Multi-Power® Cylinders

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)

Machine Design 1972/73 Bearing Reference Issue

Porous Bronze	4,500
Porous iron	8,000
Phenolics	6,000
Nylon®	1,000
TFE	500
Reinforced Telfon®	2,500
*TFE fabric	60,000
Polycarbonate	1,000
Acetal	1,000
Carbon-graphite	600

Friction Properties

	Coefficient	Slip-stick
Steel-on-steel	.50	Yes
Bronze-on-steel	.35	Yes
Sintered Bronze-on-steel with mineral oil	.13	No
Bronze-on-steel with mineral oil	.16	No
Copper lead alloy-on-steel	.22	Yes
Acetal-on-steel	.20	No
Nylon-on-steel	.32	Yes
Duralon-on-steel	.05 - .16	No

Printed with permission by Rexnord Corp.

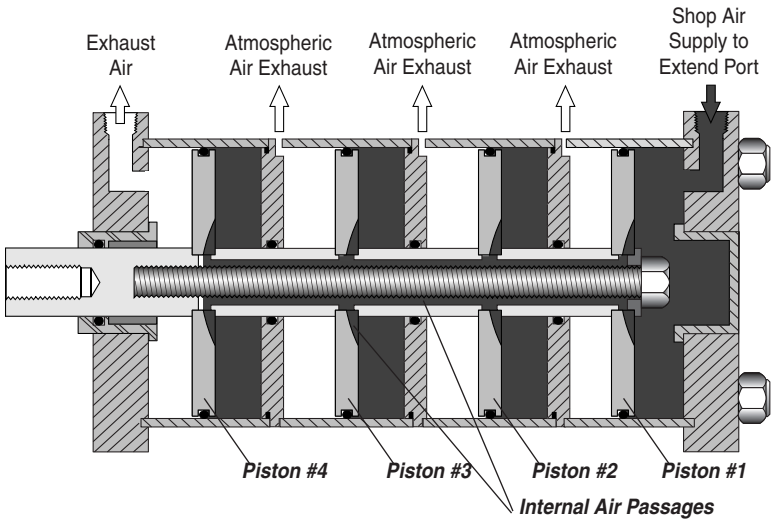
Features & Benefits

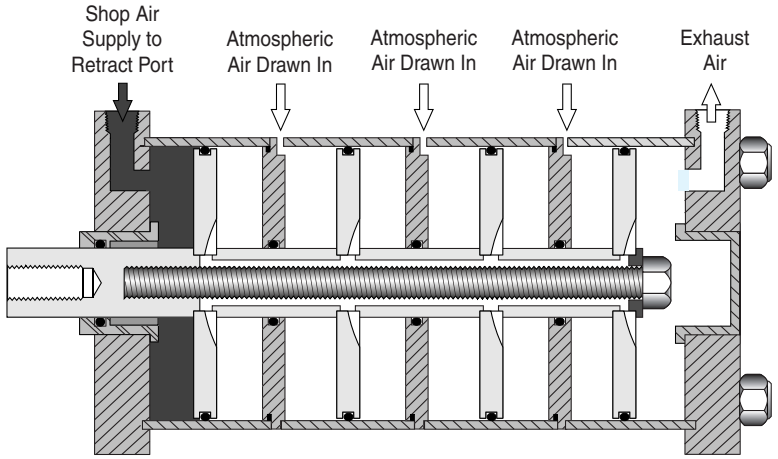
More force from available shop air	Eliminates hydraulics – stays clean
Multiple pistons on the power stroke	Saves mounting space (44 to 75%)
Single piston on the retract stroke	Saves air (22 to 37%)
Building block design	Low cost – Quick delivery – Specials
Wide range of models, sizes and options	Adapts 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 X 3 X 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, lb. 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				1.1	0.4	
	4	3.4	2.1	204				1.3	0.5	
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				2.0	0.6	
	4	7.3	3.0	438				2.4	0.8	
2-1/2	2	9.4	3.5	564	4.5	0.75	0.4	3.6	0.8	150
	3	13.8	4.2	828				4.6	1.2	
	4	18.3	4.8	1098				5.5	1.5	
3	2	13.7	4.1	822	6.6	0.75	0.4	4.5	0.8	150
	3	20.3	5.1	1218				5.5	1.2	
	4	26.9	5.8	1614				6.6	1.5	
4	2	24.4	5.6	1464	11.8	1.00	0.8	7.8	1.2	150
	3	36.1	6.8	2166				9.5	1.6	
	4	47.9	7.9	2874				11.2	2.1	
5	2	38.0	7.0	2280	18.4	1.25	1.23	12.3	1.4	150
	3	56.4	8.5	3384				15.7	2.1	
	4	74.8	9.7	4488				19.0	2.8	
6	2	55.3	8.4	3318	27.0	1.25	1.23	14.7	1.5	150
	3	82.3	10.2	4938				18.1	2.2	
	4	109.4	11.8	6564				21.7	2.9	
8	2	98.6	11.2	5916	48.5	1.50	1.7	41.5	2.3	150
	3	147.0	13.7	8820				51.5	2.9	
	4	195.4	15.8	11724				61.4	3.6	
10	2	153.9	14.0	9234	75.4	2.00	3.1	85.1	5.4	150
	3	229.3	17.1	13758				110.3	8.1	
	4	304.7	19.7	18282				135.4	10.8	
12	2	222.9	16.8	13374	109.9	2.00	3.1	116.6	7.0	150
	3	332.8	20.6	19968				153.0	10.5	130
	4	442.7	23.7	26562				189.5	14.0	100

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.

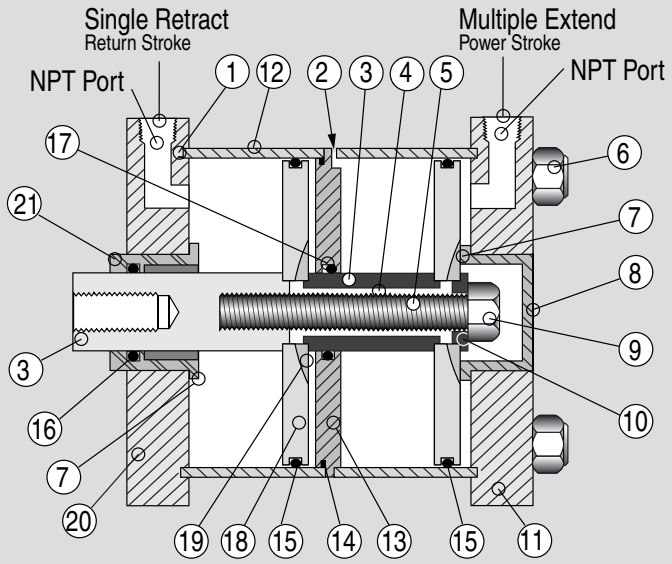
‡ Areas given are for Standard *Single* Stage Retract. For *Single* Stage Extend with a single rod, add the rod area shown.

Ratings – Standard Units

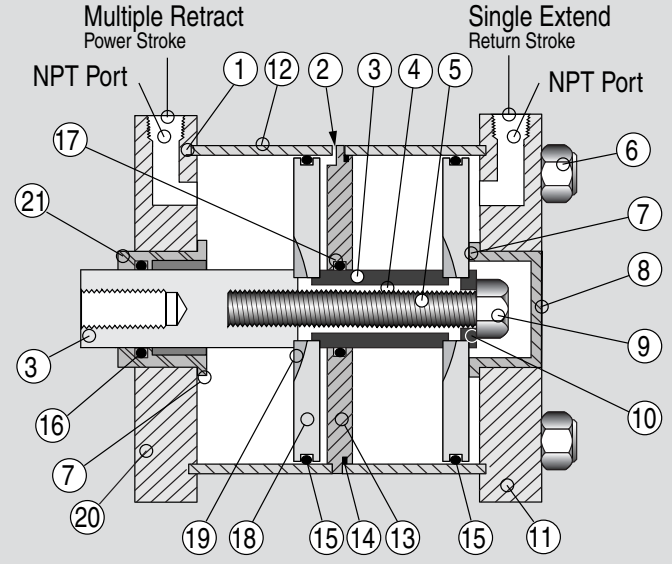
- Duralon® rod bushing. (see page 5.1 for table of physical properties)
- Female rod end with wrench flats
- Internally lubricated Buna-N O-ring piston and rod seals.
- Airline lubrication recommended
- Media . . . . . Air
- Max. operating pressure . . . . . See chart
- Min. pressure recommended . .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

Basic Construction

Multiple Stage Extend with Single Stage Retract



Multiple Stage Retract with Single Stage Extend



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

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 X 3 X 1 FF – MR

MP Series & Bore
1-1/8"
1-5/8"
2-1/2"
3"
4"
5"
6"
8"
10"
12"

Standard Strokes
1/2"
1"
1-1/2"
2"
2-1/2"
3"
4"
5"
6"
Optional Strokes
any other stroke 0" thru 12"

Stages Extend		Stages Retract
2	X	1
3	X	1
4	X	1
1	X	2‡
1	X	3‡
1	X	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.***

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
	for single stage retract only
	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" 10" 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 X 3 X 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

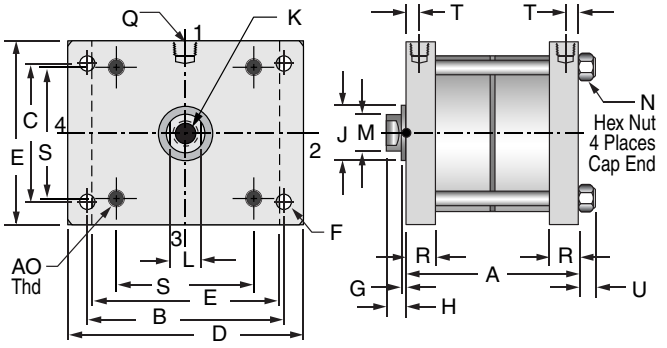
Description	Specify	See Page
1"–14 Rod thread – 8" bore only	**-KF**	5.5
Double Rod	**-DR**	5.8
Nonrotating Single Rod ‡	**-NR**	5.8
Nonrotating Double Rod ‡	**-NRDR**	5.8
Male Rod Thread		5.7
Single Rod	**-MR**	
Double Rod, Rod End	**-MR**	
Double Rod, Cap End	**-MR1**	
Double Rod, Both Ends	**-MR2**	
Viton Seals (-15° to +400°F)	**-V**	5.8
Shock & Speed Control using ‡ Hydraulics, 2-1/2" – 12" bores	**-HS**	5.11
Rubber Bumpers		5.9
Rod End	**-BF**	
Cap End	**-BR**	
Both Ends	**-BFR**	
Adjustable Extend Stroke 6" Stroke maximum. Full stroke adjustment is standard.	**-AS**	5.9
1/2" NPT Ports in Heads ‡ (2-1/2", 3", 4", 5" & 6" Bores only)		5.10
Rod End Head	**-TF**	
Cap End Head	**-TR**	
Both Heads	**-TFR**	
3/4 NPT Ports in Heads (8", 10" & 12" Bores only)	**-P34**	5.10
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	
All Ports Position #2	**-PA2**	
All Ports Position #3	**-PA3**	
All Ports Position #4	**-PA4**	
Rod End Position #1	Standard	
Rod End Position #2	**-PR2**	
Rod End Position #3	**-PR3**	
Rod End Position #4	**-PR4**	
Cap End Position #1	Standard	
Cap End Position #2	**-PC2**	
Cap End Position #3	**-PC3**	
Cap End 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 ‡ for reed switches and Electronic Sensors (Order Sensors separately)	**-E**	5.12

‡ 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

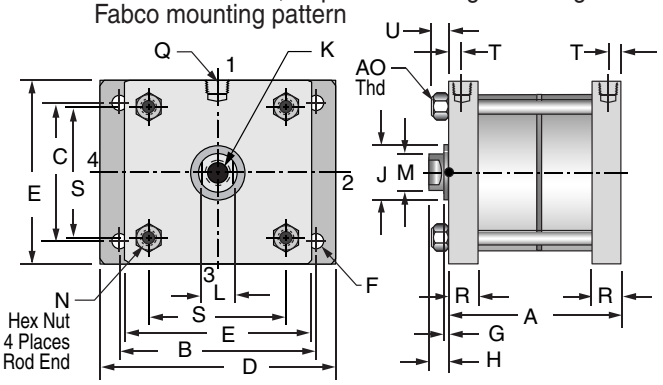
5

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

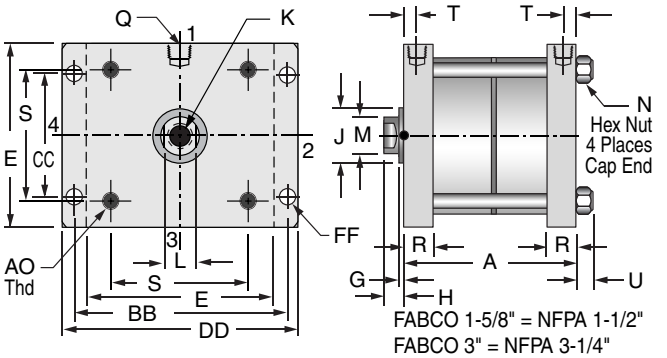
FF Front Face Mount; Rod End Rectangular Flange
Fabco mounting pattern



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

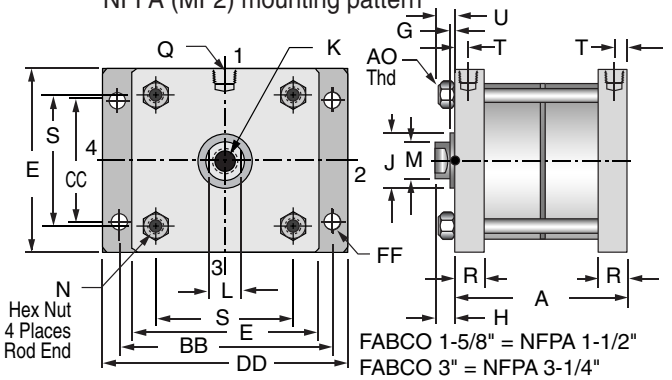


FFA Front Face Mount; Rod End Rectangular Flange
NFPA (MF1) mounting pattern



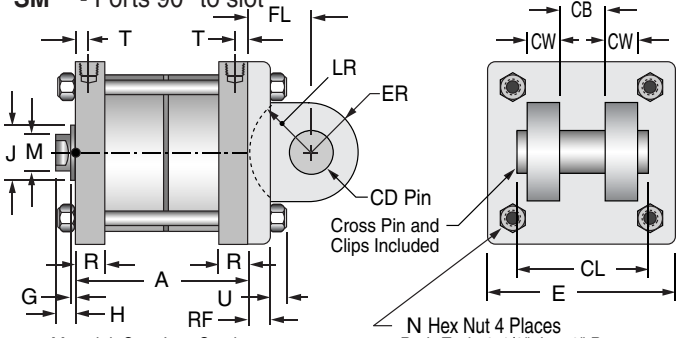
FABCO 1-5/8" = NFPA 1-1/2"
FABCO 3" = NFPA 3-1/4"

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



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

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"

Material: Gray Iron Casting,
Black Oxide Finish

N Hex Nut 4 Places
Both Ends 2-1/2" thru 6" Bores;
Rod end only 1-1/8" & 1-5/8" Bores

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).

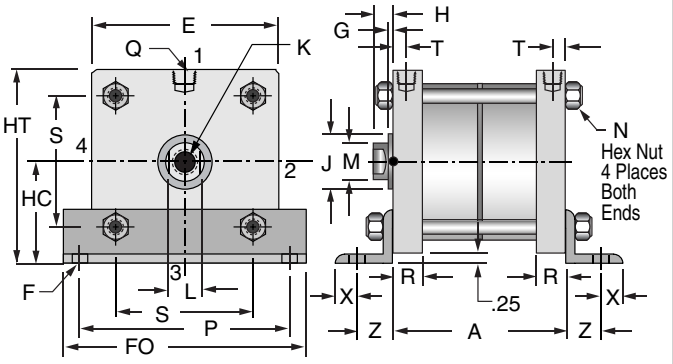
The following options also require additional cylinder length. See the respective option information pages for details. **-NR, –NRDR** (pg 5.8), **-HS** (pg 5.11), **-TF, -TR, -TFR** (pg 5.10), **-E** (pg 5.12).

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

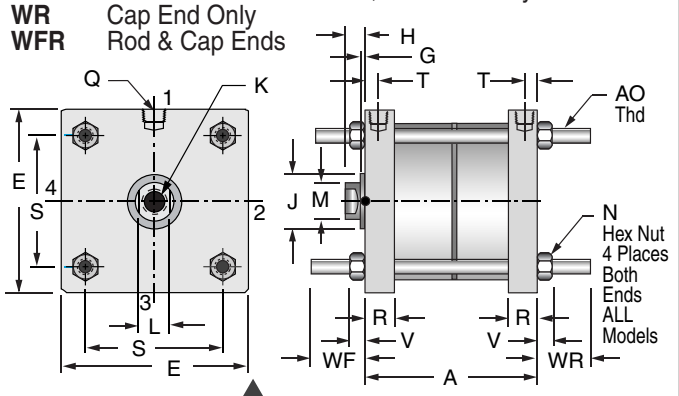
Bore	A= (No. stages x stroke) + y‡			B	C	D	E	F	G	H	J ±.002	K†	L	M ±.001	N	P	Q NPT	R
	y‡ (2 stage)	y‡ (3 stage)	y‡ (4 stage)															
1-1/8	1.86	2.41	2.96	2.00	1.25	2.50	1.75	.28	.13	.50	0.752	5/16-24x.63	7/16	0.500	7/16	2.38	1/8	.50
1-5/8	2.42	3.08	3.75	2.50	1.75	3.00	2.25	.28	.13	.50	1.001	3/8-24x.63	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

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

FT Foot Mount



WF Extended Tie Rod Mount, Rod End Only
WR Cap End Only
WFR Rod & Cap Ends



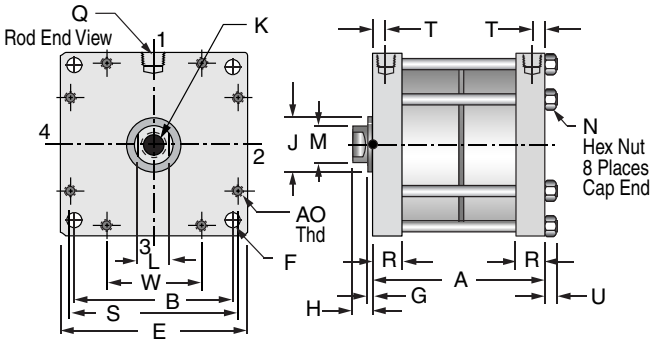
To Order
Extended Tie Rod Mount

	Specify Suffix
Rod End only	**WF**
Cap End only	**WR**
Rod & Cap Ends	**WFR**

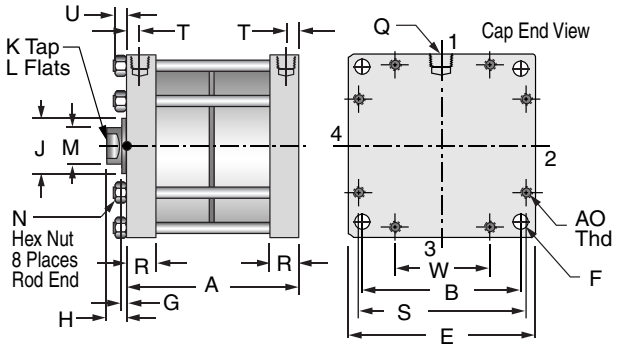
If a non-standard extension is required, specify by adding the required length to the suffix.
e.g. If **WF** length required is 2.5", Specify WF2.5"

8", 10", and 12" Bores

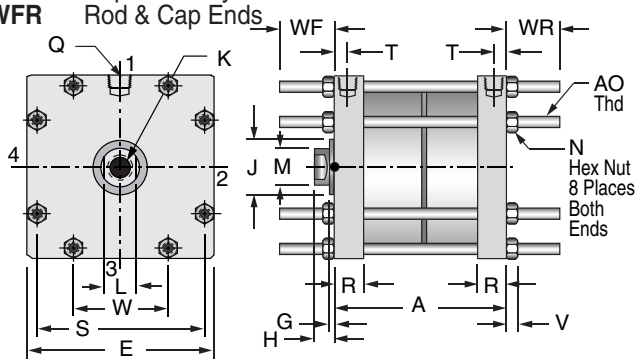
FFA Front Face Mount; Rod End Square Flange
NFPA (ME3) mounting pattern



RFA Rear Face Mount; Cap End Square Flange
NFPA (ME4) mounting pattern



WF Extended Tie Rod Mount, Rod End Only
WR Cap End Only
WFR Rod & Cap Ends



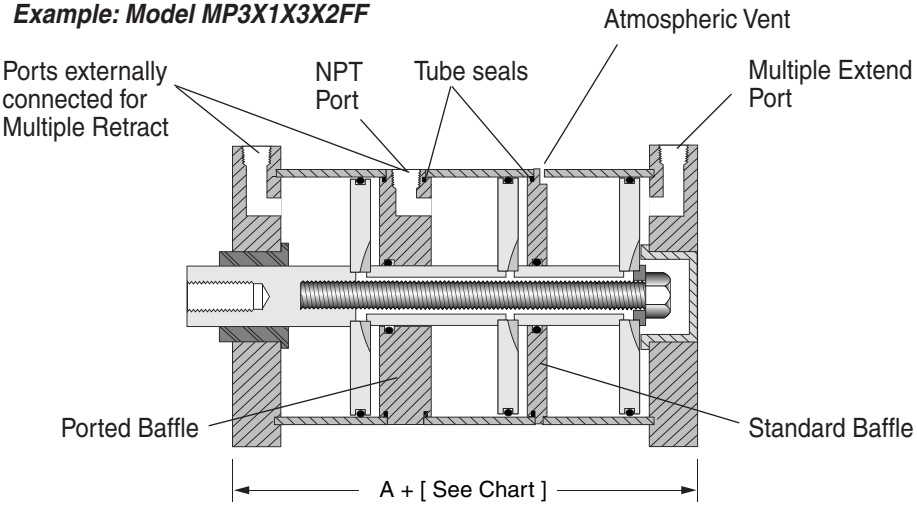
Bore	S	T	U	V	W	X	Z	AO	BB	CC	DD	FF	FO	HC	HT	WF	WR	CD	FL	RF	CB	CW	ER	LR	CL
1-1/8	1.19	.22	.27	.22	NA	.31	.44	1/4-20	2.00	1.00	2.50	.22	3.00	1.13	2.00	1.0	1.0	.500	.75	.38	.76	.50	.62	.62	2.09
1-5/8	1.62	.25	.27	.22	NA	.38	.63	1/4-20	2.75	1.43	3.25	.28	3.50	1.38	2.50	1.0	1.0	.500	.75	.38	.76	.50	.62	.62	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

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.

See pages 5.5 for Dimension "A"

Example: Model MP3X1X3X2FF



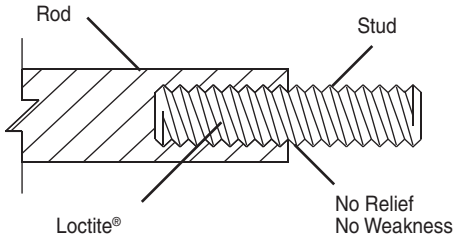
Bore	Port	Add to Dimension "A" for each Ported Baffle
1-1/8"	1/8 NPT	.50"
1-5/8"	1/8 NPT	.50"
2-1/2"	1/4 NPT	.50"
3"	1/4 NPT	.50"
4"	1/4 NPT	.50"
5"	1/4 NPT	.50"
6"	1/4 NPT	.50"
8"	1/2 NPT	1.00"

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

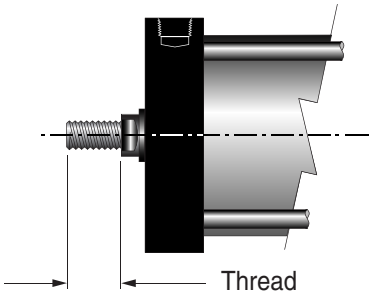
Notes:
When any of these combinations are ordered, the proper number of ported baffles are included.
As standard, the largest number of stages are internally connected.
On models with the same number of extend and retract stages, the extend stages are internally connected.

Applications that may dictate the use of Ported Baffles	
• Clean rooms, Vacuum Chambers, Wash Down Areas, Under Liquid, Dirty or Corrosive Environments	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.
• Increase Cycle Speeds	The ports have higher air flow capacity than the vents in the standard baffle.
• Selective Force Application	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	Option
Single Rod	**-MR**
Double Rod, Rod End Only	**-MR**
Double Rod, Cap End Only	**-MR1**
Double Rod, Rod & Cap Ends	**-MR2**



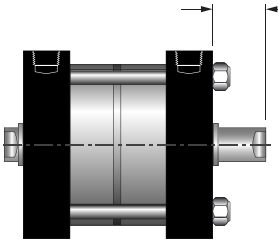
For bores 1-1/8" thru 8", a high strength stud is threaded into the standard female rod end and retained with Loctite®. This method eliminates the small diameter thread relief area normally required when machining male threads. This provides a much stronger rod end which can be repaired, rather than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

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

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

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**

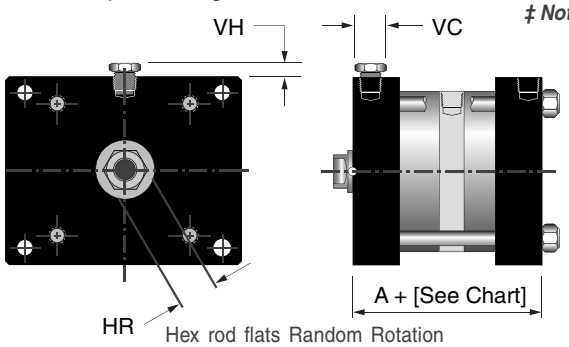
A stainless steel hex rod and a hex broached bushing of SAE 660 bearing bronze replaces the standard round rod and bushing.

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 ±1°.

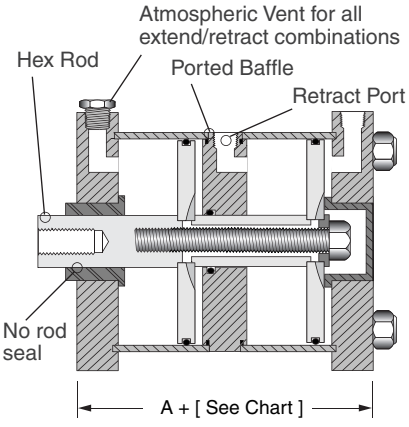
The hex rod design does allow for some torque loading on the shaft. However, torque loads that induce side loading should be minimized for best overall life and performance.

Available Combinations	No. of Ported Baffles	Total No. of Stages
2 X 1	1	2
3 X 1	1	3
3 X 2‡	2	3
4 X 1	1	4
4 X 2‡	2	4
4 X 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 VC	St'd Ports VH max	1/2 NPT Ports (–TF or –TFR) VC	1/2 NPT Ports (–TF or –TFR) VH max	3/4 NPT Ports (–P34) VC	3/4 NPT Ports (–P34) 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.

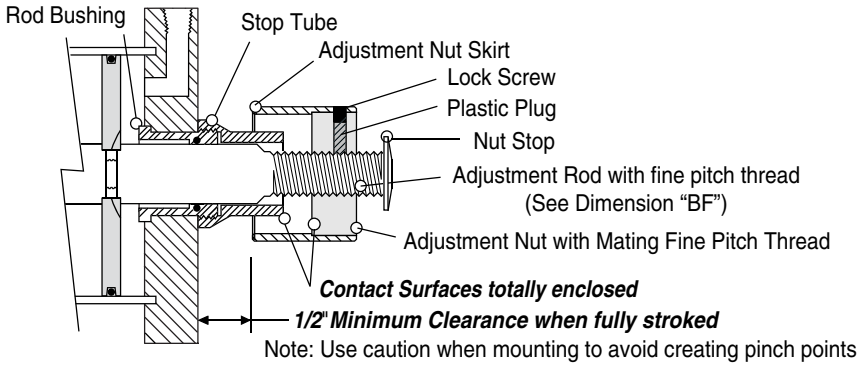
Adjustable extend stroke

Option -AS

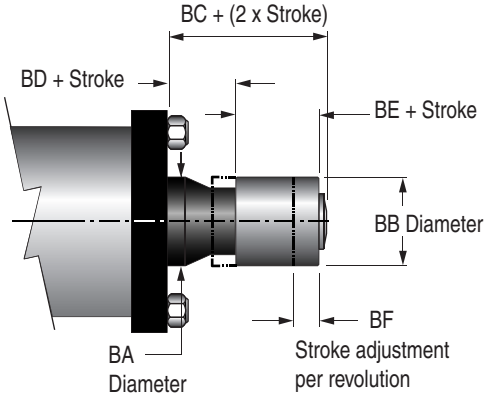
For strokes through 6"
Full stroke adjustment is standard.

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



Note: Use caution when mounting to avoid creating pinch points



5

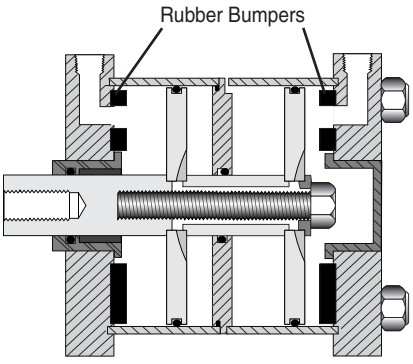
Dial-A-Stroke® provides a rugged and precision adjustment of the extend stroke of the cylinder. The stop tube, adjustment nut with skirt, and minimum clearances combine to eliminate pinch points, thus providing operator safety. **Note!** Use caution when mounting to avoid creating pinch points with other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

The stop tube is black 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**



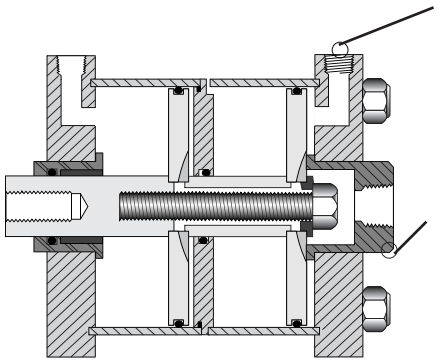
A rubber doughnut is bonded to the cylinder head to act as the piston stop and absorb the impact of the piston. This reduces noise and absorbs energy, thus reducing damage to the cylinder and tooling due to pounding. The amount of rubber that extends beyond the normal piston stop is designed to compress 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.

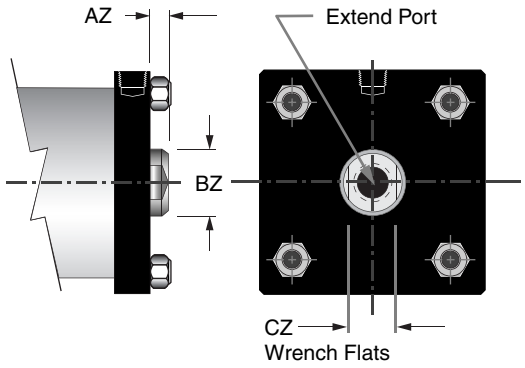
Note! On applications such as punching, shearing, setting blind rivets, etc., where high forces are built up and then released VERY quickly, the proper method of "catching" this type of load is to adjust the cylinder piston and the tooling so that at the point of breakthrough the piston is very close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

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**



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.



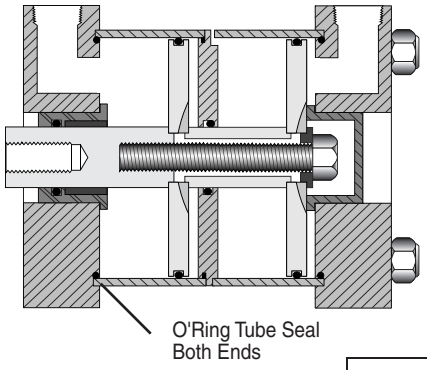
Dimensions (inches)

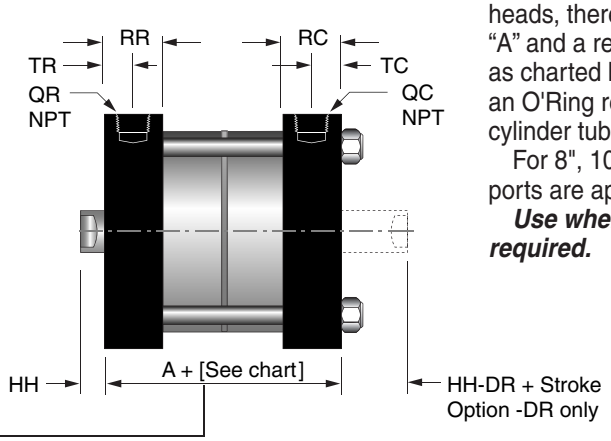
Bore	AZ	BZ	CZ	Availability E38	E12	E34
2-1/2	.38	1.13	.94	✓	✓	–
3	.38	1.13	.94	✓	✓	–
4	.38	1.50	1.26	✓	✓	–
5	.38	1.75	1.50	✓	✓	✓
6	.38	1.75	1.50	✓	✓	✓
8	.38	2.00	1.75	–	–	✓
10	.50	2.75	2.25	–	–	✓
12	.50	2.75	2.25	–	–	✓

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
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

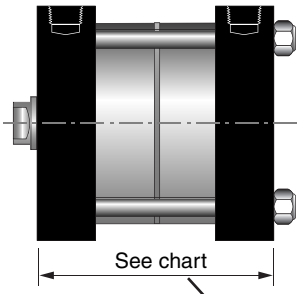
High Flow Vents **Option -HF**

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.



	Bore	Add to "A" Pg 5.5 & 5.6
Series MP	2-1/2", 3", 4"	0.50"
	5"	0.25"
	6"	0.50"
	8"	0.25"
	10", 12"	0.00"
	Bore	**Add to "B" Pg 5.24**
MLR, MLS	2, 2-1/2", 3", 4	0.50"

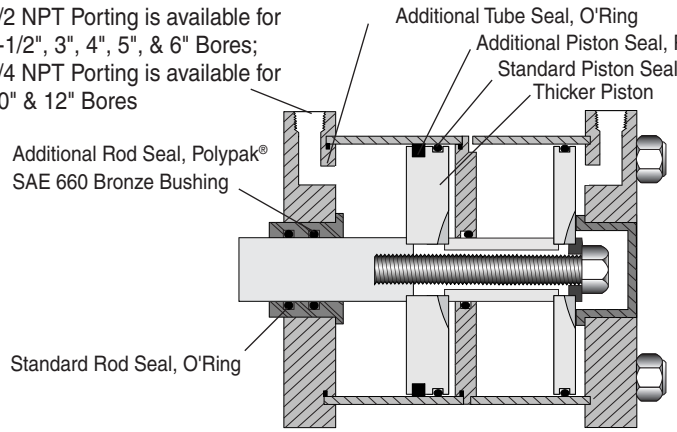
When Multi-Power® cylinders are applied to applications such as punching or shearing, high inertial and impact forces are often encountered. To capture these potentially destructive forces, and prevent possible damage to tooling and cylinder specify Option –˙HS.

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.



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

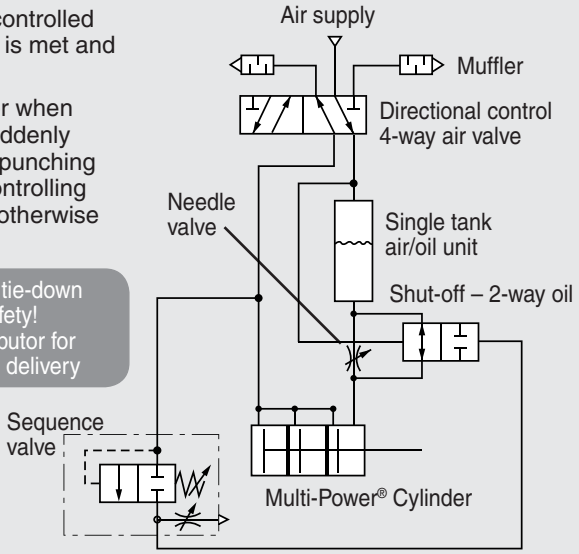
Application Tips

Two Speed & Shock Control

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

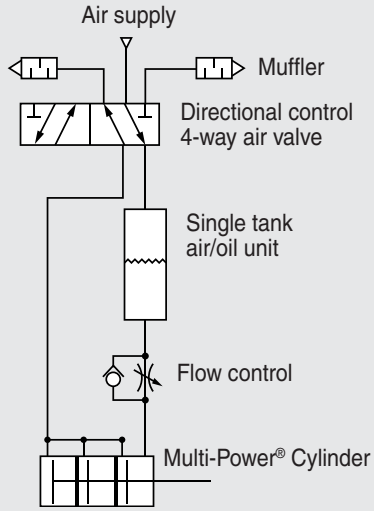
1. Rapid "Extend" stroke.
2. Automatic switch to controlled rate when resistance is met and pressure builds up.
3. Fluid catches cylinder when built-up forces are suddenly released (such as in punching applications), thus controlling the shock that could otherwise occur.
4. Automatic return to rapid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

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.

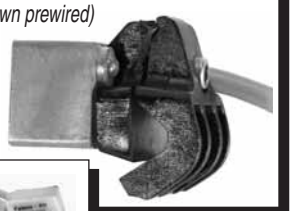


9-2A197 Series Sensor & Clamp for 1-1/8" to 3" Bores

Socket Head Screw

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

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.

Magnetic Piston Option -E

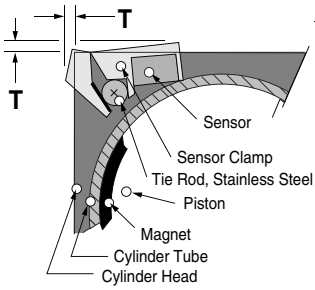
Specifies Magnetic Piston

(Order Sensors and Sensor Clamps Separately)

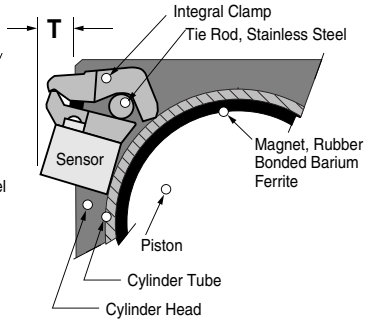
- ***Option -E*** consists of a magnet bonded into the piston head. When the piston magnet moves past an external sensor, the magnetic field activates the sensor without physical contact.
- ***Mounting*** – The sensor is attached to a 2-part clamp that attaches rigidly to a tie rod and can be positioned 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 accomodate the magnet. Using the table below add 'L' to Dimension 'A' on pages 5.5 & 5.6***

(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

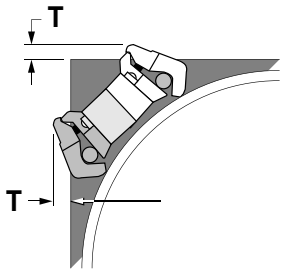
1-1/8" – 3" Bores



4" – 6" Bores



8", 10", 12" Bores



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. Sensor housing rated NEMA 6/IP67.

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