

FABCO-AIR

Cylinders, Valves, & Accessories



Mini-Pancake®
Pancake®
The Pancake Line®
Pancaked®
Pancaked Pneumatics®
Multi-Power®
Square 1®
Dial-A-Stroke®

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Hi-Power™
Micro-Fine™
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Hexless™
Pneu-Grip™
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Specials

Pancake® Cylinders

Square 1® Cylinders

Longstroke™ Cylinders

Hi-Power™ Cylinders

Multi-Power® Cylinders

Multi-Power® Boosters

Multi-Power® Air Presses
 See Catalog #FP-16

Piston Position Sensors – now included
 within each cylinder section

Air-Oil Tanks

Pneu-Grip™ Grippers
 See Catalog #GR-8

Directional Control Valves

Needle & Flow Control Valves

Special Purpose Valves

Breathers and Mufflers

Vacuum Generators

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Specials...

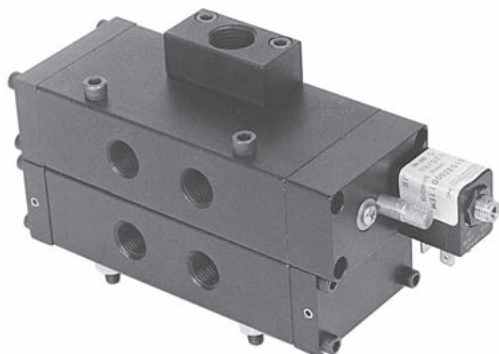
Consider asking Fabco-Air for a modified or special product to meet your necessary and specific requirements. Fabco-Air has the willingness, years of experience, manpower and equipment available to design, adapt, modify and produce in any quantity, existing or new products to meet your job requirements 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.



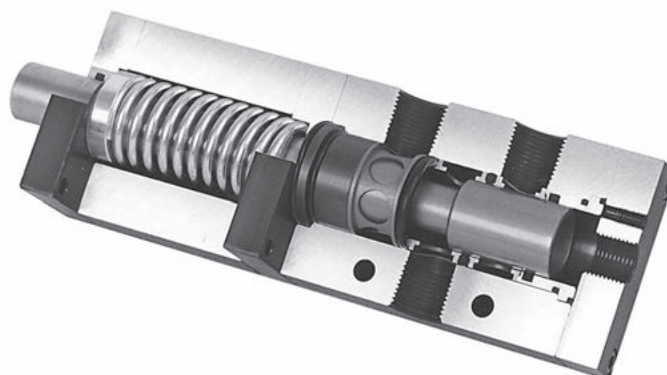
Pancake®

- Rear tapped mount with extension hub



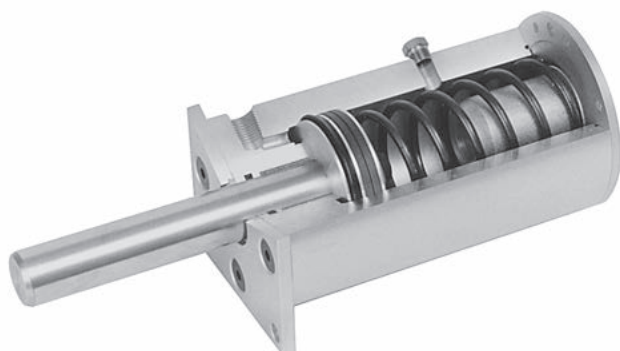
1/2 NPT Valve Stack

- Manifolder inlet into both valves
- One solenoid controlled valve with internal orificing to pilot operate second valve



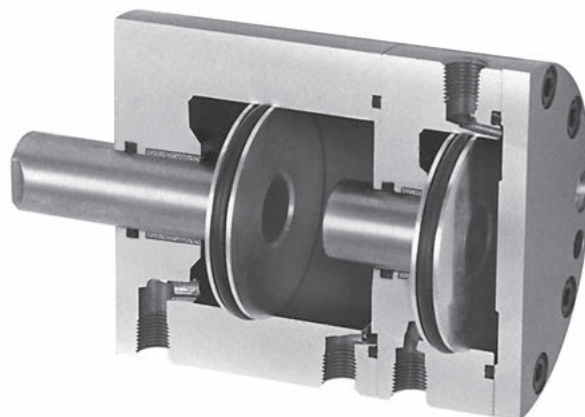
1/2 NPT Valve

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



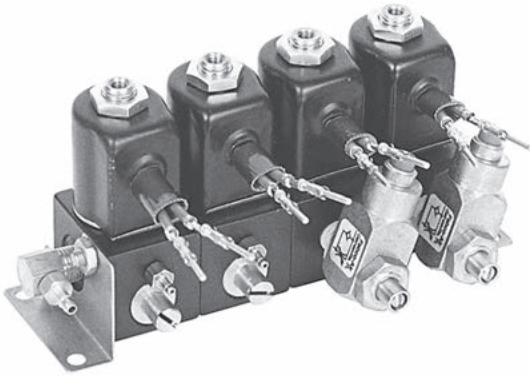
Pancake®

- Heavy spring extend
- Front flange mount



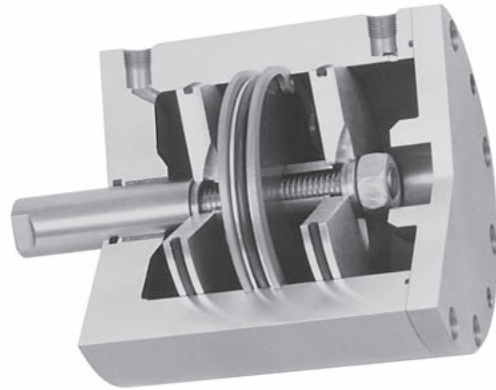
Pancake®

- 3 position



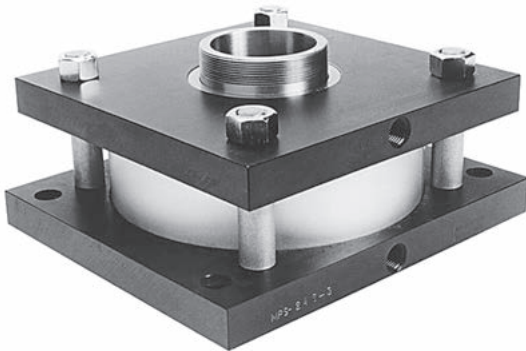
Modular Valve Bank

- Stacked with mounting brackets ■ Swivel flow controls
- Fittings ■ Wire terminals ■ Wire insulation installed



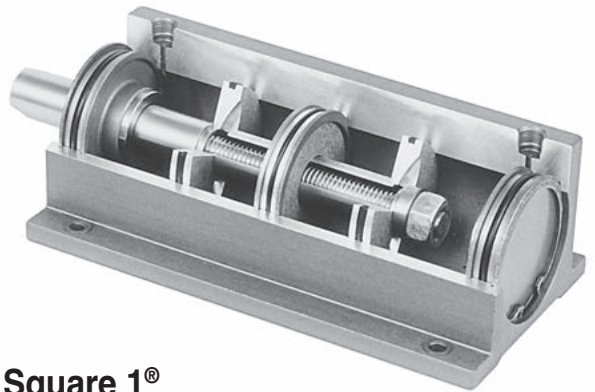
Pancake®

- 2 stage **Multi-Power®** principle



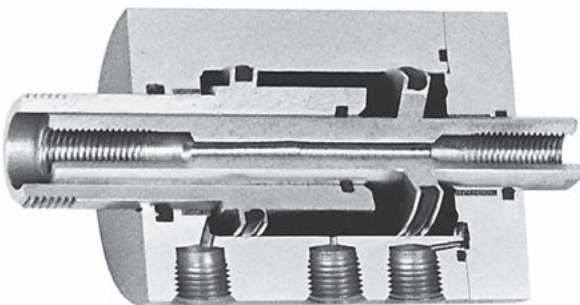
Hi-Power™

- Double rod ■ oversized rods
- Oversized hole through



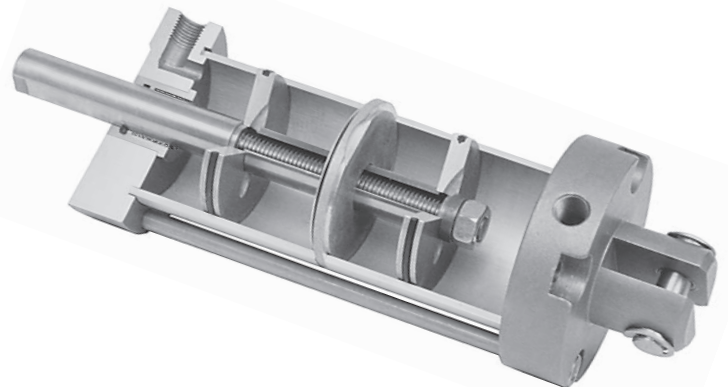
Square 1®

- 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

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2 Year Warranty	Inside back cover



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



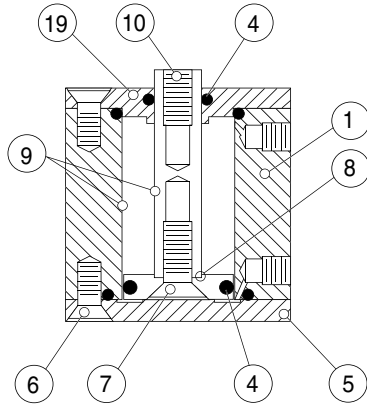
Laboratory tests confirm that internally lubricated Buna-N O-ring seals have extended Pancake® cylinder life 2 to 3 times beyond that of cylinders using standard Buna-N seals.

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"	

Original Series

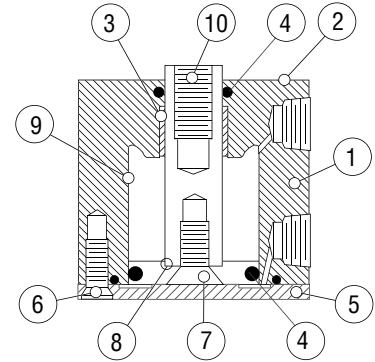
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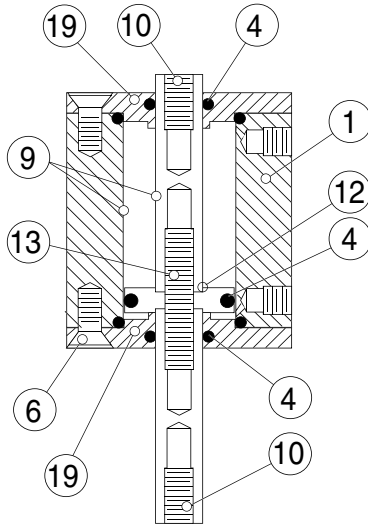
Single Rod – Double Acting
Action - X
1/2" & 3/4" Bores



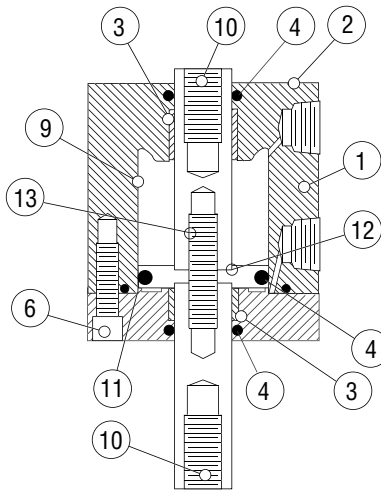
Single Rod - Double Acting
Action -X shown



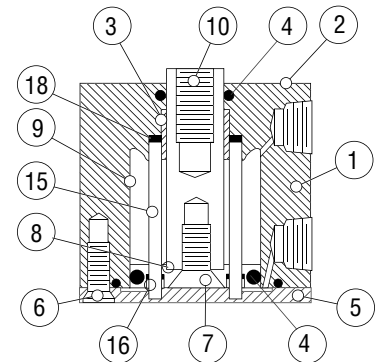
Single Rod – Double Acting
Action - X



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

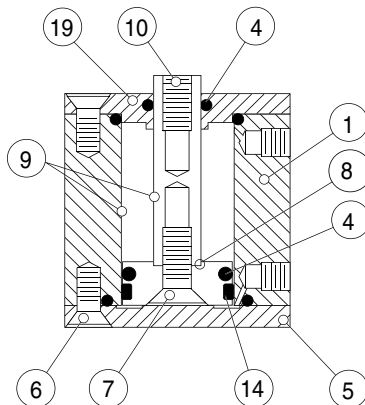


Double Rod – Double Acting
Action - XDR

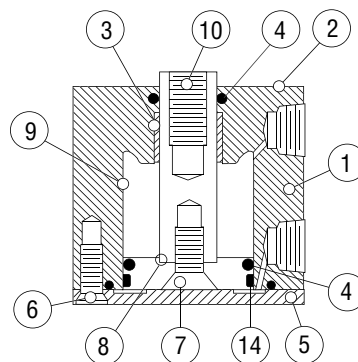


Single Rod – Double Acting –
Nonrotating
Action - XK

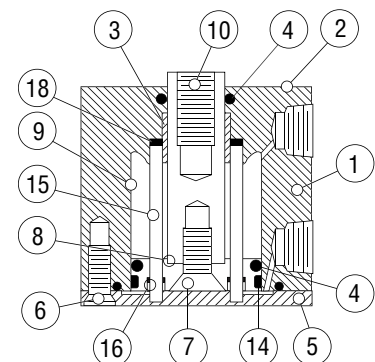
"T" Series (PTFE Piston Bearing)



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 stick-slip, 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, sand-wiching 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.

1

Original Series

"T" Series PTFE Piston Bearing

NFPA Symbol

Action Letter Action Description

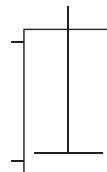
C-221-X

TC-221-X

Action -X

Single Rod
Double Acting

One Piston Rod
Power Extend - Power Retract



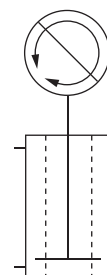
C-221-XK

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



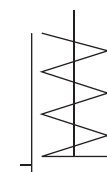
C-221-O

TC-221-O

Action -O

Single Rod
Single Acting - Spring Retracted

One Piston Rod
Power Extend - Spring Retract



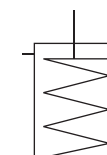
C-221-OP

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

C-221-XDR

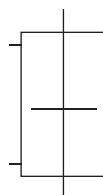


"T" Series PTFE Piston Bearing

The "T" Series is not required in the double rod version.

Two rod bushings provide superb rod support

NFPA Symbol



Action Letter Action Description

Action -XDR

Double Rod
Double Acting

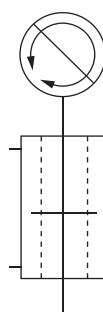
Two Piston Rods - One each end
Power Extend - Power Retract

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

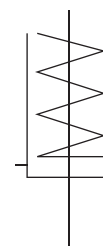
Two Piston Rods - One each end
Power Extend - Power Retract
Piston guide pins for nonrotating

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

PREFIX OPTIONS

PREFIX OPTIONS

1

MODEL NUMBER

PREFIX

METRIC Cylinder and Rod Thread. **M**
Female Rod Thread is standard.

Optional Male Rod Thread
add suffix **-MR**

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.

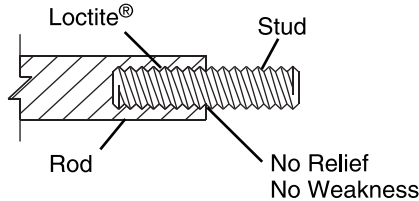
See *Option Specifications* pages of desired bore and action for complete dimensional details.

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.

SUFFIX OPTIONS

MODEL NUMBER **SUFFIX**

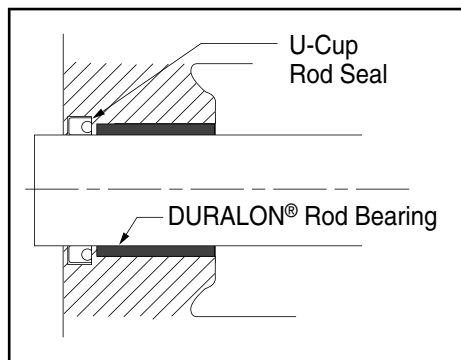
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HYDRAULIC, Low Pressure Service
to 500 psi NONSHOCK.
Temperature to +300° F max.

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.

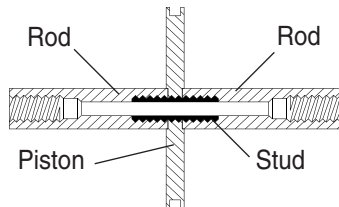
Available on all series, bores 1-5/8" (221) & larger, all strokes, all actions.

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.

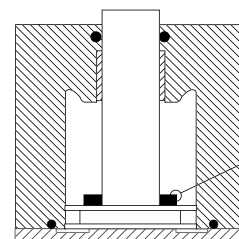
- | | | |
|---|------|------------|
| 1) Start with the next longest stroke. | 1/8" | -C1 |
| | 1/4" | -C2 |
| 2) Select the amount the stroke is to be shortened. | 3/8" | -C3 |
| | 1/2" | -C4 |
| | 5/8" | -C5 |
| 3) Specify the corresponding <u>SUFFIX</u> designation. | 3/4" | -C6 |
| | 7/8" | -C7 |

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 $\pm 1/64"$. 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.



Stroke Collar

SUFFIX OPTIONS

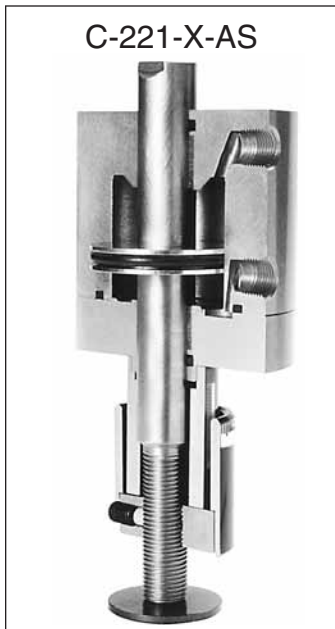
MODEL NUMBER **SUFFIX**

1

ADJUSTABLE EXTEND STROKE

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

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



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

SUFFIX OPTIONS

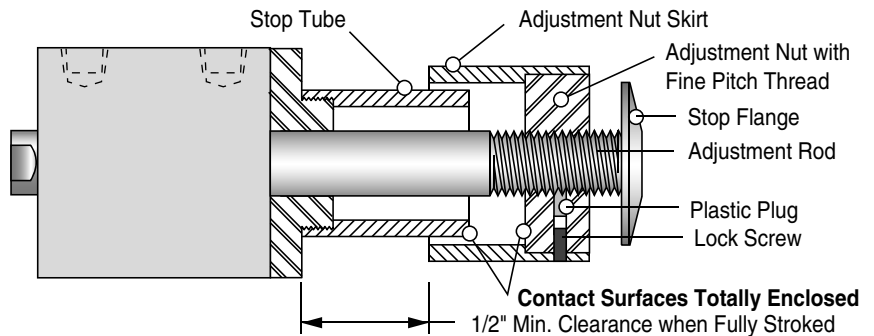
Dial-A-Stroke® provides a rugged and precision adjustment of the extend stroke of the cylinder. The stop tube, adjustment nut with skirt & minimum clearances combine to eliminate pinch points, thus providing operator safety. **Note!** Use caution when mounting to avoid creating pinch points with other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

The stop tube is black 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**



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.

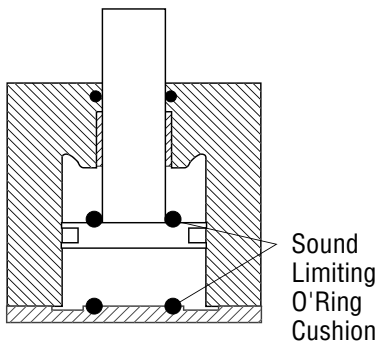
SUFFIX OPTIONS

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.

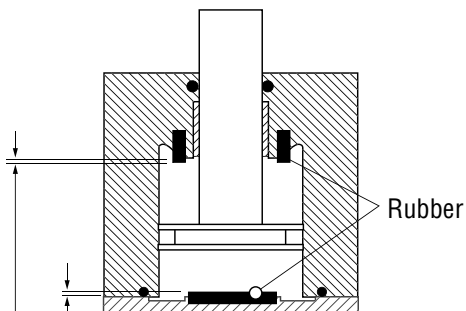
Available on all series, all bores, all strokes, actions -X, -O (Cap end only, -LR), -OP, -XDR, XDRK, -ODR (Cap end only -LR).

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 "CATCH-ING" 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.

SUFFIX OPTIONS

MODEL NUMBER **SUFFIX**

1

CLEVIS (Pivot) MOUNT

Ports in Line with Slot

Ports 90° to Slot

-PM

-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

Ports 90° to Tang

-EPM

-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.

Suffix Option -E

Specifies Magnetic Piston and Dovetail Mounting Slot(s)

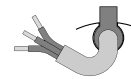
Order Sensors Separately

1

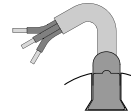


A single slot on longer stroke models has room to accommodate multiple sensors.

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

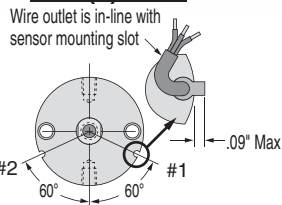


Keyway slot for 1/2" bore Pancakes to fit ø3.8mm style "9B49" sensors. Wire is in-line with slot.



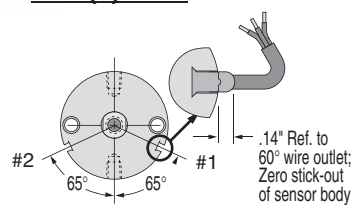
1/4" 60° Dovetail for 3/4" bore Pancake®s & up to fit "949" sensors.

1/2" (5) Bore



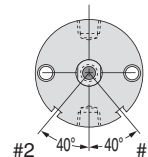
Sensors available for "D" & "TD" strokes and longer. Strokes D-J & TD-TJ have 2 mounting slots; others have 1. Strokes D & TD are ported on opposite sides.

3/4" (7) Bore



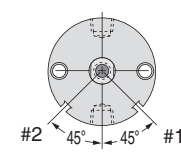
Sensors available for "D" & "TD" strokes and longer. D-J & TD-TJ have 2 mounting slots; others have 1. Strokes D & TD are ported on opposite sides.

1 1/8" (121) Bore



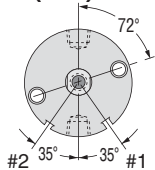
Sensors available for "D" & "TD" strokes and longer. D-F & TD-TF have 2 mounting slots; others have 1. Strokes D & TD are ported on opposite sides.

1 5/8" (221) Bore



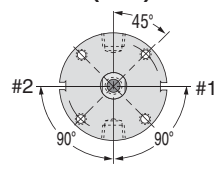
Sensors available for "A" & "TB" strokes and longer. A-D & TB-TD have 2 mounting slots; others have 1. Strokes A is ported on opposite sides.

2" (321) Bore



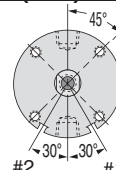
Sensors available for "AA" & "TA" strokes and longer. AA-D & TA-TD have 2 mounting slots; others have 1. Strokes AA-A & TA are ported on opposite sides.

2 1/2" (521) Bore



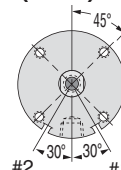
Sensors available for "AA" & "TA" strokes and longer. AA-C & TA-TC have 2 mounting slots; others have 1. Stroke AA is ported on opposite sides.

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

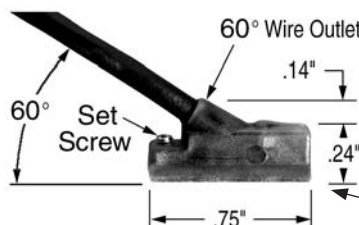


Sensors available for "AB" strokes and longer. AB-A & TAA-TA have 2 mounting slots; others have 1.

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

Sensor housing rated NEMA 6/IP67. Encased in plastic housing, dovetail style sensors are corrosion resistant. 60° wire outlet allows close mounting.

1/4" 60° Dovetail shown here.

Ordering Guide – Magnetic Sensors for Pancake® Cylinders

Model	Cylinder Model	Sensor Type	Prewired 9 ft. Part No.	Quick Disconnect Part No.*	LED	Electrical Characteristics
ø3.8mm	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
1/4" 60° Dovetail	All other Pancakes	Electronic	949-000-031	949-000-331	Yes	Sourcing, PNP, 5-28 VDC, 0.20 Amp Max current, 1.0 Voltage Drop
	All other Pancakes	Electronic	949-000-032	949-000-332	Yes	Sinking, NPN, 5-28 VDC, 0.20 Amp Max current, 1.0 Voltage Drop

Note: 1/2" bore quick disconnect style supplied with 19" pigtail. All other bores supplied with 6" pigtail. Order female cordsets separately.

Specials

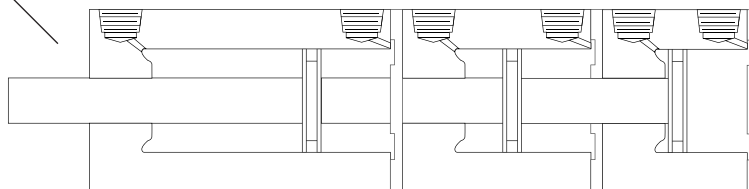
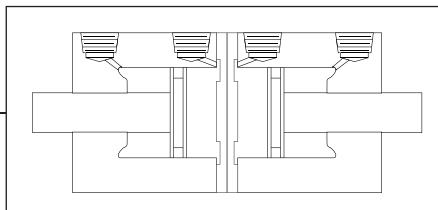
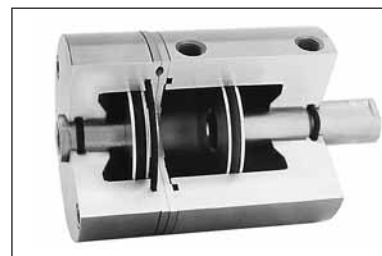
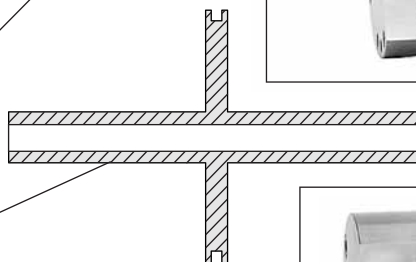
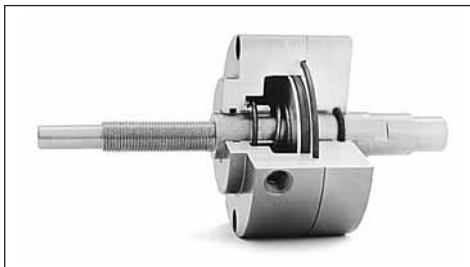
1

Let us help you!

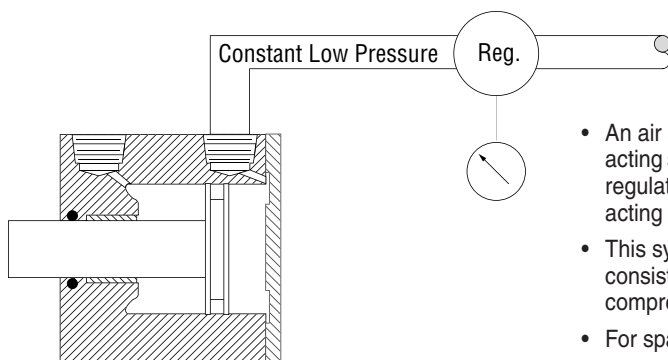
Our engineering and special products departments are willing and able to assist you with your design. FABCO-AIR will produce cylinders and valves to meet your specific application requirements. In quantities of one and up. We have been doing it for almost 40 years. Many of our specials have become custom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

1



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.

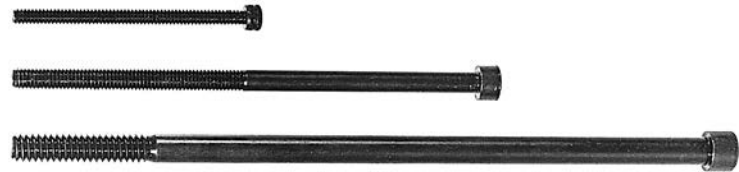
Position Sensors

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.

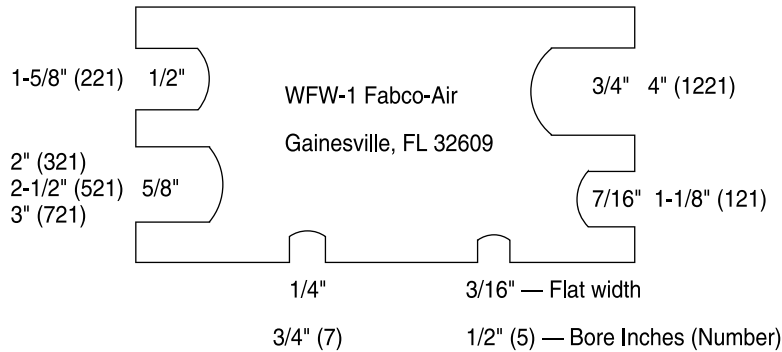


SIZE	LENGTH (Inches)															
	1/2	3/4	1	1-1/4	1-1/2	1-3/4	2	2-1/4	2-1/2	2-3/4	3	3-1/2	4	4-1/2	5	6
#6-32		✓	✓		✓	✓	✓									
#8-32	✓	✓	✓													
#10-32		✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
1/4-20			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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

Leave blank if none desired

Metric M
See pages 1.7, 1.19 & 1.22

Stroke

TE

Bore

5

Action

X

MR

Standard Strokes			
Original Series			
Action	X	O	OP
Stroke	XDR	ODR	OP
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	X	O	OP
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

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) -E
Order sensors separately. See page 1.14
Stroke length determines number of mounting slots. See page 1.14, 1.20, 1.21.

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.

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 1/4" ----- 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

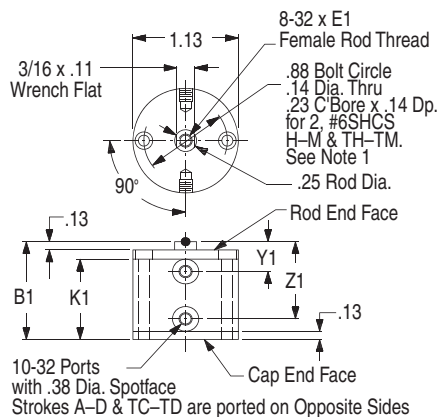
A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – <http://www.fabco-air.com>

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 Stroke, Letter	1/16	1/8	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2	3	4	1/8	1/4	3/8	1/2	5/8	1	1 1/4	1 1/2	2	3	4		
	A	B	C	D	E	F	G	H	I	J	K	L	M	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM		
	Action -X				Double Acting									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	.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	.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	.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	.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	.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	.08	.09	.11	.12	.13	.16	.19	.21	.27	.36	.46		

"T" Series

1/8	1/4	3/8	1/2	5/8	1	1 1/4	1 1/2	2	3	4
TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM
Action -X					Double Acting					
.96	1.08	1.21	1.36	1.49	1.83	2.08	2.33	2.96	3.96	4.96
.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38
.69	.81	.94	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
.46	.46	.46	.46	.46	.46	.46	.46	.55	.55	.55
.65	.77	.89	1.05	1.18	1.52	1.77	2.02	2.65	3.65	4.65
.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
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	5.3

Action	—O	Single Acting, Spring Retracted
--------	----	---------------------------------

1.08	1.36	1.49	1.83	2.33	2.96	2.96	3.96	3.96	NA*	NA*
.38	.38	.38	.38	.38	.38	.38	.38	.38	"	"
.81	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	"	"
.46	.46	.46	.46	.46	.55	.55	.55	.55	"	"
.77	1.05	1.18	1.52	2.02	2.65	2.65	3.65	3.65	"	"
.08	.09	.10	.12	.13	.16	.22	.28	.28	"	"
2.8	2.0	1.2	1.9	1.9	1.0	1.7	1.3	1.3	"	"
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	.95	1.16	1.39	1.80	2.05	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	"	"	"	"	"

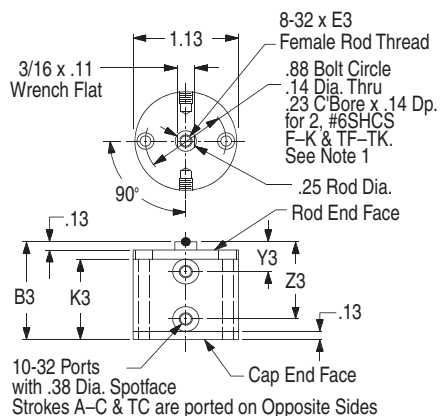
Action	-OP	Single Acting, Spring Extended
--------	-----	--------------------------------

1.26	1.67	1.92	NA*	NA*	NA*	NA*	NA*	NA*	NA*	NA*
.25	.25	.38	"	"	"	"	"	"	"	"
.88	1.16	1.29	"	"	"	"	"	"	"	"
.58	.70	.83	"	"	"	"	"	"	"	"
.95	1.36	1.61	"	"	"	"	"	"	"	"
.08	.09	.12	"	"	"	"	"	"	"	"
1.7	1.7	.7	"	"	"	"	"	"	"	"
3.0	3.0	3.0	"	"	"	"	"	"	"	"

Action -O
Single Acting
Spring Retracted



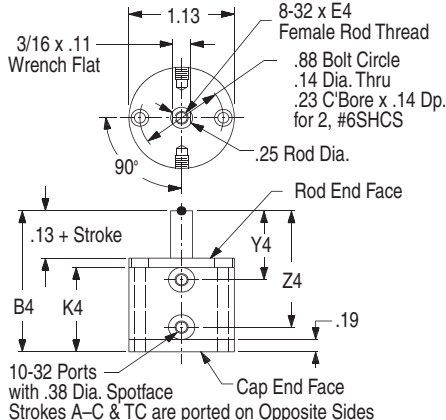
Note 1:
Strokes F-K & TF-TK
have two #6-32 x .44
Tapped Mounting
Holes on each end.
See page 1.16 for
Mounting Bolts.
Push area = .20
See chart for Spring
Forces: Preload and
End of Stroke.
Seal Kits for Series:
Original = 5-SK
"T" = 5-SKG



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

Mounting Holes
3.6mm Diameter Thru
5.9mm C-Bore x 3.6mm Dp.
2 Places for M3 SHCS
Except Strokes H-M &
TH - TM which have
two M4 x 12.0mm Dp.
Tapped Mounting
Holes on each end.

Thread Pitches
M3 = 0.5mm
M4 = 0.7mm
M5 = 0.8mm

22.2mm Bolt Circle
Standard Female Rod Thread M4.
Male Rod Thread Option -MR shown.
M4 x 12.7
M5 Ports with 9.5mm Dia. Spotface
Conversion Factor
Inches x 25.4 = mm

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.

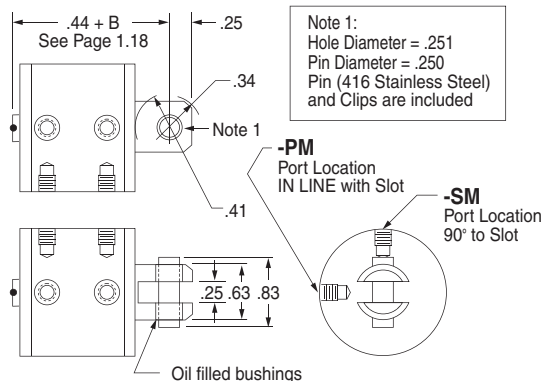
	V	Q	N	C1-C7	BF	BR	BFR
-X	✓	✓	✓	✓	✓	✓	✓
-O	✓	✓	✓	✓	NA	✓	NA
-OP	✓	✓	✓	✓	✓	NA	NA

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.

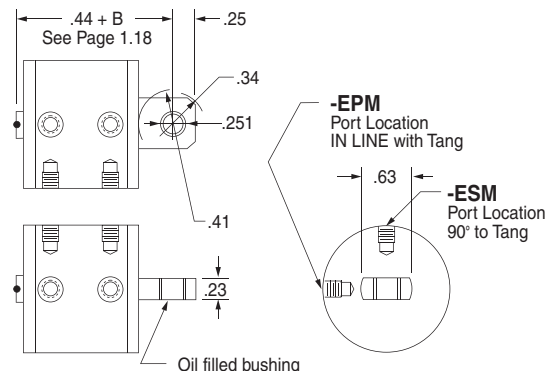


Suffix Options -EPM & -ESM Eye Mount

Available on Original and "T" Series

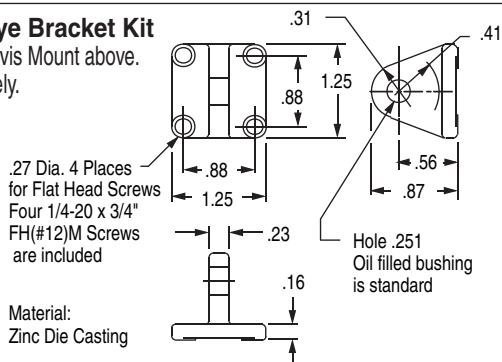
with Actions: -X, -O, -OP

Also see *Option Information* on page 1.13.



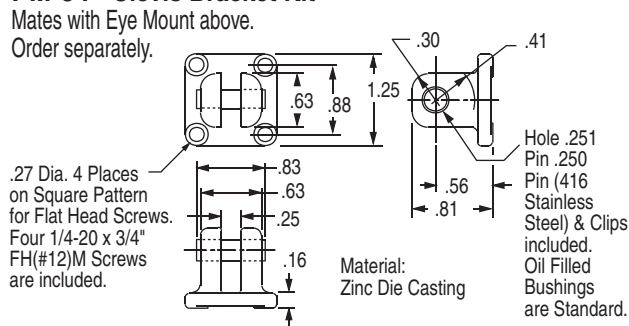
EM-04 Eye Bracket Kit

Mates with Clevis Mount above.
Order separately.



PM-04 Clevis Bracket Kit

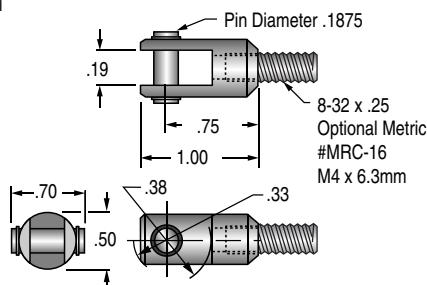
Mates with Eye Mount above.
Order separately.



RC-16 Rod Clevis and Pin

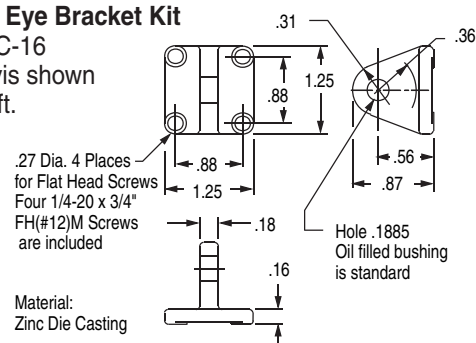
Threaded Stud mates with Female Rod thread in **Pancake®** Cylinders.
Slot & Pin Mate with EM-02 Eye Bracket shown on the right.

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

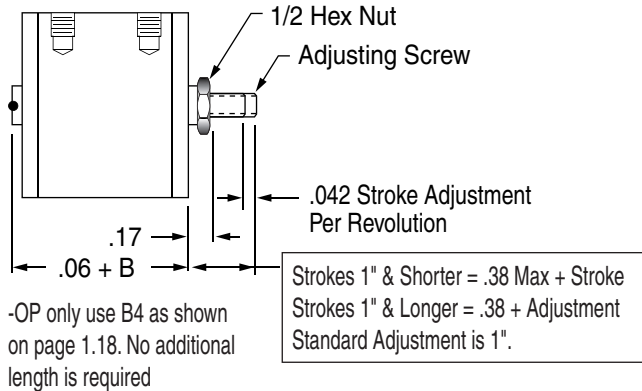


EM-02 Eye Bracket Kit

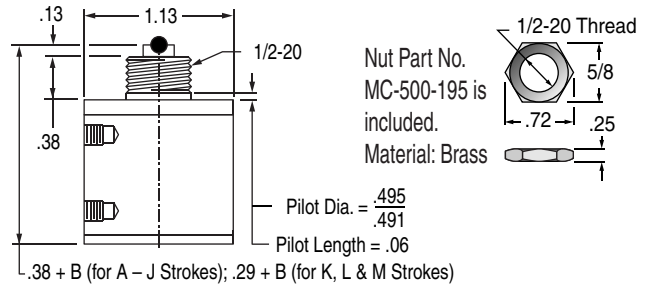
Mates RC-16 Rod Clevis shown on the left.



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

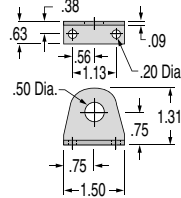


Suffix Option -F Threaded Nose Mount
Available on Original and "T" Series with Actions -X, -O, -OP.
Also see Option Information on page 1.13

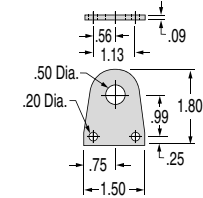


Accessory – Plated steel nose mounting brackets
Must be ordered separately

Angled Part Number **BRK-201**

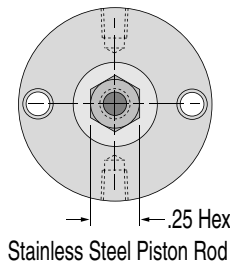


Flat Part Number **BRK-202**



Suffix Option -NR Nonrotating, Single Acting

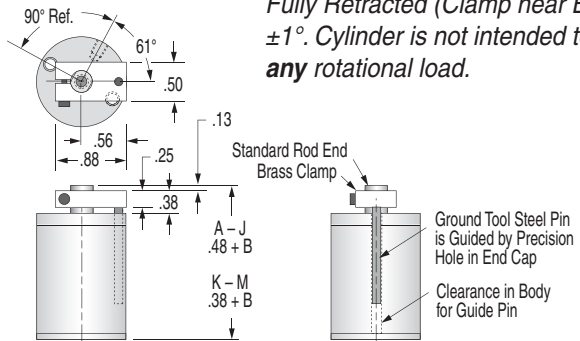
Available on Original and "T" Series with Action -O.
Also see Option Information on page 1.8



Suffix Option -K Nonrotating, Double Acting

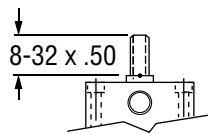
Available on Original and "T" Series with Action -X, -O, -OP.

Rotational Tolerance with Piston Rod Fully Retracted (Clamp near Body) is $\pm 1^\circ$. Cylinder is not intended to carry any rotational load.



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

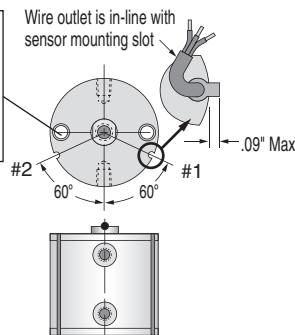
Strokes are NOT affected by Magnetic Piston Option

– 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
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
2-----	K	2-----	TK
3-----	L	3-----	TL
4-----	M	4-----	TM

Sensor Slots at Positions #1 and #2

Sensor Slot at Position #1 only

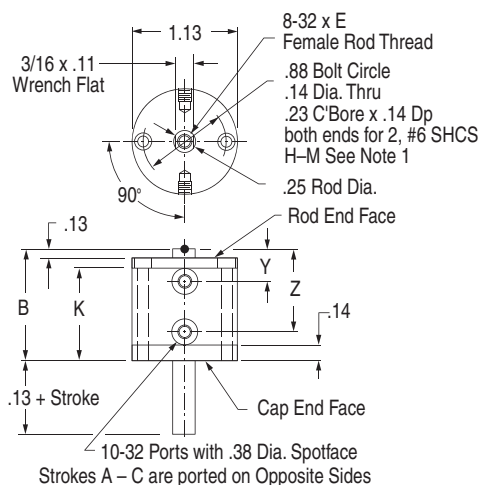
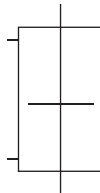
1

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



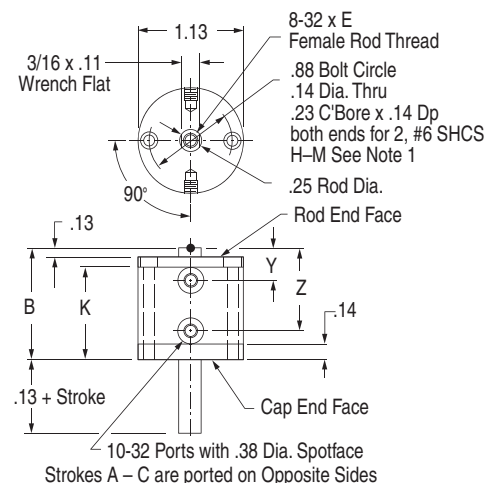
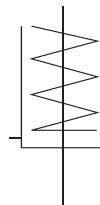
Stroke, Inches	1/16	1/8	1/4	3/8	1/2	5/8	3/4	1	1-1/4	1-1/2	2	3	4
Stroke, Letter	A	B	C	D	E	F	G	H	I	J	K	L	M
B	1.00	1.00	1.13	1.25	1.38	1.50	1.63	1.88	2.13	2.38	2.88	3.88	4.88
E	.25	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38
K	.73	.73	.86	.98	1.11	1.23	1.36	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
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

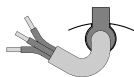


Stroke, Inches	1/16	1/8	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2
Stroke, Letter	A	B	C	D	E	F	G	H	I	J	K
B	1.00	1.13	1.25	1.55	1.67	1.88	2.38	2.88	2.88	3.88	3.88
E	.25	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38
K	.73	.86	.98	1.28	1.40	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Y	.46	.46	.46	.46	.46	.46	.46	.46	.46	.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

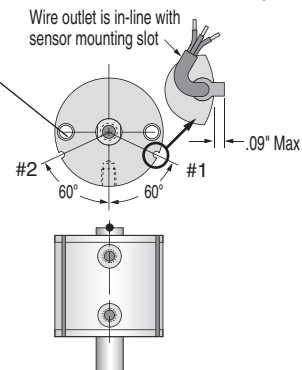
Note:
Alloy steel mounting
bolts may effect sensing.
Stainless steel or other
non-magnetic bolts are
recommended.



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

1/2" (5) Bore

Sensors available for "D" strokes and longer.



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

Available on Original Series

Stroke	Action XDR
3/8-----	D
1/2-----	E
5/8-----	F
3/4-----	G
1-----	H
1 1/4-----	I
1 1/2-----	J
2-----	K
3-----	L
4-----	M

Sensor Slots at
Positions #1
and #2

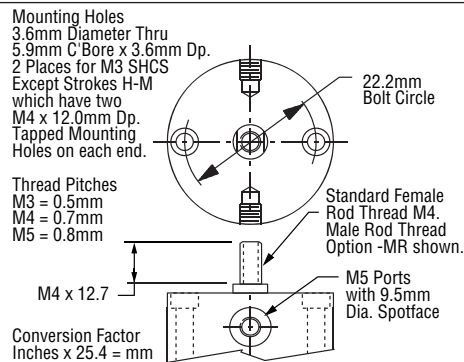
Sensor Slot at
Position #1 only

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

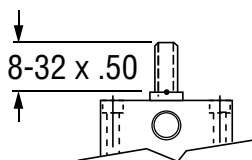
Available on Original Series with Actions -XDR, -ODR.

For Rod End only use -MR

For Cap End only use -MR1

For Both Ends use -MR2

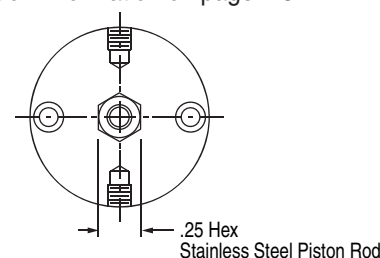
Also see
Option Information
on Page 1.8



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

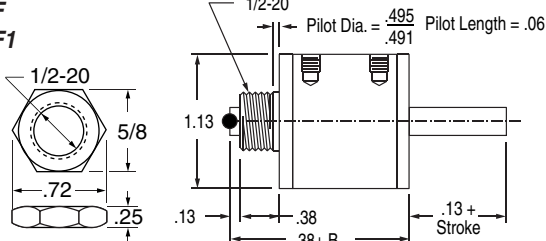
For Cap End only use -F1

For Both Ends use -F2

Nut.

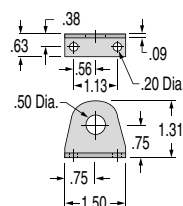
Part No. MC-500-195
is included.

Material: Brass

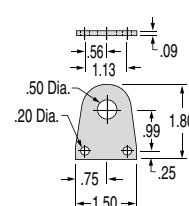


Accessory Nose Mounting Brackets

Order separately – Material Plated Steel



Part No: BRK-201



Part No: BRK-202

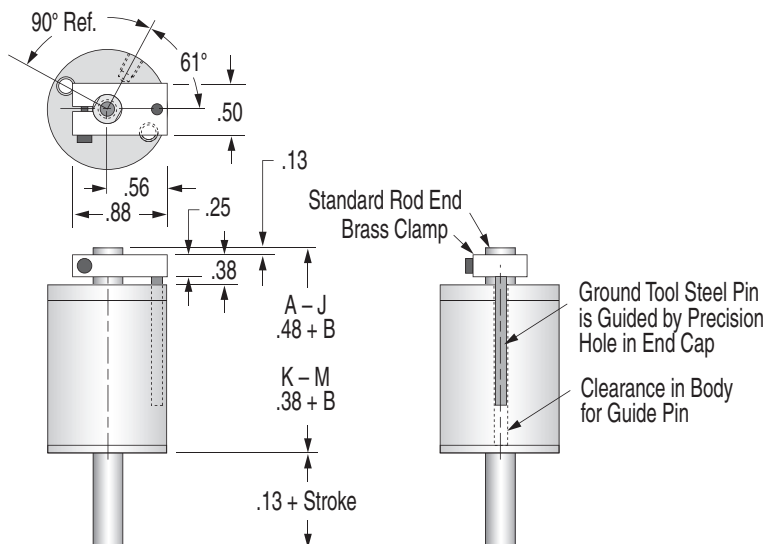
Suffix Option -K Nonrotating, Double Acting

Available on Original Series

with Actions: -XDR, -ODR.

Rotational Tolerance with Piston Rod
Fully Retracted (Clamp near Body) is $\pm 1^\circ$.

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



1

Model Number Code

Leave blank if none desired

TE

Bore

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	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 –XK
150 psi max
Single acting, spring retracted –O
Single acting, spring extended –OP

Double rod

Double acting –XDR
Double acting, Nonrotating –XDRK
150 psi max
Single acting, spring retracted –ODR

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

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 –O6

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) –E
Order sensors separately. See page 1.14.
Stroke length determines number of mounting slots. See page 1.14, 1.26, or 1.28.

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.

HOW TO ORDER

- Under **Stroke** – select letter(s) for desired Series and Stroke.
- 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 1/2"	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

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

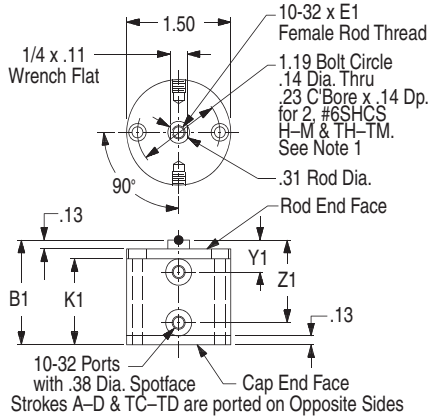
"T" Series, 3/8" Stroke - 3/4" Bore - Single Rod, Double Acting - Male Rod Thread

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.

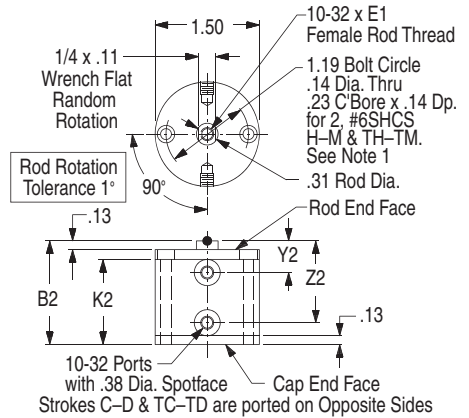
See page 1.16 for
Mounting Bolts.
Push area = .44
Pull area = .36
Seal Kits for Series:
Original = 7-SK
"T" = 7-SKG



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



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	1/8	1/4	3/8	1/2	5/8	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	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM
Action -X Double Acting														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	.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	.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	.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	.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	.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	.15	.17	.20	.21	.23	.28	.32	.36	.46	.63	.78

Stroke, Inch	1/8	1/4	3/8	1/2	5/8	1	1 1/4	1 1/2	2	3	4	B2	E2	K2	Y2	Z2	Weight, lb.
Stroke, Letter	C	D	E	F	G	H	I	J	K	L	M						
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	.46	.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						

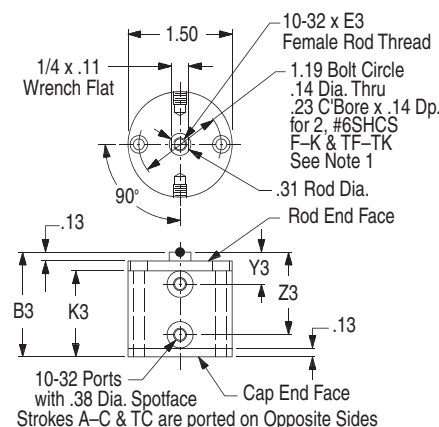
Use Strokes & Dimensions under
"T" Series Action -XK Double Acting

Stroke, Inch	1/8	1/4	3/8	1/2	5/8	1	1 1/4	1 1/2	2	3	4	B3	E3	K3	Y3	Z3	Weight, lb.	Preload, lb.	End of Stroke, lb.
Stroke, Letter	C	D	E	F	G	H	I	J	K	L	M								
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*	.83	.96	1.08	1.36	1.49	1.83
E3	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38	.38	"	"	.25	.25	.38	.38	.38	.38
K3	.56	.69	.81	1.09	1.22	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	"	"	.56	.69	.81	1.09	1.22	Note 1
Y3	.46	.46	.46	.46	.46	.46	.55	.55	.55	.55	.55	"	"	.46	.46	.46	.46	.46	.55
Z3	.52	.65	.77	1.05	1.18	1.52	2.02	2.65	2.65	3.65	3.65	"	"	.52	.65	.77	1.05	1.18	1.52
Weight, lb.	.14	.16	.18	.22	.23	.28	.36	.46	.46	.63	.63	"	"	.14	.16	.18	.22	.23	.28
Preload, lb.	2.0	2.7	1.5	2.5	2.0	2.5	2.5	2.2	1.5	1.3	1.3	"	"	2.0	2.7	1.5	2.5	2.0	2.5
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	"	"	3.0	4.5	4.5	4.7	4.7	4.8

Stroke, Inch	1/8	1/4	3/8	1/2	5/8	1	1 1/4	1 1/2	2	3	4	B4	E4	K4	Y4	Z4	Weight, lb.	Preload, lb.	End of Stroke, lb.
Stroke, Letter	C	D	E	F	G	H	I	J	K	L	M								
Action -OP Single Acting, Spring Extended																			
B4	.95	1.16	1.39	1.80	2.05	NA*	NA*	NA*	NA*	NA*	NA*	1.26	1.67	1.92	NA*	NA*	1.26	1.67	1.92
E4	.25	.25	.25	.38	.38	"	"	"	"	"	"	.25	.25	.38	"	"	.25	.25	.38
K4	.63	.77	.88	1.16	1.29	"	"	"	"	"	"	.63	.77	.88	"	"	.63	.77	.88
Y4	.52	.58	.71	.83	.96	"	"	"	"	"	"	.52	.58	.71	"	"	.52	.58	.71
Z4	.64	.85	1.08	1.49	1.74	"	"	"	"	"	"	.64	.85	1.08	"	"	.64	.85	1.08
Weight, lb.	.14	.16	.18	.22	.24	"	"	"	"	"	"	.14	.16	.18	"	"	.14	.16	.18
Preload, lb.	2.0	2.7	1.5	2.5	2.0	"	"	"	"	"	"	2.0	2.7	1.5	"	"	2.0	2.7	1.5
End of Stroke, lb.	3.0	4.5	4.5	4.7	4.7	"	"	"	"	"	"	3.0	4.5	4.5	"	"	3.0	4.5	4.5

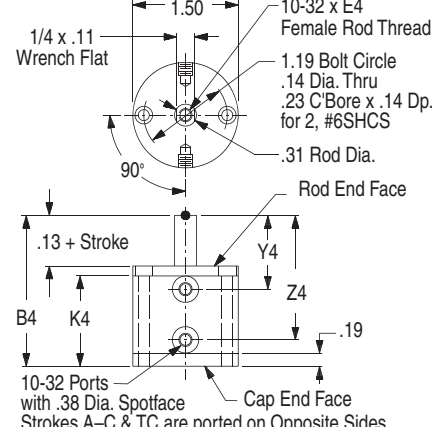
Action -O Single Acting Spring Retracted

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



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



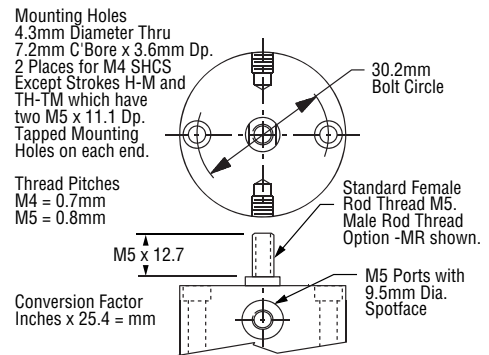
Prefix Option -M Metric Cylinder & Rod Thread, 19.1mm Bore
Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.7.

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



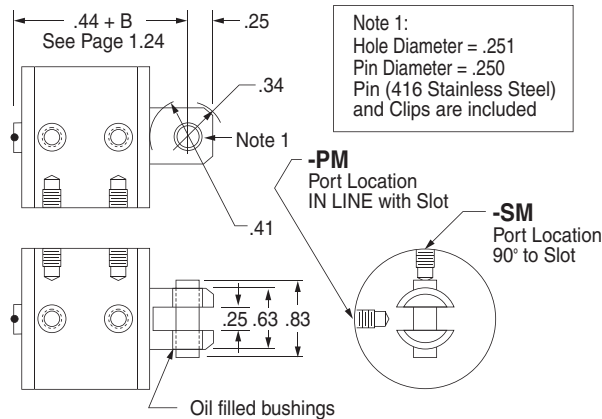
The **Suffix Options** charted on the right are available on Original & "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.24. – Also see *Option Information* on pages 1.7 thru 1.15.

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

Suffix Options -PM & -SM Clevis Mount

Available on Original and "T" Series
with Actions: -X, -XK, -O, -OP

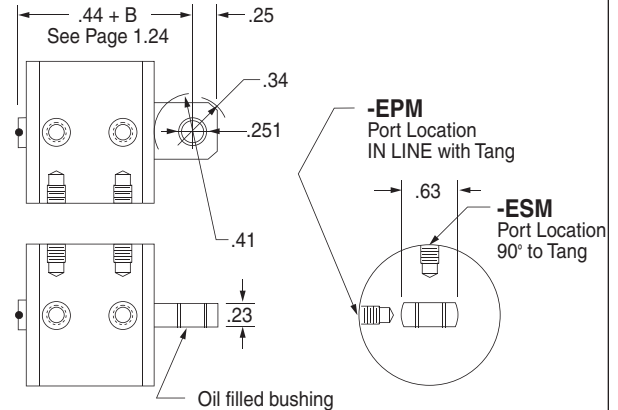
Also see *Option Information* on page 1.13.



Suffix Options -EPM & -ESM Eye Mount

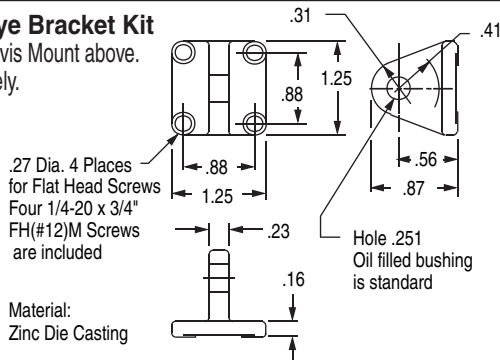
Available on Original and "T" Series
with Actions: -X, -XK, -O, -OP

Also see *Option Information* on page 1.13.



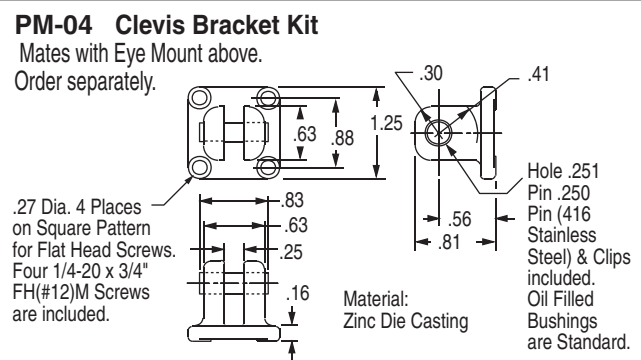
EM-04 Eye Bracket Kit

Mates with Clevis Mount above.
Order separately.



PM-04 Clevis Bracket Kit

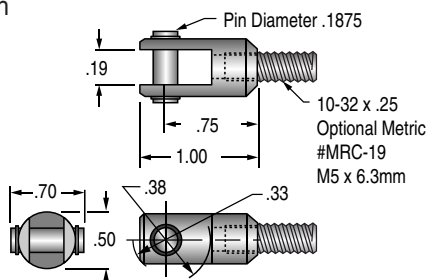
Mates with Eye Mount above.
Order separately.



RC-19 Rod Clevis and Pin

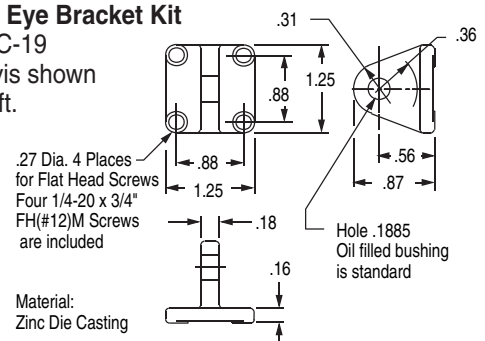
Threaded Stud mates with
Female Rod thread
in **Pancake®** Cylinders.
Slot & Pin Mate with
EM-02 Eye Bracket
shown on the right.

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



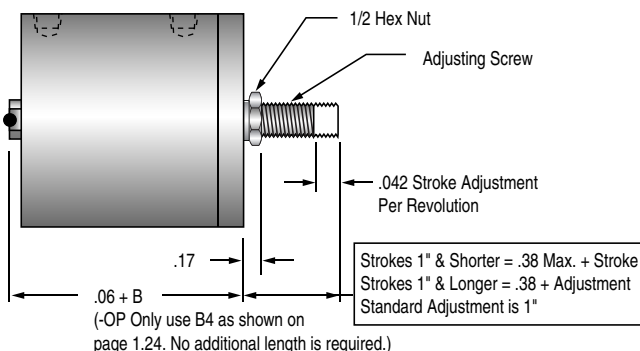
EM-02 Eye Bracket Kit

Mates RC-19
Rod Clevis shown
on the left.



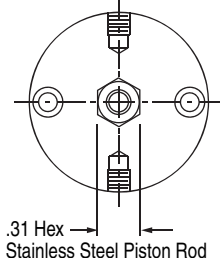
Suffix Option -RS Adjustable Retract Stroke

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



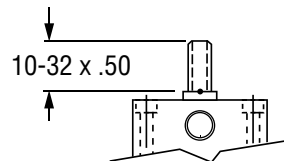
Suffix Option -NR Nonrotating, Single Acting

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



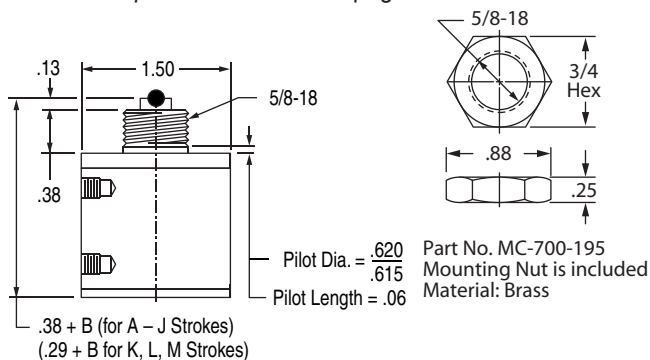
Suffix Option -MR Male Rod Thread

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



Suffix Option -F Threaded Nose Mount

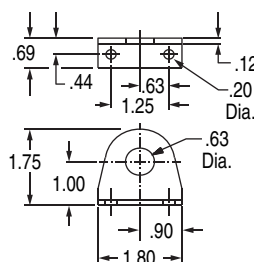
Available on Original and "T" Series with Actions: -X, -XK, -O, -OP
Also see *Option Information* on page 1.13.



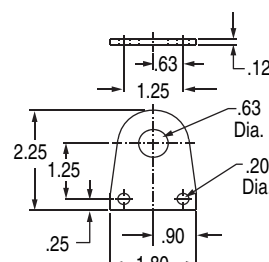
Accessory Nose Mounting Brackets

Order Separately. Material: Plated Steel

Angled Part Number
BRK-301



Flat Part Number
BRK-302



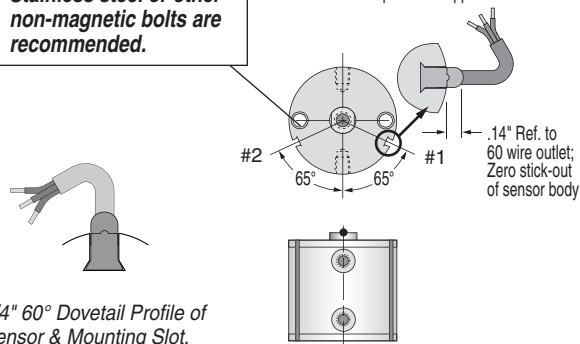
Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

Strokes are NOT affected by Magnetic Piston Option

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.



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

Quick Reference to Standard Strokes

Use the appropriate Stroke Letter in the Model Number

Available on Original Series Available on "T" Series

	Available on Original Series		Available on "T" Series	
	Stroke	Action X, XK ¹	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.

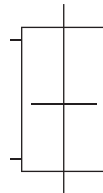
1

Action –XDR Original Series Double Rod, Double Acting

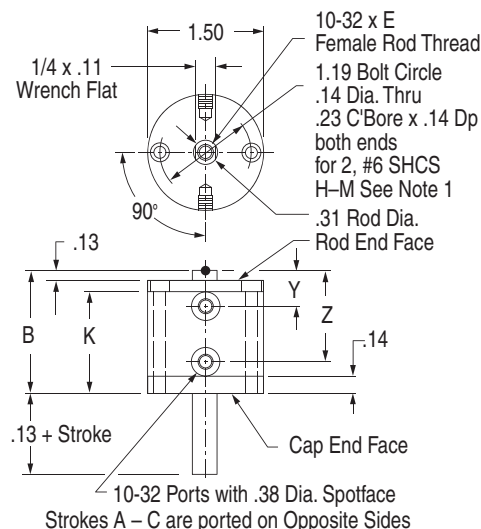
Note 1:

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

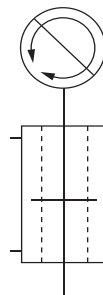


Action –XDRK Original Series Double Rod, Double Acting, Nonrotating

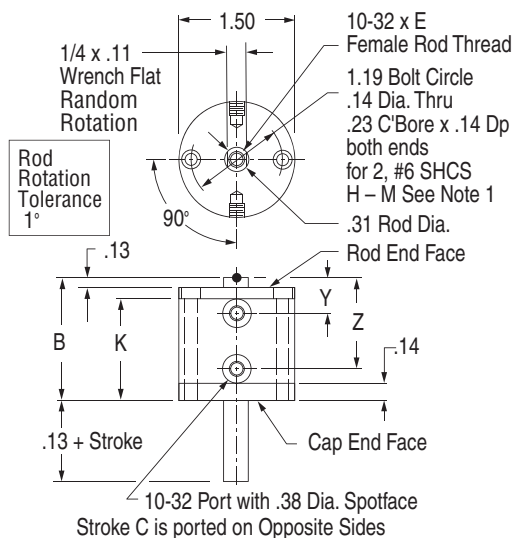
Note 1:

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

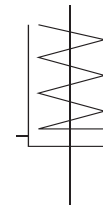


Action –ODR Original Series Double Rod, Single Acting, Spring Retracted

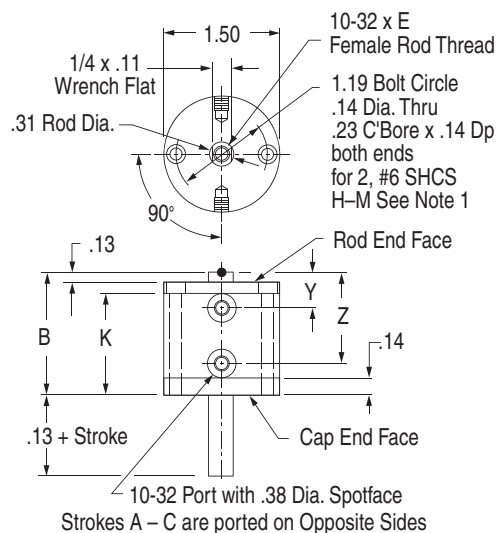
Note 1:

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

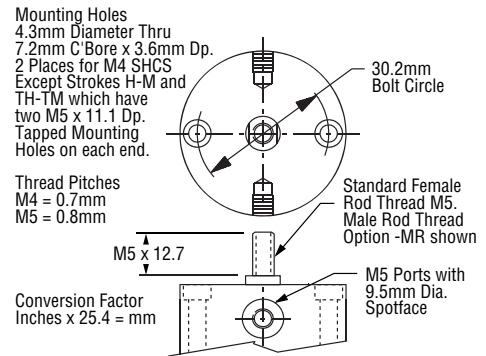


Stroke, Inches	1/16	1/8	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2
Stroke, Letter	A	B	C	D	E	F	G	H	I	J	K
B	1.00	1.13	1.25	1.55	1.67	1.88	2.38	2.88	2.88	3.88	3.88
E	.25	.25	.25	.38	.38	.38	.38	.38	.38	.38	.38
K	.73	.86	.98	1.28	1.40	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Y	.46	.46	.46	.46	.46	.46	.46	.46	.46	.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	38.1	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

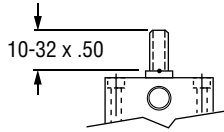


The **Suffix Options** charted on the right are available on Original Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.27. – Also see *Option Information* on pages 1.7 thru 1.15.

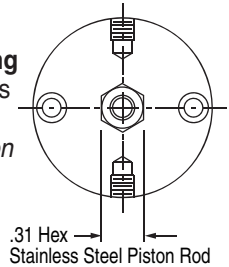
	V	Q	N	C1-C7	BF	BR	BFR	06
-XDR	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	✓	✓	✓	✓	✓	✓	✓	✓
-ODR	✓	✓	✓	✓	NA	✓	NA	✓

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



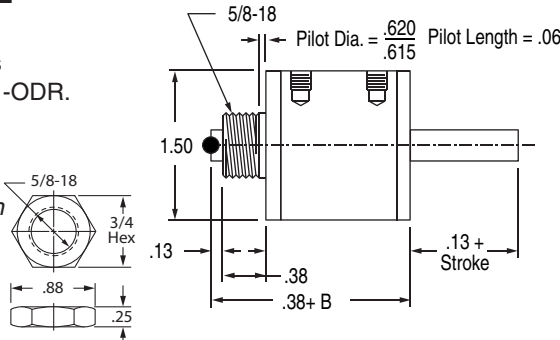
Suffix Option -NR Nonrotating, Single Acting
Available on Original Series with Actions: -ODR
Also see *Option Information* on page 1.8.



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

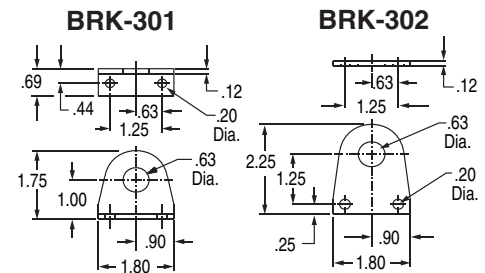
Available on Original Series with Actions -XDR, -XDRK, -ODR.
For Rod End only use **-F**
For Cap End only use **-F1**
For Both Ends use **-F2**
Also see *Option Information* on page 1.13

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



Accessory Nose Mounting Brackets

Order Separately. Material Plated Steel



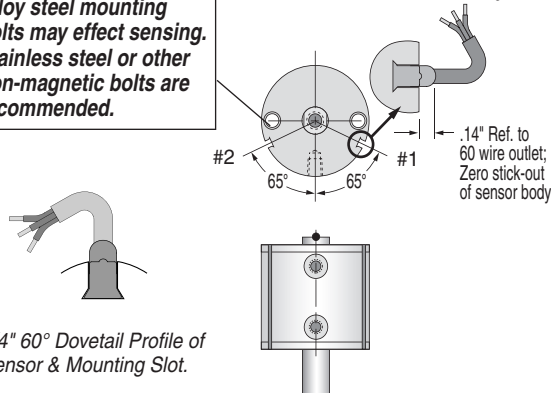
Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

Strokes are NOT affected by Magnetic Piston Option

3/4" (7) Bore

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

Sensors available for "D" strokes and longer.



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

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

Available on Original Series

	Action	
	Stroke	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.

Pancake® Cylinders 1 1/8" (121) Bore Model Number

1

Model Number Code

Leave blank if none desired

Metric M
See pages 1.7, 1.31 & 1.34

D

121

X

MR

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"

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

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"	3/8"	-C3
1/2"	5/8"	-C5
3/4"	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) -E
Order sensors separately. See page 1.14.
Stroke length determines number of mounting slots. See page 1.14, 1.32, 1.34

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.

HOW TO ORDER

- Under **Stroke** – select letter(s) for desired Series and Stroke.
- 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
- Under **Action** – select letter(s) for desired action.
- 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

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

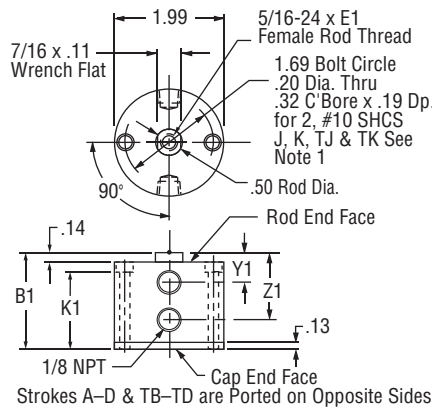
A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – <http://www.fabco-air.com>

Action -X Double Acting

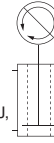


Note 1:
Strokes J, K, TJ,
& TK have two
#10-32 x .50
Tapped Mounting
Holes on each end.

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

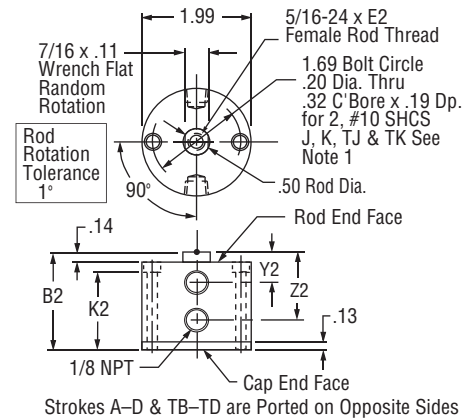


Action -XK Double Acting Nonrotating



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



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	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	A	B	C	D	X	E	F	G	H	I	J	K	TB	TC	TD	TX	TE	TF	TG	TH	TI	TJ	TK

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	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	.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	.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	.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	.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	.28	.27	.38	.49	.55	.62	.68	.82	.96	1.09	1.36				

Action -XK Double Acting, Nonrotating													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	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	.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	.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	.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	.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	.28	.27	.38	.50	.56	.63	.69	.84	.98	1.11	1.39		

	Action –O				Single Acting, Spring Retracted								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*	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	"	"	.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	"	"	.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	"	"	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	"	"	.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	"	"	.29	.29	.35	.58	.65	.85	.99	1.16	1.16	"	"	
Preload, lb.6.0	5.0	4.0	3.8	4.4	3.7	5.0	4.6	2.5	2.8	"	"	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	"	"	8.5	8.5	11.8	17.7	18.6	17.8	18.3	22.2	17.7	"	"	

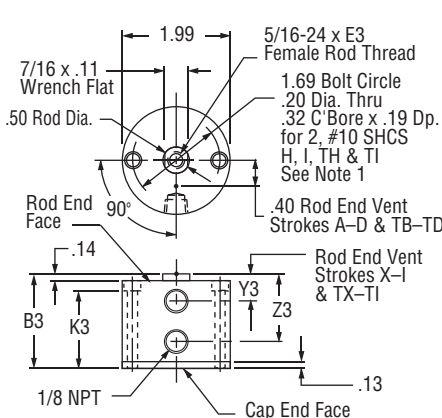
	Action				-OP				Single Acting				Spring Extended				Action				-OP				Single Acting				Spring Extended						
B4	1.40	1.46	1.52	2.08	3.02	3.52	4.45	5.14	NA*	NA*	NA*	NA*	1.33	1.40	1.96	2.90	3.40	4.33	5.02	NA*	NA*	NA*	NA*	1.33	1.40	1.96	2.90	3.40	4.33	5.02	NA*	NA*	NA*	NA*	
E4	.38	.38	.38	.38	.63	.63	.63	.63	"	"	"	"	.38	.38	.38	.63	.63	.63	.63	"	"	"	"	.38	.38	.38	.63	.63	.63	.63	"	"	"	"	
K4	.94	.94	.94	.94	1.25	1.94	2.19	2.87	3.31	"	"	"	"	.94	.94	1.25	1.94	2.19	2.87	3.31	"	"	"	"	.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	"	"	"	"	.51	.58	1.05	1.15	1.40	1.83	2.27	"	"	"	"	.51	.58	1.05	1.15	1.40	1.83	2.27	"	"	"	"	
Z4	.58	.64	.70	1.17	2.27	2.77	3.70	4.39	"	"	"	"	.51	.58	1.05	2.15	2.65	3.58	4.27	"	"	"	"	.51	.58	1.05	2.15	2.65	3.58	4.27	"	"	"	"	
Weight, lb..37	.36	.36	.43	.63	.70	.91	1.00	"	"	"	"	.37	.37	.44	.65	.72	.92	1.10	"	"	"	"	.37	.44	.65	.72	.92	1.10	"	"	"	"			
Preload, lb.6.0	5.0	4.0	3.5	3.9	3.3	2.5	4.3	"	"	"	"	5.0	4.0	3.5	6.1	5.1	4.0	5.5	"	"	"	"	4.0	3.5	6.1	5.1	4.0	5.5	"	"	"	"			
End of Stroke, lb.	8.5	8.5	8.5	11.5	17.1	18.2	16.8	18.1	"	"	"	"	8.5	8.5	8.5	17.1	18.2	16.8	18.1	"	"	"	"	8.5	8.5	8.5	17.1	18.2	16.8	18.1	"	"	"	"	

NA* = Not Available

Action -O Single Acting Spring Retracted



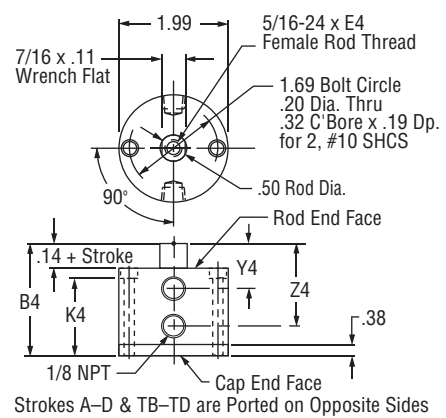
Note 1:
Strokes H, I, TH & TI
have two #10-32 x .50
Tapped Mounting
Holes on each end.
See page 1.16 for
Mounting Bolts.
Push area = .99
See chart for Spring
Forces: Preload and
End of Stroke.
Seal Kits for Series:
Original = 121-SK
"T" = 121-SKG



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



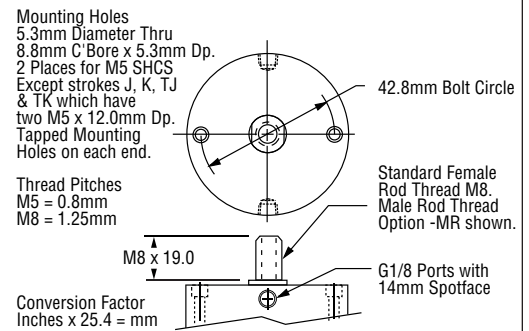
NA* = Not Available

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	

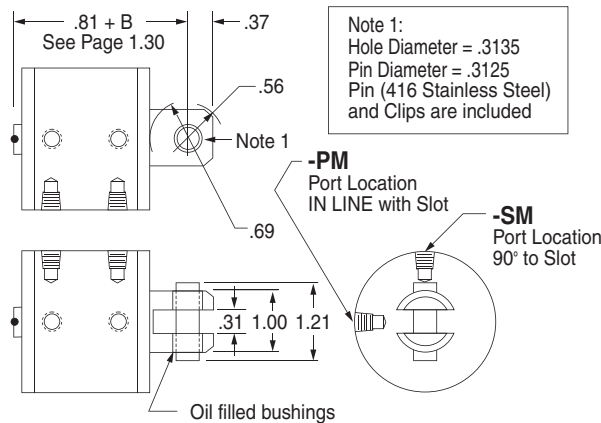


The **Suffix Options** charted on the right are available on Original and "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.30.
– Also see *Option Information* on pages 1.7 thru 1.15.

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

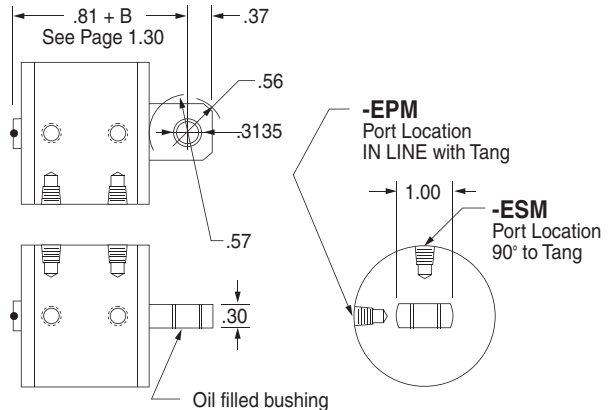
Suffix Options -PM & -SM Clevis Mount

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



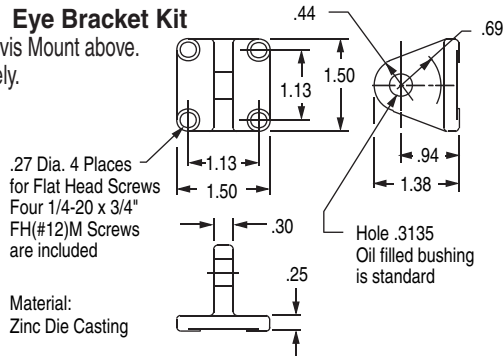
Suffix Options -EPM & -ESM Eye Mount

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



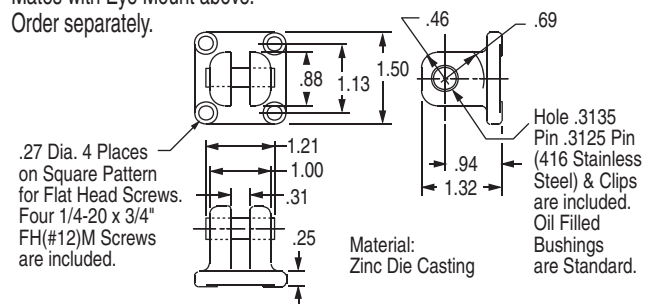
EM-121 Eye Bracket Kit

Mates with Clevis Mount above.
Order separately.



PM-121 Clevis Bracket Kit

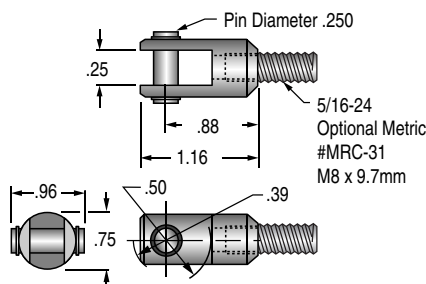
Mates with Eye Mount above.
Order separately.



RC-31 Rod Clevis and Pin

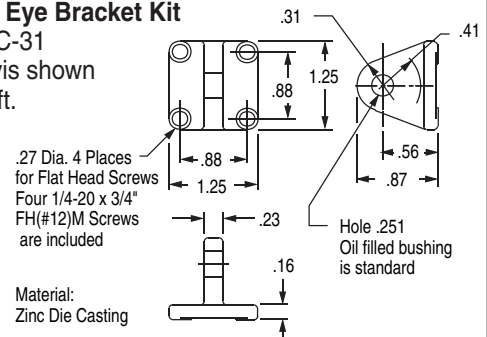
Threaded Stud mates with
Female Rod thread
in **Pancake®** Cylinders.
Slot & Pin Mate with
EM-04 Eye Bracket
shown on the right.

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



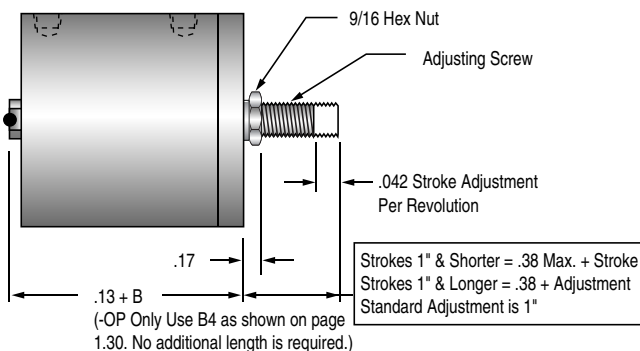
EM-04 Eye Bracket Kit

Mates RC-31
Rod Clevis shown
on the left.



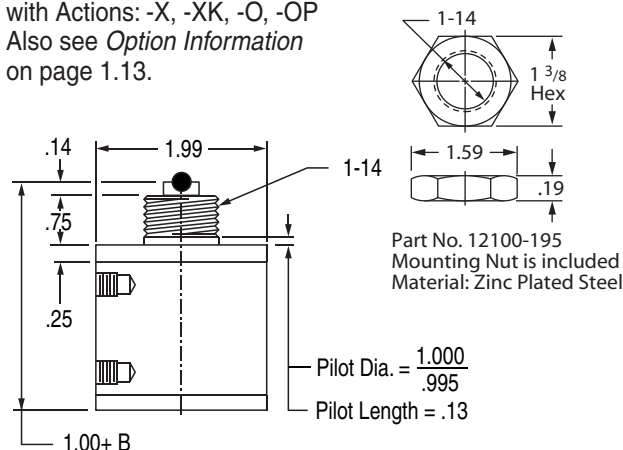
Suffix Option -RS Adjustable Retract Stroke

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.



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

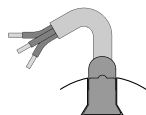
Strokes are NOT affected by magnetic piston.

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

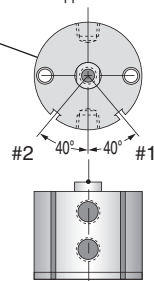
1 1/8" (121) Bore

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.



Sensor Slots at Positions #1 and #2

Sensor Slot at Position #1 only

Quick Reference to Standard Strokes

Use the appropriate Stroke Letter in the Model Number

Available on Original Series

Stroke	Action	X	XK
1/2	----- D -----	Not Available	
3/4	----- X -----	X	
1	----- E -----	E	
1 1/4	----- F -----	F	

Available on "T" Series

Stroke	Action	X	XK
3/8	----- TD -----	Not Available	
5/8	----- TX -----	TX	
7/8	----- TE -----	TE	
1 1/8	----- TF -----	TF	

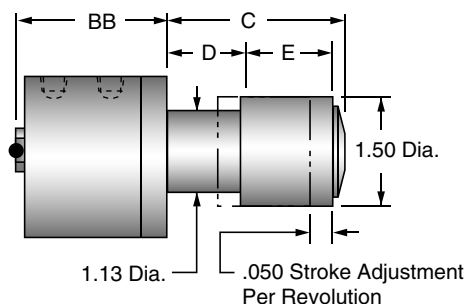
1 1/2	----- G -----	G	
1 3/4	----- H -----	H	
2	----- I -----	I	
3	----- J -----	J	
4	----- K -----	K	

1 3/8	----- TG -----	TG	
1 5/8	----- TH -----	TH	
1 7/8	----- TI -----	TI	
2 7/8	----- TJ -----	TJ	
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
Actions: -O	BB	1.36	1.36	1.36	1.67	2.36	2.61	3.30	3.74	4.33	4.33	NA
	C	1.40	1.53	1.66	2.16	2.66	3.16	3.66	4.16	4.66	5.16	7.16
	D	0.63	0.69	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	3.50
	E	0.63	0.69	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	3.50

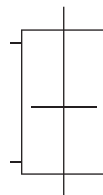


1

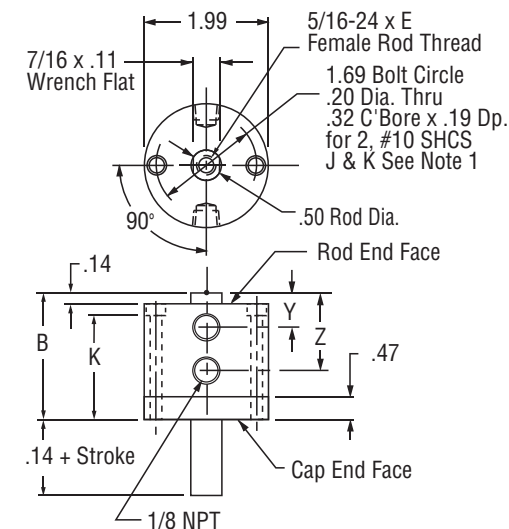
Action –XDR Original Series Double Rod, Double Acting

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

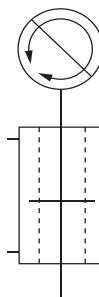


Strokes A – D are Ported on Opposite Sides

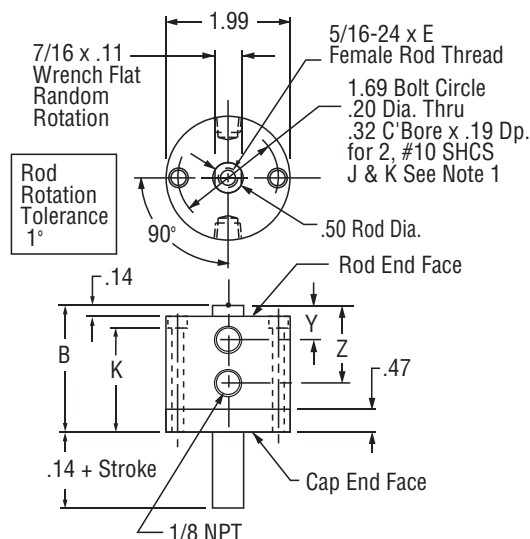
Action –XDRK Original Series Double Rod, Double Acting, Nonrotating

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

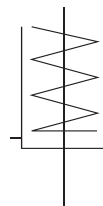


Strokes A – D are Ported on Opposite Sides

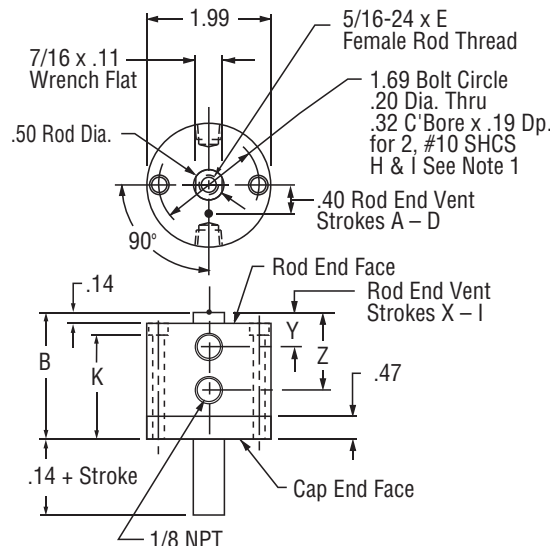
Action –ODR Original Series Double Rod, Single Acting, Spring Retracted

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	.45	.45	.45	.67	.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

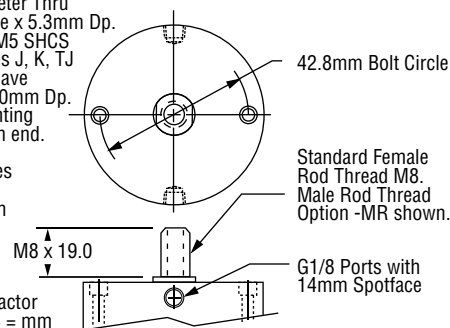
Also see *Option Information* on page 1.7.

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

Mounting Holes
5.3mm Diameter Thru
8.8mm C' Bore x 5.3mm Dp.
2 Places for M5 SHCS
Except strokes J, K, TJ
& TK which have
two M5 x 12.0mm Dp.
Tapped Mounting
Holes on each end.

Thread Pitches
M5 = 0.8mm
M8 = 1.25mm

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 1.33. – Also see *Option Information* on pages 1.7 thru 1.15.

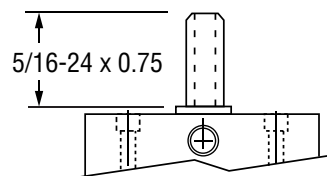
	T	V	Q	H	N	C1-C7	LF	LR	LFR	BF	BR	BFR	13	16
-XDR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	NA	✓	✓	NA	✓	✓	NA	NA	NA	✓	✓	✓	✓	✓
-ODR	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓	✓

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.

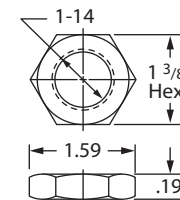
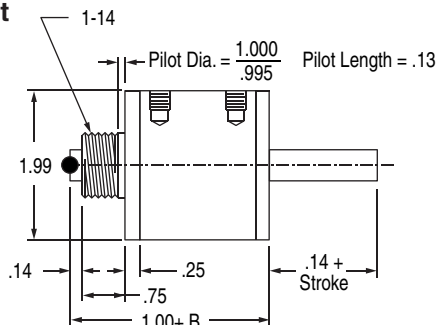


Suffix Options -F, -F1, -F2 Threaded Nose Mount

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

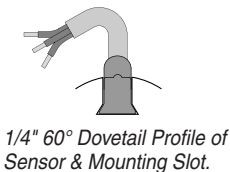
Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

Strokes are NOT affected by magnetic piston.

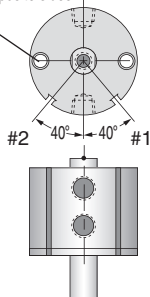
**–Sensors Must Be Ordered Separately
See Sensor Models Available page 1.14**

1 1/8" (121) Bore

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



Sensors available for "D" strokes
and longer. Stroke D 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	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

Pancake® Cylinders 1 5/8" (221) Bore Model Number

1

Model Number Code

Prefix Options

Leave blank if none desired

Stroke

Bore

Action

Suffix Options

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 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

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	-25
150 psi max	

Finish: ProCoat™ (Electroless Nickel)	-N
---------------------------------------	----

Stroke collar:	1/8"	-C1
1/4"	3/8"	-C3
1/2"	5/8"	-C5
3/4"	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)	-E
Order sensors separately. See page 1.14.	
Stroke length determines number of mounting slots. See page 1.14, 1.38, 1.40	

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.

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

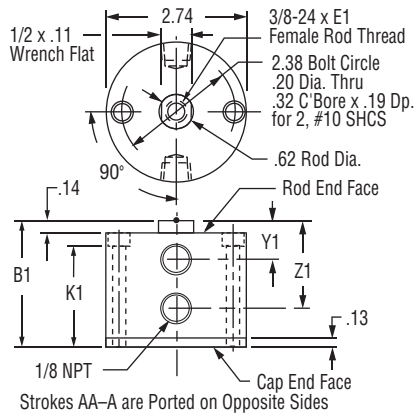
"T" Series, 1/2" Stroke - 1 5/8" Bore -
Single Rod, Spring Retract - Male Rod Thread

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>

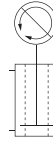
Action -X Double Acting



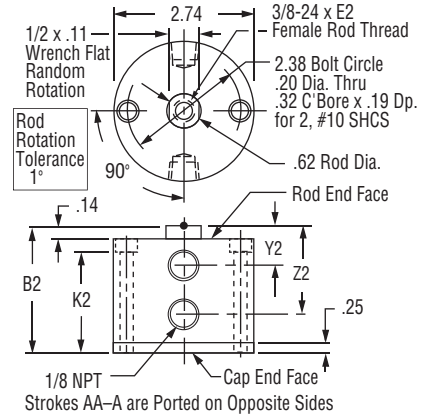
See page 1.16 for
Mounting Bolts.
Push area = 2.07
Pull area = 1.76
Seal Kits for Series:
Original = 221-SK
"T" = 221-SKG



Action -XK Double Acting Nonrotating



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
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

"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
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	1.27	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 -XK Double Acting, Nonrotating

1.90	2.15	2.46	2.96	3.46	4.46	5.46
.63	.63	.75	.75	.75	.75	.75
1.57	1.82	2.13	2.63	3.13	4.13	5.13
.52	.52	.52	.52	.52	.52	.52
1.27	1.57	1.83	2.33	2.83	3.83	4.83
1.08	1.21	1.35	1.59	1.83	2.83	3.80

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*	.95
Preload, lb.	15.0	8.5	8.5	6.0	4.8	6.0	NA*	NA*	8.5
End of Stroke, lb.	20.0	20.0	20.0	18.0	20.0	18.0	NA*	NA*	NA*

Action -O Single Acting, Spring Retracted

1.77	2.02	2.33	4.33	NA*	NA*	NA*
.63	.63	.75	.75	NA*	NA*	NA*
1.44	1.69	2.00	4.00	NA*	NA*	NA*
Rod End Face Vent			.52	NA*	NA*	NA*
1.27	1.57	1.83	3.83	NA*	NA*	NA*
1.06	1.21	2.16	NA*	NA*	NA*	
8.5	6.0	7.06	NA*	NA*	NA*	
20.0	20.0	18.0	20.0	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*	1.16
Preload, lb.	8.5	4.5	5.5	4.0	4.8	NA*	NA*	NA*	4.5
End of Stroke, lb.	15.0	15.0	18.5	17.5	20.0	NA*	NA*	NA*	NA*

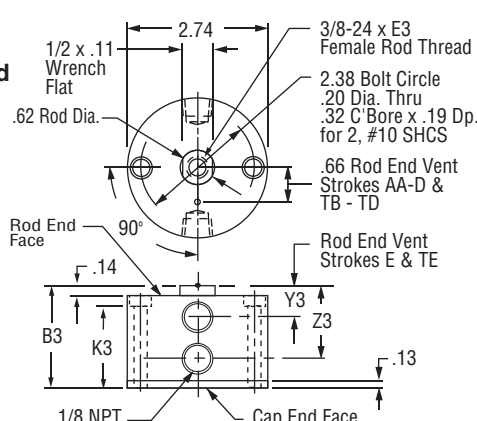
Action -OP Single Acting, Spring Extended

2.39	2.89	3.58	NA*	NA*	NA*	NA*
.63	.63	.75	NA*	NA*	NA*	NA*
1.82	2.07	2.50	NA*	NA*	NA*	NA*
.77	1.02	1.27	NA*	NA*	NA*	NA*
1.52	2.07	2.58	NA*	NA*	NA*	NA*
1.26	1.48	NA*	NA*	NA*	NA*	
5.5	4.0	NA*	NA*	NA*	NA*	
15.0	18.5	17.5	NA*	NA*	NA*	NA*

Action -O Single Acting Spring Retracted



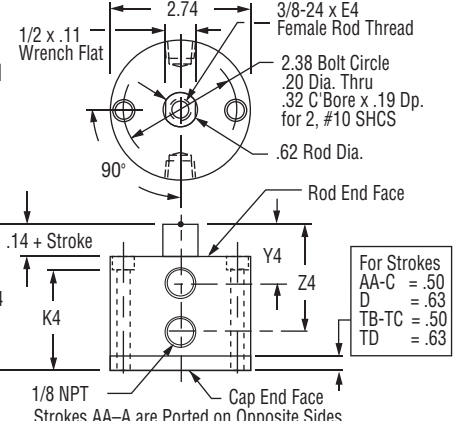
See page 1.16 for
Mounting Bolts.
Push area = 2.07
See Chart for Spring
Forces: Preload
& End of Stroke
Seal Kits for Series:
Original = 221-SK
"T" = 221-SKG



Action -OP Single Acting Spring Extended



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



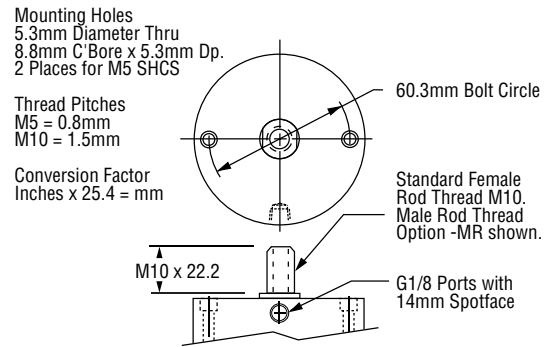
For Strokes
AA-C = .50
D = .60
TB-TC = .63
TD = .63

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

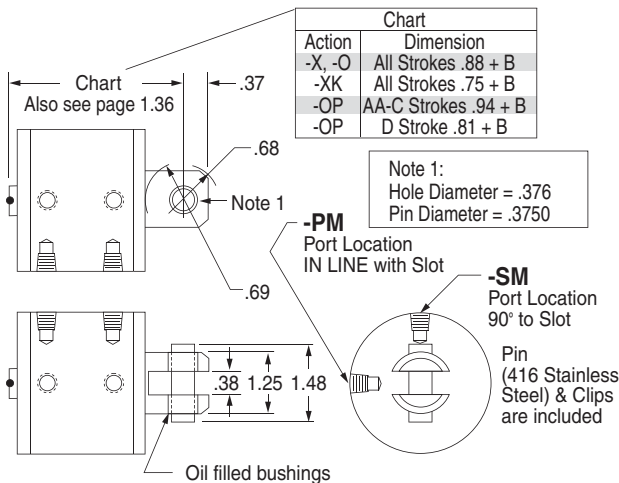


The **Suffix Options** charted on the right are available on Original and "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.36.
– Also see *Option Information* on pages 1.7 thru 1.15.

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

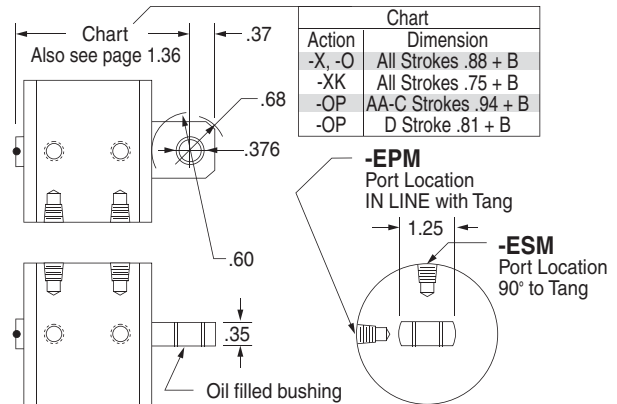
Suffix Options -PM & -SM Clevis Mount

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



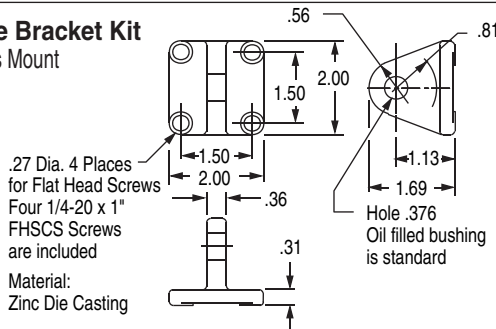
Suffix Options -EPM & -ESM Eye Mount

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



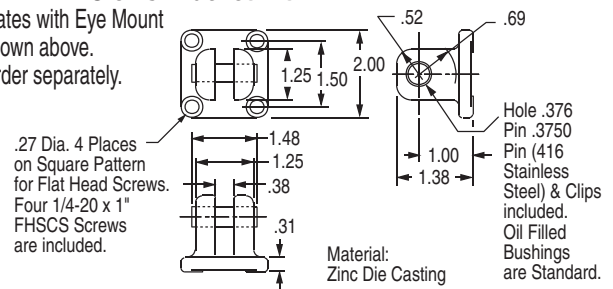
EM-221 Eye Bracket Kit

Mates with Clevis Mount shown above.
Order separately.



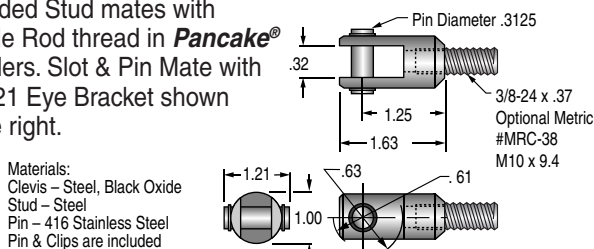
PM-221 Clevis Bracket Kit

Mates with Eye Mount shown above.
Order separately.



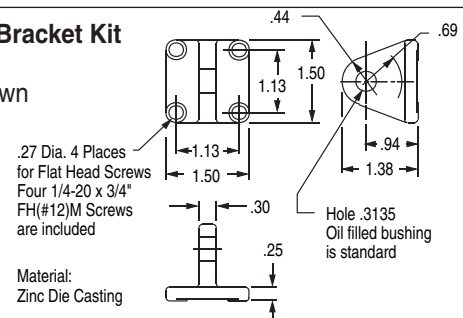
RC-38 Rod Clevis and Pin

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



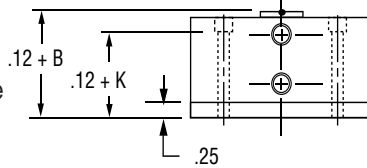
EM-121 Eye Bracket Kit

Mates RC-38 Rod Clevis shown on the left.



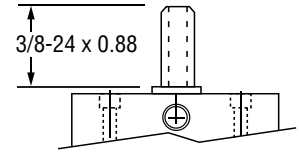
Suffix Options -HHC Hydraulic & -HC Air

Available on Original and "T" Series with Action -X, -O.
Also see *Option Information* on page 1.9 for Pressure and Mounting details.



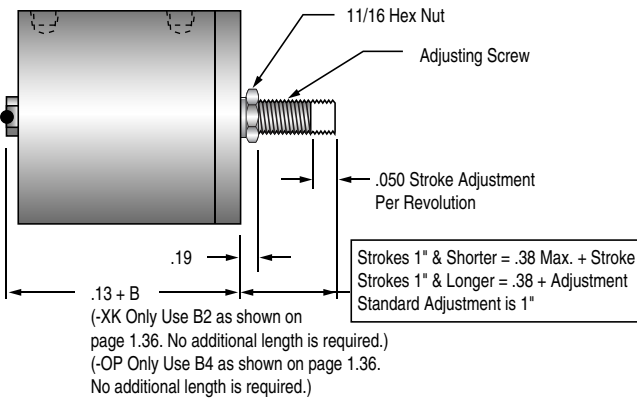
Suffix Option -MR Male Rod Thread

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



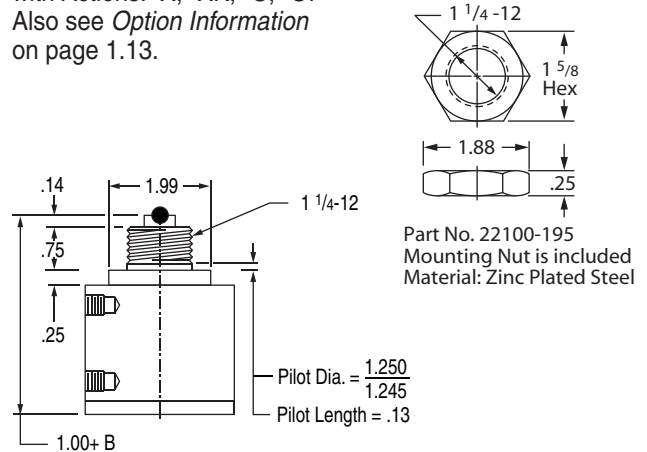
Suffix Option -RS Adjustable Retract Stroke

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



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.

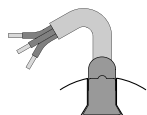


Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

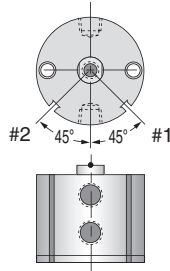
– Sensors Must be Ordered Separately
See Sensor Models Available page 1.14

1 5/8" (221) Bore

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



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



Sensor Slots at Positions #1 and #2

Sensor Slot at Position #1 only

Quick Reference to Standard Strokes

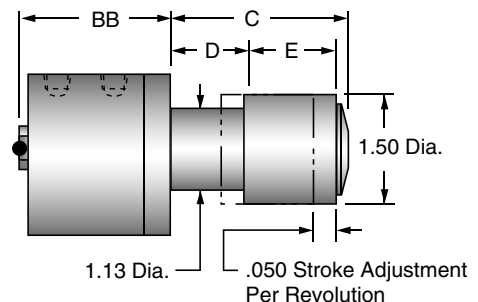
Use the appropriate Stroke Letter in the Model Number

Available on Original Series			Available on "T" Series	
Stroke	Action		Stroke	Action
	X	XK	X, XK	
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		
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.

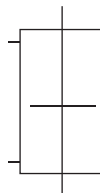
Stroke Inches	1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke Letter	AA	A	B	C	D	E	F	G	H
Actions: -X, -XK	BB	1.61	1.74	2.24	2.49	2.80	3.30	3.80	4.80
Actions: -O	BB	1.61	1.74	2.24	2.49	2.80	4.80	NA	NA
	C	1.40	1.66	2.16	2.66	3.16	4.16	5.16	7.16
	D	0.63	0.75	1.00	1.25	1.50	2.00	2.50	3.50
	E	0.63	0.75	1.00	1.25	1.50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



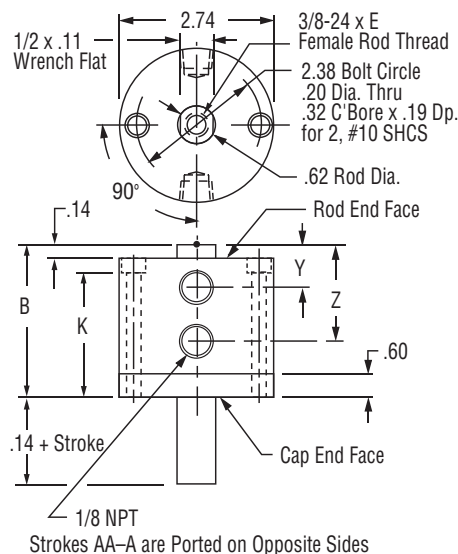
1

Action -XDR Original Series Double Rod, Double Acting

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

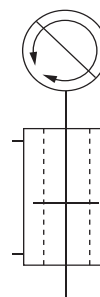


Stroke, Inches	1/8	1/4	1/2	3/4	1	1 1/2	2	3	4
Stroke, Letter	AA	A	B	C	D	E	F	G	H
B	1.61	1.74	2.24	2.49	2.80	3.30	3.80	4.80	5.80
E	.38	.44	.63	.63	.75	.75	.75	.75	.75
K	1.28	1.41	1.91	2.16	2.47	2.97	3.47	4.47	5.47
Y	.64	.64	.52	.52	.52	.52	.52	.52	.52
Z	.64	.64	1.27	1.52	1.83	2.33	2.83	3.83	4.83
Weight,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

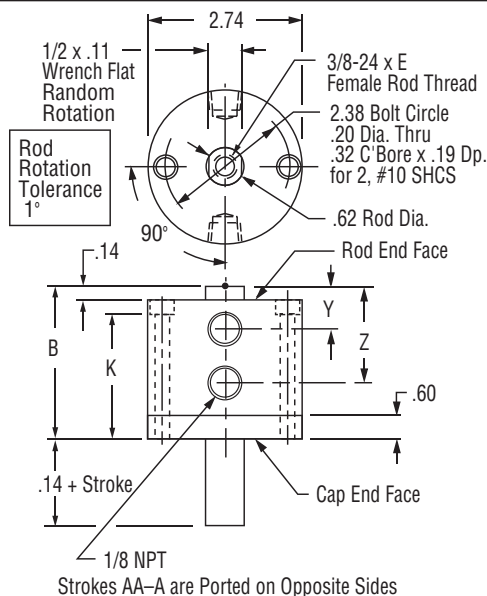


Action -XDRK Original Series Double Rod, Double Acting, Nonrotating

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

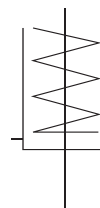


Stroke, Inches	1/8	1/4	1/2	3/4	1	1 1/2	2	3	4
Stroke, Letter	AA	A	B	C	D	E	F	G	H
B	1.61	1.74	2.24	2.49	2.80	3.30	3.80	4.80	5.80
E	.38	.44	.63	.63	.75	.75	.75	.75	.75
K	1.28	1.41	1.91	2.16	2.47	2.97	3.47	4.47	5.47
Y	.64	.64	.52	.52	.52	.52	.52	.52	.52
Z	.64	.64	1.27	1.52	1.83	2.33	2.83	3.83	4.83
Weight,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

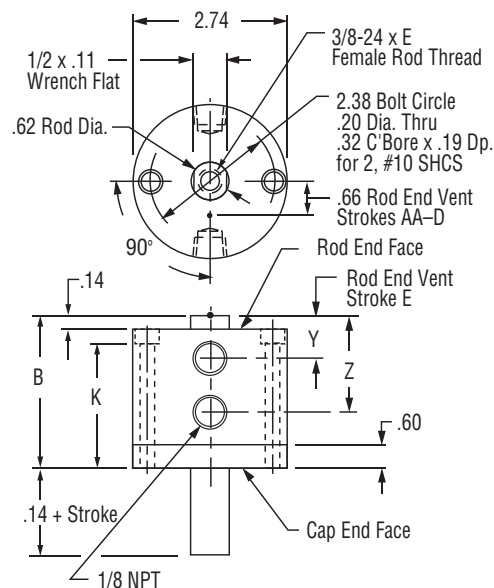


Action -ODR Original Series Double Rod, Single Acting, Spring Retracted

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

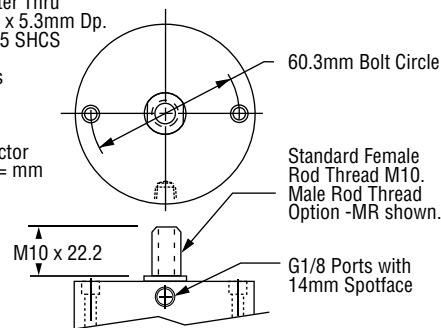
Available on Original Series with Actions: -XDR, -XDRK, -ODR

Also see *Option Information* on page 1.7.

Mounting Holes
5.3mm Diameter Thru
8.8mm C' Bore x 5.3mm Dp.
2 Places for M5 SHCS

Thread Pitches
M5 = 0.8mm
M10 = 1.5mm

Conversion Factor
Inches x 25.4 = mm



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

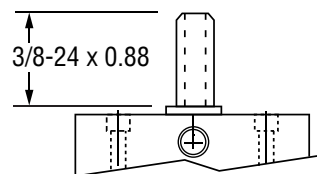
The **Suffix Options** charted on the right are available on Original Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.39. – Also see *Option Information* on pages 1.7 thru 1.15.

	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



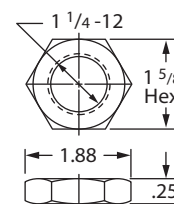
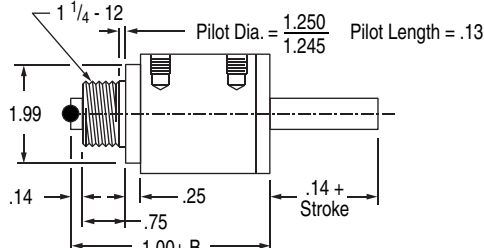
Also see *Option Information* on Page 1.8.

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

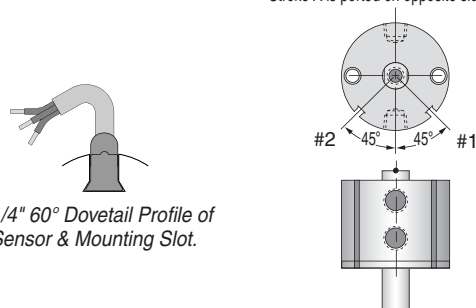
Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

Strokes are NOT affected by magnetic piston.

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

1 5/8" (221) Bore

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	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

Leave blank if none desired

Stroke

Bore

Action

Suffix Options

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

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: 5/16" hole	-16
Plus size 5/32" hole	-31
150 psi max	

Finish: ProCoat™ (Electroless Nickel)	-N
---------------------------------------	----

Stroke collar:	1/8"	-C1
1/4"	3/8"	-C3
1/2"	5/8"	-C5
3/4"	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

Magnetic piston & sensor mounting slot(s)	-E
Order sensors separately. See page 1.14.	
Stroke length determines number of mounting slots. See page 1.14, 1.44, 1.46	

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.

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

1/8" 5 1.17

3/8" 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

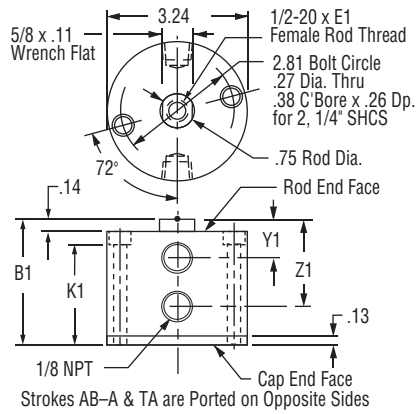
Original Series, 1/2" stroke - 2" Bore - Single Rod, Double Acting

TD-321-X-MR

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

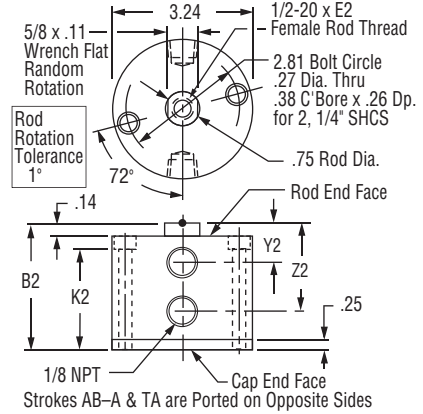
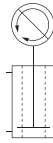
A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – <http://www.fabco-air.com>

Action -X Double Acting



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

Action -XK Double Acting Nonrotating

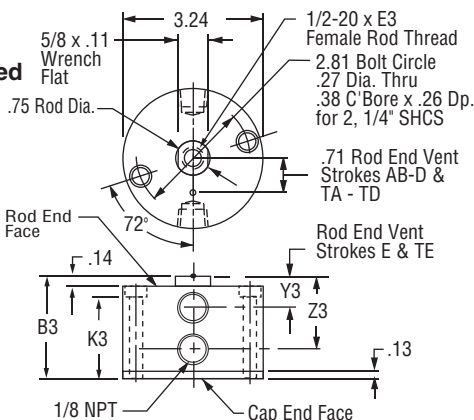


See page 1.16 for Mounting Bolts.
Push area = 3.04
Pull area = 2.60
Seal Kits for Series:
Original = 321-SK-K
"T" = 321-SKG-K

Original Series

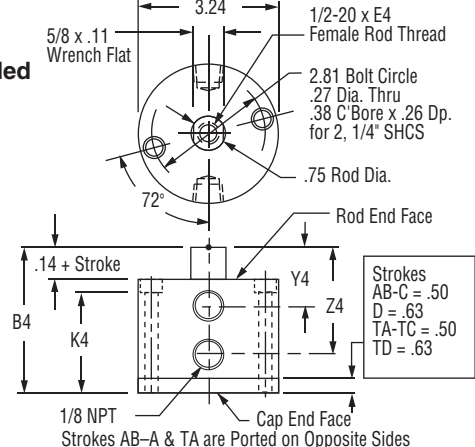
Stroke, Inches	1/8	1/4	3/8	1/2	3/4	1	1 1/2	2	3	4	1/8	1/4	1/2	3/4	1 1/4	1 3/4	2 3/4	3 3/4		
Stroke, Letter	AB	AA	A	B	C	D	E	F	G	H	TA	TB	TC	TD	TE	TF	TG	TH		
Action -X Double Acting											Action -X Double Acting									
B1	1.20	1.33	1.45	1.64	2.02	2.39	2.89	3.39	4.39	5.39	1.45	1.64	2.02	2.39	2.89	3.39	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											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											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*	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*	NA*		
End of Stroke, lb.	18.0	18.0	21.0	20.0	15.5	20.0	NA*	NA*	NA*	NA*	21.0	20.0	15.5	20.0	20.0	NA*	NA*	NA*		
Action -OP Single Acting, Spring Extended											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*	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*	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



See page 1.16 for Mounting Bolts.
Push 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.

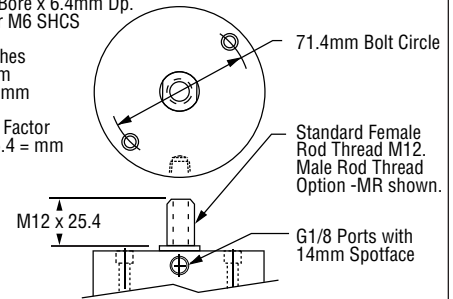
Original Series										
Stroke mm	3.2	6.4	9.5	12.7	19.1	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AB	AA	A	B	C	D	E	F	G	H

"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	

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

Thread Pitches
M6 = 1.0mm
M12 = 1.75mm

Conversion Factor
Inches x 25.4 = mm

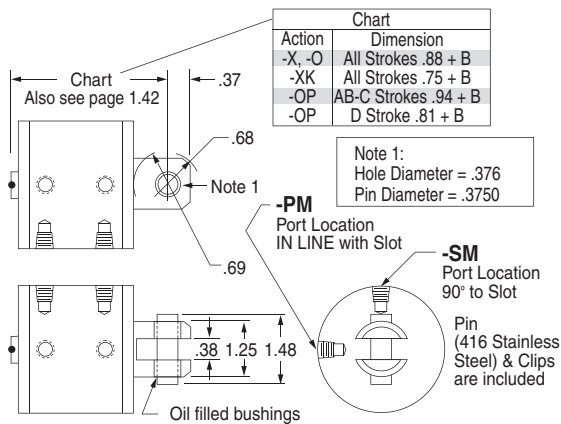


The **Suffix Options** charted on the right are available on Original and "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.42.
– Also see *Option Information* on pages 1.7 thru 1.15.

	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	NA	✓
-OP	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓

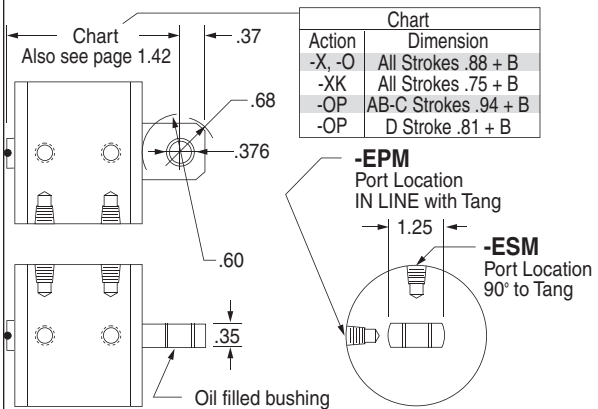
Suffix Options -PM & -SM Clevis Mount

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



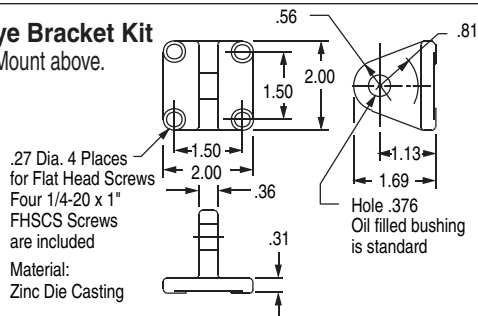
Suffix Options -EPM & -ESM Eye Mount

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



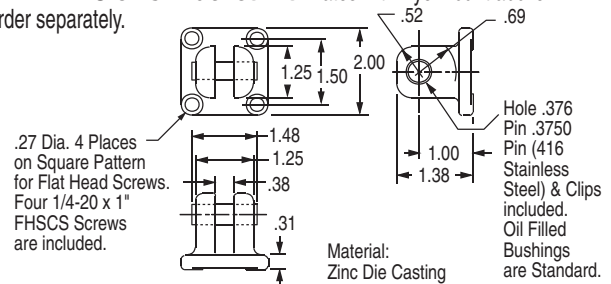
EM-221 Eye Bracket Kit

Mates with Clevis Mount above.
Order separately.

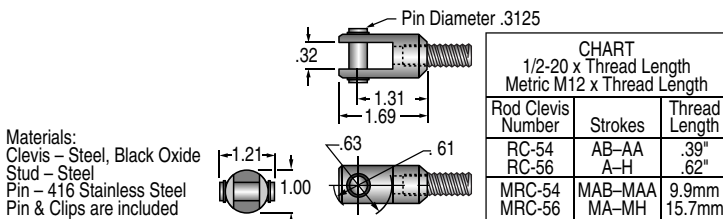


PM-221 Clevis Bracket Kit

Mates with Eye Mount above.
Order separately.

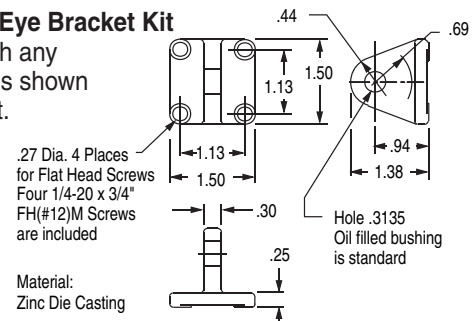


RC-Chart Rod Clevis and Pin Threaded Stud mates with Female Rod thread in the **Pancake®** Cylinders. Slot and Pin Mate with EM-121 Eye Bracket shown on the right.



EM-121 Eye Bracket Kit

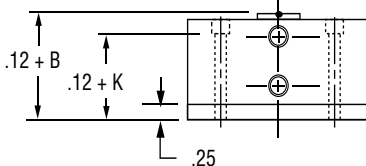
Mates with any Rod Clevis shown on the left.



Suffix Option -HHC Hydraulic & -HC Air

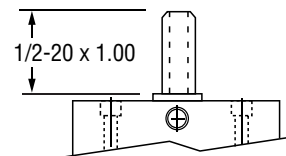
Available on Original and "T" Series with Action -X, -O.

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



Suffix Option -MR Male Rod Thread

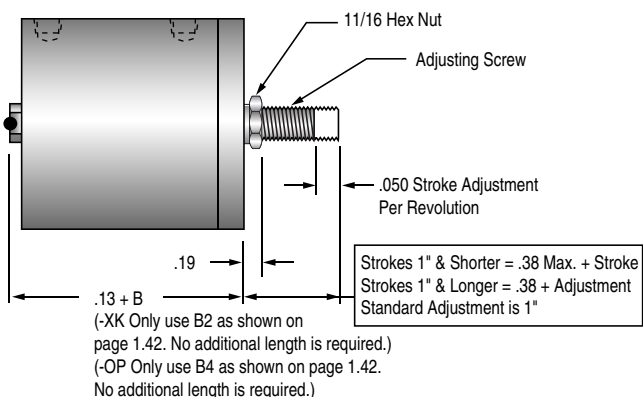
Available on Original
and "T" Series with
Actions: -X, -XK, -O, -OP.
Also see *Option Information*
on page 1.8.



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.



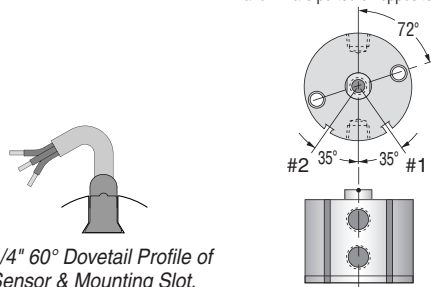
Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

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.



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
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		
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

Sensor Slots at
Positions #1 and #2

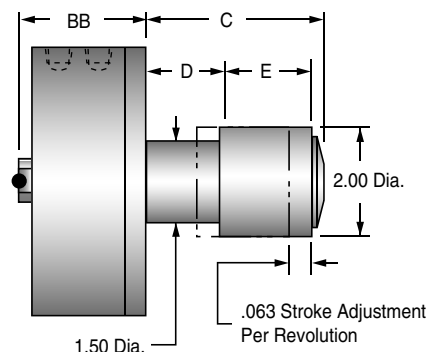
Sensor Slot at
Position #1 only

Suffix Option -AS Adjustable Extend Stroke

Available on Original Series with Actions: -X, -XK, -O

Also see *Option Information* on page 1.11.

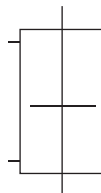
Stroke Inches	1/8	1/4	3/8	1/2	3/4	1	1-1/2	2	3	4
Stroke Letter	AB	AA	A	B	C	D	E	F	G	H
Actions: -X, -XK BB	1.83	1.95	2.08	2.27	2.64	3.02	3.52	4.02	5.02	6.02
Actions: -O BB	1.83	1.95	2.08	2.27	2.64	3.02	5.02	NA	NA	NA
C	1.67	1.91	2.17	2.41	2.91	3.41	4.41	5.41	7.41	9.41
D	0.63	0.75	0.88	1.00	1.25	1.50	2.00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



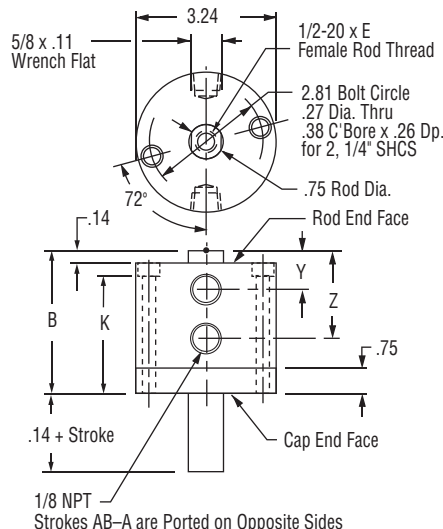
1

Action -XDR Original Series Double Rod, Double Acting

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

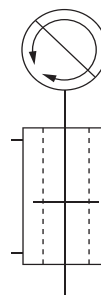


Stroke, Inches	1/8	1/4	3/8	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G	H
B	1.83	1.95	2.08	2.27	2.64	3.02	3.52	4.02	5.02	6.02
E	.40	.50	.63	.63	.75	.88	.88	.88	.88	.88
K	1.44	1.56	1.69	1.89	2.25	2.63	3.13	3.63	4.63	5.63
Y	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52
Z	.70	.83	.95	1.14	1.52	1.89	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

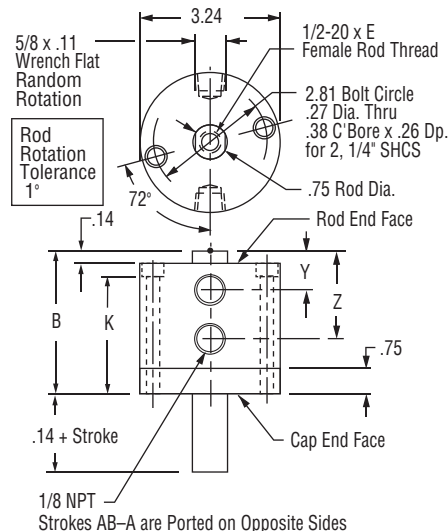


Action -XDRK Original Series Double Rod, Double Acting, Nonrotating

See page 1.16 for
Mounting Bolts
Force Area = 2.60
Seal Kit = 321-SK-K

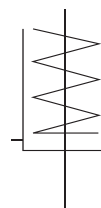


Stroke, Inches	1/8	1/4	3/8	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G	H
B	1.83	1.95	2.08	2.27	2.64	3.02	3.52	4.02	5.02	6.02
E	.40	.50	.63	.63	.75	.88	.88	.88	.88	.88
K	1.44	1.56	1.69	1.89	2.25	2.63	3.13	3.63	4.63	5.63
Y	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52
Z	.70	.83	.95	1.14	1.52	1.89	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

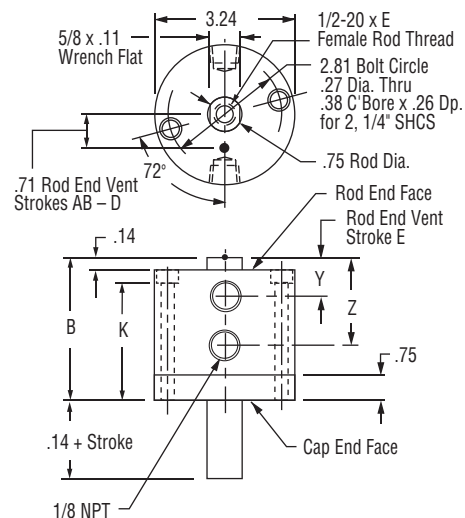


Action -ODR Original Series Double Rod, Single Acting, Spring Retracted

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.

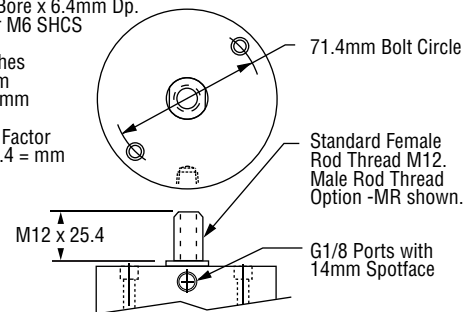
Mounting Holes

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

Thread Pitches

M6 = 1.0mm
M12 = 1.75mm

Conversion Factor
Inches x 25.4 = mm



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.

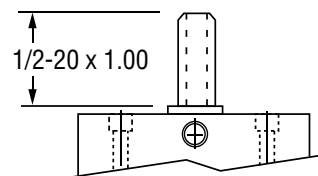
	T	V	Q	H	N	C1–C7	LF	LR	LFR	BF	BR	BFR	P14	16	31
-XDR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	NA	✓	✓	NA	✓	✓	NA	✓	NA	✓	✓	✓	✓	✓	✓
-ODR	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓	✓	✓

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



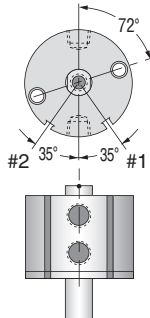
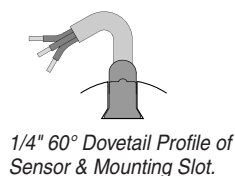
Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

Strokes are NOT affected by magnetic piston.

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

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

Pancake® Cylinders 2 1/2" (521) Bore Model Number

1

Model Number Code

Prefix Options

Leave blank if none desired

Stroke

Bore

Action


Suffix Options

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

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	-25
150 psi max	
Finish: ProCoat™ (Electroless Nickel)	-N
Stroke collar:	
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.

HOW TO ORDER

- Under **Stroke** – select letter(s) for desired Series and Stroke.
 - Under **Bore** – select **521** for 2 1/2" bore.
Seven Other Bore Sizes are Available
- | Bore | Bore Code | See page |
|--------|-----------|----------|
| 1/8" | 5 | 1.17 |
| 3/8" | 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 |
- Under **Action** – select letter(s) for desired action.
 - 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

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>

Standard Specifications

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.

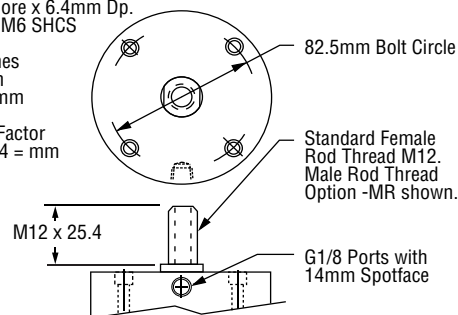
Original Series									
Stroke mm	3.2	6.4	12.7	19.1	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AB	AA	A	B	C	D	E	F	G

"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.

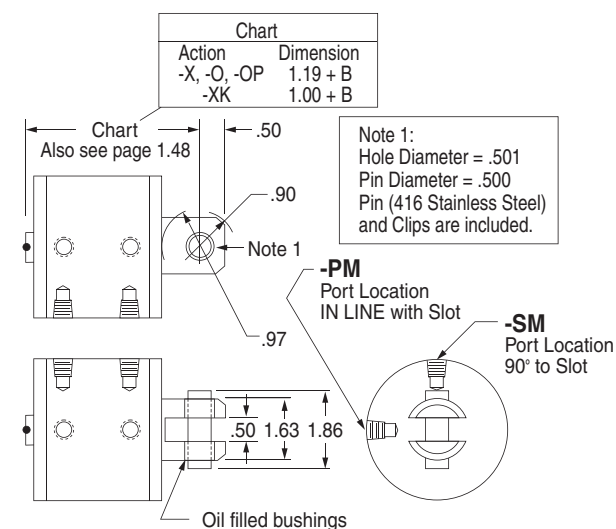
	T	V	Q	H	N	C1-C7	LF	LR	LFR	BF	BR	BFR	P14
-X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XK	NA	✓	✓	✓	✓	✓	NA	✓	✓	✓	✓	✓	✓
-O	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓
-OP	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓

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

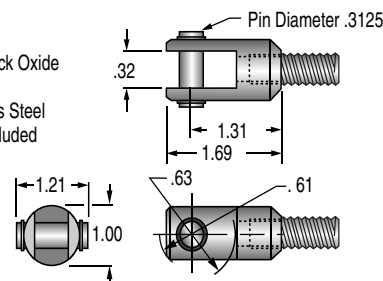
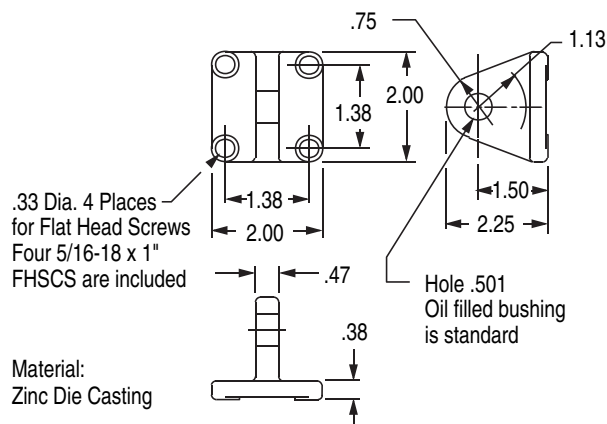


CHART 1/2-20 x Thread Length Metric M12 x Thread Length		
Rod Clevis Number	Strokes	Thread Length
RC-54	AB	.39"
RC-56	AA-G	.62"
MRC-54	MAB	9.9mm
MRC-56	MAA-MG	15.7mm

EM-521 Eye Bracket Kit

Mates with Clevis Mount shown above.

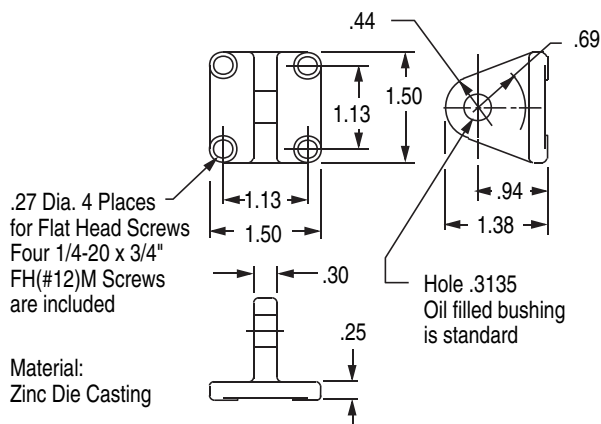
Order separately.



EM-121 Eye Bracket Kit

Mates with any Rod Clevis shown above.

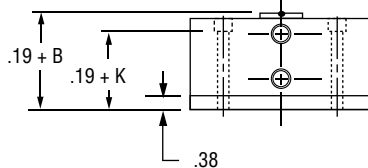
Order separately.



Suffix Option -HHC Hydraulic & -HC Air

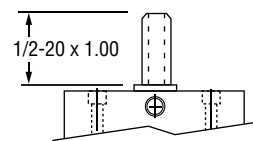
Available on Original and "T" Series with Action -X, -O.

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



Suffix Option -MR Male Rod Thread

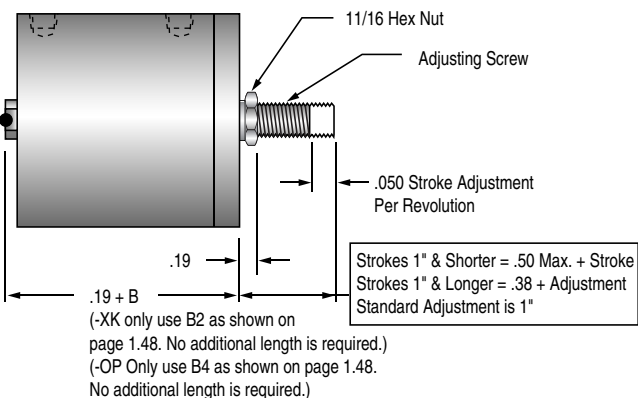
Available on Original
and "T" Series with
Actions: -X, -XK, -O, -OP.
Also see *Option Information*
on page 1.8.



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.



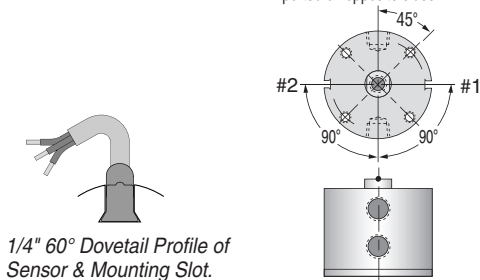
Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

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.



Quick Reference to Standard Strokes

Use the appropriate Stroke Letter in the Model Number

Available on Original Series Available on "T" Series

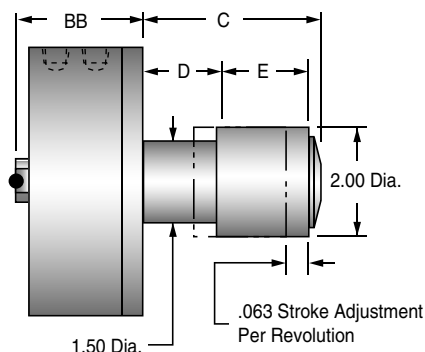
Available on Original Series		Available on "T" Series	
Stroke	Action X, XK	Stroke	Action X, XK
1/4	AA	1/4	TA
1/2	A	1/2	TB
3/4	B	3/4	TC
1	C		
1 1/2	D	1 1/4	TD
2	E	1 3/4	TE
3	F	2 3/4	TF
4	G	3 3/4	TG

Suffix Option -AS Adjustable Extend Stroke

Available on Original Series with Actions: -X, -XK, -O

Also see *Option Information* on page 1.11.

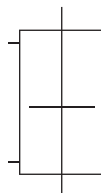
Stroke Inches	1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke Letter	AB	AA	A	B	C	D	E	F	G
Actions: -X, -XK	BB	2.02	2.14	2.39	2.77	2.89	3.39	3.89	4.89
Actions: -O	BB	2.02	2.14	2.39	2.77	2.89	4.89	NA	NA
	C	1.67	1.91	2.41	2.91	3.41	4.41	5.41	7.41
	D	0.63	0.75	1.00	1.25	1.50	2.00	2.50	3.50
	E	0.88	1.00	1.25	1.50	1.75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



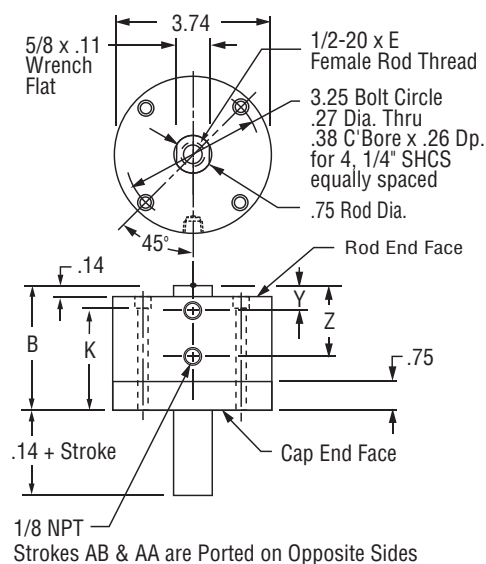
1

Action –XDR Original Series Double Rod, Double Acting

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

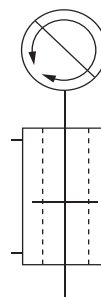


Stroke, Inches	1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G
B	2.02	2.14	2.39	2.77	2.89	3.39	3.89	4.89	5.89
E	.56	.63	.63	.88	.88	.88	.88	.88	.88
K	1.63	1.75	2.00	2.38	2.50	3.00	3.50	4.50	5.50
Y	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z	.89	1.02	1.27	1.64	1.77	2.27	2.77	3.77	4.77
Weight,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

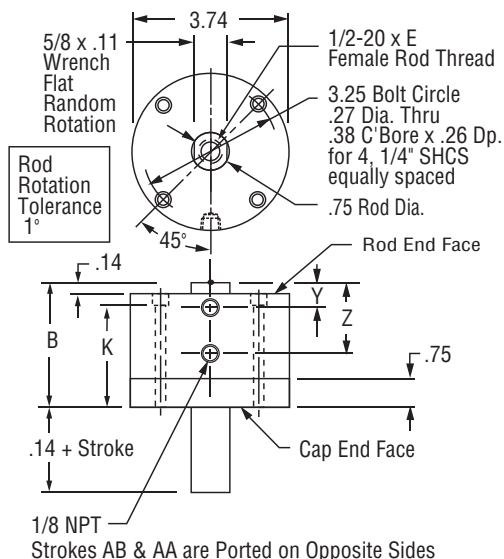


Action –XDRK Original Series Double Rod, Double Acting, Nonrotating

See page 1.16 for
Mounting Bolts
Force Area = 4.37
Seal Kit = 521-SK-K

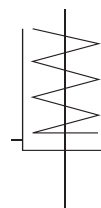


Stroke, Inches	1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G
B	2.02	2.14	2.39	2.77	2.89	3.39	3.89	4.89	5.89
E	.56	.63	.63	.88	.88	.88	.88	.88	.88
K	1.63	1.75	2.00	2.38	2.50	3.00	3.50	4.50	5.50
Y	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z	.89	1.02	1.27	1.64	1.77	2.27	2.77	3.77	4.77
Weight,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

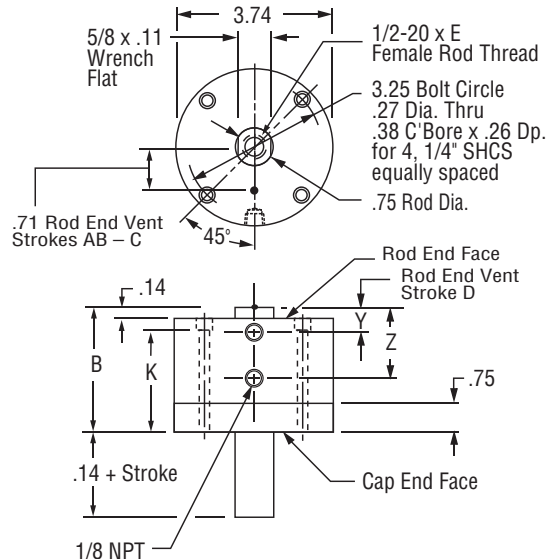


Action –ODR Original Series Double Rod, Single Acting, Spring Retracted

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

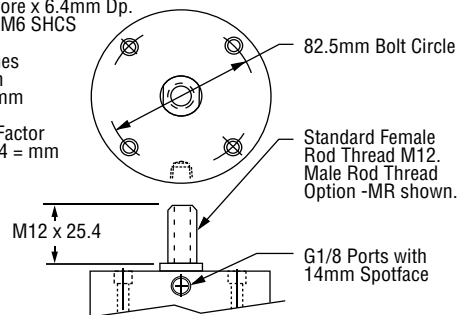
Available on Original Series with Actions: -XDR, -XDRK, -ODR

Also see *Option Information* on page 1.7.

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



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

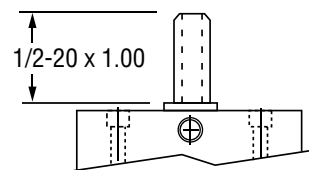
Available on Original Series with Actions -XDR, -XDRK, -ODR.

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.



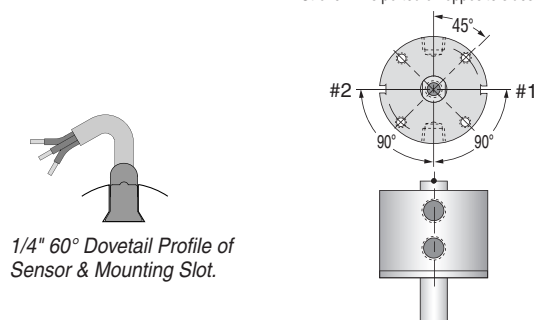
Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

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.



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

Available on Original Series

	Action	
	Stroke	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

Leave blank if none desired

Stroke

C

721

Action

X

Suffix Options

MR

Metric

M

See pages 1.7, 1.55 & 1.58

Bore

3"

76.2mm

Code

721

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

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	-25
150 psi max	

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)	-E
Order sensors separately. See page 1.14.	
Stroke length determines number of mounting slots. See page 1.14, 1.56, 1.58	

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.

HOW TO ORDER

- Under **Stroke** – select letter(s) for desired Series and Stroke.
- 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 1/4"	121	1.29
1 5/8"	221	1.35
2"	321	1.41
2 1/2"	521	1.47
4"	1221	1.59

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

EXAMPLES

A-721-X

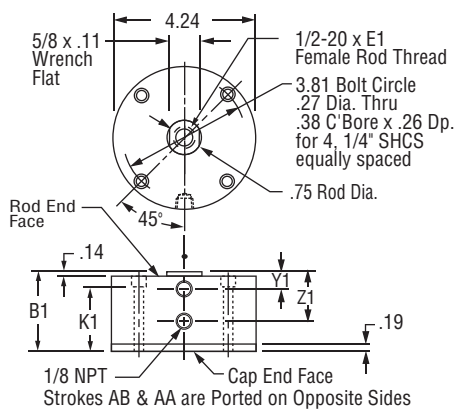
Original Series, 1/2" stroke - 3" Bore - Single Rod, Double Acting

TC-721-X-MR

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

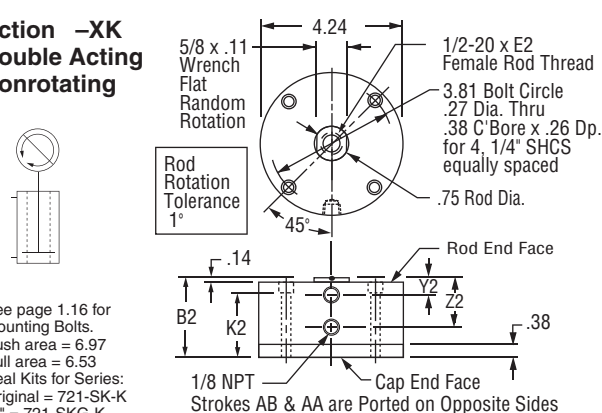
A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – <http://www.fabco-air.com>

Action -X Double Acting



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

Action -XK Double Acting Nonrotating

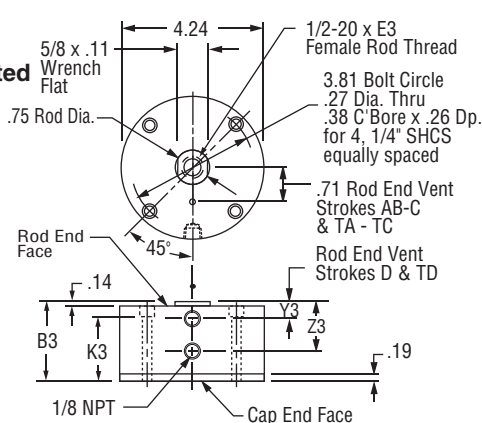


See page 1.16 for Mounting Bolts.
Push area = 6.97
Pull area = 6.53
Seal Kits for Series:
Original = 721-SK-K
"T" = 721-SKG-K

Original Series

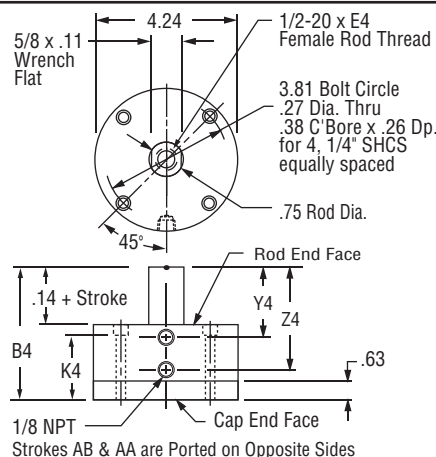
Stroke, Inches	1/8	1/4	1/2	3/4	1	1 1/2	2	3	4	1/4	1/2	3/4	1 1/4	1 3/4	2 3/4	3 3/4		
Stroke, Letter	AB	AA	A	B	C	D	E	F	G	TA	TB	TC	TD	TE	TF	TG		
Action -X Double Acting										Action -X Double Acting								
B1	1.52	1.64	1.89	2.14	2.39	2.89	3.39	4.39	5.39	1.89	2.14	2.39	2.89	3.39	4.39	5.39		
E1	.63	.63	.63	.88	.88	.88	.88	.88	.88	.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	1.49	1.74	1.99	2.49	2.99	3.99	4.99		
Y1	.52	.52	.52	.64	.64	.64	.64	.64	.64	.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	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	2.49	2.68	2.89	3.30	3.70	4.54	5.40		
Action -XK Double Acting, Nonrotating										Action -XK Double Acting, Nonrotating								
B2	1.71	1.83	2.08	2.33	2.58	3.08	3.58	4.58	5.58	2.08	2.33	2.58	3.08	3.58	4.58	5.58		
E2	.63	.63	.63	.88	.88	.88	.88	.88	.88	.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	1.68	1.93	2.18	2.68	3.18	4.18	5.18		
Y2	.52	.52	.52	.64	.64	.64	.64	.64	.64	.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	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	2.77	2.96	3.18	3.60	3.91	4.88	5.72		
Action -O Single Acting, Spring Retracted										Action -O Single Acting, Spring Retracted								
B3	1.52	1.64	1.89	2.14	2.39	4.39	NA*	NA*	NA*	1.89	2.14	2.39	4.39	NA*	NA*	NA*		
E3	.63	.63	.63	.88	.88	.88	NA*	NA*	NA*	.63	.88	.88	.88	NA*	NA*	NA*		
K3	1.12	1.24	1.49	1.74	1.99	3.99	NA*	NA*	NA*	1.49	1.74	1.99	3.99	NA*	NA*	NA*		
Y3	Rod End Face Vent					.64	NA*	NA*	NA*	Rod End Face Vent					.64	NA*	NA*	NA*
Z3	.95	1.08	1.33	1.58	1.83	3.83	NA*	NA*	NA*	1.33	1.58	1.83	3.83	NA*	NA*	NA*		
Weight, lb. 12.0	1.92	2.11	2.29	2.51	4.36	NA*	NA*	NA*	2.43	2.61	2.83	4.68	NA*	NA*	NA*			
Preload, lb. 12.0	12.0	6.5	5.0	4.7	7.3	NA*	NA*	NA*	11.7	10.6	7.9	9.5	NA*	NA*	NA*			
End of Stroke, lb.	18.0	18.5	15.5	15.5	20.0	20.0	NA*	NA*	NA*	17.0	19.3	20.0	20.0	NA*	NA*			
NA* Action -OP Single Acting, Spring Extended										NA* Action -OP Single Acting, Spring Extended								
B4	2.08	2.33	2.83	3.33	3.83	NA*	NA*	NA*	NA*	2.58	3.08	3.58	NA*	NA*	NA*	NA*		
E4	.63	.63	.63	.88	.88	NA*	NA*	NA*	NA*	.63	.88	.88	NA*	NA*	NA*	NA*		
K4	1.55	1.68	1.93	2.18	2.43	NA*	NA*	NA*	NA*	1.93	2.18	2.43	NA*	NA*	NA*	NA*		
Y4	.65	.77	1.02	1.39	1.64	NA*	NA*	NA*	NA*	.77	1.14	1.39	NA*	NA*	NA*	NA*		
Z4	1.08	1.33	1.83	2.33	2.83	NA*	NA*	NA*	NA*	1.58	2.08	2.58	NA*	NA*	NA*	NA*		
Weight, lb. 2.49	2.60	2.69	2.99	3.20	NA*	NA*	NA*	NA*	3.01	3.31	3.52	NA*	NA*	NA*	NA*			
Preload, lb. 6.2	12.0	6.5	5.0	5.2	NA*	NA*	NA*	NA*	11.7	10.6	8.5	NA*	NA*	NA*	NA*			
End of Stroke, lb.	12.0	18.5	15.5	15.5	20.5	NA*	NA*	NA*	NA*	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



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.

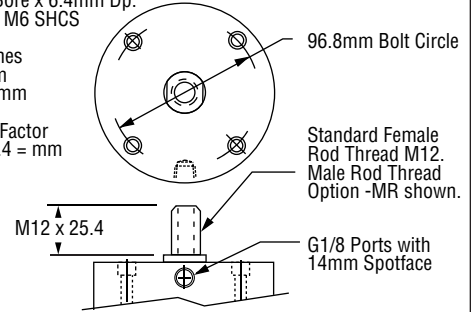
Original Series									
Stroke mm	3.2	6.4	12.7	19.1	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AB	AA	A	B	C	D	E	F	G

"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

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



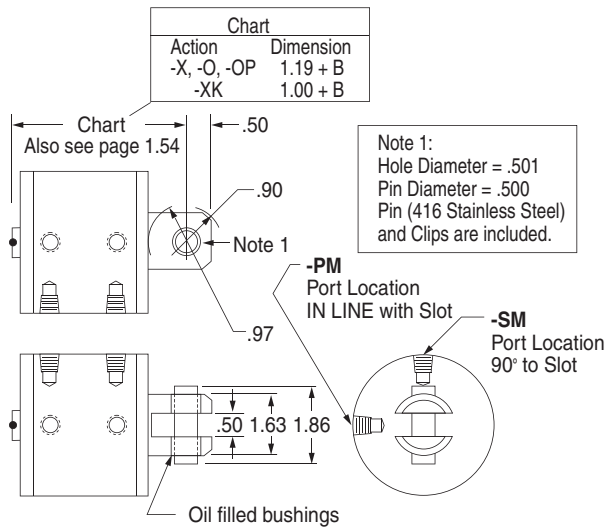
The **Suffix Options** charted on the right are available on Original and "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.54.
– Also see *Option Information* on pages 1.7 thru 1.15.

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

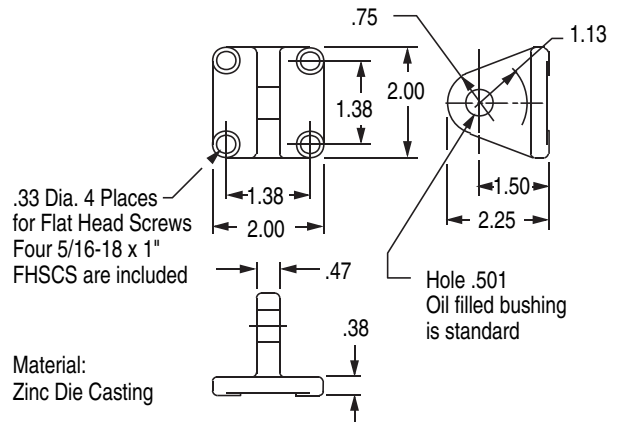
Also see *Option Information* on page 1.13.



EM-521 Eye Bracket Kit

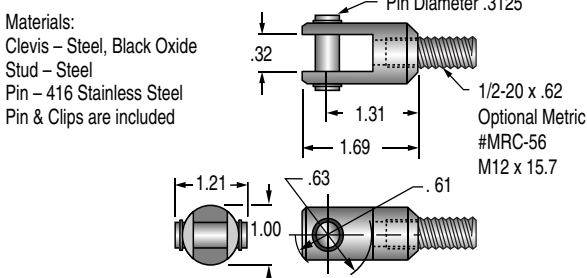
Mates with Clevis Mount shown on the left.

Order separately.



RC-56 Rod Clevis and Pin

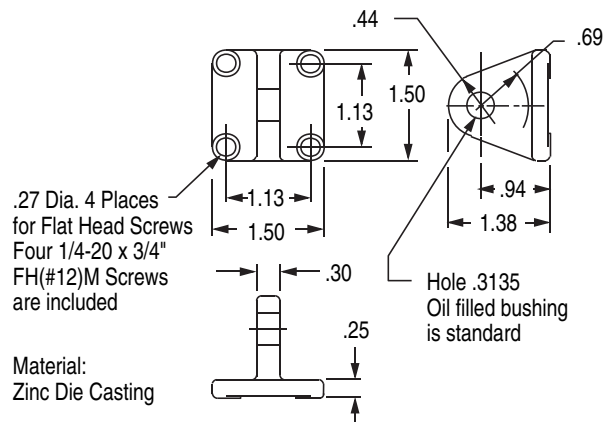
Threaded Stud mates with Female Rod thread in the **Pancake®** Cylinders.
Slot and Pin Mate with EM-121 Eye Bracket shown on the right.



EM-121 Eye Bracket Kit

Mates with RC-56 Rod Clevis shown on the left.

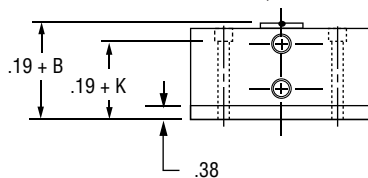
Order separately.



Suffix Option -HHC Hydraulic & -HC Air

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

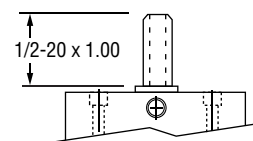
Also see
Option Information
on page 1.9 for Pressure
and Mounting details.



Suffix Option -MR Male Rod Thread

Available on Original
and "T" Series with

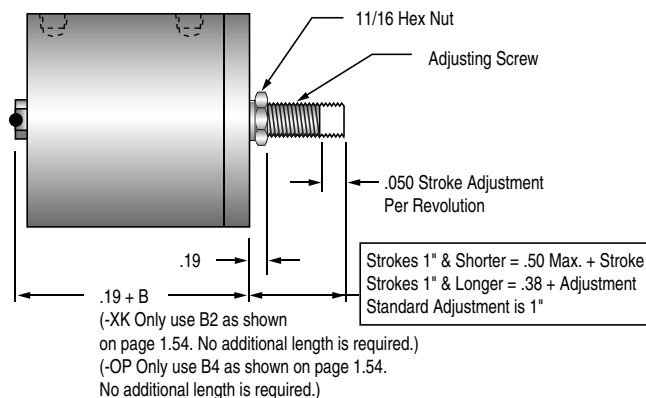
Actions: -X, -XK, -O, -OP.
Also see *Option Information*
on page 1.8.



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.



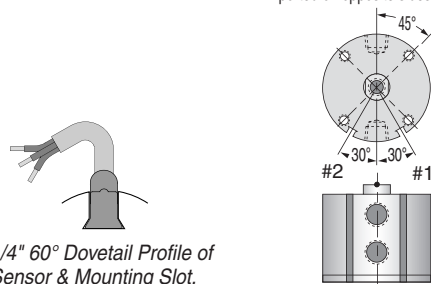
Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

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		Available on "T" Series	
Stroke	Action X, XK	Stroke	Action X, XK
1/4	-----AA	1/4	-----TA
1/2	-----A	1/2	-----TB
3/4	-----B	3/4	-----TC
1	-----C		
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

Sensor Slots at
Positions #1 and #2

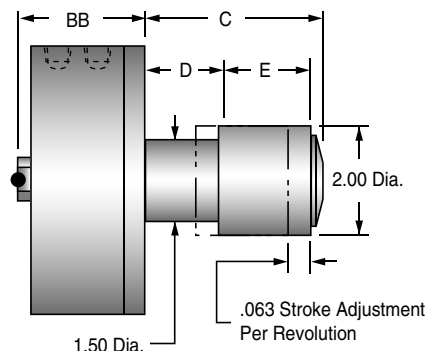
Sensor Slot at
Position #1 only

Suffix Option -AS Adjustable Extend Stroke

Available on Original Series with Actions: -X, -XK, -O

Also see *Option Information* on page 1.11.

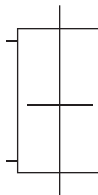
Stroke Inches	1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke Letter	AB	AA	A	B	C	D	E	F	G
Actions: -X, -XK	BB	2.08	2.20	2.45	2.70	2.95	3.45	3.95	4.95
Actions: -O	BB	2.08	2.20	2.45	2.70	2.95	4.95	NA	NA
	C	1.67	1.91	2.41	2.91	3.41	4.41	5.41	7.41
	D	0.63	0.75	1.00	1.25	1.50	2.00	2.50	3.50
	E	0.88	1.00	1.25	1.50	1.75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



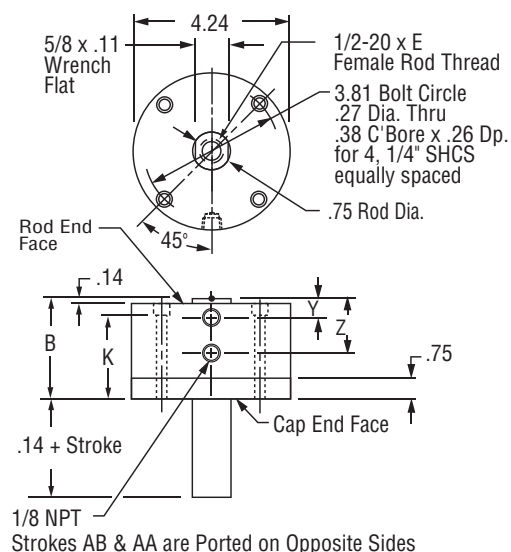
1

Action –XDR Original Series Double Rod, Double Acting

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

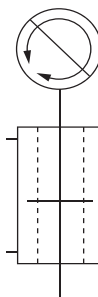


Stroke, Inches	1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G
B	2.08	2.20	2.45	2.70	2.95	3.45	3.95	4.95	5.95
E	.63	.63	.63	.88	.88	.88	.88	.88	.88
K	1.68	1.80	2.10	2.30	2.55	3.10	3.55	4.55	5.55
Y	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z	.95	1.08	1.33	1.58	1.83	2.33	2.83	3.83	4.83
Weight,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

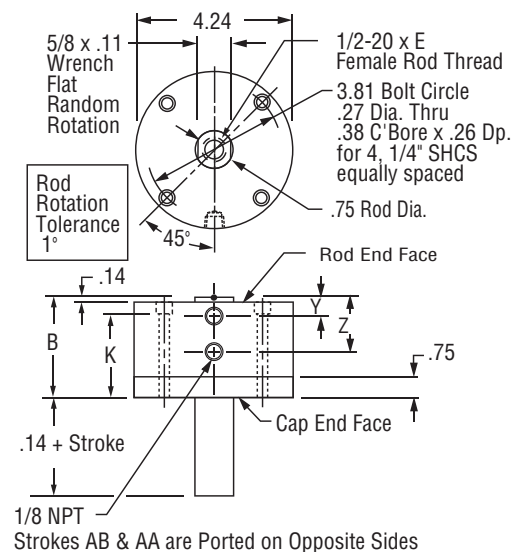


Action –XDRK Original Series Double Rod, Double Acting, Nonrotating

See page 1.16 for
Mounting Bolts
Force Area = 6.53
Seal Kit = 721-SK-K

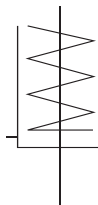


Stroke, Inches	1/8	1/4	1/2	3/4	1	1-1/2	2	3	4
Stroke, Letter	AB	AA	A	B	C	D	E	F	G
B	2.08	2.20	2.45	2.70	2.95	3.45	3.95	4.95	5.95
E	.63	.63	.63	.88	.88	.88	.88	.88	.88
K	1.68	1.80	2.10	2.30	2.55	3.10	3.55	4.55	5.55
Y	.52	.52	.52	.64	.64	.64	.64	.64	.64
Z	.95	1.08	1.33	1.58	1.83	2.33	2.83	3.83	4.83
Weight,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

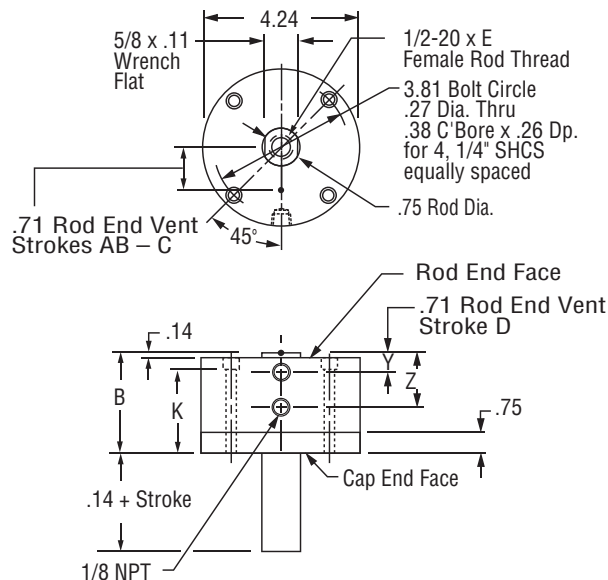


Action –ODR Original Series Double Rod, Single Acting, Spring Retracted

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	.52	.52	.52	.64	.64	.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

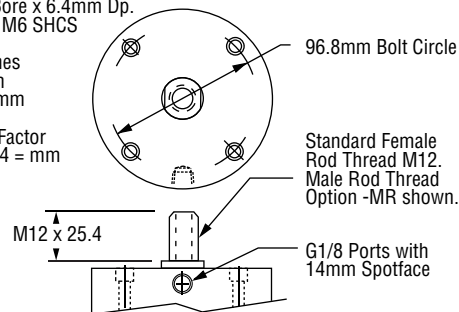
Also see *Option Information* on page 1.7.

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

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 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.

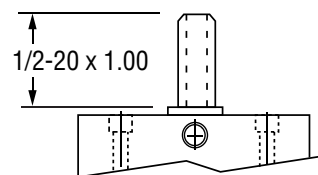
	T	V	Q	H	N	C1-C7	LF	LR	LFR	BF	BR	BFR	P14	16	25
-XDR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	NA	✓	✓	✓	✓	✓	NA	✓	NA	✓	✓	✓	✓	✓	✓
-ODR	NA	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	NA	✓	✓	✓

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



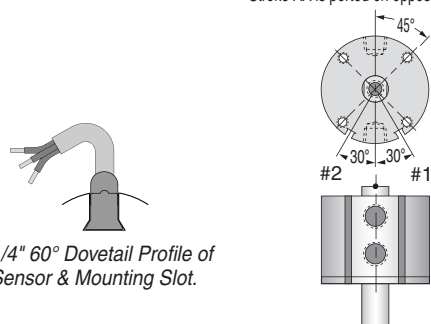
Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

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

Leave blank if none desired

Stroke

Bore

Action

Suffix Options

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

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.

HOW TO ORDER

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

Bore	Bore Code	See page
1/4"	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
- Under **Action** – select letter(s) for desired action.
- Under **Prefix & Suffix Options** – select letter(s) for desired options and add to model number.

EXAMPLES

D-1221-X

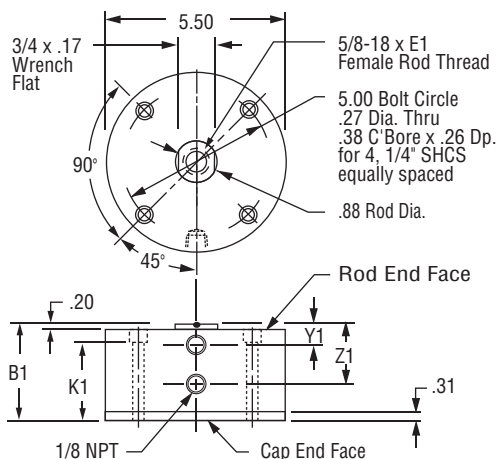
Original Series, 3" stroke - 4" Bore -
Single Rod, Double Acting

TD-1221-X-MR

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

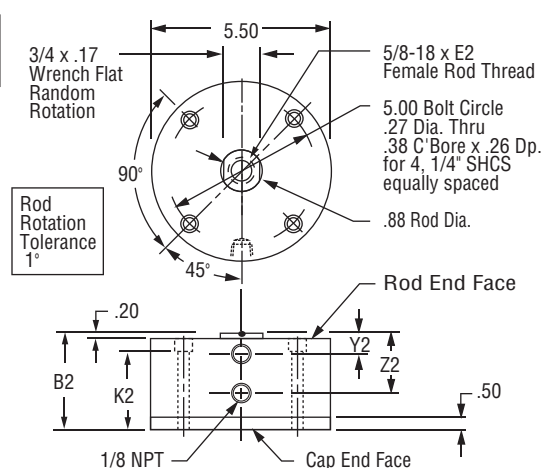
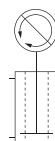
A complete library of cylinder CAD drawings is available from your local Fabco-Air Distributor or from the Fabco-Air web site – <http://www.fabco-air.com>

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

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
Action -X Double Acting								
B1	1.89	2.02	2.27	2.77	3.27	3.77	4.77	5.77
E1	.50	.50	.75	.88	.88	.88	.88	.88
K1	1.43	1.56	1.81	2.31	2.81	3.31	4.31	5.31
Y1	.58	.58	.70	.70	.70	.70	.70	.70
Z1	1.20	1.33	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
Action -XK Double Acting, Nonrotating								
B2	2.08	2.21	2.46	2.96	3.46	3.96	4.96	5.96
E2	.50	.50	.75	.88	.88	.88	.88	.88
K2	1.62	1.75	2.00	2.50	3.00	3.50	4.50	5.50
Y2	.58	.58	.70	.70	.70	.70	.70	.70
Z2	1.20	1.33	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

"T" Series

Stroke, Inches	5/16	13/16	1 5/16	1 13/16	2 13/16	3 13/16
Stroke, Letter	TAA	TA	TB	TC	TD	TE
Action -X Double Acting						
B1	2.27	2.77	3.27	3.77	4.77	5.77
E1	.75	.88	.88	.88	.88	.88
K1	1.81	2.31	2.81	3.31	4.31	5.31
Y1	.70	.70	.70	.70	.70	.70
Z1	1.58	2.08	2.58	3.08	4.08	5.08
Weight, lb.	5.04	5.61	6.33	6.92	8.23	9.54
Action -XK Double Acting, Nonrotating						
B2	2.46	2.96	3.46	3.96	4.96	5.96
E2	.75	.88	.88	.88	.88	.88
K2	2.00	2.50	3.00	3.50	4.50	5.50
Y2	.70	.70	.70	.70	.70	.70
Z2	1.58	2.08	2.58	3.08	4.08	5.08
Weight, lb.	5.48	6.06	6.80	7.50	8.74	10.08

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.

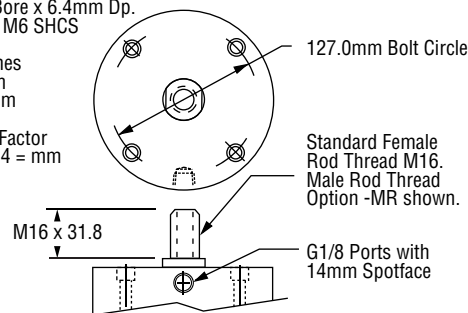
Original Series								
Stroke mm	3.2	6.4	12.7	25.4	38.1	50.8	76.2	101.6
Stroke Letter	AC	AB	AA	A	B	C	D	E

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

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



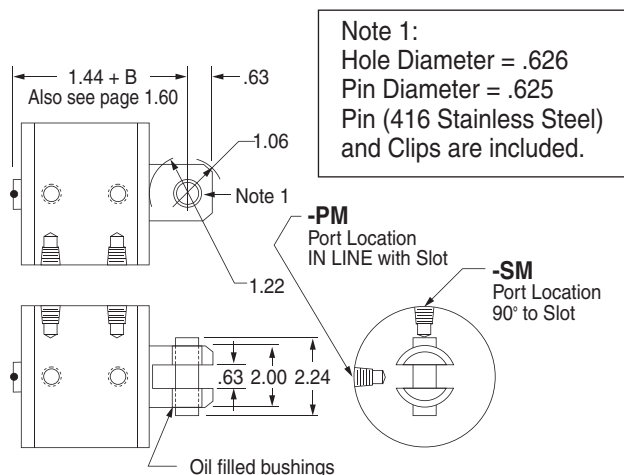
The **Suffix Options** charted on the right are available on Original and "T" Series with the Actions indicated (✓). They require no dimensional changes from the Standard Specifications on page 1.60.
– Also see *Option Information* on pages 1.7 thru 1.15.

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

Suffix Options -PM & -SM Clevis Mount

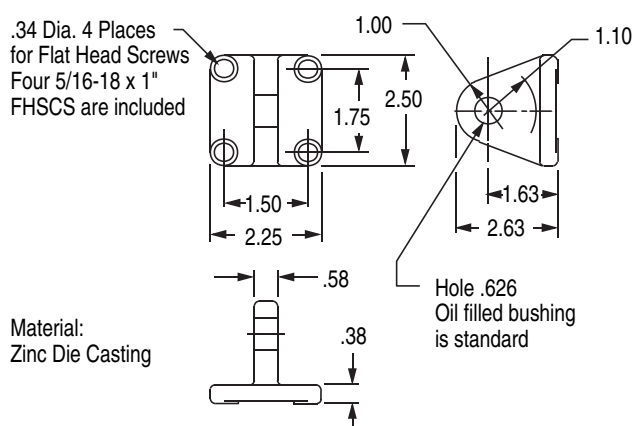
Available on Original and "T" Series
with Actions: -X, -XK

Also see *Option Information* on page 1.13.



EM-1221 Eye Bracket Kit

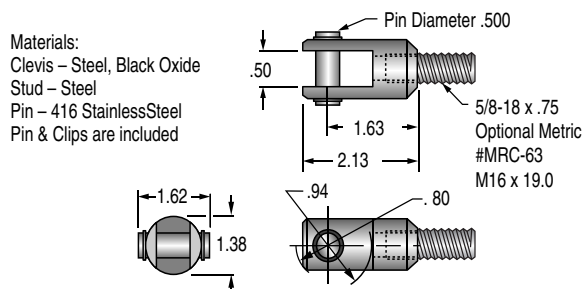
Mates with Clevis Mount shown on the left.
Order separately.



RC-63 Rod Clevis and Pin

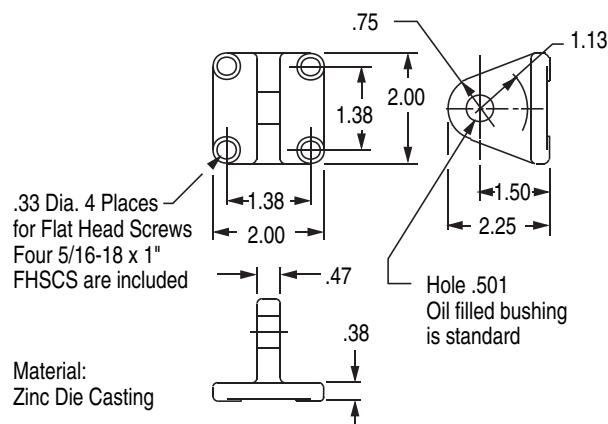
Threaded Stud mates with Female Rod thread in the **Pancake®** Cylinders.

Slot and Pin Mate with EM-521 Eye Bracket shown on the right.



EM-521 Eye Bracket Kit

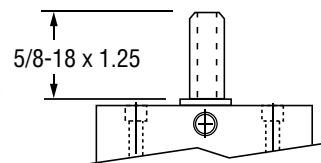
Mates with RC-63 Rod Clevis shown on the left.
Order separately.



Suffix Option -MR

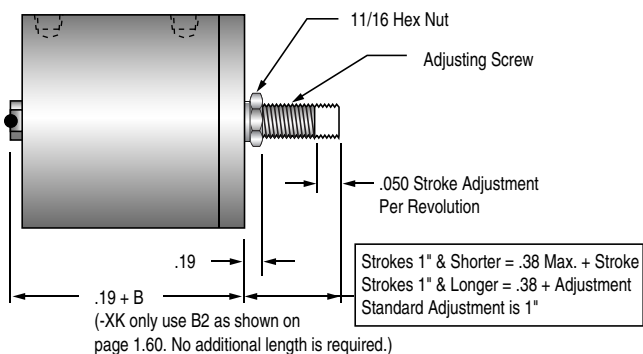
Male Rod Thread

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



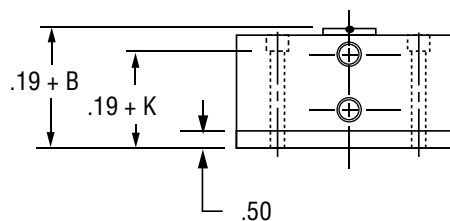
Suffix Option -RS Adjustable Retract Stroke

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.



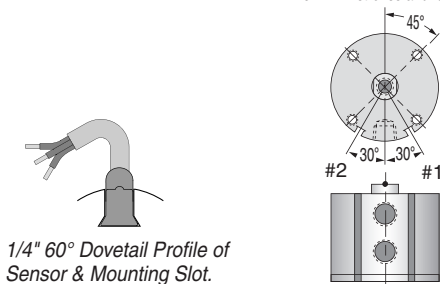
Suffix Option -E Specifies Magnetic Piston and Dovetail Mounting Slot(s)

Strokes are NOT affected by magnetic piston.

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

4" (1221) Bore

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



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

Quick Reference to Standard Strokes

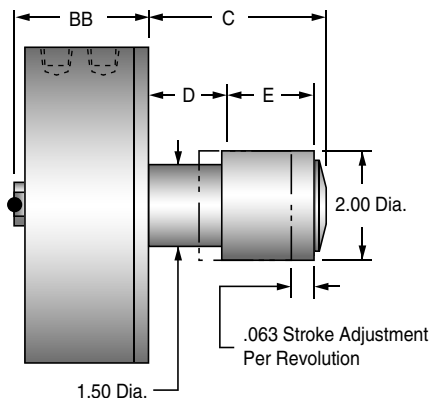
Use the appropriate Stroke Letter in the Model Number

Available on Original Series		Available on "T" Series	
Stroke	Action X, XK	Stroke	Action X, XK
1/4	-----AB	5/16	-----TAA
1/2	-----AA	13/16	-----TA
1	-----A		
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

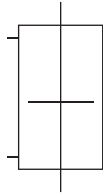
Available on Original Series with Actions: -X, -XK
Also see *Option Information* on page 1.11.

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



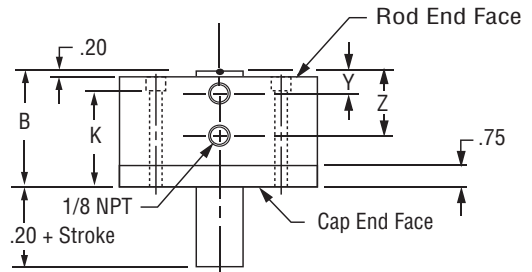
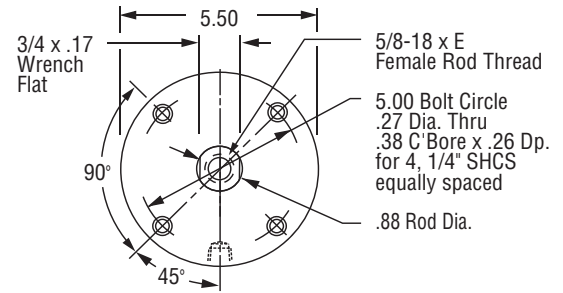
1

Action -XDR Original Series Double Rod, Double Acting

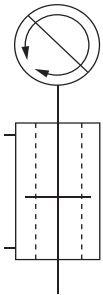


See page 1.16 for
Mounting Bolts.
Force area = 11.97
Seal Kit = 1221-SK

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

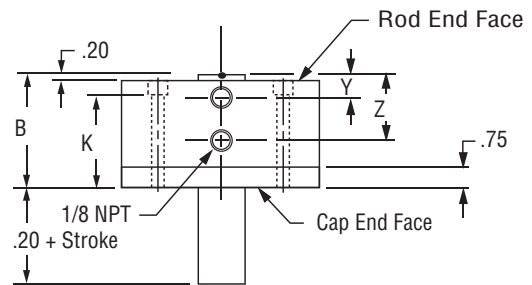
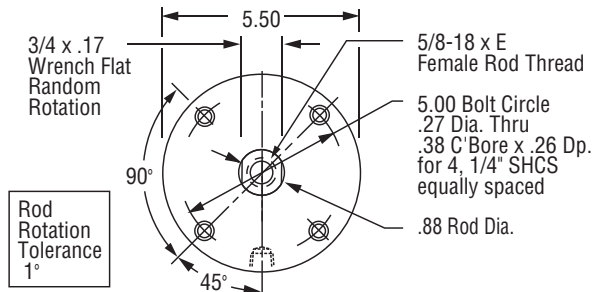


Action -XDRK Original Series Double Rod, Double Acting, Nonrotating



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

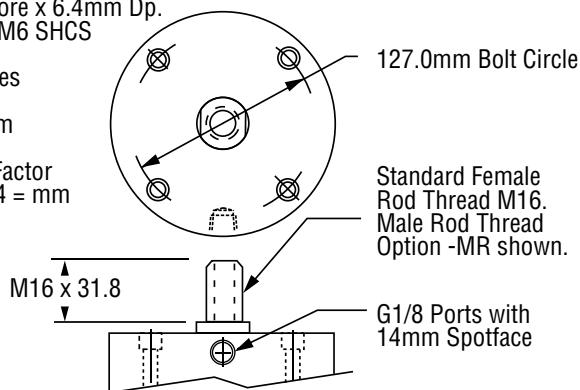
Available on Original Series with
Actions -XDR, -XDRK.
Also see Option Information on Page 1.7

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.

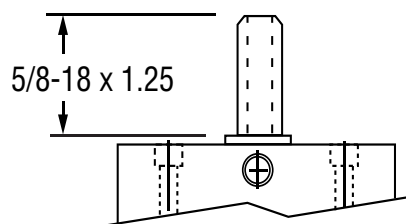
	T	V	Q	H	N	C1-C7	LF	LR	LFR	BF	BR	BFR	P14	25
-XDR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
-XDRK	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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

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

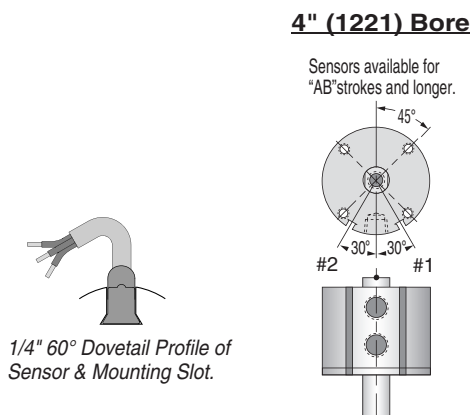
For Rod End only use **-MR**
For Cap End only use **-MR1**
For Both Ends use **-MR2**

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

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

Available on Original Series

Sensor Slots at Positions #1 and #2	Action	
	Stroke	XDR, XDRK
Sensor Slot at Position #1 only	1/4	AB
	1/2	AA
	1	A
	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

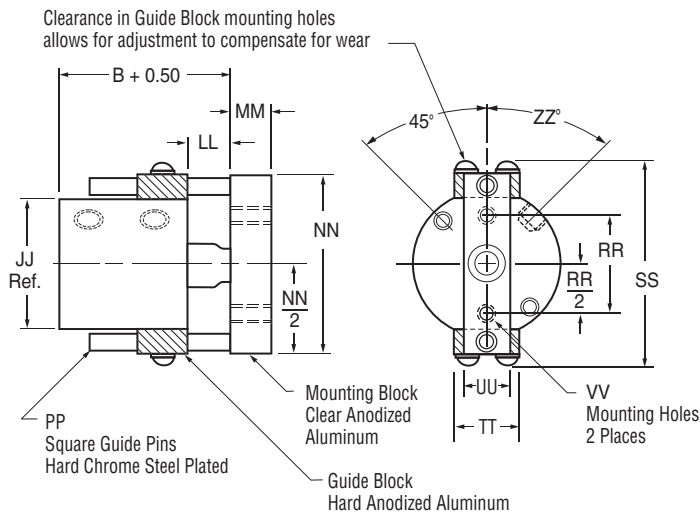
Select the basic **Pancake®** Cylinder model number for your desired series, bore and stroke. Then **add -G as a Suffix Option.**

Please Note!!

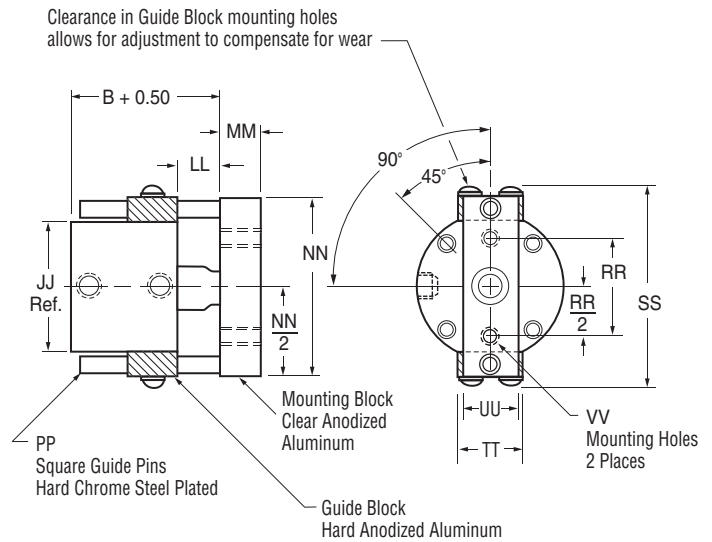
This option affects the rod end dimensions
See details on page 1.66.

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



2 1/2" through 4" 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°

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

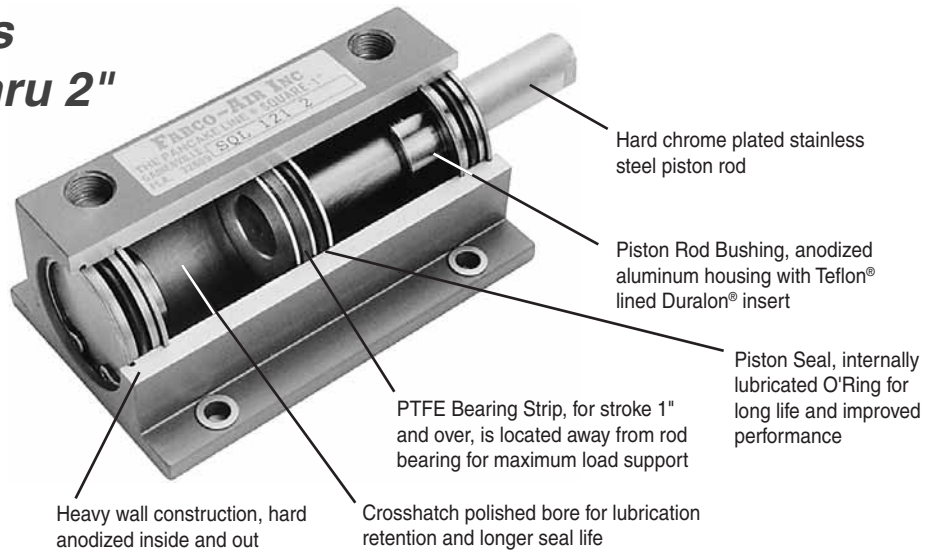
Square 1® Air Cylinders

	Page
General Standard Ratings and Sizing Guide.....	2.2
Construction Details	2.3, 2.4
How a Square 1® is built	
Standard Specifications.....	2.5
Model Number Codes.....	2.6
Option List	2.6
How to Order	2.6
Standard Specifications (Dimension Details)	2.7, 2.8
Option Specifications.....	2.9 - 2.14
Description and Dimensions of the Options	
Mounting Kits for SQF and SQFW	
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Trunnion Mounting Kits.....	2.15
Clevis Bracket Kits.....	2.15
Eye Bracket Kits	2.15
Rod Clevises	2.15
Accessories	
Flow Controls, Port Mounted and Others	Section 12
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Mounting Bolts.....	Section 1.16
Wrench Flat Wrench.....	Section 1.16
Air Spring Return.....	Section 1.15
2 Year Warranty	Inside back cover

Square 1® Cylinders

2

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)		Friction Properties	
Machine Design 1972/73			
Bearing Reference Issue			
Porous Bronze.....	4,500	Steel-on-steel.....	.50
Porous iron.....	8,000	Bronze-on-steel.....	.35
Phenolics.....	6,000	Sintered Bronze-on-steel	
Nylon®.....	1,000	with mineral oil .....	.13
TFE.....	500	Bronze-on-steel	
Reinforced Teflon®.....	2,500	with mineral oil .....	.16
*TFE fabric.....	60,000	Copper lead alloy-on-steel	.22
Polycarbonate.....	1,000	Acetal-on-steel.....	.20
Acetal.....	1,000	Nylon-on-steel.....	.32
Carbon-graphite.....	600	Duralon-on-steel.....	.05 - .16

* 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

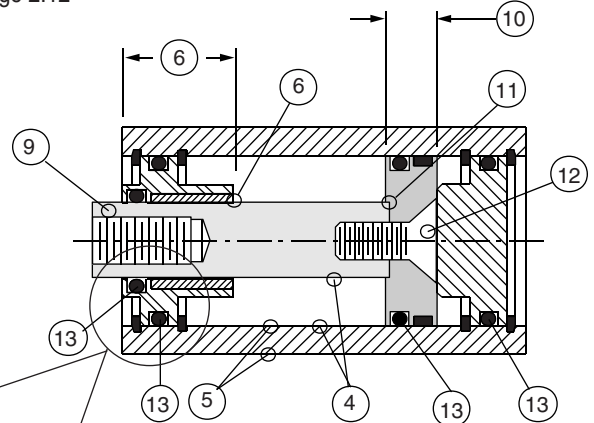
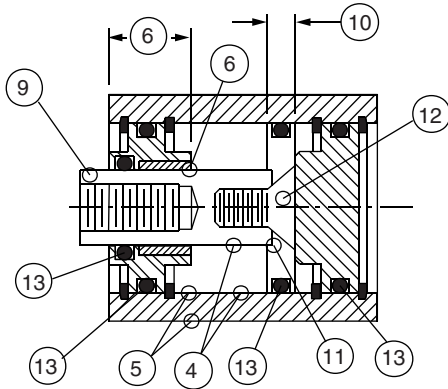
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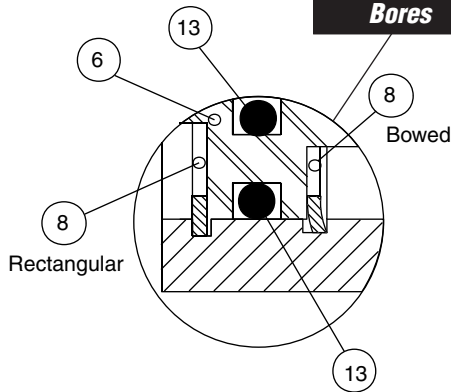
Strokes under 1"

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

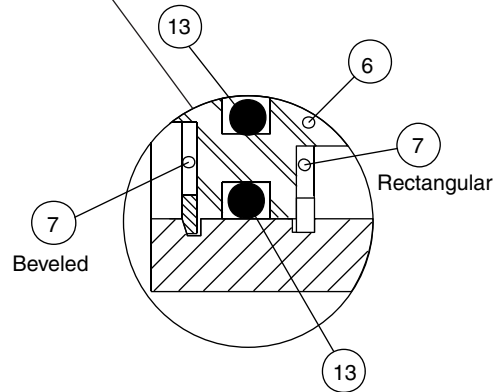
Strokes 1" and over



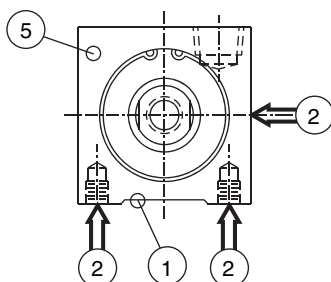
**3/4", 7/8"
1-1/8", 1-5/8"
Bores**



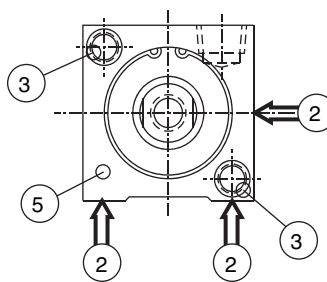
2" Bore



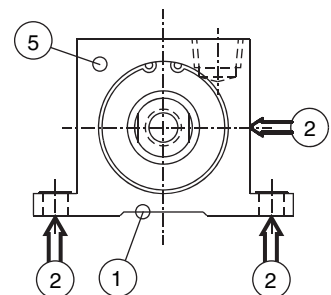
Series SQ



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 unequalled 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.

Side Tap Mounting: Series SQ

2



Model SQ-121 X 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"	SQ-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA
1-1/8"	SQ-121	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1-5/8"	SQ-221	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2"	SQ-321	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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

Face Mounting: Series SQF



Model SQF-121 X 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"	SQF-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	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 X 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"	SQL-06	✓	✓	✓	✓	✓	✓	✓	✓	✓	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.

Model Number Code

SQ	–	121	X	2	–	MR
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Mounting	Rod Extension	Bore	Standard Strokes Inches	OPTIONS		
				Description	Specify	See Page
SQ Side Tap	Single Rod Models	04 for 3/4" bore	Bores 3/4" 7/8"	Male Rod Thread		2.9
SQF Face	Blank –for standard extension per dimension "G" on page 2.7	06 for 7/8" bore	1/8	Single Rod	-MR	
SQL Side Lug	W - for Extension to dimension "W" on page 2.7	121 for 1 1/8" bore	1/4	Double Rod, Rod End	-MR	
	Double Rod Models See Page 2.10	221 for 1-5/8" bore	1/2	Double Rod, Cap End	-MR1	
	Blank –"G" extension both ends	321 for 2" bore	3/4	Double Rod, Both Ends	-MR2	
	W –"W" extension both ends		1	Viton Seals (-15° to +400°F)	-V	2.9
	GW – "G" extension on rod end; "W" extension on cap end		1-1/2	Quad Seals	-Q	2.9
	WG – "W" extension on rod end; "G" extension on cap end		2	Metric Rod Thread	-M	2.9
			3	Nonrotating	-K	2.12
			4	1-1/8", 1-5/8", 2" bores only		
			Bores 1-1/8" 1-5/8" 2"	Port Positions	-1B	2.9
			1/8	External Guide, Nonrotating	-G	2.14
			1/4	Hydraulic, Low Pressure to 150 psi NONSHOCK	-H	2.9
			1/2	Double Rod	-DR	2.10
			3/4	Hole Thru Double Rod Shaft		2.10
			1	Bore		
			1-1/2	3/4", 7/8"	-DR06	
			2	1-1/8"	-DR13	
			3	Plus size	-DR16	
			4	1-5/8"	-DR13	
			5	Plus size	-DR25	
			6	2"	-DR16	
				Plus size	-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	-RS	2.11
				For over 1" adjustment add desired length: e.g. -RS=2.000		
				Magnetic Piston & mounting slot(s) for Piston Position Sensors (Order Sensors separately.)	-E	2.13

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 X 2

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

SQW-121 X 2 - MR

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

SQLW-06 X 3 - C2 - LR

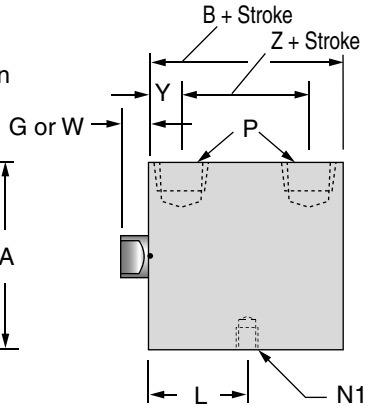
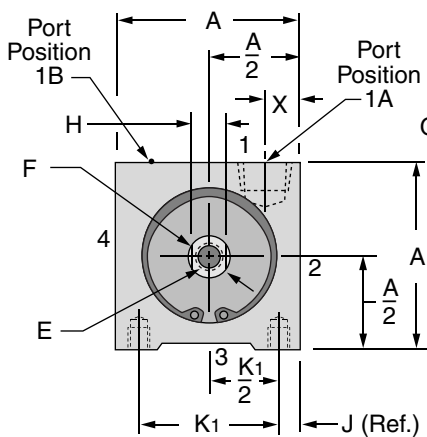
Side Lug Mounting with "W" Rod Extension;
7/8" Bore; 3" Stroke with 1/4" Stroke Collar yielding
2-3/4" Net Stroke; Sound Limiter, Cap End

Mounting Kits for Series SQF

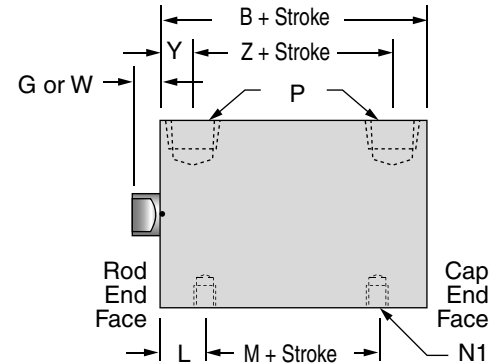
Type	See Page
Flange Mount Kit	2.14
Trunnion Mount Kit	2.15
Clevis Bracket Kit	2.15
Eye Bracket Kit	2.15
Rod Clevis	2.15

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

2

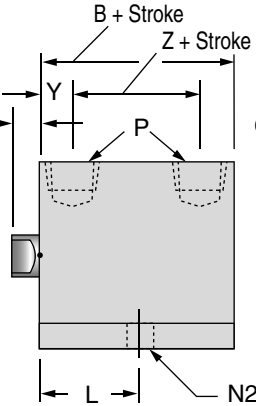
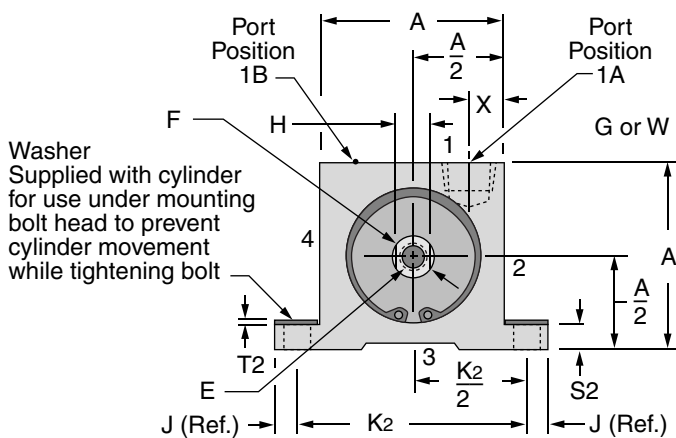


Cylinders with less than 1" stroke have 2 mounting holes

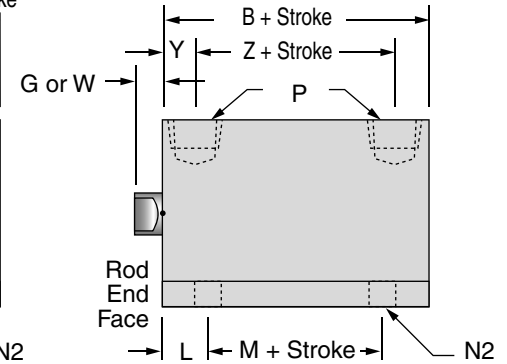


Cylinders with 1" stroke or more have 4 mounting holes

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



Cylinders with less than 1" stroke have 2 mounting holes



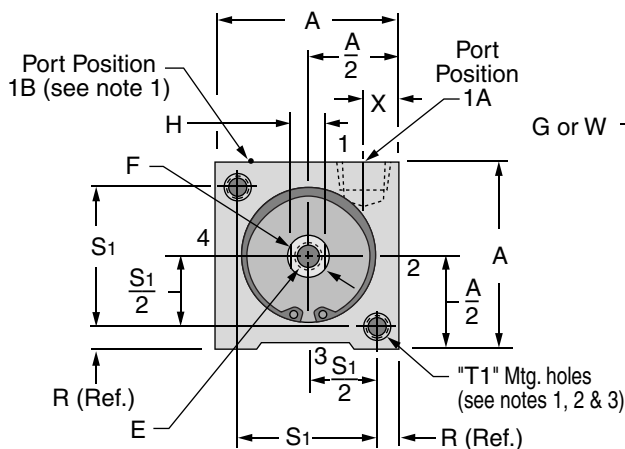
Cylinders with 1" stroke or more have 4 mounting holes

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

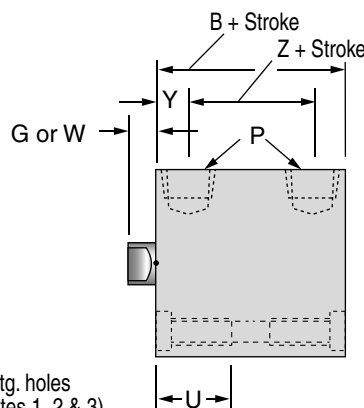
Figure 1
Rod End View



Note 1

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

Figure 2
Side View
Short Strokes



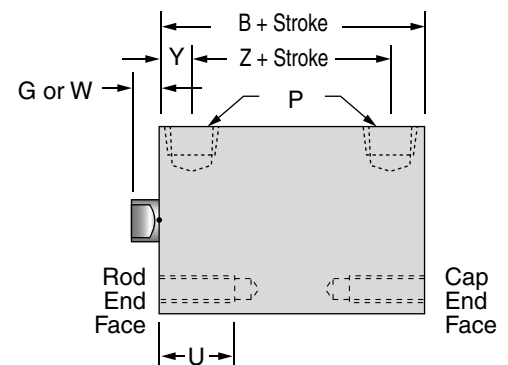
Note 2

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.

Figure 3
Side View
Long Strokes



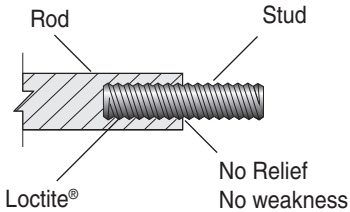
Variable Dimensions

Stroke	3/4" & 7/8" Bores						1-1/8" Bore						1-5/8" Bore						2" Bore					
	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

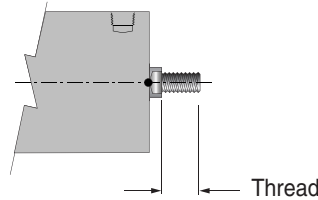
Male Rod Thread

Single Rod	-MR
Double Rod, Rod End Only	-MR
Double Rod, Cap End Only	-MR1
Double 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

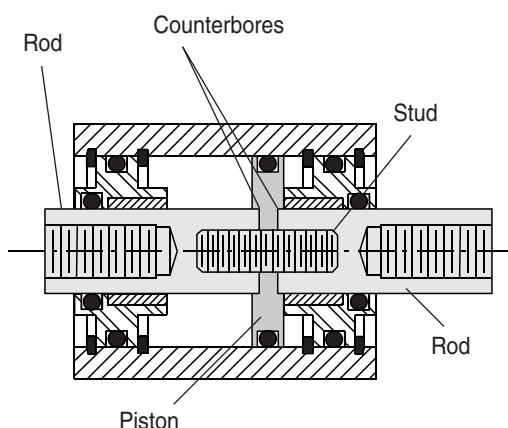
Low pressure service to 150psi **NONSHOCK**

Option -H

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



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.

- 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.

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.

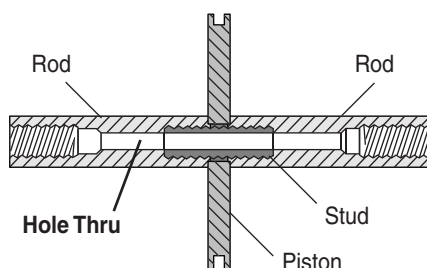
GW— "G" extension rod end;
"W" extension cap end.

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

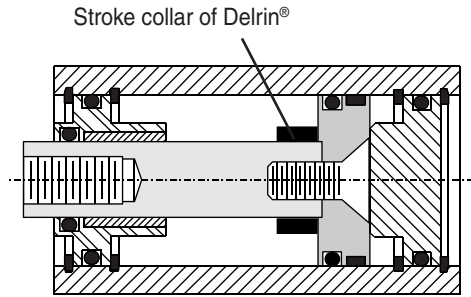
Stroke Collar on piston rod Option

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 $\pm 1/64"$. 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.

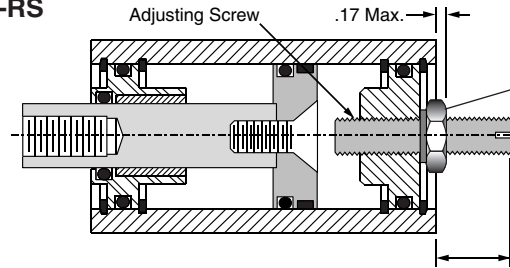
Adjustable Retract Stroke

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 = -RS=2.000



Thread sealing locknut

3/4", 7/8", 1-1/8" Bores = 1/2 Hex
1-5/8" and 2" Bores = 11/16 Hex

Strokes 1" & Under = .38 Max. + Stroke
Strokes Over 1" = .38 Max. + Adjustment

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).

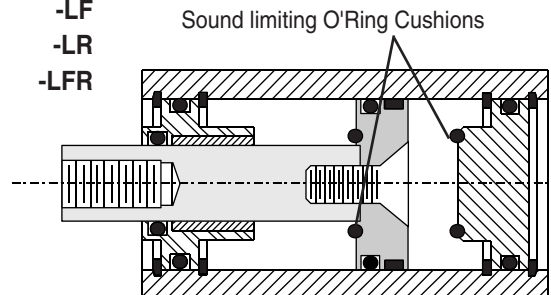
Example: -RS=2.000 will provide 2" of adjustment on any cylinder with 2" or more stroke.

Sound Limiters

Option

- Rod End Only
- Cap End Only
- Both Rod & Cap Ends

- LF
- LR
- 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 X 4 - K

WARNING

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

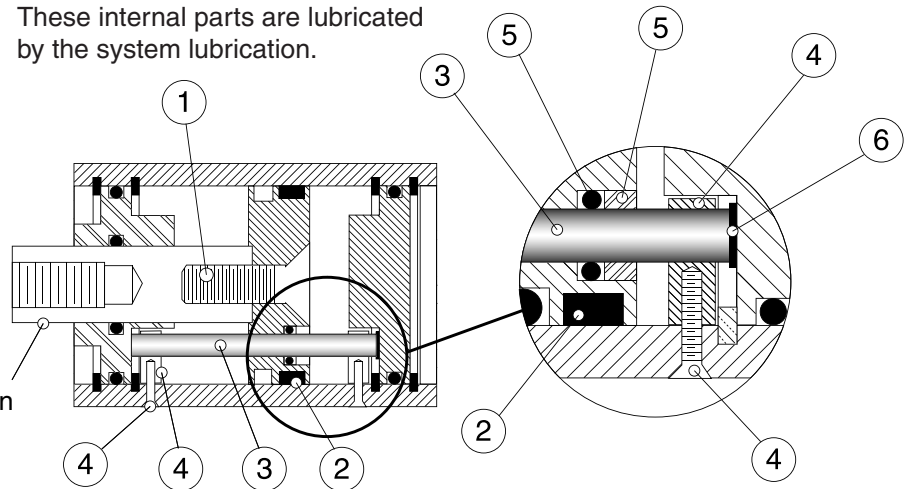
Wrench flat random rotation

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 $\pm 1^\circ$. The warning label shown at the left is applied to each cylinder.



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
Includes Dovetail Mounting Slots
Order Sensors Separately

Option -E



This short stroke **Model SQF** requires two dovetail mounting slots for proper positioning of sensors to detect beginning and end of stroke.

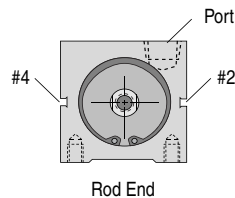
This longer stroke **Model SQL**, side lug mounting style, has room enough to fit multiple sensors in a single slot.

2

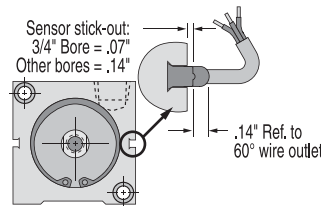
- **Dovetail style sensors** are actuated by a magnetic piston.
- Sensor dovetail slides into a mating slot on the cylinder body, is positioned as desired, and locked in place with a set screw.
- Magnetic piston and 1/4" Dovetail mounting slot(s) are specified with Suffix Option "E" in the model number.

- **Order sensors separately.**

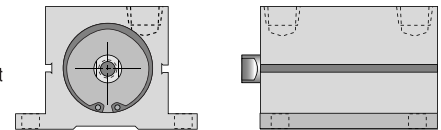
SQ Profile



SQF Profile



SQL Profile

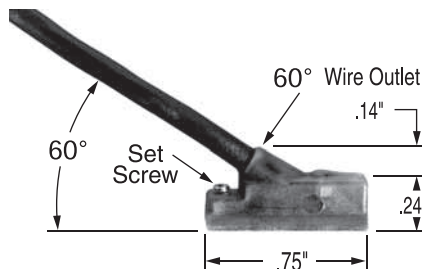


		Standard Stroke & Slot Location Guide											
		SQ (Side Tap)				SQF (Face Mount)				SQL (Side Lug)			
		3/4" 04	1 1/8" 121	1 5/8" 221	2" 321	3/4" 04	1 1/8" 121	1 5/8" 221	2" 321	7/8" 06	1 1/8" 121	1 5/8" 221	2" 321
Sensor Slots at Positions #2 and #4	1/8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	1/4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	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



Sensor housing rated NEMA 6/IP67. 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 5-28 VDC, 0.20 Amp Max current, 1.0 Voltage Drop
All Square 1's	Electronic	949-000-032	949-000-332	Yes	Sinking NPN 5-28 VDC, 0.20 Amp Max current, 1.0 Voltage Drop

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

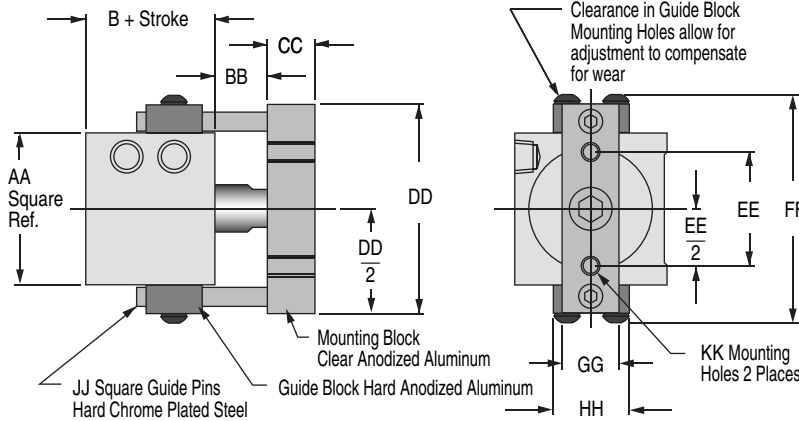
External Guide, Nonrotating

Option -G



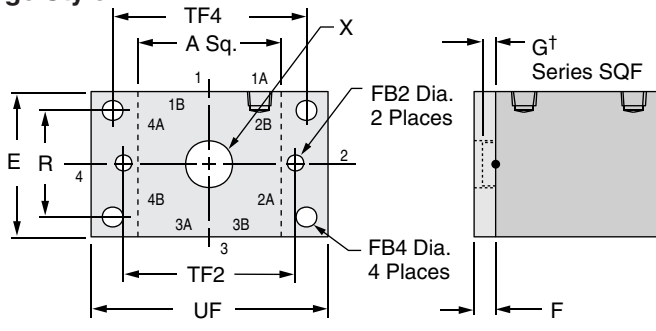
Superior nonrotating piston rod feature for applications such as package placement, figure stamping, and any application where anti-rotation and registration are critical as the piston is extended and retracted. A mounting block is bolted to the piston rod. This block has two square pins mounted to it 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

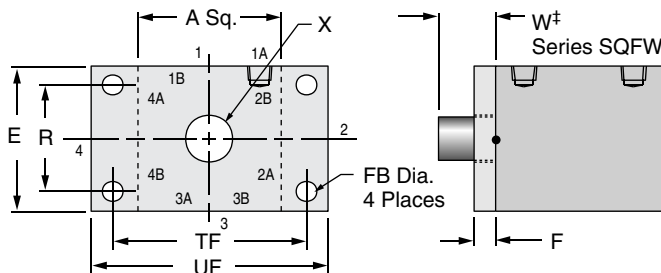
Flange Style 7



Flange 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			

Flange Style 8 & 9



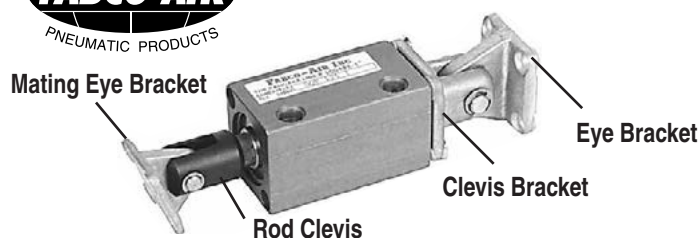
Port Positions

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-121X1 1/2
with H7-121

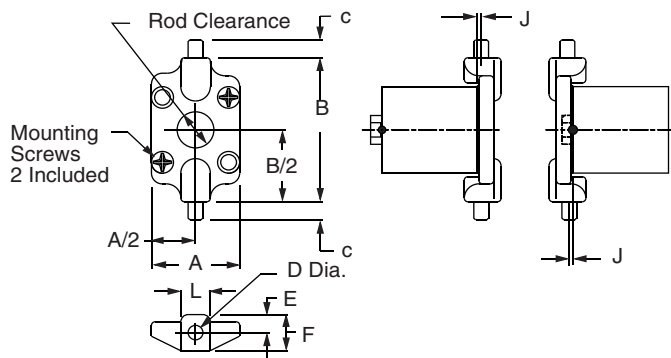
Bore	Model	Style	Kit #	A	E	F	FB	FB2	FB4	G ⁺	R	TF	TF2	TF4	UF	W ⁺	X
3/4"	04	7	H7-04	1.25	1.50	.25	NA	.22	.22	.13	1.00	NA	1.75	2.00	2.50	0.38	.38
1-1/8"	121	7	H7-121	1.50	1.50	.25	NA	.22	.22	.19	1.00	NA	2.00	2.00	2.50	0.38	.56
1-5/8"	221	7	H7-221	2.00	2.00	.38	NA	.22	.31	.19	1.43	NA	2.50	2.75	3.38	1.00	.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



2

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



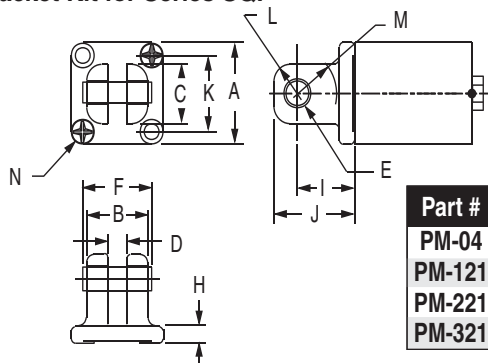
Materials

Bracket: High strength Zinc die casting
Pivot Pins: Precision dowel pins
Clips: 2, Plated steel
Mounting screws: 4, Steel, plated or black oxidized



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

Clevis Bracket Kit for Series SQF

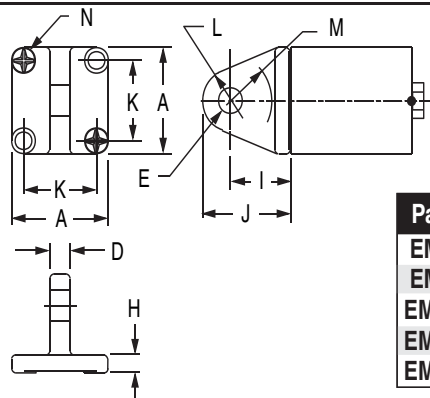


Materials

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 oxidized

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

Eye Bracket Kit for Series SQF



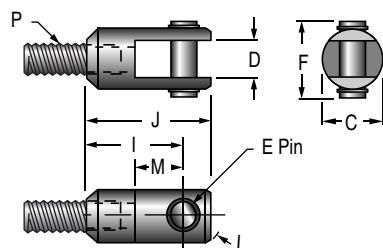
Materials

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

*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

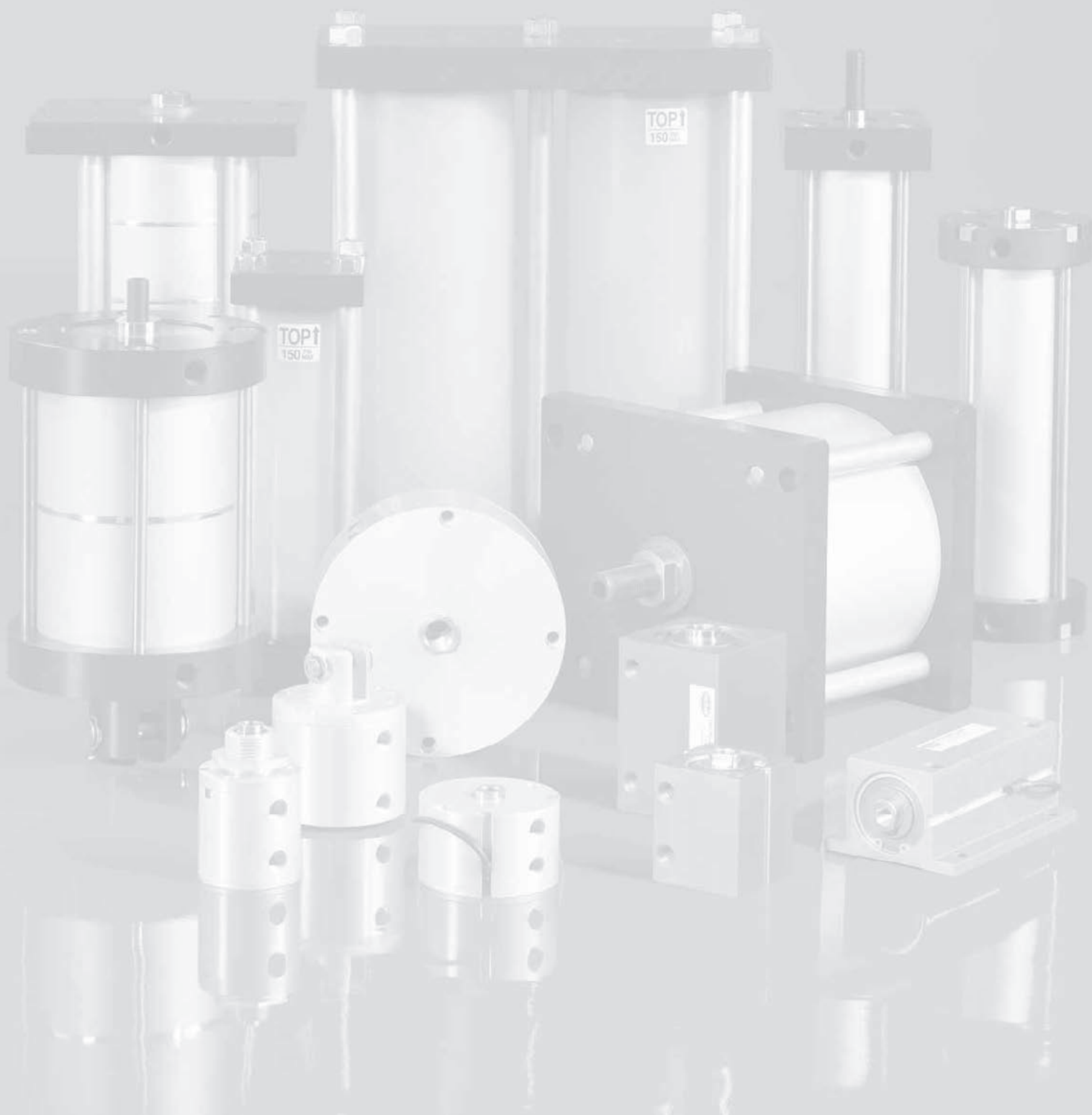


Materials

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

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

Cylinders, Valves, & Accessories





Round Head and Square Head Tie Rod Cylinders

	Page
Features & Benefits	3.2
General, Standard Ratings	3.2
Construction Information	3.3
How a Longstroke™ is built	
Model Number Chart	3.4
How to Order	
Option List	3.4
Standard Specifications	3.5 - 3.6
Option Specifications	3.7 - 3.9
Description of the Options	
Mounting Kits	3.10
Accessories	3.10
Air Spring Return	1.15
Position Sensors	3.9
Directional Control Valves	Section 11
Port Mounted Flow Control Valves	Section 12
Specials	ii & iii
2 Year Warranty	Inside back cover

Longstroke™ Cylinders

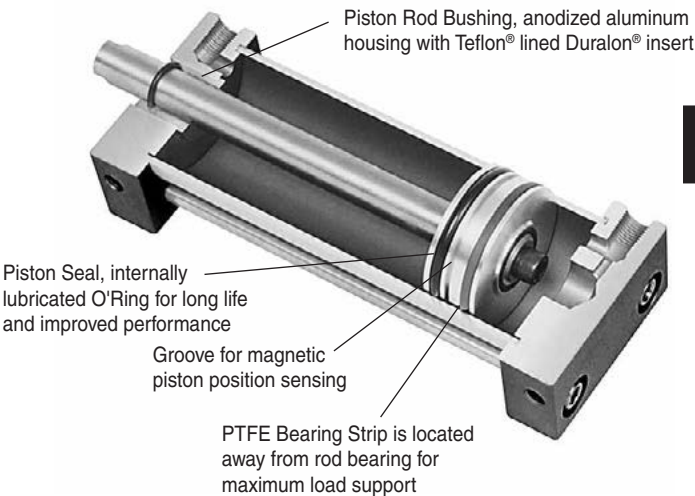
Available in 2 styles
4 Bore sizes 2" thru 4"
Strokes to 12"



Round Head Style



Square Head Style



3

Duralon® Rod Bearings Excel

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

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

* 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*

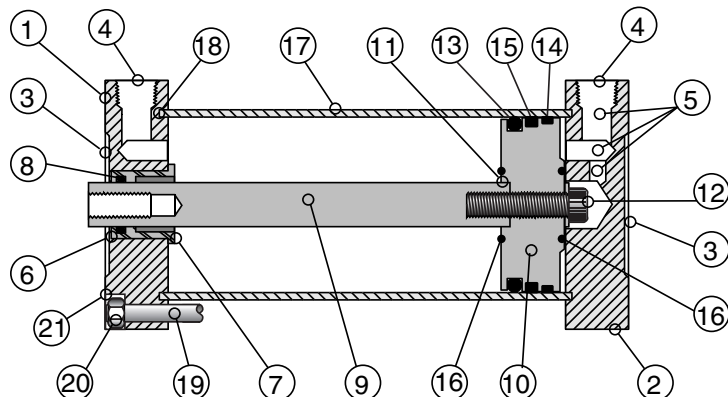
Sizing Guide

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

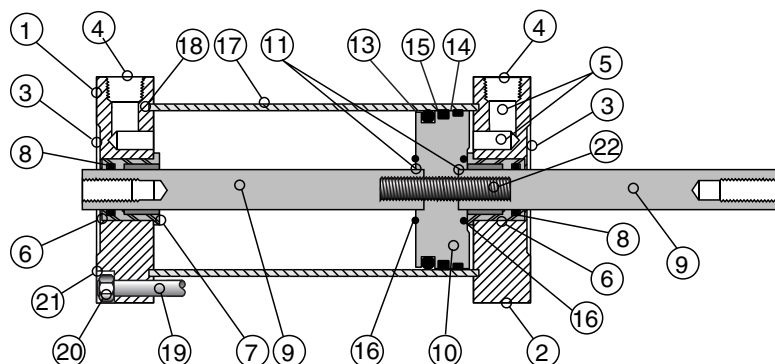
Standard Models

Standard: Single Rod, Double Acting

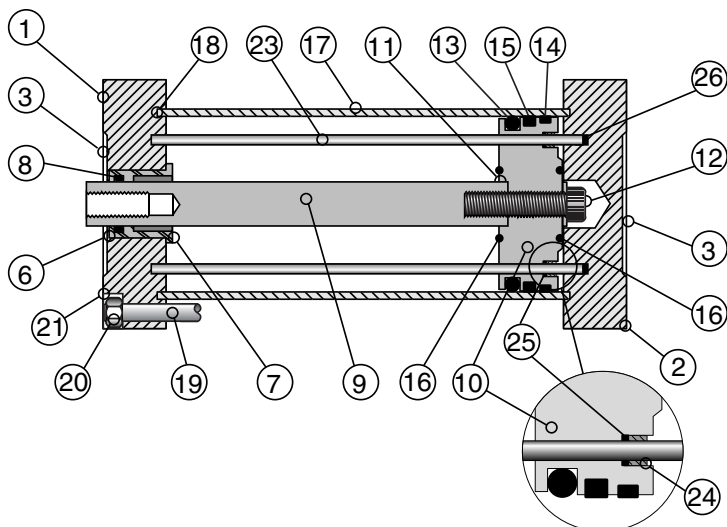
3



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 X **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	-K	3.8
150 psi max. operating pressure		
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	-H	3.7
to 500 psi NONSHOCK		
Finish, Pro-Coat™ , Electroless Nickel	-N	3.8
Rubber Bumpers		3.7
Rod End	-BF	
Cap End	-BR	
Both Ends	-BFR	
Adjustable Extend Stroke	-AS	3.8
6" Stroke maximum		
Full stroke adjustment is standard		
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	-E	3.9
for reed switches and Electronic Sensors (Order Sensors separately)		

How to Order

1. Specify code for Series and 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 X 8 - MR

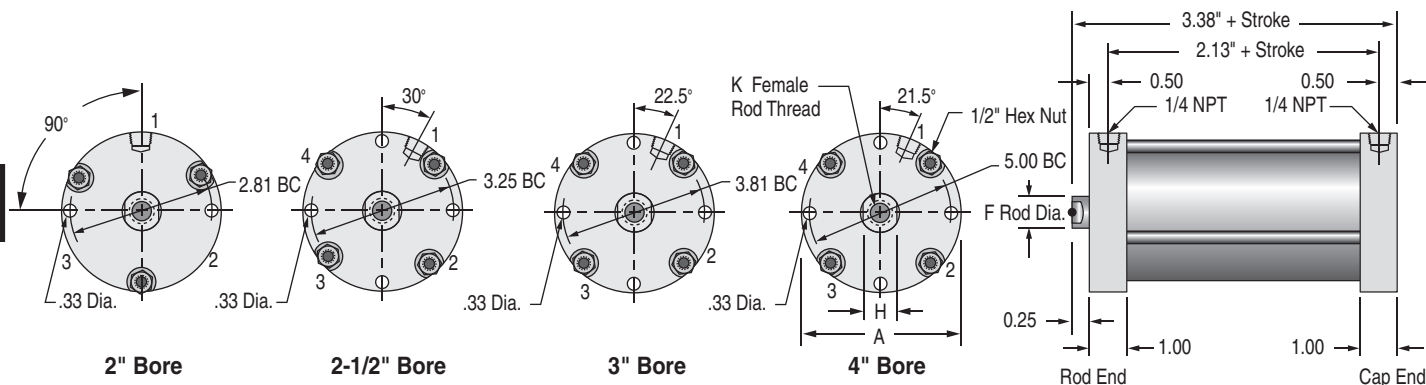
Round Head Longstroke, 2" bore, 8" stroke,
Standard Mount – Face Mount on Rod End and
Cap End, Male Rod Thread

S721 X 7 - E

Square Head Longstroke, 3" bore, 7" stroke,
Standard Mount – Side Tap Mount, Magnetic Piston

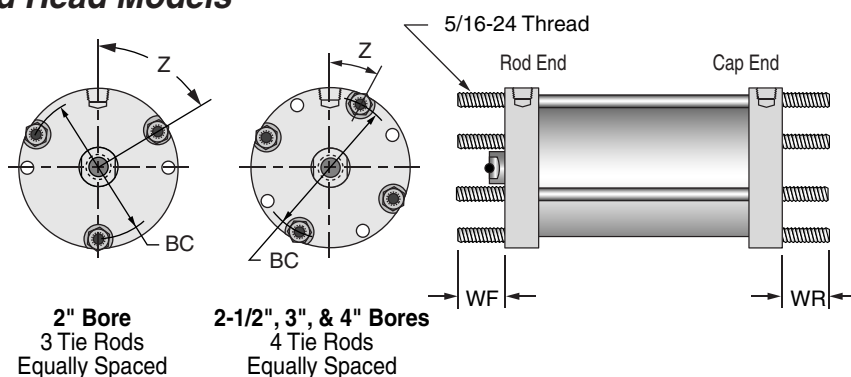
Round Head, Standard, Face Mount Rod and Cap End

3



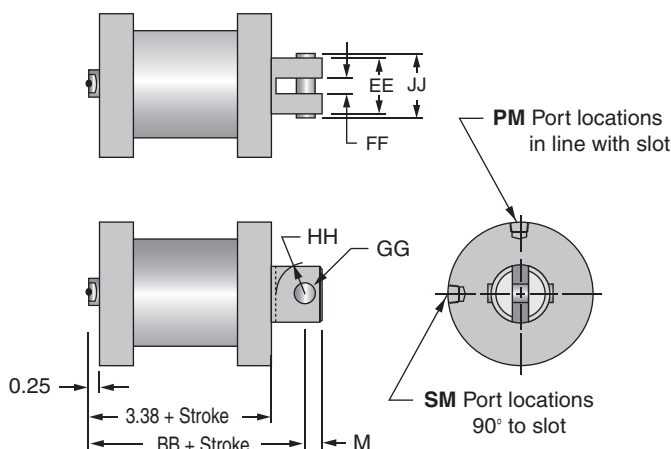
Extended Tie Rod Mount for Round Head Models Specify mounting option

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



Round Head Clevis Mount Option Specify mounting option

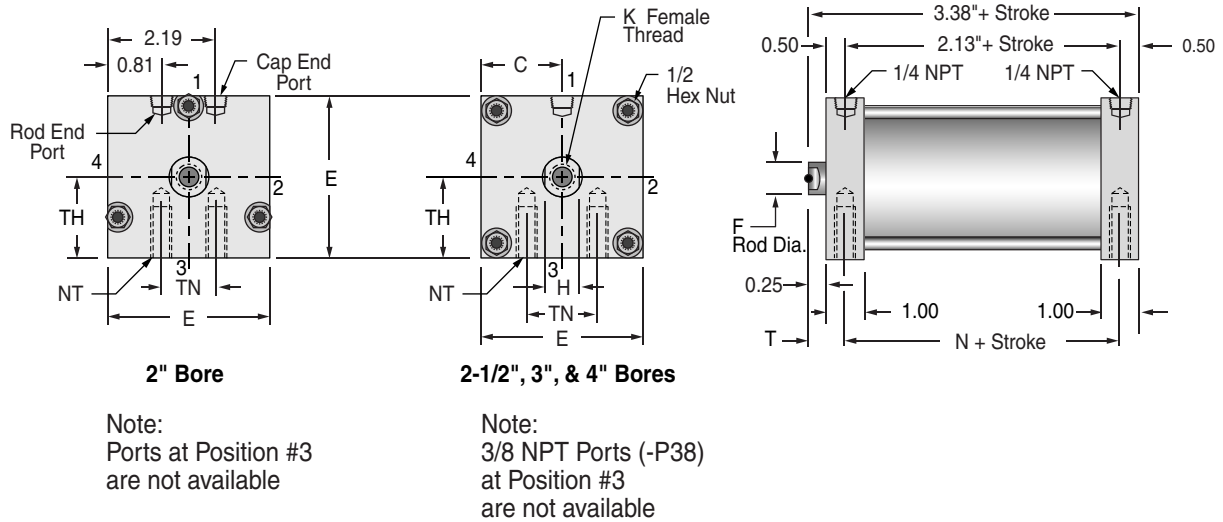
Ports in line with slot PM
Ports 90° to slot SM



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

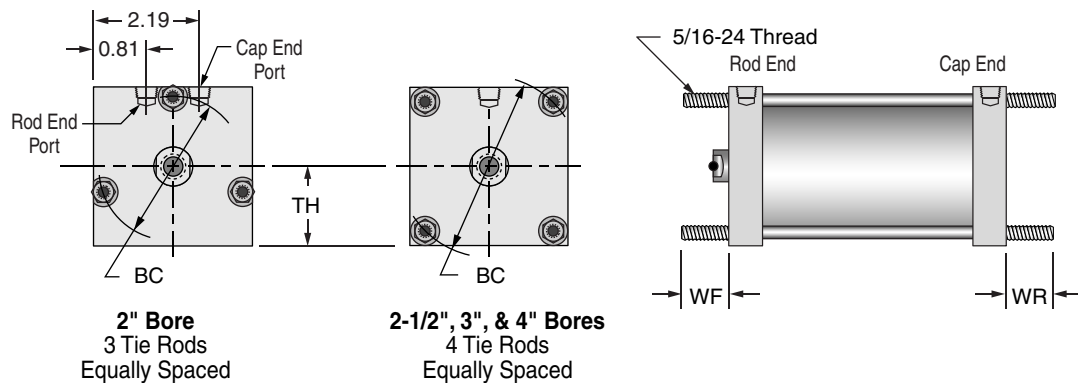


3

Extended Tie Rod Mount for Square Head Models

Specify mounting option

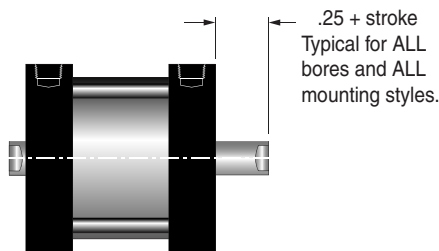
Rod End Only WF
Cap End Only WR
Rod and Cap Ends WFR



	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.

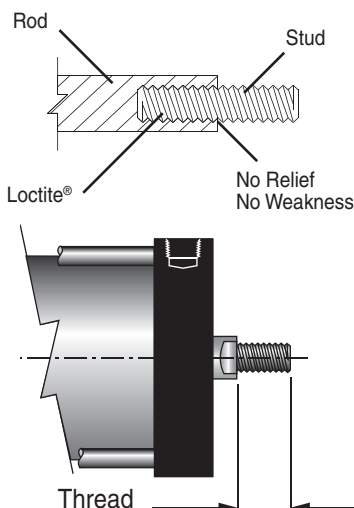
Consult engineering for compatibility information.

Male Rod Thread

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

Option

-MR
-MR
-MR1
-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

Temperature Range (–25° to + 220°F)

Rod End only
Cap End only
Both Rod & Cap Ends

-BF
-BR
-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 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.

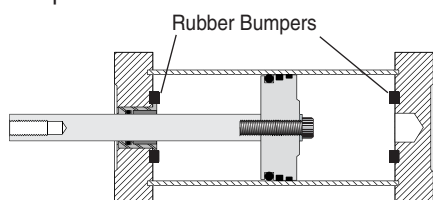
Because of the temperature limitations of the adhesives involved (–25° to +

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.

Option -BFR shown



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.

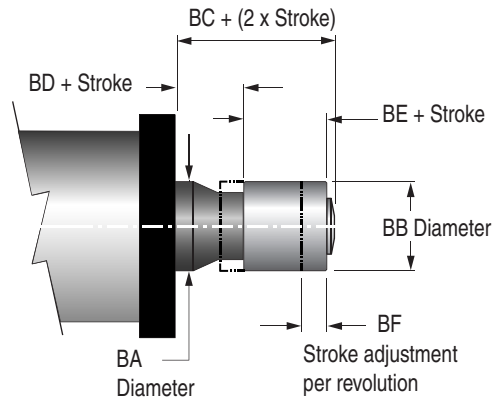
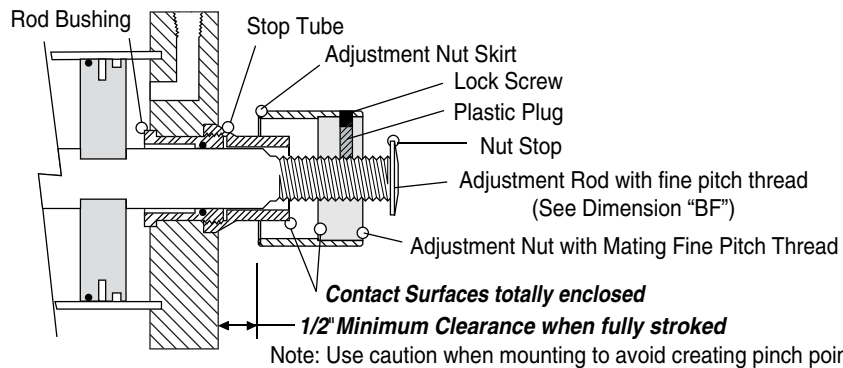
Adjustable extend stroke

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.



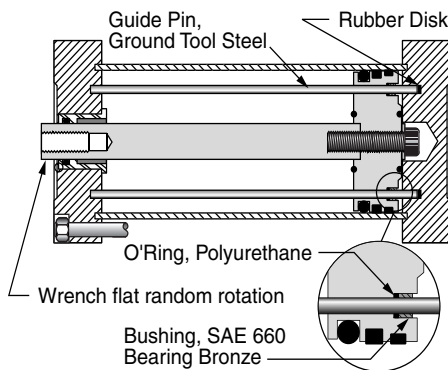
Bore	2"	2-1/2"	3"	4"	
BA	1.50	1.50	1.50	2.00	
BB	2.00	2.00	2.00	2.00	
BC	1.65	1.65	1.65	1.42	+ (2 x Stroke)
BD	0.75	0.75	0.75	0.50	+ Stroke
BE	0.75	0.75	0.75	0.75	
BF	.063	.063	.063	.063	

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 $\pm 1^\circ$. 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.

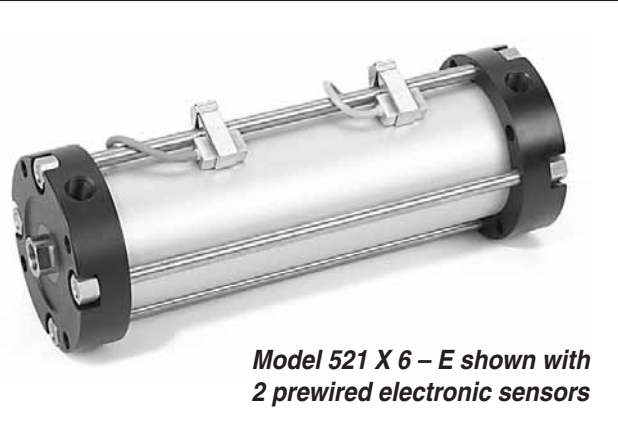
The cylinder heads and tube, inside and outside, are plated. Tie rods and nuts are standard stainless steel. Rod bushing is standard hard anodized aluminum and Duralon®.

Magnetic Piston

Option -E

(Order Sensors and Sensor Clamps Separately)

3



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

Quick Disconnect Sensor Shown

Socket Head Screw

WARNING

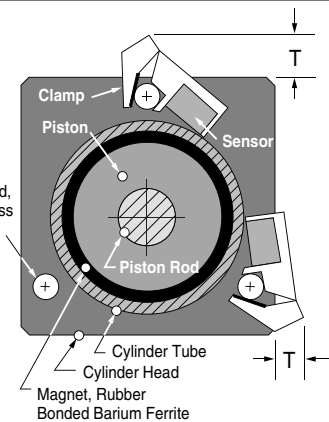
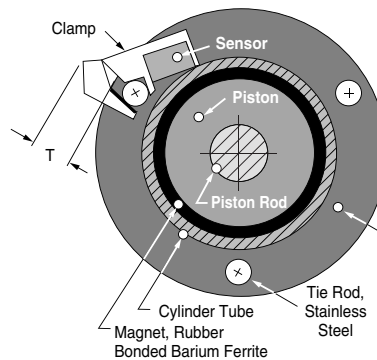
This cylinder is equipped with a Magnetic Piston for use with Magnetically Operated Sensors. Other Magnetic Sensitive Devices Should be Kept at a Distance to Avoid Inadvertent Operation.



- **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.**

Sensor Clamp Stick Out Dimensions

Model	321	S321	521	S521	721	S721	1221	S1221
T	.50"	.50"	.50"	.10"	.50"	.30	.30"	.30"



Sensor & Clamp Ordering Guide

Temperature Range: -20° to + 80°C (-4° to + 176°F)
Sensor housing rated NEMA 6/IP67.

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

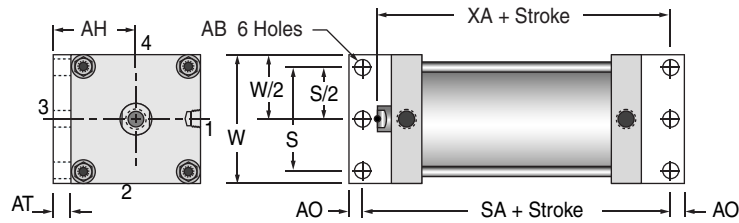
Warning!

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.

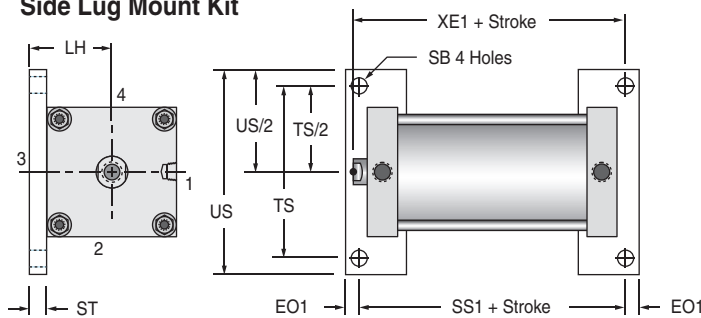
Material:

Brackets, plated steel
Screws, Black Oxide Steel

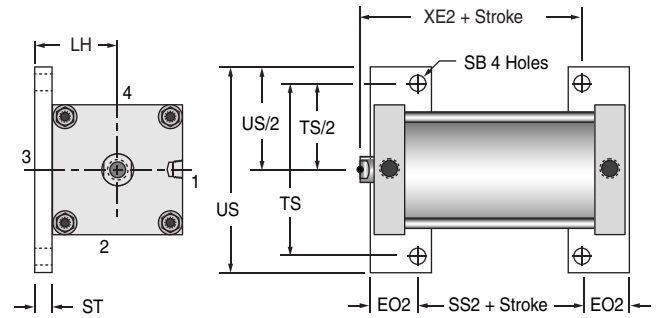
Bore	Kit No.	S	W	AB	AH	AO	AT	SA	XA
2"	EL-20	1.75	2.50	.41	1.63	.44	.25	3.75	3.69
2-1/2"	EL-25	2.25	3.00	.41	2.00	.44	.25	3.88	3.75
3"	EL-30	2.75	3.50	.53	2.13	.56	.38	4.38	4.00
4"	EL-40	3.50	4.50	.53	2.63	.56	.38	4.38	4.00

3

Side Lug Mount Kit



Position #1



Position #2

Kit includes:

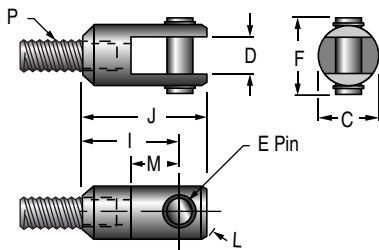
2 brackets and 4 bolts for attaching the brackets to the cylinder heads.

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

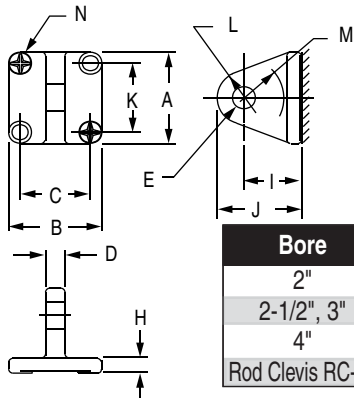


Materials

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

Bore	Part #	C	D	E PIN	F	I	J	L	M	P	Mating Eye Bkt
2", 2-1/2", & 3"	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 oxidized

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

Product Index

4



Hi-Power™ Series –	Page
Construction & engineering data . . .	4.2 & 4.3
How to Order	4.4
Dimensions	4.5 & 4.6
Option Specifications	4.7 - 4.10



Multi-Power® Series –	
Construction & engineering data . . .	5.1 - 5.3
Sizing Guide	5.2
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Pancake® Multi-Power® Series –	
Sizing Guide	5.13
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Dimensions	5.13 & 5.14



Square1® Multi-Power® Series –	
Sizing Guide	5.18
How to Order	5.18
Dimensions	5.19



Longstroke™ Multi-Power® Series –	
Sizing Guide	5.23
How to Order	5.23
Dimensions	5.24

Hi-Power™ Cylinders

Available in 3 series
10 Bore sizes 1-1/8" thru 12"
Strokes to 12"



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.



Model THP8 X 8 RFA shown

Duralon® Rod Bearings Excel

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

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

Printed with permission by Rexnord Corp.

Ratings – Standard Units all series

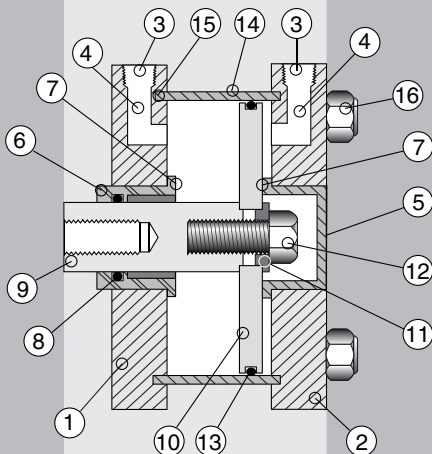
- Double acting, single rod
- Duralon® rod bushing
- Female rod end with wrench flats
- Internally lubricated Buna-N O-ring piston and rod seals.
- Ports at position #1
- Media Air
- Max. operating pressure 250 psi
- Min. operating pressure recommended 15 psi
- Ambient & media temperature range . . . -25° to +250°F
- Prelubrication Magnalube®-G Grease
- Stroke tolerance ± 1/64"

Sizing Guide

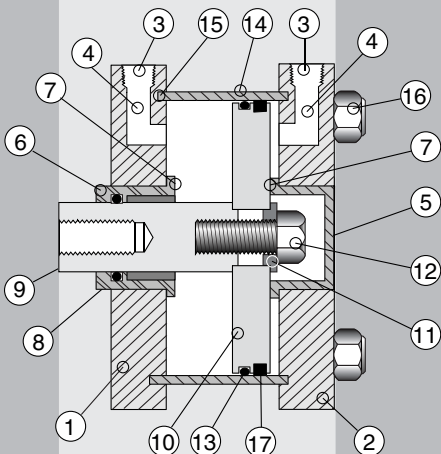
Bore Diameter	1-1/8	1-5/8	2-1/2	3	4	5	6	8	10	12
Rod Diameter	0.50	0.63	0.75	0.75	1.00	1.25	1.25	1.25	2.00	2.00
Rod Area	0.20	0.31	0.44	0.44	0.79	1.23	1.23	1.23	3.1	3.1
Push Area (Single Rod)	0.99	2.07	4.91	7.07	12.57	19.63	28.27	50.27	78.5	113.0
Pull Area	0.79	1.76	4.47	6.63	11.78	18.40	27.04	49.04	75.4	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

Standard Models

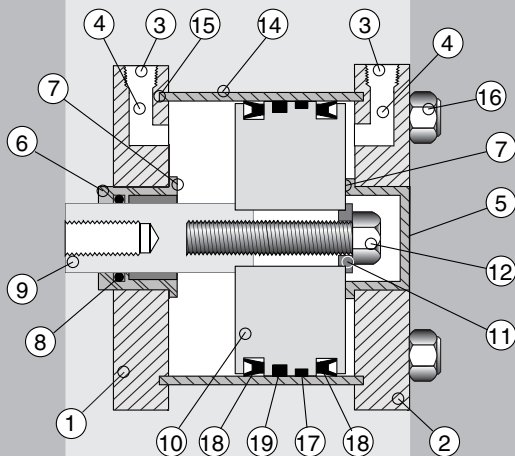
HP Series



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.)
Series THP and UHP only 8" 10" 12"	Rod end only WF
	Cap end only WR
	Rod and Cap Ends WFR
	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

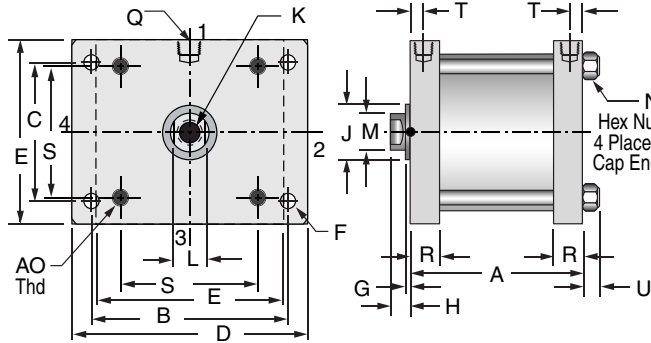
OPTIONS

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		4.10
Bore Hole 1-1/8", 1-5/8" .13" 2-1/2", 3" .16" 4", 5", 6" .25" 8", 10", 12" Not available	-DR13 -DR16 -DR25	
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 Single Rod Double Rod, Rod End Double Rod, Cap End Double Rod, Both Ends	-MR -MR -MR1 -MR2	4.7
Viton Seals (-15° to +400°F)	-V	4.7
Hydraulic, Low Pressure to 500 psi NONSHOCK (HP & THP Only)	-H	4.10
Rubber Bumpers Rod End Cap End Both Ends	-BF -BR -BFR	4.8
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) Rod End Head Cap End Head Both Heads	-TF -TR -TFR	4.8
3/4 NPT Ports in Heads 10" & 12" Bores only	-P34	4.8
Extend Port Bushing 3/8 NPT (2-1/2" – 6" Bores) 1/2 NPT (2-1/2" – 6" Bores) 3/4 NPT (5" – 12" Bores)	-E38 -E12 -E34	4.8
Port Positions All Ports Rod End Port Cap End Port	• Position #1 Standard #2 -PA2 ; #3 -PA3 ; #4 -PA4 • Position #1 Standard #2 -PR2 ; #3 -PR3 ; #4 -PR4 • Position #1 Standard #2 -PC2 ; #3 -PC3 ; #4 -PC4	4.5 & 4.6
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.		

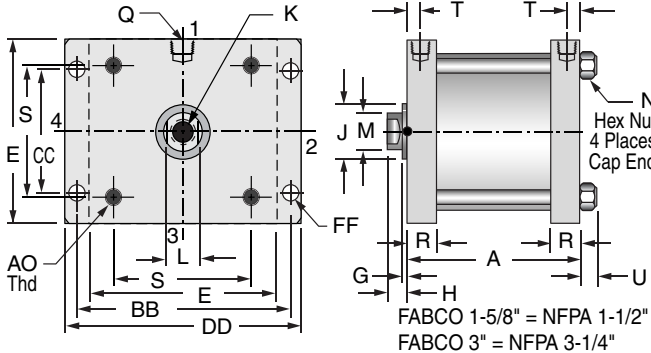
1-1/8", 1-5/8", 2-1/2", 3", 4", 5", & 6" Bores

4

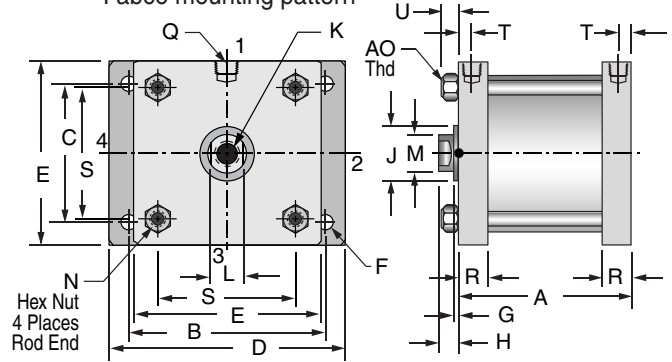
FF Front Face Mount; Rod End Rectangular Flange
Fabco mounting pattern



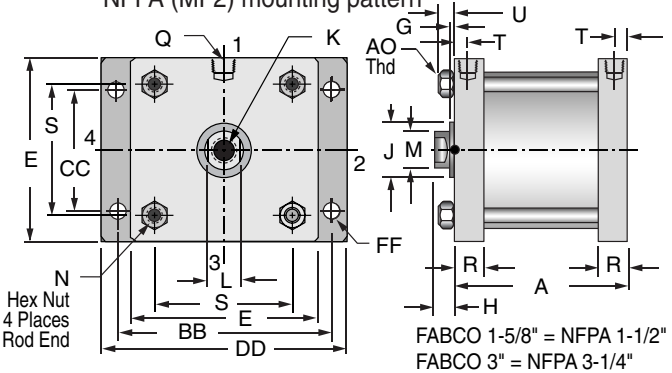
FFA Front Face Mount; Rod End Rectangular Flange
NFPA (MF1) mounting pattern



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

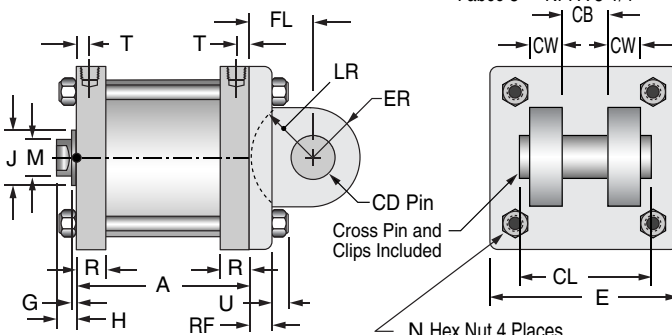


RFA Rear Face Mount; Cap End Rectangular Flange
NFPA (MF2) mounting pattern



Clevis Mount (NFPA MP1 Dimensions)

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



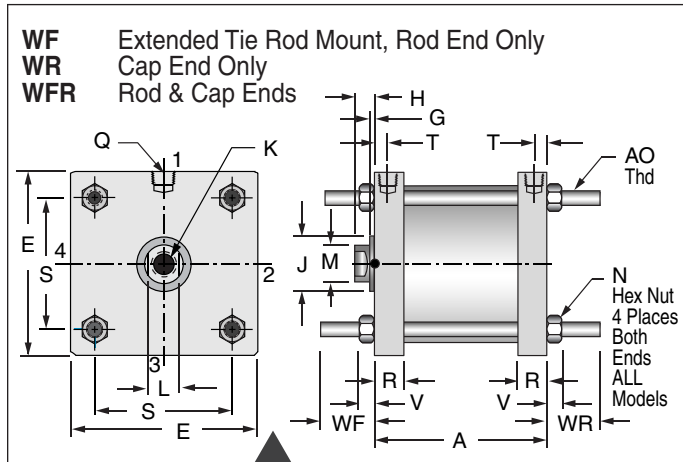
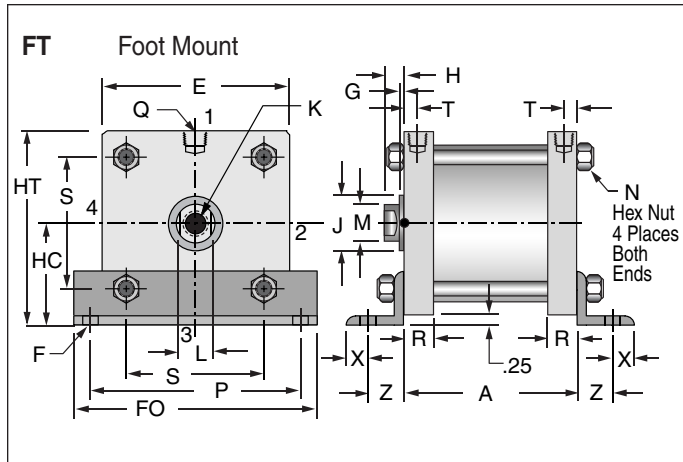
Material: Gray Iron Casting,
Black Oxide Finish

Dimensions (inches)

Bore	A			B	C	D	E	F	G	H	J ±.002	K	L ±.001	M	N	P	Q NPT	R
	Series HP	Series THP	Series UHP															
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

Mounting Styles with Dimensions

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



To Order
 Extended Tie Rod Mount

Specify Suffix

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

If a non-standard extension is required, specify by adding the required length to the suffix.

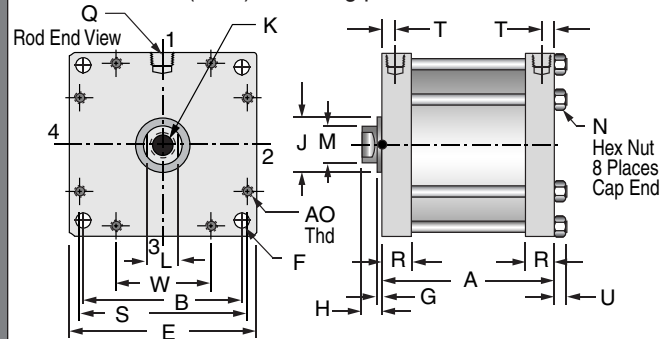
e.g. If **WF** length required is 2.5", Specify **WF2.5"**

Dimensions (inches)

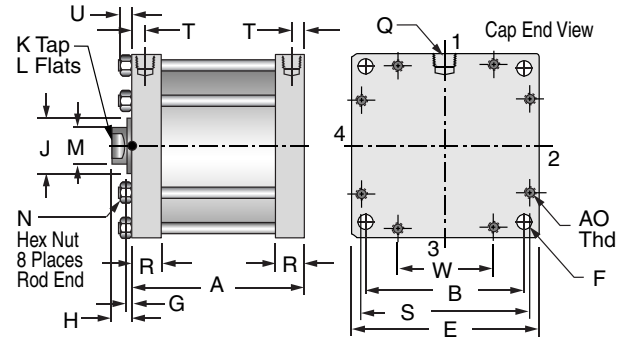
Bore	S	T	U	V	W	X	Z	AO	BB	CC	DD	FF	FO	HC	HT	WF	WR	CD	FL	RF	CB	CW	ER	LR	CL
1-1/8	1.19	.22	.27	.22	NA	.31	.44	1/4-20	2.00	1.00	2.50	.22	3.00	1.13	2.00	1.0	1.0	.500	.75	.38	.76	.50	.62	.62	2.09
1-5/8	1.62	.25	.27	.22	NA	.38	.63	1/4-20	2.75	1.43	3.25	.28	3.50	1.38	2.50	1.0	1.0	.500	.75	.38	.76	.50	.62	.62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

8", 10", and 12" Bores

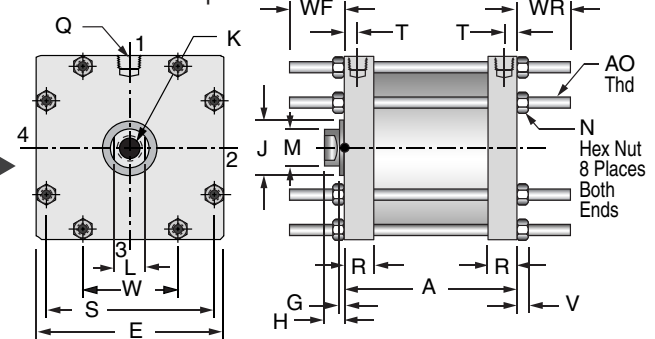
FFA Front Face Mount; Rod End Square Flange
 NFPA (ME3) mounting pattern



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



VITON SEALS

OPTION -V

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

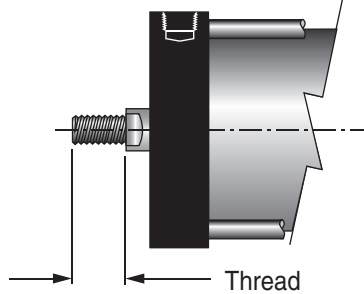
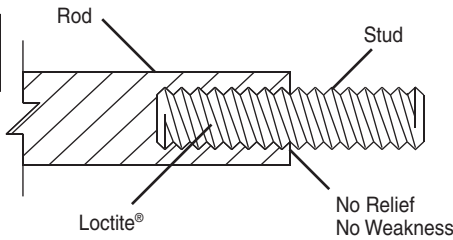
MALE ROD THREAD

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.

4



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.

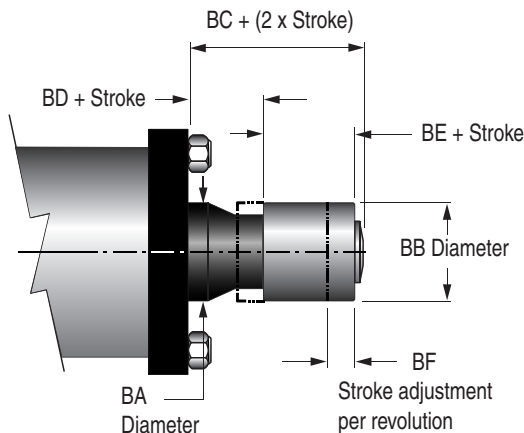
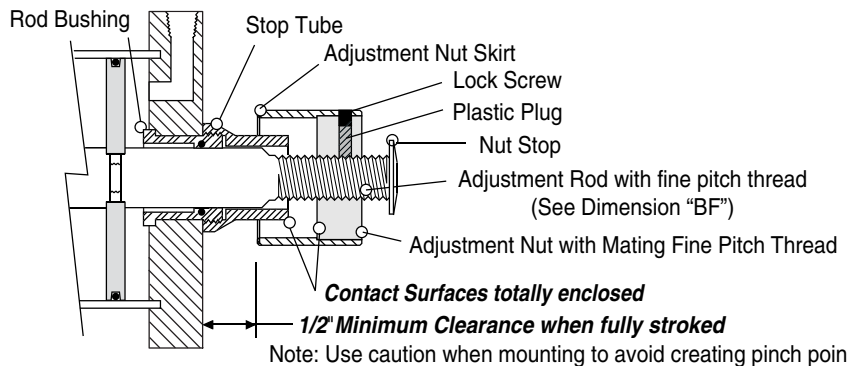
Note!

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

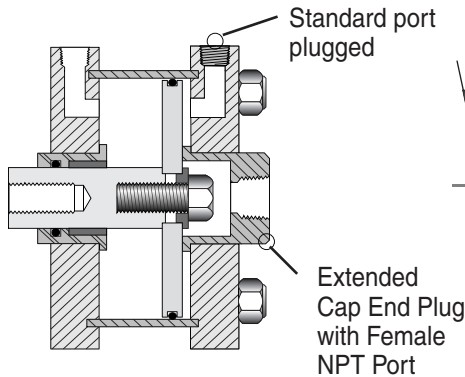
Dial-A-Stroke® provides a rugged and precision adjustment of the extend stroke of the cylinder. The stop tube, adjustment nut with skirt, and minimum clearances combine to eliminate pinch points, thus providing operator safety. **Note!** Use caution when mounting to avoid creating pinch points with other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

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



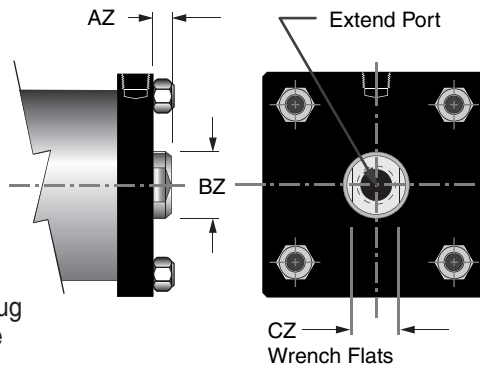
Bore	1-1/8"	1-5/8"	2-1/2"	3"	4"	5"	6"	8"	
BA	1.13	1.25	1.50	1.50	2.00	2.25	2.25	2.25	
BB	1.50	1.50	2.00	2.00	2.00	2.25	2.25	2.25	
BC	1.67	1.67	1.90	1.90	1.67	1.67	1.67	1.67	+ (2 x Stroke)
BD	1.00	1.00	1.00	1.00	.75	.75	.75	.75	+ Stroke
BE	.50	.50	.75	.75	.75	.75	.75	.75	
BF	.050	.050	.063	.063	.063	.071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

1/2 NPT PORTS IN HEADS

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

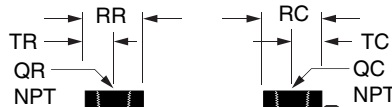
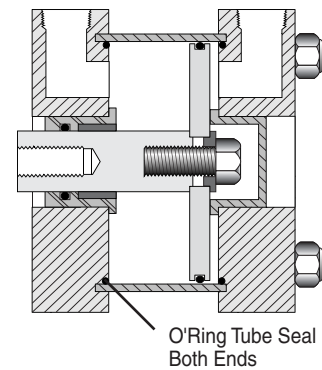
Rod End Head
Cap End Head
Both Heads

-TF
-TR
-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.

HH

A + [See chart]

HH-DR + Stroke – Option -DR only

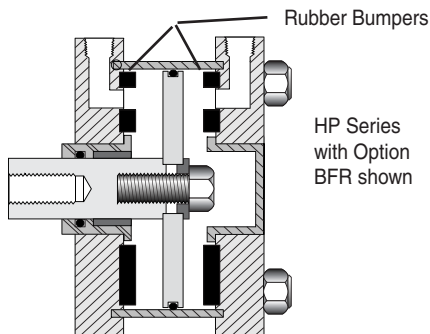
See pages 4.5 & 4.6 for Dimension "A"

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	–	–	1.00	–	–	1.00	.63	.63

RUBBER BUMPERS

Rod End only
Cap End only
Both Rod & Cap Ends

-BF
-BR
-BFR



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

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

Use where noise reduction and impact absorption is desired.

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

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.

MAGNETIC PISTON

Option -E

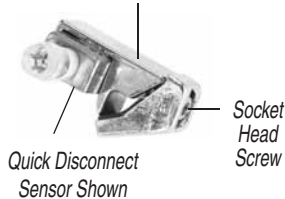


Order Sensors and Sensor Clamps Separately

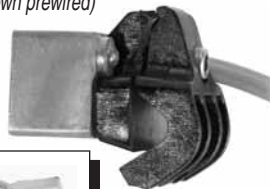
- **Option -E** consists of a magnet bonded into the piston head. When the piston magnet moves past an external sensor, the magnetic field activates the sensor without physical contact.
- **Mounting** – The sensor is attached to a 2-part clamp that attaches rigidly to a tie rod and can be positioned 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 accommodate 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



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

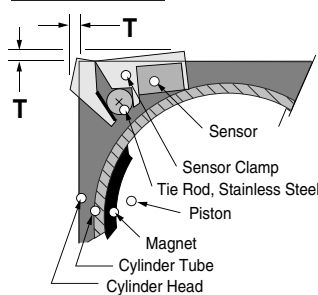
WARNING

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.

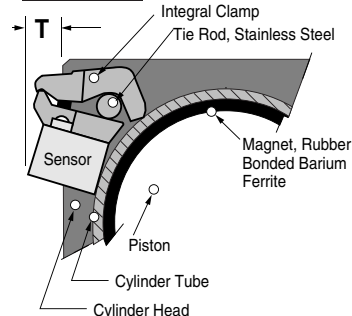
(T) Clamp Stick Out & (L) Length Adder to Dim. 'A' Pgs. 4.5 & 4.6

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

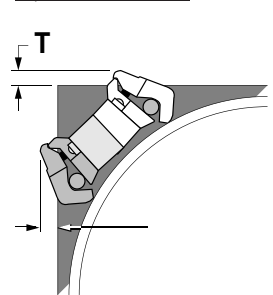
1-1/8" – 3" Bores



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. Sensor housing rated NEMA 6/IP67.

LED Lighted Magnetic Piston Position Sensors: Bores 1-1/8" – 3"

Product	9 ft. Prewired P/N	Quick Discon. P/N	Electrical Characteristics
Reed Switch	9-2A197-1004	9-2A197-1304	5-120 VDC/VAC, 0.5 Amp Max., 10 Watt Max., SPST N.O., 3.5 Voltage Drop
Electronic	9-2A197-1033	9-2A197-1333	Sourcing, PNP, 6-24 VDC, 0.5Amp Max., 1.0 Voltage Drop
Electronic	9-2A197-1034	9-2A197-1334	Sinking, NPN, 6-24VDC, 0.5Amp Max., 1.0 Voltage Drop

9-2A197 Series Sensor Mounting Clamps – Part Number 800-200-000

LED Lighted Magnetic Piston Position Sensors: Bores 4" – 8"

Reed Switch	749-000-004	749-000-504	5-240 VDC/VAC, 1 Amp Max., 30 Watt Max., SPST N.O., 3.0 Voltage Drop
Electronic	749-000-031	749-000-531	Sourcing, PNP, 6-24 VDC, 1.0 Amp Max., 0.5 Voltage Drop
Electronic	749-000-032	749-000-532	Sinking, NPN, 6-24 VDC, 1.0 Amp Max., 0.5 Voltage Drop

LED Lighted Magnetic Piston Position Sensors: Bores 10" & 12"

Reed Switch	749-111-004	749-111-504	5-240 VDC/VAC, 1 Amp Max., 30 Watt Max., SPST N.O., 3.0 Voltage Drop
Electronic	749-111-031	749-111-531	Sourcing, PNP, 6-24 VDC, 1.0 Amp Max., 0.5 Voltage Drop
Electronic	749-111-032	749-111-532	Sinking, NPN, 6-24 VDC, 1.0 Amp Max., 0.5 Voltage Drop

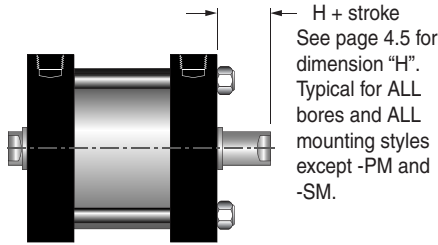
Female Cordsets for 9-2A197 Series Quick Disconnect Sensors

Length	1 Meter	2 Meter	5 Meter
Part No.	CFC-1M	CFC-2M	CFC-5M

Female Cordsets for 749 Series Quick Disconnect Sensors

Length	2 Meter	5 Meter
Part No.	CFC-2M-12	CFC-5M-12

Double Rod Option -DR



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

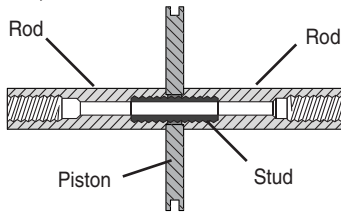
Available in Series HP – 1-1/8" thru 6" bore; THP – 8" thru 12" bore; and UHP – 1-1/8" thru 12" bore, with 1/4" inch stroke increments through 4" and 1" stroke increments to 12". The THP

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", 8", 10", 12"	.25"	-DR25
	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.

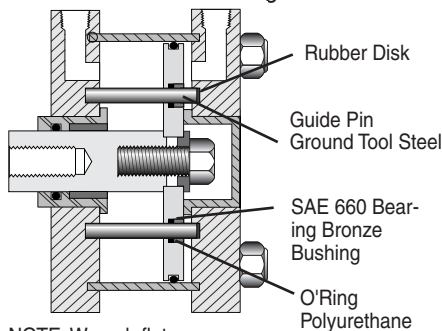
The hole for each bore size is shown in the chart at the left.

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 Option -K 150 psi max. operating pressure

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 $\pm 1^\circ$.

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

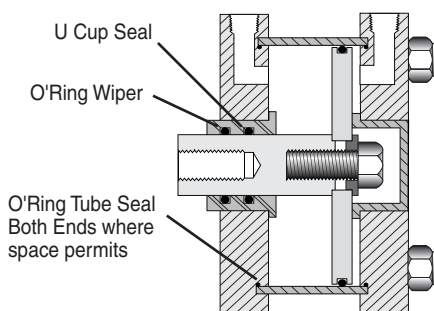
O'Rings. These features provide precision guiding and long, trouble free life. A rubber disk is included at the end of each guide pin to take up end play and seat the pins firmly in the guide pin holes.

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 Option -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 out-board wiper.

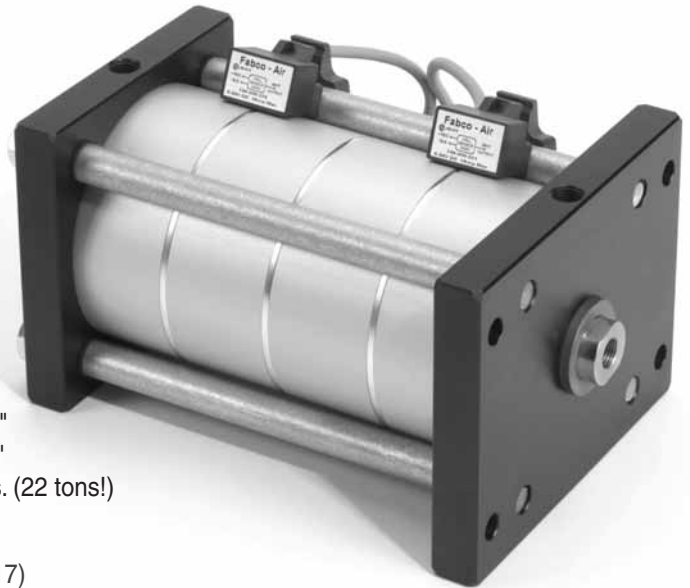
When space is limited, two O'Ring seals are used in the bronze bushing.

Note: -PM or -SM mounts are NOT available for applications over 250 psi.

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.

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-steel20	No
Nylon-on-steel32	Yes
Duralon-on-steel.....	.05 - .16	No

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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 X 3 X 1 FF

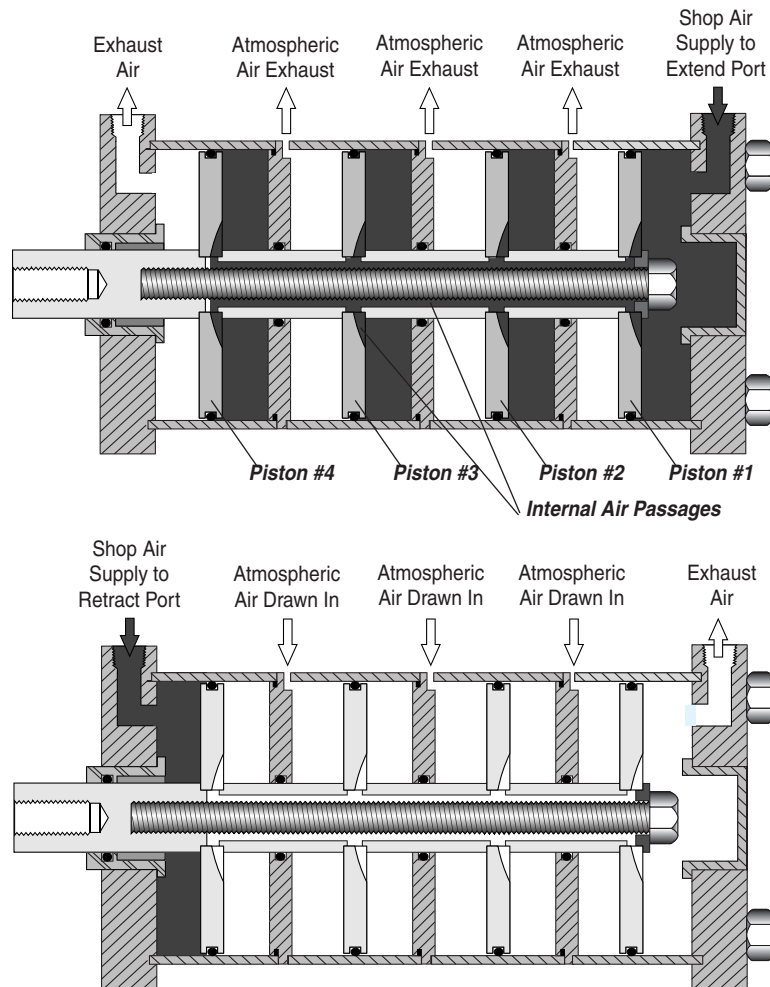
Piston Area is 20.3 sq. in.

Force = Pressure x Area

If Supply Air Pressure is 100 psi,

then Force = 100 psi x 20.3

or Force = 2030 lbs



5

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	
	4	442.7	23.7	26562				189.5	14.0	

Notes

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

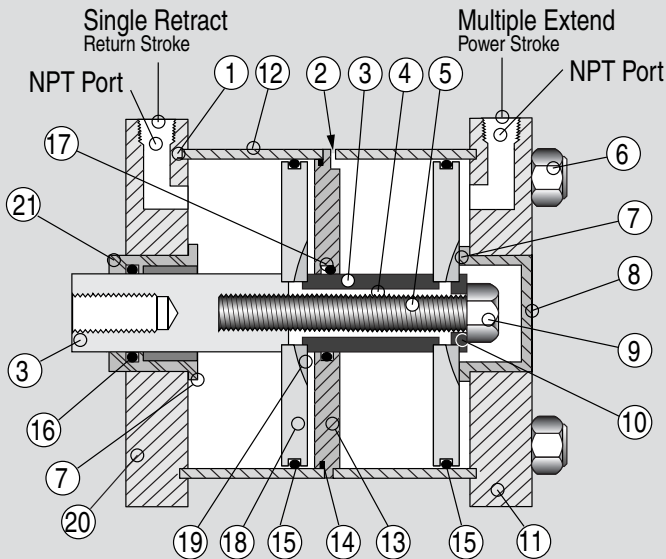
‡ Areas given are for Standard Single Stage Retract. For Single Stage Extend with a single rod, add the rod area shown.

Ratings – Standard Units

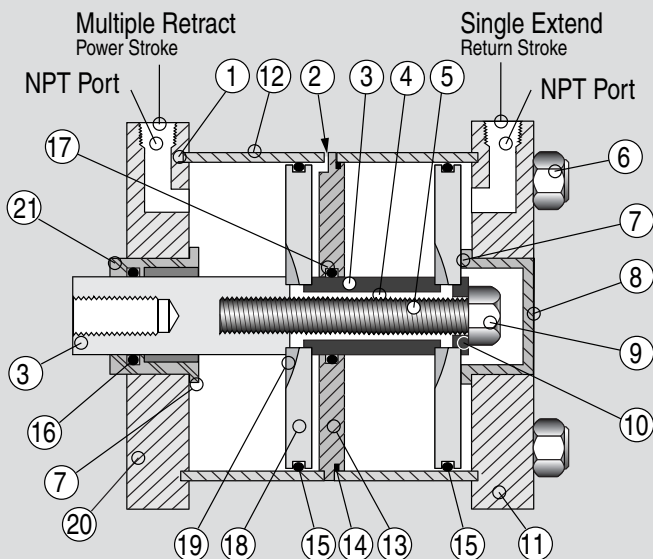
- Duralon® rod bushing. (see page 5.1 for table of physical properties)
- Female rod end with wrench flats
- Internally lubricated Buna-N O-ring piston and rod seals.
- Airline lubrication recommended
- Media Air
- Max. operating pressure See chart
- Min. pressure recommended 20 psi
- Ambient & media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

Basic Construction

Multiple Stage Extend with Single Stage Retract



Multiple Stage Retract with Single Stage Extend



Quick Reference to Components

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

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

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

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

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

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

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

Model Number Code

MP3	X	1	X	3	X	1	FF	-	MR
------------	----------	----------	----------	----------	----------	----------	-----------	----------	-----------

MP Series & Bore	Standard Strokes	Stages Extend	Stages Retract
1-1/8"	1/2"	2	1
1-5/8"	1"	3	1
2-1/2"	1-1/2"	4	1
3"	2"	1	2 [‡]
4"	2-1/2"	1	3 [‡]
5"	3"	1	4 [‡]
6"	4"	Standard available combinations are listed above. See page 5.7 for Multiple Extend–Multiple Retract Options. *Note: Applicable only to 1-1/8" thru 8" bores.	
8"	5"		
10"	6"		
12"	Optional Strokes any other stroke 0" thru 12"		

Bores	Mounting
1-1/8" thru 6"	Front Face – Fabco Pattern FF Front Face – NFPA (MF1) Pattern FFA Rear Face – Fabco Pattern..... RF Rear Face – NFPA (MF2) Pattern..... RFA Foot FT Clevis Mount NFPA (MP1) Dimensions for single stage retract only Ports in-line with slot PM Ports 90° to slot..... SM Extended Tie Rods (See page 5.6 for non-standard lengths.) Rod end only WF Cap end only WR Rod and Cap Ends..... WFR
8" 10" 12"	Front Face – NFPA (ME3) Pattern FFA Rear Face – NFPA (ME4) Pattern RFA Extended Tie Rods Rod end only WF Cap end only WR Rod and Cap Ends..... WFR

How to Order

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

Example

MP3 X 1 X 3 X 1 FF – MR

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

OPTIONS

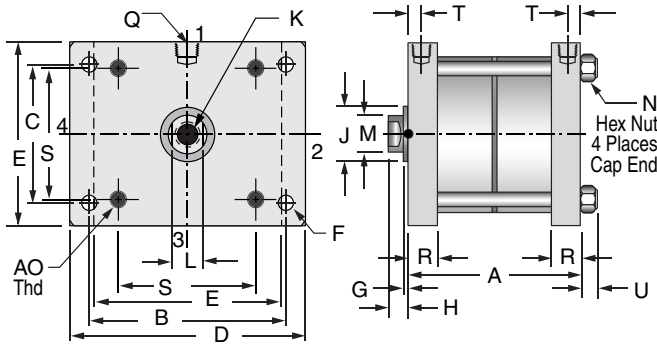
Description	Specify	See Page
1"–14 Rod thread – 8" bore only	-KF	5.5
Double Rod	-DR	5.8
Nonrotating Single Rod ‡	-NR	5.8
Nonrotating Double Rod ‡	-NRDR	5.8
Male Rod Thread		5.7
Single Rod	-MR	
Double Rod, Rod End	-MR	
Double Rod, Cap End	-MR1	
Double Rod, Both Ends	-MR2	
Viton Seals (-15° to +400°F)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

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

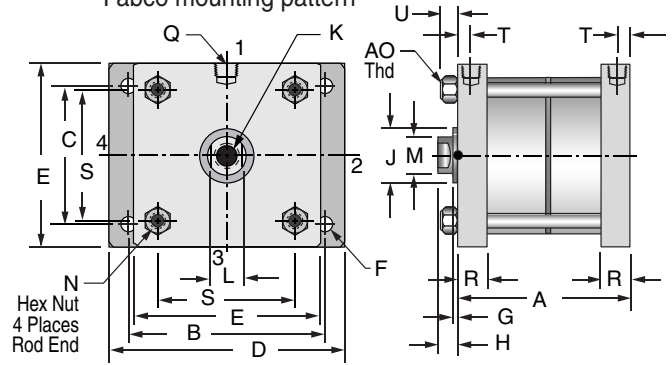
1-1/8", 1-5/8", 2-1/2", 3", 4", 5", & 6" Bores

5

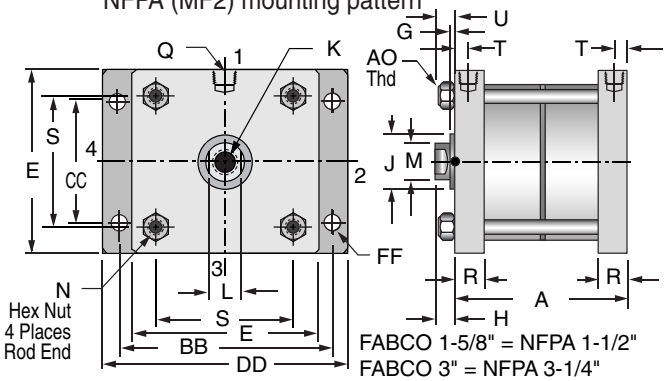
FF Front Face Mount; Rod End Rectangular Flange
Fabco mounting pattern



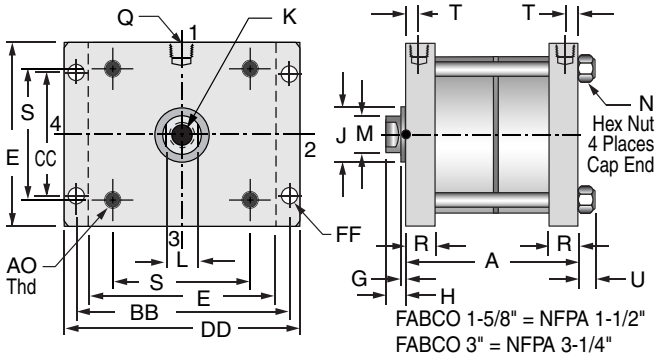
RF Rear Face Mount; Cap End Rectangular Flange
Fabco mounting pattern



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



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



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

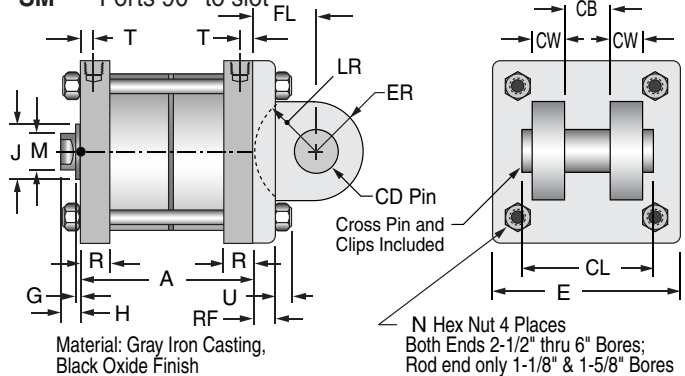
For single stage retract only

Clevis Mount (NFPA MP1 Dimensions)

PM - Ports in-line with slot

SM - Ports 90° to slot

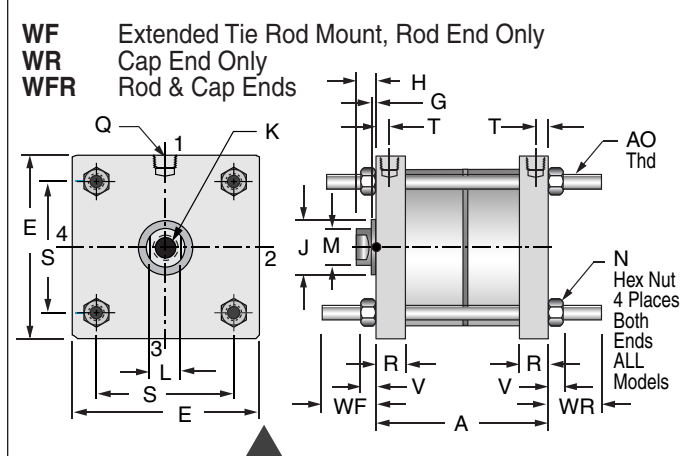
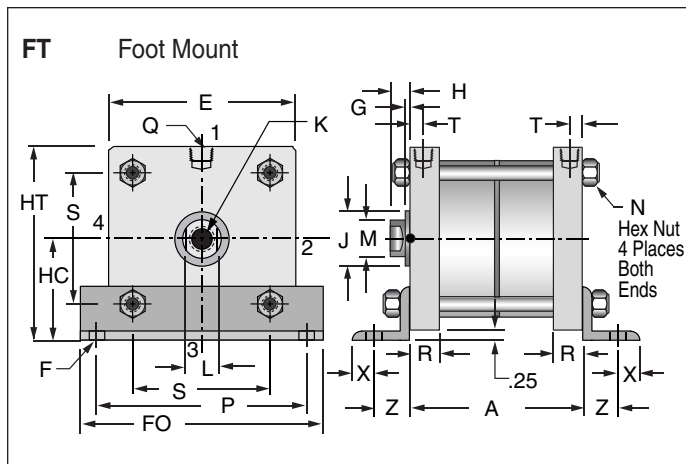
Fabco 1-1/8" = NFPA 1-1/2"
Fabco 1-5/8" = NFPA 1-1/2"
Fabco 3" = NFPA 3-1/4"



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

Mounting Styles with Dimensions

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



To Order
 Extended Tie Rod Mount
 Specify Suffix

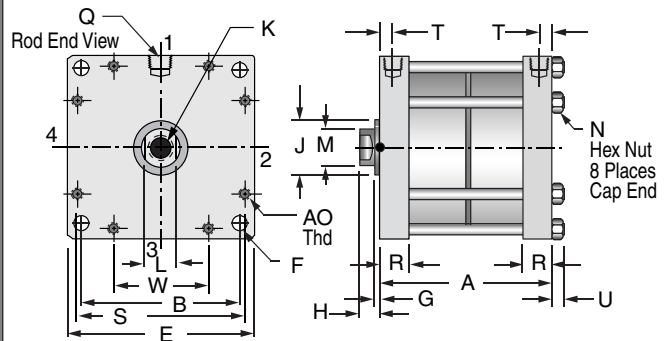
Rod End only **WF**
 Cap End only **WR**
 Rod & Cap Ends **WFR**

If a non-standard extension
 is required, specify by
 adding the required length
 to the suffix.

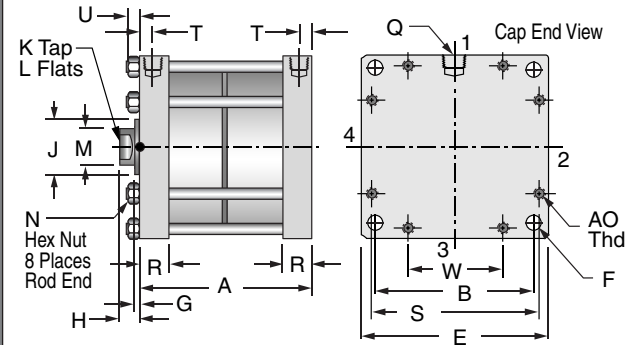
e.g. If **WF** length required is
 2.5", Specify **WF2.5"**

8", 10", and 12" Bores

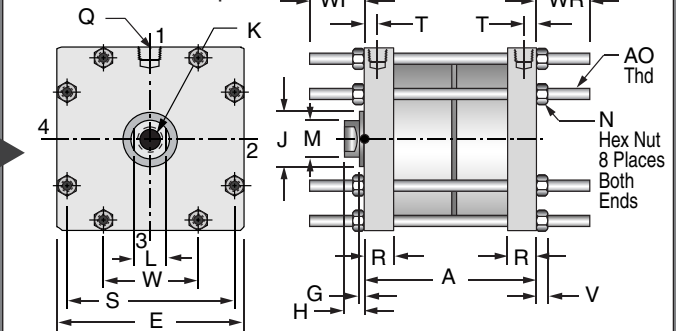
FFA Front Face Mount; Rod End Square Flange
 NFPA (ME3) mounting pattern



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

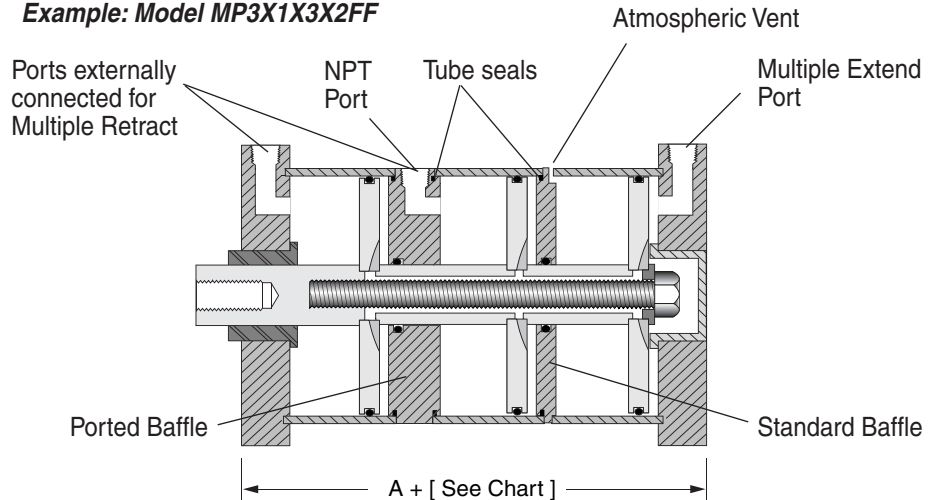


Bore	S	T	U	V	W	X	Z	AO	BB	CC	DD	FF	FO	HC	HT	WF	WR	CD	FL	RF	CB	CW	ER	LR	CL
1-1/8	1.19	.22	.27	.22	NA	.31	.44	1/4-20	2.00	1.00	2.50	.22	3.00	1.13	2.00	1.0	1.0	.500	.75	.38	.76	.50	.62	.62	2.09
1-5/8	1.62	.25	.27	.22	NA	.38	.63	1/4-20	2.75	1.43	3.25	.28	3.50	1.38	2.50	1.0	1.0	.500	.75	.38	.76	.50	.62	.62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

Example: Model MP3X1X3X2FF



5

See pages 5.5 for Dimension "A"

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

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

Applications that may dictate the use of Ported Baffles

- Clean rooms, Vacuum Chambers, Wash Down Areas, Under Liquid, Dirty or Corrosive Environments

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
- Selective Force Application

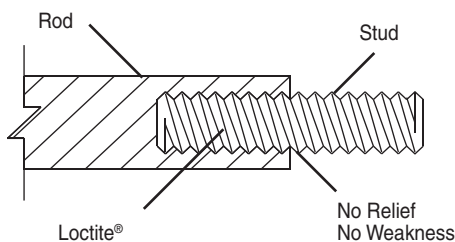
The ports have higher air flow capacity than the vents in the standard baffle.

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

Male Rod Thread

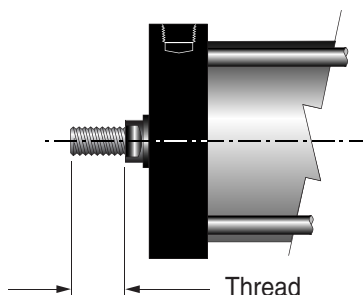
- Single Rod
- Double Rod, Rod End Only
- Double Rod, Cap End Only
- Double Rod, Rod & Cap Ends

- Option
- MR
 - MR
 - MR1
 - MR2



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

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

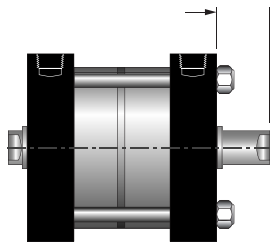


BORE	THREAD
1-1/8"	5/16-24 x .63
1-5/8"	3/8-24 x .88
2-1/2"	1/2-20 x 1.00
3"	1/2-20 x 1.00
4"	1/2-20 x 1.00
5"	3/4-16 x 1.50
6"	3/4-16 x 1.50
8" standard	1-12 x 1.50
8" optional†	1-14 x 1.50
10"	1-1/2-12 x 2.25
12"	1-1/2-12 x 2.25

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

Double Rod

Option -DR



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

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.

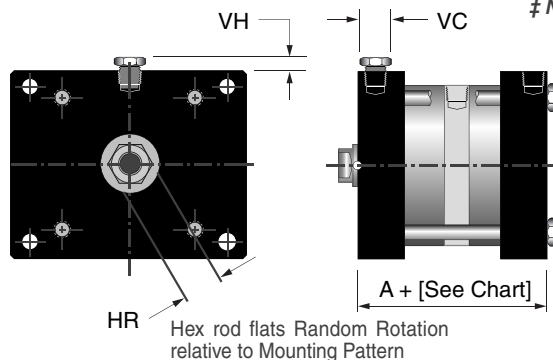
A ported baffle is used so the piston assembly can be retracted by the next piston back from the rod end. The normal rod head port becomes an atmospheric vent. The tolerance on rotation is $\pm 1^\circ$.

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

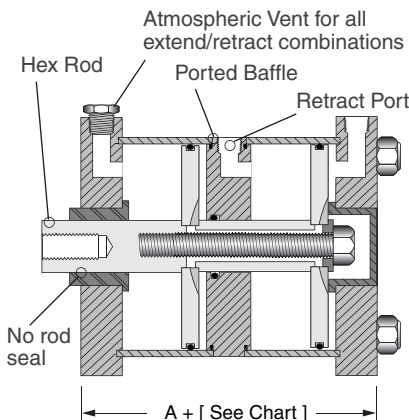
However, torque loads that induce side loading should be minimized for best overall life and performance.

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

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



See page 5.5 for Dimension "A"



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

Nonrotating Double Rod

Option -NRDR

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

Adjustable extend stroke

Option -AS

For strokes through 6"
Full stroke adjustment is standard.

Note!

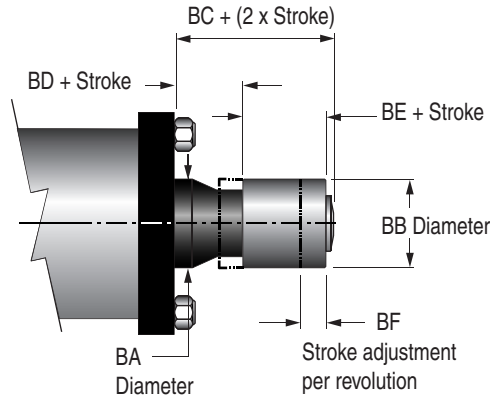
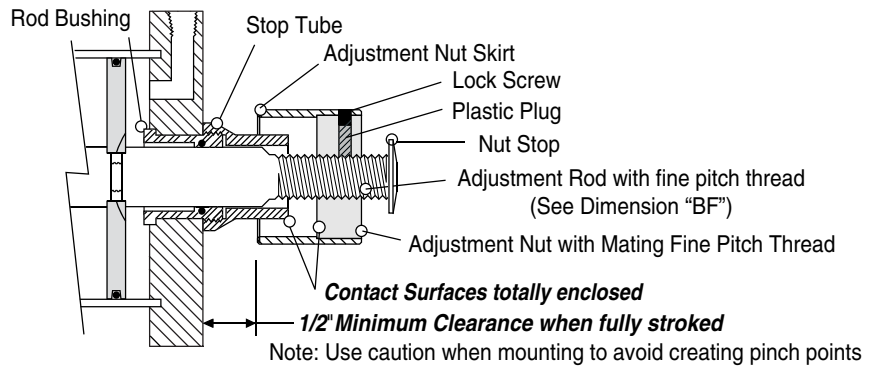
To maintain operator safety features of this option, it is NOT available with mounting styles: WR and WFR. Use caution when mounting to avoid creating pinch points.

Not available with mounting styles PM and SM.

Not available for 10" & 12" bores

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

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

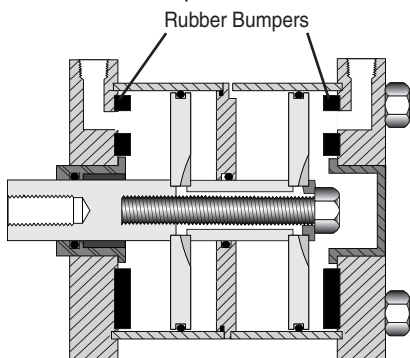


Bore	1-1/8"	1-5/8"	2-1/2"	3"	4"	5"	6"	8"	
BA	1.13	1.25	1.50	1.50	2.00	2.25	2.25	2.50	
BB	1.50	1.50	2.00	2.00	2.00	2.25	2.25	2.75	
BC	1.67	1.67	1.90	1.90	1.67	1.67	1.67	2.54	+ (2 x Stroke)
BD	1.00	1.00	1.00	1.00	.75	.75	.75	1.13	+ Stroke
BE	.50	.50	.75	.75	.75	.75	.75	1.16	
BF	.050	.050	.063	.063	.063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

Rubber Bumpers

Option

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



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

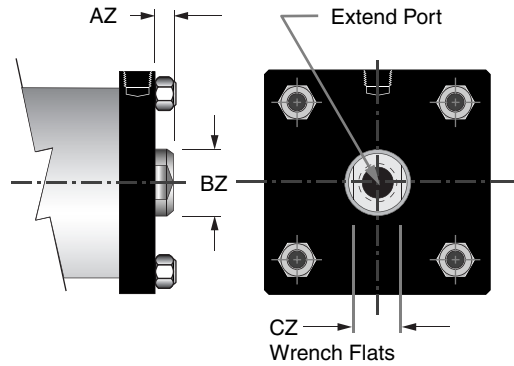
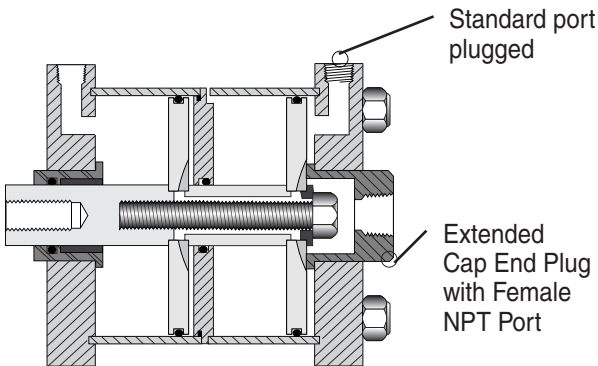
Because of the temperature limitations of the adhesives involved (-25° to +225°F), rubber bumpers are available in cylinders with standard internally lubricated Buna-N seals only.

Use where noise reduction and impact absorption is desired.

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

Extend Port Bushing

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



Dimensions (inches)

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	–	–	✓

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.

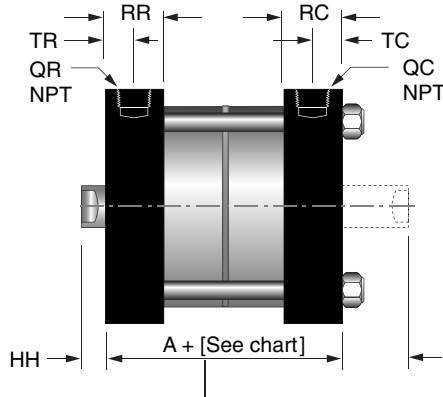
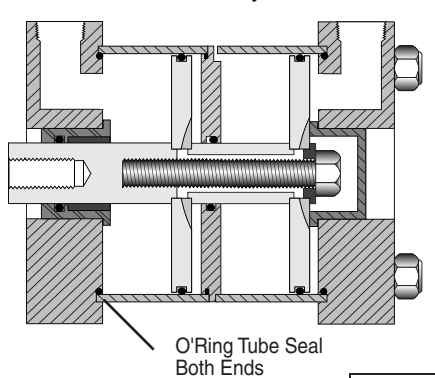
1/2 NPT Ports in Heads

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

8", 10" & 12" Bores only



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

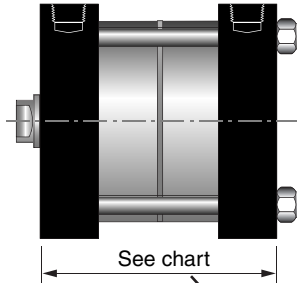
Available with Viton seals

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.



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

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

Additional Rod Seal, Polypak®
SAE 660 Bronze Bushing

Standard Rod Seal, O'Ring

Additional Tube Seal, O'Ring

Additional Piston Seal, Polypak®

Standard Piston Seal, O'Ring

Thicker Piston

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

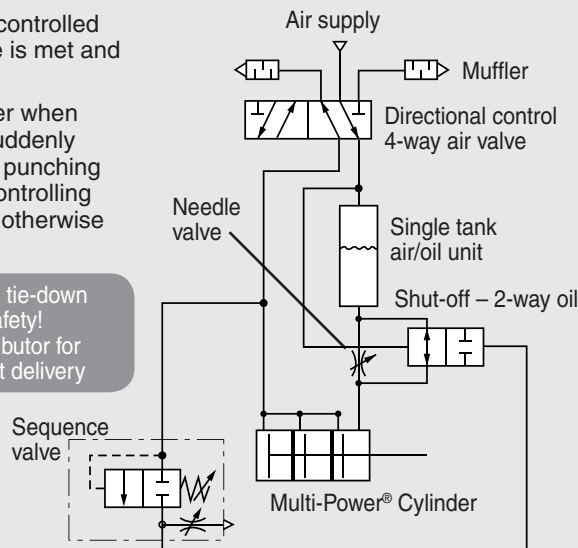
Application Tips

Two Speed & Shock Control

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

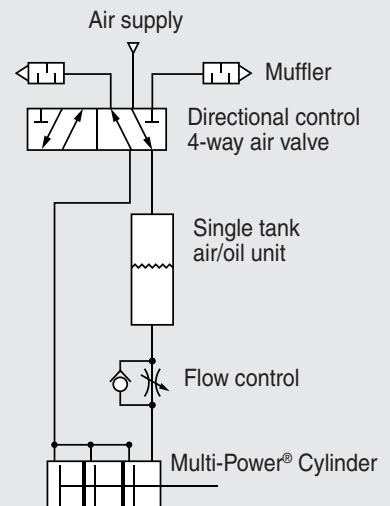
1. Rapid "Extend" stroke.
2. Automatic switch to controlled rate when resistance is met and pressure builds up.
3. Fluid catches cylinder when built-up forces are suddenly released (such as in punching applications), thus controlling the shock that could otherwise occur.

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



One Speed Circuit

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



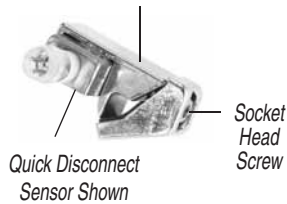
Magnetic Piston Option -E Specifies Magnetic Piston (Order Sensors and Sensor Clamps Separately)

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

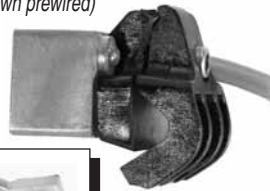
(T) Clamp Stick Out & (L) Length Adder to Dim. 'A' Pgs. 5.5 & 5.6

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

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

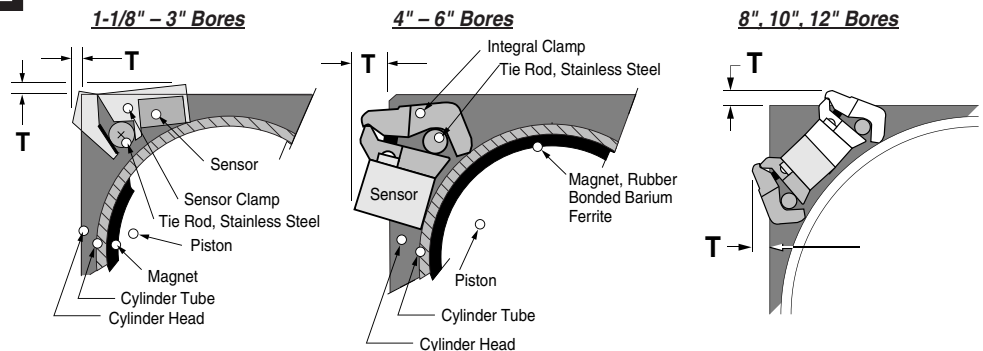


749 Series Sensor with Integral Clamp
for 4" to 12" Bore Cylinders
(shown prewired)



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.



Sensor & Clamp Ordering Guide

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

Warning! Do not exceed sensor ratings. Permanent damage to sensor may occur. Power supply polarity **MUST** be observed for proper operation of sensors. See wiring diagrams included with each sensor. Sensor housing rated NEMA 6/IP67.

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

Female Cordsets for 9-2A197 Series Quick Disconnect Sensors

Length	1 Meter	2 Meter	5 Meter
Part No.	CFC-1M	CFC-2M	CFC-5M

Female Cordsets for 749 Series Quick Disconnect Sensors

Length	2 Meter	5 Meter
Part No.	CFC-2M-12	CFC-5M-12

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

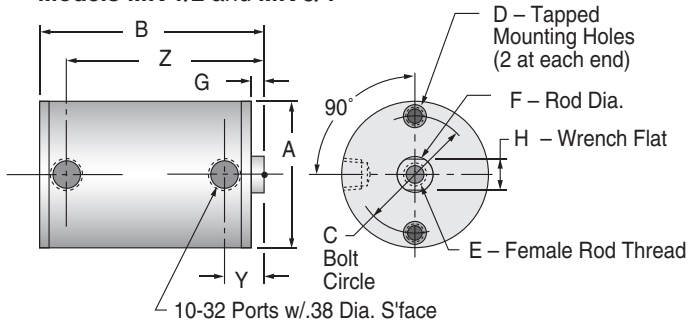


Sizing Pancake® – Multi-Power® Cylinders

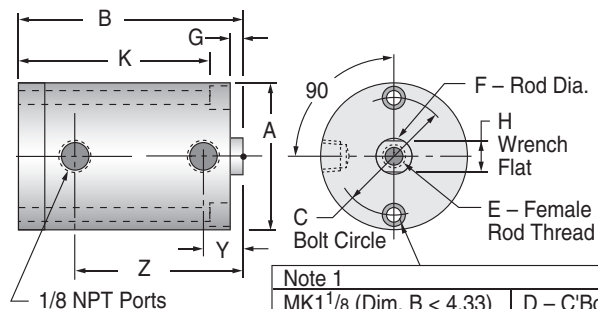
Series Bore	Stages (Pistons)	Area ±	Equivalent Bore †	Force @ 60 psi	Retract Area	Body O. D.	Available Strokes					
							1/8"	1/4"	1/2"	3/4"	1"	1-1/2"
MK 1/2	2	.35	.6	20		1.13	•	•	•	•	•	•
	3	.50	.7	30	.15		•	•	•	•	•	•
	4	.65	.9	35			•	•	•	•	•	•
MK 3/4	2	.80	1.0	45		1.50	•	•	•	•	•	•
	3	1.16	1.1	70	.36		•	•	•	•	•	•
	4	1.52	1.3	90			•	•	•	•	•	•
MK 1-1/8	2	1.79	1.5	105		1.99	•	•	•	•	•	•
	3	2.59	1.8	155	.80		•	•	•	•	•	•
	4	3.39	2.0	200			•	•	•	•	•	•
MK 1-5/8	2	3.83	2.2	230		2.74	•	•	•	•	•	•
	3	5.59	2.6	335	1.76		•	•	•	•	•	•
	4	7.35	3.0	440			•	•	•	•	•	•
MK 2	2	5.84	2.6	350		3.24	•	•	•	•	•	•
	3	8.54	3.2	510	2.70		•	•	•	•	•	•
	4	11.24	3.7	670			•	•	•	•	•	•
MK 2-1/2	2	9.38	3.3	560		3.74	•	•	•	•	•	•
	3	13.85	4.0	830	4.47		•	•	•	•	•	•
	4	18.32	4.7	1095			•	•	•	•	•	•
MK 3	2	13.70	4.0	820		4.24	•	•	•	•	•	•
	3	20.33	5.0	1215	6.63		•	•	•	•	•	•
	4	26.96	5.7	1615			•	•	•	•	•	•
MK 4	2	24.35	5.5	1461		5.50	•	•	•	•	•	•
	3	36.13	6.7	2168	11.78		•	•	•	•	•	•
	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	
MK1 ^{1/8} (Dim. B < 4.33)	D – C'Bored
All MK1 ^{5/8}	J – Thru Holes
MK1 ^{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	X	3	X	1	-	MR
Series	Bore		Stroke		Stages Extend		Stages Retract		Suffix Options - See pages 5.15 - 5.17
	1/2" 3/4" 1-1/8" 1-5/8" 2" 2-1/2" 3" 4"		See available strokes in the sizing guide on page 5.13		2 X 1 3 X 1 4 X 1 1 X 2 1 X 3 1 X 4				Stroke Collars: 1/8" -C1; 1/4" -C2; 3/8" -C3 Threaded Nose Mount: Single Rod -F Double rod, rod end -F Double rod, cap end -F1 Double rod, both ends -F2 Double Rod -DR Male rod thread: Single rod -MR Double rod, rod end -MR Double rod, cap end -MR1 Double rod, both ends -MR2 Viton seals -V External guide, nonrotating for load guiding -G Finish: ProCoat™ -N Rubber Bumpers: 1-1/8 Bores & Larger Rod end -BF Cap end -BR Both ends -BFR Adjustable extend stroke 1-1/8 Bores & Larger -AS Clevis mount: Ports in-line with slot -PM Ports 90° to slot -SM Eye mount: Ports in-line with tang -EPM Ports 90° to tang -ESM Magnetic piston & sensor mounting slot(s) -E Order sensors separately. Extend Port Bushing 3/8 NPT for 2" Bores and Larger -E38 1/4 NPT Ports for 1-5/8" Bores and Larger -P14

Ordering Examples

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

MK 2 X 1 X 2 X 1

Pancake®-Multi-Power®

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

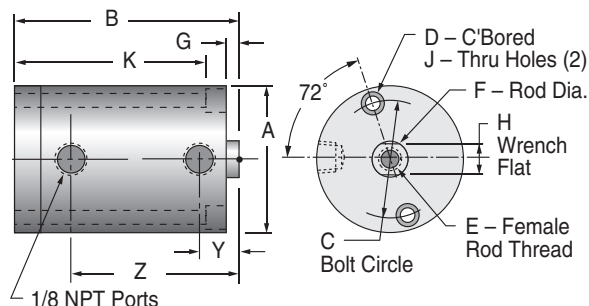
MK 1-1/8 X 1/2 X 4 X 1-MR

Pancake®-Multi-Power®

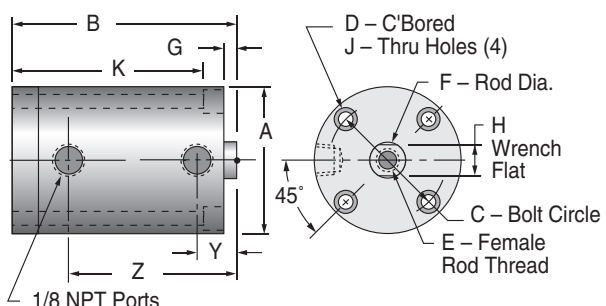
1 1/8" Bore, 1/2" Stroke, 4 Stage Extend, 1 Stage Retract, Male Rod

5

Model MK 2



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



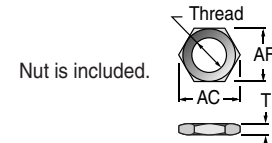
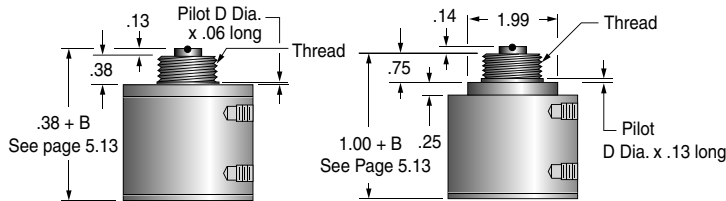
Variable Dimensions

Series Bore		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



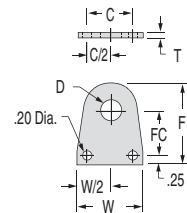
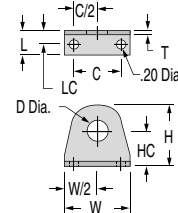
Bore	D Pilot	Thread	Nut Part No.	AC	AF	T
1/2"	.495-.491	1/2" - 20	MC-500-195	0.72	0.63	.25
3/4"	.620-.615	5/8" - 18	MC-700-195	0.88	0.75	.25
1-1/8"	1.000 -.995	1" - 14	12100-195	1.59	1.38	.19
1-5/8"	1.250-1.245	1 1/4" - 12	22100-195	1.88	1.63	.25

Plated steel nose mounting brackets *Must be ordered separately*

BRK-201 & BRK-301

BRK-202 & BRK-302

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

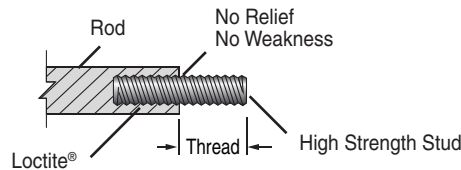


Male Rod Thread

Option

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

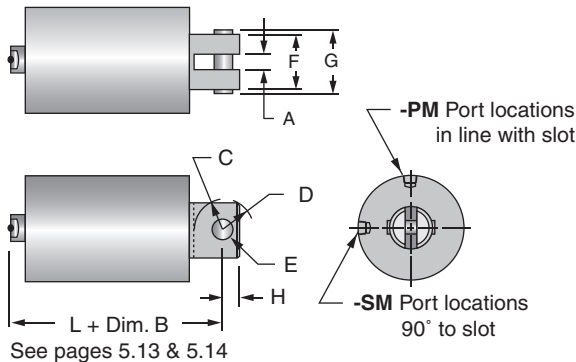
-MR
-MR
-MR1
-MR2



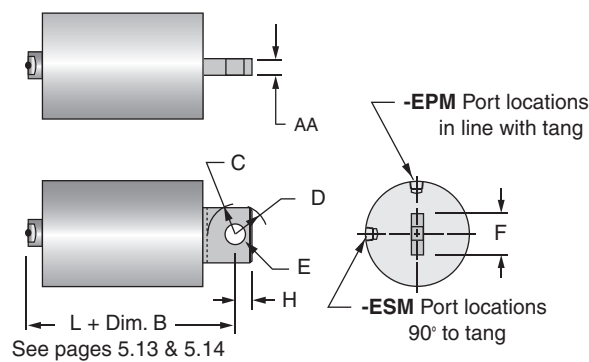
Bore	Thread
1/2"	8-32 x .50
3/4"	10-32 x .50
1-1/8"	5/16-24 x .75
1-5/8"	3/8-24 x .88
2"	1/2-20 x 1.00
2-1/2"	1/2-20 x 1.00
3"	1/2-20 x 1.00
4"	5/8-18 X 1.25

Clevis Mount

Option -PM & -SM



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



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

Pro-Coat™

Electroless Nickel plating

Option -N

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

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

Consult Engineering for specific application requirements

Series MK Option Specifications

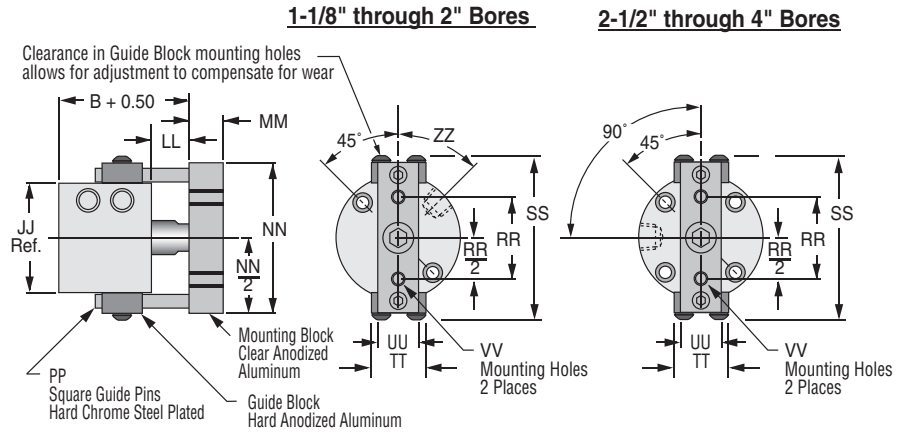
External Guide, Nonrotating

Option -G



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

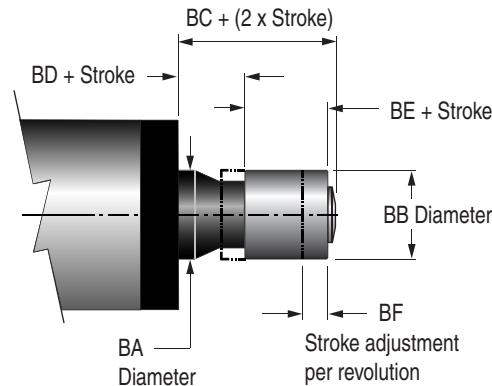
A mounting block is bolted to the piston rod. This block has two square pins mounted to it which in turn pass through guide blocks mounted on the sides of the cylinder.



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

5

Adjustable Extend Stroke Option -AS



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

Bore	1-1/8"	1-5/8"	2"	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

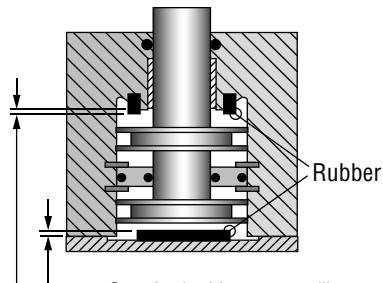
Note! Use caution when mounting to avoid creating pinch points with other parts of your machine design.

Rubber Bumpers

Rod End Only
Cap End Only
Both Ends

Temperature Range
(-25° to + 220°F)

-BF
-BR
-BFR



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

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

Extend Port Bushing

3/8 NPT for 2" Bores & Larger

-E38

Use when higher cycle speeds are required.

1/4 NPT Ports

for 1-5/8" Bores & Larger

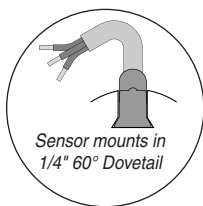
-P14

Magnetic Piston

Option -E

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

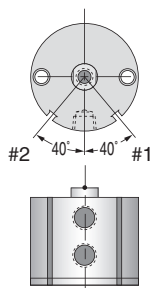
Order Sensors Separately



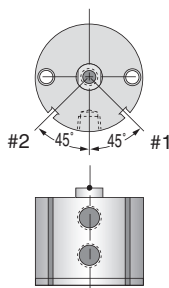
A single slot on longer stroke models has room to accommodate multiple sensors.

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

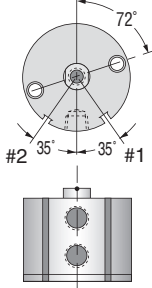
MK1-1/8



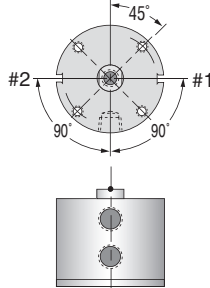
MK1-5/8



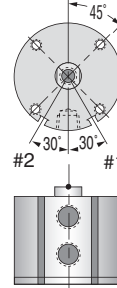
MK2



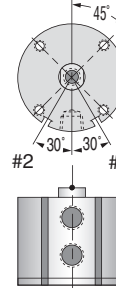
MK2-1/2



MK3



MK4

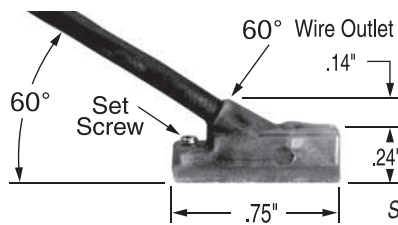


1/8" to 1" stroke models have 2 mounting slots. 1-1/2" stroke models have 1 slot at position #1. Ports are in-line for all Bores, all Strokes.

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



Sensor housing rated NEMA 6/IP67. 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

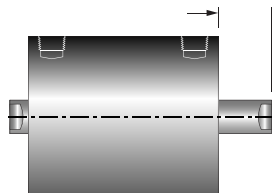
Cylinder Model	Sensor Type	Prewired 9 ft. Part No.	Quick Disconnect Part No.*	LED	Electrical Characteristics
Series MK	Electronic	949-000-031	949-000-331	Yes	Sourcing, PNP, 5-28 VDC, 0.20 Amp Max current, 1.0 Voltage Drop
	Electronic	949-000-032	949-000-332	Yes	Sinking, NPN, 5-28 VDC, 0.20 Amp Max current, 1.0 Voltage Drop

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

Double Rod

Option -DR

G + stroke



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

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

Viton Seals

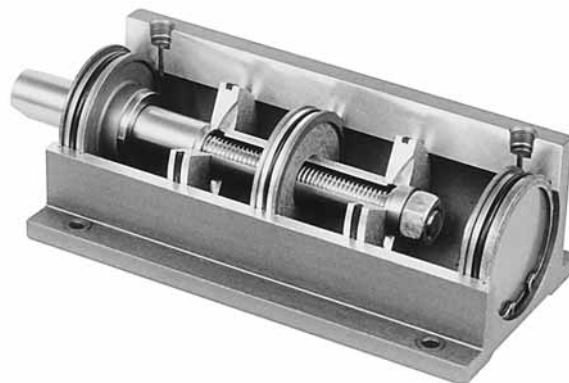
Option -V

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

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	3/4"	2	.80	1	48	.36		•	•	•	•	•		
MQW	7/8"	2	1.12	1-3/16	67	.52		•	•	•	•	•		
MQF	1-1/8"	2	1.79	1-1/2	107	.80	•	•	•		•	•	•	•
MQFW	1-5/8"	2	3.83	2-1/8	229	1.76	•	•	•		•	•	•	•
MQL	2"	2	5.84	2-5/8	350	2.70		•	•		•	•	•	•
MQLW														

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

5

How to Order

Model Number Code

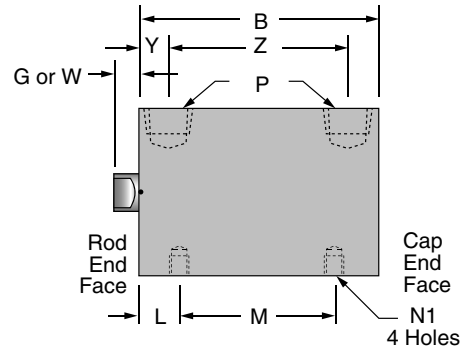
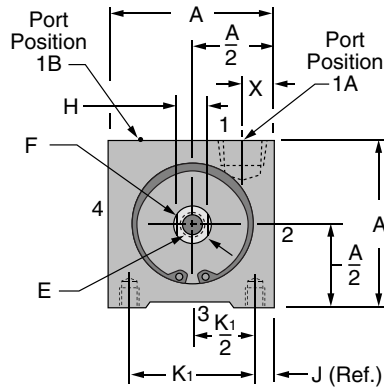
MQL		GW		1-1/8	X	1	X	2	X	1	-	DR - MR1
Mounting		Rod Extension Single Rod Models		Bore	Standard Strokes Inches		Stages Extend		Stages Retract		OPTIONS	
MQ Side Tap		Blank –for standard extension per dimension "G"		3/4"	For strokes available		2	X	1		See pages 5.20 - 5.22	
MQF Face		W - for Extension to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

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

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

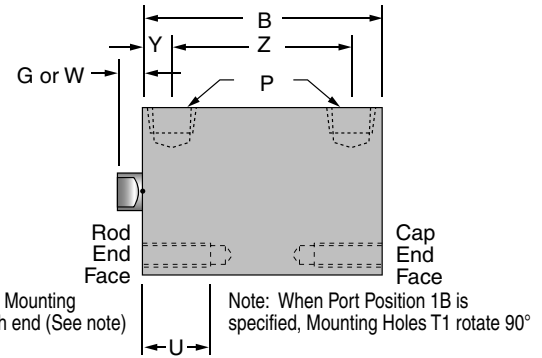
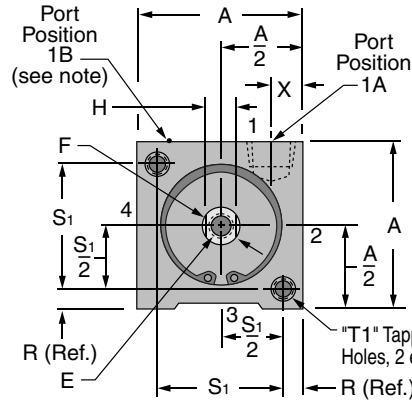
MQ Series: Side Tap Mounting

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



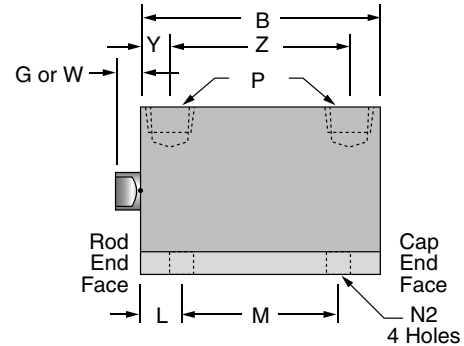
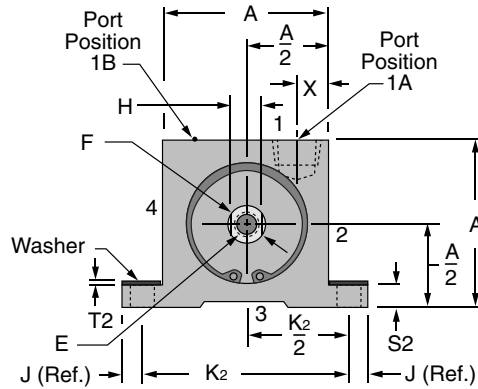
MQF Series: Face Mounting

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



MQL Series: Side Lug Mounting

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



Variable Dimensions

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

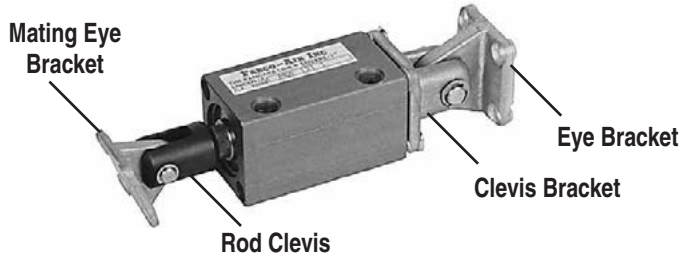
Fixed Dimensions

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

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

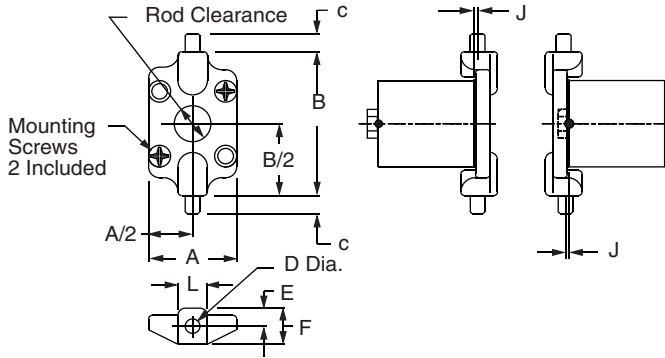
*Note: 2" bore, 1/4 stroke only: .27 Dia. thru, .38 dia. C'Bore x .26 deep for 1/4" SHCS and 5/16-18 x .75 deep tapped mounting holes, 2 places each end

Series MQF Mounting Kits



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

Trunnion Mount Kit



Materials

Bracket: High strength Zinc die casting

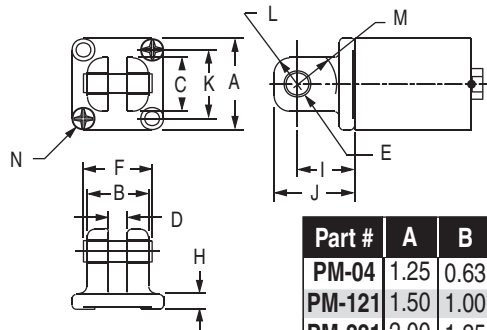
Pivot Pins: Precision dowel pins

Mounting screws: 4, Steel, plated or black oxidized

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

5

Clevis Bracket Kit



Materials

Bracket: High strength Zinc die casting

Bushings: Oil filled powdered metal

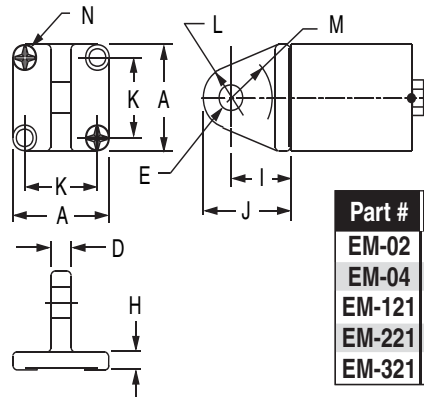
Pin: 416 Stainless Steel

Clips: 2, Plated steel

Screws: 4, Steel, plated or black oxidized

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

Eye Bracket Kit



Materials

Bracket: High strength Zinc die casting

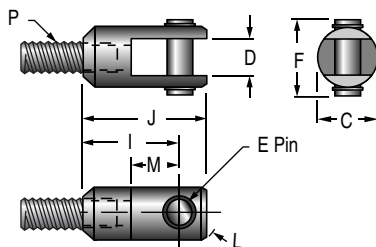
Bushings: Oil filled powdered metal

Screws: 4, Steel, plated or black oxidized.

*Special 1/4-20 with #13 Phillips Head

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

Rod Clevises



Materials

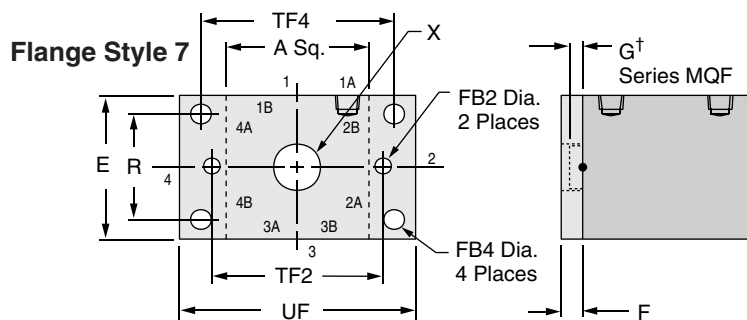
Clevis and Stud: Steel, black oxidized

Pin: 416 Stainless Steel

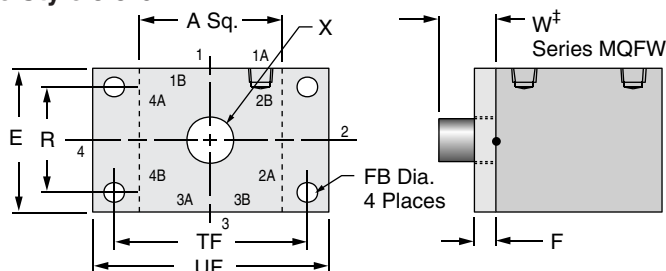
Clips: Steel, plated

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

Flange Mounting Kits for Series MQF and MQFW



Flange Style 8 & 9



Flange Style	Bore Size	Fabco Kit No.	Mounting Hole Pattern Interchange Information
7	3/4"	H7-04	4 Hole Pattern C&C: 1-1/8" Bore, Series T, F, & R Mosier: 1-1/8" Bore, Series TAV, 8 & 9 PHD: 1-1/8" Bore, Series AV, RF, & CF 2 Hole Pattern Compact Air: 3/4" Bore, Style S, FF, & RF
7	1-1/8"	H7-121	4 Hole Pattern C&C: 1-1/8" Bore, Series T, F, & R Mosier: 1-1/8" Bore, Series TAV, 8 & 9 PHD: 1-1/8" Bore, Series AV, RF, & CF 2 Hole Pattern Compact Air: 1-1/8" Bore, Style S, FF, & RF
7	1-5/8"	H7-221	4 Hole Pattern 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

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

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



SQFW-121X1-1/2
with H7-121

External Guide, Nonrotating

Option -G

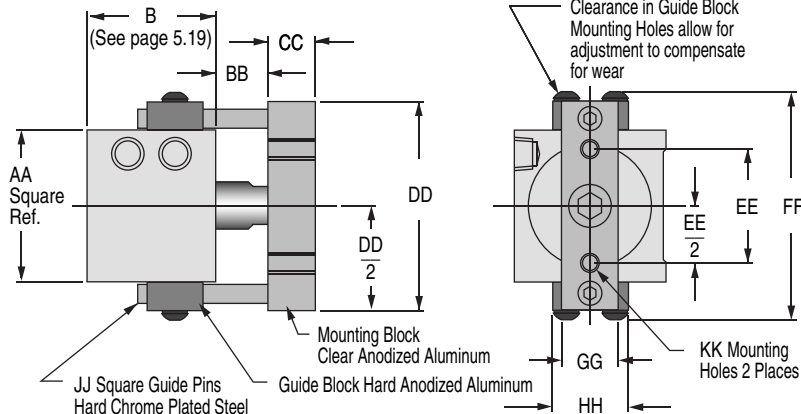
Superior nonrotating piston rod feature for applications such as package placement, figure stamping, and any application where anti-rotation and registration are critical as the piston is extended and retracted.

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

- Square guide pins are hard chrome plated

steel for long wear and corrosion resistance.

- Guide blocks are hard anodized aluminum for long wear and corrosion resistance.
- Clearance in guide block mounting holes provide for adjustment and backlash control, compensation for wear, and minimal rotation.
- Extended distance between guides provides superior nonrotation and support.
- Extended piston rod provides clearance between cylinder and guide bar mounting block to eliminate pinch points.



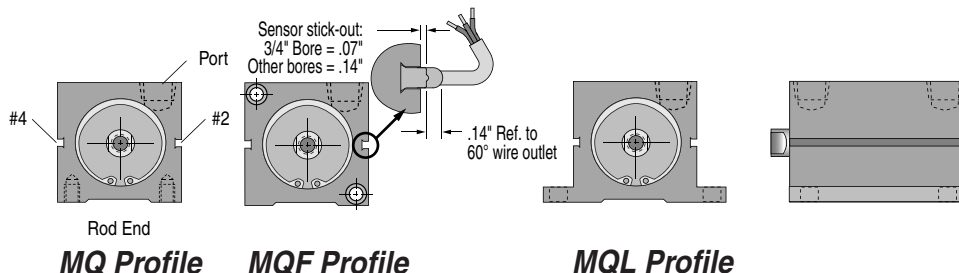
Mounting Series MQ or MQF

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

Series MQ, MQF & MQL Option Specifications

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

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

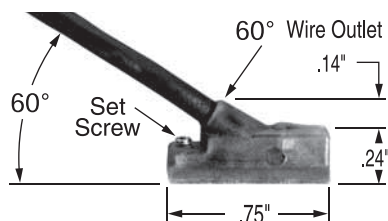


separately.

	Stroke	Standard Stroke & Slot Location Guide											
		MQ (Side Tap)				MQF (Face Mount)				MQL (Side Lug)			
		3/4"	1 1/8"	1 5/8"	2"	3/4"	1 1/8"	1 5/8"	2"	7/8"	1 1/8"	1 5/8"	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



Sensor housing rated NEMA 6/IP67. 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 5-28 VDC, 0.20 Amp Max current, 1.0 Voltage Drop Sinking NPN 5-28 VDC, 0.20 Amp Max current, 1.0 Voltage Drop
	Electronic	949-000-032	949-000-332	Yes	

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

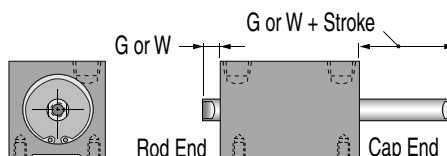
Male Rod Thread Option

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

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

Double Rod Option -DR

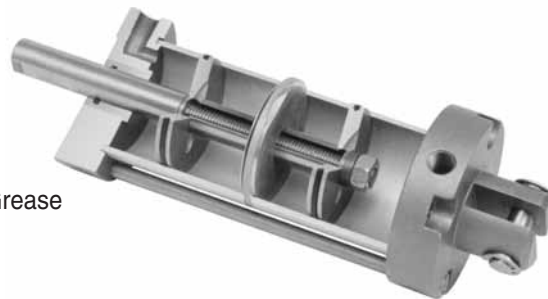
- Blank**— "G" both ends.
- W**— "W" extension both ends.
- GW**— "G" extension rod end; "W" extension cap end.
- WG**— "W" extension rod end; "G" extension cap end.



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

Specifications

Media.....Air
Recommended Minimum Pressure20 psi
Maximum Operating Pressure150 psi
Ambient & Media Temperature-25° to +250°F
PrelubricationMagnalube®-G Grease
Airline Lubrication.....Recommended



Model Number Code

MLR 2		X	3	X	2 X 1
Series	Bore	Stroke			
MLR	2	Standard strokes: 1/2", 1", 1-1/2", 2", 2-1/2", 3", 4", 5", 6" (Optional – any other stroke 0" thru 12")			
Round head	2-1/2"				
MLS	3"				
Square head	4"				

Stages Extend Retract

2	X	1
3	X	1
4	X	1
1	X	2
1	X	3
1	X	4

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

PM

–

MR

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"

Mounting

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

Ordering Example

MLS3 X 3 X 2 X 1 PM – MR

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

Sizing Longstroke™ – Multi-Power® Cylinders

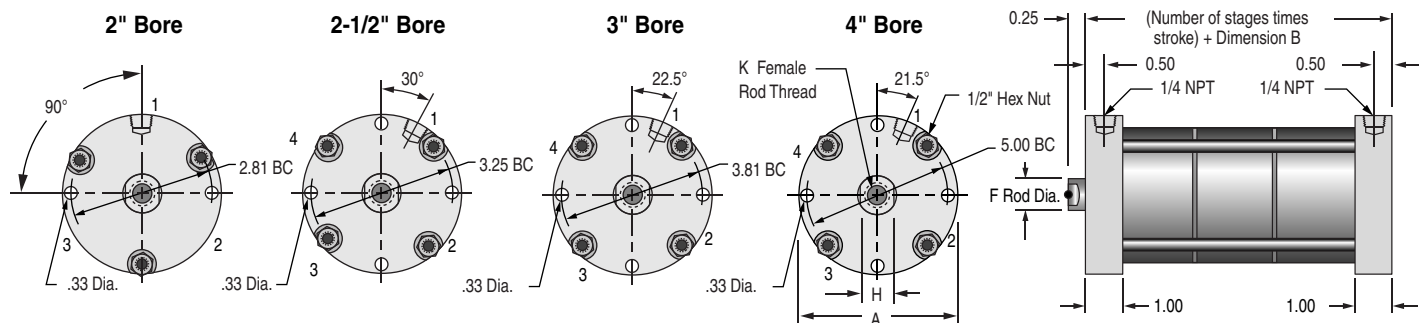
Series	Bore	Stages (Pistons)	Area ‡	Equivalent Bore †	Force @ 60 psi	Retract Area
MLR	2"	2	5.84	2.6	350	2.7
		3	8.54	3.2	512	
		4	11.24	3.7	674	
MLS	2 1/2"	2	9.38	3.3	562	4.47
		3	13.85	4.0	831	
		4	18.32	4.7	1099	
MLS	3"	2	13.70	4.0	822	6.63
		3	20.33	5.2	1219	
		4	26.96	5.7	1617	
MLS	4"	2	24.35	5.5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

‡ Area = Total effective piston area, square inches.

† Equivalent Bore = Bore required for single piston cylinder.

Longstroke™—Multi-Power® Cylinders

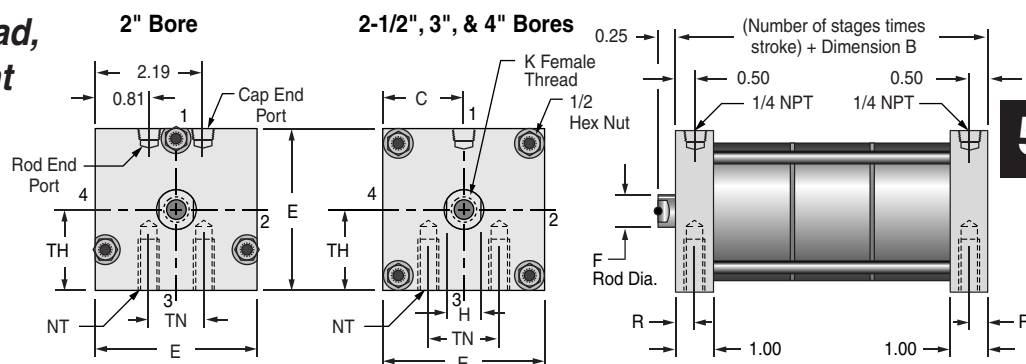
Series MLR – Round Head, Standard, Face Mount, Rod and Cap End



Series MLS – Square Head, Standard, Side Tap Mount

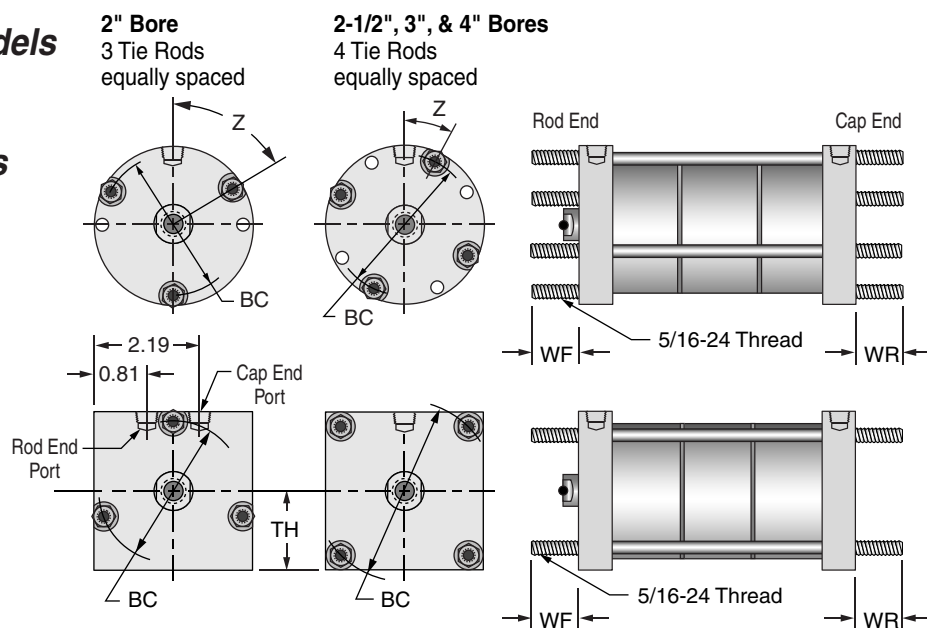
Note:

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



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	B	B	BC	C	E	F	H	K	NT	R	TH	TN	WF	WR	Z
		2 stage	3 stage	4 stage													
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

Ports 90° to slot

PM

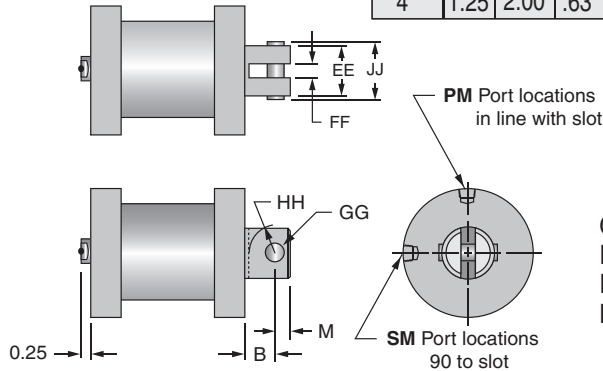
SM

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

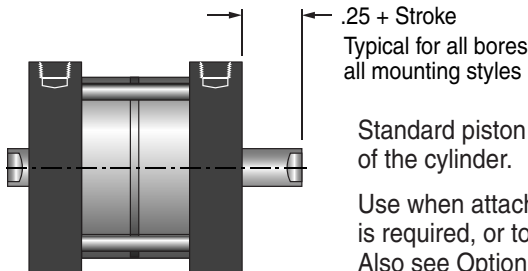


Oil filled powdered metal
Pivot Pin Bushings are standard.
Pivot Pin, 416 stainless steel
Lockrings, plated steel

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

Single Rod

Double Rod, Rod End Only

Double Rod, Cap End Only

Double Rod, Rod & Cap Ends

Option

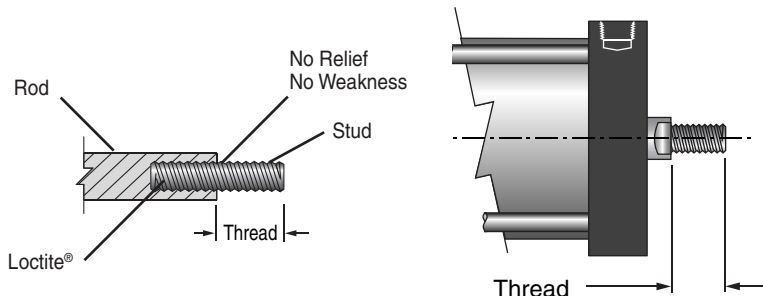
-MR

-MR

-MR1

-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

Rod End only

Cap End only

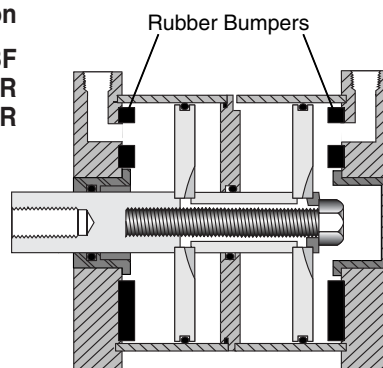
Both Rod & Cap Ends

Option

-BF

-BR

-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.

Series MLR & MLS Option Specifications

Adjustable extend stroke

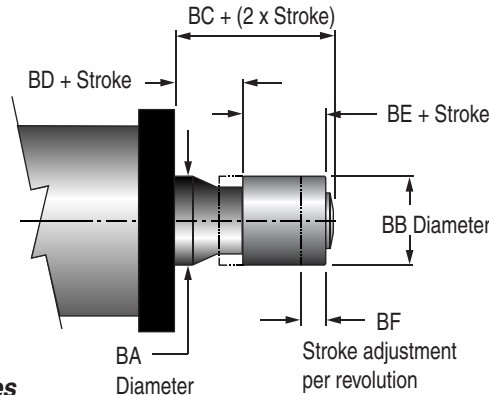
Option -AS

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

Note!

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

Note: NOT available with mounting styles PM and SM



See complete description on page 5.9.

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

3/8 NPT Ports in Heads Option -P38

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

Nonrotating Rod

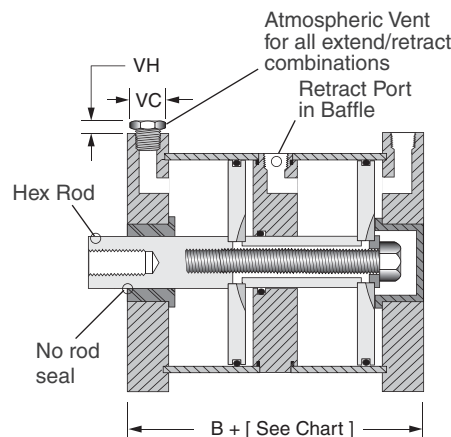
Option -NR

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

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

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

Hex rod flats have Random Rotation relative to Mounting Pattern



See page 5.24 for Dimension "B".

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

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

Nonrotating Double Rod

Option -NRDR

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

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

High Flow Vents

Option -HF

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

Use when higher cycle speeds are required.

Viton Seals

Option -V

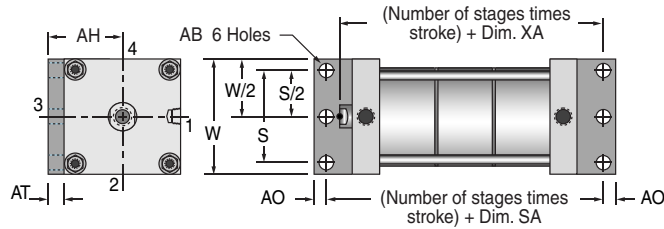
Use for elevated temperatures (-15° to $+400^\circ\text{F}$) or compatibility with exotic media.

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



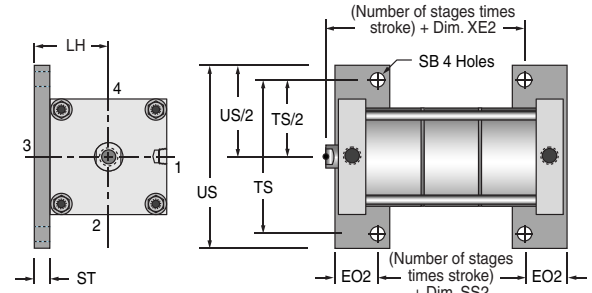
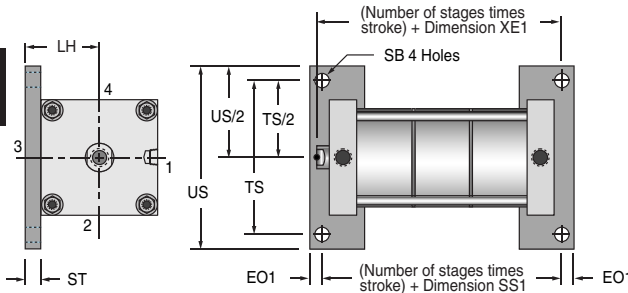
Bore	Kit No.	S	W	AB	AH	AO	AT	SA 2 stage	SA 3 stage	SA 4 stage	XA 2 stage	XA 3 stage	XA 4 stage
2"	EL-20	1.75	2.50	.41	1.63	.44	.25	4.04	4.89	5.74	3.98	4.83	5.68
2-1/2"	EL-25	2.25	3.00	.41	2.00	.44	.25	4.16	5.01	5.86	4.04	4.89	5.74
3"	EL-30	2.75	3.50	.53	2.13	.56	.38	4.66	5.51	6.36	4.29	5.14	5.99
4"	EL-40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

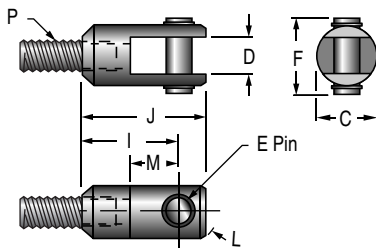


Position #1

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

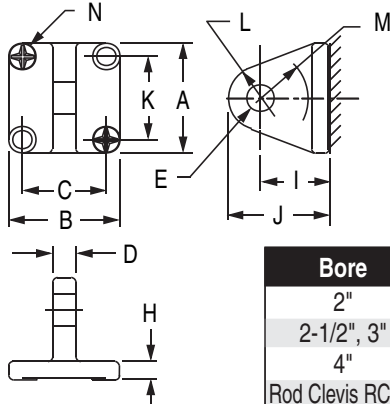
Rod Clevises



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

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

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



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

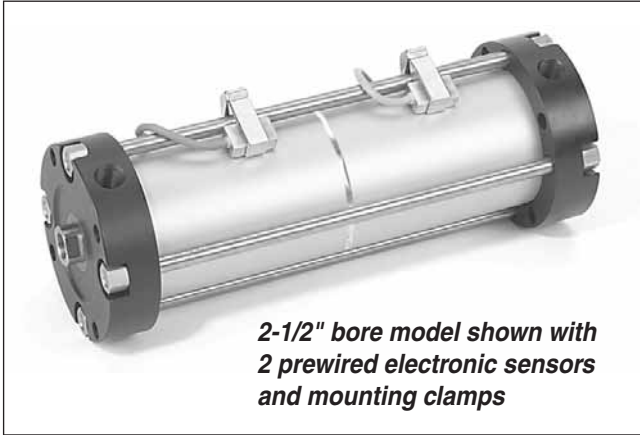
Bore	Part #	A	B	C	D	E	H	I	J	K	L	M	N
2"	EM-321	2.50	2.50	2.00	.36	.376	.31	1.13	1.69	2.00	0.56	0.81	5/16-18x1.00FHSCS
2-1/2", 3"	EM-521	2.00	2.00	1.38	.47	.501	.38	1.50	2.25	1.38	0.75	1.13	5/16-18x1.00FHSCS
4"	EM-1221	2.50	2.25	1.50	.58	.626	.38	1.63	2.63	1.75	1.00	1.10	5/16-18x1.00FHSCS
Rod Clevis RC-56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

Series MLR & MLS Option Specifications

Magnetic Piston

Option -E

(Order Sensors and Sensor Clamps 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.

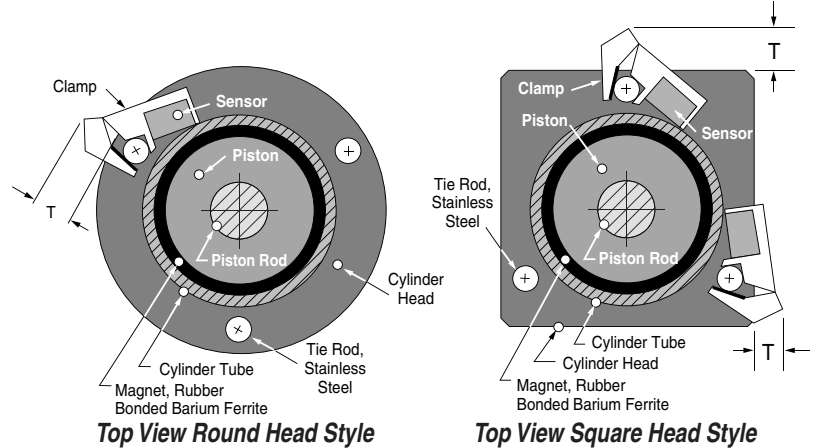
9 foot prewired sensor

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

- **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.**

Sensor Clamp Stick Out Dimensions

Model	MLR2	MLS2	MLR2-1/2	MLS2-1/2	MLR3	MLS3	MLR4	MLS4
T	.50"	.50"	.50"	.10"	.50"	.30"	.30"	.30"



Sensor & Clamp Ordering Guide

Temperature Range: -20° to + 80°C (-4° to + 176°F)
Sensor housing rated NEMA 6/IP67.

Warning!

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

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

See wiring diagrams included with each sensor.

LED Lighted Magnetic Piston Position Sensors

Product Type	Prewired 9 ft. Part No.	Quick Disconnect Part Number.	Electrical Characteristics
Reed Switch	9-2A197-1004	9-2A197-1304	5-120 VDC/VAC, 0.5 Amp Max., 10 Watt Max., SPST N.O., 3.5 Voltage Drop
Electronic	9-2A197-1033	9-2A197-1333	Sourcing, PNP, 6-24 VDC, 0.5 Amp Max., 1.0 Voltage Drop
Electronic	9-2A197-1034	9-2A197-1334	Sinking, NPN, 6-24VDC, 0.5 Amp Max., 1.0 Voltage Drop

Female Cordsets for Quick Disconnect

Length	1 Meter	2 Meter	5 Meter
Part Number	CFC-1M	CFC-2M	CFC-5M

Sensor Mounting Clamp - for all MLS & MLR Models

For all MLS & MLR Models Order Part Number 800-200-000



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.

6

- **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.

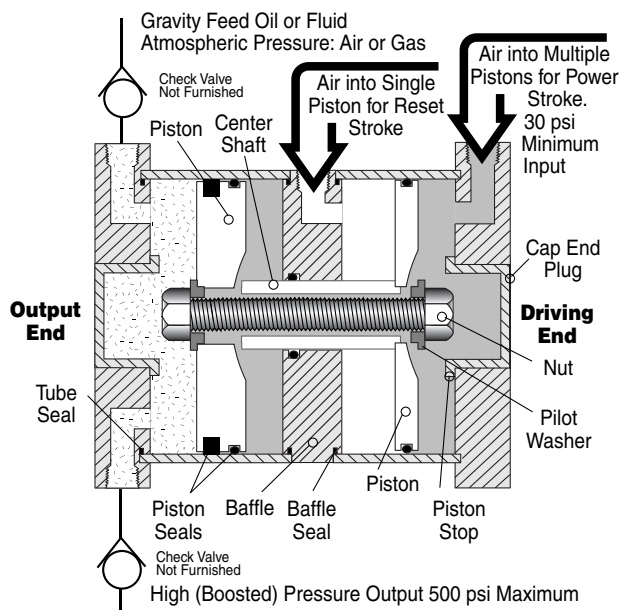
- **Smooth power:** Boosters give the work cylinder the rigid, smooth, controlled motion of hydraulics.

- **Safe:** Boosters can be completely air

operated to function safely in a potentially hazardous environment.

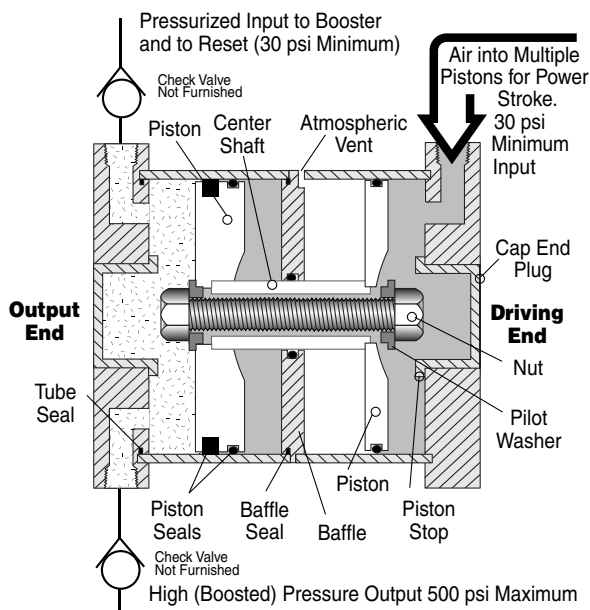
- **Clean:** Air to air boosters have no oil or liquid to contaminate the surroundings.

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 and How to Order

Sizing Guide

			Output Displacement		Input Power Air		Reset Power Air for Series BA
Bore	Number of Stages (Pistons)	Required Volume/Inch Theoretical Power Factor	Volume/Inch of Stroke		Required Volume/Inch of Stroke	Maximum	Required Volume/Inch of Stroke
			In ³	Gallons	In ³	psi	In ³
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

X

3

FF

–

PA2

Series	Bore
BA	2-1/2"
BP	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:

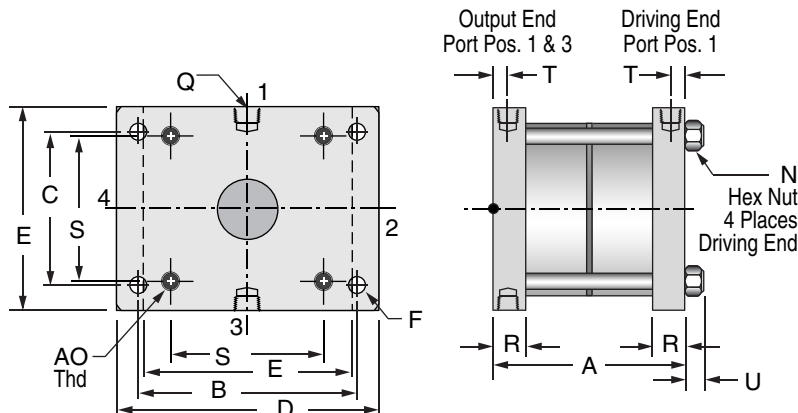
BA 2 1/2 X 2 X 3 FF – PA2

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).

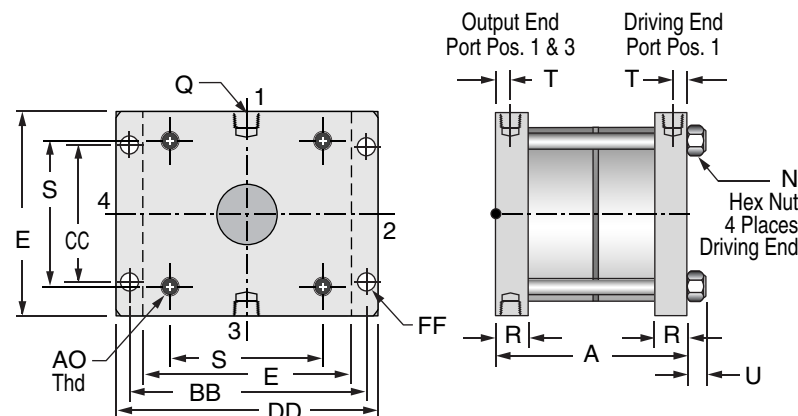
BP 4 X 6 X 5 WF

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



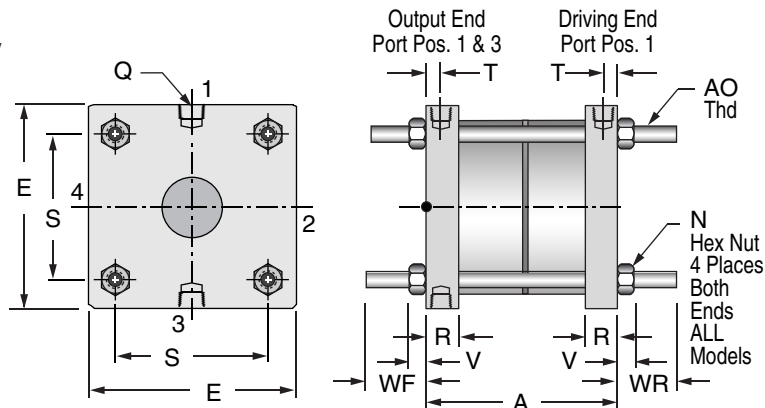
WF Extended Tie Rod Mount, Output End Only
WR Driving End Only
WFR Both Ends

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"



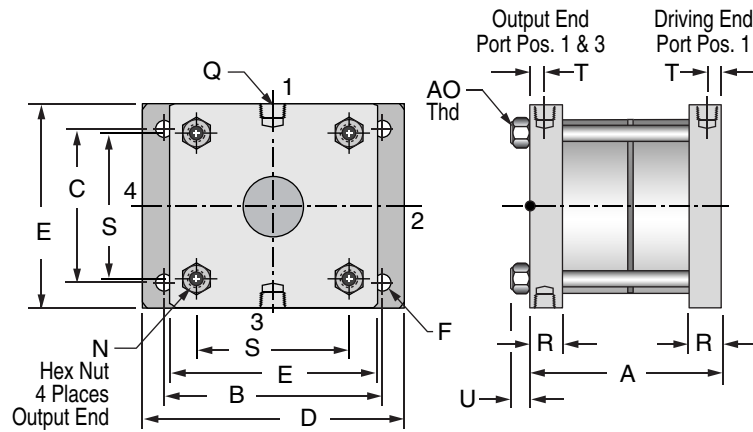
Dimensions (inches)

Dimension Y [†]			
Bore	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

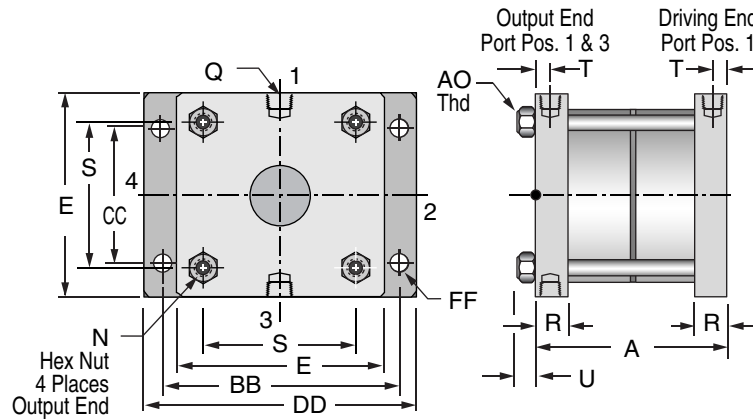
Bore	A	B	C	D	E	F	N	P	Q	R	S	T	U	V	X	Z
2-1/2	Dim. A= (No. stages x stroke) + Y [†]	3.63	2.38	4.25	3.00	.34	9/16	3.69	1/4 NPT	.75	2.31	.31	.38	.33	.44	.56
4	See Y [†] chart above	5.00	3.75	6.00	5.00	.41	3/4	5.50	1/4 NPT	.75	3.50	.31	.50	.43	.63	.88

Mounting Styles with Dimensions

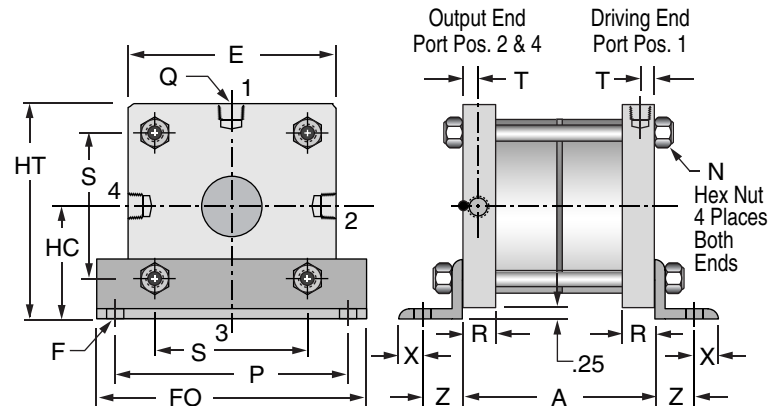
RF Rear Face Mount;
Driving End Rectangular Flange
Fabco mounting pattern



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



FT Foot Mount



Bore	Stages (Pistons)	Theoretical Power Factor	Approximate Weight, Oz.			Universal Seal Kits	
			Series BA Zero Stroke	Series BP Zero Stroke	BA or BP Per Inch of Stroke	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

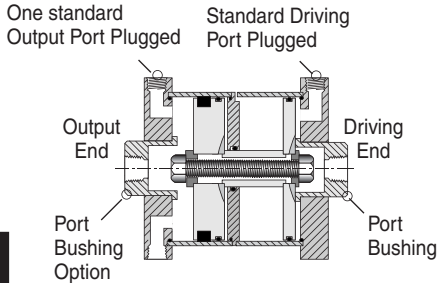
3/8 NPT	Output End	-EF38
	Driving End	-ER38
	Both Ends	-EFR38
1/2 NPT	Output End	-EF12
	Driving End	-ER12
	Both Ends	-EFR12

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

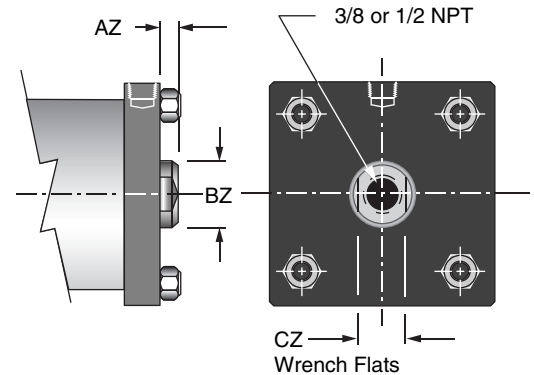
higher flows are required for higher cycle speeds and/or viscous fluids.

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

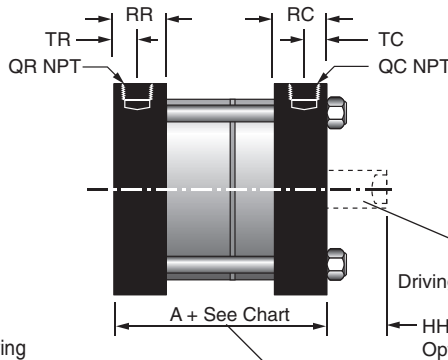
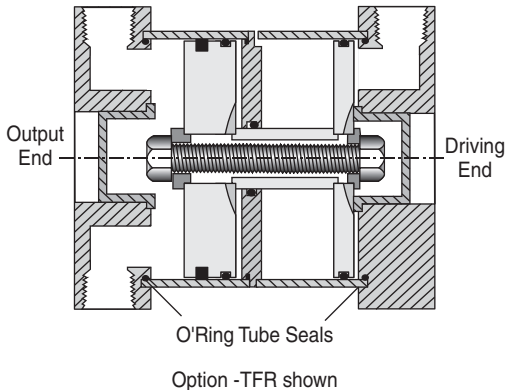


6

1/2 NPT Ports in Heads

Output End Head
Driving End Head
Both Heads

**Option
-TF
-TR
-TFR**



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.

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

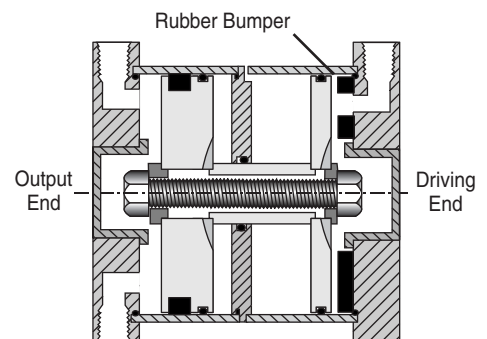
Driving End only

**Option
-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

(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
2&4	2	2
1&3	3	3
2&4	4	4

Option

Standard

-PA2

Rotate Standard

Rotate **-PA2**

All Ports with **Mount FT**

Output	Vent	Driving
2&4	1	1
1&3	2	2
2&4	3	3
1&3	4	4

Standard

-PA2

-PA3

-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

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.

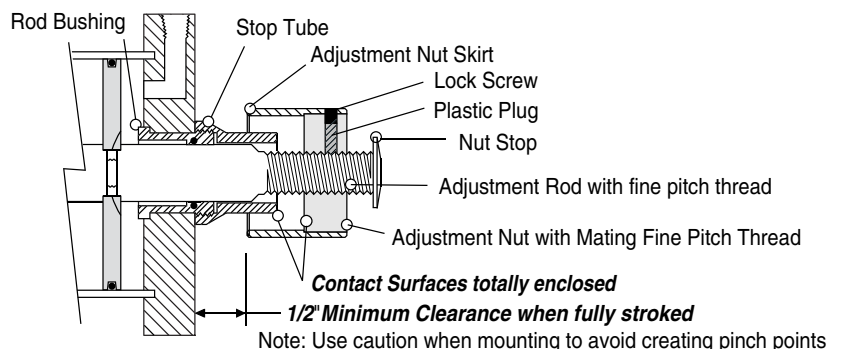
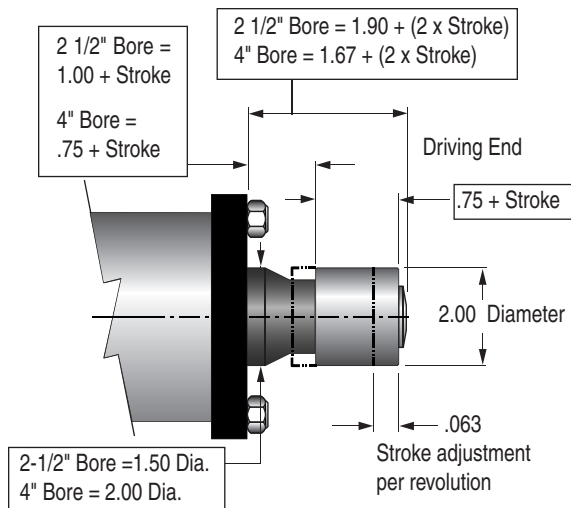
Note!

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



Magnetic Piston

Option -E

(Order Sensors and Sensor Clamps Separately)

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

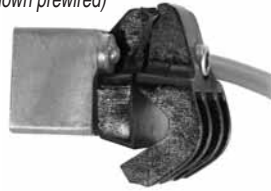


Socket Head Screw

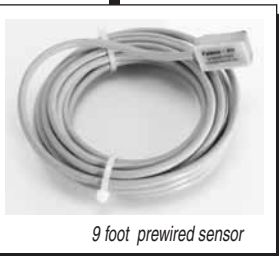
Quick Disconnect Sensor



749 Series Sensor with Integral Clamp for 4" Bore Boosters (shown prewired)



9 foot prewired sensor



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

Booster Model Number
BA 2 1/2 X 2 X 2 RF - E - PR2

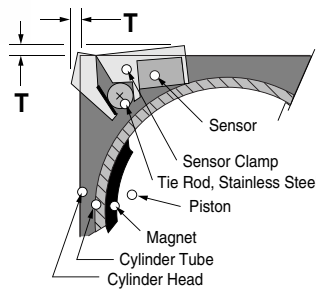


- **Option -E** consists of a magnet bonded into the piston head. When the piston magnet moves past an external sensor, the magnetic field activates the sensor without physical contact.
- **Mounting** – The sensor is attached to a 2-part clamp that attaches rigidly to a tie rod and can be positioned 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".**

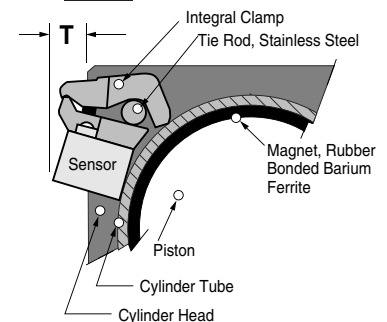
Sensor Clamp Stick Out Dimensions

Bore	2-1/2"	4"
T	.38"	.36"

2-1/2" Bore



4" Bore



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.

Sensor & Clamp Ordering Guide

Temperature Range: -20° to + 80°C (-4° to + 176°F)
Sensor housings rated NEMA 6/IP67.

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

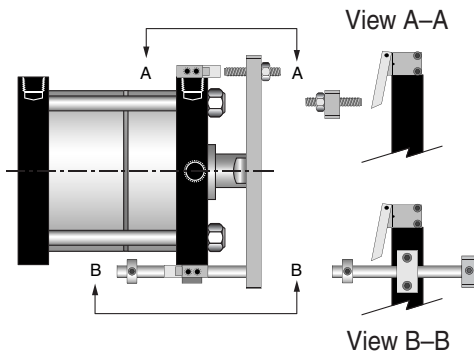
Length	2 Meter	5 Meter
Part No.	CFC-2M-12	CFC-5M-12

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.

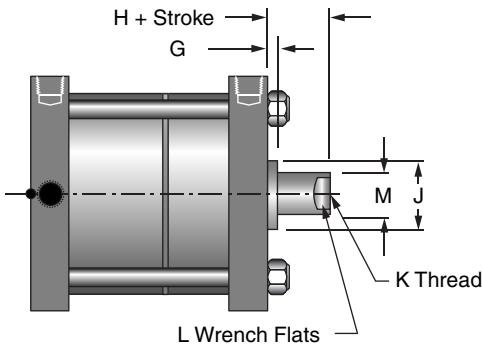
Use when the application requires pumping action (e.g. keeping a surge tank at high pressure for a test fixture) and/or there is no electricity involved (e.g. an explosive atmosphere). Also see Option -E on page 6.7 for electronic position sensors.

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



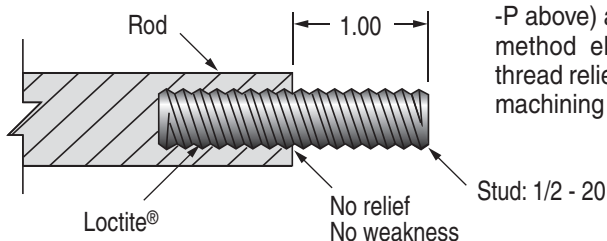
A piston rod is incorporated in the driving end. Because of the piston rod area the Power Factor changes slightly. Use the Power Factors charted above for Option -L.

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

V₁ (Initial Volume) = 4.9 cu. in./in.

P₁ (Initial Pressure) = 70 + 14.7 = 84.7

P₂ (Final Pressure) = 250 + 14.7 = 264.7

V₂ (Final Volume) = unknown

$$V_2 = \frac{P_1 \times V_1}{P_2} = \frac{84.7 \times 4.9}{264.7} = 1.5 \text{ cu. in./in. @250 psig}$$

On the basis of 20 strokes/minute (typical average)

$$\text{Booster stroke} = \frac{\text{Required Vol./min.}}{\text{vol./in. stroke} \times \text{strokes/min}}$$

$$\text{Booster stroke} = \frac{100}{1.5 \times 20} = 3.3 \text{ in.}$$

Model Choice: BP2-1/2 X 4 X 4

Alternate Solution (4" Bore): Volume - using Boyle's Law

V₁ (Initial Volume) = 12.6 cu. in./in.

P₁ (Initial Pressure) = 70 + 14.7 = 84.7

P₂ (Final Pressure) = 250 + 14.7 = 264.7

V₂ (Final Volume) = unknown

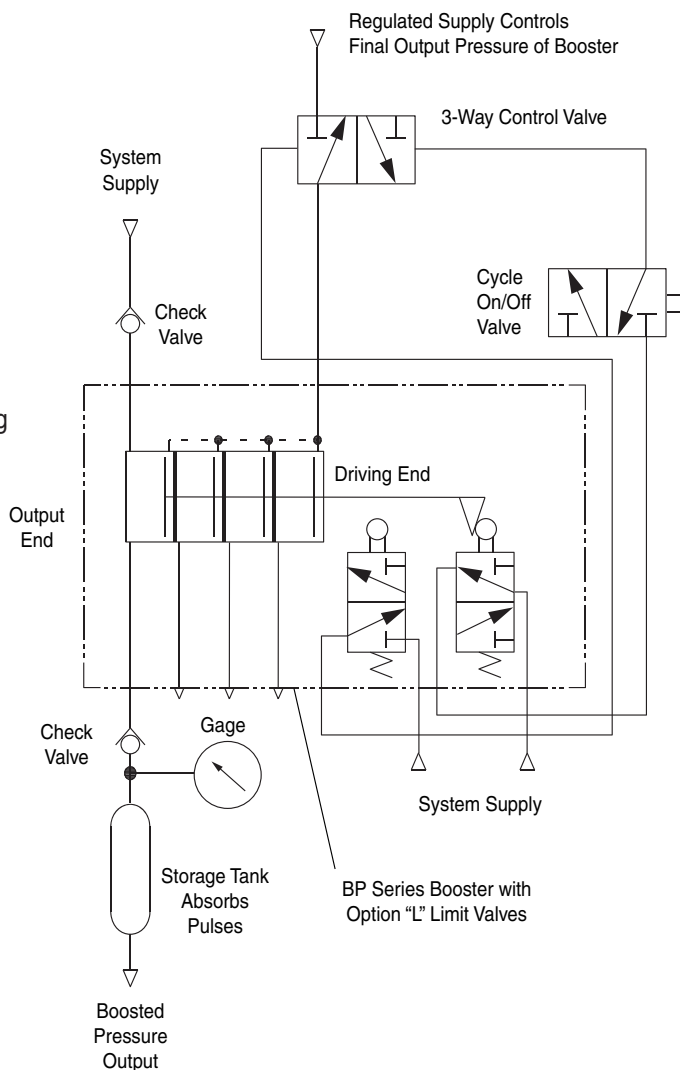
$$V_2 = \frac{P_1 \times V_1}{P_2} = \frac{84.7 \times 12.6}{264.7} = 4.0 \text{ cu. in./in. @250 psig}$$

On the basis of 20 strokes/minute (typical average)

$$\text{Booster stroke} = \frac{\text{Required Vol./min.}}{\text{vol./in. stroke} \times \text{strokes/min}}$$

$$\text{Booster stroke} = \frac{100}{4.0 \times 20} = 1.25 \text{ in.}$$

Model Choice: BP4 X 2 X 4



Input Air Usage, Pump Cycle (See Example 1 above; Model BP 2-1/2 X 4 X 4, 20 stroke/min. @ 70 psi)

Solution: **Pressure** = $\frac{\text{Required Final Pressure}}{\text{Booster Power Factor}} = \frac{250}{3.7} = 67.6 \text{ psi regulated input required}$

Solution: **Volume** (CFM) = $\frac{\text{Input Volume/Inch Stroke} \times \text{Stroke} \times \text{CPM}}{1728 \text{ cu. in./cu.ft.}}$

Input Volume/Inch Stroke = 19.3 (See Sizing Guide on page 6.2), Stroke = 4", CPM= 20

$$\text{Volume} = \frac{19.3 \times 4 \times 20}{1728} = \frac{1544}{1728} = 0.89 \text{ CFM @ 67.6 psi}$$

$$\text{Converting Volume to SCFM: SCFM} = \frac{\text{CFM} \times \text{psia}}{\text{Atmosphere}} = \frac{.89 \times (67.6 + 14.7)}{14.7} = 5.0 \text{ SCFM required}$$

Air-to-Air Sizing (for Air-to-Oil Sizing See Page 6.11)

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 = $\frac{P_2 \times V_2}{P_1} = \frac{159.7 \times 18.1}{94.7} = 30.5 \text{ cu. in.}$

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 = $\frac{\text{Required Volume}}{\text{Volume/Inch Stroke}^\dagger} = \frac{45.8}{4.9^\dagger} = 9.3 \text{ in.}$

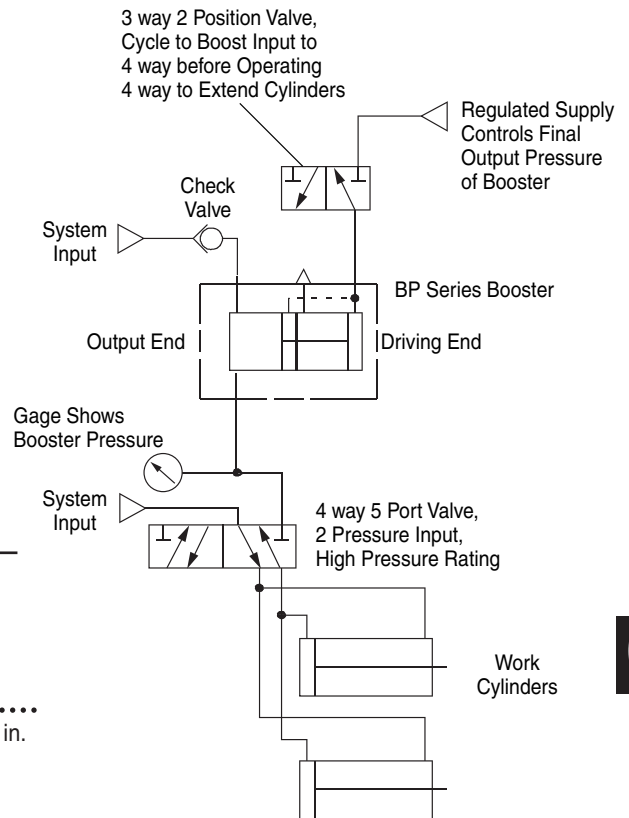
[†]For 2-1/2" Bore Volume per Inch of Stroke = 4.9 (See Sizing Guide on page 6.2)

Model Choice: BP2-1/2 X 10 X 2

Alternate Solution (4" Bore): Stroke = $\frac{\text{Required Volume}}{\text{Volume/Inch Stroke}^\dagger} = \frac{45.8}{12.6^\dagger} = 3.6 \text{ in.}$

[†] For 4" Bore Volume per Inch of Stroke = 12.6 (See Sizing Guide on page 6.2)

Model Choice: BP4 X 4 X 2



6

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 = $\frac{P_2 \times V_2}{P_1} = \frac{159.7 \times 18.1}{94.7} = 30.5 \text{ cu. in.}$

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 = $\frac{\text{Required Volume}}{\text{Volume/Inch Stroke}^\dagger} = \frac{18.6}{4.9^\dagger} = 3.8 \text{ in.}$

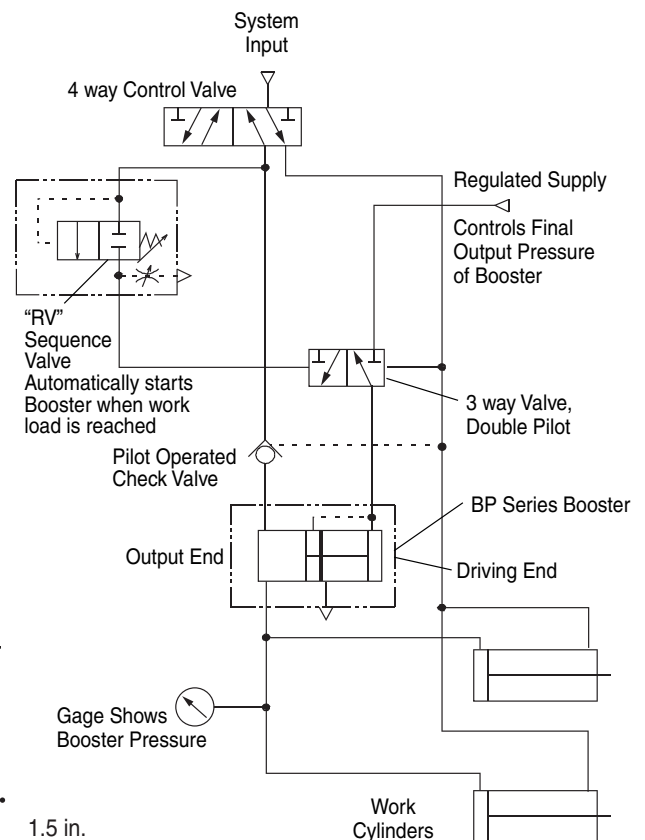
[†]For 2-1/2" Bore Volume per Inch of Stroke = 4.9 (See Sizing Guide on page 6.2)

Model Choice: BP2-1/2 X 4 X 2

Alternate Solution (4" Bore): Stroke = $\frac{\text{Required Volume}}{\text{Volume/Inch Stroke}^\dagger} = \frac{18.6}{12.6^\dagger} = 1.5 \text{ in.}$

[†] For 4" Bore Volume per Inch of Stroke = 12.6 (See Sizing Guide on page 6.2)

Model Choice: BP4 X 2 X 2



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 = $[2.07 (\text{area of } 1\text{-}5/8" \text{ bore}) \times 4" (\text{stroke}) \times 2 (\text{quantity})]$
 $\times 125\% (\text{margin})$
= $[16.6] \times 1.25 = 20.8 \text{ cu. in.}$

Solution (2-1/2" Bore): **Stroke** = $\frac{\text{Required Volume}}{\text{Volume per Inch Stroke}^\dagger} = \frac{20.8}{4.9^\dagger} = 4.3 \text{ in.}$

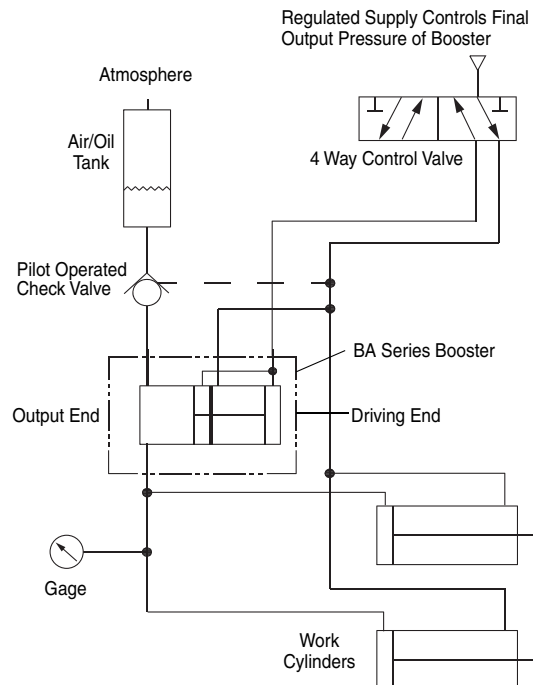
[†] For 2-1/2" Bore, Volume per Inch of Stroke = 4.9 (See Sizing Guide on page 6.2)

Model Choice: BA2-1/2 X 5 X 2

Alternate Solution (4" Bore): **Stroke** = $\frac{\text{Required Volume}}{\text{Volume per Inch Stroke}^\dagger} = \frac{20.8}{12.6^\dagger} = 1.7 \text{ in.}$

[†] For 4" Bore, Volume per Inch of Stroke = 12.6 (See Sizing Guide on page 6.2)

Model Choice: BA4 X 2 X 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** = $\frac{\text{Required Volume/Min}}{\text{Volume per Inch Stroke}^\dagger \times \text{CPM}} = \frac{1000}{4.9^\dagger \times 20} = 10.2 \text{ in.}$

[†] 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)

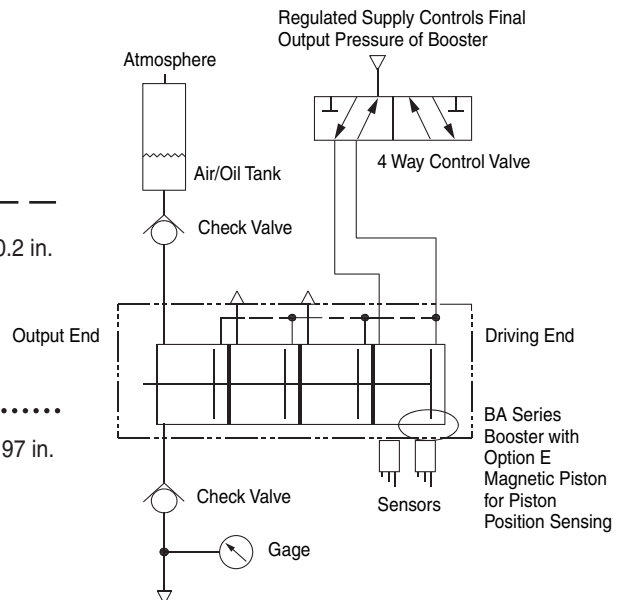
Model Choice: BA2-1/2 X 11 X 4

Alternate Solution (4" Bore): **Stroke** = $\frac{\text{Required Volume/Min}}{\text{Volume per Inch Stroke}^\dagger \times \text{CPM}} = \frac{1000}{12.6^\dagger \times 20} = 3.97 \text{ in.}$

[†] 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 X 4



Input Air Usage, Pump Cycle (See Example 5 above; Model BA 2-1/2 X 11 X 4, 20 stroke/min. @ 70 psi)

Solution: **Pressure** = $\frac{\text{Required Final Pressure}}{\text{Booster Power Factor}} = \frac{250}{3.7} = 67.6 \text{ psi regulated input required}$

Solution: **Volume** (CFM) = $[\text{Input Volume per Inch Stroke} + \text{Reset Volume per Inch Stroke}] \times \frac{\text{Stroke} \times \text{CPM}}{1728 \text{ cu.in. / cu.ft.}}$

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 = $[19.3 + 4.5] \times \frac{11 \times 20}{1728} = 23.8 \times 0.127 = 3.03 \text{ CFM @ } 67.6 \text{ psi}$

Converting Volume to SCFM: = $\frac{\text{CFM} \times \text{psia}}{\text{Atmosphere}} = \frac{3.03 \times (67.6 + 14.7)}{14.7} = 17.0 \text{ SCFM required}$

Notes



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.

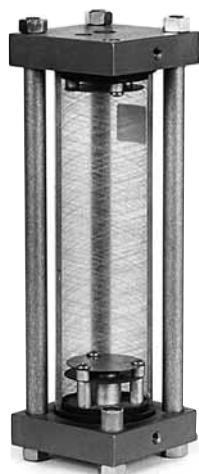
Single Tank Units are used when hydraulic control of the cylinder is required in one direction only. If there is any question as to the integrity of the piston seal, a double tank is recommended.

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

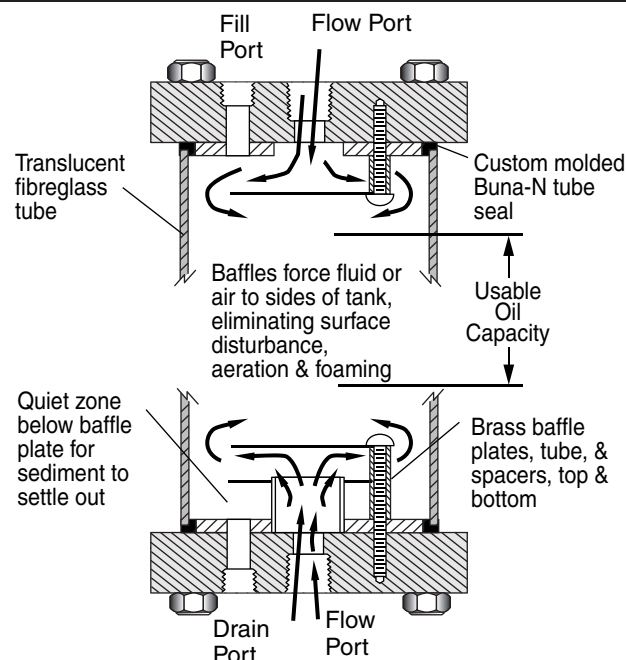


SAO – 2 x 9

- 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



Series	
Single Tank	SAO
Double Tank	DAO

Tank Bore
1-1/4"
2"
4"

Options			Specify
Description			-V
Viton Seals (-15° to +200°F)			
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		3	1
6		2	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 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.

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

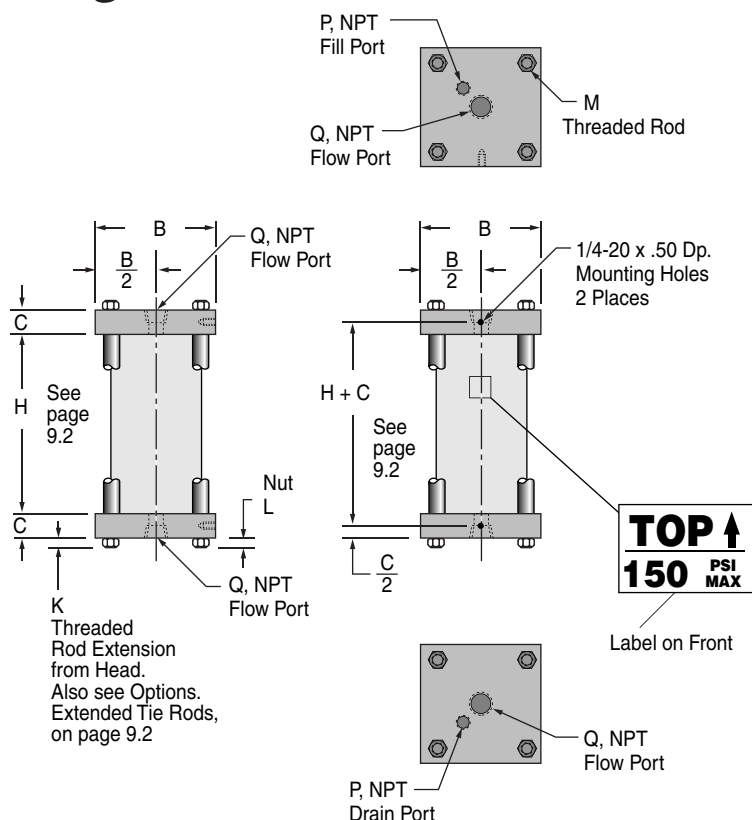
- Specify the Series
- Specify the Tank Bore
- Specify the Tank Height, "H"
- Specify Options

Examples

DAO - 4 x 30 - V Double tank, 4" bore, "H" = 30" (263 cu. in. capacity), Viton seals

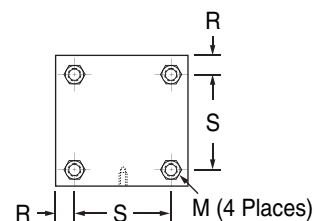
SAO - 1-1/4 x 8 Single tank, 1 1/4" bore, "H" = 8" (4 cu. in. capacity)

Single Tank Unit, SAO



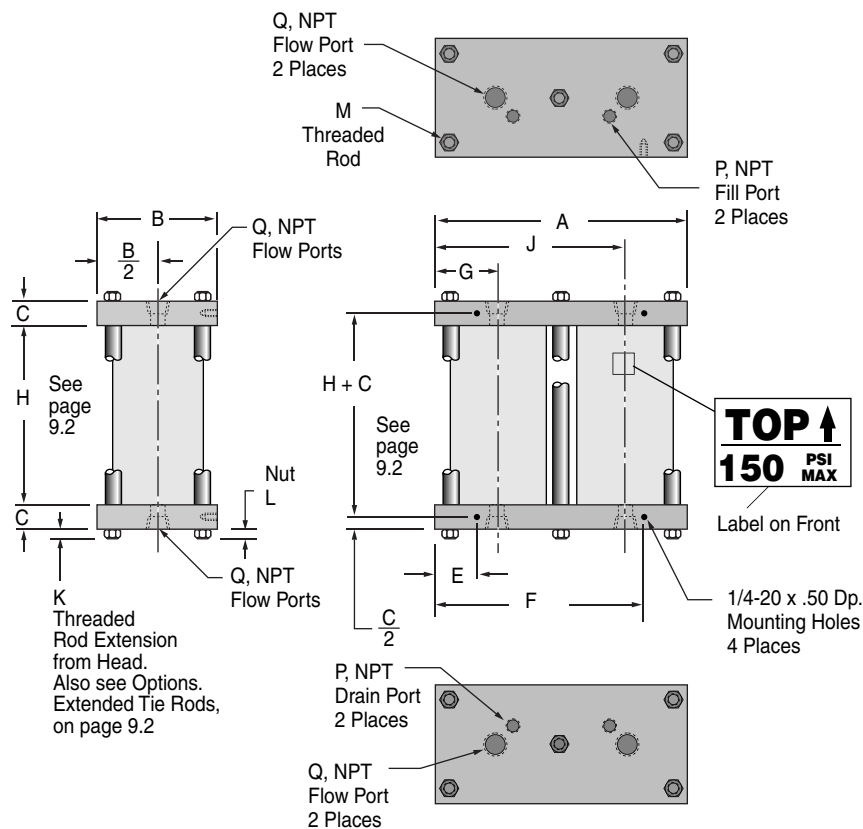
Tie Rod Pattern

SAO -1-1/4, SAO -2, SAO -4



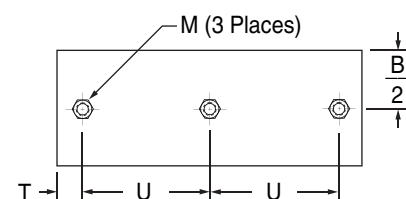
Bore	1-1/4	2	4
Vol./In.	1.22	3.14	12.56
A	4.75	7.50	10.75
B	2.00	3.00	5.25
C	0.50	0.75	1.00
E	0.38	0.50	1.88
F	4.38	7.00	8.88
G	1.31	2.13	2.63
H	See page 9.2		
J	3.44	5.38	8.13
K	0.27	0.38	0.50
L	0.22	0.33	0.43
M	1/4-20	3/8-16	1/2-13
P	1/8	1/8	1/4
Q	1/8	1/4	1/2
R	0.25	0.38	0.69
S	1.50	2.25	3.88
T	0.25	0.50	0.69
U	2.13	3.25	3.88

9 Double Tank Unit, DAO



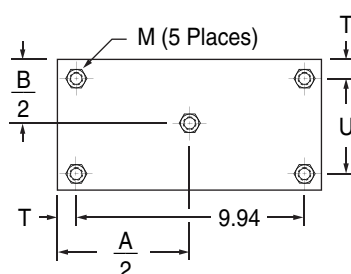
Tie Rod Pattern

DAO -1-1/4 & DAO -2



Tie Rod Pattern

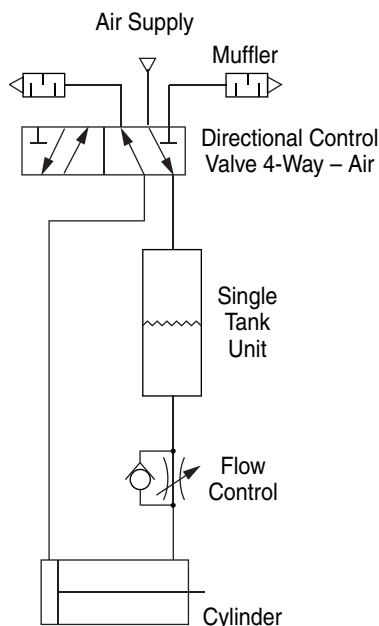
DAO -4



One Speed

Single Air-Oil Tank and flow control give hydraulic control, one speed, one direction with rapid reverse.

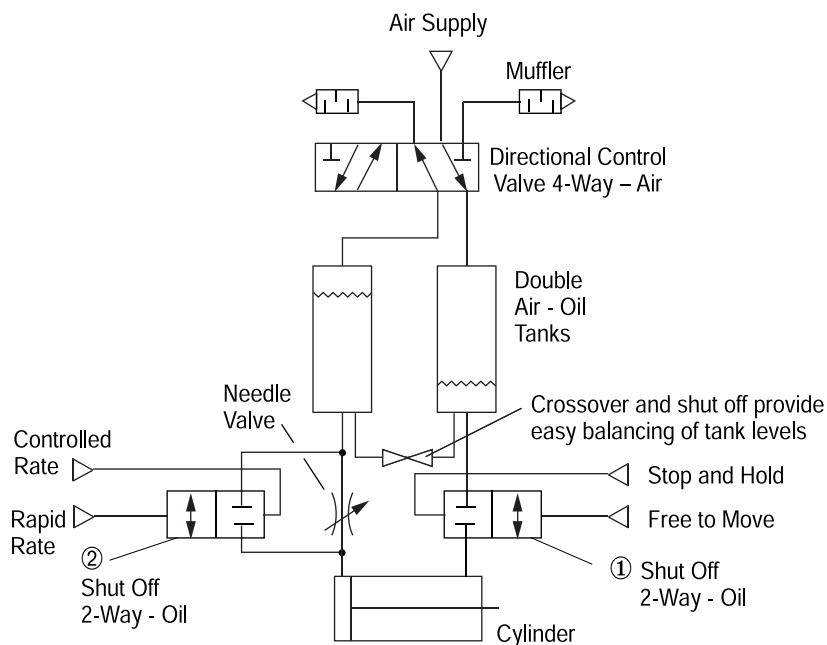
Can be used for Multi-Power® Cylinder and Multi-Power® Air Press with Option -HS. See page 5.4 and catalog #FP-16.



Two Speed Stop & Hold

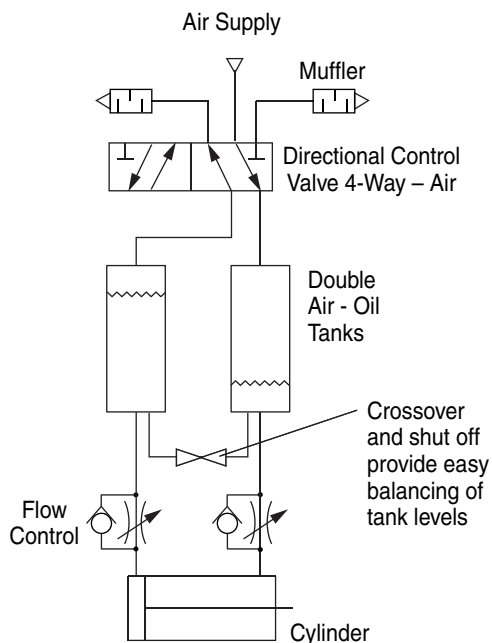
Double Air-Oil Tanks with shut-off valves & needle valve provide:

- 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.

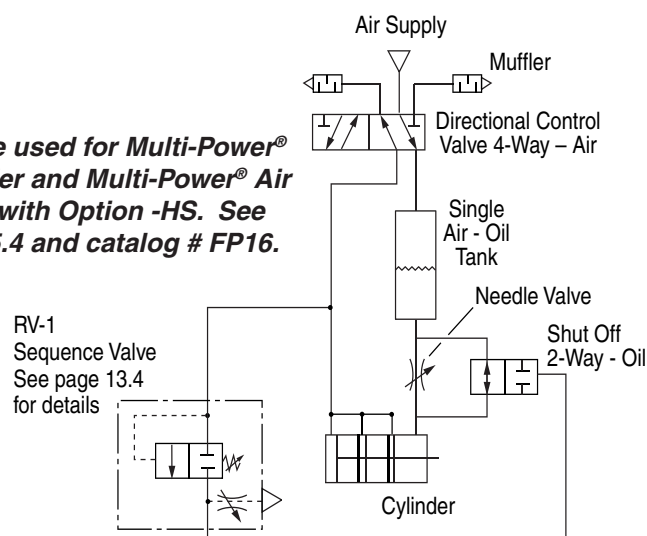


Two Speed & Shock Control

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.









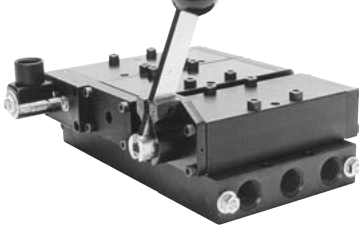



Port Size	Flow Rate/ Factor	Function	Series	Actuators	Page Number
10-32 & 1/8 NPT Modular	Cv = 0.05 to Cv = 0.23	2 Way 3 Way 4 Way, 2 Position	Modular Manifold	Solenoid	11.3 - 11.4
1/8 NPT & 1/4 NPT	Cv = 0.05 to Cv = 0.23	2 Way 3 Way	Hex Body	Solenoid	11.5–11.6
1/8 NPT	Cv = 0.27	2 Way 3 Way 4 Way, 2 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.

	<i>Series</i>	<i>Quick Page No.</i>
	Modular Manifold	11.3
	Hex Body	11.5
	18	11.7
	14	11.13
	M14.....	11.13
	34	11.13
	12A.....	11.23
	38	11.23
	12	11.23
	12B.....	11.23

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 Page 11.29

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 Minimum
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

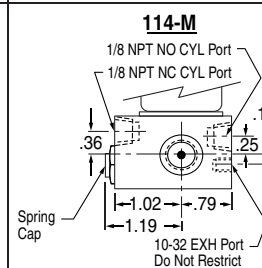
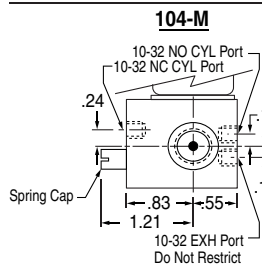
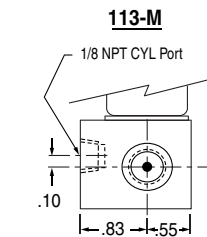
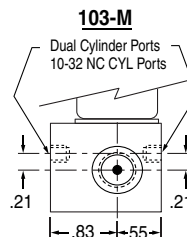
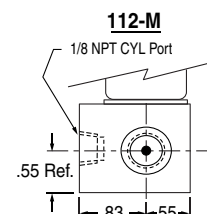
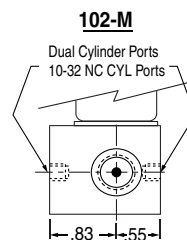
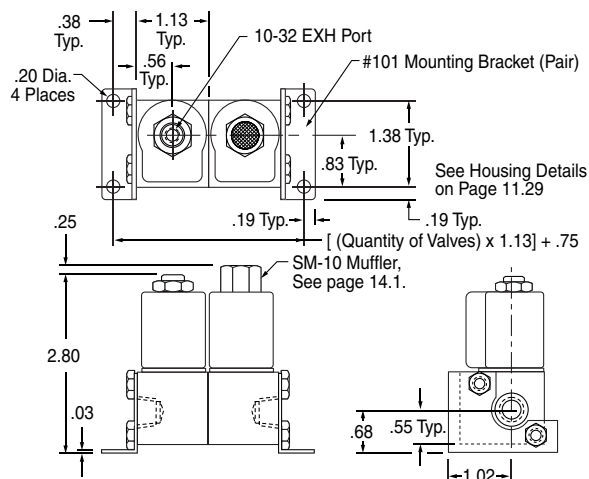
Available Orifices and Equivalent Maximum Pressure Ratings for AC Voltages (DC Ratings Slightly Lower)

			Cv Factor	2 Way N.C.	3 Way N.C.	4 Way	CFM – Flow @
				500 psi	200 psi	150 psi	100 psi 50 psi
Number 0	1/32		.022				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

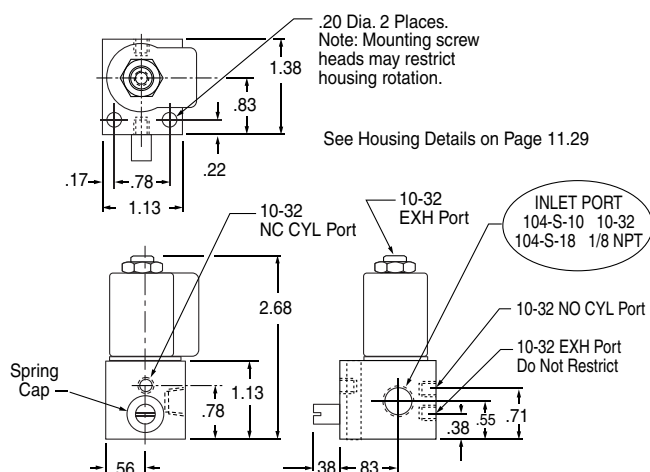
MODELS 102-M, 103-M, 104-M, 112-M, 113-M & 114-M

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.

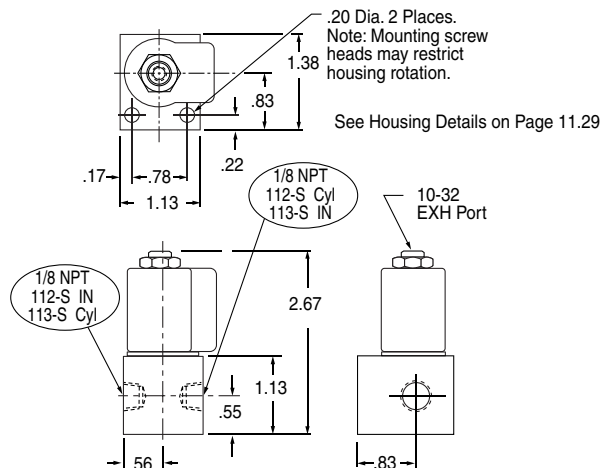
For more than two inputs a port block can be provided in midstack. Spacers can be included for applications requiring the larger EXPLOSION PROOF operator. Contact Fabco-Air with your specific requirements.



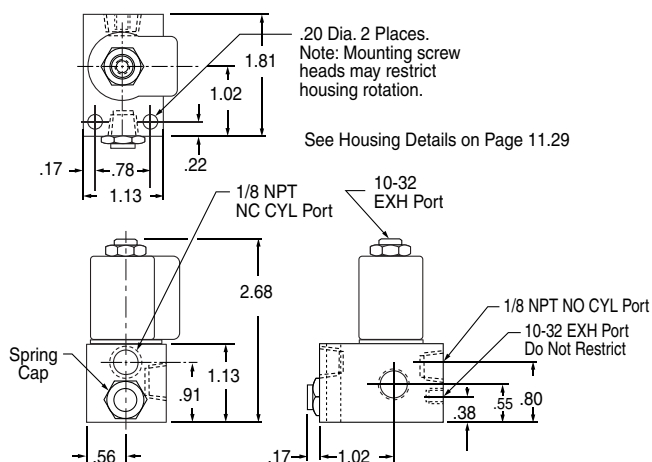
MODEL 104-S-10 (10-32 Inlet Port) MODEL 104-S-18 (1/8 NPT Inlet Port)



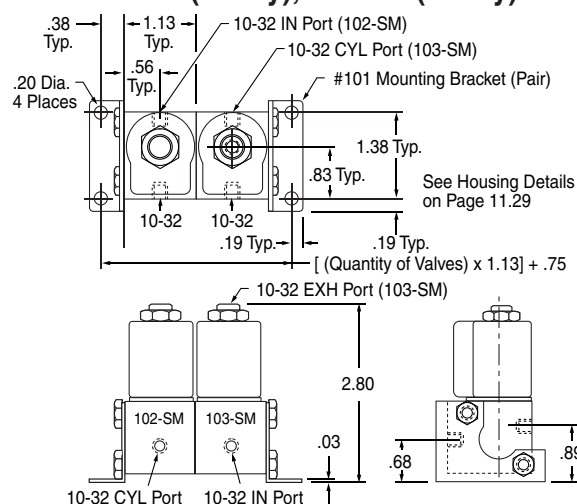
MODEL 112-S (2-Way), 113-S (3-Way)



MODEL 114-S



MODEL 102-SM (2-Way), 103-SM (3-Way)



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		
De-Energized	Energized	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				
De-Energized	Energized	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				
De-Energized	Energized	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				
De-Energized	Energized	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				
De-Energized	Energized	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		
De-Energized	Energized	IN	OUT	Basic Model
		1/8	1/8	82-★-◆
		1/4	1/4	42-★-◆

BODY STYLE 2 FEMALE BOTTOM PORT				
De-Energized	Energized	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				
De-Energized	Energized	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				
De-Energized	Energized	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				
De-Energized	Energized	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
Insert Letter for Housing at ★	-C
Number for Orifice at ◆	-1
All 3 Way EX Orifices are 1/16	
Options	
Volts & Hertz	120/60
	See Model Charts
	C Conduit, G Grommet, F DIN
	See Solenoid Information Page 11.29
	See Chart, Orifice Information
	See Chart, Option Information
	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:

- 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

Specify Suffix

ACCESSORIES:

- Solenoid Exhaust Muffler **SM-10** ... See Page 14.1
- Connectors for Mini-DIN "F" See Pg. 11.30

ORIFICE INFORMATION

Available Orifices and Equivalent Maximum Pressure Ratings for AC Voltages (DC Ratings Slightly Lower)

CFM – Flow @

		Cv Factor	2 Way N.O.	2 Way N.C.	3 Way N.O.	3 Way N.C.	100 psi	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

De-Energized	Energized	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

3 WAY NORMALLY CLOSED

BODY STYLE 1

SIDE PORTS

De-Energized	Energized	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

De-Energized	Energized	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 2

FEMALE BOTTOM PORT

De-Energized	Energized	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 3

MALE BOTTOM PORT

De-Energized	Energized	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

BODY STYLE 3

MALE BOTTOM PORT

De-Energized	Energized	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"

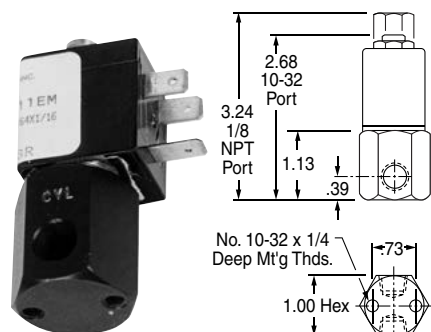
BODY STYLE 3

MALE BOTTOM PORT

De-Energized	Energized	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-★-◆

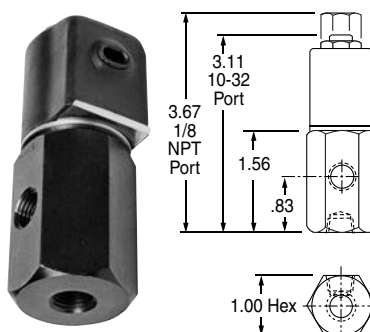
† For optional 1/8 NPT Adapter add Suffix "A"

BODY STYLE 1 – Side Ports



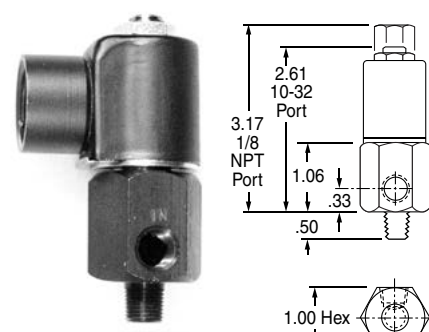
See Pg. 11.29 for Housing Details

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.

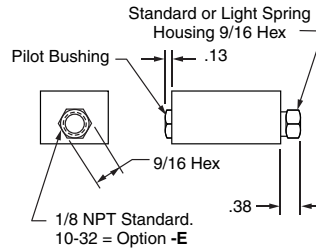
Short stroke of lightweight Delrin® spools provides fast, positive, and reliable response.

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



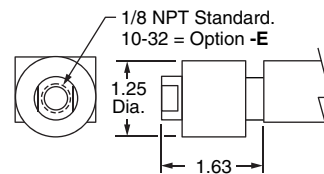
2 Way	3 Way	4 Way
Single Pilot - Spring Return 18SP-2	18SP-3	18SP-4
Double pilot 18DP-2	18DP-3	18DP-4
Replacement spool & seals 1800-902	1800-903	1800-904

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



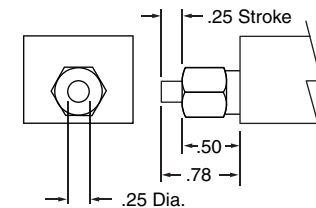
2 Way	3 Way	4 Way
Single Pilot (Amplifier) - Spring Return 18SA-2	18SA-3	18SA-4
Double pilot - 2 amplifiers 18DA-2	18DA-3	18DA-4
Double pilot - 1 amplifier, 1 air pilot 18DAP-2	18DAP-3	18DAP-4
When both pilots are pressurized, the amplifier overrides. Replacement spool & seals 1800-902	1800-903	1800-904

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.



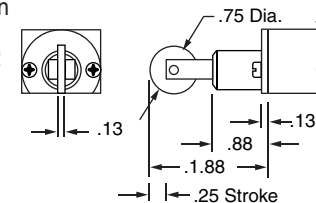
2 Way	3 Way	4 Way
Single Rod - Spring Return 18SR-2	18SR-3	18SR-4
Single Rod- Pilot Return 18SRP-2	18SRP-3	18SRP-4
Double rod 18DR-2	18DR-3	18DR-4
Replacement spool & seals 1800-902	1800-903	1800-904

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.

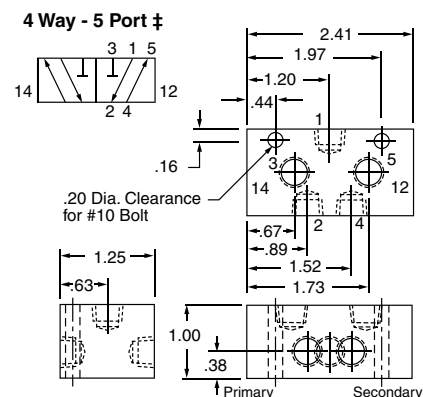
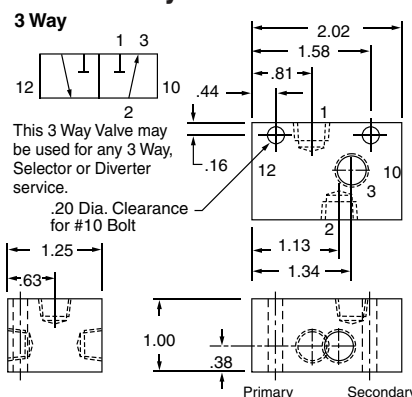
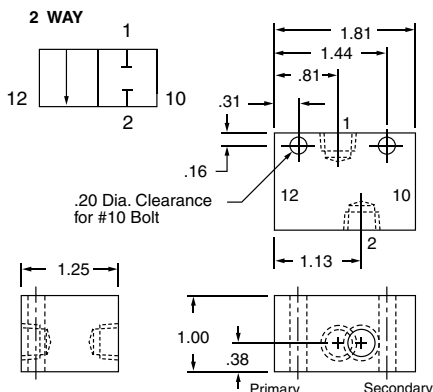


2 Way	3 Way	4 Way
Single Cam - Spring Return 18CR-2	18CR-3	18CR-4
Single Cam - Pilot Return 18CRP-2	18CRP-3	18CRP-4
Replacement spool & seals for above 1800-912	1800-913	1800-914
Double cam 18CCR-2	18CCR-3	18CCR-4
Replacement spool & seals 1800-922	1800-923	1800-924

Light return spring, Option -L

11

Valve Body Dimensions

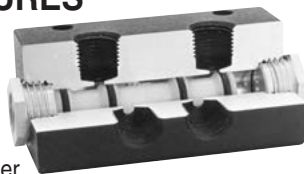


Standard 2 & 3 way spring return models are normally closed. Models with thread in actuators may be converted to normally open by exchanging actuators end for end. Other models require specification and factory assembly. See note 1.

‡ 4 way - 5 port May be used as either single inlet - dual exhaust or dual inlet - single exhaust.

- 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.

FEATURES



- 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
- #10-32 Pilot Port – Specify Option -E
- Viton seals – Specify Option -V
- Spools for bleeder pilot
- Multiple stacking with or without common inlet. Consult factory.

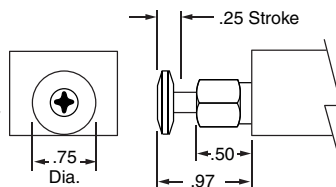
Note 1: Specify Normally Open by substituting -20 for -2 & -30 for -3.

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.

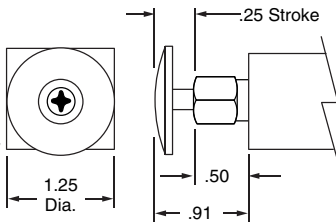


2 Way	3 Way	4 Way
Single Button - Spring Return 18PS-2 18PS-3 18PS-4		
Single Button - Pilot Return 18PSP-2 18PSP-3 18PSP-4		
Double Button 18PPS-2 18PPS-3 18PPS-4		
Replacement spool & seals 1800-902 1800-903 1800-904		
Light spring Option -L		

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.

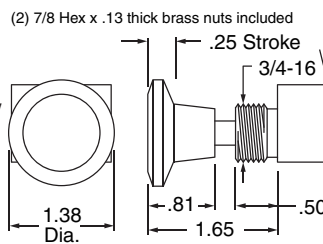


2 Way	3 Way	4 Way
Single Button - Spring Return 18PL-2 18PL-3 18PL-4		
Single Button - Pilot Return 18PLP-2 18PLP-3 18PLP-4		
Double Button 18PPL-2 18PPL-3 18PPL-4		
Replacement spool & seals 1800-902 1800-903 1800-904		
Light spring Option -L		

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.

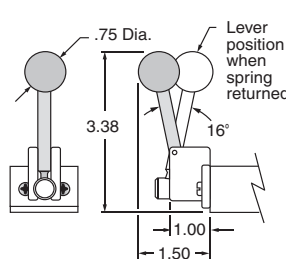


2 Way	3 Way	4 Way
Spring Return 18PMS-2 18PMS-3 18PMS-4		
Pilot Return 18PMP-2 18PMP-3 18PMP-4		
Replacement spool & seals for above. 1800-902 1800-903 1800-904		
Detented (Push Pull) 18PMD-2 18PMD-3 18PMD-4		
Replacement spool & seals 1800-942† 1800-943† 1800-944†		
Light spring Option -L		

Hand Lever


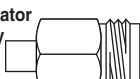


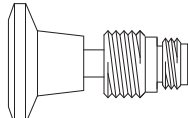
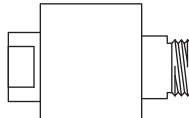


Hardened & plated steel shaft with unique connection to spool results in positive shifting. Standard 2 Way & 3 Way spring return are normally closed. For normally open specify by substituting -20 for -2 & -30 for -3. Force to actuate:
Standard spring 4.0 lb.
Light spring (Option -L) . . . 3.0 lb.
Detented 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.

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

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

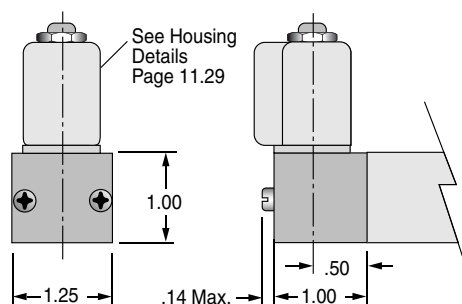
Volts & Hertz (See page 11.29)

	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



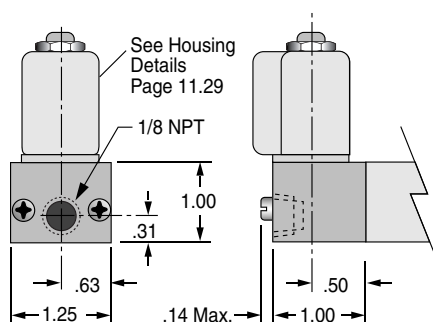
Operating Range

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



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.



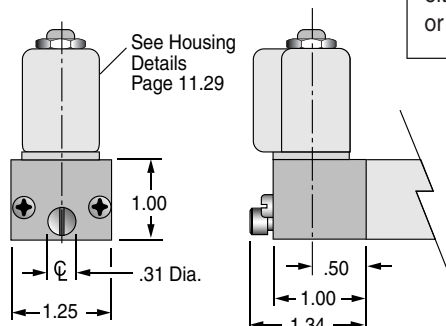
53 STYLE Solenoid Operator with External Pilot Supply

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

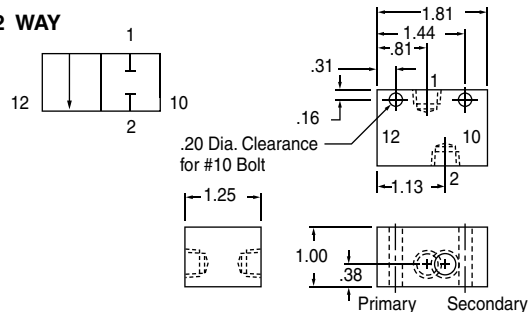


53 STYLE Solenoid Operator with Manual Override

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.

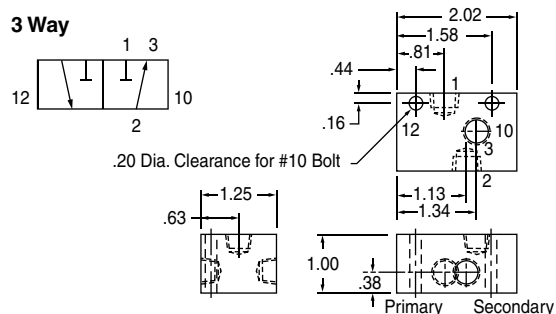
TYPE	SUFFIX
LOCKING Push to override; Turn to lock in; Turn back to release.	-MO1
NON-LOCKING Push to override.	-MO4

2 WAY



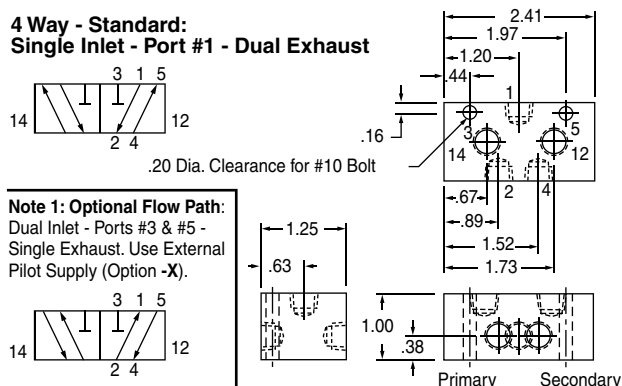
Spring Return Valves	End	Operator
Normally Closed	10	Spring
	12	Solenoid
Normally Open	10	Solenoid
	12	Spring

3 Way

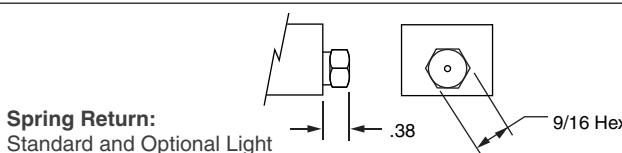


Spring Return Valves	End	Operator
Normally Closed	10	Spring
	12	Solenoid
Normally Open	10	Solenoid
	12	Spring

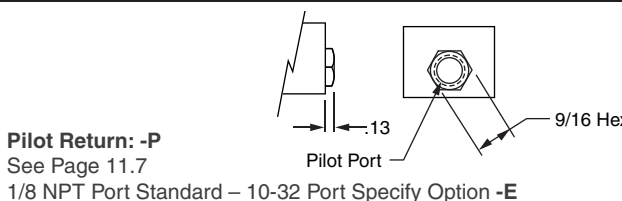
4 Way - Standard: Single Inlet - Port #1 - Dual Exhaust



Note 1: Optional Flow Path:
Dual Inlet - Ports #3 & #5 -
Single Exhaust. Use External
Pilot Supply (Option -X).



Spring Return:
Standard and Optional Light

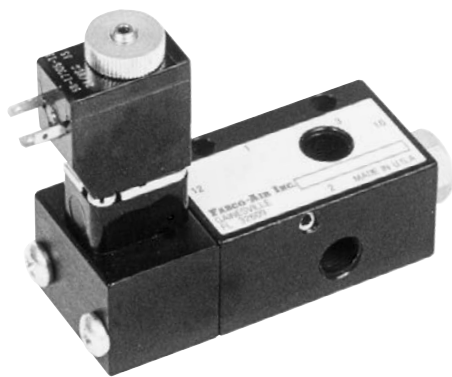


Pilot Return: -P

See Page 11.7

1/8 NPT Port Standard - 10-32 Port Specify Option -E

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

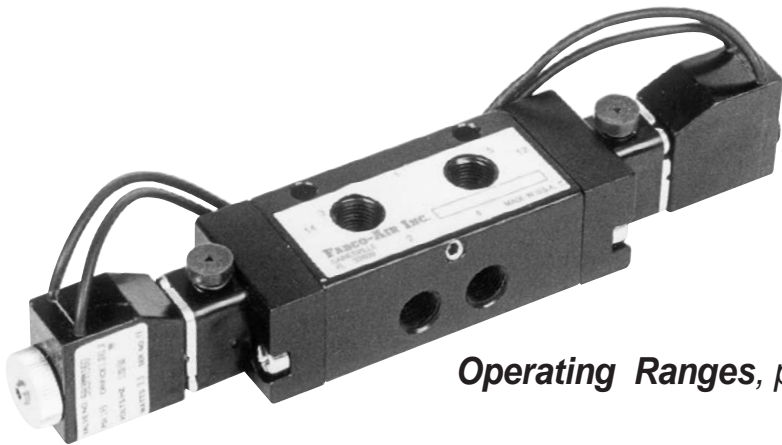
† Viton Seals are available in the main valve only, for media compatibility, and therefore only in conjunction with External Pilot +32°F (0°C) to +122°F (50°C).

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.

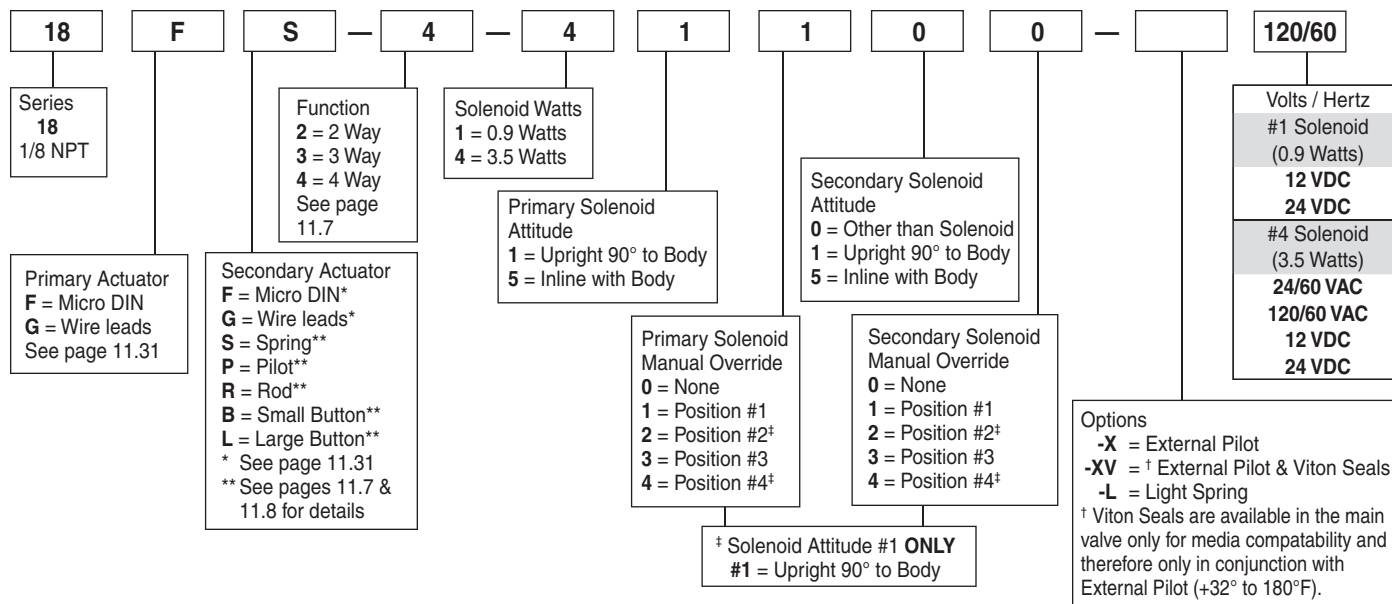
A custom aluminum spool may be substituted when long-term application temperatures are expected to be 0° to +32°F. These should be limited to double solenoid actuation. Consider that actuation force may exceed catalog specs and that spring return models may not be reliable at these low temperatures. Please consult factory.



Operating Ranges, psi

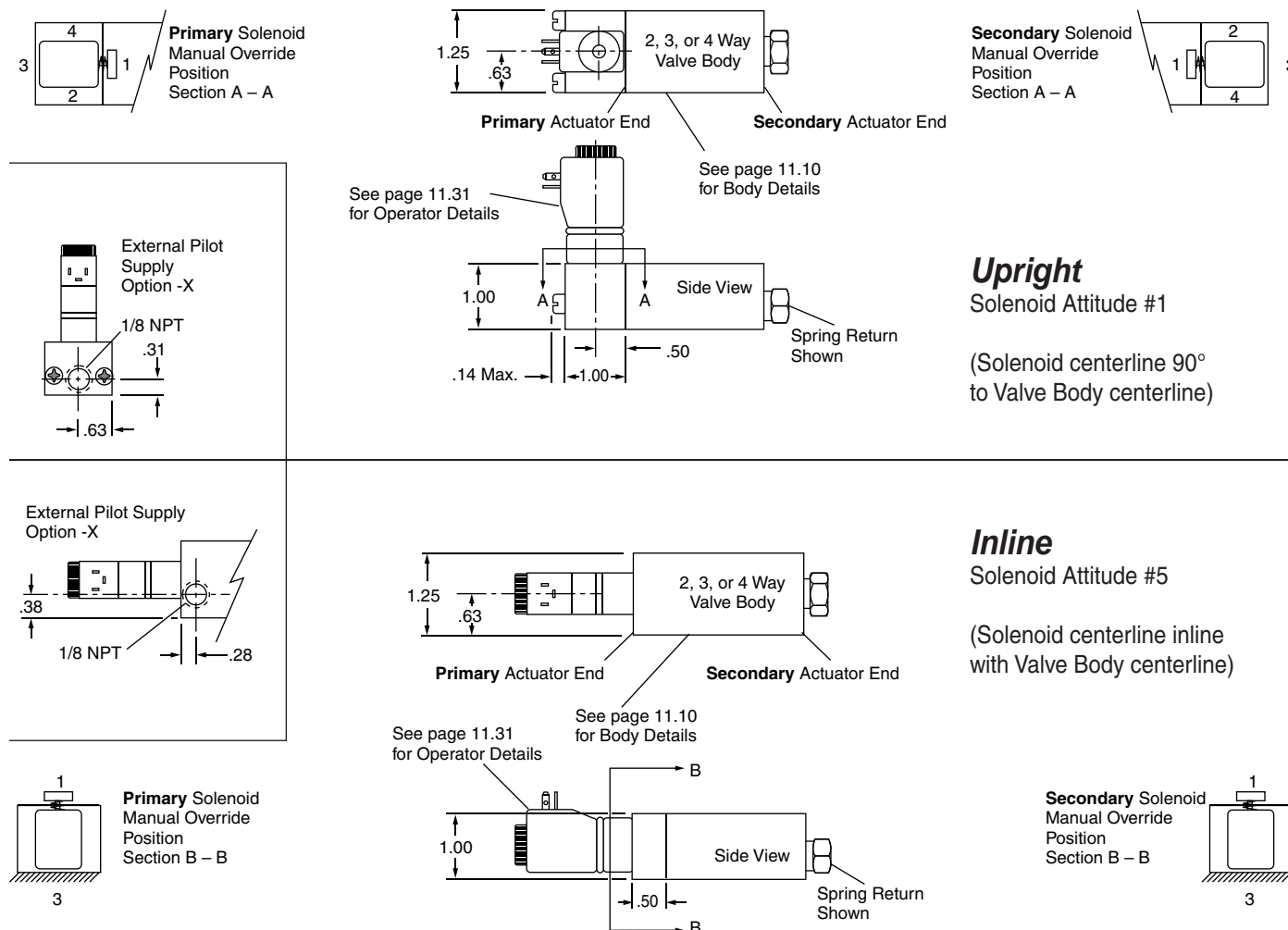
	#1 Solenoid 0.9 Watts	#4 Solenoid 3.5 Watts
Internal Pilot Supply (Standard) Inlet Pressure		
Non Spring Return	20 to 130.....	20 to 145
Spring Return.	60 to 130.....	60 to 145
Light Spring Option -L	40 to 130.....	40 to 145
External Pilot Supply, Option -X <u>Inlet Pressure</u> . . .		
0 to 150.....0 to 150		
External Pilot Supply, Option -X <u>Pilot Supply</u>		
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



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.



Directional Control Valves

1/4 & 3/8 NPT
2, 3 & 4 Way

14, M14 & 34 Series

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.

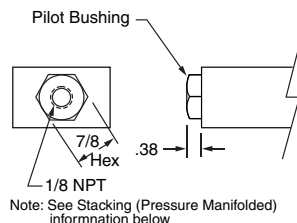
The short stroke of the lightweight Delrin® spool provides fast, positive, and reliable response.

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

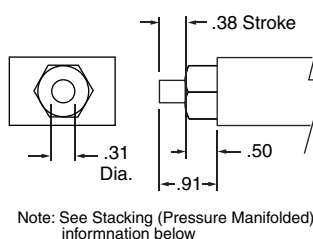


	3 Way	4 Way
Single Pilot - Spring Return		
1/4 NPT	14SP-3	14SP-4
1/4 Stacking	N/A	M14SP-4
3/8 NPT	34SP-3	34SP-4
Double Pilot		
1/4 NPT	14DP-3	14DP-4
1/4 Stacking	N/A	M14DP-4
3/8 NPT	34DP-3	34DP-4
Replacement spool & seals	1400-903	1400-904

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.

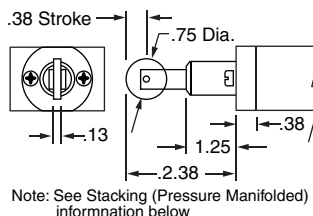


	3 Way	4 Way
Single Rod - Spring Return		
1/4 NPT	14SR-3	14SR-4
1/4 Stacking	N/A	M14SR-4
3/8 NPT	34SR-3	34SR-4
Single Rod - Pilot Return		
1/4 NPT	14SRP-3	14SRP-4
1/4 Stacking	N/A	M14SRP-4
3/8 NPT	34SRP-3	34SRP-4
Double Rod		
1/4 NPT	14DR-3	14DR-4
1/4 Stacking	N/A	M14DR-4
3/8 NPT	34DR-3	34DR-4
Replacement 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.



	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



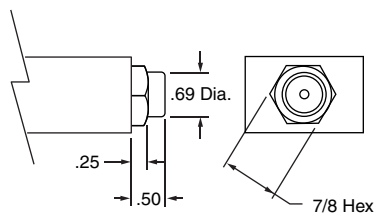
Selected models of the 14 Series 1/4" air valves can be stacked and pressure manifolded for space and money savings. The valve bodies are bolted together with 4 through tie bolts and the pressure is manifolded with O-Ring seals between the valves. Inlet pressure can be connected to either or both ends 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.

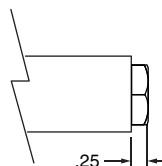
To Order: Specify the Quantity of each model desired, the Order in which they are to be assembled, and Brackets, if desired.

Spring Cap Dimensions

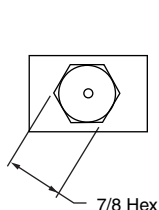
STANDARD SPRING



LIGHT SPRING



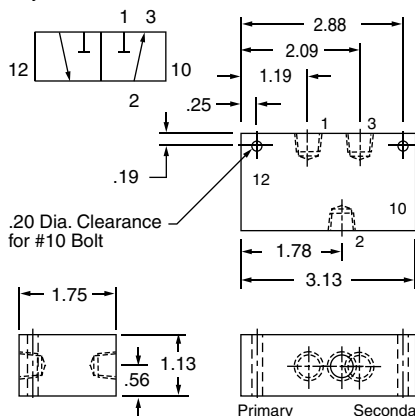
OPTION -L



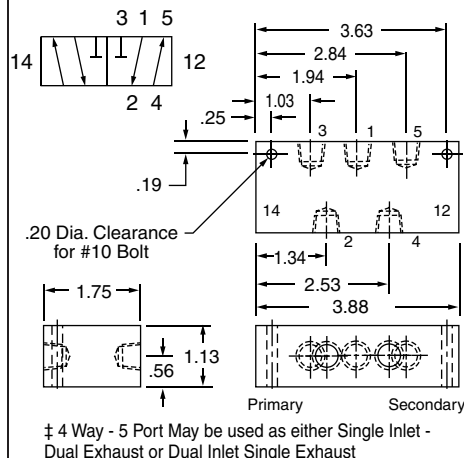
Valve Body Dimensions

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 ±



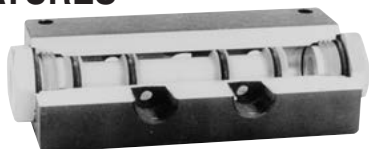
± 4 Way - 5 Port May be used as either Single Inlet - Dual Exhaust or Dual Inlet Single Exhaust

Specifications subject to change without notice or incurring obligation

5-3-12

- 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.

FEATURES



- 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

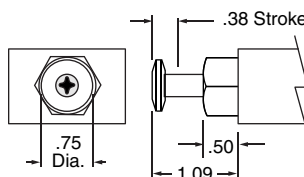
Small Palm Button



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

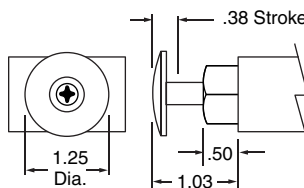
Large Palm Button



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

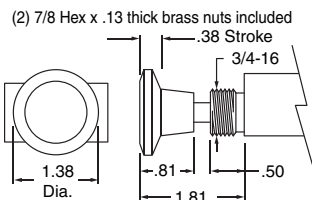
Panel Mount Button



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.

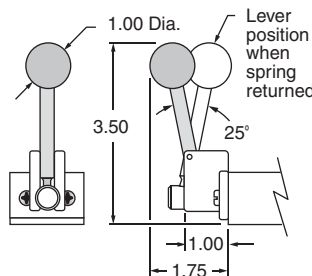
Hand Lever



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

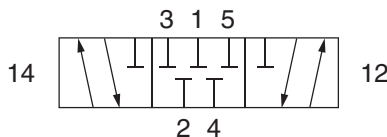
MOST THREADED-IN OPERATORS ARE INTERCHANGEABLE BETWEEN ENDS

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

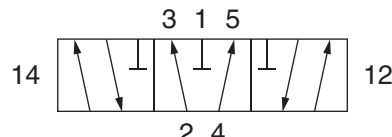
New 5 Ported, 3-Position 4-Way Operation

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 pressure50 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.

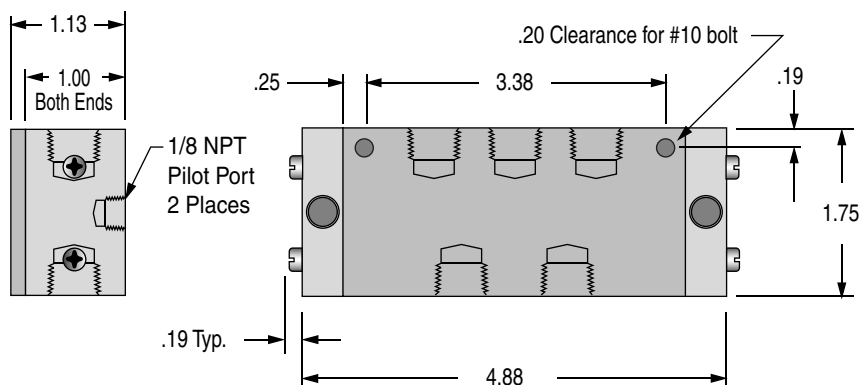
Options

Viton Seals, Specify Option -V

Model Number Guide: 3-Position, Pilot Operated

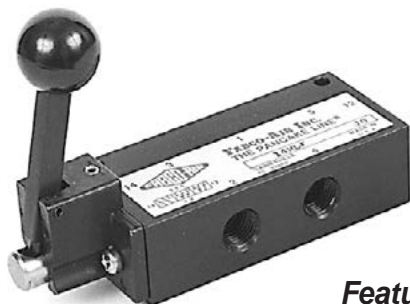
Spool Type	Spring Centered Spool		Replacement Spool and Seals
	1/4 NPT Ports	3/8 NPT Ports	
B Spool	14 DPB	34DPB	1400-904B
F Spool	14DPF	34DPF	1400-904F

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.

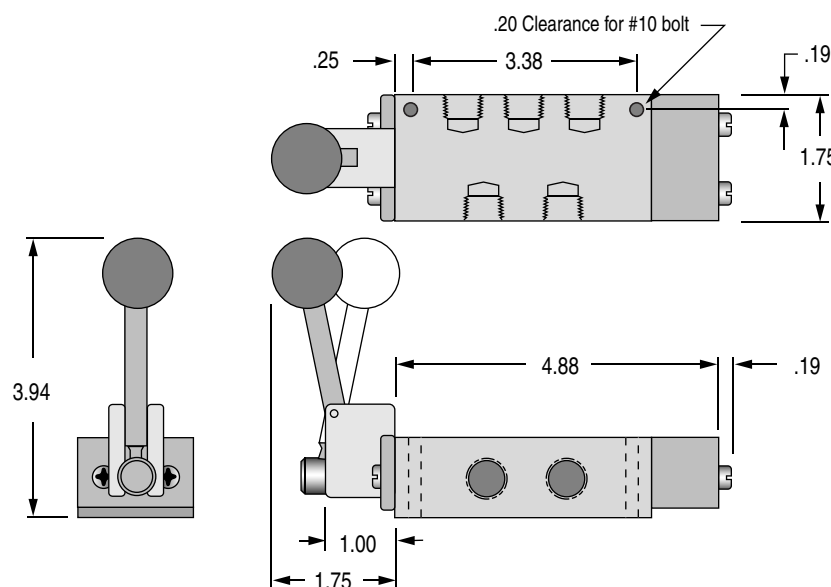
Options

Viton Seals, Specify Option -V

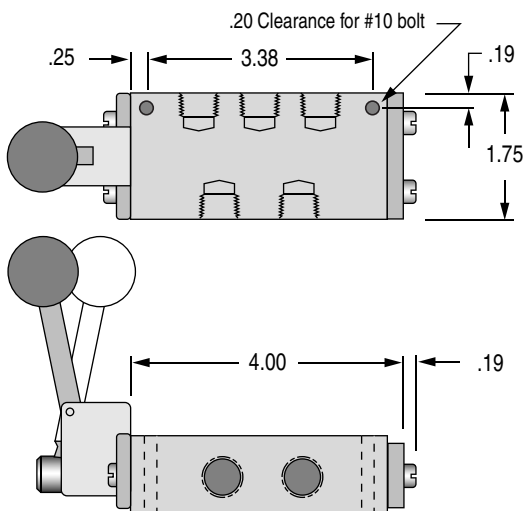
Model Number Guide: 3-Position, Hand Lever Operated

Spool Type	Spring Centered Spool		Replacement Spool & Seals	Detented Spool		Replacement Spool & Seals
	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

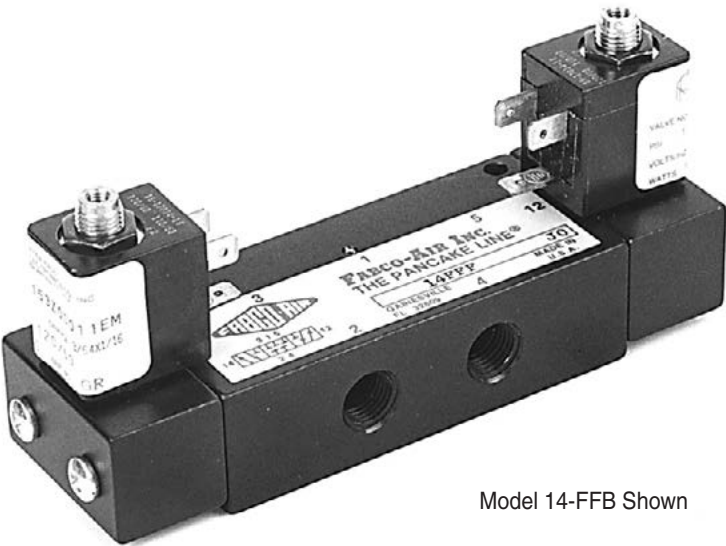


Dimensions – Detented Spool



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 Supply50 to 150 psi

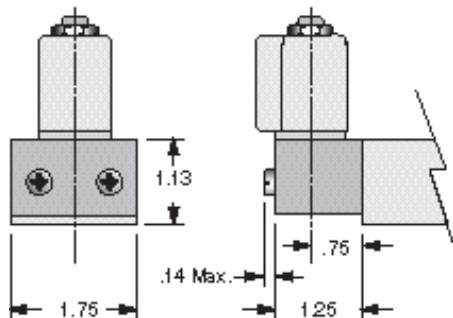
Ordering

Choose valve model number from table below and add option suffixes as required and specify voltage/hertz.

Model Number Guide: 4-Way, 3-Position, Spring Centered Double Solenoid Valves

Spool Type	Conduit Housing "C"		Grommet Housing "G"		Male Mini-DIN Housing "F"		Replacement Spool & Seals
	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

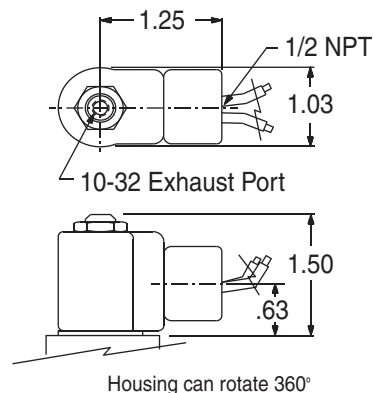
53 Style Solenoid Operators



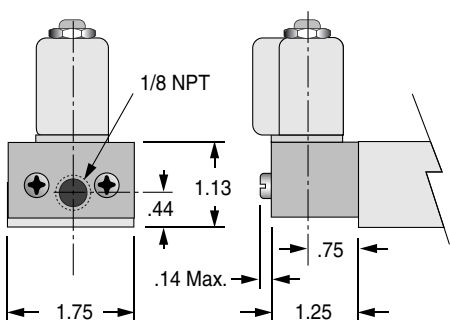
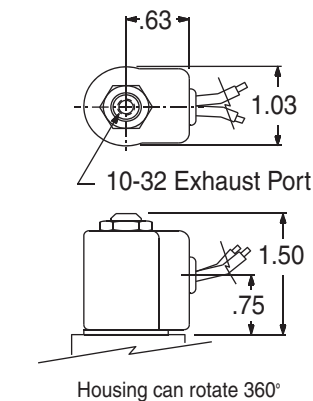
Standard 53 Style Operator

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.

Conduit Housing "C"



Grommet Housing "G"

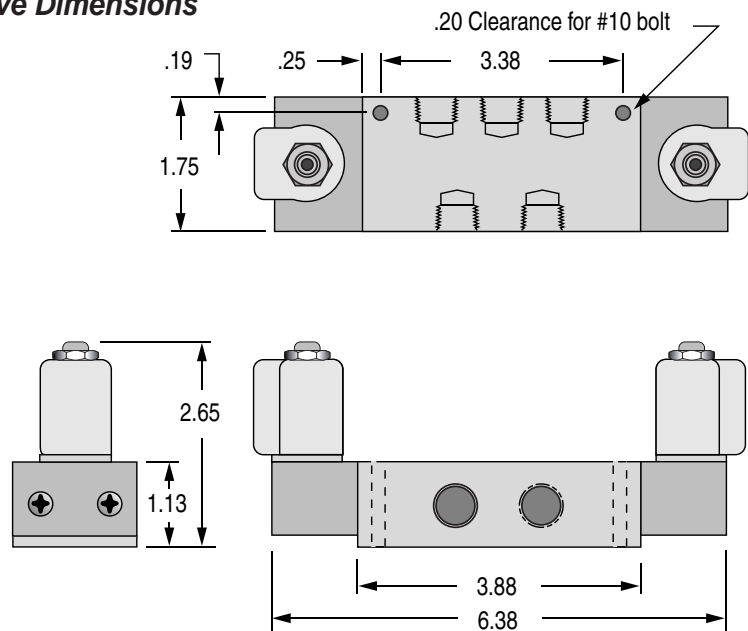


53 Style Operator with External Pilot Option -X

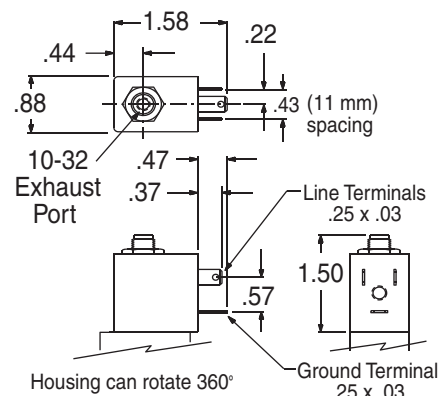
In the following listed applications, as well as many others, a proper air supply may not be available from the main valve inlet. For these applications, an external pilot supply port is available (Option -X). A proper air supply to this port then supplies the solenoid with air pressure for piloting 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



Male Mini-DIN Housing "F"



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

*Plug 3-Way Valve
for 2-Way Service.

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

	1/4 NPT PORTS				3/8 NPT PORTS		
	2 / 3 WAY Normally Closed	Normally Open	4 WAY	4 WAY Stacking See pg 11.20	2 / 3 WAY Normally Closed	Normally Open	4 WAY
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)

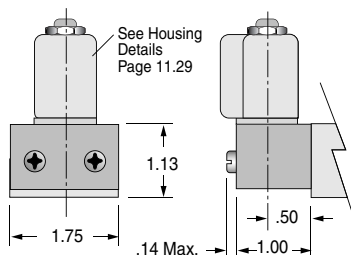
*Plug 3-Way Valve
for 2-Way Service.



Operating Range

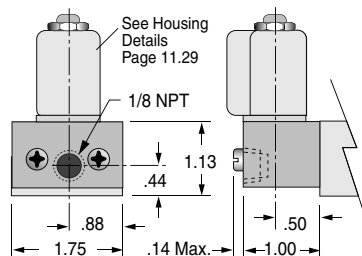
Internal Pilot Supply (Standard)
 Inlet 30 to 150 psi
 External Pilot Supply, Option -X
 Inlet Pressure 0 to 150 psi
 Pilot Supply 30 to 150 psi

	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.

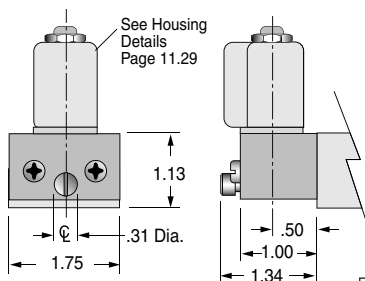


53 STYLE Solenoid Operator with External Pilot Supply

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.



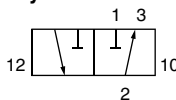
53 STYLE Solenoid Operator with Manual Override

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

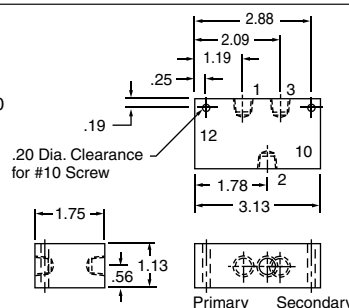
Option -X
is NOT combinable
with either Option
-MO1 or -MO4

3 Way



2 Way Function

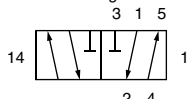
This 3 Way Valve may be used for any 2 Way, 3 Way, Selector or Diverter service.



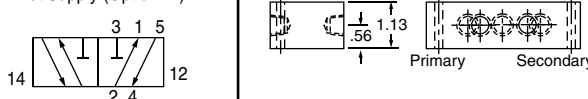
Spring Return Valves	End	Operator
Normally Closed	10	Spring
	12	Solenoid
Normally Open	10	Solenoid
	12	Spring

4 Way - 5 Port

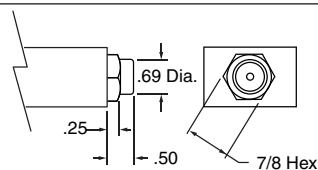
Standard: Single Inlet - Port #1 - Dual Exhaust.



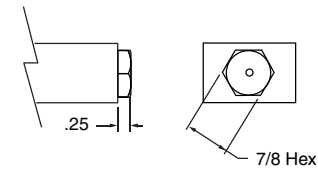
Note 1: Optional Flow Path:
Dual Inlet - Ports #3 & #5 -
Single Exhaust. Use External
Pilot Supply (Option -X).



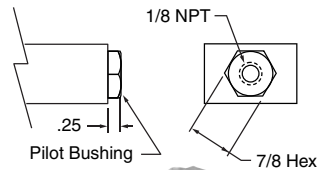
Standard Spring Return



Light Spring Return Option -L

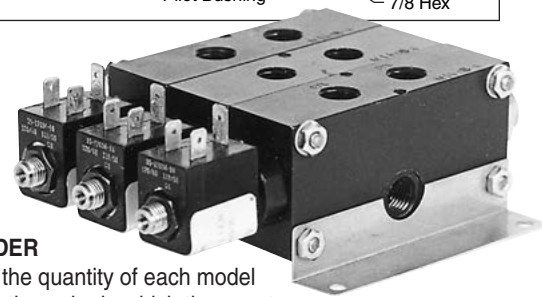


Pilot Return Option -P 1/8 NPT Port See Page 11.13



STACKING - PRESSURE MANIFOLDED

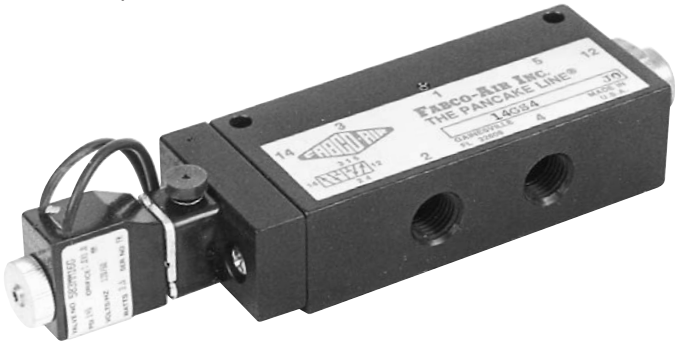
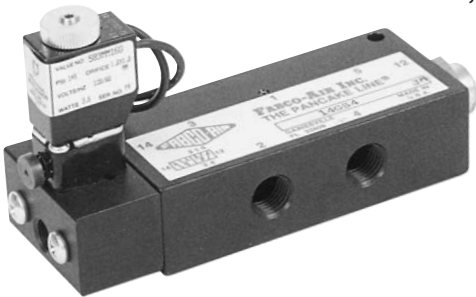
Versions of these 1400 Series 1/4 NPT solenoid valves with different adaptor blocks can be stacked and pressure manifolded for space and money savings. The valve bodies are bolted together with 4 through tie bolts and the pressure is manifolded with O-Ring seals between valves. Inlet pressure can be 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.



TO ORDER

Specify the quantity of each model desired, the order in which they are to be assembled, and Brackets, if desired.

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
- Lubed 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

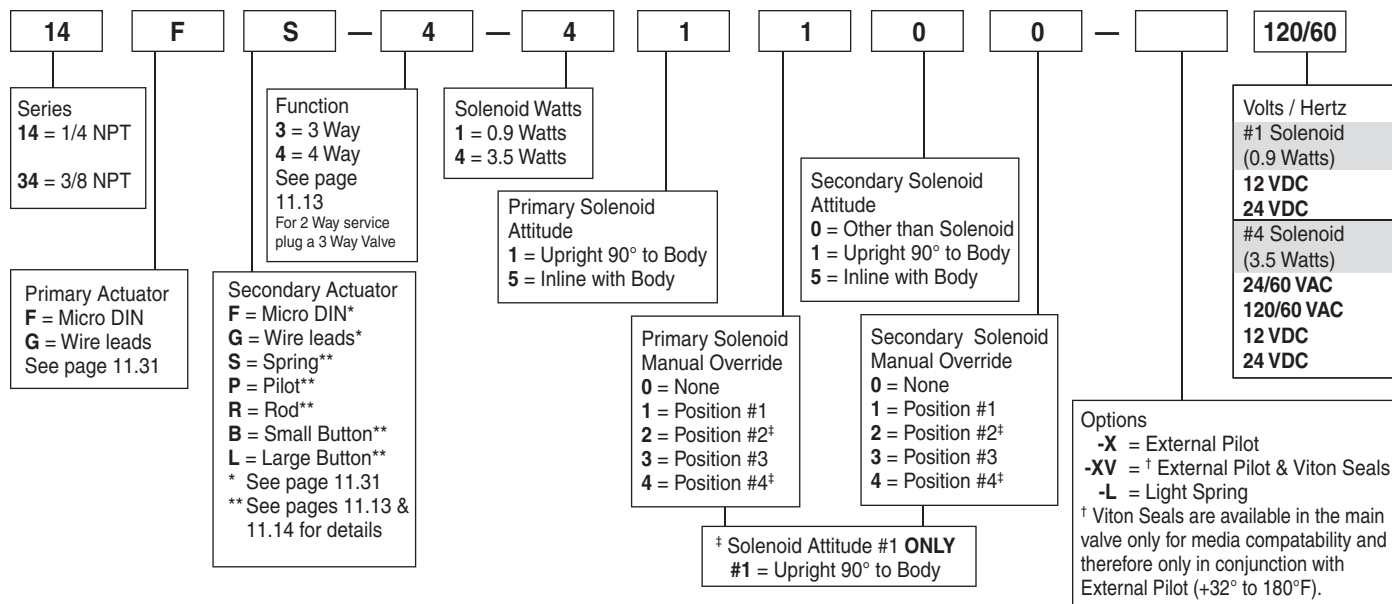
- External Pilot-X
- † External Pilot and Viton Seals -XV
- Light Spring-L

† 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

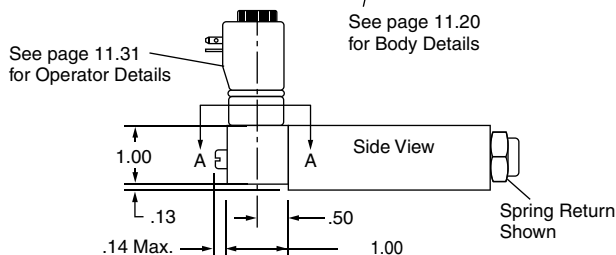
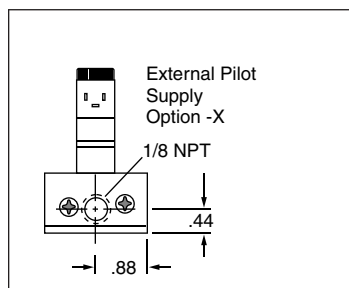
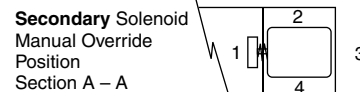
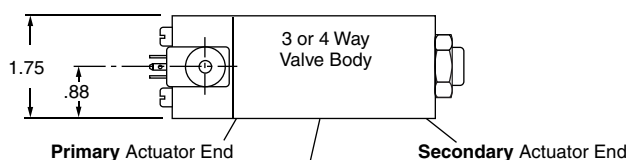
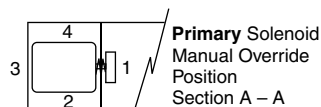
	#1 Solenoid	#4 Solenoid
	0.9 Watts	3.5 Watts
Internal pilot supply (standard) inlet pressure		
Non Spring Return	30 to 130.....	30 to 145
Spring Return	50 to 130.....	50 to 145
Light Spring Option -L	40 to 130.....	40 to 145
External pilot supply, Option -X <u>inlet pressure</u>		
	0 to 150.....	0 to 150
External pilot supply, Option -X <u>pilot supply</u>		
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

58 STYLE Solenoid Valve, Model Number Code



Example: 14FS-4-41100-120/60

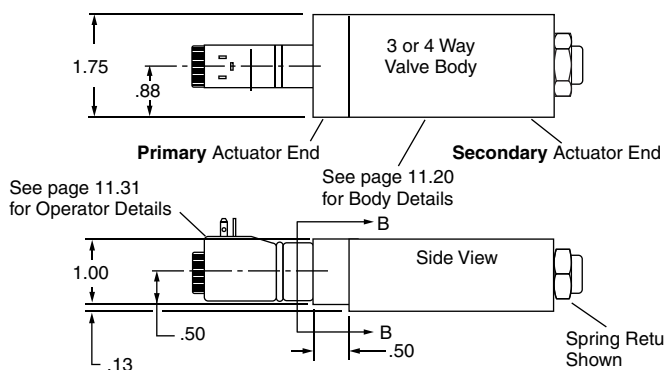
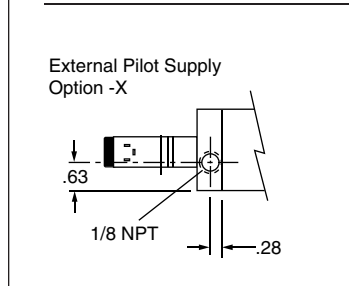
1/4 NPT – Primary Actuator Solenoid with Micro DIN coil; Secondary Actuator, Spring Return – 4 Way Function 3.5 Watt Solenoid; Primary Solenoid Upright position with Manual Override in Position #1; Secondary Actuator is not a Solenoid; no Manual Override on Secondary Actuator – No Options – 120 Volt/60 Hertz.



Upright
Solenoid Attitude #1

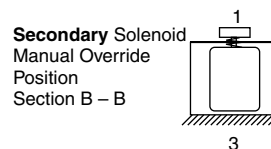
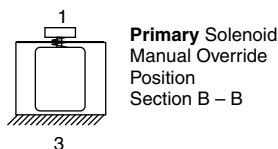
(Solenoid centerline 90° to Valve body centerline)

11



Inline
Solenoid Attitude #5

(Solenoid centerline inline with Valve body centerline)



Directional Control Valves ^{3/8 & 1/2 NPT} 12, 12A, 12B & 38 Series

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

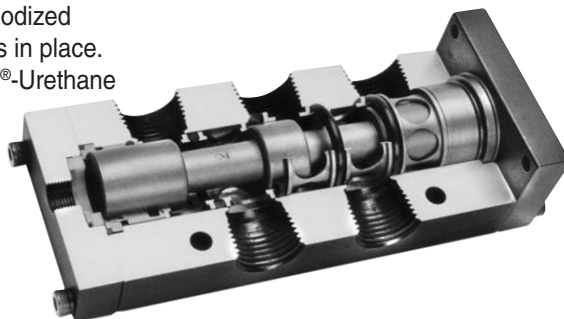
Note! Spring return & spring centered models NOT suitable for dry air service.

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

11

Custom Options

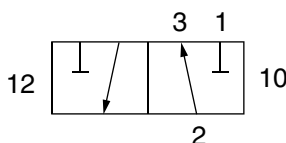
- 10-32 Pilot Ports
- 10-32 Auxiliary Pressure Outlets
- Viton Seals
- Stacking and Manifolding to Customer requirements

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

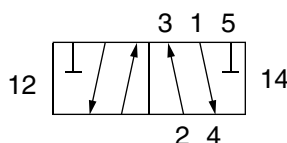
11.23

Spools



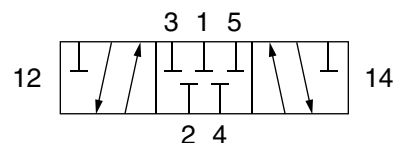
2-Way or 3 Way - 2 Position - Type 3

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

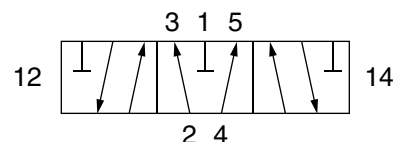
Use on all 4 Way - 2 Position applications



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.

Directional Control Valves ^{3/8 & 1/2} NPT 12, 12A, 12B & 38 Series

PILOT OPERATED

When Ordering:

Specify Model Number from chart. Specify Options.
(See page 11.27 & 11.28 for Dimensional Information.)



OPERATING RANGE:

Inlet Pressure0 - 150 psi

Pilot Pressure:

Models without Spring10 - 150 psi

2 Position Standard Service Spring45 - 150 psi

2 Position Light Service Spring (Option -L) . . .30 - 150 psi

3 Position, Spring Centered30 - 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

Directional Control Valves ^{3/8 & 1/2} NPT **12, 12A, 12B & 38 Series**

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	4 Way	38-CAB	12-CAB	NA	12A-CAB
Solenoid – Pilot, F Spool	4 Way	38-CAF	12-CAF	NA	12A-CAF
Double Solenoid – B Spool	4 Way	38-CCB	12-CCB	NA	12A-CCB
Double Solenoid – F Spool	4 Way	38-CCF	12-CCF	NA	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	4 Way	38-GAB	12-GAB	NA	12A-GAB
Solenoid – Pilot, F Spool	4 Way	38-GAF	12-GAF	NA	12A-GAF
Double Solenoid – B Spool	4 Way	38-GGB	12-GGB	NA	12A-GGB
Double Solenoid – F Spool	4 Way	38-GGF	12-GGF	NA	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	4 Way	38-FAB	12-FAB	NA	12A-FAB
Solenoid – Pilot, F Spool	4 Way	38-FAF	12-FAF	NA	12A-FAF
Double Solenoid – B Spool	4 Way	38-FFB	12-FFB	NA	12A-FFB
Double Solenoid – F Spool	4 Way	38-FFF	12-FFF	NA	12A-FFF

Directional Control Valves ^{3/8 & 1/2} NPT **12, 12A, 12B & 38 Series**

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.		

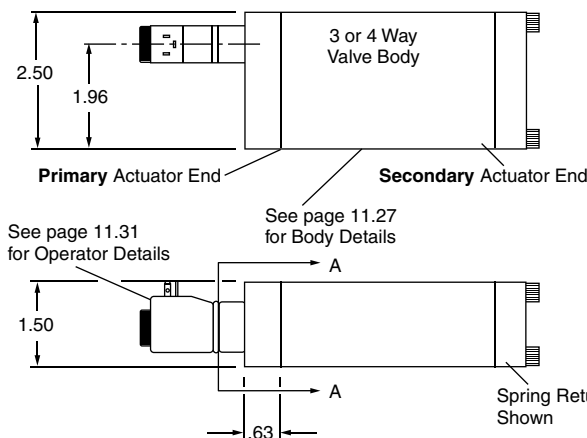
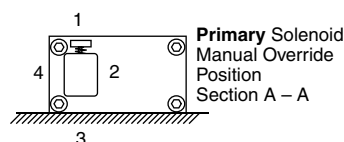
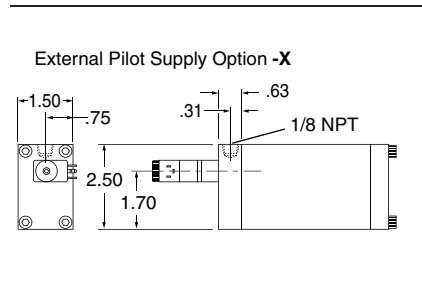
58 STYLE Solenoid Valve, Model Number Code

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 compatibility 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

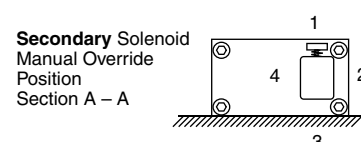
Example: 12FS-45100-120/60
 1/2 NPT, 4 Way – Primary Actuator Solenoid with Micro DIN coil; Secondary Actuator, Spring Return – 3.5 Watt; Primary Solenoid Inline Attitude with Manual Override on Primary Solenoid in Position #1; Secondary Actuator is not a Solenoid; no Manual Override on Secondary Actuator – No Options – 120 Volt/60 Hertz.

11



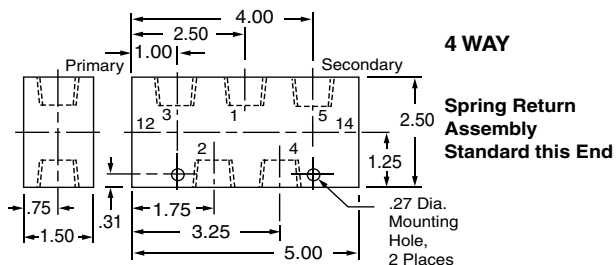
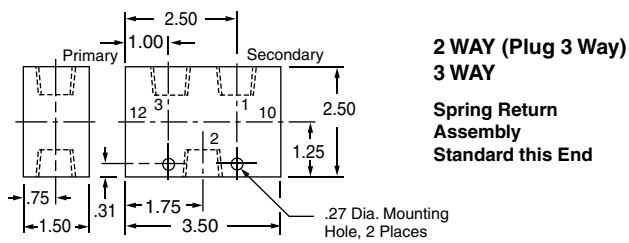
Inline Solenoid Attitude #5

(Solenoid centerline inline with Valve Body centerline)



Directional Control Valves ^{3/8 & 1/2 NPT} 12, 12A, 12B & 38 Series

BASIC BODIES



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
	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)

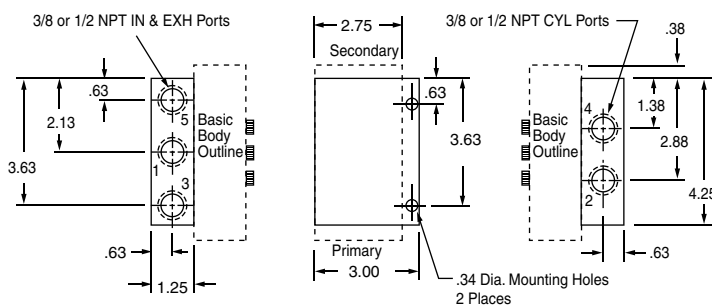
Specify Subbase Part No. listed below.

EXAMPLE - Photo shows 12A-SP-MO4 with 12 PV-50

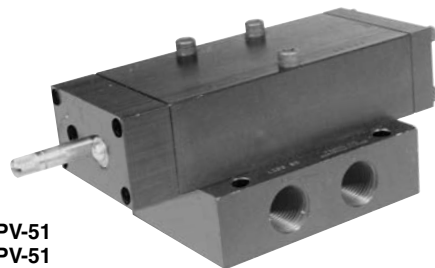
SIDE PORTED

3/8 NPT Ports Specify **38 PV-50**

1/2 NPT Ports Specify **12 PV-50**



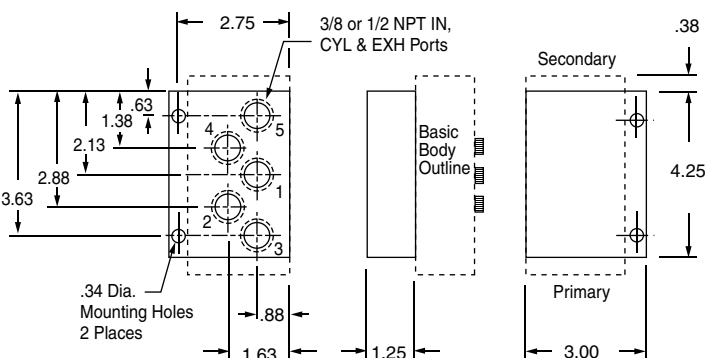
MOUNT 4 WAY VALVE WITH ANY OPERATOR



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

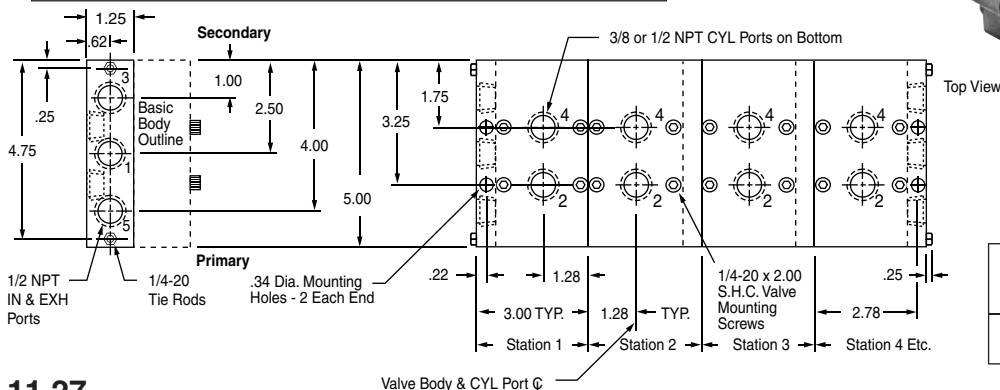
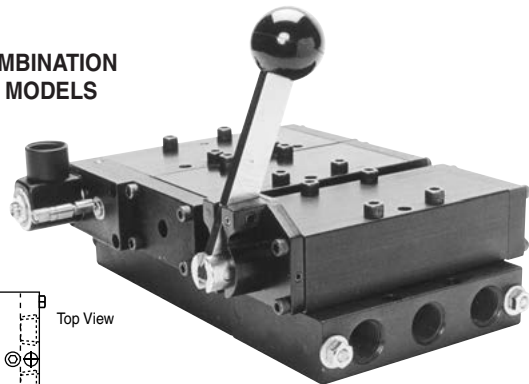
EXAMPLE - Photo shows one unit consisting of 3 valves and manifolds:

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

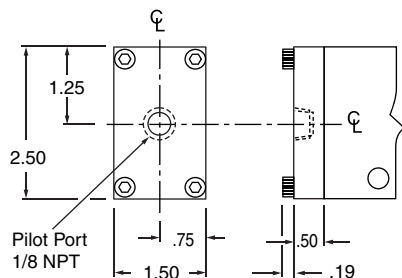
11.27

Specifications subject to change without notice or incurring obligation

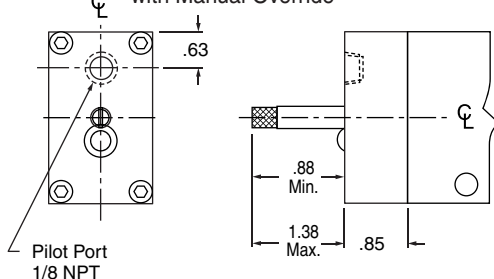
2-18-08

Directional Control Valves ^{3/8 & 1/2 NPT} 12, 12A, 12B & 38 Series

AIR PILOT OPERATOR



AIR PILOT OPERATOR with Manual Override



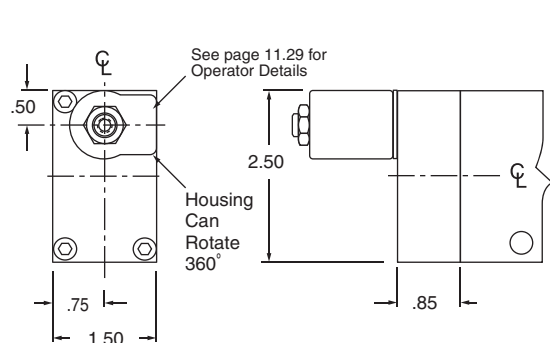
2 Position, Spring return
Dimensions shown at the
bottom of the page.

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.	

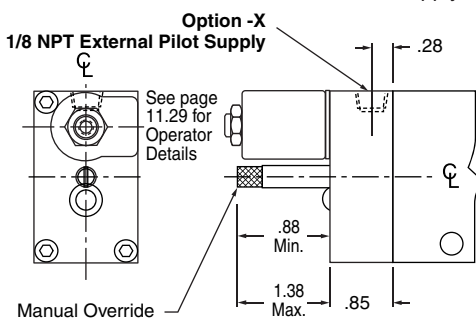
The **53 STYLE** solenoid operator is a 3-way valve which, upon receiving an electrical signal, directs a pilot pressure to shift the main valve spool. Unless otherwise specified, the operator is internally supplied from the main valve inlet with pressure for piloting. If an external pilot supply is 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, Option **-X**

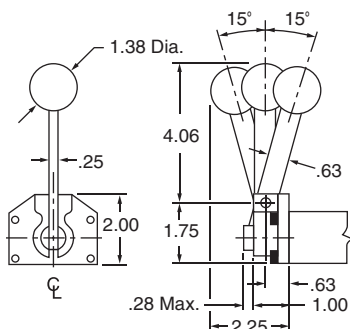


2 Position, Spring return
Dimensions shown at the
bottom of the page.

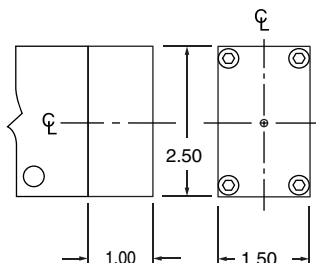
3 Position Spring Centering
is incorporated within the
operator dimensions.

58 STYLE Solenoid Operator – See page 11.26

HAND LEVER OPERATOR

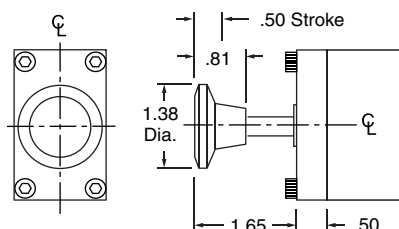


3 POSITION SPRING CENTERING OPERATOR FOR HAND LEVER ONLY



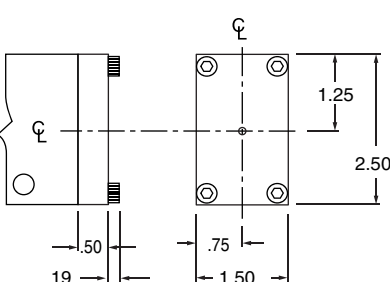
PALM BUTTON OPERATOR

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.



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

Function	AC Volts, 60 Hertz		DC Volts
	Inrush, Amp	Holding, Amp	Inrush, Amp or Holding, Amp
2 Way NC	13.2 ÷ Volts	7.8 ÷ Volts	7.2 ÷ Volts
2 Way NO	15.2 ÷ Volts	9.0 ÷ Volts	
3 Way NC or NO			
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;

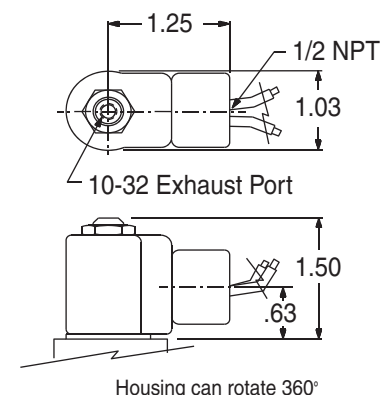
DC 9 to 15 milliseconds to open;

DC 5 to 12 milliseconds to close.

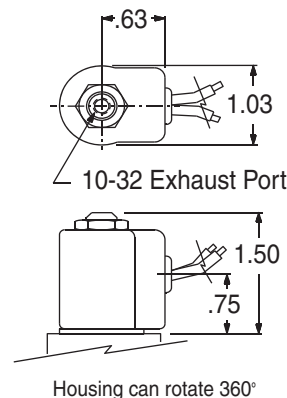
To compute current requirements (±15%) divide factor shown below by voltage.

Function	AC Volts, 60 Hertz		DC Volts
	Inrush, Amp	Holding, Amp	Inrush, Amp or Holding, Amp
2 Way NC	14.4 ÷ Volts	9.7 ÷ Volts	10.4 ÷ Volts
2 Way NO	15.2 ÷ Volts	11.8 ÷ Volts	10.4 ÷ Volts
3 Way NC or NO			
Examples	15.2 ÷ 120 = .13 Amp	11.8 ÷ 120 = .10 Amp	10.4 ÷ 12 = .87 Amp

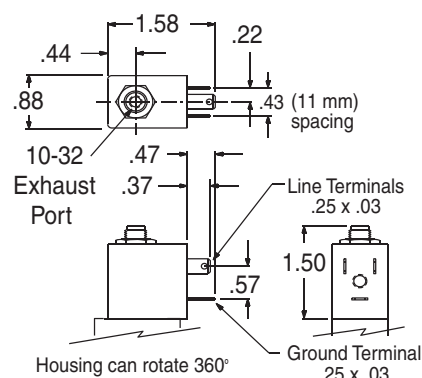
Conduit Housing "C"



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.

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 (105°C) 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.

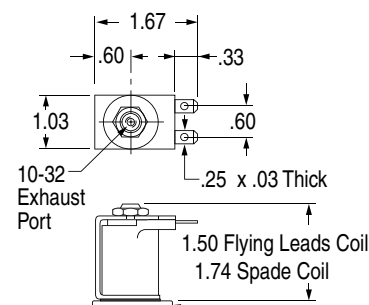
DC Voltages from 3 to 180.

- 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. 1 Groups E, F & G.

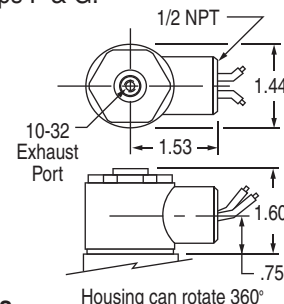
UL Class II Div. 2 Groups A, B, C, D, E & F.

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.

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”

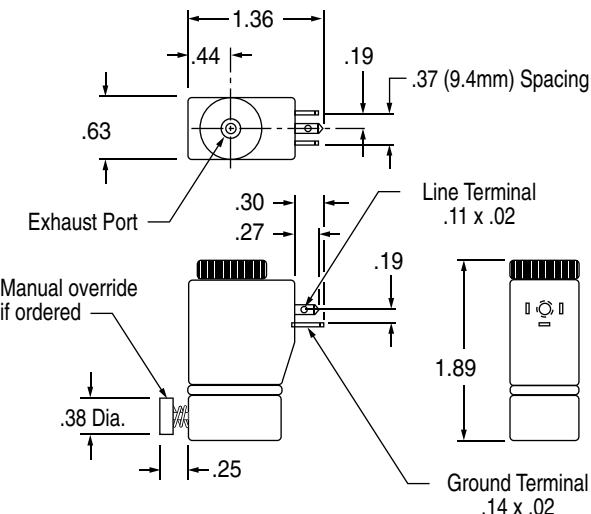
Molded – Water Tight

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

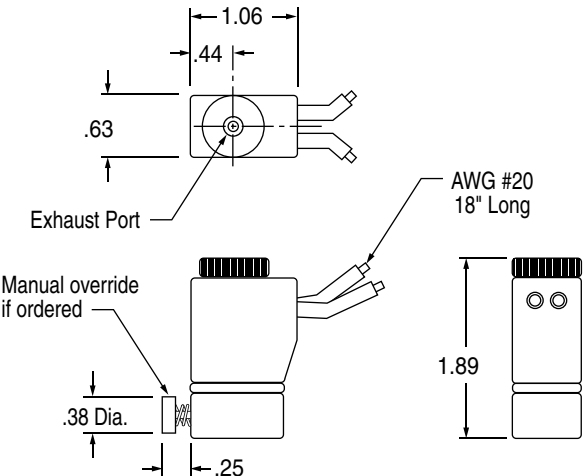
[#1 (0.9 Watts), or #4 (3.5 Watts)] Operator

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.

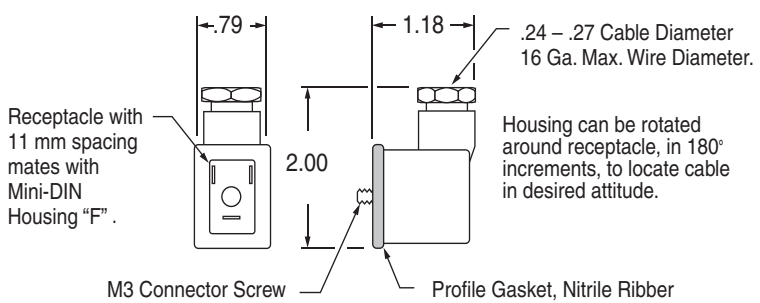
Connectors 53 Style (11 mm spacing)

NEMA 4, IP65
For Male Mini-DIN Housing "F"

Part Number without LED: 122-09-N
Black Housing (300v max. DC, 250v max. AC 50/60 Hz)

Part Number with LED:	Application
122-09-T-A.1-12VDC	12 VDC
122-09-T-A.1-24/60	24 VDC, 12-24 VAC 50/60 Hz
122-09-T-A.1-120/60	48-120 VDC, 100-240 VAC 50/60 Hz

(Transparent Housing allows LED to be seen)



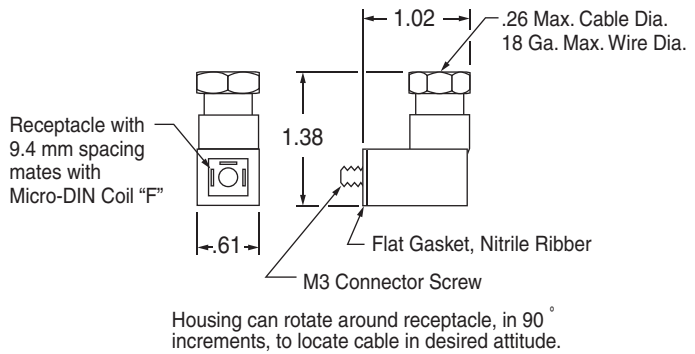
Connectors 58 Style (9.4 mm Spacing)

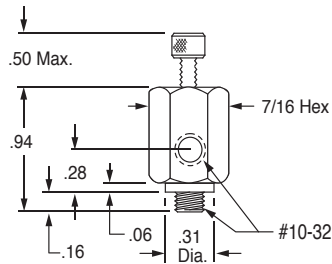
NEMA 4, IP65
For Male Micro-DIN Housing "F":

Part Number without LED: 192-07-N
Black Housing (250v max. DC or AC 50/60 Hz)

Part Number with LED:	Application
192-07-T-A.1-12/60	12 VDC or VAC 50/60 Hz
192-07-T-A.1-24/60	24 VDC or VAC 50/60 Hz
192-07-T-A.1-120/60	110-240 VDC or VAC 50/60 Hz

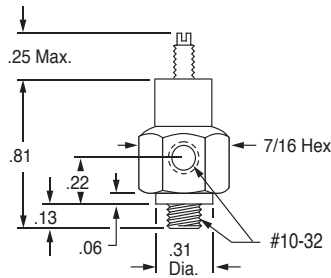
(Transparent Housing allows LED to be seen)





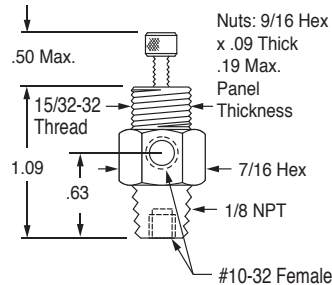
- Needle Valve**
- Controls both ways
 - Full range adjustability
 - Knurled control knob
 - Dual tapered needle
 - Gasket included (GA-10)
 - Brass construction
 - Buna-N seal
 - For infinite positioning of side port direction use a thread sealant/adhesive.

- FN32**
Options:
- Slotted knurled knob -KS
 - Screwdriver slot (MN-32 type) -S
 - Locknut on stem -L
 - Adaptor knob -B
 - Viton seal -V



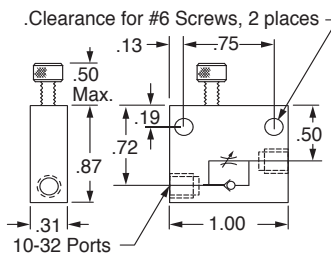
- Needle Valve**
- Controls both ways
 - Full range adjustability
 - Screwdriver slot
 - Dual tapered needle
 - Gasket included (GA-10)
 - Brass construction
 - Buna-N seal
 - For infinite positioning of side port direction use a thread sealant/adhesive.

- 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

- FN18**
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

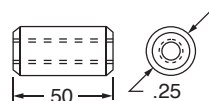


- Flow Control Valve**
- Controls one way – Full flow return
 - Full range adjustability
 - Knurled control knob
 - Dual tapered needle
 - Brass construction
 - Buna-N seals
 - For quick exhaust order without spring, Option -W
 - Flow rates - see page 12.5

- FC32**
Options:
- Slotted knurled knob -KS
 - Screwdriver slot (MN-32 type) -S
 - Locknut on stem -L
 - Adaptor knob -B
 - Viton seals -V
 - Without spring -W

12

Order any Control Valve with this Knob by specifying Option -B



- Adapter Knob**
- Allows the incorporation of decorative knobs with .25" I.D. and set screw

Option -B



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.

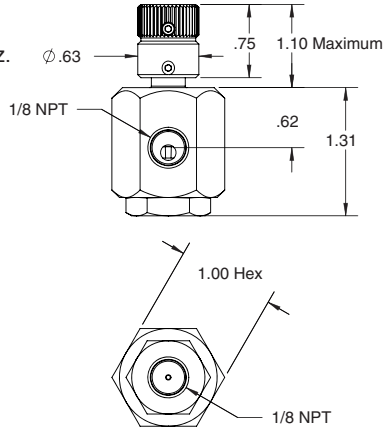
The precision is shown on the chart below. You can see how close the actual flow (plotted dots) approaches a straight line. Also note that it takes 9 full turns to go from bubble tight shut-off to its full flow of 100 Standard Cubic Feet per Hour (1.67 SCFM) at 80 psi inlet.

Features

- Linear control to 100 SCFH @ 80 psi (see chart below).
- Micrometer pitch adjusting thread, 40 TPI, .025 per turn.
- 10-32 or 1/8 NPT ports.
- Stainless steel needle - 3° taper.
- Friction O-Ring provides “stay-put” adjustment.
- Knurled adjusting knob with set screw lock.
- White Delrin® knob.
- Brass body.
- Buna-N seals.
- Operating temperature (0° to + 180°F).
- 100% tested, “Bubble-tight” shut-off.
- Air or Hydraulic service to 150 psi.

NV-55-18

Weight = 5.0 oz.

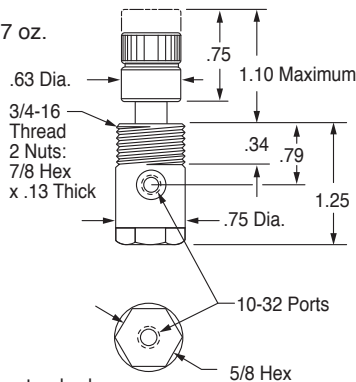


Symbol



NV-55

Weight = 2.7 oz.



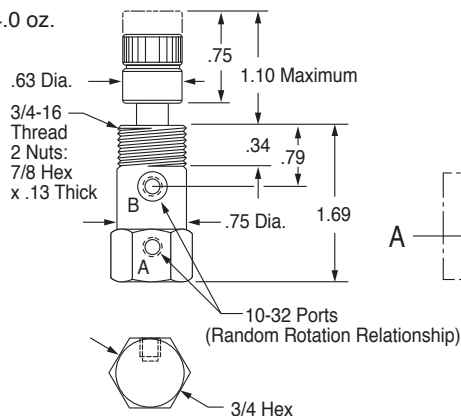
Symbol



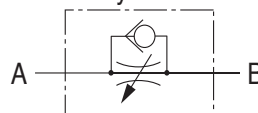
Panel mounting standard,
2 Brass panel mount nuts included as standard.

FC-55

Weight = 4.0 oz.



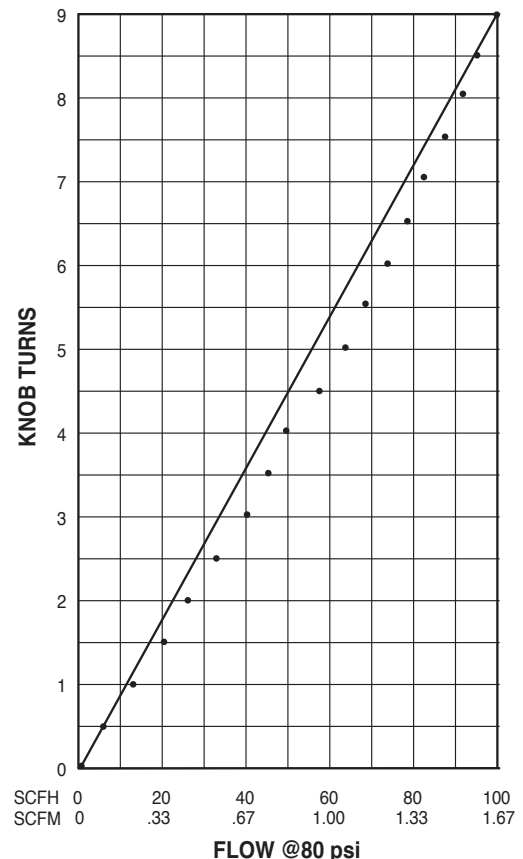
Symbol



Panel mounting standard,
2 Brass panel mount nuts included as standard.

Options

- Viton seals for media compatibility, specify Option -V.



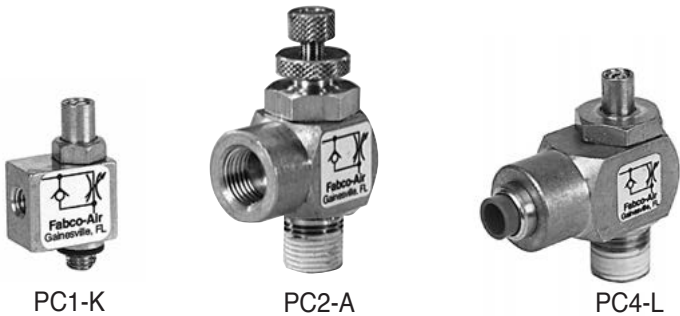
Port Mounted, Swivel, Brass Body Flow Controls (See next page 12.4)

- 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



See dimensions on next page. See flow information on page 12.5.

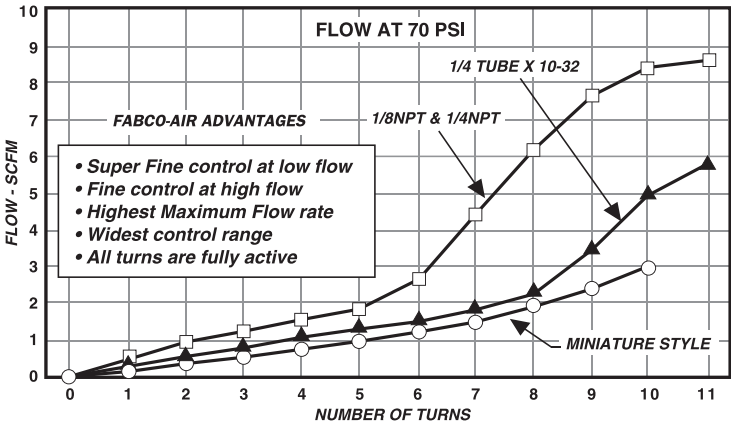
Port Mounted, Swivel, Molded Body Flow Controls.

- 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

FLOW CHARACTERISTICS OF FABCO-AIR VALVES



#10-32 male thread

Miniature Style

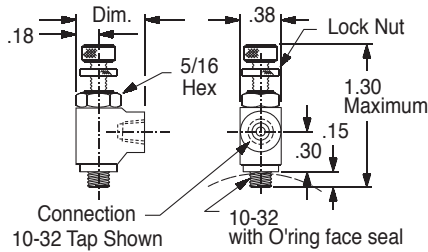
Knob Adjustable Valves

Model No.	Description	A	B max	C	Flow (Cv)
PK-82010	5/32 tubing x 10-32	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

Size 1

#10-32 Male Thread

Knob Adjustment



Valve Mount		
Model	Connection	Dim.
PV1-A	#10-32 Tap	.63
PV1-C	5/32" Tube*	1.16

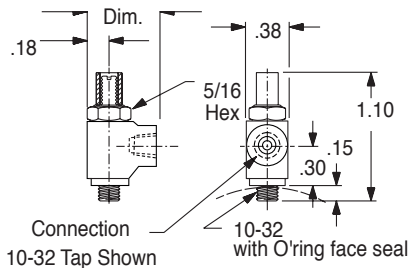
Cylinder Mount		
Model	Connection	Dim.
PC1-A	#10-32 Tap	.63
PC1-C	5/32" Tube*	1.16

* 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	#10-32 Tap	.63
PV1-M	5/32" Tube*	1.16

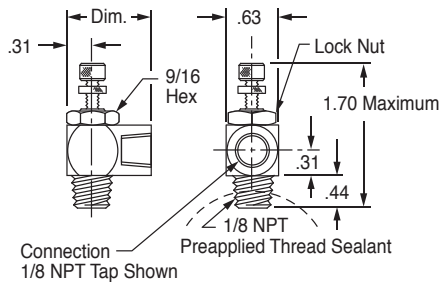
Cylinder Mount		
Model	Connection	Dim.
PC1-K	#10-32 Tap	.63
PC1-M	5/32" Tube*	1.16

* 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	1/8 NPT Tap	1.00
PV2-C	5/32" Tube*	1.65
PV2-D	1/4" Tube	1.63

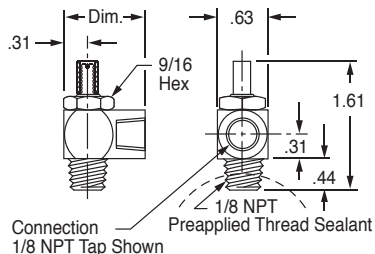
Cylinder Mount		
Model	Connection	Dim.
PC2-A	1/8 NPT Tap	1.00
PC2-C	5/32" Tube*	1.65
PC2-D	1/4" Tube	1.63

*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	1/8 NPT Tap	1.00
PV2-M	5/32" Tube*	1.65
PV2-N	1/4" Tube	1.63

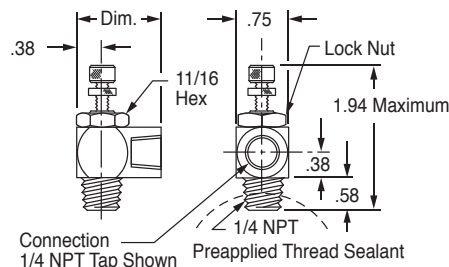
Cylinder Mount		
Model	Connection	Dim.
PC2-K	1/8 NPT Tap	1.00
PC2-M	5/32" Tube*	1.65
PC2-N	1/4" Tube	1.63

*Note! Use 5/32" Tube Models for 4mm OD Tubing.

Size 4

1/4 NPT Male Thread

Knob Adjustment



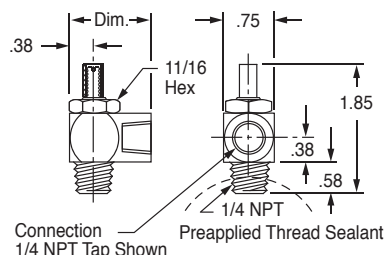
Valve Mount		
Model	Connection	Dim.
PV4-A	1/4 NPT Tap	1.25
PV4-B	1/4" Tube	1.75
PV4-C	3/8" Tube	2.00

Cylinder Mount		
Model	Connection	Dim.
PC4-A	1/4 NPT Tap	1.25
PC4-B	1/4" Tube	1.75
PC4-C	3/8" Tube	2.00

Size 4

1/4 NPT Male Thread

Screw Driver Adjustment

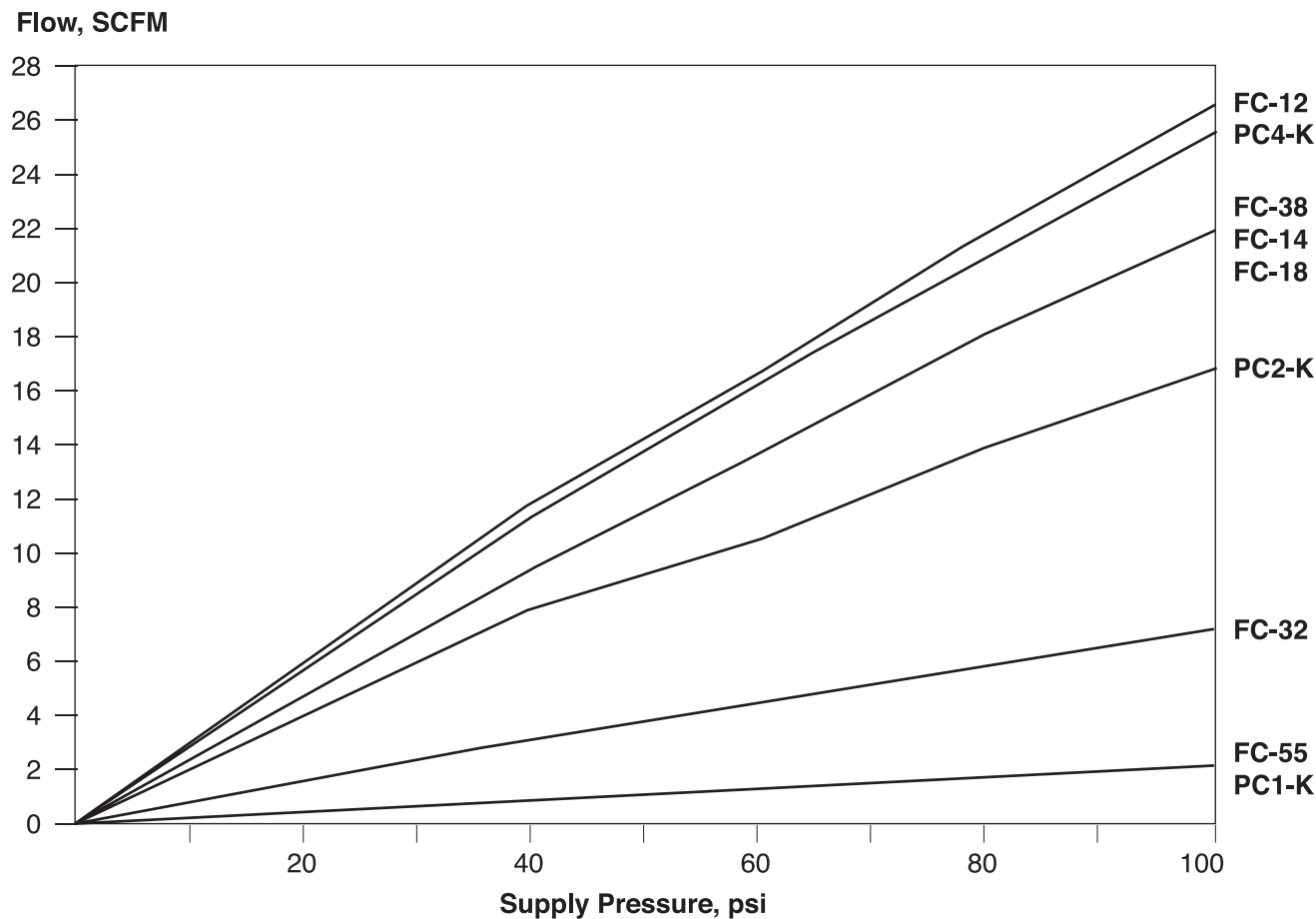


Valve Mount		
Model	Connection	Dim.
PV4-K	1/4 NPT Tap	1.25
PV4-L	1/4" Tube	1.75
PV4-M	3/8" Tube	2.00

Cylinder Mount		
Model	Connection	Dim.
PC4-K	1/4 NPT Tap	1.25
PC4-L	1/4" Tube	1.75
PC4-M	3/8" Tube	2.00

Needle & Flow Control Valves

Flow Control Valves, Typical Free Flow Maximum

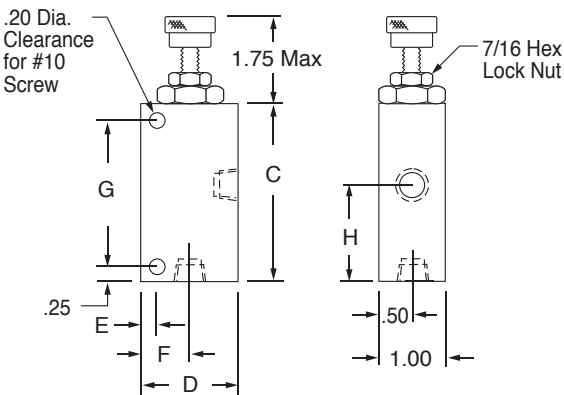


12 Super-Vee™ Needle Valve Dimensions

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





FCB-14

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.



FC-14

- 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

Features

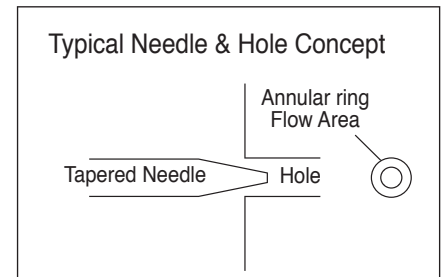
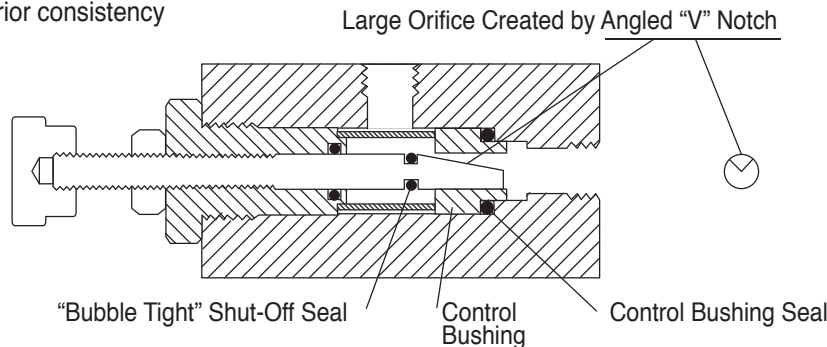
- Operating temperature (0° to + 180°F)
- Black anodized aluminum body
- Stainless steel stem
- Stainless steel spring ("FC-" Models)
- Brass cartridge and poppet
- Corrosion resistant construction
- "Bubble-tight" shut-off

Options

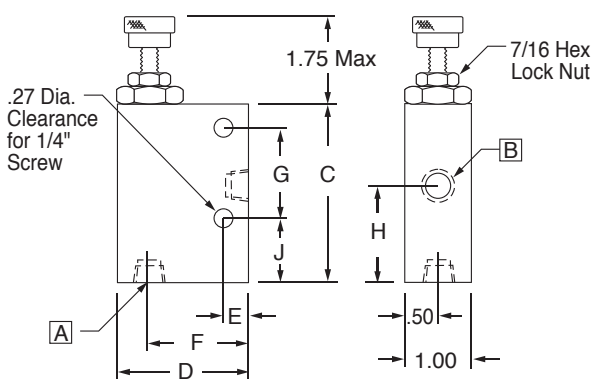
- Viton seals for media compatibility, Option -V

Super-Vee™ concept

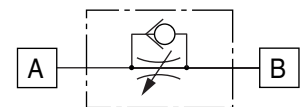
Superior consistency



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



Cylinders, Valves, & Accessories



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

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.

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.

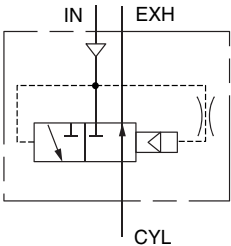
Applications

- **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

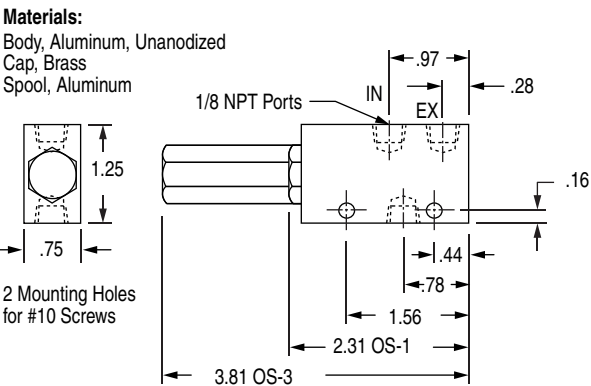
Model Number	Approximate Pulse Time, Seconds @80 psi	Approximate ResetTime, Seconds @80 psi	Port Size	Weight Oz.
OS-1	3/4	1	1/8 NPT	3.1
OS-3	1-1/2	2	1/8 NPT	4.8

Symbol



Dimensions

Model No. OS-1 & OS-3 1/8 NPT Ports





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.

“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.

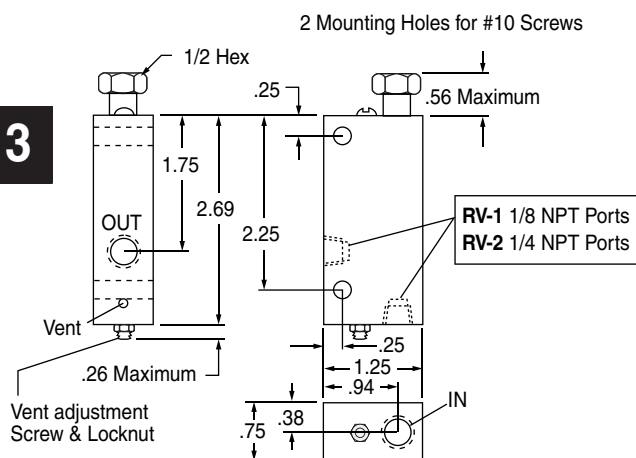
Time delay or Function delay (See circuit on page 13.4) Coupled with a flow control & volume chamber, the “RV” provides time or function delay.

Applications: Heat sealing, gluing, compacting, time between functions, load or unload time, and many others.

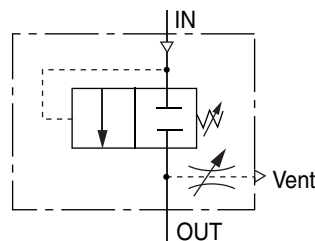
Please note the following:

- 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.

Dimensions



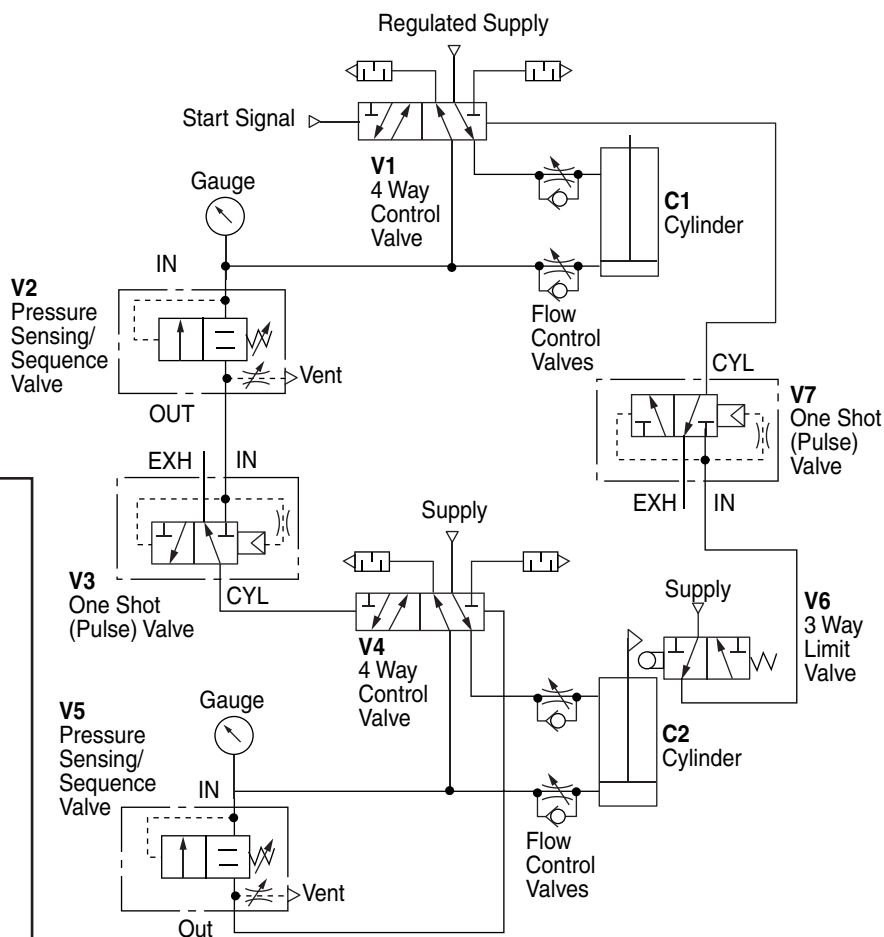
Symbol



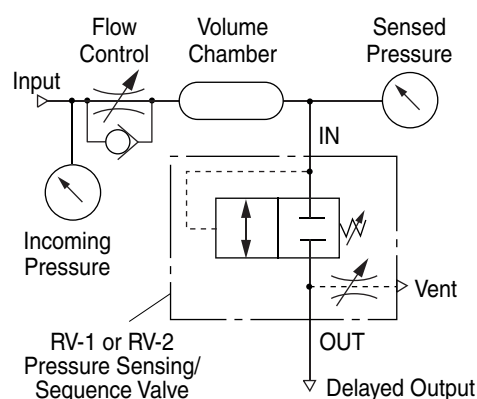
The basic “RV” valve function is two way normally closed. When the input is removed the spring automatically closes the valve, trapping downstream or output pressure. A vent is incorporated in the valve to relieve this trapped signal. The vent is adjustable so that it can be set for various pilot volumes 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

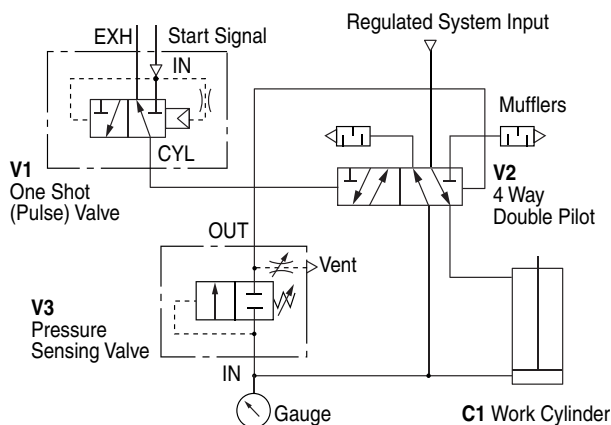
1. Start signal to **V1**
2. **C1** - extends to load
3. Load pressure from **C1** to **V2**
4. Constant signal from **V2** to **V3**
5. Pulse signal from **V3** to **V4**
6. **C2** extends to load
7. Load pressure from **C2** to **V5**
8. Signal from **V5** to **V4**
9. **C2** retracts to **V6**
10. Constant signal from **V6** to **V1**
11. Pulse signal from **V7** to **V1**
12. **C1** retracts



Time Delay Circuit



Pressure Sensing Circuit



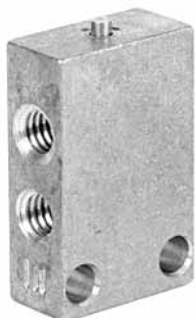
1. Start signal can be maintained or momentary
2. Pulse signal from **V1** to **V2**
3. **C1** extends
4. Load pressure from **C1** to **V3**
5. Signal from **V3** to **V2**
6. **C1** retracts

“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.



MSV-1 Stem Actuator



MSV-2 Lever Actuator

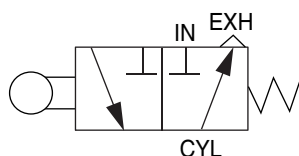


MSV-2A Roller Actuator

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, it 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**

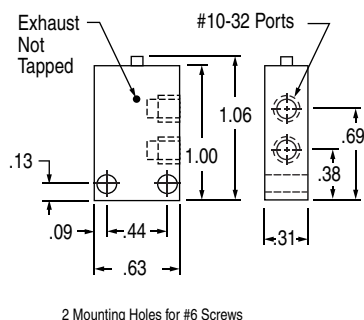
Note

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

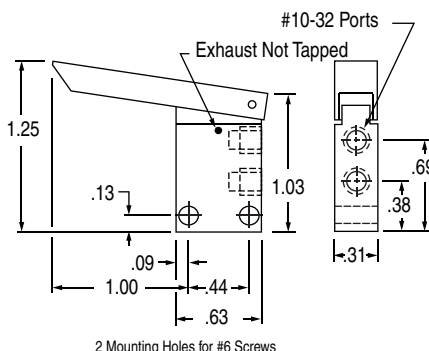
Weight 0.8 oz.



Model No. MSV-2

Lever Actuator

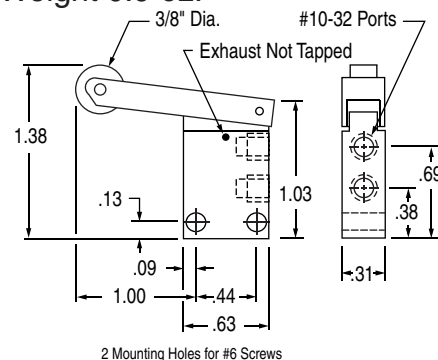
Weight 0.8 oz.



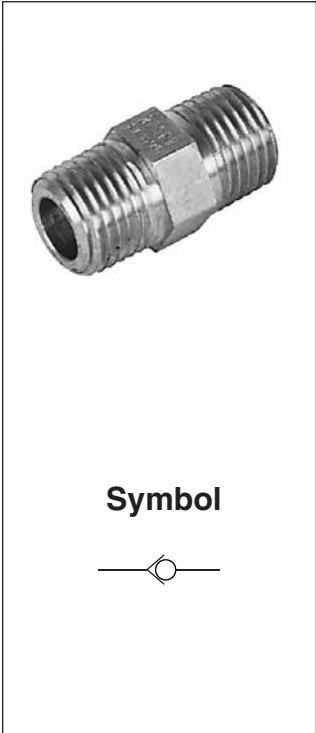
Model No. MSV-2A

Roller Actuator

Weight 0.9 oz.



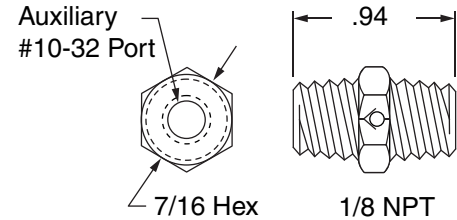
Check Valves



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.

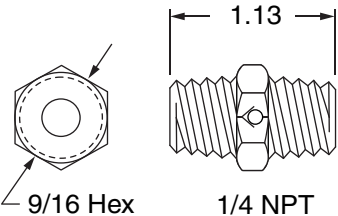
Model No. (Cracking Pressure)
18CV (without spring 0.3 psi Max.)
18CVS (with spring 10 psi Max.)
Weight 0.5 oz.
Flow rating Cv = 0.1



Options

- Viton® O-Ring Seals (-15° to +400° F); Specify Suffix -V

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



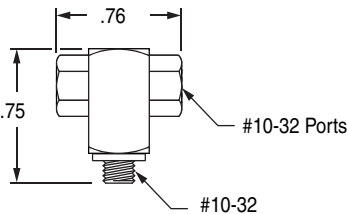
Shuttle Valves



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

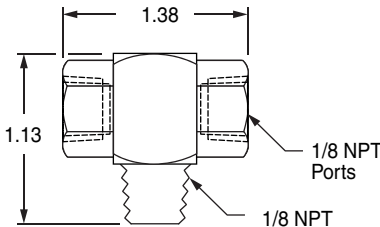
Model No. 10 SV
Weight 0.4 oz.
Flow rating Cv approx. 0.06



Options

- Viton® O-Ring Seals (for media compatibility); Specify Suffix -V

Model No. 18 SV
Weight 1.4 oz.
Flow rating Cv approx. 0.34



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:

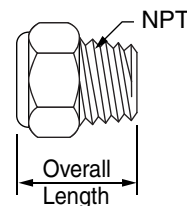
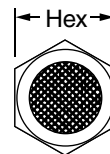
Body, Brass

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:

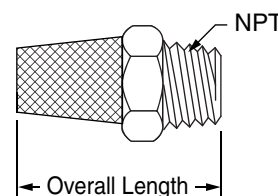
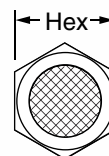
Body, Brass

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

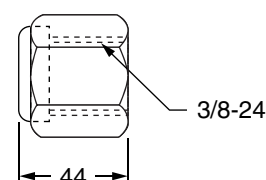
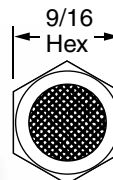
Model SM-10

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

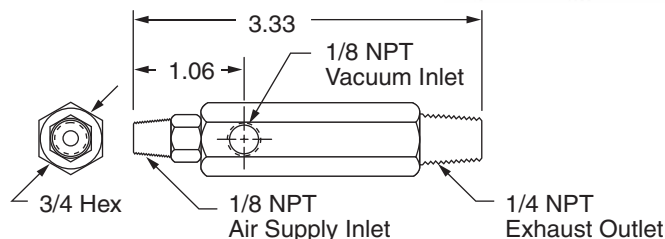
Model VTR-1

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.

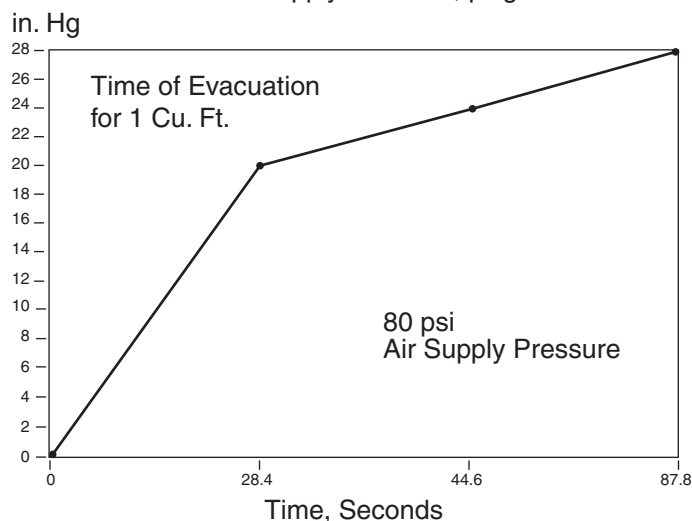
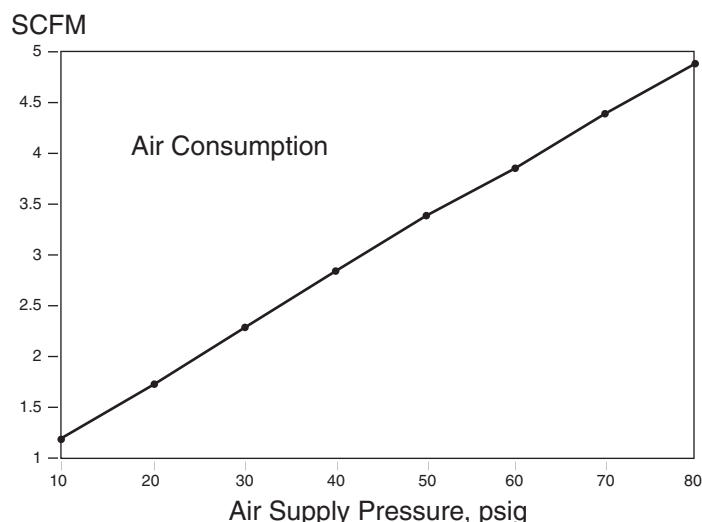
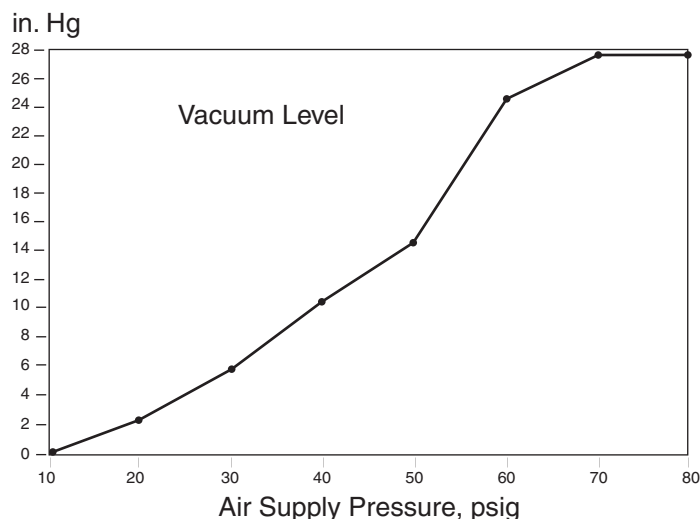


Features & Benefits

- **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.).



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

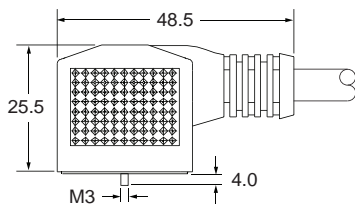
192-F64-55

192-J64-00

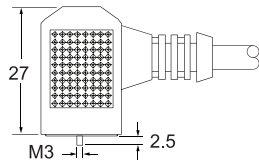
192-J64-25

192-J64-55

J Style 90° Connectors



122 Type Connector



192 Type Connector

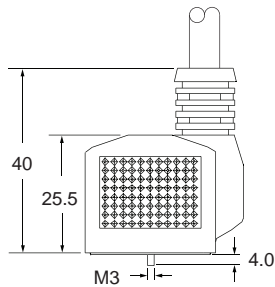
Both connector styles have captive stainless steel screw for mounting interface to solenoid valve. Low profile allows use where space is tight. Molded-in gasket is impossible to lose.

122-J61-00
Shown Left

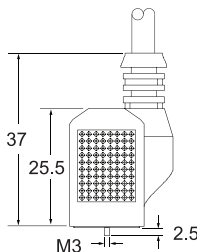
192-J64-25
Shown Right



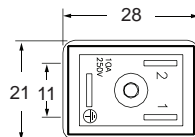
F Style Straight Connectors



122 Type Connector

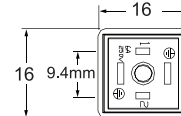


192 Type Connector



122 Mini-DIN

122-F60-55
Shown Left



192 Micro-DIN

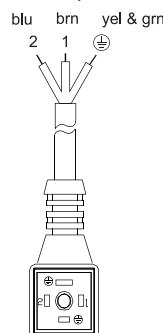
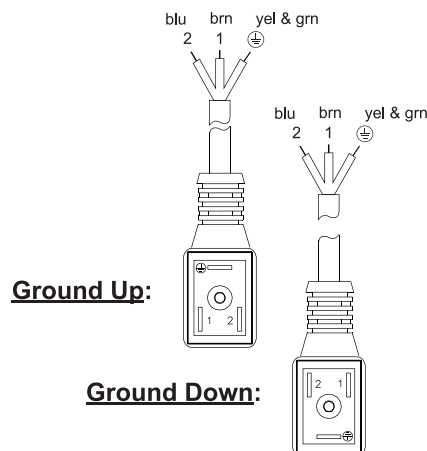
192-F64-00
Shown Right



Wiring Information

Normal polarity:

- 1 = (+) Positive, Hot
- 2 = (-) Negative, Neutral
- ⊕ = Chassis Ground



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.

Notes



Cylinders, Valves, & Accessories



Fabco-Air Product Catalog Library



3 Series of Angular & Parallel Motion Grippers Catalog #GR8



Pancake® II Air Cylinders Catalog #Pan2-2



Square Pancake® II Air Cylinders Catalog #SqPan2



ISO 6431 Cylinders Catalog #FAQR-09



Twin Rod, Non-Rotating Air Cylinders - Catalogs #FDF-09 & #FDXS-09



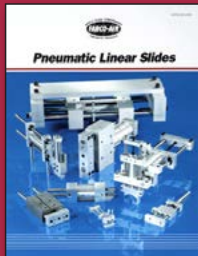
High Closing Force Angular Grippers Catalog #FKHC-10



Multi-Power® Air Presses Catalog #FP16



Swing Clamps Catalog #SC-DB04



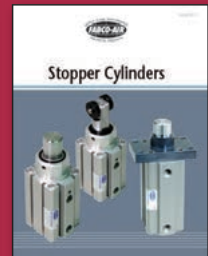
Linear Slides - 6 Families Catalog #LS-03



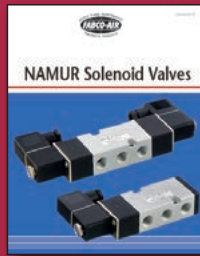
Compact Finger Slides Catalog #FDH-10



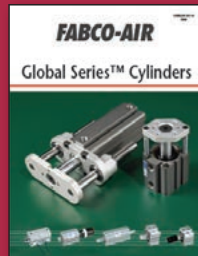
ISO 6432 Cylinders Catalog #FAE-09



Stopper Cylinders Catalog #ST-SC



NAMUR Solenoid Valves Catalog #FVEN-10



Global Series™ Metric Air Cylinders Catalog #GC-15



NFPA Air Cylinders Catalog #NF-6



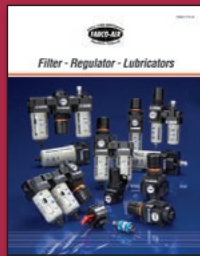
Air Table Slides Catalog #FGXS-10



Wide & Narrow Parallel Grippers - Catalogs #FKHZ-10 & #FKHQ-10



Toggle Type Angular Grippers Catalog #FKHT-10



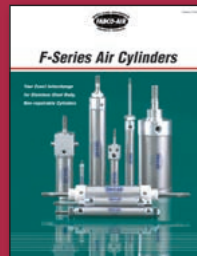
Modular Air Preparation System - FRLs Catalog #FRL-06



Guided Motion Air Cylinders Catalog #FGM-10



Pneumatic Rotary Actuators Catalog #FRA.C-09



Stainless Steel Body Air Cylinders Catalog #SSB-03



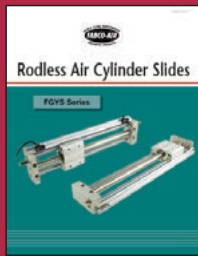
Pneumatic & Hydraulic Swing Clamps Catalog #FML.H



Wide Opening Parallel Grippers Catalog #FKHL-10



Angular Grippers Catalog #FKA-09



Magnetically Coupled Rodless Slides Catalog #FGYS-11



Magnetically Coupled Rodless Air Cylinders Catalog #FGYBR-11

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