
- ***BSP or SAE Ports*** - Special ports are available and do not increase delivery time.
- ***Any English or Metric Piston Rod Thread*** - Non-standard rod threads are available and do not increase delivery time.
- ***STEEL TUBE*** - Hydraulic grade chrome plated I.D. and honed steel tubing, black epoxy paint finish O.D.

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.

OPERATING PRESSURE	250 PSI AIR (17 BAR)
OPERATING TEMPERATURE	Carboxilated Nitrile: -20°F to 200°F (-25°C to 90°C) Fluorocarbon: 0°F to 400°F (-20°C to 200°C)

Preview

HOW TO ORDER: Series 'TD'

TD - MF1 ___ - 2½ x 10 - __ - MPR

SERIES	
TD	250 PSI AIR

NFPA MOUNTS	
MF1	FRONT FLANGE (1 1/2"-6" Bore)
MF2	REAR FLANGE (1 1/2"-6" Bore)
ME3	FRONT MOUNTING HOLES (8" Bore)
ME4	REAR MOUNTING HOLES (8" Bore)
MP1	REAR PIVOT CLEVIS (1 1/2"-8" Bore)
MP2	REAR PIVOT CLEVIS (1 1/2"-6" Bore)
MP4	REAR PIVOT EYE (1 1/2"-4" Bore)
MS1	FRONT & REAR END ANGLE (1 1/2"-8" Bore)
MS2	SIDE LUG (1 1/2"-8" Bore)
MS4	BOTTOM TAPPED HOLES (1 1/2"-8" Bore)
MT1	FRONT TRUNNION (1 1/2"-8" Bore)
MT2	REAR TRUNNION (1 1/2"-8" Bore)
MT4	INTERMEDIATE TRUNNION (1 1/2"-8" Bore)
MXO	NO MOUNT (1 1/2"-8" Bore)
MX1	EXTENDED TIE RODS - HEAD & CAP (1 1/2"-8" Bore)
MX2	EXTENDED TIE RODS (CAP) (1 1/2"-8" Bore)
MX3	EXTENDED TIE RODS (HEAD) (1 1/2"-8" Bore)

BORE	
1 1/2	2
2 1/2	3 1/4
4	5
6	8

STROKE
0" to 120" Made to Order

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

CUSHIONS		
NON-ADJUSTABLE (FIXED) HEAD & CAP CUSHIONS ARE STANDARD (LEAVE BLANK)		
OPTIONAL ADJUSTABLE CUSHIONS		
H	**ADJUSTABLE** HEAD CUSHION POSITION 2 IS *STANDARD* *SPECIFY* FOR POSITIONS: 1, 3 & 4	
LH	**ADJUSTABLE LONG** HEAD CUSHION POSITION 2 IS *STANDARD* *SPECIFY* FOR POSITIONS: 1, 3 & 4	
ELH	**ADJUSTABLE EXTRA LONG** HEAD CUSHION POSITION 2 IS *STANDARD* *SPECIFY* FOR POSITIONS: 1, 3 & 4	X
C	**ADJUSTABLE** CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	
LC	**ADJUSTABLE** LONG CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	
ELC	**ADJUSTABLE EXTRA LONG** CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	X

Notes: 1) Ordering example for adjustable cushions in non-standard locations: H3C7
2) Refer to page 83 for assistance in cushion length selection.
3) Cushions can be ordered on same side as ports. *Refer to page 87 for dimensions.*

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")
	BSP	BSP PORTS (SPECIFY SIZE, Example: BSP = 1/4")
	C =	EXTENDED PISTON ROD (Example: C = 3")
	EN	**ELECTROLESS NICKEL PLATED** *(Refer to page 84 for specifications)*
	KK2	LARGE MALE ROD THREAD
	KK3	FEMALE ROD THREAD
	KK3S	STUDDED PISTON ROD (KK3 with Stud, Loctite in place)
	KK4	FULL DIAMETER MALE ROD THREAD
	KK5	BLANK ROD END (NO THREADS, "A" = 0")
	MA	MICRO-ADJUST (6" MAX. STROKE) *Available on Double Rod End Models*
	MAB	MICRO-ADJUST WITH SOUND DAMPENING BUMPER (6" MAX. STROKE)
	MPR	MAGNETIC PISTON FOR REED OR SOLID STATE SWITCHES - TRD MODELS: R10, RAC, AND MSS *(Refer to pages 105-111 for selection)*
	MPH	MAGNETIC PISTON FOR HALL SWITCHES
	MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
	OP	OPTIONAL PORT LOCATION (Example: Ports @ 3 & 7)
	OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, Example: OS = 1 3/8")
	SAE	SAE PORTS (SPECIFY SIZE, Example: SAE #10)
	SSA	STAINLESS STEEL PISTON ROD, TIE RODS & NUTS, AND FASTENERS
	SSF	STAINLESS STEEL FASTENERS
	SSR	STAINLESS STEEL PISTON ROD
	SST	STAINLESS STEEL TIE RODS & NUTS
X	ST	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) (Example: TD MS4 2 X 24" EFFECTIVE STROKE-ST=4)
	STEEL TUBE*	STEEL CYLINDER TUBE, BLACK EPOXY PAINT FINISH
	VS	FLUOROCARBON SEALS
	XX	SPECIAL VARIATION (SPECIFY)

*STEEL TUBES do not work with MPR or MPH magnetic pistons. Refer to pages 112-115 for Baulluff end of stroke sensors.

About our Part Number System

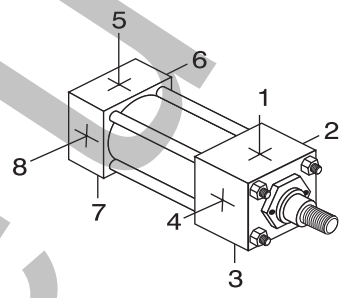
- Simple, easy to understand
- No excessive codes!
- Eliminates mistakes when ordering

Example: A 2½" Bore by 10" Stroke NFPA cylinder, Front Flange Mount, (NON-ADJUSTABLE Head & Cap Cushions), and Magnetic Piston for Switches.

Part Number: TD-MF1-2½ x 10-MPR

STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

- Ports - Positions 1 and 5
- Fixed Cushions - No Adjustment Needle Required
- Cushion Adjustment - Positions 2 and 6
- Specify Non-Standard Positions When Ordering

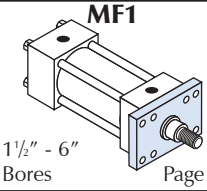
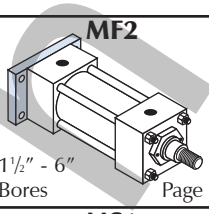
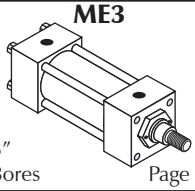
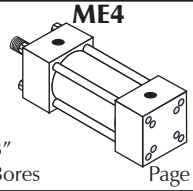
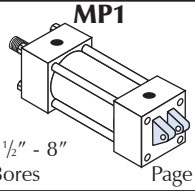
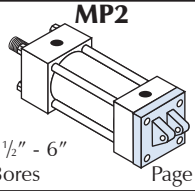
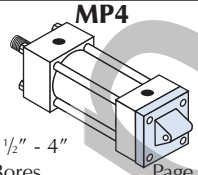
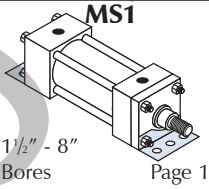
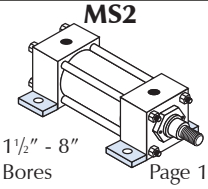
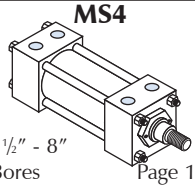
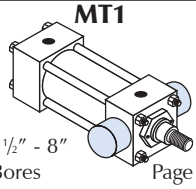
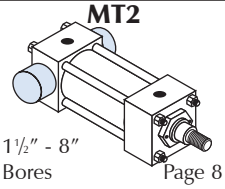
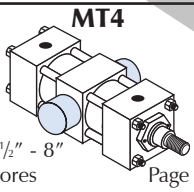
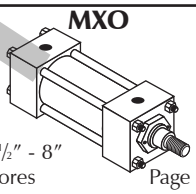
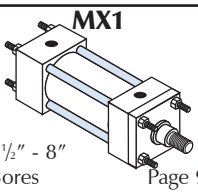
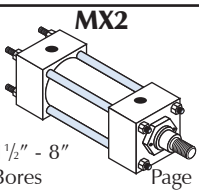
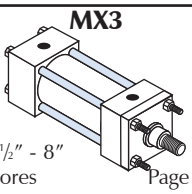


OPTION LENGTH ADDER (ADD TO CATALOG BASIC OVERALL LENGTH DIMENSIONS)			
BORE	ELC	ELH	ST* (STOP TUBE) Example: ST=2
1 1/2	1	1	2
2	1	1	2
2 1/2	1	1	2
3 1/4	1 1/4	1 1/4	2
4	1 1/4	1 1/4	2
5	1 1/4	1 1/4	2
6	1 1/2	1 1/2	2
8	1 1/2	1 1/2	2

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

NFPA MOUNTS

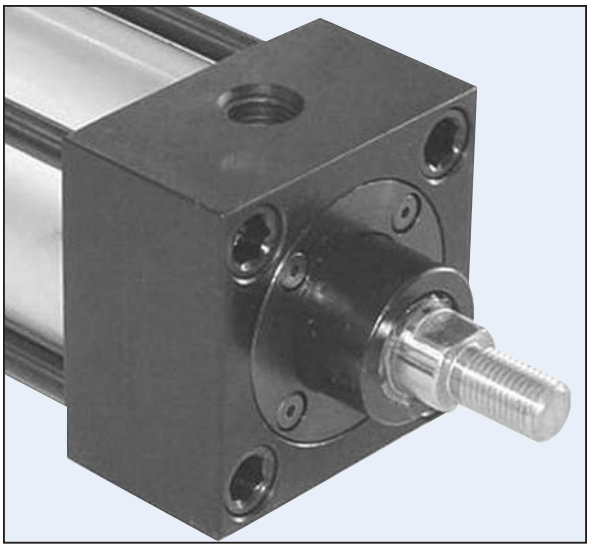
(Refer to pages 6-16 for mounting dimensions)

MF1  1½" - 6" Bores Page 9	**MF2**  1½" - 6" Bores Page 9	**ME3**  8" Bores Page 9	**ME4**  8" Bores Page 9	**MP1**  1½" - 8" Bores Page 7	**MP2**  1½" - 6" Bores Page 7
MP4  1½" - 4" Bores Page 7	**MS1**  1½" - 8" Bores Page 10	**MS2**  1½" - 8" Bores Page 10	**MS4**  1½" - 8" Bores Page 11	**MT1**  1½" - 8" Bores Page 8	**MT2**  1½" - 8" Bores Page 8
MT4  1½" - 8" Bores Page 8	**MXO**  1½" - 8" Bores Page 6	**MX1**  1½" - 8" Bores Page 9	**MX2**  1½" - 8" Bores Page 9	**MX3**  1½" - 8" Bores Page 9	

Online

ORDER ONLINE

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 (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 30 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.
- ***WB*** - Piston Wear Band, recommended for pivot mounted, long strokes or cylinders that may see side loads.
- ***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 (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 20 for ordering instructions)

BORE	1½	2	2½	3¼	4	5	6
PORT SIZE	¼ NPT	¼ NPT	¼ NPT	⅜ NPT	⅜ NPT	⅜ NPT	½ NPT

OPERATING PRESSURE	250 PSI AIR (17 BAR)
OPERATING TEMPERATURE	Carboxilated Nitrile: -20°F to 200°F (-25°C to 90°C) Fluorocarbon: 0°F to 400°F (-20°C to 200°C)

ORDER ONLINE

Preliminare

HOW TO ORDER: Series 'FM'

FM - MS4 ___ - 2½ x 10 - HC - MPR

SERIES	
FM	250 PSI AIR

NFPA MOUNTS	
MF1	FRONT FLANGE (1 1/2"-6" Bore)
MF2	REAR FLANGE (1 1/2"-6" Bore)
MP1	REAR PIVOT CLEVIS (1 1/2"-6" Bore)
MP2	REAR PIVOT CLEVIS (1 1/2"-6" Bore)
MP4	REAR PIVOT EYE (1 1/2"-6" Bore)
MS1	FRONT & REAR END ANGLE (1 1/2"-6" Bore)
MS2	SIDE LUG (1 1/2"-6" Bore)
MS4	BOTTOM TAPPED HOLES (1 1/2"-6" Bore)
MT1	FRONT TRUNNION (1 1/2"-6" Bore)
MT2	REAR TRUNNION (1 1/2"-6" Bore)
MXO	NO MOUNT (1 1/2"-6" Bore)
BASE BAR	NON-NFPA (1 1/2"-4" Bore)

BORE	
1 1/2	2
2 1/2	3 1/4
4	5
6	

STROKE
0" to 120" Made to Order

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

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 2 IS *STANDARD* *SPECIFY* FOR POSITIONS: 1, 3 & 4	X
C	CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	
LC	**LONG** CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	
ELC	**EXTRA LONG** CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	X

Notes: 1) Ordering example for non-standard cushion locations: H3C7

2) Refer to page 83 for assistance in cushion length selection.

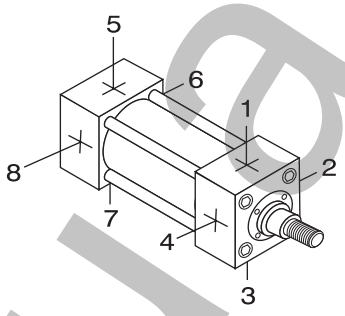
3) Cushions can be ordered on same side as ports. *Refer to page 87 for dimensions.*

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
X	B	1/4" URETHANE BUMPER BOTH ENDS
X	BC	1/4" URETHANE BUMPER CAP ONLY
X	BH	1/4" URETHANE BUMPER HEAD ONLY
	BP	BUMPER PISTON SEALS (1 1/2" - 6" Bore)
	BSP	BSP PORTS (SPECIFY SIZE, Example: BSP = 1/4")
	C =	EXTENDED PISTON ROD (Example: C = 3")
	EN	**ELECTROLESS NICKEL PLATED** *(Refer to page 84 for specifications)*
	KK2	LARGE MALE ROD THREAD
	KK3	FEMALE ROD THREAD
	KK3S	STUDDED PISTON ROD (KK3 with Stud, Loctite in place)
	KK4	FULL DIAMETER MALE ROD THREAD
	KK5	BLANK ROD END (NO THREADS, "A" = 0")
	LF	**LOW FRICTION SEALS** *(Refer to page 84 for specifications)*
	MA	MICRO-ADJUST (6" MAX. STROKE) *Available on Double Rod End Models*
	MAB	MICRO-ADJUST WITH SOUND DAMPENING BUMPER (6" MAX. STROKE)
	MPR	MAGNETIC PISTON FOR REED OR SOLID STATE SWITCHES - TRD MODELS: R10, RAC, AND MSS *(Refer to pages 105-111 for selection)*
	MPH	MAGNETIC PISTON FOR HALL SWITCHES
	MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
	NR	**NON-ROTATING** *(Refer to page 86 for specifications)*
	OP	OPTIONAL PORT LOCATION OR SIZE (Example: Ports @ 3 & 7)
	OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, Example: OS = 1 3/8")
	SAE	SAE PORTS (SPECIFY SIZE, Example: SAE #10)
X	SE	SPRING EXTEND (1 1/2", 2", 2 1/2" bore)
X	SR	SPRING RETURN (1 1/2", 2", 2 1/2" bore)
	SSA	STAINLESS STEEL PISTON ROD, TIE RODS & SLEEVE NUTS, AND FASTENERS
	SSF	STAINLESS STEEL FASTENERS
	SSR	STAINLESS STEEL PISTON ROD
	SST	STAINLESS STEEL TIE RODS & SLEEVE NUTS
X	ST	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) (Example: TA MS4 2 X 24" EFFECTIVE STROKE-ST=3)
	STEEL TUBE*	STEEL CYLINDER TUBE, BLACK EPOXY PAINT FINISH
	TH	**400 PSI HYDRAULIC NON-SHOCK** *(Refer to page 90 for specifications)*
	VS	FLUOROCARBON SEALS
	WB	PISTON WEAR BAND
	XX	SPECIAL VARIATION (SPECIFY)

*STEEL TUBES do not work with MPR or MPH magnetic pistons. Refer to pages 112-115 for Baulluff end of stroke sensors.

STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

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



About our Part Number System

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

Example: A 2½" Bore by 10" Stroke NFPA cylinder, Bottom Tap Mount, Head & Cap Cushions, and Magnetic Piston for Switches.

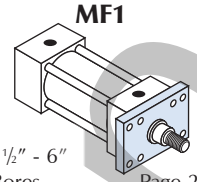
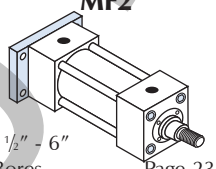
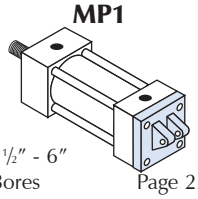
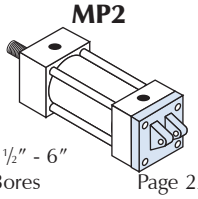
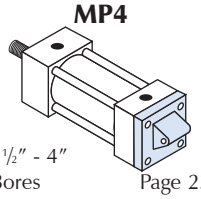
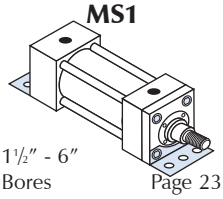
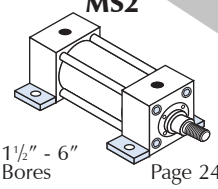
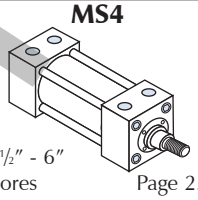
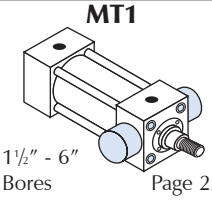
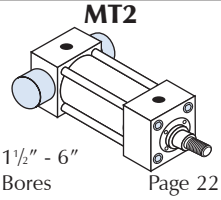
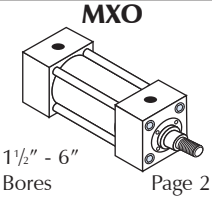
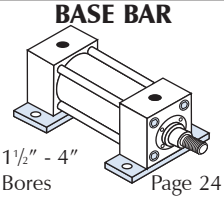
Part Number: FM-MS4-2½ x 10-HC-MPR

OPTION LENGTH ADDER
(ADD TO CATALOG BASIC OVERALL LENGTH DIMENSIONS)

BORE	OPTION							
	B	BC	BH	ELC	ELH	SE	SR	ST* (STOP TUBE) Example: ST=2
1 1/2	1/2	1/4	1/4	1	1	Refer to page 88 for length adders and available bore sizes and strokes		2
2	1/2	1/4	1/4	1	1			2
2 1/2	1/2	1/4	1/4	1	1			2
3 1/4	1/2	1/4	1/4	1 1/4	1 1/4			2
4	1/2	1/4	1/4	1 1/4	1 1/4			2
5	1/2	1/4	1/4	1 1/4	1 1/4			2
6	1/2	1/4	1/4	1 1/2	1 1/2			2

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

'FM' NFPA MOUNTS

MF1  1½" - 6" Bores Page 23	**MF2**  1½" - 6" Bores Page 23	**MP1**  1½" - 6" Bores Page 22	**MP2**  1½" - 6" Bores Page 22	**MP4**  1½" - 4" Bores Page 23	**MS1**  1½" - 6" Bores Page 23
MS2  1½" - 6" Bores Page 24	**MS4**  1½" - 6" Bores Page 25	**MT1**  1½" - 6" Bores Page 22	**MT2**  1½" - 6" Bores Page 22	**MXO**  1½" - 6" Bores Page 21	**BASE BAR**  1½" - 4" Bores Page 24

Preliminary

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

About Rod End Styles

Style 1 Male Rod End is STANDARD

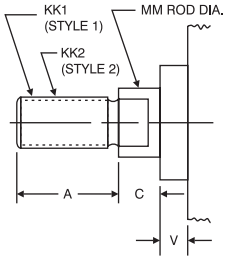
Other NFPA Styles can be specified (See Chart).

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).

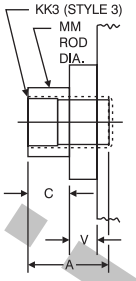
NEED SOMETHING NOT LISTED?
Just send us a sketch.
In most cases, quotes are turned around in one day!

PISTON ROD END STYLES

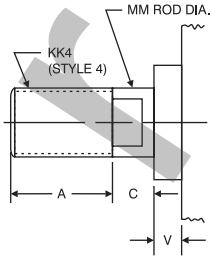
STYLE 1 & 2
KK1 & KK2



STYLE 3
KK3

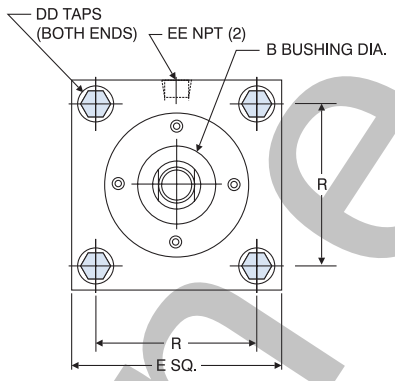


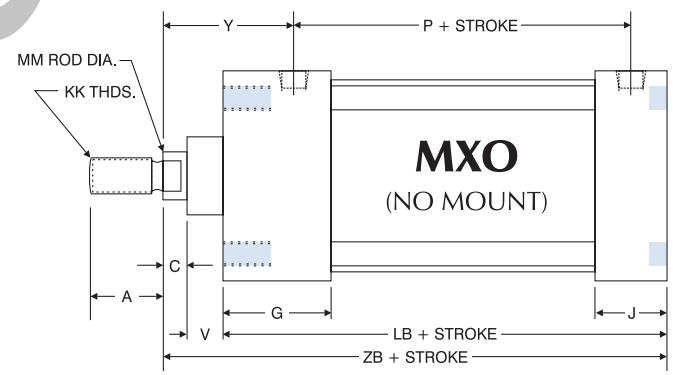
STYLE 4
KK4



BORE	MM ROD DIAMETER	STANDARD Style 1 - Male KK1	A	OPTIONAL Style 2 - Male KK2	A	Style 3 - Female KK3	A	Style 4 - Male KK4	A	Style 5 - Blank KK5	C	V
1½, 2, 2½	⅝ Standard	**⅞-20**	¾	½-20	¾	⅞-20	¾	⅝-18	¾	No Threads	⅜	⅝
	1 Oversize	**¾-16**	1⅛	⅞-14	1⅛	¾-16	1⅛	1-14	1⅛	No Threads	½	½
3¼, 4, 5	1 Standard	**¾-16**	1⅛	⅞-14	1⅛	¾-16	1⅛	1-14	1⅛	No Threads	½	⅞
	1⅜ Oversize	**1-14**	1⅝	1¼-12	1⅝	1-14	1⅝	1⅜-12	1⅝	No Threads	⅝	⅜
6	1⅜ Standard	**1-14**	1⅝	1¼-12	1⅝	1-14	1⅝	1⅜-12	1⅝	No Threads	⅝	1
	1¾ Oversize	**1¼-12**	2	1½-12	2	1¼-12	2	1¾-12	2	No Threads	¾	½

BASIC DIMENSIONS: *'MXO' (NO MOUNT)*





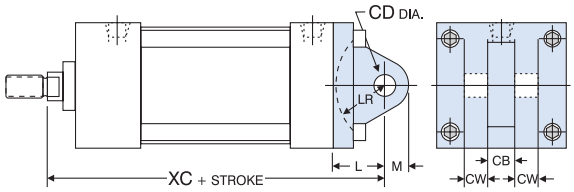
'FM' SERIES BASIC DIMENSIONS 'MXO'																
BORE	A	B	C	DD	E	EE	G	J	KK	LB	MM	P	R	V	Y	ZB
1½	¾	1⅛	⅜	¼-28	2	¼	1½	1	⅞-20	3⅝	⅝	2⅜	1.43	⅝	1⅞	4⅝
2	¾	1⅛	⅜	5/16-24	2½	¼	1½	1	⅞-20	3⅝	⅝	2⅜	1.84	⅝	1⅞	4⅝
2½	¾	1⅛	⅜	5/16-24	3	¼	1½	1	⅞-20	3¾	⅝	2½	2.19	⅝	1⅞	4¾
3¼	1⅛	1½	½	⅜-24	3¾	⅜	1¾	1¼	¾-16	4¼	1	2¾	2.76	⅞	2⅜	5⅝
4	1⅛	1½	½	⅜-24	4½	⅜	1¾	1¼	¾-16	4¼	1	2¾	3.32	⅞	2⅜	5⅝
5	1⅛	1½	½	½-20	5½	⅜	1¾	1¼	¾-16	4½	1	3	4.10	⅞	2⅜	5⅞
6	1⅝	2	⅝	½-20	6½	½	2	1½	1-14	5	1⅜	3¼	4.88	1	2¾	6⅝

For oversize rod dimensions, see page 25.

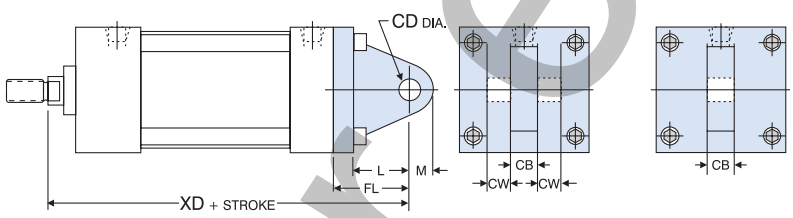
preliminary

ORDER ONLINE

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



FM-MP1

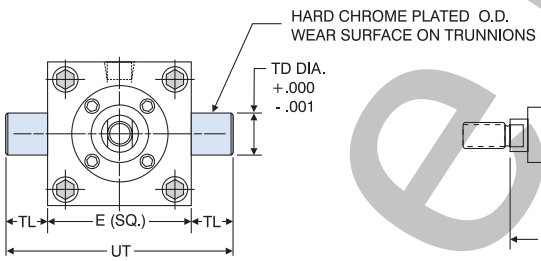


FM-MP2 **FM-MP4**

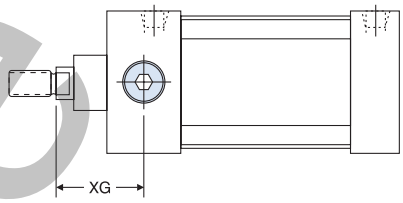
(1½-4" bore)

'FM' SERIES 'MP1' & 'MP2' CLEVIS AND 'MP4' ROD EYE MOUNT DIMENSIONS										
BORE	ROD DIAMETER	CB	CD	CW	FL	L	LR	M	ADD STROKE XC	ADD STROKE XD
1½	⅝ Standard	¾	½	½	1⅛	¾	¾	⅝	5⅜	5¾
	1 Oversize								5¾	6⅛
2	⅝ Standard	¾	½	½	1⅛	¾	¾	⅝	5⅜	5¾
	1 Oversize								5¾	6⅛
2½	⅝ Standard	¾	½	½	1⅛	¾	¾	⅝	5½	5⅞
	1 Oversize								5⅞	6¼
3¼	1 Standard	1¼	¾	⅝	1⅞	1¼	1¼	⅞	6⅞	7½
	1⅜ Oversize								7⅛	7¾
4	1 Standard	1¼	¾	⅝	1⅞	1¼	1¼	⅞	6⅞	7½
	1⅜ Oversize								7⅛	7¾
5	1 Standard	1¼	¾	⅝	1⅞	1¼	1¼	⅞	7⅛	7¾
	1⅜ Oversize								7⅜	8
6	1⅜ Standard	1½	1	¾	2¼	1½	1½	1	8⅛	8⅞
	1¾ Oversize								8⅜	9⅛

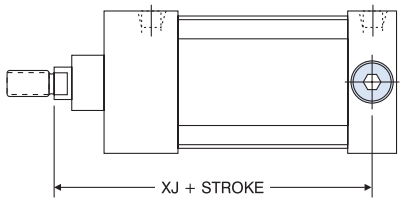
For dimensions not shown, see page 21.



FM-MT1 / MT2



FM-MT1



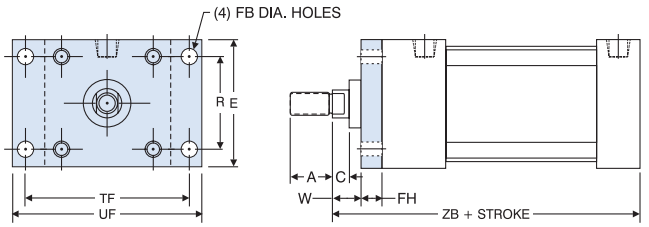
FM-MT2

'FM' SERIES 'MT1' HEAD TRUNNION AND 'MT2' CAP TRUNNION MOUNT DIMENSIONS							
BORE	ROD DIAMETER	E	TD	TL	UT	XG	ADD STROKE XJ
1½	⅝ Standard	2	1	1	4	1¾	4⅛
	1 Oversize					N/A*	4½
2	⅝ Standard	2½	1	1	4½	1¾	4⅛
	1 Oversize					2⅛	4½
2½	⅝ Standard	3	1	1	5	1¾	4¼
	1 Oversize					2⅛	4⅝
3¼	1 Standard	3¾	1	1	5¾	2¼	5
	1⅜ Oversize					2½	5¼
4	1 Standard	4½	1	1	6½	2¼	5
	1⅜ Oversize					2½	5¼
5	1 Standard	5½	1	1	7½	2¼	5¼
	1⅜ Oversize					2½	5½
6	1⅜ Standard	6½	1⅜	1⅜	9¼	2⅝	5⅞
	1¾ Oversize					2⅞	6⅛

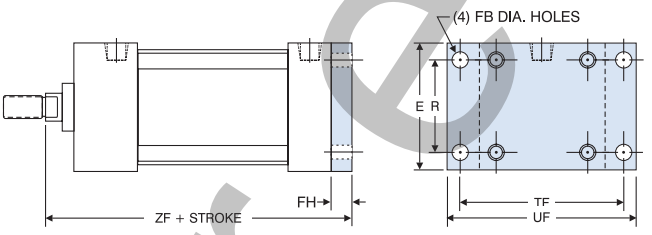
*No oversize rod available on 1½" bore MT1.
For dimensions not shown, see page 21.

ORDER ONLINE

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



FM-MF1



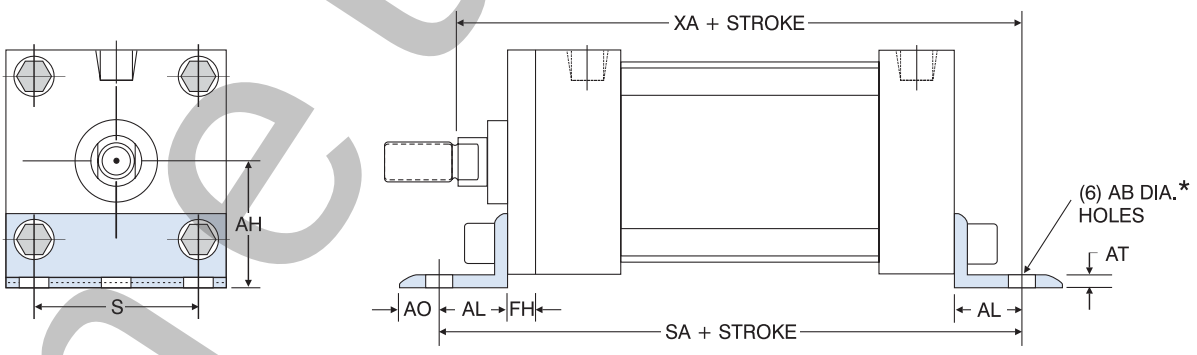
FM-MF2

'FM' SERIES 'MF1' AND 'MF2' FLANGE MOUNT DIMENSIONS												
BORE	ROD DIAMETER	A	C	E	FB	FH	R	TF	UF	W	ZB	ZF
1 1/2	5/8 Standard	3/4	3/8	2	5/16	3/8	1.43	2 3/4	3 3/8	5/8	4 5/8	5
	1 Oversize	1 1/8	1/2							1	5	5 3/8
2	5/8 Standard	3/4	3/8	2 1/2	3/8	3/8	1.84	3 3/8	4 1/8	5/8	4 5/8	5
	1 Oversize	1 1/8	1/2							1	5	5 3/8
2 1/2	5/8 Standard	3/4	3/8	3	3/8	3/8	2.19	3 7/8	4 5/8	5/8	4 3/4	5 1/8
	1 Oversize	1 1/8	1/2							1	5 1/8	5 1/2
3 1/4	1 Standard	1 1/8	1/2	3 3/4	7/16	5/8	2.76	4 11/16	5 1/2	3/4	5 5/8	6 1/4
	1 3/8 Oversize	1 5/8	5/8							1	5 7/8	6 1/2
4	1 Standard	1 1/8	1/2	4 1/2	7/16	5/8	3.32	5 7/16	6 1/4	3/4	5 5/8	6 1/4
	1 3/8 Oversize	1 5/8	5/8							1	5 7/8	6 1/2
5	1 Standard	1 1/8	1/2	5 1/2	9/16	5/8	4.10	6 5/8	7 5/8	3/4	5 7/8	6 1/2
	1 3/8 Oversize	1 5/8	5/8							1	6 1/8	6 3/4
6	1 3/8 Standard	1 5/8	5/8	6 1/2	9/16	3/4	4.88	7 5/8	8 5/8	7/8	6 5/8	7 3/8
	1 3/4 Oversize	2	3/4							1 1/8	6 7/8	7 5/8

For dimensions not shown, see page 21.

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

FM-MS1



'FM' SERIES 'MS1' ANGLE MOUNT DIMENSIONS										
BORE	ROD DIAMETER	AB	AH	AL	AO	AT	FH	S	ADD STROKE SA	ADD STROKE XA
1 1/2	5/8 Standard	7/16	1 3/16	1	3/8	1/8	3/8	1 1/4	6	5 5/8
	1 Oversize									6
2	5/8 Standard	7/16	1 7/16	1	3/8	1/8	3/8	1 3/4	6	5 5/8
	1 Oversize									6
2 1/2	5/8 Standard	7/16	1 5/8	1	3/8	1/8	3/8	2 1/4	6 1/8	5 3/4
	1 Oversize									6 1/8
3 1/4	1 Standard	9/16	1 15/16	1 1/4	1/2	1/8	5/8	2 3/4	7 3/8	6 7/8
	1 3/8 Oversize									7 1/8
4	1 Standard	9/16	2 1/4	1 1/4	1/2	1/8	5/8	3 1/2	7 3/8	6 7/8
	1 3/8 Oversize									7 1/8
5	1 Standard	11/16	2 3/4	1 3/8	5/8	3/16	5/8	4 1/4	7 7/8	7 1/4
	1 3/8 Oversize									7 1/2
6	1 3/8 Standard	13/16	3 1/4	1 3/8	5/8	3/16	3/4	5 1/4	8 1/2	8
	1 3/4 Oversize									8 1/4

*Note: 1 1/2" bore has (4) "AB" holes on "S" dimension.
For dimensions not shown, see page 21.

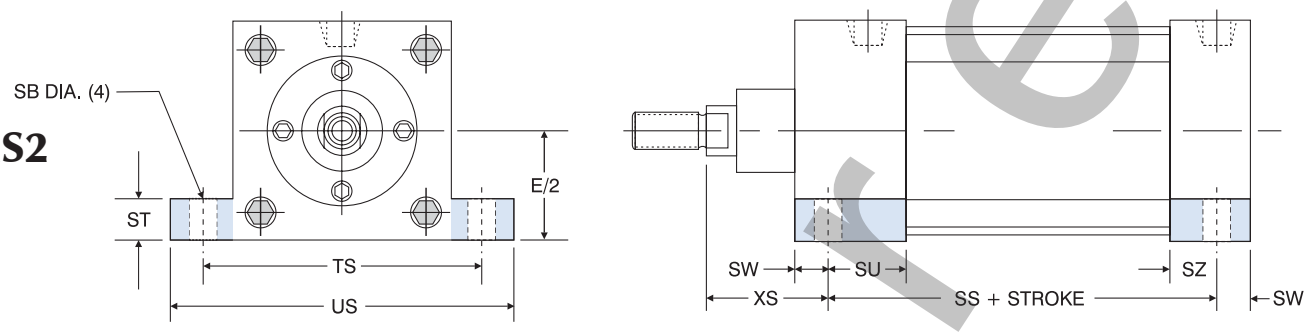
Preliminary

NEW

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

NEW

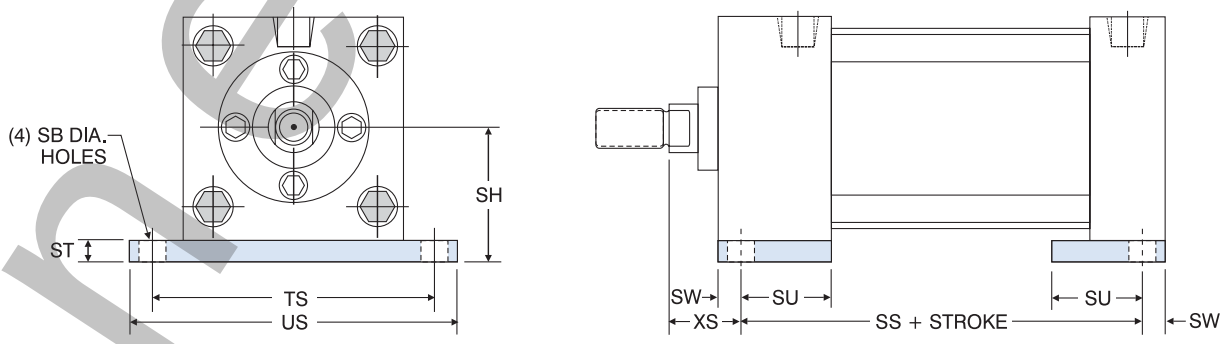
FM-MS2



'FM' SERIES 'MS2' SIDE LUG MOUNT DIMENSIONS											
BORE	ROD DIAMETER	SB	E/2	ST	SU	SW	SZ	TS	US	XS	ADD STROKE SS
1 1/2	5/8 Standard	7/16	1	1/2	1 1/8	3/8	5/8	2 3/4	3 1/2	1 3/8	2 7/8
	1 Oversize									1 3/4	
2	5/8 Standard	7/16	1 1/4	1/2	1 1/8	3/8	5/8	3 1/4	4	1 3/8	2 7/8
	1 Oversize									1 3/4	
2 1/2	5/8 Standard	7/16	1 1/2	1/2	1 1/8	3/8	5/8	3 3/4	4 1/2	1 3/8	3
	1 Oversize									1 3/4	
3 1/4	1 Standard	9/16	1 7/8	3/4	1 1/4	1/2	3/4	4 3/4	5 3/4	1 7/8	3 1/4
	1 3/8 Oversize									2 1/8	
4	1 Standard	9/16	2 1/4	3/4	1 1/4	1/2	3/4	5 1/2	6 1/2	1 7/8	3 1/4
	1 3/8 Oversize									2 1/8	
5	1 Standard	13/16	2 3/4	1	1 1/16	11/16	9/16	6 7/8	8 1/4	2 1/16	3 1/8
	1 3/8 Oversize									2 5/16	
6	1 3/8 Standard	13/16	3 1/4	1	1 5/16	11/16	13/16	7 7/8	9 1/4	2 5/16	3 5/8
	1 3/4 Oversize									2 9/16	

For dimensions not shown, see page 21.

FM-BASE BAR (Non-NFPA)



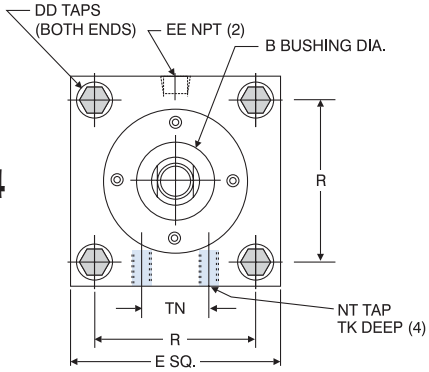
'FM' SERIES BASE BAR MOUNT (Non-NFPA) DIMENSIONS										
BORE	ROD DIAMETER	SB	SH	ST	SU	SW	TS	US	XS	ADD STROKE SS
1 1/2	5/8 Standard	7/16	1 1/4	1/4	1 1/8	3/8	2 3/4	3 1/2	1 3/8	2 7/8
	1 Oversize								1 3/4	
2	5/8 Standard	7/16	1 1/2	1/4	1 1/8	3/8	3 1/4	4	1 3/8	2 7/8
	1 Oversize								1 3/4	
2 1/2	5/8 Standard	7/16	1 7/8	3/8	1 1/8	3/8	3 3/4	4 1/2	1 3/8	3
	1 Oversize								1 3/4	
3 1/4	1 Standard	9/16	2 3/8	1/2	1 1/4	1/2	4 3/4	5 3/4	1 7/8	3 1/4
	1 3/8 Oversize								2 1/8	
4	1 Standard	9/16	2 3/4	1/2	1 1/4	1/2	5 1/2	6 1/2	1 7/8	3 1/4
	1 3/8 Oversize								2 1/8	

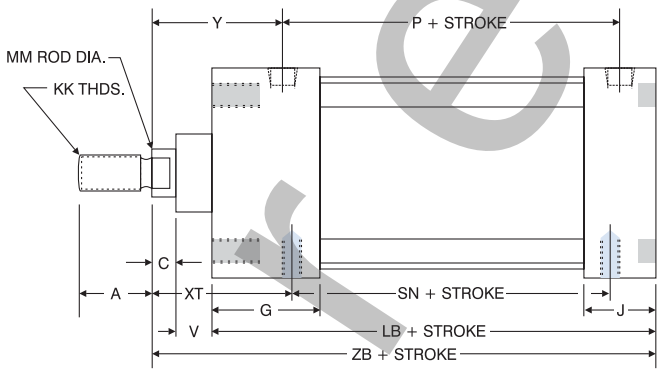
For dimensions not shown, see page 21.

Preliminary

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

FM-MS4

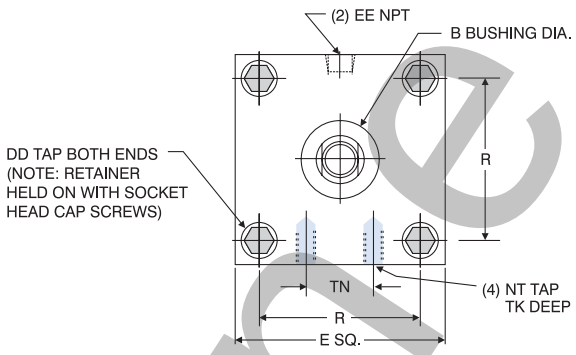


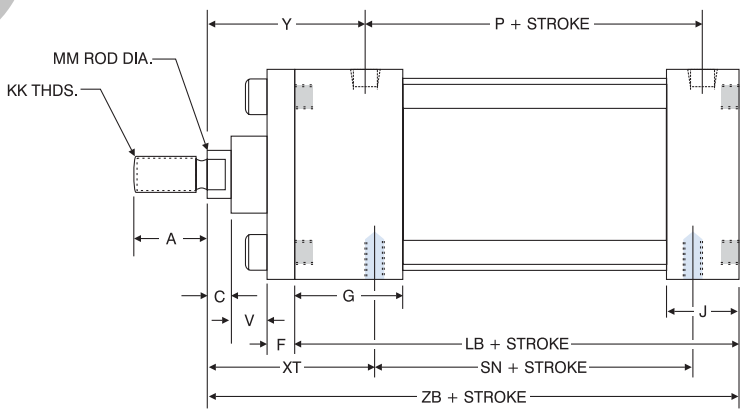


'FM' SERIES 'MS4' FLUSH MOUNT DIMENSIONS																				
BORE	A	B	C	DD	E	EE	G	J	KK	LB	MM	P	R	V	Y	ZB	NT	TK	TN	SN	XT
1½	¾	1⅛	⅜	¼-28	2	¼	1½	1	7/16-20	3⅝	⅝	2⅜	1.43	⅝	1⅞	4⅝	¼-20	⅜	⅝	2¼	1 15/16
2	¾	1⅛	⅜	5/16-24	2½	¼	1½	1	7/16-20	3⅝	⅝	2⅜	1.84	⅝	1⅞	4⅝	5/16-18	½	⅞	2¼	1 15/16
2½	¾	1⅛	⅜	5/16-24	3	¼	1½	1	7/16-20	3¾	⅝	2½	2.19	⅝	1⅞	4¾	⅜-16	⅝	1¼	2⅜	1 15/16
3¼	1⅛	1½	½	⅜-24	3¾	⅜	1¾	1¼	¾-16	4¼	1	2¾	2.76	⅞	2⅜	5⅝	½-13	¾	1½	2⅝	2 7/16
4	1⅛	1½	½	⅜-24	4½	⅜	1¾	1¼	¾-16	4¼	1	2¾	3.32	⅞	2⅜	5⅝	½-13	¾	2 1/16	2⅝	2 7/16
5	1⅛	1½	½	½-20	5½	⅜	1¾	1¼	¾-16	4½	1	3	4.10	⅞	2⅜	5⅞	⅝-11	1	2 11/16	2⅞	2 7/16
6	1⅝	2	⅝	½-20	6½	½	2	1½	1-14	5	1⅜	3¼	4.88	1	2¾	6⅝	¾-10	1⅛	3¼	3⅛	2 13/16

For dimensions not shown, see page 21.

FM-MS4: *Oversize Rod Diameter*





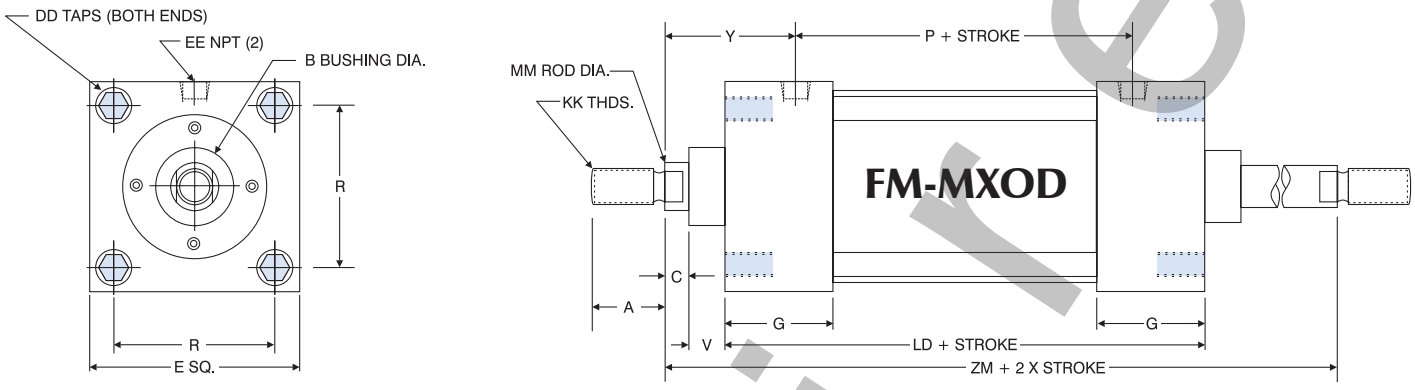
'FM' SERIES OVERSIZE ROD 'MS4' FLUSH MOUNT DIMENSIONS																						
BORE	A	B	C	DD	E	EE	F	G	J	KK	LB	MM	P	R	V	Y	NT	TK	TN	SN	XT	ZB
1½	1⅛	1½	½	¼-28	2	¼	⅜	1½	1	¾-16	3⅝	1	2⅜	1.43	½	2¼	¼-20	⅜	⅝	2¼	2 5/16	5
2	1⅛	1½	½	5/16-24	2½	¼	⅜	1½	1	¾-16	3⅝	1	2⅜	1.84	½	2¼	5/16-18	½	⅞	2¼	2 5/16	5
2½	1⅛	1½	½	5/16-24	3	¼	⅜	1½	1	¾-16	3¾	1	2½	2.19	½	2¼	⅜-16	⅝	1¼	2⅜	2 5/16	5 1/8
3¼	1⅝	2	⅝	⅜-24	3¾	⅜	⅝	1¾	1¼	1-14	4¼	1⅜	2¾	2.76	⅜	2⅝	½-13	¾	1½	2⅝	2 11/16	5⅞
4	1⅝	2	⅝	⅜-24	4½	⅜	⅝	1¾	1¼	1-14	4¼	1⅜	2¾	3.32	⅜	2⅝	½-13	¾	2 1/16	2⅝	2 11/16	5⅞
5	1⅝	2	⅝	½-20	5½	⅜	⅝	1¾	1¼	1-14	4½	1⅜	3	4.10	⅜	2⅝	⅝-11	1	2 11/16	2⅞	2 11/16	6⅛
6	2	2⅜	¾	½-20	6½	½	¾	2	1½	1¼-12	5	1¾	3¼	4.88	½	3	¾-10	1⅛	3¼	3⅛	3 1/16	6⅞

Preliminary

ORDER ONLINE

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

BASIC DIMENSIONS: *DOUBLE ROD END 'MXOD' (NO MOUNT)*



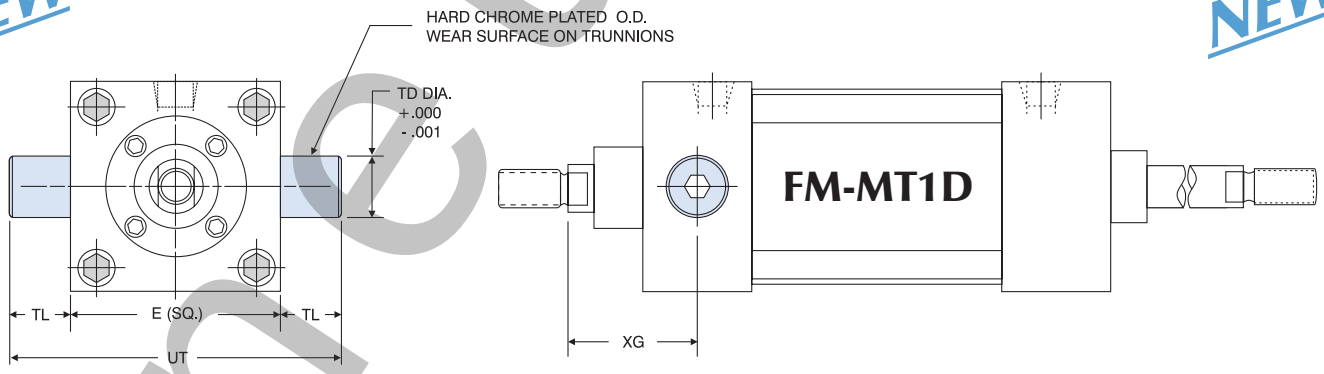
'FM' SERIES DOUBLE ROD END BASIC DIMENSIONS 'MXOD'														
BORE	A	B	C	DD	E	EE	G	KK	LD	MM	P	R	V	Y	ZM
1½	¾	1⅛	⅜	¼-28	2	¼	1½	7/16-20	4⅛	⅝	2⅜	1.43	⅝	1⅞	6⅛
2	¾	1⅛	⅜	5/16-24	2½	¼	1½	7/16-20	4⅛	⅝	2⅜	1.84	⅝	1⅞	6⅛
2½	¾	1⅛	⅜	5/16-24	3	¼	1½	7/16-20	4¼	⅝	2½	2.19	⅝	1⅞	6¼
3¼	1⅛	1½	½	⅜-24	3¾	⅜	1¾	¾-16	4¾	1	2¾	2.76	⅞	2⅜	7½
4	1⅛	1½	½	⅜-24	4½	⅜	1¾	¾-16	4¾	1	2¾	3.32	⅞	2⅜	7½
5	1⅛	1½	½	½-20	5½	⅜	1¾	¾-16	5	1	3	4.10	⅞	2⅜	7¾
6	1⅝	2	⅝	½-20	6½	½	2	1-14	5½	1⅜	3¼	4.88	1	2¾	8¾

For oversize rod dimensions, refer to page 29.

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

NEW

NEW



'FM' SERIES DOUBLE ROD END 'MT1D' HEAD TRUNNION MOUNT DIMENSIONS						
BORE	ROD DIAMETER	E	TD	TL	UT	XG
1½	⅝ Standard	2	1	1	4	1¾
	1 Oversize					N/A*
2	⅝ Standard	2½	1	1	4½	1¾
	1 Oversize					2⅛
2½	⅝ Standard	3	1	1	5	1¾
	1 Oversize					2⅛
3¼	1 Standard	3¾	1	1	5¾	2¼
	1⅜ Oversize					2½
4	1 Standard	4½	1	1	6½	2¼
	1⅜ Oversize					2½
5	1 Standard	5½	1	1	7½	2¼
	1⅜ Oversize					2½
6	1⅜ Standard	6½	1⅜	1⅜	9¼	2⅝
	1¾ Oversize					2⅞

*No oversize rod available on 1½" bore MT1D.
For dimensions not shown. see chart above.

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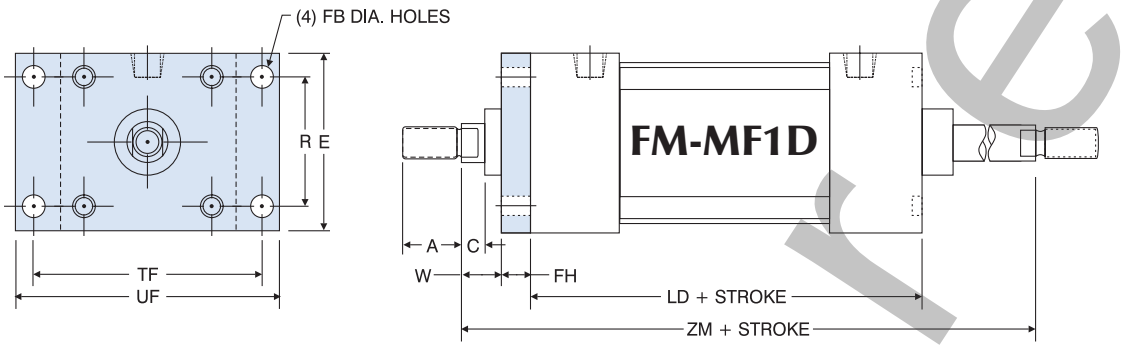
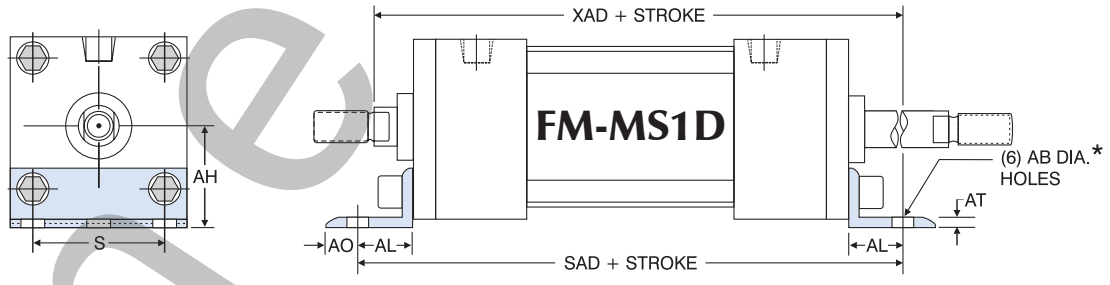
SERIES 'FM' DIMENSIONS: DOUBLE ROD END FLANGE MOUNT
FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)



'FM' SERIES DOUBLE ROD END 'MF1D' FLANGE MOUNT DIMENSIONS												
BORE	ROD DIAMETER	A	C	E	FB	FH	R	TF	UF	W	ADD STROKE LD	ADD STROKE ZM
1½	⅝ Standard	¾	⅜	2	5/16	⅜	1.43	2¾	3⅜	⅝	4⅛	6⅛
	1 Oversize	1⅛	½							1		6⅞
2	⅝ Standard	¾	⅜	2½	⅜	⅜	1.84	3⅜	4⅛	⅝	4⅛	6⅛
	1 Oversize	1⅛	½							1		6⅞
2½	⅝ Standard	¾	⅜	3	⅜	⅜	2.19	3⅞	4⅝	⅝	4¼	6¼
	1 Oversize	1⅛	½							1		7
3¼	1 Standard	1⅛	½	3¾	7/16	⅝	2.76	4 11/16	5½	¾	4¾	7½
	1⅜ Oversize	1⅝	⅝							1		8
4	1 Standard	1⅛	½	4½	7/16	⅝	3.32	5 7/16	6¼	¾	4¾	7½
	1⅜ Oversize	1⅝	⅝							1		8
5	1 Standard	1⅛	½	5½	9/16	⅝	4.10	6⅝	7⅝	¾	5	7¾
	1⅜ Oversize	1⅝	⅝							1		8¼
6	1⅜ Standard	1⅝	⅝	6½	9/16	¾	4.88	7⅝	8⅝	⅞	5½	8¾
	1¾ Oversize	2	¾							1⅛		9¼

For dimensions not shown, see page 26.

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	ADD STROKE XAD
1½	⅝ Standard	7/16	1 3/16	1	⅜	⅛	1¼	6⅞	6½
	1 Oversize								6⅞
2	⅝ Standard	7/16	1 7/16	1	⅜	⅛	1¾	6⅞	6½
	1 Oversize								6⅞
2½	⅝ Standard	7/16	1⅝	1	⅜	⅛	2¼	7	6⅝
	1 Oversize								7
3¼	1 Standard	9/16	1 15/16	1¼	½	⅛	2¾	8½	8
	1⅜ Oversize								8¼
4	1 Standard	9/16	2¼	1¼	½	⅛	3½	8½	8
	1⅜ Oversize								8¼
5	1 Standard	11/16	2¾	1⅜	⅝	3/16	4¼	9	8⅜
	1⅜ Oversize								8⅝
6	1⅜ Standard	13/16	3¼	1⅜	⅝	3/16	5¼	9¾	9¼
	1¾ Oversize								9½

*Note: 1½" bore has (4) "AB" holes on "S" dimension.
For dimensions not shown, see page 26.

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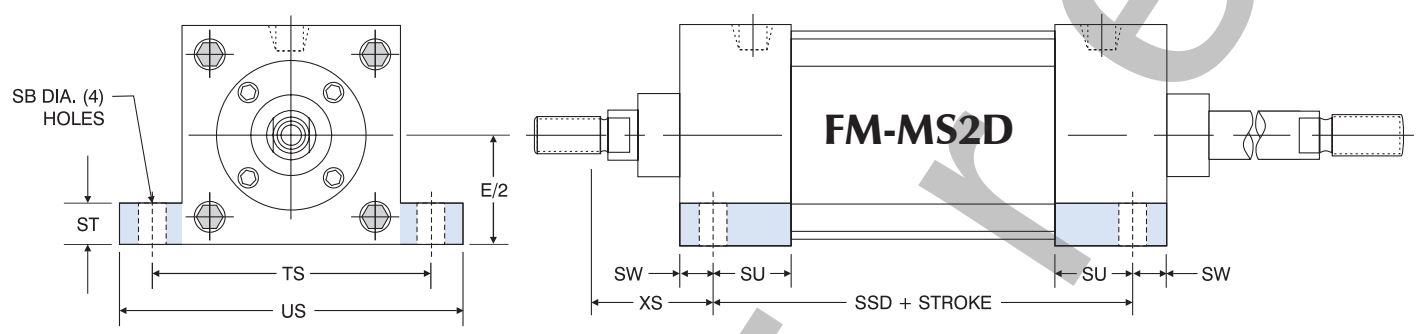
SERIES 'FM' DIMENSIONS: DOUBLE ROD END BASE MOUNTS

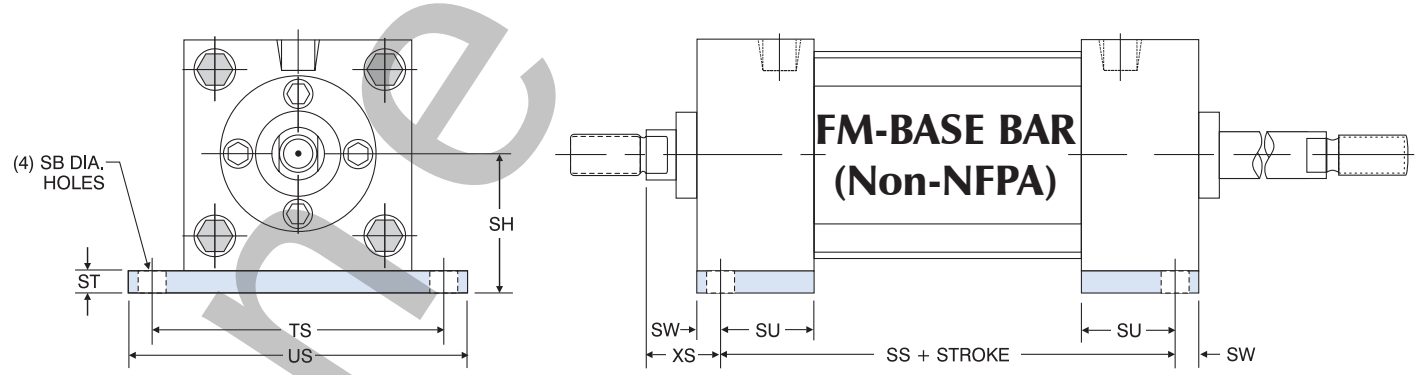
FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)

NEW NEW



'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 1/2	5/8 Standard	7/16	1	1/2	1 1/8	3/8	2 3/4	3 1/2	1 3/8	3 3/8
	1 Oversize								1 3/4	
2	5/8 Standard	7/16	1 1/4	1/2	1 1/8	3/8	3 1/4	4	1 3/8	3 3/8
	1 Oversize								1 3/4	
2 1/2	5/8 Standard	7/16	1 1/2	1/2	1 1/8	3/8	3 3/4	4 1/2	1 3/8	3 1/2
	1 Oversize								1 3/4	
3 1/4	1 Standard	9/16	1 7/8	3/4	1 1/4	1/2	4 3/4	5 3/4	1 7/8	3 3/4
	1 3/8 Oversize								2 1/8	
4	1 Standard	9/16	2 1/4	3/4	1 1/4	1/2	5 1/2	6 1/2	1 7/8	3 3/4
	1 3/8 Oversize								2 1/8	
5	1 Standard	13/16	2 3/4	1	1 1/16	11/16	6 7/8	8 1/4	2 1/16	3 5/8
	1 3/8 Oversize								2 5/16	
6	1 3/8 Standard	13/16	3 1/4	1	1 5/16	11/16	7 7/8	9 1/4	2 5/16	4 1/8
	1 3/4 Oversize								2 9/16	

For dimensions not shown, see page 26.



'FM' SERIES DOUBLE ROD END BASE BAR MOUNT (Non-NFPA) DIMENSIONS										
BORE	ROD DIAMETER	SB	SH	ADD STROKE SS	ST	SU	SW	TS	US	XS
1 1/2	5/8 Standard	7/16	1 1/4	3 3/8	1/4	1 1/8	3/8	2 3/4	3 1/2	1 3/8
	1 Oversize									1 3/4
2	5/8 Standard	7/16	1 1/2	3 3/8	1/4	1 1/8	3/8	3 1/4	4	1 3/8
	1 Oversize									1 3/4
2 1/2	5/8 Standard	7/16	1 7/8	3 1/2	3/8	1 1/8	3/8	3 3/4	4 1/2	1 3/8
	1 Oversize									1 3/4
3 1/4	1 Standard	9/16	2 3/8	3 3/4	1/2	1 1/4	1/2	4 3/4	5 3/4	1 7/8
	1 3/8 Oversize									2 1/8
4	1 Standard	9/16	2 3/4	3 3/4	1/2	1 1/4	1/2	5 1/2	6 1/2	1 7/8
	1 3/8 Oversize									2 1/8

For dimensions not shown, see page 26.

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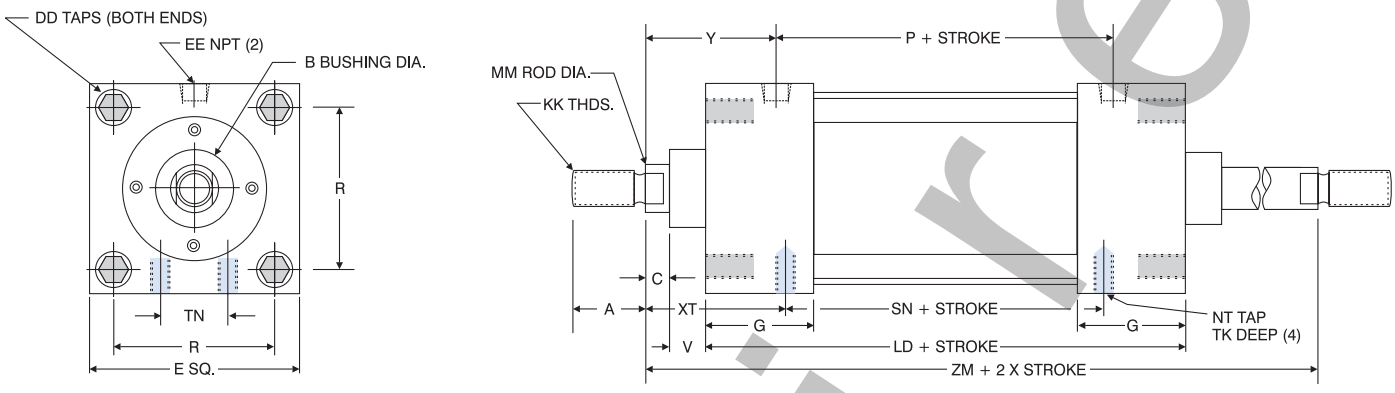
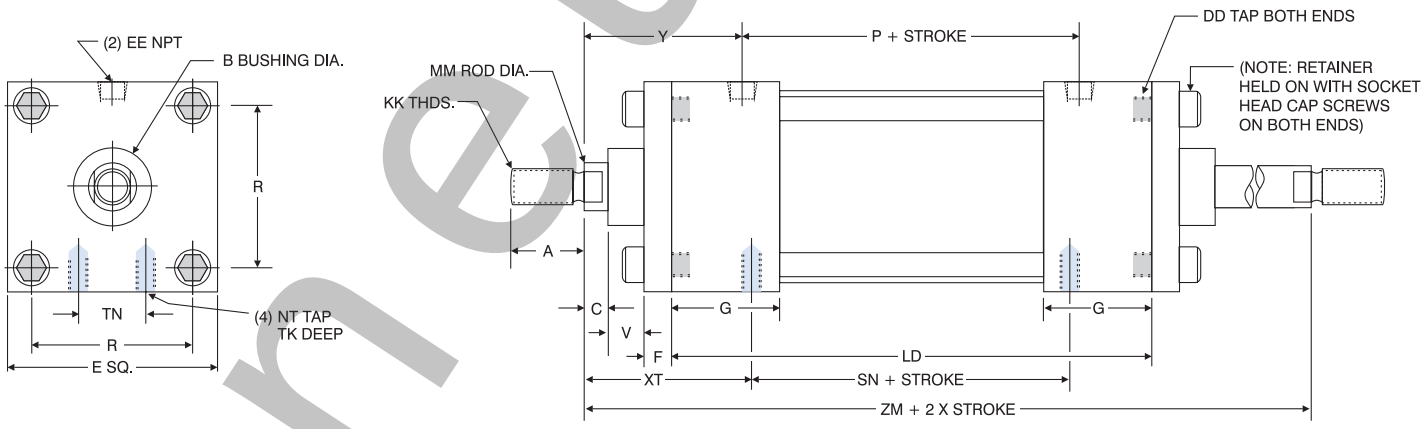
SERIES 'FM' DIMENSIONS: DOUBLE ROD END BASE MOUNT
FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)

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
1½	¾	1⅛	⅜	¼-28	2	¼	1½	7/16-20	4⅛	⅝	2⅜	1.43	⅝	1⅞	¼-20	⅜	⅝	2¼	1 15/16	6⅛
2	¾	1⅛	⅜	5/16-24	2½	¼	1½	7/16-20	4⅛	⅝	2⅜	1.84	⅝	1⅞	5/16-18	½	⅞	2¼	1 15/16	6⅛
2½	¾	1⅛	⅜	5/16-24	3	¼	1½	7/16-20	4¼	⅝	2½	2.19	⅝	1⅞	⅜-16	⅝	1¼	2⅜	1 15/16	6¼
3¼	1⅛	1½	½	⅜-24	3¾	⅜	1¾	¾-16	4¾	1	2¾	2.76	⅞	2⅜	½-13	¾	1½	2⅝	2 7/16	7½
4	1⅛	1½	½	⅜-24	4½	⅜	1¾	¾-16	4¾	1	2¾	3.32	⅞	2⅜	½-13	¾	2 1/16	2⅝	2 7/16	7½
5	1⅛	1½	½	½-20	5½	⅜	1¾	¾-16	5	1	3	4.10	⅞	2⅜	⅝-11	1	2 11/16	2⅞	2 7/16	7¾
6	1⅝	2	⅝	½-20	6½	½	2	1-14	5½	1⅜	3¼	4.88	1	2¾	¾-10	1⅛	3¼	3⅛	2 13/16	8¾

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
1½	1⅛	1½	½	¼-28	2	¼	⅜	1½	¾-16	4⅛	1	2⅜	1.43	½	2¼	¼-20	⅜	⅝	2¼	2 5/16	6⅞
2	1⅛	1½	½	5/16-24	2½	¼	⅜	1½	¾-16	4⅛	1	2⅜	1.84	½	2¼	5/16-18	½	⅞	2¼	2 5/16	6⅞
2½	1⅛	1½	½	5/16-24	3	¼	⅜	1½	¾-16	4¼	1	2½	2.19	½	2¼	⅜-16	⅝	1¼	2⅜	2 5/16	7
3¼	1⅝	2	⅝	⅜-24	3¾	⅜	⅝	1¾	1-14	4¾	1⅜	2¾	2.76	⅜	2⅝	½-13	¾	1½	2⅝	2 11/16	8
4	1⅝	2	⅝	⅜-24	4½	⅜	⅝	1¾	1-14	4¾	1⅜	2¾	3.32	⅜	2⅝	½-13	¾	2 1/16	2⅝	2 11/16	8
5	1⅝	2	⅝	½-20	5½	⅜	⅝	1¾	1-14	5	1⅜	3	4.10	⅜	2⅝	⅝-11	1	2 11/16	2⅞	2 11/16	8¼
6	2	2⅜	¾	½-20	6½	½	¾	2	1¼-12	5½	1¾	3¼	4.88	½	3⅛	¾-10	1⅛	3¼	3⅛	3 1/16	9¼

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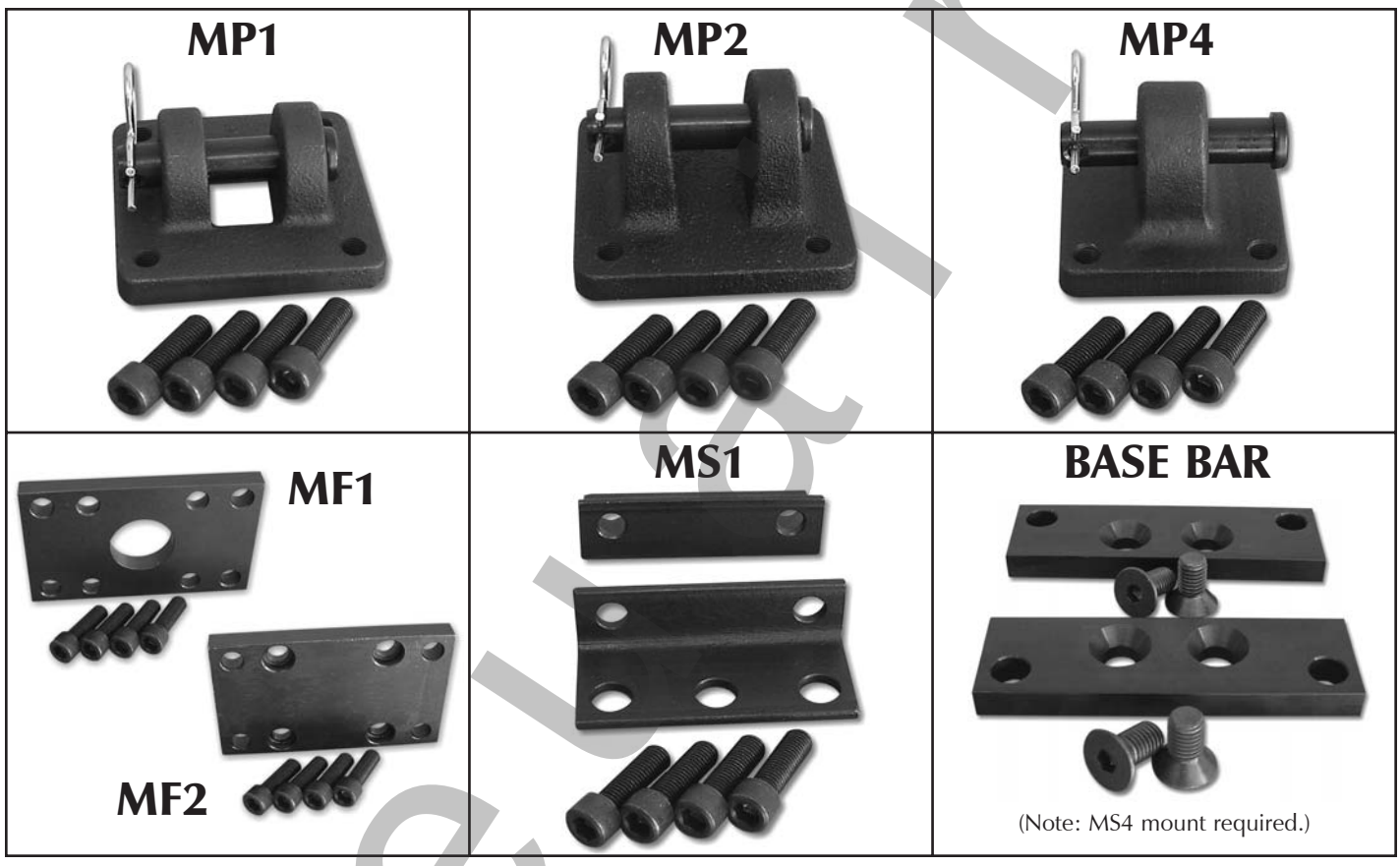
ORDER ONLINE

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 (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 (6) mounting kits. Each kit comes complete with fasteners.



SERIES 'FM' MOUNTING KITS

BORE	MP1	MP2	MP4	MF1	MF2	MS1	Base Bar	
	Part Number	Part Number	Part Number	Part Number	Part Number	Part Number	Part Number	SH Dimension
1½	FMP115	FMP215	FMP415	FMF115	FMF215	FMS115	FMS215	1¼
2	FMP120	FMP220	FMP420	FMF120	FMF220	FMS120	FMS220	1½
2½	FMP125	FMP225	FMP425	FMF125	FMF225	FMS125	FMS225	1⅞
3¼	FMP132	FMP232	FMP432	FMF132	FMF232	FMS132	FMS232	2⅜
4	FMP140	FMP240	FMP440	FMF140	FMF240	FMS140	FMS240	2¾
5	FMP150	FMP250	N/A	FMF150	FMF250	FMS150	N/A	—
6	FMP160	FMP260	N/A	FMF160	FMF260	FMS160	N/A	—

*Base Bar "SH" dimension is not NFPA. Refer to pages 24 and 28.
All other dimensions are NFPA.

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BACK-TO-BACK CYLINDERS:

You can back-to-back ***any*** series of cylinder together — mixed or matched, to provide unlimited design possibilities.

Back-to-back cylinders consist of (2) individual cylinders having common bore sizes, built as one unit utilizing commom tie-rods. Mounts include a full range of base, tie-rod and head or cap trunnions for pivot mounting. *(Tip: You can use a rod clevis on each piston rod to create additional pivot mounting styles. Refer to page 89 for stop tube considerations in combined strokes over 40 inches.)*

BACK-TO-BACK BENEFITS:

- **MULTIPLE POSITION CYLINDER —** The back-to-back design creates a true four-position cylinder. By varying stroke lengths, a multitude of positions can be created.
  (Example: CYL 1 has a 1″ stroke; CYL 2 has a 2″ stroke. The stroke positions would be:
  0″, 1″, 2″ and 3″, depending on how the cylinder is cycled.)
- **"HARD" POSITION STOPS —** Unlike a three-position cylinder, a back-to-back cylinder provides "hard" stop positioning. (Note: 3-position cylinders rely on the back piston rod to push against the front piston rod to create the intermediate position. Care must be used to prevent the front piston rod from "extending" in the intermediate position.)
- **ECONOMICAL DESIGN —** The back-to-back design uses standard parts, reducing overall costs.

HOW TO ORDER: BACK-TO-BACK CYLINDERS

CYL. #1

BTB - TA - MS4 - 2 x 10 - HC WITH

CYL. #2

TA - MXO - 2 X 5 - MPR - HC

BACK-TO-BACK

SERIES	
TA	250 PSI AIR
TD	250 PSI AIR, TOUGH-DUTY
SS	STAINLESS STEEL (Refer to Cat. # CAT-TRDSS-602 for ordering information)
FM	FLUSH MOUNT (Add-A-Mount)
TRA	TRIPLE ROD

NFPA MOUNTS	
MXO	NO MOUNT
MT1	FRONT TRUNNION
MT2	REAR TRUNNION
MX1	EXTENDED TIE RODS - HEAD & CAP
MX3	EXTENDED TIE RODS - HEAD
MF1	FRONT FLANGE (1 1/2"-6" Bore)
ME3	FRONT MOUNTING HOLES (8" Bore)
MS1	FRONT & REAR END ANGLE
MS2	SIDE LUG (1 1/2"-4" Std., 5" and above consult factory)
MS4	BOTTOM TAPPED HOLES

BORE
1 1/2
2
2 1/2
3 1/4
4
5
6
8

STROKE (CYL. #1)
0" to 50" Made to Order

CUSHIONS		
H	HEAD CUSHION POSITION 2 IS *STANDARD* *SPECIFY* FOR POSITIONS: 1, 3 & 4	
2 LH	**LONG** HEAD CUSHION POSITION 2 IS *STANDARD* *SPECIFY* FOR POSITIONS: 1, 3 & 4	
2 ELH	**EXTRA LONG** HEAD CUSHION POSITION 2 IS *STANDARD* *SPECIFY* FOR POSITIONS: 1, 3 & 4	X
C	CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	
2 LC	**LONG** CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	
2 ELC	**EXTRA LONG** CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	X

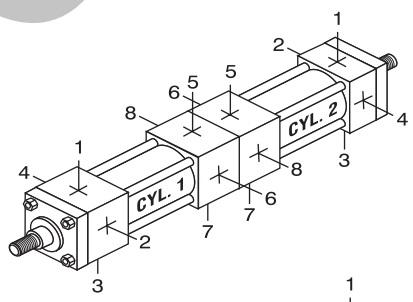
2 Not available on 'TRA' Series

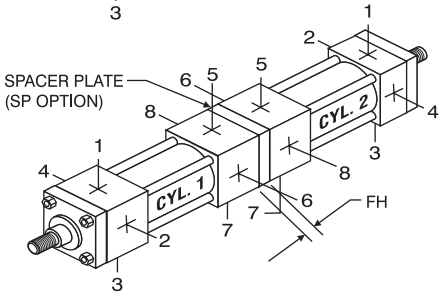
OPTIONS		
	A =	EXTENDED PISTON ROD THREAD (Example: A = 2")
	A / O	AIR / OIL PISTON
X	B	1/4" URETHANE BUMPER BOTH ENDS
X	BC	1/4" URETHANE BUMPER CAP ONLY
X	BH	1/4" URETHANE BUMPER HEAD ONLY
	BP	BUMPER PISTON SEALS (1 1/2" - 8" Bore)
	BSP	BSP PORTS (SPECIFY SIZE, Example: BSP = 1/4")
	C =	EXTENDED PISTON ROD (Example: C = 3")
	EN	**ELECTROLESS NICKEL PLATED** *(Refer to page 84 for specifications)*
	KK2	LARGE MALE ROD THREAD
	KK3	FEMALE ROD THREAD
	KK3S	STUDDED PISTON ROD (KK3 with Stud, Loctite in place)
	KK4	FULL DIAMETER MALE ROD THREAD
	KK5	BLANK ROD END (NO THREADS, "A" = 0")
	LF	**LOW FRICTION SEALS** *(Refer to page 84 for specifications)*
	MPR	MAGNETIC PISTON FOR REED OR SOLID STATE SWITCHES - TRD MODELS: R10, RAC, AND MSS *(Refer to pages 105-111 for selection)*
	MPH	MAGNETIC PISTON FOR HALL SWITCHES
	MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
	NR	**NON-ROTATING** *(Refer to page 86 for specifications)*
	OP	OPTIONAL PORT LOCATION (Example: Ports @ 3 & 7)
	OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, Example: OS = 1 3/8")
	SAE	SAE PORTS (SPECIFY SIZE, Example: SAE #10)
X	SE	SPRING EXTEND (CONSULT FACTORY)
X	SP	SPACER PLATE *(Refer to page 34 for dimensions)*
X	SR	SPRING RETURN (CONSULT FACTORY)
	SSA	STAINLESS STEEL PISTON ROD, TIE RODS & NUTS, AND FASTENERS
	SSF	STAINLESS STEEL FASTENERS
	SSR	STAINLESS STEEL PISTON ROD
	SST	STAINLESS STEEL TIE RODS & NUTS
X	ST	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) (Example: TA MS4 2 X 24" EFFECTIVE STROKE-ST=3)
	STEEL TUBE	STEEL CYLINDER TUBE, BLACK EPOXY PAINT FINISH
	TH	**400 PSI HYDRAULIC NON-SHOCK** *(Refer to page 90 for specifications)*
	VS	FLUOROCARBON SEALS
	WB	PISTON WEAR BAND
	XX	SPECIAL VARIATION (SPECIFY)

ADDS LENGTH TO CYLINDER - SEE "OPTION LENGTH ADDER" CHART, PAGE 5.

STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

- Ports - Positions 1 and 5 1
- Cushion Adjustment - Positions 2 and 6 on both cylinders (opposite sides from one another)
- Specify Non-Standard Positions When Ordering





About our Part Number System

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

Example: Back-To-Back
Cyl. 1 is a 'TA' series, MS4 mount, 2" bore X 10" stroke.
Cyl. 2 is a 'TA' series, MXO (no mount), 2" bore X 5" stroke, with a magnet (for Reed Switches), and Head & Cap cushions.

Part Number:
BTB-TA-MS4-2 x 10 with
TA-MXO-2 x 5-MPR-HC

1 Ports are in-line when using standard port locations. To add space between ports (for larger air fittings), a spacer plate can be added as an option. **(SPECIFY "SP" OPTION)**

"SP" OPTION WILL INCREASE OVERALL LENGTH BY "FH" DIMENSION. (See page 32 for "FH" dimensions)

Tip: If overall length is tight, specify rotating the ports on one of the cylinders in lieu of a spacer plate.

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BACK-TO-BACK DIMENSIONS: BASIC CYLINDER (NO MOUNT)

About Rod End Styles

Style 1 Male Rod End is STANDARD

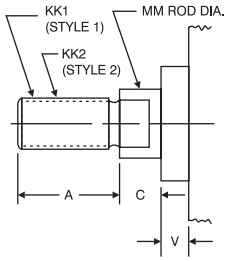
Other NFPA Styles can be specified (See Chart).

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).

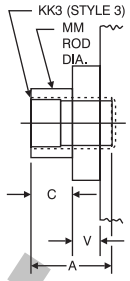
NEED SOMETHING NOT LISTED?
Just send us a sketch.
In most cases, quotes are turned around in one day!

PISTON ROD END STYLES

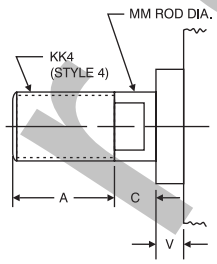
STYLE 1 & 2 — KK1 & KK2



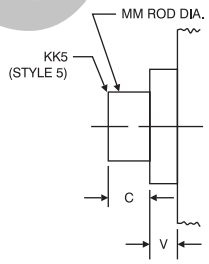
STYLE 3 — KK3



STYLE 4 — KK4



STYLE 5 — KK5

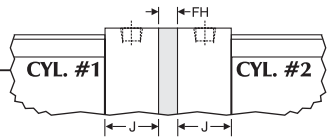


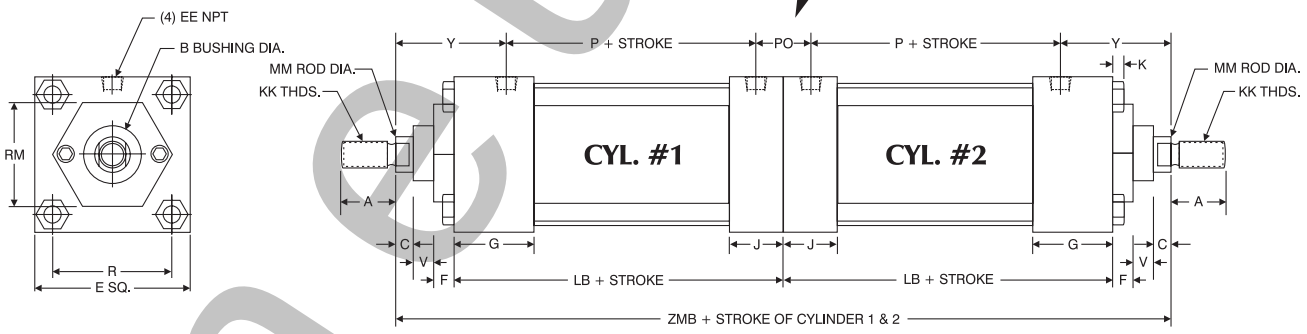
BORE	MM ROD DIAMETER	STANDARD Style 1 - Male KK1	A	OPTIONAL Style 2 - Male KK2	A	Style 3 - Female KK3	A	Style 4 - Male KK4	A	Style 5 - Blank KK5	C	V
1½, 2, 2½	⅝ Standard	7/16-20	¾	½-20	¾	7/16-20	¾	⅝-18	¾	No Threads	⅜	¼
	1 Oversize	¾-16	1⅛	⅞-14	1⅛	¾-16	1⅛	1-14	1⅛	No Threads	½	½
3¼, 4, 5	1 Standard	¾-16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

MXO/MXO

(NO MOUNT)

OPTION "SP" SPACER PLATE (DETAIL)





BACK-TO-BACK BASIC DIMENSIONS 'MXO' STANDARD & OVERSIZE RODS

BORE	ROD DIAMETER	A	B	C	E	EE	F	FH	G	J	K	KK	LB	MM	P	PO	R	RM	V	Y	ZMB*
1½	⅝ Standard	¾	1⅛	⅜	2	⅜	⅜	⅜	1½	1	¼	7/16-20	3⅝	⅝	2⅜	¾	1.43	2 SQ.	¼	1⅞	9¼
	1 Oversize	1⅛	1½	½								¾-16		1					½	2¼	10
2	⅝ Standard	¾	1⅛	⅜	2½	⅜	⅜	⅜	1½	1	5/16	7/16-20	3⅝	⅝	2⅜	¾	1.84	1¾ HEX	¼	1⅞	9¼
	1 Oversize	1⅛	1½	½								¾-16		1				2½ SQ.	½	2¼	10
2½	⅝ Standard	¾	1⅛	⅜	3	⅜	⅜	⅜	1½	1	5/16	7/16-20	3¾	⅝	2½	¾	2.19	1¾ HEX.	¼	1⅞	9½
	1 Oversize	1⅛	1½	½								¾-16		1				3 SQ.	½	2¼	10¼
3¼	1 Standard	1⅛	1½	½	3¾	½	⅝	⅝	1¾	1¼	⅜	¾-16	4¼	1	2¾	1	2.76	2¾ DIA.	¼	2⅜	11¼
	1⅜ Oversize	1⅝	2	⅝								1-14		1⅜				3¾ SQ.	⅜	2⅝	11¾
4	1 Standard	1⅛	1½	½	4½	½	⅝	⅝	1¾	1¼	⅜	¾-16	4¼	1	2¾	1	3.32	2¾ DIA.	¼	2⅜	11¼
	1⅜ Oversize	1⅝	2	⅝								1-14		1⅜				3½ DIA.	⅜	2⅝	11¾
5	1 Standard	1⅛	1½	½	5½	½	⅝	⅝	1¾	1¼	7/16	¾-16	4½	1	3	1	4.10	2¾ DIA.	¼	2⅜	11¾
	1⅜ Oversize	1⅝	2	⅝								1-14		1⅜				3½ DIA.	⅜	2⅝	12¼
6	1⅜ Standard	1⅝	2	⅝	6½	¾	⅝	¾	2	1½	7/16	1-14	5	1⅜	3¼	1¼	4.88	3½ DIA.	⅜	2¾	13¼
	1¾ Oversize	2	2⅜	¾								1¼-12		1¾					½	3	13¾
8	1⅜ Standard	1⅝	2	⅝	8½	¾	⅝	—	2	1½	9/16	1-14	5⅛	1⅜	3⅜	1¼	6.44	3½ DIA.	⅜	2¾	13½
	1¾ Oversize	2	2⅜	¾								1¼-12		1¾					½	3	14

*Overall length of "ZMB" will increase by "FH" dimension when using spacer plate option "SP".

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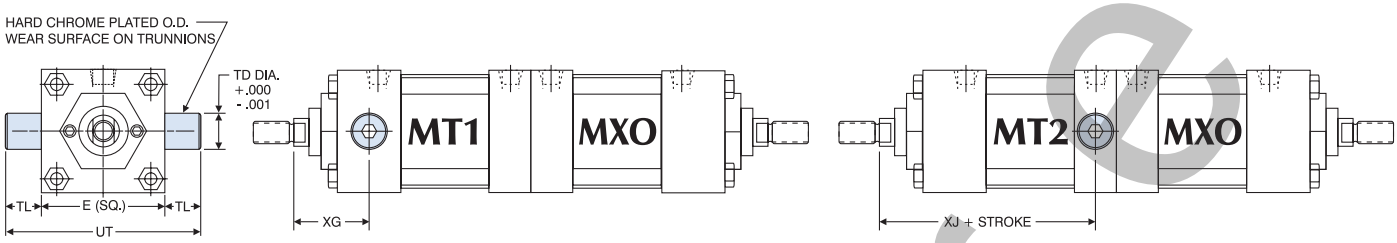
ORDER ONLINE

BACK-TO-BACK DIMENSIONS: PIVOT MOUNTS



MT1 / MT2

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

'MT1' HEAD TRUNNION AND 'MT2' CAP TRUNNION MOUNT DIMENSIONS							
BORE	ROD DIAMETER	E	TD	TL	UT	XG	ADD STROKE XJ
1½	⅝ Standard	2	1	1	4	1¾	4⅛
	1 Oversize					N/A*	4½
2	⅝ Standard	2½	1	1	4½	1¾	4⅛
	1 Oversize					2⅛	4½
2½	⅝ Standard	3	1	1	5	1¾	4¼
	1 Oversize					2⅛	4⅝
3¼	1 Standard	3¾	1	1	5¾	2¼	5
	1⅜ Oversize					2½	5¼
4	1 Standard	4½	1	1	6½	2¼	5
	1⅜ Oversize					2½	5¼
5	1 Standard	5½	1	1	7½	2¼	5¼
	1⅜ Oversize					2½	5½
6	1⅜ Standard	6½	1⅜	1⅜	9¼	2⅝	5⅞
	1¾ Oversize					2⅞	6⅛
8	1⅜ Standard	8½	1⅜	1⅜	11¼	2⅝	6
	1¾ Oversize					2⅞	6¼

*No oversize rod available on 1½" bore MT1.

BACK-TO-BACK CYLINDERS: SCHEMATICS

The following schematic is commonly used for back-to-back applications.

Cylinder strokes can be the same or different.

Back-to-Back cylinders are designed and built with (2) separate piston rods. Cylinders operate independently of one another.

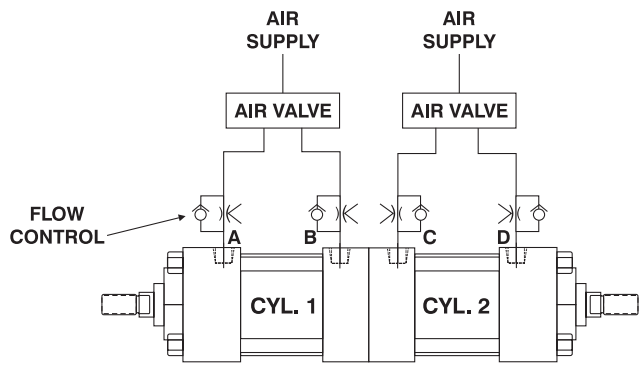
Tip: Before ordering, check the air fitting sizes to be sure you have adequate room at the ports "B" and "C" to install fittings. Ports can be rotated on one cylinder or a spacer plate can be added (between cylinder caps) to provide clearance for fittings.

EXAMPLE:

Shown is a back-to-back cylinder with each cylinder operated with an independent air valve & (2) flow controls used to regulate cylinder speed.

SCHEMATIC

ACTUATION SEQUENCE:
PRESSURE TO PORT 'B' EXTENDS CYLINDER #1,
PRESSURE TO PORT 'A' RETRACTS CYLINDER #1,
PRESSURE TO PORT 'C' EXTENDS CYLINDER #2,
PRESSURE TO PORT 'D' RETRACTS CYLINDER #2.

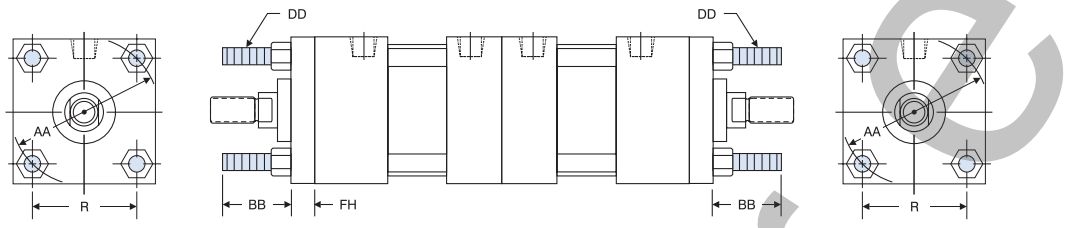


Preliminary

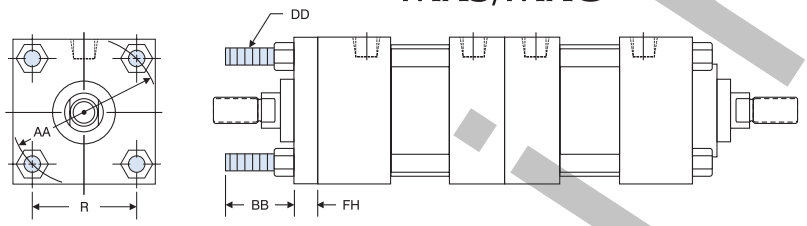
ORDER ONLINE

BACK-TO-BACK DIMENSIONS: TIE ROD & FLANGE MOUNTS

MX1



MX3/MXO



TIE ROD EXTENDED 'MX1' & 'MX3' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
1½	⅝ Standard	2.02	1	¼-28	⅜	1.43
	1 Oversize					
2	⅝ Standard	2.6	1⅛	5/16-24	⅜	1.84
	1 Oversize					
2½	⅝ Standard	3.1	1⅛	5/16-24	⅜	2.19
	1 Oversize					
3¼	1 Standard	3.9	1⅜	⅜-24	⅝	2.76
	1⅜ Oversize					

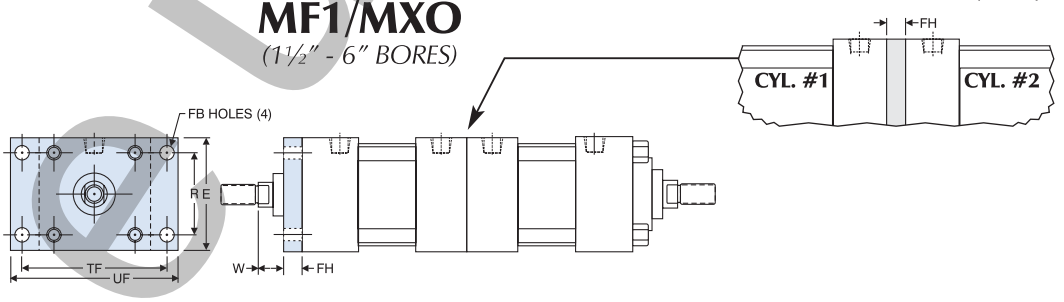
TIE ROD EXTENDED 'MX1' & 'MX3' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
4	1 Standard	4.7	1⅜	⅜-24	⅝	3.32
	1⅜ Oversize					
5	1 Standard	5.8	1 13/16	½-20	⅝	4.10
	1⅜ Oversize					
6	1⅜ Standard	6.9	1 13/16	½-20	¾	4.88
	1¾ Oversize					
8	1⅜ Standard	9.1	**2 5/16	⅝-18	*⅝	6.44
	1¾ Oversize					

*Round retainer used to retain bushing, not a full front plate as other bores.
**"BB" dimension from head on 8" bore.

MF1/MXO

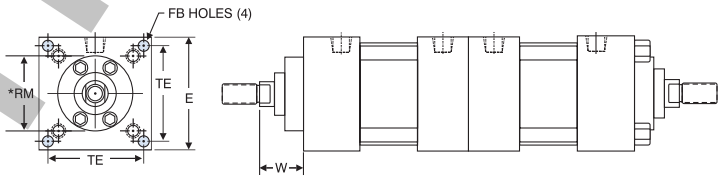
(1½" - 6" BORES)

OPTION "SP" SPACER PLATE (DETAIL)



ME3/MXO

(8" BORE ONLY)



'MF1' FLANGE & 'ME3' CAP MOUNT DIMENSIONS										
BORE	ROD DIAMETER	E	FB	FH	R	RM	TE	TF	UF	W
1½	⅝ Standard	2	5/16	⅜	1.43	—	—	2¾	3⅜	⅝
	1 Oversize									1
2	⅝ Standard	2½	⅜	⅜	1.84	—	—	3⅜	4⅛	⅝
	1 Oversize									1
2½	⅝ Standard	3	⅜	⅜	2.19	—	—	3⅞	4⅝	⅝
	1 Oversize									1
3¼	1 Standard	3¾	7/16	⅝	2.76	—	—	4 11/16	5½	¾
	1⅜ Oversize									1

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS										
BORE	ROD DIAMETER	E	FB	FH	R	RM	TE	TF	UF	W
4	1 Standard	4½	7/16	⅝	3.32	—	—	5 7/16	6¼	¾
	1⅜ Oversize									1
5	1 Standard	5½	9/16	⅝	4.10	—	—	6⅝	7⅝	¾
	1⅜ Oversize									1
6	1⅜ Standard	6½	9/16	¾	4.88	—	—	7⅝	8⅝	⅞
	1¾ Oversize									1⅛
8	1⅜ Standard	8½	11/16	N/A	N/A	*3½	7.57	N/A	N/A	1⅝
	1¾ Oversize									1⅞

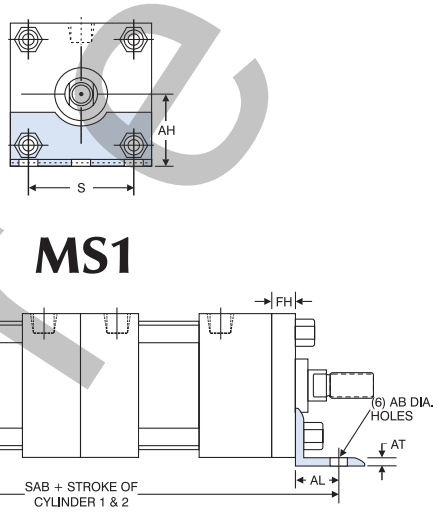
*Round retainer used to retain bushing, not a rectangular flange plate as other bores.

Repair

BACK-TO-BACK DIMENSIONS: BASE MOUNTS

'MS1' ANGLE MOUNT DIMENSIONS									
BORE	ROD DIAMETER	AB	AH	AL	AO	AT	FH	S	ADD STROKE SAB
1½	⅝ Standard	7/16	1 3/16	1	3/8	1/8	3/8	1¼	10
	1 Oversize								
2	⅝ Standard	7/16	1 7/16	1	3/8	1/8	3/8	1¾	10
	1 Oversize								
2½	⅝ Standard	7/16	1⅝	1	3/8	1/8	3/8	2¼	10¼
	1 Oversize								
3¼	1 Standard	9/16	1 15/16	1¼	½	1/8	⅝	2¾	12¼
	1⅜ Oversize								
4	1 Standard	9/16	2¼	1¼	½	1/8	⅝	3½	12¼
	1⅜ Oversize								
5	1 Standard	11/16	2¾	1⅜	⅝	3/16	⅝	4¼	13
	1⅜ Oversize								
6	1⅜ Standard	13/16	3¼	1⅜	⅝	3/16	¾	5¼	14¼
	1¾ Oversize								
8	1⅜ Standard	13/16	4¼	1 13/16	11/16	¼	⅝*	7⅛	13⅞
	1¾ Oversize								

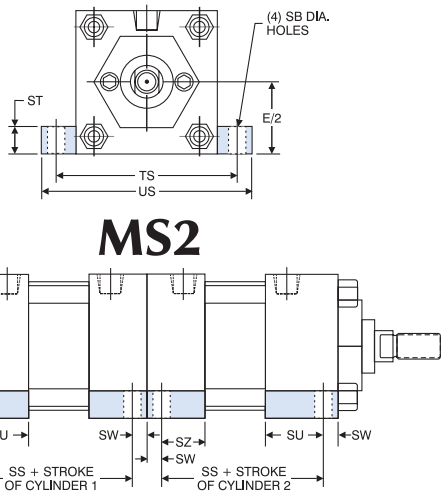
*3½" diameter round retainer on 8" bore.



'MS2' SIDE LUG MOUNT DIMENSIONS											
BORE	ROD DIAMETER	SB	E/2	ST	SU	SW	SZ	TS	US	XS	ADD STROKE SS
1½	⅝ Standard	7/16	1	½	1⅛	3/8	⅝	2¾	3½	1⅜	2⅞
	1 Oversize									1¾	
2	⅝ Standard	7/16	1¼	½	1⅛	3/8	⅝	3¼	4	1⅜	2⅞
	1 Oversize									1¾	
2½	⅝ Standard	7/16	1½	½	1⅛	3/8	⅝	3¾	4½	1⅜	3
	1 Oversize									1¾	
3¼	1 Standard	9/16	1⅞	¾	1¼	½	¾	4¾	5¾	1⅞	3¼
	1⅜ Oversize									2⅛	
4	1 Standard	9/16	2¼	¾	1¼	½	¾	5½	6½	1⅞	3¼
	1⅜ Oversize									2⅛	
5	1 Standard	13/16	2¾	1	1 1/16	11/16	9/16	6⅞	8¼	2 1/16	3⅛
	1⅜ Oversize									2 5/16	
6	1⅜ Standard	13/16	3¼	1	1 5/16	11/16	13/16	7⅞	9¼	2 5/16	3⅝
	1¾ Oversize									2 9/16	
8	1⅜ Standard	13/16	4¼	1	1 5/16	11/16	13/16	9⅞	11¼	2 5/16	3¾
	1¾ Oversize									2 9/16	

Note: The option not to have side lugs on center (2) caps is available. Use the "XX" option in the "How To Order" section (specify).

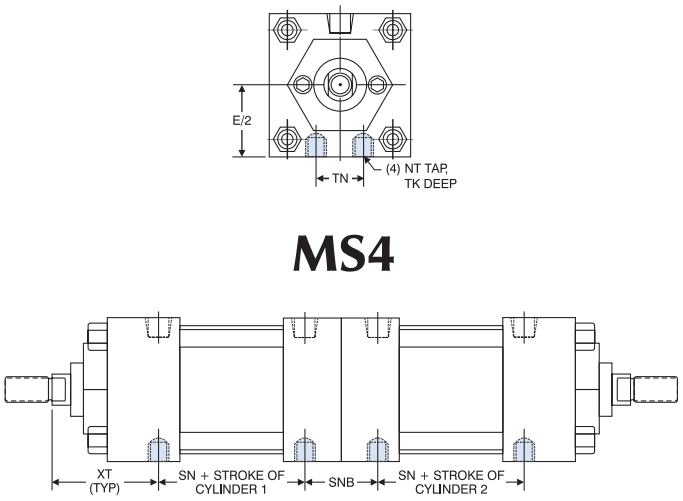
Example: BTB-TA-MS2-4 X 5-MPR with TA-MS2-4 X 3-BP-"XX"
"XX" = No side lugs on center (2) caps



'MS4' BOTTOM TAPPED MOUNT DIMENSIONS								
BORE	ROD DIAMETER	E/2	NT	TK	TN	XT	SNB	ADD STROKE SN
1½	⅝ Standard	1	¼-20	3/8	⅝	1 15/16	⅞	2¼
	1 Oversize					2 5/16		
2	⅝ Standard	1¼	5/16-18	½	⅞	1 15/16	⅞	2¼
	1 Oversize					2 5/16		
2½	⅝ Standard	1½	⅜-16	⅝	1¼	1 15/16	⅞	2⅜
	1 Oversize					2 5/16		
3¼	1 Standard	1⅞	½-13	¾	1½	2 7/16	1⅛	2⅝
	1⅜ Oversize					2 11/16		
4	1 Standard	2¼	½-13	¾	2 1/16	2 7/16	1⅛	2⅝
	1⅜ Oversize					2 11/16		
5	1 Standard	2¾	⅝-11	1	2 11/16	2 7/16	1⅛	2⅞
	1⅜ Oversize					2 11/16		
6	1⅜ Standard	3¼	¾-10	1⅛	3¼	2 13/16	1⅜	3⅛
	1¾ Oversize					3 1/16		
8	1⅜ Standard	4¼	¾-10	1⅛	4½	2 13/16	1⅜	3¼
	1¾ Oversize					3 1/16		

Note: The option not to have 'MS4' taps on center (2) caps is available. Use the "XX" option in the "How To Order" section (specify).

Example: BTB-TA-MS4-6 X 7-H with TA-MS4-6 X 4-C-"XX"
"XX" = No 'MS4' taps on center (2) caps



Preliminaire

3-POSITION CYLINDERS:

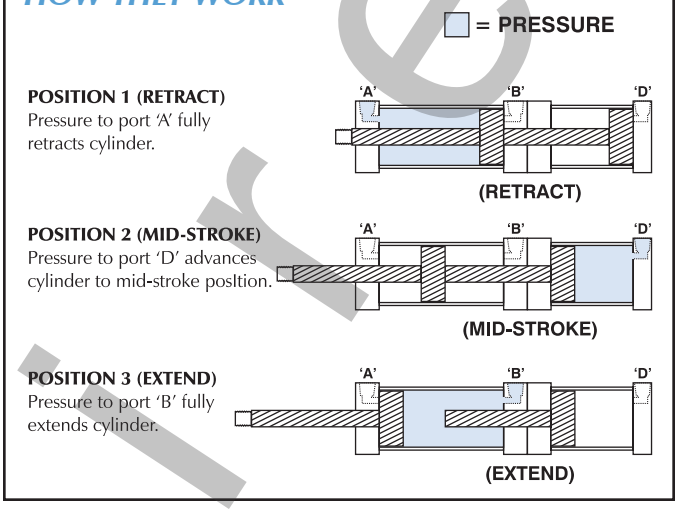
You can create a 3-Position cylinder from ***any*** single stage series of cylinder. (Note: not available on multi-stage products)

3-Position cylinders consist of multiple cylinders built as one unit having ONE exposed working rod end, capable of delivering 3 rod positions.

3-POSITION BENEFITS:

- **3-POSITIONS IN ONE CYLINDER —** One cylinder produces three different rod end positions. By varying stroke lengths, a multitude of positions can be created.
- **SIMPLIFIES MACHINE DESIGNS —** Eliminates the need for an additional cylinder to create a third position. 3-Position cylinders reduce space and the cost to mount multiple cylinders.

3-POSITION CYLINDERS
HOW THEY WORK



HOW TO ORDER: 3-POSITION CYLINDERS

CYL. #1: 3P - TA - MS4 - 2 x 10 - H - MPR WITH CYL. #2: TA - MXO - 2 X 5 - MPR

3-POSITION: 3P

SERIES	
TA	250 PSI AIR
TD	250 PSI AIR, TOUGH-DUTY
SS	STAINLESS STEEL (Refer to Cat. # CAT-TRDSS-602 for ordering information)
FM	FLUSH MOUNT (Add-A-Mount)
TRA	TRIPLE ROD (CYL. #1 Only)

BORE
1 1/2
2
2 1/2
3 1/4
4
5
6
8

STROKE (CYL. #1)
0" to 50" 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 2 IS *STANDARD* *SPECIFY* FOR POSITIONS: 1, 3 & 4	X
C	CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	
LC	**LONG** CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	
ELC	**EXTRA LONG** CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	X

NFPA MOUNTS	
MXO	NO MOUNT
MP1	REAR PIVOT CLEVIS (CYL. 2 ONLY)
MP2	REAR PIVOT CLEVIS (1 1/2"-6" Bore) (CYL. 2 ONLY)
MP4	REAR PIVOT EYE (1 1/2" - 4" Bore) (CYL. 2 ONLY)
MT1	FRONT TRUNNION (SPECIFY CYL. 1 OR 2)
MT2	REAR TRUNNION (SPECIFY CYL. 1 OR 2)
MX1	EXTENDED TIE RODS (HEAD & CAP)
MX2	EXTENDED TIE RODS (CAP END)
MX3	EXTENDED TIE RODS (HEAD END)
MF1	FRONT FLANGE (1 1/2"-6") (CYL. 1 ONLY)
MF2	REAR FLANGE (1 1/2"-6") (CYL. 2 ONLY)
ME3	FRONT MOUNTING HOLES (8") (CYL. 1 ONLY)
ME4	REAR MOUNTING HOLES (8") (CYL. 2 ONLY)
MS1	FRONT & REAR END FOOT
MS2	SIDE LUG (1 1/2"-8")
MS4	BOTTOM TAPPED HOLES

OPTIONS		
	A =	EXTENDED PISTON ROD THREAD (Example: A = 2")
	AS	ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, Example: AS = 4")
	A / O	AIR / OIL PISTON
X	B	1/4" URETHANE BUMPER BOTH ENDS
X	BC	1/4" URETHANE BUMPER CAP ONLY
X	BH	1/4" URETHANE BUMPER HEAD ONLY
	BP	BUMPER PISTON SEALS (1 1/2" - 8" Bore)
	BSP	BSP PORTS (SPECIFY SIZE, Example: BSP = 1/4")
	C =	EXTENDED PISTON ROD (Example: C = 3")
	EN	**ELECTROLESS NICKEL PLATED** *(Refer to page 84 for specifications)*
	KK2	LARGE MALE ROD THREAD
	KK3	FEMALE ROD THREAD
	KK3S	STUDDED PISTON ROD (KK3 with Stud, Loctite in place)
	KK4	FULL DIAMETER MALE ROD THREAD
	KK5	BLANK ROD END (NO THREADS, "A" = 0")
	LF	**LOW FRICTION SEALS** *(Refer to page 84 for specifications)*
	MA	MICRO-ADJUST (6" MAX. STROKE) *Available on Double Rod End Models*
	MAB	MICRO-ADJUST WITH SOUND DAMPENING BUMPER (6" MAX. STROKE)
	MPR	MAGNETIC PISTON FOR REED OR SOLID STATE SWITCHES - TRD MODELS: R10, RAC, AND MSS *(Refer to pages 105-111 for selection)*
	MPH	MAGNETIC PISTON FOR HALL SWITCHES
	MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
	NR	**NON-ROTATING** *(Refer to page 86 for specifications)*
	OP	OPTIONAL PORT LOCATION (Example: Ports @ 3 & 7)
	OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, Example: OS = 1 3/8")
	SAE	SAE PORTS (SPECIFY SIZE, Example: SAE #10)
X	SE	SPRING EXTEND (1 1/2", 2, 2 1/2" bore)
X	SR	SPRING RETURN (1 1/2", 2, 2 1/2" bore)
	SSA	STAINLESS STEEL PISTON ROD, TIE RODS & NUTS, AND FASTENERS
	SSF	STAINLESS STEEL FASTENERS
	SSR	STAINLESS STEEL PISTON ROD
	SST	STAINLESS STEEL TIE RODS & NUTS
X	ST	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) (Example: TA MS4 2 X 24" EFFECTIVE STROKE-ST=3)
	STEEL TUBE	STEEL CYLINDER TUBE, BLACK EPOXY PAINT FINISH
	TH	**400 PSI HYDRAULIC NON-SHOCK** *(Refer to page 90 for specifications)*
	VS	FLUOROCARBON SEALS
	WB	PISTON WEAR BAND
	XX	SPECIAL VARIATION (SPECIFY)

ADDS LENGTH TO CYLINDER - SEE "OPTION LENGTH ADDER" CHART, PAGE 5.

About our Part Number System

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

Example: 3-Position
Application calls for a 2" bore cylinder with stroke positions of 0", 5" and 10", base mount on rod end cylinder only, with magnetic piston for position (switch) sensors.

Part Number:
3P-TA-MS4-2 x 10-H-MPR with
TA-MXO-2 x 5-MPR

HOW TO ORDER:

3 Position Cylinder:

Position 1 (Full Retract) - This position is always 0.00"

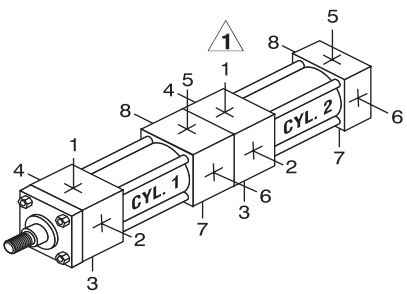
Position 2 (Mid-Stroke) - This will be the stroke of Cylinder #2

Position 3 (Full-Extend) - This will be the stroke of Cylinder #1

Multi-Position Model Available

- **3 Position (Model 3P)**
- **4 Position (Model 4P)**
- **5 Position (Model 5P)**

(Consult factory for dimensions on 4P & 5P)



⚠1 Note: The "Head" port of CYL. 2 can be used as a "vent". (Single Acting) or "Powered" (Double Acting).

STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

- Ports - Positions 1 and 5
- Cushion Adjustment - Positions 2 and 6 (Cushions not available on CYL. 1 Cap)
- Specify Non-Standard Positions When Ordering

Preliminare

3-POSITION DIMENSIONS: BASIC CYLINDER (NO MOUNT)

About Rod End Styles

Style 1 Male Rod End is STANDARD

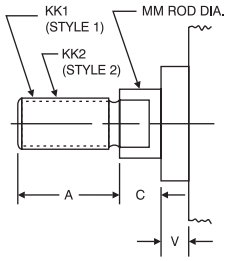
Other NFPA Styles can be specified (See Chart).

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).

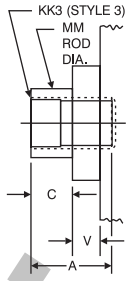
NEED SOMETHING NOT LISTED?
Just send us a sketch.
In most cases, quotes are turned around in one day!

PISTON ROD END STYLES

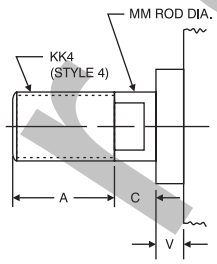
STYLE 1 & 2 — KK1 & KK2



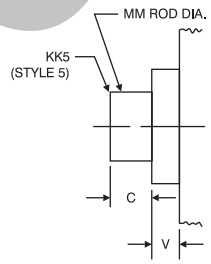
STYLE 3 — KK3



STYLE 4 — KK4



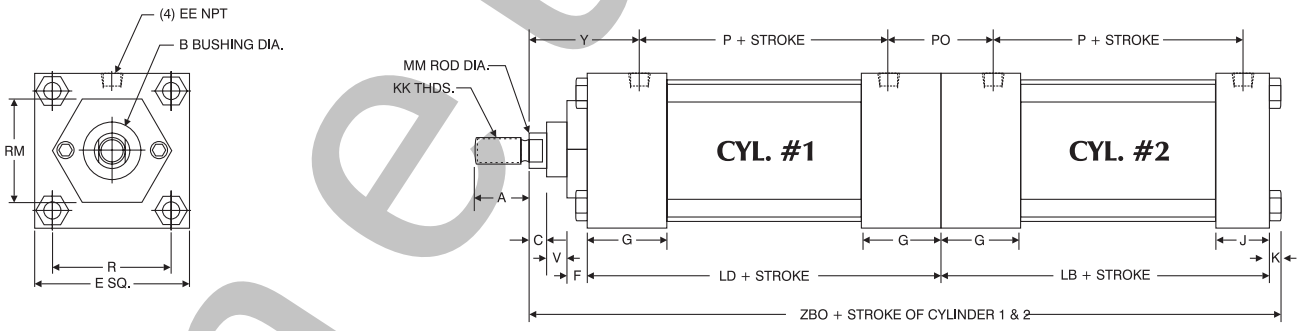
STYLE 5 — KK5



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

MXO/MXO

(NO MOUNT)



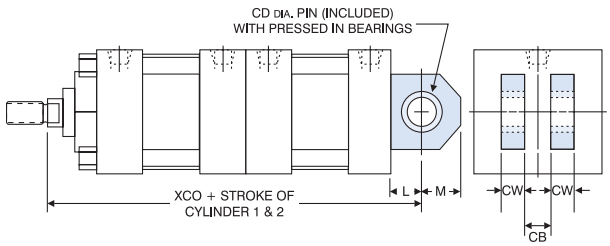
3-POSITION BASIC DIMENSIONS 'MXO' STANDARD & OVERSIZE RODS

BORE	ROD DIAMETER	A	B	C	E	EE	F	G	J	K	KK	LB	LD	MM	P	PO	R	RM	V	Y	ZBO
1½	⅝ Standard	¾	1⅛	⅜	2	⅜	⅜	1½	1	¼	7/16-20	3⅝	4⅛	⅝	2⅜	1¾	1.43	2 SQ.	¼	1⅞	9
	1 Oversize	1⅛	1½	½							¾-16			1					½	2¼	9⅜
2	⅝ Standard	¾	1⅛	⅜	2½	⅜	⅜	1½	1	5/16	7/16-20	3⅝	4⅛	⅝	2⅜	1¾	1.84	1¾ HEX	¼	1⅞	9 1/16
	1 Oversize	1⅛	1½	½							¾-16			1				2½ SQ.	½	2¼	9 7/16
2½	⅝ Standard	¾	1⅛	⅜	3	⅜	⅜	1½	1	5/16	7/16-20	3¾	4¼	⅝	2½	1¾	2.19	1¾ HEX	¼	1⅞	9 5/16
	1 Oversize	1⅛	1½	½							¾-16			1				3 SQ.	½	2¼	9 11/16
3¼	1 Standard	1⅛	1½	½	3¾	½	⅝	1¾	1¼	⅜	¾-16	4¼	4¾	1	2¾	2	2.76	2¾ DIA.	¼	2⅜	10¾
	1⅜ Oversize	1⅝	2	⅝							1-14			1⅜				3¾ SQ.	⅜	2⅝	11
4	1 Standard	1⅛	1½	½	4½	½	⅝	1¾	1¼	⅜	¾-16	4¼	4¾	1	2¾	2	3.32	2¾ DIA.	¼	2⅜	10¾
	1⅜ Oversize	1⅝	2	⅝							1-14			1⅜				3½ DIA.	⅜	2⅝	11
5	1 Standard	1⅛	1½	½	5½	½	⅝	1¾	1¼	7/16	¾-16	4½	5	1	3	2	4.10	2¾ DIA.	¼	2⅜	11 5/16
	1⅜ Oversize	1⅝	2	⅝							1-14			1⅜				3½ DIA.	⅜	2⅝	11 9/16
6	1⅜ Standard	1⅝	2	⅝	6½	¾	⅝	2	1½	7/16	1-14	5	5½	1⅜	3¼	2¼	4.88	3½ DIA.	⅜	2¾	12 9/16
	1¾ Oversize	2	2⅜	¾							1¼-12			1¾					½	3	12 13/16
8	1⅜ Standard	1⅝	2	⅝	8½	¾	⅝	2	1½	9/16	1-14	5⅛	5⅝	1⅜	3⅜	2¼	6.44	3½ DIA.	⅜	2¾	12 13/16
	1¾ Oversize	2	2⅜	¾							1¼-12			1¾					½	3	13 3/16

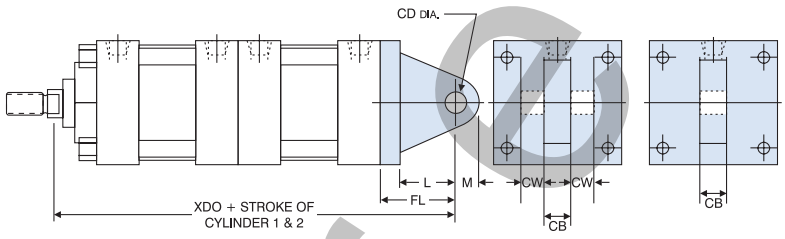
neuaire

ORDER ONLINE

3-POSITION DIMENSIONS: PIVOT MOUNTS



MXO/MP1 MOUNT
(Extruded, 1½" - 8" bores)

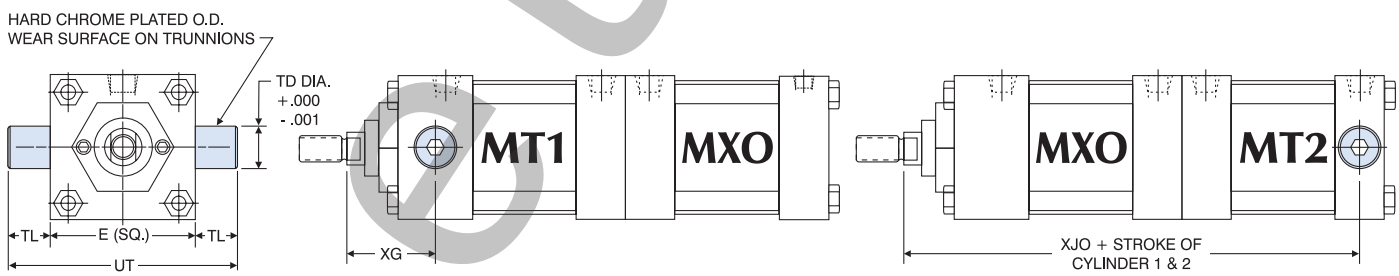


MXO/ MP2
(Casting, 1½"-6" bore)

MXO/ MP4
(Casting, 1½"-4" bore)

'MP1' & 'MP2' CLEVIS AND 'MP4' ROD EYE MOUNT DIMENSIONS									
BORE	ROD DIAMETER	CB	CD	CW	FL	L	M	ADD STROKE XCO	ADD STROKE XDO
1½	⅝ Standard	¾	½	½	1⅛	¾	⅝	9½	9⅞
	1 Oversize							9⅞	10¼
2	⅝ Standard	¾	½	½	1⅛	¾	⅝	9½	9⅞
	1 Oversize							9⅞	10¼
2½	⅝ Standard	¾	½	½	1⅛	¾	⅝	9¾	10⅛
	1 Oversize							10⅛	10½
3¼	1 Standard	1¼	¾	⅝	1⅞	1¼	⅞	11⅝	12¼
	1⅜ Oversize							11⅞	12½
4	1 Standard	1¼	¾	⅝	1⅞	1¼	⅞	11⅝	12¼
	1⅜ Oversize							11⅞	12½
5	1 Standard	1¼	¾	⅝	1⅞	1¼	⅞	12⅛	12¾
	1⅜ Oversize							12⅜	13
6	1⅜ Standard	1½	1	¾	2¼	1½	1	13⅝	14½
	1¾ Oversize							13⅞	14¾
8	1⅜ Standard	1½	1	¾	N/A	1½	1	13⅞	N/A
	1¾ Oversize							14⅛	

Clevis pins are provided with pivot mounts.
* MP4 mount not available as standard on 5" bores and above.
Note: Extruded MP1 mounts are standard (1½" - 8" bores).
Cast iron removable mounts are optional and must be requested when ordering (1½" - 6" bores).



MT1 / MT2

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

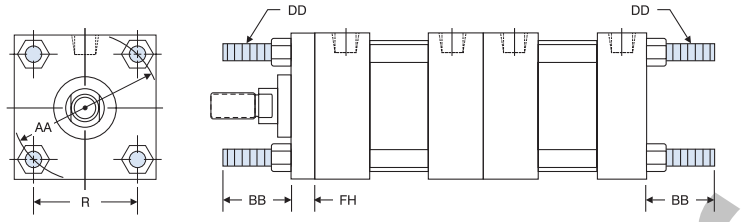
'MT1' HEAD TRUNNION AND 'MT2' CAP TRUNNION MOUNT DIMENSIONS							
BORE	ROD DIAMETER	E	TD	TL	UT	XG	ADD STROKE XJO
1½	⅝ Standard	2	1	1	4	1¾	8¼
	1 Oversize					N/A*	8⅝
2	⅝ Standard	2½	1	1	4½	1¾	8¼
	1 Oversize					2⅛	8⅝
2½	⅝ Standard	3	1	1	5	1¾	8½
	1 Oversize					2⅛	8⅞
3¼	1 Standard	3¾	1	1	5¾	2¼	9¾
	1⅜ Oversize					2½	10
4	1 Standard	4½	1	1	6½	2¼	9¾
	1⅜ Oversize					2½	10
5	1 Standard	5½	1	1	7½	2¼	10¼
	1⅜ Oversize					2½	10½
6	1⅜ Standard	6½	1⅜	1⅜	9¼	2⅝	11⅜
	1¾ Oversize					2⅞	11⅝
8	1⅜ Standard	8½	1⅜	1⅜	11¼	2⅝	11⅝
	1¾ Oversize					2⅞	11⅞

*No oversize rod available on 1½" bore MT1.

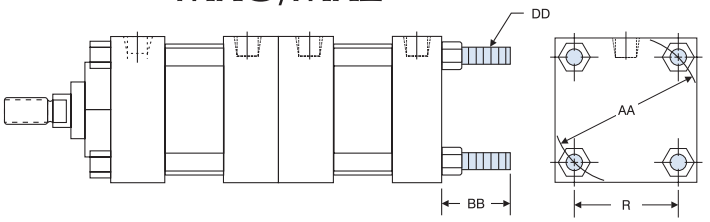
ORDER ONLINE

3-POSITION DIMENSIONS: TIE ROD & FLANGE MOUNTS

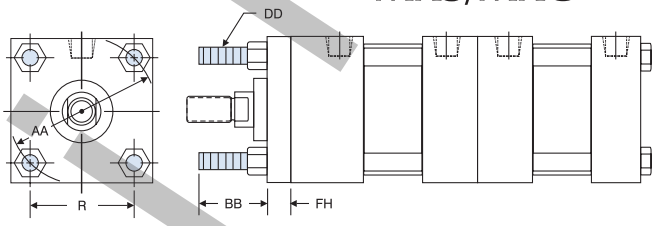
MX1



MXO/MX2



MX3/MXO



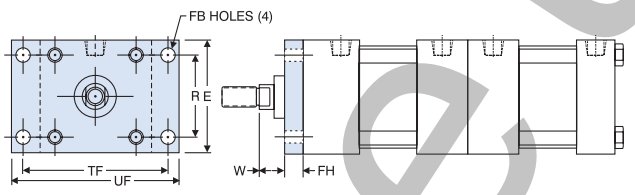
TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
1½	⅝ Standard	2.02	1	¼-28	⅜	1.43
	1 Oversize					
2	⅝ Standard	2.6	1⅛	5/16-24	⅜	1.84
	1 Oversize					
2½	⅝ Standard	3.1	1⅛	5/16-24	⅜	2.19
	1 Oversize					
3¼	1 Standard	3.9	1⅜	⅜-24	⅝	2.76
	1⅜ Oversize					

TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
4	1 Standard	4.7	1⅜	⅜-24	⅝	3.32
	1⅜ Oversize					
5	1 Standard	5.8	1 13/16	½-20	⅝	4.10
	1⅜ Oversize					
6	1⅜ Standard	6.9	1 13/16	½-20	¾	4.88
	1¾ Oversize					
8	1⅜ Standard	9.1	**2 5/16	⅝-18	*⅝	6.44
	1¾ Oversize					

*MX1 & MX3 have full square bushing retainer on 1½" - 6" bores, round retainers on 8" bores.
**BB dimension from head on 8" bore.

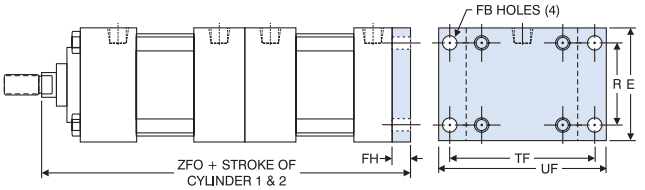
MF1/MXO

(1½" - 6" BORES)



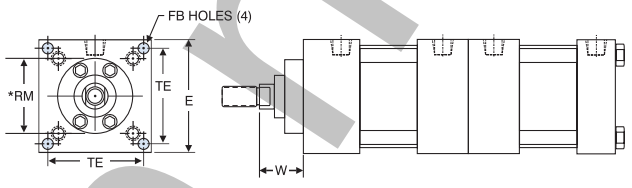
MXO/MF2

(1½" - 6" BORES)



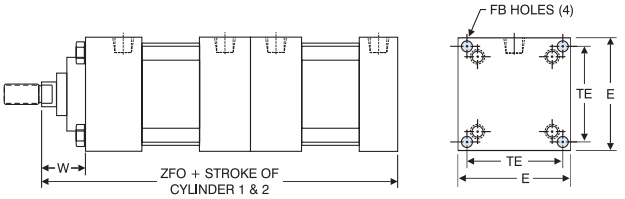
ME3/MXO

(8" BORE ONLY)



MXO/ME4

(8" BORE ONLY)



'MF1', 'MF2' FLANGE & 'ME3', 'ME4' CAP MOUNT DIMENSIONS											
BORE	ROD DIAMETER	E	FB	FH	R	RM	TE	TF	UF	W	ZFO
1½	⅝ Standard	2	5/16	⅜	1.43	—	—	2¾	3⅜	⅝	9⅛
	1 Oversize									1	9½
2	⅝ Standard	2½	⅜	⅜	1.84	—	—	3⅜	4⅛	⅝	9⅛
	1 Oversize									1	9½
2½	⅝ Standard	3	⅜	⅜	2.19	—	—	3⅞	4⅝	⅝	9⅜
	1 Oversize									1	9¾
3¼	1 Standard	3¾	7/16	⅝	2.76	—	—	4 11/16	5½	¾	11
	1⅜ Oversize									1	11¼

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS											
BORE	ROD DIAMETER	E	FB	FH	R	RM	TE	TF	UF	W	ZFO
4	1 Standard	4½	7/16	⅝	3.32	—	—	5 7/16	6¼	¾	11
	1⅜ Oversize									1	11¼
5	1 Standard	5½	9/16	⅝	4.10	—	—	6⅝	7⅝	¾	11½
	1⅜ Oversize									1	11¾
6	1⅜ Standard	6½	9/16	¾	4.88	—	—	7⅝	8⅝	⅞	12⅞
	1¾ Oversize									1⅛	13⅛
8	1⅜ Standard	8½	11/16	N/A	N/A	*3½	7.57	N/A	N/A	1⅝	12⅜
	1¾ Oversize									1⅞	12⅝

*Round retainer used to retain bushing, not a rectangle flange plate as other bores.

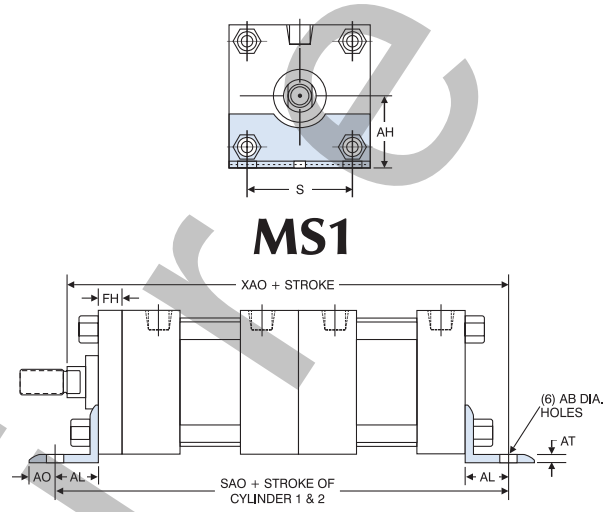
Preliminare

3-POSITION DIMENSIONS: BASE MOUNTS

'MS1' ANGLE MOUNT DIMENSIONS

BORE	ROD DIAMETER	AB	AH	AL	AO	AT	FH	S	ADD STROKE SAO	ADD STROKE XAO
1 1/2	5/8 Standard	7/16	1 3/16	1	3/8	1/8	3/8	1 1/4	10 1/8	9 3/4
	1 Oversize									10 1/8
2	5/8 Standard	7/16	1 7/16	1	3/8	1/8	3/8	1 3/4	10 1/8	9 3/4
	1 Oversize									10 1/8
2 1/2	5/8 Standard	7/16	1 5/8	1	3/8	1/8	3/8	2 1/4	10 3/8	10
	1 Oversize									10 3/8
3 1/4	1 Standard	9/16	1 15/16	1 1/4	1/2	1/8	5/8	2 3/4	12 1/8	11 5/8
	1 3/8 Oversize									11 7/8
4	1 Standard	9/16	2 1/4	1 1/4	1/2	1/8	5/8	3 1/2	12 1/8	11 5/8
	1 3/8 Oversize									11 7/8
5	1 Standard	11/16	2 3/4	1 3/8	5/8	3/16	5/8	4 1/4	12 7/8	12 1/4
	1 3/8 Oversize									12 1/2
6	1 3/8 Standard	13/16	3 1/4	1 3/8	5/8	3/16	3/4	5 1/4	14	13 1/2
	1 3/4 Oversize									13 3/4
8	1 3/8 Standard	13/16	4 1/4	1 13/16	11/16	1/4	5/8*	7 1/8	14 3/8	14 3/16
	1 3/4 Oversize									14 7/16

*Round retainer on 8" bore.

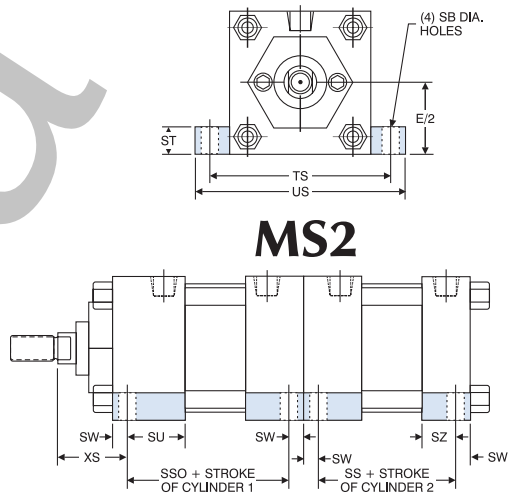


'MS2' SIDE LUG MOUNT DIMENSIONS

BORE	ROD DIAMETER	SB	E/2	ST	SU	SW	SZ	TS	US	XS	ADD STROKE SSO	ADD STROKE SS
1 1/2	5/8 Standard	7/16	1	1/2	1 1/8	3/8	5/8	2 3/4	3 1/2	1 3/8	3 3/8	2 7/8
	1 Oversize									1 3/4		
2	5/8 Standard	7/16	1 1/4	1/2	1 1/8	3/8	5/8	3 1/4	4	1 3/8	3 3/8	2 7/8
	1 Oversize									1 3/4		
2 1/2	5/8 Standard	7/16	1 1/2	1/2	1 1/8	3/8	5/8	3 3/4	4 1/2	1 3/8	3 1/2	3
	1 Oversize									1 3/4		
3 1/4	1 Standard	9/16	1 7/8	3/4	1 1/4	1/2	3/4	4 3/4	5 3/4	1 7/8	3 3/4	3 1/4
	1 3/8 Oversize									2 1/8		
4	1 Standard	9/16	2 1/4	3/4	1 1/4	1/2	3/4	5 1/2	6 1/2	1 7/8	3 3/4	3 1/4
	1 3/8 Oversize									2 1/8		
5	1 Standard	13/16	2 3/4	1	1 1/16	11/16	9/16	6 7/8	8 1/4	2 1/16	3 5/8	3 1/8
	1 3/8 Oversize									2 5/16		
6	1 3/8 Standard	13/16	3 1/4	1	1 5/16	11/16	13/16	7 7/8	9 1/4	2 5/16	4 1/8	3 5/8
	1 3/4 Oversize									2 9/16		
8	1 3/8 Standard	13/16	4 1/4	1	1 5/16	11/16	13/16	9 7/8	11 1/4	2 5/16	4 1/4	3 3/4
	1 3/4 Oversize									2 9/16		

Note: The option not to have side lugs on center (2) caps is available. Use the "XX" option in the "How To Order" section (specify).

Example: 3P-TA-MS2-4 X 5-MPR with TA-MS2-4 X 3-BP-"XX"
"XX" = No side lugs on center (2) caps

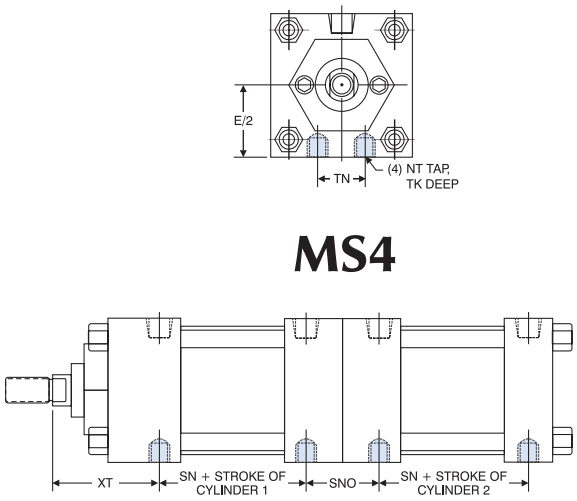


'MS4' BOTTOM TAPPED MOUNT DIMENSIONS

BORE	ROD DIAMETER	E/2	NT	TK	TN	XT	SNO	ADD STROKE SN
1 1/2	5/8 Standard	1	1/4-20	3/8	5/8	1 15/16	1 7/8	2 1/4
	1 Oversize					2 5/16		
2	5/8 Standard	1 1/4	5/16-18	1/2	7/8	1 15/16	1 7/8	2 1/4
	1 Oversize					2 5/16		
2 1/2	5/8 Standard	1 1/2	3/8-16	5/8	1 1/4	1 15/16	1 7/8	2 3/8
	1 Oversize					2 5/16		
3 1/4	1 Standard	1 7/8	1/2-13	3/4	1 1/2	2 7/16	2 1/8	2 5/8
	1 3/8 Oversize					2 11/16		
4	1 Standard	2 1/4	1/2-13	3/4	2 1/16	2 7/16	2 1/8	2 5/8
	1 3/8 Oversize					2 11/16		
5	1 Standard	2 3/4	5/8-11	1	2 11/16	2 7/16	2 1/8	2 7/8
	1 3/8 Oversize					2 11/16		
6	1 3/8 Standard	3 1/4	3/4-10	1 1/8	3 1/4	2 13/16	2 3/8	3 1/8
	1 3/4 Oversize					3 1/16		
8	1 3/8 Standard	4 1/4	3/4-10	1 1/8	4 1/2	2 13/16	2 3/8	3 1/4
	1 3/4 Oversize					3 1/16		

Note: The option not to have 'MS4' taps on center (2) caps is available. Use the "XX" option in the "How To Order" section (specify).

Example: 3P-TA-MS4-6 X 7-Hwith TA-MS4-6 X 4-C-"XX"
"XX" = No 'MS4' taps on center (2) caps



Preliminary

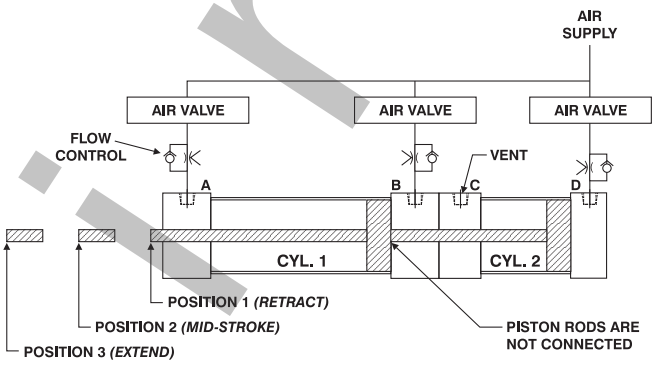
3-POSITION CYLINDERS: DESIGN TIPS & SCHEMATIC

Design Tips

- Order CYL 1 with "MPR" (magnetic piston option) and use (3) switches to sense each stroke position. *See pages 105-111 for switch ordering information.*
- You can use "MA" (micro-adjust option) on CYL 2 to create an adjustable mid-stroke position cylinder.
- During the mid-stroke position, the piston rod on CYL 1 is held in place by seal friction and can "extend" in vertical applications when the cylinder rod end is mounted down. To prevent this from happening, a lower air pressure can be applied to cylinder port "A" to offset cylinder rod or tooling weight. *See your local TRD distributor for help in designing on air circuit that's right for your application.*
- For non-rotating applications, you can use a "NR" (non-rotating) or "TR" (triple rod) Series cylinder as CYL 1 and a standard "TA" Series as CYL 2.

3-POSITION CYLINDER SCHEMATIC

ACTUATION SEQUENCE:
PRESSURE TO PORT 'A' RETRACTS THE CYLINDER TO POSITION 1
PRESSURE TO PORT 'D' EXTENDS THE CYLINDER TO POSITION 2
PRESSURE TO PORT 'B' EXTENDS THE CYLINDER TO POSITION 3

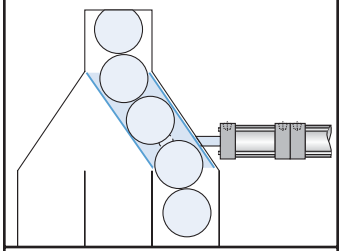


The above basic schematic demonstrates how (3) 3-way air solenoid valves and flow controls can operate a 3-position cylinder. *See your local TRD distributor for help in designing an air circuit that's right for your application.*

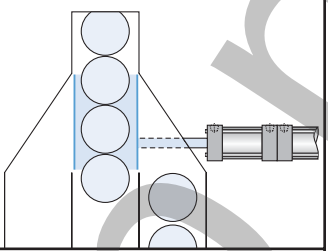
Application Possibilities:

LANE DIVERTER WITH THREE LANES

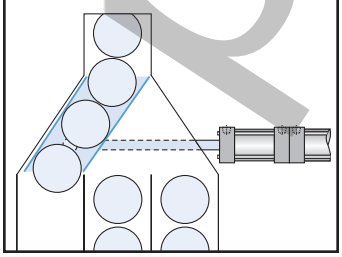
POSITION 1:
RETRACT: FILL FIRST LANE



POSITION 2:
MID-STROKE: FILL SECOND LANE

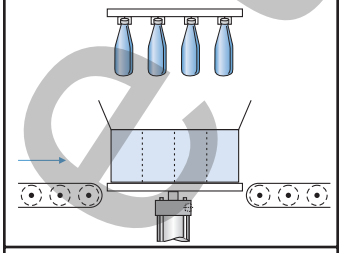


POSITION 3:
EXTEND: FILL THIRD LANE

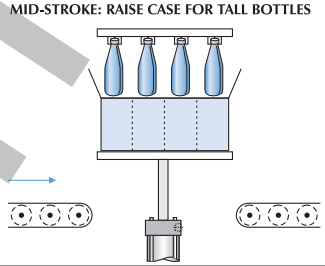


CASE PACKER WITH DIFFERENT HEIGHT BOTTLES

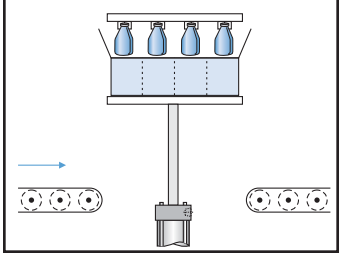
POSITION 1:
RETRACT: LOAD CASES



POSITION 2:
MID-STROKE: RAISE CASE FOR TALL BOTTLES

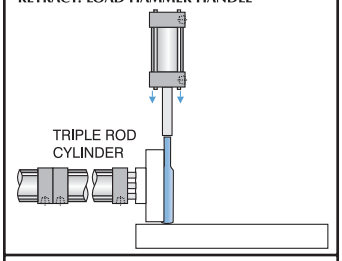


POSITION 3:
EXTEND: RAISE CASE FOR SHORT BOTTLES

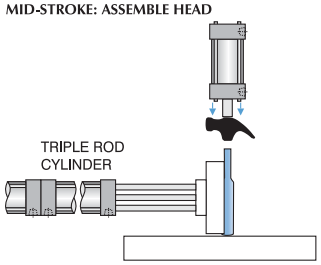


AUTOMATE SIMPLE ASSEMBLY OPERATIONS

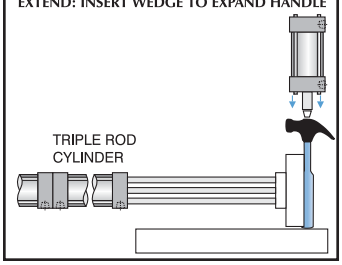
POSITION 1:
RETRACT: LOAD HAMMER HANDLE



POSITION 2:
MID-STROKE: ASSEMBLE HEAD

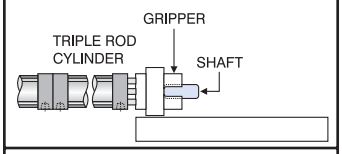


POSITION 3:
EXTEND: INSERT WEDGE TO EXPAND HANDLE

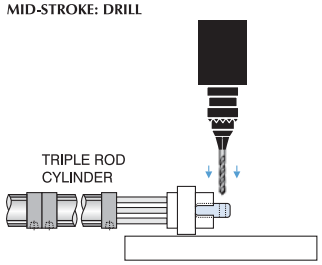


AUTOMATE SIMPLE MACHINING AND ASSEMBLY

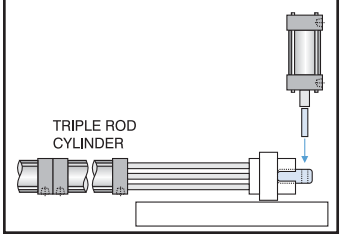
POSITION 1:
RETRACT: LOAD SHAFT



POSITION 2:
MID-STROKE: DRILL



POSITION 3:
EXTEND: PRESS PIN



pneuair

TANDEM CYLINDERS:

You can tandem ***any*** series of cylinder together to provide unlimited design possibilities.

The ***"air over oil"*** design is the most common use of tandem cylinders today. Choose from different designs to gain maximum benefit for your application.

AIR OVER OIL BENEFITS:

- Air typically provides the "force" to extend and retract the cylinder. Oil provides the precise control of the stroke.
- **CONSTANT VELOCITY —** By metering the flow of the oil cylinder, a constant velocity is achieved throughout the stroke - even at very slow velocities that air cylinders typically "chatter".
- **SMOOTH OPERATION IN PIVOT APPLICATIONS** — Pivot applications usually have varying loads throughout the stroke. Typically, you are supporting a load till it reaches "top center", and then the load tends to "run-away" with the influence of gravity. Air-oil cylinders minimize the effect of gravity, providing a smooth stroke.
- Three basic designs to choose from to satisfy most applications:
  - Dual tank design for maximum flexibility and speed
  - Single tank design for slower cycle rates, reducing component cost
  - Air/Oil piston with single tank provides force multiplication (2:1 ratio minimum depending on bore and rod sizes)

HOW TO ORDER: TANDEM CYLINDERS

CYL. #1 — CYL. #2

TM - TA - MF1 - 2 x 10 - TH WITH TA - MXO - 2 X 10 - MPR - HC

TANDEM

SERIES	
TA	250 PSI AIR
SS	STAINLESS STEEL (Refer to Cat. # CAT-TRDSS-602 for ordering information)
FM	FLUSH MOUNT (Add-A-Mount)
TRA	TRIPLE ROD (CYL. #1 Only)

BORE
1 1/2
2
2 1/2
3 1/4
4
5
6
8

STROKE (CYL. #1)

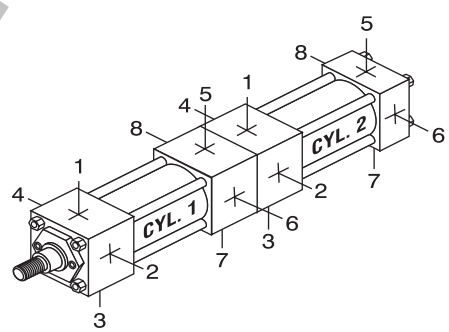
0" to 50" Made to Order

NOTE: CYL. #1 and CYL. #2 strokes must be the same. **(PISTON RODS ARE CONNECTED)**

NFPA MOUNTS	
MXO	NO MOUNT
MP1	REAR PIVOT CLEVIS (CYL. 2 ONLY)
MP2	REAR PIVOT CLEVIS (1 1/2"-6" Bore) (CYL. 2 ONLY)
MP4	REAR PIVOT EYE (1 1/2" - 4" Bore) (CYL. 2 ONLY)
MT1	FRONT TRUNNION (SPECIFY CYL. 1 OR 2)
MT2	REAR TRUNNION (SPECIFY CYL. 1 OR 2)
MX1	EXTENDED TIE RODS (HEAD & CAP)
MX2	EXTENDED TIE RODS (CAP END)
MX3	EXTENDED TIE RODS (HEAD END)
MF1	FRONT FLANGE (1 1/2"-6" Bore) (CYL. 1 ONLY)
MF2	REAR FLANGE (1 1/2"-6" Bore) (CYL. 2 ONLY)
ME3	FRONT MOUNTING HOLES (8" Bore) (CYL. 1 ONLY)
ME4	REAR MOUNTING HOLES (8" Bore) (CYL. 2 ONLY)
MS1	FRONT & REAR END FOOT
MS2	SIDE LUG (1 1/2"- 8")
MS4	BOTTOM TAPPED HOLES

COMMON OPTIONS FOR 'OIL' (CYL. 1)*	
"A" =	EXTENDED PISTON ROD THREAD (SPECIFY)
"C" =	EXTENDED PISTON ROD (SPECIFY)
H	HEAD CUSHION
C	CAP CUSHION (CYL. 2 ONLY)
EN	**ELECTROLESS NICKEL PLATED** *(Refer to page 84 for specifications)*
KK2	LARGE MALE ROD THREAD
KK3	FEMALE ROD THREAD
KK3S	STUDDED PISTON ROD (KK3 with Stud, Loctite in place)
KK4	FULL DIAMETER MALE ROD THREAD
KK5	BLANK ROD END (NO THREADS, "A" = 0")
MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
OP	OPTIONAL PORT LOCATION (SPECIFY, Example: Ports @ 3 & 7)
OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, Example: OS = 1 3/8")
TH	**400 PSI HYDRAULIC, NON-SHOCK** *(Refer to page 90 for specifications)*
WB	PISTON WEAR BAND
XX	SPECIAL VARIATION (SPECIFY)
BSP	BSP PORTS (SPECIFY SIZE, Example: BSP = 1/4")
SAE	SAE PORTS (SPECIFY SIZE, Example: SAE #10)
SSA	STAINLESS STEEL PISTON ROD, TIE RODS & NUTS, AND FASTENERS
SSF	STAINLESS STEEL FASTENERS
SSR	STAINLESS STEEL PISTON ROD
SST	STAINLESS STEEL TIE RODS & NUTS

*Refer to series TA, SS, FM, or TRA for complete list of options.



STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

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

	OPTIONS*	
	ADDS LENGTH TO CYLINDER - SEE "OPTION LENGTH ADDER" CHART, PAGE 5.	
	COMMON OPTIONS FOR 'AIR' (CYL. 2)	
X	B	1/4" URETHANE BUMPER BOTH ENDS
X	BC	1/4" URETHANE BUMPER CAP ONLY
X	BH	1/4" URETHANE BUMPER HEAD ONLY
	BP	BUMPER PISTON SEAL
	H	HEAD CUSHION
	C	CAP CUSHION (CYL. 2 ONLY)
	EN	**ELECTROLESS NICKEL PLATED** *(Refer to page 84 for specifications)*
	MPR	MAGNETIC PISTON FOR REED OR SOLID STATE SWITCHES - TRD MODELS: R10, RAC, AND MSS *(Refer to pages 105-111 for selection)*
	MPH	MAGNETIC PISTON FOR HALL SWITCHES
	MA	MICRO-ADJUST (6" MAX. STROKE) *Available on Double Rod End Models*
	TH	**400 PSI HYDRAULIC, NON-SHOCK** *(Refer to page 90 for specifications)*
	OP	OPTIONAL PORT LOCATION (Example: Ports @ 3 & 7)
	OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, Example: OS = 1 3/8")
	VS	FLUOROCARBON SEALS
	WB	PISTON WEAR BAND
	XX	SPECIAL VARIATION (SPECIFY)
	BSP	BSP PORTS (SPECIFY SIZE, Example: BSP = 1/4")
	SAE	SAE PORTS (SPECIFY SIZE, Example: SAE #10)
	SSA	STAINLESS STEEL PISTON ROD, TIE RODS & NUTS, AND FASTENERS
	SSF	STAINLESS STEEL FASTENERS
	SSR	STAINLESS STEEL PISTON ROD
	SST	STAINLESS STEEL TIE RODS & NUTS

About our Part Number System

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

Example: Air/Oil Tandem
Cyl. 1 is a 'TA' series, MF1 mount, 2" bore X 10" stroke, 400 PSI Hydraulic.
Cyl. 2 is a 'TA' series, MXO (no mount), 2" bore X 10" stroke, with a magnet (for Reed Switches), and Head & Cap cushions.

Part Number:
TM-TA-MF1-2 x 10-TH with
TA-MXO-2 x 10-MPR-HC

Prelaire

TANDEM DIMENSIONS: BASIC CYLINDER (NO MOUNT)

EASY FLIP OUT PAGE FOR REFERENCE

About Rod End Styles

Style 1 Male Rod End is STANDARD (CYL. #1)

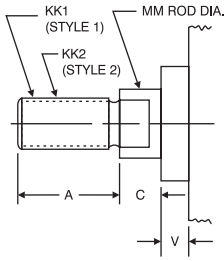
Other NFPA Styles can be specified (See Chart).

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).

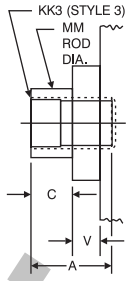
NEED SOMETHING NOT LISTED?
Just send us a sketch.
In most cases, quotes are turned around in one day!

PISTON ROD END STYLES

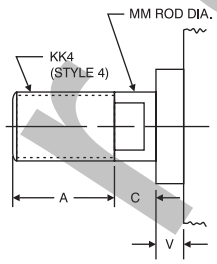
STYLE 1 & 2 — KK1 & KK2



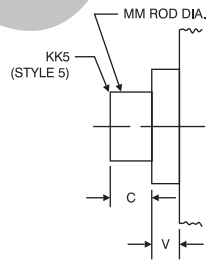
STYLE 3 — KK3



STYLE 4 — KK4



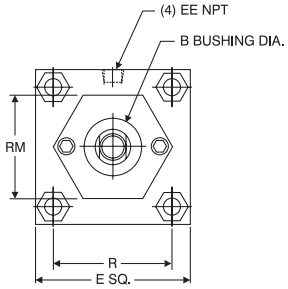
STYLE 5 — KK5

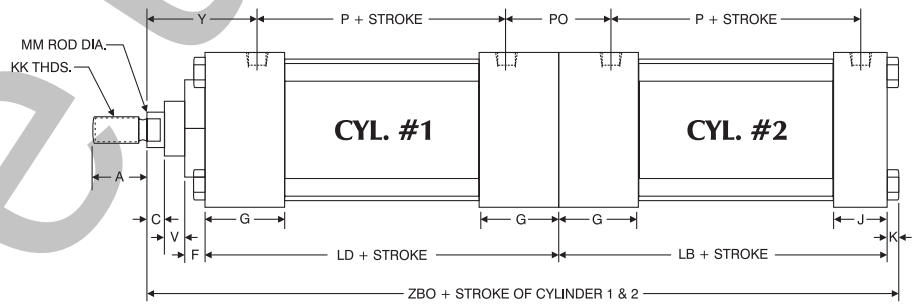


BORE	MM ROD DIAMETER	STANDARD Style 1 - Male KK1	STANDARD Style 1 - Male A	OPTIONAL Style 2 - Male KK2	OPTIONAL Style 2 - Male A	OPTIONAL Style 3 - Female KK3	OPTIONAL Style 3 - Female A	OPTIONAL Style 4 - Male KK4	OPTIONAL Style 4 - Male A	OPTIONAL Style 5 - Blank KK5	C	V
1½, 2, 2½	⅝ Standard	7/16-20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

MXO/MXO

(NO MOUNT)



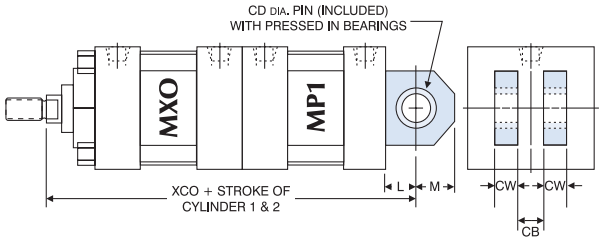


BASIC DIMENSIONS 'MXO' STANDARD & OVERSIZE RODS

BORE	ROD DIAMETER	A	B	C	E	EE	F	G	J	K	KK	LB	LD	MM	P	PO	R	RM	V	Y	ZBO
1½	⅝ Standard	¾	1⅛	⅜	2	⅜	⅜	1½	1	¼	7/16-20	3⅝	4⅛	⅝	2⅜	1¾	1.43	2 SQ.	¼	1⅞	9
	1 Oversize	1⅛	1½	½							¾-16			1					½	2¼	9⅜
2	⅝ Standard	¾	1⅛	⅜	2½	⅜	⅜	1½	1	5/16	7/16-20	3⅝	4⅛	⅝	2⅜	1¾	1.84	1¾ HEX	¼	1⅞	9 1/16
	1 Oversize	1⅛	1½	½							¾-16			1				2½ SQ.	½	2¼	9 7/16
2½	⅝ Standard	¾	1⅛	⅜	3	⅜	⅜	1½	1	5/16	7/16-20	3¾	4¼	⅝	2½	1¾	2.19	1¾ HEX	¼	1⅞	9 5/16
	1 Oversize	1⅛	1½	½							¾-16			1				3 SQ.	½	2¼	9 11/16
3¼	1 Standard	1⅛	1½	½	3¾	½	⅝	1¾	1¼	⅜	¾-16	4¼	4¾	1	2¾	2	2.76	2¾ DIA.	¼	2⅜	10¾
	1⅜ Oversize	1⅝	2	⅝							1-14			1⅜				3¾ SQ.	⅜	2⅝	11
4	1 Standard	1⅛	1½	½	4½	½	⅝	1¾	1¼	⅜	¾-16	4¼	4¾	1	2¾	2	3.32	2¾ DIA.	¼	2⅜	10¾
	1⅜ Oversize	1⅝	2	⅝							1-14			1⅜				3½ DIA.	⅜	2⅝	11
5	1 Standard	1⅛	1½	½	5½	½	⅝	1¾	1¼	7/16	¾-16	4½	5	1	3	2	4.10	2¾ DIA.	¼	2⅜	11 5/16
	1⅜ Oversize	1⅝	2	⅝							1-14			1⅜				3½ DIA.	⅜	2⅝	11 9/16
6	1⅜ Standard	1⅝	2	⅝	6½	¾	⅝	2	1½	7/16	1-14	5	5½	1⅜	3¼	2¼	4.88	3½ DIA.	⅜	2¾	12 9/16
	1¾ Oversize	2	2⅜	¾							1¼-12			1¾					½	3	12 13/16
8	1⅜ Standard	1⅝	2	⅝	8½	¾	⅝	2	1½	9/16	1-14	5⅛	5⅝	1⅜	3⅜	2¼	6.44	3½ DIA.	⅜	2¾	12 15/16
	1¾ Oversize	2	2⅜	¾							1¼-12			1¾					½	3	13 3/16

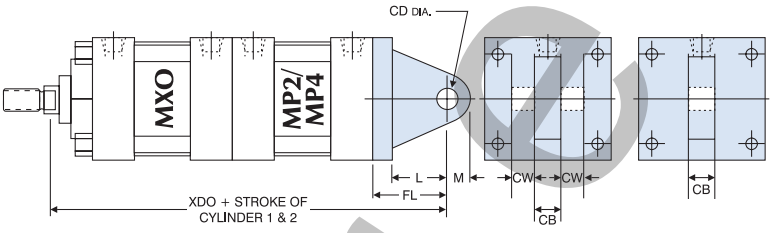
neuair

TANDEM DIMENSIONS: PIVOT MOUNTS



MXO/MP1 MOUNT

(Extruded, 1½" - 8" bores)



MXO/ MP2

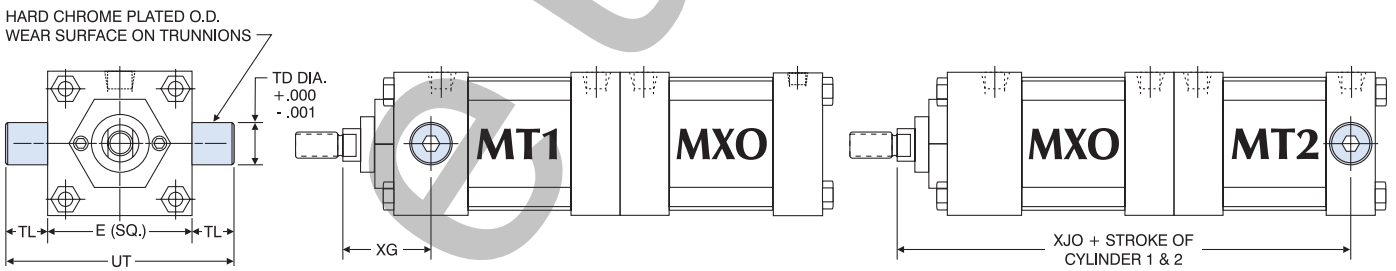
(Casting, 1½"-6" bore)

MXO/ MP4

(Casting, 1½"-4" bore)

'MP1' & 'MP2' CLEVIS AND 'MP4' ROD EYE MOUNT DIMENSIONS									
BORE	ROD DIAMETER	CB	CD	CW	FL	L	M	ADD STROKE XCO	ADD STROKE XDO
1½	⅝ Standard	¾	½	½	1⅛	¾	⅝	9½	9⅞
	1 Oversize							9⅞	10¼
2	⅝ Standard	¾	½	½	1⅛	¾	⅝	9½	9⅞
	1 Oversize							9⅞	10¼
2½	⅝ Standard	¾	½	½	1⅛	¾	⅝	9¾	10⅛
	1 Oversize							10⅛	10½
3¼	1 Standard	1¼	¾	⅝	1⅞	1¼	⅞	11⅝	12¼
	1⅜ Oversize							11⅞	12½
4	1 Standard	1¼	¾	⅝	1⅞	1¼	⅞	11⅝	12¼
	1⅜ Oversize							11⅞	12½
5	1 Standard	1¼	¾	⅝	1⅞	1¼	⅞	12⅛	12¾
	1⅜ Oversize							12⅜	13
6	1⅜ Standard	1½	1	¾	2¼	1½	1	13⅝	14½
	1¾ Oversize							13⅞	14¾
8	1⅜ Standard	1½	1	¾	N/A	1½	1	13⅞	N/A
	1¾ Oversize							14⅛	

Clevis pins are provided with pivot mounts.
* MP4 mount not available as standard on 5" bores and above.
Note: Extruded MP1 mounts are standard (1½" - 8" bores).
Cast iron removable mounts are optional and must be requested when ordering (1½" - 6" bores).



MT1 / MT2

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

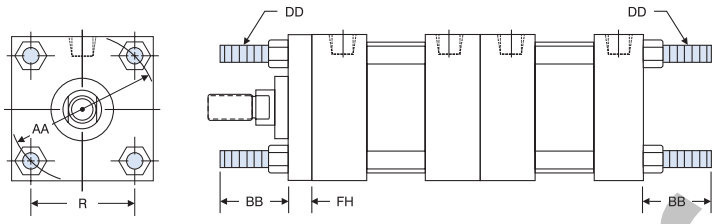
'MT1' HEAD TRUNNION AND 'MT2' CAP TRUNNION MOUNT DIMENSIONS							
BORE	ROD DIAMETER	E	TD	TL	UT	XG	ADD STROKE XJO
1½	⅝ Standard	2	1	1	4	1¾	8¼
	1 Oversize					N/A*	8⅝
2	⅝ Standard	2½	1	1	4½	1¾	8¼
	1 Oversize					2⅛	8⅝
2½	⅝ Standard	3	1	1	5	1¾	8½
	1 Oversize					2⅛	8⅞
3¼	1 Standard	3¾	1	1	5¾	2¼	9¾
	1⅜ Oversize					2½	10
4	1 Standard	4½	1	1	6½	2¼	9¾
	1⅜ Oversize					2½	10
5	1 Standard	5½	1	1	7½	2¼	10¼
	1⅜ Oversize					2½	10½
6	1⅜ Standard	6½	1⅜	1⅜	9¼	2⅝	11⅜
	1¾ Oversize					2⅞	11⅝
8	1⅜ Standard	8½	1⅜	1⅜	11¼	2⅝	11⅝
	1¾ Oversize					2⅞	11⅞

*No oversize rod available on 1½" bore MT1.

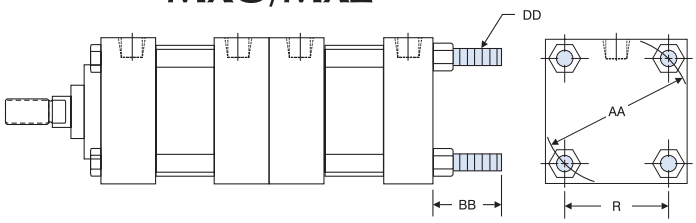
Not for Sale

TANDEM DIMENSIONS: TIE ROD & FLANGE MOUNTS

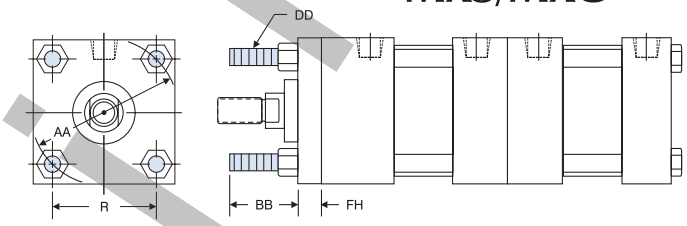
MX1



MXO/MX2



MX3/MXO



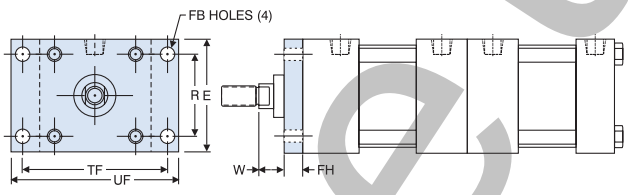
TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
1½	⅝ Standard 1 Oversize	2.02	1	¼-28	⅜	1.43
2	⅝ Standard 1 Oversize	2.6	1⅛	5/16-24	⅜	1.84
2½	⅝ Standard 1 Oversize	3.1	1⅛	5/16-24	⅜	2.19
3¼	1 Standard 1⅜ Oversize	3.9	1⅜	⅜-24	⅝	2.76

TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
4	1 Standard 1⅜ Oversize	4.7	1⅜	⅜-24	⅝	3.32
5	1 Standard 1⅜ Oversize	5.8	1 13/16	½-20	⅝	4.10
6	1⅜ Standard 1¾ Oversize	6.9	1 13/16	½-20	¾	4.88
8	1⅜ Standard 1¾ Oversize	9.1	**2 5/16	⅝-18	*⅝	6.44

*MX1 & MX3 have full square bushing retainer on 1½" - 6" bores, round retainers on 8" bores.
**"BB" dimension from head on 8" bore.

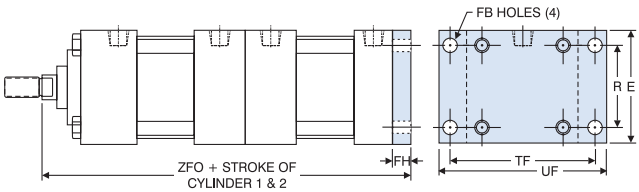
MF1/MXO

(1½" - 6" BORES)



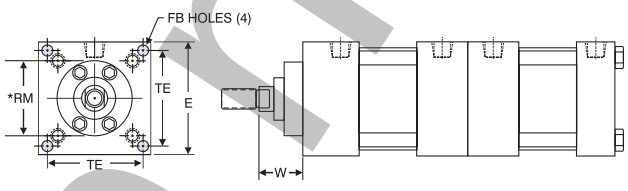
MXO/MF2

(1½" - 6" BORES)



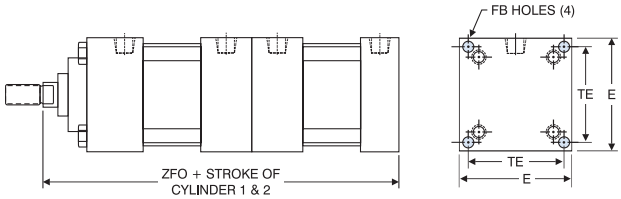
ME3/MXO

(8" BORE ONLY)



MXO/ME4

(8" BORE ONLY)



'MF1', 'MF2' FLANGE & 'ME3', 'ME4' CAP MOUNT DIMENSIONS											
BORE	ROD DIAMETER	E	FB	FH	R	RM	TE	TF	UF	W	ZFO
1½	⅝ Standard 1 Oversize	2	5/16	⅜	1.43	—	—	2¾	3⅜	⅝ 1	9⅛ 9½
2	⅝ Standard 1 Oversize	2½	⅜	⅜	1.84	—	—	3⅜	4⅛	⅝ 1	9⅛ 9½
2½	⅝ Standard 1 Oversize	3	⅜	⅜	2.19	—	—	3⅞	4⅝	⅝ 1	9⅜ 9¾
3¼	1 Standard 1⅜ Oversize	3¾	7/16	⅝	2.76	—	—	4 11/16	5½	¾ 1	11 11¼

*Round retainer used to retain bushing, not a rectangular flange plate as other bores.

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS											
BORE	ROD DIAMETER	E	FB	FH	R	RM	TE	TF	UF	W	ZFO
4	1 Standard 1⅜ Oversize	4½	7/16	⅝	3.32	—	—	5 7/16	6¼	¾ 1	11 11¼
5	1 Standard 1⅜ Oversize	5½	9/16	⅝	4.10	—	—	6⅝	7⅝	¾ 1	11½ 11¾
6	1⅜ Standard 1¾ Oversize	6½	9/16	¾	4.88	—	—	7⅝	8⅝	⅞ 1⅛	12⅞ 13⅛
8	1⅜ Standard 1¾ Oversize	8½	11/16	N/A	N/A	*3½	7.57	N/A	N/A	1⅝ 1⅞	12⅜ 12⅝

Preliminare

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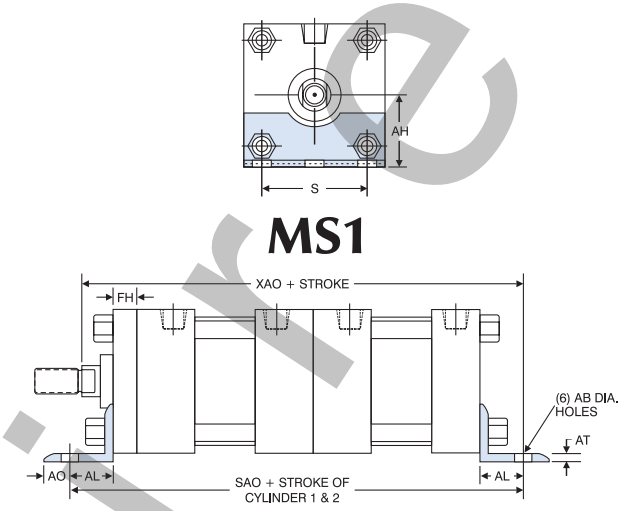
TANDEM DIMENSIONS: BASE MOUNTS

'MS1' ANGLE MOUNT DIMENSIONS

BORE	ROD DIAMETER	AB	AH	AL	AO	AT	FH	S	ADD STROKE SAO	ADD STROKE XAO
1 1/2	5/8 Standard	7/16	1 3/16	1	3/8	1/8	3/8	1 1/4	10 1/8	9 3/4
	1 Oversize									10 1/8
2	5/8 Standard	7/16	1 7/16	1	3/8	1/8	3/8	1 3/4	10 1/8	9 3/4
	1 Oversize									10 1/8
2 1/2	5/8 Standard	7/16	1 5/8	1	3/8	1/8	3/8	2 1/4	10 3/8	10
	1 Oversize									10 3/8
3 1/4	1 Standard	9/16	1 15/16	1 1/4	1/2	1/8	5/8	2 3/4	12 1/8	11 5/8
	1 3/8 Oversize									11 7/8
4	1 Standard	9/16	2 1/4	1 1/4	1/2	1/8	5/8	3 1/2	12 1/8	11 5/8
	1 3/8 Oversize									11 7/8
5	1 Standard	11/16	2 3/4	1 3/8	5/8	3/16	5/8	4 1/4	12 7/8	12 1/4
	1 3/8 Oversize									12 1/2
6	1 3/8 Standard	13/16	3 1/4	1 3/8	5/8	3/16	3/4	5 1/4	14	13 1/2
	1 3/4 Oversize									13 3/4
8	1 3/8 Standard	13/16	4 1/4	1 13/16	11/16	1/4	5/8*	7 1/8	14 3/8	14 3/16
	1 3/4 Oversize									14 7/16

*Round retainer on 8" bore.

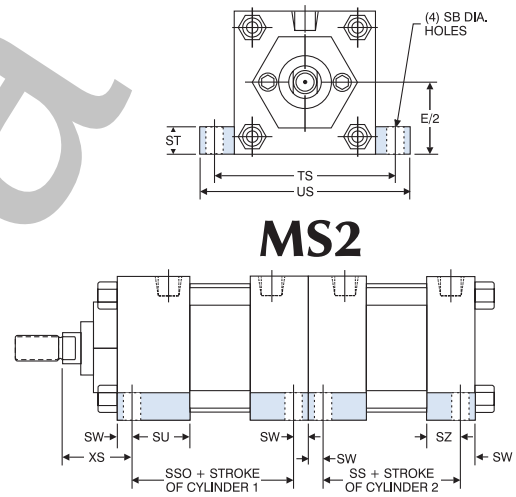


'MS2' SIDE LUG MOUNT DIMENSIONS

BORE	ROD DIAMETER	SB	E/2	ST	SU	SW	SZ	TS	US	XS	ADD STROKE SSO	ADD STROKE SS
1 1/2	5/8 Standard	7/16	1	1/2	1 1/8	3/8	5/8	2 3/4	3 1/2	1 3/8	3 3/8	2 7/8
	1 Oversize									1 3/4		
2	5/8 Standard	7/16	1 1/4	1/2	1 1/8	3/8	5/8	3 1/4	4	1 3/8	3 3/8	2 7/8
	1 Oversize									1 3/4		
2 1/2	5/8 Standard	7/16	1 1/2	1/2	1 1/8	3/8	5/8	3 3/4	4 1/2	1 3/8	3 1/2	3
	1 Oversize									1 3/4		
3 1/4	1 Standard	9/16	1 7/8	3/4	1 1/4	1/2	3/4	4 3/4	5 3/4	1 7/8	3 3/4	3 1/4
	1 3/8 Oversize									2 1/8		
4	1 Standard	9/16	2 1/4	3/4	1 1/4	1/2	3/4	5 1/2	6 1/2	1 7/8	3 3/4	3 1/4
	1 3/8 Oversize									2 1/8		
5	1 Standard	13/16	2 3/4	1	1 1/16	11/16	9/16	6 7/8	8 1/4	2 1/16	3 5/8	3 1/8
	1 3/8 Oversize									2 5/16		
6	1 3/8 Standard	13/16	3 1/4	1	1 5/16	11/16	13/16	7 7/8	9 1/4	2 5/16	4 1/8	3 5/8
	1 3/4 Oversize									2 9/16		
8	1 3/8 Standard	13/16	4 1/4	1	1 5/16	11/16	13/16	9 7/8	11 1/4	2 5/16	4 1/4	3 3/4
	1 3/4 Oversize									2 9/16		

Note: The option not to have side lugs on center (2) caps is available. Use the "XX" option in the "How To Order" section (specify).

Example: TM-TA-MS2-4 X 5-TH with TA-MS2-4 X 5-BP-"XX"
"XX" = No side lugs on center (2) caps

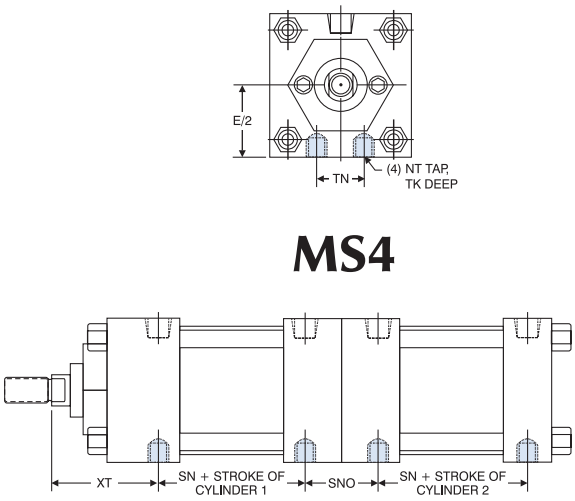


'MS4' BOTTOM TAPPED MOUNT DIMENSIONS

BORE	ROD DIAMETER	E/2	NT	TK	TN	XT	SNO	ADD STROKE SN
1 1/2	5/8 Standard	1	1/4-20	3/8	5/8	1 15/16	1 7/8	2 1/4
	1 Oversize					2 5/16		
2	5/8 Standard	1 1/4	5/16-18	1/2	7/8	1 15/16	1 7/8	2 1/4
	1 Oversize					2 5/16		
2 1/2	5/8 Standard	1 1/2	3/8-16	5/8	1 1/4	1 15/16	1 7/8	2 3/8
	1 Oversize					2 5/16		
3 1/4	1 Standard	1 7/8	1/2-13	3/4	1 1/2	2 7/16	2 1/8	2 5/8
	1 3/8 Oversize					2 11/16		
4	1 Standard	2 1/4	1/2-13	3/4	2 1/16	2 7/16	2 1/8	2 5/8
	1 3/8 Oversize					2 11/16		
5	1 Standard	2 3/4	5/8-11	1	2 11/16	2 7/16	2 1/8	2 7/8
	1 3/8 Oversize					2 11/16		
6	1 3/8 Standard	3 1/4	3/4-10	1 1/8	3 1/4	2 13/16	2 3/8	3 1/8
	1 3/4 Oversize					3 1/16		
8	1 3/8 Standard	4 1/4	3/4-10	1 1/8	4 1/2	2 13/16	2 3/8	3 1/4
	1 3/4 Oversize					3 1/16		

Note: The option not to have 'MS4' taps on center (2) caps is available. Use the "XX" option in the "How To Order" section (specify).

Example: TM-TA-MS4-6 X 7-TH with TA-MS4-6 X 7-C-"XX"
"XX" = No 'MS4' taps on center (2) caps



Preliminaire

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TANDEM CYLINDERS: SCHEMATICS

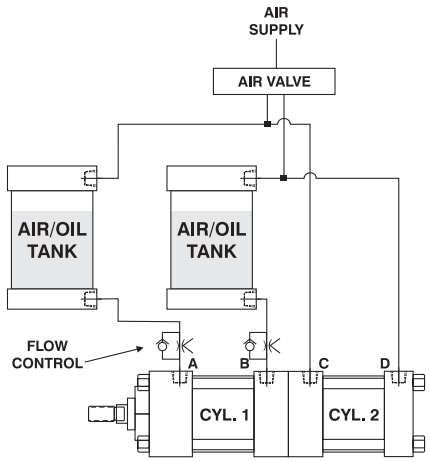
The following schematics are commonly used for air/oil applications.

In each application, a 'TA' Series (with "TH" option - 400 max. psi Hyd.) is used in tandem with a 'TA' Series (250 max* psi air) cylinder. CYL. #1 represents the 'TH' Option, and CYL. #2 represents the 'TA' Series.

*Tandem cylinders are designed and built with piston rods connected. Cylinders operate as one unit.
Refer to page 48 for maximum air inlet pressures!

SCHEMATIC "A"

ACTUATION SEQUENCE:
PRESSURE TO PORTS 'B' & 'D' EXTENDS CYLINDER
PRESSURE TO PORTS 'A' & 'C' RETRACTS CYLINDER



AIR TO OIL RATIO

Extend: 1.8:1 or greater (standard rod)
1.4:1 or greater (oversize rod)

Retract: 2:1 (for both standard and oversize rods)

(Refer to charts on page 48 for more details)

CYCLE RATES

Extend: Moderate to high speed
Retract: Moderate to high speed

NUMBER OF AIR/OIL TANKS: 2

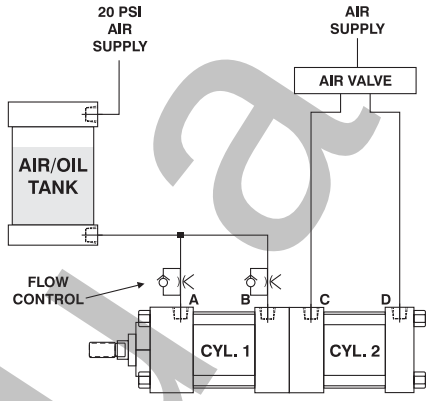
RECOMMENDED TANK SIZE:
130% - 150% of CYL. #1 total volume, filled approximately 80% full.
(Refer to page 42 for ordering information)

DESIGN BENEFITS

- Highest cycle rates per minute in both extend and retract strokes.
- Higher cylinder output force in both extend and retract strokes.
- Offers greatest range of speed control.
- Can handle higher loads in extend and retract strokes.

SCHEMATIC "B"

ACTUATION SEQUENCE:
PRESSURE TO PORT 'D' EXTENDS CYLINDER
PRESSURE TO PORT 'C' RETRACTS CYLINDER



AIR TO OIL RATIO

Extend: 1:1 (for both standard and oversize rods)

Retract: 2:1 (for both standard and oversize rods)

(Refer to charts on page 48 for more details)

CYCLE RATES

Extend: Slow to moderate speed
Retract: Slow to moderate speed

NUMBER OF AIR/OIL TANKS: 1

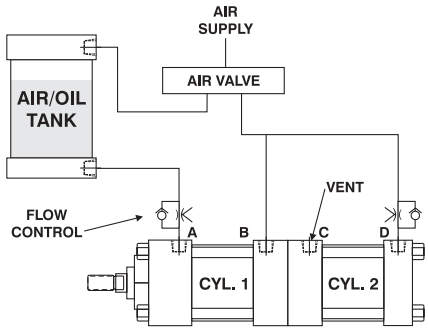
RECOMMENDED TANK SIZE:
130% - 150% of CYL. #1 total volume, filled approximately 50% full.
(Refer to page 42 for ordering information)

DESIGN BENEFITS

- Air to Oil extend ratio is 1:1.
- Compact design (uses one small Air/Oil tank).
- Greater range of speed control at slow speed.
- More economical design.

SCHEMATIC "C"

ACTUATION SEQUENCE:
PRESSURE TO PORTS 'B' & 'D' EXTENDS CYLINDER
PRESSURE TO PORT 'A' RETRACTS CYLINDER



AIR TO OIL RATIO

Extend: 1.8:1 or greater (standard rod)
1.4:1 or greater (oversize rod)

Retract: 1:1 (for both standard and oversize rods)

(Refer to charts on page 48 for more details)

CYCLE RATES

Extend: Moderate to high speed
Retract: Slow to moderate speed

NUMBER OF AIR/OIL TANKS: 1

RECOMMENDED TANK SIZE:
130% - 150% of CYL. #1 total volume, filled approximately 80% full.
(Refer to page 42 for ordering information)

DESIGN BENEFITS

- Highest cylinder force in extend stroke, moderate cylinder force in retract stroke.
- Compact design (uses one full size Air/Oil tank).
- Economical design.

Note: Air directional control valves, flow controls, fittings and tubing not provided. Order separately from your local distributor.
Refer to page 100 to order Air/Oil tanks (A/T).

Preliminary

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TANDEM CYLINDERS: TECHNICAL DATA

FORCE CHARTS

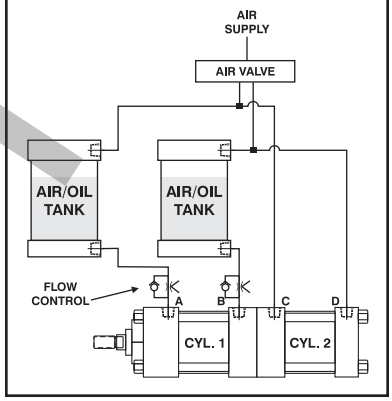
SCHEMATIC "A" - TANDEM CYLINDER THEORETICAL* FORCE CHART

BORE	ROD	EXTEND EFFECTIVE PISTON AREA (IN/SQ.)	RETRACT EFFECTIVE PISTON AREA (IN/SQ.)	EXTEND FORCE AT 100 PSI (IN POUNDS)	RETRACT FORCE AT 100 PSI (IN POUNDS)	MAXIMUM AIR INLET PRESSURE	EXTEND OIL/AIR RATIO	RETRACT OIL/AIR RATIO
1½	⅝	3.227	2.920	323	292	181	1.83	2.00
	1	2.749	1.964	275	196	143	1.56	2.00
2	⅝	5.977	5.670	598	567	190	1.90	2.00
	1	5.499	4.714	550	471	171	1.75	2.00
2½	⅝	9.511	9.204	951	920	194	1.94	2.00
	1	9.033	8.248	903	825	183	1.84	2.00
3¼	1	15.807	15.022	1581	1502	190	1.91	2.00
	1⅜	15.107	13.622	1511	1362	180	1.82	2.00
4	1	24.347	23.562	2435	2356	194	1.94	2.00
	1⅜	23.647	22.162	2365	2216	187	1.88	2.00
5	1	38.485	37.700	3849	3770	196	1.96	2.00
	1⅜	37.785	36.300	3779	3630	192	1.92	2.00
6	1⅜	55.063	53.578	5506	5358	195	1.95	2.00
	1¾	54.143	51.738	5414	5174	191	1.91	2.00
8	1⅜	99.045	97.560	9905	9756	197	1.97	2.00
	1¾	98.125	95.720	9813	9572	195	1.95	2.00

*Theoretical force only. Actual net force will be reduced by seal friction.

SCHEMATIC "A"

ACTUATION SEQUENCE:
PRESSURE TO PORTS 'B' & 'D' EXTENDS CYLINDER
PRESSURE TO PORTS 'A' & 'C' RETRACTS CYLINDER



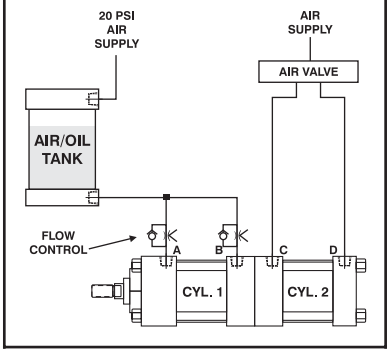
SCHEMATIC "B" - TANDEM CYLINDER THEORETICAL* FORCE CHART

BORE	ROD	EXTEND EFFECTIVE PISTON AREA (IN/SQ.)	RETRACT EFFECTIVE PISTON AREA (IN/SQ.)	EXTEND FORCE AT 100 PSI (IN POUNDS)	RETRACT FORCE AT 100 PSI (IN POUNDS)	MAXIMUM AIR INLET PRESSURE	EXTEND OIL/AIR RATIO	RETRACT OIL/AIR RATIO
1½	⅝	1.767	1.460	177	146	250	1.00	1.00
	1	1.767	0.982	177	98	222	1.00	1.00
2	⅝	3.142	2.835	314	284	250	1.00	1.00
	1	3.142	2.357	314	236	250	1.00	1.00
2½	⅝	4.909	4.602	491	460	250	1.00	1.00
	1	4.909	4.124	491	412	250	1.00	1.00
3¼	1	8.296	7.511	830	751	250	1.00	1.00
	1⅜	8.296	6.811	830	681	250	1.00	1.00
4	1	12.566	11.781	1257	1178	250	1.00	1.00
	1⅜	12.566	11.081	1257	1108	250	1.00	1.00
5	1	19.635	18.850	1964	1885	250	1.00	1.00
	1⅜	19.635	18.150	1964	1815	250	1.00	1.00
6	1⅜	28.274	26.789	2827	2679	250	1.00	1.00
	1¾	28.274	25.869	2827	2587	250	1.00	1.00
8	1⅜	50.265	48.780	5027	4878	250	1.00	1.00
	1¾	50.265	47.860	5027	4786	250	1.00	1.00

*Theoretical force only. Actual net force will be reduced by seal friction.

SCHEMATIC "B"

ACTUATION SEQUENCE:
PRESSURE TO PORT 'D' EXTENDS CYLINDER
PRESSURE TO PORT 'C' RETRACTS CYLINDER



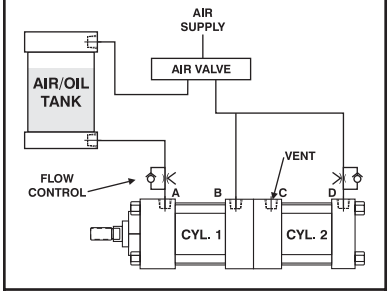
SCHEMATIC "C" - TANDEM CYLINDER THEORETICAL* FORCE CHART

BORE	ROD	EXTEND EFFECTIVE PISTON AREA (IN/SQ.)	RETRACT EFFECTIVE PISTON AREA (IN/SQ.)	EXTEND FORCE AT 100 PSI (IN POUNDS)	RETRACT FORCE AT 100 PSI (IN POUNDS)	MAXIMUM AIR INLET PRESSURE	EXTEND OIL/AIR RATIO	RETRACT OIL/AIR RATIO
1½	⅝	3.227	1.460	323	146	181	1.83	1.00
	1	2.749	0.982	275	98	143	1.56	1.00
2	⅝	5.977	2.835	598	284	190	1.90	1.00
	1	5.499	2.357	550	236	171	1.75	1.00
2½	⅝	9.511	4.602	951	460	194	1.94	1.00
	1	9.033	4.124	903	412	183	1.84	1.00
3¼	1	15.807	7.511	1581	751	190	1.91	1.00
	1⅜	15.107	6.811	1511	681	180	1.82	1.00
4	1	24.347	11.781	2435	1178	194	1.94	1.00
	1⅜	23.647	11.081	2365	1108	187	1.88	1.00
5	1	38.485	18.850	3849	1885	196	1.96	1.00
	1⅜	37.785	18.150	3779	1815	192	1.92	1.00
6	1⅜	55.063	26.789	5506	2679	195	1.95	1.00
	1¾	54.143	25.869	5414	2587	191	1.91	1.00
8	1⅜	99.045	48.780	9905	4878	197	1.97	1.00
	1¾	98.125	47.860	9813	4786	195	1.95	1.00

*Theoretical force only. Actual net force will be reduced by seal friction.

SCHEMATIC "C"

ACTUATION SEQUENCE:
PRESSURE TO PORTS 'B' & 'D' EXTENDS CYLINDER
PRESSURE TO PORT 'A' RETRACTS CYLINDER



Proof