

# NFPA Pneumatic Catalog

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We make  
things MOVE®



# Contents

	11 TA SERIES		185 TAS SERIES
	27 TD SERIES		217 CYLINDER OPTIONS & SPECIALS
	33 FM SERIES		241 BOOSTERS, RESERVOIRS & TANKS
	73 BTB SERIES 3P SERIES TM SERIES		257 BENCH TOP PRESS & CYLINDERS
	97 TRA SERIES		269 CYLINDER ACCESSORIES
	121 TC SERIES		285 POSITION SENSING
	137 MSE/MSR SERIES		301 POSITION CONTROL
	153 RS SERIES SS SERIES SS-MS SERIES		317 TECHNICAL DATA



## We Make Things Move®

A forward-thinking innovator, Bimba provides industry-leading pneumatic, hydraulic and electric motion solutions that are easy-to-use, reliable and ready for your engineering challenges.

Doing whatever it takes to help you get the job done is what the Bimba companies do best. With an extensive line of industry-leading air cylinders, rotary actuators, linear thrusters, rodless cylinders, NFPA, hydraulics, flow controls, position-sensing cylinders, valves, switches and air preparation equipment, the people of Bimba are ready to tackle your toughest applications.

Bimba is part of IMI Precision Engineering, a world leader in motion and fluid control technologies. Wherever precision, speed and engineering reliability are essential, we deliver exceptional solutions which improve the productivity and efficiency of customers' equipment.

Our range of high-performance products, such as actuators, valves, valve islands, pressure monitoring controls and air preparation products together with trusted products brands including IMI Norgren, IMI Buschjost, IMI FAS, IMI Herion and IMI Maxseal underpin our position as a leading global supplier.

Part of IMI plc, we have a sales and service network in 50 countries, as well as manufacturing capability in the USA, Germany, China, UK, Switzerland.





# Leaders In Actuation

Thousands of solutions. Thousands of configurations. Endless applications.

## Solutions

- > Pneumatic
- > Hydraulic
- > Electric
- > Air Preparation
- > Valves
- > Safety
- > Production
- > Motion Control
- > Custom Designs

## Industries & Applications

- > Medical
- > Food & Packaging
- > Agriculture
- > Semiconductor
- > Aerospace
- > Robotics
- > Energy
- > Window & Door

## Challenges Addressed

- > Space Constraints
- > Wash-Down
- > Corrosive Environments
- > Poor Air Quality
- > Heavy Side Loads
- > Position Sensing



# The Bimba Difference

## Precision Machined Throughout

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We started in business as precision machinists. Every component is machined in a manner to enhance the performance of our products. Cylinder tubes are lathe cut, not sawed. Heads and caps are 100% CNC machined to tight tolerances in jig bored fixtures. Piston and rod diameters and concentricity are held to within two thousandths of an inch, in CNC lathes. The results: cylinders that have a consistent performance and long life. Our cylinders are truly square, which eliminates shimming!

[Try the Bimba difference!](#)

## On Time, Consistent Delivery

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Every customer's order is important. Our business is managed so large orders do not disrupt our published delivery schedules.

## Cylinder Options and Custom Modifications

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Since every cylinder is made to order, you can customize each cylinder to best fit your application. You can choose from our extensive list of standard options or send us a sketch for a custom solution!

- > Port size, type or location along with cushion locations can be made to your specifications (NPTF, BSPP, BSPT or SAE sizes available).
  - » Rod End Styles and Designs:
    - » (5) NFPA Standard rod end styles available
    - » Standard or other thread lengths available
    - » Metric or other thread styles available
    - » Custom rod end styles available - just send us a sketch!
    - » "Hollow" Rod designs can be gun-drilled to your specifications
- > Most cylinder options ship in 2-3 days!

**Quick response on all requests. Most requests are answered within a day of being received.**

## Visit Us

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- > On the web: [www.bimba.com](http://www.bimba.com)
- > Email: [trdsales@bimba.com](mailto:trdsales@bimba.com)
- > 2D DXF & DWG CAD files available
- > 3D Step files available for download

## Three Year Warranty

Bimba takes great pride in its products. Bimba warrants its cylinders for a full three years to be free from defects in material and workmanship. Bimba must be notified prior to returning product for warranty evaluation. Contact your local Bimba distributor to obtain a Return Material Authorization (RMA) number for proper tracking and expedite service on all warranty evaluations. Bimba will repair or replace free of charge any products returned to the factory within three years of shipment that is proven to be defective in material and/or workmanship.

A complete explanation of defects is required with the returned product. The Bimba warranty applies only to products used properly and under normal operating conditions. All products are to be used in a safe manner, in properly designed systems. Safeguards to prevent personal injury or equipment damage must be used and are the sole responsibility of the user. In no event shall Bimba be liable for any consequential damages or installation costs resulting from delay or failure of delivery, defective material or workmanship or out of a breach by Bimba of any contract.

Bimba offers a wide range of cylinder customizations and options to provide the best cylinders in the industry for any application. Here's a brief overview of common cylinder design and option considerations to assist in choosing the right cylinder for you. A cylinder that is tailored to a specific application will improve overall performance and lead to increased cylinder life. If you need help in sizing the cylinder bore or selecting a cylinder mount, **REFER TO PAGES 321 AND 322.**

## Cylinder Material – Which is Best: Aluminum, Steel or Stainless Steel?

**Aluminum** – Used indoors and outdoors, aluminum is the go-to material since it provides the best overall value for the dollar. In moist or wet environments (and some food applications), the combination of aluminum heads/caps/tube with stainless steel hardware (tie rods, fasteners, piston rod, etc.) can provide excellent corrosion resistance and also meet some food processing safety concerns.

Bimba uses 6061 T6 aluminum extrusions whenever possible for aluminum cylinder components, heads and caps. Our MP1 and MS2 extruded aluminum mounts are as strong as steel welded mounts without the added weight.

**Steel** – Typically, steel cylinders are used in the most heavy-duty, demanding applications due to stress levels within the mounts or the piston-to-tube surface. The steel tube also provides additional resistance to denting from flying debris. An aluminum cylinder with head and cap made from solid 6061 T6 aluminum tool plate will never fail due to load or abuse but the mount may be the weakest link. For example, MT1/MT2 trunnion mounts are a bolt-on design for aluminum cylinders and cannot take the same stress levels as one-piece all steel trunnion mounts.

Steel cylinder tubes have hard chrome plated and honed IDs, which are also made to tighter diameter tolerances than aluminum tubes. In long stroke and unsupported piston rod applications, a steel tube will provide added protection from internal tube scoring due to the weight of the piston rod and light side loads. They can also outperform aluminum tubes in air/oil applications due to less piston seal bypass and smoother ID surface. This will provide the smoothest operation possible in ultra-low speed applications.

One drawback to steel tubes is that you cannot use low-cost, magnetic piston type position sensors since the steel tube itself is a magnetic material. A Balluff end of Strokemaster® type sensor or internal type transducers must be used for cylinder stroke position sensing.

**Tip: You can use an aluminum series cylinder with the TMS (steel tube option) to reduce overall weight and cost to match an all-steel cylinder performance (as long as the cylinder mount isn't MT1 or MT2).**

**303/304 Stainless Steel** – It is the preferred material for most food processing and corrosive applications due to its natural resistance to corrosion and sanitizing solutions. The more costly 316 SS is common in cheese processing, battery manufacturing, paper pulp processing and other very demanding/highly corrosive applications. Since stainless steel cylinder tubes do not have a hard chrome plated ID, they do not have the same load carrying ability as a carbon steel tube cylinder.

SS cylinders are compatible with magnetic piston type sensors.

## Piston Rods: Rod Diameters, Rod Thread Size, Type of Thread, Rod Extensions and More

Each piston rod is made-to-order and typically does not affect our two to three day delivery – so why not get exactly the rod thread, rod extension and rod end design that you NEED? In-stock rod diameters are listed in each cylinder model series. All rod diameters come in high alloy carbon steel and also 303/304 stainless steel; with hard chrome plated OD.

## Piston Rod Diameter – Which is Right for My Application?

**Standard Piston Rods** – Used 90% of the time in low to medium stroke length applications with good results.

**Oversized Piston Rods** – These should always be considered on longer stroke, high load or side load applications. Each Bimba series has a standard rod and one or more oversized (OS) rod diameters listed that ship within our published delivery schedule.

**Design Considerations** – Keep in mind that the weight of the piston rod is a mass that is moved for each cylinder extend and retract stroke. Applications that require a hammer effect, such as driving fasteners into wood, benefit with the additional weight of an oversized rod. However, higher cylinder velocities may be more difficult to achieve due to the added weight of the rod and the reduced effective piston area on the rod side (retract stroke).

**Undersized Piston Rods** – Available but rarely used because of the added cost since all of the associated parts are non-standard. All undersized rod parts (rod bushings, pistons, etc.) are made-to-order, which require additional time for engineering and delivery.

## Piston Rod Thread – How to Make the Right Selection

**All NFPA rod threads are UNF fine, class 2 threads (the catalog standard on all cylinders)** – The default rod thread (if no other thread call-out is made) is the KK1, small male; to the catalog “A” dimension length. Typically, you do not want to use a smaller thread than the KK1 due to the tendency of threads breaking at the rod shoulder, but smaller threads are possible.

**KK2 (Large Male Thread)** – Used to match an existing mating size thread or if a side load is expected that may be too much load for the standard small male rod thread. This option should also be considered for higher speed applications and higher impact applications.

**KK3 (Female Rod Thread)** – Same size thread as a KK1, but a female thread. This thread diameter is the largest female thread that you can order for any given rod size.

**KK3S (Female Rod Thread with Rod Stud Installed)** – Same physical dimensions as a KK1 thread but this is truly a go-to thread choice any time you are breaking rod threads. The hardened stud is permanently attached using anaerobic adhesives. This is one tough rod thread that rarely fails, even in the toughest applications.

**KK4 (Full Male Thread)** – The strongest male rod thread possible since it’s the same diameter as the rod. High Impact, high speed and higher suspected side load applications should use this option. The reason being it that there is no shoulder on the rod therefore no undercut area that would present itself as an area that could cause failure due to snapping off the rod threads.

**Other Rod Ends** – Course “UNC” threads, metric rod threads, plain rod ends (machined flat with no thread), cross drilled holes to attach tooling, custom rod ends used as shot pins, etc. can all be furnished.

**Tip: It is good practice to bottom out the rod thread attachment to the rod shoulder, to minimize thread breakage. The use of jam nuts to position an attachment on the rod thread should be limited to low stress applications.**

## Rod Extensions Also Known as “C” Dimensions in the Catalog – What is possible?

Many times the “C=” dimension needs to be altered to provide a drop-in replacement to an existing cylinder model or allow for additional cylinder clearance in an application. The cost adder is minimal because you are only paying for the additional rod material.

The design possibilities are unlimited. Many times a customer will add length to the rod to locate the cylinder away from a hostile environment or to provide easy access to the cylinder. One customer uses a 3.00” stroke cylinder with 36” of rod extension to make the cylinder easy to service and make adjustments. In general, the basic “C” dimension also provides the room for the piston rod wrench flat, so accessories can be tightened to the rod.

Many features can be machined into the rod extension such as a turned down diameter, an additional shoulder or tapered surface. Sometimes a bullet nose is provided so the cylinder rod can act as a shot pin. For close tolerance milled or drilled rod features, Bimba has assembled the cylinders and milled/drilled the rods as a secondary operation.

**Just send your local distributor a sketch!**

## Cylinder Strokes – The Long and Short on What is Possible and What to Expect

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Cylinder stroke components are made-to-order, so you're not limited to specifying a stroke in full inch increments. It's also easy to make a cylinder in a metric equivalent stroke length; just specify the required stroke length in inches. (Example: 80mm stroke = 3.15".) Strokes up to 120" will ship per our delivery schedule. Longer strokes are available but usually require engineering assistance and time to order the special length materials.

In general, NFPA cylinders on the market today are not considered to have close tolerance strokes. Due to the stack-up of cylinder parts and tolerances, it is common to see stroke lengths vary from -.032" to +.063." Bimba typically holds each cylinder component to a close tolerance, minimizing the stack-up of tolerance that affect the cylinder stroke.

Many customers will rely on external stroke adjustments or options such as Micro-Adjust (MA) to provide a precise, adjustable stroke output. Cylinder strokes can be made to close tolerances down to +/- .005" for an additional charge.

For the above mentioned reasons, the shortest practical cylinder stroke length is about .125" (3 mm).

## Port Size, Thread Type and Port Locations

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Any port size that can fit in a cylinder and any thread type can be provided. The most common are NPTF but BSPP, BSPT and SAE are also available (for additional cost). Delivery: two to three days standard! Many times, a smaller port size will be used to limit the air flow and cylinder speed. At the other end of the spectrum, customers may want the largest possible port size that can be machined into a head and cap for maximum cylinder speed.

Ports can be located on any cylinder side; cap ports can even be located in the rear face (at position nine). If a cushion is specified, the port and cushion adjustment can also be provided on the same side (for additional cost, depending on bore/rod size).

## Cylinder Velocities – Cushions and Other Available Options

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Cushions are the most common option to improve cylinder performance and minimize cylinder end-of-stroke noise. They work by trapping the last 1/2" (or so) of exhaust air in the cylinder and the air is then metered out over an adjustable cushion needle. For a cushion to perform properly, they do typically increase the stroke cycle time. When cycle rates permit, longer cushions can be used to trap and meter even higher amounts of air, increasing the overall effectiveness of an air cushion.

For rapid cycle rates, cushions are not always an option. Bumpers (B, BC, or BH) or bumper piston (BP) seals can be used to minimize cylinder noise and also provide some load deceleration, increasing a cylinder's life and performance.

Refer to pages 219 - 242 for a listing of the most common cylinder performance options.

## Temperatures – High, Low and Everything in Between

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**Standard operating temperature range of products:** -20°F to +200°F (-29°C to +93°C)

All cylinder components, seals and lubrication are designed to perform very well within the standard temperature range. When the application is at either end of the temperature range for extended periods of time, performance seals and lubrication should be considered for maximum performance.

**Low temperature range:** -40°F (-40°C) rated seals and lubricant are available. Ideal for freezer applications.

**High temperature range:** +400°F (+204°C) rated seals and lubricant are available. Ideal for furnace applications.

Refer to page 227 for special temperature lubes and page 232 for special temperature seals.

## Dust, Dirt and Other Unfriendly Environments

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**Standard Rod Wiper:** Urethane – Aggressive, heavy-duty, high abrasion resistance & ideal for 95% of all applications.

Since the standard rod wiper is separate from the rod seal, we can use a high performance material such as urethane. For extreme environments, such as mud, weld splatter, paint, cement dust, concentrated fruit juice syrups, etc., the standard rod wiper may not provide optimum service. There is not enough room to cover all the application possibilities and solutions; contact your local distributor for more information and for application assistance.

## Side Load – The Good, the Bad and the Ugly

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Everyone knows that a NFPA cylinder can take a certain amount of side load, even though the industry clearly states that “cylinders are not designed for side load applications.” When there is a fair amount of side load, a better actuator solution in the long run might be a thruster or a slide type actuator.

In general, a long stroke cylinder with an unsupported rod may cause a high enough stress between the piston and tube to cause tube scoring, even with a piston wear band. There is no published data that can outline all of the safe operating ranges, side load capabilities of cylinders, etc. to eliminate tube scoring and catastrophic cylinder failure.

If you are experiencing tube scoring, there are some solutions available. Special length pistons can be provided to handle multiple wear bands or extra-long wear bands. We have also used solid Delrin® pistons to increase the contact surface between the piston and tube, with excellent results. Special length rod bushings may also be used to increase the bearing surface and reduce piston rod to bearing stresses to eliminate rod bearing or piston rod scoring.

**Contact your local distributor for more details.**

**There are many more cylinder topics than can be covered in a brief cylinder design overview. If you want to improve the life of any cylinder in an application, contact your local distributor with the details. Let us show you how to maximize cylinder life and improve performance!**



# TA Series Cylinders

The TA Series is Bimba's standard pneumatic NFPA cylinder line, offering self-aligning motion that can be customized to fit any application.





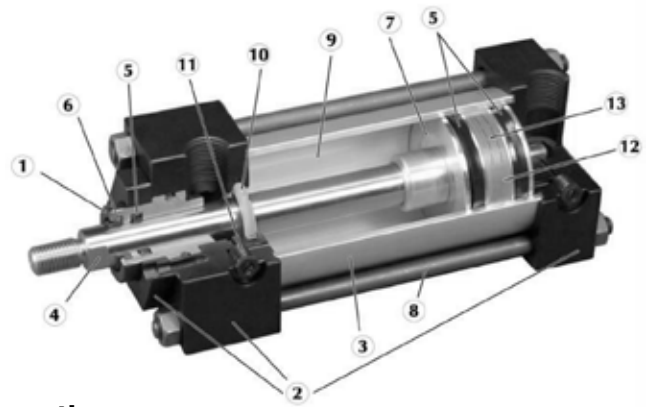
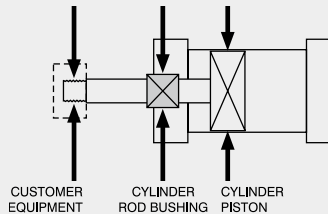
# Contents

- 
- 13** Product Features  
13 – Heavy-Duty Design  
13 – Operating Pressure  
13 – Operating Temperature
- 
- 14** How to Order  
15 – Option Length Adders  
15 – NFPA Mounts
- 
- 16** How to Specify  
16 – Piston Rod End Styles  
16 – Basic Rod Dimensions  
17 – Mounting Dimensions  
21 – Combination Mounts
- 
- 22** Double Rod End Product Features  
22 – Double Rod End Styles  
23 – Double Rod End Mounting  
Dimensions
-

## Floating Rod Bushing

**Self Alignment Feature:** Rod Bushing is designed to float .002" to improve bearing surface alignment.

- > Reduces cylinder drag and erratic operation
- > Reduces cylinder wear
- > Provides a minimum of 25% longer life than fixed rod bushing designs



## Heavy-Duty Design for Reliable, Consistent Operation

1. **Floating Rod Bushing** – Precision machined from 150,000 PSI rated graphite-filled cast iron and PTFE coated to reduce friction and extend cycle life. Bushing design traps lubrication in effective bearing area.
2. **Head, Cap & Retainer** – Precision machined from high strength 6061-T6 aluminum alloy. Black anodized for corrosion resistance
3. **Cylinder Tube** – Precision machined from 6063-T6832 high tensile aluminum alloy and hard coat to 60 Rc for wear resistance and extended cycle life.
4. **Piston Rod** – Precision machined from high yield, polished and hard chrome plated steel.
5. **Piston & Rod Seals** – Heavy lip design Carboxilated Nitrile construction. Seals are pressure activated and wear-compensating for long life (self-lubricating material).
6. **Rod Wiper** – Abrasion resistant urethane provides aggressive wiping action in all environments. External lip design prevents debris from entering cylinder.
7. **Piston** – Precision machined from 6061-T651 alloy aluminum, provides an excellent bearing surface for extended cylinder life.
8. **Tie Rods** – Pre-stressed high carbon steel tie rod construction eliminates axial loading of cylinder tube and maintains compression on tube and end seals.
9. **Permanent Lubrication** – Permanently lubricated with Magnalube-G PTFE based grease on all internal components. This is a non-migratory type high performance grease providing outstanding service life. No additional lubrication is required.
10. **Cushions** – Floating cushion seal designed for maximum cushion performance, quick return stroke break-away and extended life (Options H & C).
11. **Cushion Adjustment Needle** – Adjustable steel needle design has fine thread metering and is positively captured to prevent needle ejection during adjustment.
12. **Piston Wear Band** - 90% Virgin PTFE and 10% Polyphenylene Sulfide-filled wear band; extremely low wear rate.
13. **Piston Magnet** – For Bimba magnetically operated reed and solid state switches (Option MPR).

## Operating Pressure

**250 PSI Air (17 BAR)**

## Operating Temperature

**Carboxilated Nitrile:** -20°F to 200°F (-29°C to 93°C)

**Fluorocarbon:** 0°F to 400°F (-18°C to 204°C)

## Performance Options

**ST** – Stop tubes are used to reduce rod bearing and piston stress (refer to Options for cylinder design guidance).

**MA** – Micro-Adjust provides a precision adjustment on the cylinder extend stroke, providing quick and accurate cylinder positioning to reduce set-up time.

**SSA** – Stainless steel piston rod, tie rods, nuts and fasteners provide corrosion resistance. Refer to SS Series for a complete stainless steel solution.

**LF** – Low friction seals reduce breakaway and running friction. Effective at all operating pressures.

# How to Order

TA SERIES NFPA ALUMINUM CYLINDERS

## TA - MF1 - 2.5 x 10 - HC - MPR

Series	
TA	250 PSI Air

NFPA Mounts	
MF1	Front Flange (1.50" - 6.00" Bore)
MF2	Rear Flange (1.50" - 6.00" Bore)
ME3	Front Mounting Holes (8.00" - 12.00" Bore)
ME4	Rear Mounting Holes (8.00" - 12.00" Bore)
MP1	Rear Pivot Clevis (1.50" - 12.00" Bore)
MP2	Rear Pivot Clevis (1.50" - 6.00" Bore)
MP4	Rear Pivot Eye (1.50" - 6.00" Bore)
MS1	Front & Rear End Angle (1.50" - 8.00" Bore)
MS2	Side Lug (1.50" - 8.00" Bore)
MS4	Bottom Tapped Holes (1.50" - 12.00" Bore)
MT1	Front Trunnion (1.50" - 8.00" Bore)
MT2	Rear Trunnion (1.50" - 8.00" Bore)
MT4	Intermediate Trunnion (1.50" - 8.00" Bore)
MX0	No Mount (1.50" - 12.00" Bore)
MX1	Extended Tie Rods - Head & Cap (1.50"-12.00" Bore)
MX2	Extended Tie Rods (Cap) (1.50" - 12.00" Bore)
MX3	Extended Tie Rods (Head) (1.50" - 12.00" Bore)

Style	
(Blank)	Single Rod
D	Double Rod End

Bore		Stroke
1.5	1.50"	0" to 120" Made-To-Order
2	2.00"	
2.5	2.50"	
3.25	3.25"	
4	4.00"	
5	5.00"	
6	6.00"	
8	8.00"	
10	10.00"	
12	12.00"	

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

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

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

Options	
A	Extended Piston Rod Thread (Example: A = 2")
AS	Adjustable Stroke - Retract (Specify Length, Example: AS = 4")
AO	Air / Oil Piston
» B	.250" Urethane Bumper Both Ends
» BC	.250" Urethane Bumper Cap Only
» BH	.250" Urethane Bumper Head Only
BP	Bumper Piston Seals (1.50" - 8" Bore)
BSP	British Standard Pipe Taper (Specify Size, Example: BSP = 1/4)
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSP = 1/4)
C	Extended Piston Rod (Example: if C = 0.50", then 1" Rod Extension Is C = 1.50")
KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3S	Studded Piston Rod (KK3 With Stud, Loctite In Place)
KK4	Full Diameter Male Rod Thread
KK5	Blank Rod End (No Threads, "A" = 0")
LF	Low Friction Seals
LT	Low Temperature Seals (LT)
LTE	Low Temperature Extreme Seals (LTE)
MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust W/ Sound Dampening Bumper (12" Max Stroke)
MPR	Magnetic Piston for Reed or Solid State Switches (R10, R10P, RAC, RHT & MSS)
MS	Metallic Rod Scraper (Brass Construction)
NR	Non-Rotating
OP	Optional Port Location (Example: OP=3,7)
OS	Oversize Rod Diameter (Specify Size, Example: OS = 1.375")
SAE	SAE Ports (Specify Size, Example: SAE#10)
» SE	Spring Extend (1.50, 2.00, 2.50 Bore)
» SR	Spring Return (1.50, 2.00, 2.50 Bore)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods & Nuts
» ST	Stop Tube - Specify Stop Tube Length (in Inches) Specify Stroke as ES (Effective Stroke) (Example: TA-MS4-2X24ES-ST=3)
TMS	Steel Cylinder Tube, Black Epoxy Paint Finish
TMSS	Stainless Steel Cylinder Tube (TMSS)
TH	400 PSI Hydraulic Non-Shock
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

### About our Part Number System

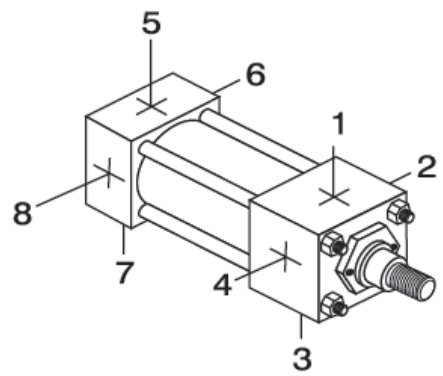
- > Simple, easy to understand
- > No excessive codes!
- > Eliminates mistakes when ordering

**Example:** A 2.5" Bore by 10" Stroke NFPA cylinder, Front Flange Mount, Head & Cap Cushions, Magnetic Piston for Switches.

**Part Number:**  
TA-MF1-2.5x10-HC-MPR

### Standard Port and Cushion Adjustment Positions

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

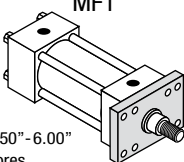
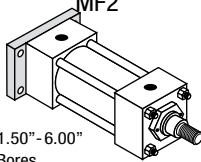
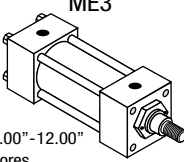
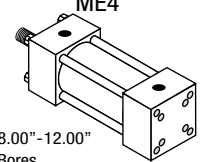
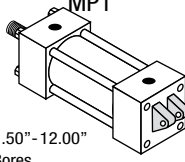
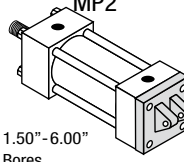
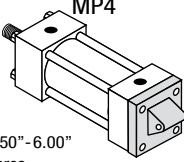
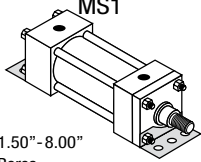
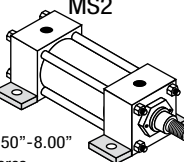
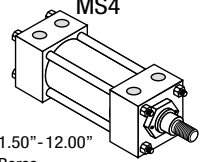
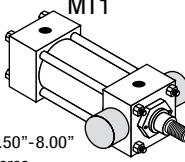
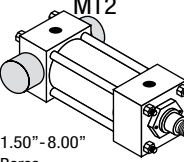
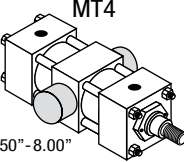
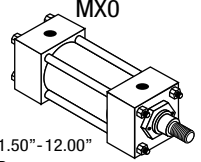
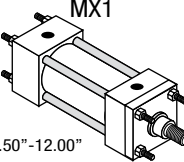
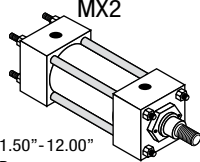
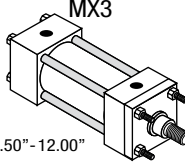


\*: Refer to Options for specifications  
» Refer to Option Length Adder

Option Length Adder (Add to Catalog Basic Overall Length Dimensions)								
Bore	Option						ST <sup>1</sup> (Stop Tube) Example: ST=2	
	B	BC	BH	ELC	ELH	SE		SR
1.50	0.500	0.250	0.250	1.000	1.000			2
2.00	0.500	0.250	0.250	1.000	1.000			2
2.50	0.500	0.250	0.250	1.000	1.000			2
3.25	0.500	0.250	0.250	1.250	1.250			2
4.00	0.500	0.250	0.250	1.250	1.250	Refer to Options for length adders and available bore sizes and strokes		2
5.00	0.500	0.250	0.250	1.250	1.250		2	
6.00	0.500	0.250	0.250	1.500	1.500		2	
8.00	0.500	0.250	0.250	1.500	1.500		2	
10.00	0.500	0.250	0.250	2.000	2.000		2	
12.00	0.500	0.250	0.250	2.000	2.000		2	

<sup>1</sup> The desired stop tube length adds directly to the overall cylinder length.

## NFPA Mounts

 <p>MF1 1.50"-6.00" Bores</p>	 <p>MF2 1.50"-6.00" Bores</p>	 <p>ME3 8.00"-12.00" Bores</p>	 <p>ME4 8.00"-12.00" Bores</p>	 <p>MP1 1.50"-12.00" Bores</p>	 <p>MP2 1.50"-6.00" Bores</p>
 <p>MP4 1.50"-6.00" Bores</p>	 <p>MS1 1.50"-8.00" Bores</p>	 <p>MS2 1.50"-8.00" Bores</p>	 <p>MS4 1.50"-12.00" Bores</p>	 <p>MT1 1.50"-8.00" Bores</p>	 <p>MT2 1.50"-8.00" Bores</p>
 <p>MT4 1.50"-8.00" Bores</p>	 <p>MX0 1.50"-12.00" Bores</p>	 <p>MX1 1.50"-12.00" Bores</p>	 <p>MX2 1.50"-12.00" Bores</p>	 <p>MX3 1.50"-12.00" Bores</p>	

# How to Specify

## About Rod End Styles

### Style 1 Male Rod End is Standard

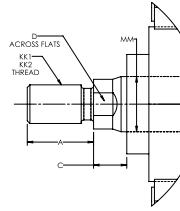
Other NFPA styles can be specified (see chart).

Need a rod end not listed? No problem! Each Piston Rod is made-to-order and does not delay shipment. Coarse UNC threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

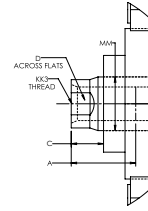
Need something not listed? Just send us a sketch. In most cases, quotes are turned around in one day!

## Piston Rod End Styles

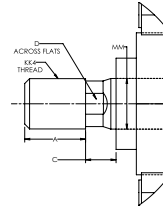
**Style 1 & 2**  
KK1 & KK2



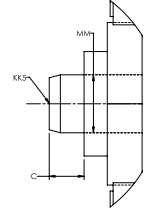
**Style 3**  
KK3



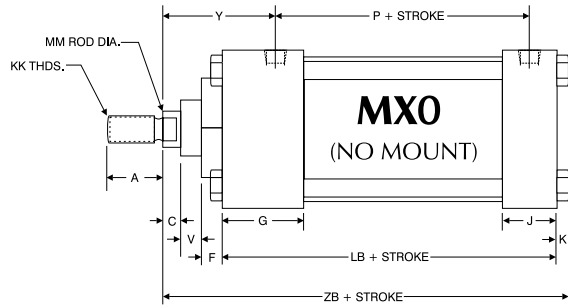
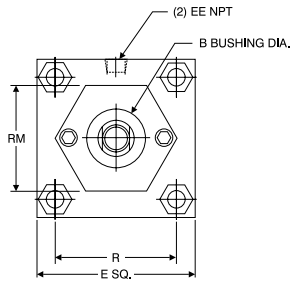
**Style 4**  
KK4



**Style 5**  
KK5



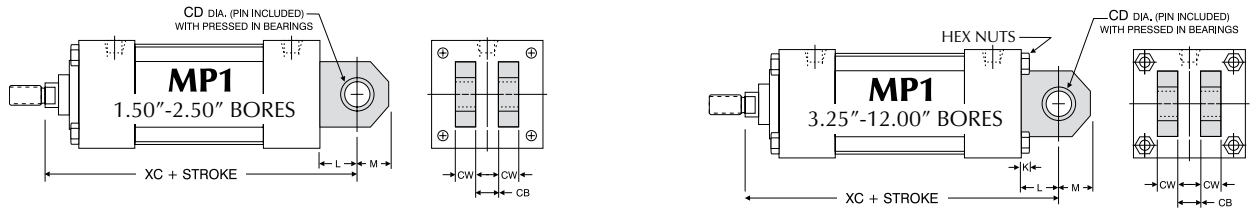
Bore	Rod Diameter (MM)	Standard		Optional						C	D	
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male				Style 5 - Blank
		KK1	A	KK2	A	KK3	A	KK4	A			KK5
1.50,	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.500
	1.000 Oversize	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1-14	1.125	No Threads	0.500	0.875
2.00, 2.50	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.500
	1.000 Oversize	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1-14	1.125	No Threads	0.500	0.875
3.25,	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.500
	1.000 Oversize	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1-14	1.125	No Threads	0.500	0.875
4.00, 5.00	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.500
	1.000 Oversize	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1-14	1.125	No Threads	0.500	0.875
6.00 & 8.00	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.500
	1.000 Oversize	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1-14	1.125	No Threads	0.500	0.875
10.00	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.500
	1.000 Oversize	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1-14	1.125	No Threads	0.500	0.875
12.00	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.500
	1.000 Oversize	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1-14	1.125	No Threads	0.500	0.875



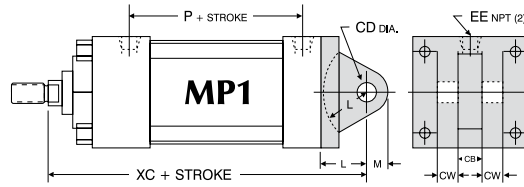
Basic Dimensions MXO Standard & Oversize Rods

Bore	Rod Diameter (MM)	A	B	C	E	EE	F	G	J	K	KK	LB	P	R	RM	V	Y	ZB
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16-20	3.625	2.375	1.438	2.00 SQ.	0.250	1.875	4.875
	1.000 Oversize	1.125	1.500	0.500	2.000	0.375	0.375	1.500	1.000	0.250	3/4-16	3.625	2.375	1.438	2.00 SQ.	0.500	2.250	5.250
2.00	0.625 Standard	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	7/16-20	3.625	2.375	1.844	1.75 HEX	0.250	1.875	4.938
	1.000 Oversize	1.125	1.500	0.500	2.500	0.375	0.375	1.500	1.000	0.313	3/4-16	3.625	2.375	1.844	2.50 SQ.	0.500	2.250	5.313
2.50	0.625 Standard	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.313	7/16-20	3.750	2.500	2.188	1.75 HEX	0.250	1.875	5.063
	1.000 Oversize	1.125	1.500	0.500	3.000	0.375	0.375	1.500	1.000	0.313	3/4-16	3.750	2.500	2.188	3.00 SQ.	0.500	2.250	5.438
3.25	0.625 Standard	0.750	1.125	0.375	3.750	0.500	0.625	1.750	1.250	0.375	3/4-16	4.250	2.750	2.766	2.75 DIA.	0.250	2.375	6.000
	1.375 Oversize	1.625	2.000	0.625	3.750	0.500	0.625	1.750	1.250	0.375	1-14	4.250	2.750	2.766	3.75 SQ.	0.375	2.625	6.250
4.00	0.625 Standard	0.750	1.125	0.375	4.500	0.500	0.625	1.750	1.250	0.375	3/4-16	4.250	2.750	3.320	2.75 DIA.	0.250	2.375	6.000
	1.375 Oversize	1.625	2.000	0.625	4.500	0.500	0.625	1.750	1.250	0.375	1-14	4.250	2.750	3.320	3.50 DIA.	0.375	2.625	6.250
5.00	0.625 Standard	0.750	1.125	0.375	5.500	0.500	0.625	1.750	1.250	0.438	3/4-16	4.500	3.000	4.100	2.75 DIA.	0.250	2.375	6.313
	1.375 Oversize	1.625	2.000	0.625	5.500	0.500	0.625	1.750	1.250	0.438	1-14	4.500	3.000	4.100	3.50 DIA.	0.375	2.625	6.563
6.00	0.625 Standard	0.750	1.125	0.375	6.500	0.750	0.625	2.000	1.500	0.438	1-14	5.000	3.250	4.875	3.50 DIA.	0.375	2.750	7.063
	1.375 Oversize	2.000	2.375	0.750	6.500	0.750	0.625	2.000	1.500	0.438	1 1/4-12	5.000	3.250	4.875	3.50 DIA.	0.500	3.000	7.313
8.00	0.625 Standard	0.750	1.125	0.375	8.500	0.750	0.625	2.000	1.500	0.563	1-14	5.125	3.375	6.438	3.50 DIA.	0.375	2.750	7.313
	1.375 Oversize	2.000	2.375	0.750	8.500	0.750	0.625	2.000	1.500	0.563	1 1/4-12	5.125	3.375	6.438	3.50 DIA.	0.500	3.000	7.563
10.00	0.625 Standard	0.750	1.125	0.375	10.625	1.000	0.625	2.250	2.000	0.688	1 1/4-12	6.375	4.313	7.922	3.50 DIA.	0.500	3.063	8.938
	1.375 Oversize	2.250	2.625	0.875	10.625	1.000	0.750	2.250	2.000	0.688	1 1/2-12	6.375	4.313	7.922	5.00 DIA.	0.375	3.188	9.063
12.00	0.625 Standard	0.750	1.125	0.375	12.750	1.000	0.750	2.250	2.000	0.688	1 1/2-12	6.875	4.813	9.400	5.00 DIA.	0.375	3.188	9.563
	1.375 Oversize	3.000	3.125	1.000	12.750	1.000	0.750	2.250	2.000	0.688	1 7/8-12	6.875	4.813	9.400	5.00 DIA.	0.500	3.438	9.813

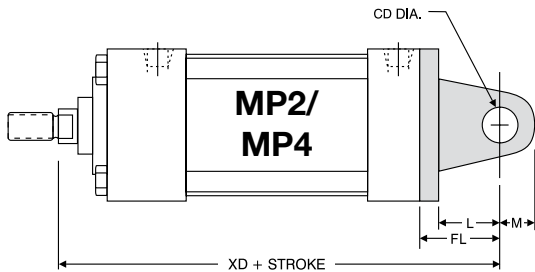
# How to Specify



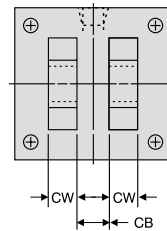
Extruded MP1 Mount  
(Extruded: 1.50" - 8.00" Bores, Weldment: 10.00" & 12.00" Bores)



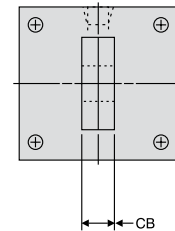
Iron Casting MP1 Mount  
(Optional)\*\*



MP2/MP4



MP2 Mount  
Iron Casting:  
1.50"-6.00" Bores



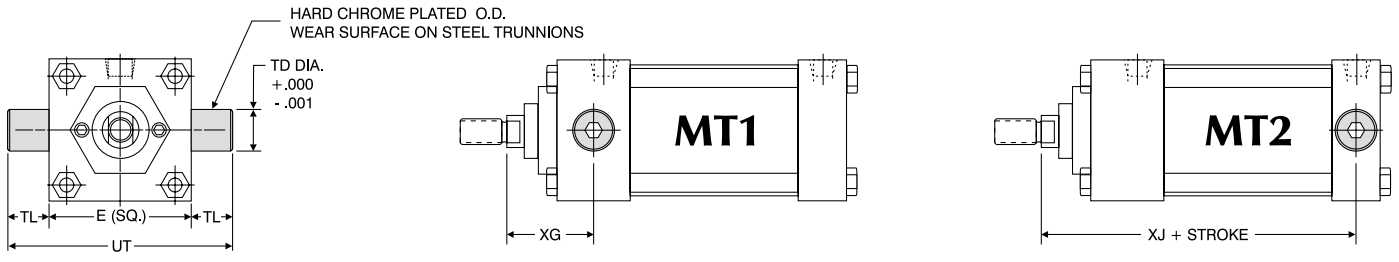
MP4 Mount  
Iron Casting: 1.50"-4.00" Bores  
Weldment: 5.00"-6.00" Bores\*

MP1, MP2 Clevis and MP4 Eye Mount Dimensions										Accessories					
Bore	Rod Diameter	CB	CD	CW	FL	K	L	M	XC	XD	Rod Clevis	Rod Eye	Clevis Pin	Eye Bracket (for MP1)	Clevis Brkt (for MP4)
1.50	0.625 Standard	0.750	0.500	0.500	1.125	N/A	0.750	0.625	5.375	5.750	RC437	RE437	CP500	EB500	CB500
	1.000 Oversize								5.750	6.125	RC750	RE750	CP750		
2.00	0.625 Standard	0.750	0.500	0.500	1.125	N/A	0.750	0.625	5.375	5.750	RC437	RE437	CP500	EB500	CB500
	1.000 Oversize								5.750	6.125	RC750	RE750	CP750		
2.50	0.625 Standard	0.750	0.500	0.500	1.125	N/A	0.750	0.625	5.500	5.875	RC437	RE437	CP500	EB500	CB500
	1.000 Oversize								5.875	6.250	RC750	RE750	CP750		
3.25	1.000 Standard	1.250	0.750	0.625	1.875	0.375	1.250	0.875	6.875	7.500	RC750	RE750	CP750	EB750	CB750
	1.375 Oversize								7.125	7.750	RC1000	RE1000	CP1000		
4.00	1.000 Standard	1.250	0.750	0.625	1.875	0.375	1.250	0.875	6.875	7.500	RC750	RE750	CP750	EB750	CB750
	1.375 Oversize								7.125	7.750	RC1000	RE1000	CP1000		
5.00*	1.000 Standard	1.250	0.750	0.625	1.875	0.438	1.250	0.875	7.125	7.750	RC750	RE750	CP750	EB750	CB750
	1.375 Oversize								7.375	8.000	RC1000	RE1000	CP1000		
6.00*	1.375 Standard	1.500	1.000	0.750	2.250	0.438	1.500	1.000	8.125	8.875	RC1000	RE1000	CP1000	EB1000	CB1000
	1.750 Oversize								8.375	9.125	RC1250	RE1250	CP1375		
8.00	1.375 Standard	1.500	1.000	0.750	N/A	0.563	1.500	1.000	8.250	N/A	RC1000	RE1000	CP1000	EB1000	CB1000
	1.750 Oversize								8.500	RC1250	RE1250	CP1375			
10.00	1.750 Standard	2.000	1.375	1.000	N/A	0.688	2.125	1.375	10.375	N/A	RC1250	RE1250	CP1375	EB1375	CB1375
	2.000 Oversize								10.500	RC1500	RE1500	CP1750	EB1750		
12.00	2.000 Standard	2.500	1.750	1.250	N/A	0.688	2.250	1.750	11.125	N/A	RC1500	RE1500	CP1750	EB1750	CB1750
	2.500 Oversize								11.375	RC1875	N/A	CP2000			

Clevis pins are provided with pivot mounts.  
\*MP4 5.00"-6.00" bores are 5-7 day delivery.  
For dimensions not shown, see page 16.

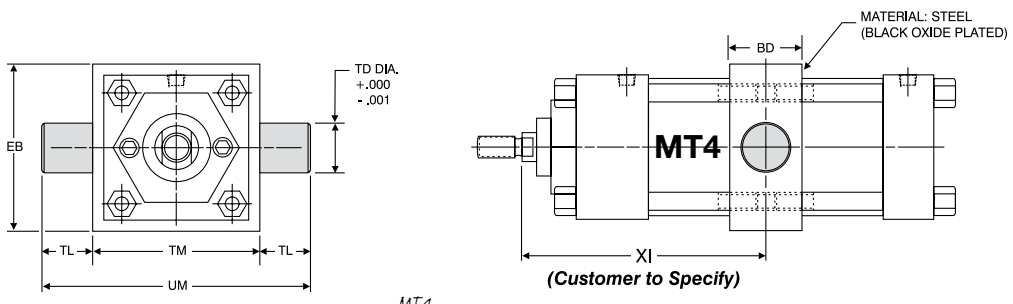
\*\*Extruded MP1 mounts are standard (1.50"-8.00" bores). Cast iron removable mounts are optional, and must be requested when ordering (1.50"-6.00" bores). Specify "CAST MP1C" when ordering.

# How to Specify



Note: MT1 and MT2 Trunnions are bolt on, non-removable design.  
Optional: One-piece solid steel trunnion available; specify MT\_S.

MT1 Head Trunnion And MT2 Cap Trunnion Mount Dimensions							Accessories			
Bore	Rod Diameter	E	TD	TL	UT	XG	Add Stroke	Rod Clevis	Rod Eye	Clevis Pin
							XJ			
1.50	0.625 Standard	2.000	1.000	1.000	4.000	1.750	4.125	RC437	RE437	CP500
	1.000 Oversize						N/A*	4.500	RC750	RE750
2.00	0.625 Standard	2.500	1.000	1.000	4.500	1.750	4.125	RC437	RE437	CP500
	1.000 Oversize						2.125	4.500	RC750	RE750
2.50	0.625 Standard	3.000	1.000	1.000	5.000	1.750	4.250	RC437	RE437	CP500
	1.000 Oversize						2.125	4.625	RC750	RE750
3.25	1.000 Standard	3.750	1.000	1.000	5.750	2.250	5.000	RC750	RE750	CP750
	1.375 Oversize						2.500	5.250	RC1000	RE1000
4.00	1.000 Standard	4.500	1.000	1.000	6.500	2.250	5.000	RC750	RE750	CP750
	1.375 Oversize						2.500	5.250	RC1000	RE1000
5.00	1.000 Standard	5.500	1.000	1.000	7.500	2.250	5.250	RC750	RE750	CP750
	1.375 Oversize						2.500	5.500	RC1000	RE1000
6.00	1.375 Standard	6.500	1.375	1.375	9.250	2.625	5.875	RC1000	RE1000	CP1000
	1.750 Oversize						2.875	6.125	RC1250	RE1250
8.00	1.375 Standard	8.500	1.375	1.375	11.250	2.625	6.000	RC1000	RE1000	CP1000
	1.750 Oversize						2.875	6.250	RC1250	RE1250



Example: TA - MT4 4 X 12  
XI = 6"

Note: MT4 Trunnions and Intermediate Section are one-piece steel construction.

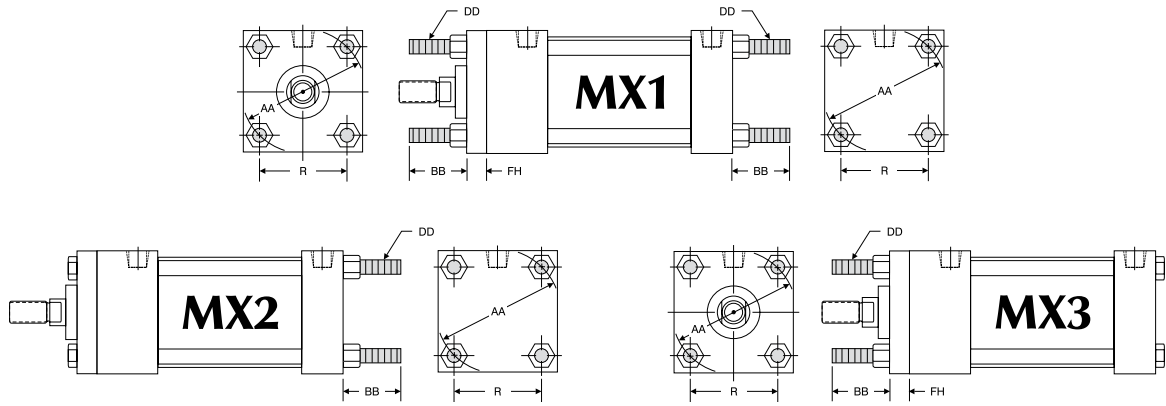
MT4 Intermediate Trunnion Mount Dimensions							
Bore	BD	EB	TD	TL	TM	UM	XI
1.50	1.250	2.500	1.000	1.000	2.500	4.500	Customer to Specify
2.00	1.500	3.000	1.000	1.000	3.000	5.000	
2.50	1.500	3.500	1.000	1.000	3.500	5.500	
3.25	2.000	4.250	1.000	1.000	4.500	6.500	
4.00	2.000	5.000	1.000	1.000	5.250	7.250	
5.00	2.000	6.000	1.000	1.000	6.250	8.250	
6.00	2.000	7.000	1.375	1.375	7.625	10.375	
8.00	2.500	9.500	1.375	1.375	9.750	12.500	

MT1, MT2, MT4 Standard Cushion Locations		
Mount	Head Cushion	Cap Cushion
MT1	3	6
MT2	2	7
MT4	2	6

Note: Ports or cushions cannot be on same side as MT1 & MT2 Trunnions.



# How to Specify



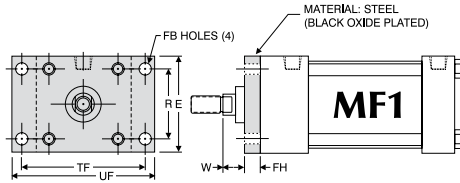
Tie Rod Extended MX1, MX2 & MX3 Mount Dimensions						
Bore	Rod Diameter	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4-28	0.375	1.430
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16-24	0.375	1.840
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16-24	0.375	2.190
	1.000 Oversize					
3.25	1.000 Standard	3.900	1.375	3/8-24	0.625	2.760
	1.375 Oversize					
4.00	1.000 Standard	4.700	1.375	3/8-24	0.625	3.320
	1.375 Oversize					

Tie Rod Extended MX1, MX2 & MX3 Mount Dimensions						
Bore	Rod Diameter	AA	BB	DD	FH	R
5.00	1.000 Standard	5.800	1.813	1/2-20	0.625	4.100
	1.375 Oversize					
6.00	1.375 Standard	6.900	1.813	1/2-20	0.750	4.880
	1.750 Oversize					
8.00	1.375 Standard	9.100	2.313**	5/8-18	0.625*	6.440
	1.750 Oversize					
10.00	1.750 Oversize	11.200	2.688**	3/4-16	0.625*	7.920
	2.000 Oversize					
12.00	2.000 Standard	13.300	2.688**	3/4-16	0.750*	9.400
	2.500 Oversize					

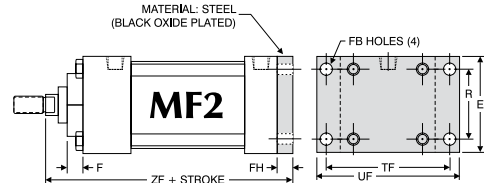
\*MX1 & MX3 have full square bushing retainer on 1.50" - 6.00" bores, round retainers on 8.00" - 12.00" bores.

\*\*BB dimension from face of head.

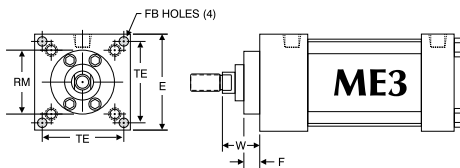
For dimensions not shown, see page 16.



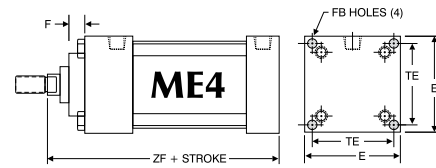
1.50" - 6.00" bores



1.50" - 6.00" bores



8.00" - 12.00" bores



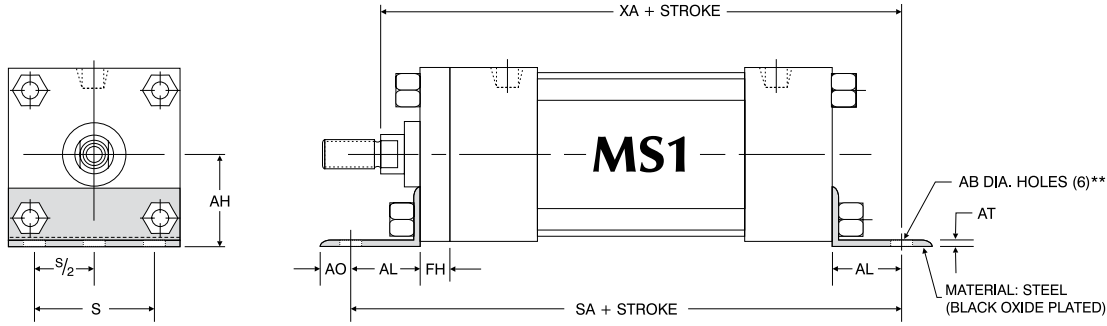
8.00" - 12.00" bores

MF1, MF2 Flange & ME3, ME4 Cap Mount Dimensions											
Bore	Rod Diameter	E	F	FB	FH	R	RM	TE	TF	UF	ZF
1.50	0.625 Standard	2.000	0.375	0.313	0.375	1.438	N/A	N/A	2.750	3.375	0.625
	1.000 Oversize										5.000
2.00	0.625 Standard	2.500	0.375	0.375	0.375	1.848	N/A	N/A	3.375	4.125	0.625
	1.000 Oversize										5.000
2.50	0.625 Standard	3.000	0.375	0.375	0.375	2.188	N/A	N/A	3.875	4.625	0.625
	1.000 Oversize										5.125
3.25	1.000 Standard	3.750	0.625	0.438	0.625	2.766	N/A	N/A	4.688	5.500	0.750
	1.375 Oversize										6.250
4.00	1.000 Standard	4.500	0.625	0.438	0.625	3.328	N/A	N/A	5.438	6.250	0.750
	1.375 Oversize										6.500

MF1, MF2 Flange & ME3, ME4 Cap Mount Dimensions											
Bore	Rod Diameter	E	F	FB	FH	R	RM	TE	TF	UF	ZF
5.00	1.000 Standard	5.500	0.625	0.563	0.625	4.100	N/A	N/A	6.625	7.625	0.750
	1.375 Oversize										6.500
6.00	1.375 Standard	6.500	0.625	0.563	0.750	4.875	N/A	N/A	7.625	8.625	0.875
	1.750 Oversize										7.625
8.00	1.375 Standard	8.500	0.625	0.688	N/A	N/A	3.500	7.570	N/A	N/A	1.625
	1.750 Oversize										7.000
10.00	1.750 Standard	10.625	0.625	0.813	N/A	N/A	3.500	9.400	N/A	N/A	1.875
	2.000 Oversize										8.250
12.00	2.000 Standard	12.750	0.750	0.813	N/A	N/A	5.000	11.100	N/A	N/A	2.000
	2.500 Oversize										8.875

For dimensions not shown, see page 16.

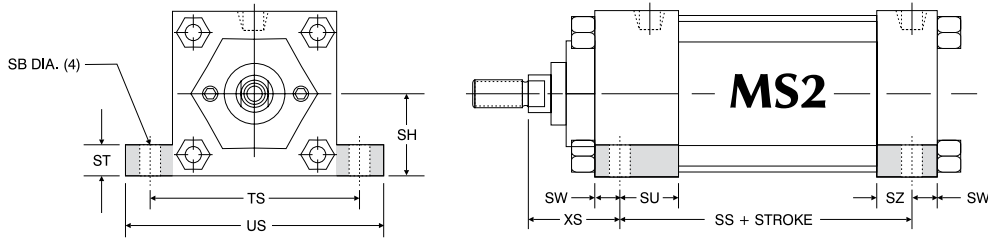
# How to Specify



**MS1 Angle Mount Dimensions**

Bore	Rod Diameter	AB	AH	AL	AO	AT	FH	S	Add Stroke	
									SA	XA
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.188	0.375	1.250	6.000	5.625
	1.000 Oversize									6.000
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.188	0.375	1.750	6.000	5.625
	1.000 Oversize									6.000
2.50	0.625 Standard	0.438	1.625	1.000	0.375	0.188	0.375	2.250	6.125	5.750
	1.000 Oversize									6.125
3.25	1.000 Standard	0.563	1.938	1.250	0.500	0.125	0.625	2.750	7.375	6.875
	1.375 Oversize									7.125
4.00	1.000 Standard	0.563	2.250	1.250	0.500	0.125	0.625	3.500	7.375	6.875
	1.375 Oversize									7.125
5.00	1.000 Standard	0.688	2.750	1.375	0.625	0.188	0.625	4.250	7.875	7.250
	1.375 Oversize									7.500
6.00	1.375 Standard	0.813	3.250	1.375	0.625	0.188	0.750	5.250	8.500	8.000
	1.750 Oversize									8.250
8.00	1.375 Standard	0.813	4.250	1.813	0.688	0.250	0.625*	7.125	8.750	8.563
	1.750 Oversize									8.813

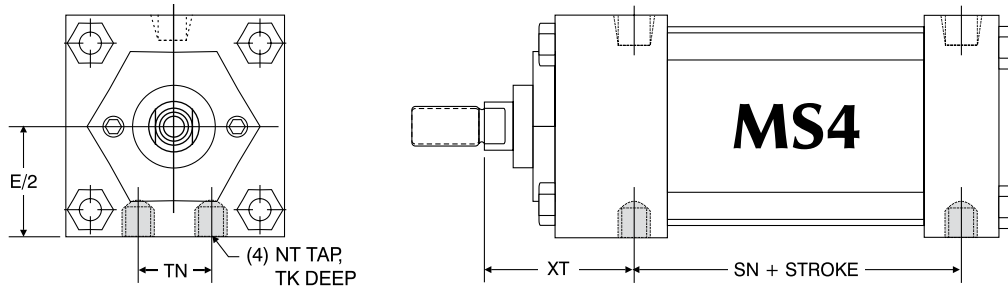
\*3.50" diameter round retainer on 8.00" bore (MS1 bracket bolted directly to head).  
 \*\*1.50" bore has four (4) AB diameter holes.



**MS2 Side Lug Mount Dimensions**

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

For dimensions not shown, see page 16.



**MS4 Bottom Tapped Mount Dimensions**

Bore	Rod Diameter	E/2	NT	TK	TN	XT	Add Stroke
							SN
1.50	0.625 Standard	1.000	1/4-20	0.375	0.625	1.938	2.250
	1.000 Oversize						
2.00	0.625 Standard	1.250	5/16-18	0.500	0.875	1.938	2.250
	1.000 Oversize						
2.50	0.625 Standard	1.500	3/8-16	0.625	1.250	1.938	2.375
	1.000 Oversize						
3.25	1.000 Standard	1.875	1/2-13	0.750	1.500	2.438	2.625
	1.375 Oversize						
4.00	1.000 Standard	2.250	1/2-13	0.750	2.063	2.438	2.625
	1.375 Oversize						
5.00	1.000 Standard	2.750	5/8-11	1.000	2.688	2.438	2.875
	1.375 Oversize						
6.00	1.375 Standard	3.250	3/4-10	1.125	3.250	2.813	3.125
	1.750 Oversize						
8.00	1.375 Standard	4.250	3/4-10	1.125	4.500	2.813	3.250
	1.750 Oversize						
10.00	1.750 Standard	5.313	1-8	1.500	5.500	3.125	4.125
	2.000 Oversize						
12.00	2.000 Standard	6.375	1-8	1.500	7.250	3.250	4.625
	2.500 Oversize						

### Combination Mounts

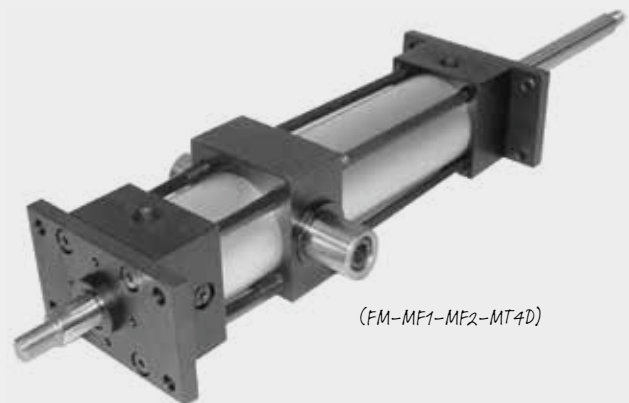
Cylinders can be ordered with a combination of mounts for added design flexibility.

### How to Order

Combination mount part numbers can be constructed by adding a dash (-) in between the desired mounts in the part number.

**Example:** 5.00" Bore TA Series cylinder with 12.00" Stroke, Head and Cap Cushions, Magnetic Piston for Reed Switches and having a MS4 and MF1 Mount.

**Part Number:** TA-MS4-MF1-5 x 12-HC-MPR



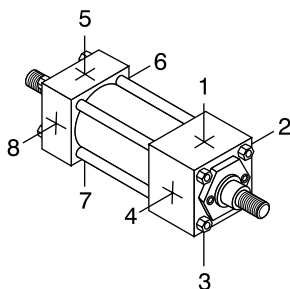
(FM-MF1-MF2-MT4D)

# Product Features

## TA Series - Double Rod End

### Benefits

- > Standard and Oversize Piston Rods available.
- > Full range of Standard Options.
- > Durable design. Full Rod Bearing at each end of cylinder.
- > Can be provided with Hollow Piston Rods (gun-drilled through to your size requirements).
- > Can be used in adjustable extend stroke applications by adding a stop collar on one rod end or option "MA" (refer to Options).



### Standard Port and Cushion Adjustment Positions

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

### About Rod End Styles

#### Style 1 Male Rod End is Standard

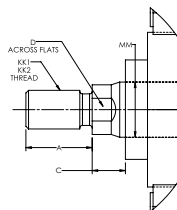
Other NFPA styles can be specified (see chart).

Need a rod end not listed? No problem! Each Piston Rod is made-to-order and does not delay shipment. Coarse UNC threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

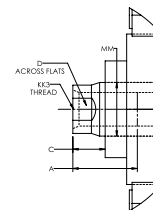
Need something not listed? Just send us a sketch. In most cases, quotes are turned around in one day!

### Piston Rod End Styles

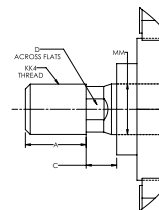
Style 1 & 2  
KK1 & KK2



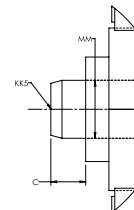
Style 3  
KK3



Style 4  
KK4

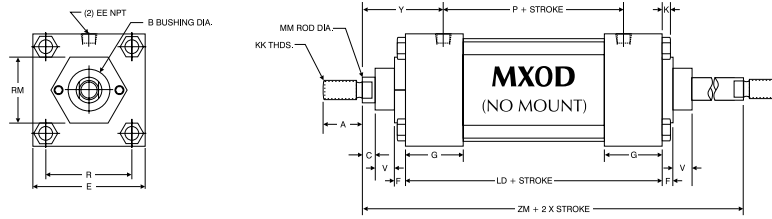


Style 5  
KK5



Bore	Rod Diameter (MM)	Standard		Optional							C	D
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male		Style 5 - Blank		
		KK1	A	KK2	A	KK3	A	KK4	A	KK5		
1.50,	0.625 Standard	7/16-20	0.750	1/2-20	0.750	7/16-20	0.750	5/8-18	0.750	No Threads	0.375	0.500
2.00, 2.50	1.000 Oversize	3/4-16	1.125	7/8-14	1.125	3/4-16	1.125	1-14	1.125	No Threads	0.500	0.875
3.25,	1.000 Standard	3/4-16	1.125	7/8-14	1.125	3/4-16	1.125	1-14	1.125	No Threads	0.500	0.875
4.00, 5.00	1.375 Oversize	1-14	1.625	1 1/4-12	1.625	1-14	1.625	1 3/8-12	1.625	No Threads	0.625	1.125
6.00 & 8.00	1.375 Standard	1-14	1.625	1 1/4-12	1.625	1-14	1.625	1 3/8-12	1.625	No Threads	0.625	1.125
	1.750 Oversize	1 1/4-12	2.000	1 1/2-12	2.000	1 1/4-12	2.000	1 3/4-12	2.000	No Threads	0.750	1.500
10.00	1.750 Standard	1 1/4-12	2.000	1 1/2-12	2.000	1 1/4-12	2.000	1 3/4-12	2.000	No Threads	0.750	1.500
	2.000 Oversize	1 1/2-12	2.250	1 3/4-12	2.250	1 1/2-12	2.250	2-12	2.250	No Threads	0.875	1.750
12.00	2.000 Standard	1 1/2-12	2.250	1 3/4-12	2.250	1 1/2-12	2.250	2-12	2.250	No Threads	0.875	1.750
	2.500 Oversize	1 7/8-12	3.000	2 1/4-12	3.000	1 7/8-12	3.000	2 1/2-12	3.000	No Threads	1.000	2.125

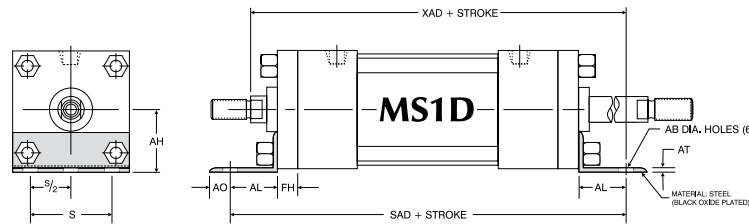
## Double Rod End MX0D (No Mount)



Double Rod End Basic Dimensions MX0D Standard & Oversize Rods

Bore	Rod Diameter	A	B	C	E	EE	F	G	K	KK	LD	MM	P	R	RM	V	Y	ZM
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	1.500	0.250	7/16-20	4.125	0.625	2.375	1.430	2.00 SQ.	0.250	1.875	6.125
	1.000 Oversize	1.125	1.500	0.500						3/4-16		1.000						
2.00	0.625 Standard	0.750	1.125	0.375	2.500	0.375	0.375	1.500	0.313	7/16-20	4.125	0.625	2.375	1.844	1.75 HEX	0.250	1.875	6.125
	1.000 Oversize	1.125	1.500	0.500						3/4-16		1.000			2.500			
2.50	0.625 Standard	0.750	1.125	0.375	3.000	0.375	0.375	1.500	0.313	7/16-20	4.250	0.625	2.500	2.188	1.75 HEX	0.250	1.875	6.250
	1.000 Oversize	1.125	1.500	0.500						3/4-16		1.000			3.000			
3.25	1.000 Standard	1.125	1.500	0.500	3.750	0.500	0.625	1.750	0.375	3/4-16	4.750	1.000	2.750	2.760	2.75 DIA.	0.250	2.375	7.500
	1.375 Oversize	1.625	2.000	0.625						1-14		1.375			3.750			
4.00	1.000 Standard	1.125	1.500	0.500	4.500	0.500	0.625	1.750	0.375	3/4-16	4.750	1.000	2.750	3.320	2.75 DIA.	0.250	2.375	7.500
	1.375 Oversize	1.625	2.000	0.625						1-14		1.375			3.500			
5.00	1.000 Standard	1.125	1.500	0.500	5.500	0.500	0.625	1.750	0.438	3/4-16	5.000	1.000	3.000	4.100	2.75 DIA.	0.250	2.375	7.750
	1.375 Oversize	1.625	2.000	0.625						1-14		1.375			3.500			
6.00	1.375 Standard	1.625	2.000	0.625	6.500	0.750	0.625	2.000	0.438	1-14	5.500	1.375	3.250	4.875	3.50 DIA.	0.375	2.750	8.750
	1.750 Oversize	2.000	2.375	0.750						1 1/4-12		1.750			0.500			
8.00	1.375 Standard	1.625	2.000	0.625	8.500	0.750	0.625	2.000	0.563	1-14	5.625	1.375	3.375	6.438	3.50 DIA.	0.375	2.750	8.875
	1.750 Oversize	2.000	2.375	0.750						1 1/4-12		1.750			0.500			
10.00	1.750 Standard	2.000	2.375	0.750	10.625	1.000	0.625	2.250	0.688	1 1/4-12	6.625	1.750	4.313	7.922	3.50 DIA.	0.500	3.060	10.375
	2.000 Oversize	2.250	2.625	0.875			1 1/2-12			2.000		5.000			10.625			
12.00	2.000 Standard	2.250	2.625	0.875	12.750	1.000	0.750	2.250	0.688	1 1/2-12	7.125	2.000	4.813	9.400	5.00 DIA.	0.375	3.188	11.125
	2.500 Oversize	3.000	3.125	1.000						1 7/8-12		2.500			0.500			

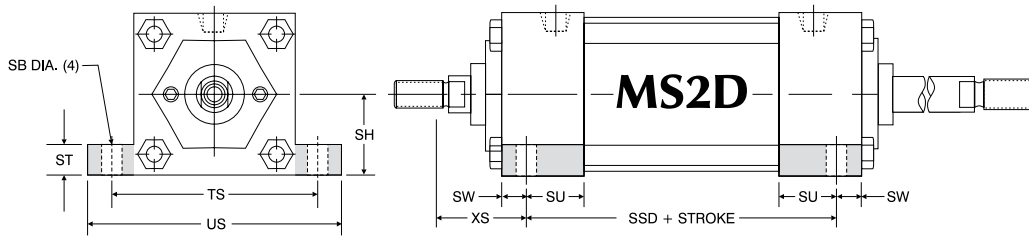
## Double Rod End Base Mounts



MS1D Angle Mount Dimensions

Bore	Rod Diameter	AB	AH	AL	AO	AT	FH	S	Add Stroke	
									SAD	XAD
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.188	0.375	1.250	6.875	6.500
	1.000 Oversize									6.875
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.188	0.375	1.750	6.875	6.500
	1.000 Oversize									6.875
2.50	0.625 Standard	0.438	1.625	1.000	0.375	0.188	0.375	2.250	7.000	6.625
	1.000 Oversize									7.000
3.25	1.000 Standard	0.563	1.938	1.250	0.500	0.125	0.625	2.750	8.500	8.000
	1.375 Oversize									8.250
4.00	1.000 Standard	0.563	2.250	1.250	0.500	0.125	0.625	3.500	8.500	8.000
	1.375 Oversize									8.250
5.00	1.000 Standard	0.688	2.750	1.375	0.625	0.188	0.625	4.250	9.000	8.375
	1.375 Oversize									8.625
6.00	1.375 Standard	0.813	3.250	1.375	0.625	0.188	0.750	5.250	9.750	9.250
	1.750 Oversize									9.500
8.00	1.375 Standard	0.813	4.250	1.813	0.688	0.250	0.625*	7.125	9.250	9.063
	1.750 Oversize									9.313

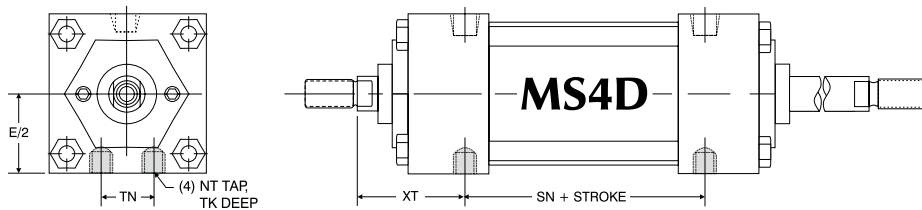
# How to Specify



**Double Rod End MS2D Side Lug Mount Dimensions**

Bore	Rod Diameter	SB	SH	ST	SU	SW	TS	US	XS	Add Stroke
										SSD
1.50	0.625 Standard	0.438	1.000	0.500	1.125	0.375	2.750	3.500	1.375	3.375
	1.000 Oversize									
2.00	0.625 Standard	0.438	1.250	0.500	1.125	0.375	3.250	4.000	1.375	3.375
	1.000 Oversize									
2.50	0.625 Standard	0.438	1.500	0.500	1.125	0.375	3.750	4.500	1.375	3.500
	1.000 Oversize									
3.25	1.000 Standard	0.563	1.875	0.750	1.250	0.500	4.750	5.750	1.875	3.750
	1.375 Oversize									
4.00	1.000 Standard	0.563	2.250	0.750	1.250	0.500	5.500	6.500	1.875	3.750
	1.375 Oversize									
5.00	1.000 Standard	0.813	2.750	1.000	1.063	0.688	6.875	8.250	2.063	3.625
	1.375 Oversize									
6.00	1.375 Standard	0.813	3.250	1.000	1.313	0.688	7.875	9.250	2.313	4.125
	1.750 Oversize									
8.00	1.375 Standard	0.813	4.250	1.000	1.563	0.688	9.875	11.250	2.313	4.250
	1.750 Oversize									

For dimensions not shown, see page 23.

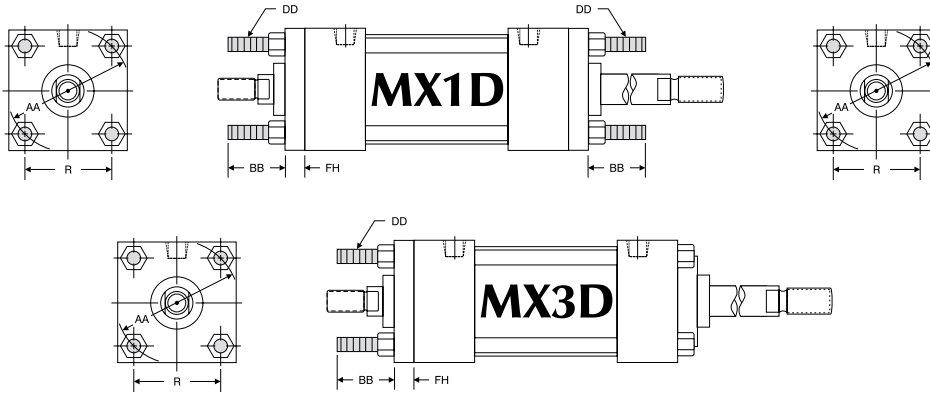


**Double Rod End MS4D Bottom Tapped Mount Dimensions**

Bore	Rod Diameter	E/2	NT	TK	TN	XT	Add Stroke
							SN
1.50	0.625 Standard	1.000	1/4-20	0.375	0.625	1.938	2.250
	1.000 Oversize						
2.00	0.625 Standard	1.250	5/16-18	0.500	0.875	1.938	2.250
	1.000 Oversize						
2.50	0.625 Standard	1.500	3/8-16	0.625	1.250	1.938	2.375
	1.000 Oversize						
3.25	1.000 Standard	1.875	1/2-13	0.750	1.500	2.438	2.625
	1.375 Oversize						
4.00	1.000 Standard	2.250	1/2-13	0.750	2.063	2.438	2.625
	1.375 Oversize						
5.00	1.000 Standard	2.750	5/8-11	1.000	2.688	2.438	2.875
	1.375 Oversize						
6.00	1.375 Standard	3.250	3/4-10	1.125	3.250	2.813	3.125
	1.750 Oversize						
8.00	1.375 Standard	4.250	3/4-10	1.125	4.500	2.813	3.250
	1.750 Oversize						
10.00	1.750 Standard	5.313	1-8	1.500	5.500	3.125	4.125
	2.000 Oversize						
12.00	2.000 Standard	6.375	1-8	1.500	7.250	3.250	4.625
	2.500 Oversize						

For dimensions not shown, see page 23.

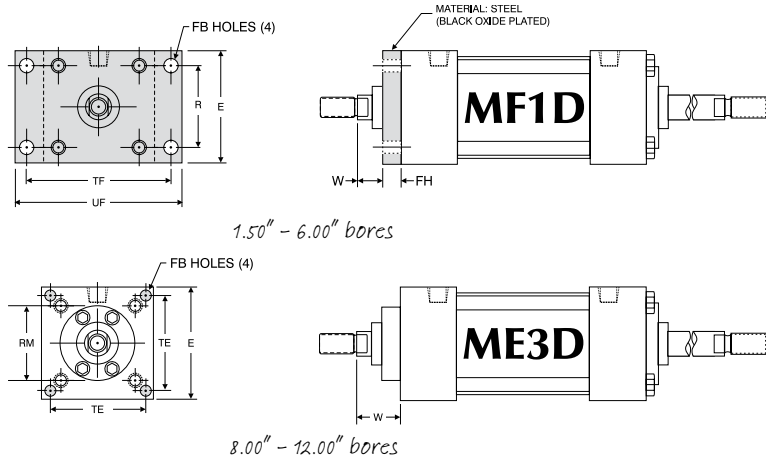
# How to Specify



Tie Rod Extended MX1D & MX3D Mount Dimensions						
Bore	Rod Diameter	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4-28	0.375	1.438
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16-24	0.375	1.844
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16-24	0.375	2.188
	1.000 Oversize					
3.25	1.000 Standard	3.900	1.375	3/8-24	0.625	2.760
	1.375 Oversize					
4.00	1.000 Standard	4.700	1.375	3/8-24	0.625	3.320
	1.375 Oversize					

Tie Rod Extended MX1D & MX3D Mount Dimensions						
Bore	Rod Diameter	AA	BB	DD	FH	R
5.00	1.000 Standard	5.800	1.813	1/2-20	0.625	4.100
	1.375 Oversize					
6.00	1.375 Standard	6.900	1.813	1/2-20	0.750	4.880
	1.750 Oversize					
8.00	1.375 Standard	9.100	2.313**	5/8-18	0.625*	6.440
	1.750 Oversize					
10.00	1.750 Oversize	11.200	2.688**	3/4-16	0.625*	7.920
	2.000 Oversize					
12.00	2.000 Standard	13.300	2.688**	3/4-16	0.750*	9.400
	2.500 Oversize					

\*Full square bushing retainer on 1.50" - 6.00" bores, round retainers on 8.00" - 12.00" bores.  
 \*\*BB dimension from head on 8.00", 10.00" & 12.00" bores.



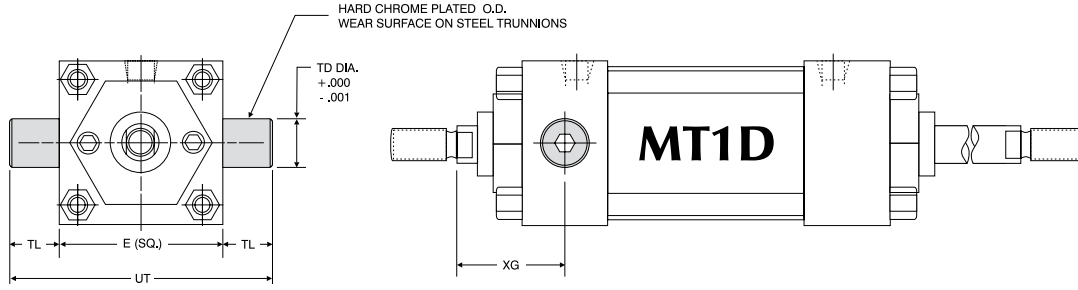
MF1D Flange & ME3D Cap Mount Dimensions										
Bore	Rod Diameter	E	FB	FH	R	RM	TE	TF	UF	W
1.50	0.625 Standard	2.000	0.313	0.375	1.438	N/A	N/A	2.750	3.375	0.625
	1.000 Oversize									1.000
2.00	0.625 Standard	2.500	0.375	0.375	1.844	N/A	N/A	3.375	4.125	0.625
	1.000 Oversize									1.000
2.50	0.625 Standard	3.000	0.375	0.375	2.188	N/A	N/A	3.875	4.625	0.625
	1.000 Oversize									1.000
3.25	1.000 Standard	3.750	0.438	0.625	2.760	N/A	N/A	4.688	5.500	0.750
	1.375 Oversize									1.000
4.00	1.000 Standard	4.500	0.438	0.625	3.320	N/A	N/A	5.438	6.250	0.750
	1.375 Oversize									1.000

MF1D Flange & ME3D Cap Mount Dimensions										
Bore	Rod Diameter	E	FB	FH	R	RM	TE	TF	UF	W
5.00	1.000 Standard	5.500	0.563	0.625	4.100	N/A	N/A	6.625	7.625	0.750
	1.375 Oversize									1.000
6.00	1.375 Standard	6.500	0.563	0.750	4.875	N/A	N/A	7.625	8.625	0.875
	1.750 Oversize									1.125
8.00	1.375 Standard	8.500	0.688	N/A	N/A	3.500	7.570	N/A	N/A	1.625
	1.750 Oversize									1.875
10.00	1.750 Standard	10.625	0.813	N/A	N/A	3.500	9.400	N/A	N/A	1.875
	2.000 Oversize									2.000
12.00	2.000 Standard	12.750	0.813	N/A	N/A	5	11.100	N/A	N/A	2.000
	2.500 Oversize									2.250

For dimensions not shown, see page 23



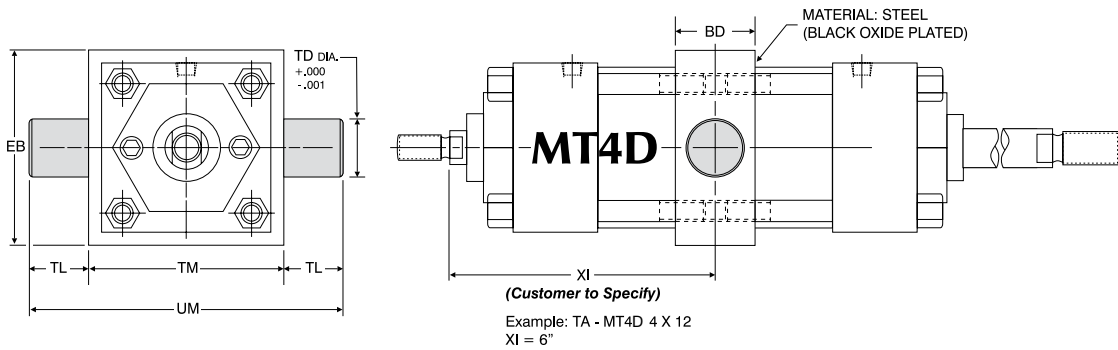
# How to Specify



Note: MT1D Trunnions are bolt on, non-removable design.

Double Rod End MT1D Head Trunnion Mount Dimensions						
Bore	Rod Diameter	E	TD	TL	UT	XG
1.50	0.625 Standard N/A*	2.000	1.000	1.000	4.000	1.750 N/A
2.00	0.625 Standard 1.000 Oversize	2.500	1.000	1.000	4.500	1.750 2.125
2.50	0.625 Standard 1.000 Oversize	3.000	1.000	1.000	5.000	1.750 2.125
3.25	1.000 Standard 1.375 Oversize	3.750	1.000	1.000	5.750	2.250 2.500
4.00	1.000 Standard 1.375 Oversize	4.500	1.000	1.000	6.500	2.250 2.500
5.00	1.000 Standard 1.375 Oversize	5.500	1.000	1.000	7.500	2.250 2.500
6.00	1.375 Standard 1.750 Oversize	6.500	1.375	1.375	9.250	2.625 2.875
8.00	1.375 Standard 1.750 Oversize	8.500	1.375	1.375	11.250	2.625 2.875

\*No oversize rod available on 1.50" bore MT1D.  
For dimensions not shown, see page 23.



Note: MT4D Trunnions and Intermediate Section are one-piece steel construction.

Double Rod End MT4D Intermediate Trunnion Mount Dimensions							
Bore	BD	EB	TD	TL	TM	UM	XI
1.50	1.250	2.500	1.000	1.000	2.500	4.500	
2.00	1.500	3.000	1.000	1.000	3.000	5.000	
2.50	1.500	3.500	1.000	1.000	3.500	5.500	
3.25	2.000	4.250	1.000	1.000	4.500	6.500	
4.00	2.000	5.000	1.000	1.000	5.250	7.250	
5.00	2.000	6.000	1.000	1.000	6.250	8.250	
6.00	2.000	7.000	1.375	1.375	7.625	10.375	
8.00	2.500	9.500	1.375	1.375	9.750	12.500	

Customer to Specify

MT1D, MT4D Standard Cushion Locations		
Mount	Head Cushion	Cap Cushion
MT1D	3	6
MT4D	2	6

Note: Ports or cushions cannot be on same side as MT1D Trunnions.



# TD Series Cylinders

Bimba's TD Series line of NFPA pneumatics is specially designed to feature bumper piston seals, reducing overall noise and machine vibration during high velocity applications.



# Contents

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<b>29</b>	Product Features
	29 – Tough-Duty Design
	29 – Operating Pressure
	29 – Operating Temperature
	29 – Performance Options

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<b>30</b>	NFPA Mounts
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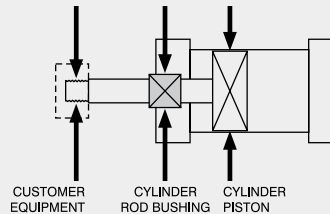
<b>31</b>	How to Order
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## Floating Rod Bushing

**Self Alignment Feature:** Rod Bushing is designed to float .002" to improve bearing surface alignment.

- > Reduces cylinder drag and erratic operation
- > Reduces cylinder wear
- > Provides a minimum of 25% longer life than fixed rod bushing designs



## Tough-Duty Design

Same construction as TA Series with these performance features standard:

- > **Impact Dampening Piston Seals** – BP Seals are designed to reduce machine vibration and noise. Higher piston velocities can be achieved due to the rapid deceleration feature, increasing productivity. Bumper Seals are rated for tough-duty, yet offer quieter operation than standard cylinder designs (refer to Options: BP Seals for performance considerations).
- > **Fixed Cushions** – Head and Cap Cushions are standard. The fixed design utilizes an internal orifice for a predetermined flow rate, eliminating the need for adjustments. The fixed cushion design provides tamper-free operation and guarantees a cushion function at each end of full stroke.

## Self-Lubricating Cylinder Design

PTFE coated cast iron bushing, PTFE Wear Band, Hard-Chrome Plated Piston Rod, Hard-Coated Aluminum Tube and PTFE based grease provide permanent lubrication and long cylinder life.

## Operating Pressure

**250 PSI air (17 bar)**

## Operating Temperature

**Carboxilated Nitrile:** -20°F to 200°F (-29°C to 93°C)

**Fluorocarbon:** 0°F to 400°F (-18°C to 204°C)

## Performance Options

*Refer to Options for Details.*

**H or C** – Adjustable Cushions allow the cylinder to be adjusted to each application, providing the optimum cushion performance and harmonious motion.

**Extended Cushion Lengths** – Longer cushions increase the capacity of air cushions, eliminating costly hydraulic shock absorbers in some cases. Choose from three different cushion lengths for maximum performance.

**MPR** – Magnetic Piston (for position sensing switches).

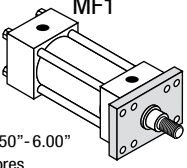
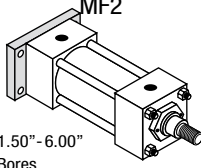
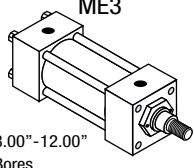
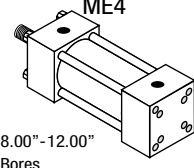
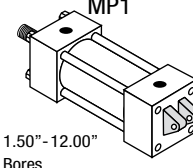
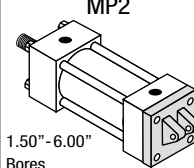
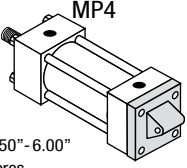
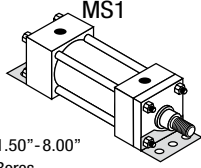
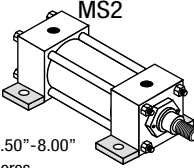
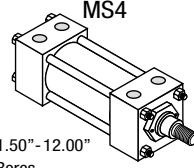
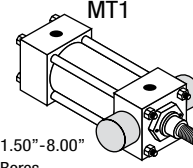
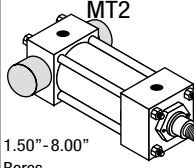
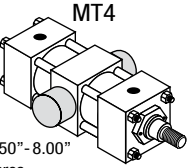
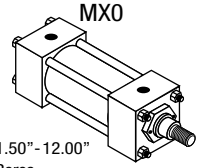
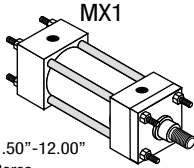
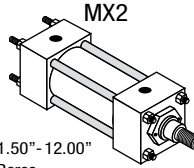
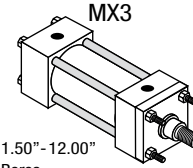
**BSP or SAE Ports** – Special ports are available and do not increase delivery time.

**Any English or Metric Piston Rod Thread** – Non-standard rod threads are available and do not increase delivery time.

**TMS Steel Tube** – Hydraulic grade chrome plated ID and honed steel tubing, black epoxy paint finish OD.

# How to Specify

## NFPA Mounts

 <p>MF1 1.50"-6.00" Bores</p>	 <p>MF2 1.50"-6.00" Bores</p>	 <p>ME3 8.00"-12.00" Bores</p>	 <p>ME4 8.00"-12.00" Bores</p>	 <p>MP1 1.50"-12.00" Bores</p>	 <p>MP2 1.50"-6.00" Bores</p>
 <p>MP4 1.50"-6.00" Bores</p>	 <p>MS1 1.50"-8.00" Bores</p>	 <p>MS2 1.50"-8.00" Bores</p>	 <p>MS4 1.50"-12.00" Bores</p>	 <p>MT1 1.50"-8.00" Bores</p>	 <p>MT2 1.50"-8.00" Bores</p>
 <p>MT4 1.50"-8.00" Bores</p>	 <p>MX0 1.50"-12.00" Bores</p>	 <p>MX1 1.50"-12.00" Bores</p>	 <p>MX2 1.50"-12.00" Bores</p>	 <p>MX3 1.50"-12.00" Bores</p>	

Refer to pages 16-23 for mounting dimensions

## TD - MF1 - 2.5 x 10 - MPR

Series	
TD	250 PSI air

NFPA Mounts	
MF1	Front Flange (1.50" - 6.00" Bore)
MF2	Rear Flange (1.50" - 6.00" Bore)
ME3	Front Mounting Holes (8.00" - 12.00" Bore)
ME4	Rear Mounting Holes (8.00" - 12.00" Bore)
MP1	Rear Pivot Clevis (1.50" - 12.00" Bore)
MP2	Rear Pivot Clevis (1.50" - 6.00" Bore)
MP4	Rear Pivot Eye (1.50" - 6.00" Bore)
MS1	Front & Rear End Angle (1.50" - 8.00" Bore)
MS2	Side Lug (1.50" - 8.00" Bore)
MS4	Bottom Tapped Holes (1.50" - 12.00" Bore)
MT1	Front Trunnion (1.50" - 8.00" Bore)
MT2	Rear Trunnion (1.50" - 8.00" Bore)
MT4	Intermediate Trunnion (1.50" - 8.00" Bore)
MX0	No Mount (1.50" - 12.00" Bore)
MX1	Extended Tie Rods - Head & Cap (1.50"-12.00" Bore)
MX2	Extended Tie Rods (Cap) (1.50" - 12.00" Bore)
MX3	Extended Tie Rods (Head) (1.50" - 12.00" Bore)

Style	
(Blank)	Single Rod
D	Double Rod End

Bore	Stroke
1.5	1.50" 0" to 120" Made-To-Order
2	2.00"
2.5	2.50"
3.25	3.25"
4	4.00"
5	5.00"
6	6.00"
8	8.00"

Options	
A	Extended Piston Rod Thread (Example: A = 2")
AS	Adjustable Stroke - Retract (Specify Length, Example: AS = 4")
BSPP	British Standard Pipe Taper (Specify Size, Example: BSPP = 1/4)
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSPT = 1/4)
C	Extended Piston Rod (Example: if C = 0.50", then 1" Rod Extension Is C = 1.50")
KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3S	Studded Piston Rod (KK3 With Stud, Loctite In Place)
KK4	Full Diameter Male Rod Thread
KK5	Blank Rod End (No Threads, "A" = 0")
MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust W/ Sound Dampening Bumper (12" Max Stroke)
MPR	Magnetic Piston for Reed or Solid State Switches (R10, R10P, RAC, RHT & MSS)
MS	Metallic Rod Scraper (Brass Construction)
NR	Non-Rotating
OP	Optional Port Location (Example: OP=3,7)
OS	Oversize Rod Diameter (Specify Size, Example: OS = 1.375")
SAE	SAE Ports (Specify Size, Example: SAE#10)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods
ST	Stop Tube - Specify Stop Tube Length (In Inches) Specify Stroke as ES (Effective Stroke) (Example: TA-MS4-2X24ES-ST=3)
TMS	Steel Cylinder Tube, Black Epoxy Paint Finish
TMSS	Stainless Steel Cylinder Tube
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

Cushions	
Non-Adjustable (Fixed) Head & Cap Cushions Are Standard (Leave Blank)	
Optional Adjustable Cushions	
H	Adjustable Head Cushion Position 2 Is Standard Specify For Positions: 1, 3 & 4
LH	Adjustable Long Head Cushion Position 2 Is Standard Specify For Positions: 1, 3 & 4
» ELH	Adjustable Extra Long Head Cushion Position 2 Is Standard Specify For Positions: 1, 3 & 4
C	Adjustable Cap Cushion Position 6 Is Standard Specify For Positions: 5, 7 & 8
LC	Adjustable Long Cap Cushion Position 6 Is Standard Specify For Positions: 5, 7 & 8
» ELC	Adjustable Extra Long Cap Cushion Position 6 Is Standard Specify For Positions: 5, 7 & 8

Notes:  
Ordering example for adjustable cushions in non-standard locations: H3C7

Refer to Options for assistance with cushion length selection.

Cushions can be ordered on same side as ports.

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

### About our Part Number System

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

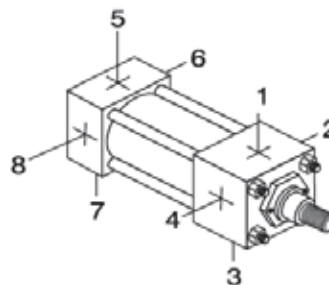
**Example:** A 2.5" bore by 10" stroke NFPA cylinder, Front Flange Mount, (NON-ADJUSTABLE Head & Cap Cushions), and Magnetic Piston for Switches.

### Part Number:

TD-MF1-2.5x10-MPR

### Standard Port and Cushion Adjustment Positions

- > Ports - Positions 1 and 5
- > Fixed Cushions - No adjustment needle required
- > Cushion Adjustment - Positions 2 and 6
- > Specify Non-Standard Positions When Ordering



Option Length Adder (Add to Catalog Basic Overall Length Dimensions)			
Bore	ELC	ELH	ST* (Stop Tube) Example: ST=2
1.50	1.000	1.000	2
2.00	1.000	1.000	2
2.50	1.000	1.000	2
3.25	1.250	1.250	2
4.00	1.250	1.250	2
5.00	1.250	1.250	2
6.00	1.500	1.500	2
8.00	1.500	1.500	2

1 The desired ST length adds directly to the overall cylinder length.

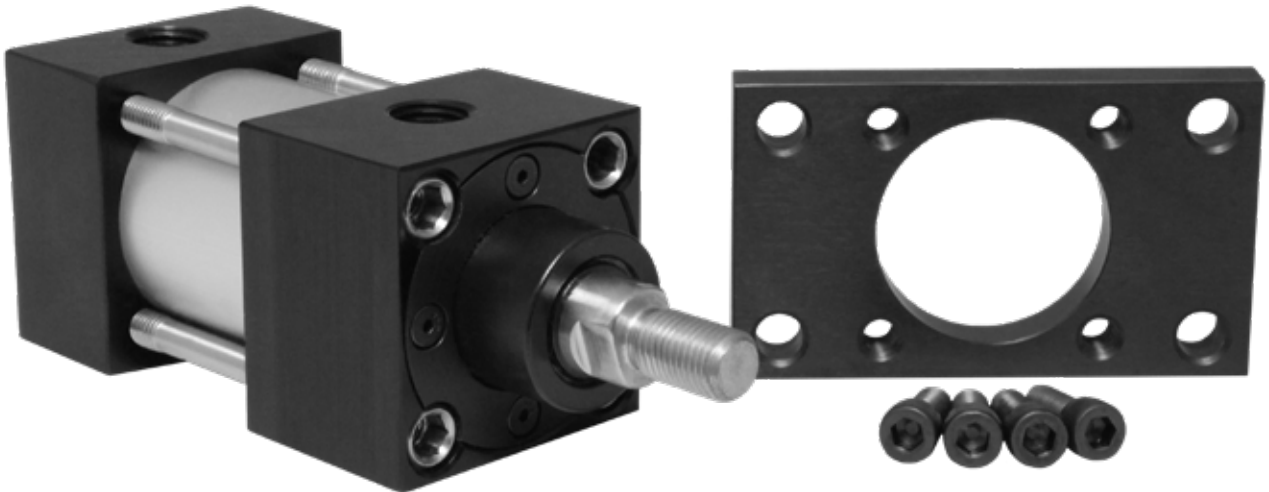






# FM Series Flush Mount Cylinders

Flush Mount (FM) Series actuators provide immense flexibility within the NFPA pneumatics market. Four tapped holes at each end and a flush sleeve nut construction on the head allow for simple interchange with other applications - simply change the mounts and you're ready to go!



# Contents

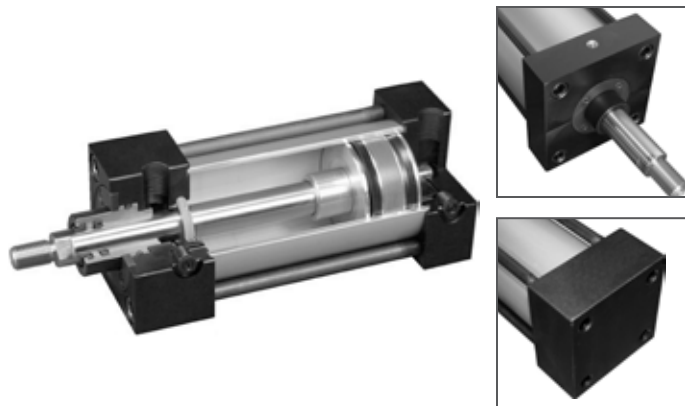
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<b>35</b>	FM Series Product Features	<b>52</b>	How to Order
	35 – Standard Port Sizes		53 – Option Length Adder
	35 – Operating Pressure		53 – FM NFPA Mounts with Rod Lock
	35 – Operating Temperature		
<hr/>			
<b>36</b>	How to Order	<b>54</b>	How to Specify
	37 – Option Length Adder		54 – Piston Rod End Styles
	37 – NFPA Mounts		54 – Mounting Options
<hr/>			
<b>38</b>	How to Specify	<b>67</b>	How it Works
	38 – Piston Rod End Styles		67 – Technical Data: Rod Lock Air Controls
	38 – Mounting Options		68 – Rod Lock Proximity Switch: Option P
	47 – Mounting Kits		69 – Rod Lock Installation Instructions
<hr/>			
<b>48</b>	FM Series with Rod Lock Product Features		70 – Safety Information
	48 – Heavy-Duty Design		70 – General Information
	49 – The Bimba Difference		70 – Operating Pressure
	49 – Operating Principle		70 – Operating Temperature
	49 – Operating Pressure		70 – Axial Movement (Clamped)*
	49 – Operating Temperature		70 – Rod Material Requirements
	50 – Axial Movement (Clamped)*		
	50 – Rod Material Requirements	<b>71</b>	Replacement Cylinders
	50 – Rod Lock Dimensions & Rated Holding Force		
	51 – Basic Cylinder Force Chart		
	51 – Rated Holding Force		

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## Benefits

- > Same construction as TA series with the added benefit of sleeve nut construction.
- > Four tapped holes in Head and Cap Faces Standard. Optional four (4) additional tapped holes in base (MS4 Mount).
- > No exposed tie rods or nuts at head and cap provides a clean design.
- > Interchanges with many older style NFPA manufacturers' cylinders out in the field.
- > Can easily add a multitude of NFPA Mounts by simply bolting in place (refer to page 40 for mount selection).
- > Available in Single & Double Rod End models.



## Performance Options

- > **LF** – Low Friction Seals reduce breakaway and running friction. Effective at all operating pressures.
- > **Extended Cushion Lengths** – Longer cushions increase the capacity of air cushions, eliminating costly hydraulic shock absorbers in some cases. Choose from three different cushion lengths for maximum performance.
- > **MPR** – Magnetic Piston (for position sensing switches).
- > **SSA** – Stainless steel piston rod, tie rods, nuts and fasteners provide corrosion resistance. Refer to Series 'SS' for a complete stainless steel solution.
- > **MA** – Micro-Adjust provides a precision adjustment on the cylinder extend stroke, providing quick and accurate cylinder positioning, reducing set-up time.
- > **AS** – Adjustable Retract Stroke allows for accurate adjustment on the cylinder return stroke.
- > **BSP or SAE Ports** – Special ports are available and do not increase delivery time.
- > **NR** – Non-Rotating option incorporates two (2) internal guide rods preventing rod rotation (NFPA dimensions held).

## Self-Lubricating Cylinder Design

PTFE coated cast iron bushing, PTFE Wear Band, Hard-Chrome Plated Piston Rod, Hard-Coated Aluminum Tube and PTFE based grease provide permanent lubrication and long cylinder life.

## Standard Port Sizes

### One Size Less Than TA Series

Additional Port Sizes Available

Bore	1.50	2.00	2.50	3.25	4.00	5.00	6.00	8.00*
Port Size	0.250 NPT	0.250 NPT	0.250 NPT	0.375 NPT	0.375 NPT	0.375 NPT	0.500 NPT	0.750 NPT

\*Same as TA Series.

## Operating Pressure

**250 PSI air (17 BAR)**

## Operating Temperature

**Carboxilated Nitrile:** -20°F to 200°F (-29°C to 93°C)

**Fluorocarbon:** 0°F to 400°F (-18°C to 204°C)

# How to Order

## FM - MS4 - 2.5 x 10 - HC - MPR

Series	
FM	250 PSI Air

NFPA Mounts	
MF1	Front Flange (1.50" - 6.00" Bore)
MF2	Rear Flange (1.50" - 6.00" Bore)
MP1	Rear Pivot Clevis (1.50" - 6.00" Bore)
MP2	Rear Pivot Clevis (1.50" - 6.00" Bore)
MP4	Rear Pivot Eye (1.50" - 4.00" Bore)
MS1	Front & Rear End Angle (1.50" - 8.00" Bore)
MS2	Side Lug (1.50" - 8.00" Bore)
MS4	Bottom Tapped Holes (1.50" - 8.00" Bore)
MT1	Front Trunnion (1.50" - 8.00" Bore)
MT2	Rear Trunnion (1.50" - 8.00" Bore)
MX0	No Mount (1.50" - 8.00" Bore)
Basebar	Non-NFPA (1.50" - 4.00" Bore)

Style	
(Blank)	Single Rod
D	Double Rod End

Bore		Stroke
1.5	1.50"	0" to 120" Made to order
2	2.00"	
2.5	2.50"	
3.25	3.25"	
4	4.00"	
5	5.00"	
6	6.00"	
8	8.00"	

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

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

Notes:  
Ordering example for adjustable cushions in non-standard locations: H3C7

Refer to Options for assistance with cushion length selection.

Cushions can be ordered on same side as ports.

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

Options	
A	Extended Piston Rod Thread (Example: A = 2")
AS	Adjustable Stroke - Retract (Specify Length, Example: AS = 4")
AO	Air / Oil Piston
» B	.250" Urethane Bumper Both Ends
» BC	.250" Urethane Bumper Cap Only
» BH	.250" Urethane Bumper Head Only
BP	Bumper Piston Seals (1.50" - 8" Bore)
BSPP	British Standard Pipe Taper (Specify Size, Example: BSP = 1/4)
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSP = 1/4)
C	Extended Piston Rod (Example: If C = 0.50", Then 1" Rod Extension Is C = 1.50")
KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3S	Studded Piston Rod (KK3 With Stud, Loctite In Place)
KK4	Full Diameter Male Rod Thread
KK5	Blank Rod End (No Threads, "A" = 0")
LF	Low Friction Seals
LT	Low Temperature Seals (LT)
LTE	Low Temperature Extreme Seals (LTE)
MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust W/ Sound Dampening Bumper (12" Max Stroke)
MPR	Magnetic Piston for Reed or Solid State Switches (R10, R10P, RAC, RHT & MSS)
MS	Metallic Rod Scraper (Brass Construction)
NR	Non-Rotating
OP	Optional Port Location (Example: OP=3,7)
OS	Oversize Rod Diameter (Specify Size, Example: OS = 1.375")
SAE	SAE Ports (Specify Size, Example: SAE#10)
» SE	Spring Extend (1.50, 2.00, 2.50 Bore)
» SR	Spring Return (1.50, 2.00, 2.50 Bore)
SSA	Stainless Steel Piston Rod, Tie Rods, Sleeve Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Sleeve Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods & Sleeve Nuts
» ST	Stop Tube - Specify Stop Tube Length (In Inches) Specify Stroke as ES (Effective Stroke) (Example: TA-MS4-2X24ES-ST=3)
TMS	Steel Cylinder Tube, Black Epoxy Paint Finish
TMSS	Stainless Steel Cylinder Tube
TH	400 PSI Hydraulic Non-Shock
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

### About our Part Number System

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

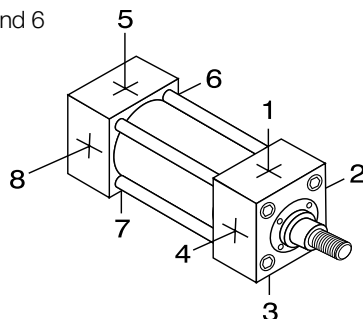
**Example:** A 2.5" Bore by 10" Stroke NFPA cylinder, Bottom Tap Mount, Head & Cap Cushions, and Magnetic Piston for Switches.

### Part Number:

FM-MS4-2.5 x 10-HC-MPR

### Standard Port and Cushion Adjustment Positions

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



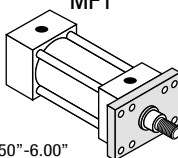
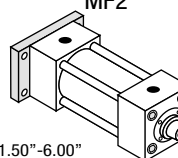
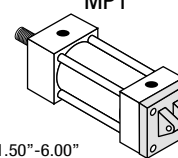
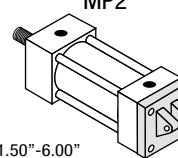
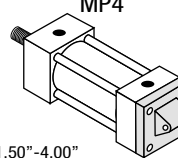
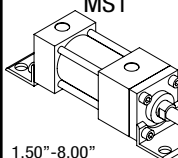
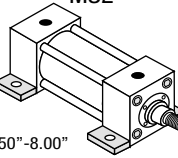
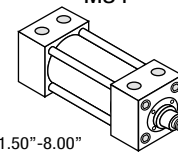
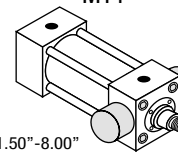
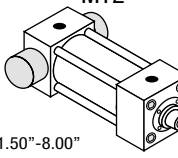
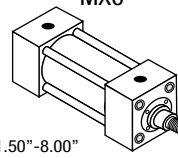
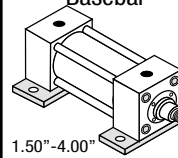
Note: Refer to Options for specifications  
\*Steel tubes do not work with MPR magnetic pistons. Refer to Balluff end of stroke sensors within Switches.  
» Refer to Option Length Adder

**Option Length Adder  
(Add To Catalog Basic Overall Length Dimensions)**

Bore	Option						ST <sup>1</sup> (Stop Tube) Example: ST=2
	B	BC	BH	ELC	ELH	SE	
1.50	0.500	0.250	0.250	1.000	1.000	Refer to Options for length adders and available bore sizes and strokes	2
2.00	0.500	0.250	0.250	1.000	1.000		2
2.50	0.500	0.250	0.250	1.000	1.000		2
3.25	0.500	0.250	0.250	1.250	1.250		2
4.00	0.500	0.250	0.250	1.250	1.250		2
5.00	0.500	0.250	0.250	1.250	1.250		2
6.00	0.500	0.250	0.250	1.500	1.500		2
8.00	0.500	0.250	0.250	1.500	1.500		2

<sup>1</sup> The desired stop tube length adds directly to the overall cylinder length.

## NFPA Mounts

 <p><b>MF1</b> 1.50"-6.00" Bores</p>	 <p><b>MF2</b> 1.50"-6.00" Bores</p>	 <p><b>MP1</b> 1.50"-6.00" Bores</p>	 <p><b>MP2</b> 1.50"-6.00" Bores</p>	 <p><b>MP4</b> 1.50"-4.00" Bores</p>	 <p><b>MS1</b> 1.50"-8.00" Bores</p>
 <p><b>MS2</b> 1.50"-8.00" Bores</p>	 <p><b>MS4</b> 1.50"-8.00" Bores</p>	 <p><b>MT1</b> 1.50"-8.00" Bores</p>	 <p><b>MT2</b> 1.50"-8.00" Bores</p>	 <p><b>MX0</b> 1.50"-8.00" Bores</p>	 <p><b>Basebar</b> 1.50"-4.00" Bores</p>

# How to Specify

## About Rod End Styles

### Style 1 Male Rod End is Standard

Other NFPA styles can be specified (see chart).

Need a rod end not listed? No problem! Each Piston Rod is made-to-order and does not delay shipment. Coarse UNC threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

Need something not listed? Just send us a sketch. In most cases, quotes are turned around in one day!

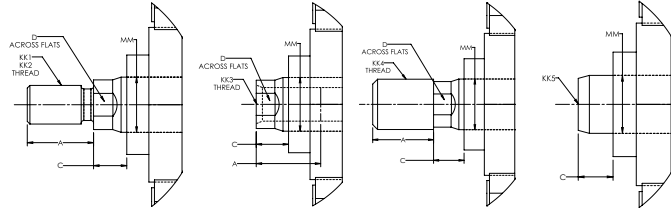
## Piston Rod End Styles

Style 1 & 2  
KK1 & KK2

Style 3  
KK3

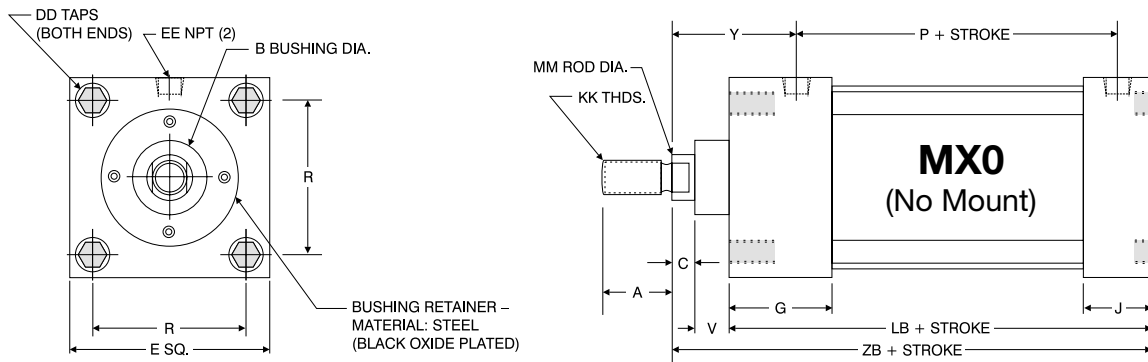
Style 4  
KK4

Style 5  
KK5



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

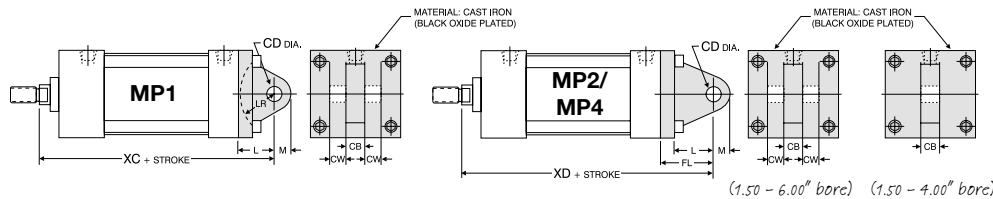
## Basic Dimensions: MX0 (No Mount) - Standard Rod



FM Series Basic Dimensions MX0

Bore	A	B	C	DD	E	EE	G	J	KK	LB	MM	P	R	V	Y	ZB
1.50	0.750	1.125	0.375	1/4 -28	2.000	0.250	1.500	1.000	7/16 -20	3.625	0.625	2.375	1.438	0.625	1.875	4.625
2.00	0.750	1.125	0.375	5/16 -24	2.500	0.250	1.500	1.000	7/16 -20	3.625	0.625	2.375	1.843	0.625	1.875	4.625
2.50	0.750	1.125	0.375	5/16 -24	3.000	0.250	1.500	1.000	7/16 -20	3.750	0.625	2.500	2.188	0.625	1.875	4.750
3.25	1.125	1.500	0.500	3/8 -24	3.750	0.375	1.750	1.250	3/4 -16	4.250	1.000	2.750	2.760	0.875	2.375	5.625
4.00	1.125	1.500	0.500	3/8 -24	4.500	0.375	1.750	1.250	3/4 -16	4.250	1.000	2.750	3.320	0.875	2.375	5.625
5.00	1.125	1.500	0.500	1/2 -20	5.500	0.375	1.750	1.250	3/4 -16	4.500	1.000	3.000	4.100	0.875	2.375	5.875
6.00	1.625	2.000	0.625	1/2 -20	6.500	0.500	2.000	1.500	1 -14	5.000	1.375	3.250	4.875	1.000	2.750	6.625
8.00	1.625	2.000	0.625	5/8 -18	8.500	0.750	2.000	1.500	1 -14	5.125	1.375	3.375	6.438	1.000	2.750	7.313

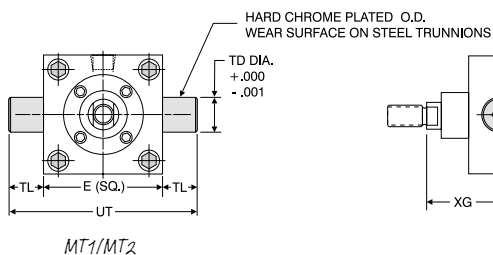
## Pivot Mounts – Flush Mount (With Sleeve Nut Construction)



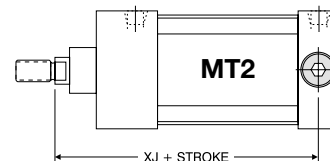
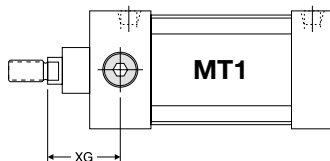
**FM Series MP1 & MP2 Clevis and MP4 Rod Eye Mount Dimensions**

Bore	Rod Diameter	CB	CD	CW	FL	L	LR	M	Add Stroke	
									XC	XD
1.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.750	0.625	5.375	5.750
	1.000 Oversize								5.750	6.125
2.00	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.750	0.625	5.375	5.750
	1.000 Oversize								5.750	6.125
2.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.750	0.625	5.500	5.875
	1.000 Oversize								5.875	6.250
3.25	1.000 Standard	1.250	0.750	0.625	1.875	1.250	1.250	0.875	6.875	7.500
	1.375 Oversize								7.125	7.750
4.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	1.250	0.875	6.875	7.500
	1.375 Oversize								7.125	7.750
5.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	1.250	0.875	7.125	7.750
	1.375 Oversize								7.375	8.000
6.00	1.375 Standard	1.500	1.000	0.750	2.250	1.500	1.500	1.000	8.125	8.875
	1.750 Oversize								8.375	9.125

For dimensions not shown, see page 38. Clevis pins are provided with pivot mounts.



Note: MT1 and MT2 Trunnions are bolt on, non-removable design.



MT1/MT2

Note: MT1 standard cushion locations at 3 and 6  
MT2 standard cushion locations at 2 and 7

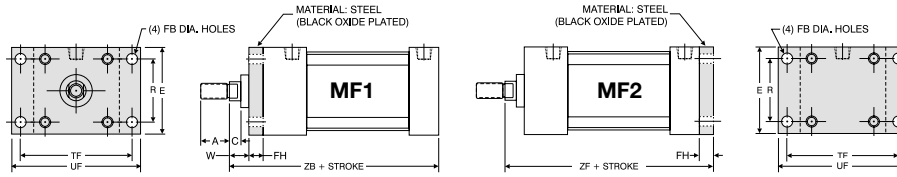
**FM Series MT1 Head Trunnion and MT2 Cap Trunnion Mount Dimensions**

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

\*No oversize rod available on 1.50" bore MT1.  
For dimensions not shown, see page 38.

# How to Specify

## Flange Mounts – Flush Mount (With Sleeve Nut Construction)

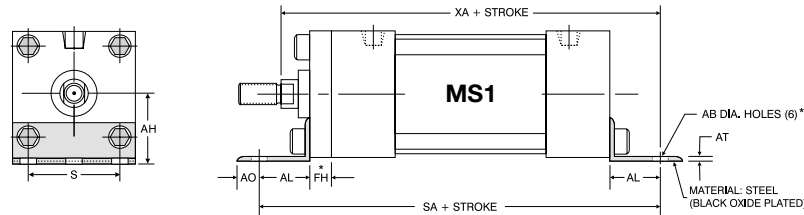


FM Series MF1 and MF2 Flange Mount Dimensions

Bore	Rod Diameter	A	C	E	FB	FH	R	TF	UF	W	ZB	ZF
1.50	0.625 Standard	0.750	0.375	2.000	0.313	0.375	1.430	2.750	3.375	0.625	4.625	5.000
	1.000 Oversize	1.125	0.500							1.000	5.000	5.375
2.00	0.625 Standard	0.750	0.375	2.500	0.375	0.375	1.840	3.375	4.125	0.625	4.625	5.000
	1.000 Oversize	1.125	0.500							1.000	5.000	5.375
2.50	0.625 Standard	0.750	0.375	3.000	0.375	0.375	2.188	3.875	4.625	0.625	4.750	5.125
	1.000 Oversize	1.125	0.500							1.000	5.125	5.500
3.25	1.000 Standard	1.125	0.500	3.750	0.438	0.625	2.760	4.688	5.500	0.750	5.625	6.250
	1.375 Oversize	1.625	0.625							1.000	5.875	6.500
4.00	1.000 Standard	1.125	0.500	4.500	0.438	0.625	3.320	5.438	6.250	0.750	5.625	6.250
	1.375 Oversize	1.625	0.625							1.000	5.875	6.500
5.00	1.000 Standard	1.125	0.500	5.500	0.563	0.625	4.100	6.625	7.625	0.750	5.875	6.500
	1.375 Oversize	1.625	0.625							1.000	6.125	6.750
6.00	1.375 Standard	1.625	0.625	6.500	0.563	0.750	4.875	7.625	8.625	0.875	6.625	7.375
	1.750 Oversize	2.000	0.750							1.125	6.875	7.625

For dimensions not shown, see page 38.

## Base Mounts – Flush Mount (With Sleeve Nut Construction)



FM Series MS1 Angle Mount Dimensions

Bore	Rod Diameter	AB	AH	AL	AO	AT	FH	S	Add Stroke	
									SA	XA
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.125	0.375	1.250	6.000	5.625
	1.000 Oversize									6.000
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.125	0.375	1.750	6.000	5.625
	1.000 Oversize									6.000
2.50	0.625 Standard	0.438	1.625	1.000	0.375	0.125	0.375	2.250	6.125	5.750
	1.000 Oversize									6.125
3.25	1.000 Standard	0.563	1.938	1.250	0.500	0.125	0.625	2.750	7.375	6.875
	1.375 Oversize									7.125
4.00	1.000 Standard	0.563	2.250	1.250	0.500	0.125	0.625	3.500	7.375	6.875
	1.375 Oversize									7.125
5.00	1.000 Standard	0.688	2.750	1.375	0.625	0.188	0.625	4.250	7.875	7.250
	1.375 Oversize									7.500
6.00	1.375 Standard	0.813	3.250	1.375	0.625	0.188	0.750	5.250	8.500	8.000
	1.750 Oversize									8.250
8.00	1.375 Standard	0.813	4.250	1.813	0.688	0.250	0.625*	7.125	8.750	8.563
	1.750 Oversize									8.813

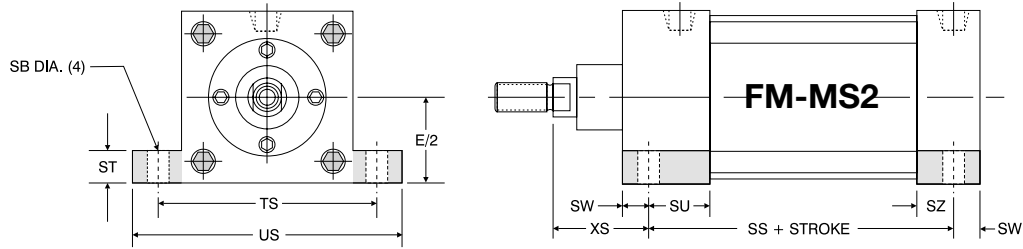
\*3.50" diameter round retainer on 8.00" bore (MS1 bracket bolted directly to head).

\*\*1.50" bore has four (4) "AB" holes on "S" dimension.

For dimensions not shown, see page 38.



## Base Mounts – Flush Mount (With Sleeve Nut Construction)

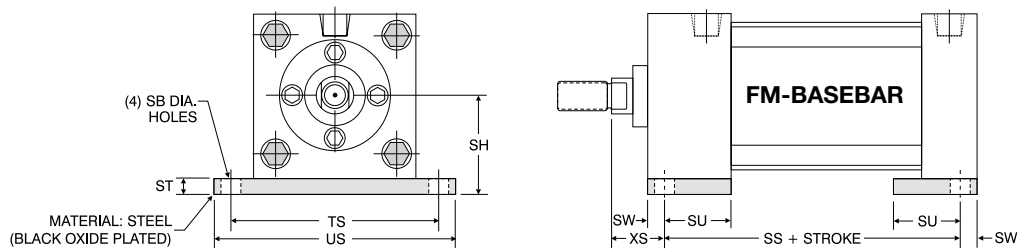


**FM Series MS2 Side Lug Mount Dimensions**

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

For dimensions not shown, see page 38.

## FM-Basebar (Non-NFPA)



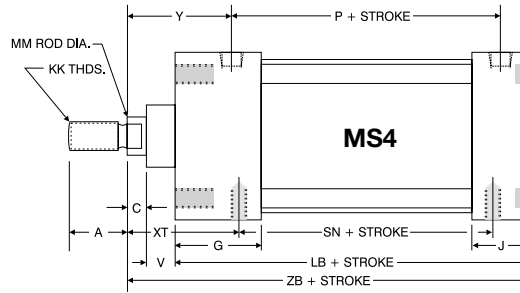
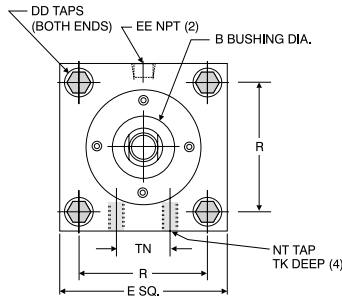
**FM Series Basebar Mount (Non-NFPA) Dimensions**

Bore	Rod Diameter	SB	SH	ST	SU	SW	TS	US	XS	Add Stroke
										SS
1.50	0.625 Standard	0.438	1.250	0.250	1.125	0.375	2.750	3.500	1.375	2.875
	1.000 Oversize									
2.00	0.625 Standard	0.438	1.500	0.250	1.125	0.375	3.250	4.000	1.375	2.875
	1.000 Oversize									
2.50	0.625 Standard	0.438	1.875	0.375	1.125	0.375	3.750	4.500	1.375	3.000
	1.000 Oversize									
3.25	1.000 Standard	0.563	2.375	0.500	1.250	0.500	4.750	5.750	1.875	3.250
	1.375 Oversize									
4.00	1.000 Standard	0.563	2.750	0.500	1.250	0.500	5.500	6.500	1.875	3.250
	1.375 Oversize									

Note: 1.50" to 3.25" oversized rods have full front retainer.  
For dimensions not shown, see page 38.

# How to Specify

## Base Mounts – Flush Mount (With Sleeve Nut Construction)

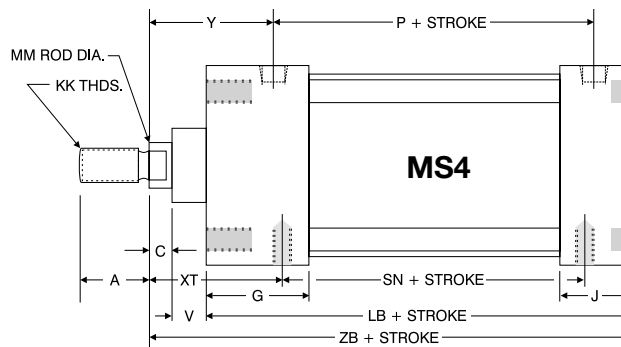
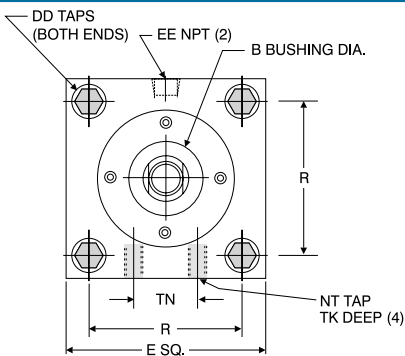


FM Series MS4 Flush Mount Dimensions

Bore	A	B	C	DD	E	EE	G	J	KK	LB	Rod Diameter (MM)	NT	P	R	SN	TK	TN	V	XT	Y	ZB
1.50	0.750	1.125	0.375	1/4-28	2.000	0.250	1.500	1.000	7/16-20	3.625	0.625	1/4-20	2.375	1.425	2.250	0.375	0.625	0.625	1.938	1.875	4.625
2.00	0.750	1.125	0.375	5/16-24	2.500	0.250	1.500	1.000	7/16-20	3.625	0.625	5/16-18	2.375	1.844	2.250	0.500	0.875	0.625	1.938	1.875	4.625
2.50	0.750	1.125	0.357	5/16-24	3.000	0.250	1.500	1.000	7/16-20	3.750	0.625	3/8-16	2.500	2.188	2.375	0.625	1.250	0.625	1.938	1.875	4.750
3.25	1.125	1.500	0.500	3/8-24	3.750	0.375	1.750	1.250	3/4-16	4.250	1.000	1/2-13	2.750	2.760	2.625	0.750	1.500	0.875	2.438	2.375	5.625
4.00	1.125	1.500	0.500	3/8-24	4.500	0.375	1.750	1.250	3/4-16	4.250	1.000	1/2-13	2.750	3.320	2.625	0.750	2.063	0.875	2.438	2.375	5.625
	1.625	2.000	0.625						1-14		1.375							1.000			
5.00	1.125	1.500	0.500	1/2-20	5.500	0.375	1.750	1.250	3/4-16	4.500	1.000	5/8-11	3.000	4.100	2.875	1.000	2.688	0.875	2.438	2.375	5.875
	1.625	2.000	0.625						1-14		1.375							1.000			
6.00	1.625	2.000	0.625	1/2-20	6.500	0.500	2.000	1.500	1-14	5.000	1.375	3/4-10	3.250	4.875	3.125	1.125	3.250	1.000	2.813	2.750	6.625
	2.000	2.375	0.750						1 1/4-12		1.750							1.125			
8.00	1.625	2.000	0.625	5/8-18	8.500	0.750	2.000	1.500	1-14	5.125	1.375	3/4-10	3.375	6.438	3.250	1.125	4.500	1.000	2.813	2.750	7.313
	2.000	2.375	0.750						1 1/4-12		1.750							1.125			

For dimensions not shown, see page 38.

## FM-MS4: Oversize Rod Diameter (1.50" Bore<sup>1</sup> to 3.25" Bore)

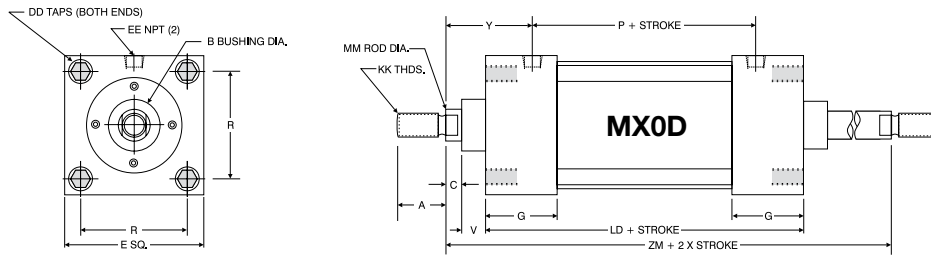


FM Series Oversize Rod MS4 Flush Mount Dimensions

Bore	A	B	C	DD	E	EE	F	G	J	KK	LB	Rod Diameter (MM)	NT	P	R	SN	TK	TN	V	XT	Y	ZB
1.50	1.125	1.500	0.500	1/4-28	2.000	0.250	0.375	1.500	1.000	3/4-16	3.625	1.000	1/4-20	2.375	1.438	2.250	0.375	0.625	0.500	2.313	2.250	5.000
2.00	1.125	1.500	0.500	5/16-24	2.500	0.250	0.375	1.500	1.000	3/4-16	3.625	1.000	5/16-18	2.375	1.844	2.250	0.500	0.875	0.500	2.313	2.250	5.000
2.50	1.125	1.500	0.500	5/16-24	3.000	0.250	0.375	1.500	1.000	3/4-16	3.750	1.000	3/8-16	2.500	2.188	2.375	0.625	1.250	0.500	2.313	2.250	5.125
3.25	1.625	2.000	0.625	3/8-24	3.750	0.375	0.625	1.750	1.250	1-14	4.250	1.375	1/2-13	2.750	2.760	2.625	0.750	1.500	0.375	2.688	2.625	5.875

1. 1.50" oversize needs a full square retainer and retaining bolts.  
For dimensions not shown, see page 38.

## Double Rod End (No Mount) – Flush Mount (With Sleeve Nut Construction)

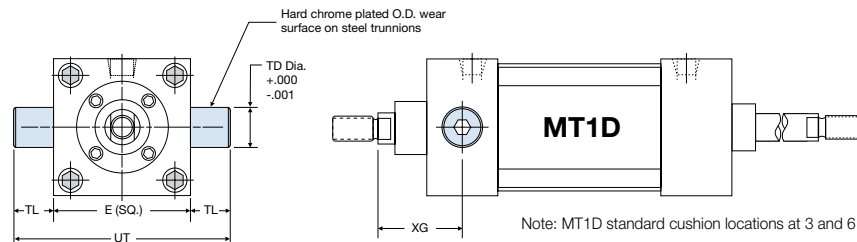


FM Series Double Rod End Basic Dimensions MX0D

Bore	A	B	C	DD	E	EE	G	KK	LD	MM	P	R	V	Y	ZM
1.50	0.750	1.125	0.375	1/4-28	2.000	0.250	1.500	7/16-20	4.125	0.625	2.375	1.438	0.625	1.875	6.125
2.00	0.750	1.125	0.375	5/16-24	2.500	0.250	1.500	7/16-20	4.125	0.625	2.375	1.844	0.625	1.875	6.125
2.50	0.750	1.125	0.375	5/16-24	3.000	0.250	1.500	7/16-20	4.250	0.625	2.500	2.188	0.625	1.875	6.250
3.25	1.125	1.500	0.500	3/8-24	3.750	0.375	1.750	3/4-16	4.750	1.000	2.750	2.760	0.875	2.375	7.500
4.00	1.125	1.500	0.500	3/8-24	4.500	0.375	1.750	3/4-16	4.750	1.000	2.750	3.320	0.875	2.375	7.500
5.00	1.125	1.500	0.500	1/2-20	5.500	0.375	1.750	3/4-16	5.000	1.000	3.000	4.100	0.875	2.375	7.750
6.00	1.625	2.000	0.625	1/2-20	6.500	0.500	2.000	1-14	5.500	1.375	3.250	4.875	1.000	2.750	8.750
8.00	1.625	2.000	0.625	5/8-18	8.500	0.750	2.000	1-14	5.625	1.375	3.375	6.438	1.000	2.750	8.875

For oversize rod dimensions, refer to page 36.

## Double Rod End Pivot Mount



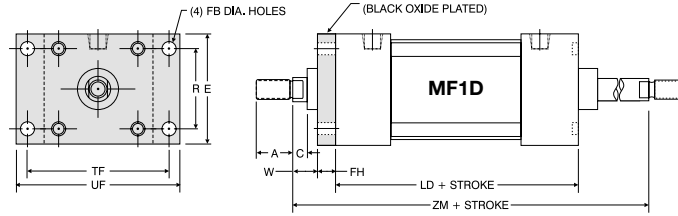
FM Series Double Rod End MT1D Head Trunnion Mount Dimensions

Bore	Rod Diameter	E	TD	TL	UT	XG
1.50*	0.625 Standard	2.000	1.000	1.000	4.000	1.750
2.00	0.625 Standard	2.500	1.000	1.000	4.500	1.750
	1.000 Oversize					2.125
2.50	0.625 Standard	3.000	1.000	1.000	5.000	1.750
	1.000 Oversize					2.125
3.25	1.000 Standard	3.750	1.000	1.000	5.750	2.250
	1.375 Oversize					2.500
4.00	1.000 Standard	4.500	1.000	1.000	6.500	2.250
	1.375 Oversize					2.500
5.00	1.000 Standard	5.500	1.000	1.000	7.500	2.250
	1.375 Oversize					2.500
6.00	1.375 Standard	6.500	1.375	1.375	9.250	2.625
	1.750 Oversize					2.875
8.00	1.375 Standard	8.500	1.375	1.375	11.250	2.625
	1.750 Oversize					2.875

\*No oversize rod available on 1.50" bore MT1D.  
For dimensions not shown, see chart above.

# How to Specify

## Double Rod End Flange Mount – Flush Mount (With Sleeve Nut Construction)

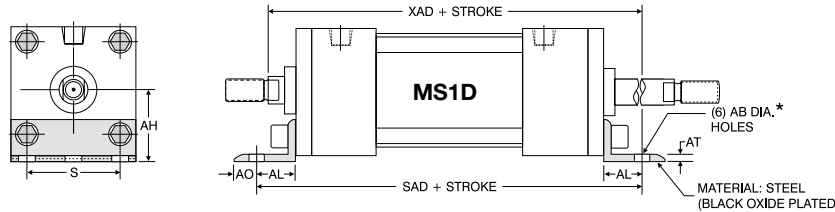


FM Series Double Rod End MF1D Flange Mount Dimensions

Bore	Rod Diameter	A	C	E	FB	FH	R	TF	UF	W	Add Stroke	
											LD	ZM
1.50	0.625 Standard	0.750	0.375	2.000	0.313	0.375	1.438	2.750	3.375	0.625	4.125	6.125
	1.000 Oversize	1.125	0.500									6.875
2.00	0.625 Standard	0.750	0.375	2.500	0.375	0.375	1.844	3.375	4.125	0.625	4.125	6.125
	1.000 Oversize	1.125	0.500									6.875
2.50	0.625 Standard	0.750	0.375	3.000	0.375	0.375	2.188	3.875	4.625	0.625	4.250	6.250
	1.000 Oversize	1.125	0.500									7.000
3.25	1.000 Standard	1.125	0.500	3.750	0.438	0.625	2.760	4.688	5.500	0.750	4.750	7.500
	1.375 Oversize	1.625	0.625									8.000
4.00	1.000 Standard	1.125	0.500	4.500	0.438	0.625	3.320	5.438	6.250	0.750	4.750	7.500
	1.375 Oversize	1.625	0.625									8.000
5.00	1.000 Standard	1.125	0.500	5.500	0.563	0.625	4.100	6.625	7.625	0.750	5.000	7.750
	1.375 Oversize	1.625	0.625									8.250
6.00	1.375 Standard	1.625	0.625	6.500	0.563	0.750	4.875	7.625	8.625	0.875	5.500	8.750
	1.750 Oversize	2.000	0.750									9.250

Note: 1.50" to 3.25" oversized rods use full retainers.  
For dimensions not shown, see page 38.

## Double Rod End Base Mounts – Flush Mount (With Sleeve Nut Construction)

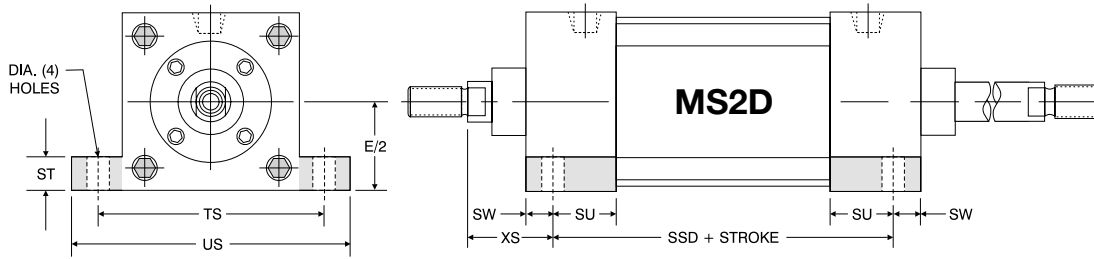


FM Series Double Rod End MS1D Angle Mount Dimensions

Bore	Rod Diameter	AB	AH	AL	AO	AT	S	Add Stroke	
								SAD	XAD
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.125	1.250	6.875	6.500
	1.000 Oversize								6.875
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.125	1.750	6.875	6.500
	1.000 Oversize								6.875
2.50	0.625 Standard	0.438	1.625	1.000	0.375	0.125	2.250	7.000	6.625
	1.000 Oversize								7.000
3.25	1.000 Standard	0.563	1.938	1.250	0.500	0.125	2.750	8.500	8.000
	1.375 Oversize								8.250
4.00	1.000 Standard	0.563	2.250	1.250	0.500	0.125	3.500	8.500	8.000
	1.375 Oversize								8.250
5.00	1.000 Standard	0.688	2.750	1.375	0.625	0.188	4.250	9.000	8.375
	1.375 Oversize								8.625
6.00	1.375 Standard	0.813	3.250	1.375	0.625	0.188	5.250	9.750	9.250
	1.750 Oversize								9.500
8.00	1.375 Standard	0.813	4.250	1.813	0.688	0.250	7.125	9.250	9.063
	1.750 Oversize								9.313

\*1.50" bore has four (4) "AB" holes on "S" dimension.  
Note: Flush retainer on 8.00" bore (MS1 bracket bolted directly to head).  
For dimensions not shown, see page 38.

## Double Rod End Base Mounts – Flush Mount (With Sleeve Nut Construction)

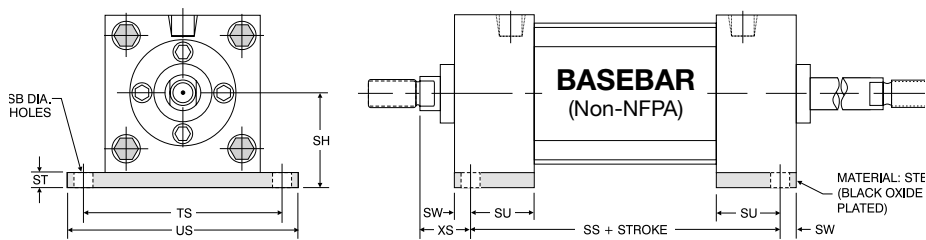


FM Series Double Rod End MS2D Side Lug Mount Dimensions

Bore	Rod Diameter	SB	E/2	ST	SU	SW	TS	US	XS	Add Stroke
										SSD
1.50	0.625 Standard	0.438	1.000	0.500	1.125	0.375	2.750	3.500	1.375	3.375
	1.000 Oversize									1.750
2.00	0.625 Standard	0.438	1.250	0.500	1.125	0.375	3.250	4.000	1.375	3.375
	1.000 Oversize									1.750
2.50	0.625 Standard	0.438	1.500	0.500	1.125	0.375	3.750	4.500	1.375	3.500
	1.000 Oversize									1.750
3.25	1.000 Standard	0.563	1.875	0.750	1.250	0.500	4.750	5.750	1.875	3.750
	1.375 Oversize									2.125
4.00	1.000 Standard	0.563	2.250	0.750	1.250	0.500	5.500	6.500	1.875	3.750
	1.375 Oversize									2.125
5.00	1.000 Standard	0.813	2.750	1.000	1.063	0.688	6.875	8.250	2.063	3.625
	1.375 Oversize									2.313
6.00	1.375 Standard	0.813	3.250	1.000	1.313	0.688	7.875	9.250	2.313	4.125
	1.750 Oversize									2.563
8.00	1.375 Standard	0.813	4.250	1.000	1.563	0.688	9.875	11.250	2.313	4.250
	1.750 Oversize									2.563

Note: 1.50" to 3.25" oversized rods use full retainers.  
For dimensions not shown, see page 38.

## FM-Basebar (Non-NFPA)



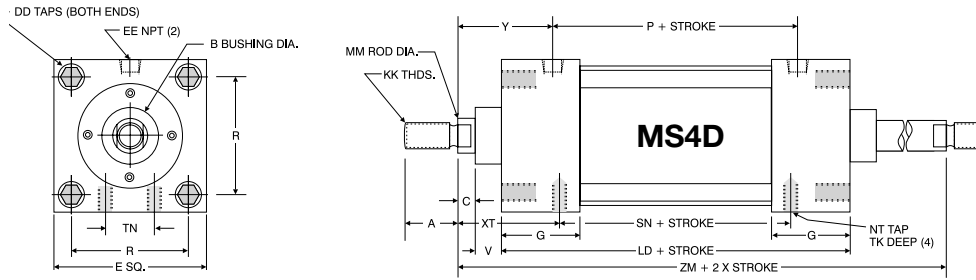
FM Series Double Rod End Basebar Mount (Non-NFPA) Dimensions

Bore	Rod Diameter	SB	SH	Add Stroke	ST	SU	SW	TS	US	XS
				SS						
1.50	0.625 Standard	0.438	1.250	3.375	0.250	1.125	0.375	2.750	3.500	1.375
	1.000 Oversize			1.750						
2.00	0.625 Standard	0.438	1.500	3.375	0.250	1.125	0.375	3.250	4.000	1.375
	1.000 Oversize			1.750						
2.50	0.625 Standard	0.438	1.875	3.500	0.375	1.125	0.357	3.750	4.500	1.375
	1.000 Oversize			1.750						
3.25	1.000 Standard	0.563	2.375	3.750	0.500	1.250	0.500	4.750	5.750	1.875
	1.375 Oversize			2.125						
4.00	1.000 Standard	0.563	2.750	3.750	0.500	1.250	0.500	5.500	6.500	1.875
	1.375 Oversize			2.125						

For dimensions not shown, see page 38.

# How to Specify

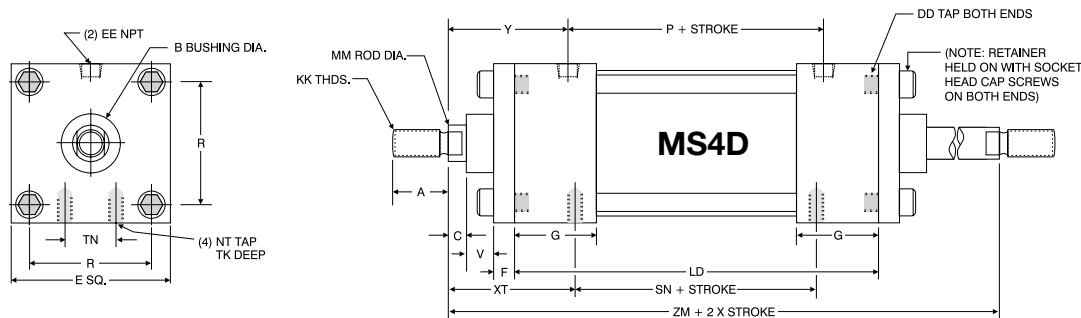
## FM-MS4D: Standard Rod Diameter



FM Series Double Rod End MS4D Flush Mount Dimensions

Bore	A	B	C	DD	E	EE	G	KK	LD	MM	P	R	V	Y	NT	TK	TN	SN	XT	ZM
1.50	0.750	1.125	0.375	1/4-28	2.000	0.250	1.500	7/16-20	4.125	0.625	2.375	1.438	0.625	1.875	1/4-20	0.375	0.625	2.250	1.938	6.125
2.00	0.750	1.125	0.375	5/16-24	2.500	0.250	1.500	7/16-20	4.125	0.625	2.375	1.844	0.625	1.875	5/16-18	0.500	0.875	2.250	1.938	6.125
2.50	0.750	1.125	0.375	5/16-24	3.000	0.250	1.500	7/16-20	4.250	0.625	2.500	2.188	0.625	1.875	3/8-16	0.625	1.250	2.375	1.938	6.250
3.25	1.125	1.500	0.500	3/8-24	3.750	0.375	1.750	3/4-16	4.750	1.000	2.750	2.760	0.875	2.375	1/2-13	0.750	1.500	2.625	2.438	7.500
4.00	1.125	1.500	0.500	3/8-24	4.500	0.375	1.750	3/4-16	4.750	1.000	2.750	3.320	0.875	2.375	1/2-13	0.750	2.063	2.625	2.438	7.500
5.00	1.125	1.500	0.500	1/2-20	5.500	0.375	1.750	3/4-16	5.000	1.000	3.000	4.100	0.875	2.375	5/8-11	1.000	2.688	2.875	2.438	7.750
6.00	1.625	2.000	0.625	1/2-20	6.500	0.500	2.000	1-14	5.500	1.375	3.250	4.875	1.000	2.750	3/4-10	1.125	3.250	3.125	2.813	8.750
8.00	1.625	2.000	0.625	5/8-18	8.500	0.750	2.000	1-14	5.625	1.375	3.375	6.438	1.000	2.750	3/4-10	1.125	4.500	3.250	2.813	8.875

## FM-MS4D: Oversize Rod Diameter



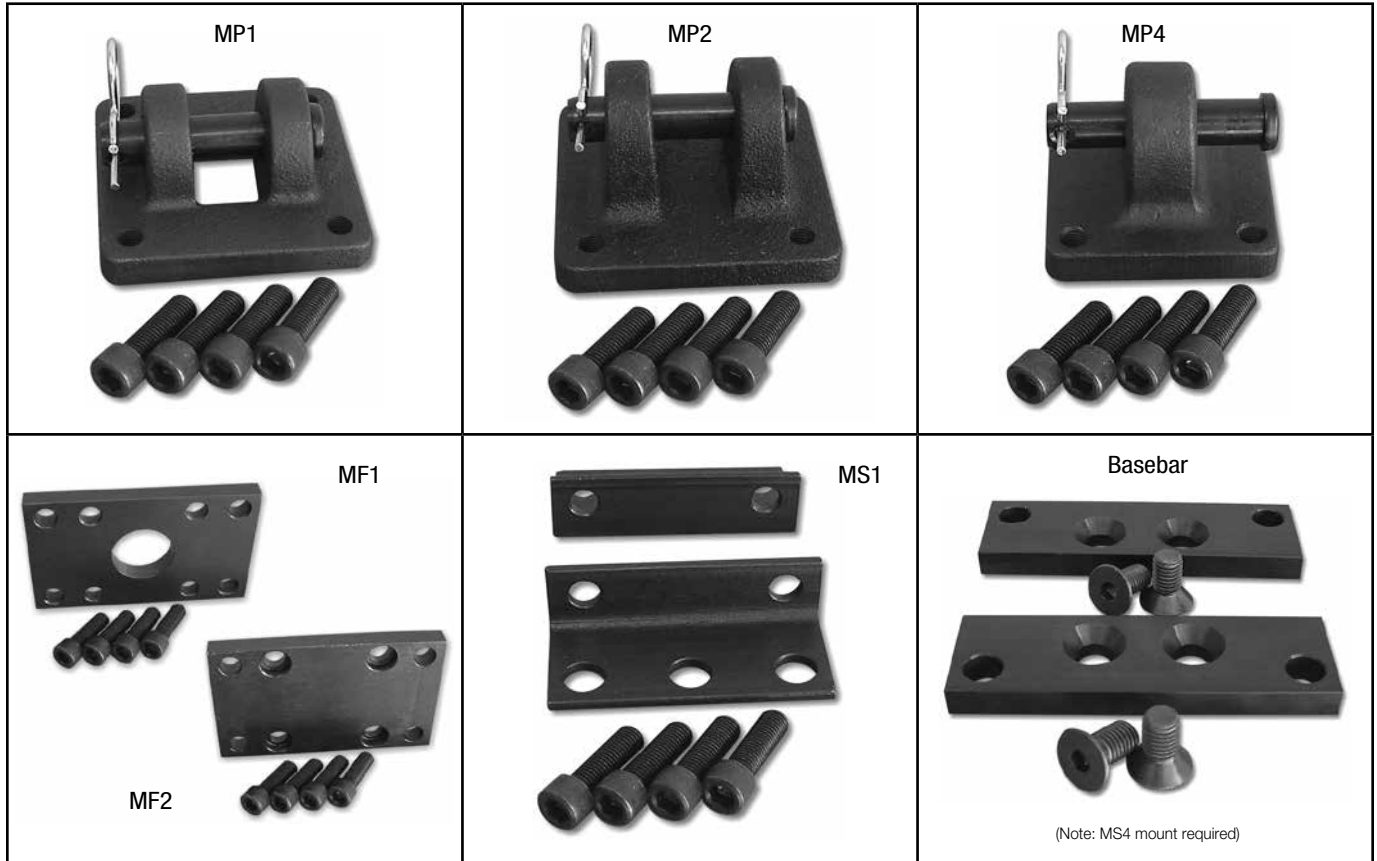
FM Series Double Rod End Oversize Rod MS4D Flush Mount Dimensions

Bore	A	B	C	DD	E	EE	F	G	KK	LD	MM	P	R	V	Y	NT	TK	TN	SN	XT	ZM
1.50	1.125	1.500	0.500	1/4-28	2.000	0.250	0.375	1.500	3/4-16	4.125	1.000	2.375	1.438	0.500	2.250	1/4-20	0.375	0.625	2.250	2.313	6.875
2.00	1.125	1.500	0.500	5/16-24	2.500	0.250	0.375	1.500	3/4-16	4.125	1.000	2.375	1.845	0.500	2.250	5/16-18	0.500	0.875	2.250	2.313	6.875
2.50	1.125	1.500	0.500	5/16-24	3.000	0.250	0.375	1.500	3/4-16	4.250	1.000	2.500	2.188	0.500	2.250	3/8-16	0.625	1.250	2.375	2.313	7.000
3.25	1.625	2.000	0.625	3/8-24	3.750	0.375	0.625	1.750	1-14	4.750	1.375	2.750	2.760	0.375	2.625	1/2-13	0.750	1.500	2.625	2.688	8.000
4.00	1.625	2.000	0.625	3/8-24	4.500	0.375	0.625	1.750	1-14	4.750	1.375	2.750	3.320	0.375	2.625	1/2-13	0.750	2.063	2.625	2.688	8.000
5.00	1.625	2.000	0.625	1/2-20	5.500	0.375	0.625	1.750	1-14	5.000	1.375	3.000	4.100	0.375	2.625	5/8-11	1.000	2.688	2.875	2.688	8.250
6.00	2.000	2.375	0.750	1/2-20	6.500	0.500	0.750	2.000	1 1/4-12	5.500	1.750	3.250	4.875	0.500	3.125	3/4-10	1.125	3.250	3.125	3.063	9.250
8.00	2.000	2.375	0.750	5/8-18	8.500	0.750	0.625	2.000	1 1/4-12	5.625	1.750	3.375	6.438	1.125	3.000	3/4-10	1.125	4.500	3.250	3.063	9.375

Note: Flush retainer on 4.00" to 8.00" bore.

## Mounting Kits

Most FM Series cylinders are shipped ready to accept any FM Series mounting kits. FM cylinders can be used in different applications simply by changing the mount. In addition, the FM Flush Mount feature can be used for mounting—just use the four (4) tapped holes in head or cap to mount cylinder. The FM Series is one of the most versatile cylinders on the market. Choose from six (6) mounting kits. Each kit comes complete with fasteners; pins are ordered separately.



## Series FM Mounting Kits

Bore	MP1	MP2	MP4	MF1	MF1 OS Rod	MF2	MS1	MS1 OS Rod	Basebar
1.50	FM-MP1-15-KIT	FM-MP2-15-KIT	FM-MP4-15-KIT	FM-MF1-15-KIT	FM-MF1-15-OS-KIT	FM-MF2-15-KIT	FM-MS1-15-KIT	N/A	FM-BASEBAR-15-KIT
2.00	FM-MP1-20-KIT	FM-MP2-20-KIT	FM-MP4-20-KIT	FM-MF1-20-KIT	FM-MF1-20-OS-KIT	FM-MF2-20-KIT	FM-MS1-20-KIT	N/A	FM-BASEBAR-20-KIT
2.50	FM-MP1-25-KIT	FM-MP2-25-KIT	FM-MP4-25-KIT	FM-MF1-25-KIT	FM-MF1-25-OS-KIT	FM-MF2-25-KIT	FM-MS1-25-KIT	N/A	FM-BASEBAR-25-KIT
3.25	FM-MP1-32-KIT	FM-MP2-32-KIT	FM-MP4-32-KIT	FM-MF1-32-KIT	FM-MF1-32-OS-KIT	FM-MF2-32-KIT	FM-MS1-32-KIT	N/A	FM-BASEBAR-32-KIT
4.00	FM-MP1-40-KIT	FM-MP2-40-KIT	FM-MP4-40-KIT	FM-MF1-40-KIT	FM-MF1-40-OS-KIT	FM-MF2-40-KIT	FM-MS1-40-KIT	N/A	FM-BASEBAR-40-KIT
5.00	FM-MP1-50-KIT	FM-MP2-50-KIT	N/A	FM-MF1-50-KIT	FM-MF1-50-OS-KIT	FM-MF2-50-KIT	FM-MS1-50-KIT	N/A	N/A
6.00	FM-MP1-60-KIT	FM-MP2-60-KIT	N/A	FM-MF1-60-KIT	FM-MF1-60-OS-KIT	FM-MF2-60-KIT	FM-MS1-60-KIT	N/A	N/A
8.00	N/A	N/A	N/A	N/A	N/A	N/A	FM-MS1-80-KIT	FM-MS1-80-OS-KIT	N/A

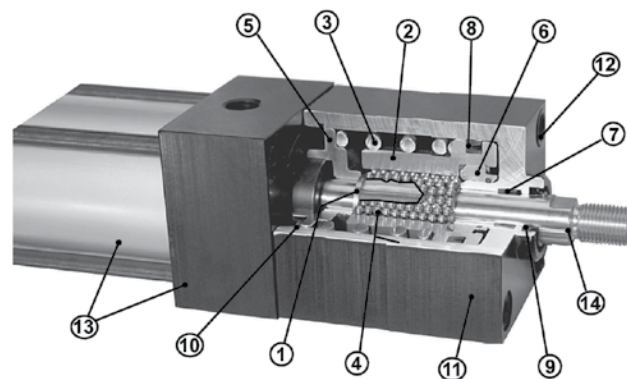
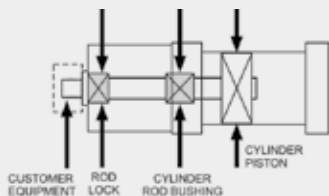
Note: Basebar "SH" dimension is not NFPA (refer to pages 41 & 45). All other dimensions are NFPA.

# Product Features

## Floating Rod Bushing

**Self Alignment Feature:** Rod Bushing is designed to float .002" to improve bearing surface alignment.

- > Reduces cylinder drag and erratic operation
- > Reduces cylinder wear
- > Provides a minimum of 25% longer life than fixed rod bushing designs



## Heavy-Duty Design for Reliable, Consistent Operation

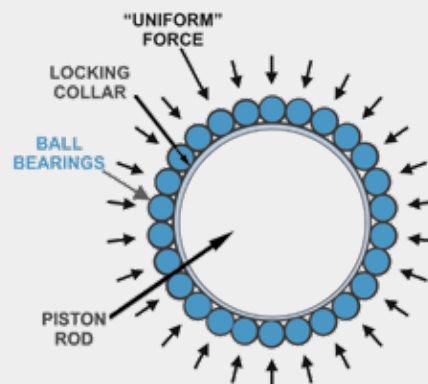
- 1. Locking Collar** – Hardened specialized tool steel, precision ground, multi-split collar design provides 4,000,000-5,000,000 cycles without fatigue or fracture.
- 2. Piston-Outer Lock Housing** – Hardened tool steel, precision ground design also serves as a spring guide for uniform clamp force distribution with virtually no wear.
- 3. Spring** – Oversized for maximum power, heavy-duty coil spring (low fatigue) will provide millions of consistent rod lock actuations at full rated load.
- 4. Ball Bearings** – Hardened, precision ground (high grade) steel ball bearings provide total transfer of spring force to locking collar.
- 5. Rod Lock Guide (Steel)** – Centers Rod Lock to cylinder rod bushing and maintains perfect alignment eliminating binding or rod scraping or reduced locking force due to misalignment.
- 6. Piston Guide** – Hardened and ground steel guide that centers the piston-outer lock housing and provides bearing surface for piston/spring assembly
- 7. Rod Guide Bearing** – High-load wear strip (PTFE based), self lubricating.
- 8. Piston Seal** – Heavy lip design Carboxylated Nitrile construction. Seal is pressure activated and wear compensating for extended life (self lubricating material).
- 9. Rod Wiper** – Urethane
- 10. Retainer Ring (Steel)** – Retains coil spring compression (under very high spring force) and internal lock components (NOTE: Do not remove).
- 11. Housing** – Precision machined from 6061-T6 aluminum, black anodized for corrosion resistance.
- 12. Sleeve Nut (Steel)** – Provides four (4) tapped holes for mounting unit or MF1 flange.
- 13. FM Series Cylinder** – Refer to catalog pages 28-36 for specifications and options.
- 14. Cylinder Piston Rod** – Hard chrome plated steel.
- 15. Permanent Lubrication** – Permanently lubricated with Magnalube-G PTFE based grease on all internal components. No additional lubrication is required.

## 100% Fill Ball Bearing Design

The cavity between the Locking Collar and Outer Lock Housing is 100% filled with ball bearings, providing UNIFORM distribution of Locking (Clamp/Holding) Force.

## Design Advantages

- > **Low Metal Fatigue** – On all clamping components.
- > **Superior Locking Forces** – Highest locking forces in the industry.
- > **Non Wearing** – Low component fatigue eliminates wear and extends life to 4,000,000-5,000,000 cycles at full rated load.





## The Bimba Difference

Bimba's floating rod bushing design and 'RL' Series Rod Lock = OPTIMIZED RESULTS and SUPERIOR PERFORMANCE.

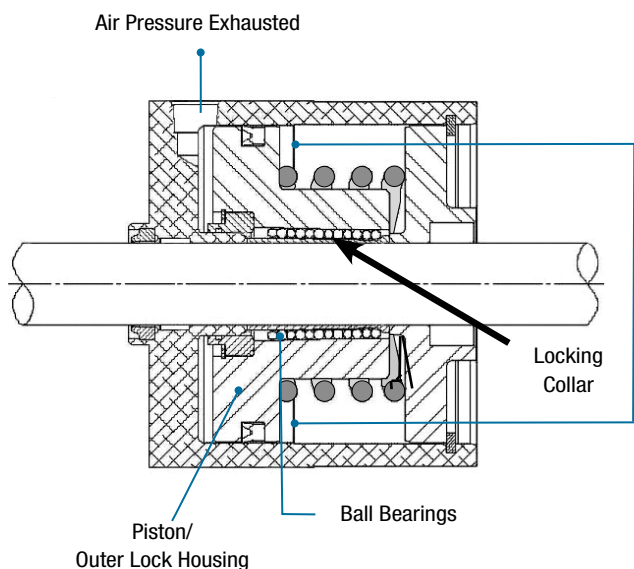
For rod locks to achieve the rated holding force and maximize cycle life, good alignment must be maintained between the locking mechanism and cylinder rod. Bimba's Floating Rod Bushing design and accurate rod lock alignment ensure superior performance and trouble-free operation.

Rod Locks are used to hold linear cylinder loads stationary in any

mounting orientation. Units will lock in both directions to rated holding force. They are not designed to withstand rotational loads or to brake the load in dynamic applications. Units are commonly used in work holding applications and for locking tools or fixtures in the event of air pressure loss. They are very common in positioning systems since they will hold the cylinder position very rigidly. Units are also common in emergency stop (E-Stop) applications.

Refer to safety information on page 70 for proper application.

## Operating Principle



### Clamping (Locked) Condition

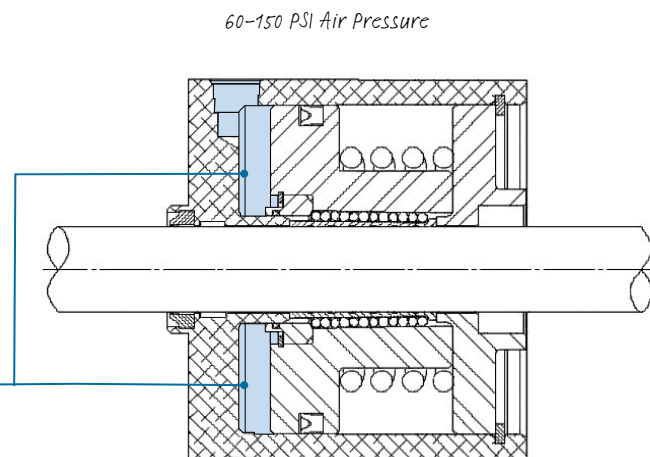
When air pressure is exhausted from rod lock, high spring force is applied to the piston/outer lock housing, which utilizes an ultra-fine tapered wedge mechanism. Ball bearings transfer the spring force directly to the locking collar. The locking collar is designed to flex and securely grip the rod. Clamping action does not move or disturb the rod, maintaining rod position during actuation.

High Spring Force Locks Piston Rod in Place

### Unclamped Condition (Free Moving Piston Rod):

When air pressure is applied to rod lock, the air pressure overcomes the spring force, moving Piston/Outer Locking Housing. This movement provides clearance in the tapered mechanism allowing the Locking Collar to relax and provide free rod movement.

Air Pressure Moves Piston, Compressing Spring, Which Eliminates Locking Force



## Operating Pressure

<b>Cylinder:</b>	0 to 250 PSI Air
<b>Rod Lock:</b>	60 to 150 PSI Air

## Operating Temperature

<b>Standard Seals:</b>	10°F to 180°F (-12°C to 82°C)
<b>Fluorocarbon Seals:</b>	0°F to 400°F (-18°C to 204°C)

# Product Features

## Axial Movement (Clamped)\*

**Standard:** .001" to .008"

**Close Tol. (Optional):** .001" to .003"

\*Represents clearance within the rod lock unit, .000" movement due to actuation.

## Rod Material Requirements

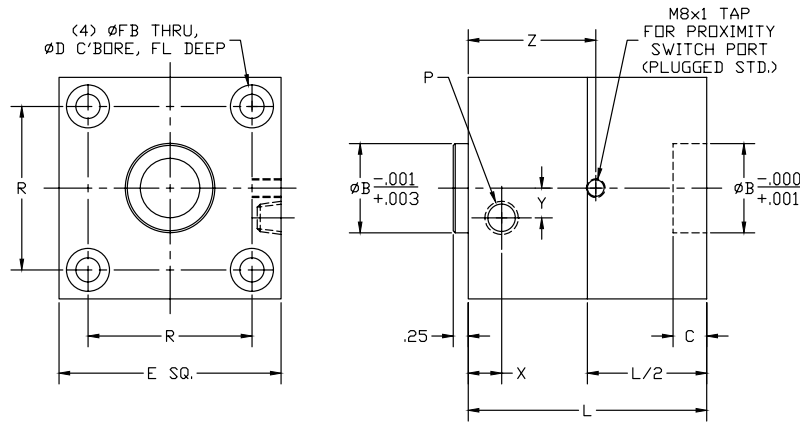
**Diameter:** +.000" to -.002" Nominal Diameter

**Hardened Shaft:** .0005" Minimum hard chrome

**Unhardened Shaft:** .001" Minimum hard chrome

**Finish:** 6 to 10 Ra

## Rod Lock Dimensions & Rated Holding Force



Rod Lock Dimensions

Bore	Rod Diameter*	Part No. Rod Lock Only	Axial Holding Force	B	C	D	FL	E	FB	L	P	R	X	Y	Z	Weight (Lbs.)
1.50	0.625 Standard	RL-063150-1	200	1.125	0.375	0.422	0.896	1.975	0.281	3.000	1/8 NPT	1.430	0.310	0.250	1.529	3.0
	0.625 Standard	RL-063200-1	500	1.125	0.375	0.515	1.031	2.475	0.343	3.000	1/8 NPT	1.840	0.310	0.380	1.196	4.0
2.00	1.000 Oversize	RL-100200-1	350	1.500	0.563	0.515	1.031	2.475	0.343	3.750	1/8 NPT	1.840	0.500	0.380	1.869	3.5
	0.625 Standard	RL-063250-1	650	1.125	0.375	0.515	1.031	2.975	0.343	3.250	1/8 NPT	2.190	0.380	0.500	1.490	5.0
2.50	1.000 Oversize	RL-100250-1	650	1.500	0.563	0.515	1.031	2.975	0.343	3.750	1/8 NPT	2.190	0.500	0.500	1.857	5.0
	1.000 Standard	RL-100325-1	1000	1.500	0.563	0.719	1.281	3.725	0.406	4.000	1/4 NPT	2.760	0.560	0.000	2.140	8.0
3.25	1.375 Oversize	RL-138325-1	1000	2.000	0.625	0.719	1.281	3.725	0.406	4.000	1/4 NPT	2.760	0.500	0.000	2.000	9.0
	1.000 Standard	RL-100400-1	1550	1.500	0.563	0.719	1.281	4.475	0.406	4.000	1/4 NPT	3.320	0.560	0.000	1.782	14.0
4.00	1.375 Oversize	RL-138400-1	1550	2.000	0.625	0.719	1.281	4.475	0.406	4.000	1/4 NPT	3.320	0.500	0.000	1.811	13.0
	1.000 Standard	RL-100500-1	2150	1.500	0.563	0.844	1.500	5.475	0.531	4.000	1/4 NPT	4.100	0.560	0.750	1.810	18.0
5.00	1.375 Oversize	RL-138500-1	2150	2.000	0.625	0.844	1.500	5.475	0.531	4.125	1/4 NPT	4.100	0.625	0.750	1.941	19.0
	1.375 Standard	RL-138600-1	2850	2.000	0.625	0.844	1.500	6.475	0.531	4.500	1/4 NPT	4.880	0.820	0.000	2.055	16.0
6.00	1.750 Oversize	RL-175600-1	2850	2.375	0.750	0.844	1.500	6.475	0.531	4.500	1/4 NPT	4.880	0.560	0.000	1.923	14.0

## Basic Cylinder Force Chart

Bore	Rod Diameter	Stroke Type	Effective Piston Area	Pounds Of Force At:		
				60 PSI	80 PSI	100 PSI
1.50	All	Push	1.767	106	142	177
	0.625	Pull	1.460	88	117	146
2.00	All	Push	3.142	188	251	314
	0.625	Pull	2.835	170	227	284
	1.000	Pull	2.357	141	189	236
2.50	All	Push	4.909	295	393	491
	0.625	Pull	4.602	276	368	460
	1.000	Pull	4.124	247	330	412
3.25	All	Push	8.296	498	664	830
	1.000	Pull	7.511	451	601	751
	1.375	Pull	6.811	409	545	681
4.00	All	Push	12.566	754	1005	1257
	1.000	Pull	11.781	707	942	1178
	1.375	Pull	11.081	665	886	1108
5.00	All	Push	19.635	1178	1571	1964
	1.000	Pull	18.850	1131	1508	1885
	1.375	Pull	18.150	1089	1452	1815
6.00	All	Push	28.274	1696	2262	2827
	1.375	Pull	26.789	1607	2144	2679
	1.750	Pull	25.869	1552	2070	2587

\*Required Rod Diameter: Nominal size +000/- .002.

## Rated Holding Force

Bore	Rod Diameter	Rod Lock Model	Holding Force*
1.50	0.625	RL-063150	200
2.00	0.625	RL-063200	500
	1.000	RL-100200	350
2.50	0.625	RL-063250	650
	1.000	RL-100250	650
3.25	1.000	RL-100325	1000
	1.375	RL-138325	1000
4.00	1.000	RL-100400	1550
	1.375	RL-138400	1550
5.00	1.000	RL-100500	2150
	1.375	RL-138500	2150
6.00	1.375	RL-138600	2850
	1.750	RL-175600	2850

\*Holding force is the minimum rating on clean and dry rods over the entire life of the unit. Add the load weight to the basic cylinder force when sizing rod lock.

**Rod locks are 100% tested** to assure that each unit exceeds the published rated holding force. When properly applied, rod locks will maintain the published holding force over the life of the unit.

# How to Order

## FM - MS4 - 2.5 x 10 - HC - RL - 063 250 - MPR

Series	
FM	250 PSI Air

NFPA Mounts	
MF1	Front Flange (1.50" - 6.00" Bore)
MF2	Rear Flange (1.50" - 6.00" Bore)
MP1	Rear Pivot Clevis (1.50" - 6.00" Bore)
MP2	Rear Pivot Clevis (1.50" - 6.00" Bore)
MP4	Rear Pivot Eye (1.50" - 4.00" Bore)
MS1	Front & Rear End Angle (1.50" - 6.00" Bore)
MS2	Side Lug (1.50" - 6.00" Bore)
MS4	Bottom Tapped Holes (1.50" - 6.00" Bore)
MT1	Front Trunnion (1.50" - 6.00" Bore)
MT2	Rear Trunnion (1.50" - 6.00" Bore)
MX0	No Mount (1.50" - 6.00" Bore)
Basebar	Non-NFPA (1.50" - 4.00" Bore)

Style	
(Blank)	Single Rod
D	Double Rod End

Bore	
1.5	1.50"
2	2.00"
2.5	2.50"
3.25	3.25"
4	4.00"
5	5.00"
6	6.00"

Stroke	
0" to 120"	
Made to order	

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

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

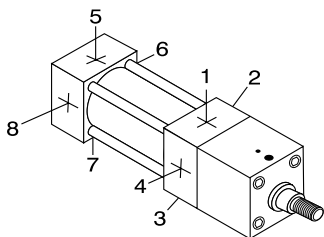
Notes:

- 1) Ordering example for adjustable cushions in non-standard locations: H3C7
- 2) Refer to Options for assistance with cushion length selection.
- 3) Cushions can be ordered on same side as ports.

Options	
A	Extended Piston Rod Thread (Example: A = 2")
AS	Adjustable Stroke - Retract (Specify Length, Example: AS = 4")
AO	Air / Oil Piston
» B	.250" Urethane Bumper Both Ends
» BC	.250" Urethane Bumper Cap Only
» BH	.250" Urethane Bumper Head Only
BP	Bumper Piston Seals (1.50" - 6.00" Bore)
BSPP	British Standard Pipe Taper (Specify Size, Example: BSPP = 1/4)
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSPT = 1/4)
KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3S	Studded Piston Rod (KK3 With Stud, Loctite In Place)
KK4	Full Diameter Male Rod Thread
KK5	Blank Rod End (No Threads, "A" = 0")
LF	Low Friction Seals
LT	Low Temperature Seals
LTE	Low Temperature Extreme Seals
MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust W/ Sound Dampening Bumper (12" Max Stroke)
MPR	Magnetic Piston For Reed Or Solid State Switches - Models: R10, R10P, RAC, RHT & MSS
NR	Non-Rotating
OP	Optional Port Location (Example: OP=3,7)
OS	Oversize Rod Diameter (Specify Size, Example: OS = 1.375")
P	Proximity Switch (1.50" - 6.00" Bore) Shipped Unassembled
RLC	Extended Piston Rod (Example: If RLC= 0.50", Then 1" Rod Extension Is RLC= 1.50")
SAE	SAE Ports (Specify Size, Example: SAE#10)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Sleeve Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods & Sleeve Nuts
» ST	Stop Tube - Specify Stop Tube Length (In Inches) Specify Stroke as ES (Effective Stroke) (Example: FM-MS4-2x24ES-ST=3)
TMS	Steel Cylinder Tube, Black Epoxy Paint Finish
TMSS	Stainless Steel Cylinder Tube
TH	400 PSI Hydraulic Non-Shock
V	Fluorocarbon Rod Lock Seals
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

### Standard Port and Cushion Adjustment Positions

- > Ports - Positions 1 and 5
- > Cushion Adjustment - Positions 2 and 6
- > Rod lock port follows head port
- > Specify Non-Standard Positions When Ordering



### Special Rod Lock Modifications

Common rod lock modifications include metallic rod scraper, close tolerance axial movement, fluorocarbon seals, electroless nickel plating or stainless steel housing.

Consult your local distributor or Bimba line customer service for more information and delivery.






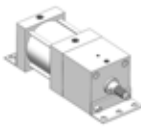



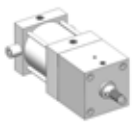

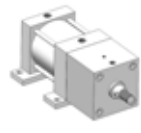
Rod Lock	Rod Size		Bore	
	RL	063	0.625"	150
	100	1.000"	200	2"
	138	1.375"	250	2.5"
	175	1.750"	325	3.25"
			400	4"
			500	5"
			600	6"

Note: Refer to Options for specifications  
» Refer to Option Length Adder

Option Length Adder (Add To Catalog Basic Overall Length Dimensions)						
Bore	Option					
	B	BC	BH	ELC	ELH	ST <sup>1</sup> (Stop Tube) Example: ST=2
1.50	0.500	0.250	0.250	1.000	1.000	2.000
2.00	0.500	0.250	0.250	1.000	1.000	2.000
2.50	0.500	0.250	0.250	1.000	1.000	2.000
3.25	0.500	0.250	0.250	1.250	1.250	2.000
4.00	0.500	0.250	0.250	1.250	1.250	2.000
5.00	0.500	0.250	0.250	1.250	1.250	2.000
6.00	0.500	0.250	0.250	1.500	1.500	2.000

<sup>1</sup> The desired stop tube length adds directly to the overall cylinder length.

## FM NFPA Mounts With Rod Lock

<p><b>MF1</b></p>  <p>1.50" - 6.00" bores</p>	<p><b>MF2</b></p>  <p>1.50" - 6.00" bores</p>	<p><b>MP1</b></p>  <p>1.50" - 6.00" bores</p>	<p><b>MP2</b></p>  <p>1.50" - 6.00" bores</p>	<p><b>MP4</b></p>  <p>1.50" - 4.00" bores</p>	<p><b>MS1</b></p>  <p>1.50" - 6.00"</p>
<p><b>MS2</b></p>  <p>1.50" - 6.00" bores</p>	<p><b>MS4</b></p>  <p>1.50" - 6.00" bores</p>	<p><b>MT1</b></p>  <p>1.50" - 6.00" bores</p>	<p><b>MT2</b></p>  <p>1.50" - 6.00" bores</p>	<p><b>MX0</b></p>  <p>1.50" - 6.00" bores</p>	<p><b>Basebar</b></p>  <p>1.50" - 4.00" bores</p>

# How to Specify

## Basic Cylinder (MX0 Mount) Flush Mount (With Sleeve Nut Construction)

### About Rod End Styles

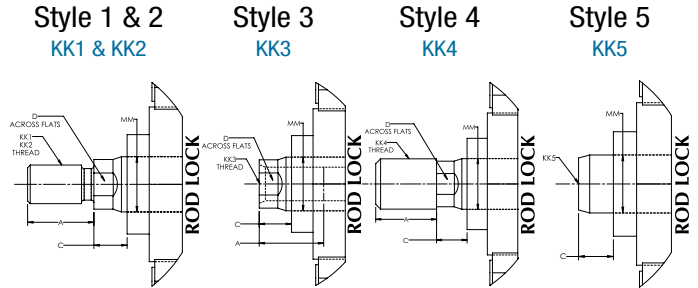
#### Style 1 Male Rod End is Standard

Other NFPA styles can be specified (see chart).

Need a rod end not listed? No problem! Each Piston Rod is made-to-order and does not delay shipment. Coarse UNC threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

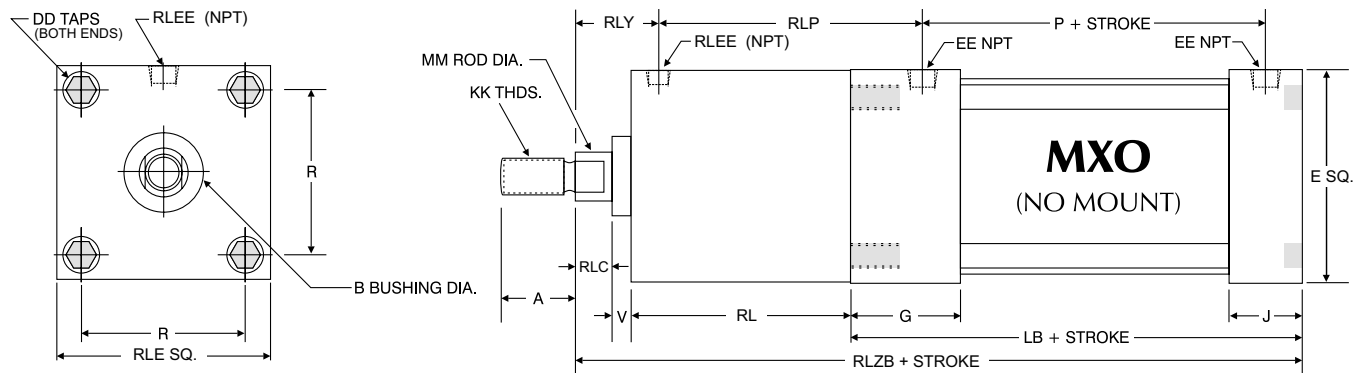
Need something not listed? Just send us a sketch. In most cases, quotes are turned around in one day!

### Piston Rod End Styles



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

## MX0 (No Mount): Standard Rod with Rod Lock Mounted



FM Series Basic Dimensions MX0 (Standard Rod)													Rod Lock Basic Dimensions							
Bore	A	B	DD	E	EE	G	J	KK	LB	MM	P	R	RL	RLC	RLE	RLEE	RLP	RLY	V	RLZB
1.50	0.750	1.125	1/4-28	2.000	1/4 NPT	1.500	1.000	7/16 -20	3.625	0.625	2.375	1.430	3.000	0.375	1.980	1/8 NPT	3.563	0.940	0.250	7.250
2.00	0.750	1.125	5/16 -24	2.500	1/4 NPT	1.500	1.000	7/16 -20	3.625	0.625	2.375	1.840	3.000	0.375	2.480	1/8 NPT	3.563	0.940	0.250	7.250
2.50	0.750	1.125	5/16 -24	3.000	1/4 NPT	1.500	1.000	7/16 -20	3.750	0.625	2.500	2.190	3.250	0.375	2.980	1/8 NPT	3.750	1.000	0.250	7.625
3.25	1.125	1.500	3/8 -24	3.750	3/8 NPT	1.750	1.250	3/4 -16	4.250	1.000	2.750	2.760	4.000	0.500	3.730	1/4 NPT	4.438	1.313	0.250	9.000
4.00	1.125	1.500	3/8 -24	4.500	3/8 NPT	1.750	1.250	3/4 -16	4.250	1.000	2.750	3.320	4.000	0.500	4.480	1/4 NPT	4.438	1.313	0.250	9.000
5.00	1.125	1.500	1/2 -20	5.500	3/8 NPT	1.750	1.250	3/4 -16	4.500	1.000	3.000	4.100	4.000	0.500	5.480	1/4 NPT	4.438	1.313	0.250	9.250
6.00	1.625	2.000	1/2 -20	6.500	1/2 NPT	2.000	1.500	1 -14	5.000	1.375	3.250	4.880	4.500	0.625	6.480	1/4 NPT	5.060	1.440	0.250	10.375

## Basic Cylinder (MX0 Mount) Flush Mount (With Sleeve Nut Construction): Oversized Rod

### About Rod End Styles

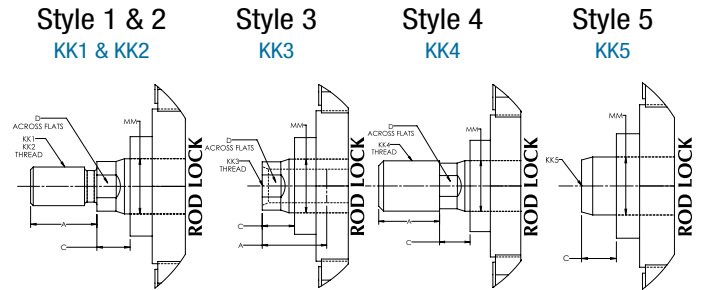
#### Style 1 Male Rod End is Standard

Other NFPA styles can be specified (see chart).

Need a rod end not listed? No problem! Each Piston Rod is made-to-order and does not delay shipment. Coarse UNC threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

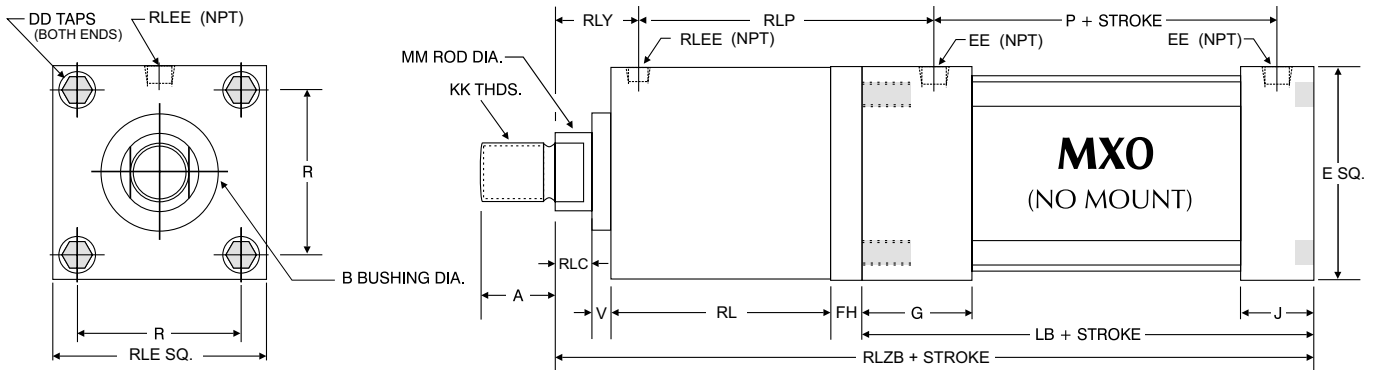
Need something not listed? Just send us a sketch. In most cases, quotes are turned around in one day!

### Piston Rod End Styles



Bore	Rod Diameter (MM)	Standard				Optional					RLC	V
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male		Style 5 - Blank		
		KK1	A	KK2	A	KK3	A	KK4	A	KK5		
2.00, 2.50	1.000	3/4-16	1.125	7/8-14	1.125	3/4-16	1.125	1-14	1.125	No Threads	0.500	0.250
3.25, 4.00, 5.00	1.375	1-14	1.625	1 1/4-12	1.625	1-14	1.625	1 3/8-12	1.625	No Threads	0.625	0.250
6.00	1.750	1 1/4-12	2.000	1 1/2-12	2.000	1 1/4-12	2.000	1 3/4-12	2.000	No Threads	0.750	0.250

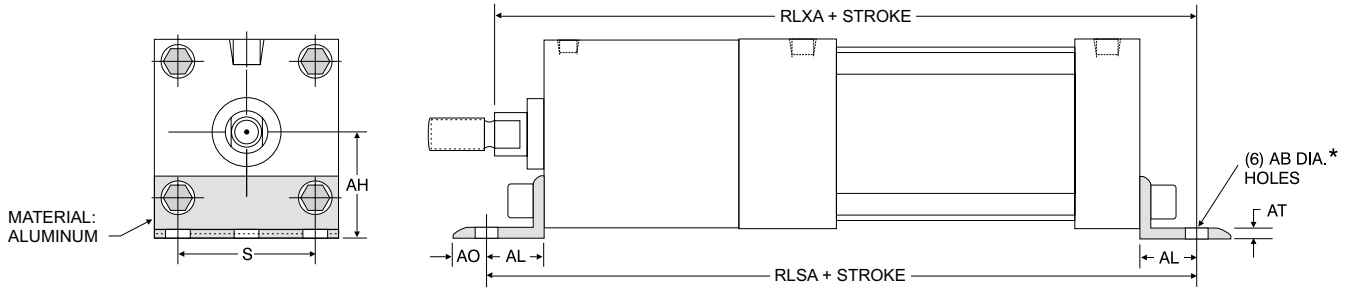
## MX0 (No Mount): Oversized Rod with Rod Lock Mounted



FM Series Basic Dimensions MX0 (Oversized Rod)													Rod Lock Basic Dimensions								
Bore	A	B	DD	E	EE	FH	G	J	KK	LB	MM	P	R	RL	RLC	RLE	RLEE	RLP	RLY	V	RLZB
2.00	1.125	1.500	5/16-24	2.500	1/4 NPT	0.375	1.500	1.000	3/4-16	3.625	1.000	2.375	1.840	3.750	0.500	2.480	1/8 NPT	4.500	1.250	0.250	8.500
2.50	1.125	1.500	5/16-24	3.000	1/4 NPT	0.375	1.500	1.000	3/4-16	3.750	1.000	2.500	2.190	3.750	0.500	2.980	1/8 NPT	4.500	1.250	0.250	8.625
3.25	1.625	2.000	3/8-24	3.750	3/8 NPT	0.625	1.750	1.250	1-14	4.250	1.375	2.750	2.760	4.000	0.625	3.730	1/4 NPT	5.063	1.438	0.250	9.750
4.00	1.625	2.000	3/8-24	4.500	3/8 NPT	0.625	1.750	1.250	1-14	4.250	1.375	2.750	3.320	4.000	0.625	4.480	1/4 NPT	5.063	1.438	0.250	9.750
5.00	1.625	2.000	1/2-20	5.500	3/8 NPT	0.625	1.750	1.250	1-14	4.500	1.375	3.000	4.100	4.125	0.625	5.480	1/4 NPT	5.188	1.438	0.250	10.125
6.00	2.000	2.375	1/2-20	6.500	1/2 NPT	0.750	2.000	1.500	1 1/4-12	5.000	1.750	3.250	4.875	4.500	0.750	6.480	1/4 NPT	5.820	1.563	0.250	11.250

# How to Specify

## MS1 (Head & Cap End Angle): Standard Rod with Rod Lock Mounted

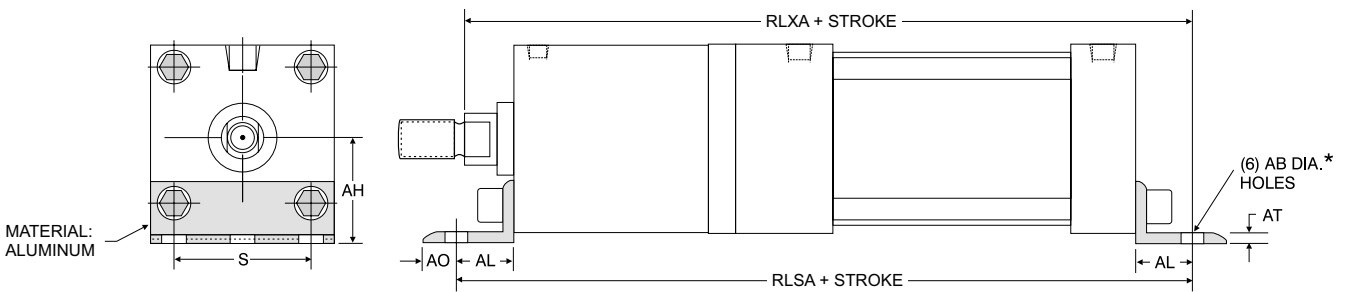


FM Series MS1 Angle Mount Dimensions

Bore	Rod Diameter	AB	AH	AL	AO	AT	S	Add Stroke	
								RLSA	RLXA
1.50	0.625	0.438	1.188	1.000	0.375	0.125	1.250	8.625	8.250
2.00	0.625	0.438	1.438	1.000	0.375	0.125	1.750	8.625	8.250
2.50	0.625	0.438	1.625	1.000	0.375	0.125	2.250	9.000	8.625
3.25	1.000	0.563	1.938	1.250	0.500	0.125	2.750	10.750	10.250
4.00	1.000	0.563	2.250	1.250	0.500	0.125	3.500	10.750	10.250
5.00	1.000	0.688	2.750	1.375	0.625	0.188	4.250	11.250	10.625
6.00	1.375	0.813	3.250	1.375	0.625	0.188	5.250	12.250	11.750

\*Note: 1.50" bore has four (4) "AB" holes on "S" dimension.  
For dimensions not shown, see page 55.

## MS1 (Head & Cap End Angle): Oversized Rod with Rod Lock Mounted



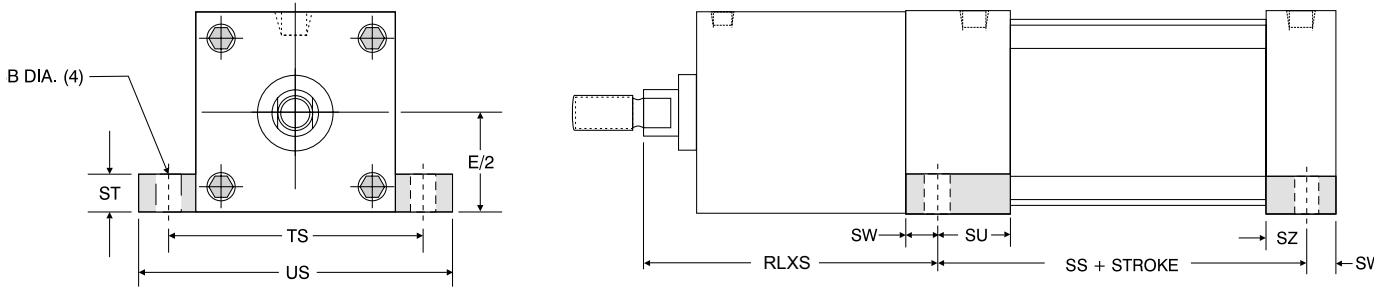
FM Series MS1 Angle Mount Dimensions

Bore	Rod Diameter	AB	AH	AL	AO	AT	S	Add Stroke	
								RLSA	RLXA
2.00	1.000	0.438	1.438	1.000	0.375	0.125	1.750	9.750	9.500
2.50	1.000	0.438	1.625	1.000	0.375	0.125	2.250	9.875	9.625
3.25	1.375	0.563	1.938	1.250	0.500	0.125	2.750	11.375	11.000
4.00	1.375	0.563	2.250	1.250	0.500	0.125	3.500	11.375	11.000
5.00	1.375	0.688	2.750	1.375	0.625	0.188	4.250	12.000	11.500
6.00	1.750	0.813	3.250	1.375	0.625	0.188	5.250	13.000	12.625

\*Note: 1.50" bore has four (4) "AB" holes on "S" dimension.  
For dimensions not shown, see page 55.



## MS2 (Side Lug): Standard Rod With Rod Lock Mounted

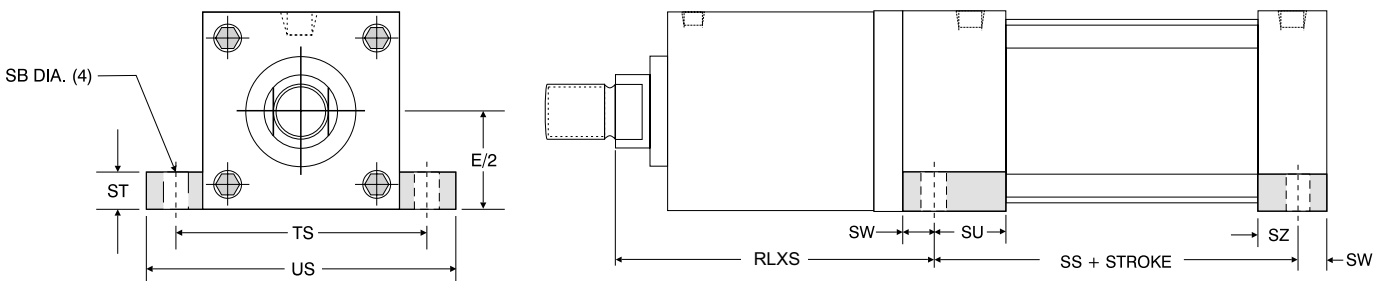


FM Series MS2 Side Lug Mount Dimensions

Bore	Rod Diameter	SB	E/2	ST	SU	SW	SZ	TS	US	RLXS	Add Stroke
											SS
1.50	0.625	0.438	1.000	0.500	1.125	0.375	0.625	2.750	3.500	4.000	2.875
2.00	0.625	0.438	1.250	0.500	1.125	0.375	0.625	3.250	4.000	4.000	2.875
2.50	0.625	0.438	1.500	0.500	1.125	0.375	0.625	3.750	4.500	4.250	3.000
3.25	1.000	0.563	1.875	0.750	1.250	0.500	0.750	4.750	5.750	5.250	3.250
4.00	1.000	0.563	2.250	0.750	1.250	0.500	0.750	5.500	6.500	5.250	3.250
5.00	1.000	0.813	2.750	1.000	1.063	0.688	0.563	6.875	8.250	5.438	3.125
6.00	1.375	0.813	3.250	1.000	1.313	0.688	0.813	7.875	9.250	6.070	3.625

For dimensions not shown, see page 55.

## MS2 (Side Lug): Oversized Rod With Rod Lock Mounted



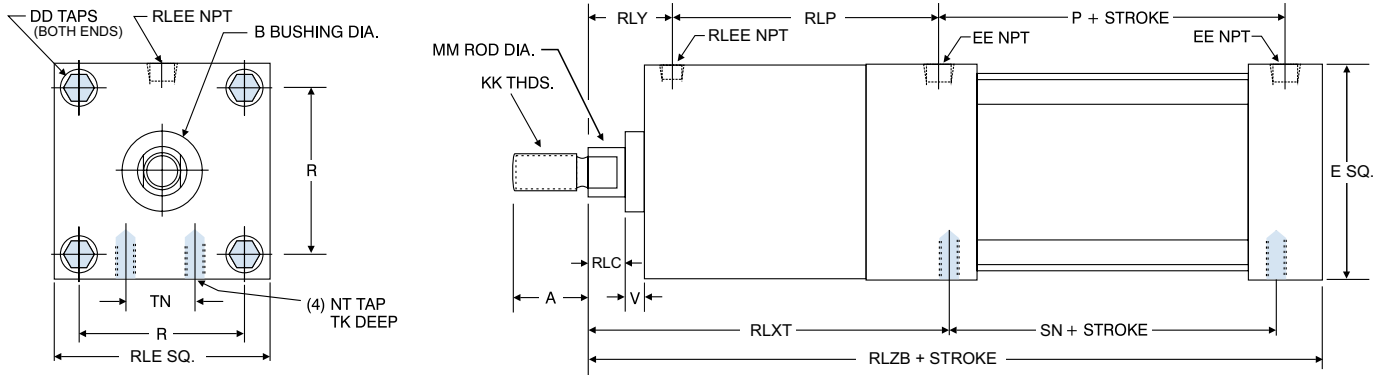
FM Series MS2 Side Lug Mount Dimensions

Bore	Rod Diameter	SB	E/2	ST	SU	SW	SZ	TS	US	RLXS	Add Stroke
											SS
2.00	1.000	0.438	1.250	0.500	1.125	0.375	0.625	3.250	4.000	5.250	2.875
2.50	1.000	0.438	1.500	0.500	1.125	0.375	0.625	3.750	4.500	5.250	3.000
3.25	1.375	0.563	1.875	0.750	1.250	0.500	0.750	4.750	5.750	6.000	3.250
4.00	1.375	0.563	2.250	0.750	1.250	0.500	0.750	5.500	6.500	6.000	3.250
5.00	1.375	0.813	2.750	1.000	1.063	0.688	0.531	6.875	8.250	6.313	3.125
6.00	1.750	0.813	3.250	1.000	1.313	0.688	0.813	7.875	9.250	6.938	3.625

For dimensions not shown, see page 55.

# How to Specify

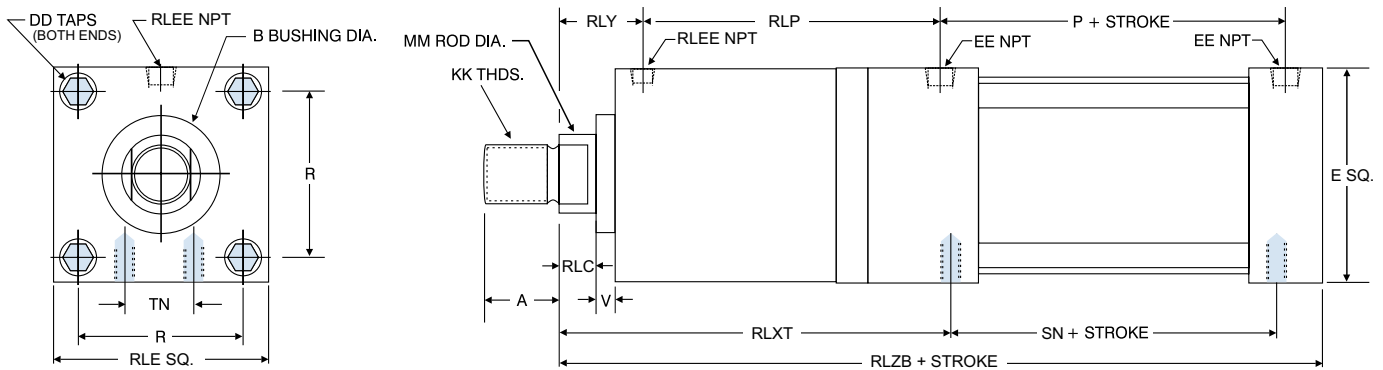
## MS4 (Bottom Tapped Holes): Standard Rod With Rod Lock Mounted



FM Series MS4 Flush Mount Dimensions														Rod Lock Basic Dimensions							
Bore	A	B	DD	E	EE	KK	MM	NT	P	R	SN	TK	TN	RLC	RLE	RLEE	RLP	RLXT	RLY	RLZB	V
1.50	0.750	1.125	1/4-28	2.000	1/4 NPT	7/16-20	0.625	1/4-20	2.375	1.438	2.250	0.375	0.625	0.375	1.984	1/8 NPT	3.563	4.570	0.938	7.250	0.250
2.00	0.750	1.125	5/16-24	2.500	1/4 NPT	7/16-20	0.625	5/16-18	2.375	1.844	2.250	0.500	0.875	0.375	2.484	1/8 NPT	3.563	4.570	0.938	7.250	0.250
2.50	0.750	1.125	5/16-24	3.000	1/4 NPT	7/16-20	0.625	3/4-16	2.500	2.188	2.375	0.625	1.250	0.375	2.984	1/8 NPT	3.750	4.820	1.000	7.625	0.250
3.25	1.125	1.500	3/8-24	3.750	3/8 NPT	3/4-16	1.000	1/2-13	2.750	2.760	2.625	0.750	1.500	0.500	3.734	1/4 NPT	4.438	5.820	1.313	9.000	0.250
4.00	1.125	1.500	3/8-24	4.500	3/8 NPT	3/4-16	1.000	1/2-13	2.750	3.320	2.625	0.750	2.063	0.500	4.484	1/4 NPT	4.438	5.820	1.313	9.000	0.250
5.00	1.125	1.500	1/2-20	5.500	3/8 NPT	3/4-16	1.000	5/8-11	3.000	4.100	2.875	1.000	2.688	0.500	5.484	1/4 NPT	4.438	5.820	1.313	9.250	0.250
6.00	1.625	2.000	1/2-20	6.500	1/2 NPT	1-14	1.375	3/4-10	3.250	4.875	3.125	1.125	3.250	0.625	6.484	1/4 NPT	5.063	6.560	1.438	10.375	0.250

For dimensions not shown, see page 55.

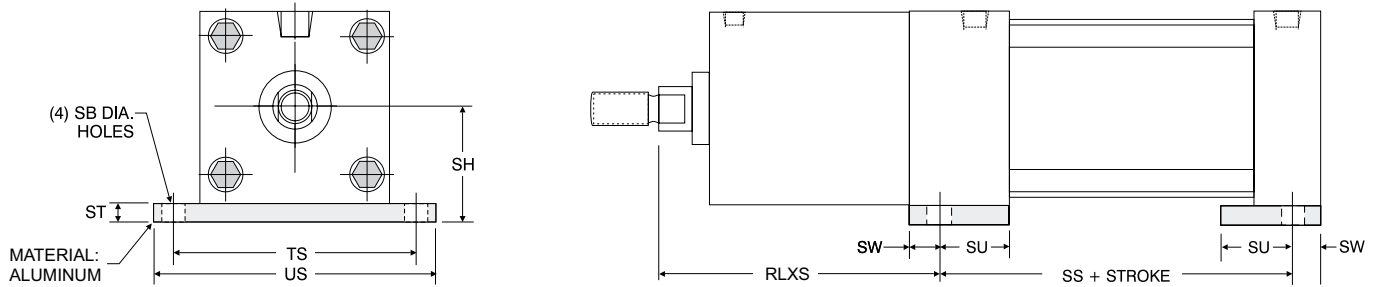
## MS4 (Bottom Tapped Holes): Oversized Rod With Rod Lock Mounted



FM Series Oversize Rod MS4 Flush Mount Dimensions														Rod Lock Basic Dimensions							
Bore	A	B	DD	E	EE	KK	MM	NT	P	R	SN	TK	TN	RLC	RLE	RLEE	RLP	RLXT	RLY	RLZB	V
2.00	1.125	1.500	5/16-24	2.500	1/4 NPT	3/4-16	1.000	5/16-18	2.375	1.844	2.250	0.500	0.875	0.500	2.484	1/8 NPT	4.500	5.813	1.250	8.500	0.250
2.50	1.125	1.500	5/16-24	3.000	1/4 NPT	3/4-16	1.000	3/4-16	2.500	2.188	2.375	0.625	1.250	0.500	2.984	1/8 NPT	4.500	5.813	1.250	8.625	0.250
3.25	1.625	2.000	3/8-24	3.750	3/8 NPT	1-14	1.375	1/2-13	2.750	2.760	2.625	0.750	1.500	0.625	3.734	1/4 NPT	5.063	6.570	1.438	9.750	0.250
4.00	1.625	2.000	3/8-24	4.500	3/8 NPT	1-14	1.375	1/2-13	2.750	3.320	2.625	0.750	2.063	0.625	4.484	1/4 NPT	5.063	6.570	1.438	9.750	0.250
5.00	1.625	2.000	1/2-20	5.500	3/8 NPT	1-14	1.375	5/8-11	3.000	4.100	2.875	1.000	2.688	0.625	5.484	1/4 NPT	5.188	6.688	1.438	10.125	0.250
6.00	2.000	2.375	1/2-20	6.500	1/2 NPT	1 1/4-12	1.750	3/4-10	3.250	4.875	3.125	1.125	3.250	0.750	6.484	1/4 NPT	5.820	7.438	1.563	11.250	0.250

For dimensions not shown, see page 55.

## Basebar (Non-NFPA): Standard Rod With Rod Lock Mounted

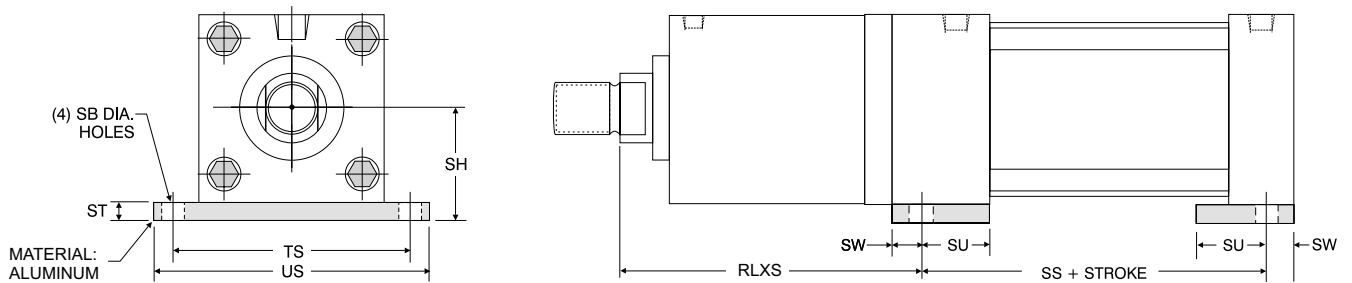


**FM Series Basebar Mount (Non-NFPA) Dimensions**

Bore	Rod Diameter	SB	SH	ST	SU	SW	TS	US	RLXS	Add Stroke
										SS
1.50	0.625	0.438	1.250	0.250	1.125	0.375	2.750	3.500	4.000	2.875
2.00	0.625	0.438	1.500	0.250	1.125	0.375	3.250	4.000	4.000	2.875
2.50	0.625	0.438	1.875	0.375	1.125	0.375	3.750	4.500	4.250	3.000
3.25	1.000	0.563	2.375	0.500	1.250	0.500	4.750	5.750	5.250	3.250
4.00	1.000	0.563	2.750	0.500	1.250	0.500	5.500	6.500	5.250	3.250

For dimensions not shown, see page 55.

## Basebar (Non-NFPA): Oversized Rod With Rod Lock Mounted



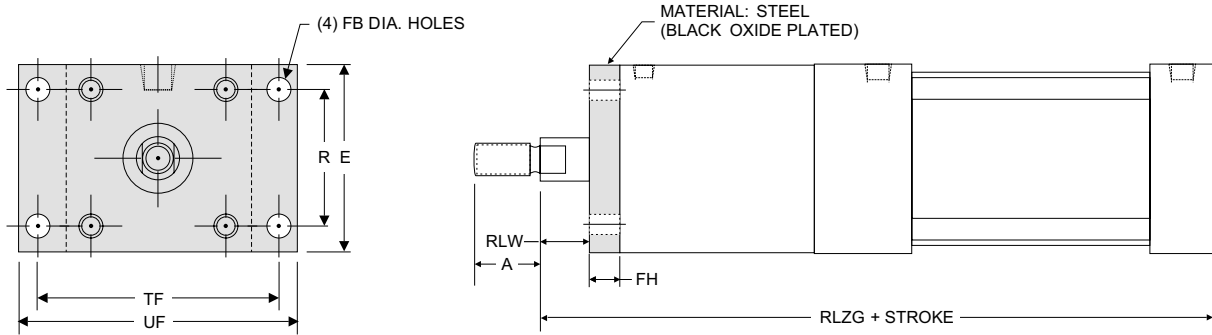
**FM Series Basebar Mount (Non-NFPA) Dimensions**

Bore	Rod Diameter	SB	SH	ST	SU	SW	TS	US	RLXS	Add Stroke
										SS
2.00	1.000	0.438	1.500	0.250	1.125	0.375	3.250	4.000	5.250	2.875
2.50	1.000	0.438	1.875	0.375	1.125	0.375	3.750	4.500	5.250	3.000
3.25	1.375	0.563	2.375	0.500	1.250	0.500	4.750	5.750	6.000	3.250
4.00	1.375	0.563	2.750	0.500	1.250	0.500	5.500	6.500	6.000	3.250

For dimensions not shown, see page 55.

# How to Specify

## MF1 (Head Flange): Standard Rod With Rod Lock Mounted

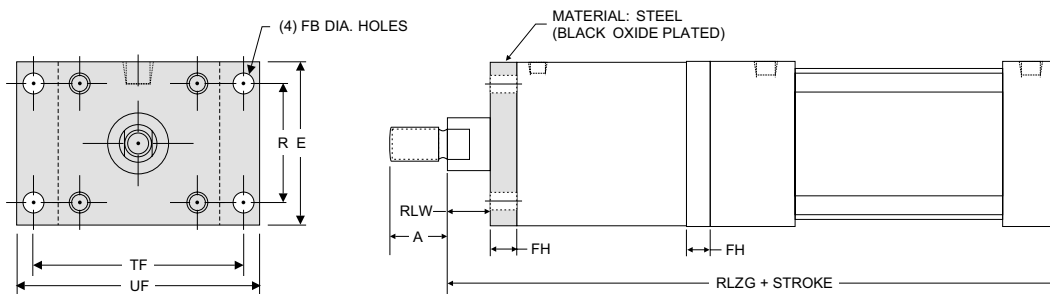


**FM Series MF1 Flange Mount Dimensions**

Bore	Rod Diameter	A	E	FB	FH	R	RLW	TF	UF	RLZG
1.50	0.625	0.750	2.000	0.313	0.375	1.438	0.625	2.750	3.375	7.625
2.00	0.625	0.750	2.500	0.375	0.375	1.844	0.625	3.375	4.125	7.625
2.50	0.625	0.750	3.000	0.375	0.375	2.188	0.625	3.875	4.625	8.000
3.25	1.000	1.125	3.750	0.438	0.625	2.760	0.750	4.688	5.500	9.625
4.00	1.000	1.125	4.500	0.438	0.625	3.320	0.750	5.438	6.250	9.625
5.00	1.000	1.125	5.500	0.563	0.625	4.100	0.750	6.625	7.625	9.875
6.00	1.375	1.625	6.500	0.563	0.750	4.875	0.875	7.625	8.625	11.125

For dimensions not shown, see page 55.

## MF1 (Head Flange): Oversized Rod With Rod Lock Mounted

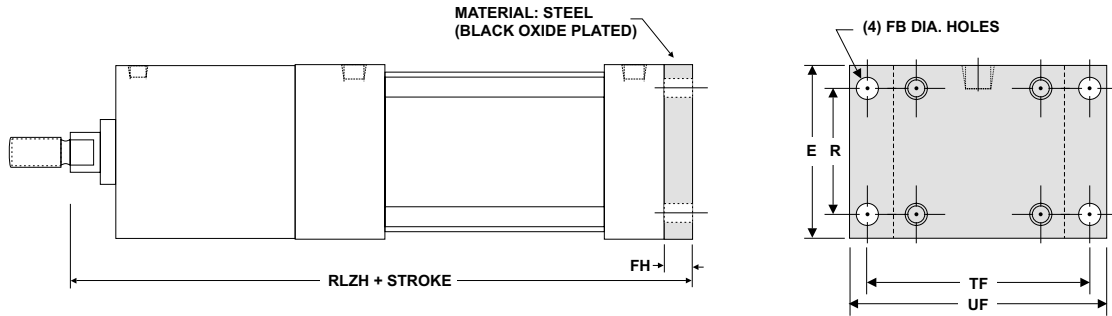


**FM Series MF2 Flange Mount Dimensions**

Bore	Rod Diameter	A	E	FB	FH	R	RLW	TF	UF	RLZG
2.00	1.000	1.125	2.500	0.375	0.375	1.844	1.000	3.375	4.125	9.125
2.50	1.000	1.125	3.000	0.375	0.375	2.188	1.000	3.875	4.625	9.250
3.25	1.375	1.625	3.750	0.438	0.625	2.760	1.000	4.688	5.500	10.500
4.00	1.375	1.625	4.500	0.438	0.625	3.320	1.000	5.438	6.250	10.500
5.00	1.375	1.625	5.500	0.563	0.625	4.100	1.000	6.625	7.625	10.875
6.00	1.750	2.000	6.500	0.563	0.750	4.875	1.125	7.625	8.625	12.125

For dimensions not shown, see page 55.

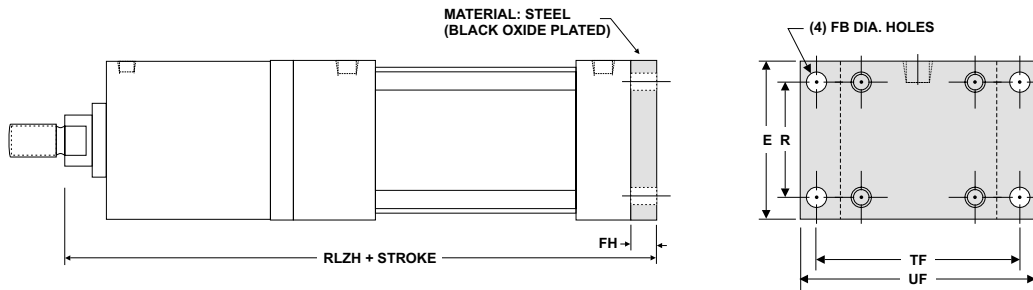
## MF2 (Cap Flange): Standard Rod With Rod Lock Mounted



FM Series MF2 Flange Mount Dimensions								
Bore	Rod Diameter	E	FB	FH	R	TF	UF	RLZH
1.50	0.625	2.000	0.313	0.375	1.438	2.750	3.375	7.625
2.00	0.625	2.500	0.375	0.375	1.844	3.375	4.125	7.625
2.50	0.625	3.000	0.375	0.375	2.188	3.875	4.625	8.000
3.25	1.000	3.750	0.438	0.625	2.760	4.688	5.500	9.625
4.00	1.000	4.500	0.438	0.625	3.320	5.438	6.250	9.625
5.00	1.000	5.500	0.563	0.625	4.100	6.625	7.625	9.875
6.00	1.375	6.500	0.563	0.750	4.875	7.625	8.625	11.125

For dimensions not shown, see page 55.

## MF2 (Cap Flange): Oversized Rod With Rod Lock Mounted

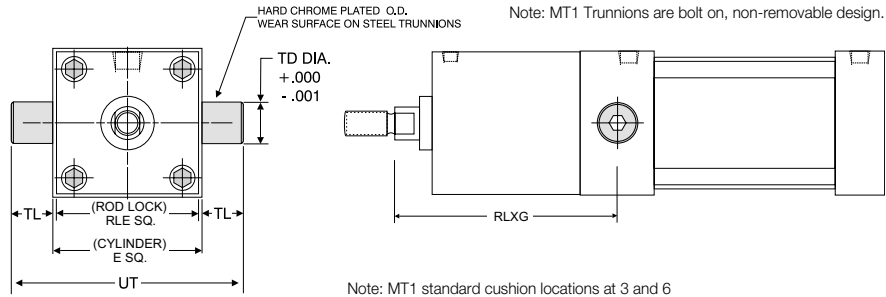


FM Series MF2 Flange Mount Dimensions								
Bore	Rod Diameter	E	FB	FH	R	TF	UF	RLZH
2.00	1.000	2.500	0.375	0.375	1.844	3.375	4.125	8.875
2.50	1.000	3.000	0.375	0.375	2.188	3.875	4.625	9.000
3.25	1.375	3.750	0.438	0.625	2.760	4.688	5.500	10.375
4.00	1.375	4.500	0.438	0.625	3.320	5.438	6.250	10.375
5.00	1.375	5.500	0.563	0.625	4.100	6.625	7.625	10.750
6.00	1.750	6.500	0.563	0.750	4.875	7.625	8.625	12.000

For dimensions not shown, see page 55.

# How to Specify

## MT1 (Head Trunnion): Standard Rod With Rod Lock Mounted



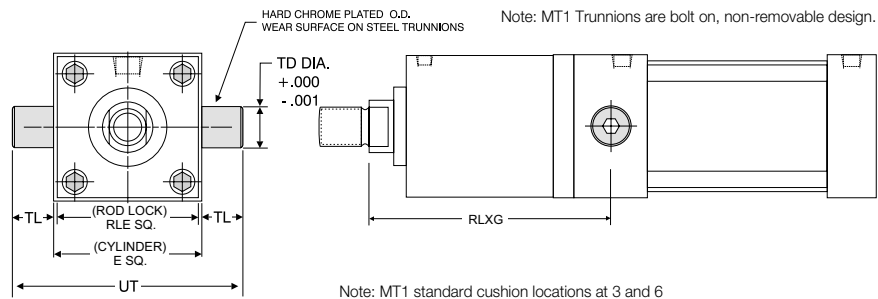
Note: MT1 standard cushion locations at 3 and 6

**FM Series MT1 Head Trunnion and MT2 Cap Trunnion Mount Dimensions**

Bore	Rod Diameter	E	RLE	TD	TL	UT	RLXG
1.50	0.625	2.000	1.984	1.000	1.000	4.000	4.375
2.00	0.625	2.500	2.484	1.000	1.000	4.500	4.375
2.50	0.625	3.000	2.984	1.000	1.000	5.000	4.625
3.25	1.000	3.750	3.734	1.000	1.000	5.750	5.625
4.00	1.000	4.500	4.484	1.000	1.000	6.500	5.625
5.00	1.000	5.500	5.484	1.000	1.000	7.500	5.625
6.00	1.375	6.500	6.484	1.375	1.375	9.250	6.375

For dimensions not shown, see page 55.

## MT1 (Head Trunnion): Oversized Rod With Rod Lock Mounted



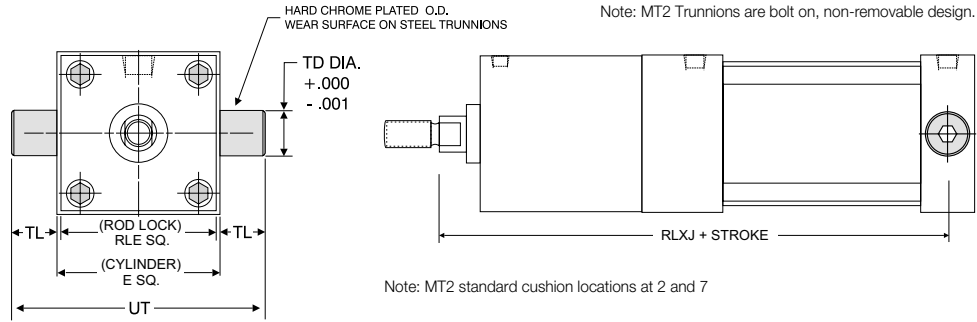
Note: MT1 standard cushion locations at 3 and 6

**FM Series MT1 Head Trunnion and MT2 Cap Trunnion Mount Dimensions**

Bore	Rod Diameter	E	RLE	TD	TL	UT	RLXG
2.00	1.000	2.500	2.484	1.000	1.000	4.500	5.625
2.50	1.000	3.000	2.984	1.000	1.000	5.000	5.625
3.25	1.375	3.750	3.734	1.000	1.000	5.750	6.375
4.00	1.375	4.500	4.484	1.000	1.000	6.500	6.375
5.00	1.375	5.500	5.484	1.000	1.000	7.500	6.500
6.00	1.750	6.500	6.484	1.375	1.375	9.250	7.250

For dimensions not shown, see page 55.

## MT2 (Cap Trunnion): Standard Rod With Rod Lock Mounted

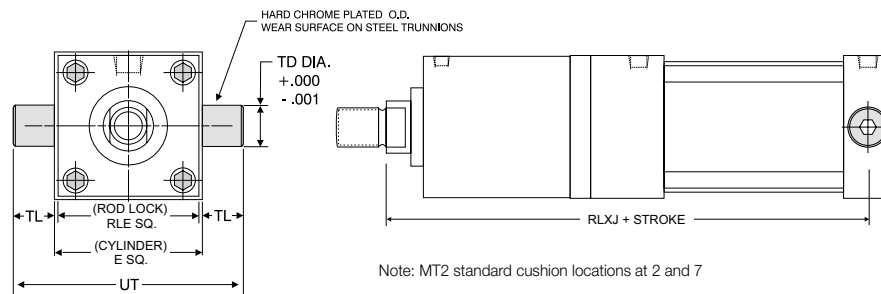


**FM Series MT1 Head Trunnion and MT2 Cap Trunnion Mount Dimensions**

Bore	Rod Diameter	E	RLE	TD	TL	UT	Add Stroke
							RLXJ
1.50	0.625	2.000	1.984	1.000	1.000	4.000	6.750
2.00	0.625	2.500	2.484	1.000	1.000	4.500	6.750
2.50	0.625	3.000	2.984	1.000	1.000	5.000	7.125
3.25	1.000	3.750	3.734	1.000	1.000	5.750	8.375
4.00	1.000	4.500	4.484	1.000	1.000	6.500	8.375
5.00	1.000	5.500	5.484	1.000	1.000	7.500	8.625
6.00	1.375	6.500	6.484	1.375	1.375	9.250	9.625

For dimensions not shown, see page 55.

## MT2 (Cap Trunnion): Oversized Rod With Rod Lock Mounted



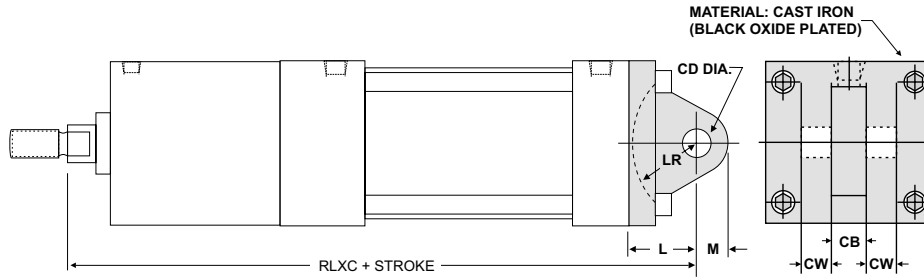
**FM Series MT1 Head Trunnion and MT2 Cap Trunnion Mount Dimensions**

Bore	Rod Diameter	E	RLE	TD	TL	UT	Add Stroke
							RLXJ
2.00	1.000	2.500	2.484	1.000	1.000	4.500	8.000
2.50	1.000	3.000	2.984	1.000	1.000	5.000	8.125
3.25	1.375	3.750	3.734	1.000	1.000	5.750	9.125
4.00	1.375	4.500	4.484	1.000	1.000	6.500	9.125
5.00	1.375	5.500	5.484	1.000	1.000	7.500	9.375
6.00	1.750	6.500	6.484	1.375	1.375	9.250	10.500

For dimensions not shown, see page 55.

# How to Specify

## MP1 (Detachable Cap Pivot Clevis): Standard Rod With Rod Lock Mounted

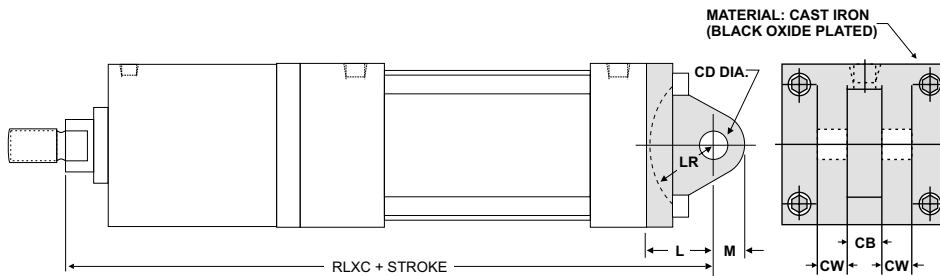


FM Series MP1 Clevis Mount Dimensions

Bore	Rod Diameter	CB	CD	CW	L	LR	M	Add Stroke
								RLXC
1.50	0.625	0.750	0.500	0.500	0.750	0.750	0.625	8.000
2.00	0.625	0.750	0.500	0.500	0.750	0.750	0.625	8.000
2.50	0.625	0.750	0.500	0.500	0.750	0.750	0.625	8.375
3.25	1.000	1.250	0.750	0.625	1.250	1.250	0.875	10.250
4.00	1.000	1.250	0.750	0.625	1.250	1.250	0.875	10.250
5.00	1.000	1.250	0.750	0.625	1.250	1.250	0.875	10.500
6.00	1.375	1.500	1.000	0.750	1.500	1.500	1.000	11.875

For dimensions not shown, see page 55.  
Clevis pins are provided with pivot mounts.

## MP1 (Detachable Cap Pivot Clevis): Oversized Rod With Rod Lock Mounted



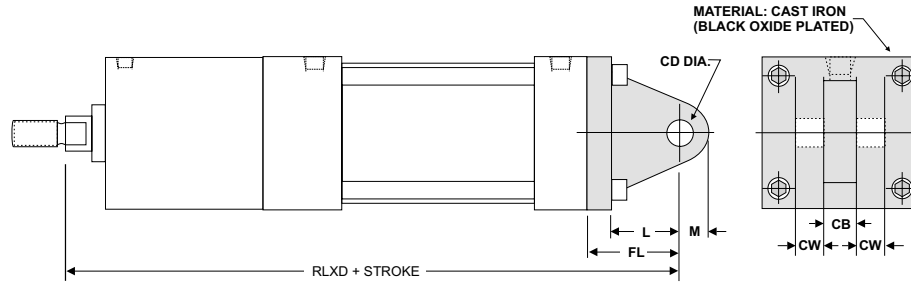
FM Series MP1 Clevis Mount Dimensions

Bore	Rod Diameter	CB	CD	CW	L	LR	M	Add Stroke
								RLXC
2.00	1.000	0.750	0.500	0.500	0.750	0.750	0.625	9.250
2.50	1.000	0.750	0.500	0.500	0.750	0.750	0.625	9.375
3.25	1.375	1.250	0.750	0.625	1.250	1.250	0.875	11.000
4.00	1.375	1.250	0.750	0.625	1.250	1.250	0.875	11.000
5.00	1.375	1.250	0.750	0.625	1.250	1.250	0.875	11.375
6.00	1.750	1.500	1.000	0.750	1.500	1.500	1.000	12.750

For dimensions not shown, see page 55.  
Clevis pins are provided with pivot mounts.



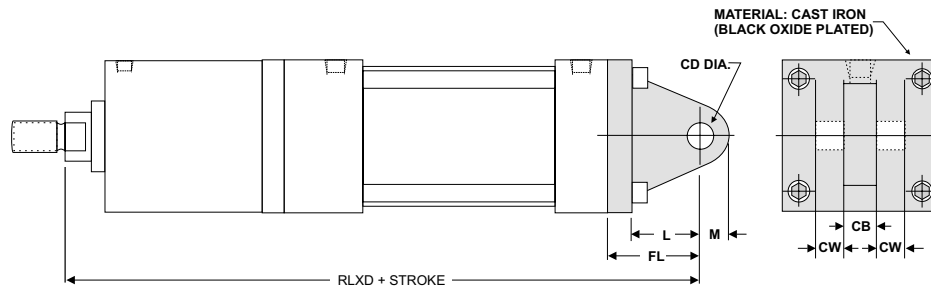
## MP2 (Detachable Cap Pivot Clevis): Standard Rod With Rod Lock Mounted



FM Series MP2 Clevis Mount Dimensions								
Bore	Rod Diameter	CB	CD	CW	FL	L	M	Add Stroke
								RLXD
1.50	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.375
2.00	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.375
2.50	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.750
3.25	1.000	1.250	0.750	0.625	1.875	1.250	0.875	10.875
4.00	1.000	1.250	0.750	0.625	1.875	1.250	0.875	10.875
5.00	1.000	1.250	0.750	0.625	1.875	1.250	0.875	11.125
6.00	1.375	1.500	1.000	0.750	2.250	1.500	1.000	12.625

For dimensions not shown, see page 55.  
Clevis pins are provided with pivot mounts.

## MP2 (Detachable Cap Pivot Clevis): Oversized Rod With Rod Lock Mounted

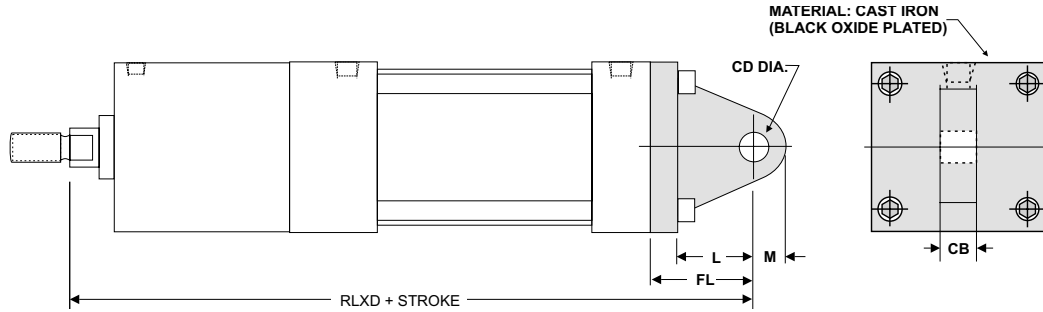


FM Series MP2 Clevis Mount Dimensions								
Bore	Rod Diameter	CB	CD	CW	FL	L	M	Add Stroke
								RLXD
2.00	1.000	0.750	0.500	0.500	1.125	0.750	0.625	9.625
2.50	1.000	0.750	0.500	0.500	1.125	0.750	0.625	9.750
3.25	1.375	1.250	0.750	0.625	1.875	1.250	0.875	11.625
4.00	1.375	1.250	0.750	0.625	1.875	1.250	0.875	11.625
5.00	1.375	1.250	0.750	0.625	1.875	1.250	0.875	12.000
6.00	1.750	1.500	1.000	0.750	2.250	1.500	1.000	13.500

For dimensions not shown, see page 55.  
Clevis pins are provided with pivot mounts.

# How to Specify

## MP4 (Detachable Cap Pivot Eye): Standard Rod With Rod Lock Mounted

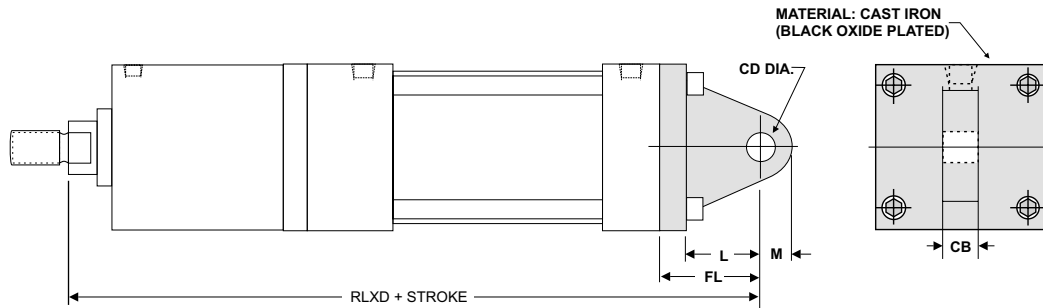


**FM Series MP4 Rod Eye Mount Dimensions**

Bore	Rod Diameter	CB	CD	CW	FL	L	M	Add Stroke
								RLXD
1.50	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.375
2.00	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.375
2.50	0.625	0.750	0.500	0.500	1.125	0.750	0.625	8.750
3.25	1.000	1.250	0.750	0.625	1.875	1.250	0.875	10.875
4.00	1.000	1.250	0.750	0.625	1.875	1.250	0.875	10.875

For dimensions not shown, see page 55. Clevis pins are provided with pivot mounts.

## MP4 (Detachable Cap Pivot Eye): Oversized Rod With Rod Lock Mounted



**FM Series MP4 Rod Eye Mount Dimensions**

Bore	Rod Diameter	CB	CD	CW	FL	L	M	Add Stroke
								RLXD
2.00	1.000	0.750	0.500	0.500	1.125	0.750	0.625	9.625
2.50	1.000	0.750	0.500	0.500	1.125	0.750	0.625	9.750
3.25	1.375	1.250	0.750	0.625	1.875	1.250	0.875	11.625
4.00	1.375	1.250	0.750	0.625	1.875	1.250	0.875	11.625

For dimensions not shown, see page 55. Clevis pins are provided with pivot mounts.

## Technical Data: Rod Lock Air Controls

Rod Locks can be used in a wide range of general purpose applications. They are designed to mechanically lock the cylinder piston rod when the air supply (60-150 PSI) is removed. Rod Locks are designed for millions of trouble-free actuations if properly applied. Avoid designs or situations where the rod lock is frequently engaged while the piston rod is in motion. Since Rod Locks have a high degree of rigidity, they can be used in positioning systems. Total Rod Lock play (under loaded conditions) is very low (.000" to .008").

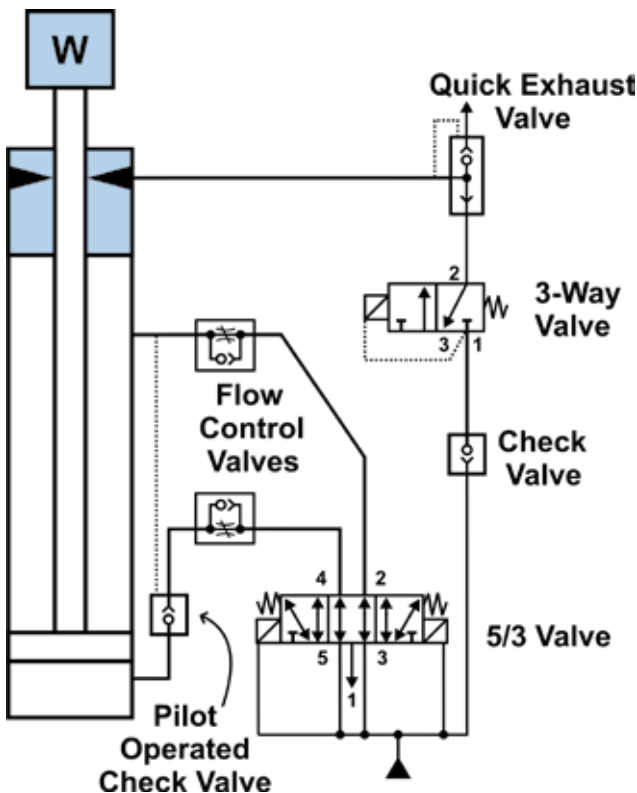
- 1. Cylinder Control** – Use a 5/3 valve to extend and retract cylinder with rod lock. A four-way valve or closed center valve can cause the cylinder to lunge before the rod lock is fully released, causing damage to the rod lock or piston rod.
- 2. Rod Lock Control** – Use a four-way NC valve to supply 60 - 150 PSI to engage and disengage the rod lock.
- 3. Check Valve** – Can be used to isolate three-way valve from drop in supply air during cylinder operation.
- 4. Air Regulator** – Can be used in vertical applications to offset the cylinder displacement differential between the rod end and cap end. They can also be used to help balance or counter the effects of gravity on the load.

- 5. Quick Exhaust Valve** – Can be used to accelerate the rod lock response time for maximum performance. Typical rod lock response time is 200ms.
- 6. E-Stop** – Rod locks can be used in E-Stop applications provided the design calls for infrequent actuation of rod lock while the cylinder rods are in motion.
- 7. Manual Override** – A three-way valve can be added to the control circuits below to act as a manual override for tooling set-up or adjustments.

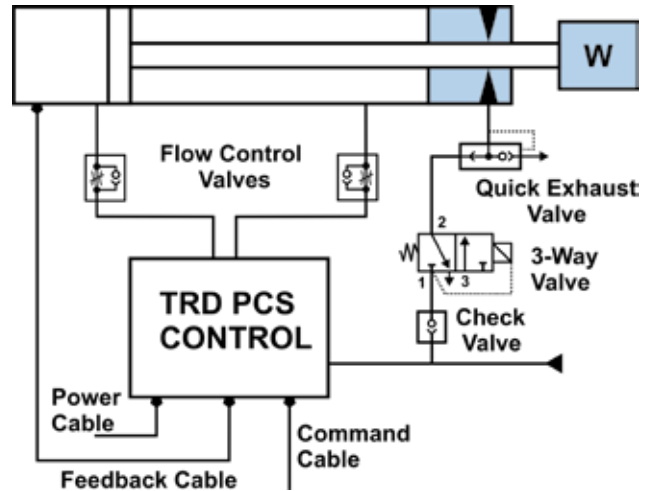
Refer to page 59 for safety precautions before using rod lock.

Consult your local distributor (or fluid power specialist) for proper air circuit design. Avoid situations where the cylinder can lunge on power up or cycling.

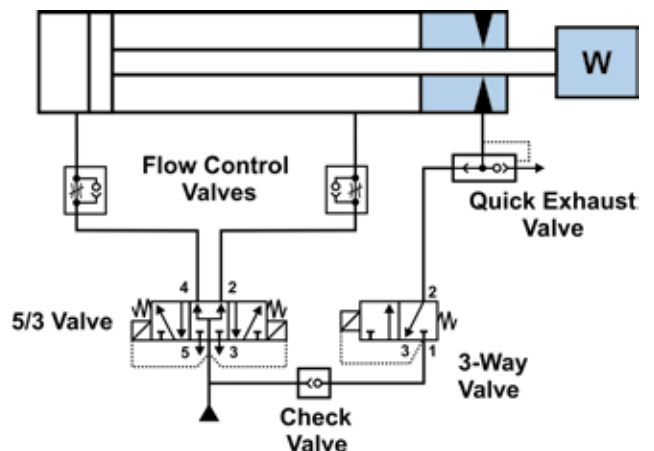
Vertical Application



Position Control Application

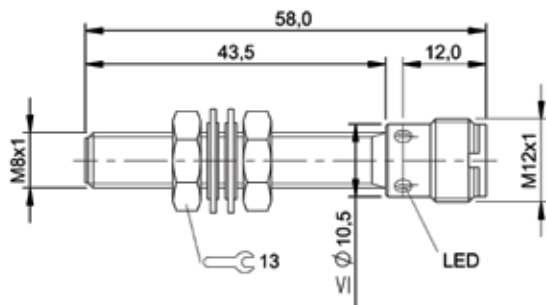


Horizontal Application



# How it Works

## Rod Lock Proximity Switch: Option P



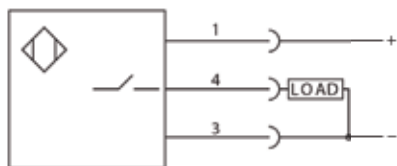
An inductive proximity switch (with M12x1 thread) can be used to sense the rod lock unclamped condition. Jam nuts are included and the switch is shipped unassembled (unthreaded) from the rod lock.

Balluff Model: BES M08EH-PSC15B-S04G

Electrical Data	
Connection type:	Connector
Effective operating current I <sub>e</sub> :	200 mA
Effective operating voltage U <sub>e</sub> DC:	24.0 V
Electrical version:	DC, direct current
Load capacitance max. (at U <sub>e</sub> ):	0.500 µF
Max. no-load cur. I <sub>o</sub> undamped:	3.0 mA
Minimum operating current I <sub>m</sub> :	0 mA
No-load current I <sub>o</sub> damped max.:	9.0 mA
Operating voltage U <sub>B</sub> max. DC [V]:	30.0 V
Operating voltage U <sub>B</sub> min. DC [V]:	10.0 V
Rated insulation voltage U <sub>i</sub> :	250 VAC
Rated short circuit current:	100 A
Ripple max. (% of U <sub>e</sub> ):	15%
Switching freq. f max. (at U <sub>e</sub> ):	3000 Hz
Switching function:	Normally open (NO)
Switching output:	PNP
Voltage drop static max.:	2.5 V

Mechanical Data	
Ambient temperature T <sub>a</sub> max.	70°C
Ambient temperature T <sub>a</sub> min.	-25°C
Assured operating distance S <sub>a</sub>	1.20 mm
Connector type	M12x1-S04
Depth	58.0 mm
Diameter d1	M08x1
Effective operating distance S <sub>r</sub>	1.50 mm
Housing material	Stainless steel
Mech. Installation condition	Flush (shielded)
Mounting length	43.0 mm
Rated operating distance S <sub>n</sub> [mm]	1.50 mm
Sensing face material	PBT
Tightening torque	8 Nm (6 FT-Lbs)
Function indicator	Yes
Function display	LED
Polarity reversal protected	Yes
Short circuit protected	Yes

### Wiring Connections: PNP Normally Open



### Proximity Switch Setting Instructions

1. Set the rod lock to the unclamped "pressure applied" position.
2. Screw the proximity switch (with jam nuts) into the designated M8x1 proximity switch hole until it contacts the position flange.
3. Unscrew (back off) the proximity switch approximately 3/4 turn. While holding the proximity switch in the set position, tighten the locking nut using 6 ft/lbs of torque. Final adjustment may be necessary to achieve desired results.
4. With the electrical power in the "off" position, connect the electrical wiring per the wiring diagram supplied with the switch. After the electrical power has been turned on, the proximity switch should indicate that the rod lock is in the unclamped position.

Notes: Ensure that the electrical power has been turned off before making adjustments. The locking nut should be tightened to a maximum of 15 ft/lbs of torque to prevent damage to the internal components of the switch. If sealing the unit for food or chemical service, make sure to include optional sealing ring.

## Rod Lock Installation Instructions

1. Apply constant air supply to rod lock port (60-150 PSI).
2. Remove shipping arbor from inside rod lock. Save for future use.
3. Remove excess grease and dirt from cylinder piston rod. Slide rod lock onto piston rod, using care not to damage seals or bearings.
4. Align rod lock to cylinder so that unit is square and flush. Make sure that the cylinder is at least 1/2" extended.
5. Remove 60-150 PSI air supply to rod lock.
6. Fasten rod lock to cylinder using four (4) sleeve nuts & rods. Tighten sleeve nuts a little at a time, in a clockwise rotation, finishing with the proper torque specification.
7. Cycle Rod Lock by applying 60-150 PSI to rod lock port, then removing 60-150 PSI pressure; cycle several times in this manner.
8. Apply constant 60-150 PSI air supply to rod lock, then hand cycle the cylinder piston rod to check for proper alignment.
9. If cylinder piston rod does not move freely, remove rod lock and repeat Installation Instructions. If the piston rod still drags or is difficult to move, check the squareness of the Rod Lock to the cylinder.

Note: Faulty alignment will cause rod damage, cylinder failure and may drastically reduce holding force.

Sleeve Nut Torque Specs	
Bore	Torque (Ft/Lbs)
1.50	5 - 7
2.00	12 - 14
2.50	12 - 14
3.25	30
4.00	35
5.00	45
6.00	50



### WARNING

**UNIT CONTAINS HIGH SPRING FORCE**

**DO NOT DISASSEMBLE – INJURY MAY OCCUR**

Return to Bimba for service

Refer to Rod Lock Catalog or visit [www.bimba.com](http://www.bimba.com) for complete instructions on proper use of rod lock.

**DO NOT REMOVE 60-150 PSI AIR SUPPLY TO ROD LOCK WHEN DISASSEMBLED FROM CYLINDER. PERMANENT DAMAGE MAY OCCUR.**

# How it Works

## Safety Information

### DANGER

**IF PERSONAL SAFETY IS REQUIRED, AN UNRELATED, REDUNDANT SAFETY SYSTEM IS REQUIRED TO PREVENT BODILY INJURY**

### WARNING

**DO NOT DISASSEMBLE ROD LOCK-UNIT CONTAINS HIGH SPRING FORCE.**

Return to Bimba for service.

### WARNING

**ROD LOCKS SHOULD BE INSTALLED, OPERATED AND MAINTAINED BY QUALIFIED PERSONNEL ONLY. UNITS SHOULD BE CHECKED PERIODICALLY FOR PROPER HOLDING FORCE.**

## General Information

One (or more rod locks) can be used on the same shaft or cylinder. Two units when combined will double the holding force. Steel cylinders should be considered in all high-load applications.

Rod locks are designed for static applications (rod not moving while engaging rod lock) and are suitable for infrequent dynamic braking (E-Stop) when used with proper shafting materials. Repeated dynamic stops may cause rod and seal damage and/or rod lock wear resulting in reduced life or holding force.

Filtered and dry air is important for proper rod lock functioning. Debris or moisture inside the rod lock may inhibit performance and/or shorten the life of the unit. Rod locks are pre-lubricated for life, no additional air lubrication is required.

The rod which the rod lock engages (clamps) must be kept clean and dry for optimum holding force.

The rod lock requires a minimum of 60 PSI to fully release. A low PSI condition (below 60 PSI) may cause the rod lock to drag on the rod, causing damage to the rod. Care should be taken to eliminate low PSI conditions.

**Rod locks are intended for use with industrial compressed air systems within the operation specifications.**



### Operating Pressure

<b>Cylinder:</b>	0 to 250 PSI AIR
<b>Rod Lock:</b>	60 to 150 PSI AIR

### Operating Temperature

<b>Standard Seals:</b>	10°F to 180°F (-12°C to 82°C)
<b>Fluorocarbon Seals:</b>	0°F to 400°F (-18°C to 204°C)

### Axial Movement (Clamped)\*

<b>Standard:</b>	.001" to .008"
<b>Close Tol. (Optional):</b>	.001" to .003"

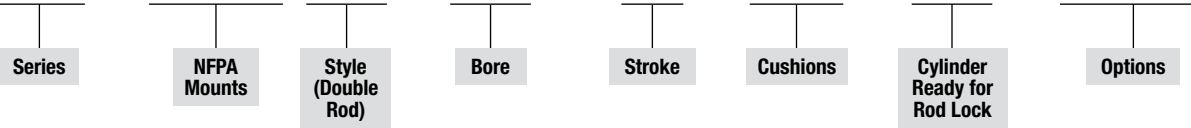
Represents clearance within the rod lock unit, .000" movement due to actuation.

### Rod Material Requirements

<b>Diameter:</b>	+.000" to -.002" Nominal Diameter
<b>Hardened Shaft:</b>	.0005" Minimum hard chrome
<b>Unhardened Shaft:</b>	.001" Minimum hard chrome
<b>Finish:</b>	6 to 10 Ra

## Replacement Cylinders

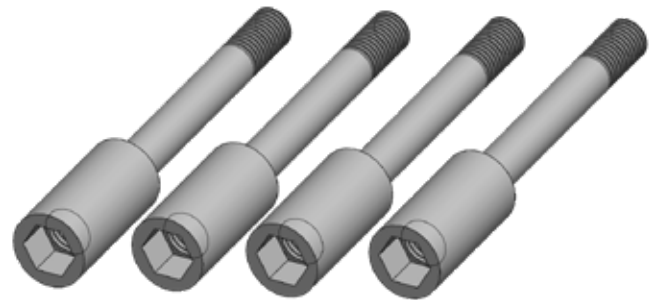
**FM - MS4 - 2.5 x 10 - HC - RL - MPR**



Note: Cylinders will ship with standard rod end (KK1) and standard rod extension (RLC dimension) unless otherwise noted by customer.



Rod Lock



Mounting Kit

Rod Lock Part List

Bore	Rod Diameter	Rod Lock Model (Rod Lock & Mounting Kit)	Rated Holding Force (Lbs.)	Rod Lock Only	Mounting Kit Only
1.50	0.625	RL-063150	200	RL-063150-1	MK-063150
2.00	0.625	RL-063200	500	RL-063200-1	MK-063200
	1.000	RL-100200	350	RL-100200-1	MK-100200
2.50	0.625	RL-063250	650	RL-063250-1	MK-063250
	1.000	RL-100250	650	RL-100250-1	MK-100250
3.25	1.000	RL-100325	1000	RL-100325-1	MK-100325
	1.375	RL-138325	1000	RL-138325-1	MK-138325
4.00	1.000	RL-100400	1550	RL-100400-1	MK-100400
	1.375	RL-138400	1550	RL-138400-1	MK-138400
5.00	1.000	RL-100500	2150	RL-100500-1	MK-100500
	1.375	RL-138500	2150	RL-138500-1	MK-138500
6.00	1.375	RL-138600	2850	RL-138600-1	MK-138600
	1.750	RL-175600	2850	RL-175600-1	MK-175600

Notes: Holding Force – The minimum rating over the entire life of the rod lock. Initial actual holding forces are higher.  
DO NOT disassemble rod lock – UNIT CONTAINS HIGH SPRING FORCE. Return to Bimba for service.  
Replacement Rod Locks are shipped with a steel shaft. DO NOT remove 60-150 PSI supply air to Rod Lock without steel shaft or cylinder rod in place – permanent damage to Rod Lock may occur.







# BTB Series, 3P Series, and TM Series

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



# Contents

---

**75** BTB Series Product Features  
75 – Back-to-Back Cylinder  
Schematics

---

**76** How to Order (BTB Series)

---

**77** How to Specify (BTB Series)  
77 – Mounting Options

---

**82** 3P Series Product Features  
82 – Application Possibilities

---

**83** How It Works (3P Series)  
83 – Design Tips

---

---

**84** How to Order (3P Series)

---

**85** How to Specify (3P Series)  
85 – Piston Rod End Styles  
85 – Mounting Options

---

**89** TM Series Product Features

---

**90** How It Works (TM Series)  
90 – Schematics  
91 – Force Charts

---

**92** How to Order (TM Series)

---

**93** How to Specify (TM Series)  
93 – Piston Rod End Styles  
93 – Mounting Options

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## Back-To-Back Cylinders

You can back-to-back any cylinder series together, mixed or matched, to provide unlimited design possibilities. Back-to-Back series cylinders (BTB) consist of two individual cylinders having common bore sizes, built as one unit utilizing common tie-rods. Mounts include a full range of base, flange, tie-rod and head or cap trunnions for pivot mounting.

**Tip:** You can use a rod clevis on each piston rod to create additional pivot mounting styles. Refer to Options for stop tube considerations in combined strokes over 40 inches.



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



*Standard BTB Design (TA Series)*



*Standard BTB Design (TA Series with "SP" Option)*

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

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

Note: 3P cylinders rely on the back piston rod to push against the front piston rod to create the intermediate position. Care must be used to prevent the front piston rod from extending in the intermediate position.

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

## Back-to-Back Cylinder Schematics

The following schematic is commonly used for back-to-back applications.

Cylinder strokes can be the same or different.

Back-to-Back cylinders are designed and built with two (2) separate piston rods. Cylinders operate independently of one another.

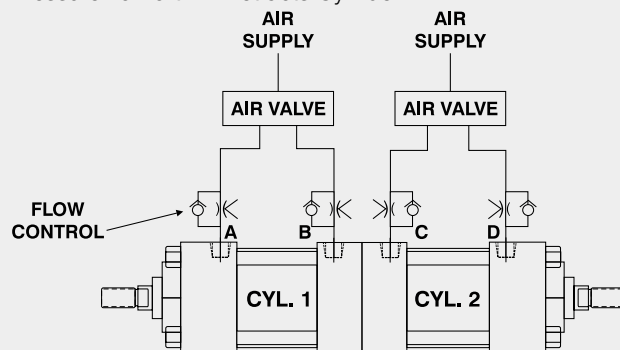
**Tip:** Before ordering, check the air fitting sizes to be sure you have adequate room at the ports "B" and "C" to install fittings. Ports can be rotated on one cylinder or a spacer plate can be added (between cylinder caps) to provide clearance for fittings.

**Example:** Shown is a back-to-back cylinder with each cylinder operated with an independent air valve & two (2) flow controls used to regulate cylinder speed.

### Schematic

#### Actuation Sequence:

Pressure To Port 'B' Extends Cylinder #1,  
 Pressure To Port 'A' Retracts Cylinder #1,  
 Pressure To Port 'C' Extends Cylinder #2,  
 Pressure To Port 'D' Retracts Cylinder #2.



# How to Order

BTB, 3P, AND TM SERIES NFPA CYLINDERS

76

CYL. #1

CYL. #2

## BTB - TA - MS4 - 2 x 10 - HC -

## WITH TA - MX0 - 2 x 5 - MPR - HC

### Back-To-Back

### Series

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

### Bore

1.5	1.50"
2	2.00"
2.5	2.50"
3.25	3.25"
4	4.00"
5	5.00"
6	6.00"
8	8.00"

### Stroke (Cyl. #1)

0" to 50"  
Made to order

### Cushions

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

### Fixed Cushions

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

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

\*Not available on 'TRA' series.

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

### Options

A	Extended Piston Rod Thread (Example: A = 2")
AS	Adjustable Stroke - Retract (Specify Length, Example: AS = 4")
A0	Air / Oil Piston
» B	.250" Urethane Bumper Both Ends
» BC	.250" Urethane Bumper Cap Only
» BH	.250" Urethane Bumper Head Only
BP	Bumper Piston Seals (1.50" - 8" Bore)
BSP	British Standard Pipe Taper (Specify Size, Example: BSP = 1/4)
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSP = 1/4)
C	Extended Piston Rod (Example: if C = 0.50", then 1" Rod Extension is C = 1.50")
KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3S	Studded Piston Rod (KK3 With Stud, Loctite In Place)
KK4	Full Diameter Male Rod Thread
KK5	Blank Rod End (No Threads, "A" = 0")
LF	Low Friction Seals
LT	Low Temperature Seals (LT)
LTE	Low Temperature Extreme Seals (LTE)
MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust W/ Sound Dampening Bumper (12" Max Stroke)
MPR	Magnetic Piston for Reed or Solid State Switches (R10, R10P, RAC, RHT & MSS)
MS	Metallic Rod Scraper (Brass Construction)
NR	Non-Rotating
OP	Optional Port Location (Example: OP=3,7)
OS	Oversize Rod Diameter (Specify Size, Example: OS = 1.375")
SAE	SAE Ports (Specify Size, Example: SAE#10)
» SE	Spring Extend (1.50, 2.00, 2.50 Bore)
» SR	Spring Return (1.50, 2.00, 2.50 Bore)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods
» ST	Stop Tube - Specify Stop Tube Length (In Inches) Specify Stroke as ES (Effective Stroke) (Example: TA MS4 2 X 24ES-ST=3)
TMS	Steel Cylinder Tube, Black Epoxy Paint Finish
TH	400 PSI Hydraulic Non-Shock
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

### NFPA Mounts

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

### About our Part Number System

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

#### Example: Back-To-Back

Cyl. 1 is a 'TA' series, MS4 mount, 2.00" bore x 10" stroke with head & cap cushions.

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

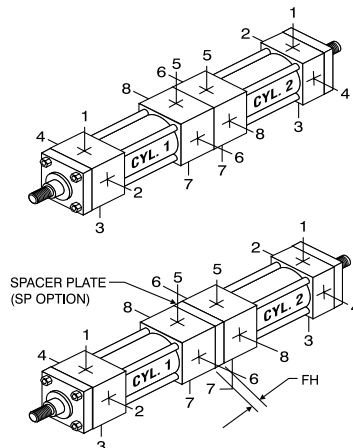
#### Part Number:

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

### Standard Port and Cushion Adjustment Positions

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

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



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

## Basic Cylinder (No Mount)

### About Rod End Styles

#### Style 1 Male Rod End is Standard

Other NFPA styles can be specified (see chart).

Need a rod end not listed? NO PROBLEM! Each Piston Rod is made-to-order and does not delay shipment. Coarse UNC threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

NEED SOMETHING NOT LISTED? Just send us a sketch. In most cases, quotes are turned around in one day!

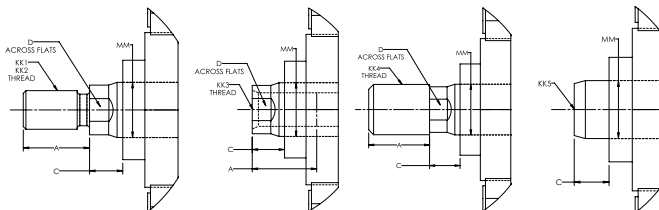
### Piston Rod End Styles

Style 1 & 2  
KK1 & KK2

Style 3  
KK3

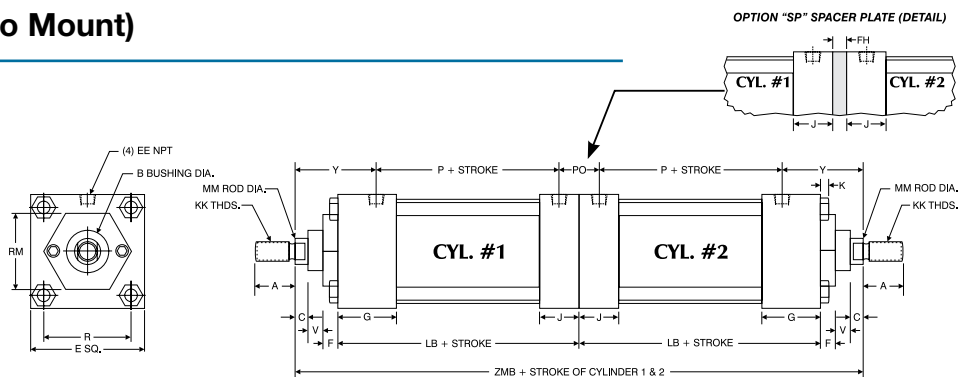
Style 4  
KK4

Style 5  
KK5



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

## MX0/MX0 (No Mount)



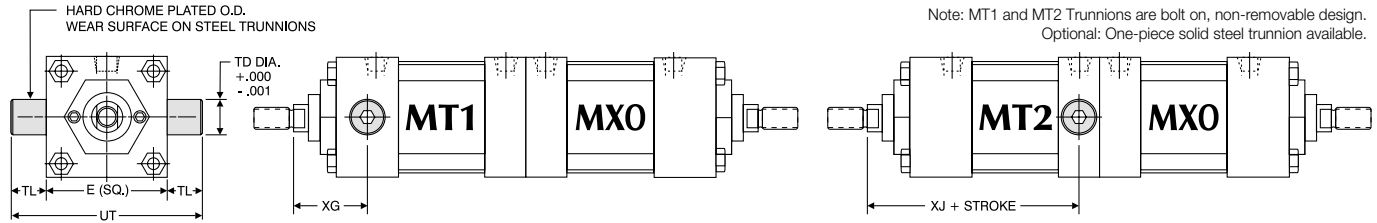
Back-To-Back Basic Dimensions 'MX0' Standard & Oversize Rods

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

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

# How to Specify

## Back-To-Back Dimensions: Pivot Mounts



### MT1/MT2

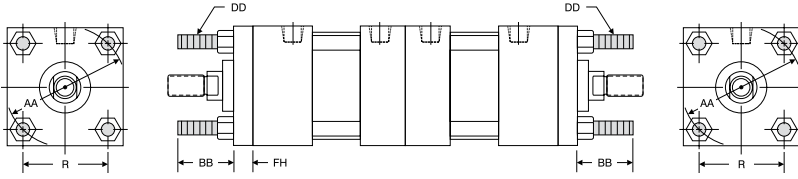
'MT1' Head Trunnion and 'MT2' Cap Trunnion Mount Dimensions

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

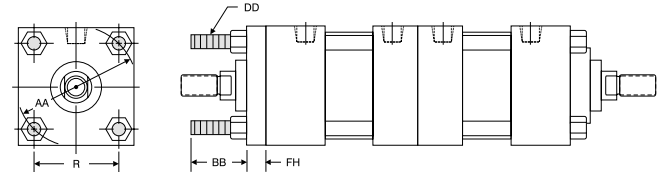
\*No oversize rod available on 1.50" bore MT1.

## Tie Rod & Flange Mounts

### MX1



### MX3/MX0

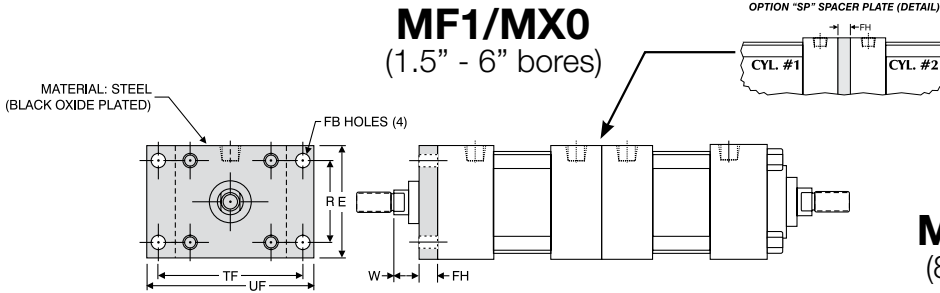


Tie Rod Extended 'MX1' & 'MX3' Mount Dimensions						
Bore	Rod Diameter	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4-28	0.375	1.438
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16-24	0.375	1.844
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16-24	0.375	2.188
	1.000 Oversize		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

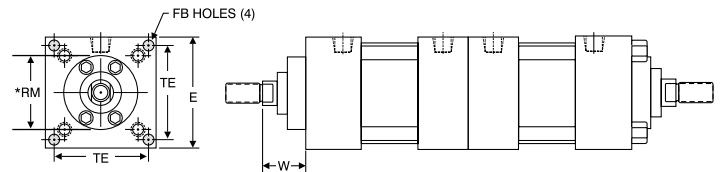
Tie Rod Extended 'MX1' & 'MX3' Mount Dimensions						
Bore	Rod Diameter	AA	BB	DD	FH	R
4.00	1.000 Standard	4.700	1.375	3/8-24	0.625	3.320
	1.375 Oversize					
5.00	1.000 Standard	5.800	1.813	1/2-20	0.625	4.100
	1.375 Oversize					
6.00	1.375 Standard	6.900	1.813	1/2-20	0.750	4.875
	1.750 Oversize				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

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

### MF1/MX0 (1.5" - 6" bores)



### ME3/MX0 (8" bore only)



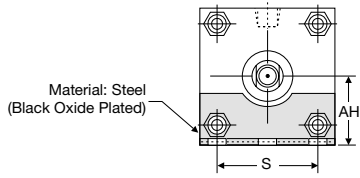
'MF1' Flange & 'ME3' Cap Mount Dimensions										
Bore	Rod Diameter	E	FB	FH	R	RM	TE	TF	UF	W
1.50	0.625 Standard	2.000	0.313	0.357	1.438	—	—	2.750	3.375	0.625
	1.000 Oversize									1.000
2.00	0.625 Standard	2.500	0.375	0.375	1.844	—	—	3.375	4.125	0.625
	1.000 Oversize									1.000
2.50	0.625 Standard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

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

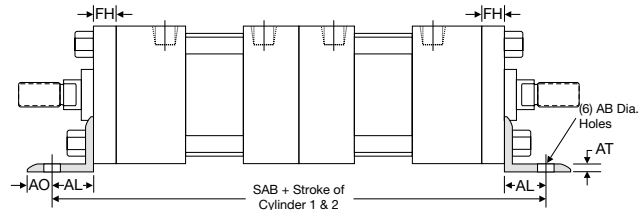
\*Round retainer used to retain bushing.

# How to Specify

## Base Mounts



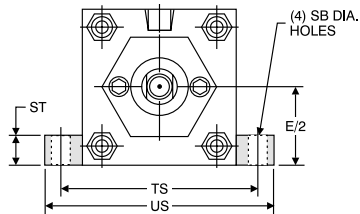
### MS1



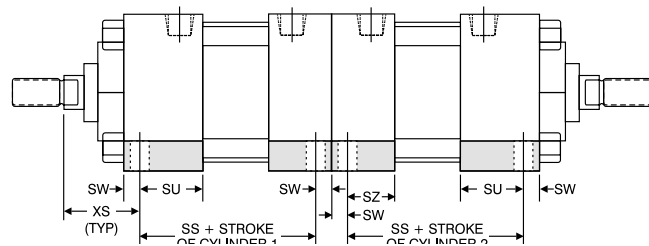
\*3.50" diameter round retainer on 8.00" bore.

'MS1' Angle Mount Dimensions

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



### MS2



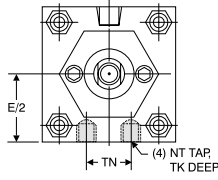
Note: The option not to have side lugs on center two (2) caps is available.  
 Use the "XX" option in the "How To Order" section (specify).  
 Example: BTB-TA-MS2-4 X 5-MPR with TA-MS2-4 X 3-BP-XX  
 \*XX" = No side lugs on center two (2) caps

'MS2' Side Lug Mount Dimensions

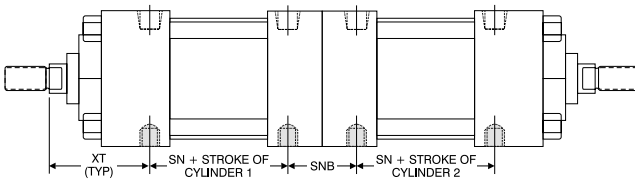
Bore	Rod Diameter	SB	E/2	ST	SU	SW	SZ	TS	US	XS	Add Stroke	
											SS	
1.50	0.625 Standard	0.438	1.000	0.500	1.125	0.375	0.625	2.750	3.500	1.375	2.875	
	1.000 Oversize											
2.00	0.625 Standard	0.438	1.250	0.500	1.125	0.375	0.625	3.250	4.000	1.375	2.875	
	1.000 Oversize											
2.50	0.625 Standard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



## Base Mounts



### MS4



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

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

# Product Features

## 3-Position Cylinders

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



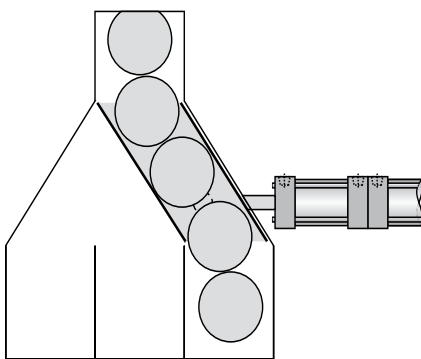
**1. Three Positions In One Cylinder** – One cylinder produces three different rod end positions. By varying stroke lengths, a multitude of positions can be created.

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

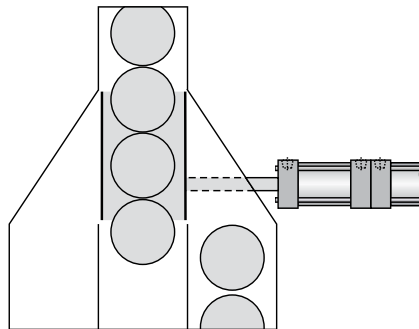
## Application Possibilities

### Lane Diverter With Three Lanes

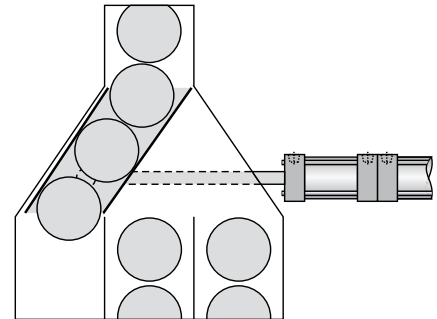
**POSITION 1:**  
RETRACT: FILL FIRST LANE



**POSITION 2:**  
MID-STROKE: FILL SECOND LANE



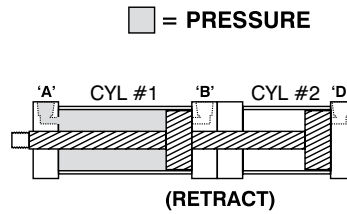
**POSITION 3:**  
EXTEND: FILL THIRD LANE



## How 3-Position Cylinders Work

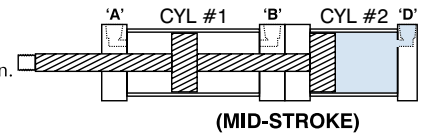
### POSITION 1 (RETRACT)

Pressure to port 'A' fully retracts cylinder.



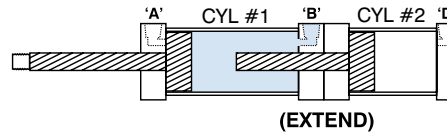
### POSITION 2 (MID-STROKE)

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



### POSITION 3 (EXTEND)

Pressure to port 'B' fully extends cylinder.



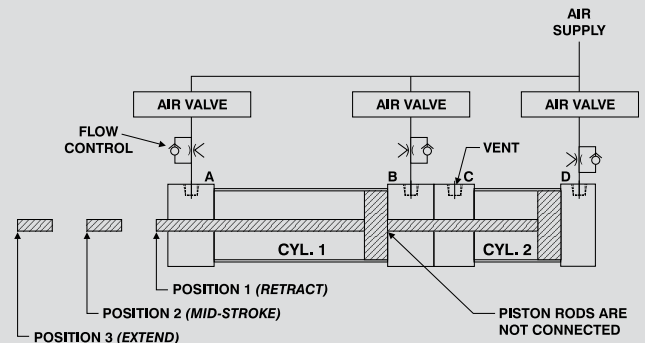
## Design Tips

- > Order CYL 1 with "MPR" (magnetic piston option) and use three switches to sense each stroke position. See Switches for switch ordering information.
- > You can use "MA" (micro-adjust option) on CYL 2 to create an adjustable mid-stroke position cylinder.
- > During the mid-stroke position, the piston rod on CYL 1 is held in place by seal friction and can "extend" in vertical applications when the cylinder rod end is mounted down. To prevent this from happening, a lower air pressure can be applied to cylinder port "A" to offset cylinder rod or tooling weight.
- > For non-rotating applications, you can use a "NR" (non-rotating option) or Triple Rod cylinder series (TRA) as CYL 1 and a standard 'TA' series as CYL 2.

### Schematic

#### Actuation Sequence:

- Pressure To Port 'A' Retracts The Cylinder To Position 1
- Pressure To Port 'D' Extends The Cylinder To Position 2
- Pressure To Port 'B' Extends The Cylinder To Position 3



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

# How to Order

BTB, 3P, AND TM SERIES NFPA CYLINDERS

84

CYL. #1

CYL. #2

**3P - TA - MS4 - 2 x 10 - H - MPR WITH**

**TA - MX0 - 2 x 5 - MPR**

**3-Position**

**Series**

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

**Bore**

1.5	1.50"
2	2.00"
2.5	2.50"
3.25	3.25"
4	4.00"
5	5.00"
6	6.00"
8	8.00"

**Total Stroke Extend (CYL. #1)**

0" to 50"  
Made-To-Order

**Mid-Stroke**

**Options**

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

**NFPA Mounts**

MX0	No Mount
MP1	Rear Pivot Clevis (Cyl. 2 Only)
MP2	Rear Pivot Clevis (1.50"-6.00" Bore) (Cyl. 2 Only)
MP4	Rear Pivot Eye (1.50" - 4.00" Bore) (Cyl. 2 Only)
MT1	Front Trunnion (Specify Cyl. 1 or 2)
MT2	Rear Trunnion (Specify Cyl. 1 or 2)
MX1	Extended Tie Rods (Head & Cap)
MX2	Extended Tie Rods (Cap End)
MX3	Extended Tie Rods (Head End)
MF1	Front Flange (1.50"-6.00") (Cyl. 1 Only)
MF2	Rear Flange (1.50"-6.00") (Cyl. 2 Only)
ME3	Front Mounting Holes (8.00") (Cyl. 1 Only)
ME4	Rear Mounting Holes (8.00") (Cyl. 2 Only)
MS1	Front & Rear End Foot
MS2	Side Lug (1.50"-8.00")
MS4	Bottom Tapped Holes

**Cushions**

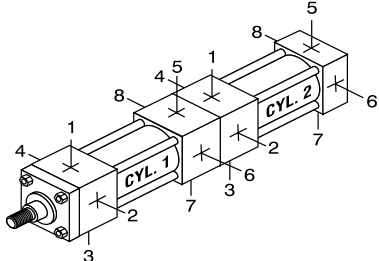
H	Adjustable Head Cushion Position 2 is Standard Specify For Positions: 1, 3 & 4
LH	Long Head Cushion Position 2 is Standard Specify For Positions: 1, 3 & 4
» ELH	Extra Long Head Cushion Position 2 is Standard Specify For Positions: 1, 3 & 4
C	Adjustable Cap Cushion <sup>1</sup> Position 6 is Standard Specify For Positions: 5, 7 & 8
LC	Adjustable Long Cap Cushion <sup>2</sup> Position 6 is Standard Specify For Positions: 5, 7 & 8
» ELC	Adjustable Extra Long Cap Cushion <sup>2</sup> Position 6 is Standard Specify For Positions: 5, 7 & 8
<b>Fixed Cushions</b>	
FCH	Fixed Head Cushion (Non-Adjustable (No Adjustment Needle))
FCC	Fixed Cap Cushion (Non-Adjustable (No Adjustment Needle))
FC	Fixed Head and Cap Cushion (Non-Adjustable, No Adjustment Needle)

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

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

### Standard Port and Cushion Adjustment Positions

- > Ports - Positions 1 and 5 \*
- > Cushion Adjustment - Positions 2 and 6 (Cushions not available on CYL. 1 Cap)
- > Specify Non-Standard Positions When Ordering



### About our Part Number System

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

**Example:** 3-Position  
Application calls for a 2.00" bore cylinder with stroke positions of 0", 5" and 10" base mount on rod end cylinder only, with magnetic piston for position (switch) sensors.

**Part Number:** 3P-TA-MS4-2 x 10-MPR with TA-MX0-2 x 5-MPR

### How To Order

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

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

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

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

## Basic Cylinder (No Mount)

### About Rod End Styles

#### Style 1 Male Rod End is Standard

Other NFPA styles can be specified (see chart).

Need a rod end not listed? NO PROBLEM! Each Piston Rod is made-to-order and does not delay shipment. Coarse UNC threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

NEED SOMETHING NOT LISTED? Just send us a sketch. In most cases, quotes are turned around in one day!

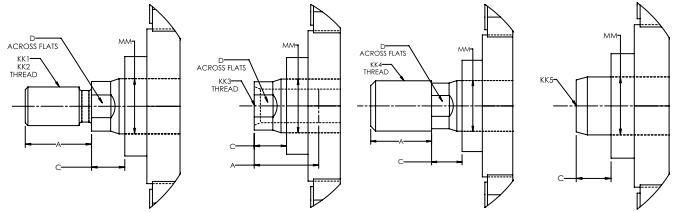
### Piston Rod End Styles

Style 1 & 2  
KK1 & KK2

Style 3  
KK3

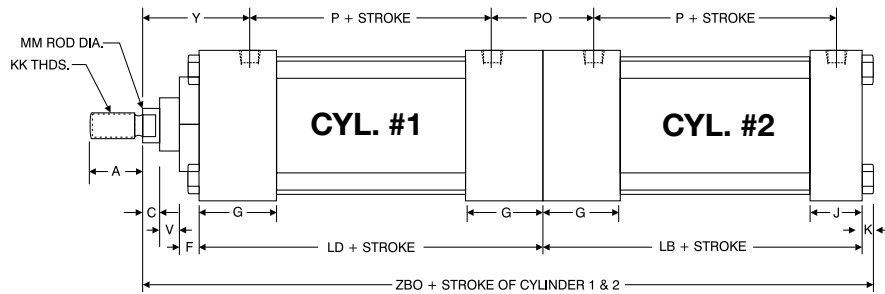
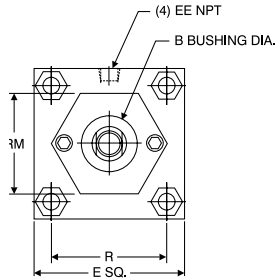
Style 4  
KK4

Style 5  
KK5



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

## MX0/MX0 (No Mount)



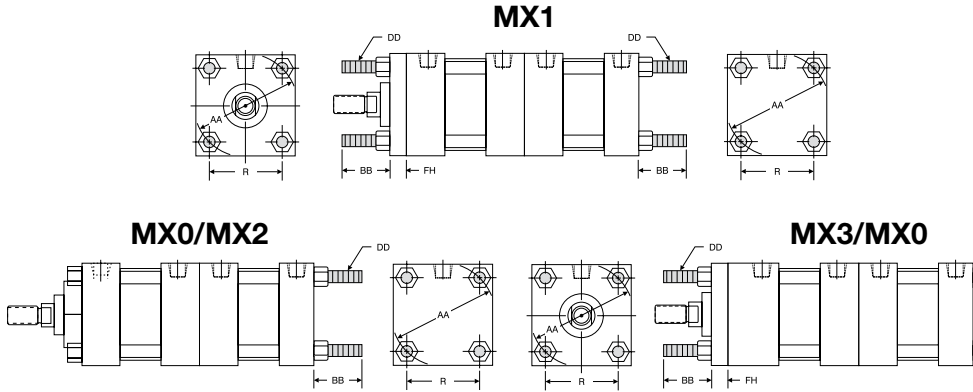
3-Position Basic Dimensions 'MX0' Standard & Oversize Rods

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

# How to Specify

## Tie Rod & Flange Mounts

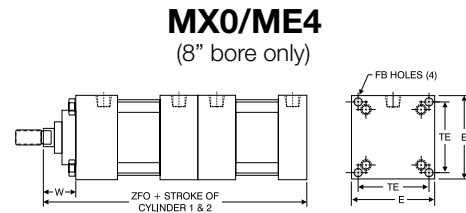
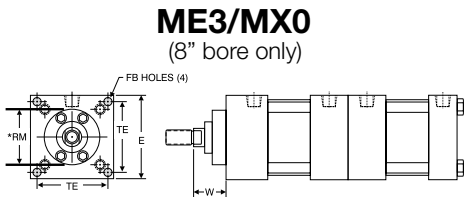
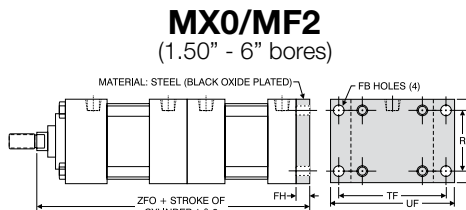
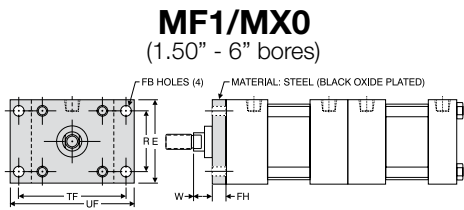
BTB, 3P, AND TM SERIES NFPA CYLINDERS



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

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

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

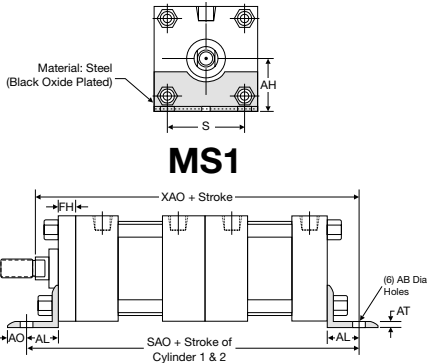


Bore	Rod Diameter	E	FB	FH	R	RM	TE	TF	UF	W	ZFO
1.50	0.625 Standard	2.000	0.313	0.375	1.438	—	—	2.750	3.375	0.625	9.125
	1.000 Oversize									1.000	9.500
2.00	0.625 Standard	2.500	0.375	0.375	1.844	—	—	3.375	4.125	0.625	9.125
	1.000 Oversize									1.000	9.500
2.50	0.625 Standard	3.000	0.375	0.375	2.188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

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

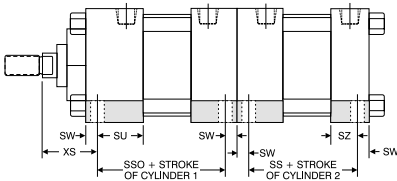
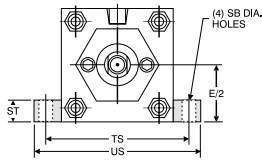
\*Round retainer used to retain bushing.  
For dimensions not shown, see page 70.

## 3-Position Dimensions: Base Mounts



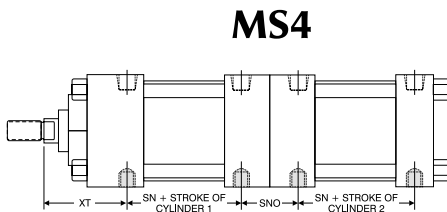
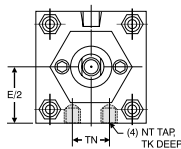
\*Round retainer on 8.00" bore.  
For dimensions not shown, see page 70.

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



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

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

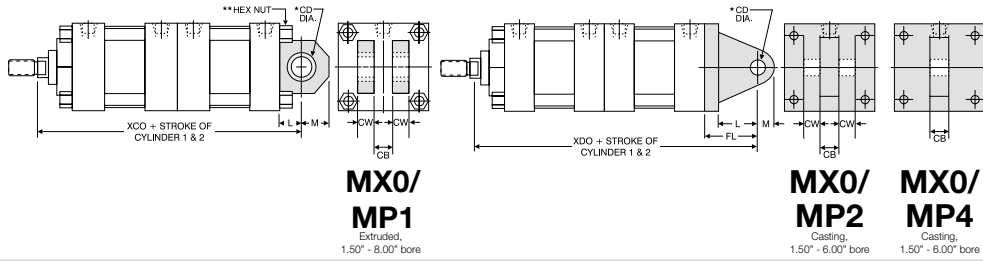


Note: The option not to have 'MS4' taps on center two (2) caps is available.  
Use the "XX" option in the "How To Order" section (specify).  
Example: 3P-TA-MS4-6 X 7-H with TA-MS4-6 X 4-C-"XX"  
"XX" = No 'MS4' taps on center two (2) caps  
For dimensions not shown, see page 70.

'MS4' Bottom Tapped Mount Dimensions									
Bore	Rod Diameter	E/2	NT	TK	TN	XT	SNO	Add Stroke	
								SN	
1.50	0.625 Standard	1.000	1/4 -20	0.375	0.625	1.938	1.875	2.250	2.313
	1.000 Oversize								
2.00	0.625 Standard	1.250	5/16 -18	0.500	0.875	1.938	1.875	2.250	2.313
	1.000 Oversize								
2.50	0.625 Standard	1.500	3/8 -16	0.625	1.250	1.938	1.875	2.375	2.313
	1.000 Oversize								
3.25	1.000 Standard	1.875	1/2 -13	0.750	1.500	2.438	2.125	2.625	2.688
	1.375 Oversize								
4.00	1.000 Standard	2.250	1/2 -13	0.750	2.063	2.438	2.125	2.625	2.688
	1.375 Oversize								
5.00	1.000 Standard	2.750	5/8 -11	1.000	2.688	2.438	2.125	2.875	2.688
	1.375 Oversize								
6.00	1.375 Standard	3.250	3/4 -10	1.125	3.250	2.813	2.375	3.125	3.063
	1.750 Oversize								
8.00	1.375 Standard	4.250	3/4 -10	1.125	4.500	2.813	2.375	3.250	3.063
	1.750 Oversize								

# How to Specify

## Pivot Mounts

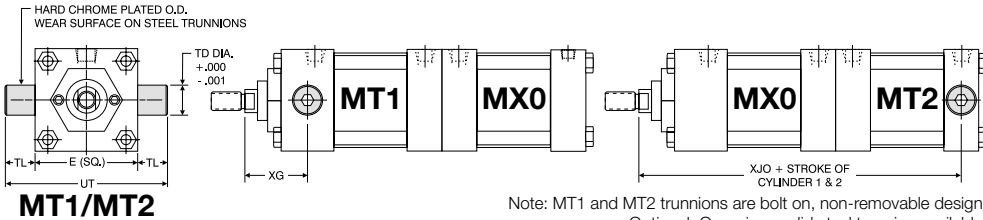


**'MP1' & 'MP2' Clevis and 'MP4' Rod Eye Mount Dimensions**

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

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

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



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

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

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

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



## Air/Oil Tandem Cylinders



You can tandem any cylinder series together in order to provide unlimited design possibilities. The “air over oil” design is the most common use of tandem cylinders today. Choose from different designs to gain maximum benefit for your application.

- > Air typically provides the force to extend and retract the cylinder. Oil provides the precise control of the stroke.
- > **Constant Velocity** – By metering the flow of the oil cylinder, a constant velocity is achieved throughout the stroke—even at very slow velocities air cylinders will typically chatter.
- > **Smooth Operation In Pivot Applications** – Pivot applications usually have varying loads throughout the stroke. Typically, you are supporting a load until it reaches top center and then the load tends to run away with the influence of gravity. Air/Oil cylinders minimize the effect of gravity, providing a smooth stroke.
- > Three basic designs to choose from to satisfy a variety of applications:
  - » Dual tank design for maximum flexibility and speed
  - » Single tank design for slower cycle rates, reducing component cost
  - » Air/Oil piston with single tank provides force multiplication (2:1 ratio minimum depending on bore and rod sizes)

# How It Works

## Schematics

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

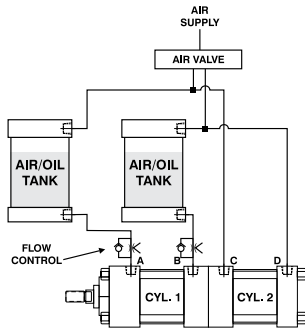
In each application, a 'TA' Series (with "TH" option - 400 max. PSI Hyd.) is used in tandem with a 'TA' Series (250 max\* PSI air) cylinder. CYL. #1 represents the 'TH' Option and CYL. #2 represents the 'TA' Series.

\*Tandem cylinders are designed and built with piston rods connected. Cylinders operate as one unit.  
Refer to page 80 for maximum air inlet pressures!

### Schematic A

#### Actuation Sequence:

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



#### Air To Oil Ratio

**Extend:** 1.8:1 Or Greater (Standard Rod)  
1.4:1 Or Greater (Oversize Rod)

**Retract:** 2:1 (For Both Standard and Oversize Rods)

(Refer To Charts On Page 80 For More Details)

#### Cycle Rates

**Extend:** Moderate To High Speed  
**Retract:** Moderate To High Speed

**Number Of Air/Oil Tanks:** 2

#### Recommended Tank Size:

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

(Refer To Page 74 For Ordering Information)

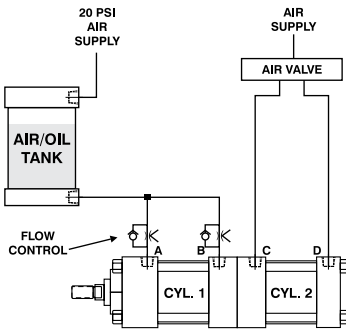
#### Design Benefits

- > Highest cycle rates per minute in both extend and retract strokes.
- > Higher cylinder output force in both extend and retract strokes.
- > Offers greatest range of speed control.
- > Can handle higher loads in extend and retract strokes.

### Schematic B

#### Actuation Sequence:

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



#### Air To Oil Ratio

**Extend:** 1:1 (for both standard and oversize rods)

**Retract:** 2:1 (for both standard and oversize rods)

(Refer To Charts On Page 80 For More Details)

#### Cycle Rates

**Extend:** Slow To Moderate Speed  
**Retract:** Slow To Moderate Speed

**Number Of Air/Oil Tanks:** 1

#### Recommended Tank Size:

130% - 150% of CYL. #1 total volume, filled approximately 50% full.

(Refer To Page 74 For Ordering Information)

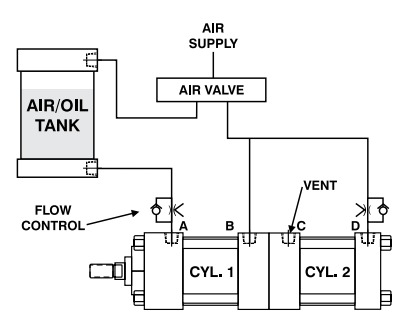
#### Design Benefits

- > Air to Oil extend ratio is 1:1.
- > Compact design (uses one small Air/Oil tank).
- > Greater range of speed control at slow speed.
- > More economical design.

### Schematic C

#### Actuation Sequence:

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



#### Air To Oil Ratio

**Extend:** 1.8:1 Or Greater (Standard Rod)  
1.4:1 Or Greater (Oversize Rod)

**Retract:** 1:1 (For Both Standard and Oversize Rods)

(Refer To Charts On Page 80 For More Details)

#### Cycle Rates

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

**Number Of Air/Oil Tanks:** 2

#### Recommended Tank Size:

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

(Refer To Page 74 For Ordering Information)

#### Design Benefits

- > Highest cylinder force in extend stroke, moderate cylinder force in retract stroke.
- > Compact design (uses one full size Air/Oil tank).
- > Economical design.

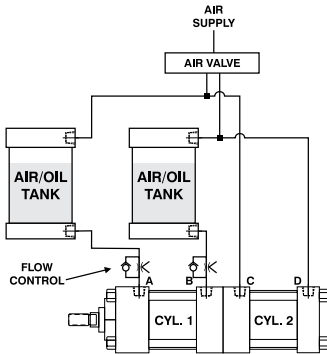
Note: Air directional control valves, flow controls, fittings and tubing not provided. Order separately from your local distributor.  
Refer Air/Oil tanks (AT) on page 213.

## Force Charts

### Schematic A

#### Actuation Sequence:

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

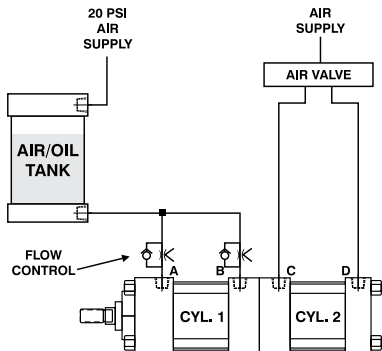


Bore	Rod Dia.	Extend Effective Piston Area (In/Sq.)	Retract Effective Piston Area (In/Sq.)	Extend Force At 100 PSI (In Pounds)	Retract Force At 100 PSI (In Pounds)	Maximum Air Inlet Pressure	Extend Oil/Air Ratio	Retract Oil/Air Ratio
1.50	0.625	3.227	2.920	323	292	181	1.83	2.00
	1.000	2.749	1.964	275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

### Schematic B

#### Actuation Sequence:

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

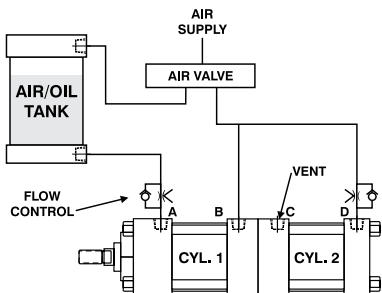


Bore	Rod Dia.	Extend Effective Piston Area (In/Sq.)	Retract Effective Piston Area (In/Sq.)	Extend Force At 100 PSI (In Pounds)	Retract Force At 100 PSI (In Pounds)	Maximum Air Inlet Pressure	Extend Oil/Air Ratio	Retract Oil/Air Ratio
1.50	0.625	1.767	1.460	177	146	250	1.00	1.00
	1.000	1.767	0.982	177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

### Schematic C

#### Actuation Sequence:

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



Bore	Rod Dia.	Extend Effective Piston Area (In/Sq.)	Retract Effective Piston Area (In/Sq.)	Extend Force At 100 PSI (In Pounds)	Retract Force At 100 PSI (In Pounds)	Maximum Air Inlet Pressure	Extend Oil/Air Ratio	Retract Oil/Air Ratio
1.50	0.625	3.227	1.460	323	146	181	1.83	1.00
	1.000	2.749	0.982	275	98	143	1.56	1.00
2.00	0.625	5.977	2.835	598	284	190	1.90	1.00
	1.000	5.499	2.357	550	236	171	1.75	1.00
2.50	0.625	9.511	4.602	951	460	194	1.94	1.00
	1.000	9.033	4.124	903	412	183	1.84	1.00
3.25	1.000	15.807	7.511	1581	751	190	1.91	1.00
	1.375	15.107	6.811	1511	681	180	1.82	1.00
4.00	1.000	24.347	11.781	2435	1178	194	1.94	1.00
	1.375	23.647	11.081	2365	1108	187	1.88	1.00
5.00	1.000	38.485	18.850	3849	1885	196	1.96	1.00
	1.375	37.785	18.150	3779	1815	192	1.92	1.00
6.00	1.375	55.063	26.789	5506	2679	195	1.95	1.00
	1.750	54.143	25.869	5414	2587	191	1.91	1.00
8.00	1.375	99.045	48.780	9905	4878	197	1.97	1.00
	1.750	98.125	47.860	9813	4786	195	1.95	1.00

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

# How to Order

CYL. #1

CYL. #2

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

**Tandem**

**Series**

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

Bore	Stroke (Cyl. #1)
1.5	1.50"
2	2.00"
2.5	2.50"
3.25	3.25"
4	4.00"
5	5.00"
6	6.00"
8	8.00"

Note: CYL. #1 and CYL. #2 strokes must be the same. (Piston Rods are connected.)

**NFPA Mounts**

MX0	No Mount
MP1	Rear Pivot Clevis (Cyl. 2 Only)
MP2	Rear Pivot Clevis (1.50"-6.00" Bore) (Cyl. 2 Only)
MP4	Rear Pivot Eye (1.50" - 4.00" Bore) (Cyl. 2 Only)
MT1	Front Trunnion (Specify Cyl. 1 Or 2)
MT2	Rear Trunnion (Specify Cyl. 1 Or 2)
MX1	Extended Tie Rods (Head & Cap)
MX2	Extended Tie Rods (Cap End)
MX3	Extended Tie Rods (Head End)
MF1	Front Flange (1.50"-6.00" Bore) (Cyl. 1 Only)
MF2	Rear Flange (1.50"-6.00" Bore) (Cyl. 2 Only)
ME3	Front Mounting Holes (8.00" Bore) (Cyl. 1 Only)
ME4	Rear Mounting Holes (8.00" Bore) (Cyl. 2 Only)
MS1	Front & Rear End Foot
MS2	Side Lug (1.50" - 8.00")
MS4	Bottom Tapped Holes

**Common Options For 'Oil' Cylinder<sup>1 2</sup>**

A=	Extended Piston Rod Thread (Specify)
BSPP	British Standard Pipe Taper (Specify Size, Example: BSP = 1/4)
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSP = 1/4)
C=	Extended Piston Rod (Example: If C= 0.50", Then 1" Rod Extension Is C= 1.50")
H	Head Cushion
KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3S	Studded Piston Rod (Kk3 With Stud, Loctite In Place)
KK4	Full Diameter Male Rod Thread
KK5	Blank Rod End (No Threads, "A" = 0")
MS	Metallic Rod Scraper (Brass Construction)
OP=	Optional Port Location (Specify, Example: Ports @ 3 & 7, OP=3,7)
OS	Oversize Rod Diameter (Specify Size, Example: Os = 1.375")
SAE	SAE Ports (Specify Size, Example: SAE#10)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods
TH	400 PSI Hydraulic, Non-Shock
XX	Special Variation (Specify)

**Common Options For 'Air' Cylinder<sup>2</sup>**

B	.25" Urethane Bumper Both Ends
BC	.25" Urethane Bumper Cap Only
BH	.25" Urethane Bumper Head Only
BP	Bumper Piston Seal
BSPP	British Standard Pipe Taper (Specify Size, Example: BSP = 1/4)
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSP = 1/4)
C	Cap Cushion (Cyl. 2 Only)
H	Head Cushion
MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust With Sound Dampening Bumper (12" Max Stroke)
MPR	Magnetic Piston For Reed or Solid State Switches (Models: R10, R10P, RAC, RHT & MSS)
OP	Optional Port Location (Example: OP=3,7)
OS	Oversize Rod Diameter (Specify Size, Example: OS = 1.375")
SAE	SAE Ports (Specify Size, Example: SAE#10)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods
TH	400 PSI Hydraulic, Non-Shock
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

**About our Part Number System**

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

**Example:** Air/Oil Tandem

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

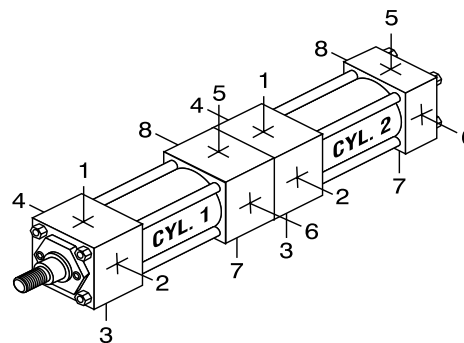
Cyl. 2 is a 'TA' series, MX0 (no mount), 2.00" bore x 10" stroke, with a magnet (for Reed Switches), and Head & Cap cushions.

**Part Number:**

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

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

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



**Standard Port and Cushion Adjustment Positions**

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

## Basic Cylinder (No Mount)

### About Rod End Styles

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

Other NFPA styles can be specified (see chart).

Need a rod end not listed? NO PROBLEM! Each Piston Rod is made-to-order and does not delay shipment. Coarse UNC threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

NEED SOMETHING NOT LISTED? Just send us a sketch. In most cases, quotes are turned around in one day!

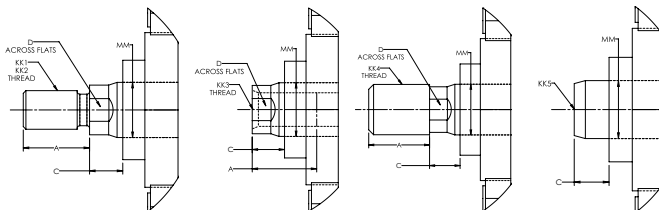
### Piston Rod End Styles

Style 1 & 2  
KK1 & KK2

Style 3  
KK3

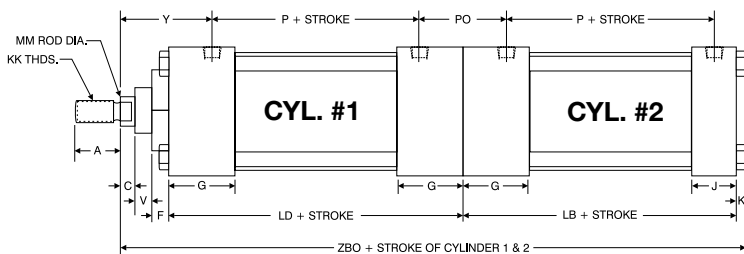
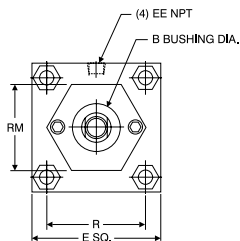
Style 4  
KK4

Style 5  
KK5



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

## MX0/MX0 (No Mount)

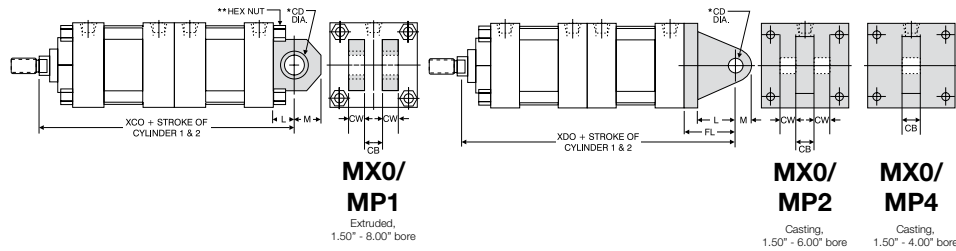


Basic Dimensions 'MX0' Standard & Oversize Rods

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

# How to Specify

## Pivot Mounts



**MX0/  
MP1**  
Extruded,  
1.50" - 8.00" bore

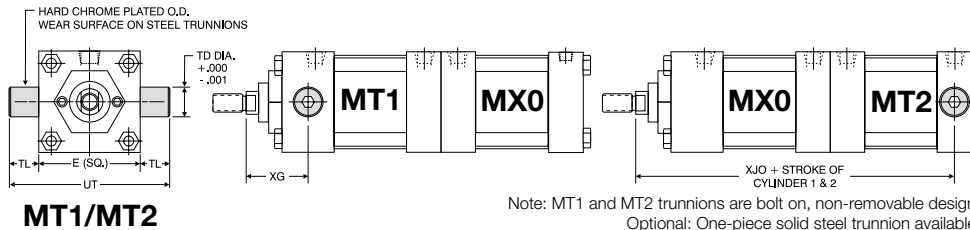
**MX0/  
MP2**      **MX0/  
MP4**  
Casting,  
1.50" - 6.00" bore      Casting,  
1.50" - 4.00" bore

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

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

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

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



**MT1/MT2**

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

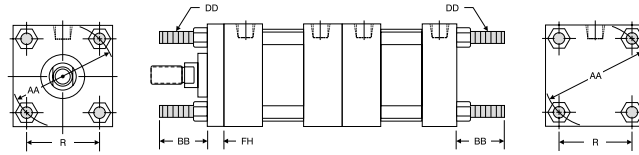
**'MT1' Head Trunnion and 'MT2' Cap Trunnion Mount Dimensions**

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

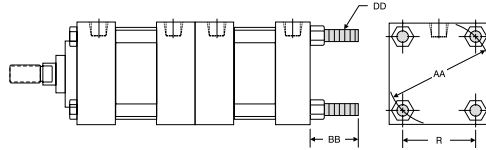
\*No oversize rod available on 1.50" bore MT1.  
For dimensions not shown, see page 75.

## Tie Rod & Flange Mounts

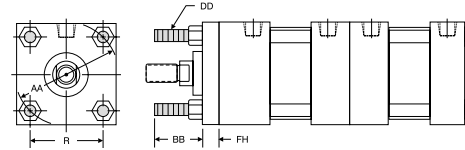
### MX1



### MX0/MX2



### MX3/MX0



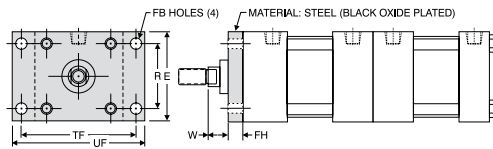
Bore	Rod Diameter	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4 -28	0.375	1.438
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16 -24	0.375	1.844
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16 -24	0.375	2.188
	1.000 Oversize					
3.25	1.000 Standard	3.900	1.375	3/8 -24	0.625	2.766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

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

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

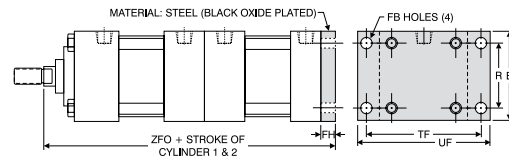
### MF1/MX0

1.50" - 6.00" bores



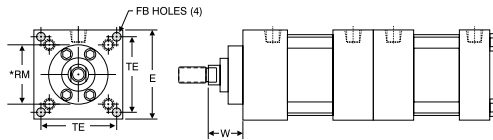
### MX0/MF2

1.50" - 6.00" bores



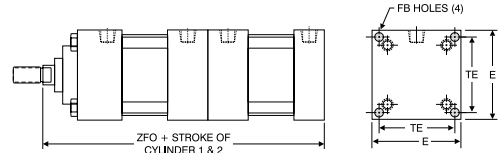
### ME3/MX0

8.00" bores only



### MX0/ME4

8.00" bores only



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

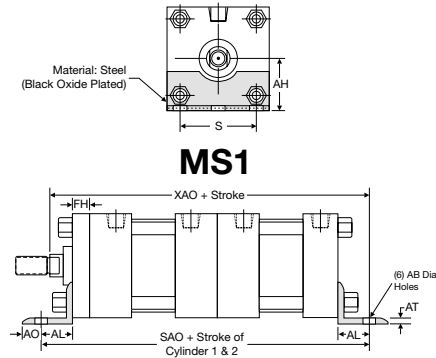
Bore	Rod Diameter	E	FB	FH	R	RM	TE	TF	UF	W	ZFO
4.00	1.000 Standard	4.500	0.438	0.625	3.320	—	—	5.438	6.250	0.750	11.000
	1.375 Oversize										
5.00	1.000 Standard	5.500	0.563	0.625	4.100	—	—	6.625	7.625	0.750	11.500
	1.375 Oversize										
6.00	1.375 Standard	6.500	0.563	0.750	4.875	—	—	7.625	8.625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

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



# How to Specify

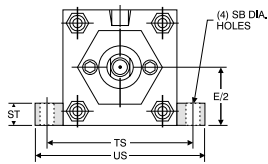
## Tandem Dimensions: Base Mounts



**MS1**

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

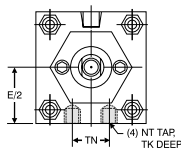
'MS1' Angle Mount Dimensions										
Bore	Rod Diameter	AB	AH	AL	AO	AT	FH	S	Add Stroke	
									SAO	XAO
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.125	0.375	1.250	10.125	9.750
	1.000 Oversize									10.125
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.125	0.375	1.750	10.125	9.750
	1.000 Oversize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



**MS2**

Note: The option not to have side lugs on center two (2) caps is available.  
Use the "XX" option in the "How To Order" section (specify).  
Example: TM-TA-MS2-4 X 5-TH with TA-MS2-4 X 5-BP-"XX"  
"XX" = No side lugs on center two (2) caps  
For dimensions not shown, see page 75.

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



**MS4**

Note: The option not to have 'MS4' taps on center two (2) caps is available.  
Use the "XX" option in the "How To Order" section (specify).  
Example: TM-TA-MS4-6 X 7-TH with TA-MS4-6 X 7-C-"XX"  
"XX" = No 'MS4' taps on center two (2) caps  
For dimensions not shown, see page 75.

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





# TRA Series Cylinders

Bimba's TRA series features heavy duty triple rod cylinders perfect for intense applications that require a sturdy pneumatic actuator and maximized load handling capabilities.



# Contents

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<b>99</b>	Triple Rod (TRA) Product Features
	99 – Other Models Available
	99 – Operating Temperature
	99 – Operating Pressure

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<b>100</b>	How to Order
	100 – Option Length Adders

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<b>101</b>	How to Specify
	101 – Mounting Options

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<b>110</b>	How to Customize
	110 – Options

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<b>111</b>	How to Specify
	111 – Technical Data – Load Charts: .50" - 4.00" Bore
	112 – Technical Data – Load Charts: 5.00" - 8.00" Bore
	113 – Technical Data (D3 Models) – Load Charts: 1.50" - 4.00" Bore – Double Rod End
	114 – Technical Data (D3 Models) – Load Charts: 5.00" - 8.00" Bore – Double Rod End
	115 – Technical Data – Torque Charts
	116 – Technical Data – Tooling Plate End Play Charts
	117 – Technical Data – Tooling Plate End Play Charts (D3 Models)
	118 – Technical Data

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## Triple Rod: Heavy-Duty Triple Rod Design

### Benefits

- > **Extended Heavy-Duty Rod Bearings** — Cast iron material is rated at 150,000 PSI compressive strength. Extended bearing design maximizes Load handling abilities without compromising design.
- > **Piston Wear Band Standard** — PTFE material rated for high loads and non-lube service.
- > **Non Lube Service** — PTFE coated bushings, Carboxilated Nitrile Seal material and PTFE based lube provide permanent lubrication for long life.
- > **Longer Strokes Available** — The heavy-duty design allows for longer strokes (see page 94 for details).
- > **Load and End Play Charts Available** — Refer to pages 95-99 for charts.



## Other Models Available:

### SS-TRA

300 Series Stainless Steel



### MA Option (Micro-Adjust)

Available on all "D1" Double Rod End models.

Allows for extended stroke adjustment in .001" increments.

(Note: up to 12" strokes)



## Operating Temperature

**Carboxilated Nitrile:** -20°F to 200°F (-29°C to 93°C)

**Fluorocarbon:** 0°F to 400°F (-18°C to 204°C)

## Operating Pressure

250 PSI (17 bar)

# How to Order

TRA SERIES CYLINDERS

## TRA - MF1 - 3.25 x 10 - HC - MPR

Series	
TRA	250 PSI Air

NFPA Mounts	
MX0	No Mount
MS4	Bottom Tapped Holes (1.50" - 8.00" Bore)
MS2	Side Lug (1.50" - 8.00" Bore)
Base Bar	Side Lug (1.50" - 4.00" Bore)
MP1	Rear Pivot Clevis (Extruded)
MP2	Rear Pivot Clevis (Casting) (1.50" - 6.00" Bore)
MP4	Rear Pivot Eye (Casting) (1.50" - 4.00" Bore)
MF1	Front Flange (1.50" - 6.00" Bore)
MF2	Rear Flange (1.50" - 6.00" Bore)
ME4	Rear Mounting Holes (8.00" Bore)
ME5	Front Mounting Holes (8.00" Bore)

Style	
(Blank)	Single End
D3	Double End - 3 Rods
D1	Double End - 1 Rod (KK1 Standard Rod End - See Options For Other Rod End Styles)

Bore	
1.5	1.50"
2	2.00"
2.5	2.50"
3.25	3.25"
4	4.00"
5	5.00"
6	6.00"
8	8.00"

**Stroke**  
See Stroke Options on page 94  
Made-to-Order

Cushions	
H	Head Cushion Position 2 Is Standard Specify For Positions: 1 & 4
C	Cap Cushion Position 6 Is Standard Specify For Positions: 5, 7 & 8

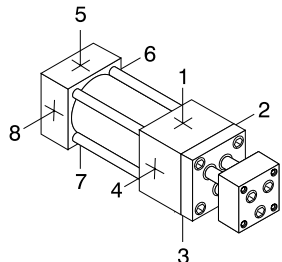
Options	
AS	Adjustable Stroke - Retract (Specify Length, Example: AS = 4")
AO	Air / Oil Piston
» B	.250" Urethane Bumper Both Ends
» BC	.250" Urethane Bumper Cap Only
» BH	.250" Urethane Bumper Head Only
BSPP	British Standard Pipe Taper (Specify Size, Example: BSP = 1/4)
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSP = 1/4)
C	Extended Piston Rod (Example: If C = 0.50", Then 1" Rod Extension Is C = 1.50")
MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust W/ Sound Dampening Bumper (12" Max Stroke)
MPR*	Magnetic Piston for Reed or Solid State Switches (R10, R10P, RAC, RHT & MSS)
» MPR-WB	Combination Magnetic Piston & Wear-Band (Specify On 1.50"-2 .50" Bores Only)
OP	Optional Port Location (Example: OP=3,7)
SAE	SAE Ports (Specify Size, Example: SAE#10)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods
» ST	Stop Tube - Specify Stop Tube Length (In Inches) Specify Stroke as ES (Effective Stroke) (Example: TA MS4 2 X 24ES-ST=3)
TMS	Steel Cylinder Tube*, Black Epoxy Paint Finish
TMSS	Stainless Steel Cylinder Tube*
TH	400 PSI Hydraulic Non-Shock
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

**Example:** A Triple Rod Cylinder with a 3.25" Bore, 10" Stroke, Front Flange Mount, Head & Cap Cushions, Magnetic Piston for Reed or Solid State Switches.

**Part Number:**  
TRA-MF1-3.25 x 10-HC-MPR

### Standard Port and Cushion Adjustment Positions

- > Ports - Positions 1 and 5 (Ports not available at position 3)
- > Cushion Adjustment - Positions 2 and 6 (Cushions not available at position 3)
- > Specify Non-Standard Positions When Ordering



Note: Ports or Cushions NOT available at position 3

Note: Refer to Options for specifications.  
\* If "MPR" option is ordered on 1.50"-2.50" bore models, the wear-band is eliminated and must be ordered separately (if needed (see MPR-WB option)).  
\*\* Steel tubes do not work with MPR magnetic pistons. Refer to Balluff end of stroke sensors within Switches.  
» Refer to Option Length Adder

Options For "D1" Double Rod End Model - Single Rod	
KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3S	Studded Piston Rod (KK3 With Stud, Loctite In Place)
KK4	Full Diameter Male Rod Thread
KK5	Blank Rod End (No Threads, "A" = 0")

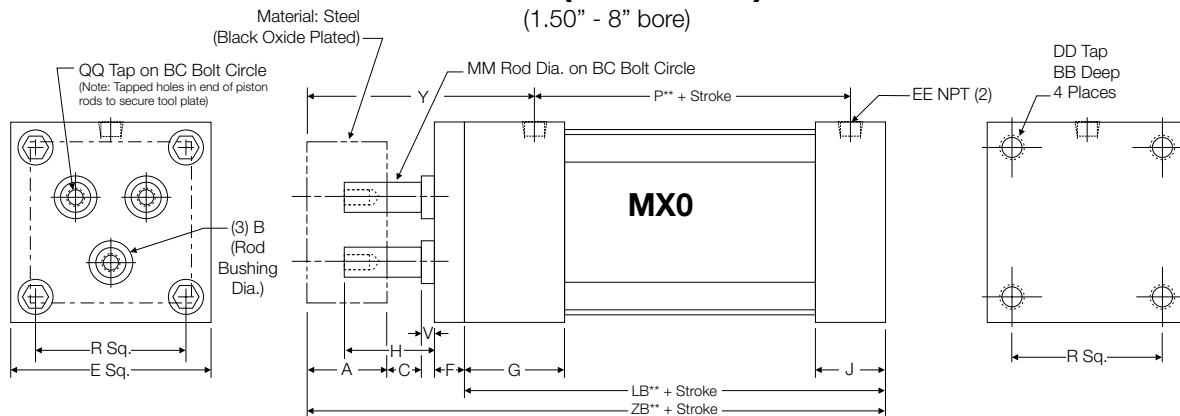
Option Length Adder (Add To Catalog Basic Overall Length Dimensions)						
Bore	Option					
	B	BC	BH	MPR (Without "WB" Wearband)	MPR-WB (Magnet & Wearband)	ST* (Stop Tube) Example: ST=2
1.50	0.500	0.250	0.250	0	0.500	2
2.00	0.500	0.250	0.250	0	0.500	2
2.50	0.500	0.250	0.250	0	0.500	2
3.25	0.500	0.250	0.250			2
4.00	0.500	0.250	0.250			2
5.00	0.500	0.250	0.250	Note: There is no length adder for MPR Option and Wear Band on 3.25" - 8.00" Bore.		2
6.00	0.500	0.250	0.250			2
8.00	0.500	0.250	0.250			2

\*The desired Stop Tube length adds directly to the overall cylinder length.  
Note: If a stop tube is used on 1.50" - 2.50" bore with a minimum stop tube length of 0.5", there is no length adder for MPR-WB option other than the stop tube length.

100

## TRA Series Heavy-Duty: Triple Piston Rod

### MX0 (No Mount) (1.50" - 8" bore)



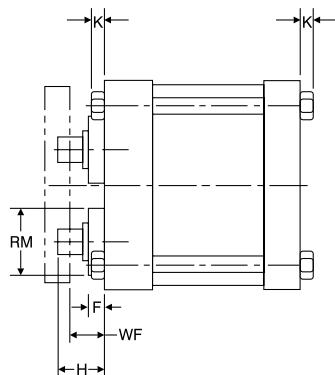
**MX0 (No Mount)**

Bore	A	B	BB	BC	C	DD	E	EE	F	G	H	J	LB	MM	P	QQ	R	V	Y	ZB
1.50	0.750	0.563	0.500	0.891	0.500	1/4-28	2.000	0.250	0.375	1.500	1.100	1.000	3.625**	0.313	2.375**	10-32	1.438	0.250	2.750	5.500**
2.00	0.750	0.813	0.500	1.195	0.500	5/16-24	2.500	0.250	0.375	1.500	1.100	1.000	3.625**	0.500	2.375**	1/4-28	1.844	0.250	2.750	5.500**
2.50	1.000	1.016	0.500	1.500	0.500	5/16-24	3.000	0.250	0.375	1.500	1.350	1.000	3.750**	0.625	2.500**	5/16-24	2.188	0.250	3.000	5.875**
3.25	1.000	1.125	0.625	2.075	0.500	3/8-24	3.750	0.375	0.625	1.750	1.100	1.250	4.250	0.625	2.750	3/8-24	2.766	0.250	3.375	6.625
4.00	1.000	1.125	0.625	2.825	0.500	3/8-24	4.500	0.375	0.625	1.750	1.100	1.250	4.250	0.625	2.750	3/8-24	3.320	0.250	3.375	6.625
5.00	1.000	1.500	0.625	3.375	1.000	1/2-20	5.500	0.375	0.625	1.750	1.844	1.250	4.500	1.000	3.000	1/2-20	4.100	0.250	3.875	7.375
6.00	1.000	1.500	0.750	3.938	1.000	1/2-20	6.500	0.500	0.750	2.000	1.844	1.500	5.000	1.000	3.250	1/2-20	4.875	0.250	4.125	8.000
8.00	1.000	1.500	—	5.750	1.375	—	8.500	0.750	—	2.000	2.844	1.500	5.125	1.000	3.375	1/2-20	6.438	0.250	4.375	8.375*

\*\*ZB\* does not include "K" hex nut dimension (see below for dimensions).

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

### MX0 (No Mount) (8.00" Bore)



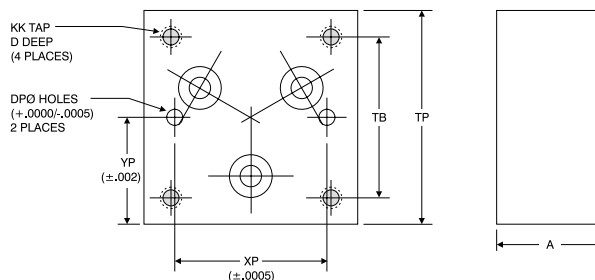
MX0 (No Mount)					
Bore	F	H	K	RM	WF
8.00	0.625	2.844	0.563	2.750	2.250

"8.00" bore has three (3) round retainers, 0.625" thick, 2.75" dia. and uses hex nuts on both ends for MX0 mount.

### Tooling Plate

Material: Steel (Black Oxide Plated)

Note: standard tool plate includes (2) dowel pin holes included with cylinder (dowel pins not included).



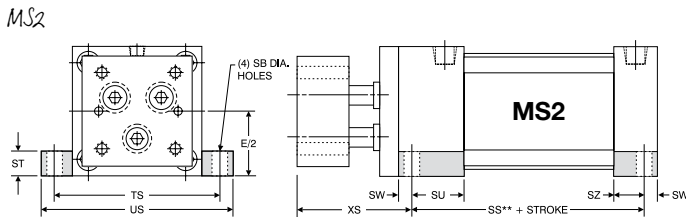
**Tooling Plate Dimensions**

Standard						Dowel Pin Dimensions			
Bore	A	D	KK	TB	TP	Bore	DP Ø	XP	YP
1.50	0.750	0.750	10-32	1.125	1.500	1.50	0.125	1.125	0.750
2.00	0.750	0.750	1/4-28	1.438	2.000	2.00	0.125	1.375	1.000
2.50	1.000	1.000	5/16-24	1.844	2.500	2.50	0.188	1.750	1.250
3.25	1.000	1.000	3/8-24	2.188	3.250	3.25	0.250	2.250	1.625
4.00	1.000	1.000	3/8-24	2.766	4.000	4.00	0.250	2.750	2.000
5.00	1.000	1.000	1/2-20	3.313	5.000	5.00	0.313	3.250	2.500
6.00	1.000	1.000	1/2-20	4.100	6.000	6.00	0.313	4.000	3.000
8.00	1.000	1.000	1/2-20	4.875	8.000	8.00	0.375	4.875	4.000

# How to Specify

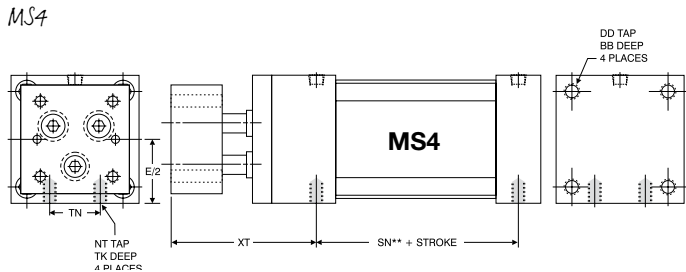
## Base & Pivot Mounts

### Base Mounts (1.50" - 8.00" Bore)



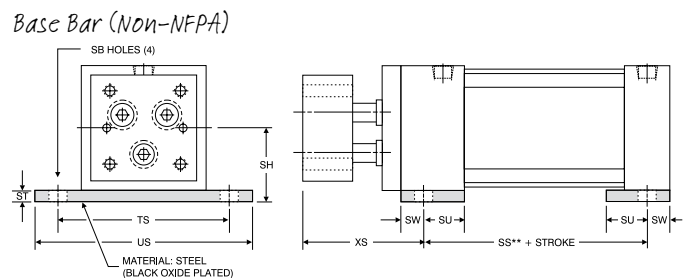
MS2 Mount										
Bore	SB	E/2	SS	ST	SU	SW	SZ	TS	US	XS
1.50	0.438	1.000	2.875**	0.500	1.125	0.375	0.625	2.750	3.500	2.250
2.00	0.438	1.250	2.875**	0.500	1.125	0.375	0.625	3.250	4.000	2.250
2.50	0.438	1.500	3.000**	0.500	1.125	0.375	0.625	3.750	4.500	2.500
3.25	0.563	1.875	3.250	0.750	1.250	0.500	0.750	4.750	5.750	2.875
4.00	0.563	2.250	3.250	0.750	1.250	0.500	0.750	5.500	6.500	2.875
5.00	0.813	2.750	3.125	1.000	1.063	0.688	0.563	6.875	8.250	3.563
6.00	0.813	3.250	3.625	1.000	1.313	0.688	0.813	7.875	9.250	3.688
8.00	0.813	4.250	3.750	1.000	1.313	0.688	0.813	9.875	11.250	3.938

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.



MS4 Mount						
Bore	E/2	NT	TK	TN	XT	SN
1.50	1.000	1/4-20	0.375	0.625	2.813	2.250**
2.00	1.250	5/16-18	0.500	0.875	2.813	2.250**
2.50	1.500	3/8-16	0.625	1.250	3.063	2.375**
3.25	1.875	1/2-13	0.750	1.500	3.438	2.625
4.00	2.250	1/2-13	0.750	2.063	3.438	2.625
5.00	2.750	5/8-11	1.000	2.688	3.938	2.875
6.00	3.250	3/4-10	1.125	3.250	4.188	3.125
8.00	4.250	3/4-10	1.125	4.500	4.438	3.250

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.



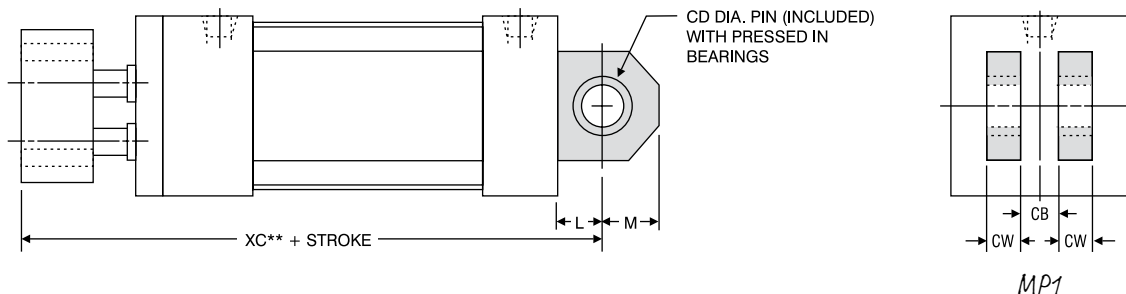
Base Bar (Non-NFPA)										
Bore	SB	SH	SS	ST	SU	SW	TS	US	XS	
1.50	0.438	1.250	2.875**	0.250	1.125	0.375	2.750	3.500	2.250	
2.00	0.438	1.500	2.875**	0.250	1.125	0.375	3.250	4.000	2.250	
2.50	0.438	1.875	3.000**	0.375	1.125	0.375	3.750	4.500	2.500	
3.25	0.563	2.375	3.250	0.500	1.250	0.500	4.750	5.750	2.875	
4.00	0.563	2.750	3.250	0.500	1.250	0.500	5.500	6.500	2.875	

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

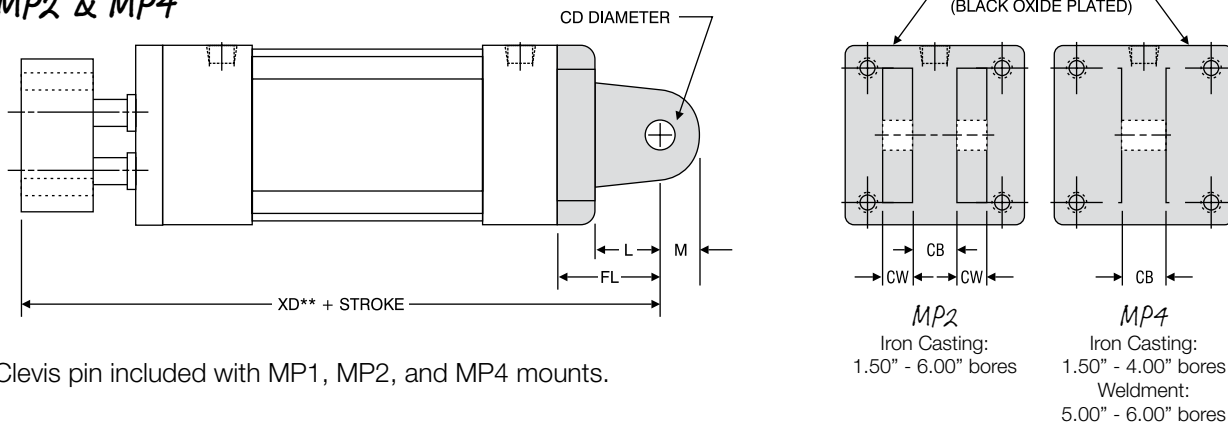
## Base & Pivot Mounts

### Pivot Mounts (1.50" - 8.00" Bore)

#### MP1 (Extruded Mount)



#### MP2 & MP4



Clevis pin included with MP1, MP2, and MP4 mounts.

**MP2**  
Iron Casting:  
1.50" - 6.00" bores

**MP4**  
Iron Casting:  
1.50" - 4.00" bores  
Weldment:  
5.00" - 6.00" bores

MP1, MP2 & MP4 Mounts ▲								
Bore	CB	CD	CW	FL	L	M	XC	XD
1.50	0.750	0.500	0.500	1.125	0.750	0.625	6.250**	6.625**
2.00	0.750	0.500	0.500	1.125	0.750	0.625	6.250**	6.625**
2.50	0.750	0.500	0.500	1.125	0.750	0.625	6.625**	7.000**
3.25	1.250	0.750	0.625	1.875	1.250	0.875	7.875	8.500
4.00	1.250	0.750	0.625	1.875	1.250	0.875	7.875	8.500
5.00	1.250	0.750	0.625	1.875	1.250	0.875	8.625	9.250
6.00	1.500	1.000	0.750	2.250	1.500	1.000	9.500	10.250
8.00	1.500	1.000	0.750	N/A	1.500	1.000	9.875	N/A

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

Note: 8.00" bore is a welded mount with through holes and tie rod nuts.

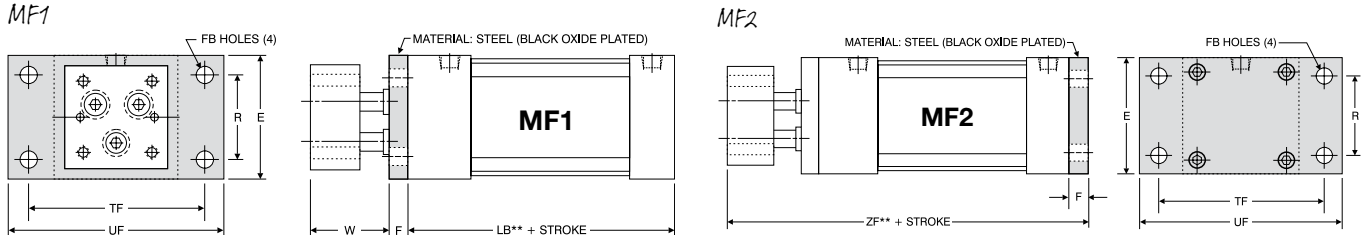
▲ MP4 available as specials in 5.00" and 6.00" bores; delivery for 5.00" and 6.00" bore MP4 models is 5-7 days.

Note: Extruded MP1 mounts are standard (1.50" - 8.00" bores) Cast Iron removable mounts are optional and must be requested when ordering (1.50" - 6.00" bores).

# How to Specify

## Flange Mounts

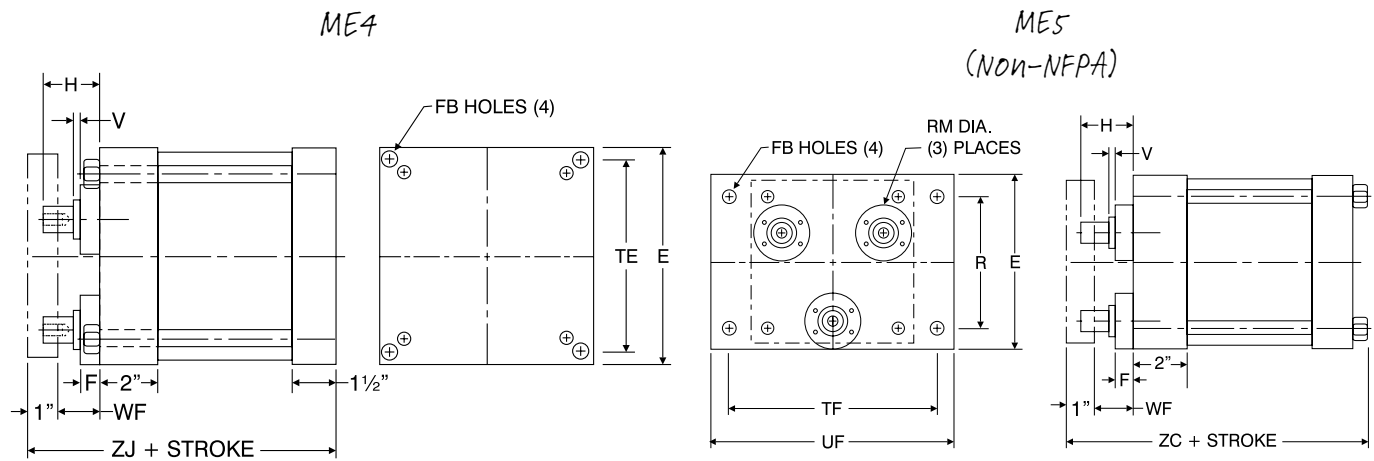
### Flange Mounts (1.50" - 6.00" Bore)



MF1 & MF2 Mounts									
Bore	E	F	FB	LB	R	TF	UF	W	ZF
1.50	2.000	0.375	0.313	3.625**	1.430	2.750	3.375	1.500	5.875**
2.00	2.500	0.375	0.375	3.625**	1.844	3.375	4.125	1.500	5.875**
2.50	3.000	0.375	0.375	3.750**	2.188	3.875	4.625	1.750	6.250**
3.25	3.750	0.625	0.438	4.250	2.760	4.688	5.500	1.750	7.250
4.00	4.500	0.625	0.438	4.250	3.320	5.438	6.250	1.750	7.250
5.00	5.500	0.625	0.563	4.500	4.100	6.625	7.625	2.250	8.000
6.00	6.500	0.750	0.563	5.000	4.875	7.625	8.625	2.250	8.750

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.  
For dimensions not shown, see page 84

### Flange Mounts (8.00" Bore)



ME4 & ME5 Mounts													
Bore	E	F	FB	H	R	RM	TE	TF	UF	V	WF	ZC	ZJ
8.00	8.500	0.625	0.688	2.844	6.438	2.750	7.570	10.250	12.000	0.250	2.250	8.938	8.375

Note: Three (3) 1.00" diameter rods on 5.750 B.C.

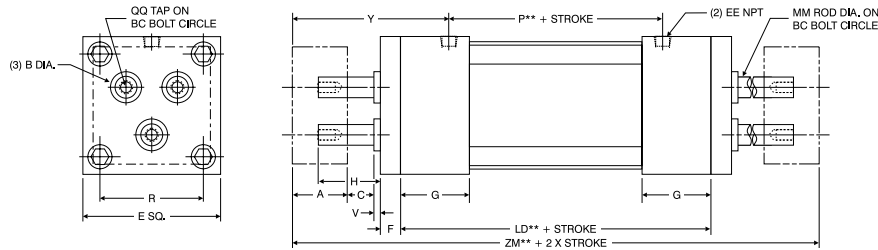


## Double Rod End

### Benefits

- > Durable Design. Full rod bearing(s) at each end of cylinder.
- > Single Rod (D1) and Triple Rod (D3) models available.
- > Full range of options available.
- > Reduces Tool Plate End Play
- > Increases Load Ratings

## MX0D3 (Triple Rod Both Ends) Basic Dimensions (No Mount)



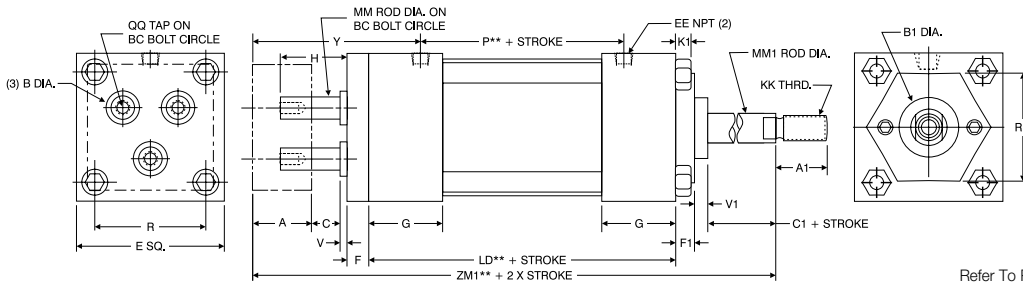
Tool Plates Included -

Twin Tooling Plate - MX0D3

Bore	A	B	BC	C	E	EE	F	G	H	LD	MM	P	QQ	R	V	Y	ZM
1.50	0.750	0.563	0.891	0.500	2.000	0.250	0.375	1.500	1.100	4.125**	0.313	2.375**	10-32	1.430	0.250	2.750	7.875**
2.00	0.750	0.813	1.195	0.500	2.500	0.250	0.375	1.500	1.100	4.125**	0.500	2.375**	1/4-28	1.844	0.250	2.750	7.875**
2.50	1.000	1.016	1.500	0.500	3.000	0.250	0.375	1.500	1.350	4.250**	0.625	2.500**	5/16-24	2.188	0.250	3.000	8.500**
3.25	1.000	1.125	2.075	0.500	3.750	0.375	0.625	1.750	1.100	4.750	0.625	2.750	3/8-24	2.760	0.250	3.375	9.500
4.00	1.000	1.125	2.825	0.500	4.500	0.375	0.625	1.750	1.100	4.750	0.625	2.750	3/8-24	3.320	0.250	3.375	9.500
5.00	1.000	1.500	3.375	1.000	5.500	0.375	0.625	1.750	1.844	5.000	1.000	3.000	1/2-20	4.100	0.250	3.875	10.750
6.00	1.000	1.500	3.937	1.000	6.500	0.500	0.750	2.000	1.844	5.500	1.000	3.250	1/2-20	4.875	0.250	4.125	11.500
8.00	1.000	1.500	5.750	1.375	8.500	0.750	0.625*	2.000	2.844	5.625	1.000	3.375	1/2-20	6.438	0.250	4.375	12.125

\*8.00" bore has three (3) round retainers, 0.625" thick, 2.750" dia. and uses hex nuts on ends (see page 84).  
 \*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

## MX0D1 (Triple Rod with Single Rod) Basic Dimensions (No Mount)



Tool Plate Included -  
 Refer To Page 82 For Tool Plate Detail

Twin Tooling Plate Basic - MX0D1

Bore	A	A1	B	B1	BC	C	C1	E	EE	F	F1	G	H	K1	KK	LD	MM	MM1	P	QQ	R	RM	V	V1	Y	ZM1
1.50	0.750	0.750	0.563	1.125	0.891	0.500	0.375	2.000	0.250	0.375	0.375	1.500	1.100	0.250	7/16-20	4.125**	0.313	0.625	2.375**	10	1.438	2.00 Sq.	0.250	0.250	2.750	7.000**
2.00	0.750	0.750	0.816	1.125	1.195	0.500	0.375	2.500	0.250	0.375	0.375	1.500	1.100	0.313	7/16-20	4.125**	0.500	0.625	2.375**	1/4-28	1.844	1.75 Hex.	0.250	0.250	2.750	7.000**
2.50	1.000	0.750	1.016	1.125	1.500	0.500	0.375	3.000	0.250	0.375	0.375	1.500	1.350	0.313	7/16-20	4.250**	0.625	0.625	2.500**	5/16-24	2.188	1.75 Hex.	0.250	0.250	3.000	7.375**
3.25	1.000	1.125	1.125	1.500	2.075	0.500	0.500	3.750	0.375	0.625	0.625	1.750	1.100	0.375	3/4-16	4.750	0.625	1.000	2.750	3/8-24	2.760	2.75 Dia.	0.250	0.250	3.375	8.500
4.00	1.000	1.125	1.125	1.500	2.825	0.500	0.500	4.500	0.375	0.625	0.625	1.750	1.100	0.375	3/4-16	4.750	0.625	1.000	2.750	3/8-24	3.320	2.75 Dia.	0.250	0.250	3.375	8.500
5.00	1.000	1.125	1.500	1.500	3.375	1.000	0.500	5.500	0.375	0.625	0.625	1.750	1.844	0.438	3/4-16	5.000	1.000	1.000	3.000	1/2-20	4.100	2.75 Dia.	0.250	0.250	3.875	9.250
6.00	1.000	1.625	1.500	2.000	3.937	1.000	0.625	6.500	0.500	0.750	0.625	2.000	1.844	0.438	1-14	5.500	1.000	1.375	3.250	1/2-20	4.875	3.50 Dia.	0.250	0.375	4.125	10.125
8.00	1.000	1.625	1.500	2.000	5.750	1.375	0.625	8.500	0.750	0.625*	0.625	2.000	2.844	0.563	1-14	5.625	1.000	1.375	3.375	1/2-20	6.438	3.50 Dia.	0.250	0.375	4.375	10.500

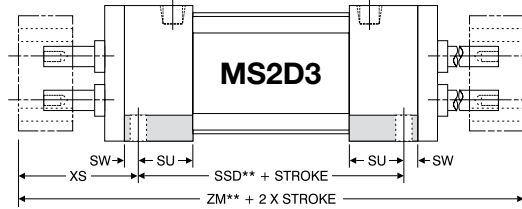
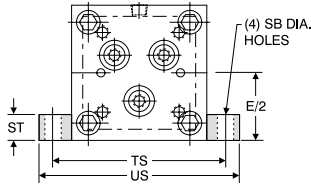
\*8.00" bore has three (3) round retainers, 0.625" thick, 2.750" dia. and uses hex nuts on ends (see page 84).  
 \*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

# How to Specify

## TRA Series Dimensions: Double Rod End

### Base Mounts

MS2D3

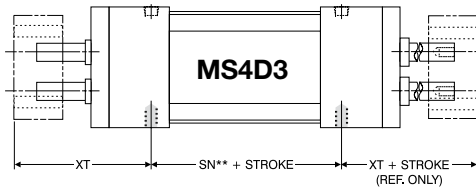
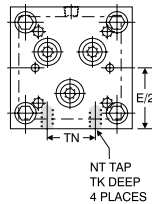


MS2D3 Mount

Bore	SB	E/2	SSD	ST	SU	SW	TS	US	XS	ZM
1.50	0.438	1.000	3.375**	0.500	1.125	0.375	2.750	3.500	2.250	7.875**
2.00	0.438	1.250	3.375**	0.500	1.125	0.375	3.250	4.000	2.250	7.875**
2.50	0.438	1.500	3.500**	0.500	1.125	0.375	3.750	4.500	2.500	8.500**
3.25	0.563	1.875	3.750	0.750	1.250	0.500	4.750	5.750	2.875	9.500
4.00	0.563	2.250	3.750	0.750	1.250	0.500	5.500	6.500	2.875	9.500
5.00	0.813	2.750	3.625	1.000	1.063	0.688	6.875	8.250	3.563	10.750
6.00	0.813	3.250	4.125	1.000	1.313	0.688	7.875	9.250	3.688	11.500
8.00	0.813	4.250	4.250	1.000	1.313	0.688	9.875	11.250	3.938	12.125

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

MS4D3



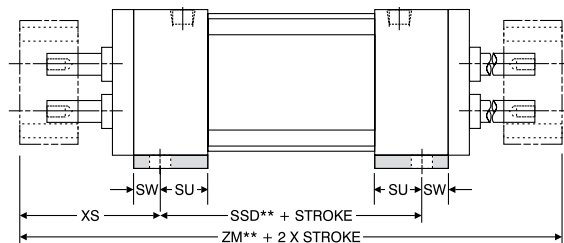
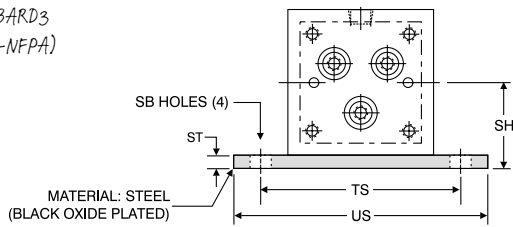
MS4D3 Mount

Bore	E/2	NT	TK	TN	XT	SN
1.50	1.000	1/4-20	0.375	0.625	2.813	2.250**
2.00	1.250	5/16-18	0.500	0.875	2.813	2.250**
2.50	1.500	3/8-16	0.625	1.250	3.063	2.375**
3.25	1.875	1/2-13	0.750	1.500	3.438	2.625
4.00	2.250	1/2-13	0.750	2.063	3.438	2.625
5.00	2.750	5/8-11	1.000	2.688	3.938	2.875
6.00	3.250	3/4-10	1.125	3.250	4.188	3.125
8.00	4.250	3/4-10	1.125	4.500	4.438	3.250

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

BASEBARD3

(Non-NFPA)



BASEBARD3 (Non-NFPA) Mount

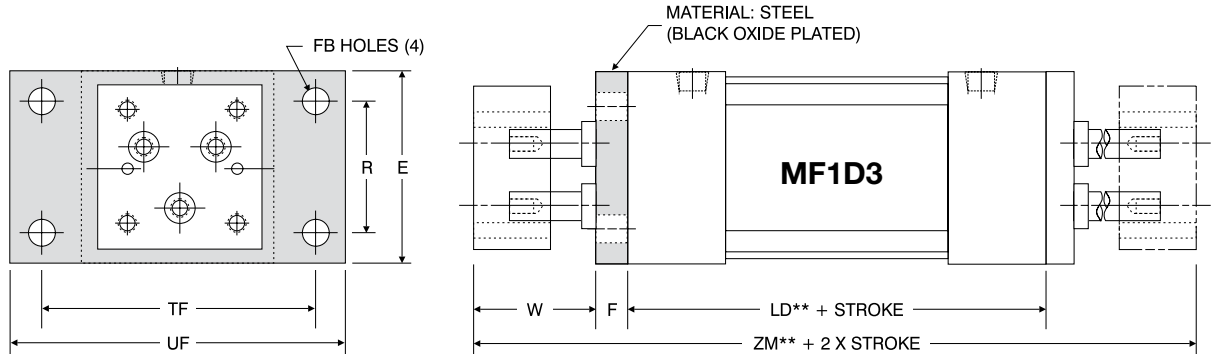
Bore	SB	SH	SSD	ST	SU	SW	TS	US	XS	ZM
1.50	0.438	1.250	3.375**	0.250	1.125	0.375	2.750	3.500	2.250	7.875**
2.00	0.438	1.500	3.375**	0.250	1.125	0.375	3.250	4.000	2.250	7.875**
2.50	0.438	1.875	3.500**	0.375	1.125	0.375	3.750	4.500	2.500	8.500**
3.25	0.563	2.375	3.750	0.500	1.250	0.500	4.750	5.750	2.875	9.500
4.00	0.563	2.750	3.750	0.500	1.250	0.500	5.500	6.500	2.875	9.500

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

## TRA Series Dimensions: Double Rod End

### Flange Mounts (1.50" - 6.00" Bore)

MF1D3



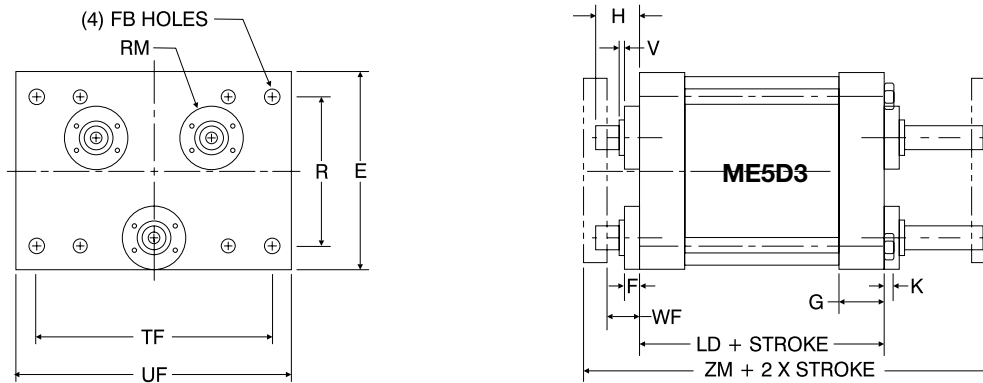
MF1D3 Mount

Bore	E	F	FB	LD	R	TF	UF	W	ZM
1.50	2.000	0.375	0.313	4.125**	1.438	2.750	3.375	1.500	7.875**
2.00	2.500	0.375	0.375	4.125**	1.844	3.375	4.125	1.500	7.875**
2.50	3.000	0.375	0.375	4.250**	2.188	3.875	4.625	1.750	8.500**
3.25	3.750	0.625	0.438	4.750	2.760	4.688	5.500	1.750	9.500
4.00	4.500	0.625	0.438	4.750	3.320	5.438	6.250	1.750	9.500
5.00	5.500	0.625	0.563	5.000	4.100	6.625	7.625	2.250	10.750
6.00	6.500	0.750	0.563	5.500	4.875	7.625	8.625	2.250	11.500

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

### Flange Mounts (8.00" Bore)

ME5D3



ME5D3 Mount

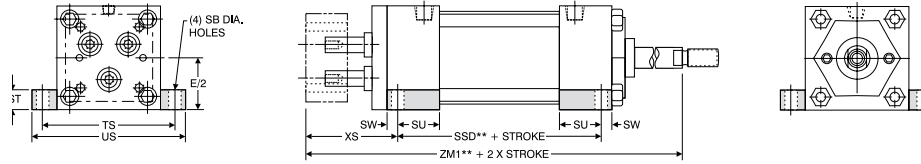
Bore	E	F	FB	G	H	K	LD	R	RM	TE	TF	UF	V	WF	ZM
8.00	8.500	0.625	0.688	2.000	2.844	0.563	5.625	6.438	2.750	7.563	10.250	12.000	.250	2.250	12.125

Note: Three (3) 1.00" diameter rods on 5.750 B.C.

# How to Specify

## TRA Series Dimensions: Double Rod End (With Single Rod) Base Mounts

### MS2D1 (Triple Rod With Single Rod)

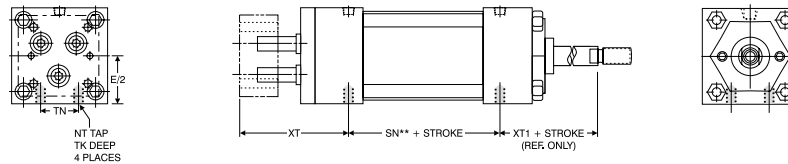


MS2D1 Mount

Bore	SB	E/2	SSD	ST	SU	SW	TS	US	XS	ZM1
1.50	0.438	1.000	3.375**	0.500	1.125	0.375	2.750	3.500	2.250	7.000**
2.00	0.438	1.250	3.375**	0.500	1.125	0.375	3.250	4.000	2.250	7.000**
2.50	0.438	1.500	3.500**	0.500	1.125	0.375	3.750	4.500	2.500	7.375**
3.25	0.563	1.875	3.750	0.750	1.250	0.500	4.750	5.750	2.875	8.500
4.00	0.563	2.250	3.750	0.750	1.250	0.500	5.500	6.500	2.875	8.500
5.00	0.813	2.750	3.625	1.000	1.063	0.688	6.875	8.250	3.563	9.250
6.00	0.813	3.250	4.125	1.000	1.313	0.688	7.875	9.250	3.688	10.125
8.00	0.813	4.250	4.250	1.000	1.313	0.688	9.875	11.250	3.938	10.500

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

### MS4D1 (Triple Rod With Single Rod)

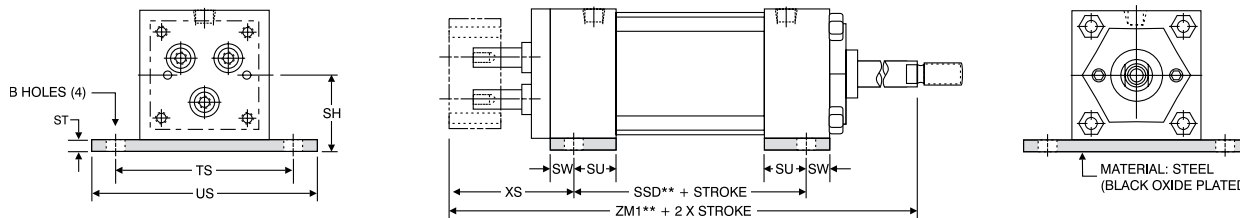


MS4D1 Mount

Bore	E/2	NT	TK	TN	XT	SN	XT1
1.50	1.000	1/4 - 20	0.375	0.625	2.813	2.250**	1.938
2.00	1.250	5/16 - 18	0.500	0.875	2.813	2.250**	1.938
2.50	1.500	3/8 - 16	0.625	1.250	3.063	2.375**	1.938
3.25	1.875	1/2 - 13	0.750	1.500	3.438	2.625	2.438
4.00	2.250	1/2 - 13	0.750	2.063	3.438	2.625	2.438
5.00	2.750	5/8 - 11	1.000	2.688	3.938	2.875	2.438
6.00	3.250	3/4 - 10	1.125	3.250	4.188	3.125	2.813
8.00	4.250	3/4 - 10	1.125	4.500	4.438	3.250	2.813

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

### BASEBARD1 (Triple Rod With Single Rod) (Non-NFPA)



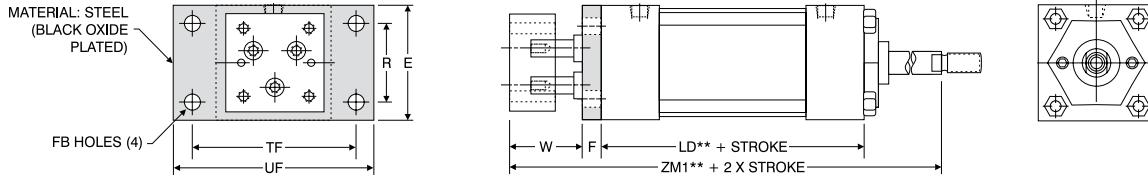
BASEBARD1 (Non-NFPA) Mount

Bore	SB	SH	SSD	ST	SU	SW	TS	US	XS	ZM1
1.50	0.438	1.250	3.375**	0.250	1.125	0.375	2.750	3.500	2.250	7.000**
2.00	0.438	1.500	3.375**	0.250	1.125	0.375	3.250	4.000	2.250	7.000**
2.50	0.438	1.875	3.500**	0.375	1.125	0.375	3.750	4.500	2.500	7.375**
3.25	0.563	2.375	3.750	0.500	1.250	0.500	4.750	5.750	2.875	8.500
4.00	0.563	2.750	3.750	0.500	1.250	0.500	5.500	6.500	2.875	8.500

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

## TRA Series Dimensions: Double Rod End (With Single Rod) Base Mounts

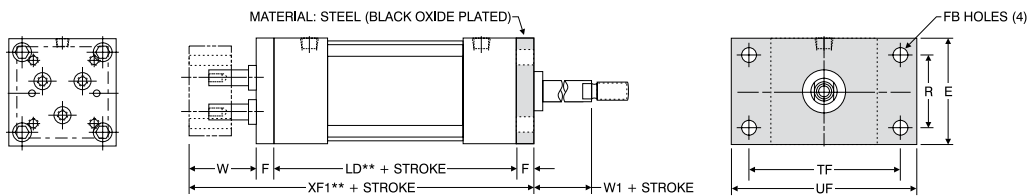
### MF1D1 (Triple Rod With Single Rod)



MF1D1 Mount										
Bore	E	F	FB	LD	R	TF	UF	W	ZM1	
1.50	2.000	0.375	0.313	4.125**	1.438	2.750	3.375	1.500	7.000**	
2.00	2.500	0.375	0.375	4.125**	1.844	3.375	4.125	1.500	7.000**	
2.50	3.000	0.375	0.375	4.250**	2.188	3.875	4.625	1.750	7.375**	
3.25	3.750	0.625	0.438	4.750	2.760	4.688	5.500	1.750	8.500	
4.00	4.500	0.625	0.438	4.750	3.320	5.438	6.250	1.750	8.500	
5.00	5.500	0.625	0.563	5.000	4.100	6.625	7.625	2.250	9.250	
6.00	6.500	0.750	0.563	5.500	4.875	7.625	8.625	2.250	10.125	

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

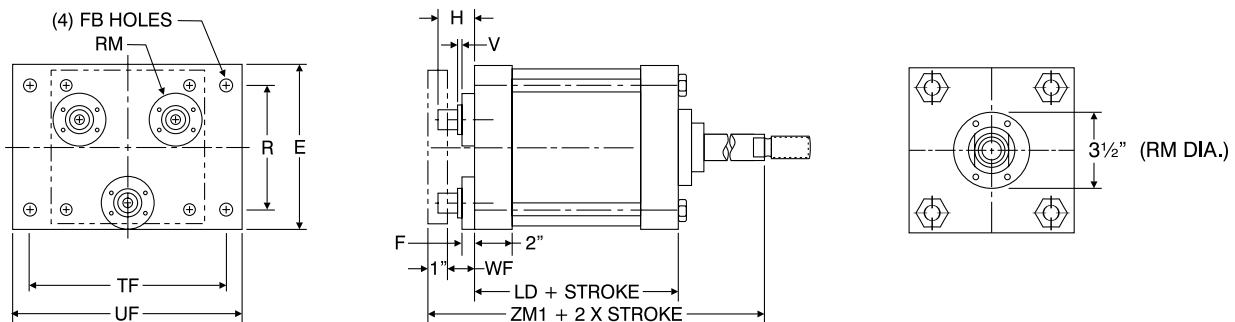
### MF2D1 (Triple Rod With Single Rod)



MF2D1 Mount											
Bore	E	F	FB	LD	R	TF	UF	W	XF1	W1	
1.50	2.000	0.375	0.313	4.125**	1.438	2.750	3.375	1.500	6.375**	0.625	
2.00	2.500	0.375	0.375	4.125**	1.844	3.375	4.125	1.500	6.375**	0.625	
2.50	3.000	0.375	0.375	4.250**	2.188	3.875	4.625	1.750	6.750**	0.625	
3.25	3.750	0.625	0.438	4.750	2.760	4.688	5.500	1.750	7.750	0.750	
4.00	4.500	0.625	0.438	4.750	3.320	5.438	6.250	1.750	7.750	0.750	
5.00	5.500	0.625	0.563	5.000	4.100	6.625	7.625	2.250	8.500	0.750	
6.00	6.500	0.750	0.563	5.500	4.875	7.625	8.625	2.250	9.250	0.875	

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

### ME5D1 (Triple Rod With Single Rod)



ME5D1 Mount												
Bore	E	F	FB	H	R	RM	TF	UF	V	WF	LD	ZM1
8.00	8.500	0.625	0.688	2.844	6.438	2.750	10.250	12.000	0.250	2.250	5.625	10.500

Note: Three (3) 1.00" diameter rods on 5.750 B.C.

# How to Customize

## Options

### ST=2 • ST=4

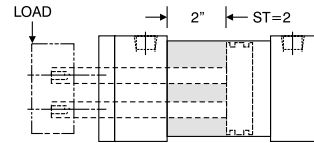
#### Stop Tubes

Stop Tubes are designed to reduce the piston rod bushing stress to within the designed range of the bearing material. This will insure proper cylinder performance, in any given application. Stop Tubes lower cylinder bearing stress by adding length to the piston, which increases the overall length of the cylinder.

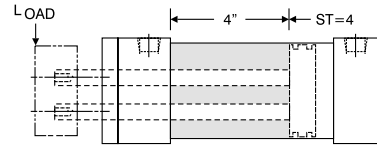
Ordering Example: TRA MS4 2.00 x 10ES-ST=2

**The effective stroke (ES) must be included when ordering.**

ST=2



ST=4



Note: 2" and 4" are recommended stop tube lengths. Other lengths can be specified, but will not increase side load tolerance or reduce tool plate end play.

## Strokes

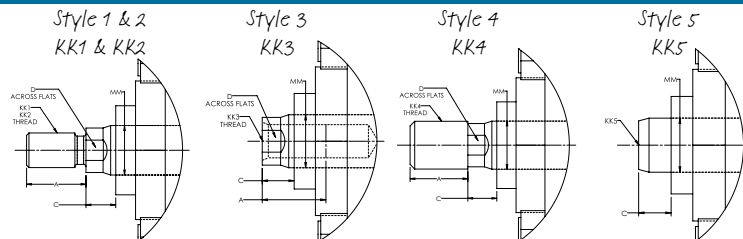
Bore	Recommended Maximum* Stroke Lengths					
	Single Rod End Models			Double Rod End Models		
	TRA	TRA ST=2"	TRA ST=4"	TRA "D"	TRA "D" ST=2"	TRA "D" ST=4"
1.50	10	12	14	12	14	16
2.00	14	18	24	18	24	30
2.50	20	24	30	30	38	40
3.25	24	28	36	34	42	46
4.00	24	30	38	36	44	48
5.00	26	34	42	40	52	56
6.00	28	36	44	42	54	58
8.00	30	38	46	42	54	60

\*Maximum Stroke For Horizontal Applications.

## "D1" Rod End Options

KK1 is standard (leave blank). Specify at end of part number for -KK2, -KK3, -KK4 or -KK5.

Piston rod end styles apply to single rod end of cylinder only.



Bore	MM1 Rod Diameter	Standard		Optional							C1*	V1
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male		Style 5 - Blank		
		KK1	A	KK2	A	KK3	A	KK4	A	KK5		
1.50, 2.00, 2.50	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.250
3.25, 4.00, 5.00	1.000 Standard	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1 -14	1.125	No Threads	0.500	0.250
6.00 & 8.00	1.375 Standard	1 -14	1.625	1 1/4 -12	1.625	1 -14	1.625	1 3/8 -12	1.625	No Threads	0.625	0.375

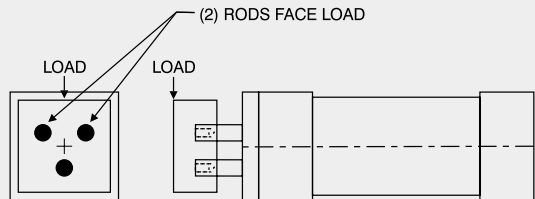
\*Dimension is with single rod fully retracted.

## Technical Data – Load Charts: 1.50” - 4.00” Bore

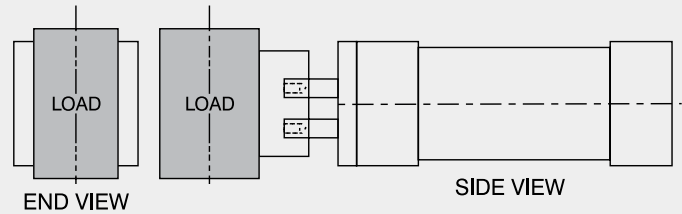
### How To Use Load Charts:

1. Determine weight of Load (pounds)
2. Refer to Load Charts for model selection

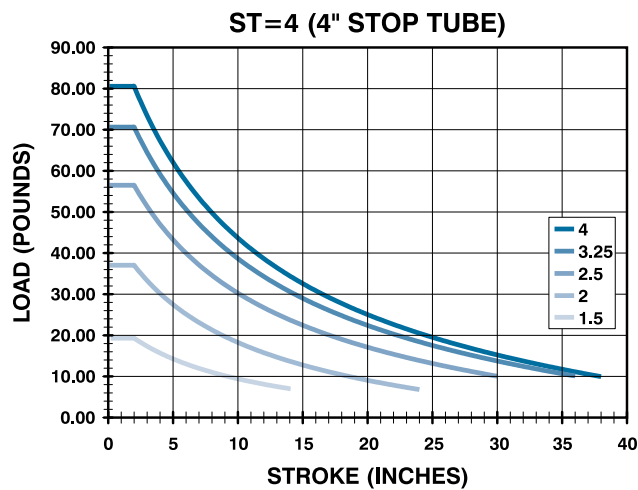
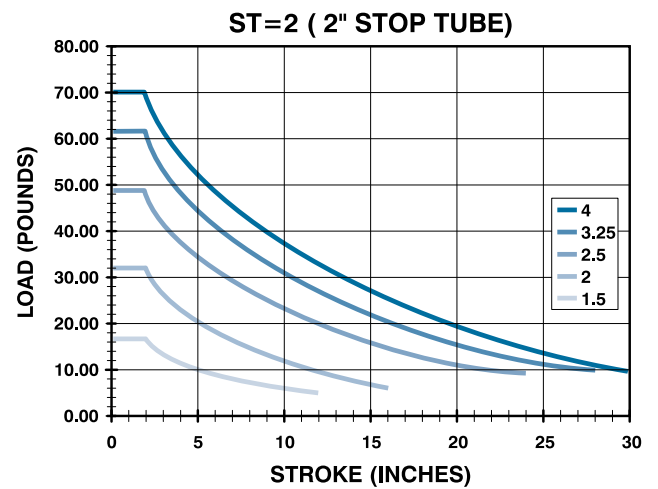
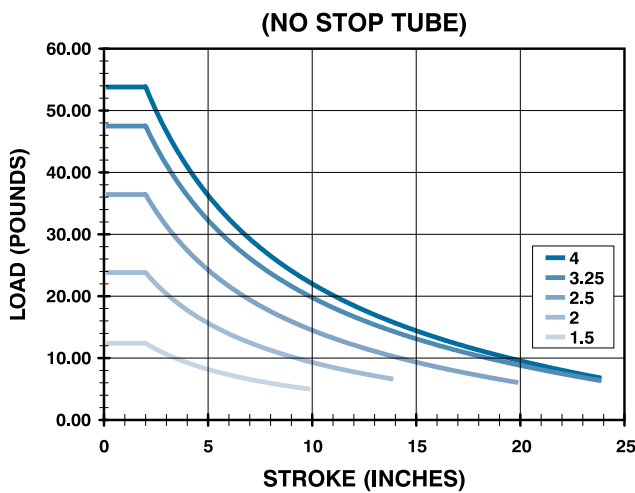
### Triple Rod Mounting To Load:



*Example 1*



## Single Rod End: 1.50” - 4.00” Bore Maximum Recommended Load



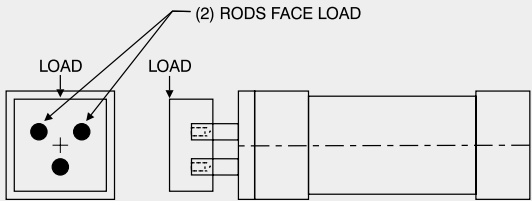
# How to Specify

## Technical Data – Load Charts: 5.00” - 8.00” Bore

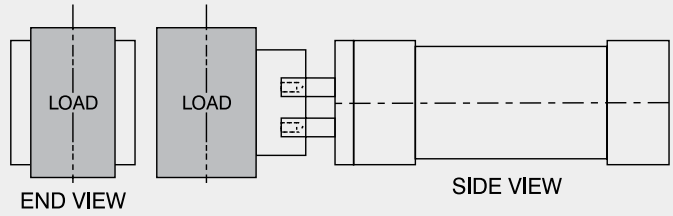
### How To Use Load Charts:

1. Determine weight of Load (pounds)
2. Refer to Load Charts for model selection

### Triple Rod Mounting To Load:

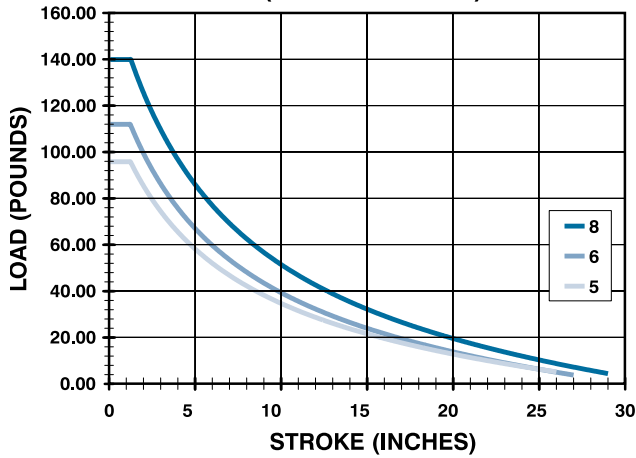


*Example 1*

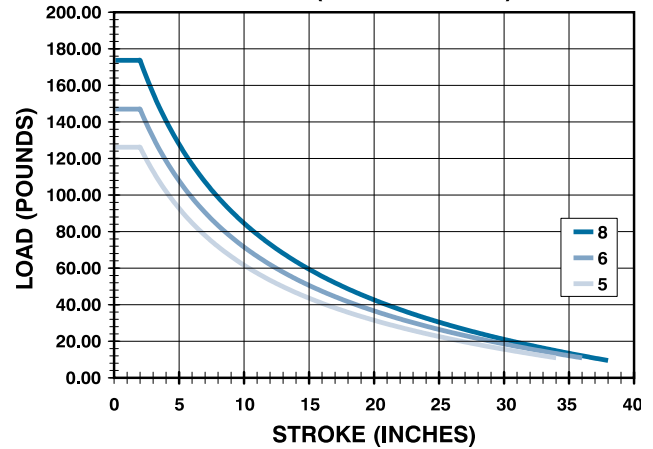


## Single Rod End: 5.00” - 8.00” Bore Maximum Recommended Load

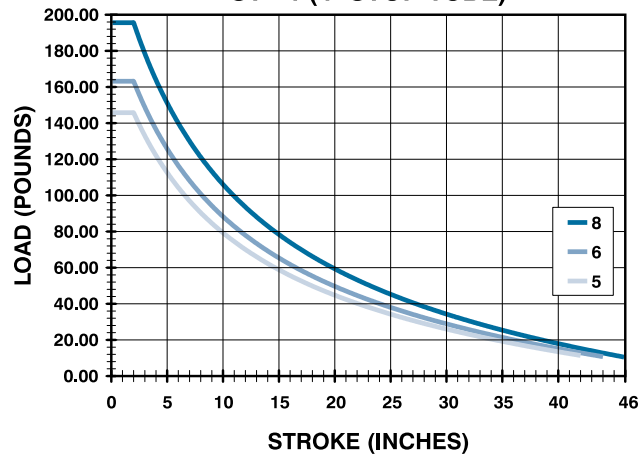
(NO STOP TUBE)



ST=2 (2" STOP TUBE)



ST=4 (4" STOP TUBE)



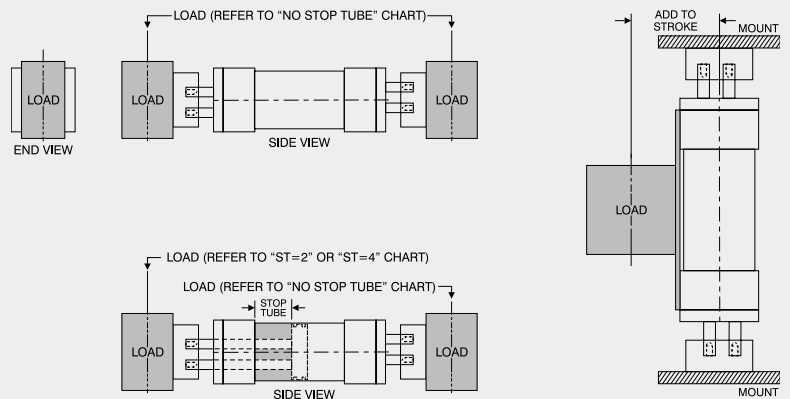
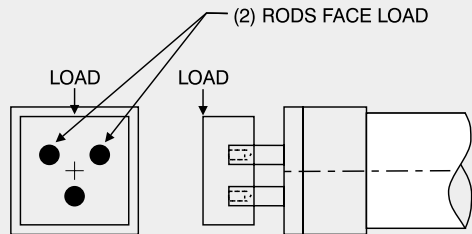


## Technical Data (D3 Models) – Load Charts: 1.50” - 4.00” Bore – Double Rod End

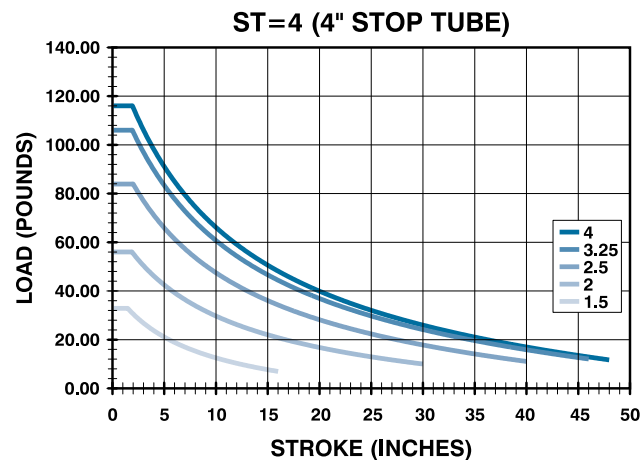
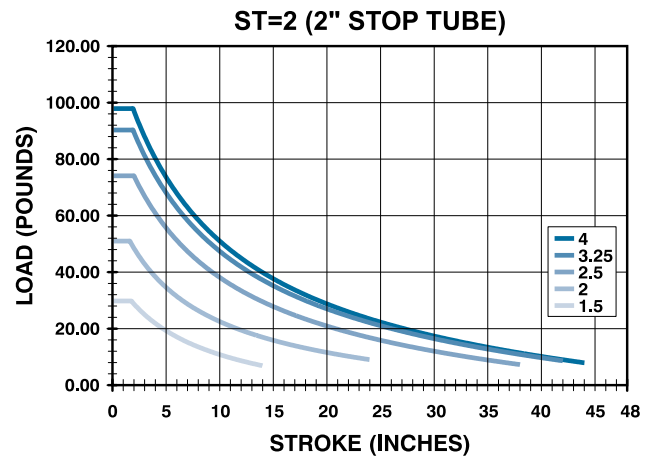
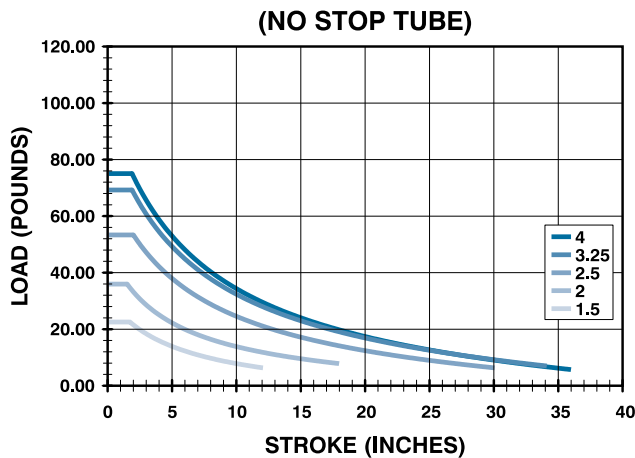
### How To Use Load Charts:

1. Determine weight of Load (pounds)
2. Refer to Load Charts for model selection

### Triple Rod Mounting To Load:



## Double Rod End: 1.50” - 4.00” Bore Maximum Recommended Load



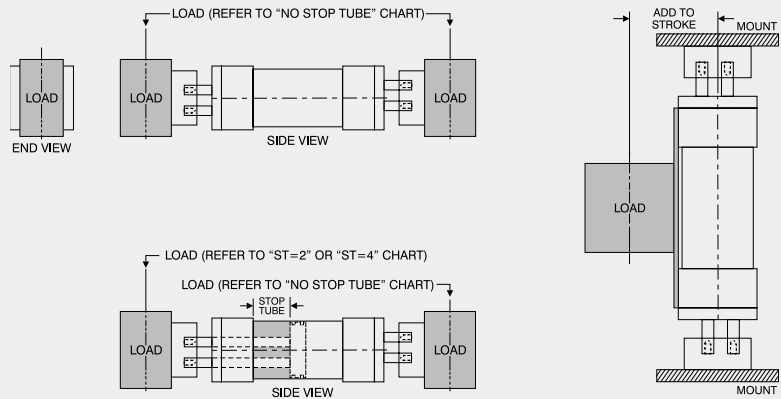
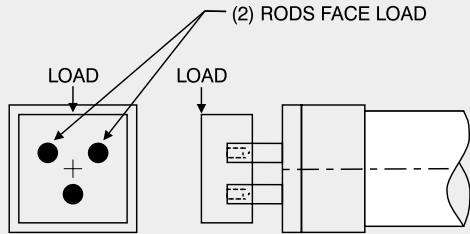
# How to Specify

## Technical Data (D3 Models) – Load Charts: 5.00” - 8.00” Bore – Double Rod End

### How To Use Load Charts:

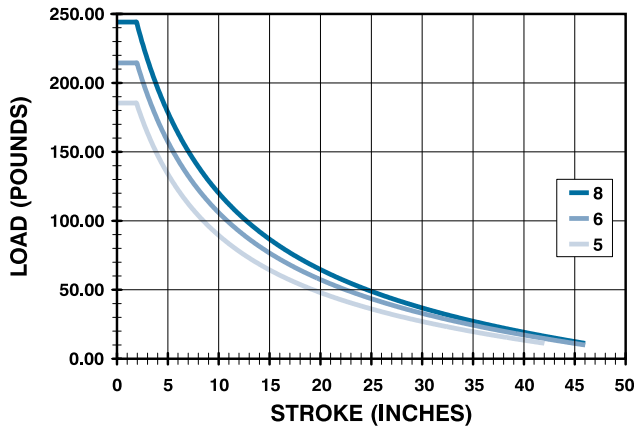
1. Determine weight of Load (pounds)
2. Refer to Load Charts for model selection

### Triple Rod Mounting To Load:

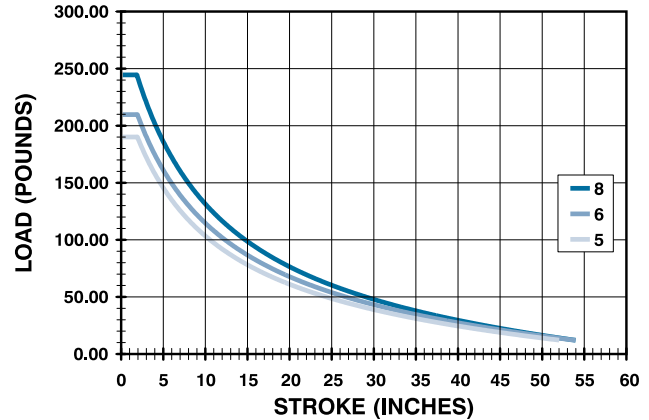


## Double Rod End: 5.00” - 8.00” Bore Maximum Recommended Load

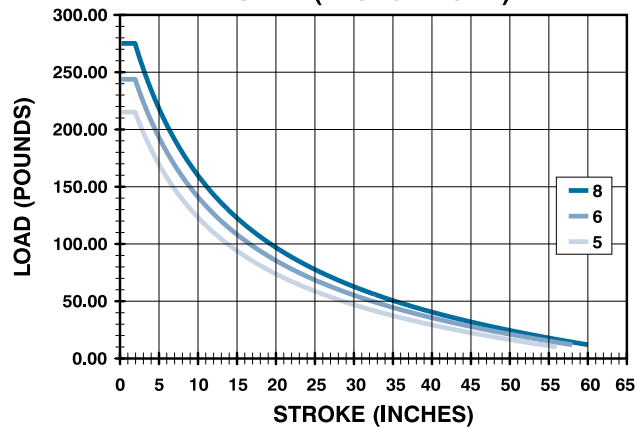
(NO STOP TUBE)



ST=2 (2" STOP TUBE)



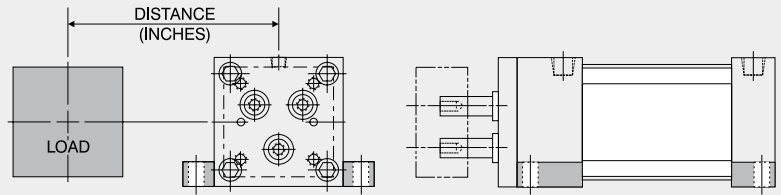
ST=4 (4" STOP TUBE)



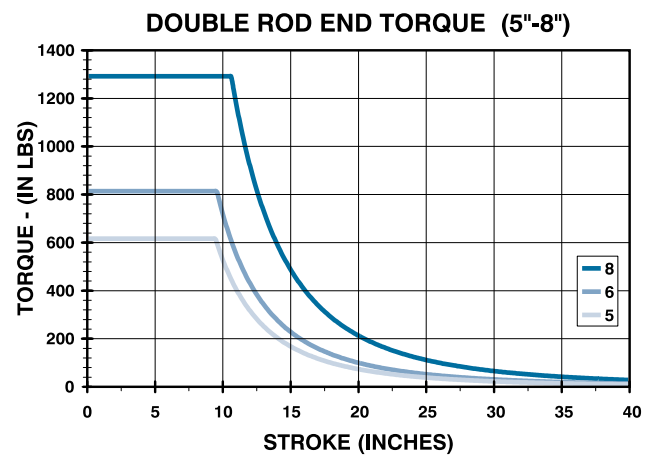
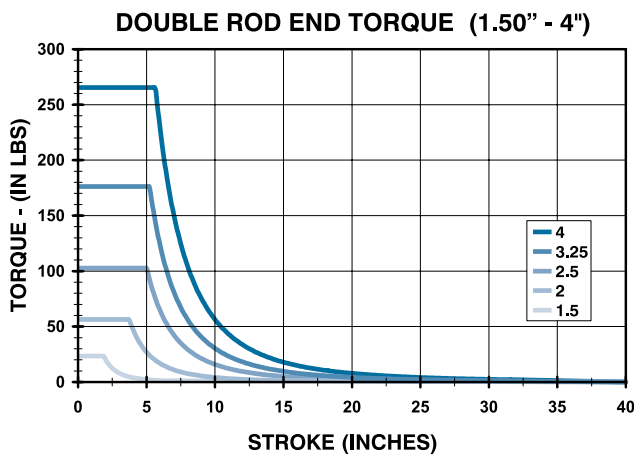
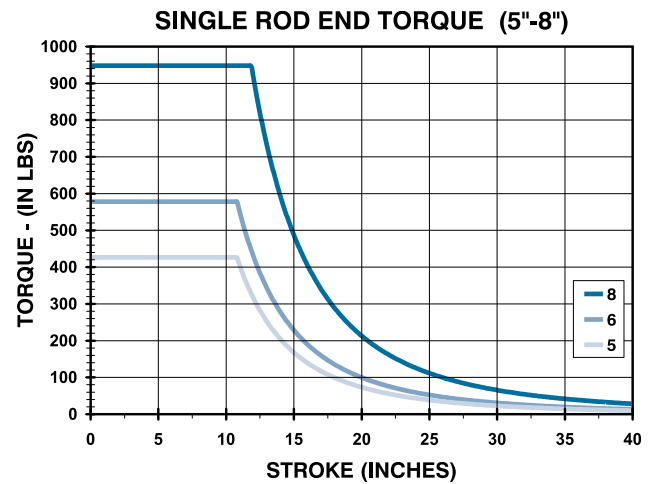
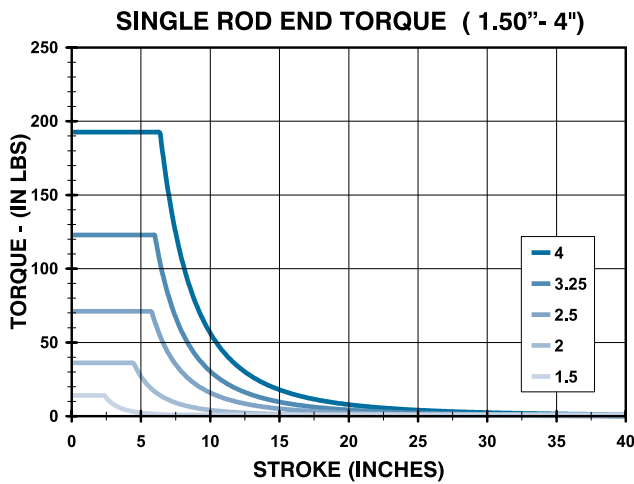
## Technical Data – Torque Charts

### How To Use Torque Charts:

1. Determine weight of Load (pounds)
2. Determine DISTANCE (inches) of Load off center of Cylinder
3. Multiply:  
Load (in pounds) X DISTANCE (inches)  
= Inch-Pounds of TORQUE
4. Refer to Torque Charts for model selection



## Torque (Inch-Pounds) – (For No Stop Tube, ST=2" & ST=4" Models)

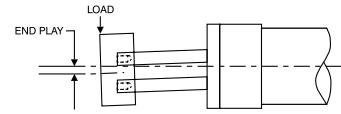


# How to Specify

## Technical Data – Tooling Plate End Play Charts

Note: Tooling Plate End Play values include rod deflection due to weight of rods and tool plate only (no load), parts clearance and maximum manufacturing tolerances.

### TOOLING PLATE END PLAY



### Single Rod End Cylinders - No Stop Tube

1.50" - 8.00" Bore Single Rod End Cylinders - No Stop Tube								
Stroke	1.50	2.00	2.50	3.25	4.00	5.00	6.00	8.00
0	0.006	0.006	0.006	0.006	0.009	0.010	0.010	0.007
2	0.015	0.017	0.013	0.013	0.022	0.024	0.023	0.018
4	0.024	0.027	0.021	0.021	0.034	0.038	0.037	0.030
6	0.033	0.037	0.029	0.028	0.047	0.051	0.051	0.042
8	0.042	0.047	0.037	0.036	0.059	0.065	0.065	0.053
10	0.051	0.058	0.044	0.044	0.071	0.079	0.079	0.065
12	—	0.068	0.052	0.051	0.084	0.092	0.093	0.077
14	—	0.078	0.060	0.059	0.096	0.106	0.106	0.088
16	—	—	0.067	0.066	0.109	0.120	0.120	0.100
18	—	—	0.075	0.074	0.121	0.133	0.134	0.112
20	—	—	0.083	0.081	0.134	0.147	0.148	0.123
22	—	—	—	0.089	0.146	0.161	0.162	0.135
24	—	—	—	0.097	0.158	0.174	0.176	0.147
26	—	—	—	—	—	0.188	0.190	0.158
28	—	—	—	—	—	—	0.203	0.170
30	—	—	—	—	—	—	—	0.182

### Single Rod End Cylinders - 2" Stop Tube

1.50" - 8.00" Bore Single Rod End Cylinders - 2.00" Stop Tube								
Stroke	1.50	2.00	2.50	3.25	4.00	5.00	6.00	8.00
0	0.006	0.004	0.004	0.004	0.007	0.008	0.008	0.007
2	0.009	0.011	0.009	0.009	0.016	0.019	0.019	0.016
4	0.014	0.017	0.014	0.015	0.026	0.030	0.031	0.026
6	0.019	0.024	0.019	0.020	0.035	0.041	0.042	0.036
8	0.024	0.030	0.024	0.026	0.044	0.052	0.054	0.047
10	0.030	0.037	0.029	0.031	0.054	0.063	0.065	0.057
12	0.035	0.043	0.035	0.036	0.063	0.074	0.076	0.067
14	—	0.049	0.040	0.042	0.072	0.084	0.088	0.077
16	—	0.056	0.045	0.047	0.082	0.095	0.099	0.088
18	—	0.062	0.050	0.053	0.091	0.106	0.111	0.098
20	—	—	0.055	0.058	0.100	0.117	0.122	0.108
22	—	—	0.060	0.064	0.110	0.128	0.134	0.118
24	—	—	0.065	0.069	0.119	0.139	0.145	0.129
26	—	—	—	0.074	0.128	0.150	0.156	0.139
28	—	—	—	0.080	0.138	0.161	0.168	0.149
30	—	—	—	—	0.147	0.172	0.179	0.159
32	—	—	—	—	—	0.183	0.191	0.170
34	—	—	—	—	—	0.193	0.202	0.180
36	—	—	—	—	—	—	0.214	0.190
38	—	—	—	—	—	—	—	0.200

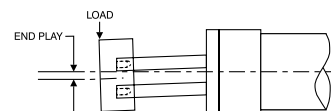
### Single Rod End Cylinders - 4" Stop Tube

1.50" - 8.00" Bore Single Rod End Cylinders - 4.00" Stop Tube								
Stroke	1.50	2.00	2.50	3.25	4.00	5.00	6.00	8.00
0	0.002	0.003	0.003	0.003	0.005	0.006	0.008	0.005
2	0.006	0.007	0.006	0.007	0.012	0.015	0.015	0.014
4	0.009	0.012	0.010	0.011	0.019	0.023	0.025	0.022
6	0.013	0.016	0.014	0.015	0.026	0.032	0.034	0.031
8	0.016	0.021	0.017	0.019	0.033	0.040	0.043	0.039
10	0.020	0.025	0.021	0.023	0.040	0.049	0.052	0.048
12	0.024	0.030	0.024	0.027	0.047	0.057	0.061	0.057
14	0.027	0.035	0.028	0.031	0.054	0.066	0.070	0.065
16	—	0.039	0.032	0.035	0.061	0.074	0.080	0.074
18	—	0.044	0.035	0.039	0.068	0.083	0.089	0.083
20	—	0.048	0.039	0.043	0.075	0.091	0.098	0.091
22	—	0.053	0.043	0.047	0.082	0.100	0.107	0.100
24	—	0.057	0.046	0.050	0.089	0.108	0.116	0.109
26	—	—	0.050	0.054	0.096	0.117	0.125	0.117
28	—	—	0.053	0.058	0.103	0.125	0.135	0.126
30	—	—	0.057	0.062	0.110	0.134	0.144	0.135
32	—	—	—	0.066	0.117	0.142	0.153	0.143
34	—	—	—	0.070	0.124	0.151	0.162	0.152
36	—	—	—	0.074	0.131	0.159	0.171	0.161
38	—	—	—	—	0.138	0.168	0.180	0.169
40	—	—	—	—	—	0.176	0.190	0.178
42	—	—	—	—	—	0.185	0.199	0.187
44	—	—	—	—	—	—	0.208	0.195
46	—	—	—	—	—	—	—	0.204

## Technical Data – Tooling Plate End Play Charts (D3 Models)

Note: Tooling Plate End Play values include rod deflection due to weight of rods and tool plate only (no load), parts clearance and maximum manufacturing tolerances.

### TOOLING PLATE END PLAY



### Double Rod End Cylinders - No Stop Tube

1.50" - 8.00" Bore Double Rod End Cylinders - No Stop Tube								
Stroke	1.50	2.00	2.50	3.25	4.00	5.00	6.00	8.00
0	0.003	0.003	0.003	0.003	0.004	0.005	0.005	0.004
2	0.007	0.008	0.006	0.006	0.011	0.012	0.011	0.009
4	0.012	0.013	0.010	0.010	0.017	0.019	0.018	0.015
6	0.017	0.018	0.014	0.014	0.023	0.025	0.025	0.021
8	0.021	0.023	0.018	0.018	0.029	0.032	0.032	0.026
10	0.026	0.029	0.022	0.022	0.035	0.039	0.039	0.032
12	0.031	0.034	0.026	0.025	0.042	0.046	0.046	0.038
14	—	0.038	0.030	0.029	0.048	0.053	0.053	0.044
16	—	0.044	0.033	0.033	0.054	0.060	0.060	0.050
18	—	0.050	0.037	0.037	0.060	0.066	0.067	0.056
20	—	—	0.041	0.040	0.067	0.073	0.074	0.061
22	—	—	0.045	0.044	0.073	0.080	0.081	0.067
24	—	—	0.049	0.048	0.079	0.087	0.088	0.073
26	—	—	0.053	0.052	0.085	0.094	0.095	0.079
28	—	—	0.057	0.056	0.091	0.100	0.101	0.085
30	—	—	0.060	0.059	0.098	0.107	0.108	0.091
32	—	—	—	0.063	0.104	0.114	0.115	0.096
34	—	—	—	—	0.110	0.121	0.122	0.102
36	—	—	—	—	0.116	0.128	0.129	0.108
38	—	—	—	—	—	0.135	0.136	0.114
40	—	—	—	—	—	—	0.143	0.120
42	—	—	—	—	—	—	0.150	0.126

### Double Rod End Cylinders - 2" Stop Tube

1.50" - 8.00" Bore Double Rod End Cylinders - 2.00" Stop Tube								
Stroke	1.50	2.00	2.50	3.25	4.00	5.00	6.00	8.00
0	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.003
2	0.005	0.005	0.005	0.005	0.008	0.009	0.009	0.008
4	0.007	0.009	0.007	0.008	0.013	0.015	0.015	0.013
6	0.009	0.012	0.009	0.010	0.017	0.020	0.021	0.018
8	0.012	0.015	0.012	0.013	0.022	0.026	0.027	0.023
10	0.015	0.018	0.014	0.015	0.027	0.031	0.032	0.028
12	0.018	0.021	0.017	0.018	0.031	0.037	0.038	0.033
14	0.020	0.025	0.020	0.021	0.036	0.042	0.044	0.038
16	—	0.028	0.022	0.023	0.041	0.047	0.049	0.044
18	—	0.031	0.025	0.026	0.045	0.053	0.055	0.049
20	—	0.034	0.027	0.029	0.050	0.058	0.061	0.054
22	—	0.037	0.030	0.032	0.055	0.064	0.067	0.059
24	—	0.041	0.032	0.034	0.059	0.069	0.072	0.064
26	—	—	0.035	0.037	0.064	0.075	0.078	0.069
28	—	—	0.037	0.040	0.069	0.080	0.084	0.074
30	—	—	0.040	0.042	0.073	0.086	0.089	0.079
32	—	—	0.043	0.045	0.078	0.091	0.095	0.085
34	—	—	0.045	0.048	0.083	0.096	0.101	0.090
36	—	—	0.048	0.050	0.088	0.102	0.107	0.095
38	—	—	0.051	0.053	0.092	0.107	0.112	0.100
40	—	—	—	0.056	0.097	0.113	0.118	0.105
42	—	—	—	0.059	0.101	0.118	0.124	0.110
44	—	—	—	—	0.106	0.124	0.129	0.115
46	—	—	—	—	—	0.129	0.135	0.120
48	—	—	—	—	—	0.135	0.141	0.126
50	—	—	—	—	—	0.140	0.147	0.131
52	—	—	—	—	—	0.145	0.152	0.136
54	—	—	—	—	—	—	0.158	0.141

### Double Rod End Cylinders - 4" Stop Tube

1.50" - 8.00" Bore Double Rod End Cylinders - 4.00" Stop Tube								
Stroke	1.50	2.00	2.50	3.25	4.00	5.00	6.00	8.00
0	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.003
2	0.003	0.004	0.004	0.004	0.006	0.007	0.007	0.007
4	0.004	0.006	0.005	0.005	0.009	0.011	0.012	0.011
6	0.006	0.008	0.007	0.007	0.013	0.016	0.017	0.015
8	0.008	0.010	0.008	0.009	0.016	0.020	0.021	0.019
10	0.010	0.012	0.010	0.011	0.020	0.024	0.026	0.024
12	0.012	0.015	0.012	0.013	0.023	0.028	0.030	0.028
14	0.014	0.017	0.014	0.015	0.027	0.033	0.035	0.032
16	0.016	0.020	0.016	0.017	0.030	0.037	0.040	0.037
18	—	0.022	0.017	0.019	0.034	0.041	0.044	0.041
20	—	0.024	0.019	0.021	0.038	0.045	0.049	0.045
22	—	0.026	0.021	0.023	0.041	0.050	0.053	0.050
24	—	0.028	0.023	0.025	0.044	0.054	0.058	0.054
26	—	0.031	0.025	0.027	0.048	0.058	0.062	0.058
28	—	0.033	0.026	0.029	0.051	0.062	0.067	0.063
30	—	0.035	0.028	0.031	0.055	0.067	0.072	0.067
32	—	—	0.030	0.033	0.058	0.071	0.076	0.071
34	—	—	0.032	0.035	0.062	0.075	0.081	0.076
36	—	—	0.034	0.037	0.065	0.079	0.085	0.080
38	—	—	0.036	0.039	0.069	0.084	0.090	0.084
40	—	—	0.038	0.041	0.072	0.088	0.095	0.089
42	—	—	—	0.043	0.076	0.092	0.099	0.093
44	—	—	—	0.045	0.079	0.096	0.104	0.097
46	—	—	—	0.047	0.083	0.101	0.108	0.102
48	—	—	—	—	0.086	0.105	0.113	0.106
50	—	—	—	—	—	0.109	0.117	0.110
52	—	—	—	—	—	0.113	0.122	0.115
54	—	—	—	—	—	0.117	0.127	0.119
56	—	—	—	—	—	0.122	0.131	0.123
58	—	—	—	—	—	—	0.136	0.128
60	—	—	—	—	—	—	—	0.132

# How to Specify

## Technical Data

### Weight Chart - Triple Rod Double End

(Weight in Pounds)

Bore	MX0	MS4	MS2 BASE BAR	* MP1	* MP2	* MP4	MF1 ME4	MF2	ME5	Add Per Inch of Stroke
1.50	2.2	2.2	2.5	2.7	2.8	2.8	2.8	2.9	N/A	0.19
2.00	3.7	3.7	4.0	4.5	4.6	4.6	4.5	4.7	N/A	0.34
2.50	6.0	6.0	6.5	7.0	7.2	7.2	7.1	7.4	N/A	0.45
3.25	10.1	10.1	11.0	12.8	13.7	13.7	13.1	13.5	N/A	0.52
4.00	15.0	15.0	16.2	18.3	19.5	19.5	19.3	19.7	N/A	0.55
5.00	24.0	24.0	25.3	28.6	30.7	N/A	30.5	31.1	N/A	1.10
6.00	35.2	35.2	36.6	43.4	45.9	N/A	45.8	46.7	N/A	1.15
8.00	50.8	50.8	N/A	58.9	N/A	N/A	50.8 (ME4)	N/A	56.7	1.50

All weights are in pounds & include tooling plate.  
\*Weight includes clevis pins.

### Weight Chart - Triple Rod Double End (D3 Models)

(Weight in Pounds)

Bore	MX0D	MS4D	MS2D BASE BAR	MF1D ME4D	Add Per Inch of Stroke
1.50	4.3	4.3	4.6	4.9	0.30
2.00	6.2	6.2	6.5	7	0.55
2.50	11.2	11.2	11.7	12.3	0.75
3.25	18.5	18.5	19.4	21.5	0.82
4.00	26.4	26.4	27.6	30.7	0.85
5.00	42.9	42.9	44.3	49.4	1.83
6.00	59.8	59.8	61.4	70.4 (ME4D)	1.95
8.00	75.8	75.8	N/A	75.0 (ME4D)	2.45

All weights are in pounds & include tooling plate.

### Weight Chart - Tooling Plate

(Weight in Pounds)

Bore	Weight	Bore	Weight	Bore	Weight	Bore	Weight
1.50	0.45	2.50	1.5	4.00	4.16	6.00	9.30
2.00	0.70	3.25	2.7	5.00	6.25	8.00	17.0

### Torque Chart - Cylinder Tie Rods

Bore	Tie Rod Thread Size	Torque in Ft. - Lbs.
1.50	1/4-28	7
2.00	5/16-24	12
2.50	5/16-24	14
3.25	3/8-24	30
4.00	3/8-24	35
5.00	1/2-20	45
6.00	1/2-20	50
8.00	5/8-18	125

1.50" - 6.00" bore have full square retainer plate, 8.00" bore as three (3) separate round retainer plates.

Tighten cylinders using an "X" tightening pattern on tie rods.

### Torque Chart - Retainer Screws

Bore	Retainer Screw Thread Size	Torque in Ft. - Lbs.
1.50	1/4-28	7
2.00	5/16-24	12
2.50	5/16-24	12
3.25	3/8-24	22
4.00	3/8-24	22
5.00	1/2-20	35
6.00	1/2-20	35
8.00	1/4-28	7

1.50" - 6.00" bore have full square retainer plate, 8.00" bore as three (3) separate round retainer plates.

Tighten cylinders using an "X" tightening pattern on tie rods.

### Triple Rod Force/Volume Chart

Bore	Stroke Type	Effective Piston Area	Pounds of Force at PSI						Cu. Ft. Displacement per In. of Stroke
			60	80	100	200	250	400	
1.50	Push	1.767	106	142	177	353	442	706	.00102
	Pull	1.536	92	123	154	308	384	614	.00089
2.00	Push	3.142	188	251	314	628	785	1256	.00182
	Pull	2.553	153	204	255	510	638	1021	.00147
2.50	Push	4.909	295	393	491	982	1227	1962	.00284
	Pull	3.989	239	319	399	798	997	1595	.00231
3.25	Push	8.296	498	664	830	1660	2074	3318	.00480
	Pull	7.376	442	590	738	1476	1844	2950	.00427
4.00	Push	12.566	754	1005	1257	2514	3141	5026	.00727
	Pull	11.646	699	932	1165	2330	2911	4658	.00674
5.00	Push	19.635	1178	1571	1964	3928	4908	7854	.01136
	Pull	17.279	1037	1382	1728	3456	4320	6911	.00999
6.00	Push	28.274	1696	2262	2827	5654	7068	11310	.01636
	Pull	25.918	1555	2073	2592	5184	6479	10367	.01499
8.00	Push	50.265	3016	4021	5026	10052	12566	20106	.02908
	Pull	47.909	2874	3832	4791	9582	11977	19163	.02773









# TC Series Cylinders

Bimba's Telescoping TC series provides a robust 2-stage telescoping motion profile with strokes up to 60" standard.



# Contents

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<b>123</b>	TC Series Product Features
123	– Operating Pressure
123	– Operating Temperature

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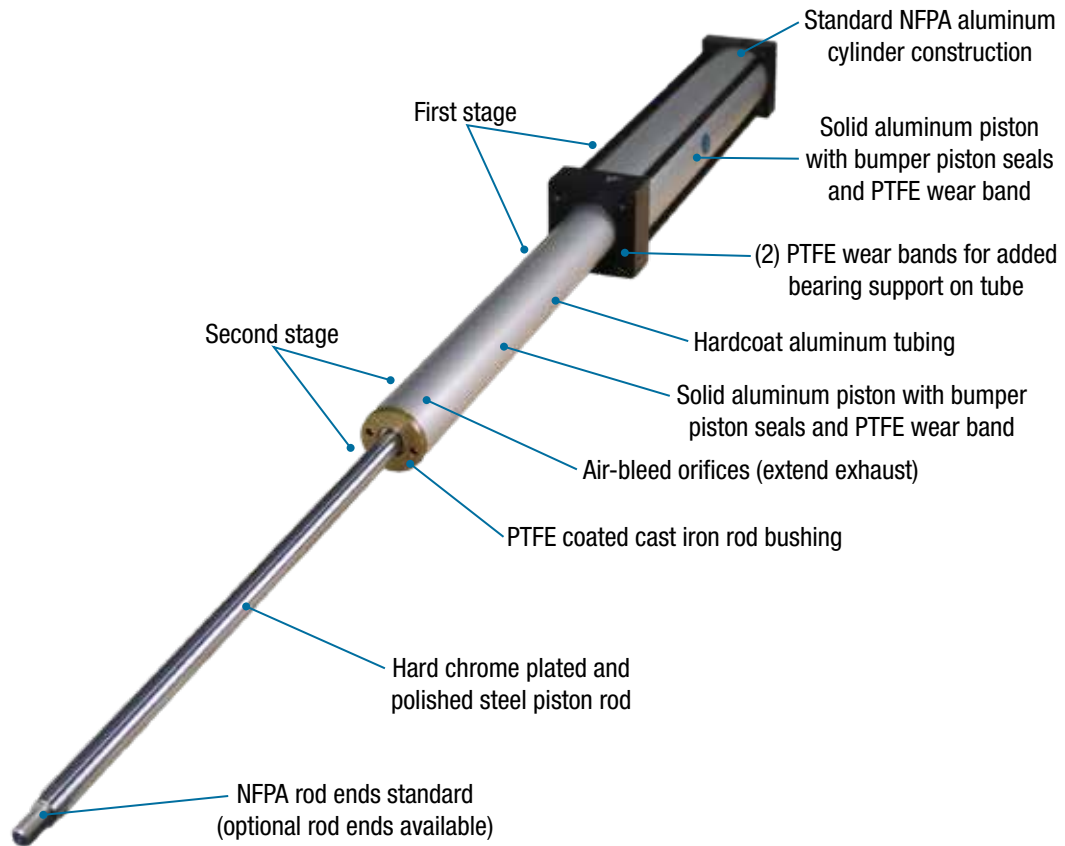
<b>124</b>	How to Order
------------	--------------

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<b>125</b>	How to Specify
125	– TC Series 0.750" Bore – Construction
126	– 0.750" Bore Mounting Options
128	– TC Series 1.500" Bore – Construction
129	– 1.500" Bore Mounting Options
131	– TC Series 2.500" Bore – Construction
132	– 2.500" Bore Mounting Options

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## TC Series 2-Stage Telescoping Cylinder



### Benefits

- > Three effective bore sizes: 0.75", 1.50" and 2.50"
- > Strokes up to 60" (depending on mounting)
- > 2-Stage Telescoping
- > Space saving design
- > 100% double action
- > Reliable operation
- > Rated for non-lube service
- > Standard NFPA mounting
- > Internal bumpers at each stage

Cylinder Stroke	Space Saving Design Stroke Examples For 1.50" Bore		Space Savings
	Standard NFPA Cylinder	Telescoping Cylinder	
12"	16.625"	10.750"	35.34%
18"	22.625"	13.750"	39.23%
24"	28.625"	16.750"	41.48%
30"	34.625"	19.750"	42.96%
36"	40.625"	22.750"	44.00%
42"	46.625"	25.750"	44.77%
48"	52.625"	28.750"	45.37%
54"	58.625"	31.750"	45.84%
60"	64.625"	34.750"	46.23%

Note: cylinders are made to any stroke.

### Design Tips

- > Cylinders are designed to support the unit's weight only, and not intended for side-Load applications. All Loads should be guided and supported.
- > For proper speed control, use "meter-in" type flow control devices.
- > In high cycle speed applications, external shock absorbers should be used at end of strokes.

### Operating Pressure

125 PSI Air

### Operating Temperature

-20°F to 200°F (-29°C to 93°C)

# How to Order

## TC - MS4 - 1.5 x 10 - 2S - KK2 - SSA

Series	
TC	125 PSI Air

Bore		Stroke
0.75	0.75"	0" to 60" Made-To-Order
1.5	1.50"	
2.5	2.50"	

Stages	
2S	Two Stage

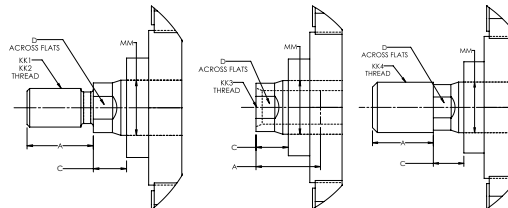
Options	
A	Extended Piston Rod Thread (Example: A=2)
C	Extended Piston Rod (Example: C=3)
KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3S	Studded Piston Rod (KK3 With Stud, Loctite In Place)
KK4	Full Diameter Male Rod Thread
MPR	Magnetic Piston for Reed or Solid State Switches Bimba Models R10, RAC, and MSS. Note: magnet is only on 1st stage and will only detect the position off one stage.
OS	1" Piston Rod (Available on 2.50" Bore only)
OP	Optional Port Location (Example: OP=3,7)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Sleeve Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods & Sleeve Nuts
XX	Special Variation (Specify XX=)

NFPA Mounts	
BASEBAR	Side Lug Mount (Non-NFPA)
MF1	Front Flange
MF2	Rear Flange
MP1	Rear Pivot Clevis
MP2	Rear Pivot Clevis
MP4	Rear Pivot Eye
MS1	Front & Rear Angles
MS4	Bottom Tapped Holes (1.50" - 8.00" Bore)
MT2	Rear Trunnion
MX0	No Mount

Style 1 & 2  
KK1 & KK2

Style 3  
KK3

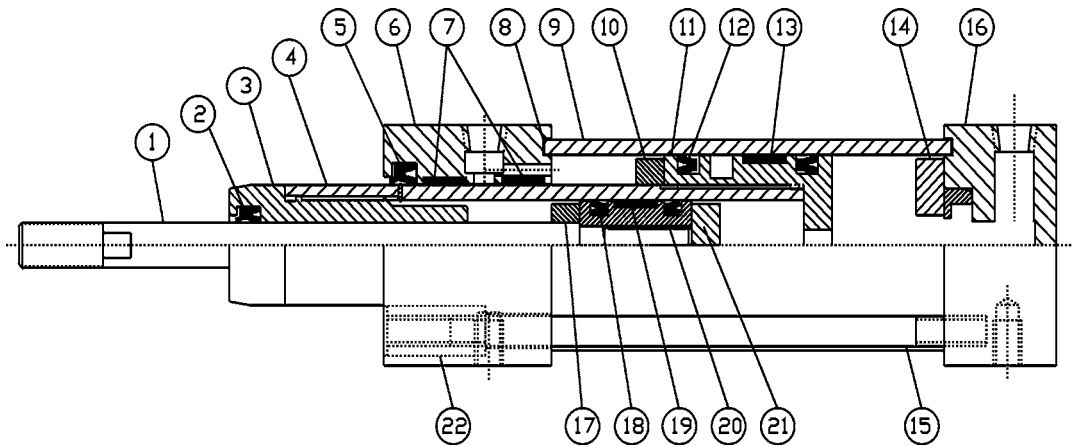
Style 4\*  
KK4



Bore	Rod Diameter (MM)	Standard		Optional						C
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male*		
		KK1	A	KK2	A	KK3	A	KK4	A	
0.75	0.375	—	—	—	—	10-32	0.750	3/8-24	0.750	0.375
1.50 & 2.50	0.625	7/16-20	0.750	1/2-20	0.750	7/16-20	0.750	5/8-18	0.750	0.375
2.50	1.000	3/4-16	1.125	7/8-14	1.125	3/4-16	1.125	1-14	1.125	0.500

\*Style 4 (KK4) is standard thread on 0.75" bore.

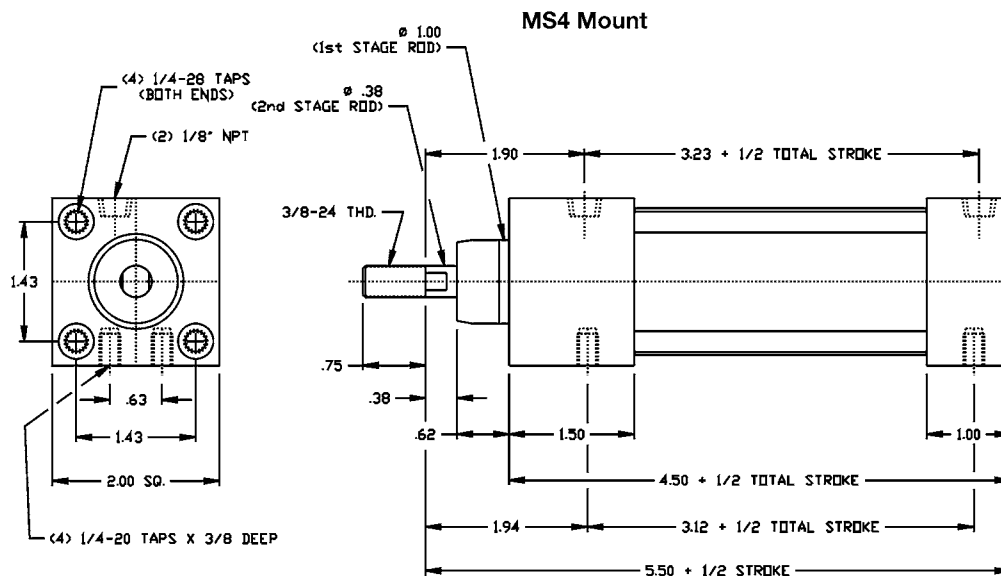
## TC Series 0.750" Bore – Construction



- |                          |                            |                            |
|--------------------------|----------------------------|----------------------------|
| 1. 0.375" Rod Piston     | 9. 1.500" Tube             | 17. 0.750" Head Bumper     |
| 2. Rod Seal              | 10. 1.500" Head Bumper     | 18. 0.750" Piston Seal (2) |
| 3. Rod Bushing           | 11. 1.500" Piston          | 19. PTFE Wear Band         |
| 4. 0.750" ID Tube        | 12. 1.500" Piston Seal (2) | 20. 0.750" Piston          |
| 5. Rod Seal              | 13. PTFE Wear Band         | 21. 0.750" Cap Bumper      |
| 6. Aluminum Head         | 14. 1.500" Cap Bumper      | 22. Sleeve Nut (4)         |
| 7. PTFE Wear Bands (2)   | 15. Tie Rod (4)            |                            |
| 8. 1.500" Tube Seals (2) | 16. Aluminum Cap           |                            |

Cylinder Force Comparison Chart (At 100 PSI)

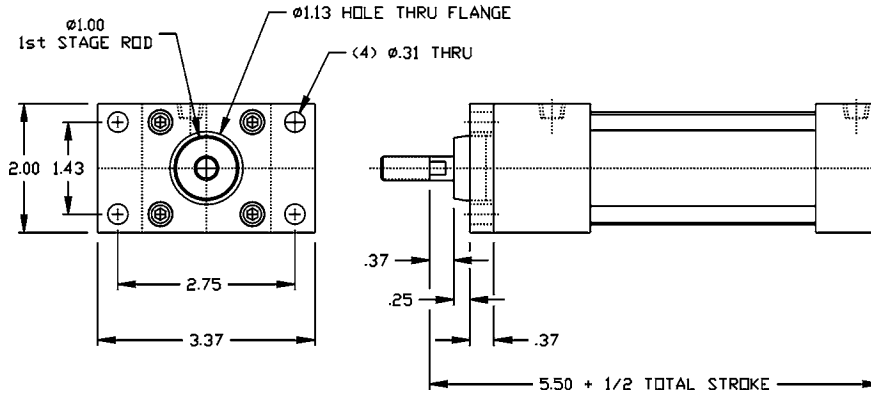
Type	Stroke	1st Stage	2nd Stage
2-Stage Telescoping	Push	176 lbs	44 lbs
	Pull	98 lbs	33 lbs
Standard 0.75" Bore	Push	44 lbs	N/A
	Pull	33 lbs	N/A



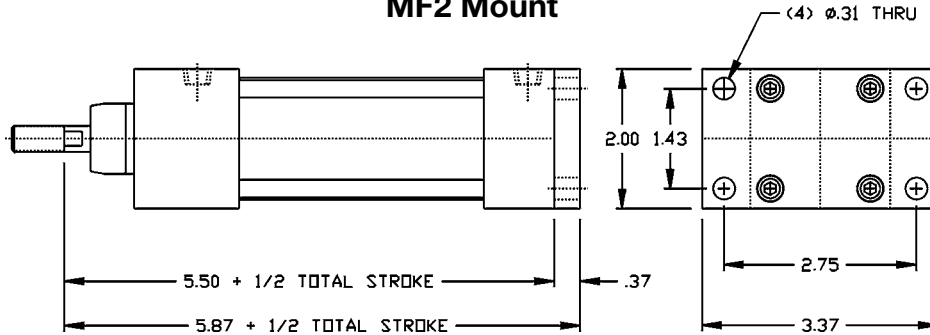
# How to Specify

## TC Series Dimensions – Base Mounts (Strokes 0" to 36")

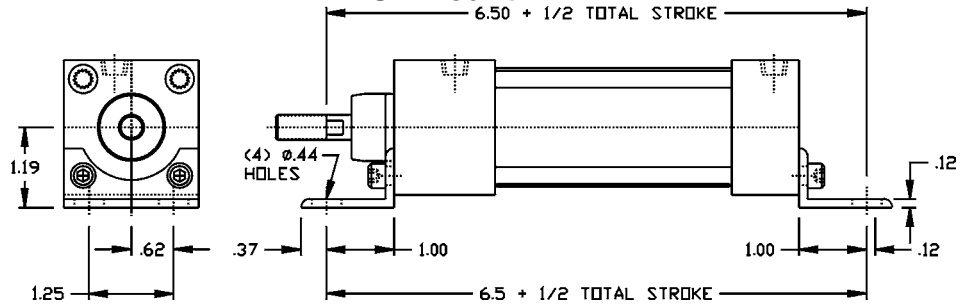
### MF1 Mount



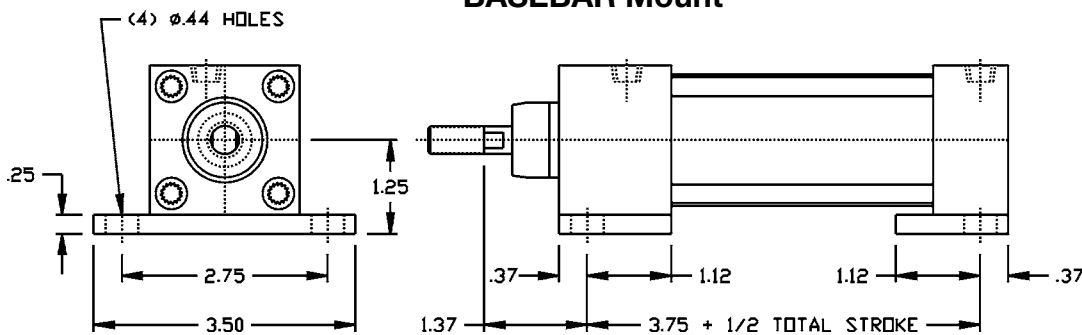
### MF2 Mount



### MS1 Mount

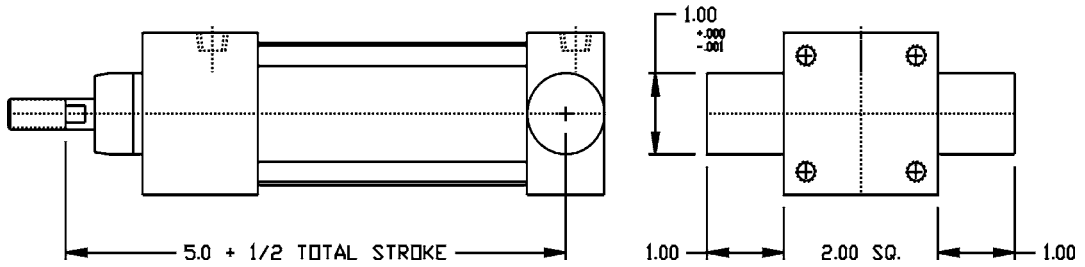


### BASEBAR Mount

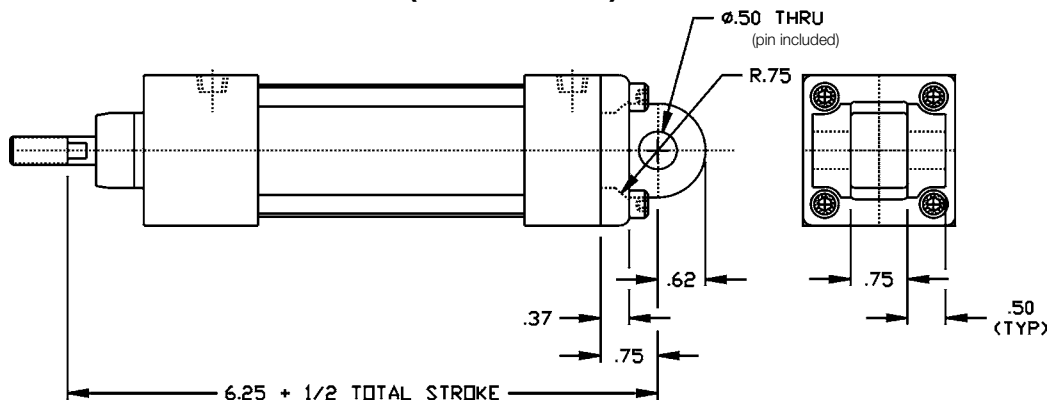


## TC Series Dimensions: Pivot Mounts (Strokes 0" to 24")

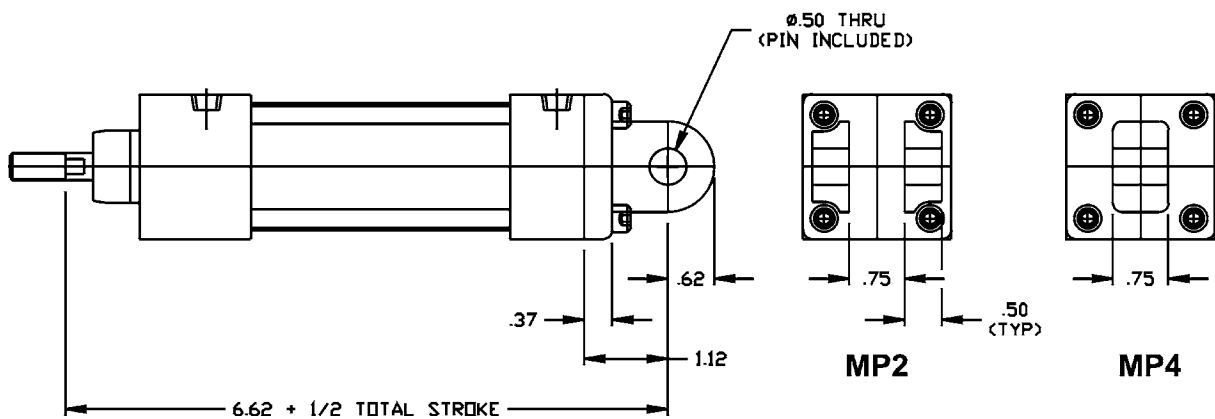
### MT2 Mount



### MP1 (Cast Bolt On) Mount

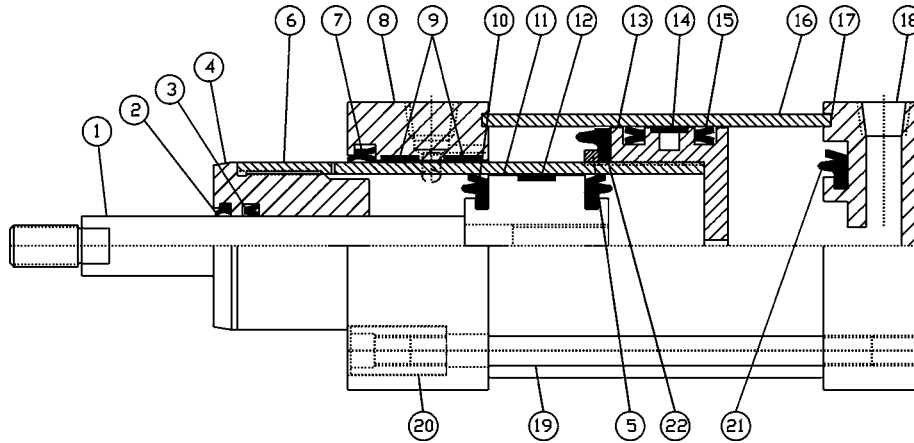


### MP2 & MP4 (Cast Bolt On) Mount



# How to Specify

## TC Series 1.500' Bore – Construction

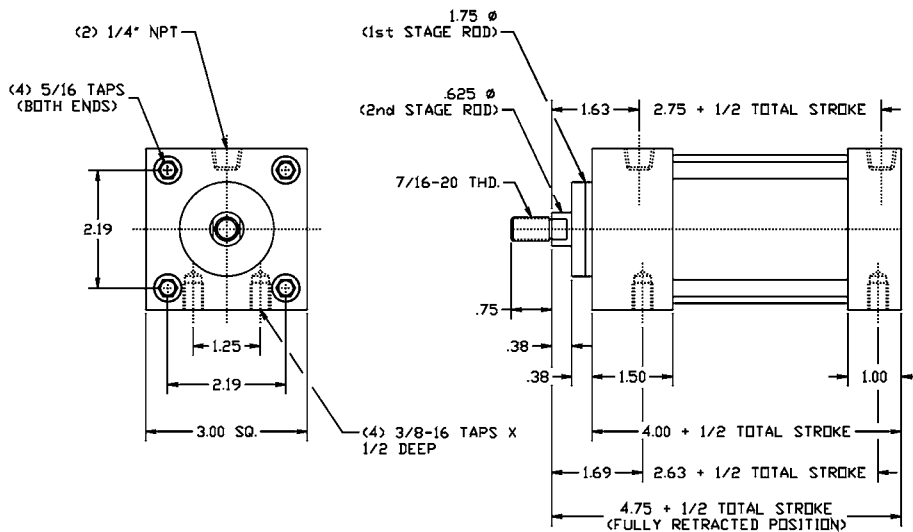


- |                             |  |                               |
|-----------------------------|--|-------------------------------|
| <b>1.</b> 0.625" Piston Rod | <b>9.</b> PTFE Wear Band (2)                 | <b>16.</b> 2.500" Tube        |
| <b>2.</b> Rod Wiper         | <b>10.</b> 1.500" Bumper<br>Piston Seals (2) | <b>17.</b> Tube Seals (2)     |
| <b>3.</b> Rod Seal          | <b>11.</b> 1.500" OD Piston                  | <b>18.</b> Aluminum Cap       |
| <b>4.</b> Rod Bushing       | <b>12.</b> PTFE Wear Band                    | <b>19.</b> Tie Rods (4)       |
| <b>5.</b> Bumper Retainer   | <b>13.</b> 2.500" OD Piston                  | <b>20.</b> Sleeve Nut (4)     |
| <b>6.</b> 1.750" OD Tube    | <b>14.</b> PTFE Wear Band                    | <b>21.</b> 2.500" Cap Bumper  |
| <b>7.</b> Rod Wiper/Seal    | <b>15.</b> 2.500" Piston Seal (2)            | <b>22.</b> 2.500" Head Bumper |
| <b>8.</b> Aluminum Head     |  |                               |

**Cylinder Force Comparison Chart (At 100 PSI)**

Type	Stroke	1st Stage	2nd Stage
2-Stage Telescoping	Push	490 lbs	176 lbs
	Pull	250 lbs	146 lbs
Standard 1.50" Bore	Push	176 lbs	N/A
	Pull	146 lbs	N/A

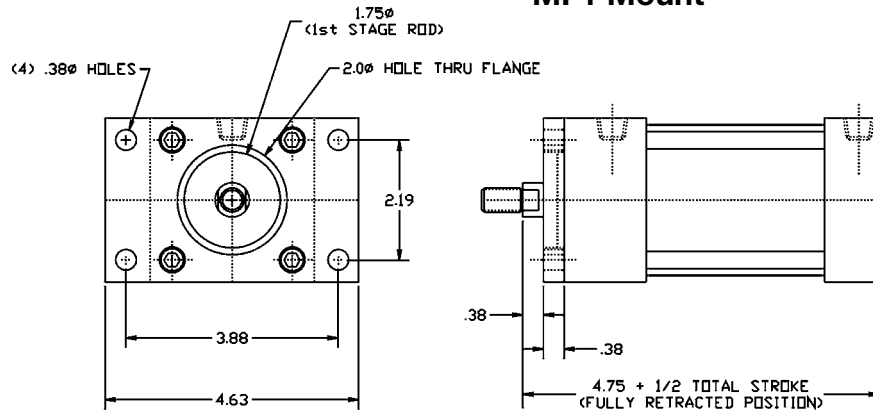
### MS4 Mount



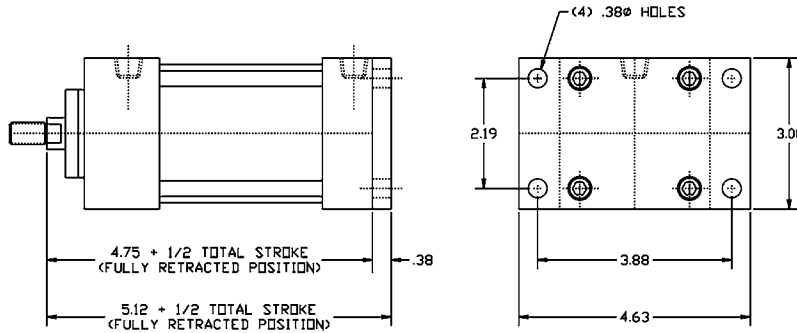


## TC Series Dimensions: Base Mounts (Strokes 0" to 60")

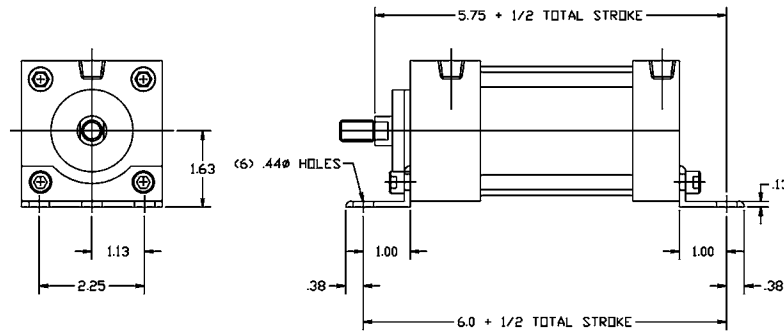
### MF1 Mount



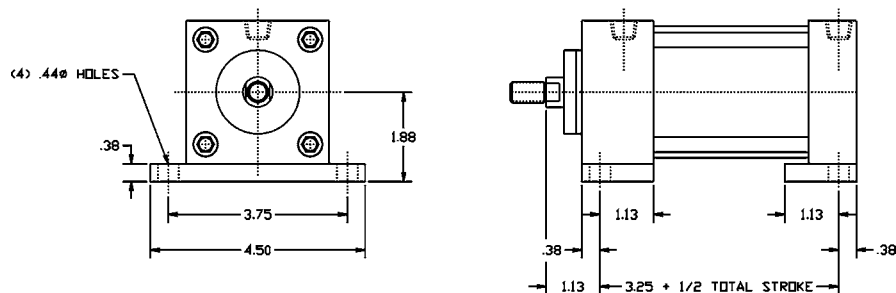
### MF2 Mount



### MS1 Mount



### BASEBAR Mount



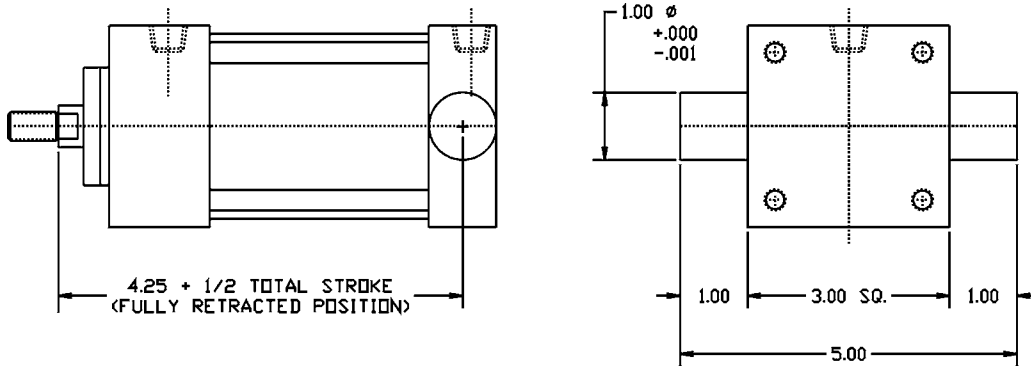
# How to Specify

## TC Series Dimensions: Pivot Mounts (Strokes 0" to 36")

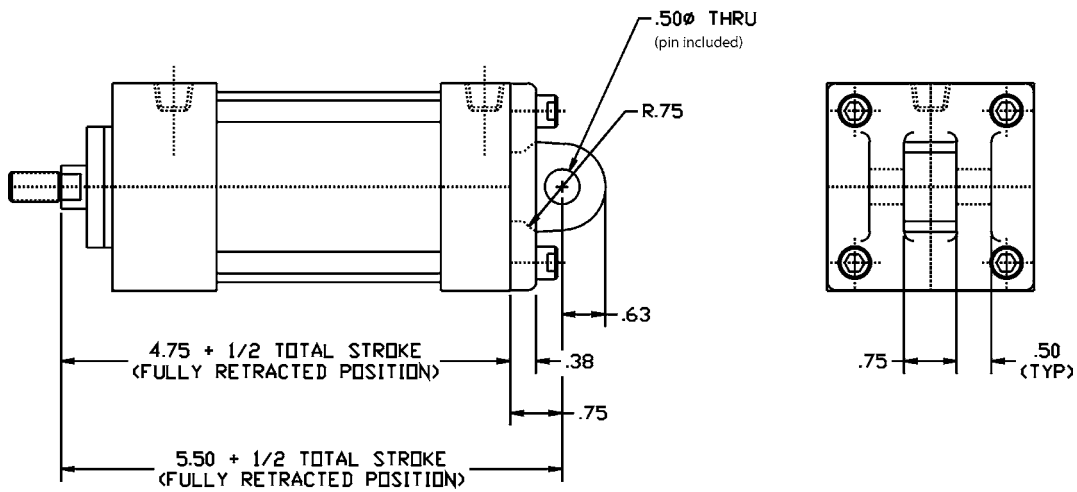
TC SERIES NFPA TELESCOPING CYLINDERS

130

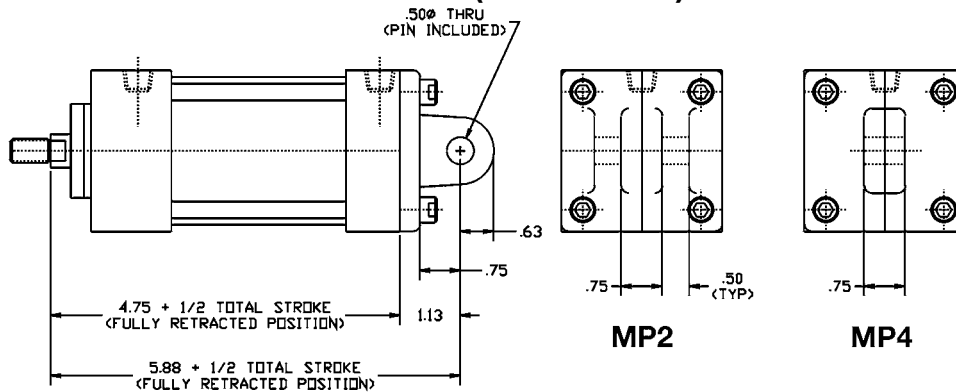
### MT2 Mount



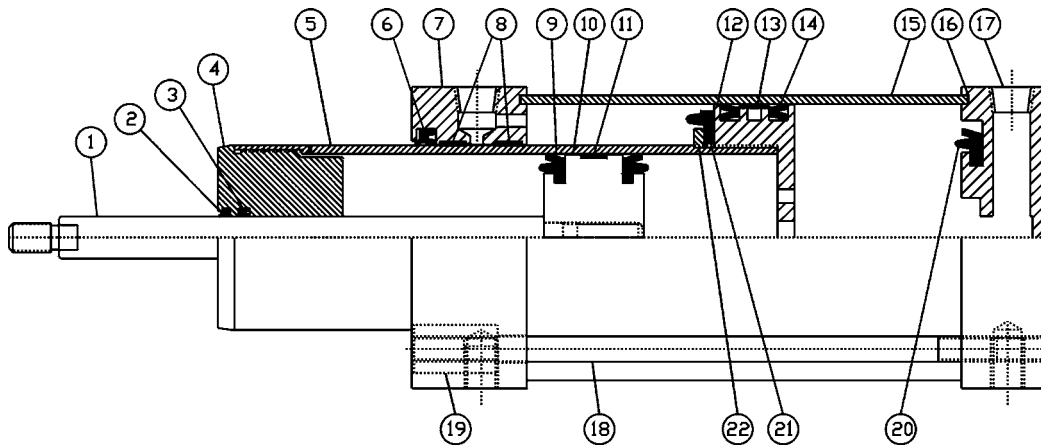
### MP1 (Cast Bolt On) Mount



### MP2 & MP4 (Cast Bolt On) Mount



## TC Series 2.500" Bore – Construction

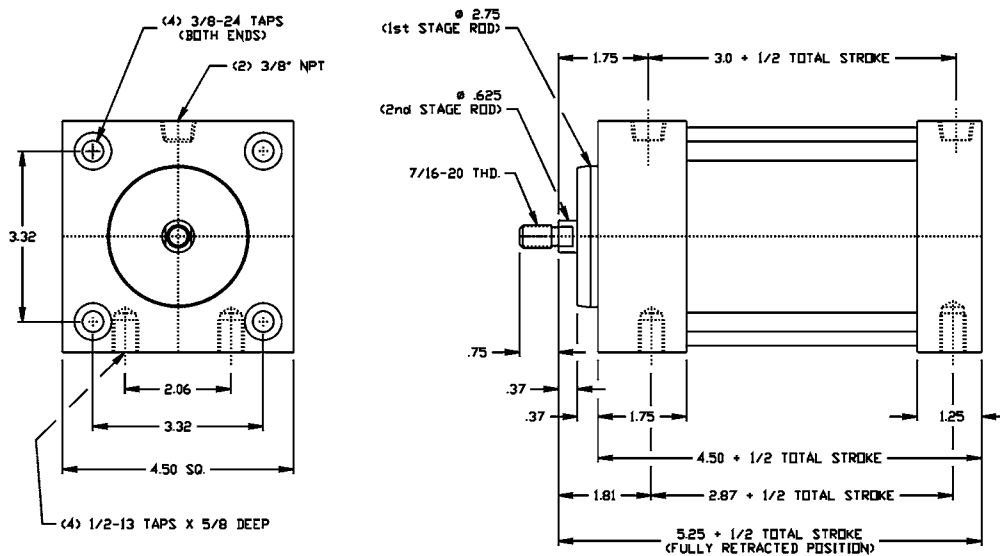


- |                              |   |                                 |
|------------------------------|---|---------------------------------|
| <b>1.</b> 0.625" Piston Rod  | <b>9.</b> 2.500" Bumper<br>Piston Seals (2) | <b>16.</b> 4.00" Tube Seals (2) |
| <b>2.</b> Rod Wiper          | <b>10.</b> 2.500" Piston                    | <b>17.</b> Aluminum Cap         |
| <b>3.</b> Rod Seal           | <b>11.</b> PTFE Wear Band                   | <b>18.</b> Tie Rods (4)         |
| <b>4.</b> Rod Bushing        | <b>12.</b> 4.00" Piston                     | <b>19.</b> Sleeve Nut (4)       |
| <b>5.</b> 2.500" OD Tube     | <b>13.</b> PTFE Wear Band                   | <b>20.</b> Bumper Piston Seal   |
| <b>6.</b> Rod Wiper/Seal     | <b>14.</b> 4.00" Piston Seal (2)            | <b>21.</b> Bumper Piston Seal   |
| <b>7.</b> Aluminum Head      | <b>15.</b> 4.00" OD Tube                    | <b>22.</b> Bumper Retainer      |
| <b>8.</b> PTFE Wear Band (2) |   |                                 |

**Cylinder Force Comparison Chart (at 100 PSI)**

Type	Stroke	1st Stage	2nd Stage
2-Stage Telescoping	Push	1256 lbs	490 lbs
	Pull (0.625" Rod)	662 lbs	460 lbs
	Pull (1.000" Rod)	662 lbs	412 lbs
Standard 2.50" Bore	Push	490 lbs	N/A
	Pull	460 lbs	N/A

### MS4 Mount



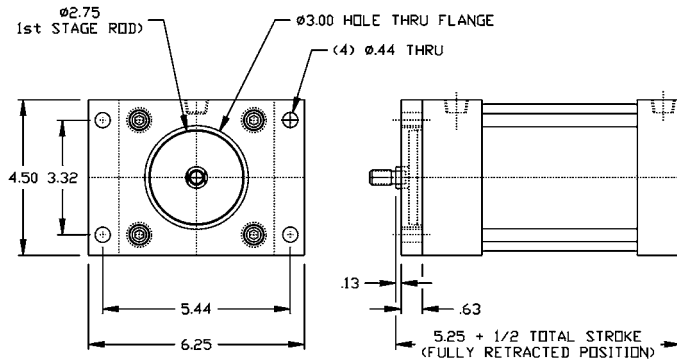
# How to Specify

## TC Series Dimensions: Base Mounts (Strokes 0" to 60")

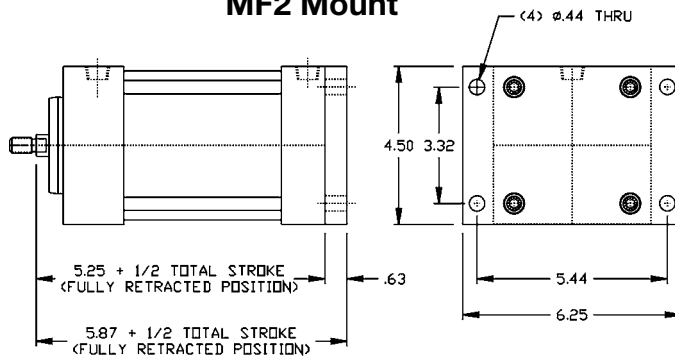
TC SERIES NFPA TELESCOPING CYLINDERS

132

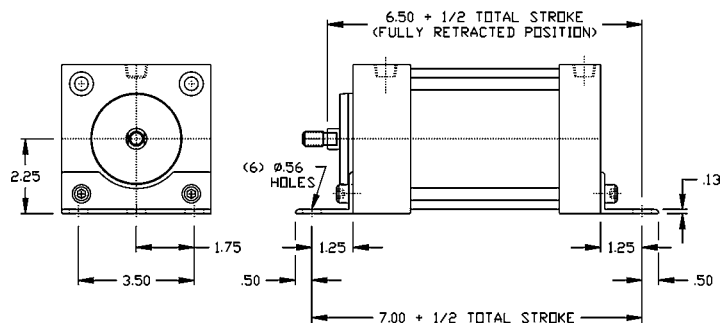
### MF1 Mount



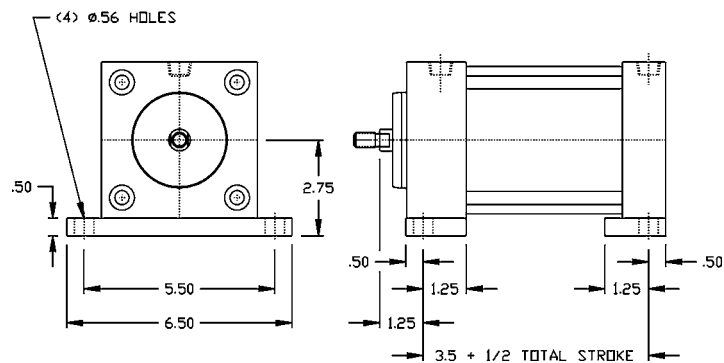
### MF2 Mount



### MS1 Mount

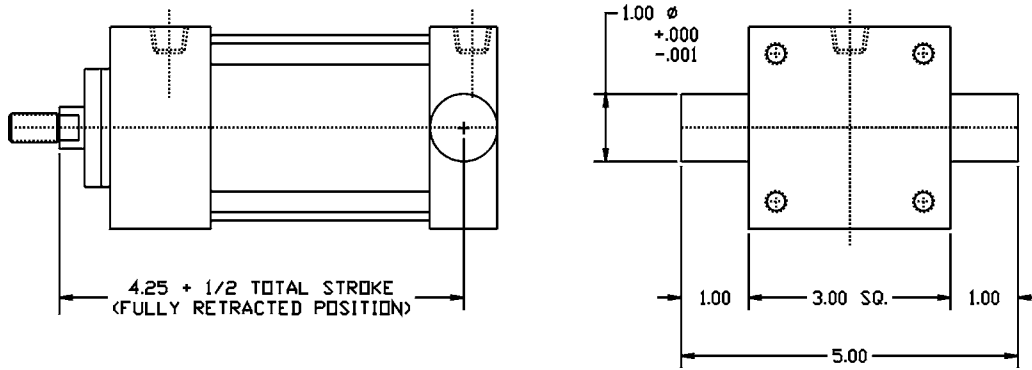


### BASEBAR Mount

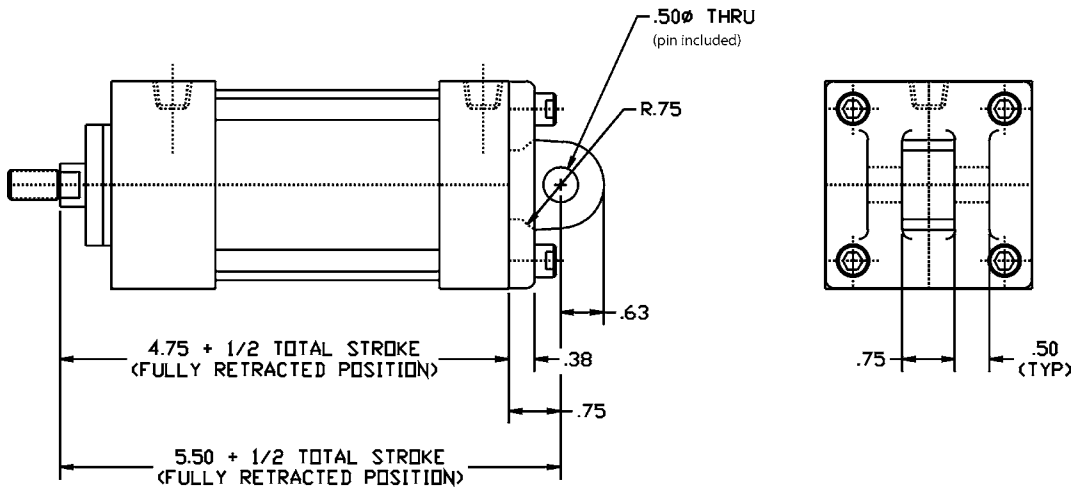


## TC Series Dimensions: Pivot Mounts (Strokes 0" to 36")

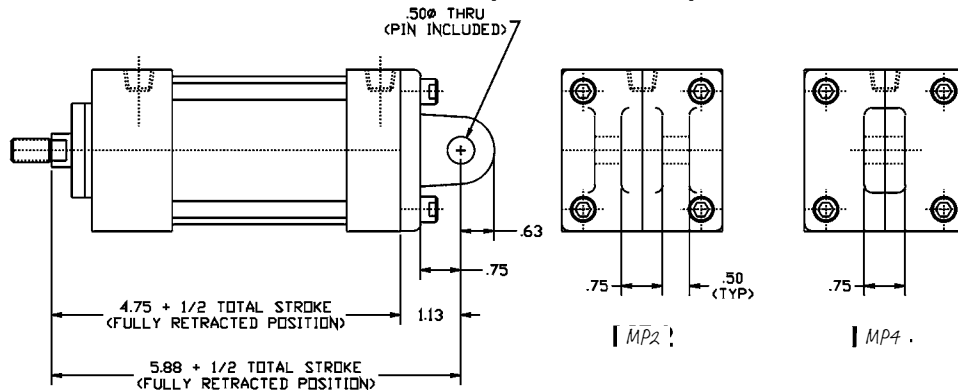
### MT2 Mount



### MP1 (Cast Bolt On) Mount



### MP2 & MP4 (Cast Bolt On) Mount













# Multi-Stage Cylinders (MSE, MSR, & MSE-MSR)

Multi-stage MSE, MSR, and MSE-MSR cylinders offer similar output forces to much larger cylinders at a fraction of the price. They provide immense force in a smaller footprint, and come in stainless steel models to accommodate washdown and corrosive applications.



# Contents

---

**139** MS Series Product Features  
139 – How They Work

---

**140** How to Order  
141 – Option Length Adder  
141 – MS Series Cylinders -  
NFPA Mounts

---

**142** How to Specify  
142 – Piston Rod End Styles  
143 – Mounting Options  
150 – MS Series Effective Piston  
Area/Force Chart

---

## MS Series Multi-Stage – Force Multiplying Cylinders



Note: Models MSR, MSE-MSR, and MSED are not field repairable – units must be returned to factory for service or repair.

The MSE and MSR Series are double acting, single rod end cylinders that multiply the force output by supplying air to multiple pistons.

The MSE multiplies the force on the extend stroke, the MSR multiplies the force on the retract stroke. Both models use only one piston on the opposite stroke, saving air volume and operating costs.

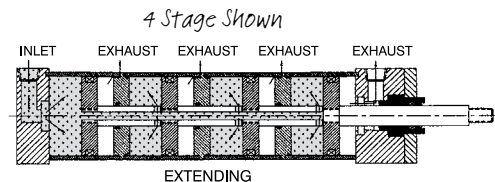
### Benefits

- > Rated for 125 PSI Air, or Hydraulic (non-shock)
- > Eliminates the need for high pressure systems
- > Bore size vs. output force saves space
- > Optional Double Rod End Models available
- > Optional force multiplying in both extend and retract strokes available
- > Heavy Duty construction
- > 2 Stage, 3 Stage, 4 Stage & 5 Stage models

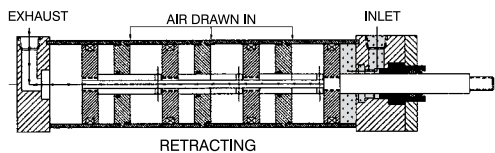
## How They Work

### Model MSE

Extension-air supplied to multiple pistons



Retraction-air supplied to one piston

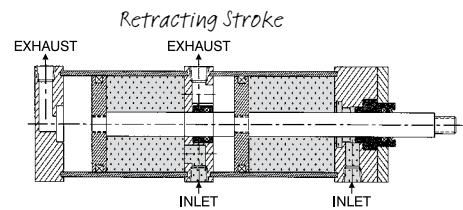
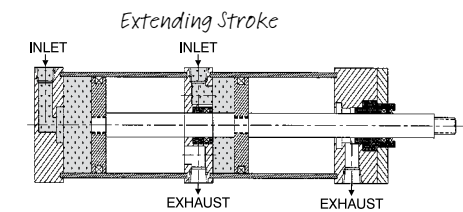


### Force multiplying in both Extend and Retract strokes

(Note: Overall lengths are increased – consult factory for details)

To Order, specify:  
MSE-MSR as description

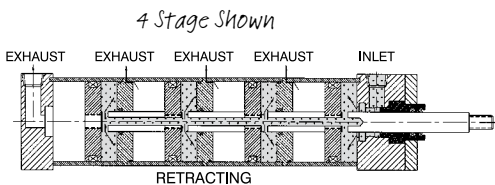
Extension AND Retraction-air supplied to multiple pistons



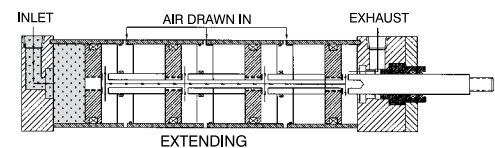
*Model MSE/MSR  
2 Stage Shown*

### Model MSR

Retraction-air supplied to multiple pistons



Extension-air supplied to one piston



# How to Order

## Features

- > Force multiplier air and non-shock hydraulic cylinders 125 PSI
- > Eight bore sizes 1.50" - 8.00"
- > Extend 2, 3, 4 or 5 stages through 5.00" bores
- > Extend or retract 2, 3 or 4 stages through 8.00" bores
- > Exposed tie rod and nut construction (similar to TA)
- > FM flush mount and TRA triple rod construction available as an option

## MSE - MF1 - 2 x 3 x 4S - MPR

Series		NFPA Mounts	Model Variations		Bore		Stroke	Stages		Options	
MSE	Multi-Stage Extend	MX0	(Blank)	None	1.5	1.50"	.5"* to 12" Consult Factory for Other Strokes	2S	Two	A	Extended Piston Rod Thread (Example: A = 2")
MSR	Multi-Stage Retract	MX1	D	Double Rod End	2	2.00"	*0.125" for MSE	3S	Three	AS	Adjustable Stroke - Retract (Specify Length, Example: AS = 4")
MSE-MSR	Multi-Stage Extend and Retract	MX2			2.5	2.50"		4S	Four	B	.25" Urethane Bumper Both Ends
		MX3			3.25	3.25"		5S	Five*	BC	.25" Urethane Bumper Cap Only
		MF1			4	4.00"				BH	.25" Urethane Bumper Head Only
		MF2			5	5.00"				BSP	British Standard Pipe Taper (Specify Size, Example: BSP = 1/4)
		ME3			6	6.00"				BSP	British Standard Pipe Parallel (Specify Size, Example: BSP = 1/4)
		ME4			8	8.00"				C	Extended Piston Rod (Example: If C = 0.50", then 1" Rod Extension is C = 1.50")
		MP1								FM	Flush Mount Head And Cap (Refer to Factory for Dimensions)
		MP2								H	Head Cushion (Available On MSE Only)
		MS2								KK2	Large Male Rod Thread
		MS4								KK3	Female Rod Thread

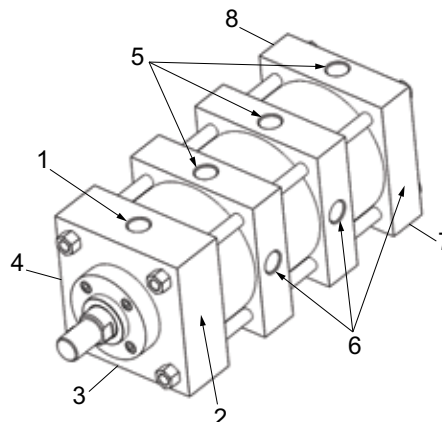
## Ordering Examples:

**Example 1:** MSE-MSR MF1 3.25" Bore, 2.00" Stroke, 3 Stage:  
MSE-MSR MF1 3.25" x 2 x 3S=Extend ports 5, 5, and 5 Retract ports 1, 6, and 6

**Example 2:** Double Rod End MS4 Mount, 2 Stage, 6.00" Bore, 3.00" Stroke, Force Multiplied in RETRACT with Magnetic Piston for REED Switches is:  
MSR MS4D 6 x 3 x 2S - MPR  
(Note: MPR Option adds 0.750" to Cylinder Length)

## MSE-MSR Standard Port And Cushion Adjustment Positions

- > Extend Ports - Positions 5, 5, 5
- > Retract Ports - Positions 1, 6, 6
- > Cushion Adjustment - Positions 2 & 6
- > Always specify standard and non-standard port locations when ordering



MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust With Sound Dampening Bumper (12" Max Stroke)
MPR	Magnetic Piston For Reed Or Solid State Switches - Models: R10, R10P, RAC, RHT & MSS
MS	Metallic Rod Scraper (Brass Construction)
NR	Non-Rotating
OP	Optional Port Location (Example: OP=3,7)
OS	Oversize Rod Diameter (Specify Size, Example: OS = 1.375")
SAE	SAE Ports (Specify Size, Example: SAE#10)
SSA	Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods
ST	Stop Tube - Specify Stop Tube Length (in inches) Specify Stroke as ES (Effective Stroke) (Example: MSE-MS4 2 X 12 ES - 2S - ST=3)
TMS	Steel Cylinder Tube, Black Epoxy Paint Finish*
TMSS	Stainless Steel Cylinder Tube (TMSS)
TH	125 PSI Hydraulic Non-Shock**
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

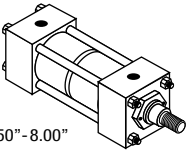
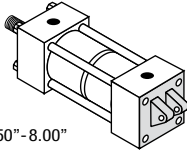
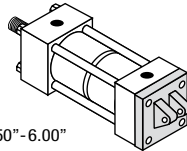
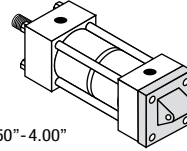
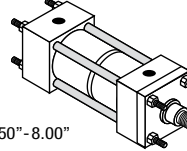
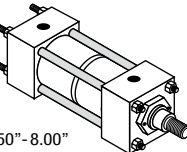
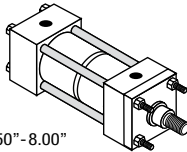
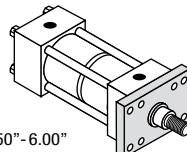
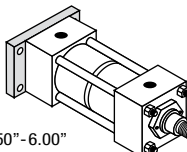
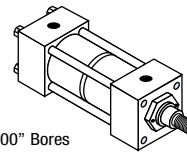
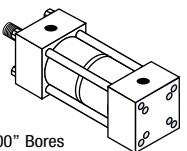
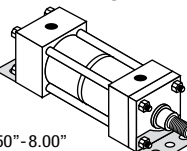
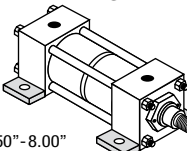
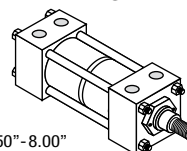
Note: Refer to Options for specifications  
\*Steel tubes do not work with MPR magnetic pistons. Refer to Balluff end of stroke sensors within Switches.  
\*\*Available on head end of MSE/MSE-MSR only. Not available on MSE cap end.  
» Refer to Option Length Adder

**Option Length Adder**  
(Add To Catalog Basic Overall Length Dimensions)

Bore	Option					
	B	BC	BH	MPR	NR	ST* (Stop Tube) Example: ST=2
1.50	0.500	0.250	0.250	0.625	0.625	2
2.00	0.500	0.250	0.250	0.625	0.625	2
2.50	0.500	0.250	0.250	0.750	0.750	2
3.25	0.500	0.250	0.250	0.625	0.625	2
4.00	0.500	0.250	0.250	0.625	0.625	2
5.00	0.500	0.250	0.250	0.875	0.875	2
6.00	0.500	0.250	0.250	0.750	0.750	2
8.00	0.500	0.250	0.250	0.875	0.875	2

\*Note: The desired stop tube length adds directly to the overall cylinder length. Specify stop tube location.  
Example: Stop tube on rear stage only.

## MS Series Cylinders – NFPA Mounts

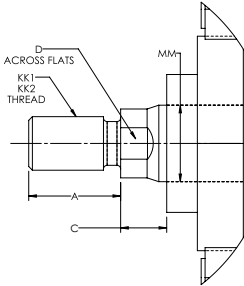
 MX0 1.50"-8.00" Bores	 MP1 1.50"-8.00" Bores	 MP2 1.50"-6.00" Bores	 MP4 1.50"-4.00" Bores	 MX1 1.50"-8.00" Bores
 MX2 1.50"-8.00" Bores	 MX3 1.50"-8.00" Bores	 MF1 1.50"-6.00" Bores	 MF2 1.50"-6.00" Bores	 ME3 8.00" Bores (Consult factory)
 ME4 8.00" Bores (Consult factory)	 MS1 1.50"-8.00" Bores	 MS2 1.50"-8.00" Bores	 MS4 1.50"-8.00" Bores	

# How to Specify

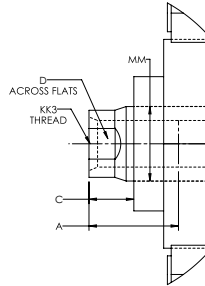
## MS Series Dimensions – Multi-Stage

### Piston Rod End Styles

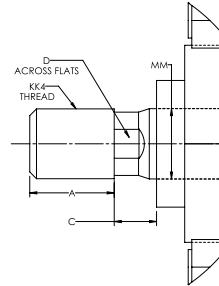
Style 1 & 2  
KK1 & KK2



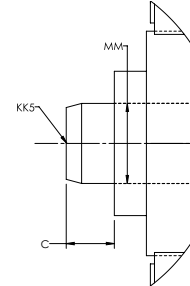
Style 3  
KK3



Style 4  
KK4



Style 5  
KK5

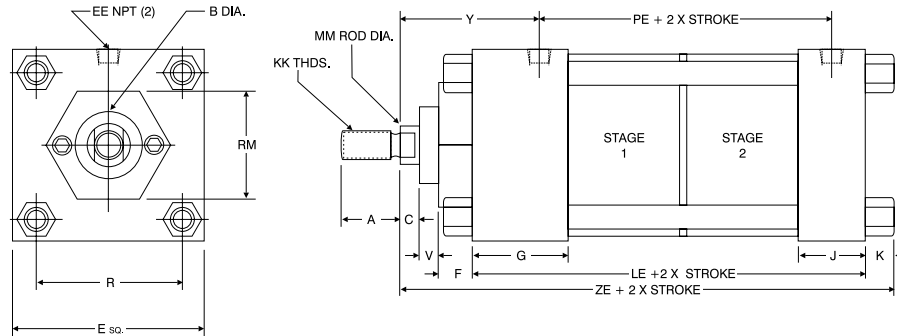


Bore	Rod Diameter (MM)	Standard		Optional						C	D	
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male				Style 5 - Blank
		KK1	A	KK2	A	KK3	A	KK4	A			KK5
1.50, 2.00, 2.50	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.500
	1.000 Oversize	3/4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



## MS Series Dimensions – 2 Stage Extend or Retract

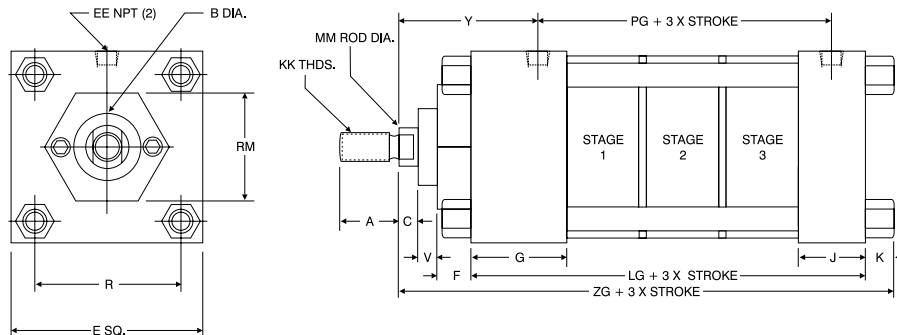
### Standard Rod Diameter Basic Dimensions MX0 (No Mount)



Bore	A	B	C	E	EE	F	G	J	K	KK	LE	MM	PE	R	RM	V	Y	ZE
1.50	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16-20	4.000	0.625	2.750	1.438	2.00 SQ.	0.250	1.875	5.250
2.00	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	7/16-20	4.000	0.625	2.750	1.844	1.75 HEX	0.250	1.875	5.313
2.50	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.313	7/16-20	4.000	0.625	2.750	2.188	1.75 HEX	0.250	1.875	5.313
3.25	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.388	3/4-16	4.875	1.000	3.375	2.760	2.75 DIA.	0.250	2.375	6.625
4.00	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.388	3/4-16	4.875	1.000	3.375	3.320	2.75 DIA.	0.250	2.375	6.625
5.00	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.438	3/4-16	4.875	1.000	3.375	4.100	2.75 DIA.	0.250	2.375	6.688
6.00	1.625	2.000	0.625	6.500	0.750	0.625	2.000	1.500	0.438	1-14	5.750	1.375	4.000	4.875	3.50 DIA.	0.375	2.750	7.813
8.00	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.500	0.563	1-14	5.750	1.375	4.000	6.438	3.50 DIA.	0.375	2.750	7.938

## MS Series Dimensions – 3 Stage Extend or Retract

### Standard Rod Diameter Basic Dimensions MX0 (No Mount)

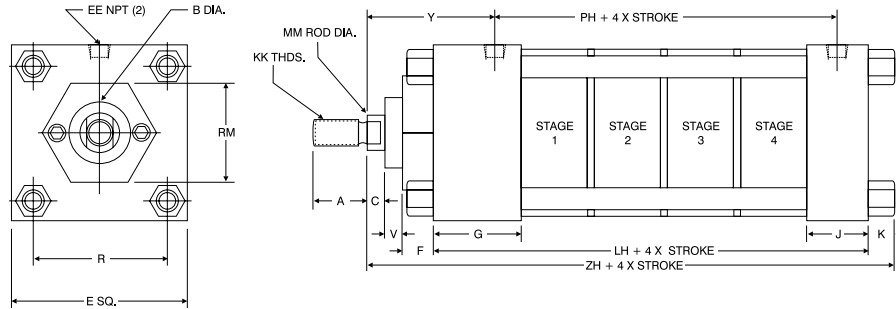


Bore	A	B	C	E	EE	F	G	J	K	KK	LG	MM	PG	R	RM	V	Y	ZG
1.50	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16-20	5.000	0.625	3.750	1.438	2.00 SQ.	0.250	1.875	6.250
2.00	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	7/16-20	5.000	0.625	3.750	1.844	1.75 HEX	0.250	1.875	6.313
2.50	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.313	7/16-20	5.000	0.625	3.750	2.188	1.75 HEX	0.250	1.875	6.313
3.25	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.375	3/4-16	6.125	1.000	4.625	2.760	2.75 DIA.	0.250	2.375	7.875
4.00	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.375	3/4-16	6.125	1.000	4.625	3.320	2.75 DIA.	0.250	2.375	7.875
5.00	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.438	3/4-16	6.125	1.000	4.625	4.100	2.75 DIA.	0.250	2.375	7.938
6.00	1.625	2.000	0.625	6.500	0.750	0.625	2.000	1.500	0.438	1-14	7.250	1.375	5.500	4.875	3.50 DIA.	0.375	2.750	9.313
8.00	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.500	0.563	1-14	7.250	1.375	5.500	6.438	3.50 DIA.	0.375	2.750	9.438

# How to Specify

## MS Series Dimensions – 4 Stage Extend or Retract

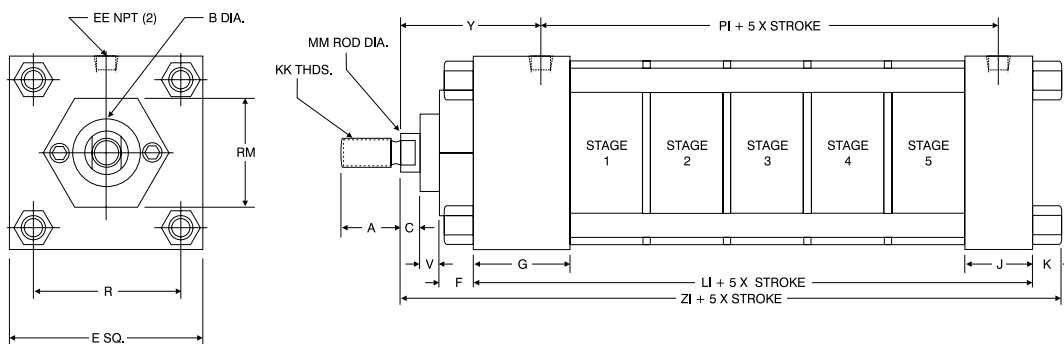
### Standard Rod Diameter Basic Dimensions MX0 (No Mount)



Bore	A	B	C	E	EE	F	G	J	K	KK	LH	MM	PH	R	RM	V	Y	ZH
1.50	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16-20	6.000	0.625	4.750	1.438	2.00 SQ.	0.250	1.875	7.250
2.00	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	7/16-20	6.000	0.625	4.750	1.844	1.75 HEX	0.250	1.875	7.313
2.50	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.313	7/16-20	6.000	0.625	4.750	2.188	1.75 HEX	0.250	1.875	7.313
3.25	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.375	3/4-16	7.375	1.000	5.875	2.760	2.75 DIA.	0.250	2.375	9.125
4.00	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.375	3/4-16	7.375	1.000	5.875	3.320	2.75 DIA.	0.250	2.375	9.125
5.00	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.438	3/4-16	7.375	1.000	5.875	4.100	2.75 DIA.	0.250	2.375	9.188
6.00	1.625	2.000	0.625	6.500	0.750	0.625	2.000	1.500	0.438	1-14	8.750	1.375	7.000	4.875	3.50 DIA.	0.375	2.750	10.813
8.00	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.500	0.563	1-14	8.750	1.375	7.000	6.438	3.50 DIA.	0.375	2.750	10.938

## MS Series Dimensions – 5 Stage Extend or Retract

### Standard Rod Diameter Basic Dimensions MX0 (No Mount)

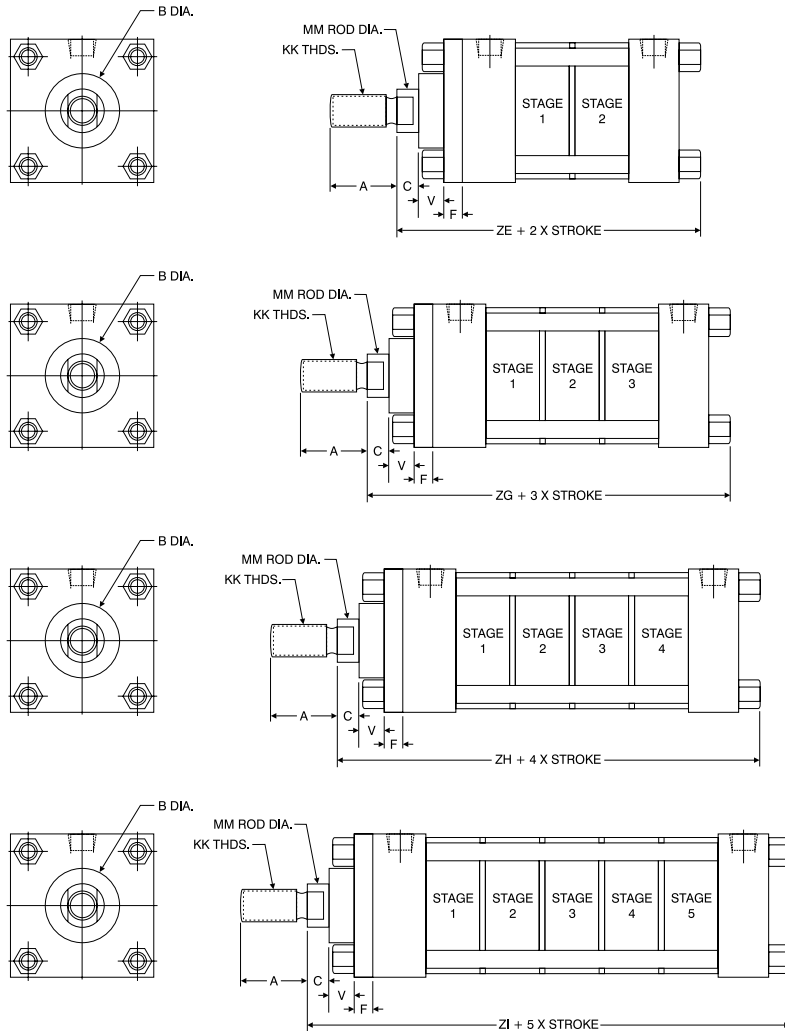


Bore	A	B	C	E	EE	F	G	J	K	KK	LI	MM	PI	R	RM	V	Y	ZI
1.50	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16-20	7.000	0.625	5.750	1.438	2.00 SQ.	0.250	1.875	8.250
2.00	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	7/16-20	7.000	0.625	5.750	1.844	1.75 HEX	0.250	1.875	8.313
2.50	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.313	7/16-20	7.000	0.625	5.750	2.188	1.75 HEX	0.250	1.875	8.313
3.25	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.375	3/4-16	8.625	1.000	7.125	2.760	2.75 DIA.	0.250	2.375	10.375
4.00	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.375	3/4-16	8.625	1.000	7.125	3.320	2.75 DIA.	0.250	2.375	10.375
5.00	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.438	3/4-16	8.625	1.000	7.125	4.100	2.75 DIA.	0.250	2.375	10.438



## MS Series Cylinders – Extend or Retract

### Overize Rod Diameter Basic Dimensions MX0 (No Mount)

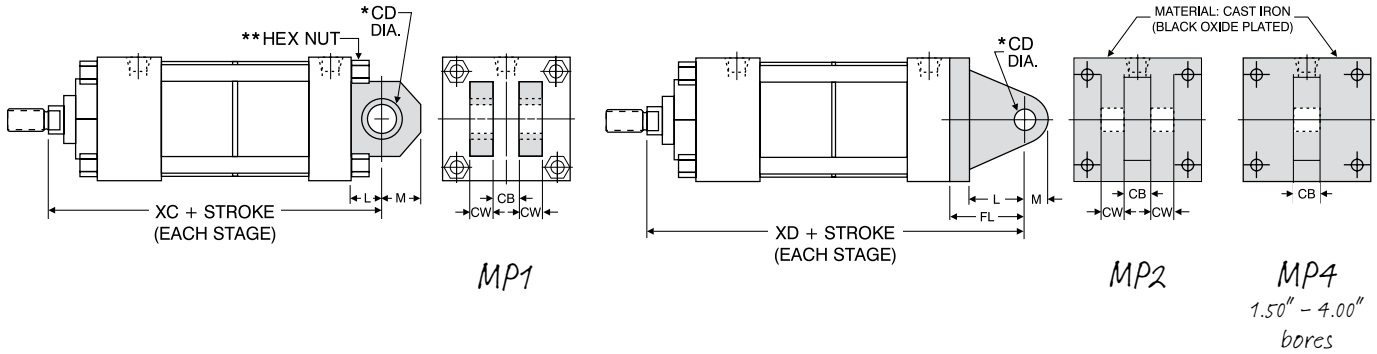


Bore	Multi-Stage Overize Rod Diameter							Add Stroke Per Stage			
	A	B	C	F	V	KK	MM	ZE	ZG	ZH	ZI
1.50	1.125	1.500	0.500	0.375	0.500	3/4 -16	1.000	5.625	6.625	7.625	8.625
2.00	1.125	1.500	0.500	0.375	0.500	3/4 -16	1.000	5.688	6.688	7.688	8.688
2.50	1.125	1.500	0.500	0.375	0.500	3/4 -16	1.000	5.688	6.688	7.688	8.688
3.25	1.625	2.000	0.625	0.625	0.375	1 -14	1.375	6.875	8.125	9.375	10.625
4.00	1.625	2.000	0.625	0.625*	0.375	1 -14	1.375	6.875	8.125	9.375	10.625
5.00	1.625	2.000	0.625	0.625*	0.375	1 -14	1.375	6.938	8.188	9.438	10.688
6.00	2.000	2.375	0.750	0.625*	0.500	1 1/4 -12	1.750	8.063	9.563	11.063	—
8.00	2.000	2.375	0.750	0.625*	0.500	1 1/4 -12	1.750	8.188	9.688	11.188	—

\*Round retainer 4.00" through 8.00" bore (square retainer shown).

# How to Specify

## MS Series Cylinders – Pivot Mounts

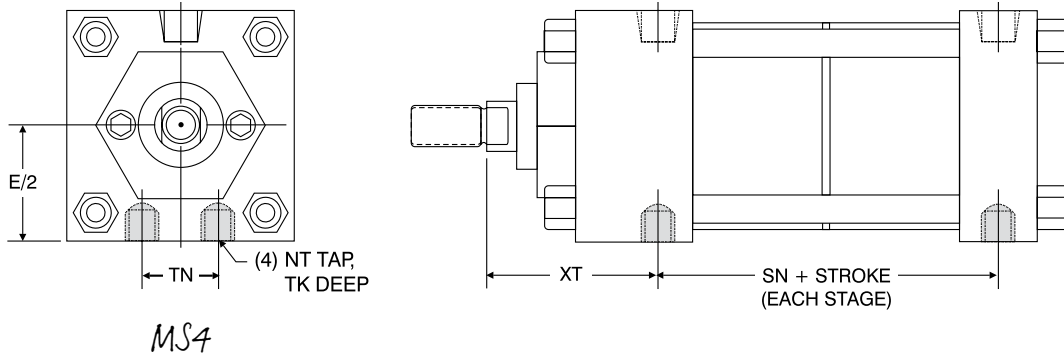


Multi-Stage MP1 & MP2 Clevis And MP4 Eye Mount Dimensions								Add Stroke Per Stage							
Bore	Rod Diameter	CB	CD	CW	FL	L	M	2 Stage		3 Stage		4 Stage		5 Stage	
								XC	XD	XC	XD	XC	XD	XC	XD
1.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	5.750	6.125	6.750	7.125	7.750	8.125	8.750	9.125
	6.125							6.500	7.125	7.500	8.125	8.500	9.125	9.500	
2.00	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	5.750	6.125	6.750	7.125	7.750	8.125	8.750	9.125
	6.125							6.500	7.125	7.500	8.125	8.500	9.125	9.500	
2.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	5.750	6.125	6.750	7.125	7.750	8.125	8.750	9.125
	6.125							6.500	7.125	7.500	8.125	8.500	9.125	9.500	
3.25	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	7.500	8.125	8.750	9.375	10.000	10.625	11.250	11.875
	7.750							8.375	9.000	9.625	10.250	10.875	11.500	12.125	
4.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	7.500	8.125	8.750	9.375	10.000	10.625	11.250	11.875
	7.750							8.375	9.000	9.625	10.250	10.875	11.500	12.125	
5.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	7.500	8.125	8.750	9.375	10.000	10.625	11.250	11.875
	7.750							8.375	9.000	9.625	10.250	10.875	11.500	12.125	
6.00	1.375 Standard	1.500	1.000	0.750	2.250	1.500	1.000	8.875	9.625	10.375	11.125	11.875	12.625	N/A	N/A
	9.125							9.875	10.625	11.375	12.125	12.875	N/A	N/A	
8.00	1.375 Standard	1.500	1.000	0.750	N/A	1.500	1.000	8.875	N/A	10.375	N/A	11.875	N/A	N/A	N/A
	9.125							N/A	10.625	N/A	11.875	N/A	N/A	N/A	

\*Pin included, two (2) pressed in bearings.  
 \*\*Hex nuts are located on cap end (3.25"-8.00" bores).

Note: Extruded MP1C mounts are standard (1.50"-8.00" bores).  
 Cast iron removable mounts are optional and must be requested when ordering (1.50"-6.00" bores).

## MS Series Dimensions – Base Mounts

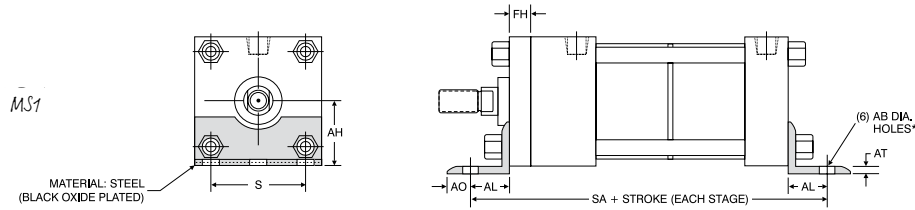


Multi-Stage MS4 Bottom Tapped Mount Dimensions

Bore	Rod Diameter	E/2	NT	TK	TN	XT	SN + Stroke Per Stage			
							2 Stage	3 Stage	4 Stage	5 Stage
1.50	0.625 Standard	1.000	1/4 -20	0.375	0.625	1.938	2.625	3.625	4.625	5.625
	1.000 Oversize					2.313				
2.00	0.625 Standard	1.250	5/16 -18	0.500	0.875	1.938	2.625	3.625	4.625	5.625
	1.000 Oversize					2.313				
2.50	0.625 Standard	1.500	3/8 -16	0.625	1.250	1.938	2.625	3.625	4.625	5.625
	1.000 Oversize					2.313				
3.25	1.000 Standard	1.875	1/2 -13	0.750	1.500	2.438	3.250	4.500	5.750	7.000
	1.375 Oversize					2.688				
4.00	1.000 Standard	2.250	1/2 -13	0.750	2.063	2.438	3.250	4.500	5.750	7.000
	1.375 Oversize					2.688				
5.00	1.000 Standard	2.750	5/8 -11	1.000	2.688	2.438	3.250	4.500	5.750	7.000
	1.375 Oversize					2.688				
6.00	1.375 Standard	3.250	3/4 -10	1.125	3.250	2.813	3.875	5.375	6.875	N/A
	1.750 Oversize					3.063				
8.00	1.375 Standard	4.250	3/4 -10	1.125	4.500	2.813	3.875	5.375	6.875	N/A
	1.750 Oversize					3.063				

# How to Specify

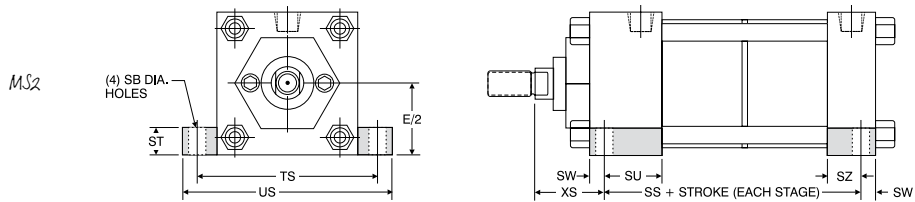
## MS Series Dimensions – Base Mounts



**Multi-Stage MS1 Angle Mount Dimensions**

Bore	Rod Diameter	AB	AH	AL	AO	AT	FH	S	**SA + Stroke Per Stage			
									2-Stage	3-Stage	4-Stage	5-Stage
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.188	0.375	1.250	6.375	7.375	8.375	9.375
	1.000 Oversize											
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.188	0.375	1.750	6.375	7.375	8.375	9.375
	1.000 Oversize											
2.50	0.625 Standard	0.438	1.625	1.000	0.375	0.188	0.375	2.250	6.375	7.375	8.375	9.375
	1.000 Oversize											
3.25	1.000 Standard	0.563	1.938	1.250	0.500	0.125	0.625	2.750	8.000	9.250	10.500	11.750
	1.375 Oversize											
4.00	1.000 Standard	0.563	2.250	1.250	0.500	0.125	0.625	3.500	8.000	9.250	10.500	11.750
	1.375 Oversize											
5.00	1.000 Standard	0.688	2.750	1.375	0.625	0.188	0.625	4.250	8.250	9.500	10.750	12.000
	1.375 Oversize											
6.00	1.375 Standard	0.813	3.250	1.375	0.625	0.188	0.750	5.250	9.250	10.750	12.250	N/A
	1.750 Oversize											
8.00	1.375 Standard	0.813	4.250	1.813	0.688	0.250	0.625***	7.125	9.375	10.875	12.375	N/A
	1.750 Oversize											

\*Note: 1.50" bore has four (4) "AB" holes on "S" dimension.  
 \*\*SA dimensions increase 0.500" and one FH on double rod cylinders.  
 \*\*\*3.50" diameter round retainer on 8.00" bore.

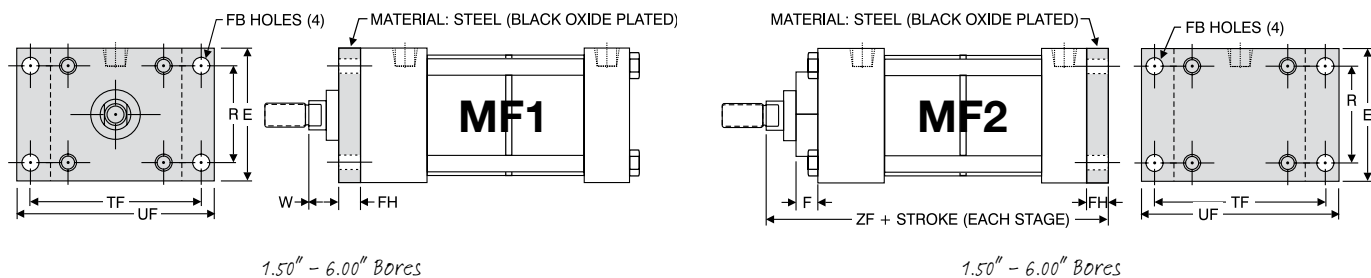


**Multi-Stage MS2 Side Lug Mount Dimensions**

Bore	Rod Diameter	SB	E/2	ST	SU	SW	SZ	TS	US	XS	SS + Stroke Per Stage			
											2-Stage	3-Stage	4-Stage	5-Stage
1.50	0.625 Standard	0.438	1.000	0.500	1.125	0.375	0.625	2.750	3.500	1.375	3.250	4.250	5.250	6.250
	1.000 Oversize													
2.00	0.625 Standard	0.438	1.250	0.500	1.125	0.375	0.625	3.250	4.000	1.375	3.250	4.250	5.250	6.250
	1.000 Oversize													
2.50	0.625 Standard	0.438	1.500	0.500	1.125	0.375	0.625	3.750	4.500	1.375	3.250	4.250	5.250	6.250
	1.000 Oversize													
3.25	1.000 Standard	0.563	1.875	0.750	1.250	0.500	0.750	4.750	5.750	1.875	3.875	5.125	6.375	7.625
	1.375 Oversize													
4.00	1.000 Standard	0.563	2.250	0.750	1.250	0.500	0.750	5.500	6.500	1.875	3.875	5.125	6.375	7.625
	1.375 Oversize													
5.00	1.000 Standard	0.813	2.750	1.000	1.063	0.688	0.563	6.875	8.250	2.063	3.500	4.750	6.000	7.250
	1.375 Oversize													
6.00	1.375 Standard	0.813	3.250	1.000	1.313	0.688	0.813	7.875	9.250	2.313	4.375	5.875	7.375	N/A
	1.750 Oversize													
8.00	1.375 Standard	0.813	4.250	1.000	1.313	0.688	0.813	9.875	11.250	2.313	4.375	5.875	7.375	N/A
	1.750 Oversize													

\*SS dimensions increase 0.500" on double rod cylinders.

## MS Series Dimensions – Flange Mounts



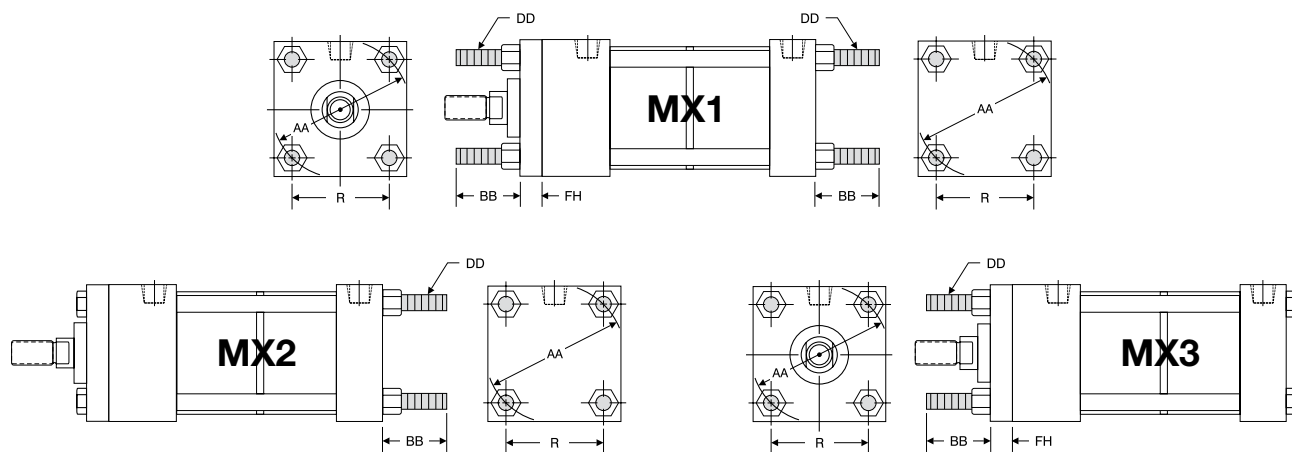
1.50" - 6.00" Bores

1.50" - 6.00" Bores

Multi-Stage MF1 & MF2 Flange Mount Dimensions

Bore	Rod Diameter	E	F	FB	FH	R	TF	UF	W	ZF-Stroke Per Stage			
										2-Stage	3-Stage	4-Stage	5-Stage
1.50	0.625 Standard	2.000	0.375	0.313	0.375	1.438	2.750	3.375	0.625	5.375	6.375	7.375	8.375
	1.000 Oversize									5.750	6.750	7.750	8.750
2.00	0.625 Standard	2.500	0.375	0.375	0.375	1.844	3.375	4.125	0.625	5.375	6.375	7.375	8.375
	1.000 Oversize									1.000	5.750	6.750	7.750
2.50	0.625 Standard	3.000	0.375	0.375	0.375	2.188	3.875	4.625	0.625	5.375	6.375	7.375	8.375
	1.000 Oversize									1.000	5.750	6.750	7.750
3.25	1.000 Standard	3.750	0.625	0.438	0.625	2.760	4.688	5.500	0.750	6.875	8.125	9.375	10.625
	1.375 Oversize								1.000	7.125	8.375	9.625	10.875
4.00	1.000 Standard	4.500	0.625	0.438	0.625	3.320	5.438	6.250	0.750	6.875	8.125	9.375	10.625
	1.375 Oversize								1.000	7.125	8.375	9.625	10.875
5.00	1.000 Standard	5.500	0.625	0.563	0.625	4.100	6.625	7.625	0.750	6.875	8.125	9.375	10.625
	1.375 Oversize								1.000	7.125	8.375	9.625	10.875
6.00	1.375 Standard	6.500	0.625	0.563	0.750	4.875	7.625	8.625	0.875	8.125	9.625	11.125	N/A
	1.750 Oversize								1.125	8.375	9.875	11.375	N/A

## MS Series Dimensions – Tie Rod Mounts



Tie Rod Extended MX1, MX2 & MX3 Mount Dimensions

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

Tie Rod Extended MX1, MX2 & MX3 Mount Dimensions

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

Full square bushing retainer on 1.50" - 6.00" bores.  
 \*Round retainer on 8.00" bore. BB dimension from face of head.

# How to Specify

## MS Series Effective Piston Area/Force Chart\*

Bore	Stages	Effective Piston Area (Sq. In.)				Force In Lbs. At 60 PSI				Force In Lbs. At 100 PSI			
		Extend (MSE)		Retract (MSR)		Extend (MSE)		Retract (MSR)		Extend (MSE)		Retract (MSR)	
		Std. Rod Ø	O' Size Ø	Std. Rod Ø	O' Size Ø	Std. Rod Ø	O' Size Ø	Std. Rod Ø	O' Size Ø	Std. Rod Ø	O' Size Ø	Std. Rod Ø	O' Size Ø
1.50	2	3.228	2.749	2.922	1.964	193	164	175	117	322	274	292	196
	3	4.687	3.731	4.383	2.946	281	223	262	176	468	373	438	294
	4	6.150	4.713	5.844	3.928	369	282	350	235	615	471	584	392
	5	7.607	5.695	N/A	N/A	456	342	N/A	N/A	761	570	N/A	N/A
2.00	2	5.974	5.499	5.668	4.714	358	329	340	282	597	549	566	471
	3	8.808	7.856	8.502	7.071	528	471	510	424	880	785	850	707
	4	11.642	10.213	11.336	9.428	698	612	680	565	1164	1021	1133	942
	5	14.482	12.568	N/A	N/A	869	754	N/A	N/A	1448	1257	N/A	N/A
2.50	2	9.490	9.033	9.188	8.248	569	541	551	494	949	903	918	824
	3	14.080	13.157	13.782	12.372	844	789	826	742	1408	1315	1378	1237
	4	18.680	17.281	18.376	16.496	1120	1036	1102	989	1868	1728	1837	1649
	5	23.312	21.405	N/A	N/A	1398	1284	N/A	N/A	2330	2140	N/A	N/A
3.25	2	15.807	15.107	15.022	13.622	948	906	901	817	1580	1510	1502	1362
	3	23.317	21.918	22.532	20.433	1399	1315	1351	1225	2331	2191	2253	2043
	4	30.828	28.729	30.043	27.244	1849	1723	1802	1634	3082	2872	3004	2724
	5	38.340	35.540	N/A	N/A	2300	2132	N/A	N/A	3834	3554	N/A	N/A
4.00	2	24.347	23.647	23.562	22.166	1460	1418	1413	1329	2434	2364	2356	2216
	3	36.127	34.728	35.342	33.243	2167	2083	2120	1994	3612	3472	3534	3324
	4	47.908	45.809	47.123	44.324	2874	2748	2827	2659	4790	4580	4712	4432
	5	59.690	56.890	N/A	N/A	3581	3413	N/A	N/A	5969	5689	N/A	N/A
5.00	2	38.485	37.785	37.700	36.3	2309	2267	2262	2178	3848	3778	3770	3630
	3	57.334	55.935	56.549	54.45	3440	3356	3392	3267	5733	5593	5654	5445
	4	76.184	74.085	75.399	72.6	4571	4445	4523	4356	7618	7408	7539	7260
	5	95.035	92.235	N/A	N/A	5701	5534	N/A	N/A	9503	9223	N/A	N/A
6.00	2	55.065	54.143	53.582	51.736	3303	3248	3214	3104	5506	5414	5358	5136
	3	81.854	80.012	80.370	77.607	4911	4800	4822	4656	8185	8001	8037	7760
	4	108.644	105.881	107.16	103.476	6518	6352	6429	6208	10864	10588	10716	10347
8.00	2	99.047	98.125	97.564	95.72	5942	5887	5853	5743	9904	9812	9756	9572
	3	147.834	145.985	146.35	143.58	8870	8759	8781	8614	14783	14598	14635	14358
	4	196.611	193.845	195.13	191.44	11796	11630	11707	11486	19661	19384	19513	19144

\*Theoretical force; actual force will be reduced due to seal friction.

MSE/MSR SERIES NPPA MULTI-STAGE CYLINDERS

150



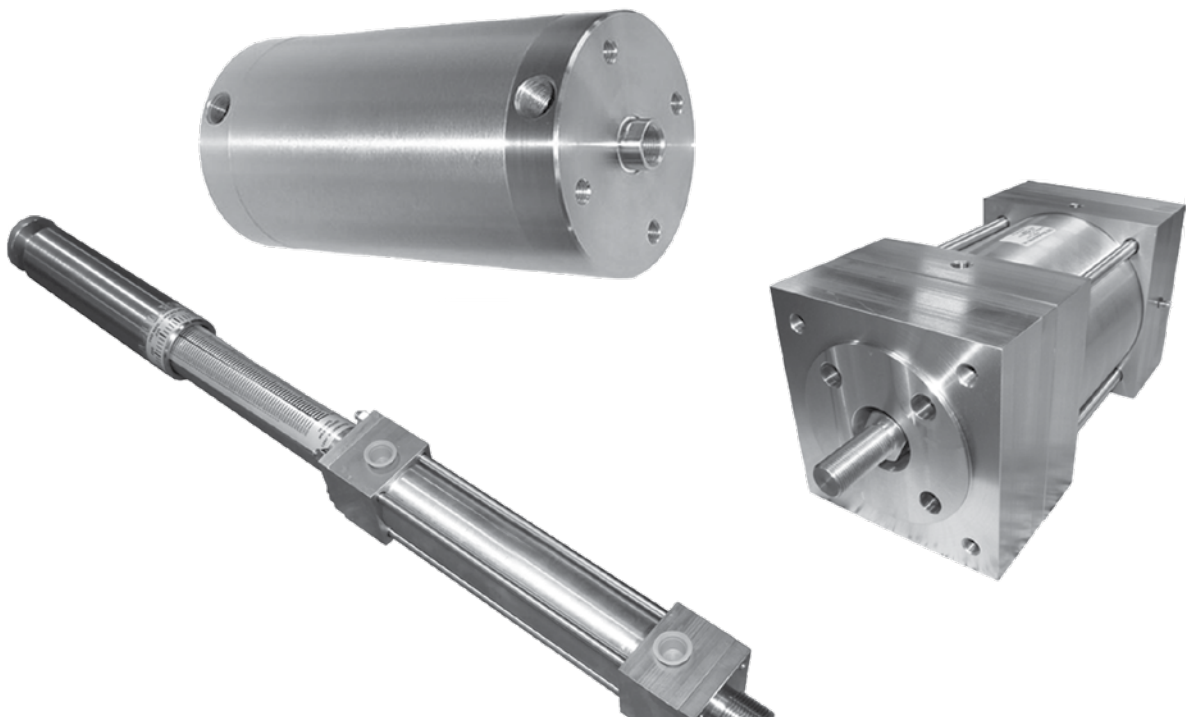






# Stainless Steel Cylinders (RS, SS, and SS-MS Series)

Stainless steel cylinder models offer reliable protection against contaminants and media ingress during washdown, corrosive, and other applications that can impede the regular operation of a traditional actuator.



# Contents

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**155** RS Series Product Features

- 155 – Repairable Stainless Steel (RS) Construction
- 155 – Operating Pressure
- 155 – Operating Temperature

---

**156** How to Order (RS Series)

- 156 – Front & Rear Mount

---

**157** How to Specify (RS Series)

- 157 – Clevis Mount
- 157 – Pivot Mount
- 158 – USDA Approved Option U
- 159 – RS Series - Options
- 159 – Foot Bracket Accessory (in)
- 160 – Switches
- 160 – Specifications
- 161 – Switch Ordering Instructions
- 161 – About Our Switches
- 161 – Accessories

---

**162** How to Order (RS Series)

- 162 – Options
- 

---

**163** SS Series Product Features

- 163 – Construction
- 163 – Operating Pressure
- 163 – Operating Temperature

---

**164** How to Order (SS Series)

- 164 – Option Length Adder
- 165 – NFPA Mounts

---

**166** How to Specify (SS Series)

- 166 – Basic Cylinder (No Mount)
- 167 – Pivot Mounts
- 168 – Tie Rod & Flange Mounts
- 169 – Base Mounts

---

**170** SS Series (Double Rod End) Product Features

---

**171** How to Specify (SS Series Double Rod End)

- 171 – SS Series Dimensions – Double Rod End
  - 173 – SS Series Dimensions – Double Rod End Flange Mounts
  - 174 – SS Series Dimensions – Double Rod End Base Mounts
- 

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**175** SS-MS Series Product Features

- 175 – How They Work

---

**176** How to Order (SS-MS Series)

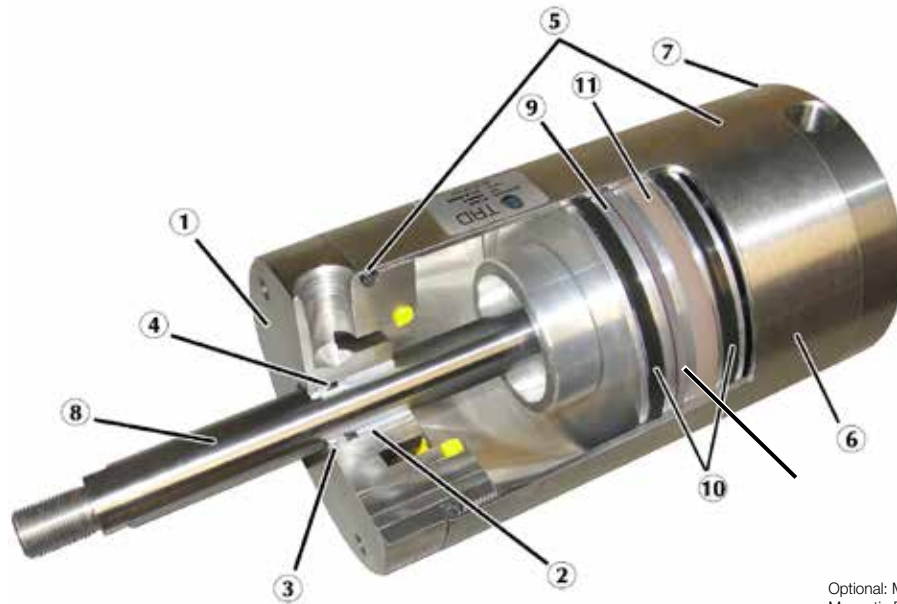
- 176 – Piston Rod End Styles

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**177** How to Specify (SS-MS Series)

- 177 – 2 Stage Extend or Retract
  - 177 – 3 Stage Extend or Retract
  - 178 – Oversized Rod
  - 179 – 4 Stage Extend or Retract
  - 179 – SS-MS Dimensions
  - 180 – Pivot Mounts
  - 180 – Base Mounts
  - 181 – SS-MS Series Effective Piston Area/Force Chart
-

## Repairable Stainless Steel (RS) – Construction



Optional: MPR  
Magnetic Piston

### USDA APPROVAL OPTION U - EQUIPMENT ACCEPTANCE CERTIFICATE

#### UNITED STATES DEPARTMENT OF AGRICULTURE MARKETING AND REGULATORY PROGRAMS AGRICULTURAL MARKING SERVICE

The issuance of this form is based on U.S. Department of Agriculture, Dairy and Grading Branch, Equipment Design Review Section, evaluation of the equipment listed above for compliance with: 3-A Sanitary Standard

**1. Rod Guide/Head** – Corrosion resistant 300 series stainless steel is ideal for wash-down applications. Designed to reduce sharp edges and corners to provide a smooth transition to the cylinder body eliminating catch points for contamination and to allow ease in cleaning. Optional Tapped holes are provided to allow easy mounting of USDA approved secondary wiper retainer or foot bracket as an option.

**2. Rod Bushing** – Material is Acetal for extended life.

**3. Rod Wiper** – A PTFE rod wiper is standard (FKM or urethane material is optional) and offers resistance to a wide variety of wash-down chemicals.

**4. Rod Seal** – Nitrile rod seal (FKM material is optional) is pressure activated and wear compensating for long life.

**5. Body Seals** – Nitrile material is standard (FKM material is optional).

**6. Body** – Thick walled 300 series stainless steel offers superior corrosion resistance and is designed to minimize gaps with the mating end caps where contamination can build up.

**7. Rear Cap** – Corrosion resistant 300 series stainless steel is ideal for wash-down applications. Designed specifically to reduce sharp edges and corners and provide a smooth transition to the cylinder body eliminating catch points for contamination and to allow ease in cleaning. Optional tapped holes allow for easy mounting of NFPA rear pivot or rear clevis mounting brackets.

**8. Piston Rod** – Hard Chrome Plated 300 series stainless steel for maximum corrosion resistance.

**9. Piston** – Precision machined from aluminum (optional stainless steel for internal corrosion resistance when required).

**10. Piston Seals** – Nitrile material is standard (high temperature material is optional). Seals are pressure activated and wear compensating.

**11. Piston Wear Band** – 90% Virgin PTFE and 10% Polyphenylene Sulfide filled wear band; 65,000 PSI Compressive Modules; extremely low wear rate.

**12. Lubricant** – Food Grade Grease (L008).

### Operating Pressure

200 PSI Maximum (14 bar)

### Operating Temperature

**Standard:** -20°F to 200°F (-29°C to 93°C)

**VS Option:** 0°F to 400°F (-18°C to 204°C)

# How to Order

**RS - MP2 - 4 x 1.50 - U**

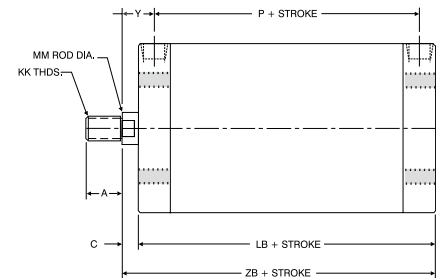
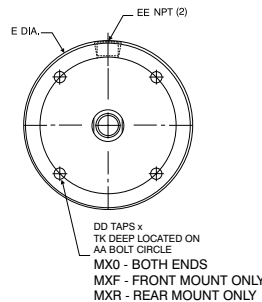
Series	NFPA Mounts	Bore	Stroke	Options
RS Repairable Stainless Steel	MX0 Tapped Both Ends MXF Tapped Front MXR Tapped Rear MP2 Clevis Rear MP4 Pivot Rear	1.5 1.50" 2 2.00" 2.5 2.50" 3.25 3.25" 4 4.00" 5 5.00" 6 6.00" 8 8.00"	0" to 48" Made to order  NOTE: Consult factory for strokes longer than 24"	A Extended Piston Rod Thread (Example: A = 2") » B Urethane Bumper Both Ends » BC Urethane Bumper Cap Only » BH Urethane Bumper Head Only BP Bumper Piston Seals (1.50"-8.00" Bore) C Extended Piston Rod (Specify) (Example: C = 2) FC Fixed Cushions KK2 Intermediate Male Rod Thread KK3 Female Rod Thread KK4 Full Diameter Male Rod Thread KK5 Blank Rod End (No Threads, "A" = 0") L001 Magnalube G Grease LF Low Friction Seals MPR Magnetic Piston For Reed Switches OS Oversize Rod Diameter (5.00"-8.00" Only) P Proximity Switch Both Ends (1.50"-4.00" Only) PXX Sinking Proximity Switch (1.50"-4.00" Only) RWU Urethane Rod Wiper RWV Fluorocarbon Rod Wiper SSP Stainless Steel Piston (With Wear-Band) U USDA Approved Options* VS Fluorocarbon Seals** XX Special Variation (Specify) (Example - No Piston Wear Band, Etc.)

### Option Notes:

- > Option (B) Bumpers cannot be combined with Option (FC) Cushions or Option (P) Proximity Switches
- > If Option (P) (Proximity switch both ends) and Option (VS) are ordered in combination, the standard proximity switch thread seal material will be used
- > Option (MPR) Magnetic Piston and Option (VS) High Temperature Seals should be specified for chemical compatibility requirements only. The piston magnet is nitrile based, hence the temperature rating remains at 200°F.

### Option Length Adder (Add To Catalog Basic Overall Length Dimensions)

Bore	Option		
	B	BC	BH
1.50	0.250"	0.125"	0.125"
2.00	0.250"	0.125"	0.125"
2.50	0.250"	0.125"	0.125"
3.25	0.250"	0.125"	0.125"
4.00	0.250"	0.125"	0.125"
5.00	0.500"	0.250"	0.250"
6.00	0.500"	0.250"	0.250"
8.00	0.500"	0.250"	0.250"



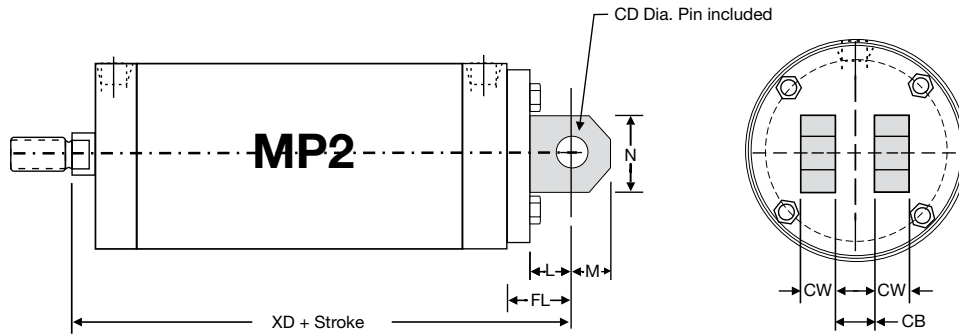
\* USDA approved option includes an external wiper as required by the USDA. The cylinder rod length will automatically increase by the amount required to accommodate the seal retaining bracket.  
\*\* PTFE scraper will be used unless otherwise specified.  
» Refer to Option Length Adder

## RS Series Dimensions – Front & Rear Mount

### MX0, MXR & MXF Mount Dimensions

Bore	Rod Diameter	A	AA	C	DD	E DIA.	EE NPT	KK	LB	MM	TK	Y	P	ZB
1.50	0.625 Standard	0.750	1.450	0.560	8-32	1.750	0.375	7/16-20	5.210	0.625	0.330	2.050	3.260	5.770
2.00	0.625 Standard	0.750	1.850	0.560	10-24	2.250	0.375	7/16-20	5.450	0.625	0.375	2.050	3.500	6.010
2.50	0.625 Standard	0.750	2.150	0.560	1/4-20	2.750	0.375	7/16-20	5.950	0.625	0.500	2.050	4.000	6.510
3.25	1.000 Standard	1.125	2.620	0.640	5/16-18	3.500	0.500	3/4-16	7.430	1.000	0.625	2.420	5.120	8.070
4.00	1.000 Standard	1.125	3.250	0.640	3/8-16	4.250	0.500	3/4-16	7.430	1.000	0.750	2.420	5.120	8.070
5.00	1.000 Standard	1.125	4.250	0.500	3/8-16	5.250	0.500	3/4-16	5.750	1.000	0.625	1.000	4.750	6.250
	1.375 Oversized	1.625	4.250	0.625	3/8-16	5.250	0.500	1-14	5.750	1.375	0.625	1.125	4.750	6.375
6.00	1.375 Standard	1.625	5.000	0.625	1/2-13	6.250	0.500	1-14	5.750	1.375	0.875	1.125	4.750	6.375
	1.750 Oversized	2.000	5.000	0.750	1/2-13	6.250	0.500	1-1/4-12	5.750	1.750	0.875	1.250	4.750	6.500
8.00	1.375 Standard	1.625	6.500	0.625	5/8-11	8.375	0.500	1-14	5.875	1.375	1.000	1.125	4.875	6.500
	1.750 Oversized	2.000	6.500	0.750	5/8-11	8.375	0.500	1-1/4-12	5.875	1.750	1.000	1.250	4.875	6.625

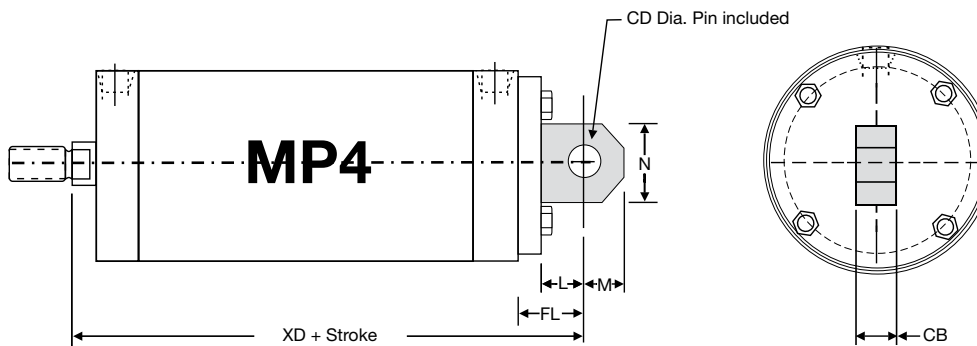
## RS Series Dimensions – Clevis Mount



**MP2 Clevis Mount Dimensions**

Bore	Rod Diameter	CB	CD	CW	FL	L	M	N	XD
1.50	0.625 Standard	0.750	0.500	0.490	1.125	0.750	0.350	0.700	6.900
2.00	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.400	0.800	7.140
2.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.400	0.800	7.640
3.25	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.600	1.000	9.940
4.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.750	1.400	9.940
5.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	1.750	8.125
	1.375 Oversized	1.250	0.750	0.625	1.875	1.250	0.875	1.750	8.250
6.00	1.375 Standard	1.500	1.000	0.750	2.250	1.500	1.000	2.000	8.625
	1.750 Oversized	1.500	1.000	0.750	2.250	1.500	1.000	2.000	8.750
8.00	1.375 Standard	1.500	1.000	0.750	2.250	1.500	1.000	3.500	8.750
	1.750 Oversized	1.500	1.000	0.750	2.250	1.500	1.000	3.500	8.875

## RS Series Dimensions – Pivot Mount

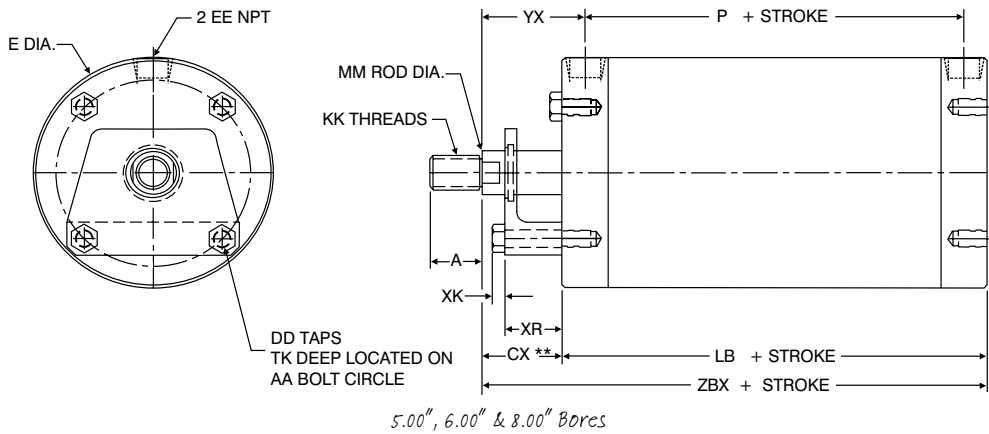
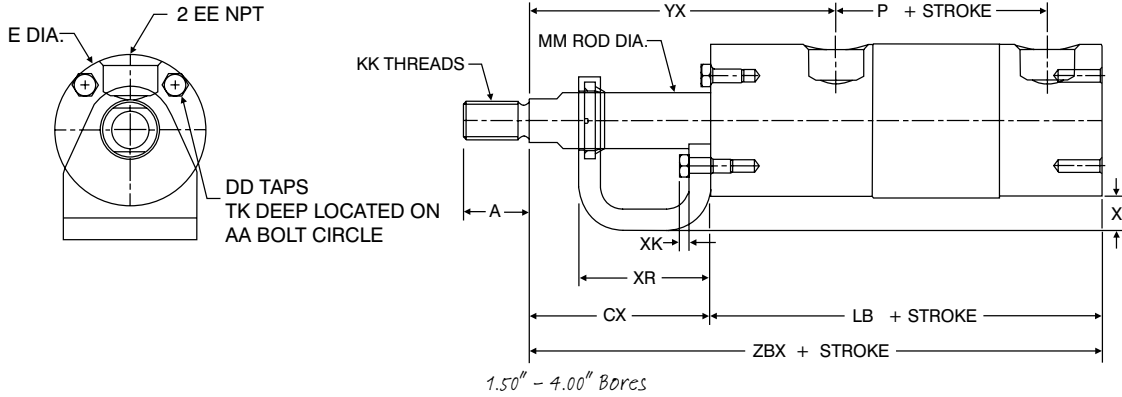


**MP4 Pivot Mount Dimensions**

Bore	Rod Diameter	CB	CD	FL	L	M	N	XD
1.50	0.625 Standard	0.750	0.500	1.125	0.750	0.350	0.700	6.900
2.00	0.625 Standard	0.750	0.500	1.125	0.750	0.400	0.800	7.140
2.50	0.625 Standard	0.750	0.500	1.125	0.750	0.400	0.800	7.640
3.25	1.000 Standard	1.250	0.750	1.875	1.250	0.600	1.000	9.940
4.00	1.000 Standard	1.250	0.750	1.875	1.250	0.750	1.400	9.940
5.00	1.000 Standard	1.250	0.750	1.875	1.250	0.875	1.750	8.125
	1.375 Oversized	1.250	0.750	1.875	1.250	0.875	1.750	8.250
6.00	1.375 Standard	1.500	1.000	2.250	1.500	1.000	2.000	8.625
	1.750 Oversized	1.500	1.000	2.250	1.500	1.000	2.000	8.750
8.00	1.375 Standard	1.500	1.000	2.250	1.500	1.000	3.500	8.750
	1.750 Oversized	1.500	1.000	2.250	1.500	1.000	3.500	8.875

# How to Specify

## RS Series Dimensions – USDA Approved Option U



External Wiper - Option U Dimensions

Bore	Rod Diameter	A	AA	CX	DD	E DIA.	EE NPT	KK	LB	MM	TK	YX	P	XR	XK	ZBX	X
1.50	0.625 Standard	0.750	1.450	2.060	8-32	1.750	0.375	7/16-20	5.210	0.625	0.330	3.550	3.260	1.500	0.100	7.270	0.375
2.00	0.625 Standard	0.750	1.850	2.060	10-24	2.250	0.375	7/16-20	5.450	0.625	0.375	3.550	3.500	1.500	0.120	7.510	0.500
2.50	0.625 Standard	0.750	2.150	2.060	1/4-20	2.750	0.375	7/16-20	5.950	0.625	0.500	3.550	4.000	1.500	0.170	8.010	0.260
3.25	1.000 Standard	1.125	2.620	2.140	5/16-18	3.500	0.500	3/4-16	7.430	1.000	0.625	3.920	5.120	1.500	0.240	9.570	0.250
4.00	1.000 Standard	1.125	3.250	2.140	3/8-16	4.250	0.500	3/4-16	7.430	1.000	0.750	3.920	5.120	1.500	0.270	9.570	0.250
5.00	1.000 Standard	1.125	4.250	1.750	3/8-16	5.250	0.500	3/4-16	5.750	1.000	0.625	2.250	4.750	1.250	0.270	7.500	N/A
	1.375 Oversized	1.625	4.250	1.875	3/8-16	5.250	0.500	1-14	5.750	1.375	0.625	2.375	4.750	1.250	0.270	7.625	N/A
6.00	1.375 Standard	1.625	5.000	1.875	1/2-13	6.250	0.500	1-14	5.750	1.375	0.875	2.375	4.750	1.250	0.360	7.625	N/A
	1.750 Oversized	2.000	5.000	2.000	1/2-13	6.250	0.500	1 1/4-12	5.750	1.750	0.875	2.500	4.750	1.250	0.360	7.750	N/A
8.00	1.375 Standard	1.625	6.500	1.875	5/8-11	8.375	0.500	1-14	5.875	1.375	1.000	2.375	4.875	1.250	0.440	7.750	N/A
	1.750 Oversized	2.000	6.500	2.000	5/8-11	8.375	0.500	1 1/4-12	5.875	1.750	1.000	2.500	4.875	1.250	0.440	7.875	N/A

NOTE: The USDA-approved 'Option U' includes an external wiper as required by the USDA. Cylinder rod length is increased as shown.

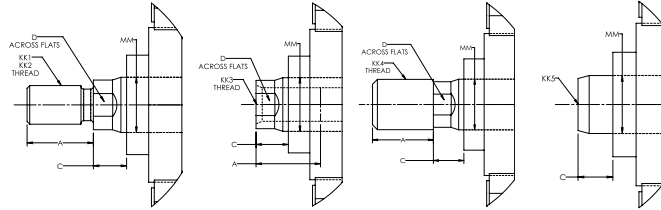
## RS Series – Options

Style 1 & 2  
KK1 & KK2

Style 3  
KK3

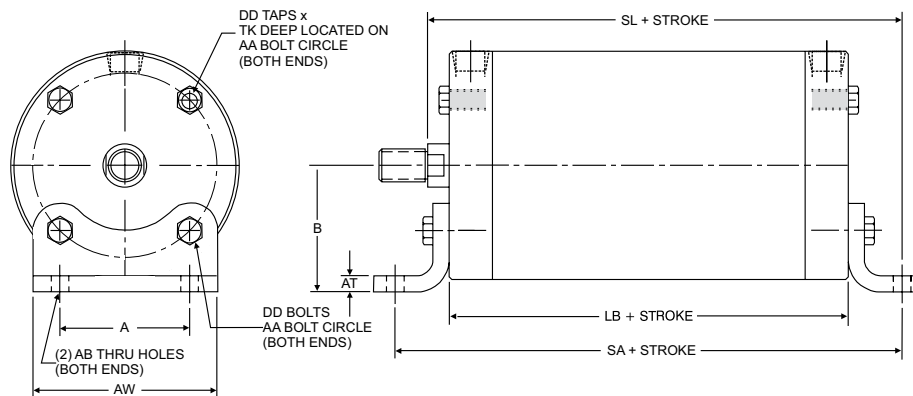
Style 4  
KK4

Style 5  
KK5



Bore	Rod Diameter (mm)	Standard		Optional							C
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male		Style 5 - Blank	
		KK1	A	KK2	A	KK3	A	KK4	A	KK5	
1.50, 2.00, 2.50	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.560
3.25 & 4.00	1.000 Standard	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1 -14	1.125	No Threads	0.640
5.00	1.000 Standard	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1 -14	1.125	No Threads	0.500
	1.375 Oversize	1 -14	1.625	1 1/4 -12	1.625	1 -14	1.625	1 3/8 -12	1.625	No Threads	0.625
6.00 & 8.00	1.375 Standard	1 -14	1.625	1 1/4 -12	1.625	1 -14	1.625	1 3/8 -12	1.625	No Threads	0.625
	1.750 Oversize	1 1/4 -12	2.000	1 1/2 -12	2.000	1 1/4 -12	2.000	1 3/4 -12	2.000	No Threads	0.750

## Foot Bracket Accessory (in)



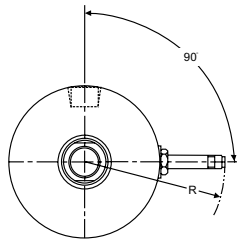
Bore	Rod Diameter	Foot Bracket Kit	A	AB	AW	B	AT	DD	AA	LB	TK	SA	SL
1.50	0.625 Standard	RS-FB150	1.030	0.188	1.520	1.250	0.250	8-32	1.450	5.210	0.330	6.620	6.460
2.00	0.625 Standard	RS-FB200	1.310	0.219	1.810	1.620	0.250	10-24	1.850	5.450	0.375	7.580	7.070
2.50	0.625 Standard	RS-FB250	1.550	0.281	2.300	1.640	0.250	1/4 -20	2.150	5.950	0.500	7.900	7.480
3.25	1.000 Standard	RS-FB325	1.860	0.344	2.860	2.000	0.250	5/16 -18	2.620	7.430	0.625	9.740	9.230
4.00	1.000 Standard	RS-FB400	2.300	0.406	3.500	2.375	0.250	3/8 -16	3.250	7.430	0.750	10.050	9.390
5.00	1.000 Standard	RS-FB500	3.000	0.688	4.500	2.875	0.188	3/8 -16	4.250	5.750	0.625	8.500	7.625
	1.375 Oversized		7.750										
6.00	1.375 Standard	RS-FB600	4.000	0.813	5.500	3.375	0.188	1/2 -13	5.000	5.750	0.875	8.500	7.750
	1.750 Oversized		7.875										
8.00	1.375 Standard	RS-FB800	5.000	0.813	7.000	4.440	0.250	5/8 -11	6.500	5.875	1.000	9.500	8.312
	1.750 Oversized		8.438										

Note: Foot bracket mounting kits include two brackets and eight stainless steel screws. Can only be applied to MX0 mounting styles

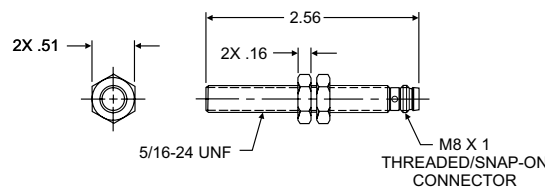
# How to Specify

## RS Series Options – Switches

### Proximity Switch Option Dimensions (Options P & PXX)



Bore Size	Dimension R
1.50	3.04"
2.00	3.04"
2.50	3.04"
3.25	3.19"
4.00	3.19"
5.00	N/A
6.00	N/A
8.00	N/A



### Specifications

**Output:** Option P: PNP Sourcing output, normally open  
Option PXX: NPN Sinking output, normally open

**Load Current:** 100mA max.

**Leakage Current:** 10uA max.

**Voltage Drop:** 2VDC

**Short Circuit and Overload Protection:** Yes

**Reverse Polarity Protection:** Yes

**Supply Voltage:** 10-30 VDC

**LED:** Yes

**Current Consumption:** 15mA

**Repeatability:** 0.010° (.25mm)

**Hysteresis:** 5%

**Response Time:** 330uS

**Electromagnetic Compatibility Compliance:** NEMA ICS5-1996

**Protection Class:** IP67

**Ambient Temperature:** -14°F to 158°F (-25°C to 70°C)

**Housing Material:** Stainless Steel

**Sensing Face:** Crastin

**Approvals:** UL - General Purpose  
CSA - General Purpose  
FM - Non-incendive

#### Application Recommendations and Precautions

- > Noise Suppression: Motors and valve solenoids will produce high pulses throughout an electrical system. Therefore, primary and control circuit wiring should not be mixed in the same conduit. Separate power supplies for both logic level signals (Microprocessor, P.C., CPU, Input Devices) and Output Field Devices (Motors, Valve Solenoids) is recommended.
- > Never connect R10, R10P, RHT or MSS type switches without a Load present. The switch will be destroyed.
- > Some electrical Loads may be capacitive. Capacitive Loading may occur due to distributed capacity in cable runs over 25 feet. Use switch model RAC whenever capacitive Loading may occur.

- > To obtain optimum performance and long life, switches should not be subjected to strong magnetic fields, extreme temperatures (outside of specifications), excessive ferrous filings or chip buildup.
- > Improper wiring may damage or destroy the switch. Therefore, the wiring diagrams along with the listed power ratings, should be carefully observed before connecting power to the switch.

Following these tips can save time and provide trouble-free installations!

**Specify 'MPR' Option for ALL Switch Models When Ordering Actuators.**



## Switch Options – Switch Ordering Instructions

### To Order, Specify:

- > Switch Model
- > Lead Type
- > Bracket Size

# R10 - X - USB - 25

Switch Model	
R10	AC/DC Reed
RAC	High Power AC Reed
RHT	Extended Temperature Reed
MSS	Solid State
R10P	AC/DC Reed with Circuit Protection

Switch Lead Options	
(Blank)	24" Plain Cable
X	120" Plain Cable
Q	8mm Quick Connect (not available on RAC or RHT)

Refer to Switches section for complete specifications.

Switch Mounting Bands	
USB-25	Use with bores: 1.50", 2.00", 2.50"
USB-50	Use with bores: 3.25", 4.00", 5.00"
USB-80	Use with bores: 6.00", 8.00"

Switch Accessories: Quick Connect Cord Sets	
Model	Description
C4-T	8mm Straight Quick Connect Cord x 2 Meter (78")
C4X-T	8mm Straight Quick Connect Cord x 5 Meter (196")



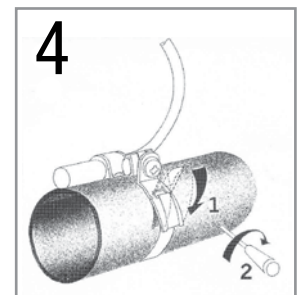
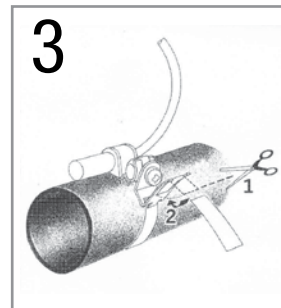
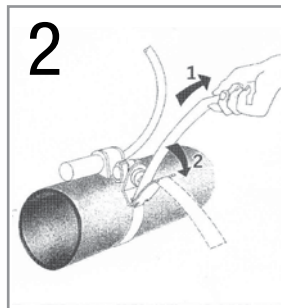
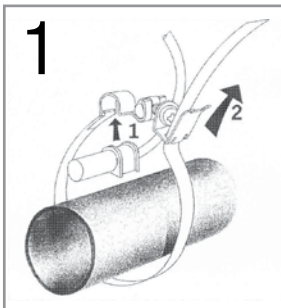
## About Our Switches

Our switches are different! The most common complaint in the market is the unreliability of magnetically operated switches. Most cylinder piston magnets have about 10-30% more power than required to operate the switch. This results in erratic operation, a nuisance for maintenance and lowering overall plant productivity.

Bimba designed our magnet to have 50-100% more power than required to operate our switch! The combination of Bimba R10, R10P, RAC, RHT and MSS Switches and our cylinders, raises the reliability of switch operation comparable to that of many mechanically operated limit switches.

## RS Series – Accessories

### Universal Switch Band Mounting Illustrations



### WARNING

**BE CAREFUL NOT TO SLIP WHEN PULLING BAND TIGHT. USE THUMB AND FINGER AND DO NOT PULL TOO HARD, THE BAND TIGHTENS WELL WITH THREAD TO SPARE.**

Note: see Stainless Steel Cylinder Accessories for more information.

# How to Order

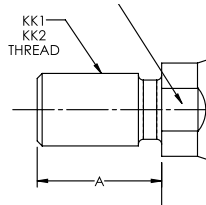
## RS Series – Options

### A= Extended Piston Rod Thread

"A=" refers to the length of piston rod thread.

Shorter than standard lengths can be furnished at no charge. Longer than standard lengths can be furnished at a nominal price adder.

(Note: Special length threads do not delay orders!)

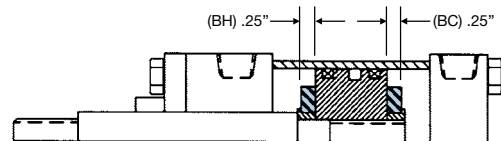


### B • BC • BH Bumpers

Urethane impact dampening bumpers, used when cylinder speeds do not allow for standard cushions.

**BC**=Cap Bumper **BH**=Head Bumper **B**=Head & Cap Bumper

Note: Each bumper for 1.50"-4.00" Bore adds .125" to cylinder length  
Each bumper for 5.00"-8.00" Bore adds .250" to cylinder length



### BP Bumper Piston Seals



1.50" Bore Shown



Available on 1.50" to 8.00" Bore

Bumper Piston Seals, when used with our advanced cushion design, decelerates the cylinder at end of stroke; reducing noise and extending cylinder life.

(Note: See Bumper Pistons on page XXX for stroke reduction PSI.)

**Standard Material:** Nitrile

**Operating Temp:** -20°F to 200°F (-29°C to 93°C)

**Optional Material:** Fluorocarbon

Available in 1.50"-8.00" Bores

**Operating Temp:** 0°F to 400°F (-18°C to 204°C)

**Operating Pressure:** 200 PSI Air (14 bar)

### L001 Magnalube-G Grease

Magnalube-G Grease is our standard lubricant used for all products except for PFLF and RS Series.

**MAGNALUBE-G**

Magnalube-G is a non-soap elastomer/PTFE grease designed for superior performance in a wide range of applications. Insoluble in water, Magnalube-G is a nonmigratory grease that tends to stay put in the cylinder if there is no other oil present.

(Note: if an FRL is used in the pneumatic system, the FRL must be properly maintained to provide continued cylinder lubrication as any oil will negate the Magnalube-G.)

See [www.magnalube.com](http://www.magnalube.com) for more information.

**Color:** Green

**Recommended temperature range:** -20°F to 200°F (-29°C to 93°C)

### LF Low Friction

Low Friction (LF) option incorporates the use of round-lip, extremely low friction carboxylated nitrile seals. Round-lip seals "hydroplane" on opposed sealing surfaces, and have a lower running and break-away friction.

**Bore Sizes:** 1.50" to 8.00" Bore

**Material:** Carboxylated Nitrile

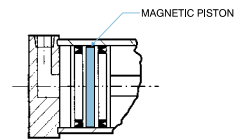
**Operating Temperature:** -20°F to 200°F (-29°C to 93°C)

**Operating Pressure:** 200 PSI Air (17 BAR)

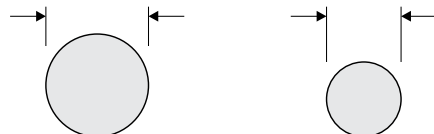
### MPR Magnetic Piston

Magnetic Pistons (MPR) are used in conjunction with TRD R10, R10P, RHT, RAC Reed and MSS Solid State Switches.

(Note: See Switches section on page XXX for more information)



### OS Oversize Rod



OVERSIZED PISTON ROD

STANDARD PISTON ROD

Applications requiring long strokes may require oversize piston rod diameters to prevent sagging or buckling. To determine the recommended rod diameter, refer to Chart 3 on page XXX (available on 5.00"-8.00" bore in RS Series only).

### RWU Rod Wiper made of Urethane

Abrasion resistant urethane provides aggressive wiping action in most environments. External lip design prevents debris from entering cylinder.

### VS • RWV Fluorocarbon Seals

Higher temperature performance: 0°F to 400°F (-18°C to 204°C)

Higher Chemical resistance: Resists most wash down solutions.

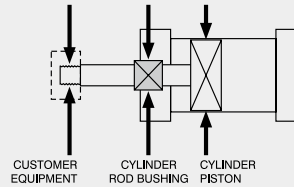
(Note: Teflon wiper is used on "VS" Fluorocarbon seal option unless RWV is requested also.)

## Heavy Duty Stainless Steel (SS) – Construction

### Floating Rod Bushing

**Self Alignment Feature:** Rod Bushing is designed to float .002" to improve bearing surface alignment.

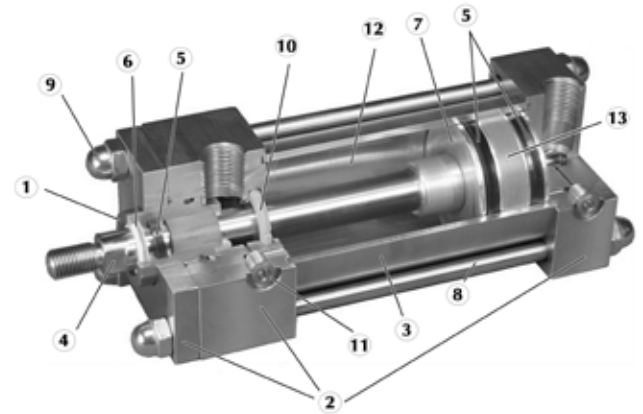
- > Reduces cylinder wear
- > Provides a minimum of 25% longer life than fixed rod bushing designs



### Ideal for:

- > Food Processing Applications
- > Chemical, Medical or Pharmaceutical
- > Offshore or Marine Equipment (316 SS models)
- > Energy Production or Waste Treatment

- 1. Floating Rod Bushing** – Precision machined from 300 stainless steel, extra-long PTFE composite wear band for extended service.
- 2. Head, Cap & Retainer** – 100% Precision machined from highly corrosion resistant 303 stainless steel bar for tough and corrosive environments.
- 3. Cylinder Tube** – Precision machined and honed from 300 stainless steel, providing smooth consistent operation.
- 4. Piston Rod** – Drawn, ground and polished high yield 300 stainless steel, hard chrome plated.
- 5. Piston & Rod Seals** – Heavy lip design Carboxylated Nitrile construction. Seals are pressure activated and wear compensating for long life.
- 6. Rod Wiper** – PTFE scraper design for maximum compatibility with wash-down and chemical solutions (FDA approved material).
- 7. Piston** – Precision machined from 6061-T651 alloy aluminum for excellent bearing surface to extend life (Optional: Stainless Steel with PTFE wear band).



- 8. Tie Rods** – Drawn and ground 300 high strength stainless steel, rolled threads for maximum strength.
- 9. Acorn Nuts** – 300 Stainless steel, eliminates exposed threads for food grade applications.
- 10. Cushions** – (Options H & C) Floating cushion seal designed for maximum cushion performance, quick return stroke break-away and extended life.
- 11. Cushion Adjustment Needle** – 300 stainless steel design has fine thread metering and is positively captured to prevent needle ejection during adjustment.
- 12. Lubrication** – Permanently lubricated with Magnalube-G PTFE based grease on all internal components. This lubricant is a non-migratory type high performance grease, providing outstanding service for life (no additional lubrication is required).
- 13. Piston Wear Band** – 90% Virgin PTFE and 10% Polyphenylene Sulfide filled wear band; extremely low wear rate.

## Operating Pressure

- 250 PSI Air (17 BAR)
- 400 PSI Hydraulic (27 BAR)
- ("TH" Option)

## Operating Temperature

- Carboxylated Nitrile:** -20°F to 200°F (-29°C to 93°C)
- Fluorocarbon:** 0°F to 400°F (-18°C to 204°C)

### Performance Options:

- > **L005** – FDA approved lubricant, rated for 15°F to 300°F (-9°C to 149°C).
- > **RBD** – Solid Delrin® Rod Bushing (FDA approved) for extra long life under "high pressure" wash-down applications. This bearing material requires ZERO lubrication due to self lubricating properties.  
*(Note: Delrin® temperature range is -20F to 100F)*
- > **VS** – Fluorocarbon seals provide a higher chemical resistance to most wash-down solutions. Note: PTFE scraper will be used unless otherwise specified.
- > **SSP** – Solid Stainless Steel Piston provides maximum corrosion resistance and FDA approval for food contact (PTFE wear band standard).
- > **316 Stainless Steel** – Added corrosion resistance for offshore or marine applications.

# How to Order

## SS - MF1 - 2.5 x 10 - HC - MPR

Series
SS 250 PSI Air

NFPA Mounts	
ME3	Front Mounting Holes (8.00" Bore)
ME4	Rear Mounting Holes (8.00" Bore)
MF1	Front Flange (1.50" - 6.00" Bore)
MF2	Rear Flange (1.50" - 6.00" Bore)
MP1	Rear Pivot Clevis (1.50" - 8.00" Bore)
MP4	Rear Pivot Eye (1.50" - 6.00" Bore)
MS2	Side Lug (1.50" - 8.00" Bore)
MS4	Bottom Tapped Holes (1.50" - 8.00" Bore)
MT1	Front Trunnion (1.50" - 8.00" Bore)
MT2	Rear Trunnion (1.50" - 8.00" Bore)
MX0	No Mount (1.50" - 8.00" Bore)
MX1	Extended Tie-Rods (Head & Cap) (1.50"-8.00" Bore)
MX2	Extended Tie-Rods (Cap) (1.50"- 8.00" Bore)
MX3	Extended Tie-Rods (Head) (1.50" - 8.00" Bore)

Bore	
1.5	1.50"
2	2.00"
2.5	2.50"
3.25	3.25"
4	4.00"
5	5.00"
6	6.00"
8	8.00"

Stroke
0" To 120"
Consult Factory For Other Strokes

Cushions	
H	Head Cushion Position 2 is Standard Specify For Positions: 1, 3 or 4
C	Cap Cushion Position 6 is Standard Specify For Positions: 5, 7 or 8

Style	
(Blank)	Single Rod
D	Double Rod End

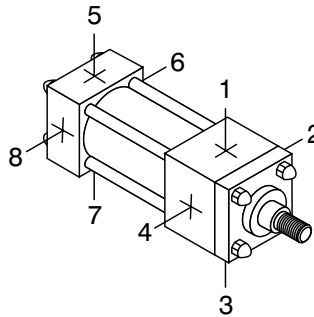
Options	
A	Extended Piston Rod Thread (Specify)
AO	Air / Oil Piston
AS	Adjustable Stroke (Retract) (Specify) (e.g. AS =1)
» B	.25" Urethane Bumper Both Ends
» BC	.25" Urethane Bumper Cap Only
» BH	.25" Urethane Bumper Head Only
BP	Bumper Piston Seal (1.50" - 8.00" Bore)
BSP	British Standard Pipe Parallel (Specify)
BSPT	British Standard Pipe Taper (Specify)
C	Extended Piston Rod (Specify)
L005	FDA Approved Lubricant
KK2	Intermediate Male Rod Thread
KK3	Female Rod Thread
KK3S	Studded Piston Rod (With KK3)
KK4	Full Diameter Male Rod Thread
KK5	Blank Rod End (No Threads, A = 0)
LF	Low Friction Seals (250 PSI Air)
MA	Micro-Adjust (12" Max Stroke) Available On Double Rod End Models
MAB	Micro-Adjust With Sound Dampening Bumper (12" Max Stroke)
MPR	Magnetic Piston For Reed Switches
MS	Metallic Rod Scraper (Brass)
NR	Non-Rotating
OP	Optional Port Location (Example: OP=3,7)
OS	Oversize Rod Diameter (Example: OS=1.375)
RBD	Solid Delrin® Rod Bushing
RWU	Urethane Rod Wiper
RWV	Fluorocarbon Rod Wiper
SAE	SAE Ports (Specify, E.g. SAE#10)
» SE	Spring Extend (Consult Factory)
» SR	Spring Return (Consult Factory)
SSP	Stainless Steel Piston (With Wearband)
» ST	Stop Tube, Specify ST length (Inches), Specify stroke as ES (Effective Stroke) Example: SS-MS4-2X24ES-ST=3
TH	400 PSI Hydraulic (Non-Shock)
VS <sup>1</sup>	Fluorocarbon Seals
XX	Special Variation (Specify)

**Example:** A 2.50" Bore by 10" Stroke, Front Flange Mount, Head & Cap Cushions, Magnetic Piston for Switches.

**Part Number:**  
SS-MF1-2.50 x 10-HC-MPR

### Standard Port and Cushion Adjustment Positions

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

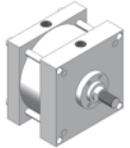
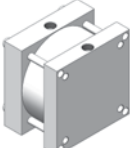
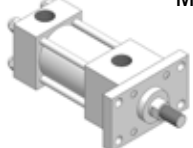
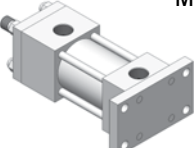
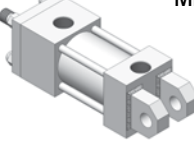
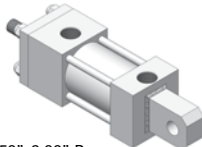
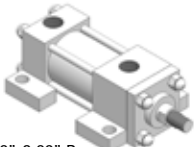
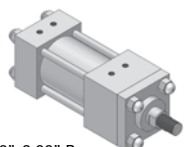
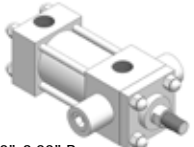
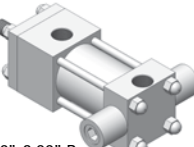
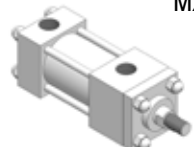
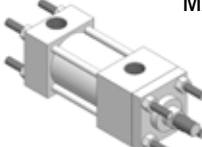
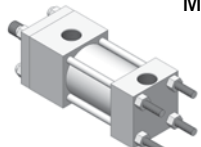
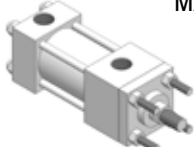


<sup>1</sup> PTFE scraper will be used unless otherwise specified.  
» Refer to Option Length Adder

Option Length Adder (Add To Catalog Basic Overall Length Dimensions)						
Bore	Option					
	B	BC	BH	SE	SR	ST <sup>1</sup> (Stop Tube) Example: ST=2
1.50	0.500	0.250	0.250			2
2.00	0.500	0.250	0.250			2
2.50	0.500	0.250	0.250			2
3.25	0.500	0.250	0.250	Refer to basic options for length adders and available bore sizes and strokes.		2
4.00	0.500	0.250	0.250			2
5.00	0.500	0.250	0.250			2
6.00	0.500	0.250	0.250			2
8.00	0.500	0.250	0.250			2

<sup>1</sup> The desired stop tube (ST) length adds directly to the overall cylinder length.

## NFPA Mounts

 <p><b>ME3</b></p> <p>8.00" Bore</p>	 <p><b>ME4</b></p> <p>8.00" Bore</p>	 <p><b>MF1</b></p> <p>1.50"-6.00" Bores</p>	 <p><b>MF2</b></p> <p>1.50"-6.00" Bores</p>	 <p><b>MP1</b></p> <p>1.50"-8.00" Bores</p>
 <p><b>MP4</b></p> <p>1.50"-6.00" Bores</p>	 <p><b>MS2</b></p> <p>1.50"-8.00" Bores</p>	 <p><b>MS4</b></p> <p>1.50"-8.00" Bores</p>	 <p><b>MT1</b></p> <p>1.50"-8.00" Bores</p>	 <p><b>MT2</b></p> <p>1.50"-8.00" Bores</p>
 <p><b>MX0</b></p> <p>1.50"-8.00" Bores</p>	 <p><b>MX1</b></p> <p>1.50"-8.00" Bores</p>	 <p><b>MX2</b></p> <p>1.50"-8.00" Bores</p>	 <p><b>MX3</b></p> <p>1.50"-8.00" Bores</p>	

# How to Specify

## SS Series Dimensions – Basic Cylinder (No Mount)

### About Rod End Styles

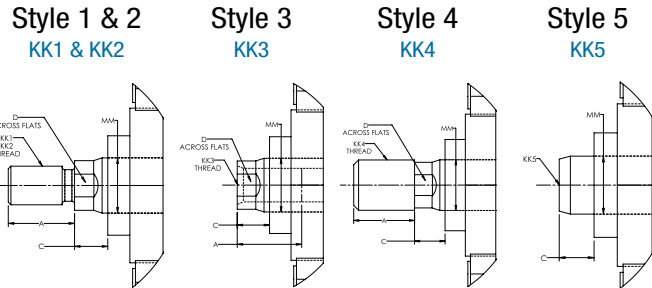
#### Style 1 Male Rod End is Standard

Other NFPA styles can be specified (see chart).

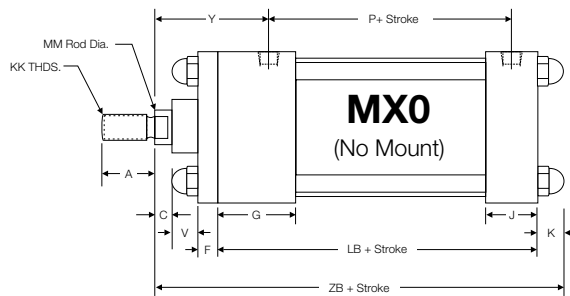
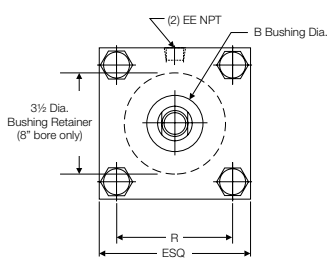
Need a rod end not listed? NO PROBLEM! Each Piston Rod is made-to-order and does not delay shipment. Coarse UNC threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

NEED SOMETHING NOT LISTED? Just send us a sketch. In most cases, quotes are turned around in one day!

### Piston Rod End Styles



Bore	Rod Diameter (MM)	Standard		Optional						C	D
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male			
		KK1	A	KK2	A	KK3	A	KK4	A		
1.50, 2.00, 2.50	0.625 Standard	7/16 -20	0.750	1/2-20	0.750	7/16 -20	0.750	5/8 -18	0.750	0.375	0.500
	1.000 Oversize	3/4 -16	1.125	7/8-14	1.125	3/4 -16	1.125	1 -14	1.125	0.500	0.875
3.25, 4.00, 5.00	1.000 Standard	3/4 -16	1.125	7/8-14	1.125	3/4 -16	1.125	1 -14	1.125	0.500	0.875
	1.375 Oversize	1 -14	1.625	1 1/4-12	1.625	1 -14	1.625	1 3/8 -12	1.625	0.625	1.125
6.00	1.375 Standard	1 -14	1.625	1 1/4-12	1.625	1 -14	1.625	1 3/8 -12	1.625	0.625	1.125
	1.750 Oversize	1 1/4 -12	2.000	1 1/2-12	2.000	1 1/4 -12	2.000	1 3/4 -12	2.000	0.750	1.500
8.00	1.375 Standard	1 -14	1.625	1 1/4-12	1.625	1 -14	1.625	1 3/8 -12	1.625	0.625	1.125
	1.750 Oversize	1 1/4 -12	2.000	1 1/2-12	2.000	1 1/4 -12	2.000	1 3/4 -12	2.000	0.750	1.750

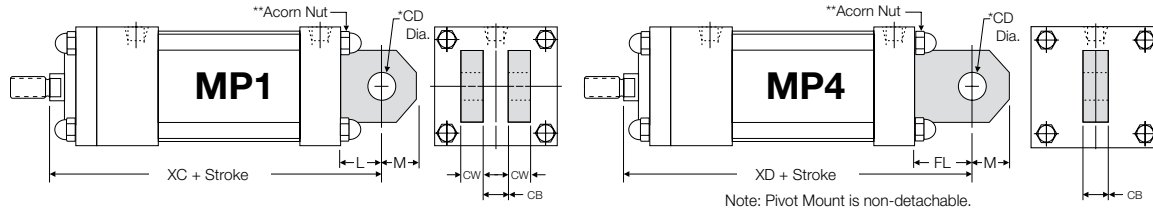


Basic Dimensions MX0 Standard & Oversized Rods

Bore	Rod Diameter	A	B	C	E	EE	F	G	J	K	KK	LB	MM	P	R	V	Y	ZB
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.438	7/16 -20	3.625	0.625	2.375	1.430	0.250	1.875	5.063
	1.000 Oversize	1.125	1.500	0.500							3/4 -16		1.000			0.500	2.250	5.438
2.00	0.625 Standard	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.563	7/16 -20	3.625	0.625	2.375	1.840	0.250	1.875	5.188
	1.000 Oversize	1.125	1.500	0.500							3/4 -16		1.000			0.500	2.250	5.563
2.50	0.625 Standard	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.563	7/16 -20	3.750	0.625	2.500	2.190	0.250	1.875	5.313
	1.000 Oversize	1.125	1.500	0.500							3/4 -16		1.000			0.500	2.250	5.688
3.25	1.000 Standard	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.625	3/4 -16	4.250	1.000	2.750	2.760	0.250	2.375	6.250
	1.375 Oversize	1.625	2.000	0.625							1 -14		1.375			0.375	2.625	6.500
4.00	1.000 Standard	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.625	3/4 -16	4.250	1.000	2.750	3.320	0.250	2.375	6.250
	1.375 Oversize	1.625	2.000	0.625							1 -14		1.375			0.375	2.625	6.500
5.00	1.000 Standard	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.813	3/4 -16	4.500	1.000	3.000	4.100	0.250	2.375	6.625
	1.375 Oversize	1.625	2.000	0.625							1 -14		1.375			0.375	2.625	6.875
6.00	1.375 Standard	1.625	2.000	0.625	6.500	0.750	0.750	2.000	1.500	0.813	1 -14	5.000	1.375	3.250	4.880	0.250	2.750	7.375
	1.750 Oversize	2.000	2.375	0.750							1 1/4 -12		1.750			0.375	3.000	7.625
8.00	1.375 Standard	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.500	1.000	1 -14	5.125	1.375	3.375	6.440	0.375	2.750	7.750
	1.750 Oversize	2.000	2.375	0.750							1 1/4 -12		1.750			0.500	3.000	8.000



## SS Series Dimensions – Pivot Mounts



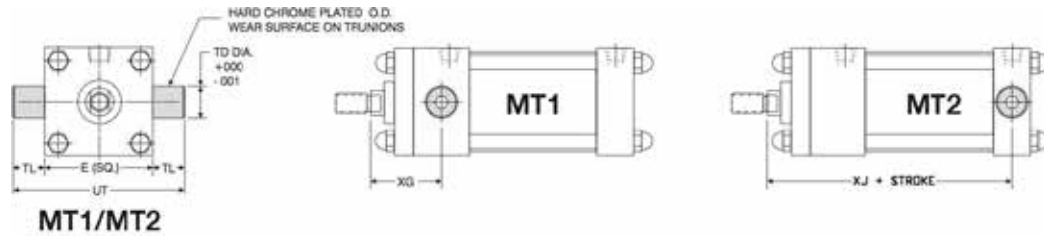
Note: Pivot Mount is non-detachable.  
Contact factory for detachable mount options.

MP1 Clevis and MP4 Eye Mount Dimensions								Accessories					
Bore	Rod Diameter	CB	CD	CW	FL	L	M	XC	XD	Rod Clevis	Rod Eye	Clevis Pin	Eye Bracket (For MP1)
1.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	5.375	5.750	SS-RC437	SS-RE437	SS-CP500	SS-EB500
	1.000 Oversize							5.750	6.125	SS-RC750	SS-RE750	SS-CP750	
2.00	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	5.375	5.750	SS-RC437	SS-RE437	SS-CP500	SS-EB500
	1.000 Oversize							5.750	6.125	SS-RC750	SS-RE750	SS-CP750	
2.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	5.500	5.875	SS-RC437	SS-RE437	SS-CP500	SS-EB500
	1.000 Oversize							5.875	6.250	SS-RC750	SS-RE750	SS-CP750	
3.25	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	6.875	7.500	SS-RC750	SS-RE750	SS-CP750	SS-EB750
	1.375 Oversize							7.125	7.750	SS-RC1000	SS-RE1000	SS-CP1000	
4.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	6.875	7.500	SS-RC750	SS-RE750	SS-CP750	SS-EB750
	1.375 Oversize							7.125	7.750	SS-RC1000	SS-RE1000	SS-CP1000	
5.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	7.125	7.750	SS-RC750	SS-RE750	SS-CP750	SS-EB750
	1.375 Oversize							7.375	8.000	SS-RC1000	SS-RE1000	SS-CP1000	
6.00	1.375 Standard	1.500	1.000	0.750	2.250	1.500	1.000	8.125	8.875	SS-RC1000	SS-RE1000	SS-CP1000	SS-EB1000
	1.750 Oversize							8.375	9.125	SS-RC1250	SS-RE1250	SS-CP1375	
8.00	1.375 Standard	1.500	1.000	0.750	N/A	1.500	1.000	8.250	N/A	SS-RC1000	SS-RE1000	SS-CP1000	SS-EB1000
	1.750 Oversize							8.500	N/A	SS-RC1250	SS-RE1250	SS-CP1375	

\*Clevis pin provided with MP1 and MP4 mounts.

\*\*Acorn nuts are located on cap end (4.00"-8.00" bores).

Note: MP4 8.00" bore not available.



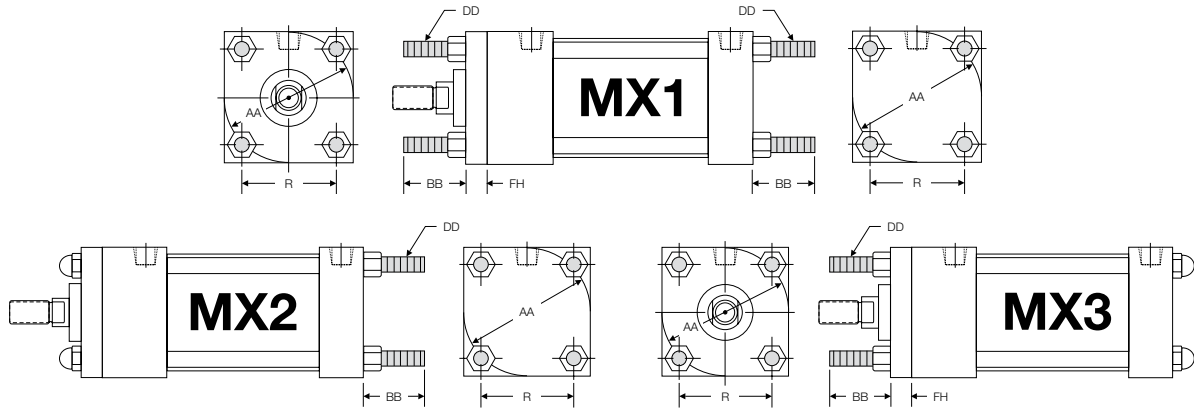
Note: Trunnions are bolt on, non-removable design.

MT1 Head Trunnion and MT2 Cap Trunnion Mount Dimensions								Accessories		
Bore	Rod Diameter	E	TD	TL	UT	XG	XJ	Rod Clevis	Rod Eye	Clevis Pin
1.50	0.625 Standard	2.000	1.000	1.000	4.000	1.750	4.125	SS-RC437	SS-RE437	SS-CP500
	1.000 Oversize*					N/A	4.500	SS-RC750	SS-RE750	SS-CP750
2.00	0.625 Standard	2.500	1.000	1.000	4.500	1.750	4.125	SS-RC437	SS-RE437	SS-CP500
	1.000 Oversize					2.125	4.500	SS-RC750	SS-RE750	SS-CP750
2.50	0.625 Standard	3.000	1.000	1.000	5.000	1.750	4.250	SS-RC437	SS-RE437	SS-CP500
	1.000 Oversize					2.125	4.625	SS-RC750	SS-RE750	SS-CP750
3.25	1.000 Standard	3.750	1.000	1.000	5.750	2.250	5.000	SS-RC750	SS-RE750	SS-CP750
	1.375 Oversize					2.500	5.250	SS-RC1000	SS-RE1000	SS-CP1000
4.00	1.000 Standard	4.500	1.000	1.000	6.500	2.250	5.000	SS-RC750	SS-RE750	SS-CP750
	1.375 Oversize					2.500	5.250	SS-RC1000	SS-RE1000	SS-CP1000
5.00	1.000 Standard	5.500	1.000	1.000	7.500	2.250	5.250	SS-RC750	SS-RE750	SS-CP750
	1.375 Oversize					2.500	5.500	SS-RC1000	SS-RE1000	SS-CP1000
6.00	1.375 Standard	6.500	1.375	1.375	9.250	2.625	5.875	SS-RC1000	SS-RE1000	SS-CP1000
	1.750 Oversize					2.875	6.125	SS-RC1250	SS-RE1250	SS-CP1375
8.00	1.375 Standard	8.500	1.375	1.375	11.250	2.625	6.000	SS-RC1000	SS-RE1000	SS-CP1000
	1.750 Oversize					2.875	6.250	SS-RC1250	SS-RE1250	SS-CP1375

\*No Oversize rod on 1.50" bore on MT1 mount.

# How to Specify

## SS Series Dimensions – Tie Rod & Flange Mounts



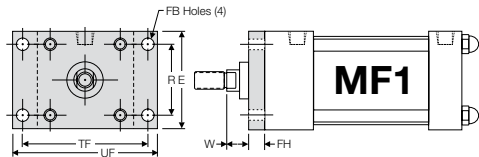
Tie Rod Extended MX1, MX2 & MX3 Mount Dimensions

Bore	Rod Diameter	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4 -28	0.375	1.430
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16 -24	0.375	1.840
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16 -24	0.375	2.190
	1.000 Oversize					
3.25	1.000 Standard	3.900	1.375	3/8 -24	0.625	2.760
	1.375 Oversize					

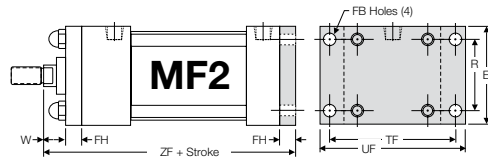
Tie Rod Extended MX1, MX2 & MX3 Mount Dimensions

Bore	Rod Diameter	AA	BB	DD	FH	R
4.00	1.000 Standard	4.700	1.375	3/8 -24	0.625	3.320
	1.375 Oversize					
5.00	1.000 Standard	5.800	1.813	1/2 -20	0.625	4.100
	1.375 Oversize					
6.00	1.375 Standard	6.900	1.813	1/2 -20	0.750	4.880
	1.750 Oversize					
8.00	1.375 Standard	9.100	2.313	5/8 -18	0.625*	6.440
	1.750 Oversize					

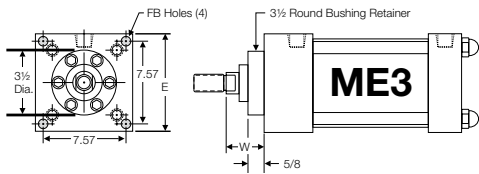
Full square bushing retainer on 1.50" through 6.00" bore.  
 \*Round retainer on 8.00" bore. BB dimension from face of head.



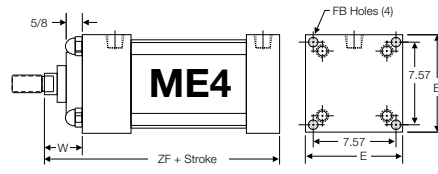
1.50" - 6.00" bores



1.50" - 6.00" bores



8.00" bore only



8.00" bore only

MF1, MF2 Flange & ME3, ME4 Cap Mount Dimensions

Bore	Rod Diameter	E	FB	FH	R	TF	UF	W	ZF
1.50	0.625 Standard	2.000	0.313	0.375	1.430	2.750	3.375	0.625	5.000
	1.000							5.375	
2.00	0.625 Standard	2.500	0.375	0.375	1.840	3.375	4.125	0.625	5.000
	1.000							5.375	
2.50	0.625 Standard	3.000	0.375	0.375	2.190	3.875	4.625	0.625	5.125
	1.000							5.500	
3.25	1.000 Standard	3.750	0.438	0.625	2.760	4.688	5.500	0.750	6.250
	1.375							6.500	

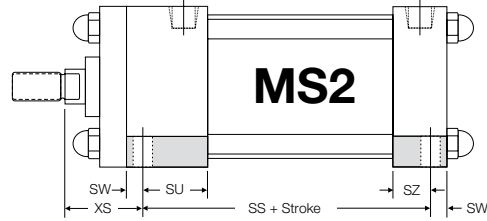
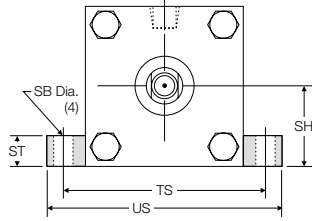
MF1, MF2 Flange & ME3, ME4 Cap Mount Dimensions

Bore	Rod Diameter	E	FB	FH	R	TF	UF	W	ZF
4.00	1.000 Standard	4.500	0.438	0.625	3.320	5.438	6.250	0.750	6.250
	1.375							6.500	
5.00	1.000 Standard	5.500	0.563	0.625	4.100	6.625	7.625	0.750	6.500
	1.375							6.750	
6.00	1.375 Standard	6.500	0.563	0.750	4.880	7.625	8.625	0.875	7.375
	1.750							7.625	
8.00	1.375 Standard	8.500	0.688	N/A	N/A	N/A	N/A	1.625	6.750
	1.750			7.000					

Full square bushing retainer on 1.50" through 6.00" bore.  
 \*Round retainer on 8.00" bore.



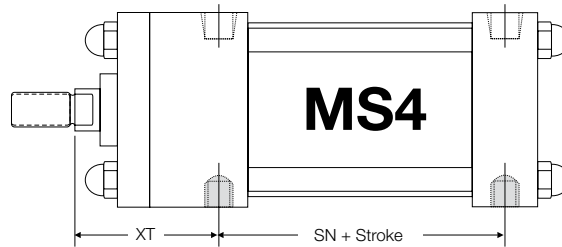
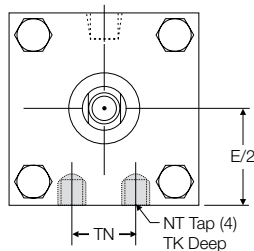
## SS Series Dimensions – Base Mounts



**MS2 Side Lug Mount Dimensions**

Bore	Rod Diameter	SB	SH	ST	SU	SW	SZ	TS	US	XS	SS Add Stroke
1.50	0.625 Standard	0.438	1.000	0.500	1.125	0.375	0.625	2.750	3.500	1.375	2.875
	1.000 Oversize										
2.00	0.625 Standard	0.438	1.250	0.500	1.125	0.375	0.625	3.250	4.000	1.375	2.875
	1.000 Oversize										
2.50	0.625 Standard	0.438	1.500	0.500	1.125	0.375	0.625	3.750	4.500	1.375	3.000
	1.000 Oversize										
3.25	1.000 Standard	0.563	1.875	0.750	1.250	0.500	0.750	4.750	5.750	1.875	3.250
	1.375 Oversize										
4.00	1.000 Standard	0.563	2.250	0.750	1.250	0.500	0.750	5.500	6.500	1.875	3.250
	1.375 Oversize										
5.00	1.000 Standard	0.813	2.750	1.000	1.063	0.688	0.563	6.875	8.250	2.063	3.125
	1.375 Oversize										
6.00	1.375 Standard	0.813	3.250	1.000	1.313	0.688	0.813	7.875	9.250	2.313	3.625
	1.750 Oversize										
8.00	1.375 Standard	0.813	4.250	1.000	1.563	0.688	0.813	9.875	11.250	2.313	3.750
	1.750 Oversize										

Full square bushing retainer on 1.50" through 6.00" bore.  
Round retainer on 8.00" bore.



**MS4 Bottom Tap Mount Dimensions**

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

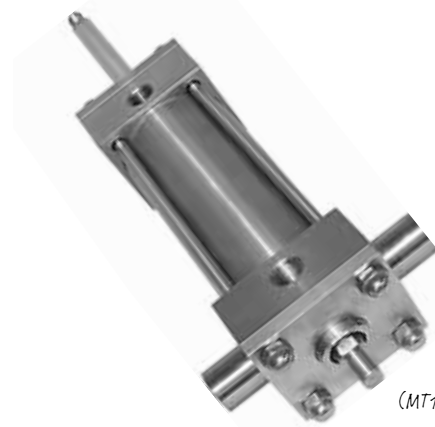
Full square bushing retainer on 1.50" through 6.00" bore  
Round retainer on 8.00" bore.

# Product Features

## SS Series Dimensions – Double Rod End

### Benefits

- > Standard and Oversized Piston Rods available.
- > Full range of Standard Options.
- > Durable design. Full Rod Bearing at each end of cylinder.
- > Can be provided with Hollow Piston Rods (gun-drilled through, to your size requirements).
- > Can be used in adjustable extend stroke applications (by adding a stop collar on one rod end).
- > MA Micro Adjust option available up to 12" strokes



(MT1D mount shown)

### About Rod End Styles

#### Style 1 Male Rod End is Standard

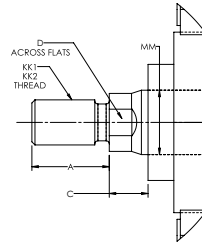
Other NFPA styles can be specified (see chart).

Need a rod end not listed? No problem! Each Piston Rod is made-to-order and does not delay shipment. Coarse UNC threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

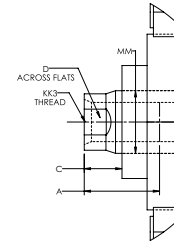
Need something not listed? Just send us a sketch. In most cases, quotes are turned around in one day!

### Piston Rod End Styles

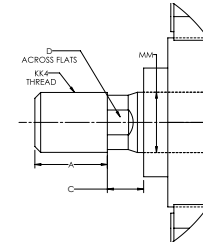
Style 1 & 2  
KK1 & KK2



Style 3  
KK3

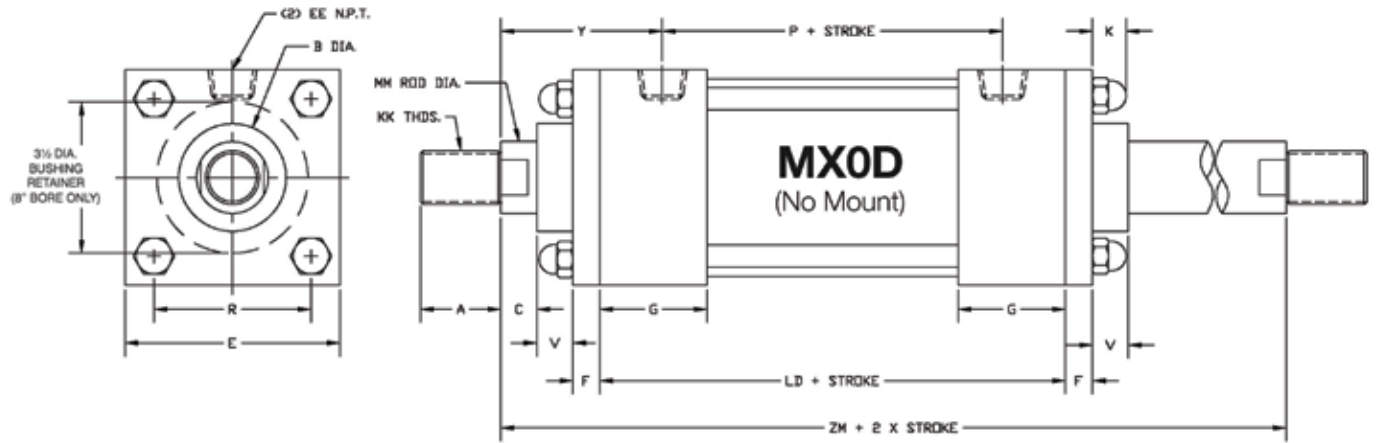


Style 4  
KK4



Bore	Rod Diameter (mm)	Standard		Optional						C	D
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male			
		KK1	A	KK2	A	KK3	A	KK4	A		
1.50, 2.00, 2.50	0.625 Standard	<b>7/16 -20</b>	0.750	<b>1/2 -20</b>	0.750	<b>7/16 -20</b>	0.750	<b>5/8 -18</b>	0.750	0.375	0.500
	1.000 Oversize	<b>3/4 -16</b>	1.125	<b>7/8 -14</b>	1.125	<b>3/4 -16</b>	1.125	<b>1 -14</b>	1.125	0.500	0.875
3.25, 4.00, 5.00	1.000 Standard	<b>3/4 -16</b>	1.125	<b>7/8 -14</b>	1.125	<b>3/4 -16</b>	1.125	<b>1 -14</b>	1.125	0.500	0.875
	1.375 Oversize	<b>1 -14</b>	1.625	<b>1 1/4 -12</b>	1.625	<b>1 -14</b>	1.625	<b>1 3/8 -12</b>	1.625	0.625	1.125
6.00	1.375 Standard	<b>1 -14</b>	1.625	<b>1 1/4 -12</b>	1.625	<b>1 -14</b>	1.625	<b>1 3/8 -12</b>	1.625	0.625	1.125
	1.750 Oversize	<b>1 1/4 -12</b>	2.000	<b>1 1/2 -12</b>	2.000	<b>1 1/4 -12</b>	2.000	<b>1 3/4 -12</b>	2.000	0.750	1.500
8.00	1.375 Standard	<b>1 -14</b>	1.625	<b>1 1/4 -12</b>	1.625	<b>1 -14</b>	1.625	<b>1 3/8 -12</b>	1.625	0.625	1.125
	1.750 Oversize	<b>1 1/4 -12</b>	2.000	<b>1 1/2 -12</b>	2.000	<b>1 1/4 -12</b>	2.000	<b>1 3/4 -12</b>	2.000	0.750	1.500

## SS Series Dimensions – Double Rod End

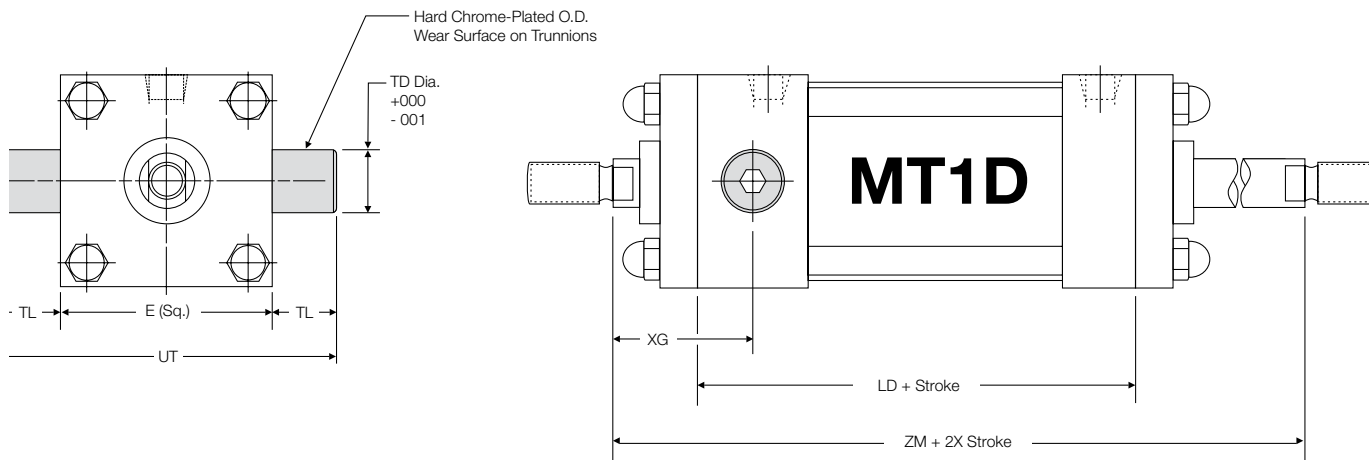


Double Rod MX0D Dimensions Standard & Oversized Rods

Bore	Rod Diameter (mm)	A	B	C	E	EE	F	G	K	KK	LD	P	R	V	Y	ZM
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	1.500	0.438	7/16-20	4.125	2.375	1.430	0.250	1.875	6.125
	1.000 Oversize	1.125	1.500	0.500	2.000	0.375	0.375	1.500	0.438	3/4-16	4.125	2.375	1.430	0.500	2.250	6.875
2.00	0.625 Standard	0.750	1.125	0.375	2.500	0.375	0.375	1.500	0.563	7/16-20	4.125	2.375	1.840	0.250	1.875	6.125
	1.000 Oversize	1.125	1.500	0.500	2.500	0.375	0.375	1.500	0.563	3/4-16	4.125	2.375	1.840	0.500	2.250	6.875
2.50	0.625 Standard	0.750	1.125	0.375	3.000	0.375	0.375	1.500	0.563	7/16-20	4.250	2.500	2.190	0.250	1.875	6.250
	1.000 Oversize	1.125	1.500	0.500	3.000	0.375	0.375	1.500	0.563	3/4-16	4.250	2.500	2.190	0.500	2.250	7.000
3.25	1.000 Standard	1.125	1.500	0.500	3.750	0.500	0.625	1.750	0.625	3/4-16	4.750	2.750	2.760	0.250	2.375	7.500
	1.375 Oversize	1.625	2.000	0.625	3.750	0.500	0.625	1.750	0.625	1-14	4.750	2.750	2.760	0.375	2.625	8.000
4.00	1.000 Standard	1.125	1.500	0.500	4.500	0.500	0.625	1.750	0.625	3/4-16	4.750	2.750	3.320	0.250	2.375	7.500
	1.375 Oversize	1.625	2.000	0.625	4.500	0.500	0.625	1.750	0.625	1-14	4.750	2.750	3.320	0.375	2.625	8.000
5.00	1.000 Standard	1.125	1.500	0.500	5.500	0.500	0.625	1.750	0.813	3/4-16	5.000	3.000	4.100	0.250	2.375	7.750
	1.375 Oversize	1.625	2.000	0.625	5.500	0.500	0.625	1.750	0.813	1-14	5.000	3.000	4.100	0.375	2.625	8.250
6.00	1.375 Standard	1.625	2.000	0.625	6.500	0.750	0.750	2.000	0.813	1-14	5.500	3.250	4.880	0.250	2.750	8.750
	1.750 Oversize	2.000	2.375	0.750	6.500	0.750	0.750	2.000	0.813	1 1/4-12	5.500	3.250	4.880	0.375	3.000	9.250
8.00	1.375 Standard	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.000	1-14	5.625	3.375	6.440	0.375	2.750	8.875
	1.750 Oversize	2.000	2.375	0.750	8.500	0.750	0.625	2.000	1.000	1 1/4-12	5.625	3.375	6.440	0.500	3.000	9.375

# How to Specify

## SS Series Dimensions – Double Rod End



Note: Trunnions are bolt on, non-removable design.

SS-MT1D Head Trunnion Mount Dimensions

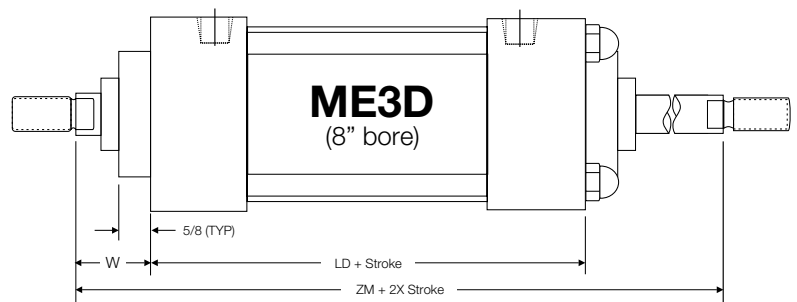
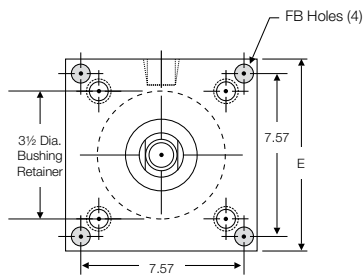
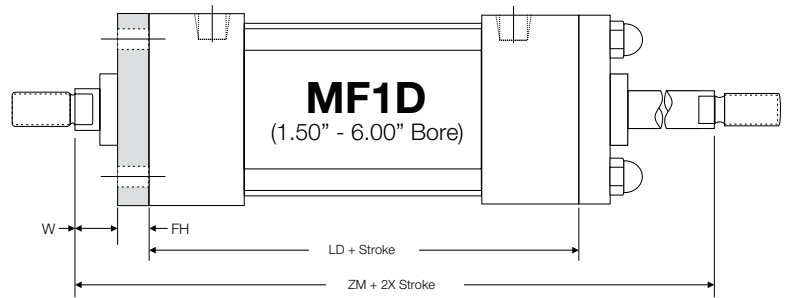
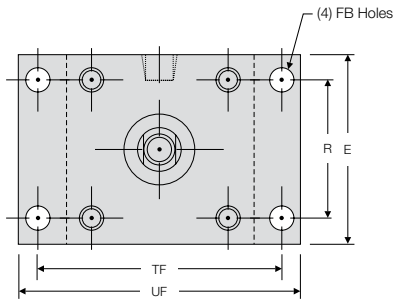
Bore	Rod Diameter	E	LD	TD	TL	UT	XG	ZM
1.50	0.625 Standard	2.000	4.125	1.000	1.000	4.000	1.750	6.125
	N/A*						N/A	
2.00	0.625 Standard	2.500	4.125	1.000	1.000	4.500	1.750	6.125
	1.000 Oversize						2.125	6.875
2.50	0.625 Standard	3.000	4.250	1.000	1.000	5.000	1.750	6.250
	1.000 Oversize						2.125	7.000
3.25	1.000 Standard	3.750	4.750	1.000	1.000	5.750	2.250	7.500
	1.375 Oversize						2.500	8.000
4.00	1.000 Standard	4.500	4.750	1.000	1.000	6.500	2.250	7.500
	1.375 Oversize						2.500	8.000
5.00	1.000 Standard	5.500	5.000	1.000	1.000	7.500	2.250	7.750
	1.375 Oversize						2.500	8.250
6.00	1.375 Standard	6.500	5.500	1.375	1.375	9.250	2.625	8.750
	1.750 Oversize						2.875	9.250
8.00	1.375 Standard	8.500	5.625	1.375	1.375	11.250	2.625	8.875
	1.750 Oversize						2.875	9.375

\*No oversized rod available on 1.50" bore.

RS, SS, AND SS-MS SERIES CYLINDERS

172

## SS Series Dimensions – Double Rod End Flange Mounts

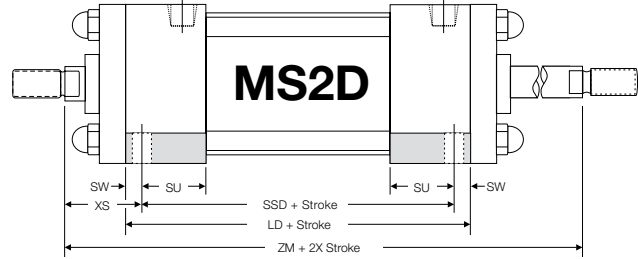
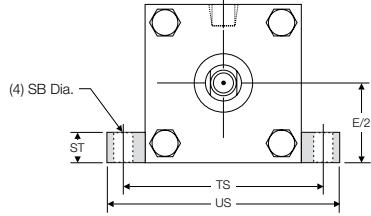


SS-MF1D Flange & SS-ME3D Head Mount Dimensions

Bore	Rod Diameter	E	FB	FH	LD	R	TF	UF	W	ZM
1.50	0.625 Standard	2.000	0.313	0.375	4.125	1.430	2.750	3.375	0.625	6.125
	1.000 Oversize								1.000	6.875
2.00	0.625 Standard	2.500	0.375	0.375	4.125	1.840	3.375	4.125	0.625	6.125
	1.000 Oversize								1.000	6.875
2.50	0.625 Standard	3.000	0.375	0.375	4.250	2.190	3.875	4.625	0.625	6.250
	1.000 Oversize								1.000	7.000
3.25	1.000 Standard	3.750	0.438	0.625	4.750	2.760	4.688	5.500	0.750	7.500
	1.375 Oversize								1.000	8.000
4.00	1.000 Standard	4.500	0.438	0.625	4.750	3.320	5.438	6.250	0.750	7.500
	1.375 Oversize								1.000	8.000
5.00	1.000 Standard	5.500	0.563	0.625	5.000	4.100	6.625	7.625	0.750	7.750
	1.375 Oversize								1.000	8.250
6.00	1.375 Standard	6.500	0.563	0.750	5.500	4.880	7.625	8.625	0.875	8.750
	1.750 Oversize								1.125	9.250
8.00	1.375 Standard	8.500	0.688	N/A	5.625	N/A	N/A	N/A	1.625	8.875
	1.750 Oversize								1.875	9.375

# How to Specify

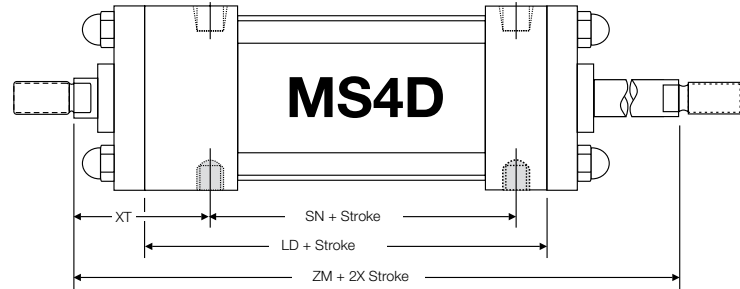
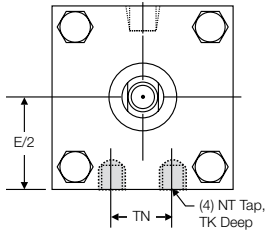
## SS Series Dimensions – Double Rod End Base Mounts



**SS-MS2D Side Lug Mount Dimensions**

Bore	Rod Diameter	E/2	LD	SB	ST	SU	SW	TS	US	XS	ZM	SSD
1.50	0.625 Standard	1.000	4.125	0.438	0.500	1.125	0.375	2.750	3.500	1.375	6.125	3.375
	1.000 Oversize									1.750	6.875	
2.00	0.625 Standard	1.250	4.125	0.438	0.500	1.125	0.375	3.250	4.000	1.375	6.125	3.375
	1.000 Oversize									1.750	6.875	
2.50	0.625 Standard	1.500	4.250	0.438	0.500	1.125	0.375	3.750	4.500	1.375	6.250	3.500
	1.000 Oversize									1.750	7.000	
3.25	1.000 Standard	1.875	4.750	0.563	0.750	1.250	0.500	4.750	5.750	1.875	7.500	3.750
	1.375 Oversize									2.125	8.000	
4.00	1.000 Standard	2.250	4.750	0.563	0.750	1.250	0.500	5.500	6.500	1.875	7.500	3.750
	1.375 Oversize									2.125	8.000	
5.00	1.000 Standard	2.750	5.000	0.813	1.000	1.063	0.688	6.875	8.250	2.063	7.750	3.625
	1.375 Oversize									2.313	8.250	
6.00	1.375 Standard	3.250	5.500	0.813	1.000	1.313	0.688	7.875	9.250	2.313	8.750	4.125
	1.750 Oversize									2.563	9.250	
8.00	1.375 Standard	4.250	5.625	0.813	1.000	1.313	0.688	9.875	11.250	2.313	8.875	4.250
	1.750 Oversize									2.563	9.375	

Note: Round retainer on 8.00" bore only.



**SS-MS4D Bottom Tapped Mount Dimensions**

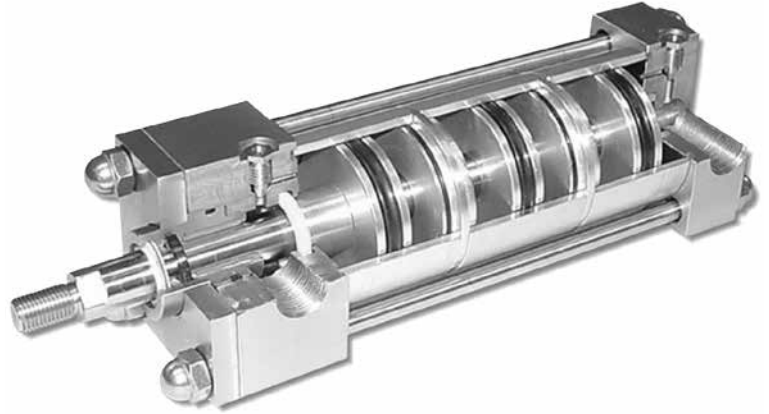
Bore	Rod Diameter	E/2	LD	NT	TK	TN	XT	SN	ZM
1.50	0.625 Standard	1.000	4.125	1/4-20	0.375	0.625	1.938	2.250	6.125
	1.000 Oversize						2.313		6.875
2.00	0.625 Standard	1.250	4.125	5/16-18	0.500	0.875	1.938	2.250	6.125
	1.000 Oversize						2.313		6.875
2.50	0.625 Standard	1.500	4.250	3/8-16	0.625	1.250	1.938	2.375	6.250
	1.000 Oversize						2.313		7.000
3.25	1.000 Standard	1.875	4.750	1/2-13	0.750	1.500	2.438	2.625	7.500
	1.375 Oversize						2.688		8.000
4.00	1.000 Standard	2.250	4.750	1/2-13	0.750	2.063	2.438	2.625	7.500
	1.375 Oversize						2.688		8.000
5.00	1.000 Standard	2.750	5.000	5/8-11	1.000	2.688	2.438	2.875	7.750
	1.375 Oversize						2.688		8.125
6.00	1.375 Standard	3.250	5.500	3/4-10	1.125	3.250	2.813	3.125	8.750
	1.750 Oversize						3.063		9.250
8.00	1.375 Standard	4.250	5.625	3/4-10	1.125	4.500	2.813	3.250	8.875
	1.750 Oversize						3.063		9.375

Note: Round retainer on 8.00" bore only.

## SS-MS Series Multi-Stage – Force Multiplying Cylinders

### Benefits

- > Rated for 125 PSI Air or Hydraulic (non-shock)
- > Eliminates the need for high pressure systems
- > Bore size vs output force saves space
- > Optional Double Rod End Models available
- > Optional force multiplying in both extend and retract strokes available
- > Heavy Duty 'SS' construction
- > 2 Stage, 3 Stage and 4 Stage models

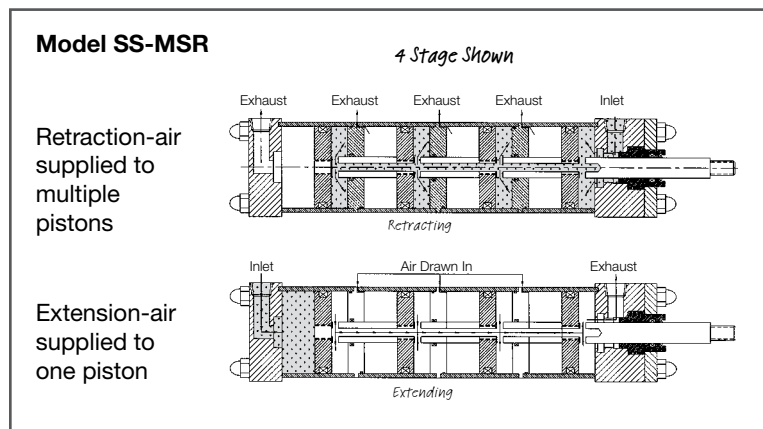
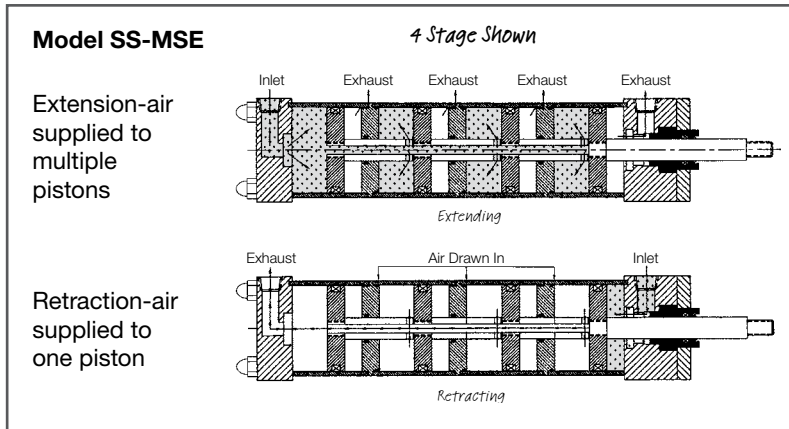


The Bimba SS-MSE and SS-MSR Series are double acting, single rod end cylinders that multiply the force output by supplying air to multiple pistons.

The SS-MSE multiplies the force on the extend stroke, the SS-MSR multiplies the force on the retract stroke. Both models use only one piston on the return stroke, saving air volume and operating costs.

Note: Models MSR and MSE are not field-repairable - units must be returned to factory for service.

### How They Work



# How to Order

## SS-MSE - MS4 - 3.25 x 2 - 3S - MPR

Series	
SS-MSE	Multi-Stage Extend
SS-MSR	Multi-Stage Retract

Style	
(Blank)	Single Rod
D	Double Rod End

Bore	
1.5	1.50"
2	2.00"
2.5	2.50"
3.25	3.25"
4	4.00"
5	5.00"
6	6.00"

Stroke	
0.5** To 12"	
Consult Factory For Other Strokes	
*0.125" For SS-MSE	

Stages	
2S	Two Stage
3S	Three Stage
4S	Four Stage

Options	
A	Extended Piston Rod Thread (Specify)
AS	Adjustable Stroke (Retract)
» B	.25" Urethane Bumper Both Ends
» BC	.25" Urethane Bumper Cap Only
» BH	.25" Urethane Bumper Head Only
BSPP	British Standard Pipe Taper (Specify Size)
BSPT	British Standard Pipe Parallel (Specify Size)
C	Cap Cushion (Available On MSR Only)
C	Extended Piston Rod (Specify)
H	Head Cushion (Available On MSE Only)
KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3S	Studded Piston Rod (With KK3)
KK4	Full Diameter Male Rod Thread
LO05	FDA Approved Lubricant
» MPR	Magnetic Piston For Reed Switches
MS	Metallic Rod Scraper (Brass)
» NR	Non-Rotating (Internally Guided) Additional Length - See Chart
OP	Optional Port Location (Example: OP=3,7)
OS	Oversize Rod Diameter (Specify Size)
RBD	Delrin® Rod Bushing
RWU	Urethane Rod Wiper
RWV	Fluorocarbon Rod Wiper
ST	Stop Tube, Specify Stop Tube Length In Inches Specify Stroke As ES (Effective Stroke) (Example: SS-MS-MS4 2 X 24ES-ST=3)
TH	Hydraulic (Non-Shock)
VS	Fluorocarbon Seals*
AS	Adjustable Stroke (Retract)
	XX = Special Variation (Specify)
	BSPP, BSPT, SAE Ports (Specify Size)

NFPA Mounts	
MX0	No Mount
MX1	Extended Tie Rods - Head & Cap (1.50"-6.00" Bore)
MX2	Extended Tie Rods (Cap) (1.50"-6.00" Bore)
MX3	Extended Tie Rods (Head) (1.50"-6.00" Bore)
MF1	Front Flange (1.50"- 6.00" Bore)
MF2	Rear Pivot Clevis (1.50"- 6.00" Bore)
MP1	Rear Pivot Clevis (1.50"- 6.00" Bore)
MP2	Rear Pivot Clevis (1.50"- 6.00" Bore)
MS2	Side Lug (1.50"- 6.00" Bore)
MS4	Bottom Tapped Holes (1.50"- 6.00" Bore)

### Ordering Examples:

**Example 1:** MF1 3.25" Bore, 2" Stroke, 3 Stage Force Multiplied in EXTEND is:  
**SS-MSE MF1 3.25 x 2 x 3S**

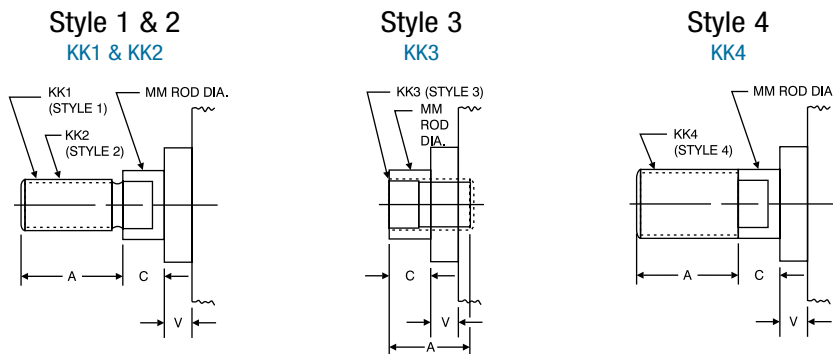
**Example 2:** Double Rod End MS4 Mount, 2 Stage, 6.00" Bore, 3" Stroke, Force Multiplied in RETRACT with Magnetic Piston for REED Switches is:  
**SS-MSR MS4D 6 x 3 x 2S - MPR**

Bore	Option Length Adder (Add To Catalog Basic Overall Length Dimensions)					
	B	BC	BH	MPR	MPH	NR
1.50	0.500	0.250	0.250	0.625	0.625	0.625
2.00	0.500	0.250	0.250	0.625	0.625	0.625
2.50	0.500	0.250	0.250	0.750	0.750	0.750
3.25	0.500	0.250	0.250	0.625	0.625	0.625
4.00	0.500	0.250	0.250	0.625	0.625	0.625
5.00	0.500	0.250	0.250	0.875	0.875	0.875
6.00	0.500	0.250	0.250	0.750	0.750	0.750

MPR Option: Magnet is located in stage at cap for standard units, in stage at head for 'NR' units

\* PTFE scraper will be used unless otherwise specified.  
» Refer to Option Length Adder

## SS Series Dimensions – Piston Rod End Styles

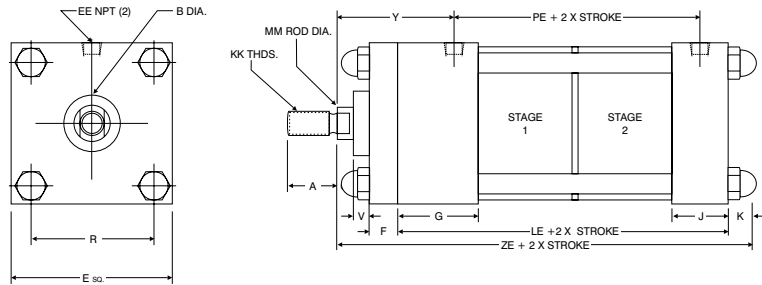


Bore	Rod Diameter (MM)	Standard		Optional						C	D
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male			
		KK1	A	KK2	A	KK3	A	KK4	A		
1.50, 2.00, 2.50	0.625 Standard	7/16-20	0.750	1/2-20	0.750	7/16-20	0.750	5/8-18	0.750	0.375	0.500
	1.000 Oversize	3/4-16	1.125	7/8-14	1.125	3/4-16	1.125	1-14	1.125	0.500	0.875
3.25, 4.00, 5.00	1.000 Standard	3/4-16	1.125	7/8-14	1.125	3/4-16	1.125	1-14	1.125	0.500	0.875
	1.375 Oversize	1-14	1.625	1 1/4-12	1.625	1-14	1.625	1 3/8-12	1.625	0.625	1.125
6.00 & 8.00	1.375 Standard	1-14	1.625	1 1/4-12	1.625	1-14	1.625	1 3/8-12	1.625	0.625	1.125
	1.750 Oversize	1 1/4-12	2.000	1 1/4-12	2.000	1 1/4-12	2.000	1 3/4-12	2.000	0.750	1.500



## SS-MS Series Cylinders – 2 Stage Extend or Retract

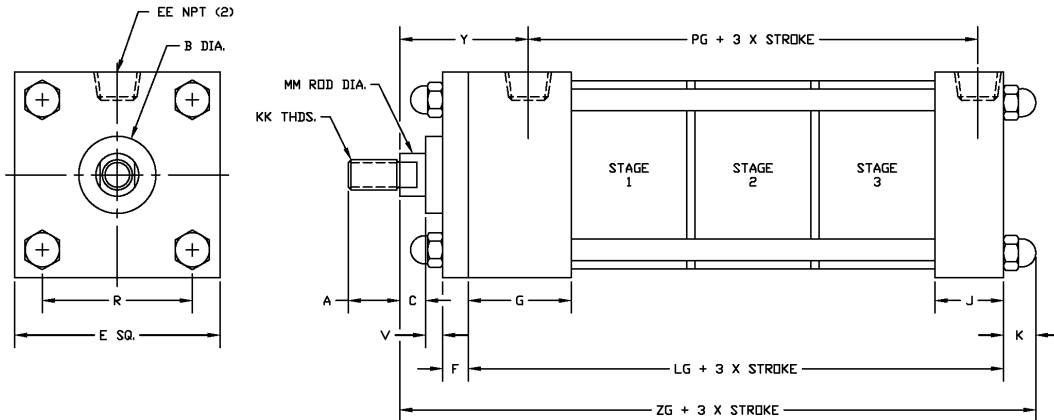
Standard Rod Diameter  
Basic Dimensions MX0



Bore	A	B	C	E	EE	F	G	J	K	KK	LE	MM	PE	R	V	Y	ZE
1.50	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.438	7/16-20	4.000	0.625	2.750	1.430	0.250	1.875	5.438
2.00	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.563	7/16-20	4.000	0.625	2.750	1.840	0.250	1.875	5.563
2.50	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.563	7/16-20	4.000	0.625	2.750	2.190	0.250	1.875	5.563
3.25	1.125	<b>1.500</b>	0.500	3.750	0.500	0.625	1.750	1.250	0.625	3/4-16	4.875	1.000	3.375	2.760	0.250	2.375	6.875
4.00	1.125	<b>1.500</b>	0.500	4.500	0.500	0.625	1.750	1.250	0.625	3/4-16	4.875	1.000	3.375	3.320	0.250	2.375	6.875
5.00	1.125	<b>1.500</b>	0.500	5.500	0.500	0.625	1.750	1.250	0.813	3/4-16	4.875	1.000	3.375	4.100	0.250	2.375	7.063
6.00	1.625	2.000	0.625	6.500	0.750	0.750	2.000	1.500	0.813	1-14	5.750	1.375	4.000	4.880	0.250	2.750	8.313

## SS-MS Series Cylinders – 3 Stage Extend or Retract

Standard Rod Diameter Basic Dimensions MX0

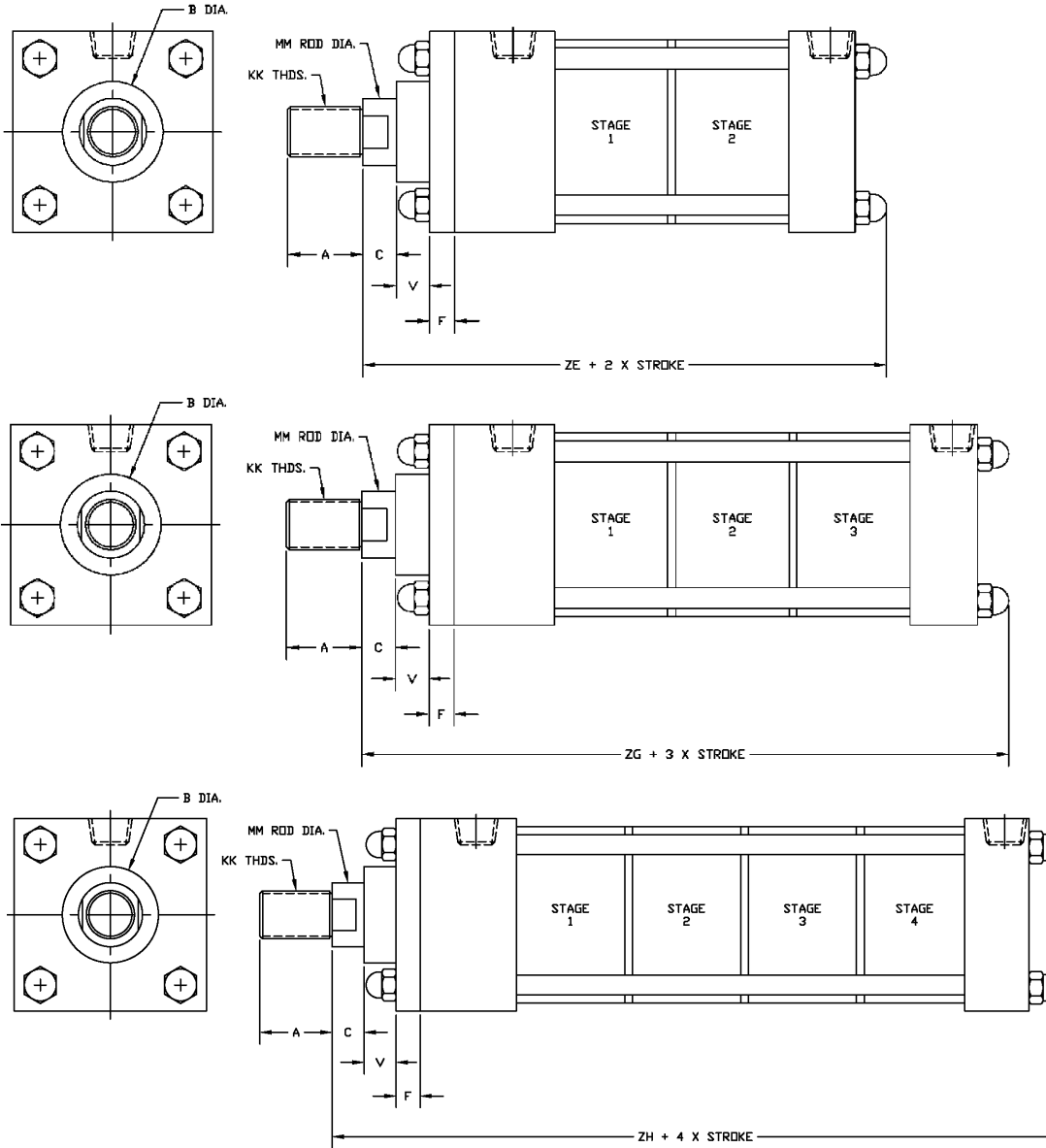


Bore	A	B	C	E	EE	F	G	J	K	KK	LG	MM	PG	R	V	Y	ZG
1.50	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.438	7/16-20	5.000	0.625	3.750	1.430	0.250	1.875	6.438
2.00	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.563	7/16-20	5.000	0.625	3.750	1.840	0.250	1.875	6.563
2.50	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.563	7/16-20	5.000	0.625	3.750	2.190	0.250	1.875	6.563
3.25	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.625	3/4-16	6.125	1.000	4.625	2.760	0.250	2.375	8.125
4.00	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.625	3/4-16	6.125	1.000	4.625	3.320	0.250	2.375	8.125
5.00	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.813	3/4-16	6.125	1.000	4.625	4.100	0.250	2.375	8.313
6.00	1.625	2.000	0.625	6.500	0.750	0.750	2.000	1.500	0.813	1-14	7.250	1.375	5.500	4.880	0.250	2.750	9.813

# How to Specify

## SS-MS Series Dimensions – Oversized Rod

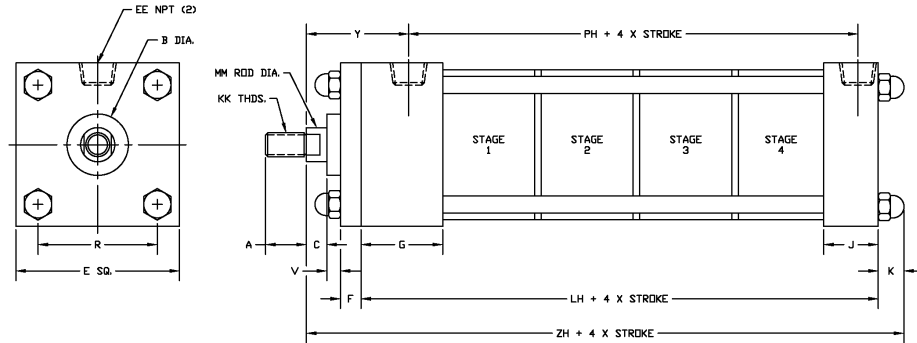
### Oversized Rod Diameter Basic Dimensions MX0 (No Mount)



Bore	Multi-Stage Oversize Rod Diameter							Add Stroke Per Stage		
	A	B	C	F	V	KK	MM	ZE	ZG	ZH
1.50	1.125	1.500	0.500	0.375	0.500	3/4-16	1.000	5.813	6.813	7.813
2.00	1.125	1.500	0.500	0.375	0.500	3/4-16	1.000	5.938	6.938	7.938
2.50	1.125	1.500	0.500	0.375	0.500	3/4-16	1.000	5.938	6.938	7.938
3.25	1.625	2.000	0.625	0.625	0.375	1-14	1.375	7.125	8.375	9.625
4.00	1.625	2.000	0.625	0.625	0.375	1-14	1.375	7.125	8.375	9.625
5.00	1.625	2.000	0.625	0.625	0.375	1-14	1.375	7.313	8.563	9.813
6.00	2.000	2.375	0.750	0.750	0.375	1 1/4-12	1.750	8.438	9.938	11.438

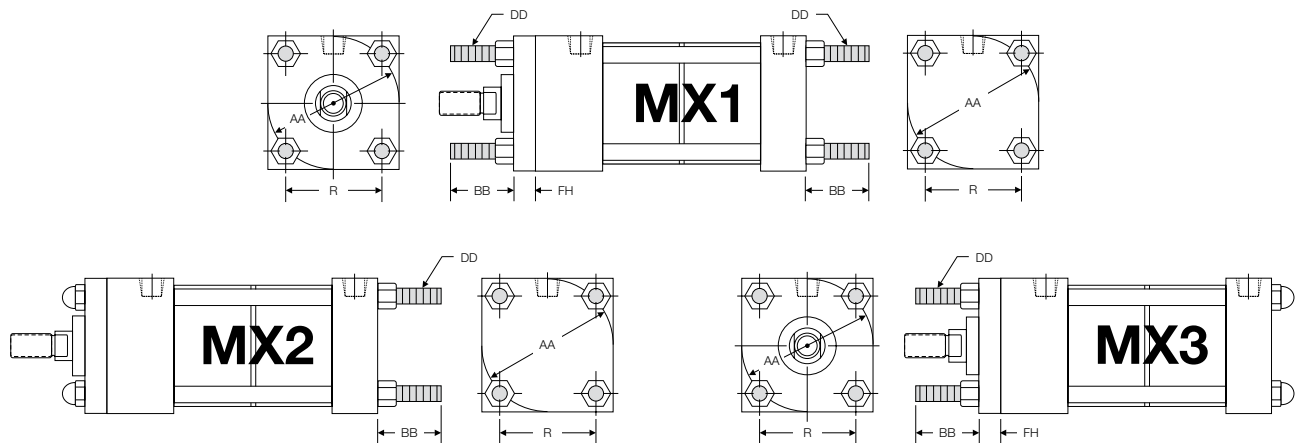
## SS-MS Series Cylinders – 4 Stage Extend or Retract

### Standard Rod Diameter Basic Dimensions MX0



Bore	A	B	C	E	EE	F	G	J	K	KK	LH	MM	PH	R	V	Y	ZH
1.50	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.438	7/16 -20	6.000	0.625	4.750	1.430	0.250	1.875	7.438
2.00	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.563	7/16 -20	6.000	0.625	4.750	1.840	0.250	1.875	7.563
2.50	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.563	7/16 -20	6.000	0.625	4.750	2.190	0.250	1.875	7.563
3.25	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.625	3/4 -16	7.375	1.000	5.875	2.760	0.250	2.375	9.375
4.00	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.625	3/4 -16	7.375	1.000	5.875	3.320	0.250	2.375	9.375
5.00	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.813	3/4 -16	7.375	1.000	5.875	4.100	0.250	2.375	9.563
6.00	1.625	2.000	0.625	6.500	0.750	0.750	2.000	1.500	0.813	1 -14	8.750	1.375	7.000	4.880	0.250	2.750	11.313

### SS Series Dimensions – SS-MS Dimensions

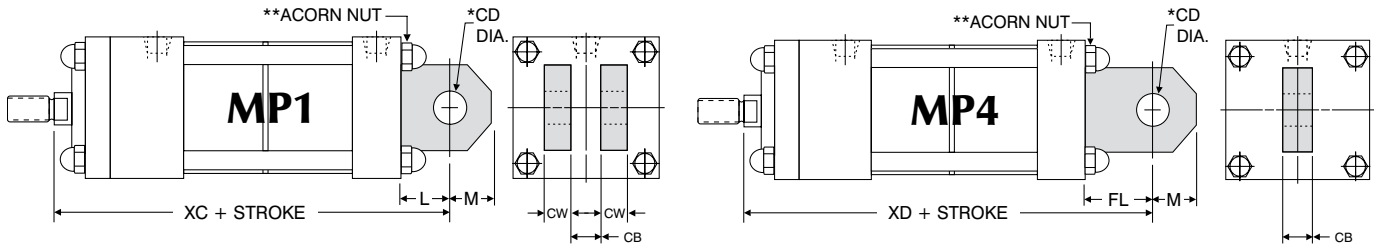


Tie Rod Extended MX1, MX2 & MX3 Mount Dimensions						
Bore	Rod Diameter	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4 -28	0.375	1.430
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16 -24	0.375	1.840
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16 -24	0.375	2.190
	1.000 Oversize					
3.25	1.000 Standard	3.900	1.375	3/8 -24	0.625	2.760
	1.375 Oversize					

Tie Rod Extended MX1, MX2 & MX3 Mount Dimensions						
Bore	Rod Diameter	AA	BB	DD	FH	R
4.00	1.000 Standard	4.700	1.375	3/8 -24	0.625	3.320
	1.375 Oversize					
5.00	1.000 Standard	5.800	1.813	1/2 -20	0.625	4.100
	1.375 Oversize					
6.00	1.375 Standard	6.900	1.813	1/2 -20	0.750	4.880
	1.750 Oversize					

# How to Specify

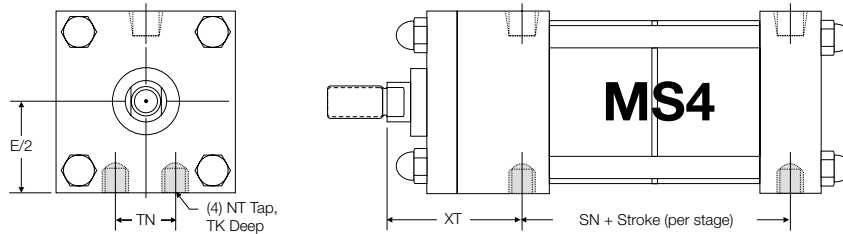
## SS-MS Series Dimensions – Pivot Mounts



Multi-Stage MP1 Clevis and MP4 Eye Mount Dimensions								Add Stroke Per Stage					
Bore	Rod Diameter	CB	CD	CW	FL	L	M	2 Stage		3 Stage		4 Stage	
								XC	XD	XC	XD	XC	XD
1.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	5.750	6.125	6.750	7.125	7.750	8.125
	1.000 Oversize							6.125	6.500	7.125	7.500	8.125	8.500
2.00	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	5.750	6.125	6.750	7.125	7.750	8.125
	1.000 Oversize							6.125	6.500	7.125	7.500	8.125	8.500
2.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.625	5.750	6.125	6.750	7.125	7.750	8.125
	1.000 Oversize							6.125	6.500	7.125	7.500	8.125	8.500
3.25	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	7.500	8.125	8.750	9.375	10.000	10.625
	1.375 Oversize							7.750	8.375	9.000	9.625	10.250	10.875
4.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	7.500	8.125	8.750	9.375	10.000	10.625
	1.375 Oversize							7.750	8.375	9.000	9.625	10.250	10.875
5.00	1.000 Standard	1.250	0.750	0.625	1.875	1.250	0.875	7.500	8.125	8.750	9.375	10.000	10.625
	1.375 Oversize							7.750	8.375	9.000	9.625	10.250	10.875
6.00	1.375 Standard	1.500	1.000	0.750	2.250	1.500	1.000	8.875	9.625	10.375	11.125	11.875	12.625
	1.750 Oversize							9.125	9.875	10.625	11.375	12.125	12.875

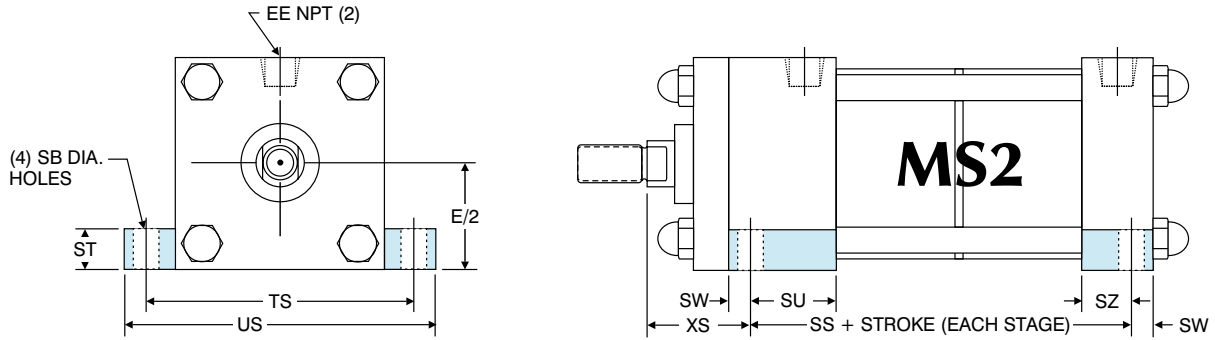
\*Clevis pin provided with MP1 and MP4 mounts.  
 \*\*Acorn nuts are located on cap end (4.00"-6.00" bores).

## SS-MS Series Dimensions – Base Mounts



MS4 Bottom Tapped Mount Dimensions									
Bore	Rod Diameter	E/2	NT	TK	TN	XT	SN + Stroke Per Stage		
							2 Stage	3 Stage	4 Stage
1.50	0.625 Standard	1.000	1/4 -20	0.375	0.625	1.938	2.625	3.625	4.625
	1.000 Oversize					2.313			
2.00	0.625 Standard	1.250	5/16 -18	0.500	0.875	1.938	2.625	3.625	4.625
	1.000 Oversize					2.313			
2.50	0.625 Standard	1.500	3/8 -16	0.625	1.250	1.938	2.625	3.625	4.625
	1.000 Oversize					2.313			
3.25	1.000 Standard	1.875	1/2 -13	0.750	1.500	2.438	3.250	4.500	5.750
	1.375 Oversize					2.688			
4.00	1.000 Standard	2.250	1/2 -13	0.750	2.063	2.438	3.250	4.500	5.750
	1.375 Oversize					2.688			
5.00	1.000 Standard	2.750	5/8 -11	1.000	2.688	2.438	3.250	4.500	5.750
	1.375 Oversize					2.688			
6.00	1.375 Standard	3.250	3/4 -10	1.125	3.250	2.813	3.875	5.375	6.875
	1.750 Oversize					3.063			

## SS-MS Series Dimensions – Base Mounts



**MS2 Side Lug Mount Dimensions**

Bore	Rod Diameter	E/2	SB	ST	SU	SW	SZ	TS	US	XS	SS + Stroke Per Stage		
											2 Stage	3 Stage	4 Stage
1.50	0.625 Standard	1.000	0.438	0.500	1.125	0.375	0.625	2.750	3.500	1.375	3.250	4.250	5.250
	1.000 Oversize												
2.00	0.625 Standard	1.250	0.438	0.500	1.125	0.375	0.625	3.250	4.000	1.375	3.250	4.250	5.250
	1.000 Oversize												
2.50	0.625 Standard	1.500	0.438	0.500	1.125	0.375	0.625	3.750	4.500	1.375	3.250	4.250	5.250
	1.000 Oversize												
3.25	1.000 Standard	1.875	0.563	0.750	1.250	0.500	0.750	4.750	5.750	1.875	3.875	5.125	6.375
	1.375 Oversize												
4.00	1.000 Standard	2.250	0.563	0.750	1.250	0.500	0.750	5.500	6.500	1.875	3.875	5.125	6.375
	1.375 Oversize												

\* SS dimensions increase 0.500" on double rod cylinders  
 Note: Overall lengths will change with the addition of non-rotating or magnetic pistons; consult factory.

## SS-MS Series Effective Piston Area/Force Chart

Bore	Stages	Effective Piston Area (Sq. In.)				Force in Lbs. at 60 PSI				Force in Lbs. at 100 PSI			
		Extend (MSE)		Retract (MSR)		Extend (MSE)		Retract (MSR)		Extend (MSE)		Retract (MSR)	
		Std. Rod Ø	Oversize Ø	Std. Rod Ø	Oversize Ø	Std. Rod Ø	Oversize Ø	Std. Rod Ø	Oversize Ø	Std. Rod Ø	Oversize Ø	Std. Rod Ø	Oversize Ø
1.50	2	3.228	2.749	2.922	1.964	193	164	175	117	322	274	292	196
	3	4.687	3.731	4.383	2.946	281	223	262	176	468	373	438	294
	4	6.150	4.713	5.844	3.928	369	282	350	235	615	471	584	392
2.00	2	5.974	5.499	5.668	4.714	358	329	340	282	597	549	566	471
	3	8.808	7.856	8.502	7.071	528	471	510	424	880	785	850	707
	4	11.642	10.213	11.336	9.428	698	612	680	565	1164	1021	1133	942
2.50	2	9.490	9.033	9.188	8.248	569	541	551	494	949	903	918	824
	3	14.080	13.157	13.782	12.372	844	789	826	742	1408	1315	1378	1237
	4	18.680	17.281	18.376	16.496	1120	1036	1102	989	1868	1728	1837	1649
3.25	2	15.807	15.107	15.022	13.622	948	906	901	817	1580	1510	1502	1362
	3	23.317	21.918	22.532	20.433	1399	1315	1351	1225	2331	2191	2253	2043
	4	30.828	28.729	30.043	27.244	1849	1723	1802	1634	3082	2872	3004	2724
4.00	2	24.347	23.647	23.562	22.166	1460	1418	1413	1329	2434	2364	2356	2216
	3	36.127	34.728	35.342	33.243	2167	2083	2120	1994	3612	3472	3534	3324
	4	47.908	45.809	47.123	44.324	2874	2748	2827	2659	4790	4580	4712	4432
5.00	2	38.485	37.785	37.700	36.3	2309	2267	2262	2178	3848	3778	3770	3630
	3	57.334	55.935	56.549	54.45	3440	3356	3392	3267	5733	5593	5654	5445
	4	76.184	74.085	75.399	72.6	4571	4445	4523	4356	7618	7408	7539	7260
6.00	2	55.065	54.143	53.582	51.736	3303	3248	3214	3104	5506	5414	5358	5136
	3	81.854	80.012	80.370	77.607	4911	4800	4822	4656	8185	8001	8037	7760
	4	108.644	105.881	107.16	103.476	6518	6352	6429	6208	10864	10588	10716	10347











# TAS Series Steel Cylinders

Bimba's TAS Series standard steel cylinders are built to handle the toughest, most abusive applications and keep going. Hard chrome-plated, honed I.D.s and durable walls that can resist the impacts of metal debris keep this NFPA actuator going through the toughest environments.



# Contents

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<b>187</b>	TAS (NFPA) Series Product Features
187	– Heavy-Duty Design For Reliable, Consistent Operation
187	– Operating Pressure
187	– Operating Temperature
187	– Performance Options

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<b>188</b>	How to Order
188	– Option Length Adder
189	– NFPA Mounts

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<b>190</b>	How to Specify
190	– Threads
191	– Basic Cylinder (MX0 Mount)
193	– Trunnion Mounts
195	– Extended Tie Rod Mounts
197	– Flange Mounts
200	– Base Mounts
201	– Lug Mounts
202	– Bottom Mounts
203	– Pivot Mounts
205	– Spherical Bearing Mount
206	– Basic Double Rod End Mounts
207	– Double Rod End Mounts

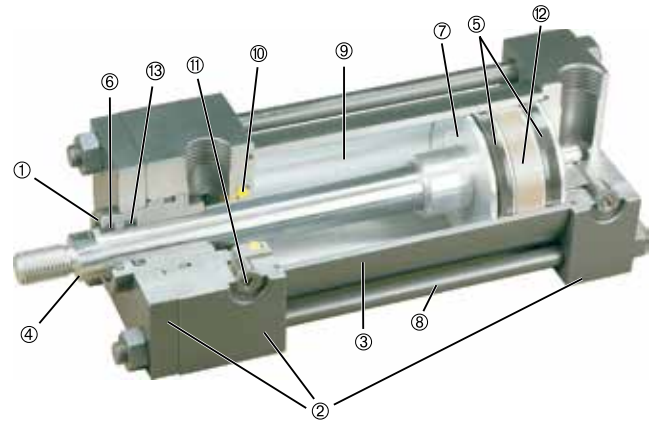
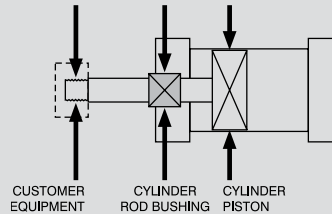
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## Series TAS (NFPA) Cylinder

### Floating Rod Bushing

**Self Alignment Feature:** Rod Bushing is designed to float .002" to improve bearing surface alignment.

- > Reduces cylinder drag and erratic operation
- > Reduces cylinder wear
- > Provides a minimum of 25% longer life than fixed rod bushing designs



## Heavy-Duty Design For Reliable, Consistent Operation

1. **Floating Rod Bushing** – Precision machined from 150,000 PSI rated graphite filled cast iron and PTFE coated to reduce friction and extend cycle life. Bushing design traps lubrication in effective bearing area.
2. **Head, Cap & Retainer** – Precision machined steel head, cap and retainer are held to close tolerances and ensure accurate alignment for a truly square cylinder.
3. **Cylinder Tube** – Precision machined steel tube with hard chrome ID, is honed and micro finished for extended seal life and improved cycle rates.
4. **Piston Rod** – Precision machined from high yield, polished and hard chrome plated steel.
5. **Piston Seals** – Heavy lip design Carboxylated Nitrile construction. Seals are pressure activated and wear compensating for extended life.
6. **Rod Wiper** – Urethane construction on 3.5" rod and under. Flocked Nitrile construction on the other rod diameters. External lip design prevents debris from entering cylinder.
7. **Piston** – Precision machined from 6061-T651 alloy aluminum, provides an excellent bearing surface for extended cylinder life.
8. **Tie Rods** – Pre-stressed high carbon steel tie rod construction eliminates axial loading of cylinder tube and maintains compression on tube and end seals.
9. **Permanent Lubrication** – Permanently lubricated with Magnalube-G PTFE based grease on all internal components. This is a non-migratory type high performance grease providing outstanding service life. No additional lubrication is required.
10. **Cushions** – (Options H & C) Floating cushion seal designed for maximum cushion performance, quick return stroke break-away and extended life.
11. **Cushion Adjustment Needle** – Adjustable steel needle design has fine thread metering and is positively captured to prevent needle ejection during adjustment.
12. **Wear Band** – 90% Virgin PTFE and 10% Polyphenylene Sulfide material provides extended life due to extremely low wear factor.
13. **Rod Seal** – Carboxylated Nitrile construction on 3.5" rod and under. Polyurethane construction on the other rod diameters. Both seals are pressure activated and wear compensating for extended life.
14. **Finish** – Black urethane paint.

## Operating Pressure

250 PSI Air (17 BAR)

## Operating Temperature

**Standard Seals:** -20°F to 200°F (-29°C to 93°C)

**Fluorocarbon:** 0°F to 400°F (-18°C to 204°C)

### Performance Options:

- > **ST** – Stop tubes are used to reduce rod bearing and piston stress (refer to pages 201-202 for cylinder design guidance).
- > **MA** – Micro-adjust provides a precision adjustment on the cylinder extend stroke, providing quick and accurate cylinder positioning, reducing set-up time.
- > **SSA** – Stainless steel piston rod, tie rods, nuts and fasteners provide corrosion resistance. Refer to Series 'SS' for a complete stainless steel solution.
- > **LF** – Low friction seals reduce breakaway and running friction. Effective at all operating pressures.

# How to Order

TAS SERIES STEEL CYLINDERS

## TAS - MF1 - 2.5 x 10 - HC - KK3

Series	TAS 250 PSI Air
Style	(Blank) Single Rod D Double Rod End

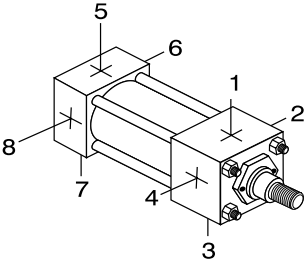
Bore	1.5 1.50" 2 2.00" 2.5 2.50" 3.25 3.25" 4 4.00" 5 5.00" 6 6.00" 8 8.00"
Stroke	0" to 120" Made-to-Order

Options	
A	Extended Piston Rod Thread (Example: A=2")
AS	Adjustable Stroke - Retract (Specify Length, Example: AS=4")
AO	Air / Oil Piston
B	0.250" Urethane Bumper Both Ends
BC	0.250" Urethane Bumper Cap Only
BH	0.250" Urethane Bumper Head Only
BP	Bumper Piston Seals
BSPP	British Standard Pipe Taper (Specify Size, Example: BSPP= 1/4)
BSPT	British Standard Pipe Parallel (Specify Size, Example: BSPP= 1/4)
C	Extended Piston Rod (Example: If C=0.50", Then 1" Rod Extension Is C=1.50")
CS	Center Support
EK	Extended Key Plate
KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3M	Female Metric Rod Thread
KK3S	Studded Piston Rod (KK3 With Stud, Locite In Place)
KK3X	Female Special Thread
KK4	Full Diameter Male Rod Thread
KK5	Blank Rod End (No Threads, A=0")
KK10	Rod Coupler End
KKM	Male Metric Thread
KKX	Male Special Thread
LF	Low Friction Seals
LT	Low Temperature Seals (Temp Rating: -30°F To 200°F)
LTE	Low Temperature Extreme Seals (Temp Rating: -65°F To 200°F)
MA	Micro-Adjust (12" Max. Stroke) Available On Double Rod Ends
MAB	Micro-Adjust With Sound Dampening Bumper (12" Max. Stroke)
MS	Metallic Rod Scraper (Brass Construction)
NR	Non-Rotating
OP	Optional Port Location (Example: OP=3,7)
OS	Oversize Rod Diameter (Specify Size, Example: OS=1.375")
PLS	Piston Lock Screw
PMC	Solid Cast Iron Piston
RBB	Rod Bushing Material: Bronze
SAE	SAE Ports (Specify Size, Example: SAE#6)
SE	Spring Extend
SR	Spring Retract
SSA	Stainless Steel Piston Rod, Tie Rods & Nuts, And Fasteners
SSC	Stainless Steel Cushion Needles
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods & Nuts
ST	Stop Tube Note: Specify Stop Tube Length (In Inches) Specify Stroke As ES (Effective Stroke) (Example: TAS MS4 2 X 24ES-ST=3")
TH	400 PSI Hyd. Non-Shock
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

NFPA Mounts	
MF1	Front Flange (1.50" - 6.00" Bore)
MF2	Rear Flange (1.50" - 6.00" Bore)
MF5	Front Square Flange (1.50" - 6.00" Bore)
MF6	Rear Square Flange (1.50" - 6.00" Bore)
ME3	Front Mounting Holes (8.00" Bore)
ME4	Rear Mounting Holes (8.00" Bore)
MP1	Rear Pivot Clevis (1.50" - 8.00" Bore)
MP2	Rear Pivot Clevis (1.50" - 6.00" Bore)
MP4	Rear Pivot Eye (1.50" - 6.00" Bore)
MS1	Front & Rear End Angle (1.50" - 8.00" Bore)
MS2	Side Lug (1.50" - 8.00" Bore)
MS4	Bottom Tapped Holes (1.50" - 8.00" Bore)
MT1	Front Trunnion (1.50" - 8.00" Bore)
MT2	Rear Trunnion (1.50" - 8.00" Bore)
MT4	Intermediate Trunnion (1.50" - 8.00" Bore)
MX0	No Mount (1.50" - 8.00" Bore)
MX1	Extended Tie Rods - Head & Cap (1.50" - 8.00" Bore)
MX2	Extended Tie Rods - Cap (1.50" - 8.00" Bore)
MX3	Extended Tie Rods - Head (1.50" - 8.00" Bore)
SB	Spherical Bearing Cap Pivot (1.50" - 8.00" Bore)

Cushions	
H	Head Cushion Position 2 Is Standard, Specify For Positions: 1, 3 & 4
LH	Long Head Cushion Position 2 Is Standard, Specify For Positions: 1, 3 & 4
C	Cap Cushion Position 6 Is Standard, Specify For Positions: 5, 7 & 8
LC	Long Cap Cushion Position 6 Is Standard, Specify For Positions: 5, 7 & 8
Fixed Cushions	
FCH	Fixed Head Cushion (Non-Adjustable, No Adjustment Needle)
FCC	Fixed Cap Cushion (Non-Adjustable, No Adjustment Needle)
FC	Fixed Head and Cap Cushion (Non-Adjustable, No Adjustment Needle)

Note: "L" Cushion Option Can Be Ordered As Fixed Cushions. Example: FCLH



### Standard Port and Cushion Adjustment Positions

- > Ports - Positions 1 and 5
- > Cushion Adjustment - Positions 2 and 6
- > Specify Non-Standard Positions When Ordering
- > Port Location 9 is Center of Cap Face.

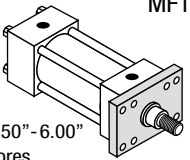
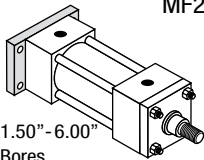
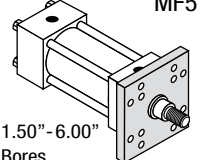
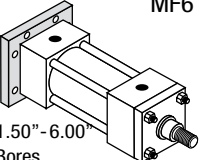
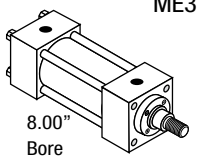
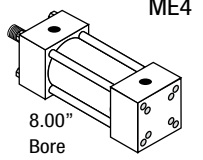
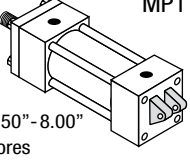
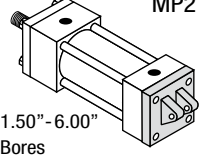
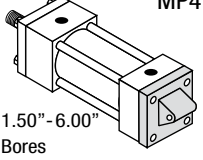
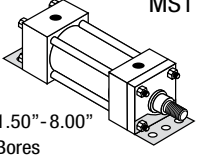
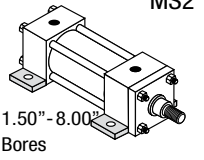
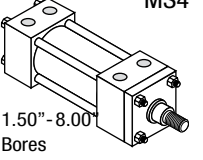
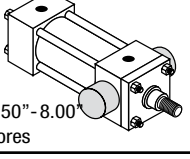
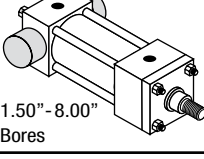
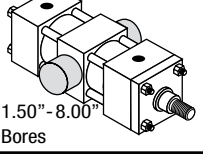
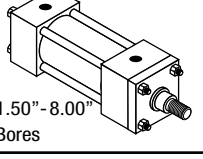
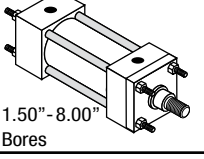
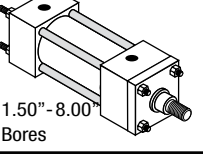
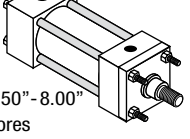
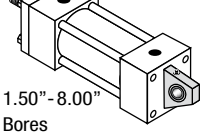
Note: Refer to Options for specifications.  
» Refer to Option Length Adder

Option Length Adder For Bumpers & Stop Tubes (Add To Catalog Basic Overall Length Dimensions)				
Bore	Option			
	B	BC	BH	ST* (Stop Tube) Example: ST=2
1.50	0.500	0.250	0.250	2
2.00	0.500	0.250	0.250	2
2.50	0.500	0.250	0.250	2
3.25	0.500	0.250	0.250	2
4.00	0.500	0.250	0.250	2
5.00	0.500	0.250	0.250	2
6.00	0.500	0.250	0.250	2
8.00	0.500	0.250	0.250	2

Maximum Stroke Recommendations			
Bore	No Center Support	With Center Supports (GS Option)	
		One Support	Two Supports
1.50", 2.00" & 2.50"	48 Inches	Over 48 Inches	Over 72 Inches
3.25", 4.00" & 5.00"	65 Inches	Over 65 Inches	Over 92 Inches
6.00"	72 Inches	Over 72 Inches	Not Required

See Options section (page XXX) for SE and SR adder options.

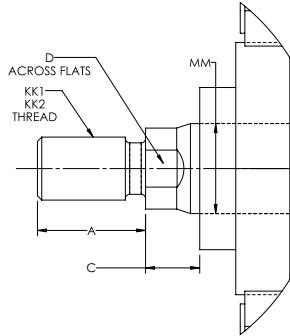
## NFPA Mounts

 <p><b>MF1</b> 1.50"-6.00" Bores</p>	 <p><b>MF2</b> 1.50"-6.00" Bores</p>	 <p><b>MF5</b> 1.50"-6.00" Bores</p>	 <p><b>MF6</b> 1.50"-6.00" Bores</p>	 <p><b>ME3</b> 8.00" Bore</p>	 <p><b>ME4</b> 8.00" Bore</p>
 <p><b>MP1</b> 1.50"-8.00" Bores</p>	 <p><b>MP2</b> 1.50"-6.00" Bores</p>	 <p><b>MP4</b> 1.50"-6.00" Bores</p>	 <p><b>MS1</b> 1.50"-8.00" Bores</p>	 <p><b>MS2</b> 1.50"-8.00" Bores</p>	 <p><b>MS4</b> 1.50"-8.00" Bores</p>
 <p><b>MT1</b> 1.50"-8.00" Bores</p>	 <p><b>MT2</b> 1.50"-8.00" Bores</p>	 <p><b>MT4</b> 1.50"-8.00" Bores</p>	 <p><b>MX0</b> 1.50"-8.00" Bores</p>	 <p><b>MX1</b> 1.50"-8.00" Bores</p>	 <p><b>MX2</b> 1.50"-8.00" Bores</p>
 <p><b>MX3</b> 1.50"-8.00" Bores</p>	 <p><b>SB</b> 1.50"-8.00" Bores</p>				

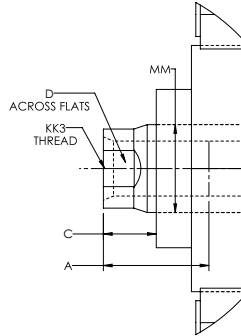
# How to Specify

## Series 'TAS' Dimensions – Threads

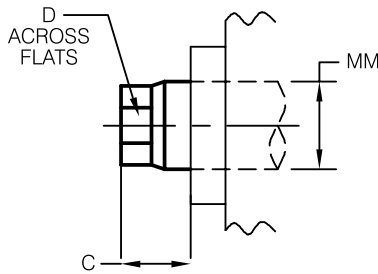
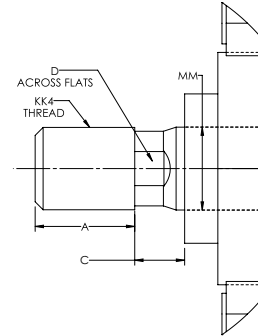
Style 1 & 2  
KK1 & KK2



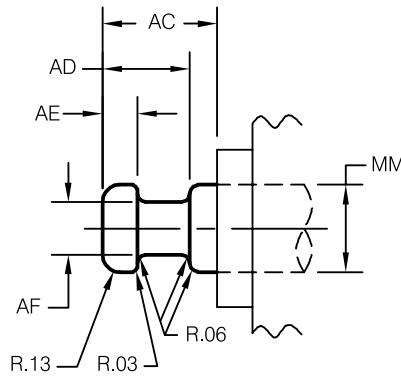
Style 3  
KK3



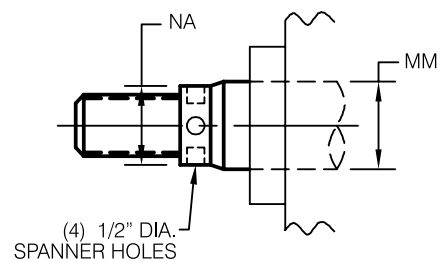
Style 4  
KK4



KK5



KK10



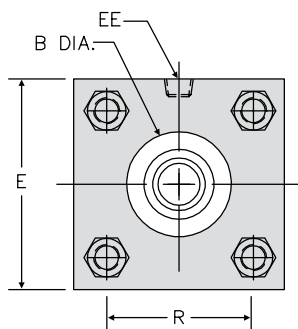
Spanner Holes  
(shown on KK1-KK2)

Rod Diameter (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4	NA ±.002
0.625	0.750	0.375	0.500	1.125	0.625	0.250	0.375	7/16 - 20	1/2 - 20	7/16 - 20	5/8 - 18	—
1.000	1.125	0.500	0.875	1.625	0.938	0.375	0.688	3/4 - 16	7/8 - 14	3/4 - 16	1 - 14	—
1.375	1.625	0.625	1.125	1.750	1.062	0.375	0.875	1 - 14	1 1/4 - 12	1 - 14	1 3/8 - 12	—
1.750	2.000	0.750	1.500	2.000	1.313	0.500	1.125	1 1/4 - 12	1 1/2 - 12	1 1/4 - 12	1 3/4 - 12	—
2.000	2.250	0.875	1.750	2.625	1.688	0.625	1.375	1 1/2 - 12	1 3/4 - 12	1 1/2 - 12	2 - 12	—
2.500	3.000	1.000	2.250	3.250	1.938	0.750	1.750	1 7/8 - 12	2 1/4 - 12	1 7/8 - 12	2 1/2 - 12	—
3.000	3.500	1.000	2.625	3.625	2.438	0.875	2.250	2 1/4 - 12	2 3/4 - 12	2 1/4 - 12	3 - 12	—
3.500	3.500	1.000	3.000	4.375	2.688	1.000	2.500	2 1/2 - 12	3 1/4 - 12	2 1/2 - 12	3 1/2 - 12	—
4.000	4.000	1.000	—	4.500	2.688	1.000	3.000	3 - 12	3 3/4 - 12	3 - 12	4 - 12	3.875
4.500	4.500	1.000	—	5.250	3.188	1.500	3.500	3 1/4 - 12	4 1/4 - 12	3 1/4 - 12	4 1/2 - 12	4.375
5.000	5.000	1.000	—	5.375	3.188	1.500	3.875	3 1/2 - 12	4 3/4 - 12	3 1/2 - 12	5 - 12	4.875
5.500	5.500	1.000	—	6.250	3.938	1.875	4.375	4 - 12	5 1/4 - 12	4 - 12	5 1/2 - 12	5.375

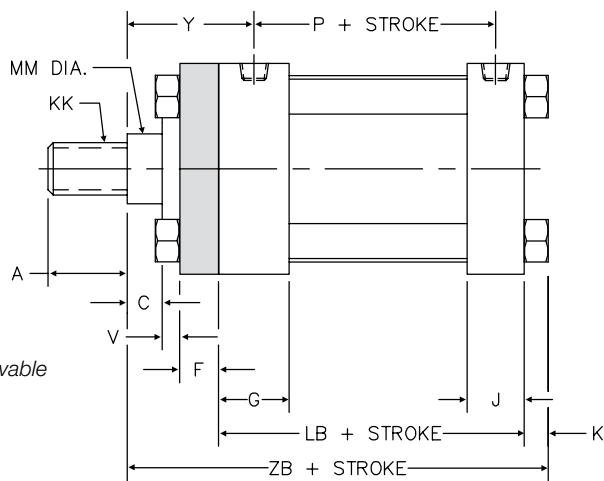
Four (4) wrench flats is an option.

Rods larger than 3.50" diameter utilize four (4) 0.50" diameter spanner holes 0.50" deep in place of wrench flats and also utilize rod end turn down above.

## Series TAS Dimensions – Basic Cylinder (MX0 Mount)

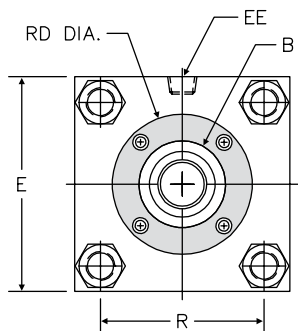


Note: Full square retainer is removable to service rod bushing.

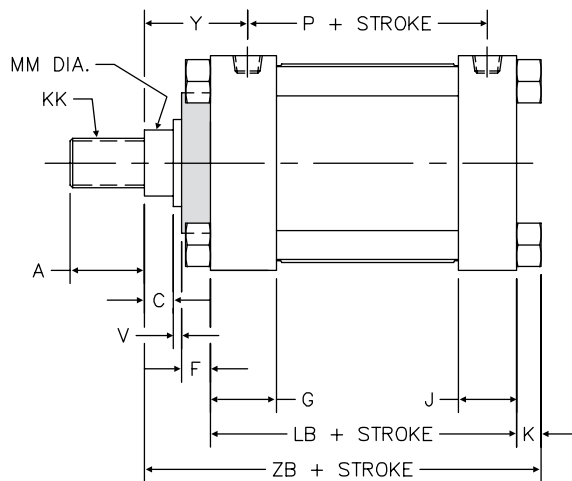


Full Square Retainer Used On:	
Bore	Rod Diameter
1.50	0.625
	1.000
2.00	0.625
	1.000
	1.375
2.50	0.625
	1.000
	1.375
	1.750
3.25	1.000
	1.375
	1.750
	2.000
	1.000
4.00	1.375
	1.750
	2.000
	2.500
	1.000
	1.375
	1.750
5.00	2.000
	2.500
	3.000
	3.500
	1.375
	1.750
6.00	2.000
	2.500
	3.000
	3.500
	4.000

### Round Retainer Construction



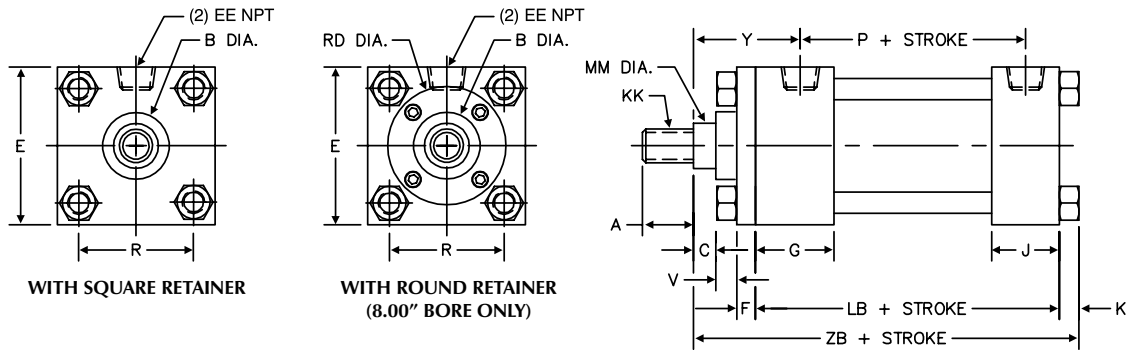
Note: Round retainer is removable to service rod bushing.



Round Retainer Used On:	
Bore	Rod Diameter
8.00	1.375
	1.750
	2.000
	2.500
	3.000
	3.500
	4.000
	4.500
	5.000
	5.500

# How to Specify

## Series TAS Dimensions – Basic Cylinder (MX0 Mount)



Bore	Rod Diameter (MM)	A	B	C	E	EE NPT	F	G	J	K	KK	LB	P	R	RD <sup>1</sup>	V	Y	ZB		
1.50	0.625	0.750	1.124	0.375	2.000	3/8	0.375	1.500	1.000	0.250		3.625	2.375	1.430	SQ	0.250	1.875	4.875		
	1.000	1.125	1.499	0.500												0.500	2.250	5.250		
2.00	0.625	0.750	1.124	0.375	2.500	3/8	0.375	1.500	1.000	0.313		3.625	2.375	1.840	SQ	0.250	1.875	4.938		
	1.000	1.125	1.499	0.500												0.500	2.250	5.313		
	1.375	1.625	1.999	0.625												0.625	2.500	5.563		
2.50	0.625	0.750	1.124	0.375	3.000	3/8	0.375	1.500	1.000	0.313		3.750	2.500	2.190	SQ	0.250	1.875	5.063		
	1.000	1.125	1.499	0.500												0.500	2.250	5.438		
	1.375	1.625	1.999	0.625												0.625	2.500	5.688		
	1.750	2.000	2.374	0.750												0.750	2.750	5.938		
3.25	1.000	1.125	1.499	0.500	3.750	1/2	0.625	1.750	1.250	0.375		4.250	2.750	2.760	SQ	0.250	2.375	6.000		
	1.375	1.625	1.999	0.625												0.375	2.625	6.250		
	1.750	2.000	2.374	0.750												0.500	2.875	6.500		
	2.000	2.250	2.624	0.875												0.500	3.000	6.625		
	1.000	1.125	1.499	0.500												0.250	2.375	6.000		
4.00	1.375	1.625	1.999	0.625	4.500	1/2	0.625	1.750	1.250	0.375		4.250	2.750	3.320	SQ	0.375	2.625	6.250		
	1.750	2.000	2.374	0.750												0.500	2.875	6.500		
	2.000	2.250	2.624	0.875												0.500	3.000	6.625		
	2.500	3.000	3.124	1.000												0.625	3.250	6.875		
	1.000	1.125	1.499	0.500												0.250	2.375	6.313		
5.00	1.375	1.625	1.999	0.625	5.500	1/2	0.625	1.750	1.250	0.438		4.500	3.000	4.100	SQ	0.375	2.625	6.563		
	1.750	2.000	2.374	0.750												0.500	2.875	6.813		
	2.000	2.250	2.624	0.875												0.500	3.000	6.983		
	2.500	3.000	3.124	1.000												0.625	3.250	7.188		
	3.000	3.500	3.749	1.000												0.625	3.250	7.188		
	3.500	3.500	4.249	1.000												0.625	3.250	7.188		
	1.375	1.625	1.999	0.625												0.250	2.750	7.063		
6.00	1.750	2.000	2.374	0.750	6.500	3/4	0.750	2.000	1.500	0.438		5.000	3.250	4.880	SQ	0.375	3.000	7.313		
	2.000	2.250	2.624	0.875												0.375	3.125	7.438		
	2.500	3.000	3.124	1.000												0.500	3.375	7.688		
	3.000	3.500	3.749	1.000												0.500	3.375	7.688		
	3.500	3.500	4.249	1.000												0.500	3.375	7.688		
	4.000	4.000	4.749	1.000												0.500	3.375	7.688		
	1.375	1.625	1.999	0.625												0.375	2.750	7.313		
	1.750	2.000	2.374	0.750												0.500	3.000	7.563		
8.00	2.000	2.250	2.624	0.875	8.500	3/4	0.750	2.000	1.500	0.563		5.125	3.375	6.440	SQ	0.500	0.500	3.125	7.688	
	2.500	3.000	3.124	1.000												0.500	0.500	3.375	7.938	
	3.000	3.500	3.749	1.000												0.500	0.500	3.375	7.938	
	3.500	3.500	4.249	1.000												0.500	0.500	3.375	7.938	
	4.000	4.000	4.749	1.000												0.500	0.500	3.375	7.938	
	4.500	4.500	5.249	1.000												0.500	0.500	3.375	7.938	
	5.000	5.000	5.749	1.000												0.500	0.500	3.375	7.938	
	5.500	5.500	6.249	1.000												0.500	0.500	3.375	7.938	
	2.000	2.250	2.624	0.875												0.625	3.500	0.375	2.750	7.313
	2.500	3.000	3.124	1.000												0.625	3.500	0.500	3.000	7.563

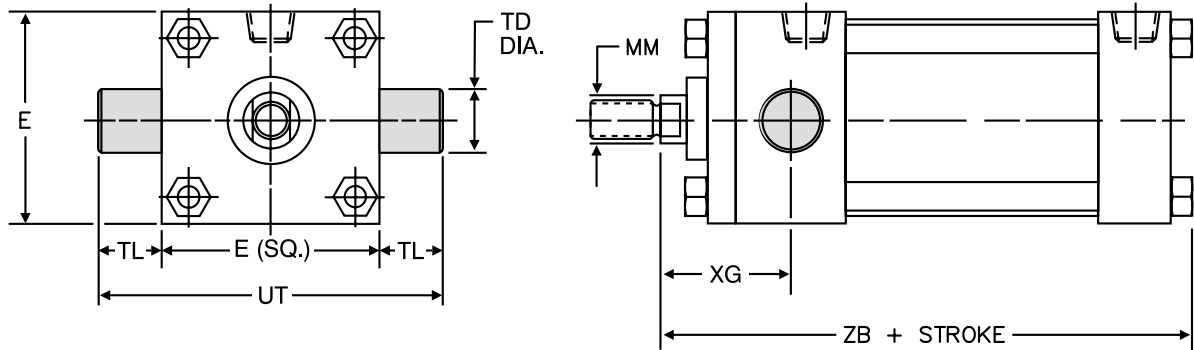
See Rod End Detail Chart On Page 160

<sup>1</sup> Where SQ is shown in chart, cylinder utilizes a full square retainer.

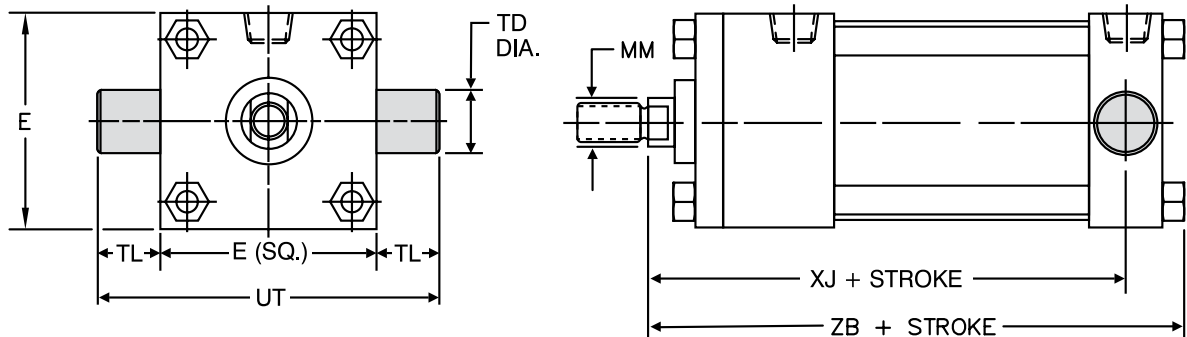


## Series TAS Dimensions – Trunnion Mounts

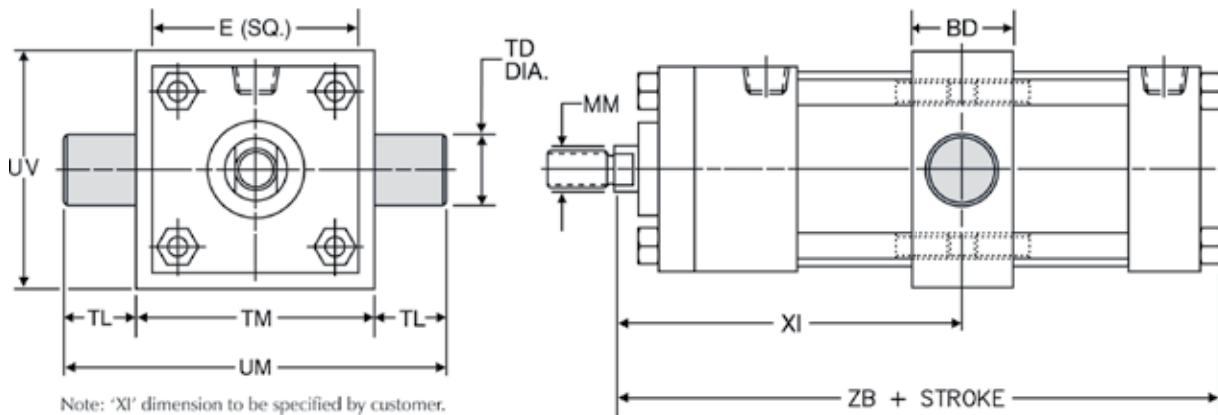
### MT1: Head Trunnion



### MT2: Cap Trunnion



### MT4: Intermediate Trunnion



'MT1', 'MT2', 'MT4' Standard Cushion Locations		
Mount	Head Cushion	Cap Cushion
MT1	3	6
MT2	2	7
MT4	2	6

Note: Ports or cushions cannot be on same side as MT1 & MT2 trunnions.

# How to Specify

## Series TAS Dimensions – Trunnion Mounts

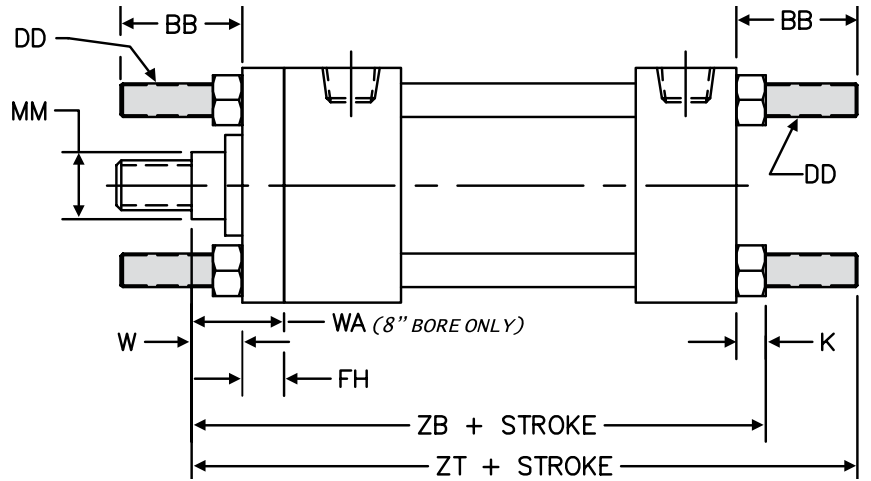
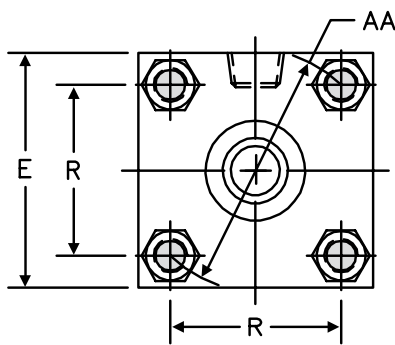
Bore	Rod Diameter (mm)	E	BD	TD <sup>1</sup>	TL	TM	UM	UT	UV	XG	XI <sup>2</sup>	MT4 Min. Stroke	Add To Stroke	
													XJ	ZB
1.50	0.625	2.000	1.250	1.000	1.000	2.500	4.500	4.000	2.500	1.750	3.250	0.375	4.125	4.875
	2.125									3.625	4.500		5.250	
2.00	0.625	2.500	1.500	1.000	1.000	3.000	5.000	4.500	3.000	1.750	3.375	0.625	4.125	4.938
	2.125									3.750	4.500		5.313	
	2.375									4.000	4.750		5.563	
2.50	0.625	3.000	1.500	1.000	1.000	3.500	5.500	5.000	3.500	1.750	3.375	0.500	4.250	5.063
	2.125									3.750	4.625		5.438	
	2.375									4.000	4.875		5.688	
	2.625									4.250	5.125		5.938	
3.25	1.000	3.750	2.000	1.000	1.000	4.500	6.500	5.750	4.250	2.250	4.250	1.000	5.000	6.000
	1.375									2.500	4.500		5.250	6.250
	1.750									2.750	4.750		5.500	6.500
	2.000									2.875	4.875		5.625	6.625
	2.250									2.250	4.250		5.000	6.000
4.00	1.375	4.500	2.000	1.000	1.000	5.250	7.250	6.500	5.000	2.500	4.500	1.000	5.250	6.250
	1.750									2.750	4.750		5.500	6.500
	2.000									2.875	4.875		5.625	6.625
	2.500									3.125	5.125		5.875	6.875
	1.000									2.250	4.250		5.250	6.313
5.00	1.375	5.500	2.000	1.000	1.000	6.250	8.250	7.500	6.000	2.500	4.500	0.750	5.500	6.563
	1.750									2.750	4.750		5.750	6.813
	2.000									2.875	4.875		5.875	6.938
	2.500									3.125	5.125		6.125	7.188
	3.000									3.125	5.125		6.125	7.188
	3.500									3.125	5.125		6.125	7.188
6.00	1.375	6.500	2.000	1.375	1.375	7.625	10.375	9.250	7.000	2.625	4.750	0.750	5.875	7.063
	1.750									2.875	5.000		6.125	7.313
	2.000									3.000	5.125		6.250	7.438
	2.500									3.250	5.375		6.500	7.688
	3.000									3.250	5.375		6.500	7.688
	3.500									3.250	5.375		6.500	7.688
	4.000									3.250	5.375		6.500	7.688
	1.375									2.625	5.000		6.000	7.313
8.00	1.750	8.500	2.500	1.375	1.375	9.750	12.500	11.250	9.500	2.875	5.250	1.125	6.250	7.563
	2.000									3.000	5.375		6.375	7.688
	2.500									3.250	5.625		6.625	7.938
	3.000									3.250	5.625		6.625	7.938
	3.500									3.250	5.625		6.625	7.938
	4.000									3.250	5.625		6.625	7.938
	4.500									3.250	5.625		6.625	7.938
	5.000									3.250	5.625		6.625	7.938
	5.500									3.250	5.625		6.625	7.938

<sup>1</sup> 'TD' dimension tolerance is + .000 / - .001

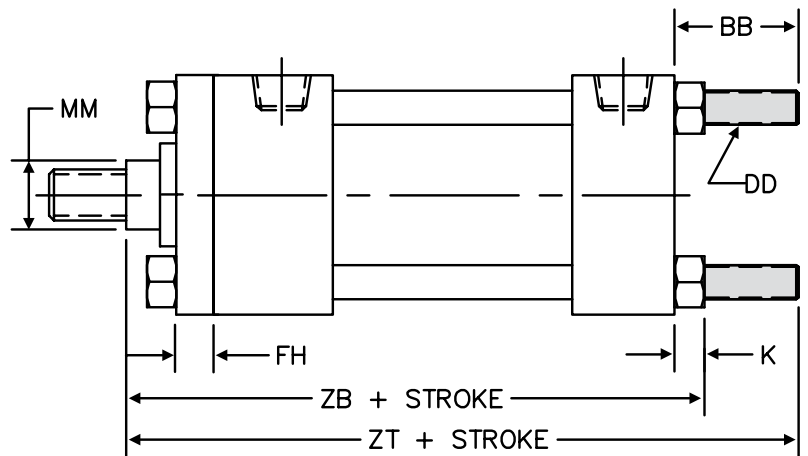
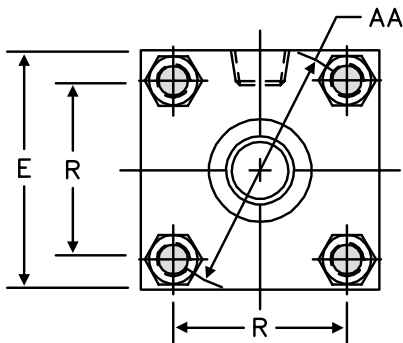
<sup>2</sup> 'XI' dimension is the minimum that can be supplied and leaves 1/8" gap between head & trunnion block; customer to specify 'XI' dimension.

## Series TAS Dimensions – Extended Tie Rod Mounts

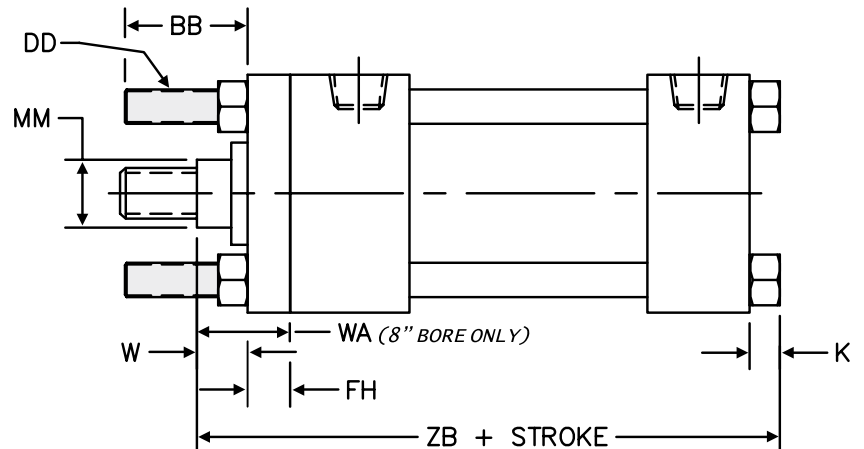
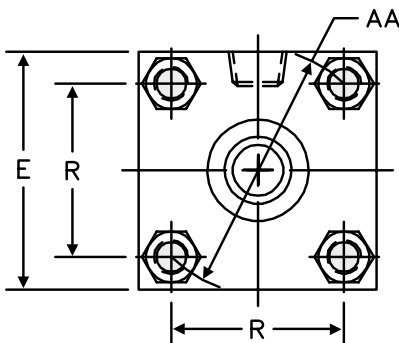
MX1: Extended Tie-Rods - Head & Cap



MX2: Extended Tie-Rods - Cap End



MX3: Extended Tie-Rods - Head End



# How to Specify

## Series TAS Dimensions – Extended Tie Rod Mounts

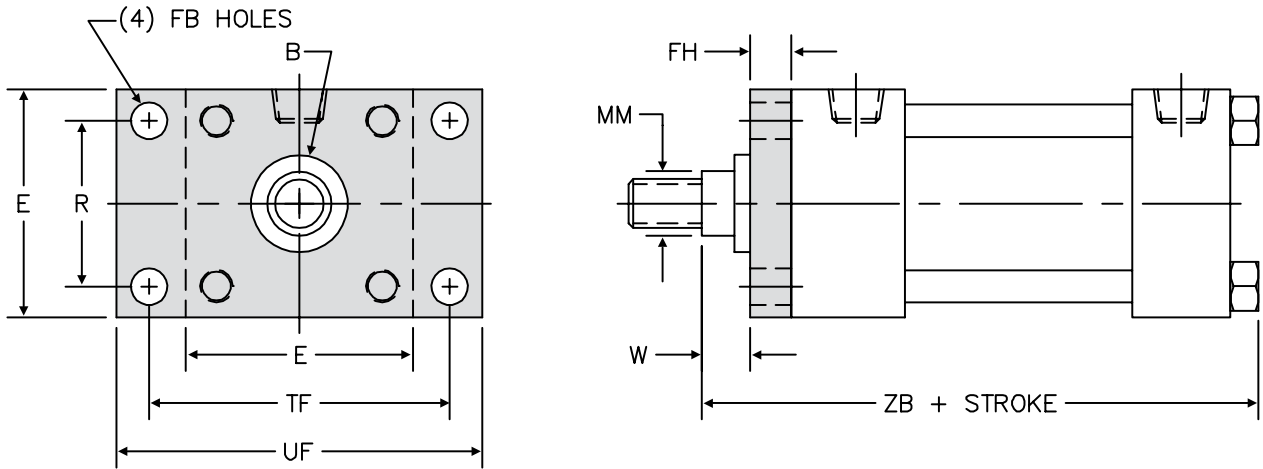
Bore	Rod Dia. (mm)	E	FH	AA	BB	DD	K	R	RD <sup>1</sup>	W or WA (8")	Add To Stroke	
											ZB	ZT
1.50	0.625	2.000	0.375	2.020	1.000	1/4 - 28	0.250	1.430	SQ	0.625	4.875	5.625
	1.000									5.250	6.000	
2.00	0.625	2.500	0.375	2.600	1.125	5/16 - 24	0.313	1.840	SQ	0.625	4.938	5.750
	1.000									5.313	6.125	
	1.375									5.563	6.375	
2.50	0.625	3.000	0.375	3.100	1.125	5/16 - 24	0.313	2.190	SQ	0.625	5.063	5.875
	1.000									5.438	6.250	
	1.375									5.688	6.500	
	1.750									5.938	6.750	
3.25	1.000	3.750	0.625	3.900	1.375	3/8 - 24	0.375	2.760	SQ	0.750	6.000	7.000
	1.375									6.250	7.250	
	1.750									6.500	7.500	
	2.000									6.625	7.625	
	1.000									6.000	7.000	
4.00	1.375	4.500	0.625	4.700	1.375	3/8 - 24	0.375	3.320	SQ	1.000	6.250	7.250
	1.750									6.500	7.500	
	2.000									6.625	7.625	
	2.500									6.875	7.875	
	1.000									6.000	7.000	
	1.375									6.250	7.250	
5.00	1.750	5.500	0.625	5.800	1.813	1/2 - 20	0.438	4.100	SQ	0.750	6.313	7.688
	2.000									6.563	7.938	
	2.500									6.813	8.188	
	3.000									6.938	8.313	
	3.500									7.188	8.563	
	1.625									7.188	8.563	
	1.625									7.188	8.563	
6.00	1.375	6.500	0.750	6.900	1.813	1/2 - 20	0.438	4.880	SQ	0.875	7.063	8.438
	1.750									7.313	8.688	
	2.000									7.438	8.813	
	2.500									7.688	9.063	
	3.000									7.688	9.063	
	3.500									7.688	9.063	
	4.000									7.688	9.063	
	1.500									7.688	9.063	
8.00	1.375	8.500	0.625	9.100	2.3132	5/8 - 18	0.563	6.440	SQ	3.500	1.625	7.313
	1.750									1.875	7.563	
	2.000									2.000	7.688	
	2.500									2.250	7.938	
	3.000									2.250	7.938	
	3.500									2.250	7.938	
	4.000									2.250	7.938	
	4.500									2.250	7.938	
	5.000									2.250	7.938	
	5.500									2.250	7.938	

<sup>1</sup>Where SQ is shown in chart, cylinder utilizes a full square retainer.

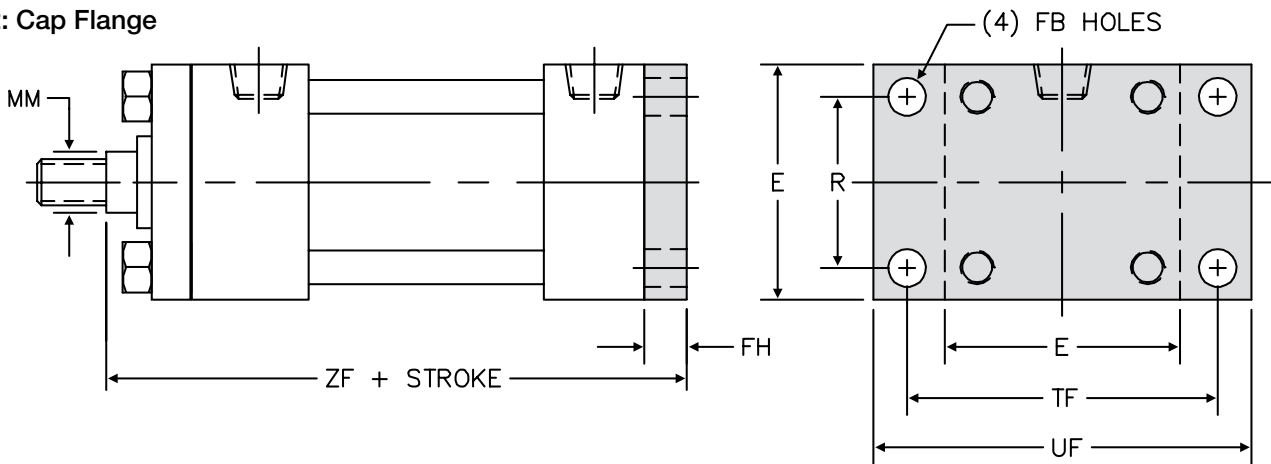
<sup>2</sup>Round retainer used to retain bushing, not a full front plate as other bores. 'BB' is dimension from head on the 8.00" bore.

## Series TAS Dimensions – Flange Mounts

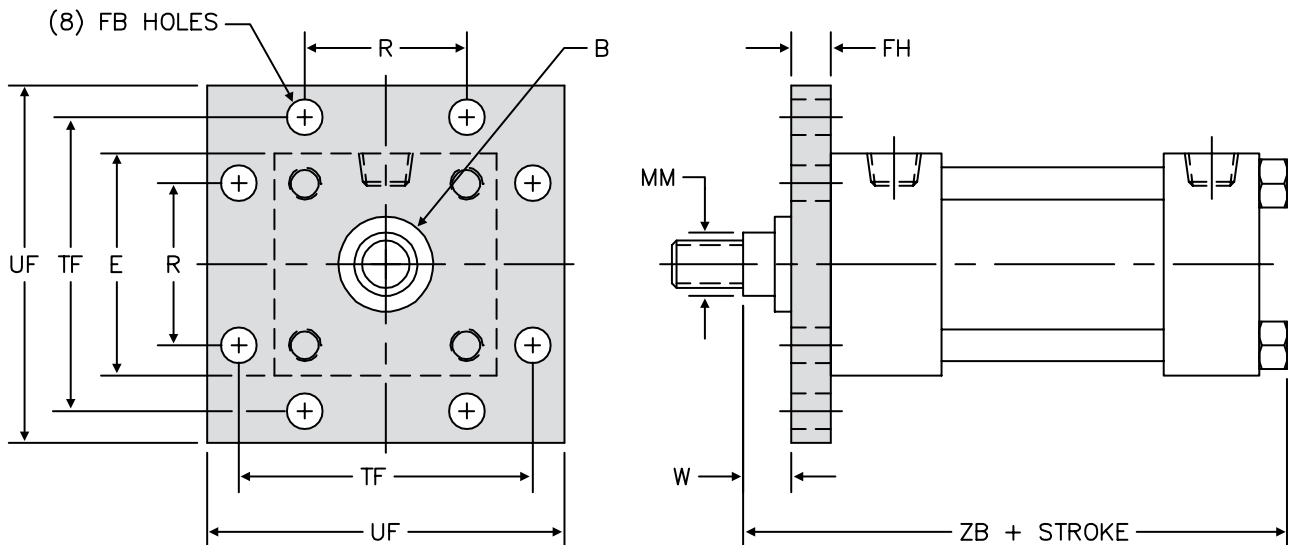
### MF1: Head Flange



### MF2: Cap Flange



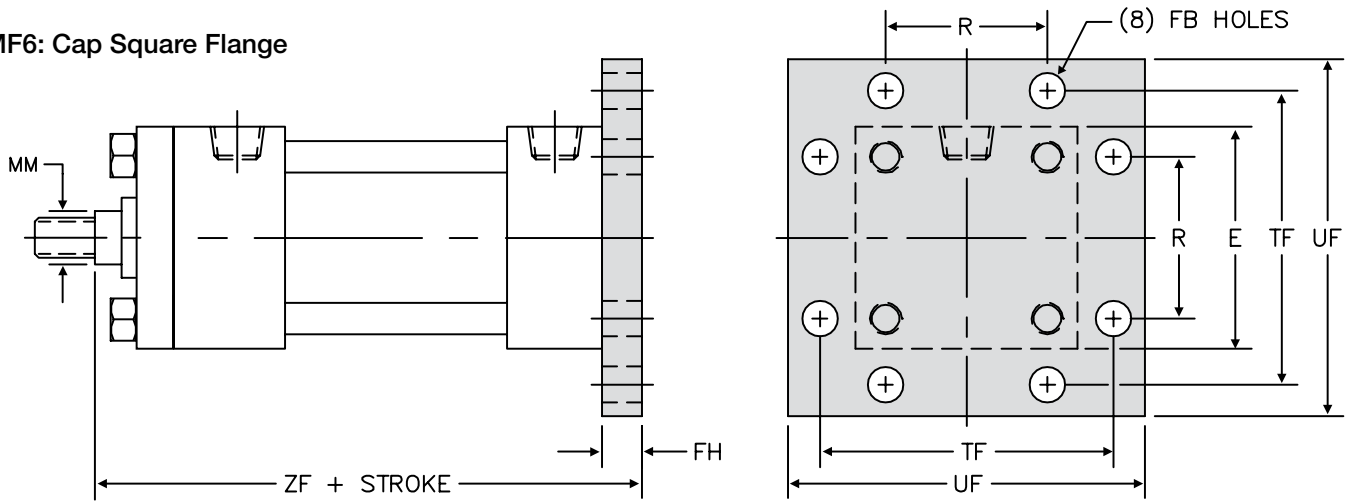
### MF5: Head Square Flange



# How to Specify

## Series TAS Dimensions – Flange Mounts

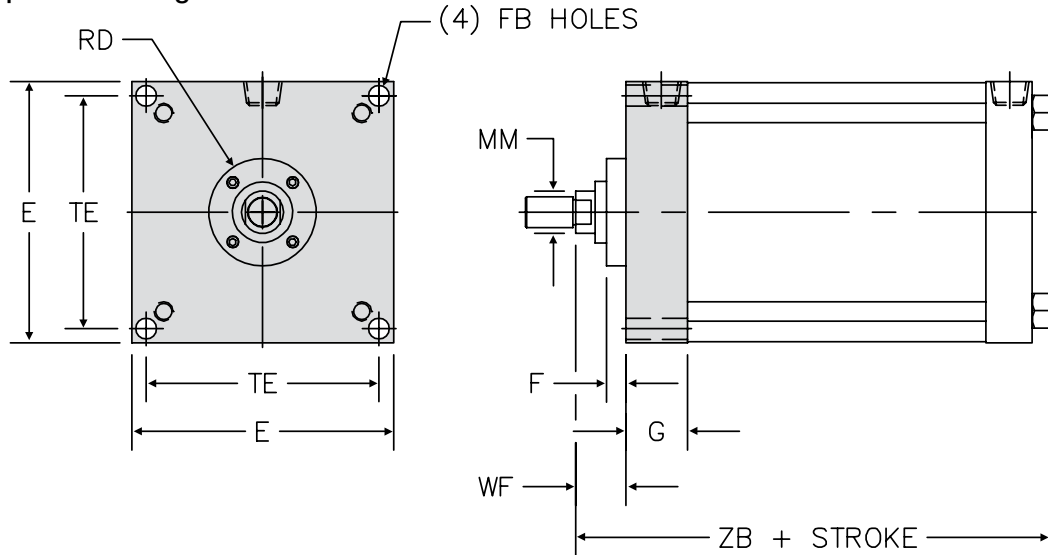
MF6: Cap Square Flange



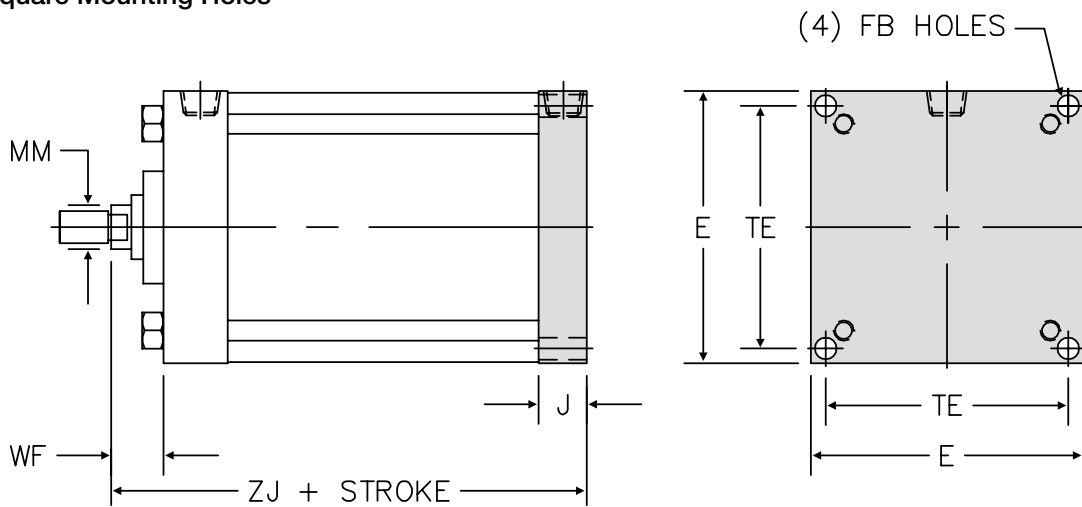
Bore	Rod Diameter (mm)	B	E	FB	FH	R	TF	UF	W	Add To Stroke	
										ZB	ZF
1.50	0.625	1.124	2.000	0.313	0.375	1.438	2.750	3.375	0.625	4.875	5.000
	1.000	1.499							1.000	5.250	5.375
2.00	0.625	1.124	2.500	0.375	0.375	1.844	3.375	4.125	0.625	4.938	5.000
	1.000	1.499							1.000	5.313	5.375
2.00	1.375	1.999	3.000	0.375	0.375	2.188	3.875	4.625	1.250	5.563	5.625
	0.625	1.124							0.625	5.063	5.125
2.50	1.000	1.499	3.000	0.375	0.375	2.188	3.875	4.625	1.000	5.438	5.500
	1.375	1.999							1.250	5.688	5.750
	1.750	2.374							1.500	5.938	6.000
3.25	1.000	1.499	3.750	0.438	0.625	2.766	4.688	5.500	0.750	6.000	6.250
	1.375	1.999							1.000	6.250	6.500
	1.750	2.374							1.250	6.500	6.750
	2.000	2.624							1.375	6.625	6.875
4.00	1.000	1.499	4.500	0.438	0.625	3.328	5.438	6.250	0.750	6.000	6.250
	1.375	1.999							1.000	6.250	6.500
	1.750	2.374							1.250	6.500	6.750
	2.000	2.624							1.375	6.625	6.875
	2.500	3.124							1.625	6.875	7.125
5.00	1.000	1.499	5.500	0.563	0.625	4.109	6.625	7.625	0.750	6.313	6.500
	1.375	1.999							1.000	6.563	6.750
	1.750	2.374							1.250	6.813	7.000
	2.000	2.624							1.375	6.938	7.125
	2.500	3.124							1.625	7.188	7.375
	3.000	3.749							1.625	7.188	7.375
6.00	1.375	1.999	6.500	0.563	0.750	4.875	7.625	8.625	0.875	7.063	7.375
	1.750	2.374							1.125	7.313	7.625
	2.000	2.624							1.250	7.438	7.750
	2.500	3.124							1.500	7.688	8.000
	3.000	3.749							1.500	7.688	8.000
	3.500	4.249							1.500	7.688	8.000
	4.000	4.749				1.500	7.688	8.000			

## Series TAS Dimensions – Flange Mounts

### ME3: Head Square Mounting Holes



### ME4: Cap Square Mounting Holes

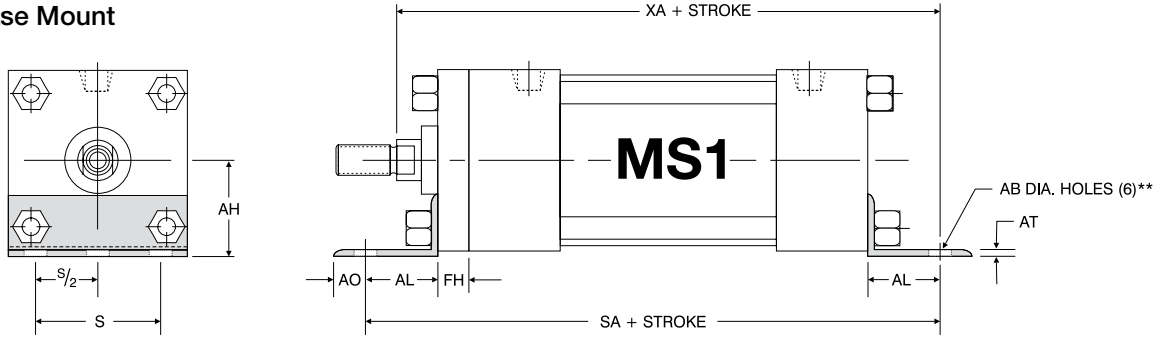


Bore	Rod Diameter (mm)	E	F	FB	G	J	TE	RD	WF	Add To Stroke	
										ZB	ZJ
8.00	1.375	8.500	0.625	0.688	2.000	1.500	7.570	3.500	1.625	7.313	6.750
	1.750		0.625					3.500	1.875	7.563	7.000
	2.000		0.625					5.000	2.000	7.688	7.125
	2.500		0.750					5.000	2.250	7.938	7.375
	3.000		0.750					5.250	2.250	7.938	7.375
	3.500		0.750					5.625	2.250	7.938	7.375
	4.000		0.750					6.500	2.250	7.938	7.375
	4.500		0.750					7.250	2.250	7.938	7.375
	5.000		0.750					7.500	2.250	7.938	7.375
	5.500		0.750					7.500	2.250	7.938	7.375

# How to Specify

## Series TAS Dimensions – Base Mounts

### MS1: Base Mount



'MS1' Angle Mount Dimensions

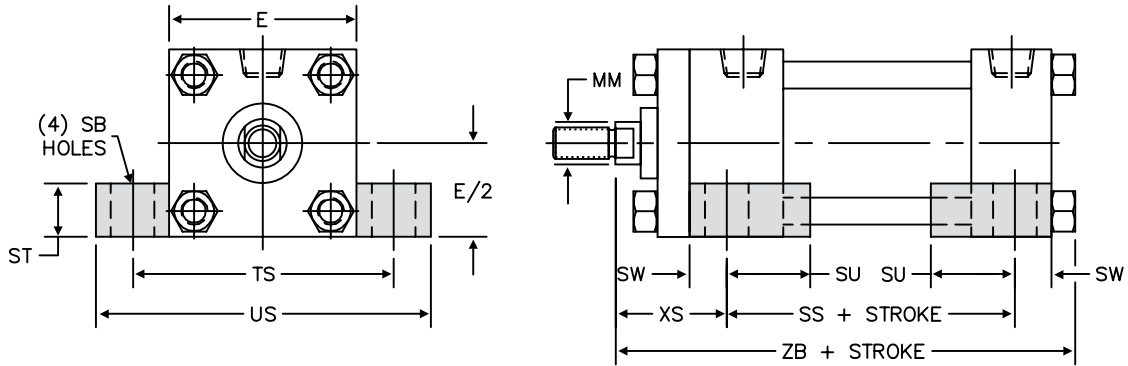
Bore	Rod Diameter (MM)	AB	AH	AL	AO	AT	FH	S	Add To Stroke	
									SA	XA
1.50	0.625	0.438	1.188	1.000	0.375	0.188	0.375	1.250	6.000	5.625
	1.000									6.000
2.00	0.625	0.438	1.438	1.000	0.375	0.188	0.375	1.750	6.000	5.625
	1.000									6.000
	1.375									6.250
2.50	0.625	0.438	1.625	1.000	0.375	0.188	0.375	2.250	6.125	5.750
	1.000									6.125
	1.375									6.375
	1.750									6.625
3.25	1.000	0.563	1.938	1.250	0.500	0.125	0.625	2.750	7.375	6.875
	1.375									7.125
	1.750									7.375
	2.000									7.500
	1.000									6.875
4.00	1.375	0.563	2.250	1.250	0.500	0.125	0.625	3.500	7.375	7.125
	1.750									7.375
	2.000									7.500
	2.500									7.750
	1.000									7.250
5.00	1.375	0.688	2.750	1.375	0.625	0.188	0.625	4.250	7.875	7.500
	1.750									7.500
	1.750									7.750
	2.000									7.875
	2.500									8.125
	3.000									8.125
6.00	1.375	0.813	3.250	1.375	0.625	0.188	0.750	5.250	8.500	8.125
	1.750									8.000
	2.000									8.250
	2.500									8.375
	3.000									8.625
	3.500									8.625
	4.000									8.625
8.00*	1.375	0.813	4.250	1.813	0.688	0.250	0.625	7.125	8.750	8.563
	1.750						0.625			8.813
	2.000						0.625			8.938
	2.500						0.750			9.188
	3.000						0.750			9.188
	3.500						0.750			9.188
	4.000						0.750			9.188
	4.500						0.750			9.188
	5.000						0.750			9.188
5.500	0.750	9.188								

\*8.00" bore utilizes a round retainer.  
 \*\*1.50" bore has (4) AB diameter holes.



## Series TAS Dimensions – Lug Mounts

### MS2: Side Lugs

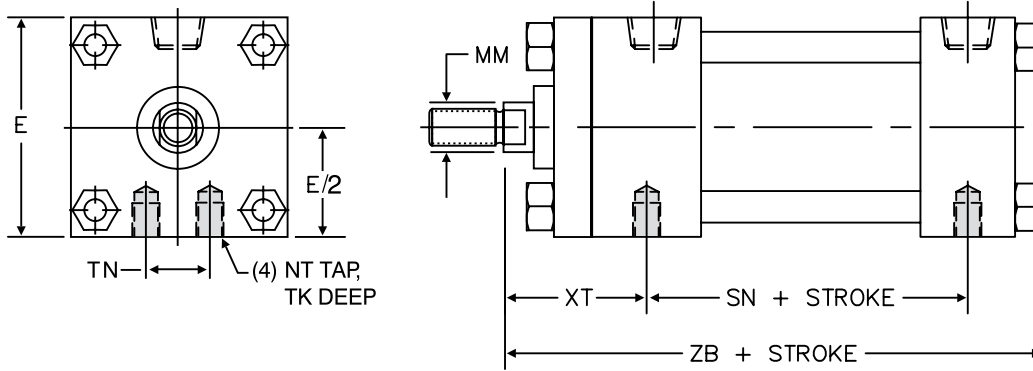


Bore	Rod Diameter (MM)	E	SB	ST	SU	SW	TS	US	XS	Add To Stroke	
										SS	ZB
1.50	0.625	2.000	0.438	0.500	1.125	0.375	2.750	3.500	1.375	2.875	4.875
	1.000								5.250		
2.00	0.625	2.500	0.438	0.500	1.125	0.375	3.250	4.000	1.375	2.875	4.938
	1.000								5.313		
	1.375								5.563		
2.50	0.625	3.000	0.438	0.500	1.125	0.375	3.750	4.500	1.375	3.000	5.063
	1.000								5.438		
	1.375								5.688		
	1.750								5.938		
3.25	1.000	3.750	0.563	0.750	1.250	0.500	4.750	5.750	1.875	3.250	6.000
	1.375								6.250		
	1.750								6.500		
	2.000								6.625		
	2.500								6.875		
4.00	1.000	4.500	0.563	0.750	1.250	0.500	5.500	6.500	2.125	3.250	6.250
	1.375								6.250		
	1.750								6.500		
	2.000								6.625		
	2.500								6.875		
	3.000								7.188		
5.00	1.000	5.500	0.813	1.000	1.063	0.688	6.875	8.250	2.063	3.125	6.313
	1.375								6.563		
	1.750								6.813		
	2.000								6.938		
	2.500								7.188		
	3.000								7.188		
	3.500								7.188		
6.00	1.375	6.500	0.813	1.000	1.313	0.688	7.875	9.250	2.313	3.625	7.063
	1.750								7.313		
	2.000								7.438		
	2.500								7.688		
	3.000								7.688		
	3.500								7.688		
	4.000								7.688		
	4.500								7.688		
8.00	1.375	8.500	0.813	1.000	1.313	0.688	9.875	11.250	2.313	3.750	7.313
	1.750								7.563		
	2.000								7.688		
	2.500								7.938		
	3.000								7.938		
	3.500								7.938		
	4.000								7.938		
	5.000								7.938		
5.500	7.938										

# How to Specify

## Series TAS Dimensions – Bottom Mounts

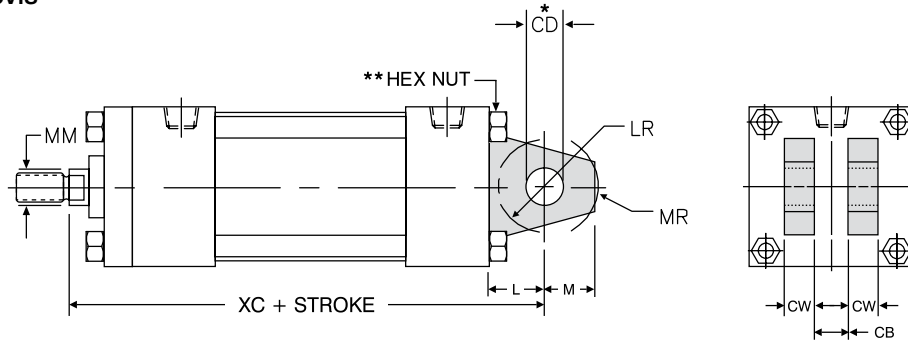
### MS4: Bottom Tapped Holes



Bore	Rod Diameter (MM)	E	NT	TN	TK	XT	Add To Stroke	
							SN	ZB
1.50	0.625	2.000	1/4- 20	0.625	0.375	1.938	2.250	4.875
	2.313					5.250		
2.00	0.625	2.500	5/16- 18	0.875	0.500	1.938	2.250	4.938
	0.500				2.313	5.313		
	0.375				2.563	5.563		
2.50	0.625	3.000	3/8 - 16	1.250	0.625	1.938	2.375	5.063
	0.625				2.313	5.438		
	0.438				2.563	5.688		
	0.375				2.813	5.938		
3.25	1.000	3.750	1/2 - 13	1.500	0.750	2.438	2.625	6.000
	0.750				2.688	6.250		
	0.500				2.938	6.500		
	0.500				3.063	6.625		
	0.750				2.438	6.000		
4.00	1.375	4.500	1/2 - 13	2.063	0.750	2.688	2.625	6.250
	0.750				2.938	6.500		
	0.750				3.063	6.625		
	0.625				3.313	6.875		
	1.000				2.438	6.313		
5.00	1.375	5.500	5/8 - 11	2.688	1.000	2.688	2.875	6.563
	1.750				2.938	6.813		
	2.000				3.063	6.938		
	2.500				3.313	7.188		
	3.000				0.750	3.313		7.188
	3.500				0.625	3.313		7.188
6.00	1.375	6.500	3/4 - 10	3.250	1.125	2.813	3.125	7.063
	1.750				3.063	7.313		
	2.000				3.188	7.438		
	2.500				3.438	7.688		
	3.000				3.438	7.688		
	3.500				3.438	7.688		
	4.000				1.000	3.438		7.688
8.00	1.375	8.500	3/4 - 10	4.500	1.125	2.813	3.250	7.313
	1.750					3.063		7.563
	2.000					3.188		7.688
	2.500					3.438		7.938
	3.000					3.438		7.938
	3.500					3.438		7.938
	4.000					3.438		7.938
	4.500					3.438		7.938
	5.000					3.438		7.938
5.500	3.438	7.938						

## Series TAS Dimensions – Pivot Mounts

### MP1: Rear Pivot Clevis



Bore	Rod Diameter (MM)	CB	CD	CW	E	L	LR	M	MR	Add To Stroke	
										XC	
1.50	0.625	0.750	0.500	0.500	2.000	0.750	0.750	0.500	0.625	5.375	
	1.000									5.750	
2.00	0.625	0.750	0.500	0.500	2.500	0.750	0.750	0.500	0.625	5.375	
	1.000									5.750	
2.50	1.375	0.750	0.500	0.500	3.000	0.750	0.750	0.500	0.625	6.000	
	0.625									5.500	
2.50	1.000	0.750	0.500	0.500	3.000	0.750	0.750	0.500	0.625	5.875	
	1.375									6.125	
3.25	1.750	1.250	0.750	0.625	3.750	1.250	1.000	0.875	0.938	6.375	
	1.000									6.875	
3.25	1.375	1.250	0.750	0.625	3.750	1.250	1.000	0.875	0.938	7.125	
	1.750									7.375	
4.00	2.000	1.250	0.750	0.625	4.500	1.250	1.000	0.875	0.938	7.500	
	1.000									6.875	
4.00	1.375	1.250	0.750	0.625	4.500	1.250	1.000	0.875	0.938	7.125	
	1.750									7.375	
5.00	2.500	1.250	0.750	0.625	5.500	1.250	1.000	0.875	0.938	7.750	
	1.000									7.125	
5.00	1.375	1.250	0.750	0.625	5.500	1.250	1.000	0.875	0.938	7.375	
	1.750									7.625	
6.00	3.000	1.500	1.000	0.750	6.500	1.500	1.250	1.000	1.188	8.000	
	1.375									8.125	
6.00	1.750	1.500	1.000	0.750	6.500	1.500	1.250	1.000	1.188	8.375	
	2.000									8.500	
8.00	2.500	1.500	1.000	0.750	8.500	1.500	1.250	1.000	1.188	8.750	
	3.000									8.750	
8.00	1.375	1.500	1.000	0.750	8.500	1.500	1.250	1.000	1.188	8.250	
	1.750									8.500	
8.00	2.000	1.500	1.000	0.750	8.500	1.500	1.250	1.000	1.188	8.625	
	2.500									8.875	
8.00	3.000	1.500	1.000	0.750	8.500	1.500	1.250	1.000	1.188	8.875	
	3.500									8.875	
8.00	4.000	1.500	1.000	0.750	8.500	1.500	1.250	1.000	1.188	8.875	
	5.000									8.875	
8.00	5.000	1.500	1.000	0.750	8.500	1.500	1.250	1.000	1.188	8.875	
	5.500									8.875	

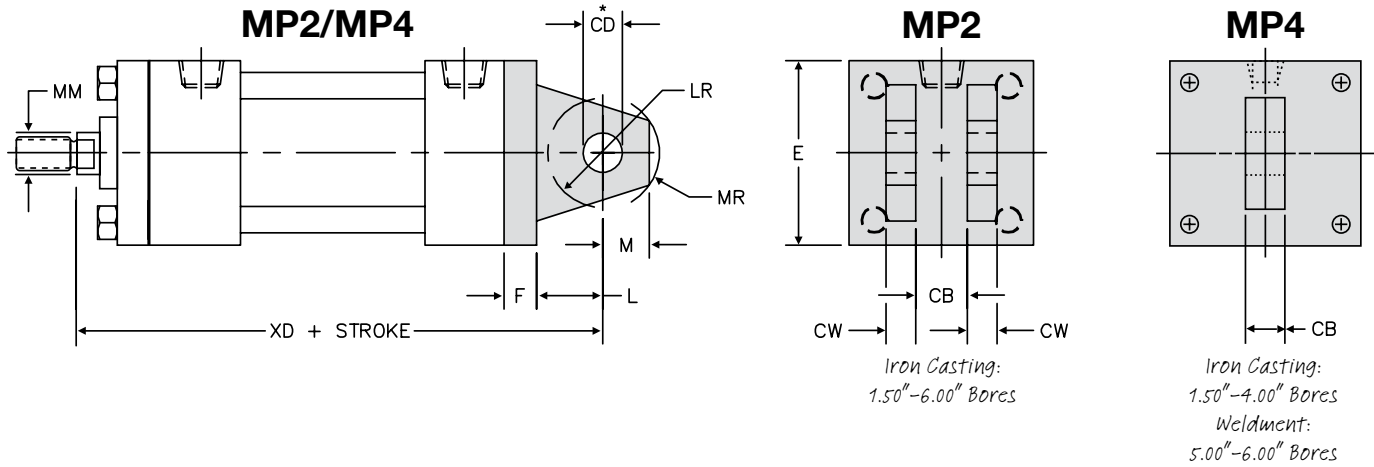
\*Clevis pins are provided with pivot mounts.

\*\*Hex nuts are located on cap end (4.00"-8.00" bores).

# How to Specify

## Series TAS Dimensions – Pivot Mounts

### MP2 & MP4: Rear Pivot Detachable Clevis

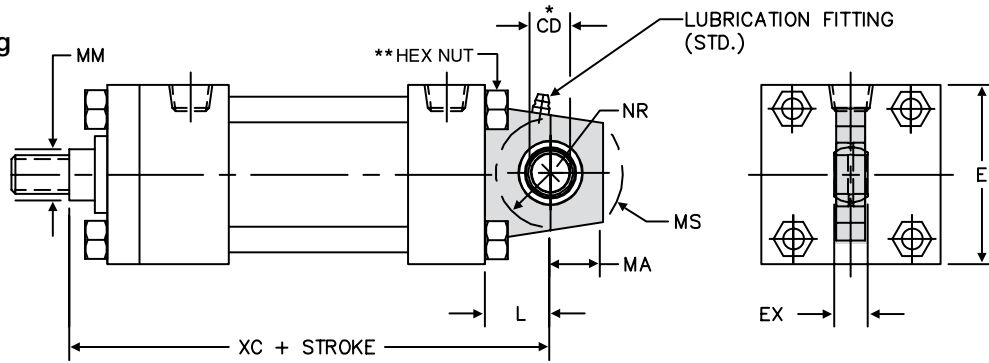


Bore	Rod Diameter (MM)	CB	CD	CW	E	F	L	LR	M	MR	Add To Stroke	
											XD	
1.50	0.625	0.750	0.500	0.500	2.000	0.375	0.750	0.750	0.500	0.625	5.750	
	1.000										6.125	
2.00	0.625	0.750	0.500	0.500	2.500	0.375	0.750	0.750	0.500	0.625	5.750	
	1.000										6.125	
	1.375										6.375	
2.50	0.625	0.750	0.500	0.500	3.000	0.375	0.750	0.750	0.500	0.625	5.875	
	1.000										6.250	
	1.375										6.500	
	1.750										6.750	
3.25	1.000	1.250	0.750	0.625	3.750	0.625	1.250	1.000	0.875	0.938	7.500	
	1.375										7.750	
	1.750										8.000	
	2.000										8.125	
	2.500										8.375	
4.00	1.000	1.250	0.750	0.625	4.500	0.625	1.250	1.000	0.875	0.938	7.500	
	1.375										7.750	
	1.750										8.000	
	2.000										8.125	
	2.500										8.375	
5.00	1.000	1.250	0.750	0.625	5.500	0.625	1.250	1.000	0.875	0.938	7.750	
	1.375										8.000	
	1.750										8.250	
	2.000										8.375	
	2.500										8.625	
	3.000										8.625	
6.00	1.375	1.500	1.000	0.750	6.500	0.750	1.500	1.250	1.000	1.188	8.875	
	1.750										9.125	
	2.000										9.250	
	2.500										9.500	
	3.000										9.500	
	3.500	9.500										
	4.000	9.500										

\*Clevis pins are provided with pivot mounts.

## Series TAS Dimensions – Spherical Bearing Mount

### SB: Spherical Bearing



Bore	Rod Diameter (MM)	CD	E	EX	L	MA	MS	NR	Add To Stroke
									XC
1.50	0.625	0.500	2.000	0.437	0.750	0.750	0.938	0.625	5.375
	1.000								5.750
2.00	0.625	0.500	2.500	0.437	0.750	0.750	0.938	0.625	5.375
	1.000								5.750
	1.375								6.000
2.50	0.625	0.500	3.000	0.437	0.750	0.750	0.938	0.625	5.500
	1.000								5.875
	1.375								6.125
	1.750								6.375
3.25	1.000	0.750	3.750	0.656	1.250	1.000	1.375	1.000	6.875
	1.375								7.125
	1.750								7.375
	2.000								7.500
4.00	1.000	0.750	4.500	0.656	1.250	1.000	1.375	1.000	6.875
	1.375								7.125
	1.750								7.375
	2.000								7.500
	2.500								7.750
5.00	1.000	0.750	5.500	0.656	1.250	1.000	1.375	1.000	7.125
	1.375								7.375
	1.750								7.625
	2.000								7.750
	2.500								8.000
	3.000								8.000
6.00	1.375	1.000	6.500	0.875	1.500	1.250	1.688	1.250	8.125
	1.750								8.375
	2.000								8.500
	2.500								8.750
	3.000								8.750
	3.500								8.750
	4.000								8.750
8.00	1.375	1.000	8.500	0.875	1.500	1.250	1.688	1.250	8.250
	1.750								8.500
	2.000								8.625
	2.500								8.875
	3.000								8.875
	3.500								8.875
	5.000								8.875
5.500	8.875								

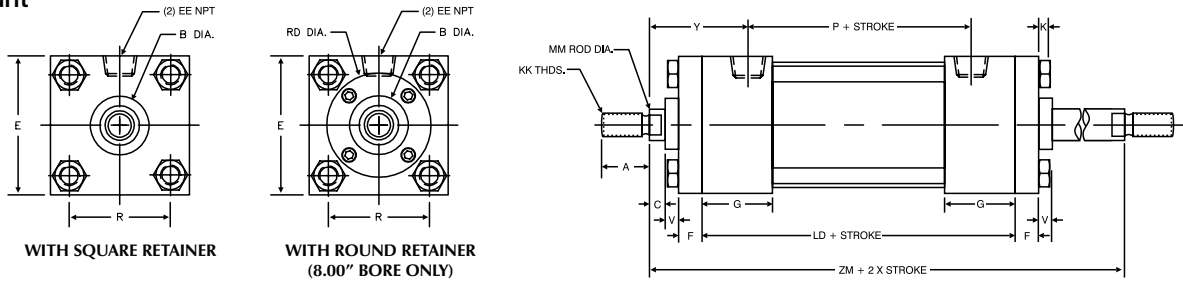
\*Clevis pins are provided with pivot mounts.  
 \*\*Hex nuts are located on cap end (3.25"-8.00" bores).

Note: Must specify KKK rod end if to be used with 'MSRE' series rod eye.

# How to Specify

## Series TAS Dimensions – Basic Double Rod End Mounts

### MX0D: No Mount



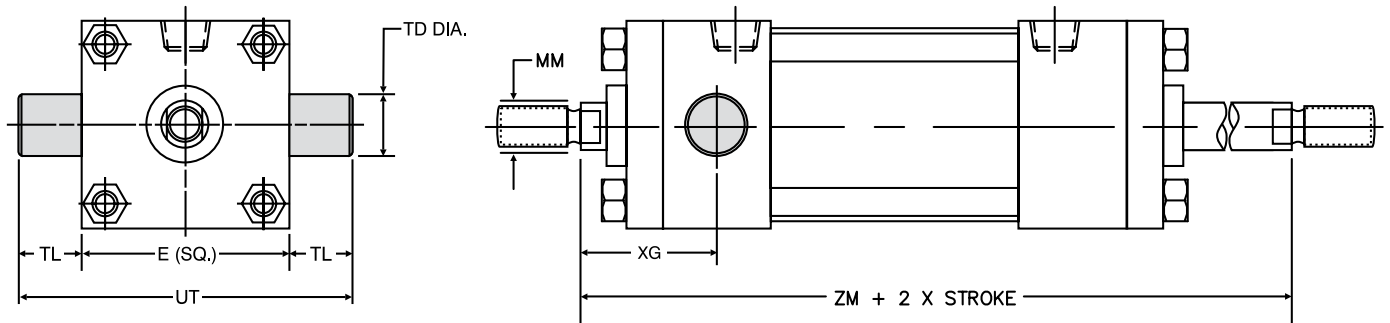
Bore	Rod Dia. (MM)	A	B	C	E	EE NPT	F	G	K	KK	LD	P	R	RD <sup>1</sup>	V	Y	ZM
1.50	0.625	0.750	1.124	0.375	2.000	3/8	0.375	1.500	0.250		4.125	2.375	1.438	SQ	0.250	1.875	6.125
	1.000	1.125	1.499	0.500											0.500	2.250	6.875
2.00	0.625	0.750	1.124	0.375	2.500	3/8	0.375	1.500	0.313		4.125	2.375	1.844	SQ	0.250	1.875	6.125
	1.000	1.125	1.499	0.500											0.500	2.250	6.875
2.50	1.375	1.625	1.999	0.625	3.000	3/8	0.375	1.500	0.313		4.250	2.500	2.188	SQ	0.625	2.500	7.375
	0.625	0.750	1.124	0.375											0.250	1.875	6.250
3.25	1.000	1.125	1.499	0.500	3.750	1/2	0.625	1.750	0.375		4.750	2.750	2.766	SQ	0.500	2.250	7.000
	1.375	1.625	1.999	0.625											0.625	2.500	7.500
4.00	1.750	2.000	2.374	0.750	4.500	1/2	0.625	1.750	0.375		4.750	2.750	3.328	SQ	0.750	2.750	8.000
	1.000	1.125	1.499	0.500											0.250	2.375	7.500
5.00	1.375	1.625	1.999	0.625	5.500	1/2	0.625	1.750	0.438		5.000	3.000	4.109	SQ	0.375	2.625	8.250
	2.000	2.250	2.624	0.875											0.500	2.875	8.750
6.00	1.750	2.000	2.374	0.750	6.500	3/4	0.750	2.000	0.438		5.500	3.250	4.875	SQ	0.500	3.000	9.000
	2.500	3.000	3.124	1.000											0.625	3.250	9.500
8.00	3.500	3.500	4.249	1.000	8.500	3/4	0.750	2.000	0.563		5.625	3.375	6.438	SQ	0.625	3.125	9.500
	1.375	1.625	1.999	0.625											0.250	2.750	8.875
8.00	1.750	2.000	2.374	0.750	8.500	3/4	0.750	2.000	0.563		5.625	3.375	6.438	SQ	0.375	3.000	9.375
	2.000	2.250	2.624	0.875											0.500	3.375	10.125
	2.500	3.000	3.124	1.000											0.500	3.375	10.125
	3.000	3.500	3.749	1.000											0.500	3.375	10.125
	3.500	3.500	4.249	1.000											0.500	3.375	10.125
	4.000	4.000	4.749	1.000											0.500	3.375	10.125
	4.500	4.500	5.249	1.000											0.500	3.375	10.125
	5.000	5.000	5.749	1.000											0.500	3.375	10.125
	5.500	5.500	6.249	1.000											0.500	3.375	10.125

See rod end detail chart on page 160

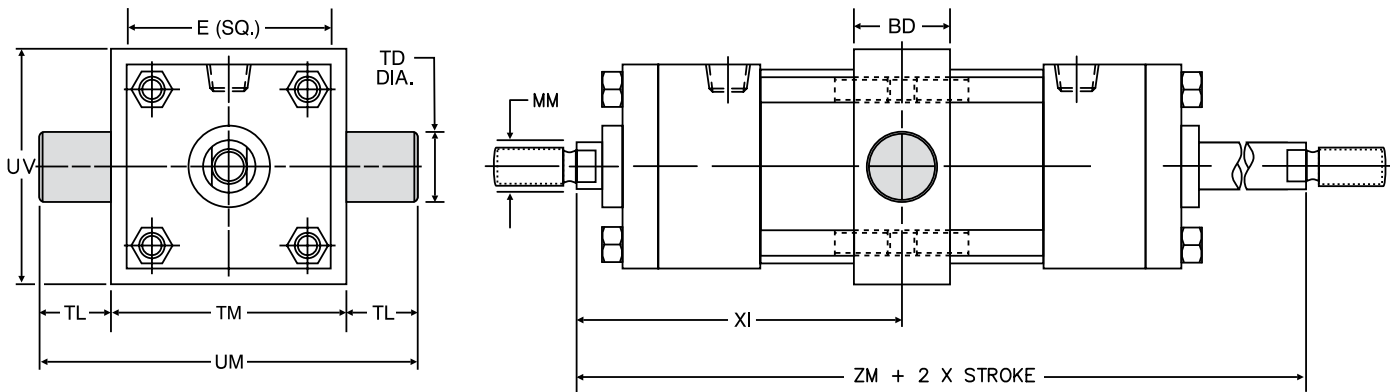
<sup>1</sup> Where SQ is shown in chart, cylinder utilizes a full square retainer.

## Series TAS Dimensions – Double Rod End Mounts

### MT1D: Head Trunnion



### MT4D: Intermediate Trunnion



**Note:** 'XI' dimensions to be specified by customer.

'MT1D', 'MT4D' Standard Cushion Locations		
Mount	Head Cushion	Cap Cushion
MT1D	3	6
MT4D	2	6

Note: Ports or cushions cannot be on same side as MT1D trunnions.

# How to Specify

## Series TAS Dimensions – Double Rod End Mounts

Bore	Rod Diameter (MM)	E	BD	TD <sup>1</sup>	TL	TM	UM	UT	UV	XG	XI <sup>2</sup>	MT4D Min. Stroke	Add 2X Stroke
													ZM
1.50	0.625	2.000	1.250	1.000	1.000	2.500	4.500	4.000	2.500	1.750	3.250	0.375	6.125
	1.000									2.125	3.625		6.875
2.00	0.625	2.500	1.500	1.000	1.000	3.000	5.000	4.500	3.000	1.750	3.375	0.625	6.125
	1.000									2.125	3.750		6.875
	1.375									2.375	4.000		7.375
2.50	0.625	3.000	1.500	1.000	1.000	3.500	5.500	5.000	3.500	1.750	3.375	0.500	6.250
	1.000									2.125	3.750		7.000
	1.375									2.375	4.000		7.500
	1.750									2.625	4.250		8.000
3.25	1.000	3.750	2.000	1.000	1.000	4.500	6.500	5.750	4.250	2.250	4.250	1.000	7.500
	1.375									2.500	4.500		8.000
	1.750									2.750	4.750		8.500
	2.000									2.875	4.875		8.750
	1.000									2.250	4.250		7.500
4.00	1.375	4.500	2.000	1.000	1.000	5.250	7.250	6.500	5.000	2.500	4.500	1.000	8.000
	1.750									2.750	4.750		8.500
	2.000									2.875	4.875		8.750
	2.500									3.125	5.125		9.250
	1.000									2.250	4.250		7.750
	1.375									2.500	4.500		8.250
5.00	1.750	5.500	2.000	1.000	1.000	6.250	8.250	7.500	6.000	2.750	4.750	0.750	8.750
	2.000									2.875	4.875		9.000
	2.500									3.125	5.125		9.500
	3.000									3.125	5.125		9.500
	3.500									3.125	5.125		9.500
	1.375									2.625	4.750		8.750
	1.750									2.875	5.000		9.250
6.00	2.000	6.500	2.000	1.375	1.375	7.625	10.375	9.250	7.000	3.000	5.125	0.750	9.500
	2.500									3.250	5.375		10.000
	3.000									3.250	5.375		10.000
	3.500									3.250	5.375		10.000
	4.000									3.250	5.375		10.000
	1.375									2.625	5.000		8.875
	1.750									2.875	5.250		9.375
	2.000									3.000	5.375		9.625
8.00	2.500	8.500	2.500	1.375	1.375	9.750	12.500	11.250	9.500	3.250	5.625	1.125	10.125
	3.000									3.250	5.625		10.125
	3.500									3.250	5.625		10.125
	4.000									3.250	5.625		10.125
	4.500									3.250	5.625		10.125
	5.000									3.250	5.625		10.125
	5.500									3.250	5.625		10.125

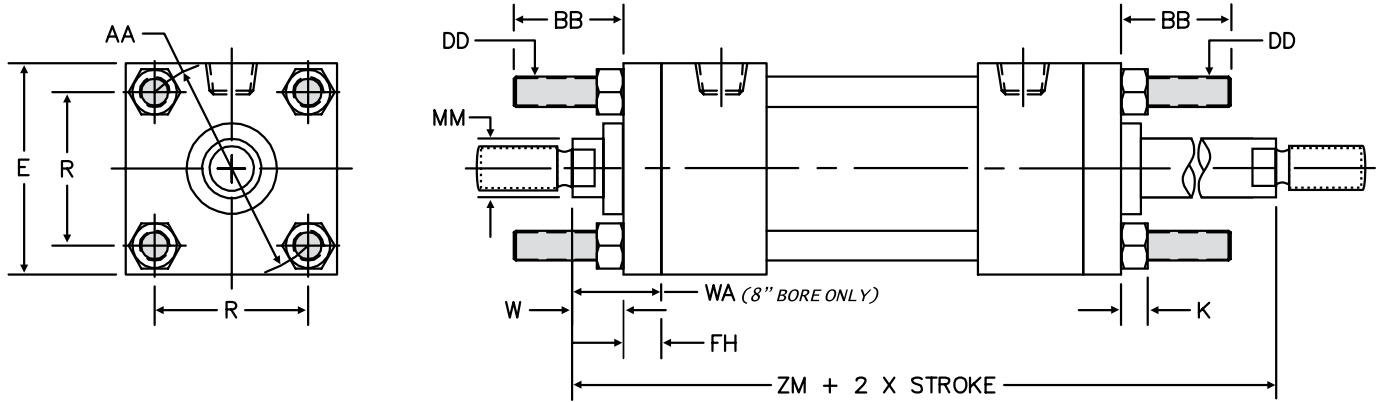
<sup>1</sup> 'TD' dimension tolerance is + .000 / - .001

<sup>2</sup> 'XI' dimension is the minimum that can be supplied and leaves 1/8" gap between head & trunnion block (customer to specify 'XI' dimension).

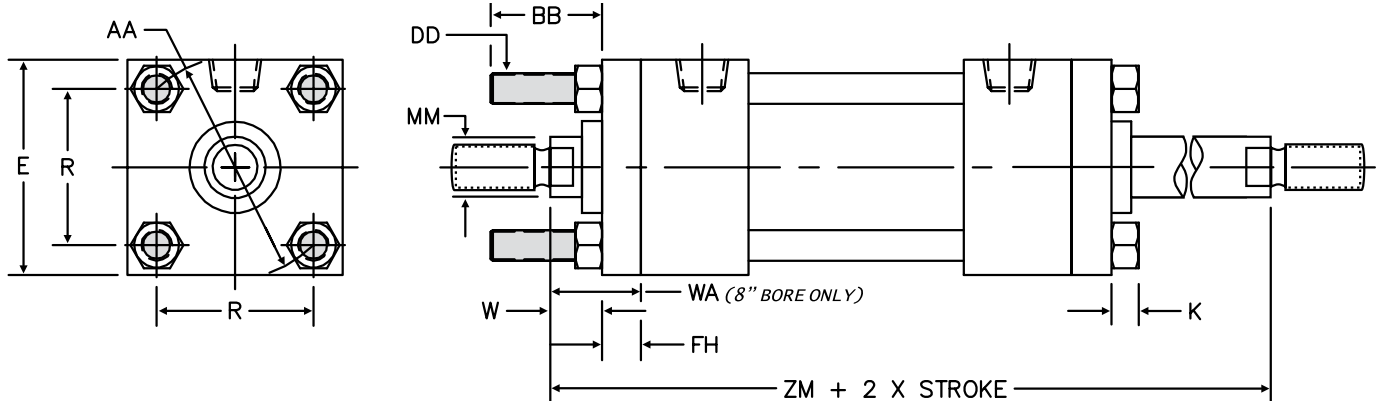


## Series TAS Dimensions – Double Rod End Mounts

MX1D: Extended Tie Rods - Head & Cap



MX3D: Extended Tie Rods - Head End



# How to Specify

## Series TAS Dimensions – Double Rod End Mounts

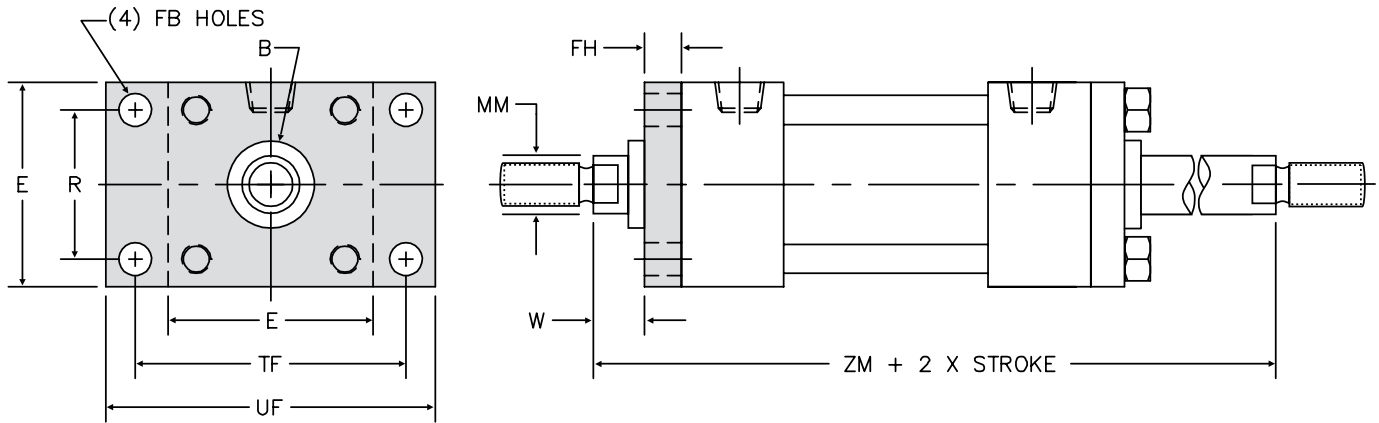
Bore	Rod Diameter (MM)	E	FH	AA	BB	DD	K	R	RD <sup>1</sup>	W or WA (8")	Add 2X Stroke	
											ZM	
1.50	0.625	2.000	0.375	2.020	1.000	1/4 - 28	0.250	1.430	SQ	0.625	6.125	
	1.000									6.875		
2.00	0.625	2.500	0.375	2.600	1.125	5/16 - 24	0.313	1.840	SQ	0.625	6.125	
	1.000									6.875		
	1.375									7.375		
2.50	0.625	3.000	0.375	3.100	1.125	5/16 - 24	0.313	2.190	SQ	0.625	6.250	
	1.000									7.000		
	1.375									7.500		
	1.750									8.000		
3.25	1.000	3.750	0.625	3.900	1.375	3/8 - 24	0.375	2.760	SQ	0.750	7.500	
	1.375									8.000		
	1.750									8.500		
	2.000									8.750		
4.00	1.000	4.500	0.625	4.700	1.375	3/8 - 24	0.375	3.320	SQ	0.750	7.500	
	1.375									8.000		
	1.750									8.500		
	2.000									8.750		
5.00	2.500	5.500	0.625	5.800	1.813	1/2 - 20	0.438	4.100	SQ	1.625	9.250	
	3.000									9.500		
	3.500									9.500		
	1.000									7.750		
	1.375									8.250		
	1.750									8.750		
6.00	2.000	6.500	0.750	6.900	1.813	1/2 - 20	0.438	4.880	SQ	1.250	9.500	
	2.500									10.000		
	3.000									10.000		
	3.500									10.000		
	4.000									10.000		
8.00	1.375	8.500	0.625	9.100	2.3132	5/8 - 18	0.563	6.440	3.500	1.500	8.875	
	1.750		0.625							3.500	1.750	9.375
	2.000		0.625							5.000	1.875	9.625
	2.500		0.750							5.000	2.125	10.125
	3.000		0.750							5.250	2.125	10.125
	3.500		0.750							5.625	2.125	10.125
	4.000		0.750							6.500	2.125	10.125
	4.500		0.750							7.250	2.125	10.125
	5.000		0.750							7.500	2.125	10.125
5.500	0.750	7.500	2.125	10.125								

<sup>1</sup> Where SQ is shown in chart, cylinder utilizes a full square retainer.

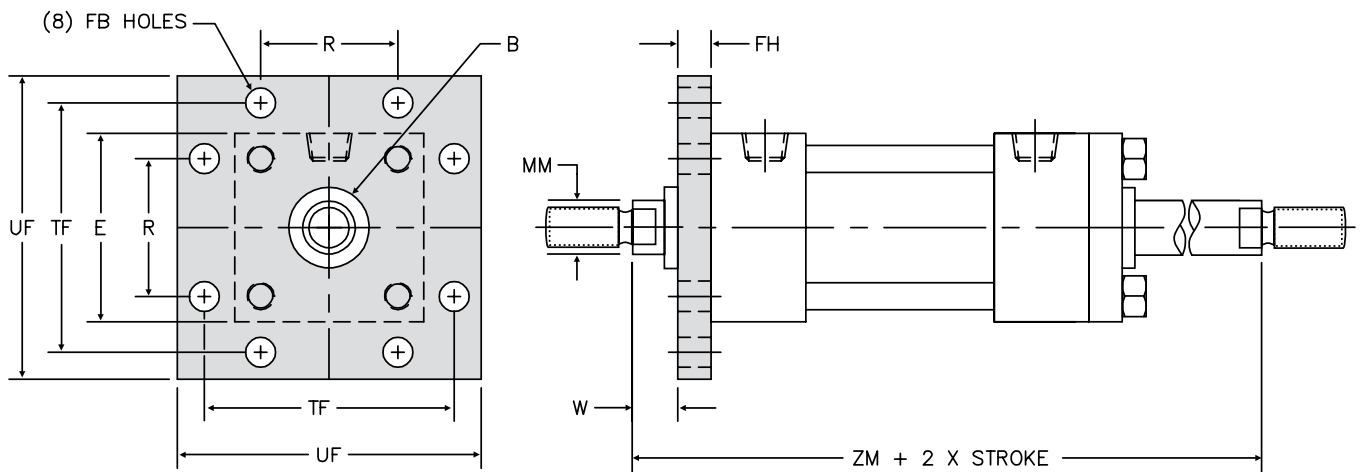
<sup>2</sup> Round retainer used to retain bushing, not a full front plate as other bores. 'BB' is dimension from head on the 8.00" bore.

## Series TAS Dimensions – Double Rod End Mounts

### MF1D: Head Flange



### MF5D: Head Square Flange



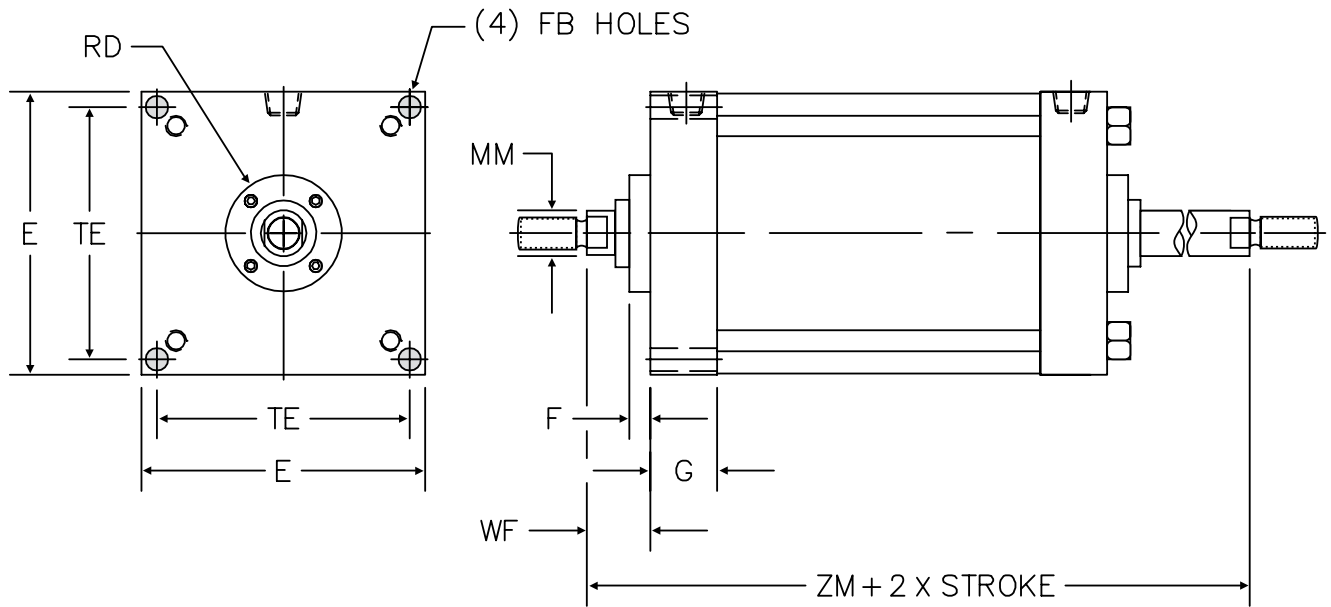
# How to Specify

## Series TAS Dimensions – Double Rod End Mounts

Bore	Rod Diameter (MM)	B	E	FB	FH	R	TF	UF	W	Add 2X Stroke
										ZM
1.50	0.625	1.124	2.000	0.313	0.375	1.430	2.750	3.375	0.625	6.125
	1.000	1.499							1.000	6.875
2.00	0.625	1.124	2.500	0.375	0.375	1.840	3.375	4.125	0.625	6.125
	1.000	1.499							1.000	6.875
	1.375	1.999							1.250	7.375
2.50	0.625	1.124	3.000	0.375	0.375	2.190	3.875	4.625	0.625	6.250
	1.000	1.499							1.000	7.000
	1.375	1.999							1.250	7.500
	1.750	2.374							1.500	8.000
3.25	1.000	1.499	3.750	0.438	0.625	2.760	4.688	5.500	0.750	7.500
	1.375	1.999							1.000	8.000
	1.750	2.374							1.250	8.500
	2.000	2.624							1.375	8.750
4.00	1.000	1.499	4.500	0.438	0.625	3.320	5.438	6.250	0.750	7.500
	1.375	1.999							1.000	8.000
	1.750	2.374							1.250	8.500
	2.000	2.624							1.375	8.750
	2.500	3.124							1.625	9.250
5.00	1.000	1.499	5.500	0.563	0.625	4.100	6.625	7.625	0.750	7.750
	1.375	1.999							1.000	8.250
	1.750	2.374							1.250	8.750
	2.000	2.624							1.375	9.000
	2.500	3.124							1.625	9.500
	3.000	3.749							1.625	9.500
6.00	3.500	4.249	6.500	0.563	0.750	4.880	7.625	8.625	1.625	9.500
	1.375	1.999							0.875	8.750
	1.750	2.374							1.125	9.250
	2.000	2.624							1.250	9.500
	2.500	3.124							1.500	10.000
	3.000	3.749							1.500	10.000
6.00	3.500	4.249	6.500	0.563	0.750	4.880	7.625	8.625	1.500	10.000
	4.000	4.749							1.500	10.000

## Series TAS Dimensions – Double Rod End Mounts

### ME3D: Head Square Mounting Holes

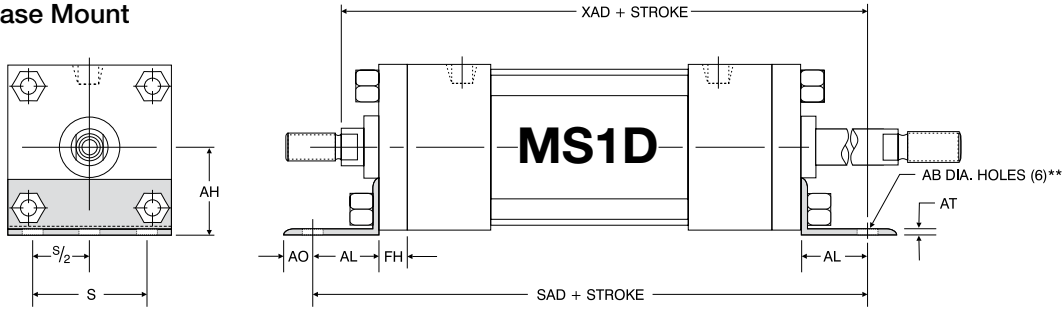


Bore	Rod Diameter (MM)	E	F	FB	G	TE	RD	WF	Add 2X Stroke
									ZM
8.00	1.375	8.500	0.625	0.688	2.000	7.570	3.500	1.625	8.875
	1.750								9.375
	2.000								9.625
	2.500								10.125
	3.000								10.125
	3.500								10.125
	4.000								10.125
	4.500								10.125
	5.000								10.125
	5.500								10.125

# How to Specify

## Series TAS Dimensions – Double Rod End Mounts

### MS1D: Base Mount



'MS1D' Angle Mount Dimensions

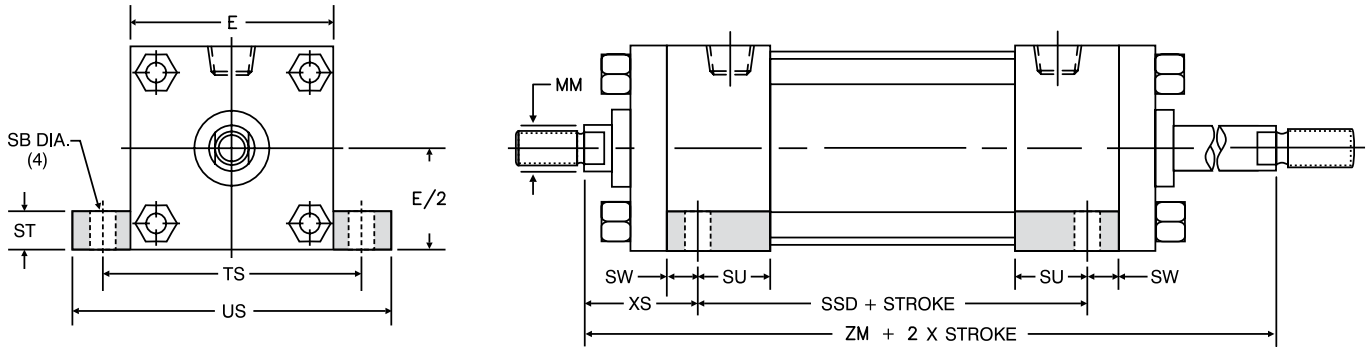
Bore	Rod Diameter (MM)	AB	AH	AL	AO	AT	FH	S	Add To Stroke	
									SAD	XAD
1.50	0.625	0.438	1.188	1.000	0.375	0.188	0.375	1.250	6.875	6.500
	1.000									6.875
2.00	0.625	0.438	1.438	1.000	0.375	0.188	0.375	1.750	6.875	6.500
	1.000									6.875
	1.375									7.125
2.50	0.625	0.438	1.625	1.000	0.375	0.188	0.375	2.250	7.000	6.625
	1.000									7.000
	1.375									7.250
	1.750									7.500
3.25	1.000	0.563	1.938	1.250	0.500	0.125	0.625	2.750	8.500	8.000
	1.375									8.250
	1.750									8.500
	2.000									8.625
	1.000									8.000
4.00	1.375	0.563	2.250	1.250	0.500	0.125	0.625	3.500	8.500	8.250
	1.750									8.500
	2.000									8.625
	2.500									8.875
	1.000									8.375
	1.375									8.625
5.00	1.750	0.688	2.750	1.375	0.625	0.188	0.625	4.250	9.000	8.875
	2.000									9.000
	2.500									9.250
	3.000									9.250
	3.500									9.250
	1.375									9.250
	1.750									9.500
6.00	2.000	0.813	3.250	1.375	0.625	0.188	0.750	5.250	9.750	9.625
	2.500									9.875
	3.000									9.875
	3.500									9.875
	4.000									9.875
	1.375									9.250
	1.750									9.500
	2.000									9.625
8.00*	2.500	0.813	4.250	1.813	0.688	0.250	0.750	7.125	9.250	9.688
	3.000									9.688
	3.500									9.688
	4.000									9.688
	4.500									9.688
	5.000									9.688
	5.500									9.688
	0.625									9.063
	0.625									9.313
	0.625									9.438

\*8.00" bore utilizes round retainer.

\*\*1.50" bore uses (4) "AB" holes.

## Series TAS Dimensions – Double Rod End Mounts

### MS2D: Side Lugs

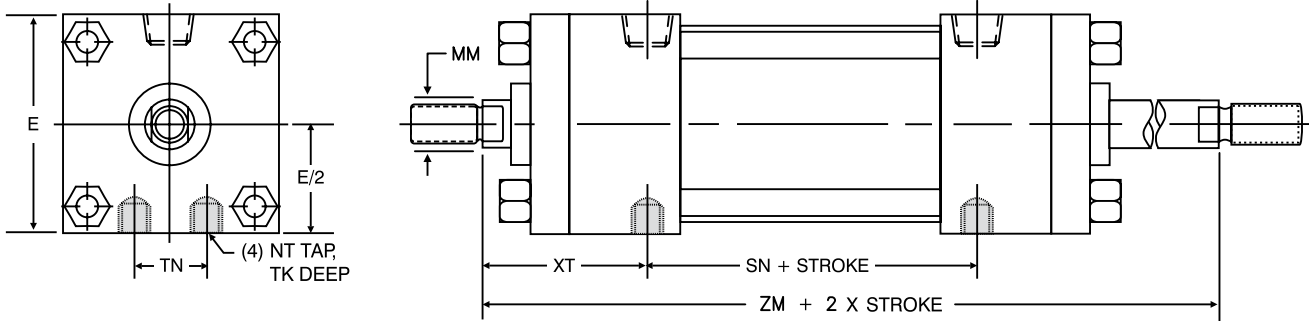


Bore	Rod Diameter (MM)	E	SB	ST	SU	SW	TS	US	XS	Add To Stroke	Add 2X Stroke
										SSD	ZM
1.50	0.625	2.000	0.438	0.500	1.125	0.375	2.750	3.500	1.375	3.375	6.125
	1.750										6.875
2.00	0.625	2.500	0.438	0.500	1.125	0.375	3.250	4.000	1.375	3.375	6.125
	1.000										6.875
	1.375										7.375
2.50	0.625	3.000	0.438	0.500	1.125	0.375	3.750	4.500	1.375	3.500	6.250
	1.000										7.000
	1.375										7.500
	1.750										8.000
3.25	1.000	3.750	0.563	0.750	1.250	0.500	4.75	5.750	1.875	3.750	7.500
	1.375										8.000
	1.750										8.500
	2.000										8.750
	2.500										9.500
4.00	1.000	4.500	0.563	0.750	1.250	0.500	5.500	6.500	1.875	3.750	7.500
	1.375										8.000
	1.750										8.500
	2.000										8.750
5.00	2.500	5.500	0.813	1.000	1.063	0.688	6.875	8.250	2.500	3.625	9.250
	1.000										7.750
	1.375										8.250
	1.750										8.750
	2.000										9.000
	2.500										9.500
	3.000										9.500
6.00	1.375	6.500	0.813	1.000	1.313	0.688	7.875	9.250	2.063	4.125	7.750
	1.750										8.250
	2.000										8.750
	2.500										9.250
	3.000										9.500
8.00	1.375	8.500	0.813	1.000	1.313	0.688	9.875	11.250	2.313	4.250	8.750
	1.750										9.375
	2.000										9.625
	2.500										10.125
	3.000										10.125
	3.500										10.125
	4.000										10.125
	4.500										10.125
	5.000										10.125
5.500	10.125										

# How to Specify

## Series TAS Dimensions – Double Rod End Mounts

### MS4D: Bottom Tapped Holes



Bore	Rod Diameter (MM)	E	NT	TN	TK	XT	Add To Stroke	Add 2X Stroke
							SN	ZM
1.50	0.625	2.000	1/4 - 20	0.625	0.375	1.938	2.250	6.125
	1.000							6.875
2.00	0.625	2.500	5/16 - 18	0.875	0.500	1.938	2.250	6.125
	1.000				0.500	2.313		6.875
	1.375				0.375	2.563		7.375
2.50	0.625	3.000	3/8 - 16	1.250	0.625	1.938	2.375	6.250
	1.000				0.625	2.313		7.000
	1.375				0.438	2.563		7.500
	1.750				0.375	2.813		8.000
3.25	1.000	3.750	1/2 - 13	1.500	0.750	2.438	2.625	7.500
	1.375				0.750	2.688		8.000
	1.750				0.500	2.938		8.500
	2.000				0.500	3.063		8.750
4.00	1.000	4.500	1/2 - 13	2.063	0.750	2.438	2.625	7.500
	1.375				0.750	2.688		8.000
	1.750				0.750	2.938		8.500
	2.000				0.750	3.063		8.750
	2.500				0.625	3.313		9.250
5.00	1.000	5.500	5/8 - 11	2.688	1.000	2.438	2.875	7.750
	1.375				1.000	2.688		8.250
	1.750				1.000	2.938		8.750
	2.000				1.000	3.063		9.000
	2.500				1.000	3.313		9.500
	3.000				0.750	3.313		9.500
6.00	1.375	6.500	3/4 - 10	3.250	0.625	3.313	3.125	9.500
	1.750				1.125	2.813		8.750
	2.000				1.125	3.063		9.250
	2.500				1.125	3.188		9.500
	3.000				1.125	3.438		10.000
	3.500				1.125	3.438		10.000
8.00	4.000	8.500	3/4 - 10	4.500	1.000	3.438	3.250	10.000
	1.375					2.813		8.875
	1.750					3.063		9.375
	2.000					3.188		9.625
	2.500					3.438		10.125
	3.000				1.125	3.438		10.125
	3.500				1.125	3.438		10.125
	5.000				1.125	3.438		10.125
5.500	1.125	3.438	10.125					

TAS SERIES STEEL CYLINDERS

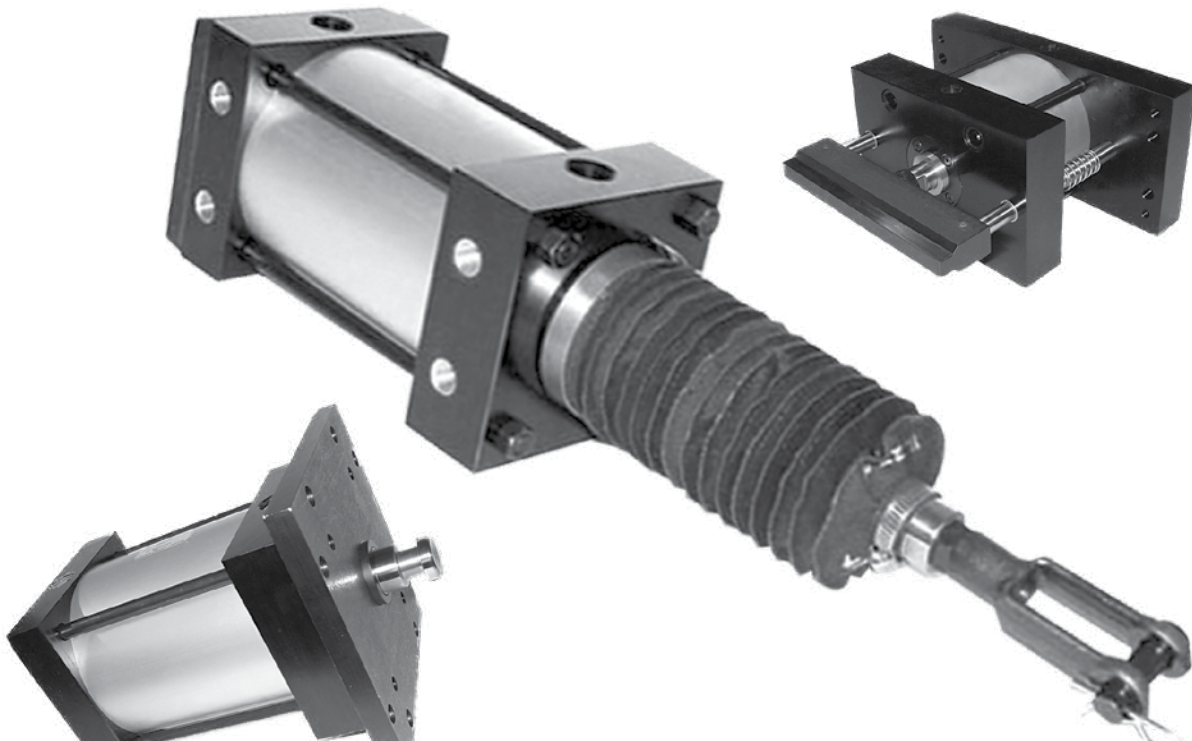
216





# Options and Specials

Bimba's standard cylinders offer a huge variety of standard and uncommon options, as well as the ability to customize to adapt to your specific applications. Work directly with our experienced engineers to create the perfect solution for your unique motion needs.



# Contents

<b>219</b> A= Extended Piston Rod Thread	<b>227</b> MPR Magnetic Piston	<b>232</b> ST Stop Tube and Rod Size Selection
<b>219</b> AS Adjustable Stroke (Retract)	<b>227</b> MS Metallic Rod Scraper	<b>233</b> Piston Rod Size Selection
<b>219</b> AO Air/Oil Piston	<b>227</b> NR Non-Rotating (NFPA) Cylinders	<b>234</b> OS Oversize Rod
<b>219</b> B • BC • BH Bumpers	<b>228</b> OP Optional Port Location	<b>234</b> SAE SAE "O"-Ring Boss Ports (SAE J514)
<b>220</b> BP Bumper Piston Seals	<b>228</b> PLS Piston Lock Screw	<b>234</b> SE Spring Extend (1.50" - 2.50" bore)
<b>221</b> H • C • LH • LC • ELH • ELC Cushions	<b>229</b> PMB Solid Brass Pistons	<b>234</b> SR Spring Retract (1.50" - 2.50" bore)
<b>222</b> ELH • ELC Cushions	<b>229</b> PMC Solid Cast Iron Pistons	<b>235</b> TMS Tube Material - Steel
<b>222</b> FC • FCH • FCC Fixed Head & Cap Cushions	<b>229</b> PMD Solid Delrin® Pistons	<b>235</b> TMSS Tube Material - Stainless Steel
<b>223</b> BSPT British Standard Piper Taper	<b>229</b> SSP Solid Stainless Steel Pistons	<b>235</b> WB Piston Wear Band
<b>223</b> BSPP British Standard Pipe Parallel	<b>229</b> RBB Solid Bronze Rod Bushing	<b>236</b> Uncommon Options
<b>223</b> C= Extended Piston Rod	<b>229</b> RBC Solid G2 Durabar Cast Iron Rod Bushing, PTFE Baked Finish	236 – ABP= Air Bleed Ports
<b>223</b> CS Center Support	<b>230</b> RBD Solid Delrin® Rod Bushing	236 – AS3POS Adjustable Mid Stroke (3 Position Cyl.)
<b>223</b> EK Extended Key Plate	<b>230</b> RBS Solid Stainless Steel Rod Bushings (with PTFE wear band)	236 – DAS Double Rod Adjustable Stroke (Extend)
<b>224</b> KK10 Rod Coupler End	<b>230</b> LF Low Friction	236 – Paint and Other Special Finishes
<b>224</b> KK3S Studded Piston Rod	<b>230</b> LTE Low Temperature Extreme Seals	236 – Manifold Block or Plate
<b>224</b> KKX • KK3X Special Rod Thread	<b>230</b> LT Low Temperature Seals	236 – Hollow Piston Rods
<b>224</b> KKM • KK3M Metric Rod Thread	<b>231</b> OTS O-Ring Tube Seals	236 – Rod Boots
<b>225</b> Lubricants (L001 thru L017)	<b>231</b> TH 400 PSI Hydraulic (Non-Shock)	237 – HP High Impact Piston
<b>226</b> MA Micro-Adjust	<b>231</b> RWV Rod Wiper Made of FKM	237 – Special MF1 Flange
<b>226</b> MAB Micro-Adjust with Urethane Bumper	<b>231</b> VS Fluorocarbon Seals	237 – Special Short Tap with Orifice
	<b>231</b> EP Ethylene Propylene Seals	

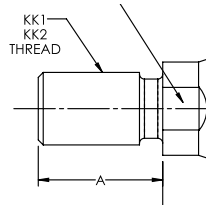
## A= Extended Piston Rod Thread

"A=" refers to the length of piston rod thread.

Shorter than standard lengths can be furnished at no charge. Longer than standard lengths can be furnished at a nominal price adder.

Special length threads do not delay orders!

Note: Maximum recommended thread length is double the standard "A" length. Longer lengths may require a studded rod end (KK3S).

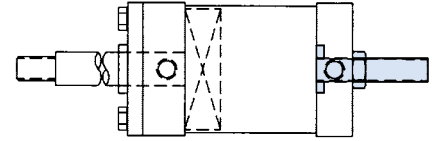


## AS Adjustable Stroke (Retract)

Consists of a threaded rod in the cylinder cap, non-removable. Provides an adjustable positive stop on the cylinder retract.

To order, specify "AS" and length of adjustment (Example: AS=3")

Note: Offered on standard through 2x oversized rods. Consult factory for adjustable strokes over 12"



## AO Air/Oil Piston

Air/Oil pistons allow for the combination of pneumatic supply air with the precise control of oil.

The basic A/O piston is designed for oil on the cylinder cap end, and a "meter out" flow control (not provided) for precise return stroke control.

For applications that require the oil to be on the cylinder rod end, specify the TH option.

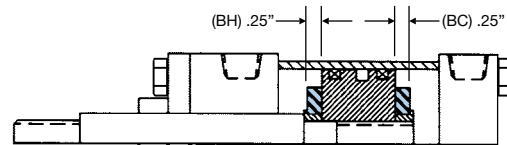
Note: Due to the nature of oil to remain in the tubing finish recesses, a condition called "collaring" will allow oil to seep past the A/O seal over time, escaping in the air valve exhaust.

## B • BC • BH Bumpers

Urethane impact dampening bumpers are used when cylinder speeds do not allow for standard cushions.

**BC**=Cap Bumper **BH**=Head Bumper **B**=Head & Cap Bumper

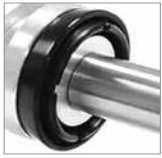
Note: Each bumper adds .25" to cylinder length.



Note: Offered on standard through 1x oversized rods. Consult factory for other offerings.

# How to Customize

## BP Bumper Piston Seals



1.50" Bore Shown



Available on 1.50" to 8.00" Bore

Note: "BP" Seals are Standard on Series 'TD' Tough Duty.

Bumper Piston Seals, when used with our advanced cushion design, decelerates the cylinder at end of stroke, reducing noise and extending cylinder life.

**Standard Material:** Nitrile

**Operating Temp:** -20°F to 200°F (-29°C to 93°C)

**Optional Material:** Fluorocarbon

**Operating Temp:** 0°F to 400°F (-18°C to 204°C)

**Operating Pressure:** 250 PSI Air (17 BAR)

### Benefits

- > Reduces cycle rates: Higher piston velocities can be achieved due to rapid deceleration feature, increasing productivity.
- > Provides maximum impact dampening: Reduces machine vibration.
- > Reduces cylinder end-of-stroke noise.
- > Available in Fluorocarbon Seals
- > Offered on 1.50" to 8.00" bores.

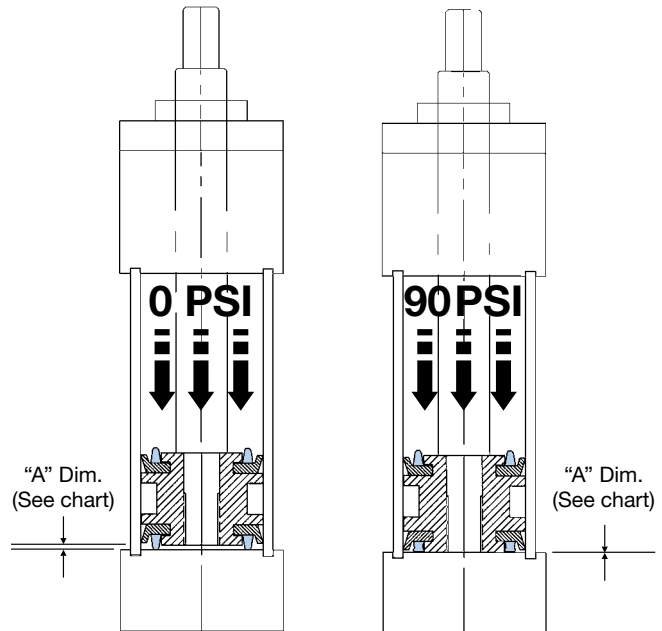
### Design Tips

- > Use cushions to achieve optimum performance on longer strokes (Options HC & BP).
- > Use the BP Seals without cushions on short strokes requiring fast cycles.
- > Due to compressibility, BP Seals are not recommended for applications that require 100% repeatable stroke increments.

**Bumper Piston Seals will shorten the cylinder stroke when operated at less than 90 PSI supply air.** The charts below show the approximate (average) stroke reduction, at various pressure (for new cylinders). As the cylinders are cycled, the seals will take a slight set. Tests have shown that after 1,500,000 cycles, the seals will have between .001" and .008" compression set per seal. After that, there is no noticeable compression set.

Total Stroke Reduction ("A" Dimension X 2) (In Inches)						
Bore	0 PSI	10 PSI	30 PSI	50 PSI	70 PSI	90 PSI
1.50	.10	.09	.07	.06	.04	.00
2.00	.14	.11	.07	.04	.01	.00
2.50	.18	.14	.08	.05	.02	.00
3.25	.14	.12	.08	.04	.01	.00
4.00	.17	.14	.09	.05	.02	.00
5.00	.18	.14	.07	.03	.01	.00
6.00	.23	.18	.10	.05	.01	.00
8.00	.31	.26	.15	.07	.03	.00

Per End Stroke Reduction ("A" Dimension) (In Inches)						
Bore	0 PSI	10 PSI	30 PSI	50 PSI	70 PSI	90 PSI
1.50	.048	.043	.035	.028	.021	.00
2.00	.069	.056	.037	.020	.010	.00
2.50	.091	.070	.042	.024	.008	.00
3.25	.071	.059	.039	.020	.002	.00
4.00	.087	.069	.045	.026	.009	.00
5.00	.092	.072	.036	.013	.005	.00
6.00	.113	.091	.051	.023	.003	.00
8.00	.154	.132	.076	.037	.016	.00



## H • C • LH • LC • ELH • ELC Cushions

Our advanced cushion design features a unique, one-piece seal that is allowed to float in a precision machined groove. This type of seal design provides consistent cushion performance and maximum seal life. Oversized flow paths molded in the periphery of the seal provide full flow on the return stroke without the use of ball checks.

Note: Cylinders with a short stroke (value varies with bore/rod diameter and cushion combinations) may result in improper cylinder operation. Consult factory for availability.

### Head Cushions

- H** Standard Length Head Cushion
- LH** Long Head Cushion
- ELH** Extra-Long Head Cushion<sup>1</sup>

### Cap Cushions

- C** Standard Length Cap Cushion
- LC** Long Cap Cushion
- ELC** Extra-Long Cap Cushion<sup>1</sup>

<sup>1</sup> Extra-long cushions add length to cylinder. Refer to ELH/ELC in Basic Options for details.

### How To Size Cushions For Your Application

Cylinders with air cushions provide a possible solution to destructive energies. The air cushion traps a small amount of exhaust air at the end of a stroke, providing an air pocket that decelerates the load. This reduces the potentially destructive energy being transmitted to the cylinder and other components. The following is a brief explanation on how to determine the energy level of your application and determine if an air cushion can provide adequate energy absorption. Air cushions do not build heat since the heat generated is dissipated with the exhausted air flow.

1. Determine the total load to be stopped by the cylinder. Include the piston rod weight (see piston rod weight chart below).
2. Determine the velocity (in feet per second) at which the load impacts the cylinder end caps.
3. Use the following formula to calculate the energy the cylinder generates.
4. Using the table below, select the proper cushion length. Note: You can choose a larger bore size to increase cushion capacities.

### Cushion Sizing Formula

$$\text{energy} = \left(\frac{W}{64} \times v^2\right) + (p \times k)$$

W = Total weight of load in pounds (including piston rod)

V = Velocity (in feet per second)

P = Driving pressure in PSI (usually the air line pressure)

K = Bore constant value (see chart below for "K" values)

### Sizing Example

How to figure the energy for a 2.50" bore cylinder, 10" stroke, 0.625" piston rod, moving a 25 lb. load at 6 feet per second with 80 PSI air.

$$P=80 \text{ PSI} \quad W=26.25 \text{ lbs.} \quad V=6 \text{ FPS.} \quad K=.17$$

$$\text{Energy} = (26.25/64) \times (6)^2 \text{ or } (36) + (80 \times .17)$$

$$\text{Energy} = 28.36 \text{ ft/lbs.}$$

The Maximum Energy Data Chart indicates that the long cushion at 38.6 maximum energy value would be the right choice for this application.

Maximum Energy Data				
Bore	K	H or C	LH or LC	ELH or ELC
		Standard Cushion Series Max Energy (Ft-Lbs)	Long Cushion Series Max Energy (Ft-Lbs)	Extra-Long Cushion Series Max Energy (Ft-Lbs)
1.50	.06	8.2	12.8	26.9
2.00	.11	13.8	21.7	45.8
2.50	.17	24.6	38.6	81.5
3.25	.25	45.7	83.6	172.2
4.00	.38	57.3	137.1	282.6
5.00	.59	94.6	226.0	465.8
6.00	1.37	225.5	334.4	767.6
8.00	2.43	411.3	609.8	1399.8
10.00	3.79	379.4	621.4	1620.9
12.00	5.47	554.8	908.8	2370.6

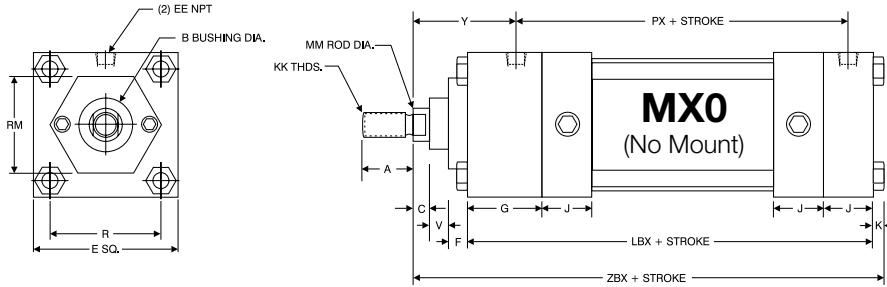
Piston Rod Weight Chart	
Rod Dia.	Piston Rod Weight*
0.625	.35 lb. + .09 lb./in. of stroke
1.000	1.1 lb. + .22 lb./in. of stroke
1.375	2.3 lb. + .42 lb./in. of stroke
1.750	5.0 lb. + .68 lb./in. of stroke
2.000	6.1 lb. + .88 lb./in. of stroke
2.500	10.4 lb. + 1.39 lb./in. of stroke
3.000	20.0 lb. + 2.01 lb./in. of stroke
3.500	28.7 lb. + 2.73 lb./in. of stroke
4.000	39.2 lb. + 3.57 lb./in. of stroke
4.500	50.0 lb. + 4.52 lb./in. of stroke
5.000	60.4 lb. + 5.58 lb./in. of stroke
5.500	78.5 lb. + 6.75 lb./in. of stroke

\*Double weight for double rod end cylinders.

# How to Customize

## ELH • ELC Cushions

Extra-Long Head Cushions (ELH) and Extra-Long Cap Cushions (ELC) add length to the cylinder. Refer to the chart for dimensions.



TAJ-MS4-4x6-ELH

Basic Dimensions 'MX0' Standard & Oversize Rods

Bore	Rod Diameter (MM)	A	B	C	E	EE	F	G	J	K	KK	LBX	PX	R	RM	V	Y	ZBX
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16-20	5.625	4.375	1.438	2.00 sq.	0.250	1.875	6.875
	1.000 Oversize	N/A	N/A	N/A							N/A					N/A	N/A	N/A
2.00	0.625 Standard	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	7/16-20	5.625	4.375	1.844	1.75 hex	0.250	1.875	6.938
	1.000 Oversize	1.125	1.500	0.500							3/4-16				2.50 sq.	0.500	2.250	7.313
2.50	0.625 Standard	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.313	7/16-20	5.750	4.500	2.188	1.75 hex	0.250	1.875	7.063
	1.000 Oversize	1.125	1.500	0.500							3/4-16				3.00 sq.	0.500	2.250	7.438
3.25	1.000 Standard	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.375	3/4-16	6.750	5.250	2.760	2.75 dia.	0.250	2.375	8.500
	1.375 Oversize	1.625	2.000	0.625							1-14				3.75 sq.	0.375	2.625	8.750
4.00	1.000 Standard	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.375	3/4-16	6.750	5.250	3.320	2.75 dia.	0.250	2.375	8.500
	1.375 Oversize	1.625	2.000	0.625							1-14				3.50 dia.	0.375	2.625	8.750
5.00	1.000 Standard	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.438	3/4-16	7.000	5.500	4.100	2.75 dia.	0.250	2.375	8.813
	1.375 Oversize	1.625	2.000	0.625							1-14				3.50 dia.	0.375	2.625	9.063
6.00	1.375 Standard	1.625	2.000	0.625	6.500	0.750	0.625	2.000	1.500	0.438	1-14	8.000	6.250	4.875	3.50 dia.	0.375	2.750	10.063
	1.750 Oversize	2.000	2.375	0.750							1 1/4-12				0.500	3.000	10.313	
8.00	1.375 Standard	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.500	0.563	1-14	8.125	6.375	6.438	3.50 dia.	0.375	2.750	10.313
	1.750 Oversize	2.000	2.375	0.750							1 1/4-12				0.500	3.000	10.563	
10.00	1.750 Standard	2.000	2.375	0.750	10.625	1.000	0.625	2.250	2.000	0.688	1 1/4-12	10.375	8.313	7.922	3.50 dia.	0.500	3.063	12.938
	2.000 Oversize	2.250	2.625	0.875			0.750				1 1/2-12				5.00 dia.	0.375	3.188	13.063
12.00	2.000 Standard	2.250	2.625	0.875	12.750	1.000	0.750	2.250	2.000	0.688	1 1/2-12	10.875	8.813	9.400	5.00 dia.	0.375	3.188	13.563
	2.500 Oversize	3.000	3.125	1.000							1 7/8-12				0.500	3.438	13.813	

## FC • FCH • FCC Fixed Head & Cap Cushions

The fixed cushion option is comprised of a drilled orifice internally to provide a fixed flow rate for the cushion. The flow path is set at about 50% of the cushions capability. Since the orifice is internal to the cylinder, there is no external adjustable cushion hardware.

The advantage of a fixed cushion is there are no cushion adjustments to tamper with and get out of adjustment. Since the cushion flow path is a drilled hole, the flow path is less susceptible to blockage due to compressed air system contamination.

The disadvantage of the fixed cushion is the cylinder cannot be adjusted for optimum cushioning at end of stroke.



### Fixed Head & Cap Cushions

- FC** Fixed Head & Cap Cushions
- FCH** Fixed Standard Head Cushion
- FCC** Fixed Standard Cap Cushion

Note: Cylinders with a short stroke (value varies with bore/rod diameter and cushion combinations) may result in improper cylinder operation. Consult factory for availability.  
Note: "FC" Fixed Cushions Are Standard on "TD" Tough Duty Series

### Custom Length Cushions

Custom length cushions can be designed for your application. Contact Bimba for details!

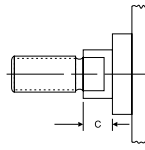
**Example:** An OEM manufacturer of industrial equipment needed a cylinder to shuttle a 125 lb. rolling (and guided) fixture 36 inches of travel, at low airline pressure to avoid operator injury. Bimba developed a 3.50" long head and cap cushion to meet the operating specifications.

## BSPT British Standard Pipe Taper

British Standard Pipe Taper (BSPT) threads have the same taper as American NPT tapered threads, but use a 55° Whitworth thread form and different diameters (not interchangeable with NPT). i.e. BSPT=.25"

## C= Extended Piston Rod

"C=" is commonly referred to as Piston Rod Extension. Piston rods can be extended to any length up to 120" total piston rod length, including stroke portion. Cylinders with long "C" lengths can be mounted away from obstacles or outside hazardous environments, i.e. C=1.50"

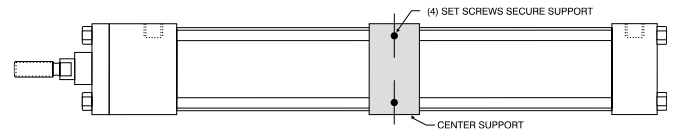


## BSPP British Standard Pipe Parallel

British Standard Pipe Parallel (BSPP), also referred to as BSP Straight Thread (not interchangeable with NPT). i.e. BSPP=.25"

## CS Center Supports

Center supports are a design requirement for certain stroke lengths to help in the tiered torque process. In some applications longer tie rods without the center support may droop or bow to a point where the tube won't remain properly aligned in the tube groove. Center supports will prevent this from occurring.



Center Support Recommendations	
1.50", 2.00" & 2.50" Bores	Strokes longer than 48"
3.25", 4.00" & 5.00" Bores	Strokes longer than 65"
6.00"	Strokes longer than 72"

Note: Extremely long strokes may require two (2) center supports. Chart for (2) center supports is in the MH section of the Hydraulic Catalog

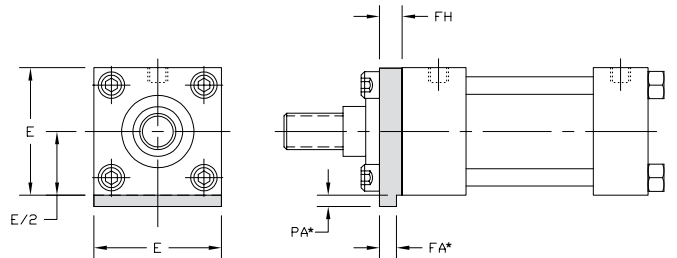
## EK Extended Key Plate

Extended key plate or thrust key is made from a full square bushing retainer plate. The key is designed to fit in a milled slot on the equipment to prevent the cylinder from shifting. An additional mount needs to be specified to secure cylinder.

Available bore sizes: 1.50" to 6.00" Bore

Dimensions For Extended Key Plate				
Bore	E	FA*	FH	PA*
1.50	2.000	0.312 / 0.310	0.375	0.188
2.00	2.500	0.312 / 0.310	0.375	0.188
2.50	3.000	0.312 / 0.310	0.375	0.188
3.25	3.750	0.562 / 0.560	0.625	0.313
4.00	4.500	0.562 / 0.560	0.625	0.313
5.00	5.500	0.562 / 0.560	0.625	0.313
6.00	6.500	0.687 / 0.685	0.750	0.375

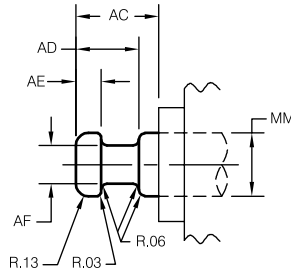
\*FA & PA dimensions will have a black oxide finish and will not be painted.



# How to Customize

## KK10 Rod Coupler End

The KK10 rod end was made popular in 3000 PSI hydraulic applications due to its versatility and high strength. Typically, a commercially available split flange end coupler and weld plate is used to connect the cylinder directly to the work that is being performed. Refer to page 230 for KK10 accessories.



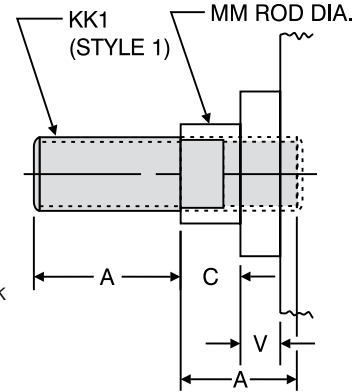
**Example:** TA-ME3-12x10-KK10

Rod Diameter (MM)	AC	AD	AE	AF
0.625	1.125	0.625	0.250	0.375
1.000	1.625	0.938	0.375	0.688
1.375	1.750	1.062	0.375	0.875
1.750	2.000	1.313	0.500	1.125
2.000	2.625	1.688	0.625	1.375
2.500	3.250	1.938	0.750	1.750

## KK3S Studded Piston Rod

KK3S option combines the KK3 female threaded rod end design and a case-hardened stud, with permanent anaerobic sealant. When assembled, the KK3S has the same dimensions as a KK1 rod end.

This option is useful in applications that typically break standard KK1 rod ends due to high load impacting.



## KKX • KK3X Special Rod Thread

Bimba can machine virtually any diameter and type of rod thread on the piston rod end. Standard NFP rod threads are UNF (fine), class 2 threads. Common alternative choices are UNC (course) threads. Some uncommon thread choices are threads larger than the rod diameter. This is only possible by providing a KK3 (female) rod end and making a stud with the larger rod thread.

**Example:** TA-MX0-2x6-KKX=1/2-13 UNC

Note: Unless otherwise specified, the rod thread will be standard catalog "A" dimension lengths. Female special rod thread is also available; please specify KK3X.

## KKM • KK3M Metric Rod Thread

This is a very popular European tie rod cylinder design. Equipment that is imported from outside the U.S. will typically contain metric tie-rod cylinders. In general, this tie rod cylinder is not as robust as NFP cylinder designs and some customers prefer to replace the metric cylinders with NFP designs that will provide longer life.

**Example:** TA-MX0-2x6-KKM=M10X1

Bimba can provide cylinders with metric piston rod end threads to assist customers in mating replacement cylinders to existing equipment.

Female metric rod thread is also available; please specify KK3M.



## L001 Magnalube-G Grease

Magnalube-G Grease is our standard lubricant used for all products except for PFLF and RS Series. Magnalube-G is a non-soap elastomer/PTFE grease designed for superior performance in a wide range of applications. Insoluble in water, Magnalube-G is a nonmigratory grease that tends to stay put in the cylinder if there is no other oil present. Note: if the pneumatic system uses an FRL, the FRL must be properly maintained to provide continued lubrication; any oil will negate the Magnalube-G.



**Color:** Green

**Recommended temperature range:** -20°F to 400°F (-29°C to 204°C)

See [www.magnalube.com](http://www.magnalube.com) for more information.

## L002 PFLF Series Standard Grease

A perfluoropolyether based grease that is relatively low friction and is matched to perform with PFLF cylinders in PCS controlled positioning systems.

**Color:** White Grease

**Recommended temperature range:** -55°F to 300°F (-48°C to 149°C)

## L004 Non-Conductive Grease

A petroleum-lithium based grease developed specifically for the electrical industry. Used primarily on ultrasonic welding equipment to eliminate internal arcing and rapid metal degradation in cylinders. NLGI #1

**Color:** White-Light Tan Grease

**Recommended temperature range:** -20°F to 200°F (-29°C to 93°C)

## L006 High Temperature Lube

A silicone oil (Phenylmethyl siloxane, trimethyl-terminated) with exceptional high temperature stability and lubricating properties. Relatively low friction; 500cs viscosity.

**Color:** Clear Liquid

**Recommended temperature range:** 32°F to 500°F (0°C to 260°C)

## L008 RS Series Standard Grease

USDA Food Grade grease. Synthetic based fluid with aluminum complex soap thickener type grease that is ideal for freezer applications. USDA approved for incidental food contact.

**Color:** White

**Recommended temperature range:** -60°F to 300°F (-51°C to 149°C)

## L012 Water Hydraulic Grease

A polymer-fortified petroleum grease, PTFE additives, and high molecular weight polymers formulated to resist water washout. Used specifically for water hydraulic cylinders. NLGI #2

**Color:** Green

**Recommended temperature range:** 0°F to 300°F (-18°C to 149°C)

## L017 Silicon Food Grade Grease

Silicon-based food grade grease. Used specifically with EPDM-type special seal materials.

**Color:** White

**Recommended temperature range:** -58°F to 300°F (-50°C to 149°C)

## L003 Low Temperature Grease (formerly LTG)

A silicone based high performance grease that is specifically designed for extremely low temperatures. The grease will cause slight swelling in seals, which improves the sealing abilities.

**Color:** Pink Grease

**Recommended temperature range:** -85°F to 200°F (-65°C to 90°C)

## L005 USDA Food Grade Grease (formerly FDAL)

Primarily white mineral oil based with zinc oxide and polytetrafluoroethylene. NLGI #2 grease; recommended for all food applications. USDA approved for incidental food contact.

**Color:** White Grease

**Recommended temperature range:** 15°F to 300°F (-9°C to 149°C)

## L007 High Vacuum Grease

A silicone compound (Polydimethylsiloxane, silica amorphous, dimethyl siloxane, hydroxyl-terminated) stiff grease used specifically in vacuum atmospheres on heat treat furnace and silicon wafer manufacturing processes. Non melting type. Note: Additional seals will be required for vacuum service; contact TRD for assistance.

**Color:** White-Gray

**Recommended temperature range:** -20°F to 375°F (-25°C to 190°C)

## L011 EPDM Seal Lube

A silicone (Dimethyl Siloxane Polymer) based, tacky-stiff lubricant used specifically with EPDM type special seal materials.

**Color:** Clear

**Recommended temperature range:** -40°F to 300°F (-40°C to 149°C)

## L013 Low Friction Oil

A low friction, synthetic oil offering superior extreme pressure (EP), anti-wear properties and extremely low wear rates. Designed specifically for low friction applications such as counterbalance cylinders.

**Color:** White-Gray Liquid

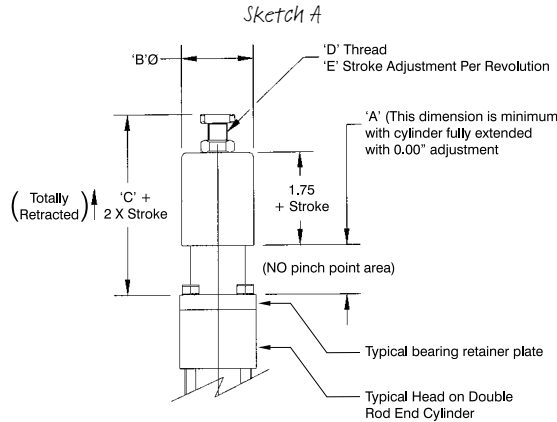
**Recommended temperature range:** -30°F to 300°F (-34°C to 149°C)

# How to Customize

## MA Micro-Adjust

- > Allows precise adjustment of cylinder extend stroke
- > Easy to read precision scale (.001" calibration)
- > Enclosed; no pinch point design
- > Available on all cylinder models with "D" Double Rod End option
- > Up to 12" stroke and adjustment\*

\*Note: The adjustment range is throughout entire stroke. Consult factory for longer stroke requirements or modifications not listed.



TA-MF1D-MA (SHOWN)

Micro-Adjust Dimensions

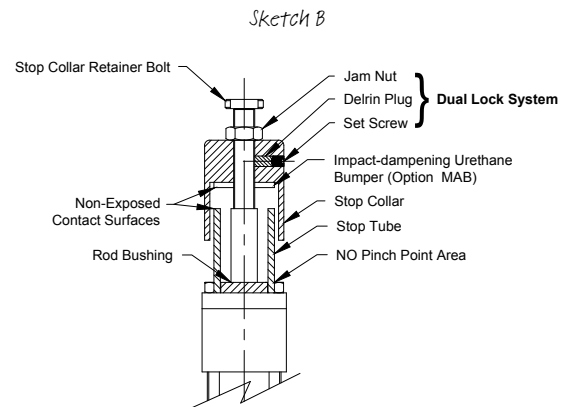
Bore	A	B	C	D	E
1.50	1.000	1.875	3.710	1/2-20	0.050
2.00	1.000	1.875	3.710	1/2-20	0.050
2.50	1.000	1.875	3.710	1/2-20	0.050
3.25	1.000	2.813	3.710	3/4-16	0.063
4.00	0.750	2.813	3.469	3/4-16	0.063
5.00	0.750	2.813	3.469	3/4-16	0.063
6.00	0.750	3.750	3.469	3/4-16	0.063
8.00	0.750	3.750	3.469	3/4-16	0.063

Note: See double rod end cylinder drawings for dimensions not shown.

### Micro-Adjust Set-Up Instructions

1. Set actuator to desired stroke
2. Turn stop collar until it makes contact with stop
3. Tighten set screw
4. Tighten jam nut for positive lock of stop collar

NOTE: Do NOT apply torque to stop collar retainer bolt. Hold stop collar by hand to tighten jam nut. Stroke adjustments to be made while cylinder is in the retract position only.



### MAB Micro-Adjust with Urethane Bumper

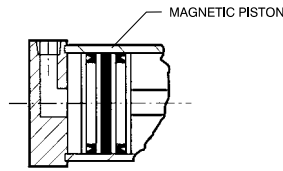
An impact-dampening urethane bumper is added between the metal contact points, minimizing noise (see Sketch B).

**If the option you need isn't listed, just call! We can accommodate most requests.**

## MPR Magnetic Piston

Magnetic Pistons (MPR) are used in conjunction with TRD R10, R10P, RHT, RAC Reed and MSS Solid State Switches.

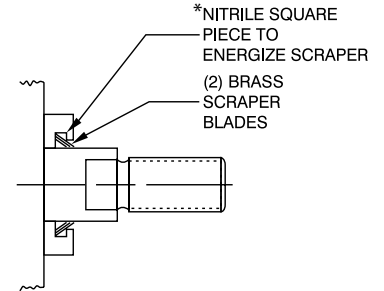
Note: Must be used with Aluminum (TMA) or Stainless Steel (TMSS) tube material.



## MS Metallic Rod Scraper

Aggressively scrapes the piston rod, removing foreign material such as spatter, sprays and powders (brass construction).

\*Square energizer piece will match cylinder seals.



## NR Non-Rotating (NFPA) Cylinders

**2.00" through 12.00" Bore**  
**250 PSI Air, 400 PSI Hydraulic (Non-Shock)**

### Benefits

- > Two internal guide rods throughout stroke
- > High repeatability at each end of stroke (+/- 1 degree)
- > All external dimensions are the same as standard cylinder (no additional length or width required)
- > Standard diameter guide rod seals & bronze bearings for long life and reliable operation
- > Available in double rod end models

### Advantages

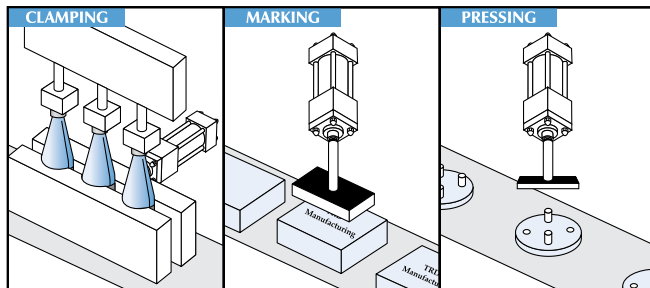
- > Eliminates the need for external guide shafts in many positioning applications
- > Guide rods are internal, self-cleaning and not subjected to harsh cleaners
- > Compact design saves space; no larger than standard NFPA cylinders!
- > Durable, self-contained construction



Force Chart  
 Refer to page 279

Note: "NR" option not available in combination with "BP" bumper piston seal option.

## Application Possibilities



'NR' Guide Rod Sizes And Max. Stroke				
Bore	Rod Diameter	Cushions	Guide Rod Diameters	Maximum Stroke*
2.00	0.625 Standard	Cap Only	0.250	10"
	0.625 Standard	Cap Only	0.312	12"
2.50	1.000 Standard	Cap Only	0.312	12"
	1.000 Standard	Available	0.375	18"
3.25	1.375 Standard	Cap Only	0.375	18"
	1.375 Standard	Available	0.625	30"
4.00	1.750 Standard	Available	0.625	30"
	1.750 Standard	Available	0.625	30"
5.00	2.000 Standard	Available	0.625	30"
	2.000 Standard	Available	0.625	30"
6.00	2.375 Standard	Available	0.625	30"
	2.375 Standard	Available	1.000	40"
8.00	2.750 Standard	Available	1.000	40"
	2.750 Standard	Available	1.000	40"
10.00	3.125 Standard	Available	1.000	40"
	3.125 Standard	Available	1.000	40"
12.00	3.500 Standard	Available	1.000	40"
	3.500 Standard	Available	1.000	40"

\* Consult factory for strokes other than listed above

Note: Longer stroke available, but may allow guide rod flex or require special design. Consult factory for details.

# How to Customize

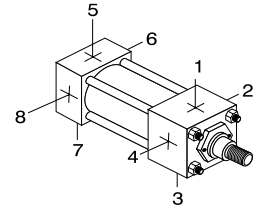
## OP Optional Port Location

Optional port locations can be ordered simply by calling out the location numbers:

**Example:** TA-MS4-2x10-OP=2,6

Note: When optional port locations are ordered, specify both port locations, even if one port is in the standard location.

- > Standard Port Positions at 1 & 5
- > Standard Cushion Positions at 2 & 6
- > Please specify non-standard locations when ordering.



## Optional Port and Cushion at Same Location ('TA' & 'TAS' Series)\*

Specify ports and cushions on the same cylinder side!

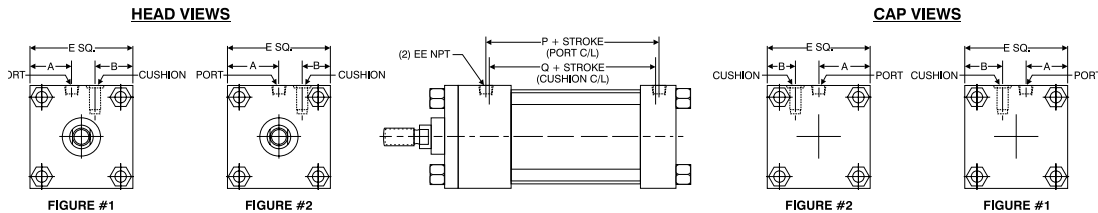
### Ordering Examples:

TA - MS4 - 2 x 10 - H1C5 - OP=1,5 (Ports and Cushions @ 1 & 5)

TA - MS4 - 2 x 10 - H2C6 - OP=2,6 (Ports and Cushions @ 2 & 6)

Note: When optional port & cushion locations are ordered, specify both port and cushion locations, even if a port or cushion is in the standard location.

\*Check with factory for availability on other series.

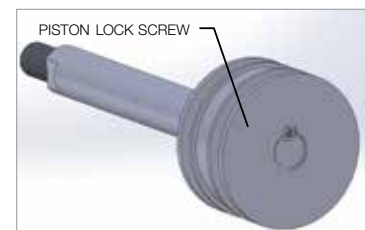


Bores	Rod Diameter	Figure	A	B	E	P	Q	EE
1.50	0.625 Standard	1	0.750	0.625	2.000	2.375	2.125	0.250
	1.000 Oversize	N/A	N/A	N/A	N/A			
2.00	0.625 Standard	1	0.875	0.938	2.500	2.375	2.125	0.375
	1.000 Oversize	1	1.000	0.750	2.500			
2.50	0.625 Standard	1	1.125	1.125	3.000	2.500	2.250	0.375
	1.000 Oversize	1	1.125	1.000	3.000			
3.25	1.000 Standard	1	1.500	1.375	3.750	2.750	2.500	0.500
	1.375 Oversize	2	1.875	1.000	3.750			
4.00	1.000 Standard	2	2.250	1.250	4.500	2.750	2.500	0.500
	1.375 Oversize	2	2.250	1.125	4.500			
5.00	1.000 Standard	2	2.750	1.750	5.500	3.000	3.000	0.500
	1.375 Oversize	2	2.750	1.625	5.500			
6.00	1.375 Standard	2	3.250	1.875	6.500	3.250	3.000	0.750
	1.750 Oversize	2	3.250	1.875	6.500			
8.00	1.375 Standard	2	4.250	2.750	8.500	3.375	3.125	0.750
	1.750 Oversize	2	4.250	2.750	8.500			
10.00	1.750 Standard	2	5.313	3.688	10.625	4.313	4.125	1.000
	2.000 Oversize	2	5.313	3.688	10.625			
12.00	2.000 Standard	2	6.375	4.750	12.750	4.813	4.625	1.000
	2.500 Oversize	2	6.375	4.750	12.750			

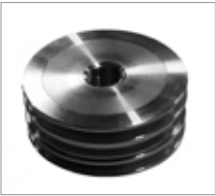
## PLS Piston Lock Screw (For Higher Shock Load Application)

The Piston Lock Screw (PLS) acts as a shear pin between the piston and rod threads, lessening the chance of a piston coming loose from the rod.

All cylinders use a specified torque with a permanent anaerobic thread lock/sealant to secure pistons to the piston rod; threads are then staked. This standard connection method has proven to be very effective in almost all applications. However, in severe shock load applications, the PLS option provides a 100% positive connection that is not likely to come apart.



## PMB Solid Brass Pistons



The most common application for solid brass pistons is for water based hydraulic cylinder use.

Note: This option may require additional time for delivery depending on bore size and quantity.

## PMD Solid Delrin® Pistons



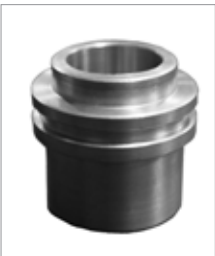
The most common use for solid Delrin® pistons are in moderate side load, high frequency applications to reduce heat build-up and also provide higher piston to tube contact than a wear band can provide.

Note: Solid Delrin® pistons use the HP-style piston and rod connection.

**Available bore sizes:** 1.50" to 6.00" This option may require additional time for delivery depending on bore size and quantity.

**Temp Rating:** -20°F to 100°F (-25°C to 38°C)

## RBB Solid Bronze Rod Bushing



**Material:** SAE 660 Bronze

Our standard floating rod bushing design is used in conjunction with solid SAE 660 bronze material.

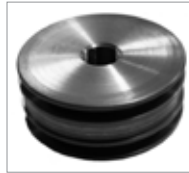
**Material specifications:** 20,000 PSI compressive strength.

Some customers prefer to use bronze rod bushings. Most common used are in water hydraulic applications.

Note: Since the mechanical properties of bronze is much lower than cast iron, bronze rod bushings typically do not provide the same long life that our standard PTFE coated cast iron rod bushings provide.

**Specials:** Bimba can provide special length rod bushings; contact your local distributor for details.

## PMC Solid Cast Iron Pistons



Solid cast iron pistons are standard in the 'HH' and 'MH' series. They can be ordered as an option for any other Bimba series. Not suitable for use with an aluminum tube; we recommend that cast iron pistons are only used with a steel tube (Option TMS).

The most common use is to provide a more heavy-duty cylinder design in tough applications having higher side loads and/or higher impact loads.

## SSP Solid Stainless Steel Pistons



**Material:** 300 Stainless Steel

Optional 316 SS (Note: This option may require additional time for delivery depending on bore size and quantity).

Stainless steel pistons can be used in a multitude of applications ranging from water

hydraulics to food processing, when the cylinders are used to dispense food products.

Standard features include a piston wear band.

## RBC Solid G2 Durabar Cast Iron Rod Bushing, PTFE Baked Finish



This is our standard rod bushing material, used in all series (except for 'SS' and 'RS' series).

Note: since this is our standard rod bushing, there is no need to specify the RBC option in the part number except in rare occurrences.

**Material specifications:** 150,000 PSI compressive strength. Graphite filled. PTFE baked finish that provides good exterior corrosion resistance.

**Specials:** Bimba can provide special length rod bushings; contact your local distributor for details.

# How to Customize

## RBD Solid Delrin® Rod Bushing



Delrin® (Acetal Resin) rod bushings use our standard floating rod bushing design and are machined from solid bar stock material; color is white.

Delrin® has excellent overall properties: High mechanical strength and rigidity; long-term fatigue endurance against repeat impacts; resistant to moisture, solvents, and many other neutral chemicals; wide temperature range use; and excellent natural lubricity.

The most common use of Delrin® rod bushings are in the SS Series cylinders, in food processing applications. The Delrin® material has a natural lubricity that extends the rod bushing life in repeated wash down applications and requires no further lubrication. This material has exceptionally long bearing life in food processing applications.

**Temp Rating:** -20°F to 100°F (-25°C to 38°C)

## LF Low Friction

Low Friction (LF) option incorporates the use of round-lip, extremely low friction carboxylated nitrile seals. Round-lip seals hydroplane on opposed sealing surfaces, having lower running and break-away friction.

**Material:** Carboxylated Nitrile

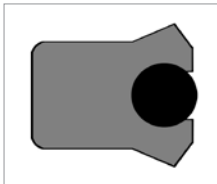
**Operating Temperature:** -20°F to 200°F (-29°C to 93°C)

**Operating Pressure:** 250 PSI Air (17 Bar)

## LT Low Temperature Seals

**Temp Rating:** -30°F to 200°F (-34°C to 93°C)

**Pressure Rating:** 0 to 250 PSI Air (17 Bar);  
0-400 PSI Hydraulic (27.6 Bar)



The LT option uses a special seal in the piston and rod areas to provide proper sealing and cylinder function at lower temperatures.

Note: These seals will fit in most standard seal grooves.

**Seal Type:** U-Cup, urethane seals with O-ring energizer, which functions as a spring to maintain sealing contact under low temperature applications. Unidirectional seal.

**Must also specify L003 (Low Temperature Grease) option.**

How to order LT seal kit: SK100-325-LT-L003 (1" Rod, 3.25" Bore)

## RBS Solid Stainless Steel Rod Bushings (with PTFE wear band)



**Material:** 300 Stainless Steel

Optional 316 SS (Note: This option may require additional delivery time depending on bore size and quantity).

Stainless steel rod bushings can be used in a multitude of applications ranging from water hydraulics to wet environments. The RBS option incorporates our floating rod bushing design and an internal PTFE wear band as

the rod bearing.

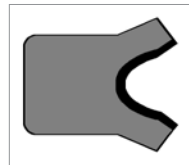
Anodized aluminum head, cap and tube type series cylinders with optional stainless steel tie rods, fasteners, piston rod and the RBS rod bushing option provide excellent corrosion resistance in many wet environments. This design combination is also a low cost alternative to solid stainless steel type cylinders such as the SS Series.

## LTE Low Temperature Extreme Seals

**Temp Rating:** -65°F to 200°F (-54°C to 93°C)

**Pressure Rating:** 0 to 250 PSI Air (17 Bar);  
0-400 PSI Hydraulic (27.6 Bar)

Note: LTE seals experience reduced service life below -40°F (-40°C).



The LTE option uses a special seal in the piston and rod areas to provide proper sealing and cylinder function at extremely lower temperatures.

Note: These seals will fit in most standard seal grooves.

**Seal Type:** U-Cup, urethane seals with metal expander, which functions as a spring to maintain sealing contact under extremely low temperature applications. Unidirectional seal.

**Must also specify L003 (Low Temperature Grease) option.**

How to order LTE seal kit: SK100-325-LTE-L003 (1" Rod, 3.25" Bore)



## OTS O-Ring Tube Seals

O-Ring tube seals can provide added sealing capabilities in high impact and/or hydraulic applications. The cylinders are machined with an O-Ring groove in the head and cap areas.

Note: Our standard tube end seals are a flat gasket type, rubber-like material. Static tests have shown that our standard flat gasket seals will withstand 1000 PSI static pressure. We recommend using the OTS option only if you are experiencing leakage in your specific application.

O-ring Tube Seals are standard on TAS series cylinders.

Flat gasket and O-Ring tube seals are not interchangeable. We recommend providing the cylinder serial number (for any seal kit requests) to verify the type of seals so the correct seal kit number can be provided.

**Temp Rating:** -20°F to 200°F (-29°C to 93°C)

**Pressure Rating:** 0 to 250 PSI Air (17 Bar);  
0-400 PSI Hyd. (27.6 Bar)

**Material:** Nitrile

## TH 400 PSI Hydraulic (Non-Shock)

**Rating:** 400 PSI Hydraulic, Non-Shock

**Seals:** Piston Seals - (1) Poly-Pak, (1) Square-lip  
Rod Seal - Poly-Pak

Many other seal materials are available. Contact Bimba for proper seal material selection in tough applications or environments.

## RWV Rod Wiper Made of FKM

RWV Option contains Fluorocarbon rod wiper

Fluorocarbon seal material has an overall shorter seal life due to the higher wear rate inherent with the material. In general, Fluorocarbon seals should only be specified when temperatures exceed 200° F for prolonged periods of time or when there is a fluid compatibility issue with standard seals.

The RWV Option can provide a more cost effective solution than the “VS” Option when wash down fluid compatibility is the only issue.

## VS Fluorocarbon Seals

VS Option contains two (2) Fluorocarbon U-Cup piston seals, Bushing O-Ring, rod seal and rod wiper.

### Benefits of Fluorocarbon Seals:

- > Higher temperature performance: 0°F to 400°F (-18°C to 204°C)
- > Higher chemical resistance: Resists most wash down solutions

Many other seal materials are available. Contact Bimba for proper seal material selection in tough applications or environments.

## EP Ethylene Propylene Seals

EP Option contains two (2) Ethylene Propylene U-Cup piston seals, bushing o-ring, rod seal and rod wiper. Note: PTFE rod wiper is used on 2” diameter rod and larger.

### Benefits of Ethylene Propylene Seals:

- > Higher temperature performance: -50°F to 300°F (-45°C to 149°C)
- > Higher chemical resistance: Resists most wash down solutions
- > Not compatible with MagnaLube-G; Requires L013 or L017.

# How to Customize

## ST Stop Tube and Rod Size Selection

Stop tubes are designed to reduce the piston rod bushing stress to within the designed range of the bearing material. This will ensure proper cylinder performance in any given application. Stop tubes lower the cylinder bearing stress by adding length to the piston, which increases the overall length of the cylinder.

Note: Bimba uses a double piston design when possible.

### Stop Tube Selection

To determine the proper amount of stop tube for your application, you must first find the value of "D", which represents the stroke (adjusted for mounting condition). Each mounting condition creates different levels of bushing stress, which has direct impact on the amount of stop tube required (see Chart 1).

Once the value of "D" is known, refer to Chart 2 for the recommended amount of stop tube.

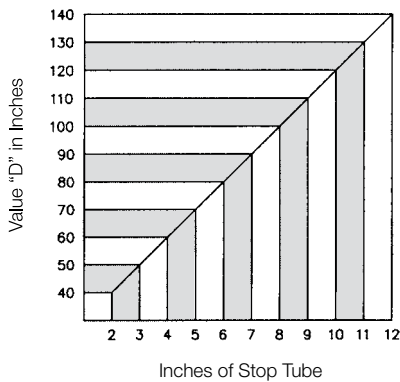
### To Order A Stop Tube

- > Add the stop tube prefix "ST=" and the stop tube length to the cylinder model number.
- > Add "ES" after the cylinder stroke to indicate that the stroke is the effective stroke.

**Example:** TA - MP1 - 3.25 x 40 ES - ST = 2

### Chart 2

Using the value of "D", find the recommended amount of stop tube.



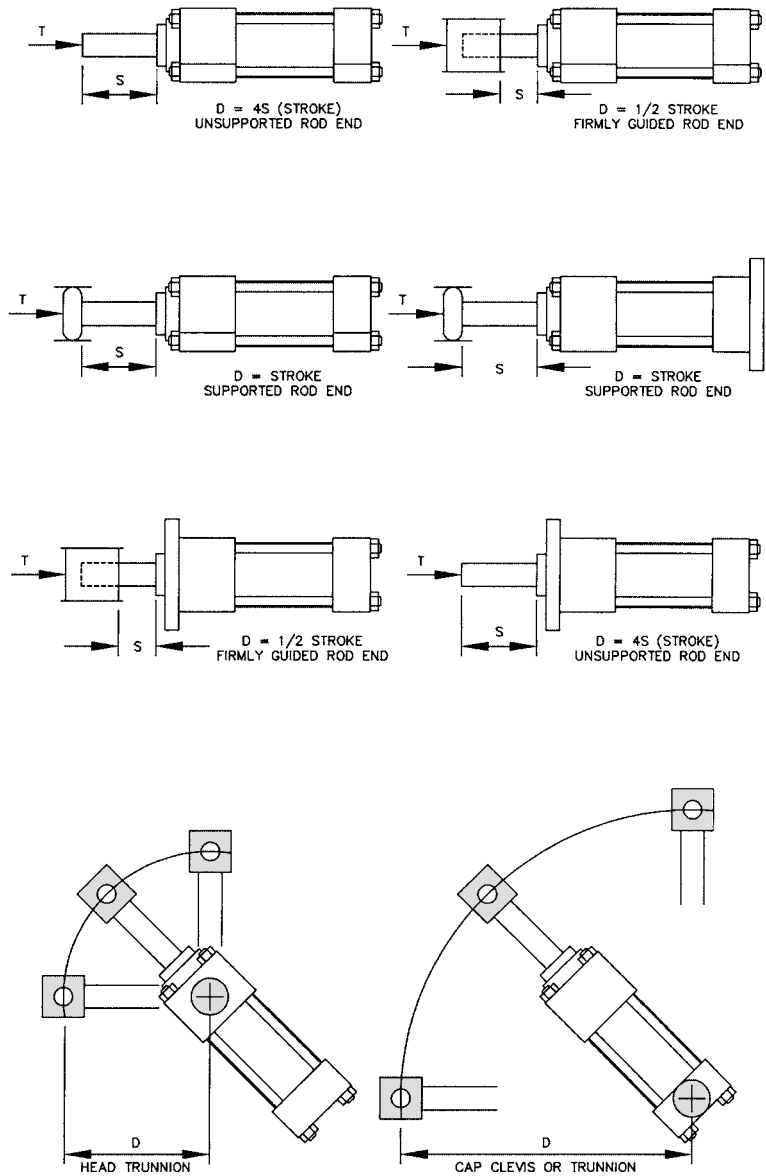
### Chart 1

Find the value of "D" for your application.

"D" = Stroke, adjusted for mounting condition

"S" = Actual cylinder stroke

"T" = Axial thrust (refer to Chart 3)



Note: Measure "D" when cylinder is fully extended.

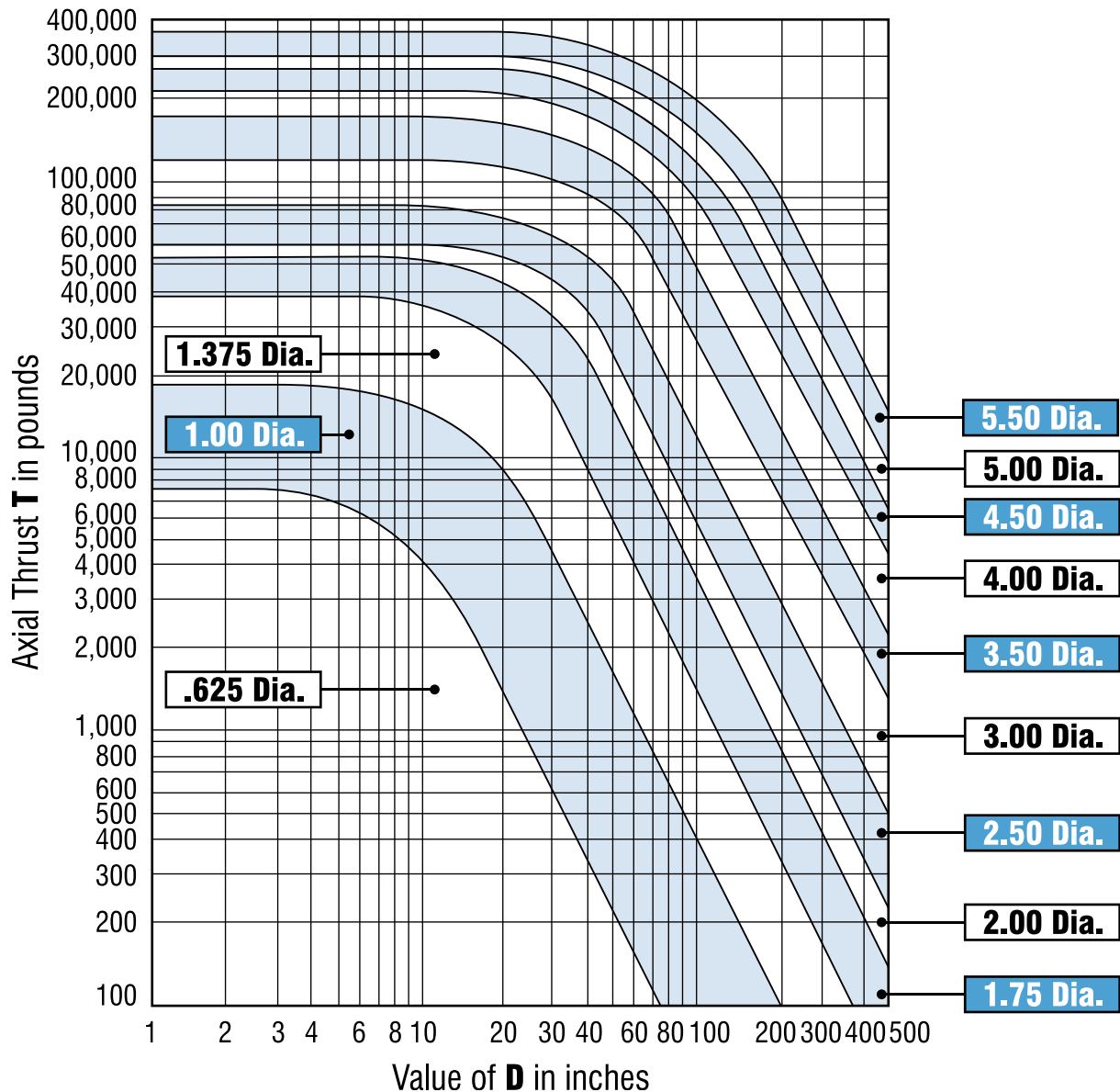


## Piston Rod Size Selection

Standard rod sizes are usually suitable for shorter stroke applications at lower air pressures. With high thrust force or long stroke applications, you must check the column strength of the rod in the mounting style to determine the proper rod diameter size.

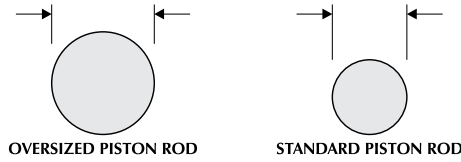
1. Determine the total axial thrust by multiplying the bore area size (in inches) by the operating pressure (in PSI).
2. Determine the value of "D" for the application.
3. Find the value of "D" in the chart below. Follow the value of "D" vertically on the graph until it intersects with the axial thrust value of the cylinder. The intersection of these two values will fall within one of the shaded areas representing the piston rod diameter size required for the application.

### Chart 3 (Piston Rod Diameter Selection)



# How to Customize

## OS Oversize Rod



Applications requiring long strokes may require oversize piston rod diameters to prevent sagging or buckling. To determine the recommended rod diameter, refer to Chart 3 on page 202.

## SE Spring Extend (1.50" - 2.50" Bore)

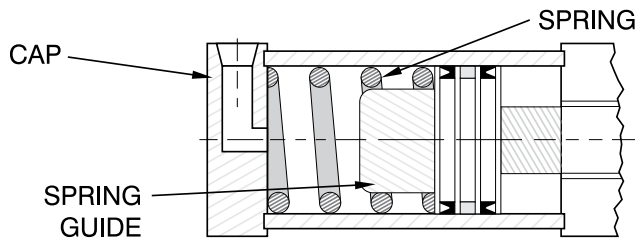
"SE" Option is designed to provide a spring bias to extend cylinder in the event of air pressure loss.

Springs add length to cylinder and provide a modest amount of extend spring force. See chart below for application design specs.

Note: Cylinders are furnished with standard head and cap.

1.50", 2.00" and 2.50" Bore Specs*			
Stroke (Inches)	Overall Length Adder For "SE" Option (Inches)	Spring Rate (Lbs. Per Inch)	Spring Force At Full Extend (Lbs.)
0.500	0.625	18	16
1.000	0.875	12	13
1.500	1.125	9	12
2.000	1.375	7	11
2.500	1.500	7	12

\*Only available on 0.625" and 1.000" rods. Consult factory for other bores, rods and forces. Note: Spring rates are for reference only; actual rates may vary from spring to spring.



Note: Contact factory if you require spring forces for sizes or forces outside of the forces listed here.

## SE Spring Extend (1.50" - 2.50" Bore)

Stainless steel provides corrosion resistance when used in conjunction with anodized aluminum heads, caps and tube. Customize your cylinder by choosing from stainless steel fasteners, piston rod or tie rods and nuts. Refer to Series 'SS' for a complete stainless steel solution.

**SSA** Stainless Steel Piston Rod (Hard-Chrome Plated), Stainless Steel Fasteners, Stainless Steel Tie Rods & Nuts

**SSR** Stainless Steel Piston Rod (Hard-Chrome Plated)

**SSC** Stainless Steel Cushion Needle (External Adjustment Components)

## SAE SAE "O"-Ring Boss Ports (SAE J514)

SAE ports can be ordered in place of NPT ports. Order by SAE number. Example: SAE=6

Recommended SAE Port Size By Cylinder Bore			
Bore	SAE#	Bore	SAE#
1.50	#4 (7/16-20)	5.00	#6 (9/16-18)
2.00	#4 (7/16-20)	6.00	#8 (3/4-16)
2.50	#4 (7/16-20)	8.00	#8 (3/4-16)
3.25	#6 (9/16-18)	10.00	#10 (7/8-14)
4.00	#6 (9/16-18)	12.00	#10 (7/8-14)

## SR Spring Retract (1.50" - 2.50" Bore)

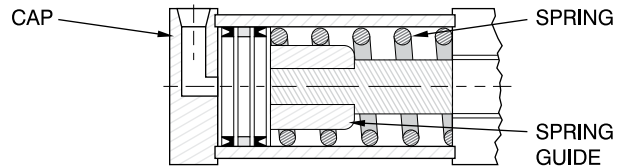
"SR" Option is designed to provide a spring bias to retract cylinder in the event of air pressure loss.

Springs add length to cylinder and provide a modest amount of retract spring force. See chart below for application design specs.

Note: Cylinders are furnished with standard head and cap.

1.50", 2.00" and 2.50" Bore Specs*			
Stroke (Inches)	Overall Length Adder For "SR" Option (Inches)	Spring Rate (Lbs. Per Inch)	Spring Force At Full Retract (Lbs.)
0.500	0.750	18	16
1.000	1.000	12	13
1.500	1.500	9	12
2.000	1.500	7	11
2.500	1.625	7	12
3.000	2.500	6	10
3.500	3.000	6	10
4.000	3.250	6	10
4.500	3.750	6	9
5.000	4.000	6	9
5.500	4.000	5	8
6.000	4.000	5	8

\*Only available on 0.625" and 1.000" rods. Consult factory for other bores, rods and forces. Note: Spring rates are for reference only - actual rates may vary from spring to spring.



**SSF** Stainless Steel Fasteners (Bushing Retainer Screws)

**SST** Stainless Steel Tie Rods and Nuts

**SSN** Stainless Steel Tie Rod Nuts (Includes 'FM' Series sleeve nuts)

## TMS Tube Material - Steel

Let's face it, some applications require a cylinder that can withstand higher side-loading, resistance to denting, and in general a more robust design than what hard-coated ID aluminum tube cylinders can offer. Bimba has offered Steel Tubes for years as a special in the lumber, packaging machinery, and other industries that typically used 100% all steel cylinders. This proven option is now available as a standard option on the "TAS" Series.

Steel Tube Spec: Hydraulic grade chrome plated ID and honed steel tubing, black urethane paint finished OD.

### Benefits

- > **Higher Side-Load Capacity** — Same size load capacity as 100% all steel cylinders.
- > **Higher Tensile And Yield Strength** — Steel tubing offers double the mechanical properties of aluminum, drastically improving the resistance to internal scoring. In addition, the column strength of the cylinder tubing is twice that of aluminum tubing.
- > **Higher Dent Resistance** — Same resistance to dents as 100% all steel cylinders.
- > **Low Weight** — The head and cap are machined from high grade aluminum alloy tool plate, reducing the overall cylinder weight by half when compared to typical 100% all steel cylinders.
- > **Improved Hydraulic Performance** — Since the ID of the tubing is honed, the tubing roundness and diameter size limits are held to close tolerances, improving seal performance in hydraulic (TH Option) or air/oil applications.

### Design Tips

- > The steel tube option was designed to replace many 100% all steel cylinders in use today, but it is not intended to replace mill-type cylinder applications. Since 'TA' Series mounts are standard, they may not offer adequate strength to replace 1-piece all steel pivot style mount applications. As an option, Bimba can furnish 1-piece steel mounts on request.
- > Since hard chrome plating is not a 100% homogeneous coating, steel cylinders are prone to internal rusting of the cylinder bore when used in pneumatic applications. Care must be taken to remove excessive line moisture and properly lubricate the air with standard FRL units for maximum seal life.
- > For end of stroke position sensing, see Balluff Proximity end of stroke sensors.

Note: TMS option will prevent use of magnetic switches.



Steel Tube

## TMSS Tube Material - Stainless Steel

Since Bimba uses the exact same design in our basic TA, FM, TD, SS and TAS series cylinder component materials can be easily substituted from series to series. The TMSS option can be ordered on any series for increased corrosion resistance.

Stainless steel cylinder tubes are the same wall thickness as the aluminum tubes in our standard product lines. The stainless steel tubing ID is "stainless steel" (not hard chrome plated) and is honed to close tolerances.



## WB Piston Wear Band

Piston wear bands are standard on all Bimba NFPA series (except for MSE, MSR and PFLF series) and cylinder model numbers do not need to include the "WB" option suffix for standard wear bands.

- Material:** 90% Virgin PTFE  
10% Polyphenylene Sulfide
- Tensile Strength:** 2,700 - 3,300 PSI
- Compressive Modulus:** 65,000 PSI
- Wear Factor:** Extremely low

Bore	Wear Band Widths	
	Wear Band Width	
1.50 - 8.00	0.375	
10.00	0.750	
12.00	1.000	



### Special Wear Bands

Bimba can provide special wear band designs for higher side load applications. Piston widths can be increased to accommodate wider wear bands or multiple wear bands for increased performance.



Special 1" width dual wear band



ST option with dual wear bands

Note: Special wear band widths will increase the overall cylinder length.

# How to Customize

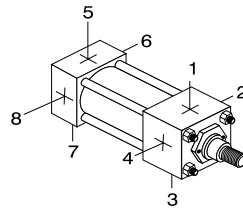
## Uncommon Options

### ABP= Air Bleed Ports

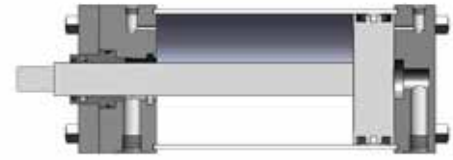
Air bleeds can be provided at either or both ends of a hydraulic cylinder. Air bleeds should be located at the highest point in the cylinder for maximum effectiveness. The location needs to be specified, similar to port locations.

**Example:** ABP=15 (Air Bleed ports at Position 1 & 5)

Plugged from factory.



Location 9 is center of cap face.



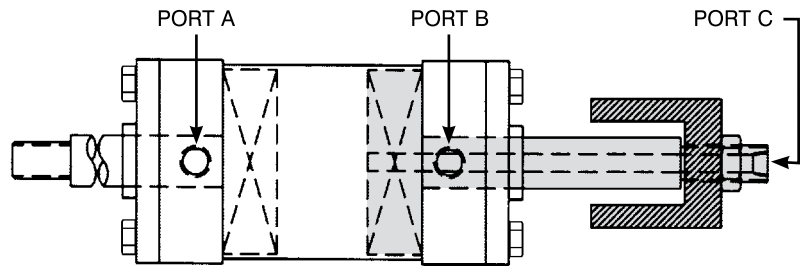
Note: Not available in some bore and rod size combinations.

### AS3POS Adjustable Mid Stroke (3 Position Cyl.)

Double piston design allows for adjustment of the mid stroke position. Three ported cylinder with adjustable stop collar.

To order, specify "AS3POS" and length of adjustment.

**Example:** AS3POS=4"

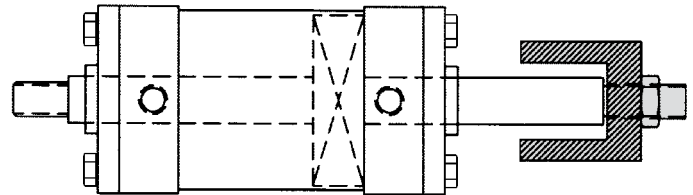


### DAS Double Rod Adjustable Stroke (Extend)

Consists of a double rod end cylinder and an adjustable stop collar. Used to adjust the extend cylinder stroke. Strokes up to 120" available (adjustments to 12" available).

To order, specify "DAS" and length of adjustment.

**Example:** DAS=4"



### Paint & Other Special Finishes

**Standard Finish:** Black Urethane Paint (indoor/outdoor use)

**Optional Paint:** Black Epoxy Paint (indoor use only)

**Additional Paint Choices:** Bimba can provide paint in any color or type with provided paint specification and color code.

**Electroless Nickel Plating:** Attractive finish with high abrasion and corrosion resistance.

**Heavy Chrome Plated Piston Rods**

Contact Bimba with your specifications for a quote.

### Hollow Piston Rods

This cylinder shows a multitude of options:

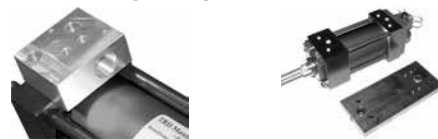
Double Oversize Piston Rod, Gun-Drilled, Double Rod End with rod extension, special female rod thread and special side drilled angle hole in piston rod.



### Manifold Block or Plate

For OEM's, Bimba can design and provide custom made manifolds in high quantity.

Contact Bimba with your specifications.



### Rod Boots

Rod Boots are common in dust filled environments—a standard spec for many robot welding applications.

Note: Rod Boots add length to cylinder rod extension; contact Bimba for specifications.



## Uncommon Options

### HP High Impact Piston

Bimba threads each piston to the piston rod, and uses a permanent type anaerobic sealant to provide a leak-free piston to piston rod connection. This design provides excellent service in 98% of applications. In high impact applications (lumber mills, vinyl shears, etc) a more robust connection may be needed.

The high impact piston option consists of a steel hex locking nut in addition to the standard piston to rod connection. The hex locking nut is also staked to the piston rod for added durability; refer to PLS option for additional information.



#### Special Features

Counter bored Piston, Zinc Plated Steel Lock Nut

#### Standard Features

Staked Rod End, Permanent anaerobic sealant, Threaded Piston to Rod Connection

### Special MF1 Flange

Customer needed front flange mounting but didn't have the room for the standard flanges.

Bimba provided flanges that were notched for a more compact design.

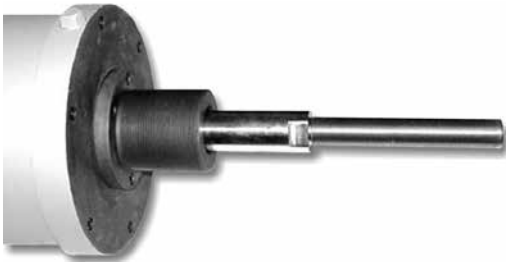


### Special Short Tap With Orifice

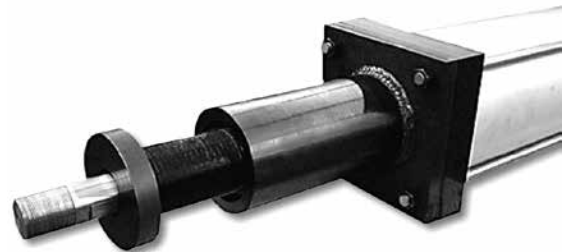
Customer required a special short pipe tap, and different size drilled orifices at each end of cylinder, for built-in speed control.



### 7.00" Bore Steel Non-Tie Rod Design With "Steel-It" Paint (Food Grade Design)



### 8.00" Bore - Front Extension Adjustable Stroke



### External Non-Rotating With Special Tool Plate



### 12.00" Bore Steel, Rated For -40°F Below Zero



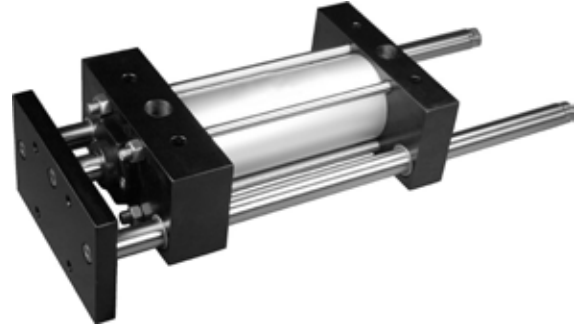
# How to Customize

## Uncommon Options

**Twin Piston Rod 6.00" Bore, Non-Rotating**



**2.00" Bore With External Guide Rods And Tool Plate, SS Hardware For Wash-Down**



**'MA' Micro Adjust On Extend and Retract Stroke For Process Web Control**



**3A Sanitary SS Coupling With Cylinder For Measuring and Dispensing Food**



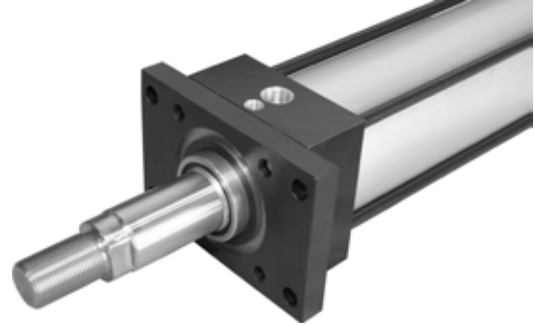


## Uncommon Options

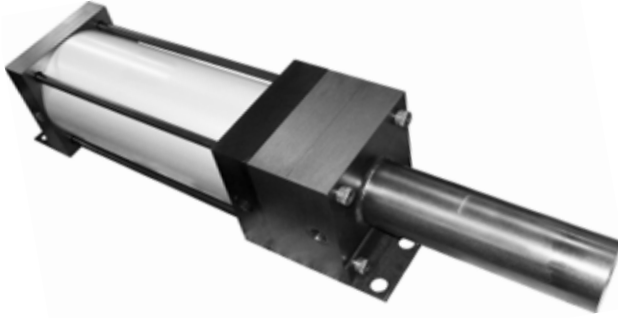
**Close Tolerance Piston Rod Machining After Cylinder Is Assembled**



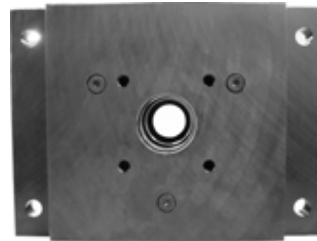
**Vacuum Seal Face With Bushing Vent (For Furnace And Silicon Wafer Processes)**



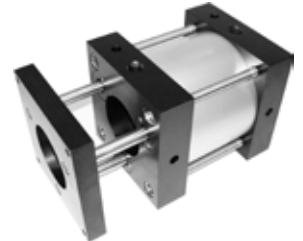
**Air/Oil Booster Pump**



**TRA Series With Through Hole**



*10" Bore Special*



*5" Bore*







# Boosters, Intensifiers, Reservoirs, & Tanks

Boosters, intensifiers, reservoirs, and tanks all help manage and sometimes improve the air movement inside your pneumatic systems.



# Contents

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**243** Auto Reciprocating Air Booster  
245 – Engineering Specifications

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**244** How to Order (Air Boosters)

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**245** Air to Air/Air to Hydraulic Intensifiers

---

**246** How to Order (Intensifiers)

---

**247** How to Specify (Intensifiers)  
248 - Air to Air Intensifiers  
(Schematics)  
248 - Air to Hydraulic Intensifiers  
(Schematics)

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**249** Air/Oil Tanks  
250 – AT Models  
251 – SS-AT Models

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**253** AR Series Air Reservoir

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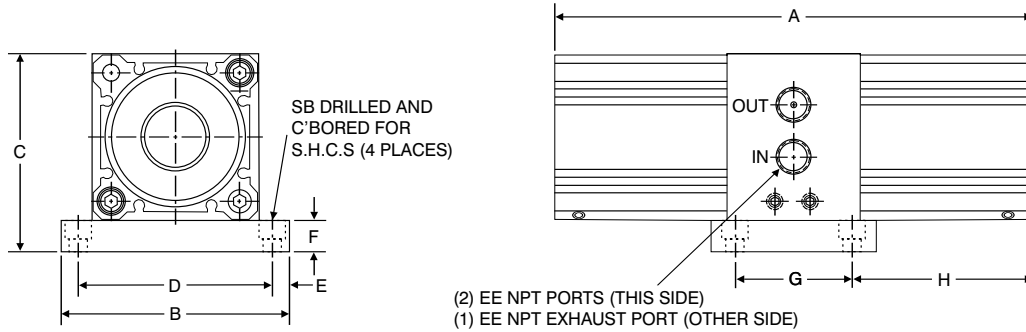
## Series: Auto Reciprocating Air Booster – Model Numbers: AB121 & AB221

This 2:1 ratio air-to-air booster is compact and self-contained. Unit incorporates integral valve components to perform auto-reciprocating function.

Can amplify inadequate air pressure in the following situations:

**Cylinders or Grippers:** When space isn't available, a smaller bore or model size can be used with higher input PSI to achieve the desired output or grip force.

**Problem Solver:** Sometimes a cylinder or gripper was sized for an application, but in use, does not perform up to the production requirements. Increasing the input PSI can provide a quick and cost effective solution.



Auto Reciprocating Air Booster Dimensions

Part No.	A	B	C	D	E	F	G	H	EE NPT	SB Diameter
AB121	7.33	3.50	3.04	2.98	0.26	0.48	1.79	2.77	1/4 NPT	1/4
AB221	14.20	7.00	6.00	5.95	0.53	1.00	3.58	5.31	1/2 NPT	1/2

### Engineering Specifications

**Maximum Input Pressure:** 125 PSI

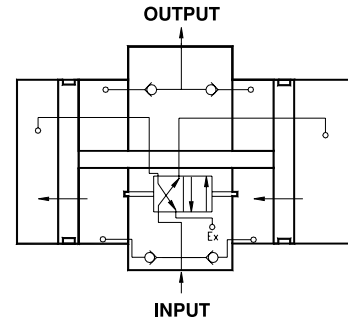
**Operating Temperature:** 15° to 160°F

**Lubrication:** HT-99 oil; Pre-lubricated

**Bodies and Center Section:** Aluminum; Hard Coat with PTFE

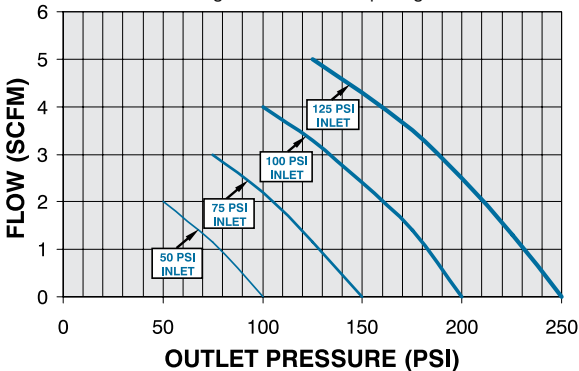
**Mounting Plate:** Anodized Aluminum

NOTE: Bimba Air Boosters are designed for intermittent duty usage such as maintaining pressure in an air reservoir. Continuous cycling decreases seal life. Max boosted pressure will be 10% to 20% less than 2x input pressure due to system pressure drops.



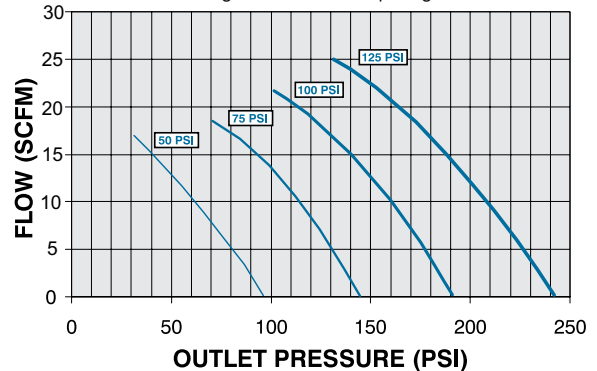
### AB121 Flow Data

Estimated charge time: 28 seconds per 1 gallon reservoir



### AB221 Flow Data

Estimated charge time: 30 seconds per 5 gallon reservoir



# How to Order

## Series: AB121 With Air Reservoir

Model AB121 Air Booster furnished with Air Reservoir. Anodized Aluminum Tube and End Cap construction.

### AB121 - ARB 800 x 36

Auto Reciprocating  
Air Booster

Air Reservoir  
for Booster

8" Bore Size

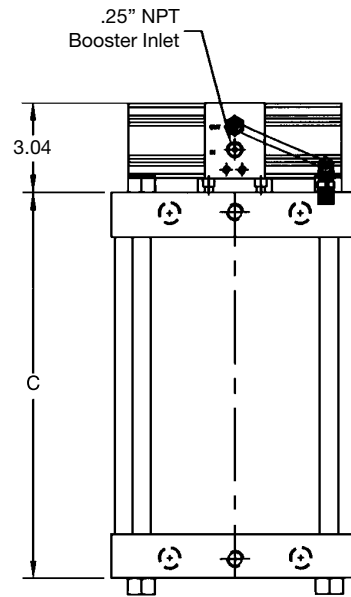
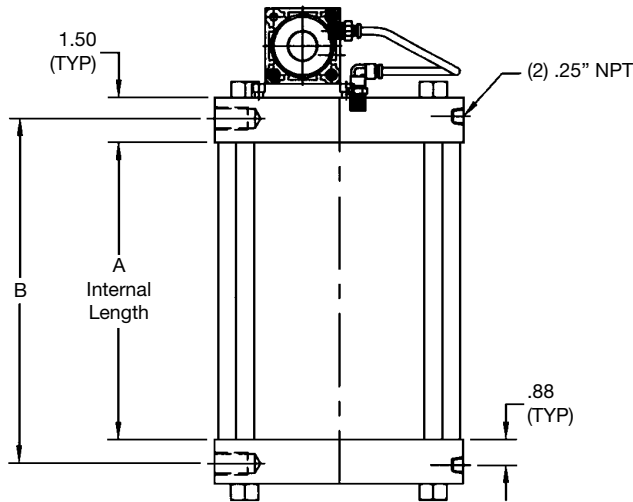
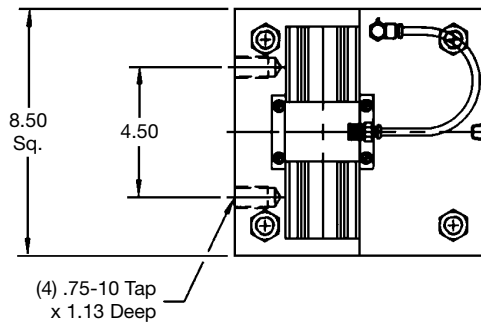
Internal Length

12, 18, 24, or 36

Note: Other lengths available. Contact factory for details.



Pressure Rating  
250 Psi Max.



## Series AB121-ARB800 X \_\_ – Air Booster Model AB121 Mounted And Piped To ARB800 Air Reservoir

Part Number & Volume					Internal Length (Inches)	Dimensions		
Part No.	Tank Bore	Area	Gal. Per In. Of Tank	Total Cu. Ft. Per Tank *	A	B	C	
AB121-ARB800 X 12	8	50.26	.2175	.349	12	13.63	15	
AB121-ARB800 X 18	8	50.26	.2175	.523	18	19.63	21	
AB121-ARB800 X 24	8	50.26	.2175	.698	24	25.63	27	
AB121-ARB800 X 36	8	50.26	.2175	1.047	36	37.63	39	

\*Internal Volume of reservoir.

## Series: Air To Air Intensifier/Air To Hydraulic Intensifiers

Air-to-Air or Air-to-Hydraulic intensifiers are single-shot, one output per stroke design.

### Benefits of Air to Air Intensifiers:

- > Quick Response
- > High Volume Outputs Available
- > Simple Design
- > Heavy-Duty Construction

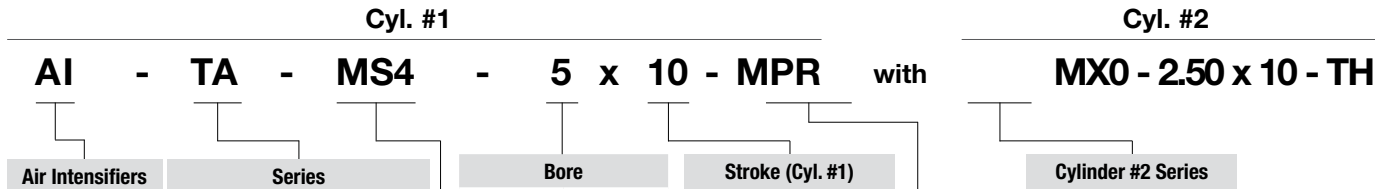
### Benefits of Air to Hydraulic Intensifiers:

- > Quick Response
- > High Volume Outputs Available
- > Intensified Material Can Be Oil or Other Media
- > Can Be Used For Measuring and Dispensing



# How to Order

## Series: Air To Air Intensifier and Air To Hydraulic Intensifiers



**NFPA Mounts**

MX0	No Mount (1.50" - 12.00" Bore)
MF1	Front Flange (1.50"-6.00" Bore)
MS2	Side Lug (1.50"- 4.00" Bore Std., 5.00" & Above Consult Factory)
MS4	Bottom Tapped Holes (1.50" - 12.00" Bore)

**Options (Cyl. #1 or Cyl. #2)**

AS	Adjustable Stroke - Retract (Specify Length, Example: AS = 4")
» B	.25" Urethane Bumper Both Ends
» BC	.25" Urethane Bumper Cap Only
» BH	.25" Urethane Bumper Head Only
BP	BSP/BSPT Ports - Bumper Piston Seals (1.50" - 8.00" Bore)
BSPP	British Standard Pipe Taper
BSPT	British Standard Pipe Parallel
H	Head Cushion
C	Cap Cushion
MA	Micro-Adjust (12" Max. Stroke) Available On Double Rod End Models
MAB	Micro-Adjust With Sound Dampening Bumper (12" Max. Stroke)
MPR	Magnetic Piston For Reed Or Solid State Switches (Models: R10, RAC, and MSS)
OP	Optional Port Location (Example: OP=3,7)
SAE	SAE Ports (Specify Size, Example: SAE #10)
SSA	Stainless Steel Piston Rod, Tie Rods & Nuts, and Fasteners
SSF	Stainless Steel Fasteners
SSN	Stainless Steel Tie Rod Nuts
SSP	Solid Stainless Steel Piston
SSR	Stainless Steel Piston Rod
SST	Stainless Steel Tie Rods
TH	400 PSI Hydraulic Non-Shock
VS	Fluorocarbon Seals
XX	Special Variation (Specify)

### About our Part Number System

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

**Example:** Cyl. 1 is a standard 'TA' series, MS4 mount, 5" bore X 10" stroke, with a magnet (for Reed Switches), Air-to-Hydraulic Cylinder.

Cyl. 2 is a 'TA' series, MX0 (no mount), 2.50" bore X 10" stroke with "TH" option.

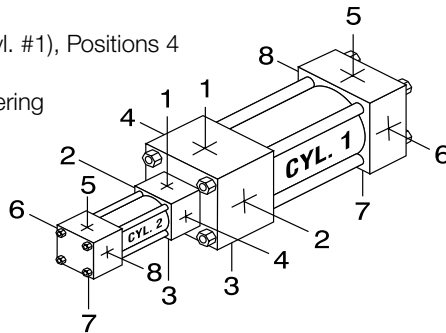
### Part Number:

AI - TA - MS4 - 5 x 10 - MPR with TA - MX0 - 2.50 x 10 - TH

Note: Refer to Options for specifications.  
 \*\*Bumpers add .25" per end to cylinder length.  
 » Adds Length To Cylinder - See "Option Length Adder" Chart Below.

### Standard Port and Cushion Adjustment Positions

- > Ports - Positions 1 and 5 (both cylinders)
- > Cushion Adjustment - Positions 2 and 6 (Cyl. #1), Positions 4 and 8 (Cyl. #2)
- > Specify Non-Standard Positions When Ordering



## Air To Air and Air To Hydraulic Intensifier Cylinders

Two (2) strokes must be the same, rods are connected.

### Air To Air Intensifiers – Standard Combinations

Cyl. #1	Cyl. #2		Intensifier Ratio	Output (PSI) of Cyl. #2 @ Input Pressure Of:			
	Bore	Area		50	80	100	120
3.25	8.296	1.50	1.767	4.69	235		
		2.00	3.142	2.64	132	211	264
4.00	12.566	2.00	3.142	4	200		
		2.50	4.909	2.56	128	205	256
5.00	19.635	2.50	4.909	4	200		
		3.25	8.296	2.37	119	190	237
6.00	28.274	3.25	8.296	3.41	171		
		4.00	12.566	2.25	113	180	225
8.00	50.265	4.00	12.566	4	200		
		5.00	19.635	2.56	128	205	256
10.00	78.54	6.00	28.274	1.78	89	143	178
		6.00	28.274	2.78	139	223	
12.00	113.10	6.00	28.274	4	200		
		8.00	50.265	2.25	113	180	225

Note: Cyl. #2 Output Not To Exceed 250 PSI.  
 Intensifier Ratio = Cyl. #1 Area / Cyl. #2 Area  
 Output Pressure = Input Pressure X Intensifier Ratio

Note: Usable volume of air-to-air output will not match cylinder #2 volume due to compressibility of air.

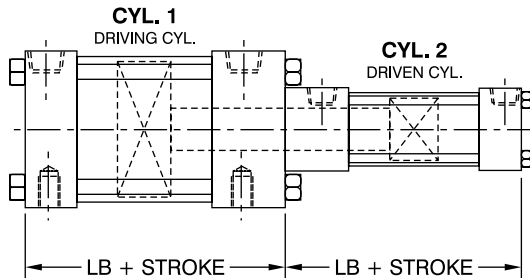
### Air To Hydraulic Intensifiers – Standard Combinations

Cyl. #1	Cyl. #2		Intensifier Ratio	Output (PSI) of Cyl. #2 @ Input Pressure Of:			
	Bore	Area		50	80	100	120
3.25	8.296	1.50	1.767	4.69	235	375	
		2.00	3.142	2.64	132	211	264
4.00	12.566	1.50	1.767	7.11	356		
		2.00	3.142	4	200	320	400
5.00	19.635	2.50	4.909	2.56	128	205	256
		2.00	3.142	6.25	313		
6.00	28.274	2.50	4.909	4	200	320	400
		3.25	8.296	2.37	119	190	237
8.00	50.265	2.50	4.909	5.76	288		
		3.25	8.296	3.41	171	273	341
10.00	78.54	4.00	12.566	2.25	113	180	225
		3.25	8.296	6.06	303		
12.00	113.10	4.00	12.566	4	200	320	400
		5.00	19.635	2.56	128	205	256
12.00	113.10	6.00	28.274	1.78	89	143	178
		6.00	28.274	2.78	139	223	278
12.00	113.10	5.00	19.635	5.76	288		
		8.00	50.265	2.25	113	180	225

Note: Cyl. #2 Output Not To Exceed 400 PSI Non-Shock.  
 Intensifier Ratio = Cyl. #1 Area / Cyl. #2 Area  
 Output Pressure = Input Pressure X Intensifier Ratio

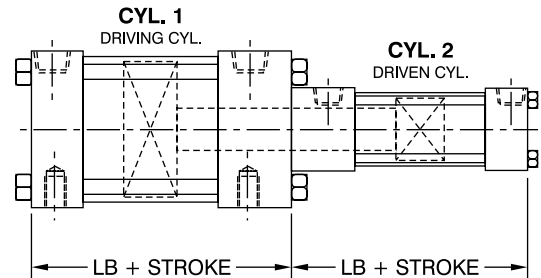
For complete dimensions, refer to 'TA' section of catalog.

### Air To Air Intensifiers – Basic Dimensions



Bore	LB	Bore	LB	Bore	LB
1.50	3.625	4.00	4.250	10.00	6.375
2.00	3.625	5.00	4.500	12.00	6.875
2.50	3.750	6.00	5.000		
3.25	4.250	8.00	5.125		

### Air To Hydraulic Intensifiers – Basic Dimensions



Bore	LB	Bore	LB	Bore	LB
1.50	3.625	4.00	4.250	10.00	6.375
2.00	3.625	5.00	4.500	12.00	6.875
2.50	3.750	6.00	5.000		
3.25	4.250	8.00	5.125		

### Cylinder Volumes (Per Inch Of Cylinder Stroke)

Bore	Area	Gal. Per In. Of Stroke	Bore	Area	Gal. Per In. Of Stroke	Bore	Area	Gal. Per In. Of Stroke
1.50	1.767	.0076	4.00	12.566	.0054	10.00	78.54	.340
2.00	3.142	.0136	5.00	19.635	.085	12.00	113.10	.4896
2.50	4.909	.0213	6.00	28.274	.122			
3.25	8.296	.0359	8.00	50.265	.2175			

Notes: (To Figure Volumes) Cubic Inches = Area X Stroke Gallons = (Area X Stroke) / 231  
 Example: 3.25" Bore X 16" Stroke Cylinder = 8.296 X 16 = 132.736 Cu. In. Or .575 Gallons

### Cylinder Volumes (Per Inch Of Cylinder Stroke)

Bore	Area	Gal. Per In. Of Stroke	Bore	Area	Gal. Per In. Of Stroke	Bore	Area	Gal. Per In. Of Stroke
1.50	1.767	.0076	4.00	12.566	.0054	10.00	78.54	.340
2.00	3.142	.0136	5.00	19.635	.085	12.00	113.10	.4896
2.50	4.909	.0213	6.00	28.274	.122			
3.25	8.296	.0359	8.00	50.265	.2175			

Notes: (To Figure Volumes) Cubic Inches = Area X Stroke Gallons = (Area X Stroke) / 231  
 Example: 3.25" Bore X 16" Stroke Cylinder = 8.296 X 16 = 132.736 Cu. In. Or .575 Gallons

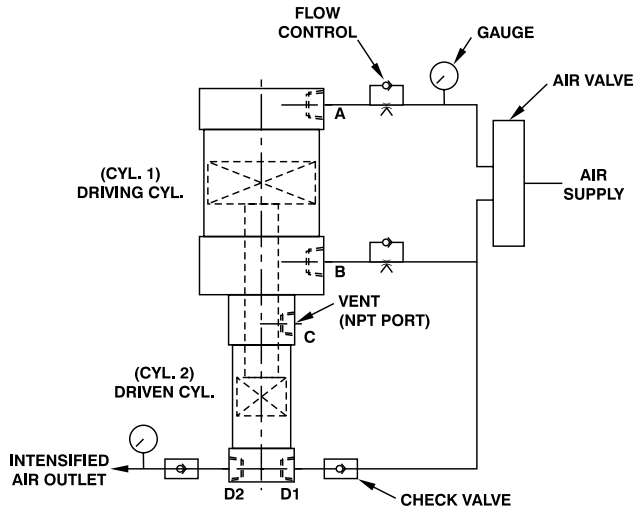
# How to Specify

## Air to Air Intensifiers – Schematics

- > Same Stroke In Each Cylinder
- > Rods Are Connected

### Actuation Sequence:

- > Pressure To Ports 'A' Extends Cylinder
- > Pressure To Ports 'B' Retracts Cylinder



### Example:

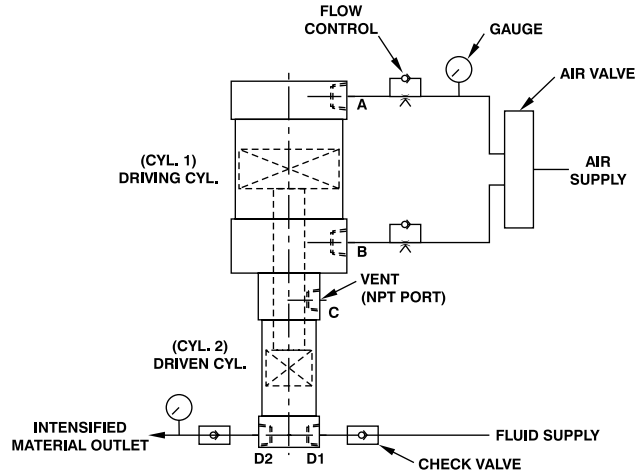
Shown is an air to air intensifier for applications requiring supply to be intensified. Supply air to port 'A' will stroke cylinder and intensified air will exit port 'D2'. To return cylinder supply air to port 'B' two (2) flow controls used to regulate cylinder speed.

## Air to Hydraulic Intensifiers – Schematics

- > Same Stroke In Each Cylinder
- > Rods Are Connected

### Actuation Sequence:

- > Pressure To Ports 'A' Extends Cylinder
- > Pressure To Ports 'B' Retracts Cylinder



### Example:

Shown is an air to hydraulic intensifier for applications requiring fluid supply to be intensified. Supply air to port 'A' will stroke cylinder and intensified material will exit port 'D2'. To return cylinder supply air to port 'B' two (2) flow controls used to regulate cylinder speed.





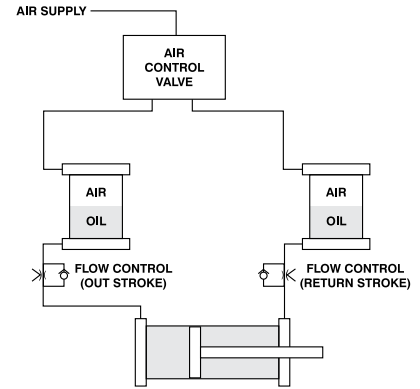
# Product Features

## AT – Air/Oil Tanks

Part Number & Volume				Plus Internal Length	Tank Dimensions							
Part No.	Bore	Area	Gals Per Inch Tank*		B	AH	C	D	E	F	G	H
AT250	2.50	4.91	.0213		4.000	1.625	3.000	2.250	1.125	0.438	0.375	0.375
AT325	3.25	8.29	.0359		5.000	1.938	3.750	2.750	1.375	0.563	0.500	0.375
AT400	4.00	12.56	.0544		5.000	2.250	4.500	3.500	1.750	0.563	0.500	0.375
AT500	5.00	19.64	.085		5.250	2.750	5.500	4.250	2.125	0.688	0.500	0.375
AT800	8.00	50.26	.2175		6.625	4.250	8.500	7.125	3.563	0.688	0.750	0.750

\* This is total internal volume, not recommended usable oil capacity.  
 \*\* Fill and drain ports located at top & bottom of air oil tank.  
 † On the AT500 & AT800 the fill & drain ports are not on centerline.  
 Note: When torquing Air/Oil Tank tie rods, refer to page 280 for specifications.

TYPICAL AIR-OIL CIRCUIT



Cylinder Bore (in.)	Piston Area (sq. in.)
1.50	1.77
2.00	3.14
2.50	4.91
3.25	8.30
4.00	12.57
5.00	19.64
6.00	28.27
8.00	50.27

Bore	Area	Actual Internal Length Of Tank															
		5	6	7	8	9	10	12	14	16	18	20	25	30	35	40	45
2.50	4.91	17	20	24	27	31	34	41	48	55	61	68	86	103	120	137	154
3.25	8.30	29	34	40	46	52	58	69	81	93	104	116	145	174	203	232	261
4.00	12.57	44	52	61	70	79	88	105	123	140	158	176	220	264	308	352	396
5.00	19.64	68	82	96	110	123	137	165	192	220	247	275	343	412	481	550	618
8.00	50.27	176	211	246	281	317	352	422	493	563	633	704	880	1056	1232	1408	1584

## SS-AT – Air/Oil Tanks

### Features:

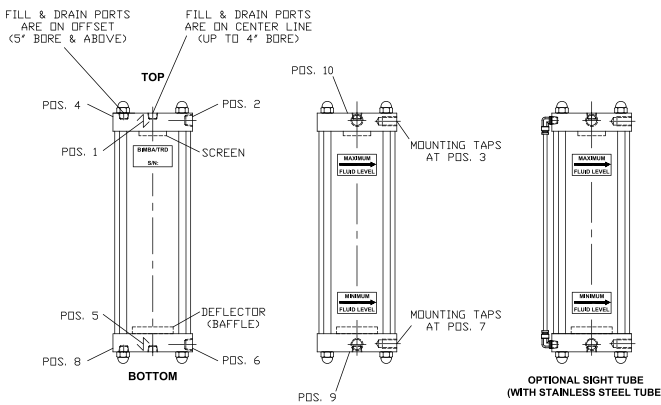
- > 300 series stainless steel hardware
- > 250 PSI operating pressure
- > Internal steel baffles to reduce aeration and foaming
- > Fiber wound translucent tube (non-FDA material)
- > Optional stainless steel tube with sight glass (FDA approved materials)
- > Standard mount (MS4; four-tapped mounting holes back side)
- > Side lug mount (MS2) optional
- > Fill port located in top, drain port in bottom cap
- > Optional oversized ports for high flow applications or SAE and BSP ports

The Bimba air/oil system gives you the smooth operation typically associated with hydraulic systems but without the expense. Uses shop air, two air/oil tanks and a cylinder equipped with “TH” (hydraulic seals). Low initial investment and low maintenance to operate.

Tanks need to be mounted above the cylinder but not necessarily by the cylinder. This will create a self-purging oil circuit. It is advisable to size tanks 30-50% larger than cylinder volume in order to prevent the tanks from running dry and to allow for heat expansion.

### Sizing Your Air/Oil Tank:

1. Determine the cylinder volume by multiplying the square inches of piston area by the inches of stroke (see Table B). Add 30-50% to determine actual tank size.
2. Find the volume closest to your tank volume requirement in Table C. Note: Tanks of smaller diameters with greater lengths are generally less expensive than larger diameter, short tanks of equal volume.
3. To order, specify bore and internal length required. Example: SS-AT250 x 14 (2.50” bore, 14” internal tank length, with a usable volume of 52 cubic inches).



### How To Order:

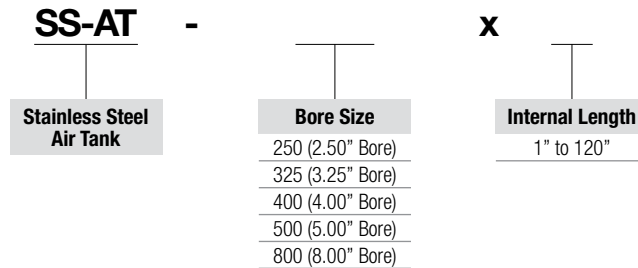
Specify bore and internal length required.

#### Example 1: SS-AT250 x 10

(2.50” bore, 10” internal tank length with a usable volume of 52 cubic inches)

#### Example 2: SS-AT800 x 25

(8” bore, 25” internal tank length with a usable volume of 92 cubic inches)



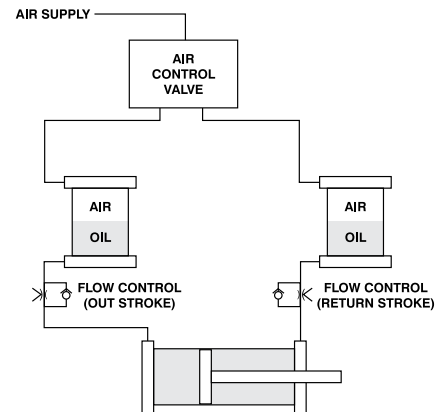
# Product Features

## SS-AT – Air/Oil Tanks

SS-AT Model			Plus Internal Length	Tank Dimensions					
Part No.	Bore	Gals Per Inch Tank*		B	C	D	F	G	EE
SS-AT250	2.50	0.0213	2.000	3.000	1.250	0.438	3/8-16 x 0.625 DEEP	0.375	0.375
SS-AT325	3.25	0.0359	2.500	3.750	1.500	0.563	1/2-13 x 0.750 DEEP	0.500	0.375
SS-AT400	4.00	0.0544	2.500	4.500	2.063	0.563	1/2-13 x 0.750 DEEP	0.500	0.375
SS-AT500	5.00	0.0850	2.500	5.500	2.688	0.688	5/8-11 x 1.000 DEEP	0.500	0.375
SS-AT800	8.00	0.2175	3.000	8.500	4.500	0.688	3/4-10 x 1.125 DEEP	0.750	0.750

\* This is total internal volume, not recommended usable oil capacity.  
 \*\* Fill and drain ports located at top & bottom of air oil tank.  
 ▲ On the SS-AT500 & SS-AT800 the fill & drain ports are not on centerline.  
 Note: When torquing Air/Oil Tank tie rods, refer to page 280 for specifications.

### TYPICAL AIR-OIL CIRCUIT



**Table B - Cylinder Piston Area**

Cylinder Bore (In.)	Piston Area (Sq. In.)
1.50	1.77
2.00	3.14
2.50	4.91
3.25	8.30
4.00	12.57
5.00	19.64
6.00	28.27
8.00	50.27

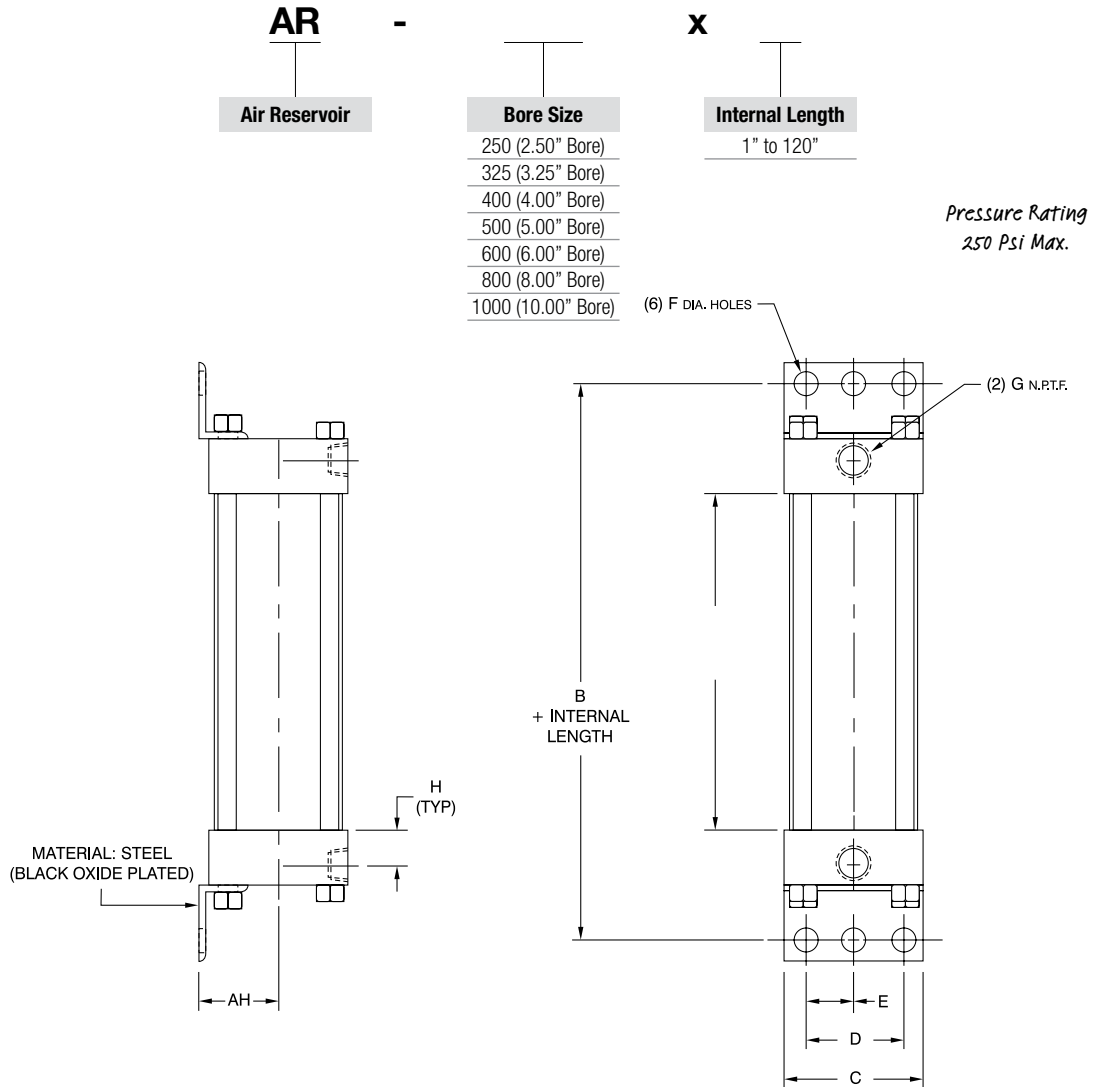
**Table C - Recommended Usable Tank Volume (Cubic Inches) With 30% Safety Factor**

Bore	Area	Actual Internal Length Of Tank															
		5	6	7	8	9	10	12	14	16	18	20	25	30	35	40	45
2.50	4.91	17	20	24	27	31	34	41	48	55	61	68	86	103	120	137	154
3.25	8.30	29	34	40	46	52	58	69	81	93	104	116	145	174	203	232	261
4.00	12.57	44	52	61	70	79	88	105	123	140	158	176	220	264	308	352	396
5.00	19.64	68	82	96	110	123	137	165	192	220	247	275	343	412	481	550	618
8.00	50.27	176	211	246	281	317	352	422	493	563	633	704	880	1056	1232	1408	1584

## AR Series Air Reservoir

Stand-alone Air Reservoir from 2.50" to 10.00" bore size. Anodized Aluminum Tube and End Cap, Steel Mounting Bracket construction.

Note: Air reservoir is supplemental to existing air only. It is not a long-term storage vessel.



Part Number & Volume				Dimensions								
Part Number	Bore	Area	Gallon Per Inch of Reservoir*	Plus Internal Length	AH	C	D	E	F	G	H	
				B								
AR-250	2.50	4.909	.0213	4.000	1.625	3.000	2.250	1.125	0.438	0.375	0.625	
AR-325	3.25	8.29	.0359	5.000	1.938	3.750	2.750	1.375	0.563	0.500	0.625	
AR-400	4.00	12.56	.0544	5.000	2.250	4.500	3.500	1.750	0.563	0.500	0.750	
AR-500	5.00	19.64	.085	5.250	2.750	5.500	4.250	2.125	0.688	0.500	0.750	
AR-600	6.00	28.27	.122	5.750	3.250	6.500	5.250	2.625	0.813	0.750	0.875	
AR-800	8.00	50.26	.2175	6.625	4.250	8.500	7.125	3.563	0.813	0.750	0.875	
AR-1000	10.00	78.54	.340	7.625	5.313	10.625	8.625	4.313	0.813	1.000	1.125	

\*Internal Volume of reservoir.











# Bench Top Press & Cylinders

Bimba offers several bench top press options to accommodate your pressing applications, including pre-assembled solutions and standalone press frames.



# Contents

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**259** Heavy Duty Bench Top Press  
260 – How to Order  
260 – Dimensions  
261 – Technical Data

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**262** Press Frame Cylinder  
262 – How Multi-Stage Cylinders  
Works  
263 – How to Order - Single Stage  
263 – How to Order - Multi-Stage  
264 – How to Order - Triple Rod  
265 – Options  
266 – Dimensions

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## Heavy Duty Bench Top Press

### Model: BTP-501

- > For single piston rod, 5.00" Bore, MF1 mount cylinders



Heavy Duty Bench Top Press shown with 5.00" Bore three (3) Stage Multi-Stage Cylinder and Micro-Adjust precision stroke adjustment

### Model: BTP-502

- > For 'TRA' triple piston rod, 5.00" Bore, MF1 mount cylinders



Heavy Duty Bench Top Press shown with 5.00" Bore Single-Stage Triple Rod Cylinder and Tooling Plate

### Heavy Duty Bench Top Press Features

- > Heavy duty steel keyed and bolted construction
- > Adjustable work heights - Choose from three different built-in height settings (2" increments)
- > Open work area - Allows for through feed or side feed of large parts.
- > Removable, oversized ground tool plate, dowel pinned to press frame - provides precision location of tool plate to press frame
- > Press designed to accept 5.00" Bore NFPA standard cylinders, Multi-Stage cylinders, or optional Triple Rod Cylinders.
- > 8.00" Bore specials also available upon request
- > Optional External Mounted Non-Rotating Feature
- > Strokes from 1.00" to 6.00"
- > Easy to Assemble or can be ordered fully assembled
- > Finish - All steel parts are Black Oxide Plated, aluminum parts are Anodized
- > NRE (non-rotating) option available

# How to Order

TRD Series Bench Top Presses are ordered using an alphanumeric cluster. An example Bench Top Press part number can be found below.

## BTP

Series	
BTP	Bench Top Press Frame

## 501

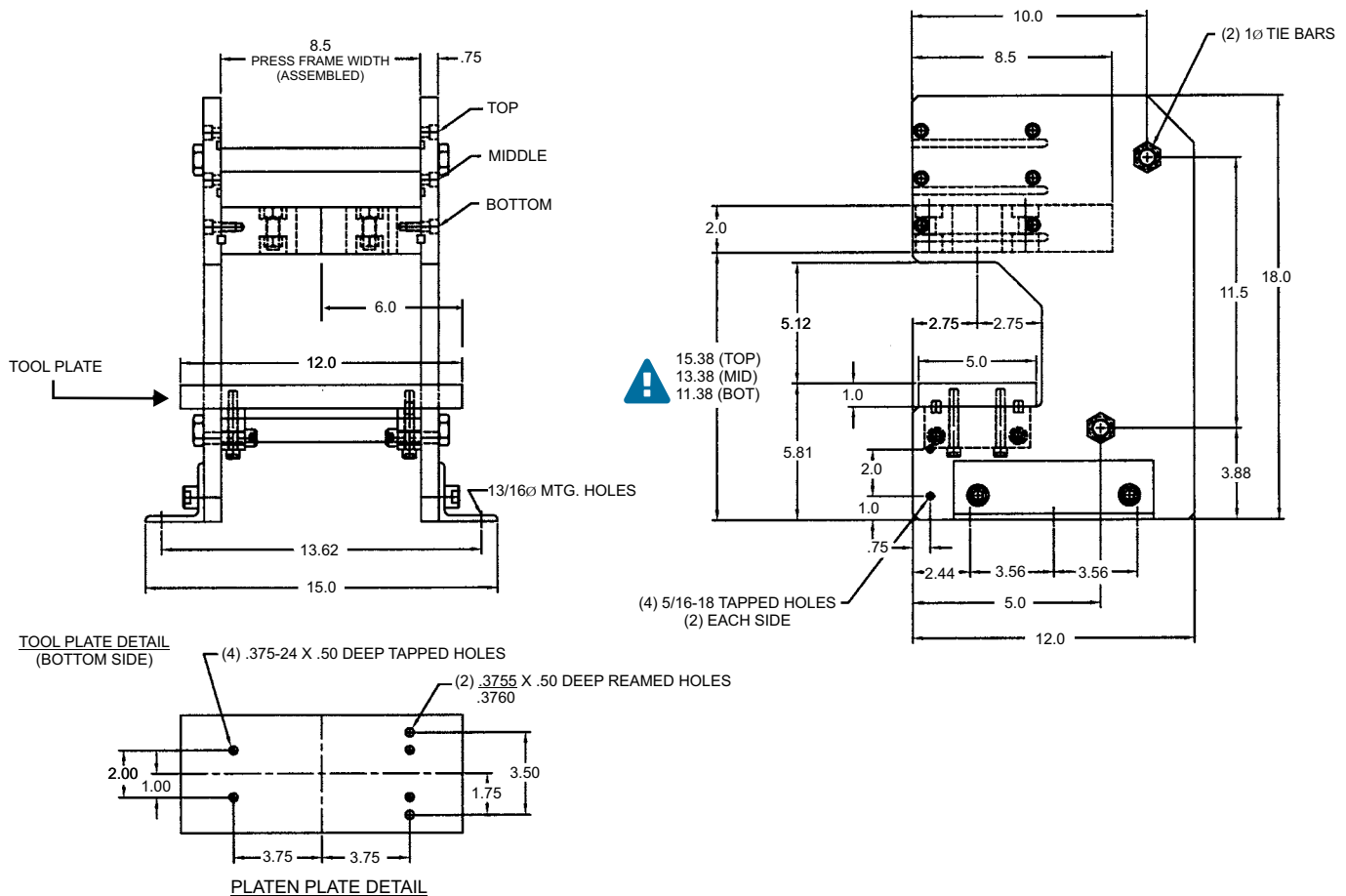
Model	
501	5.00" Bore Cylinder Mounting (Single Stage Or Multi-Stage)
502	5.00" Bore Triple Rod Cylinder Mounting

Order cylinder separately.

### Options

A	Fully Assembled (Press & Cyl.)
NRE	Non-Rotating External (Specify Cyl. Stroke & Rod Dia.)
U	Unassembled Unit

## Dimensions



### Notes:

- > **▲** Dimension reflects the press top plate mounted in the bottom (lowest) position. Add 2" for mid position and 4" for top position
- > Mounting brackets are reversible and can be assembled on inside of press frame to reduce overall width.
- > **Weight:** 120 pounds (press frame only)

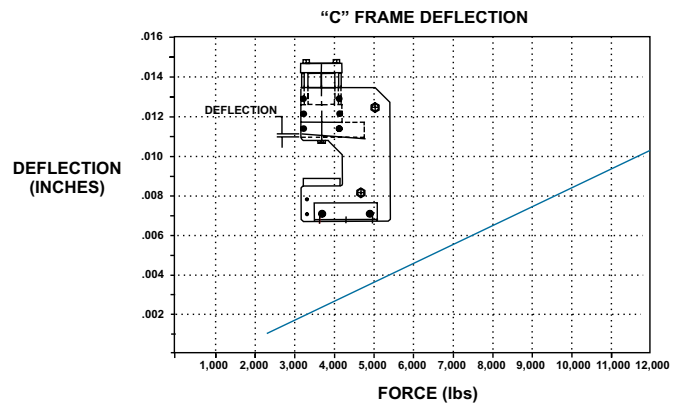
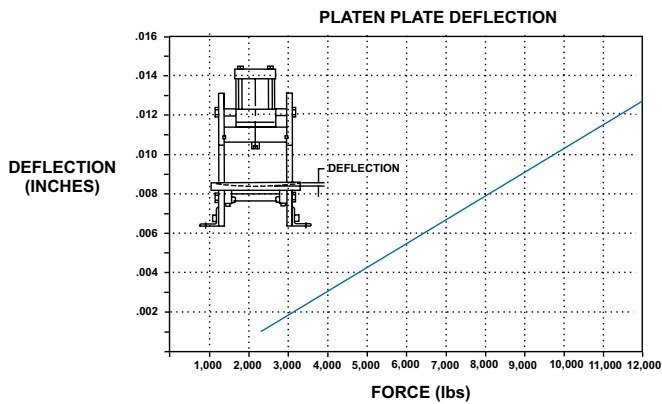
## Bench Top Press – Technical Data

### Cylinder Selection Force Chart

Extend Force									
Cylinder	Rod Diameter	Effective Area Extending	60 PSI	70 PSI	80 PSI	90 PSI	100 PSI	110 PSI	125 PSI
Single Stage	1.000	19.635	1178	1374	1570	1767	1963	2160	2454
	1.375	19.635	1178	1374	1570	1767	1963	2160	2454
(2) Stage	1.000	38.485	2309	2693	3078	3463	3848	4233	4810
	1.375	37.785	2267	2644	3022	3400	3778	4156	4723
(3) Stage	1.000	57.334	3440	4013	4586	5160	5733	6306	7166
	1.375	55.935	3356	3915	4474	5034	5593	6153	6992
(4) Stage	1.000	76.184	4571	5332	6094	6856	7618	8380	9523
	1.375	74.085	4445	5186	5927	6667	7408	8149	9260
(5) Stage	1.000	95.034	5702	6652	7602	8553	9503	10453	11879
	1.375	92.235	5533	6456	7379	8301	9223	10145	11529

Retract Force									
Cylinder	Rod Diameter	Effective Area Extending	60 PSI	70 PSI	80 PSI	90 PSI	100 PSI	110 PSI	125 PSI
Single Stage (Or Multi-Stage)	1.000	18.85	1131	1319	1508	1696	1885	2073	2356
	1.375	18.15	1089	1270	1452	1633	1815	1996	2268
Triple Rod	1.000	17.279	1036	1209	1382	1555	1728	1900	2160

### Press Frame Deflection Charts



### Press Frame Cylinder Speed Chart

#### Notes:

- > Cylinder cycle rates can vary depending on air valve sizes, airline diameter and length, type of fitting, and if quick exhaust dump valves are used.
- > The Speed Chart represents how fast cylinders can cycle and build pressure at each end of stroke (to simulate work being done.) To maximize cylinder performance, all cycle tests were performed using 5 Cv double solenoid valves, .750" air hose and quick-dump exhaust valves.

Cylinder	Cycles Per Minute
(1) Stage-TA	263
(2) Stage	141
(3) Stage	125
(4) Stage	91
(5) Stage	77

# Product Features

## Press Frame Cylinder

Choose from **Single Stage, Multi-Stage, Triple-Rod (Non-Rotating with Tool Plate)** or **Triple-Rod Multi-Stage Press Cylinders**. Double rod end styles are available on all models.

- > **Single Stage:** Basic single bore, double acting cylinder.
- > **Multi-Stage:** Multi-Stage cylinders are double acting and multiply the output force by supplying air to multiple pistons. The MSEP multiplies the force on the extend stroke and uses only one piston on the return stroke, saving air volume and operating costs. The MSEP-MSRP multiplies the force in both directions. Choose from 2 stage (2S), 3 stage (3S), 4 stage (4S), or 5 stage (5S) models.
- > **Triple Rod:** A cylinder with three piston rods and a tooling plate as standard features. The 5.00" square tooling plate distributes the cylinder force over a large work area. Standard features also include four (4) .500-20 UNF tapped holes in the tooling plate that can be used to mount customer fixtures or tooling. Triple rod cylinders can be ordered as a single stage or multi-stage (2S, 3S, 4S or 5S) models.

### About Rod End Styles

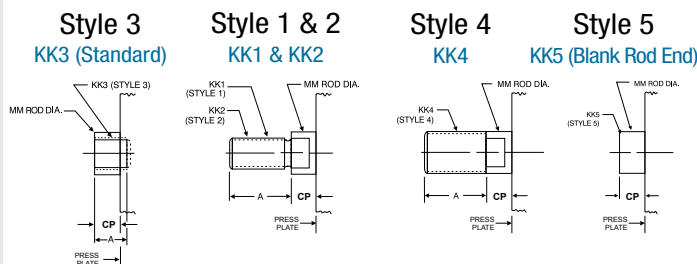
Style 3 (KK3) Female Rod End is STANDARD.

Other NFPA styles can be specified (see chart).

Need a rod end not listed? NO PROBLEM! Each Piston Rod is made-to-order and does not delay shipment. Coarse UNC threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

NEED SOMETHING NOT LISTED? Just send us a sketch. In most cases, quotes are turned around in one day!

### Piston Rod End Styles



Single Stage or Multi-Stage Rod End Styles & Options

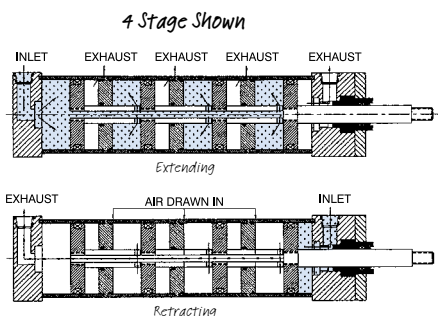
Rod Diameter (MM)	C	Standard		Optional						
		Style 3 - Female		Style 1 - Male		Style 2 - Male		Style 4 - Male		Style 5 - Blank
		KK3	A	KK1	A	KK2	A	KK4	A	KKS
1.000 Standard	0.875	3/4-16	1.125	3/4-16	1.125	7/8-14	1.125	1-14	1.125	No Thread
1.375 Oversize	0.875	1-14	1.625	1-14	1.625	1 1/4-12	1.625	1 3/8-12	1.625	

## How Multi-Stage Cylinders Work

### Model MSEP

Extension-air supplied to multiple pistons

Retraction-air supplied to one piston



Note: Cap cushion not available on MSEP

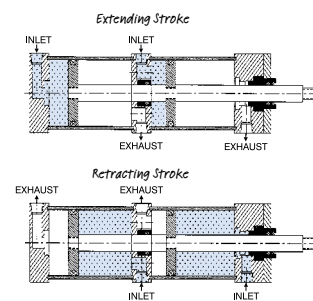
### Model MSEP/MSRP

Extension AND Retraction-air supplied to multiple pistons

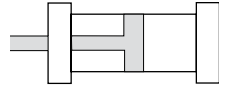
Head and Cap Cushion Available

To Order, specify: MSEP/MSRP as model number

Note: Overall lengths are increased



Model MSEP/MSRP  
2 Stage Shown



## Single Stage

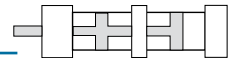
**TAP - MX3 - 5 x 1 - - -**

<b>Series</b>	<b>NFPA Mount</b>	<b>Bore</b>	<b>Stroke</b>	<b>Options</b>
TAP 250 PSI Air			0.5"* To 6" Made-To-Order	AO Air / Oil Piston
	<b>Style</b>	<b>Cushions</b>	<b>Rod Style End &amp; Modifications</b>	B** .25" Urethane Bumper Both Ends
	(Blank) Single Rod	(Blank) Non-Cushion	(Blank) KK3 Female Rod Thread	BH** .25" Urethane Bumper Head Only
	D Double Rod End (Required For "MA" Option)	H Head Cushion Position 1 Standard, Specify For Positions 2, 3 Or 4 (Example = H2)	KK3S Studded Piston Rod (With KK3)	BC** .25" Urethane Bumper Cap Only
		C Cap Cushion Position 5 Standard, Specify For Positions 6, 7 Or 8 (Example = C6)	KK1 Small Male Rod Thread	BSPP British Standard Pipe Taper
			KK2 Large Male Rod Thread	BSPT British Standard Pipe Parallel
			KK4 Full Diameter Male Rod Thread	MPR Magnetic Piston For Switches
			KK5 Blank Rod End	MA Micro-Adjust
			"A" Extended Piston Rod Thread (Specify)	MAB With Noise Dampening Bumper Installed
			"C" Extended Piston Rod (Specify)	MS Metallic Rod Scraper (Brass)
				OS Optional Port Location (Example: OP=3,7)
				OP Oversized Rod Diameter (1.375")
				SAE SAE Ports (specify size)
				TH 400 PSI Hydraulic, Non-Shock
				VS FKM® Seals
				XX Special Variation (Specify)

**PORT & CUSHION POSITIONS**

Standard Port Positions @ 3 and 7 (Back Of Press)  
Standard Cushion Positions @ 1 and 5 (Front Of Press)  
Specify Non-Standard Locations When Ordering

## Multi-Stage



**MSEP - MX3 - 5 x 1 - 2S - - -**

<b>Series</b>	<b>NFPA Mount</b>	<b>Bore</b>	<b>Stroke</b>	<b>Stages</b>	<b>Options</b>
MSEP 125 PSI Air or Hydraulic, Non-Shock (High Force Extend)			0.5"* To 6" Made-To-Order <small>*0.125 for MSEP</small>	2S Two	B** .25" Urethane Bumper Both Ends
MSEP/MSRP 125 PSI Air or Hydraulic, Non-Shock (High Force Extend and Retract)	<b>Style</b>	<b>Cushions</b>	<b>Rod Style End &amp; Modifications</b>	3S Three	BH** .25" Urethane Bumper Head Only
	(Blank) Single Rod	(Blank) Non-Cushion	(Blank) Female Rod Thread (KK3)	4S Four	BC** .25" Urethane Bumper Cap Only
	D Double Rod End (Required For "MA" Option)	H Head Cushion Position 1 Standard, Specify for Positions 2, 3 or 4 (Example = H2)	KK3S Studded Piston Rod (With KK3)	5S Five	BSPP British Standard Pipe Taper
		C Cap Cushion Position 5 Standard, Specify for Positions 6, 7 or 8 (Example = C6)	KK1 Small Male Rod Thread		BSPT British Standard Pipe Parallel
			KK2 Large Male Rod Thread		MPR* Magnetic Piston For Switches
			KK4 Full Diameter Male Rod Thread		MS Metallic Rod Scraper (Brass)
			KK5 Blank Rod End		OP Optional Port Location (Example: OP=3,7)
			"A" Extended Piston Rod Thread (Specify)		OS Oversized Rod Diameter (1.375")
			"C" Extended Piston Rod (Specify)		VS FKM® Seals
					XX Special Variation (Specify)
					SAE SAE Ports (Specify Size)

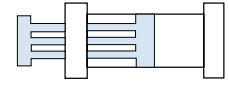
Note: MSEP vent ports are provided in line with cylinder ports as standard.

<b>Micro-Adjust</b>
MA Micro-Adjust
MAB With Noise Dampening Bumper Installed

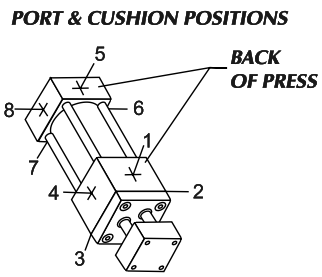
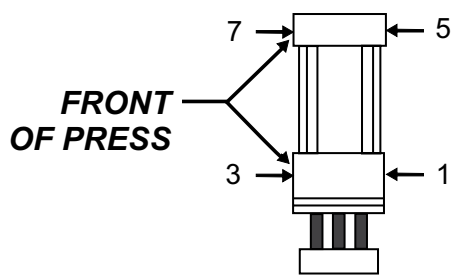
\*MPR add 0.875" to cylinder length  
\*\*Bumpers add .25" per end to cylinder length.

# How to Order

## Triple Rod (With Tool Plate)



<b>TRAP</b>		<b>MF1</b>		<b>5</b>		<b>x 1</b>		<b>x 2S</b>		<b>-</b>		<b>-</b>	
Series		NFPA Mount		Bore		Stroke		Stages		Cushions		Options	
TRAP	Single Stage, 250 PSI Air					0" To 6" Made-To-Order		(Blank)	Single Stage	(Blank)	Non-Cushion Head Cushion	B**	.25" Urethane Bumper Both Ends
TRAP-MSE	Multi-Stage Extend, 125 PSI Air							2S	Two	H	Position 2 Standard Specify For Positions 1 or 4 (Example = H2)	BH**	.25" Urethane Bumper Head Only
								3S	Three		Cap Cushion (TRP Only) Position 6 Standard Specify For Positions 5 or 8 (Example = C6)	BC**	.25" Urethane Bumper Cap Only
								4S	Four	C		BSPP	British Standard Pipe Taper
								5S	Five			BSPPT	British Standard Pipe Parallel
												MPR	Magnetic Piston For Switches
												OP	Optional Port Location (Example: OP=3,7)
												TH	400 PSI Hydraulic, Non-Shock
												VS	FKM® Seals
												XX	Special Variation (Specify)
												SAE	SAE Ports (Specify Size)



Standard Port Positions @ 1 and 5 (Back Of Press)  
 Standard Cushion Positions @ 2 and 6 (Front Of Press)  
 (Note: Ports or cushions not available at positions 3 & 7, front of press)  
 TRAP-MSEP vent ports are on back of press in line with cylinder ports as standard.

Micro-Adjust	
MA	Micro-Adjust
MAB	With Noise Dampening Bumper Installed

\*\*Bumpers add .25" per end to cylinder length.



## Options

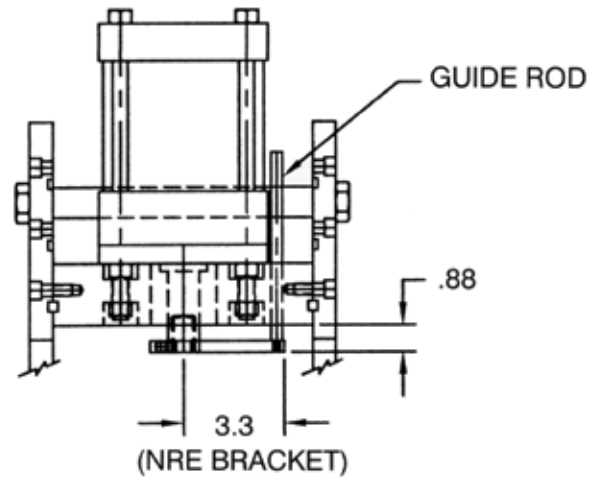
### NRE External Non-Rotating

The External Non-Rotating option prevents the piston rod (and any attached tooling) from rotating as the cylinder cycles.

Since the “NRE” bracket and guide rod are externally mounted, they can be added or removed for different applications. All press frames are made to accept this add-on option.

For high torsional load applications, cylinder can be equipped with a twin guide rod internally (“NR” cylinder option).

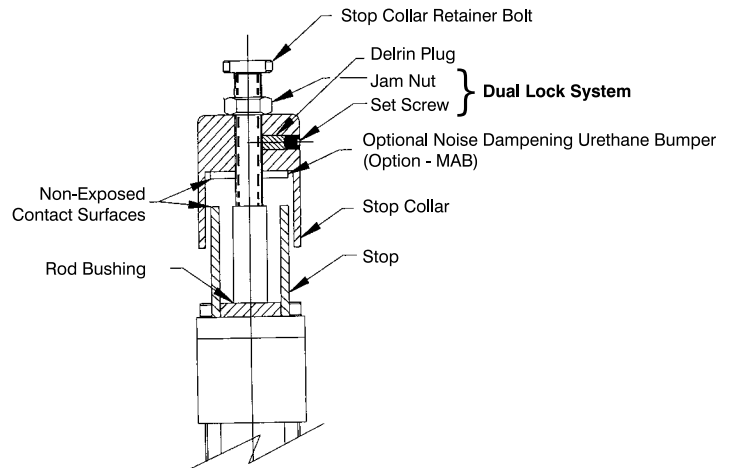
Consult factory for details.



### MA Micro-Adjust

- > Allows precision adjustment of cylinder extend stroke
- > Easy to read precision scale (.001” calibration)
- > Enclosed, no pinch point design
- > Available on all cylinder models with “D” Double Rod End option
- > Up to 6” stroke\* and adjustment over full range of stroke

\*6” stroke on BTP models.



### Balluff Transducer

Balluff transducers can provide positive verification on the depth of each cylinder stroke cycle. This is very important for today’s quality control system requirements.

#### Ideal Applications:

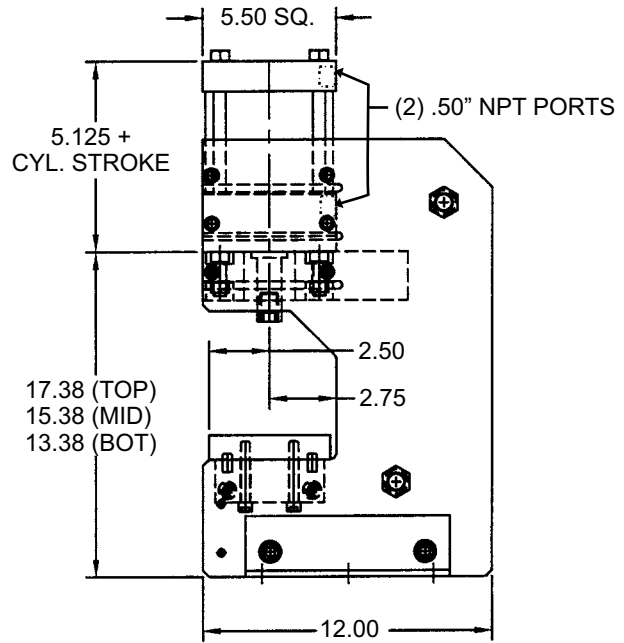
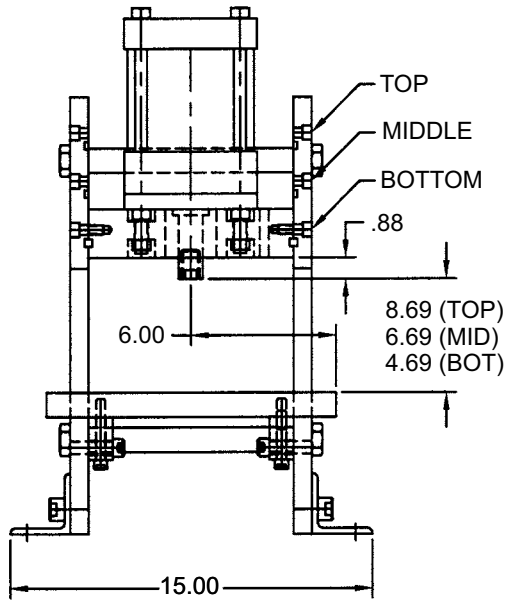
- > Pressing bearings into housings and depth control is critical.
- > Parts assembly
- > Parts positioning for joining operations (i.e. riveting)



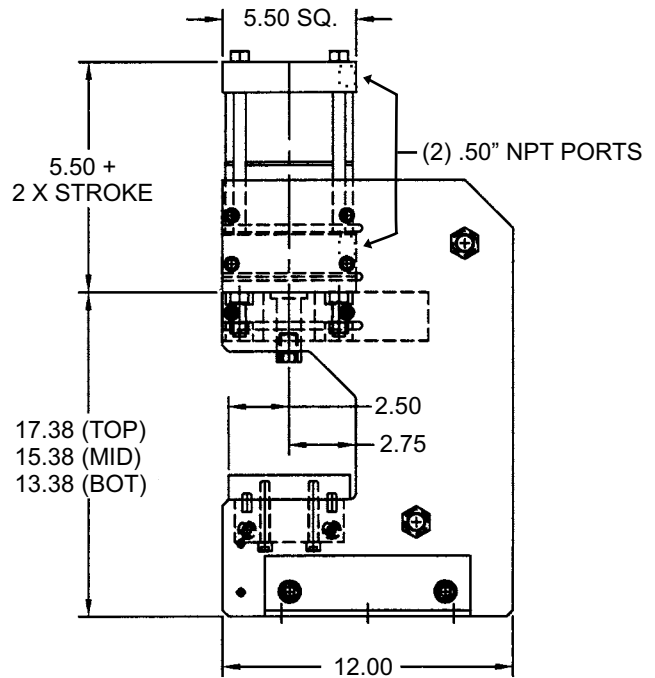
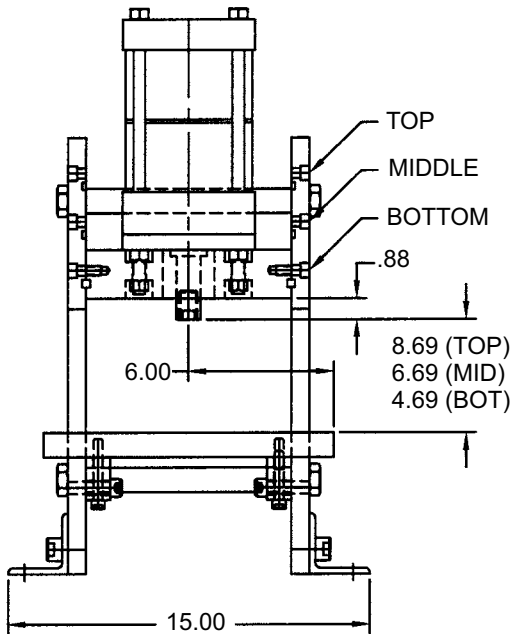
# How to Specify

## Dimensions

### TAP (Single Stage) - Dimensions

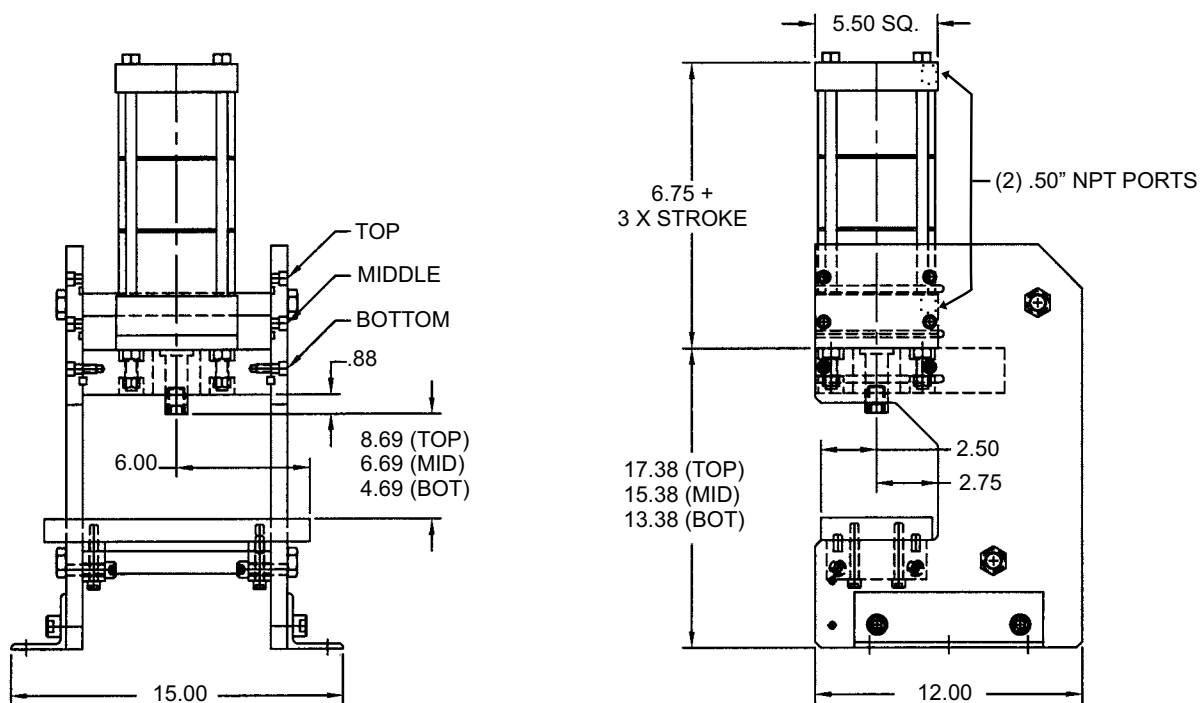


### MSEP 2S (2 Stage) - Dimensions

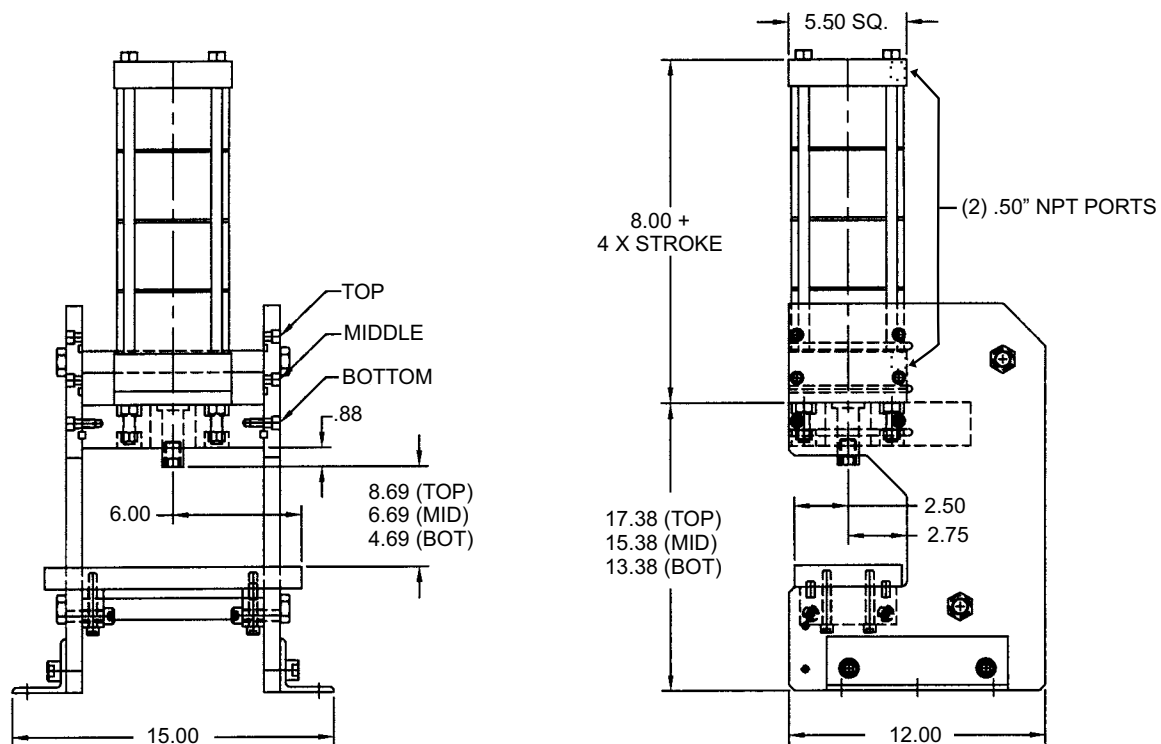


## Press Frame Cylinder – Dimensions

### MSEP 3S (3 Stage) – Dimensions



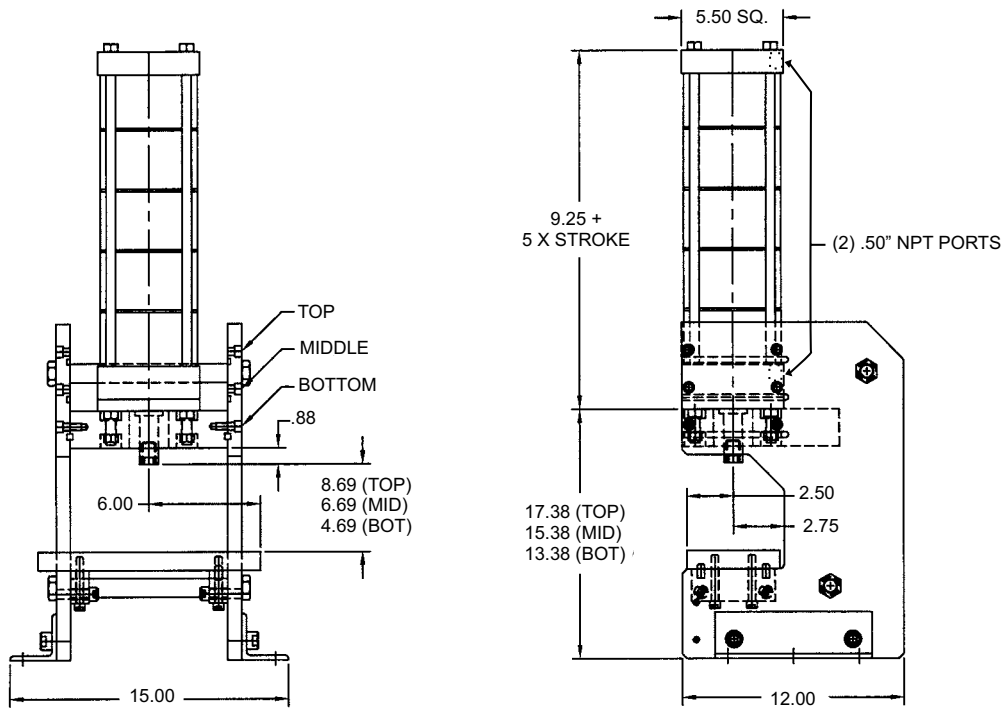
### MSEP 4S (4 Stage) – Dimensions



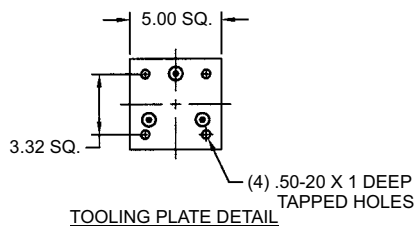
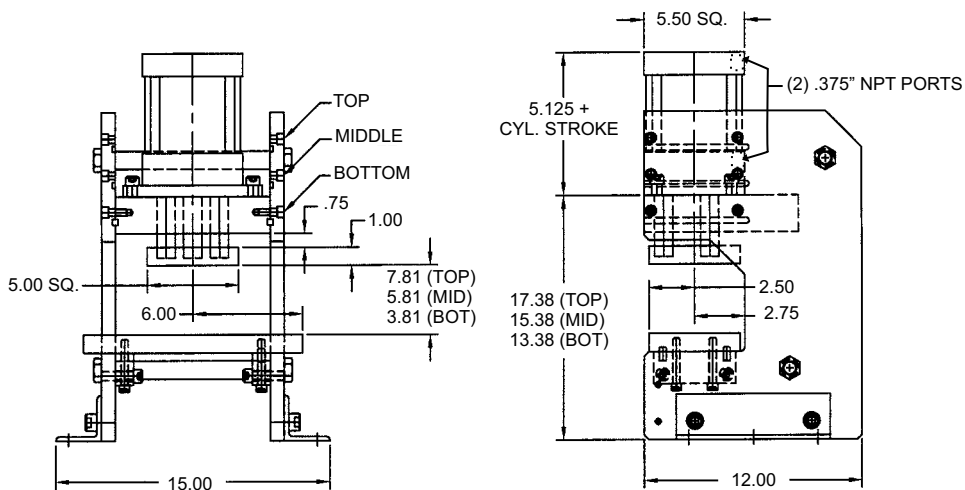
# Product Features

## Press Frame Cylinder – Dimensions

### MSEP 5S (5 Stage) – Dimensions



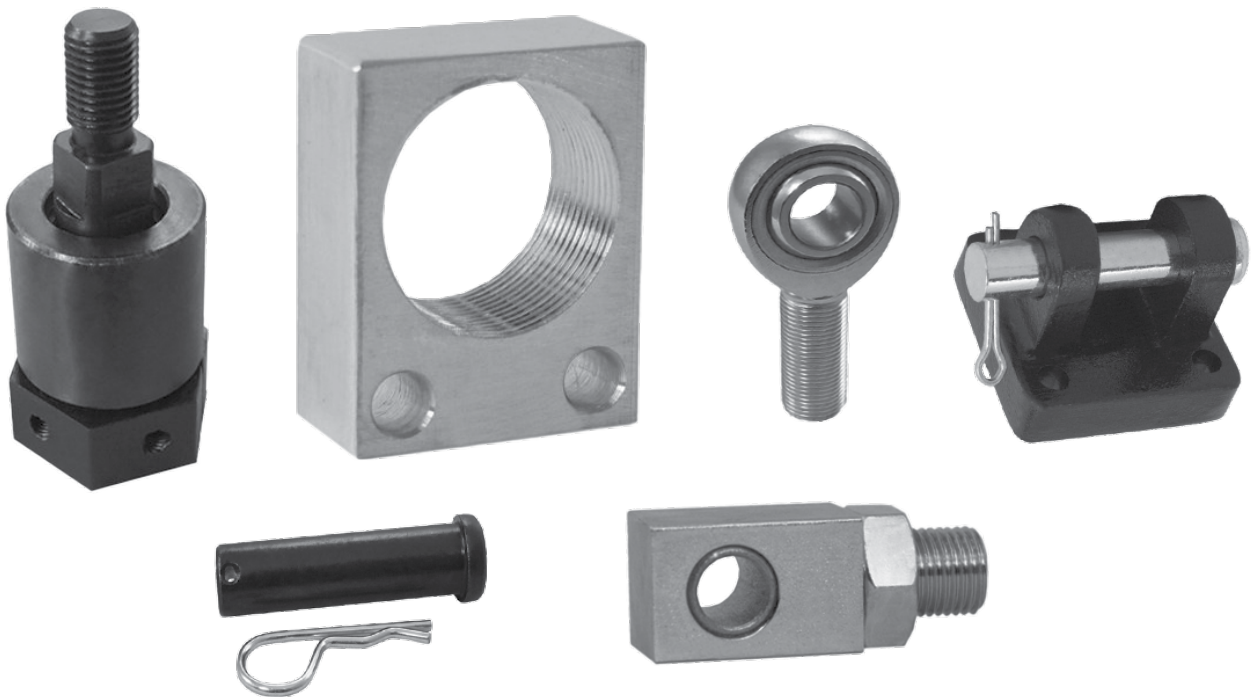
### TRP (Triple Rod) – Dimensions





# Cylinder Accessories

Every pneumatic actuator needs accessories to help facilitate normal operation, and Bimba offers a wide variety of accessory options that are designed to work with our NFPA actuators.



# Contents

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**271** How to Specify

271 – Clevis, Pins & Mounts

275 – Stainless Steel

    Clevis, Pins & Mounts

276 – Clevis, Pins & Mounts

277 – Spherical Rod Eyes

278 – Trunnion Blocks

281 – Alignment Couplers

283 – Flow Controls (FCP Series)

284 – Quik-Flo® Flow Controls  
    (FQP Series)

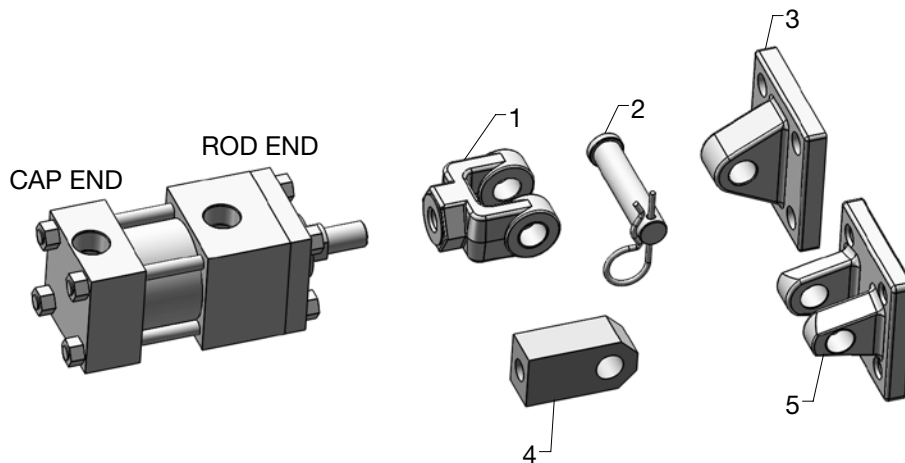
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## Accessories – Clevis, Pins & Mounts

Bore	Rod Diameter	Rod Thread	1	2	3	4	5
			Rod Clevis (Rod End) <sup>1</sup>	Clevis Pin (Rod End)	Eye Bracket (Rod End) <sup>2</sup>	Rod Eye (Rod End) <sup>1</sup>	Clevis Bracket (Rod End) <sup>2</sup>
1.50	0.625	7/16-20	RC437	CP500	EB500	RE437	CB500
1.50	1.000	3/4-16	RC750	CP750	EB750	RE750	CB750
2.00	0.625	7/16-20	RC437	CP500	EB500	RE437	CB500
2.00	1.000	3/4-16	RC750	CP750	EB750	RE750	CB750
2.50	0.625	7/16-20	RC437	CP500	EB500	RE437	CB500
2.50	1.000	3/4-16	RC750	CP750	EB750	RE750	CB750
3.25	1.000	3/4-16	RC750	CP750	EB750	RE750	CB750
3.25	1.375	1-14	RC1000	CP1000	EB1000	RE1000	CB1000
4.00	1.000	3/4-16	RC750	CP750	EB750	RE750	CB750
4.00	1.375	1-14	RC1000	CP1000	EB1000	RE1000	CB1000
5.00	1.000	3/4-16	RC750	CP750	EB750	RE750	CB750
5.00	1.375	1-14	RC1000	CP1000	EB1000	RE1000	CB1000
6.00	1.375	1-14	RC1000	CP1000	EB1000	RE1000	CB1000
6.00	1.750	1 1/4-12	RC1250	CP1375C	EB1375	RE1250	CB1375
8.00	1.375	1-14	RC1000	CP1000	EB1000	RE1000	CB1000
8.00	1.750	1 1/4-12	RC1250	CP1375C	EB1375	RE1250	CB1375
10.00	1.750	1 1/4-12	RC1250	CP1375C	EB1375	RE1250	CB1375
10.00	2.000	1 1/2-12	RC1500	CP1750C	EB1750	RE1500	CB1750
12.00	2.000	1 1/2-12	RC1500	CP1750C	EB1750	RE1500	CB1750
12.00	2.500	1 7/8-12	RC1875	CP2000C	EB2000	RE1875	CB2000

<sup>1</sup> For use with standard KK1/KK3S rod end.

<sup>2</sup> Does not bolt directly to the cylinder.



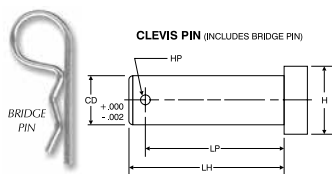
Note: additional accessory sheets for other mounts and series are available.

# How to Specify

## Accessories Cross Reference Chart

Cylinder Model				Accessories				
Bore	Rod Size	Rod Style (KK)	Rod Thread	Rod Clevis	Rod Eye	Clevis Pin	Clevis Bracket	Eye Bracket
1.50, 2.00, 2.50	0.625	#1 (Standard) KK1	7/16-20	RC437	RE437	CP500	CB500	EB500
		#2 KK2	1/2-20	RC500	RE500	CP500		
	1.000	#1 (St'd-Oversize) KK1	3/4-16	RC750	RE750	CP750		
		#4 KK4	1-14	RC1000	RE1000	CP1000		
3.25, 4.00, 5.00	1.000	#1 (Standard) KK1	3/4-16	RC750	RE750	CP750	CB750	EB750
		#4 KK4	1-14	RC1000	RE1000	CP1000		
	1.375	#1 (St'd-Oversize) KK1	1-14	RC1000	RE1000	CP1000		
		#2 KK2	1 1/4-12	RC1250	N/A	CP1375		
6.00 & 8.00	1.375	#1 (Standard) KK1	1-14	RC1000	RE1000	CP1000	CB1000	EB1000
		#2 KK2	1 1/4-12	RC1250	N/A	CP1375		
	1.750	#1 (St'd-Oversize) KK1	1 1/4-12	RC1250	N/A	CP1375		
		#2 KK2	1 1/2-12	RC1500	N/A	CP1750		
10.00	1.750	#1 (Standard) KK1	1 1/4-12	RC1250	RE1250	CP1375	CB1375	EB1375
		#2 KK2	1 1/2-12	RC1500	RE1500	CP1750	CB1750	EB1750
	2.000	#1 (Standard) KK1	1 1/2-12	RC1500	RE1500	CP1750	CB1750	EB1750
		#1 (Standard) KK1	1 1/2-12	RC1500	RE1500	CP1750	CB1750	EB1750

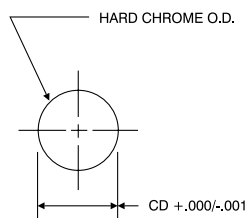
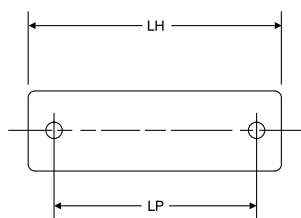
### Clevis Pin (With Bridge Pin - Standard)



Material: 1018 CRS  
Finish: Black Oxide

Part Number	CD	H	HP	LH	LP
CP500	0.500	0.63	0.16	2.25	2.09
CP750	0.750	0.94	0.16	3.00	2.84
CP1000	1.000	1.19	0.20	3.50	3.30

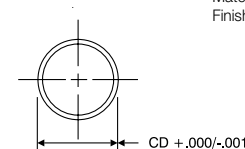
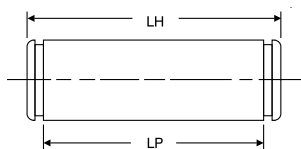
### Clevis Pin (With Cotter Pins)



Material: 1045 CRS  
Finish: Chrome Plated O.D.

Part Number	CD	LH	LP
CP500C	0.500	2.33	1.97
CP750C	0.750	3.15	2.75
CP1000C	1.000	3.60	3.25
CP1375C	1.375	4.63	4.28
CP1750C	1.750	6.09	5.53
CP2000C	2.000	6.09	5.53

### Clevis Pin (With E-Rings)



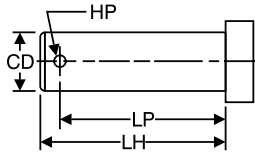
Material: 1045 CRS  
Finish: Nitrotech Plated\*

Part Number	CD	LH	LP
CP500E	0.500	2.13	1.88
CP750E	0.750	2.88	2.63
CP1000E	1.000	3.38	3.13
CP1375E	1.375	4.50	4.19
CP1750E	1.750	5.55	5.19
CP2000E	2.000	5.55	5.19

\*Hard chrome plated O.D. available.



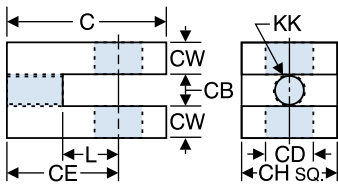
## Small Clevis Pin (With Bridge Pin)



Material: 1018 CRS  
Finish: Black Oxide

Part Number	CD	HP	LH	LP
CP500CCS	0.500	0.16	1.43	1.25
CP750CCS	0.750	0.16	2.02	1.85

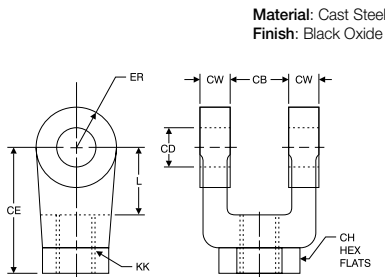
## Small Rod Clevis



Material: 1018 CRS  
Finish: Black Oxide

Part Number	C	CB	CD	CE	CH	CW	KK1	KK2	L
RC437CCS	1.875	0.500	0.500	1.375	1.000	0.250	7/16-20	—	0.750
RC500CCS	1.875	0.500	0.500	1.375	1.000	0.250	—	1/2-20	0.750
RC750CCS	2.500	0.750	0.750	1.750	1.500	0.375	3/4-16	—	1.000

## Rod Clevis



Material: Cast Steel  
Finish: Black Oxide

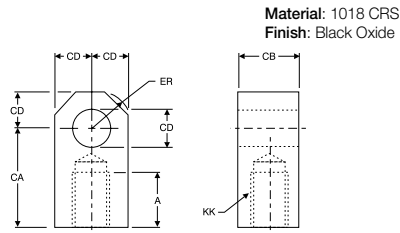
(Clevis Pins sold separately from Rod Clevises)

Note: When using a Rod Clevis in combination with an Eye Bracket, the operating angle is limited to +/-75° from the bracket center line.

Rod Clevis Dimensions									
Part Number	Max Load (Tension) Rated In Lbs	CB	CD (Dia.)	CE	CH	CW	ER (Radius)	KK	L
RC437	5667	0.750	0.500	1.500	1.000	0.500	0.500	7/16-20	0.750
RC500	6533	0.750	0.500	1.500	1.000	0.500	0.500	1/2-20	0.750
RC625		0.750	0.500	1.500	1.000	0.500	0.500	5/8-18	0.750
RC750	14933	1.250	0.750	2.375	1.250	0.625	0.750	3/4-16	1.250
RC875	26000	1.250	0.750	2.375	1.250	0.625	0.750	7/8-14	1.250
RC1000	44667	1.500	1.000	3.125	1.500	0.750	1.000	1-14	1.500
RC1250	44667	2.000	1.375	4.125	2.000	1.000	1.375	1 1/4-12	2.125
RC1375	60800	2.000	1.375	4.125	2.000	1.000	1.375	1 3/8-12	2.125
RC1500	60800	2.500	1.750	4.500	2.375	1.250	1.750	1 1/2-12	2.250
RC1750	87467	2.500	1.750	4.500	2.375	1.250	1.750	1 3/4-12	2.250
RC1875	130933	2.500	2.000	5.500	3.000	1.250	2.000	1 7/8-12	2.500
RC2250	130933	3.031	2.500	6.500	3.500	1.500	2.500	2 1/4-12	3.000
RC2500	208933	3.031	3.000	6.750	3.875	1.500	2.750	2 1/2-12	3.250
RC3250	294933	4.031	3.500	8.500	5.000	2.000	3.500	3 1/4-12	4.000
RC4000	200000	4.531	4.000	10.000	6.125	2.250	4.000	4-12	4.500

# How to Specify

## Rod Eye

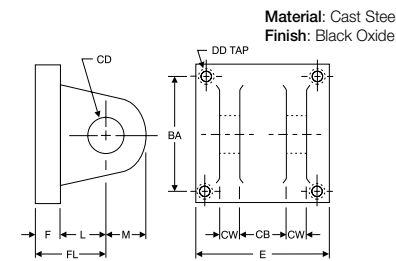


(Clevis Pins sold separately from Rod Eyes)

Note: When using a Rod Eye in combination with a Clevis Bracket, the operating angle is +/-90 from the bracket center line.

Rod Eye Dimensions							
Part Number	Max Load (Tension) Rated In Lbs	A	CA	CB	CD (Dia.)	ER (Radius)	KK
RE437	6667	0.750	1.500	0.750	0.500	0.625	7/16-20
RE500	7600	0.750	1.500	0.750	0.500	0.625	1/2-20
RE750	16133	1.125	2.063	1.250	0.750	0.875	3/4-16
RE875	16133	1.125	2.063	1.250	0.750	0.875	7/8-14
RE1000	28933	1.625	2.813	1.500	1.000	1.188	1-14
RE1250	44667	2.000	3.438	2.000	1.375	1.563	1 1/4-12
RE1500	60000	2.250	4.000	2.500	1.750	2.000	1 1/2-12
RE1875	71333	3.000	5.000	2.500	2.000	2.500	1 7/8-12
RE2250	131600	3.500	5.810	3.000	2.500	2.813	2 1/4-12
RE2500	146667	3.500	6.125	3.000	3.000	3.250	2 1/2-12
RE3250	215067	4.500	7.625	4.000	3.500	3.875	3 1/4-12
RE3500	289733	5.000	7.625	4.000	3.500	3.875	3 1/2-12
RE4000	365067	5.500	9.125	4.500	4.000	4.438	4-12

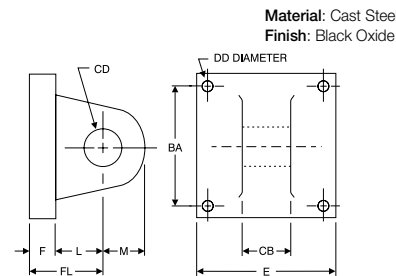
## Clevis Bracket



(Clevis Pins sold separately from Clevis Brackets)

Clevis Bracket Dimensions											
Part Number	Max Load (Tension) Rated In Lbs	BA	CB	CD (Dia.)	CW	DD	E	F	FL	L	M
CB500	9733	1.625	0.750	0.500	0.500	3/8-24	2.500	0.375	1.125	0.750	0.500
CB750	18667	2.563	1.250	0.750	0.625	1/2-20	3.500	0.625	1.875	1.250	0.750
CB1000	25600	3.250	1.500	1.000	0.750	5/8-18	4.500	0.750	2.250	1.500	1.000
CB1375	49200	3.813	2.000	1.375	1.000	5/8-18	5.000	0.875	3.000	2.125	1.375
CB1750	45333	4.938	2.500	1.750	1.250	7/8-14	6.500	0.875	3.125	2.250	1.750
CB2000	44000	5.750	2.500	2.000	1.250	1-14	7.500	1.000	3.500	2.500	2.000
CB2500	46533	6.594	3.000	2.500	1.500	1 1/8-12	8.500	1.000	4.000	3.000	2.500
CB3000	45067	7.500	3.000	3.000	1.500	1 1/4-12	9.500	1.000	4.250	3.250	2.750
CB3500	111333	9.625	4.000	3.500	2.000	1 3/4-12	12.625	1.688	5.688	4.000	3.500

## Eye Bracket



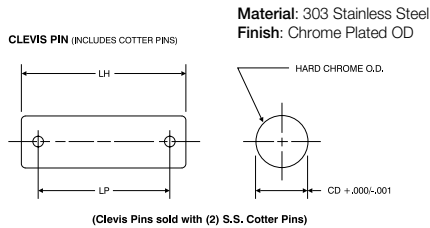
(Clevis Pins sold separately from Eye Brackets)

Eye Bracket Dimensions										
Part Number	Max Load (Tension) Rated In Lbs	BA	CB	CD (Dia.)	DD	E	F	FL	L	M
EB500	5467	1.625	0.750	0.500	0.406	2.500	0.375	1.125	0.750	0.500
EB750	14000	2.563	1.250	0.750	0.531	3.500	0.625	1.875	1.250	0.750
EB1000	27200	3.250	1.500	1.000	0.656	4.500	0.750	2.250	1.500	1.000
EB1375	28267	3.813	2.000	1.375	0.656	5.000	0.875	3.000	2.125	1.375
EB1750	65973	4.938	2.500	1.750	0.906	6.500	0.875	3.125	2.250	1.750
EB2000	93333	5.750	2.500	2.000	1.063	7.500	1.000	3.500	2.500	2.000
EB2500	125600	6.594	3.000	2.500	1.188	8.500	1.000	4.000	3.000	2.500
EB3000	162533	7.500	3.000	3.000	1.313	9.500	1.000	4.250	3.250	2.750
EB3500	76533	9.625	4.000	3.500	1.813	12.625	1.688	5.688	4.000	3.500
EB4000	100000	11.500	4.500	4.000	2.063	14.875	1.938	6.480	4.500	4.000

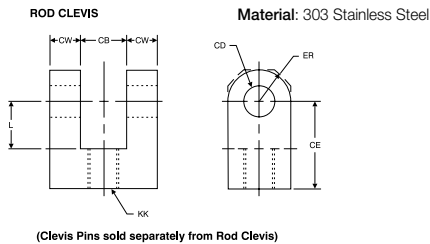
## Accessories – Stainless Steel Clevis, Pins & Mounts

### Stainless Steel Accessories Cross Reference Chart

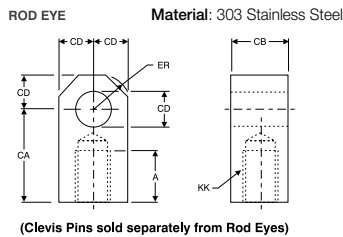
Cylinder Model				Accessories				
Bore	Rod Size	Rod Style (KK)	Rod Thread	Rod Clevis	Rod Eye	Clevis Pin	Clevis Bracket	Eye Bracket
1.50, 2.00, 2.50	0.625	#1 (Standard) KK1	7/16-20	SS-RC437	SS-RE437	SS-CP500	SS-CB500	SS-EB500
		#2 KK2	1/2-20	SS-RC500	SS-RE500	SS-CP500		
	1.000	#1 (Std Oversize) KK1	3/4-16	SS-RC750	SS-RE750	SS-CP750		
3.25, 4.00, 5.00	1.000	#4 KK4	1-14	SS-RC1000	SS-RE1000	SS-CP1000	SS-CB750	SS-EB750
		#1 (Standard) KK1	3/4-16	SS-RC750	SS-RE750	SS-CP750		
	1.375	#1 (Std Oversize) KK1	1-14	SS-RC1000	SS-RE1000	SS-CP1000		
	#2 KK2	1 1/4-12	SS-RC1250	N/A	SS-CP1375			
6.00 & 8.00	1.375	#1 (Standard) KK1	1-14	SS-RC1000	SS-RE1000	SS-CP1000	SS-CB1000	SS-EB1000
		#2 KK2	1 1/4-12	SS-RC1250	N/A	SS-CP1375		
	1.750	#1 (Std Oversize) KK1	1 1/4-12	SS-RC1250	N/A	SS-CP1375		
	#2 KK2	1 1/2-12	SS-RC1500	N/A	SS-CP1750			



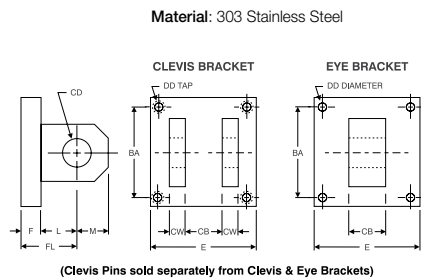
Clevis Pin (With Cotter Pins)			
Part Number	CD	LH	LP
SS-CP500	0.500	2.33	1.97
SS-CP750	0.750	3.15	2.75
SS-CP1000	1.000	3.60	3.25
SS-CP1375	1.375	4.63	4.28
SS-CP1750	1.750	6.09	5.53



Rod Clevis							
Part Number	CB	CD	CE	CW	ER	KK	L
SS-RC437	0.750	0.500	1.500	0.500	0.500	7/16-20	0.750
SS-RC500	0.750	0.500	1.500	0.500	0.500	1/2-20	0.750
SS-RC750	1.250	0.750	2.375	0.625	0.750	3/4-16	1.250
SS-RC1000	1.500	1.000	3.125	0.750	1.000	1-14	1.500
SS-RC1250	2.000	1.375	4.125	1.000	1.375	1 1/4-12	2.125
SS-RC1500	2.500	1.750	4.500	1.250	1.750	1 1/2-12	2.250



Rod Eye						
Part Number	A	CA	CB	CD	ER	KK
SS-RE437	0.750	1.500	0.750	0.500	0.625	7/16-20
SS-RE500	0.750	1.500	0.750	0.500	0.625	1/2-20
SS-RE750	1.125	2.063	1.250	0.750	0.875	3/4-16
SS-RE1000	1.625	2.813	1.500	1.000	1.188	1-14
SS-RE1250	2.000	3.438	2.000	1.375	1.563	1 1/4-12
SS-RE1500	2.250	4.000	2.500	1.750	2.000	1 1/2-12

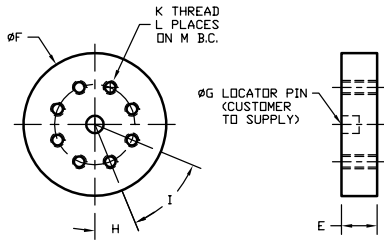


Clevis Brackets and Eye Brackets											
Part Number		BA	CB	CD	CW	DD	E	F	FL	L	M
Clevis Brackets	SS-CB500	1.625	0.750	0.500	0.500	3/8-24	2.500	0.375	1.125	0.750	0.625
	SS-CB750	2.563	1.250	0.750	0.625	1/2-20	3.500	0.625	1.875	1.250	0.750
	SS-CB1000	3.250	1.500	1.000	0.750	5/8-18	4.500	0.750	2.250	1.500	1.000
	SS-CB1375	3.813	2.000	1.375	1.000	5/8-18	5.000	0.875	3.000	2.125	1.375
Eye Brackets	SS-EB500	1.625	0.750	0.500	N/A	0.406	2.500	0.375	1.125	0.750	0.500
	SS-EB750	2.563	1.250	0.750		0.532	3.500	0.625	1.875	1.250	0.750
	SS-EB1000	3.250	1.500	1.000		0.656	4.500	0.750	2.250	1.500	1.000
	SS-EB1375	3.813	2.000	1.375		5/8-18	5.000	0.875	3.000	2.125	1.375

# How to Specify

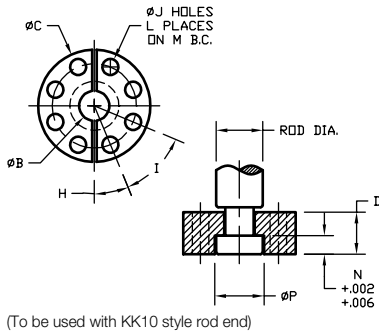
## Accessories – Clevis, Pins & Mounts

### Weld Plate



Weld Plate Dimensions									
Part Number	Rod Diameter	E	F	G (Dia.)	H	I	K	L	M
WP625	0.625	0.500	2.000	0.250	45.0°	90.0°	10 -20	4	1.125
WP1000	1.000	0.500	2.500	0.250	30.0°	60.0°	1/4-20	6	1.500
WP1375	1.375	0.625	3.000	0.250	30.0°	60.0°	5/16-18	6	2.000
WP1750	1.750	0.625	4.000	0.250	22.5°	45.0°	5/16-18	8	2.375
WP2000	2.000	0.750	4.000	0.375	15.0°	30.0°	3/8-16	12	2.688
WP2500	2.500	0.750	4.500	0.375	15.0°	30.0°	3/8-16	12	3.188
WP3000	3.000	1.000	5.500	0.375	15.0°	30.0°	1/2-13	12	4.000
WP3500	3.500	1.000	7.000	0.375	15.0°	30.0°	5/8-11	12	4.688
WP4000	4.000	1.000	7.000	0.375	15.0°	30.0°	5/8-11	12	5.188
WP4500	4.500	1.000	8.000	0.375	15.0°	30.0°	5/8-11	12	5.688
WP5000	5.000	1.000	8.000	0.375	15.0°	30.0°	5/8-11	12	6.188
WP5500	5.500	1.250	9.000	0.375	15.0°	30.0°	3/4-10	12	6.875

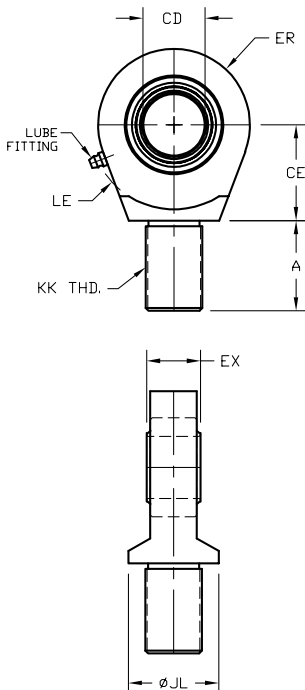
### Flange End Coupler



(To be used with KK10 style rod end)

Flange End Coupler Dimensions											
Part Number	Rod Diameter	B	C	D	H	I	J	L	M	N	P
FEC625	0.625	0.406	1.500	0.563	45.0°	90.0°	0.219	4	1.125	0.250	0.656
FEC1000	1.000	0.750	2.000	0.875	30.0°	60.0°	0.281	6	1.500	0.375	1.063
FEC1375	1.375	0.938	2.500	1.000	30.0°	60.0°	0.344	6	2.000	0.375	1.438
FEC1750	1.750	1.188	3.000	1.250	22.5°	45.0°	0.344	8	2.375	0.500	1.813
FEC2000	2.000	1.438	3.500	1.625	15.0°	30.0°	0.406	12	2.688	0.625	2.063
FEC2500	2.500	1.875	4.000	1.875	15.0°	30.0°	0.406	12	3.188	0.750	2.625
FEC3000	3.000	2.375	5.000	2.375	15.0°	30.0°	0.531	12	4.000	0.875	3.125
FEC3500	3.500	2.625	5.875	2.625	15.0°	30.0°	0.656	12	4.688	1.000	3.625
FEC4000	4.000	3.125	6.375	2.625	15.0°	30.0°	0.656	12	5.188	1.000	4.125
FEC4500	4.500	3.625	6.875	3.125	15.0°	30.0°	0.656	12	5.688	1.500	4.625
FEC5000	5.000	4.000	7.375	3.125	15.0°	30.0°	0.656	12	6.188	1.500	5.125
FEC5500	5.500	4.500	8.250	3.875	15.0°	30.0°	0.781	12	6.875	1.875	5.625

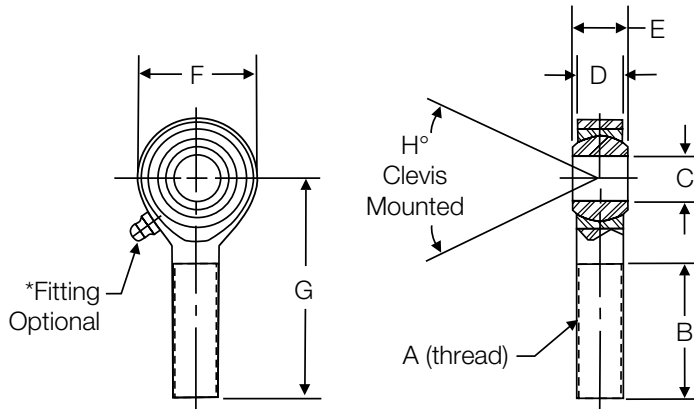
### Male Spherical Rod Eye



Male Spherical Rod Eye Dimensions									
Part Number	A	CD	CE	ER	EX	JL	KK	LE	Load Capacity Lbs
HH-MSRE-500	0.688	0.500	0.875	0.875	0.437	0.875	7/16-20	0.750	2600
HH-MSRE-750	1.000	0.750	1.250	1.250	0.656	1.313	3/4-16	1.063	9400
HH-MSRE-750	1.000	0.750	1.250	1.250	0.656	1.313	3/4-16	1.063	9400
HH-MSRE-1000	1.500	1.000	1.875	1.375	0.875	1.500	1-14	1.438	16800
HH-MSRE-1375	2.000	1.375	2.125	1.813	1.188	2.000	1 1/4-12	1.875	28500
HH-MSRE-1750	2.125	1.750	2.500	2.188	1.531	2.250	1 1/2-12	2.125	43000
HH-MSRE-2000	2.875	2.000	2.750	2.625	1.750	2.750	1 7/8-12	2.500	70200

## Accessories – Spherical Rod Eyes

### Male Spherical Rod Eye

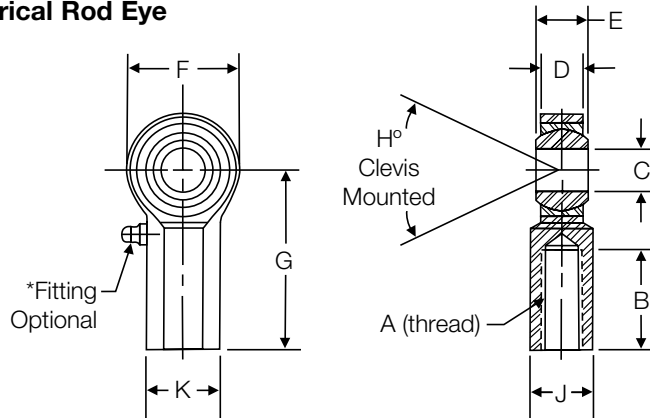


Assortment of Male Spherical Rod Eyes.

Male Spherical Rod Eye Dimensions

Part Number	A	B	C +.0015 -.0005	D	E	F	G	H	Static Load Capacity (Lbs.)	Approx. Weight (Lbs.)
MSRE-437	7/16-20	1.500	0.5000	0.500	0.625	1.313	2.438	12	6,660	.25
MSRE-500	1/2-20	1.500	0.5000	0.500	0.625	1.313	2.438	12	6,660	.25
MSRE-750	3/4-16	1.750	0.7500	0.688	0.875	1.750	2.875	14	11,515	.60
MSRE-1000	1-14	2.125	1.0000	1.000	1.375	2.750	4.125	17	43,540	2.4
MSRE-1250	1 1/4-12	2.125	1.0000	1.000	1.375	2.750	4.125	17	43,540	2.4

### Female Spherical Rod Eye



Assortment of Female Spherical Rod Eyes.

Female Spherical Rod Eye Dimensions

Part Number	A	B	C +.0015 -.0005	D	E	F	G	H	J	K	Static Load Capacity (Lbs.)	Approx. Weight (Lbs.)
FSRE-312*	5/16-24	0.750	0.3125	0.340	0.438	0.875	1.375	14	0.437	0.500	3,130	.09
FSRE-437	7/16-20	1.188	0.5000	0.500	0.625	1.313	2.125	12	0.750	0.875	6,660	.33
FSRE-500	1/2-20	1.188	0.5000	0.500	0.625	1.313	2.125	12	0.750	0.875	6,660	.33
FSRE-750	3/4-16	1.750	0.7500	0.688	0.875	1.750	2.875	14	1.000	1.125	11,515	.72
FSRE-1000	1-14	2.125	1.0000	1.000	1.375	2.750	4.125	17	1.500	1.625	43,540	2.4
FSRE-1250*	1 1/4-12	2.125	1.0000	1.000	1.375	2.750	4.125	17	1.500	1.625	43,540	2.4

\* Consult factory for delivery.

# How to Specify

## Accessories – Trunnion Blocks

Bimba is making it easier to set up trunnion style actuation solutions. Bimba offers mountable trunnion supports for 1.50" to 8.00" bore trunnion mounts. The TB-1000 support will take all 1.50" to 5.00" bores and the TB-1375 support will fit 6.00" and 8.00" bores. Trunnion blocks are available in aluminum and stainless steel constructions.

All supports feature IGNUS® "High-Load" bearings as standard. These bearings are made of T-500 composite, which provide over ten times the strength of bronze bushings for heavy-duty performance and long life. T-500 is rated for intermittent food and wash down applications.

Trunnion supports can be used with all NFPA mounts MT1, MT2 and MT4, as well as Bimba solid one-piece steel trunnion styles MT1S and MT2S.

All trunnion blocks are in stock and available for immediate order.

Consult factory for delivery for large orders or special requirements.



Aluminum trunnion blocks TB-1000 and TB-1375 with T-500 composite bearings.



Stainless steel trunnion block SS-TB-1000 with T-500 composite bearings.

### Trunnion Block Ordering Information

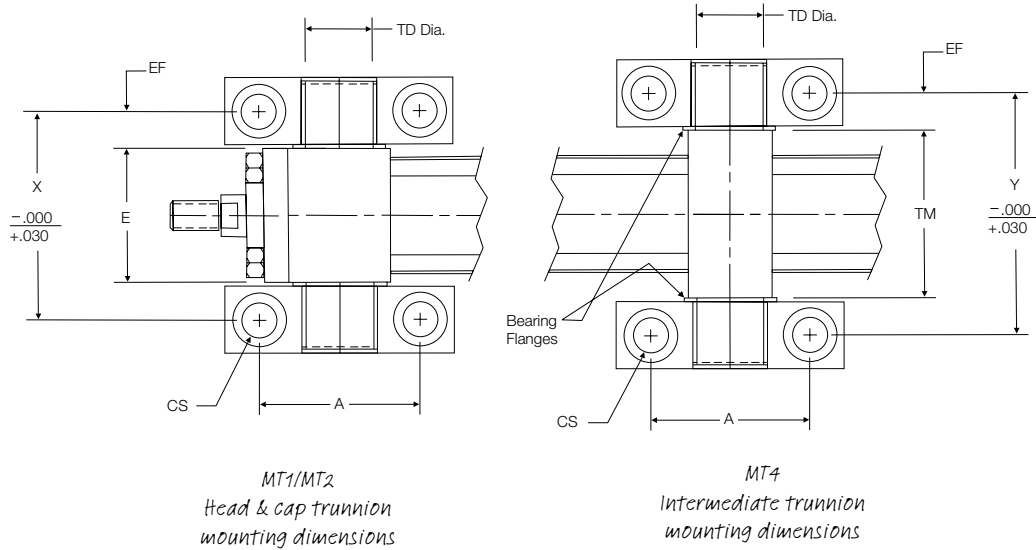
Part Number	Bore Size	Block Material	Bearing Material
TB-1000	1.50 to 5.00	Aluminum with Black Anodize	T-500 Composite
TB-1375	6.00 & 8.00	Aluminum with Black Anodize	T-500 Composite
SS-TB-1000	1.50 to 5.00	303 Stainless Steel	T-500 Composite
SS-TB-1375	6.00 & 8.00	303 Stainless Steel	T-500 Composite

All above part numbers are for a pair of trunnion blocks. To order a single trunnion block, add -1 to the end of the part number (example: TB-1000-1). Note: fasteners are not supplied.

### Replacement Bearing Ordering Information

Part Number	Qty Required Per Trunnion	Replacement For Trunnion Block Series	Bearing Material
TB-30-1	1	TB-1000 & SS-TB-1000	T-500 Composite
TB-30-2	2	TB-1375 & SS-TB-1375	T-500 Composite

## Accessories – Trunnion Blocks

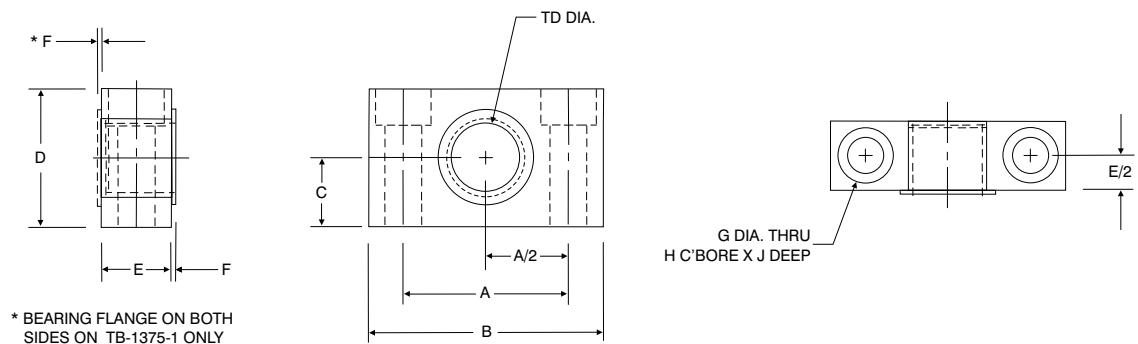


Note: Shown with bearing flanges on inside of blocks facing cylinder.

Bore	Part Number	A	TD	E	EF	X	CS*	TM	Y
1.50	TB-1000	2.375	1.000	2.000	0.563	3.125	0.500	2.500	3.625
2.00	TB-1000	2.375	1.000	2.500	0.563	3.625	0.500	3.000	4.125
2.50	TB-1000	2.375	1.000	3.000	0.563	4.125	0.500	3.500	4.625
3.25	TB-1000	2.375	1.000	3.750	0.563	4.875	0.500	4.500	5.625
4.00	TB-1000	2.375	1.000	4.500	0.563	5.625	0.500	5.250	6.375
5.00	TB-1000	2.375	1.000	5.500	0.563	6.625	0.500	6.250	7.375
6.00	TB-1375	4.000	1.375	6.500	1.078	8.656	0.750	7.625	9.781
8.00	TB-1375	4.000	1.375	8.500	1.078	10.656	0.750	9.750	11.906

\* Recommended cap screw size (cap screws not supplied).

## Standard Aluminum Trunnion Blocks With Bearing

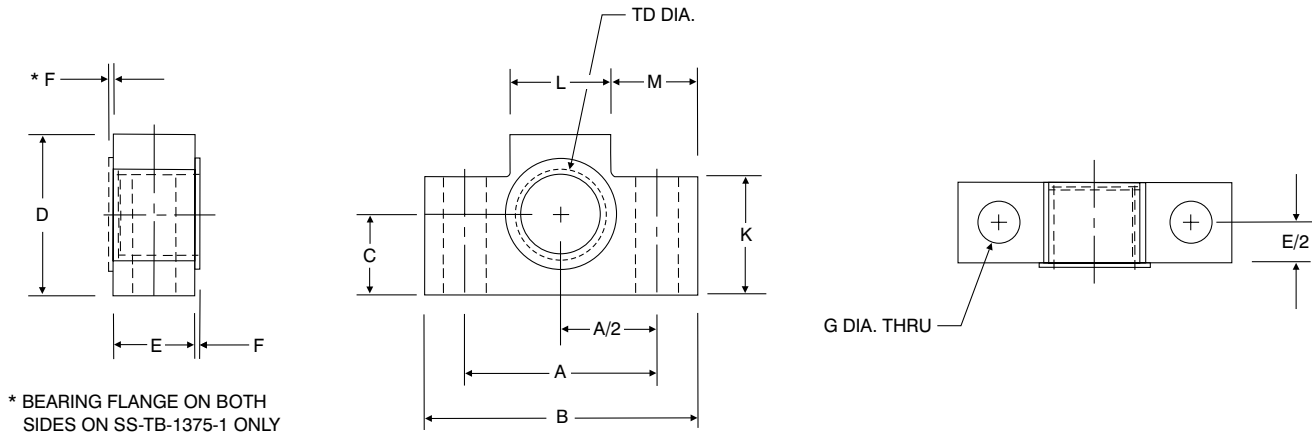


Part Number	A	B	C	D	E	F	G	H	J	TB
TB-1000-1	2.375	3.375	1.000	2.000	1.000	0.062	0.531	0.797	0.531	1.000
TB-1375-1	4.000	5.500	1.500	3.000	2.000	0.078	0.781	1.187	0.781	1.375

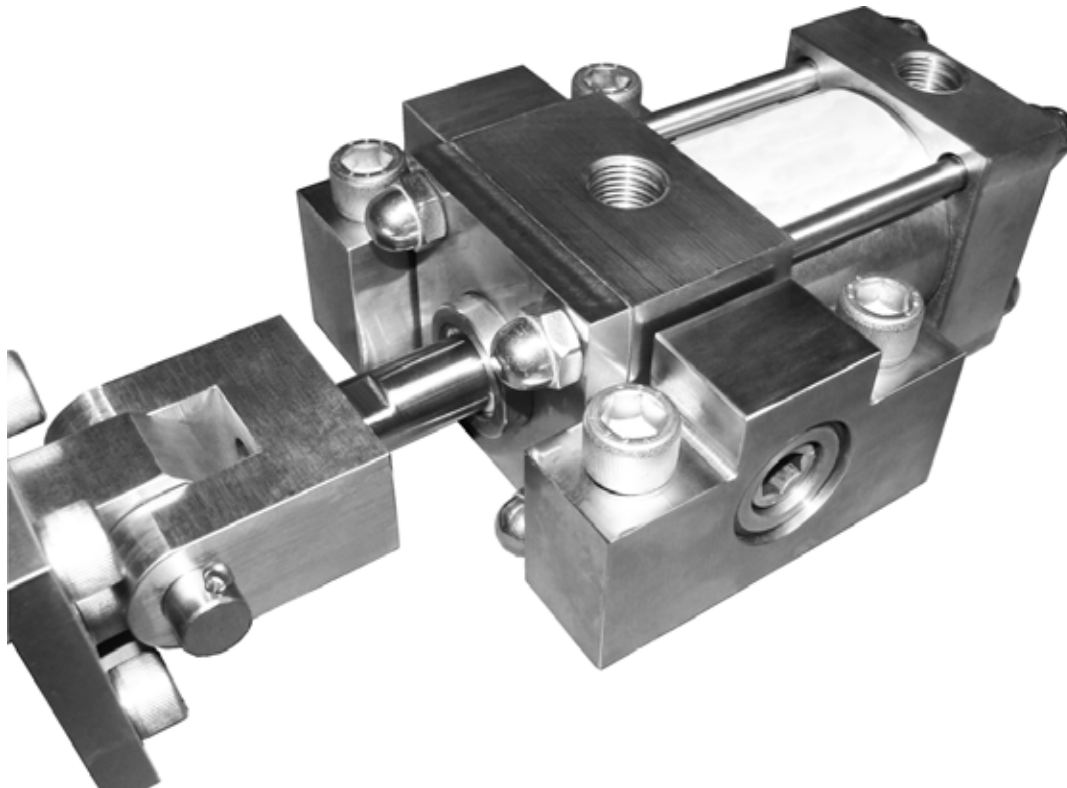
# How to Specify

## Accessories – Trunnion Blocks

### Stainless Steel Trunnion Blocks With Bearing



Part Number	A	B	C	D	E	F	G	K	L	M	TD
SS-TB-1000-1	2.375	3.375	1.000	2.000	1.000	0.062	0.531	1.469	1.250	1.063	1.000
SS-TB-1375-1	4.000	5.500	1.500	3.000	2.000	0.078	0.781	2.219	2.125	1.688	1.375





## Accessories – Alignment Couplers

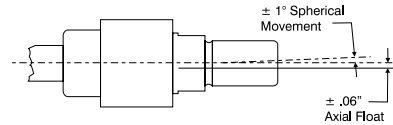
### Benefits

- > Rod alignment couplers eliminate expensive machining for mounting fixed or rigid cylinders on guided or slide applications.
- > Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 1° angular error and .06" lateral misalignment on push or pull strokes.
- > Couplers provide greater reliability, performance and reduce cylinder component wear.
- > Simplifies alignment problems in the field.

### Design Tips

- > Alignment couplers can be exposed to high stresses that are not apparent in an application. Always use the largest thread size practical in your application (see chart for maximum pull yields).
- > Use jam nut to lock coupler to rod when used with full diameter threads (example: 0.625" thread on 0.625" rod).
- > Large thread sizes can be pinned in high impact applications, eliminating unwanted loosening of coupler from rod. Always use the smallest pin possible to avoid weakening the piston rod thread (example: Use a 0.090" diameter pin for 0.625" rod threads and larger).

MATERIAL: 100,000 MIN. YIELD STRESS-PROOF™



Standard AC Coupler  
AC250 - AC500  
Metric AC Coupler  
MAC250-M4x0.7 -  
MAC750-M20x1.5

### How to Order:

## AC 250 - 312 FEMALE

SERIES	SIZE	SIZE
AC	250	250
ACH	312	312
	375	375
	437	437
	500	500
	625	625
	750	750
	875	875
	1000	1000
	1250	1250
	1375	1375
	1500	1500
	1750	1750

(Optional alternative size\*)

\*You can order different thread sizes within the same size of coupler housing diameter (refer to "B" Diameter in dimension chart).

Recommended Maximum Stroke For Cylinders With Alignment Couplers In Horizontal Applications	
Bore	Maximum Stroke
1.50	27
2.00	43
2.50	50
3.25	50
4.00	55
5.00	55
6.00	55
8.00	55

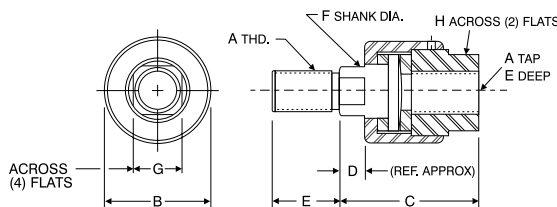
### Ordering Examples:

- > AC250 (AC with male & female 1/4-28 thread)
- > ACH500 (ACH with male & female 1/2-20 thread)
- > AC437-625 FEMALE (AC with 7/16-20 male and 5/8-18 female thread)



ACH Coupler  
ACH250 - ACH1250

### Metric Rod AC Series



Metric Rod Alignment Couplers (Steel)									
Part Number	A	B	C	D	E	F	G	H	Max Pull Pounds (3:1 Safety Factor)
MAC250-M4x0.7	M4x0.7	1.125	1.750	.375	.500	.500	.375	.687	251
MAC250-M6x1.0	M6x1.0	1.125	1.750	.375	.500	.500	.375	.687	687
MAC312-M8x1.25	M8x1.25	1.125	1.750	.375	.500	.500	.375	.687	1,349
MAC437-M10x1.25	M10x1.25	1.250	2.000	.437	.750	.625	.500	.812	2,435
MAC500-M12x1.25	M12x1.25	1.250	2.000	.437	.750	.625	.500	.812	3,860
MAC625-M16x1.5	M16x1.5	1.250	2.000	.437	.750	.625	.500	.812	7,299
MAC750-M20x1.5	M20x1.5	1.750	2.312	.437	1.125	.968	.812	1.125	12,537

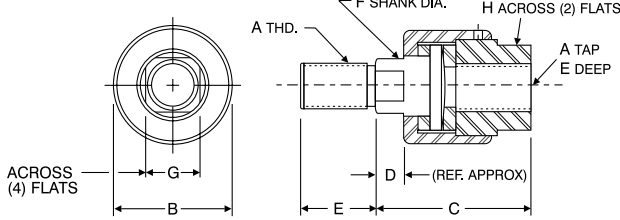


Stainless Steel  
Standard AC Coupler  
SS-AC250 - SS-AC1500

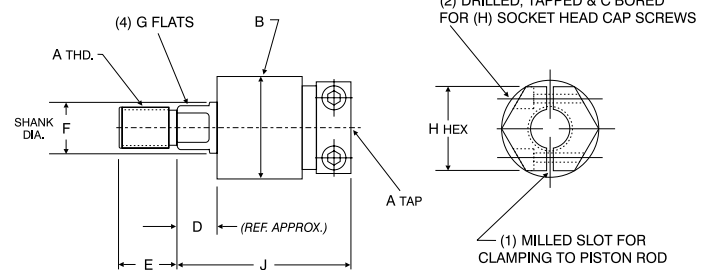
# How to Specify

## Accessories – Alignment Couplers

### AC Series



### ACH Series



Alignment Coupler Dimensions

Part Number	A	B	C	D	E	F	G	H	H Hex	J	Max Pull Pounds (3:1 Safety Factor)
AC250	1/4-28	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	886
AC312	5/16-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	1,623
AC375	3/8-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	2,532
AC437	7/16-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.250	2.156	3,526
AC500	1/2-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.250	2.156	4,841
AC625	5/8-18	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.250	2.156	7,862
AC750	3/4-16	1.750	2.313	0.438	1.125	0.969	0.813	1.125	1.750	2.500	11,543
AC875	7/8-14	1.750	2.313	0.438	1.125	0.969	0.813	1.125	1.750	2.500	15,846
AC1000	1-14	2.500	2.938	0.438	1.625	1.344	1.156	1.625	2.500	2.938	21,206
AC1250	1 1/4-12	2.500	2.938	0.438	1.625	1.344	1.156	1.625	2.500	2.938	34,024
AC1375	1 3/8-12	2.500	2.938	0.438	1.625	1.344	1.156	1.625	—	—	40,710
AC1500	1 1/2-12	3.250	4.375	0.875	2.250	1.969	1.750	2.375	—	—	49,857
AC1750	1 3/4-12	3.250	4.375	0.875	2.250	1.969	1.750	2.375	—	—	69,558
AC1875	1 7/8-12	3.750	5.625	1.000	3.000	2.469	2.125	2.750	—	—	79,354
AC2000	2-12	3.750	5.625	1.000	3.000	2.469	2.125	2.750	—	—	92,531
AC2250	2 1/4-12	4.500	6.375	1.000	3.500	2.969	2.625	3.375	—	—	118,776
AC2500	2 1/2-12	5.000	6.563	1.000	3.500	3.938	—	—	—	—	149,543
AC2750	2 3/4-12	5.000	6.563	1.000	3.500	3.938	—	—	—	—	182,464
AC3000	3-12	5.000	6.563	1.000	3.500	3.938	—	—	—	—	218,658
AC3250	3 1/4-12	6.250	8.125	1.000	4.500	4.938	—	—	—	—	258,124
AC3500	3 1/2-12	6.250	8.125	1.000	4.500	4.938	—	—	—	—	300,863
AC3750	3 3/4-12	6.250	8.125	1.000	4.500	4.938	Spanner Holes	—	—	—	346,875
AC4000	4-12	7.500	9.500	1.000	5.500	5.938	—	—	—	—	396,158
AC4500	4 1/2-12	7.500	9.500	1.000	5.500	5.938	—	—	—	—	504,544
AC5000	5-12	7.500	9.500	1.000	5.500	5.938	—	—	—	—	626,019

\*Please specify AC or ACH coupler when ordering; i.e.: AC750 (Std. Coupler) or ACH750 (Hex Coupler).

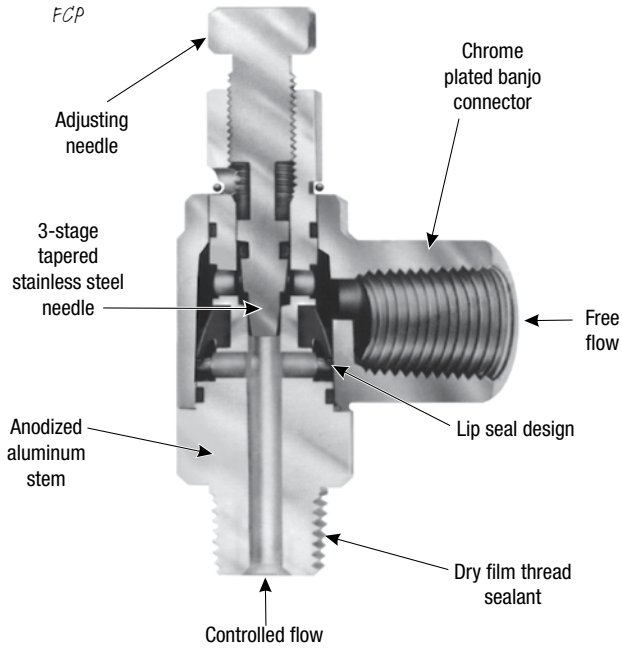
\*\*Spanner holes are used on AC2250 and larger. Two (2) 0.500" diameter holes, 0.500" deep, 180° apart (each end).

### Stainless Steel Alignment Couplers

Alignment Couplers - Stainless Steel

Part Number	A	B	C	D	E	F	G	H	Max Pull Pounds (3:1 Safety Factor)
SS-AC250	1/4-28	1.125	1.750	0.375	0.500	0.500	0.375	0.688	310
SS-AC312	5/16-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	568
SS-AC375	3/8-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	886
SS-AC437	7/16-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1,234
SS-AC500	1/2-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1,694
SS-AC625	5/8-18	1.250	2.000	0.438	0.750	0.625	0.500	0.813	2,752
SS-AC750	3/4-16	1.750	2.313	0.438	1.125	0.969	0.813	1.125	4,040
SS-AC875	7/8-14	1.750	2.313	0.438	1.125	0.969	0.813	1.125	5,546
SS-AC1000	1-14	2.500	2.938	0.438	1.625	1.344	1.156	1.625	7,422
SS-AC1250	1 1/4-12	2.500	2.938	0.438	1.625	1.344	1.156	1.625	11,908
SS-AC1500	1 1/2-12	3.250	4.375	0.875	2.250	1.969	1.750	2.375	17,450

## Accessories – Flow Controls (FCP Series)



### Materials:

Banjo Connector: Chrome plated, zinc die cast

Banjo Retaining Ring: Zinc plated steel

Stem: High strength anodized aluminum alloy

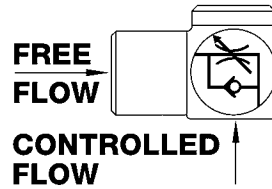
Adjusting Needle: Stainless steel

“O” Rings and Lip Seal: Buna N

**Maximum Operating Pressure:**  
150 PSI Air Only

**Operating Temperature Range:**  
-20°F to +200°F (-25°C to +95°C)

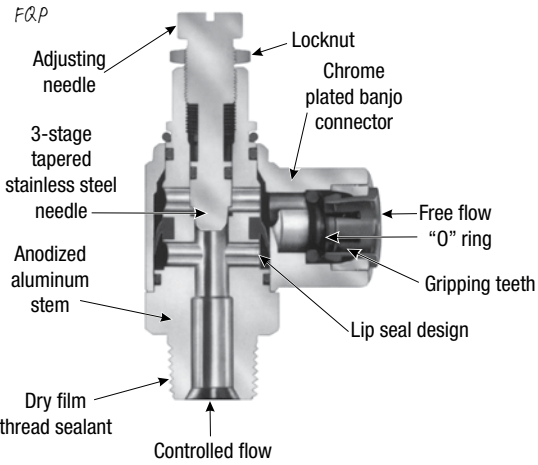
**Port Size:**  
0.250", 0.375", 0.500"



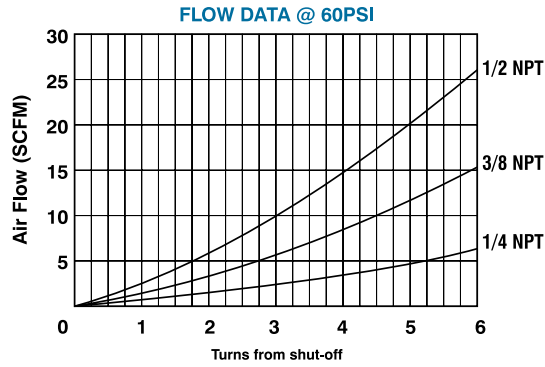
Contact Bimba for additional information on available fittings options.

# How to Specify

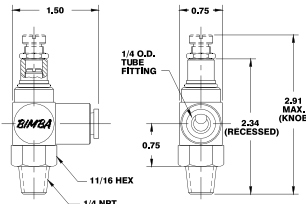
## Accessories – Quick-Flo® Flow Controls (FQP Series)



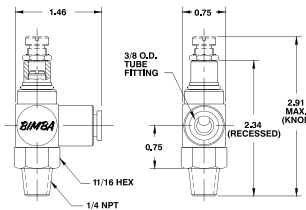
FQP & FCP Series



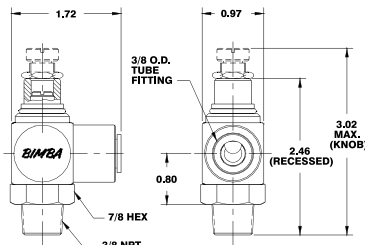
### FQP44 FQP44K For 1/4" port, 1/4" OD tubing



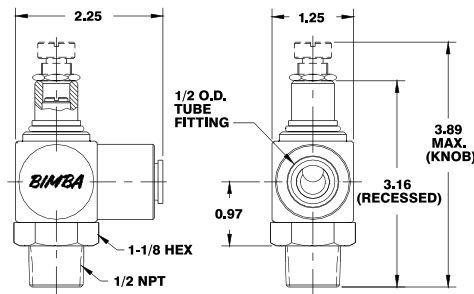
### FQP4 FQP4K For 1/4" port, 3/8" OD tubing



### FQP6 FQP6K For 3/8" port, 3/8" OD tubing



### FQP8 FQP8K For 1/2" port, 1/2" OD tubing



### Materials:

Banjo Connector: Chrome plated, zinc die cast

Banjo Retaining Ring: Zinc plated steel

Stem: High strength anodized aluminum alloy

Adjusting Needle: Stainless steel

"O" Rings and Lip Seal: Buna N

Collet: Acetal copolymer

Gripping teeth: Stainless steel

Collet Retainer (if applicable): Brass

Locknut: Chrome plated brass

Tube Types: All plastic tubing, including nylon and polyethylene

**Maximum Operating Pressure:**  
150 PSI Air Only

**Operating Temperature Range:**  
-20°F to +200°F (-29°C to +93°C)



# Position Sensing

Bimba offers a variety of positioning sensing options to accommodate your unique pneumatic application needs, including reed switches, solid state switches, inductive sensors, and magnetostrictive transducers.



# Contents

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**287** Switch Accessories

- 288 – Reed Switches
  - 289 – Solid State Switches
  - 290 – Switches
  - 292 – Switch Mounting Dimensions
  - 292 – How to Assemble  
Switch and Brackets
  - 293 – Switches Hysteresis &  
Bandwidth
  - 294 – Switch Ordering Instructions
- 

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**295** Balluff Inductive Sensors

- 296 – Balluff Induction Sensors  
(DC Inductive Sensors)
  - 297 – Balluff Induction Sensors  
(AC/DC Inductive Sensors)
  - 298 – Balluff Induction Sensors  
(Cable Connectors)
- 

**299** Balluff Linear Position Transducers

- 300 - How to Specify
-

## Accessories – Switches

Reed and Solid State switches are available to meet a wide variety of your customers' needs.



- > Miniature AC/DC Reed
- > High Power AC Reed
- > Miniature DC Solid State
- > RoHS & IP69K
- > Miniature AC/DC Reed with built-in circuit protection
- > Extended Temperature Range Reed

### Advantages:

- > One magnet type (MPR) for both Reed and Solid State TRD switches.
- > Switches and brackets are suitable for wash down or corrosive environments (IP69K).
- > Quick, simple set-up that requires standard (slotted) screwdriver.
- > High visibility LED that can be seen up to 20 feet away.
- > Suitable for all bore sizes (1.50" to 12.00").
- > Magnetically operated, which can be located anywhere in the actuator stroke range.
- > Compact, low profile switch/bracket assembly.
- > Can be used with all TRD series where an aluminum or stainless steel tube and piston are used.

### Benefits of Reed Switches:

#### R10 Miniature Reed Switch

- > 5-240 V max. (AC/DC); 500 mA max.
- > Cable options include 24" or 120" plain cable leads and 8mm Threaded Quick Connect.
- > High visibility LED

#### R10P Miniature AC/DC Reed Switch

- > Provides built-in circuit protection.
- > 5-120 V max. (AC/DC); 150 mA current rating (max.)
- > Cable options include 24" or 120" plain cable leads and 8mm Threaded Quick Connect.
- > High visibility LED

#### RAC High Power AC Reed Switch

- > 12-240 VAC; 800 mA current rating; TRIAC output
- > Cable options include 24" or 120" plain cable leads

#### RHT Miniature Extended Temperature Range Reed Switch

- > 5-240 V max. (AC/DC); 500 mA max.
- > -40°F to 260°F (-40°C to 125°C)
- > Cable options include 24" or 120" plain cable leads.

### Benefits of Solid State Switch:

#### MSS Miniature Solid State Switch

- > 10-30 VDC; 4-300 mA current rating
- > Can be wired current sinking (NPN) or current sourcing (PNP)
- > Cable options include 24" or 120" plain cable leads and 8mm Threaded Quick Connect
- > High visibility LED
- > Shockproof
- > GMR technology—giant magneto-resistive design. Reverse polarity and over voltage protection

## Switch Selection Guide For Your Application

Switch Model	Programmable Controllers	Relays	Solenoids	Indicator Lights		Motors	Time Counters
				Bulbs	Solid State		
R10 or RHT Reed Switch	Yes	<10VA*	<10VA*	<10VA*	Yes	<10VA*	<10VA*
RAC High Power AC Reed Switch**	No	Yes	Yes	Yes	No	Yes	Yes
MSS Solid State Switch	Yes	<300mA	<300mA	<300mA	Yes	<300mA	<300mA
R10P Reed Switch	Yes	<10VA	<10VA	<10VA	Yes	<10VA	<10VA

\*Use resistor-capacitor protection

\*\*Minimum current = 80 mA

**Specify 'MPR' Option for ALL switch models when ordering actuators.**

# How It Works

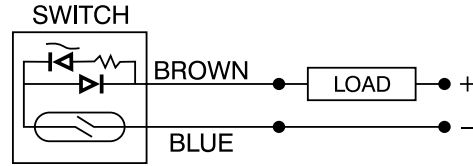
## Accessories – Reed Switches

### Electrical Specifications

<b>CE</b>	R10	Miniature Reed Switch, 24" (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)
	R10X	Miniature Reed Switch, 120" (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)
	R10Q	Miniature Reed Switch, 8mm Male Quick Connect, 24 AWG Wire, PVC Jacket (2 wire Switch)
	Contacts:	SPST Form A (normally open)
	Contact Rating:	10 W maximum (resistive)
	Input Voltage:	5-240 V maximum (AC/DC)
	Maximum Load Current:	500 mA maximum
	Actuating Time Average:	1.0 millisecond
	LED Indicator:	High luminescence housing
	Temperature Range:	-4°F to 158°F (-20°C to 70°C)
Protection Rating:	IP69K	

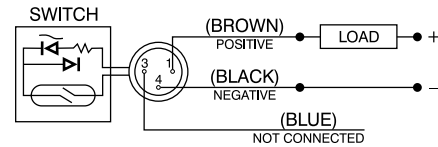
### Schematics R10/R10X

Miniature Reed Switch, Plain Cable Lead, (2 Wire Switch)



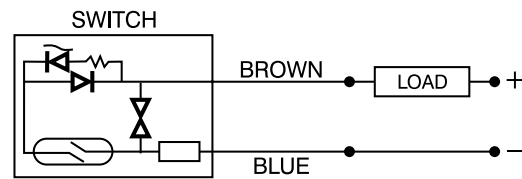
### R10Q

Miniature Reed Switch, 8mm Male Quick Connect, (2 Wire Switch)



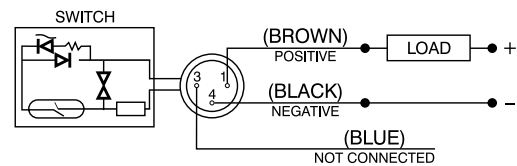
### R10P/R10PX

Miniature Reed Switch, Plain Cable Lead, (2 Wire Switch)



### R10PQ

Miniature Reed Switch, 8mm Male Quick Connect, (2 Wire Switch)

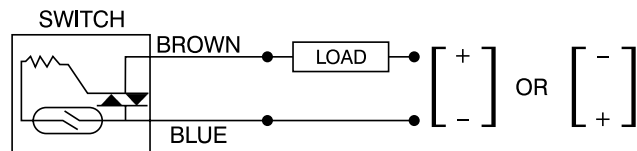


<b>CE</b>	R10P	Miniature Reed Switch, 24" (24 AWG Wire, PVC Jacket) Plain Cable Lead, Circuit Protection (2 wire Switch)
	R10PX	Miniature Reed Switch, 120" (24 AWG Wire, PVC Jacket) Plain Cable Lead, Circuit Protection (2 wire Switch)
	R10PQ	Miniature Reed Switch, 8mm Male Quick Connect, (24 AWG Wire, PVC Jacket) Circuit Protection (2 wire Switch)
	Contacts:	SPST Form A (normally open)
	Contact Rating:	10 W maximum (resistive)
	Input Voltage:	5-120 V max. (AC/DC)
	Maximum Load Current:	150 mA max.
	Actuating Time Average:	1.0 millisecond
	LED Indicator:	High luminescence housing
	Temperature Range:	-4°F to 158°F (-20°C to 70°C)
Protection Rating:	IP69K	
Circuit Protection*:		
Varistor:	190 V	
Choke:	680 µH	

\*The circuit protection consists of a Varistor and Choke arrangement. The Varistor will take transient & voltage spikes out of the line and is mounted in parallel with the switch. The Choke will disperse inrush currents, normally caused by long cable runs, and is mounted in series with the switch.

### RAC/RACX

High Power AC Reed Switch, Plain Cable Lead, (2 Wire Switch)



<b>CE</b>	RAC	High Power AC Reed Switch, 24" (20 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)
	RACX	High Power AC Reed Switch, 120" (20 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)
	Contacts:	TRIAC Output
	Contact Rating:	200 W maximum (resistive)
	Input Voltage:	12-240 VAC
	Minimum Load Current:	80 mA
	Maximum Load Current:	800 mA
	Actuating Time Average:	1.0 millisecond
	LED Indicator:	Not available
	Temperature Range:	-4°F to 158°F (-20°C to 70°C)
Protection Rating:	IP69K	

**Specify 'MPR' Option for ALL switch models when ordering actuators.**

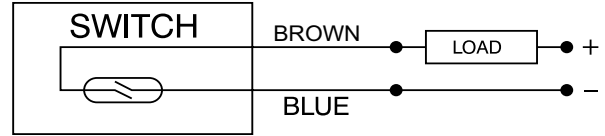


## Accessories – Reed Switches

Electrical Specifications		
CE	RHT	Extended Temperature Range Miniature Reed Switch, 24" (24 AWG Wire, Silicone rubber insulation with gray outer sheath, 4.5mm OD) Plain Cable Lead, (2 wire switch)
	RHTX	Extended Temperature Range Miniature Reed Switch, 120" (24 AWG Wire, Silicone rubber insulation with gray outer sheath, 4.5mm OD) Plain Cable Lead, (2 wire switch)
	Contacts:	SPST Form A (normally open)
	Contact Rating:	10 W max (resistive)
	Actuating Time Average:	1.0 millisecond
	LED Indicator:	Not available
	Temperature Range:	-40°F to 260°F (-40°C to 125°C)
	Protection Rating:	IP69K

### Schematics RHT/RHTX

Miniature Reed Switch, Plain Cable Lead, Extended Temperature Range (2 Wire Switch)



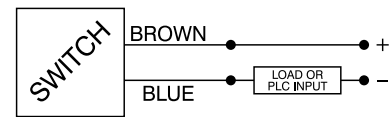
Input Voltage:	5-240 V max. (AC/DC)
Maximum Load Current:	500 mA max.

## Accessories – Solid State Switches

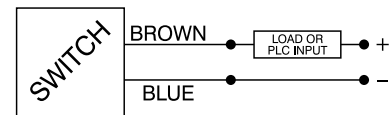
Electrical Specifications		
CE	MSS Miniature Solid State Switch	24" (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)
	MSSX Miniature Solid State Switch	120" (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)
	Output Type*:	Current sinking or current sourcing
	Input Voltage:	10-30 VDC
	Current Consumption (not sensing):	0.17 mA at 28 VDC
	Minimum Load Current:	4 mA
	Maximum Load Current:	300 mA
	"ON" Voltage Drop:	2.8 V at 300 mA
	LED Indicator:	High luminescence housing
	Temperature Range:	-4°F to 158°F (-20°C to 70°C)
	Actuating Time Average:	2.0 milliseconds
	Protection Rating:	IP69K
	Reverse Polarity Protected:	Yes
	Transient (over voltage) Protected:	Yes

### MSS/MSSX

Miniature Solid State Switch, Plain Cable Lead, (2 Wire Switch)



Typical Current Sourcing (PNP) Configuration



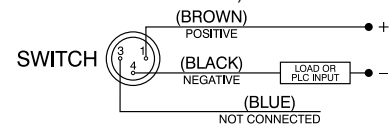
Typical Current Sinking (NPN) Configuration

\*This is a two (2) wire switch used in series with the load. Therefore, this switch can be used with devices requiring either a current sinking (NPN) output or a current sourcing (PNP) output.

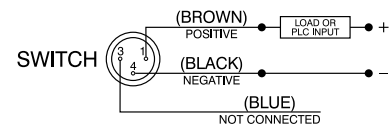
Electrical Specifications		
CE	MSSQ	Miniature Solid State Switch, 8mm Male Quick Connect, 24 AWG Wire, PVC Jacket (2 wire Switch)
	Output Type*:	Current sinking or current sourcing
	Input Voltage:	10-30 VDC
	Current Consumption (not sensing):	0.17 mA at 28 VDC
	Minimum Load Current:	4 mA
	Maximum Load Current:	300 mA
	"ON" Voltage Drop:	2.8 V at 300 mA
	LED Indicator:	High Luminescence Housing
	Temperature Range:	-4°F to 158°F (-20°C to 70°C)
	Actuating Time Average:	2.0 milliseconds
	Protection Rating:	IP69K
	Reverse Polarity Protected:	Yes
	Transient (over voltage) Protected:	Yes

### MSSQ

Miniature Solid State Switch, 8mm Male Quick Connect, (2 Wire Switch)



Typical Current Sourcing (PNP) Configuration



Typical Current Sinking (NPN) Configuration

\*This is a two wire switch used in series with the load. Therefore, this switch can be used with devices requiring either a current sinking (NPN) output or a current sourcing (PNP) output.

**Specify 'MPR' Option for ALL switch models when ordering actuators.**

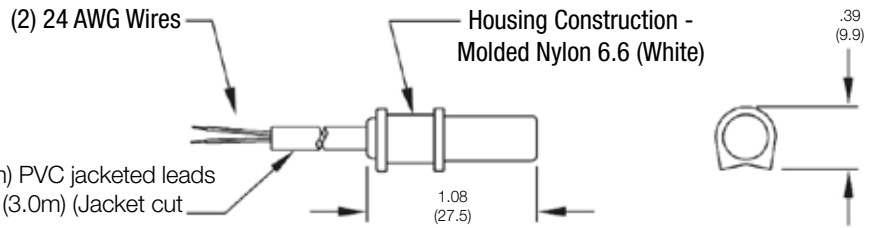
# How to Specify

## Accessories – Switches

**For Switches:** R10/R10X  
RHT/RHTX  
MSS/MSSX

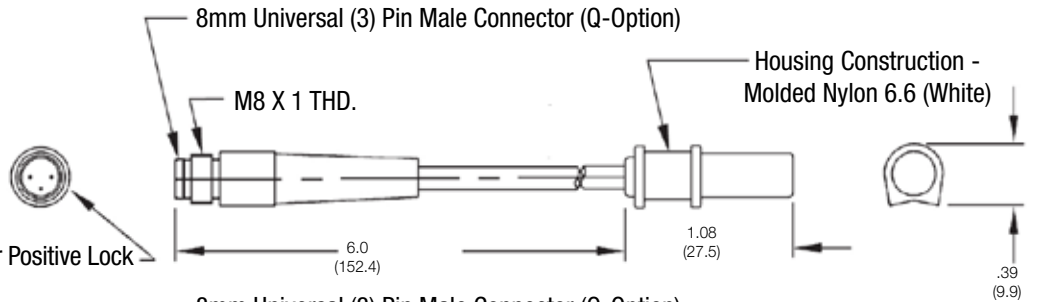
**Plain Cable Leads**

- > R10/RHT/MSS = 24" (0.6m) PVC jacketed leads
- > R10X/RHTX/MSSX = 120" (3.0m) (Jacket cut back 1" on end [25.4])



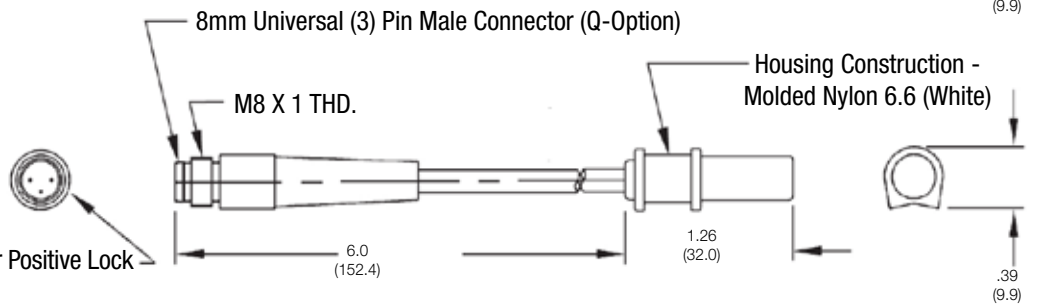
**For Switches:** R10Q  
MSSQ

Rugged Threaded Connection For Positive Lock



**For Switches:** R10PQ

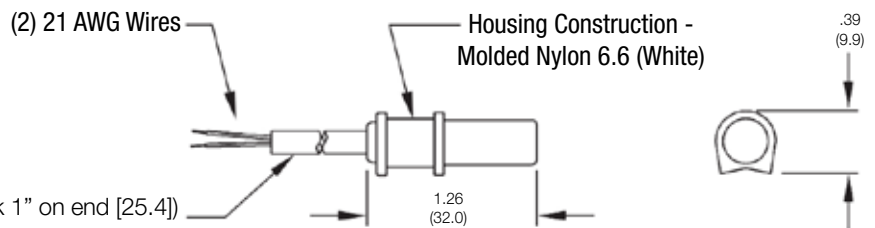
Rugged Threaded Connection For Positive Lock



**For Switches:** RAC/RACX  
R10P/R10PX

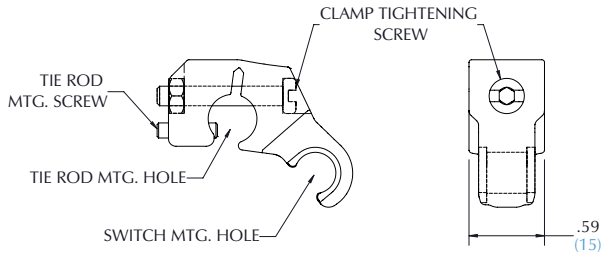
**Plain Cable Leads**

- > R10P/RAC = 24" (0.6m) PVC jacketed leads
- > R10PX/RACX = 120" (3.0m) (Jacket cut back 1" on end [25.4])

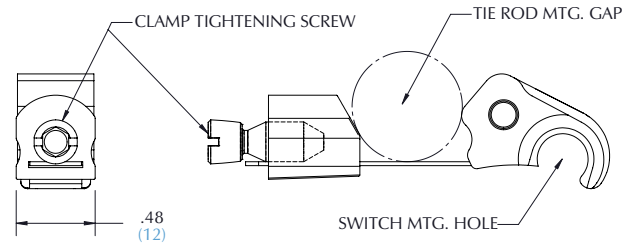


## Accessories – Switches

### Switch Bracket: SB15 (For 1.50" - 2.50" Bore Cylinders)



### Switch Bracket: SB32 (For 3.25" - 8.00" Bore Cylinders)



NOTE: Bracket construction is Molded PP (Black) and Stainless Steel Hardware for SB15, SB32 and USB.

### Quick Connect Cord Sets

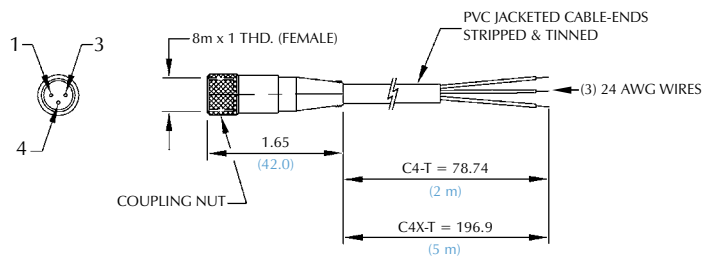
(used with "Q" Type switch leads)

#### For Cables:

- C4-T (2 meter cable length)
- C4X-T (5 meter cable length)

#### Conductor Colors:

- 1. Brown - Pin 1
- 3. Blue - Pin 3
- 4. Black - Pin 4

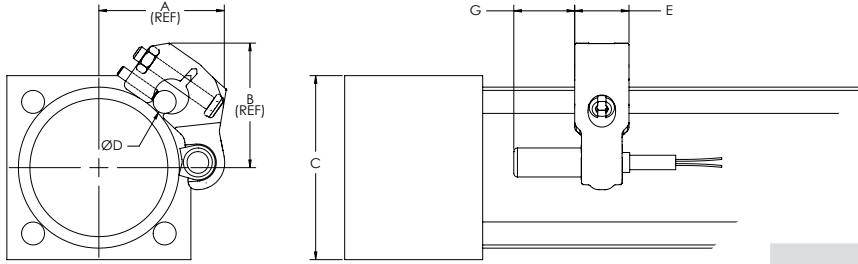


NOTE: All dimensions are in inches (mm in parentheses)

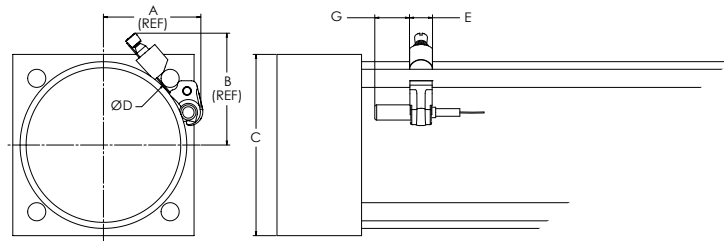
# How to Specify

## Accessories – Switch Mounting Dimensions

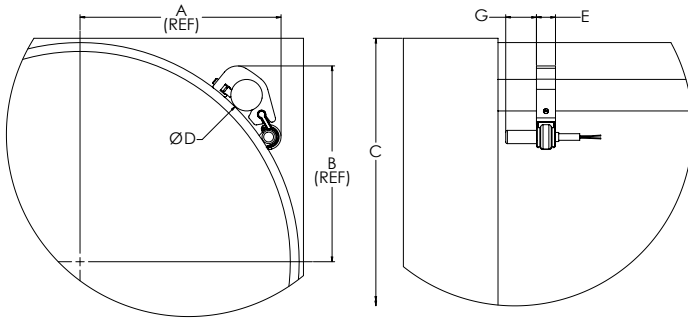
### SB15



### SB32



### SB100



Switch Bracket Letter Dimensions

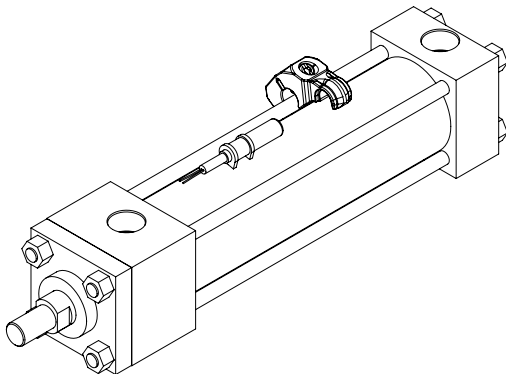
Part No.	Bore	A	B	C	D	E	G
SB15	1.50	1.375	1.406	2.000	0.250	0.590	0.661
	2.00	1.625	1.656	2.500	0.313	0.590	0.661
	2.50	1.875	1.875	3.000	0.313	0.590	0.661
	3.25	2.125	2.125	3.750	0.375	0.480	0.726
SB32	4.00	2.438	2.375	4.500	0.375	0.480	0.726
	5.00	2.875	2.750*	5.500	0.500	0.480	0.726
	6.00	3.250*	3.250*	6.500	0.500	0.480	0.726
	8.00	4.250*	4.250*	8.500	0.625	0.480	0.726
SB100	10.00	5.313*	5.313*	10.625	0.750	0.450	0.730
	12.00	6.375*	6.375*	12.750	0.750	0.450	0.730

\*These dimensions are 0.500" of the 'C' dimension. The switch bracket does not protrude beyond standard head/cap.

## Accessories – How To Assemble Switch and Brackets

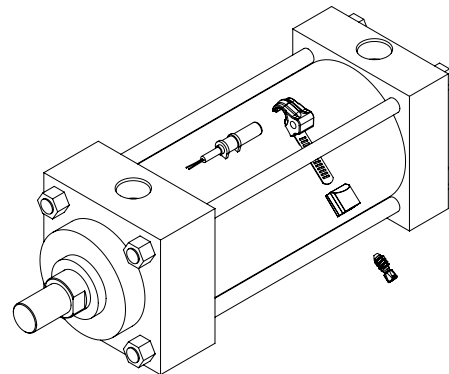
### SB15

Recommended Torque: 6-10 inch-lbs.  
(Do not exceed 12 inch-lbs.)



### SB32

Recommended Torque: 8-12 inch-lbs.  
(Do not exceed 14 inch-lbs.)



## Accessories – Switches Hysteresis & Bandwidth

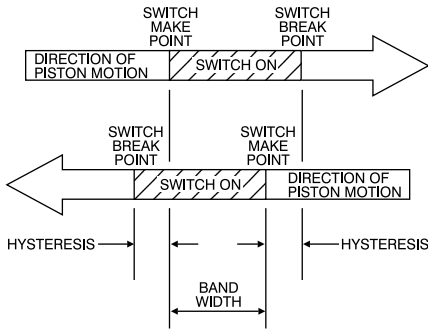
### Hysteresis:

The distance between the switch break point moving in one direction and the switch make point moving in the opposite direction.

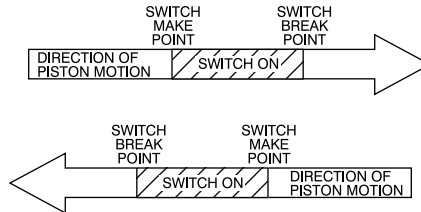
### Bandwidth:

The distance the piston moves while the switch is made (in either direction), less the hysteresis.

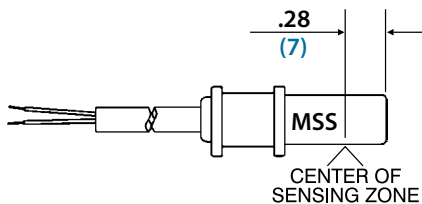
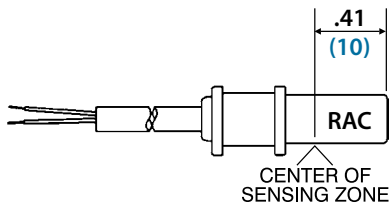
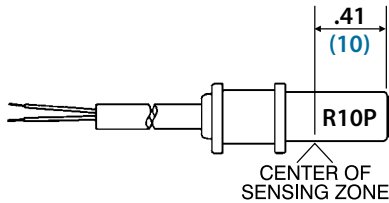
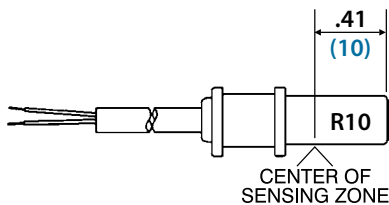
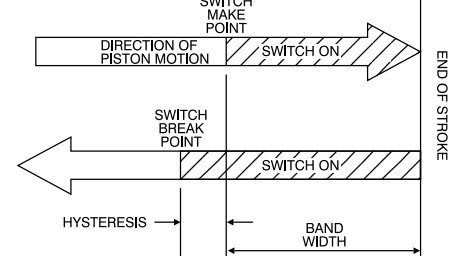
#### Mid Stroke Operation



#### Terminology Illustration



#### End of Stroke Operation



Switch	Repeatability	Hysteresis (Max)	Bandwidth (Max)
R10			
RHT	±.010"	.040"	.200"
R10X	(±.25)	(1)	(5)
RHTX			
R10Q			

Switch	Repeatability	Hysteresis (Max)	Bandwidth (Max)
R10P			
R10PQ	±.010"	.040"	.200"
R10PX	(±.25)	(1)	(5)

Switch	Repeatability	Hysteresis (Max)	Bandwidth (Max)
RAC			
RACX	±.010"	.040"	.200"
	(±.25)	(1)	(5)

Switch	Repeatability	Hysteresis (Max)	Bandwidth (Max)
MSS			
MSSX	±.010"	.030"	.150"
MSSQ	(±.25)	(1.9)	(8)

Note: Dimensions are in inches; (mm in parentheses). Results are based upon TRD piston and magnet assemblies. Results may vary if used with other manufacturers cylinder products.

**Specify 'MPR' Option for ALL switch models when ordering actuators.**

# How to Order

## Accessories – Switch Ordering Instructions

### Switch Model, Lead Type and Bracket Size

## R10 X - SB15

Switch Model		Switch Lead Options		Switch Bracket	
R10	AC/DC Reed	(Blank)	24" Plain Cable	SB15	1.50" to 2.50" bore
RAC	High Power AC Reed	X	120" Plain Cable	SB32	3.25" to 8.00" bore
RHT	Extended Temperature Reed	Q	8mm Quick Connect (Not available on RAC or RHT)	SB100	10.00" to 12.00"
MSS	Solid State			USB25	Up to 2.50" bore
R10P	AC/DC Reed with Circuit Protection			USB50	2.50" to 5.00" bore
				USB80	5.00"+ bore
				(Blank)	Switch only

### Switch Accessories

Quick Connect Cord Sets	
Model	Description
C4-T	8mm Straight Quick Connect Cord X 2 Meter (78")
C4X-T	8mm Straight Quick Connect Cord X 5 Meter (196")

### About Our Switches:

Our switches are different! The most common complaint in the market is the unreliability of magnetically operated switches. Most cylinder piston magnets have about 10-30% more power than required to operate the switch. This results in erratic operation, a nuisance for maintenance and lowering overall plant productivity.

Bimba designed our magnet to have 50-100% more power than required to operate our switch! The combination of Bimba R10, R10P, RAC, RHT and MSS Switches and our Cylinders, raises the reliability of switch operation comparable to that of many mechanically operated limit switches.

### Application Recommendations and Precautions:

- > Noise suppression - Motors and valve solenoids will produce high pulses throughout an electrical system. Therefore, primary and control circuit wiring should not be mixed in the same conduit. Separate power supplies for both logic level signals (Microprocessor, PC, CPU, Input Devices) and Output Field Devices (Motors, Valve Solenoids) is recommended.
- > Never connect R10, R10P, RHT or MSS type switches without a load present. The switch will be destroyed.
- > Some electrical loads may be capacitive. Capacitive loading may occur due to distributed capacity in cable runs over 25 feet. Use switch model RAC whenever capacitive loading may occur.
- > To obtain optimum performance and long life, switches should not be subjected to strong magnetic fields, extreme temperatures (outside of specifications) or excessive ferrous filings or chip buildup.
- > Improper wiring may damage or destroy the switch. Therefore, the wiring diagrams along with the listed power ratings, should be carefully observed before connecting power to the switch.

Following these tips can save time and provide trouble-free installations!

**Specify 'MPR' Option for ALL switch models when ordering actuators.**

## Series – Balluff Inductive Sensors

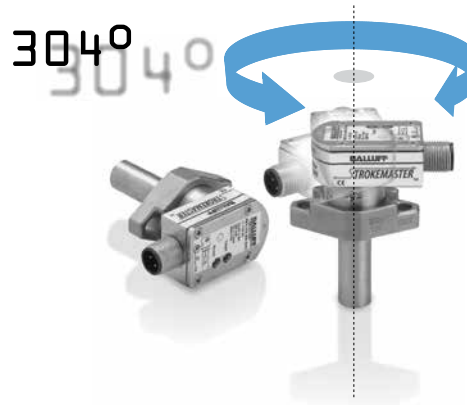


### Flexible Solutions for an Often Inflexible World

Balluff's Strokemaster® cylinder-piston sensors provide precision end-of-stroke sensing for hydraulic cylinders. The sensor body allows 304° of rotation to eliminate the hassle of post-installation cable management, which in some competitive designs requires unbolting the flange and breaking the hydraulic seal.

A high-pressure inductive proximity sensor, the Strokemaster® provides a 2mm (0.08") sensing range to detect the "spud" of hydraulic/pneumatic cylinders and indicate fully retracted or extended position. It mounts with two socket-head cap screws and seals with a FKM O-ring. Withstanding cylinder pressures to 3000 psi (207 BAR), the embeddable design keeps most of the switch protected within the cylinder, with only a 0.62" (16mm) high housing exposed outside.

Strokemaster® sensors are available in 3-wire DC and 2-wire AC/DC versions, both with mini or micro connectors. Switching frequency is 50 Hz for the AC/DC versions. All units are weld-field immune, short-circuit, and reverse polarity protected. They fit all TRD series cylinder designs, with standard available probe lengths of 0.912" - 4.560" (23.165mm - 115.8mm). Custom probe lengths can be achieved by using TRD supplied spacer kits. Probes are made of stainless steel with a high-strength ceramic face. Both DC and AC/DC sensors have all-metal housings. The Strokemaster® sensor is UL-listed, CE-certified, and its housing is sealed to IP69K requirements.



Inductive Sensors



### Features/Advantages

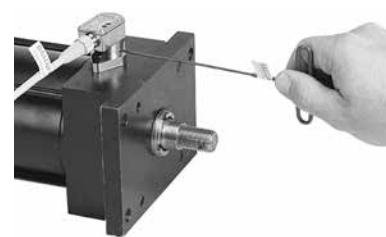
- > Magnetic field immune, for use with welding equipment
- > Available in DC or all current (AC/DC) versions
- > Easy installation - sensor mounts to cylinder with two (2) fasteners
- > Sealed directly at flange, connector can be oriented after installation
- > Various lengths available for different cylinder sizes



Bolt sensor to cylinder.



Position cable to desired orientation (even over mounting bolts).

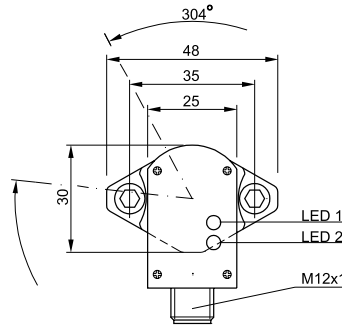


Lock chosen position with one or both of the two integral set screws.

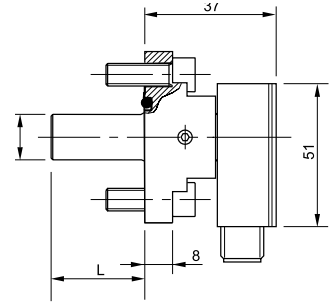
# How to Specify

## Series – Balluff Induction Sensors (DC Inductive Sensors)

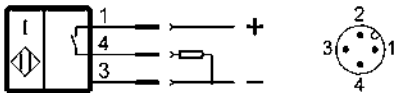
PNP Normally-Open	BES 516-300-S 295-S 4
Rated operational voltage Ue	24 VDC
Supply voltage UB	10-30 VDC
Voltage drop Ud at Ie	< 2.5 V
Rated insulation voltage Ui	75 VDC
Rated operational current Ie	200 mA
No-load supply current Ir d./und.	< 18 mA/< 10 mA
Off-state current Ir	< 80 µA
Protected against polarity reversal	Yes
Short circuit/overload protected	Yes/Yes
Load capacitance	< 1.0 µF
Repeat accuracy R	< 5 %
Ambient temperature range Ta	-25...+70°C
Frequency of operating cycles f	10 Hz
Utilization categories	DC 13
Function/Operating voltage indication	Yes/Yes
Degree of protection per IEC 529	IP 67/connector IP 65
Housing material	Stainless steel/aluminum
Material of sensing face	Ceramic
Connection	Micro connector
Approvals	cULus
High pressure rated up to	207 bar (3000 PSI)
Recommended connector	BCC M415-0000-1A-003-VX44T2-050



Micro M12DC Connector



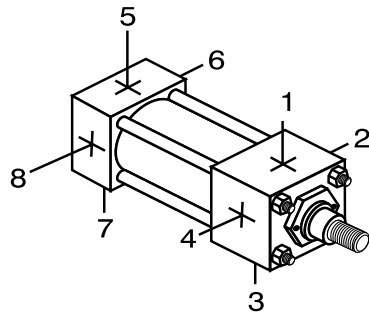
### Wiring Diagram – PNP Normally Closed



Bimba will supply the correct length probe and spacer combination (if required) for each cylinder. Using the combination of standard probe lengths and spacers will give the appropriate .030" gap between sensor and cylinder spud. The spacers supplied have the same base profile as the sensor.

**Material:** Stainless Steel

### How To Order Cylinders With Balluff Sensors:

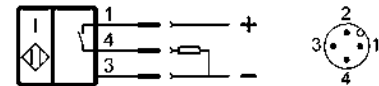


#### Standard Locations:

- > Ports at 1 and 5
  - > Cushions at 2 and 6
  - > Sensors at 4 and 8
- (Specify non-standard locations)

Cylinder Model Number:	TA - MS2 3.25 X 6 - HC
Sensor Model (Head):	BES 516-300-S 295-S4 (Head)
Sensor Model (Cap):	BES 516-300-S 295-S4 (Cap)
(Include ALL Sensor Positions):	Sensors at 4 & 8

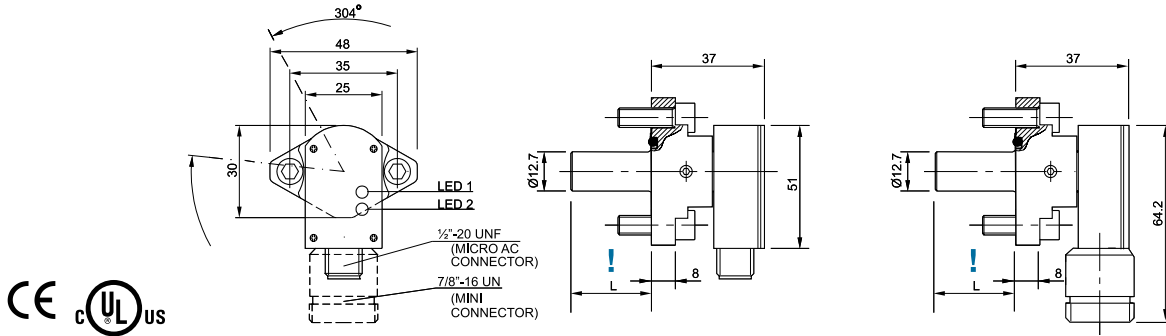
PNP Normally Open



Note: Bimba will include the Strokemaster® probe length on your order and any sensor spacers required (example: TA-MS2 4 X 6-HC- BES 516-300-S4 /1.025-S21 (Head) -BES 516-300-S4 /1.75-S21 (Cap)- Sensors at 4 & 8.



## Series – Balluff Induction Sensors (AC/DC Inductive Sensors)

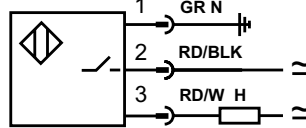


Normally-open	BES 516-200-S 2-S21	BES 516-200-S 2-S5
Rated operational voltage $U_o$	110 V AC	110 V AC
Supply voltage $U_s$	20...250 V AC/DC	20...250 V AC/DC
Voltage drop $U_v$ at $I_o$	$\leq 6$ V	$< 6$ V
Rated insulation voltage $U_i$	250 V AC	250 V AC
Rated operational current $I_o$	500 mA	500 mA
Minimum operational current $I_m$	5 mA	5 mA
Off-state current $I_i$	$\leq 1.7$ mA @ 110 V AC	$< 1.7$ mA @ 110 V AC
Inrush current $I_k$ ( $t = 20$ ms)	3 A max./1 Hz	3 A max./1 Hz
Protected against polarity reversal	Yes	Yes
Short circuit protected	Yes	Yes
Repeat accuracy R	$\leq 5\%$	$< 5\%$
Ambient temperature range $T_a$	-25...+70°C	-25...+70°C
Frequency of operating cycles f	$\leq 50$ Hz	$< 50$ Hz
Utilization categories	AC 140/DC 13	AC 140/DC 13
Function/Operating voltage indication	Yes/Yes	Yes/Yes
Degree of protection per IEC 529	IP 67	IP 67
Insulation class	1	1
Housing material	Stainless steel/aluminum	Stainless steel/aluminum
Material of sensing face	Ceramic	Ceramic
Connection	Micro connector	Mini connector
Approvals	cULus	cULus
High pressure rated up to	207 bar (3000 PSI)	207 bar (3000 PSI)
Recommended connector	BCC A213-0000-1C-123-EX43T2-050	BCC A313-0000-10-071-VX43W6-050

Bimba will supply the correct length probe and spacer combination (if required) for each cylinder. Using the combination of standard probe lengths & spacers will give the appropriate .030" gap between sensor and cylinder spud. The spacers supplied have the same base profile as the sensor

**Material:** Stainless Steel

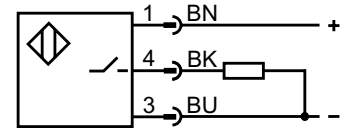
Wiring



Pinout



Wiring



Pinout

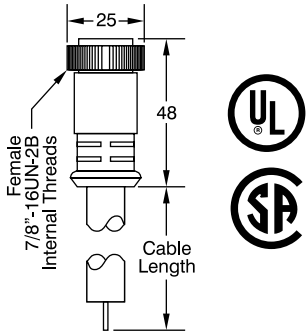


# How to Order

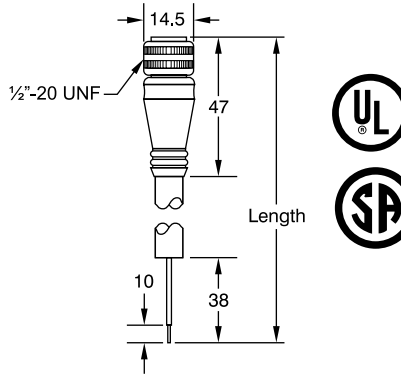
## Series – Balluff Induction Sensors (Cable Connectors)



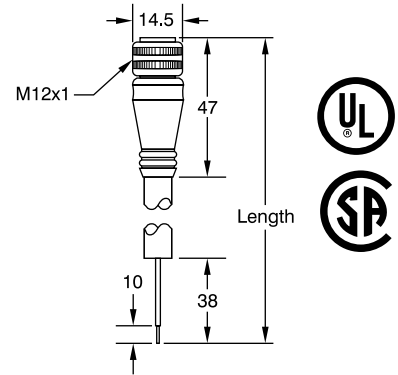
### S5 - Mini Connectors 7/8"-16 UNF Threads



### S21 - Micro Connectors 1/2"-20 UNF Threads



### S4 - Micro Connectors M12x1 Metric Threads



Recommended Connector	<b>BCC A313-0000-10-071-VX43W6-050</b>
Connector	3-5 Pole Mini
Style	Mini Size A
Configuration	Straight Female

Recommended Connector	<b>BCC A213-0000-1C-123-EX43T2-050</b>
Connector	Micro AC 1/2" x 20 UNF
Style	3 Pin Dual Keyway
Configuration	Straight Female

Recommended Connector	<b>BCC M415-0000-1A-003-VX44T2-050</b>
Connector	Micro
Style	M12 DC Single Keyway
Configuration	Straight Female

Order Number	
<b>3 Pole</b>	<b>BCC A313-0000-10-071-VX43W6-050</b>
Voltage Rating	300 V AC/DC
Current	10 A
Wire Gauge	16 AWG
Jacket	PVC
Coupling Nut	Black Epoxy Coated Zinc
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-4°F - 221°F (-21°C - 105°C)
UL Listed	Yes
CSA Certified	Yes

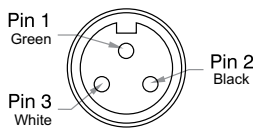
Order Number	
<b>3 Pin Dual Keyway</b>	<b>BCC A213-0000-1C-123-EX43T2-050</b>
Voltage Rating	250 V AC/DC
Current	4 A
Wire Gauge	22 AWG
Jacket	TPE
Coupling Nut	Black Epoxy Coated Zinc
O-Ring	FKM
Overmold Head	TPE
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-4°F - 221°F (-21°C - 105°C)
UL Listed	Yes
CSA Certified	Yes

Note	Order Number
<b>3 Wire DC</b>	
<b>3 Wire Normally Open, non-LED</b>	<b>BCC M415-0000-1A-001-*X43T2-050</b>
<b>3 Wire Normally Open PNP w/ LED</b>	<b>BCC M415-0000-1A-004-*X43T2-050</b>
<b>4 Wire DC (NO/NC)</b>	
<b>4 Wire, non-LED</b>	<b>BCC M415-0000-1A-003-*X44T2-050</b>
<b>4 Wire PNP w/LED</b>	<b>BCC M415-0000-1A-008-*X44T2-050</b>

Voltage Rating	10 - 30 VDC
Current	4 A
Wire Gauge	22 AWG
Jacket	Yellow PVC or TPE
Coupling Nut	Black Epoxy Coated Zinc
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-4°F - 221°F (-21°C - 105°C)
UL Listed	Yes
CSA Certified	Yes

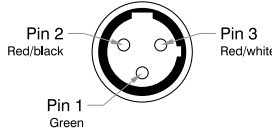
For 3 pole versions only

#### Female 3-pin - Face view



For 3 pole versions only

#### Female - Face view

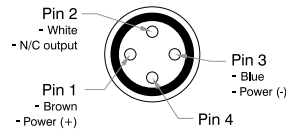


Note: 15 ft (5 m) cable is standard (other lengths available - consult factory)

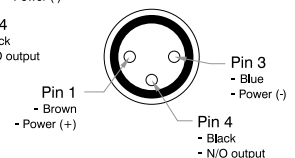
Note: 15 ft (5 m) cable is standard (other lengths available - consult factory)

\* Insert V = PVC Cable  
E = TPE Cable

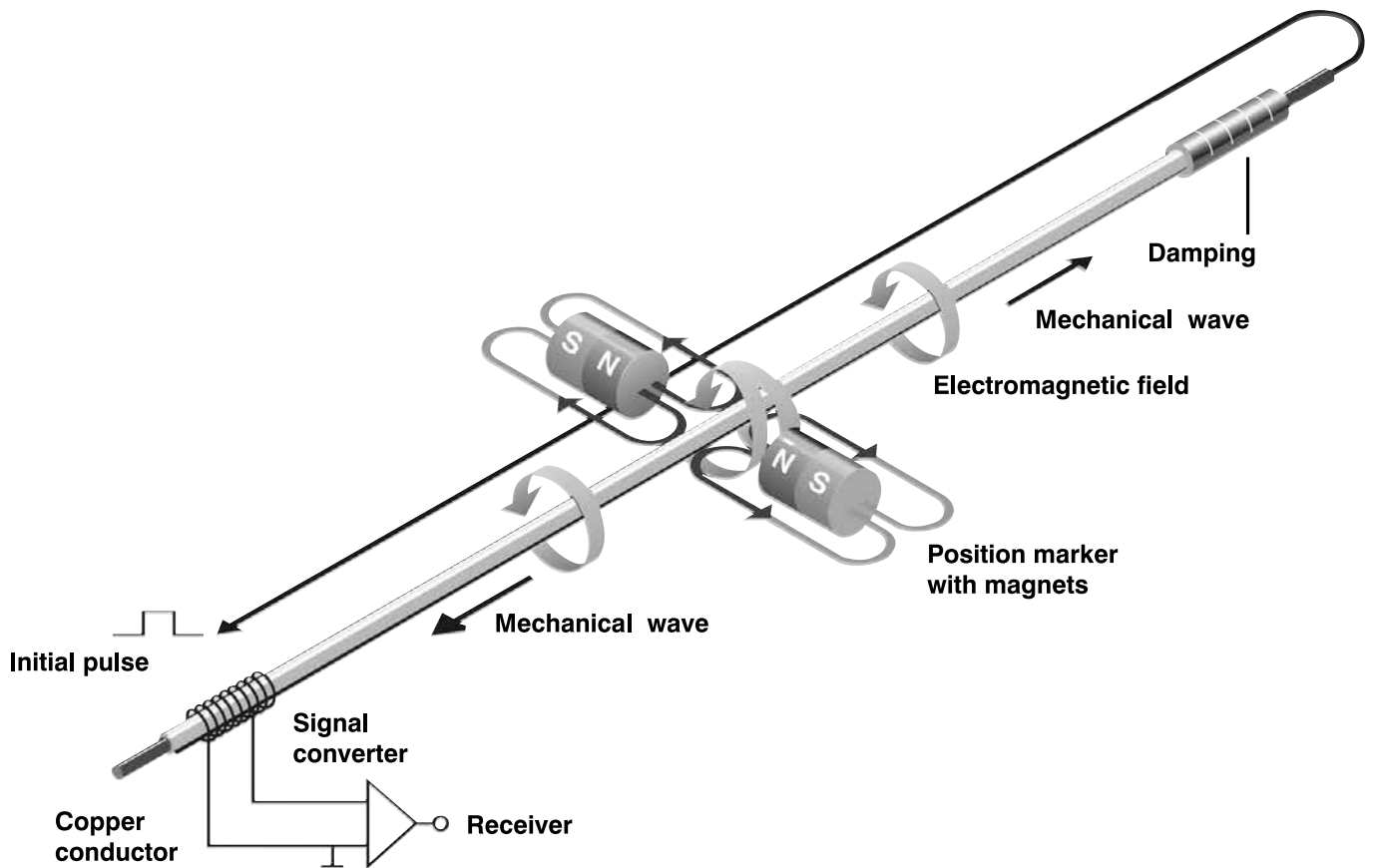
#### Female - Face view



#### Female - Face view



## Balluff Linear Position Transducers



### Enhanced Magnetostrictive Technology

The waveguide consists of a special nickel-iron alloy with 0.7 mm OD and 0.5 mm ID.

A copper conductor is introduced through the length of this tube. The start of measurement is initiated by a short current pulse. This current generates a circular magnetic field which rotates around the waveguide.

A permanent magnet at the point of measurement is used as the marker element, whose lines of field run at right angles to the electromagnetic field.

### Rugged and Wear-Free

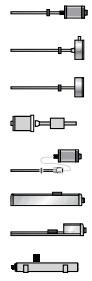
- > No mechanical contact between magnet and sensing element
- > Immune to dirt, dust, and other potential contaminants
- > Available in many different form factors for many different applications

In the area on the waveguide where the two fields intersect, a magnetostrictive effect causes an elastic deformation of the waveguide, which propagates along the waveguide in both directions in the form of a mechanical wave.

The mechanical wave is converted to an electrical signal by the signal converter. The propagation time of the mechanical wave is determined by the position of the permanent magnet and can be determined to resolutions down to 5  $\mu\text{m}$ .

# How to Specify

## Balluff Linear Position Transducers



**Balluff has the right transducer for any application!**

- > Rod styles
- > Profile styles
- > Tubular styles
- > Embeddable style
- > Explosion-proof style

### Rod Style (Z)



- > 3/4"-16 UNF threads
- > Pressure rated to 8700 PSI for use in hydraulic cylinders
- > Replaceable electronics head
- > Analog signal adjustable in field

### Rugged, Compact Rod Style (W)



- > Rugged all stainless steel housing
- > Designed for demanding applications
- > Eliminates the need for protective cover
- > 3/4"-16 UNF threads
- > Pressure rated to 8700 PSI

### Compact, Bolt-in Rod Style (K)



- > Rugged all stainless steel housing
- > Bolt in design
- > Pressure rated to 8700 PSI
- > Eliminates the need for protective cover

#### Sensor Output Options

##### Analog

0...10 V and 10...0 V	•	•	•
-5...+5 V and +5...-5 V	•	•	•
-10...+10 V and +10...-10 V	•	•	•
4...20 mA or 20...4 mA	•	•	•
0...20 mA or 20...0 mA	•	•	•

##### Digital

Start/Stop, RS422	•	•	•
Pulse-Width Modulated, RS422	•	•	•
PWM (w/ recirculation), RS422	•	•	•

##### Specialized

Synchronous Serial Interface*	•	•	•
CANopen	•		
Profibus DP	•		
Quadrature	•		

##### Resolution

0.1 mV (analog)		•	•
0.2 µA (analog)		•	•
16 bit (analog)	•		
Controller-dependent (Start/Stop & PWM)	•	•	•
1,2,3,5,10 µm selectable (Quadrature output)	•		
1,5,10,20,40 µm selectable (SSI output)	•	•	•
5 µm increments selectable (CANopen & Profibus)	•		
10 µm			

##### Stroke Length

Active measurement area: 1" to 156"	1" - 156"	1" - 156"	1" - 156"
(Consult factory for longer lengths)			
Wiring Options			
Quick disconnect	•	•	•
Cable-out	•	•	•
Operating Voltage			
24 V DC (±20%)	•	•	•
±15 V DC (±2%)	•	•	•

\* (24 or 25 bit binary or gray code)



# Continual Position Feedback Cylinders

Accurately position your pneumatic motion applications with Bimba's TRD line position control technologies, including cylinders with built-in position control and systems you can add to existing set-ups.



# Contents

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**303** PFLF Series Product Features

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**304** How to Order (PFLF Series)  
304 – PFLF Mounts

---

**305** How It Works (PFLF Series)

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**306** How to Specify (PFLF Series)  
306 – Piston Rod End Styles  
306 – Mounting Options  
313 – Specifications

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**314** How to Repair (PFLF Series)  
314 – Components/Repair Kits

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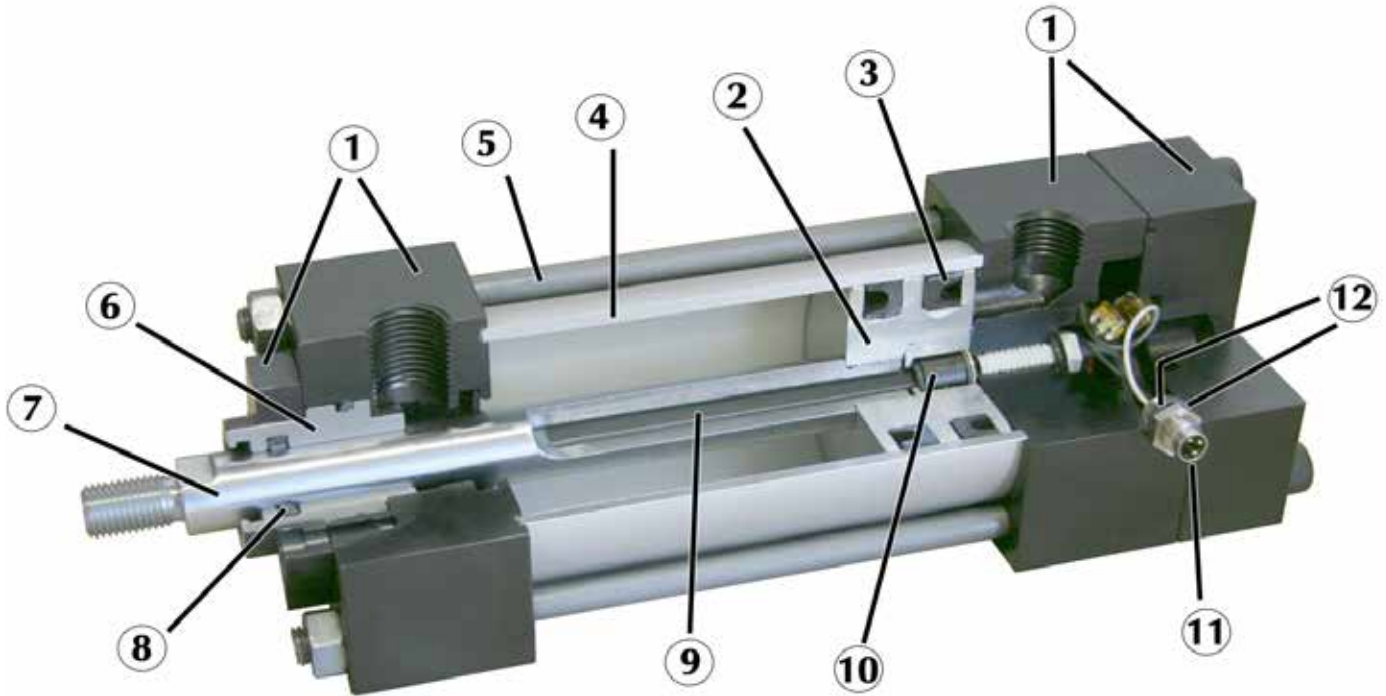
**315** SPCS-2 Servo Pneumatic Control  
System Product Features

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**316** How to Specify (SPCS-2 Series)  
316 – Dimensions

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## Position Feedback Low Friction (PFLF) Cylinder



1. **Head, Cap & Retainer:** Precision machined from high strength 6061-T6 aluminum alloy. Black anodized for corrosion resistance.
2. **Piston:** Precision machined from high strength aluminum alloy for light weight and extended cycle life.
3. **Piston Seals:** Seals are low friction and packed with special low friction non-migrating Teflon® based grease for permanent lubrication. Lip seals are pressure activated and wear compensating.
4. **Cylinder Tube:** Precision machined from 6063-T832 high tensile aluminum alloy and hard coat to 60 Rc for wear resistance and extended cycle life.
5. **Tie Rods:** Pre-stressed tie rod construction eliminates axial loading of cylinder tube and maintains compression on tube end seals.
6. **Bearing:** Precision machined from graphite filled cast iron and Teflon® coated to reduce friction and extend cycle life. Design allows increased lubrication in effective bearing area.
7. **Piston Rod:** Precision machined from high yield, polished and chrome plated steel.
8. **Rod Seal:** Seals are low friction and packed with special low friction non-migrating Teflon® based grease for permanent lubrication. Lip seals are pressure activated and wear compensating (rod wiper is omitted unless requested—see options note on performance).
9. **Linear Resistive Transducer (LRT) Probe:** The LRT probe is an anodized aluminum probe with Delrin® threaded flange, o-ring and back-up washer. The probe has infinite resolution, nonlinearity of  $\pm 1$  percent of full stroke and a rated life of 10 million cycles. Typical probe input is 10 VDC, input impedance required is 1 M Ohm with a temperature rating of 0 ° to +200 °F. Note: probe is subject to mechanical wear.
10. **Linear Resistive Transducer (LRT) Wiper:** The LRT wiper is completely assembled precision molded assembly with a rated life of up to 1,000 linear miles.
11. **Three Pin Connector:** This connector is supplied on all PFLF cylinders. The connector has a universal 8mm (3) pin DIN male connection.
12. **O-Rings:** To provide a positive seal to prevent any contaminants or liquids from entering cylinder cavity and affecting cylinder performance.

### Features of the PFLF Cylinder

- > Continuous position sensing
- > Highly accurate: infinite resolution, linearity of  $\pm 1$  percent of full stroke,  $\pm .001$ " mechanical repeatability
- > Strokes up to 24"
- > Easily repairable

- > Electronic Position Controllers (usable with DC input electronic position controllers)
- > SPCS-2/2T available
- > Permanently lubricated seals
- > Quick Connect (IP67) standard on all models.



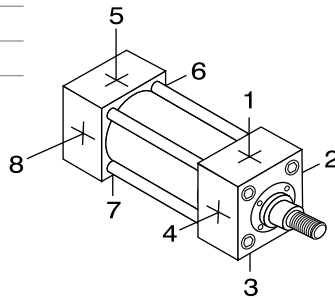
# How to Order

## Position Feedback Low Friction (PFLF)

### PFLF - MS4 - 4.00 x 10 - KK3 - MPR

Series	NFPA Mounts	Bore	Stroke	Cylinder Options
PFLF Anodized Aluminum	MX0 No Mount (1.50" - 8.00" Bore)	1.50 2.00	2"-24" (1.50" - 2.50")	B* .25" Urethane Bumper Both Ends
	MP1 Rear Pivot Clevis (1.50" - 8.00" Bore)	2.50 3.25		BC* .25" Urethane Bumper Cap Only
	MP2 Rear Pivot Clevis (1.50" - 6.00" Bore)	4.00 5.00	3"-24" (3.25" - 8.00")	BH* .25" Urethane Bumper Head Only
	MP4 Rear Pivot Eye (1.50" - 4.00" Bore)	6.00 8.00		A = Extended Piston Rod Thread - Specify (Example: A = 2")
	MT1 Front Trunnion (1.50" - 8.00" Bore)			C = Extended Piston Rod - Specify (Example: C = 1.5")
	MT2 Rear Trunnion (1.50" - 8.00" Bore)			KK2 Large Male Rod Thread
	MT4 Intermediate Trunnion (1.50" - 8.00" Bore)			KK3 Female Rod Thread
	MX3 Extended Tie-Rods (Head) (1.50" - 8.00" Bore)			KK4 Full Diameter Male Rod Thread
	MF1 Front Flange (1.50" - 6.00" Bore)			MPR Magnetic Piston for Reed Switches
	MF2 Rear Flange (1.50" - 6.00" Bore)			OP Optional Port Location (Example: OP=3,7)
	ME3 Front Mounting Holes (8.00" Bore)			XX Special Variations (Specify)
	MS1 Front and Rear End Foot (1.50" - 8.00" Bore)			
	MS2 Side Lug (1.50" - 8.00" Bore)			
	MS4 Bottom Tapped Holes (1.50" - 8.00" Bore)			

\* Urethane Bumpers add .25" per end of Cylinder



#### Options Available But Not Recommended (Will Affect Cylinder Performance)

B*	.25" Urethane Bumper Both Ends
H	Head Cushion
MS	Metallic Rod Scraper
RW	Rod Wiper

#### Standard Port Positions And Feedback Cable Connector Positions

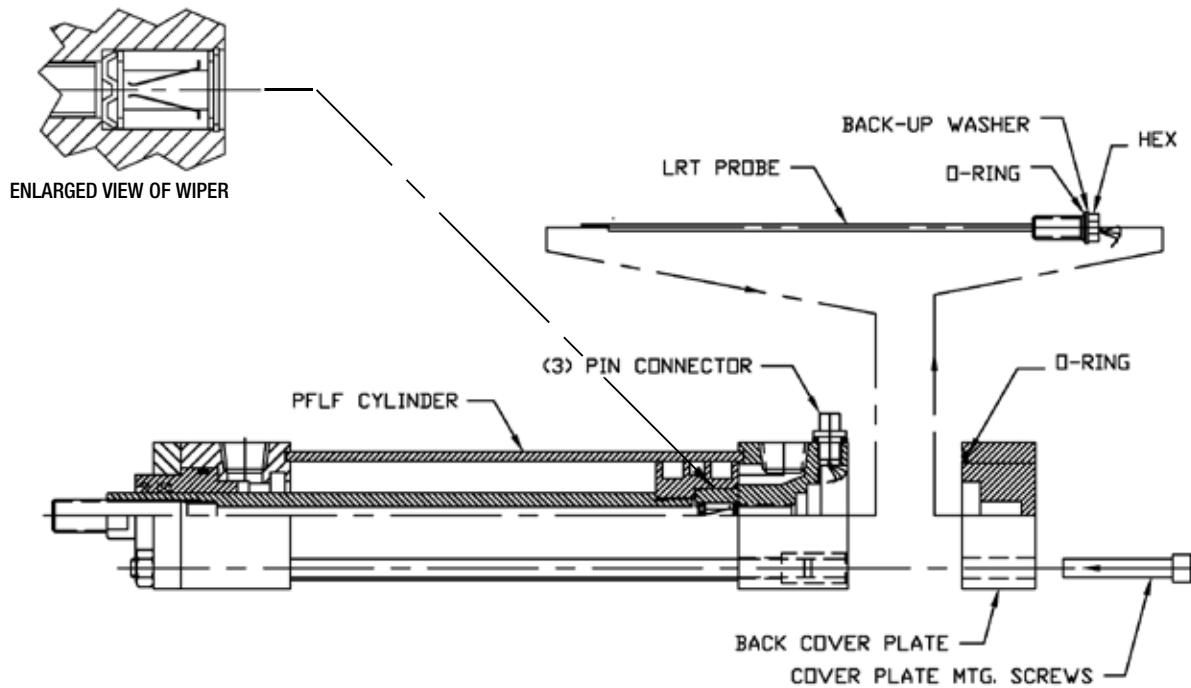
- > Ports - Positions 1 and 5
- > Cushion Adjustment - Positions 2 and 6
- > Specify Non-Standard Positions When Ordering

#### PFLF Mounts

 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-6.00" Bores	 1.50"-4.00" Bores
 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-6.00" Bores	 1.50"- 6.00" Bores
 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-8.00" Bores	 8.00" Bore	Oversize rods and stainless steel cylinders available. Consult factory.



## Position Feedback Low Friction (PFLF) Cylinder



**The Position Feedback Cylinder** contains a Linear Resistive Transducer (LRT) or potentiometer mounted in the cylinder rear head. The LRT probe, which has a resistive element on one side and a collector strip on the other, is inside the cylinder rod. A wiper assembly is installed in the piston. As the piston moves, an electrical circuit is created between the resistive element and collector strip. The resulting voltage is directed externally via wiring. The output voltage is proportional to the wiper position on the resistive element, which allows the cylinder position to be determined.

For example, in a 12-inch stroke cylinder, if the output voltage is 0 VDC when fully retracted and 10 VDC when fully extended, voltage readings of 2.5 and 5.833 VDC would indicate cylinder extensions of three inches and seven inches.

The accuracy of an LRT is determined by three factors: resolution, linearity and repeatability.

**Resolution** refers to the smallest change that can be detected on the LRT. The LRT has infinite resolution and can be divided into as many parts as the electronics allow. For example, with a 12-bit, 4096-part controller, the stroke could be divided into 4096 equal parts. When 10 VDC is placed on a 10" cylinder, the smallest detectable increment would be  $10 \text{ VDC} \div 4096 = 2.4$  millivolts or 0.0024". Resolution is stroke sensitive (i.e. the longer the stroke, the less resolution).

**Linearity** refers to the maximum deviation of the output voltage to a straight line. The LRT's linearity is  $\pm 1$  percent of stroke.

**Repeatability** is the ability of the LRT to provide the same output voltage relative to a unique cylinder position each time the cylinder is cycled. Mechanical repeatability of the Bimba NFPA Position Feedback Cylinder is  $\pm 0.001$ ".



# How to Specify

## Position Feedback Low Friction Cylinder – Dimensions

### About Rod End Styles

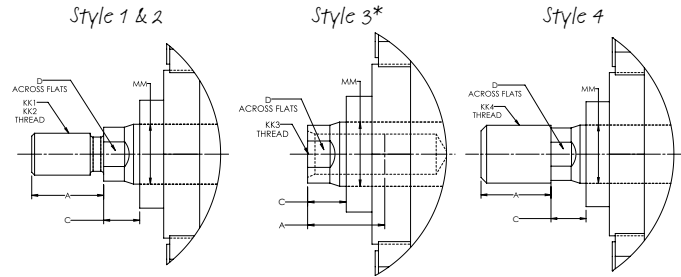
#### Style 1 Male Rod End is STANDARD

Other NFPA Styles can be specified (see chart).

Need a rod end not listed? NO PROBLEM! Each Piston Rod is made-to-order and does not delay shipment. Coarse (UNC) threads, Metric threads or just plain rod ends are common. Thread lengths are also made-to-order (Specify: "A"=Length).

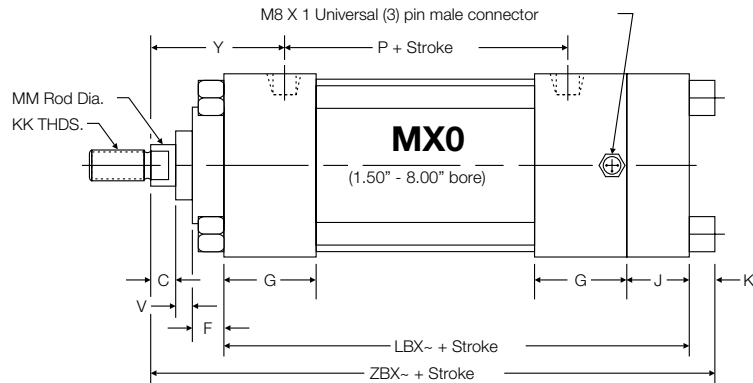
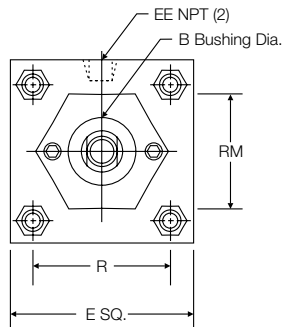
NEED SOMETHING NOT LISTED? Just send us a sketch. In most cases, quotes are turned around in one day!

### Piston Rod End Styles



Bore	Rod Diameter (MM)	Standard		Optional				C	D		
		Style 1 - Male		Style 2 - Male		Style 3 - Female				Style 4 - Male	
		KK1	A	KK2	A	KK3	A			KK4	A
1.50, 2.00, 2.50	0.625	7/16-20	0.750	1/2-20	0.750	7/16-20	0.750	5/8-18	0.750	0.375	0.500
3.25, 4.00, 5.00	1.000	3/4-16	1.125	7/8-14	1.125	3/4-16	1.125	1-14	1.125	0.500	0.875
6.00 & 8.00	1.375	1-14	1.625	1 1/4-12	1.625	1-14	1.625	1 3/8-12	1.625	0.625	1.125

\* KK3 (Style 3 - Female) will have a recessed plug due to through hole in rod.

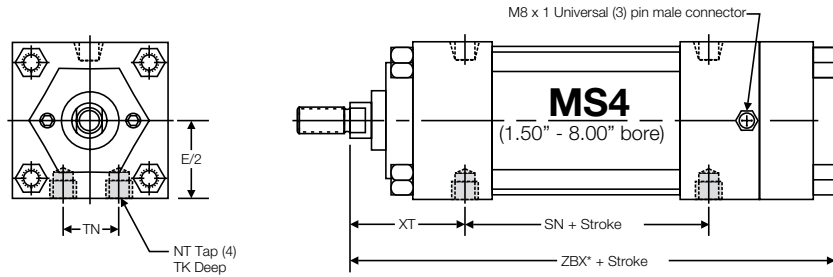


'MX0' PFLF Cylinder Dimensions - Standard Rod Only

Bore	Rod Diameter	A	B	C	E	EE	F	G	J	K	KK	LBX~	P	R	RM	V	Y	ZBX~
1.50	0.625	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16-20	5.125	2.375	1.430	2.000 SQ.	0.250	1.875	6.375~
2.00	0.625	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	7/16-20	5.125	2.375	1.840	1.750 Hex	0.250	1.875	6.438~
2.50	0.625	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.313	7/16-20	5.250	2.500	2.190	1.750 Hex	0.250	1.875	6.563~
3.25	1.000	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.375	3/4-16	6.000	2.750	2.760	2.750*	0.250	2.375	7.750~
4.00	1.000	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.375	3/4-16	6.000	2.750	3.320	2.750*	0.250	2.375	7.750~
5.00	1.000	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.500	3/4-16	6.250	3.000	4.100	2.750*	0.250	2.375	8.125~
6.00	1.375	1.625	2.000	0.625	6.500	0.750	0.625	2.000	1.500	0.500	1-14	7.000	3.250	4.880	3.500*	0.375	2.750	9.125~
8.00	1.375	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.500	0.625	1-14	7.125	3.375	6.440	3.500*	0.375	2.750	9.375~

\* RM dimension is round retainer diameter  
~ Non-NFPA Dimensions

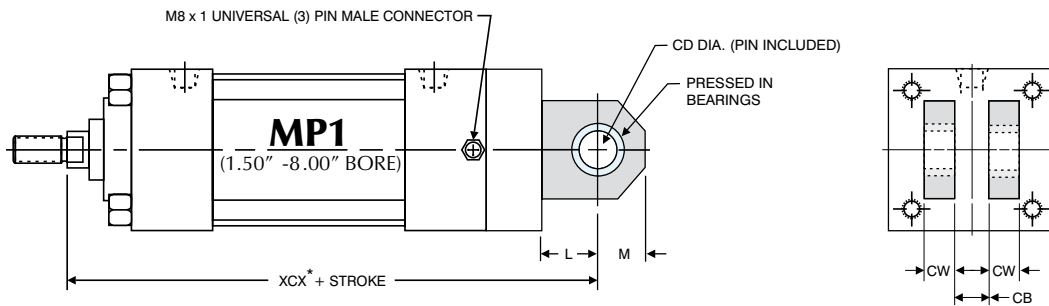
## Position Feedback Low Friction Cylinder – Dimensions



**'MS4' PFLF Cylinder Dimensions - Standard Rod Only**

Bore	Rod Diameter	E/2	NT	TK	TN	XT	Add Stroke	
							SN	ZBX*
1.50	0.625 Standard	1.000	1/4-20	0.375	0.625	1.938	2.250	6.375
2.00	0.625 Standard	1.250	5/16-18	0.500	0.875	1.938	2.250	6.438
2.50	0.625 Standard	1.500	3/8-16	0.625	1.250	1.938	2.375	6.563
3.25	1.000 Standard	1.875	1/2-13	0.750	1.500	2.438	2.625	7.750
4.00	1.000 Standard	2.250	1/2-13	0.750	2.063	2.438	2.625	7.750
5.00	1.000 Standard	2.750	5/8-11	1.000	2.688	2.438	2.875	8.125
6.00	1.375 Standard	3.250	3/4-10	1.125	3.250	2.813	3.125	9.125
8.00	1.375 Standard	4.250	3/4-10	1.125	4.500	2.813	3.250	9.375

Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.  
\* Non-NFPA Dimensions



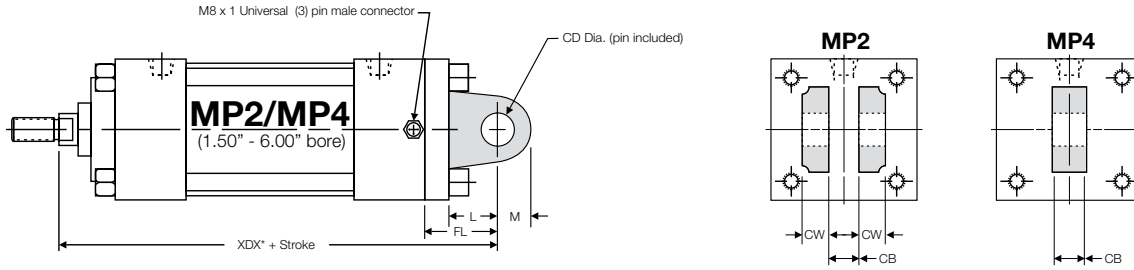
**'MP1' PFLF Cylinder Dimensions - Standard Rod Only**

Bore	Rod Diameter	CB	CD	CW	L	M	Add Stroke
							XCX*
1.50	0.625 Standard	0.750	0.500	0.500	0.750	0.625	6.875
2.00	0.625 Standard	0.750	0.500	0.500	0.750	0.625	6.875
2.50	0.625 Standard	0.750	0.500	0.500	0.750	0.625	7.000
3.25	1.000 Standard	1.250	0.750	0.625	1.250	0.875	8.625
4.00	1.000 Standard	1.250	0.750	0.625	1.250	0.875	8.625
5.00	1.000 Standard	1.250	0.750	0.625	1.250	0.875	8.875
6.00	1.375 Standard	1.500	1.000	0.750	1.500	1.000	10.125
8.00	1.375 Standard	1.500	1.000	0.750	1.500	1.000	10.250

Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.  
1.50" & 2.00" bore MP1 extruded mounts are through tie rod construction.  
2.50" bore and larger the rear MP1 cap is bolted on.  
\* Non-NFPA Dimensions

# How to Specify

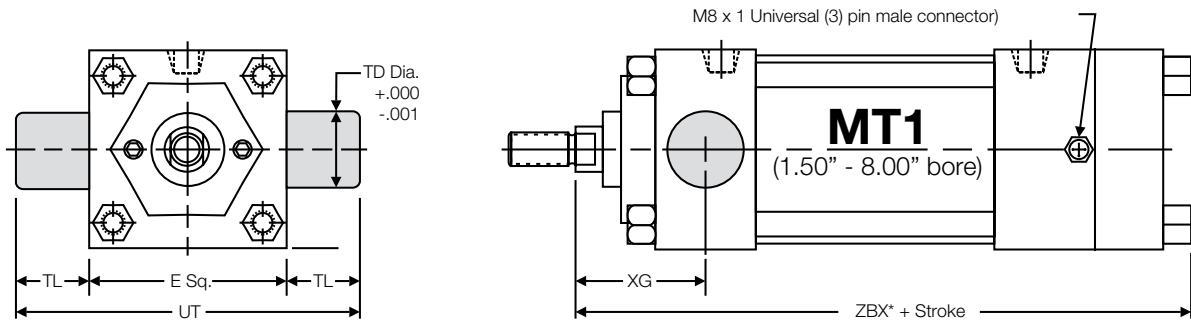
## Position Feedback Low Friction Cylinder – Dimensions



**'MP2' & 'MP4' Cast PFLF Cylinder Dimensions - Standard Rod Only**

Bore	Rod Diameter	CB	CD	CW	L	M	FL	Add Stroke
								XDX*
1.50	0.625 Standard	0.750	0.500	0.500	0.750	0.625	1.125	6.250
2.00	0.625 Standard	0.750	0.500	0.500	0.750	0.625	1.125	6.250
2.50	0.625 Standard	0.750	0.500	0.500	0.750	0.625	1.125	6.375
3.25	1.000 Standard	1.250	0.750	0.625	1.250	0.875	1.875	8.000
4.00	1.000 Standard	1.250	0.750	0.625	1.250	0.875	1.875	8.000
5.00	1.000 Standard	1.250	0.750	0.625	1.250	0.875	1.875	8.250
6.00	1.375 Standard	1.500	1.000	0.750	1.500	1.000	2.250	9.375

Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.  
 MP4 cast mount not available for 5.00" & 6.00" bores.  
 Special welded mounts are available. Consult factory for more information.  
 \* Non-NFPA dimensions

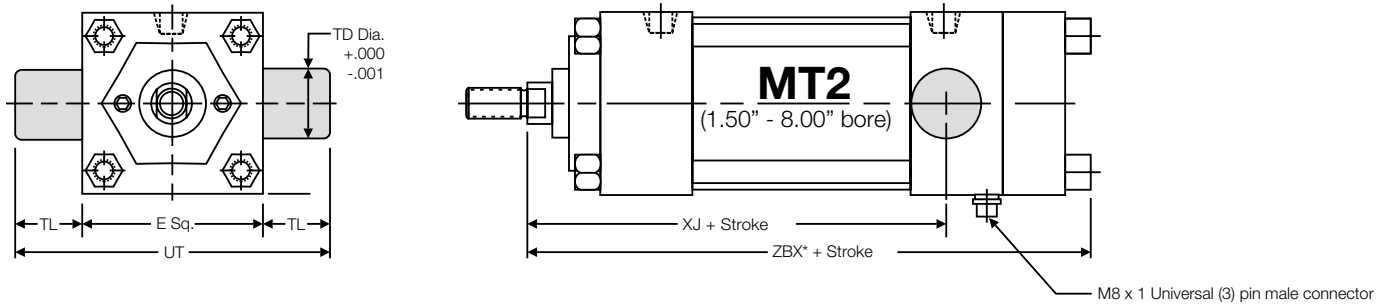


**'MT1' PFLF Cylinder Dimensions - Standard Rod Only**

Bore	Rod Diameter	E	TD	TL	UT	XG	Add Stroke
							ZBX*
1.50	0.625 Standard	2.000	1.000	1.000	4.000	1.750	6.375
2.00	0.625 Standard	2.500	1.000	1.000	4.500	1.750	6.438
2.50	0.625 Standard	3.000	1.000	1.000	5.000	1.750	6.563
3.25	1.000 Standard	3.750	1.000	1.000	5.750	2.250	7.750
4.00	1.000 Standard	4.500	1.000	1.000	6.500	2.250	7.750
5.00	1.000 Standard	5.500	1.000	1.000	7.500	2.250	8.125
6.00	1.375 Standard	6.500	1.375	1.375	9.250	2.625	9.125
8.00	1.375 Standard	8.500	1.375	1.375	11.250	2.625	9.375

Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.  
 \* Non-NFPA Dimensions

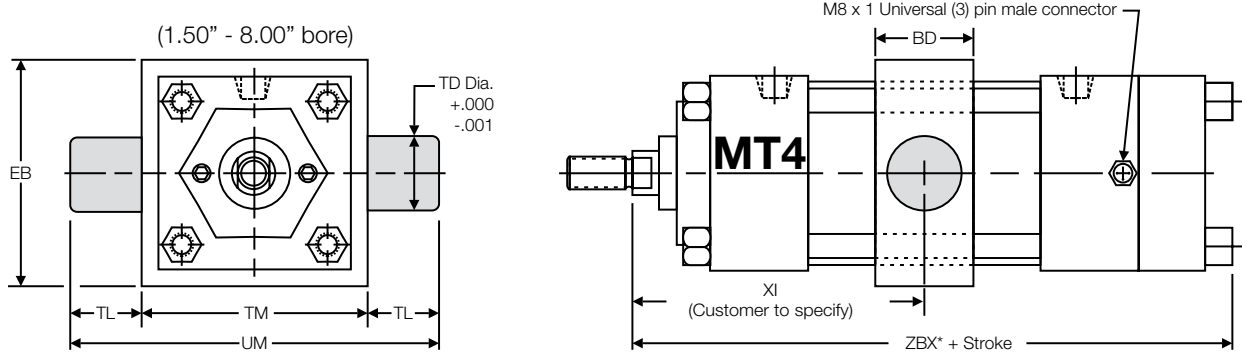
## Position Feedback Low Friction Cylinder – Dimensions



**'MT2' PFLF Cylinder Dimensions - Standard Rod Only**

Bore	Rod Diameter	E	TD	TL	UT	XJ	Add Stroke ZBX*
1.50	0.625 Standard	2.000	1.000	1.000	4.000	4.125	6.375
2.00	0.625 Standard	2.500	1.000	1.000	4.500	4.125	6.438
2.50	0.625 Standard	3.000	1.000	1.000	5.000	4.250	6.563
3.25	1.000 Standard	3.750	1.000	1.000	5.750	5.000	7.750
4.00	1.000 Standard	4.500	1.000	1.000	6.500	5.000	7.750
5.00	1.000 Standard	5.500	1.000	1.000	7.500	5.250	8.125
6.00	1.375 Standard	6.500	1.375	1.375	9.250	5.875	9.125
8.00	1.375 Standard	8.500	1.375	1.375	11.250	6.000	9.375

Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.  
\* Non-NFPA Dimensions



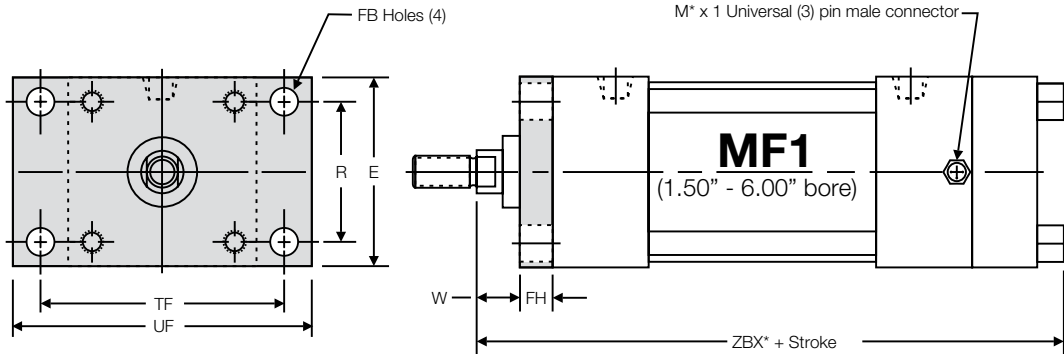
**'MT4' PFLF Cylinder Dimensions - Standard Rod Only**

Bore	Rod Diameter	BD	EB	TD	TL	TM	UM	XI	Add Stroke ZBX*
1.50	0.625 Standard	1.250	2.500	1.000	1.000	2.500	4.500	CUSTOMER TO SPECIFY	6.375
2.00	0.625 Standard	1.500	3.000	1.000	1.000	3.000	5.000		6.438
2.50	0.625 Standard	1.500	3.500	1.000	1.000	3.500	5.500		6.563
3.25	1.000 Standard	2.000	4.250	1.000	1.000	4.500	6.500		7.750
4.00	1.000 Standard	2.000	5.000	1.000	1.000	5.250	7.250		7.750
5.00	1.000 Standard	2.000	6.000	1.000	1.000	6.250	8.250		8.125
6.00	1.375 Standard	2.000	7.000	1.375	1.375	7.625	10.375		9.125
8.00	1.375 Standard	2.500	9.500	1.375	1.375	9.750	12.500		9.375

Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.  
\* Non-NFPA Dimensions

# How to Specify

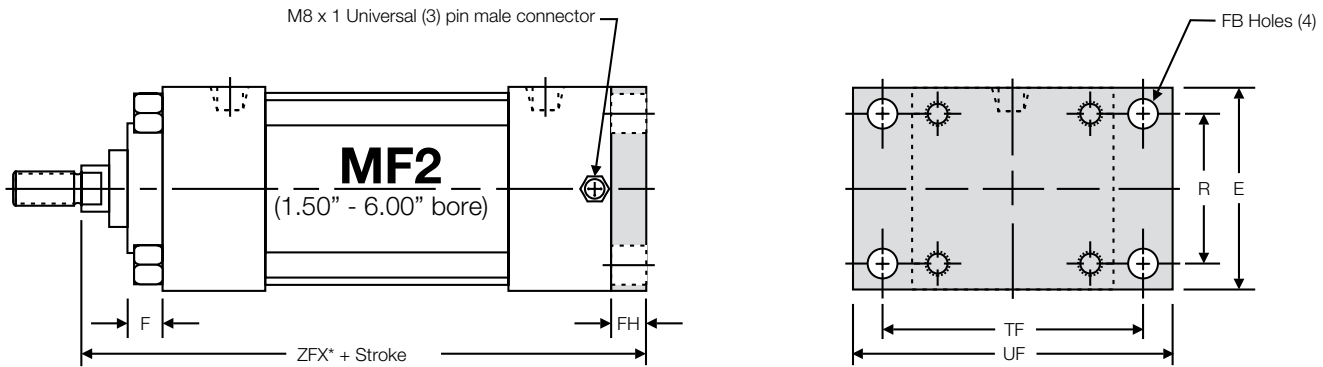
## Position Feedback Low Friction Cylinder – Dimensions



**'MF1' PFLF Cylinder Dimensions - Standard Rod Only**

Bore	Rod Diameter	E	FB	FH	R	TF	UF	W	Add Stroke
									ZBX*
1.50	0.625 Standard	2.000	0.313	0.375	1.430	2.750	3.375	0.625	6.375
2.00	0.625 Standard	2.500	0.375	0.375	1.840	3.375	4.125	0.625	6.438
2.50	0.625 Standard	3.000	0.375	0.375	2.190	3.875	4.625	0.625	6.563
3.25	1.000 Standard	3.750	0.438	0.625	2.760	4.688	5.500	0.750	7.750
4.00	1.000 Standard	4.500	0.438	0.625	3.320	5.438	6.250	0.750	7.750
5.00	1.000 Standard	5.500	0.563	0.625	4.100	6.625	7.625	0.750	8.125
6.00	1.375 Standard	6.500	0.563	0.750	4.880	7.625	8.625	0.875	9.125

Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.  
\* Non-NFPA Dimensions

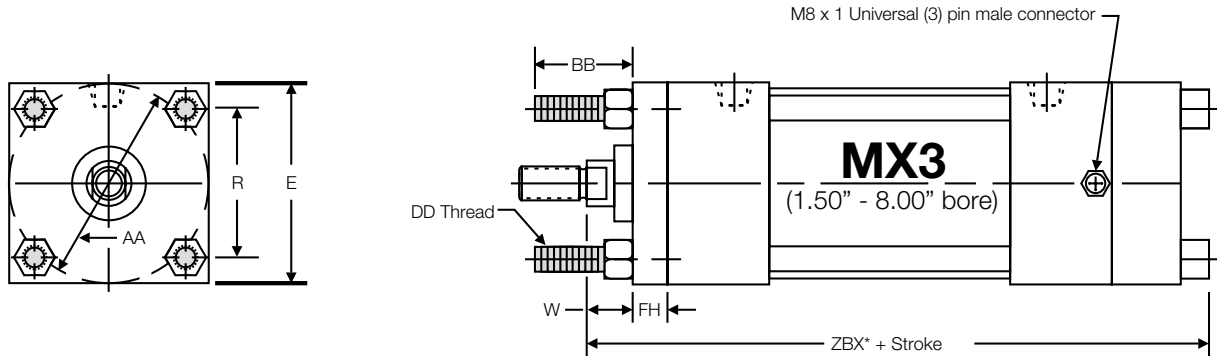


**'MF2' PFLF Cylinder Dimensions - Standard Rod Only**

Bore	Rod Diameter	E	FB	FH	R	TF	UF	F	Add Stroke
									ZFX*
1.50	0.625 Standard	2.000	0.313	0.375	1.430	2.750	3.375	0.375	5.500
2.00	0.625 Standard	2.500	0.375	0.375	1.840	3.375	4.125	0.375	5.500
2.50	0.625 Standard	3.000	0.375	0.375	2.190	3.875	4.625	0.375	5.625
3.25	1.000 Standard	3.750	0.438	0.625	2.760	4.688	5.500	0.625	6.750
4.00	1.000 Standard	4.500	0.438	0.625	3.320	5.438	6.250	0.625	6.750
5.00	1.000 Standard	5.500	0.563	0.625	4.100	6.625	7.625	0.625	7.000
6.00	1.375 Standard	6.500	0.563	0.750	4.880	7.625	8.625	0.625	7.875

Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.  
\* Non-NFPA Dimensions

## Position Feedback Low Friction Cylinder – Dimensions



**'MX3' PFLF Cylinder Dimensions - Standard Rod Only**

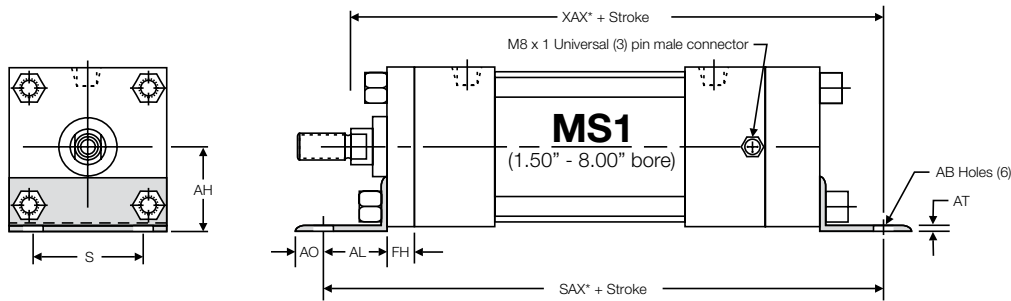
Bore	Rod Diameter	E	FH	R	AA	BB	DD	W	Add Stroke	
									ZBX*	
1.50	0.625 Standard	2.000	0.375	1.430	2.020	1.000	1/4-28	0.625	6.375	
2.00	0.625 Standard	2.500	0.375	1.840	2.600	1.125	5/16-24	0.625	6.438	
2.50	0.625 Standard	3.000	0.375	2.190	3.100	1.125	5/16-24	0.625	6.563	
3.25	1.000 Standard	3.750	0.625	2.760	3.900	1.375	3/8-24	0.750	7.750	
4.00	1.000 Standard	4.500	0.625	3.320	4.700	1.375	3/8-24	0.750	7.750	
5.00	1.000 Standard	5.500	0.625	4.100	5.800	1.813	1/2-20	0.750	8.125	
6.00	1.375 Standard	6.500	0.750	4.880	6.900	1.813	1/2-20	0.875	9.125	
8.00	1.375 Standard	8.500	0.625**	6.440	9.100	2.313**	5/8-18	1.625	9.375	

Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.

\* Non-NFPA Dimensions

\*\* 8.00" Bore has round retainer, not a full square retainer as smaller bores.

"BB" dimension is from head.



**'MS1' PFLF Cylinder Dimensions - Standard Rod Only**

Bore	Rod Diameter	AB	AH	AL	AO	AT	FH	S	Add Stroke	
									SAX*	XAX*
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.125	0.375	1.250	7.500	7.125
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.125	0.375	1.750	7.500	7.125
2.50	0.625 Standard	0.438	1.625	1.000	0.375	0.125	0.375	2.250	7.625	7.250
3.25	1.000 Standard	0.563	1.938	1.250	0.500	0.125	0.625	2.750	9.125	8.625
4.00	1.000 Standard	0.563	2.250	1.250	0.500	0.125	0.625	3.500	9.125	8.625
5.00	1.000 Standard	0.688	2.750	1.375	0.625	0.188	0.625	4.250	9.625	9.000
6.00	1.375 Standard	0.813	3.250	1.375	0.625	0.188	0.750	5.250	10.500	10.000
8.00	1.375 Standard	0.813	4.250	1.813	0.688	0.250	0.625**	7.125	10.750	10.563

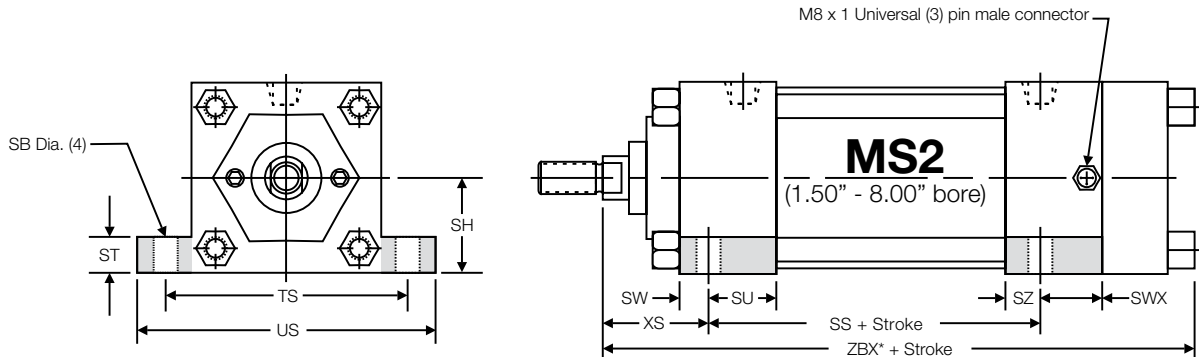
Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.

\*\* 8.00" bore cylinders have round retainer, bracket bolted to head.

\* Non-NFPA Dimensions

# How to Specify

## Position Feedback Low Friction Cylinder – Dimensions

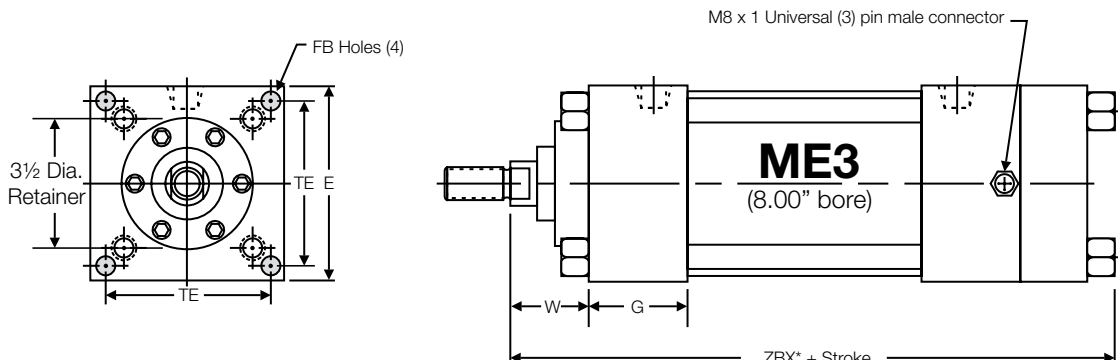


**'MS2' PFLF Cylinder Dimensions - Standard Rod Only**

Bore	Rod Diameter	SB	SH	ST	SU	SW	SZ	TS	US	XS	SWX*	Add Stroke	
												SS	ZBX*
1.50	0.625 Standard	0.438	1.000	0.500	1.125	0.375	0.625	2.750	3.500	1.375	0.875	2.875	6.375
2.00	0.625 Standard	0.438	1.250	0.500	1.125	0.375	0.625	3.250	4.000	1.375	0.875	2.875	6.438
2.50	0.625 Standard	0.438	1.500	0.500	1.125	0.375	0.625	3.750	4.500	1.375	0.875	3.000	6.563
3.25	1.000 Standard	0.563	1.875	0.750	1.250	0.500	0.750	4.750	5.750	1.875	1.000	3.250	7.750
4.00	1.000 Standard	0.563	2.250	0.750	1.250	0.500	0.750	5.500	6.500	1.875	1.000	3.250	7.750
5.00	1.000 Standard	0.813	2.750	1.000	1.063	0.688	0.563	6.875	8.250	2.063	1.188	3.125	8.125
6.00	1.375 Standard	0.813	3.250	1.000	1.313	0.688	0.813	7.875	9.250	2.313	1.188	3.625	9.125
8.00	1.375 Standard	0.813	4.250	1.000	1.313	0.688	0.813	9.875	11.250	2.313	1.188	3.750	9.375

Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.

\* Non-NFPA dimensions



**'ME3' PFLF Cylinder Dimensions - Standard Rod Only**

Bore	Rod Diameter	E	TE	W	G	FB	Add Stroke
							ZBX*
8.00	1.375 Standard	8.500	7.570	1.625	2.000	0.688	9.375

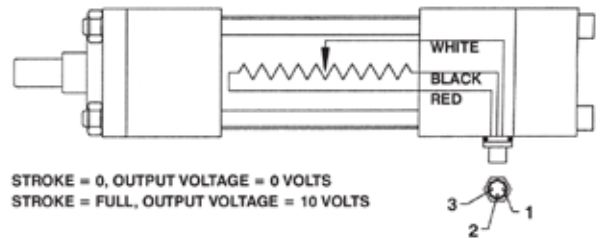
Note: All cylinder dimensions not shown are standard 'MX0' cylinder dimensions.

\* Non-NFPA dimensions



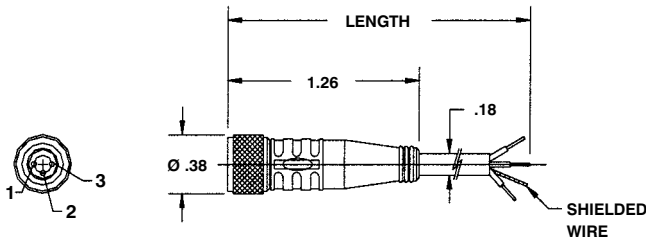
## Position Feedback Low Friction Cylinder – Specifications

<b>Repeatability:</b>	±.001" Cylinder Only Refer to specifications in the following sections for positioning or measuring repeatability. Power supply ripple and A/D error will reduce repeatability when PFLF is utilized with industrial control systems.
<b>Nonlinearity:</b>	± 1% of full stroke
<b>Resolution:</b>	Infinite
<b>Signal Input:</b>	10 VDC typical
<b>Input Impedance Required:</b>	1 MOhm
<b>Signal Output:</b>	> 0 to slightly less than FS signal input (The internal electrical stroke is slightly larger than the mechanical stroke of the cylinder)
<b>Rated Life of Probe:</b>	up to 10 million cycles
<b>Rated Life of Wiper:</b>	up to 1000 linear miles
<b>Pressure Rating:</b>	150 PSI
<b>Temperature Rating (Cylinder &amp; Probe):</b>	0° to 200°F
<b>Maximum Speed:</b>	25 in/sec
<b>Interface:</b>	8mm DIN connector
<b>NEMA:</b>	6 (IP67)
<b>Resistance Rating:</b>	1kΩ resistance/inch



Wire Description	Probe/Plug Wire Colors	Plug Pin Numbers	Quick Connect Cable/ Wire Colors
Input (+)	Red	3	Blue
Ground (-)	Black	2	Black
Output	White	1	Brown

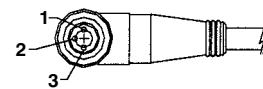
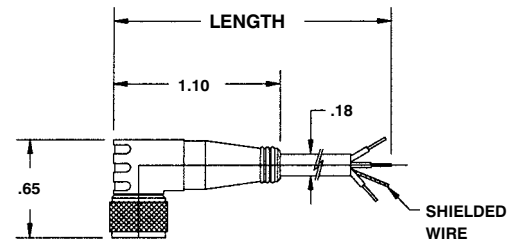
### Straight-Models C4-S-T (2m), C4X-S-T (5m)



#### CONDUCTOR COLORS:

- 1 - BROWN
- 2 - BLACK
- 3 - BLUE

### Right Angle-Models C5-S-T (2m), C5X-S-T (5m)



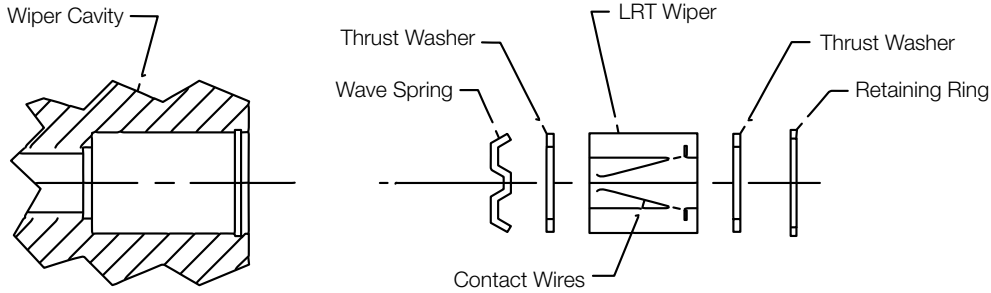
Cable: 24 AWG. PVC insulated, fine stranded copper conductors, with Gray PVC jacket with stripped and tinned ends

Note: All models have a M8 x 1 female thread.

# How to Repair

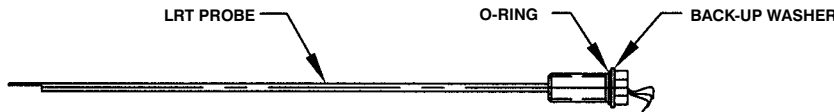
## Position Feedback Low Friction Cylinder – Components/Repair Kits

### LRT Wiper Replacement Kit



Part Number	Description	Remarks
PFLF-Wk2	Position Feedback Wiper Kit	Kit To Consist Of The Following: (1) Wave Spring, (1) LTR Wiper, (1) Guide Washer, (1) Retaining Ring, (3) Wire Connectors & Wiper/Probe Installation Instruction Sheet

### LRT Probe Replacement Kit

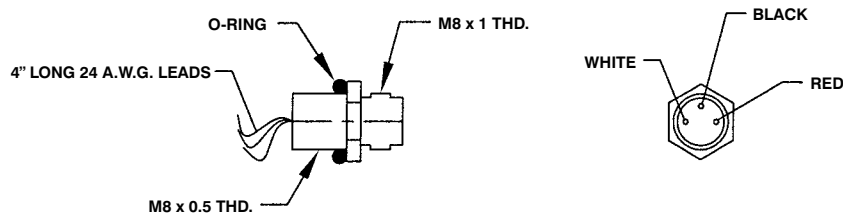


**PROBE WIRE COLORS:**  
**RED = SUPPLY (+)**  
**BLACK = GROUND (-)**  
**WHITE = OUTPUT**

Part Number	Description	Remarks
PFLF-PRK-Stroke	Position Feedback Probe Replacement Kit	Kit To Consist Of The Following: One (1) LRT Probe With O-Ring & Back-Up Washer, Three (3) Wire Connectors & Wiper/Probe Installation Instruction Sheet

Replacement LRT probe ordering example: 8.00" stroke PFLF cylinder, replacement probe would be PART NO. PFLF-PRK-8.  
 Fractional stroke length cylinders use the next whole number. Example: 8.50" stroke replacement probe would be PFLF-PRK-9.

### (3) Pin Connector Replacement Kit



Part Number	Description	Remarks
PFLF-CK	Position Feedback Connector Kit	Kit To Consist Of The Following: One (1) 3 Pin Connector With O-Ring & Three (3) Wire Connectors

### PFLF Basic Cylinder Seal Kits

Bore	Part Number	Bore	Part Number	Bore	Part Number	Bore	Part Number
1.50	PFLFSK625-150	2.50	PFLFSK625-250	4.00	PFLFSK100-400	6.00	PFLFSK137-600
2.00	PFLFSK625-200	3.25	PFLFSK100-325	5.00	PFLFSK100-500	8.00	PFLFSK137-800

Replacement PFLF cylinder seal kit to consist of the following: two low friction piston seals, two tube end seals, one rod seal, one bushing o-ring and one container of low friction grease.  
 Note: basic seal kit DOES NOT include wiper, probe or connector kits

## SPCS-2 Servo Pneumatic Control System

The SPCS-2 provides a robust solution to accurate continuous closed loop pneumatic positioning. Easily installed and configured, this servo pneumatic control provides positioning accuracy with loads over 1,000 pounds and average velocity as high as 20 inches per second. Use the SPCS-2 with any TRD position feedback actuators (PFLF or a cylinder fitted with Balluff Transducers) bore sizes 1.50" - 12.00" to create a solution to your motion control application.

The SPCS-2 is typically utilized when the application requires product flexibility by providing on the fly adjustments. Manufacturing application examples: to adjust a machine's tooling, positioning gates, to position a product for further processing or to inspect its size to confirm it is within the required specification. Pneumatic control systems can achieve higher load carrying and speed capabilities than electric actuators. The SPCS-2 is a flexible, low cost motion control system that can be used on a variety of pneumatic actuator bore sizes.



### How to Order

Part Number	Description
SPCS-2	Servo Pneumatic Control System
SPCS-CBL-PWR-CMD	2 meter female connector, both ends
SPCS-CBL-FBK	2 meter female/strip wire

Horizontal Application - Average Velocity				
Bore	At Maximum Payload (in/sec)*	Maximum Payload (lbs)	At 50% Maximum Payload (in/sec)	At 25% Maximum Payload (in/sec)
1.50	10	100	20	30
2.00	15	200	20	30
2.50	15	315	25	30
3.25	15	450	20	20
4.00	8.5	300	9	10
5.00	4.5	400	5.5	7
6.00	4.5	800	4.5	5
8.00	2.5	1000+	2.5	2.75
10.00	1.75	1000+	1.75	1.75
12.00	1.0	1000+	1.0	1.0

Vertical Application - Average Velocity				
Bore	At Maximum Payload (in/sec)*	Maximum Payload (lbs)	At 50% Maximum Payload (in/sec)	At 25% Maximum Payload (in/sec)
1.50	70	10	60	60
2.00	50	30	40	60
2.50	15	95	30	30
3.25	20	135	20	20
4.00	8	200	10	11
5.00	4	300	5	7
6.00	3.25	800	4	4.5
8.00	2	1000	2.5	2.5
10.00	2	1000+	2.0	2.0
12.00	1.25	1000+	1.0	1.0

\*Average velocity at Max. Payload without overshoot  
 Bores 1.50" - 3.25" use low friction seals without rod wiper  
 Bores 4.00" - 12.00" use standard seals with rod wiper

Low friction seals greatly enhance performance on smaller bores. Using standard seals will decrease max payload and velocity.

Note: if velocity is decreased, payloads can be increased and if payloads are decreased, velocity can be increased.

# How to Specify

## Position Feedback Low Friction Cylinder – Dimensions

### SPCS-2 Compared to PCS

SPCS-2 vs PCS	
SPCS-2	PCS
Can move 450 lbs with a 3.25" bore cylinder at 20 in/sec (no overshoot)	Can move 200 lbs with a 3.25" bore cylinder at 2 in/sec.
Operating pressure range from 0 to 150	Operating pressure range from 70 to 80 PSI
PFLF, MTS, and Balluff Compatible	Accuracy $\pm$ 1% of full actuator stroke
Bore sizes 1.50" to 12.00"	PFLF and Balluff Compatible
	Bore sizes 1.50" to 4.00"

SPCS will accept 0-10V or 4-20mA feedback signal (programmable).

Bore	SPCS-2		PCS	
	Maximum Payload (lbs)	Average Velocity (in/sec)*	Maximum Payload (lbs)	Average Velocity (in/sec)*
1.50	100	10	50	5.5
2.00	200	15	90	6.5
2.50	315	15	120	2
3.25	400	15	200	2
4.00	400	8.5	360	2
5.00	400	4.5		
6.00	800	4.5		
8.00	1000+	2.5		
10.00	1000+	1.75		
12.00	1000+	1.0		

\*Average velocity without overshoot.

Fail Safe Question: Can the valve be set to extend the cylinder in the event of a power loss?

Answer: Default position adjustment.

- > 1. Remove the side plate.
- > 2. When no power is applied to the valve, the default position is neutral and it will float in the last commanded position.
  - » a. To set the default position to an extended rod, turn the setscrew counterclockwise 1/4 or more turns.
  - » b. To set the default position to a retracted rod, turn the setscrew clockwise 1/4 or more turns.

Additional info: When changing default position, cylinder will begin to move after 1/4 turn of the setscrew. Turning the setscrew about 3/4 turn will reach maximum velocity. Maximum velocity with no power will generally be less than five inches per second.

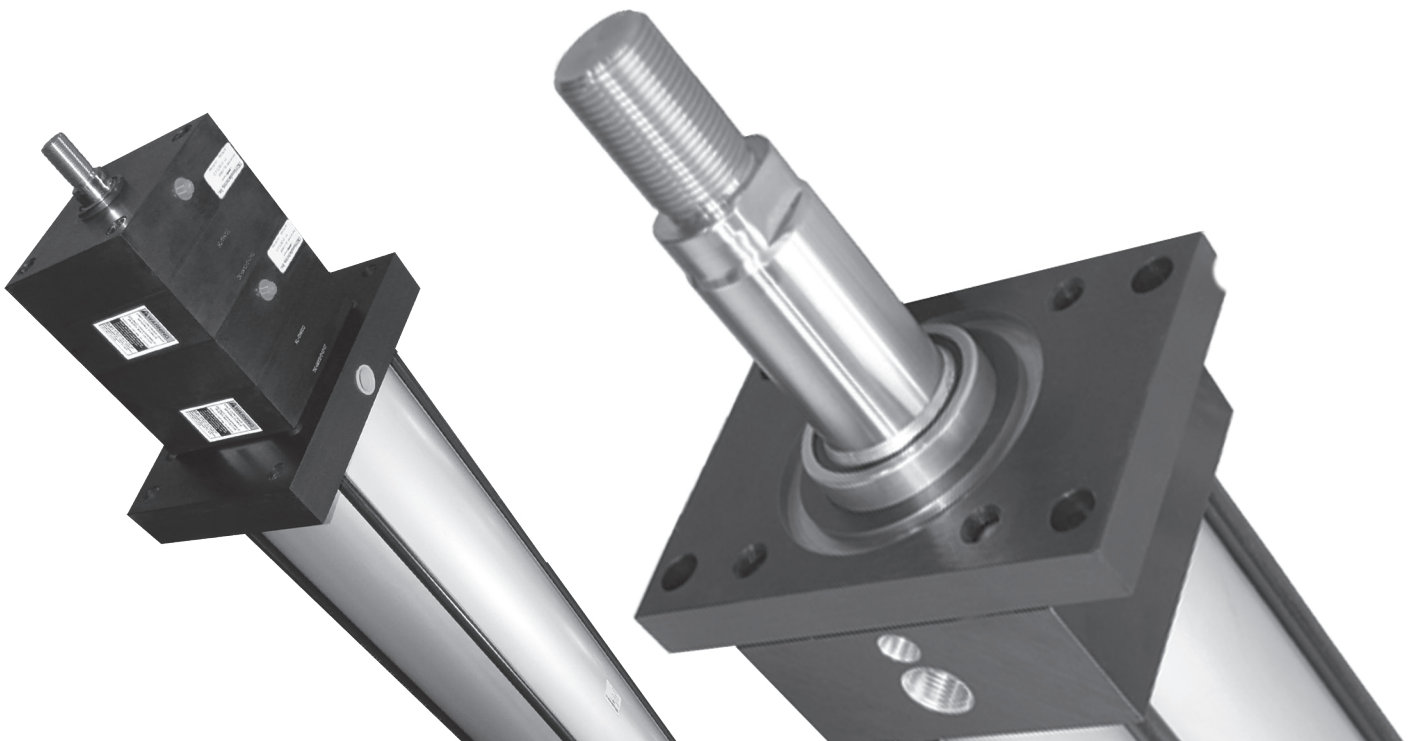
Note: As system pressure bleeds, any retracting force applied to the rod will move it.



# Technical Data

95% of our cylinders ship in 2-3 days!

One day rush service available on all cataloged cylinder models.



# Contents

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**319** How It Works

319 – Technical Data

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**321** How to Specify

321 – Force Chart

322 – Force & Torque

323 – Weight Charts

326 – Seal Kits

329 – Conversion Charts

330 – Common Fluid Power Formulas

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## Technical Data

### How to determine the right cylinder size for the job.

To determine what cylinder size the task requires, you need to answer a few questions about three main points: load, velocity and air pressure.

### How heavy (in pounds) is the load to be moved?

The answer to this is usually given, set by the machine design. However, unless you are lifting a load vertically, with no external friction, it can be difficult to determine the true load. If the load cannot be calculated, try to physically measure the load. The closer the true load is known, the better the results. In order to move the load, you need to choose a cylinder that provides force greater than the load. So, if the load is 100 lbs, it will take of force greater than 100 lbs to move it. In fact, it's a good idea to allow an additional factor of 25% force to allow for friction.

### What's the required velocity?

Although velocity may also be set by machine design, often you have some latitude within a range. Whenever possible, for best results, we recommend using moderate speed because the greater the velocity required, the greater the additional force needed to achieve it. Slow speeds (up to four in/sec) require 25% more force than the load, moderate speeds (four to 16 in/sec) about 50% more and high speeds (greater than 16 in/sec) about 100% more force. Therefore, for a 100 lbs load, you need 125 lbs of force to move it slowly, 150 lbs of force to move it at moderate speeds and 200 lbs. of force to move it quickly. Don't forget to add 25 lbs. (25% of 100 lb.) for friction!

### What's the minimum effective air pressure you can use and is your pressure source constant?

This is important because high pressures can accelerate seal wear and create stress on the cylinder and inconsistent pressures can cause system malfunctions or failures. To maximize cylinder life and performance, you need to provide consistent airflow at the minimum effective pressure to maintain the desired velocity. The idea then, is for the cylinder to be able to move the maximum load, at the minimum acceptable velocity and at the minimum available pressure.

### About bore sizes.

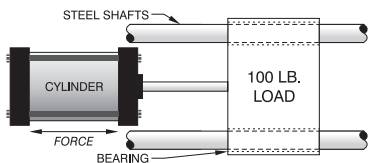
Once you've determined the force you need to move the load at the desired velocity and allow for friction, here's how to find the cylinder bore that meets your specifications.

The force generated by a cylinder is determined by the effective piston area times the air pressure. The force chart on page 280 lists the effective piston area for each bore size, the "Push" (extend) and "Pull" (retract) stroke, at various air pressures. If you assume a maximum load of 100 lbs, a minimum velocity of four in/sec, and a minimum pressure of 60 psi, here's how to select the right cylinder bore. Since the velocity is slow, the force should be 25% greater than the load or 125 lbs. After adding 25 lbs for friction (25% of 100 lbs), the total force needed is 150 lbs. The chart on page 280 shows that at 60 PSI, the 2" bore with .625" rod extend force is 188 lbs and retract force is 170 lbs; the right cylinder for the application.

## Horizontal Applications

Cylinder force is reduced by the coefficient of friction between the bearing surface and guide shafts. Bearing materials and bearing types (plain or ball) all perform differently. With hardened steel shafts, the following information lists how much cylinder force is required to move a 100 lb. load, on various bearing materials (for reference purposes only).

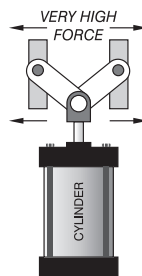
Plain Bearing Material	Cylinder Force	
	Dry Bearing	Oiled Bearing
PTFE	10 lbs.	10 lbs.
UHMW	20 lbs.	20 lbs.
Hardened Steel	25 lbs.	20 lbs.
Brass	40 lbs.	25 lbs.
Cast Iron	45 lbs.	25 lbs.
Steel (soft)	85 lbs.	25 lbs.
Ball Bearing	5-10 lb. Cylinder Force	



## General Mechanics

### Toggle

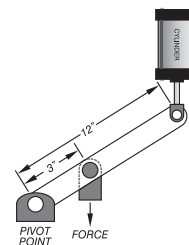
Toggles are complex mechanisms that can achieve very high force.



### Force Multiplying Lever

Force Multiplying Levers reduce the cylinder output stroke, while increasing the output force.

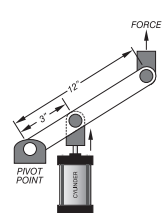
4:1 Force Multiplier (400%)



### Force Reducing Lever

Force Reducing Levers increase the cylinder output stroke but reduce the output force.

1:4 Force Reduction (25%)

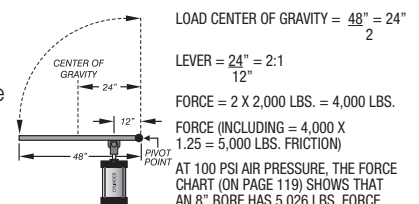


### Example

A 2000 lb. steel plate needs to be raised from horizontal, 90° vertical. The highest force required will be at the horizontal position. As the plate nears the vertical position, less force will be required.

The example assumes that the weight (load) is evenly distributed over the plate length. For uneven loads, estimate the center of gravity of the load.

Additional force must be added for friction.



## Technical Data

### How the right mounting and careful installation helps prevent premature cylinder wear.

Choosing the right style of mounting for your cylinder's size, force and function has a direct effect on its service life. The wrong mounting or incorrect installation, can result in side load, which creates excessive wear on the piston, piston rod, rod bearing and seals. When wear occurs, leakage usually follows and that's how cylinders fail.

Side load occurs when a load is placed on the piston rod without guidance or support, or when the mounting and piston rod connection are misaligned. It can also occur in pivot type mounts when the weight of the cylinder places load on the piston and rod bearing points.

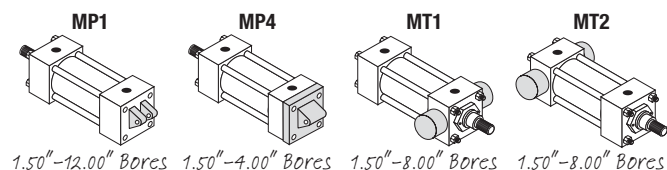
There are cylinder mounts and options to suit virtually every application.

### Pivot Type Mountings: Clevis & Trunnion

Pivot type of mounts can eliminate side load in one plane, but careful alignment in the other plane is crucial. Since TRD uses a floating rod bushing design, side loading caused by misalignment is minimized but not totally eliminated.

Long stroke pivot mount cylinders will have high side loads just because of the weight of the cylinder components. In these applications, a stop tube is usually essential for proper cylinder operation (see pages 201-202 to determine if a stop tube is needed).

### Samples of Pivot Mounts:

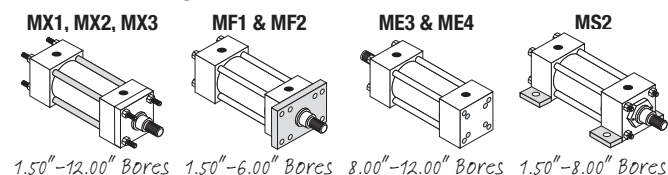


### Rigid Mount Cylinders

Base mounted, flange mounted and tie-rod mounted cylinders must be carefully aligned with the direction of load travel to avoid side loads.

If for some reason, proper alignment cannot be maintained throughout the entire cylinder stroke, a rod end connection that allows for some lateral misalignment should be used. TRD offers a full line of Rod Alignment Couplers to solve misalignment issues (refer to page 235). Keep in mind, the rod alignment couplers do not provide any rod end support. Always check to see if your application requires a stop tube.

### Samples of Rigid Mounts:



### Choose options that enhance and extend the working life of your cylinders.

**Cushions** can be designed into either one or both ends of the cylinder to provide controlled deceleration. This option prevents excessive end-of-stroke impact, reducing vibration and noise. Cushions are designed to stop light loads at moderate speeds. Heavy loads or higher speed applications may require shock absorbers. Your local distributor representative is qualified to provide expert advise on what options are best suited for your application.

**Bumper Piston Seals.** Whether used by themselves or with cushions, bumper piston seals provide additional controlled deceleration at end of stroke.

**Fluorocarbon Seals** are usually associated with higher temperature applications, fluorocarbon can provide additional chemical resistance. Consult factory for additional information.

**"SSP" Solid Stainless Steel Piston** with wear band. When cylinder bores are used to measure or dispense food products, it is essential to eliminate non-FDA approved materials from the cylinder internal construction. Specify "FDA approved materials only" (L005) at time of order.

**L005 (FDA) Lubricant** is typically used with stainless steel cylinders for food dispensing applications. Can also be specified when there is concern for possible contamination from petroleum based, air-borne particles associated with the normal cylinder operation.

**Switches.** Position sensing switches give you the potential for expanding the capabilities of your cylinder functions to include accurate piston sensing, event timing, sequencing and more. Magnetically operated, the switches are mounted to the exterior of the cylinder where they are actuated by a magnet contained on the piston.



## Force Chart

### Basic Cylinder Force Chart\* (TA, TD, FM)

Bore	Rod Diameter	Stroke Type	Effective Piston Area	Pounds of Force at PSI						Cu. Ft. Displacement Per In. Of Stroke
				60	80	100	200	250	400	
1.50	All	Push	1.767	106	142	177	353	442	706	.00102
	0.625	Pull	1.460	88	117	146	292	365	584	.00084
	1.000	Pull	0.982	59	79	98	196	246	392	.00057
2.00	All	Push	3.142	188	251	314	628	785	1256	.00182
	0.625	Pull	2.835	170	227	284	567	708	1134	.00164
	1.000	Pull	2.357	141	189	236	471	589	942	.00136
2.50	All	Push	4.909	295	393	491	981	1227	1962	.00284
	0.625	Pull	4.602	276	368	460	920	1150	1840	.00266
	1.000	Pull	4.124	247	330	412	825	1031	1650	.00239
3.25	All	Push	8.296	498	664	830	1659	2074	3318	.00480
	1.000	Pull	7.511	451	601	751	1502	1877	3004	.00435
	1.375	Pull	6.811	409	545	681	1362	1702	2724	.00394
4.00	All	Push	12.566	754	1005	1257	2513	3141	5026	.00727
	1.000	Pull	11.781	707	942	1178	2356	2945	4712	.00682
	1.375	Pull	11.081	665	886	1108	2216	2770	4432	.00641
5.00	All	Push	19.635	1178	1571	1964	3927	4908	7854	.01136
	1.000	Pull	18.850	1131	1508	1885	3770	4712	7540	.01090
	1.375	Pull	18.150	1089	1452	1815	3630	4537	7260	.01050
6.00	All	Push	28.274	1696	2262	2827	5655	7068	11310	.01636
	1.375	Pull	26.789	1607	2144	2679	5358	6697	10716	.01550
	1.750	Pull	25.869	1552	2070	2587	5174	6467	10348	.01497
8.00	All	Push	50.265	3016	4021	5026	10053	12566	20106	.02908
	1.375	Pull	48.780	2927	3902	4878	9756	12195	19512	.02832
	1.750	Pull	47.860	2872	3829	4786	9572	11965	19144	.02770
10.00	All	Push	78.540	4712	6283	7854	15708	19635	31416	.04545
	1.750	Pull	76.130	4568	6090	7613	15226	19032	30452	.04406
	2.000	Pull	75.400	4524	6032	7540	15080	18850	30160	.04363
12.00	All	Push	113.098	6786	9048	11310	22620	28275	45239	.06545
	2.000	Pull	109.956	6597	8796	10996	21992	27489	43982	.06363
	2.500	Pull	108.189	6491	8655	10819	21638	27047	43276	.06261

\*Theoretical force. Actual force will be reduced by friction.

### 'NR' Non-Rotating Cylinder Force Chart\*

Bore	Rod Diameter	Guide Rods Diameter	Stroke Type	Effective Piston Area	Pounds of Force at PSI						Cu. Ft. Displacement Per In. Of Stroke
					60	80	100	200	250	400	
2.00	All	0.250	Push	3.044	182	243	304	609	761	1217	.00176
	0.625		Pull	2.737	164	218	273	547	684	1094	.00158
	All		Push	4.755	285	380	475	951	1188	1902	.00275
2.50	0.625	0.313	Pull	4.448	266	355	444	889	1112	1779	.00257
	1.000		Pull	3.970	238	317	397	794	992	1588	.00229
	All		Push	8.076	484	646	807	1613	2016	3226	.00466
3.25	1.000	0.375	Pull	7.291	437	583	729	1458	1822	2916	.00422
	1.375		Pull	6.591	395	527	659	1318	1647	2636	.00381
	All		Push	11.952	717	956	1195	2390	2988	4780	.00692
4.00	1.000	0.625	Pull	11.167	670	893	1116	2233	2791	4466	.00646
	1.375		Pull	11.467	628	837	1046	2093	2616	4186	.00606
	All		Push	19.021	1141	1521	1902	3804	4755	7608	.01100
5.00	1.000	0.625	Pull	18.236	1094	1458	1823	3647	4559	7294	.01050
	1.375		Pull	17.536	1052	1402	1753	3507	4384	7014	.01010
	All		Push	27.660	1659	2212	2766	5532	6915	11064	.01600
6.00	1.375	0.625	Pull	26.175	1570	2094	2617	5235	6543	10470	.01510
	1.750		Pull	25.255	1515	2020	2525	5051	6313	10102	.01460
	All		Push	48.694	2921	3895	4869	9738	12173	19477	.02810
8.00	1.375	1.000	Pull	47.209	2832	3776	4720	9441	11802	18883	.02730
	1.750		Pull	46.289	2777	3703	4628	9257	11572	18515	.02670
	All		Push	76.969	4618	6157	7696	15393	19242	30787	.04450
10.00	1.750	1.000	Pull	74.564	4473	5965	7456	14912	18641	29825	.04310
	2.000		Pull	73.829	4429	5906	7382	14765	18457	29531	.04270
	All		Push	111.527	6691	8922	11152	22305	27881	44610	.06450
12.00	2.000	1.000	Pull	108.385	6503	8670	10838	21677	27096	43354	.06270
	2.500		Pull	106.618	6397	8529	10661	21323	26654	42647	.06170

Note: Use the pull force/volume numbers for both ends of a double end cylinder.  
For TRA triple rod force chart, see page 102.

\*Theoretical force. Actual force will be reduced by friction.

# How to Specify

## Force & Torque

### Series 'MS' Effective Piston Area/Force Chart\*

Bore	Stages	Effective Piston Area (Sq. In.)				Force In Lbs. at 60 PSI				Force In Lbs. at 100 PSI			
		Extend (MSE)		Retract (MSR)		Extend (MSE)		Retract (MSR)		Extend (MSE)		Retract (MSR)	
		Std. Rod Ø	O' Size Ø	Std. Rod Ø	O' Size Ø	Std. Rod Ø	O' Size Ø	Std. Rod Ø	O' Size Ø	Std. Rod Ø	O' Size Ø	Std. Rod Ø	O' Size Ø
1.50	2	3.228	2.749	2.922	1.964	193	164	175	117	322	274	292	196
	3	4.687	3.731	4.383	2.946	281	223	262	176	468	373	438	294
	4	6.150	4.713	5.844	3.928	369	282	350	235	615	471	584	392
	5	7.607	5.695	N/A	N/A	456	342	N/A	N/A	761	570	N/A	N/A
2.00	2	5.974	5.499	5.668	4.714	358	329	340	282	597	549	566	471
	3	8.808	7.856	8.502	7.071	528	471	510	424	880	785	850	707
	4	11.642	10.213	11.336	9.428	698	612	680	565	1164	1021	1133	942
	5	14.482	12.568	N/A	N/A	869	754	N/A	N/A	1448	1257	N/A	N/A
2.50	2	9.490	9.033	9.188	8.248	569	541	551	494	949	903	918	824
	3	14.080	13.157	13.782	12.372	844	789	826	742	1408	1315	1378	1237
	4	18.680	17.281	18.376	16.496	1120	1036	1102	989	1868	1728	1837	1649
	5	23.312	21.405	N/A	N/A	1398	1284	N/A	N/A	2330	2140	N/A	N/A
3.25	2	15.807	15.107	15.022	13.622	948	906	901	817	1580	1510	1502	1362
	3	23.317	21.918	22.532	20.433	1399	1315	1351	1225	2331	2191	2253	2043
	4	30.828	28.729	30.043	27.244	1849	1723	1802	1634	3082	2872	3004	2724
	5	38.340	35.540	N/A	N/A	2300	2132	N/A	N/A	3834	3554	N/A	N/A
4.00	2	24.347	23.647	23.562	22.166	1460	1418	1413	1329	2434	2364	2356	2216
	3	36.127	34.728	35.342	33.243	2167	2083	2120	1994	3612	3472	3534	3324
	4	47.908	45.809	47.123	44.324	2874	2748	2827	2659	4790	4580	4712	4432
	5	59.690	56.890	N/A	N/A	3581	3413	N/A	N/A	5969	5689	N/A	N/A
5.00	2	38.485	37.785	37.700	36.3	2309	2267	2262	2178	3848	3778	3770	3630
	3	57.334	55.935	56.549	54.45	3440	3356	3392	3267	5733	5593	5654	5445
	4	76.184	74.085	75.399	72.6	4571	4445	4523	4356	7618	7408	7539	7260
	5	95.035	92.235	N/A	N/A	5701	5534	N/A	N/A	9503	9223	N/A	N/A
6.00	2	55.065	54.143	53.582	51.736	3303	3248	3214	3104	5506	5414	5358	5136
	3	81.854	80.012	80.370	77.607	4911	4800	4822	4656	8185	8001	8037	7760
	4	108.644	105.881	107.16	103.476	6518	6352	6429	6208	10864	10588	10716	10347
	5	135.434	131.623	N/A	N/A	8125	7914	N/A	N/A	13543	13162	N/A	N/A
8.00	2	99.047	98.125	97.564	95.72	5942	5887	5853	5743	9904	9812	9756	9572
	3	147.834	145.985	146.35	143.58	8870	8759	8781	8614	14783	14598	14635	14358
	4	196.611	193.845	195.13	191.44	11796	11630	11707	11486	19661	19384	19513	19144
	5	245.398	241.587	N/A	N/A	14723	14512	N/A	N/A	24539	24158	N/A	N/A

\*Theoretical force - actual force will be reduced due to seal friction.

### Torque Charts: Cylinder Tie Rods

#### (Aluminum, Stainless Steel & Steel Tubing)

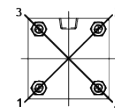
Cylinder Bore	Tie Rod Thread Size	Torque In Ft.-Lbs.
1.50	1/4-28	7
2.00	5/16-24	12
2.50	5/16-24	14
3.25	3/8-24	30
4.00	3/8-24	35
5.00	1/2-20	45
6.00	1/2-20	50
8.00	5/8-18	125
10.00	3/4-16	125
12.00	3/4-16	125

Tighten cylinders using an "X" tightening pattern on tie rods.

#### (Fiberglass Air/Oil Tank Tubing Only)

Cylinder Bore	Tie Rod Thread Size	Torque In Ft.-Lbs.
2.50	5/16-24	10
3.25	3/8-24	10
4.00	3/8-24	15
5.00	1/2-20	20
6.00	1/2-20	20
8.00	5/8-18	45
10.00	3/4-16	45

Tighten cylinders using an "X" tightening pattern on tie rods.



### Retainer Screws

Cylinder Bore	Size	Torque In Ft.-Lbs.
2.00 & 2.50	#10-32 SHCS	5
3.25 TO 10.00	1/4-28 SHCS	12
12.00	5/16-24 SHCS	20

## Weight Charts

### TA, TD, FM Basic Cylinders (With Standard Rod Size)

Weight In Pounds

Bore	Mount								Add Per Inch of Stroke
	MX0	MS1 MT1/MT2	MS4	MP1*	MP2*	MP4*	MF1/MF2 ME3/ME4	MS2	
1.50	1.6	2.0	1.6	2.1	2.2	2.2	2.2	2.5	.20
2.00	2.4	2.9	2.4	3.2	3.3	3.2	3.2	3.6	.25
2.50	3.3	3.9	3.3	4.3	4.5	4.5	4.5	4.7	.27
3.25	6.5	7.9	6.5	9.2	10.1	10.0	10.0	9.0	.51
4.00	8.8	10.5	8.8	12.1	13.3	13.2	13.2	11.1	.55
5.00	13.2	14.3	13.2	17.8	19.9	—	20.0	17.5	.59
6.00	21.5	25.2	21.5	29.7	32.2	—	32.2	27.2	.84
8.00	35.4	36.5	35.4	43.5	—	—	35.4	N/A	1.25
10.00	70.3	—	70.0	72.0	—	—	70.3	N/A	1.60
12.00	107.9	—	—	109.9	—	—	107.5	N/A	2.30

For oversize rod series, add 10%.  
\*Weight includes clevis pins.

### FM Cylinders With Rod Lock Mounted

Weight In Pounds

Bore	Rod Diameter (mm)	Mount								Add Per Inch of Stroke	Rod Lock Unit Only
		MX0	MS1 MT1/MT2	MS4	MP1*	MP2*	MP4*	MF1 MF2	MS2 Basebar		
1.50	0.625	3.3	3.7	3.3	3.8	3.9	3.9	3.9	4.2	0.20	1.23
	1.000	6.3	6.8	6.8	7.5	7.6	7.5	7.5	7.9	0.28	2.40
2.00	0.625	5.1	5.6	5.1	5.9	6.0	5.9	5.9	6.3	0.25	2.12
	1.000	7.0	7.6	7.0	8.0	8.2	8.2	8.2	8.4	0.27	3.04
2.50	0.625	7.0	7.6	7.0	8.0	8.2	8.2	8.2	8.4	0.27	3.04
	1.000	8.5	9.1	8.5	9.5	9.7	9.7	9.7	9.9	0.30	3.64
3.25	1.000	13.9	15.3	13.9	16.6	17.5	17.5	17.5	16.5	0.51	5.88
	1.375	15.4	16.8	15.4	18.1	19.0	19.0	19.0	18.0	0.56	5.81
4.00	1.000	19.6	21.3	19.6	22.9	24.1	24.0	24.0	21.9	0.55	9.28
	1.375	21.2	22.9	21.2	24.5	25.7	25.6	25.6	23.5	0.61	9.01
5.00	1.000	28.0	28.9	28.0	32.6	34.8	—	34.9	32.3	0.59	12.70
	1.375	31.2	32.1	31.2	35.8	38.0	—	38.1	35.5	0.65	13.86
6.00	1.375	45.6	49.3	45.6	53.8	56.3	—	56.3	51.3	0.84	20.83
	1.750	49.4	53.1	49.4	57.6	60.1	—	60.1	55.1	0.93	21.25

\*Weight includes clevis pins.

### PFLF Basic Cylinders

Weight In Pounds

Bore	Mount									Add Per Inch of Stroke
	MX0	MS1 MT1/MT2	MS4	MP1*	MP2*	MP4*	MF1 ME3	MF2	MS2	
1.50	2.4	2.8	2.4	2.9	2.7	2.7	3.0	2.7	3.3	.19
2.00	3.6	4.1	3.6	4.4	3.9	3.9	4.4	3.8	4.8	.24
2.50	4.9	5.5	4.9	5.9	5.2	5.2	6.1	5.2	6.3	.26
3.25	9.0	10.4	9.0	11.7	11.1	11.1	12.5	11.0	11.5	.49
4.00	12.3	14.0	12.3	15.6	14.5	14.5	16.7	14.4	14.6	.53
5.00	18.6	19.7	18.6	23.2	21.8	N/A	25.4	21.9	22.9	.57
6.00	29.7	33.4	29.7	37.9	34.6	N/A	40.4	34.6	35.4	.81
8.00	49.6	50.7	49.6	57.7	N/A	N/A	49.6	N/A	N/A	1.22

For oversize rod series add 10%.  
\*Weight includes clevis pins.

# How to Specify

## Weight Charts

### 'SS' Series Basic Cylinders

Weight In Pounds

Bore	Rod Diameter (MM)	Mount				Add per Inch of Stroke
		MX0/MS4 ME3/ME4	MF1 MF2	MT1 MT2	MP1*	
1.50	0.625	3.3	4	3.8	3.8	0.3
	1.000	4.1	4.8	4.6	4.6	0.4
2.00	0.625	5.8	7	6.4	6.4	0.5
	1.000	6.2	7.4	6.8	6.8	0.6
2.50	0.625	8	9.5	8.5	8.7	0.6
	1.000	8.5	10	9	9.2	0.7
3.25	1.000	15	18.7	15.5	16	0.8
	1.375	15.4	19.2	16	16.5	1.0

\*Weight includes clevis pins.

Bore	Rod Diameter (MM)	Mount				Add per Inch of Stroke
		MX0/MS4 ME3/ME4	MF1 MF2	MT1 MT2	MP1*	
4.00	1.000	23	28	23.5	27	1.0
	1.375	23.4	28.5	24	27.5	1.2
5.00	1.000	34.4	42	35	41	1.1
	1.375	34.9	42.5	35.5	41.5	1.3
6.00	1.375	60	71.9	61.5	69	1.5
	1.750	62	73.9	63.2	71	1.7
8.00	1.375	79	N/A	80.2	88	2.0
	1.750	82	N/A	83.2	91	2.3

\*Weight includes clevis pins.

### 'TAS' Series Basic Cylinders

Weight In Pounds

Bore	Rod Dia. (MM)	Mount													Add per Inch of Stroke
		MX0 MS4 ME3 ME4	MF1	MF2	MF5	MF6	MP1*	MP2* MP4*	MS1	MS2	MT1 MT2	MT4	MX1 MX2 MX3	SB*	
1.50	0.625	3.5	3.8	4.2	4.3	4.7	3.9	4.3	3.9	3.8	3.9	5.3	3.5	3.7	0.31
	1.000	3.6	4.1	4.3	4.6	4.8	4.0	4.4	4.0	3.9	4.0	5.4	3.6	3.9	0.45
2.00	0.625	5.5	6.1	6.6	6.8	7.3	6.0	6.6	6.1	5.8	6.0	8.1	5.6	5.8	0.39
	1.000	5.7	6.3	6.8	7.0	7.5	6.1	6.8	6.2	6.0	6.1	8.3	5.8	5.9	0.53
2.50	1.375	6.0	6.7	7.1	7.5	7.8	6.4	7.1	6.5	6.3	6.4	8.6	6.1	6.3	0.73
	0.625	8.1	8.8	9.6	9.5	10.4	8.6	9.5	8.8	8.4	8.6	11.3	8.2	8.4	0.45
3.25	1.000	8.3	9.0	9.7	9.8	10.5	8.7	9.7	8.9	8.6	8.7	11.4	8.4	8.5	0.59
	1.375	8.6	9.4	10.1	10.2	10.9	9.0	10.0	9.2	8.9	9.0	11.7	8.7	8.9	0.78
4.00	1.750	9.4	10.3	10.8	11.1	11.6	9.8	10.7	10.0	9.7	9.8	12.5	9.4	9.6	1.04
	1.000	15.7	17.1	19.3	18.9	21.0	16.7	19.2	16.3	16.4	16.1	21.5	15.8	16.6	0.70
5.00	1.375	15.8	17.5	19.4	19.2	21.1	16.8	19.3	16.5	16.5	16.2	21.6	15.9	16.7	0.90
	1.750	16.4	18.4	20.1	20.1	21.8	17.4	19.9	17.1	17.2	16.9	22.2	16.6	17.3	1.16
6.00	2.000	17.1	19.2	20.7	20.9	22.4	18.1	20.6	17.7	17.8	17.5	22.9	17.2	18.0	1.37
	1.000	22.7	24.4	27.6	26.3	29.6	23.9	27.5	23.6	23.4	23.1	29.9	22.8	23.6	0.79
7.00	1.375	22.8	24.7	27.7	26.6	29.7	24.0	27.6	23.7	23.5	23.2	30.0	22.9	23.7	0.99
	1.750	23.4	25.6	28.4	27.5	30.3	24.7	28.3	24.3	24.1	23.8	30.7	23.5	24.3	1.25
8.00	2.000	24.0	26.4	29.0	28.3	30.9	25.3	28.9	25.0	24.8	24.5	31.3	24.2	25.0	1.45
	2.500	26.3	29.1	31.3	31.0	33.2	27.6	31.2	27.3	27.1	26.8	33.6	26.5	27.3	1.95
9.00	1.000	34.7	37.1	42.1	39.9	45.0	36.0	41.3	36.6	36.1	35.1	44.1	35.0	35.6	0.98
	1.375	34.8	37.4	42.2	40.3	45.1	36.1	41.4	36.7	36.2	35.3	44.2	35.2	35.7	1.18
10.00	1.750	35.4	38.3	42.9	41.1	45.7	36.7	42.1	37.4	36.8	35.9	44.8	35.8	36.4	1.44
	2.000	36.1	39.1	43.5	42.0	46.4	37.4	42.7	38.0	37.4	36.5	45.5	36.4	37.0	1.65
11.00	2.500	38.4	41.8	45.8	44.7	48.7	39.7	45.0	40.3	39.7	38.8	47.8	38.7	39.3	2.15
	3.000	40.8	44.9	48.3	47.7	51.1	42.1	47.5	42.8	42.2	41.3	50.3	41.2	41.8	2.76
12.00	3.500	43.4	47.9	50.8	50.8	53.6	44.6	50.0	45.3	44.7	43.8	52.8	43.7	44.3	3.48
	1.375	55.7	59.3	67.6	63.2	71.5	57.7	66.7	58.0	57.3	56.9	69.7	56.1	57.6	1.29
13.00	1.750	56.3	60.2	68.2	64.0	72.1	58.3	67.2	58.6	57.8	57.4	70.3	56.6	58.1	1.55
	2.000	56.9	60.9	68.8	64.8	72.7	58.9	67.8	59.2	58.4	58.0	70.9	57.2	58.7	1.76
14.00	2.500	59.0	63.6	70.9	67.5	74.8	61.0	70.0	61.3	60.6	60.2	73.0	59.4	60.9	2.26
	3.000	61.3	66.5	73.1	70.4	77.0	63.2	72.2	63.5	62.8	62.4	75.3	61.6	63.1	2.87
15.00	3.500	63.6	69.5	75.5	73.4	79.4	65.6	74.5	65.9	65.1	64.7	77.6	63.9	65.4	3.59
	4.000	68.1	74.8	80.0	78.7	83.9	70.1	79.1	70.4	69.7	69.3	82.1	68.5	69.9	4.43
16.00	1.375	83.8	—	—	—	—	85.8	—	89.5	85.3	84.9	111.5	84.5	85.6	2.09
	1.750	84.3	—	—	—	—	86.3	—	90.0	85.9	85.5	112.0	85.0	86.2	2.35
17.00	2.000	87.0	—	—	—	—	89.0	—	92.7	88.6	88.2	114.7	87.7	88.9	2.56
	2.500	89.2	—	—	—	—	91.2	—	94.9	90.8	90.4	116.9	89.9	91.0	3.06
18.00	3.000	91.8	—	—	—	—	93.8	—	97.6	93.4	93.0	119.6	92.6	93.7	3.67
	3.500	94.9	—	—	—	—	96.8	—	100.6	96.4	96.0	122.6	95.6	96.7	4.39
19.00	4.000	101.2	—	—	—	—	103.1	—	106.9	102.7	102.3	128.9	101.9	103.0	5.23
	4.500	108.8	—	—	—	—	110.8	—	114.5	110.3	109.9	136.5	109.5	110.6	6.17
20.00	5.000	116.8	—	—	—	—	118.8	—	122.5	118.4	118.0	144.5	117.5	118.6	7.23
	5.500	125.9	—	—	—	—	127.9	—	131.6	127.5	127.1	153.6	126.6	127.7	8.39

\*Weight includes clevis pins.

## Weight Charts

### Accessories Weight Chart

Weight In Pounds

Rod Clevis		Rod Eyes		Eye Brackets		Clevis Brackets	
Part No.	Weight	Part No.	Weight	Part No.	Weight	Part No.	Weight
RC437	.40	RE437	.30	EB500	.86	CB500	.90
RC500	.40	RE500	.30	EB750	3.00	CB750	3.10
RC625	.40	RE625	.30	EB1000	6.36	CB1000	6.20
RC750	1.22	RE750	1.10	EB1375	11.22	CB1375	9.70
RC875	1.22	RE1000	2.40	EB1750	17.5	CB1750	17
RC1000	2.58	RE1250	5.58	EB2000	25	CB2000	26
RC1250	6.28	RE1375	5.58	EB2500	39	CB2500	37
RC1375	6.28	RE1500	10.52	—	—	—	—
RC1500	11.6	RE1875	11.5	—	—	—	—
RC1750	12.7	RE2250	23	—	—	—	—
RC1875	18	RE2500	32	—	—	—	—
RC2250	27	—	—	—	—	—	—
RC2500	36	—	—	—	—	—	—

Clevis Pins (With Cotter Pins)		Clevis Pins (With E-Rings)		Weld Plate		Flange End Coupler	
Part No.	Weight	Part No.	Weight	Part No.	Weight	Part No.	Weight
CP500C	.12	CP500E	.12	WP625	.45	FEC625	.41
CP750C	.38	CP750E	.38	WP1000	.69	FEC1000	.65
CP1000C	.80	CP1000E	.80	WP1375	1.26	FEC1375	1.22
CP1375C	1.22	CP1375E	1.22	WP1750	2.25	FEC1750	2.25
CP1750C	4.1	CP1750E	3.78	WP2000	2.67	FEC2000	2.59
CP2000C	5.36	CP2000E	4.93	WP2500	3.38	FEC2500	3.30
CP2500C	9.42	CP2500E	9.22	—	—	—	—

### Alignment Couplers Weight Chart

Weight In Pounds

Alignment Couplers									
Part No.	Weight	Part No.	Weight	Part No.	Weight	Part No.	Weight	Part No.	Weight
AC250	.30	AC625	.40	AC1375	7.50	AC2250	8.50	AC3500	39.5
AC312	.30	AC750	1.10	AC1500	7.60	AC2500	28	AC3750	40.2
AC375	.30	AC875	1.10	AC1750	7.60	AC2750	29.2	AC4000	55
AC437	.30	AC1000	2.90	AC1875	8.00	AC3000	30.4	AC4500	60
AC500	.30	AC1250	2.90	AC2000	8.30	AC3250	38	AC5000	66

Alignment Couplers (Stainless Steel)			
Part No.	Weight	Part No.	Weight
SS-AC250	.30	SS-AC750	1.10
SS-AC312	.32	SS-AC875	1.30
SS-AC375	.34	SS-AC1000	2.90
SS-AC437	.36	SS-AC1250	3.10
SS-AC500	.38	SS-AC1500	8.00
SS-AC625	.40	—	—

### Stainless Steel Accessories Weight Chart

Weight In Pounds

Rod Clevis		Rod Eyes		Eye Brackets & Clevis Brackets		Clevis Pins	
Part Number	Weight	Part Number	Weight	Part Number	Weight	Part Number	Weight
SS-RC437	.28	SS-RE750	.32	SS-EB500	1.2	SS-CP500-1	.12
SS-RC500	.28	SS-RE1000	.30	SS-EB750	3.8	SS-CP750-1	.38
SS-RC750	.78	SS-RE1375	1.10	SS-EB1000	6.9	SS-CP1000-1	.80
SS-RC1000	2.13	SS-RE1500	2.40	SS-CB500	1.5	SS-CP1375-1	1.22
SS-RC1250	5.8	—	—	SS-CB750	4.5	SS-CP1750-1	4.7
SS-RC1500	11.1	—	—	SS-CB1000	7.6	—	—

# How to Specify

## Seal Kits

### Series 'TA', 'EN' & 'FM'

Note: To ensure proper seals are supplied for all models, always supply Bimba serial number.

Bore	Standard Single Rod End				Standard Double Rod End		
	Part Number	With Cushions			Part Number	With Cushions	
		H	C	HC		H	HC
1.50	SK 625-150	SK 625-150-H	SK 625-150-C	SK 625-150-HC	SKD 625-150	SKD 625-150-H	SKD 625-150-HC
2.00	SK 625-200	SK 625-200-H	SK 625-200-C	SK 625-200-HC	SKD 625-200	SKD 625-200-H	SKD 625-200-HC
2.50	SK 625-250	SK 625-250-H	SK 625-250-C	SK 625-250-HC	SKD 625-250	SKD 625-250-H	SKD 625-250-HC
3.25	SK 100-325	SK 100-325-H	SK 100-325-C	SK 100-325-HC	SKD 100-325	SKD 100-325-H	SKD 100-325-HC
4.00	SK 100-400	SK 100-400-H	SK 100-400-C	SK 100-400-HC	SKD 100-400	SKD 100-400-H	SKD 100-400-HC
5.00	SK 100-500	SK 100-500-H	SK 100-500-C	SK 100-500-HC	SKD 100-500	SKD 100-500-H	SKD 100-500-HC
6.00	SK 137-600	SK 137-600-H	SK 137-600-C	SK 137-600-HC	SKD 137-600	SKD 137-600-H	SKD 137-600-HC
8.00	SK 137-800	SK 137-800-H	SK 137-800-C	SK 137-800-HC	SKD 137-800	SKD 137-800-H	SKD 137-800-HC
10.00	SK 175-1000	SK 175-1000-H	SK 175-1000-C	SK 175-1000-HC	SKD 175-1000	SKD 175-1000-H	SKD 175-1000-HC
12.00	SK 200-1200	SK 200-1200-H	SK 200-1200-C	SK 200-1200-HC	SKD 200-1200	SKD 200-1200-H	SKD 200-1200-HC

Bore	Oversize Single Rod End				Oversize Double Rod End		
	Part Number	With Cushions			Part Number	With Cushions	
		H	C	HC		H	HC
1.50	SK 100-150	N/A	SK 100-150-C	N/A	SKD 100-150	N/A	N/A
2.00	SK 100-200	SK 100-200-H	SK 100-200-C	SK 100-200-HC	SKD 100-200	SKD 100-200-H	SKD 100-200-HC
2.50	SK 100-250	SK 100-250-H	SK 100-250-C	SK 100-250-HC	SKD 100-250	SKD 100-250-H	SKD 100-250-HC
3.25	SK 137-325	SK 137-325-H	SK 137-325-C	SK 137-325-HC	SKD 137-325	SKD 137-325-H	SKD 137-325-HC
4.00	SK 137-400	SK 137-400-H	SK 137-400-C	SK 137-400-HC	SKD 137-400	SKD 137-400-H	SKD 137-400-HC
5.00	SK 137-500	SK 137-500-H	SK 137-500-C	SK 137-500-HC	SKD 137-500	SKD 137-500-H	SKD 137-500-HC
6.00	SK 175-600	SK 175-600-H	SK 175-600-C	SK 175-600-HC	SKD 175-600	SKD 175-600-H	SKD 175-600-HC
8.00	SK 175-800	SK 175-800-H	SK 175-800-C	SK 175-800-HC	SKD 175-800	SKD 175-800-H	SKD 175-800-HC
10.00	SK 200-1000	SK 200-1000-H	SK 200-1000-C	SK 200-1000-HC	SKD 200-1000	SKD 200-1000-H	SKD 200-1000-HC
12.00	SK 250-1200	SK 250-1200-H	SK 250-1200-C	SK 250-1200-HC	SKD 250-1200	SKD 250-1200-H	SKD 250-1200-HC

Single rod end seal kit includes: 2 Piston Seals, 2 Tube End Seals, Rod Wiper, Rod Seal & Bushing "O" Ring.  
Note: Back-to-Back cylinders would require two (2) of the above kits.

### Series 'TA', 'EN' & 'FM' (With 'TH' Option)

Note: To ensure proper seals are supplied for all models, always supply Bimba serial number.

Bore	Standard Single Rod End				Standard Double Rod End		
	Part Number	With Cushions			Part Number	With Cushions	
		H	C	HC		H	HC
1.50	SK625-150-TH	SK 625-150-H-TH	SK 625-150-C-TH	SK 625-150-HC-TH	SKD 625-150-TH	SKD 625-150-H-TH	SKD625-150-HC-TH
2.00	SK625-200-TH	SK 625-200-H-TH	SK 625-200-C-TH	SK 625-200-HC-TH	SKD 625-200-TH	SKD 625-200-H-TH	SKD625-200-HC-TH
2.50	SK625-250-TH	SK 625-250-H-TH	SK 625-250-C-TH	SK 625-250-HC-TH	SKD 625-250-TH	SKD 625-250-H-TH	SKD625-250-HC-TH
3.25	SK100-325-TH	SK 100-325-H-TH	SK 100-325-C-TH	SK 100-325-HC-TH	SKD 100-325-TH	SKD 100-325-H-TH	SKD100-325-HC-TH
4.00	SK100-400-TH	SK 100-400-H-TH	SK 100-400-C-TH	SK 100-400-HC-TH	SKD 100-400-TH	SKD 100-400-H-TH	SKD100-400-HC-TH
5.00	SK100-500-TH	SK 100-500-H-TH	SK 100-500-C-TH	SK 100-500-HC-TH	SKD 100-500-TH	SKD 100-500-H-TH	SKD100-500-HC-TH
6.00	SK137-600-TH	SK 137-600-H-TH	SK 137-600-C-TH	SK 137-600-HC-TH	SKD 137-600-TH	SKD 137-600-H-TH	SKD137-600-HC-TH
8.00	SK137-800-TH	SK 137-800-H-TH	SK 137-800-C-TH	SK 137-800-HC-TH	SKD 137-800-TH	SKD 137-800-H-TH	SKD137-800-HC-TH
10.00	SK175-1000-TH	SK 175-1000-H-TH	SK 175-1000-C-TH	SK 175-1000-HC-TH	SKD 175-1000-TH	SKD 175-1000-H-TH	SKD175-1000-HC-TH
12.00	SK200-1200-TH	SK 200-1200-H-TH	SK 200-1200-C-TH	SK 200-1200-HC-TH	SKD 200-1200-TH	SKD 200-1200-H-TH	SKD200-1200-HC-TH

Bore	Oversize Single Rod End				Oversize Double Rod End		
	Part Number	With Cushions			Part Number	With Cushions	
		H	C	HC		H	HC
1.50	SK 100-150-TH	N/A	SK 100-150-C-TH	N/A	SKD 100-150-TH	N/A	N/A
2.00	SK 100-200-TH	SK 100-200-H-TH	SK 100-200-C-TH	SK 100-200-HC-TH	SKD 100-200-TH	SKD 100-200-H-TH	SKD 100-200-HC-TH
2.50	SK 100-250-TH	SK 100-250-H-TH	SK 100-250-C-TH	SK 100-250-HC-TH	SKD 100-250-TH	SKD 100-250-H-TH	SKD 100-250-HC-TH
3.25	SK 137-325-TH	SK 137-325-H-TH	SK 137-325-C-TH	SK 137-325-HC-TH	SKD 137-325-TH	SKD 137-325-H-TH	SKD 137-325-HC-TH
4.00	SK 137-400-TH	SK 137-400-H-TH	SK 137-400-C-TH	SK 137-400-HC-TH	SKD 137-400-TH	SKD 137-400-H-TH	SKD 137-400-HC-TH
5.00	SK 137-500-TH	SK 137-500-H-TH	SK 137-500-C-TH	SK 137-500-HC-TH	SKD 137-500-TH	SKD 137-500-H-TH	SKD 137-500-HC-TH
6.00	SK 175-600-TH	SK 175-600-H-TH	SK 175-600-C-TH	SK 175-600-HC-TH	SKD 175-600-TH	SKD 175-600-H-TH	SKD 175-600-HC-TH
8.00	SK 175-800-TH	SK 175-800-H-TH	SK 175-800-C-TH	SK 175-800-HC-TH	SKD 175-800-TH	SKD 175-800-H-TH	SKD 175-800-HC-TH
10.00	SK 200-1000-TH	SK 200-1000-H-TH	SK 200-1000-C-TH	SK 200-1000-HC-TH	SKD 200-1000-TH	SKD 200-1000-H-TH	SKD 200-1000-HC-TH
12.00	SK 250-1200-TH	SK 250-1200-H-TH	SK 250-1200-C-TH	SK 250-1200-HC-TH	SKD 250-1200-TH	SKD 250-1200-H-TH	SKD 250-1200-HC-TH

Single rod end Seal Kit includes: 2 Piston Seals, 2 Tube End Seals, Rod Wiper, Rod Seal & Bushing "O" Ring.  
Note: Back-to-Back cylinders would require two (2) of the above kits.

## Seal Kits

### 3-Position & Tandem

Bore	Standard Single Rod End				Oversize Single Rod End			
	Part Number	With Cushions			Part Number	With Cushions		
		H	C	HC				
1.50	TSK625-150	TSK625-150-H	TSK625-150-C	TSK625-150-HC	TSK100-150	N/A	TSK100-150-C	N/A
2.00	TSK625-200	TSK625-200-H	TSK625-200-C	TSK625-200-HC	TSK100-200	TSK100-200-H	TSK100-200-C	TSK100-200-HC
2.50	TSK625-250	TSK625-250-H	TSK625-250-C	TSK625-250-HC	TSK100-250	TSK100-250-H	TSK100-250-C	TSK100-250-HC
3.25	TSK100-325	TSK100-325-H	TSK100-325-C	TSK100-325-HC	TSK137-325	TSK137-325-H	TSK137-325-C	TSK137-325-HC
4.00	TSK100-400	TSK100-400-H	TSK100-400-C	TSK100-400-HC	TSK137-400	TSK137-400-H	TSK137-400-C	TSK137-400-HC
5.00	TSK100-500	TSK100-500-H	TSK100-500-C	TSK100-500-HC	TSK137-500	TSK137-500-H	TSK137-500-C	TSK137-500-HC
6.00	TSK137-600	TSK137-600-H	TSK137-600-C	TSK137-600-HC	TSK175-600	TSK175-600-H	TSK175-600-C	TSK175-600-HC
8.00	TSK137-800	TSK137-800-H	TSK137-800-C	TSK137-800-HC	TSK175-800	TSK175-800-H	TSK175-800-C	TSK175-800-HC

Note: Tandem actuators are considered non-repairable in the field due to the connected piston rod between stages.  
To ensure proper seals are supplied for all models, always supply Bimba serial number.

### Series 'TD'

Bore	Standard Single Rod End		Oversize Single Rod End	
	Part Number		Part Number	
1.50	TDSK625-150		TDSK100-150	
2.00	TDSK625-200		TDSK100-200	
2.50	TDSK625-250		TDSK100-250	
3.25	TDSK100-325	Kits include cushion seals and bumper piston seals	TDSK137-325	Kits include cushion seals and bumper piston seals
4.00	TDSK100-400		TDSK137-400	
5.00	TDSK100-500		TDSK137-500	
6.00	TDSK137-600		TDSK175-600	
8.00	TDSK137-800		TDSK175-800	

Note: to ensure proper seals are supplied for all models, always supply Bimba serial number.

### Series 'NR' (Internally Guided Non-Rotating)

Bore	Piston Rod Diameter	Part Number
2.00	0.625	SK625-200-NR
	0.625	SK625-250-NR
2.50	1.000	SK100-250-NR
	1.000	SK100-325-NR
3.25	1.375	SK137-325-NR
	1.000	SK100-400-NR
4.00	1.375	SK137-400-NR
	1.000	SK100-500-NR
5.00	1.375	SK137-500-NR
	1.375	SK137-600-NR
6.00	1.750	SK175-600-NR
	1.375	SK137-800-NR
8.00	1.750	SK175-800-NR
	1.750	SK175-1000-NR
10.00	2.000	SK200-1000-NR
	2.000	SK200-1200-NR
12.00	2.500	SK250-1200-NR

Note: Add suffix H and/or C to indicate if cushion seals are required on Head and/or Cap.

Example: SK100-400-HC-NR

### Series 'MS' (Multi-Stage) Seal Kits Same For 'MSE' or 'MSR'

Standard Rod Diameter		Oversize Rod Diameter	
Bore	Part Number	Bore	Part Number
1.50	MSESK625-150-2S	1.50	MSESK100-150-2S
	MSESK625-150-3S		MSESK100-150-3S
	MSESK625-150-4S		MSESK100-150-4S
2.00	MSESK625-200-2S	2.00	MSESK100-200-2S
	MSESK625-200-3S		MSESK100-200-3S
	MSESK625-200-4S		MSESK100-200-4S
2.50	MSESK625-250-2S	2.50	MSESK100-250-2S
	MSESK625-250-3S		MSESK100-250-3S
	MSESK625-250-4S		MSESK100-250-4S
3.25	MSESK100-325-2S	3.25	MSESK137-325-2S
	MSESK100-325-3S		MSESK137-325-3S
	MSESK100-325-4S		MSESK137-325-4S
4.00	MSESK100-400-2S	4.00	MSESK137-400-2S
	MSESK100-400-3S		MSESK137-400-3S
	MSESK100-400-4S		MSESK137-400-4S
5.00	MSESK100-500-2S	5.00	MSESK137-500-2S
	MSESK100-500-3S		MSESK137-500-3S
	MSESK100-500-4S		MSESK137-500-4S
6.00	MSESK137-600-2S	6.00	MSESK175-600-2S
	MSESK137-600-3S		MSESK175-600-3S
	MSESK137-600-4S		MSESK175-600-4S
8.00	MSESK137-800-2S	8.00	MSESK175-800-2S
	MSESK137-800-3S		MSESK175-800-3S
	MSESK137-800-4S		MSESK175-800-4S

Note: MSR series actuators are considered non-repairable in the field due to the connected piston rod between stages.

# How to Specify

## Seal Kits

### Series 'SS'

Note: To ensure proper seals are supplied for all models, ALWAYS supply Bimba serial number.

Bore	Standard Single Rod End				Standard Double Rod End		
	Part No.	With Cushions			Part No.	With Cushions	
		H	C	HC		H	HC
1.50	SSSK 625-150	SSSK 625-150-H	SSSK 625-150-C	SSSK 625-150-HC	SSSKD 625-150	SSSKD 625-150-H	SSSKD 625-150-HC
2.00	SSSK 625-200	SSSK 625-200-H	SSSK 625-200-C	SSSK 625-200-HC	SSSKD 625-200	SSSKD 625-200-H	SSSKD 625-200-HC
2.50	SSSK 625-250	SSSK 625-250-H	SSSK 625-250-C	SSSK 625-250-HC	SSSKD 625-250	SSSKD 625-250-H	SSSKD 625-250-HC
3.25	SSSK 100-325	SSSK 100-325-H	SSSK 100-325-C	SSSK 100-325-HC	SSSKD 100-325	SSSKD 100-325-H	SSSKD 100-325-HC
4.00	SSSK 100-400	SSSK 100-400-H	SSSK 100-400-C	SSSK 100-400-HC	SSSKD 100-400	SSSKD 100-400-H	SSSKD 100-400-HC
5.00	SSSK 100-500	SSSK 100-500-H	SSSK 100-500-C	SSSK 100-500-HC	SSSKD 100-500	SSSKD 100-500-H	SSSKD 100-500-HC
6.00	SSSK 137-600	SSSK 137-600-H	SSSK 137-600-C	SSSK 137-600-HC	SSSKD 137-600	SSSKD 137-600-H	SSSKD 137-600-HC
8.00	SSSK 137-800	SSSK 137-800-H	SSSK 137-800-C	SSSK 137-800-HC	SSSKD 137-800	SSSKD 137-800-H	SSSKD 137-800-HC

Bore	Oversize Single Rod End				Oversize Double Rod End		
	Part No.	With Cushions			Part No.	With Cushions	
		H	C	HC		H	HC
1.50	SSSK 100-150	N/A	SSSK 100-150-C	N/A	SSSKD 100-150	N/A	N/A
2.00	SSSK 100-200	SSSK 100-200-H	SSSK 100-200-C	SSSK 100-200-HC	SSSKD 100-200	SSSKD 100-200-H	SSSKD 100-200-HC
2.50	SSSK 100-250	SSSK 100-250-H	SSSK 100-250-C	SSSK 100-250-HC	SSSKD 100-250	SSSKD 100-250-H	SSSKD 100-250-HC
3.25	SSSK 137-325	SSSK 137-325-H	SSSK 137-325-C	SSSK 137-325-HC	SSSKD 137-325	SSSKD 137-325-H	SSSKD 137-325-HC
4.00	SSSK 137-400	SSSK 137-400-H	SSSK 137-400-C	SSSK 137-400-HC	SSSKD 137-400	SSSKD 137-400-H	SSSKD 137-400-HC
5.00	SSSK 137-500	SSSK 137-500-H	SSSK 137-500-C	SSSK 137-500-HC	SSSKD 137-500	SSSKD 137-500-H	SSSKD 137-500-HC
6.00	SSSK 175-600	SSSK 175-600-H	SSSK 175-600-C	SSSK 175-600-HC	SSSKD 175-600	SSSKD 175-600-H	SSSKD 175-600-HC
8.00	SSSK 175-800	SSSK 175-800-H	SSSK 175-800-C	SSSK 175-800-HC	SSSKD 175-800	SSSKD 175-800-H	SSSKD 175-800-HC

Single rod end Seal Kit includes: 2 Piston Seals, 2 Tube End Seals, Rod Wiper, Rod Seal & Bushing "O" Ring.  
Note: Back-to-Back cylinders would require two (2) of the above kits.

### 'TAS' Seal Kits – How To Order

SK		137		250		Options		OTS
Style		Rod Size		Bore		Options		O-Ring Tube Seal
(Blank)	Single Rod	062	0.625" Rod Dia.	150	1.50" Bore	Standard Carboxylated Nitrile Seals		
D	Double Rod	100	1.000" Rod Dia.	200	2.00" Bore	BP	Bumper Piston Seals	
		137	1.375" Rod Dia.	250	2.50" Bore	C	Cap Cushion Seal	
		175	1.750" Rod Dia.	325	3.25" Bore	H	Head Cushion Seal	
		200	2.000" Rod Dia.	400	4.00" Bore	LF	Low Friction	
		250	2.500" Rod Dia.	500	5.00" Bore	MS	Metallic Rod Scraper	
		300	3.000" Rod Dia.	600	6.00" Bore	NR	Non-Rotating	
		350	3.500" Rod Dia.	800	8.00" Bore	TH	400 PSI Hydraulic Seals	
		400	4.000" Rod Dia.			VS	Fluorocarbon Seals	
		450	4.500" Rod Dia.					
		500	5.000" Rod Dia.					
		550	5.500" Rod Dia.					

Note: To ensure proper seals are supplied for all models, ALWAYS supply Bimba serial number.

All seal kits come with proper backup rings when required. To order replacement seal kits, call out the rod size, bore size and the seal selection from the original order.

Examples:  
SK137-400-OTS  
SK100-250-HC-OTS





# How to Specify

## Common Fluid Power Formulas

Property	Word Formula	Mathematic Equation
Fluid Pressure PSI (Pounds Per Square Inch)	Pressure = $\frac{\text{Force (lbs)}}{\text{Area (in}^2\text{)}}$	$P = \frac{F}{A}$
Cylinder Area Extend In <sup>2</sup> (Square Inches)	Area = $\frac{\pi}{4} \times \text{Diameter}^2$ (inches)	$A = .7854 D^2$
Cylinder Area Retract In <sup>2</sup> (Square Inches)	Area = $(\frac{\pi}{4} \times \text{Bore Diameter}^2) - (\frac{\pi}{4} \times \text{Rod Diameter}^2)$	$A = (.7854 D_1^2) - (.7854 D_2^2)$
Cylinder Force Lbs. (Pounds Of Force)	Force = Pressure (PSI) x Net Area (in <sup>2</sup> )	$F = PA$
Cylinder Velocity Ft/S (Feet Per Second)	Velocity = $\frac{231 \times \text{Flow Rate (GPM)}}{12 \times 60 \times \text{Net Area (in}^2\text{)}}$	$v = \frac{.3208 Q}{A}$
Cylinder Volume G (Gallons Of Fluid)	Volume = $\frac{\text{Net Area (in}^2\text{)} \times \text{Stroke (in)}}{231}$	$V = \frac{A L}{231}$
Cylinder Flow Rate GPM (Gallons Per Minute)	Flow Rate = $\frac{12 \times 60 \times \text{Velocity (ft/s)} \times \text{Net Area (in}^2\text{)}}{231}$	$Q = 3.117 v A$
Cylinder Power hp (Horsepower)	Horsepower = $\frac{\text{Pressure (PSI)} \times \text{Flow Rate (GPM)}}{1714}$	$hp = \frac{P Q}{1714}$
Fluid Motor Torque Lb-In (Inch Pounds)	Torque = $\frac{\text{Pressure (PSI)} \times \text{FM Displacement (in}^3\text{/rev.)}}{2 \pi}$	$T = \frac{P d}{2 \pi}$
	Torque = $\frac{\text{Horsepower} \times 63025}{\text{RPM}}$	$T = \frac{63025 hp}{n}$
	Torque = $\frac{\text{Flow Rate (GPM)} \times \text{Pressure (PSI)} \times 36.77}{\text{RPM}}$	$T = \frac{36.77 Q P}{n}$
Fluid Motor Speed RPM (Revolutions Per Minute)	Speed = $\frac{231 \times \text{Flow Rate (GPM)}}{\text{FM Displacement (in}^3\text{/rev.)}}$	$n = \frac{231 Q}{d}$
Fluid Motor Power hp (Horsepower)	Horsepower = $\frac{\text{Torque (lbs-in)} \times \text{RPM}}{63025}$	$hp = \frac{T n}{63025}$
Pump Outlet Flow GPM (Gallons Per Minute)	Flow = $\frac{\text{RPM} \times \text{Pump Displacement (in}^3\text{/rev.)}}{231}$	$Q = \frac{n d}{231}$
Flow Rate Through Piping Ft/S Velocity (Feet Per Second)	Velocity = $\frac{.3208 \times \text{Flow Rate Through ID (GPM)}}{\text{Internal Area (in}^2\text{)}}$	$v = \frac{.3208 Q}{A}$
Torque Requirement Lb-In (Inch Pounds)	Torque = Lever Length (in.) x Pull (lbs.)	$T = L F$





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