WORLD CLASS PERFORMANCE
FABCO-AIR
PNEUMATIC PRODUCTS

Cylinders, Valves, & Accessories

QUICK INDEX

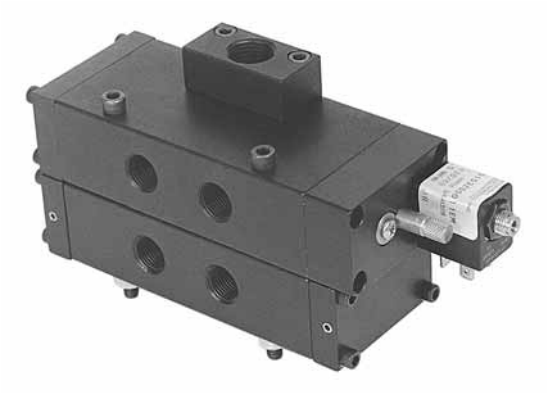
Specials...

Consider asking Fabco-Air for a modified or special product to meet your necessary and specific requirements. Fabco-Air has the willingness, years of experience, manpower and equipment available to design, adapt, modify and produce in any quantity, existing or new products to meet your job requirements more effectively. Please contact your local distributor with details of your requirements so that we may assist you.

The photos here show just a few examples of the thousands of specials that have been produced over the past three decades.

Pancake®

■ Rear tapped mount with extension hub



1/2 NPT Valve Stack

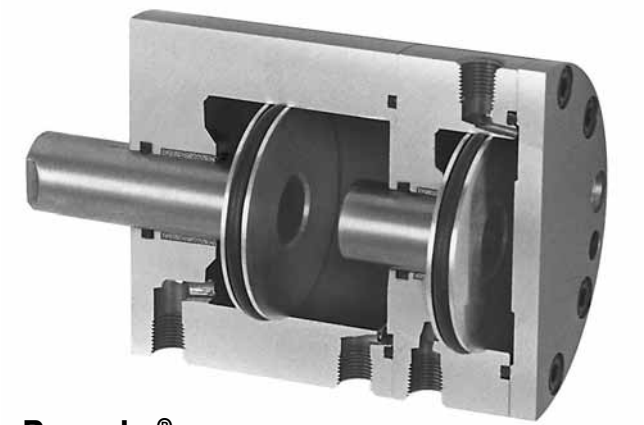
■ Manifolded inlet into both valves ■ One solenoid controlled valve with internal orificing to pilot operate second valve

1/2 NPT Valve

■ 3 way with heavy spring ■ Provision for operator attachment and positive manual override for foot operation

Pancake®

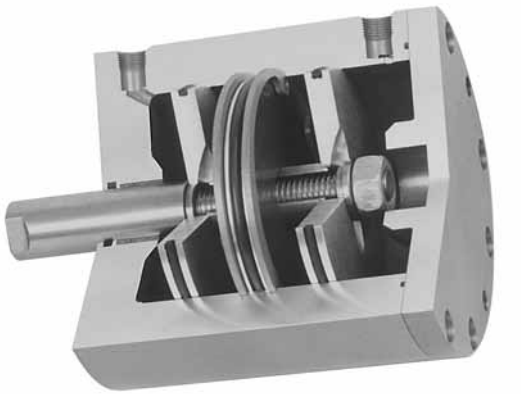
■ Heavy spring extend ■ Front flange mount



Pancake®

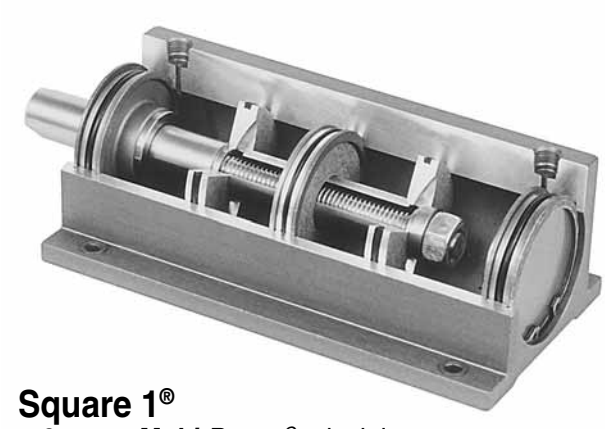
■ 3 position

Modular Valve Bank
■ Stacked with mounting brackets ■ Swivel flow controls
■ Fittings ■ Wire terminals ■ Wire insulation installed

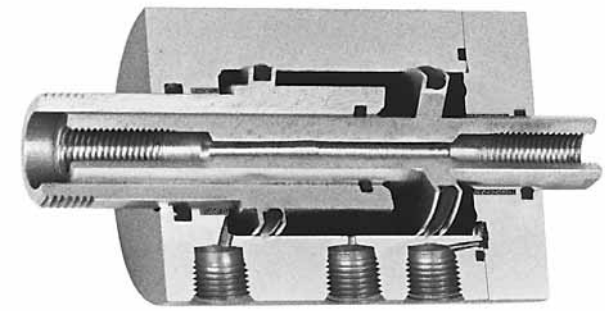


Pancake®
■ 2 stage ***Multi-Power®*** principle

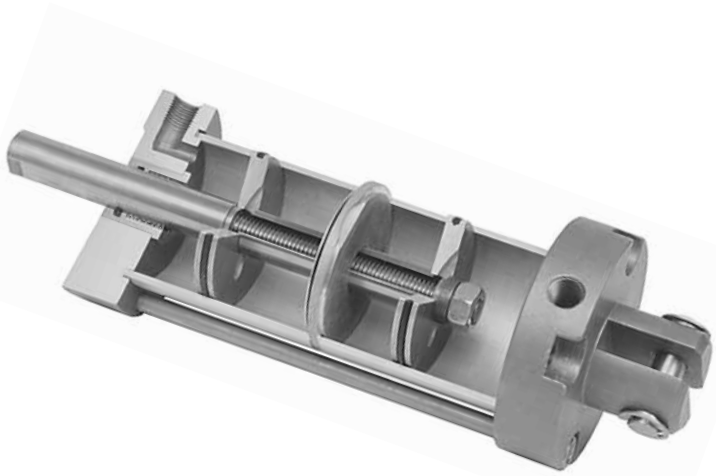
Hi-Power™
■ Double rod ■ oversized rods
■ Oversized hole through



Square 1®
■ 2 stage ***Multi-Power®*** principle



Pancake®
■ Double rods with hole through concentric shafts and independent ports for stripper control



Longstroke® Pivot Mount
■ 2 stage ***Multi-Power®*** principle

1

Original Series

Original Series

Original Series, Nonrotating

"T" Series

Laboratory tests confirm that internally lubricated Buna-N O-ring seals have extended Pancake® cylinder life 2 to 3 times beyond that of cylinders using standard Buna-N seals.

This, the original ***Pancake® Cylinder***, was designed in 1958 to satisfy the need for short stroke cylinders that would fit in very tight spaces. Today, with almost four decades of experience in thousands of cylinder applications around the world, ***The Pancake® Line*** offers you far more than any of its imitators – more features and options – better quality, strength and appearance – and far longer product life!

We are so confident in our design and manufacturing skills that ***we back every Pancake® Cylinder with our 2-year Warranty!***

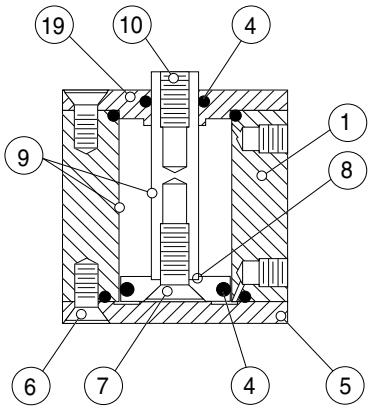
Features	Benefits
• Machined from aluminum bar-stock	• Strength, precision & clean lines
• Heavy wall construction	• Bore protection
• Internally lubricated O-rings	• Smooth operation & long life
• Duralon® nonmetallic rod bushing	• Superior bushing & rod life
• Hard chrome plated stainless steel piston rod	• Long life, corrosion resistance
• Crosshatch polished bore	• Lubrication retention for seal life
• More bores, strokes, options	• Fit your application
• Clear anodized	• Appearance & corrosion resistance
• Internal guide pins in non-rotating	• Protected from environment
• Prelubed with Magnalube®-G Grease	• Long life, smooth operation
• "T" Series	• Includes PTFE piston bearing
• 2 Year warranty	• Extended buyer protection

General, Standard Specifications

Media	Air	Optional - Hydraulic
Maximum operating pressure	250 psi	Optional - 500 psi
Minimum operating pressure	See page 1.4, Item 4	
Ambient & media temperature	–25° to + 250°F	
Prelubrication	Magnalube®-G Grease	
Air line lubrication	Recommended	
Stroke tolerance	± 1/64"	

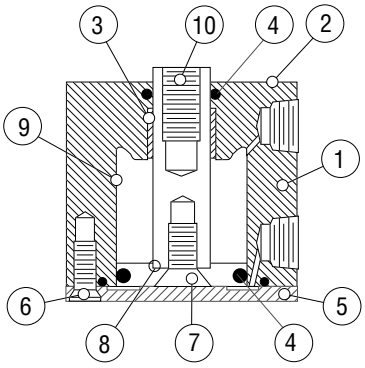
1

Original Series

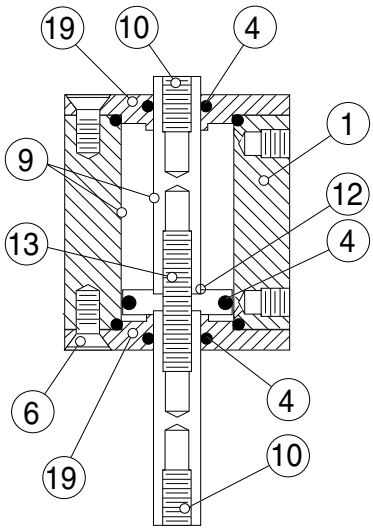


Single Rod – Double Acting
Action - X
1/2" & 3/4" Bores

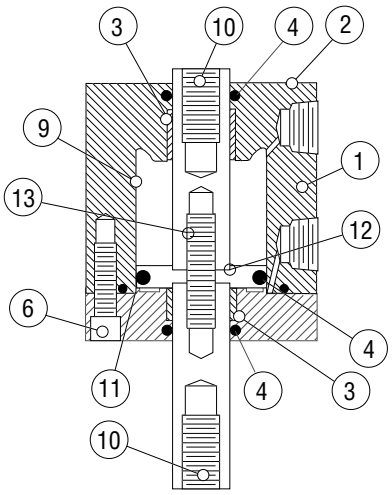
Single Rod - Double Acting
Action -X shown



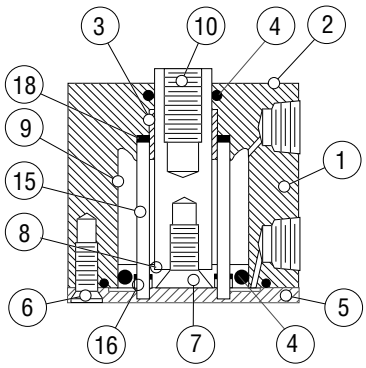
Single Rod – Double Acting
Action - X



Double Rod – Double Acting
Action - XDR
1/2" & 3/4" Bores

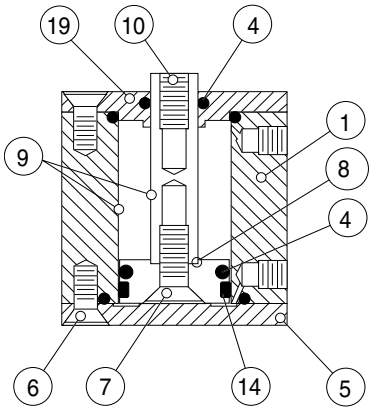


Double Rod – Double Acting
Action - XDR

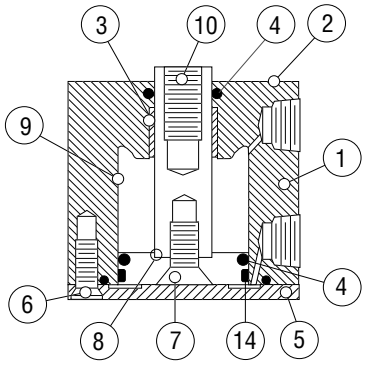


Single Rod – Double Acting –
Nonrotating
Action - XK

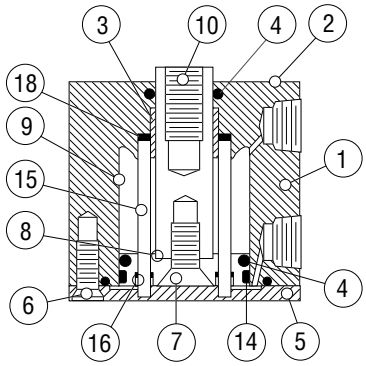
"T" Series (PTFE Piston Bearing)



Single Rod – Double Acting
Action - X
1/2" & 3/4" Bores



Single Rod – Double Acting
Action - X



Single Rod – Double Acting –
Nonrotating
Action - XK

Nearly 4 decades of experience paying close attention to design detail, production and assembly techniques have resulted in the ultimate Fabco-Air Pancake®, short stroke cylinders. Pancakes® fit into very tight spaces and virtually ANY short stroke cylinder application. Think how well they will fit with your application!

1. The heavy wall prohibits any damage to the bore from external forces.

2. The one piece cylinder body and bushing support end is machined from solid aluminum bar-stock. This provides unequalled strength, rigidity, and piston rod support. Machining all surfaces provides perpendicularity and concentricity for locating, mounting, and making attachments to the rod. It also presents a clean, smooth, "no-dirt-catching" appearance on your machine.

3. Unique construction provides unequalled piston rod support and prohibits "Blowout"! The one piece Duralon® rod bushing is inserted from the inside and then staked in place. Duralon® is a Teflon® lined fiberglass structure with a load carrying capacity of 60,000 psi. Compare capacity with Nylon® at 1,000 psi, porous bronze at 4,500 psi, and porous iron at 8,000 psi. Duralon also provides: CONSISTENCY, reliable and predictable performance from bushing to bushing; CORROSION RESISTANCE, nonmetallic materials resist galvanic, chemical and fretting corrosion; SELF LUBRICATION, Teflon® lining provides low friction and minimizes stickslip, even under no-lube conditions; SEIZURE RESISTANCE, fiberglass backing material will not seize or gall on shaft under extreme wear. Generally the bearing length is increased as the stroke increases, providing even more piston rod support.

4. Internally lubricated Buna-N O'Rings (-25° to + 250°F) provide low profile, low friction, and long life sealing of piston and rod. All static seals are Buna-N.

These dynamic O'Rings are compounded to provide extra long wear and lower breakaway (starting) and running friction and smoother operation. In tests, cylinders with internally lubricated O'Rings have extended cycle life two to three times beyond cylinders with standard Buna-N seals. The chart below shows maximum breakaway or starting pressure to extend the rod of single rod, double acting (Action -X) cylinders with internally lubricated O'Rings under no-load conditions after 3 days delay at zero pressure. With other actions and/or combinations of options, breakaway pressures may vary.

Bore Number	5	7	121	221	321	521	721	1221
Bore, Inches	1/2	3/4	1-1/8	1-5/8	2	2-1/2	3	4
Breakaway psi	12.0	6.5	4.5	4.5	4.0	3.0	3.0	2.5

These low operating pressures allow for the use of vacuum as an Operating Media in many applications. 1.0 psi is the equivalent of 2.04" Hg of vacuum. To determine the force output of a cylinder with vacuum, multiply: Force Area of cylinder x inch Hg vacuum x 0.49 = Force, lb.

5. The thinnest possible piston and rear cover design keeps the overall height as short as possible. Please note that any cylinder offering less height than that of a Pancake® with the same stroke, sacrifices rod bushing length and/or overall strength.

6. The aluminum cover is held in place with multiple plated screws for strength, rigidity, ease of modification for specific application requirements, and ease of access for maintenance should it be required.

7. The aluminum piston is attached to the piston rod with a socket flat head cap screw which is torqued for proper preload on the screw and clamping of the piston. Loctite® on the threads and faces assures sealing and locks the assembly against pounding and vibration.

8. The piston in all bores has a counterbore for piston rod location and control of concentricity between piston rod and piston O.D.

9. Polishing the cylinder bore and piston rod produces a fine crosshatched finish. This crosshatching provides minute oil ring type grooves for retaining lubrication. This finish, unlike an ultra smooth finish, provides a place for lubrication to lie and support the seal as it moves along the surface. The surface finish and lubrication provide lower friction and longer seal life.

10. The piston rod is centerless ground, polished, and hard chrome plated (68-72 Rc) stainless steel. Surface finish is 12 RMS or better and carries lubrication like our cylinder bore (see 9). These features combined with the low friction and high load capacity of the Duralon® bushing provide exceptional cylinder life. Female, fine pitch rod thread and wrench flats are standard.

11. A pilot diameter on the cover is concentric with the rod bushing and locates in the cylinder bore to maintain the concentricity, precision, and rigidity of the ***Pancake®*** design.

12. Counterbores on both sides of the piston maintain concentricity of piston rods to each other as well as to the piston O'Ring. This also provides complete axial and radial rigidity of the piston so that it cannot float or be pounded loose.

13. The piston rods are connected by a high strength stud, sandwiching the piston between the rod end faces. The assembly is torqued for proper preload of the stud and clamping of the piston head. Loctite® on the threads and faces assures sealing and locks the assembly against pounding and vibration. This procedure provides a positive and rigid assembly that will not allow the piston to float or be pounded loose.

14. The "T" Series has a thicker piston which incorporates a bearing strip in addition to the O-ring seal. This bearing strip is a close tolerance, rectangular cross section strip of a tough, stable, wear resistant PTFE compound. If the piston rod assembly is forced off center by misalignment or other forces, this bearing, along with the long and rigid Duralon® rod bushing, supports the load and helps to maintain the long life of the cylinder bore and O-ring seal. Note: the bearing is not included, or required in double rod models because the long rod bushings at each end of the cylinder provide superb support.

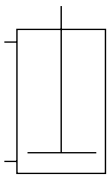
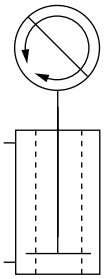
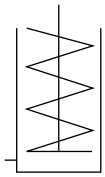
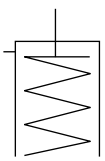
15. Two guide pins of precision ground tool steel pass through the piston head. These guide pins prevent rotation of the rod with a tolerance of ±1°. Note that the guide pins are located internally. This provides protection from the environment and from physical damage. Lubrication is provided with other internal parts. NO additional space is required and the rod end is left free for attachments and tooling as required by the application. An information label, similar to this one, is applied to each cylinder to warn against damage.

WARNING
THIS CYLINDER HAS A NONROTATING ROD.
TO PREVENT INTERNAL DAMAGE HOLD ROD BY WRENCH FLATS WHEN INSTALLING OR REMOVING ATTACHMENTS

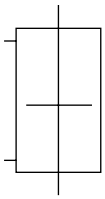
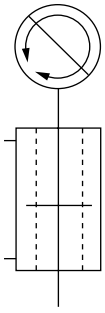
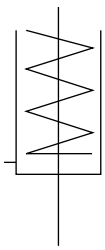
16. The guide pins pass through Polyurethane O'Ring seals and SAE660 bearing bronze bushings incorporated in the piston head. This combination provides no leak, precision guiding and long life.

18. A disk of rubber is included at the end of the guide pins to take up play and firmly seat the pins in the precision machined guide pin holes.

19. Integral rod bearing and endcap is hard anodized aluminum. The piston rod seal O-ring is located as close to the outer end as feasible so that as much of the bearing as possible gets system lubrication as well as protecting most of the bearing length from the environment. A precision machined pilot diameter locates the cylinder bore to assure concentricity and proper rod alignment.

Original Series	"T" Series PTFE Piston Bearing	NFPA Symbol	Action Letter Action Description
C-221-**X** 	TC-221-**X** 		Action -**X** Single Rod Double Acting One Piston Rod Power Extend - Power Retract
C-221-**XK** 	TC-221-**XK** 		Action -**XK** 150 psi maximum Single Rod Double Acting Nonrotating One Piston Rod Power Extend - Power Retract Piston guide pins for nonrotating
C-221-**O** 	TC-221-**O** 		Action -**O** Single Rod Single Acting - Spring Retracted One Piston Rod Power Extend - Spring Retract
C-221-**OP** 	TC-221-**OP** 		Action -**OP** Single Rod Single Acting - Spring Extended One Piston Rod Spring Extend - Power Retract

The "Action Letter" portion of the Pancake® Model Number specifies how many piston rods the cylinder has (Single Rod or Double Rod), how the piston rod is extended and retracted (Double Acting or Single Acting), and if the piston rod is restricted from rotating by internal guide pins (Nonrotating).

Original Series	"T" Series PTFE Piston Bearing	NFPA Symbol	Action Letter Action Description
C-221-**XDR** 	The "T" Series is not required in the double rod version. Two rod bushings provide superb rod support		Action -**XDR** Double Rod Double Acting Two Piston Rods - One each end Power Extend - Power Retract
C-221-**XDRK** 	The "T" Series is not required in the double rod version. Two rod bushings provide superb rod support		Action -**XDRK** 150 psi maximum Double Rod Double Acting Nonrotating Two Piston Rods - One each end Power Extend - Power Retract Piston guide pins for nonrotating
C-221-**ODR** 	The "T" Series is not required in the double rod version. Two rod bushings provide superb rod support		Action -**ODR** Double Rod Single Acting - Spring Retracted Two Piston Rods - One each end Power Extend - Spring Retract

1

PREFIX OPTIONS

MODEL NUMBER	PREFIX
METRIC Cylinder and Rod Thread. Female Rod Thread is standard.	**M**
Optional Male Rod Thread add suffix **-MR**	

PREFIX OPTIONS

Mounting holes and rod thread are configured to common METRIC sizes. Ports in 1/2" (5) and 3/4" (7) bores are M5. Ports in 1-1/8" (121) bore and larger are G1/8 with 14mm spotface for 1/8 BSP-Parallel fittings and gaskets.

Available on all series, bore, stroke and action combinations.

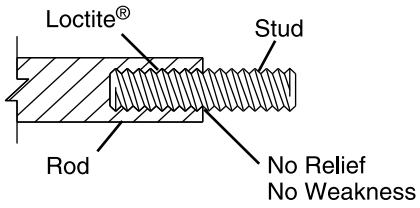
See *Option Specifications* pages of desired bore and action for complete dimensional details.

SUFFIX OPTIONS

MODEL NUMBER **SUFFIX**

MALE ROD THREAD

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



SUFFIX OPTIONS

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.

Available on all series, bore, stroke and action combinations.

See *Option Specifications* pages of desired bore and action for complete dimensional details.

TEFLON® O'RING SEALS (+400° to +500° F) **-T**

For elevated temperatures (+400° to +500° F) or compatibility with exotic medias. Consult engineering for compatibility information.

NOTE: Teflon seals are **NOT** for low friction. This seal material assumes the shape of the rectangular groove, exhibits no "memory"and will not return to round O'Ring cross section. Therefore the piston and rod seals may exhibit some leakage. This is even more pronounced in applications that require thermal cycling over wide temperature ranges. They are not, therefore, recommended for such applications.

Available on all series, bores 1-1/8" (121) and larger, all strokes and actions -X, -XDR.

See *Standard Specifications* pages of desired bore and action for complete dimensional details. There are no dimensional changes from standard.

VITON® O'RING SEALS (-15° to +400° F) **-V**

For elevated temperatures (–15° to + 400°F) or compatibility with exotic medias. Consult engineering for compatibility information.

Available on all series, bore, stroke and action combinations.

See *Standard Specifications* pages of desired bore and action for complete dimensional details. There are no dimensional changes from standard.

QUAD SEALS (-30° to +250° F) **-Q**

A **QUAD** seal replaces the standard O'Ring on the piston only. Standard seal material is Buna-N (-30° to +250°F). For other materials consult engineering.

Available on all series, bore, stroke and action combinations.

See *Standard Specifications* pages of desired bore and action for complete dimensional details. There are no dimensional changes from standard.

NONROTATING Single Acting **-NR**

For Double Acting, Nonrotating
SEE Action -XK, -XDRK
on pages 1.5 and 1.6

A Hex Rod of stainless steel in a broached, hard anodized aluminum endcap replaces the round rod in Single Acting, Spring Retracted (Actions -O, -ODR) cylinders.

Available in all series, bores 1/2" (5), 3/4" (7), all strokes, actions -O, -ODR.

See *Option Specifications* pages of desired bore and action for complete dimensional details.

1

SUFFIX OPTIONS

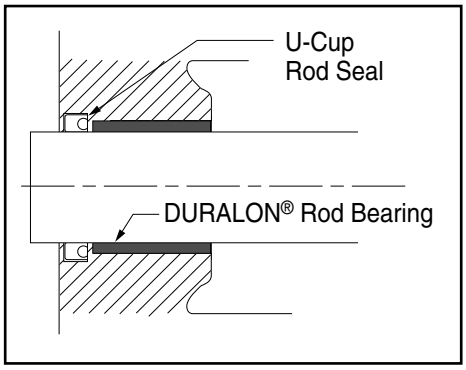
MODEL NUMBER **SUFFIX**

HYDRAULIC, Low Pressure Service to 500 psi NONSHOCK. Temperature to +300° F max.

Consult factory for media compatability and operating temperatures over 300°F.

With Standard Thickness Cover **-H**

With Thick Cover **-HHC**



SUFFIX OPTIONS

For Air-Oil or Hydraulic systems to 500 psi NONSHOCK.

1. A specially formulated U-Cup seal replaces the O-ring piston rod seal. This eliminates leakage past the rod seal and around the bushing.

2. Option **-HHC**, on single rod bores 1-5/8" (221) & larger, includes a thicker rear cover to assure that there is no warpage or failure when the mounting surface is the Rod End Face. See chart below.

3. **1/4 NPT Ports** are available on bores 1-5/8" (221) & larger. See Option **-P14** below.

4. Single Acting (Spring Return) Cylinders are designed for the spring to return the piston & rod assembly. Because of the low return forces available & the somewhat restricted flow, the piston returns slowly when used with oil at any pressure. Double Acting Cylinders are therefore recommended for Hydraulic service.

–H is available on all series, bores 1-1/8" (121) and larger, actions -X & -O, -OP, -XDR & -ODR, all strokes. Available also for Actions -XK & -XDRK on bores 2-1/2" (521) and larger. Consult factory for available strokes on bores 1-1/8 (121) to 2" (321) and actions -XK & -XDRK.

-HHC is available on all series. Bores 1-5/8" (221) and larger, all strokes, Actions -X & -O.

SEE *Option Specifications* pages of desired Bore & Action for complete dimensional details.

Pressure Ratings (psi) for Various Mountings						
OPTION / **ACTION**	**–H** **–X, –O**	**–H** **–OP**	**–H** **–XDR, –ODR**	**–H** **–XK**	**–H** **–XDRK**	**–HHC** **–X, –O**
Mounting surface is at rod end	250	500	500	150	150	500
Mounting surface is at cap end	500	500	500	150	150	500
Other Options in Combination with –H or –HHC						
–F	250	500	500	150	150	500
–PM	500	500	NA	150	NA	NA
–SM	500	500	NA	150	NA	NA
–EPM	500	500	NA	150	NA	NA
–ESM	500	500	NA	150	NA	NA
–AS	500	NA	NA	150	NA	NA
–RS	500	500	NA	150	NA	NA

AIR SERVICE
With Thick Cover **-HC**

-HC includes the thick rear cover. It is for AIR service, to 250 psi, when the thick rear cover is desired.

Available on all series, Bores 1 5/8" (221) and larger, all strokes, Actions; -X, -O.

See *Option Specifications* pages of desired Bore and Action for complete dimensional details.

1/4 NPT PORTS **-P14**

Port size 1/4 NPT. On bores 1-5/8" (221) and 2" (321) the orifice between the port and the bore is also increased. All ports are in the standard locations.

Use when reduced pressure drop or higher cycle speeds are desired. They are particularly advantageous in Air-Oil Hydraulic applications.

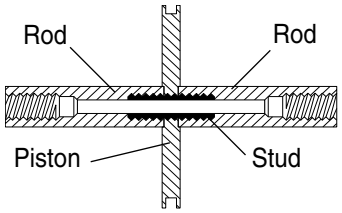
Available on all series, bores 1-5/8" (221) & larger, all strokes, all actions.

See *Standard Specifications* pages of desired bore & action for complete dimensional details. There are no dimensional changes from standard other than port size.

SUFFIX OPTIONS

HOLE THRU Double Rod Shaft

Bore	Standard		Standard Plus	
	Hole Size thru stud	Model No. Suffix (Std)	Hole Size thru stud	Model No. Suffix (Std Plus)
1/2", 3/4"	1/16	-06	–	–
1-1/8"	1/8	-13	5/32	-16
1-5/8"	1/8	-13	1/4	-25
2"	5/32	-16	5/16	-31
2-1/2"	5/32	-16	1/4	-25
3"	5/32	-16	1/4	-25
4"	1/4	-25	–	–



SUFFIX OPTIONS
150 psi maximum operating pressure

A hole is drilled through the piston rods & the double rod stud (see construction details on page 1.3). This hole is used for the passage of Vacuum, Air, Gas, Oil, Liquid or any media that is compatible with the stainless steel piston rod and the steel stud. Maximum pressure, 150 psi. Hole sizes available for each bore size are shown in the chart to the left. If a larger hole is needed (for higher flows or mechanical members) or all stainless steel construction is needed (for compatibility or higher pressure) see "One Piece Piston & Rod Construction" under *Custom Options* on page 1.15.

Insert the SUFFIX Number into the Model Number immediately after the desired Action. For example: -XDR13

Available on Original Series, all Bores, all Strokes, Action; -XDR, -XDRK, -ODR.

See *Standard Specifications* pages of desired Bore & Action for complete dimensional details. There are no dimensional changes from standard.

FINISH: Clear anodize is standard.

Plating: ***Pro-Coat™***
Electroless Nickel **-N**

Pro-Coat™, Electroless Nickel Plating, is a hard, smooth, corrosion and wear resistant coating. It will often suffice for applications where stainless steel is specified. Its lasting luster provides high visual appeal.

The coating is a high nickel, low phosphorous alloy deposited by chemical reduction without electric current that is “mil-for-mil” more corrosion resistant than electroplated nickel. The surface is virtually pore free. The thickness of the nickel deposit is consistent over the entire surface. Blind holes, threads, small diameter holes and internal surfaces all receive the same amount of plating. It has natural lubricity and a high resistance to abrasion. As shipped hardness of the coating is approximately 49 Rockwell C. Heat treating can increase hardness to approximately 60 Rockwell C. For specific applications, consult engineering.

Besides cylinder parts, ***Pro-Coat™*** may be applied to valve bodies, solenoid housings, fittings and most any item that appears in this catalog.

Pro-Coat™ is available on all series, bore, stroke and action combinations.

See *Standard Specifications* pages of desired bore and action for complete dimensional details. There are no dimensional changes from standard.

STROKE COLLAR

on Piston Rod in 1/8" increments.

1) Start with the next longest stroke.
2) Select the amount the stroke is to be shortened.
3) Specify the corresponding SUFFIX designation.

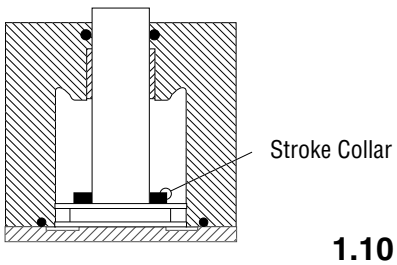
1/8"	**-C1**
1/4"	**-C2**
3/8"	**-C3**
1/2"	**-C4**
5/8"	**-C5**
3/4"	**-C6**
7/8"	**-C7**

For those "in-between" strokes, a STROKE COLLAR is incorporated on the piston rod. The collar fits tightly on the piston rod so that it cannot float as the piston is stroked. Tolerance on the stroke is ± 1/64". For tighter tolerances on the stroke or final rod position, consult Engineering.

Available on all Series, all Bores, all Strokes, Actions; -X, -XDR, -OP. Also all series, Bores 3/4" (7) and larger, all Strokes, Actions; -XK, -XDRK. Also all Series, Bores 1/2" (5) & 3/4" (7), Actions; -O, -ODR.

SEE *Standard Specifications* pages of desired Bore & Action for complete dimensional details.

Cap End Rod Stick-out of Double Rod Units increases by amount stroke is shortened.



SUFFIX OPTIONS

MODEL NUMBER **SUFFIX**

1

ADJUSTABLE EXTEND STROKE

For strokes through 4". **-AS**
Full stroke adjustment is standard.

NOTE! Use caution when mounting to avoid creating pinch poiunts.

C-221-X-AS

Adjustment settings are simplified by convenient scale markings applied to nut skirt and stop tube.

SUFFIX OPTIONS

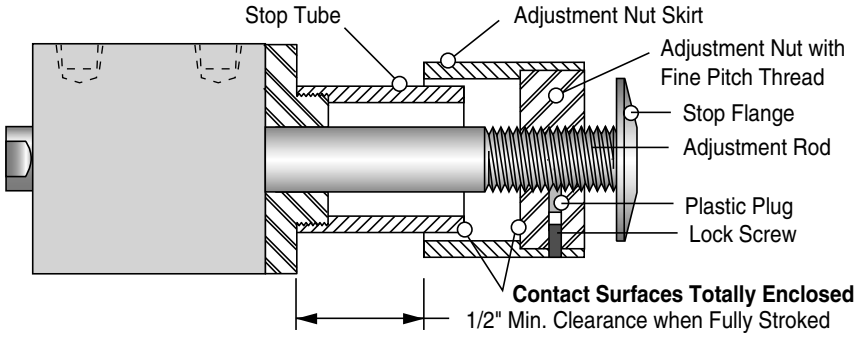
Dial-A-Stroke® provides a rugged and precision adjustment of the extend stroke of the cylinder. The stop tube, adjustment nut with skirt & minimum clearances combine to eliminate pinch points, thus providing operator safety. **Note!** Use caution when mounting to avoid creating pinch points with other 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 stop flange 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 stop flange 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. Bores 1-1/8" (121) and 1-5/8" (221) have a 1/2-20 thread giving .050" adjustment per revolution & Bores 2" (321) & larger have a 3/4-16 thread giving .063" adjustment per revolution.

The -AS designation provides full stroke adjustment.

Available on Original Series, Bores 1 1/8" (121) & larger, all Strokes, Actions; -X, -XK, -O.

SEE *Option Specifications* pages of desired Bore and Action for complete dimensional details.



ADJUSTABLE RETRACT STROKE

Any stroke with up to and including 1" adjustment.. . . . . **-RS**
Any stroke with over 1" adjustment, specify adjustment length after the -RS
Example: 2" adjustment. . . . . **-RS2**

D-221-X-RS

An adjusting screw with a thread sealing locknut mounted in a thick rear cover provides a simple yet rugged and precision adjustment of the cylinder stroke in the retract direction. The fine thread of the adjusting screw provides precision adjustment. Bores 1/2" (5), 3/4" (7), have a 5/16-24 thread giving .042" adjustment per revolution. Bore 1-1/8" (121) has a 3/8-24 thread giving .042" adjustment per revolution. Bores 1-5/8" (221) and larger have a 1/2-20 thread giving .050" adjustment per revolution.

The –RS designation provides full stroke adjustment of any cylinder with 1" stroke or less, and 1" of stroke adjustment on all longer strokes. When longer adjustments are required, on longer cylinders, add the desired adjustment to the -RS designation (1/2" increments please). Example:-RS2 will provide 2" of adjustment on any cylinder with 2" or more of stroke.

Available on all series, all bores, all strokes, actions -X, -XK, -O, -OP.

See *Option Specifications* pages of desired bore and action for complete dimensional details.

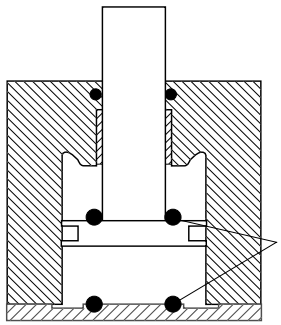
SUFFIX OPTIONS

MODEL NUMBER **SUFFIX**

SOUND LIMITERS

Rod End Only	**-LF**
Cap End Only	**-LR**
Both Rod and Cap Ends	**-LFR**

Temperature Range: –25° to +220° F



SUFFIX OPTIONS

For applications where you need a small amount of cushion at the end of the cylinder stroke to take out the metallic "slap" of piston head on piston stop. This is accomplished by placing an O'Ring on the piston, and/or in the rear cover so that initial contact is with the elastomer and not metal-to-metal.

The Fabco-Air design assures sufficient compression of the seals to allow full stroke.

Because of the temperature limitations of the adhesives involved, sound limiters are available in cylinders with internally lubricated Buna-N O'Rings only.

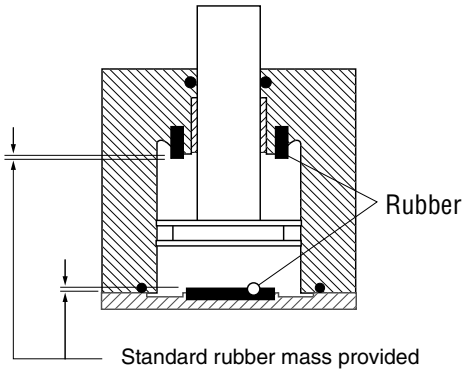
Available on all series, all bores, all strokes, actions -X, -O (Cap end only, -LR), -OP, -XDR, XDRK, -ODR (Cap end only -LR).

See *Standard Specifications* pages of desired bore and action for complete dimensional details. There are no dimensional changes from standard.

RUBBER BUMPERS

Rod End Only	**-BF**
Cap End Only	**-BR**
Both Rod and Cap Ends	**-BFR**

Temperature Range: –25° to +220° F



Standard rubber mass provided will compress and give full stroke at 60-80 psi.
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 destruction of 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.

On applications such as punching, shearing, etc., where high forces are built up and then very quickly released, the proper method of "CATCHING" this load is to adjust the position of the cylinder and tooling so at the point of breakthrough the piston is very close to or touching the bumper. This reduces the dynamic load that the piston and bumper are required to absorb. It is highly recommended that shock absorbers be considered and built into the tooling to assist in absorbing the force and dynamic loads generated in such applications.

Because of the temperature limitations of the adhesives involved (-25° to + 220°F) Rubber Bumpers are available in cylinders with standard internally lubricated Buna-N seals only.

Use to reduce noise and absorb impact.

Note! The springs in single acting models are designed to return only the piston and rod assembly and will not significantly compress the rubber bumpers.

Available on all series, all bores, all strokes, actions -X, -XK, -O (Cap end only, -BR), -OP (Rod end only, -BF), -XDR, XDRK, -ODR (Cap end only -BR).

See *Standard Specifications* pages of desired bore and action for complete dimensional details. There are no dimensional changes from standard.

1

SUFFIX OPTIONS

MODEL NUMBER **SUFFIX**

CLEVIS (Pivot) **MOUNT**
Ports in Line with Slot **-PM**
Ports 90° to Slot **-SM**

C-221-X-PM with RC-38

SUFFIX OPTIONS

CLEVIS MOUNT provides a pivot point attachment to allow pivotal motion of the cylinder as the piston rod extends or retracts. The pivot is bushed with an oil filled powdered metal bushing. The pivot pin (416 stainless steel) and clips are included as standard. On bores 1-5/8" (221), 2-1/2" (521), 3" (721) and 4" (1221), the Clevis Mount can be rotated 90° to provide either -PM or -SM option. To further assist in the mounting, rod clevises and eye brackets are available accessories.

In many applications requiring pivotal mounting, the cylinder is mounted with its centerline horizontal. Due to the weight of the cylinder and its attachments, this can result in some off center loading, and possibly binding of the piston and rod, causing accelerated wear. For such applications the "T" Series cylinders are recommended.

Available on all series, all bores, all strokes, actions: -X, -XK, -O, -OP.

See *Options Specifications* pages of desired bore and action for complete dimensional details of cylinders, rod clevises and eye brackets.

EYE (Pivot) **MOUNT**
Ports in Line with Tang **-EPM**
Ports 90° to Tang **-ESM**

C-221-X-EPM

EYE MOUNT provides a pivot point attachment to allow pivotal motion of the cylinder as the piston rod extends or retracts. The pivot is bushed with an oil filled powdered metal bushing. On bore 1-5/8" (221) the Eye Mount can be rotated 90° to provide either -EPM or -ESM option. To further assist in the mounting, rod clevises and clevis brackets are available.

In many applications requiring pivotal mounting, the cylinder is mounted with its centerline horizontal. Due to the weight of the cylinder and its attachments, this can result in some off center loading, and possibly binding of the piston and rod, causing accelerated wear. For such applications the "T" Series cylinders are recommended.

Available on all series, bores:1/2" (5), 3/4" (7), 1-1/8" (121), 1-5/8" (221) and 2" (321), all strokes, actions: -X, -XK, -O, -OP.

See *Option Specifications* pages of desired bore and action for complete dimensional details of cylinders, rod clevises and eye brackets.

THREADED NOSE MOUNT **-F**

C-221-X-F

THREADED NOSE with pilot diameter provides convenient, rigid and precision mounting. A hex mounting nut is included as standard and is also available separately. On bores 1-1/8" (121) and 1-5/8 (221) a urethane rod wiper is included, as standard, to exclude dirt from the rod bushing and seal.

Available on all series, bores:1/2" (5), 3/4" (7), 1-1/8" (121), 1-5/8" (221), all strokes, all actions.

See *Option Specifications* pages of desired bore and action for complete dimensional details of cylinder and mounting nuts.

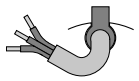
A single slot on longer stroke models has room to accommodate multiple sensors.

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

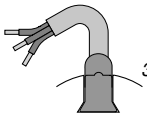
Suffix Option -E

Specifies Magnetic Piston and Dovetail Mounting Slot(s)

Order Sensors Separately

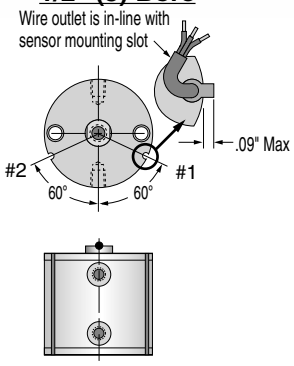


Keyway slot for 1/2" bore Pancakes. Wire is in-line with slot.



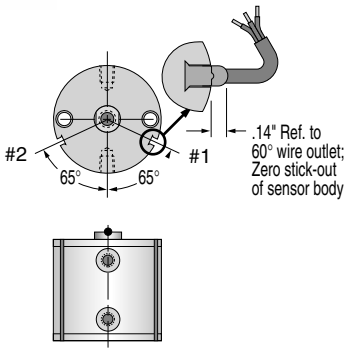
1/4" 60° Dovetail for 3/4" bore Pancake®s & up.

1/2" (5) Bore



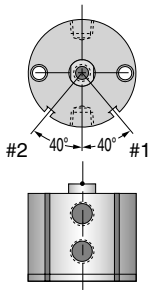
Sensors available for "D" & "TD" strokes and longer. Strokes D – J & TD – TJ have 2 mounting slots; others have 1. Strokes D & TD are ported on opposite sides.

3/4" (7) Bore



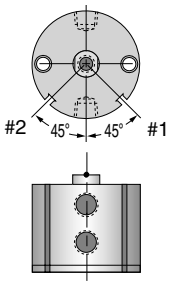
Sensors available for "D" & "TD" strokes and longer. D – J & TD – TJ have 2 mounting slots; others have 1. Strokes D & TD are ported on opposite sides.

1 1/8" (121) Bore



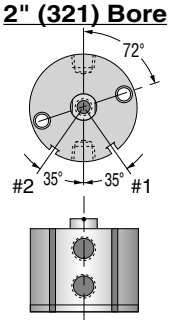
Sensors available for "D" & "TD" strokes and longer. D – F & TD – TF have 2 mounting slots; others have 1. Strokes D & TD are ported on opposite sides.

1 5/8" (221) Bore



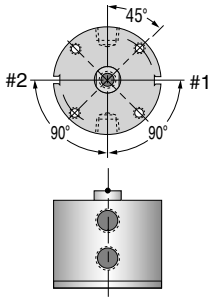
Sensors available for "A" & "TB" strokes and longer. A – D & TB – TD have 2 mounting slots; others have 1. Strokes A is ported on opposite sides.

2" (321) Bore



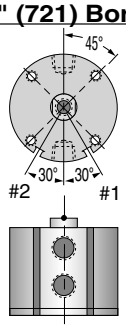
Sensors available for "AA" & "TA" strokes and longer. AA – D & TA – TD have 2 mounting slots; others have 1. Strokes AA – A & TA are ported on opposite sides.

2 1/2" (521) Bore



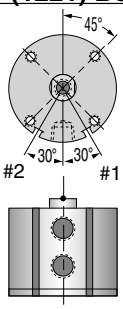
Sensors available for "AA" & "TA" strokes and longer. AA – C & TA – TC have 2 mounting slots; others have 1. Stroke AA is ported on opposite sides.

3" (721) Bore



Sensors available for "AA" & "TA" strokes and longer. AA – C & TA – TC have 2 mounting slots; others have 1. Stroke AA is ported on opposite sides.

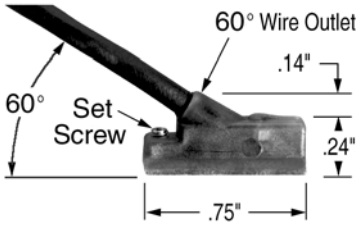
4" (1221) Bore



Sensors available for "AB" strokes and longer. AB – A & TAA – TA have 2 mounting slots; others have 1.

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

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



Low Profile, Solid State, Magnetic Piston Position Sensors

Encased in plastic housing, dovetail style sensors are corrosion resistant. 60° wire outlet allows close mounting. Profile shown here is typical for all but 1/2" bore Pancake®s.

Ordering Guide – Dovetail Style Magnetic Sensors for Pancake® Cylinders

Cylinder Model	Sensor Type	Prewired 9 ft. Part No.	Quick Disconnect Part No.*	LED	Electrical Characteristics
1/2" Bore Pancake	Electronic	9B49-000-031	9B49-000-331	Yes	Sourcing, PNP, 6-24 VDC, 0.20 Amp Max current, 1.0 Voltage Drop
1/2" Bore Pancake	Electronic	9B49-000-032	9B49-000-332	Yes	Sinking, NPN, 6-24 VDC, 0.20 Amp Max current, 1.0 Voltage Drop
All other Pancakes	Electronic	949-000-031	949-000-331	Yes	Sourcing , PNP, 6-24 VDC, 0.20 Amp Max current, 0.5 Voltage Drop
All other Pancakes	Electronic	949-000-032	949-000-332	Yes	Sinking, NPN, 6-24 VDC, 0.20 Amp Max current, 0.5 Voltage Drop

Note: 1/2" bore quick disconnect style supplied with 12" pigtail. All other bores supplied with 6" pigtail. Order female cordsets separately.*

Specials

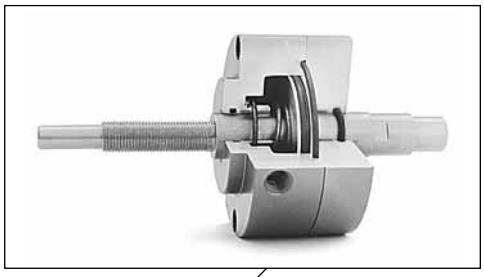
1

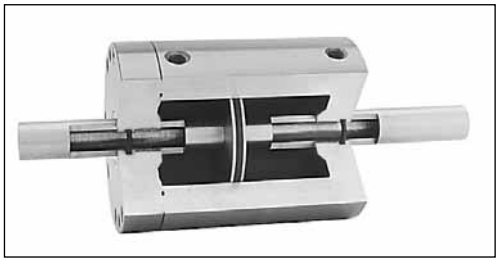
Let us help you!

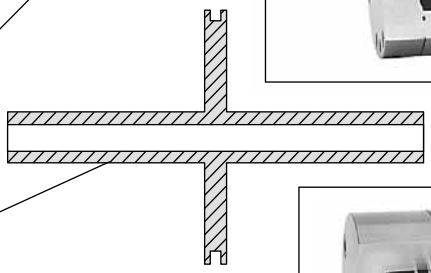
Our engineering and special products departments are willing and able to assist you with your design. FABCO-AIR will produce cylinders and valves to meet your specific application requirements. In quantities of one and up. We have been doing it for almost 40 years. Many of our specials have become custom options; many have become standard catalog options.

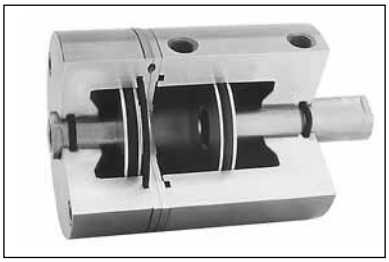
Custom Options are modifications that we produce on a routine basis, but they have too many combinations of features for practical listing in this catalog. Following are just a few of the more common of these custom options:

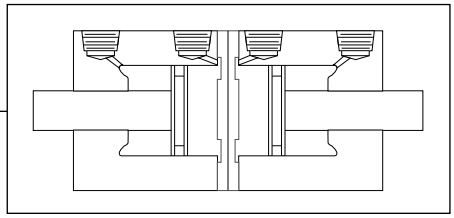
- Custom rod extensions
- Custom rod end configurations
- Pilot diameters on mounting faces
- 1 Piece double rod, piston & rod assembly with or without a hole through
- Rod wipers, urethane or metallic
- Thick covers with ports
- Covers with manifolding
- Other materials
- Other lubricants
- Strokes other than listed with special length bodies and rods
- Mounting styles & dimensions to specifications
- Back-to-Back cylinders for 3 or 4 positions
- Multiple position cylinders– Tandem type for 3 or more positions

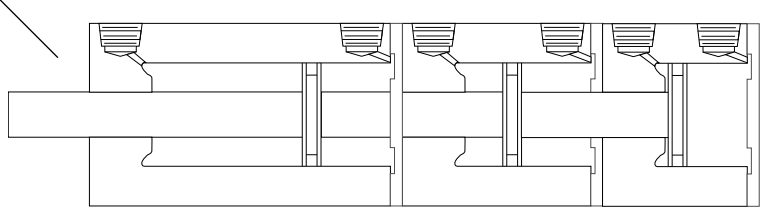




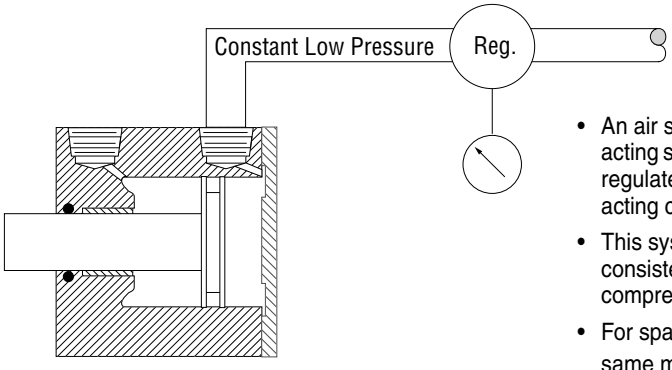








Air Springs



- Small regulator supplies constant pressure & controls spring force.
- Connection to Rod End Port results in a spring retracted type cylinder
- Connection to Cap End Port results in a spring extended type cylinder

- An air spring allows the use of any standard double acting cylinder as a single acting spring return (push or pull) type. To accomplish this simply connect a constant regulated pressure (must be a relieving regulator) to the proper port of the double acting cylinder.
- This system gives you a variable spring load (by adjusting the pressure) that is consistent over the full stroke and life of the cylinder and will not break as helical compression springs often do.
- For space and cost savings, one regulator can serve several cylinders on the same machine.

Flow Controls

Port Mounted, Swivel: Brass or Molded Body

Mounts directly to Cylinder,Valve or Manifold.

Brass Body Style *(above)*
Male Sizes: #10-32, 1/8 NPT, 1/4 NPT
Female NPT or Instant Tube Connections:
#10-32, 1/8 NPT, 1/4 NPT, 5/32" T, 1/4" T, 3/8" T
See page 12.3 & 12.4 for details.

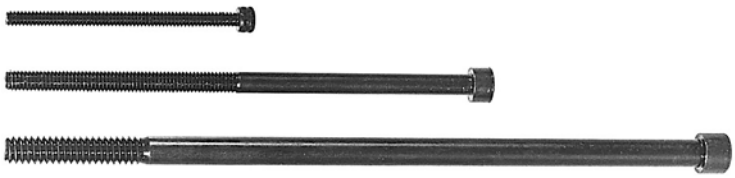
Molded Body Style *(left)*
Male Sizes: #10-32, 1/8 NPT, 1/4 NPT, 3/8 NPT
Instant Tube Connections: 5/32" T, 1/4" T, 3/8" T
See page 12.3 for details.

Position Sensors

Dovetail Style, Low Profile, Solid State Electronic

Sensor dovetail slides into a mating slot on the cylinder body, is positioned as desired, and locked in place with a set screw.
See page 1.14 for Specifications

Bolts

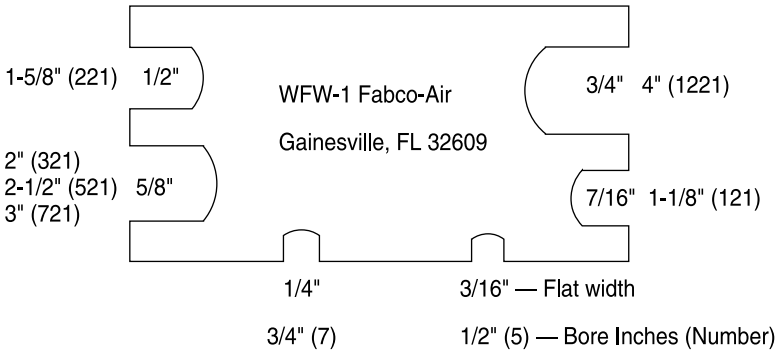


Pancake® Cylinder Mounting Bolts

Fabco-Air has in stock socket head cap screws to mount all standard ***Pancake®*** cylinders, all bores, all strokes.

Also consider for ***Square1®*** and other products.

SIZE	LENGTH (Inches)															
	1/2	3/4	1	1-1/4	1-1/2	1-3/4	2	2-1/4	2-1/2	2-3/4	3	3-1/2	4	4-1/2	5	6
#6-32		✓	✓		✓	✓	✓									
#8-32	✓	✓	✓													
#10-32		✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
1/4-20			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



Wrench Flat Wrench

Part Number **WFW-1**

0.09" Thick, heat treated and plated steel wrench for holding the piston rod of ***Pancake®*** cylinders while tightening or loosening rod end tooling or attachments.

Also consider for ***Square1®*** and other products.

1 Model Number Code

Prefix Options	Stroke		Bore		Action		Suffix Options
Leave blank if none desired	TE	–	5	–	X	–	MR

Metric	M
See pages 1.7, 1.19 & 1.22	

Bore	Code
1/2"	5
12.7mm	5

Standard Strokes

Original Series

Action	X XDR	O ODR	OP
Stroke			
1/16	A	A	A
1/8	B	B	B
1/4	C	C	C
3/8	D	D	D
1/2	E	E	E
5/8	F	F	–
3/4	G	G	–
1	H	H	–
1 1/4	I	I	–
1 1/2	J	J	–
2	K	K	–
3	L	–	–
4	M	–	–

"T" Series Includes PTFE piston bearing

Action	X	O	OP
Stroke			
1/8	TC	TC	TC
1/4	TD	TD	TD
3/8	TE	TE	TE
1/2	TF	TF	–
5/8	TG	TG	–
1	TH	TH	–
1 1/4	TI	TI	–
1 1/2	TJ	TJ	–
2	TK	TK	–
3	TL	–	–
4	TM	–	–

Grey shading indicates sensors are not available.

Strokes are NOT affected by magnetic piston Option "E"

Action

Single rod

Double acting	-X
Single acting, spring retracted	-O
Single acting, spring extended	-OP

Double rod

Double acting	-XDR
Single acting, spring retracted	-ODR

See pages 1.5 & 1.6 for Action Information.
See pages 1.18 & 1.21 for Standard Specifications

HOW TO ORDER

1. Under ***Stroke*** – select letter(s) for desired Series and Stroke.

2. Under ***Bore*** – select **5** for 1/2" bore.
   Seven Other Bore Sizes are Available

Bore	Bore Code	See page
3/4"	7	1.23
1 1/8"	121	1.29
1 5/8"	221	1.35
2"	321	1.41
2 1/2"	521	1.47
3"	721	1.53
4"	1221	1.59

3. Under ***Action*** – select letter(s) for desired action.

4. Under ***Prefix & Suffix Options***– select letter(s) for desired options and add to model number.

EXAMPLES

E-5-X
Original Series, 1/2" stroke - 1/2" Bore - Single Rod, Double Acting

TE-5-X-MR
"T" Series, 3/8" Stroke - 1/2" Bore - Single Rod, Double Acting - Male Rod Thread

Suffix Options

Male rod thread: Single rod			-MR
Double rod, rod end			-MR
Double rod, cap end			-MR1
Double rod, both ends			-MR2
Viton seals			-V
Quad seals			-Q
External nonrotating guide			-K
Hex rod nonrotating, single acting models to 2" stroke only			-NR
Hole thru double rod shaft : 1/16" hole 150 psi max			-06
Finish: **ProCoat**™ (Electroless Nickel)			-N
Stroke collar:		1/8"	-C1
1/4"	-C2	3/8"	-C3
1/2"	-C4	5/8"	-C5
3/4"	-C6	7/8"	-C7
Rubber Bumpers:		Rod end	-BF
		Cap end	-BR
		Both ends	-BFR
Adjustable retract stroke (Over 1" adjustment add desired length, e.g. -RS2)			-RS
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
Threaded nose mount: Single rod			-F
		Double rod, rod end	-F
		Double rod, cap end	-F1
		Double rod, both ends	-F2
Magnetic piston & sensor mounting slot(s) Order sensors separately. See page 1.14 Stroke length determines number of mounting slots. See page 1.14, 1.20, 1.21.			-E

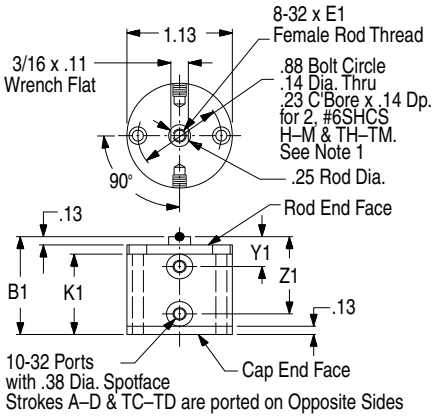
See pages 1.7 – 1.15 for general option information and pages 1.19, 1.20 & 1.22 for option specifications of 1/2" bore models.

A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – http://www.fabco-air.com

Action –X
Double Acting

Note 1:
Strokes H–M & TH–TM have two #6-32 x .44 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts.
Push area = .20
Pull area = .15
Seal Kits for Series:
Original = 5-SK
"T" = 5-SKG



For
Single Rod, Double Acting, Nonrotating
See Option -K on page 1.20

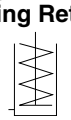
Original Series

Stroke, Inch	1/16	1/8	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2	3	4
Stroke, Letter	A	B	C	D	E	F	G	H	I	J	K	L	M
Action –X Double Acting													
B1	.83	.83	.96	1.08	1.21	1.36	1.49	1.83	2.08	2.33	2.96	3.96	4.96
E1	.25	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38
K1	.56	.56	.69	.81	.94	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Y1	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46	.55	.55	.55
Z1	.52	.52	.65	.77	.89	1.05	1.18	1.52	1.77	2.02	2.65	3.65	4.65
Weight, lb.	.08	.08	.08	.09	.11	.12	.13	.16	.19	.21	.27	.36	.46
Action –O Single Acting, Spring Retracted													
B3	.83	.96	1.08	1.36	1.49	1.83	2.33	2.96	2.96	3.96	3.96	NA*	NA*
E3	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	"	"
K3	.56	.69	.81	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	"	"
Y3	.46	.46	.46	.46	.46	.46	.46	.55	.55	.55	.55	"	"
Z3	.52	.65	.77	1.05	1.18	1.52	2.02	2.65	2.65	3.65	3.65	"	"
Weight,. lb.	.08	.09	.10	.12	.13	.16	.22	.28	.28	.37	.37	"	"
Preload, lb.	2.0	2.0	.9	1.2	.7	1.9	1.2	1.0	1.7	1.3	1.3	"	"
End of Stroke, lb.	3.2	3.2	3.2	3.2	3.2	3.5	3.2	3.5	5.7	5.3	6.7	"	"
Action –OP Single Acting, Spring Extended													
B4	.95	1.16	1.39	1.80	2.05	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
E4	.25	.25	.25	.38	.38	"	"	"	"	"	"	"	"
K4	.63	.77	.88	1.16	1.29	"	"	"	"	"	"	"	"
Y4	.52	.58	.71	.83	.96	"	"	"	"	"	"	"	"
Z4	.64	.85	1.08	1.49	1.74	"	"	"	"	"	"	"	"
Weight, lb.	.08	.09	.12	.13	.14	"	"	"	"	"	"	"	"
Preload, lb.	1.7	1.7	.7	1.2	.7	"	"	"	"	"	"	"	"
End of Stroke, lb.	3.0	3.0	3.0	3.2	3.2	"	"	"	"	"	"	"	"

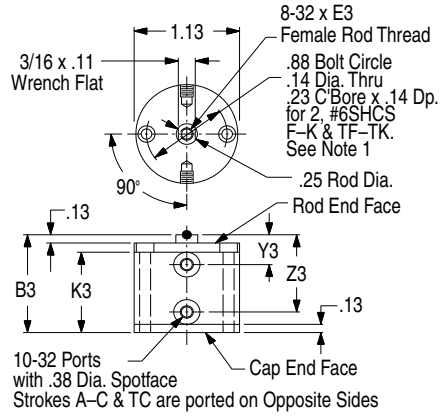
"T" Series

Stroke, Inch	1/8	1/4	3/8	1/2	5/8	1	1 1/4	1 1/2	2	3	4
Stroke, Letter	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM
Action –X Double Acting											
B1	.96	1.08	1.21	1.36	1.49	1.83	2.08	2.33	2.96	3.96	4.96
E1	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38
K1	.69	.81	.94	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Y1	.46	.46	.46	.46	.46	.46	.46	.46	.55	.55	.55
Z1	.65	.77	.89	1.05	1.18	1.52	1.77	2.02	2.65	3.65	4.65
Weight, lb.	.08	.09	.11	.12	.13	.16	.19	.21	.27	.36	.46
Action –O Single Acting, Spring Retracted											
B3	1.08	1.36	1.49	1.83	2.33	2.96	2.96	3.96	3.96	NA*	NA*
E3	.38	.38	.38	.38	.38	.38	.38	.38	.38	"	"
K3	.81	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	"	"
Y3	.46	.46	.46	.46	.46	.55	.55	.55	.55	"	"
Z3	.77	1.05	1.18	1.52	2.02	2.65	2.65	3.65	3.65	"	"
Weight,. lb.	.08	.09	.10	.12	.13	.16	.22	.28	.28	"	"
Preload, lb.	2.8	2.0	1.2	1.9	1.9	1.0	1.7	1.3	1.3	"	"
End of Stroke, lb.	3.2	3.2	3.2	3.5	3.5	3.5	5.7	5.3	5.3	"	"
Action –OP Single Acting, Spring Extended											
B4	1.26	1.67	1.92	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
E4	.25	.25	.38	"	"	"	"	"	"	"	"
K4	.88	1.16	1.29	"	"	"	"	"	"	"	"
Y4	.58	.70	.83	"	"	"	"	"	"	"	"
Z4	.95	1.36	1.61	"	"	"	"	"	"	"	"
Weight, lb.	.08	.09	.12	"	"	"	"	"	"	"	"
Preload, lb.	1.7	1.7	.7	"	"	"	"	"	"	"	"
End of Stroke, lb.	3.0	3.0	3.0	"	"	"	"	"	"	"	"

Action –O
Single Acting
Spring Retracted

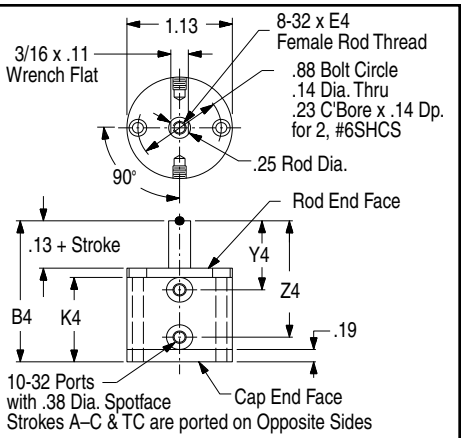


Note 1:
Strokes F–K & TF–TK have two #6-32 x .44 Tapped Mounting Holes on each end.
See page 1.16 for Mounting Bolts.
Push area = .20
See chart for Spring Forces: Preload and End of Stroke.
Seal Kits for Series:
Original = 5-SK
"T" = 5-SKG



Action –OP
Single Acting
Spring Extended

See page 1.16 for Mounting Bolts.
Pull area = .15
See Chart for Spring Forces: Preload & End of Stroke
Seal Kits for Series:
Original = 5-SK
"T" = 5-SKG

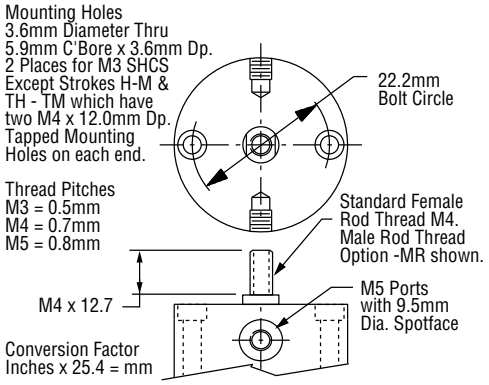


1

Prefix Option -M Metric Cylinder & Rod Thread, 12.7mm Bore
Available on Original and "T" Series with Actions: -X, -O, -OP
Also see *Option Information* on page 1.7.

Original Series													
Stroke mm	1.6	3.2	6.4	9.5	12.7	15.9	19.1	25.4	31.8	38.1	50.8	76.2	101.6
Stroke Letter	A	B	C	D	E	F	G	H	I	J	K	L	M

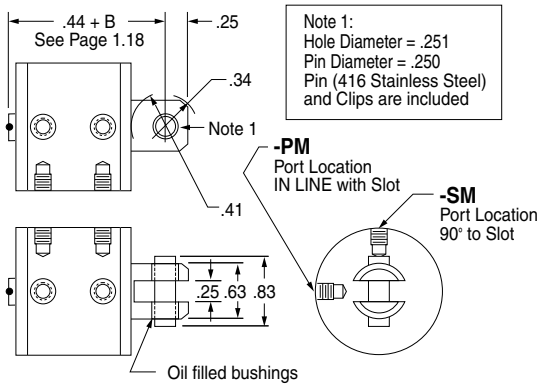
"T" Series											
Stroke mm	3.2	6.4	9.5	12.7	15.9	25.4	31.8	38.1	50.8	76.2	101.6
Stroke Letter	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM



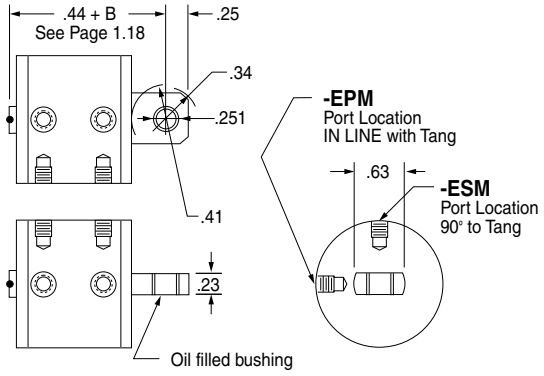
The **Suffix Options** charted on the right are available on Original & "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.18. – *Also see Option Information on pages 1.7 thru 1.15.*

	V	Q	N	C1–C7	BF	BR	BFR
-X	✓	✓	✓	✓	✓	✓	✓
-O	✓	✓	✓	✓	NA	✓	NA
-OP	✓	✓	✓	✓	✓	NA	NA

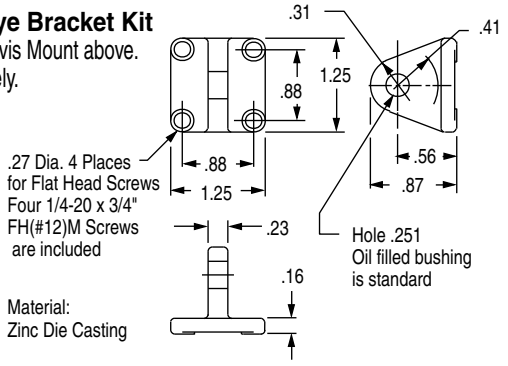
Suffix Options -PM & -SM Clevis Mount
Available on Original and "T" Series
with Actions: -X, -O, -OP
Also see *Option Information* on page 1.13.



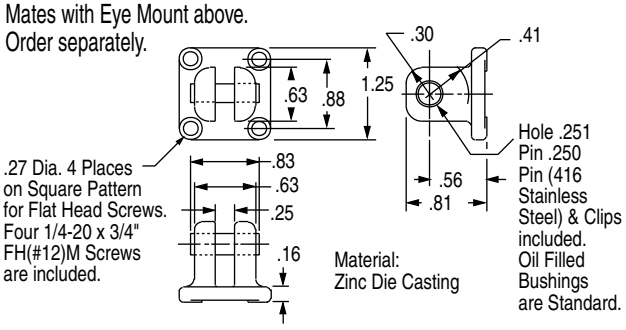
Suffix Options -EPM & -ESM Eye Mount
Available on Original and "T" Series
with Actions: -X, -O, -OP
Also see *Option Information* on page 1.13.



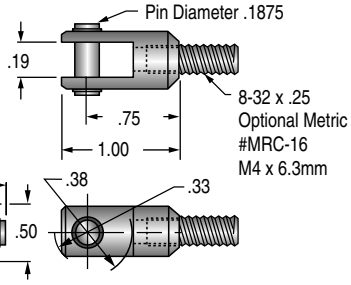
EM-04 Eye Bracket Kit
Mates with Clevis Mount above.
Order separately.



PM-04 Clevis Bracket Kit
Mates with Eye Mount above.
Order separately.

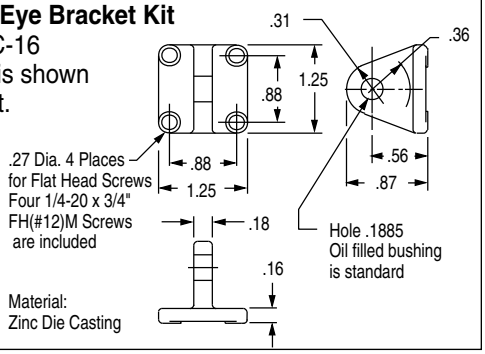


RC-16 Rod Clevis and Pin
Threaded Stud mates with
Female Rod thread
in ***Pancake®*** Cylinders.
Slot & Pin Mate with
EM-02 Eye Bracket
shown on the right.



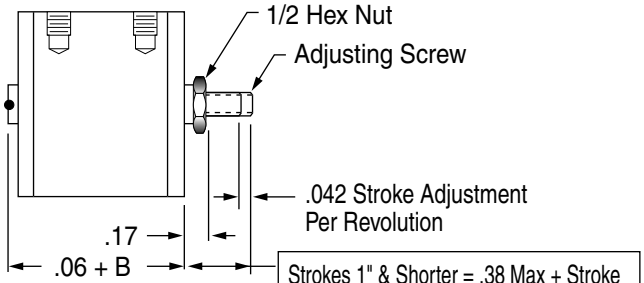
Materials:
Clevis – Steel, Black Oxide
Stud – Steel
Pin – 416 Stainless Steel
Pin & Clips are included

EM-02 Eye Bracket Kit
Mates RC-16
Rod Clevis shown
on the left.



Suffix Option -RS Adjustable Retract Stroke

Available on Original and "T" Series with Actions -X, -O, -OP. Also see Option Information on page 1.11

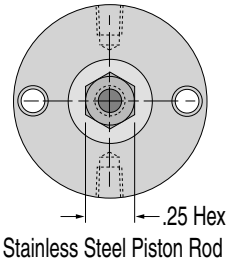


Strokes 1" & Shorter = .38 Max + Stroke
Strokes 1" & Longer = .38 + Adjustment
Standard Adjustment is 1".

-OP only use B4 as shown on page 1.18. No additional length is required

Suffix Option -NR Nonrotating, Single Acting

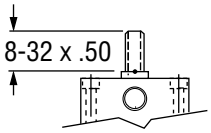
Available on Original and "T" Series with Action -O. Also see Option Information on page 1.8



Stainless Steel Piston Rod

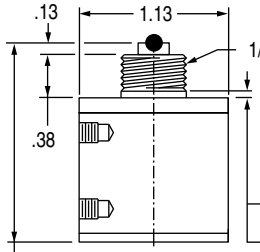
Suffix Option -MR Male Rod Thread

Available on Original and "T" Series with Actions -X, -O, -OP. Also see Option Information on page 1.8

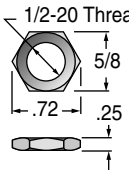


Suffix Option -F Threaded Nose Mount

Available on Original and "T" Series with Actions -X, -O, -OP. Also see Option Information on page 1.13



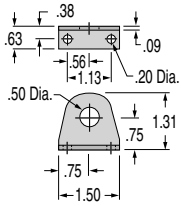
Nut Part No. MC-500-195 is included.
Material: Brass



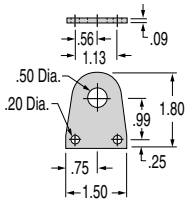
Accessory – Plated steel nose mounting brackets

Must be ordered separately

Angled Part Number **BRK-201**



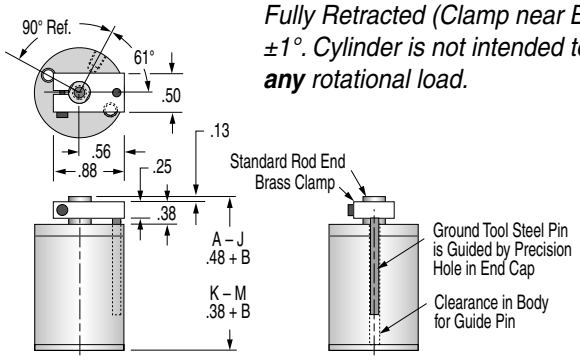
Flat Part Number **BRK-202**



Suffix Option -K Nonrotating, Double Acting

Available on Original and "T" Series with Action -X, -O, -OP.

*Rotational Tolerance with Piston Rod Fully Retracted (Clamp near Body) is ±1°. Cylinder is not intended to carry **any** rotational load.*



Suffix Option -E *Specifies Magnetic Piston and Dovetail Mounting Slot(s)*

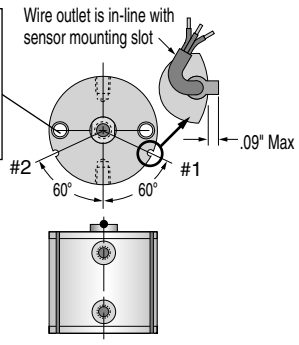
Strokes are NOT affected by Magnetic Piston Option

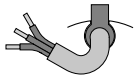
– Sensors Must be Ordered Separately See Sensor Models Available page 1.14

1/2" (5) Bore

Sensors available for "D" & "TD" strokes and longer. Strokes D & TD are ported on opposite sides.

Note:
Alloy steel mounting bolts may effect sensing. Stainless steel or other nonmagnetic bolts are recommended.





Profile of Sensor & Keyway Slot. Wire is in line with slot.

Quick Reference to Standard Strokes

Use the appropriate Stroke Letter in the Model Number

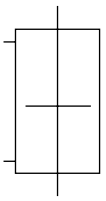
	Available on Original Series		*Available on "T" Series*	
	Stroke	**Action X**	**Stroke**	**Action X**
Sensor Slots at Positions #1 and #2	3/8	D	1/4	TD
	1/2	E	3/8	TE
	5/8	F	1/2	TF
	3/4	G	5/8	TG
	1	H	1	TH
	1 1/4	I	1 1/4	TI
	1 1/2	J	1 1/2	TJ
Sensor Slot at Position #1 only	2	K	2	TK
	3	L	3	TL
	4	M	4	TM

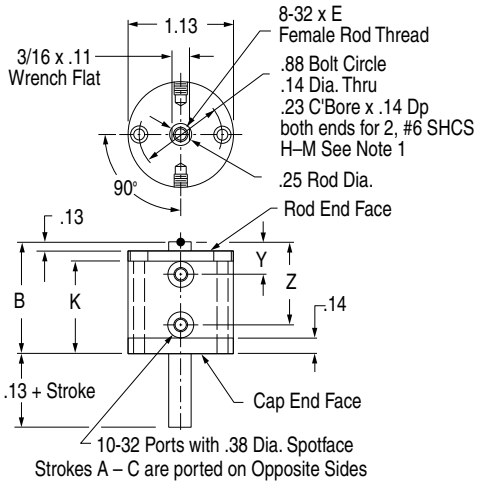
1

Action –XDR Original Series
Double Rod, Double Acting

Note 1:
Strokes H – M have two #6-32 x .44 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts
Force Area = .15
Seal Kit = 5-SK



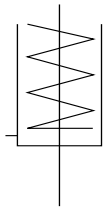


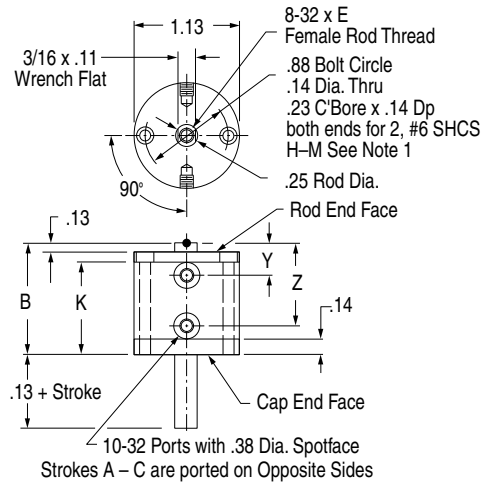
Stroke, Inches	1/16	1/8	1/4	3/8	1/2	5/8	3/4	1	1-1/4	1-1/2	2	3	4
Stroke, Letter	A	B	C	D	E	F	G	H	I	J	K	L	M
B	1.00	1.00	1.13	1.25	1.38	1.50	1.63	1.88	2.13	2.38	2.88	3.88	4.88
E	.25	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38
K	.73	.73	.86	.98	1.11	1.23	1.36	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Y	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46
Z	.67	.67	.80	.92	1.05	1.17	1.30	1.55	1.80	2.05	2.55	3.55	4.55
Weight, lb.	.09	.10	.11	.12	.13	.14	.16	.18	.21	.24	.31	.41	.52

Action –ODR Original Series
Double Rod, Single Acting, Spring Retracted

Note 1:
Strokes F – K have two #6-32 x .44 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts
Force Area = .15
Seal Kit = 5-SK





Stroke, Inches	1/16	1/8	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2
Stroke, Letter	A	B	C	D	E	F	G	H	I	J	K
B	1.00	1.13	1.25	1.55	1.67	1.88	2.38	2.88	2.88	3.88	3.88
E	.25	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38
K	.73	.86	.98	1.28	1.40	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Y	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46
Z	.67	.80	.92	1.22	1.34	1.55	2.05	2.55	2.55	3.55	3.55
Weight, lb.	.09	.10	.13	.15	.16	.19	.24	.30	.30	.40	.40
Spring Return											
Preload	2.0	2.0	0.9	1.2	0.7	1.9	1.2	1.0	1.7	1.3	1.3
End of Stroke	3.2	3.2	3.2	3.2	3.2	3.5	3.2	3.5	5.9	5.3	6.7

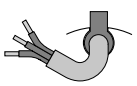
Suffix Option -E *Specifies Magnetic Piston and Dovetail Mounting Slot(s)*

Strokes are NOT affected by Magnetic Piston Option

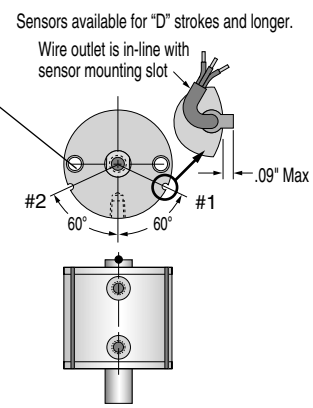
– Sensors Must be Ordered Separately
See Sensor Models Available page 1.14

1/2" (5) Bore

Note:
Alloy steel mounting bolts may effect sensing. Stainless steel or other non-magnetic bolts are recommended.



Profile of Sensor & Keyway Slot. Wire is in line with slot.



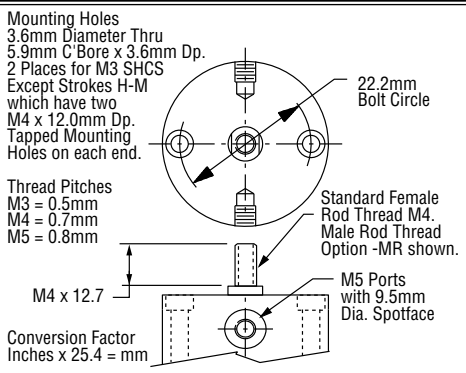
Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

Available on Original Series

	Stroke	Action XDR
Sensor Slots at Positions #1 and #2	3/8	D
	1/2	E
	5/8	F
	3/4	G
	1	H
	1 1/4	I
	1 1/2	J
Sensor Slot at Position #1 only	2	K
	3	L
	4	M

Prefix Option -M Metric Cylinder & Rod Thread, 12.7mm Bore
Available on Original Series with Actions: -XDR, -ODR
Also see *Option Information* on page 1.7.

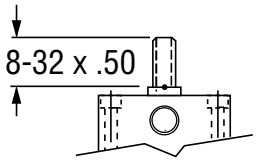
Stroke mm	1.6	3.2	6.4	9.5	12.7	15.9	19.1	25.4	31.8	38.1	50.8	76.2	101.6
Stroke Letter	A	B	C	D	E	F	G	H	I	J	K	L	M



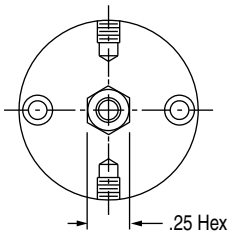
The **Suffix Options** charted on the right are available on Original Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.21. – *Also see Option Information on pages 1.7 thru 1.15.*

	V	Q	N	C1–C7	BF	BR	BFR	06
-XDR	✓	✓	✓	✓	✓	✓	✓	✓
-ODR	✓	✓	✓	✓	NA	✓	NA	✓

Suffix Option -MR, -MR1, -MR2
Male Rod Thread
Available on Original Series with Actions -XDR, -ODR.
For Rod End only use –MR
For Cap End only use –MR1
For Both Ends use –MR2
Also see Option Information on Page 1.8

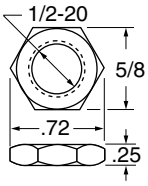


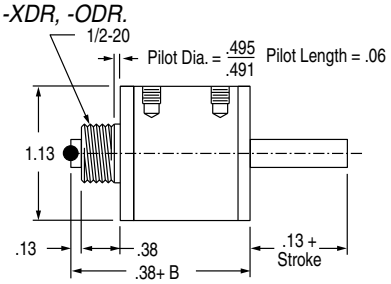
Suffix Option -NR Nonrotating, Single Acting
Available on Original Series with Action -ODR
Also see *Option Information* on page 1.8.



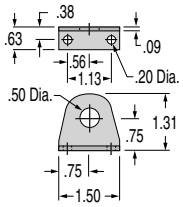
Suffix Option -F, -F1, -F2 Threaded Nose Mount (See info page 1.13)
Available on Original Series with Actions -XDR, -ODR.
*For Rod End only use **-F***
*For Cap End only use **-F1***
*For Both Ends use **-F2***

Nut.
Part No. MC-500-195
is included.
Material: Brass

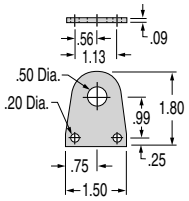




Accessory Nose Mounting Brackets
Order separately – Material Plated Steel



Part No: BRK-201

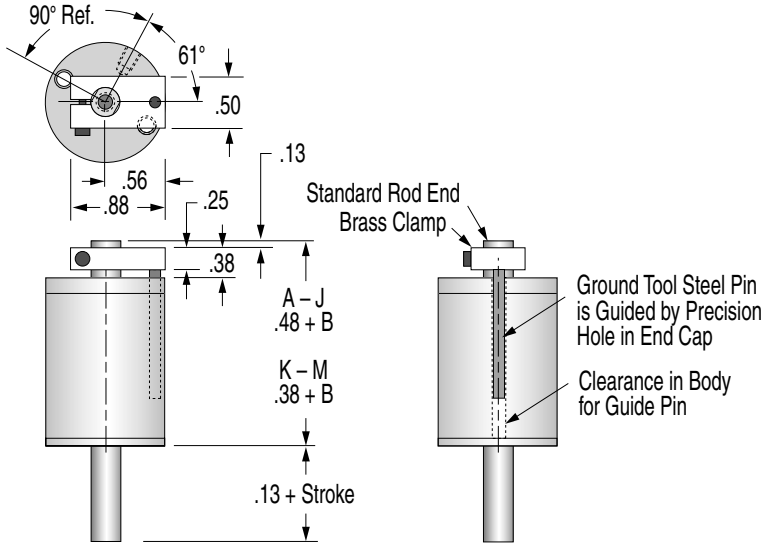


Part No: BRK-202

Suffix Option -K
Nonrotating, Double Acting
Available on Original Series with Actions: -XDR, -ODR.

Rotational Tolerance with Piston Rod Fully Retracted (Clamp near Body) is ±1°.

*Cylinder is not intended to carry **any** rotational load.*



1

Model Number Code

Prefix Options	Stroke		Bore		Action		Suffix Options
Leave blank if none desired	TE	–	7	–	X	–	MR

Metric M
See pages 1.7, 1.25, 1.28

Bore	Code
3/4"	7
19.1mm	7

Standard Strokes

***Note 1**: For action XK strokes A – G are decreased by 1/8" from those shown (Original Series only).*

***Note 2**: For action XDRK strokes A – M are decreased by 1/8" from those shown (Original Series only).*

Original Series

Action	X XK[1] XDR XDRK[2]	O ODR	OP
Stroke			
1/16	A	A	A
1/8	B	B	B
1/4	C	C	C
3/8	D	D	D
1/2	E	E	E
5/8	F	F	–
3/4	G	G	–
1	H	H	–
1 1/4	I	I	–
1 1/2	J	J	–
2	K	K	–
3	L	–	–
4	M	–	–

"T" Series Includes PTFE piston bearing

Action	X, XK	O	OP
Stroke			
1/8	TC	TC	TC
1/4	TD	TD	TD
3/8	TE	TE	TE
1/2	TF	TF	–
5/8	TG	TG	–
1	TH	TH	–
1 1/4	TI	TI	–
1 1/2	TJ	TJ	–
2	TK	TK	–
3	TL	–	–
4	TM	–	–

Grey shading indicates sensors are not available.

Strokes are NOT affected by magnetic piston Option "E"

Action

Single rod
- Double acting **-X**
- Double acting, Nonrotating 150 psi max **-XK**
- Single acting, spring retracted **-O**
- Single acting, spring extended **-OP**

Double rod
- Double acting **-XDR**
- Double acting, Nonrotating 150 psi max **-XDRK**
- Single acting, spring retracted **-ODR**

See pages 1.5 & 1.6 for Action Information.
See pages 1.24 & 1.27 for Standard Specifications

HOW TO ORDER

1. Under ***Stroke*** – select letter(s) for desired Series and Stroke.
2. Under ***Bore*** – select **7** for 3/4" bore.

Seven Other Bore Sizes are Available

Bore	Bore Code	See page
1/2"	5	1.17
1 1/8"	121	1.29
1 5/8"	221	1.35
2"	321	1.41
2 1/2"	521	1.47
3"	721	1.53
4"	1221	1.59

3. Under ***Action*** – select letter(s) for desired action.
4. Under ***Prefix & Suffix Options***– select letter(s) for desired options and add to model number.

EXAMPLES

E-7-X
Original Series, 1/2" stroke - 3/4" Bore - Single Rod, Double Acting

TE-7-X-MR
"T" Series, 3/8" Stroke - 3/4" Bore - Single Rod, Double Acting - Male Rod Thread

Suffix Options

Male rod thread: Single rod			**-MR**
Double rod, rod end			**-MR**
Double rod, cap end			**-MR1**
Double rod, both ends			**-MR2**
Viton seals			**-V**
Quad seals			**-Q**
External guide, nonrotating for load guiding (See page 1.65)			**-G**
Hex rod nonrotating, single acting models to 2" stroke only			**-NR**
Hole thru double rod shaft : 1/16" hole 150 psi max			**-06**
Finish: **ProCoat™** (Electroless Nickel)			**-N**
Stroke collar:		1/8"	**-C1**
1/4"	**-C2**	3/8"	**-C3**
1/2"	**-C4**	5/8"	**-C5**
3/4"	**-C6**	7/8"	**-C7**
Rubber Bumpers:		Rod end	**-BF**
		Cap end	**-BR**
		Both ends	**-BFR**
Adjustable retract stroke (Over 1" adjustment add desired length, e.g. -RS2)			**-RS**
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**
Threaded nose mount: Single rod			**-F**
Double rod, rod end			**-F**
Double rod, cap end			**-F1**
Double rod, both ends			**-F2**
Magnetic piston & sensor mounting slot(s) Order sensors separately. See page 1.14. Stroke length determines number of mounting slots. See page 1.14, 1.26, or 1.28.			**-E**

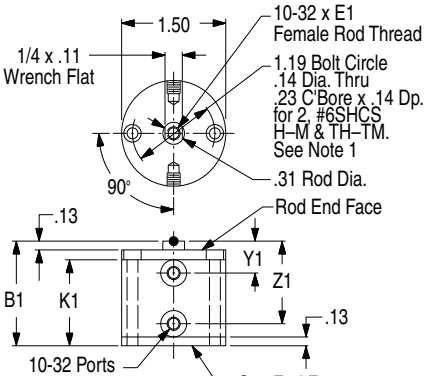
See pages 1.7 – 1.15 for general option information and pages 1.25, 1.26 & 1.28 for option specifications of 3/4" bore models.

A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – http://www.fabco-air.com

Action –X Double Acting

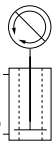
Note 1:
Strokes H–M & TH–TM have two #8-32 x .44 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts.
Push area = .44
Pull area = .36
Seal Kits for Series:
Original = 7-SK
"T" = 7-SKG



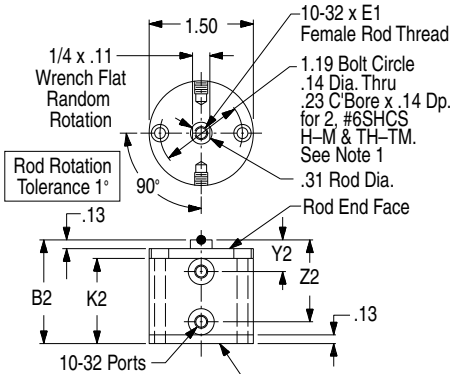
Strokes A–D & TC–TD are ported on Opposite Sides

Action –XK Double Acting Nonrotating



Note 1:
Strokes H–M & TH–TM have two #8-32 x .44 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts.
Push area = .42
Pull area = .34
Seal Kits for Series:
Original = 7-SK-K
"T" = 7-SKG-K



Strokes C–D & TC–TD are ported on Opposite Sides

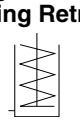
Original Series

Stroke, Inch	1/16	1/8	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2	3	4
Stroke, Letter	A	B	C	D	E	F	G	H	I	J	K	L	M
Action –X Double Acting													
B1	.83	.83	.96	1.08	1.21	1.36	1.49	1.83	2.08	2.33	2.96	3.96	4.96
E1	.25	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38
K1	.56	.56	.69	.81	.94	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note1	Note 1
Y1	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46	.55	.55	.55
Z1	.52	.52	.65	.77	.89	1.05	1.18	1.52	1.77	2.02	2.65	3.65	4.65
Weight, lb.	.14	.14	.15	.17	.20	.21	.23	.28	.32	.36	.46	.63	.78
Action –XK Double Acting, Nonrotating													
Stroke, Inch	1/8	1/4	3/8	1/2	5/8	1	1 1/4	1 1/2	2	3	4		
Stroke, Letter	C	D	E	F	G	H	I	J	K	L	M		
Use Strokes & Dimensions under "T" Series Action –XK Double Acting													
Action –O Single Acting, Spring Retracted													
B3	.83	.96	1.08	1.36	1.49	1.83	2.33	2.96	2.96	3.96	3.96	NA*	NA*
E3	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	"	"
K3	.56	.69	.81	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	"	"
Y3	.46	.46	.46	.46	.46	.46	.55	.55	.55	.55	.55	"	"
Z3	.52	.65	.77	1.05	1.18	1.52	2.02	2.65	2.65	3.65	3.65	"	"
Weight,. lb.	.14	.16	.18	.22	.23	.28	.36	.46	.46	.63	.63	"	"
Preload, lb.	2.0	2.7	1.5	2.5	2.0	2.5	2.5	2.2	1.5	1.3	1.3	"	"
End of Stroke, lb.	3.0	4.5	4.5	4.7	4.7	4.8	4.8	4.9	5.0	5.3	6.7	"	"
Action –OP Single Acting, Spring Extended													
B4	.95	1.16	1.39	1.80	2.05	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
E4	.25	.25	.25	.38	.38	"	"	"	"	"	"	"	"
K4	.63	.77	.88	1.16	1.29	"	"	"	"	"	"	"	"
Y4	.52	.58	.71	.83	.96	"	"	"	"	"	"	"	"
Z4	.64	.85	1.08	1.49	1.74	"	"	"	"	"	"	"	"
Weight, lb.	.14	.16	.18	.22	.24	"	"	"	"	"	"	"	"
Preload, lb.	2.0	2.7	1.5	2.5	2.0	"	"	"	"	"	"	"	"
End of Stroke, lb.	3.0	4.5	4.5	4.7	4.7	"	"	"	"	"	"	"	"

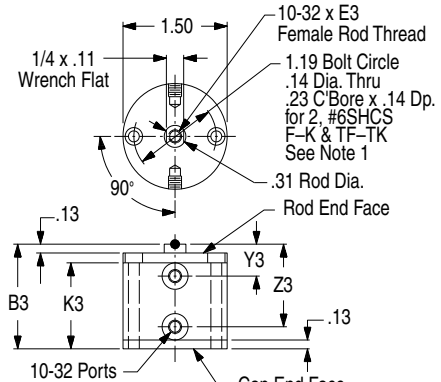
"T" Series

Stroke, Inch	1/8	1/4	3/8	1/2	5/8	1	1 1/4	1 1/2	2	3	4
Stroke, Letter	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM
Action –X Double Acting											
B1	.96	1.08	1.21	1.36	1.49	1.83	2.08	2.33	2.96	3.96	4.96
E1	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38
K1	.69	.81	.94	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Y1	.46	.46	.46	.46	.46	.46	.46	.46	.55	.55	.55
Z1	.65	.77	.89	1.05	1.18	1.52	1.77	2.02	2.65	3.65	4.65
Weight, lb.	.15	.17	.20	.21	.23	.28	.32	.36	.46	.63	.78
Action –XK Double Acting, Nonrotating											
B2	.96	1.08	1.21	1.36	1.49	1.83	2.08	2.33	2.96	3.96	4.96
E2	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38
K2	.69	.81	.94	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Y2	.46	.46	.46	.46	.46	.46	.46	.46	.55	.55	.55
Z2	.65	.77	.89	1.05	1.18	1.52	1.77	2.02	2.65	3.65	4.65
Weight, lb.	.15	.18	.21	.22	.24	.29	.33	.37	.48	.65	.81
Action –O Single Acting, Spring Retracted											
B3	1.08	1.36	1.49	1.83	2.33	2.96	2.96	3.96	3.96	NA*	NA*
E3	.38	.38	.38	.38	.38	.38	.38	.38	.38	"	"
K3	.81	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	"	"
Y3	.46	.46	.46	.46	.46	.55	.55	.55	.55	"	"
Z3	.77	1.05	1.18	1.52	2.02	2.65	2.65	3.65	3.65	"	"
Weight,. lb.	.18	.22	.23	.28	.28	.46	.46	.63	.63	"	"
Preload, lb.	2.8	1.5	2.5	2.5	2.5	1.5	1.2	1.3	1.3	"	"
End of Stroke, lb.	4.5	4.5	4.8	4.8	4.8	4.9	5.0	5.3	6.7	"	"
Action –OP Single Acting, Spring Extended											
B4	1.26	1.67	1.92	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
E4	.25	.25	.38	"	"	"	"	"	"	"	"
K4	.88	1.16	1.29	"	"	"	"	"	"	"	"
Y4	.58	.70	.83	"	"	"	"	"	"	"	"
Z4	.95	1.36	1.61	"	"	"	"	"	"	"	"
Weight, lb.	.18	.22	.24	"	"	"	"	"	"	"	"
Preload, lb.	1.5	2.5	2.0	"	"	"	"	"	"	"	"
End of Stroke, lb.	4.5	4.8	4.8	"	"	"	"	"	"	"	"

Action –O Single Acting Spring Retracted



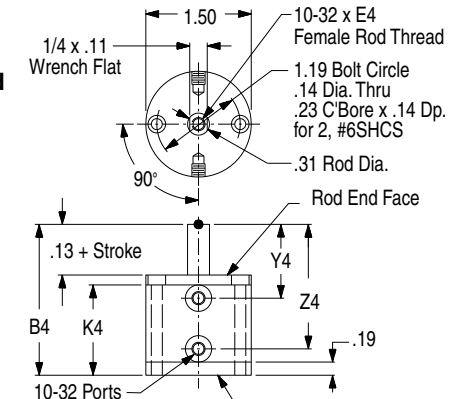
Note 1:
Strokes F–K & TF–TK have two #8-32 x .44 Tapped Mounting Holes on each end.
See page 1.16 for Mounting Bolts.
Push area = .44
See chart for Spring Forces: Preload and End of Stroke.
Seal Kits for Series:
Original = 7-SK
"T" = 7-SKG



Strokes A–C & TC are ported on Opposite Sides

Action –OP Single Acting Spring Extended

See page 1.16 for Mounting Bolts.
Pull area = .36
See Chart for Spring Forces: Preload & End of Stroke
Seal Kits for Series:
Original = 7-SK
"T" = 7-SKG



Strokes A–C & TC are ported on Opposite Sides

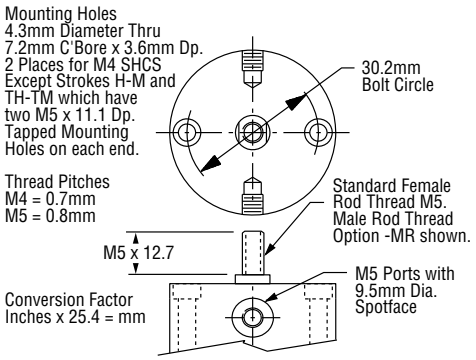
1

Prefix Option -M Metric Cylinder & Rod Thread, 19.1mm Bore

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.7.

Original Series													
Stroke mm	1.6	3.2	6.4	9.5	12.7	15.9	19.1	25.4	31.8	38.1	50.8	76.2	101.6
Stroke Letter	A	B	C	D	E	F	G	H	I	J	K	L	M

"T" Series											
Stroke mm	3.2	6.4	9.5	12.7	15.9	25.4	31.8	38.1	50.8	76.2	101.6
Stroke Letter	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM

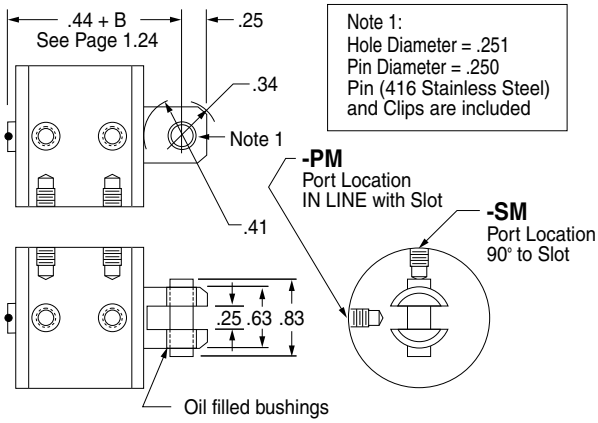


The **Suffix Options** charted on the right are available on Original & "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.24. – *Also see Option Information on pages 1.7 thru 1.15.*

	V	Q	N	C1–C7	BF	BR	BFR
-X	✓	✓	✓	✓	✓	✓	✓
-XK	✓	✓	✓	✓	✓	✓	✓
-O	✓	✓	✓	✓	NA	✓	NA
-OP	✓	✓	✓	✓	✓	NA	NA

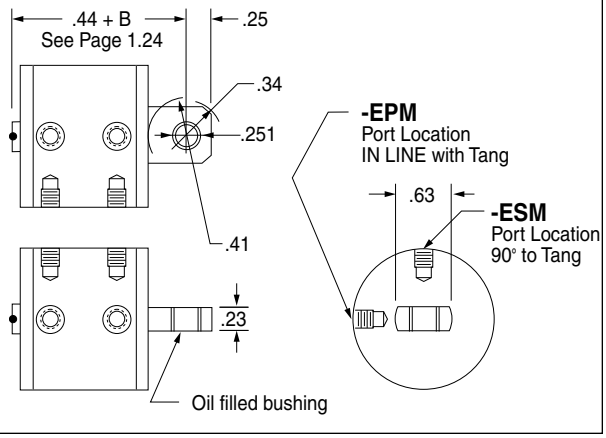
Suffix Options -PM & -SM Clevis Mount

Available on Original and "T" Series
with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



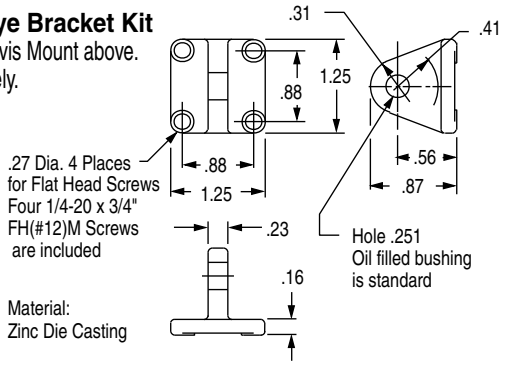
Suffix Options -EPM & -ESM Eye Mount

Available on Original and "T" Series
with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



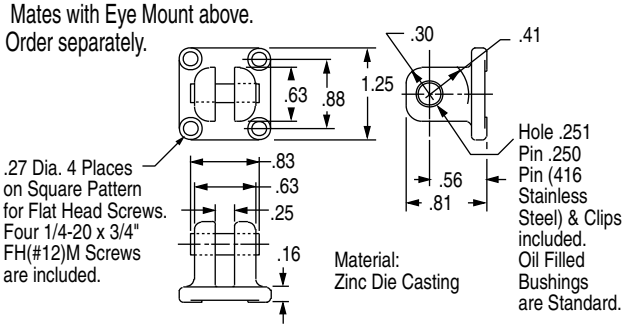
EM-04 Eye Bracket Kit

Mates with Clevis Mount above.
Order separately.



PM-04 Clevis Bracket Kit

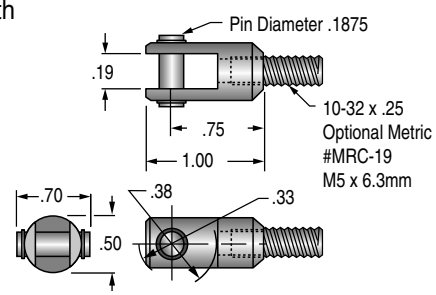
Mates with Eye Mount above.
Order separately.



RC-19 Rod Clevis and Pin

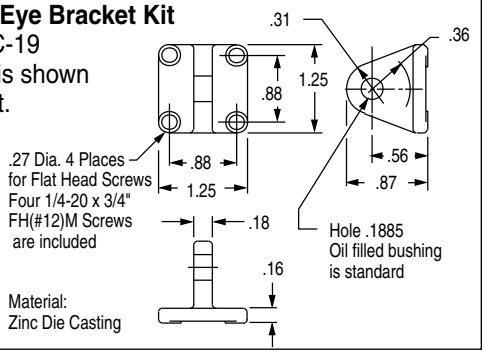
Threaded Stud mates with
Female Rod thread
in ***Pancake®*** Cylinders.
Slot & Pin Mate with
EM-02 Eye Bracket
shown on the right.

Materials:
Clevis – Steel, Black Oxide
Stud – Steel
Pin – 416 Stainless Steel
Pin & Clips are included



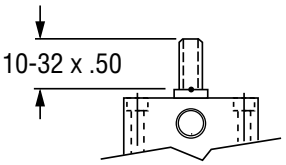
EM-02 Eye Bracket Kit

Mates RC-19
Rod Clevis shown
on the left.



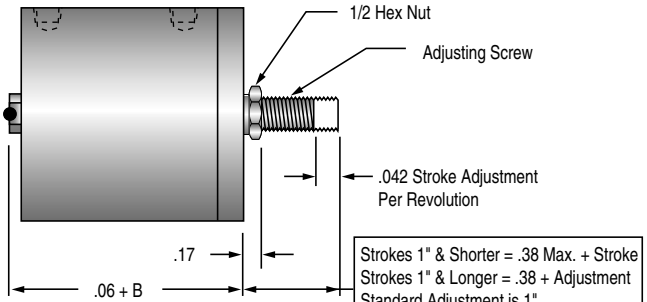
Suffix Option -MR Male Rod Thread

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP.
Also see *Option Information* on page 1.8.



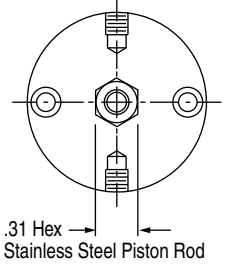
Suffix Option -RS Adjustable Retract Stroke

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.11.



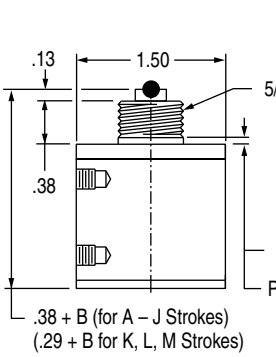
Suffix Option -NR Nonrotating, Single Acting

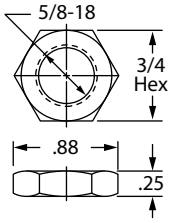
Available on Original and "T" Series with Action -O
Also see *Option Information* on page 1.8.



Suffix Option -F Threaded Nose Mount

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



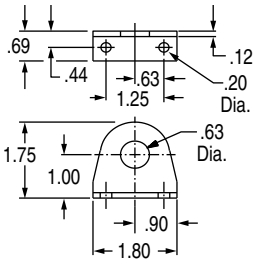


Part No. MC-700-195
Mounting Nut is included
Material: Brass

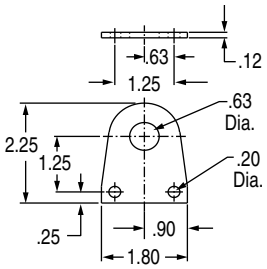
Accessory Nose Mounting Brackets

Order Separately. Material: Plated Steel

Angled Part Number **BRK-301**



Flat Part Number **BRK-302**



Suffix Option -E *Specifies Magnetic Piston and Dovetail Mounting Slot(s)*

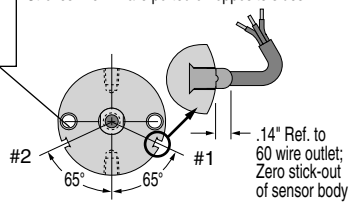
Strokes are NOT affected by Magnetic Piston Option

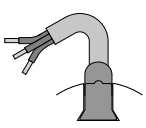
– Sensors Must be Ordered Separately See Sensor Models Available page 1.14

Note:
Alloy steel mounting bolts may effect sensing. Stainless steel or other non-magnetic bolts are recommended.

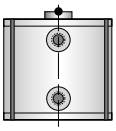
3/4" (7) Bore

Sensors available for "D" & "TD" strokes and longer. Strokes D & TD are ported on opposite sides.





1/4" 60° Dovetail Profile of Sensor & Mounting Slot.



Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

	Available on Original Series Stroke	Action X, XK[1]	*Available on "T" Series* Stroke	Action X, XK
Sensor Slots at Positions #1 and #2	3/8	D	1/4	TD
	1/2	E	3/8	TE
	5/8	F	1/2	TF
	3/4	G	5/8	TG
	1	H	1	TH
	1 1/4	I	1 1/4	TI
	1 1/2	J	1 1/2	TJ
Sensor Slot at Position #1 only	2	K	2	TK
	3	L	3	TL
	4	M	4	TM

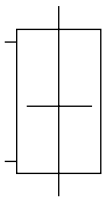
Note 1: *For Action XK strokes D–G are decreased by 1/8" for those shown for Original Series. There is no decrease in stroke for "T" Series.*

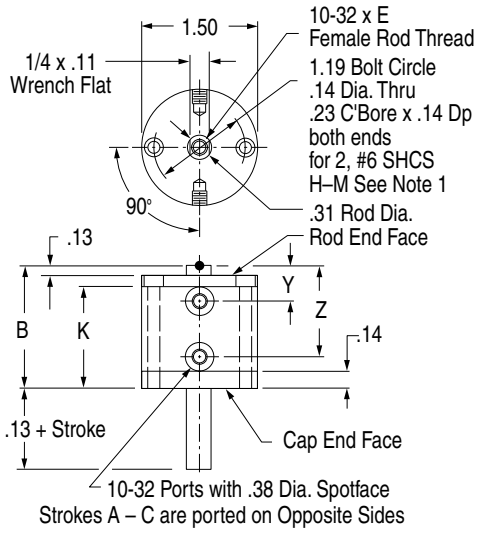
1

Action –XDR Original Series
Double Rod, Double Acting

Note 1:
Strokes H – M have two #8-32 x .44 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts
Force Area = .36
Seal Kit = 7-SK



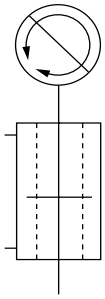


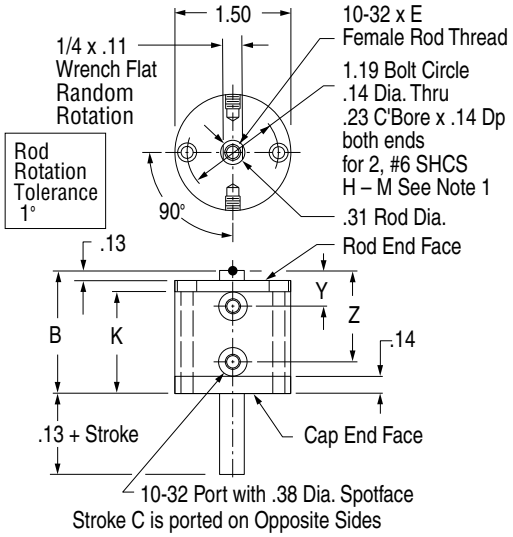
Stroke, Inches	1/16	1/8	1/4	3/8	1/2	5/8	3/4	1	1-1/4	1-1/2	2	3	4
Stroke, Letter	A	B	C	D	E	F	G	H	I	J	K	L	M
B	1.00	1.00	1.13	1.25	1.38	1.50	1.63	1.88	2.13	2.38	2.88	3.88	4.88
E	.25	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38
K	.73	.73	.86	.98	1.11	1.23	1.36	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Y	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46
Z	.67	.67	.80	.92	1.05	1.17	1.30	1.55	1.80	2.05	2.55	3.55	4.55
Weight, lb.	.16	.16	.19	.22	.23	.26	.28	.32	.36	.41	.49	.69	.86

Action –XDRK Original Series
Double Rod, Double Acting, Nonrotating

Note 1:
Strokes H – M have two #8-32 x .44 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts
Force Area = .35
Seal Kit = 7-SK-K



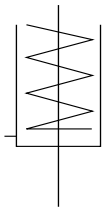


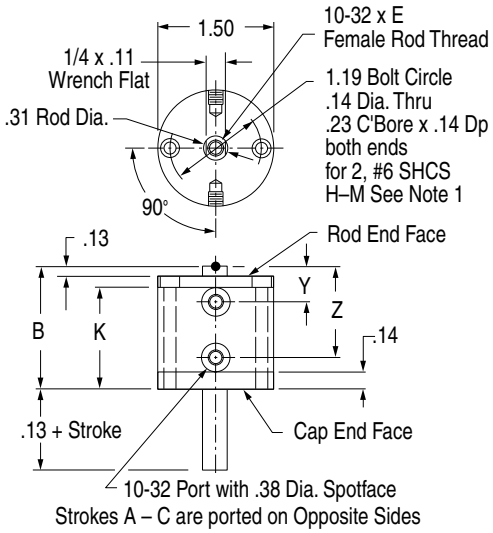
Stroke, Inches	1/8	1/4	3/8	1/2	5/8	7/8	1 1/8	1 3/8	1 7/8	2 7/8	3 7/8
Stroke, Letter	C	D	E	F	G	H	I	J	K	L	M
B	1.13	1.25	1.38	1.50	1.63	1.88	2.13	2.38	2.88	3.88	4.88
E	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38
K	.86	.98	1.11	1.23	1.36	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Y	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46
Z	.80	.92	1.05	1.17	1.30	1.55	1.80	2.05	2.55	3.55	4.55
Weight, lb.	.20	.22	.24	.27	.29	.33	.37	.43	.51	.71	.89

Action –ODR Original Series
Double Rod, Single Acting, Spring Retracted

Note 1:
Strokes F – K have two #8-32 x .44 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts
Force Area = .36
Seal Kit = 7-SK

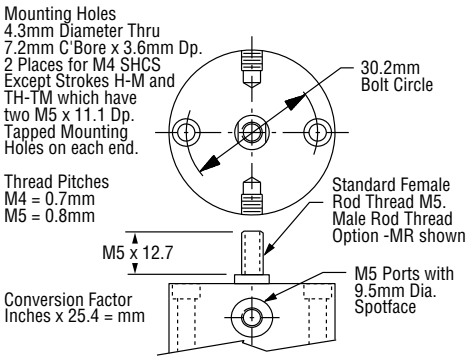




Stroke, Inches	1/16	1/8	1/4	3/8	1/2	5.8	3/4	1	1 1/4	1 1/2	2
Stroke, Letter	A	B	C	D	E	F	G	H	I	J	K
B	1.00	1.13	1.25	1.55	1.67	1.88	2.38	2.88	2.88	3.88	3.88
E	.25	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38
K	.73	.86	.98	1.28	1.40	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Y	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46	.46
Z	.67	.80	.92	1.22	1.34	1.55	2.05	2.55	2.55	3.55	3.55
Weight, lb.	.16	.19	.20	.22	.23	.33	.43	.51	.51	.71	.71
Spring Return											
Preload	2.0	2.8	1.5	2.5	2.0	2.5	2.5	2.2	1.5	1.3	1.3
End of Stroke	3.0	4.5	4.5	4.8	4.8	4.8	4.8	4.9	5.0	5.3	6.7

Prefix Option -M Metric Cylinder & Rod Thread, 19.1mm Bore
Available on Original Series with Actions: -XDR, -XDRK, -ODR
Also see *Option Information* on page 1.7.

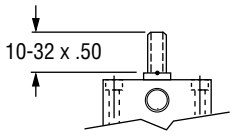
Action	-XDR & -ODR											-XDR	
Stroke mm	1.6	3.2	6.4	9.5	12.7	15.9	19.1	25.4	31.8	3.81	50.8	76.2	101.6
Stroke Letter	A	B	C	D	E	F	G	H	I	J	K	L	M
Action -XDRK													
Stroke mm	NA	NA	3.2	6.3	9.5	12.7	15.9	22.2	28.6	34.9	47.6	73.0	98.4
Stroke Letter	A	B	C	D	E	F	G	H	I	J	K	L	M



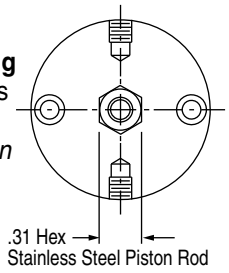
The **Suffix Options** charted on the right are available on Original Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.27. – *Also see Option Information on pages 1.7 thru 1.15.*

	V	Q	N	C1–C7	BF	BR	BFR	06
-XDR	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	✓	✓	✓	✓	✓	✓	✓	✓
-ODR	✓	✓	✓	✓	NA	✓	NA	✓

Suffix Option -MR, -MR1, -MR2 Male Rod Thread
Available on Original Series with Actions -XDR, -XDRK, -ODR.
For Rod End only use **–MR**
For Cap End only use **–MR1**
For Both Ends use **–MR2**
Also see Option Information on Page 1.8

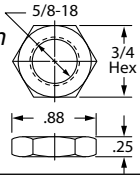


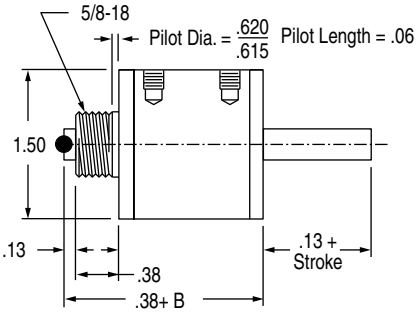
Suffix Option -NR
Nonrotating, Single Acting
Available on Original Series with Actions: -ODR
Also see *Option Information* on page 1.8.



Suffix Option -F, -F1, -F2
Threaded Nose Mount
Available on Original Series with Actions -XDR, -XDRK, -ODR.
For Rod End only use **-F**
For Cap End only use **-F1**
For Both Ends use **-F2**
Also see Option Information on page 1.13

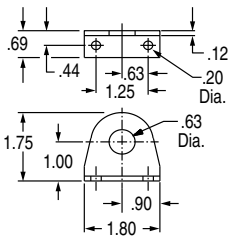
Nut Part No. MC-700-195 is included. Material: Brass



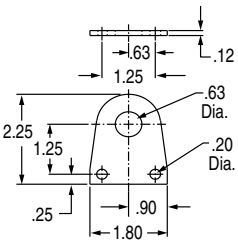


Accessory Nose Mounting Brackets
Order Separately. Material Plated Steel

BRK-301



BRK-302



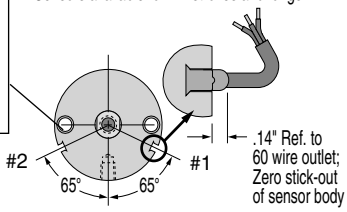
Suffix Option -E ***Specifies Magnetic Piston and Dovetail Mounting Slot(s)***
Strokes are NOT affected by Magnetic Piston Option

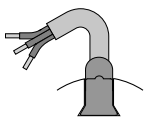
– Sensors Must be Ordered Separately
See Sensor Models Available page 1.14

Note:
Alloy steel mounting bolts may effect sensing. Stainless steel or other non-magnetic bolts are recommended.

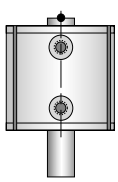
3/4" (7) Bore

Sensors available for "D" strokes and longer.





1/4" 60° Dovetail Profile of Sensor & Mounting Slot.



Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

	Available on Original Series	
	Stroke	**Action XDR, XDRK[2]**
Sensor Slots at Positions #1 and # 2	3/8 ---------- D 1/2 ----------E 5/8 ----------F 3/4 ---------- G 1----------H 1 1/4----------I 1 1/2----------J	
Sensor Slot at Position #1 only	2----------K 3----------L 4---------- M	

Note 2: *For Action XDRK strokes D–M are decreased by 1/8" for those shown for Original Series.*

1 **Model Number Code**

Prefix Options	Stroke		Bore		Action		Suffix Options
Leave blank if none desired	D	–	121	–	X	–	MR

Metric	M
See pages 1.7, 1.31 & 1.34	

Bore	Code
1 1/8"	121
28.5mm	121

Standard Strokes

Original Series

Action	X XK XDR XDRK	O ODR	OP
Stroke			
1/8	A	A	A
3/16	B	B	B
1/4	C	C	C
1/2	D*	D	D
3/4	X	X	X
1	E	E	E
1 1/4	F	F	F
1 1/2	G	G	G
1 3/4	H	H	–
2	I	I	–
3	J	–	–
4	K	–	–

"T" Series Includes PTFE piston bearing

Action	X XK	O	OP
Stroke			
1/16	TB	TB	TB
1/8	TC	TC	TC
3/8	TD*	TD	TD
5/8	TX	TX	TX
7/8	TE	TE	TE
1 1/8	TF	TF	TF
1 3/8	TG	TG	TG
1 5/8	TH	TH	–
1 7/8	TI	TI	–
2 7/8	TJ	–	–
3 7/8	TK	–	–

Grey shading indicates sensors are not available.

Strokes are NOT affected by magnetic piston Option "E"

*** Note – Sensors not available:**
D-121-XK, TD-121-XK, D-121-XDRK

Action

Single rod

Double acting	**-X**
Double acting, Nonrotating Internal guide pins - 150 psi max	**-XK**
Single acting, spring retracted	**-O**
Single acting, spring extended	**-OP**

Double rod

Double acting	**-XDR**
Double acting, Nonrotating Internal guide pins - 150 psi max	**-XDRK**
Single acting, spring retracted	**-ODR**

See pages 1.5 & 1.6 for Action Information.
See pages 1.30 & 1.33 for Standard Specifications

HOW TO ORDER

1. Under ***Stroke*** – select letter(s) for desired Series and Stroke.
2. Under ***Bore*** – select **121** for 1 1/8" bore.
   Seven Other Bore Sizes are Available

Bore	Bore Code	See page
1/2"	5	1.17
3/4"	7	1.23
1 5/8"	221	1.35
2"	321	1.41
2 1/2"	521	1.47
3"	721	1.53
4"	1221	1.59

3. Under ***Action*** – select letter(s) for desired action.
4. Under ***Prefix & Suffix Options***– select letter(s) for desired options and add to model number.

EXAMPLES

D-121-X
Original Series, 1/2" stroke - 1 1/8" Bore - Single Rod, Double Acting

TD-121-X-MR
"T" Series, 3/8" Stroke - 1 1/8" Bore - Single Rod, Double Acting - Male Rod Thread

Suffix Options

Male rod thread: Single rod			**-MR**
Double rod, rod end			**-MR**
Double rod, cap end			**-MR1**
Double rod, both ends			**-MR2**
PTFE seals			**-T**
Viton seals			**-V**
Quad seals			**-Q**
External guide, nonrotating for load guiding (See page 1.65)			**-G**
Hydraulic: Standard cover			**-H**
Hole thru double rod shaft: 1/8" hole			**-13**
Plus size: 5/32" hole 150 psi max			**-16**
Finish: **ProCoat**™ (Electroless Nickel)			**-N**
Stroke collar:		1/8"	**-C1**
1/4"	**-C2**	3/8"	**-C3**
1/2"	**-C4**	5/8"	**-C5**
3/4"	**-C6**	7/8"	**-C7**
Sound limiters:	Rod end		**-LF**
	Cap end		**-LR**
	Both ends		**-LFR**
Rubber Bumpers:	Rod end		**-BF**
	Cap end		**-BR**
	Both ends		**-BFR**
Adjustable extend stroke (Full stroke adjustment is standard)			**-AS**
Adjustable retract stroke (Over 1" adjustment add desired length, e.g. -RS2)			**-RS**
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**
Threaded nose mount: Single rod			**-F**
Double rod, rod end			**-F**
Double rod, cap end			**-F1**
Double rod, both ends			**-F2**
Magnetic piston & sensor mounting slot(s) Order sensors separately. See page 1.14. Stroke length determines number of mounting slots. See page 1.14, 1.32, 1.34			**-E**

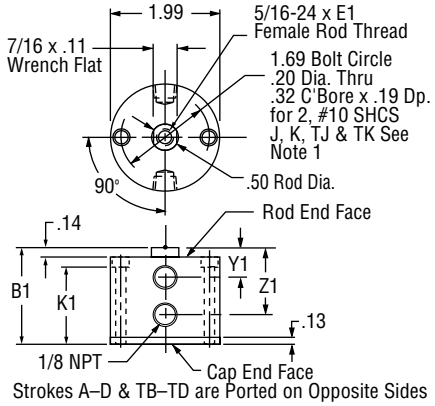
See pages 1.3 – 1.15 for general option information and pages 1.31, 1.32 & 1.34 for option specifications of 1 1/8" bore models.

A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – http://www.fabco-air.com

Action –X Double Acting

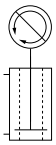
Note 1:
Strokes J, K, TJ, & TK have two #10-32 x .50 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts.
Push area = .99
Pull area = .80
Seal Kits for Series:
Original = 121-SK
"T" = 121-SKG



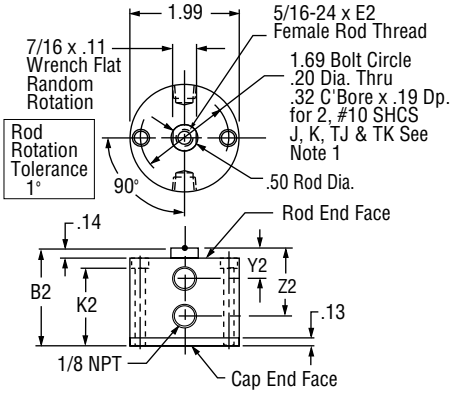
Strokes A–D & TB–TD are Ported on Opposite Sides

Action –XK Double Acting Nonrotating



Note 1:
Strokes J, K, TJ, & TK have two #10-32 x .50 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts.
Push area = .97
Pull area = .78
Seal Kits for Series:
Original = 121-SK-K
"T" = 121-SKG-K



Strokes A–D & TB–TD are Ported on Opposite Sides

Original Series

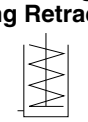
Stroke, Inches	1/8	3/16	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	3	4
Stroke, Letter	A	B	C	D	X	E	F	G	H	I	J	K
Action –X Double Acting												
B1	1.02	1.02	1.02	1.33	1.77	2.02	2.27	2.52	2.95	3.39	3.99	4.99
E1	.38	.38	.38	.38	.63	.63	.63	.63	.63	.63	.63	.63
K1	.69	.69	.69	1.00	1.44	1.69	1.94	2.19	2.62	3.06	Note 1	Note 1
Y1	.45	.45	.45	.67	.52	.52	.52	.52	.70	.89	.52	.52
Z1	.45	.45	.45	.67	1.27	1.52	1.77	2.02	2.45	2.89	3.49	4.49
Weight, lb.	.28	.27	.26	.37	.48	.54	.61	.67	.81	.95	1.08	1.35
Action –XK Double Acting, Nonrotating												
B2	1.02	1.02	1.02	1.33	1.77	2.02	2.27	2.52	2.95	3.39	3.99	4.99
E2	.38	.38	.38	.38	.63	.63	.63	.63	.63	.63	.63	.63
K2	.69	.69	.69	1.00	1.44	1.69	1.94	2.19	2.62	3.06	Note 1	Note 1
Y2	.45	.45	.45	.67	.52	.52	.52	.52	.70	.89	.52	.52
Z2	.45	.45	.45	.67	1.27	1.52	1.77	2.02	2.45	2.89	3.49	4.49
Weight, lb.	.28	.27	.26	.37	.49	.55	.62	.68	.83	.97	1.10	1.38
Action –O Single Acting, Spring Retracted												
B3	1.02	1.02	1.02	1.33	2.02	2.27	2.95	3.39	3.99	3.99	NA*	NA*
E3	.38	.38	.38	.38	.63	.63	.63	.63	.63	.63	"	"
K3	.69	.69	.69	1.00	1.69	1.94	2.62	3.06	Note 1	Note 1	"	"
Y3	Rod End Face Vent				.52	.52	.70	.89	.52	.52	"	"
Z3	.45	.45	.45	.67	1.52	1.77	2.45	2.89	3.49	3.49	"	"
Weight,. lb.	.28	.28	.28	.34	.57	.63	.84	.98	1.15	1.15	"	"
Preload, lb.	6.0	5.0	4.0	3.8	4.4	3.7	5.0	4.6	2.5	2.8	"	"
End of Stroke, lb.	8.5	8.5	8.5	11.8	17.7	18.6	17.8	18.3	22.2	17.7	"	"
Action –OP Single Acting, Spring Extended												
B4	1.40	1.46	1.52	2.08	3.02	3.52	4.45	5.14	NA*	NA*	NA*	NA*
E4	.38	.38	.38	.38	.63	.63	.63	.63	"	"	"	"
K4	.94	.94	.94	1.25	1.94	2.19	2.87	3.31	"	"	"	"
Y4	.58	.64	.70	1.17	1.27	1.52	1.95	2.39	"	"	"	"
Z4	.58	.64	.70	1.17	2.27	2.77	3.70	4.39	"	"	"	"
Weight, lb.	.37	.36	.36	.43	.63	.70	.91	1.00	"	"	"	"
Preload, lb.	6.0	5.0	4.0	3.5	3.9	3.3	2.5	4.3	"	"	"	"
End of Stroke, lb.	8.5	8.5	8.5	11.5	17.1	18.2	16.8	18.1	"	"	"	"

"T" Series

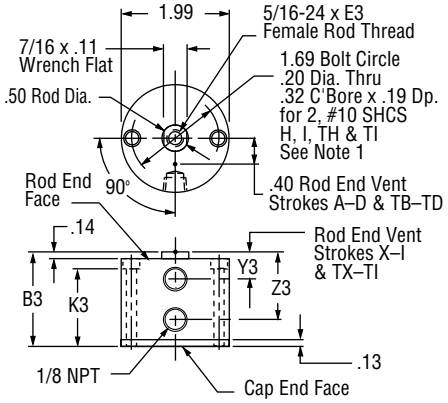
Stroke, Inches	1/16	1/8	3/8	5/8	7/8	1 1/8	1 3/8	1 5/8	1 7/8	2 7/8	3 7/8
Stroke, Letter	TB	TC	TD	TX	TE	TF	TG	TH	TI	TJ	TK
Action –X Double Acting											
B1	1.02	1.02	1.33	1.77	2.02	2.27	2.52	2.95	3.39	3.99	4.99
E1	.38	.38	.38	.63	.63	.63	.63	.63	.63	.63	.63
K1	.69	.69	1.00	1.44	1.69	1.94	2.19	2.62	3.06	Note 1	Note 1
Y1	.45	.45	.67	.52	.52	.52	.52	.70	.89	.52	.52
Z1	.45	.45	.67	1.27	1.52	1.77	2.02	2.45	2.89	3.49	4.49
Weight, lb.	.28	.27	.38	.49	.55	.62	.68	.82	.96	1.09	1.36
Action –XK Double Acting, Nonrotating											
B2	1.02	1.02	1.33	1.77	2.02	2.27	2.52	2.95	3.39	3.99	4.99
E2	.38	.38	.38	.63	.63	.63	.63	.63	.63	.63	.63
K2	.69	.69	1.00	1.44	1.69	1.94	2.19	2.62	3.06	Note 1	Note 1
Y2	.45	.45	.67	.52	.52	.52	.52	.70	.89	.52	.52
Z2	.45	.45	.67	1.27	1.52	1.77	2.02	2.45	2.89	3.49	4.49
Weight, lb.	.28	.27	.38	.50	.56	.63	.69	.84	.98	1.11	1.39
Action –O Single Acting, Spring Retracted											
B3	1.02	1.02	1.33	2.02	2.27	2.95	3.39	3.99	3.99	NA*	NA*
E3	.38	.38	.38	.63	.63	.63	.63	.63	.63	"	"
K3	.69	.69	1.00	1.69	1.94	2.62	3.06	Note 1	Note 1	"	"
Y3	Rod End Face Vent			.52	.52	.70	.89	.52	.52	"	"
Z3	.45	.45	.67	1.52	1.77	2.45	2.89	3.49	3.49	"	"
Weight,. lb.	.29	.29	.35	.58	.65	.85	.99	1.16	1.16	"	"
Preload, lb.	5.0	4.0	3.8	4.4	3.7	5.0	4.6	2.5	2.8	"	"
End of Stroke, lb.	8.5	8.5	11.8	17.7	18.6	17.8	18.3	22.2	17.7	"	"
Action –OP Single Acting, Spring Extended											
B4	1.33	1.40	1.96	2.90	3.40	4.33	5.02	NA*	NA*	NA*	NA*
E4	.38	.38	.38	.63	.63	.63	.63	"	"	"	"
K4	.94	.94	1.25	1.94	2.19	2.87	3.31	"	"	"	"
Y4	.51	.58	1.05	1.15	1.40	1.83	2.27	"	"	"	"
Z4	.51	.58	1.05	2.15	2.65	3.58	4.27	"	"	"	"
Weight, lb.	.37	.37	.44	.65	.72	.92	1.10	"	"	"	"
Preload, lb.	5.0	4.0	3.5	6.1	5.1	4.0	5.5	"	"	"	"
End of Stroke, lb.	8.5	8.5	8.5	17.1	18.2	16.8	18.1	"	"	"	"

N/A* = Not Available

Action –O Single Acting Spring Retracted

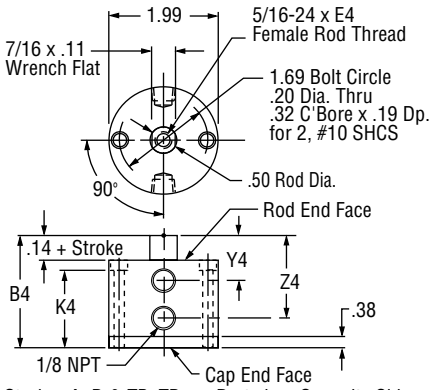


Note 1:
Strokes H, I, TH & TI have two #10-32 x .50 Tapped Mounting Holes on each end.
See page 1.16 for Mounting Bolts.
Push area = .99
See chart for Spring Forces: Preload and End of Stroke.
Seal Kits for Series:
Original = 121-SK
"T" = 121-SKG



Action –OP Single Acting Spring Extended

See page 1.16 for Mounting Bolts.
Pull area = .80
See Chart for Spring Forces: Preload & End of Stroke
Seal Kits for Series:
Original = 121-SK
"T" = 121-SKG



Strokes A–D & TB–TD are Ported on Opposite Sides

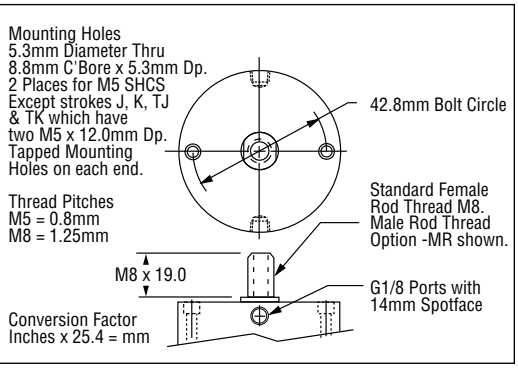
NA* = Not Available

1

Prefix Option -M Metric Cylinder & Rod Thread, 28.5mm Bore
Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.7.

Original Series												
Stroke mm	3.2	4.8	6.4	12.7	19.1	25.4	31.8	38.1	44.5	50.8	76.2	101.6
Stroke Letter	A	B	C	D	X	E	F	G	H	I	J	K

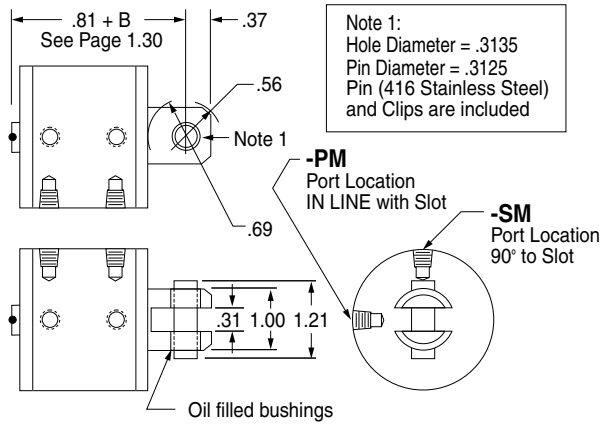
"T" Series											
Stroke mm	1.6	3.2	9.5	15.9	22.2	28.6	34.9	41.3	47.6	73.0	96.4
Stroke Letter	TB	TC	TD	TX	TE	TF	TG	TH	TI	TJ	TK



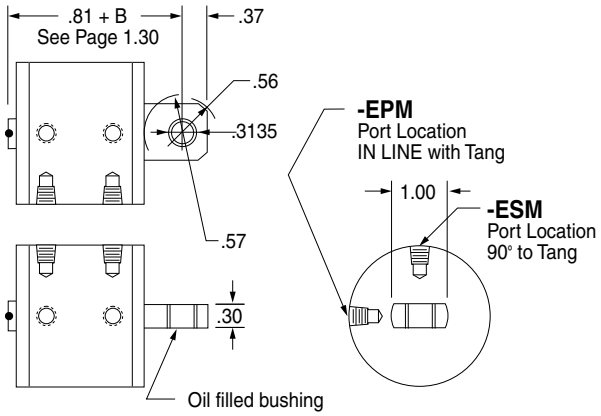
The **Suffix Options** charted on the right are available on Original and "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.30.
– Also see Option Information on pages 1.7 thru 1.15.

	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR
-X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XK	NA	✓	✓	NA	✓	✓	NA	✓	NA	✓	✓	✓
-O	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA
-OP	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA

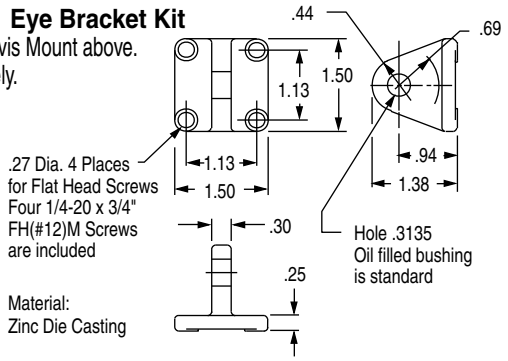
Suffix Options -PM & -SM Clevis Mount
Available on Original and "T" Series
with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



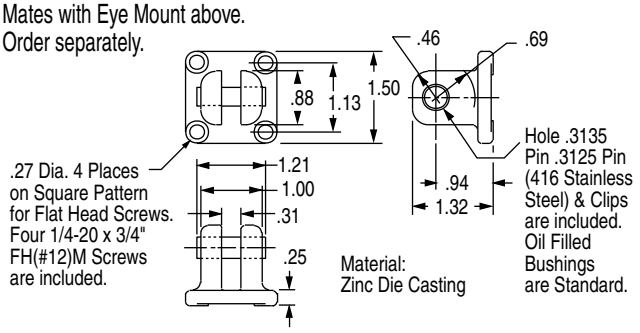
Suffix Options -EPM & -ESM Eye Mount
Available on Original and "T" Series
with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



EM-121 Eye Bracket Kit
Mates with Clevis Mount above.
Order separately.

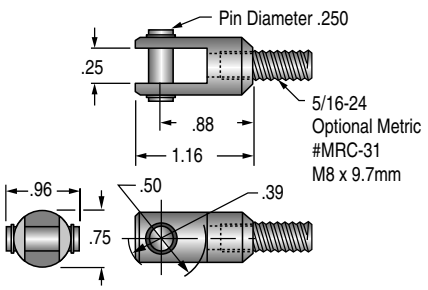


PM-121 Clevis Bracket Kit
Mates with Eye Mount above.
Order separately.

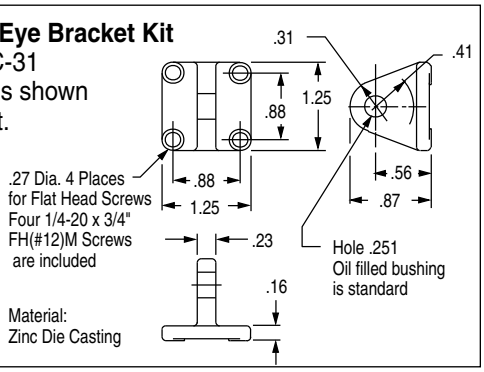


RC-31 Rod Clevis and Pin
Threaded Stud mates with
Female Rod thread
in ***Pancake®*** Cylinders.
Slot & Pin Mate with
EM-04 Eye Bracket
shown on the right.

Materials:
Clevis – Steel, Black Oxide
Stud – Steel
Pin – 416 Stainless Steel
Pin & Clips are included

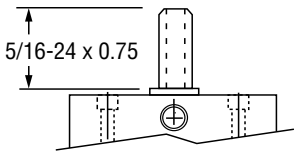


EM-04 Eye Bracket Kit
Mates RC-31
Rod Clevis shown
on the left.



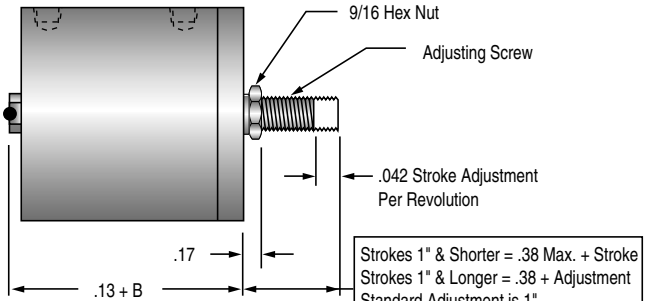
Suffix Option -MR Male Rod Thread

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP. Also see *Option Information* on page 1.8.



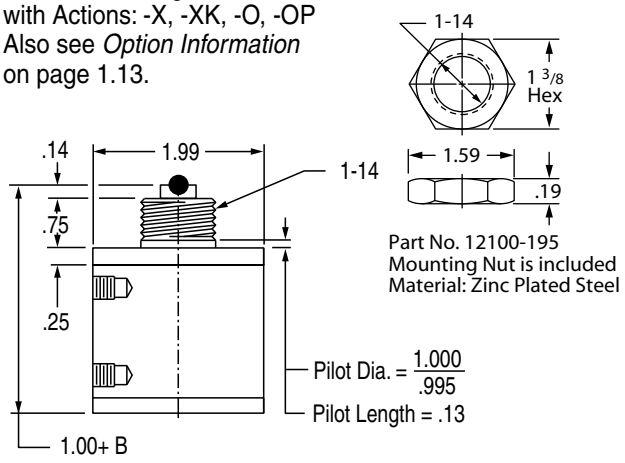
Suffix Option -RS Adjustable Retract Stroke

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.11.



Suffix Option -F Threaded Nose Mount

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



Part No. 12100-195
Mounting Nut is included
Material: Zinc Plated Steel

Suffix Option -E *Specifies Magnetic Piston and Dovetail Mounting Slot(s)*

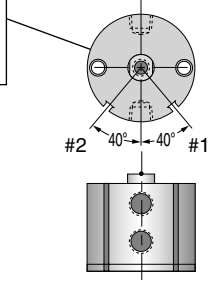
Strokes are NOT affected by magnetic piston.

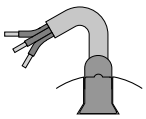
– Sensors Must be Ordered Separately See Sensor Models Available page 1.14

1 1/8" (121) Bore

Note:
Alloy steel mounting bolts may effect sensing. Stainless steel or other non-magnetic bolts are recommended.

Sensors available for "D" & "TD" strokes and longer. Strokes "D" & "TD" are ported on opposite sides.





1/4" 60° Dovetail Profile of Sensor & Mounting Slot.

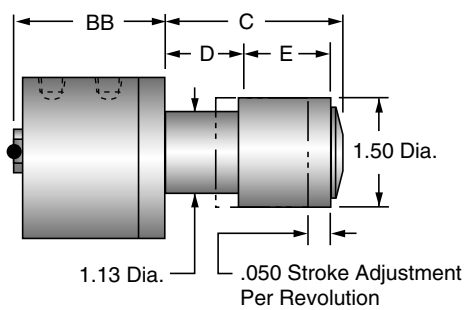
Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

	Available on Original Series			Available on "T" Series		
	Stroke	Action X	Action XK	Stroke	Action X	Action XK
Sensor Slots at Positions #1 and # 2	1/2	D	Not Available	3/8	TD	Not Available
	3/4	X	X	5/8	TX	TX
	1	E	E	7/8	TE	TE
	1 1/4	F	F	1 1/8	TF	TF
Sensor Slot at Position #1 only	1 1/2	G	G	1 3/8	TG	TG
	1 3/4	H	H	1 5/8	TH	TH
	2	I	I	1 7/8	TI	TI
	3	J	J	2 7/8	TJ	TJ
	4	K	K	3 7/8	TK	TK

Suffix Option -AS Adjustable Extend Stroke

Available on Original Series with Actions: -X, -XK, -O
Also see *Option Information* on page 1.11.

Stroke Inches		1/8	3/16	1/4	1/2	3/4	1	1-1/4	1-1/2	1-3/4	2	3	4
Stroke Letter		A	B	C	D	X	E	F	G	H	I	J	K
Actions: -X, -XK	BB	1.36	1.36	1.36	1.67	2.11	2.36	2.61	2.86	3.30	3.74	4.33	5.33
Actions:-O	BB	1.36	1.36	1.36	1.67	2.36	2.61	3.30	3.74	4.33	4.33	NA	NA
	C	1.40	1.53	1.66	2.16	2.66	3.16	3.66	4.16	4.66	5.16	7.16	9.16
	D	0.63	0.69	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	3.50	4.50
	E	0.63	0.69	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	3.50	4.50

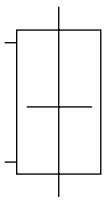


1

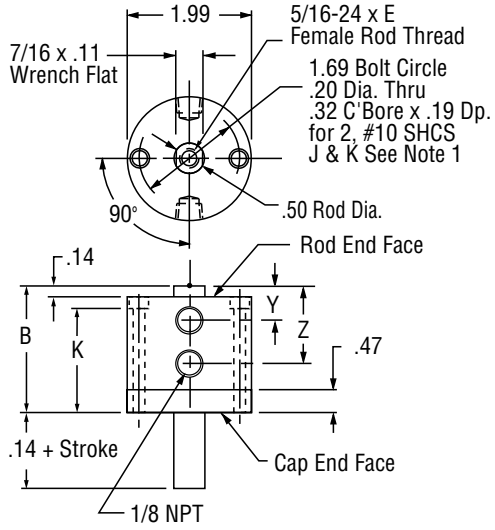
Action –XDR Original Series
Double Rod, Double Acting

Note 1:
Strokes J & K have two #10-32 x .50 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts
Force Area = .80
Seal Kit = 121-SK



Stroke, Inches	1/8	3/16	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	3	4
Stroke, Letter	A	B	C	D	X	E	F	G	H	I	J	K
B	1.36	1.36	1.36	1.67	2.11	2.36	2.61	2.86	3.30	3.74	4.33	5.33
E	.38	.38	.38	.34	.63	.63	.63	.63	.63	.63	.63	.63
K	1.04	1.04	1.04	1.34	1.78	2.03	2.28	2.53	2.96	3.40	Note 1	Note 1
Y	.45	.45	.45	.67	.52	.52	.52	.52	.70	.89	.52	.52
Z	.45	.45	.45	.67	1.27	1.52	1.77	2.02	2.45	2.89	3.49	4.49
Weight, lb.	.46	.45	.44	.55	.68	.76	.83	.91	1.07	1.22	1.41	1.71

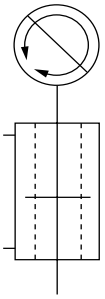


Strokes A – D are Ported on Opposite Sides

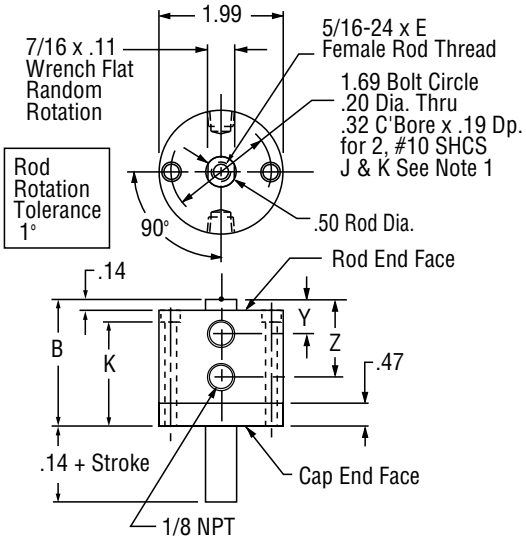
Action –XDRK Original Series
Double Rod, Double Acting, Nonrotating

Note 1:
Strokes J & K have two #10-32 x .50 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts
Force Area = .78
Seal Kit = 121-SK-K



Stroke, Inches	1/8	3/16	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	3	4
Stroke, Letter	A	B	C	D	X	E	F	G	H	I	J	K
B	1.36	1.36	1.36	1.67	2.11	2.36	2.61	2.86	3.30	3.74	4.33	5.33
E	.38	.38	.38	.34	.63	.63	.63	.63	.63	.63	.63	.63
K	1.04	1.04	1.04	1.34	1.78	2.03	2.28	2.53	2.96	3.40	Note 1	Note 1
Y	.45	.45	.45	.67	.52	.52	.52	.52	.70	.89	.52	.52
Z	.45	.45	.45	.67	1.27	1.52	1.77	2.02	2.45	2.89	3.49	4.49
Weight, lb.	.47	.46	.45	.56	.69	.77	.84	.93	1.09	1.24	1.43	1.74

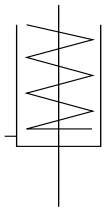


Strokes A – D are Ported on Opposite Sides

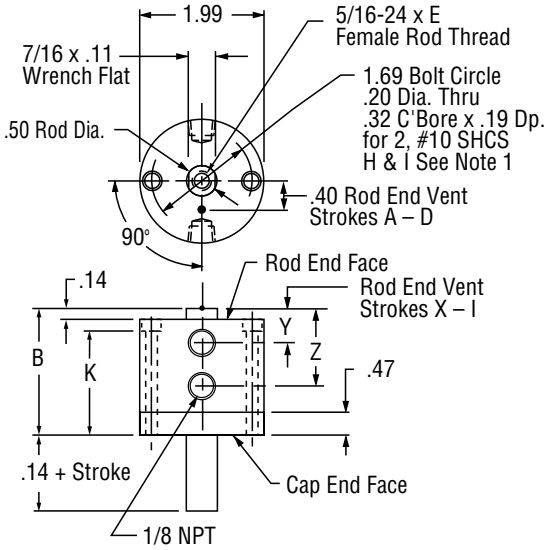
Action –ODR Original Series
Double Rod, Single Acting, Spring Retracted

Note 1:
Strokes H & I have two #10-32 x .50 Tapped Mounting Holes on each end.

See page 1.16 for Mounting Bolts
Force Area = .80
Seal Kit = 121-SK

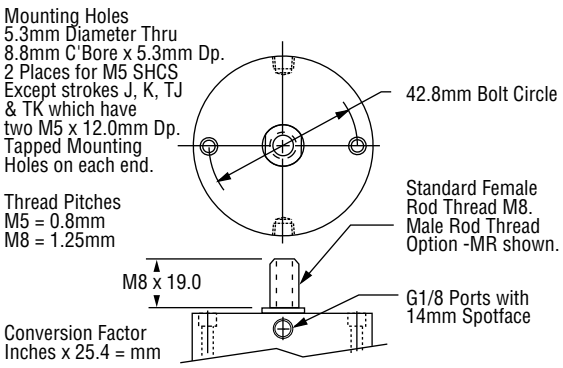


Stroke, Inches	1/8	3/16	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2
Stroke, Letter	A	B	C	D	X	E	F	G	H	I
B	1.36	1.36	1.36	1.67	2.36	2.61	3.30	3.74	4.33	4.33
E	.38	.38	.38	.34	.63	.63	.63	.63	.63	.63
K	1.04	1.04	1.04	1.34	2.03	2.28	2.96	3.40	Note 1	Note 1
Y	Rod End Vent Face				.52	.52	.70	.89	.52	.52
Z	.45	.45	.45	.67	1.52	1.77	2.45	2.89	3.49	3.49
Weight, lb.	.44	.44	.43	.53	.76	.83	1.07	1.22	1.41	1.41
Spring Return Forces, lb.										
Preload	6.0	5.0	4.0	3.5	4.4	3.7	2.8	4.6	2.8	2.8
End of Stroke	8.5	8.5	8.5	11.5	17.7	18.6	17.1	18.3	15.8	17.7



Prefix Option -M Metric Cylinder & Rod Thread, 50.8mm Bore
Available on Original Series with Actions: -XDR, -XDRK, -ODR
Also see *Option Information* on page 1.7.

Stroke mm	3.2	4.8	6.4	12.7	19.1	25.4	31.8	38.1	44.5	50.8	76.2	101.6
Stroke Letter	A	B	C	D	X	E	F	G	H	I	J	K



The **Suffix Options** charted on the right are available on Original Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.33. – *Also see Option Information on pages 1.7 thru 1.15.*

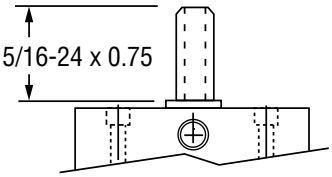
	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	13	16
-XDR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	NA	✓	✓	NA	✓	✓	NA	NA	NA	✓	✓	✓	✓	✓
-ODR	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓	✓

Suffix Options -MR, -MR1, -MR2 Male Rod Thread

Available on Original Series with Actions -XDR, -XDRK, -ODR.

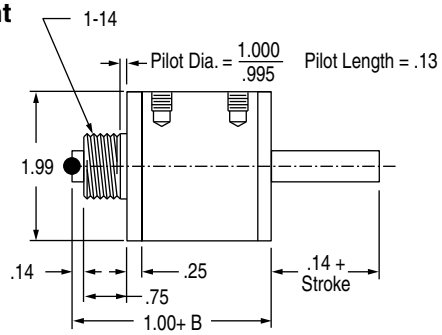
For Rod End only use –MR
For Cap End only use –MR1
For Both Ends use –MR2

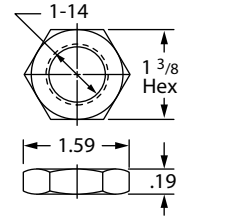
Also see Option Information on Page 1.8.



Suffix Options -F, -F1, -F2 Threaded Nose Mount
Available on Original Series
with Actions -XDR, -XDRK, -ODR.
For Rod End only use **-F**
For Cap End only use **-F1**
For Both Ends use **-F2**

Also see Option Information page 1.13.





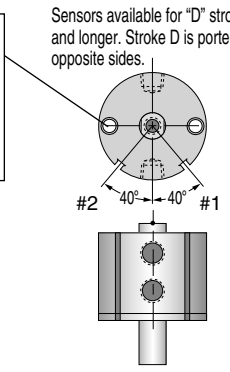
Part No. 12100-195
Mounting Nut is included
Material: Zinc Plated Steel

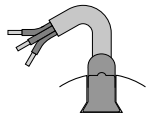
Suffix Option -E ***Specifies Magnetic Piston and Dovetail Mounting Slot(s)***
Strokes are NOT affected by magnetic piston.

–Sensors Must Be Ordered Separately
See Sensor Models Available page 1.14

1 1/8" (121) Bore

Note:
Alloy steel mounting bolts may effect sensing. Stainless steel or other non-magnetic bolts are recommended.





1/4" 60° Dovetail Profile of Sensor & Mounting Slot.

Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

Available on Original Series

	Stroke	Action XDR	Action XDRK
Sensor Slots at Positions #1 and # 2	1/2	D	Not Available
	3/4	X	X
	1	E	E
	1 1/4	F	F
Sensor Slot at Position #1 only	1 1/2	G	G
	1 3/4	H	H
	2	I	I
	3	J	J
	4	K	K

1

Model Number Code

Prefix Options	Stroke		Bore		Action		Suffix Options
Leave blank if none desired	D	–	221	–	X	–	MR

Metric M
See pages 1.7, 1.37 & 1.40

Bore	Code
1 5/8"	221
41.3mm	221

Standard Strokes

Original Series

Action	X XK XDR XDRK	O ODR	OP
Stroke			
1/8	AA	AA	AA
1/4	A*	A	A
1/2	B	B	B
3/4	C	C	C
1	D	D	D
1 1/2	E	E	–
2	F	–	–
3	G	–	–
4	H	–	–

"T" Series Includes PTFE piston bearing

Action	X XK	O	OP
Stroke			
1/4	TB	TB	TB
1/2	TC	TC	TC
3/4	TD	TD	TD
1 1/4	TE	TE	–
1 3/4	TF	–	–
2 3/4	TG	–	–
3 3/4	TH	–	–

Grey shading indicates sensors are not available.

Strokes are NOT affected by magnetic piston Option "E"

***Note –**
Sensors not available:
A-221-XK
A-221-XDRK

Action

Single rod

Double acting	-X
Double acting, Nonrotating Internal guide pins - 150 psi max	-XK
Single acting, spring retracted	-O
Single acting, spring extended	-OP

Double rod

Double acting	-XDR
Double acting, Nonrotating Internal guide pins - 150 psi max	-XDRK
Single acting, spring retracted	-ODR

See pages 1.5 & 1.6 for Action Information.
See pages 1.36 & 1.39 for Standard Specifications

HOW TO ORDER

1. Under ***Stroke*** – select letter(s) for desired Series and Stroke.
2. Under ***Bore*** – select **221** for 1 5/8" bore.
   Seven Other Bore Sizes are Available

Bore	Bore Code	See page
1/2"	5	1.17
3/4"	7	1.23
1 1/8"	121	1.29
2"	321	1.41
2 1/2"	521	1.47
3"	721	1.53
4"	1221	1.59

3. Under ***Action*** – select letter(s) for desired action.
4. Under ***Prefix & Suffix Options***– select letter(s) for desired options and add to model number.

EXAMPLES

B-221-X
Original Series, 1/2" stroke - 1 5/8" Bore - Single Rod, Double Acting

TC-221-O-MR
"T" Series, 1/2" Stroke - 1 5/8" Bore - Single Rod, Spring Retract - Male Rod Thread

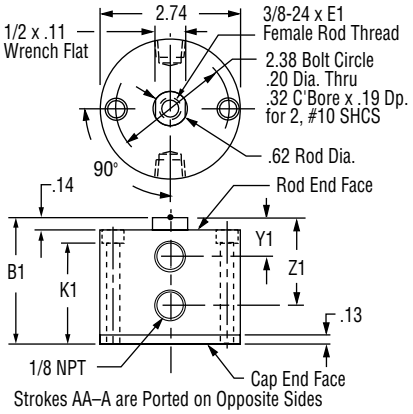
Suffix Options

Male rod thread: Single rod	-MR
Double rod, rod end	-MR
Double rod, cap end	-MR1
Double rod, both ends	-MR2
PTFE seals	-T
Viton seals	-V
Quad seals	-Q
External guide, nonrotating for load guiding (See page 1.65)	-G
Hydraulic: Standard cover	-H
Thick cover	-HHC
Air service: Thick cover	-HC
1/4 NPT ports	-P14
Hole thru double rod shaft: 1/8" hole	-13
Plus size: 1/4" hole 150 psi max	-25
Finish: **ProCoat**™ (Electroless Nickel)	-N
Stroke collar: 1/4" -C2, 1/2" -C4, 3/4" -C6, 1/8" -C1, 3/8" -C3, 5/8" -C5, 7/8" -C7	
Sound limiters: Rod end	-LF
Cap end	-LR
Both ends	-LFR
Rubber Bumpers: Rod end	-BF
Cap end	-BR
Both ends	-BFR
Adjustable extend stroke (Full stroke adjustment is standard)	-AS
Adjustable retract stroke (Over 1" adjustment add desired length, e.g. -RS2)	-RS
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
Threaded nose mount: Single rod	-F
Double rod, rod end	-F
Double rod, cap end	-F1
Double rod, both ends	-F2
Magnetic piston & sensor mounting slot(s) Order sensors separately. See page 1.14. Stroke length determines number of mounting slots. See page 1.14, 1.38, 1.40	-E

See pages 1.3 – 1.15 for general option information. and pages 1.37, 1.38 & 1.40 for option specifications of 1 5/8" bore models.

A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – http://www.fabco-air.com

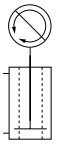
Action –X
Double Acting

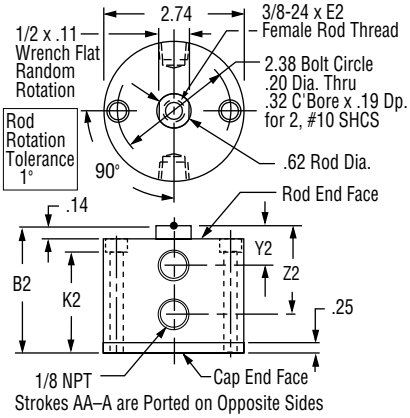


Strokes AA–A are Ported on Opposite Sides

See page 1.16 for Mounting Bolts.
Push area = 2.07
Pull area = 1.76
Seal Kits for Series:
Original = 221-SK
"T" = 221-SKG

Action –XK
Double Acting
Nonrotating





Strokes AA–A are Ported on Opposite Sides

See page 1.16 for Mounting Bolts.
Push area = 2.01
Pull area = 1.70
Seal Kits for Series:
Original = 221-SK-K
"T" = 221-SKG-K

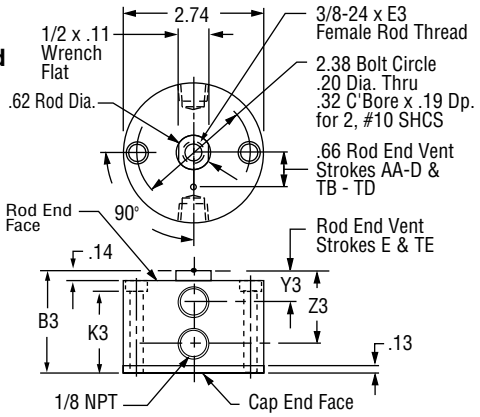
Original Series

Stroke, Inches	1/8	1/4	1/2	3/4	1	1 1/2	2	3	4
Stroke, Letter	AA	A	B	C	D	E	F	G	H
Action –X Double Acting									
B1	1.14	1.27	1.77	2.02	2.33	2.83	3.33	4.33	5.33
E1	.38	.44	.63	.63	.75	.75	.75	.75	.75
K1	.81	.94	1.44	1.69	2.00	2.50	3.00	4.00	5.00
Y1	.64	.64	.52	.52	.52	.52	.52	.52	.52
Z1	.64	.64	1.27	1.52	1.83	2.33	2.83	3.83	4.83
Weight, lb.	.60	.64	.93	1.06	1.19	1.43	1.66	2.14	2.60
Action –XK Double Acting, Nonrotating									
B2	1.27	1.40	1.90	2.15	2.46	2.96	3.46	4.46	5.46
E2	.38	.44	.63	.63	.75	.75	.75	.75	.75
K2	.94	1.06	1.57	1.82	2.13	2.63	3.13	4.13	5.13
Y2	.64	.64	.52	.52	.52	.52	.52	.52	.52
Z2	.64	.64	1.27	1.52	1.83	2.33	2.83	3.83	4.83
Weight, lb.	.68	.72	1.02	1.15	1.29	1.53	1.77	2.27	2.74
Action –O Single Acting, Spring Retracted									
B3	1.14	1.27	1.77	2.02	2.33	4.33	NA*	NA*	NA*
E3	.38	.44	.63	.63	.75	.75	NA*	NA*	NA*
K3	.81	.94	1.44	1.69	2.00	4.00	NA*	NA*	NA*
Y3	Rod End Face Vent					.52	NA*	NA*	NA*
Z3	.64	.77	1.27	1.52	1.83	3.83	NA*	NA*	NA*
Weight,. lb.	.58	.63	.89	1.00	1.15	2.10	NA*	NA*	NA*
Preload, lb.	15.0	8.5	8.5	6.0	4.8	6.0	NA*	NA*	NA*
End of Stroke, lb.	20.0	20.0	20.0	18.0	20.0	18.0	NA*	NA*	NA*
Action –OP Single Acting, Spring Extended									
B4	1.65	1.89	2.64	3.14	3.83	NA*	NA*	NA*	NA*
E4	.38	.44	.63	.63	.75	NA*	NA*	NA*	NA*
K4	1.19	1.32	1.82	2.07	2.50	NA*	NA*	NA*	NA*
Y4	.77	.89	1.02	1.27	1.52	NA*	NA*	NA*	NA*
Z4	.77	.89	1.77	2.27	2.83	NA*	NA*	NA*	NA*
Weight, lb.	.81	.83	1.10	1.20	1.42	NA*	NA*	NA*	NA*
Preload, lb.	8.5	4.5	5.5	4.0	4.8	NA*	NA*	NA*	NA*
End of Stroke, lb.	15.0	15.0	18.5	17.5	20.0	NA*	NA*	NA*	NA*

"T" Series

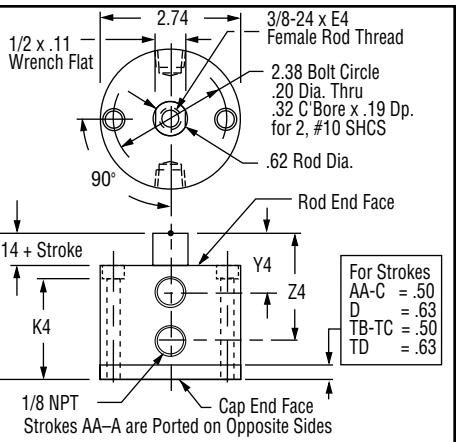
Stroke, Inches	1/4	1/2	3/4	1 1/4	1 3/4	2 3/4	3 3/4
Stroke, Letter	TB	TC	TD	TE	TF	TG	TH
Action –X Double Acting							
B1	1.77	2.02	2.33	2.83	3.33	4.33	5.33
E1	.63	.63	.75	.75	.75	.75	.75
K1	1.44	1.69	2.00	2.50	3.00	4.00	5.00
Y1	.52	.52	.52	.52	.52	.52	.52
Z1	1.27	1.57	1.83	2.33	2.83	3.83	4.83
Weight, lb.	.99	1.12	1.25	1.49	1.72	2.20	2.66
Action –XK Double Acting, Nonrotating							
B2	1.90	2.15	2.46	2.96	3.46	4.46	5.46
E2	.63	.63	.75	.75	.75	.75	.75
K2	1.57	1.82	2.13	2.63	3.13	4.13	5.13
Y2	.52	.52	.52	.52	.52	.52	.52
Z2	1.27	1.57	1.83	2.33	2.83	3.83	4.83
Weight, lb.	1.08	1.21	1.35	1.59	1.83	2.83	3.80
Action –O Single Acting, Spring Retracted							
B3	1.77	2.02	2.33	4.33	NA*	NA*	NA*
E3	.63	.63	.75	.75	NA*	NA*	NA*
K3	1.44	1.69	2.00	4.00	NA*	NA*	NA*
Y3	Rod End Face Vent			.52	NA*	NA*	NA*
Z3	1.27	1.57	1.83	3.83	NA*	NA*	NA*
Weight,. lb.	.95	1.06	1.21	2.16	NA*	NA*	NA*
Preload, lb.	8.5	8.5	6.0	7.06	NA*	NA*	NA*
End of Stroke, lb.	20.0	20.0	18.0	20.0	NA*	NA*	NA*
Action –OP Single Acting, Spring Extended							
B4	2.39	2.89	3.58	NA*	NA*	NA*	NA*
E4	.63	.63	.75	NA*	NA*	NA*	NA*
K4	1.82	2.07	2.50	NA*	NA*	NA*	NA*
Y4	.77	1.02	1.27	NA*	NA*	NA*	NA*
Z4	1.52	2.07	2.58	NA*	NA*	NA*	NA*
Weight, lb.	1.16	1.26	1.48	NA*	NA*	NA*	NA*
Preload, lb.	4.5	5.5	4.0	NA*	NA*	NA*	NA*
End of Stroke, lb.	15.0	18.5	17.5	NA*	NA*	NA*	NA*

Action –O
Single Acting
Spring Retracted



See page 1.16 for Mounting Bolts.
Push area = 2.07
See Chart for Spring Forces: Preload & End of Stroke
Seal Kits for Series:
Original = 221-SK
"T" = 221-SKG

Action –OP
Single Acting
Spring Extended



Strokes AA–A are Ported on Opposite Sides

See page 1.16 for Mounting Bolts.
Pull area = 1.76
See Chart for Spring Forces: Preload & End of Stroke
Seal Kits for Series:
Original = 221-SK
"T" = 221-SKG

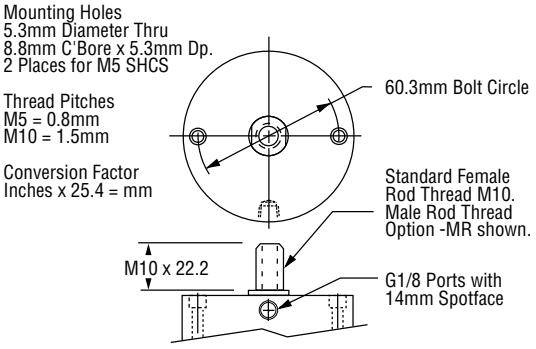
1

Prefix Option -M Metric Cylinder & Rod Thread, 41.3mm Bore

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.7.

Original Series									
Stroke mm	3.2	6.4	12.7	19.1	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AA	A	B	C	D	E	F	G	H

"T" Series							
Stroke mm	6.4	12.7	19.1	31.8	44.5	69.9	95.3
Stroke Letter	TB	TC	TD	TE	TF	TG	TH

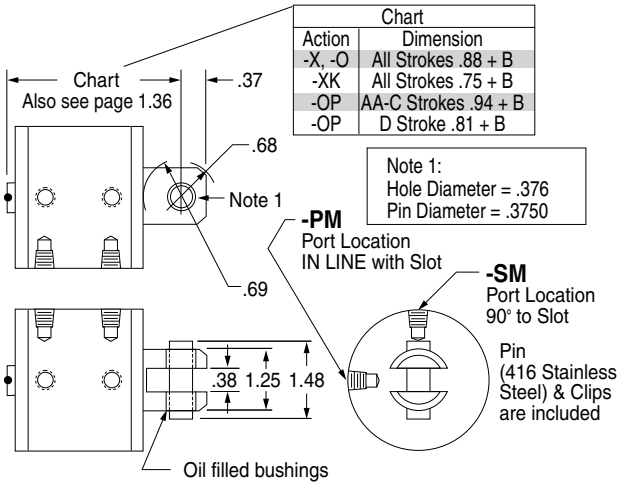


The **Suffix Options** charted on the right are available on Original and "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.36.
– Also see Option Information on pages 1.7 thru 1.15.

	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	P14
-X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XK	NA	✓	✓	NA	✓	✓	NA	✓	NA	✓	✓	✓	✓
-O	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓
-OP	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓

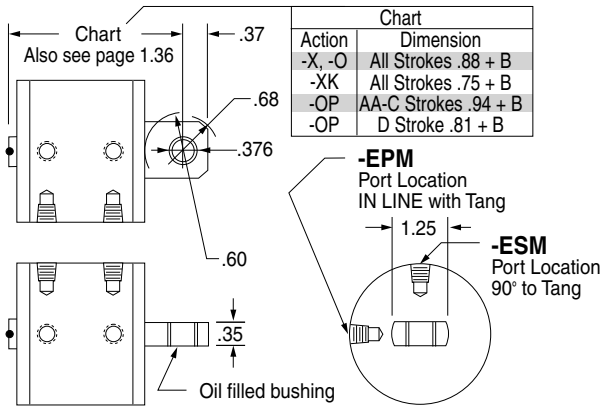
Suffix Options -PM & -SM Clevis Mount

Available on Original and "T" Series
with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



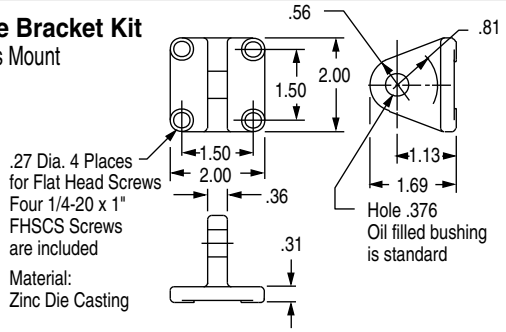
Suffix Options -EPM & -ESM Eye Mount

Available on Original and "T" Series
with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



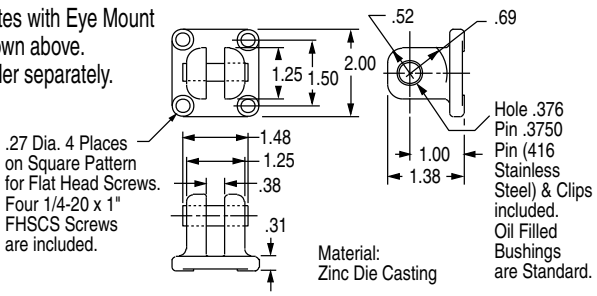
EM-221 Eye Bracket Kit

Mates with Clevis Mount
shown above.
Order separately.



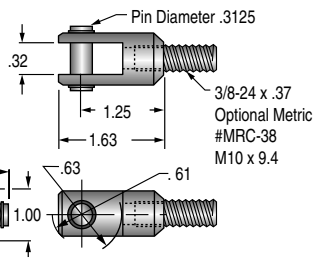
PM-221 Clevis Bracket Kit

Mates with Eye Mount
shown above.
Order separately.



RC-38 Rod Clevis and Pin

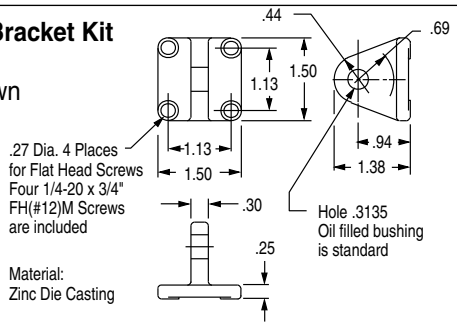
Threaded Stud mates with
Female Rod thread in ***Pancake***®
Cylinders. Slot & Pin Mate with
EM-121 Eye Bracket shown
on the right.



Materials:
Clevis – Steel, Black Oxide
Stud – Steel
Pin – 416 Stainless Steel
Pin & Clips are included

EM-121 Eye Bracket Kit

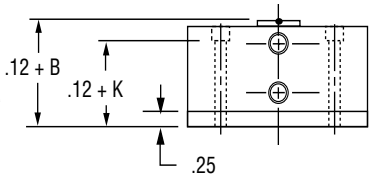
Mates RC-38
Rod Clevis shown
on the left.



Suffix Options -HHC Hydraulic & -HC Air

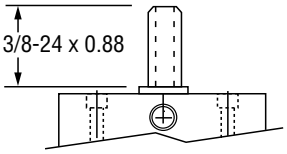
Available on Original and "T" Series with Action -X, -O.

Also see *Option Information* on page 1.9 for Pressure and Mounting details.



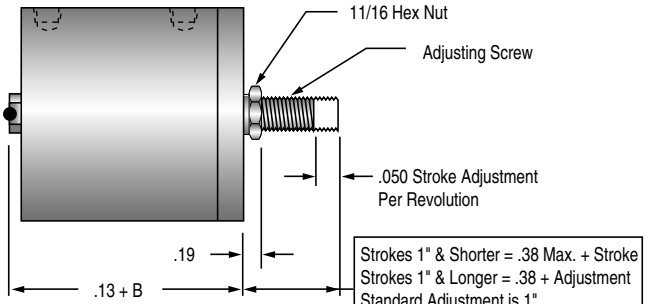
Suffix Option -MR Male Rod Thread

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP. Also see *Option Information* on page 1.8.



Suffix Option -RS Adjustable Retract Stroke

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.11.

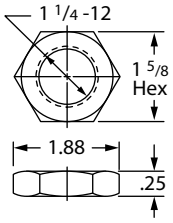


Strokes 1" & Shorter = .38 Max. + Stroke
Strokes 1" & Longer = .38 + Adjustment
Standard Adjustment is 1"

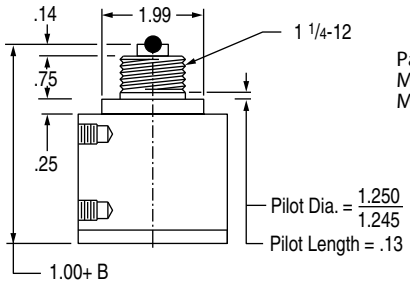
(-XK Only Use B2 as shown on page 1.36. No additional length is required.)
(-OP Only Use B4 as shown on page 1.36. No additional length is required.)

Suffix Option -F Threaded Nose Mount

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



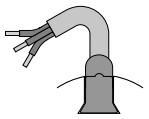
Part No. 22100-195
Mounting Nut is included
Material: Zinc Plated Steel



Suffix Option -E *Specifies Magnetic Piston and Dovetail Mounting Slot(s)*

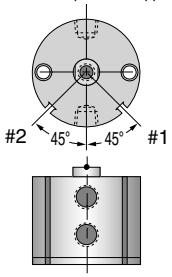
– Sensors Must be Ordered Separately See Sensor Models Available page 1.14

1 5/8" (221) Bore



1/4" 60° Dovetail Profile of Sensor & Mounting Slot.

Sensors available for "A" & "TB" strokes and longer. Stroke A is ported on opposite sides.



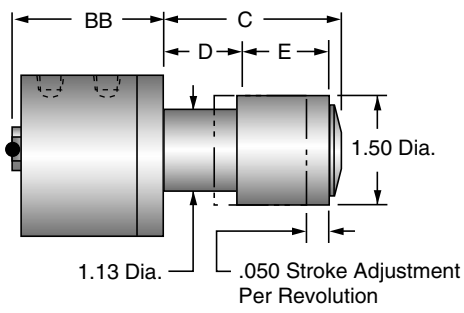
Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

	Available on Original Series			Available on "T" Series	
	Stroke	Action X	Action XK	Stroke	Action X, XK
Sensor Slots at Positions #1 and # 2	1/4	A	Not Available	1/4	TB
	1/2	B	B	1/2	TC
	3/4	C	C	3/4	TD
	1	D	D		
Sensor Slot at Position #1 only	1 1/2	E	E	1 1/4	TE
	2	F	F	1 3/4	TF
	3	G	G	2 3/4	TG
	4	H	H	3 3/4	TH

Suffix Option -AS Adjustable Extend Stroke

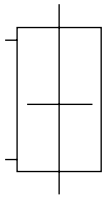
Available on Original Series with Actions: -X, -XK, -O
Also see *Option Information* on page 1.11.

Stroke Inches		1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke Letter		AA	A	B	C	D	E	F	G	H
Actions: -X, -XK	BB	1.61	1.74	2.24	2.49	2.80	3.30	3.80	4.80	5.80
Actions:-O	BB	1.61	1.74	2.24	2.49	2.80	4.80	NA	NA	NA
	C	1.40	1.66	2.16	2.66	3.16	4.16	5.16	7.16	9.16
	D	0.63	0.75	1.00	1.25	1.50	2.00	2.50	3.50	4.50
	E	0.63	0.75	1.00	1.25	1.50	2.00	2.50	3.50	4.50



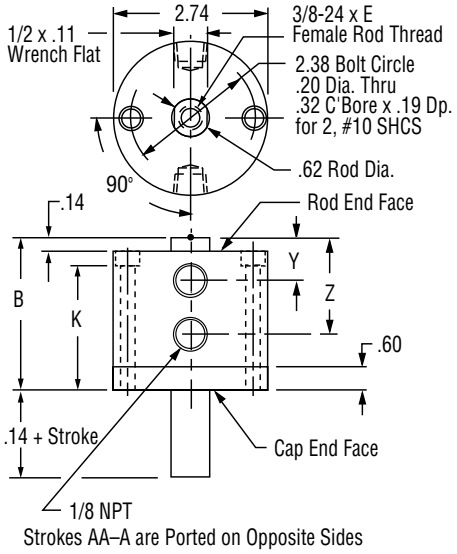
1

Action –XDR Original Series
Double Rod, Double Acting



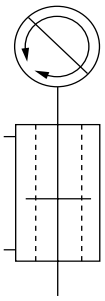
See page 1.16 for Mounting Bolts
Force Area = 1.76
Seal Kit = 221-SK

Stroke, Inches	1/8	1/4	1/2	3/4	1	1 1/2	2	3	4
Stroke, Letter	AA	A	B	C	D	E	F	G	H
B	1.61	1.74	2.24	2.49	2.80	3.30	3.80	4.80	5.80
E	.38	.44	.63	.63	.75	.75	.75	.75	.75
K	1.28	1.41	1.91	2.16	2.47	2.97	3.47	4.47	5.47
Y	.64	.64	.52	.52	.52	.52	.52	.52	.52
Z	.64	.64	1.27	1.52	1.83	2.33	2.83	3.83	4.83
Weight, lb.	.97	1.03	1.35	1.46	1.63	1.91	2.19	2.73	3.28



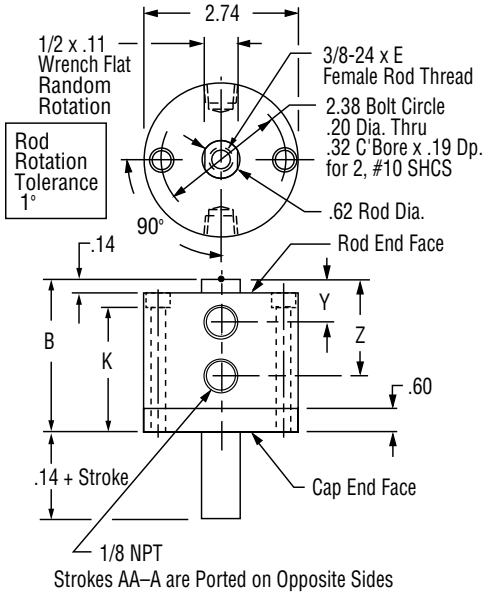
Strokes AA–A are Ported on Opposite Sides

Action –XDRK Original Series
Double Rod, Double Acting, Nonrotating



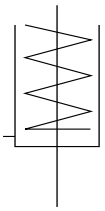
See page 1.16 for Mounting Bolts
Force Area = 1.70
Seal Kit = 221-SK-K

Stroke, Inches	1/8	1/4	1/2	3/4	1	1 1/2	2	3	4
Stroke, Letter	AA	A	B	C	D	E	F	G	H
B	1.61	1.74	2.24	2.49	2.80	3.30	3.80	4.80	5.80
E	.38	.44	.63	.63	.75	.75	.75	.75	.75
K	1.28	1.41	1.91	2.16	2.47	2.97	3.47	4.47	5.47
Y	.64	.64	.52	.52	.52	.52	.52	.52	.52
Z	.64	.64	1.27	1.52	1.83	2.33	2.83	3.83	4.83
Weight, lb.	1.05	1.11	1.44	1.55	1.73	2.01	2.30	2.86	3.42



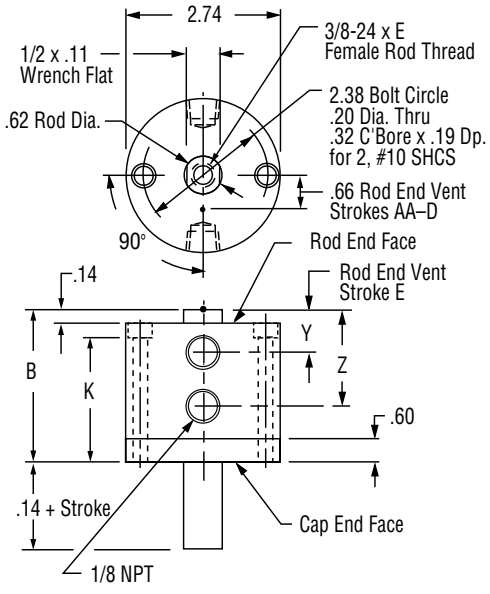
Strokes AA–A are Ported on Opposite Sides

Action –ODR Original Series
Double Rod, Single Acting, Spring Retracted



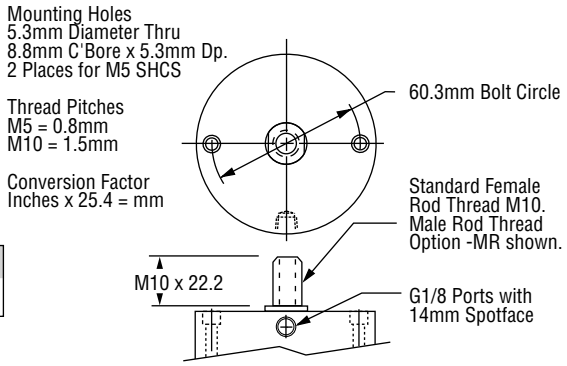
See page 1.16 for Mounting Bolts
Force Area = 1.76
Seal Kit = 221-SK

Stroke, Inches	1/8	1/4	1/2	3/4	1	1 1/2
Stroke, Letter	AA	A	B	C	D	E
B	1.61	1.74	2.24	2.49	2.80	4.80
E	.38	.44	.63	.63	.75	.75
K	1.28	1.41	1.91	2.16	2.47	4.47
Y	Rod End Vent Face					.52
Z	.64	.77	1.27	1.52	1.83	3.83
Weight, lb.	.95	1.01	1.30	1.42	1.58	1.86
Spring Return Forces, lb.						
Preload	15.0	8.5	8.5	6.0	4.8	6.0
End of Stroke	20.0	20.0	20.0	18.0	20.0	18.0



Prefix Option -M Metric Cylinder & Rod Thread, 41.3mm Bore
Available on Original Series with Actions: -XDR, -XDRK, -ODR
Also see *Option Information* on page 1.7.

Stroke mm	3.2	6.4	12.7	19.1	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AA	A	B	C	D	E	F	G	H



The **Suffix Options** charted on the right are available on Original Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.39. – *Also see Option Information on pages 1.7 thru 1.15.*

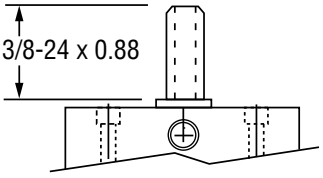
	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	P14	13	25
-XDR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	NA	✓	✓	NA	✓	✓	NA	✓	NA	✓	✓	✓	✓	✓	✓
-ODR	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓	✓	✓

Suffix Options -MR, -MR1, -MR2 Male Rod Thread

Available on Original Series with Actions -XDR, -XDRK, -ODR.

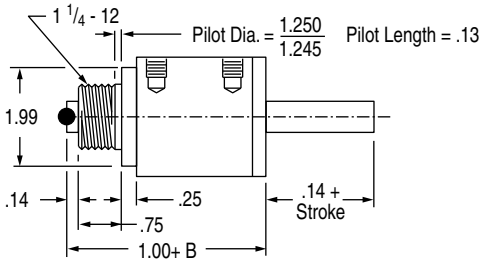
For Rod End only use –MR
For Cap End only use –MR1
For Both Ends –MR2

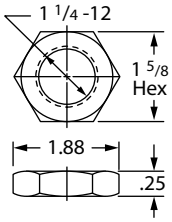
Also see Option Information on Page 1.8.



Suffix Options -F, -F1, -F2 Threaded Nose Mount

Available on Original Series
with Actions -XDR, -XDRK, -ODR.
For Rod End only use **-F**
For Cap End only use **-F1**
For Both Ends use **-F2**
Also see Option Information on page 1.13.



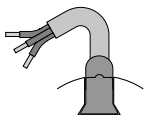


Part No. 22100-195
Mounting Nut is included
Material: Zinc Plated Steel

Suffix Option -E ***Specifies Magnetic Piston and Dovetail Mounting Slot(s)***
Strokes are NOT affected by magnetic piston.

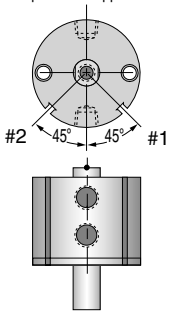
– Sensors Must be Ordered Separately
See Sensor Models Available page 1.14

1 5/8" (221) Bore



1/4" 60° Dovetail Profile of Sensor & Mounting Slot.

Sensors available for "A" strokes and longer.
Stroke A is ported on opposite sides.



Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

Available on Original Series

	Stroke	Action XDR	Action XDRK
Sensor Slots at Positions #1 and # 2	1/4	A	Not Available
	1/2	B	B
	3/4	C	C
	1	D	D
Sensor Slot at Position #1 only	1 1/2	E	E
	2	F	F
	3	G	G
	4	H	H

1 **Model Number Code**

Prefix Options	Stroke		Bore		Action	Suffix Options
Leave blank if none desired	D	–	321	–	X	– MR

Metric M
See pages 1.7, 1.43 & 1.46

Bore	Code
2"	321
50.8mm	321

Standard Strokes

Original Series

Action	X XK XDR XDRK	O ODR	OP
Stroke			
1/8	AB	AB	AB
1/4	AA	AA	AA
3/8	A	A	A
1/2	B	B	B
3/4	C	C	C
1	D	D	D
1 1/2	E	E	–
2	F	–	–
3	G	–	–
4	H	–	–

"T" Series Includes PTFE piston bearing

Action	X XK	O	OP
Stroke			
1/8	TA	TA	TA
1/4	TB	TB	TB
1/2	TC	TC	TC
3/4	TD	TD	TD
1 1/4	TE	TE	–
1 3/4	TF	–	–
2 3/4	TG	–	–
3 3/4	TH	–	–

Grey shading indicates sensors are not available.

Strokes are NOT affected by magnetic piston Option "E"

Action

Single rod

Double acting	**-X**
Double acting, Nonrotating Internal guide pins - 150 psi max	**-XK**
Single acting, spring retracted	**-O**
Single acting, spring extended	**-OP**

Double rod

Double acting	**-XDR**
Double acting, Nonrotating Internal guide pins - 150 psi max	**-XDRK**
Single acting, spring retracted	**-ODR**

See pages 1.5 & 1.6 for Action Information.
See pages 1.42 & 1.45 for Standard Specifications

HOW TO ORDER

1. Under ***Stroke*** – select letter(s) for desired Series and Stroke.
2. Under ***Bore*** – select **321** for 2" bore.
   Seven Other Bore Sizes are Available

Bore	Bore Code	See page
1/2"	5	1.17
3/4"	7	1.23
1 1/8"	121	1.29
1 5/8"	221	1.35
2 1/2"	521	1.47
3"	721	1.53
4"	1221	1.59

3. Under ***Action*** – select letter(s) for desired action.
4. Under ***Prefix & Suffix Options***– select letter(s) for desired options and add to model number.

EXAMPLES

B-321-X
Original Series, 1/2" stroke - 2" Bore - Single Rod, Double Acting

TD-321-X-MR
"T" Series, 3/4" Stroke - 2" Bore - Single Rod, Double Acting - Male Rod Thread

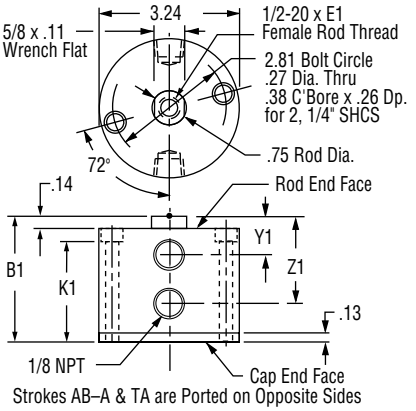
Suffix Options

Male rod thread: Single rod		**-MR**
Double rod, rod end		**-MR**
Double rod, cap end		**-MR1**
Double rod, both ends		**-MR2**
PTFE seals		**-T**
Viton seals		**-V**
Quad seals		**-Q**
External guide, nonrotating for load guiding (See page 1.65)		**-G**
Hydraulic: Standard cover		**-H**
Thick cover		**-HHC**
Air service: Thick cover		**-HC**
1/4 NPT ports		**-P14**
Hole thru double rod shaft: 5/32" hole		**-16**
Plus size 5/16" hole 150 psi max		**-31**
Finish: **ProCoat**™ (Electroless Nickel)		**-N**
Stroke collar: 1/4"	**-C2**	**-C1**
1/2"	**-C4**	**-C3**
3/4"	**-C6**	**-C5**
		-C7
Sound limiters:	Rod end	**-LF**
	Cap end	**-LR**
	Both ends	**-LFR**
Rubber Bumpers:	Rod end	**-BF**
	Cap end	**-BR**
	Both ends	**-BFR**
Adjustable extend stroke (Full stroke adjustment is standard)		**-AS**
Adjustable retract stroke (Over 1" adjustment add desired length, e.g. -RS2)		**-RS**
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) Order sensors separately. See page 1.14. Stroke length determines number of mounting slots. See page 1.14, 1.44, 1.46		**-E**

See pages 1.3 – 1.15 for general option information and pages 1.43, 1.44 & 1.46 for option specifications of 2" bore models.

A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – http://www.fabco-air.com

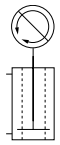
Action –X Double Acting

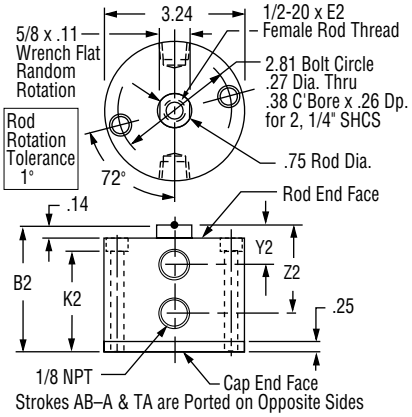


Strokes AB–A & TA are Ported on Opposite Sides

See page 1.16 for Mounting Bolts.
Push area = 3.14
Pull area = 2.70
Seal Kits for Series:
Original = 321-SK
"T" = 321-SKG

Action –XK Double Acting Nonrotating





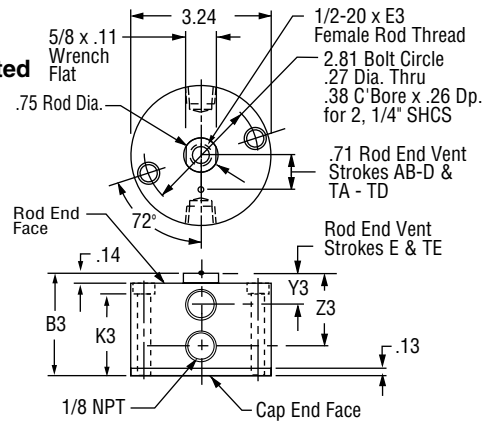
Strokes AB–A & TA are Ported on Opposite Sides

See page 1.16 for Mounting Bolts.
Push area = 2.94
Pull area = 2.50
Seal Kits for Series:
Original = 321-SK-K
"T" = 321-SKG-K

Original Series / "T" Series

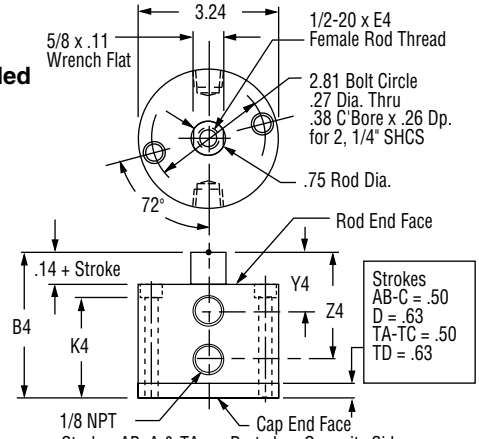
Stroke, Inches	1/8	1/4	3/8	1/2	3/4	1	1 1/2	2	3	4	1/8	1/4	1/2	3/4	1 1/4	1 3/4	2 3/4	3 3/4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G	H	TA	TB	TC	TD	TE	TF	TG	TH
Action –X Double Acting																		
B1	1.20	1.33	1.45	1.64	2.02	2.39	2.89	3.39	4.39	5.39	1.45	1.64	2.02	2.39	2.89	3.39	4.39	5.39
E1	.40	.50	.63	.63	.75	.88	.88	.88	.88	.88	.63	.63	.75	.88	.88	.88	.88	.88
K1	.80	.93	1.05	1.24	1.62	1.99	2.49	2.99	3.99	4.99	1.05	1.24	1.62	1.99	2.49	2.99	3.99	4.99
Y1	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52
Z1	.70	.83	.95	1.14	1.52	1.89	2.39	2.89	3.89	4.89	.95	1.14	1.52	1.89	2.39	2.89	3.89	4.89
Weight, lb.	.89	.96	1.04	1.16	1.45	1.70	2.02	2.34	2.97	3.58	1.10	1.30	1.56	1.84	2.16	2.48	3.11	3.71
Action –XK Double Acting, Nonrotating																		
B2	1.33	1.46	1.58	1.77	2.15	2.52	3.02	3.52	4.52	5.52	1.58	1.77	2.15	2.52	3.02	3.52	4.52	5.52
E2	.40	.50	.63	.63	.75	.88	.88	.88	.88	.88	.63	.63	.75	.88	.88	.88	.88	.88
K2	.93	1.06	1.18	1.37	1.75	2.12	2.62	3.12	4.12	5.12	1.18	1.37	1.75	2.12	2.62	3.12	4.12	5.12
Y2	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52
Z2	.70	.83	.95	1.14	1.52	1.89	2.39	2.89	3.89	4.89	.95	1.14	1.52	1.89	2.39	2.89	3.89	4.89
Weight, lb.	1.02	1.09	1.18	1.30	1.60	1.85	2.19	2.52	3.18	3.82	1.24	1.44	1.71	2.00	2.33	2.66	3.32	3.95
Action –O Single Acting, Spring Retracted																		
B3	1.20	1.33	1.45	1.64	2.02	2.39	4.39	NA*	NA*	NA*	1.45	1.64	2.02	2.39	4.39	NA*	NA*	NA*
E3	.40	.50	.63	.63	.75	.88	.88	NA*	NA*	NA*	.63	.63	.75	.88	.88	NA*	NA*	NA*
K3	.80	.93	1.05	1.24	1.62	1.99	3.99	NA*	NA*	NA*	1.05	1.24	1.62	1.99	3.99	NA*	NA*	NA*
Y3	Rod End Face Vent						.52	NA*	NA*	NA*	Rod End Face Vent				.52	NA*	NA*	NA*
Z3	.70	.83	.95	1.14	1.52	1.89	3.89	NA*	NA*	NA*	.95	1.14	1.52	1.89	3.89	NA*	NA*	NA*
Weight,. lb.	.85	.97	1.01	1.13	1.36	1.61	3.11	NA*	NA*	NA*	1.01	1.13	1.36	1.61	3.25	NA*	NA*	NA*
Preload, lb.	12.0	6.2	12.0	7.0	5.0	4.7	5.0	NA*	NA*	NA*	11.3	7.3	6.2	7.6	4.8	NA*	NA*	NA*
End of Stroke, lb.	18.0	18.0	21.0	20.0	15.5	20.0	20.0	NA*	NA*	NA*	21.0	20.0	15.5	20.0	20.0	NA*	NA*	NA*
Action –OP Single Acting, Spring Extended																		
B4	1.71	1.96	2.21	2.52	3.14	3.89	NA*	NA*	NA*	NA*	1.96	2.27	2.89	3.61	NA*	NA*	NA*	NA*
E4	.40	.50	.63	.63	.75	.88	NA*	NA*	NA*	NA*	.63	.63	.75	.88	NA*	NA*	NA*	NA*
K4	1.18	1.30	1.43	1.62	1.99	2.49	NA*	NA*	NA*	NA*	1.43	1.62	1.99	2.49	NA*	NA*	NA*	NA*
Y4	.65	.77	.90	1.02	1.27	1.52	NA*	NA*	NA*	NA*	.65	.77	1.02	1.25	NA*	NA*	NA*	NA*
Z4	.83	1.08	1.33	1.64	2.27	2.89	NA*	NA*	NA*	NA*	1.08	1.33	1.64	2.27	NA*	NA*	NA*	NA*
Weight, lb.	1.22	1.29	1.36	1.49	1.76	2.13	NA*	NA*	NA*	NA*	1.50	1.63	1.89	2.26	NA*	NA*	NA*	NA*
Preload, lb.	8.5	4.5	9.5	7.0	6.0	4.7	NA*	NA*	NA*	NA*	10.7	7.0	6.0	4.7	NA*	NA*	NA*	NA*
End of Stroke, lb.	15.0	15.0	20.0	20.0	18.0	20.0	NA*	NA*	NA*	NA*	18.0	20.0	18.0	20.0	NA*	NA*	NA*	NA*

Action –O Single Acting Spring Retracted



See page 1.16 for Mounting Bolts.
Push area = 3.14
See Chart for Spring Forces: Preload & End of Stroke
Seal Kits for Series:
Original = 321-SK
"T" = 321-SKG

Action –OP Single Acting Spring Extended



Strokes AB–A & TA are Ported on Opposite Sides

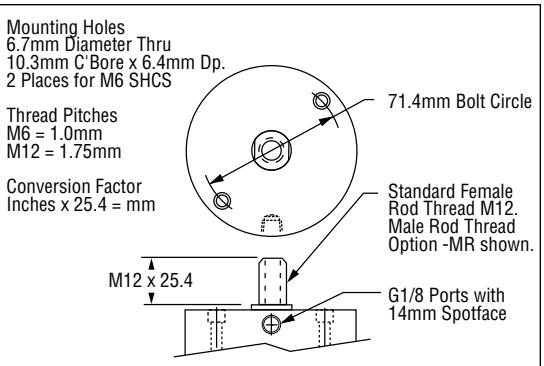
See page 1.16 for Mounting Bolts.
Pull area = 2.70
See Chart for Spring Forces: Preload & End of Stroke
Seal Kits for Series:
Original = 321-SK
"T" = 321-SKG

1

Prefix Option -M Metric Cylinder & Rod Thread, 50.8mm Bore
Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.7.

Original Series										
Stroke mm	3.2	6.4	9.5	12.7	19.1	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AB	AA	A	B	C	D	E	F	G	H

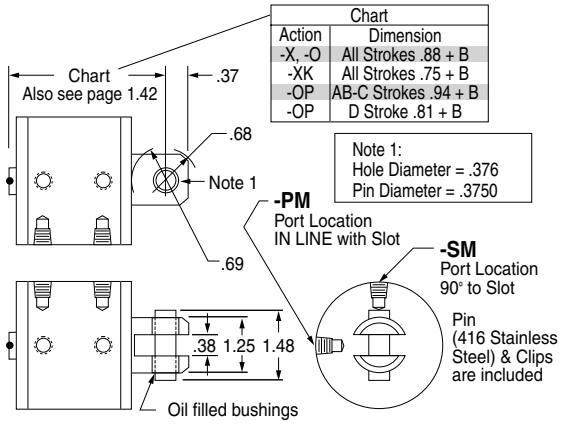
"T" Series								
Stroke mm	3.2	6.4	12.7	19.1	31.8	44.5	69.9	95.3
Stroke Letter	TA	TB	TC	TD	TE	TF	TG	TH



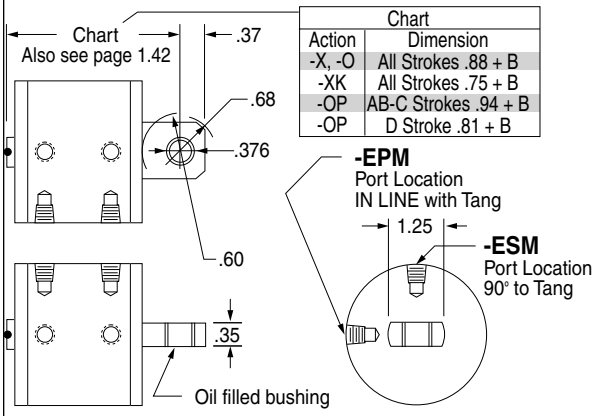
The **Suffix Options** charted on the right are available on Original and "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.42. *– Also see Option Information on pages 1.7 thru 1.15.*

	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	P14
-X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XK	NA	✓	✓	NA	✓	✓	NA	✓	NA	✓	✓	✓	✓
-O	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓
-OP	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓

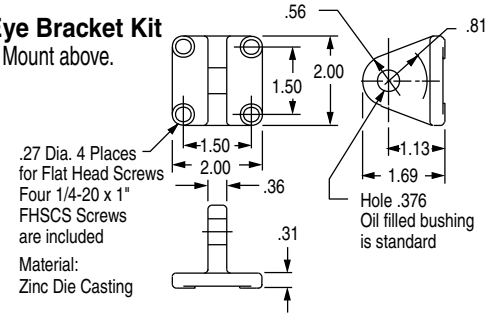
Suffix Options -PM & -SM Clevis Mount
Available on Original and "T" Series
with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



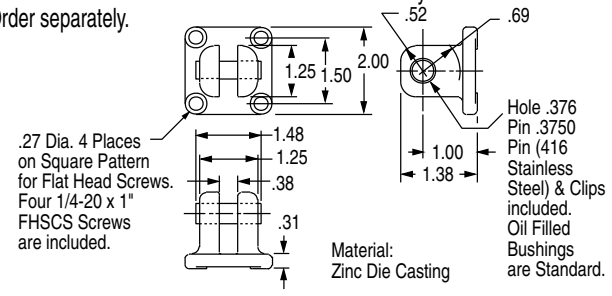
Suffix Options -EPM & -ESM Eye Mount
Available on Original and "T" Series
with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



EM-221 Eye Bracket Kit
Mates with Clevis Mount above.
Order separately.



PM-221 Clevis Bracket Kit Mates with Eye Mount above.
Order separately.



RC-Chart Rod Clevis and Pin Threaded Stud mates with Female Rod thread in the ***Pancake®*** Cylinders. Slot and Pin Mate with EM-121 Eye Bracket shown on the right.

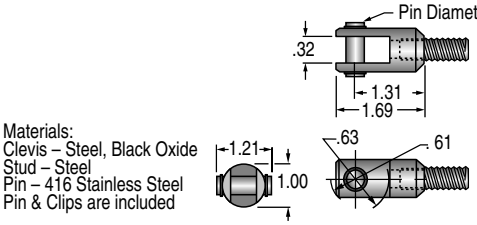
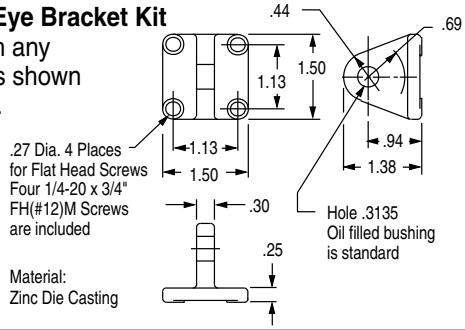


CHART 1/2-20 x Thread Length Metric M12 x Thread Length		
Rod Clevis Number	Strokes	Thread Length
RC-54	AB–AA	.39"
RC-56	A–H	.62"
MRC-54	MAB–MAA	9.9mm
MRC-56	MA–MH	15.7mm

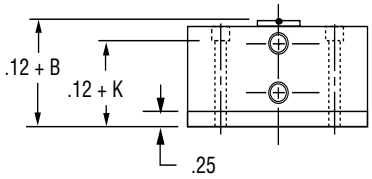
EM-121 Eye Bracket Kit
Mates with any
Rod Clevis shown
on the left.



Suffix Option -HHC Hydraulic & -HC Air

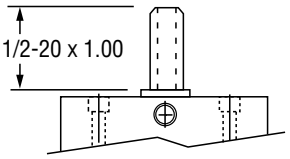
Available on Original and "T" Series with Action -X, -O.

Also see *Option Information* on page 1.9 for Pressure and Mounting details.



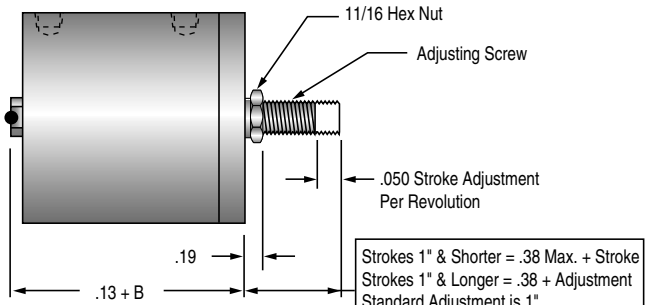
Suffix Option -MR Male Rod Thread

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP.
Also see *Option Information* on page 1.8.



Suffix Option -RS Adjustable Retract Stroke

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.11.



(-XK Only use B2 as shown on page 1.42. No additional length is required.)
(-OP Only use B4 as shown on page 1.42. No additional length is required.)

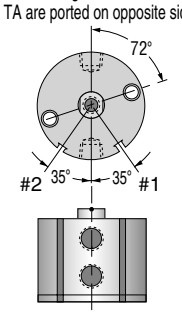
Suffix Option -E *Specifies Magnetic Piston and Dovetail Mounting Slot(s)*

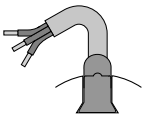
Strokes are NOT affected by magnetic piston.

– Sensors Must be Ordered Separately See Sensor Models Available page 1.14

2" (321) Bore

Sensors available for "AA" & "TA" strokes and longer. Strokes AA – A and TA are ported on opposite sides.





1/4" 60° Dovetail Profile of Sensor & Mounting Slot.

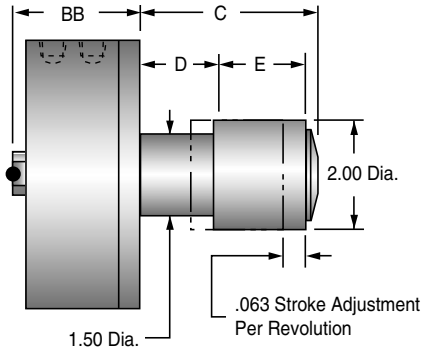
Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

	Available on Original Series		Available on "T" Series	
	Stroke	Action X, XK	Stroke	Action X, XK
Sensor Slots at Positions #1 and # 2	1/4	AA	1/8	TA
	3/8	A	1/4	TB
	1/2	B	1/2	TC
	3/4	C	3/4	TD
	1	D		
Sensor Slot at Position #1 only	1 1/2	E	1 1/4	TE
	2	F	1 3/4	TF
	3	G	2 3/4	TG
	4	H	3 3/4	TH

Suffix Option -AS Adjustable Extend Stroke

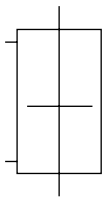
Available on Original Series with Actions: -X, -XK, -O
Also see *Option Information* on page 1.11.

Stroke Inches		1/8	1/4	3/8	1/2	3/4	1	1-1/2	2	3	4
Stroke Letter		AB	AA	A	B	C	D	E	F	G	H
Actions: -X, -XK	BB	1.83	1.95	2.08	2.27	2.64	3.02	3.52	4.02	5.02	6.02
Actions:-O	BB	1.83	1.95	2.08	2.27	2.64	3.02	5.02	NA	NA	NA
	C	1.67	1.91	2.17	2.41	2.91	3.41	4.41	5.41	7.41	9.41
	D	0.63	0.75	0.88	1.00	1.25	1.50	2.00	2.50	3.50	4.50
	E	0.88	1.00	1.13	1.25	1.50	1.75	2.25	2.75	3.75	4.75



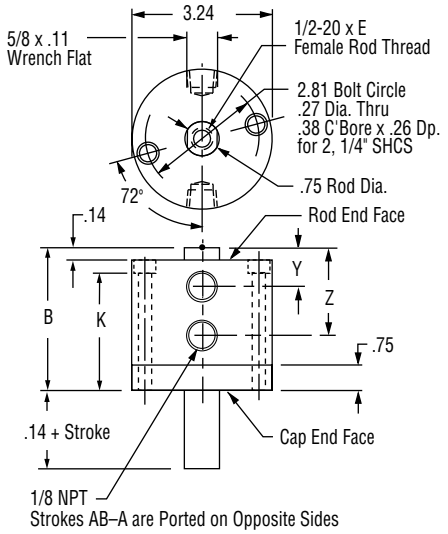
1

Action –XDR Original Series
Double Rod, Double Acting

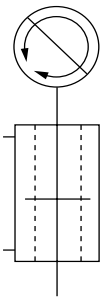


See page 1.16 for Mounting Bolts
Force Area = 2.70
Seal Kit = 321-SK

Stroke, Inches	1/8	1/4	3/8	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G	H
B	1.83	1.95	2.08	2.27	2.64	3.02	3.52	4.02	5.02	6.02
E	.40	.50	.63	.63	.75	.88	.88	.88	.88	.88
K	1.44	1.56	1.69	1.89	2.25	2.63	3.13	3.63	4.63	5.63
Y	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52
Z	.70	.83	.95	1.14	1.52	1.89	2.39	2.89	3.89	4.89
Weight, lb.	1.56	1.64	1.72	1.86	2.15	2.44	2.80	3.18	3.94	4.72

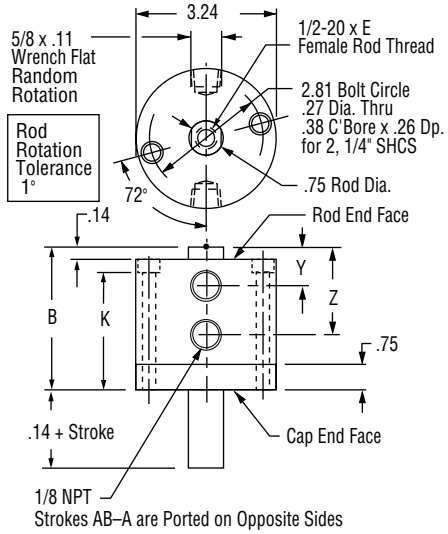


Action –XDRK Original Series
Double Rod, Double Acting, Nonrotating

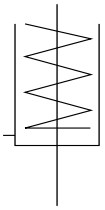


See page 1.16 for Mounting Bolts
Force Area = 2.51
Seal Kit = 321-SK-K

Stroke, Inches	1/8	1/4	3/8	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G	H
B	1.83	1.95	2.08	2.27	2.64	3.02	3.52	4.02	5.02	6.02
E	.40	.50	.63	.63	.75	.88	.88	.88	.88	.88
K	1.44	1.56	1.69	1.89	2.25	2.63	3.13	3.63	4.63	5.63
Y	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52
Z	.70	.83	.95	1.14	1.52	1.89	2.39	2.89	3.89	4.89
Weight, lb.	1.70	1.78	1.87	2.01	2.31	2.61	2.98	3.37	4.16	4.97

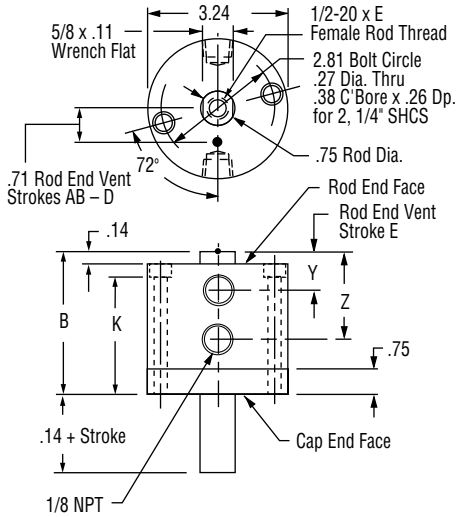


Action –ODR Original Series
Double Rod, Single Acting, Spring Retracted

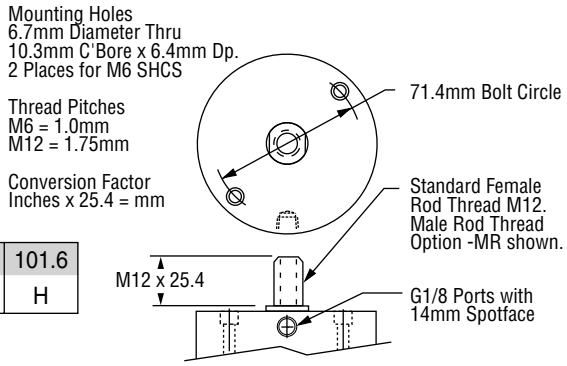


See page 1.16 for Mounting Bolts
Force Area = 2.70
Seal Kit = 321-SK

Stroke, Inches	1/8	1/4	3/8	1/2	3/4	1	1-1/2
Stroke, Letter	AB	AA	A	B	C	D	E
B	1.83	1.95	2.08	2.27	2.64	3.02	5.02
E	.40	.50	.63	.63	.75	.88	.88
K	1.44	1.56	1.69	1.89	2.25	2.63	4.63
Y	Rod End Face Vent						.52
Z	.70	.83	.95	1.14	1.52	1.89	3.89
Weight, lb.	1.51	1.60	1.69	1.81	2.10	2.39	4.16
Spring Return Forces, lb.							
Preload	12.0	6.2	12.0	7.0	5.0	4.7	5.0
End of Stroke	18.0	18.0	21.0	20.0	15.5	20.0	20.0



Prefix Option -M Metric Cylinder & Rod Thread, 50.8mm Bore
Available on Original Series with Actions: -XDR, -XDRK, -ODR
Also see *Option Information* on page 1.7.



Stroke mm	3.2	6.4	9.5	12.7	19.1	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AB	AA	A	B	C	D	E	F	G	H

The **Suffix Options** charted on the right are available on Original Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.45. – *Also see Option Information on pages 1.7 thru 1.15.*

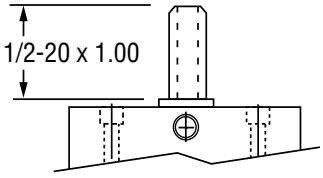
	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	P14	16	31
-XDR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	NA	✓	✓	NA	✓	✓	NA	✓	NA	✓	✓	✓	✓	✓	✓
-ODR	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓	✓	✓

Suffix Options -MR, -MR1, -MR2 Male Rod Thread

Available on Original Series with Actions -XDR, -XDRK, -ODR.

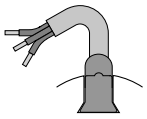
For Rod End only use –MR
For Cap End only use –MR1
For Both Ends –MR2

Also see Option Information on Page 1.8



Suffix Option -E ***Specifies Magnetic Piston and Dovetail Mounting Slot(s)***
Strokes are NOT affected by magnetic piston.

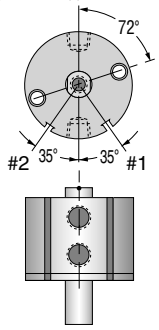
– Sensors Must be Ordered Separately
See Sensor Models Available page 1.14



1/4" 60° Dovetail Profile of Sensor & Mounting Slot.

2" (321) Bore

Sensors available for "AA"strokes and longer. Strokes AA – A are ported on opposite sides.



Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

Available on Original Series

	Stroke	Action XDR, XDRK
Sensor Slots at Positions #1 and # 2	1/4	AA
	3/8	A
	1/2	B
	3/4	C
	1	D
Sensor Slot at Position #1 only	1 1/2	E
	2	F
	3	G
	4	H

1

Model Number Code

Prefix Options	Stroke		Bore		Action		Suffix Options
Leave blank if none desired	C	–	521	–	X	–	MR

Metric M
See pages 1.7, 1.49 & 1.52

Bore	Code
2 1/2"	521
63.5mm	521

Standard Strokes

Original Series

Action	X XK XDR XDRK	O ODR	OP
Stroke			
1/8	AB	AB	AB
1/4	AA	AA	AA
1/2	A	A	A
3/4	B	B	B
1	C	C	C
1 1/2	D	D	–
2	E	–	–
3	F	–	–
4	G	–	–

"T" Series Includes PTFE piston bearing

Action	X XK	O	OP
Stroke			
1/4	TA	TA	TA
1/2	TB	TB	TB
3/4	TC	TC	TC
1 1/4	TD	TD	–
1 3/4	TE	–	–
2 3/4	TF	–	–
3 3/4	TG	–	–

Grey shading indicates sensors are not available.

Strokes are NOT affected by magnetic piston Option "E"

Action

Single rod

Double acting	-X
Double acting, Nonrotating Internal guide pins - 150 psi max	-XK
Single acting, spring retracted	-O
Single acting, spring extended	-OP

Double rod

Double acting	-XDR
Double acting, Nonrotating Internal guide pins - 150 psi max	-XDRK
Single acting, spring retracted	-ODR

See pages 1.5 & 1.6 for Action Information.
See pages 1.48 & 1.51 for Standard Specifications

HOW TO ORDER

1. Under ***Stroke*** – select letter(s) for desired Series and Stroke.
2. Under ***Bore*** – select **521** for 2 1/2" bore.
   Seven Other Bore Sizes are Available

Bore	Bore Code	See page
1/2"	5	1.17
3/4"	7	1.23
1 1/8"	121	1.29
1 5/8"	221	1.35
2"	321	1.41
3"	721	1.53
4"	1221	1.59

3. Under ***Action*** – select letter(s) for desired action.
4. Under ***Prefix & Suffix Options***– select letter(s) for desired options and add to model number.

EXAMPLES

A-521-X
Original Series, 1/2" stroke - 2 1/2" Bore - Single Rod, Double Acting

TC-521-X-MR
"T" Series, 3/4" Stroke - 2 1/2" Bore - Single Rod, Double Acting - Male Rod Thread

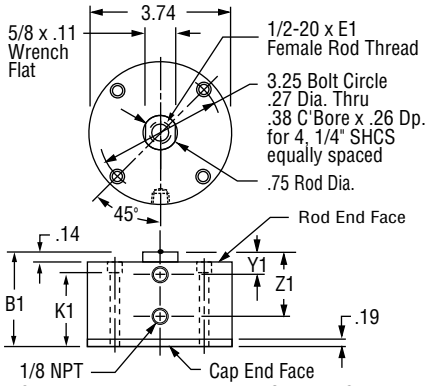
Suffix Options

Male rod thread: Single rod		-MR
Double rod, rod end		-MR
Double rod, cap end		-MR1
Double rod, both ends		-MR2
PTFE seals		-T
Viton seals		-V
Quad seals		-Q
External guide, nonrotating for load guiding (See page 1.65)		-G
Hydraulic: Standard cover		-H
Thick cover		-HHC
Air service: Thick cover		-HC
1/4 NPT ports		-P14
Hole thru double rod shaft: 5/32" hole		-16
Plus size: 1/4" hole 150 psi max		-25
Finish: **ProCoat**™ (Electroless Nickel)		-N
Stroke collar:	1/8"	-C1
1/4"	-C2	3/8" -C3
1/2"	-C4	5/8" -C5
3/4"	-C6	7/8" -C7
Sound limiters:	Rod end	-LF
	Cap end	-LR
	Both ends	-LFR
Rubber Bumpers:	Rod end	-BF
	Cap end	-BR
	Both ends	-BFR
Adjustable extend stroke (Full stroke adjustment is standard)		-AS
Adjustable retract stroke (Over 1" adjustment add desired length, e.g. -RS2)		-RS
Clevis mount:	Ports in-line with slot	-PM
	Ports 90° to slot	-SM
Magnetic piston & sensor mounting slot(s) Order sensors separately. See page 1.14. Stroke length determines number of mounting slots. See page 1.14, 1.50, 1.52		-E

See pages 1.3 – 1.15 for general option information and pages 1.49, 1.50 & 1.52 for option specifications of 2 1/2" bore models.

A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – http://www.fabco-air.com

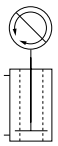
Action –X
Double Acting

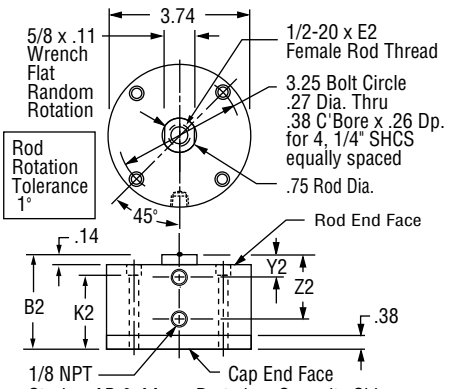


Strokes AB & AA are Ported on Opposite Sides

See page 1.16 for Mounting Bolts.
Push area = 4.91
Pull area = 4.47
Seal Kits for Series:
Original = 521-SK
"T" = 521-SKG

Action –XK
Double Acting
Nonrotating





Strokes AB & AA are Ported on Opposite Sides

See page 1.16 for Mounting Bolts.
Push area = 4.71
Pull area = 4.27
Seal Kits for Series:
Original = 521-SK-K
"T" = 521-SKG-K

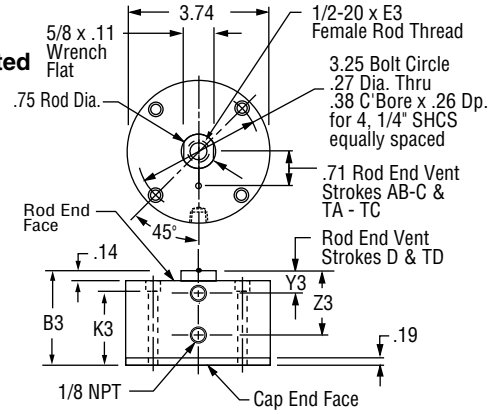
Original Series

Stroke, Inches	1/8	1/4	1/2	3/4	1	1 1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G
Action –X Double Acting									
B1	1.45	1.58	1.83	2.20	2.33	2.83	3.33	4.33	5.33
E1	.56	.63	.63	.88	.88	.88	.88	.88	.88
K1	1.05	1.18	1.43	1.80	1.93	2.43	2.93	3.93	4.93
Y1	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z1	.89	1.02	1.27	1.64	1.77	2.27	2.77	3.77	4.77
Weight, lb.	1.43	1.50	1.67	2.00	2.03	2.38	2.73	3.46	4.19
Action –XK Double Acting, Nonrotating									
B2	1.64	1.77	2.02	2.39	2.52	3.02	3.52	4.52	5.52
E2	.56	.63	.63	.88	.88	.88	.88	.88	.88
K2	1.24	1.37	1.62	1.99	2.12	2.62	3.12	4.12	5.12
Y2	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z2	.89	1.02	1.27	1.64	1.77	2.27	2.77	3.77	4.77
Weight, lb.	1.64	1.72	1.89	2.23	2.27	2.63	3.00	3.75	4.51
Action –O Single Acting, Spring Retracted									
B3	1.45	1.58	1.83	2.20	2.33	4.33	NA*	NA*	NA*
E3	.56	.63	.63	.88	.88	.88	NA*	NA*	NA*
K3	1.05	1.13	1.43	1.80	1.93	3.93	NA*	NA*	NA*
Y3	Rod End Face Vent					.64	NA*	NA*	NA*
Z3	.89	1.02	1.27	1.64	1.77	3.77	NA*	NA*	NA*
Weight,. lb.	1.38	1.46	1.62	1.94	1.96	3.60	NA*	NA*	NA*
Preload, lb.	12.0	6.2	7.0	5.0	4.7	7.3	NA*	NA*	NA*
End of Stroke, lb.	18.0	18.0	20.0	15.5	20.0	20.0	NA*	NA*	NA*
Action –OP Single Acting, Spring Extended									
B4	2.02	2.27	2.77	3.39	3.77	NA*	NA*	NA*	NA*
E4	.56	.63	.63	.88	.88	NA*	NA*	NA*	NA*
K4	1.49	1.62	1.87	2.24	2.37	NA*	NA*	NA*	NA*
Y4	.65	.77	1.02	1.40	1.64	NA*	NA*	NA*	NA*
Z4	1.02	1.27	1.77	2.39	2.77	NA*	NA*	NA*	NA*
Weight, lb.	1.91	1.98	2.16	2.49	2.51	NA*	NA*	NA*	NA*
Preload, lb.	6.2	2.5	5.5	5.0	5.2	NA*	NA*	NA*	NA*
End of Stroke, lb.	12.0	12.0	18.5	15.5	20.5	NA*	NA*	NA*	NA*

"T" Series

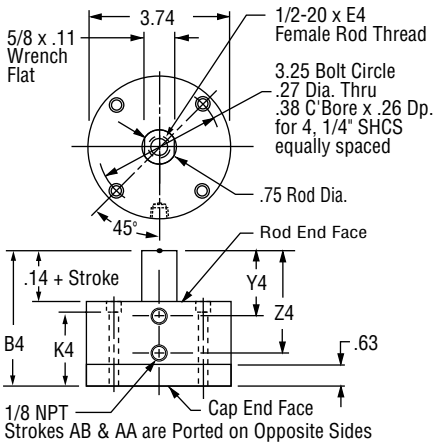
Stroke, Inches	1/4	1/2	3/4	1 1/4	1 3/4	2 3/4	3 3/4
Stroke, Letter	TA	TB	TC	TD	TE	TF	TG
Action –X Double Acting							
B1	1.83	2.20	2.33	2.83	3.33	4.33	5.33
E1	.63	.88	.88	.88	.88	.88	.88
K1	1.43	1.80	1.93	2.43	2.93	3.93	4.93
Y1	.52	.64	.64	.64	.64	.64	.64
Z1	1.27	1.64	1.77	2.27	2.77	3.77	4.77
Weight, lb.	1.89	2.22	2.25	2.60	2.95	3.68	4.41
Action –XK Double Acting, Nonrotating							
B2	2.02	2.39	2.52	3.02	3.52	4.52	5.52
E2	.63	.88	.88	.88	.88	.88	.88
K2	1.62	1.99	2.12	2.62	3.12	4.12	5.12
Y2	.52	.64	.64	.64	.64	.64	.64
Z2	1.27	1.64	1.77	2.27	2.77	3.77	4.77
Weight, lb.	2.11	2.45	2.50	2.85	3.22	4.00	4.73
Action –O Single Acting, Spring Retracted							
B3	1.83	2.20	2.33	4.33	NA*	NA*	NA*
E3	.63	.88	.88	.88	NA*	NA*	NA*
K3	1.43	1.80	1.93	3.93	NA*	NA*	NA*
Y3	Rod End Face Vent			.64	NA*	NA*	NA*
Z3	1.27	1.64	1.77	3.77	NA*	NA*	NA*
Weight,. lb.	1.84	2.16	2.18	3.82	NA*	NA*	NA*
Preload, lb.	13.1	10.6	8.0	9.5	NA*	NA*	NA*
End of Stroke, lb.	20.0	15.5	20.0	20.0	NA*	NA*	NA*
Action –OP Single Acting, Spring Extended							
B4	2.52	3.14	3.52	NA*	NA*	NA*	NA*
E4	.63	.88	.88	NA*	NA*	NA*	NA*
K4	1.87	2.24	2.37	NA*	NA*	NA*	NA*
Y4	.77	1.14	1.39	NA*	NA*	NA*	NA*
Z4	1.52	2.14	2.52	NA*	NA*	NA*	NA*
Weight, lb.	2.38	2.71	2.73	NA*	NA*	NA*	NA*
Preload, lb.	11.2	12.4	10.2	NA*	NA*	NA*	NA*
End of Stroke, lb.	18.5	21.1	22.6	NA*	NA*	NA*	NA*

Action –O
Single Acting
Spring Retracted



See page 1.16 for Mounting Bolts.
Push area = 4.91
See Chart for Spring Forces: Preload & End of Stroke
Seal Kits for Series:
Original = 521-SK
"T" = 521-SKG

Action –OP
Single Acting
Spring Extended



Strokes AB & AA are Ported on Opposite Sides

See page 1.16 for Mounting Bolts.
Pull area = 4.47
See Chart for Spring Forces: Preload & End of Stroke
Seal Kits for Series:
Original = 521-SK
"T" = 521-SKG

NA* = Not Available

1

Prefix Option -M Metric Cylinder & Rod Thread 63.5mm Bore
Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.7.

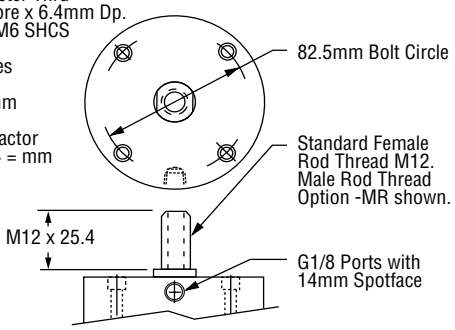
Original Series									
Stroke mm	3.2	6.4	12.7	19.1	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AB	AA	A	B	C	D	E	F	G

"T" Series							
Stroke mm	6.4	12.7	19.1	31.8	44.5	69.9	95.3
Stroke Letter	TA	TB	TC	TD	TE	TF	TG

Mounting Holes
6.7mm Diameter Thru
10.3mm C'Bore x 6.4mm Dp.
4 Places for M6 SHCS

Thread Pitches
M6 = 1.0mm
M12 = 1.75mm

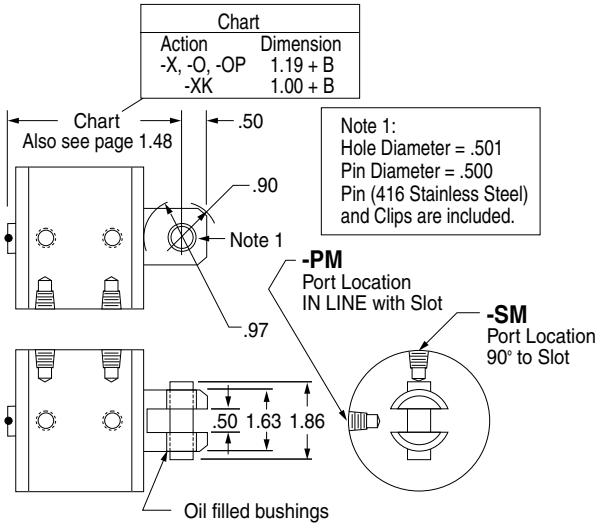
Conversion Factor
Inches x 25.4 = mm



The **Suffix Options** charted on the right are available on Original and "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.48.
– Also see Option Information on pages 1.7 thru 1.15.

	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	P14
-X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XK	NA	✓	✓	✓	✓	✓	NA	✓	NA	✓	✓	✓	✓
-O	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓
-OP	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓

Suffix Options -PM & -SM Clevis Mount
Available On Original and "T" Series
with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



RC-Chart Rod Clevis and Pin
Threaded Stud mates with Female Rod thread in the ***Pancake®*** Cylinders.
Slot and Pin Mate with EM-121 Eye Bracket shown below.

Materials:
Clevis – Steel, Black Oxide
Stud – Steel
Pin – 416 Stainless Steel
Pin & Clips are included

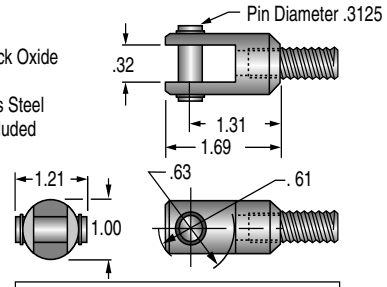
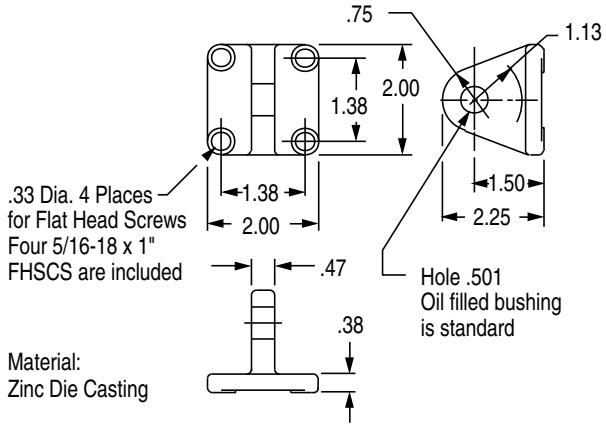
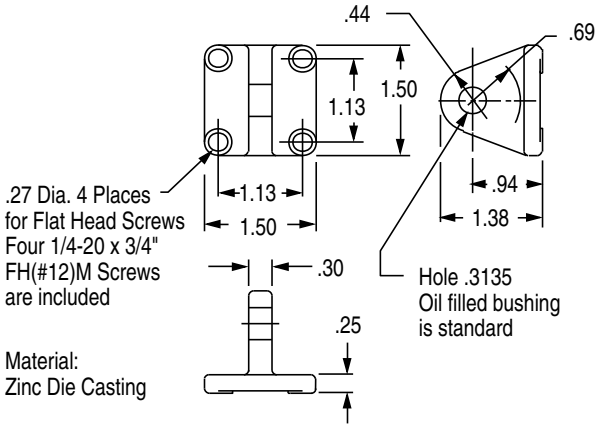


CHART 1/2-20 x Thread Length Metric M12 x Thread Length		
Rod Clevis Number	Strokes	Thread Length
RC-54 RC-56	AB AA–G	.39" .62"
MRC-54 MRC-56	MAB MAA–MG	9.9mm 15.7mm

EM-521 Eye Bracket Kit
Mates with Clevis Mount shown above.
Order separately.



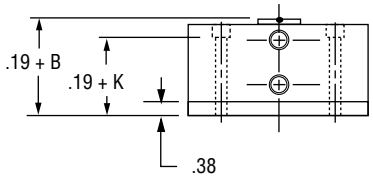
EM-121 Eye Bracket Kit
Mates with any Rod Clevis shown above.
Order separately.



Suffix Option -HHC Hydraulic & -HC Air

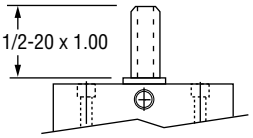
Available on Original and "T" Series with Action -X, -O.

Also see *Option Information* on page 1.9 for Pressure and Mounting details.



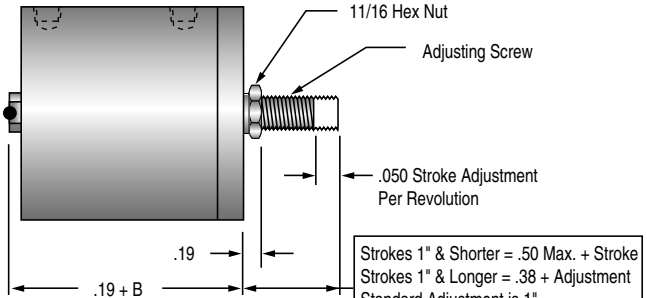
Suffix Option -MR Male Rod Thread

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP.
Also see *Option Information* on page 1.8.



Suffix Option -RS Adjustable Retract Stroke

Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.11.



(-XK only use B2 as shown on page 1.48. No additional length is required.)
(-OP Only use B4 as shown on page 1.48. No additional length is required.)

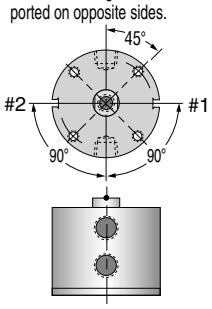
Suffix Option -E *Specifies Magnetic Piston and Dovetail Mounting Slot(s)*

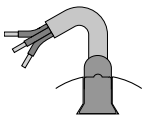
Strokes are NOT affected by magnetic piston.

– Sensors Must be Ordered Separately See Sensor Models Available page 1.14

2 1/2" (521) Bore

Sensors available for "AA" & "TA" strokes and longer. Stroke AA is ported on opposite sides.





1/4" 60° Dovetail Profile of Sensor & Mounting Slot.

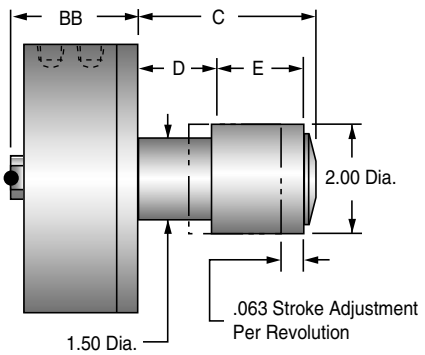
Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

	Available on Original Series		*Available on "T" Series*	
	Stroke	Action X, XK	Stroke	Action X, XK
Sensor Slots at Positions #1 and # 2	1/4	AA	1/4	TA
	1/2	A	1/2	TB
	3/4	B	3/4	TC
	1	C		
Sensor Slot at Position #1 only	1 1/2	D	1 1/4	TD
	2	E	1 3/4	TE
	3	F	2 3/4	TF
	4	G	3 3/4	TG

Suffix Option -AS Adjustable Extend Stroke

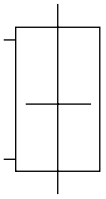
Available on Original Series with Actions: -X, -XK, -O
Also see *Option Information* on page 1.11.

Stroke Inches		1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke Letter		AB	AA	A	B	C	D	E	F	G
Actions: -X, -XK	BB	2.02	2.14	2.39	2.77	2.89	3.39	3.89	4.89	5.89
Actions:-O	BB	2.02	2.14	2.39	2.77	2.89	4.89	NA	NA	NA
	C	1.67	1.91	2.41	2.91	3.41	4.41	5.41	7.41	9.41
	D	0.63	0.75	1.00	1.25	1.50	2.00	2.50	3.50	4.50
	E	0.88	1.00	1.25	1.50	1.75	2.25	2.75	3.75	4.75



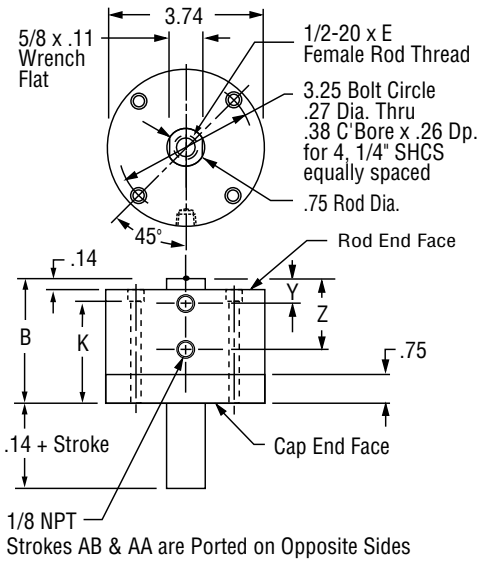
1

Action –XDR Original Series
Double Rod, Double Acting



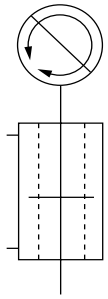
See page 1.16 for Mounting Bolts
Force Area = 4.47
Seal Kit = 521-SK

Stroke, Inches	1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G
B	2.02	2.14	2.39	2.77	2.89	3.39	3.89	4.89	5.89
E	.56	.63	.63	.88	.88	.88	.88	.88	.88
K	1.63	1.75	2.00	2.38	2.50	3.00	3.50	4.50	5.50
Y	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z	.89	1.02	1.27	1.64	1.77	2.27	2.77	3.77	4.77
Weight, lb.	2.20	2.29	2.48	2.82	2.83	3.28	3.67	4.60	5.40



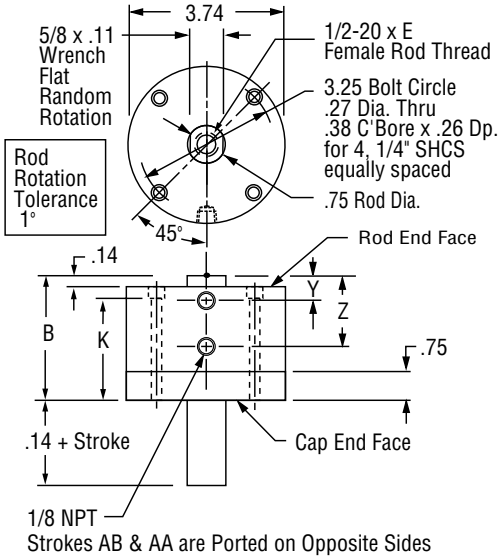
Strokes AB & AA are Ported on Opposite Sides

Action –XDRK Original Series
Double Rod, Double Acting, Nonrotating



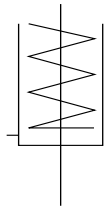
See page 1.16 for Mounting Bolts
Force Area = 4.27
Seal Kit = 521-SK-K

Stroke, Inches	1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G
B	2.02	2.14	2.39	2.77	2.89	3.39	3.89	4.89	5.89
E	.56	.63	.63	.88	.88	.88	.88	.88	.88
K	1.63	1.75	2.00	2.38	2.50	3.00	3.50	4.50	5.50
Y	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z	.89	1.02	1.27	1.64	1.77	2.27	2.77	3.77	4.77
Weight, lb.	2.34	2.43	2.63	2.97	2.99	3.45	3.85	4.79	5.62



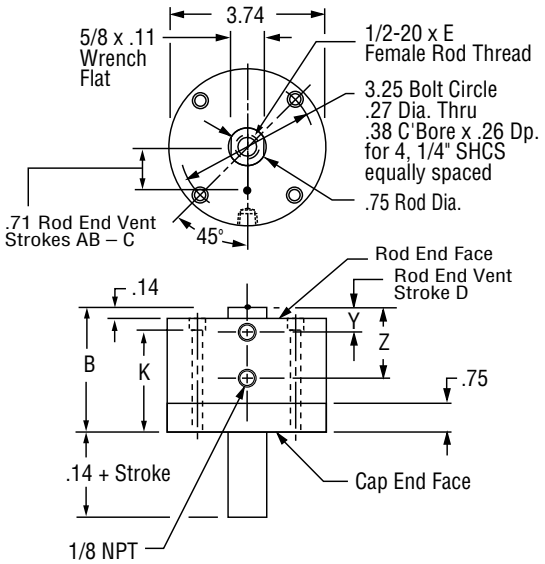
Strokes AB & AA are Ported on Opposite Sides

Action –ODR Original Series
Double Rod, Single Acting, Spring Retracted

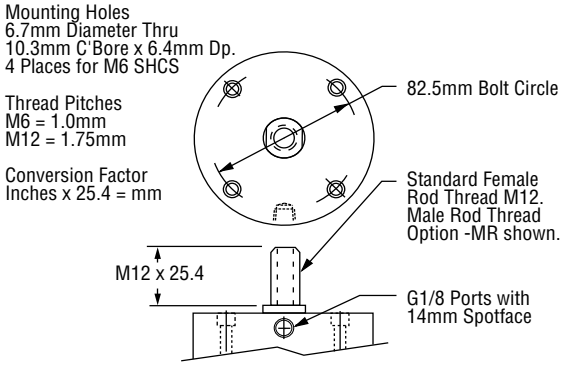


See page 1.16 for Mounting Bolts
Force Area = 4.47
Seal Kit = 521-SK

Stroke, Inches	1/8	1/4	1/2	3/4	1	1-1/2
Stroke, Letter	AB	AA	A	B	C	D
B	2.02	2.14	2.39	2.77	2.89	4.89
E	.56	.63	.63	.88	.88	.88
K	1.63	1.75	2.00	2.38	2.50	4.50
Y	Rod End Face Vent					.64
Z	.89	1.02	1.27	1.64	1.77	3.77
Weight, lb.	2.14	2.23	2.41	2.76	2.77	4.52
Spring Return Forces, lb.						
Preload	12.0	6.3	7.0	5.0	4.8	7.3
End of Stroke	18.0	18.0	20.0	15.5	20.0	20.0



Prefix Option -M Metric Cylinder & Rod Thread, 63.5mm Bore
Available on Original Series with Actions: -XDR, -XDRK, -ODR
Also see *Option Information* on page 1.7.



Stroke mm	3.2	6.4	12.7	19.1	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AB	AA	A	B	C	D	E	F	G

The **Suffix Options** charted on the right are available on Original Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.51. – *Also see Option Information on pages 1.7 thru 1.15.*

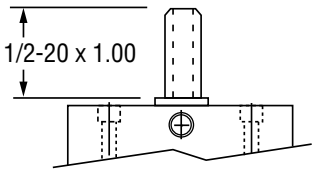
	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	P14	16	25
-XDR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	NA	✓	✓	✓	✓	✓	NA	✓	NA	✓	✓	✓	✓	✓	✓
-ODR	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓	✓	✓

Suffix Options -MR, -MR1, -MR2 Male Rod Thread

Available on Original Series with Actions -XDR, -XDRK, -ODR.

For Rod End only use **–MR**
For Cap End only use **–MR1**
For Both Ends use **–MR2**

Also see Option Information on Page 1.8.

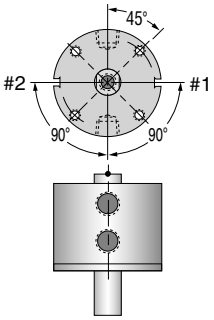


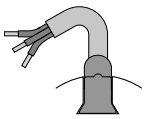
Suffix Option -E ***Specifies Magnetic Piston and Dovetail Mounting Slot(s)***
Strokes are NOT affected by magnetic piston.

– Sensors Must be Ordered Separately
See Sensor Models Available page 1.14

2 1/2" (521) Bore

Sensors available for "AA"strokes and longer.
Stroke AA is ported on opposite sides.





1/4" 60° Dovetail Profile of Sensor & Mounting Slot.

Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

Available on Original Series

	Stroke	Action XDR, XDRK
Sensor Slots at Positions #1 and # 2	1/4	AA
	1/2	A
	3/4	B
	1	C
Sensor Slot at Position #1 only	1 1/2	D
	2	E
	3	F
	4	G

1 Model Number Code

Prefix Options	Stroke		Bore		Action		Suffix Options
Leave blank if none desired	C	–	721	–	X	–	MR

Metric M
See pages 1.7, 1.55 & 1.58

Bore	Code
3"	721
76.2mm	721

Standard Strokes

Original Series

Action	X XK XDR XDRK	O ODR	OP
Stroke			
1/8	AB	AB	AB
1/4	AA	AA	AA
1/2	A	A	A
3/4	B	B	B
1	C	C	C
1 1/2	D	D	–
2	E	–	–
3	F	–	–
4	G	–	–

"T" Series Includes PTFE piston bearing

Action	X XK	O	OP
Stroke			
1/4	TA	TA	TA
1/2	TB	TB	TB
3/4	TC	TC	TC
1 1/4	TD	TD	–
1 3/4	TE	–	–
2 3/4	TF	–	–
3 3/4	TG	–	–

Grey shading indicates sensors are not available.

Strokes are NOT affected by magnetic piston Option "E"

Action

Single rod

Double acting	-X
Double acting, Nonrotating Internal guide pins - 150 psi max	-XK
Single acting, spring retracted	-O
Single acting, spring extended	-OP

Double rod

Double acting	-XDR
Double acting, Nonrotating Internal guide pins - 150 psi max	-XDRK
Single acting, spring retracted	-ODR

See pages 1.5 & 1.6 for Action Information.
See pages 1.54 & 1.57 for Standard Specifications

HOW TO ORDER

1. Under ***Stroke*** – select letter(s) for desired Series and Stroke.
2. Under ***Bore*** – select **721** for 3" bore.

Seven Other Bore Sizes are Available

Bore	Bore Code	See page
1/2"	5	1.17
3/4"	7	1.23
1 1/8"	121	1.29
1 5/8"	221	1.35
2"	321	1.41
2 1/2"	521	1.47
4"	1221	1.59

3. Under ***Action*** – select letter(s) for desired action.
4. Under ***Prefix & Suffix Options***– select letter(s) for desired options and add to model number.

EXAMPLES

A-721-X
Original Series, 1/2" stroke - 3" Bore - Single Rod, Double Acting

TC-721-X-MR
"T" Series, 3/4" Stroke - 3" Bore - Single Rod, Double Acting - Male Rod Thread

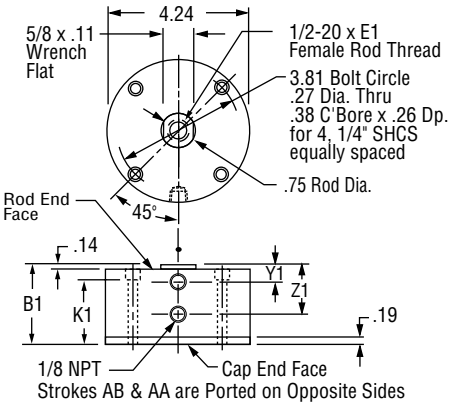
Suffix Options

Male rod thread: Single rod	-MR
Double rod, rod end	-MR
Double rod, cap end	-MR1
Double rod, both ends	-MR2
PTFE seals	-T
Viton seals	-V
Quad seals	-Q
External guide, nonrotating for load guiding (See page 1.65)	-G
Hydraulic:	
Standard cover	-H
Thick cover	-HHC
Air service:	
Thick cover	-HC
1/4 NPT ports	-P14
Hole thru double rod shaft: 5/32" hole	-16
Plus size: 1/4" hole 150 psi max	-25
Finish: **ProCoat**™ (Electroless Nickel)	-N
Stroke collar: 1/4" -C2, 1/2" -C4, 3/4" -C6, 1/8" -C1, 3/8" -C3, 5/8" -C5, 7/8" -C7	
Sound limiters: Rod end -LF, Cap end -LR, Both ends -LFR	
Rubber Bumpers: Rod end -BF, Cap end -BR, Both ends -BFR	
Adjustable extend stroke (Full stroke adjustment is standard)	-AS
Adjustable retract stroke (Over 1" adjustment add desired length, e.g. -RS2)	-RS
Clevis mount: Ports in-line with slot	-PM
Ports 90° to slot	-SM
Magnetic piston & sensor mounting slot(s) Order sensors separately. See page 1.14. Stroke length determines number of mounting slots. See page 1.14, 1.56, 1.58	-E

See pages 1.3 – 1.15 for general option information and pages 1.55 , 1.56 & 1.58 for option specifications of 3" bore models.

A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – http://www.fabco-air.com

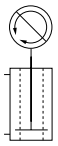
Action –X Double Acting

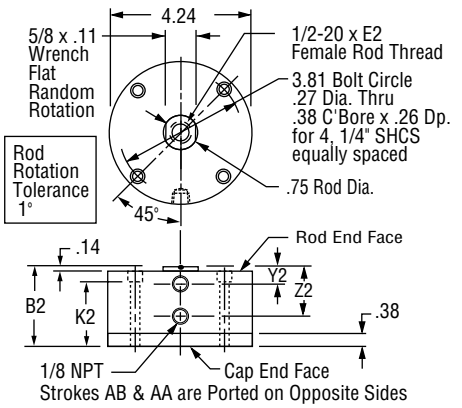


Strokes AB & AA are Ported on Opposite Sides

See page 1.16 for Mounting Bolts.
Push area = 7.07
Pull area = 6.63
Seal Kits for Series:
Original = 721-SK
"T" = 721-SKG

Action –XK Double Acting Nonrotating





Strokes AB & AA are Ported on Opposite Sides

See page 1.16 for Mounting Bolts.
Push area = 6.87
Pull area = 6.43
Seal Kits for Series:
Original = 721-SK-K
"T" = 721-SKG-K

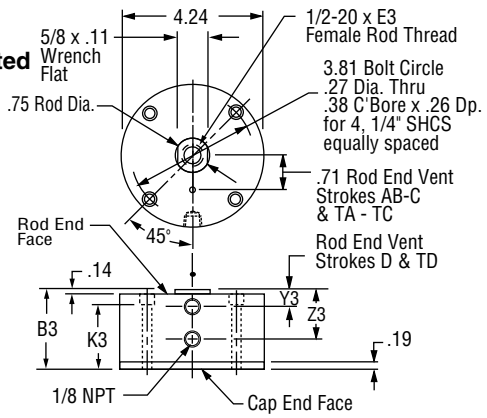
Original Series

Stroke, Inches	1/8	1/4	1/2	3/4	1	1 1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G
Action –X Double Acting									
B1	1.52	1.64	1.89	2.14	2.39	2.89	3.39	4.39	5.39
E1	.63	.63	.63	.88	.88	.88	.88	.88	.88
K1	1.12	1.24	1.49	1.74	1.99	2.49	2.99	3.99	4.99
Y1	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z1	.95	1.08	1.33	1.58	1.83	2.33	2.83	3.83	4.83
Weight, lb.	1.89	1.97	2.18	2.36	2.57	2.98	3.28	4.22	5.03
Action –XK Double Acting, Nonrotating									
B2	1.71	1.83	2.08	2.33	2.58	3.08	3.58	4.58	5.58
E2	.63	.63	.63	.88	.88	.88	.88	.88	.88
K2	1.31	1.43	1.68	1.93	2.18	2.68	3.18	4.18	5.18
Y2	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z2	.95	1.08	1.33	1.58	1.83	2.33	2.83	3.83	4.83
Weight, lb.	2.15	2.24	2.45	2.64	2.86	3.28	3.59	4.56	5.40
Action –O Single Acting, Spring Retracted									
B3	1.52	1.64	1.89	2.14	2.39	4.39	NA*	NA*	NA*
E3	.63	.63	.63	.88	.88	.88	NA*	NA*	NA*
K3	1.12	1.24	1.49	1.74	1.99	3.99	NA*	NA*	NA*
Y3	Rod End Face Vent					.64	NA*	NA*	NA*
Z3	.95	1.08	1.33	1.58	1.83	3.83	NA*	NA*	NA
Weight,. lb.	1.20	1.92	2.11	2.29	2.51	4.36	NA*	NA*	NA*
Preload, lb.	12.0	12.0	6.5	5.0	4.7	7.3	NA*	NA*	NA*
End of Stroke, lb.	18.0	18.5	15.5	15.5	20.0	20.0	NA*	NA*	NA*
Action –OP Single Acting, Spring Extended									
B4	2.08	2.33	2.83	3.33	3.83	NA*	NA*	NA*	NA*
E4	.63	.63	.63	.88	.88	NA*	NA*	NA*	NA*
K4	1.55	1.68	1.93	2.18	2.43	NA*	NA*	NA*	NA*
Y4	.65	.77	1.02	1.39	1.64	NA*	NA*	NA*	NA*
Z4	1.08	1.33	1.83	2.33	2.83	NA*	NA*	NA*	NA*
Weight, lb.	2.49	2.60	2.69	2.99	3.20	NA*	NA*	NA*	NA*
Preload, lb.	6.2	12.0	6.5	5.0	5.2	NA*	NA*	NA*	NA*
End of Stroke, lb.	12.0	18.5	15.5	15.5	20.5	NA*	NA*	NA*	NA*

"T" Series

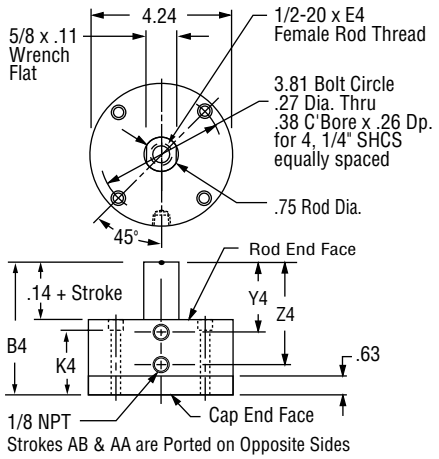
Stroke, Inches	1/4	1/2	3/4	1 1/4	1 3/4	2 3/4	3 3/4
Stroke, Letter	TA	TB	TC	TD	TE	TF	TG
Action –X Double Acting							
B1	1.89	2.14	2.39	2.89	3.39	4.39	5.39
E1	.63	.88	.88	.88	.88	.88	.88
K1	1.49	1.74	1.99	2.49	2.99	3.99	4.99
Y1	.52	.64	.64	.64	.64	.64	.64
Z1	1.33	1.58	1.83	2.33	2.83	3.83	4.83
Weight, lb.	2.49	2.68	2.89	3.30	3.70	4.54	5.40
Action –XK Double Acting, Nonrotating							
B2	2.08	2.33	2.58	3.08	3.58	4.58	5.58
E2	.63	.88	.88	.88	.88	.88	.88
K2	1.68	1.93	2.18	2.68	3.18	4.18	5.18
Y2	.52	.64	.64	.64	.64	.64	.64
Z2	1.33	1.58	1.83	2.33	2.83	3.83	4.83
Weight, lb.	2.77	2.96	3.18	3.60	3.91	4.88	5.72
Action –O Single Acting, Spring Retracted							
B3	1.89	2.14	2.39	4.39	NA*	NA*	NA*
E3	.63	.88	.88	.88	NA*	NA*	NA*
K3	1.49	1.74	1.99	3.99	NA*	NA*	NA*
Y3	Rod End Face Vent			.64	NA*	NA*	NA*
Z3	1.33	1.58	1.83	3.83	NA*	NA*	NA*
Weight,. lb.	2.43	2.61	2.83	4.68	NA*	NA*	NA*
Preload, lb.	11.7	10.6	7.9	9.5	NA*	NA*	NA*
End of Stroke, lb.	17.0	19.3	20.0	20.0	NA*	NA*	NA*
Action –OP Single Acting, Spring Extended							
B4	2.58	3.08	3.58	NA*	NA*	NA*	NA*
E4	.63	.88	.88	NA*	NA*	NA*	NA*
K4	1.93	2.18	2.43	NA*	NA*	NA*	NA*
Y4	.77	1.14	1.39	NA*	NA*	NA*	NA*
Z4	1.58	2.08	2.58	NA*	NA*	NA*	NA*
Weight, lb.	3.01	3.31	3.52	NA*	NA*	NA*	NA*
Preload, lb.	11.7	10.6	8.5	NA*	NA*	NA*	NA*
End of Stroke, lb.	17.1	19.3	20.8	NA*	NA*	NA*	NA*

Action –O Single Acting Spring Retracted



See page 1.16 for Mounting Bolts.
Push area = 7.07
See Chart for Spring Forces: Preload & End of Stroke
Seal Kits for Series:
Original = 721-SK
"T" = 721-SKG

Action –OP Single Acting Spring Extended



Strokes AB & AA are Ported on Opposite Sides

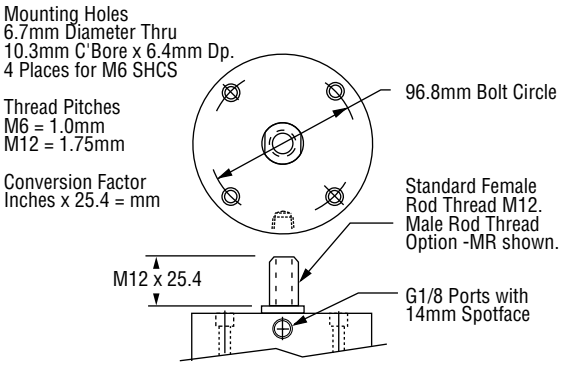
See page 1.16 for Mounting Bolts.
Pull area = 6.63
See Chart for Spring Forces: Preload & End of Stroke
Seal Kits for Series:
Original = 721-SK
"T" = 721-SKG

1

Prefix Option -M Metric Cylinder & Rod Thread 76.2mm Bore
Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.7.

Original Series									
Stroke mm	3.2	6.4	12.7	19.1	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AB	AA	A	B	C	D	E	F	G

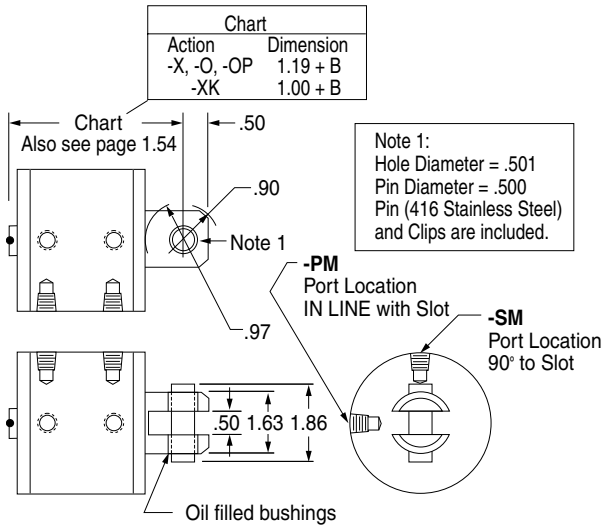
"T" Series							
Stroke mm	6.4	12.7	19.1	31.8	44.5	69.9	95.3
Stroke Letter	TA	TB	TC	TD	TE	TF	TG



The **Suffix Options** charted on the right are available on Original and "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.54.
– Also see Option Information on pages 1.7 thru 1.15.

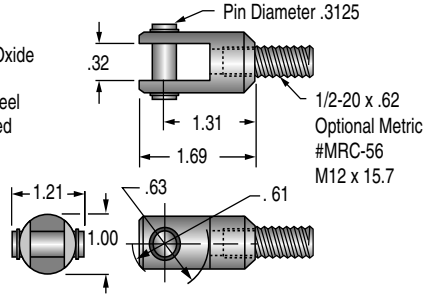
	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	P14
-X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XK	NA	✓	✓	✓	✓	✓	NA	✓	NA	✓	✓	✓	✓
-O	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓
-OP	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓

Suffix Options -PM & -SM Clevis Mount
Available on Original and "T" Series
with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.

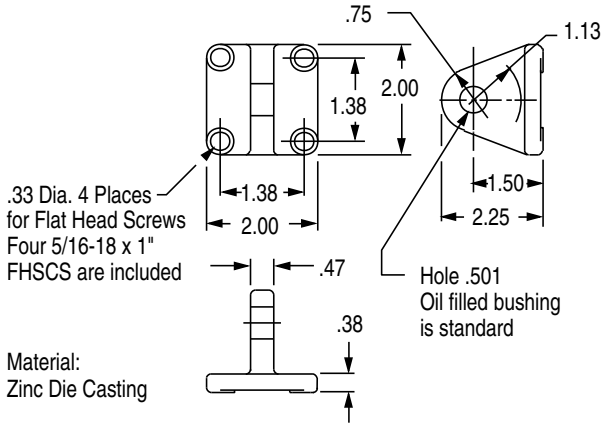


RC-56 Rod Clevis and Pin
Threaded Stud mates with Female Rod thread in the ***Pancake®*** Cylinders.
Slot and Pin Mate with EM-121 Eye Bracket shown on the right.

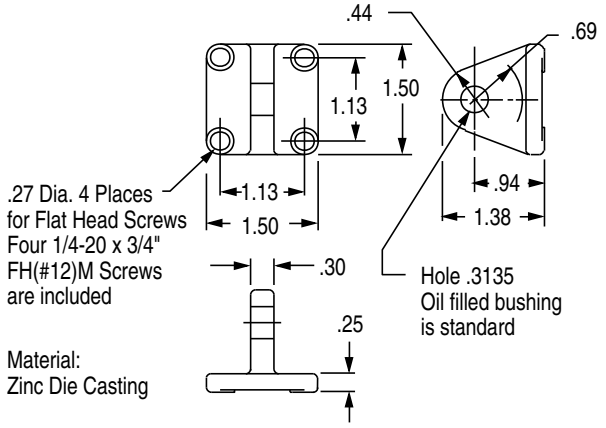
Materials:
Clevis – Steel, Black Oxide
Stud – Steel
Pin – 416 Stainless Steel
Pin & Clips are included



EM-521 Eye Bracket Kit
Mates with Clevis Mount shown on the left.
Order separately.

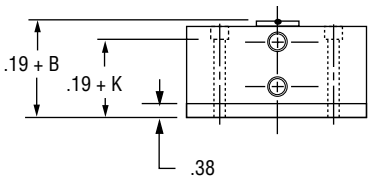


EM-121 Eye Bracket Kit
Mates with RC-56 Rod Clevis shown on the left.
Order separately.

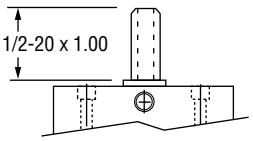


Suffix Option -HHC Hydraulic & -HC Air
Available on Original and "T" Series with Action -X, -O.

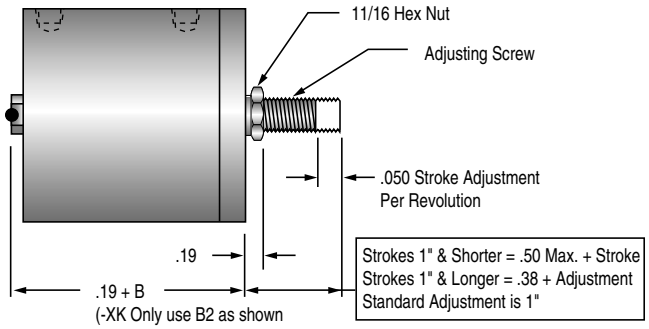
Also see *Option Information* on page 1.9 for Pressure and Mounting details.



Suffix Option -MR Male Rod Thread
Available on Original and "T" Series with Actions: -X, -XK, -O, -OP.
Also see *Option Information* on page 1.8.



Suffix Option -RS Adjustable Retract Stroke
Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.11.



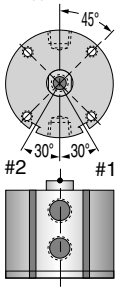
(-XK Only use B2 as shown on page 1.54. No additional length is required.)
(-OP Only use B4 as shown on page 1.54. No additional length is required.)

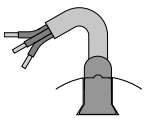
Suffix Option -E ***Specifies Magnetic Piston and Dovetail Mounting Slot(s)***
Strokes are NOT affected by magnetic piston.

– Sensors Must be Ordered Separately See Sensor Models Available page 1.14

3" (721) Bore

Sensors available for "AA" & "TA" strokes and longer. Stroke AA is ported on opposite sides.





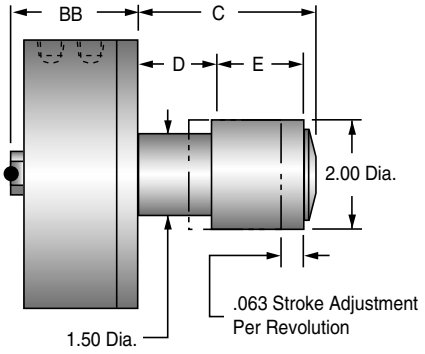
1/4" 60° Dovetail Profile of Sensor & Mounting Slot.

Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

	Available on Original Series Stroke	Action X, XK	*Available on "T" Series* Stroke	Action X, XK
Sensor Slots at Positions #1 and # 2	1/4	AA	1/4	TA
	1/2	A	1/2	TB
	3/4	B	3/4	TC
	1	C		
Sensor Slot at Position #1 only	1 1/2	D	1 1/4	TD
	2	E	1 3/4	TE
	3	F	2 3/4	TF
	4	G	3 3/4	TG

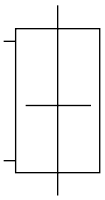
Suffix Option -AS Adjustable Extend Stroke
Available on Original Series with Actions: -X, -XK, -O
Also see *Option Information* on page 1.11.

Stroke Inches		1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke Letter		AB	AA	A	B	C	D	E	F	G
Actions: -X, -XK	BB	2.08	2.20	2.45	2.70	2.95	3.45	3.95	4.95	5.95
Actions:-O	BB	2.08	2.20	2.45	2.70	2.95	4.95	NA	NA	NA
	C	1.67	1.91	2.41	2.91	3.41	4.41	5.41	7.41	9.41
	D	0.63	0.75	1.00	1.25	1.50	2.00	2.50	3.50	4.50
	E	0.88	1.00	1.25	1.50	1.75	2.25	2.75	3.75	4.75



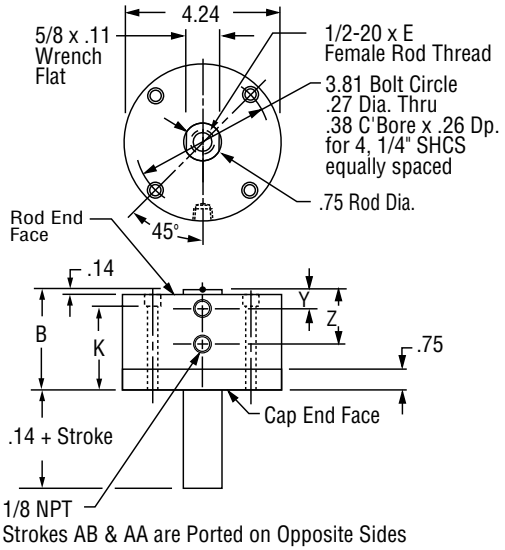
1

Action –XDR Original Series
Double Rod, Double Acting



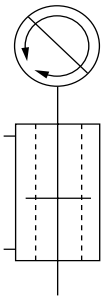
See page 1.16 for Mounting Bolts
Force Area = 6.63
Seal Kit = 721-SK

Stroke, Inches	1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G
B	2.08	2.20	2.45	2.70	2.95	3.45	3.95	4.95	5.95
E	.63	.63	.63	.88	.88	.88	.88	.88	.88
K	1.68	1.80	2.10	2.30	2.55	3.10	3.55	4.55	5.55
Y	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z	.95	1.08	1.33	1.58	1.83	2.33	2.83	3.83	4.83
Weight, lb.	2.84	2.95	3.16	3.39	3.61	4.09	4.53	5.50	6.47



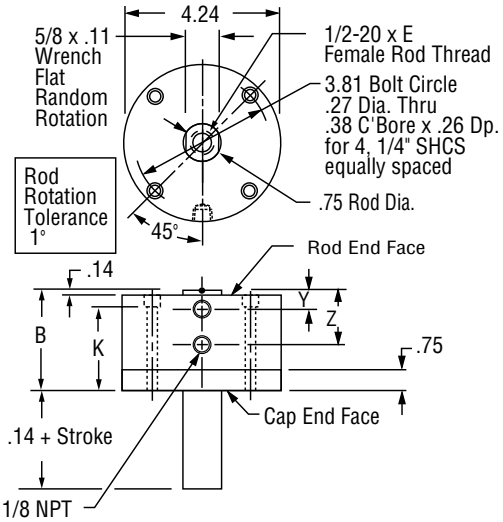
Strokes AB & AA are Ported on Opposite Sides

Action –XDRK Original Series
Double Rod, Double Acting, Nonrotating



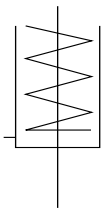
See page 1.16 for Mounting Bolts
Force Area = 6.43
Seal Kit = 721-SK-K

Stroke, Inches	1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G
B	2.08	2.20	2.45	2.70	2.95	3.45	3.95	4.95	5.95
E	.63	.63	.63	.88	.88	.88	.88	.88	.88
K	1.68	1.80	2.10	2.30	2.55	3.10	3.55	4.55	5.55
Y	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z	.95	1.08	1.33	1.58	1.83	2.33	2.83	3.83	4.83
Weight, lb.	3.10	3.21	3.43	3.67	3.90	4.39	4.84	5.84	6.84



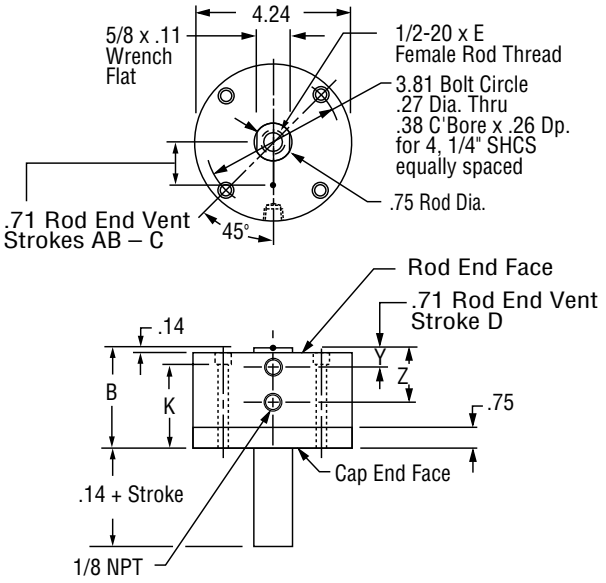
Strokes AB & AA are Ported on Opposite Sides

Action –ODR Original Series
Double Rod, Single Acting, Spring Retracted



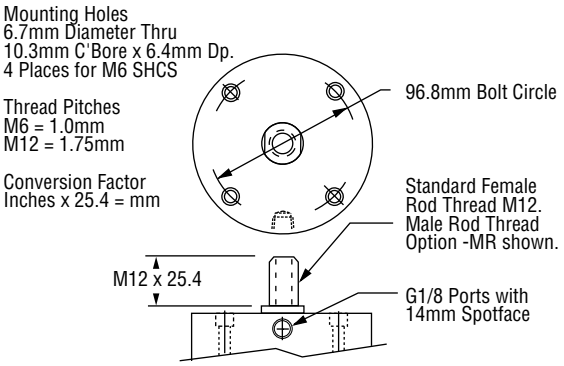
See page 1.16 for Mounting Bolts
Force Area = 6.63
Seal Kit = 721-SK

Stroke, Inches	1/8	1/4	1/2	3/4	1	1-1/2
Stroke, Letter	AB	AA	A	B	C	D
B	2.08	2.20	2.45	2.70	2.95	4.95
E	.63	.63	.63	.88	.88	.88
K	1.68	1.80	2.10	2.30	2.55	4.55
Y	Rod End Face Vent					.64
Z	.95	1.08	1.33	1.58	1.83	3.83
Weight, lb.	2.77	2.88	3.10	3.31	3.54	5.64
Spring Return Forces, lb.						
Preload	12.0	12.0	6.5	5.0	4.7	7.3
End of Stroke	18.0	18.5	15.5	15.5	20.0	20.0



Prefix Option -M Metric Cylinder & Rod Thread, 76.2mm Bore
Available on Original Series with Actions: -XDR, -XDRK, -ODR
Also see *Option Information* on page 1.7.

Stroke mm	3.2	6.4	12.7	19.1	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AB	AA	A	B	C	D	E	F	G



The **Suffix Options** charted on the right are available on Original Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.57. – *Also see Option Information on pages 1.7 thru 1.15.*

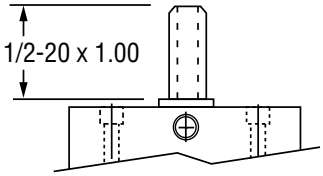
	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	P14	16	25
-XDR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	NA	✓	✓	✓	✓	✓	NA	✓	NA	✓	✓	✓	✓	✓	✓
-ODR	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓	✓	✓

Suffix Options -MR, -MR1, -MR2 Male Rod Thread

Available on Original Series with Actions -XDR, -XDRK, -ODR.

For Rod End only use –MR
For Cap End only use –MR1
For Both Ends –MR2

Also see Option Information on Page 1.8

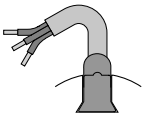


Suffix Option -E ***Specifies Magnetic Piston and Dovetail Mounting Slot(s)***
Strokes are NOT affected by magnetic piston.

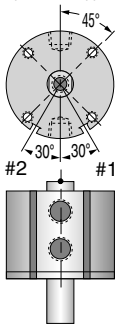
– Sensors Must be Ordered Separately
See Sensor Models Available page 1.14

3" (721) Bore

Sensors available for "AA"strokes and longer.
Stroke AA is ported on opposite sides.



1/4" 60° Dovetail Profile of Sensor & Mounting Slot.



Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

Available on Original Series

	Stroke	Action XDR, XDRK
Sensor Slots at Positions #1 and # 2	1/4	AA
	1/2	A
	3/4	B
	1	C
Sensor Slot at Position #1 only	1 1/2	D
	2	E
	3	F
	4	G

1 Model Number Code

Prefix Options	Stroke		Bore		Action	Suffix Options
Leave blank if none desired	D	–	1221	–	X	– MR

Metric M
See pages 1.7, 1.61 & 1.64

Bore	Code
4"	1221
101.6mm	1221

Standard Strokes

Original Series

Action	X XK XDR XDRK
Stroke	
1/8	AC
1/4	AB
1/2	AA
1	A
1 1/2	B
2	C
3	D
4	E

"T" Series Includes PTFE piston bearing

Action	X XK
Stroke	
5/16	TAA
13/16	TA
1 5/16	TB
1 13/16	TC
2 13/16	TD
3 13/16	TE

Grey shading indicates sensors are not available.

Strokes are NOT affected by magnetic piston Option "E"

Action

Single rod

Double acting	**-X**
Double acting, Nonrotating Internal guide pins - 150 psi max	**-XK**

Double rod

Double acting	**-XDR**
Double acting, Nonrotating Internal guide pins - 150 psi max	**-XDRK**

See pages 1.5 & 1.6 for Action Information.
See pages 1.60 & 1.63 for Standard Specifications

HOW TO ORDER

1. Under ***Stroke*** – select letter(s) for desired Series and Stroke.
2. Under ***Bore*** – select **1221** for 4" bore.
   Seven Other Bore Sizes are Available

Bore	Bore Code	See page
1/2"	5	1.17
3/4"	7	1.23
1 1/8"	121	1.29
1 5/8"	221	1.35
2"	321	1.41
2 1/2"	521	1.47
3"	721	1.53

3. Under ***Action*** – select letter(s) for desired action.
4. Under ***Prefix & Suffix Options***– select letter(s) for desired options and add to model number.

EXAMPLES

D-1221-X
Original Series, 3" stroke - 4" Bore - Single Rod, Double Acting

TD-1221-X-MR
"T" Series, 2 13/16" Stroke - 4" Bore - Single Rod, Double Acting - Male Rod Thread

Suffix Options

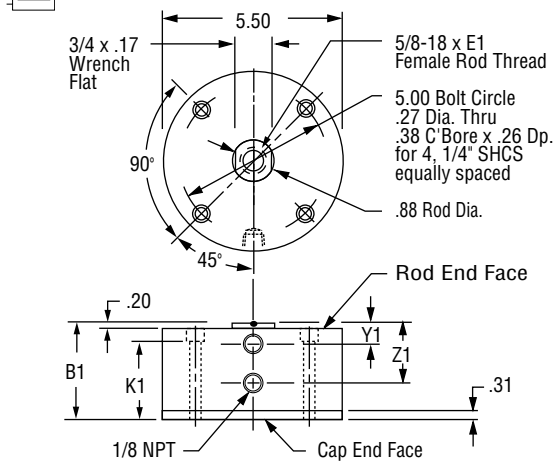
Male rod thread: Single rod	**-MR**		
Double rod, rod end	**-MR**		
Double rod, cap end	**-MR1**		
Double rod, both ends	**-MR2**		
PTFE seals	**-T**		
Viton seals	**-V**		
Quad seals	**-Q**		
External guide, nonrotating for load guiding (See page 1.65)	**-G**		
Hydraulic:			
Standard cover	**-H**		
Thick cover	**-HHC**		
Air service:			
Thick cover	**-HC**		
1/4 NPT ports	**-P14**		
Hole thru double rod shaft: 1/4" hole 150 psi max	**-25**		
Finish: **ProCoat**™ (Electroless Nickel)	**-N**		
Stroke collar:		1/8"	**-C1**
1/4"	**-C2**	3/8"	**-C3**
1/2"	**-C4**	5/8"	**-C5**
3/4"	**-C6**	7/8"	**-C7**
Sound limiters:	Rod end **-LF**	Cap end **-LR**	Both ends **-LFR**
Rubber Bumpers:	Rod end **-BF**	Cap end **-BR**	Both ends **-BFR**
Adjustable extend stroke (Full stroke adjustment is standard)	**-AS**		
Adjustable retract stroke (Over 1" adjustment add desired length, e.g. -RS2)	**-RS**		
Clevis mount: Ports in-line with slot	**-PM**		
Ports 90° to slot	**-SM**		
Magnetic piston & sensor mounting slot(s) Order sensors separately. See page 1.14. Stroke length determines number of mounting slots. See page 1.14, 1.62, 1.64	**-E**		

See pages 1.3 – 1.15 for general option information and pages 1.61, 1.62 & 1.64 for option specifications of 4" bore models.

A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – http://www.fabco-air.com

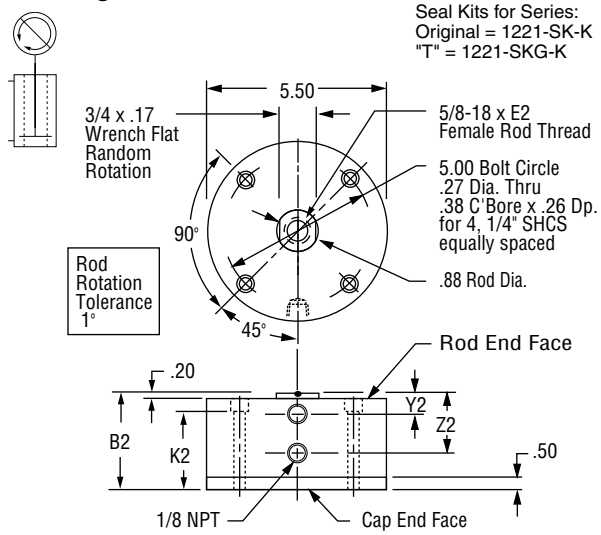
Action –X
Double Acting

See page 1.16 for Mounting Bolts.
Push area = 12.57
Pull area = 11.97
Seal Kits for Series:
Original = 1221-SK
"T" = 1221-SKG



Action –XK
Double Acting
Nonrotating

See page 1.16 for Mounting Bolts.
Push area = 12.47
Pull area = 11.87
Seal Kits for Series:
Original = 1221-SK-K
"T" = 1221-SKG-K



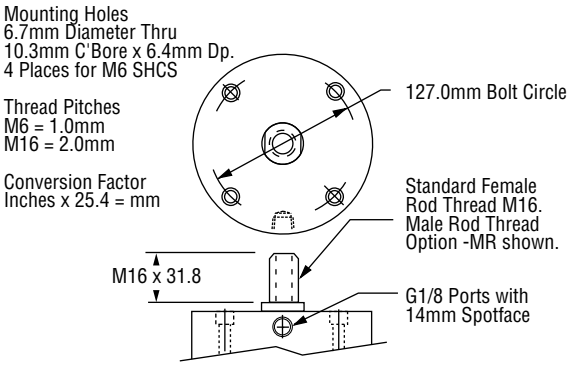
	Original Series								"T" Series					
Stroke, Inches	1/8	1/4	1/2	1	1 1/2	2	3	4	5/16	13/16	1 5/16	1 13/16	2 13/16	3 13/16
Stroke, Letter	AC	AB	AA	A	B	C	D	E	TAA	TA	TB	TC	TD	TE
	Action –X Double Acting								**Action –X Double Acting**					
B1	1.89	2.02	2.27	2.77	3.27	3.77	4.77	5.77	2.27	2.77	3.27	3.77	4.77	5.77
E1	.50	.50	.75	.88	.88	.88	.88	.88	.75	.88	.88	.88	.88	.88
K1	1.43	1.56	1.81	2.31	2.81	3.31	4.31	5.31	1.81	2.31	2.81	3.31	4.31	5.31
Y1	.58	.58	.70	.70	.70	.70	.70	.70	.70	.70	.70	.70	.70	.70
Z1	1.20	1.33	1.58	2.08	2.58	3.08	4.08	5.08	1.58	2.08	2.58	3.08	4.08	5.08
Weight, lb.	3.88	4.01	4.34	4.91	5.63	6.22	7.53	8.84	5.04	5.61	6.33	6.92	8.23	9.54
	Action –XK Double Acting, Nonrotating								**Action –XK Double Acting, Nonrotating**					
B2	2.08	2.21	2.46	2.96	3.46	3.96	4.96	5.96	2.46	2.96	3.46	3.96	4.96	5.96
E2	.50	.50	.75	.88	.88	.88	.88	.88	.75	.88	.88	.88	.88	.88
K2	1.62	1.75	2.00	2.50	3.00	3.50	4.50	5.50	2.00	2.50	3.00	3.50	4.50	5.50
Y2	.58	.58	.70	.70	.70	.70	.70	.70	.70	.70	.70	.70	.70	.70
Z2	1.20	1.33	1.58	2.08	2.58	3.08	4.08	5.08	1.58	2.08	2.58	3.08	4.08	5.08
Weight, lb.	4.31	4.44	4.78	5.36	6.10	6.70	8.04	9.38	5.48	6.06	6.80	7.50	8.74	10.08

1

Prefix Option -M Metric Cylinder & Rod Thread 101.6mm Bore
Available on Original and "T" Series with Actions: -X, -XK
Also see *Option Information* on page 1.7.

Original Series								
Stroke mm	3.2	6.4	12.7	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AC	AB	AA	A	B	C	D	E

"T" Series						
Stroke mm	7.9	20.6	33.3	46.0	71.4	96.7
Stroke Letter	TAA	TA	TB	TC	TD	TE

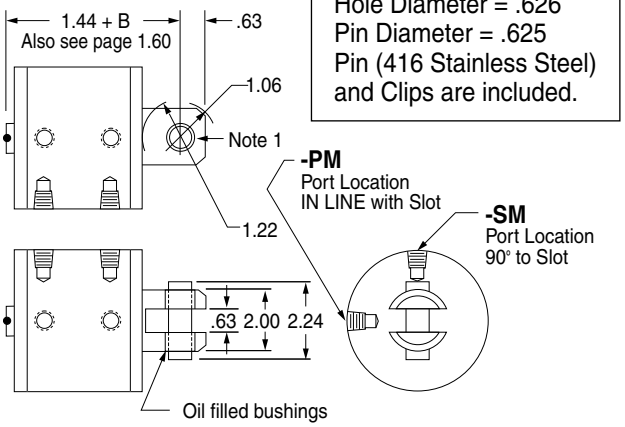


The **Suffix Options** charted on the right are available on Original and "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.60.
– Also see Option Information on pages 1.7 thru 1.15.

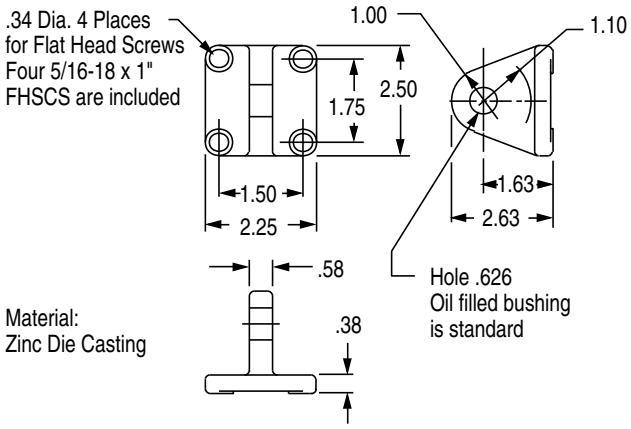
	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	P14
-X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XK	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Suffix Options -PM & -SM Clevis Mount
Available on Original and "T" Series with Actions: -X, -XK
Also see *Option Information* on page 1.13.

Note 1:
Hole Diameter = .626
Pin Diameter = .625
Pin (416 Stainless Steel) and Clips are included.

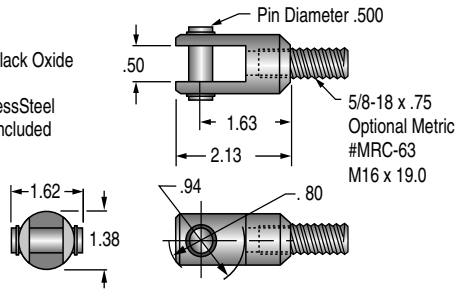


EM-1221 Eye Bracket Kit
Mates with Clevis Mount shown on the left.
Order separately.

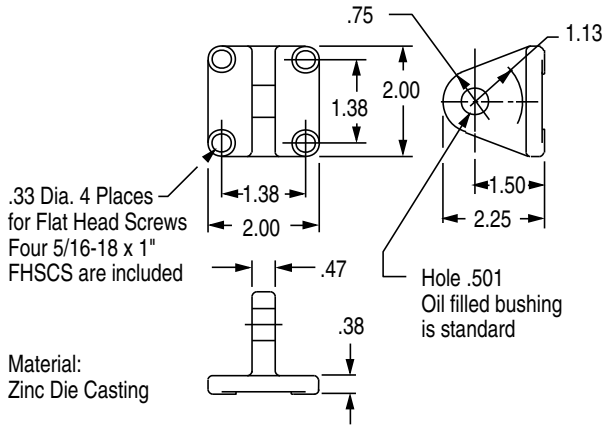


RC-63 Rod Clevis and Pin
Threaded Stud mates with Female Rod thread in the ***Pancake®*** Cylinders.
Slot and Pin Mate with EM-521 Eye Bracket shown on the right.

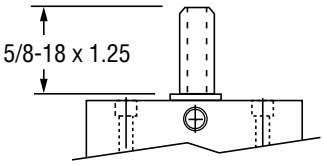
Materials:
Clevis – Steel, Black Oxide
Stud – Steel
Pin – 416 StainlessSteel
Pin & Clips are included



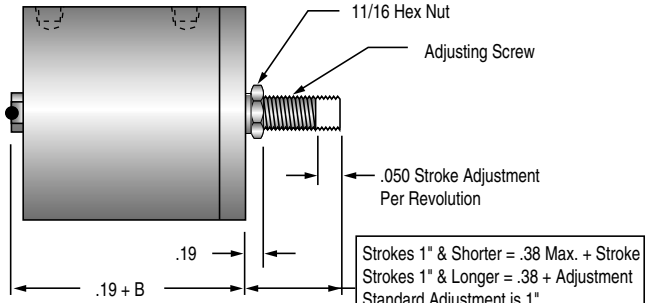
EM-521 Eye Bracket Kit
Mates with RC-63 Rod Clevis shown on the left.
Order separately.



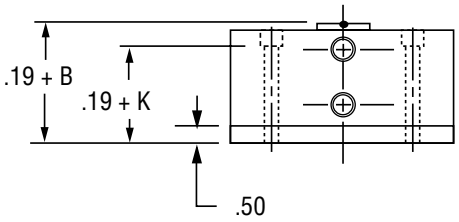
Suffix Option -MR **Male Rod Thread**
Available on Original and "T" Series with Actions: -X, -XK
Also see *Option Information* on page 1.8.



Suffix Option -RS **Adjustable Retract Stroke**
Available on Original and "T" Series with Actions: -X, -XK
Also see *Option Information* on page 1.11.



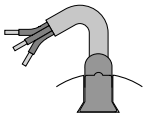
Suffix Option -HHC **Hydraulic** **&** **-HC** **Air**
Available on Original and "T" Series with Action -X.
Also see *Option Information* on page 1.9.



Suffix Option -E ***Specifies Magnetic Piston and Dovetail Mounting Slot(s)***
Strokes are NOT affected by magnetic piston.

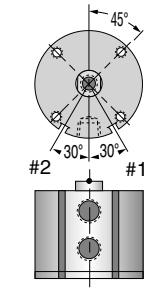
– Sensors Must be Ordered Separately
See Sensor Models Available page 1.14

4" (1221) Bore



1/4" 60° Dovetail Profile of Sensor & Mounting Slot.

Sensors available for "AB" & "TAA" strokes and longer.

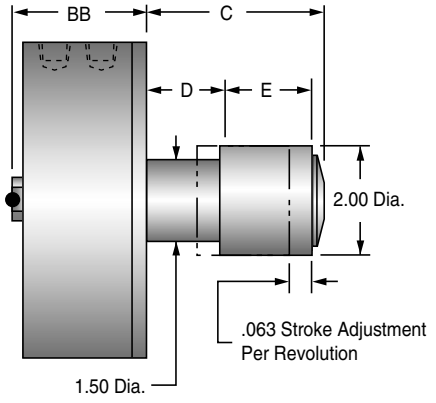


Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

	Available on Original Series		*Available on "T" Series*	
	Stroke	**Action X, XK**	**Stroke**	**Action X, XK**
Sensor Slots at Positions #1 and # 2	1/4	AB	5/16	TAA
	1/2	AA	13/16	TA
	1	A		
Sensor Slot at Position #1 only	1-1/2	B	15/16	TB
	2	C	1-13/16	TC
	3	D	2-13/16	TD
	4	E	3-13/16	TE

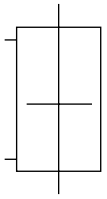
Suffix Option -AS **Adjustable Extend Stroke**
Available on Original Series with Actions: -X, -XK
Also see *Option Information* on page 1.11.

Stroke Inches	1/8	1/4	1/2	1	1-1/2	2	3	4
Stroke Letter	AC	AB	AA	A	B	C	D	E
BB	2.33	2.45	2.70	3.20	3.70	4.20	5.20	6.20
C	1.66	1.91	2.41	3.41	4.41	5.41	7.41	9.41
D	0.63	.75	1.00	1.50	2.00	2.50	3.50	4.50
E	0.88	1.00	1.25	1.75	2.25	2.75	3.75	4.75

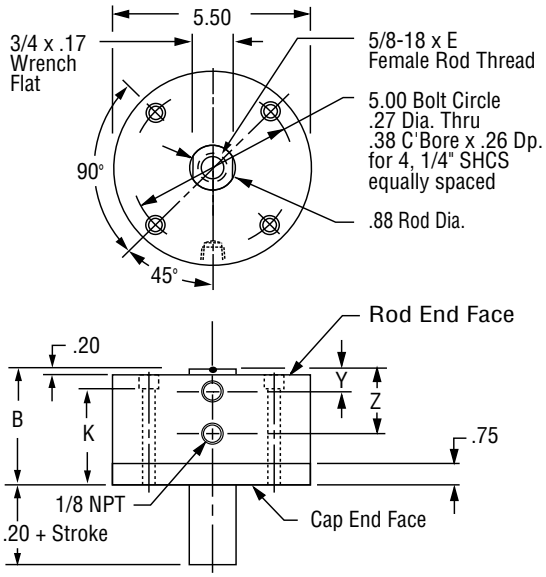


1

Action –XDR Original Series
Double Rod, Double Acting

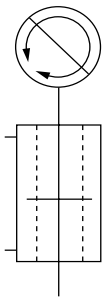


See page 1.16 for Mounting Bolts.
Force area = 11.97
Seal Kit = 1221-SK

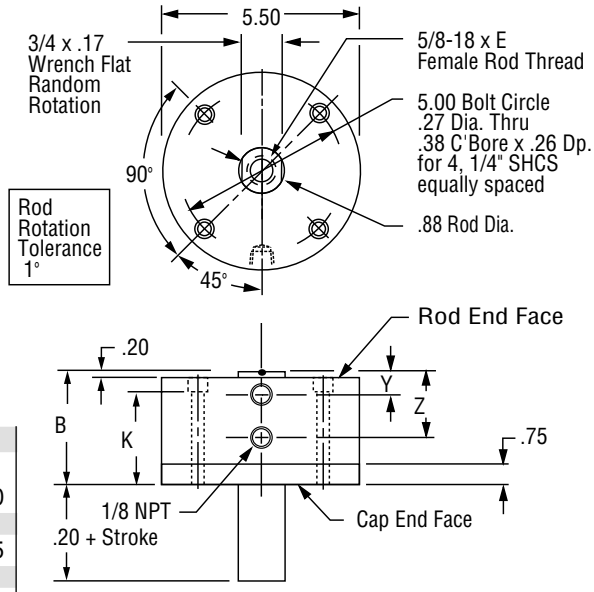


Stroke, Inches	1/8	1/4	1/2	1	1 1/2	2	3	4
Stroke, Letter	AC	AB	AA	A	B	C	D	E
B	2.33	2.45	2.70	3.20	3.70	4.20	5.20	6.20
E	.50	.50	.75	.88	.88	.88	.88	.88
K	1.87	2.00	2.25	2.75	3.25	3.75	4.75	5.75
Y	.58	.58	.70	.70	.70	.70	.70	.70
Z	1.20	1.33	1.58	2.08	2.58	3.08	4.08	5.08
Weight, lb.	5.22	5.38	5.75	6.44	7.16	7.72	9.19	10.31

Action –XDRK Original Series
Double Rod, Double Acting, Nonrotating



See page 1.16 for Mounting Bolts.
Force area = 11.87
Seal Kit = 1221-SK-K



Stroke, Inches	1/8	1/4	1/2	1	1 1/2	2	3	4
Stroke, Letter	AC	AB	AA	A	B	C	D	E
B	2.33	2.45	2.70	3.20	3.70	4.20	5.20	6.20
E	.50	.50	.75	.88	.88	.88	.88	.88
K	1.87	2.00	2.25	2.75	3.25	3.75	4.75	5.75
Y	.58	.58	.70	.70	.70	.70	.70	.70
Z	1.20	1.33	1.58	2.08	2.58	3.08	4.08	5.08
Weight, lb.	5.65	5.81	6.19	6.89	7.63	8.23	9.70	10.85

Prefix Option M
Metric Cylinder & Rod Thread
101.6mm Bore

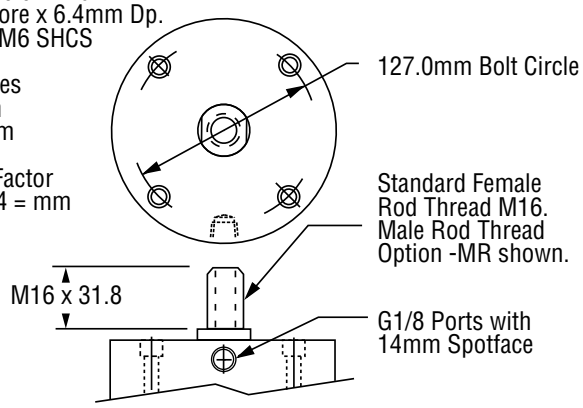
Available on Original Series with Actions -XDR, -XDRK.
Also see Option Information on Page 1.7

Stroke mm	3.2	6.4	12.7	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AC	AB	AA	A	B	C	D	E

Mounting Holes
6.7mm Diameter Thru
10.3mm C'Bore x 6.4mm Dp.
4 Places for M6 SHCS

Thread Pitches
M6 = 1.0mm
M16 = 2.0mm

Conversion Factor
Inches x 25.4 = mm



The **Suffix Options** charted on the right are available on Original Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.63. – *Also see Option Information on pages 1.7 thru 1.15.*

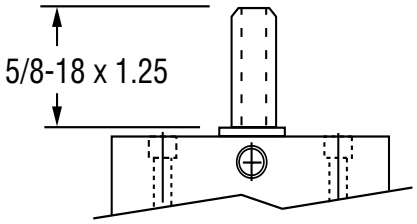
	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	P14	25
-XDR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Suffix Options -MR, -MR1, -MR2 Male Rod Thread

Available on Original Series with Actions -XDR, -XDRK.

For Rod End only use **–MR**
For Cap End only use **–MR1**
For Both Ends use **–MR2**

Also see Option Information on Page 1.8

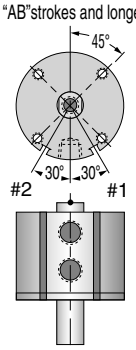


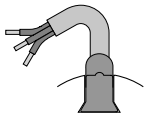
Suffix Option -E ***Specifies Magnetic Piston and Dovetail Mounting Slot(s)***
Strokes are NOT affected by magnetic piston.

– Sensors Must be Ordered Separately
See Sensor Models Available page 1.14

4" (1221) Bore

Sensors available for "AB"strokes and longer.





1/4" 60° Dovetail Profile of Sensor & Mounting Slot.

Quick Reference to Standard Strokes
Use the appropriate Stroke Letter in the Model Number

	Available on Original Series	
	Stroke	**Action XDR, XDRK**
Sensor Slots at Positions #1 and # 2	1/4	AB
	1/2	AA
	1	A
Sensor Slot at Position #1 only	1 1/2	B
	2	C
	3	D
	4	E

1

External Guide Pins Provide Load Guiding

External guide pins, adapted to the ***Pancake®*** cylinder line provide a 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.

Model G-221-X-G Shown

Available on *Pancake®* cylinders:
Original and "T" Series

Bores: 3/4" (7), 1 1/8" (121), 1 5/8" (221), 2" (321), 2 1/2" (521), 3" (721), and 4" (1221)

Strokes: 1/8" through 4"

Actions: –X, –XDR

In combination with Options:
Suffix;
-T, -V, -Q, -H, HHC, -HC,-P14, -N, -C1 — -C7, -AS, -RS, -LF, -LR, -LFR, -BF, -BR, -BFR, -E

Also available in Square 1® cylinders:
Bores 3/4" through 2"
Strokes 1/8" through 6"
See page 2.14 of this catalog.

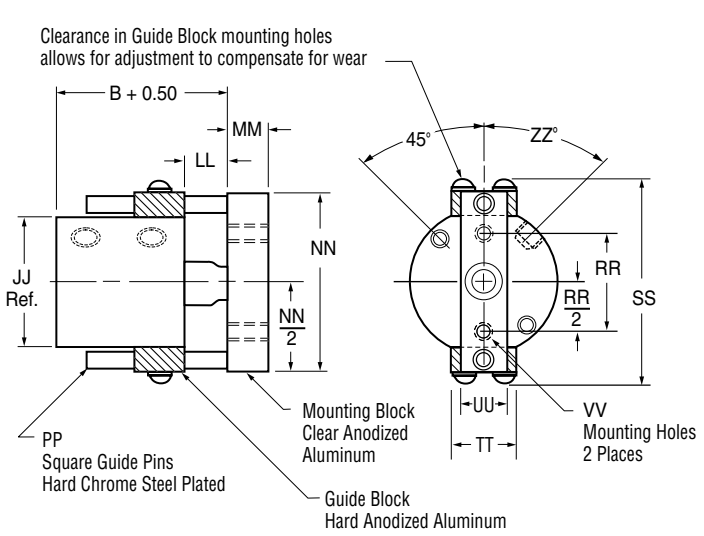
HOW TO ORDER

Select the basic ***Pancake®*** Cylinder model number for your desired series, bore and stroke. Then **add -G as a Suffix Option.**

Please Note!!
This option affects the rod end dimensions
See details on page 1.66.

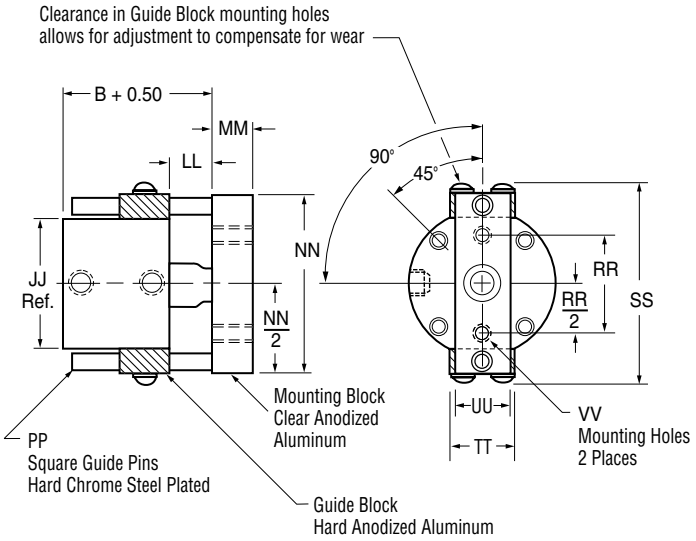
For dimensions B and all other dimensions not noted, please refer back to the main dimension table associated with your cylinder model and option selections.
Use the CAD library of ***Pancake®*** cylinders with your CAD program to reduce design time.

3/4" through 2" Bores



Model	7	121	221	321
Bore	3/4"	1 1/8"	1 5/8"	2"
JJ	1.50	1.99	2.74	3.24
LL	0.63	0.64	0.64	0.64
MM	0.63	0.63	0.63	0.75
NN	2.20	2.75	3.50	4.00
PP	0.19	0.25	0.25	0.25
RR	0.88	1.06	1.50	1.88
SS	2.30	3.13	3.85	4.37
TT	0.75	1.00	1.00	1.00
UU	0.63	0.63	0.75	1.00
VV	#6-32	#8-32	1/4-20	5/16-18
ZZ	45°	45°	45°	63°

2 1/2" through 4" Bores

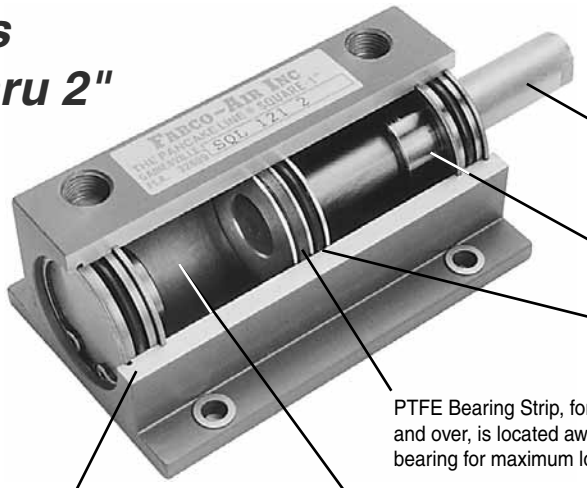


Model	521	721	1221
Bore	2 1/2"	3"	4"
JJ	3.74	4.24	5.50
LL	0.64	0.64	0.70
MM	0.75	1.00	1.25
NN	4.56	5.06	6.32
PP	0.31	0.31	0.31
RR	1.88	1.88	1.88
SS	4.88	5.38	7.09
TT	1.00	1.00	1.00
UU	1.00	1.00	1.25
VV	5/16-18	5/16-18	5/16-18

Square 1® Air Cylinders

Square 1® Cylinders

Available in 3 styles
5 Bore sizes 3/4" thru 2"
Strokes to 6"



Series SQ, Side Tap Mount

Side view (opposite ports) shows mounting holes and relief for mounting rails.

Series SQF, Face Mount

Series SQL, Side Lug Mount

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

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

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Ratings – Standard Units all series

- Double acting, single rod
- Duralon® rod bushing
- Female rod end with wrench flats
- Internally lubricated Buna-N O-ring piston and rod seals.
- Ports at position #1

- Media . . . . . Air, Optional Hydraulic
- Max. operating pressure . . . . . 150 psi Air or Hydraulic
- Min. operating pressure recommended . . . . . 10 psi
- Ambient & media temperature range . . . -25° to +250°F
- Prelubrication . . . . . Magnalube®–G Grease
- Air Line Lubrication . . . . . Recommended
- Stroke tolerance . . . . . ± 1/64"

Sizing Guide

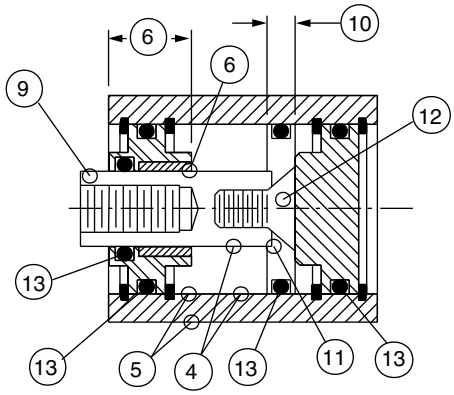
Bore Diameter	3/4"	7/8"	1-1/8"	1-5/8"	2"
Rod Diameter	0.3125	0.3125	0.500	0.625	0.750
Rod Area	0.08	0.08	0.19	0.31	0.44
Push Area (Single Rod)	0.44	0.60	0.99	2.07	3.14
Pull Area	0.36	0.52	0.80	1.76	2.70
SQ & SQF Base Weight, lb.	0.18	–	0.31	0.63	1.05
SQL Base Weight, lb.	–	0.18	0.33	0.70	1.16
Weight Per Inch, lb.	0.13	0.13	0.19	0.32	0.45

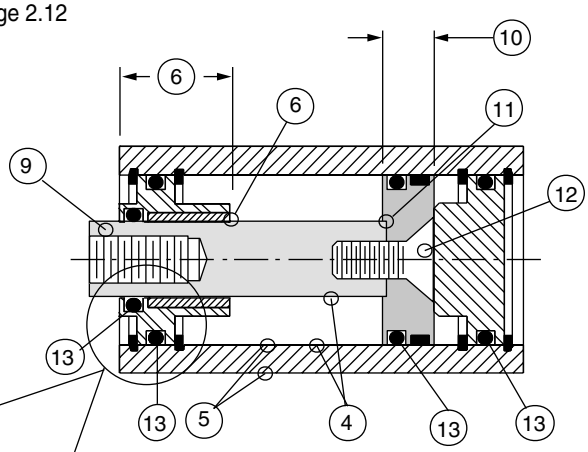
2

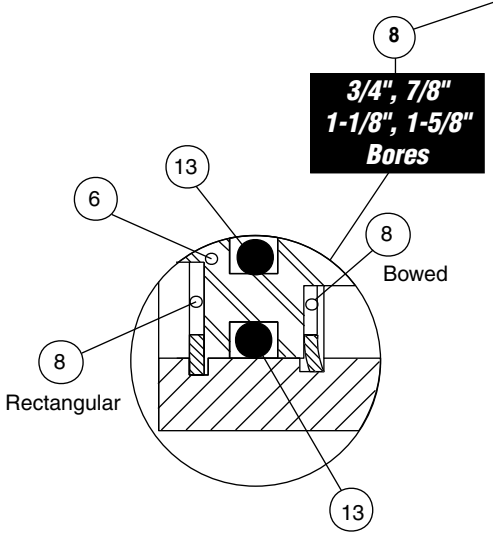
Strokes under 1"

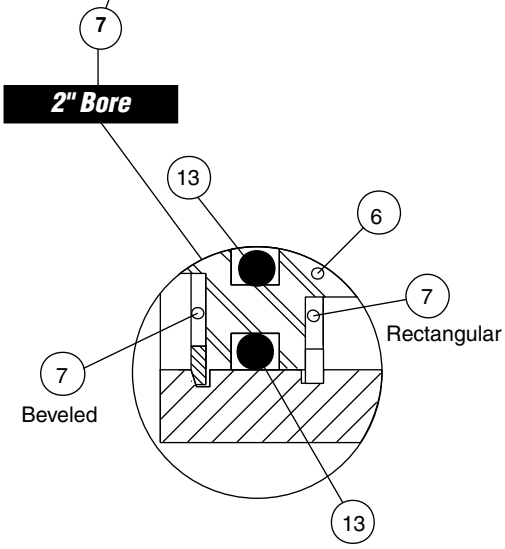
Standard Single Rod Models Shown
Double Rod: See Option -DR page 2.10
Nonrotating: See Option -K page 2.12

Strokes 1" and over

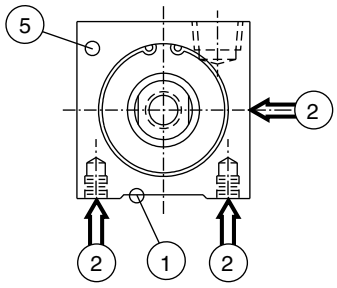




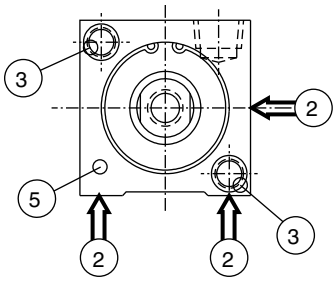




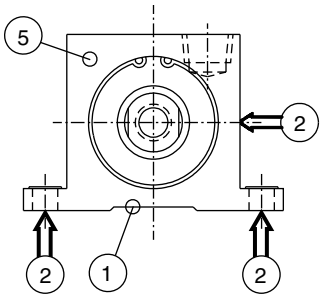
Series SQ



Series SQF



Series SQL



Over 3 decades of experience and close attention to detail at design, production and assembly produce the ultimate Fabco-Air Square 1® Cylinders. They FIT, not only into very tight spaces, but into ANY cylinder application. They WILL fit YOUR application.

1 The square body material is a custom aluminum extrusion with a relief extruded in to provide mounting rails. The SQL series extrusion includes the body side extensions for the Side Lug Mounting. These mounting rails are machined flat before any other machining is done. This step eliminates any twist or curl in the rails, assuring a flat mounting surface.

2 The cylinder body is located on fixture points (⇧ ⇦) or the bore during machining operations for other features. This provides an accurate and consistent dimension from the bore centerline to the mounting surface for mounting the cylinder and making attachments to the piston rod.

3 The Face Mount, Series SQF and SQFW, mounting holes are machined in relationship to the centerline of the bore to control the accuracy and consistency for mounting and making attachments to the rod.

4 The cylinder bore is polished to produce a fine crosshatch finish, which, unlike an ultra smooth finish, provides a reservoir for lubrication. Lubrication, of course, provides lower friction and longer seal life.

5 The cylinder is hard anodized inside and out. This is an electrochemical process which provides a very dense surface of aluminum oxide. This surface has extreme hardness (60 Rc), excellent wear and corrosion resistance, and low coefficient of friction. The hard anodizing actually impregnates the base aluminum rather than just coating the surface like a plating. The hardness and wear resistance exceed that of hard chrome plated steel. The appearance is an attractive, satin gray.

6 Unique construction provides unequaled piston rod support and prohibits rod bushing BLOWOUT! The one-piece Duralon® rod bushing is inserted from the inside and then staked in place. Duralon® is a Teflon® lined, fiberglass structure with load carrying capacity of 60,000 psi. See the chart comparing this to other bearing materials on page 2.2. Duralon® also provides: **consistency**- reliable and predictable performance from bushing to bushing; **corrosion resistance-** nonmetallic materials resist galvanic, chemical, and fretting corrosion; **self lubrication-** Teflon® lining provides low friction and minimizes slipstick, even under no-load conditions; **seizure resistance**- fiberglass backing material will not seize or gall on shaft under extreme wear. Rod bearing length on 1" stroke and over is longer to provide additional load support at the longer extensions. The O'Ring seal is located outboard as far as possible to allow air system lubrication onto most of the bearing surface.

7 The rod bearings and cap end plugs are held in place by two internal lockrings. In the 2" (321) bore size the inboard lockring and its groove are of standard rectangular cross section. The outboard lockring and its groove are beveled. As the outboard lockring expands in this beveled arrangement, it drives the rod bearing or cap end plug into and tightly against the inboard lockring. This locks the bearing or plug rigidly in place, thus providing precision, non-floating location and rigid support for the piston rod.

8 The rod bearings and cap end plugs are held in place by two internal lockrings. In bore sizes 3/4" (04) thru 1-5/8" (221) all the lockring grooves are of standard rectangular cross section. The internal groove is wider and the lockring is bowed. This bowed lockring drives the rod bearing or cap end plug tightly against the outboard lockring, thus providing precision, non-floating location and rigid support for the piston rod.

9 The piston rod is centerless ground, polished and hard chrome plated (68-72 Rc) stainless steel. Surface finish is 12 RMS or better and carries lubrication like our cylinder bore (see 4). These features, combined with the low friction and high load capacity of the Duralon® bushing provide exceptional cylinder life. Female, fine pitch rod thread and wrench flats are standard.

10 Cylinders with strokes under 1" have a thin piston head with a single O'Ring for space savings. Cylinders with 1" stroke and over have a thicker piston which incorporates a PTFE bearing in addition to the O'Ring seal. This bearing is a close tolerance, rectangular cross section strip of a tough, stable, wear resistant PTFE compound located at the rear of the piston head, the furthest point from the rod bearing. The bearing material and its location provide maximum load support and maintain the long life of the cylinder bore and piston seal.

11 The piston is aluminum for light weight. It has a counterbore which locates the piston rod and provides precise concentricity control for smooth cylinder movement.

12 The piston is attached to the piston rod with a socket flat head screw which is torqued for both proper preload on the screw and secure clamping of the piston. Loctite® on the threads and faces assures sealing and locks the assembly against pounding and vibration.

13 Internally lubricated Buna-N O'Rings (–25° to + 250° F) provide low profile, low friction, and long life sealing of the piston and rod. These are compounded to provide extra long wear and low breakaway (starting) pressure, running friction and smoother operation. In tests, cylinders with internally lubricated O'Rings have extended cycle life of 2 to 3 times beyond cylinders with standard Buna-N seals.

2

Side Tap Mounting: Series SQ

Model SQ 121-2

Side view (opposite ports) shows mounting holes and relief for mounting rails.

Bore	Series	Available Stroke Lengths (Inches)										
		1/8	1/4	1/2	3/4	1	1-1/2	2	3	4	5	6
3/4"	**SQ04**	✔	✔	✔	✔	✔	✔	✔	✔	✔	NA	NA
1-1/8"	**SQ121**	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
1-5/8"	**SQ221**	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
2"	**SQ321**	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

*Magnetic piston option does **NOT** affect stroke.*

Face Mounting: Series SQF

Model SQF 121-2

Bore	Series	Available Stroke Lengths (Inches)										
		1/8	1/4	1/2	3/4	1	1-1/2	2	3	4	5	6
3/4"	**SQF04**	✔	✔	✔	✔	✔	✔	✔	✔	✔	NA	NA
1-1/8"	**SQF 121**	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
1-5/8"	**SQF 221**	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
2"	**SQF 321**	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

*Magnetic piston option does **NOT** affect stroke.*

Side Lug Mounting: Series SQL

Model SQL 121-2

Bore	Series	Available Stroke Lengths (Inches)										
		1/8	1/4	1/2	3/4	1	1-1/2	2	3	4	5	6
7/8"	**SQL06**	✔	✔	✔	✔	✔	✔	✔	✔	✔	NA	NA
1-1/8"	**SQL 121**	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
1-5/8"	**SQL 221**	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
2"	**SQL 321**	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

*Magnetic piston option does **NOT** affect stroke.*

All Square 1® Mountings

- **Double Acting – Single Rod**
  Choice of "G" or "W" Rod Extension*
- **For single acting use air spring as shown on page 1.15**
- **Double Acting – Double Rod**
  Choice of combinations of "G" and "W" rod extensions*
- **Female Rod End with Wrench Flats**
- **PTFE Piston Bearing; 1" Stroke and Up**
- **Internally lubricated Buna-N Seals (-25° to + 250°F)**
- **Operation to 150 psi**
- **Rod and Cap End Ports in Position 1A**

***For Rod Extension Information See Dimension "G" and "W" on pages 2.6, 2.7 or 2.8.**

CAD Drawings on CD-ROM

A complete library of cylinder CAD drawings is available. Contact your local distributor for details, download from our web site http://www.fabco-air.com or E-Mail us at fabco@fabco-air.com

Model Number Code

SQ | **121** – **2** – **MR**

Mounting

SQ
Side Tap

SQF
Face

SQL
Side Lug

Rod Extension

Single Rod Models

Blank –for **standard** extension per dimension "G" on page 2.7

W - for **Extension** to dimension "W" on page 2.7

Double Rod Models
See Page 2.10

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

Bore

04 for 3/4" bore

06 for 7/8" bore

121 for 1 1/8" bore

221 for 1-5/8" bore

321 for 2" bore

Standard Strokes Inches

Bores 3/4" 7/8"

1/8
1/4
1/2
3/4
1
1-1/2
2
3
4

Bores 1-1/8" 1-5/8" 2"

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

How to Order

1. Specify Mounting Series including Rod Extension Information
2. Specify Bore
3. Specify Stroke in Inches and Fractions
4. Specify Options

Examples

SQ 121 - 2
Side Tap Mounting with "G" Rod Extension;
1-1/8" Bore; 2" Stroke

SQW 121 -2 - MR
Side Tap Mounting with "W" Rod Extension;
1-1/8" Bore; 2" Stroke; Male Rod Thread

SQLW 06 - 3 - C2 - LR
Side Lug Mounting with "W" Rod Extension;
7/8" Bore; 3" Stroke with 1/4" Stroke Collar yielding
2-3/4" Net Stroke; Sound Limiter, Cap End

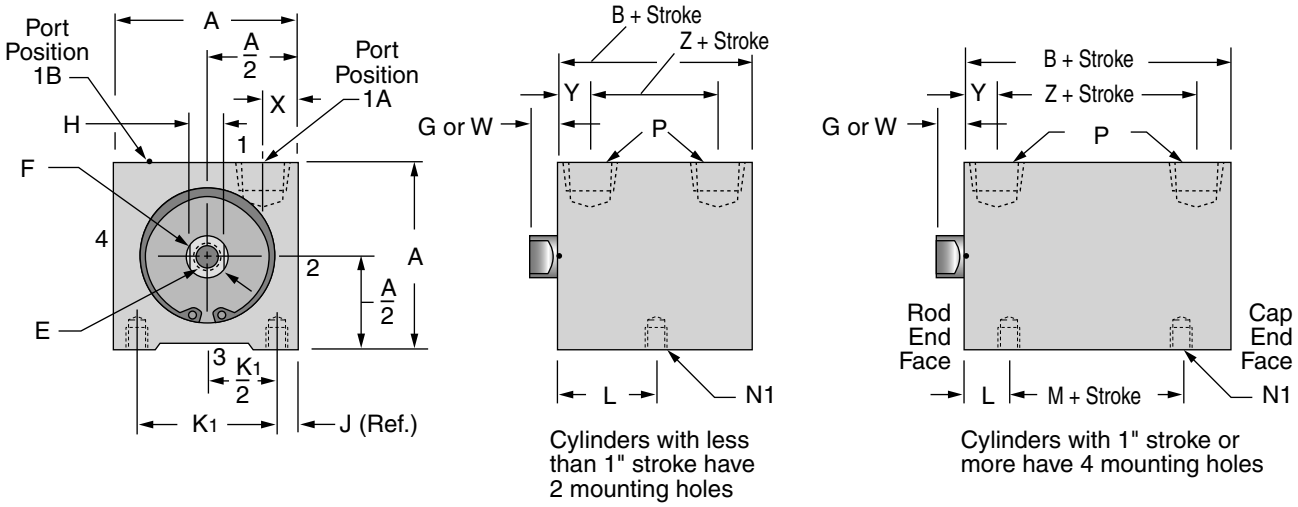
OPTIONS

Description		Specify	See Page
Male Rod Thread			2.9
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**	2.9
Quad Seals		**-Q**	2.9
Metric Rod Thread		**-M**	2.9
Nonrotating 1-1/8", 1-5/8", 2" bores only		**-K**	2.12
Port Positions		**-1B**	2.9
External Guide, Nonrotating		**-G**	2.14
Hydraulic, Low Pressure to 150 psi **NONSHOCK**		**-H**	2.9
Double Rod		**-DR**	2.10
Hole Thru Double Rod Shaft			2.10
Bore	Hole		
3/4", 7/8"	1/16"	**-DR06**	
1-1/8"	1/8"	**-DR13**	
Plus size	5/32"	**-DR16**	
1-5/8"	1/8"	**-DR13**	
Plus size	1/4"	**-DR25**	
2"	5/32"	**-DR16**	
Plus size	5/16"	**-DR31**	
Stroke Collar	1/8"	**C1**	2.11
	1/4"	**C2**	
	3/8"	**C3**	
	1/2"	**C4**	
	5/8"	**C5**	
	3/4"	**C6**	
	7/8"	**C7**	
Sound Limiters			2.11
Rod End		**-LF**	
Cap End		**-LR**	
Both Ends		**-LFR**	
Adjustable Retract Stroke For over 1" adjustment add desired length: e.g. -RS2		**-RS**	2.11
Magnetic Piston & mounting slot(s) for Piston Position Sensors (Order Sensors separately.)		**-E**	2.13

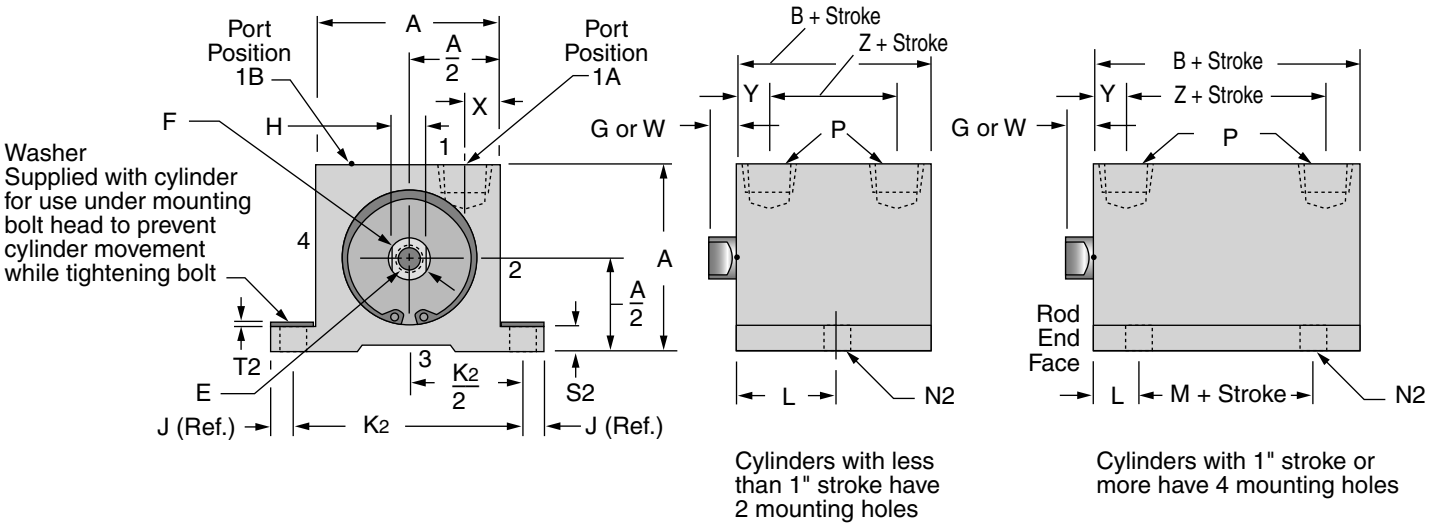
Mounting Kits for Series SQF

Type	See Page
Flange Mount Kit	2.14
Trunnion Mount Kit	2.15
Clevis Bracket Kit	2.15
Eye Bracket Kit	2.15
Rod Clevis	2.15

SQ Series: Side Tap Mounting – 3/4", 1-1/8", 1-5/8" and 2" Bores



SQL Series: Side Lug Mounting – 7/8", 1-1/8", 1-5/8" and 2" Bores



Fixed Dimensions

Bore	A	F Dia.	G	H	J	K1	K2	N1	N2	P	R	S1	S2	T1	T2	U	W	X
3/4"	1.25	.31	.13	1/4	.19	.88	–	10-24x.25	–	10-32	.19	.88	–	1/4-20 x.75dp (Note 2)	–	.75	.38	.31
7/8"	1.25	.31	.13	1/4	.19	–	1.63	–	.21	10-32	–	–	.19	–	.02	–	.38	.31
1-1/8"	1.50	.50	.19	7/16	.19	1.13	1.88	10-24x.25	.21	1/8	.19	1.13	.19	1/4-20 x.75dp (Note 2)	.02	.75	.38	.28
1-5/8"	2.00	.62	.19	1/2	.25	1.50	2.50	1/4-20x.31	.27	1/8	.25	1.50	.25	1/4-20 x.75dp (Note 2)	.03	.75	1.00	.31
2"	2.50	.75	.19	5/8	.25	2.00	3.00	5/16-18x.38	.27	1/8	.25	2.00	.31	5/16-18 x.75dp (Note 3)	.03	.75	1.00	.38

SQF Series: Face Mounting – 3/4", 1-1/8", 1-5/8" and 2" Bores

Figure 1
Rod End View

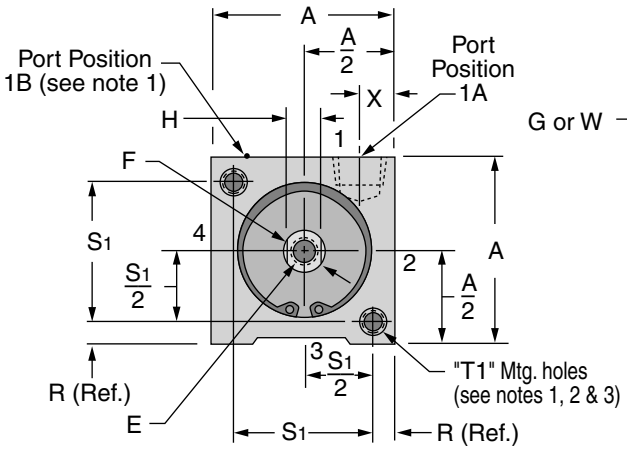


Figure 2
Side View
Short Strokes

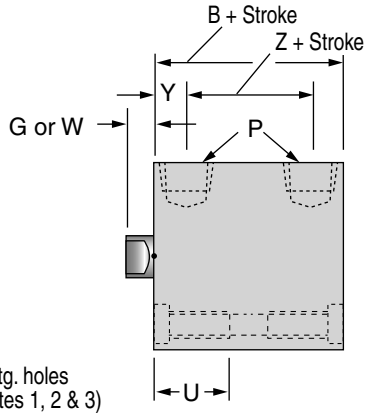
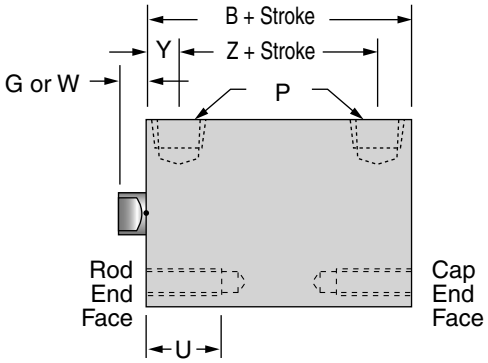


Figure 3
Side View
Long Strokes



Note 1
"T1" Tapped mounting holes, 2 each end. When port position "1B" is specified, mounting holes "T1" rotate 90°.

Note 2
3/4", 1-1/8", and 1-5/8" Bores, 1/8" thru 1" Strokes 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 3
2" Bore, 1/8" thru 1-1/2" Strokes 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.

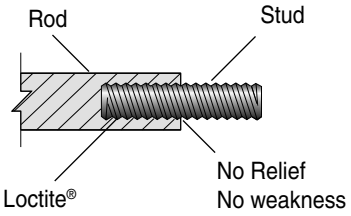
Variable Dimensions

	3/4" & 7/8" Bores						1-1/8" Bore						1-5/8" Bore						2" Bore					
Stroke	B	E	L	M	Y	Z	B	E	L	M	Y	Z	B	E	L	M	Y	Z	B	E	L	M	Y	Z
1/8"	1.03	10-32 x .38	.58	NA	.39	.25	1.28	5/16-24x.44	.70	NA	.44	.41	1.57	3/8-24x.50	.85	NA	.54	.50	1.73	1/2-20x.50	.93	NA	.62	.50
1/4"	1.03	10-32 x .38	.64	NA	.39	.25	1.28	5/16-24x.50	.77	NA	.50	.28	1.57	3/8-24x.63	.91	NA	.54	.50	1.73	1/2-20x.56	.99	NA	.62	.50
1/2"	1.03	10-32 x .38	.76	NA	.39	.25	1.28	5/16-24x.63	.89	NA	.50	.28	1.57	3/8-24x.75	1.04	NA	.54	.50	1.73	1/2-20x.75	1.12	NA	.62	.50
3/4"	1.03	10-32 x .38	.89	NA	.39	.25	1.28	5/16-24x.63	1.01	NA	.50	.28	1.57	3/8-24x.75	1.16	NA	.54	.50	1.73	1/2-20x.88	1.24	NA	.62	.50
1"	1.27	10-32 x .38	.51	.25	.39	.49	1.68	5/16-24x.63	.59	.50	.50	.69	1.94	3/8-24x.75	.66	.63	.54	.88	2.11	1/2-20x.88	.68	.75	.62	.88
1-1/2"	1.27	10-32 x .38	.51	.25	.39	.49	1.68	5/16-24x.63	.59	.50	.50	.69	1.94	3/8-24x.75	.66	.63	.54	.88	2.11	1/2-20x.88	.68	.75	.62	.88
2"	1.27	10-32 x .38	.51	.25	.39	.49	1.68	5/16-24x.63	.59	.50	.50	.69	1.94	3/8-24x.75	.66	.63	.54	.88	2.11	1/2-20x.88	.68	.75	.62	.88
3"	1.27	10-32 x .38	.51	.25	.39	.49	1.68	5/16-24x.63	.59	.50	.50	.69	1.94	3/8-24x.75	.66	.63	.54	.88	2.11	1/2-20x.88	.68	.75	.62	.88
4"	1.27	10-32 x .38	.51	.25	.39	.49	1.68	5/16-24x.63	.59	.50	.50	.69	1.94	3/8-24x.75	.66	.63	.54	.88	2.11	1/2-20x.88	.68	.75	.62	.88
5"	NA	NA	NA	NA	NA	NA	1.68	5/16-24x.63	.59	.50	.50	.69	1.94	3/8-24x.75	.66	.63	.54	.88	2.11	1/2-20x.88	.68	.75	.62	.88
6"	NA	NA	NA	NA	NA	NA	1.68	5/16-24x.63	.59	.50	.50	.69	1.94	3/8-24x.75	.66	.63	.54	.88	2.11	1/2-20x.88	.68	.75	.62	.88

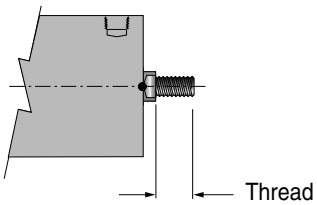
2

Male Rod Thread **Option**

Single Rod	**-MR**
Double Rod, Rod End Only	**-MR**
Double Rod, Cap End Only	**-MR1**
Single Rod, Both 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. It provides a much stronger rod end which can be repaired, rather than replacing the complete rod, should the thread be damaged.



Bore	Thread
3/4"	10-32 x 0.50
7/8"	10-32 x 0.50
1-1/8"	5/16-24 x 0.75
1-5/8"	3/8-24 x 0.88
2"	1/2-20 x 1.00

Viton Seals **Option -V**

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

Quad Seals **Option -Q**

A **QUAD** seal replaces the standard O'Ring on the piston only. Standard seal material is Buna-N with operating temperatures of –25°F to + 250°F. Consult engineering for other materials.

Metric Rod Thread **Option -M**

See page 2.15 for Metric Rod Clevis

Rod threads are configured in common METRIC sizes. To arrive at Female Rod Thread depth in mm, multiply English depth by 25.4. See page 2.15 for Metric Rod Clevis.

Bore	Female Rod Thread	Pitch	Male Rod Thread x Length
3/4	M5	0.8	M5 x 12.7
7/8	M5	0.8	M5 x 12.7
1-1/8	M8	1.25	M8 x 19.0
1-5/8	M10	1.50	M10 x 22.2
2	M12	1.75	M12 x 25.4

Ports Position **Option -1B**

Both ports are located at Position 1B (see drawings on page 2.7). This position is achieved by reverse assembly of the cylinder. Therefore, it is a no-charge option. Please note that on Series SQF and SQFW the mounting holes rotate 90°.

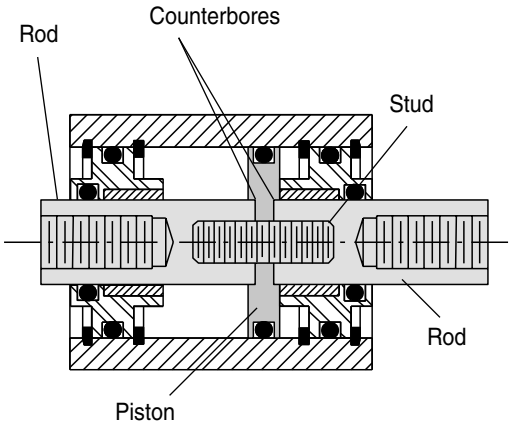
Ports can be located in other positions on a special basis. Consult engineering with application requirements for details on other locations.

Hydraulic **Option -H**

Low pressure service to 150psi **NONSHOCK**

For Air-over-Oil or Hydraulic systems to 150 psi, NONSHOCK. Where space permits, a U-cup rod seal or an additional rod O'Ring is incorporated in the rod bearing to help prevent fluid carry-over past the rod seal.

Double Rod **Option -DR**



SQ . . . . . **-DR** "G" rod ext. both ends.
SQW . . . . **-DR** "W" rod ext. both ends.
SQGW . . . **-DR** "G" rod ext. rod end;
"W" rod ext. cap end.
SQWG . . . **-DR** "W" rod ext. rod end;
"G" rod ext. cap end.

SQF . . . . . **-DR** "G" rod ext. both ends.
SQFW . . . **-DR** "W" rod ext. both ends.
SQFGW . . **-DR** "G" rod ext. rod end;
"W" rod ext. cap end.
SQFWG . . **-DR** "W" rod ext. rod end;
"G" rod ext. cap end.

SQL . . . . . **-DR** "G" rod ext. both ends.
SQLW . . . **-DR** "W" rod ext. both ends.
SQLGW . . **-DR** "G" rod ext. rod end;
"W" rod ext. cap end.
SQLWG . . **-DR** "W" rod ext. rod end;
"G" rod ext. cap end.

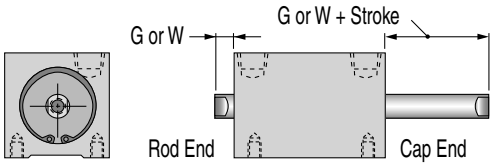
Standard piston rod and rod bushing on both ends of the cylinder. Counterbores on both sides of the piston maintain concentricity of the piston rods to each other as well as to the piston O-ring.

The piston rods are connected by a high strength stud, sandwiching the piston between the rod faces. The assembly is torqued for proper preload of the stud and clamping of the piston head. Loctite® on the threads and faces assures sealing and locks the assembly against pounding and vibration. This procedure provides a positive and rigid assembly that will not allow the piston rod to float or be pounded loose.

The PTFE piston bearing is not required because the two rod bushings provide excellent piston support.

Use when attachment to both ends of the cylinder is required or to indicate piston position.

The availability of 2 rod extensions offers a number of model combinations as shown in the listings at the left.



Single Rod Models
Blank– for standard extension per dimension "G".
W– for extension to dimension "W".

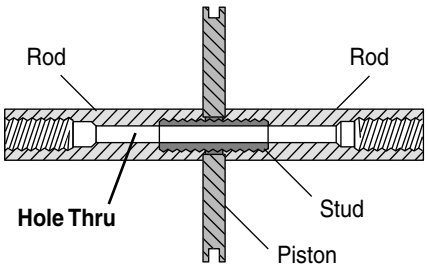
Double Rod Models
Blank– "G" both ends.
W– "W" extension both ends.
GW– "G" extension rod end; "W" extension cap end.
WG– "W" extension rod end; "G" extension cap end.

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

Note: When using stroke collars in double rod units, CAP END ROD STICK-OUT increases by amount stroke is shortened.

Hole Thru Double Rod Shaft



A hole is drilled through the piston rods and the double rod stud. This hole is used for the passage of Vacuum, Air, Gas, Liquid, or any media that is compatible with the stainless steel piston rod and the steel stud. Maximum pressure is 150 psi. The maximum hole size for each bore is shown in the chart below.

The PTFE piston bearing is not required because the two rod bushings provide excellent piston support.

Bore	Standard		Standard Plus	
	Hole Size thru stud	Model No. Suffix (Std)	Hole Size thru stud	Model No. Suffix (Std Plus)
3/4", 7/8"	1/16	**-DR06**	–	–
1-1/8"	1/8	**-DR13**	5/32	**-DR16**
1-5/8"	1/8	**-DR13**	1/4	**-DR25**
2"	5/32	**-DR16**	5/16	**-DR31**

2

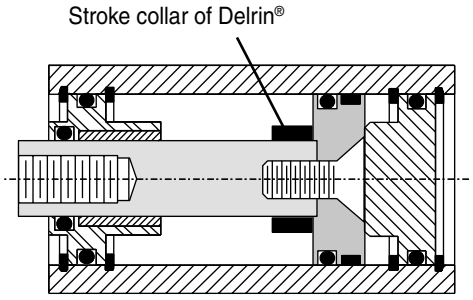
Stroke Collar on piston rod **Option**

How to Order

1) Start with the next longest stroke cylinder.
2) Select the amount the stroke is to be shortened.
3) Use the corresponding designation immediately after the stroke in the model number.

1/8"	**-C1**
1/4"	**-C2**
3/8"	**-C3**
1/2"	**-C4**
5/8"	**-C5**
3/4"	**-C6**
7/8"	**-C7**

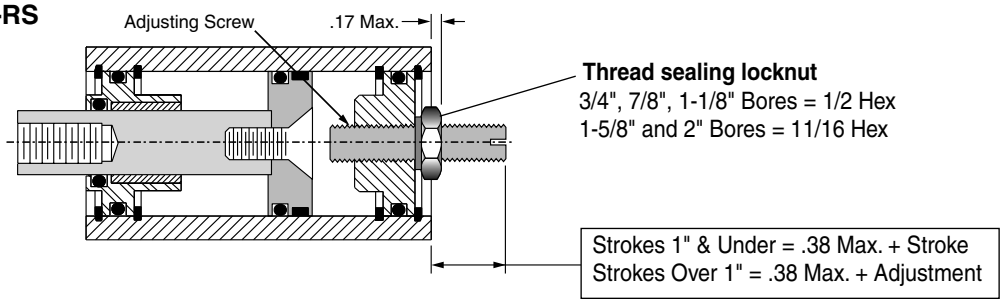
For those "in-between" strokes, a **STROKE COLLAR** of Delrin® is incorporated on the piston rod. The collar fits tightly on the piston rod so that it cannot float as the piston is stroked. Tolerance on the stroke is ± 1/64". For tighter tolerances on the stroke or final rod position, contact engineering with application details.



Note: When using stroke collars in double rod units, CAP END ROD STICK-OUT increases by amount stroke is shortened.

Adjustable Retract Stroke **Option -RS**

Any stroke with up to and including 1" adjustment. Any stroke with over 1" adjustment, specify the adjustment length after the -RS.
Example:
2" Adjustment = -RS2



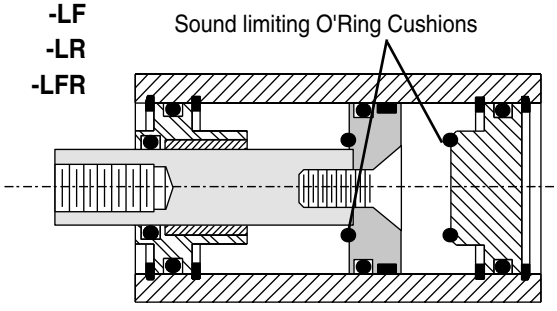
An adjusting screw with a thread sealing locknut mounted in the Cap End Plug provides a simple, yet rugged and precision adjustment of the cylinder stroke in the retract direction. Bores 3/4", 7/8", and 1-1/8" have a 5/16"-24 thread giving 0.042" adjustment per revolution. Bores 1-5/8" and 2" have a 1/2-20 thread giving 0.050" adjustment per revolution.

The **-RS** designation provides full stroke adjustment of any cylinder with 1" stroke or less, and 1" stroke adjustment on all longer strokes. When specifying longer adjustments on longer cylinders, add the desired adjustment to the -RS designation (1/2" increments, please).

Example: **-RS2** will provide 2" of adjustment on any cylinder with 2" or more stroke.

Sound Limiters **Option**

Rod End Only	**-LF**
Cap End Only	**-LR**
Both Rod & Cap Ends	**-LFR**



Option -LFR shown

For applications where you need a small amount of cushion at the end of the cylinder stroke to take out the metallic "slap" of piston head on piston stop. This is accomplished by placing an O'Ring on the rod at the piston, and/or in the cap end plug so that initial contact is with the elastomer and not metal-to-metal.

The Fabco-Air design assures sufficient compression of the seals to allow full stroke.

Because of the temperature limitations of the adhesives involved, sound limiters are available in cylinders with internally lubricated Buna-N O'Rings only.

Nonrotating **Option -K**

1-1/8", 1-5/8", and 2" bores only

Cutaway view of Model SQL 321 - 4 - K

An internal piston guide pin prohibits rod rotation so that objects attached to or moved by the rod will not rotate. Incorporating the guide mechanism inside the cylinder saves you the time, space and cost of mounting external guide pins and bushings in and around your mechanism. The guide pin and bushing are also protected from damage by the environment, the atmosphere, or mechanical abuse. These internal parts are lubricated by the system lubrication.

Available in 1-1/8", 1-5/8", and 2" bores.

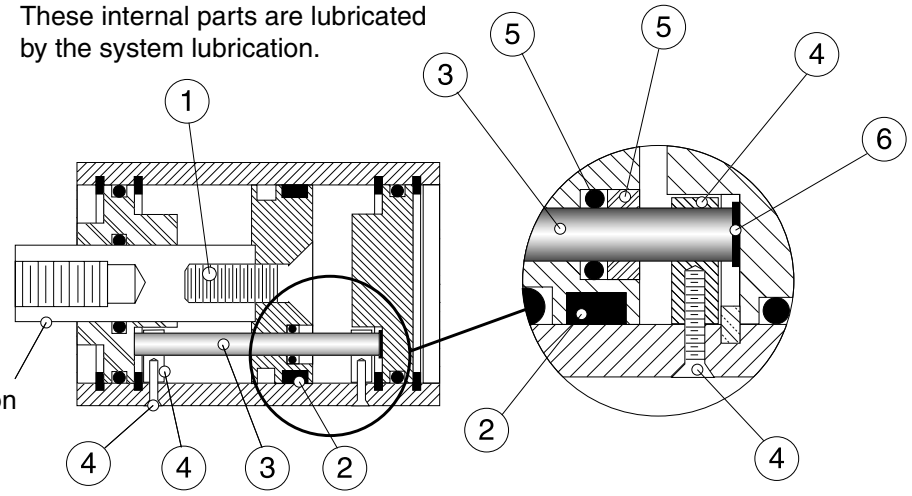
May be used in conjunction with all options including -E piston position sensing.

Rotational accuracy is ±1°. The warning label shown at the left is applied to each cylinder.

WARNING

THIS CYLINDER HAS A NONROTATING ROD. TO PREVENT INTERNAL DAMAGE HOLD ROD BY WRENCH FLATS WHEN INSTALLING OR REMOVING ATTACHMENTS.

Wrench flat random rotation



Construction Details

1. The aluminum piston is attached to the piston rod with a socket flat head cap screw which is torqued for proper preload of the screw and clamping of the piston. Loctite® on the threads and faces assures sealing and locks the assembly against pounding and vibration.

2. PTFE bearing is standard in 1" strokes and longer for single rod models.

3. The non-rotating guide pin is ground tool steel for precision and long life. Incorporated inside the cylinder it is protected from environmental dirt and grime and mechanical abuse. It receives lubrication from the air system lubricator.

4. A precision machined guide pin support block is attached to each end of the cylinder by a flat head screw. These support blocks provide rigid and precise location of the guide pin.

5. The guide pin passes through a polyurethane O-ring seal and an SAE660 bearing bronze bushing installed in the piston head. This combination provides "no-leak" precision guiding and long life.

6. A disk of rubber is included at the end of the guide pin to take up end play and firmly seat the pin in its support blocks.

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

2

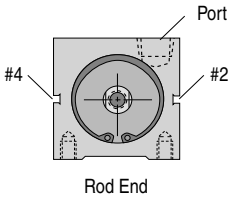
- ***Dovetail style sensors*** are actuated by a magnetic piston.
- Sensor dovetail slides into a mating slot on the cylinder body, is positioned as desired, and locked in place with a set screw.
- Magnetic piston and 1/4" Dovetail mounting slot(s) are specified with Suffix Option "E" in the model number.

*This short stroke **Model SQF** requires two dovetail mounting slots for proper positioning of sensors to detect beginning and end of stroke.*

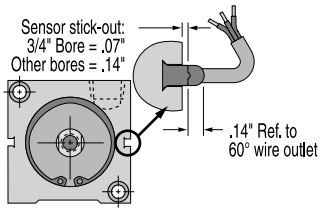
*This longer stroke **Model SQL,** side lug mounting style, has room enough to fit multiple sensors in a single slot.*

- ***Order sensors separately.***

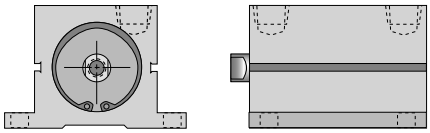
SQ Profile



SQF Profile



SQL Profile



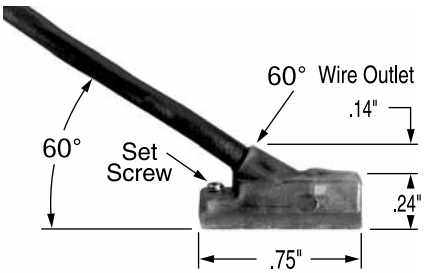
Standard Stroke & Slot Location Guide

	Stroke	SQ (Side Tap)				SQF (Face Mount)				SQL (Side Lug)			
		3/4" 04	1 1/8" 121	1 5/8" 221	2" 321	3/4" 04	1 1/8" 121	1 5/8" 221	2" 321	7/8" 06	1 1/8" 121	1 5/8" 221	2" 321
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, 3, 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	5, 6	NA	✓	✓	✓	NA	✓	✓	✓	NA	✓	✓	✓

Low Profile, Solid State,
Magnetic Piston Position Sensors

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

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 for Square 1® Cylinders

Cylinder Model	Sensor Type	Prewired 9 ft. Part No.	Quick Disconnect Part No.*	LED	Electrical Characteristics
All Square 1's	Electronic	949-000-031	949-000-331	Yes	Sourcing PNP 6-24 VDC, 0.20 Amp Max current, 0.5 Voltage Drop
All Square 1's	Electronic	949-000-032	949-000-332	Yes	Sinking NPN 6-24 VDC, 0.20 Amp Max current, 0.5 Voltage Drop

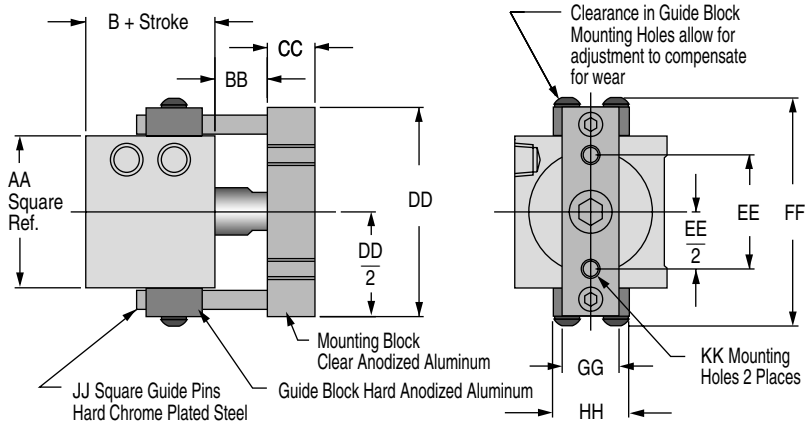
Note: Quick disconnect styles are supplied with 6 inch pigtail with male connector. Order female cordsets separately.*

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.

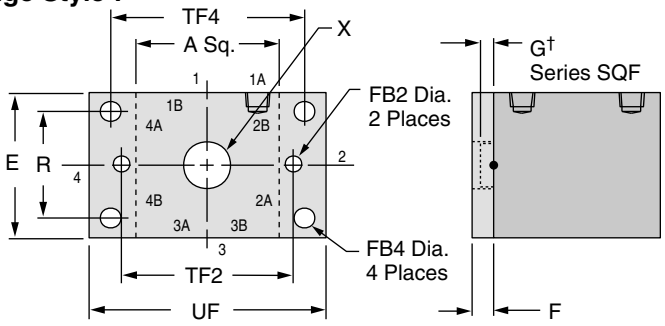
- Square guide pins are hard chrome plated steel for long wear and corrosion resistance.
- Guide blocks are hard anodized aluminum for long wear and corrosion resistance.
- Clearance in guide block mounting holes provide for adjustment and backlash control, compensation for wear, and minimal rotation.
- 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.



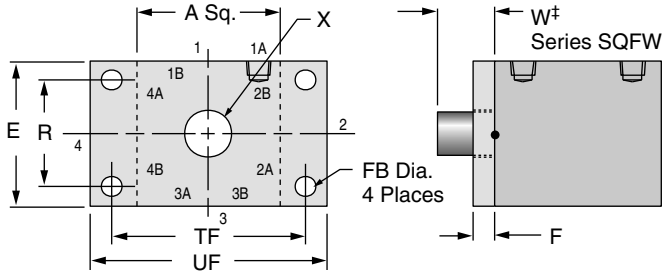
Mounting Series SQ or SQF

Model	04	121	221	321
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

Flange Style 7



Flange Style 8 & 9



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

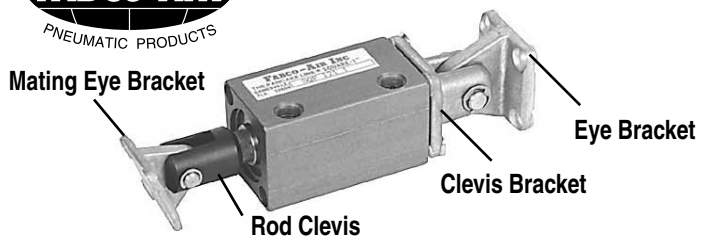
SQFW-121-1 1/2
with H7-121

Flange Mounting Kits for Series SQF and SQFW

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** NFPA Code 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** NFPA Code 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

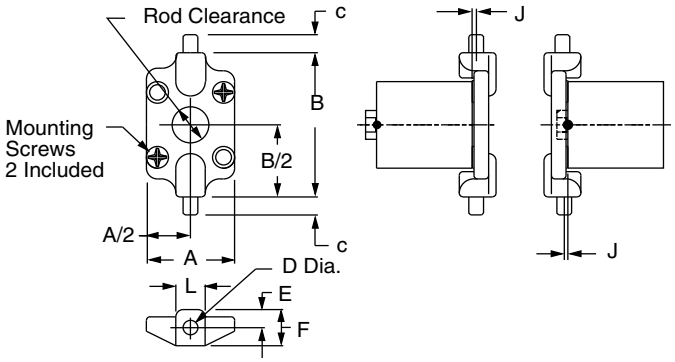
Kits include Flange and 2 Flange Mounting Screws

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	0.38	.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	0.38	.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	.28	NA	NA	.19	2.00	3.00	NA	NA	3.50	1.00	.81



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 for Series SQF

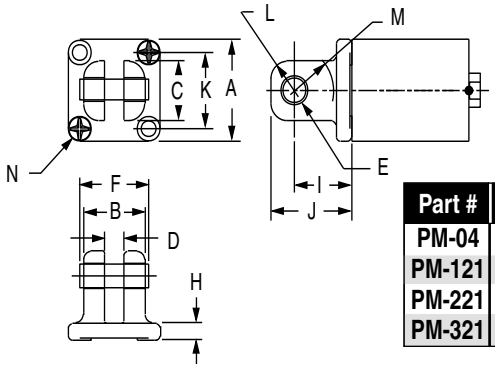


Materials
Bracket: High strength Zinc die casting
Pivot Pins: Precision dowel pins
Clips: 2, Plated steel
Mounting screws: 4, Steel, plated or black oxided


SQFW-121-1 with TR-121

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

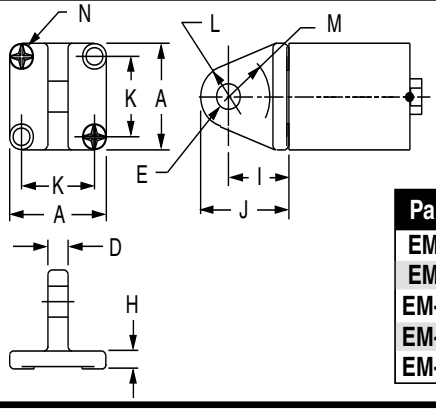
Clevis Bracket Kit for Series SQF



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 oxided

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 for Series SQF

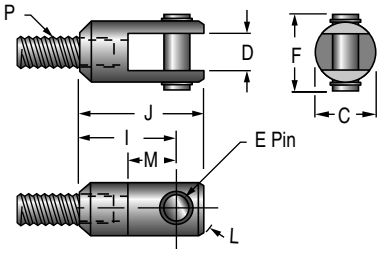


Materials
Bracket: High strength Zinc die casting
Bushings: Oil filled powdered metal
Screws: 4, Steel, plated or black oxided

***Note: Special 1/4-20 with #12 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 oxided
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

Notes

Cylinders, Valves, & Accessories

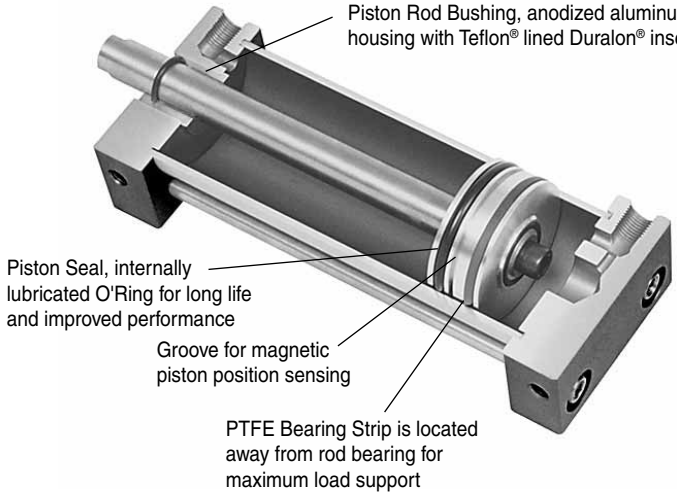
Round Head and Square Head Tie Rod Cylinders

Longstroke™ Cylinders

Available in 2 styles
4 Bore sizes 2" thru 4"
Strokes to 12"

Round Head Style

Square Head Style



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

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

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Ratings – Standard Units all series

- Double acting, single rod
- Duralon® rod bushing
- Female rod end with wrench flats
- Internally lubricated Buna-N O-ring piston and rod seals.
- Ports at position #1

- Media . . . . . Air
- Max. operating pressure . . . . . 250 psi
- Min. operating pressure recommended . . . . . 15 psi
- Ambient & media temperature range . . . -25° to +250°F
- Prelubrication . . . . . Magnalube®–G Grease
- Stroke tolerance . . . . . ± 1/64"
- Optional – Hydraulic . . . . . 500 psi ***nonshock***

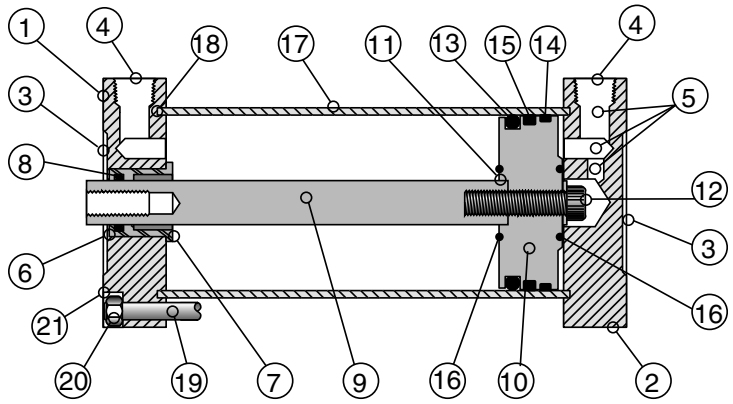
Sizing Guide

Bore Diameter	2"	2-1/2"	3"	4"
Rod Diameter	0.75	0.75	0.75	0.88
Rod Area	0.44	0.44	0.44	0.79
Push Area (Single Rod)	3.14	4.91	7.07	12.57
Pull Area	2.70	4.47	6.63	11.97
Round Head Base Weight, lb.	2.21	2.83	3.66	5.98
Square Head Weight, lb.	2.34	3.08	3.27	5.20
Weight Per Inch, lb.	0.18	0.21	0.23	0.34

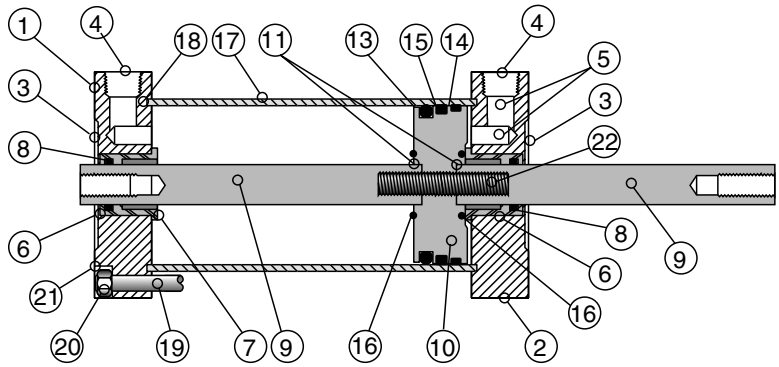
3

Standard Models

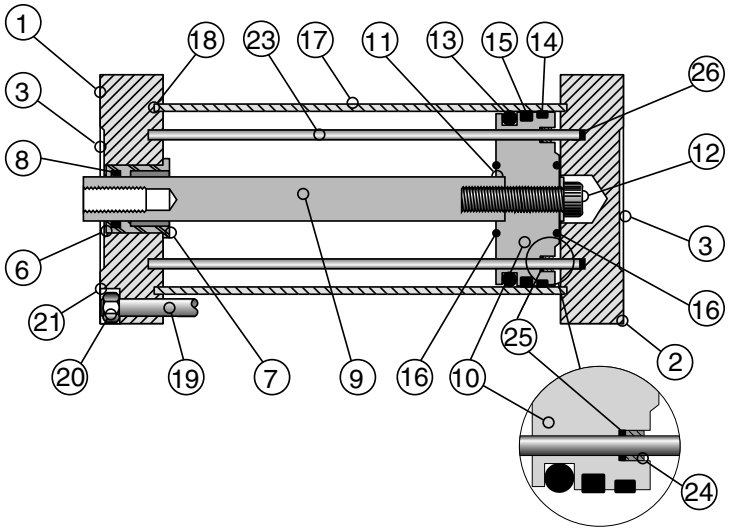
Standard: Single Rod, Double Acting



Option -DR: Double Rod, see page 3.7



Option -K: Nonrotating, see page 3.8



Basic Construction

Quick Reference to Components

No.	Description
1	Rod End Head, aluminum, black anodized
2	Cap End Head, aluminum, black anodized
3	Recessed faces assure flat mounting
4	1/4 NPT Ports
5	Full flow porting for fast response
6	Piston Rod Bushing, anodized aluminum housing with Teflon® lined Duralon® insert
7	Piston Stop
8	Rod Seal, internally lubricated O'Ring for long life
9	Piston Rod, stainless steel, centerless ground, polished, and hard chrome plated (68-72Rc)
10	Piston, aluminum
11	Counter bore locates piston rod to maintain precise concentricity
12	Piston Bolt, steel, Loctited® and torqued
13	Piston Seal, internally lubricated O'Ring for long life and improved performance
14	PTFE Bearing Strip is located away from rod bearing for maximum load support
15	Groove for magnet to activate position sensors
16	O'Ring bumpers reduce metallic slap of piston on piston stop for quiet operation
17	Cylinder Tube, aluminum
	Hard anodized ID (Rc60); Clear anodized OD
18	Cylinder Tube end seal
19	Stainless steel tie rods
20	Stainless steel hex nuts
21	Counterbore for nuts assures flat mounting
22	Steel double rod stud, Loctited® and torqued
23	Guide pin, precision ground tool steel
24	Guide pin bushing, SAE 660 bearing bronze
25	Guide pin seal, Urethane O'Ring
26	Rubber disk prevents guide pin movement

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 3.2 for a chart comparing the exceptional physical properties of Duralon® to other common, though less durable, bearing materials.

The Piston Rod – is Hard Chrome Plated Stainless Steel. The standard rod end is fine female thread tapped and has long wrench flats.

Model Number Code

321	–	8	–		–	MR

Series	Bore	Specify
Round head	2	**321**
	2-1/2"	**521**
	3"	**721**
	4"	**1221**
Square head	2	**S321**
	2-1/2"	**S521**
	3"	**S721**
	4"	**S1221**

Stroke

Standard strokes:
1" Increments
4" minimum
through
12" maximum

Optional Strokes:
Shorter and
fractional

Mounting

Rod end face, round head only . . . . . **Standard**
Cap end face, round head only . . . . . **Standard**
Side tap, square head only . . . . . **Standard**
Cap end clevis, round head only
Ports in line with slot . . . . . **–PM**
Ports 90° to slot . . . . . **–SM**
Extended tie rods
Rod end only . . . . . **-WF**
Cap end only . . . . . **-WR**
Rod & Cap end. . . . . **-WFR**

Mounting Kits for Square Head Series

Type	See page
End Lug mount kit	3.10
Side Lug mount kit	3.10

Mounting Kits for Round Head Series

Type	See page
Eye bracket kit	3.10
Rod clevis	3.10

Options

Description		Specify	See Page
Double Rod		**-DR**	3.7
Nonrotating, Square Head only 150 psi max. operating pressure		**-K**	3.8
Male Rod Thread			3.7
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**	3.7
Hydraulic, Low Pressure to 500 psi ***NONSHOCK***		**-H**	3.7
Finish, **Pro-Coat™** ,			
Electroless Nickel		**-N**	3.8
Rubber Bumpers			3.7
Rod End		**-BF**	
Cap End		**-BR**	
Both Ends		**-BFR**	
Adjustable Extend Stroke 6" Stroke maximum Full stroke adjustment is standard		**-AS**	3.8
3/8 NPT Ports		**-P38**	3.7
Port Positions			3.5 & 3.6
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**	
Any port not specified will be in Position #1 as shown on page 3.5 & 3.6			
Magnetic Piston for reed switches and Electronic Sensors (Order Sensors separately)		**-E**	3.9

How to Order

1. Specify Series–Bore
2. Specify stroke
   Note standard strokes listed above.
   Any stroke not listed is available,
   to 12" maximum, at nominal increase
   in delivery time and cost.
3. Specify mounting if other than standard
4. Specify options

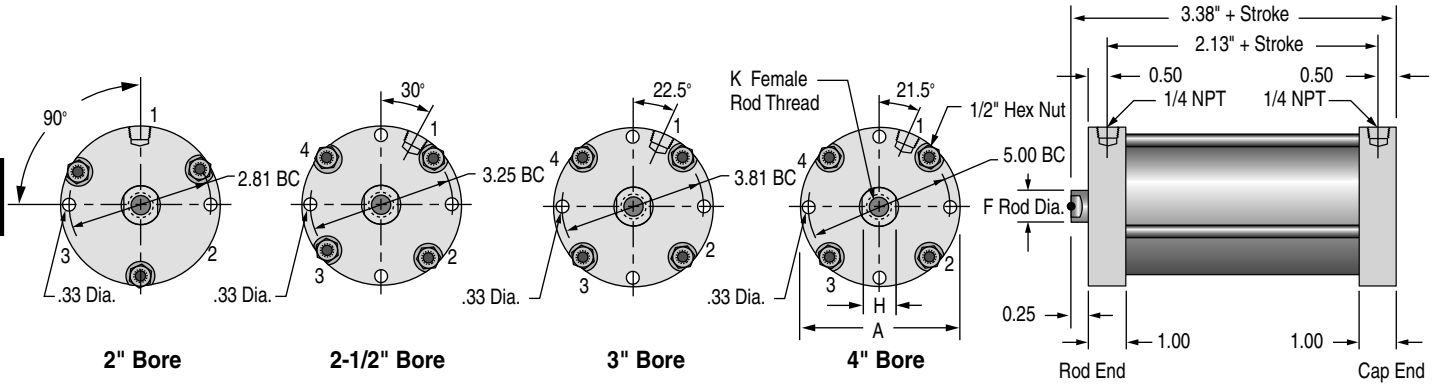
Examples

321 - 8 - MR
Round Head Longstroke, 2" bore, 8" stroke,
Standard Mount – Face Mount on Rod End and
Cap End, Male Rod Thread

S721 - 7 - E
Square Head Longstroke, 3" bore, 7" stroke,
Standard Mount – Side Tap Mount, Magnetic Piston

3

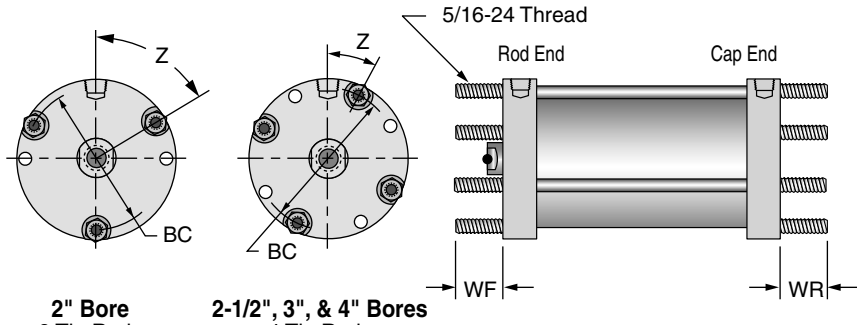
Round Head, Standard, Face Mount Rod and Cap End



Extended Tie Rod Mount for Round Head Models

Specify mounting option

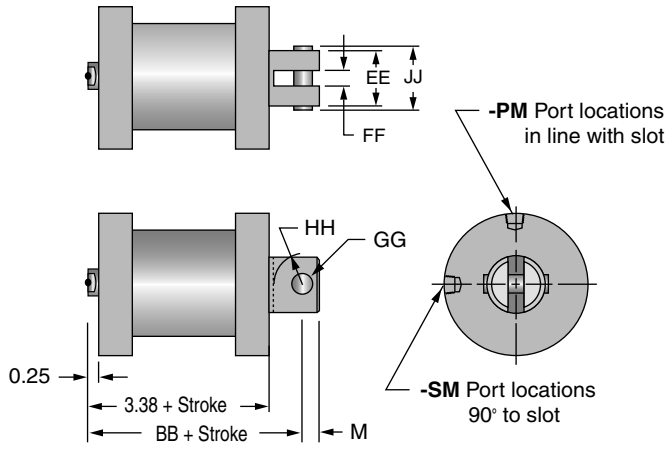
Rod End Only	**- WF**
Cap End Only	**-WR**
Rod and Cap Ends	**-WFR**



Round Head Clevis Mount Option

Specify mounting option

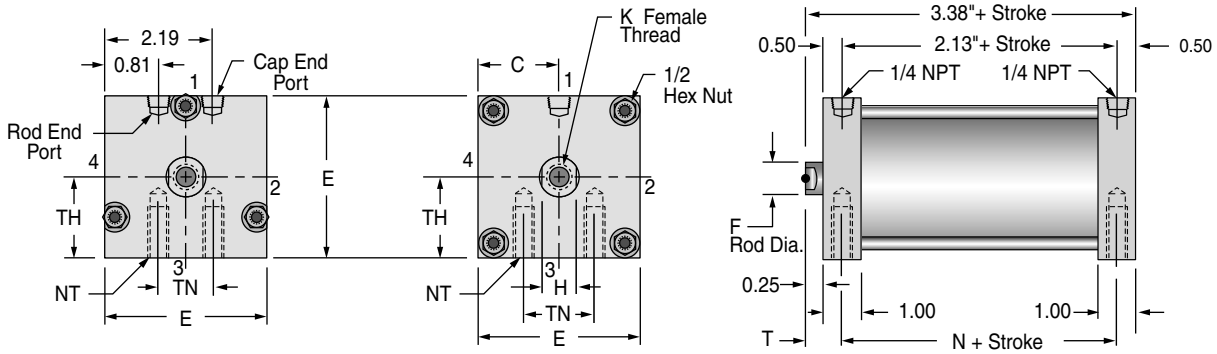
Ports in line with slot	**-PM**
Ports 90° to slot	**-SM**



Dimensions

Bore	A	BB	BC	C	E	EE	F Dia.	FF	GG Pin	GG Hole	H	HH
2"	3.25	4.13	2.81	NA	3.00	1.25	.750	.38	.3745	.376	.63	0.69
2-1/2"	3.75	4.38	3.25	1.75	3.50	1.63	.750	.50	.4995	.501	.63	0.97
3"	4.25	4.38	3.81	1.75	3.50	1.63	.750	.50	.4995	.501	.63	0.97
4"	5.50	4.63	4.63	2.25	4.50	2.00	.875	.63	.6245	.626	.75	1.22

Square Head, Standard, Side Tap Mount



2" Bore | **2-1/2", 3", & 4" Bores**

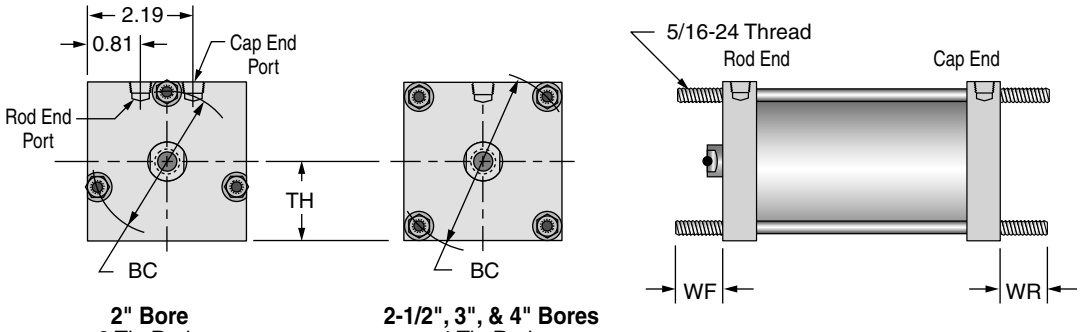
Note:
Ports at Position #3
are not available

Note:
3/8 NPT Ports (-P38)
at Position #3
are not available

Extended Tie Rod Mount for Square Head Models

Specify mounting option

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

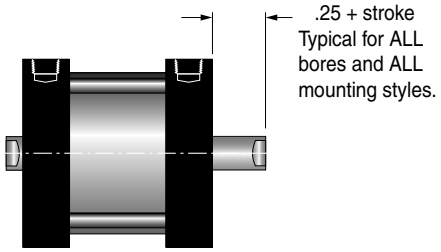


2" Bore
3 Tie Rods
Equally Spaced

2-1/2", 3", & 4" Bores
4 Tie Rods
Equally Spaced

JJ	K	M	N	NT	T	TH	TN	WF	WR	Z
1.48	1/2-20 x 1.00	.38	2.25	5/16-18 x .62	.69	1.375	0.875	1.3	1.3	60°
1.86	1/2-20 x 1.00	.50	2.38	3/8-16 x .75	.63	1.750	1.250	1.3	1.3	30°
1.86	1/2-20 x 1.00	.50	2.13	1/2-13 x 1.00	.75	1.750	1.500	1.4	1.4	22.5°
2.24	5/8-18 x 1.25	.63	2.13	1/2-13 x 1.00	.75	2.250	2.060	1.4	1.4	23.5°

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 3.9.

3

Hydraulic
Low Pressure Service to 500 psi non-shock — **Option -H**

A U Cup rod seal is placed inboard in an SAE 660 bronze bushing to eliminate leakage past the rod seal. An additional O'ring is used as an outboard wiper.

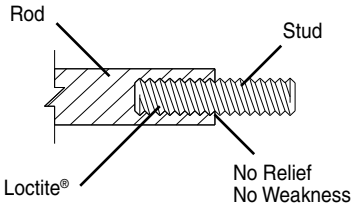
Use with Air-Oil systems and low pressure hydraulic systems when the rigidity and precision smoothness of hydraulics and control is required.

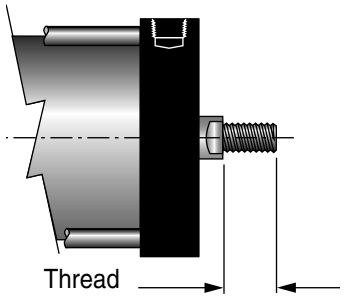
Viton Seals — **Option -V**

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

Consult engineering for compatibility information.

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"	5/8-18 x 1.25

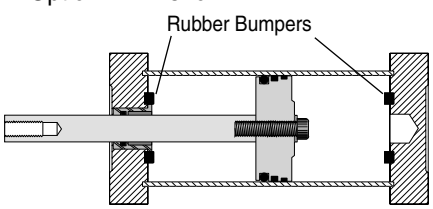
3/8 NPT Ports — **Option -P38**

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

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

Temperature Range (–25° to + 220°F)

Option -BFR shown



Standard rubber mass will compress and give full stoke 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 destruction of 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 + 220°F) Rubber Bumpers are available in cylinders with standard internally lubricated Buna-N seals only.

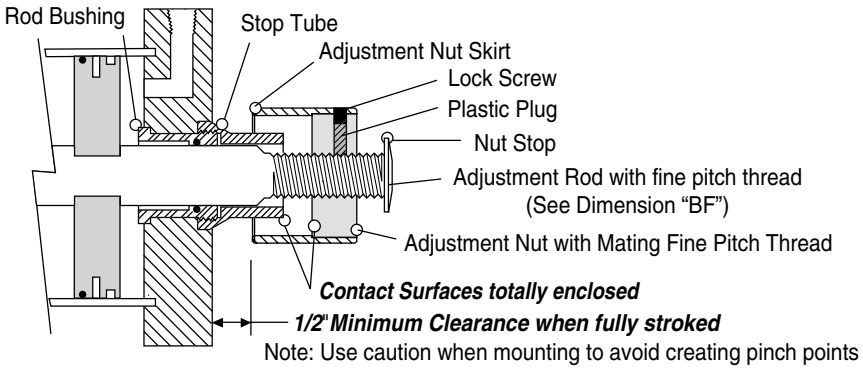
Use to reduce noise and absorb impact.

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.

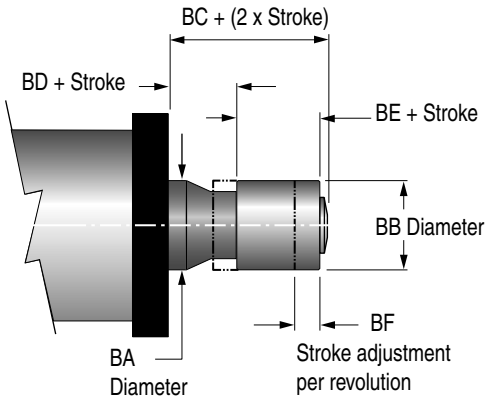
Adjustable extend stroke
Option -AS

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.

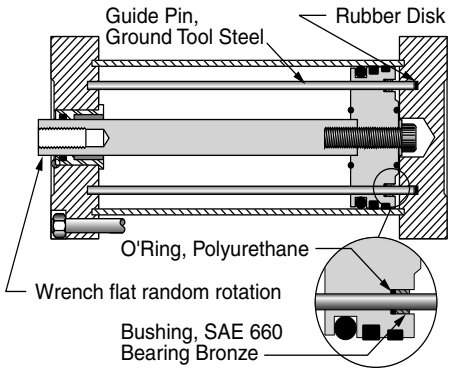


Note: Use caution when mounting to avoid creating pinch points



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	

Nonrotating **Option -K**
150 psi Max. Operating Pressure
Square Head Series only in Single Rod and optional Double Rod (-DR)



Two guide pins incorporated inside the cylinder pass through the piston head. These guide pins prevent rotation of the rod with a tolerance of ±1°. The guide pins, being incorporated inside, are protected from the environment, physical damage, and are lubricated by the system lubrication, and require NO additional space, leaving the rod end area free for attachments and tooling as required by your application.

The guide pins are precision ground tool steel and run in SAE 660 bearing bronze bushings and Polyurethane O'rings. These features provide precision guiding and long, trouble free life. A rubber disk is included at the end of each guide pin to take up end play and firmly seat the pins in the precision guide pin holes.

An information label is applied to each cylinder to warn against damage.

WARNING
THIS CYLINDER HAS A NONROTATING ROD. TO PREVENT INTERNAL DAMAGE HOLD ROD BY WRENCH FLATS WHEN INSTALLING OR REMOVING ATTACHMENTS.

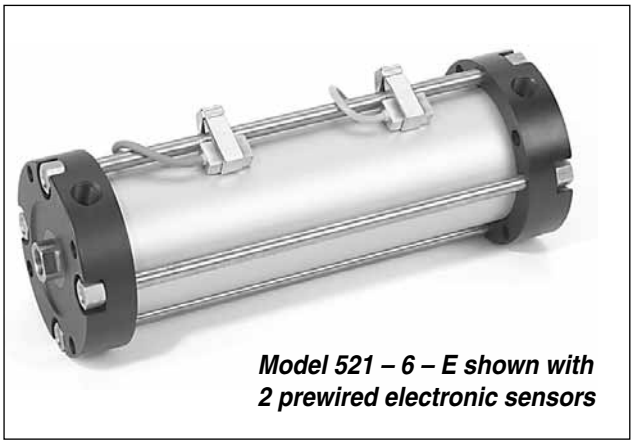
Use when any attachment to the piston rod must not rotate.

Finish
Plating; ***Pro-Coat™***, Electroless Nickel, Heads & Tube **Option -N**

Pro-Coat™, Electroless Nickel Plating is a hard, smooth, corrosion and wear resistant coating. It will often suffice for applications where stainless steel is specified. Its lasting luster provides high eye appeal.

The coating is a high nickel, low phosphorous alloy deposited by chemical reduction without electric current that is "mil-for-mil" more corrosion resistant than electroplated nickel. The surface is virtually pore free. The thickness of the nickel deposit is constant over the entire surface. Blind holes, threads, small diameter holes and internal surfaces all receive the same amount of plating. It has natural lubricity and a high resistance to abrasion. As shipped hardness of the coating is approximately 49 Rockwell C. Heat treating can increase hardness to approximately 60 Rockwell C. For specific applications, consult engineering.

The cylinder heads and tube, inside and outside, are plated. Tie rods and nuts are standard stainless steel. Rod bushing is standard hard anodized aluminum and Duralon®.



Model 521 – 6 – E shown with 2 prewired electronic sensors

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.
- ***Sensor clamps and sensors are ordered separately.***

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

Quick Disconnect Sensor Shown

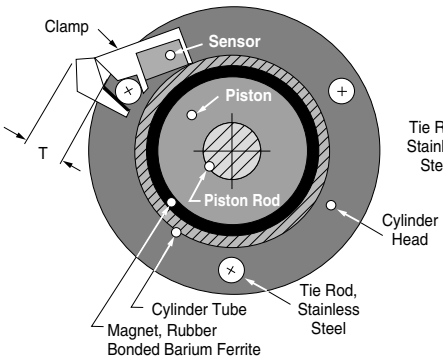
Socket Head Screw

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.

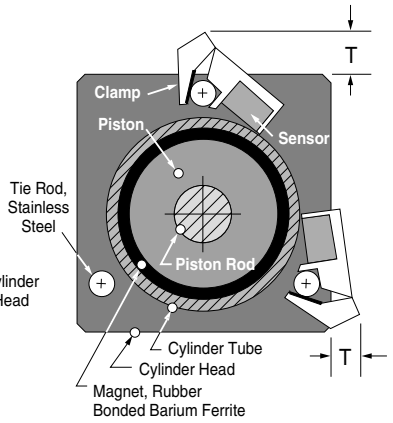
Female Cordsets available in 1, 2, & 5 meter lengths

9 foot prewired sensor

Sensor Clamp Stick Out Dimensions								
Model	321	S321	521	S521	721	S721	1221	S1221
T	.50"	.50"	.50"	.10"	.50"	.30	.30"	.30"



Top View Round Head Style



Top View Square Head Style

Sensor & Clamp Ordering Guide

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

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 Longstroke Models
For all Longstroke Models Order **Part Number 800-200-000**

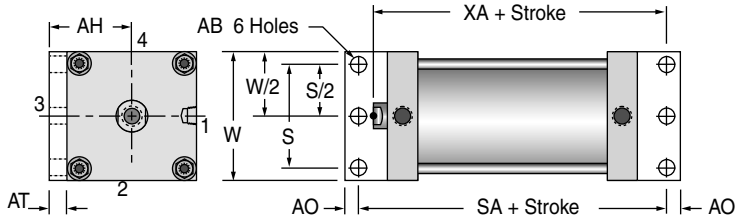
Warning!

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.

End Lug Mount Kit

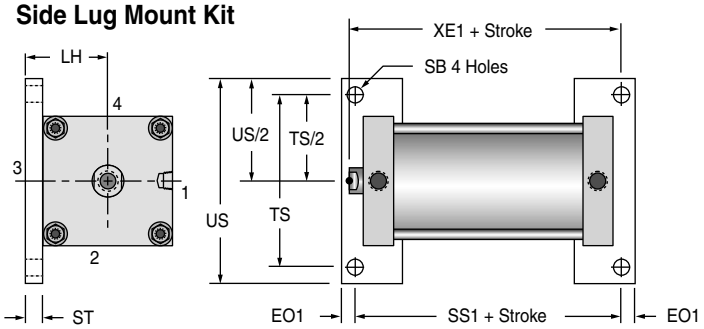


Kit includes:
2 brackets and 4 bolts for attaching the brackets to the cylinder heads.

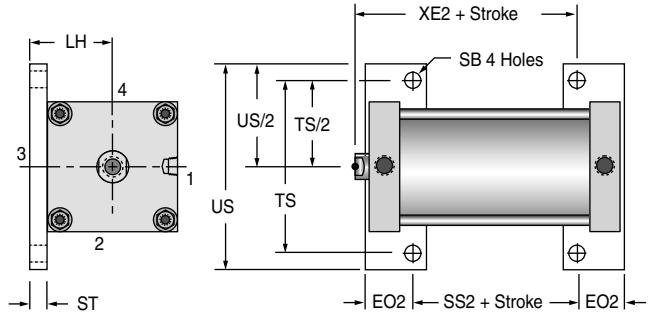
Material:
Brackets, plated steel
Screws, Black Oxide Steel

Bore	Kit No.	S	W	AB	AH	AO	AT	SA	XA
2"	**EL-20**	1.75	2.50	.41	1.63	.44	.25	3.75	3.69
2-1/2"	**EL-25**	2.25	3.00	.41	2.00	.44	.25	3.88	3.75
3"	**EL-30**	2.75	3.50	.53	2.13	.56	.38	4.38	4.00
4"	**EL-40**	3.50	4.50	.53	2.63	.56	.38	4.38	4.00

Side Lug Mount Kit



Position #1



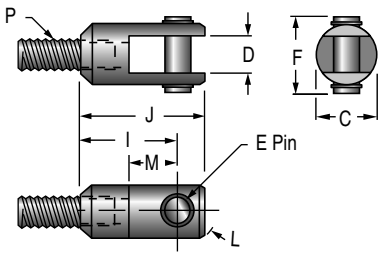
Position #2

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

Material:
Brackets, plated steel
Screws, Black Oxide Steel

Bore	Kit No.	EO1	EO2	LH	SB	SS1	SS2	ST	TS	US	XE1	XE2
2"	**SL-20**	0.50	0.50	1.63	.41	2.38	2.13	.25	3.75	4.50	3.00	2.88
2-1/2"	**SL-25**	0.50	0.63	2.00	.41	2.63	2.13	.25	4.25	5.00	3.13	2.88
3"	**SL-30**	0.56	1.19	2.13	.53	3.25	1.00	.38	4.75	5.88	3.44	2.31
4"	**SL-40**	0.56	1.19	2.63	.53	3.25	1.00	.38	5.50	6.63	3.44	2.31

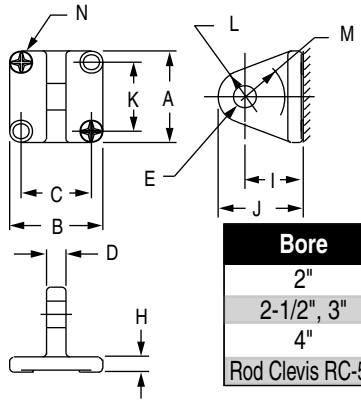
Rod Clevises



Materials
Clevis and Stud: Steel, black oxided
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"	**RC-56**	1.00	.32	.3120	1.21	1.31	1.69	.61	.63	1/2-20x.62	**EM-121**
4"	**RC-63**	1.38	.50	.4995	1.62	1.63	2.13	.80	.94	5/8-18x.75	**EM-521**

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 oxided

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

Product Index

Hi-Power™ Series –

Multi-Power® Series –

Pancake® Multi-Power® Series –

Square1® Multi-Power® Series –

Longstroke™ Multi-Power® Series –

Hi-Power™ Cylinders

Available in 3 series
10 Bore sizes 1-1/8" thru 12"
Strokes to 12"

Model THP8 x 8 - RFA shown

HP Series
- Designed for minimum overall length in relationship to stroke.
- 1/4" stroke increments to 4" maximum. For longer strokes use THP Series below.

THP Series
- Designed for minimum overall length in relationship to stroke.
- PTFE piston bearing for superior load support and longer strokes.
- 1/4" stroke increments through 4", 1" increments 5" through 12" max.

UHP Series
- Designed for minimum overall length relative to stroke.
- Buna-N U-cup seals for low break-away.
- PTFE piston bearing for superior load support and longer strokes.
- 1/4" stroke increments through 4", 1" increments 5" through 12" max.

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

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

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Ratings – Standard Units all series

- Double acting, single rod
- Duralon® rod bushing
- Female rod end with wrench flats
- Internally lubricated Buna-N O-ring piston and rod seals.
- Ports at position #1

- Media . . . . . Air
- Max. operating pressure . . . . . 250 psi
- Min. operating pressure recommended . . . . . 15 psi
- Ambient & media temperature range . . . -25° to +250°F
- Prelubrication . . . . . Magnalube®–G Grease
- Stroke tolerance . . . . . ± 1/64"

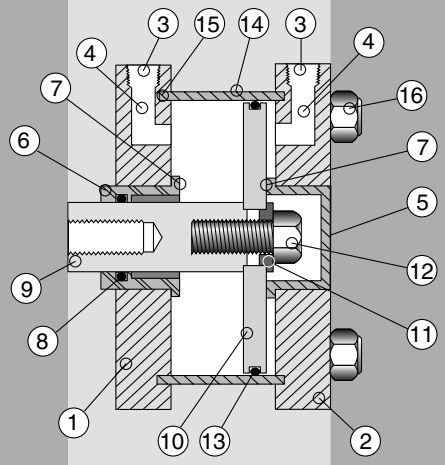
Sizing Guide

Bore Diameter	1-1/8	1-5/8	2-1/2	3	4	5	6	8	10	12
Rod Diameter	0.50	0.63	0.75	0.75	1.00	1.25	1.25	1.25	2.00	2.00
Rod Area	0.20	0.31	0.44	0.44	0.79	1.23	1.23	1.23	3.1	3.1
Push Area (Single Rod)	0.99	2.07	4.91	7.07	12.57	19.63	28.27	50.27	78.5	113.0
Pull Area	0.79	1.76	4.47	6.63	11.78	18.40	27.04	49.04	75.4	109.9
HP Base Weight, lb.	0.50	1.03	2.2	2.8	5.3	8.1	10.4	N/A	N/A	N/A
THP Base Weight, lb.	0.50	1.06	2.3	2.9	5.5	8.6	11.3	19.4	61.1	82.3
UHP Base Weight, lb.	0.62	1.29	2.8	3.6	6.8	10.1	13.5	23.7	67.3	91.3
Weight Per Inch, lb.	0.13	0.20	0.4	0.4	0.6	0.7	0.8	1.7	2.6	3.4

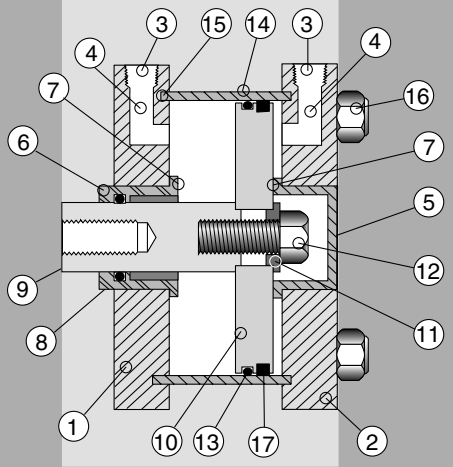
4

Standard Models

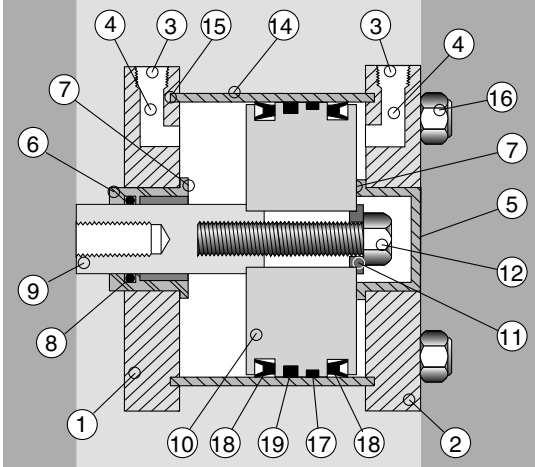
HP Series



THP Series



UHP Series



Basic Construction

Quick Reference to Components

No.	Description
1	Rod End Head, aluminum, black anodized
2	Cap End Head, aluminum, black anodized
3	NPT Ports
4	Full flow porting for fast response
5	Cap End Plug, aluminum, black anodized
6	Piston Rod Bushing, anodized aluminum housing with Teflon® lined Duralon® insert
7	Piston Stop
8	Rod Seal, internally lubricated O'Ring for long life
9	Piston Rod, stainless steel, centerless ground, polished, and hard chrome plated (68-72Rc)
10	Piston, aluminum
11	Piston Rod Pilot Washer locates piston to maintain precise concentricity
12	Piston Bolt, steel, Loctite® applied and torqued
13	Piston Seal, internally lubricated O'Ring for long life and improved performance
14	Cylinder Tube, aluminum Hard anodized ID (Rc60); Clear anodized OD
15	Cylinder Tube Seal
16	Stainless steel tie rods and plated steel nuts
17	PTFE Piston Bearing for superior load support
18	U Cup Seals, Buna-N
19	Magnet for piston position sensors

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 4.2 for a chart comparing the exceptional physical properties of Duralon® to other common, though less durable, bearing materials.

The Piston Rod – is Hard Chrome Plated Stainless Steel. 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.

Model Number Code

HP | **3** x **3** – **FF** – **MR**

Series	Bore	Standard Strokes
HP	1-1/8 1-5/8 2-1/2 3 4 5 6	1/4" Stroke Increments through 4" (maximum)
THP **UHP**	1-1/8 1-5/8 2-1/2 3 4 5 6 8 10 12	1/4" Stroke Increments through 4" 1" Stroke Increments through 12" (maximum)

Bores	Mounting
Series HP, THP, and UHP 1-1/8" through 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 Ports in-line with slot . . . . . **-PM** Ports 90° to slot . . . . . **-SM** Extended Tie Rods (See pg. 4.6 for non-standard lengths.) Rod end only . . . . . **–WF** Cap end only . . . . . **–WR** Rod and Cap Ends. . . . . **–WFR**
Series THP and UHP only 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
3. Specify Mounting
4. Specify Options

Examples

HP3 x 3 FF – MR
HP Series Hi-Power™, 3" bore, 3" stroke, Front Face (Fabco Pattern) Mount, Male Rod Thread

THP5 x 7 – RFA – TFR
PTFE Piston Bearing Series, 5" Bore, 7" Stroke, Rear Face [NFPA MF2 pattern] Mount, 1/2 NPT Ports in Rod and Cap Heads

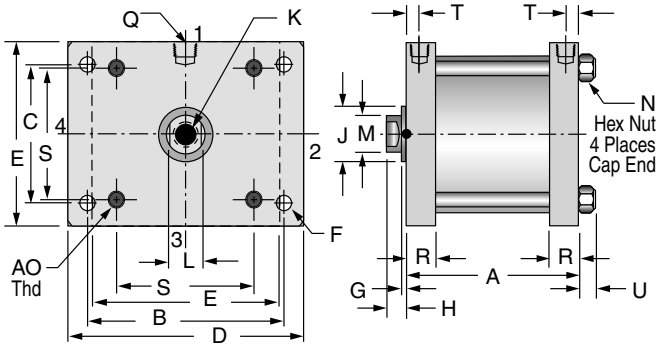
OPTIONS

Description	Specify	See Page
Double Rod HP: 1-1/8" thru 6" Bore THP: 8" thru 12" Bore UHP: 1-1/8" thru 12" Bore	**-DR**	4.10
Hole Thru Double Rod Shaft 150 psi max. operating pressure Bore / Hole 1-1/8", 1-5/8" / .13"	**-DR13**	4.10
2-1/2", 3" / .16"	**-DR16**	
4", 5", 6" / .25"	**-DR25**	
8", 10", 12" / Not available		
Nonrotating 150 psi max. operating pressure HP: 1-5/8" Bore & Larger THP: All Bores UHP: 2-1/2" Bore & Larger	**-K**	4.10
Male Rod Thread		4.7
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**	4.7
Hydraulic, Low Pressure to 500 psi NONSHOCK (HP & THP Only)	**-H**	4.10
Rubber Bumpers		4.8
Rod End	**-BF**	
Cap End	**-BR**	
Both Ends	**-BFR**	
Adjustable Extend Stroke 6" Stroke Maximum Full stroke adjustment is standard.	**-AS**	4.7
1/2 NPT Ports in Heads ‡ (2-1/2", 3", 4", 5", & 6" Bores only)		4.8
Rod End Head	**-TF**	
Cap End Head	**-TR**	
Both Heads	**-TFR**	
3/4 NPT Ports in Heads		4.8
10" & 12" Bores only	**-P34**	
Extend Port Bushing		4.8
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**	
Port Positions		4.5 & 4.6
All Ports • Position #1	**Standard**	
#2 **-PA2**; #3 **-PA3**; #4 **-PA4**		
Rod End Port •Position #1	**Standard**	
#2 **-PR2**; #3 **-PR3**; #4 **-PR4**		
Cap End Port •Position #1	**Standard**	
#2 **-PC2**; #3 **-PC3**; #4 **-PC4**		
Any port not specified will be in position #1 as shown on pages 4.5 & 4.6		
Magnetic Piston ‡ for Reed Switches and Electronic Sensors (Order Sensors separately)	**-E**	4.9

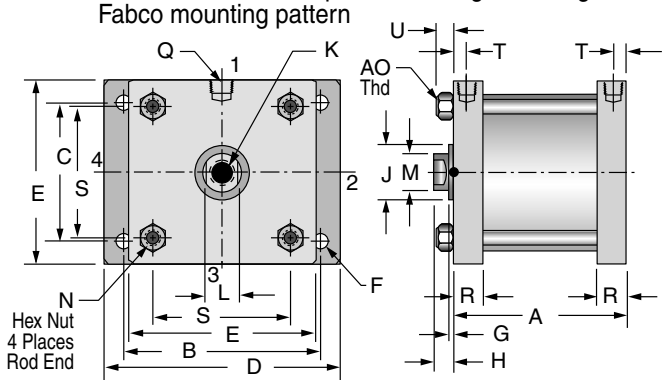
‡ Note: Additional Cylinder Length Required for 1/2 NPT Ports Option see page 4.8; for Option -E see page 4.9.

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

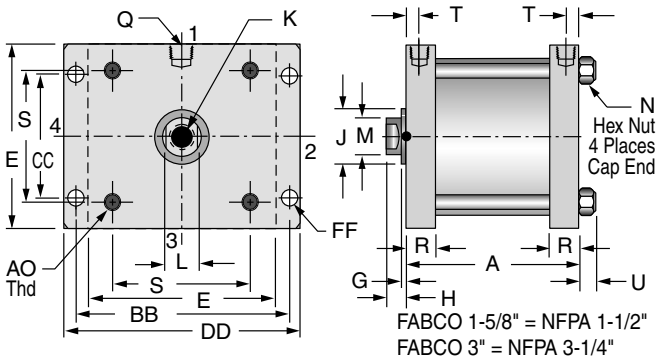
-FF Front Face Mount; Rod End Rectangular Flange
Fabco mounting pattern



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

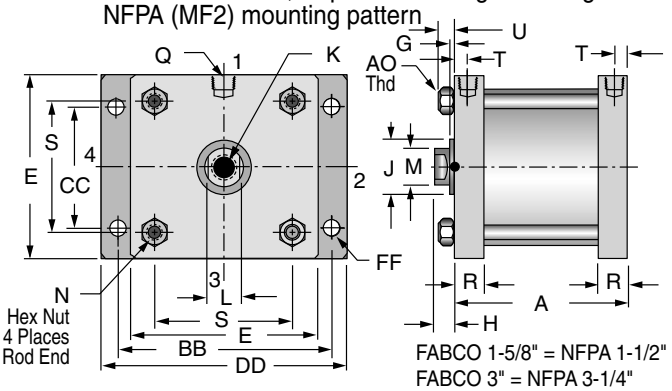


-FFA Front Face Mount; Rod End Rectangular Flange
NFPA (MF1) mounting pattern



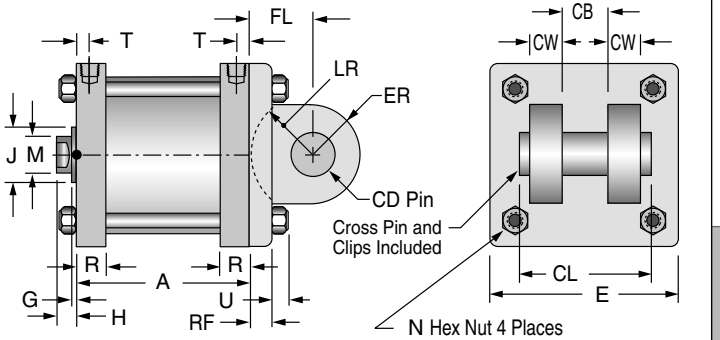
FABCO 1-5/8" = NFPA 1-1/2"
FABCO 3" = NFPA 3-1/4"

-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"

Clevis Mount (NFPA MP1 Dimensions)
-PM - Ports in-line with slot
-SM -Ports 90° to slot



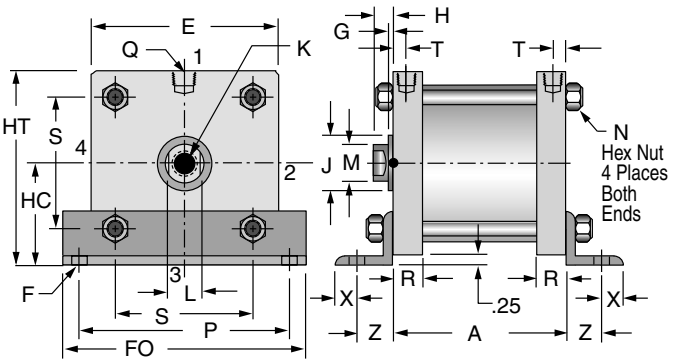
Material: Gray Iron Casting,
Black Oxide Finish

Dimensions (inches)

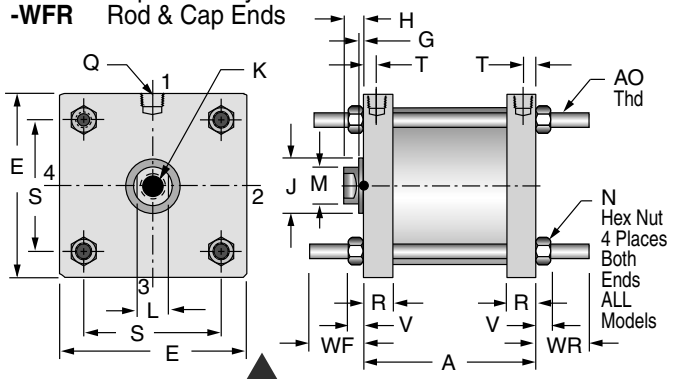
Bore	A			B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R
	Series HP	Series THP	Series UHP								±.002			±.001			NPT	
1-1/8	1.31 + stroke	1.50+stroke	2.63+stroke	2.00	1.25	2.50	1.75	.28	.13	.50	.752	5/16-24x.63	7/16	.500	7/16	2.38	1/8	.50
1-5/8	1.75 + stroke	2.00+stroke	3.00+stroke	2.50	1.75	3.00	2.25	.28	.13	.50	1.001	3/8-24x.63	1/2	.625	7/16	2.88	1/8	.63
2-1/2	2.06 + stroke	2.25+stroke	3.25+stroke	3.63	2.38	4.25	3.00	.34	.19	.50	1.127	1/2-20x.75	5/8	.750	9/16	3.69	1/4	.75
3	2.06 + stroke	2.25+stroke	3.25+stroke	3.88	2.75	4.50	3.50	.34	.19	.50	1.127	1/2-20x.75	5/8	.750	9/16	4.13	1/4	.75
4	2.06 + stroke	2.25+stroke	3.25+stroke	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	2.50 + stroke	2.75+stroke	3.50+stroke	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	2.38 + stroke	2.75+stroke	3.50+stroke	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	NA	2.88+stroke	3.75+stroke	7.57	NA	NA	9.00	.69	.13	.63	1.752	3/4-16x1.13	1	1.250	3/4	NA	3/8	1.00
10	NA	4.75+stroke	5.75+stroke	9.40	NA	NA	12.00	.78	.25	1.00	2.751	1 1/2-12x1.75	1.75	2.000	1-1/8	NA	1/2	1.50
12	NA	4.75+stroke	5.75+stroke	11.10	NA	NA	14.00	.78	.25	1.00	2.751	1 1/2-12x1.75	1.75	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



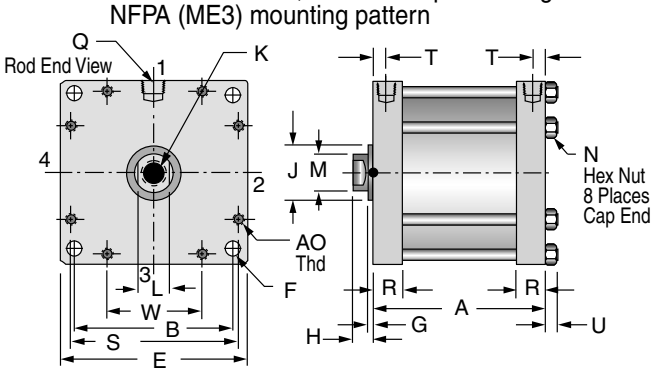
To Order Extended Tie Rod Mount Specify Suffix

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

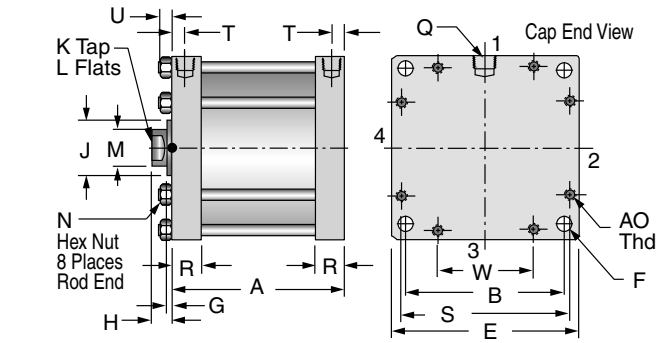
If a non-standard extension is required, specify by adding the required length to the suffix.
e.g. If **–WF** length required is 2.5", Specify –WF2.5"

8", 10", and 12" Bores

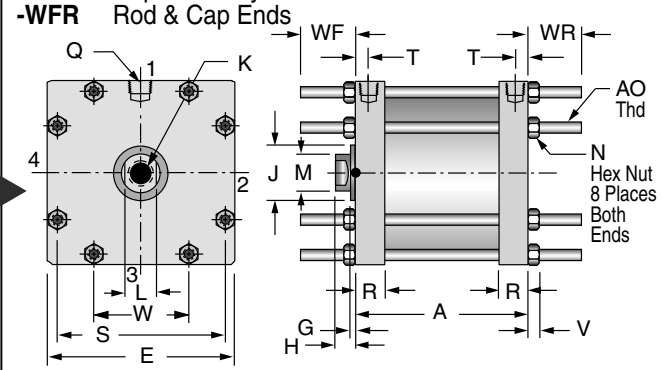
-FFA Front Face Mount; Rod End Square Flange
NFPA (ME3) mounting pattern



-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



Dimensions (inches)

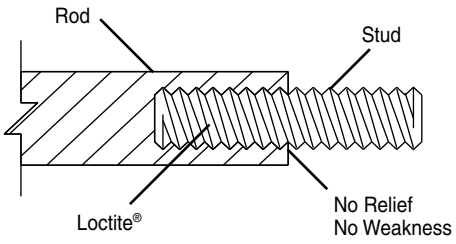
Bore	S	T	U	V	W	X	Z	AO	BB	CC	DD	FF	FO	HC	HT	WF	WR	CD	FL	RF	CB	CW	ER	LR	CL
1-1/8	1.19	.22	.27	.22	NA	.31	.44	1/4-20	2.00	1.00	2.50	.22	3.00	1.13	2.00	1.0	1.0	.500	.75	.38	.76	.50	.62	.62	2.09
1-5/8	1.62	.25	.27	.22	NA	.38	.63	1/4-20	2.75	1.43	3.25	.28	3.50	1.38	2.50	1.0	1.0	.500	.75	.38	.76	.50	.62	.62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

VITON SEALS — **OPTION -V**

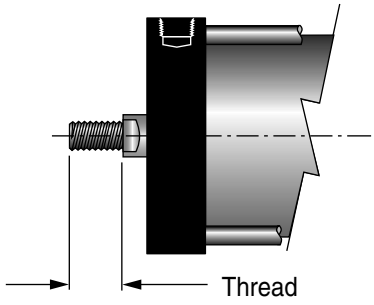
Use for elevated temperatures (–15° to + 400°F) or compatibility with exotic media. Consult engineering for compatibility information.

MALE ROD THREAD

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"	3/4–16 x 1.50
10"	1-1/2–12 x 2.25
12"	1-1/2–12 x 2.25

ADJUSTABLE EXTEND STROKE

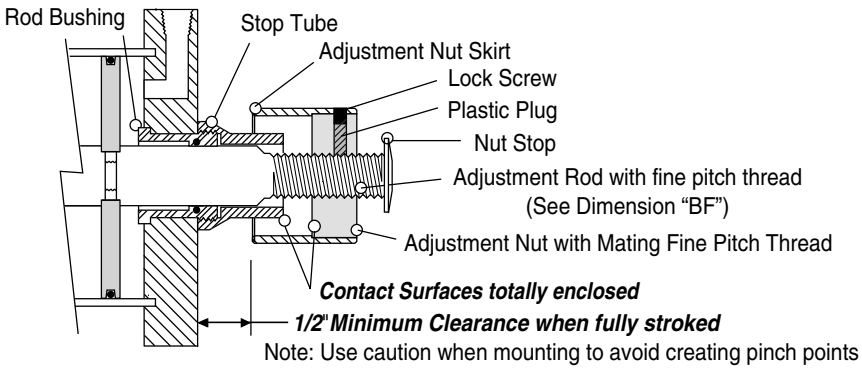
For strokes through 6" **-AS**
Full stroke adjustment is standard.

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.

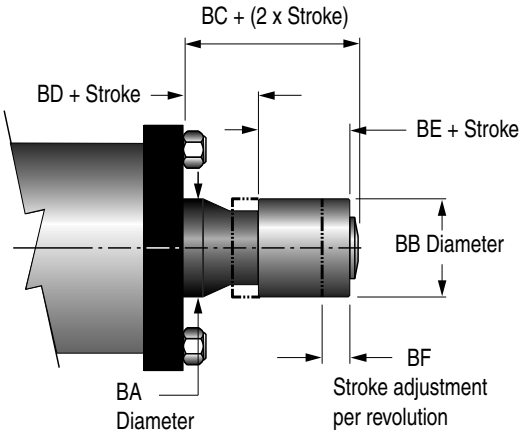
Not available for 10" & 12" bores

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.



Note: Use caution when mounting to avoid creating pinch points



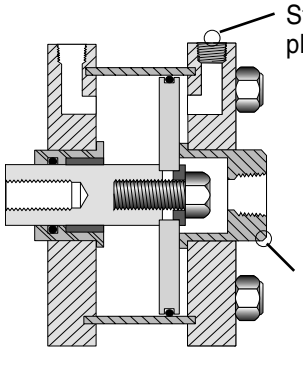
Bore	1-1/8"	1-5/8"	2-1/2"	3"	4"	5"	6"	8"	
BA	1.13	1.25	1.50	1.50	2.00	2.25	2.25	2.25	
BB	1.50	1.50	2.00	2.00	2.00	2.25	2.25	2.25	
BC	1.67	1.67	1.90	1.90	1.67	1.67	1.67	1.67	+ (2 x Stroke)
BD	1.00	1.00	1.00	1.00	.75	.75	.75	.75	+ Stroke
BE	.50	.50	.75	.75	.75	.75	.75	.75	
BF	.050	.050	.063	.063	.063	.071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

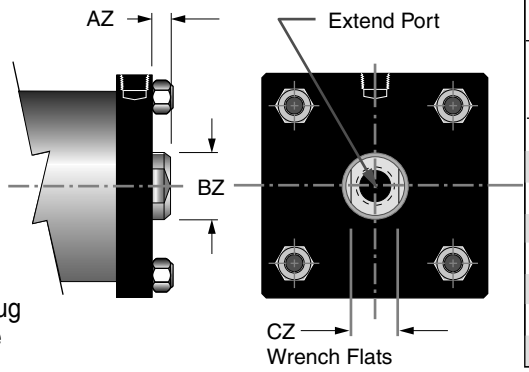
EXTEND PORT BUSHING **OPTION**

3/8 NPT	(2-1/2" – 8" bores)	**-E38**
1/2 NPT	(2-1/2" – 8" 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	.31	1.75	1.50	✓	✓	✓
10	.50	2.75	2.25	–	–	✓
12	.50	2.75	2.25	–		✓

4

1/2 NPT PORTS IN HEADS

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

Rod End Head	**-TF**
Cap End Head	**-TR**
Both Heads	**-TFR**

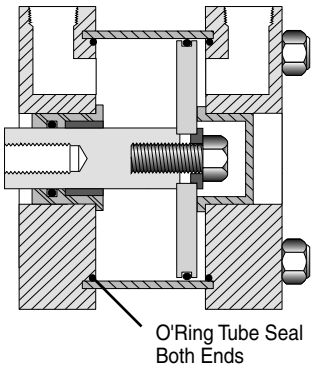
3/4 NPT PORTS IN BOTH HEADS

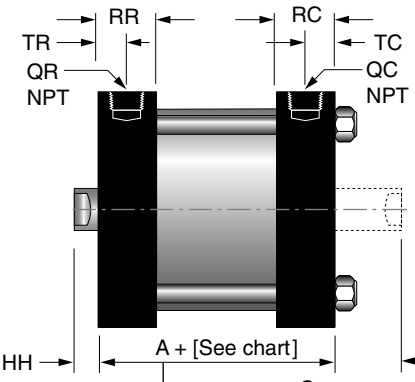
10" & 12" Bores only **-P34**

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

Use when higher cycle speeds are required.



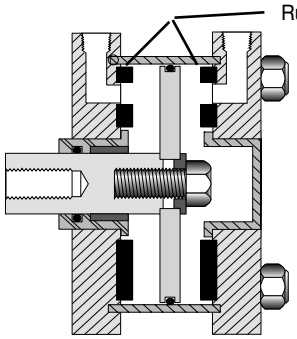


See pages 4.5 & 4.6 for Dimension "A"

Option	Add to A	QC	QR	RC 2-1/2 & 3" Bore	RC 4, 5 & 6" Bore	RC 10 & 12" Bore	RR 2-1/2 & 3" Bore	RR 4, 5 & 6" Bore	RR 10 & 12" Bore	HH 2-1/2, 3 & 4" Bore	HH 5 & 6" Bore	HH 10 & 12" Bore	HH-DR 2-1/2, 3 & 4" Bore	HH-DR 5 & 6" Bore	HH-DR 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

RUBBER BUMPERS

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.

MAGNETIC PISTON Option -E

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 4.5 & 4.6.***

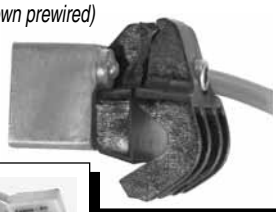
4

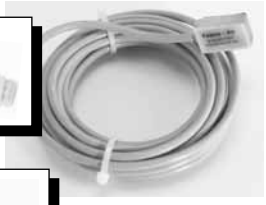
9-2A197 Series Sensor & Clamp for 1-1/8" to 3" Bores

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

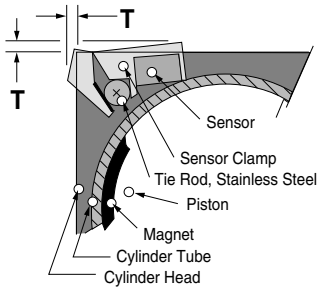
Female Cordsets available in 1, 2, & 5 meter lengths

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.

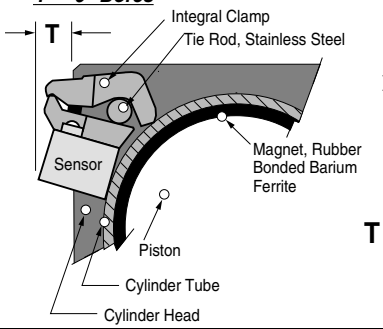
(T) Clamp Stick Out & (L) Length Adder to Dim. 'A' Pgs. 4.5 & 4.6

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 (for Series HP)	1	1	1	1	1	1	1"	NA	NA	NA
L (for Series THP)	.81	.75	.81	.81	.81	.75	.63	1.25	1.00	1.00
L (for Series UHP)	0	0	0	0	0	0	0	0	0	0

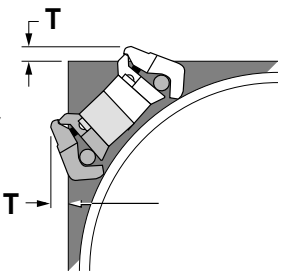
1-1/8" – 3" Bores



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.

Product	9 ft. Prewired P/N	Quick Discon. P/N	Electrical Characteristics
LED Lighted Magnetic Piston Position Sensors: Bores 1-1/8" – 3"			
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

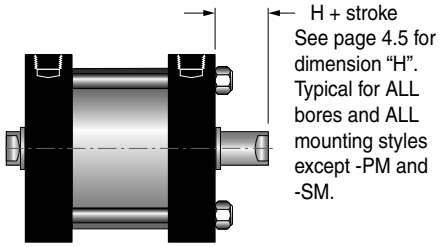
Female Cordsets for 9-2A197 Series Quick Disconnect Sensors

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

Double Rod **Option -DR**



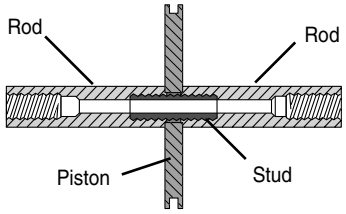
Standard piston rod and rod bushing on both ends of the cylinder.

Available in Series HP – 1-1/8" thru 6" bore; THP – 8" thru 12" bore; and UHP – 1-1/8" thru 12" bore, with 1/4" inch stroke increments through 4" and 1" stroke increments to 12". The THP Series (PTFE piston bearing) is not required because the two rod bushings provide excellent piston support.

Use when attachment to both ends of the cylinder is required, or to indicate piston position. Also see Option –E on page 4.9.

Hole Thru (4" stroke maximum)
150 psi max. operating pressure

Bore	Hole Size	
1-1/8", 1-5/8"	.13"	**-DR13**
2-1/2", 3"	.16"	**-DR16**
4", 5", 6",	.25"	**-DR25**
8", 10", 12"	Not available	



A hole is drilled through the piston rods and the double rod stud. The rods are centered by pilot bosses in the piston and threaded tightly on the hollow stud.

This hole can be used for the passage of air, gas, liquid, or any media that is compatible with the stainless steel piston rod and the steel stud.

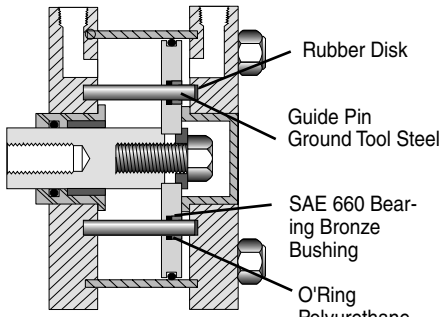
The hole for each bore size is shown in the chart at the left.

Available in Series HP and UHP only with 1/4" stroke increments through a maximum of 4".

Use when the attachment to the rod required a fluid or vacuum.

Nonrotating Rod
150 psi max. operating pressure **-K**

HP 1-5/8" Bore and larger
THP All Bores
UHP 2-1/2" Bore and larger



NOTE: Wrench flats have random location

Two guide pins incorporated inside the cylinder pass through the piston head. These guide pins prevent rotation of the rod with a tolerance of ± 1°.

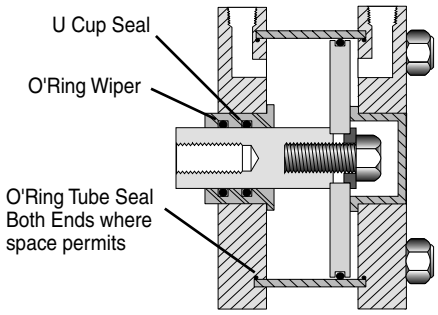
Note that the nonrotating guide pins are located internally. This provides protection from the environment and from physical damage, common lubrication with the cylinder, and NO additional space requirements. The rod end area is free for any attachments or tooling required by your application.

The guide pins are precision ground tool steel and run in SAE 660 bearing bronze bushings and polyurethane O'Rings. These features provide precision guiding and long, trouble free life. A rubber disk is included at the end of each guide pin to take up end play and seat the pins firmly in the guide pin holes.

An information label similar to the one below is applied to each cylinder to warn against damage.

> WARNING
> THIS CYLINDER HAS A NONROTATING ROD. TO PREVENT INTERNAL DAMAGE, HOLD ROD BY WRENCH FLATS WHEN INSTALLING OR REMOVING ATTACHMENTS.

Hydraulic **-H**
Low pressure service to 500 psi ***Nonshock***



Where space permits, a U Cup seal is placed inboard in an SAE 660 bronze bushing to eliminate leakage past the rod seal; an O'Ring is used as an outboard wiper.

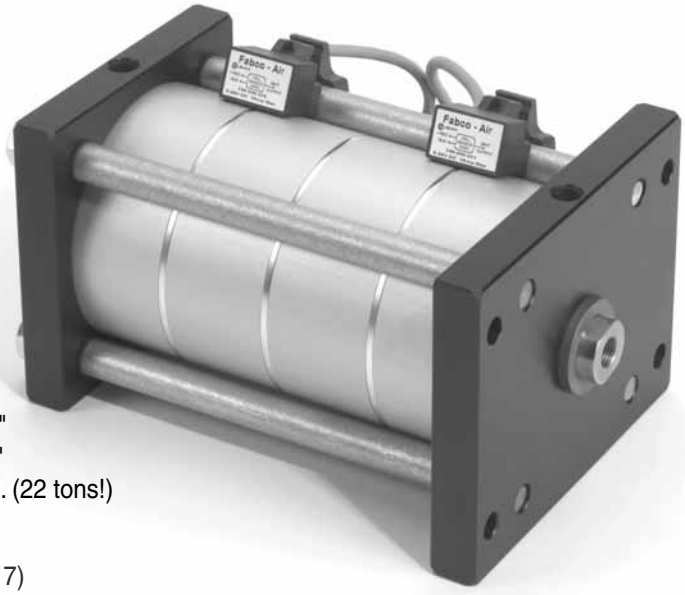
When space is limited, two O'Ring seals are used in the bronze bushing.

Use with an Air-over-Oil system when the rigidity and precision smoothness of hydraulics and control is required. See page 5.11 and section 9 of this catalog for information on Air Oil Tanks and systems.

Note: -PM or -SM mounts are NOT available for applications over 250 psi.

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

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

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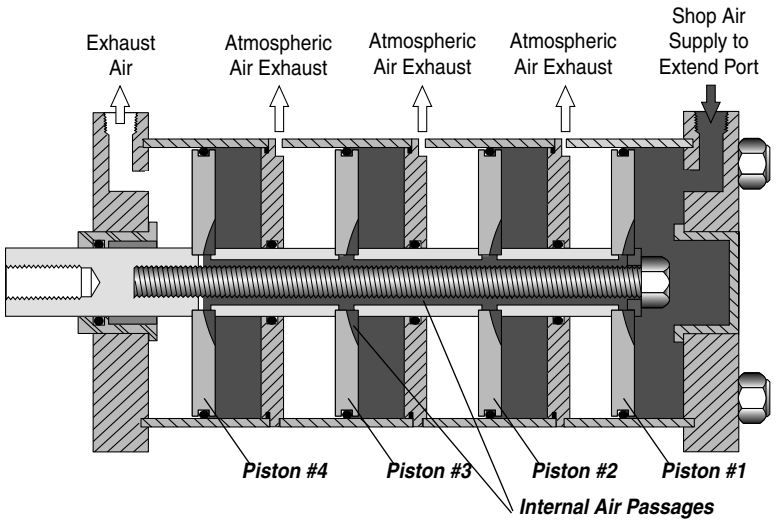
Features & Benefits

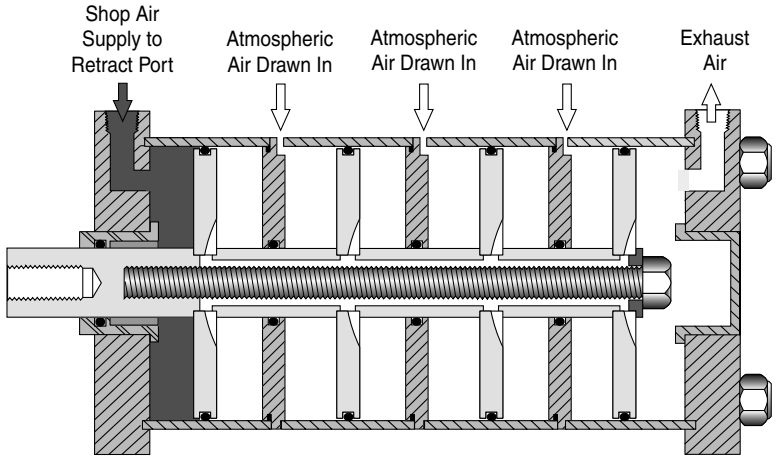
More force from available shop air	Eliminates hydraulics – stays clean
Multiple pistons on the power stroke	Saves mounting space (44 to 75%)
Single piston on the retract stroke	Saves air (22 to 37%)
Building block design	Low cost – Quick delivery – Specials
Wide range of models, sizes and options	Adapts 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, 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.

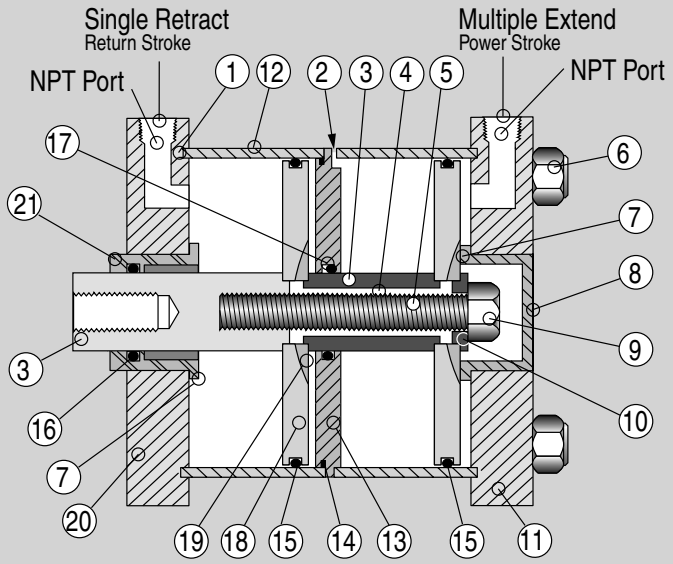
‡ Areas given are for Standard *Single* Stage Retract. For *Single* Stage Extend with a single rod, add the rod area shown.

Ratings – Standard Units

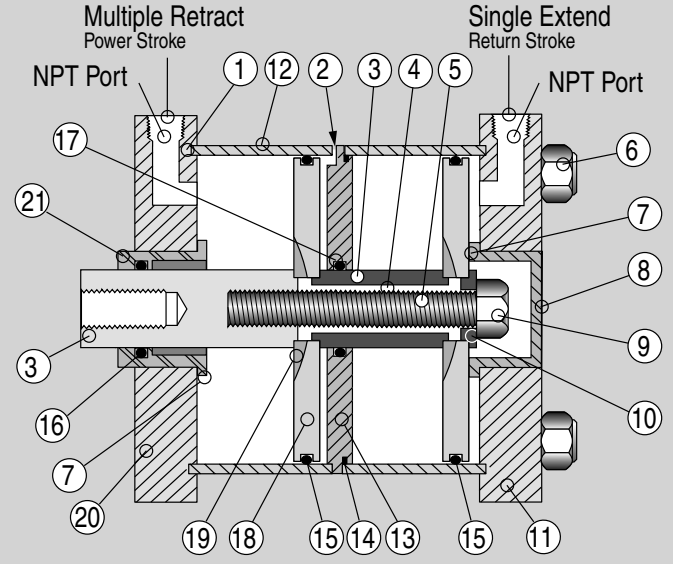
- Duralon® rod bushing. (see page 5.1 for table of physical properties)
- Female rod end with wrench flats
- Internally lubricated Buna-N O-ring piston and rod seals.
- Airline lubrication recommended
- Media . . . . . Air
- Max. operating pressure . . . . . See chart
- Min. pressure recommended . . . . . 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 – 3 – 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	—	1
3	—	1
4	—	1
1	—	2‡
1	—	3‡
1	—	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 – 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

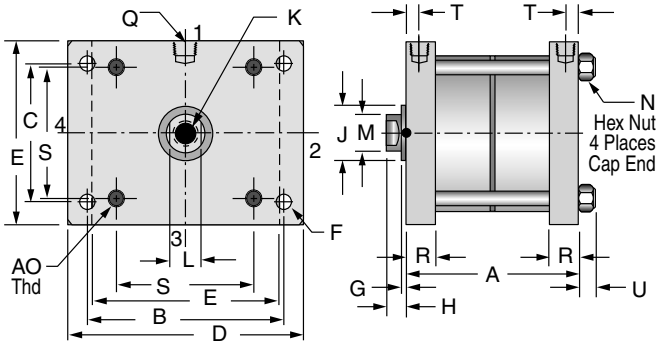
Description			Specify	See Page
1"–14 Rod thread – 8" bore only			**-KF**	5.5
Double Rod			**-DR**	5.8
Nonrotating Single Rod ‡			**-NR**	5.8
Nonrotating Double Rod ‡			**-NRDR**	5.8
Male Rod Thread				5.7
Single Rod			**-MR**	
Double Rod, Rod End			**-MR**	
Double Rod, Cap End			**-MR1**	
Double Rod, 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 ‡				
(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			**-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

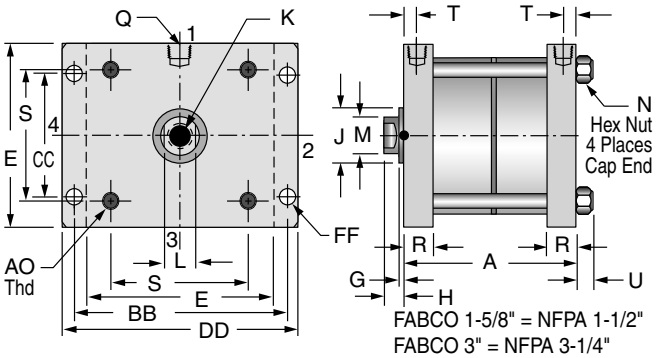
5

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

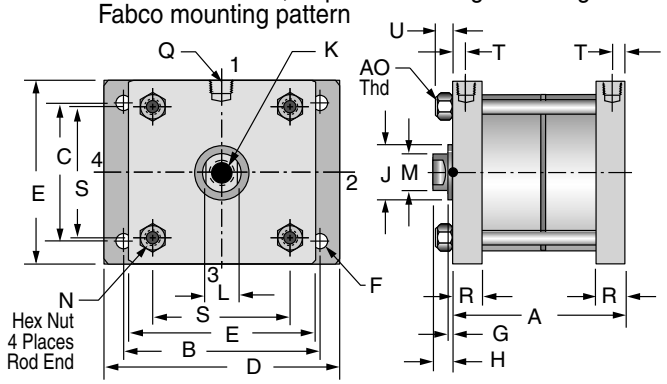


-FFA Front Face Mount; Rod End Rectangular Flange
NFPA (MF1) mounting pattern

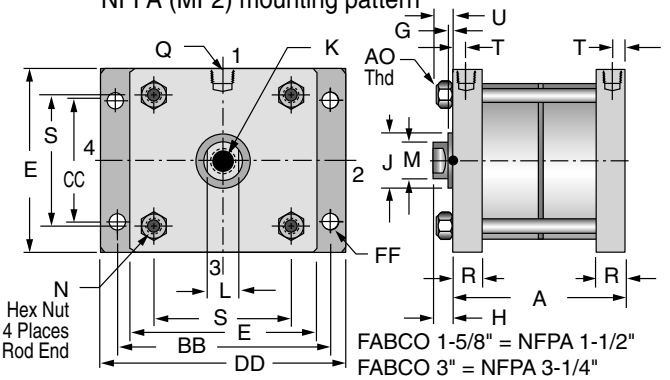


FABCO 1-5/8" = NFPA 1-1/2"
FABCO 3" = NFPA 3-1/4"

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

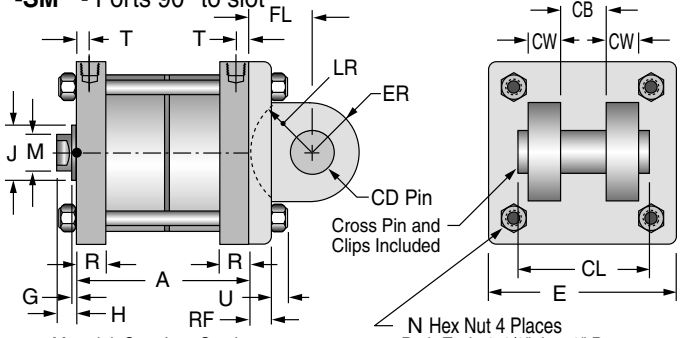


-RFA Rear Face Mount; Cap End Rectangular Flange
NFPA (MF2) mounting pattern



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



Material: Gray Iron Casting,
Black Oxide Finish

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).

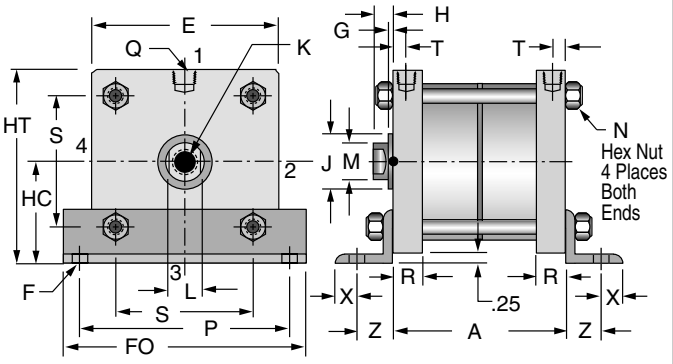
The following options also require additional cylinder length. See the respective option information pages for details. **-NR, –NRDR** (pg 5.8), **-HS** (pg 5.11), **-TF, -TR, -TFR** (pg 5.10), **-E** (pg 5.12).

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

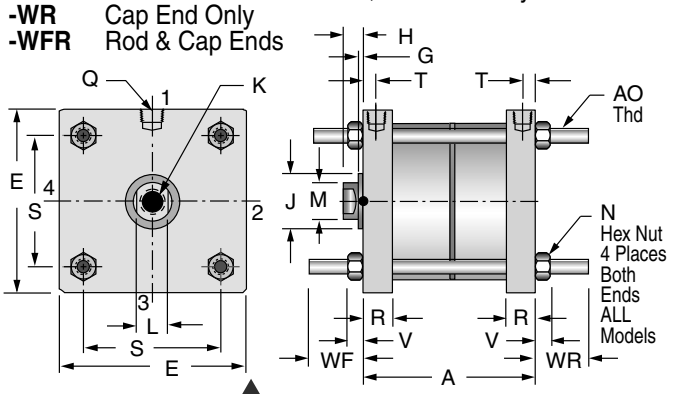
Bore	A= (No. stages x stroke) + y‡			B	C	D	E	F	G	H	J	K†	L	M	N	P	Q	R
	y‡ (2 stage)	y‡ (3 stage)	y‡ (4 stage)								±.002			±.001			NPT	
1-1/8	1.86	2.41	2.96	2.00	1.25	2.50	1.75	.28	.13	.50	0.752	5/16-24x.63	7/16	0.500	7/16	2.38	1/8	.50
1-5/8	2.42	3.08	3.75	2.50	1.75	3.00	2.25	.28	.13	.50	1.001	3/8-24x.63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



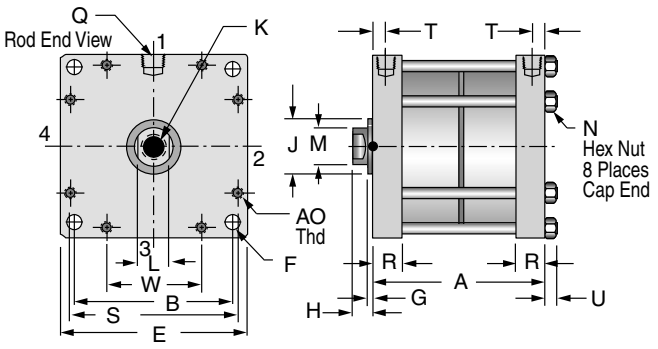
To Order Extended Tie Rod Mount — Specify Suffix

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

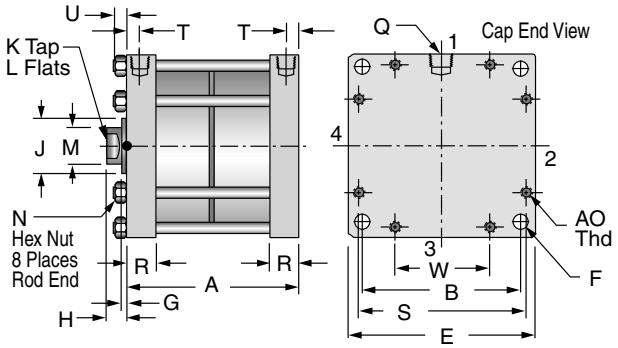
If a non-standard extension is required, specify by adding the required length to the suffix.
e.g. If **–WF** length required is 2.5", Specify –WF2.5"

8", 10", and 12" Bores

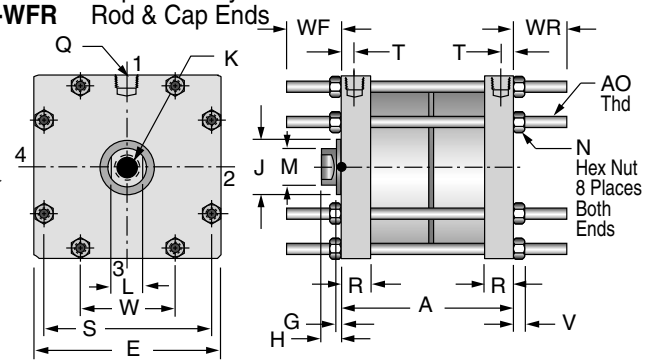
-FFA Front Face Mount; Rod End Square Flange
NFPA (ME3) mounting pattern



-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



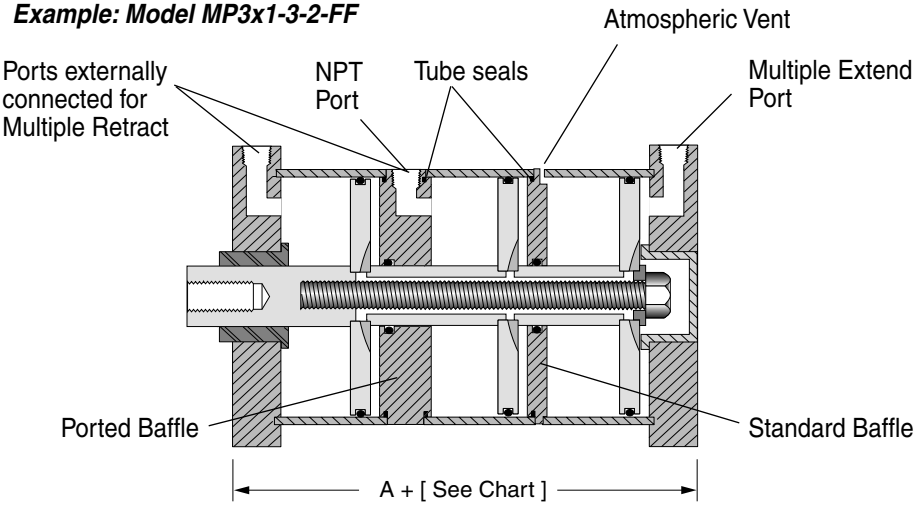
Bore	S	T	U	V	W	X	Z	AO	BB	CC	DD	FF	FO	HC	HT	WF	WR	CD	FL	RF	CB	CW	ER	LR	CL
1-1/8	1.19	.22	.27	.22	NA	.31	.44	1/4-20	2.00	1.00	2.50	.22	3.00	1.13	2.00	1.0	1.0	.500	.75	.38	.76	.50	.62	.62	2.09
1-5/8	1.62	.25	.27	.22	NA	.38	.63	1/4-20	2.75	1.43	3.25	.28	3.50	1.38	2.50	1.0	1.0	.500	.75	.38	.76	.50	.62	.62	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 MP3x1-3-2-FF



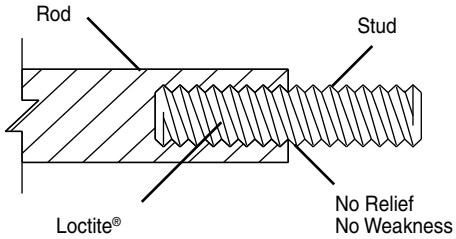
Bore	Port	Add to Dimension "A" for each Ported Baffle
1-1/8"	1/8 NPT	.50"
1-5/8"	1/8 NPT	.50"
2-1/2"	1/4 NPT	.50"
3"	1/4 NPT	.50"
4"	1/4 NPT	.50"
5"	1/4 NPT	.50"
6"	1/4 NPT	.50"
8"	1/2 NPT	1.00"

Available Combinations	No. of Ported Baffles	Total No. of Stages
2 – 2	1	2
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

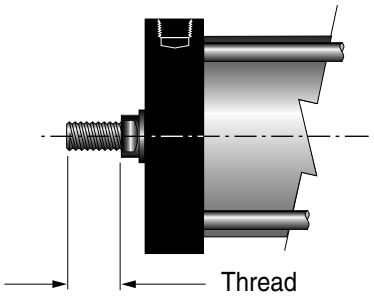
Notes:
When any of these combinations are ordered, the proper number of ported baffles are included.
As standard, the largest number of stages are internally connected.
On models with the same number of extend and retract stages, the extend stages are internally connected.

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**



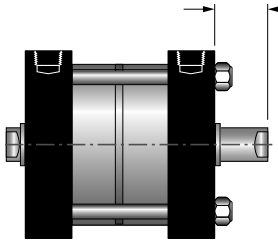
For bores 1-1/8" thru 8", a high strength stud is threaded into the standard female rod end and retained with Loctite®. This method eliminates the small diameter thread relief area normally required when machining male threads. This provides a much stronger rod end which can be repaired, rather than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

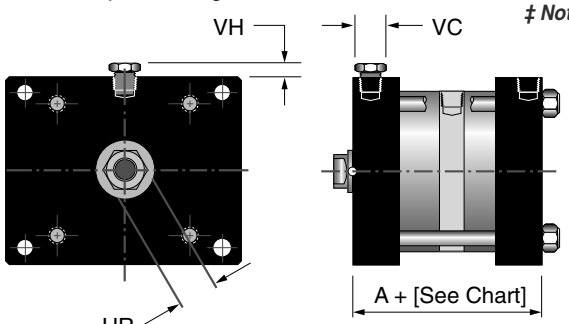
A stainless steel hex rod and a hex broached bushing of SAE 660 bearing bronze replaces the standard round rod and bushing.

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°.

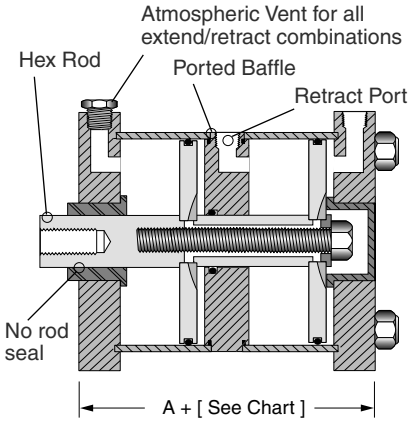
The hex rod design does allow for some torque loading on the shaft. However, torque loads that induce side loading should be minimized for best overall life and performance.

Available Combinations	No. of Ported Baffles	Total No. of Stages
2 – 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 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.

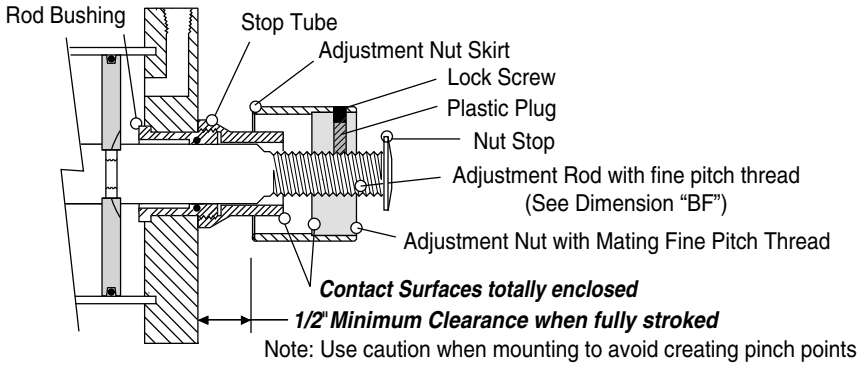
Adjustable extend stroke

Option -AS

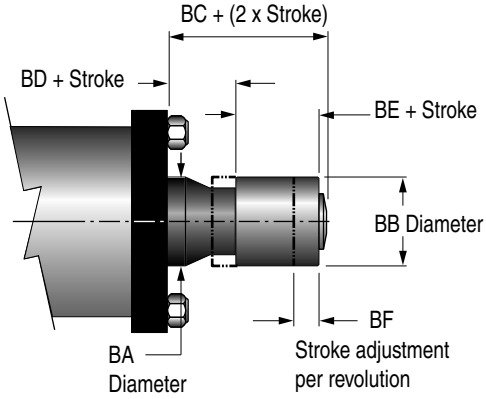
For strokes through 6"
Full stroke adjustment is standard.

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

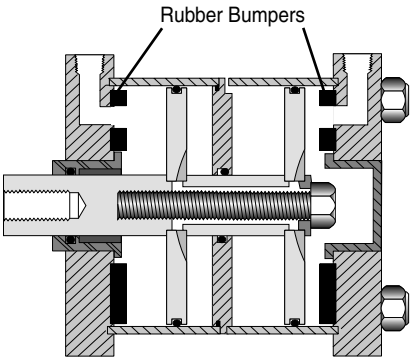
Dial-A-Stroke® provides a rugged and precision adjustment of the extend stroke of the cylinder. The stop tube, adjustment nut with skirt, and minimum clearances combine to eliminate pinch points, thus providing operator safety. **Note!** Use caution when mounting to avoid creating pinch points with other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

The stop tube is 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.

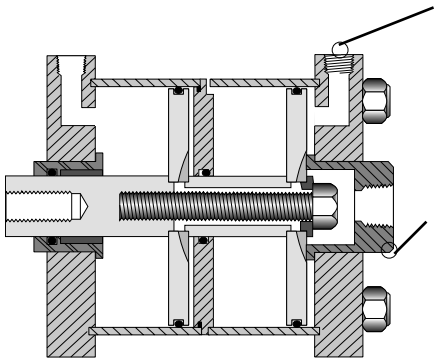
Because of the temperature limitations of the adhesives involved (-25° to +225°F), rubber bumpers are available in cylinders with standard internally lubricated Buna-N seals only.

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.

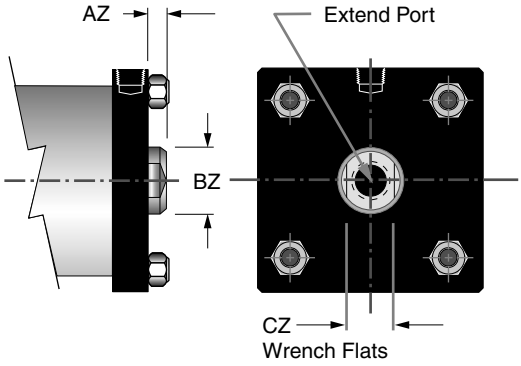
Extend Port Bushing **Option**

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

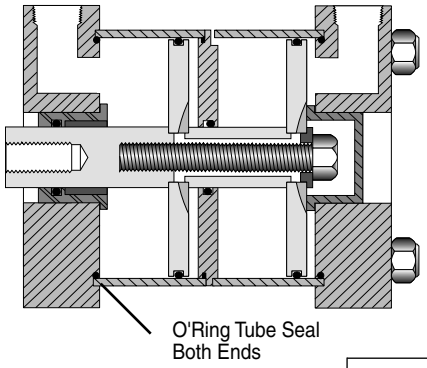
1/2 NPT Ports in Heads **Option**

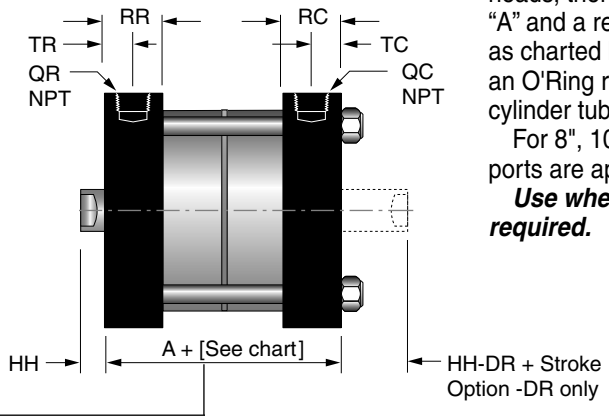
2-1/2", 3", 4", 5", & 6" Bores only

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**

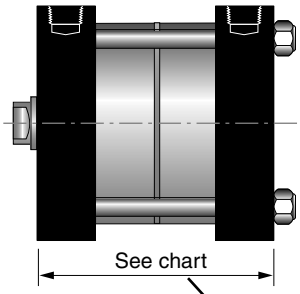
The atmospheric vent in the baffle is cut larger to provide less resistance to the air flow.

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"

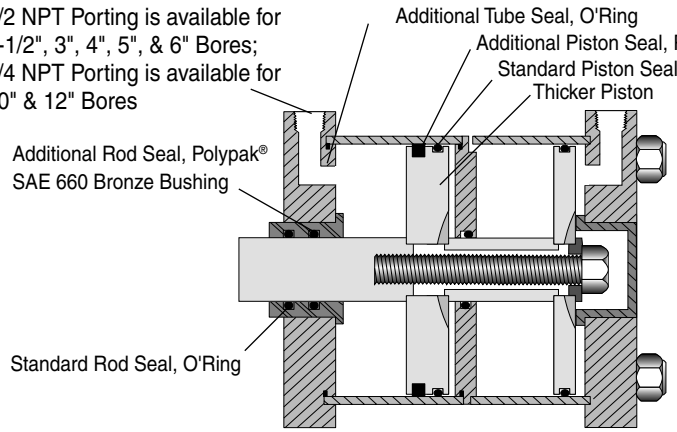
When Multi-Power® cylinders are applied to applications such as punching or shearing, high inertial and impact forces are often encountered. To capture these potentially destructive forces, and prevent possible damage to tooling and cylinder specify Option –˙HS.

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.

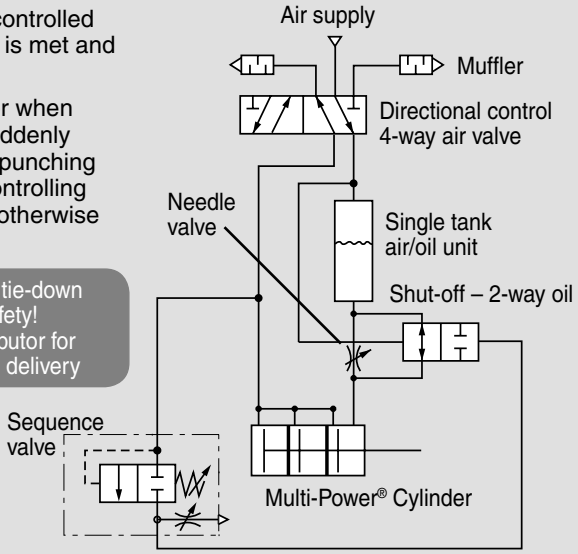
Application Tips

Two Speed & Shock Control

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

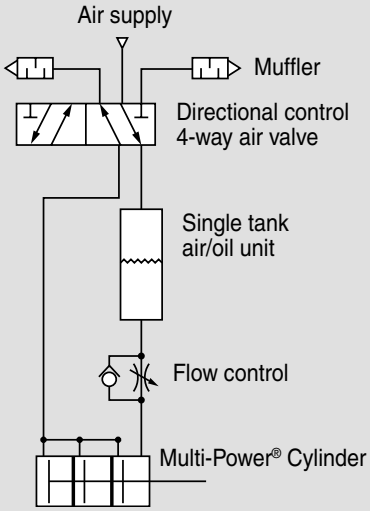
1. Rapid "Extend" stroke.
2. Automatic switch to controlled rate when resistance is met and pressure builds up.
3. Fluid catches cylinder when built-up forces are suddenly released (such as in punching applications), thus controlling the shock that could otherwise occur.
4. Automatic return to rapid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

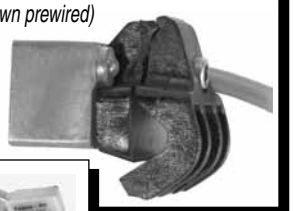


9-2A197 Series Sensor & Clamp for 1-1/8" to 3" Bores

Quick Disconnect Sensor Shown

Socket Head Screw

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.

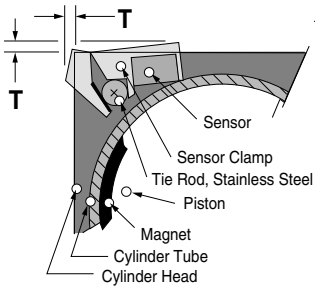
Magnetic Piston Option -E

Specifies Magnetic Piston (Order Sensors and Sensor Clamps Separately)

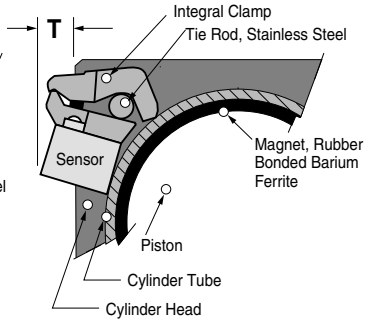
- ***Option -E*** consists of a magnet bonded into the piston head. When the piston magnet moves past an external sensor, the magnetic field activates the sensor without physical contact.
- ***Mounting*** – The sensor is attached to a 2-part clamp that attaches rigidly to a tie rod and can be positioned 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

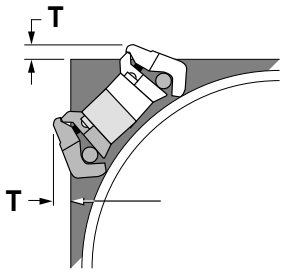
1-1/8" – 3" Bores



4" – 6" Bores



8", 10", 12" Bores



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

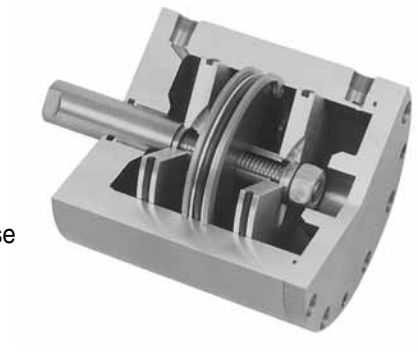
LED Lighted Magnetic Piston Position Sensors: Bores 1-1/8" – 3"			
Product	**9 ft. Prewired P/N**	**Quick Discon. P/N**	**Electrical Characteristics**
Reed Switch	9-2A197-1004	9-2A197-1304	5-120 VDC/VAC, 0.5 Amp Max., 10 Watt Max., SPST N.O., 3.5 Voltage Drop
Electronic	9-2A197-1033	9-2A197-1333	Sourcing, 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

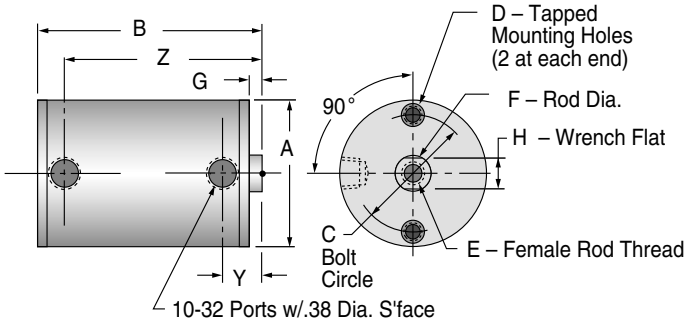


Sizing *Pancake® – Multi-Power®* Cylinders

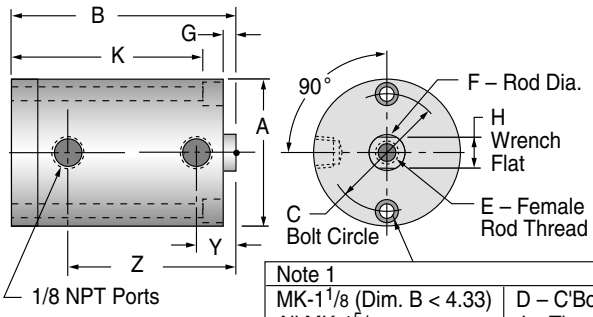
Series Bore	Stages (Pistons)	Area ‡	Equivalent Bore †	Force @ 60 psi	Retract Area	Body O. D.	Available Strokes 1/8"	1/4"	1/2"	3/4"	1"	1-1/2"
MK 1/2	2	.35	.6	20	.15	1.13	•	•	•		•	•
	3	.50	.7	30			•	•	•	•		
	4	.65	.9	35				•	•			
MK 3/4	2	.80	1.0	45	.36	1.50	•	•	•		•	•
	3	1.16	1.1	70			•	•	•	•		
	4	1.52	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.

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) All MK-1 5/8	D – C'Bored 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		Stroke		Stages Extend	Stages Retract		

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

Stroke: See available strokes in the sizing guide on page 5.13

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.

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) Order sensors separately.		**-E**
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®

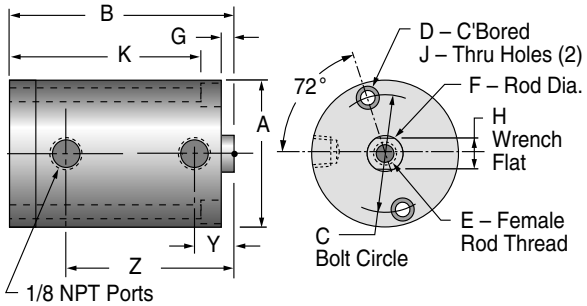
2" Bore, 1" Stroke, 2 Stage Extend, 1 Stage Retract

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

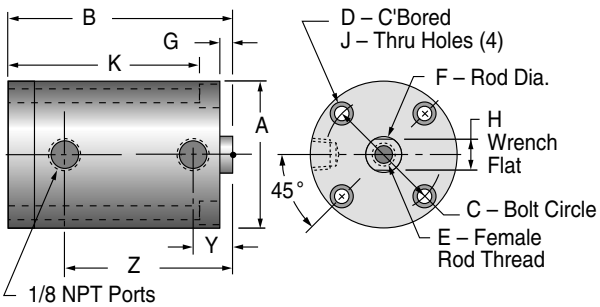
Pancake®-Multi-Power®

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

Model -MK 2



Models -MK 2-1/2, -MK 3, and **-MK4**

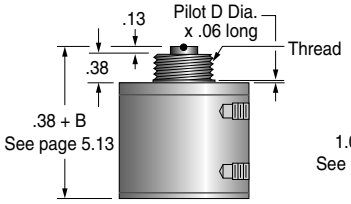


Variable Dimensions

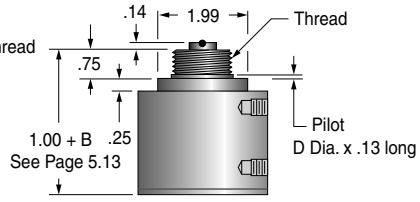
Series Bore		MK 1/2		MK 3/4		MK 1-1/8				MK 1-5/8			MK 2			MK 2-1/2			MK 3			MK 4		
	Stroke	B	Z	B	Z	B	K	Y	Z	B	K	Z	B	K	Z	B	K	Z	B	K	Z	B	K	Z
2 Stages extend	1/8	1.88	1.55	1.88	1.55	2.36	2.03	0.52	1.52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1/4	2.13	1.80	2.13	1.80	2.61	2.28	0.52	1.77	3.30	2.97	2.96	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*

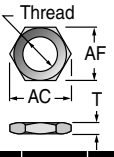
1/2" & 3/4" Bores



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



Nut is included.

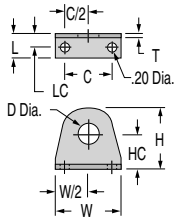


Bore	D Pilot	Thread	Nut Part No.	AC	AF	T
1/2"	.495-.491	1/2" – 20	**MC-500-195**	0.72	0.63	.25
3/4"	.620-.615	5/8" –18	**MC-700-195**	0.88	0.75	.25
1-1/8"	1.000 -.995	1" –14	**12100-195**	1.59	1.38	.19
1-5/8"	1.250-1.245	$1\frac{1}{4}$"-12	**22100-195**	1.88	1.63	.25

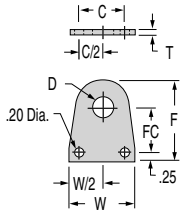
Plated steel nose mounting brackets *Must be ordered separately*

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

BRK-201 & BRK-301

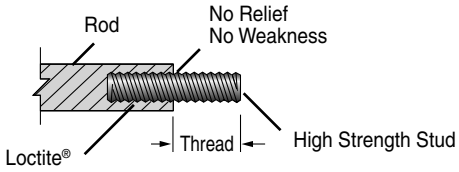


BRK-202 & BRK-302



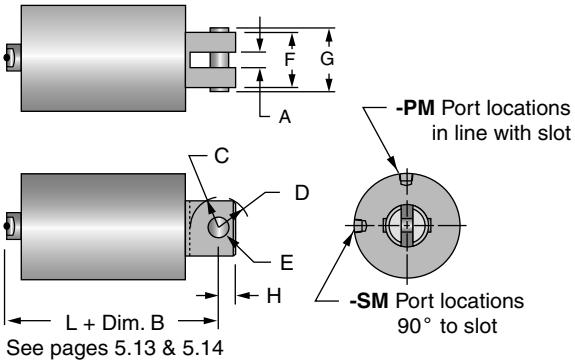
Male Rod Thread **Option**

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



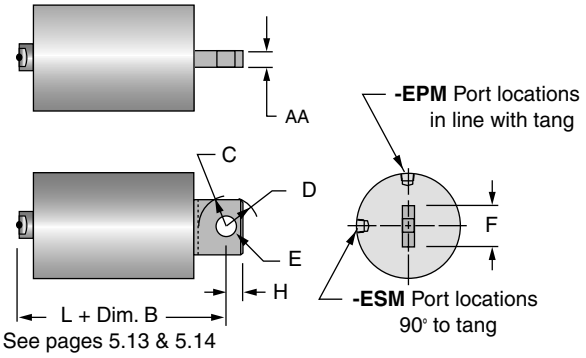
Bore	Thread
1/2"	8-32 x .50
3/4"	10-32 x .50
1-1/8"	5/16–24 x .75
1-5/8"	3/8–24 x .88
2"	1/2–20 x 1.00
2-1/2"	1/2–20 x 1.00
3"	1/2–20 x 1.00
4"	5/8-18 X 1.25

Clevis Mount **Option -PM & -SM**



See pages 5.13 & 5.14

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



See pages 5.13 & 5.14

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™ **Option -N**

Electroless Nickel plating

Consult Engineering for specific application requirements

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.

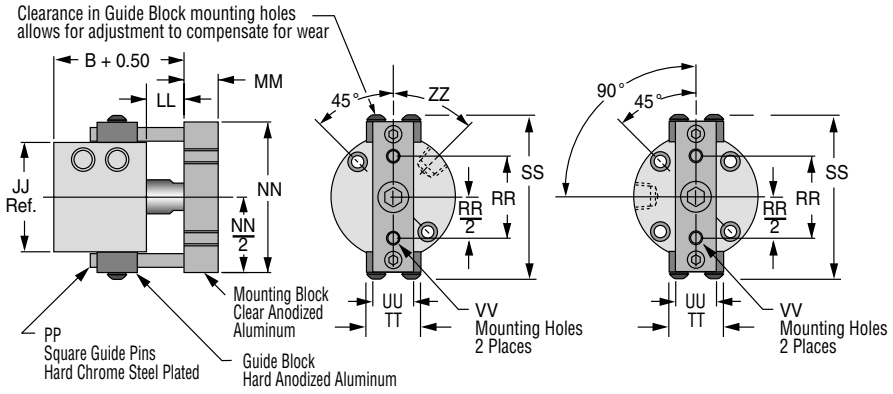
External Guide, Nonrotating

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.

1-1/8" through 2" Bores **2-1/2" through 4" Bores**

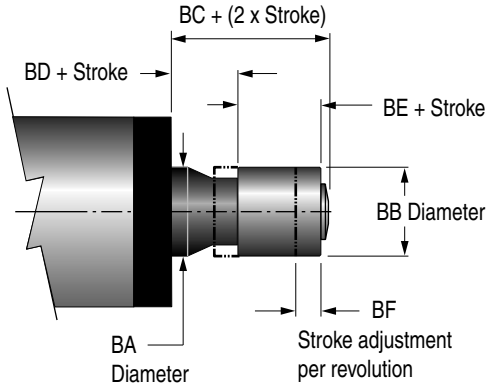


Bore	3/4"	1-1/8"	1-5/8"	2"	2-1/2"	3 "	4"
JJ	1.50	1.99	2.74	3.24	3.74	4.24	5.50
LL	0.63	0.64	0.64	0.64	0.64	0.64	0.70
MM	0.63	0.63	0.63	0.75	0.75	1.00	1.25
NN	2.20	2.75	3.50	4.00	4.56	5.06	6.32
PP	0.19	0.25	0.25	0.25	0.31	0.31	0.31
RR	0.88	1.06	1.50	1.88	1.88	1.88	1.88
SS	2.30	3.13	3.85	4.37	4.88	5.38	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.



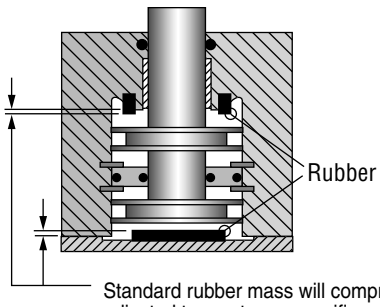
Bore	1-1/8"	1-5/8"	2"	2-1/2"	3"	4"	
BA	1.13	1.13	1.50	1.50	1.50	1.50	
BB	1.50	1.50	2.00	2.00	2.00	2.00	
BC	1.16	1.16	1.41	1.41	1.41	1.41	+ (2 x Stroke)
BD	.50	.50	.50	.50	.50	.50	+ Stroke
BE	.50	.50	.75	.75	.75	.75	
BF	.050	.050	.063	.063	.063	.063	

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

Rubber Bumpers

Rod End Only	**-BF**
Cap End Only	**-BR**
Both Ends	**-BFR**

Temperature Range
(-25° to + 220°F)



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 **-E38**
3/8 NPT for 2" Bores & Larger

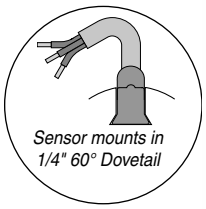
Use when higher cycle speeds are required.

1/4 NPT Ports **-P14**
for 1-5/8" Bores & Larger

Magnetic Piston **Option -E**

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

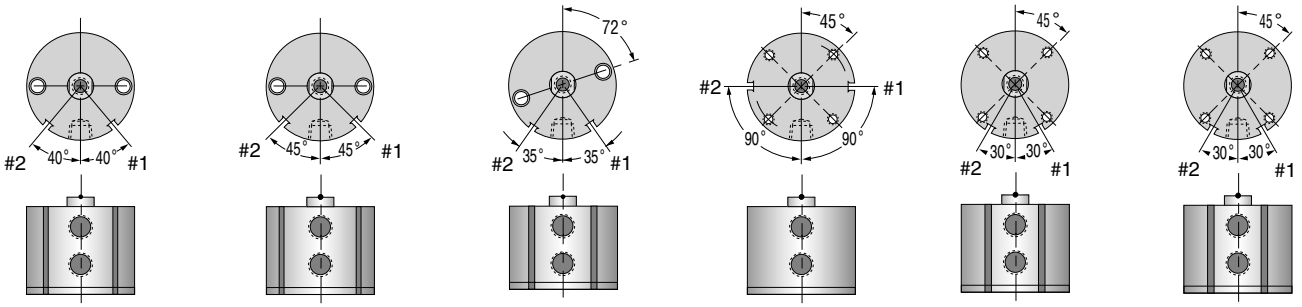
Order Sensors Separately



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**

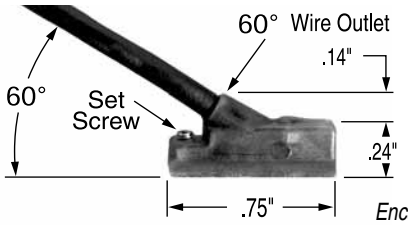


1/8" to 1" stroke models have 2 mounting slots. 1-1/2" stroke models have 1 slot at position #1. Ports are in-line for all Bores, all Strokes.

Low Profile, Solid State,
Magnetic Piston Position Sensors

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

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



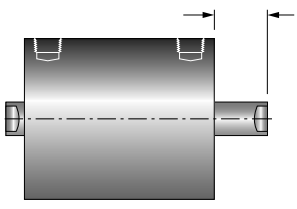
Encased in plastic housing, dovetail style sensors are corrosion resistant. 60° wire outlet allows close mounting. Profile shown here is typical.

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**



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**

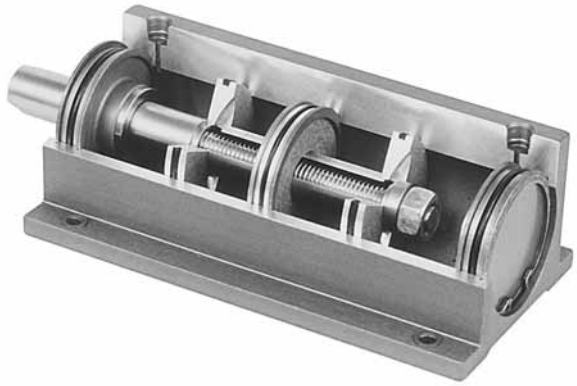
Use for elevated temperatures (–15° to + 400°F) or compatibility with exotic media. Consult engineering for compatibility information.

Series MQ, MQF, MQL

Square 1®–Multi-Power®

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 MQW MQF MQFW MQL MQLW	3/4"	2	.80	1	48	.36		•	•	•	•	•		
	7/8"	2	1.12	1-3/16	67	.52		•	•	•	•	•		
	1-1/8"	2	1.79	1-1/2	107	.80	•	•	•		•	•	•	•
	1-5/8"	2	3.83	2-1/8	229	1.76	•	•	•		•	•	•	•
	2"	2	5.84	2-5/8	350	2.70		•	•		•	•	•	•

‡ 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

MQ Side Tap

MQF Face

MQL Side Lug

Rod Extension

Single Rod Models

Blank –for **standard** extension per dimension "G"
W - for **Extension** to dimension "W"

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

Bore

3/4"
7/8"
1-1/8"
1-5/8"
2"

Standard Strokes Inches

For strokes available See chart above

Stages Extend — Stages Retract

2 — 1
1 — 2

Standard available combinations are listed above.

OPTIONS

See pages 5.20 - 5.22

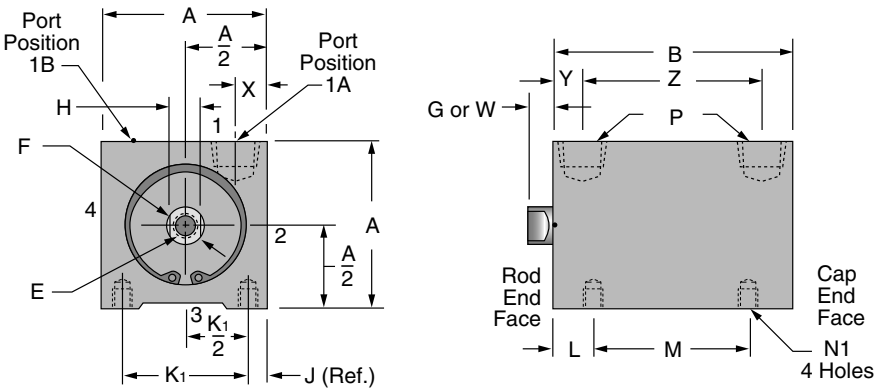
Description	Specify
Male Rod Thread	
Single Rod	-MR
Double Rod, Rod End	-MR
Double Rod, Cap End	-MR1
Double Rod, Both Ends	-MR2
Viton Seals:-15° to + 400°F	-V
Metric Rod Thread	-M
Port Positions (page 5.19)	-1B
External Guide, Nonrotating	-G
Double Rod	-DR
Magnetic piston and sensor mounting slot(s) Order sensors separately.	-E

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.

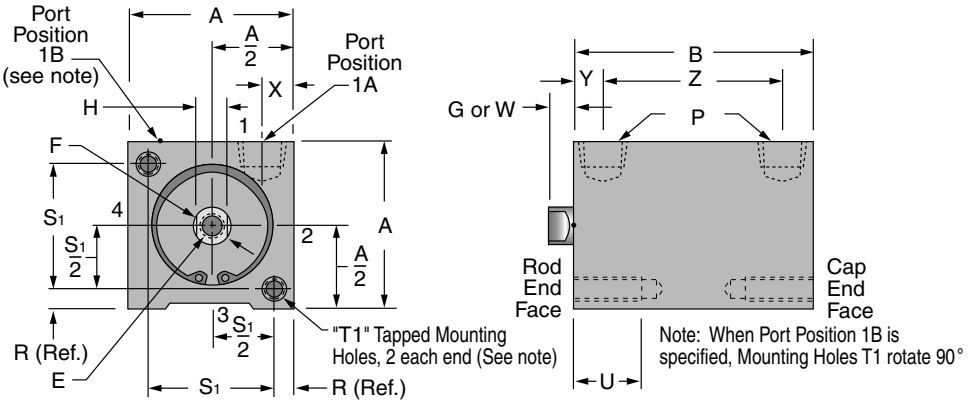
MQ Series: Side Tap Mounting

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



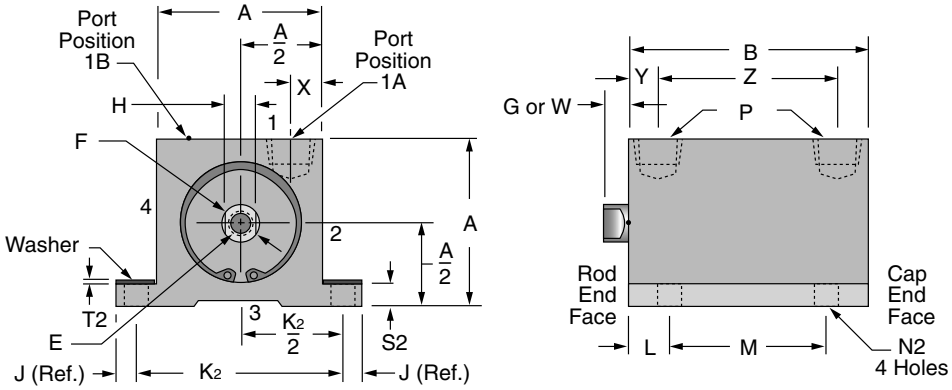
MQF Series: Face Mounting

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"



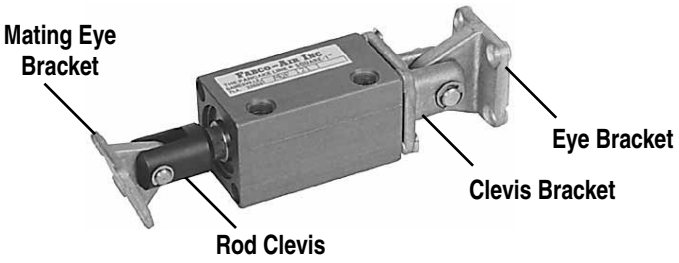
Variable Dimensions

	3/4" & 7/8" Bores			1-1/8" Bore			1-5/8" Bore			2" Bore		
Stroke	**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

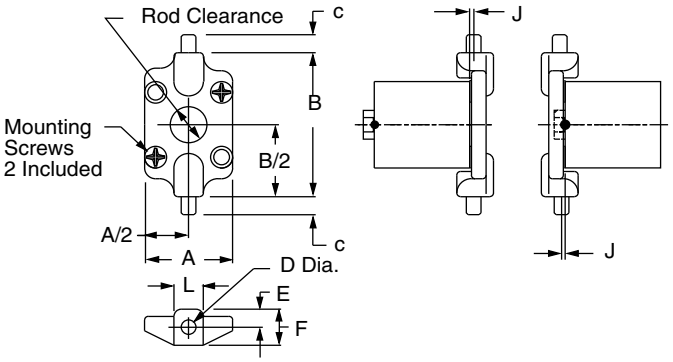
Bore	A	E	F Dia.	G	H	J	K1	K2	L	N1	N2	P	R	S1	S2	T1	T2	U	W	X	Y
3/4"	1.25	10-32x.38dp	.31	.13	1/4	.19	.88	–	.51	10-24x.25	–	10-32	.19	.88	–	1/4-20x.75dp	–	.75	.38	.31	.39
7/8"	1.25	10-32x.38dp	.31	.13	1/4	.19	–	1.63	.51	–	.21	10-32	–	–	.19	–	.02	–	.38	.31	.39
1-1/8"	1.50	5/16-24x.63dp	.50	.19	7/16	.19	1.13	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



Bore	Rod End: Stroke	Rod End: Rod Clevis English	Rod End: Rod Clevis Metric	Rod End: Mating Eye Bkt.	Cap End: Clevis Bracket	Cap End: Eye Bracket
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

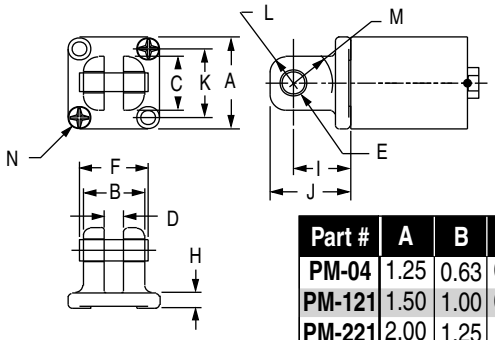


Materials
Bracket: High strength Zinc die casting
Pivot Pins: Precision dowel pins
Mounting screws: 4, Steel, plated or black oxided

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

5

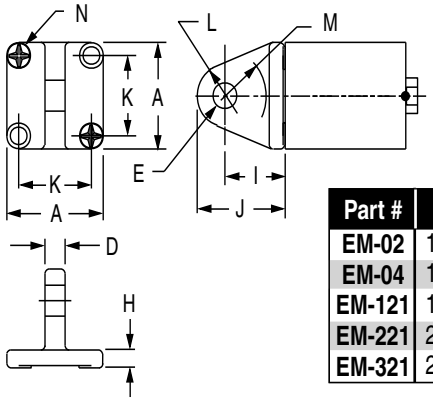
Clevis Bracket Kit



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 oxided

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

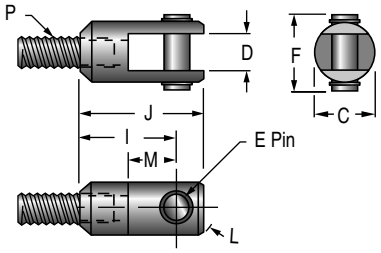
Eye Bracket Kit



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

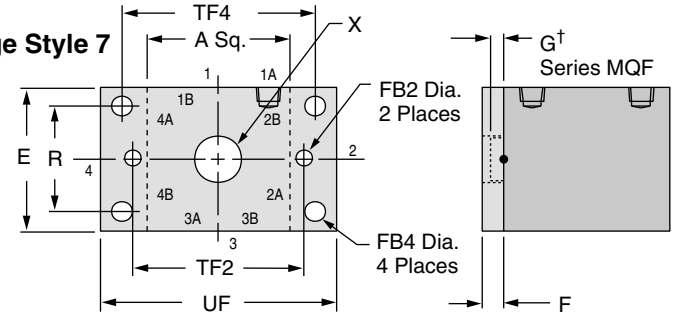


Materials
Clevis and Stud: Steel, black oxided
Pin: 416 Stainless Steel
Clips: Steel, plated

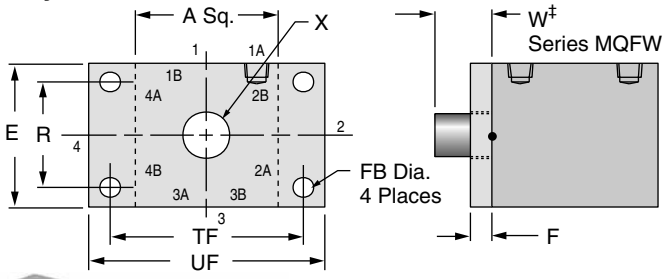
Part #	C	D	E PIN	F	I	J	L	M	P English	P Metric
RC-19,MRC-19	0.50	.19	.1870	0.70	0.75	1.00	.33	.38	10-32x.25	M5x6.3mm
RC-31, MRC-31	0.75	.25	.2495	0.96	0.88	1.16	.39	.50	5/16-24x.38	M8x9.7mm
RC-38, MRC-38	1.00	.32	.3120	1.21	1.25	1.63	.61	.63	3/8-24x.37	M10x9.4mm
RC-54, MRC-54	1.00	.32	.3120	1.21	1.31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



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** NFPA COde 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** NFPA COde 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			

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

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

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.

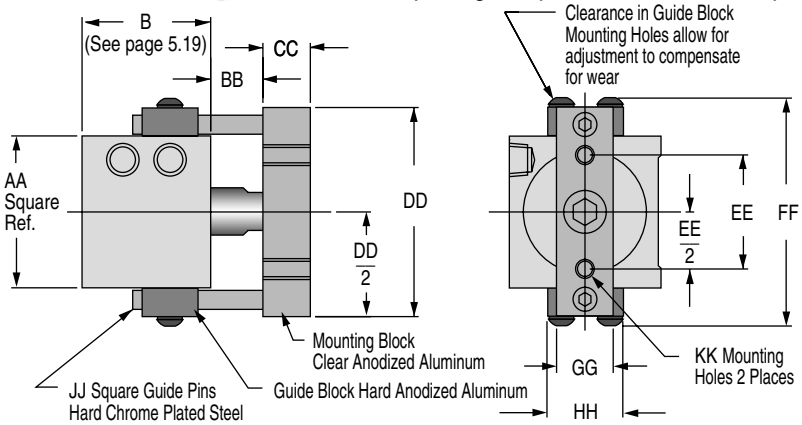
• Square guide pins are hard chrome plated steel for long wear and corrosion resistance.

• 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.

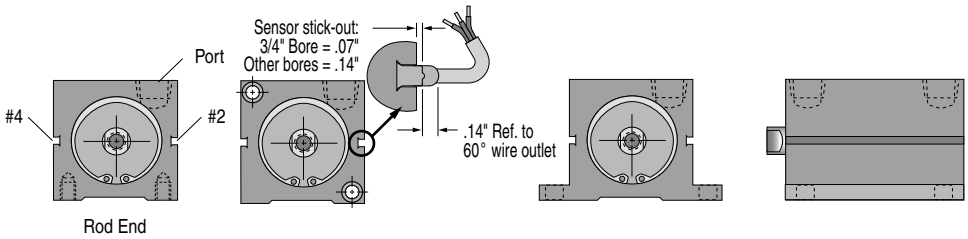
• Extended piston rod provides clearance between cylinder and guide bar mounting block to eliminate pinch points.



Mounting Series MQ or MQF				
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

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.***



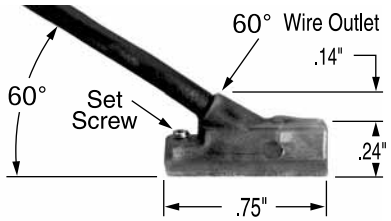
MQ Profile ***MQF Profile*** ***MQL Profile***

Standard Stroke & Slot Location Guide

	Stroke	MQ (Side Tap) 3/4"	MQ 1 1/8"	MQ 1 5/8"	MQ 2"	MQF (Face Mount) 3/4"	MQF 1 1/8"	MQF 1 5/8"	MQF 2"	MQL (Side Lug) 7/8"	MQL 1 1/8"	MQL 1 5/8"	MQL 2"
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
	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 styles are supplied with 6 inch pigtail with male connector. Order female cordsets separately.*

Male Rod Thread Option

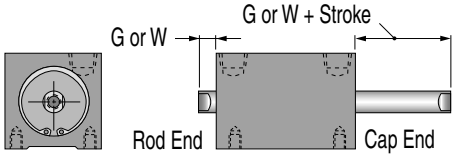
Single Rod	**-MR**
Double Rod, Rod End Only	**-MR**
Double Rod, Cap End Only	**-MR1**
Double Rod, Both Ends	**-MR2**

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.

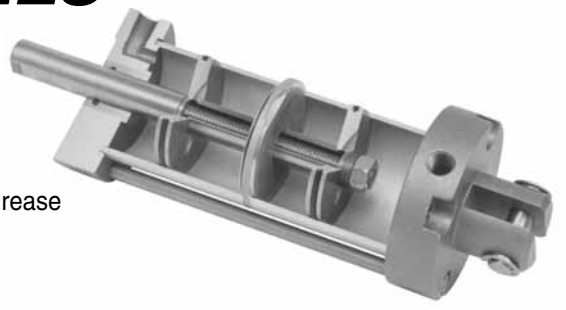


Rod Extension Dimensions					
Bore	3/4"	7/8"	1 1/8"	1 5/8"	2"
G	.13	.13	.19	.19	.19
W	.38	.38	.38	1.00	1.00

Series MLR & MLS

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 Round head	2 2-1/2" 3" 4"
MLS Square head	

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.

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

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"

Ordering Example

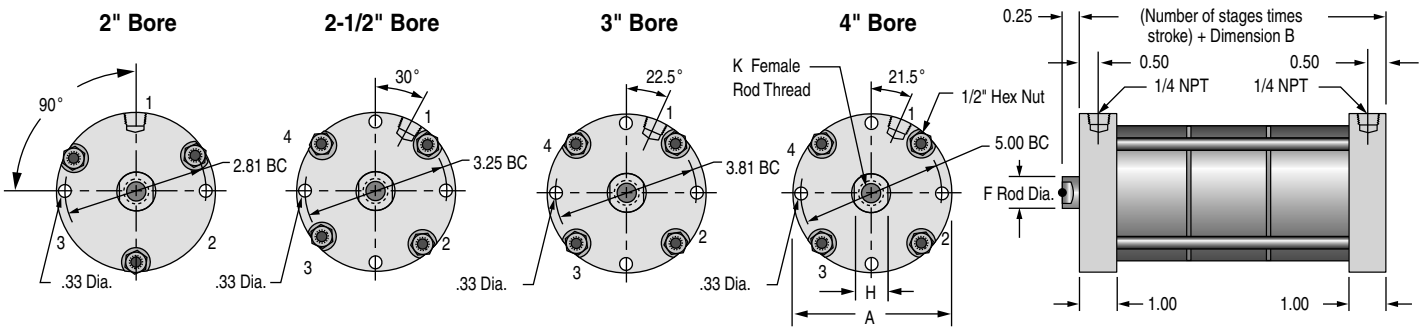
MLS3 x 3 – 2 – 1 – PM – MR
Square head series, 3" bore, 3" stroke, 2 stages extend, 1 stage retract, clevis mount ports in-line with slot , male rod thread

Sizing *Longstroke™ – Multi-Power® Cylinders*

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

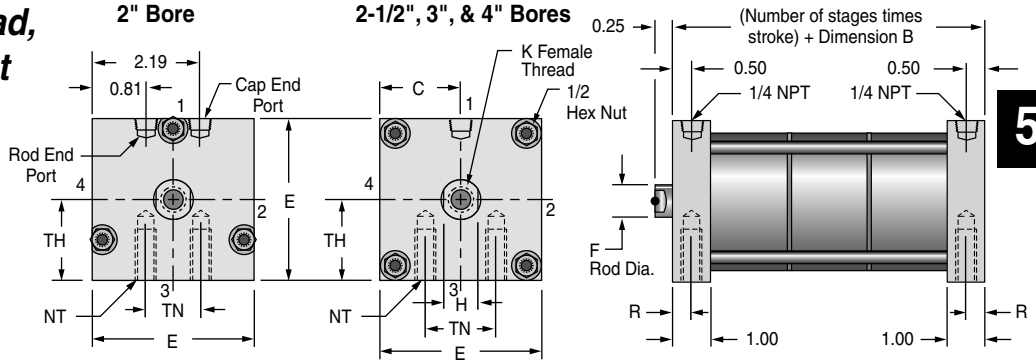
‡ Area = Total effective piston area, square inches.
† Equivalent Bore = Bore required for single piston cylinder.

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



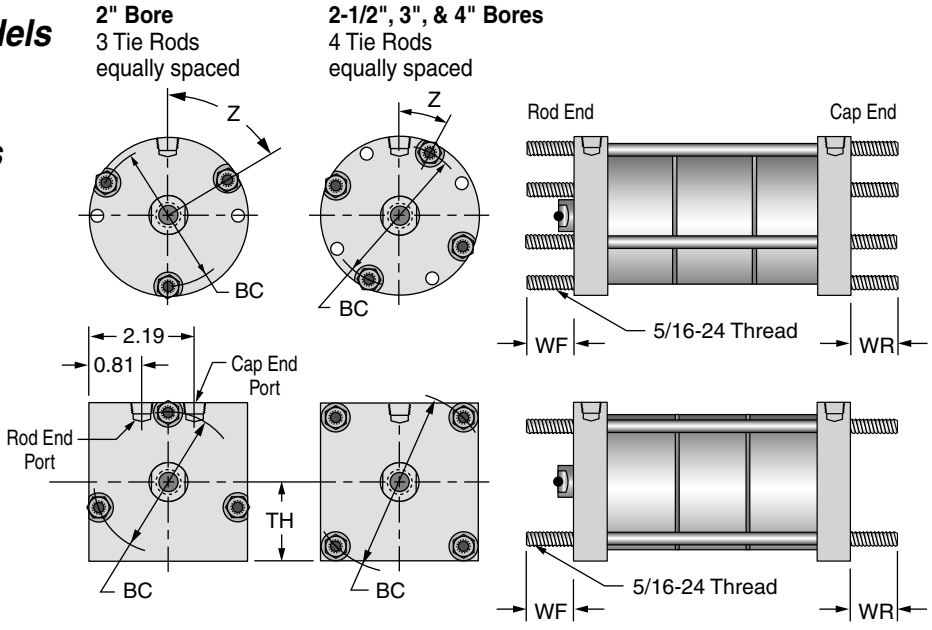
Series MLS – Square Head, Standard, Side Tap Mount

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.



Extended Tie Rod Mount for Round and Square Head Models

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



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**

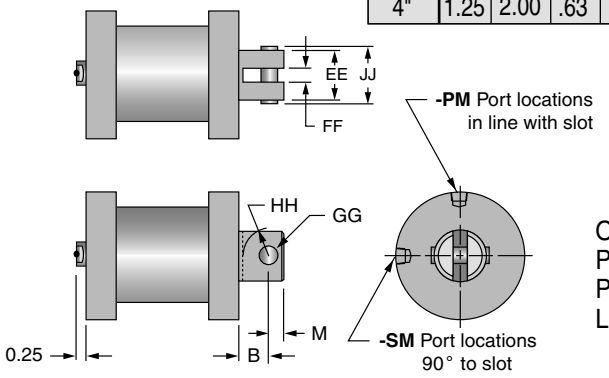
Specify mounting option

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

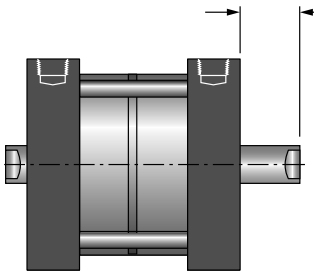
Bore	B	EE	FF	GG Pin	GG Hole	HH	JJ	M
2"	0.75	1.25	.38	.3745	.376	0.69	1.48	.38
2-1/2"	1.00	1.63	.50	.4995	.501	0.97	1.86	.50
3"	1.00	1.63	.50	.4995	.501	0.97	1.86	.50
4"	1.25	2.00	.63	.6245	.626	1.22	2.24	.63



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

5

Double Rod **Option -DR**

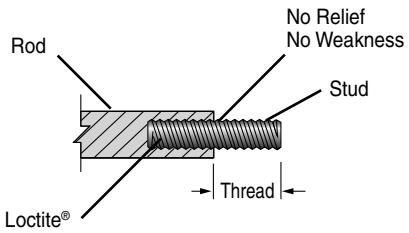


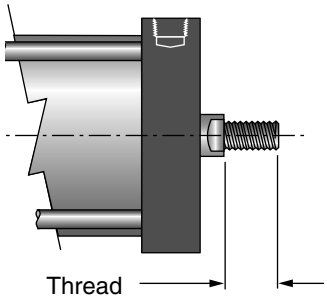
Standard piston rod and rod bushing on both ends of the cylinder.

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**



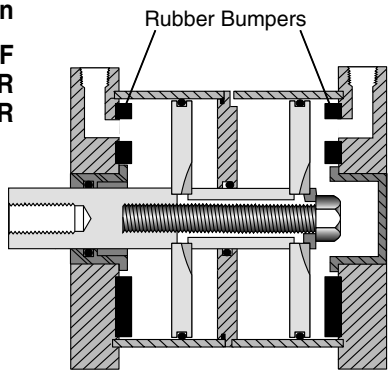


A high strength stud is threaded into the standard female rod end and retained with Loctite®. This method eliminates the small diameter thread relief area normally required when machining male threads. This provides a much stronger rod end which can be repaired, rather than replacing the complete rod,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

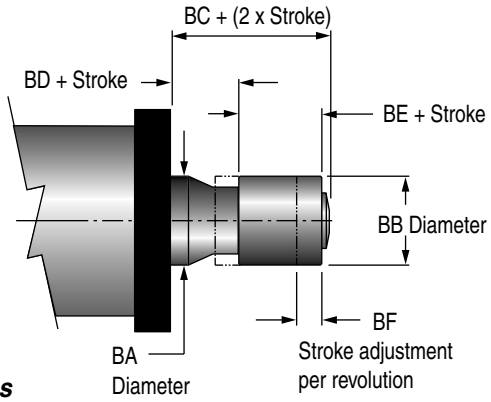
Standard rubber mass will compress and give full stroke at 60 to 80 psi. This mass can be adjusted to meet your specific pressure and/or dynamic load requirements requirements

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	

5

3/8 NPT Ports in Heads **Option -P38**

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

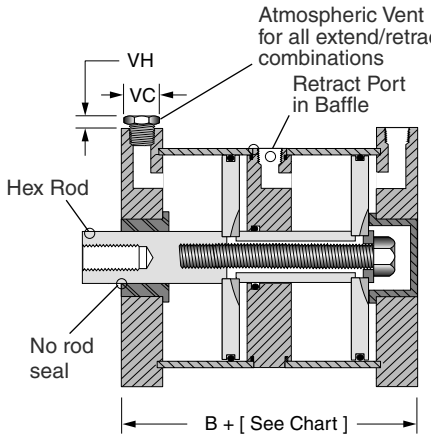
Nonrotating Rod **Option -NR**

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.

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 VC	St'd Ports VH max	3/8 NPT Ports (–P38) VC	3/8 NPT Ports (–P38) 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**

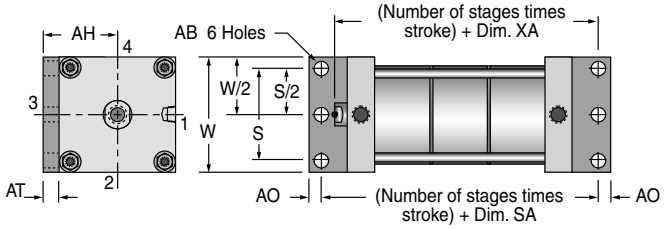
Use for elevated temperatures (–15° to + 400°F) or compatibility with exotic media.

Consult engineering for compatibility information.

End Lug Mount Kit

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

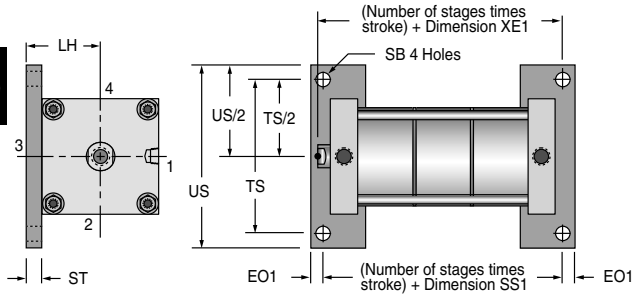
Materials:
Brackets, steel, plated
Screws, steel, black oxide



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

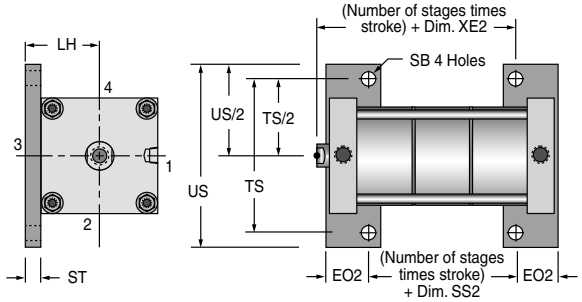
Side Lug Mount Kit

– 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.

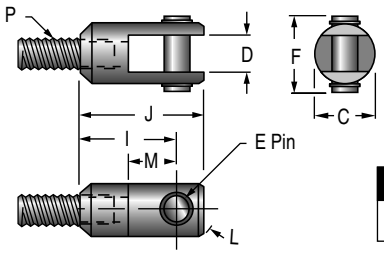
Materials:
Brackets, steel, plated
Screws, steel, black
oxide



Position #1 **Position #2**

Bore	Kit No.	EO1	EO2	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

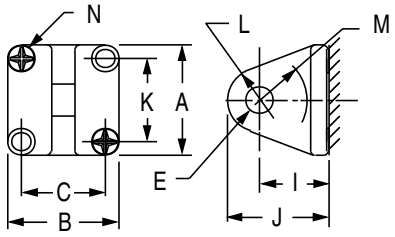
Rod Clevises

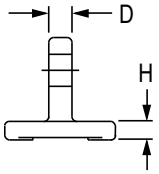


Materials
Clevis and Stud: Steel, black oxided
Pin: 416 Stainless Steel
Clips: Steel, plated

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

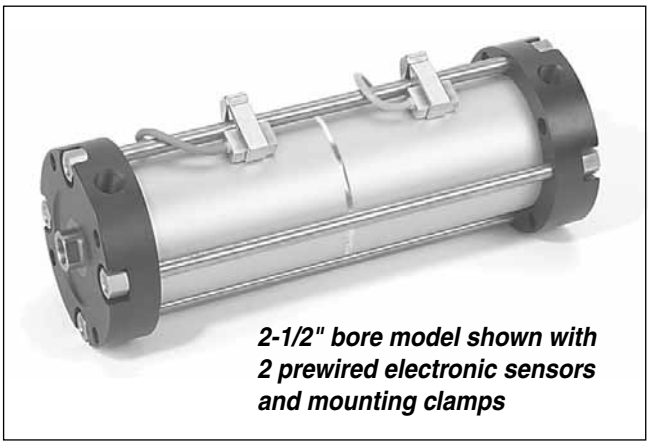
Eye Bracket Kits mate with Option -PM or -SM and Rod Clevis





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

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



2-1/2" bore model shown with 2 prewired electronic sensors and mounting clamps

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 accomodate the magnet. Add 1.00" to Dimension 'B' on pages 5.24.***

5

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

Quick Disconnect Sensor Shown

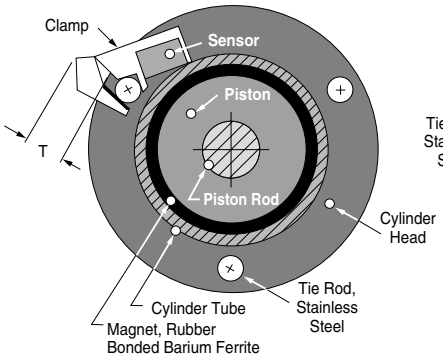
Socket Head Screw

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.

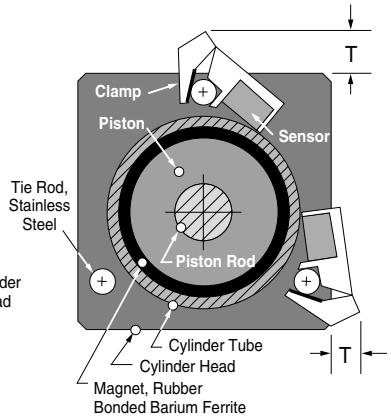
Female Cordsets available in 1, 2, & 5 meter lengths

9 foot prewired sensor

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"



Top View Round Head Style



Top View Square Head Style

Sensor & Clamp Ordering Guide

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

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**

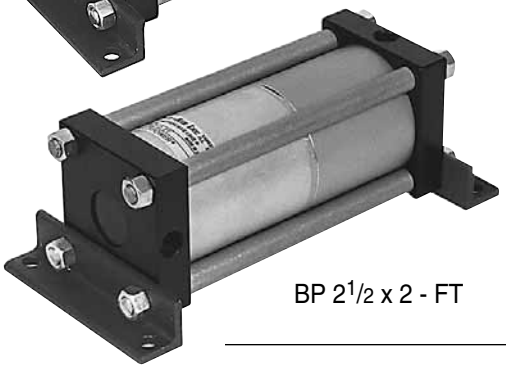
Warning!

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.

BA 2 1/2 x 2 - FT



BP 2 1/2 x 2 - FT

Fabco-Air Multi-Power® Boosters provide a convenient, low cost way of adding the control, rigidity, and power of hydraulics to an air powered machine. Boosters use shop air to raise the pressure of another gas or liquid. They are compact, and versatile finding use in numerous of applications such as clamping, shearing, pressing, crimping, bending, testing, and many more.

When relatively small volumes of high-pressure fluid are called for intermittently, boosters show obvious advantages over continuously running hydraulic systems.

For applications where high pressure must be maintained for prolonged times, boosters are ideal. After the booster strokes, there is no further energy input required and no heat build up.

A booster can be mounted in almost any convenient location, and most of its control valves are installed in the low-pressure circuit where lower cost components save costs over hydraulics.

The input is shop air, or any compatible gas, up to 150 psi; the output can be oil, liquid, air, or gas pressurized to 500 psi maximum.

By selecting the proper combination of bore size, stroke, power factor and regulating the input air pressure, the ***exact output pressure and required volume can be achieved and maintained***.

Since it is a basic booster without controls built-in, it can be adapted and controlled to perform a wide variety of applications. Fabco-Air boosters are not limited to cylinder applications. They may be used wherever a small volume of high-pressure media is required.

• ***Low initial cost***: Boosters can eliminate the need for costly hydraulic systems.

• ***Low energy cost***: Boosters hold pressure indefinitely without energy loss.

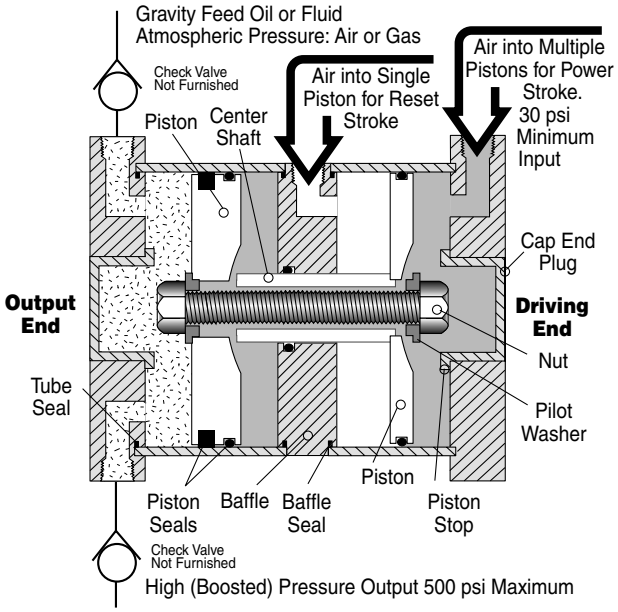
Save space: Boosters can usually be mounted directly on the machine unlike pumping units which are large and bulky.

• ***Smooth power***: Boosters give the work cylinder the rigid, smooth, controlled motion of hydraulics.

• ***Safe***: Boosters can be completely air operated to function safely in a potentially hazardous environment.

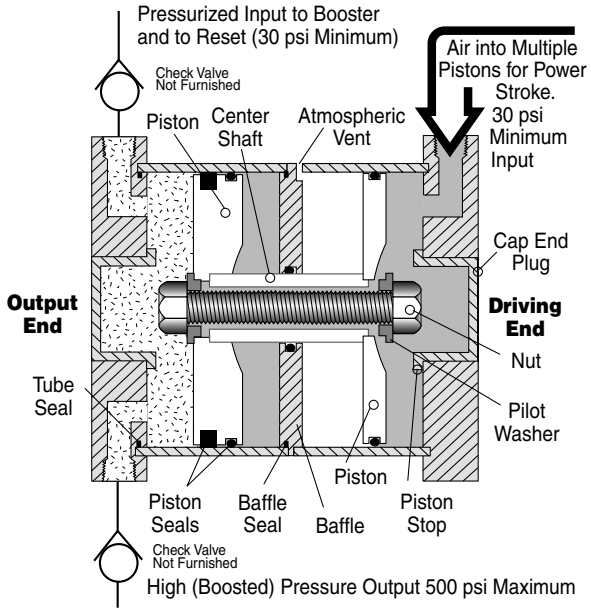
• ***Clean***: Air to air boosters have no oil or liquid to contaminate the surroundings.

Atmospheric Pressure Inlet to Booster: Series BA



This series is built for use on systems in which the input to the booster will be gravity fed (no pressure) fluid or atmospheric pressure gas. It requires a 4-way air valve for operation. Porting is provided on the unit for the multiple piston power stroke and the single piston reset stroke. (See example circuits on page 6.11.)

Pressurized Inlet to Booster: Series BP



This series is built for use on systems in which the input to the booster will be pressurized fluid or gas. It requires a 3-way air valve for operation. Porting is provided on the unit for the power stroke only. When power stroke air is removed, the pressurized booster input will reset the pistons. (See example circuits on page 6.9 and 6.10.)

- 2 Ports in boost chamber for inlet/outlet. Note: Check valves are not included.
- Internally lubricated Buna-N seals (-25° to + 250°F)
- U-Cup and O'Ring seals on the booster piston
- Heavy duty, corrosion resistant construction
- Aluminum tubing: Hard anodized ID, Clear anodized OD
- Black anodized heads.
- Plated tie rods and nuts.
- Outputs of 4.9 or 12.5 cu. in. per inch of stroke
- Standard strokes: 1" increments through 6"
- 1.9 through 4.8 power factors

Sizing Guide

Bore	Number of **Stages** (Pistons)	Required Volume/Inch Theoretical **Power Factor**	Output Displacement: Volume/Inch of Stroke In³	Output Displacement: Volume/Inch of Stroke Gallons	Input Power Air: Required Volume/Inch of Stroke In³	Input Power Air: Maximum psi	Reset Power Air for Series BA: Required Volume/Inch of Stroke In³
2-1/2	2	1.9	4.9	.021	9.7	150	4.5
	3	2.8			14.5	150	
	4	3.7			19.3	135	
	5	4.6			24.1	105	
4	2	1.9	12.5	.054	25.1	150	11.8
	3	2.9			37.6	150	
	4	3.8			50.1	125	
	5	4.8			62.6	100	

Model Number Code

BA 2-1/2 x 2 – 3 – FF – PA2

Series
BA
BP

Bore
2-1/2"
4"

Standard Strokes
1
2
3
4
5
6

Optional Strokes
Any other stroke through 12"

Stages
2
3
4
5

See **Power Factor** information above

Mounting

Output End Flange – Fabco Pattern . . . . . **–FF**
Output End Flange – NFPA (MF1) Pattern . . . . **–FFA**
Driving End Flange – Fabco Pattern . . . . . **–RF**
Driving End Flange – NFPA (MF2) Pattern . . . . **–RFA**

Foot . . . . . **–FT**

Extended Tie Rods
Output End only . . . . . **–WF**
Driving End only . . . . . **–WR**
Both Ends . . . . . **–WFR**

Options

Description		Specify	See Page
Viton Seals (-15° to +400°F)		**-V**	6.5
Rubber Bumpers, Driving End		**-BR**	6.5
Adjustable Extend Stroke		**-AS**	6.6
6" Stroke maximum. Full stroke adjustment is standard.			
1/2 NPT Ports in Heads ‡			6.5
Output End		**-TF**	
Driving End		**-TR**	
Both Ends		**-TFR**	
Extend Port Bushing			6.5
3/8 NPT	Output End	**-EF38**	
	Driving End	**-ER38**	
	Both Ends	**-EFR38**	
1/2 NPT	Output End	**-EF12**	
	Driving End	**-ER12**	
	Both Ends	**-EFR12**	
High Flow Vents		**-HF**	6.6
Port Positions (**PA2, PA3, etc.**)			See page 6.6
Any port or vent not specified will be in position shown on page 6.3			
Magnetic Piston ‡		**-E**	6.7
for Reed Switches and Electronic Sensors (Order Sensors separately)			
Piston Rod Driving End		**-P**	6.8
Pneumatic Continuous Cycling		**-L**	6.8
Male Rod Thread		**-MR**	6.8

‡ Note: Additional cylinder length required: for Option -E add 1" to driving end stage only; for 1/2 NPT Ports Option see page 6.5.

How to Order

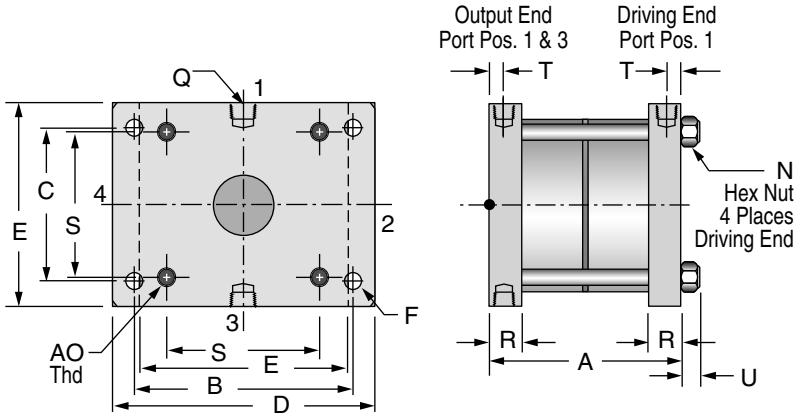
1. Specify Series and Bore
2. Specify Stroke
3. Specify stages (**Power Factor**)
4. Specify Mounting
5. Specify Option(s)

Examples:

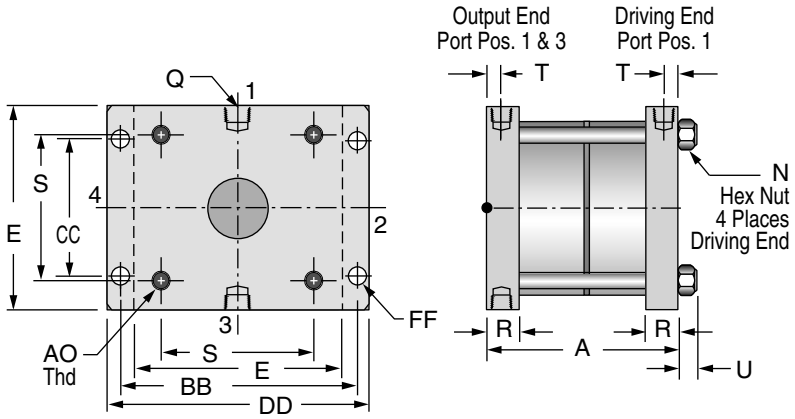
BA 2 1/2 x 2 – 3 – FF – PA2
BA Series, 2 1/2" Bore, 2" Stroke, 3 Stage (2.8 **PF**), Output End Flange Mounting, All Ports Position#2 (See page 6.6).

BP 4 x 6 – 5 – WF
BP Series, 4" Bore, 6" Stroke, 5 Stage (4.8 **PF**), Extended Tie Rods (Output End Only) Mounting.

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



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



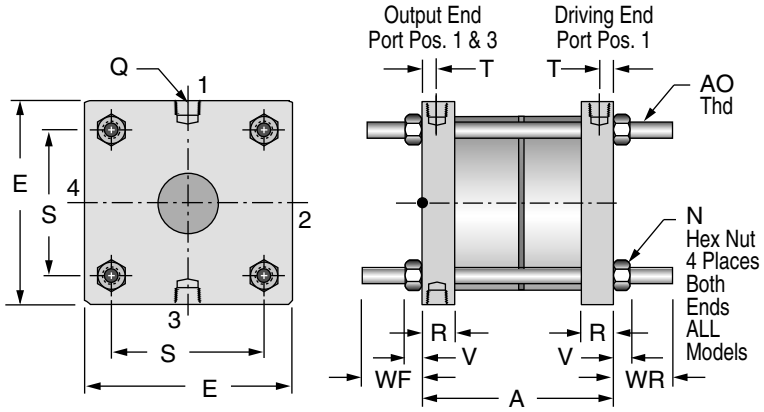
-WF Extended Tie Rod Mount, Output End Only
-WR Driving End Only
-WFR Both Ends

To order Extended Tie Rod Mount

	Specify Suffix
Output End Only	**-WF**
Driving End Only	**-WR**
Both 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"

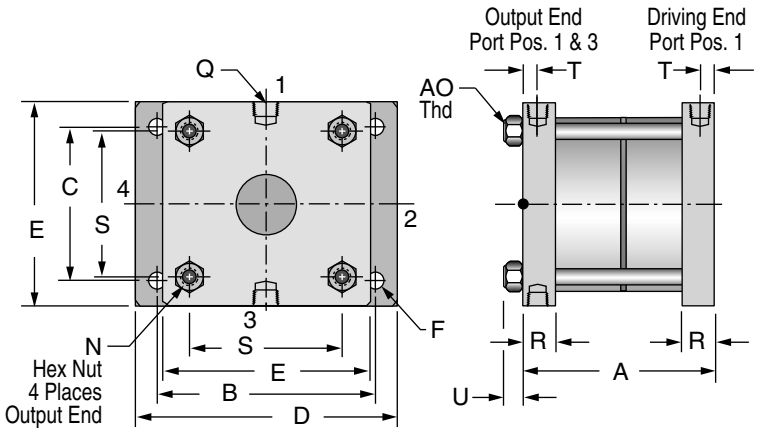


Dimensions (inches)

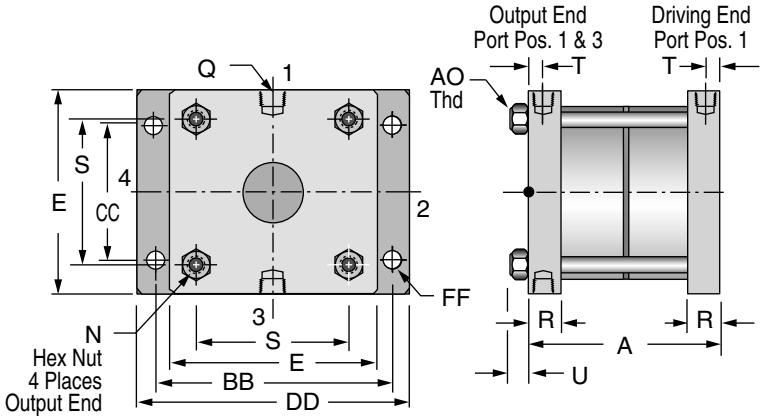
Bore	Dimension Y‡ Stages	Series BA	Series BP
2-1/2 or 4	2	3.91	3.41
	3	4.76	4.26
	4	5.61	5.11
	5	6.46	5.96

Bore	A	B	C	D	E	F	N	P	Q	R	S	T	U	V	X	Z
2-1/2	Dim. A= (No. stages x stroke) + Y‡	3.63	2.38	4.25	3.00	.34	9/16	3.69	1/4 NPT	.75	2.31	.31	.38	.33	.44	.56
4	See Y‡ chart above	5.00	3.75	6.00	5.00	.41	3/4	5.50	1/4 NPT	.75	3.50	.31	.50	.43	.63	.88

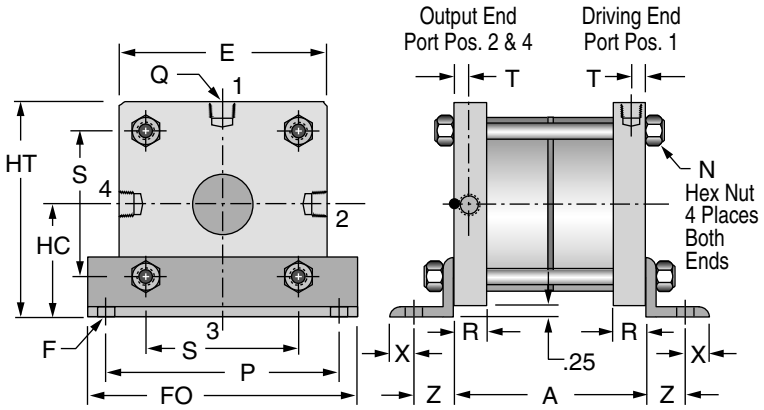
-RF Rear Face Mount;
Driving End Rectangular Flange
Fabco mounting pattern



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



-FT Foot Mount



Bore	Stages (Pistons)	Theoretical **Power Factor**	Approximate Weight, Oz. Series BA Zero Stroke	Series BP Zero Stroke	BA or BP Per Inch of Stroke	Universal Seal Kits Internally Lubricated Buna-N	Viton
2-1/2	2	1.9	46	44	12	BA/BP2 1/2-2SK	BA/BP2 1/2-2SKV
	3	2.8	55	53	17	BA/BP2 1/2-3SK	BA/BP2 1/2-3SKV
	4	3.7	64	62	23	BA/BP2 1/2-4SK	BA/BP2 1/2-4SKV
	5	4.6	73	71	30	BA/BP2 1/2-5SK	BA/BP2 1/2-5SKV
4	2	1.9	111	105	17	BA/BP4-2SK	BA/BP4-2SKV
	3	2.9	130	124	24	BA/BP4-3SK	BA/BP4-3SKV
	4	3.8	149	142	32	BA/BP4-4SK	BA/BP4-4SKV
	5	4.8	166	160	41	BA/BP4-5SK	BA/BP4-5SKV

AO	BB	CC	DD	FF	FO	HC	HT	WF	WR
3/8-16	3.88	2.19	4.50	.34	4.38	1.75	3.25	1.30	1.30
1/2-13	5.44	3.32	6.38	.41	6.38	2.75	5.25	1.40	1.40

Viton Seals — **Option -V**

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

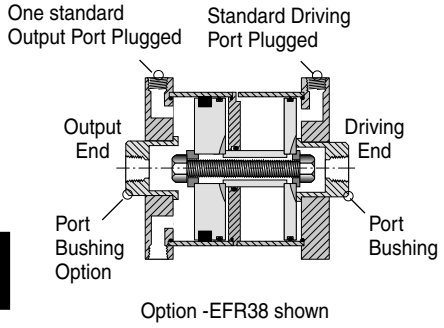
Extend Port Bushing — **Option**

3/8 NPT	Output End	**-EF38**
	Driving End	**-ER38**
	Both Ends	**-EFR38**
1/2 NPT	Output End	**-EF12**
	Driving End	**-ER12**
	Both Ends	**-EFR12**

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

Use for plumbing convenience, or when higher flows are required for higher cycle speeds and/or viscous fluids.

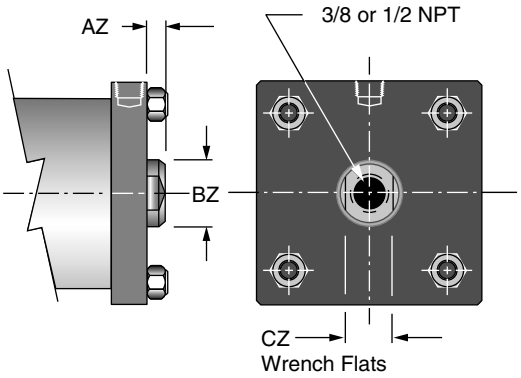
Also see 1/2 NPT ports in heads, Options -TF, -TR, -TFR below.



Option -EFR38 shown

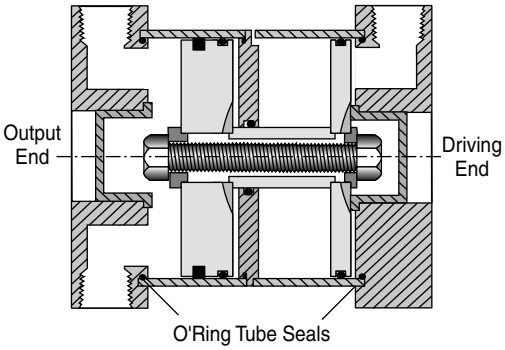
Dimensions (inches)

Bore	AZ	BZ	CZ
2-1/2	.38	1.13	.94
4	.38	1.50	1.25

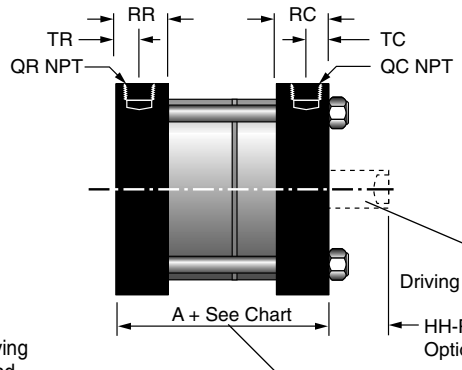


1/2 NPT Ports in Heads — **Option**

Output End Head	**-TF**
Driving End Head	**-TR**
Both Heads	**-TFR**



Option -TFR shown



Thicker heads to accept 1/2 NPT ports, replace the standard heads. Because of the thicker heads, there is an increase in the Dimension "A" and a reduction of the optional rod extension as charted below. With this construction, an O-ring replaces the fiber gasket cylinder tube seal.

Use when higher cycle speeds or viscous fluids are required.

Option -P Piston Rod
See page 6.8

See pages 6.3 & 6.4 for Dimension "A"

Option	Add to A	QC	QR	RC 2-1/2" Bore	RC 4" Bore	RR 2-1/2" Bore	RR 4" Bore	HH-P 2-1/2 & 4" Bore	TC	TR
TF	.38	1/4	1/2	0.75	0.75	1.00	1.25	0.50	.31	.50
TR	.38	1/2	1/4	1.00	1.25	0.75	0.75	0.12	.50	.31
TFR	.76	1/2	1/2	1.00	1.25	1.00	1.25	0.12	.50	.50

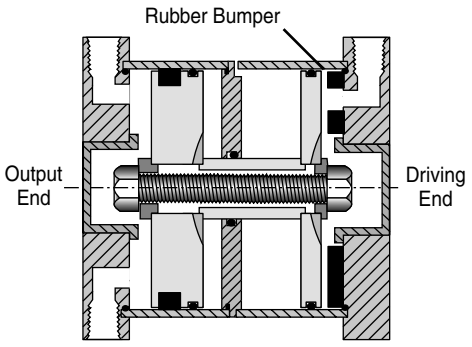
Rubber Bumpers — **Option**

Driving End only — **-BR**

A ring of rubber is bonded to the cylinder head, on the driving end, to act as a piston stop and absorb the impact of the piston. This reduces noise and absorbs energy.

Because of the temperature limitations of the adhesives used (-25° to +220°F), the rubber bumper is available in boosters with standard internally lubricated Buna-N seals only.

Use where noise reduction and impact absorption is desired.



Port Positions **Option**

(Facing Output End, see Drawings on pages 6.3 & 6.4)

All Ports with Mounts: **-FF, -FFA, -RF, -RFA, -WF, -WR, -WFR**

Output	Vent	Driving	
1&3	1	1	Standard
2&4	2	2	**-PA2**
1&3	3	3	Rotate Standard
2&4	4	4	Rotate **-PA2**

All Ports with **Mount -FT**

Output	Vent	Driving	
2&4	1	1	Standard
1&3	2	2	**-PA2**
2&4	3	3	**-PA3**
1&3	4	4	**-PA4**

For all other combinations of port locations specify each port location per the chart on the right. Any port or vent not specified will be in position shown on pages 6.3 & 6.4.

Mounts: -FF, -FFA, -RF, -RFA, -WF, -WR, -WFR	
Output Ports	**Specify**
1&3	**Standard**
2&4	**-PR2**
1&2	**-PR3**
1&4	**-PR4**
2&3	**-PR5**
3&4	**-PR6**

Mount FT	
Output Ports	**Specify**
2&4	**Standard**
1&3	**-PR2**
1&2	**-PR3**
1&4	**-PR4**
2&3	**-PR5**
3&4	**-PR6**

Atmospheric Vent or Ported Baffle Port	Specify
1	**Standard**
2	**-PB2**
3	**-PB3**
4	**-PB4**

Driving Port	Specify
1	**Standard**
2	**-PC2**
3	**-PC3**
4	**-PC4**

6

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.

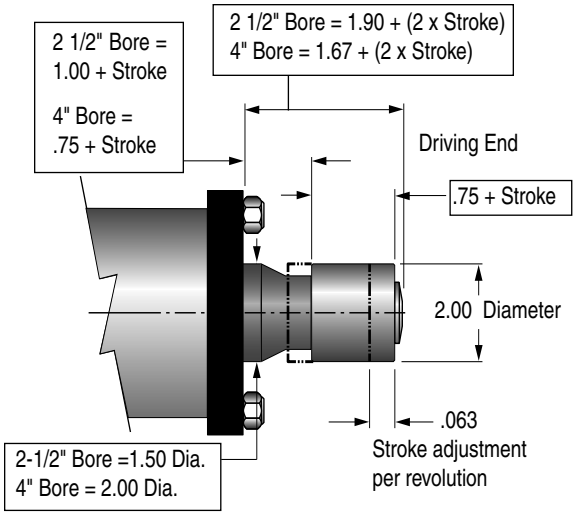
Adjustable Extend Stroke

For strokes through 6" **Option -AS**

Full stroke adjustment is standard.

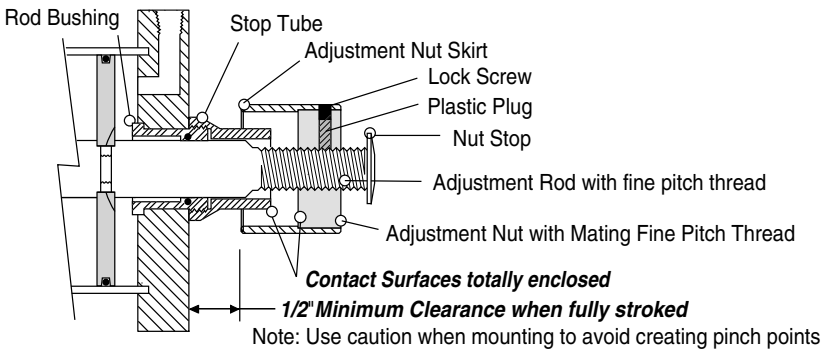
Note!

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.



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. Adjustment settings are simplified by convenient scale markings applied to nut skirt and stop tube.



Note: Use caution when mounting to avoid creating pinch points

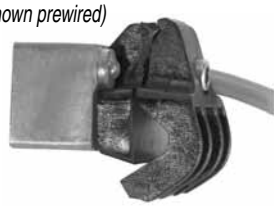
Suffix Option E

Specifies Magnetic Piston
(Order Sensors and Sensor Clamps Separately)

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

Socket Head Screw

749 Series Sensor with Integral Clamp for 4" Bore Boosters
(shown prewired)



Quick Disconnect Sensor

9 foot prewired sensor

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

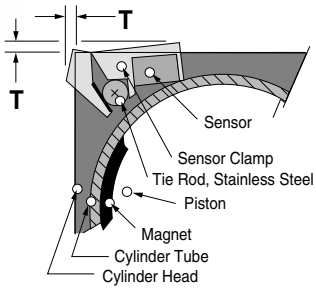
Booster Model Number
BA 2 1/2 x 2 – 2 – RF – E – PR2

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.

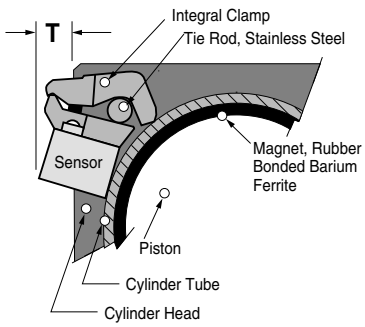
- ***Option-E*** consists of a magnet bonded into the piston head. When the piston magnet moves past an external sensor, the magnetic field activates the sensor without physical contact.
- ***Mounting*** – The sensor is attached to a 2-part clamp that attaches rigidly to a tie rod and can be positioned anywhere along the length of the cylinder for very precise signaling.
- Two sensor styles are used – (a) the ***9-2A197 Series*** for 2 1/2" bore requires a tie rod clamp, and (b) the ***749 Series*** which accommodates the larger diameter tie rods of the 4" bore 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 booster to accommodate the magnet. The driving end stage only, is increased by 1".***

Sensor Clamp Stick Out Dimensions	Bore	2-1/2"	4"
	T	.38"	.36"

2-1/2" Bore



4" Bore



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: 2 1/2" Bore			
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, 0.5Amp 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**

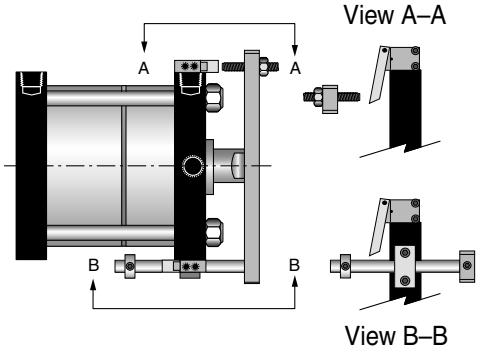
LED Lighted Magnetic Piston Position Sensors: 4" Bore			
Reed Switch	749-000-004	749-000-504	5-240 VDC/VAC, 1 Amp Max., 30 Watt Max., SPST N.O., 3.0 Voltage Drop
Electronic	749-000-031	749-000-531	Sourcing, PNP, 6-24 VDC, 1.0 Amp Max., 0.5 Voltage Drop
Electronic	749-000-032	749-000-532	Sinking, NPN, 6-24 VDC, 1.0 Amp Max., 0.5 Voltage Drop

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

Pneumatic Continuous Cycling — Option -L

For details on the limit valves, which are included, see MSV-2 on page 13.5



Provisions for operator protection are always the full responsibility of the user.

A piston rod is incorporated in the driving end. Two limit valves are mounted on the driving end head and a piston rod guide and limit valve actuators are attached to the piston rod. The limit valves control a 3 or 4 way control valve (not included, see Section 11) which in turn controls the booster. When the system is "powered up" the booster strokes, raising the fluid pressure in the output end. When it fully strokes, a limit valve is actuated, reversing the booster, resetting it. When it is fully reset, the other limit valve is actuated shifting the control valve for another power stroke. This cycle continues until the output pressure reaches the desired level. The booster then stalls out and holds that pressure until some of the fluid is used. The booster then resumes cycling until output fluid again reaches desired pressure and the booster stalls out. This cycling will continue as long as the system is "powered up."

During the stall mode there is no energy used, making the air powered booster an extremely efficient and quiet method of maintaining that high pressure. A hydraulic power unit, for instance, requires continuous energy input.

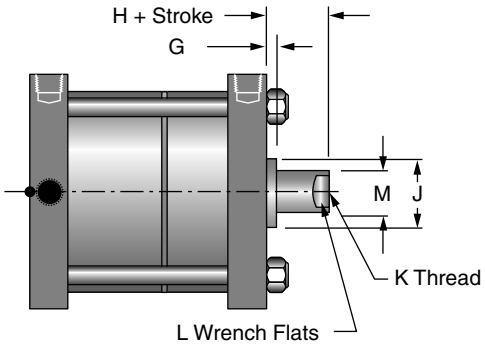
Because of the piston rod, the Power Factors change slightly as shown in the chart below. A typical circuit and sizing instructions are shown in example 1 on page 6.9.

Use when the application requires pumping action (e.g. keeping a surge tank at high pressure for a test fixture) and/or there is no electricity involved (e.g. an explosive atmosphere). Also see Option -E on page 6.7 for electronic position sensors.

Bore	# Stages (Pistons)	Theoretical **Power Factor**
2-1/2	2	1.8
	3	2.7
	4	3.6
	5	4.5
4	2	1.9
	3	2.8
	4	3.7
	5	4.7

6

Piston Rod on Driving End — Option -P

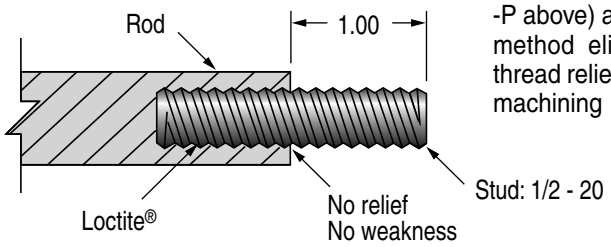


A piston rod is incorporated in the driving end. Because of the piston rod area the Power Factor changes slightly. Use the Power Factors charted above for Option -L.

Use for booster position indication.

Bore	G	H	J ± .002	K	L	M ± .001
2-1/2	.19	.50	1.127	1/2-20 x .75	5/8	0.750
4	.19	.50	1.502	1/2-20 x .75	7/8	1.000

Male Rod Thread — Option -MR



A high strength stud is threaded into the standard female rod end (see Option -P above) 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.

Use in conjunction with Option -P above.

To size an **Air to Air** booster Boyle's Law must be used because air is compressible. Boyle's Law states: "When the temperature of a confined gas remains constant, the volume varies inversely as its absolute pressure."

This can be stated mathematically as a simple equation: initial absolute pressure x initial volume = final absolute pressure x final volume or $P_1 \times V_1 = P_2 \times V_2$

Absolute pressure (psia) = gauge pressure (psig) + atmospheric pressure (14.7 psi).

Consult your distributor or Fabco-Air Engineering for assistance with booster sizing.

EXAMPLE 1: Pump cycle, Air to Air Booster
Required output = 100 cu. in. per minute @ 250 psi
Available air pressure = 70 psi

Solution: **Power** = $\frac{\text{Required Pressure psig}}{\text{Available Pressure psig}} = \frac{250}{70}$

= 3.6 Minimum Required **Power Factor**

Choose either: 2-1/2" Bore – 4 Stage
or 4" Bore – 4 Stage (See Sizing Guide on page 6.2)

Solution (2-1/2" Bore): Volume - using Boyle's Law
V_1 (Initial Volume) = 4.9 cu. in./in.
P_1 (Initial Pressure) = 70 + 14.7 = 84.7
P_2 (Final Pressure) = 250 + 14.7 = 264.7
V_2 (Final Volume) = unknown

$V_2 = \frac{P_1 \times V_1}{P_2} = \frac{84.7 \times 4.9}{264.7}$ = 1.5 cu. in./in. @250 psig

On the basis of 20 strokes/minute (typical average)

Booster stroke = $\frac{\text{Required Vol/min.}}{\text{vol/in. stroke x strokes/min}}$

Booster stroke = $\frac{100}{1.5 \times 20}$ = 3.3 in.

Model Choice: BP2-1/2 x 4 - 4

Alternate Solution (4" Bore): Volume - using Boyle's Law
V_1 (Initial Volume) = 12.6 cu. in./in.
P_1 (Initial Pressure) = 70 + 14.7 = 84.7
P_2 (Final Pressure) = 250 + 14.7 = 264.7
V_2 (Final Volume) = unknown

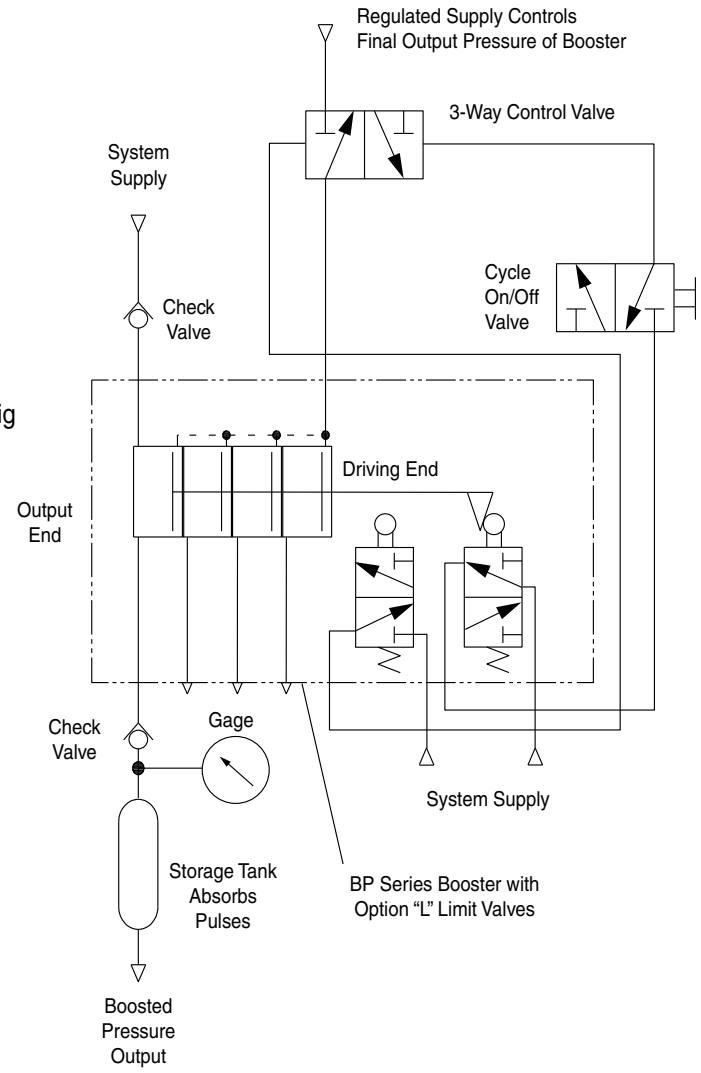
$V_2 = \frac{P_1 \times V_1}{P_2} = \frac{84.7 \times 12.6}{264.7}$ = 4.0 cu. in./in. @250 psig

On the basis of 20 strokes/minute (typical average)

Booster stroke = $\frac{\text{Required Vol/min.}}{\text{vol/in. stroke x strokes/min}}$

Booster stroke = $\frac{100}{4.0 \times 20}$ = 1.25 in.

Model Choice: BP4 x 2 - 4



Input Air Usage, Pump Cycle (See Example 1 above; Model BP 2-1/2 x 4 - 4, 20 stroke/min. @ 70 psi)

Solution: **Pressure** = $\frac{\text{Required Final Pressure}}{\text{Booster Power Factor}} = \frac{250}{3.7}$ = 67.6 psi regulated input required

Solution: **Volume** (CFM) = Input Volume/Inch Stroke x $\frac{\text{Stroke x CPM}}{\text{1728 cu. in./cu.ft.}}$

Input Volume/Inch Stroke = 19.3 (See Sizing Guide on page 6.2), Stroke = 4", CPM= 20

Volume = $\frac{19.3 \times 4 \times 20}{1728} = \frac{1544}{1728}$ = 0.89 CFM @ 67.6 psi

Converting Volume to SCFM: SCFM = $\frac{\text{CFM x psia}}{\text{Atmosphere}} = \frac{.89 \times (67.6 + 14.7)}{14.7}$ = 5.0 SCFM required

EXAMPLE 2: One shot cycle, Air to Air Booster to extend cylinders with boosted (high) pressure. Application shown: 2 cylinders, 1-5/8" bore x 4" stroke must extend to full stroke at 145 psi, then retract at system (80 psi) pressure.

Solution: **Power** = $\frac{\text{Required Pressure psig}}{\text{Available Pressure psig}} = \frac{145}{80}$

= 1.8 Minimum Required **Power Factor**

Choose either: 2-1/2" Bore – 2 Stage
or 4" Bore – 2 Stage (See Sizing Guide on page 6.2)

Solution: Volume - using Boyle's Law
V1 (Initial Volume) = Unknown
P1 (Initial Pressure) = 80 + 14.7 = 94.7
P2 (Final Pressure) = 145 + 14.7 = 159.7
V2 (Final Volume) = Volume required in cylinders, plus estimated volume in fittings and tubing

V2 = 2.07 (area of 1-5/8" bore) x 4" (Stroke) x 2 (quantity) + 1.5 (estimate of fittings in this example) = 18.1 cu. in.

$V1 = \frac{P2 \times V2}{P1} = \frac{159.7 \times 18.1}{94.7} = 30.5$ cu. in.

Note! Add a recommended factor of 25% to 50% to allow for volumetric efficiency and other losses: 30.5 x 150% = 45.8 cu. in. required in booster.

Solution (2-1/2" Bore): Stroke = $\frac{\text{Required Volume}}{\text{Volume/Inch Stroke}^{\ddagger}} = \frac{45.8}{4.9^{\ddagger}}$ = 9.3 in.

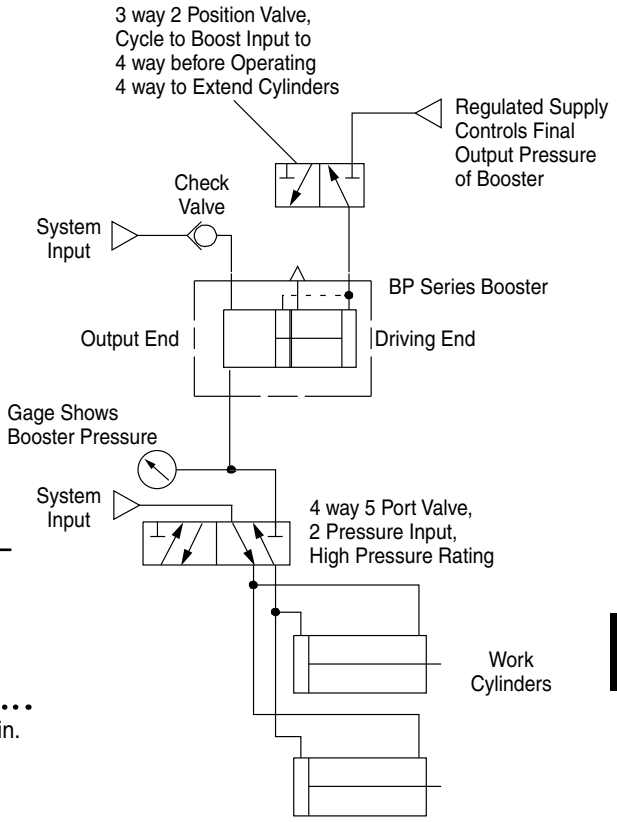
‡For 2-1/2" Bore Volume per Inch of Stroke = 4.9 (See Sizing Guide on page 6.2)

Model Choice: BP2-1/2 x 10 - 2

Alternate Solution (4" Bore): Stroke = $\frac{\text{Required Volume}}{\text{Volume/Inch Stroke}^{\ddagger}} = \frac{45.8}{12.6^{\ddagger}}$ = 3.6 in.

‡ For 4" Bore Volume per Inch of Stroke = 12.6 (See Sizing Guide on page 6.2)

Model Choice: BP4 x 4 - 2



EXAMPLE 3: One shot cycle, Air to Air Booster to extend cylinders with low (system) pressure, then boost to high pressure.
Application shown: 2 cylinders, 1-5/8" bore x 4" stroke must extend to full stroke at system (80 psi) pressure, then apply full (145 psi) clamp load. Cylinders are to retract at system (80 psi) pressure.

Solution: **Power** = $\frac{\text{Required Pressure psig}}{\text{Available Pressure psig}} = \frac{145}{80}$

= 1.8 Minimum Required **Power Factor**

Choose either: 2-1/2" Bore – 2 Stage
or 4" Bore – 2 Stage (See Sizing Guide on Page 6.2)

Solution: Volume - using Boyle's Law
V1 (Initial Volume) = Unknown
P1 (Initial Pressure) = 80 + 14.7 = 94.7
P2 (Final Pressure) = 145 + 14.7 = 159.7
V2 (Final Volume) = Volume required in cylinders, plus estimated volume in fittings and tubing

V2 = 2.07 (area of 1-5/8" bore) x 4" (Stroke) x 2 (quantity) + 1.5 (estimate of fittings in this example) = 18.1 cu. in.

$V1 = \frac{P2 \times V2}{P1} = \frac{159.7 \times 18.1}{94.7} = 30.5$ cu. in.

Note! In this cycle, the volume of the cylinders and tubing may be deducted because it is a part of the final volume; thus, 30.5 - 18.1 = 12.4 cu.in.
Add a recommended factor of 25% to 50% to allow for volumetric efficiency and other losses: 12.4 x 150% = 18.6 cu. in. required in booster.

Solution (2-1/2" Bore): Stroke = $\frac{\text{Required Volume}}{\text{Volume/Inch Stroke}^{\ddagger}} = \frac{18.6}{4.9^{\ddagger}}$ = 3.8 in.

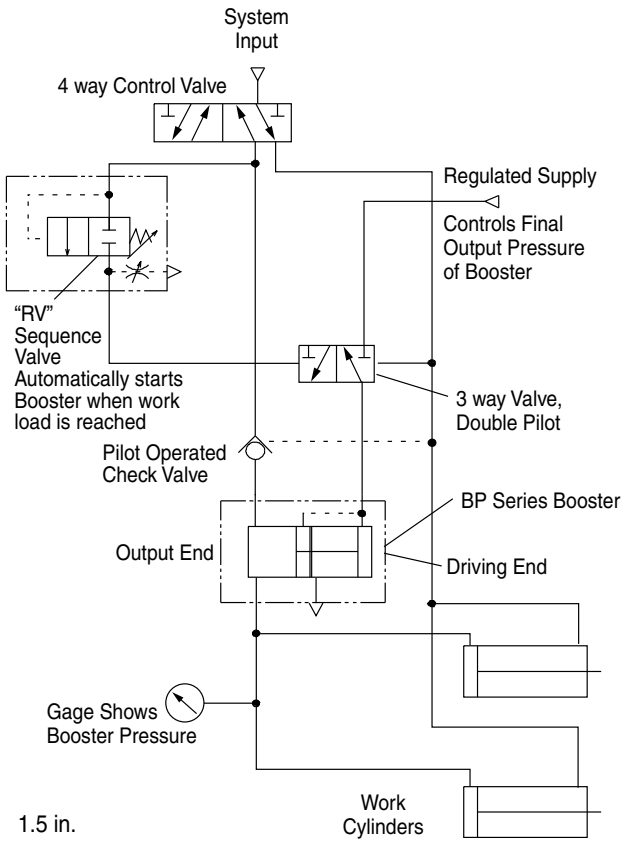
‡For 2-1/2" Bore Volume per Inch of Stroke = 4.9 (See Sizing Guide on page 6.2)

Model Choice: BP2-1/2 x 4 - 2

Alternate Solution (4" Bore): Stroke = $\frac{\text{Required Volume}}{\text{Volume/Inch Stroke}^{\ddagger}} = \frac{18.6}{12.6^{\ddagger}}$ = 1.5 in.

‡ For 4" Bore Volume per Inch of Stroke = 12.6 (See Sizing Guide on page 6.2)

Model Choice: BP4 x 2 - 2



Air-to-Oil Sizing *(for Air-to-Air Sizing See Page 6.9 & 6.10)*

To size an **Air to Oil** booster, Boyle's Law need not be taken into account because oil is considered an incompressible fluid. Consult Fabco-Air Engineering for fluid compatibility with standard internally lubricated Buna-N seals or optional Viton seals.

EXAMPLE 4: One shot cycle, Air to Oil Booster
Application shown: 2 cylinders, 1-5/8" bore x 4" stroke must extend to full stroke at 145 psi, then retract at system (80 psi) pressure.

Solution: **Power** = $\frac{\text{Required Pressure psig}}{\text{Available Pressure psig}} = \frac{145}{80}$
= 1.8 Minimum Required **Power Factor**

Choose either: 2-1/2" Bore – 2 Stage
or 4" Bore – 2 Stage (See Sizing Guide on page 6.2)

Solution: Volume of Booster = Displacement of Cylinders + Margin
Displacement = Area of Bore x Stroke x Quantity of Cylinders
Margin = 25% Recommended to allow for losses and make-up fluid
Booster Volume = [2.07 (area of 1-5/8" bore) x 4" (stroke) x 2 (quantity)]
x 125% (margin)
= [16.6] x 1.25 = 20.8 cu. in.

Solution (2-1/2" Bore): Stroke = $\frac{\text{Required Volume}}{\text{Volume per Inch Stroke}^{\ddagger}} = \frac{20.8}{4.9^{\ddagger}}$ = 4.3 in.

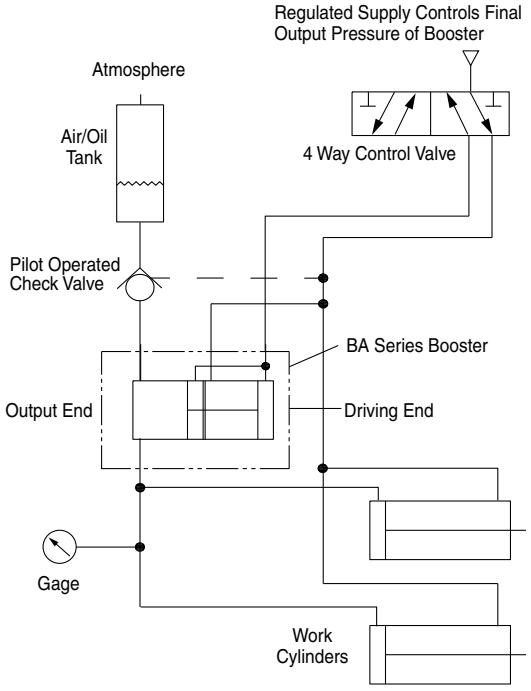
‡ For 2-1/2" Bore, Volume per Inch of Stroke = 4.9 (See Sizing Guide on page 6.2)

Model Choice: BA2-1/2 x 5 - 2

Alternate Solution (4" Bore): Stroke = $\frac{\text{Required Volume}}{\text{Volume per Inch Stroke}^{\ddagger}} = \frac{20.8}{12.6^{\ddagger}}$ = 1.7 in.

‡ For 4" Bore, Volume per Inch of Stroke = 12.6 (See Sizing Guide on page 6.2)

Model Choice: BA4 x 2 - 2



EXAMPLE 5: Pump cycle, Air to Oil Booster
Required output = 1000 cu. in./min. @ 250 psi
Available air pressure = 70 psi

Solution: **Power** = $\frac{\text{Required Pressure psig}}{\text{Available Pressure psig}} = \frac{250}{70}$
= 3.6 Minimum Required **Power Factor**

Choose either: 2-1/2" Bore – 4 Stage
or 4" Bore – 4 Stage (See Sizing Guide on page 6.2)

Solution (2-1/2" Bore): Stroke = $\frac{\text{Required Volume/Min}}{\text{Volume per Inch Stroke}^{\ddagger} \times \text{CPM}} = \frac{1000}{4.9^{\ddagger} \times 20}$ = 10.2 in.

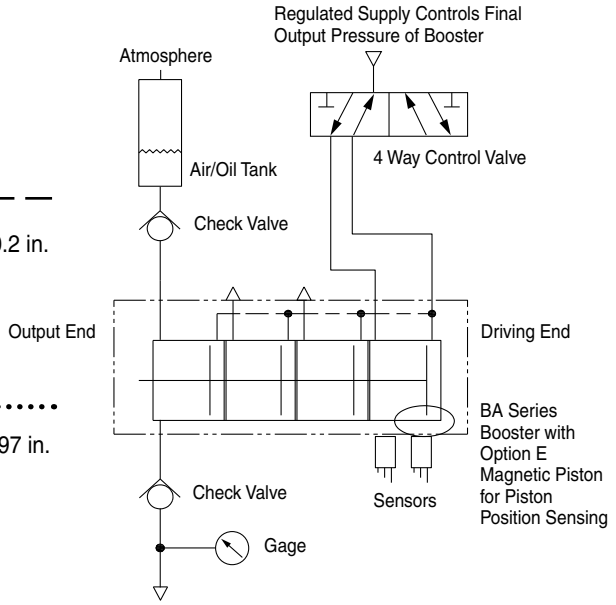
‡ For 2-1/2" Bore, Volume per Inch of Stroke = 4.9 (See Sizing Guide on page 6.2)
CPM = 20 (Typical average for Fabco-Air Air to Oil Booster)

Model Choice: BA2-1/2 x 11 - 4

Alternate Solution (4" Bore): Stroke = $\frac{\text{Required Volume/Min}}{\text{Volume per Inch Stroke}^{\ddagger} \times \text{CPM}} = \frac{1000}{12.6^{\ddagger} \times 20}$ = 3.97 in.

‡ For 4" Bore, Volume per Inch of Stroke = 12.6 (See Sizing Guide on page 6.2)
CPM = 20 (Typical average for Fabco-Air Air to Oil Booster)

Model Choice: BA4 x 4 - 4



Input Air Usage, Pump Cycle (See Example 5 above; Model BA 2-1/2 x 11 - 4, 20 stroke/min. @ 70 psi)

Solution: **Pressure** = $\frac{\text{Required Final Pressure}}{\text{Booster Power Factor}} = \frac{250}{3.7}$ = 67.6 psi regulated input required

Solution: **Volume** (CFM) = [Input Volume per Inch Stroke + Reset Volume per Inch Stroke] x $\frac{\text{Stroke x CPM}}{\text{1728 cu.in. / cu.ft.}}$

Input Volume per Inch Stroke = 19.3; Reset Volume per Inch Stroke = 4.5 (See Sizing Guide on page 6.2)
Stroke = 11 CPM = 20

Volume = [19.3 + 4.5] x $\frac{11 \times 20}{1728}$ = 23.8 x 0.127 = 3.03 CFM @ 67.6 psi

Converting Volume to SCFM: = $\frac{\text{CFM x psia}}{\text{Atmosphere}} = \frac{3.03 \times (67.6 + 14.7)}{14.7}$ = 17.0 SCFM required

Notes

WORLD CLASS PERFORMANCE
FABCO-AIR
PNEUMATIC PRODUCTS

Cylinders, Valves, & Accessories

DAO – 2 x 9

These units, with their many unique and attractive features, provide the ultimate for those systems that require hydraulic-type (precision, smooth, and rigid) cylinder control from shop air.

Air-oil systems can provide the smoothness and rigidity of a hydraulic system without the inherent high costs and space consuming pump, motor, tank, relief valve, and other components required for a noisy hydraulic system. They may also be used as storage tanks in booster systems, see page 6.11.

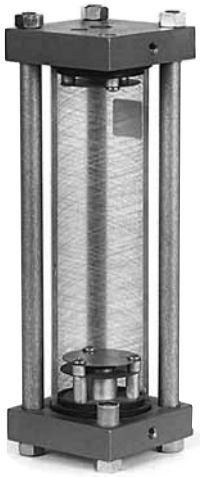
Fabco-Air's unique AIr-Oil tanks are available in single tank and space-saving double tank versions with bore (I.D.) sizes of 1-1/4", 2" and 4" to suit all applications.

Single Tank Units are used when hydraulic control of the cylinder is required in one direction only. If there is any question as to the integrity of the piston seal, a double tank is recommended. ***Single Tank Units*** are also used as fluid storage tanks for boosters, hydraulic shock options, and other applications.

Double Tank Units are used when hydraulic control of the cylinder is required in both directions. The one-piece heads that hold both tanks simplify mounting and save space.

Features and Benefits

- Operation to 150 psi
- Single tank units
- Double tank units, save space in two direction control systems
- Black anodized heads
- Tapped mounting holes in top and bottom heads
- Large flow ports
- Fill port on top
- Drain port on bottom
- Brass baffle plates and internal parts
- Baffles, top and bottom, help prevent fluid aeration



SAO – 2 x 9

- Choice of 1-1/4", 2" and 4" I.D. tanks
- Tank lengths to your requirements
- No sight tubes or gauges
- Translucent fiberglass tube provides full visibility of the fluid at all times. You can see when fluid levels are too low or too high. You can also see if there is air or foam in the fluid. (-15° to + 200°F)
- Custom molded Buna-N tube seals provide both I.D. and face sealing for a positive, no leak assembly
- Tie rods of plated, high strength threaded rod
- Aluminum tie rod cover tubes control the “H” dimension and provide controlled compression of tube seals. They also provide a clean appearance.
- Plated tie rod nuts

Air-Oil System Notes

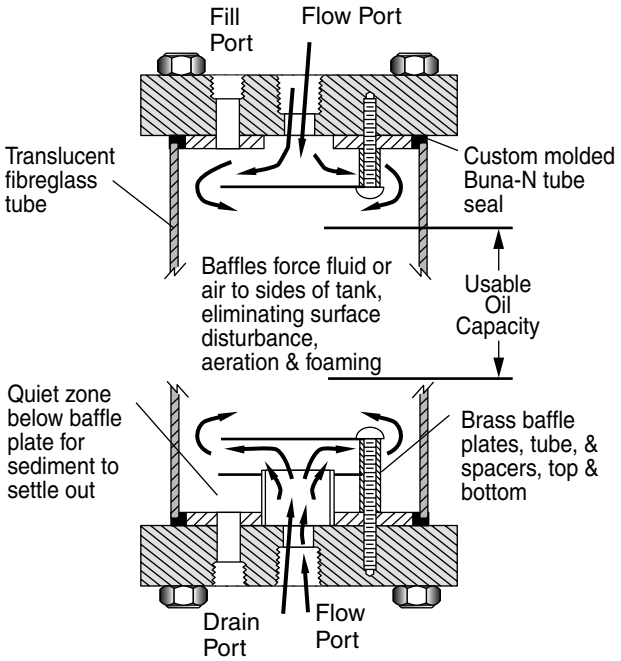
1 The best control is achieved by installing the speed control valves so that the fluid being forced out of the cylinder is being controlled. See the circuits on page 9.4.

2 The piping between the cylinder and the speed controlling valve should be rigid enough to maintain the required rigidity of the system.

3 It is best to mount the tanks so that the bottoms of the tanks are higher than the cylinder. Cylinder ports should be up with piping running as straight as possible to the tanks. This aids in purging the cylinder of air, by allowing the air to rise through the piping and into the tank where it will dissipate.

4 The highest fluid level should be kept reasonably near the top baffle to avoid excessive air usage, providing the quickest cycle reversal, and to allow for possible fluid loss.

5 If the fluid levels in the tanks unbalance, the fluid is bypassing the cylinder's piston seal. This can occur in a new cylinder with U-Cups designed for air service or side loading on the piston rod. In old systems the bypass can be a result of seal and cylinder wear, seal shrinkage, and many other reasons. See circuits on page 9.4 showing crossover valve for tank balancing.



Model Number Code

DAO – **4** x **30** – **V**

Series
Single Tank **SAO**
Double Tank **DAO**

Tank Bore
1-1/4"
2"
4"

Tank Height
"H" Dimension
(See page 9.3)
Specify in Inches as required.

See charts at left for "***Useable Oil Capacity***" and see "***Tank Selection***" below.

Options

Description			Specify
Viton Seals (-15° to +200°F)			**-V**
Oversize Ports			
Bore	Port Size	Location	
1-1/4	1/4 NPT	Top	**-T14**
		Bottom	**-B14**
		Both	**-TB14**
2	1/2 NPT	Top	**-T12**
		Bottom	**-B12**
		Both	**-TB12**
4	3/4 NPT	Top	**-T34**
		Bottom	**-B34**
		Both	**-TB34**
Any port not specified will be standard size.			
Extended Tie Rods			
	Top only		**-WT‡**
	Bottom only		**-WB‡**
	Both		**-WTB‡**

‡ Specify Dimension "K" in inches & fractions.
See page 9.3, 1/2" increments please.

Tank Height Inches "H"	Tank Bore Useable Oil Capacity Cubic Inches		
	4	2	1-1/4
5			1
6		3	2
7	6	6	3
8	12	8	4
9	24	11	5
10	35	13	6
11	47	15	7
12	58	18	8
13	70	20	9
14	81	23	10
15	92	25	11
16	104	27	
17	115	30	
18	127	33	
19	138	36	
20	150	39	
21	161	41	
22	173	44	
23	184	47	
24	195	50	
25	207	53	
26	218		
27	229		
28	240		
29	251		
30	263		
31	276		
32	288		
33	301		
34	314		
35	328		
36	340		
37	352		
38	364		
39	376	DAO maximum	
40	388		
41	401		
42	414		
43	427		
44	440		
45	452		
46	463		
47	477		
48	490		
49	502		
50	515		
51	527		
52	540		
53	552		
54	565		
55	578		
56	590		
57	603		
58	615		
59	628		
60	640	SAO maximum	

Tank Selection

Step 1 Calculate work cylinder volume in cubic inches. Area x Stroke = Volume.

Step 2 Add 10% to 40% to the volume for an operating margin based on system speed and level of maintenance. The higher the speed and the lower the maintenance the higher the operating margin should be.

Step 3 From the "Usable Oil Capacity" chart, select the Bore and Height combination that provides a volume equal to, or greater than, the calculated volume with operating margin. Base your final selection on a combination of economics, available space, port size (system speed), and operating margin.

Example

System: 3" Bore x 6" Stroke cylinder with oil on both ends, running at low speed and well maintained.

Step 1 Volume of 3" Bore = 7.07 sq. in. Area x 6" Stroke = 42.42 cu. in. Volume

Step 2 42.42 cu. in. Volume + 10% operating margin = 46.66 cu. in. with operating margin

Step 3 Choices: DAO - 4 x 11 or DAO -2 x 23

How to Order

1 *Specify the Series*

2 *Specify the Tank Bore*

3 *Specify the Tank Height, "H"*

4 *Specify Options*

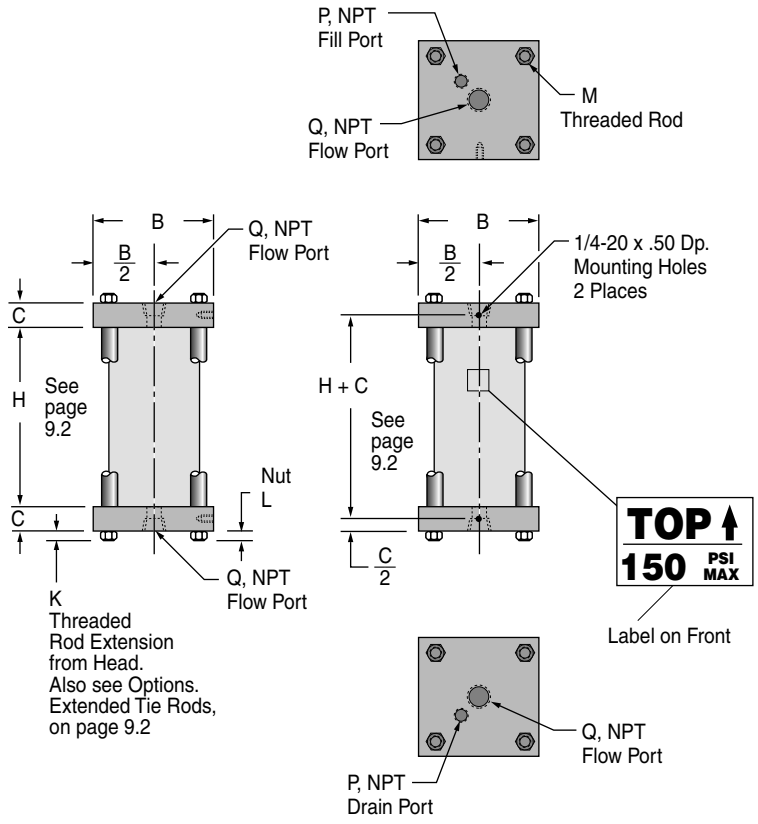
Examples

DAO - 4 x 30 - V Double tank, 4" bore, "H" = 30" (263 cu. in. capacity), Viton seals

SAO - 1-1/4 x 8 Single tank, 1 1/4" bore, "H" = 8" (4 cu. in. capacity)

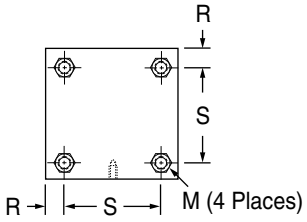
9

Single Tank Unit, SAO



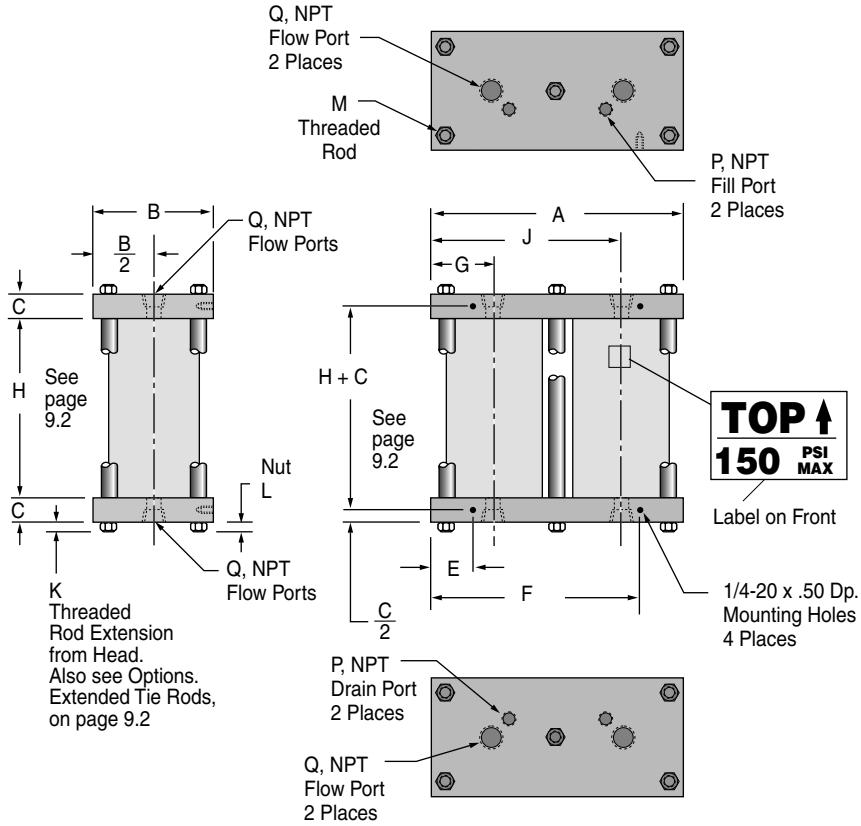
Tie Rod Pattern

SAO –1-1/4, SAO –2, SAO –4



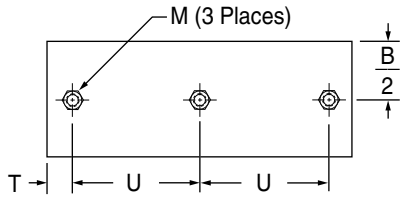
Bore	1-1/4	2	4
Vol./In.	1.22	3.14	12.56
A	4.75	7.50	10.75
B	2.00	3.00	5.25
C	0.50	0.75	1.00
E	0.38	0.50	1.88
F	4.38	7.00	8.88
G	1.31	2.13	2.63
H	See page 9.2		
J	3.44	5.38	8.13
K	0.27	0.38	0.50
L	0.22	0.33	0.43
M	1/4-20	3/8-16	1/2-13
P	1/8	1/8	1/4
Q	1/8	1/4	1/2
R	0.25	0.38	0.69
S	1.50	2.25	3.88
T	0.25	0.50	0.69
U	2.13	3.25	3.88

Double Tank Unit, DAO



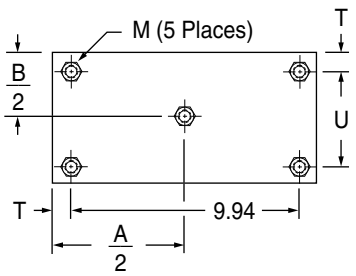
Tie Rod Pattern

DAO –1-1/4 & DAO –2



Tie Rod Pattern

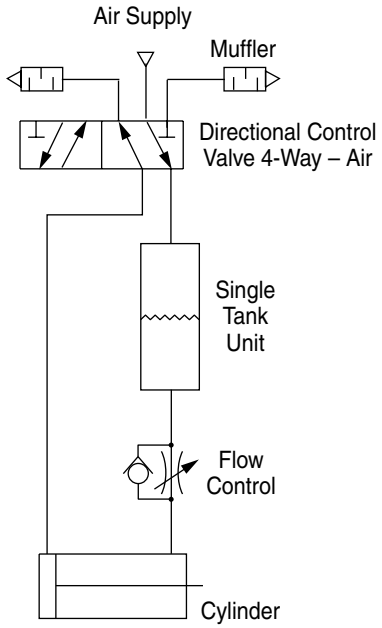
DAO –4



One Speed

Single Air-Oil Tank and flow control give hydraulic control, one speed, one direction with rapid reverse.

Can be used for Multi-Power® Cylinder and Multi-Power® Air Press with Option -HS. See page 5.4 and catalog #FP-16.

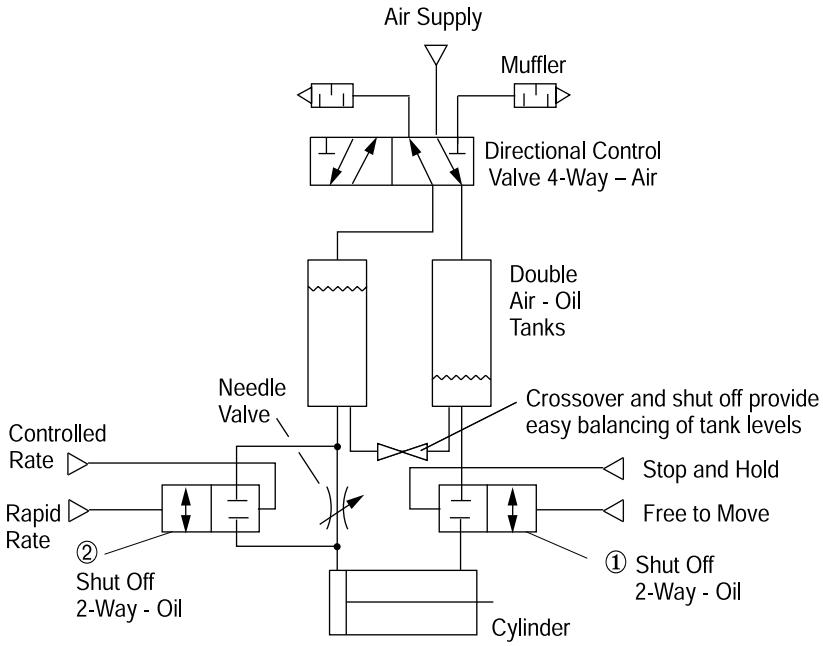


Two Speed Stop & Hold

Double Air-Oil Tanks with shut-off valves & needle valve provide:

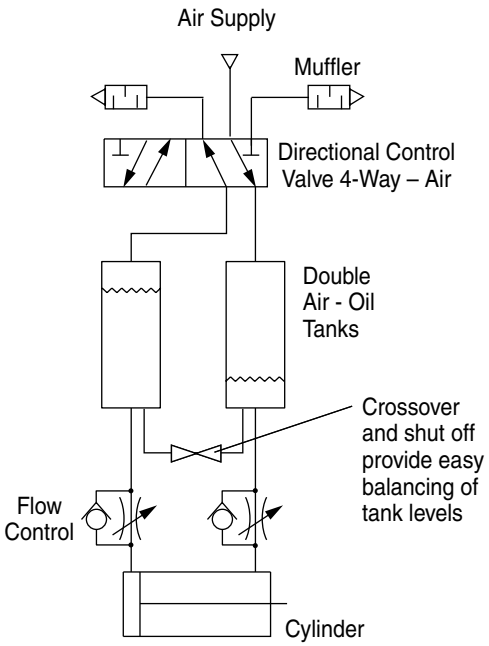
① Stop and hold in either direction at any point in cylinder travel.

② Choice of rapid or control rate in either direction at any point of cylinder travel.



Two Speed

Double Air-Oil Tanks and flow controls give hydraulic control, one speed, each direction.

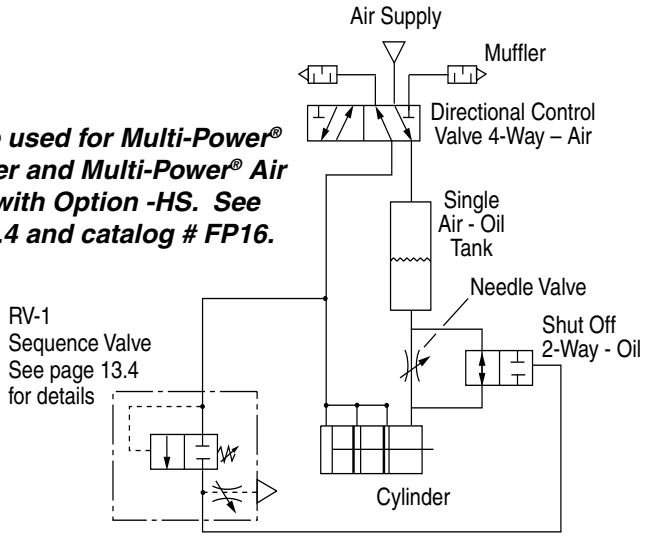


Two Speed & Shock Control

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 a punching operation), thus controlling the shock that could otherwise occur.
4. Automatic return to rapid rate on return stroke.

Can be used for Multi-Power® Cylinder and Multi-Power® Air Press with Option -HS. See page 5.4 and catalog # FP16.



9

Port Size	Flow Rate/ Factor	Function	Series	Actuators	Page Number
10-32 & 1/8 NPT Modular	Cv = 0.05 to Cv = 0.23	2 Way 3 Way 4 Way, 2 Position	Modular Manifold	Solenoid	11.3 - 11.4
1/8 NPT & 1/4 NPT	Cv = 0.05 to Cv = 0.23	2 Way 3 Way	Hex Body	Solenoid	11.5–11.6
1/8 NPT	Cv = 0.27	2 Way 3 Way 4 Way, 2 Position	18	Manual Mechanical Pilot Solenoid	11.7-11.8 11.7-11.8 11.7-11.8 11.9-11.12
1/4 NPT	Cv = 1.0	3 Way 4 Way, 2 Position 4 Way, 3 Position	14	Manual Mechanical Pilot Solenoid	11.13-11.16 11.13-11.14 11.13-11.15 11.17-11.22
1/4 NPT Stacking	Cv = 1.0	3 Way 4 Way, 2 Position	M14	Manual Mechanical Pilot Solenoid	11.13 11.13 11.13 11.20
3/8 NPT	Cv = 1.0	3 Way 4 Way, 2 Position 4 Way, 3 Position	34	Manual Mechanical Pilot Solenoid	11.13-11.16 11.13-11.14 11.13-11.15 11.17-11.22
3/8 NPT & 1/2 NPT Manifold	Cv = 2.2 to Cv = 3.9	3 Way 4 Way, 2 Position 4 Way, 3 Position	12A	Manual Pilot Solenoid	11.23-11.28
3/8 NPT	Cv = 2.4 to Cv = 4.1	3 Way 4 Way, 2 Position 4 Way, 3 Position	38	Manual Pilot Solenoid	11.23–11.28
1/2 NPT	Cv = 2.4 to Cv = 4.1	3 Way 4 Way, 2 Position 4 Way, 3 Position	12	Manual Pilot Solenoid	11.23–11.28
1/2 NPT High Flow	Cv = 6.2	3 Way 4 Way, 2 Position	12B	Manual Pilot Solenoid	11.23–11.28

Note: ***Operating Temperature references for 18 Series and 14 Series valves described on pages 11.8 and 11.14.***

Standard catalog models are suitable for operation in intermittent low temperatures in a range of 0° to + 32 °F.

A custom aluminum spool may be substituted when long-term application temperatures are expected to be –40° to +32°F. These should be limited to manual or mechanical actuation, not spring return. Consider that actuation force may exceed catalog specs and that spring return models may not be reliable at these low temperatures. Please consult factory.

For long-term, continuous operation in a range of +150°F to +180°F, the Viton seal option can provide the benefits of reliable leak-free operation and extended durability. For applications exceeding +180°F, please consult factory.

11

Miniature 53 STYLE Solenoid Valves
2, 3 or 4 Way - Modular Manifolding
2, 3 or 4 Way - Single Mounting

Time Proven • Space Saving • Reliable• 2, 3 and 4 Way Solenoid Valves with 10-32 or 1/8 NPT ports are available in singular or modular manifold versions. Any combination of function and ports can be combined in the same manifold stack to save time, space and plumbing. With pressure manifold plugging, two or more pressure ranges and/or medias can be controlled in the same stack.

For Each Valve Specify:

	EXAMPLE	
Basic Model Number	**103-M**	See Chart Below
Letter for Housing	**-C**	**C** Conduit, **G** Grommet, **F** DIN
Number for Seat	**-1**	See orifice information chart below
Options		See option Information below
Volts & Hertz	**120/60**	See solenoid information Page11.29

Example: 3 Way modular mounting with manifold inlet, 1/8 NPT inlet, 10-32 Cylinder Port, Conduit Housing, 3/64 Seat, 120 Volts/60 HZ.
Model Number = 103-M-C-1, 120/60

For Complete Assembled Banks Specify:

- Quantity of assembled **Banks**
- Valve models (start left to right, see photo above)
- Mounting brackets, if desired #101

Example… Using the photo above
1 Bank consisting of:
1 113-M-C-1 120/60
1 103-M-F-1 120/60
1 104-M-G-1 120/60
1 114-M-C-1 120/60
1 Pair #101 Mounting Brackets

	Function	Inlet Port	Cylinder Port	Basic Model No.
Valves for Individual Mounting & Individual Inlet	2 Way N.C.	1/8 NPT	1/8 NPT	112-S
	3 Way N.C.	1/8 NPT	1/8 NPT	113-S
	4 Way	10-32	10-32	104-S-10
	4 Way	1/8 NPT	10-32	104-S-18
	4 Way	1/8 NPT	1/8 NPT	114-S
Valves for Modular Mounting & Individual Inlet	2 Way N.C.	10-32	10-32	102-SM
	3 Way N.C.	10-32	10-32	103-SM
Valves for Modular Mounting & Manifolded Inlet (Pressure Manifolded)	2 Way N.C.	1/8 NPT	10-32	102-M
	2 Way N.C.	1/8 NPT	1/8 NPT	112-M
	3 Way N.C.	1/8 NPT	10-32	103-M
	3 Way N.C.	1/8 NPT	1/8 NPT	113-M
	4 Way	1/8 NPT	10-32	104-M
	4 Way	1/8 NPT	1/8 NPT	114-M

All Mountings 3 Way Normally Open use 4 Way & Plug N.C. port

Operating Pressures

Applies to all 4 Way 104 and 114 series valves.
See ***Orifice Information*** below for pressure ranges of 2 & 3 Way valves.

STANDARD SPRING
40 psi Minimium
150 psi Maximum with #1, 3/64 orifice.
See ***Orifice Information*** below for Maximum with other orifices.

OPTIONAL LOW PRESSURE SPRING
20 psi:
20 psi Minimum
25 psi Maximum
25 psi:
25 psi Minimum
60 psi Maximum

OPTION INFORMATION

- Viton Seals for media compatibility specify Option **-V**
- Coils & Housing, See page 11.29.
- Low Pressure Spring - 4 Way Only - See Operating Pressures.
- Pro-Coat™ (Electroless Nickel Plate) Option **-N**, See page 1.10.
- Special Bank Assembly (Plugs, Fittings, Wire Terminals) See Pg iii.
- Normally Open (N.O.) 2 & 3 Way Valves - Use 4 Way Valve & Plug N.C. Port.

Accessories
- Mounting Brackets Part # 101.
- Connectors for Mini-DIN "F", See page 11.30.
- SM-10 Muffler, See page 14.1.

ORIFICE INFORMATION

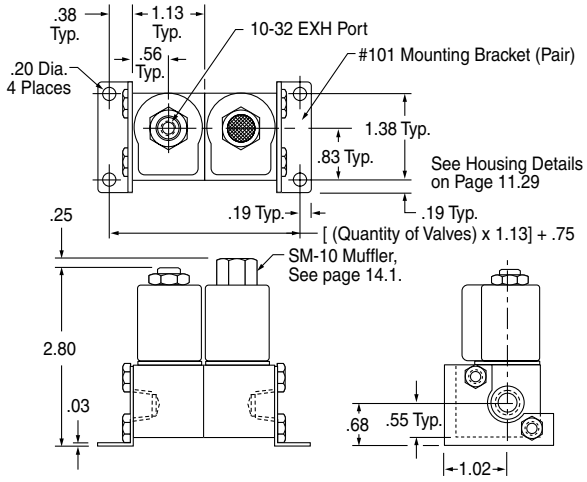
Available Orifices and Equivalent Maximum Pressure Ratings for AC Voltages (DC Ratings Slightly Lower)

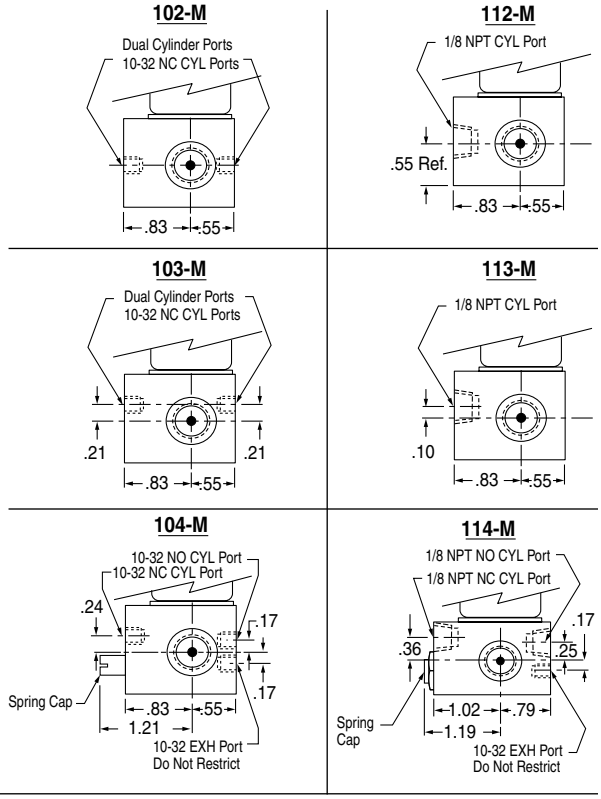
						CFM – Flow @	
		Cv Factor	2 Way N.C.	3 Way N.C.	4 Way	100 psi	50 psi
Number 0	1/32	.022	500 psi	200 psi	150 psi	1.3	0.9
Number 1	3/64	.055	400	150	150	3.5	2.0
Number 2	1/16	.075	200	100	100	5.8	3.4
Number 3	3/32	.156	100	60	80	9.0	6.0
Number 4	1/8	.230	75	30	Not Available	Not Available	8.0

MODELS 102-M, 103-M, 104-M, 112-M, 113-M & 114-M

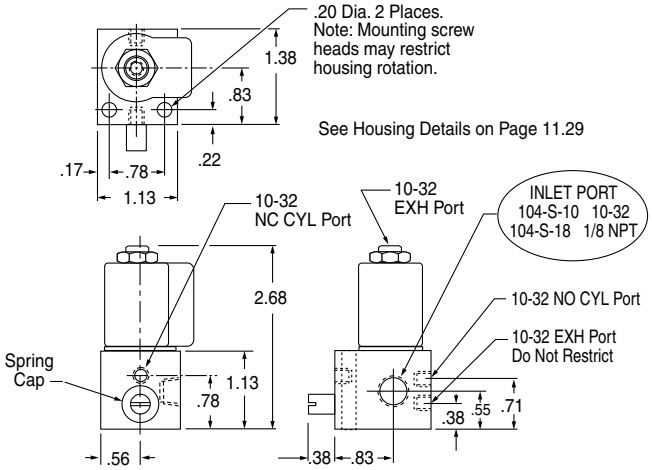
Supply pressure can be connected to either or both ends of the stack. Due to the fact that the supply pressure port on all "M" valve bodies is tapped on both sides, the pressure manifold can be plugged at any point within the stack. This allows you to supply the stack with two different pressures or media, one from each end.

For more than two inputs a port block can be provided in midstack. Spacers can be included for applications requiring the larger EXPLOSION PROOF operator. Contact Fabco-Air with your specific requirements.

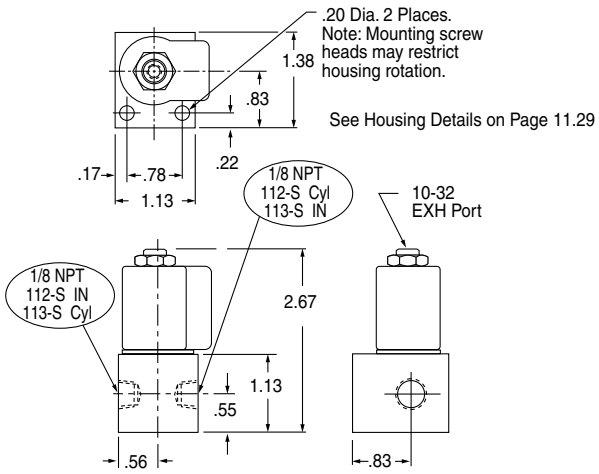




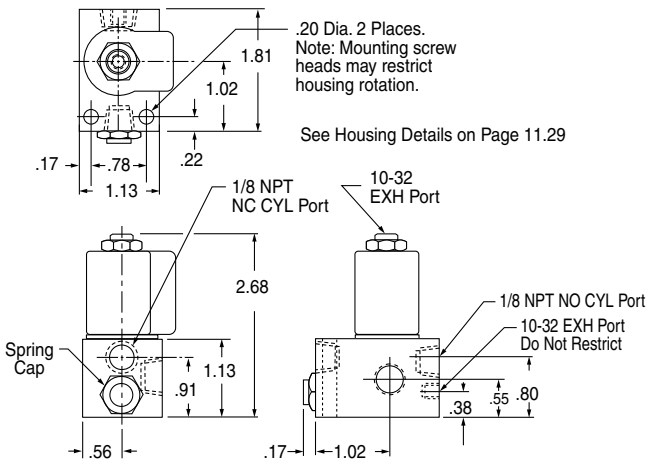
MODEL 104-S-10 (10-32 Inlet Port)
MODEL 104-S-8 (1/8 NPT Inlet Port)



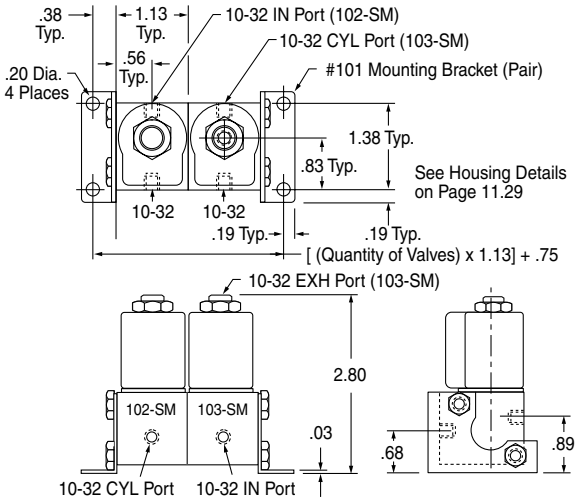
MODEL 112-S (2-Way), 113-S (3-Way)



MODEL 114-S



MODEL 102-SM (2-Way), 103-SM (3-Way)



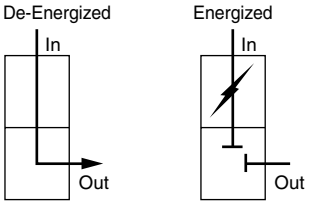
11

Hex Body 53 STYLE Solenoid Valves

- **Body** Hex aluminum, black anodized - 3 Different porting styles.
- **Media** Air, water & other fluids compatible with standard Buna-N seals and aluminum.
- **Power** See page 11.29
- **Operating Temperature:** 0°F (–18°C) to +104°F (40°C) ambient. 0°F (–18°C) to +150°F (65°C) media.
- **Voltages** See page 11.29
- **Operating Pressure** See chart with orifice information
- **Internal Parts** Stainless Steel

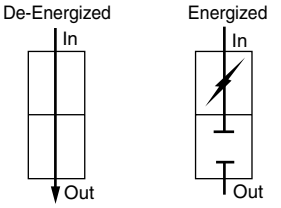
2 WAY NORMALLY OPEN

BODY STYLE 1 — SIDE PORT



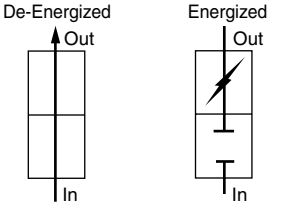
IN	OUT	Basic Model
10-32	1/8	82-★-✦-NO1
1/8	1/8	82-★-✦-NO2
10-32	1/4	42-★-✦-NO1
1/8	1/4	42-★-✦-NO2

BODY STYLE 2 — FEMALE BOTTOM PORT



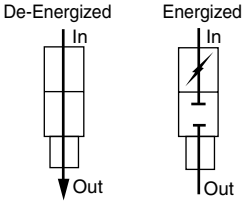
IN	OUT	Basic Model
10-32	1/8	F-82-★-✦-NO1
1/8	1/8	F-82-★-✦-NO2
10-32	1/4	F-42-★-✦-NO1
1/8	1/4	F-42-★-✦-NO2

BODY STYLE 2 — FEMALE BOTTOM PORT



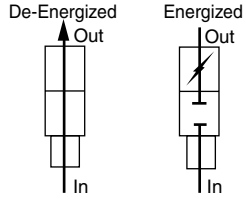
IN	OUT	Basic Model
1/8	10-32	FX-82-★-✦-NO1
1/8	1/8	FX-82-★-✦-NO2
1/4	10-32	FX-42-★-✦-NO1
1/4	1/8	FX-42-★-✦-NO2

BODY STYLE 3 — MALE BOTTOM PORT



IN	OUT	Basic Model
10-32	1/8	082-★-✦-NO1
1/8	1/8	082-★-✦-NO2
10-32	1/4	042-★-✦-NO1
1/8	1/4	042-★-✦-NO2

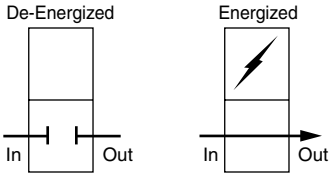
BODY STYLE 3 — MALE BOTTOM PORT



IN	OUT	Basic Model
1/8	10-32	X-82-★-✦-NO1
1/8	1/8	X-82-★-✦-NO2
1/4	10-32	X-42-★-✦-NO1
1/4	1/8	X-42-★-✦-NO2

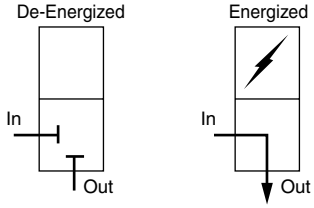
2 WAY NORMALLY CLOSED

BODY STYLE 1 — SIDE PORTS



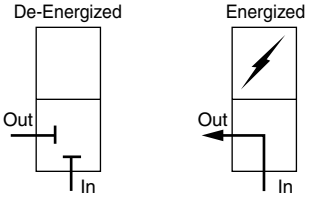
IN	OUT	Basic Model
1/8	1/8	82-★-✦
1/4	1/4	42-★-✦

BODY STYLE 2 — FEMALE BOTTOM PORT



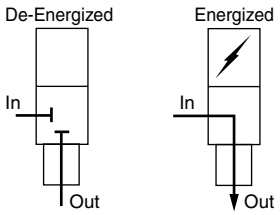
IN	OUT	Basic Model
1/8	1/8	F-882-★-✦
1/8	1/4	F-842-★-✦
1/4	1/8	F-482-★-✦
1/4	1/4	F-442-★-✦

BODY STYLE 2 — FEMALE BOTTOM PORT



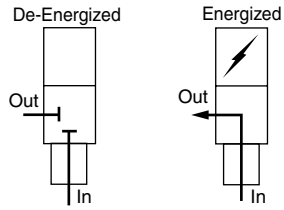
IN	OUT	Basic Model
1/8	1/8	FX-882-★-✦
1/8	1/4	FX-482-★-✦
1/4	1/8	FX-842-★-✦
1/4	1/4	FX-442-★-✦

BODY STYLE 3 — MALE BOTTOM PORT



IN	OUT	Basic Model
1/8	1/8	882-★-✦
1/8	1/4	842-★-✦
1/4	1/8	482-★-✦
1/4	1/4	442-★-✦

BODY STYLE 3 — MALE BOTTOM PORT



IN	OUT	Basic Model
1/8	1/8	X-882-★-✦
1/8	1/4	X-482-★-✦
1/4	1/8	X-842-★-✦
1/4	1/4	X-442-★-✦

HOW TO ORDER

	EXAMPLE	
Basic Model Number	X883	See Model Charts
Insert Letter for Housing at ★	-C	**C** Conduit, **G** Grommet, **F** DIN See Solenoid Information Page 11.29
Number for Orifice at ✦ All 3 Way EX Orifices are 1/16	-1	See Chart, Orifice Information
Options		See Chart, Option Information
Volts & Hertz	120/60	See Solenoid Information Page 11.29

Example: 3 Way N.C., 1/8 NPT Male Bottom Inlet, 1/8 NPT Side Cylinder, Conduit Housing, 3/64 Seat, 120 Volts/60 HZ.
Model Number = X883-C-1, 120/60

OPTIONS: **Specify Suffix**

- 1/8 NPT Adapter (3 Way N.C. Top Exhaust) ..... **-A ..... See Pg. 11.6**
- Viton Seals (for media compatibility) ..... **-V**
- Explosion Proof ..... **-EP ..... See Pg. 11.30**
- Pro-Coat™ (Electroless Nickel Plate) ..... **-N ..... See Pg. 1.10**
- Spade Electrical Connections See Pgs. 11.29 & 11.30

ACCESSORIES:

- Solenoid Exhaust Muffler ..... **SM-10 ... See Page 14.1**
- Connectors for Mini-DIN "F" ..... See Pg. 11.30

11

ORIFICE INFORMATION

Available Orifices and Equivalent Maximum Pressure Ratings for AC Voltages (DC Ratings Slightly Lower)

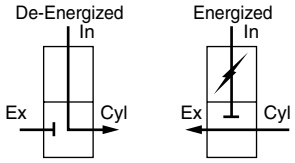
		Cv Factor	2 Way N.O.	2 Way N.C.	3 Way N.O.	3 Way N.C.	CFM – Flow @ 100 psi	CFM – Flow @ 50 psi
Number 0	1/32	.022	150 psi	500 psi	150 psi	200 psi	1.3	0.9
Number 1	3/64	.055	125	400	125	150	3.5	2.0
Number 2	1/16	.075	100	200	100	100	5.8	3.4
Number 3	3/32	.156	NA	100	NA	60	9.0	6.0
Number 4	1/8	.230	NA	75	NA	30	NA	8.0

All 3 way (EX) exhaust orifices are 1/16.

All 3 way (EX) exhaust orifices are 1/16.

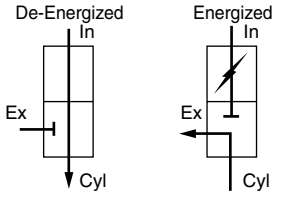
3 WAY NORMALLY OPEN

BODY STYLE 1 — SIDE PORT



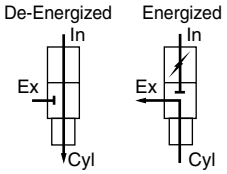
IN	CYL	EX†	Basic Model
10-32	1/8	1/8	83-★-✦-NO1
1/8	1/8	1/8	83-★-✦-NO2
10-32	1/4	1/4	43-★-✦-NO1
1/8	1/4	1/4	43-★-✦-NO2

BODY STYLE 2 — FEMALE BOTTOM PORT



IN	CYL	EX	Basic Model
10-32	1/8	1/8	F-883-★-✦-NO1
1/8	1/8	1/8	F-883-★-✦-NO2
10-32	1/8	1/4	F-483-★-✦-NO1
1/8	1/8	1/4	F-483-★-✦-NO2
10-32	1/4	1/8	F-843-★-✦-NO1
1/8	1/4	1/8	F-843-★-✦-NO2
10-32	1/4	1/4	F-443-★-✦-NO1
1/8	1/4	1/4	F-443-★-✦-NO2

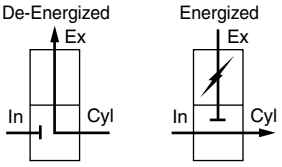
BODY STYLE 3 — MALE BOTTOM PORT



IN	CYL	EX	Basic Model
10-32	1/8	1/8	883-★-✦-NO1
1/8	1/8	1/8	883-★-✦-NO2
10-32	1/8	1/4	483-★-✦-NO1
1/8	1/8	1/4	483-★-✦-NO2
10-32	1/4	1/8	843-★-✦-NO1
1/8	1/4	1/8	843-★-✦-NO2
10-32	1/4	1/4	443-★-✦-NO1
1/8	1/4	1/4	443-★-✦-NO2

3 WAY NORMALLY CLOSED

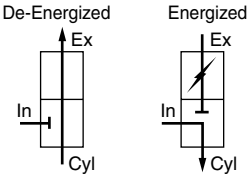
BODY STYLE 1 — SIDE PORTS



IN	CYL	EX†	Basic Model
1/8	1/8	10-32	83-★-✦
1/4	1/4	10-32	43-★-✦

† For optional 1/8 NPT Adapter add Suffix "A"

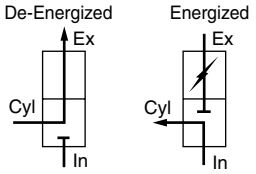
BODY STYLE 2 — FEMALE BOTTOM PORT



IN	CYL	EX†	Basic Model
1/8	1/8	10-32	F-883-★-✦
1/8	1/4	10-32	F-843-★-✦
1/4	1/8	10-32	F-483-★-✦
1/4	1/4	10-32	F-443-★-✦

† For optional 1/8 NPT Adapter add Suffix "A"

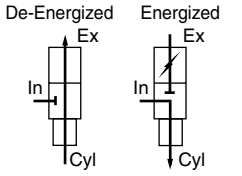
BODY STYLE 2 — FEMALE BOTTOM PORT



IN	CYL	EX†	Basic Model
1/8	1/8	10-32	FX-883-★-✦
1/8	1/4	10-32	FX-483-★-✦
1/4	1/8	10-32	FX-843-★-✦
1/4	1/4	10-32	FX-443-★-✦

† For optional 1/8 NPT Adapter add Suffix "A"

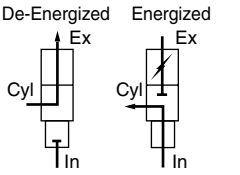
BODY STYLE 3 — MALE BOTTOM PORT



IN	CYL	EX†	Basic Model
1/8	1/8	10-32	883-★-✦
1/8	1/4	10-32	843-★-✦
1/4	1/8	10-32	483-★-✦
1/4	1/4	10-32	443-★-✦

† For optional 1/8 NPT Adapter add Suffix "A"

BODY STYLE 3 — MALE BOTTOM PORT

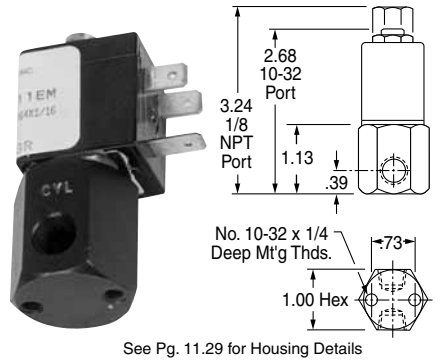


IN	CYL	EX†	Basic Model
1/8	1/8	10-32	X-883-★-✦
1/8	1/4	10-32	X-483-★-✦
1/4	1/8	10-32	X-843-★-✦
1/4	1/4	10-32	X-443-★-✦

† For optional 1/8 NPT Adapter add Suffix "A"

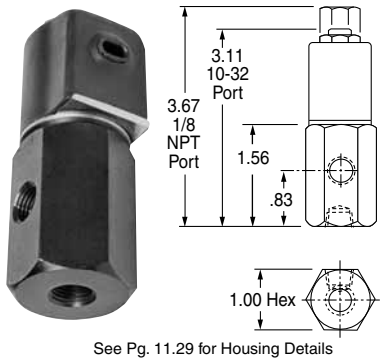
11

BODY STYLE 1 – Side Ports



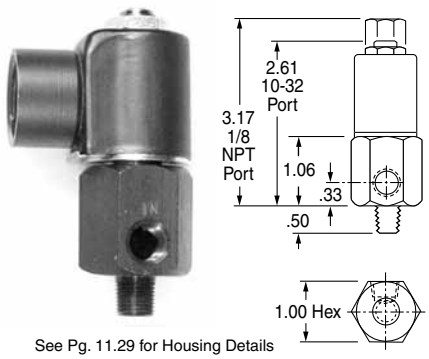
See Pg. 11.29 for Housing Details

BODY STYLE 2 – Female Bottom Port



See Pg. 11.29 for Housing Details

BODY STYLE 3 – Male Bottom Port



See Pg. 11.29 for Housing Details

1/8 NPT PORTED, MANUAL, MECHANICAL AND PILOT OPERATED AIR VALVES – *"The Finest in Simplicity"*
2, 3 and 4 Way - 2 Position – Operation to 150 psi Air

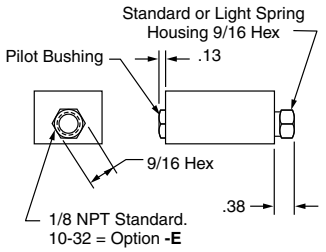
Suitable for Vacuum directional flow applications, but NOT for holding vacuum.

Short stroke of lightweight Delrin® spools provides fast, positive, and reliable response.

Note 1: Specify Normally Open by substituting -20 for -2 & -30 for -3.

Air Pilot

Standard 2 Way & 3 Way spring return are normally closed. For normally open the actuators may be exchanged end for end or by specifying -20 for -2 & -30 for -3.
Minimum pilot pressure:
- Standard spring . . . . . 60 psi
- Light spring (Option **-L**) . . . 40 psi
- Double pilot . . . . . 20 psi

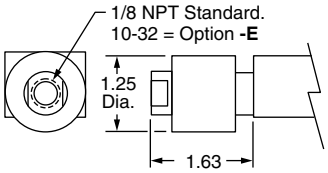


2 Way	3 Way	4 Way
Single Pilot - Spring Return		
18SP-2	18SP-3	18SP-4
Double pilot		
18DP-2	18DP-3	18DP-4
Replacement spool & seals		
1800-902	1800-903	1800-904

Light spring, Option **-L**
10-32 pilot port, Option **-E**

Air Pilot Amplifier

1" Delrin piston in aluminum housing meets low pressure requirements. Standard 2 Way & 3 Way spring return are normally closed. For normally open the actuators may be exchanged end for end or by specifying -20 for -2 & -30 for -3.
Minimum pilot pressure:
- Standard spring . . . . . 10 psi
- Light spring (Option **-L**) . . . . 7 psi
- Against 0 psi pilot . . . . . 2 psi

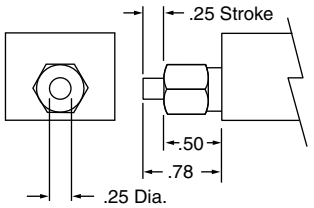


2 Way	3 Way	4 Way
Single Pilot (Amplifier) - Spring Return		
18SA-2	18SA-3	18SA-4
Double pilot - 2 amplifiers		
18DA-2	18DA-3	18DA-4
Double pilot - 1 amplifier, 1 air pilot		
18DAP-2	18DAP-3	18DAP-4
When both pilots are pressurized, the amplifier overrides.		
Replacement spool & seals		
1800-902	1800-903	1800-904

Light spring, Option **-L**
10-32 pilot port, Option **-E**

Rod Actuator

Stainless steel rod in brass bushing. Standard 2 Way & 3 Way spring return are normally closed. For normally open the actuators may be exchanged end for end or specify by substituting -20 for -2 & -30 for -3.
Force to actuate:
- Standard spring . . . . . 6.5 lb.
- Light spring (Option **-L**) . . . 5.0 lb.
- Double Rod . . . . . 1.2 lb.

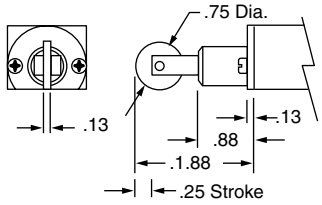


2 Way	3 Way	4 Way
Single Rod - Spring Return		
18SR-2	18SR-3	18SR-4
Single Rod- Pilot Return		
18SRP-2	18SRP-3	18SRP-4
Double rod		
18DR-2	18DR-3	18DR-4
Replacement spool & seals		
1800-902	1800-903	1800-904

Light return spring, Option **-L**

Roller Cam

Case hardened steel roller and shaft in hard anodized aluminum housing. Standard 2 Way & 3 Way spring return are normally closed. For normally open specify by substituting -20 for -2 & -30 for -3.
Force to actuate:
- Standard spring . . . . . 6.5 lb.
- Light spring (Option **-L**) . . . 5.0 lb.
- Double Cam. . . . . 1.2 lb.

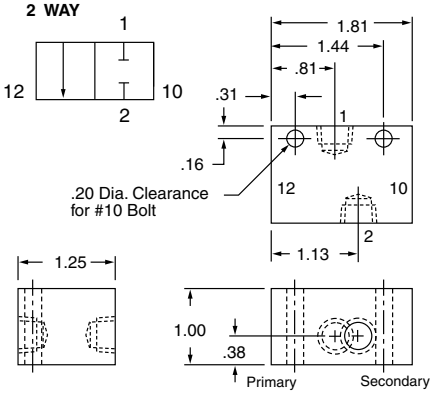


2 Way	3 Way	4 Way
Single Cam - Spring Return		
18CR-2	18CR-3	18CR-4
Single Cam - Pilot Return		
18CRP-2	18CRP-3	18CRP-4
Replacement spool & seals for above		
1800-912	1800-913	1800-914
Double cam		
18CCR-2	18CCR-3	18CCR-4
Replacement spool & seals		
1800-922	1800-923	1800-924

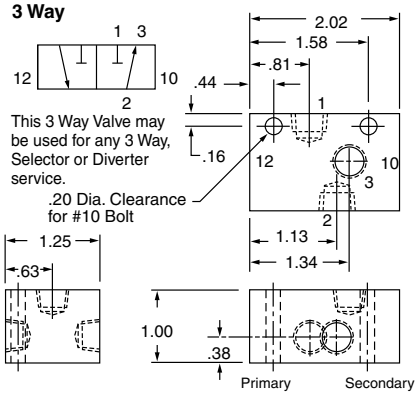
Light return spring, Option **-L**

Valve Body Dimensions

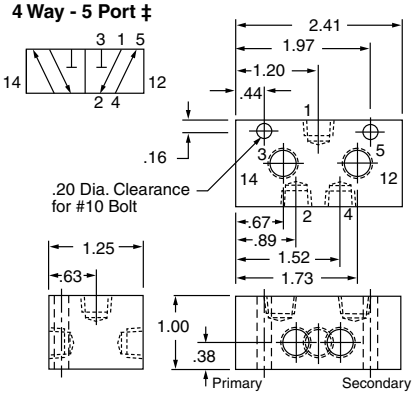
2 WAY



3 Way



4 Way - 5 Port ‡

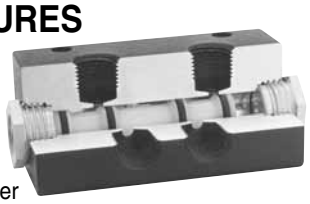


Standard 2 & 3 way spring return models are normally closed. Models with thread in actuators may be converted to normally open by exchanging actuators end for end. Other models require specification and factory assembly. See note 1.

‡ 4 way - 5 port May be used as either single inlet - dual exhaust or dual inlet - single exhaust.

FEATURES

- Aluminum bar body
- Anodized black
- Honed & burnished bore
- Pressure balanced spool
- Delrin spool
- Buna-N seals
- Operation to 150 psi
- 4 Way - 5 port may be used as either single inlet - dual exhaust or dual inlet - single exhaust.



- Prelubed with Magnalube®–G Grease
- Interchangeability of Parts
- Cv = 0.27 (14.2 SCFM Free Flow to Atmosphere at 80 psi Supply)
- Operating temperature +32° to +180°F; Solenoid controlled models +150°F max. See pages 11.9 and 11.11.

OPTIONS

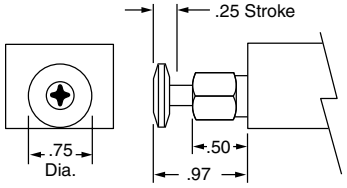
- Light spring – Specify Option **-L**
- Viton seals – Specify Option **-V**
- Spools for bleeder pilot
- Multiple stacking with or without common inlet. Consult factory.

Note 1: Specify Normally Open by substituting -20 for -2 & -30 for -3.

OPERATING TEMPERATURE FOOTNOTE SEE PAGE 11.1

Small Palm Button

Un-anodized aluminum button with stainless steel rod in brass bushing. Standard 2 Way & 3 Way spring return are normally closed. For normally open the actuators may be exchanged end for end or specify by substituting -20 for -2 & -30 for -3.
Force to actuate:
Standard spring . . . . . 6.5 lb.
Light spring (Option **-L**) . . . 5.0 lb.
Double Button . . . . . 1.2 lb.

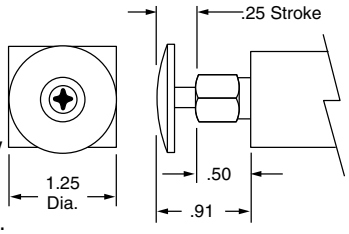


2 Way	3 Way	4 Way
Single Button - Spring Return		
18PS-2	18PS-3	18PS-4
Single Button - Pilot Return		
18PSP-2	18PSP-3	18PSP-4
Double Button		
18PPS-2	18PPS-3	18PPS-4
Replacement spool & seals		
1800-902	1800-903	1800-904

Light spring Option **-L**

Large Palm Button

Red anodized aluminum button with stainless steel rod in brass bushing. Standard 2 Way & 3 Way spring return are normally closed. For normally open the actuators may be exchanged end for end or specify by substituting -20 for -2 & -30 for -3.
Force to actuate:
Standard spring . . . . . 6.5 lb.
Light spring (Option **-L**) . . . 5.0 lb.
Double Button . . . . . 1.2 lb.

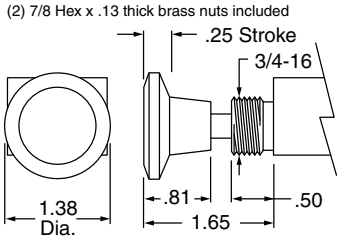


2 Way	3 Way	4 Way
Single Button - Spring Return		
18PL-2	18PL-3	18PL-4
Single Button - Pilot Return		
18PLP-2	18PLP-3	18PLP-4
Double Button		
18PPL-2	18PPL-3	18PPL-4
Replacement spool & seals		
1800-902	1800-903	1800-904

Light spring Option **-L**

Panel Mount Button

Phenolic button with plated steel rod in brass bushing; **black** button standard, **red** button Option **-R**. Standard 2 Way and 3 Way assemblies are normally closed with knob in the "out" position. For normally open specify by substituting -20 for -2 and -30 for -3.
Force to actuate:
Standard spring . . . . . 6.5 lb.
Light spring (Option **-L**) . . . 5.0 lb.
Double Button . . . . . 1.2 lb.
Detented . . . . . 3.0 lb.

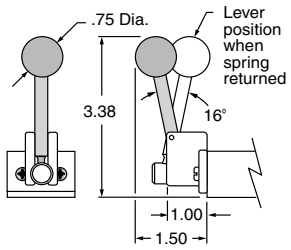


2 Way	3 Way	4 Way
Spring Return		
18PMS-2	18PMS-3	18PMS-4
Pilot Return		
18PMP-2	18PMP-3	18PMP-4
Replacement spool & seals for above.		
1800-902	1800-903	1800-904
Detented (Push Pull)		
18PMD-2	18PMD-3	18PMD-4
Replacement spool & seals		
1800-942†	1800-943†	1800-944†

Light spring Option **-L**

Hand Lever

Hardened & plated steel shaft with unique connection to spool results in positive shifting. Standard 2 Way & 3 Way spring return are normally closed. For normally open specify by substituting -20 for -2 & -30 for -3.
Force to actuate:
Standard spring . . . . . 4.0 lb.
Light spring (Option **-L**) . . . 3.0 lb.
Detented . . . . . 2.0 lb.



2 Way	3 Way	4 Way
Spring Return		
18HLS-2	18HLS-3	18HLS-4
Detented		
18HL-2	18HL-3	18HL-4
Replacement spool & seals		
1800-932†	1800-933†	1800-934†

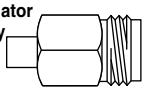
† Includes factory assembled spool attachments.
Light spring Option **-L**

MOST THREADED-IN OPERATORS ARE INTERCHANGEABLE BETWEEN ENDS

Palm Button Assembly

No. **1800-1** Large Button
No. **1800-2** Small Button

Rod Actuator Assembly



No. **1800-3**

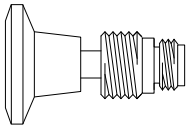
Spring Housing Assembly

No. **1800-4** Light Spring only (for Option L).
No. **1800-5** Standard Spring only
No. **1800-46** Light Spring & Housing Ass'y (for Option **-L**).
No. **1800-56** Standard Spring & Housing Assembly.

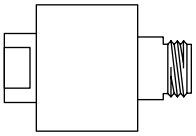
Pilot Bushing

No. **1800-10** 10-32 Port
No. **1800-18** 1/8 NPT Port

Panel Mount Button Assembly
For Detented (with Spool)
No. **1800-7-2** (2W NC) **1800-7-20** (2W NO)
1800-7-3 (3W NC) **1800-7-30** (3W NO)
Above NOT interchangeable End for End
1800-7-4 (4 Way)
For Spring or Pilot Return (No Spool)
1800-8 (2 or 3 Way, NO or NC, and 4 Way))



Air Pilot Amplifier
1/8 NPT Standard

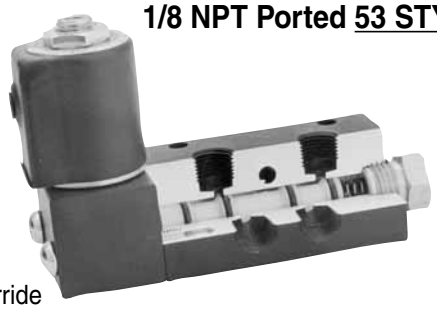


No. **18 AMP-1** 1/8 NPT Port
No. **10 AMP-1** 10-32 Port Option **-E**

***Fabco-Air** has the expertise and willingness to design. modify and adapt these valves to your necessary and specific job requirements. Please advise us of your needs.*

11

1/8 NPT Ported 53 STYLE Solenoid Controlled, Pilot Operated Air Valves
2, 3 & 4 Way - 2 Position – Operation to 150 psi Air



Options
Manual Override
- Locking . . . . . **-MO1**
- Non-Locking . . . . . **-MO4**

External Pilot . . . . . **-X**
Light Spring . . . . . **-L**
Viton Seals for media compatibility. . . . . **-V**
Explosion Proof Operators . . . . . **-EP**
See page 11.30
Dual Inlet - Single Exhaust 4 Way
See page 11.10
Note 1: Optional Flow Path

Features
- Black anodized aluminum bar stock body • Honed and burnished bore
- Lightweight Delrin® spool provides fast, positive, reliable response
- Buna N seals • Operation to 150 psi
- Coils & housing information see page 11.29
- Cv = 0.27 • 14.2 SCFM free flow to atmosphere @ 80 psi
- Prelubed with Magnalube®-G grease
- Operating temperature:
  +32°F (0°C) to +104°F (40°C) ambient.
  +32°F (0°C) to +150°F (65°C) media.

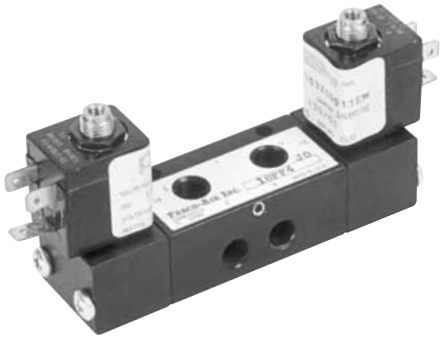
Standard catalog models are suitable for operation in intermittent low temperatures in a range of 0° to + 32 °F.

A custom aluminum spool may be substituted when long-term application temperatures are expected to be 0° to +32°F. These should be limited to double solenoid actuation. Consider that actuation force may exceed catalog specs and that spring return models may not be reliable at these low temperatures. Please consult factory.

Operating Range
Internal Pilot Supply (Standard)
- Standard Spring . . . . . 60 to 150 psi
- Light Spring, Option **-L** . . . 40 to 150 psi
- Pilot Return (0 psi Pilot) . . 20 to 150 psi

External Pilot Supply, Option **-X**
- Inlet Pressure . . . . . 0 to 150 psi

External Pilot Supply, Option **-X**
- Standard Spring . . . . . 60 to 150 psi
- Light Spring, Option **-L** . . . 40 to 150 psi
- Pilot Return (0 psi Pilot) . . 20 to 150 psi



Operating Range
Internal Pilot Supply (Standard)
- Inlet . . . . . 20 to 150 psi

External Pilot Supply, Option **-X**
- Inlet Pressure . . . . . 0 to 150 psi
- Pilot Supply . . . . . 20 to 150 psi

SINGLE SOLENOID
To Order Specify: Model Number from chart
Options
Volts & Hertz (See page 11.29)

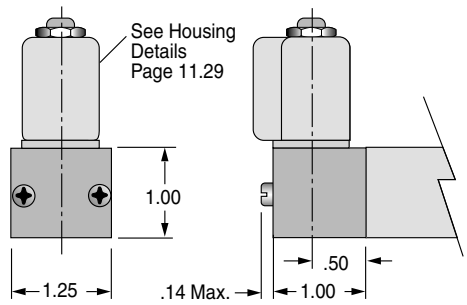
	2 WAY		3WAY		4 WAY
	Normally Closed	Normally Open	Normally Closed	Normally Open	
Conduit Housing	18CS-2	18CS-20	18CS-3	18CS-30	18CS-4
Grommet Housing	18GS-2	18GS-20	18GS-3	18GS-30	18GS-4
Male Mini-DIN Housing	18FS-2	18FS-20	18FS-3	18FS-30	18FS-4
Replacement Spool and Seals	1800-912	1800-9120	1800-913	1800-9130	1800-914

SINGLE SOLENOID - PILOT RETURN MODELS
A pilot return can be substituted for the standard spring return.
It may be used in two manners.
1. For a pulse signal, then pilot return.
2. As a constant, adjustable force, spring.
   Supply pilot port with a constant regulated pressure. This will act as a very constant spring against the solenoid controlled pilot signal. The pilot return should be a minimum of 20 psi below the solenoid controlled pressure.

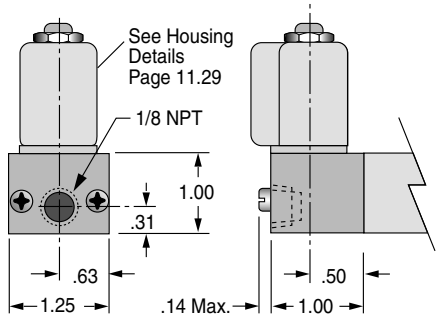
To Specify, Substitute **P** for **S** in the Model Number.
(Example 18CP-3-120/60)
1/8 NPT Pilot Port standard.
10-32 Pilot Port optional, Specify Option **-E**.

DOUBLE SOLENOID
To Order Specify: Model Number from chart
Options
Volts & Hertz (See page 11.29)

	2 WAY	3WAY	4 WAY
Conduit Housing	18CC-2	18CC-3	18CC-4
Grommet Housing	18GG-2	18GG-3	18GG-4
Male Mini-DIN Housing	18FF-2	18FF-3	18FF-4
Replacement Spool and Seals	1800-922	1800-923	1800-924



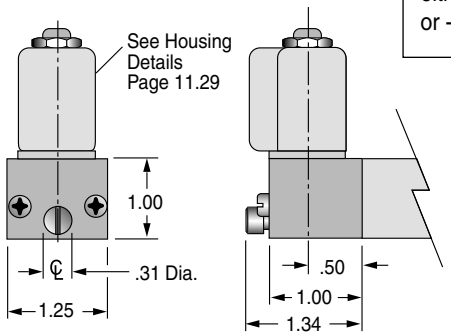
Standard 53 STYLE Solenoid Operator
The solenoid operator is a 3-way NC valve which, upon receiving an electrical signal, directs a pilot pressure to shift the main valve spool. As standard, the operator is internally supplied with air pressure from the main valve inlet. Also see "External Pilot Supply" below.



53 STYLE Solenoid Operator with External Pilot Supply
Option **-X**
In the following listed applications, as well as many others, a proper air supply may not be available from the main valve inlet. For these applications, an external pilot supply port is available (Option **-X**).
A proper air supply to this port then supplies the solenoid with air pressure for piloting the main valve spool.

- Dual Inlet - Single Exhaust 4 Way.
- Insufficient pressure at main valve inlet.
- Media, at main valve inlet, other than air.
- Extremely fast cycling.

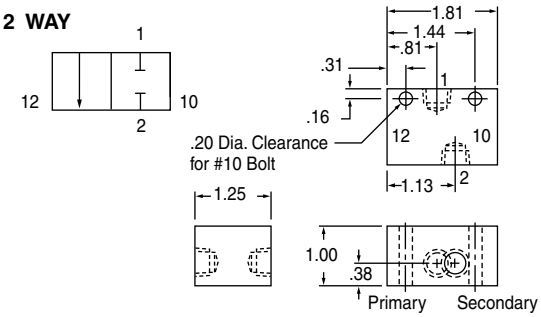
Option **-X** is NOT combinable with either Option -MO1 or -MO4



53 STYLE Solenoid Operator with Manual Override
This manual override is a 3-way NC valve that when pushed, directs pilot pressure to shift the main spool. Pressure must be present at main valve inlet for this override to function.

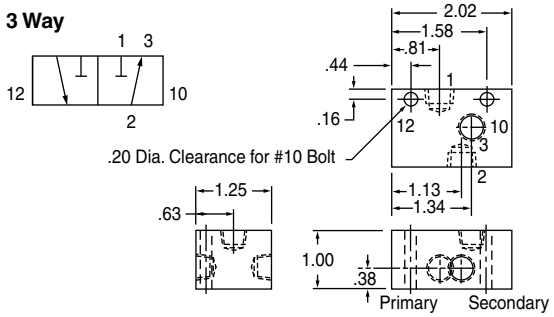
TYPE	*SUFFIX*
LOCKING Push to override; Turn to lock in; Turn back to release.	-MO1
NON-LOCKING Push to override.	-MO4

2 WAY



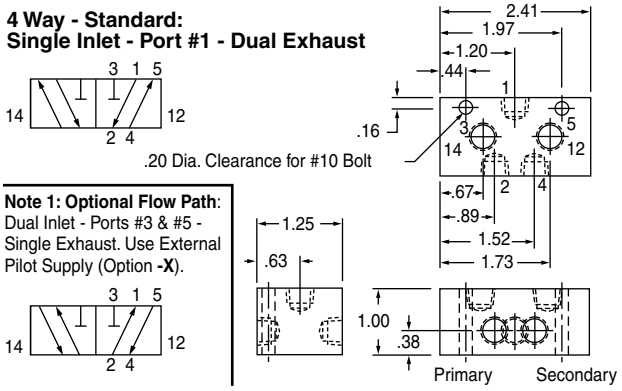
Spring Return Valves	End	Operator
Normally Closed	10	Spring
	12	Solenoid
Normally Open	10	Solenoid
	12	Spring

3 Way

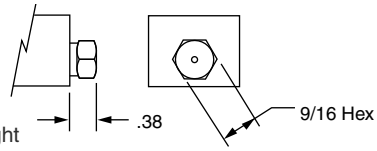


Spring Return Valves	End	Operator
Normally Closed	10	Spring
	12	Solenoid
Normally Open	10	Solenoid
	12	Spring

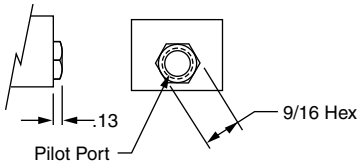
4 Way - Standard:
Single Inlet - Port #1 - Dual Exhaust



Note 1: Optional Flow Path: Dual Inlet - Ports #3 & #5 - Single Exhaust. Use External Pilot Supply (Option **-X**).



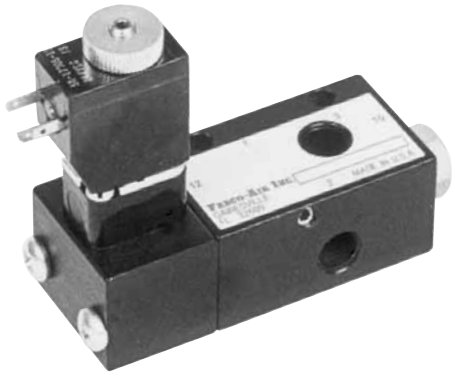
Spring Return:
Standard and Optional Light



Pilot Return: -P
See Page 11.7
1/8 NPT Port Standard – 10-32 Port Specify Option **-E**

11

1/8 NPT Ported 58 STYLE Solenoid Controlled, Pilot Operated Air Valves
2, 3 & 4 Way - 2 Position – Operation to 150 psi Air



Options

External Pilot . . . . . .**-X**

† External Pilot and Viton Seals . . . . **-XV**

Light Spring . . . . . .**-L**

† Viton Seals are available in the main valve only, for media compatibility, and therefore only in conjunction with External Pilot +32°F (0°C) to +122°F (50°C).

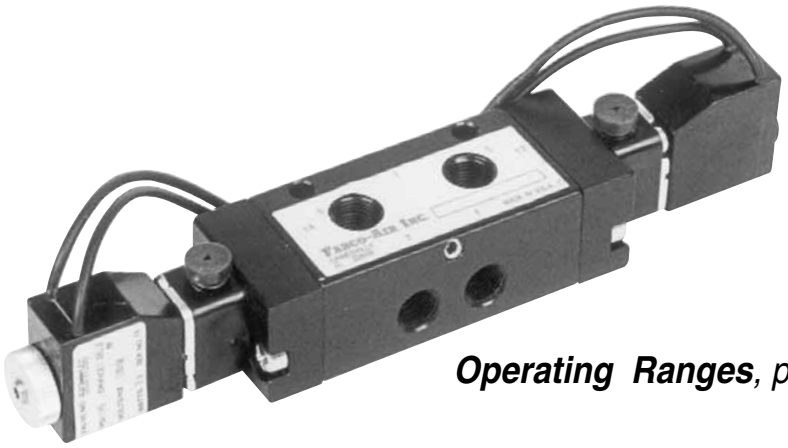
Features

- Black anodized aluminum bar stock body
- Honed and burnished bore
- Lightweight Delrin® spool provides fast, positive, reliable response
- Simplicity • Reliability
- Corrosion resistant construction
- Buna N seals • Operation to 150 psi
- Solenoid operator information see page 11.31
- Cv = 0.27 • 14.2 SCFM Free flow to atmosphere @ 80 psi
- Prelubed with Magnalube®-G grease
- Operating temperature:

  +32°F (0°C) to +122°F (50°C) ambient.
  +32°F (0°C) to +122°F (50°C) media.

Standard catalog models are suitable for operation in intermittent low temperatures in a range of 0° to + 32 °F.

A custom aluminum spool may be substituted when long-term application temperatures are expected to be 0° to +32°F. These should be limited to double solenoid actuation. Consider that actuation force may exceed catalog specs and that spring return models may not be reliable at these low temperatures. Please consult factory.



11

Operating Ranges, psi

	#1 Solenoid 0.9 Watts	#4 Solenoid 3.5 Watts
Internal Pilot Supply (Standard) Inlet Pressure		
Non Spring Return	20 to 130	20 to 145
Spring Return	60 to 130	60 to 145
Light Spring Option -L	40 to 130	40 to 145
External Pilot Supply, Option -X Inlet Pressure	0 to 150	0 to 150
External Pilot Supply, Option -X Pilot Supply		
Non Spring Return	20 to 130	20 to 145
Spring Return	60 to 130	60 to 145
Light Spring Option -L	40 to 130	40 to 145

58 STYLE Solenoid Valve, Model Number Code

18	F	S	—	4	—	4	1	1	0	0	—		120/60

18 — Series **18**, 1/8 NPT

F — Primary Actuator
F = Micro DIN
G = Wire leads
See page 11.31

S — Secondary Actuator
F = Micro DIN*
G = Wire leads*
S = Spring**
P = Pilot**
R = Rod**
B = Small Button**
L = Large Button**
* See page 11.31
** See pages 11.7 & 11.8 for details

4 — Function
2 = 2 Way
3 = 3 Way
4 = 4 Way
See page 11.7

4 — Solenoid Watts
1 = 0.9 Watts
4 = 3.5 Watts

1 — Primary Solenoid Attitude
1 = Upright 90° to Body
5 = Inline with Body

1 — Primary Solenoid Manual Override
0 = None
1 = Position #1
2 = Position #2‡
3 = Position #3
4 = Position #4‡

0 — Secondary Solenoid Attitude
0 = Other than Solenoid
1 = Upright 90° to Body
5 = Inline with Body

0 — Secondary Solenoid Manual Override
0 = None
1 = Position #1
2 = Position #2‡
3 = Position #3
4 = Position #4‡

‡ Solenoid Attitude #1 **ONLY**
#1 = Upright 90° to Body

Options
-X = External Pilot
-XV = † External Pilot & Viton Seals
-L = Light Spring
† Viton Seals are available in the main valve only for media compatability and therefore only in conjunction with External Pilot (+32° to 180°F).

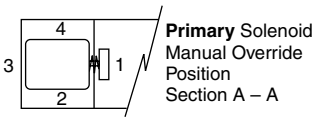
120/60 — Volts / Hertz

#1 Solenoid (0.9 Watts)
12 VDC
24 VDC

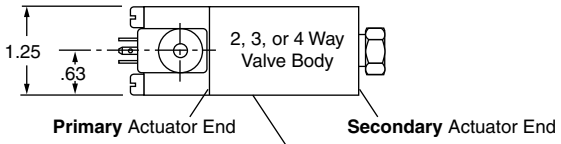
#4 Solenoid (3.5 Watts)
24/60 VAC
120/60 VAC
12 VDC
24 VDC

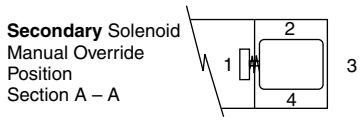
Example: ***18FS-4-41100-120/60***

1/8 NPT – Primary Actuator Solenoid with Micro DIN coil; Secondary Actuator, Spring Return – 4 Way Function 3.5 Watt Solenoid; Primary Solenoid Upright position with Manual Override in Position #1; Secondary Actuator is not a Solenoid; no Manual Override on Secondary Actuator – No Options – 120 Volt/60 Hertz.

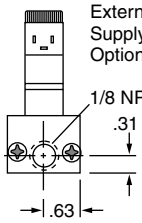


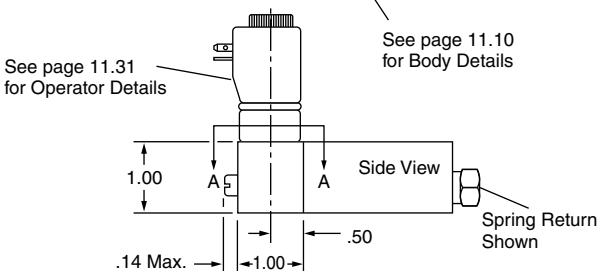
Primary Solenoid Manual Override Position Section A – A





Secondary Solenoid Manual Override Position Section A – A

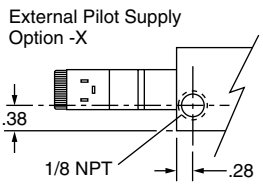


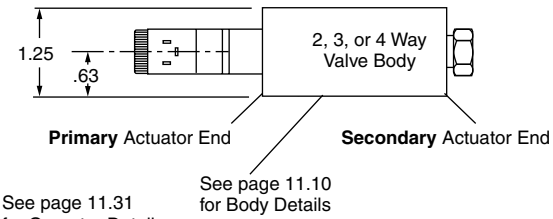


Upright

Solenoid Attitude #1

(Solenoid centerline 90° to Valve Body centerline)

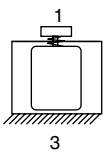




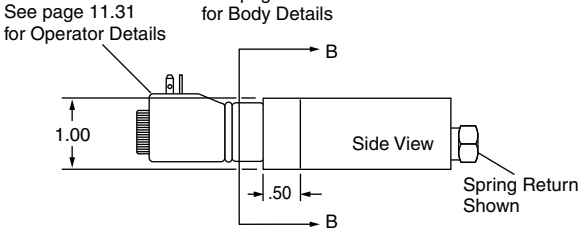
Inline

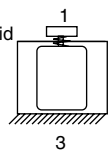
Solenoid Attitude #5

(Solenoid centerline inline with Valve Body centerline)



Primary Solenoid Manual Override Position Section B – B





Secondary Solenoid Manual Override Position Section B – B

11

1/4 & 3/8 NPT PORTED, MANUAL, MECHANICAL AND PILOT OPERATED AIR VALVES – *"The Finest in Simplicity"*
2, 3 and 4 Way - 2 Position – Operation to 150 psi Air

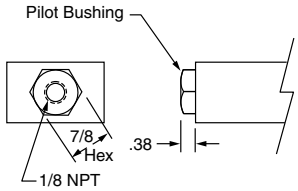
Suitable for Vacuum directional flow applications, but NOT for holding vacuum.

The short stroke of the lightweight Delrin® spool provides fast, posiitive, and reliable response.

Note 1: Specify Normally Open by substituting -30 for -3.

Air Pilot

Brass bushing with 1/8 NPT port. Standard 3 Way spring return is normally closed. For normally open the actuators may be exchanged end for end or by specifying -30 for -3.
Minimum pilot pressure:
Standard spring . . . . . 50 psi
Light spring (Option **-L**) . . . 40 psi
Double pilot . . . . . 20 psi

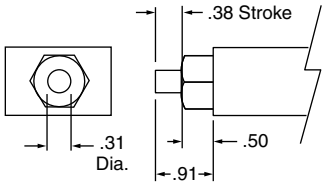


Note: See Stacking (Pressure Manifolded) informnation below

	3 Way	4 Way
Single Pilot - Spring Return		
1/4 NPT	14SP-3	14SP-4
1/4 Stacking	N/A	M14SP-4
3/8 NPT	34SP-3	34SP-4
Double Pilot		
1/4 NPT	14DP-3	14DP-4
1/4 Stacking	N/A	M14DP-4
3/8 NPT	34DP-3	34DP-4
Replacement spool & seals	1400-903	1400-904

Rod Actuator

Stainless steel rod in brass bushing. Standard 3 Way spring return is normally closed. For normally open the actuators may be exchanged end for end or specify by substituting -30 for -3.
Force to actuate:
Standard spring . . . . . 10.5 lb.
Light spring (Option-**L**) . . . 9.0 lb.
Double rod . . . . . 1.2 lb.

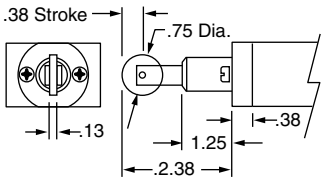


Note: See Stacking (Pressure Manifolded) informnation below

	3 Way	4 Way
Single Rod - Spring Return		
1/4 NPT	14SR-3	14SR-4
1/4 Stacking	N/A	M14SR-4
3/8 NPT	34SR-3	34SR-4
Single Rod - Pilot Return		
1/4 NPT	14SRP-3	14SRP-4
1/4 Stacking	N/A	M14SRP-4
3/8 NPT	34SRP-3	34SRP-4
Double Rod		
1/4 NPT	14DR-3	14DR-4
1/4 Stacking	N/A	M14DR-4
3/8 NPT	34DR-43	34DR-4
Replacement spool & seals	1400-903	1400-904

Roller Cam

Case hardened steel roller and shaft in hard anodized aluminum housing. Standard 3 Way spring return is normally closed. For normally open specify by substituting -30 for -3.
Force to actuate:
Standard spring . . . . . 10.5 lb.
Light spring (Option-**L**) . . . 9.0 lb.
Cam-Pilot return . . . . . 1.2 lb.



Note: See Stacking (Pressure Manifolded) informnation below

	3 Way	4 Way
Single Cam - Spring Return		
1/4 NPT	14CR-3	14CR-4
1/4 Stacking	N/A	M14CR-4
3/8 NPT	34CR-3	34CR-4
Single Cam - Pilot Return		
1/4 NPT	14CRP-3	14CRP-4
1/4 Stacking	N/A	M14CRP-4
3/8 NPT	34CRP-3	34CRP-4
Replacement spool & seals for above	1400-913	1400-914
Double cam		
1/4 NPT	14CCR-3	14CCR-4
1/4 Stacking	N/A	M14CCR-4
3/8 NPT	34CCR-3	34CCR-4
Replacement spool & seals	1400-923	1400-924

Stacking - Pressure Manifold

Selected models of the 14 Series 1/4" air valves can be stacked and pressure manifolded for space and money savings. The valve bodies are bolted together with 4 through tie bolts and the pressure is manifolded with O-Ring seals between the valves. Inlet pressure can be connected to either or both ends of the stack. Due to the fact that the pressure port, on all valve bodies, is tapped on both sides, the pressure manifold can be plugged at any point within the stack. This allows you to supply the stack with two different pressures, one from each end.

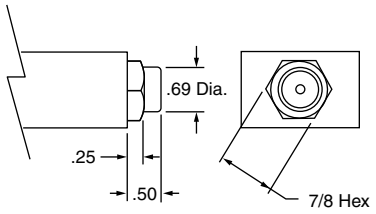
See Model Numbers in the Air-Pilot Rod Actuator, Roller Cam and Small Palm Button sections of Pgs 11.13 and 11.14 and Solenoid Valves on Pgs 11.19 and 11.20.

To Order: Specify the Quantity of each model desired, the Order in which they are to be assembled, and Brackets, if desired.

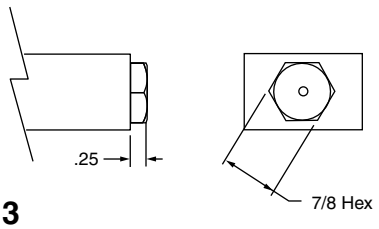
11

Spring Cap Dimensions

STANDARD SPRING



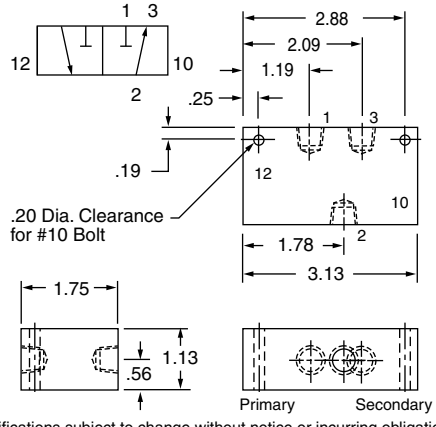
LIGHT SPRING **OPTION -L**



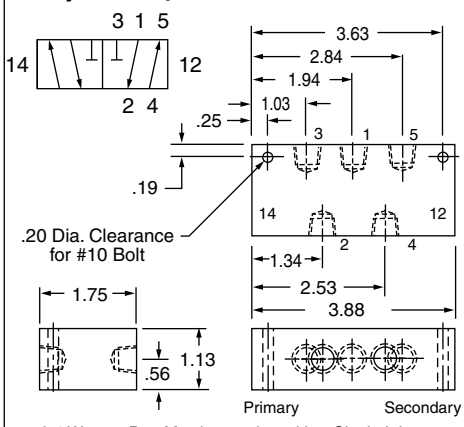
Valve Body Dimensions

2 Way / 3 Way

This 3 Way Valve may be used for any 2 Way, 3 Way, Selector or Diverter service.



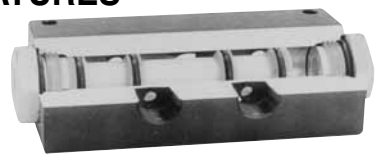
4 Way - 5 Port ‡



‡ 4 Way - 5 Port May be used as either Single Inlet - Dual Exhaust or Dual Inlet Single Exhaust

FEATURES

- Aluminum bar body
- Anodized black
- Honed & burnished bore
- Pressure balanced spool
- Delrin spool
- Buna-N seals
- Operation to 150 psi
- 4 Way - 5 port may be used as either single inlet - dual exhaust or dual inlet - single exhaust.



- Prelubed with Magnalube®–G Grease
- Interchangeability of Parts
- Cv = 1.0
  56.2 SCFM Free Flow to Atmosphere at 80 psi Supply
- Operating Temperature +32° to +180°F; Solenoid controlled models +150°F max. See pages 11.17, 11.19 & 11.21.

OPTIONS

- Light spring – Specify Option **-L**
- Viton seals – Specify Option **-V**
- Spools for bleeder pilot – Consult factory.

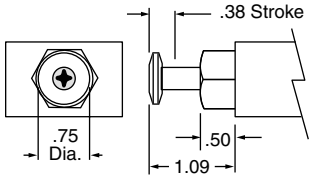
Note 1: Specify Normally Open by substituting -30 for -3.

OPERATING TEMPERATURE FOOTNOTE SEE PAGE 11.1

Small Palm Button

Un-anodized aluminum button with stainless steel rod in brass bushing. Standard 3 Way spring return is normally closed. For normally open the actuators may be exchanged end for end or specify by substituting -30 for -3.

Force to actuate:
- Standard spring ..... 10.5 lb.
- Light spring (Option **-L**) ..... 9.0 lb.
- Double Button ..... 1.2 lb.

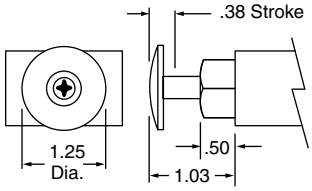


	3 Way	4 Way
Single Button - Spring Return		
1/4 NPT	14PS-3	14PS-4
1/4 Stacking	N/A	M14PS-4
3/8 NPT	34PS-3	34PS-4
Single Button - Pilot Return		
1/4 NPT	14PSP-3	14PSP-4
1/4 Stacking	N/A	M14PSP-4
3/8 NPT	34PSP-3	34PSP-4
Double Button		
1/4 NPT	14PPS-3	14PPS-4
1/4 Stacking	N/A	M14PPS-4
3/8 NPT	34PPS-3	34PPS-4
Replacement spool & seals	1400-903	1400-904

Large Palm Button

Red anodized aluminum button with stainless steel rod in brass bushing. Standard 3 Way spring return is normally closed. For normally open the actuators may be exchanged end for end or specify by substituting -30 for -3.

Force to actuate:
- Standard spring ..... 10.5 lb.
- Light spring (Option **-L**) ..... 9.0 lb.
- Double Button ..... 1.2 lb.

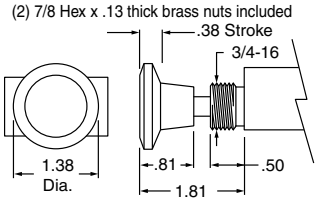


	3 Way	4 Way
Single Button - Spring Return		
1/4 NPT	14PL-3	14PL-4
3/8 NPT	34PL-3	34PL-4
Single Button - Pilot Return		
1/4 NPT	14PLP-3	14PLP-4
3/8 NPT	34PLP-3	34PLP-4
Double Button		
1/4 NPT	14PPL-3	14PPL-4
3/8 NPT	34PPL-3	34PPL-4
Replacement spool & seals	1400-903	1400-904

Panel Mount Button

Phenolic button with plated steel rod in brass bushing; **black** button standard, **red** button Option **-R**. Standard 3 Way assemblies are normally closed with knob in the "out" position. For normally open specify by substituting -30 for -3.

Force to actuate:
- Standard spring ..... 10.5 lb.
- Light spring (Option **-L**) ..... 9.0 lb.
- Detented ..... 3.0 lb.



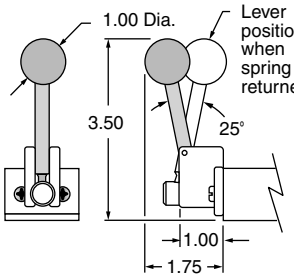
	3 Way	4 Way
Spring Return		
1/4 NPT	14PMS-3	14PMS-4
3/8 NPT	34PMS-3	34PMS-4
Pilot Return		
1/4 NPT	14PMP-3	14PMP-4
3/8 NPT	34PMP-3	34PMP-4
Replacement spool & seals for above	1400-903	1400-904
Detented (Push Pull)		
1/4 NPT	14PMD-3	14PMD-4
3/8 NPT	34PMD-3	34PMD-4
Replacement spool & seals	1400-943†	1400-944†

† Includes factory assembled spool attachments.

Hand Lever

Hardened & plated steel shaft with unique connection to spool results in positive shifting. Standard 3 Way spring return is normally closed. For normally open specify by substituting -30 for -3.

Force to actuate:
- Standard spring . . . 10.0 lb.
- Light spring . . . . . 6.0 lb. (Option **-L**)
- Detented . . . . . 3.0 lb.



	3 Way	4 Way
Spring Return		
1/4 NPT	14HLS-3	14HLS-4
3/8 NPT	34HLS-3	34HLS-4
Detented		
1/4 NPT	14HL-3	14HL-4
3/8 NPT	34HL-3	34HL-4
Replacement spool & seals	1400-933†	1400-934†

† Includes factory assembled spool attachments

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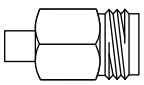
MOST THREADED-IN OPERATORS ARE INTERCHANGEABLE BETWEEN ENDS

Palm Button Assembly

No. **1400-1** Large Button
No. **1400-2** Small Button

Rod Actuator Assembly



No. **1400-3**

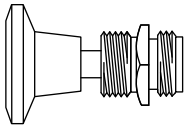
Spring Housing Assembly

No. **1400-4** Light Spring only (for Option **-L**)
No. **1400-5** Standard Spring only
No. **1400-46** Light Spring & Housing Assembly (for Option **-L**).
No. **1400-56** Standard Spring & Housing Assembly .

Pilot Bushing

No. **1400-18** 1/8 NPT Port

Panel Mount Button Assembly



Black button standard
Red button Option **-R**

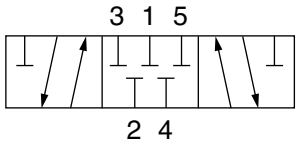
For Detented (with Spool)
No. **1400-7-3** (3 Way Normally Closed)
1400-7-30 (3 Way Normally Open)
Above NOT interchangeable End for End
1400-7-4 (4 Way)
For Spring or Pilot Return (No Spool)
1400-8 (3 Way N.O. or N.C., and 4 Way)

***Fabco-Air** has the expertise and willingness to design. modify and adapt these valves to your necessary and specific job requirements. Please advise us of your needs.*

1/4 NPT & 3/8 NPT Ported, Manual & Pilot Operated, & Solenoid Controlled Air Valves

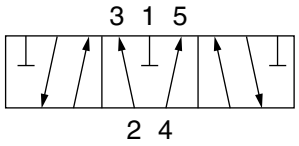
New 5 Ported, 3-Position 4-Way Operation

New Spools for 14 & 34 Series Air Valves



4-Way - 5 Ported - 3 Position - Type B
"Blocked"

Center position - All ports blocked and isolated. Use on conventional block and hold circuits.



4-Way - 5 Ported - 3 Position - Type F
"Float"

Center position - Inlet blocked and Cylinders open to exhaust
Used to vent both ends of cylinder to allow cylinder to float with a manual or machine movement. Flow controls or exhaust speed controls should not be used.

1/4 NPT & 3/8 NPT Ported, Pilot Operated Air Valves

5 Ported, 3-Position 4-Way Operation

Model 14-DPF Shown

Features

- Aluminum bar body
- Anodized black
- Honed and burnished bore
- Delrin spool, pressure balanced
- Buna N seals
- May be used as either
  single inlet-dual exhaust or
  dual inlet-single exhaust
- Pre-lubed with Magnalube–G® Grease

Operating Range

- Operating pressure.....0 to 150 psi
- Minimum pilot pressure .....50 psi
- Cv = 1.0 (56.2 SCFM free flow to atmosphere @ 80 psi supply)
- Temperature .....+32° to 180°F

For long-term, continuous operation in a range of +150°F to +180°F, the Viton seal option can provide the benefits of reliable leak-free operation and extended durability.

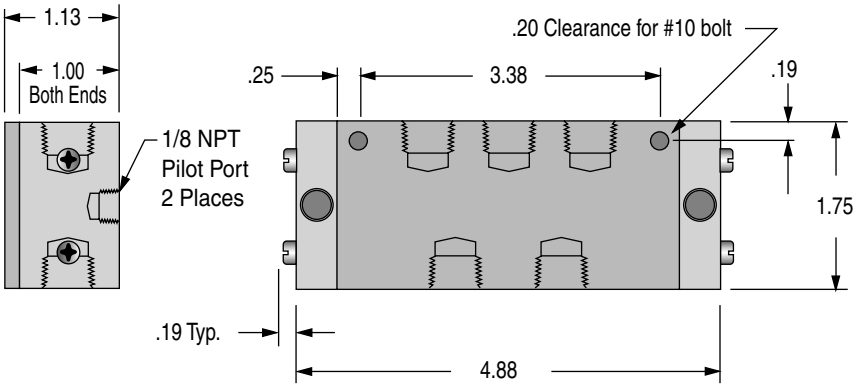
Options

Viton Seals, Specify Option **–V**

Model Number Guide: 3-Position, Pilot Operated

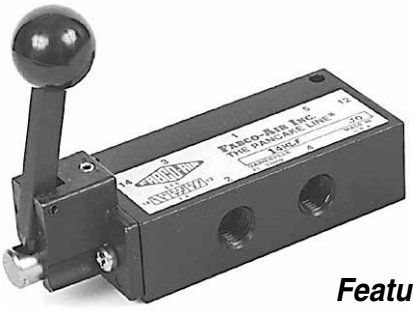
	Spring Centered Spool		*Replacement Spool and Seals*
Spool Type	1/4 NPT Ports	3/8 NPT Ports	
B Spool	14 DPB	34DPB	1400-904B
F Spool	14DPF	34DPF	1400-904F

Valve Dimensions



1/4 NPT & 3/8 NPT Ported, Hand Lever Operated Air Valves

5 Ported, 3-Position 4-Way Operation



Model 14-HLF Shown

Features

Hardened and plated steel shaft with unique connections results in positive shifting

- Aluminum bar body
- Anodized black
- Honed and burnished bore
- Delrin spool, pressure balanced
- Buna N seals
- May be used as either
  single inlet-dual exhaust or
  dual inlet-single exhaust
- Pre-lubed with Magnalube–G® Grease

Operating Range

- Operating pressure..... 0 to 150 psi
- Cv = 1.0 (56.2 SCFM free flow to atmosphere @ 80 psi supply)
- Temperature .....+32° to 180°F

Standard catalog models are suitable for operation in intermittent low temperatures in a range of 0° to + 32 °F.

A custom aluminum spool may be substituted when long-term application temperatures are expected to be –40°to +32°F. These should be limited to manual actuation, not spring centered. Consider that actuation force may exceed catalog specs and that spring return models may not be reliable at these low temperatures. Please consult factory. For long-term, continuous operation in a range of +150°F to +180°F, the Viton seal option can provide the benefits of reliable leak-free operation and extended durability.

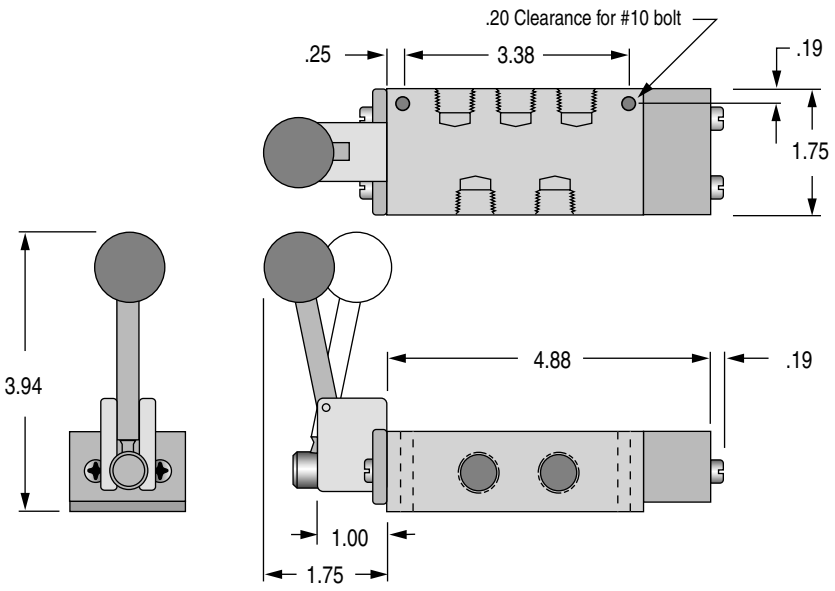
Options

Viton Seals, Specify Option **–V**

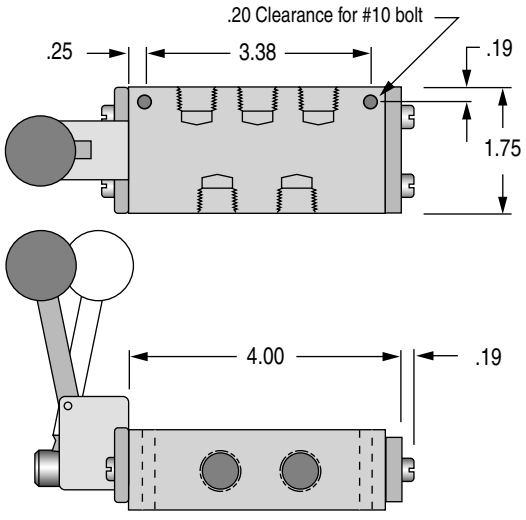
Model Number Guide: 3-Position, Hand Lever Operated

	Spring Centered Spool		Replacement Spool & Seals	Detented Spool		Replacement Spool & Seals
Spool Type	1/4 NPT Ports	3/8 NPT Ports		1/4 NPT Ports	3/8 NPT Ports	
B Spool	14HLSB	34HLSB	1400-934SB	14HLB	34HLB	1400-934B
F Spool	14HLSF	34HLSF	1400-934SF	14HLF	34HLF	1400-934F

Dimensions – Spring Centered Spool



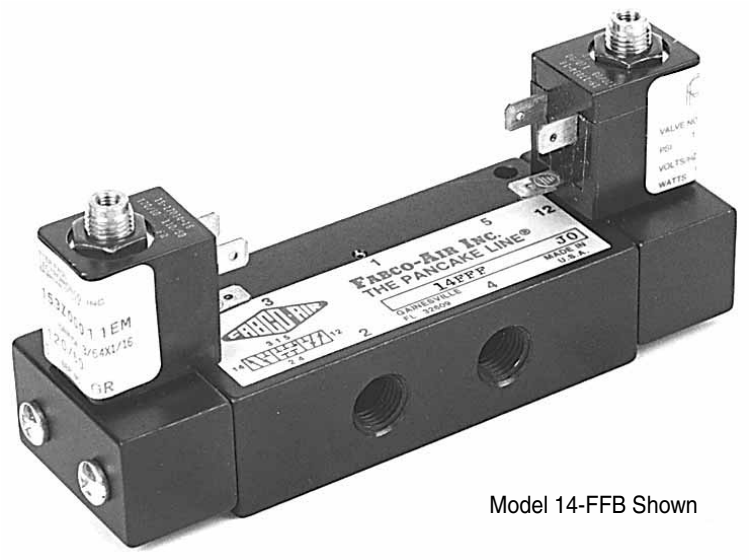
Dimensions – Detented Spool



11

1/4 NPT & 3/8 NPT Ported, 53 Style Solenoid Controlled, Pilot Operated Air Valves

5 Ported, 3-Position 4-Way Operation



Model 14-FFB Shown

Features

- Aluminum bar body
- Anodized black
- Honed and burnished bore
- Delrin spool
- Buna N seals
- Cv = 1.0 (56.2 SCFM free flow to atmosphere @ 80 psi supply)
- Operation to 150 psi
- Operating Temperature:
  +32°F (0°C) to +104°F (40°C) ambient.
  +32°F (0°C) to +150°F (65°C) media.
- Pre-lubed with Magnalube–G® Grease
- Coils & Housing information see page 11.29.

Operating Range

Internal pilot supply - standard
Inlet.....50 to 150 psi

External pilot supply Option **–X**
Inlet.....0 to 150 psi
Pilot Supply .....50 to 150 psi

Ordering

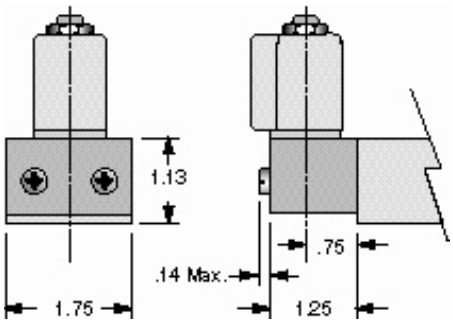
Choose valve model number from table below and add option suffixes as required and specify voltage/hertz.

11

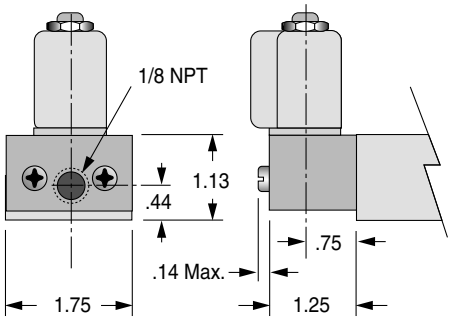
Model Number Guide: 4-Way, 3-Position, Spring Centered Double Solenoid Valves

	Conduit Housing "C"		*Grommet Housing "G"*		*Male Mini-DIN Housing "F"*		*Replacement Spool & Seals*
Spool Type	1/4 NPT Ports	3/8 NPT Ports	1/4 NPT Ports	3/8 NPT Ports	1/4 NPT Ports	3/8 NPT Ports	
B Spool	14-CCB	34-CCB	14-GGB	34-GGB	14-FFB	34-FFB	1400-904B
F Spool	14-CCF	34-CCF	14-GGF	34-GGF	14-FFF	34-FFF	1400-904F

53 Style Solenoid Operators

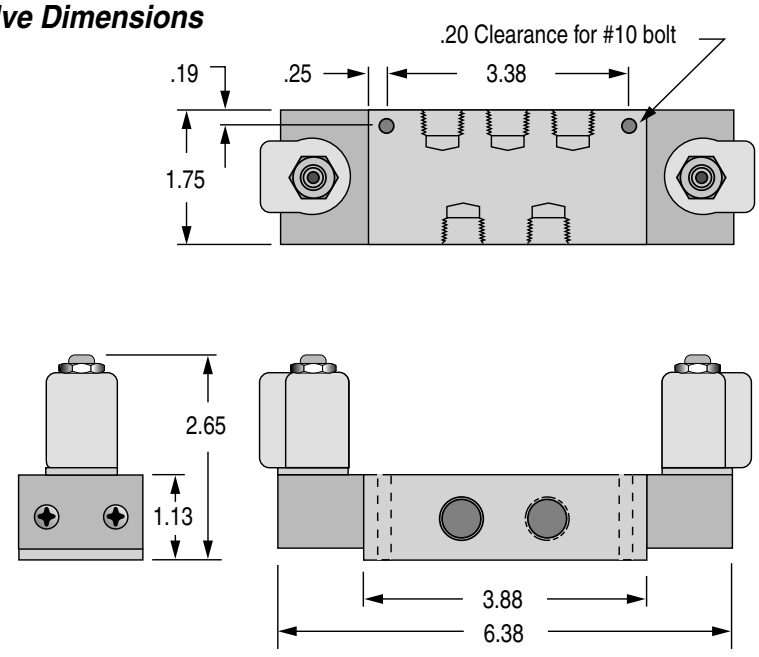


Standard 53 Style Operator
The solenoid operator is a 3-way NC valve which, upon receiving an electrical signal, directs pressure to shift the main valve spool. As standard, the operator is internally supplied with air pressure from the main valve inlet.

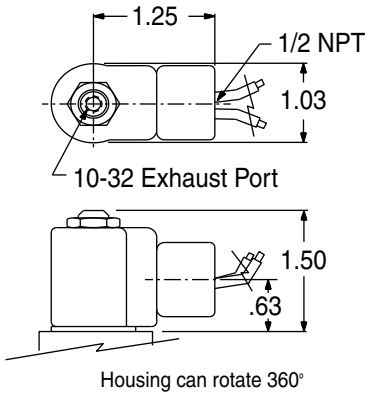


53 Style Operator with External Pilot Option –X
In the following listed applications, as well as many others, a proper air supply may not be available from the main valve inlet. For these applications, an external pilot supply port is available (Option –X). A proper air supply to this port then supplies the solenoid with air pressure for piloting the main valve spool.
- Dual inlet, single exhaust
- Insufficient Pressure at main valve inlet
- Media at main valve inlet is other than air
- Extreme fast cycling

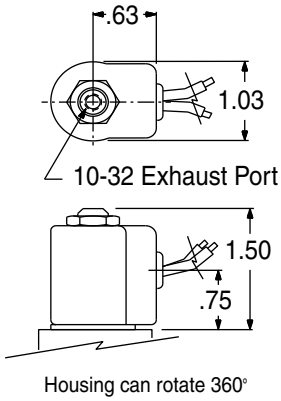
Valve Dimensions



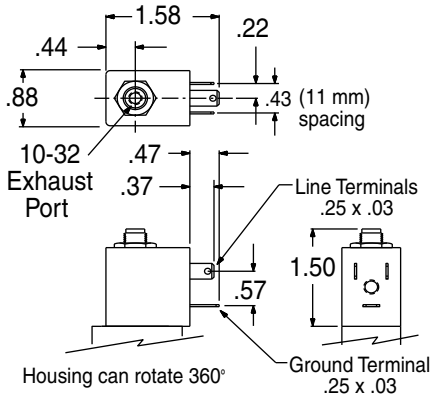
Conduit Housing "C"



Grommet Housing "G"



Male Mini-DIN Housing "F"



11

1/4 & 3/8 NPT Ported 53 STYLE Solenoid Controlled, Pilot Operated Air Valves
2, 3 & 4 Way - 2 Position – Operation to 150 psi Air

Options
Manual override
- Locking . . . . . **-MO1**
- Non-Locking . . . . . **-MO4**

External pilot. . . . . **-X**
Light spring. . . . . **-L**
Viton seals for media compatibility . . . . **-V**
Explosion proof operators. . . . . **-EP**
See page 11.30
Dual Inlet - Single Exhaust 4 Way
See page 11.20, Note 1: Optional Flow Path.

Features
- Black anodized aluminum bar stock body • Honed and burnished bore
- Lightweight Delrin® spool provides fast, positive, reliable response
- Buna N seals • Operation to 150 psi
- Coils & housing information see page 11.29
- Cv = 1.0 • 56.2 SCFM free flow to atmosphere @ 80 psi
- Prelubed with Magnalube®-G grease
- Operating temperature:
  +32°F (0°C) to +104°F (40°C) ambient.
  +32°F (0°C) to +150°F (65°C) media.

Standard catalog models are suitable for operation in intermittent low temperatures in a range of 0° to + 32 °F.

A custom aluminum spool may be substituted when long-term application temperatures are expected to be 0° to +32°F. These should be limited to double solenoid actuation. Consider that actuation force may exceed catalog specs and that spring return models may not be reliable at these low temperatures. Please consult factory.

SINGLE SOLENOID

To Order Specify: Model Number from chart
Options
Volts & Hertz (See page 11.29)

Operating Range
Internal Pilot Supply (Standard)
- Standard Spring . . . . . 50 to 150 psi
- Light Spring, Option **-L** . . . 40 to 150 psi
- Pilot Return (0 psi Pilot) . . 30 to 150 psi

External Pilot Supply, Option **-X**
- Inlet Pressure . . . . . 0 to 150 psi

External Pilot Supply, Option **-X**
- Standard Spring . . . . . 50 to 150 psi
- Light Spring, Option **-L** . . . 40 to 150 psi
- Pilot Return (0 psi Pilot) . . 30 to 150 psi

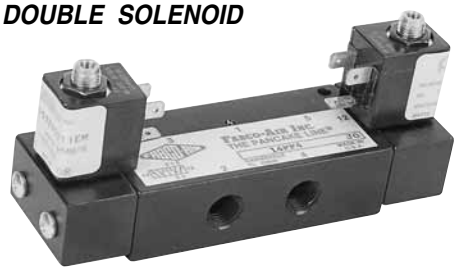
‡Plug 3-Way Valve for 2-Way Service.

	1/4 NPT PORTS				3/8 NPT PORTS		
	‡2 / 3 WAY		4 WAY	4 WAY Stacking See pg 11.20	‡2 / 3WAY		4 WAY
	Normally Closed	Normally Open			Normally Closed	Normally Open	
Conduit Housing	14CS-3	14CS-30	14CS-4	M14CS-4	34CS-3	34CS-30	34CS-4
Grommet Housing	14GS-3	14GS-30	14GS-4	M14GS-4	34GS-3	34GS-30	34GS-4
Male Mini-DIN Housing	14FS-3	14FS-30	14FS-4	M14FS-4	34FS-3	34FS-30	34FS-4
Replacement Spool & Seals	1400-913	1400-9130	1400-914	1400-904	1400-913	1400-9130	1400-914

SINGLE SOLENOID - PILOT RETURN MODELS
A pilot return can be substituted for the standard spring return.
It may be used in two manners.
1. For a pulse signal, then pilot return.
2. As a constant, adjustable force, spring.
   Supply pilot port with a constant regulated pressure. This will act as a very constant spring against the solenoid controlled pilot signal. The pilot return should be a minimum of 30 psi below the solenoid controlled pressure.

To Specify, Substitute **P** for **S** in the Model Number. (Ex: 14CP-3-120/60)

DOUBLE SOLENOID



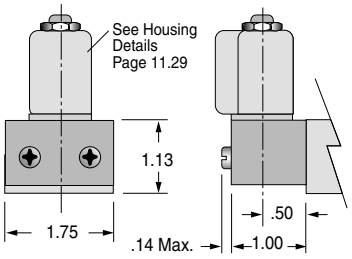
To Order Specify: Model Number from chart
Options
Volts & Hertz (See page 11.29)

‡Plug 3-Way Valve for 2-Way Service.

Operating Range
Internal Pilot Supply (Standard)
- Inlet. . . . . 30 to 150 psi

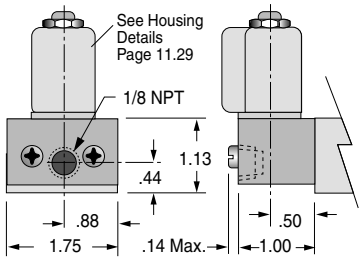
External Pilot Supply, Option **-X**
- Inlet Pressure . . . . . 0 to 150 psi
- Pilot Supply. . . . . 30 to 150 psi

	1/4 NPT PORTS			3/8 NPT PORTS	
	‡2 / 3 WAY	4 WAY	4 WAY Stacking See pg 11.20	‡2 / 3 WAY	4 WAY
Conduit Housing	14CC-3	14CC-4	M14CC-4	34CC-3	34CC-4
Grommet Housing	14GG-3	14GG-4	M14GG-4	34GG-3	34GG-4
Male Mini-DIN Housing	14FF-3	14FF-4	M14FF-4	34FF-3	34FF-4
Replacement Spool & Seals	1400-923	1400-924	1400-904	1400-923	1400-924



Standard 53 STYLE Solenoid Operator

The solenoid operator is a 3-way NC valve which, upon receiving an electrical signal, directs a pilot pressure to shift the main valve spool. As standard, the operator is internally supplied with air pressure from the main valve inlet. Also see "External Pilot Supply" below.



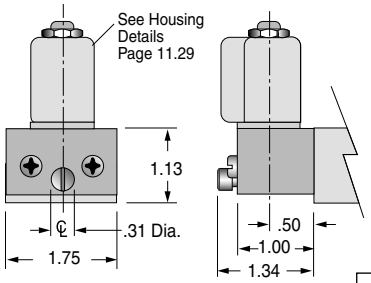
53 STYLE Solenoid Operator with External Pilot Supply

Option **-X**

In the following listed applications, as well as many others, a proper air supply may not be available from the main valve inlet. For these applications, an external pilot supply port is available (Option **-X**). A proper air supply to this port then supplies the solenoid with air pressure for piloting the main valve spool.

- Dual Inlet - Single Exhaust 4 Way.
- Insufficient pressure at main valve inlet.
- Media, at main valve inlet, other than air.
- Extremely fast cycling.

Option **-X** is NOT combinable with either Option **-MO1** or **-MO4**



53 STYLE Solenoid Operator with Manual Override

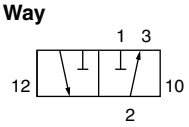
This manual override is a 3-way NC valve that when pushed, directs pilot pressure to shift the main spool. Pressure must be present at main valve inlet for this override to function.

TYPE	*SUFFIX*
LOCKING Push to override; Turn to lock in; Turn back to release.	-MO1
NON-LOCKING Push to override.	-MO4

STACKING - PRESSURE MANIFOLDED

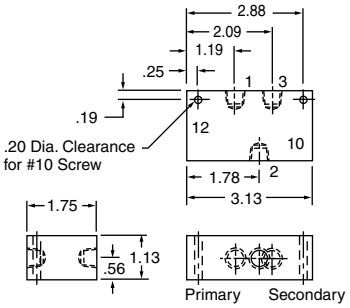
Versions of these 1400 Series 1/4 NPT solenoid valves with different adaptor blocks can be stacked and pressure manifolded for space and money savings. The valve bodies are bolted together with 4 through tie bolts and the pressure is manifolded with O-Ring seals between valves. Inlet pressure can be connected to either or both ends of the stack. Due to the fact that the pressure port, on all valve bodies, is tapped on both sides, the pressure manifold can be plugged at any point within the stack. This allows you to supply the stack with two different pressures, one from each end. Versions of the Air Pilot, Rod Actuator, Roller Cam and Small Palm Button valves may be mounted in the same stack along with these solenoid valves.

3 Way



2 Way Function

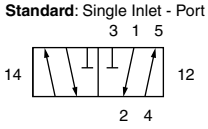
This 3 Way Valve may be used for any 2 Way, 3 Way, Selector or Diverter service.

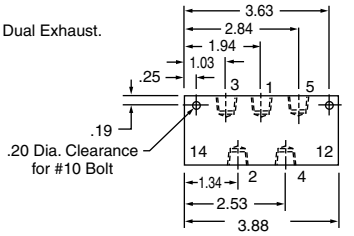


Spring Return Valves	End	Operator
Normally Closed	10	Spring
	12	Solenoid
Normally Open	10	Solenoid
	12	Spring

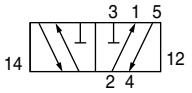
4 Way - 5 Port

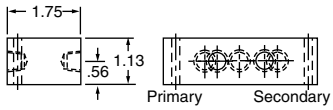
Standard: Single Inlet - Port #1 - Dual Exhaust.



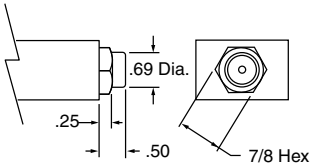


Note 1: Optional Flow Path: Dual Inlet - Ports #3 & #5 - Single Exhaust. Use External Pilot Supply (Option **-X**).



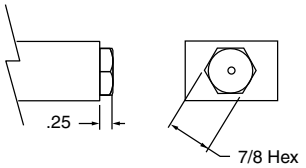


Standard Spring Return



Light Spring Return

Option **-L**

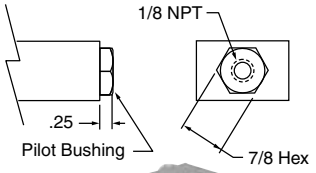


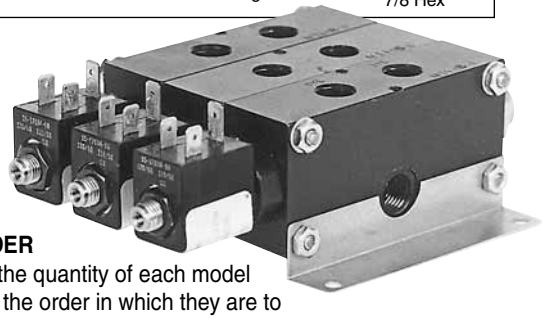
Pilot Return

Option **-P**

1/8 NPT Port

See Page 11.13





TO ORDER

Specify the quantity of each model desired, the order in which they are to be assembled, and Brackets, if desired.

11

1/4 & 3/8 NPT Ported 58 STYLE Solenoid Controlled, Pilot Operated Air Valves
2, 3 & 4 Way - 2 Position

Features

- Black anodized aluminum bar stock body
- Honed and burnished bore
- Lightweight Delrin® spool provides fast, positive, reliable response
- Simplicity • Reliability
- Corrosion resistant construction
- Buna N seals • Operation to 150 psi
- Solenoid operator information see page 11.31
- Cv = 1.0
- 56.2 SCFM Free flow to atmosphere @ 80 psi
- Prelubed with Magnalube®-G grease
- Operating temperature:

  +32°F (0°C) to +122°F (50°C) ambient.
  +32°F (0°C) to +122°F (50°C) media.

Standard catalog models are suitable for operation in intermittent low temperatures in a range of 0° to + 32 °F.

A custom aluminum spool may be substituted when long-term application temperatures are expected to be 0° to +32°F. These should be limited to double solenoid actuation. Consider that actuation force may exceed catalog specs and that spring return models may not be reliable at these low temperatures. Please consult factory.

Options

External Pilot . . . . . **-X**
† External Pilot and Viton Seals . . . . **-XV**
Light Spring . . . . . **-L**

† Viton Seals are available in the main valve only, for media compatibility, and therefore only in conjunction with External Pilot: +32°F (0°C) to +122°F (50°C).

Operating Ranges, *psi*

	#1 Solenoid 0.9 Watts	#4 Solenoid 3.5 Watts
Internal pilot supply (standard) inlet pressure		
Non Spring Return	30 to 130	30 to 145
Spring Return	50 to 130	50 to 145
Light Spring Option **-L**	40 to 130	40 to 145
External pilot supply, Option **-X** inlet pressure	0 to 150	0 to 150
External pilot supply, Option **-X** pilot supply		
Non Spring Return	30 to 130	30 to 145
Spring Return	50 to 130	50 to 145
Light Spring Option **-L**	40 to 130	40 to 145

11

58 STYLE Solenoid Valve, Model Number Code

14	F	S	—	4	—	4	1	1	0	0	—		120/60

Series
14 = 1/4 NPT
34 = 3/8 NPT

Primary Actuator
F = Micro DIN
G = Wire leads
See page 11.31

Function
3 = 3 Way
4 = 4 Way
See page 11.13
For 2 Way service plug a 3 Way Valve

Secondary Actuator
F = Micro DIN*
G = Wire leads*
S = Spring**
P = Pilot**
R = Rod**
B = Small Button**
L = Large Button**
* See page 11.31
** See pages 11.13 & 11.14 for details

Solenoid Watts
1 = 0.9 Watts
4 = 3.5 Watts

Primary Solenoid Attitude
1 = Upright 90° to Body
5 = Inline with Body

Primary Solenoid Manual Override
0 = None
1 = Position #1
2 = Position #2‡
3 = Position #3
4 = Position #4‡

Secondary Solenoid Attitude
0 = Other than Solenoid
1 = Upright 90° to Body
5 = Inline with Body

Secondary Solenoid Manual Override
0 = None
1 = Position #1
2 = Position #2‡
3 = Position #3
4 = Position #4‡

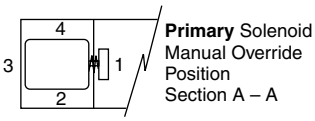
‡ Solenoid Attitude #1 **ONLY**
#1 = Upright 90° to Body

Volts / Hertz
#1 Solenoid (0.9 Watts)
12 VDC
24 VDC
#4 Solenoid (3.5 Watts)
24/60 VAC
120/60 VAC
12 VDC
24 VDC

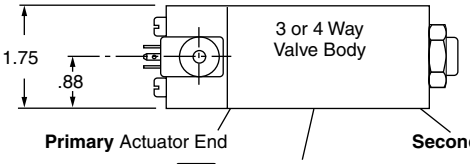
Options
-X = External Pilot
-XV = † External Pilot & Viton Seals
-L = Light Spring
† Viton Seals are available in the main valve only for media compatability and therefore only in conjunction with External Pilot (+32° to 180°F).

Example: ***14FS-4-41100-120/60***

1/4 NPT – Primary Actuator Solenoid with Micro DIN coil; Secondary Actuator, Spring Return – 4 Way Function 3.5 Watt Solenoid; Primary Solenoid Upright position with Manual Override in Position #1; Secondary Actuator is not a Solenoid; no Manual Override on Secondary Actuator – No Options – 120 Volt/60 Hertz.

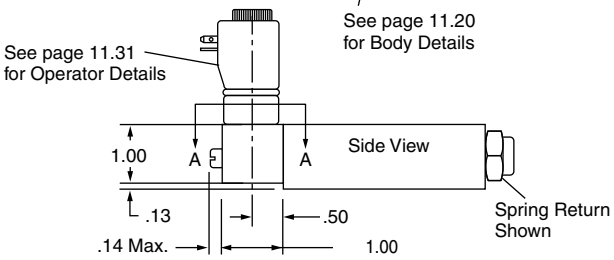


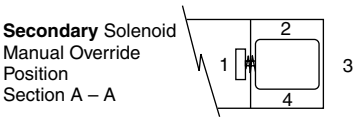
Primary Solenoid Manual Override Position Section A – A



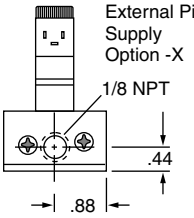
See page 11.20 for Body Details

See page 11.31 for Operator Details





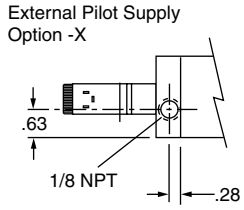
Secondary Solenoid Manual Override Position Section A – A

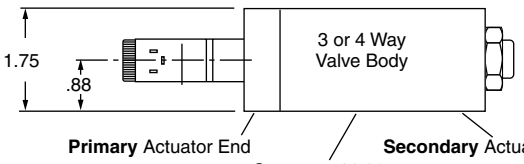


Upright

Solenoid Attitude #1

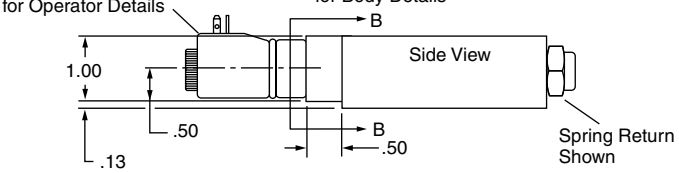
(Solenoid centerline 90° to Valve Body centerline)





See page 11.20 for Body Details

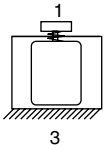
See page 11.31 for Operator Details



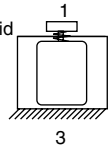
Inline

Solenoid Attitude #5

(Solenoid centerline inline with Valve Body centerline)



Primary Solenoid Manual Override Position Section B – B



Secondary Solenoid Manual Override Position Section B – B

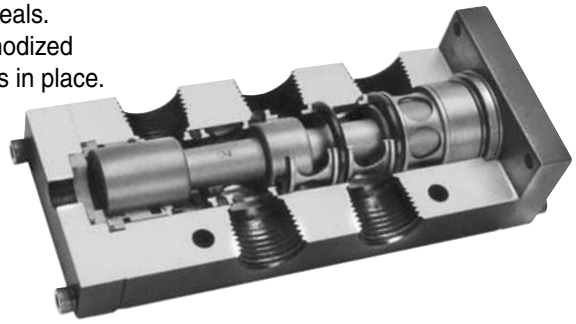
11

38 SERIES: 3/8 NPT Ported Air Valves
12, 12A & 12B SERIES: 1/2 NPT Ported Air Valves

2, 3 & 4 Way; 2 & 3 Position Operation to 150 psi
Note! *Spring return & spring centered models NOT suitable for dry air service.*

Features

- Direct ported 3/8 NPT, 1/2 NPT and 1/2 NPT high flow:
  2 & 3 Way - 2 Position.
  4 Way - 2 & 3 Position.
- Aluminum bar stock body and operator blocks, black anodized.
- Light weight aluminum spool, hard anodized for long life.
- Operator blocks field interchangeable.
- Buna N seals.
- Operating temperature (0° to + 180°F); solenoid controlled models +150° F max. See pages 11.25 & 11.26.
- All spool seals size checked to assure reliability.
- Single Subbase or multiple manifolds with 3/8 and 1/2 NPT ports for 4 Way - 2 & 3 Position see Pg 11.27.
- High flow factors, see Pg 11.27.
- Parts anodized for corrosion resistance.
- Aluminum end caps, anodized red, locate counterbores in body to control static squeeze on seals.
- Aluminum center cages, anodized gold, have lips to hold seals in place.
- Spool cushioned with Delrin®-Urethane bumper combination that absorbs shock but does not bounce the spool.
- Simple construction for easy servicing.
- Spool "Lands" double tapered and polished to assure easy entry into seal.
- Prelubed with Magnalube®-G grease.



Catalog Options

- Manual Overrides for Piloted and Solenoid Valves
- External Pilot Supply for Solenoid Valve Option -X
- Explosion Proof Operators, Spade Coil Connections, and other Solenoid Coil choices - see Pg 11.29 - 11.32
- High Flow Body (see Model Charts)
- Service Kits
  2 or 3 Way - Seal Kit 12PV-903
  4 Way - Seal Kit 12PV-904
- Dual Inlet - Single Exhaust - 4 Way: See note below
- Mufflers for Solenoid Exhaust… SM-10, See page 14.4
- Other Operator Combinations
  Solenoid - Pilot Return
  Solenoid - Push-Pull Knob
  See Model Charts

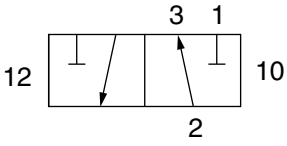
Custom Options

- 10-32 Pilot Ports
- 10-32 Auxiliary Pressure Outlets
- Viton Seals
- Stacking and Manifolding to Customer requirements

Specials

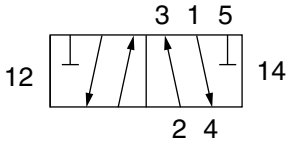
Fabco-Air, Inc. *has the expertise and willingness to design and modify these valves to your necessary and specific job requirements. Please advise us of your needs. See pages ii & iii*

Spools



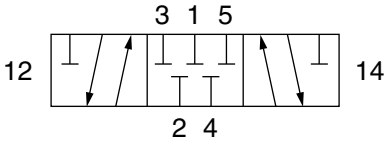
2-Way or 3 Way - 2 Position - Type 3

This 3 Way Valve may be used for any 2 Way, 3 Way, Selector or Diverter service.
When used with internally supplied Solenoid Operators, the Supply Pressure must be connected to Port #1. For this same reason when a normally open Solenoid Valve is ordered the Solenoid Operator will be mounted on end 10 and the Spring on End 12.



4-Way - 5 Ported - 2 Position - Type 2

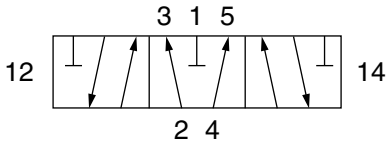
Use on all 4 Way - 2 Position applications



4-Way - 5 Ported - 3 Position - Type B

"Blocked"

Center position - All ports blocked and isolated. Use on conventional block and hold circuits.



4-Way - 5 Ported - 3 Position - Type F

"Float"

Center position - Inlet blocked and Cylinders open to exhaust.
Used to vent both ends of cylinder to allow cylinder to float with a manual or machine movement. Flow controls or exhaust speed controls should not be used.

Note: Any of these 4 Way Valves, except the internally supplied Solenoid Valves, (See Option -X) can be used as Dual Inlet, Single Exhaust. Using this concept, with different pressures for force application and retraction, can effect large savings of high pressure air and its cost. The larger the cylinder or the faster the cycle, the higher the savings.

PILOT OPERATED

When Ordering:
Specify Model Number from chart. Specify Options.
(See page 11.27 & 11.28 for Dimensional Information.)

OPERATING RANGE:
Inlet Presure . . . . . .0 - 150 psi
Pilot Pressure:
Models without Spring . . . . . .10 - 150 psi
2 Position Standard Service Spring . . . . . .45 - 150 psi
2 Position Light Service Spring (Option **-L**) . . .30 - 150 psi
3 Position, Spring Centered . . . . . .30 - 150 psi

Optional Manual Overrides	Model Suffix
LOCKING	-MO1
LOCKS IN - Does not lock OUT	-MO2
Does not lock IN - LOCKS OUT	-MO3
NON-LOCKING	-MO4

		Direct Ported			SUBBASE OR MANIFOLD MOUNTED See pg 11.27 and Specify
		3/8 NPT	1/2 NPT	1/2 NPT High Flow	
2 Position					
Single Pilot Spring Return	2 Way - 3 Way 4 Way	383-SP 38-SP	123-SP 12-SP	123B-SP 12B-SP	NA 12A-SP
Double Pilot	2 Way - 3 Way 4 Way	383-DP 38-DP	123-DP 12-DP	123B-DP 12B-DP	N 12A-DP
3 Position					
Double Pilot Type B Spool	4 Way	38-DPB	12-DPB	NA	12A-DPB
Double Pilot Type F Spool	4 Way	38-DPF	12-DPF	NA	12A-DPF

HAND LEVER OPERATED

When Ordering:
Specify Model Number from chart. Specify Options.
(See page 11.27 & 11.28 for Dimensional Information.)

OPERATING RANGE: . . . . . .0 - 150 psi

		Direct Ported			SUBBASE OR MANIFOLD MOUNTED See pg 11.27 and Specify
		3/8 NPT	1/2 NPT	1/2 NPT High Flow	
2 Position					
Spring Return	2 Way - 3 Way 4 Way	383-HLS 38-HLS	123-HLS 12-HLS	123B-HLS 12B-HLS	NA 12A-HLS
Detented	2 Way - 3 Way 4 Way	383-HL 38-HL	123-HL 12-HL	123B-HL 12B-HL	N 12A-HL
3 Position					
Spring Centered Type B Spool	4 Way	38-HLSB	12-HLSB	NA	12A-HLSB
Spring Centered Type F Spool	4 Way	38-HLSF	12-HLSF	NA	12A-HLSF
Detented Type B Spool	4 Way	38-HLB	12-HLB	NA	12A-HLB
Detented Type F Spool	4 Way	38-HLF	12-HLF	NA	12A-HLF

PUSH-PULL KNOB OPERATED

When Ordering:
Specify Model Number from chart. Specify Options.
(See page 11.27 & 11.28 for Dimensional Information.)

OPERATING RANGE: . . . . . .0 - 150 psi
Standard knob color is black.
For red knob add suffix **-R** to Model Number.

		Direct Ported			SUBBASE OR MANIFOLD MOUNTED See pg 11.27 and Specify
		3/8 NPT	1/2 NPT	1/2 NPT High Flow	
2 Position					
Push - Pull (Natural Detent)	2 Way - 3 Way 4 Way	383-PO 38-PO	123-PO 12-PO	123B-PO 12B-PO	NA 12A-PO
Push Spring Return	2 Way - 3 Way 4 Way	383-PS 38-PS	123-PS 12-PS	123B-PS 12B-PS	NA 12A-PS
Push Pilot Return	2 Way - 3 Way 4 Way	383-PA 38-PA	123-PA 12-PA	123B-PA 12B-PA	NA 12A-PA
Push - Push Knob Both Ends	2 Way - 3 Way 4 Way	383-PP 38-PP	123-PP 12-PP	123B-PP 12B-PP	NA 12A-PP
3 Position					
Push - Pull Spring Centered Type B Spool	4 Way	38-PB	12-PB	NA	12A-PB
Push - Push Spring Centered Knob Both ends Type B Spool	4 Way	38-PPB	12-PPB	NA	12A-PPB
Push - Pull Spring Centered Type F Spool	4 Way	38-PF	12-PF	NA	12A-PF
Push - Push Spring Centered Knob Both ends Type F Spool	4 Way	38-PPF	12-PPF	NA	12A-PPF

3/8 & 1/2 NPT Ported, 53 STYLE Solenoid Controlled, Pilot Operated Air Valves
2 Way, 3 Way - 2 Position — 4 Way 2 or 3 Position — Operation to 150 PSI Air

See pages 11.27 & 11.28 for dimensional information.

Operating Temperature:
0°F (–18°C) to +104°F (40°C) ambient.
0°F (–18°C) to +150°F (65°C) media.

When Ordering:
Specify Model Number from Chart
Specify Options
Specify Volts / Hertz
See pages 11.29 & 11.30 for Solenoid Operator, Coil and Housing information.

Operating Ranges, psi
Internal Pilot Supply (Standard) Inlet Pressure
No Spring . . . . . 10 to 150
Spring: 2 Position . . . . . 45 to 150
2 Position Light Service Spring, Option **-L** . . . . . 30 to 150
3 Position . . . . . 30 to 150
External Pilot Supply, Option **-X**:
Inlet Pressure . . . . . 0 to 150
Pilot Pressure, Same as Internal Pilot Supply above.

Optional Manual Overrides	Model Suffix
LOCKING	-MO1
LOCKS IN - Does not lock OUT	-MO2
Does not lock IN - LOCKS OUT	-MO3
NON-LOCKING	-MO4

Conduit Housing "C"

		3/8 NPT	1/2 NPT	1/2NPT High Flow	Sub-base/Manifold, See Pg. 11.27
2 Position					
Single Solenoid Spring Return	2 / 3 Way, NC 2 / 3 Way, NO 4 Way	383–CS 3830–CS 38–CS	123–CS 1230–CS 12–CS	123B–CS 1230B–CS 12B–CS	NA NA 12A–CS
Single Solenoid Pilot Return	2 / 3 Way 4 Way	383–CA 38–CA	123–CA 12–CA	123B–CA 12B–CA	NA 12A–CA
Single Solenoid Knob Return	2 / 3 Way 4Way	383–CP 38–CP	123–CP 12–CP	123B–CP 12B–CP	NA 12A–CP
Double Solenoid	2 / 3 Way 4 Way	383–CC 38–CC	123–CC 12–CC	123B–CC 12B–CC	NA 12A–CC
3 Position					
Solenoid – Pilot, B Spool Solenoid – Pilot, F Spool	4 Way 4 Way	38–CAB 38–CAF	12–CAB 12–CAF	NA NA	12A—CAB 12A–CAF
Double Solenoid – B Spool Double Solenoid – F Spool	4 Way 4 Way	38–CCB 38–CCF	12–CCB 12–CCF	NA NA	12A—CCB 12A–CCF

Grommet Housing "G"

		3/8 NPT	1/2 NPT	1/2NPT High Flow	Sub-base/Manifold, See Pg. 11.27
2 Position					
Single Solenoid Spring Return	2 / 3 Way, NC 2 / 3 Way, NO 4 Way	383–GS 3830–GS 38–GS	123–GS 1230–GS 12–GS	123B–GS 1230B–GS 12B–GS	NA NA 12A–GS
Single Solenoid Pilot Return	2 / 3 Way 4 Way	383–GA 38–GA	123–GA 12–GA	123B–GA 12B–GA	NA 12A–GA
Single Solenoid Knob Return	2 / 3 Way 4Way	383–GP 38–GP	123–GP 12–GP	123B–GP 12B–GP	NA 12A–GP
Double Solenoid	2 / 3 Way 4 Way	383–GG 38–GG	123–GG 12–GG	123B–GG 12B–GG	NA 12A–GG
3 Position					
Solenoid – Pilot, B Spool Solenoid – Pilot, F Spool	4 Way 4 Way	38–GAB 38–GAF	12–GAB 12–GAF	NA NA	12A—GAB 12A–GAF
Double Solenoid – B Spool Double Solenoid – F Spool	4 Way 4 Way	38–GGB 38–GGF	12–GGB 12–GGF	NA NA	12A—GGB 12A–GGF

Male Mini-DIN Housing "F"

		3/8 NPT	1/2 NPT	1/2NPT High Flow	Sub-base/Manifold, See Pg. 11.27
2 Position					
Single Solenoid Spring Return	2 / 3 Way, NC 2 / 3 Way, NO 4 Way	383–FS 3830–FS 38–FS	123–FS 1230–FS 12–FS	123B–FS 1230B–FS 12B–FS	NA NA 12A–FS
Single Solenoid Pilot Return	2 / 3 Way 4 Way	383–FA 38–FA	123–FA 12–FA	123B–FA 12B–FA	NA 12A–FA
Single Solenoid Knob Return	2 / 3 Way 4Way	383–FP 38–FP	123–FP 12–FP	123B–FP 12B–FP	NA 12A–FP
Double Solenoid	2 / 3 Way 4 Way	383–FF 38–FF	123–FF 12–FF	123B–FF 12B–FF	NA 12A–FF
3 Position					
Solenoid – Pilot, B Spool Solenoid – Pilot, F Spool	4 Way 4 Way	38–FAB 38–FAF	12–FAB 12–FAF	NA NA	12A—FAB 12A–FAF
Double Solenoid – B Spool Double Solenoid – F Spool	4 Way 4 Way	38–FFB 38–FFF	12–FFB 12–FFF	NA NA	12A—FFB 12A–FFF

3/8 & 1/2 NPT Ported, 58 STYLE Solenoid Controlled, Pilot Operated Air Valves
2 Way, 3 Way - 2 Position — 4 Way 2 or 3 Position

*Spring Return and Spring Centered Models **NOT** suitable for dry air service*

See pages 11.27 & 11.28 for other dimensional information, 11.31 for solenoid information.

Operating Temperature:
0°F (–18°C) to +122°F (50°C) ambient.
0°F (–18°C) to +122°F (50°C) media.

Operating Ranges, psi

	#1 Solenoid 0.9 Watts	#4 Solenoid 3.5 Watts
Internal Pilot Supply (Standard) Inlet Pressure		
No Spring:	10 to 130	10 to 145
Spring: 2 Position	45 to 130	45 to 145
2 Position Light Service Spring, Option **-L**	30 to 130	30 to 145
3 Position	30 to 130	30 to 145
External Pilot Supply, Option -X:		
Inlet Pressure	0 to 150	0 to 150
Pilot Pressure, Same as Internal Pilot Supply above.		

58 STYLE Solenoid Valve, Model Number Code

12	F	S	—	4	5	1	0	0	—		120/60

Primary Actuator
F = Micro DIN
G = Wire leads
See page 11.31

Secondary Actuator
F = Micro DIN, 2 Pos.*
FB = Micro DIN 3 Position Type B*
FF = Micro DIN 3 Position Type F*
G = Wire leads, 2 Pos.*
GB = Wire leads 3 Position Type B*
GF = Wire leads 3 Position Type F*
S = Spring**
A = Pilot**
P = Knob (Black)**
PR = Knob (Red)**
* See page 11.23, 11.31.
** See pages 11.24 & 11.28 for details.

Primary Solenoid Attitude
5 = Inline with Body

Solenoid Watts
1 = 0.9 Watts
4 = 3.5 Watts

Primary Solenoid Manual Override
0 = None
1 = Position #1
2 = Position #2
3 = Position #3
4 = Position #4

Secondary Solenoid Attitude
0 = Other than Solenoid
5 = Inline with Body

Secondary Solenoid Manual Override
0 = None
1 = Position #1
2 = Position #2
3 = Position #3
4 = Position #4

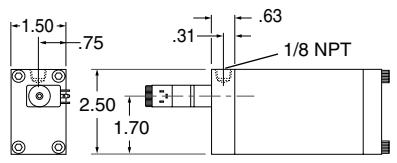
Options
-X = External Pilot
-XV = † External Pilot & Viton Seals
-L = Light Spring
† Viton Seals are available in the main valve only for media compatability and therefore only in conjunction with External Pilot [0°F (–18°C) to +122°F (50°C)].

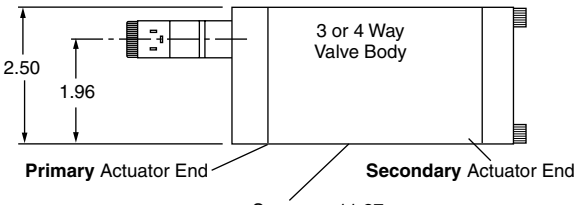
Volts / Hertz
#1 Solenoid (0.9 Watts)
12 VDC, 24 VDC
#4 Solenoid (3.5 Watts)
24/60 VAC
120/60 VAC
12 VDC
24 VDC

Series:
38 = 3/8 NPT, 4 Way
383 = 3/8 NPT, 3 Way NC
3830 = 3/8 NPT, 3 Way NO
12 = 1/2 NPT, 4 Way
123 = 1/2 NPT, 3 Way NC
1230 = 1/2 NPT, 3 Way NO
12A = 4 Way, Subbase Mount
12B = 1/2 NPT, 4 Way, 2 Position High Flow
123B = 1/2 NPT, 3 Way NC, High Flow
1230B = 1/2 NPT, 3 Way NO, High Flow

Example: ***12FS-45100-120/60***
1/2 NPT, 4 Way – Primary Actuator Solenoid with Micro DIN coil; Secondary Actuator, Spring Return – 3.5 Watt; Primary Solenoid Inline Attitude with Manual Override on Primary Solenoid in Position #1; Secondary Actuator is not a Solenoid; no Manual Override on Secondary Actuator – No Options – 120 Volt/60 Hertz.

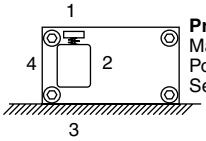
External Pilot Supply Option **-X**





Inline
Solenoid Attitude #5

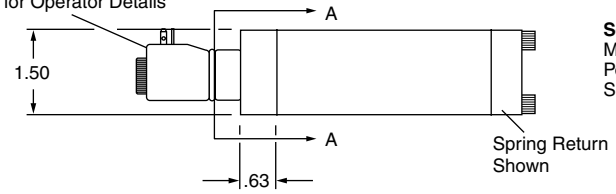
(Solenoid centerline inline with Valve Body centerline)

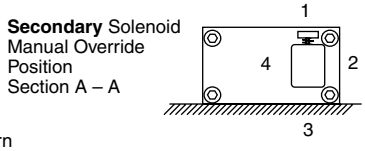


Primary Solenoid Manual Override Position Section A – A

See page 11.31 for Operator Details

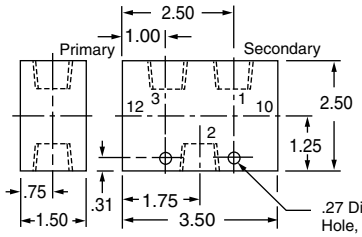
See page 11.27 for Body Details





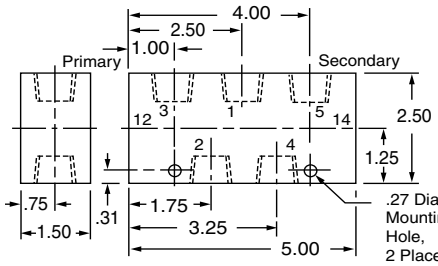
Secondary Solenoid Manual Override Position Section A – A

BASIC BODIES



2 WAY (Plug 3 Way)
3 WAY

Spring Return Assembly Standard this End



4 WAY

Spring Return Assembly Standard this End

Cv FLOW FACTORS

			Direct Ported		Subbase Mounted Side or Bottom Ported	
			3/8 or 1/2 NPT	1/2 NPT High Flow	3/8 NPT	1/2 NPT
2-Way – 3-Way 2 Position - Type 3 Spool			4.1	6.2	NA	NA
4-Way 2 Position - Type 2 Spool			4.1	6.2	3.1	3.7
4 Way 3 Position	Type B Spool		2.4	NA	2.2	2.4
	Type F Spool	Shifted 1 to 2; 1 to 4	2.4	NA	2.2	2.3
		Shifted 2 to 3; 4 to 5	4.1	NA	3.4	3.9
		Centered 2 to 3; 4 to 5	2.7	NA	2.6	2.8

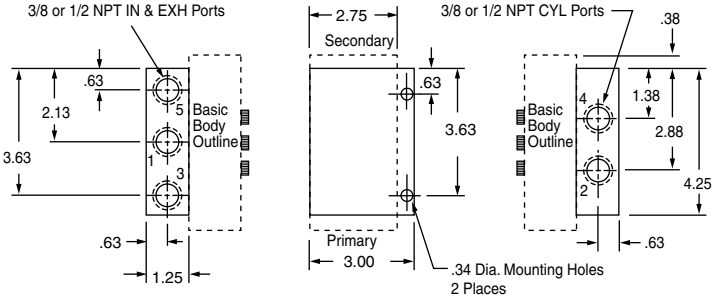
NOTE: Any of these 4-way valves, except the internally supplied solenoid valves (see Option -X), can be used as dual inlet, single exhaust. Using this concept, with different pressures for force application and retraction, can effect large savings of high pressure air and its cost. The larger the cylinder or the faster the cycle, the higher the savings.

SINGLE SUBBASES

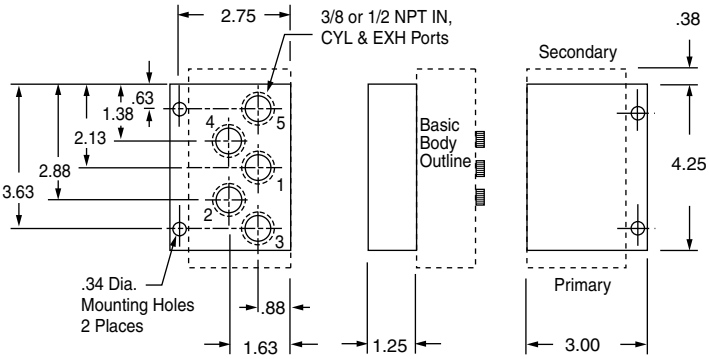
To Order
Specify Valve Model No. (See pages 11.23 - 11.26)
Specify Subbase Part No. listed below.
EXAMPLE - Photo shows 12A-SP-MO4 with 12 PV-50

MOUNT 4 WAY VALVE WITH ANY OPERATOR

SIDE PORTED
3/8 NPT Ports Specify **38 PV-50**
1/2 NPT Ports Specify **12 PV-50**



BOTTOM PORTED
3/8 NPT Ports Specify **38 PV-51**
1/2 NPT Ports Specify **12 PV-51**

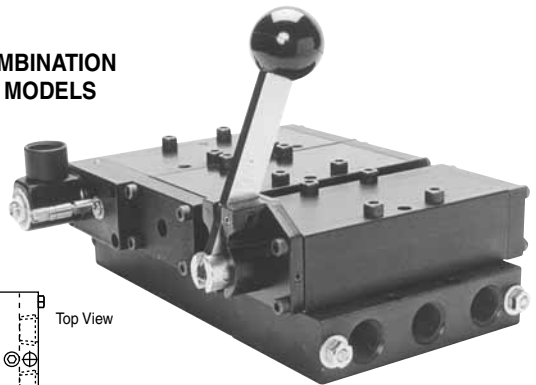


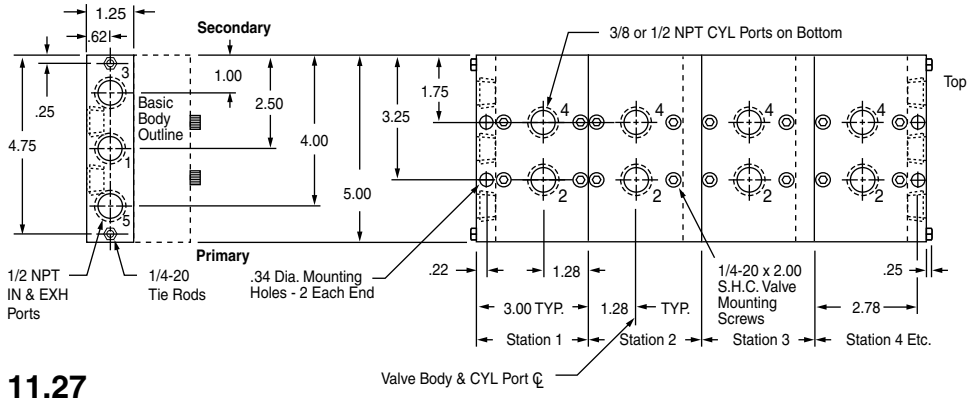
11

MULTIPLE MANIFOLDS

To Order
Specify Station No. - Valve Model - Manifold Number
EXAMPLE - Photo shows one unit consisting of 3 valves and manifolds:
Sta. No. 1 12A-CS-MO1 with 12 PV-65
Sta. No. 2 12A-DP with 12 PV-66
Sta. No. 3 12A-HL with 38 PV-65

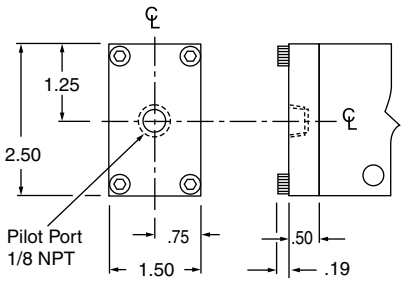
MOUNT ANY COMBINATION OF 4 WAY VALVE MODELS & PORT SIZES



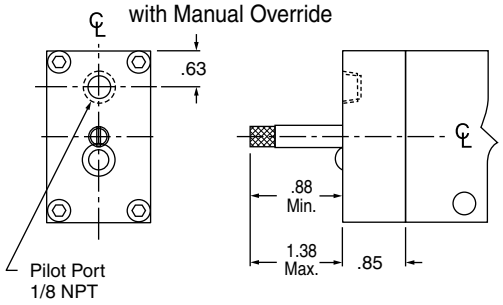


	CYLINDER PORTS	
	3/8 NPT	1/2 NPT
End Unit 1/2 NPT IN & EXH	**38 PV-65**	**12 PV-65**
CENTER UNIT	**38 PV-66**	**12 PV-66**

AIR PILOT OPERATOR



AIR PILOT OPERATOR
with Manual Override



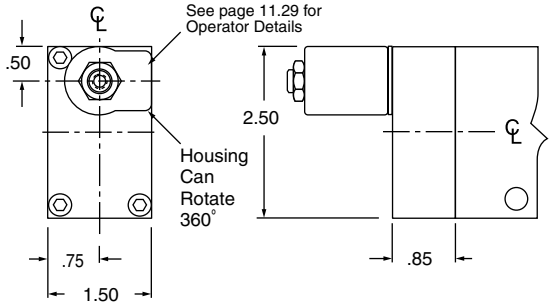
2 Position, Spring return
Dimensions shown at the bottom of the page.

3 Position Spring Centering is incorporated within the operator dimensions.

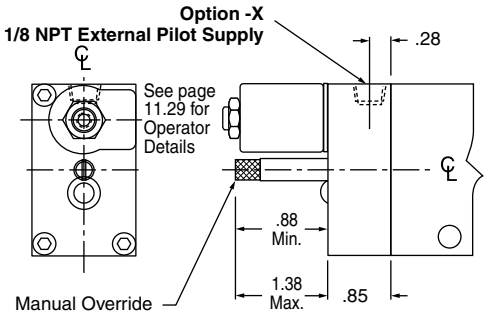
Manual Overrides applicable to Pilot Operated or **53 Style** Solenoid Operated Valves	To Specify Add Suffix to Model Number
LOCKING	-MO1
LOCKS IN - Does not lock OUT	-MO2
Does not lock IN - LOCKS OUT	-MO3
NON-LOCKING	-MO4
Note: The manual override stem physically contacts and moves the spool.	

The **53 STYLE** solenoid operator is a 3-way valve which, upon receiving an electrical signal, directs a pilot pressure to shift the main valve spool. Unless otherwise specified, the operator is internally supplied from the main valve inlet with pressure for piloting. If an external pilot supply is required specify Suffix **-X** after the model number. This external pilot supply may be required; where the media through the main valve is of insufficient pressure for piloting, where the media through the main valve is something other than compressed air, for 4-way dual inlet-single exhaust, or other applications.

53 STYLE SOLENOID OPERATOR



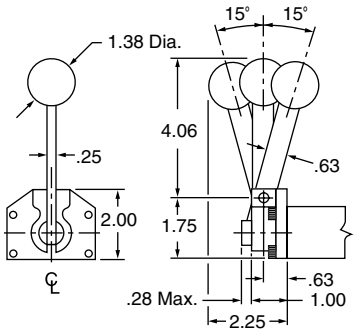
53 STYLE SOLENOID OPERATOR
with Manual Override and External Pilot Supply, Opption **-X**



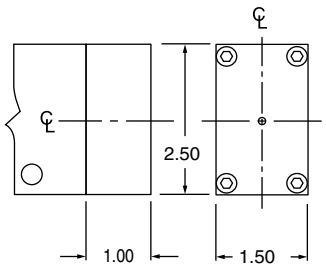
2 Position, Spring return
Dimensions shown at the bottom of the page.

3 Position Spring Centering is incorporated within the operator dimensions.

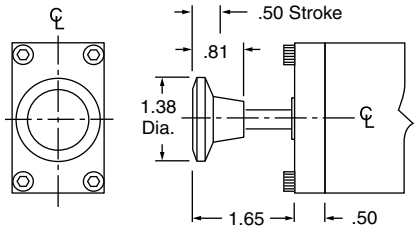
58 STYLE Solenoid Operator – See page 11.26



HAND LEVER OPERATOR

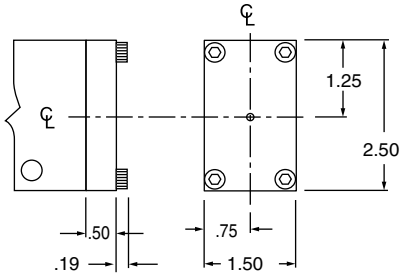


3 POSITION SPRING CENTERING OPERATOR FOR HAND LEVER ONLY



PALM BUTTON OPERATOR
2 Position, Spring return
Dimensions shown to right.

3 Position Spring Centering is incorporated within the operator dimensions.



2 POSITION SPRING RETURN, STANDARD & LIGHT SERVICE

All valve models – Standard service spring consists of two concentric helical springs. Either may be removed for "Light" Service.

11

53 STYLE Stocked Coils and Housings

Conduit Housing "C" and Grommet Housing "G"

Non-molded – Class A 221°F (105°C) Rating,
24" Leads of AWG #18 Wire.
Stocked Voltages:
24, 120 and 240 Volt at 50 or 60 Hertz;
6, 12 and 24 Volt DC;
Others available, see Options on page 11.30.
Temperature Range:
0°F (–18°C) to + 104°F (+40°C), ambient.
0°F (–18°C) to + 150°F (+65°C), media.
Typical Response Times:
AC 4 to 8 milliseconds to open or close;
DC 9 to 15 milliseconds to open;
DC 5 to 12 milliseconds to close.
To compute current requirements (±15%) divide factor shown below by voltage

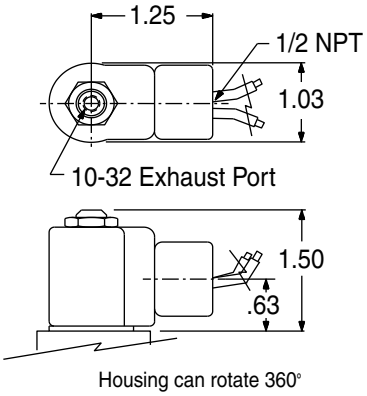
	AC Volts, 60 Hertz		DC Volts
Function	Inrush, Amp	Holding, Amp	Inrush, Amp or Holding, Amp
2 Way NC	13.2 ÷ Volts	7.8 ÷ Volts	7.2 ÷ Volts
2 Way NO 3 Way NC or NO	15.2 ÷ Volts	9.0 ÷ Volts	
Examples	15.2 ÷ 120 = .13 Amp	9.0 ÷ 120 = .08 Amp	7.2 ÷ 12 = .60 Amp

Male Mini-DIN Housing "F"

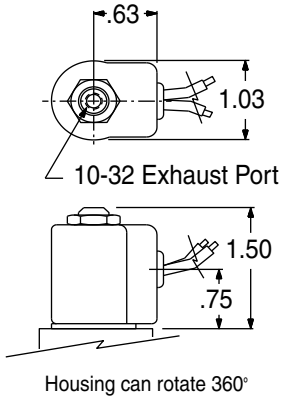
Molded – Water Tight - Class A 221°F (105°C) IP65 Coil Rating.
European (DIN) Style – 11 mm spacing.
See page 11.30 for connectors or contact your local distributor for additional choices.
Can also be connected with individual .25" quick connect terminals.
Stocked Voltages:
24, 120 and 240 Volt at 50 or 60 Hertz;
12 and 24 Volt DC;
Others available, see Options on page 11.30.
Temperature Range:
0°F (–18°C) to + 104°F (+40°C), ambient.
0°F (–18°C) to + 150°F (+65°C), media.
Typical Response Times:
AC 4 to 8 milliseconds to open or close;
DC 9 to 15 milliseconds to open;
DC 5 to 12 milliseconds to close.
To compute current requirements (±15%) divide factor shown below by voltage.

	AC Volts, 60 Hertz		DC Volts
Function	Inrush, Amp	Holding, Amp	Inrush, Amp or Holding, Amp
2 Way NC	14.4 ÷ Volts	9.7 ÷ Volts	10.4 ÷ Volts
2 Way NO 3 Way NC or NO	15.2 ÷ Volts	11.8 ÷ Volts	10.4 ÷ Volts
Examples	15.2 ÷ 120 = .13 Amp	11.8 ÷ 120 = .10 Amp	10.4 ÷ 12 = .87 Amp

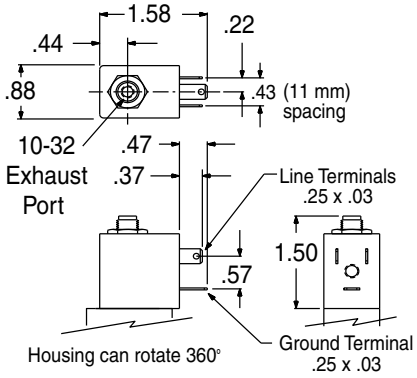
Conduit Housing "C"



Grommet Housing "G"



Male Mini-DIN Housing "F"



Spade terminals accept miniature rectangular quick connect socket (Female DIN style connector, 11 mm spacing) or individual .25" quick connect terminals.

11

53 STYLE Options for Conduit Housing "C" and Grommet Housing "G"

AC Voltages from 5.4 to 575 in 50 or 60 Hertz.
DC Voltages from 3 to 300.

- Molded Coil . . . . . Option **-M**
  Water tight, Molded Coil with Class A 221°F (105°C) Rating. Coil is completely molded in epoxy for maximum moisture resistance.

  NEMA 1, 2, and 3 when in Conduit "C", or Grommet "G" housing.
- Potted Coil . . . . . Option **-P**
  Coil is epoxy potted into Conduit "C" housing only. Class F 221°F (105C) Rating.

  It offers maximum moisture and vibration resistance. NEMA 3R, 3S, 4, 4X, 6, 11, 12 & 13.
- High Temperature . . . . . Option **-H**
  Molded coil with 356°F (180°C) rating.
- Viton Seals (for media compatibility) . . . . . Option **-V**
- Strain Relief Connector . . . . . Option **-Q**
- "AN" Connector . . . . . Option **-W**
- Splice Box . . . . . Option **-J**
- Mounting Bracket . . . . . Option **-R**
- Third Wire Ground . . . . . Option **-CC**
  A CSA requirement.

53 STYLE Options for Male Mini-DIN Housing "F"

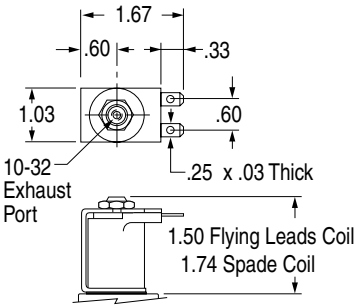
AC Voltages from 4.4 to 277 in 50 or 60 Hertz.
DC Voltages from 3 to 180.

- Viton Seals (for media compatibility) . . . . . Option **-V**

53 STYLE Options for Yoke Housing

- Yoke with Standard coil (24" flying leads) . . . . . Option **-YB**
- Yoke with Molded coil (24" flying leads) . . . . . Option **-YM**
- Yoke with Molded Spade Terminal and coil . . . . . Option **-KM**

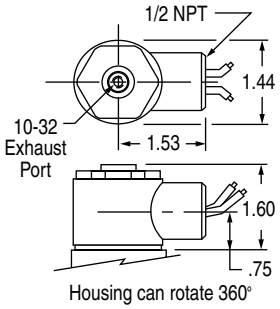
Yoke replaces housing for protected and control box applications. Molded coil with two .25" spade terminals for quick assembly and disconnect.



53 STYLE Explosion Proof . . . . . Option **-EP**

UL File #E37780
CSA File #LR-26894
For hazardous locations, includes Molded Coil.
UL Class I Div. 1 Groups C & D.
UL Class II Div. 1Groups E, F & G.
UL Class II Div. 2 Groups A, B, C, D, E & F.
NEMA 7 Class 1 Group D.
NEMA 9 & 9A Class II Groups F & G.

! CAUTION !
To prevent explosion, disconnect electrical circuit before opening enclosure! Keep tightly closed when in operation.



Option -EP Current Factors

AC Volts, 60 Hertz	Inrush	Holding
2 Way NC	16.0	7.8
2 Way NO	16.9	10.7
3 Way NC or NO	16.9	10.7

DC Volts	Inrush or Holding
2 Way NC or NO	7.2
3 Way NC or NO	7.2

Divide "Factor" shown above by Volts to find current.
See examples on opposite page.

11

58 Style

3 Way – Normally Closed – Exhaust to Atmosphere
Temperature Range:
0°F (–18°C) to + 122°F (+50°C), ambient.
0°F (–18°C) to + 122°F (+50°C), media.
Available with or without Push Button Manual Override

#1 Operator

0.9 Watts
Volts – . . . . . 12 VDC . . .24 VDC
Amperage Draw – (approximate) . . . .73 mA . . . . 37 mA
Response time: 9 ms @ 0 psi
0.6 mm Inlet Orifice – 0.8 mm Exhaust Orifice
130 psi Maximum Operating Pressure

#4 Operator

3.5 Watts
Volts – See Chart at Right
Amperage Draw – See Chart at Right
Response time: 8 ms with DC Volts;
3 – 9 ms with AC Volts.
1.0 mm Inlet Orifice – 1.0 mm Exhaust Orifice
145 psi Maximum Operating Pressure

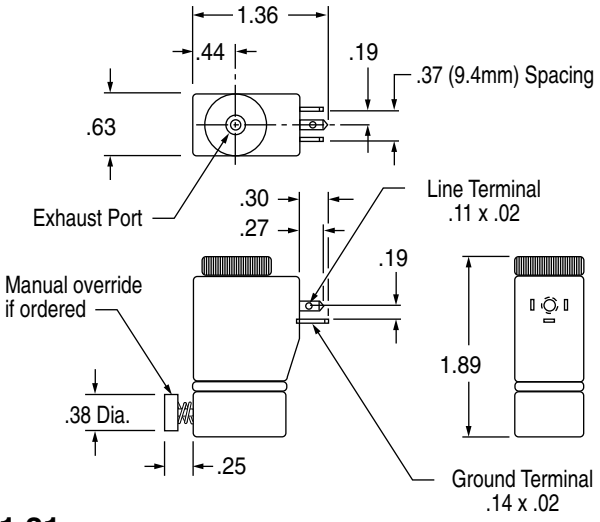
Volts	Hertz	Amperage Draw, mA	
		Inrush	Holding
24	60	252	220
120	60	43	37
12	DC	294	294
24	DC	145	145

---

58 Style

[#1 (0.9 Watts), or #4 (3.5 Watts)] Operator

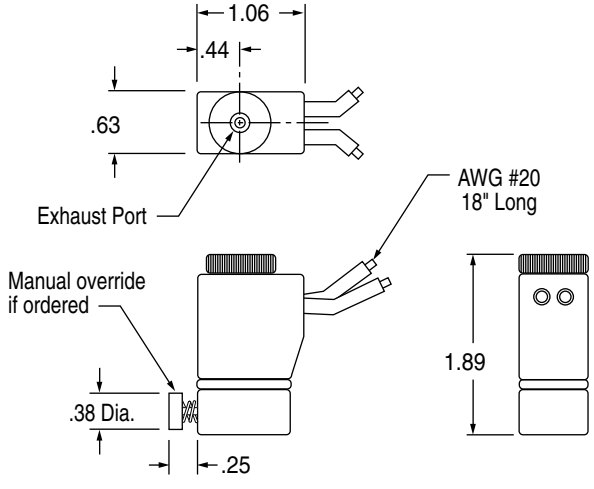
Male Micro-DIN, Coil "F"
Molded – Water Tight
Class A 221°F (105°C) IP65 Coil Rating
European (DIN) Style – 9.4 mm spacing
See page 11.32 for connectors or contact your local distributor for additional choices.



58 Style

[#1 (0.9 Watts), or #4 (3.5 Watts)] Operator

Wire Leads, Coil "G"
Molded – Water Tight
Class A 221°F (105°C) IP65 Coil Rating
Leadwires – AWG #20, 18 inches long



Solenoid Exhaust Mufflers, #SM-10

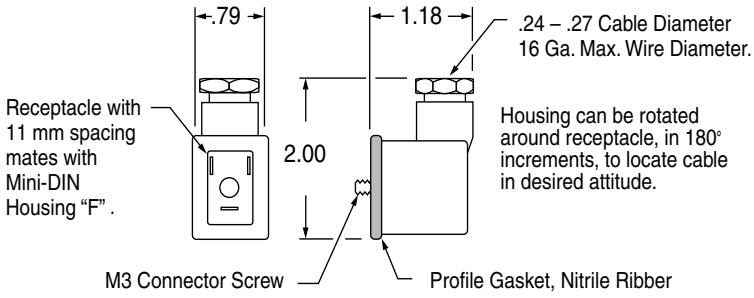
for "C" & "G" housings and "F" DIN coil operators. See page 14.1.

Connectors 53 Style (11 mm spacing)

For Male Mini-DIN Housing "F"

Part Number without LED: **122-09-N**
Black Housing

Part Number with LED:. **122-09-T-A.1-Voltage**
Available in 12, 24, 120, or 240 Volt; AC or DC only.
(Transparent Housing allows LED to be seen)

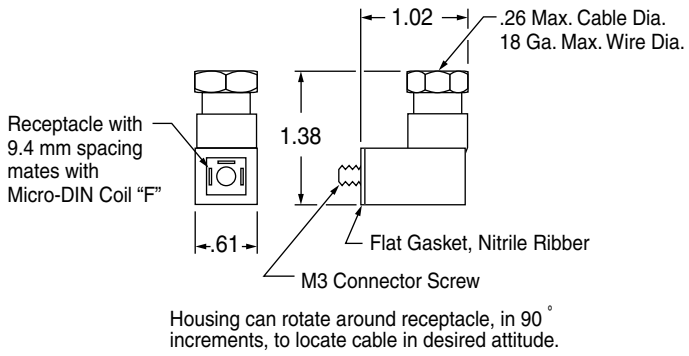


Connectors 58 Style (9.4 mm Spacing)

For Male Micro-DIN Housing "F":

Part Number without LED: **192-07-N**
Black Housing

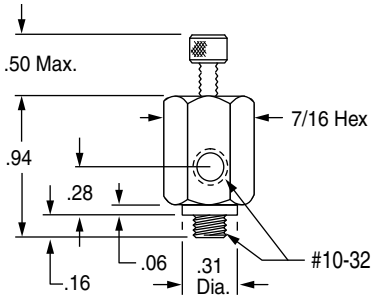
Part Number with LED: **192-07-T-A.1-Voltage**
Available in 12 or 24 Volt, AC or DC only.
(Transparent Housing allows LED to be seen)



Hard Wired Connectors . . . . . Please see Section 16

J Series - Mini-DIN and Micro-DIN hard wired connectors

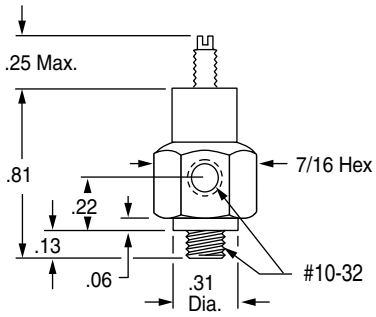
F Series - Mini-DIN and Micro-DIN hard wired connectors



Needle Valve
- Controls both ways
- Full range adjustability
- Knurled control knob
- Dual tapered needle
- Gasket included (GA-10)
- Brass construction
- Buna-N seal
- For infinite positioning of side port direction use a thread sealant/adhesive.

FN-32
Options:

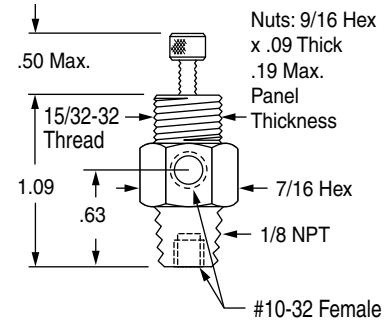
Slotted knurled knob	**-KS**
Screwdriver slot (MN-32 type)	**-S**
Locknut on stem	**-L**
Adaptor knob	**-B**
Viton seal	**-V**



Needle Valve
- Controls both ways
- Full range adjustability
- Screwdriver slot
- Dual tapered needle
- Gasket included (GA-10)
- Brass construction
- Buna-N seal
- For infinite positioning of side port direction use a thread sealant/adhesive.

MN-32
Options:

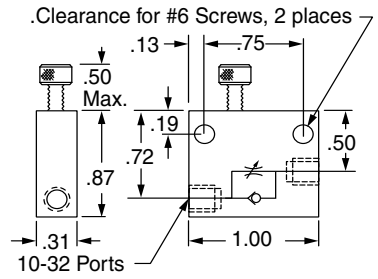
Knurled knob (FN-32 type)	**-K**
Slotted knurled knob	**-KS**
Locknut on stem	**-L**
Adaptor knob	**-B**
Viton seal	**-V**



Panel Mount Needle Valve
- Controls both ways
- Full range adjustability
- Knurled control knob
- Dual tapered needle
- Brass construction
- Buna-N seal
- Mount in panel or directly into valve or cylinder port
- 2 Nuts & 1 Washer included

FN-18
Options:

Slotted knurled knob	**-KS**
Screwdriver slot (MN-32 type)	**-S**
Locknut on stem	**-L**
Adaptor knob	**-B**
Without panel nuts	**-C**
Viton seal	**-V**

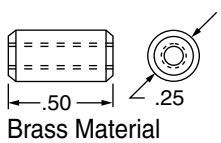


Flow Control Valve
- Controls one way – Full flow return
- Full range adjustability
- Knurled control knob
- Dual tapered needle
- Brass construction
- Buna-N seals
- For quick exhaust order without spring, Option -W
- Flow rates - see page 12.5

FC-32
Options:

Slotted knurled knob	**-KS**
Screwdriver slot (MN-32 type)	**-S**
Locknut on stem	**-L**
Adaptor knob	**-B**
Viton seals	**-V**
Without spring	**-W**

Order any Control Valve with this Knob by specifying Option -B



Brass Material

Adapter Knob
- Allows the incorporation of decorative knobs with .25" I.D. and set screw

Option -B

NV-55
Needle Valve

FC-55
Flow Control Valve

These precision machined valves are designed and manufactured to provide Micro-Fine™ control of gasses and liquids. They have a micrometer pitch (40 threads per inch) adjusting thread and precision machined tapered needle and seat. They are available as needle valves and flow control valves.

The precision is shown on the chart below. You can see how close the actual flow (plotted dots) approaches a straight line. Also note that it takes 9 full turns to go from bubble tight shut-off to its full flow of 100 Standard Cubic Feet per Hour (1.67 SCFM) at 80 psi inlet.

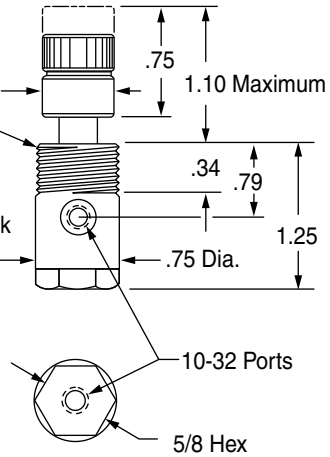
Features

- Linear control to 100 SCFH @ 80 psi (see chart below).
- Micrometer pitch adjusting thread, 40 TPI, .025 per turn.
- 10-32 ports.
- Stainless steel needle - 3° taper.
- Friction O-Ring provides “stay-put” adjustment.
- Knurled adjusting knob with set screw lock.
- White Delrin® knob, colors available.
- Brass body.
- Buna-N seals.
- Operating temperature (0° to + 180°F).
- Panel mounting standard.
- 2 Brass panel mount nuts included as standard.
- 100% tested, “Bubble-tight” shut-off.
- Air or Hydraulic service to 150 psi.

Options

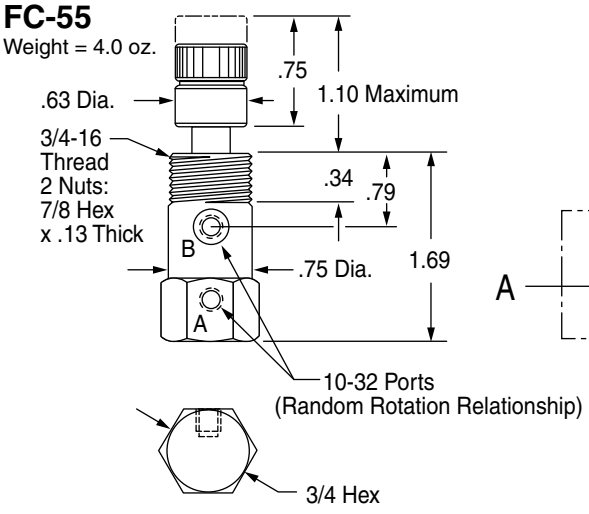
- Viton seals for media compatibility, specify Option **-V.**

NV-55
Weight = 2.7 oz.

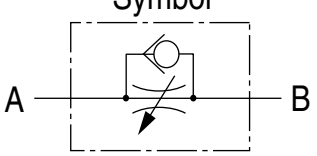


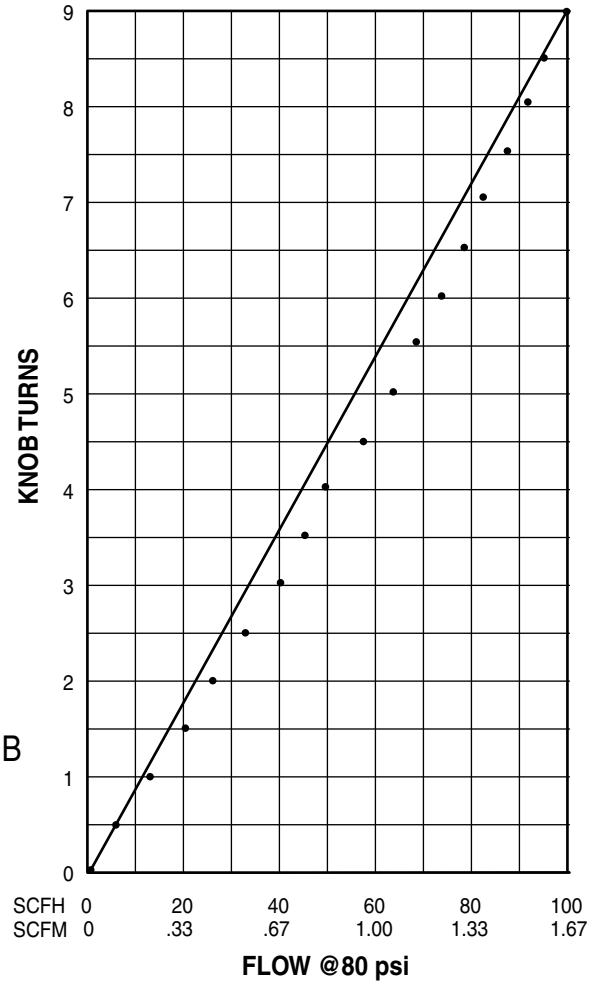
Symbol

FC-55
Weight = 4.0 oz.



Symbol





12

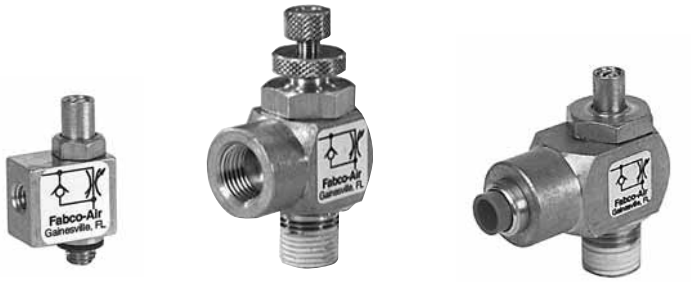
Port Mounted, Swivel, Brass Body Flow Controls *(See next page 12.4)*

• Full 360° Swivel • Compact Size • Pre-applied Thread Sealant

SPECIFICATIONS

- Male sizes:
  #10-32, 1/8 NPT, 1/4 NPT
- Female NPT or instant tube connections:
  10-32, 1/8 NPT, 1/4 NPT,
  5/32" T, 1/4" T, 3/8" T
- Choice of controlled flow direction
  - Valve mount – Meter in
  - Cylinder mount – Meter out
- Operating pressure to 150 PSI (10 bar)
- Operating temperature: -25° to 250°F

Easy Disassembly for Maintenance



PC1-K PC2-A PC4-L

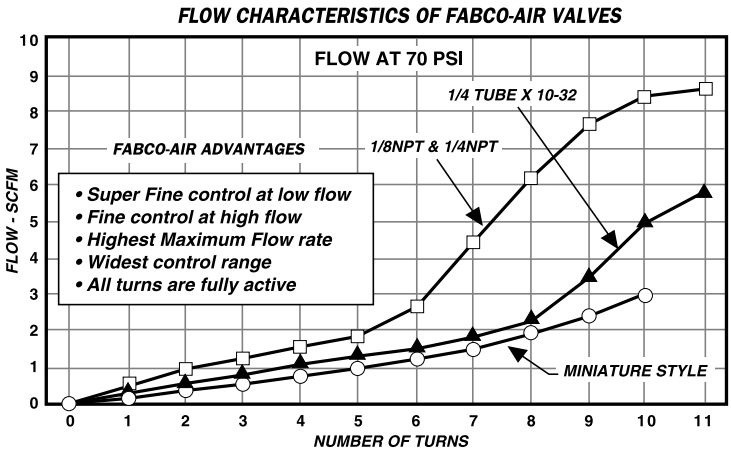
See dimensions on next page. See flow information on page 12.5.

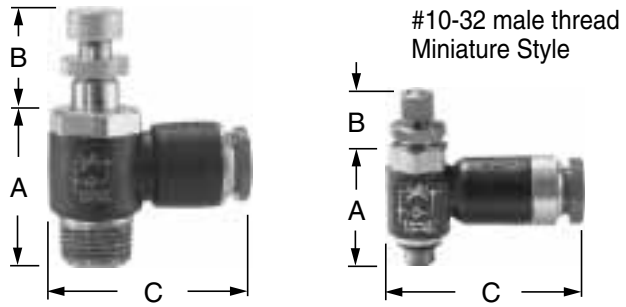
Port Mounted, Swivel, Molded Body Flow Controls.

• Full 360° Swivel • Compact Size • Pre-applied Thread Sealant

SPECIFICATIONS

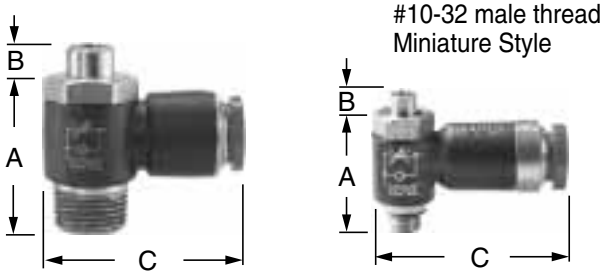
- Male sizes:
  #10-32, 1/8 NPT, 1/4 NPT, 3/8 NPT
- Female instant tube connections:
  5/32" T, 1/4" T, 3/8" T
- Operating pressure to 150 PSI (10 bar)
- Operating temperature:
  0 to 160°F (-18°C to 70°C)
- High flow rates (see chart at right)
- Use with air or other inert gas only
- Not recommended for use with liquids
- Meter out only





Knob Adjustable Valves

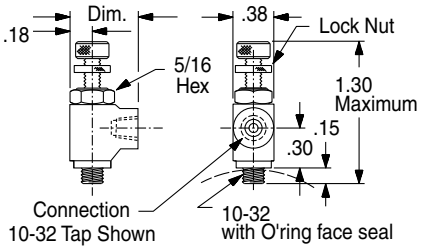
Model No.	Description	A	B max	C	Flow (Cv)
PK-82010	5/32 tubing x 10-32 miniature	0.68	0.45	1.08	0.05
PK-82012	5/32 tubing x 1/8 NPT	1.05	0.75	1.25	0.13
PK-82014	5/32 tubing x 1/4 NPT	1.17	0.75	1.37	0.13
PK-82040	1/4 tubing x 10-32	0.95	0.75	1.30	0.08
PK-82042	1/4 tubing x 1/8 NPT	1.05	0.75	1.30	0.13
PK-82044	1/4 tubing x 1/4 NPT	1.17	0.75	1.40	0.13
PK-82046	1/4 tubing x 3/8 NPT	1.38	0.92	1.75	0.27
PK-82064	3/8 tubing x 1/4 NPT	1.34	0.92	1.70	0.27
PK-82066	3/8 tubing x 3/8 NPT	1.38	0.92	1.75	0.27



Recessed Screw Adjustable Valves

Model No.	Description	A	B max	C	Flow (Cv)
PR-82110	5/32 tubing x 10-32 miniature	0.68	0.11	1.08	0.05
PR-82112	5/32 tubing x 1/8 NPT	1.05	0.20	1.25	0.13
PR-82114	5/32 tubing x 1/4 NPT	1.17	0.20	1.37	0.13
PR-82140	1/4 tubing x 10-32	0.95	0.20	1.30	0.08
PR-82142	1/4 tubing x 1/8 NPT	1.05	0.20	1.30	0.13
PR-82144	1/4 tubing x 1/4 NPT	1.17	0.20	1.40	0.13
PR-82146	1/4 tubing x 3/8 NPT	1.38	0.28	1.75	0.27
PR-82164	3/8 tubing x 1/4 NPT	1.34	0.28	1.70	0.27
PR-82166	3/8 tubing x 3/8 NPT	1.38	0.28	1.75	0.27

Size 1 #10-32 Male Thread Knob Adjustment

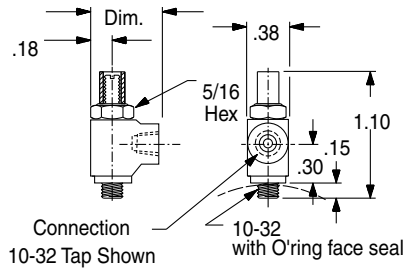


Valve Mount		
Model	Connection	Dim.
PV1-A PV1-C	#10-32 Tap 5/32" Tube*	.63 1.16

Cylinder Mount		
Model	Connection	Dim.
PC1-A PC1-C	#10-32 Tap 5/32" Tube*	.63 1.16

* Note! Use 5/32" Tube Models for 4mm OD Tubing.

Size 1 #10-32 Male Thread Screw Driver Adjustment

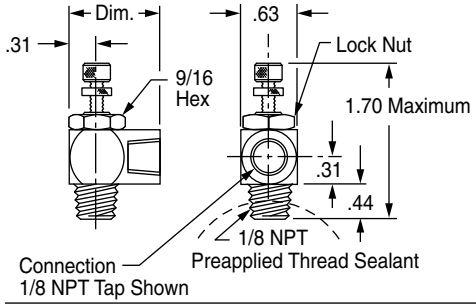


Valve Mount		
Model	Connection	Dim.
PV1-K PV1-M	#10-32 Tap 5/32" Tube*	.63 1.16

Cylinder Mount		
Model	Connection	Dim.
PC1-K PC1-M	#10-32 Tap 5/32" Tube*	.63 1.16

* Note! Use 5/32" Tube Models for 4mm OD Tubing.

Size 2 1/8 NPT Male Thread Knob Adjustment

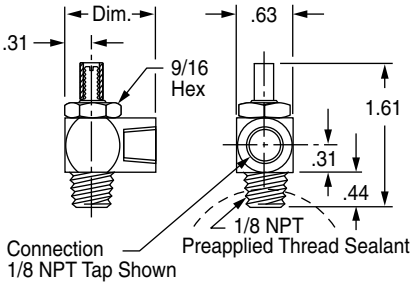


Valve Mount		
Model	Connection	Dim.
PV2-A PV2-C PV2-D	1/8 NPT Tap 5/32" Tube* 1/4" Tube	1.00 1.65 1.63

Cylinder Mount		
Model	Connection	Dim.
PC2-A PC2-C PC2-D	1/8 NPT Tap 5/32" Tube* 1/4" Tube	1.00 1.65 1.63

*Note! Use 5/32" Tube Models for 4mm OD Tubing.

Size 2 1/8 NPT Male Thread Screw Driver Adjustment

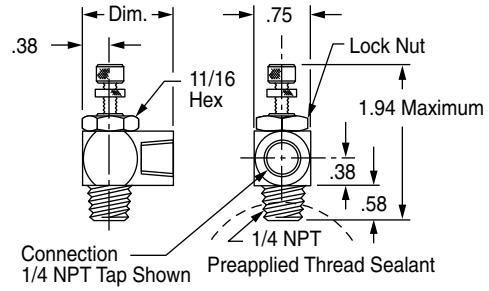


Valve Mount		
Model	Connection	Dim.
PV2-K PV2-M PV2-N	1/8 NPT Tap 5/32" Tube* 1/4" Tube	1.00 1.65 1.63

Cylinder Mount		
Model	Connection	Dim.
PC2-K PC2-M PC2-N	1/8 NPT Tap 5/32" Tube* 1/4" Tube	1.00 1.65 1.63

*Note! Use 5/32" Tube Models for 4mm OD Tubing.

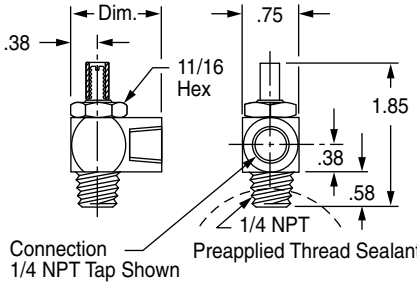
Size 4 1/4 NPT Male Thread Knob Adjustment



Valve Mount		
Model	Connection	Dim.
PV4-A PV4-B PV4-C	1/4 NPT Tap 1/4" Tube 3/8" Tube	1.25 1.75 2.00

Cylinder Mount		
Model	Connection	Dim.
PC4-A PC4-B PC4-C	1/4 NPT Tap 1/4" Tube 3/8" Tube	1.25 1.75 2.00

Size 4 1/4 NPT Male Thread Screw Driver Adjustment

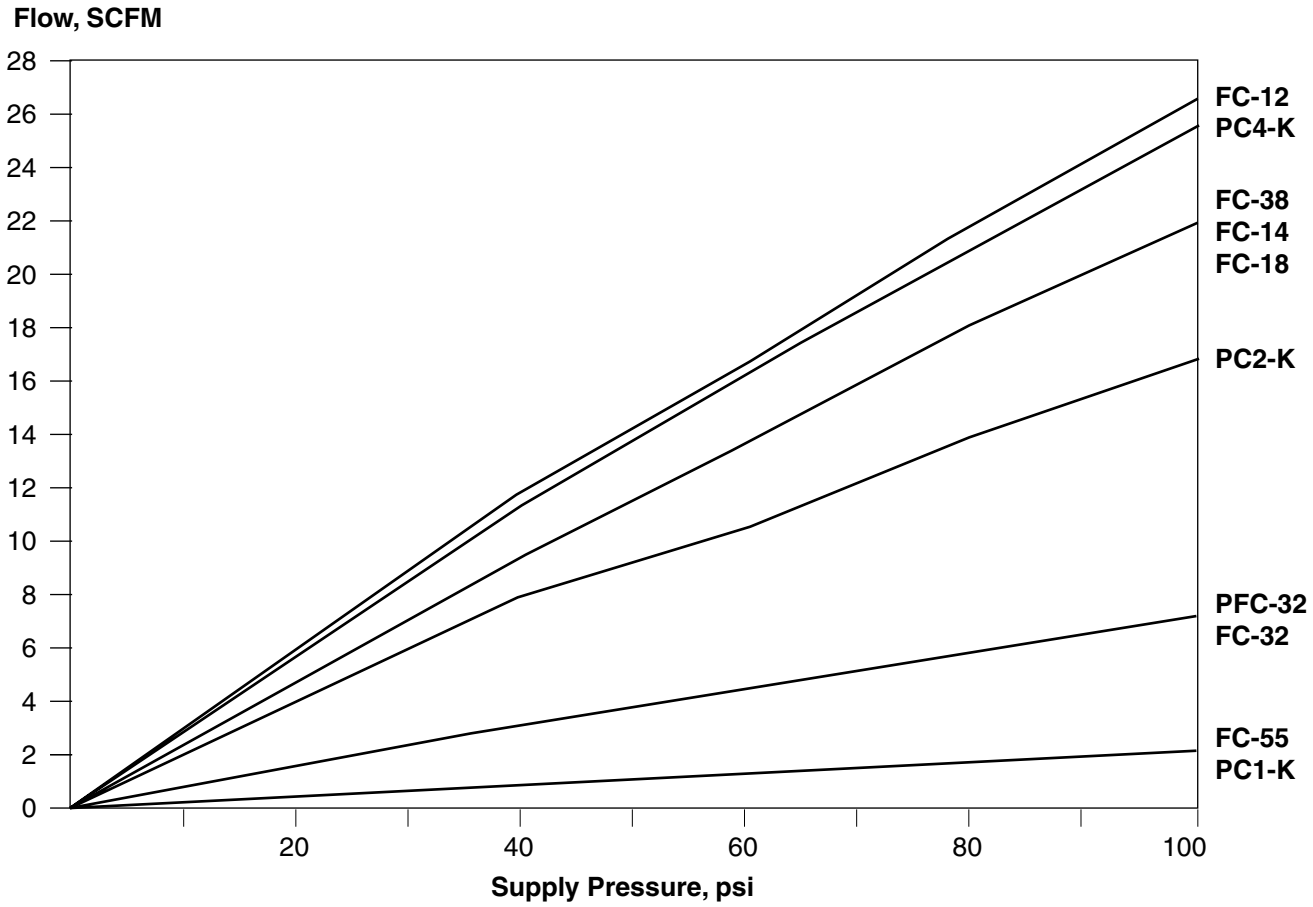


Valve Mount		
Model	Connection	Dim.
PV4-K PV4-L PV4-M	1/4 NPT Tap 1/4" Tube 3/8" Tube	1.25 1.75 2.00

Cylinder Mount		
Model	Connection	Dim.
PC4-K PC4-L PC4-M	1/4 NPT Tap 1/4" Tube 3/8" Tube	1.25 1.75 2.00

12

Flow Control Valves, Typical Free Flow Maximum

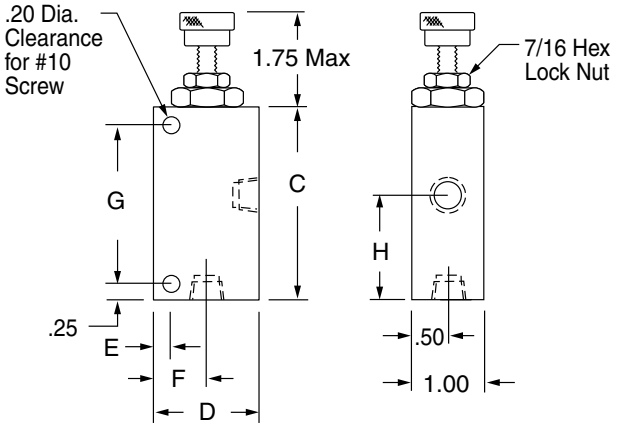


12

Super-Vee™ Needle Valve Dimensions

Super-Vee™ Needle Valve controls both directions

Model	FCB-18	FCB-14	FCB-38	FCB-12
Port Size, NPT	1/8	1/4	3/8	1/2
C	2.75	2.75	2.75	3.00
D	1.50	1.50	1.50	1.75
E	.25	.25	.25	1.50
F	.75	.75	.75	.56
G	2.25	2.25	2.25	2.50
H	1.50	1.50	1.50	1.75
Weight, lb.	.50	.50	.50	.56



The unique design of the **Super-Vee™** control results in SUPER adjustability from full flow to bubble tight shut-off with an orifice that provides precise repetition of selected flow rates.

A straight stem with an angled **"V" Notch** fits snugly into a control bushing. The actual control orifice is one large hole compared to the narrow annular ring (see drawing below) that is the orifice formed by the typical tapered needle in a round hole.

When controlling air or liquid at a very low rate with a tapered needle and hole, the annular ring becomes minute and will catch even very small dirt particles and create blockage. This changes the orifice size and causes the flow rate to vary. However, the Super-Vee™s large hole orifice will allow much larger particles to flow through freely; thus not changing flow rate.

Even with this large orifice advantage, we recommend that when you require extremely fine control and exact repetition every cycle, that you incorporate a filter on each side of the Super-Vee™ to assure that no particles can reach the "V" Notch orifice.

Features

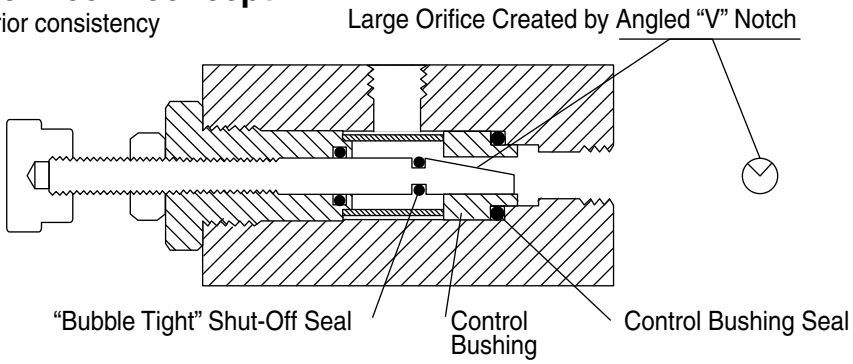
- Air service to 150 psi
- Hydraulic service to 150 psi
- No tapered needles
- Delrin® control bushing
- Repairable
- Knurled adjusting knob
- Adjustment lock nut
- Quality design
- Quality construction
- Buna-N seals
- Operating temperature (0° to + 180°F)
- Black anodized aluminum body
- Stainless steel stem
- Stainless steel spring ("FC-" Models)
- Brass cartridge and poppet
- Corrosion resistant construction
- "Bubble-tight" shut-off

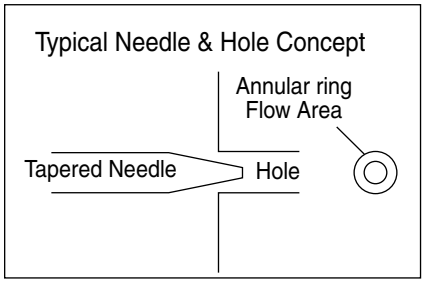
Options

- Viton seals for media compatibility, Option -V

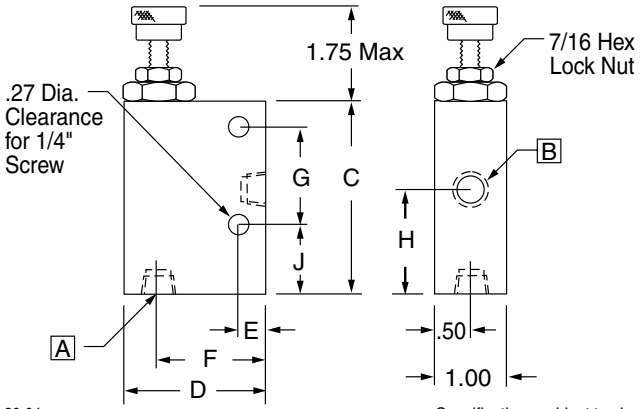
Super-Vee™ concept

Superior consistency

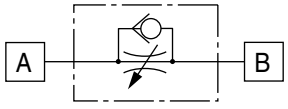




Super-Vee™ Flow Control Dimensions



Super-Vee™ Flow Control controls one direction – Free flow return



Model	FC-18	FC-14	FC-38	FC-12
Port Size, NPT	1/8	1/4	3/8	1/2
C	2.75	2.75	2.75	3.25
D	2.00	2.00	2.00	2.50
E	.38	.38	.38	.50
F	1.50	1.50	1.50	1.88
G	1.38	1.38	1.38	2.50
H	1.50	1.50	1.56	2.06
J	1.00	1.00	1.00	.38
Weight, lb.	.63	.63	.63	.83

Interval Delay

Upon application of an input signal (pressure) there is an output signal for an adjustable time, within ranges shown. At the end of this time the output signal is vented. Another output is not possible until the input is vented to atmosphere for 1 second minimum (reset time). Another input signal can then be applied for another output signal.

The time proven Fabco-Air OS-1 Pulse Valve (see page 13.1) is the basis of this unique, all pneumatic, adjustable, **Interval Delay**. The OS-1 is mounted on and connected to an adjustable volume chamber. When the incoming signal is applied to the **IN** port of the OS-1, its spool is immediately shifted, and the chamber dump valve is closed. This allows pressure to and through the **CYL** port, becoming the output signal. Pressure then bleeds across an orifice through the piston head and into the adjustable volume chamber. When pressure is equal on both sides of the piston head there is a force unbalance on the spool. This force unbalance returns the spool to its original position. In this position the incoming signal is blocked and **CYL** is connected to **EXH**, in turn venting the output signal. Adjusting the volume of the chamber adjusts the length of the output signal.

Before the valve can produce another signal it must be reset. Resetting is accomplished by removing the input signal from and venting the **IN** for 1 second minimum. This allows pressure behind the piston to bleed back through the orifice and opens the chamber dump valve. All volume behind the piston then bleeds down to zero psi. This action self cleans the orifice at every cycle. The next incoming signal can then produce another output signal.

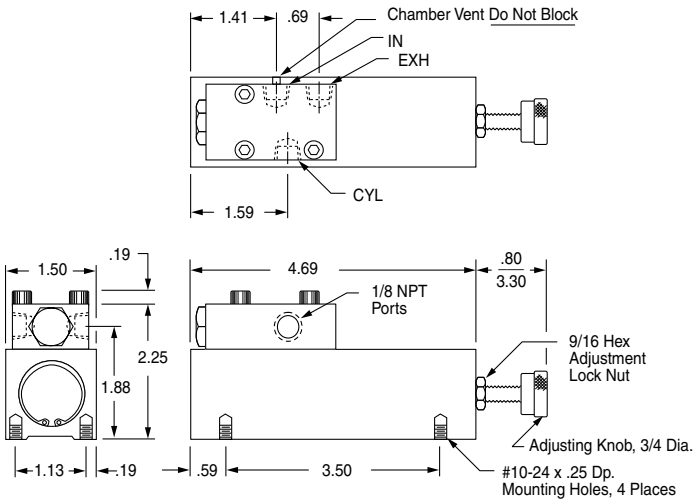
NOTE! The incoming signal MUST be of sufficient pressure and volume to shift the spool before bleeding across the orifice and balancing out.

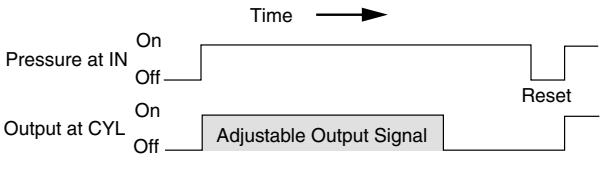
Model OS-5 1 to 6 second output signal
Model OS-6 3 to 8 second output signal
Model OS-7 6 to 13 second output signal

Features

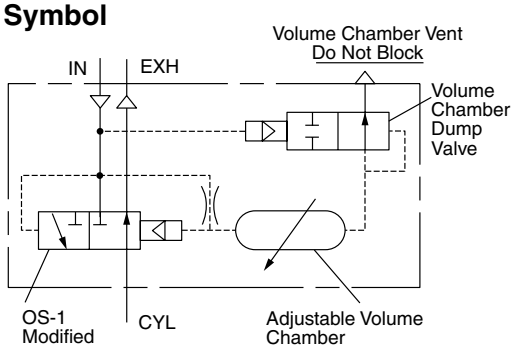
- One moving part.
- Buna-N seals.
- Repeatability: ± 5% of Output signal.
- Can be cleaned or repaired without removing from installation.
- Spool can be observed for circuit trouble shooting.
- Operating pressure: 45 to 150 psi.
- Operating temperature: 0° to + 180°F.
- No springs.
- Self-cleaning orifice.
- 1/8 NPT ports.

Dimensions





Symbol



13

Sizing

Model Number	RV-1	RV-2
Port Size, NPT	1/8	1/4
Weight	4.7 oz.	4.6 oz.

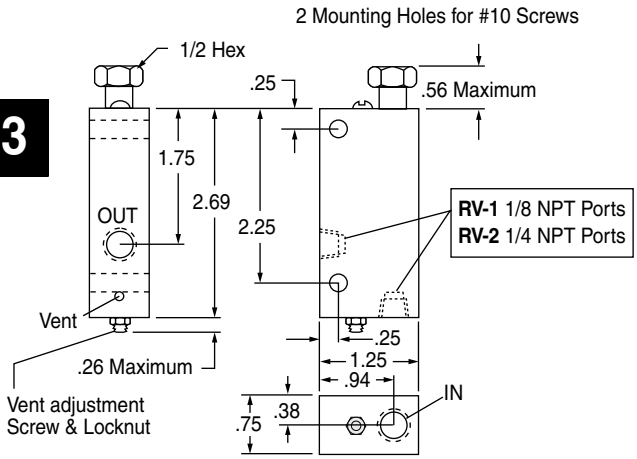
Features

- Simple - One moving part
- Corrosion resistant construction
- Black anodized aluminium body
- Light weight
- Compact
- Repairable
- Buna-N seals
- Simple adjustment
- Operating temperature 0° to + 180°F

Operating pressure: 20 to 150 psi
Standard Spring: 50 to 150 psi
Light Spring: 20 to 55 psi

Light spring and instructions included with each unit.

Dimensions



"RV" Valve Function

The "RV", with its unique poppet type seal, senses the pressure being applied and opens at a pre-adjusted point to provide a pilot signal for circuit control. Because the output force of a cylinder is a direct function of pressure times area, the "RV" provides direct and precision adjustable force sensing.

If the application requires that a predetermined force be applied to an object at a point that may vary in physical dimension (such as riveting, crimping, etc.) the "RV" is the control to use. It assures that the predetermined force (pressure) is applied. If the system pressure should drop below the "RV's" set point, the valve cannot open. Therefore the cycle will stop and wait for the required pressure rather than produce an unacceptable rivet or crimp. When the required pressure is restored the cycle will continue.

If the application requires that a particular physical point is reached by the cylinder then a position sensor, such as a limit valve, Hall Effect sensor, Reed Switch, limit switch, or other device should be used.

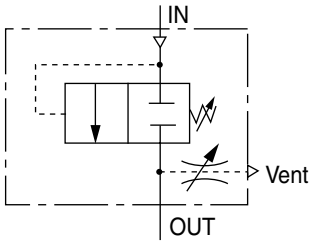
Pressure Sensing (See circuit on page 13.4) Accurately senses pressure (force) and provides a control signal to retract cylinder.
Applications: Riveting, crimping, marking, staking, molding and more.

Sequencing (See circuit on page 13.4) The pressure rise in a cylinder indicates that it is applying the force intended. When the pressure preset into the "RV" is reached, it produces a signal for the control circuit to initiate the next function, thus the next sequence.
Applications: Step by step extension and retraction of multiple cylinders.

Time delay or Function delay (See circuit on page 13.4) Coupled with a flow control & volume chamber, the "RV" provides time or function delay.
Applications: Heat sealing, gluing, compacting, time between functions, load or unload time, and many others.

Please note the following:
- This valve is intended for control circuit signals only and **CANNOT** operate a cylinder directly.
- For most consistent accuracy, the "RV" set-point should be at 90% to 95% of incoming system pressure.
- For accurate circuit setup, pressure gages should be installed to monitor incoming circuit pressure and indicate "sensed" pressure. See circuits on page 13.4.

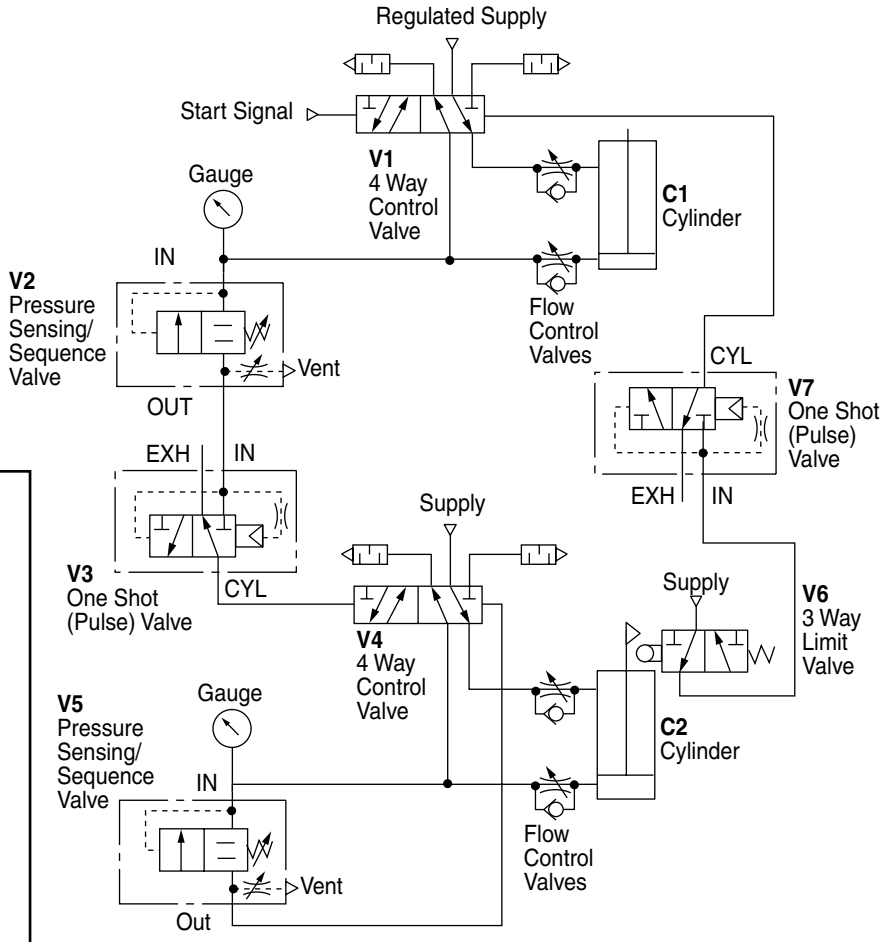
Symbol



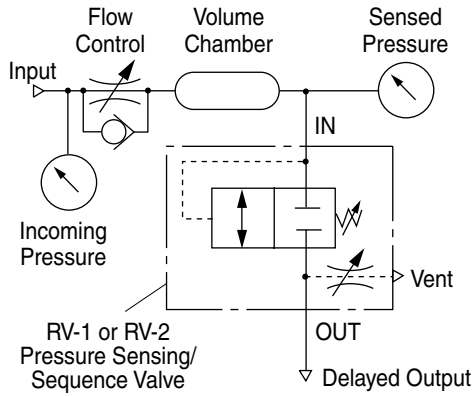
The basic "RV" valve function is two way normally closed. When the input is removed the spring automatically closes the valve, trapping downstream or output pressure. A vent is incorporated in the valve to relieve this trapped signal. The vent is adjustable so that it can be set for various pilot volumes and cycle times. Basic procedure for setting adjustment is to close the vent (turn adjustment screw clockwise), then open 1/4 to 1/2 turn. Fine tuning can then be made from that point.

Sequencing Circuit

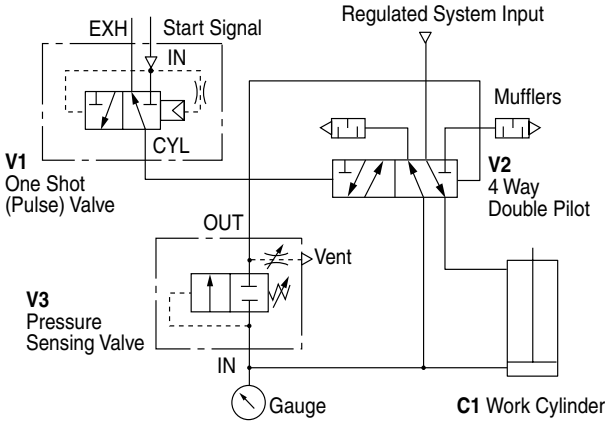
1. Start signal to **V1**
2. **C1** - extends to load
3. Load pressure from **C1** to **V2**
4. Constant signal from **V2** to **V3**
5. Pulse signal from **V3** to **V4**
6. **C2** extends to load
7. Load pressure from **C2** to **V5**
8. Signal from **V5** to **V4**
9. **C2** retracts to **V6**
10. Constant signal from **V6** to **V7**
11. Pulse signal from **V7** to **V1**
12. **C1** retracts



Time Delay Circuit



Pressure Sensing Circuit



1. Start signal can be maintained or momentary
2. Pulse signal from **V1** to **V2**
3. **C1** extends
4. Load pressure from **C1** to **V3**
5. Signal from **V3** to **V2**
6. **C1** retracts

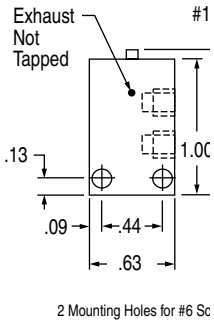
"RV" Valve Function

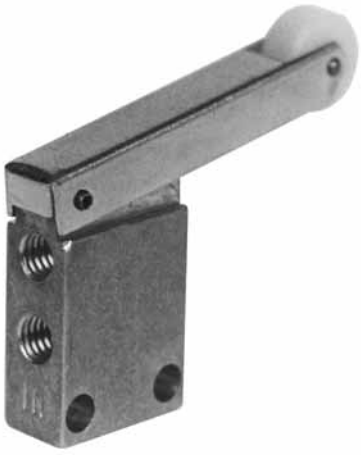
As the cylinders in any circuit move, there is a natural pressure drop or differential between the incoming system supply and the cylinder where the "RV" is sensing the pressure. When the cylinder meets its load it slows or stops. Air flow then becomes slow or static and the pressure rises to the "RV" setting. An output signal is then produced by the "RV". This pressure change (differential) between the dynamic or moving pressure and the static or stopped pressure is a natural function of the cycle and is ESSENTIAL for proper "RV" function. If the load is a constant high load throughout the stroke, or speed controls are closed down causing a consistent high load, the "RV" may see "set point" pressure before the cylinder has done its final work. This results in a premature signal. Therefore, it is highly recommended that a gage be mounted in the "RV" line (as indicated in the circuit) so that the differential or lack thereof can be seen as well as the actual "set point" of the "RV" for cylinder force actuation.

The basic "RV" valve function is two way normally closed. When the input is removed the spring automatically closes the valve, trapping downstream or output pressure. A vent is incorporated in the valve to relieve this trapped signal. That vent is adjustable so that it can be set for various pilot volumes and cycle times. Basic procedure for setting the adjustment is to close the vent (turn adjustment screw clockwise), then open 1/4 to 1/2 turn. Fine tuning can then be made from that point.

Please note that when applying these products or circuit concepts, all safety features that the equipment may warrant should be included and are the responsibility of the user.

13



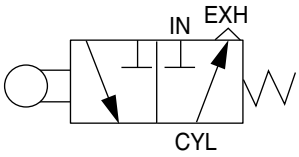


MSV-1 Stem Actuator **MSV-2 Lever Actuator** **MSV-2A Roller Actuator**

Micro Limit Valves

This is a microsize, poppet type, 3 way, normally closed, limit valve. It is primarily designed for momentary contact work that requires very light actuating forces. Therefore, is does not have a 100% seal on the actuating stem. This means that, while the valve is held actuated (and only then), there is a slight bleed to atmosphere around the stem.

Symbol



Features

- Machined brass bar stock body
- Brass internal parts
- Buna-N O'Ring seals (–30° to + 250°F)
- Delrin® roller (180° F max.)
- Plated steel lever arm
- Low operating force
  - Lever or roller: 40 psi – 1 oz.
    100 psi – 2 oz.
  - Stem: 40 psi – 7 oz.
    100 psi – 16 oz.
- Extremely short stroke
  .005" to .010" movement of stem normally provides sufficient pilot volume.
- Operating pressure 30 to 150 psi
- #10-32 ports
- 3 SCFM free flow at 80 psi

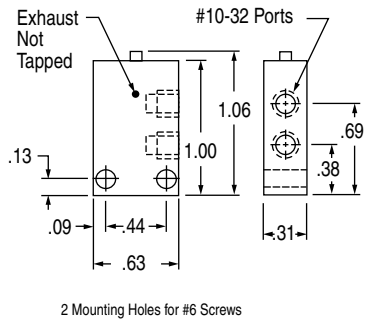
Options

- Viton Seal (–15° to + 400°F); Specify suffix **–V**
- Reverse Lever Assembly; Specify suffix **–R**

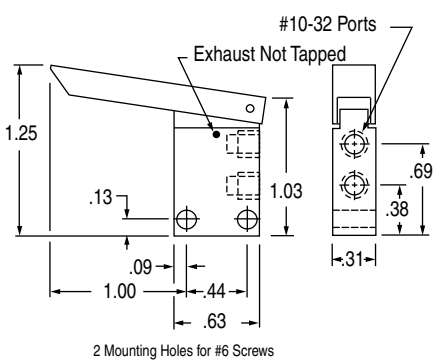
Note

The standard assembly of lever, in relation to ports, is shown in the drawings below. A second lever pivot pin hole allows for the lever to be assembled 180° from standard. Specify ***Suffix-R, Reverse lever assembly***, if required.

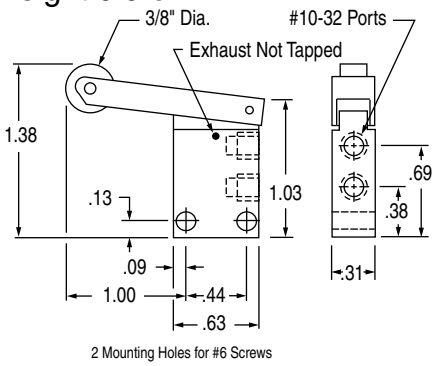
Model No. MSV-1
Stem Actuator
Weight 0.8 oz.



Model No. MSV-2
Lever Actuator
Weight 0.8 oz.

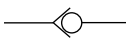


Model No. MSV-2A
Roller Actuator
Weight 0.9 oz.



Check Valves

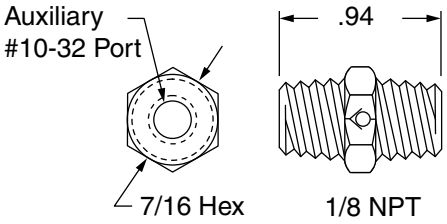
Symbol



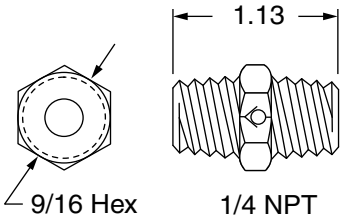
Features
- Machined brass bar stock
- Brass poppet
- Buna-N O'Ring seals (–30° to +250° F)
- Available with or without spring
- Operating pressure: 150 psi max.

Options
- Viton® O-Ring Seals
  (-15° to +400° F); Specify Suffix -V

Model No. **(Cracking Pressure)**
18CV. . . . . (without spring 0.3 psi Max.)
18CVS . . . . . .(with spring 10 psi Max.)
Weight 0.5 oz.
Flow rating Cv = 0.1

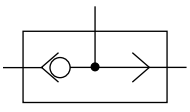


Model No. **(Cracking Pressure)**
14CV. . . . . (without spring 0.3 psi Max.)
14CVS . . . . . .(with spring 10 psi Max.)
Weight 0.8 oz.
Flow rating Cv = 0.4



Shuttle Valves

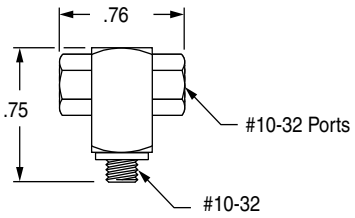
Symbol



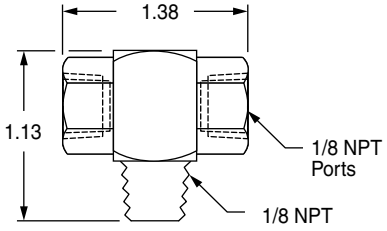
Features
- Machined brass bar stock
- Light weight Delrin® poppet
- Operating temperature: (0° to +180° F)
- Buna-N O'Ring seals
- Operating pressure: 10 to 150 psi

Options
- Viton® O-Ring Seals
  (for media compatibility); Specify Suffix -V

Model No. 10 SV
Weight 0.4 oz.
Flow rating Cv approx. 0.06



Model No. 18 SV
Weight 1.4 oz.
Flow rating Cv approx. 0.34



13

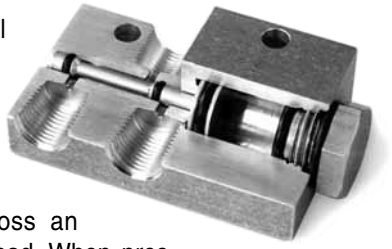
This valve provides a momentary (pulse) output at its cylinder port when pressure is applied at its inlet. No additional flow is possible until pressure at the inlet is removed, reset time allowed, and pressure reapplied. Reset time is slightly longer than output pulse time.

OS-1

Features

- One moving part.
- Buna-N seals.
- Pulse time preset at factory. (See Model Chart)
- Shorter pulse can be field set with ordinary sewing needle.
- Can be cleaned or repaired without removing from installation.
- Spool action can be observed for trouble shooting circuit.
- Operating pressure: 45 to 150 psi.
- Operating temperature: 0° to + 180°F.
- No springs.
- Self-cleaning orifice.

Operation



When the incoming signal is applied to the **IN** port, the spool is immediately shifted, allowing the pressure to and through the **CYL** port, becoming the output signal. Pressure then bleeds across an orifice through the piston head. When pressure is equal on both sides of the piston head there is a force unbalance on the spool. This force unbalance returns the spool to its original position. In this position the incoming signal is blocked and the **CYL** is connected to the **EXH**, in turn venting the output signal.

Before the valve can produce another output signal it must be reset. This is accomplished when the input signal is removed from the **IN** port and the pressure behind the piston bleeds back through the orifice and drops to zero psi. This also self cleans the orifice every cycle. The next incoming signal can then produce another output signal.

NOTE! The incoming signal MUST be of sufficient pressure and volume to shift the spool before bleeding across the orifice and balancing out.

Applications

• ***Signal Conversion - Pulse***, to convert a constant or maintained signal from a limit valve or other source to a pulse or momentary signal for a double piloted valve or other device. This allows the double piloted valve to be shifted back even though the originating limit valve is still held open. See sequencing circuit on page 13.4.

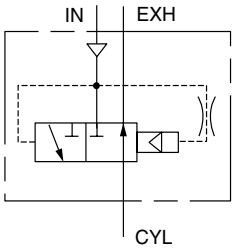
• ***Single Cycle***, to convert a signal from a hand or foot control to a pulse signal. This allows only one cycle of the circuit even if the operator holds the starting device on. The operator must release the starting device to reset the one-shot / pulse valve and then reactuate to achieve the next cycle. See pressure sensing circuit on page 13.4.

• ***Open End Blast***, to provide a pulse of air through a nozzle or tube for automatic part blow off or chip removal.

Sizing

Model Number	Approximate Pulse Time, Seconds @80 psi	Approximate ResetTime, Seconds @80 psi	Port Size	Weight Oz.
OS-1	3/4	1	1/8 NPT	3.1
OS-3	1-1/2	2	1/8 NPT	4.8

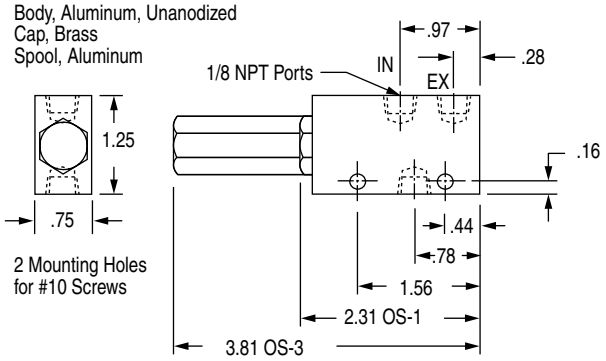
Symbol



Dimensions

Model No. OS-1 & OS-3 1/8 NPT Ports

Materials:
Body, Aluminum, Unanodized
Cap, Brass
Spool, Aluminum



Breather Series MB

MB Series low profile breather vents have many applications. They are most often used on single acting cylinders or valves to prevent dirt and foreign particles from entering ports open to atmosphere.

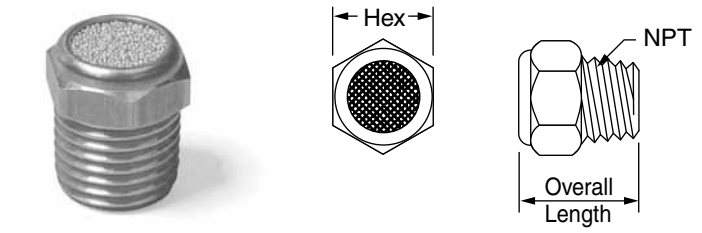
Unit should be mounted in a protected position free from excessive vibration. Use wrench on hex to tighten the vent.

Materials:

Body, Brass
Element, Sintered Bronze, 90 micron.

Operating Ranges:

Pressure: 300 psi max.
Temperature: 35° to 300° F (2° to 149° C)



	MB-18	MB-14	MB-38	MB-12
Connection NPT	1/8	1/4	3/8	1/2
Overall length In.	1/2	11/16	27/32	31/32
Hex In.	7/16	9/16	11/16	7/8

Exhaust Muffler Series MM

MM Series mufflers utilize porous sintered bronze filter elements secured to a brass base. They are used to diffuse air and muffle noise from the exhaust ports of air valves, air cylinders and air tools to an acceptable level.

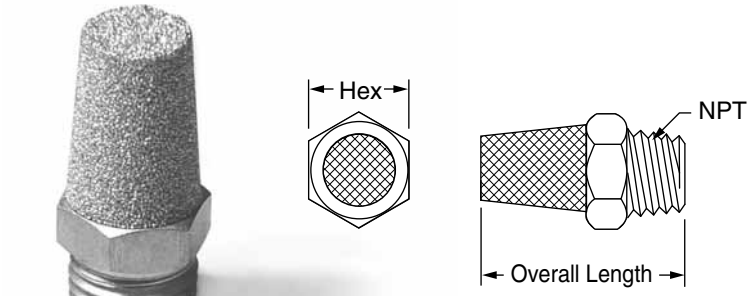
Unit should be mounted in a protected position free from excessive vibration. Use wrench on hex to tighten the muffler.

Materials:

Body, Brass
Element, Sintered Bronze, 40 micron.

Operating Ranges:

Pressure: 300 psi max.
Temperature: 35° to 300° F (2° to 149° C)



	MM-18	MM-14	MM-38	MM-12
Connection NPT	1/8	1/4	3/8	1/2
Overall length In.	29/32	1-5/16	1-9/16	1-7/8
Hex In.	7/16	9/16	11/16	7/8

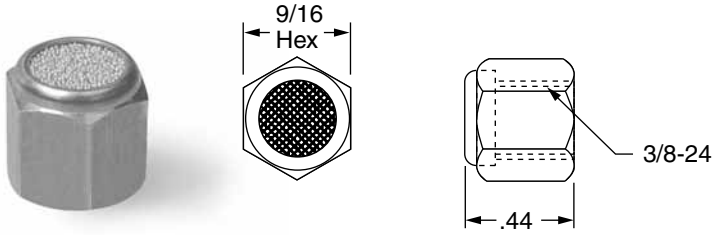
Breather / Muffler for 53 Style Solenoid Exhaust Port

Model SM-10

A breather / muffler specifically designed to replace the housing nut on any 53 Style solenoid operator (except explosion proof, Option -EP) in Section 11 of this catalog. It keeps dirt out and noise down.

Materials:

Body, Brass
Element, sintered bronze, 250 micron.



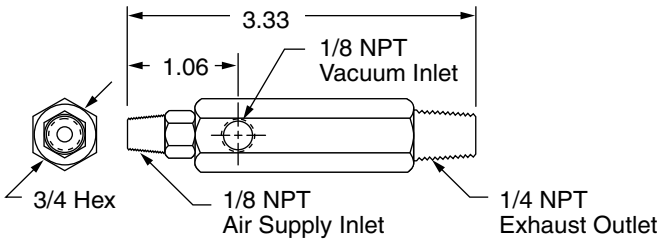
Adds 0.25 to height of solenoid

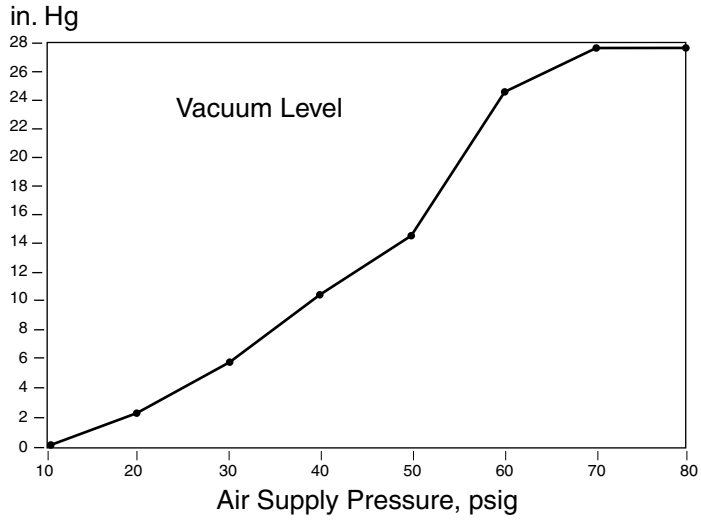
Model VTR-1

Materials: Aluminum, black anodized and Brass

Weight: 2.1 oz.

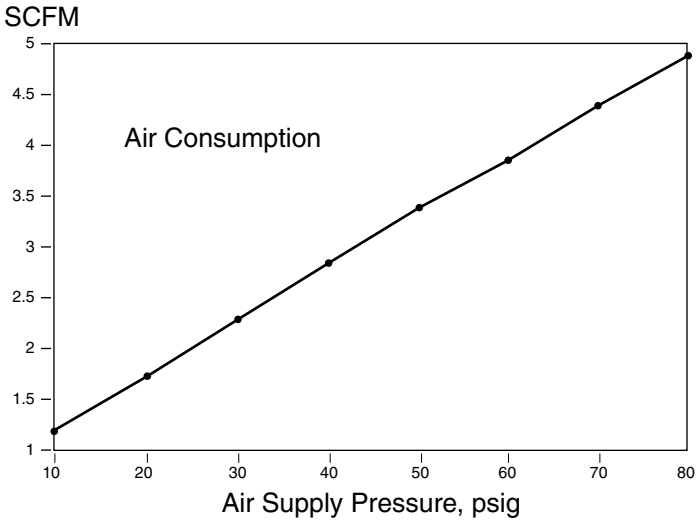
The VTR Vacuum Generator produces high quality vacuum, from shop air, that can be used for applications such as suction cups for parts handling, chamber evacuation, and countless others.





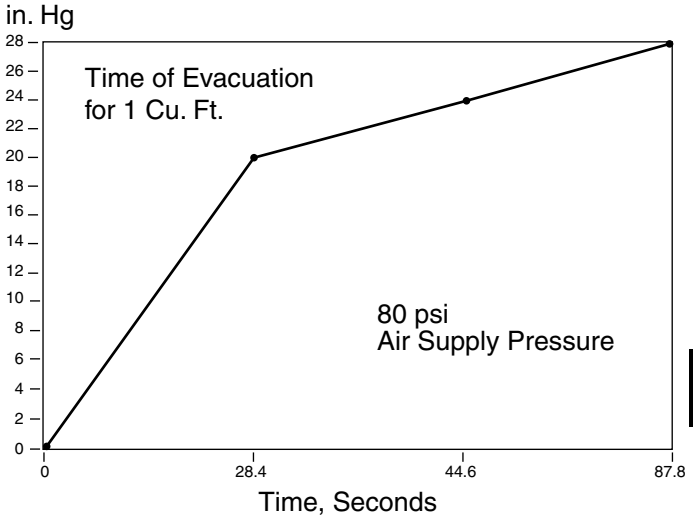
Features & Benefits

- ***Low Cost***
  Simple design results in low cost.
  No moving parts to wear means no maintenance costs.
  No maintenance means no down time costs.
- ***Adjustable***
  Control vacuum level by adjusting air supply pressure.
- ***Compact***
  Allows you to locate the vacuum generator at the point of application for highest efficiency.
- ***Quiet***
  No vanes, pistons or motors.
- ***Safe***
  No moving parts, safe in hazardous atmospheres.
- ***Efficient***
  Air consumption: 4.8 SCFM @ 80 psi inlet.
  Vacuum level: 28 in. Hg @ 80 psi inlet.



Glossary of Terms

- ***Air Consumption***
  The volume of compressed air, per unit time, required to operate the vacuum generator; measured in standard cubic per minute (SCFM).
- ***Air Supply Pressure***
  Pressure of the compressed air at the supply inlet of the vacuum generator; measured in pounds per square inch (psi).
- ***Time of Evacuation***
  The time required to evacuate a given system from atmospheric pressure to a specified negative pressure (vacuum level).
- ***Vacuum***
  Vacuum exists when atmospheric air is removed from a system, resulting in less pressure within the system than the atmospheric pressure outside the system.
- ***Vacuum Flow***
  The rate at which atmospheric air moves out of a system is defined as the vacuum flow rate and is expressed in standard cubic feet per minute (SCFM).
- ***Vacuum Level***
  The level of negative pressure is defined as vacuum level and expressed in inches of Mercury (in. Hg.).



15

The Fabco-Air all-molded DIN solenoid valve connector/gasket/cord assembly offers a completely molded design that is far better for environmental integrity than field wired versions. The integrated gasket design boasts IP67/NEMA 6 rating and makes it impossible to lose the gasket.

How to Order

Part Number ☐ – ☐☐☐ – ☐☐

Connector Type
122 = Mini-DIN
192 = Micro-DIN

Wire Direction
J = 90° style
F = Straight style

Wire Length
6 = 6 foot

Contacts
4 = dual ground (192-J and 192-F only)
0 = ground down (122-J and 122-F only)
1 = ground up (122-J only)

Operating Voltage / Housing
00 = 250VAC 50/60Hz, 300VDC.
No light, black housing.
No suppression.

25 = 6-24 VAC/VDC 50/60 Hz.
Lighted, translucent housing.
Metal oxide varistor (MOV) suppression.

55 = 48-120 VAC/VDC 50/60 Hz,
Lighted, translucent housing.
Metal oxide varistor (MOV) suppression.

85 = 208-240 VAC 50/60 Hz,
Lighted, translucent housing.
Metal oxide varistor (MOV) suppression.

Ordering Examples

192-J64-00
Micro-DIN connector,
90° wire direction,
6 foot wire, dual ground,
250 VAC 50/60Hz, 300VDC,
no light, black housing,
no suppression.

122-F60-25
Mini-DIN connector,
straight wire direction,
6 foot wire, ground down,
6-24 VAC/VDC 50/60 Hz,
lighted, translucent housing,
metal oxide varistor suppression.

Choose From These Available Models

122-F60-00
122-F60-25
122-F60-55
122-F60-85

122-J60-00
122-J60-25
122-J60-55
122-J60-85

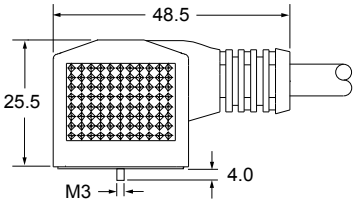
122-J61-00
122-J61-25
122-J61-55
122-J61-85

192-F64-00
192-F64-25
192-F64-55

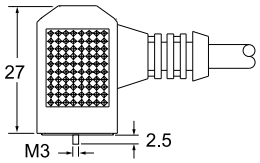
192-J64-00
192-J64-25
192-J64-55

J Style 90° Connectors

Both connector styles have captive stainless steel screw for mounting interface to solenoid valve. Low profile allows use where space is tight. Molded-in gasket is impossible to lose.



122 Type Connector

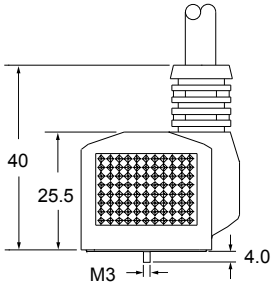


192 Type Connector

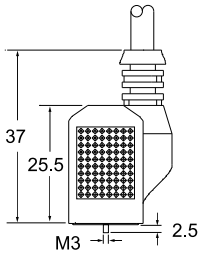
122-J61-00
Shown Left

192-J64-25
Shown Right

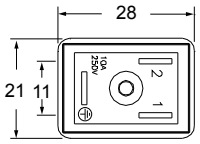
F Style Straight Connectors

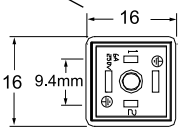


122 Type Connector



192 Type Connector





122 Mini-DIN

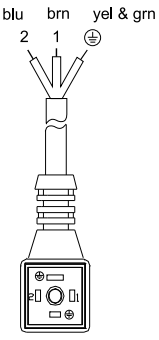
122-F60-55
Shown Left

192 Micro-DIN

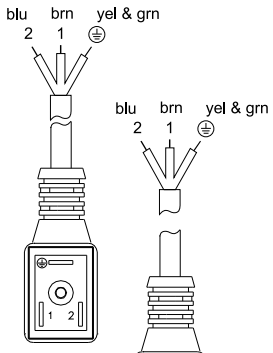
192-F64-00
Shown Right

Wiring Information

Normal polarity: 1 = (+) Positive, Hot
2 = (-) Negative, Neutral
⏚ = Chassis Ground



Ground Up:



Ground Down:

Technical Data

- Cable type: Pressure extruded PVC jacket.
- Cross section of conductor wire:
  18 gauge standard for 122 Mini DIN.
  20 gauge standard for 192 Micro DIN.
- Enclosure material: polyurethane.
- Molded-in gasket material: polyurethane, impossible to lose.
- Ambient temperature:
  –13°F to 176°F (–25°C to 80°C).
- Slight discoloration may occur to translucent housing after prolonged exposure to UV rays.

2 Year Limited Warranty

Subject to the following conditions, FABCO-AIR, Inc., warrants to its immediate purchaser (Purchaser) that at the time of shipment this product is free and clear of all liens and encumbrances, is free from defects in material and workmanship and will conform to samples if the order is based on samples, or to FABCO-AIR's applicable product specifications, or to Purchaser's written specifications to the extent they have been accepted in writing by FABCO-AIR. All products are subject to FABCO-AIR's normal manufacturing and commercial variations and practices. **THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESSED OR IMPLIED BY OPERATION OF LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PURPOSE.** Purchaser's exclusive remedy, and FABCO-AIR's sole liability under this warranty is expressly limited to the correction, replacement or refund of purchase price, at FABCO-AIR's option, of products which are returned freight prepaid, accompanied by proof of purchase and written claim of defect, and which upon inspection by FABCO-AIR and in FABCO-AIR's sole judgement do not comply with this warranty.

All warranties made by FABCO-AIR or imposed on FABCO-AIR by law shall expire two (2) years from date of shipment by FABCO-AIR.

This warranty does not cover and no warranty is made with respect to:

(A) failures not reported to FABCO-AIR within the period specified above;

(B) failure or damage due to misapplication, misuse, abuse, improper storage or handling, abnormal conditions of temperature, water, dirt, corrosive substances or other contaminants;

(C) products which have been repaired with parts or materials not furnished or approved by FABCO-AIR or by anyone other than FABCO-AIR or its authorized representatives or products which have been in any way tampered with or altered; and

(D) products damaged in shipment or storage or otherwise without fault of FABCO-AIR.

Limitations on Liability

FABCO-AIR's total responsibility for any claims, damages, losses or liabilities related to the product covered hereunder shall not exceed the purchase price of such product. In no event shall FABCO-AIR be liable for any special, indirect, incidental or consequential damages of any character, including but not limited to loss of use of productive facilities or equipment, lost profits, property damage, transportation, installation or removal or lost production whether suffered by Purchaser or any third party. FABCO-AIR disclaims all liability for any and all costs, claims, demands, charges, expenses or other damages, either direct or indirect, incident to all property damage arising out of any cause of action based on strict liability. This warranty gives you specific legal rights and you may have other rights which vary from state to state.

WORLD CLASS PERFORMANCE
FABCO-AIR
PNEUMATIC PRODUCTS

FABCO-AIR, Inc. ■ 3716 N.E. 49th Avenue ■ Gainesville, FL 32609-1699
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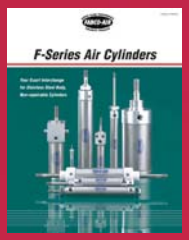
■ Web Site http://www.fabco-air.com

Fabco-Air Product Catalog Library

New Linear Thrusters Bulletin GB-JA02
Features longer strokes to 10" – and 4mm round profile sensors with surge suppression and polarity protection.

Linear Slides Catalog LS-03
Line includes 6 families of slides, pick & place units, and thin parts placers. 5/16" to 4" bores. Guide shafts 1/4" to 1-1/2".

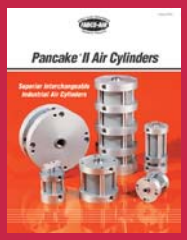
Pneumatic Grippers Catalog GR-8
SPG & LPG parallel jaw motion with strokes from 1/4" to 24" & forces to 402 lbs. GR & GS angular jaw styles with on-the-fly adjustment.



Stainless Steel Body Air Cylinders Catalog SSB-03
Exact interchange in bores from 5/16" to 3", strokes to 32". Popular options includes magnetic piston, non-rotating, and position feedback.

Multi-Power® Air Presses Catalog FP16
Details the powerful line of precision, force-multiplying air presses. Deliver forces to 11,000 pounds.

Swing Clamps Bulletin #SC-DB04
Clamp arm rotates 90° as it extends away from the workpiece. Features standard magnetic piston.



Pancake® II Cylinders Catalog Pan2-2
The direct industrial interchange. High strength composite cylinder barrel. 4 popular styles: Standard, Nonrotating, Multi-Power® and 3-position.

Square Pancake® II Catalog SqPan2
Drop-in interchangeable standard & non-rotating models. 3/4" to 4" bores. Strokes to 4". High strength composite barrel, hard chrome plated piston rod and more.

Stopper Cylinders Bulletin #ST-DIX04
Standard magnetic piston and a wide selection of styles. Roller direction is adjustable. Magnetic sensors can be mounted on body.

NFPA Interchangeable Air Cylinders Catalog NF-6
All the desirable NFPA mounts. Bores from 1-1/2" to 6"; strokes to 99". Aluminum or high strength composite cylinder body. Magnetic position sensing.

Dual Function Slides Bulletin EDF-10
Either of two slide styles (gantry or thruster) can be made from a single set of parts. Users can inventory less parts and assemble styles as needed.

Specialty Valves and Control Valves Bulletin #14CAN
• Composite body solenoid valves in 2 or 3-way, N/O or N/C, and manifoldable configurations. Process Solenoid valves. 5 Ported, 3 position, 1/4 NPT 4-way air valves.

Global Series™ Air Cylinders Cat. GC-15
Widest choice of models and options. Features non-lube service to 150 psi. Bores 12mm to 100mm. Strokes 5mm to 150mm. NPT or Metric ports. Metric or inch rod thread and mounting.

Air Preparation - FRLs Catalog FRL-06
Broad line with port sizes from 1/8 NPT to 1 NPT includes new 3-way slide valves. Modular assembly. New 3-way lock out/tag out valves for safe equipment maintenance.

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