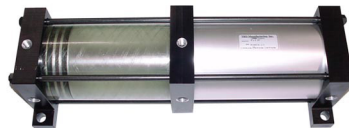




BTB Series, 3P Series, and TM Series

Bimba's Back-to-Back (BTB), Three Position (3P), and Air/Oil Tandem (TM) cylinders provide a variety of NFPA-compliant, multi-position, multi-power options to adapt to your pneumatic application needs.



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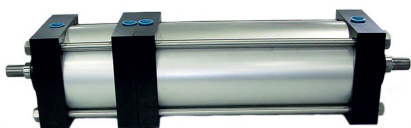
Back-To-Back Cylinders

You can back-to-back any cylinder series together, mixed or matched, to provide unlimited design possibilities. Back-to-Back series cylinders (BTB) consist of two individual cylinders having common bore sizes, built as one unit utilizing common tie-rods. Mounts include a full range of base, flange, 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 Options for stop tube considerations in combined strokes over 40 inches.



Special Long Cap with Common Cap Port ('FM' Series)



Standard BTB Design ('TA' Series)



Standard BTB Design ('TA' Series with '3P' Option)

1. Multiple Position Cylinder – The BTB series design creates a true four-position cylinder. By varying stroke lengths, a multitude of positions can be created. For example: CYL 1 has a 1" stroke and CYL 2 has a 2" stroke. The stroke positions would be 0", 1", 2" and 3" depending on how the cylinder is cycled.

2. Hard Position Stops – Unlike a 3-Position series cylinder (3P), a BTB cylinder provides hard stop positioning.

Note: 3P 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.

3. Economical Design – The BTB series design uses standard parts, reducing overall costs and follows Bimba's industry-leading delivery schedule.

Back-to-Back Cylinder 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 two (2) separate piston rods. Cylinders operate independently of one another.

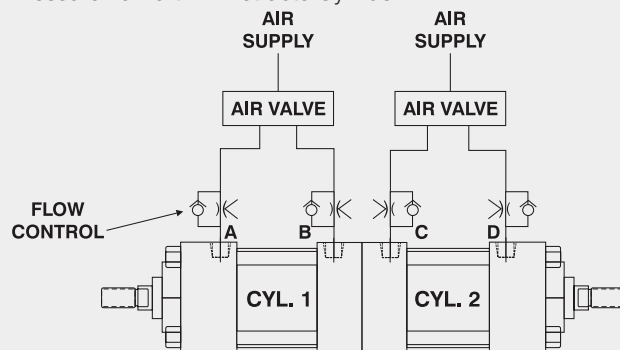
Tip: Before ordering, check the air fitting sizes to be sure you have adequate room at the ports "B" and "C" to install fittings. Ports can be rotated on one cylinder or a spacer plate can be added (between cylinder caps) to provide clearance for fittings.

Example: Shown is a back-to-back cylinder with each cylinder operated with an independent air valve & two (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.



How to Order

BTB, 3P, AND TM SERIES NFPA CYLINDERS

78

CYL. #1 CYL. #2

BTB - TA - MS4 - 2 x 10 - HC - WITH TA - MX0 - 2 x 5 - MPR - HC

Back-To-Back

Series	
TA	Aluminum
TD	Tough-Duty
SS	Stainless Steel
FM	Flush Mount (Add-A-Mount)
TRA	Triple Rod
TAS	Steel

Bore	Stroke (Cyl. #1)
1.50	0" to 50" Made-To-Order
2.00	
2.50	
3.25	
4.00	
5.00	
6.00	
8.00	

Cushions

H	Adjustable Head Cushion Position 2 Is Standard Specify For Positions: 1, 3 & 4
LH	Long Head Cushion Position 2 Is Standard Specify For Positions: 1, 3 & 4 *
» ELH	Extra Long Head Cushion Position 2 Is Standard Specify For Positions: 1, 3 & 4 *
C	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 *

Options

A	Extended Piston Rod Thread (Example: A = 2")
AS	Adjustable Stroke - Retract (Specify Length, Example: AS = 4")
A0	Air / Oil Piston
» B	.250" Urethane Bumper Both Ends
» BC	.250" Urethane Bumper Cap Only
» BH	.250" Urethane Bumper Head Only
BP	Bumper Piston Seals (1.50" - 8" Bore)
BSPP	British Standard Pipe Taper (Specify Size, Example: BSP = .250")
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSP = .250")
C	Extended Piston Rod (Example: If C = 0.50", Then 1" Rod Extension Is C = 1.50")
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
LT	Low Temperature Seals (LT)
LTE	Low Temperature Extreme Seals (LTE)
MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust W/ Sound Dampening Bumper (12" Max Stroke)
MPR	Magnetic Piston for Reed or Solid State Switches (R10, R10P, RAC, RHT & MSS)
MS	Metallic Rod Scraper (Brass Construction)
NR	Non-Rotating
OP	Optional Port Location (Example: Ports @ 3 & 7)
OS	Oversize Rod Diameter (Specify Size, Example: OS = 1.375")
SAE	SAE Ports (Specify Size, Example: SAE #10)
» SE	Spring Extend (1.50, 2.00, 2.50 Bore)
» SR	Spring Return (1.50, 2.00, 2.50 Bore)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods
» ST	Stop Tube - Specify Stop Tube Length (In Inches) Specify Stroke as ES (Effective Stroke) (Example: TA MS4 2 X 24ES-ST=3)
TMS	Steel Cylinder Tube, Black Epoxy Paint Finish
TH	400 PSI Hydraulic Non-Shock
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

NFPA Mounts

MX0	No Mount
MT1	Front Trunnion
MT2	Rear Trunnion
MX1	Extended Tie Rods - Head & Cap
MX3	Extended Tie Rods (Head)
MF1	Front Flange (1.50"-6.00" Bore)
ME3	Front Mounting Holes (8.00" Bore)
MS1	Front & Rear End Angle
MS2	Side Lug (1.50"-4.00" Std., 5.00" and Above Consult Factory)
MS4	Bottom Tapped Holes (1.50" - 12.00" Bore)

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, 2.00" bore x 10" stroke with head & cap cushions.
Cyl. 2 is a 'TA' series, MX0 (no mount), 2.00" bore x 5" stroke, with a magnet (for Reed Switches) and head and cap cushions.

Part Number:
BTB-TA-MS4-2 x 10-HC with
TA-MX0-2 x 5-HC-MPR

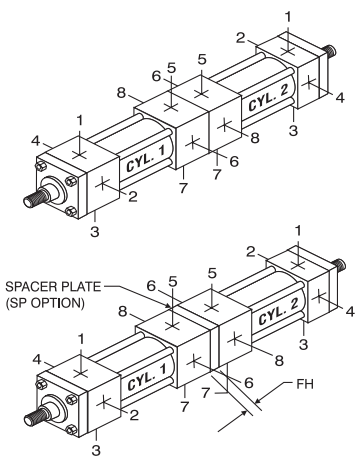
Fixed Cushions

FCH	Fixed Head Cushion (Non-Adjustable, No Adjustment Needle)
FCC	Fixed Cap Cushion (Non-Adjustable, No Adjustment Needle)
FC	Fixed Head and Cap Cushion (Non-Adjustable, No Adjustment Needle)

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

*Not available on 'TRA' series.

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



Note: Refer to Options for specifications
» Adds Length To Cylinder - See "Option Length Adder" Chart

Standard Port and Cushion Adjustment Positions

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

* Ports are in-line when using standard port locations. To add space between ports (for larger air fittings), a spacer plate can be added using the "SP" option. "SP" option will increase overall length by "FH" dimension (see back-to-back flip-out for "FH" 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!

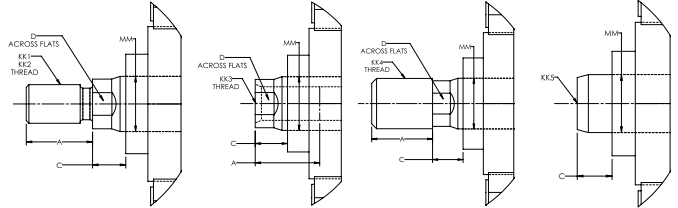
Piston Rod End Styles

Style 1 & 2
KK1 & KK2

Style 3
KK3

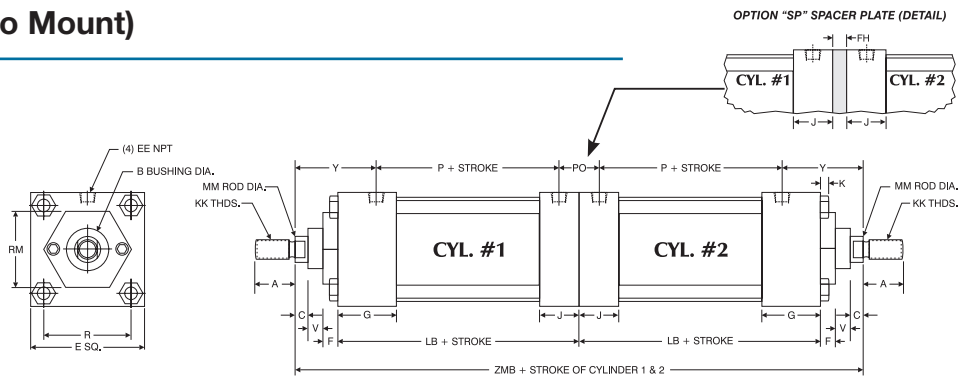
Style 4
KK4

Style 5
KK5



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

MX0/MX0 (No Mount)



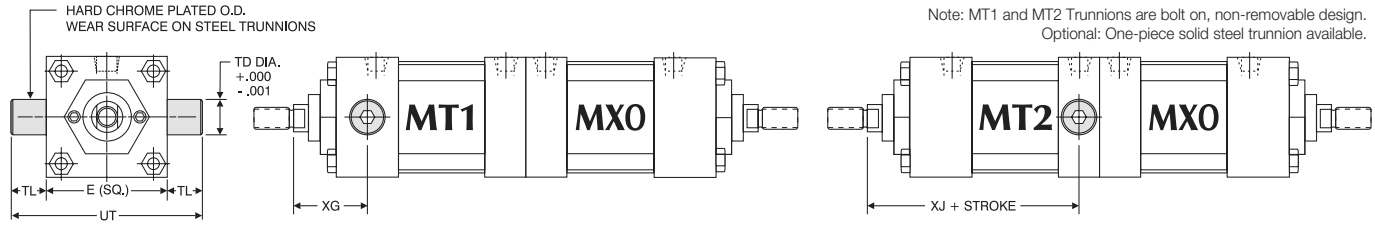
Back-To-Back Basic Dimensions 'MX0' Standard & Oversize Rods

Bore	Rod Diameter (MM)	A	B	C	E	EE	F	FH	G	J	K	KK	LB	P	PO	R	RM	V	Y	ZMB*
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	0.375	1.500	1.000	0.250	7/16 -20	3.625	2.375	0.750	1.438	2.00 SQ.	0.250	1.875	9.250
	1.000 Oversize	1.125	1.500	0.500	2.000	0.375	0.375	0.375	1.500	1.000	0.250	3/4 -16	3.625	2.375	0.750	1.844	2.50 SQ.	0.500	2.250	10.000
2.00	0.625 Standard	0.750	1.125	0.375	2.500	0.375	0.375	0.375	1.500	1.000	0.313	7/16 -20	3.625	2.375	0.750	1.844	1.75 HEX	0.250	1.875	9.250
	1.000 Oversize	1.125	1.500	0.500	2.500	0.375	0.375	0.375	1.500	1.000	0.313	3/4 -16	3.625	2.375	0.750	2.188	2.50 SQ.	0.500	2.250	10.000
2.50	0.625 Standard	0.750	1.125	0.375	3.000	0.375	0.375	0.375	1.500	1.000	0.313	7/16 -20	3.750	2.500	0.750	2.188	1.75 HEX.	0.250	1.875	9.500
	1.000 Oversize	1.125	1.500	0.500	3.000	0.375	0.375	0.375	1.500	1.000	0.313	3/4 -16	3.750	2.500	0.750	2.188	3.00 SQ.	0.500	2.250	10.250
3.25	1.000 Standard	1.125	1.500	0.500	3.750	0.500	0.625	0.625	1.750	1.250	0.375	3/4 -16	4.250	2.750	1.000	2.760	2.75 DIA.	0.250	2.375	11.250
	1.375 Oversize	1.625	2.000	0.625	3.750	0.500	0.625	0.625	1.750	1.250	0.375	1 -14	4.250	2.750	1.000	2.760	3.75 SQ.	0.375	2.625	11.750
4.00	1.000 Standard	1.125	1.500	0.500	4.500	0.500	0.625	0.625	1.750	1.250	0.375	3/4 -16	4.250	2.750	1.000	3.320	2.75 DIA.	0.250	2.375	11.250
	1.375 Oversize	1.625	2.000	0.625	4.500	0.500	0.625	0.625	1.750	1.250	0.375	1 -14	4.250	2.750	1.000	3.320	3.50 DIA.	0.375	2.625	11.750
5.00	1.000 Standard	1.125	1.500	0.500	5.500	0.500	0.625	0.625	1.750	1.250	0.438	3/4 -16	4.500	3.000	1.000	4.100	2.75 DIA.	0.250	2.375	11.750
	1.375 Oversize	1.625	2.000	0.625	5.500	0.500	0.625	0.625	1.750	1.250	0.438	1 -14	4.500	3.000	1.000	4.100	3.50 DIA.	0.375	2.625	12.250
6.00	1.375 Standard	1.625	2.000	0.625	6.500	0.750	0.625	0.750	2.000	1.500	0.438	1 -14	5.000	3.250	1.250	4.875	3.50 DIA.	0.375	2.750	13.250
	1.750 Oversize	2.000	2.375	0.750	6.500	0.750	0.625	0.750	2.000	1.500	0.438	1 1/4 -12	5.000	3.250	1.250	4.875	3.50 DIA.	0.500	3.000	13.750
8.00	1.375 Standard	1.625	2.000	0.625	8.500	0.750	0.625	—	2.000	1.500	0.563	1 -14	5.125	3.375	1.250	6.438	3.50 DIA.	0.375	2.750	13.500
	1.750 Oversize	2.000	2.375	0.750	8.500	0.750	0.625	—	2.000	1.500	0.563	1 1/4 -12	5.125	3.375	1.250	6.438	3.50 DIA.	0.500	3.000	14.000

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

How To Specify

Back-To-Back Dimensions: Pivot Mounts



MT1/MT2

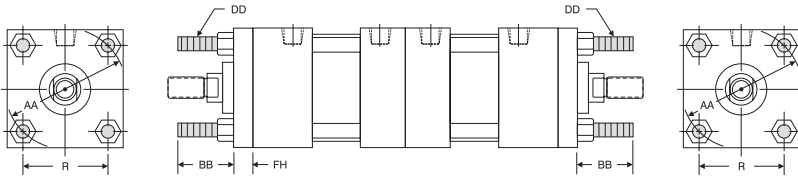
'MT1' Head Trunnion and 'MT2' Cap Trunnion Mount Dimensions

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

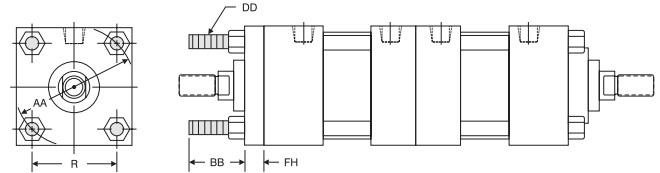
*No oversize rod available on 1.50" bore MT1.

Tie Rod & Flange Mounts

MX1



MX3/MX0

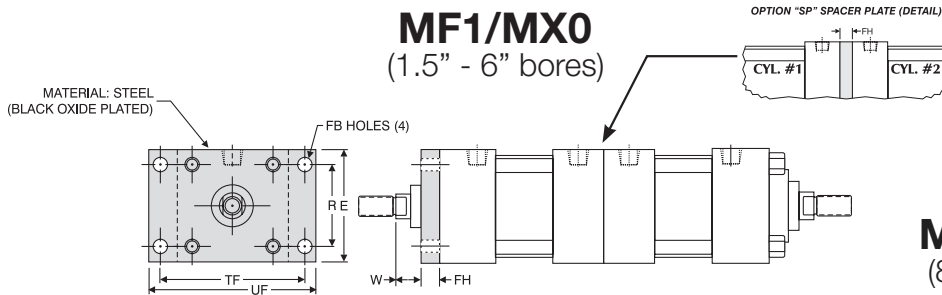


Tie Rod Extended 'MX1' & 'MX3' Mount Dimensions						
Bore	Rod Diameter	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4-28	0.375	1.438
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16-24	0.375	1.844
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16-24	0.375	2.188
	1.000 Oversize					
3.25	1.000 Standard	3.900	1.375	3/8-24	0.625	2.760
	1.375 Oversize					

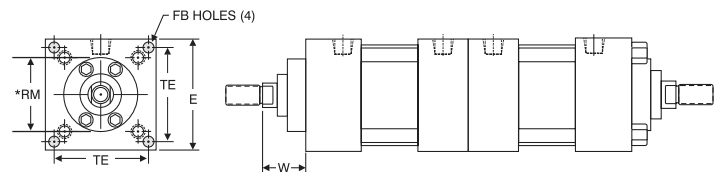
Tie Rod Extended 'MX1' & 'MX3' Mount Dimensions						
Bore	Rod Diameter	AA	BB	DD	FH	R
4.00	1.000 Standard	4.700	1.375	3/8-24	0.625	3.320
	1.375 Oversize					
5.00	1.000 Standard	5.800	1.813	1/2-20	0.625	4.100
	1.375 Oversize					
6.00	1.375 Standard	6.900	1.813	1/2-20	0.750	4.875
	1.750 Oversize					
8.00	1.375 Standard	9.100	2.313**	5/8-18	0.625*	6.438
	1.750 Oversize					

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

MF1/MX0 (1.5" - 6" bores)



ME3/MX0 (8" bore only)



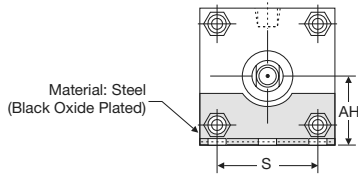
'MF1' Flange & 'ME3' Cap Mount Dimensions										
Bore	Rod Diameter	E	FB	FH	R	RM	TE	TF	UF	W
1.50	0.625 Standard	2.000	0.313	0.357	1.438	—	—	2.750	3.375	0.625
	1.000 Oversize									1.000
2.00	0.625 Standard	2.500	0.375	0.375	1.844	—	—	3.375	4.125	0.625
	1.000 Oversize									1.000
2.50	0.625 Standard	3.000	0.375	0.375	2.188	—	—	3.875	4.625	0.625
	1.000 Oversize									1.000
3.25	1.000 Standard	3.750	0.438	0.625	2.760	—	—	4.688	5.500	0.750
	1.375 Oversize									1.000

'MF1' Flange & 'ME3' Cap Mount Dimensions										
Bore	Rod Diameter	E	FB	FH	R	RM	TE	TF	UF	W
4.00	1.000 Standard	4.500	0.438	0.625	3.320	—	—	5.438	6.250	0.750
	1.375 Oversize									1.000
5.00	1.000 Standard	5.500	0.563	0.625	4.100	—	—	6.625	7.625	0.750
	1.375 Oversize									1.000
6.00	1.375 Standard	6.500	0.563	0.750	4.875	—	—	7.625	8.625	0.875
	1.750 Oversize									1.125
8.00	1.375 Standard	8.500	0.688	N/A	N/A	3.500*	7.570	N/A	N/A	1.625
	1.750 Oversize									1.875

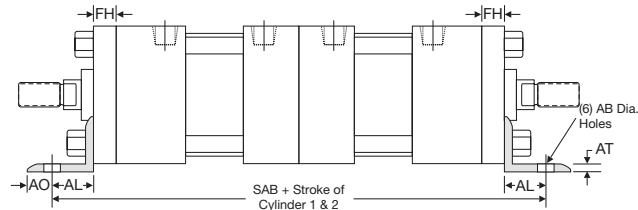
*Round retainer used to retain bushing.

How To Specify

Base Mounts



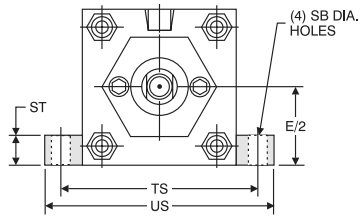
MS1



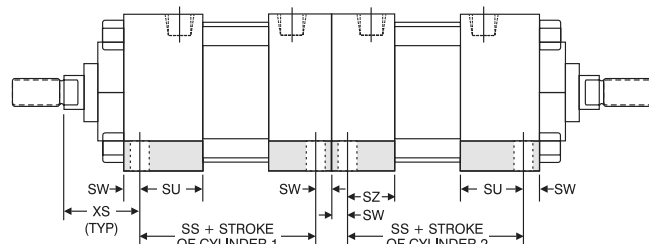
*3.50" diameter round retainer on 8.00" bore.

'MS1' Angle Mount Dimensions

Bore	Rod Diameter	AB	AH	AL	AO	AT	FH	S	Add Stroke	
									SAB	
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.125	0.375	1.250	10.000	
	1.000 Oversize									
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.125	0.375	1.750	10.000	
	1.000 Oversize									
2.50	0.625 Standard	0.438	1.625	1.000	0.375	0.125	0.375	2.250	10.250	
	1.000 Oversize									
3.25	1.000 Standard	0.563	1.938	1.250	0.500	0.125	0.625	2.750	12.250	
	1.375 Oversize									
4.00	1.000 Standard	0.563	2.250	1.250	0.500	0.125	0.625	3.500	12.250	
	1.375 Oversize									
5.00	1.000 Standard	0.688	2.750	1.375	0.625	0.188	0.625	4.250	13.000	
	1.375 Oversize									
6.00	1.375 Standard	0.813	3.250	1.375	0.625	0.188	0.750	5.250	14.250	
	1.750 Oversize									
8.00	1.375 Standard	0.813	4.250	1.813	0.688	0.250	0.625*	7.125	13.875	
	1.750 Oversize									



MS2

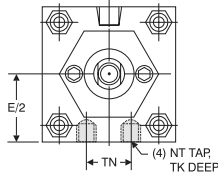


Note: The option not to have side lugs on center two (2) caps is available.
 Use the "XX" option in the "How To Order" section (specify).
 Example: BTB-TA-MS2-4 X 5-MPR with TA-MS2-4 X 3-BP-"XX"
 "XX" = No side lugs on center two (2) caps

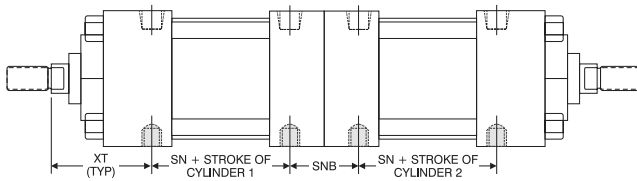
'MS2' Side Lug Mount Dimensions

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

Base Mounts



MS4



Note: The option not to have 'MS4' taps on center two (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 two (2) caps

'MS4' Bottom Tapped Mount Dimensions								
Bore	Rod Diameter	E/2	NT	TK	TN	XT	SNB	Add Stroke SN
1.50	0.625 Standard	1.000	1/4-20	0.375	0.625	1.938	0.875	2.250
	1.000 Oversize					2.313		
2.00	0.625 Standard	1.250	5/16-18	0.500	0.875	1.938	0.875	2.250
	1.000 Oversize					2.313		
2.50	0.625 Standard	1.500	3/8-16	0.625	1.250	1.938	0.875	2.375
	1.000 Oversize					2.313		
3.25	1.000 Standard	1.875	1/2-13	0.750	1.500	2.438	1.125	2.625
	1.375 Oversize					2.688		
4.00	1.000 Standard	2.250	1/2-13	0.750	2.063	2.438	1.125	2.625
	1.375 Oversize					2.688		
5.00	1.000 Standard	2.750	5/8-11	1.000	2.688	2.438	1.125	2.875
	1.375 Oversize					2.688		
6.00	1.375 Standard	3.250	3/4-10	1.125	3.250	2.813	1.375	3.125
	1.750 Oversize					3.063		
8.00	1.375 Standard	4.250	3/4-10	1.125	4.500	2.813	1.375	3.250
	1.750 Oversize					3.063		

Product Features

3-Position Cylinders

You can create a 3-Position (3P) cylinder from any single stage series of cylinder (Note: not available on multi-stage products). 3P cylinders consist of multiple cylinders built as one unit having ONE exposed working rod end, capable of delivering three rod positions.



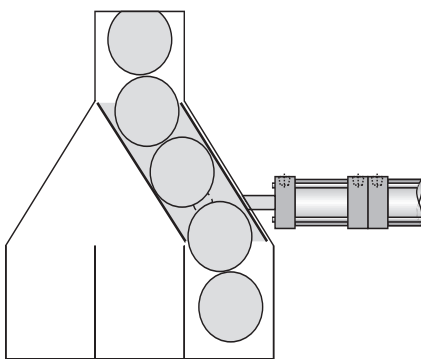
1. Three Positions In One Cylinder – One cylinder produces three different rod end positions. By varying stroke lengths, a multitude of positions can be created.

2. Simplifies Machine Designs – Eliminates the need for an additional cylinder to create a third position. 3P cylinders reduce space and the cost to mount multiple cylinders.

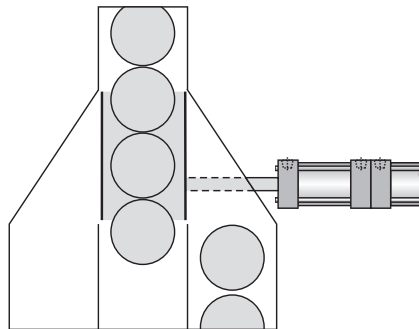
Application Possibilities

Lane Diverter With Three Lanes

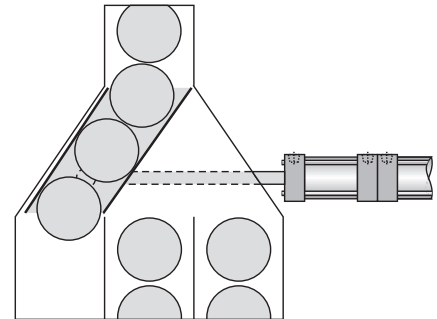
POSITION 1:
RETRACT: FILL FIRST LANE



POSITION 2:
MID-STROKE: FILL SECOND LANE



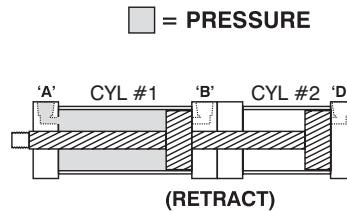
POSITION 3:
EXTEND: FILL THIRD LANE



How 3-Position Cylinders Work

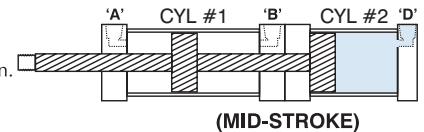
POSITION 1 (RETRACT)

Pressure to port 'A' fully retracts cylinder.



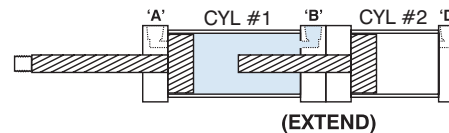
POSITION 2 (MID-STROKE)

Pressure to port 'D' advances cylinder to mid-stroke position.



POSITION 3 (EXTEND)

Pressure to port 'B' fully extends cylinder.



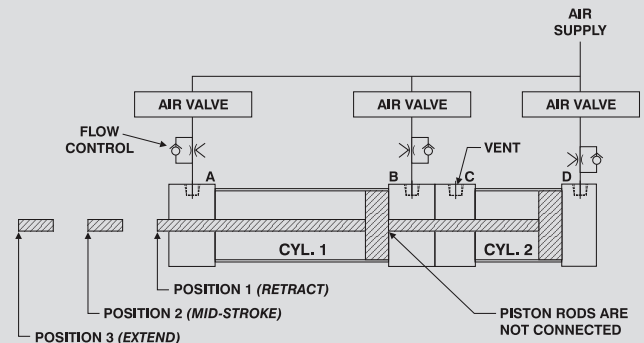
Design Tips

- > Order CYL 1 with "MPR" (magnetic piston option) and use three switches to sense each stroke position. See Switches 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.
- > For non-rotating applications, you can use a "NR" (non-rotating option) or Triple Rod cylinder series (TRA) as CYL 1 and a standard 'TA' series as CYL 2.

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 three-way air solenoid valves and flow controls can operate a three-position cylinder. See your local Bimba distributor for help in designing an air circuit that's right for your application.

How to Order

BTB, 3P, AND TM SERIES NFPA CYLINDERS

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CYL. #1 **3P - TA - MS4 - 2 x 10 - H - MPR** WITH CYL. #2 **TA - MX0 - 2 x 5 - MPR**

3-Position

Series

TA	Aluminum
TD	Tough-Duty
SS	Stainless Steel
FM	Flush Mount (Add-A-Mount)
TRA	Triple Rod (Cyl. #1 only)
TAS	Steel

Bore

1.50
2.00
2.50
3.25
4.00
5.00
6.00
8.00

Total Stroke Extend (CYL. #1)

0" to 50"
Made-To-Order

Mid-Stroke

Options

A	Extended Piston Rod Thread (Example: A= 2")
AS	Adjustable Stroke - Retract (Specify Length, Example: As = 4")
A0	Air/Oil Piston
» B	.25" Urethane Bumper Both Ends
» BC	.25" Urethane Bumper Cap Only
» BH	.25" Urethane Bumper Head Only
BP	Bumper Piston Seals (1.50" - 8.00" Bore)
BSP	British Standard Pipe Taper (Specify Size, Example: BSP = .25")
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSP = .25")
C	Extended Piston Rod (Example: If C= 0.50" Then 1" Rod Extension Is C= 1.50")
EK	Extended Key Plate
KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3M	Female Metric Rod Thread
KK3S	Studded Piston Rod (KK3 With Stud, Loctite In Place)
KK3X	Female Special Thread
KK4	Full Diameter Male Rod Thread
KK5	Blank Rod End (No Threads, "A" = 0")
KK10	Rod Coupler End
KKM	Male Metric Thread
KKX	Male Special Thread
LF	Low Friction Seals
LT	Low Temperature Seals (Temp Rating: -30°F To 200°F)
LTE	Low Temperature Extreme Seals (Temp Rating: -65°F To 200°F)
MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust With Sound Dampening Bumper (12" Max Stroke)
MPR	Magnetic Piston For Reed Or Solid State Switches - Bimba Models: R10, R10P, RAC, RHT & MSS
MS	Metallic Rod Scraper (Brass Construction)
NR	Non-Rotating
OP	Optional Port Location (Example: Ports @ 3 & 7)
OS	Oversize Rod Diameter (Specify Size, Example: OS = 1.375")
SAE	SAE Ports (Specify Size, Example: SAE #10)
» SE	Spring Extend (Consult Factory)
» SR	Spring Return (1.50", 2.00, 2.50" Bore)
SSA	Stainless Steel Piston Rod, Tie Rods & Nuts And Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods
ST	Stop Tube - Specify Stop Tube Length (Inches) Specify Stroke As Es (Effective Stroke) (Example: TA-MS4 2 X 24 ES-ST=3)
TMS	Steel Cylinder Tube, Black Epoxy Paint Finish
TH	400 PSI Hydraulic Non-Shock
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

NFPA Mounts

MX0	No Mount
MP1	Rear Pivot Clevis (Cyl. 2 Only)
MP2	Rear Pivot Clevis (1.50"-6.00" Bore) (Cyl. 2 Only)
MP4	Rear Pivot Eye (1.50" - 4.00" 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 (1.50"-6.00") (Cyl. 1 Only)
MF2	Rear Flange (1.50"-6.00") (Cyl. 2 Only)
ME3	Front Mounting Holes (8.00") (Cyl. 1 Only)
ME4	Rear Mounting Holes (8.00") (Cyl. 2 Only)
MS1	Front & Rear End Foot
MS2	Side Lug (1.50"-8.00")
MS4	Bottom Tapped Holes

Cushions

H	Adjustable Head Cushion Position 2 is Standard Specify For Positions: 1, 3 & 4
LH	Long Head Cushion Position 2 is Standard Specify For Positions: 1, 3 & 4
» ELH	Extra Long Head Cushion Position 2 is Standard Specify For Positions: 1, 3 & 4
C	Adjustable Cap Cushion ¹ Position 6 is Standard Specify For Positions: 5, 7 & 8
LC	Adjustable Long Cap Cushion ² Position 6 is Standard Specify For Positions: 5, 7 & 8
» ELC	Adjustable Extra Long Cap Cushion ² Position 6 is Standard Specify For Positions: 5, 7 & 8

Fixed Cushions

FCH	Fixed Head Cushion (Non-Adjustable (No Adjustment Needle))
FCC	Fixed Cap Cushion (Non-Adjustable (No Adjustment Needle))
FC	Fixed Head and Cap Cushion (Non-Adjustable, No Adjustment Needle)

Note: "L" and "EL" Cushion Options Can Be Ordered As Fixed Cushions. Example: FCLH, FCEHL

¹ Not available on CYL. #1.
² Long/extra long cushions not available on TRA.

About our Part Number System

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

Example: 3-Position Application calls for a 2.00" 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-MPR with TA-MX0-2 x 5-MPR

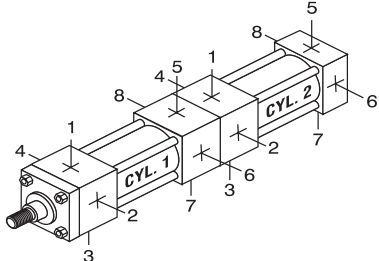
How To Order

3 Position Cylinder:
Position 1 (Full Retract) - This position is always 0.00"
Position 2 (Mid-Stroke) - Total stroke of Cyl. #2
Position 3 (Full-Extend) - Total stroke of Cyl. #1

Multi-Position Model Available
3 Position (Model 3P)
4 Position (Model 4P)
5 Position (Model 5P)
(Consult factory for dimensions on 4P & 5P)

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



* The "Head" port of CYL. 2 can be used as a vent (Single Acting) or powered (Double Acting).

Note: Refer to Options for specifications
» Adds Length To Cylinder - See "Option Length Adder" Chart

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!

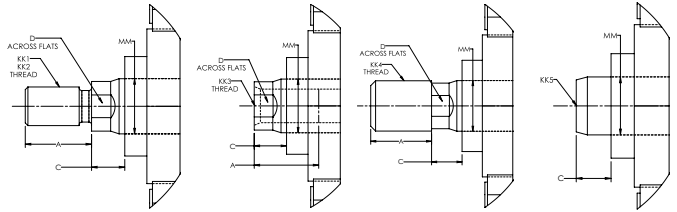
Piston Rod End Styles

Style 1 & 2
KK1 & KK2

Style 3
KK3

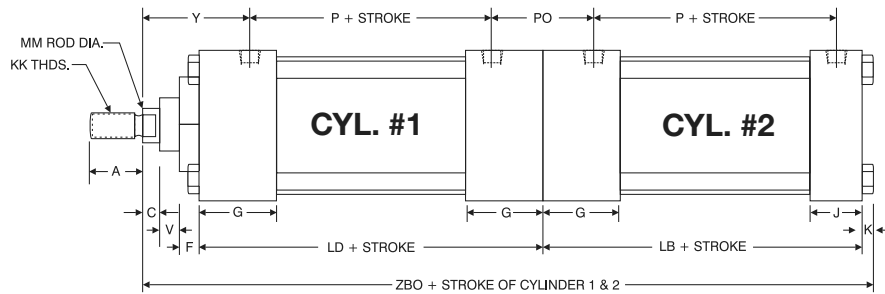
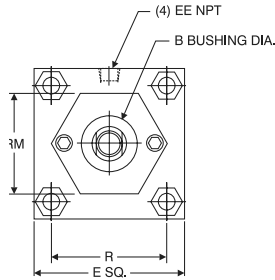
Style 4
KK4

Style 5
KK5



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

MX0/MX0 (No Mount)



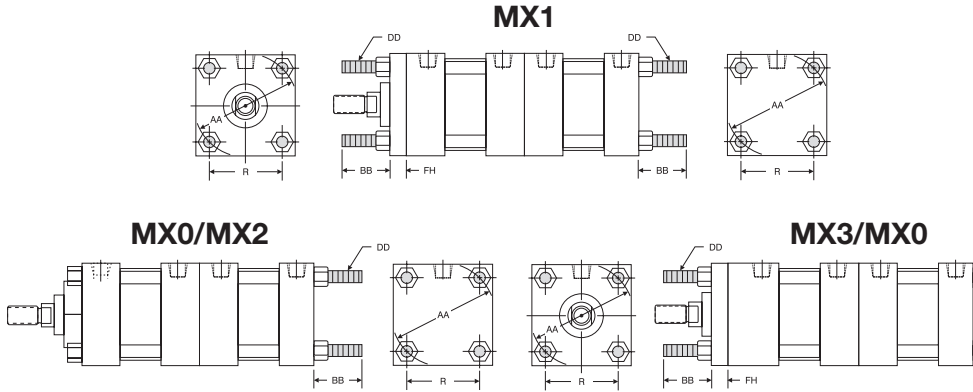
3-Position Basic Dimensions 'MX0' Standard & Oversize Rods

Bore	Rod Diameter (MM)	A	B	C	E	EE	F	G	J	K	KK	LB	LD	P	PO	R	RM	V	Y	ZBO
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16-20	3.625	4.125	2.375	1.750	1.438	2.00 Sq.	0.250	1.875	9.000
	1.000 Oversize	1.125	1.500	0.500							3/4-16						0.500	2.250	9.375	
2.00	0.625 Standard	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	7/16-20	3.625	4.125	2.375	1.750	1.844	1.75 Hex	0.250	1.875	9.063
	1.000 Oversize	1.125	1.500	0.500							3/4-16						2.50 Sq.	0.500	2.250	9.438
2.50	0.625 Standard	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.313	7/16-20	3.750	4.250	2.500	1.750	2.188	1.75 Hex	0.250	1.875	9.313
	1.000 Oversize	1.125	1.500	0.500							3/4-16						3.00 Sq.	0.500	2.250	9.688
3.25	1.000 Standard	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.375	3/4-16	4.250	4.750	2.750	2.000	2.760	2.75 Dia.	0.250	2.375	10.750
	1.375 Oversize	1.625	2.000	0.625							1-14						3.75 Sq.	0.375	2.625	11.000
4.00	1.000 Standard	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.375	3/4-16	4.250	4.750	2.750	2.000	3.320	2.75 Dia.	0.250	2.375	10.750
	1.375 Oversize	1.625	2.000	0.625							1-14						3.50 Dia.	0.375	2.625	11.000
5.00	1.000 Standard	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.438	3/4-16	4.500	5.000	3.000	2.000	4.100	2.75 Dia.	0.250	2.375	11.313
	1.375 Oversize	1.625	2.000	0.625							1-14						3.50 Dia.	0.375	2.625	11.563
6.00	1.375 Standard	1.625	2.000	0.625	6.500	0.750	0.625	2.000	1.500	0.438	1-14	5.000	5.500	3.250	2.250	4.875	3.50 Dia.	0.375	2.750	12.563
	1.750 Oversize	2.000	2.375	0.750							1 1/4-12						0.500	3.000	12.813	
8.00	1.375 Standard	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.500	0.563	1-14	5.125	5.625	3.375	2.250	6.438	3.50 Dia.	0.375	2.750	12.813
	1.750 Oversize	2.000	2.375	0.750							1 1/4-12						0.500	3.000	13.188	

How To Specify

Tie Rod & Flange Mounts

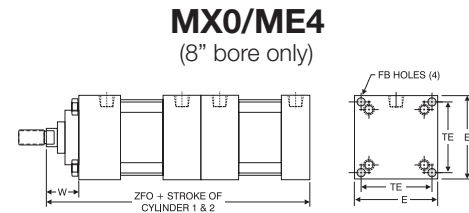
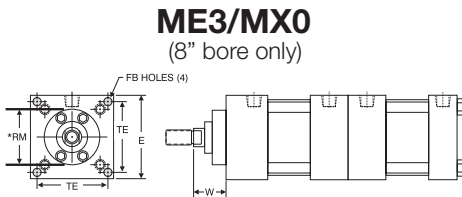
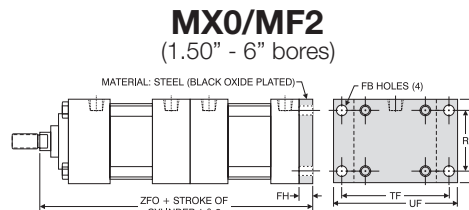
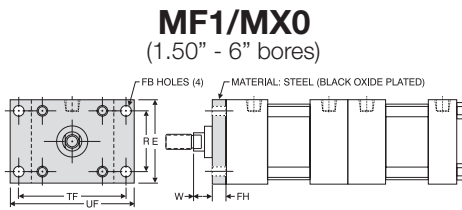
BTB, 3P, AND TM SERIES NFPA CYLINDERS



Bore	Rod Diameter	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4-28	0.375	1.438
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16-24	0.375	1.844
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16-24	0.375	2.188
	1.000 Oversize					
3.25	1.000 Standard	3.900	1.375	3/8-24	0.625	2.766
	1.375 Oversize					

Bore	Rod Diameter	AA	BB	DD	FH	R
4.00	1.000 Standard	4.700	1.375	3/8-24	0.625	3.320
	1.375 Oversize					
5.00	1.000 Standard	5.800	1.813	1/2-20	0.625	4.100
	1.375 Oversize					
6.00	1.375 Standard	6.900	1.813	1/2-20	0.750	4.875
	1.750 Oversize					
8.00	1.375 Standard	9.100	2.313**	5/8-18	0.625*	6.438
	1.750 Oversize					

*MX1 & MX3 have full square bushing retainer on 1.50" - 6.00" bores, round retainers on 8.00" bores.
**BB dimension from head on 8.00" bore.

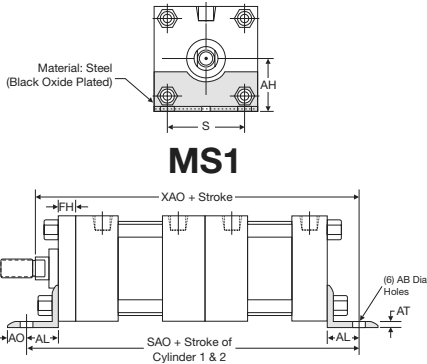


Bore	Rod Diameter	E	FB	FH	R	RM	TE	TF	UF	W	ZFO
1.50	0.625 Standard	2.000	0.313	0.375	1.438	—	—	2.750	3.375	0.625	9.125
	1.000 Oversize									1.000	9.500
2.00	0.625 Standard	2.500	0.375	0.375	1.844	—	—	3.375	4.125	0.625	9.125
	1.000 Oversize									1.000	9.500
2.50	0.625 Standard	3.000	0.375	0.375	2.188	—	—	3.875	4.625	0.625	9.375
	1.000 Oversize									1.000	9.750
3.25	1.000 Standard	3.750	0.438	0.625	2.766	—	—	4.688	5.500	0.750	11.000
	1.375 Oversize									1.000	11.250

Bore	Rod Diameter	E	FB	FH	R	RM	TE	TF	UF	W	ZFO
4.00	1.000 Standard	4.500	0.438	0.625	3.320	—	—	5.438	6.250	0.750	11.000
	1.375 Oversize									1.000	11.250
5.00	1.000 Standard	5.500	0.563	0.625	4.100	—	—	6.625	7.625	0.750	11.500
	1.375 Oversize									1.000	11.750
6.00	1.375 Standard	6.500	0.563	0.750	4.875	—	—	7.625	8.625	0.875	12.875
	1.750 Oversize									1.125	13.125
8.00	1.375 Standard	8.500	0.688	N/A	N/A	3.500*	7.570	N/A	N/A	1.625	12.375
	1.750 Oversize									1.875	12.625

*Round retainer used to retain bushing.
For dimensions not shown, see page 70.

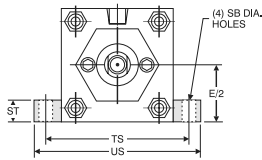
3-Position Dimensions: Base Mounts



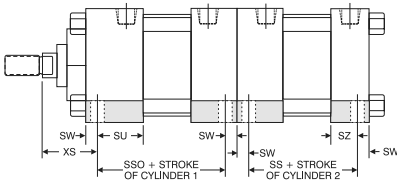
MS1

*Round retainer on 8.00" bore.
For dimensions not shown, see page 70.

'MS1' Angle Mount Dimensions										
Bore	Rod Diameter	AB	AH	AL	AO	AT	FH	S	Add Stroke	
									SAO	XAO
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.125	0.375	1.250	10.125	9.750
	1.000 Oversize									10.125
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.125	0.375	1.750	10.125	9.750
	1.000 Oversize									10.125
2.50	0.625 Standard	0.438	1.625	1.000	0.375	0.125	0.375	2.250	10.375	10.000
	1.000 Oversize									10.375
3.25	1.000 Standard	0.563	1.938	1.250	0.500	0.125	0.625	2.750	12.125	11.625
	1.375 Oversize									11.875
4.00	1.000 Standard	0.563	2.250	1.250	0.500	0.125	0.625	3.500	12.125	11.625
	1.375 Oversize									11.875
5.00	1.000 Standard	0.688	2.750	1.375	0.625	0.188	0.625	4.250	12.875	12.250
	1.375 Oversize									12.500
6.00	1.375 Standard	0.813	3.250	1.375	0.625	0.188	0.750	5.250	14.000	13.500
	1.750 Oversize									13.750
8.00	1.375 Standard	0.813	4.250	1.813	0.688	0.250	0.625*	7.125	14.375	14.188
	1.750 Oversize									14.438

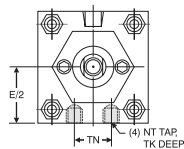


MS2

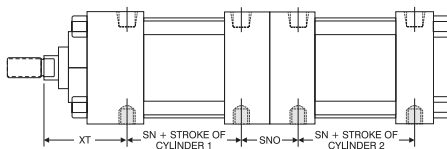


Note: The option not to have side lugs on center two (2) caps is available.
Use the "XX" option in the "How To Order" section (specify).
Example: 3P-TA-MS2-4 X 5-MPR with TA-MS2-4 X 3-BP-"XX"
"XX" = No side lugs on center two (2) caps
For dimensions not shown, see page 70.

'MS2' Side Lug Mount Dimensions												
Bore	Rod Diameter	SB	E/2	ST	SU	SW	SZ	TS	US	XS	Add Stroke	
											SSO	SS
1.50	0.625 Standard	0.438	1.000	0.500	1.125	0.375	0.625	2.750	3.500	1.375	3.375	2.875
	1.000 Oversize											
2.00	0.625 Standard	0.438	1.250	0.500	1.125	0.375	0.625	3.250	4.000	1.375	3.375	2.875
	1.000 Oversize											
2.50	0.625 Standard	0.438	1.500	0.500	1.125	0.375	0.625	3.750	4.500	1.375	3.500	3.000
	1.000 Oversize											
3.25	1.000 Standard	0.563	1.875	0.750	1.250	0.500	0.750	4.750	5.750	1.875	3.750	3.250
	1.375 Oversize											
4.00	1.000 Standard	0.563	2.250	0.750	1.250	0.500	0.750	5.500	6.500	1.875	3.750	3.250
	1.375 Oversize											
5.00	1.000 Standard	0.813	2.750	1.000	1.063	0.688	0.563	6.875	8.250	2.063	3.625	3.125
	1.375 Oversize											
6.00	1.375 Standard	0.813	3.250	1.000	1.313	0.688	0.813	7.875	9.250	2.313	4.125	3.625
	1.750 Oversize											
8.00	1.375 Standard	0.813	4.250	1.000	1.313	0.688	0.813	9.875	11.250	2.313	4.250	3.750
	1.750 Oversize											



MS4

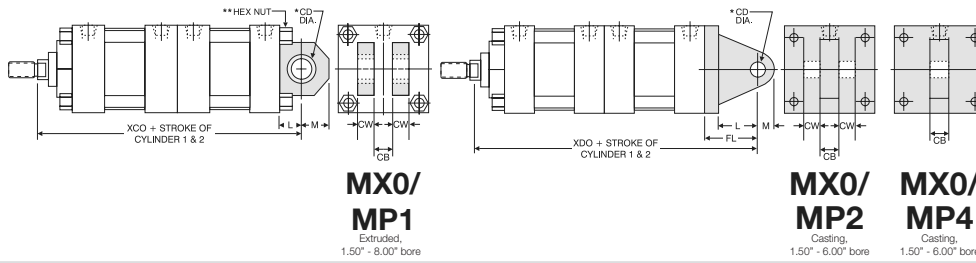


Note: The option not to have 'MS4' taps on center two (2) caps is available.
Use the "XX" option in the "How To Order" section (specify).
Example: 3P-TA-MS4-6 X 7-H with TA-MS4-6 X 4-C-"XX"
"XX" = No 'MS4' taps on center two (2) caps
For dimensions not shown, see page 70.

'MS4' Bottom Tapped Mount Dimensions								
Bore	Rod Diameter	E/2	NT	TK	TN	XT	SNO	Add Stroke
								SN
1.50	0.625 Standard	1.000	1/4 -20	0.375	0.625	1.938	1.875	2.250
	1.000 Oversize							
2.00	0.625 Standard	1.250	5/16 -18	0.500	0.875	1.938	1.875	2.250
	1.000 Oversize							
2.50	0.625 Standard	1.500	3/8 -16	0.625	1.250	1.938	1.875	2.375
	1.000 Oversize							
3.25	1.000 Standard	1.875	1/2 -13	0.750	1.500	2.438	2.125	2.625
	1.375 Oversize							
4.00	1.000 Standard	2.250	1/2 -13	0.750	2.063	2.438	2.125	2.625
	1.375 Oversize							
5.00	1.000 Standard	2.750	5/8 -11	1.000	2.688	2.438	2.125	2.875
	1.375 Oversize							
6.00	1.375 Standard	3.250	3/4 -10	1.125	3.250	2.813	2.375	3.125
	1.750 Oversize							
8.00	1.375 Standard	4.250	3/4 -10	1.125	4.500	2.813	2.375	3.250
	1.750 Oversize							

How To Specify

Pivot Mounts

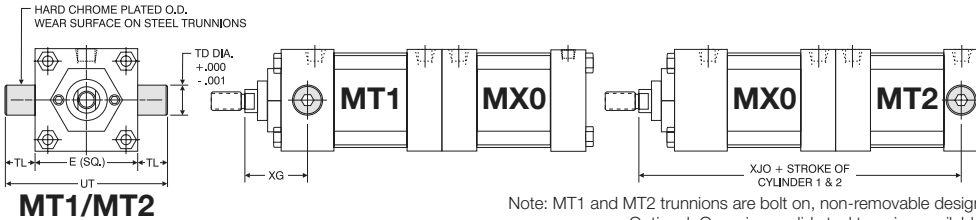


'MP1' & 'MP2' Clevis and 'MP4' Rod Eye Mount Dimensions

Bore	Rod Diameter	CB	CD	CW	FL	L	M	Add Stroke	
								XCO	XDO
1.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	9.500	9.875
	1.000 Oversize							9.875	10.250
2.00	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	9.500	9.875
	1.000 Oversize							9.875	10.250
2.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	9.750	10.125
	1.000 Oversize							10.125	10.500
3.25	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	11.625	12.250
	1.375 Oversize							11.875	12.500
4.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	11.625	12.250
	1.375 Oversize							11.875	12.500
5.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	12.125	12.750
	1.375 Oversize							12.375	13.000
6.00	1.375 Standard	1.500	1.000	0.750	2.250	1.500	1.000	13.625	14.500
	1.750 Oversize							13.875	14.750
8.00	1.375 Standard	1.500	1.000	0.750	N/A	1.500	1.000	13.875	N/A
	1.750 Oversize							14.125	N/A

For dimensions not shown, see page 70.
 *Pin included, two (2) pressed in bearings.
 **Hex nuts are located on cap end (3.25"-8.00" bores).

Note: Extruded MP1 mounts are standard (1.50" - 8.00" bores).
 Cast iron removable mounts are optional and must be requested when ordering (1.50" - 6.00" bores).
 MP4 mount is not available as standard on 5.00" bores and above.



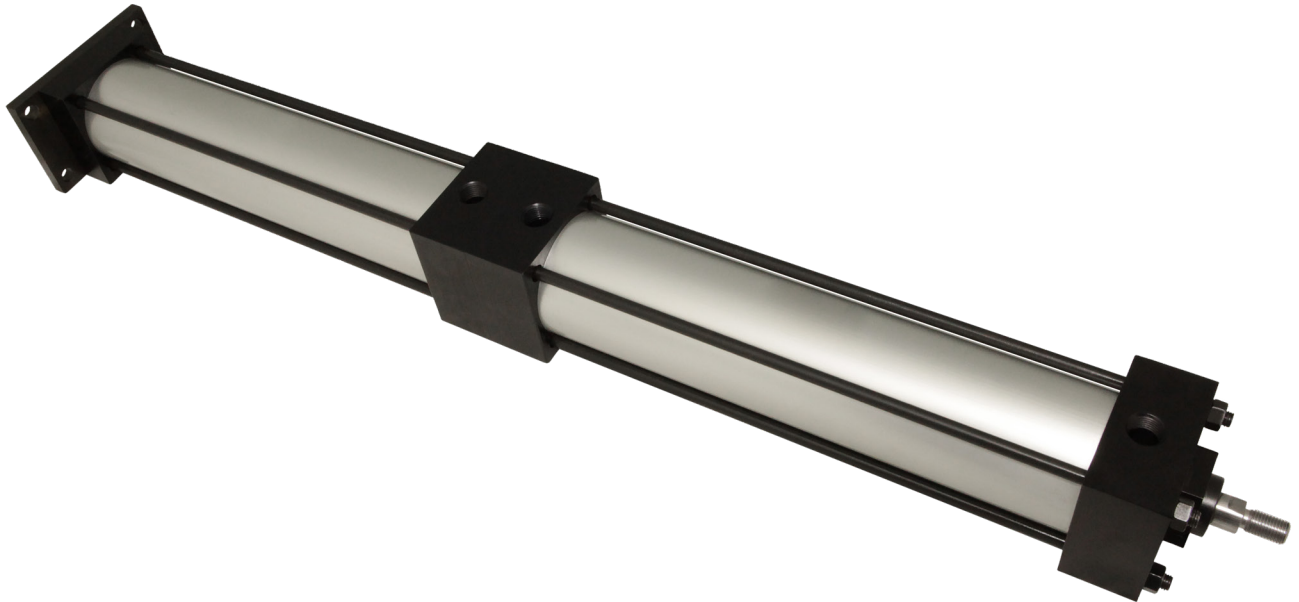
Note: MT1 and MT2 trunnions are bolt on, non-removable design.
 Optional: One-piece solid steel trunnion available.

'MT1' Head Trunnion and 'MT2' Cap Trunnion Mount Dimensions

Bore	Rod Diameter	E	TD	TL	UT	XG	Add Stroke	
							XJO	
1.50	0.625 Standard	2.000	1.000	1.000	4.000	1.750		8.250
	1.000 Oversize						N/A*	8.625
2.00	0.625 Standard	2.500	1.000	1.000	4.500	1.750		8.250
	1.000 Oversize						2.125	8.625
2.50	0.625 Standard	3.000	1.000	1.000	5.000	1.750		8.500
	1.000 Oversize						2.125	8.875
3.25	1.000 Standard	3.750	1.000	1.000	5.750	2.250		9.750
	1.375 Oversize						2.500	10.000
4.00	1.000 Standard	4.500	1.000	1.000	6.500	2.250		9.750
	1.375 Oversize						2.500	10.000
5.00	1.000 Standard	5.500	1.000	1.000	7.500	2.250		10.250
	1.375 Oversize						2.500	10.500
6.00	1.375 Standard	6.500	1.375	1.375	9.250	2.625		11.375
	1.750 Oversize						2.875	11.625
8.00	1.375 Standard	8.500	1.375	1.375	11.250	2.625		11.625
	1.750 Oversize						2.875	11.875

*No oversize rod available on 1.50" bore MT1.
 For dimensions not shown, see page 70.

Air/Oil Tandem Cylinders



You can tandem any cylinder series together in order 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 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 air cylinders will typically chatter.
- > **Smooth Operation In Pivot Applications** – Pivot applications usually have varying loads throughout the stroke. Typically, you are supporting a load until 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 a variety of 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 it Works

Schematics

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

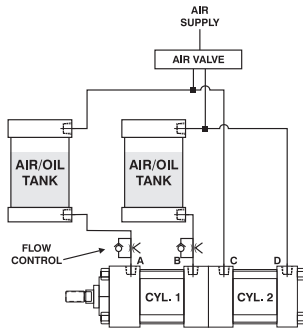
In each application, a 'TA' Series (with "TH" option - 400 max. PSI Hyd.) is used in tandem with a 'TA' Series (250 max* PSI air) cylinder. CYL. #1 represents the 'TH' Option and CYL. #2 represents the 'TA' Series.

*Tandem cylinders are designed and built with piston rods connected. Cylinders operate as one unit.
Refer to page 80 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 80 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 74 For Ordering Information)

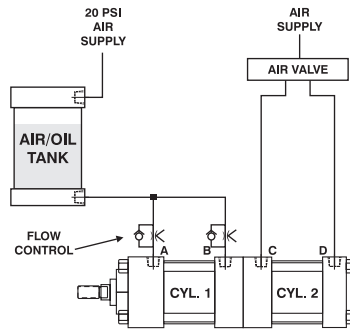
Design Benefits

- > 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 80 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 74 For Ordering Information)

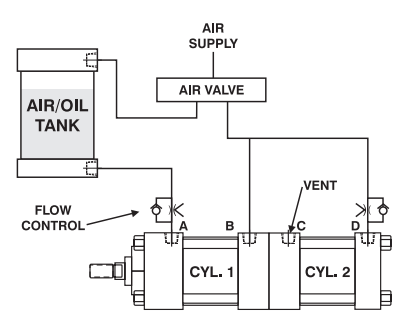
Design Benefits

- > 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 80 For More Details)

Cycle Rates

Extend: Moderate To High Speed
Retract: Slow To Moderate Speed

Number Of Air/Oil Tanks: 2

Recommended Tank Size:

130% - 150% Of Cyl. #1 Total Volume, Filled Approximately 80% Full.

(Refer To Page 74 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.

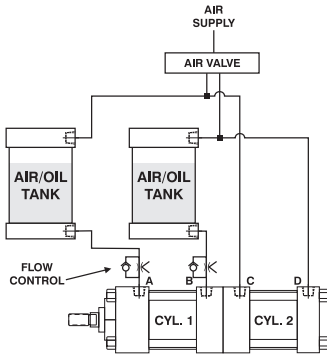
Note: Air directional control valves, flow controls, fittings and tubing not provided. Order separately from your local distributor.
Refer Air/Oil tanks (AT) on page 213.

Force Charts

Schematic A

Actuation Sequence:

Pressure To Ports 'B' & 'D' Extends Cylinder
Pressure To Ports 'A' & 'C' Retracts Cylinder

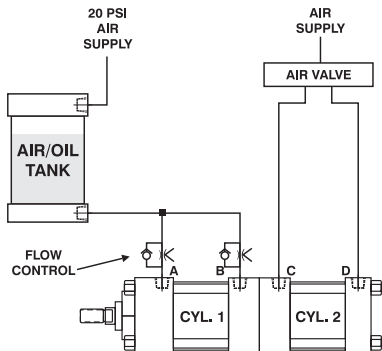


Bore	Rod Dia.	Extend Effective Piston Area (In/Sq.)	Retract Effective Piston Area (In/Sq.)	Extend Force At 100 PSI (In Pounds)	Retract Force At 100 PSI (In Pounds)	Maximum Air Inlet Pressure	Extend Oil/Air Ratio	Retract Oil/Air Ratio
1.50	0.625	3.227	2.920	323	292	181	1.83	2.00
	1.000	2.749	1.964	275	196	143	1.56	2.00
2.00	0.625	5.977	5.670	598	567	190	1.90	2.00
	1.000	5.499	4.714	550	471	171	1.75	2.00
2.50	0.625	9.511	9.204	951	920	194	1.94	2.00
	1.000	9.033	8.248	903	825	183	1.84	2.00
3.25	1.000	15.807	15.022	1581	1502	190	1.91	2.00
	1.375	15.107	13.622	1511	1362	180	1.82	2.00
4.00	1.000	24.347	23.562	2435	2356	194	1.94	2.00
	1.375	23.647	22.162	2365	2216	187	1.88	2.00
5.00	1.000	38.485	37.700	3849	3770	196	1.96	2.00
	1.375	37.785	36.300	3779	3630	192	1.92	2.00
6.00	1.375	55.063	53.578	5506	5358	195	1.95	2.00
	1.750	54.143	51.738	5414	5174	191	1.91	2.00
8.00	1.375	99.045	97.560	9905	9756	197	1.97	2.00
	1.750	98.125	95.720	9813	9572	195	1.95	2.00

Schematic B

Actuation Sequence:

Pressure To Port 'D' Extends Cylinder
Pressure To Port 'C' Retracts Cylinder

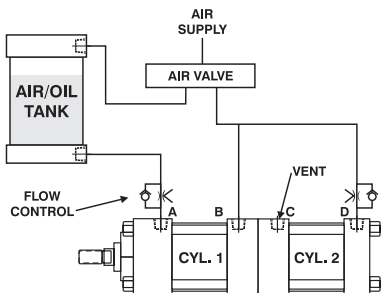


Bore	Rod Dia.	Extend Effective Piston Area (In/Sq.)	Retract Effective Piston Area (In/Sq.)	Extend Force At 100 PSI (In Pounds)	Retract Force At 100 PSI (In Pounds)	Maximum Air Inlet Pressure	Extend Oil/Air Ratio	Retract Oil/Air Ratio
1.50	0.625	1.767	1.460	177	146	250	1.00	1.00
	1.000	1.767	0.982	177	98	222	1.00	1.00
2.00	0.625	3.142	2.835	314	284	250	1.00	1.00
	1.000	3.142	2.357	314	236	250	1.00	1.00
2.50	0.625	4.909	4.602	491	460	250	1.00	1.00
	1.000	4.909	4.124	491	412	250	1.00	1.00
3.25	1.000	8.296	7.511	830	751	250	1.00	1.00
	1.375	8.296	6.811	830	681	250	1.00	1.00
4.00	1.000	12.566	11.781	1257	1178	250	1.00	1.00
	1.375	12.566	11.081	1257	1108	250	1.00	1.00
5.00	1.000	19.635	18.850	1964	1885	250	1.00	1.00
	1.375	19.635	18.150	1964	1815	250	1.00	1.00
6.00	1.375	28.274	26.789	2827	2679	250	1.00	1.00
	1.750	28.274	25.869	2827	2587	250	1.00	1.00
8.00	1.375	50.265	48.780	5027	4878	250	1.00	1.00
	1.750	50.265	47.860	5027	4786	250	1.00	1.00

Schematic C

Actuation Sequence:

Pressure To Ports 'B' & 'D' Extends Cylinder
Pressure To Port 'A' Retracts Cylinder



Bore	Rod Dia.	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
1.50	0.625	3.227	1.460	323	146	181	1.83	1.00
	1.000	2.749	0.982	275	98	143	1.56	1.00
2.00	0.625	5.977	2.835	598	284	190	1.90	1.00
	1.000	5.499	2.357	550	236	171	1.75	1.00
2.50	0.625	9.511	4.602	951	460	194	1.94	1.00
	1.000	9.033	4.124	903	412	183	1.84	1.00
3.25	1.000	15.807	7.511	1581	751	190	1.91	1.00
	1.375	15.107	6.811	1511	681	180	1.82	1.00
4.00	1.000	24.347	11.781	2435	1178	194	1.94	1.00
	1.375	23.647	11.081	2365	1108	187	1.88	1.00
5.00	1.000	38.485	18.850	3849	1885	196	1.96	1.00
	1.375	37.785	18.150	3779	1815	192	1.92	1.00
6.00	1.375	55.063	26.789	5506	2679	195	1.95	1.00
	1.750	54.143	25.869	5414	2587	191	1.91	1.00
8.00	1.375	99.045	48.780	9905	4878	197	1.97	1.00
	1.750	98.125	47.860	9813	4786	195	1.95	1.00

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

How to Order

CYL. #1

CYL. #2

TM - TA - MF1 - 2 x 10 - TH WITH TA - MX0 - 2 x 10 - MPR - HC

Tandem

Series	
TA	250 PSI Air, Aluminum
SS	Stainless Steel
FM	Flush Mount (Add-A-Mount)
TRA	Triple Rod (Cyl. #1 Only)
TAS	250 PSI Air, Steel

Bore

- 1.50
- 2.00
- 2.50
- 3.25
- 4.00
- 5.00
- 6.00
- 8.00

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

MX0	No Mount
MP1	Rear Pivot Clevis (Cyl. 2 Only)
MP2	Rear Pivot Clevis (1.50"-6.00" Bore) (Cyl. 2 Only)
MP4	Rear Pivot Eye (1.50" - 4.00" 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 (1.50"-6.00" Bore) (Cyl. 1 Only)
MF2	Rear Flange (1.50"-6.00" Bore) (Cyl. 2 Only)
ME3	Front Mounting Holes (8.00" Bore) (Cyl. 1 Only)
ME4	Rear Mounting Holes (8.00" Bore) (Cyl. 2 Only)
MS1	Front & Rear End Foot
MS2	Side Lug (1.50" - 8.00")
MS4	Bottom Tapped Holes

Common Options For 'Oil' Cylinder^{1 2}

A=	Extended Piston Rod Thread (Specify)
BSPP	British Standard Pipe Taper (Specify Size, Example: BSP = .25")
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSP = .25")
C=	Extended Piston Rod (Example: If C= 0.50", Then 1" Rod Extension Is C= 1.50")
H	Head Cushion
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 = 1.375")
SAE	SAE Ports (Specify Size, Example: SAE #10)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods
TH	400 PSI Hydraulic, Non-Shock
XX	Special Variation (Specify)

¹ Refer to series 'FM', 'SS', 'TA', 'TAS' or 'TRA' for complete list of options.

² Order does not determine cylinder type; CYL. #1 and CYL. #2 may be "air" or "oil", depending on your configuration.

Common Options For 'Air' Cylinder²

» B	.25" Urethane Bumper Both Ends
» BC	.25" Urethane Bumper Cap Only
» BH	.25" Urethane Bumper Head Only
BP	Bumper Piston Seal
BSPP	British Standard Pipe Taper (Specify Size, Example: BSP = .25")
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSP = .25")
C	Cap Cushion (Cyl. 2 Only)
H	Head Cushion
MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust With Sound Dampening Bumper (12" Max Stroke)
MPR	Magnetic Piston For Reed or Solid State Switches (Models: R10, R10P, RAC, RHT & MSS)
OP	Optional Port Location (Example: Ports @ 3 & 7)
OS	Oversize Rod Diameter (Specify Size, Example: Os = 1.375")
SAE	SAE Ports (Specify Size, Example: SAE #10)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods
TH	400 PSI Hydraulic, Non-Shock
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

About our Part Number System

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

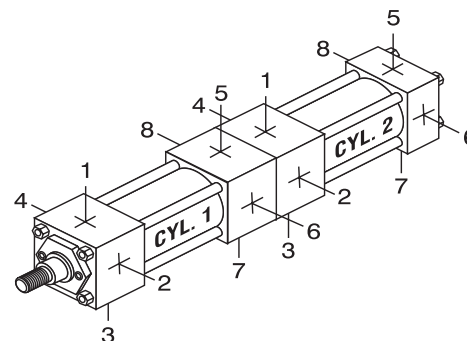
Example: Air/Oil Tandem

Cyl. 1 is a 'TA' series, MF1 mount, 2.00" bore x 10" stroke, 400 PSI Hydraulic.

Cyl. 2 is a 'TA' series, MX0 (no mount), 2.00" 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-MX0-2 x 10-MPR-HC



Standard Port and Cushion Adjustment Positions

- > Ports - Positions 1 and 3
- > Cushion Adjustment - Positions 2 and 4
- > Specify Non-Standard Positions When Ordering

Basic Cylinder (No Mount)

About Rod End Styles

Style 1 Male Rod End is Standard (CLY. #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!

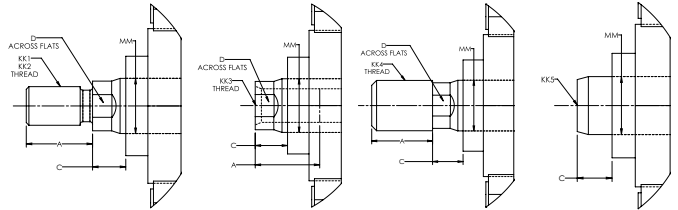
Piston Rod End Styles

Style 1 & 2
KK1 & KK2

Style 3
KK3

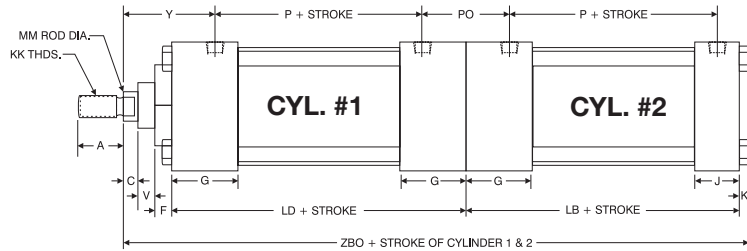
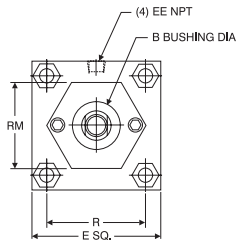
Style 4
KK4

Style 5
KK5



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

MX0/MX0 (No Mount)



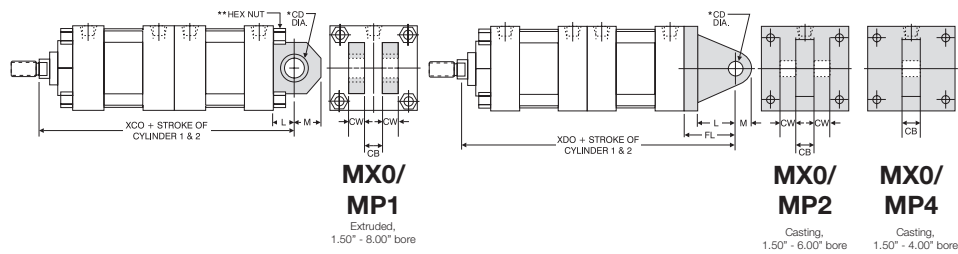
Basic Dimensions 'MX0' Standard & Oversize Rods

Bore	Rod Dia.	A	B	C	E	EE	F	G	J	K	KK	LB	LD	MM	P	PO	R	RM	V	Y	ZBO
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16 -20	3.625	4.125	0.625	2.375	1.750	1.438	2.00 SQ.	0.250	1.875	9.000
	1.000 Oversize	1.125	1.500	0.500							3/4 -16			1.000					0.500	2.250	9.375
2.00	0.625 Standard	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	7/16 -20	3.625	4.125	0.625	2.375	1.750	1.844	1.75 HEX	0.250	1.875	9.063
	1.000 Oversize	1.125	1.500	0.500							3/4 -16			1.000				2.50 SQ.	0.500	2.250	9.438
2.50	0.625 Standard	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.313	7/16 -20	3.750	4.250	0.625	2.500	1.750	2.188	1.75 HEX	0.250	1.875	9.313
	1.000 Oversize	1.125	1.500	0.500							3/4 -16			1.000				3.00 SQ.	0.500	2.250	9.688
3.25	1.000 Standard	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.375	3/4 -16	4.250	4.750	1.000	2.750	2.000	2.766	2.75 DIA.	0.250	2.375	10.750
	1.375 Oversize	1.625	2.000	0.625							1 -14			1.375				3.75 SQ.	0.375	2.625	11.000
4.00	1.000 Standard	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.375	3/4 -16	4.250	4.750	1.000	2.750	2.000	3.320	2.75 DIA.	0.250	2.375	10.750
	1.375 Oversize	1.625	2.000	0.625							1 -14			1.375				3.50 DIA.	0.375	2.625	11.000
5.00	1.000 Standard	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.438	3/4 -16	4.500	5.000	1.000	3.000	2.000	4.100	2.75 DIA.	0.250	2.375	11.313
	1.375 Oversize	1.625	2.000	0.625							1 -14			1.375				3.50 DIA.	0.375	2.625	11.563
6.00	1.375 Standard	1.625	2.000	0.625	6.500	0.750	0.625	2.000	1.500	0.438	1 -14	5.000	5.500	1.375	3.250	2.250	4.875	3.50 DIA.	0.375	2.750	12.563
	1.750 Oversize	2.000	2.375	0.750							1 1/4 -12			1.750					0.500	3.000	12.813
8.00	1.375 Standard	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.500	0.563	1 -14	5.125	5.625	1.375	3.375	2.250	6.438	3.50 DIA.	0.375	2.750	12.938
	1.750 Oversize	2.000	2.375	0.750							1 1/4 -12			1.750					0.500	3.000	13.188

How To Specify

Pivot Mounts

BTB, 3P, AND TM SERIES NFPA CYLINDERS

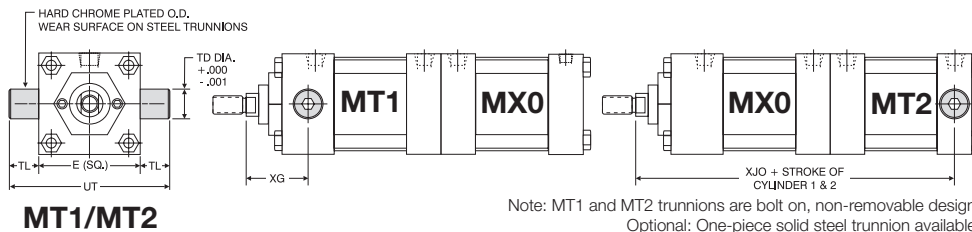


'MP1' & 'MP2' Clevis and 'MP4' Rod Eye Mount Dimensions

Bore	Rod Diameter	CB	CD	CW	FL	L	M	Add Stroke	
								XCO	XDO
1.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	9.500	9.875
	1.000 Oversize							9.875	10.250
2.00	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	9.500	9.875
	1.000 Oversize							9.875	10.250
2.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	9.750	10.125
	1.000 Oversize							10.125	10.500
3.25	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	11.625	12.250
	1.375 Oversize							11.875	12.500
4.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	11.625	12.250
	1.375 Oversize							11.875	12.500
5.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	12.125	12.750
	1.375 Oversize							12.375	13.000
6.00	1.375 Standard	1.500	1.000	0.750	2.250	1.500	1.000	13.625	14.500
	1.750 Oversize							13.875	14.750
8.00	1.375 Standard	1.500	1.000	0.750	N/A	1.500	1.000	13.875	N/A
	1.750 Oversize							14.125	N/A

For dimensions not shown, see page 75.
 *Pin included, two (2) pressed in bearings.
 **Hex nuts are located on cap end (3.25"-8.00" bores).

Note: Extruded MP1 mounts are standard (1.50" - 8.00" bores).
 Cast iron removable mounts are optional and must be requested when ordering (1.50" - 6.00" bores).
 MP4 mount is not available as standard on 5.00" bores and above.



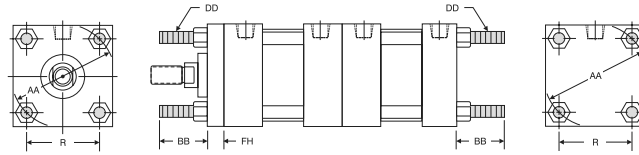
'MT1' Head Trunnion and 'MT2' Cap Trunnion Mount Dimensions

Bore	Rod Diameter	E	TD	TL	UT	XG	Add Stroke
							XJO
1.50	0.625 Standard	2.000	1.000	1.000	4.000	1.750	8.250
	1.000 Oversize						N/A*
2.00	0.625 Standard	2.500	1.000	1.000	4.500	1.750	8.250
	1.000 Oversize						2.125
2.50	0.625 Standard	3.000	1.000	1.000	5.000	1.750	8.500
	1.000 Oversize						2.125
3.25	1.000 Standard	3.750	1.000	1.000	5.750	2.250	9.750
	1.375 Oversize						2.500
4.00	1.000 Standard	4.500	1.000	1.000	6.500	2.250	9.750
	1.375 Oversize						2.500
5.00	1.000 Standard	5.500	1.000	1.000	7.500	2.250	10.250
	1.375 Oversize						2.500
6.00	1.375 Standard	6.500	1.375	1.375	9.250	2.625	11.375
	1.750 Oversize						2.875
8.00	1.375 Standard	8.500	1.375	1.375	11.250	2.625	11.625
	1.750 Oversize						2.875

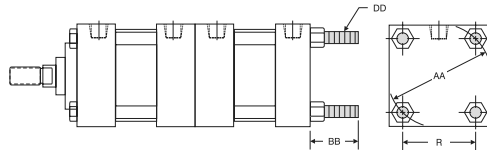
*No oversize rod available on 1.50" bore MT1.
 For dimensions not shown, see page 75.

Tie Rod & Flange Mounts

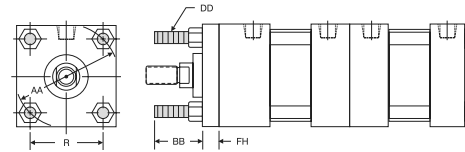
MX1



MX0/MX2



MX3/MX0



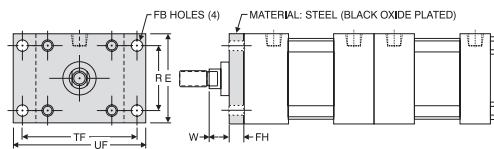
Bore	Rod Diameter	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4 -28	0.375	1.438
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16 -24	0.375	1.844
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16 -24	0.375	2.188
	1.000 Oversize					
3.25	1.000 Standard	3.900	1.375	3/8 -24	0.625	2.766
	1.375 Oversize					

Bore	Rod Diameter	AA	BB	DD	FH	R
4.00	1.000 Standard	4.700	1.375	3/8 -24	0.625	3.320
	1.375 Oversize					
5.00	1.000 Standard	5.800	1.813	1/2 -20	0.625	4.100
	1.375 Oversize					
6.00	1.375 Standard	6.900	1.813	1/2 -20	0.750	4.875
	1.750 Oversize					
8.00	1.375 Standard	9.100	2.313**	5/8 -18	0.625*	6.438
	1.750 Oversize					

*MX1 & MX3 have full square bushing retainer on 1.50" - 6.00" bores, round retainers on 8.00" bores.
 ***BB" dimension from head on 8.00" bore.
 For dimensions not shown, see page 75.

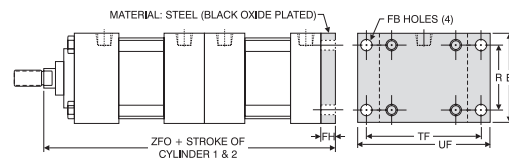
MF1/MX0

1.50" - 6.00" bores



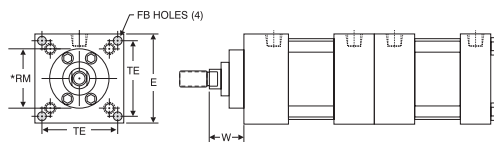
MX0/MF2

1.50" - 6.00" bores



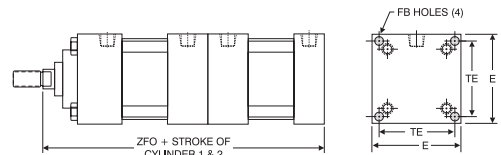
ME3/MX0

8.00" bores only



MX0/ME4

8.00" bores only



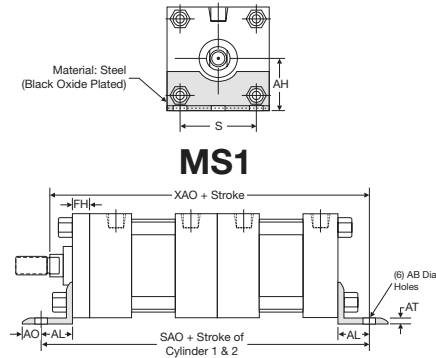
Bore	Rod Diameter	E	FB	FH	R	RM	TE	TF	UF	W	ZFO
1.50	0.625 Standard	2.000	0.313	0.375	1.438	—	—	2.750	3.375	0.625	9.125
	1.000 Oversize										
2.00	0.625 Standard	2.500	0.375	0.375	1.844	—	—	3.375	4.125	0.625	9.125
	1.000 Oversize										
2.50	0.625 Standard	3.000	0.375	0.375	2.188	—	—	3.875	4.625	0.625	9.375
	1.000 Oversize										
3.25	1.000 Standard	3.750	0.438	0.625	2.766	—	—	4.688	5.500	0.750	11.000
	1.375 Oversize										

Bore	Rod Diameter	E	FB	FH	R	RM	TE	TF	UF	W	ZFO
4.00	1.000 Standard	4.500	0.438	0.625	3.320	—	—	5.438	6.250	0.750	11.000
	1.375 Oversize										
5.00	1.000 Standard	5.500	0.563	0.625	4.100	—	—	6.625	7.625	0.750	11.500
	1.375 Oversize										
6.00	1.375 Standard	6.500	0.563	0.750	4.875	—	—	7.625	8.625	0.875	12.875
	1.750 Oversize										
8.00	1.375 Standard	8.500	0.688	N/A	N/A	3.500*	7.570	N/A	N/A	1.625	12.375
	1.750 Oversize										

*Round retainer used to retain bushing.
 For dimensions not shown, see page 75.

How To Specify

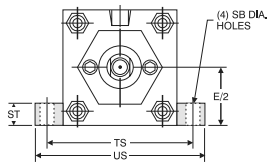
Tandem Dimensions: Base Mounts



MS1

*Round retainer on 8.00" bore.
For dimensions not shown, see page 75.

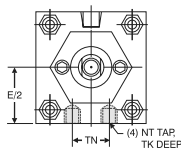
'MS1' Angle Mount Dimensions										
Bore	Rod Diameter	AB	AH	AL	AO	AT	FH	S	Add Stroke	
									SAO	XAO
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.125	0.375	1.250	10.125	9.750
	1.000 Oversize									10.125
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.125	0.375	1.750	10.125	9.750
	1.000 Oversize									10.125
2.50	0.625 Standard	0.438	1.625	1.000	0.375	0.125	0.375	2.250	10.375	10.000
	1.000 Oversize									10.375
3.25	1.000 Standard	0.563	1.938	1.250	0.500	0.125	0.625	2.705	12.125	11.625
	1.375 Oversize									11.875
4.00	1.000 Standard	0.563	2.250	1.250	0.500	0.125	0.625	3.500	12.125	11.625
	1.375 Oversize									11.875
5.00	1.000 Standard	0.688	2.750	1.375	0.625	0.188	0.625	4.250	12.875	12.250
	1.375 Oversize									12.500
6.00	1.375 Standard	0.813	3.250	1.375	0.625	0.188	0.750	5.250	14.000	13.500
	1.750 Oversize									13.750
8.00	1.375 Standard	0.813	4.250	1.813	0.688	0.250	0.625*	7.125	14.375	14.188
	1.750 Oversize									14.438



MS2

Note: The option not to have side lugs on center two (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 two (2) caps
For dimensions not shown, see page 75.

'MS2' Side Lug Mount Dimensions												
Bore	Rod Diameter	SB	E/2	ST	SU	SW	SZ	TS	US	XS	Add Stroke	
											SSO	SS
1.50	0.625 Standard	0.438	1.000	0.500	1.125	0.375	0.625	2.750	3.500	1.375	3.375	2.875
	1.000 Oversize											
2.00	0.625 Standard	0.438	1.250	0.500	1.125	0.375	0.625	3.250	4.000	1.375	3.375	2.875
	1.000 Oversize											
2.50	0.625 Standard	0.438	1.500	0.500	1.125	0.375	0.625	3.750	4.500	1.375	3.500	3.000
	1.000 Oversize											
3.25	1.000 Standard	0.563	1.875	0.750	1.250	0.500	0.750	4.750	5.750	1.875	3.750	3.250
	1.375 Oversize											
4.00	1.000 Standard	0.563	2.250	0.750	1.250	0.500	0.750	5.500	6.500	1.875	3.750	3.250
	1.375 Oversize											
5.00	1.000 Standard	0.813	2.750	1.000	1.063	0.688	0.563	6.875	8.250	2.063	3.625	3.125
	1.375 Oversize											
6.00	1.375 Standard	0.813	3.250	1.000	1.313	0.688	0.813	7.875	9.250	2.313	4.125	3.625
	1.750 Oversize											
8.00	1.375 Standard	0.813	4.250	1.000	1.313	0.688	0.813	9.875	11.250	2.313	4.250	3.750
	1.750 Oversize											



MS4

Note: The option not to have 'MS4' taps on center two (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 two (2) caps
For dimensions not shown, see page 75.

'MS4' Bottom Tapped Mount Dimensions								
Bore	Rod Diameter	E/2	NT	TK	TN	XT	SNO	Add Stroke
								SN
1.50	0.625 Standard	1.000	1/4-20	0.375	0.625	1.938	1.875	2.250
	1.000 Oversize							
2.00	0.625 Standard	1.250	5/16-18	0.500	0.875	1.938	1.875	2.250
	1.000 Oversize							
2.50	0.625 Standard	1.500	3/8-16	0.625	1.250	1.938	1.875	2.375
	1.000 Oversize							
3.25	1.000 Standard	1.875	1/2-13	0.750	1.500	2.438	2.125	2.625
	1.375 Oversize							
4.00	1.000 Standard	2.250	1/2-13	0.750	2.063	2.438	2.125	2.625
	1.375 Oversize							
5.00	1.000 Standard	2.750	5/8-11	1.000	2.688	2.438	2.125	2.875
	1.375 Oversize							
6.00	1.375 Standard	3.250	3/4-10	1.125	3.250	2.813	2.375	3.125
	1.750 Oversize							
8.00	1.375 Standard	4.250	3/4-10	1.125	4.500	2.813	2.375	3.250
	1.750 Oversize							