



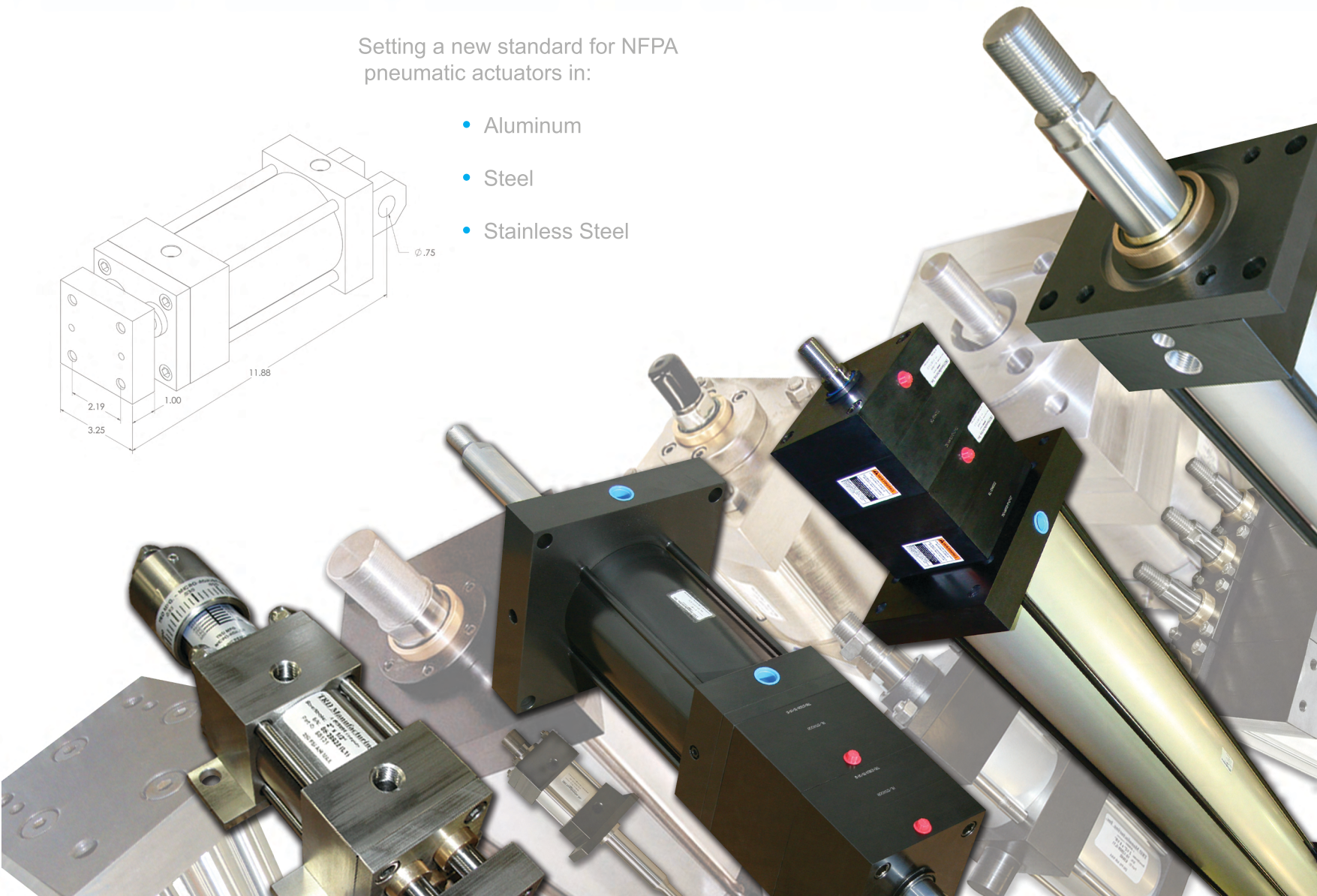
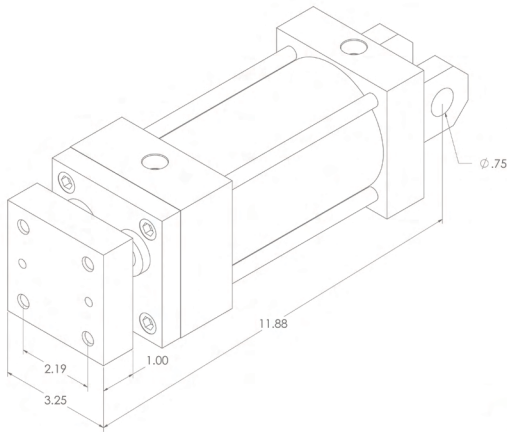
| TRD

Full Line Catalog



Setting a new standard for NFPA
pneumatic actuators in:

- Aluminum
- Steel
- Stainless Steel



The TRD difference...

Precision machined throughout. 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 TRD difference!**



On time, consistent delivery. 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 - 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.** (All NFPA, BSP or SAE Sizes available)
- **Rod End Styles and Designs:**
 - (5) NFPA Standard rod end styles available
 - Custom 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 the day they are received.

Visit us on the web: <http://www.trdmfg.com> e-mail: sales@trdmfg.com

2D DXF & DWG CAD files available 3D Step files available for download

NEW 3 YEAR WARRANTY

TRD Manufacturing Incorporated, A Bimba Company, is an employee owned company. We take great pride in our products.

TRD Manufacturing, Inc. warrants its cylinders for a full 3 years to be free from defects in material and workmanship. TRD Manufacturing, Inc. must be notified prior to returning product for warranty evaluation. Contact your local TRD distributor to obtain an RGA (Returned Goods Authorization Number) for proper tracking and expedite service on all warranty evaluations. TRD will repair or replace free of charge any products returned to the factory within 3 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 TRD 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 TRD Manufacturing, Inc. 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 TRD Manufacturing, Inc. of any contract.

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QUICK GUIDE – Design the right cylinder for your application

TRD 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 any application. 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 257 and 258.

Cylinder material– Which is best, Aluminum, Steel or Stainless Steel?

Aluminum – Used indoors and outdoors, aluminum is the "go to" material in general 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.

TRD 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 all steel welded mounts without the added weight.

Steel – Typically, "all" 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 & cap made from solid 6061 T6 aluminum tool plate will never fail due to loading 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 1-piece all steel trunnion mounts.

Steel cylinder tubes have hard chrome plated and honed I.D.s and 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 I.D. surface, which will provide the smoothest possible operation in ultra low speed applications.

One drawback to steel tubes is you cannot use low cost, "magnetic piston" type position sensors since the steel tube itself is a magnetic material. A Balluff end of stroke 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 & cost and match an "all-steel" cylinder performance (as long as the cylinder mount isn't MT1 or MT2).

303/304 Stainless Steel – 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 I.D., 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 effect our 2-3 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 SS; with hard chrome plated O.D. Diameters are "nominal" with a tolerance of +.000" to -.001"

Piston rod diameter, which is right for my application?

"Standard" piston rods - Are used 90% of the time in low to medium stroke length applications, with good results.

"Oversized" piston rods – Should always be considered on longer stroke, high load or side load applications. Each TRD series has a standard rod and OS (oversized) rod diameter listed and both ship within our published delivery schedule. Larger rod sizes are also available (but will add additional cost and a few days to the 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 – Are 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.

QUICK GUIDE – Design the right cylinder for your application (continued)

Piston Rod Thread– How to make the right selection

All “NFA” 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, 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” 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, TRD 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....

Cylinder stroke components are also made to order, so you are not limited to specifying a stroke in full inch increments. It is 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 inches will ship per our delivery schedule (usually in 2-3 days). Longer strokes are available and usually require engineering assistance and time to order the special length materials.

In general, NFA 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 $-.000$ ” to $+.060$ ”. TRD typically holds each cylinder component to a close tolerance, minimizing the “stack-up of tolerance” that effect the cylinder stroke.

Many customers will rely on external stroke adjustments or options such as “MA” micro-adjust to provide a precision, adjustable stroke output. Cylinder strokes can be made to “close tolerances” down to $\pm .005$ ”, for an additional charge.

For the above mentioned reasons, the shortest practical cylinder stroke length is about 1/8” (or 3 mm).

QUICK GUIDE – Design the right cylinder for your application (continued)

Port size, thread type, and port locations.....

Any port size that can fit in a cylinder, any thread type, can be provided. The most common are NPTF, but BSPP, BSPT, and SAE are also available (for additional cost). Delivery: 2-3 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 end (@ position 9). If a cushion is specified, the port and cushion adjustment can also be provided on the same side (for additional cost).

Cylinder velocities: Cushions and other available options.....

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 or BP bumper piston seals can be used to minimize cylinder noise and also provide some load deceleration, increasing a cylinder's life and performance.

For even higher impacts and loads, there are only a few internal cylinder solutions available to consider. The DC dampening cushion option is very effective, but available in only the 2.50, 3.25, and 4.00 bore sizes.

Refer to pages 167-186 for a listing of the most common cylinder performance options.

Temperatures.....HIGH, LOW, and everything in between.....

Standard operating temperature range of products: -20°F to +200°F (-25°C to +90°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: -65°F (-65°C) rated seals and lubricant are available. Ideal for freezer applications.

High temperature range: +400°F (+200°C) rated seals and lubricant are available. Ideal for furnace applications.

Refer to page 174 for special temperature lubes and page 179 for special temperature seals

Dust, dirt, and other "unfriendly" environments....

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 isn't enough room to cover all the application possibilities and solutions; contact your local distributor for more information and application assistance.

Side load: "The Good, The Bad, and the Ugly".....

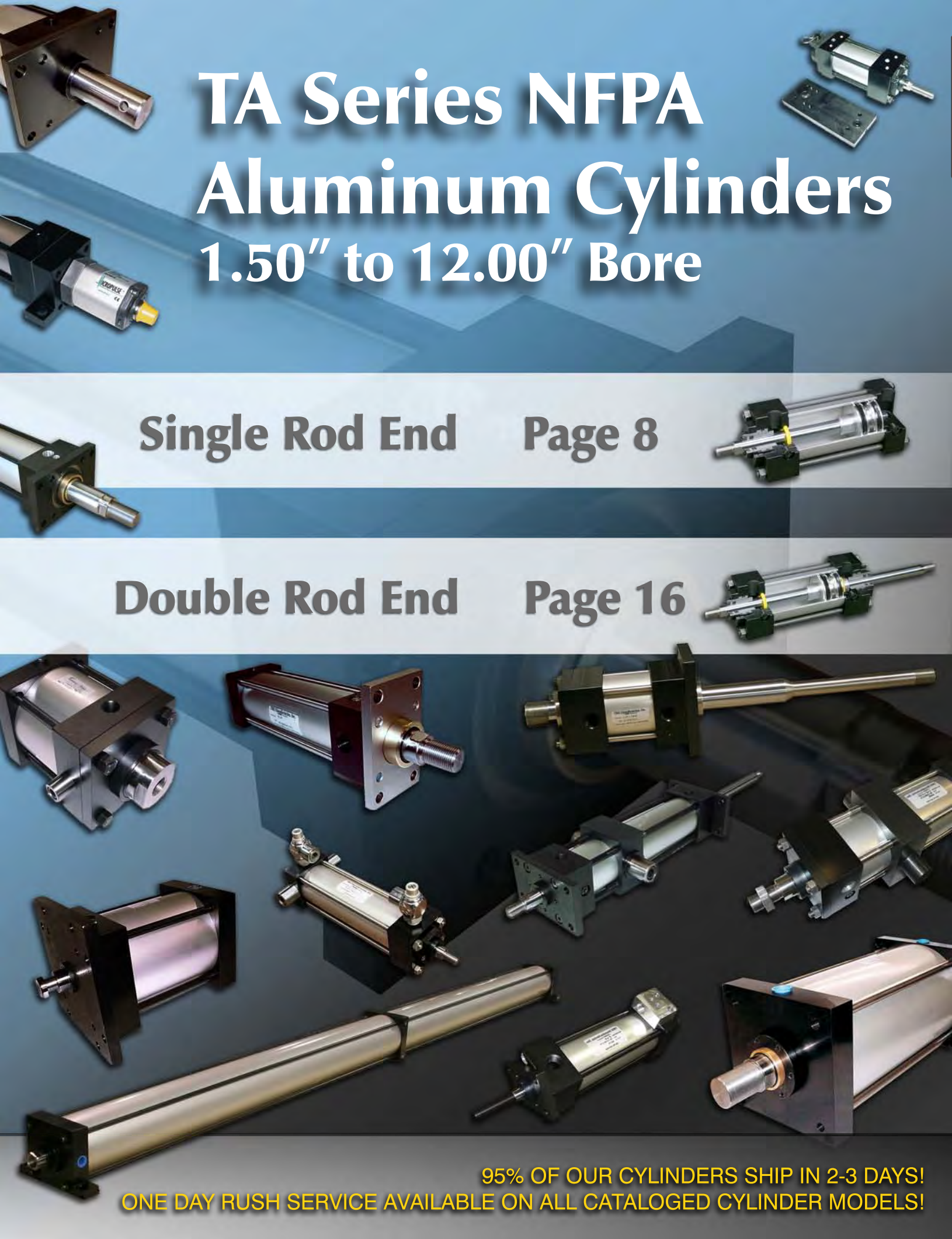
Everyone knows that an NFPA cylinder can take a certain amount of side load, even though the industry clearly states that "cylinders are not designed for side load applications". When you know you have a fair amount of side load, a better actuator solution in the long run might be a thruster or a slide 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. But 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 way more cylinder topics than can be practically covered in a brief cylinder design over-view. 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!

The background of the entire page is a collage of various TA Series NFPA aluminum cylinders. These include single rod end cylinders, double rod end cylinders, and a long telescopic cylinder. The cylinders are shown in different sizes and configurations, highlighting the product range. The text is overlaid on the top half of the image.

TA Series NFPA Aluminum Cylinders 1.50" to 12.00" Bore

A single rod end cylinder with a black mounting bracket and a silver rod.

Single Rod End

Page 8

Double Rod End

Page 16

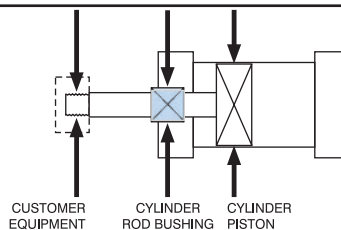
**95% OF OUR CYLINDERS SHIP IN 2-3 DAYS!
ONE DAY RUSH SERVICE AVAILABLE ON ALL CATALOGED CYLINDER MODELS!**

SERIES 'TA' (NFPA) CYLINDER

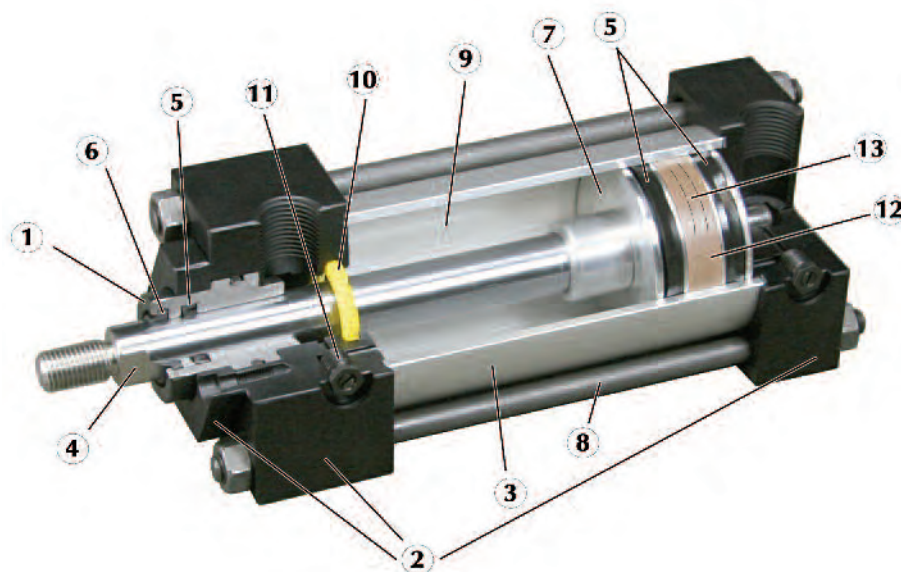
Floating Rod Bushing

SELF ALIGNMENT FEATURE

Rod Bushing is designed to float .002", improving 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 Carboxylated 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** – Prestressed 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 Magna-Lube 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 **PISTON WEAR BAND** - 90% Virgin PTFE and 10% Polyphenylene Sulfide filled wear band; 65,000 PSI Compressive Strength; extremely low wear rate.
- ⑬ **PISTON MAGNET** – (Option MPR) for TRD magnetically operated reed and solid state switches (refer to pages 176).

OPERATING PRESSURE

250 PSI AIR (17 BAR)

OPERATING TEMPERATURE

Carboxylated Nitrile: -20°F to 200°F (-25°C to 90°C)
Fluorocarbon: 0°F to 400°F (-20°C to 200°C)

Performance options:

- **ST** – Stop tubes are used to reduce rod bearing and piston stress (refer to page 89 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 in outdoor applications and wet environments.
- **LF** – Low Friction seals reduce breakaway and running friction. Effective at all operating pressures.

HOW TO ORDER: SERIES 'TA' (STANDARD CYLINDER)

TA - **MF1** - **2.50** 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)

BORE	
1.50	2.00
2.50	3.25
4.00	5.00
6.00	8.00
10.00	12.00

STROKE
0" to 120"
Made to Order

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 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, FCELH

OPTIONS	
A =	EXTENDED PISTON ROD THREAD (Example: A = 2")
AS	ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, Example: AS = 4")
A/O	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	BSP PORTS (SPECIFY SIZE, Example: BSP = .250")
C =	EXTENDED PISTON ROD (Example: IF C = 0.50", THEN 1" ROD EXTENSION IS C = 1.50")
EN	ELECTROLESS NICKEL PLATED (Refer to page 172 for specifications)
KK2	LARGE MALE ROD THREAD
KK3	FEMALE ROD THREAD
KK3S	STUDDER 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 (Refer to page 179 for specifications)
MA	MICRO-ADJUST (6" MAX. STROKE) Available on Double Rod End Models
MAB	MICRO-ADJUST WITH SOUND DAMPENING BUMPER (6" MAX. STROKE)
MPR	MAGNETIC PISTON FOR REED OR SOLID STATE SWITCHES - TRD MODELS: R10, R10P, RAC, RHT & MSS (Refer to pages 220-226 for selection)
MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
NR	NON-ROTATING (Refer to page 176 for specifications)
OP	OPTIONAL PORT LOCATION (Example: Ports @ 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, AND FASTENERS
SSF	STAINLESS STEEL FASTENERS
SSR	STAINLESS STEEL PISTON ROD
SST	STAINLESS STEEL TIE RODS & NUTS
ST	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) (Example: TA MS4 2 X 24" EFFECTIVE STROKE-ST=3)
TMS	STEEL CYLINDER TUBE, BLACK EPOXY PAINT FINISH
TH	400 PSI HYDRAULIC NON-SHOCK (Refer to page 179 for specifications)
VS	FLUOROCARBON SEALS
XX	SPECIAL VARIATION (SPECIFY)

STYLE
SINGLE ROD (LEAVE BLANK)
D = DOUBLE ROD END

About our Part Number System

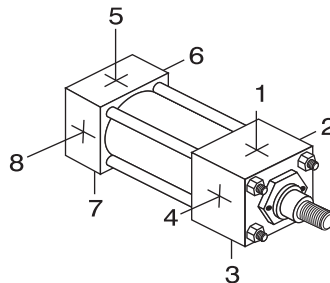
- Simple, easy to understand
- No excessive codes!
- Eliminates mistakes when ordering

Example: A 2.50" Bore by 10" Stroke NFPA cylinder, Front Flange Mount, Head & Cap Cushions, Magnetic Piston for Switches.

Part Number: TA-MF1-2.50 x 10-HC-MPR

STANDARD TIE PORT AND CUSHION ADJUSTMENT POSITIONS

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



NFPA MOUNTS

1.50"-6.00" Bores Page 13	1.50"-6.00" Bores Page 13	8.00"-12.00" Bores Page 13	8.00"-12.00" Bores Page 13	1.50"-12.00" Bores Page 11	1.50"-6.00" Bores Page 11
1.50"-6.00" Bores Page 11	1.50"-8.00" Bores Page 14	1.50"-8.00" Bores Page 14	1.50"-12.00" Bores Page 15	1.50"-8.00" Bores Page 12	1.50"-8.00" Bores Page 12
1.50"-8.00" Bores Page 12	1.50"-12.00" Bores Page 10	1.50"-12.00" Bores Page 13	1.50"-12.00" Bores Page 13	1.50"-12.00" Bores Page 13	

OPTION LENGTH ADDER (ADD TO CATALOG BASIC OVERALL LENGTH DIMENSIONS)							
BORE	B	BC	BH	ELC	ELH	SE	SR
1.50	0.500	0.250	0.250	1.000	1.000	Refer to page 180 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
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

*Note: The desired Stop Tube length adds directly to the overall cylinder length.

SERIES 'TA' DIMENSIONS: BASIC CYLINDER (NO MOUNT)

EASY FLIP OUT PAGE FOR REFERENCE

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?

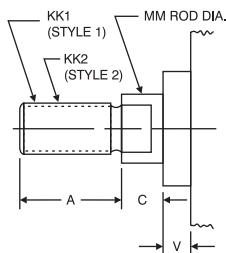
Just send us a sketch.

In most cases, quotes are turned around in one day!

PISTON ROD END STYLES

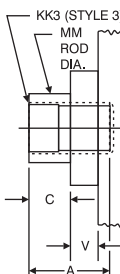
STYLE 1 & 2

KK1 & KK2



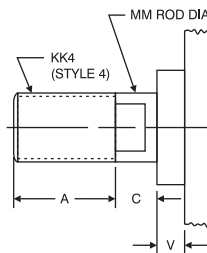
STYLE 3

KK3



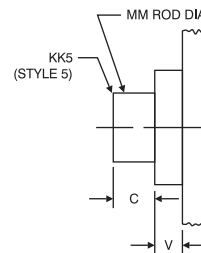
STYLE 4

KK4

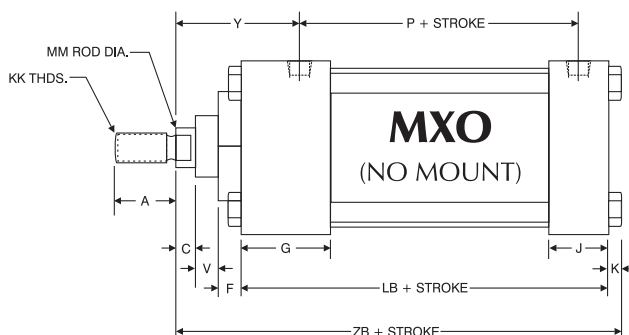
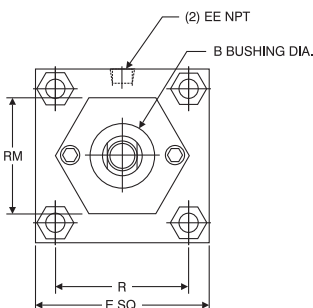


STYLE 5

KK5



BORE	MM ROD DIAMETER	STANDARD		OPTIONAL							C	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		
1.50,	0.625 Standard	0.438-20	0.750	0.500-20	0.750	0.438-20	0.750	0.625-18	0.750	No Threads	0.375	0.250
2.00, 2.50	1.000 Oversize	0.750-16	1.125	0.875-14	1.125	0.750-16	1.125	1.000-14	1.125	No Threads	0.500	0.500
3.25,	1.000 Standard	0.750-16	1.125	0.875-14	1.125	0.750-16	1.125	1.000-14	1.125	No Threads	0.500	0.250
4.00, 5.00	1.375 Oversize	1.000-14	1.625	1.250-12	1.625	1.000-14	1.625	1.375-12	1.625	No Threads	0.625	0.375
6.00 & 8.00	1.375 Standard	1.000-14	1.625	1.250-12	1.625	1.000-14	1.625	1.375-12	1.625	No Threads	0.625	0.375
	1.750 Oversize	1.250-12	2.000	1.500-12	2.000	1.250-12	2.000	1.750-12	2.000	No Threads	0.750	0.500
10.00	1.750 Standard	1.250-12	2.000	1.500-12	2.000	1.250-12	2.000	1.750-12	2.000	No Threads	0.750	0.500
	2.000 Oversize	1.500-12	2.250	1.750-12	2.250	1.500-12	2.250	2.000-12	2.250	No Threads	0.875	0.375
12.00	2.000 Standard	1.500-12	2.250	1.750-12	2.250	1.500-12	2.250	2.000-12	2.250	No Threads	0.875	0.375
	2.500 Oversize	1.875-12	3.000	2.250-12	3.000	1.875-12	3.000	2.500-12	3.000	No Threads	1.000	0.500



BASIC DIMENSIONS 'MXO' STANDARD & OVERSIZE RODS

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

SERIES 'TA' DIMENSIONS: BASIC CYLINDER (NO MOUNT)

About Rod End Styles

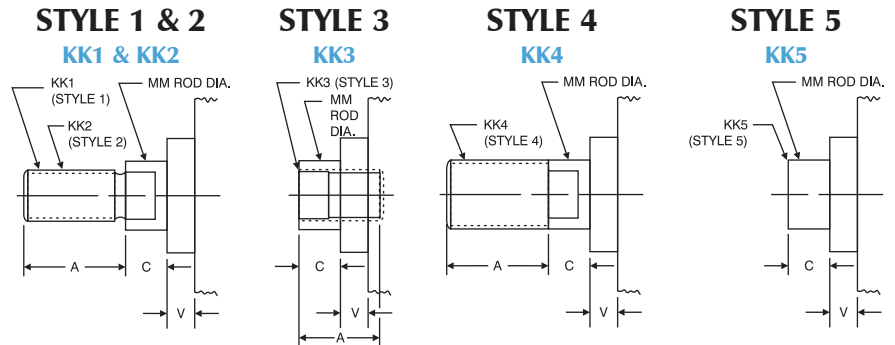
Style 1 Male Rod End is STANDARD

Other NFPA Styles can be specified (See Chart).

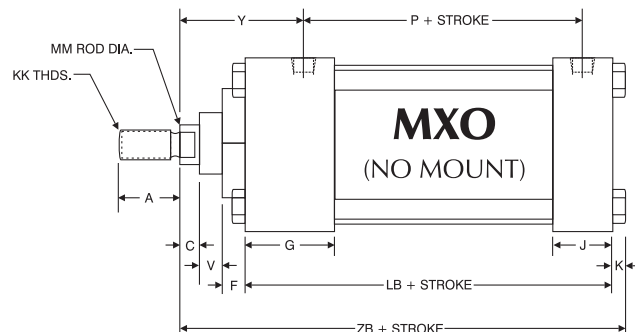
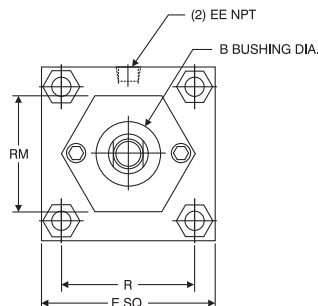
Need a rod end not listed?
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PISTON ROD END STYLES

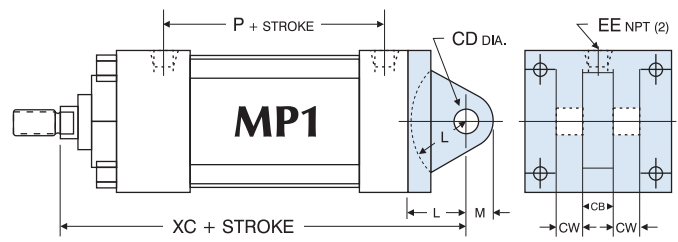
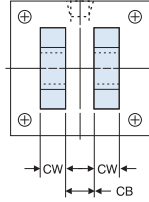
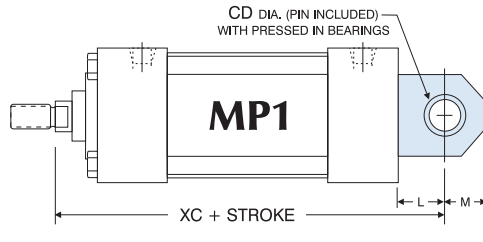


BORE	MM ROD DIAMETER	STANDARD		OPTIONAL							C	V
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male		Style 5 - Blank		
		KK1	A	KK2	A	KK3	A	KK4	A	KK5		
1.50, 2.00, 2.50	0.625 Standard	0.438-20	0.750	0.500-20	0.750	0.438-20	0.750	0.625-18	0.750	No Threads	0.375	0.250
	1.000 Oversize	0.750-16	1.125	0.875-14	1.125	0.750-16	1.125	1.000-14	1.125	No Threads	0.500	0.500
3.25, 4.00, 5.00	1.000 Standard	0.750-16	1.125	0.875-14	1.125	0.750-16	1.125	1.000-14	1.125	No Threads	0.500	0.250
	1.375 Oversize	1.000-14	1.625	1.250-12	1.625	1.000-14	1.625	1.375-12	1.625	No Threads	0.625	0.375
6.00 & 8.00	1.375 Standard	1.000-14	1.625	1.250-12	1.625	1.000-14	1.625	1.375-12	1.625	No Threads	0.625	0.375
	1.750 Oversize	1.250-12	2.000	1.500-12	2.000	1.250-12	2.000	1.750-12	2.000	No Threads	0.750	0.500
10.00	1.750 Standard	1.250-12	2.000	1.500-12	2.000	1.250-12	2.000	1.750-12	2.000	No Threads	0.750	0.500
	2.000 Oversize	1.500-12	2.250	1.750-12	2.250	1.500-12	2.250	2.000-12	2.250	No Threads	0.875	0.375
12.00	2.000 Standard	1.500-12	2.250	1.750-12	2.250	1.500-12	2.250	2.000-12	2.250	No Threads	0.875	0.375
	2.500 Oversize	1.875-12	3.000	2.250-12	3.000	1.875-12	3.000	2.500-12	3.000	No Threads	1.000	0.500



BASIC DIMENSIONS 'MXO' STANDARD & OVERSIZE RODS																			
BORE	ROD DIAMETER	A	B	C	E	EE	F	G	J	K	KK	LB	MM	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	0.438-20	3.625	0.625	2.375	1.438	2.00 SQ.	0.250	1.875	4.875
	1.000 Oversize	1.125	1.500	0.500							0.750-16		1.000			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	0.438-20	3.625	0.625	2.375	1.844	1.75 HEX	0.250	1.875	4.938
	1.000 Oversize	1.125	1.500	0.500							0.750-16		1.000			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	0.438-20	3.750	0.625	2.500	2.188	1.75 HEX	0.250	1.875	5.063
	1.000 Oversize	1.125	1.500	0.500							0.750-16		1.000			3.00 SQ.	0.500	2.250	5.438
3.25	1.000 Standard	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.375	0.750-16	4.250	1.000	2.750	2.766	2.75 DIA.	0.250	2.375	6.000
	1.375 Oversize	1.625	2.000	0.625							1.000-14		1.375			3.75 SQ.	0.375	2.625	6.250
4.00	1.000 Standard	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.375	0.750-16	4.250	1.000	2.750	3.320	2.75 DIA.	0.250	2.375	6.000
	1.375 Oversize	1.625	2.000	0.625							1.000-14		1.375			3.50 DIA.	0.375	2.625	6.250
5.00	1.000 Standard	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.438	0.750-16	4.500	1.000	3.000	4.100	2.75 DIA.	0.250	2.375	6.313
	1.375 Oversize	1.625	2.000	0.625							1.000-14		1.375			3.50 DIA.	0.375	2.625	6.563
6.00	1.375 Standard	1.625	2.000	0.625	6.500	0.750	0.625	2.000	1.500	0.438	1.000-14	5.000	1.375	3.250	4.875	3.50 DIA.	0.375	2.750	7.063
	1.750 Oversize	2.000	2.375	0.750							1.250-12		1.750				0.500	3.000	7.313
8.00	1.375 Standard	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.500	0.563	1.000-14	5.125	1.375	3.375	6.438	3.50 DIA.	0.375	2.750	7.313
	1.750 Oversize	2.000	2.375	0.750							1.250-12		1.750				0.500	3.000	7.563
10.00	1.750 Standard	2.000	2.375	0.750	10.625	1.000	0.625	2.250	2.000	0.688	1.250-12	6.375	1.750	4.313	7.922	3.50 DIA.	0.500	3.063	8.938
	2.000 Oversize	2.250	2.625	0.875							1.500-12		2.000			5.00 DIA.	0.375	3.188	9.063
12.00	2.000 Standard	2.250	2.625	0.875	12.750	1.000	0.750	2.250	2.000	0.688	1.500-12	6.875	2.000	4.813	9.400	5.00 DIA.	0.375	3.188	9.563
	2.500 Oversize	3.000	3.125	1.000							1.875-12		2.500				0.500	3.438	9.813

SERIES 'TA' DIMENSIONS: PIVOT MOUNTS

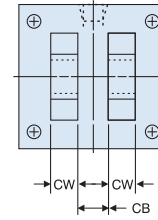
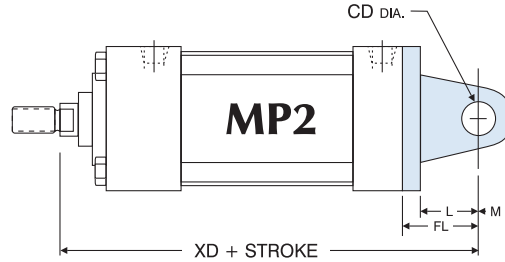


EXTRUDED MP1 MOUNT

(EXTRUDED: 1.50" - 8.00" BORES,
WELDMENT: 10.00" & 12.00" BORES)

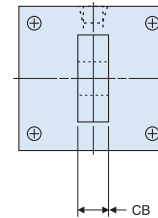
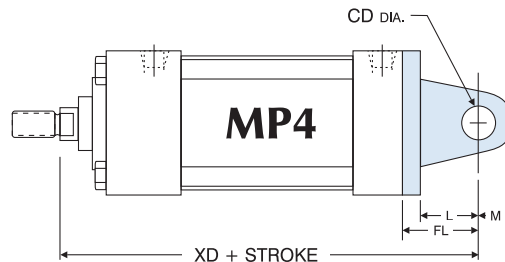
IRON CASTING MP1 MOUNT

(OPTIONAL)**



MP2 MOUNT

(IRON CASTING)



MP4 MOUNT

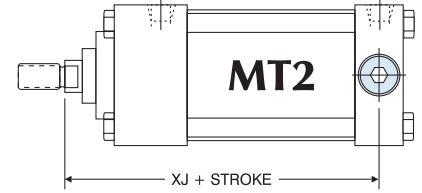
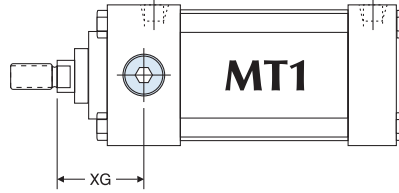
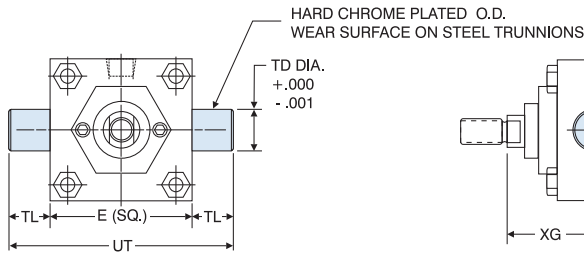
(IRON CASTING: 1.50" - 4.00" BORES, WELDMENT: 5.00" - 6.00" BORES*)

'MP1', 'MP2' CLEVIS AND 'MP4' EYE MOUNT DIMENSIONS										ACCESSORIES (SEE PAGES 206-208 FOR DIMENSIONS)				
BORE	ROD DIAMETER	CB	CD	CW	FL	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	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	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	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	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	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	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	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	1.500	1.000	8.250	N/A	RC1000	RE1000	CP1000	EB1000	CB1000
	1.750 Oversize							8.500	N/A	RC1250	RE1250	CP1375		
10.00	1.750 Standard	2.000	1.375	1.000	N/A	2.125	1.375	10.375	N/A	RC1250	RE1250	CP1375	EB1375	CB1375
	2.000 Oversize							10.500	N/A	RC1500	RE1500	CP1750		
12.00	2.000 Standard	2.500	1.750	1.250	N/A	2.250	1.750	11.125	N/A	RC1500	RE1500	CP1750	EB1750	CB1750
	2.500 Oversize							11.375	N/A	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 10.

**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 MP1" when ordering.

SERIES 'TA' DIMENSIONS: PIVOT MOUNTS

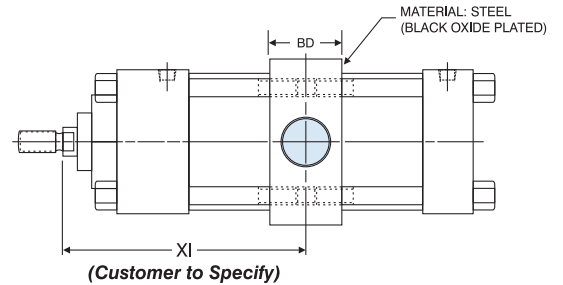
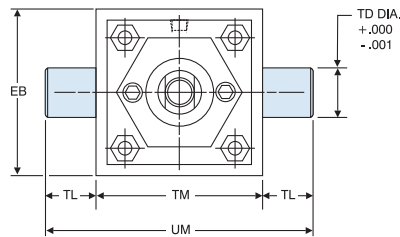


MT1 / MT2

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								ACCESSORIES (SEE PAGES 206-208 FOR DIMENSIONS)		
BORE	ROD DIAMETER	E	TD	TL	UT	XG	ADD STROKE XJ	ROD CLEVIS	ROD EYE	CLEVIS PIN
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	CP750
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	CP750
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	CP750
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	CP1000
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	CP1000
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	CP1000
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	CP1375
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	CP1375

*No oversize rod available on 1.50" bore MT1.
For dimensions not shown, see page 10.



MT4

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

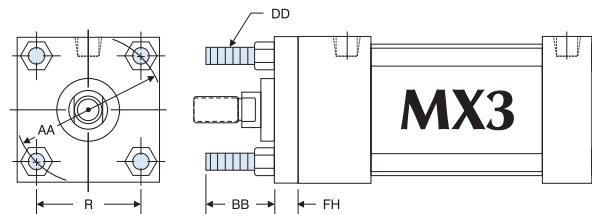
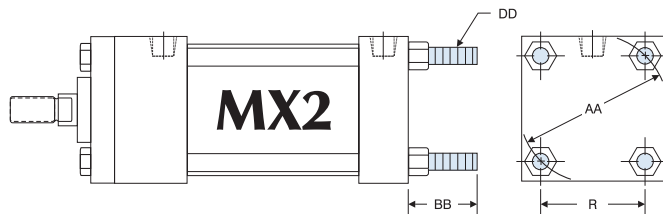
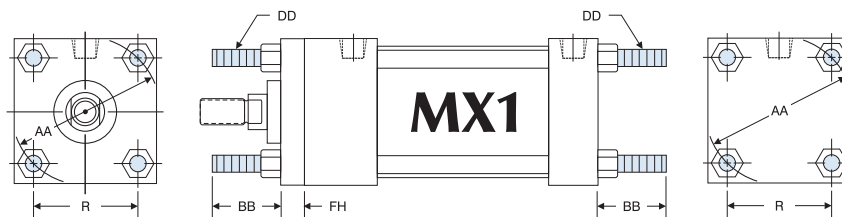
Note: MT4 Trunnions and Intermediate Section are one-piece steel construction.

'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.

'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	

SERIES 'TA' 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	0.250-28	0.375	1.430
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	0.313-24	0.375	1.840
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	0.313-24	0.375	2.190
	1.000 Oversize					
3.25	1.000 Standard	3.900	1.375	0.375-24	0.625	2.760
	1.375 Oversize					
4.00	1.000 Standard	4.700	1.375	0.375-24	0.625	3.320
	1.375 Oversize					

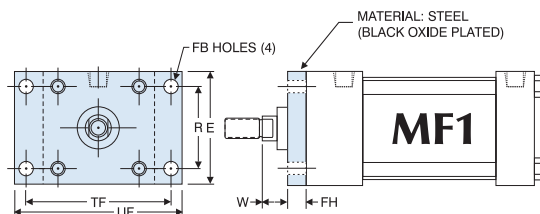
TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS

BORE	ROD DIAMETER	AA	BB	DD	FH	R
5.00	1.000 Standard	5.800	1.813	0.500-20	0.625	4.100
	1.375 Oversize					
6.00	1.375 Standard	6.900	1.813	0.500-20	0.750	4.880
	1.750 Oversize					
8.00	1.375 Standard	9.100	**2.313	0.625-18	*0.625	6.440
	1.750 Oversize					
10.00	1.750 Oversize	11.200	**2.688	0.750-16	*0.625	7.920
	2.000 Oversize					
12.00	2.000 Standard	13.300	**2.688	0.750-16	*0.750	9.400
	2.500 Oversize					

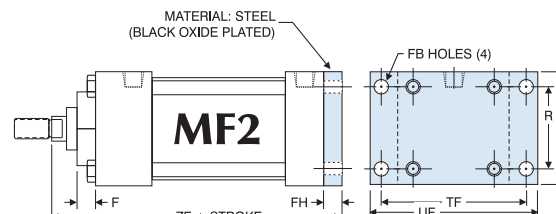
*MX1 & MX3 have full square bushing retainer on 1.50" - 6.00" bores, round retainers on 8.00" - 12.00" bores.

**BB dimension from face of head.

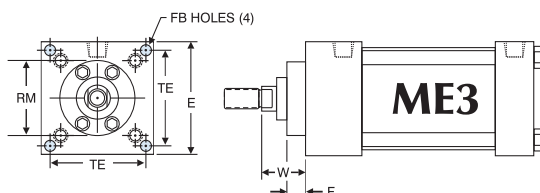
For dimensions not shown, see page 10.



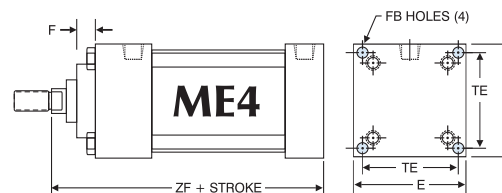
1.50" - 6.00" BORES



1.50" - 6.00" BORES



8.00" - 12.00" BORES



8.00" - 12.00" BORES

'MF1', 'MF2' FLANGE & 'ME3', 'ME4' CAP MOUNT DIMENSIONS

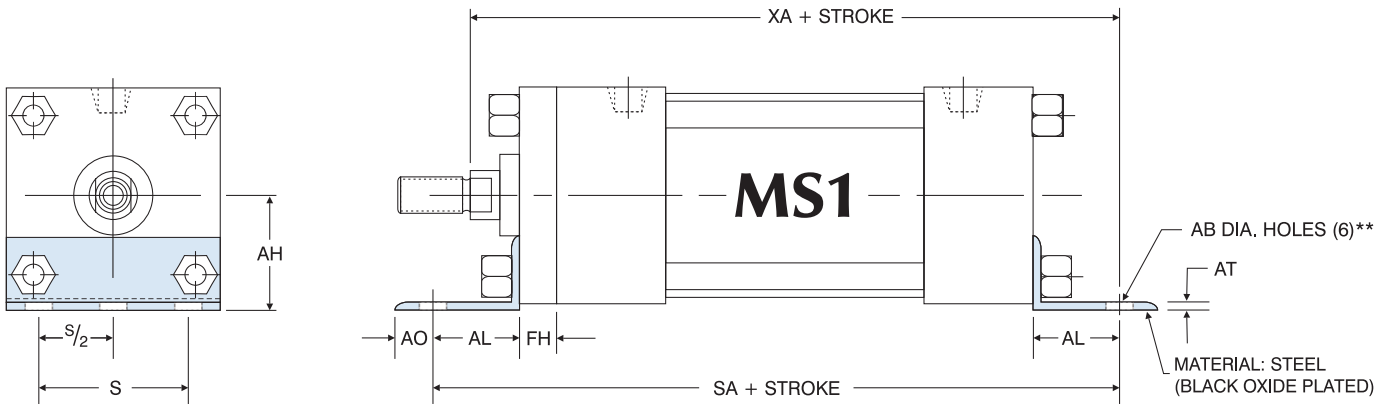
BORE	ROD DIAMETER	E	F	FB	FH	R	RM	TE	TF	UF	W	ZF
1.50	0.625 Standard	2.000	0.375	0.313	0.375	1.438	—	—	2.750	3.375	0.625	5.000
	1.000 Oversize										1.000	5.375
2.00	0.625 Standard	2.500	0.375	0.375	0.375	1.848	—	—	3.375	4.125	0.625	5.000
	1.000 Oversize										1.000	5.375
2.50	0.625 Standard	3.000	0.375	0.375	0.375	2.188	—	—	3.875	4.625	0.625	5.125
	1.000 Oversize										1.000	5.500
3.25	1.000 Standard	3.750	0.625	0.438	0.625	2.766	—	—	4.688	5.500	0.750	6.250
	1.375 Oversize										1.000	6.500
4.00	1.000 Standard	4.500	0.625	0.438	0.625	3.328	—	—	5.438	6.250	0.750	6.250
	1.375 Oversize										1.000	6.500

'MF1', 'MF2' FLANGE & 'ME3', 'ME4' CAP MOUNT DIMENSIONS

BORE	ROD DIAMETER	E	F	FB	FH	R	RM	TE	TF	UF	W	ZF
5.00	1.000 Standard	5.500	0.625	0.563	0.625	4.100	—	—	6.625	7.625	0.750	6.500
	1.375 Oversize										1.000	6.750
6.00	1.375 Standard	6.500	0.625	0.563	0.750	4.875	—	—	7.625	8.625	0.875	7.375
	1.750 Oversize										1.125	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	6.750
	1.750 Oversize										1.875	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	8.250
	2.000 Oversize										2.000	8.375
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	8.875
	2.500 Oversize										2.250	9.125

For dimensions not shown, see page 10.

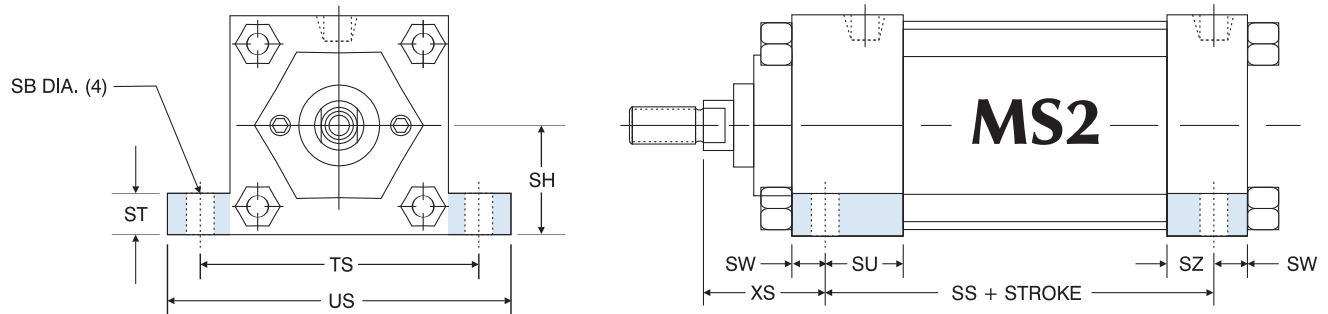
SERIES 'TA' DIMENSIONS: BASE MOUNTS



'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)

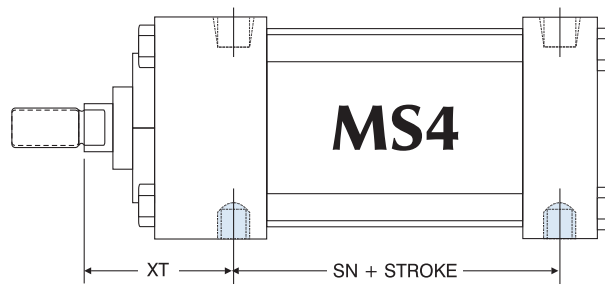
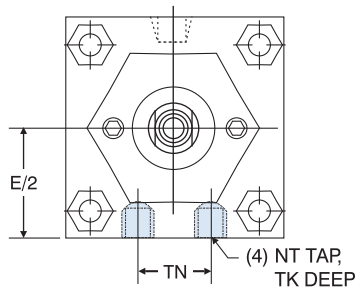
**1.50" bore has (4) AB diameter holes.



'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
	1.000 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 10.

SERIES 'TA' DIMENSIONS: BASE MOUNTS



'MS4' BOTTOM TAPPED MOUNT DIMENSIONS							
BORE	ROD DIAMETER	E/2	NT	TK	TN	XT	ADD STROKE
							SN
1.50	0.625 Standard	1.000	0.250-20	0.375	0.625	1.938	2.250
	1.000 Oversize					2.313	
2.00	0.625 Standard	1.250	0.313-18	0.500	0.875	1.938	2.250
	1.000 Oversize					2.313	
2.50	0.625 Standard	1.500	0.375-16	0.625	1.250	1.938	2.375
	1.000 Oversize					2.313	
3.25	1.000 Standard	1.875	0.500-13	0.750	1.500	2.438	2.625
	1.375 Oversize					2.688	
4.00	1.000 Standard	2.250	0.500-13	0.750	2.063	2.438	2.625
	1.375 Oversize					2.688	
5.00	1.000 Standard	2.750	0.625-11	1.000	2.688	2.438	2.875
	1.375 Oversize					2.688	
6.00	1.375 Standard	3.250	0.750-10	1.125	3.250	2.813	3.125
	1.750 Oversize					3.063	
8.00	1.375 Standard	4.250	0.750-10	1.125	4.500	2.813	3.250
	1.750 Oversize					3.063	
10.00	1.750 Standard	5.313	1.000-8	1.500	5.500	3.125	4.125
	2.000 Oversize					3.250	
12.00	2.000 Standard	6.375	1.000-8	1.500	7.250	3.250	4.625
	2.500 Oversize					3.500	

For dimensions not shown, see page 10.

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.

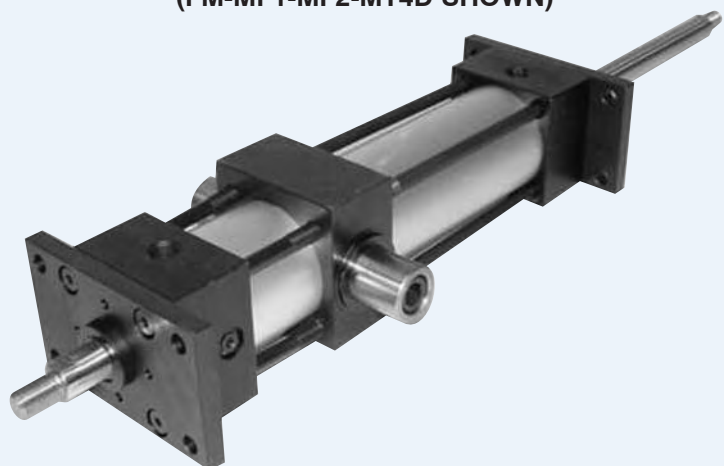
Example:

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

Part Number:

TA-MS4-MF1-5 X 12-HC-MPR

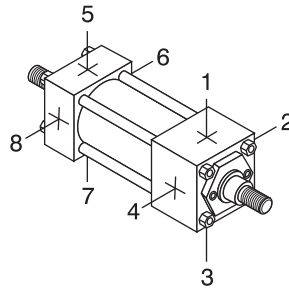
(FM-MF1-MF2-MT4D SHOWN)



SERIES 'TA' DIMENSIONS: DOUBLE ROD END

Benefits

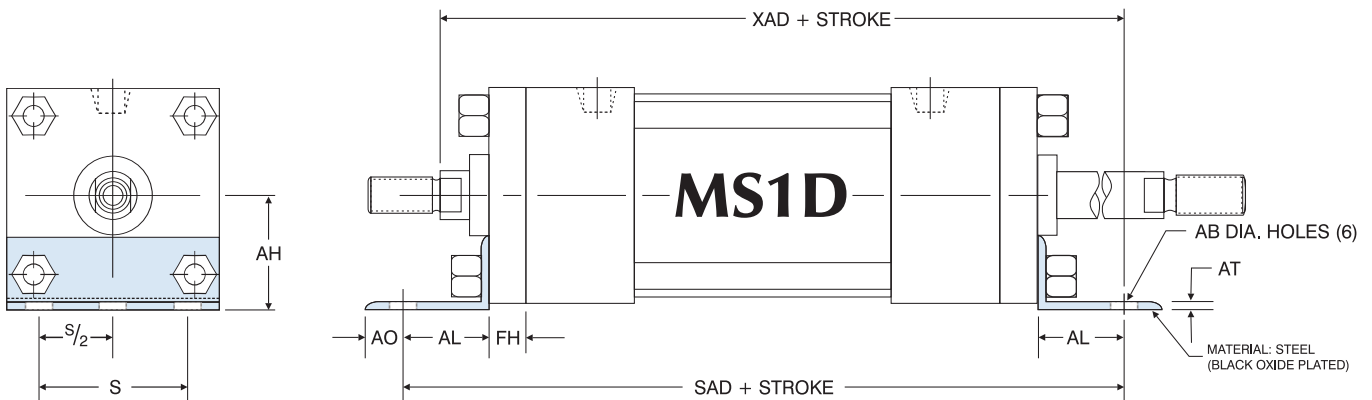
- Standard and Oversize Piston Rods available.
- Full range of Standard Options.
- Durable design. Full Rod Bearing at each end of cylinder.
- Can be provided with Hollow Piston Rods (gun-drilled through, to your size requirements).
- Can be used in adjustable extend stroke applications (by adding a stop collar on one rod end, or option "MA" - Refer to page 175).



STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

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

SERIES 'TA' DIMENSIONS: 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

*3.50 diameter round retainer on 8.00" bore. (MS1 BRACKETS BOLTED DIRECTLY TO HEAD)

SERIES 'TA' DIMENSIONS: DOUBLE ROD END

EASY FLIP OUT PAGE FOR REFERENCE

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?

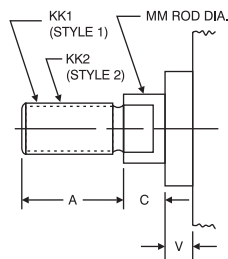
Just send us a sketch.

In most cases, quotes are turned around in one day!

PISTON ROD END STYLES

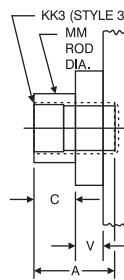
STYLE 1 & 2

KK1 & KK2



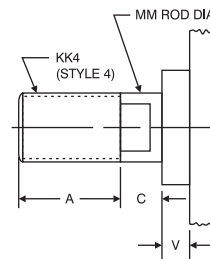
STYLE 3

KK3



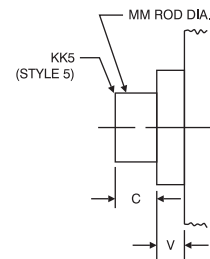
STYLE 4

KK4



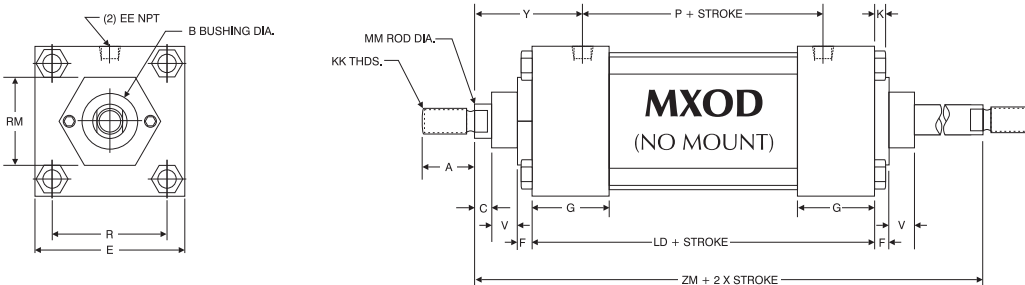
STYLE 5

KK5



BORE	MM ROD DIAMETER	STANDARD		OPTIONAL							C	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		
1.50,	0.625 Standard	0.438-20	0.750	0.500-20	0.750	0.438-20	0.750	0.625-18	0.750	No Threads	0.375	0.250
2.00, 2.50	1.000 Oversize	0.750-16	1.125	0.875-14	1.125	0.750-16	1.125	1.000-14	1.125	No Threads	0.500	0.500
3.25,	1.000 Standard	0.750-16	1.125	0.875-14	1.125	0.750-16	1.125	1.000-14	1.125	No Threads	0.500	0.250
4.00, 5.00	1.375 Oversize	1.000-14	1.625	1.250-12	1.625	1.000-14	1.625	1.375-12	1.625	No Threads	0.625	0.375
6.00 &	1.375 Standard	1.000-14	1.625	1.250-12	1.625	1.000-14	1.625	1.375-12	1.625	No Threads	0.625	0.375
8.00	1.750 Oversize	1.250-12	2.000	1.500-12	2.000	1.250-12	2.000	1.750-12	2.000	No Threads	0.750	0.500
10.00	1.750 Standard	1.250-12	2.000	1.500-12	2.000	1.250-12	2.000	1.750-12	2.000	No Threads	0.750	0.500
	2.000 Oversize	1.500-12	2.250	1.750-12	2.250	1.500-12	2.250	2.000-12	2.250	No Threads	0.875	0.375
12.00	2.000 Standard	1.500-12	2.250	1.750-12	2.250	1.500-12	2.250	2.000-12	2.250	No Threads	0.875	0.375
	2.500 Oversize	1.875-12	3.000	2.250-12	3.000	1.875-12	3.000	2.500-12	3.000	No Threads	1.000	0.500

DOUBLE ROD END DIMENSIONS: 'MXOD' (NO MOUNT)



DOUBLE ROD END BASIC DIMENSIONS 'MXOD' 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	0.438-20	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						0.750-16		1.000				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	0.313	0.438-20	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						0.750-16		1.000			2.50 SQ.	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	0.313	0.438-20	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						0.750-16		1.000			3.00 SQ.	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	0.375	0.750-16	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						1.000-14		1.375			3.75 SQ.	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	0.375	0.750-16	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						1.000-14		1.375			3.50 DIA.	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	0.438	0.750-16	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						1.000-14		1.375			3.50 DIA.	0.375	2.625	8.250
6.00	1.375 Standard	1.625	2.000	0.625	6.500	0.750	0.625	2.000	0.438	1.000-14	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						1.250-12		1.750				0.500	3.000	9.250
8.00	1.375 Standard	1.625	2.000	0.625	8.500	0.750	0.625	2.000	0.563	1.000-14	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						1.250-12		1.750				0.500	3.000	9.375
10.00	1.750 Standard	2.000	2.375	0.750	10.625	1.000	0.625	2.250	0.688	1.250-12	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			0.750			1.500-12		2.000			5.00 DIA.	0.375	3.188	10.625
12.00	2.000 Standard	2.250	2.625	0.875	12.750	1.000	0.750	2.250	0.688	1.500-12	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						1.875-12		2.500				0.500	3.438	11.625

SERIES 'TA' DIMENSIONS: DOUBLE ROD END

About Rod End Styles

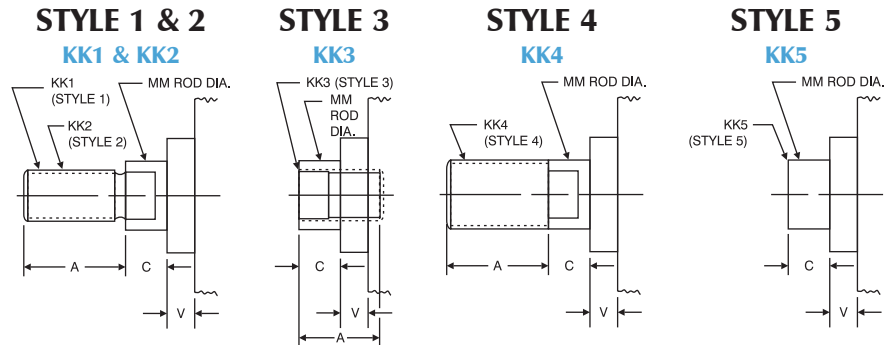
Style 1 Male Rod End is STANDARD

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).

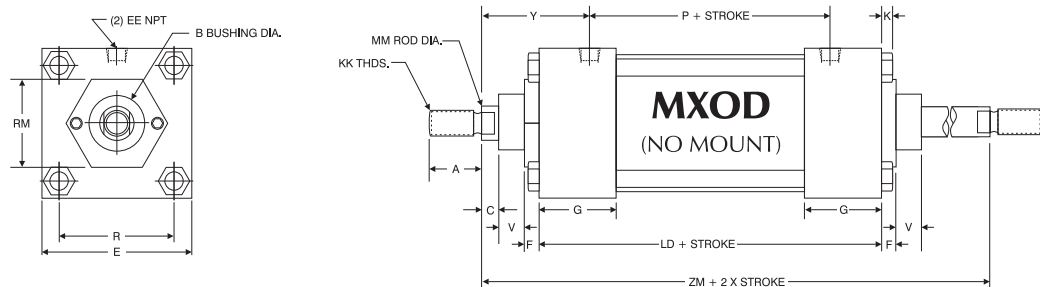
NEED SOMETHING NOT LISTED?
Just send us a sketch.
In most cases, quotes are turned around in one day!

PISTON ROD END STYLES



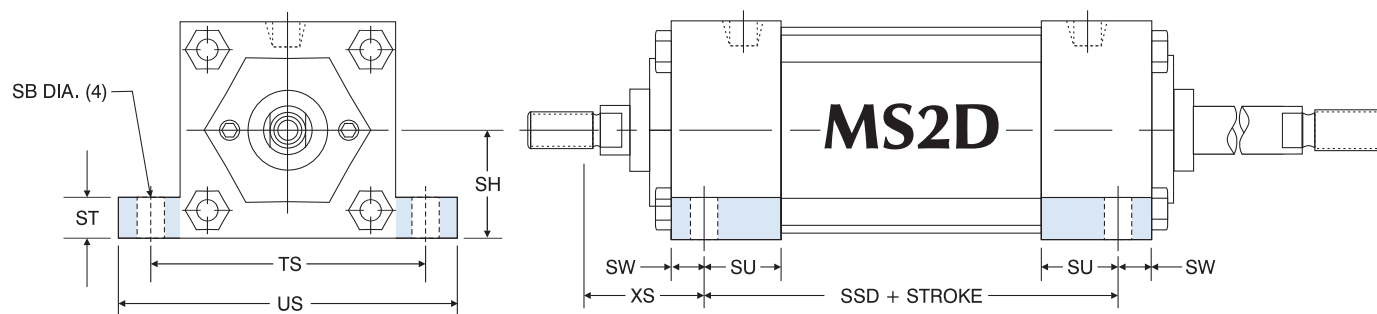
BORE	MM ROD DIAMETER	STANDARD		OPTIONAL							C	V
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male		Style 5 - Blank		
		KK1	A	KK2	A	KK3	A	KK4	A	KK5		
1.50, 2.00, 2.50	0.625 Standard	0.438-20	0.750	0.500-20	0.750	0.438-20	0.750	0.625-18	0.750	No Threads	0.375	0.250
	1.000 Oversize	0.750-16	1.125	0.875-14	1.125	0.750-16	1.125	1.000-14	1.125	No Threads	0.500	0.500
3.25, 4.00, 5.00	1.000 Standard	0.750-16	1.125	0.875-14	1.125	0.750-16	1.125	1.000-14	1.125	No Threads	0.500	0.250
	1.375 Oversize	1.000-14	1.625	1.250-12	1.625	1.000-14	1.625	1.375-12	1.625	No Threads	0.625	0.375
6.00 & 8.00	1.375 Standard	1.000-14	1.625	1.250-12	1.625	1.000-14	1.625	1.375-12	1.625	No Threads	0.625	0.375
	1.750 Oversize	1.250-12	2.000	1.500-12	2.000	1.250-12	2.000	1.750-12	2.000	No Threads	0.750	0.500
10.00	1.750 Standard	1.250-12	2.000	1.500-12	2.000	1.250-12	2.000	1.750-12	2.000	No Threads	0.750	0.500
	2.000 Oversize	1.500-12	2.250	1.750-12	2.250	1.500-12	2.250	2.000-12	2.250	No Threads	0.875	0.375
12.00	2.000 Standard	1.500-12	2.250	1.750-12	2.250	1.500-12	2.250	2.000-12	2.250	No Threads	0.875	0.375
	2.500 Oversize	1.875-12	3.000	2.250-12	3.000	1.875-12	3.000	2.500-12	3.000	No Threads	1.000	0.500

DOUBLE ROD END DIMENSIONS: 'MXOD' (NO MOUNT)



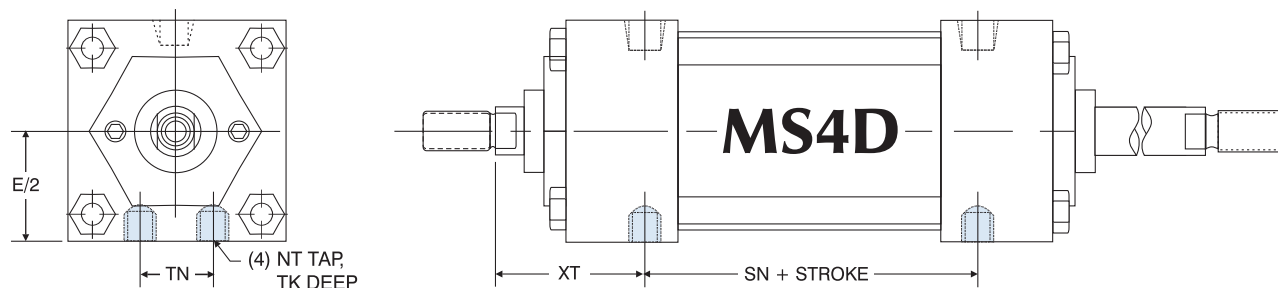
DOUBLE ROD END BASIC DIMENSIONS 'MXOD' STANDARD & OVERSIZE RODS																		
BORE	ROD DIAMETER	A	B	C	E	EE	F	G	K	KK	LD	MM	P	R	RM	V	Y	ZM
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	1.500	0.250	0.438-20	4.125	0.625	2.375	1.430	2.00 SQ.	0.250	1.875	6.125
	1.000 Oversize	1.125	1.500	0.500						0.750-16		1.000				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	0.313	0.438-20	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						0.750-16		1.000			2.50 SQ.	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	0.313	0.438-20	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						0.750-16		1.000			3.00 SQ.	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	0.375	0.750-16	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						1.000-14		1.375			3.75 SQ.	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	0.375	0.750-16	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						1.000-14		1.375			3.50 DIA.	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	0.438	0.750-16	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						1.000-14		1.375			3.50 DIA.	0.375	2.625	8.250
6.00	1.375 Standard	1.625	2.000	0.625	6.500	0.750	0.625	2.000	0.438	1.250-12	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						1.500-12		1.750				0.500	3.000	9.250
8.00	1.375 Standard	1.625	2.000	0.625	8.500	0.750	0.625	2.000	0.563	1.000-14	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						1.250-12		1.750				0.500	3.000	9.375
10.00	1.750 Standard	2.000	2.375	0.750	10.625	1.000	0.625	2.250	0.688	1.250-12	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			0.750			1.500-12		2.000			5.00 DIA.	0.375	3.188	10.625
12.00	2.000 Standard	2.250	2.625	0.875	12.750	1.000	0.750	2.250	0.688	1.500-12	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						1.875-12		2.500				0.500	3.438	11.625

SERIES 'TA' DIMENSIONS: DOUBLE ROD END BASE MOUNTS



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								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	

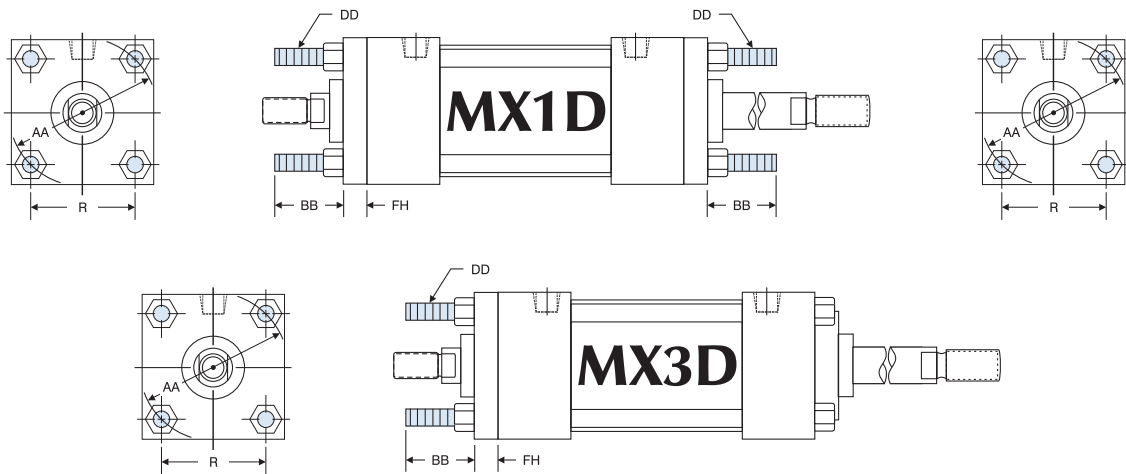
For dimensions not shown, see page 17.



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	0.250-20	0.375	0.625	1.938	2.250
	1.000 Oversize					2.313	
2.00	0.625 Standard	1.250	0.313-18	0.500	0.875	1.938	2.250
	1.000 Oversize					2.313	
2.50	0.625 Standard	1.500	0.375-16	0.625	1.250	1.938	2.375
	1.000 Oversize					2.313	
3.25	1.000 Standard	1.875	0.500-13	0.750	1.500	2.438	2.625
	1.375 Oversize					2.688	
4.00	1.000 Standard	2.250	0.500-13	0.750	2.063	2.438	2.625
	1.375 Oversize					2.688	
5.00	1.000 Standard	2.750	0.625-11	1.000	2.688	2.438	2.875
	1.375 Oversize					2.688	
6.00	1.375 Standard	3.250	0.750-10	1.125	3.250	2.813	3.125
	1.750 Oversize					3.063	
8.00	1.375 Standard	4.250	0.750-10	1.125	4.500	2.813	3.250
	1.750 Oversize					3.063	
10.00	1.750 Standard	5.313	1.000-8	1.500	5.500	3.125	4.125
	2.000 Oversize					3.250	
12.00	2.000 Standard	6.375	1.000-8	1.500	7.250	3.250	4.625
	2.500 Oversize					3.500	

For dimensions not shown, see page 17.

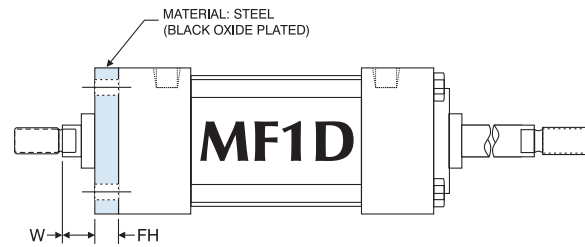
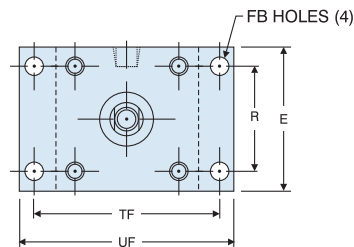
SERIES 'TA' DIMENSIONS: DOUBLE ROD END TIE ROD & FLANGE MOUNTS



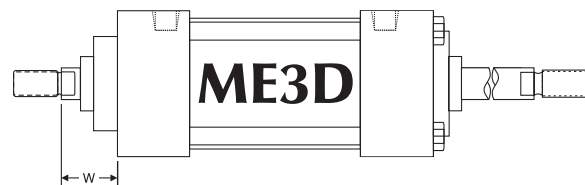
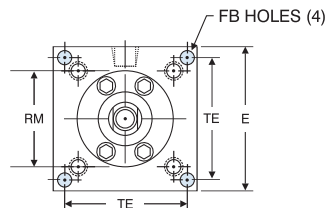
TIE ROD EXTENDED 'MX1D' & 'MX3D' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	0.250-28	0.375	1.438
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	0.313-24	0.375	1.844
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	0.313-24	0.375	2.188
	1.000 Oversize					
3.25	1.000 Standard	3.900	1.375	0.375-24	0.625	2.760
	1.375 Oversize					
4.00	1.000 Standard	4.700	1.375	0.375-24	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	0.500-20	0.625	4.100
	1.375 Oversize					
6.00	1.375 Standard	6.900	1.813	0.500-20	0.750	4.880
	1.750 Oversize					
8.00	1.375 Standard	9.100	**2.313	0.625-18	*0.625	6.440
	1.750 Oversize					
10.00	1.750 Oversize	11.200	**2.688	0.750-16	*0.625	7.920
	2.000 Oversize					
12.00	2.000 Standard	13.300	**2.688	0.750-16	*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.



1.50" - 6.00" BORES



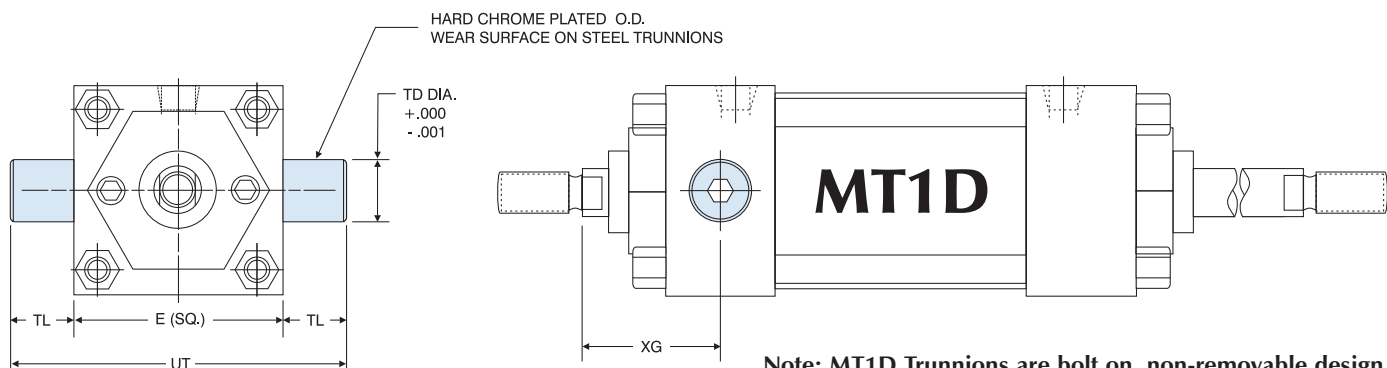
8.00" - 12.00" BORES ONLY

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS									
BORE	ROD DIAMETER	E	FB	FH	R	RM	TE	TF	UF
1.50	0.625 Standard	2.000	0.313	0.375	1.438	—	—	2.750	3.375
	1.000 Oversize								
2.00	0.625 Standard	2.500	0.375	0.375	1.844	—	—	3.375	4.125
	1.000 Oversize								
2.50	0.625 Standard	3.000	0.375	0.375	2.188	—	—	3.875	4.625
	1.000 Oversize								
3.25	1.000 Standard	3.750	0.438	0.625	2.760	—	—	4.688	5.500
	1.375 Oversize								
4.00	1.000 Standard	4.500	0.438	0.625	3.320	—	—	5.438	6.250
	1.375 Oversize								

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS									
BORE	ROD DIAMETER	E	FB	FH	R	RM	TE	TF	UF
5.00	1.000 Standard	5.500	0.563	0.625	4.100	—	—	6.625	7.625
	1.375 Oversize								
6.00	1.375 Standard	6.500	0.563	0.750	4.875	—	—	7.625	8.625
	1.750 Oversize								
8.00	1.375 Standard	8.500	0.688	N/A	N/A	3.500	7.570	N/A	N/A
	1.750 Oversize								
10.00	1.750 Standard	10.625	0.813	N/A	N/A	3.500	9.400	N/A	N/A
	2.000 Oversize								
12.00	2.000 Standard	12.750	0.813	N/A	N/A	5	11.100	N/A	N/A
	2.500 Oversize								

For dimensions not shown, see page 17.

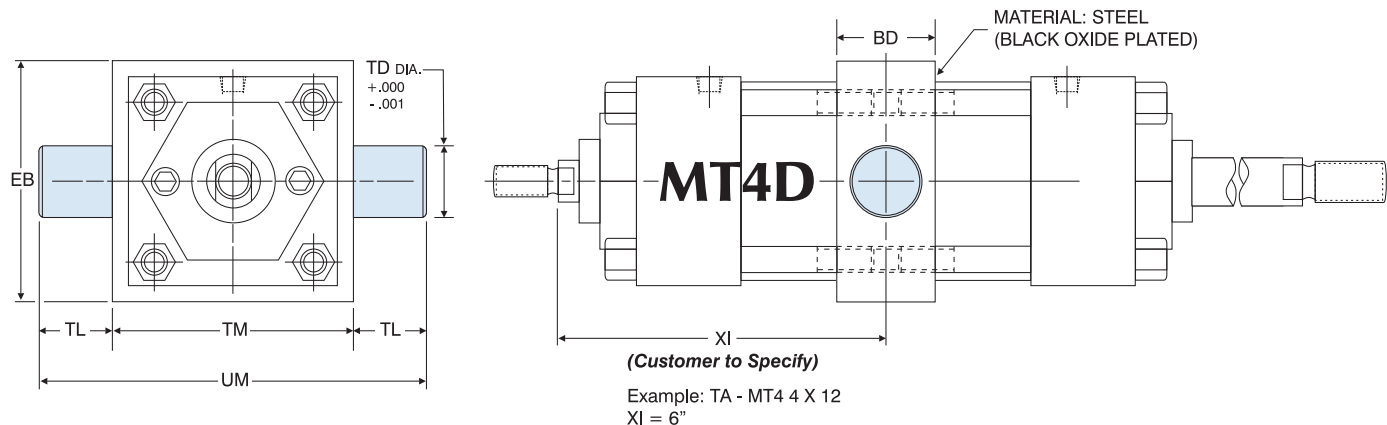
SERIES 'TA' DIMENSIONS: DOUBLE ROD END PIVOT MOUNTS



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	2.000	1.000	1.000	4.000	1.750
	N/A*					N/A
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 page 17.



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	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	

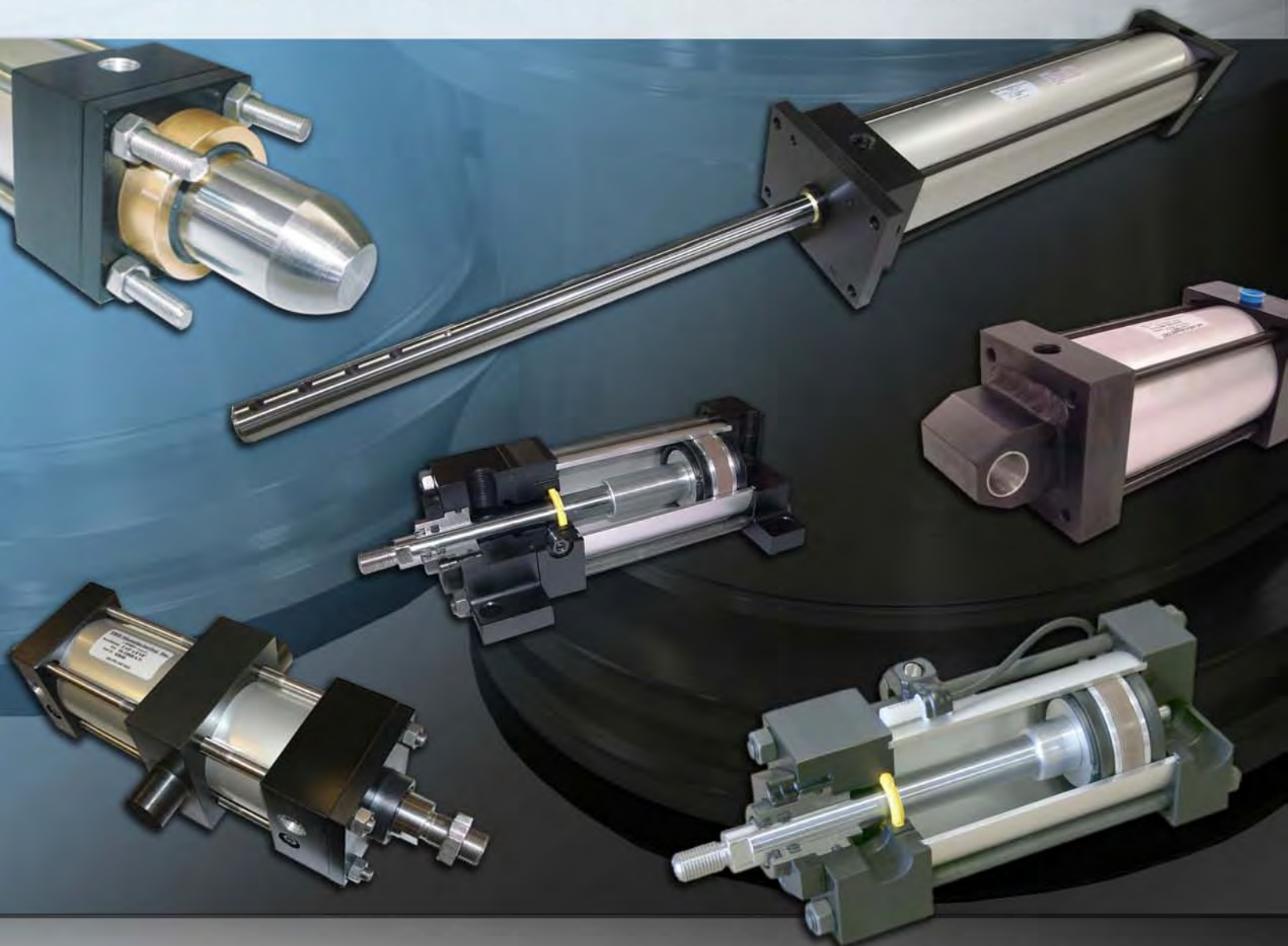
'MT1D', 'MT4D' STANDARD CUSHION LOCATIONS		
MOUNT	HEAD CUSHION	CAP CUSHION
MT1D	3	6
MT4D	2	6

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

TD Series NFPA ***TOUGH-DUTY***

Aluminum Cylinders **1.50" to 8.00" Bore**

Refer to TA Series for dimensions



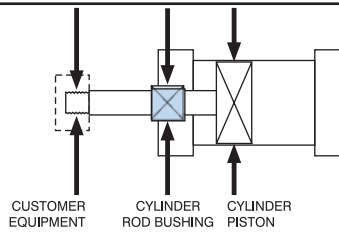
95% OF OUR CYLINDERS SHIP IN 2-3 DAYS!
ONE DAY RUSH SERVICE AVAILABLE ON ALL CATALOGED CYLINDER MODELS!

SERIES 'TD' TOUGH-DUTY

Floating Rod Bushing

SELF ALIGNMENT FEATURE

Rod Bushing is designed to float .002", improving 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 page 169 in options section, "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.
- **PTFE Piston Wear Band** - 90% Virgin PTFE with performance additives to increase Compressive Modulus to 65,000 PSI. Wear Band material is designed to provide low-friction, long life operation even in the most demanding applications.

Performance options (Refer to pages 168-182 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).
- **EN** - Electroless Nickel Plated and Stainless Steel Fasteners provide corrosion resistance.
- **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.
- **STEEL TUBE** - Hydraulic grade chrome plated I.D. and honed steel tubing, black epoxy paint finish O.D.

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 (-25°C to 90°C)
Fluorocarbon: 0°F to 400°F (-20°C to 200°C)

HOW TO ORDER: SERIES 'TD' (TOUGH-DUTY)

TD - **MF1** - **2.50** 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" 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" - 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)
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)

BORE	
1.50	2.00
2.50	3.25
4.00	5.00
6.00	8.00

STROKE	
0" to 120" Made to Order	

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

OPTIONS	
ADD LENGTH TO CYLINDER - SEE "OPTION LENGTH ADDER" CHART BELOW.	
A =	EXTENDED PISTON ROD THREAD (Example: A = 2")
AS	ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, Example: AS = 4")
BSP	BSP PORTS (SPECIFY SIZE, Example: BSP = .25")
C =	EXTENDED PISTON ROD (Example: IF C = 0.50", THEN 1" ROD EXTENSION IS C = 1.50")
EN	ELECTROLESS NICKEL PLATED (Refer to page 172 for specifications)
KK2	LARGE MALE ROD THREAD
KK3	FEMALE ROD THREAD
KK3S	STUDDER 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 (6" MAX. STROKE) Available on Double Rod End Models
MAB	MICRO-ADJUST WITH SOUND DAMPENING BUMPER (6" MAX. STROKE)
MPR	MAGNETIC PISTON FOR REED OR SOLID STATE SWITCHES - TRD MODELS: R10, R10P, RAC, RHT & MSS (Refer to pages 220-226 for selection)
MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
OP	OPTIONAL PORT LOCATION (Example: Ports @ 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, AND FASTENERS
SSF	STAINLESS STEEL FASTENERS
SSR	STAINLESS STEEL PISTON ROD
SST	STAINLESS STEEL TIE RODS & NUTS
X ST	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) (Example: TD MS4 2 X 24" EFFECTIVE STROKE-ST=4)
TMS	STEEL CYLINDER TUBE, BLACK EPOXY PAINT FINISH
VS	FLUOROCARBON SEALS
XX	SPECIAL VARIATION (SPECIFY)

STYLE	
SINGLE ROD (LEAVE BLANK)	
D = DOUBLE ROD END	

Notes:

- Ordering example for adjustable cushions in non-standard locations: H3C7
- Refer to page 170 for assistance in cushion length selection.
- Cushions can be ordered on same side as ports. Refer to page 177 for dimensions.

*STEEL TUBES do not work with MPR magnetic pistons. Refer to pages 227-229 for Balluff end of stroke sensors.

About our Part Number System

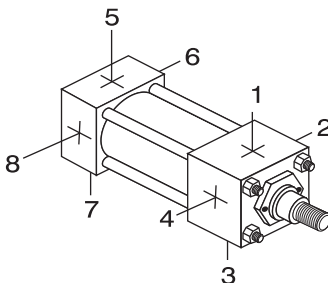
- Simple, easy to understand
- No excessive codes!
- Eliminates mistakes when ordering

Example: A 2.50" Bore by 10" Stroke NFPA cylinder, Front Flange Mount, (NON-ADJUSTABLE Head & Cap Cushions), and Magnetic Piston for Switches.

Part Number: TD-MF1-2.50 x 10-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

*Note: The desired Stop Tube length adds directly to the overall cylinder length.

NFPA MOUNTS

(Refer to pages 10-15 for mounting dimensions)

MF1 1.50" - 6.00" Bores Page 13	MF2 1.50" - 6.00" Bores Page 13	ME3 8.00" Bores Page 13	ME4 8.00" Bores Page 13	MP1 1.50" - 8.00" Bores Page 11	MP2 1.50" - 6.00" Bores Page 11
MP4 1.50" - 4.00" Bores Page 11	MS1 1.50" - 8.00" Bores Page 14	MS2 1.50" - 8.00" Bores Page 14	MS4 1.50" - 8.00" Bores Page 15	MT1 1.50" - 8.00" Bores Page 12	MT2 1.50" - 8.00" Bores Page 12
MT4 1.50" - 8.00" Bores Page 12	MX0 1.50" - 8.00" Bores Page 10	MX1 1.50" - 8.00" Bores Page 13	MX2 1.50" - 8.00" Bores Page 13	MX3 1.50" - 8.00" Bores Page 13	

NOTES

Technical Data Page 256	Switches Page 220	Accessories Page 206	Options Page 168	TD - Base Dimensions & Mounts refer to TA section	TD - How to Order
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