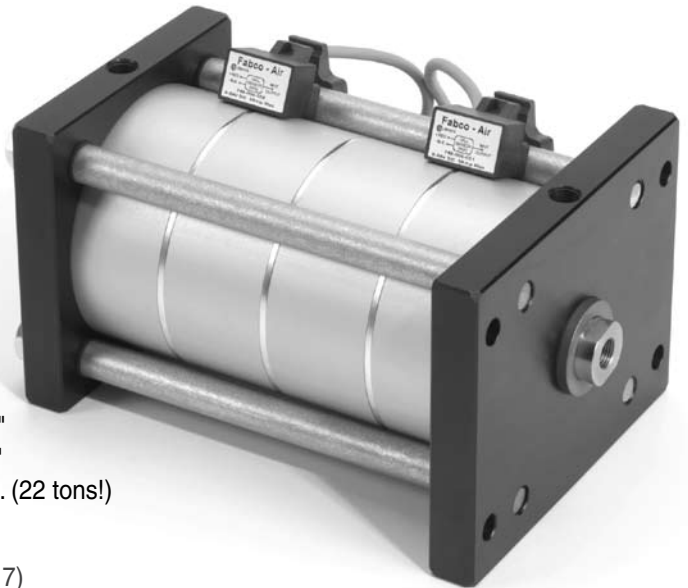


Available in 4 series
 Bore sizes 1/2" thru 12"
 Strokes 1/8" thru 12"

5



Original Series

(shown right)

- Bores 1-1/8" thru 12"
- Strokes 1/2" thru 12"
- Forces to 44,000 lbs. (22 tons!)

Pancake® Series

(see pages 5.13 to 5.17)

- Bores 1/2" thru 4"
- Strokes 1/8" thru 1-1/2"
- Forces to 7,186 lbs



Square1® Series

(see pages 5.18 to 5.22)

- Bores 3/4" thru 2"
- Strokes 1/8" thru 2-1/2"
- Forces to 870 lbs.



Longstroke™ Series

(see pages 5.23 to 5.28)

- Bores 2" thru 4"
- Strokes 1/2" thru 12"
- Forces to 7,186 lbs



Duralon® Rod Bearings Excel

Load Capacity (psi)	Friction Properties		
		Coefficient	Slip-stick
Machine Design 1972/73			
Bearing Reference Issue			
Porous Bronze.....	4,500	Steel-on-steel.....	.50 Yes
Porous iron.....	8,000	Bronze-on-steel.....	.35 Yes
Phenolics.....	6,000	Sintered Bronze-on-steel	
Nylon®.....	1,000	with mineral oil.....	.13 No
TFE.....	500	Bronze-on-steel	
Reinforced Telfon®.....	2,500	with mineral oil.....	.16 No
*TFE fabric.....	60,000	Copper lead alloy-on-steel	.22 Yes
Polycarbonate.....	1,000	Acetal-on-steel.....	.20 No
Acetal.....	1,000	Nylon-on-steel.....	.32 Yes
Carbon-graphite.....	600	Duralon-on-steel.....	.05 - .16 No

* Shows Duralon bearing classification. Not to be used for design purposes.

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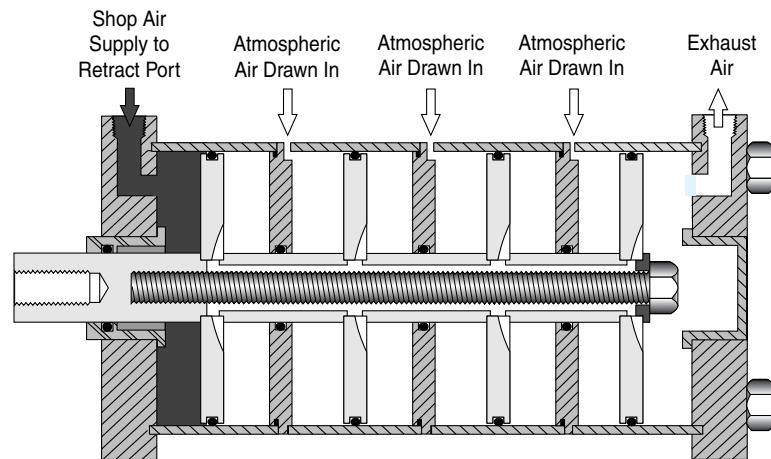
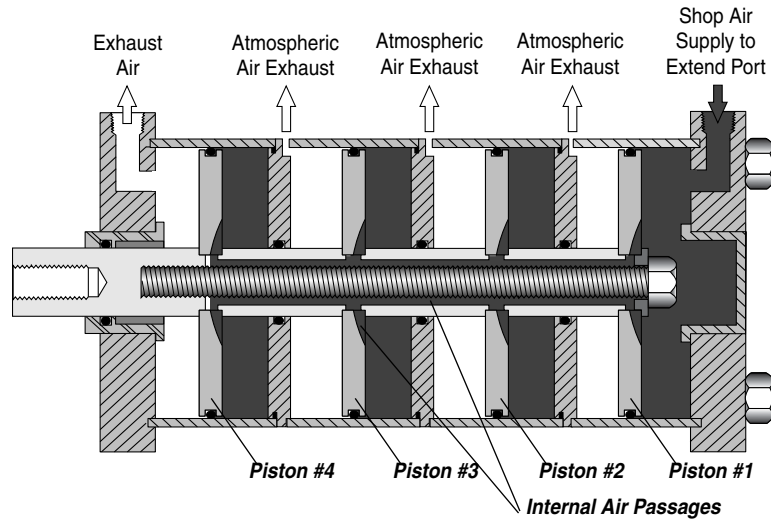
Features & Benefits

- More force from available shop air Eliminates hydraulics – stays clean
- Multiple pistons on the power stroke Saves mounting space (44 to 75%)
- Single piston on the retract stroke Saves air (22 to 37%)
- Building block design Low cost – Quick delivery – Specials
- Wide range of models, sizes and options . . . Adapts to your application requirements
- Corrosion resistant construction Long life – clean appearance
- Internally lubricated dynamic seals Smooth operation and long product life
- Duralon rod bearings See chart above – extended product life
- Hard anodized ID cylinder tubing More cycles – less wear
- 2 Year warranty Extended buyer protection

How it works

Fabco-Air attaches multiple pistons to a common shaft and provides **internal** air passages through the shaft to all pistons. Thus, when shop air pressure is applied to the extend port, all pistons are pressurized simultaneously enabling tremendous thrust forces to be obtained.

See the handy sizing guide below for available force multiplying factors (column 3 – Total Effective Piston Area) and maximum operating pressures for various cylinder bore sizes.



Sizing Example

MP3 x 1 - 3 - 1 - FF

Piston Area is 20.3 sq. in.

Force = Pressure x Area

If Supply Air Pressure is 100 psi,

then Force = 100 psi x 20.3

or Force = 2030 lbs

Sizing Guide

Bore Inches	Stages (Number of Pistons)	Total Effective Piston Area-Square Inches	Equivalent Bore of a Single Piston Cylinder	Force @ 60 psi	Single Stage Retract Piston Area, sq. in. †	Rod Diameter, in.	Rod Area, sq. in.	Base Weight, lb. Zero Stroke	Weight Per inch. of Stroke	Max. Operating Pressure
1-1/8	2	1.8	1.5	108	0.8	0.50	0.2	0.9	0.3	150
	3	2.6	1.8	156						
	4	3.4	2.1	204						
1-5/8	2	3.8	2.2	228	1.7	0.62	0.3	1.7	0.4	150
	3	5.6	2.6	336						
	4	7.3	3.0	438						
2-1/2	2	9.4	3.5	564	4.5	0.75	0.4	4.6	1.2	150
	3	13.8	4.2	828						
	4	18.3	4.8	1098						
3	2	13.7	4.1	822	6.6	0.75	0.4	5.5	1.5	150
	3	20.3	5.1	1218						
	4	26.9	5.8	1614						
4	2	24.4	5.6	1464	11.8	1.00	0.8	9.5	1.6	150
	3	36.1	6.8	2166						
	4	47.9	7.9	2874						
5	2	38.0	7.0	2280	18.4	1.25	1.23	12.3	1.4	150
	3	56.4	8.5	3384						
	4	74.8	9.7	4488						
6	2	55.3	8.4	3318	27.0	1.25	1.23	14.7	1.5	150
	3	82.3	10.2	4938						
	4	109.4	11.8	6564						
8	2	98.6	11.2	5916	48.5	1.50	1.7	41.5	2.3	150
	3	147.0	13.7	8820						
	4	195.4	15.8	11724						
10	2	153.9	14.0	9234	75.4	2.00	3.1	85.1	5.4	150
	3	229.3	17.1	13758						
	4	304.7	19.7	18282						
12	2	222.9	16.8	13374	109.9	2.00	3.1	116.6	7.0	150
	3	332.8	20.6	19968						
	4	442.7	23.7	26562						

Notes

★ Areas given are for Multiple Stage Extend - Single Stage Retract with a Single Rod. For Single Stage Extend - Multiple Stage Retract and any Double Rod Models, deduct the rod area shown.

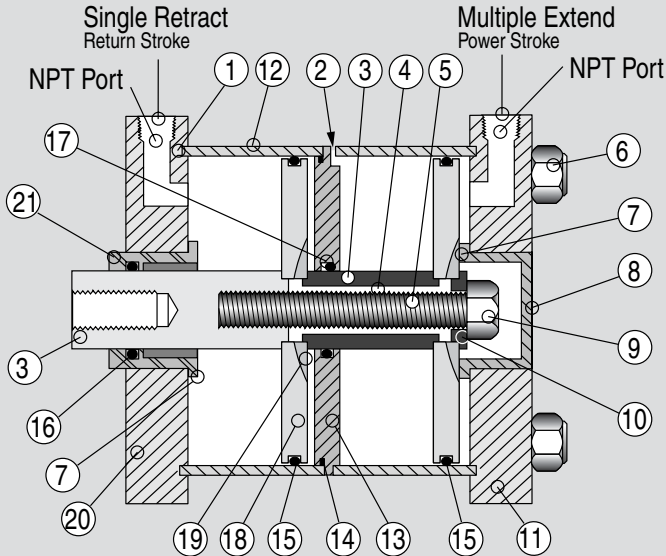
† Areas given are for Standard Single Stage Retract. For Single Stage Extend with a single rod, add the rod area shown.

Ratings - Standard Units

- Duralon® rod bushing. (see page 5.1 for table of physical properties)
- Female rod end with wrench flats
- Internally lubricated Buna-N O-ring piston and rod seals.
- Airline lubrication recommended
- Media Air
- Max. operating pressure See chart
- Min. pressure recommended 20 psi
- Ambient & media temp. -25° to +250°F
- Prelubrication Magnalube® -G Grease

Basic Construction

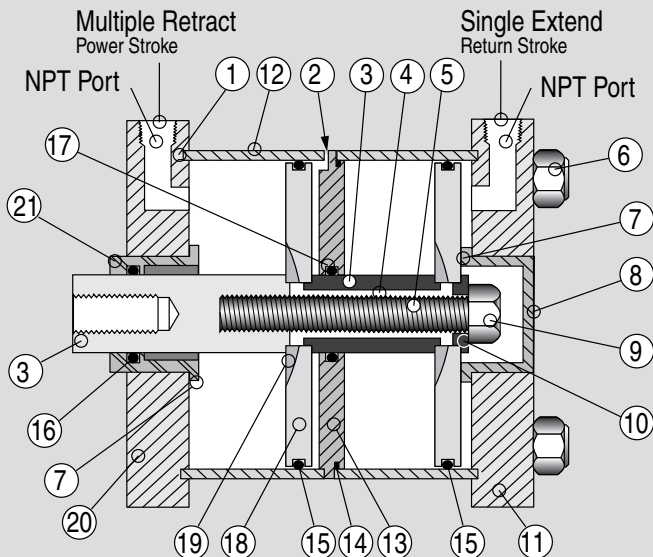
Multiple Stage Extend with Single Stage Retract



Quick Reference to Components

No.	Description
1	Cylinder tube seal
2	Atmospheric vent
3	Piston rod
4	Air passage between stages
5	Center stud, high tensile, plated
6	Stainless steel tie rods and plated steel nuts
7	Piston stop
8	Cap End Plug, aluminum, black anodized
9	Nut, plated steel
10	Piston Rod Pilot Washer locates piston to maintain precise concentricity
11	Cap end head, aluminum, black anodized
12	Cylinder tube, aluminum
13	Baffle, aluminum
14	Baffle seal, Buna-N O'Rings, -25° to + 250°F
15	Piston seal, internally lubricated O'Ring
16	Piston rod seal, internally lubricated O'Ring
17	Center shaft seal, internally lubricated O'Ring
18	Piston, aluminum
19	Piston air slot, note direction of air flow
20	Rod end head, aluminum, black anodized
21	Piston rod bushing, anodized aluminum housing with Teflon® lined Duralon® insert

Multiple Stage Retract with Single Stage Extend



Cylinder OD – is clear anodized aluminum for corrosion resistance and an attractive appearance.

The Bore ID is Hard Anodized – Hard anodizing is an electrochemical process which provides a very dense surface of aluminum oxide that actually impregnates the base aluminum. It forms an extremely hard (60 Rc) surface with a low coefficient of friction. Hardness, corrosion resistance and wear resistance exceeds that of chrome plated steel.

An Extra Long Rod Bearing – provides long and rigid support for the piston rod. The bearing material is Duralon® on all bore sizes. See page 5.1 for a chart comparing the exceptional physical properties of Duralon® to other, less durable, bearing materials.

The Piston Rod – is Hard Chrome Plated Stainless Steel. Surface finish is 12 RMS or better. The standard rod end is fine female thread tapped and has long wrench flats.

Piston Construction – The piston is aluminum for light weight. The piston rod pilot end and a pilot washer enable bolting the assembly securely while maintaining precise concentricity for smooth cylinder performance.

Dynamic Seals – Internally lubricated O'Rings are compounded to provide extra long wear, lower breakaway (starting) and running friction, and smoother operation. In tests, cylinders with these seals have extended cycle life 2 to 3 times beyond cylinders with standard Buna-N seals.

Model Number Code

MP3 x **1** - **3** - **1** - **FF** - **MR**

MP Series & Bore	Standard Strokes	Stages Extend	Stages Retract
1-1/8"	1/2"	2	1
1-5/8"	1"	3	1
2-1/2"	1-1/2"	4	1
3"	2"	1	2 [‡]
4"	2-1/2"	1	3 [‡]
5"	3"	1	4 [‡]
6"	4"	Standard available combinations are listed above. See page 5.7 for Multiple Extend–Multiple Retract Options. *Note: Applicable only to 1-1/8" thru 8" bores.	
8"	5"		
10"	6"		
12"			

Bores	Mounting
1-1/8" thru 6"	Front Face – Fabco Pattern-FF Front Face – NFPA (MF1) Pattern-FFA Rear Face – Fabco Pattern.....-RF Rear Face – NFPA (MF2) Pattern.....-RFA Foot-FT Clevis Mount NFPA (MP1) Dimensions <i>for single stage retract only</i> Ports in-line with slot-PM Ports 90° to slot.....-SM Extended Tie Rods (See page 5.6 for non-standard lengths.) Rod end only-WF Cap end only-WR Rod and Cap Ends-WFR
8" thru 12"	Front Face – NFPA (ME3) Pattern-FFA Rear Face – NFPA (ME4) Pattern-RFA Extended Tie Rods Rod end only-WF Cap end only-WR Rod and Cap Ends-WFR

How to Order

1. Specify Series and Bore
2. Specify Stroke in Inches and Fractions. Note standard strokes listed above. Strokes not listed are available to 12" maximum at a nominal increase in delivery time and cost.
3. Specify stages extend
4. Specify stages retract
5. Specify Mounting
6. Specify Options

Example

MP3 x 1 – 3 – 1 – FF – MR
 Multi-Power® Series, 3" bore, 1" stroke, 3 Stage Extend, 1 Stage Retract, Front Face (Fabco Pattern) Mount, Male Rod Thread.

OPTIONS

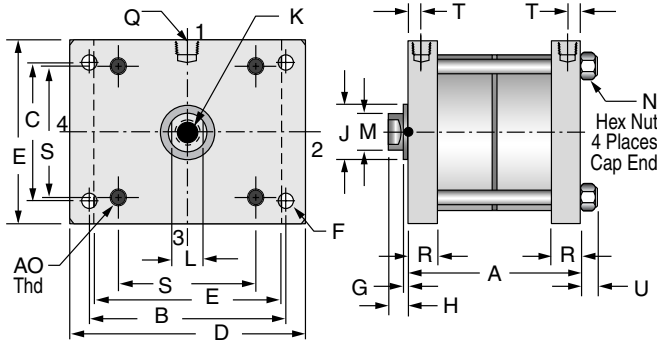
Description	Specify	See Page
1"-14 Rod thread – 8" bore only	-KF	5.5
Double Rod	-DR	5.8
Nonrotating Single Rod ‡	-NR	5.8
Nonrotating Double Rod ‡	-NRDR	5.8
Male Rod Thread		5.7
Single Rod	-MR	
Double Rod, Rod End	-MR	
Double Rod, Cap End	-MR1	
Double Rod, Both Ends	-MR2	
Viton Seals (-15° to +400°F)	-V	5.8
Shock & Speed Control using ‡	-HS	5.11
Hydraulics, 2-1/2" – 12" bores		
Rubber Bumpers		5.9
Rod End	-BF	
Cap End	-BR	
Both Ends	-BFR	
Adjustable Extend Stroke	-AS	5.9
6" Stroke maximum. Full stroke adjustment is standard.		
1/2" NPT Ports in Heads ‡		5.10
(2-1/2", 3", 4", 5" & 6" Bores only)		
Rod End Head	-TF	
Cap End Head	-TR	
Both Heads	-TFR	
3/4" NPT Ports in Heads	-P34	5.10
(8", 10" & 12" Bores only)		
Extend Port Bushing		5.10
3/8" NPT (2-1/2" – 6" Bores)	-E38	
1/2" NPT (2-1/2" – 6" Bores)	-E12	
3/4" NPT (5" – 12" Bores)	-E34	
High Flow Vents	-HF	5.10
Port Positions		5.5 & 5.6
All Ports	Position #1 Standard	
	Position #2 -PA2	
	Position #3 -PA3	
	Position #4 -PA4	
Rod End	Position #1 Standard	
	Position #2 -PR2	
	Position #3 -PR3	
	Position #4 -PR4	
Cap End	Position #1 Standard	
	Position #2 -PC2	
	Position #3 -PC3	
	Position #4 -PC4	
Atmospheric Vent or Ported Baffle Port		
	Position #1 Standard	
	Position #2 -PB2	
	Position #3 -PB3	
	Position #4 -PB4	
Any port or vent not specified will be in Position #1 as shown on page 5.5 & 5.6		
Magnetic Piston ‡	-E	5.12
for reed switches and Electronic Sensors (Order Sensors separately)		

‡ Note: Additional cylinder length required for Nonrotating Rods see page 5.8; for Option -HS see page 5.11; for 1/2 NPT Ports Option see page 5.10; for Option -E see page 5.12

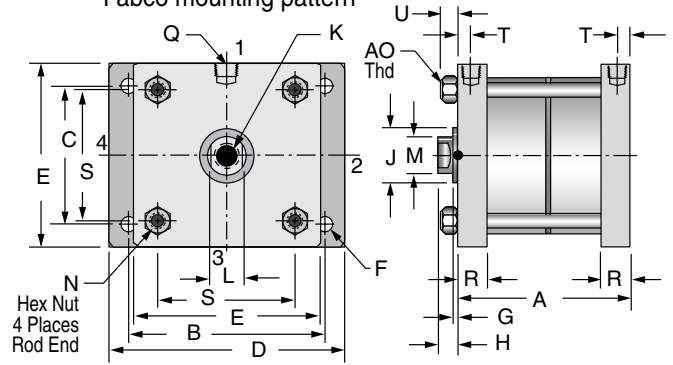
1-1/8", 1-5/8", 2-1/2", 3", 4", 5", & 6" Bores

5

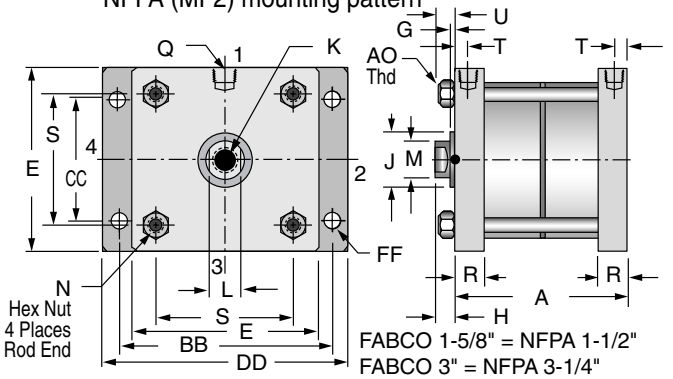
-FF Front Face Mount; Rod End Rectangular Flange
 Fabco mounting pattern



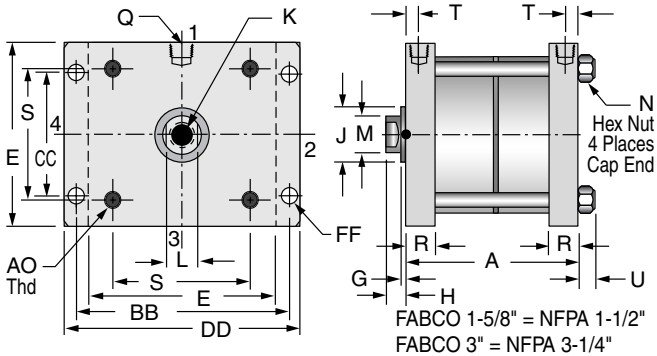
-RF Rear Face Mount; Cap End Rectangular Flange
 Fabco mounting pattern



-RFA Rear Face Mount; Cap End Rectangular Flange
 NFPA (MF2) mounting pattern



-FFA Front Face Mount; Rod End Rectangular Flange
 NFPA (MF1) mounting pattern



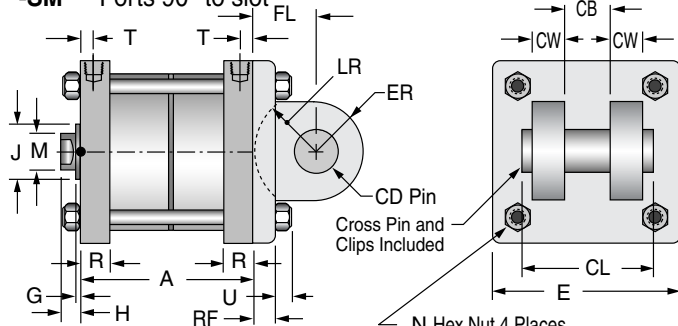
For single stage retract only

Clevis Mount (NFPA MP1 Dimensions)

-PM - Ports in-line with slot

-SM - Ports 90° to slot

Fabco 1-1/8" = NFPA 1-1/2"
 Fabco 1-5/8" = NFPA 1-1/2"
 Fabco 3" = NFPA 3-1/4"



Dimensions (inches)

‡ Note:

The "Dimension Y" is for standard models: Multiple extend/single retract and Single extend/multiple retract. Optional Multiple extend/multiple retract models require additional cylinder length (see page 5.7).

The following options also require additional cylinder length. See the respective option information pages for details. **-NR**, **-NRDR** (pg 5.8), **-HS** (pg 5.11), **-TF**, **-TR**, **-TFR** (pg 5.10), **-E** (pg 5.12).

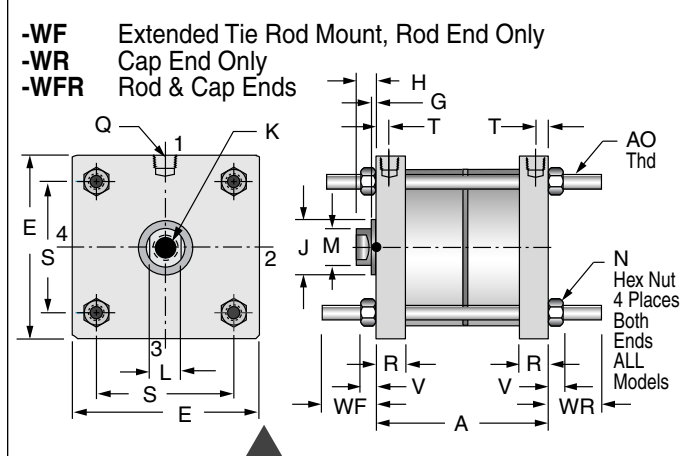
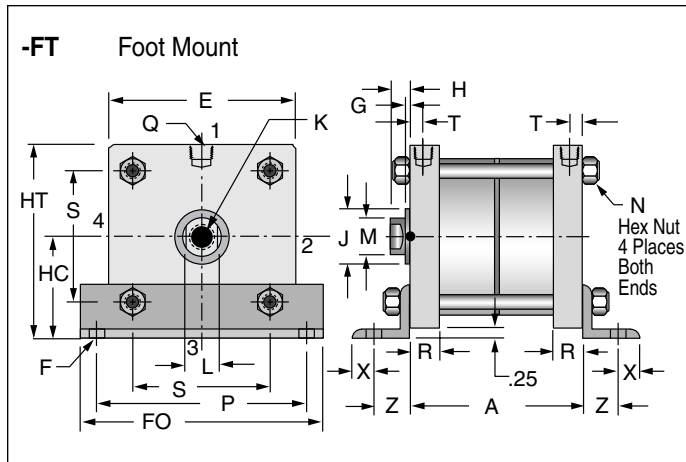
† Note:

"Dimension K" for 8" Bore only, specify Option -KF for 1"-14 Rod Thread

Bore	A= (No. stages x stroke) + y†			B	C	D	E	F	G	H	J ±.002	K†	L	M ±.001	N	P	Q NPT	R
	y‡ (2 stage)	y‡ (3 stage)	y‡ (4 stage)															
1-1/8	1.86	2.41	2.96	2.00	1.25	2.50	1.75	.28	.13	.50	0.752	5/16-24x.63	7/16	0.500	7/16	2.38	1/8	.50
1-5/8	2.42	3.08	3.75	2.50	1.75	3.00	2.25	.28	.13	.50	1.001	3/8-24x.63	1/2	0.625	7/16	2.88	1/8	.63
2-1/2	2.91	3.76	4.61	3.63	2.38	4.25	3.00	.34	.19	.50	1.127	1/2-20x.75	5/8	0.750	9/16	3.69	1/4	.75
3	2.91	3.76	4.61	3.88	2.75	4.50	3.50	.34	.19	.50	1.127	1/2-20x.75	5/8	0.750	9/16	4.13	1/4	.75
4	2.91	3.76	4.61	5.00	3.75	6.00	5.00	.41	.19	.50	1.502	1/2-20x.75	7/8	1.000	3/4	5.50	1/4	.75
5	3.81	5.15	6.50	6.00	4.50	7.00	6.00	.53	.19	.69	1.752	3/4-16x1.13	1	1.250	3/4	6.25	1/4	.75
6	3.46	4.55	5.65	7.00	5.25	8.00	7.00	.53	.19	.69	1.752	3/4-16x1.13	1	1.250	3/4	3.38	1/4	.75
8	6.25	8.25	10.25	7.57	NA	NA	9.00	.69	.25	1.00	2.001	1-12x1.50†	1-1/4	1.500	3/4	NA	1/2	1.50
10	7.75	10.75	13.75	9.40	NA	NA	12.00	.78	.25	1.00	2.751	1 1/2-12x1.75	1-3/4	2.000	1-1/8	NA	1/2	1.50
12	7.75	10.75	13.75	11.10	NA	NA	14.00	.78	.25	1.00	2.751	1 1/2-12x1.75	1-3/4	2.000	1-1/8	NA	1/2	1.50

Mounting Styles with Dimensions

1-1/8", 1-5/8", 2-1/2", 3", 4", 5", & 6" Bores

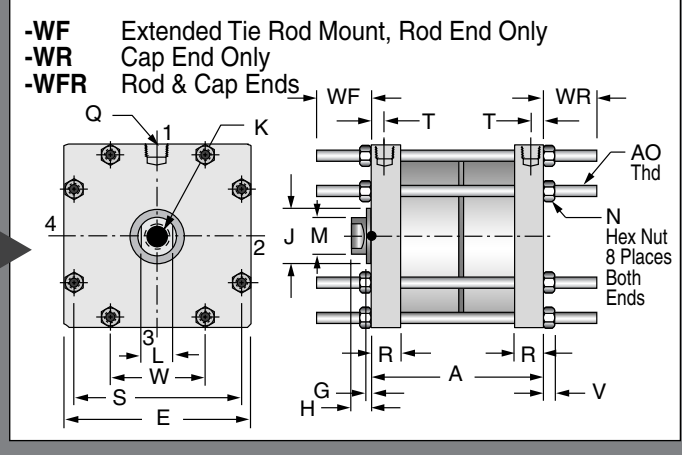
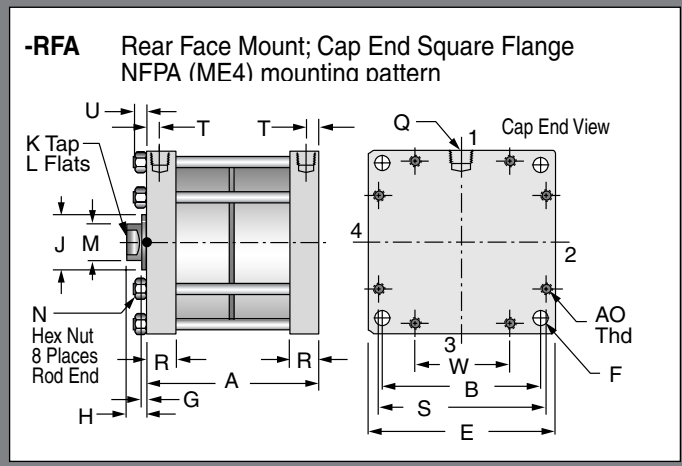
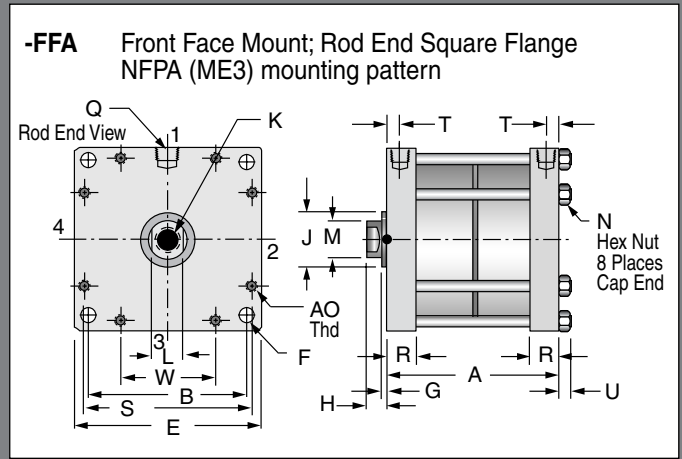


To Order
 Extended Tie Rod Mount
 Specify Suffix

Rod End only **-WF**
 Cap End only **-WR**
 Rod & Cap Ends **-WFR**

If a non-standard extension is required, specify by adding the required length to the suffix.
 e.g. If **-WF** length required is 2.5", Specify **-WF2.5"**

8", 10", and 12" Bores



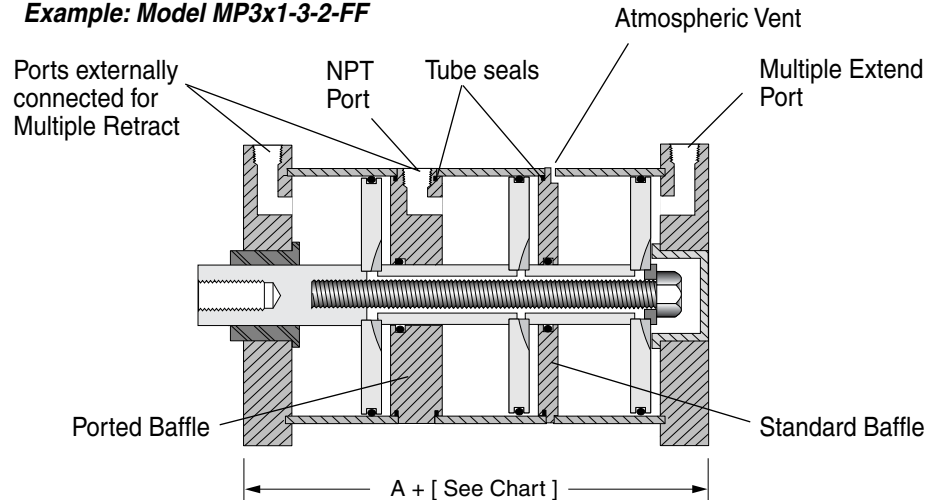
Bore	S	T	U	V	W	X	Z	AO	BB	CC	DD	FF	FO	HC	HT	WF	WR	CD	FL	RF	CB	CW	ER	LR	CL
1-1/8	1.19	.22	.27	.22	NA	.31	.44	1/4-20	2.00	1.00	2.50	.22	3.00	1.13	2.00	1.0	1.0	.500	.75	.38	.76	.50	.62	.62	2.09
1-5/8	1.62	.25	.27	.22	NA	.38	.63	1/4-20	2.75	1.43	3.25	.28	3.50	1.38	2.50	1.0	1.0	.500	.75	.38	.76	.50	.62	.62	2.09
2-1/2	2.31	.31	.38	.33	NA	.44	.56	3/8-16	3.88	2.19	4.50	.34	4.38	1.75	3.25	1.3	1.3	.500	.75	.38	.76	.50	.62	.62	2.09
3	2.69	.31	.38	.33	NA	.50	.75	3/8-16	4.69	2.76	5.31	.41	4.88	2.00	3.75	1.4	1.4	.750	1.25	.63	1.26	.62	.87	.87	2.88
4	3.50	.31	.50	.43	NA	.63	.88	1/2-13	5.44	3.32	6.38	.41	6.38	2.75	5.25	1.4	1.4	.750	1.25	.63	1.26	.62	.87	.87	2.88
5	4.25	.31	.50	.43	NA	.75	1.00	1/2-13	6.63	4.10	7.63	.53	7.25	3.25	6.25	1.8	1.8	.750	1.25	.63	1.26	.62	.87	.87	2.88
6	5.13	.31	.50	.43	NA	.75	1.00	1/2-13	7.63	4.88	8.63	.53	7.00	3.75	7.25	1.8	1.8	1.000	1.50	.75	1.51	.75	1.25	1.13	3.38
8	7.90	.75	.50	.43	4.56	NA	NA	1/2-13	NA	NA	NA	NA	NA	NA	NA	2.3	2.3	NA	NA	NA	NA	NA	NA	NA	NA
10	10.63	.75	.80	.66	5.00	NA	NA	3/4-10	NA	NA	NA	NA	NA	NA	NA	2.68	2.68	NA	NA	NA	NA	NA	NA	NA	NA
12	12.46	.75	.80	.66	5.81	NA	NA	3/4-10	NA	NA	NA	NA	NA	NA	NA	2.68	2.68	NA	NA	NA	NA	NA	NA	NA	NA

5

Multiple Stages Extend & Multiple Stages Retract (Not available on 10" and 12" bores)

When required return forces (Extend or Retract) are greater than the standard single piston can provide, multiple stages (pistons) can be pressurized. This is accomplished by replacing one or more of the standard baffles with a ported baffle as shown in the illustration. When these thicker baffles are used, the overall length ("Dimension A") increases. See the chart below for port size and dimension details.

Example: Model MP3x1-3-2-FF



5 See pages 5.5 for Dimension "A"

Bore	Port	Add to Dimension "A" for each Ported Baffle
1-1/8"	1/8 NPT	.50"
1-5/8"	1/8 NPT	.50"
2-1/2"	1/4 NPT	.50"
3"	1/4 NPT	.50"
4"	1/4 NPT	.50"
5"	1/4 NPT	.50"
6"	1/4 NPT	.50"
8"	1/2 NPT	1.00"

Available Combinations	No. of Ported Baffles	Total No. of Stages	Notes:
2 - 2	1	2	<p>When any of these combinations are ordered, the proper number of ported baffles are included.</p> <p>As standard, the largest number of stages are internally connected.</p> <p>On models with the same number of extend and retract stages, the extend stages are internally connected.</p>
3 - 2	1	3	
3 - 3	2	3	
2 - 3	1	3	
4 - 2	1	4	
4 - 3	2	4	
4 - 4	3	4	
3 - 4	2	4	
2 - 4	1	4	

Applications that may dictate the use of Ported Baffles

- Clean rooms, Vacuum Chambers, Wash Down Areas, Under Liquid, Dirty or Corrosive Environments
- Increase Cycle Speeds
- Selective Force Application

Filters can be installed in the ports of stages not requiring pressurization, or they can be plumbed to a common filter or point outside the critical environment.

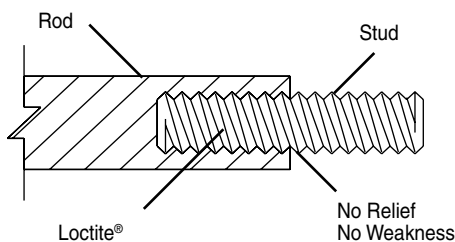
The ports have higher air flow capacity than the vents in the standard baffle.

With control circuitry, the number of stages that are pressurized (thus the amount of force being applied) at any given time can be selected and varied. Consult engineering with application details.

Male Rod Thread

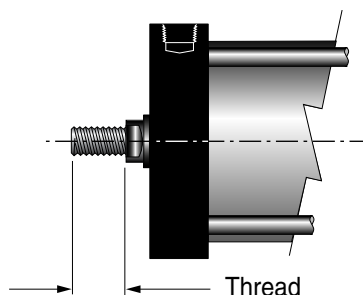
- Single Rod
- Double Rod, Rod End Only
- Double Rod, Cap End Only
- Double Rod, Rod & Cap Ends

- Option
- MR
 - MR
 - MR1
 - MR2



For bores 1-1/8" thru 8", a high strength stud is threaded into the standard female rod end and retained with Loctite®. This method eliminates the small diameter thread relief area normally required when machining male threads. This provides a much stronger

rod end which can be repaired, rather than replacing the complete rod, should the thread be damaged. For 10" and 12", the thread is machined integral with the rod.



BORE	THREAD
1-1/8"	5/16-24 x .63
1-5/8"	3/8-24 x .88
2-1/2"	1/2-20 x 1.00
3"	1/2-20 x 1.00
4"	1/2-20 x 1.00
5"	3/4-16 x 1.50
6"	3/4-16 x 1.50
8" standard	1-12 x 1.50
8" optional†	1-14 x 1.50
10"	1-1/2-12 x 2.25
12"	1-1/2-12 x 2.25

†Note: Male rod callout must be preceded by "-KF"

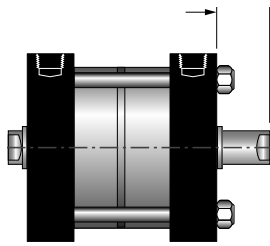
Double Rod

Option -DR

Standard piston rod and rod bushing on both ends of the cylinder.

For 8" bore only, when -KF is specified, 1"-14 threads will be applied at both ends.

Use when attachment to both ends of the cylinder is required, or to indicate piston position. Also see Option -E on page 5.12.



H + stroke
See page 5.5 for dimension "H".
Typical for ALL bores and ALL mounting styles.

*Note: 10" & 12" Bores for Position Indication Only—
Rod Thread 3/8-16 x 5/8 Deep*

Viton Seals

Option -V

Use for elevated temperatures (-15° to +400°F) or compatibility with exotic media. Consult engineering for compatibility information.

Nonrotating Rod

Option -NR

A stainless steel hex rod and a hex broached bushing of SAE 660 bearing bronze replaces the standard round rod and bushing.

A ported baffle is used so the piston assembly can be retracted by the next piston back from the rod end. The normal rod head port becomes an atmospheric vent. The tolerance on rotation is $\pm 1^\circ$.

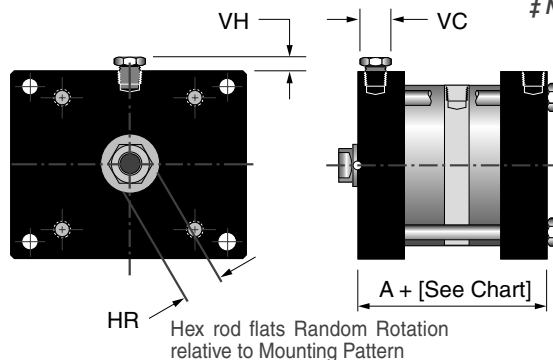
The hex rod design does allow for some torque loading on the shaft.

However, torque loads that induce side loading should be minimized for best overall life and performance.

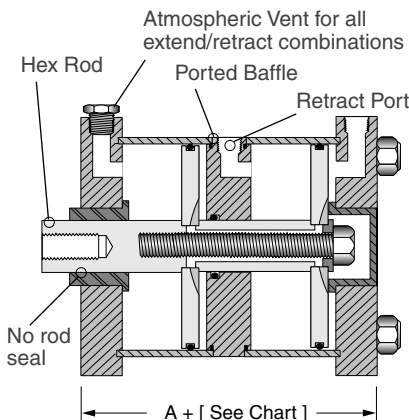
5

Available Combinations	No. of Ported Baffles	Total No. of Stages
2-1	1	2
3-1	1	3
3-2†	2	3
4-1	1	4
4-2†	2	4
4-3†	3	4

† Note: Not applicable to 10" and 12" bores



See page 5.5 for Dimension "A"



Bore	Retract Port	Add to Dimension "A" for each Ported Baffle	HR	St'd Ports		1/2 NPT Ports (-TF or -TFR)		3/4 NPT Ports (-P34)	
				VC	VH max	VC	VH max	VC	VH max
1-1/8"	1/8 NPT	.50"	.50"	.51	.50	-	-	-	-
1-5/8"	1/8 NPT	.50"	.63"	.51	.50	-	-	-	-
2-1/2"	1/4 NPT	.50"	.75"	.65	.69	1.01	1.88	-	-
3"	1/4 NPT	.50"	.75"	.65	.69	1.01	1.88	-	-
4"	1/4 NPT	.50"	1.00"	.65	.69	1.01	1.88	-	-
5"	1/4 NPT	.50"	1.38"	.65	.69	1.01	1.88	-	-
6"	1/4 NPT	.50"	1.38"	.65	.69	1.01	1.88	-	-
8"	1/2 NPT	1.00"	1.50"	1.01	1.88	-	-	-	-
10"	1/2 NPT	.50"	2.00"	1.01	1.88	-	-	1.32	2.28
12"	1/2 NPT	.50"	2.00"	1.01	1.88	-	-	1.32	2.28

Nonrotating Double Rod

Option -NRDR

A combination of the Options -NR and -DR as shown above. The rod end rod is Hex and the cap end rod is round. The ported baffles are included and the "Dimension A" adjustments shown for Option -NR must be made. Extended piston areas must also be reduced by the rod area.

Adjustable extend stroke

Option -AS

For strokes through 6"
Full stroke adjustment is standard.

Note!

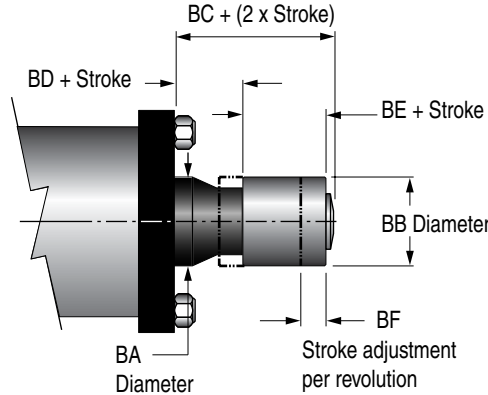
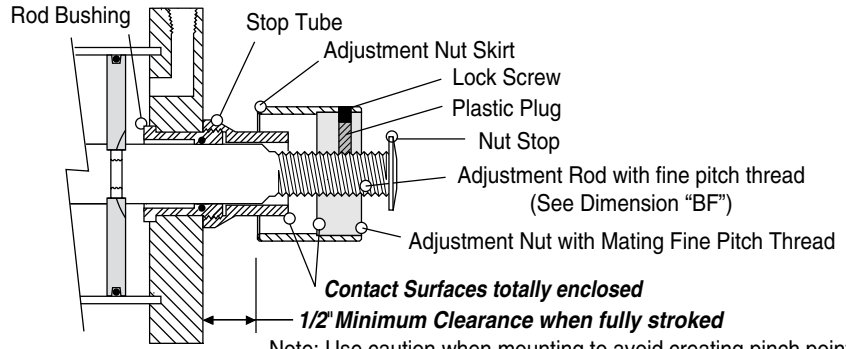
To maintain operator safety features of this option, it is NOT available with mounting styles: -WR and -WFR. Use caution when mounting to avoid creating pinch points.

Not available with mounting styles -PM and -SM.

Not available for 10" & 12" bores

Dial-A-Stroke® provides a rugged and precision adjustment of the extend stroke of the cylinder. The stop tube, adjustment nut with skirt, and minimum clearances combine to eliminate pinch points, thus providing operator safety. **Note!** Use caution when mounting to avoid creating pinch points with other parts of your machine design.

The stop tube is blue anodized aluminum, the adjustment nut is blackened steel with a black anodized aluminum skirt, and the nut stop is red anodized aluminum; all for corrosion resistance and appearance. The adjustment nut, steel for long life, includes a lock screw with a plastic plug so that the adjustment nut can be locked in place without damaging the threads. The nut stop is mounted on the end of the adjustment rod so that the nut cannot come off. The fine pitch threads on the adjustment rod and nut provide precision adjustment. (See dimension "BF"). Adjustment settings are simplified by convenient scale markings applied to nut skirt and stop tube.

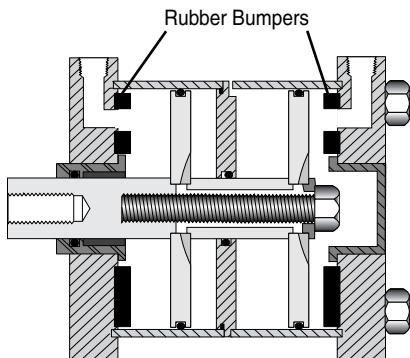


Bore	1-1/8"	1-5/8"	2-1/2"	3"	4"	5"	6"	8"	
BA	1.13	1.25	1.50	1.50	2.00	2.25	2.25	2.50	
BB	1.50	1.50	2.00	2.00	2.00	2.25	2.25	2.75	
BC	1.67	1.67	1.90	1.90	1.67	1.67	1.67	2.54	+ (2 x Stroke)
BD	1.00	1.00	1.00	1.00	.75	.75	.75	1.13	+ Stroke
BE	.50	.50	.75	.75	.75	.75	.75	1.16	
BF	.050	.050	.063	.063	.063	.071	.071	.071	

Rubber Bumpers

Option

- Rod End only **-BF**
- Cap End only **-BR**
- Both Rod & Cap Ends **-BFR**



Standard rubber mass will compress and give full stroke at 60 to 80 psi. This mass can be adjusted to meet your specific pressure and/or dynamic load requirements.

A rubber doughnut is bonded to the cylinder head to act as the piston stop and absorb the impact of the piston. This reduces noise and absorbs energy, thus reducing damage to the cylinder and tooling due to pounding. The amount of rubber that extends beyond the normal piston stop is designed to compress and allow full stroke of the cylinder at 60 to 80 psi. If your application uses lower pressure or has high energy, consult engineering with application details so that rubber mass can be adjusted to meet your specific requirements.

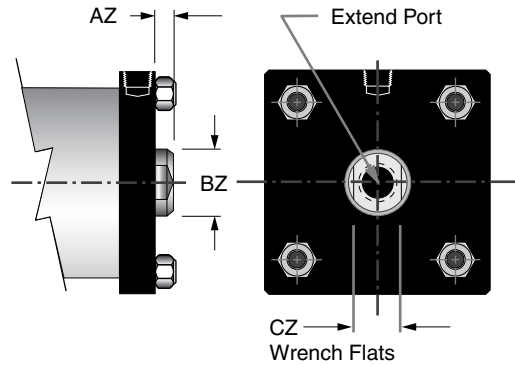
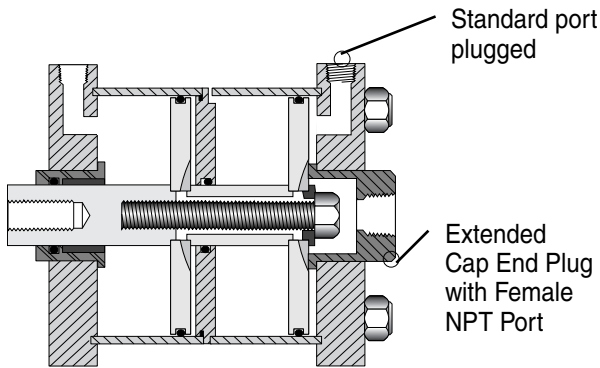
Because of the temperature limitations of the adhesives involved (-25° to +225°F), rubber bumpers are available in cylinders with standard internally lubricated Buna-N seals only.

Use where noise reduction and impact absorption is desired.

Note! On applications such as punching, shearing, setting blind rivets, etc., where high forces are built up and then released VERY quickly, the proper method of "catching" this type of load is to adjust the cylinder piston and the tooling so that at the point of breakthrough the piston is very close to the bumper. This reduces the dynamic load that the piston and bumper are required to absorb.

Option Specifications

Extend Port Bushing		Option
3/8 NPT	(2-1/2" – 6" bores)	-E38
1/2 NPT	(2-1/2" – 6" bores)	-E12
3/4 NPT	(5" – 12" bores)	-E34



Dimensions (inches)				Availability		
Bore	AZ	BZ	CZ	E38	E12	E34
				2-1/2	.38	1.13
3	.38	1.13	.94	✓	✓	-
4	.38	1.50	1.26	✓	✓	-
5	.38	1.75	1.50	✓	✓	✓
6	.38	1.75	1.50	✓	✓	✓
8	.31	1.75	1.50	-	-	✓
10	.50	2.75	2.25	-	-	✓
12	.50	2.75	2.25	-	-	✓

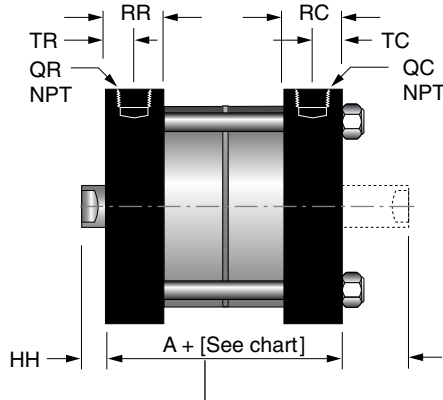
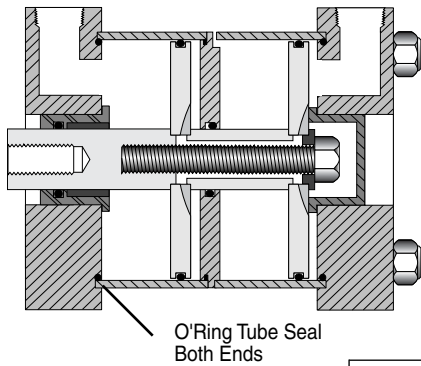
The cap end plug is replaced with an extended plug of black anodized aluminum with a female NPT port. The standard cap end port is plugged.

Use for plumbing convenience, or when higher air flows are required for higher cycle speeds.

5

1/2 NPT Ports in Heads		Option
2-1/2", 3", 4", 5", & 6" Bores only		
Rod End Head		-TF
Cap End Head		-TR
Both Heads		-TFR

3/4 NPT Ports in BOTH Heads		Option
8", 10" & 12" Bores only		
		-P34



For 2-1/2" thru 6" bores, thicker heads (to accept 1/2 NPT ports) replace the standard heads. Because of the thicker heads, there is an increase in Dimension "A" and a reduction of the rod extension as charted below. With this construction, an O'Ring replaces the fiber gasket cylinder tube seal.

For 8", 10" and 12" bores, 3/4 NPT ports are applied to standard heads.

Use when higher cycle speeds are required.

See pages 5.5 & 5.6 for Dimension "A"

Option	Add to A	QC	QR	RC 2-1/2 & 3" Bore	RC 4, 5 & 6" Bore	RC 8, 10 & 12" Bore	RR 2-1/2 & 3" Bore	RR 4, 5 & 6" Bore	RR 8, 10 & 12" Bore	HH 2-1/2, 3 & 4" Bore	HH 5 & 6" Bore	HH 8, 10 & 12" Bore	HH-DR 2-1/2, 3 & 4" Bore	HH-DR 5 & 6" Bore	HH-DR 8, 10 & 12" Bore	TC	TR
TF	.38	1/4	1/2	0.75	0.75	-	1.00	1.25	-	0.12	0.31	-	0.50	0.69	-	.31	.50
TR	.38	1/2	1/4	1.00	1.25	-	0.75	0.75	-	0.50	0.69	-	0.12	0.31	-	.50	.31
TFR	.76	1/2	1/2	1.00	1.25	-	1.00	1.25	-	0.12	0.31	-	0.12	0.31	-	.50	.50
P34	0.00	3/4	3/4	-	-	1.50	-	-	1.50	-	-	1.00	-	-	1.00	.63	.63

High Flow Vents		Option -HF
-----------------	--	------------

The atmospheric vent in the baffle is cut larger to provide less resistance to the air flow.

Use when higher cycle speeds are required.

Speed & Shock Control Using Hydraulics

Option -HS

Available in 2-1/2" through 12" Bore

Temperature range: -25° to +250°F

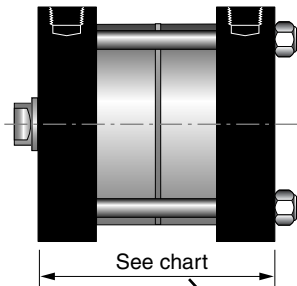
Available with Viton seals

Add -V

Temperature range: -15° to +400°F

Note!!!

All 4-Stage Units 2-1/2" thru 10" Bores are rated at 120 psi maximum air input! 12" Bore, 3-Stage is rated at 130 psi max. 12" Bore, 4-Stage is rated at 100 psi max.



When Multi-Power® cylinders are applied to applications such as punching or shearing, high inertial and impact forces are often encountered. To capture these potentially destructive forces, and prevent possible damage to tooling and cylinder specify Option -HS.

The seals on the piston, piston rod and tube are increased in the **single return stage** (retract or extend) and fluid is used to control speed and shock. Fluid from an air-over-oil tank is used for the return media. This fluid passes through a resistance, such as a flow control, which provides speed control of the cylinder. When the material shears and the cylinder tries to complete its stroke, the non-compressible fluid resists rapid movement, providing shock and speed control. Note the circuits shown below.

For less fluid restriction and larger plumbing on 2-1/2" through 6" bores, see the 1/2 NPT porting options -TF, -TR, and -TFR on page 5.10. Also for 10" & 12" bores, 3/4 NPT Port Option -P34 is available. See page 5.10.

Note!! The fluid pressure in the return stage is limited to 500 psi. This dictates that all 4-stage units thru 10" bore be limited to 120 psi maximum air input! 12" bore, 3 stage units are limited to 130 psi; 4 stage units are limited to 100 psi.

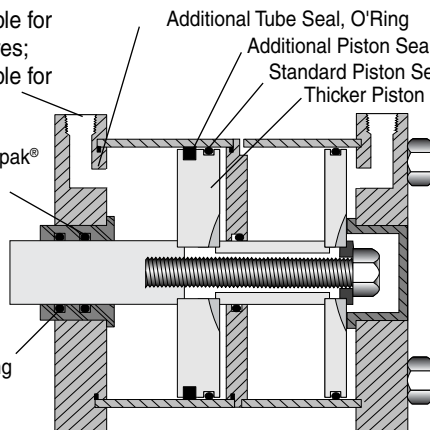
Use when smooth, rigid, and precision speed control is required. Also with applications such as punching, shearing, setting blind rivets, etc., where high forces are built up and then released very quickly. The fluid, being incompressible, "catches" these forces, both static and dynamic, dissipating them before the cylinder reaches the end of its stroke – and before the piston can pound on the piston stop.

1/2 NPT Porting is available for 2-1/2", 3", 4", 5", & 6" Bores;
 3/4 NPT Porting is available for 10" & 12" Bores

Additional Rod Seal, Polypak®
 SAE 660 Bronze Bushing

Additional Tube Seal, O'Ring
 Additional Piston Seal, Polypak®
 Standard Piston Seal, O'Ring
 Thicker Piston

Standard Rod Seal, O'Ring



The Polypak® seals combine an automatic lip seal with an O'spring energizer for excellent sealing from 0 to 500 psi.

Series MP	Bore	Add to "A" Pg 5.5 & 5.6
		2-1/2", 3", 4"
	5"	0.25"
	6"	0.50"
	8"	0.25"
	10", 12"	0.00"

MLR, MLS	Bore	Add to "B" Pg 5.24
		2, 2-1/2", 3", 4"

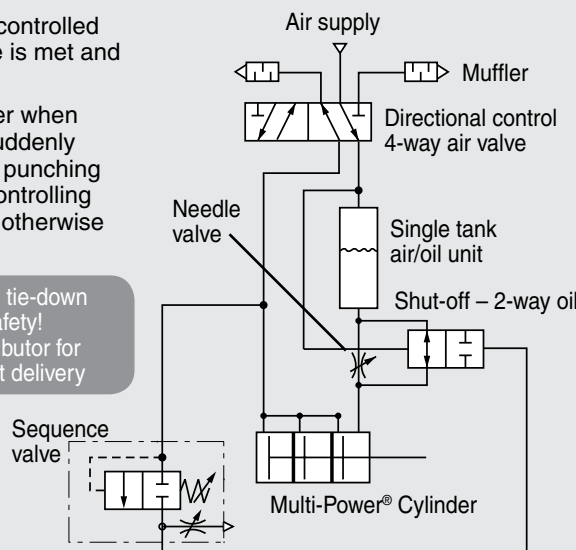
Application Tips

Two Speed & Shock Control

Single air/oil tank with sequence, needle and shut-off valves give:

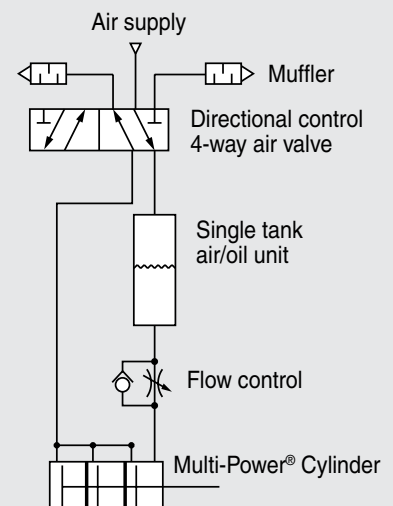
1. Rapid "Extend" stroke.
2. Automatic switch to controlled rate when resistance is met and pressure builds up.
3. Fluid catches cylinder when built-up forces are suddenly released (such as in punching applications), thus controlling the shock that could otherwise occur.

Always use 2-hand anti tie-down systems for operator safety!
 Consult your local distributor for information and product delivery



One Speed Circuit

Single air/oil tank and flow control valve give hydraulic control with speed control on "Extend" stroke with rapid rate on "Retract" stroke.

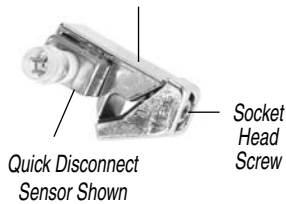


Magnetic Piston Option -E Specifies Magnetic Piston (Order Sensors and Sensor Clamps Separately)

- **Option -E** consists of a magnet bonded into the piston head. When the piston magnet moves past an external sensor, the magnetic field activates the sensor without physical contact.
- **Mounting** – The sensor is attached to a 2-part clamp that attaches rigidly to a tie rod and can be positioned anywhere along the length of the cylinder for very precise signaling.
- Two sensor styles are used – (a) the **9-2A197 Series** for 1-1/8" thru 3" bores requires a tie rod clamp, and (b) the **749 Series** which accommodates the larger diameter tie rods of the 4" thru 12" bores with an integral clamp.
- **Reliability** – The annular piston magnet is permanently bonded into a groove in the piston. It is a polarized permanent magnet of rubber bonded barium ferrite that is very stable and is not affected by shock. Under normal usage it will remain magnetized indefinitely.
- **Warning** – External magnetic fields and/or ferrous objects may affect the strength of the piston magnet therefore affecting sensor actuation and piston position indication. Labels noting this are affixed to the cylinder.
- **Please note there is an increase in base length of the cylinder to accommodate the magnet. Using the table below add 'L' to Dimension 'A' on pages 5.5 & 5.6**

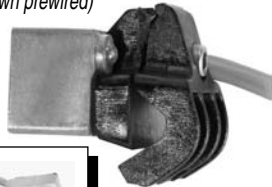


9-2A197 Series Sensor & Clamp
for 1-1/8" to 3" Bores



Quick Disconnect
Sensor Shown

749 Series Sensor with Integral Clamp
for 4" to 12" Bore Cylinders
(shown prewired)



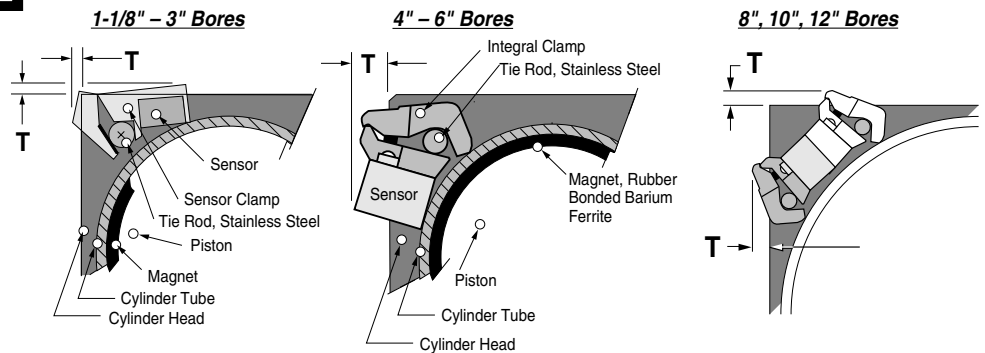
9 foot prewired sensor



Female Cordsets available
in 1, 2, & 5 meter lengths

(T) Clamp Stick Out & (L) Length Adder to Dim. 'A' Pgs. 5.5 & 5.6

Bore	1-1/8"	1-5/8"	2-1/2"	3"	4"	5"	6"	8"	10"	12"
T	.38	.38	.38	.38	.36	.25	.14	.10	.38	.38
L	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00



WARNING
This cylinder is equipped with a Magnetic Piston for use with Magnetically Operated Sensors. Other Magnetic Sensitive Devices Should be Kept at a Distance to Avoid Inadvertent Operation.

Temperature Range: -20° to + 80°C (-4° to + 176°F)

Warning! Do not exceed sensor ratings. Permanent damage to sensor may occur. Power supply polarity **MUST** be observed for proper operation of sensors. See wiring diagrams included with each sensor.

Sensor & Clamp Ordering Guide

LED Lighted Magnetic Piston Position Sensors: Bores 1-1/8" – 3"			
Product	9 ft. Prewired P/N	Quick Discon. P/N	Electrical Characteristics
Reed Switch	9-2A197-1004	9-2A197-1304	5-120 VDC/VAC, 0.5 Amp Max., 10 Watt Max., SPST N.O., 3.5 Voltage Drop
Electronic	9-2A197-1033	9-2A197-1333	Sourcing, PNP, 6-24 VDC, 0.5Amp Max., 1.0 Voltage Drop
Electronic	9-2A197-1034	9-2A197-1334	Sinking, NPN, 6-24VDC, 0.5Amp Max., 1.0 Voltage Drop
9-2A197 Series Sensor Mounting Clamps – Part Number 800-200-000			
LED Lighted Magnetic Piston Position Sensors: Bores 4" – 8"			
Reed Switch	749-000-004	749-000-504	5-240 VDC/VAC, 1 Amp Max., 30 Watt Max., SPST N.O., 3.0 Voltage Drop
Electronic	749-000-031	749-000-531	Sourcing, PNP, 6-24 VDC, 1.0 Amp Max., 0.5 Voltage Drop
Electronic	749-000-032	749-000-532	Sinking, NPN, 6-24 VDC, 1.0 Amp Max., 0.5 Voltage Drop
LED Lighted Magnetic Piston Position Sensors: Bores 10" & 12"			
Reed Switch	749-111-004	749-111-504	5-240 VDC/VAC, 1 Amp Max., 30 Watt Max., SPST N.O., 3.0 Voltage Drop
Electronic	749-111-031	749-111-531	Sourcing, PNP, 6-24 VDC, 1.0 Amp Max., 0.5 Voltage Drop
Electronic	749-111-032	749-111-532	Sinking, NPN, 6-24 VDC, 1.0 Amp Max., 0.5 Voltage Drop

Female Cordsets for 9-2A197 Series Quick Disconnect Sensors			
Length	1 Meter	2 Meter	5 Meter
Part No.	CFC-1M	CFC-2M	CFC-5M
Female Cordsets for 749 Series Quick Disconnect Sensors			
Length	2 Meter	5 Meter	
Part No.	CFC-2M-12	CFC-5M-12	

Specifications

Media.....	Air
Recommended Minimum Pressure	20 psi
Duralon® rod bushing.	See chart pg. 5.1
Maximum Operating Pressure.....	150 psi
Ambient & Media Temperature	-25° to + 250°F
Prelubrication	Magnalube®-G Grease
Airline Lubrication.....	Recommended



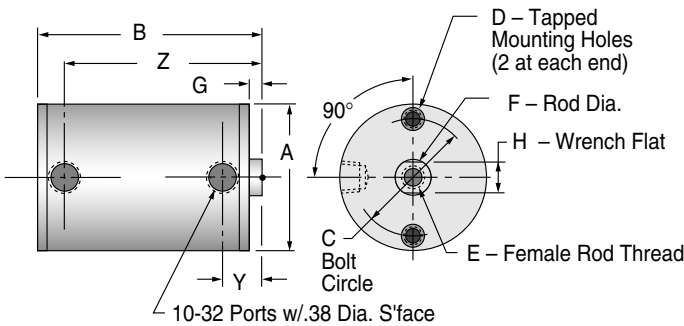
Sizing Pancake® - Multi-Power® Cylinders

Series Bore	Stages (Pistons)	Area ‡	Equivalent Bore †	Force @ 60 psi	Retract Area	Body O. D.	Available Strokes					
							1/8"	1/4"	1/2"	3/4"	1"	1-1/2"
MK 1/2	2	.35	.6	20	.15	1.13	•	•	•	•	•	•
	3	.50	.7	30			•	•	•	•	•	•
	4	.65	.9	35			•	•	•	•	•	•
MK 3/4	2	.80	1.0	45	.36	1.50	•	•	•	•	•	•
	3	1.16	1.1	70			•	•	•	•	•	•
	4	1.52	1.3	90			•	•	•	•	•	•
MK 1-1/8	2	1.79	1.5	105	.80	1.99	•	•	•	•	•	•
	3	2.59	1.8	155			•	•	•	•	•	•
	4	3.39	2.0	200			•	•	•	•	•	•
MK 1-5/8	2	3.83	2.2	230	1.76	2.74	•	•	•	•	•	•
	3	5.59	2.6	335			•	•	•	•	•	•
	4	7.35	3.0	440			•	•	•	•	•	•
MK 2	2	5.84	2.6	350	2.70	3.24	•	•	•	•	•	•
	3	8.54	3.2	510			•	•	•	•	•	•
	4	11.24	3.7	670			•	•	•	•	•	•
MK 2-1/2	2	9.38	3.3	560	4.47	3.74	•	•	•	•	•	•
	3	13.85	4.0	830			•	•	•	•	•	•
	4	18.32	4.7	1095			•	•	•	•	•	•
MK 3	2	13.70	4.0	820	6.63	4.24	•	•	•	•	•	•
	3	20.33	5.0	1215			•	•	•	•	•	•
	4	26.96	5.7	1615			•	•	•	•	•	•
MK 4	2	24.35	5.5	1461	11.78	5.50	•	•	•	•	•	•
	3	36.13	6.7	2168			•	•	•	•	•	•
	4	47.91	7.7	2875			•	•	•	•	•	•

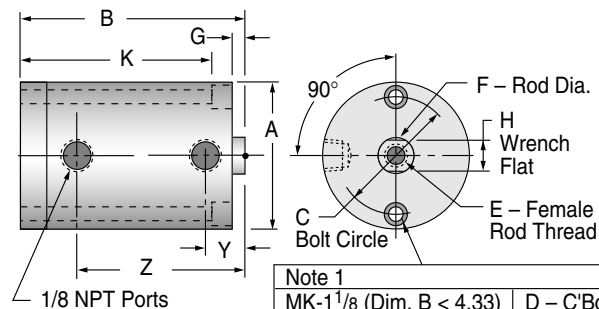
‡ Area = Total effective piston area, square inches. † Equivalent Bore = Bore required for a single piston cylinder.

5

Models -MK 1/2 and -MK 3/4



Models -MK 1-1/8 and -MK 1-5/8



Note 1	
MK-1 ¹ / ₈ (Dim. B < 4.33)	D - C'Bored
All MK-1 ⁵ / ₈	J - Thru Holes
MK-1 ¹ / ₈ (Dim. B ≥ 4.33)	D-Tapped Mtg. Holes (2 at each end)

Fixed Dimensions

Series Bore	A	C	D	J Dia	E	F	G	H	Y
MK 1/2	1.13	0.88	#6-32 x .44 dp	-	8-32 x .38 dp	.25	0.13	3/16 x .11	0.46
MK 3/4	1.50	1.19	#8-32 x .44 dp	-	10-32 x .38 dp	.31	0.13	1/4 x .11	0.46
MK 1-1/8 (Dim. B < 4.33)	1.99	1.69	.32 C'Bore x .19 dp	0.20	5/16-24 x .63 dp	.50	0.14	7/16 x .11	-
MK 1-1/8 (Dim. B ≥ 4.33)	1.99	1.69	#10-32 x .50 dp	-	5/16-24 x .63 dp	.50	0.14	7/16 x .11	-
MK 1-5/8	2.74	2.38	.32 C'Bore x .19 dp	0.20	3/8-24 x .75 dp	.62	0.14	1/2 x .11	0.52
MK 2	3.24	2.81	.38 C'Bore x .26 dp	0.27	1/2-20 x .88 dp	.75	0.14	5/8 x .11	0.52
MK 2-1/2	3.74	3.25	.38 C'Bore x .26 dp	0.27	1/2-20 x .88 dp	.75	0.14	5/8 x .11	0.64
MK 3	4.24	3.81	.38 C'Bore x .26 dp	0.27	1/2-20 x .88 dp	.75	0.14	5/8 x .11	0.64
MK 4	5.50	5.00	.38 C'Bore x .26 dp	0.27	5/8-18 x .88 dp	1.00	0.20	7/8 x .18	0.70

Model Number Code

MK	1-1/8	x	1	-	3	-	1	-	MR
Series	Bore		Stroke		Stages Extend		Stages Retract		
	1/2" 3/4" 1-1/8" 1-5/8" 2" 2-1/2" 3" 4"		See available strokes in the sizing guide on page 5.13		2 — 1 3 — 1 4 — 1 1 — 2 1 — 3 1 — 4				
					Standard available combinations are listed above. Consult factory for Multiple Extend-Multiple Retract Options.				

Suffix Options - See pages 5.15 - 5.17

Stroke Collars: 1/8" -C1; 1/4" -C2; 3/8" -C3

Threaded Nose Mount: Single Rod -F
 Double rod, rod end -F
 Double rod, cap end -F1
 Double rod, both ends -F2

Double Rod -DR

Male rod thread: Single rod -MR
 Double rod, rod end -MR
 Double rod, cap end -MR1
 Double rod, both ends -MR2

Viton seals -V

External guide, nonrotating for load guiding -G

Finish: ProCoat™ -N

Rubber Bumpers:
 1-1/8 Bores & Larger Rod end -BF
 Cap end -BR
 Both ends -BFR

Adjustable extend stroke
 1-1/8 Bores & Larger -AS

Clevis mount: Ports in-line with slot -PM
 Ports 90° to slot -SM

Eye mount: Ports in-line with tang -EPM
 Ports 90° to tang -ESM

Magnetic piston & sensor mounting slot(s) -E
 Order sensors separately.

Extend Port Bushing
 3/8 NPT for 2" Bores and Larger -E38
 1/4 NPT Ports for 1-5/8" Bores and Larger -P14

Ordering Examples

Model No: Series Bore x Stroke - Stages Extend - Stages Retract

MK2 X 1-2-1

Pancake®-Multi-Power®

2" Bore, 1" Stroke, 2 Stage Extend, 1 Stage Retract

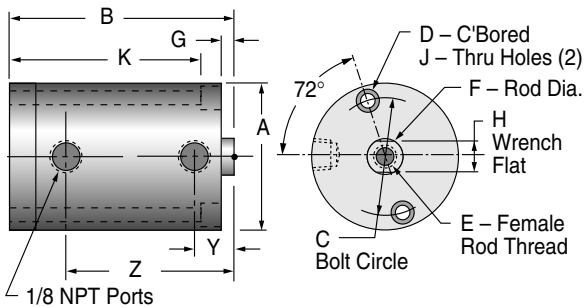
MK 1-1/8 X 1/2-4-1-MR

Pancake®-Multi-Power®

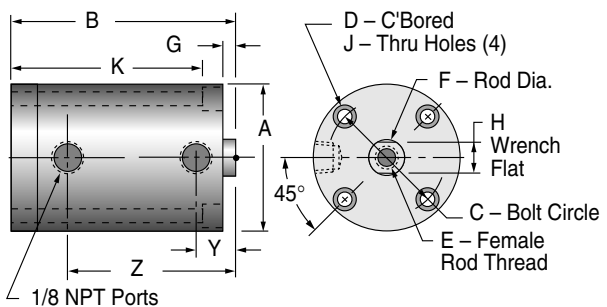
1 1/8" Bore, 1/2" Stroke, 4 Stage Extend, 1 Stage Retract, Male Rod

5

Model -MK 2



Models -MK 2-1/2, -MK 3, and -MK 4



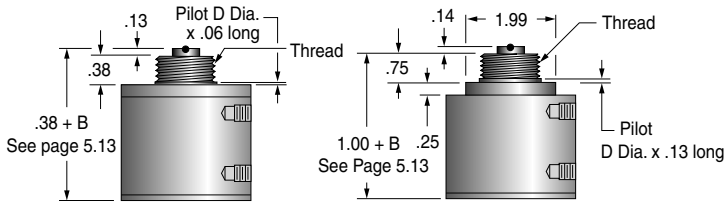
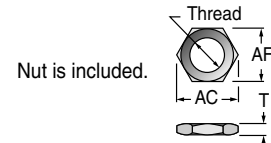
Variable Dimensions

Series	Bore	Stroke	MK 1/2		MK 3/4		MK 1-1/8				MK 1-5/8			MK 2			MK 2-1/2			MK 3			MK 4		
			B	Z	B	Z	B	K	Y	Z	B	K	Z	B	K	Z	B	K	Z	B	K	Z	B	K	Z
2 Stages extend	1/8	1.88	1.55	1.88	1.55	2.36	2.03	0.52	1.52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/4	2.13	1.80	2.13	1.80	2.61	2.28	0.52	1.77	3.30	2.97	2.96	3.52	3.13	3.02	3.39	3.00	2.89	3.45	3.10	2.96	3.70	3.25	3.21	
	1/2	2.88	2.55	2.88	2.55	3.30	2.96	0.70	2.45	3.80	3.47	3.46	4.02	3.63	3.52	3.89	3.50	3.39	3.95	3.55	3.46	4.20	3.75	3.71	
	1	3.88	3.55	3.88	3.55	4.33	note1	0.99	3.49	4.80	4.47	4.46	5.02	4.63	4.52	4.89	4.50	4.39	4.95	4.55	4.46	5.20	4.75	4.71	
	1-1/2	4.88	4.55	4.88	4.55	5.33	note1	0.99	4.49	5.80	5.47	5.46	6.02	5.63	5.52	5.89	5.50	5.39	5.95	5.55	5.46	6.20	5.75	5.71	
3 Stages extend	1/8	2.38	2.05	2.38	2.05	2.86	2.53	0.52	2.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	1/4	2.88	2.55	2.88	2.55	3.74	3.40	0.89	2.89	NA	NA	NA	5.02	4.63	4.52	4.89	4.50	4.39	4.95	4.55	4.46	5.20	4.75	4.71	
	1/2	3.88	3.55	3.88	3.55	4.33	note1	0.99	3.49	4.80	4.47	4.46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	3/4	4.88	4.55	4.88	4.55	5.33	note1	0.99	4.49	5.80	5.47	5.46	6.02	5.63	5.52	5.89	5.50	5.39	5.95	5.55	5.46	6.20	5.75	5.71	
4 Stages extend	1/4	3.88	3.55	3.88	3.55	4.33	note1	0.99	3.49	4.80	4.47	4.46	6.02	5.63	5.52	5.89	5.50	5.39	5.95	5.55	5.46	6.20	5.75	5.71	
	1/2	4.88	4.55	4.88	4.55	5.33	note1	0.99	4.49	5.80	5.47	5.46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Threaded Nose Mount Option -F Available on 1/2" to 1-5/8" Bore Models

1/2" & 3/4" Bores

1-1/8" & 1-5/8" Bore



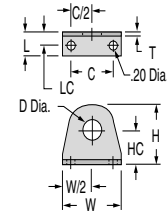
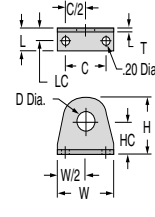
Bore	D Pilot	Thread	Nut Part No.	AC	AF	T
1/2"	.495-.491	1/2" - 20	MC-500-195	0.72	0.63	.25
3/4"	.620-.615	5/8" - 18	MC-700-195	0.88	0.75	.25
1-1/8"	1.000 -.995	1" - 14	12100-195	1.59	1.38	.19
1-5/8"	1.250-1.245	1 1/4" - 12	22100-195	1.88	1.63	.25

Plated steel nose mounting brackets *Must be ordered separately*

BRK-201 & BRK-301

BRK-202 & BRK-302

Bore	Part No.	C	D	F	FC	H	HC	L	LC	T	W
1/2"	BRK-201	1.13	.50	-	-	1.31	.75	.63	.38	.09	1.50
1/2"	BRK-202	1.13	.50	1.80	0.99	-	-	-	-	.09	1.50
3/4"	BRK-301	1.25	.63	-	-	1.75	1.00	.69	.44	.12	1.80
3/4"	BRK-302	1.25	.63	2.25	1.25	-	-	-	-	.12	1.80



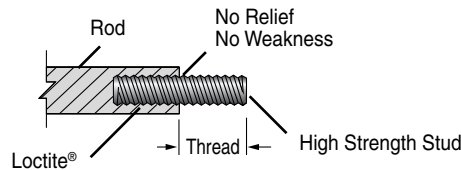
5

Male Rod Thread

Option

- Single Rod
- Double Rod, Rod End Only
- Double Rod, Cap End Only
- Double Rod, Both Ends

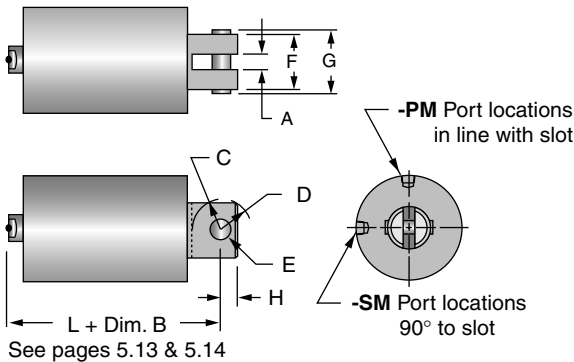
- MR
- MR
- MR1
- MR2



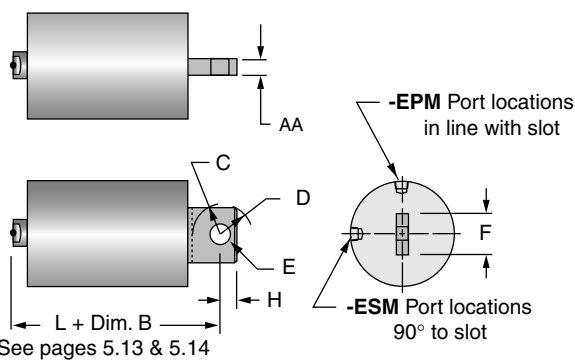
Bore	Thread
1/2"	8-32 x .50
3/4"	10-32 x .50
1-1/8"	5/16-24 x .75
1-5/8"	3/8-24 x .88
2"	1/2-20 x 1.00
2-1/2"	1/2-20 x 1.00
3"	1/2-20 x 1.00
4"	5/8-18 X 1.25

Clevis Mount

Option -PM & -SM



Pivot Mount Option -EPM & -ESM (Available 1/2" thru 2" Bore)



Bore	A	AA	C	D	E Hole	E Pin	F	G	H	L
1/2"	.25	.23	0.41	0.34	.251	.250	0.63	0.83	.25	0.56
3/4"	.25	.23	0.41	0.34	.251	.250	0.63	0.83	.25	0.56
1-1/8"	.31	.30	0.69	0.56	.3135	.3125	1.00	1.21	.37	0.94
1-5/8"	.38	.35	0.69	0.68	.376	.3750	1.25	1.48	.37	1.00
2"	.38	.36	0.69	0.68	.376	.3750	1.25	1.48	.37	1.00
2-1/2"	.50	NA	0.97	0.90	.501	.500	1.63	1.86	.50	1.38
3"	.50	NA	0.97	0.90	.501	.500	1.63	1.86	.50	1.38
4"	.63	NA	1.22	1.06	.626	.625	2.00	2.24	.63	1.75

Pro-Coat™

Electroless Nickel plating

Option -N

Electroless Nickel plating is a hard, smooth, corrosion & wear resistant coating that will often suffice for applications where stainless steel is specified. The coating is a high nickel low phosphorous alloy deposited by chemical reduction without electric current that is more corrosion resistant than plated

nickel. Its lasting luster provides high eye appeal. It has natural lubricity & high resistance to abrasion. Standard hardness of the coating is approximately 49 Rockwell C. Heat treating can increase hardness to 60 Rockwell C.

Consult Engineering for specific application requirements

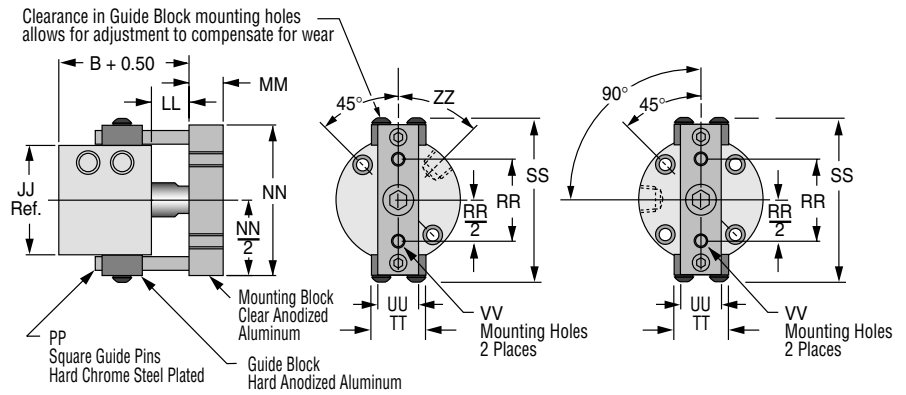
Series MK Option Specifications

1-1/8" through 2" Bores

2-1/2" through 4" Bores

External Guide, Nonrotating

Option -G



Superior nonrotating piston rod feature for applications such as package placement, figure stamping, and any application where anti-rotation and registration are critical as the piston is extended and retracted.

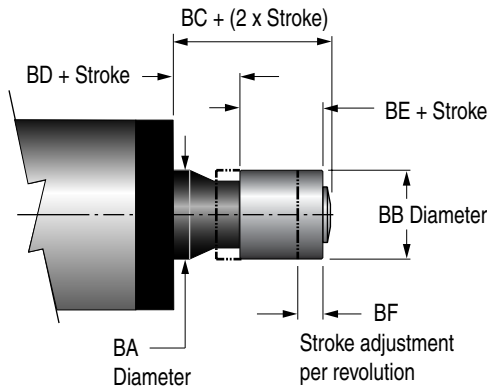
A mounting block is bolted to the piston rod. This block has two square pins mounted to it which in turn pass through guide blocks mounted on the sides of the cylinder.

Bore	3/4"	1-1/8"	1-5/8"	2"	2-1/2"	3"	4"
JJ	1.50	1.99	2.74	3.24	3.74	4.24	5.50
LL	0.63	0.64	0.64	0.64	0.64	0.64	0.70
MM	0.63	0.63	0.63	0.75	0.75	1.00	1.25
NN	2.20	2.75	3.50	4.00	4.56	5.06	6.32
PP	0.19	0.25	0.25	0.25	0.31	0.31	0.31
RR	0.88	1.06	1.50	1.88	1.88	1.88	1.88
SS	2.30	3.13	3.85	4.37	4.88	5.38	7.09
TT	0.75	1.00	1.00	1.00	1.00	1.00	1.00
UU	0.63	0.63	0.75	1.00	1.00	1.00	1.25
VV	#6-32	#8-32	1/4-20	5/16-18	5/16-18	5/16-18	5/16-18
ZZ	45°	45°	45°	63°	-	-	-

5

Adjustable Extend Stroke Option -AS

Available on bores 1-1/8" and larger. See description on page 5.9.



Bore	1-1/8"	1-5/8"	2-1/2"	3"	4"	
BA	1.13	1.13	1.50	1.50	1.50	
BB	1.50	1.50	2.00	2.00	2.00	
BC	1.16	1.16	1.41	1.41	1.41	+ (2 x Stroke)
BD	.50	.50	.50	.50	.50	+ Stroke
BE	.50	.50	.75	.75	.75	
BF	.050	.050	.063	.063	.063	

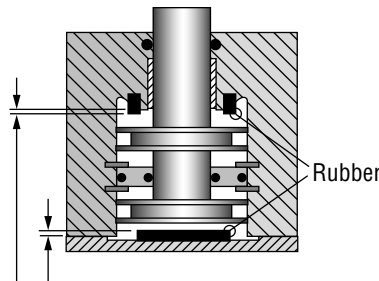
Note! Use caution when mounting to avoid creating pinch points with other parts of your machine design.

Rubber Bumpers

- Rod End Only
- Cap End Only
- Both Ends

Temperature Range
(-25° to + 220°F)

- BF
- BR
- BFR



A donut or pad of rubber is bonded in place to reduce noise and absorb energy, thus reducing destruction of the cylinder and tooling due to pounding. See complete description of benefits on page 5.9.

Standard rubber mass will compress and give full stroke at 60 to 80 psi. This mass can be adjusted to meet your specific pressure and/or dynamic load requirements.

Extend Port Bushing

3/8 NPT for 2" Bores & Larger

-E38

Use when higher cycle speeds are required.

1/4 NPT Ports

for 1-5/8" Bores & Larger

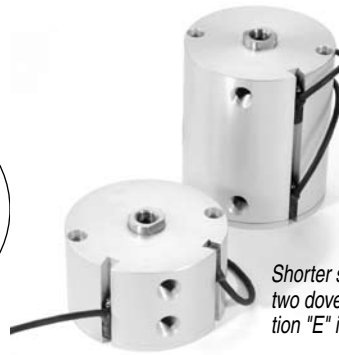
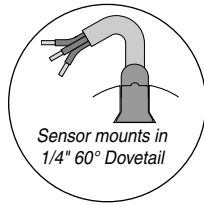
-P14

Magnetic Piston

Option -E

For 1-1/8" Bore and larger
Includes Dovetail Mounting Slots

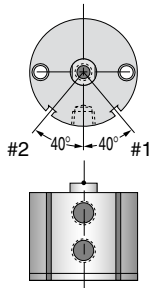
Order Sensors Separately



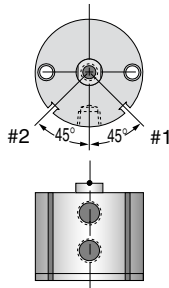
A single slot on longer stroke models has room to accommodate multiple sensors.

Shorter stroke cylinders are furnished with two dovetail mounting slots when Suffix Option "E" is specified.

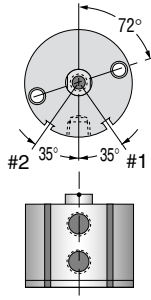
MK1-1/8



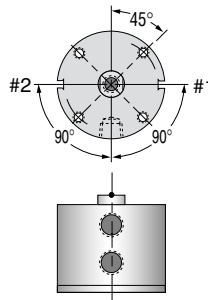
MK1-5/8



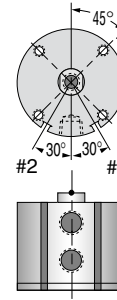
MK2



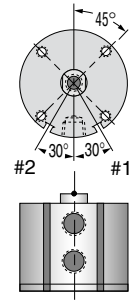
MK2-1/2



MK3



MK4

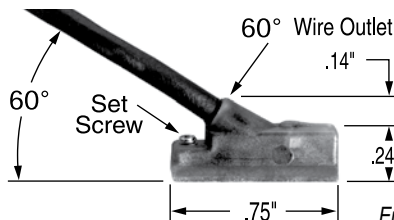


1/8" to 1" stroke models have 2 mounting slots. 1-1/2" stroke models have 1 slot. Ports are in-line for all Bores, all Strokes.

5

Low Profile, Solid State, Magnetic Piston Position Sensors

Temperature Range:
-20° to +80°C (-4° to +176°F)



Encased in plastic housing, dovetail style sensors are corrosion resistant. 60° wire outlet allows close mounting. Profile shown here is typical.

Female Cordsets for Quick Disconnect	Length	Part No.
	1 Meter	CFC-1M
	2 Meters	CFC-2M
	5 Meters	CFC-5M

Ordering Guide – Dovetail Style Magnetic Sensors

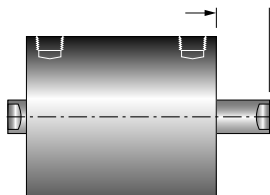
Cylinder Model	Sensor Type	Prewired 9 ft. Part No.	Quick Disconnect Part No.*	LED	Electrical Characteristics
Series MK	Electronic	949-000-031	949-000-331	Yes	Sourcing, PNP, 6-24 VDC, 0.20 Amp Max current, 0.5 Voltage Drop
	Electronic	949-000-032	949-000-332	Yes	Sinking, NPN, 6-24 VDC, 0.20 Amp Max current, 0.5 Voltage Drop

Note*: Quick disconnect style sensors are supplied with 6" pigtail. Order female cordsets separately.

Double Rod

Option -DR

G + stroke



Standard piston rod and rod bushing on both ends of the cylinder.

Bore	1/2"	3/4"	1-1/8"	1-5/8"	2"	2-1/2"	3"	4"
G	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.20

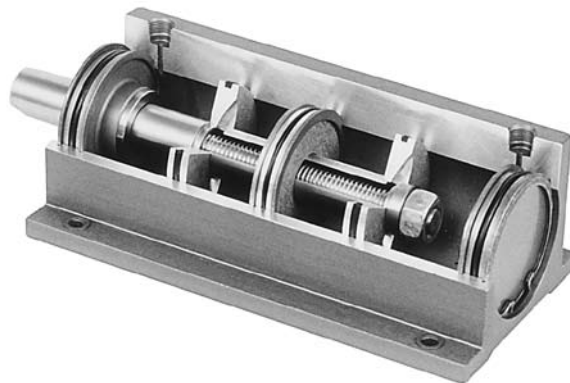
Viton Seals

Option -V

Use for elevated temperatures (-15° to + 400°F) or compatibility with exotic media. Consult engineering for compatibility information.

Specifications

Media..... Air
 Recommended Minimum Pressure 20 psi
 Maximum Operating Pressure 150 psi
 Ambient & Media Temperature -25° to +250°F
 Prelubrication Magnalube® -G Grease
 Airline Lubrication..... Recommended



Sizing Square 1® – Multi-Power® Cylinders

Series	Bore	Stages (Piston)	Area ‡	Equivalent Bore †	Force @ 60 psi	Retract Area	Available Strokes							
							1/8"	1/4"	1/2"	3/4"	1"	1-1/2"	2"	2-1/2"
MQ	3/4"	2	.80	1	48	.36		•	•	•	•	•		
MQW	7/8"	2	1.12	1-3/16	67	.52		•	•	•	•	•		
MQF	1-1/8"	2	1.79	1-1/2	107	.80	•	•	•		•	•	•	•
MQFW	1-5/8"	2	3.83	2-1/8	229	1.76	•	•	•		•	•	•	•
MQL	2"	2	5.84	2-5/8	350	2.70		•	•		•	•	•	•
MQLW														

‡ Area = Total effective piston area, square inches. † Equivalent Bore = Bore required for a single piston cylinder.

5

How to Order

Model Number Code

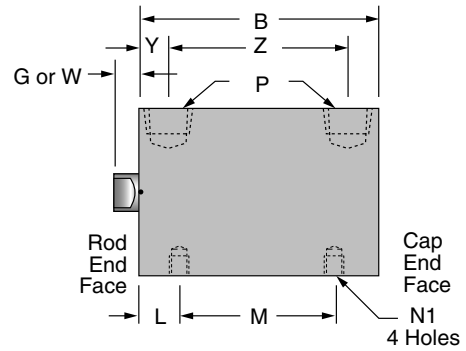
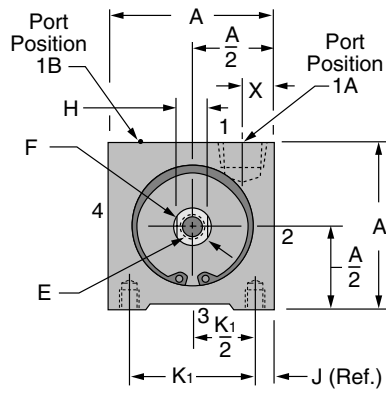
MQL	GW	1-1/8 x	1	-	2 -	1	-	DR - MR1
Mounting	Rod Extension Single Rod Models	Bore	Standard Strokes Inches	Stages Extend	Stages Retract	OPTIONS <i>See pages 5.20 - 5.22</i>		
MQ Side Tap	Blank –for standard extension per dimension "G" W - for Extension to dimension "W"	3/4" 7/8" 1-1/8" 1-5/8" 2"	For strokes available See chart above	2 — 1 1 — 2	Standard available combinations are listed above.	Description	Specify	
MQF Face						Male Rod Thread		
MQL Side Lug	Double Rod Models Blank –"G" extension both ends W –"W" extension both ends	GW – "G" extension on rod end; "W" extension on cap end WG – "W" extension on rod end; "G" extension on cap end				Single Rod	-MR	
						Double Rod, Rod End	-MR	
						Double Rod, Cap End	-MR1	
						Double Rod, Both Ends	-MR2	
						Viton Seals:-15° to + 400°F	-V	
						Metric Rod Thread	-M	
						Port Positions (page 5.19)	-1B	
						External Guide, Nonrotating	-G	
						Double Rod	-DR	
						Magnetic piston and sensor mounting slot(s)	-E	
						Order sensors separately.		

Ordering Example: MQL GW 1-1/8 x 1 - 2 - 1 - DR - MR1

Model number code above describes Square 1® Multi-Power® side lug mount cylinder with "G" rod extension on rod end; "W" rod extension on cap end; 1-1/8" bore; 1" stroke; 2 stages extend; 1 stage retract; double rod; male rod on cap end.

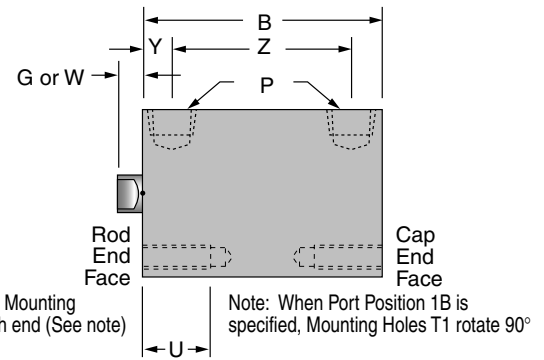
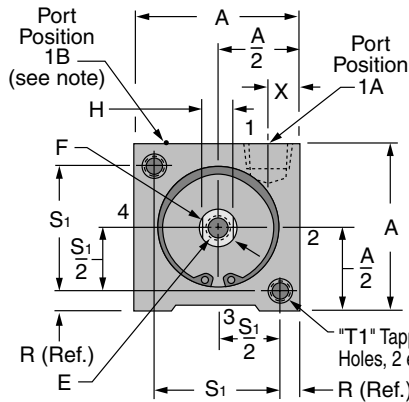
MQ Series: Side Tap Mounting

Bore availability:
3/4", 1-1/8", 1-5/8", 2"



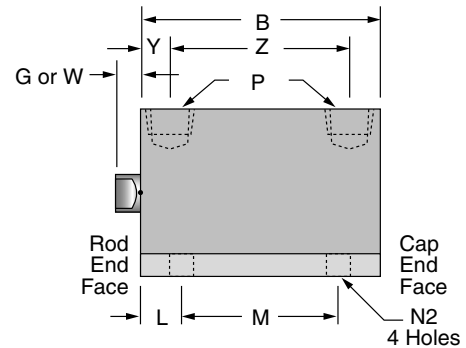
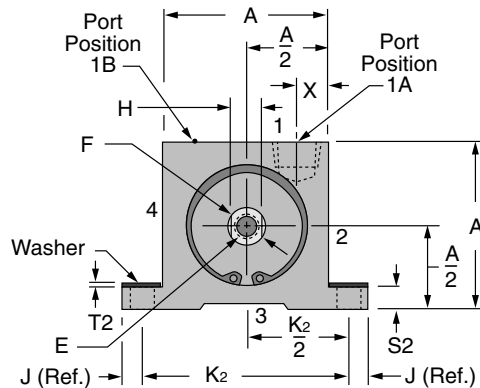
MQF Series: Face Mounting

Bore availability:
3/4", 1-1/8", 1-5/8", 2"



MQL Series: Side Lug Mounting

Bore availability:
7/8", 1-1/8", 1-5/8", 2"



Variable Dimensions

Stroke	3/4" & 7/8" Bores			1-1/8" Bore			1-5/8" Bore			2" Bore		
	B	Z	M	B	Z	M	B	Z	M	B	Z	M
1/8"	-	-	-	2.69	1.69	1.50	2.94	1.88	1.63	-	-	-
1/4"	2.27	1.49	1.25	3.19	2.19	2.00	3.44	2.38	2.13	3.61	2.38	2.25
1/2"	2.77	1.99	1.75	3.69	2.69	2.50	3.94	2.88	2.63	4.11	2.88	2.75
3/4"	3.27	2.49	2.25	-	-	-	-	-	-	-	-	-
1"	4.27	3.49	3.25	4.69	3.69	3.50	4.94	3.88	3.63	5.11	3.88	3.75
1-1/2"	5.27	4.49	4.25	5.69	4.69	4.50	5.94	4.88	4.63	6.11	4.88	4.75
2"	-	-	-	6.69	5.69	5.50	6.94	5.88	5.63	7.11	5.88	5.75
2-1/2"	-	-	-	7.69	6.69	6.50	7.94	6.88	6.63	8.11	6.88	6.75

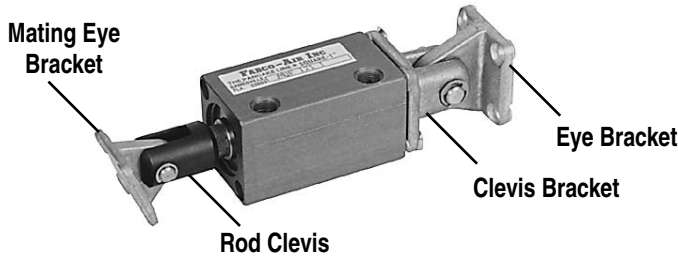
Fixed Dimensions

Bore	A	E	F Dia.	G	H	J	K1	K2	L	N1	N2	P	R	S1	S2	T1	T2	U	W	X	Y
3/4"	1.25	10-32x.38dp	.31	.13	1/4	.19	.88	-	.51	10-24x.25	-	10-32	.19	.88	-	1/4-20x.75dp	-	.75	.38	.31	.39
7/8"	1.25	10-32x.38dp	.31	.13	1/4	.19	-	1.63	.51	-	.21	10-32	-	-	.19	-	.02	-	.38	.31	.39
1-1/8"	1.50	5/16-24x.63dp	.50	.19	7/16	.19	1.13	1.88	.59	10-24x.25	.21	1/8	.19	1.13	.19	1/4-20x.75dp†	.02	.75	.38	.28	.50
1-5/8"	2.00	3/8-24x.75dp	.62	.19	1/2	.25	1.50	2.50	.66	1/4-20x.31	.27	1/8	.25	1.50	.25	1/4-20x.75dp†	.03	.75	1.00	.31	.54
2"	2.50	1/2-20x.88dp	.75	.19	5/8	.25	2.00	3.00	.68	5/16-18x.38	.27	1/8	.25	2.00	.31	5/16-18x.75dp*	.03	.75	1.00	.38	.62

*Note: 1-1/8" & 1-5/8" bores, 1/8 stroke only: .20 Dia. thru, .32 dia. C'Bore x .19 deep for #10 SHCS and 1/4-20 x .75 deep tapped mounting holes, 2 places each end

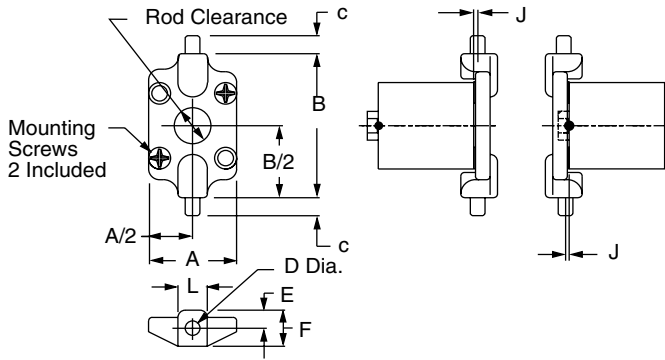
†Note: 2" bore, 1/4 stroke only: .27 Dia. thru, .38 dia. C'Bore x .26 deep for 1/4" SHCS and 5/16-18 x .75 deep tapped mounting holes, 2 places each end

Series MQF Mounting Kits



Bore	Stroke	Rod End			Cap End	
		Rod Clevis		Mating Eye Bkt.	Clevis Bracket	Eye Bracket
		English	Metric			
3/4"	All	RC-19	MRC-19	EM-02	PM-04	EM-04
1-1/8"	All	RC-31	MRC-31	EM-04	PM-121	EM-121
1-5/8"	All	RC-38	MRC-38	EM-121	PM-221	EM-221
2"	1/4	RC-54	MRC-54	EM-121	PM-321	EM-321
2"	1/2 Up	RC-56	MRC-56	EM-121	PM-321	EM-321

Trunnion Mount Kit

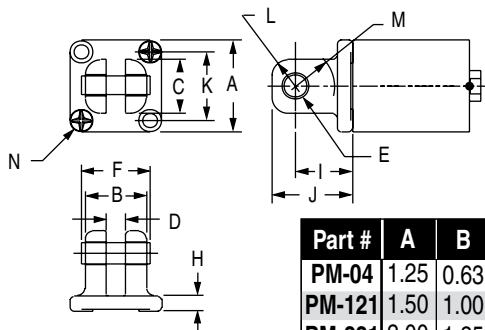


Materials
 Bracket: High strength Zinc die casting
 Pivot Pins: Precision dowel pins
 Mounting screws: 4, Steel, plated or black oxidized

Bore	Kit No.	A	B	C	D	E	F	J	L
3/4"	TR-04	1.25	2.00	.25	.1253	.25	.50	.07	.38
1-1/8"	TR-121	1.50	2.50	.31	.2503	.31	.63	.06	.50
1-5/8"	TR-221	2.00	3.00	.31	.2503	.44	.81	.06	.63
2"	TR-321	2.50	3.75	.31	.2503	.44	.94	.06	.75

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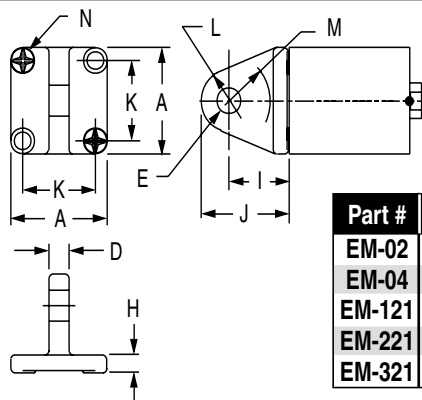
Clevis Bracket Kit



Materials
 Bracket: High strength Zinc die casting
 Bushings: Oil filled powdered metal
 Pin: 416 Stainless Steel
 Clips: 2, Plated steel
 Screws: 4, Steel, plated or black oxidized

Part #	A	B	C	D	E Pin	E Hole	F	H	I	J	K	L	M	N
PM-04	1.25	0.63	0.63	0.25	.250	.251	0.83	.16	0.56	0.81	0.88	.30	.41	1/4-20x.75
PM-121	1.50	1.00	0.88	0.31	.3125	.3135	1.21	.25	0.94	1.32	1.13	.46	.69	1/4-20x.75
PM-221	2.00	1.25	1.25	0.38	.375	.376	1.48	.31	1.00	1.38	1.50	.52	.69	1/4-20x1.00
PM-321	2.50	1.25	1.25	0.38	.375	.376	1.48	.31	1.00	1.38	2.00	.52	.69	5/16-18x1.00

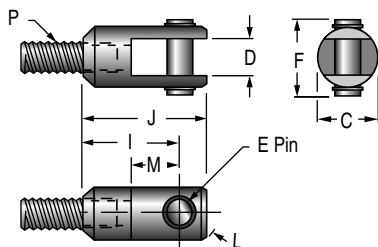
Eye Bracket Kit



Materials
 Bracket: High strength Zinc die casting
 Bushings: Oil filled powdered metal
 Screws: 4, Steel, plated or black oxidized.
 *Special 1/4-20 with #13 Phillips Head

Part #	A	D	E	H	I	J	K	L	M	N
EM-02	1.25	.18	.1885	.16	0.56	0.87	0.88	.31	.36	1/4-20x.75 FHMS*
EM-04	1.25	.23	.251	.16	0.56	0.87	0.88	.31	.41	1/4-20x.75 FHMS*
EM-121	1.50	.30	.3135	.25	0.94	1.38	1.13	.44	.69	1/4-20x.75 FHMS*
EM-221	2.00	.36	.376	.31	1.13	1.69	1.50	.56	.81	1/4-20x1.00 FHMS*
EM-321	2.50	.36	.376	.31	1.13	1.69	2.00	.56	.81	5/16-18x1.00 FHSCS

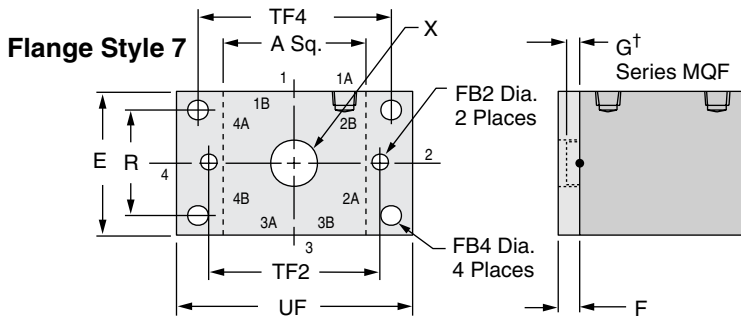
Rod Clevises



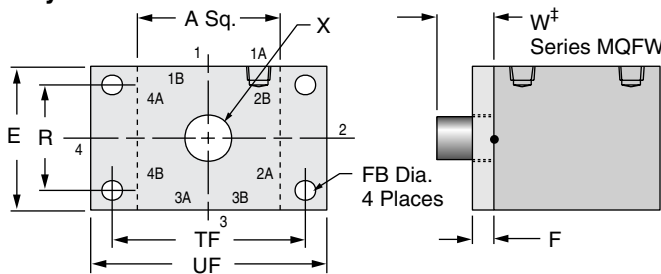
Materials
 Clevis and Stud: Steel, black oxidized
 Pin: 416 Stainless Steel
 Clips: Steel, plated

Part #	C	D	E PIN	F	I	J	L	M	P English	P Metric
RC-19, MRC-19	0.50	.19	.1870	0.70	0.75	1.00	.33	.38	10-32x.25	M5x6.3mm
RC-31, MRC-31	0.75	.25	.2495	0.96	0.88	1.16	.39	.50	5/16-24x.38	M8x9.7mm
RC-38, MRC-38	1.00	.32	.3120	1.21	1.25	1.63	.61	.63	3/8-24x.37	M10x9.4mm
RC-54, MRC-54	1.00	.32	.3120	1.21	1.31	1.69	.61	.63	1/2-20x.39	M12x9.9mm
RC-56, MRC-56	1.00	.32	.3120	1.21	1.31	1.69	.61	.63	1/2-20x.62	M12x15.7mm

Flange Mounting Kits for Series MQF and MQFW



Flange Style 8 & 9



Flange Style	Bore Size	Fabco Kit No.	Mounting Hole Pattern Interchange Information
7	3/4"	H7-04	4 Hole Pattern C&C: 1-1/8" Bore, Series T, F, & R Mosier: 1-1/8" Bore, Series TAV, 8 & 9 PHD: 1-1/8" Bore, Series AV, RF, & CF 2 Hole Pattern Compact Air: 3/4" Bore, Style S, FF, & RF
7	1-1/8"	H7-121	4 Hole Pattern C&C: 1-1/8" Bore, Series T, F, & R Mosier: 1-1/8" Bore, Series TAV, 8 & 9 PHD: 1-1/8" Bore, Series AV, RF, & CF 2 Hole Pattern Compact Air: 1-1/8" Bore, Style S, FF, & RF
7	1-5/8"	H7-221	4 Hole Pattern NFA C&C MF1 & MF2 for 1-1/2" Bore All brands conforming to this code 2 Hole Pattern Compact Air: 1-5/8" Bore, Style S, FF, & RF
8	2"	H8-321	4 Hole Pattern NFA C&C MF1 & MF2 for 2" Bore All brands conforming to this code
9	2"	H9-321	4 Hole Pattern Compact Air: 2" Bore, Style S, FF, & RF

Kits include Flange and 2 Flange Mounting Screws

Port Positions 1A Standard all models. • To achieve 2A, 3A or 4A, rotate flange.
• For 1B, specify Option -1B • For 2B, 3B, or 4B: Specify Option -1B and rotate flange

Bore	Model	Style	Kit #	A	E	F	FB	FB2	FB4	G†	R	TF	TF2	TF4	UF	W†	X
3/4"	04	7	H7-04	1.25	1.50	.25	NA	.22	.22	.13	1.00	NA	1.75	2.00	2.50	.38	.38
1-1/8"	121	7	H7-121	1.50	1.50	.25	NA	.22	.22	.19	1.00	NA	2.00	2.00	2.50	.38	.56
1-5/8"	221	7	H7-221	2.00	2.00	.38	NA	.22	.31	.19	1.43	NA	2.50	2.75	3.38	1.00	.69
2"	321	8	H8-321	2.50	2.50	.38	.38	NA	NA	.19	1.84	3.38	NA	NA	4.13	1.00	.81
2"	321	9	H9-321	2.50	2.50	.38	.38	NA	NA	.19	2.00	3.00	NA	NA	3.50	1.00	.81



SQFW-121-1 1/2 with H7-121

External Guide, Nonrotating

Option -G

Superior nonrotating piston rod feature for applications such as package placement, figure stamping, and any application where anti-rotation and registration are critical as the piston is extended and retracted.

A mounting block is bolted to the piston rod. This block has two square pins mounted to it which in turn pass through guide blocks mounted on the sides of the cylinder.

• Square guide pins are hard chrome plated

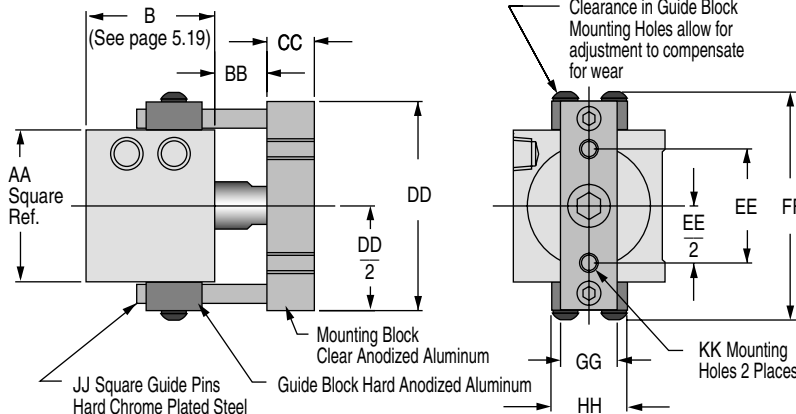
steel for long wear and corrosion resistance.

• Guide blocks are hard anodized aluminum for long wear and corrosion resistance.

• Clearance in guide block mounting holes provide for adjustment and backlash control, compensation for wear, and minimal rotation.

• Extended distance between guides provides superior nonrotation and support.

• Extended piston rod provides clearance between cylinder and guide bar mounting block to eliminate pinch points.

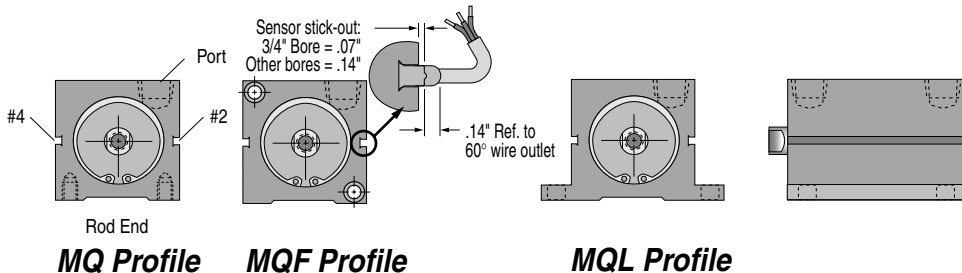


Mounting Series MQ or MQF				
Bore	3/4"	1 1/8"	1 5/8"	2"
AA	1.25	1.50	2.00	2.50
BB	.63	.69	.69	.69
CC	.63	.63	.63	.75
DD	1.94	2.26	2.75	3.25
EE	.87	1.06	1.50	1.88
FF	2.19	2.50	3.00	3.50
GG	.63	.63	.75	1.00
HH	1.00	1.00	1.00	1.00
JJ	.19	.25	.25	.25
KK	#6-32	#8-32	1/4-20	5/16-18

Series MQ, MQF & MQL Option Specifications

Magnetic Piston Option-E Includes Dovetail Mounting Slots Order Sensors Separately

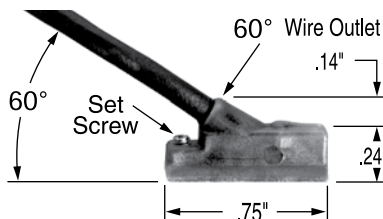
- **Dovetail style sensors** are actuated by a magnetic piston.
- Sensor dovetail slides into a mating slot on the cylinder body, is positioned as desired, and locked in place with a slotted set screw.
- Magnetic piston and 1/4" Dovetail mounting slot(s) are specified with Suffix Option "E" in the model number.
- **Order sensors separately.**



		Standard Stroke & Slot Location Guide											
		MQ (Side Tap)				MQF (Face Mount)				MQL (Side Lug)			
		Stroke	3/4"	1 1/8"	1 5/8"	2"	3/4"	1 1/8"	1 5/8"	2"	7/8"	1 1/8"	1 5/8"
Sensor slots at positions #2 and #4	1/8	-	✓	✓	-	-	✓	✓	-	-	✓	✓	-
	1/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	1/2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	3/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sensor slot at position #2 only	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	1-1/2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	2	-	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓
	2-1/2	-	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓

Low Profile, Solid State, Magnetic Piston Position Sensors

Female Cordsets for Quick Disconnect	Length	Part No.
	1 Meter	CFC-1M
	2 Meters	CFC-2M
	5 Meters	CFC-5M



Encased in plastic housing, dovetail style sensors are corrosion resistant. 60° wire outlet allows close mounting. Profile shown here is typical.

Dovetail Style Magnetic Sensors

Temperature Range: 20° to +80°C (-4° to +176°F)

Cylinder Model	Sensor Type	Prewired 9 ft. Part No.	Quick Disconnect Part No.*	LED	Electrical Characteristics
Series MQ, MQF & MQL	Electronic	949-000-031	949-000-331	Yes	Sourcing PNP 6-24 VDC, 0.20 Amp Max current, 0.5 Voltage Drop Sinking NPN 6-24 VDC, 0.20 Amp Max current, 0.5 Voltage Drop
	Electronic	949-000-032	949-000-332	Yes	

Note*: Quick disconnect styles are supplied with 6 inch pigtail with male connector. Order female cordsets separately.

Male Rod Thread Option

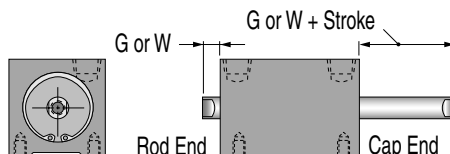
- Single Rod **-MR**
- Double Rod, Rod End Only **-MR**
- Double Rod, Cap End Only **-MR1**
- Double Rod, Both Ends **-MR2**

Metric Rod Thread Option -M

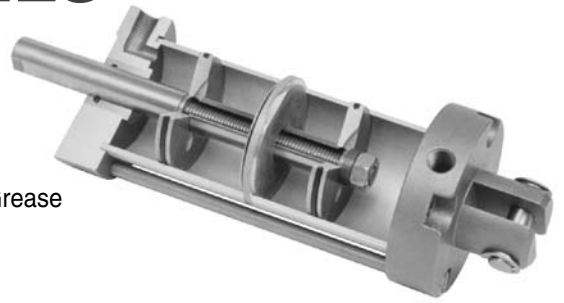
St'd Inch Thread	Bore	Female Rod Thread	Pitch	Male Rod Thread x Length
10-32 x .50	3/4	M5	0.8	M5 x 12.7
10-32 x .50	7/8	M5	0.8	M5 x 12.7
5/16-24 x .75	1-1/8	M8	1.25	M8 x 19.0
3/8-24 x .88	1-5/8	M10	1.50	M10 x 22.2
1/2-20 x 1.00	2	M12	1.75	M12 x 25.4

Double Rod Option -DR

- Blank**— "G" both ends.
- W**— "W" extension both ends.
- GW**— "G" extension rod end; "W" extension cap end.
- WG**— "W" extension rod end; "G" extension cap end.



Rod Extension Dimensions					
Bore	3/4"	7/8"	1 1/8"	1 5/8"	2"
G	.13	.13	.19	.19	.19
W	.38	.38	.38	1.00	1.00



Specifications

Media.....Air
 Recommended Minimum Pressure.....20 psi
 Maximum Operating Pressure.....150 psi
 Ambient & Media Temperature.....-25° to +250°F
 Prelubrication.....Magnalube®-G Grease
 Airline Lubrication.....Recommended

Model Number Code

MLR 2 x **3** - **2 - 1** - **PM** - **MR**

Series	Bore
MLR	2
Round head	2-1/2"
MLS	3"
Square head	4"

Stroke
Standard strokes: 1/2", 1", 1-1/2", 2", 2-1/2", 3", 4", 5", 6"
(Optional - any other stroke 0" thru 12")

Stages Extend	Stages Retract
2 — 1	
3 — 1	
4 — 1	
1 — 2	
1 — 3	
1 — 4	

Standard available combinations are listed above. Consult factory for Multiple Extend-Multiple Retract Options.

OPTIONS

See pages 5.11, 5.25 - 5.28

Description	Specify
Double Rod	-DR
Nonrotating Single Rod ‡	-NR
Nonrotating Double Rod ‡	-NRDR
Male Rod Thread	
Single Rod	-MR
Double Rod, Rod End	-MR
Double Rod, Cap End	-MR1
Double Rod, Both Ends	-MR2
Viton Seals (-15° to +400°F)	-V
Shock & Speed Control using hydraulics ‡	-HS
Rubber Bumpers	
Rod End	-BF
Cap End	-BR
Both Ends	-BFR
Adjustable Extend Stroke	-AS
3/8 NPT Ports in Heads	-P38
High Flow Vents	-HF
Port Positions All Ports	
Position #1	Standard
Position #2	-PA2
Position #3	-PA3
Position #4	-PA4
Rod End	
Position #1	Standard
Position #2	-PR2
Position #3	-PR3
Position #4	-PR4
Cap End	
Position #1	Standard
Position #2	-PC2
Position #3	-PC3
Position #4	-PC4
Atmospheric Vent or Ported Baffle Port	
Position #1	Standard
Position #2	-PB2
Position #3	-PB3
Position #4	-PB4
Any port or vent not specified will be in Position #1 as shown on page 5.24	
Magnetic Piston ‡	-E
for reed switches and Electronic Sensors (Order Sensors separately)	
‡ Note: Additional cylinder length required	
for Nonrotating Rods	0.50"
for Option -HS (see page 5.11)	0.50"
for Option -E	1.00"

5

Mounting

Extended Tie Rods	
Rod end only	-WF
Cap end only	-WR
Rod and Cap Ends.	-WFR
Clevis Mount	
Round head only	
Ports in-line with slot	-PM
Ports 90° to slot	-SM

Ordering Example

MLS3 x 3 - 2 - 1 - PM - MR
 Square head series, 3" bore, 3" stroke, 2 stages extend, 1 stage retract, clevis mount ports in-line with slot, male rod thread

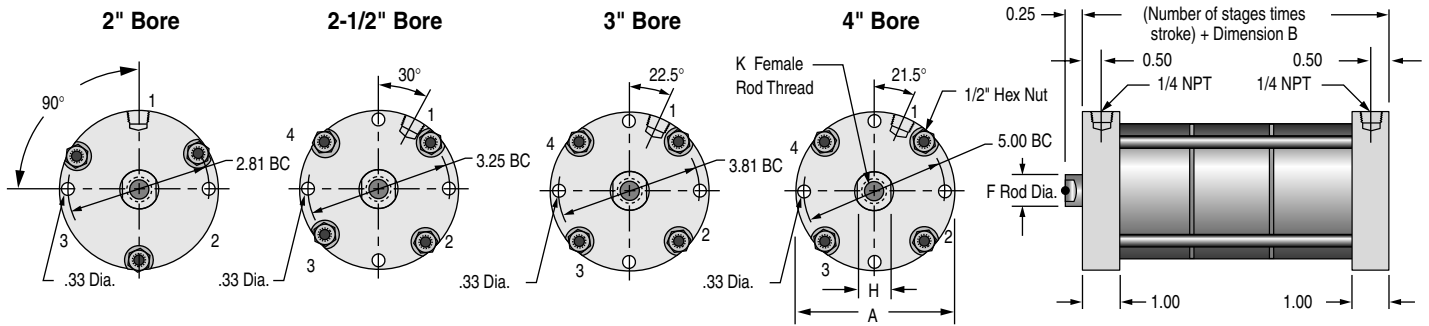
Sizing Longstroke™ - Multi-Power® Cylinders

Series	Bore	Stages (Pistons)	Area ‡	Equivalent Bore †	Force @ 60 psi	Retract Area
MLR	2"	2	5.84	2.6	350	2.7
		3	8.54	3.2	512	
		4	11.24	3.7	674	
MLR	2 1/2"	2	9.38	3.3	562	4.47
		3	13.85	4.0	831	
		4	18.32	4.7	1099	
MLS	3"	2	13.70	4.0	822	6.63
		3	20.33	5.2	1219	
		4	26.96	5.7	1617	
MLS	4"	2	24.35	5.5	1461	11.78
		3	36.13	6.7	2167	
		4	47.91	7.7	2874	

‡ Area = Total effective piston area, square inches.
 † Equivalent Bore = Bore required for single piston cylinder.

Longstroke™ – Multi-Power® Cylinders

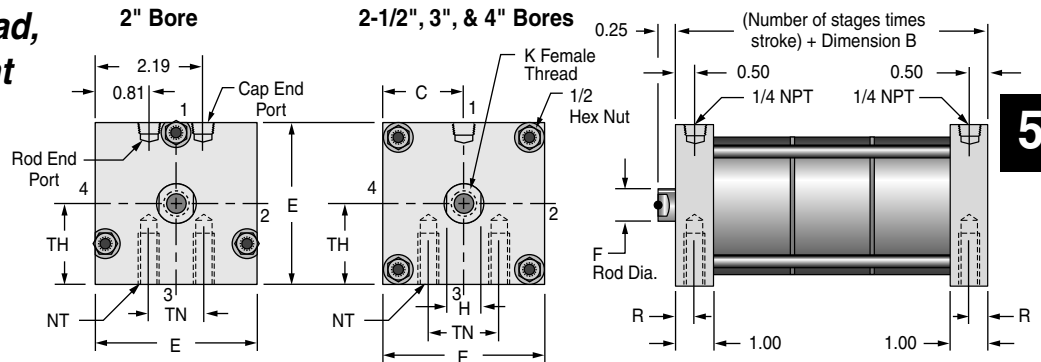
Series MLR – Round Head, Standard, Face Mount, Rod and Cap End



Series MLS – Square Head, Standard, Side Tap Mount

Note:

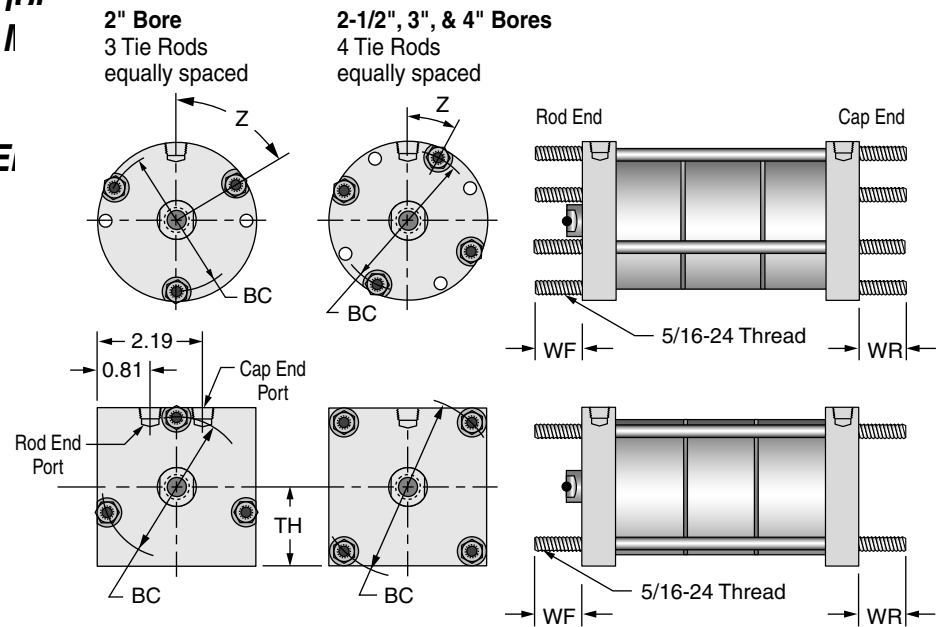
- 1) 2" Bore – Ports at Position #3 NOT available.
- 2) 2-1/2, 3 & 4 Bores – 3/8 NPT Ports (-P38) at Position #3 NOT available.



5

Extended Tie Rod Mount for Round and Square Head I

- WF Rod End Only
- WR Cap End Only
- WFR Rod and Cap End



Dimensions

Bore	A	B 2 stage	B 3 stage	B 4 stage	BC	C	E	F	H	K	NT	R	TH	TN	WF	WR	Z
2"	3.25	3.42	4.27	5.12	2.81	NA	3.00	0.75	5/8 x .25	1/2-20 x .75 dp	5/16-18 x .62 dp	0.44	1.38	0.88	1.3	1.3	60°
2-1/2"	3.75	3.42	4.27	5.12	3.25	1.75	3.50	0.75	5/8 x .25	1/2-20 x .75 dp	3/8-16 x .75 dp	0.38	1.75	1.25	1.3	1.3	30°
3"	4.25	3.42	4.27	5.12	3.81	1.75	3.50	0.75	5/8 x .25	1/2-20 x .75 dp	1/2-13 x 1.00 dp	0.50	1.75	1.50	1.4	1.4	22.5°
4"	5.50	3.42	4.27	5.12	4.63	2.25	4.50	1.00	7/8 x .25	1/2-20 x .75 dp	1/2-13 x 1.00 dp	0.50	2.25	2.06	1.4	1.4	23.5°

Round Head Clevis Mount Option

Specify mounting option

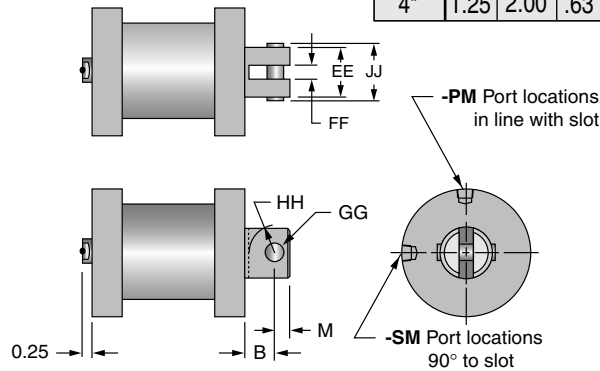
- Ports in line with slot** **-PM**
Ports 90° to slot **-SM**

Pivot pin and retaining lockrings are included as standard.

Accessories: See page 5.27

- Eye Bracket Kits
- Rod Clevises

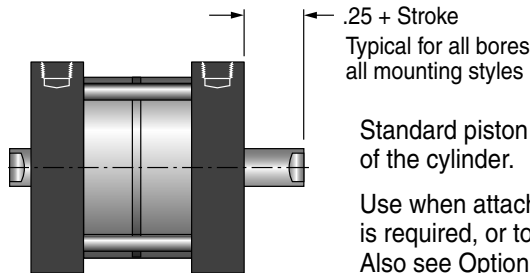
Bore	B	EE	FF	GG Pin	GG Hole	HH	JJ	M
2"	0.75	1.25	.38	.3745	.376	0.69	1.48	.38
2-1/2"	1.00	1.63	.50	.4995	.501	0.97	1.86	.50
3"	1.00	1.63	.50	.4995	.501	0.97	1.86	.50
4"	1.25	2.00	.63	.6245	.626	1.22	2.24	.63



Oil filled powdered metal
 Pivot Pin Bushings are standard.
 Pivot Pin, 416 stainless steel
 Lockrings, plated steel

5

Double Rod Option -DR



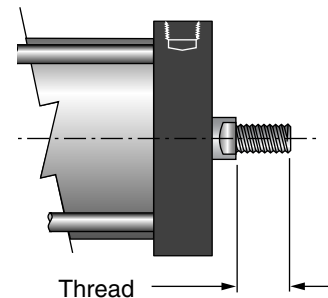
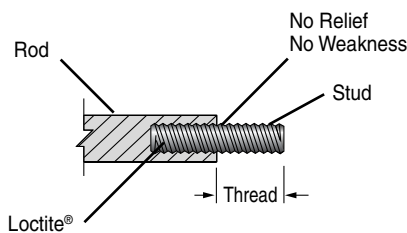
Standard piston rod and rod bushing on both ends of the cylinder.

Use when attachment to both ends of the cylinder is required, or to indicate piston position location. Also see Option –E on page 5.28.

Male Rod Thread Option

- Single Rod **-MR**
 Double Rod, Rod End Only **-MR**
 Double Rod, Cap End Only **-MR1**
 Double Rod, Rod & Cap Ends **-MR2**

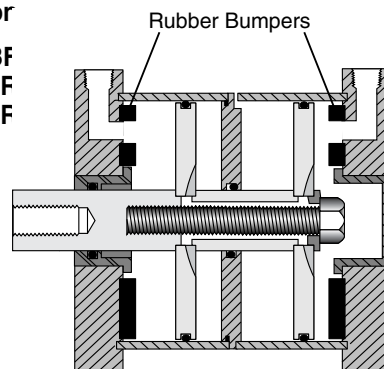
A high strength stud is threaded into the standard female rod end and retained with Loctite®. This method eliminates the small diameter thread relief area normally required when machining male threads. This provides a much stronger rod end which can be repaired, rather than replacing the complete rod, should the thread be damaged.



Bore	Thread
2"	1/2–20 x 1.00
2 1/2"	1/2–20 x 1.00
3"	1/2–20 x 1.00
4"	1/2–20 x 1.00

Rubber Bumpers Option

- Rod End only **-BF**
 Cap End only **-BF**
 Both Rod & Cap Ends **-BFF**



A rubber doughnut is bonded to the cylinder head to act as the piston stop and absorb the impact of the piston. This reduces noise and absorbs energy, thus reducing damage to the cylinder and tooling due to pounding.

Standard rubber mass will compress and give full stroke at 60 to 80 psi. This mass can be adjusted to meet your specific pressure and/or dynamic load requirements requirements

Series MLR & MLS Option Specifications

Adjustable extend stroke

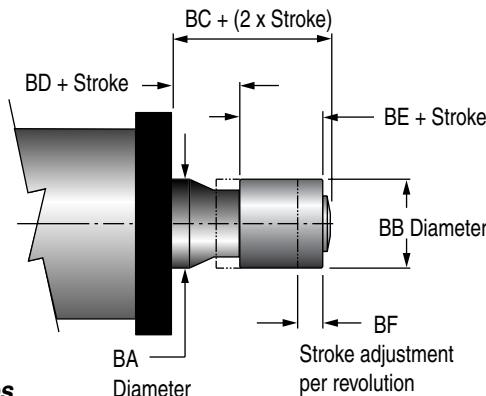
Option -AS

Available all Bores.
For strokes through 6"
Full stroke adjustment is standard.

Note!

To maintain operator safety features of this option, it is **NOT** available with mounting styles: -WR and -WFR. Use caution when mounting to avoid creating pinch points.

Note: NOT available with mounting styles -PM and -SM



See complete description on page 5.9.

Bore	2"	2-1/2"	3"	4"	
BA	1.50	1.50	1.50	2.00	
BB	2.00	2.00	2.00	2.00	
BC	1.65	1.65	1.65	1.42	+ (2 x Stroke)
BD	0.75	0.75	0.75	0.50	+ Stroke
BE	0.75	0.75	0.75	0.75	
BF	.063	.063	.063	.063	

3/8 NPT Ports in Heads Option -P38

Use 3/8 NPT ports for higher flows, air over oil systems, etc.

5

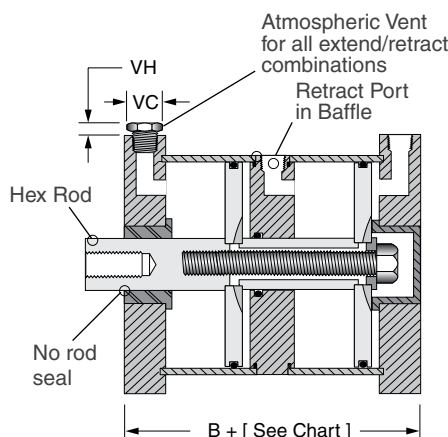
Nonrotating Rod Option -NR

A stainless steel hex rod and a hex broached bushing of SAE 660 bearing bronze replaces the standard round rod and bushing.

A ported baffle is used so the piston assembly can be retracted by the next piston back from the rod end. The normal rod head port becomes an atmospheric vent. The tolerance on rotation is $\pm 1^\circ$.

The hex rod design does allow for some torque loading on the shaft. However, torque loads that induce side loading should be minimized for best overall life and performance.

Hex rod flats have Random Rotation relative to Mounting Pattern



See page 5.24 for Dimension "B".

Available Combinations	No. of Ported Baffles	Total No. of Stages
2 - 1	1	2
3 - 1	1	3
3 - 2	2	3
4 - 1	1	4
4 - 2	2	4
4 - 3	3	4

Bore	Retract Port	Add to Dimension "B" for each Ported Baffle	Hex Rod Across Flats	St'd Ports		3/8 NPT Ports (-P38)	
				VC	VH max	VC	VH max
2"	1/4 NPT	.50"	.75"	.65	.69	.80	1.56
2-1/2"	1/4 NPT	.50"	.75"	.65	.69	.80	1.56
3"	1/4 NPT	.50"	.75"	.65	.69	.80	1.56
4"	1/4 NPT	.50"	1.00"	.65	.69	.80	1.56

Nonrotating Double Rod Option -NRDR

A combination of the Options -NR and -DR as shown above. The rod end rod is Hex and the cap end rod is round. The ported baffles are

included and the "Dimension B" adjustments shown for Option -NR must be made. Extend piston areas must also be reduced by the rod area.

High Flow Vents Option -HF

The atmospheric vent in the baffle is cut larger to provide less resistance to the air flow.

Use when higher cycle speeds are required.

Viton Seals Option -V

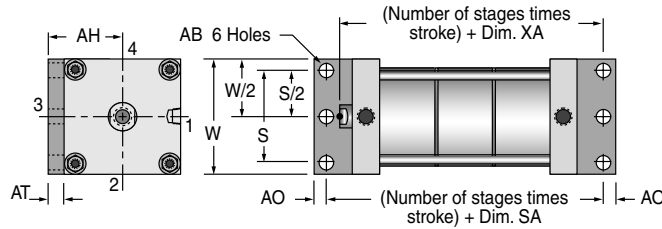
Use for elevated temperatures (-15° to + 400°F) or compatibility with exotic media.

Consult engineering for compatibility information.

End Lug Mount Kit

Kit includes:
2 Brackets and
4 bolts for attaching
the brackets to the
cylinder heads.

Materials:
Brackets, steel, plated
Screws, steel, black oxide



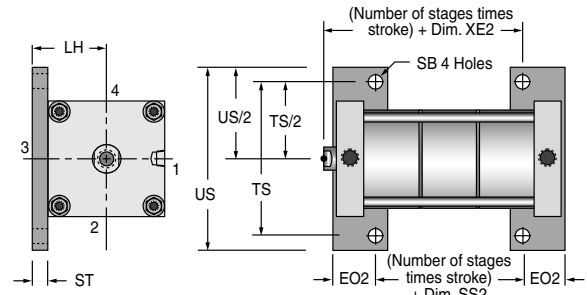
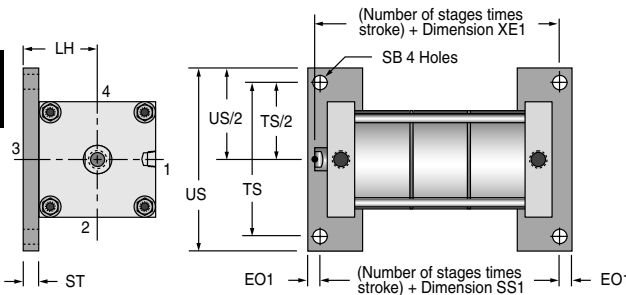
Bore	Kit No.	S	W	AB	AH	AO	AT	SA 2 stage	SA 3 stage	SA 4 stage	XA 2 stage	XA 3 stage	XA 4 stage
2"	EL-20	1.75	2.50	.41	1.63	.44	.25	4.04	4.89	5.74	3.98	4.83	5.68
2-1/2"	EL-25	2.25	3.00	.41	2.00	.44	.25	4.16	5.01	5.86	4.04	4.89	5.74
3"	EL-30	2.75	3.50	.53	2.13	.56	.38	4.66	5.51	6.36	4.29	5.14	5.99
4"	EL-40	3.50	4.50	.53	2.63	.56	.38	4.66	5.51	6.36	4.29	5.14	5.99

Side Lug Mount Kit

- Brackets may be mounted in two different positions as shown -

Kit includes:
2 Brackets and
4 bolts for attaching
the brackets to the
cylinder heads.

Materials:
Brackets, steel, plated
Screws, steel, black oxide

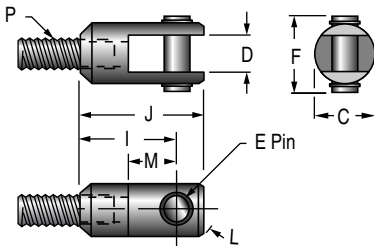


Position #1

Position #2

Bore	Kit No.	E01	E02	LH	SB	SS1 2 stage	SS1 3 stage	SS1 4 stage	XE1 2 stage	XE1 3 stage	XE1 4 stage	ST	TS	US	SS2 2 stage	SS2 3 stage	SS2 4 stage	XE2 2 stage	XE2 3 stage	XE2 4 stage
2"	SL-20	.50	0.50	1.63	.41	2.66	3.51	4.36	3.29	4.14	4.99	.25	3.75	4.50	2.42	3.27	4.12	3.17	4.02	4.87
2-1/2"	SL-25	.50	0.63	2.00	.41	2.92	3.77	4.62	3.42	4.27	5.12	.25	4.25	5.00	2.42	3.27	4.12	3.17	4.02	4.87
3"	SL-30	.56	1.19	2.13	.53	3.54	4.39	5.24	3.73	4.58	5.43	.38	4.75	5.88	1.29	2.14	2.99	2.60	3.45	4.30
4"	SL-40	.56	1.19	2.63	.53	3.54	4.39	5.24	3.73	4.58	5.43	.38	5.50	6.63	1.29	2.14	2.99	2.60	3.45	4.30

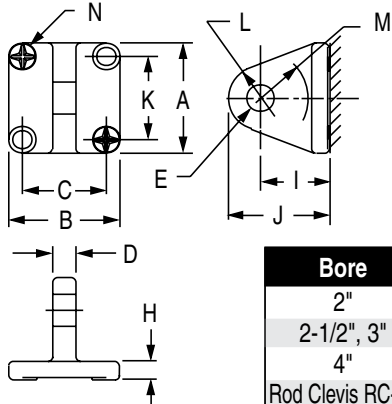
Rod Clevises



Materials
Clevis and Stud: Steel, black oxidized
Pin: 416 Stainless Steel
Clips: Steel, plated

Bore	Part #	C	D	E	PIN	F	I	J	L	M	P	Mating Eye Bkt
2", 2-1/2", 3" & 4"	RC-56	1.00	.32	.3120	1.21	1.31	1.69	.61	.63	1/2-20x.62	EM-121	

Eye Bracket Kits mate with Option -PM or -SM and Rod Clevis

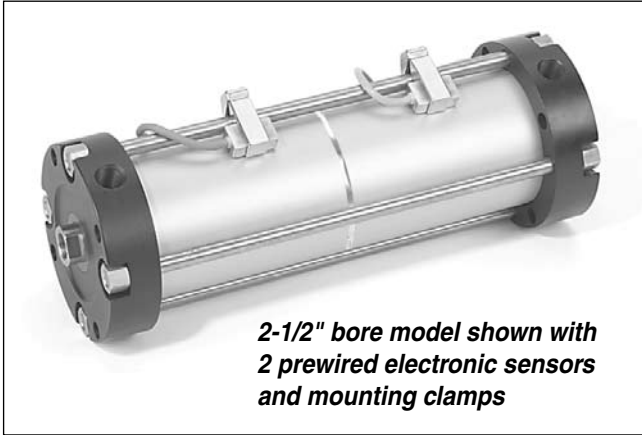


Materials
Bracket: High strength Zinc die casting
Bushings: Oil filled powdered metal
Screws: 4, Steel, plated or black oxidized

Bore	Part #	A	B	C	D	E	H	I	J	K	L	M	N
2"	EM-321	2.50	2.50	2.00	.36	.376	.31	1.13	1.69	2.00	0.56	0.81	5/16-18x1.00FHSCS
2-1/2", 3"	EM-521	2.00	2.00	1.38	.47	.501	.38	1.50	2.25	1.38	0.75	1.13	5/16-18x1.00FHSCS
4"	EM-1221	2.50	2.25	1.50	.58	.626	.38	1.63	2.63	1.75	1.00	1.10	5/16-18x1.00FHSCS
Rod Clevis RC-56	EM-121	1.50	1.50	1.13	.30	.3135	.25	0.94	1.38	1.13	0.44	0.69	1/4-20X.75 FH(#12)MS

Series MLR & MLS Option Specifications

Suffix Option E Specifies Magnetic Piston (Order Sensors and Sensor Clamps Separately)



- **Option -E** consists of a magnet bonded into the piston head. When the piston magnet moves past an external sensor, the magnetic field activates the sensor without physical contact.
- **Mounting** – The sensor snaps into a 2-part clamp that attaches rigidly to any of the tie rods and can be positioned anywhere along the length of the cylinder.
- **Reliability** – The annular piston magnet is permanently bonded into a groove in the piston. It is a polarized permanent magnet of rubber bonded barium ferrite that is very stable and is not affected by shock. Under normal usage it will remain magnetized indefinitely.
- **Warning** – External magnetic fields and/or ferrous objects may affect the strength of the piston magnet therefore affecting sensor actuation and piston position indication. Warning labels (shown left) are affixed to the cylinder.
- **Please note there is an increase in base length of the cylinder to accommodate the magnet. Add 1.00" to Dimension 'B' on pages 5.24.**

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2-Piece Sensor Clamp shown with quick disconnect sensor snapped in place

Quick Disconnect Sensor Shown

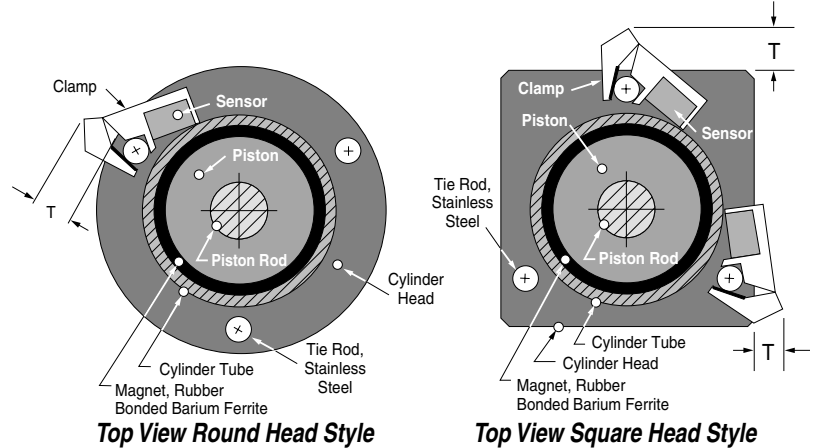
Socket Head Screw

WARNING
This cylinder is equipped with a Magnetic Piston for use with Magnetically Operated Sensors. Other Magnetic Sensitive Devices Should be Kept at a Distance to Avoid Inadvertent Operation.

9 foot prewired sensor

Female Cordsets available in 1, 2, & 5 meter lengths

Sensor Clamp Stick Out Dimensions								
Model	MLR2	MLS2	MLR2-1/2	MLS2-1/2	MLR3	MLS3	MLR4	MLS4
T	.50"	.50"	.50"	.10"	.50"	.30"	.30"	.30"



Sensor & Clamp Ordering Guide

Temperature Range: -20° to + 80°C (-4° to + 176°F)

Warning!

Do not exceed sensor ratings. Permanent damage to sensor may occur.

Power supply polarity **MUST** be observed for proper operation of sensors.

See wiring diagrams included with each sensor.

LED Lighted Magnetic Piston Position Sensors			
Product Type	Prewired 9 ft. Part No.	Quick Disconnect Part Number.	Electrical Characteristics
Reed Switch	9-2A197-1004	9-2A197-1304	5-120 VDC/VAC, 0.5 Amp Max., 10 Watt Max., SPST N.O., 3.5 Voltage Drop
Electronic	9-2A197-1033	9-2A197-1333	Sourcing, PNP, 6-24 VDC, 0.5 Amp Max., 1.0 Voltage Drop
Electronic	9-2A197-1034	9-2A197-1334	Sinking, NPN, 6-24VDC, 0.5 Amp Max., 1.0 Voltage Drop
Female Cordsets for Quick Disconnect			
Length	1 Meter	2 Meter	5 Meter
Part Number	CFC-1M	CFC-2M	CFC-5M
Sensor Mounting Clamp - for all MLS & MLR Models			
For all MLS & MLR Models Order Part Number 800-200-000			