

NFPA CYLINDERS

NASON

NEW THINKING



Nason actuators are recognized for their durability and long-lasting performance

- Pneumatic & Hydraulic
- NFPA interchangeable
- 1.50" - 12" Bores
- Precision Made to Order
- High Quality
- Heavy Duty Construction
- Up to 3,000 PSI Hydraulic



NAC Series, Nason Air Cylinder
HDC Series, Heavy Duty Cylinder
SNC Series, Sleeve Nut Construction
HHD Series, Hydraulic Heavy Duty
HMD Series, Hydraulic Medium Duty
WDN Series, Wash Down Nason
CRN Series, Corrosion Resistant Nason

www.mfcp.com

DELIVERY SCHEDULE

Nason Deliveries (FOB Factory)

Delivery Schedule

SERIES 'NAC' (Nason Air Cylinders)	2-3 Days
SERIES 'HDC' (Heavy Duty Cylinder)	2-3 Days
SERIES 'SNC' (Sleeve Nut Construction)	2-3 Days
SERIES 'SNC' (Sleeve Nut Construction) with Rod Lock	2-3 Days
SERIES 'WDN' (Wash Down Nason)	3-4 Days
SERIES 'CRN' (Corrosion Resistant Nason) (excluding MP1, MP4, MS2 mounts)	2-3 Days
SERIES 'CRN' (Corrosion Resistant Nason) with MP1, MP4, MS2 mounts	3-5 Days
SERIES 'HMD' (Hydraulic Medium Duty)	2-3 Days
SERIES 'HHD' (Hydraulic Heavy Duty)	2-3 Days
SERIES 'HHD' (Hydraulic Heavy Duty) with Rod Lock	3-4 Weeks
Nason Switches	1 Day
Balluff STROKEMASTER	7-10 Days
Balluff Micropulses Transducers	10-12 Days
Rod Clevis, Pins, Mounts & Alignment Couplers	1 Day

Standard Options Included in the above deliveries

Options with Extended Deliveries

SE, SR (with catalog spring rates)	3-5 Days
SMT1, SMT2 (one Piece Steel Mount)	3-5 Days
MP4SP Mounts	3-5 Days
Special Piston Materials (PMB, PMC, PMD options)	5-7 Days
EN Plating Option	5-7 Days
Non Catalog welded mounts (for bore sizes up to 12")	5-7 Days
LTE Seal Option	35-40 Days

**RUSH SERVICE IS AVAILABLE FOR ALL NASON PRODUCTS.
CONTACT YOUR LOCAL NASON DISTRIBUTOR FOR DETAILS.**

WARRANTY & RETURN

NEW 3 YEAR WARRANTY

Nason is located in Walhalla, South Carolina. We take great pride in our products. Nason warranties its cylinders for a full 3 years to be free from defects in material and workmanship. Nason must be notified prior to returning product for warranty evaluation. Contact your local Nason distributor to obtain an RGA (Returned Goods Authorization Number) for proper tracking and expedite service on all warranty evaluations. Nason 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 Nason 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 Nason 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 Nason of any contract.

TABLE OF CONTENTS

	<u>PAGE</u>
DELIVERY SCHEDULE	2
WARRANTY & RETURN INFO	2
QUICK GUIDE - How to Design the Right Cylinder for your Application	4-6
SERIES 'NAC' (Nason Air Cylinders)	7-20
SERIES 'HDC' (Heavy Duty Cylinder)	21-24
SERIES 'SNC' (Sleeve Nut Construction)	25-37
SERIES 'SNC' (Sleeve Nut Construction) with ROD LOCK	38-59
SERIES 'WDN' (Wash Down Nason)	60-71
SERIES 'CRN' (Corrosion Resistant Nason)	72-81
SERIES 'HMD' (Hydraulic Medium Duty)	82-113
SERIES 'HHD' (Hydraulic Heavy Duty)	114-141
Options - Pneumatic/Air	142-161
Options - Hydraulic	162-171
Accessories: Clevis, Pins & Mounts	172-176
Accessories: Spherical Rod Eyes	177
Accessories: Trunnion Blocks	178-180
Accessories: Alignment Couplers	181-182
Switches	184-191
STROKEMASTER	192-195
Balluff Transducers	196-197
Technical Data: General How to	198-200
Technical Data: Force & Torque Charts	201-204
Technical Data: Weight Charts	205-207
Technical Data: Hydraulic Cylinder Speeds	208
Technical Data: Seal Kits	209-212
Conversion Charts & Common Fluid Power Formulas	213-214
Nason Application Checklist	215-216

QUICK GUIDE – Design the right cylinder for your application

Nason 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 199 and 200.

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.

Nason 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 Nason 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.

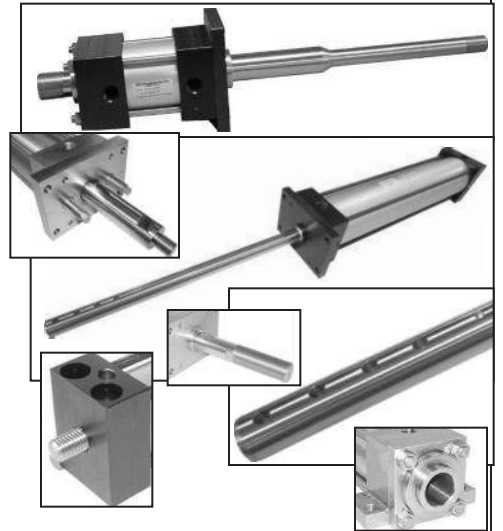
The design possibilities are unlimited. Many times a customer will add length to the rod to locate the cylinder away from a hostile environment or to provide easy access to the cylinder. One customer uses a 3” stroke cylinder with 36” of rod extension to make the cylinder easy to service and make adjustments.

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, Nason 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 $+.060$ ”. Nason 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 142-171 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 149 for special temperature lubes and page 154 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 us 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 us with the details; let us show you how to maximize cylinder life and improve performance!



NASON

NEW THINKING

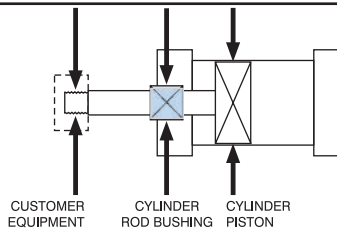


SERIES 'NAC' (NFPA) CYLINDER

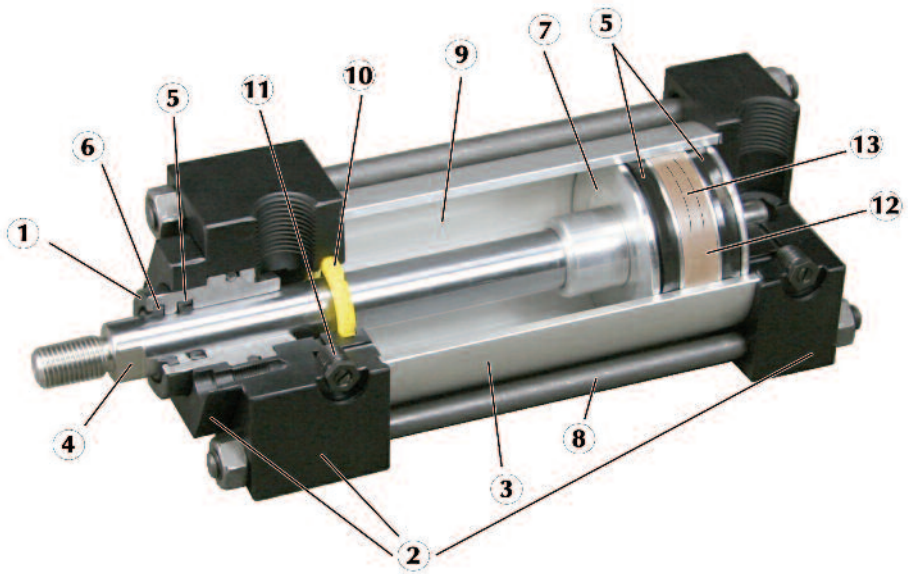
Floating Rod Bushing

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 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** – 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 Nason magnetically operated reed and solid state switches (refer to pages 151).

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)

Performance options:

- **ST** – Stop tubes are used to reduce rod bearing and piston stress (refer to page 156 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 'NAC' (STANDARD CYLINDER)

NAC - **MF1** - **2.50** x **10** - **HC** - **MPR**

SERIES	
NAC	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

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

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: FCH, FCELH

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")
A / O	AIR / OIL PISTON
X B	.250" URETHANE BUMPER BOTH ENDS
X BC	.250" URETHANE BUMPER CAP ONLY
X 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 147 for specifications)
KK2	LARGE MALE ROD THREAD
KK3	FEMALE ROD THREAD
KK3S	STUDD 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 154 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 - NASON MODELS: R10, R10P RAC, RHT & MSS (Refer to pages 184-191 for selection)
MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
NR	NON-ROTATING (Refer to page 151 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)
X SE	SPRING EXTEND (1.50, 2.00, 2.50 bore)
X 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
X 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 154 for specifications)
VS	FLUOROCARBON SEALS
XX	SPECIAL VARIATION (SPECIFY)

About our Part Number System

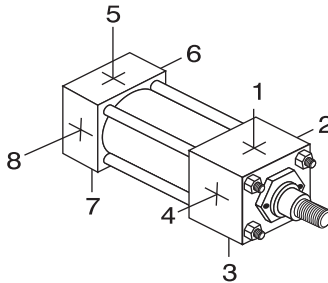
- Simple, easy to understand
- No excessive codes!
- Eliminates mistakes when ordering

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

Part Number: NAC-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



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	OPTION							
	B	BC	BH	ELC	ELH	SE	SR	ST* (STOP TUBE) Example: ST=2
1.50	0.500	0.250	0.250	1.000	1.000			Refer to page 180
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 'NAC' DIMENSIONS: BASIC CYLINDER (NO MOUNT)

EASY FLIP OUT PAGE FOR REFERENCE

About Rod End Styles

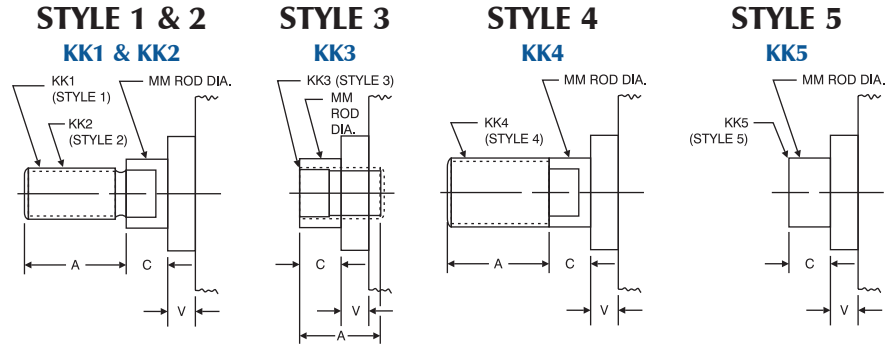
Style 1 Male Rod End is STANDARD

Other NFPA Styles can be specified (See Chart).

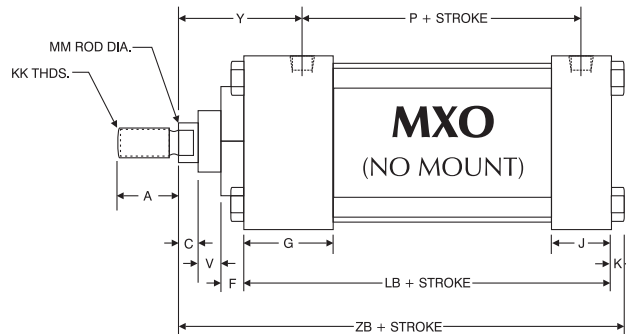
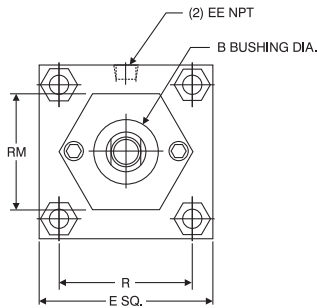
Need a rod end not listed? NO PROBLEM! Each Piston Rod is made to order and does not delay shipment. Coarse (UNC) threads, Metric threads or just plain rod ends are common. Thread lengths are also made to order (Specify: "A"=Length).

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

PISTON ROD END STYLES



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	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	
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	0.500	
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	0.250	
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	0.375	
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	No Threads	0.625	0.375	
8.00	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	0.500	
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	0.500	
	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	0.375	
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	0.375	
	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	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	7/16 -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							3/4 -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	3/4 -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							3/4 -16		1.000			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	0.625	2.500	2.188	1.75 HEX	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	
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	1.000	2.750	2.766	2.75 DIA.	0.250	2.375	6.000
	1.375 Oversize	1.625	2.000	0.625							1-14		1.375			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	3/4 -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							1-14		1.375			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	3/4 -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							1-14		1.375			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	1-14	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 1/4 -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	1-14	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 1/4 -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 1/4 -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 1/2 -12				2.000		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 1/2 -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 7/8 -12		2.500			0.500	3.438	9.813	

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

About Rod End Styles

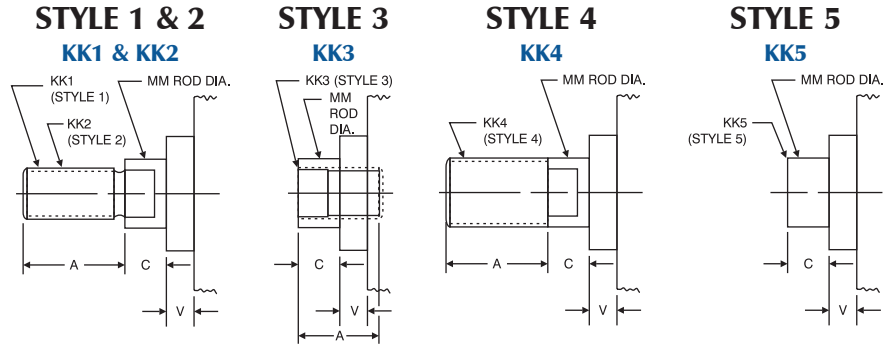
Style 1 Male Rod End is STANDARD

Other NFPA Styles can be specified (See Chart).

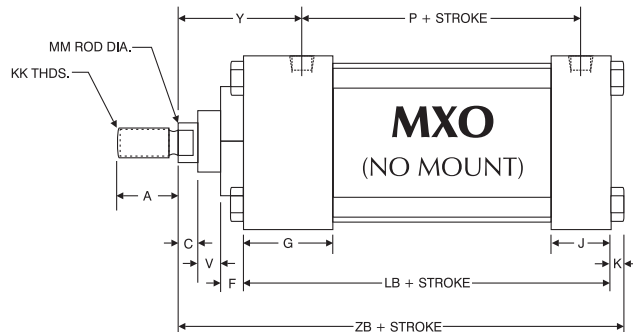
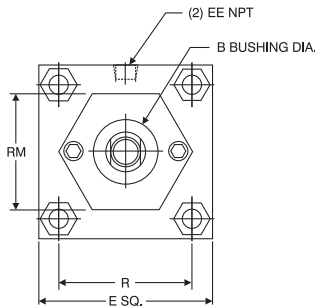
Need a rod end not listed?
NO PROBLEM! Each Piston Rod is made to order and does not delay shipment. Coarse (UNC) threads, Metric threads or just plain rod ends are common. Thread lengths are also made to order (Specify: "A"=Length).

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PISTON ROD END STYLES

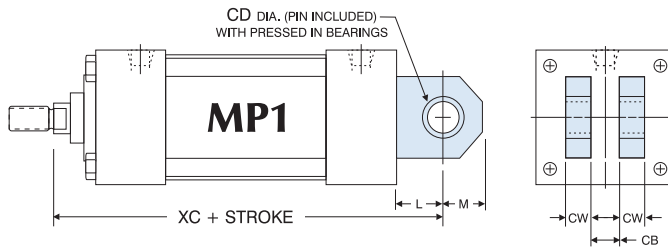


BORE	MM ROD DIAMETER	STANDARD		OPTIONAL							C	V
		Style 1 - Male KK1	A	Style 2 - Male KK2	A	Style 3 - Female KK3	A	Style 4 - Male KK4	A	Style 5 - Blank KK5		
1.50	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.250
2.00, 2.50	1.000 Oversize	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1-14	1.125	No Threads	0.500	0.500
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	0.250
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	0.375
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
	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	0.500
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	0.500
	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	0.375
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	0.375
	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	0.500



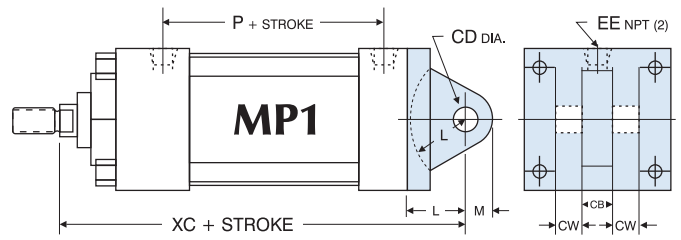
BASIC DIMENSIONS 'MXO' STANDARD & OVERSIZE RODS																			
BORE	ROD DIAMETER	A	B	C	E	EE	F	G	J	K	KK	LB	MM	P	R	RM	V	Y	ZB
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16 -20	3.625	0.625	2.375	1.438	2.00 SQ.	0.250	1.875	4.875
	1.000 Oversize	1.125	1.500	0.500							3/4 -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	3/4 -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							3/4 -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	7/16 -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							3/4 -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	3/4 -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							1-14		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	3/4 -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							1-14		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	3/4 -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							1-14		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	1-14	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 1/4 -12		1.750			5.00 DIA.	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	1-14	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 1/4 -12		1.750			5.00 DIA.	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 1/4 -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 1/2 -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 1/2 -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 7/8 -12		2.500			5.00 DIA.	0.500	3.438	9.813

SERIES 'NAC' DIMENSIONS: PIVOT MOUNTS



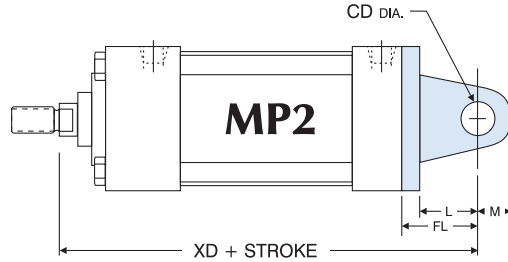
EXTRUDED MP1 MOUNT

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



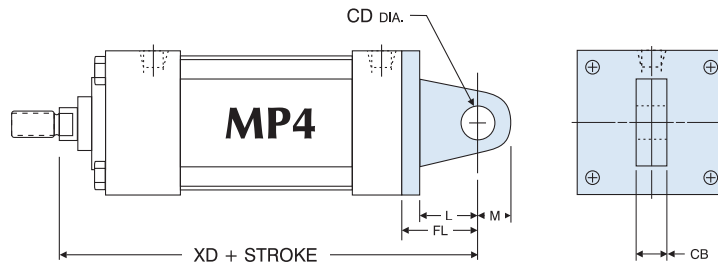
IRON CASTING MP1 MOUNT

(OPTIONAL)**



MP2 MOUNT

(IRON CASTING)



MP4 MOUNT

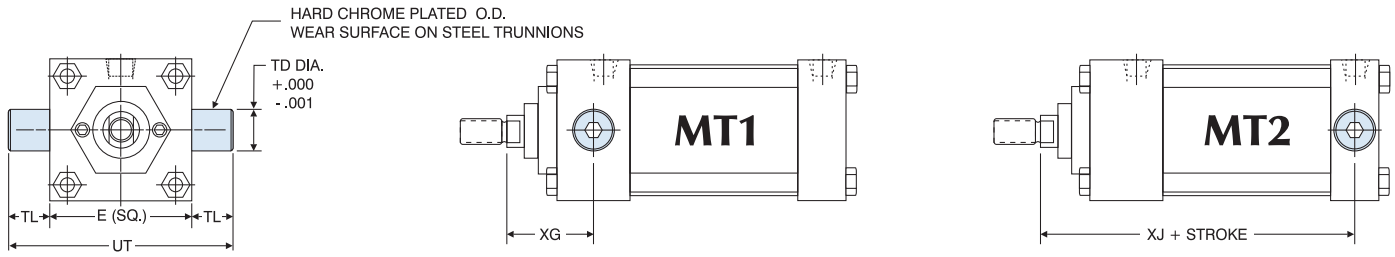
(IRON CASTING: 1.50" - 4.00" BORES, WELDMNT: 5.00" - 6.00" BORES*)

'MP1', 'MP2' CLEVIS AND 'MP4' EYE MOUNT DIMENSIONS									ACCESSORIES (SEE PAGES 173-175 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 'NAC' DIMENSIONS: PIVOT MOUNTS

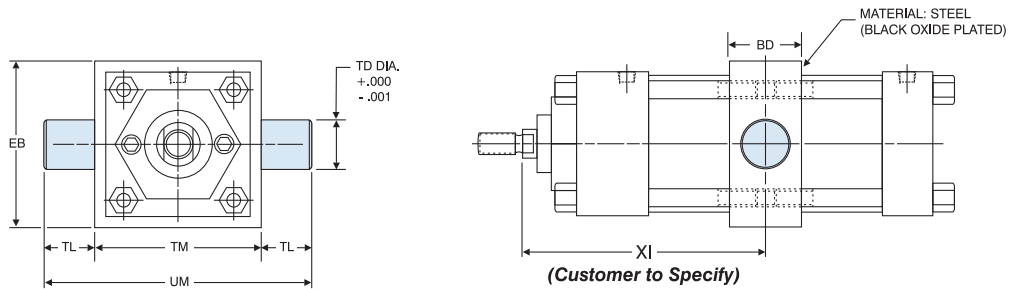


MT1 / MT2

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 173-175 FOR DIMENSIONS)			
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	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.

'MT4' INTERMEDIATE TRUNNION MOUNT DIMENSIONS							XI
BORE	BD	EB	TD	TL	TM	UM	
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.

SERIES 'NAC' DIMENSIONS: TIE ROD & FLANGE MOUNTS

NAC - How to Order

NAC - Base Dimensions

NAC - Single Rod Mounts

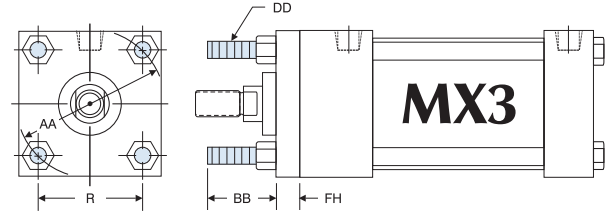
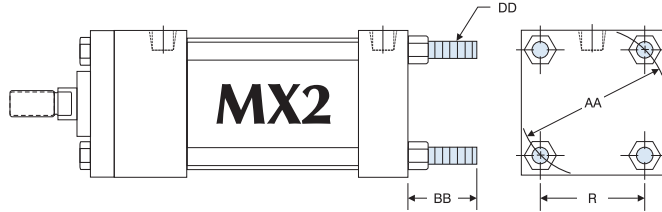
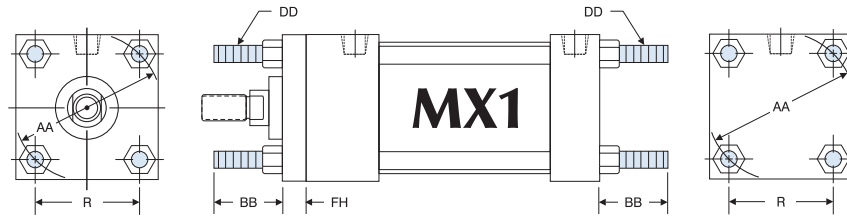
NAC - Double Rod Mounts

Options Page 142

Accessories Page 172

Switches Page 184

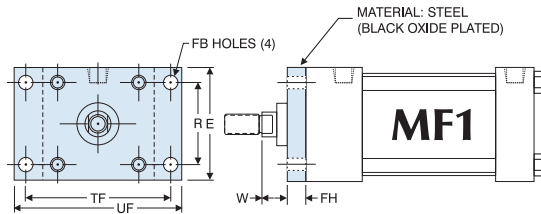
Technical Data Page 198



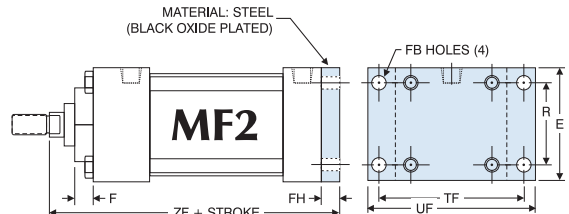
TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4 -28	0.375	1.430
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16 -24	0.375	1.840
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16 -24	0.375	2.190
	1.000 Oversize					
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					

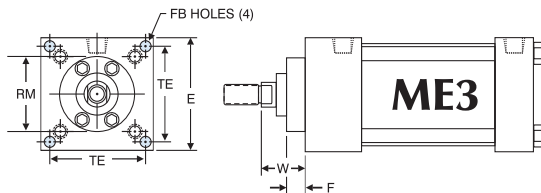
*MX1 & MX3 have full square bushing retainer on 1.50" - 6.00" bores, round retainers on 8.00" - 12.00" bores.
 **BB dimension from face of head.
 For dimensions not shown, see page 10.



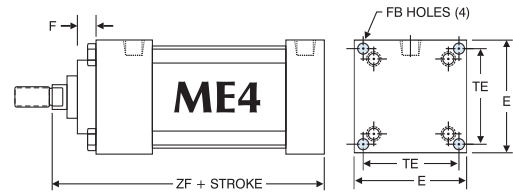
1.50" - 6.00" BORES



1.50" - 6.00" BORES



8.00" - 12.00" BORES



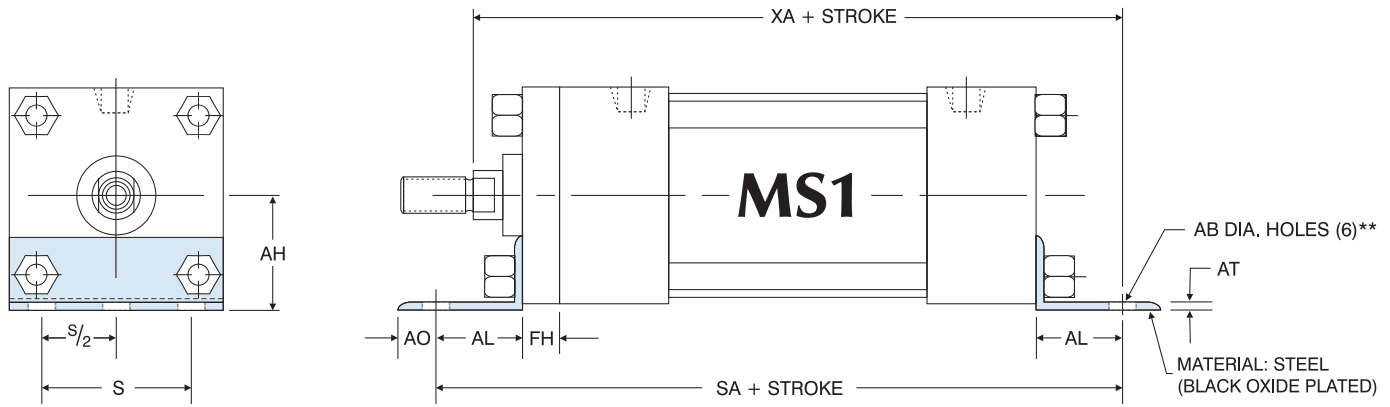
8.00" - 12.00" BORES

'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.

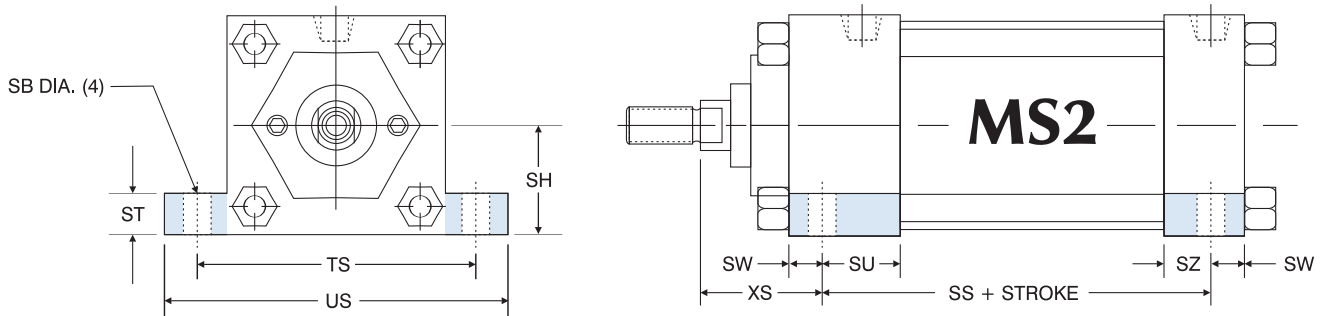
SERIES 'NAC' DIMENSIONS: BASE MOUNTS



'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)

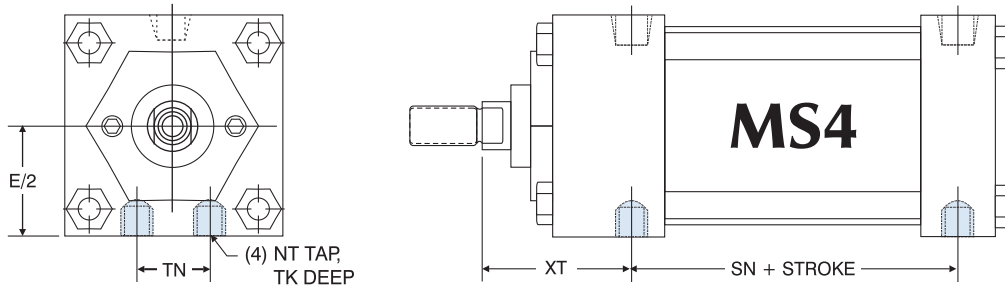
**1.50" bore has (4) AB diameter holes.



'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										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
	1.000 Oversize										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
	1.000 Oversize										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										2.125
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										2.125
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										2.313
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										2.563
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										2.563

For dimensions not shown, see page 10.

SERIES 'NAC' 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	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 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.

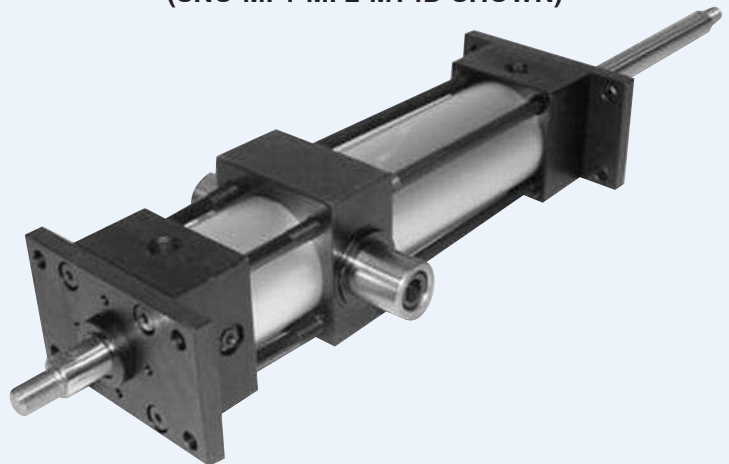
Example:

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

Part Number:

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

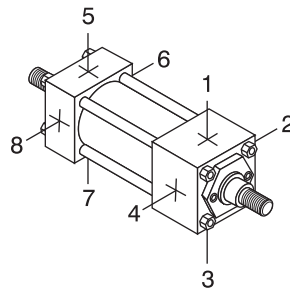
(SNC-MF1-MF2-MT4D SHOWN)



SERIES 'NAC' DIMENSIONS: DOUBLE ROD END

Benefits

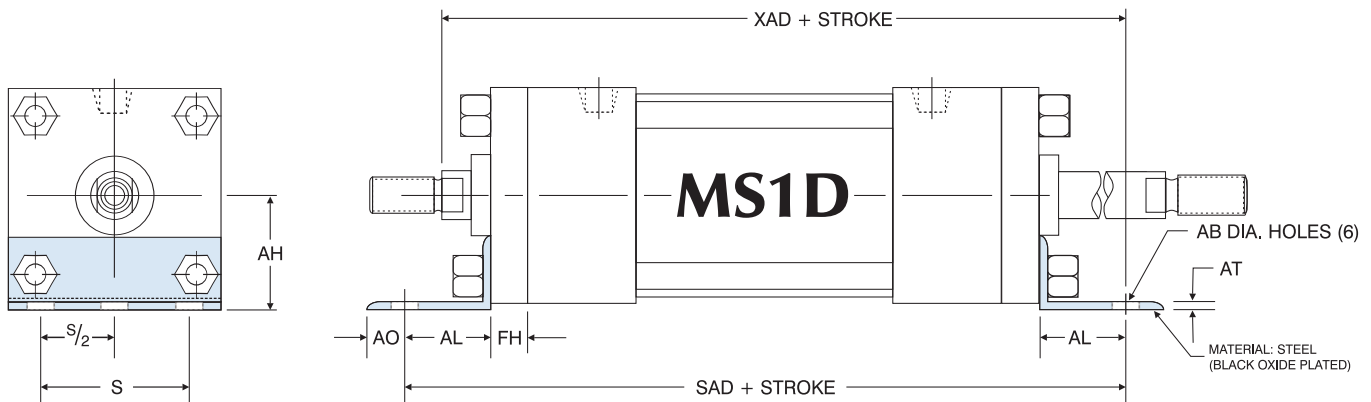
- Standard and Oversize Piston Rods available.
- Full range of Standard Options.
- Durable design. Full Rod Bearing at each end of cylinder.
- Can be provided with Hollow Piston Rods (gun-drilled through, to your size requirements).
- Can be used in adjustable extend stroke applications (by adding a stop collar on one rod end, or option "MA" - Refer to page 150).



STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

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

SERIES 'NAC' 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 'NAC' DIMENSIONS: DOUBLE ROD END

EASY FLIP OUT PAGE FOR REFERENCE

About Rod End Styles

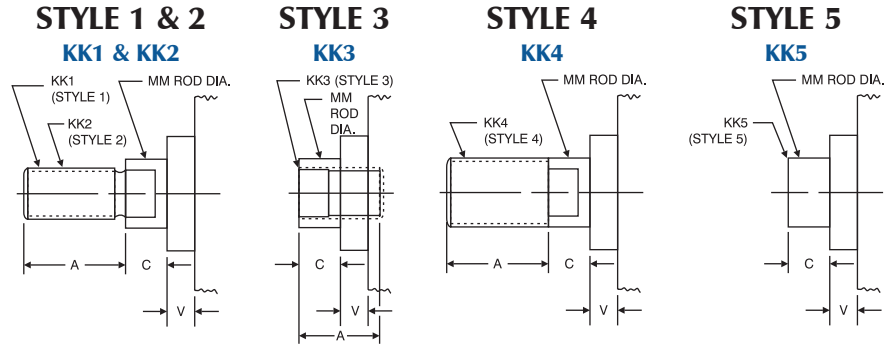
Style 1 Male Rod End is STANDARD

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).

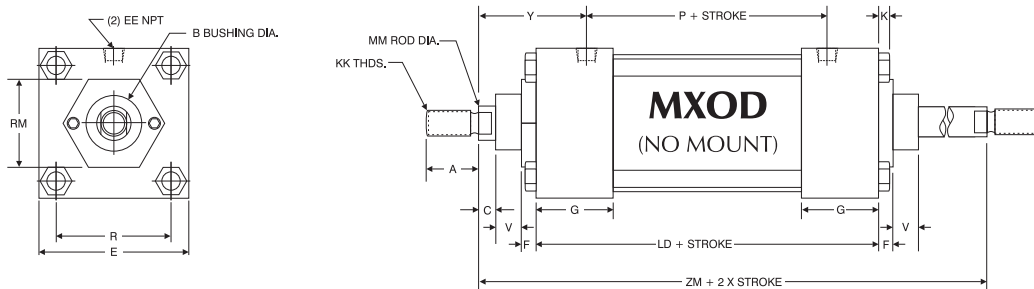
NEED SOMETHING NOT LISTED? Just send us a sketch. In most cases, quotes are turned around in one day!

PISTON ROD END STYLES



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	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
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	0.500
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	0.250
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	0.375
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	No Threads	0.625	0.375
8.00	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	0.500
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	0.500
	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	0.375
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	0.375
	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	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	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			0.500			
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			0.500			
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			0.375			
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			0.375			
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			0.375			
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		0.375			3.188			
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			

SERIES 'NAC' DIMENSIONS: DOUBLE ROD END

About Rod End Styles

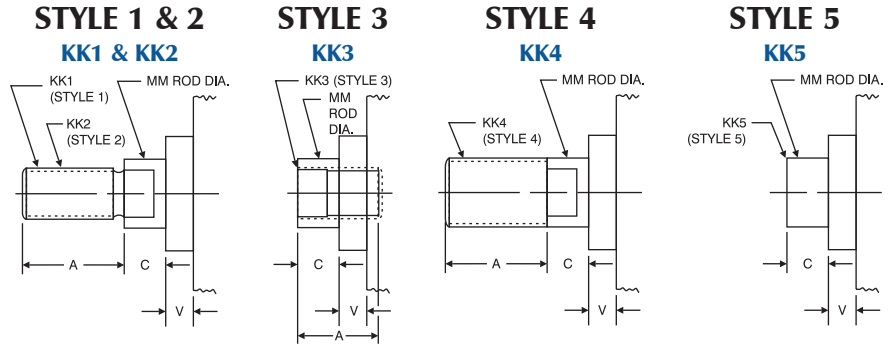
Style 1 Male Rod End is STANDARD

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).

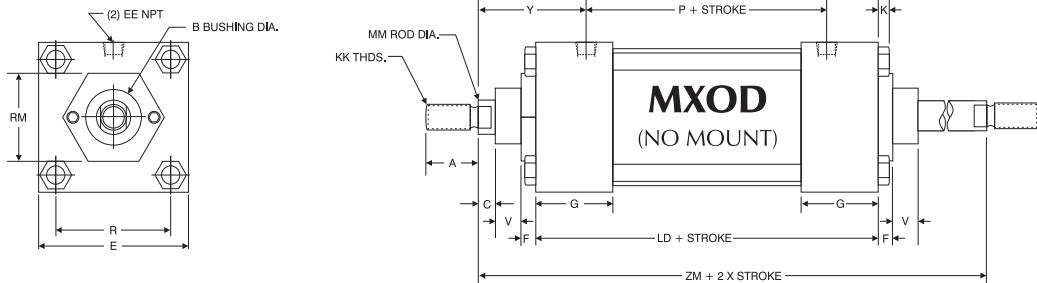
NEED SOMETHING NOT LISTED? Just send us a sketch. In most cases, quotes are turned around in one day!

PISTON ROD END STYLES



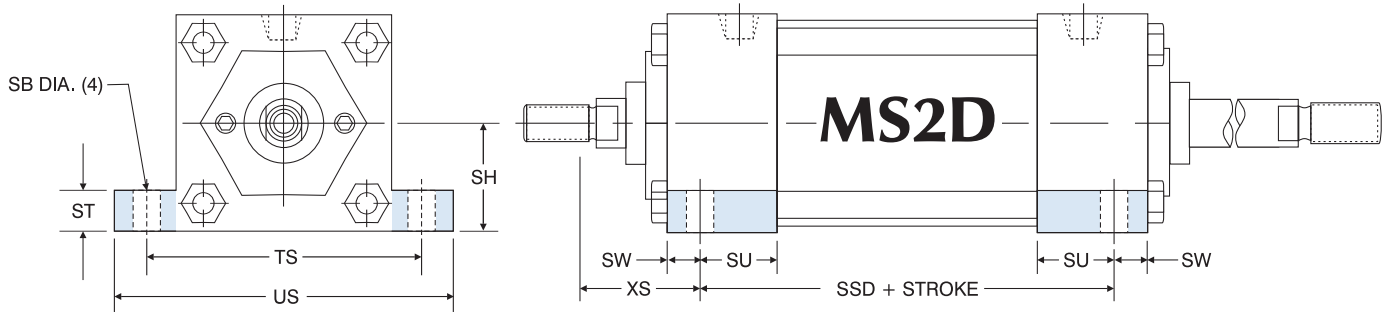
BORE	MM ROD DIAMETER	STANDARD		OPTIONAL							C	V
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male		Style 5 - Blank		
		KK1	A	KK2	A	KK3	A	KK4	A	KK5		
1.50,	0.625 Standard	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.250
2.00, 2.50	1.000 Oversize	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1 -14	1.125	No Threads	0.500	0.500
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	0.250
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	0.375
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
	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	0.500
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	0.500
	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	0.375
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	0.375
	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	0.500

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



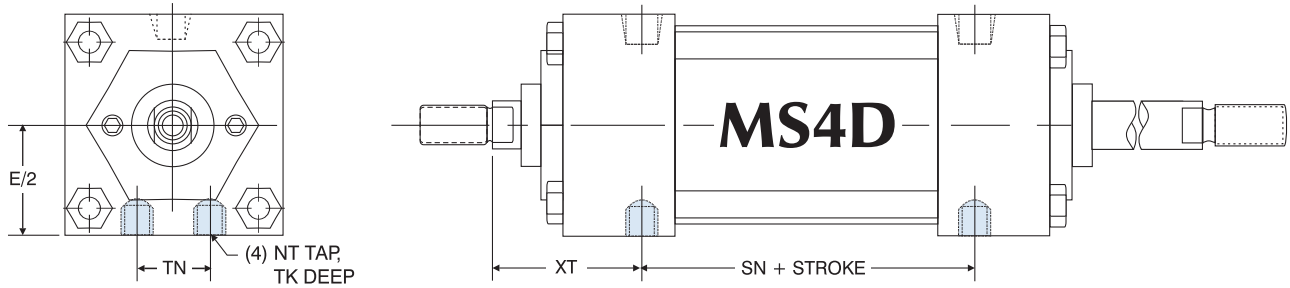
DOUBLE ROD END BASIC DIMENSIONS 'MXOD' STANDARD & OVERSIZE RODS																		
BORE	ROD DIAMETER	A	B	C	E	EE	F	G	K	KK	LD	MM	P	R	RM	V	Y	ZM
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	1.500	0.250	7/16 -20	4.125	0.625	2.375	1.430	2.00 SQ.	0.250	1.875	6.125
	1.000 Oversize	1.125	1.500	0.500						3/4 -16		1.000			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	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			2.50 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	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			3.00 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	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			3.75 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	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			3.50 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	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			3.50 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 -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	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 -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	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 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			0.750			1 1/2 -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 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	3.438	11.625

SERIES 'NAC' 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									
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									

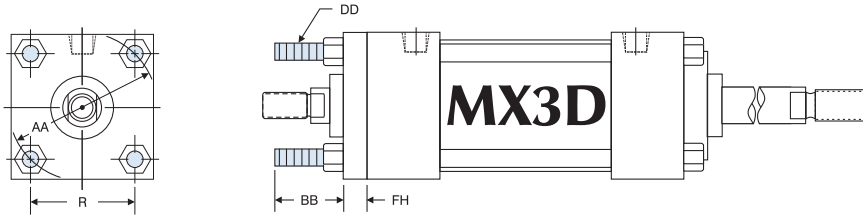
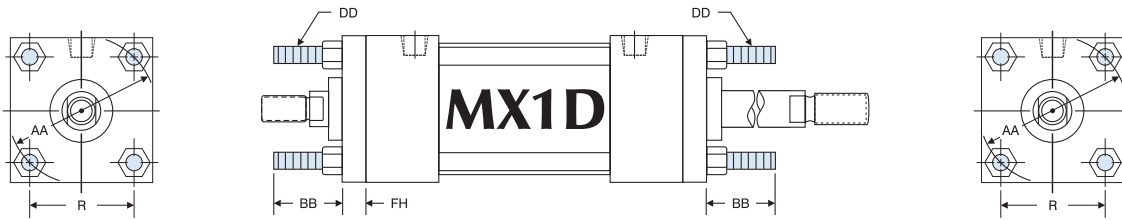
For dimensions not shown, see page 17.



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	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 17.

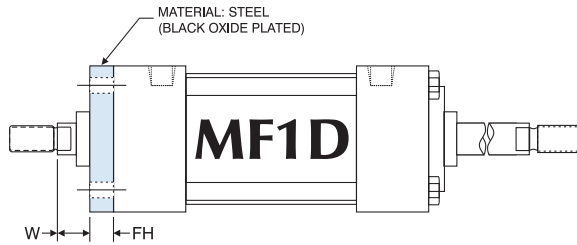
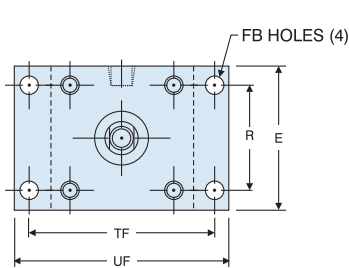
SERIES 'NAC' DIMENSIONS: DOUBLE ROD END TIE ROD & FLANGE MOUNTS



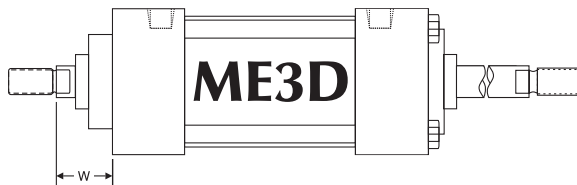
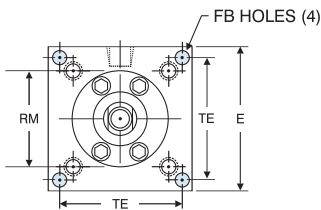
TIE ROD EXTENDED 'MX1D' & 'MX3D' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4 -28	0.375	1.438
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16 -24	0.375	1.844
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16 -24	0.375	2.188
	1.000 Oversize					
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				*0.750	
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.



1.50" - 6.00" BORES



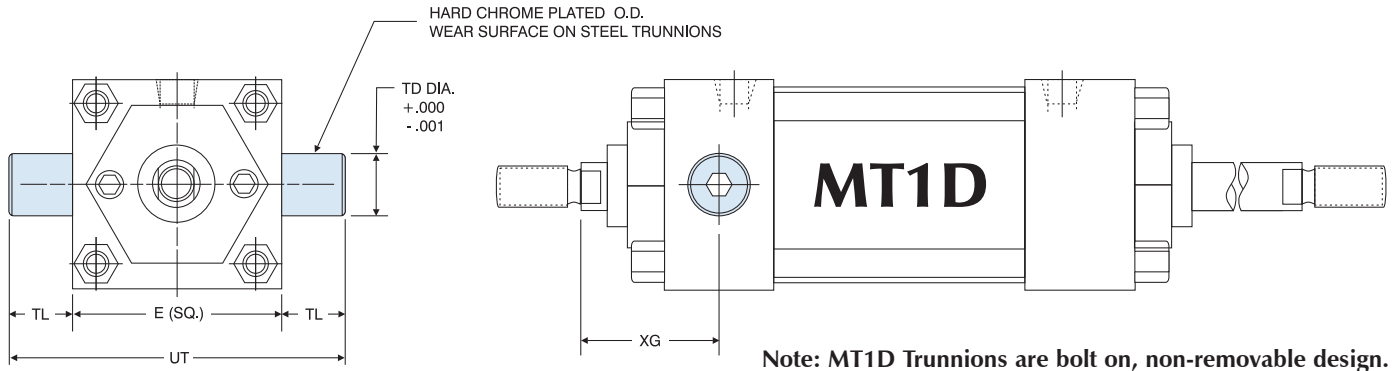
8.00" - 12.00" BORES ONLY

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS										
BORE	ROD DIAMETER	E	FB	FH	R	RM	TE	TF	UF	W
1.50	0.625 Standard	2.000	0.313	0.375	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
4.00	1.000 Standard	4.500	0.438	0.625	3.320	—	—	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	—	—	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
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 17.

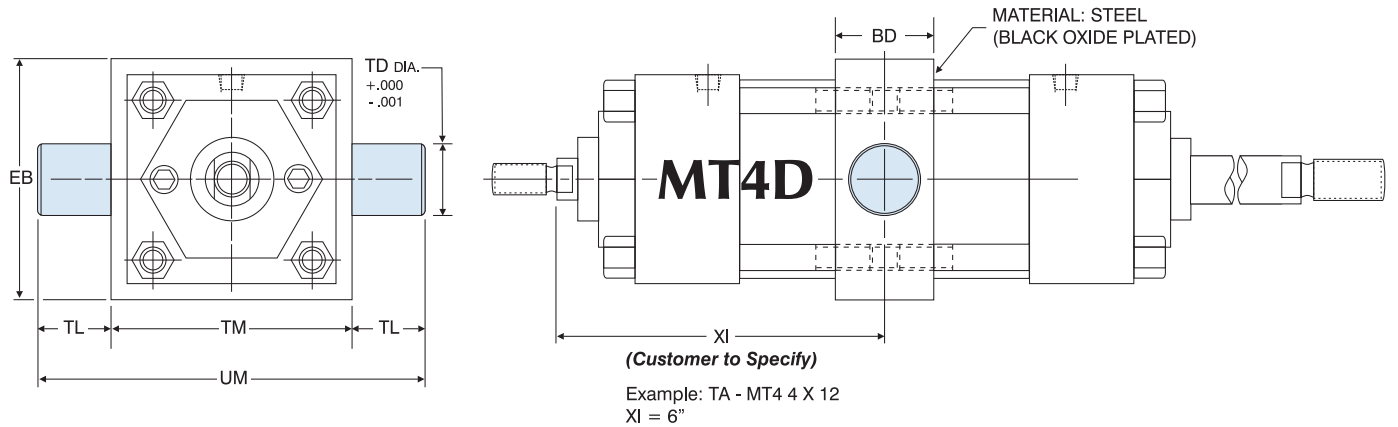
SERIES 'NAC' DIMENSIONS: DOUBLE ROD END PIVOT MOUNTS



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.



NASON

NEW THINKING

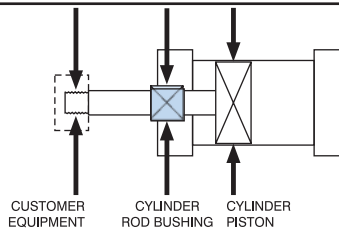


SERIES 'HDC' HEAVY-DUTY CYLINDER

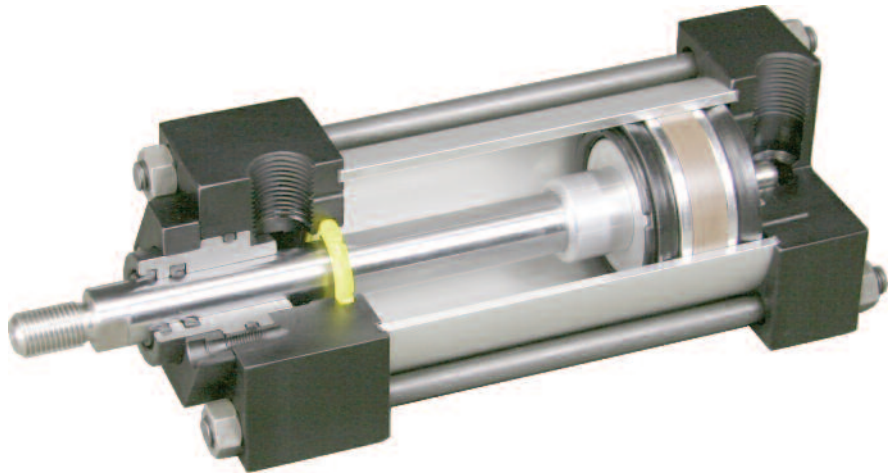
Floating Rod Bushing

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



TOUGH-DUTY DESIGN - Same construction as 'NAC' 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 144 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 143-158 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 'HDC' (TOUGH-DUTY)

HDC - MF1 - 2.50 x 10 - MPR

SERIES		BORE		STROKE	CUSHIONS		OPTIONS	
HDC	250 PSI AIR	1.50	2.00	0" to 120" Made to Order	NON-ADJUSTABLE (FIXED) HEAD & CAP CUSHIONS ARE STANDARD (LEAVE BLANK)		ADDS LENGTH TO CYLINDER - SEE "OPTION LENGTH ADDER" CHART BELOW.	
NFPA MOUNTS		2.50	3.25		OPTIONAL ADJUSTABLE CUSHIONS		A =	EXTENDED PISTON ROD THREAD (Example: A = 2")
MF1	FRONT FLANGE (1.50" - 6.00" Bore)	4.00	5.00		H	ADJUSTABLE HEAD CUSHION POSITION 2 IS STANDARD SPECIFY FOR POSITIONS: 1, 3 & 4	AS	ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, Example: AS = 4")
MF2	REAR FLANGE (1.50" - 6.00" Bore)	6.00	8.00		LH	ADJUSTABLE LONG HEAD CUSHION POSITION 2 IS STANDARD SPECIFY FOR POSITIONS: 1, 3 & 4	BSP	BSP PORTS (SPECIFY SIZE, Example: BSP = .25")
ME3	FRONT MOUNTING HOLES (8.00" Bore)				ELH	ADJUSTABLE EXTRA LONG HEAD CUSHION POSITION 2 IS STANDARD SPECIFY FOR POSITIONS: 1, 3 & 4	C =	EXTENDED PISTON ROD (Example: IF C = 0.50", THEN 1" ROD EXTENSION IS C = 1.50")
ME4	REAR MOUNTING HOLES (8.00" Bore)				C	ADJUSTABLE CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	EN	ELECTROLESS NICKEL PLATED (Refer to page 147 for specifications)
MP1	REAR PIVOT CLEVIS (1.50" - 8.00" Bore)				LC	ADJUSTABLE LONG CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	KK2	LARGE MALE ROD THREAD
MP2	REAR PIVOT CLEVIS (1.50" - 8.00" Bore)				ELC	ADJUSTABLE EXTRA LONG CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8	KK3	FEMALE ROD THREAD
MP4	REAR PIVOT EYE (1.50" - 4.00" Bore)						KK3S	STUDD PISTON ROD (KK3 with Stud, Loctite in place)
MS1	FRONT & REAR END ANGLE (1.50" - 8.00" Bore)						KK4	FULL DIAMETER MALE ROD THREAD
MS2	SIDE LUG (1.50" - 8.00" Bore)						KK5	BLANK ROD END (NO THREADS, "A" = 0")
MS4	BOTTOM TAPPED HOLES (1.50" - 8.00" Bore)						MA	MICRO-ADJUST (6" MAX. STROKE) Available on Double Rod End Models
MT1	FRONT TRUNNION (1.50" - 8.00" Bore)						MAB	MICRO-ADJUST WITH SOUND DAMPENING BUMPER (6" MAX. STROKE)
MT2	REAR TRUNNION (1.50" - 8.00" Bore)						MPR	MAGNETIC PISTON FOR REED OR SOLID STATE SWITCHES - NASON MODELS: R10, R10P, RAC, RHT & MSS (Refer to pages 184-191 for selection)
MT4	INTERMEDIATE TRUNNION (1.50" - 8.00" Bore)						MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
MX0	NO MOUNT (1.50" - 8.00" Bore)						OP	OPTIONAL PORT LOCATION (Example: Ports @ 3 & 7)
MX1	EXTENDED TIE RODS - HEAD & CAP (1.50" - 8.00" Bore)						OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, Example: OS = 1.375")
MX2	EXTENDED TIE RODS (CAP) (1.50" - 8.00" Bore)						SAE	SAE PORTS (SPECIFY SIZE, Example: SAE #10)
MX3	EXTENDED TIE RODS (HEAD) (1.50" - 8.00" 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
							X ST	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) (Example: HDC MS4 2 X 24" EFFECTIVE STROKE-ST=4)
							TMS	STEEL CYLINDER TUBE, BLACK EPOXY PAINT FINISH
							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 2.50" Bore by 10" Stroke NFPA cylinder, Front Flange Mount, (NON-ADJUSTABLE Head & Cap Cushions), and Magnetic Piston for Switches.

Part Number: HDC-MF1-2.50 x 10-MPR

- Notes:**
- 1) Ordering example for adjustable cushions in non-standard locations: H3C7
 - 2) Refer to page 145 for assistance in cushion length selection.
 - 3) Cushions can be ordered on same side as ports. Refer to page 152 for dimensions.

*STEEL TUBES do not work with MPR magnetic pistons. Refer to pages 192-197 for Balluff end of stroke sensors.

OPTION LENGTH ADDER

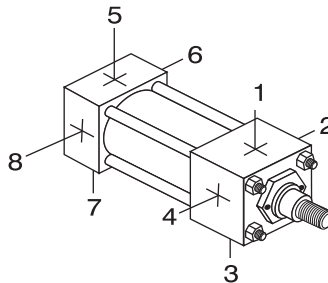
(ADD TO CATALOG BASIC OVERALL LENGTH DIMENSIONS)

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.

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



NFPA MOUNTS

(Refer to pages 10-15 for mounting dimensions)

 1.50" - 6.00" Bores Page 13	 1.50" - 6.00" Bores Page 13	 8.00" Bores Page 13	 8.00" Bores Page 13	 1.50" - 8.00" Bores Page 11	 1.50" - 6.00" Bores Page 11
 1.50" - 4.00" Bores Page 11	 1.50" - 8.00" Bores Page 14	 1.50" - 8.00" Bores Page 14	 1.50" - 8.00" 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" - 8.00" Bores Page 10	 1.50" - 8.00" Bores Page 13	 1.50" - 8.00" Bores Page 13	 1.50" - 8.00" Bores Page 13	

NOTES

Technical Data
Page 198

Switches
Page 184

Accessories
Page 172

Options
Page 1642

HDC- Base Dimensions & Mounts refer to NAC section

HDC - How to Order

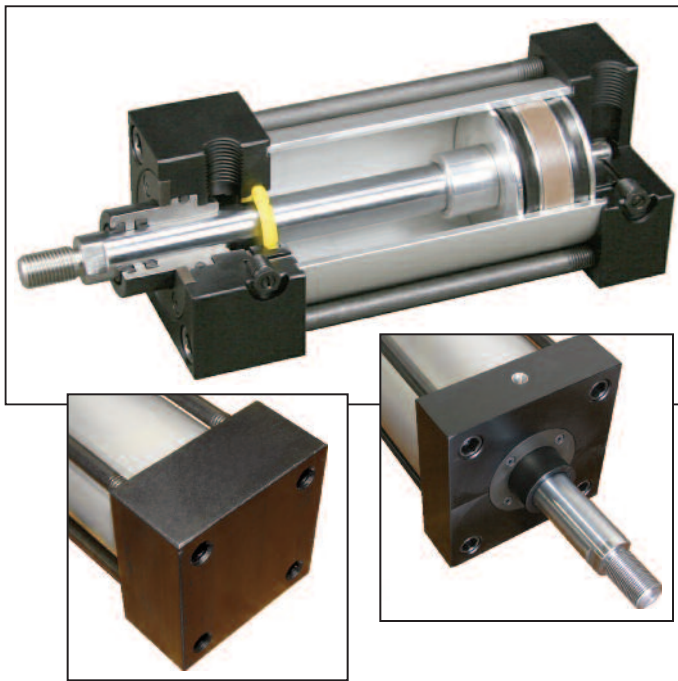


NASON

NEW THINKING



SERIES 'SNC': FLUSH MOUNT (WITH SLEEVE NUT CONSTRUCTION)



Benefits

- Same construction as 'NAC' series with the added benefit of "Sleeve Nut" construction.
- Four tapped holes in Head and Cap-Standard. Optional (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 multiple of NFPA Mounts by simply bolting in place (refer to page 37 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).
- **EN** - Electroless Nickel Plated and Stainless Steel Fasteners provide corrosion resistance.
- **SSA** - Stainless Steel Piston Rod, Tie Rods, Sleeve Nuts, and Fasteners provide corrosion resistance in outdoor applications and wet environments.
- **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 (2) internal guide rods preventing rod rotation (NFPA dimensions).

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 'NAC' SERIES)

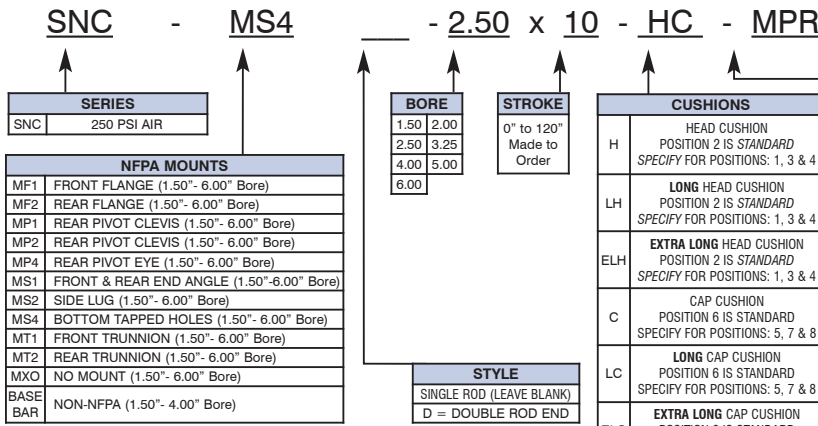
(Optional Port Sizes Available - Refer to page 24 for ordering instructions)

BORE	1.50	2.00	2.50	3.25	4.00	5.00	6.00
PORT SIZE	1/4 NPT	1/4 NPT	1/4 NPT	3/8 NPT	3/8 NPT	3/8 NPT	1/2 NPT

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 'SNC' (SLEEVE NUT CONSTRUCTION)



OPTIONS	
A =	EXTENDED PISTON ROD THREAD (Example: A = 2")
AS	ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, Example: AS = 4")
A / O	AIR / OIL PISTON
X B	.25" URETHANE BUMPER BOTH ENDS
X BC	.25" URETHANE BUMPER CAP ONLY
X BH	.25" URETHANE BUMPER HEAD ONLY
BP	BUMPER PISTON SEALS (1.50" - 6.00" Bore)
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 147 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 154 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 - NASON MODELS: R10, R10P, RAC, RHT & MSS (Refer to pages 184-191 for selection)
MS	METALLIC ROD SCRAPER (BRASS CONSTRUCTION)
NR	NON-ROTATING (Refer to page 151 for specifications)
OP	OPTIONAL PORT LOCATION OR SIZE (Example: Ports @ 3 & 7)
OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, Example: OS = 1.375")
SAE	SAE PORTS (SPECIFY SIZE, Example: SAE #10)
X SE	SPRING EXTEND (1.50", 2.00", 2.50" bore)
X SR	SPRING RETURN (1.50", 2.00", 2.50" bore)
SSA	STAINLESS STEEL PISTON ROD, TIE RODS & SLEEVE NUTS, AND FASTENERS
SSF	STAINLESS STEEL FASTENERS
SSR	STAINLESS STEEL PISTON ROD
SST	STAINLESS STEEL TIE RODS & SLEEVE NUTS
X 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 154 for specifications)
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 2.50" Bore by 10" Stroke NFPA cylinder, Bottom Tap Mount, Head & Cap Cushions, and Magnetic Piston for Switches.

Part Number: SNC-MS4-2.5 x 10-HC-MPR

Note: "L" AND "EL" CUSHION OPTIONS CAN BE ORDERED AS FIXED CUSHIONS.

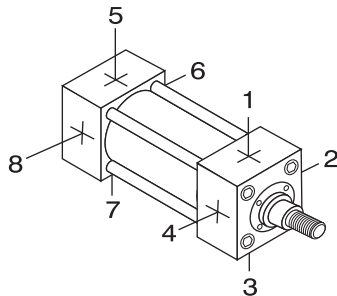
Example: FCLH, FCELH

- Notes:**
- 1) Ordering example for non-standard cushion locations: HC7
 - 2) Refer to page 145 for assistance in cushion length selection.
 - 3) Cushions can be ordered on same side as ports. Refer to page 152 for dimensions.

*STEEL TUBES do not work with MPR magnetic pistons. Refer to pages 192-197 for Balluff end of stroke sensors.

STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

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



OPTION LENGTH ADDER								
(ADD TO CATALOG BASIC OVERALL LENGTH DIMENSIONS)								
BORE	OPTION							
	B	BC	BH	ELC	ELH	SE	SR	ST* (STOP TUBE) Example: ST=2
1.50	0.500	0.250	0.250	1.000	1.000	Refer to page 88 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	

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

'SNC' NFPA MOUNTS

MF1 1.50" - 6.00" Bores Page 30	MF2 1.50" - 6.00" Bores Page 30	MP1 1.50" - 6.00" Bores Page 29	MP2 1.50" - 6.00" Bores Page 29	MP4 1.50" - 4.00" Bores Page 29	MS1 1.50" - 6.00" Bores Page 30
MS2 1.50" - 6.00" Bores Page 31	MS4 1.50" - 6.00" Bores Page 32	MT1 1.50" - 6.00" Bores Page 29	MT2 1.50" - 6.00" Bores Page 29	MXO 1.50" - 6.00" Bores Page 28	BASE BAR 1.50" - 4.00" Bores Page 31

SERIES 'SNC' DIMENSIONS: BASIC CYLINDER (MXO MOUNT) SLEEVE NUT CONSTRUCTION

SNC - How to Order

SNC - Base Dimensions

SNC - Mount Dimensions

SNC - with Rod Lock

Options
Page 142

Accessories
Page 172

Switches
Page 184

Technical Data
Page 198

About Rod End Styles

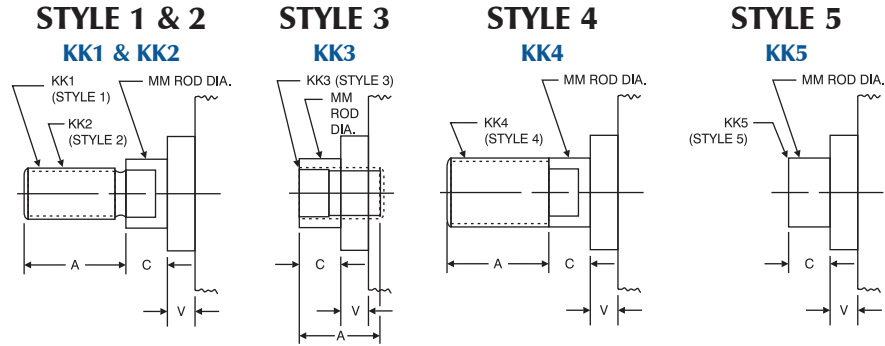
Style 1 Male Rod End is STANDARD

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).

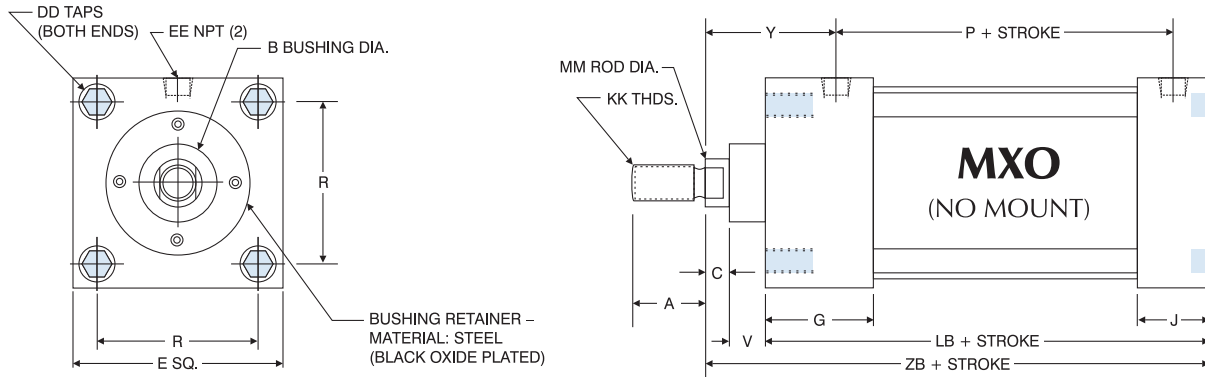
NEED SOMETHING NOT LISTED? Just send us a sketch. In most cases, quotes are turned around in one day!

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,	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	0.625
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	0.500
	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	0.375
	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	1.000
6.00	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	0.500

BASIC DIMENSIONS: 'MXO' (NO MOUNT)



'SNC' SERIES BASIC DIMENSIONS 'MXO'																
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	5/16 -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	3/4 -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	3/4 -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

For oversize rod dimensions, see page 32.

SERIES 'SNC' DIMENSIONS: BASIC CYLINDER (MXO MOUNT) SLEEVE NUT CONSTRUCTION

About Rod End Styles

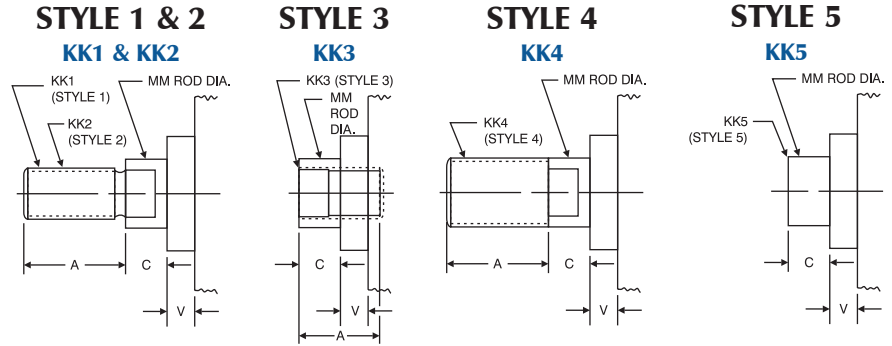
Style 1 Male Rod End is STANDARD

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).

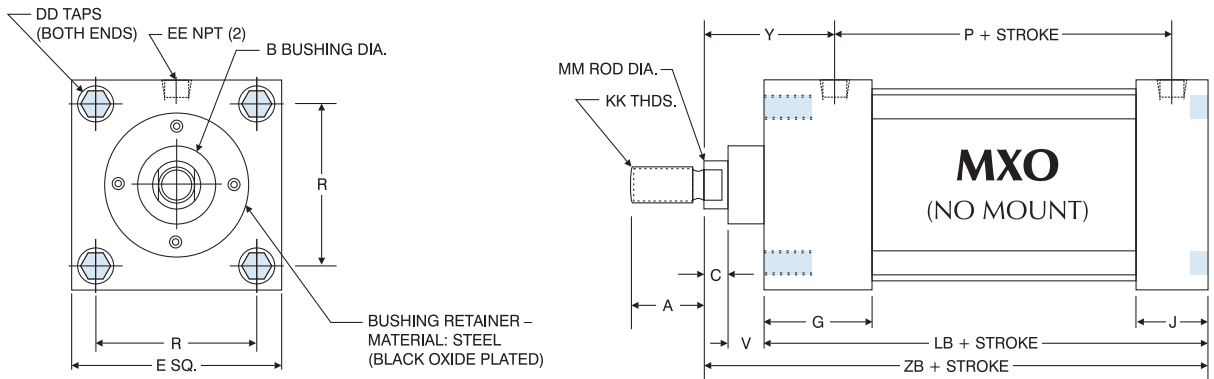
NEED SOMETHING NOT LISTED?
Just send us a sketch.
In most cases, quotes are turned around in one day!

PISTON ROD END STYLES



BORE	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	7/16 -20	0.750	1/2 -20	0.750	7/16 -20	0.750	5/8 -18	0.750	No Threads	0.375	0.625
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	0.500
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	0.375
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	No Threads	0.625	1.000
	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	0.500

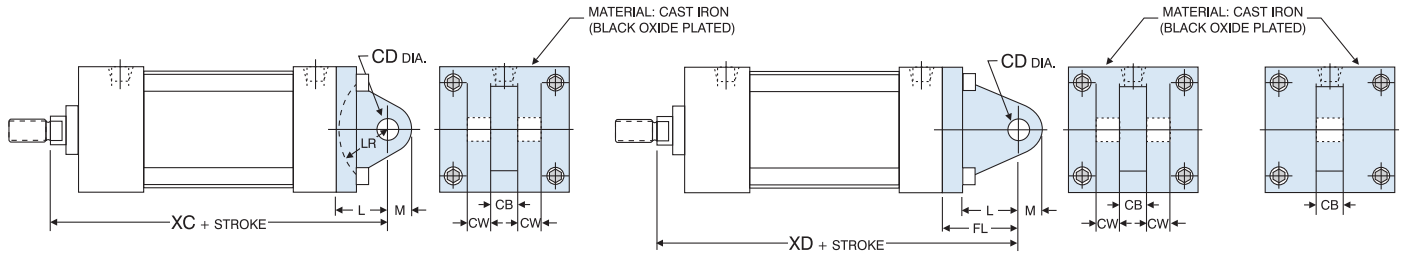
BASIC DIMENSIONS: 'MXO' (NO MOUNT)



'SNC' SERIES BASIC DIMENSIONS 'MXO'																
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	5/16 -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	3/4 -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	3/4 -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

For oversize rod dimensions, see page 32.

SERIES 'SNC' DIMENSIONS: PIVOT MOUNTS SLEEVE NUT CONSTRUCTION



SNC-MP1

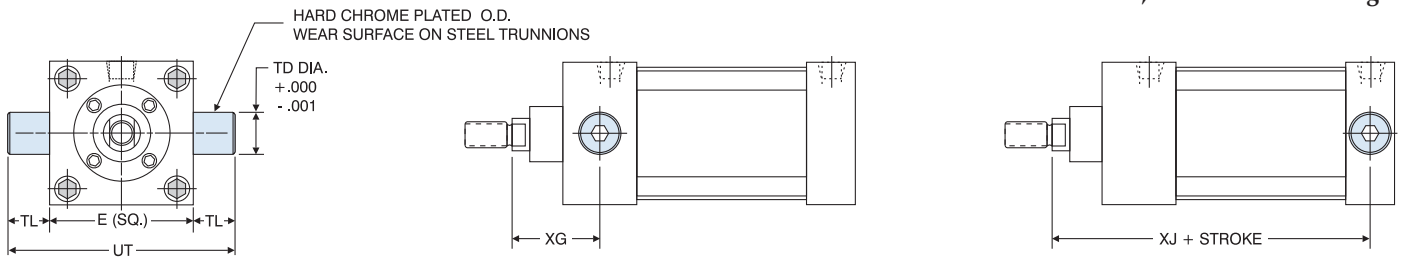
SNC-MP2 SNC-MP4

(1.50" - 4.00" bore)

'SNC' 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 28.

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



SNC-MT1 / MT2

SNC-MT1

SNC-MT2

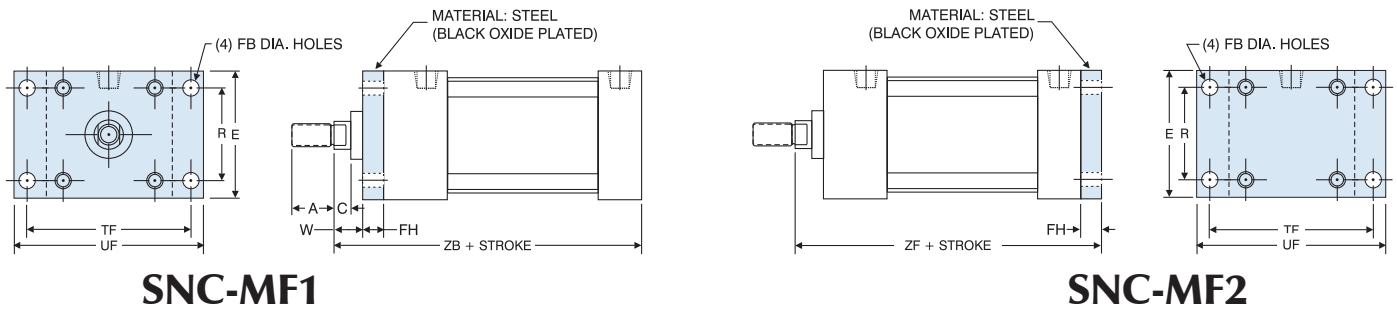
Note: MT1 standard cushion locations at 3 and 6
MT2 standard cushion locations at 2 and 7

'SNC' 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*	4.500
2.00	0.625 Standard	2.500	1.000	1.000	4.500	1.750	4.125
	1.000 Oversize					2.125	4.500
2.50	0.625 Standard	3.000	1.000	1.000	5.000	1.750	4.250
	1.000 Oversize					2.125	4.625
3.25	1.000 Standard	3.750	1.000	1.000	5.750	2.250	5.000
	1.375 Oversize					2.500	5.250
4.00	1.000 Standard	4.500	1.000	1.000	6.500	2.250	5.000
	1.375 Oversize					2.500	5.250
5.00	1.000 Standard	5.500	1.000	1.000	7.500	2.250	5.250
	1.375 Oversize					2.500	5.500
6.00	1.375 Standard	6.500	1.375	1.375	9.250	2.625	5.875
	1.750 Oversize					2.875	6.125

*No oversize rod available on 1.50" bore MT1.
For dimensions not shown, see page 28.

SERIES 'SNC' DIMENSIONS: FLANGE MOUNTS

SLEEVE NUT CONSTRUCTION



SNC-MF1

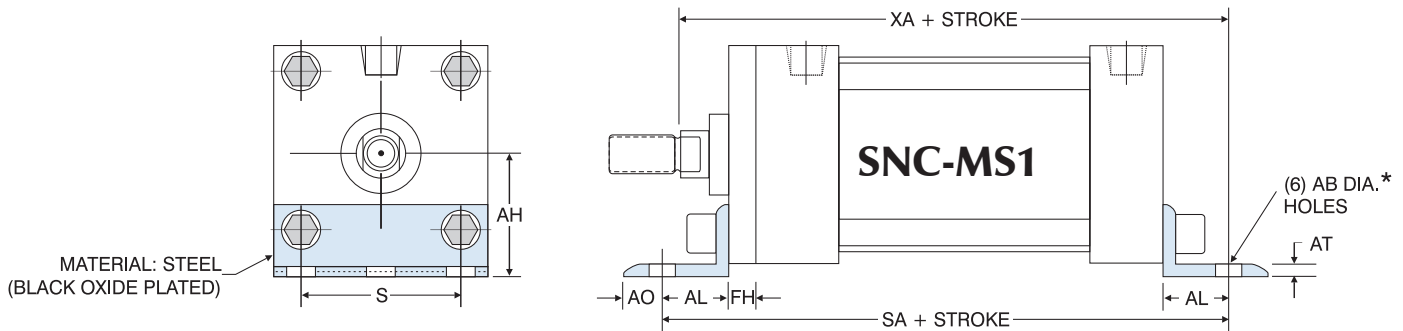
SNC-MF2

'SNC' 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 28.

SERIES 'SNC' DIMENSIONS: BASE MOUNTS

SLEEVE NUT CONSTRUCTION

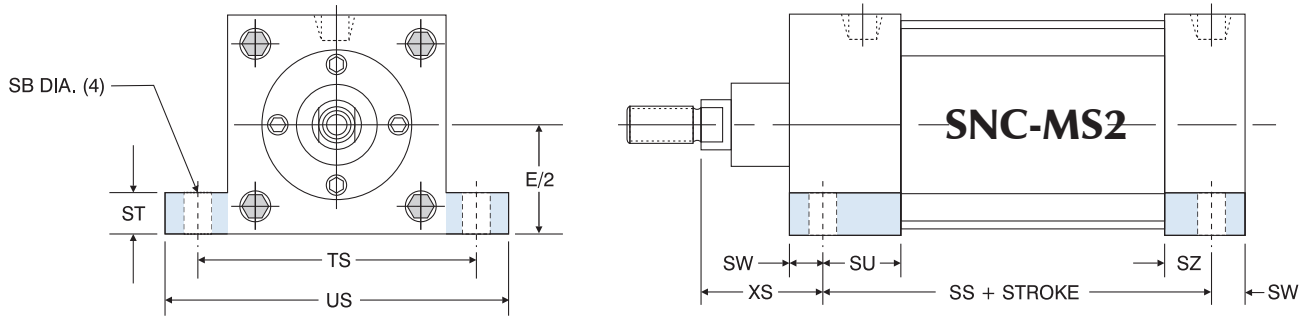


'SNC' SERIES 'MS1' ANGLE MOUNT DIMENSIONS										
BORE	ROD DIAMETER	AB	AH	AL	AO	AT	FH	S	ADD STROKE	
									SA	XA
1.50	0.625 Standard	0.438	1.188	1.000	0.375	0.125	0.375	1.250	6.000	5.625
	1.000 Oversize									6.000
2.00	0.625 Standard	0.438	1.438	1.000	0.375	0.125	0.375	1.750	6.000	5.625
	1.000 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

*Note: 1.50" bore has (4) "AB" holes on "S" dimension.
For dimensions not shown, see page 28.

SERIES 'SNC' DIMENSIONS: BASE MOUNTS

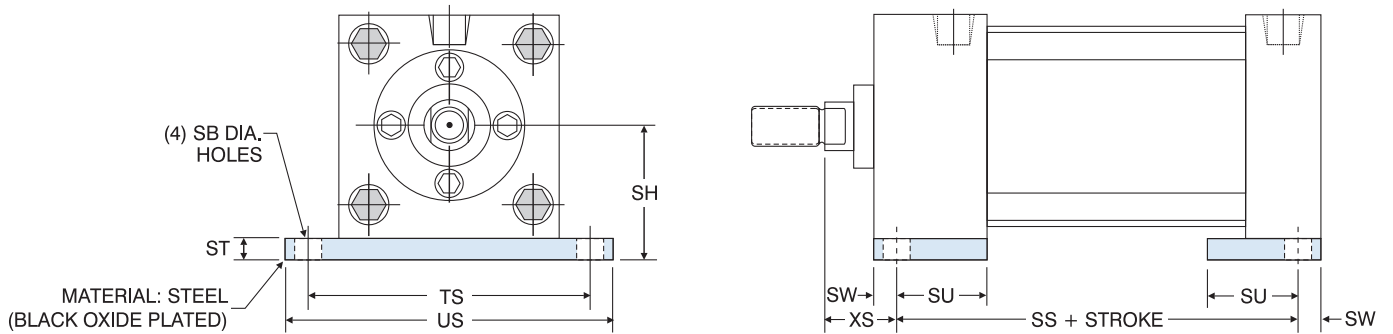
SLEEVE NUT CONSTRUCTION



'SNC' 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									2.125	
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									2.125	
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									2.313	
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									2.563	

For dimensions not shown, see page 28.

SNC-BASE BAR (Non-NFPA)

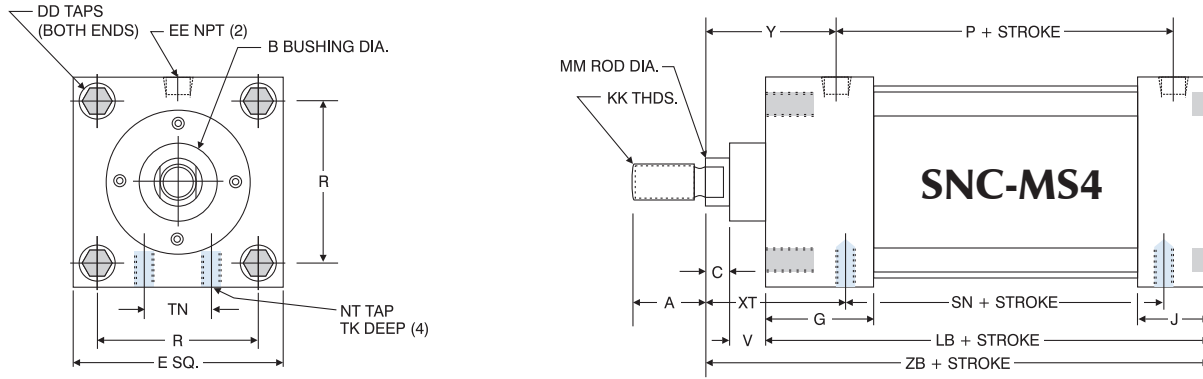


'SNC' SERIES BASE BAR MOUNT (Non-NFPA) DIMENSIONS											
BORE	ROD DIAMETER	SB	SH	ST	SU	SW	TS	US	XS	ADD STROKE	
										SS	
1.50	0.625 Standard	0.438	1.250	0.250	1.125	0.375	2.750	3.500	1.375	2.875	
	1.000 Oversize										1.750
2.00	0.625 Standard	0.438	1.500	0.250	1.125	0.375	3.250	4.000	1.375	2.875	
	1.000 Oversize										1.750
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										1.750
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								2.125		
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								2.125		

For dimensions not shown, see page 28.

SERIES 'SNC' DIMENSIONS: BASE MOUNTS

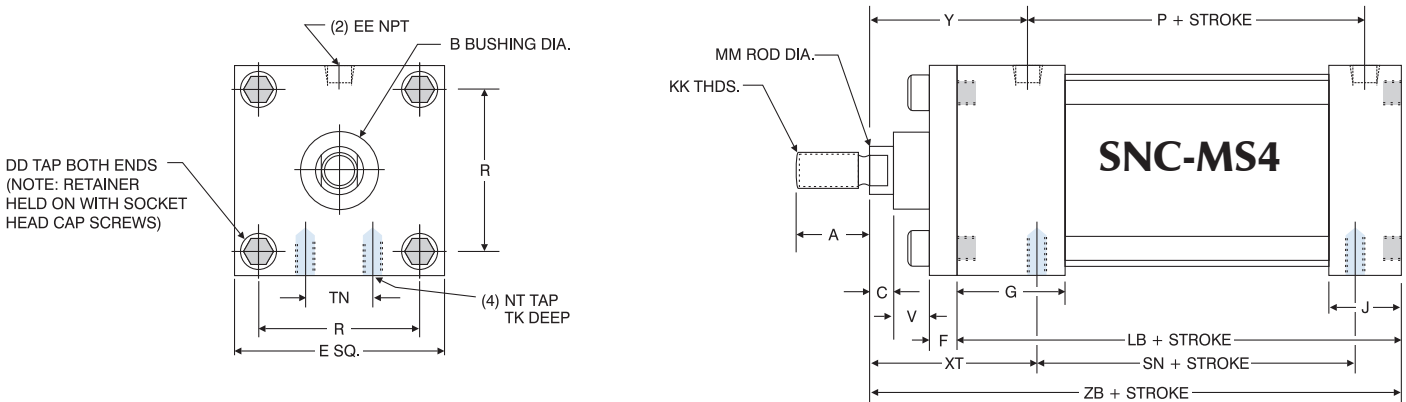
SLEEVE NUT CONSTRUCTION



'SNC' SERIES 'MS4' FLUSH MOUNT DIMENSIONS																					
BORE	A	B	C	DD	E	EE	G	J	KK	LB	MM	P	R	V	Y	ZB	NT	TK	TN	SN	XT
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	1.425	0.625	1.875	4.625	1/4 -20	0.375	0.625	2.250	1.938
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	1.844	0.625	1.875	4.625	5/16 -18	0.500	0.875	2.250	1.938
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	2.500	2.188	0.625	1.875	4.750	3/8 -16	0.625	1.250	2.375	1.938
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	1/2 -13	0.750	1.500	2.625	2.438
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	1/2 -13	0.750	2.063	2.625	2.438
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	5/8 -11	1.000	2.688	2.875	2.438
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	3/4 -10	1.125	3.250	3.125	2.813

For dimensions not shown, see page 28.

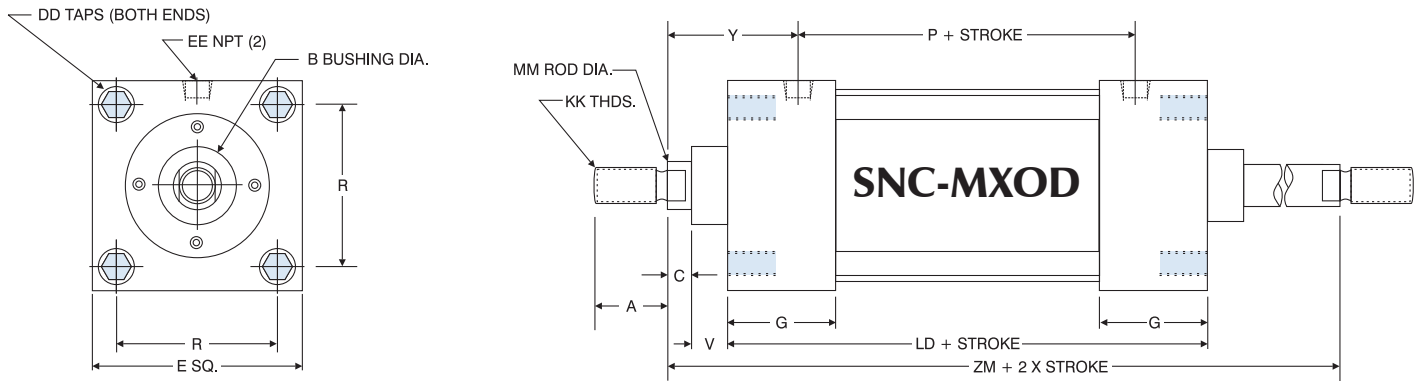
SNC-MS4: Oversize Rod Diameter



'SNC' SERIES OVERSIZE ROD 'MS4' FLUSH MOUNT DIMENSIONS																						
BORE	A	B	C	DD	E	EE	F	G	J	KK	LB	MM	P	R	V	Y	NT	TK	TN	SN	XT	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	2.375	1.438	0.500	2.250	1/4 -20	0.375	0.625	2.250	2.313	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	2.375	1.844	0.500	2.250	5/16 -18	0.500	0.875	2.250	2.313	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	2.500	2.188	0.500	2.250	3/8 -16	0.625	1.250	2.375	2.313	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	2.750	2.760	0.375	2.625	1/2 -13	0.750	1.500	2.625	2.688	5.875
4.00	1.625	2.000	0.625	3/8 -24	4.500	0.375	0.625	1.750	1.250	1 -14	4.250	1.375	2.750	3.320	0.375	2.625	1/2 -13	0.750	2.063	2.625	2.688	5.875
5.00	1.625	2.000	0.625	1/2 -20	5.500	0.375	0.625	1.750	1.250	1 -14	4.500	1.375	3.000	4.100	0.375	2.625	5/8 -11	1.000	2.688	2.875	2.688	6.125
6.00	2.000	2.375	0.750	1/2 -20	6.500	0.500	0.750	2.000	1.500	1/4 -12	5.000	1.750	3.250	4.88	0.500	3.000	3/4 -10	1.125	3.250	3.125	3.063	6.875

SERIES 'SNC' DIMENSIONS: DOUBLE ROD END (NO MOUNT) SLEEVE NUT CONSTRUCTION

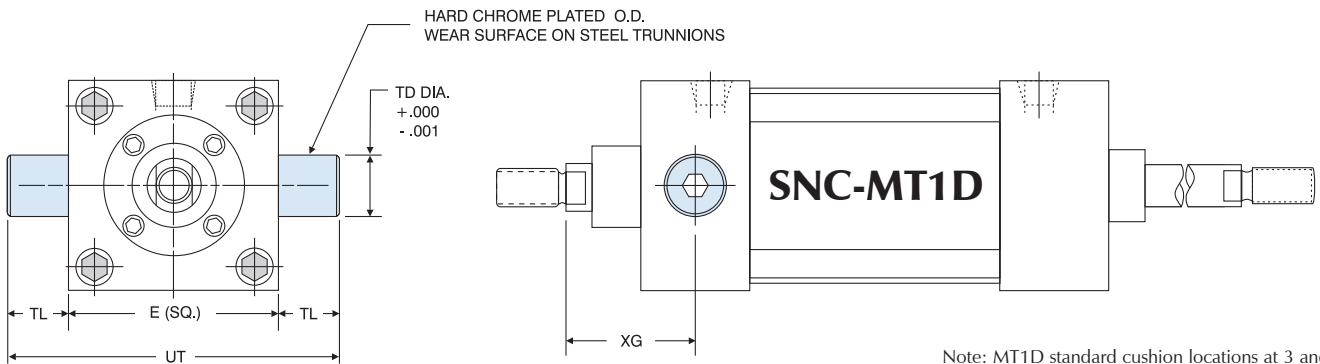
BASIC DIMENSIONS: DOUBLE ROD END 'MXOD' (NO MOUNT)



'SNC' SERIES DOUBLE ROD END BASIC DIMENSIONS 'MXOD'															
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

For oversize rod dimensions, refer to page 36.

SERIES 'SNC' DIMENSIONS: DOUBLE ROD END PIVOT MOUNT

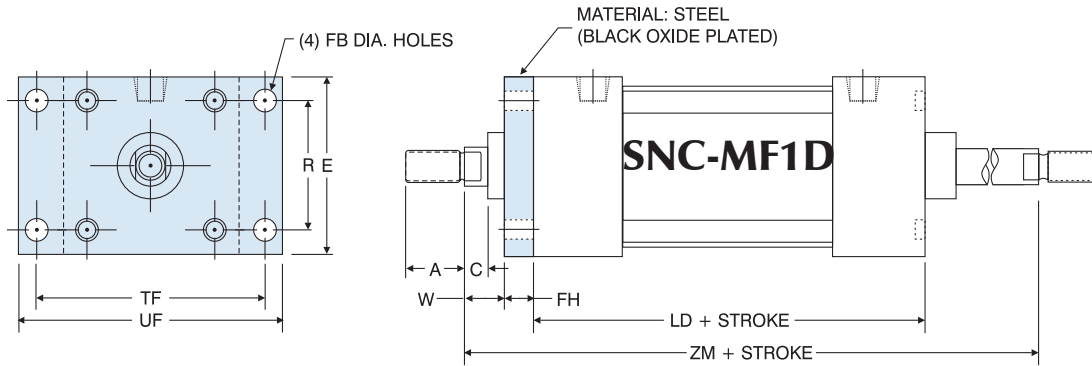


Note: MT1D standard cushion locations at 3 and 6

'SNC' 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
	1.000 Oversize					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

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

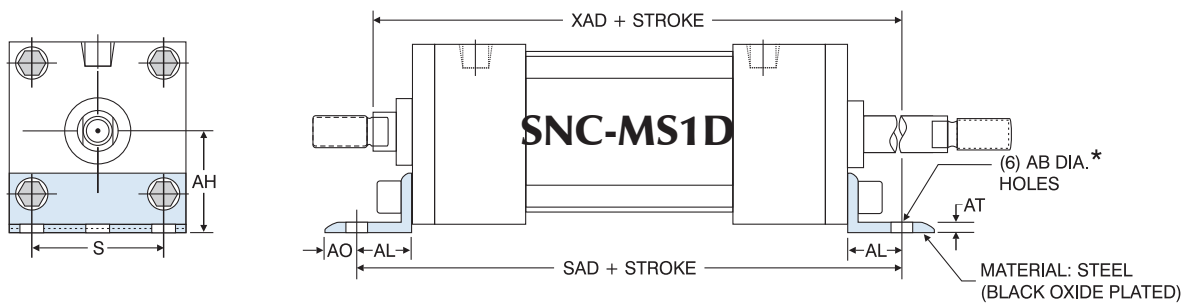
SERIES 'SNC' DIMENSIONS: DOUBLE ROD END FLANGE MOUNT SLEEVE NUT CONSTRUCTION



'SNC' 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

For dimensions not shown, see page 33.

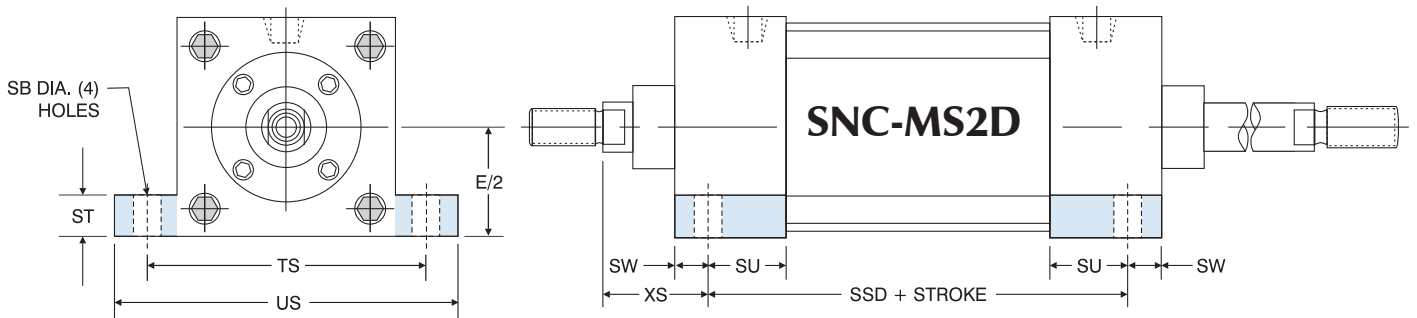
SERIES 'SNC' DIMENSIONS: DOUBLE ROD END BASE MOUNTS SLEEVE NUT CONSTRUCTION



'SNC' 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

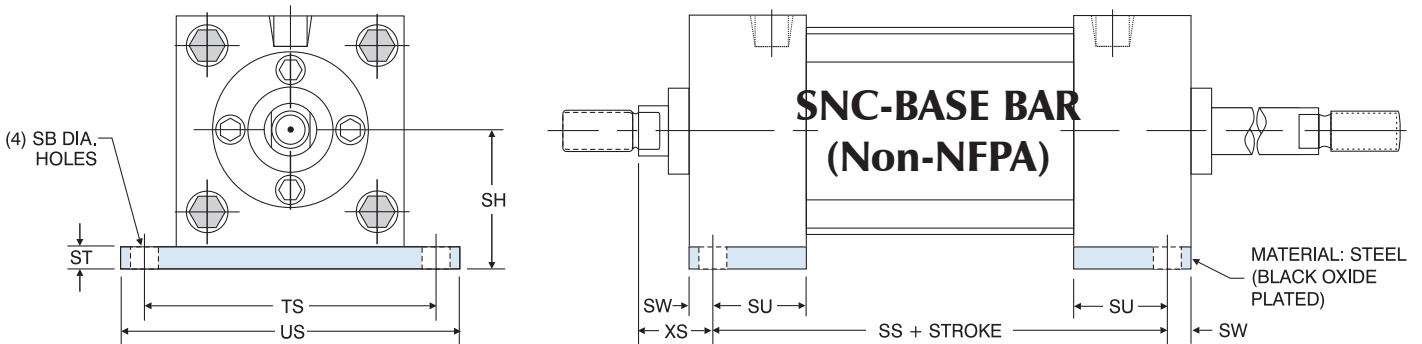
*Note: 1.50" bore has (4) "AB" holes on "S" dimension.
For dimensions not shown, see page 33.

SERIES 'SNC' DIMENSIONS: DOUBLE ROD END BASE MOUNTS SLEEVE NUT CONSTRUCTION



'SNC' 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									
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									

For dimensions not shown, see page 33.

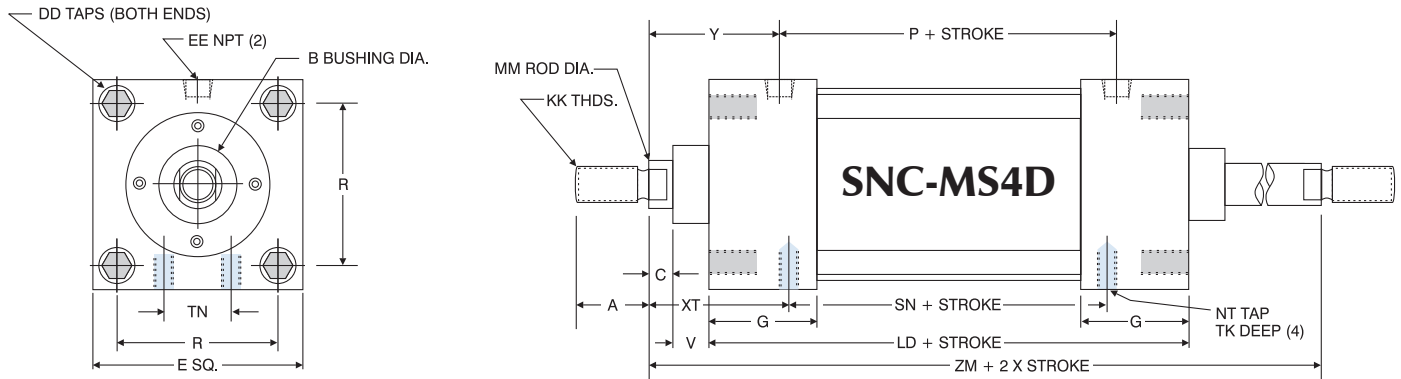


'SNC' SERIES DOUBLE ROD END BASE BAR MOUNT (Non-NFPA) DIMENSIONS										
BORE	ROD DIAMETER	SB	SH	ADD STROKE	ST	SU	SW	TS	US	XS
				SS						
1.50	0.625 Standard	0.438	1.250	3.375	0.250	1.125	0.375	2.750	3.500	1.375
	1.000 Oversize									
2.00	0.625 Standard	0.438	1.500	3.375	0.250	1.125	0.375	3.250	4.000	1.375
	1.000 Oversize									
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									
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									
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									

For dimensions not shown, see page 33.

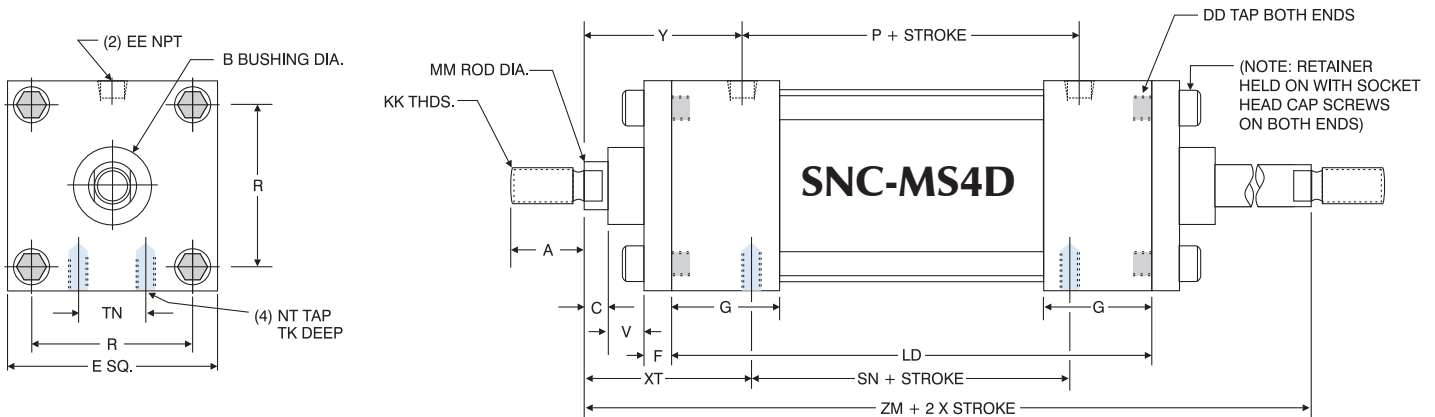
SERIES 'SNC' DIMENSIONS: DOUBLE ROD END BASE MOUNT SLEEVE NUT CONSTRUCTION

SNC-MS4D: Standard Rod Diameter



'SNC' 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

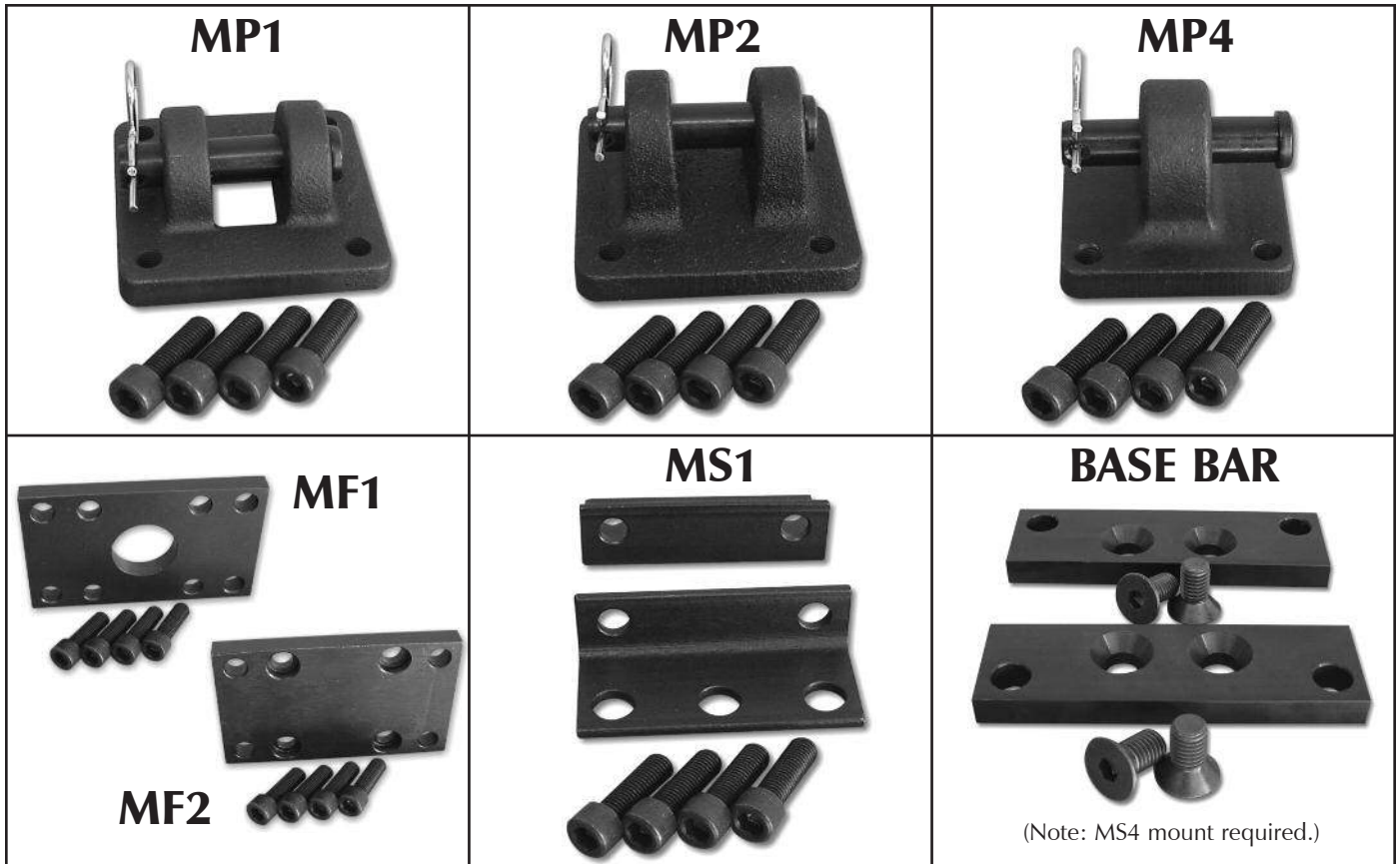
SNC-MS4D: Oversize Rod Diameter



'SNC' 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

SERIES 'SNC' SLEEVE NUT: MOUNTING KITS

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



SERIES 'SNC' MOUNTING KITS

BORE	MP1	MP2	MP4	MF1	MF2	MS1	Base Bar	
	Part Number	Part Number	Part Number	Part Number	Part Number	Part Number	Part Number	SH Dimension
1.50	A85-15D	A81-15D	A83-15D	FM61-15	FM62-15	A75-15 (H) A77-15 (C)	BB-15-HC	1.250
2.00	A85-20D	A81-20D	A83-20D	FM61-20	FM62-20	A75-20 (H) A77-20 (C)	BB-20-HC	1.500
2.50	A85-25D	A81-25D	A83-25D	FM61-25	FM62-25	A77-25	BB-25-HC	1.875
3.25	A85-32D	A81-32D	A83-32D	FM61-32	FM62-32	A75-32	BB-32-HC	2.375
4.00	A85-40D	A81-40D	A83-40D	FM61-40	FM62-40	A77-40	BB-40-HC	2.750
5.00	A85-50D	A81-50D	N/A	FM61-50	FM62-50	A77-50	N/A	—
6.00	A85-60D	A81-60D	N/A	FM61-60	FM62-60	A77-60	N/A	—

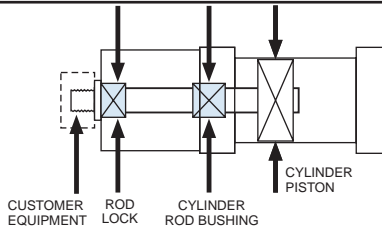
*Base Bar "SH" dimension is not NFPA. Refer to pages 31 and 35.
All other dimensions are NFPA.

SERIES 'SNC' (NFPA) CYLINDER WITH ROD LOCK

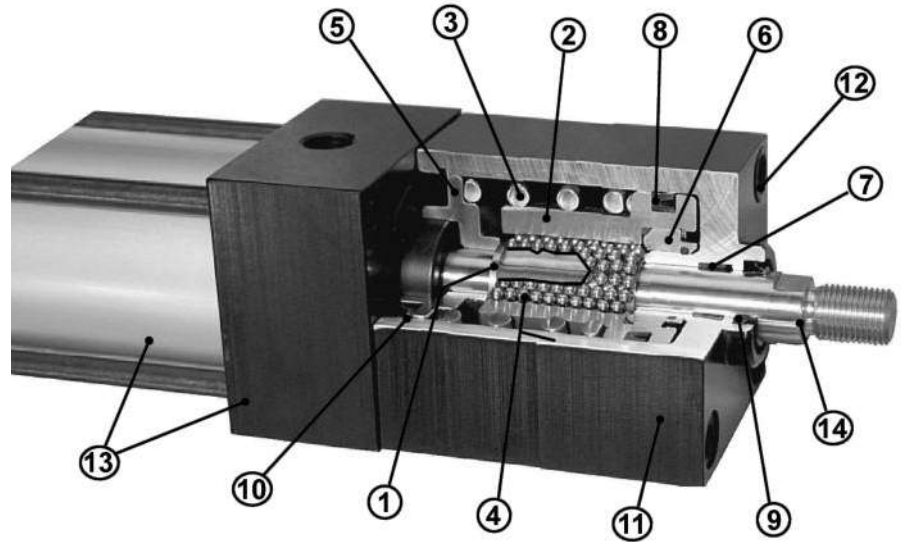
Floating Rod Bushing

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

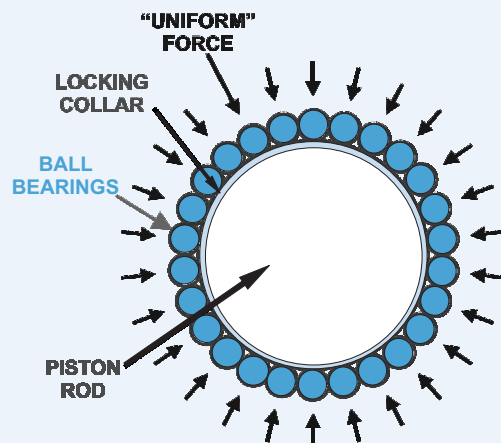
- LOCKING COLLAR** – Hardened specialized tool steel, precision ground, multi-split collar design provides 4,000,000-5,000,000 cycles without fatigue or fracture.
 - PISTON-OUTER LOCK HOUSING** – Hardened tool steel, precision ground design also serves as a spring guide for uniform clamp force distribution with virtually no wear.
 - SPRING** – Oversized for maximum power, heavy-duty coil spring (low fatigue) will provide millions of consistent rod lock actuations at full rated load.
 - BALL BEARINGS** – Hardened, precision ground (high grade) steel ball bearings provide total transfer of spring force to locking collar.
 - 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.
 - PISTON GUIDE** – Hardened and ground steel guide that centers the piston-outer lock housing and provides bearing surface for piston/spring assembly
 - ROD GUIDE BEARING** – High-load wear strip (PTFE based), self lubricating
 - PISTON SEAL** – Heavy lip design Carboxylated Nitrile construction. Seal is pressure activated and wear compensating for extended life (self lubricating material)
 - ROD WIPER** – Urethane
 - RETAINER RING** (Steel) – Retains coil spring compression (under very high spring force) and internal lock components. (NOTE: Do not remove)
 - HOUSING** – Precision machined from 6061-T6 aluminum, black anodized for corrosion resistance.
 - SLEEVE NUT** (Steel) – Provides (4) tapped holes for mounting unit or MF1 flange.
 - FM SERIES CYLINDER** – Refer to Nason catalog pages 28-36 for specifications and options.
 - CYLINDER PISTON ROD** – Hard chrome plated steel.
- PERMANENT LUBRICATION** – Permanently lubricated with Magna-Lube 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:

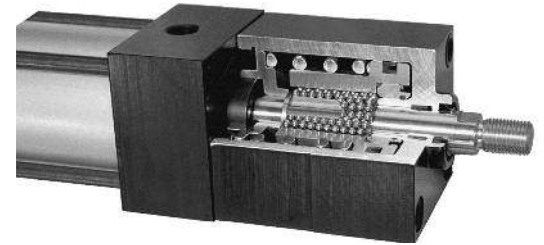
- **LOW METAL FATIGUE** – On all clamping components.
- **SUPERIOR LOCKING FORCES** – HIGHEST LOCKING FORCES IN THE INDUSTRY.
- **NON WEARING** – Low component fatigue eliminates wear and extends life to 4,000,000 - 5,000,000 cycles at full rated load.



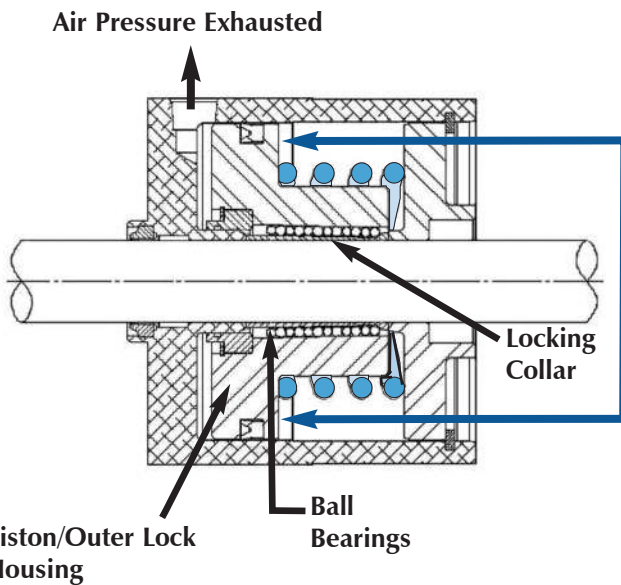
The Nason difference...

Nason'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. With Nason's Floating Rod Bushing design and accurate rod lock alignment - superior performance and trouble-free operation are assured.



OPERATING PRINCIPAL

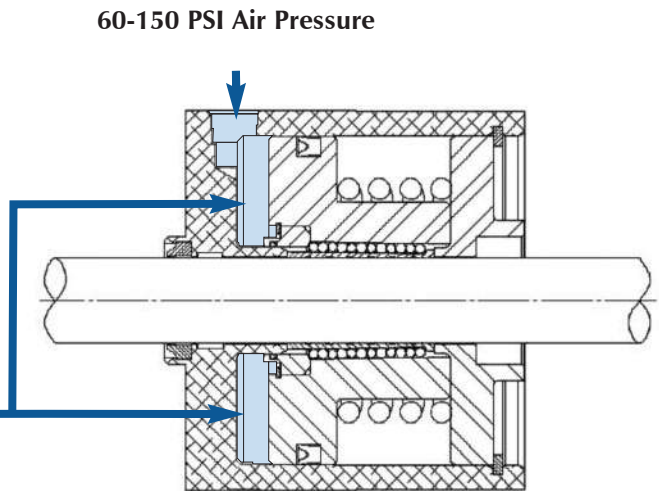


CLAMPING (Locked) CONDITION:
 When air pressure is exhausted from rod lock, high spring force is applied to the piston/outer lock housing which utilizes an ultra-fine tapered wedge mechanism. Ball bearings transfer the spring force directly to the locking collar. The locking collar is designed to flex 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	
Cylinder	0 TO 250 PSI AIR
Rod Lock	60 TO 150 PSI AIR

OPERATING TEMPERATURE	
Standard Seals	10° F to 180° F (-12° C to 82° C)
Fluorocarbon Seals	0° F to 400° F (-18° C to 204° C)

AXIAL MOVEMENT (CLAMPED) *	
Standard	.000" to .008"
Close Tol. (Optional)	.000" to .002" - .003"

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 micro-inch

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

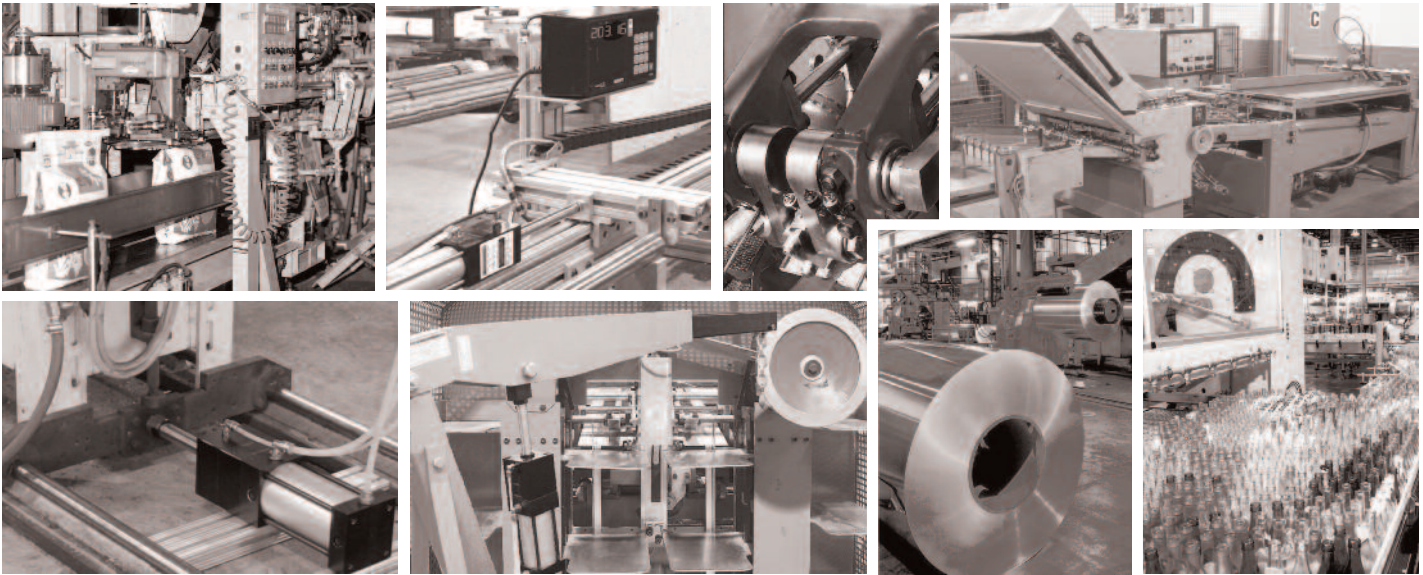
SNC - How to Order
 SNC - Base Dimensions
 SNC - Mount Dimensions
 SNC - with Rod Lock
 Options Page 142
 Accessories Page 172
 Switches Page 184
 Technical Data Page 198

APPLICATION & RATED HOLDING FORCE

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 E-Stop (emergency stop) applications.

Refer to safety information on page 58 for proper application.

COMMON APPLICATIONS



BASIC CYLINDER FORCE CHART

BORE	ROD DIA.	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

RATED HOLDING FORCE

BORE	ROD DIA.	ROD LOCK MODEL	HOLDING FORCE *
1.50	0.625	RL-063150	200
	0.625	RL-063200	500
2.00	1.000	RL-100200	350
	0.625	RL-063250	650
2.50	1.000	RL-100250	650
	1.000	RL-100325	1000
3.25	1.375	RL-138325	1000
	1.000	RL-100400	1550
4.00	1.375	RL-138400	1550
	1.000	RL-100500	2150
5.00	1.375	RL-138500	2150
	1.375	RL-138600	2850
6.00	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: CYLINDER WITH ROD LOCK

SNC - How to Order

SNC - Base Dimensions

SNC - Mount Dimensions

SNC - with Rod Lock

Options Page 142

Accessories Page 172

Switches Page 184

Technical Data Page 198

SNC - 250 PSI AIR

MS4

2.50 x 10

HC

RL

063 250

MPR

BORE

1.50	2.00
2.50	3.25
4.00	5.00
6.00	

STROKE

0" to 120"
MADE TO ORDER

ROD LOCK

RL

ROD SIZE

063	0.625"
100	1.000"
138	1.375"
175	1.750"

BORE

150	1.50"
200	2.00"
250	2.50"
325	3.25"
400	4.00"
500	5.00"
600	6.00"

CYLINDER OPTIONS

ADDS 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")
A / O	AIR / OIL PISTON
X B	.25" URETHANE BUMPER BOTH ENDS
X BC	.25" URETHANE BUMPER CAP ONLY
X BH	.25" URETHANE BUMPER HEAD ONLY
BP	BUMPER PISTON SEALS (1.50" - 6.00" Bore)
BSP	BSP PORTS (SPECIFY SIZE, Example: BSP = 1/4")
EN	ELECTROLESS NICKEL PLATED
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
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 - NASON MODELS: R10, R10P, RAC, RHT & MSS
NR	NON-ROTATING
OP	OPTIONAL PORT LOCATION OR SIZE (Example: Ports @ 3 & 7)
OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, Example: OS = 1.38")
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 & SLEEVE NUTS, AND FASTENERS
SSF	STAINLESS STEEL FASTENERS
SSR	STAINLESS STEEL PISTON ROD
SST	STAINLESS STEEL TIE RODS & SLEEVE NUTS
X ST	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) (Example: SNC MS4 2 X 24" EFFECTIVE STROKE-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

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" - 6.00" 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)
MXO	NO MOUNT (1.50" - 6.00" Bore)
BASE BAR	NON-NFPA (1.50" - 4.00" Bore)

STYLE

SINGLE ROD (LEAVE BLANK)
D = DOUBLE ROD END

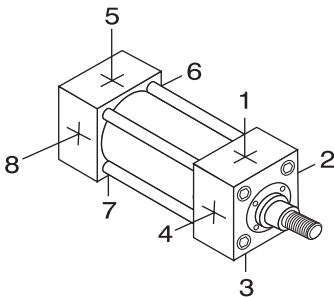
CUSHIONS

ADDS LENGTH TO CYLINDER - SEE "OPTION LENGTH ADDER" CHART BELOW.

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)

STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

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



Note: "L" AND "EL" CUSHION OPTIONS CAN BE ORDERED AS FIXED CUSHIONS.

Example: FCLH, FCELH

Notes:

- Ordering example for non-standard cushion locations: H3C7
- Refer to page 145 for assistance in cushion length selection.
- Cushions can be ordered on same side as ports.

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 Nason for more information and delivery.

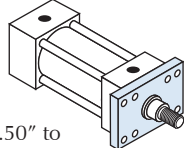
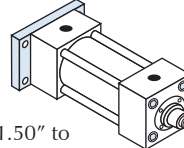
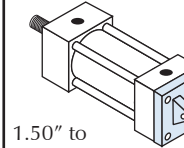
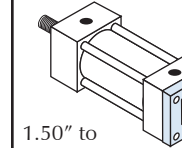
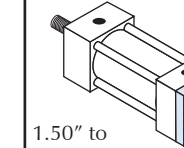
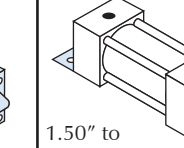
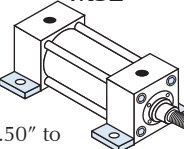
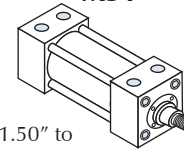
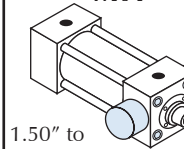
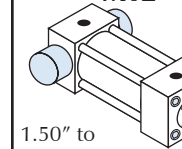
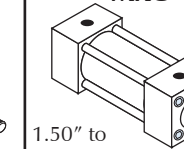
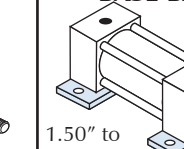
OPTION LENGTH ADDER

(ADD TO CATALOG BASIC OVERALL LENGTH DIMENSIONS)

BORE	OPTION					
	B	BC	BH	ELC	ELH	ST* (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

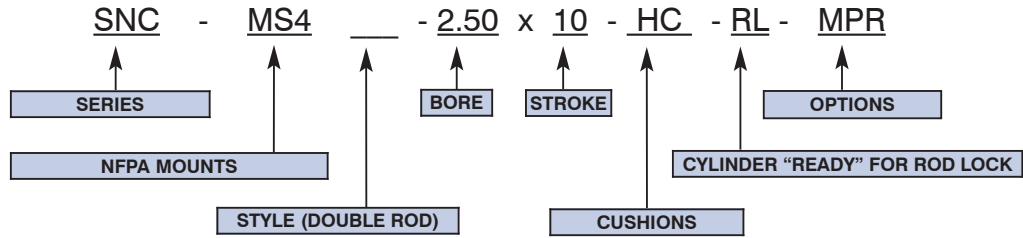
*Note: The desired Stop Tube length adds directly to the overall cylinder length.

'SNC' NFPA MOUNTS

<p>MF1</p>  <p>1.50" to 6.00" Bores Page 49</p>	<p>MF2</p>  <p>1.50" to 6.00" Bores Page 50</p>	<p>MP1</p>  <p>1.50" to 6.00" Bores Page 53</p>	<p>MP2</p>  <p>1.50" to 6.00" Bores Page 54</p>	<p>MP4</p>  <p>1.50" to 4.00" Bores Page 55</p>	<p>MS1</p>  <p>1.50" to 6.00" Bores Page 45</p>
<p>MS2</p>  <p>1.50" to 6.00" Bores Page 46</p>	<p>MS4</p>  <p>1.50" to 6.00" Bores Page 47</p>	<p>MT1</p>  <p>1.50" to 6.00" Bores Page 51</p>	<p>MT2</p>  <p>1.50" to 6.00" Bores Page 52</p>	<p>MXO</p>  <p>1.50" to 6.00" Bores Page 43-44</p>	<p>BASE BAR</p>  <p>1.50" to 4.00" Bores Page 48</p>

HOW TO ORDER: CYLINDER / ROD LOCK REPLACEMENT PARTS

REPLACEMENT CYLINDERS



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

ROD LOCK PART LIST

Bore	Rod Diameter	Rod Lock Model	Rated Holding Force (lbs)	Rod Lock ONLY	Mounting Kit
					
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 Nason 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.

SERIES 'SNC' DIMENSIONS: BASIC CYLINDER (MXO MOUNT) SLEEVE NUT CONSTRUCTION

About Rod End Styles

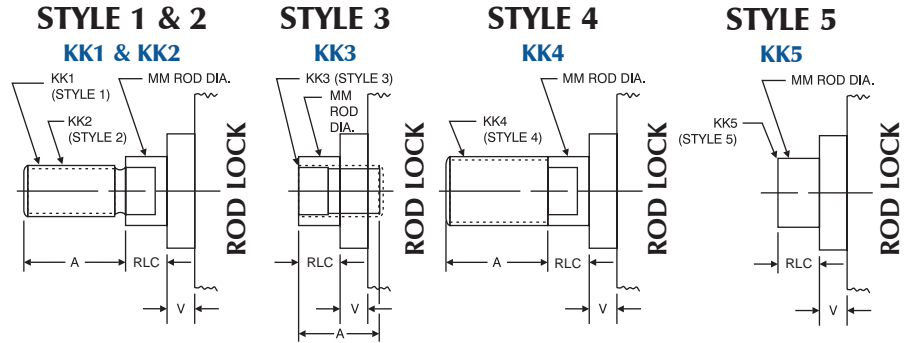
Style 1 Male Rod End is STANDARD

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).

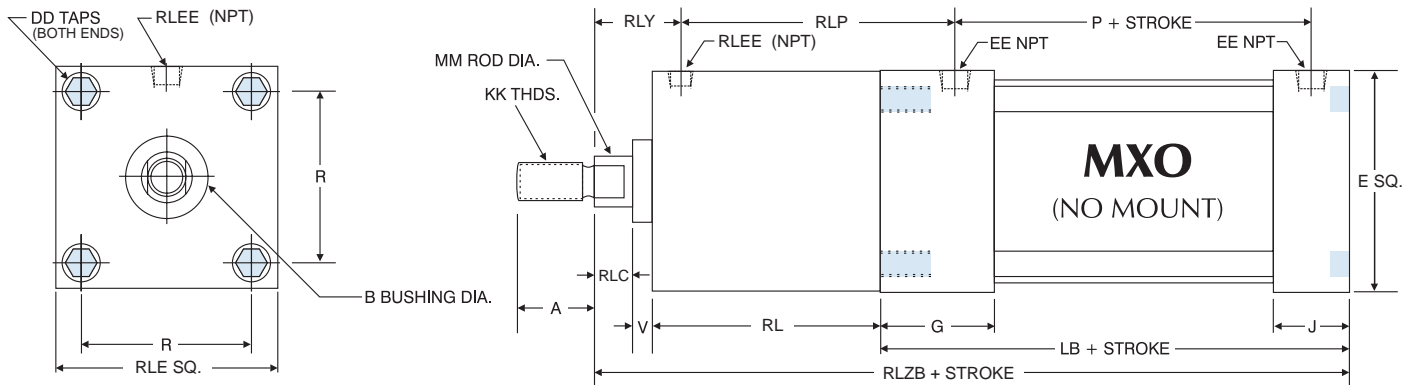
NEED SOMETHING NOT LISTED?
Just send us a sketch.
In most cases, quotes are turned around in one day!

PISTON ROD END STYLES



BORE	MM ROD DIAMETER	STANDARD		OPTIONAL							RLC	V
		Style 1 - Male KK1	A	Style 2 - Male KK2	A	Style 3 - Female KK3	A	Style 4 - Male KK4	A	Style 5 - Blank 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	0.250
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	0.250
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	0.250

STANDARD ROD: 'MXO' (NO MOUNT) WITH ROD LOCK MOUNTED



'SNC' SERIES BASIC DIMENSIONS 'MXO' (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

SERIES 'SNC' DIMENSIONS: BASIC CYLINDER (MXO MOUNT) SLEEVE NUT CONSTRUCTION

About Rod End Styles

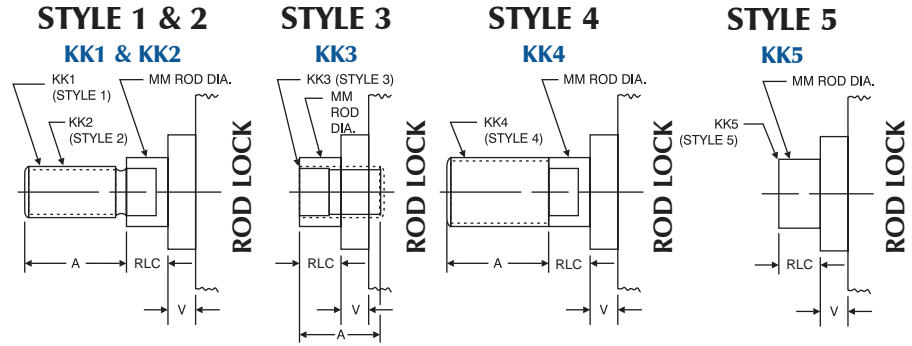
Style 1 Male Rod End is STANDARD

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).

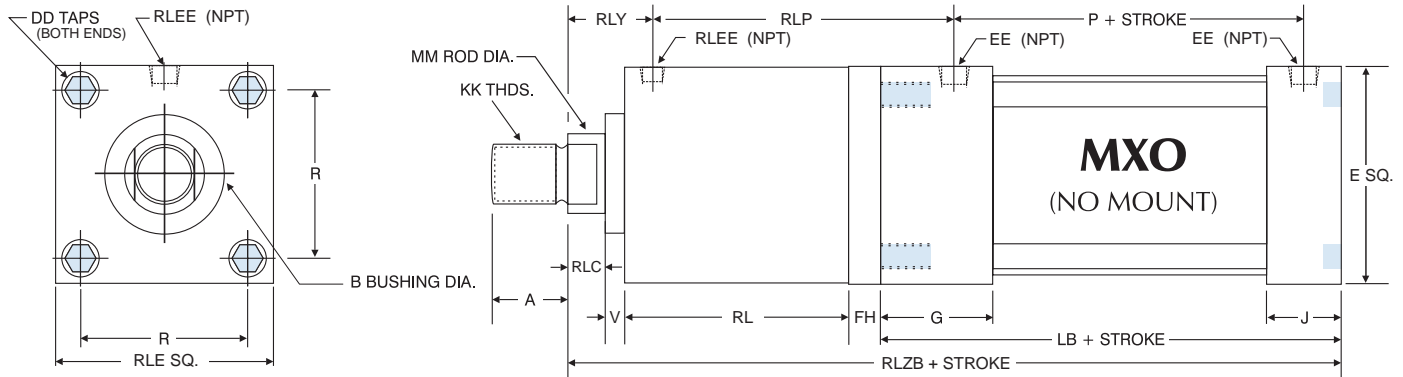
NEED SOMETHING NOT LISTED?
Just send us a sketch.
In most cases, quotes are turned around in one day!

PISTON ROD END STYLES



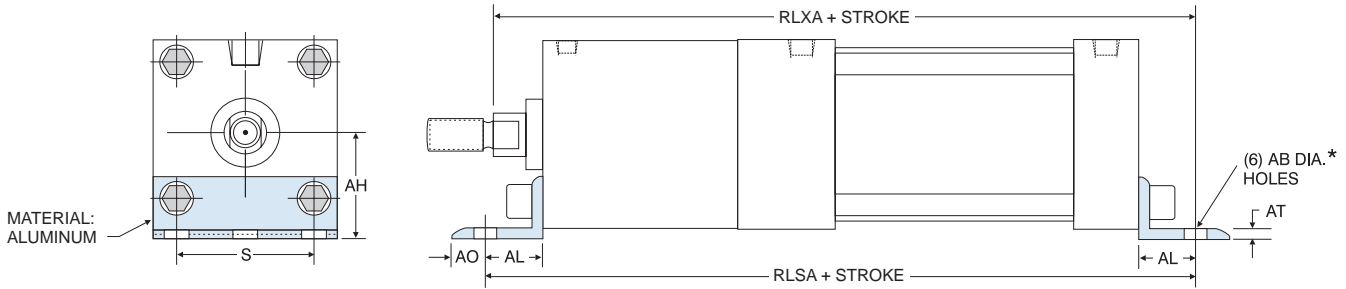
BORE	MM ROD DIAMETER	STANDARD		OPTIONAL							RLC	V
		Style 1 - Male	Style 2 - Male	Style 3 - Female	Style 4 - Male	Style 5 - Blank						
		KK1	A	KK2	A	KK3	A	KK4	A	KK5		
2.00, 2.50	1.000	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1 -14	1.125	No Threads	0.500	0.250
3.25, 4.00, 5.00	1.375	1 -14	1.625	1 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

'MXO' (NO MOUNT): OVERSIZED ROD WITH ROD LOCK MOUNTED



'SNC' SERIES BASIC DIMENSIONS 'MXO' (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	7/16 -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	7/16 -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

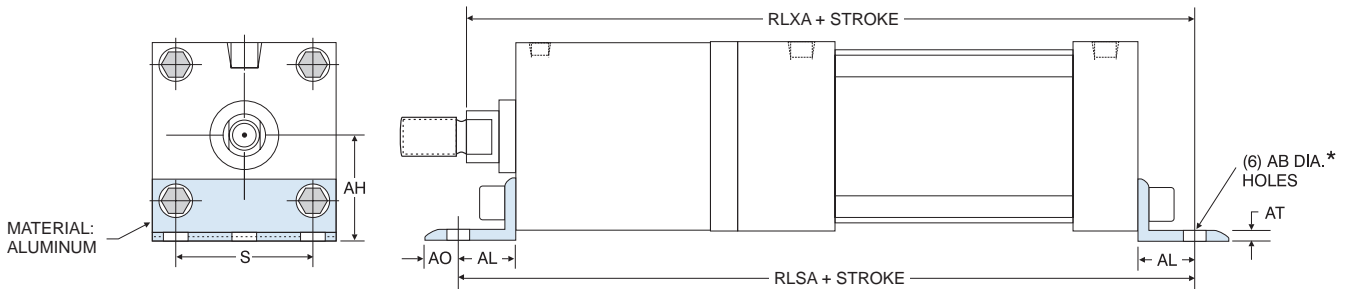
'MS1' (HEAD & CAP END ANGLE): STANDARD ROD WITH ROD LOCK MOUNTED



'SNC' 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 (4) "AB" holes on "S" dimension.
For dimensions not shown, see page 43.

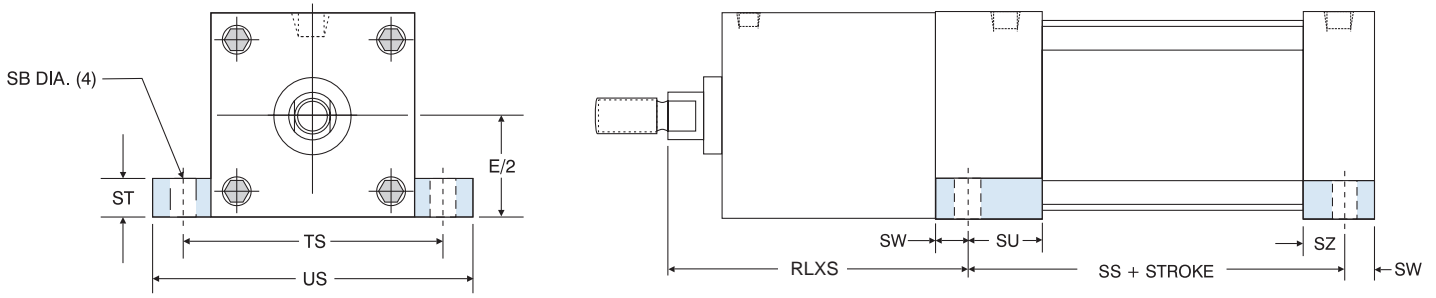
'MS1' (HEAD & CAP END ANGLE): OVERSIZED ROD WITH ROD LOCK MOUNTED



'SNC' 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 (4) "AB" holes on "S" dimension.
For dimensions not shown, see page 44.

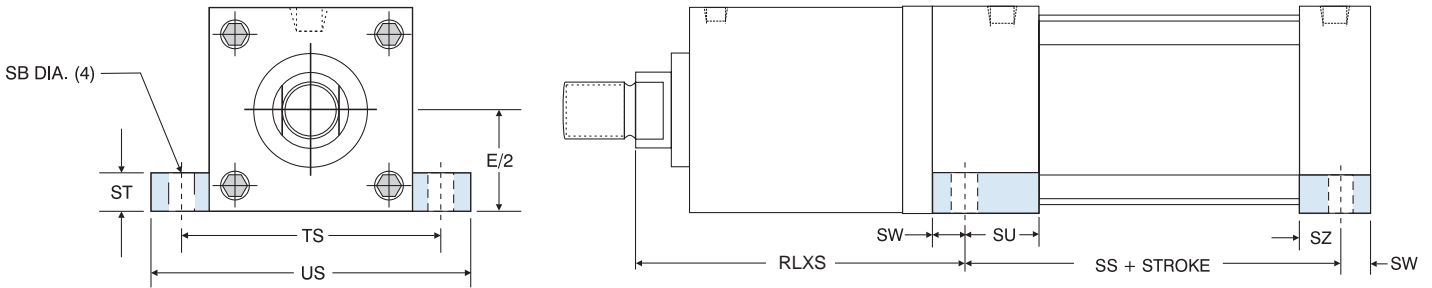
'MS2' (SIDE LUG): STANDARD ROD WITH ROD LOCK MOUNTED



'SNC' 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 43.

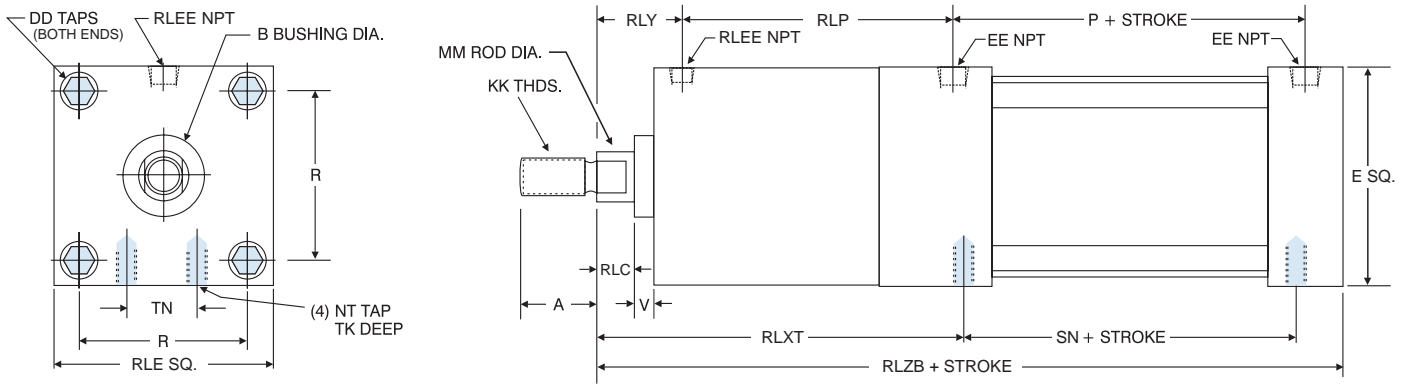
'MS2' (SIDE LUG): OVERSIZED ROD WITH ROD LOCK MOUNTED



'SNC' 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 44.

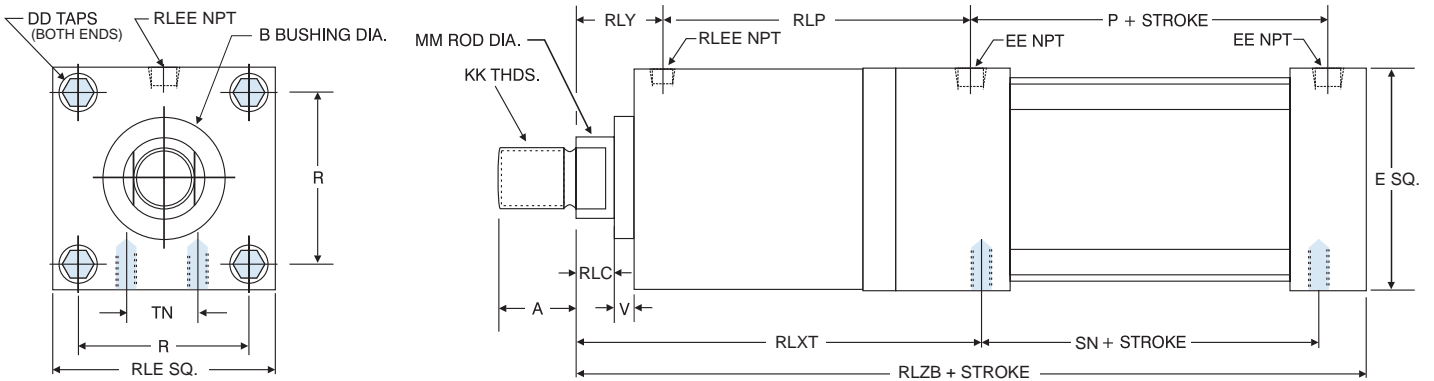
'MS4' (BOTTOM TAPPED HOLES): STANDARD ROD WITH ROD LOCK MOUNTED



'SNC' 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 43.

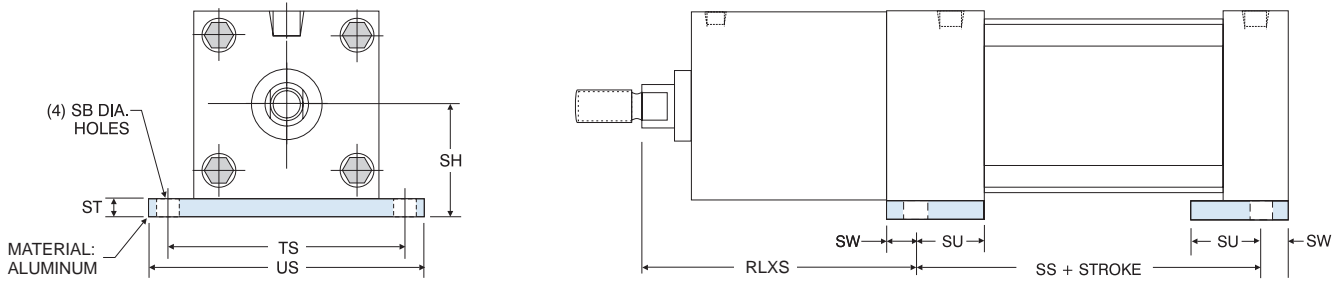
'MS4' (BOTTOM TAPPED HOLES): OVERSIZED ROD WITH ROD LOCK MOUNTED



'SNC' 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	0.313-18	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	0.375-16	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	0.500-13	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	0.500-13	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	0.636-11	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	0.750-10	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 44.

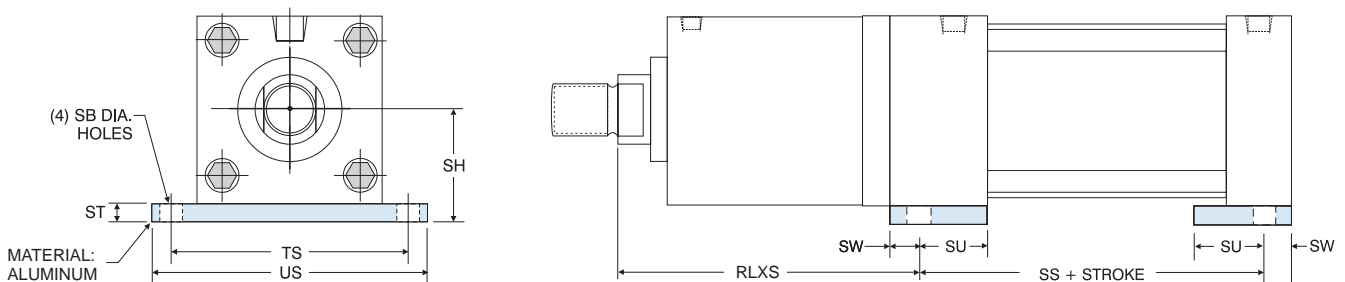
'BASEBAR' (NON-NFPA): STANDARD ROD WITH ROD LOCK MOUNTED



'SNC' SERIES BASE BAR 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 43.

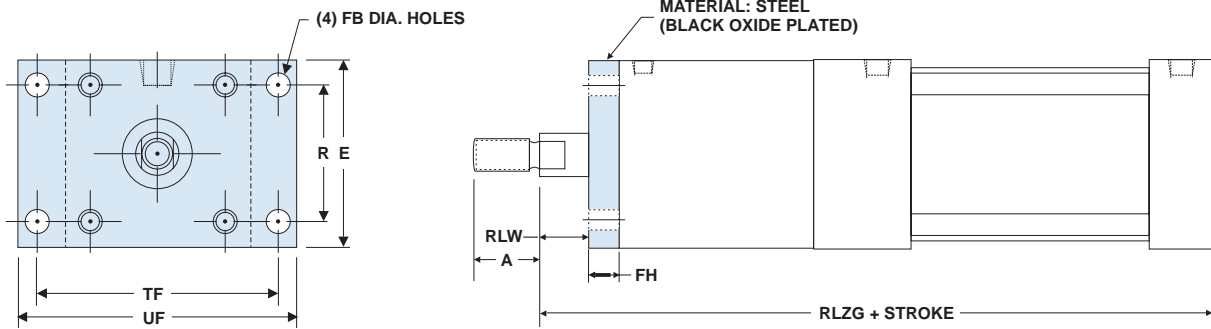
'BASEBAR' (NON-NFPA): OVERSIZED ROD WITH ROD LOCK MOUNTED



'SNC' SERIES BASE BAR 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 44.

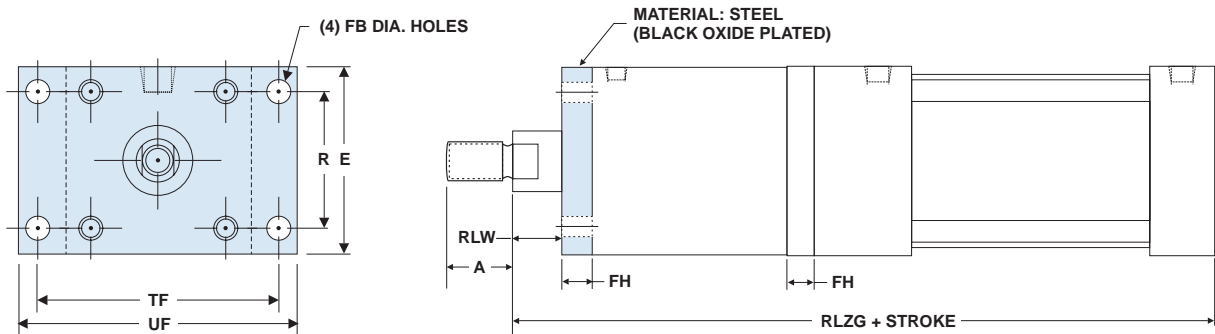
'MF1' (HEAD FLANGE): STANDARD ROD WITH ROD LOCK MOUNTED



'SNC' 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 43.

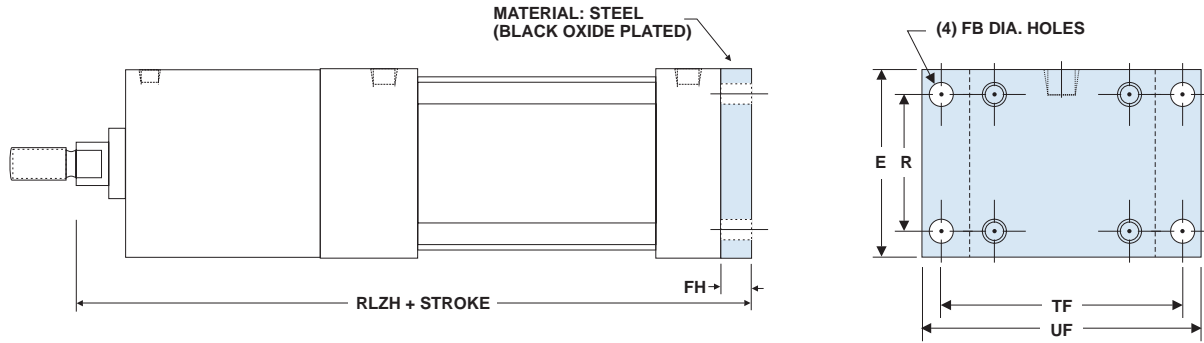
'MF1' (HEAD FLANGE): OVERSIZED ROD WITH ROD LOCK MOUNTED



'SNC' 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 44.

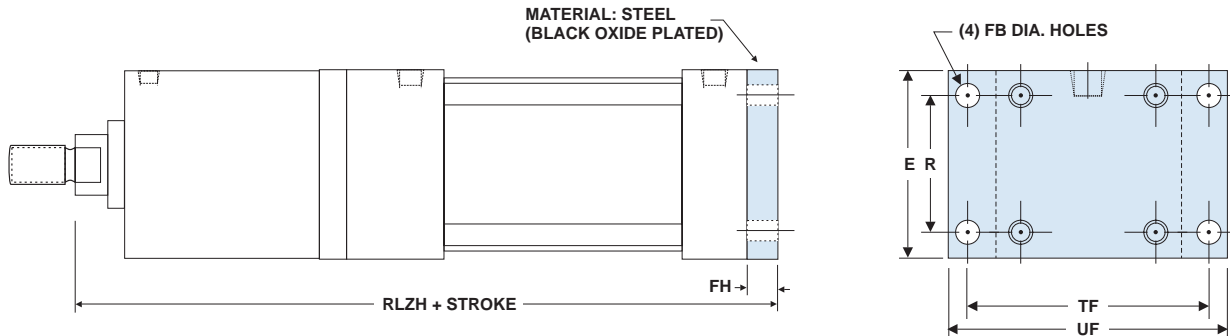
'MF2' (CAP FLANGE): STANDARD ROD WITH ROD LOCK MOUNTED



'SNC' 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 43.

'MF2' (CAP FLANGE): OVERSIZED ROD WITH ROD LOCK MOUNTED

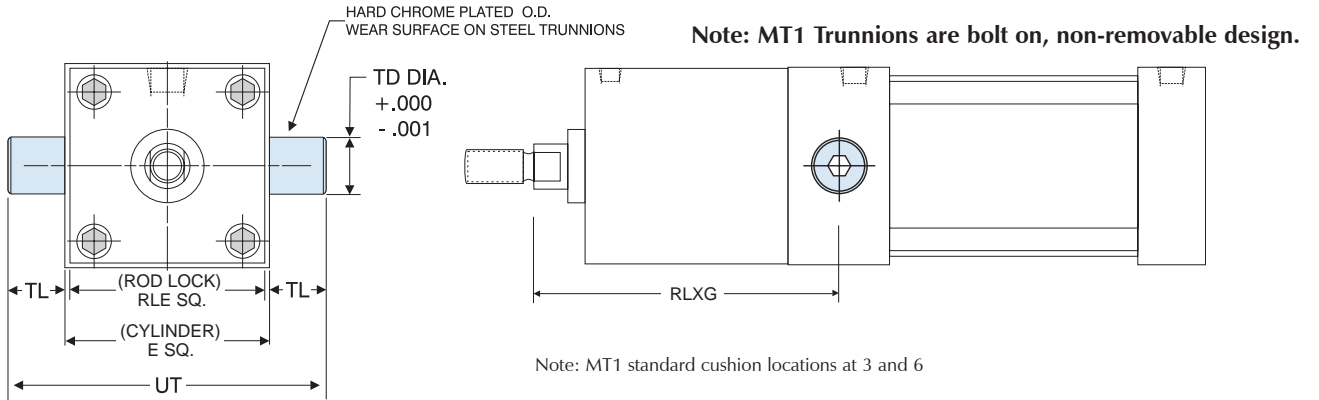


'SNC' SERIES 'MF2' FLANGE MOUNT DIMENSIONS								
BORE	ROD DIAMETER	E	FB	FH	R	TF	UF	RLZH
2.00	1.000	2.500	0.375	0.375	1.844	3.375	4.125	8.875
2.50	1.000	3.000	0.375	0.375	2.188	3.875	4.625	9.000
3.25	1.375	3.750	0.438	0.625	2.760	4.688	5.500	10.375
4.00	1.375	4.500	0.438	0.625	3.320	5.438	6.250	10.375
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 44.

'MT1' (HEAD TRUNNION): STANDARD ROD

WITH ROD LOCK MOUNTED



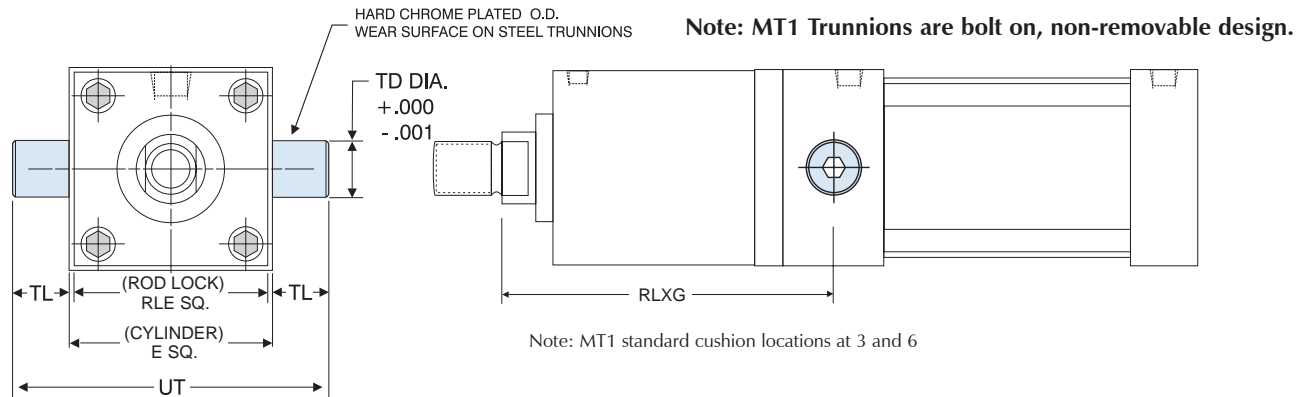
'SNC' SERIES 'MT1' HEAD TRUNNION AND 'MT2' CAP TRUNNION MOUNT DIMENSIONS

BORE	ROD DIAMETER	E	RL-E	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 43.

'MT1' (HEAD TRUNNION): OVERSIZED ROD

WITH ROD LOCK MOUNTED

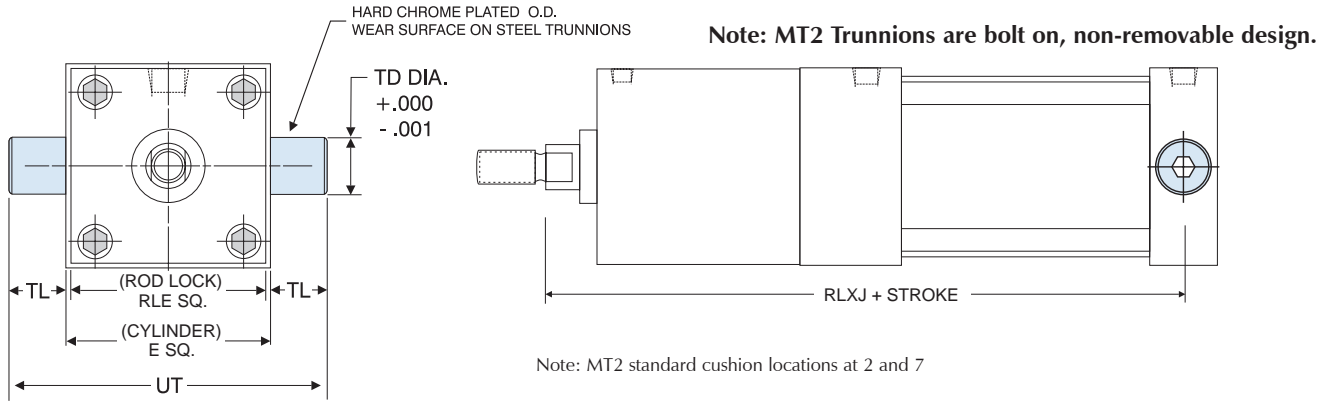


'SNC' SERIES 'MT1' HEAD TRUNNION AND 'MT2' CAP TRUNNION MOUNT DIMENSIONS

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 44.

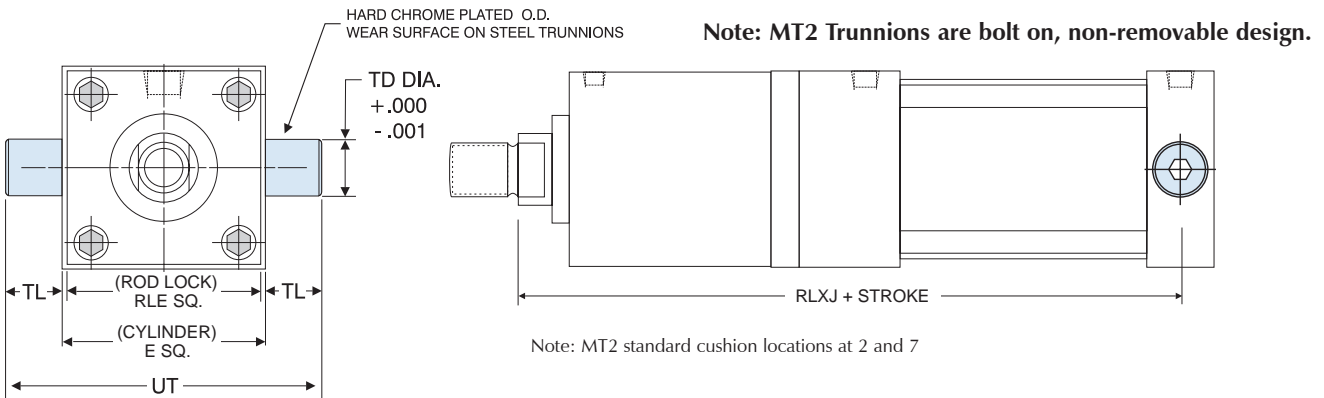
'MT2' (CAP TRUNNION): STANDARD ROD WITH ROD LOCK MOUNTED



'SNC' 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 43.

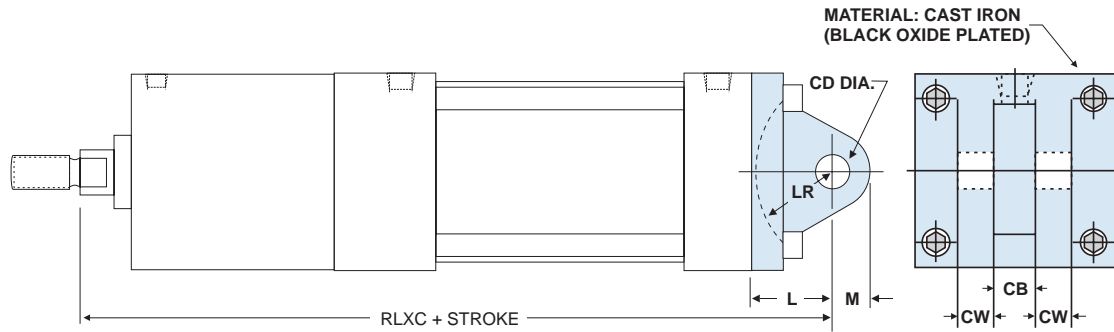
'MT2' (CAP TRUNNION): OVERSIZED ROD WITH ROD LOCK MOUNTED



'SNC' 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 44.

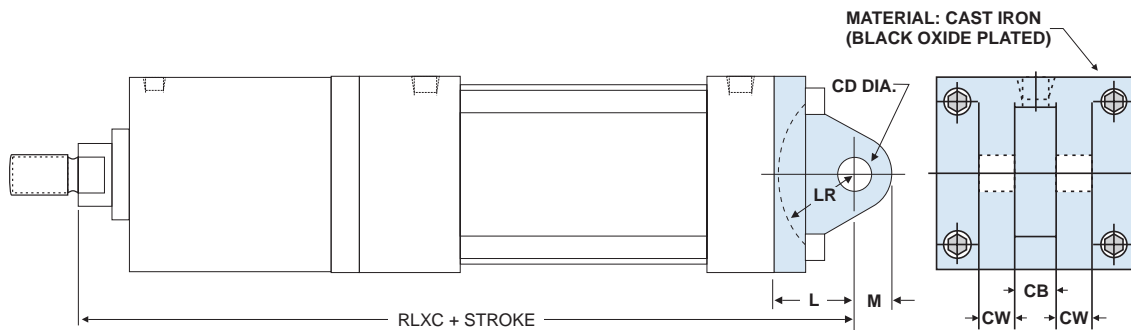
'MP1' (Detachable Cap Pivot Clevis): STANDARD ROD WITH ROD LOCK MOUNTED



'SNC' 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 43.

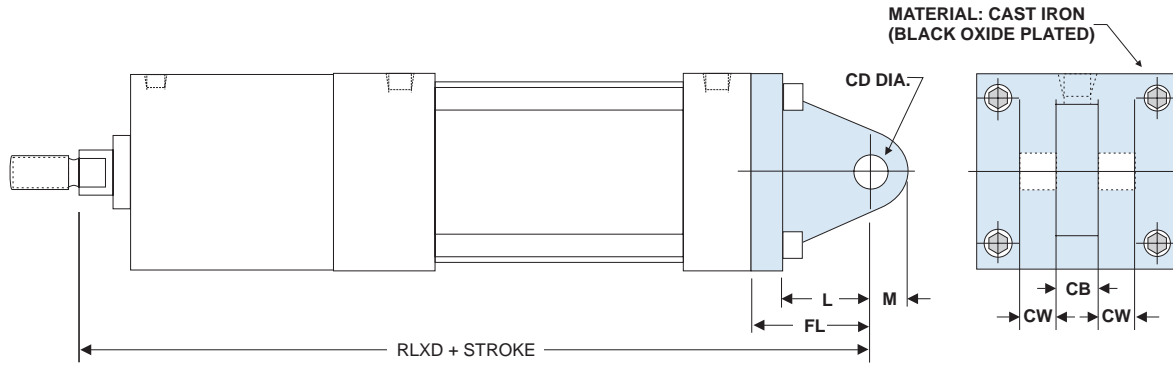
'MP1' (Detachable Cap Pivot Clevis): OVERSIZED ROD WITH ROD LOCK MOUNTED



'SNC' 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 44.

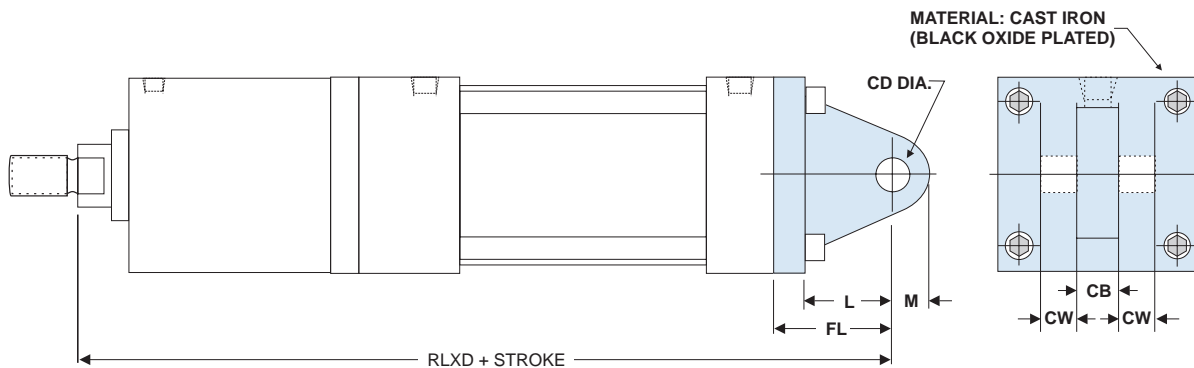
'MP2' (Detachable Cap Pivot Clevis): STANDARD ROD WITH ROD LOCK MOUNTED



'SNC' 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 43.

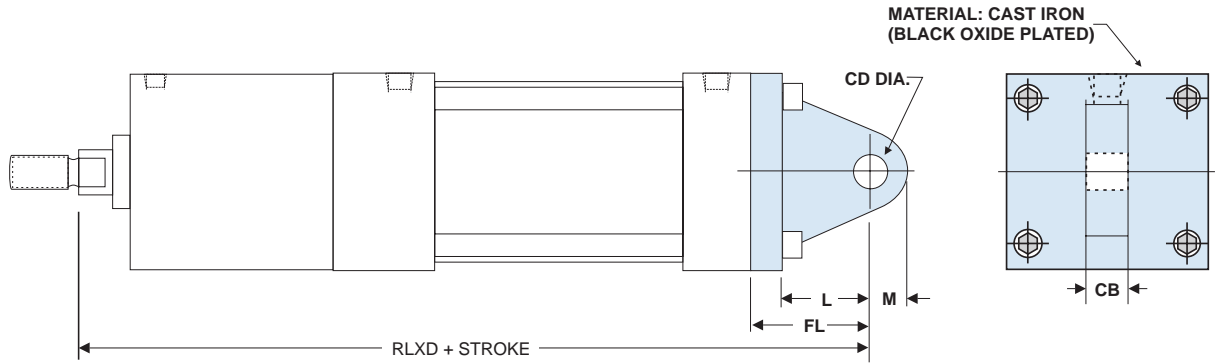
'MP2' (Detachable Cap Pivot Clevis): OVERSIZED ROD WITH ROD LOCK MOUNTED



'SNC' 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 44.

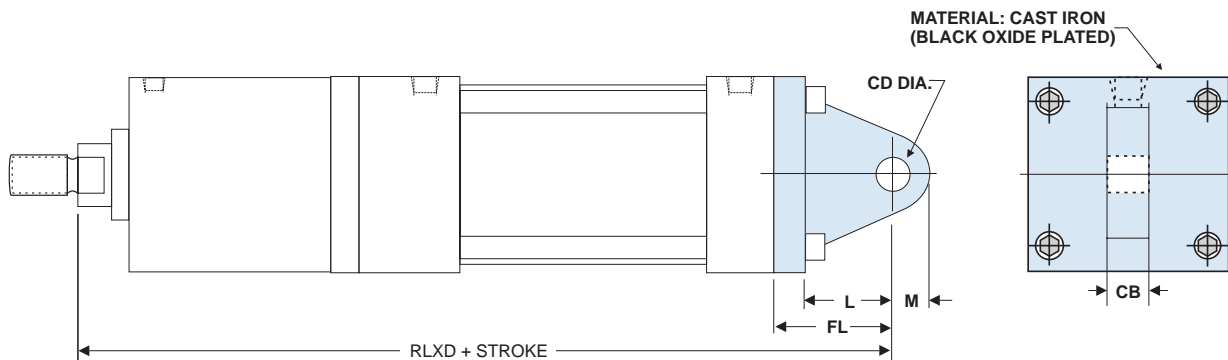
'MP4' (Detachable Cap Pivot Eye): STANDARD ROD WITH ROD LOCK MOUNTED



'SNC' 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	1.878	1.250	0.875	10.875
4.00	1.000	1.250	0.750	0.625	1.878	1.250	0.875	10.875

For dimensions not shown, see page 43.

'MP4' (Detachable Cap Pivot Eye): OVERSIZED ROD WITH ROD LOCK MOUNTED



'SNC' 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 44.

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").

Cylinder Control - Use a 5/3 valve to extend and retract cylinder with rod lock. A 4-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.

Rod Lock Control - Use a 3-way NC valve to supply 60 - 150 PSI to engage and disengage the rod lock.

Check Valve - Can be used to isolate 3-way valve from drop in supply air during cylinder operation.

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.

Quick Exhaust Valve - Can be used to accelerate the rod lock response time for maximum performance. Typical rod lock response time is 200ms.

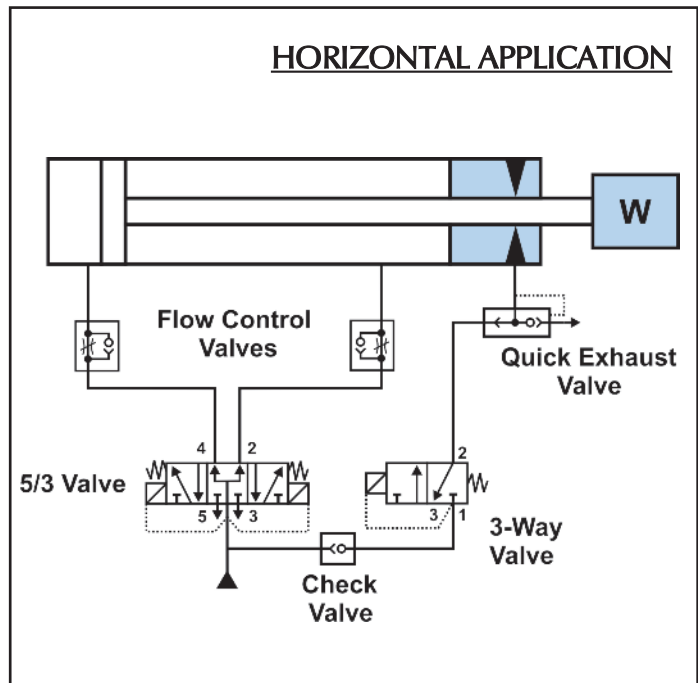
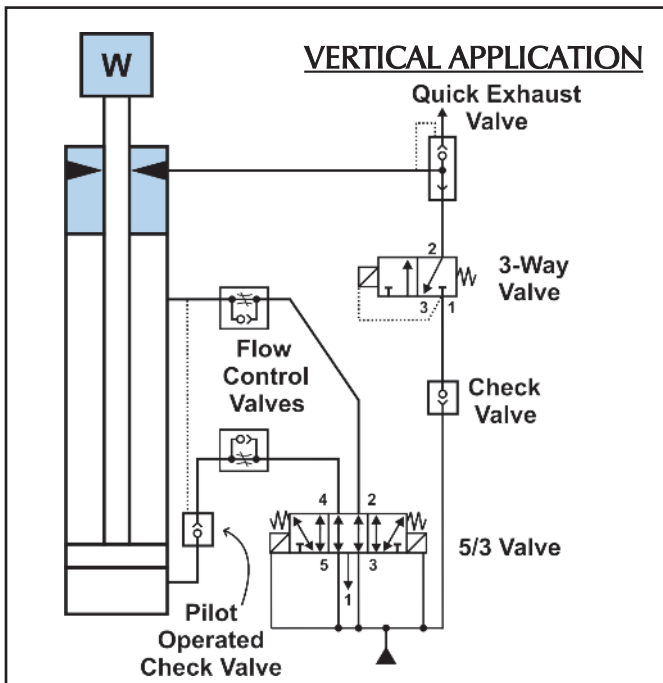
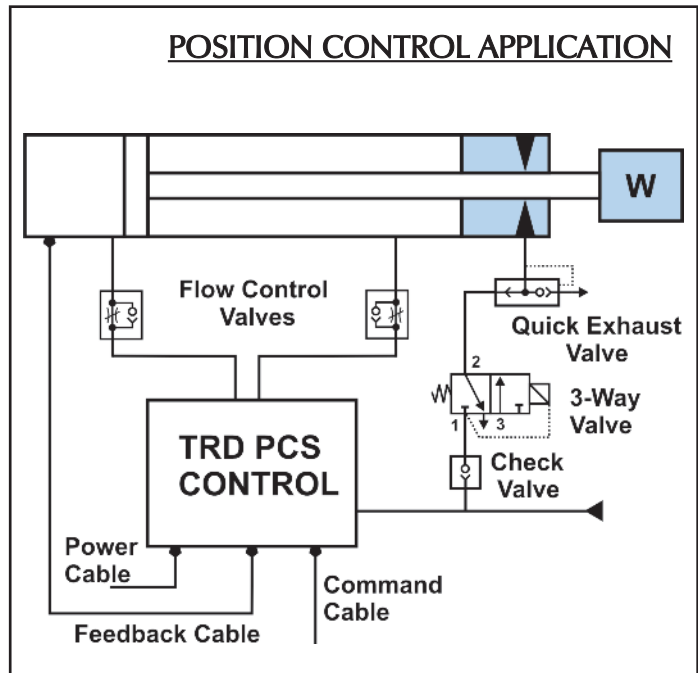
E-Stop - Rod Locks can be used in E-Stop applications provided the design calls for infrequent actuation of rod lock while the cylinder rods are in motion.

Manual Override - A 3-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 58 FOR SAFETY PRECAUTIONS BEFORE USING ROD LOCK.

Manual Override - A 3-way valve can be added to the control circuits below to act as a manual override for tooling set-up or adjustments.

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.



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 (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 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 - DO NOT DISASSEMBLE ROD LOCK - UNIT CONTAINS HIGH SPRING FORCE.
Return to Nason for service.

CAUTION - DO NOT REMOVE 60 - 150 PSI AIR SUPPLY TO ROD LOCK UNIT WITHOUT SHIPPING ARBOR OR CYLINDER PISTON ROD IN PLACE - PERMANENT DAMAGE MAY OCCUR

⚠ WARNING

UNIT CONTAINS HIGH SPRING FORCE

DO NOT DISASSEMBLE - INJURY MAY OCCUR

Return to Nason for service

Refer to Rod Lock Catalog or visit www.nasonptc.com for complete instructions on proper use of rod lock

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

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 Nason 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	
Cylinder	0 TO 250 PSI AIR
Rod Lock	60 TO 150 PSI AIR

OPERATING TEMPERATURE	
Standard Seals	10°F to 180°F (-12°C to 82°C)
Fluorocarbon Seals	0°F to 400°F (-18°C to 204°C)

AXIAL MOVEMENT (CLAMPED) *	
Standard	.000" to .008"
Close Tol. (Optional)	.000" to .002" - .003"

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 micro-inch

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

NOTES

Technical Data
Page 198

Switches
Page 184

Accessories
Page 172

Options
Page 142

SNC - with Rod
Lock

SNC - Mount
Dimensions

SNC - Base
Dimensions

SNC - How to Order

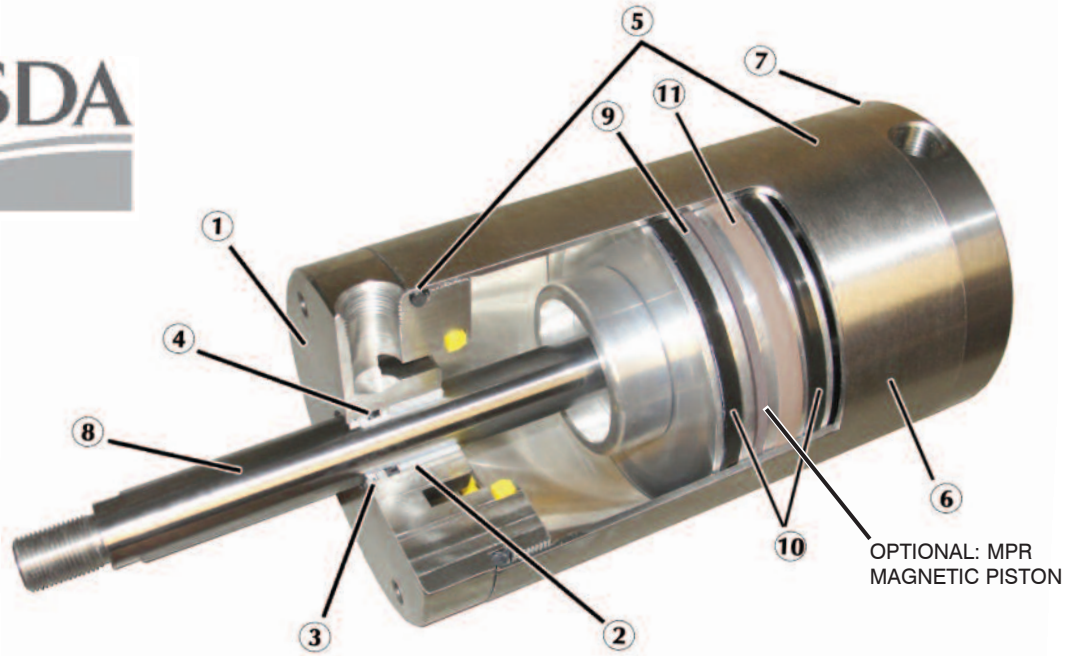


NASON

NEW THINKING



WASH DOWN NASON 'WDN': CONSTRUCTION



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 303 stainless steel is ideal for washdown 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 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 (high temperature or urethane material is optional) and offers resistance to a wide variety of washdown chemicals.
- ④ **ROD SEAL** – Nitrile rod seal (high temperature material is optional) is pressure activated and wear compensating for long life.
- ⑤ **BODY SEALS** – Nitrile material is standard (high temperature 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 303 stainless steel is ideal for washdown 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 303 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 (H1) Grease.

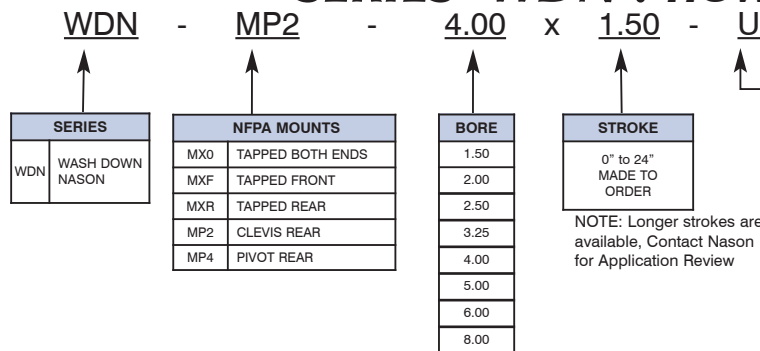
OPERATING PRESSURE

200 PSI Maximum

OPERATING TEMPERATURE

Standard: -20°F to 200°F (-25°C to 90°C)
VS Option: 0°F to 400°F (-20°C to 200°C)

SERIES 'WDN': HOW TO ORDER



OPTIONS	
ADDS LENGTH TO CYLINDER - SEE "OPTION LENGTH ADDER" CHART BELOW.	
A =	EXTENDED PISTON ROD THREAD (Example: A = 2")
X B	URETHANE BUMPER BOTH ENDS
X BC	URETHANE BUMPER CAP ONLY
X 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
RWU	URETHANE ROD WIPER
RWV	FLUOROCARBON ROD WIPER
SSP	STAINLESS STEEL PISTON (WITH WEARBAND)
U	USDA APPROVED OPTIONS *
VS	FLUOROCARBON SEALS
XX	SPECIAL VARIATION (SPECIFY) EXAMPLE - NO PISTON WEAR BAND, ETC.

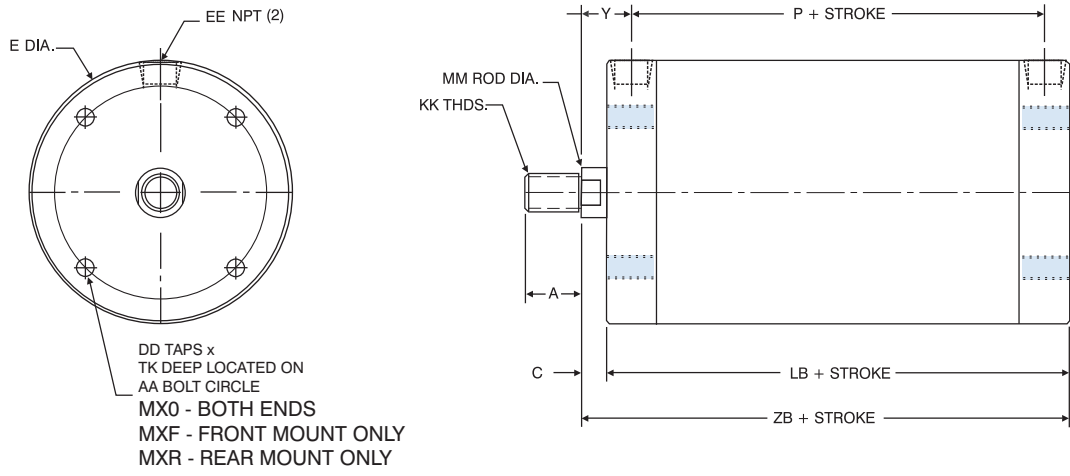
OPTION NOTES:

- Option (B) Bumpers cannot be combined with Option (FC) Cushions or Option (P) Prox. 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"

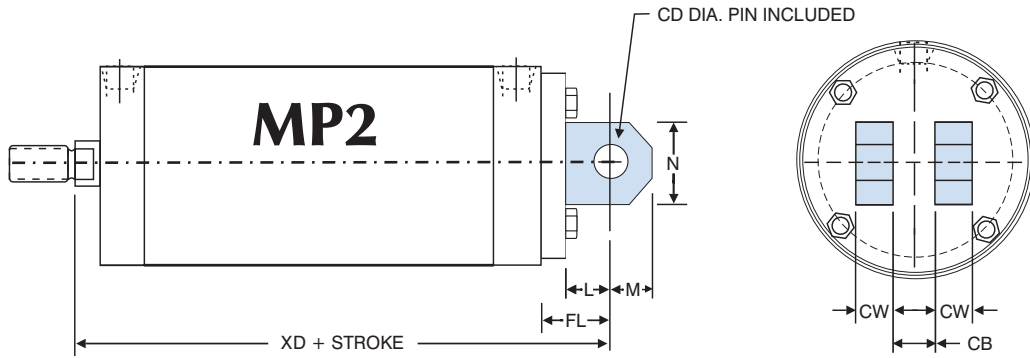
* USDA APPROVED OPTION- Includes an external wiper as required by the USDA. The cylinder rod length will automatically increase by the amount required to accommodate the seal retaining bracket. See page 64.

SERIES 'WDN' DIMENSIONS: FRONT & REAR MOUNT



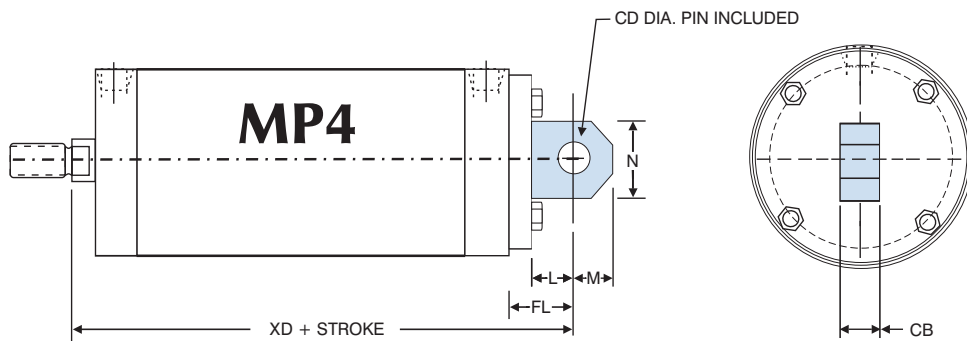
'MX0', 'MXR' & 'MXF' MOUNT DIMENSIONS														
BORE	ROD DIAMETER	A	AA	C	DD	E Dia.	EE NPT	KK	LB	MM	TK	Y	P	ZB
1.50	0.625 Standard	0.750	1.450	0.560	8-32	1.750	0.375	7/16-20	5.210	0.625	0.330	1.990	3.160	5.770
2.00	0.625 Standard	0.750	1.850	0.560	10-24	2.250	0.375	7/16-20	5.450	0.625	0.375	1.940	3.150	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	1.930	3.390	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	2.640	3.830	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	2.520	3.930	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

SERIES 'WDN' DIMENSIONS: CLEVIS MOUNT



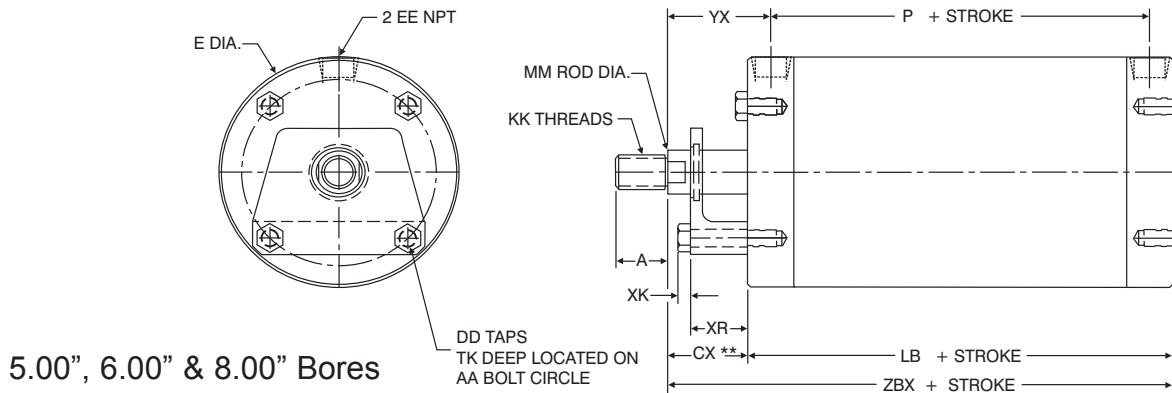
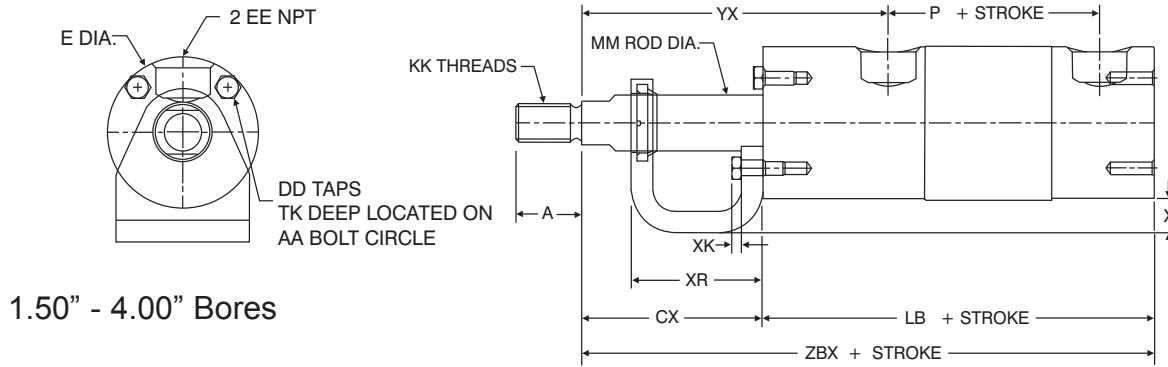
'MP2' CLEVIS MOUNT DIMENSIONS									
BORE	ROD DIAMETER	CB	CD	CW	FL	L	M	N	XD
1.50	0.625 Standard	0.750	0.500	0.490	1.125	0.750	0.350	0.700	6.900
2.00	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.400	0.800	7.140
2.50	0.625 Standard	0.750	0.500	0.500	1.125	0.750	0.400	0.800	7.640
3.25	1.000 Standard	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

SERIES 'WDN' 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

SERIES 'WDN' 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	3.490	3.160	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	3.440	3.150	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	3.430	3.390	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	4.140	3.830	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	4.020	3.930	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.

EXAMPLES OF 'U OPTION' MOUNTING BRACKET



SERIES 'WDN': OPTIONS

About Rod End Styles

Style 1 Male Rod End is STANDARD

Other NFPA Styles can be specified (See Chart).

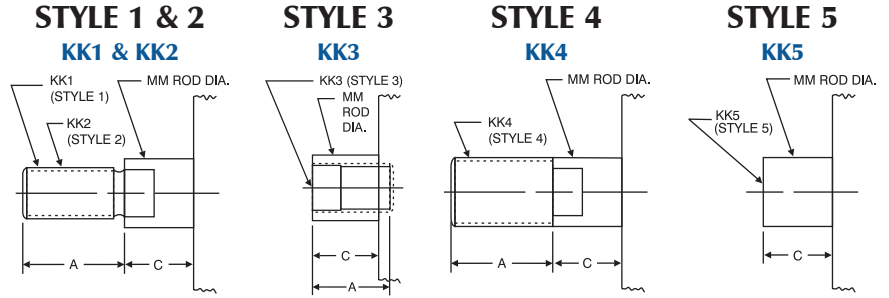
Need a rod end not listed?

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?

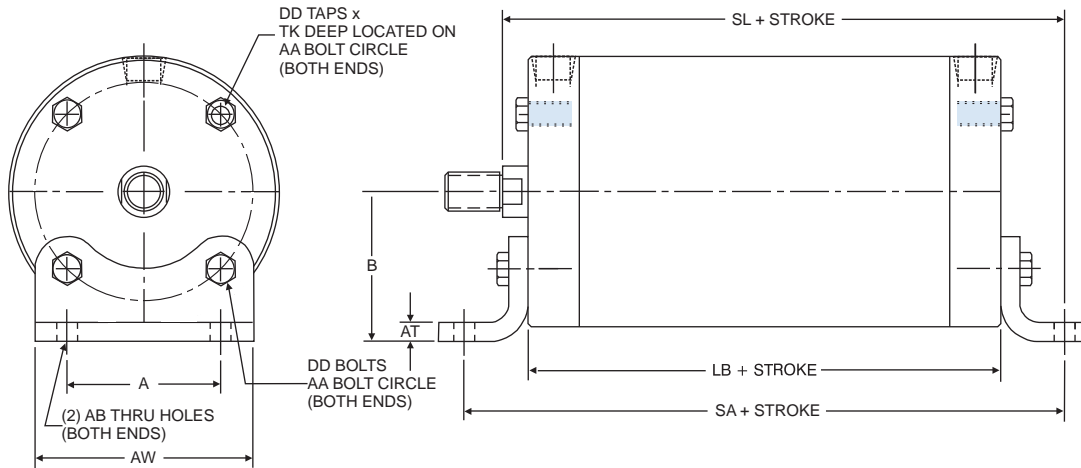
Just send us a sketch.

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



BORE	MM ROD DIAMETER	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 (INCHES)

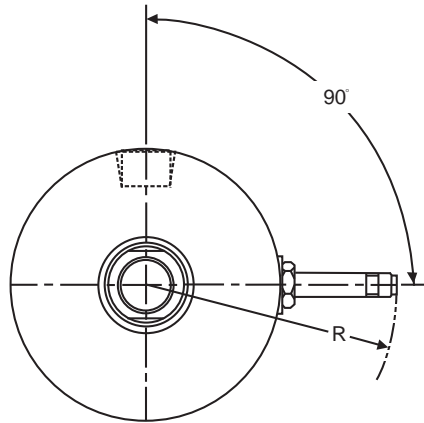


BORE	ROD DIAMETER	FOOT BRACKET KIT	A	AB	AW	B	AT	DD	AA	LB	TK	SA	SL
1.50	0.625 Standard	RS-FB150	1.030	0.188	1.520	1.250	0.250	8-32	1.450	5.210	0.330	6.620	6.460
2.00	0.625 Standard	RS-FB200	1.310	0.219	1.810	1.620	0.250	10-24	1.850	5.450	0.375	7.580	7.070
2.50	0.625 Standard	RS-FB250	1.550	0.281	2.300	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										

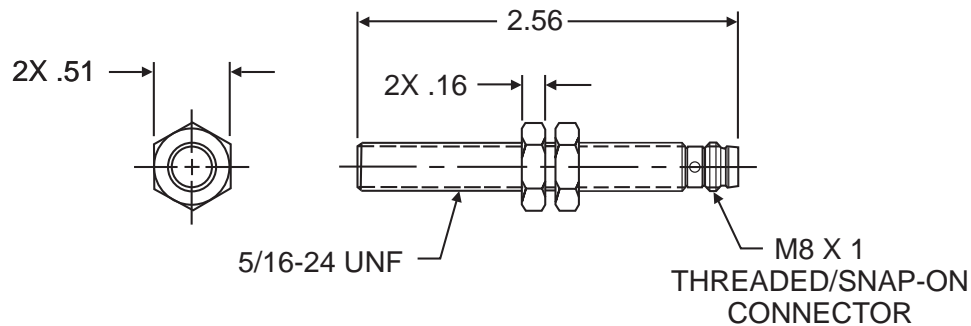
Note: Foot bracket mounting kits include two brackets and eight stainless steel screws. Can only be applied to MX0 mounting styles

SERIES 'WDN' 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-Nonincendive

SWITCH OPTIONS: SWITCH ORDERING INSTRUCTIONS

TO ORDER, SPECIFY: Switch Model, Lead Type, and Bracket Size

R10 X

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	
(leave blank)	= 24" Plain Cable
X	= 120" Plain Cable
Q	= 8mm Quick Connect (not available on RAC, or RHT)

Refer to catalog pages 184-190 for complete specifications.

Switch Mounting Bands	
USB25	Use with bores: 1.50", 2.00", 2.50"
USB50	Use with bores: 3.25", 4.00", 5.00"
USB80	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.

Nason designed our magnet to have 50-100% more power than required to operate our switch! The combination of Nason 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, 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), 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!

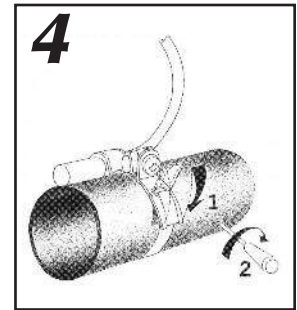
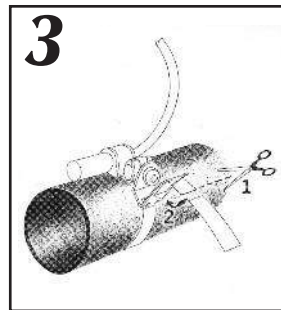
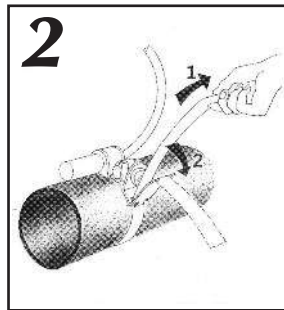
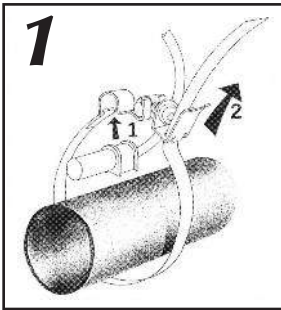
Other switches available:

- 12mm Quick Connect
- Special Length Cable
- Weld Immune Switch
- Pulse Extension Switch (For Sensing Mid-Stroke Positions)
- Change Over Switch (SPDT)
(Consult factory for details.)

Specify 'M' Option for ALL switch models when ordering actuators.

SERIES 'WDN': ACCESSORIES

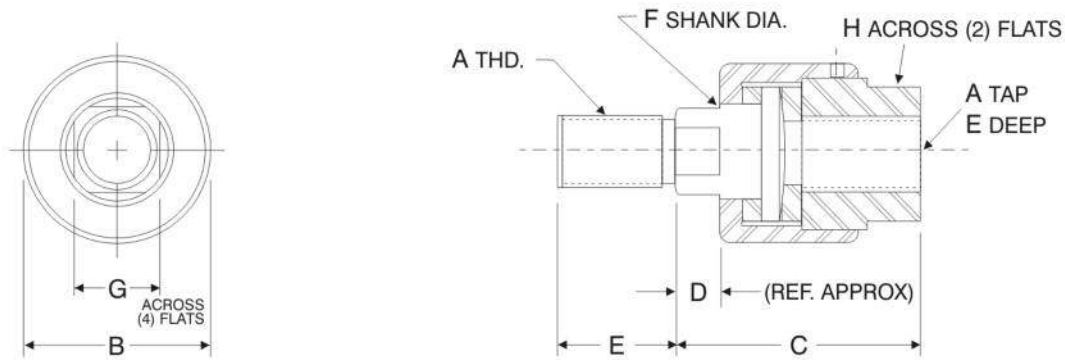
UNIVERSAL SWITCH BAND MOUNTING ILLUSTRATIONS



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.

STAINLESS STEEL ALIGNMENT COUPLERS (INCHES)

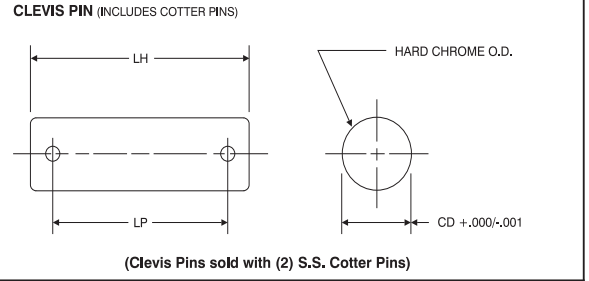


ALIGNMENT COUPLERS (INCHES)									
PART NO.	A	B	C	D	E	F	G	H	MAXIMUM PULL AT YIELD (LBS.)
SS-AC250	1/4-28	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1,000
SS-AC312	5/16-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1,800
SS-AC375	3/8-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	2,900
SS-AC437	7/16-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	4,000
SS-AC500	1/2-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	5,500
SS-AC625	5/8-18	1.250	2.000	0.438	0.750	0.625	0.500	0.813	7,000
SS-AC750	3/4-16	1.750	2.313	0.438	1.125	0.969	0.813	1.125	10,300
SS-AC875	7/8-14	1.750	2.313	0.438	1.125	0.969	0.813	1.125	12,000
SS-AC1000	1-14	2.500	2.938	0.438	1.625	1.344	1.156	1.625	15,000
SS-AC1250	1 1/4-12	2.500	2.938	0.438	1.625	1.344	1.156	1.625	17,000
SS-AC1500	1 1/2-12	3.250	4.375	0.875	2.250	1.969	1.750	2.375	20,000

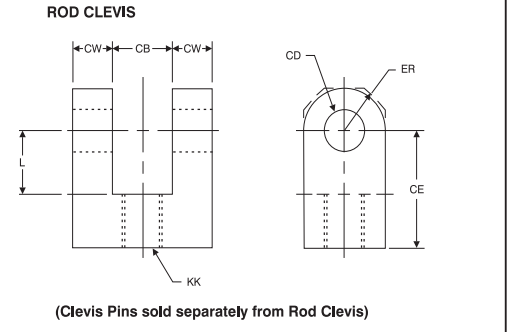
SERIES 'WDN': BASIC ACCESSORIES

Accessories (303 Stainless Steel)

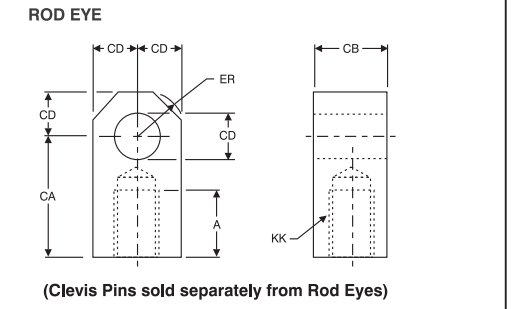
CLEVIS PIN (WITH COTTER PINS)			
PART NO.	CD	LH	LP
SS-CP500	0.500	2.250	1.938
SS-CP750	0.750	3.000	2.719
SS-CP1000	1.000	3.500	3.219
SS-CP1375	1.375	5.000	4.250
SS-CP1750	1.750	6.000	5.500



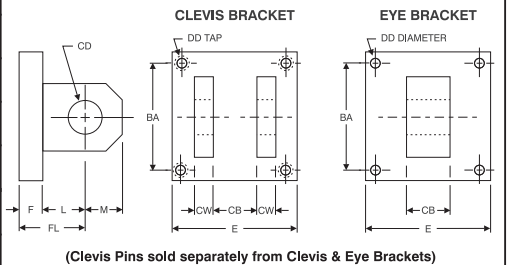
ROD CLEVIS							
PART NO.	CB	CD	CE	CW	ER	KK	L
SS-RC437	0.750	0.500	1.500	0.500	0.500	7/16-20	0.750
SS-RC500						1/2-20	
SS-RC750	1.250	0.750	2.375	0.625	0.750	3/4-16	1.250
SS-RC1000	1.500	1.000	3.125	0.750	1.000	1-14	1.500
SS-RC1250	2.000	1.375	4.125	1.000	1.375	1 1/4-12	2.125
SS-RC1500	2.500	1.750	4.500	1.250	1.750	1 1/2-12	2.250



ROD EYE						
PART NO.	A	CA	CB	CD	ER	KK
SS-RE437	0.750	1.500	0.750	0.500	0.625	7/16-20
SS-RE500						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 NO.	BA	CB	CD	CW	DD	E	F	FL	L	M
CLEVIS BRACKETS										
SS-CB500	1.625	0.750	0.500	0.500	3/4-24	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		0.656	5.000	0.875	3.000	2.125	1.375



WEIGHTS OF CYLINDERS

APPROXIMATE WEIGHT FOR STANDARD RODS (LBS.)					
CYLINDER BORE	BASE WEIGHT	ADD PER INCH OF STROKE	CYLINDER BORE	BASE WEIGHT	ADD PER INCH OF STROKE
1.50	2.82	0.27	4.00	30.20	0.70
2.00	5.25	0.33	5.00	24.10	0.84
2.50	8.92	0.39	6.00	36.45	1.12
3.25	20.63	0.61	8.00	69.80	1.80

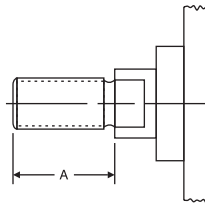
WDN - How to Order
WDN - Base Dimensions
WDN - Mount Dimensions
WDN - Options
Options Page 142
Accessories Page 172
Switches Page 184
Technical Data Page 198

SERIES 'WDN': 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. *Special length threads do not delay orders!*

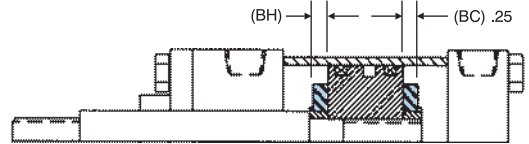


B BC BH Bumpers

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

Nason's Bumper Piston Seal, 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 (-25°C to 90°C)

Optional Material: Fluorocarbon

Available in 1.50"-8.00" Bores

Operating Temp: 0°F to 400°F (-18°C to 205°C)

Operating Pressure: 200 PSI Air (17 BAR)

For additional info, see page 144.

L001 MagnaLube G Grease

MagnaLube G Grease is our standard lubricant used for all products except for PFLF and WDN 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 for more information.

Color: Green

Recommended temperature range: -20°F to 200°F (-25°C to 90°C)

LF Low Friction

"LF" Low Friction 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

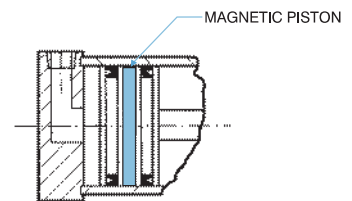
MATERIAL: Carboxylated Nitrile

OPERATING TEMPERATURE: -20°F to 200°F (-25°C to 90°C)

OPERATING PRESSURE: 200 PSI AIR (17 BAR)

MPR Magnetic Piston

"MPR" Magnetic Pistons are used in conjunction with Nason R10, R10P, RHT, RAC Reed and MSS Solid State Switches. (See pages 186-191 for switches)



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 156 in Full Line Catalog. (Available on 5.00"-8.00" Bore in WDN 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 (-20°C to 200°C)
Higher Chemical resistance: Resists most wash down solutions.

Note: Teflon wiper is used on "VS" Fluorocarbon seal option unless RWV is requested also.

NOTES

WDM - How to Order

WDM - Base Dimensions

WDM - Mount Dimensions

WDM- Options

Options
Page 142

Accessories
Page 172

Switches
Page 184

Technical Data
Page 198



NASON

NEW THINKING

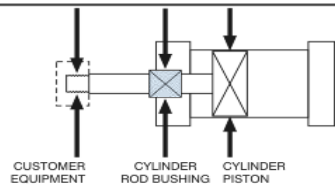


CORROSION RESISTANT NASON 'CRN' : CONSTRUCTION

Floating Rod Bushing

SELF ALIGNMENT FEATURE

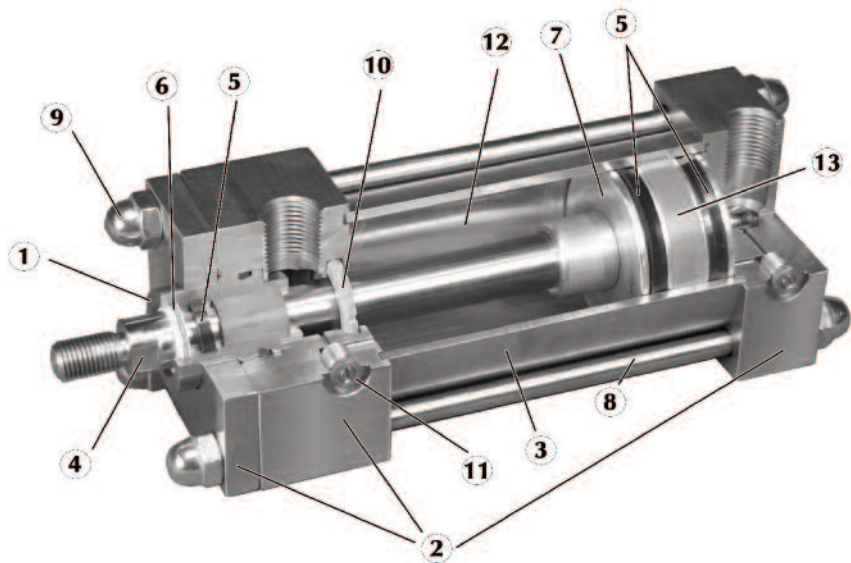
Rod Bushing is designed to float .002", improving bearing surface alignment.



- Reduces cylinder drag and erratic operation
- Reduces cylinder wear
- Provides a minimum of 25% longer life than "fixed" Rod Bushing designs

Ideal for:

- Food Processing Applications
- Chemical, Medical or Pharmaceutical
- Offshore or Marine Equipment
- Energy Production or Waste Treatment



- ① **FLOATING ROD BUSHING** – Precision machined from 303 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 304 stainless steel, providing smooth consistent operation.
- ④ **PISTON ROD** – Drawn, ground and polished high yield 303 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, provides an excellent bearing surface for extended cylinder life. (Optional: Stainless Steel with PTFE wear band)
- ⑧ **TIE RODS** – Drawn and ground 303 high strength stainless steel, rolled threads for maximum strength.
- ⑨ **ACORN NUTS** – 304 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** - 303 stainless steel design has fine thread metering and is positively captured to prevent needle ejection during adjustment.
- ⑫ **LUBRICATION** - Permanently lubricated with Magna-Lube 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; 65,000 PSI Compressive Strength; 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 (-25°C to 90°C) Fluorocarbon: 0°F to 400°F (-20°C to 200°C)
------------------------------	-----------------------------------------------------------------------------------------------------

Performance options:

- **FDAL** – FDA approved lubricant, rated for 0°F to 300°F (-20°C to 150°C)
- **DRB** – 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.
- **VS** – Fluorocarbon seals provide a higher chemical resistance to most wash-down solutions.
- **SSP** – Solid Stainless Steel Piston provides maximum corrosion resistance and FDA approval for food contact. (PTFE wear band standard)

SERIES 'CRN': HOW TO ORDER

CRN - MXO - 1.50 X 1.00 - H1C5 - BP - KK3 - MPR - OP = PORTS AT 3 & 7

SERIES	
CRN	250 PSI AIR

NFPA MOUNTS	
MXO	NO MOUNT (1.50" - 8.00" BORE)
MP1	REAR PIVOT CLEVIS (1.50" - 8.00" BORE)
MP4	REAR PIVOT EYE (1.50" - 6.00" BORE)
MT1	FRONT TRUNNION (1.50" - 8.00" BORE)
MT2	REAR TRUNNION (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)
MF1	FRONT FLANGE (1.50" - 6.00" BORE)
MF2	REAR FLANGE (1.50" - 6.00" BORE)
ME3	FRONT MOUNTING HOLES (8.0.0" BORE)
ME4	REAR MOUNTING HOLES (8.0.0" BORE)
MS2	SIDE LUG (1.50" - 8.00" BORE)
MS4	BOTTOM TAPPED HOLES (1.50" - 8.00" BORE)

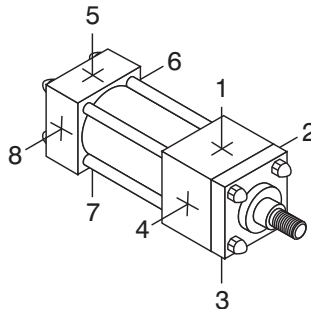
STYLE
SINGLE ROD (LEAVE BLANK)
D = DOUBLE ROD END

BORE
1.50
2.00
2.50
3.25
4.00
5.00
6.00
8.00

STROKE
0" TO 120"
CONSULT FACTORY FOR OTHER STROKES

CUSHIONS
H = HEAD CUSHION POSITION 2 STANDARD SPECIFY FOR POSITIONS 1, 3 OR 4
C = CAP CUSHION POSITION 6 STANDARD SPECIFY FOR POSITIONS 5, 7 OR 8

OPTIONS	
A / O	AIR / OIL PISTON
B**	.25" URETHANE BUMPER BOTH ENDS
BH**	.25" URETHANE BUMPER HEAD ONLY
BC**	.25" URETHANE BUMPER CAP ONLY
BP	BUMPER PISTON SEAL (1.50" - 5.00" BORE)
"A"	EXTENDED PISTON ROD THREAD (SPECIFY)
"C"	EXTENDED PISTON ROD (SPECIFY)
DRB	DELRI [®] ROD BUSHING
FDAL	FDA APPROVED LUBRICANT
KK2	INTERMEDIATE MALE ROD THREAD
KK3	FEMALE ROD THREAD
KK3S	STUDDER PISTON ROD (WITH KK3)
KK4	FULL DIAMETER MALE ROD THREAD
LF	LOW FRICTION, 250 PSI AIR
MPR	MAGNETIC PISTON FOR REED SWITCHES
MPH	MAGNETIC PISTON FOR HALL SWITCHES
MS	METALLIC ROD SCRAPER (BRASS)
NR	NON-ROTATING
OP	OPTIONAL PORT LOCATION
OS	OVERSIZED ROD DIAMETER (SPECIFY SIZE)
SE	SPRING EXTEND (CONSULT FACTORY)
SR	SPRING RETURN (CONSULT FACTORY)
SSP	STAINLESS STEEL PISTON (WITH WEARBAND)
ST	STOP TUBE (SPECIFY LENGTH)
TH	400 PSI HYDRAULIC, NON-SHOCK
VS	FLUOROCARBON SEALS
AS	ADJUSTABLE STROKE (RETRACT)
XX	SPECIAL VARIATION (SPECIFY)
BSP SAE PORTS (SPECIFY SIZE)	



STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

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

** BUMPERS ADD 0.250" PER END TO CYLINDER LENGTH

About our Part Number System

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

Example: A 2.50" Bore by 10" Stroke, Front Flange Mount, Head & Cap Cushions

Part Number: CRN-MF1-2.50 x 10-HC

NFPA MOUNTS

<p>MXO</p> <p>1.50"-8.00" Bores Page 74 FO</p>	<p>MXOD</p> <p>1.50"-8.00" Bores Page 78-FO</p>	<p>MP1</p> <p>1.50"-8.00" Bores Page 75</p>	<p>MP4</p> <p>1.50"-6.00" Bores Page 75</p>	<p>MT1</p> <p>1.50"-8.00" Bores Page 75</p>
<p>MT2</p> <p>1.50"-8.00" Bores Page 75</p>	<p>MX1</p> <p>1.50"-8.00" Bores Page 76</p>	<p>MX2</p> <p>1.50"-8.00" Bores Page 76</p>	<p>MX3</p> <p>1.50"-8.00" Bores Page 76</p>	<p>MF1</p> <p>1.50"-6.00" Bores Page 76</p>
<p>MF2</p> <p>1.50"-6.00" Bores Page 76</p>	<p>ME3</p> <p>8.00" Bore Page 76</p>	<p>ME4</p> <p>8.00" Bore Page 76</p>	<p>MS2</p> <p>1.50"-8.00" Bores Page 77</p>	<p>MS4</p> <p>1.50"-8.00" Bores Page 77</p>

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

EASY FLIP OUT PAGE FOR REFERENCE

About Rod End Styles

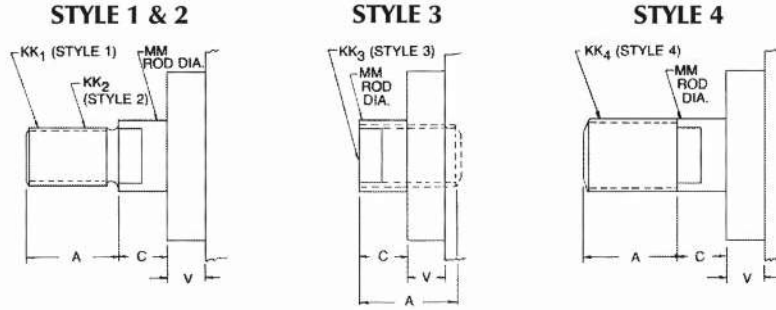
Style 1 Male Rod End is STANDARD

Other NFPA Styles can be specified (See Chart).

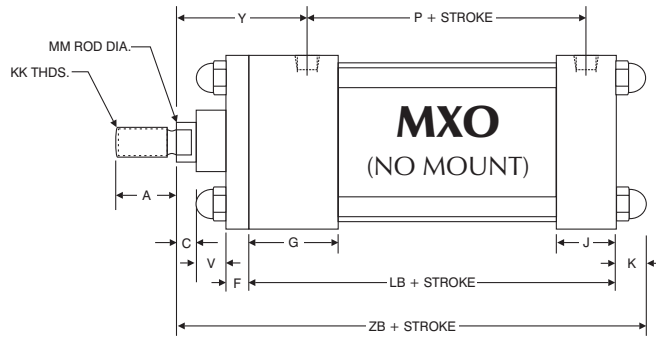
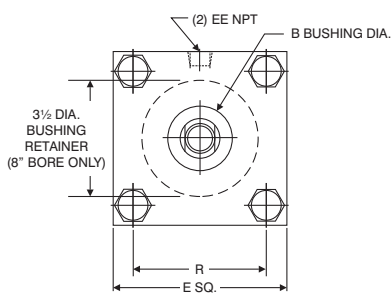
Need a rod end not listed? NO PROBLEM! Each Piston Rod is made to order and does not delay shipment. Coarse (UNC) threads, Metric threads or just plain rod ends are common. Thread lengths are also made to order (Specify: "A"=Length).

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

PISTON ROD END STYLES



BORE	MM ROD DIAMETER	STANDARD		OPTIONAL						C	V
		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	0.500-20	0.750	7/16 -20	0.750	5/8 -18	0.750	0.375	0.250
	1.000 Oversize	3/4 -16	1.125	0.875-14	1.125	3/4 -16	1.125	1 -14	1.125	0.500	0.500
3.25, 4.00, 5.00	1.000 Standard	3/4 -16	1.125	0.875-14	1.125	3/4 -16	1.125	1 -14	1.125	0.500	0.250
	1.375 Oversize	1 -14	1.625	1.250-12	1.625	1 -14	1.625	1 3/8 -12	1.625	0.625	0.375
6.00 & 8.00	1.375 Standard	1 -14	1.625	1.250-12	1.625	1 -14	1.625	1 3/8 -12	1.625	0.625	0.375
	1.750 Oversize	1 1/4 -12	2.000	1.500-12	2.000	1 1/4 -12	2.000	1 3/4 -12	2.000	0.750	0.500



BASIC DIMENSIONS 'MXO' 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

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

About Rod End Styles

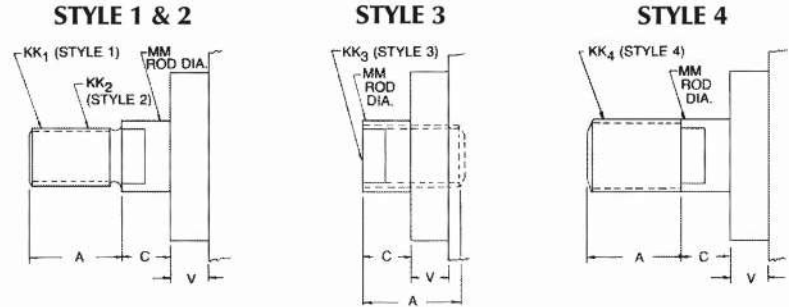
Style 1 Male Rod End is STANDARD

Other NFPA Styles can be specified (See Chart).

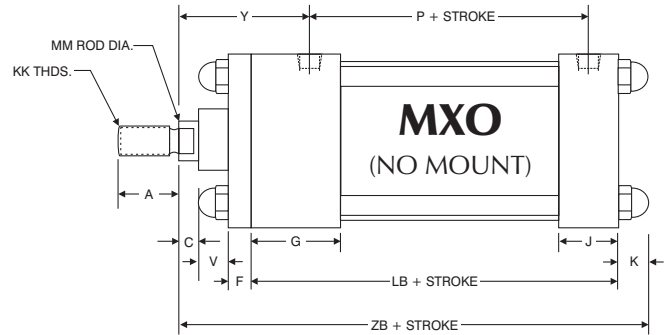
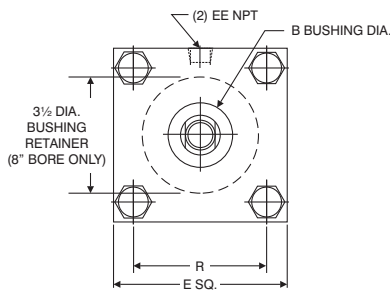
Need a rod end not listed?
NO PROBLEM! Each Piston Rod is made to order and does not delay shipment. Coarse (UNC) threads, Metric threads or just plain rod ends are common. Thread lengths are also made to order (Specify: "A"=Length).

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

PISTON ROD END STYLES



BORE	MM ROD DIAMETER	STANDARD		OPTIONAL						C	V
		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	0.500-20	0.750	7/16-20	0.750	5/8-18	0.750	0.375	0.250
	1.000 Oversize	3/4-16	1.125	0.875-14	1.125	3/4-16	1.125	1-14	1.125	0.500	0.500
3.25, 4.00, 5.00	1.000 Standard	3/4-16	1.125	0.875-14	1.125	3/4-16	1.125	1-14	1.125	0.500	0.250
	1.375 Oversize	1-14	1.625	1.250-12	1.625	1-14	1.625	1 3/8-12	1.625	0.625	0.375
6.00 & 8.00	1.375 Standard	1-14	1.625	1.250-12	1.625	1-14	1.625	1 3/8-12	1.625	0.625	0.375
	1.750 Oversize	1 1/4-12	2.000	1.500-12	2.000	1 1/4-12	2.000	1 3/4-12	2.000	0.750	0.500

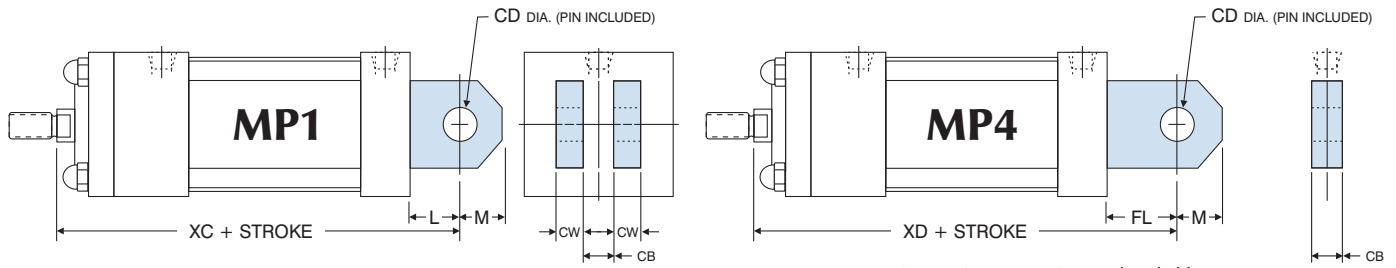


BASIC DIMENSIONS 'MXO' STANDARD & OVERSIZED RODS																		
BORE	ROD DIAMETER	A	B	C	E	EE	F	G	J	K	KK	LB	MM	P	R	V	Y	ZB
1.50	0.625 Standard	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.438	7/16-20	3.625	0.625	2.375	1.430	0.250	1.875	5.063
	1.000 Oversize	1.125	1.500	0.500							3/4-16		1.000			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

BASE DIMENSION FOLD OUT

www.mfcp.com

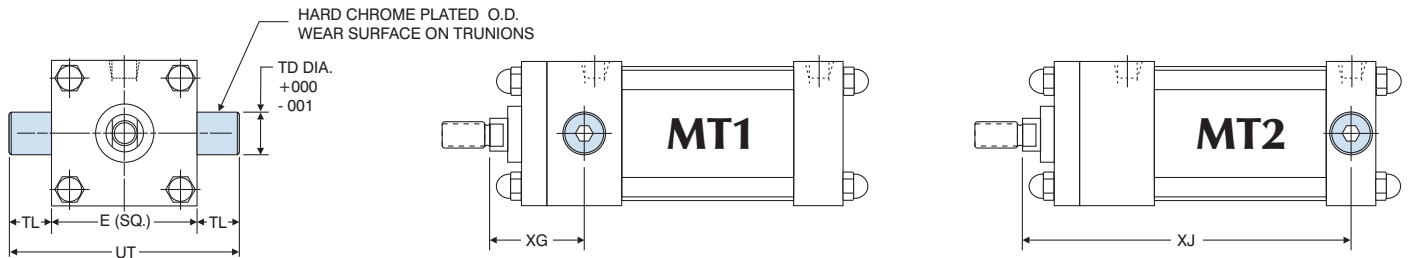
SERIES 'CRN' DIMENSIONS: PIVOT MOUNTS



Note: Pivot Mount is non-detachable.
Contact factory for detachable mount options.

'MP1' CLEVIS AND 'MP4' EYE MOUNT DIMENSIONS								ACCESSORIES (SEE PAGE 172 FOR DIMENSIONS)							
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-EB750	
	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-EB1000
	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-EB1000
	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-EB1000		
	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.
MP4 8.00" bore not available.
For dimensions not shown see page 74-Fold Out.



MT1 / MT2

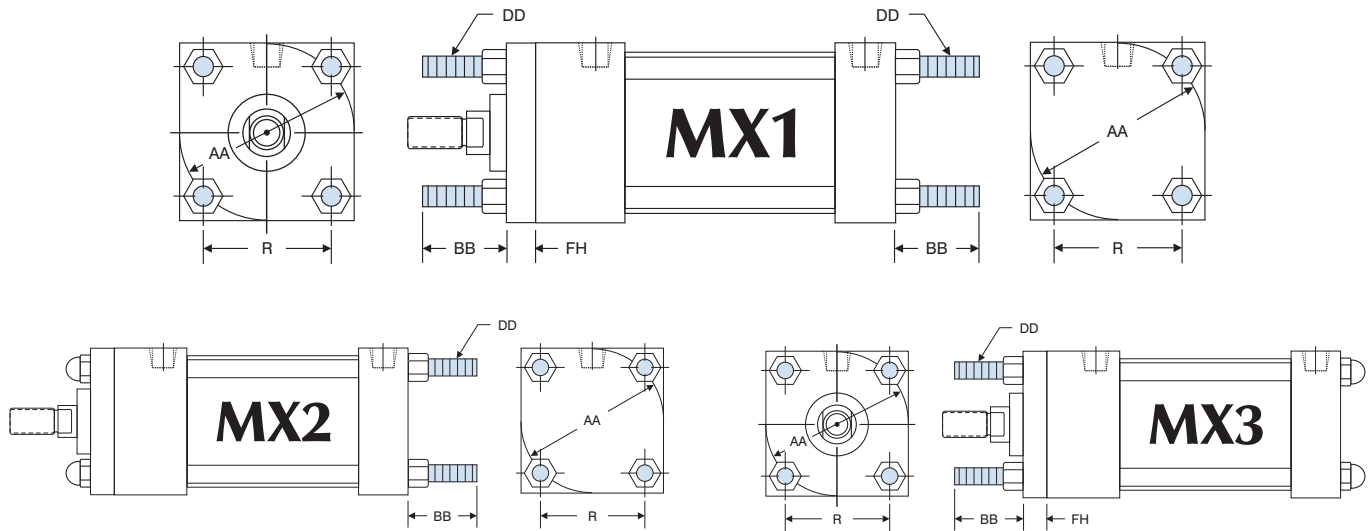
Note: Trunnions are bolt on, non-removable design.

'MT1' HEAD TRUNNION AND 'MT2' CAP TRUNNION MOUNT DIMENSIONS							ACCESSORIES (SEE PAGE 172 FOR DIMENSIONS)			
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.
For dimensions not shown see page 74-Fold Out.

SERIES 'CRN' DIMENSIONS: TIE ROD & FLANGE MOUNTS

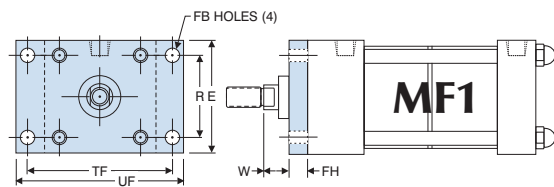
CRN - How to Order
 CRN - Base Dimensions
 CRN - Single Rod Mounts
 CRN - Double Rod Mounts
 Options Page 142
 Accessories Page 172
 Switches Page 184
 Technical Data Page 198



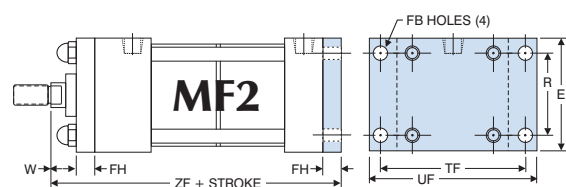
TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS						
BORE	ROD DIAMETER	AA	BB	DD	FH	R
1.50	0.625 Standard	2.020	1.000	1/4 -28	0.375	1.430
	1.000 Oversize					
2.00	0.625 Standard	2.600	1.125	5/16 -24	0.375	1.840
	1.000 Oversize					
2.50	0.625 Standard	3.100	1.125	5/16 -24	0.375	2.190
	1.000 Oversize					
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					

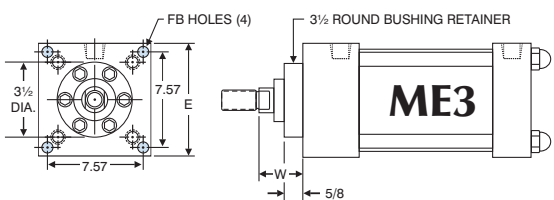
Full square bushing retainer on 1.50" thru 6.00" bore.
 * Round retainer on 8.00" bore. BB dimension from face of head.
 For dimensions not shown, see page 74-Fold Out.



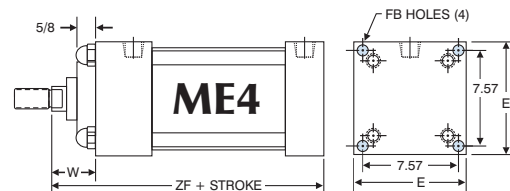
1.50" - 6.00" BORES



1.50" - 6.00" BORES



8.00" BORE ONLY



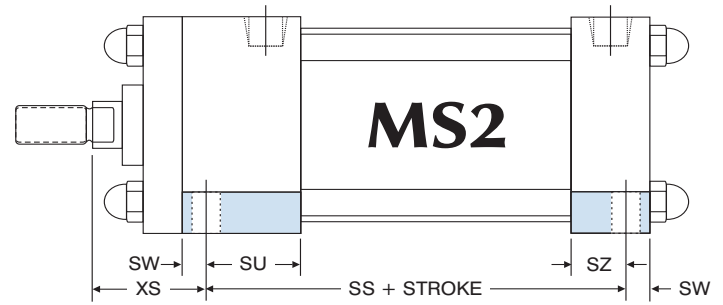
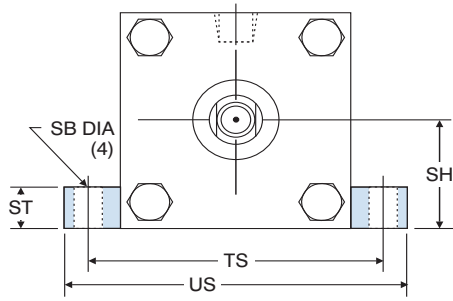
8.00" BORE ONLY

'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	

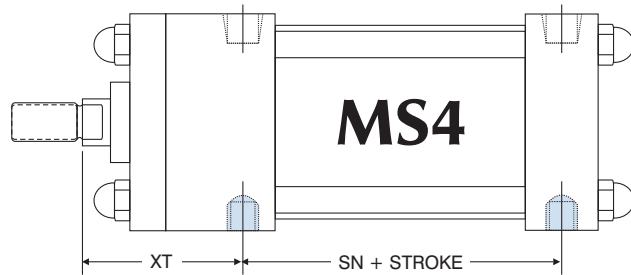
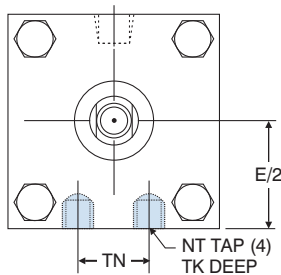
Full square bushing retainer on 1.50" thru 6.00" bore.
 * Round retainer on 8.00" bore.
 For dimensions not shown, see page 74-Fold Out.

SERIES 'CRN' 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									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
	1.000 Oversize									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
	1.000 Oversize									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									2.125	
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									2.125	
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									2.313	
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									2.563	
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									2.563	

Full square bushing retainer on 1.50" thru 6.00" bore.
 Round retainer on 8.00" bore.
 For dimensions not shown, see page 74-Fold Out.



'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					2.313	
2.00	0.625 Standard	1.250	5/16-18	0.500	0.875	1.938	2.250
	1.000 Oversize					2.313	
2.50	0.625 Standard	1.500	3/8-16	0.625	1.250	1.938	2.375
	1.000 Oversize					2.313	
3.25	1.000 Standard	1.875	1/2-13	0.750	1.500	2.438	2.625
	1.375 Oversize					2.688	
4.00	1.000 Standard	2.250	1/2-13	0.750	2.063	2.438	2.625
	1.375 Oversize					2.688	
5.00	1.000 Standard	2.750	5/8-11	1.000	2.688	2.438	2.875
	1.375 Oversize					2.688	
6.00	1.375 Standard	3.250	3/4-10	1.125	3.250	2.813	3.125
	1.750 Oversize					3.063	
8.00	1.375 Standard	4.250	3/4-10	1.125	4.500	2.813	3.250
	1.750 Oversize					3.063	

Full square bushing retainer on 1.50" thru 6.00" bore.
 Round retainer on 8.00" bore.
 For dimensions not shown, see 74-Fold Out.

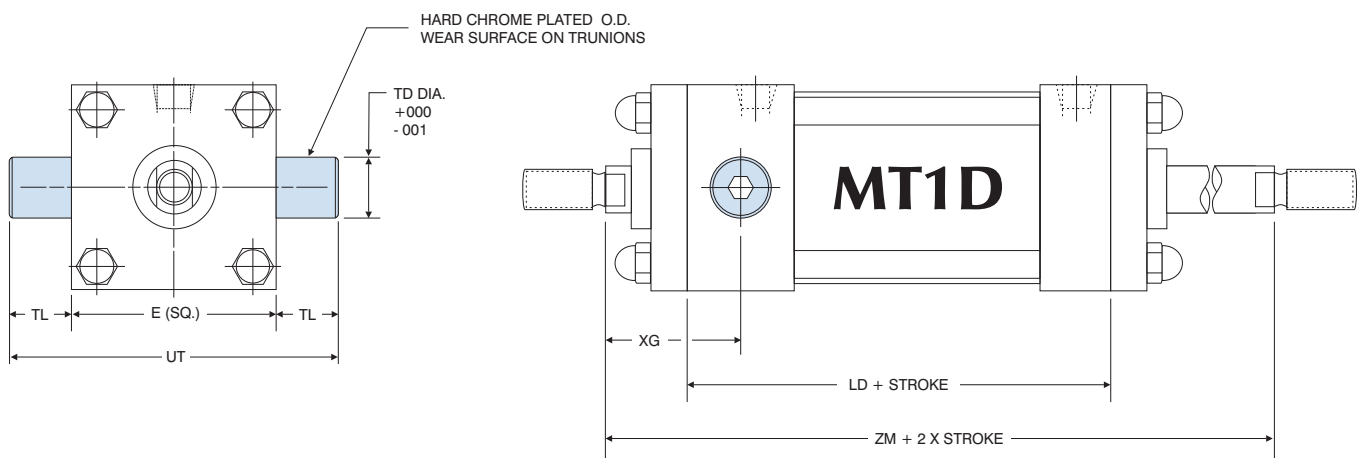
SERIES 'CRN' DIMENSIONS: DOUBLE ROD END

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).



(MT1D MOUNT SHOWN)



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

'CRN-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	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.

SERIES 'CRN' DIMENSIONS: DOUBLE ROD END

EASY FLIP OUT PAGE FOR REFERENCE

About Rod End Styles

Style 1 Male Rod End is STANDARD

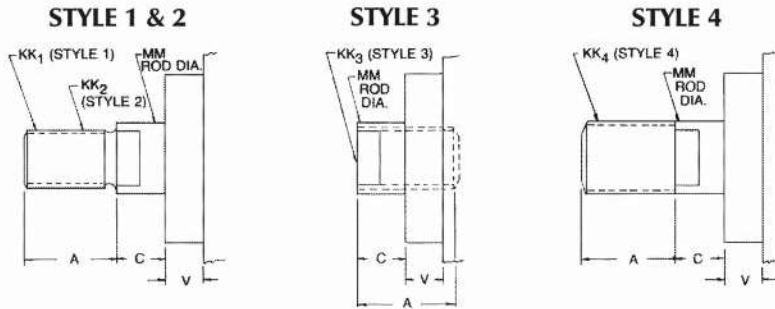
Other NFPA Styles can be specified (See Chart).

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).

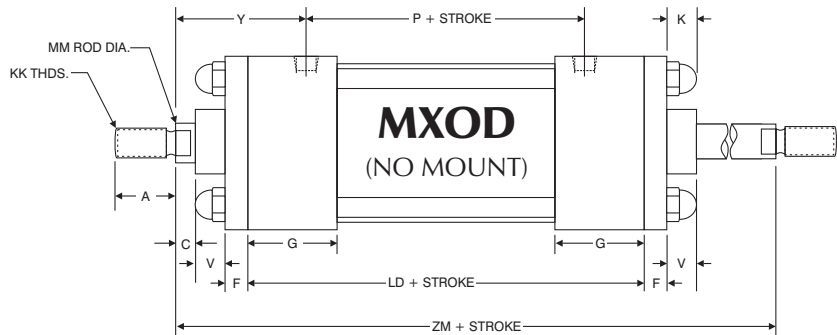
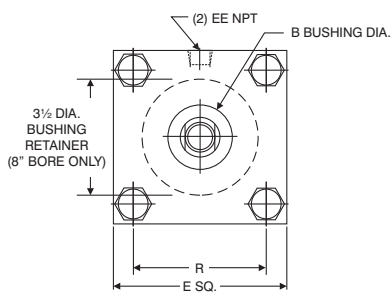
NEED SOMETHING NOT LISTED? Just send us a sketch.

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

PISTON ROD END STYLES



BORE	MM ROD DIAMETER	STANDARD		OPTIONAL						C	V
		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	0.250
	1.000 Oversize	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1 -14	1.125	0.500	0.500
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	0.250
	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	0.375
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	0.375
	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	0.500



DOUBLE ROD 'MXOD' DIMENSIONS STANDARD & OVERSIZED RODS

BORE	ROD DIAMETER	A	B	C	E	EE	F	G	K	KK	LD	MM	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	0.625	2.375	1.430	0.250	1.875	6.125
	1.000 Oversize	1.125	1.500	0.500						3/4 -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	0.563	7/16 -20	4.125	0.625	2.375	1.840	0.250	1.875	6.125
	1.000 Oversize	1.125	1.500	0.500						3/4 -16		1.000			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	0.625	2.500	2.190	0.250	1.875	6.250
	1.000 Oversize	1.125	1.500	0.500						3/4 -16		1.000			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	1.000	2.750	2.760	0.250	2.375	7.500
	1.375 Oversize	1.625	2.000	0.625						1 -14		1.375			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	1.000	2.750	3.320	0.250	2.375	7.500
	1.375 Oversize	1.625	2.000	0.625						1 -14		1.375			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	1.000	3.000	4.100	0.250	2.375	7.750
	1.375 Oversize	1.625	2.000	0.625						1 -14		1.375			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	1.375	3.250	4.880	0.250	2.750	8.750
	1.750 Oversize	2.000	2.375	0.750						1 1/4 -12		1.750			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	1.375	3.375	6.440	0.375	2.750	8.875
	1.750 Oversize	2.000	2.375	0.750						1 1/4 -12		1.750			0.500	3.000	9.375

SERIES 'CRN' DIMENSIONS: DOUBLE ROD END

About Rod End Styles

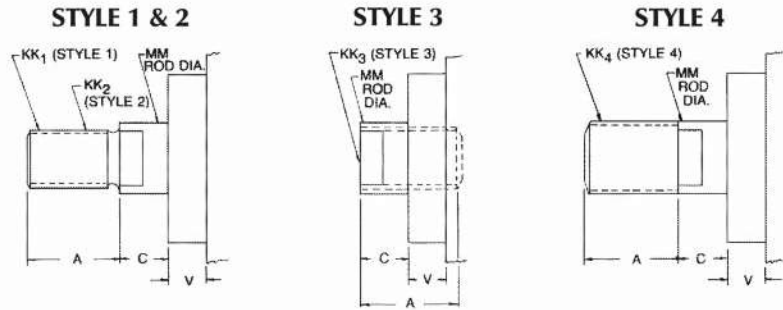
Style 1 Male Rod End is STANDARD

Other NFPA Styles can be specified (See Chart).

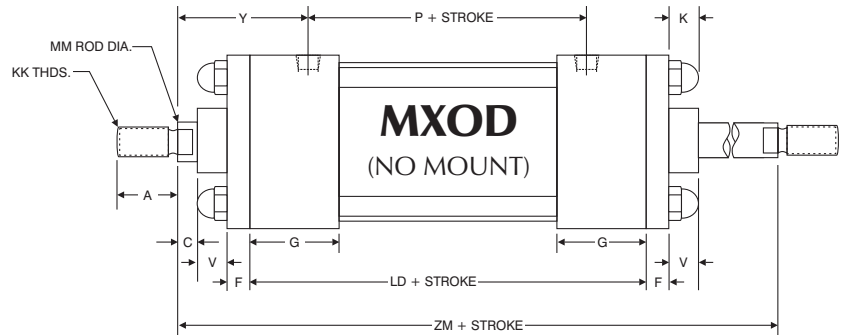
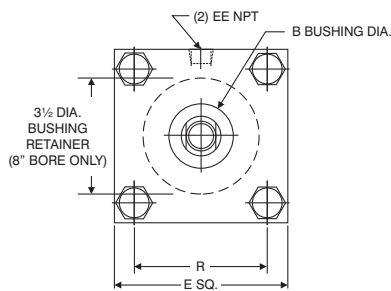
Need a rod end not listed? NO PROBLEM! Each Piston Rod is made to order and does not delay shipment. Coarse (UNC) threads, Metric threads or just plain rod ends are common. Thread lengths are also made to order (Specify: "A"=Length).

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			
		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	0.250
	1.000 Oversize	3/4 -16	1.125	7/8 -14	1.125	3/4 -16	1.125	1 -14	1.125	0.500	0.500
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	0.250
	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	0.375
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	0.375
	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	0.500



DOUBLE ROD 'MXOD' DIMENSIONS STANDARD & OVERSIZED RODS																	
BORE	ROD DIAMETER	A	B	C	E	EE	F	G	K	KK	LD	MM	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	0.625	2.375	1.430	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	0.563	7/16 -20	4.125	0.625	2.375	1.840	0.250	1.875	6.125
	1.000 Oversize	1.125	1.500	0.500						3/4 -16		1.000					
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	0.625	2.500	2.190	0.250	1.875	6.250
	1.000 Oversize	1.125	1.500	0.500						3/4 -16		1.000					
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	1.000	2.750	2.760	0.250	2.375	7.500
	1.375 Oversize	1.625	2.000	0.625						1 -14		1.375					
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	1.000	2.750	3.320	0.250	2.375	7.500
	1.375 Oversize	1.625	2.000	0.625						1 -14		1.375					
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	1.000	3.000	4.100	0.250	2.375	7.750
	1.375 Oversize	1.625	2.000	0.625						1 -14		1.375					
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	1.375	3.250	4.880	0.250	2.750	8.750
	1.750 Oversize	2.000	2.375	0.750						1 1/4 -12		1.750					
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	1.375	3.375	6.440	0.375	2.750	8.875
	1.750 Oversize	2.000	2.375	0.750						1 1/4 -12		1.750					

SERIES 'CRN' DIMENSIONS: DOUBLE ROD END FLANGE MOUNTS

CRN - How to Order

CRN - Base Dimensions

CRN - Single Rod Mounts

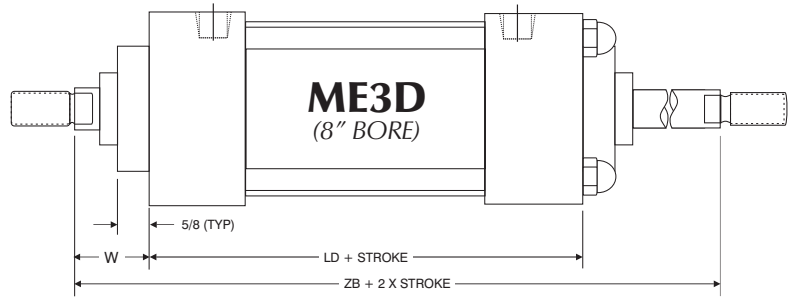
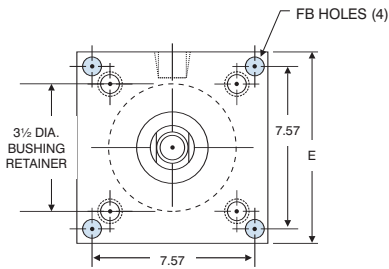
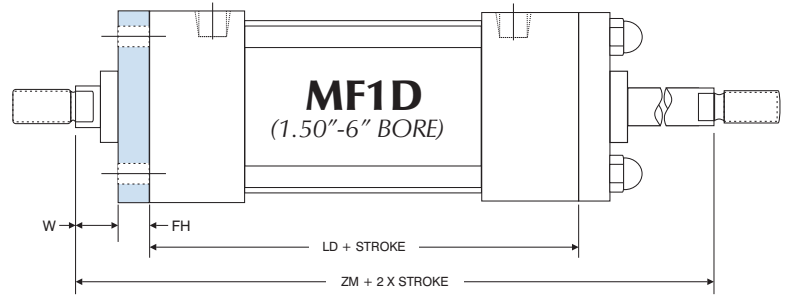
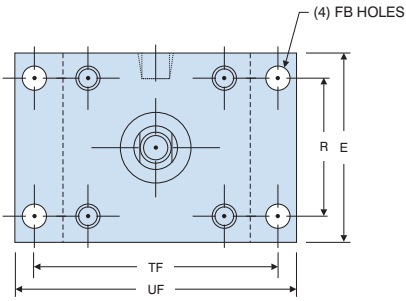
CRN - Double Rod Mounts

Options Page 142

Accessories Page 172

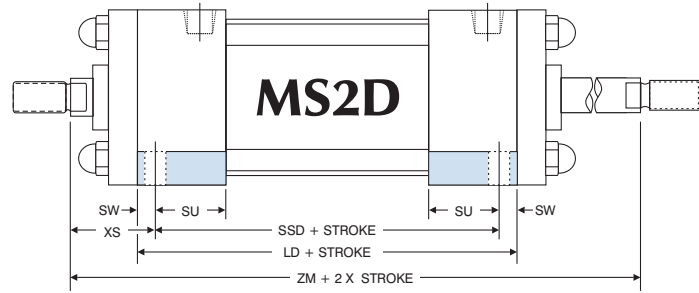
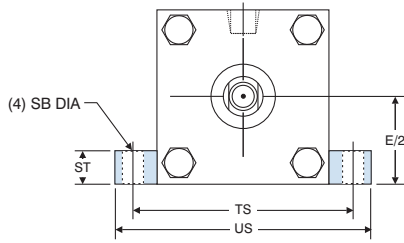
Switches Page 184

Technical Data Page 198

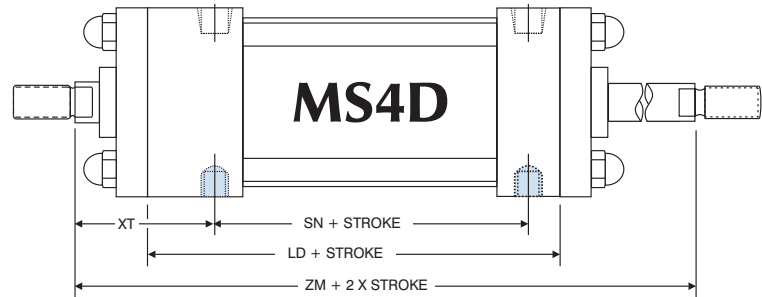
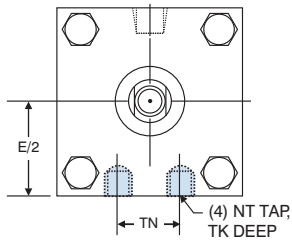


'CRN-MF1D' FLANGE & 'CRN-ME3D' HEAD MOUNT DIMENSIONS										
BORE	ROD DIAMETER	E	FB	FH	LD	R	TF	UF	W	ZM
1.50	0.625 Standard	2.000	0.313	0.375	4.125	1.430	2.750	3.375	0.625	6.125
	1.000 Oversize								1.000	6.875
2.00	0.625 Standard	2.500	0.375	0.375	4.125	1.840	3.375	4.125	0.625	6.125
	1.000 Oversize								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

SERIES 'CRN' DIMENSIONS: DOUBLE ROD END BASE MOUNTS



'CRN-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		
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		
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		
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		
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		
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		
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		
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		



'CRN-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		
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		
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		
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		
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		
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		
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		
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		

SERIES 'CRN': TECHNICAL DATA

How to determine the right size Cylinder for the job

To determine what size cylinder 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 a 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 4 in/sec) require 25% more force than the load, moderate speeds (4 to 16 in/sec) about 50% more, and high speeds (greater than 16 in/sec) about 100% more force. So, for that 100 lb. 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 lbs.) 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. So, 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 chart below 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 4 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 below shows that at 60 psi, the 2.00" bore with 0.625" rod extend force is 188 lbs., and retract force is 170 lbs. - the right cylinder for the application.

FORCE/VOLUME CHART

CYLINDER		STROKE TYPE	EFFECTIVE PISTON AREA	POUNDS OF FORCE AT PSI						CU. FT. DISPLACEMENT PER IN. OF STROKE
BORE	ROD			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	1961	.00284
	0.625	PULL	4.602	267	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	.02823
	1.750	PULL	47.860	2872	3829	4786	9572	11965	19144	.02770

CRN - How to Order
 CRN - Base Dimensions
 CRN - Single Rod Mounts
 CRN - Double Rod Mounts
 Options Page 142
 Accessories Page 172
 Switches Page 184
 Technical Data Page 198



NASON

NEW THINKING

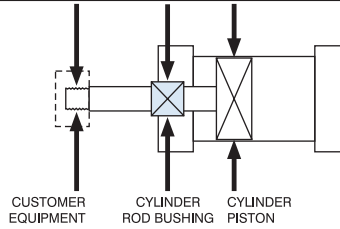


SERIES 'HMD' (NFPA) CYLINDER

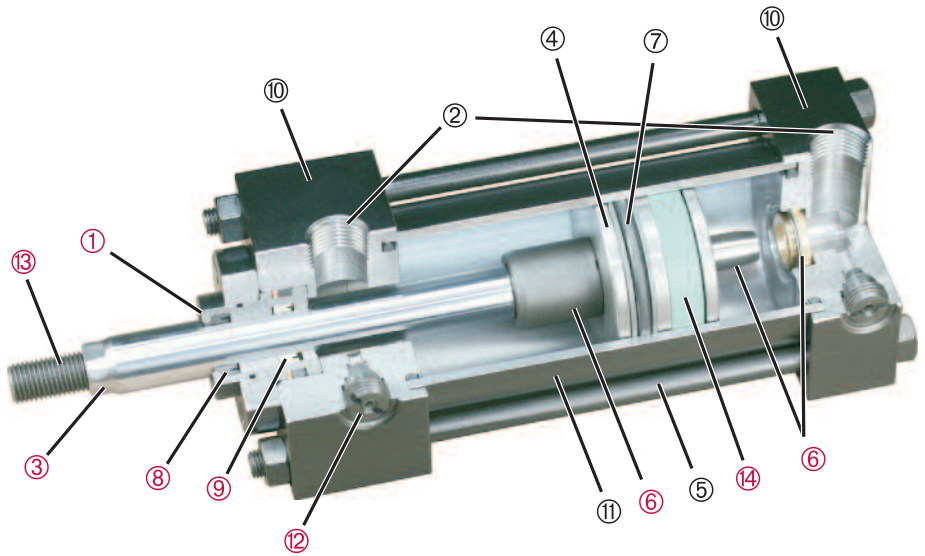
Floating Rod Bushing

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

- FLOATING ROD BUSHING** – Precision machined from 150,000 PSI rated graphite filled ductile iron and PTFE coated to reduce friction and extend cycle life. Bushing design "traps" lubrication in effective bearing area. Bronze bushings also available.
- PORTS** – NPTF and SAE ports available standard. Non-standard locations, sizes, and other port styles can be made to order to fit any application needs.
- PISTON ROD** – Steel piston rod provides high strength and damage resistance. Induction hardened and chrome plated for maximum wear resistance and long life. (100K min. yield up to 5" rod; 75K min. yield for 5 1/2" rod)
- PISTON** – Precision machined ductile iron provides high strength and an excellent bearing surface for extended cylinder life.
- TIE RODS** – Pre-stressed high carbon steel tie rod construction eliminates axial loading of cylinder tube and maintains compression on tube. (100K min. yield)
- CUSHION** – Precision machined cushions are available at either end and provide smooth deceleration which helps reduce end of stroke shock.
- PISTON SEAL** – Heavy-Duty, bi-directional Carboxylated

Nitrile T-Seal with double back-up. Rated for shock loads and incorporates anti-extrusion technology. EP, PTFE, and fluorocarbon designs available.

- ROD WIPER** – Flocked nitrile wiper removes contaminants on retract stroke, helping insure long life for all internal components.
- ROD SEALS** – Polyurethane seals offer high abrasion resistance and strength. Pressure activated double lip and wear compensating for extended life.
- HEAD & CAP** – Precision machined steel head and cap are held to tight tolerances and insure accurate alignment for a truly "square" cylinder.
- TUBE** – Precision machined steel tube with hard chrome I.D. is honed and micro finished for extended seal life and improved cycle rates.
- CUSHION ADJUSTMENT NEEDLE** – Adjustable steel needle design has fine thread metering and is positively captured to prevent needle ejection during adjustment.
- PISTON ROD STUD** – Standard on KK1 and KK2 threads for 5/8" - 2" rods (125K min. yield). Available up to 2 times standard "A" thread length.
- WEAR BAND** – Wear Guard Nylon (standard); reinforced PTFE for E and V seal option.

Note: Items in RED are the exact same heavy-duty components used in Nason's 3000 PSI (207 BAR) HHD Series.

OPERATING PRESSURE

Refer to page 203 for specific PSI ratings by bore size and mount

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 page 156 for cylinder design guidance).
- **CS** – Center Supports are recommended for cylinders with long strokes in horizontal applications to prevent buckling of the cylinder and extend cylinder life.
- **SSR** – 17-4 Chrome Plated Stainless Steel Piston Rod provide corrosion resistance in outdoor applications and wet environments. (100K min. yield up to 5" rod; 75K min. yield 5 1/2" rod)
- **HP** – High impact pistons use a high strength steel nut retained piston for fatigue resistance and additional strength in demanding applications.

HOW TO ORDER: SERIES 'HMD' (MEDIUM DUTY HYDRAULIC CYLINDERS)

HMD - MF1 - 250 x 10 - H2C6 - 100 - KK1 - P15 = N375 - S S S S -

SERIES HMD HYDRAULIC MEDIUM DUTY	STYLE (BLANK) SINGLE ROD D DOUBLE ROD	STROKE 0" to 120" Made to Order. (Use decimals for fractional strokes)	ROD SIZE 062 0.625" Rod Dia. 100 1.000" Rod Dia. 137 1.375" Rod Dia. 175 1.750" Rod Dia. 200 2.000" Rod Dia. 250 2.500" Rod Dia. 300 3.000" Rod Dia. 350 3.500" Rod Dia. 400 4.000" Rod Dia. 450 4.500" Rod Dia. 500 5.000" Rod Dia. 550 5.500" Rod Dia.	PORT LOC P 1 2 3 4 5 6 7 8 9 Call out 'P' followed by all desired locations.	PORT SIZE N062 0.063" NPTF N125 0.125" NPTF N250 0.250" NPTF N375 0.375" NPTF N500 0.500" NPTF N750 0.750" NPTF S6 #6 SAE S8 #8 SAE S10 #10 SAE S12 #12 SAE	SEALS See Below for Seal Ordering Instructions	OPTIONS A= EXTENDED PISTON ROD THREAD (Example: A = 2") (MAX = 2 TIMES ST'D "A" DIM.) AS= ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, Example: AS = 4") C= EXTENDED PISTON ROD (Example: IF C = 0.500", THEN 1" ROD EXTENSION IS C = 1.500") CS CENTER SUPPORT EK EXTENDED KEYPLATE (Refer to page 164 for specifications) HP HIGH IMPACT PISTON NR NON-ROTATING (Refer to page 165 for specifications) RBB ROD BUSHING MATERIAL: BRONZE SSR STAINLESS STEEL PISTON ROD ST= STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) Example: (HMD-MS2-250x48ES- H2C6-ST=3") 4WF FOUR WRENCH FLATS (ROD SIZES: 0.625"- 3.500") XX= SPECIAL VARIATION (SPECIFY)
--------------------------------------------------	----------------------------------------------------------------	-------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

NFPA MOUNTS	BORE	CUSHIONS
MX0 NO MOUNT (1.50" to 8.00" Bore)	150 1.50" Bore	H 1
MF1 HEAD RECTANGULAR FLANGE (1.50" to 6.00" Bore)	200 2.00" Bore	2
MF2 CAP RECTANGULAR FLANGE (1.50" to 6.00" Bore)	250 2.50" Bore	3
MF5 HEAD SQUARE FLANGE (1.50" to 6.00" Bore)	325 3.25" Bore	4
MF6 CAP SQUARE FLANGE (1.50" to 6.00" Bore)	400 4.00" Bore	C 5
ME3 HEAD MOUNTING HOLES (8.00" Bore)	500 5.00" Bore	6
ME4 CAP MOUNTING HOLES (8.00" Bore)	600 6.00" Bore	7
MP1 FIXED CAP PIVOT CLEVIS (1.50" to 8.00" Bore)	800 8.00" Bore	8
MP2 DETACHABLE CAP PIVOT CLEVIS (1.50" to 6.00" Bore)		
MS2 SIDE LUGS (1.50" to 8.00" Bore)		
MS3 CENTER LINE LUGS (1.50" to 8.00" Bore)		
MS4 BOTTOM TAPPED HOLES (1.50" to 8.00" Bore)		
MS7 END LUGS (1.50" to 8.00" Bore)		
MT1 HEAD TRUNNION (1.50" to 8.00" Bore)		
MT2 CAP TRUNNION (1.50" to 8.00" Bore)		
MT4 INTERMEDIATE (CENTER) TRUNNION (1.50" to 8.00" Bore)		
MX1 EXTENDED TIE RODS - HEAD & CAP (1.50" to 8.00" Bore)		
MX2 EXTENDED TIE RODS - CAP (1.50" to 8.00" Bore)		
MX3 EXTENDED TIE RODS - HEAD (1.50" to 8.00" Bore)		
SB SPHERICAL BEARING CAP PIVOT (1.50" to 8.00" Bore)		

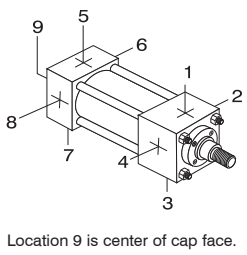
ROD END
KK1 Small Male Thread
KK2 Large Male Thread
KK3 Female Thread
KK4 Full Dia. Male Thread
KK5 Plain End
KK10 Rod Coupler End
KKM Metric Thread
KKX Non-Std Thread

When additional thread details are required, use format "Rod End" = "Modification".
Example: KKM=M12 x 1.75

HOW TO ORDER SEALS
S S S S

PISTON SEAL	ROD SEAL	TUBE SEAL	ROD WIPER *
S STANDARD (Carboxylated)	S STANDARD (Polyurethane)	S STANDARD (Buna)	S STANDARD (Flocked Nitrile)
C Cast-Ring	E EP	E EP	M Metallic Scraper
E EP	V Fluorocarbon	V Fluorocarbon	T PTFE
T PTFE			V Fluorocarbon
V Fluorocarbon			

*Note: When cylinder design calls for all EP seals, use PTFE rod wiper.



MAXIMUM STROKE RECOMMENDATIONS			
BORE	NO CENTER SUPPORT	WITH CENTER SUPPORTS (CS 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 75 INCHES	OVER 92 INCHES
6.00" & 8.00"	72 INCHES	OVER 72 INCHES	NOT REQUIRED

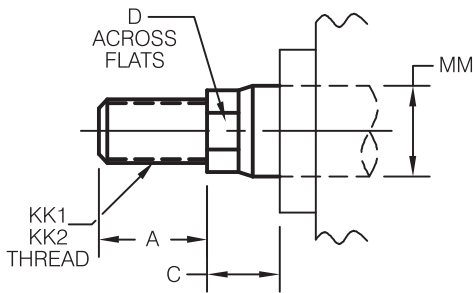
NFPA MOUNTS

MF5 1.50"-6.00" Bores Page 92	MF6 1.50"-6.00" Bores Page 93	ME3 8.00" Bore Page 94	ME4 8.00" Bore Page 94	MP1 1.50"-8.00" Bores Page 100	MP2 1.50"-6.00" Bores Page 101
MS2 1.50"-8.00" Bores Page 96	MS3 1.50"-8.00" Bores Page 96	MS4 1.50"-8.00" Bores Page 98	MS7 1.50"-8.00" Bores Page 98	MT1 1.50"-8.00" Bores Page 88	MT2 1.50"-8.00" Bores Page 88
MT4 1.50"-8.00" Bores Page 88	MX0 1.50"-8.00" Bores Page 86	MX1 1.50"-8.00" Bores Page 90	MX2 1.50"-8.00" Bores Page 90	MX3 1.50"-8.00" Bores Page 90	SB 1.50"-8.00" Bores Page 95

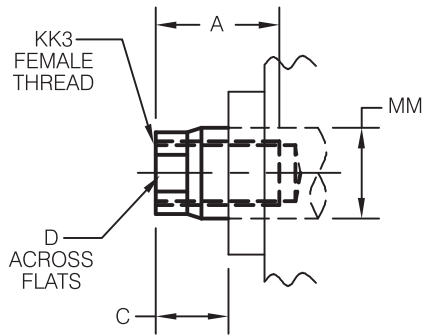
HMD - How to Order
HMD - Base Dimensions
HMD - Single Rod Mounts
HMD - Double Rod Mounts
Options Page 142
Accessories Page 172
Switches Page 184
Technical Data Page 198

SERIES 'HMD' DIMENSIONS: THREADS

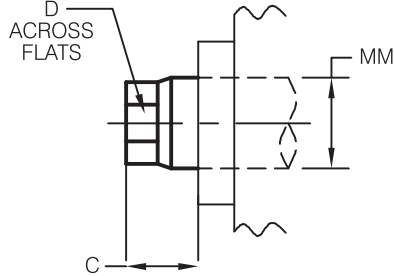
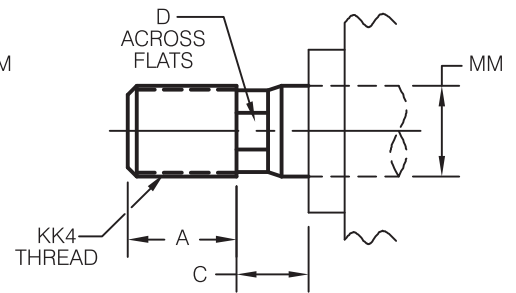
ROD END STYLE:
KK1
KK2



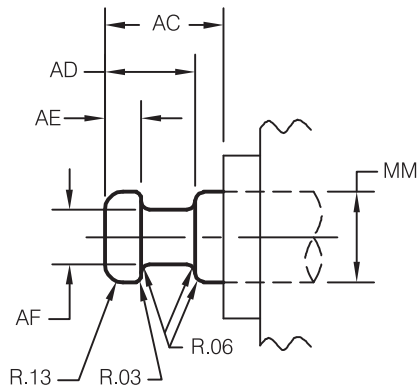
ROD END STYLE:
KK3



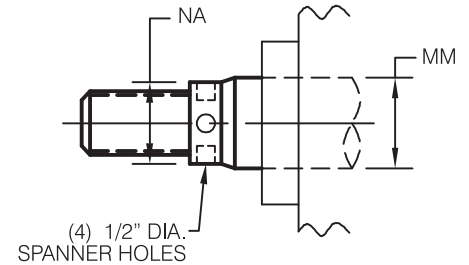
ROD END STYLE:
KK4



ROD END STYLE:
KK5



ROD END STYLE:
KK10



SPANNER HOLES (4.000-5.500 RODS)
(SHOWN ON KK1-KK2)

ROD DIA (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	2.125	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	3.937
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	4.421
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	4.921
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	5.421

* Studded rod end.

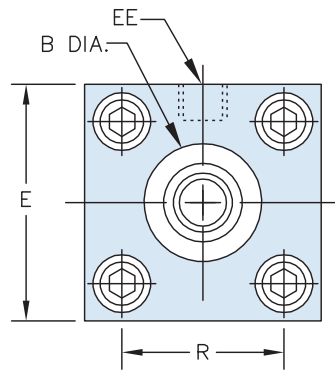
(4) Wrench flats is an option.

Note: Rods larger than 3.50" dia. utilize (4) 0.50" dia. spanner holes 0.50" deep.

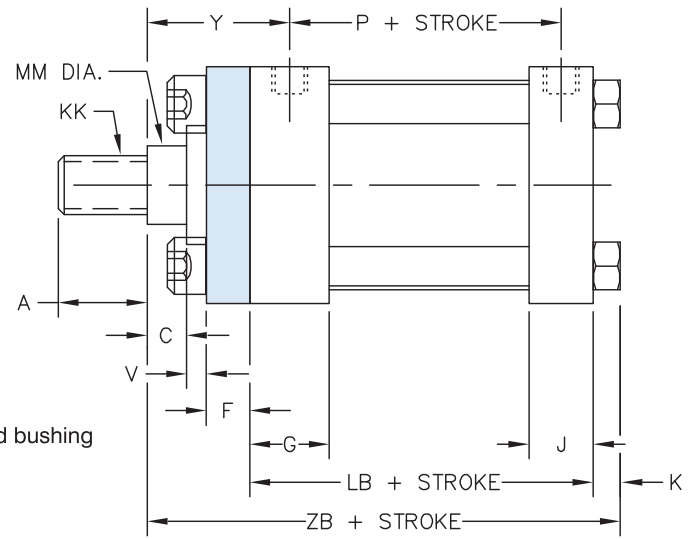
SERIES 'HMD' DIMENSIONS: BASIC CYLINDER (MX0 MOUNT)

RETAINER CONSTRUCTION

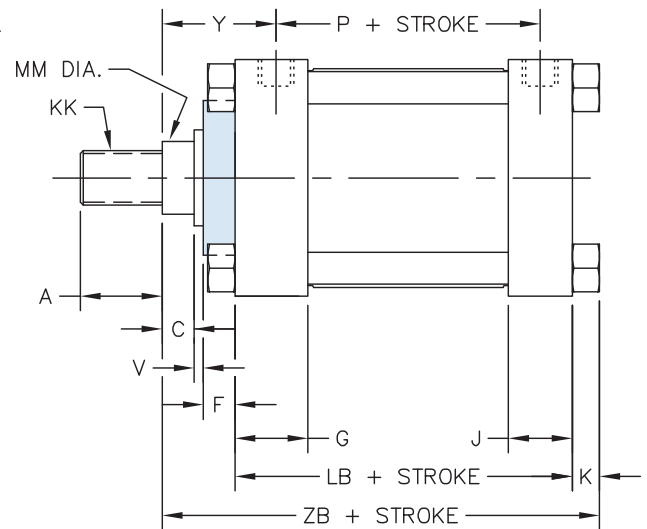
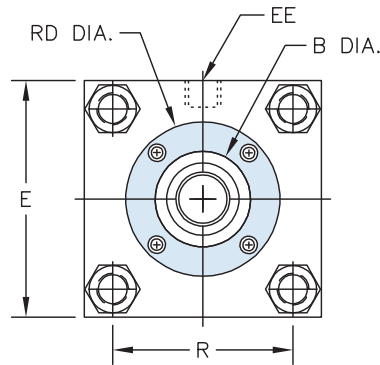
FULL SQUARE RETAINER USED ON:	
BORE	ROD DIA.
1.50	0.625
	1.000
2.00	1.000
	1.375
2.50	1.000
	1.375
3.25	1.375
	1.750
	2.000
4.00	2.000
	2.500
5.00	2.500
	3.500
6.00	4.000



Note: Full square retainer is removable to service rod bushing

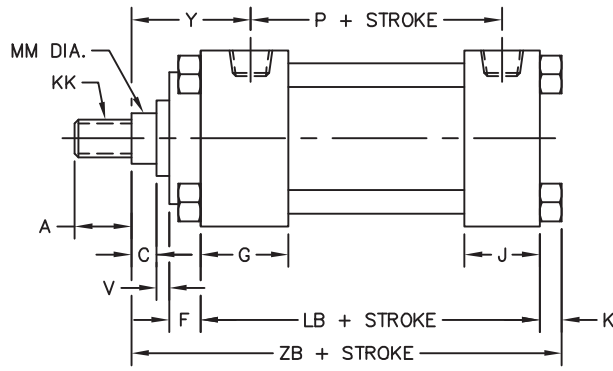
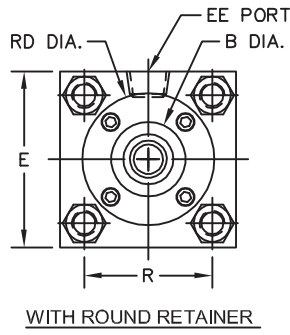
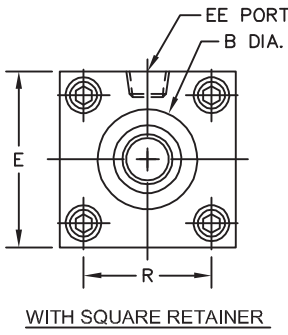


ROUND RETAINER USED ON:	
BORE	ROD DIA.
2.00	0.625
2.50	0.625
3.25	1.000
	1.375
4.00	1.000
	1.375
5.00	1.750
	2.000
	2.500
6.00	1.375
	1.750
	2.000
	2.500
8.00	3.000
	3.500
	4.000
	4.500
	5.000
	5.500
	5.500



SERIES 'HMD' DIMENSIONS: BASIC CYLINDER (MX0 MOUNT)

EASY FLIP OUT PAGE FOR REFERENCE



BORE	ROD DIA (MM)	MAX. PSI RATING ③	E	A	B ①	C	EE		F	G	J	K	KK	R	RD ②	V	Y	ADD TO STROKE		
							NPTF	SAE										LB	P	ZB
1.50	0.625	1500	2.000	0.750	1.124	0.375	0.375	#6	0.375	1.500	1.000	0.250	1.430	SQ	0.250	1.875	3.625	2.375	4.875	
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			5.250	
2.00	0.625	1500	2.500	0.750	1.124	0.375	0.375	#6	0.375	1.500	1.000	0.313	1.840	2.000	0.250	1.875	3.625	2.375	4.938	
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			5.313	
	1.375	1500		1.625	1.999	0.625								SQ	0.625	2.500			5.563	
2.50	0.625	1000	3.000	0.750	1.124	0.375	0.375	#6	0.375	1.500	1.000	0.313	2.190	2.000	0.250	1.875	3.750	2.500	5.063	
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			5.438	
	1.375	1500		1.625	1.999	0.625								SQ	0.625	2.500			5.688	
	1.750	1500		2.000	2.374	0.750								SQ	0.750	2.750			5.938	
3.25	1.000	1500	3.750	1.125	1.499	0.500	0.500	#10	0.625	1.750	1.250	0.375	2.760	2.750	0.250	2.375	4.250	2.750	6.000	
	1.375	1500		1.625	1.999	0.625								SQ	0.375	2.625			6.250	
	1.750	1500		2.000	2.374	0.750								SQ	0.500	2.875			6.500	
	2.000	1500		2.250	2.624	0.875								SQ	0.500	3.000			6.625	
4.00	1.000	1000	4.500	1.125	1.499	0.500	0.500	#10	0.625	1.750	1.250	0.375	3.32	2.750	0.250	2.375	4.250	2.750	6.000	
	1.375	1000		1.625	1.999	0.625								3.500	0.375	2.625			6.250	
	1.750	1000		2.000	2.374	0.750								SQ	0.500	2.875			6.500	
	2.000	1000		2.250	2.624	0.875								SQ	0.500	3.000			6.625	
	2.500	1000		3.000	3.124	1.000								SQ	0.625	3.250			6.875	
5.00	1.000	750	5.500	1.125	1.499	0.500	0.500	#10	0.625	1.750	1.250	0.438	4.100	2.750	0.250	2.375	4.500	3.000	6.313	
	1.375	1000		1.625	1.999	0.625								3.500	0.375	2.625			6.563	
	1.750	1000		2.000	2.374	0.750								3.500	0.500	2.875			6.813	
	2.000	1000		2.250	2.624	0.875								SQ	0.500	3.000			6.983	
	2.500	1000		3.000	3.124	1.000								SQ	0.625	3.250			7.188	
	3.000	1000		3.500	3.749	1.000								SQ	0.625	3.250			7.188	
6.00	1.375	750	6.500	1.625	1.999	0.625	0.750	#12	0.750	2.000	1.500	0.438	4.880	3.500	0.250	2.750	5.000	3.250	7.063	
	1.750	750		2.000	2.374	0.750								3.875	0.375	3.000			7.313	
	2.000	750		2.250	2.624	0.875								4.250	0.375	3.125			7.438	
	2.500	750		3.000	3.124	1.000								4.625	0.500	3.375			7.688	
	3.000	750		3.500	3.749	1.000								5.250	0.500	3.375			7.688	
	3.500	750		3.500	4.249	1.000								5.750	0.500	3.375			7.688	
	4.000	750		4.000	4.749	1.000								SQ	0.500	3.375			7.688	
8.00	1.375	500	8.500	1.625	1.999	0.625	0.750	#12	0.750	2.000	1.500	0.563	6.440	3.500	0.250	2.750	5.125	3.375	7.313	
	1.750	500		2.000	2.374	0.750								3.875	0.375	3.000			7.563	
	2.000	675		2.250	2.624	0.875								4.250	0.375	3.125			7.688	
	2.500	675		3.000	3.124	1.000								4.625	0.500	3.375			7.938	
	3.000	675		3.500	3.749	1.000								5.250	0.500	3.375			7.938	
	3.500	675		3.500	4.249	1.000								5.750	0.500	3.375			7.938	
	4.000	675		4.000	4.749	1.000								6.500	0.500	3.375			7.938	
	4.500	675		4.500	5.249	1.000								7.250	0.500	3.375			7.938	
	5.000	675		5.000	5.749	1.000								7.500	0.500	3.375			7.938	
	5.500	675		5.500	6.249	1.000								7.500	0.500	3.375			7.938	

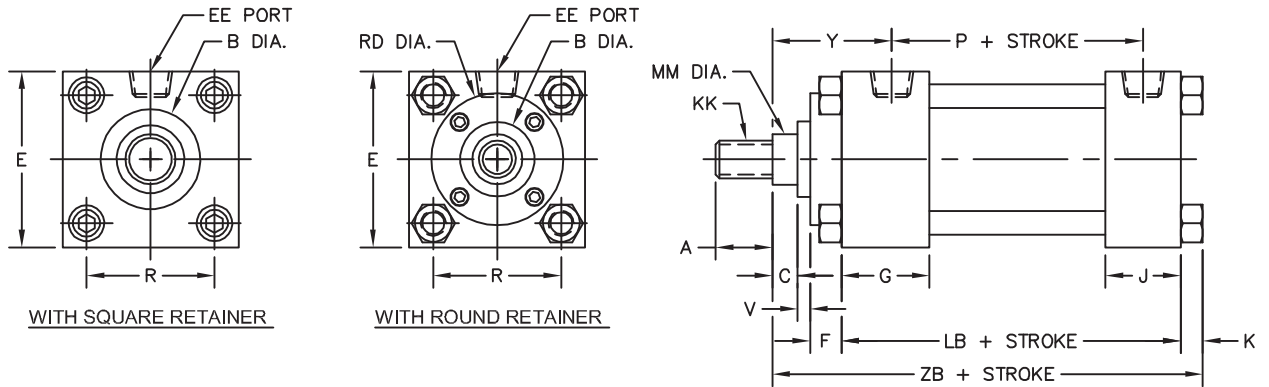
SEE ROD END DETAIL CHART ON PAGE 85

① 'B' dimension tolerance is +.000 / -.002

② Where SQ is shown in chart, cylinder utilizes a full square retainer.

③ Max. pressure rating. (NON-SHOCK)

SERIES 'HMD' DIMENSIONS: BASIC CYLINDER (MX0 MOUNT)



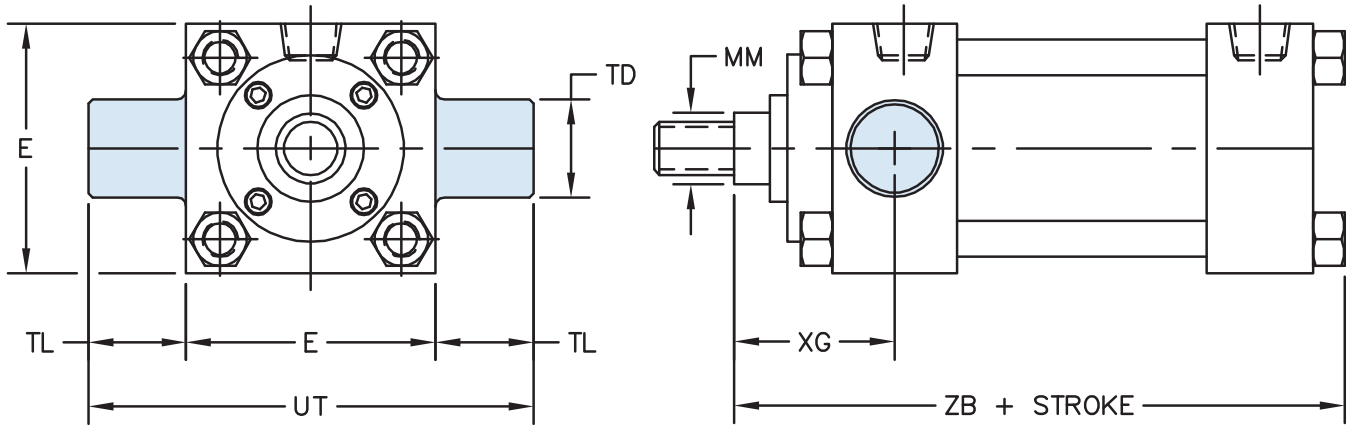
BORE	ROD DIA (MM)	MAX. PSI RATING ③	E	A	B ①	C	EE		F	G	J	K	KK	R	RD ②	V	Y	ADD TO STROKE		
							NPTF	SAE										LB	P	ZB
1.50	0.625	1500	2.000	0.750	1.124	0.375	0.375	#6	0.375	1.500	1.000	0.250	1.430	SQ	0.250	1.875	3.625	2.375	4.875	
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			5.250	
2.00	0.625	1500	2.500	0.750	1.124	0.375	0.375	#6	0.375	1.500	1.000	0.313	1.840	2.000	0.250	1.875	3.625	2.375	4.938	
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			5.313	
	1.375	1500		1.625	1.999	0.625								SQ	0.625	2.500			5.563	
2.50	0.625	1000	3.000	0.750	1.124	0.375	0.375	#6	0.375	1.500	1.000	0.313	2.190	2.000	0.250	1.875	3.750	2.500	5.063	
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			5.438	
	1.375	1500		1.625	1.999	0.625								SQ	0.625	2.500			5.688	
	1.750	1500		2.000	2.374	0.750								SQ	0.750	2.750			5.938	
3.25	1.000	1500	3.750	1.125	1.499	0.500	0.500	#10	0.625	1.750	1.250	0.375	2.760	2.750	0.250	2.375	4.250	2.750	6.000	
	1.375	1500		1.625	1.999	0.625								SQ	0.375	2.625			6.250	
	1.750	1500		2.000	2.374	0.750								SQ	0.500	2.875			6.500	
	2.000	1500		2.250	2.624	0.875								SQ	0.500	3.000			6.625	
4.00	1.000	1000	4.500	1.125	1.499	0.500	0.500	#10	0.625	1.750	1.250	0.375	3.32	2.750	0.250	2.375	4.250	2.750	6.000	
	1.375	1000		1.625	1.999	0.625								SQ	0.375	2.625			6.250	
	1.750	1000		2.000	2.374	0.750								SQ	0.500	2.875			6.500	
	2.000	1000		2.250	2.624	0.875								SQ	0.500	3.000			6.625	
5.00	1.000	750	5.500	1.125	1.499	0.500	0.500	#10	0.625	1.750	1.250	0.438	4.100	2.750	0.250	2.375	4.500	3.000	6.313	
	1.375	1000		1.625	1.999	0.625								3.500	0.375	2.625			6.563	
	1.750	1000		2.000	2.374	0.750								3.500	0.500	2.875			6.813	
	2.000	1000		2.250	2.624	0.875								SQ	0.625	3.250			7.188	
	2.500	1000		3.000	3.124	1.000								SQ	0.625	3.250			7.188	
	3.000	1000		3.500	3.749	1.000								SQ	0.625	3.250			7.188	
6.00	1.375	750	6.500	1.625	1.999	0.625	0.750	#12	0.750	2.000	1.500	0.438	4.880	3.500	0.250	2.750	5.000	3.250	7.063	
	1.750	750		2.000	2.374	0.750								3.875	0.375	3.000			7.313	
	2.000	750		2.250	2.624	0.875								4.250	0.375	3.125			7.438	
	2.500	750		3.000	3.124	1.000								4.625	0.500	3.375			7.688	
	3.000	750		3.500	3.749	1.000								5.250	0.500	3.375			7.688	
	3.500	750		3.500	4.249	1.000								5.750	0.500	3.375			7.688	
	4.000	750		4.000	4.749	1.000								SQ	0.500	3.375			7.688	
8.00	1.375	500	8.500	1.625	1.999	0.625	0.750	#12	0.750	2.000	1.500	0.563	6.440	3.500	0.250	2.750	5.125	3.375	7.313	
	1.750	500		2.000	2.374	0.750								3.875	0.375	3.000			7.563	
	2.000	675		2.250	2.624	0.875								4.250	0.375	3.125			7.688	
	2.500	675		3.000	3.124	1.000								4.625	0.500	3.375			7.938	
	3.000	675		3.500	3.749	1.000								5.250	0.500	3.375			7.938	
	3.500	675		3.500	4.249	1.000								5.750	0.500	3.375			7.938	
	4.000	675		4.000	4.749	1.000								6.500	0.500	3.375			7.938	
	4.500	675		4.500	5.249	1.000								7.250	0.500	3.375			7.938	
	5.000	675		5.000	5.749	1.000								7.500	0.500	3.375			7.938	
	5.500	675		5.500	6.249	1.000								7.500	0.500	3.375			7.938	

SEE ROD END DETAIL CHART ON PAGE 85

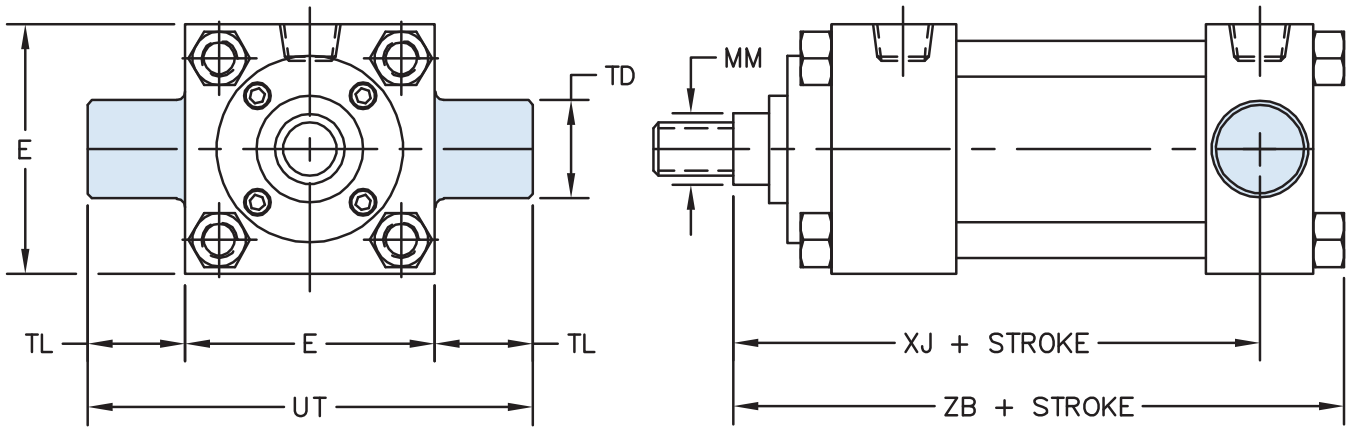
① 'B' dimension tolerance is +.000 / -.002
 ② Where SQ is shown in chart, cylinder utilizes a full square retainer.
 ③ Max. pressure rating. (NON-SHOCK)

SERIES 'HMD' DIMENSIONS: TRUNNION MOUNTS

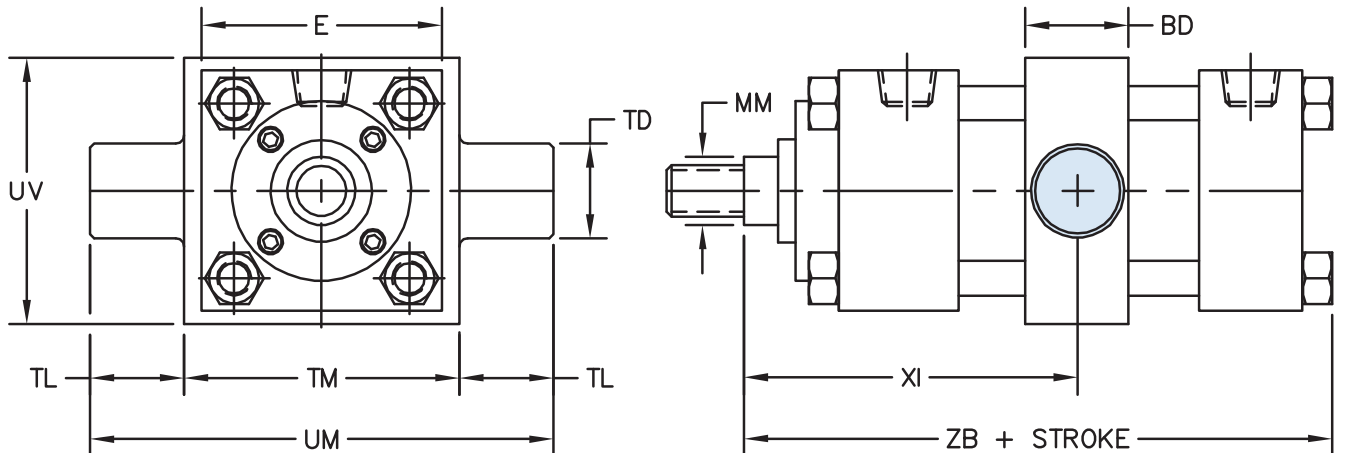
MT1: HEAD TRUNNION



MT2: CAP TRUNNION



MT4: INTERMEDIATE TRUNNION



NOTE:
'XI' DIMENSION TO BE SPECIFIED BY CUSTOMER

HMD - How to Order
HMD - Base Dimensions
HMD - Single Rod Mounts
HMD - Double Rod Mounts
Options Page 142
Accessories Page 172
Switches Page 184
Technical Data Page 198

SERIES 'HMD' DIMENSIONS: TRUNNION MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	BD	② TD	TL	TM	UM	UT	UV	XG	③ XI	MT4 Min Stroke	ADD TO STROKE	
														XJ	ZB
1.50	0.625	1500	2.000	1.250	1.000	1.000	2.500	4.500	4.000	2.500	1.750	3.375	0.250	4.125	4.875
	1.000	1500									2.125	3.750		4.500	5.250
2.00	0.625	1500	2.500	1.500	1.000	1.000	3.000	5.000	4.500	3.000	1.750	3.500	0.250	4.125	4.938
	1.000	1500									2.125	3.875		4.500	5.313
	1.375	1500									2.375	4.125		4.750	5.563
2.50	0.625	1000	3.000	1.500	1.000	1.000	3.500	5.500	5.000	3.500	1.750	3.500	0.375	4.250	5.063
	1.000	1500									2.125	3.875		4.625	5.438
	1.375	1500									2.375	4.125		4.875	5.688
	1.750	1500									2.625	4.375		5.125	5.938
3.25	1.000	1500	3.750	2.000	1.000	1.000	4.500	6.500	5.750	4.250	2.250	4.375	0.875	5.000	6.000
	1.375	1500									2.500	4.625		5.250	6.250
	1.750	1500									2.750	4.875		5.500	6.500
	2.000	1500									2.875	5.000		5.625	6.625
4.00	1.000	1000	4.500	2.000	1.000	1.000	5.250	7.250	6.500	5.000	2.250	4.375	1.125	5.000	6.000
	1.375	1000									2.500	4.625		5.250	6.250
	1.750	1000									2.750	4.875		5.500	6.500
	2.000	1000									2.875	5.000		5.625	6.625
	2.500	1000									3.125	5.250		5.875	6.875
5.00	1.000	750	5.500	2.000	1.000	1.000	6.250	8.250	7.500	6.000	2.250	4.375	1.125	5.250	6.313
	1.375	1000									2.500	4.625		5.500	6.563
	1.750	1000									2.750	4.875		5.750	6.813
	2.000	1000									2.875	5.000		5.875	6.938
	2.500	1000									3.125	5.250		6.125	7.188
	3.000	1000									3.125	5.250		6.125	7.188
	3.500	1000									3.125	5.250		6.125	7.188
6.00	1.375	750	6.500	2.000	1.375	1.375	7.625	10.375	9.250	7.000	2.625	5.125	1.250	5.875	7.063
	1.750	750									2.875	5.375		6.125	7.313
	2.000	750									3.000	5.500		6.250	7.438
	2.500	750									3.250	5.750		6.500	7.688
	3.000	750									3.250	5.750		6.500	7.688
	3.500	750									3.250	5.750		6.500	7.688
	4.000	750									3.250	5.750		6.500	7.688
	4.000	750									3.250	5.750		6.500	7.688
8.00	1.375	500	8.500	2.500	1.375	1.375	9.750	12.500	11.250	9.500	2.625	5.125	2.125	6.000	7.313
	1.750	500									2.875	5.375		6.250	7.563
	2.000	675									3.000	5.500		6.375	7.688
	2.500	675									3.250	5.750		6.625	7.938
	3.000	675									3.250	5.750		6.625	7.938
	3.500	675									3.250	5.750		6.625	7.938
	4.000	675									3.250	5.750		6.625	7.938
	4.500	675									3.250	5.750		6.625	7.938
	5.000	675									3.250	5.750		6.625	7.938
	5.500	675									3.250	5.750		6.625	7.938

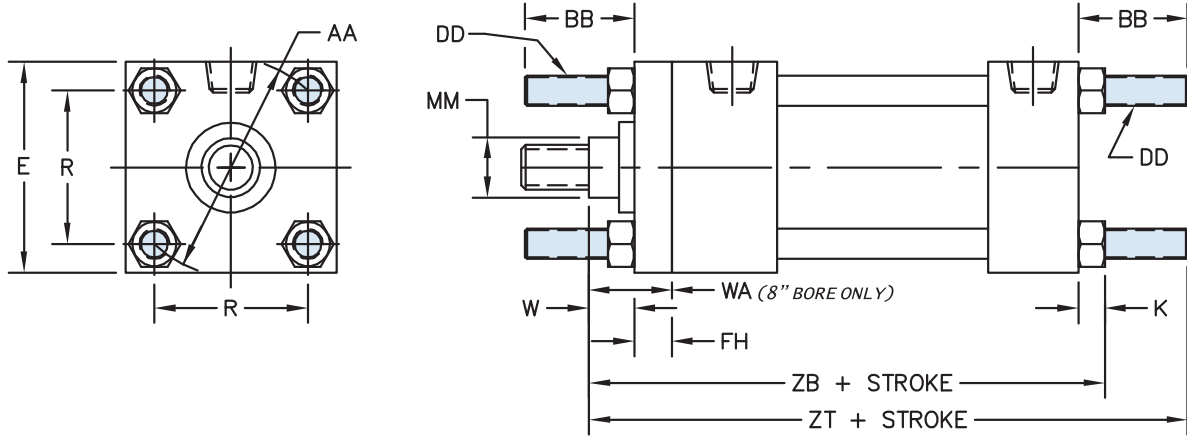
① Max. pressure rating. (NON-SHOCK)

② 'TD' dimension tolerance is + .000 / - .001

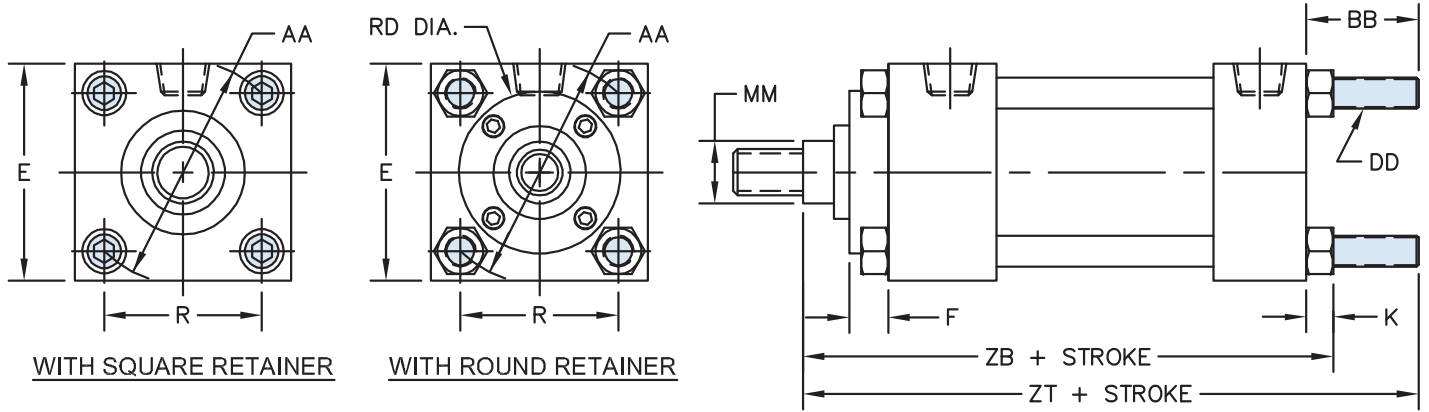
③ 'XI' dimension is the minimum that can be supplied and leaves 1/4" gap between head & trunnion block. (customer to specify 'XI' dimension).

SERIES 'HMD' DIMENSIONS: EXTENDED TIE ROD MOUNTS

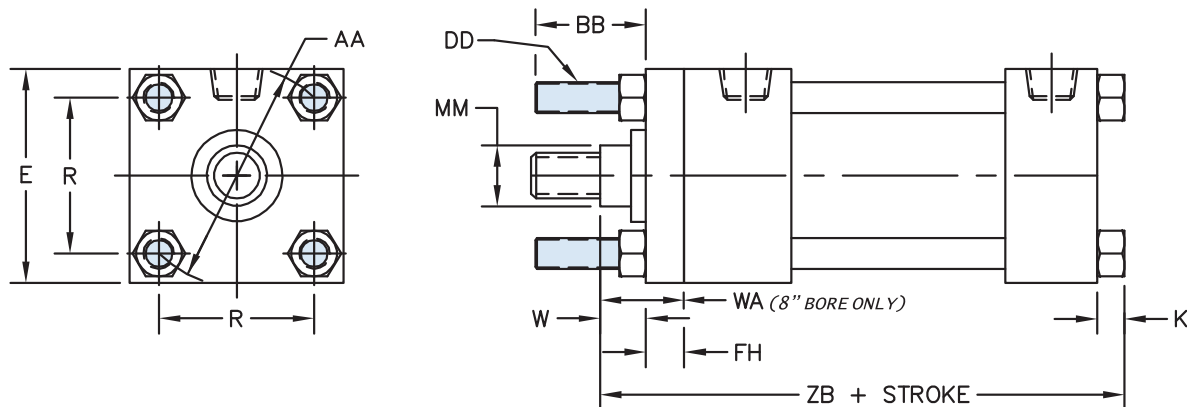
MX1: EXTENDED TIE-RODS - HEAD & CAP



MX2: EXTENDED TIE-RODS - CAP END



MX3: EXTENDED TIE-RODS - HEAD END



SERIES 'HMD' DIMENSIONS: EXTENDED TIE ROD MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	FH	AA	BB	DD	F	K	R	② RD	W or WA (8")	ADD TO STROKE	
													ZB	ZT
1.50	0.625	1500	2.000	0.375	2.020	1.000	1/4 - 28	0.375	0.250	1.430	SQ	0.625	4.875	5.625
	1.000	1500									SQ	1.000	5.250	6.000
2.00	0.625	1500	2.500	0.375	2.600	1.125	5/16 - 24	0.375	0.313	1.840	2.000	0.625	4.938	5.750
	1.000	1500									SQ	1.000	5.313	6.125
	1.375	1500									SQ	1.250	5.563	6.375
2.50	0.625	1000	3.000	0.375	3.100	1.125	5/16 - 24	0.375	0.313	2.190	2.000	0.625	5.063	5.875
	1.000	1500									SQ	1.000	5.438	6.250
	1.375	1500									SQ	1.250	5.688	6.500
	1.750	1500									SQ	1.500	5.938	6.750
3.25	1.000	1500	3.750	0.625	3.900	1.375	3/8 - 24	0.625	0.375	2.760	2.750	0.750	6.000	7.000
	1.375	1500									SQ	1.000	6.250	7.250
	1.750	1500									SQ	1.250	6.500	7.500
	2.000	1500									SQ	1.375	6.625	7.625
4.00	1.000	1000	4.500	0.625	4.700	1.375	3/8 - 24	0.625	0.375	3.320	2.750	0.750	6.000	7.000
	1.375	1000									3.500	1.000	6.250	7.250
	1.750	1000									3.500	1.250	6.500	7.500
	2.000	1000									SQ	1.375	6.625	7.625
	2.500	1000									SQ	1.625	6.875	7.875
5.00	1.000	750	5.500	0.625	5.800	1.813	1/2 - 20	0.625	0.438	4.100	2.750	0.750	6.313	7.688
	1.375	1000									3.500	1.000	6.563	7.938
	1.750	1000									3.500	1.250	6.813	8.188
	2.000	1000									4.250	1.375	6.938	8.313
	2.500	1000									SQ	1.625	7.188	8.563
	3.000	1000									SQ	1.625	7.188	8.563
	3.500	1000									SQ	1.625	7.188	8.563
6.00	1.375	750	6.500	0.750	6.900	1.813	1/2 - 20	0.750	0.438	4.880	3.500	0.875	7.063	8.438
	1.750	750									3.875	1.125	7.313	8.688
	2.000	750									4.250	1.250	7.438	8.813
	2.500	750									4.625	1.500	7.688	9.063
	3.000	750									5.250	1.500	7.688	9.063
	3.500	750									5.750	1.500	7.688	9.063
	4.000	750									SQ	1.500	7.688	9.063
	8.00	1.375									500	8.500	*0.625 ③	9.10
1.750		500	3.875	1.875	7.563	9.313								
2.000		675	4.250	2.000	7.688	9.438								
2.500		675	4.625	2.250	7.938	9.688								
3.000		675	5.250	2.250	7.938	9.688								
3.500		675	5.750	2.250	7.938	9.688								
4.000		675	6.500	2.250	7.938	9.688								
4.500		675	7.250	2.250	7.938	9.688								
5.000		675	7.500	2.250	7.938	9.688								
5.500		675	7.500	2.250	7.938	9.688								

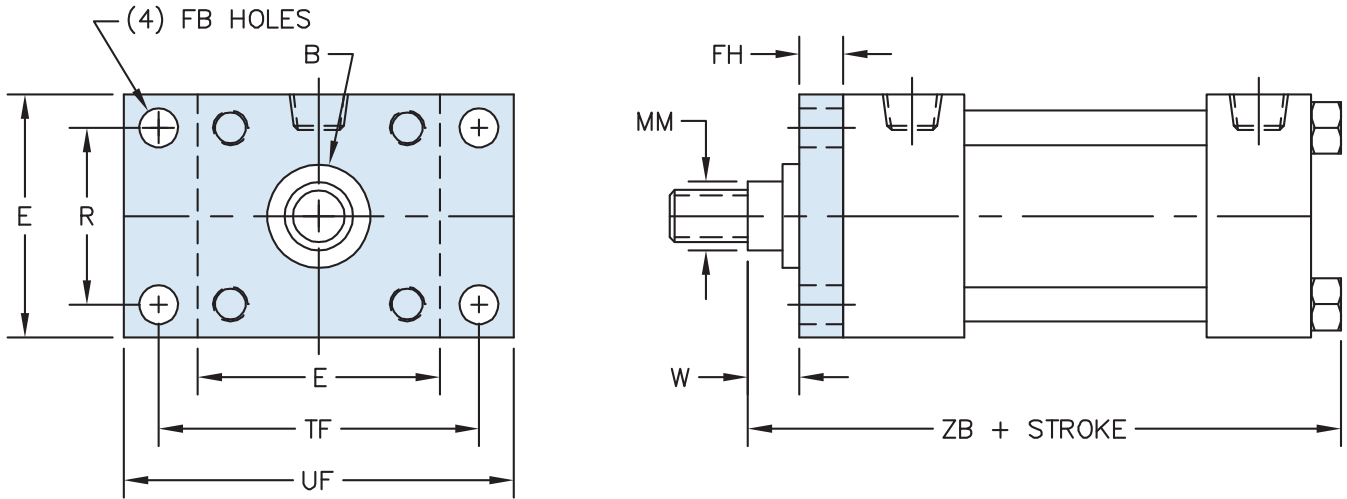
① Max. pressure rating. (NON-SHOCK)

② Where SQ is shown in chart, cylinder utilizes a full square retainer. ALL MX1 & MX3 MOUNTS USE FULL SQ. RETAINER.

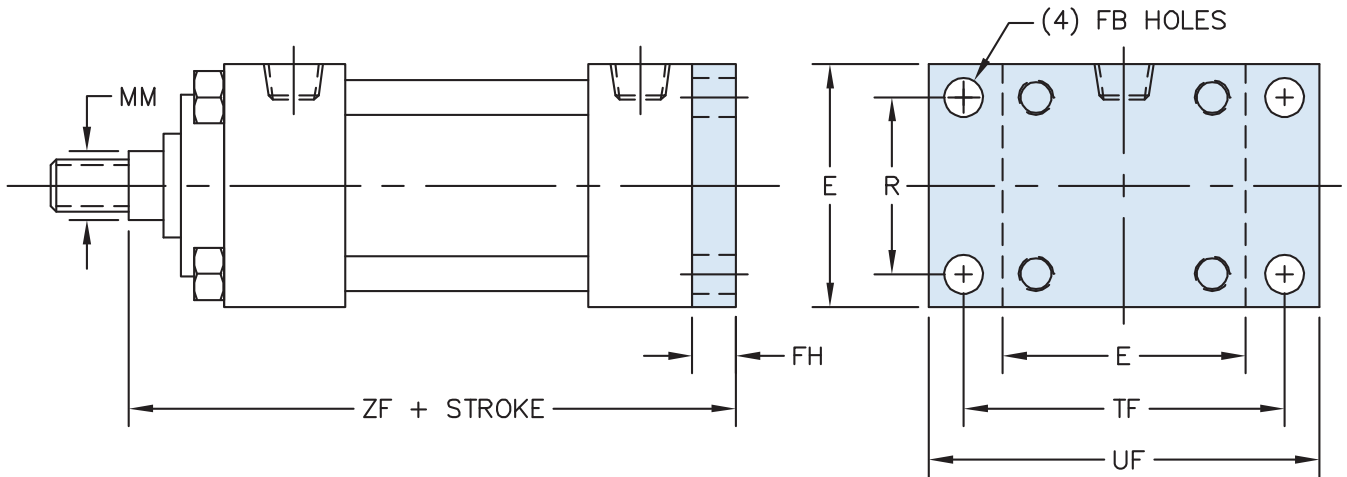
③ *Round retainer used to retain bushing, not a full front plate as other bores. 'BB' is dimension from head on the 8.00" bore.

SERIES 'HMD' DIMENSIONS: FLANGE MOUNTS

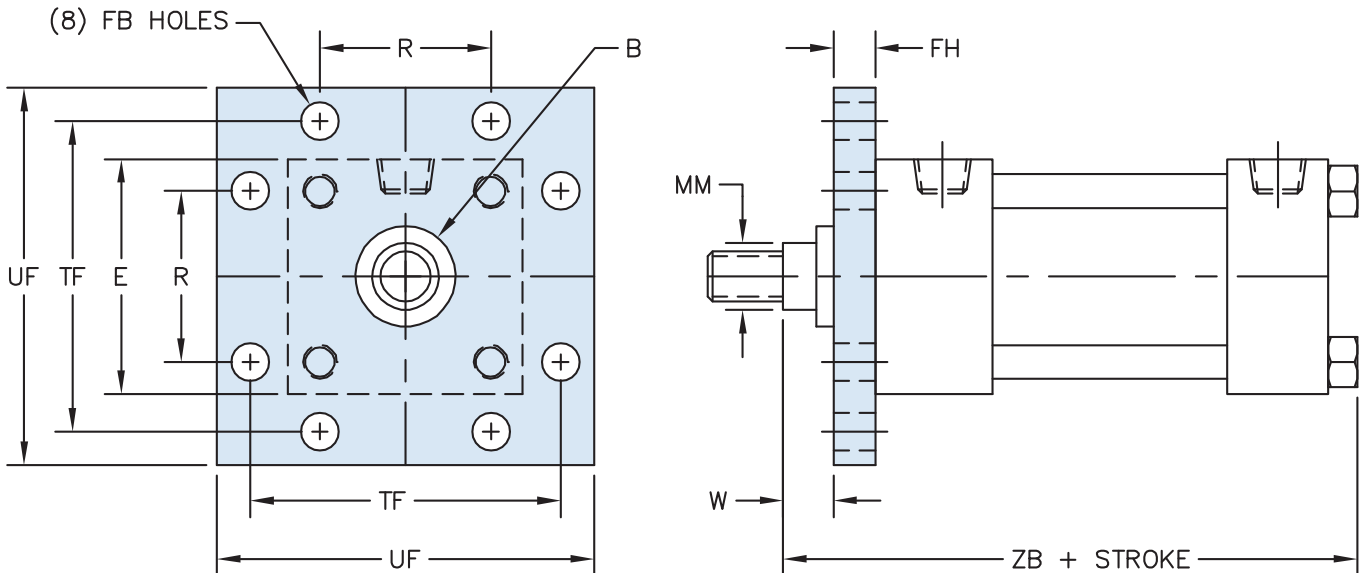
MF1: HEAD FLANGE



MF2: CAP FLANGE



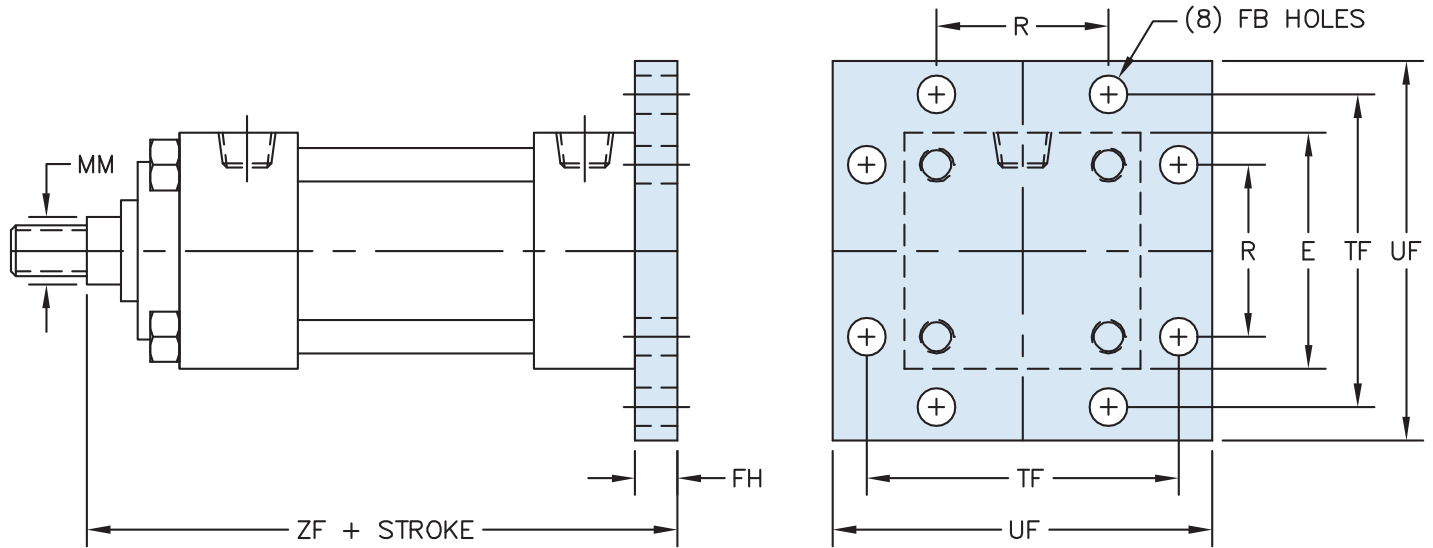
MF5: HEAD SQUARE FLANGE



HMD - How to Order
HMD - Base Dimensions
HMD - Single Rod Mounts
HMD - Double Rod Mounts
Options Page 142
Accessories Page 172
Switches Page 184
Technical Data Page 198

SERIES 'HMD' DIMENSIONS: FLANGE MOUNTS

MF6: CAP SQUARE FLANGE

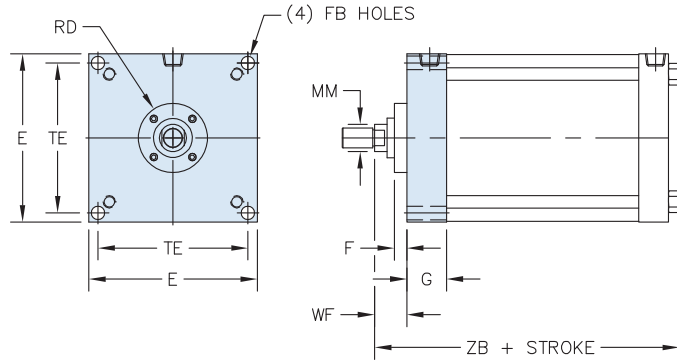


BORE	ROD DIAM (MM)	MAX. PSI RATING ①	② B	E	FB	FH	R	TF	UF	W	ADD TO STROKE	
											ZB	ZF
1.50	0.625	1500	1.124	2.000	0.313	0.375	1.438	2.750	3.375	0.625	4.875	5.000
	1.000	1500	1.499							1.000	5.250	5.375
2.00	0.625	1500	1.124	2.500	0.375	0.375	1.844	3.375	4.125	0.625	4.938	5.000
	1.000	1500	1.499							1.000	5.313	5.375
	1.375	1500	1.999							1.250	5.563	5.625
2.50	0.625	1000	1.124	3.000	0.375	0.375	2.188	3.875	4.625	0.625	5.063	5.125
	1.000	1500	1.499							1.000	5.438	5.500
	1.375	1500	1.999							1.250	5.688	5.750
	1.750	1500	2.374							1.500	5.938	6.000
3.25	1.000	1500	1.499	3.750	0.438	0.625	2.766	4.688	5.500	0.750	6.000	6.250
	1.375	1500	1.999							1.000	6.250	6.500
	1.750	1500	2.374							1.250	6.500	6.750
	2.000	1500	2.624							1.375	6.625	6.875
4.00	1.000	1000	1.499	4.500	0.438	0.625	3.328	5.438	6.250	0.750	6.000	6.250
	1.375	1000	1.999							1.000	6.250	6.500
	1.750	1000	2.374							1.250	6.500	6.750
	2.000	1000	2.624							1.375	6.625	6.875
	2.500	1000	3.124							1.625	6.875	7.125
5.00	1.000	750	1.499	5.500	0.563	0.625	4.109	6.625	7.625	0.750	6.313	6.500
	1.375	1000	1.999							1.000	6.563	6.750
	1.750	1000	2.374							1.250	6.813	7.000
	2.000	1000	2.624							1.375	6.938	7.125
	2.500	1000	3.124							1.625	7.188	7.375
	3.000	1000	3.749							1.625	7.188	7.375
	3.500	1000	4.249							1.625	7.188	7.375
6.00	1.375	750	1.999	6.500	0.563	0.750	4.875	7.625	8.625	0.875	7.063	7.375
	1.750	750	2.374							1.125	7.313	7.625
	2.000	750	2.624							1.250	7.438	7.750
	2.500	750	3.124							1.500	7.688	8.000
	3.000	750	3.749							1.500	7.688	8.000
	3.500	750	4.249							1.500	7.688	8.000
	4.000	750	4.749							1.500	7.688	8.000

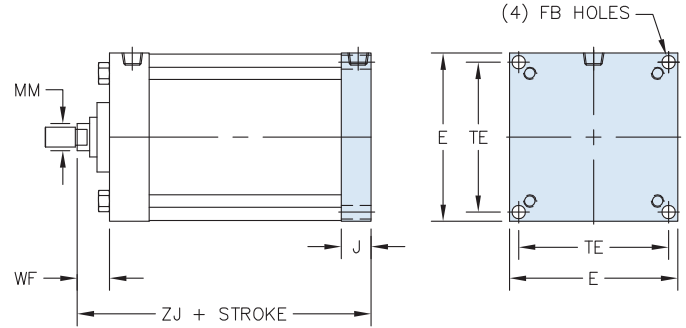
① Max. pressure rating. (NON-SHOCK)
 ② 'B' dimension tolerance is +.000 / -.002

SERIES 'HMD' DIMENSIONS: FLANGE MOUNTS

ME3: HEAD SQUARE MOUNTING HOLES



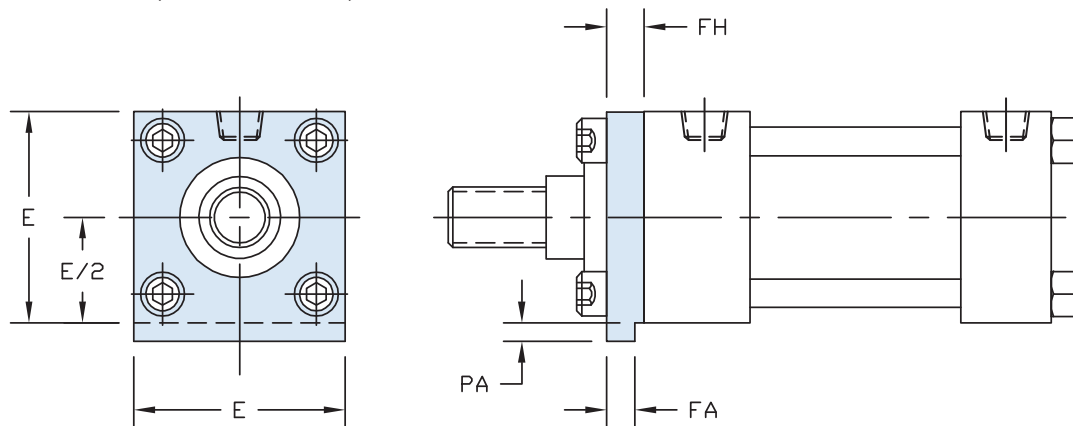
ME4: CAP SQUARE MOUNTING HOLES



BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	F	FB	G	J	TE	RD	WF	ADD TO STROKE	
											ZB	ZJ
8.00	1.375	500	8.500	0.750	0.688	2.000	1.500	7.570	3.500	1.625	7.313	6.750
	1.750	500							3.875	1.875	7.563	7.000
	2.000	675							4.250	2.000	7.688	7.125
	2.500	675							4.625	2.250	7.938	7.375
	3.000	675							5.250	2.250	7.938	7.375
	3.500	675							5.750	2.250	7.938	7.375
	4.000	675							6.500	2.250	7.938	7.375
	4.500	675							7.250	2.250	7.938	7.375
	5.000	675							7.500	2.250	7.938	7.375
	5.500	675							7.500	2.250	7.938	7.375

① Max. pressure rating.

EXTENDED KEYPLATE ('EK' OPTION)

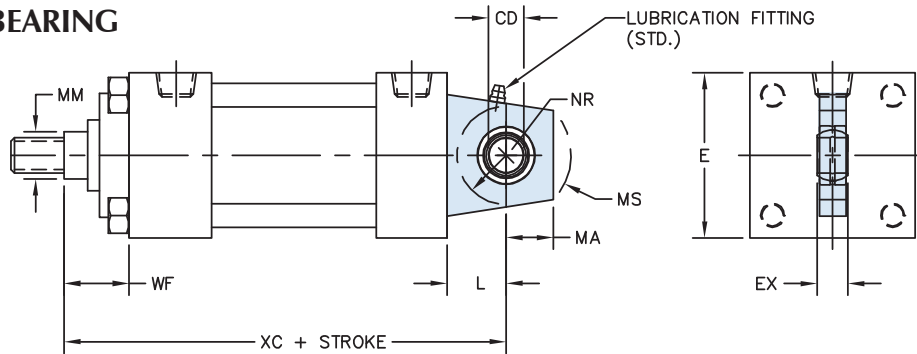


BORE	E	FA	FH	PA
1.50	2.000	0.312 / 0.310	0.375	0.188
2.00	2.500	0.312 / 0.310	0.375	0.188
2.50	3.000	0.312 / 0.310	0.375	0.188
3.25	3.750	0.562 / 0.560	0.625	0.313
4.00	4.500	0.562 / 0.560	0.625	0.313
5.00	5.500	0.562 / 0.560	0.625	0.313
6.00	6.500	0.687 / 0.685	0.750	0.375

HMD - How to Order
HMD - Base Dimensions
HMD - Single Rod Mounts
HMD - Double Rod Mounts
Options Page 142
Accessories Page 172
Switches Page 184
Technical Data Page 198

SERIES 'HMD' DIMENSIONS: SPHERICAL BEARING MOUNT

SB: SPHERICAL BEARING



BORE	ROD DIAM (MM)	MAX. PSI RATING	CD	E	EX	L	MA	MS	NR	WF	ADD TO STROKE	
											XC	
1.50	0.625	1500	0.500	2.000	0.437	0.750	0.750	0.938	0.625	1.000	5.375	
	1.000	1500								1.375	5.750	
2.00	0.625	1500	0.500	2.500	0.437	0.750	0.750	0.938	0.625	1.000	5.375	
	1.000	1500								1.375	5.750	
	1.375	1500								1.625	6.000	
2.50	0.625	1000	0.500	3.000	0.437	0.750	0.750	0.938	0.625	1.000	5.500	
	1.000	1500								1.375	5.875	
	1.375	1500								1.625	6.125	
	1.750	1500								1.875	6.375	
3.25	1.000	1500	0.750	3.750	0.656	1.250	1.000	1.375	1.000	1.375	6.875	
	1.375	1500								1.625	7.125	
	1.750	1500								1.875	7.375	
	2.000	1500								2.000	7.500	
4.00	1.000	1000	0.750	4.500	0.656	1.250	1.000	1.375	1.000	1.375	6.875	
	1.375	1000								1.625	7.125	
	1.750	1000								1.875	7.375	
	2.000	1000								2.000	7.500	
	2.500	1000								2.250	7.750	
5.00	1.000	750	0.750	5.500	0.656	1.250	1.000	1.375	1.000	1.375	7.125	
	1.375	1000								1.625	7.375	
	1.750	1000								1.875	7.625	
	2.000	1000								2.000	7.750	
	2.500	1000								2.250	8.000	
	3.000	1000								2.250	8.000	
	3.500	1000								2.250	8.000	
6.00	1.375	750	1.000	6.500	0.875	1.500	1.250	1.688	1.250	1.625	8.125	
	1.750	750								1.875	8.375	
	2.000	750								2.000	8.500	
	2.500	750								2.250	8.750	
	3.000	750								2.250	8.750	
	3.500	750								2.250	8.750	
	4.000	750								2.250	8.750	
8.00	1.375	500	1.000	8.500	0.875	1.500	1.250	1.688	1.250	1.625	8.250	
	1.750	500								1.875	8.500	
	2.000	675								2.000	8.625	
	2.500	675								2.250	8.875	
	3.000	675								2.250	8.875	
	3.500	675								2.250	8.875	
	4.000	675								2.250	8.875	
	4.500	675								2.250	8.875	
	5.000	675								2.250	8.875	
5.500	675	2.250	8.875									

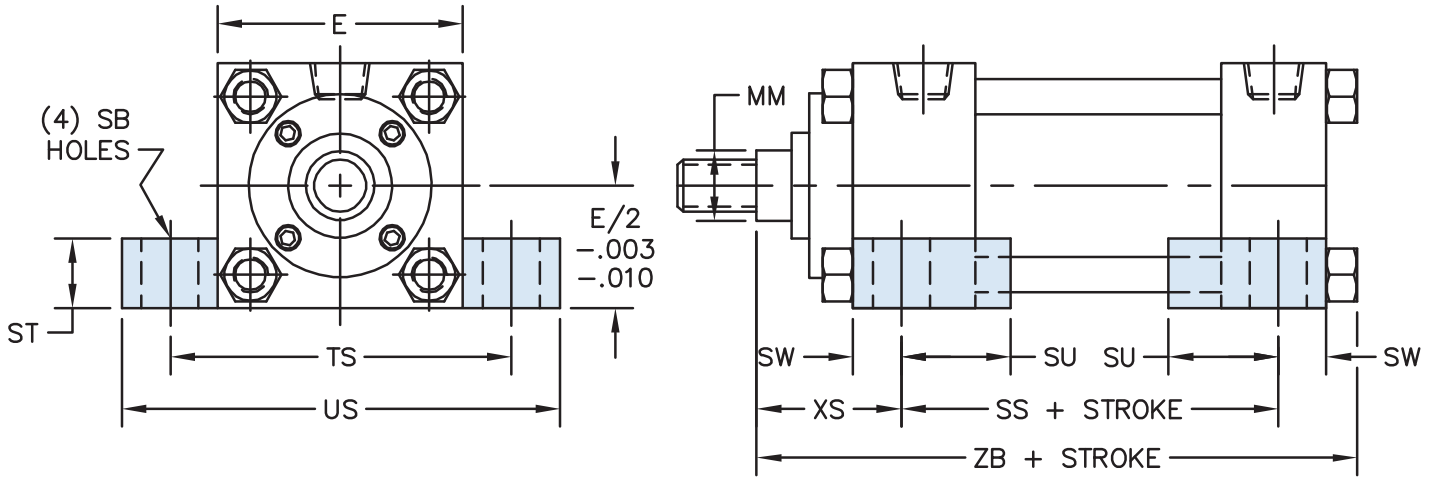
① Max. pressure rating. (NON-SHOCK)

Note: Pivot pin included with cylinder cap end only. 5.00", 6.00" & 8.00" bores have tie rod nuts exposed on cap end.

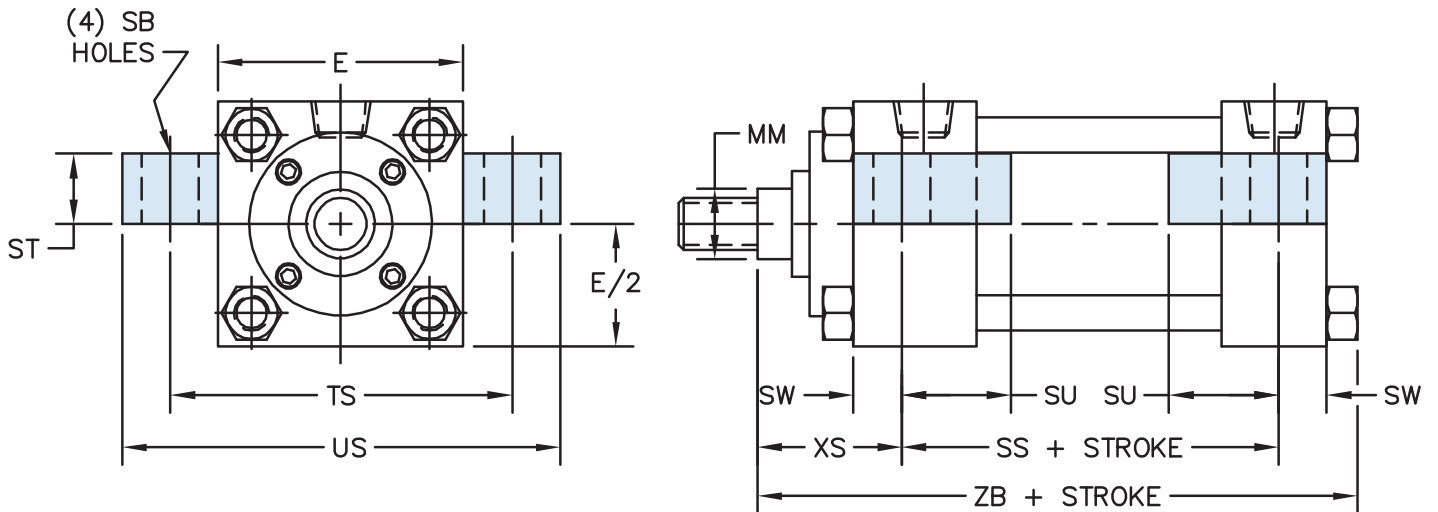
*Must specify KK3 rod end if to be used with "HH-MSRE" series rod eye.

SERIES 'HMD' DIMENSIONS: LUG MOUNTS

MS2: SIDE LUGS



MS3: CENTER LINE LUGS



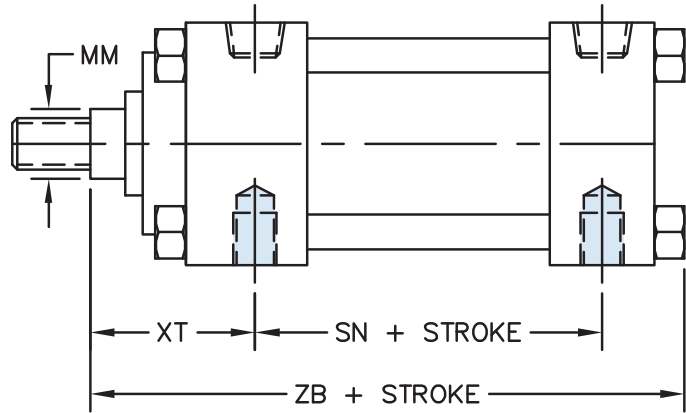
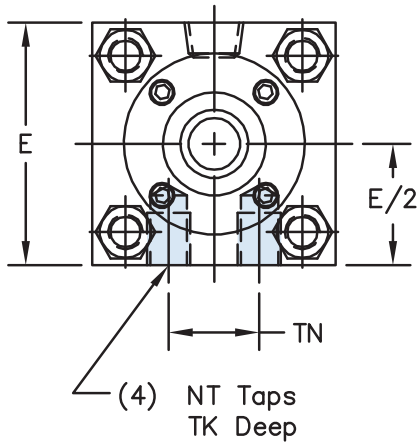
SERIES 'HMD' DIMENSIONS: LUG MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	SB	ST	SU	SW	TS	US	XS	ADD TO STROKE	
											SS	ZB
1.50	0.625	1500	2.000	0.438	0.500	1.125	0.375	2.750	3.500	1.375	2.875	4.875
	1.000	1500								1.750		5.250
2.00	0.625	1500	2.500	0.438	0.500	1.125	0.375	3.250	4.000	1.375	2.875	4.938
	1.000	1500								1.750		5.313
	1.375	1500								2.000		5.563
2.50	0.625	1000	3.000	0.438	0.500	1.125	0.375	3.750	4.500	1.375	3.000	5.063
	1.000	1500								1.750		5.438
	1.375	1500								2.000		5.688
	1.750	1500								2.250		5.938
3.25	1.000	1500	3.750	0.563	0.750	1.250	0.500	4.75	5.750	1.875	3.250	6.000
	1.375	1500								2.125		6.250
	1.750	1500								2.375		6.500
	2.000	1500								2.500		6.625
4.00	1.000	1000	4.500	0.563	0.750	1.250	0.500	5.500	6.500	1.875	3.250	6.000
	1.375	1000								2.125		6.250
	1.750	1000								2.375		6.500
	2.000	1000								2.500		6.625
	2.500	1000								2.750		6.875
5.00	1.000	750	5.500	0.813	1.000	1.063	0.688	6.875	8.250	2.063	3.125	6.313
	1.375	1000								2.313		6.563
	1.750	1000								2.563		6.813
	2.000	1000								2.688		6.938
	2.500	1000								2.938		7.188
	3.000	1000								2.938		7.188
	3.500	1000								2.938		7.188
6.00	1.375	750	6.500	0.813	1.000	1.313	0.688	7.875	9.250	2.313	3.625	7.063
	1.750	750								2.563		7.313
	2.000	750								2.688		7.438
	2.500	750								2.938		7.688
	3.000	750								2.938		7.688
	3.500	750								2.938		7.688
	4.000	750								2.938		7.688
	4.000	750								2.938		7.688
8.00	1.375	500	8.500	0.813	1.000	1.313	0.688	9.875	11.250	2.313	3.750	7.313
	1.750	500								2.563		7.563
	2.000	675								2.688		7.688
	2.500	675								2.938		7.938
	3.000	675								2.938		7.938
	3.500	675								2.938		7.938
	4.000	675								2.938		7.938
	4.500	675								2.938		7.938
	5.000	675								2.938		7.938
	5.500	675								2.938		7.938

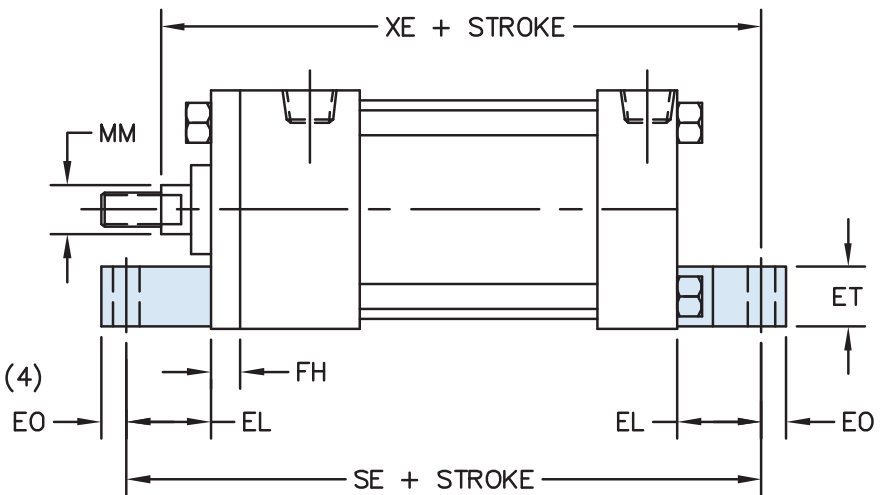
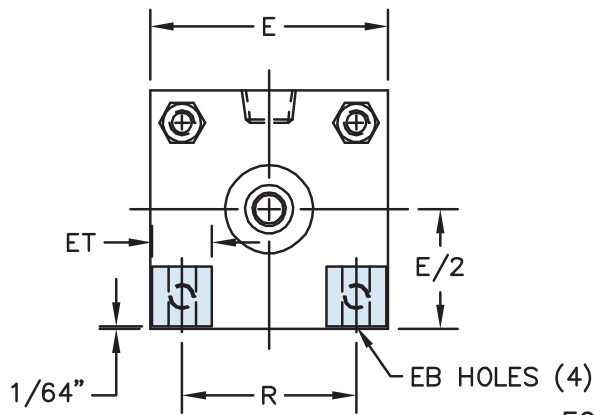
① Max. pressure rating. (NON-SHOCK)

SERIES 'HMD' DIMENSIONS: BOTTOM MOUNTS

MS4: BOTTOM TAPPED HOLES



MS7: END LUGS



SERIES 'HMD' DIMENSIONS: BOTTOM MOUNTS

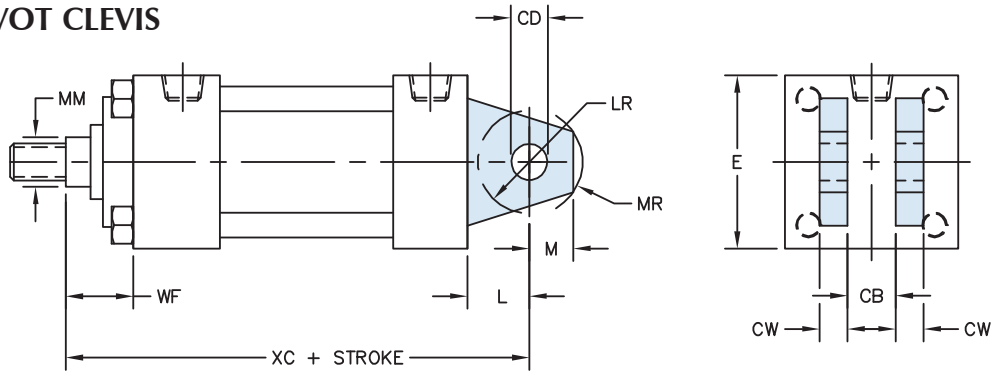
BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	EB	EL	EO	ET	FH	NT	R	TN	TK	XT	ADD TO STROKE			
														SN	ZB	SE	XE
1.50	0.625	1500	2.000	0.281	0.750	0.250	0.563	0.375	1/4 - 20	1.438	0.625	0.375	1.938	2.250	4.875	5.500	5.375
	2.313	5.250											5.750				
2.00	0.625	1500	2.500	0.344	0.938	0.313	0.625	0.375	5/16 - 18	1.844	0.875	0.406	1.938	2.250	4.938	5.875	5.563
	2.313	5.313											5.938				
	2.563	5.563											6.188				
2.50	0.625	1000	3.000	0.344	1.063	0.313	0.750	0.375	3/8 - 16	2.188	1.250	0.438	1.938	2.375	5.063	6.250	5.813
	2.313	5.438											6.188				
	2.563	5.688											6.438				
	2.813	5.938											6.688				
3.25	1.000	1500	3.750	0.406	0.875	0.375	0.938	0.625	1/2 - 13	2.766	1.500	0.500	2.438	2.625	6.000	6.625	6.500
	2.688	6.250											6.750				
	2.938	6.500											7.000				
	3.063	6.625											7.125				
4.00	1.000	1000	4.500	0.406	1.000	0.375	1.125	0.625	1/2 - 13	3.328	2.063	0.625	2.438	2.625	6.000	6.875	6.625
	2.688	6.250											6.875				
	2.938	6.500											7.125				
	3.063	6.625											7.250				
	3.313	6.875											7.500				
5.00	1.000	750	5.500	0.531	1.063	0.500	1.375	0.625	7/8 - 11	4.109	2.688	0.750	2.438	2.875	6.313	7.250	6.938
	2.688	6.563											7.188				
	2.938	6.813											7.438				
	3.063	6.938											7.563				
	3.313	7.188											7.813				
	3.313	7.188											7.813				
6.00	1.375	750	6.500	0.531	1.000	0.500	1.563	0.750	3/4 - 10	4.875	3.250	1.000	2.813	3.125	7.063	7.750	7.625
	3.063	7.313											7.875				
	3.188	7.438											8.000				
	3.438	7.688											8.250				
	3.438	7.688											8.250				
	3.438	7.688											8.250				
	3.438	7.688											8.250				
	3.438	7.688											8.250				
8.00	1.375	500	8.500	0.688	1.125	0.625	2.000	②	3/4 - 10	6.438	4.500	1.250	2.813	3.250	7.313	7.375	7.875
	3.063	7.563											8.125				
	3.188	7.688											8.250				
	3.438	7.938											8.500				
	3.438	7.938		8.500													
	3.438	7.938		8.500													
	3.438	7.938		8.500													
	3.438	7.938		N/A													
	3.438	7.938		N/A													
	3.438	7.938		N/A													
3.438	7.938	N/A															

① Max. pressure rating. (NON-SHOCK)

② (1) piece MS7 brackets bolted directly to head & cap. (Uses round retainer)

SERIES 'HMD' DIMENSIONS: PIVOT MOUNTS

MP1: REAR PIVOT CLEVIS



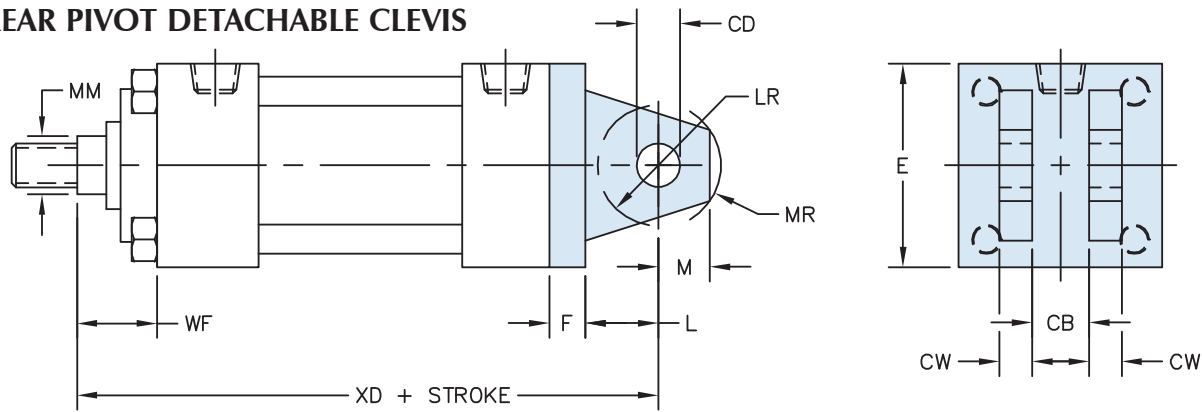
BORE	ROD DIAM (MM)	MAX. PSI RATING (1)	CB	CD	CW	E	L	LR	M	MR	WF	ADD TO STROKE	
												XC	
1.50	0.625	1500	0.750	0.500	0.500	2.000	0.750	0.750	0.500	0.625	1.000	5.375	
	1.000	1500										1.375	5.750
2.00	0.625	1500	0.750	0.500	0.500	2.500	0.750	0.750	0.500	0.625	1.000	5.375	
	1.000	1500										1.375	5.750
	1.375	1500										1.625	6.000
2.50	0.625	1000	0.750	0.500	0.500	3.000	0.750	0.750	0.500	0.625	1.000	5.500	
	1.000	1500										1.375	5.875
	1.375	1500										1.625	6.125
	1.750	1500										1.875	6.375
3.25	1.000	1500	1.250	0.750	0.625	3.750	1.250	1.000	0.750	0.938	1.375	6.875	
	1.375	1500										1.625	7.125
	1.750	1500										1.875	7.375
	2.000	1500										2.000	7.500
4.00	1.000	1000	1.250	0.750	0.625	4.500	1.250	1.000	0.750	0.938	1.375	6.875	
	1.375	1000										1.625	7.125
	1.750	1000										1.875	7.375
	2.000	1000										2.000	7.500
5.00	2.500	1000	1.250	0.750	0.625	5.500	1.250	1.000	0.750	0.938	2.250	7.750	
	1.000	750										1.375	7.125
	1.375	1000										1.625	7.375
	1.750	1000										1.875	7.625
	2.000	1000										2.000	7.750
	3.000	1000										2.250	8.000
6.00	1.375	750	1.500	1.000	0.750	6.500	1.500	1.250	1.000	1.188	1.625	8.125	
	1.750	750										1.875	8.375
	2.000	750										2.000	8.500
	2.500	750										2.250	8.750
	3.000	750										2.250	8.750
	3.500	750										2.250	8.750
8.00	1.375	500	1.500	1.000	0.750	8.500	1.500	1.250	1.000	1.188	1.625	8.250	
	1.750	500										1.875	8.500
	2.000	675										2.000	8.625
	2.500	675										2.250	8.875
	3.000	675										2.250	8.875
	3.500	675										2.250	8.875
	4.000	675										2.250	8.875
	4.500	675										2.250	8.875
	5.000	675										2.250	8.875
5.500	675	2.250	8.875										

(1) Max. pressure rating. (NON-SHOCK)

Note: Pivot pin included with cylinder cap end only.

SERIES 'HMD' DIMENSIONS: PIVOT MOUNTS

MP2: REAR PIVOT DETACHABLE CLEVIS

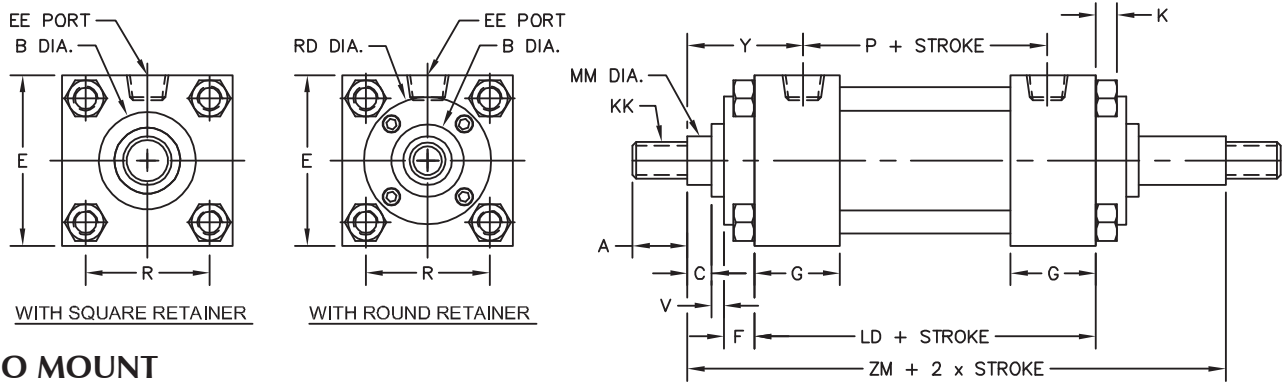


BORE	ROD DIAM (MM)	MAX. PSI RATING ①	CB	CD	CW	E	F	L	LR	M	MR	WF	ADD TO STROKE	
													XD	
1.50	0.625	1500	0.750	0.500	0.500	2.000	0.375	0.750	0.750	0.500	0.625	1.000	5.750	
	1.000	1500											1.375	6.125
2.00	0.625	1500	0.750	0.500	0.500	2.500	0.375	0.750	0.750	0.500	0.625	1.000	5.750	
	1.000	1500											1.375	6.125
	1.375	1500											1.625	6.375
2.50	0.625	1000	0.750	0.500	0.500	3.000	0.375	0.750	0.750	0.500	0.625	1.000	5.875	
	1.000	1500											1.375	6.250
	1.375	1500											1.625	6.500
	1.750	1500											1.875	6.750
3.25	1.000	1500	1.250	0.750	0.625	3.750	0.625	1.250	1.000	0.750	0.938	1.375	7.500	
	1.375	1500											1.625	7.750
	1.750	1500											1.875	8.000
	2.000	1500											2.000	8.125
4.00	1.000	1000	1.250	0.750	0.625	4.500	0.625	1.250	1.000	0.750	0.938	1.375	7.500	
	1.375	1000											1.625	7.750
	1.750	1000											1.875	8.000
	2.000	1000											2.000	8.125
	2.500	1000											2.250	8.375
5.00	1.000	750	1.250	0.750	0.625	5.500	0.625	1.250	1.000	0.750	0.938	1.375	7.750	
	1.375	1000											1.625	8.000
	1.750	1000											1.875	8.250
	2.000	1000											2.000	8.375
	2.500	1000											2.250	8.625
	3.000	1000											2.250	8.625
	3.500	1000											2.250	8.625
6.00	1.375	750	1.500	1.000	0.750	6.500	0.750	1.500	1.250	1.000	1.188	1.625	8.875	
	1.750	750											1.875	9.125
	2.000	750											2.000	9.250
	2.500	750											2.250	9.500
	3.000	750											2.250	9.500
	3.500	750											2.250	9.500
	4.000	750											2.250	9.500

① Max. pressure rating. (NON-SHOCK)

Note: Pivot pin included with cylinder cap end only.

SERIES 'HMD' DIMENSIONS: BASIC DOUBLE END (MX0 MOUNT)



MX0D: NO MOUNT

BORE	ROD DIA (MM)	MAX. PSI RATING ③	E	A	B ①	C	EE		F	G	K	KK	R	RD ②	V	Y	ADD TO STROKE		ADD 2x STROKE ZM
							NPTF	SAE									LD	P	
1.50	0.625	1500	2.000	0.750	1.124	0.375	0.375	#6	0.375	1.500	0.250	1.438	SQ	0.250	1.875	4.125	2.375	6.125	
	1.000	1500		1.125	1.499	0.500							SQ	0.500	2.250			6.875	
2.00	0.625	1500	2.500	0.750	1.124	0.375	0.375	#6	0.375	1.500	0.313	1.844	2.000	0.250	1.875	4.125	2.375	6.125	
	1.000	1500		1.125	1.499	0.500							SQ	0.500	2.250			6.875	
	1.375	1500		1.625	1.999	0.625							SQ	0.625	2.500			7.375	
2.50	0.625	1000	3.000	0.750	1.124	0.375	0.375	#6	0.375	1.500	0.313	2.188	2.000	0.250	1.875	4.250	2.500	6.250	
	1.000	1500		1.125	1.499	0.500							SQ	0.500	2.250			7.000	
	1.375	1500		1.625	1.999	0.625							SQ	0.625	2.500			7.500	
	1.750	1500		2.000	2.374	0.750							SQ	0.750	2.750			8.000	
3.25	1.000	1500	3.750	1.125	1.499	0.500	0.500	#10	0.625	1.750	0.375	2.766	2.750	0.250	2.375	4.750	2.750	7.500	
	1.375	1500		1.625	1.999	0.625							SQ	0.375	2.625			8.000	
	1.750	1500		2.000	2.374	0.750							SQ	0.500	2.875			8.500	
	2.000	1500		2.250	2.624	0.875							SQ	0.500	3.000			8.750	
4.00	1.000	1000	4.500	1.125	1.499	0.500	0.500	#10	0.625	1.750	0.375	3.328	2.750	0.250	2.375	4.750	2.750	7.500	
	1.375	1000		1.625	1.999	0.625							3.500	0.375	2.625			8.000	
	1.750	1000		2.000	2.374	0.750							SQ	0.500	3.000			8.500	
	2.000	1000		2.250	2.624	0.875							SQ	0.625	3.250			9.250	
	2.500	1000		3.000	3.124	1.000							4.109	2.750	0.250			2.375	5.000
1.375	1000	1.625	1.999	0.625	3.500	0.375	2.625	8.250											
1.750	1000	2.000	2.374	0.750	3.500	0.500	2.875	8.750											
2.000	1000	2.250	2.624	0.875	SQ	0.625	3.250	9.500											
3.000	1000	3.500	3.749	1.000	SQ	0.625	3.250	9.500											
6.00	1.375	750	6.500	1.625	1.999	0.625	0.750	#12	0.750	2.000	0.438	4.875	3.500	0.250	2.750	5.500	3.250	8.750	
	1.750	750		2.000	2.374	0.750							3.875	0.375	3.000			9.250	
	2.000	750		2.250	2.624	0.875							4.250	0.375	3.125			9.500	
	2.500	750		3.000	3.124	1.000							4.625	0.500	3.375			10.000	
	3.000	750		3.500	3.749	1.000							5.250	0.500	3.375			10.000	
	3.500	750		3.500	4.249	1.000							5.750	0.500	3.375			10.000	
	4.000	750		4.000	4.749	1.000							SQ	0.500	3.375			10.000	
	1.375	500		8.500	1.625	1.999							0.625	0.750	#12			0.750	2.000
1.750	500	2.000	2.374		0.750	3.875	0.375	3.000	9.375										
2.000	675	2.250	2.624		0.875	4.250	0.375	3.125	9.625										
2.500	675	3.000	3.124		1.000	4.625	0.500	3.375	10.125										
3.000	675	3.500	3.749		1.000	5.250	0.500	3.375	10.125										
3.500	675	3.500	4.249		1.000	5.750	0.500	3.375	10.125										
4.000	675	4.000	4.749		1.000	6.500	0.500	3.375	10.125										
4.500	675	4.500	5.249		1.000	7.250	0.500	3.375	10.125										
5.000	675	5.000	5.749		1.000	7.500	0.500	3.375	10.125										
5.500	675	5.500	6.249		1.000	7.500	0.500	3.375	10.125										

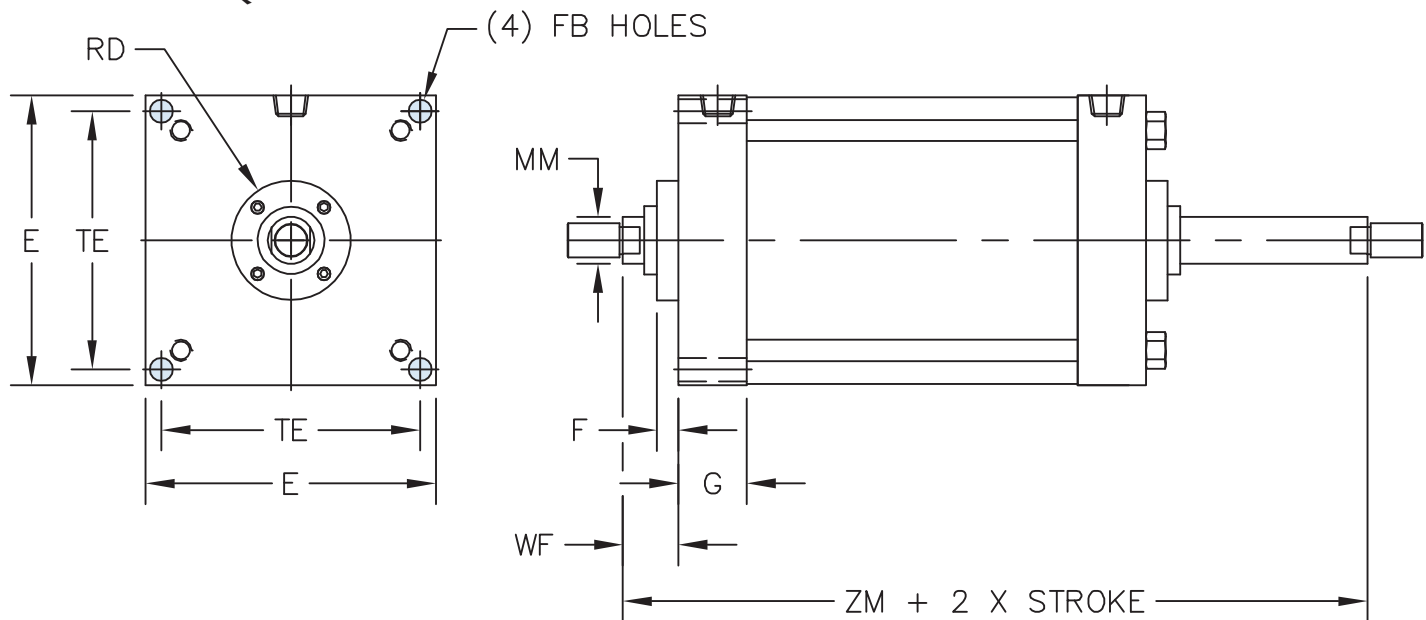
SEE ROD END DETAIL CHART ON PAGE 85

① 'B' dimension tolerance is +.000 / -.002
 ② Where SQ is shown in chart, cylinder utilizes a full square retainer.
 ③ Max. pressure rating. (NON-SHOCK)

HMD - How to Order
 HMD - Base Dimensions
 HMD - Single Rod Mounts
 HMD - Double Rod Mounts
 Options Page 142
 Accessories Page 172
 Switches Page 184
 Technical Data Page 198

SERIES 'HMD' DIMENSIONS: DOUBLE END MOUNTS

ME3D: HEAD SQUARE MOUNTING HOLES

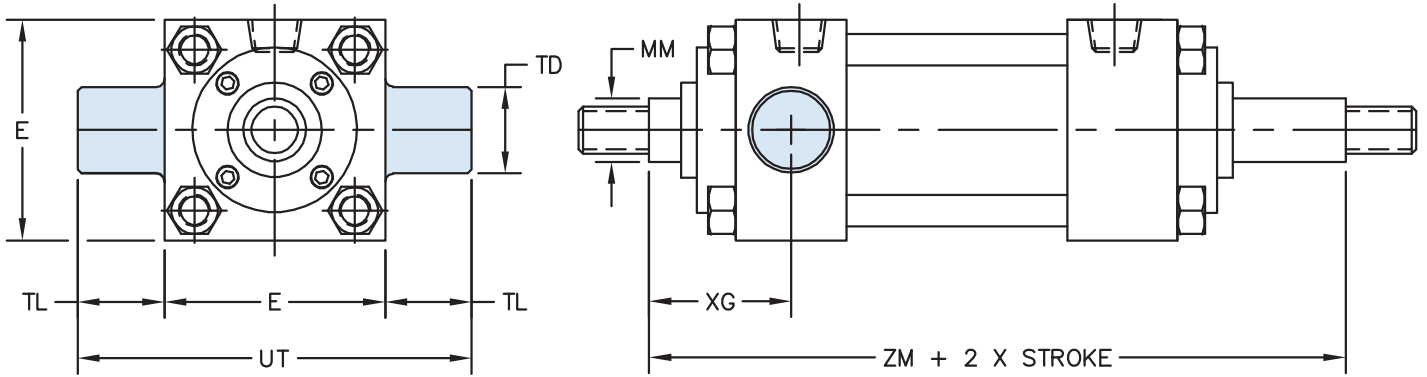


BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	F	FB	G	TE	RD	WF	ADD 2x STROKE
										ZM
8.00	1.375	500	8.500	0.750	0.688	2.000	7.570	3.500	1.625	8.875
	1.750	500						3.875	1.875	9.375
	2.000	675						4.250	2.000	9.625
	2.500	675						4.625	2.250	10.125
	3.000	675						5.250	2.250	10.125
	3.500	675						5.750	2.250	10.125
	4.000	675						6.500	2.250	10.125
	4.500	675						7.250	2.250	10.125
	5.000	675						7.500	2.250	10.125
5.500	675	7.500	2.250	10.125						

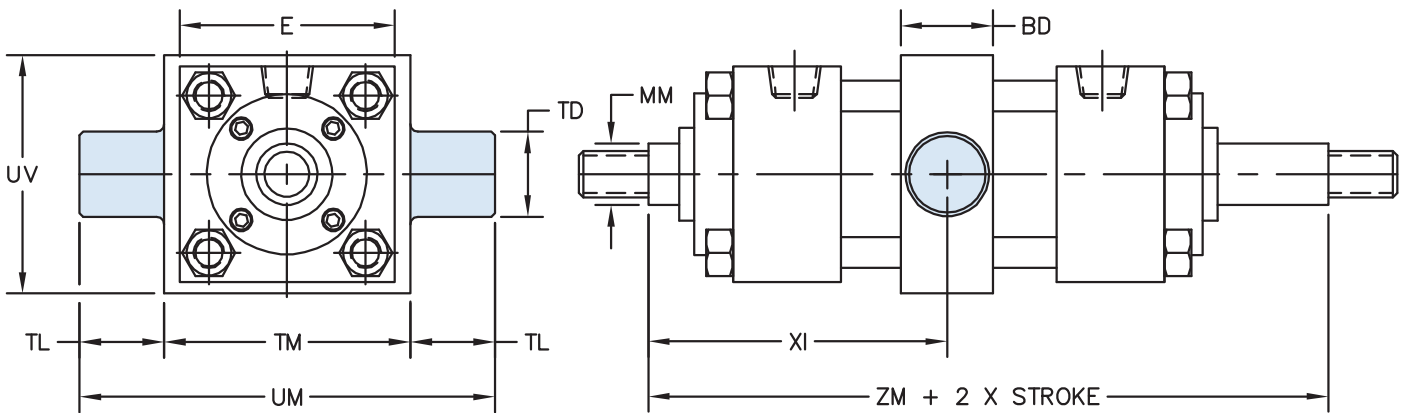
① Max. pressure rating. (NON-SHOCK)

SERIES 'HMD' DIMENSIONS: DOUBLE END MOUNTS

MT1D: HEAD TRUNNION



MT4D: INTERMEDIATE TRUNNION



NOTE:
 'XI' DIMENSION TO BE SPECIFIED BY CUSTOMER

SERIES 'HMD' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	BD	② TD	TL	TM	UM	UT	UV	XG	③ XI	MT4D Min Stroke	ADD 2x STROKE
														ZM
1.50	0.625	1500	2.000	1.250	1.000	1.000	2.500	4.500	4.000	2.500	1.750	3.375	0.250	6.125
	1.000	1500									2.125	3.750		6.875
2.00	0.625	1500	2.500	1.500	1.000	1.000	3.000	5.000	4.500	3.000	1.750	3.500	0.250	6.125
	1.000	1500									2.125	3.875		6.875
	1.375	1500									2.375	4.125		7.375
2.50	0.625	1000	3.000	1.500	1.000	1.000	3.500	5.500	5.000	3.500	1.750	3.500	0.375	6.250
	1.000	1500									2.125	3.875		7.000
	1.375	1500									2.375	4.125		7.500
	1.750	1500									2.625	4.375		8.000
3.25	1.000	1500	3.750	2.000	1.000	1.000	4.500	6.500	5.750	4.250	2.250	4.375	0.875	7.500
	1.375	1500									2.500	4.625		8.000
	1.750	1500									2.750	4.875		8.500
	2.000	1500									2.875	5.000		8.750
4.00	1.000	1000	4.500	2.000	1.000	1.000	5.250	7.250	6.500	5.000	2.250	4.375	1.125	7.500
	1.375	1000									2.500	4.625		8.000
	1.750	1000									2.750	4.875		8.500
	2.000	1000									2.875	5.000		8.750
	2.500	1000									3.125	5.250		9.250
5.00	1.000	750	5.500	2.000	1.000	1.000	6.250	8.250	7.500	6.000	2.250	4.375	1.125	7.750
	1.375	1000									2.500	4.625		8.250
	1.750	1000									2.750	4.875		8.750
	2.000	1000									2.875	5.000		9.000
	2.500	1000									3.125	5.250		9.500
	3.000	1000									3.125	5.250		9.500
	3.500	1000									3.125	5.250		9.500
6.00	1.375	750	6.500	2.000	1.375	1.375	7.625	10.375	9.250	7.000	2.625	5.125	1.250	8.750
	1.750	750									2.875	5.375		9.250
	2.000	750									3.000	5.500		9.500
	2.500	750									3.250	5.750		10.000
	3.000	750									3.250	5.750		10.000
	3.500	750									3.250	5.750		10.000
	4.000	750									3.250	5.750		10.000
	4.000	750									3.250	5.750		10.000
8.00	1.375	500	8.500	2.500	1.375	1.375	9.750	12.500	11.250	9.500	2.625	5.125	2.125	8.875
	1.750	500									2.875	5.375		9.375
	2.000	675									3.000	5.500		9.625
	2.500	675									3.250	5.750		10.125
	3.000	675									3.250	5.750		10.125
	3.500	675									3.250	5.750		10.125
	4.000	675									3.250	5.750		10.125
	4.500	675									3.250	5.750		10.125
	5.000	675									3.250	5.750		10.125
	5.500	675									3.250	5.750		10.125

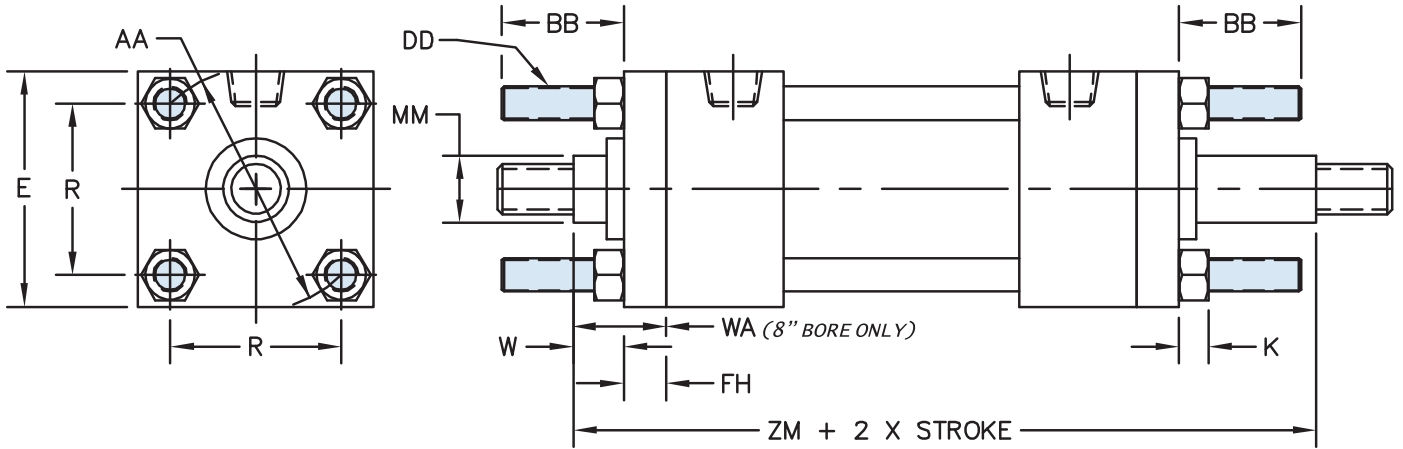
① Max. pressure rating. (NON-SHOCK)

② 'TD' dimension tolerance is + .000 / - .001

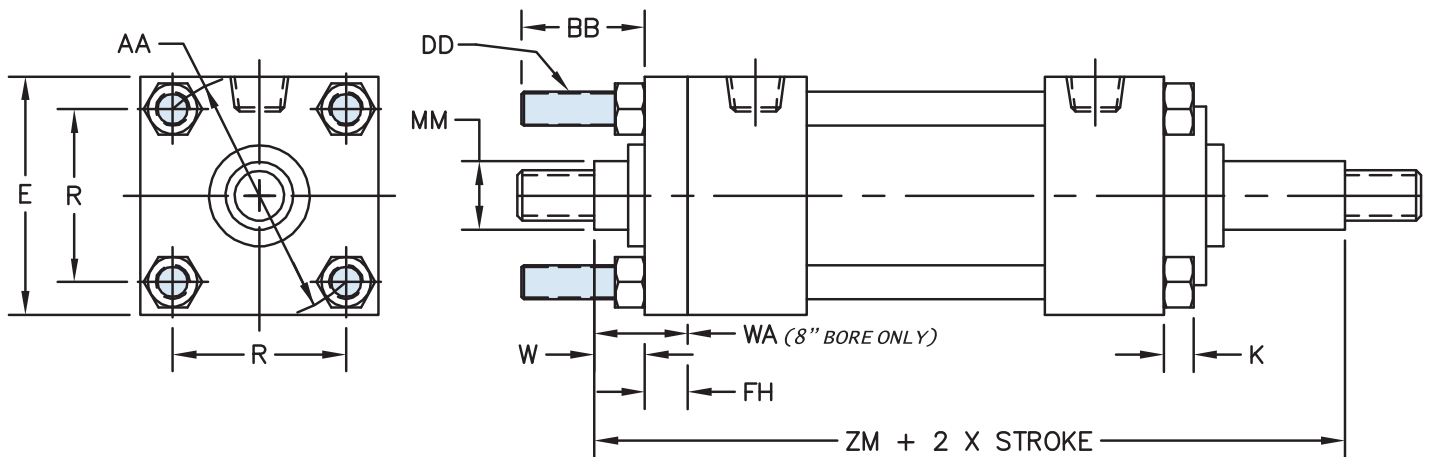
③ 'XI' dimension is the minimum that can be supplied and leaves 1/4" gap between head & trunnion block. (customer to specify 'XI' dimension).

SERIES 'HMD' DIMENSIONS: DOUBLE END MOUNTS

MX1D: EXTENDED TIE RODS - HEAD & CAP



MX3D: EXTENDED TIE RODS - HEAD END



SERIES 'HMD' DIMENSIONS: DOUBLE END MOUNTS

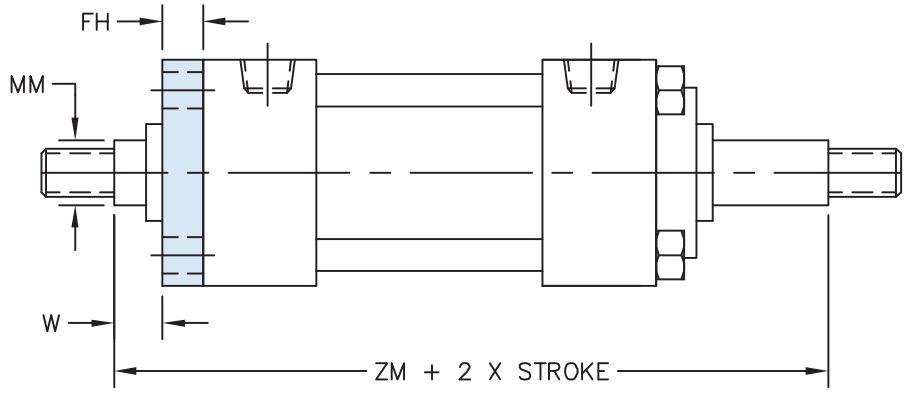
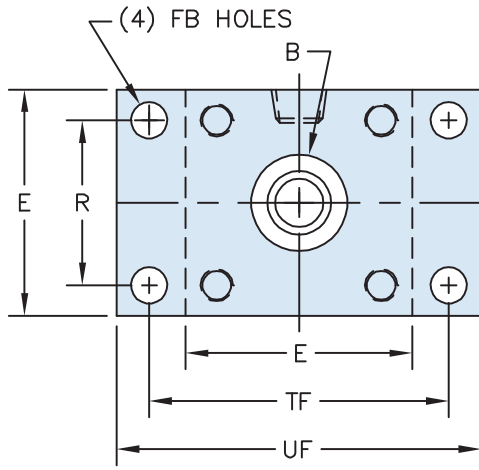
BORE	ROD DIAM (MM)	MAX. PSI RATING (1)	E	FH	AA	BB	DD	K	R	W or WA (8")	ADD 2x STROKE
											ZM
1.50	0.625	1500	2.000	0.375	2.020	1.000	1/4 - 28	0.250	1.430	0.625	6.125
	1.000	1500									6.875
2.00	0.625	1500	2.500	0.375	2.600	1.125	5/16 - 24	0.313	1.840	0.625	6.125
	1.000	1500									6.875
	1.375	1500									7.375
2.50	0.625	1000	3.000	0.375	3.100	1.125	5/16 - 24	0.313	2.190	0.625	6.25
	1.000	1500									7.000
	1.375	1500									7.500
	1.750	1500									8.000
3.25	1.000	1500	3.750	0.625	3.900	1.375	3/8 - 24	0.375	2.760	0.750	7.500
	1.375	1500									8.000
	1.750	1500									8.500
	2.000	1500									8.750
4.00	1.000	1000	4.500	0.625	4.700	1.375	3/8 - 24	0.375	3.320	0.750	7.500
	1.375	1000									8.000
	1.750	1000									8.500
	2.000	1000									8.750
	2.500	1000									9.250
5.00	1.000	750	5.500	0.625	5.800	1.813	1/2 - 20	0.438	4.100	0.750	7.750
	1.375	1000									8.250
	1.750	1000									8.750
	2.000	1000									9.000
	2.500	1000									9.500
	3.000	1000									9.500
	3.500	1000									9.500
6.00	1.375	750	6.500	0.750	6.900	1.813	1/2 - 20	0.438	4.880	0.875	8.750
	1.750	750									9.250
	2.000	750									9.500
	2.500	750									10.000
	3.000	750									10.000
	3.500	750									10.000
	4.000	750									10.000
	4.000	750									10.000
8.00	1.375	500	8.500	*0.625 (2)	9.10	2.313	5/8 - 18	0.563	6.440	1.500	8.875
	1.750	500									9.375
	2.000	675									9.625
	2.500	675									10.125
	3.000	675									10.125
	3.500	675									10.125
	4.000	675									10.125
	4.500	675									10.125
	5.000	675									10.125
	5.500	675									10.125

(1) Max. pressure rating. (NON-SHOCK)

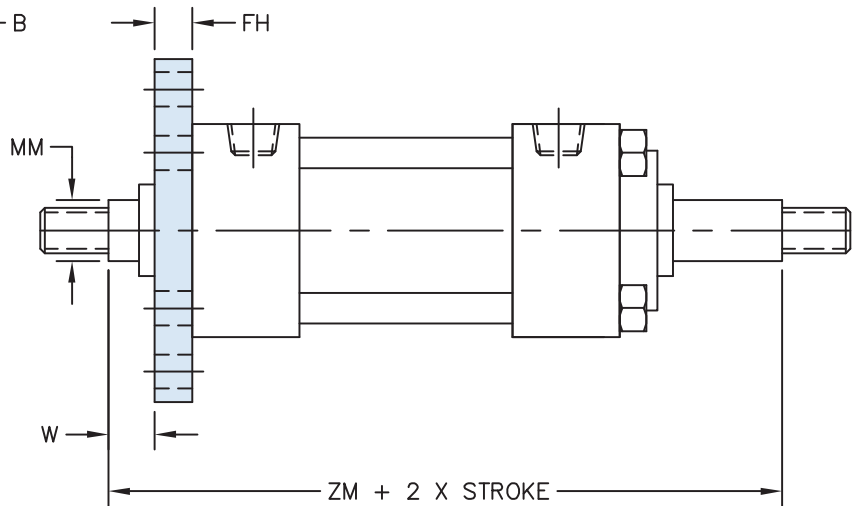
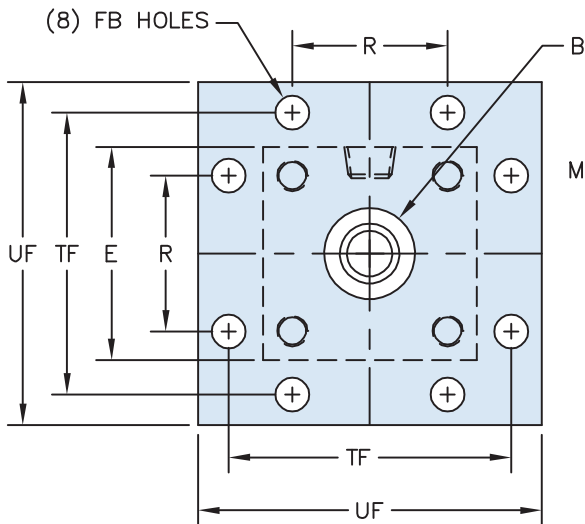
(2) *Round retainer used to retain bushing, not a full front plate as other bores. 'BB' is dimension from head on the 8.00" bore.

SERIES 'HMD' DIMENSIONS: DOUBLE END MOUNTS

MF1D: HEAD FLANGE



MF5D: HEAD SQUARE FLANGE



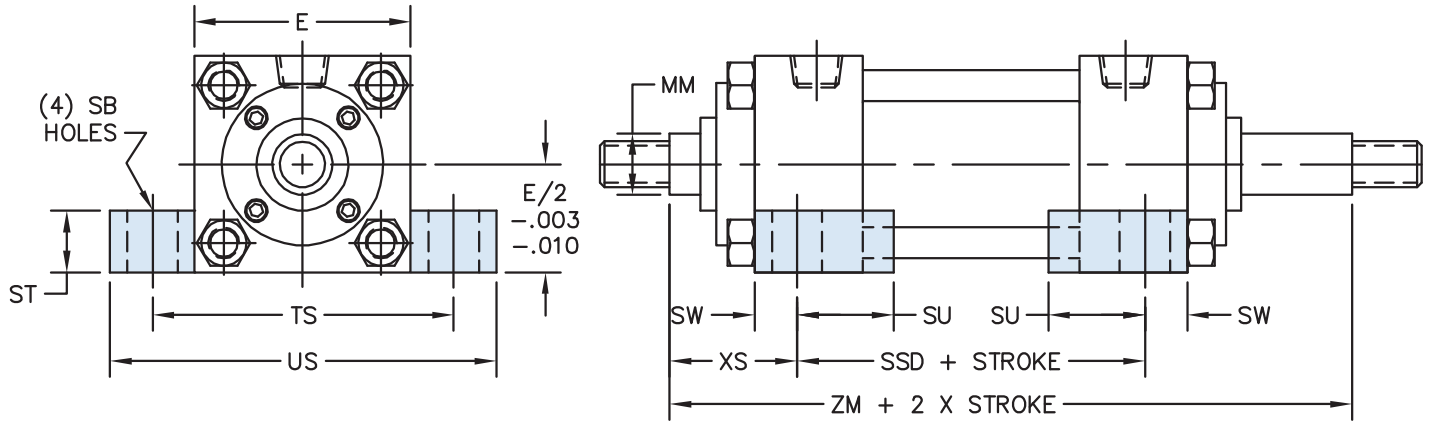
SERIES 'HMD' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING ①	B ②	E	FB	FH	R	TF	UF	W	ADD 2x STROKE
											ZM
1.50	0.625	1500	1.124	2.000	0.313	0.375	1.430	2.750	3.375	0.625	6.125
	1.000	1500	1.499								6.875
2.00	0.625	1500	1.124	2.500	0.375	0.375	1.840	3.375	4.125	0.625	6.125
	1.000	1500	1.499							1.000	6.875
	1.375	1500	1.999							1.250	7.375
2.50	0.625	1000	1.124	3.000	0.375	0.375	2.190	3.875	4.625	0.625	6.250
	1.000	1500	1.499							1.000	7.000
	1.375	1500	1.999							1.250	7.500
	1.750	1500	2.374							1.500	8.000
3.25	1.000	1500	1.499	3.750	0.438	0.625	2.760	4.688	5.500	0.750	7.500
	1.375	1500	1.999							1.000	8.000
	1.750	1500	2.374							1.250	8.500
	2.000	1500	2.624							1.375	8.750
4.00	1.000	1000	1.499	4.500	0.438	0.625	3.320	5.438	6.250	0.750	7.500
	1.375	1000	1.999							1.000	8.000
	1.750	1000	2.374							1.250	8.500
	2.000	1000	2.624							1.375	8.750
	2.500	1000	3.124							1.625	9.250
5.00	1.000	750	1.499	5.500	0.563	0.625	4.100	6.625	7.625	0.750	7.750
	1.375	1000	1.999							1.000	8.250
	1.750	1000	2.374							1.250	8.750
	2.000	1000	2.624							1.375	9.000
	2.500	1000	3.124							1.625	9.500
	3.000	1000	3.749							1.625	9.500
	3.500	1000	4.249							1.625	9.500
6.00	1.375	750	1.999	6.500	0.563	0.750	4.880	7.625	8.625	0.875	8.750
	1.750	750	2.374							1.125	9.250
	2.000	750	2.624							1.250	9.500
	2.500	750	3.124							1.500	10.000
	3.000	750	3.749							1.500	10.000
	3.500	750	4.249							1.500	10.000
	4.000	750	4.749							1.500	10.000

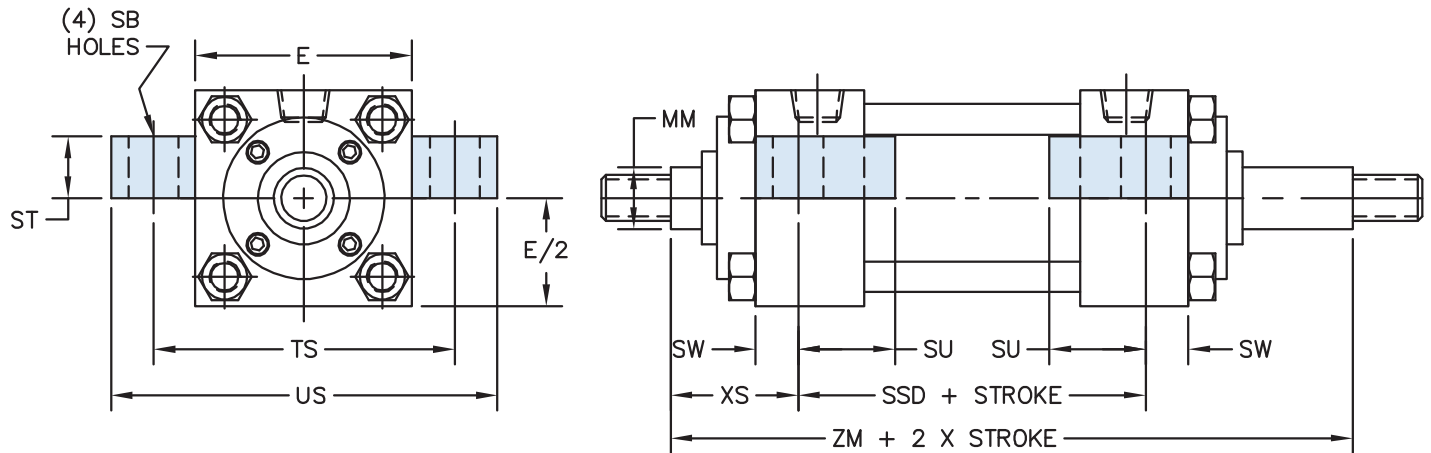
① Max. pressure rating. (NON-SHOCK)
 ② 'B' dimension tolerance is +.000 / -.002

SERIES 'HMD' DIMENSIONS: DOUBLE END MOUNTS

MS2D: SIDE LUGS



MS3D: CENTER LINE LUGS



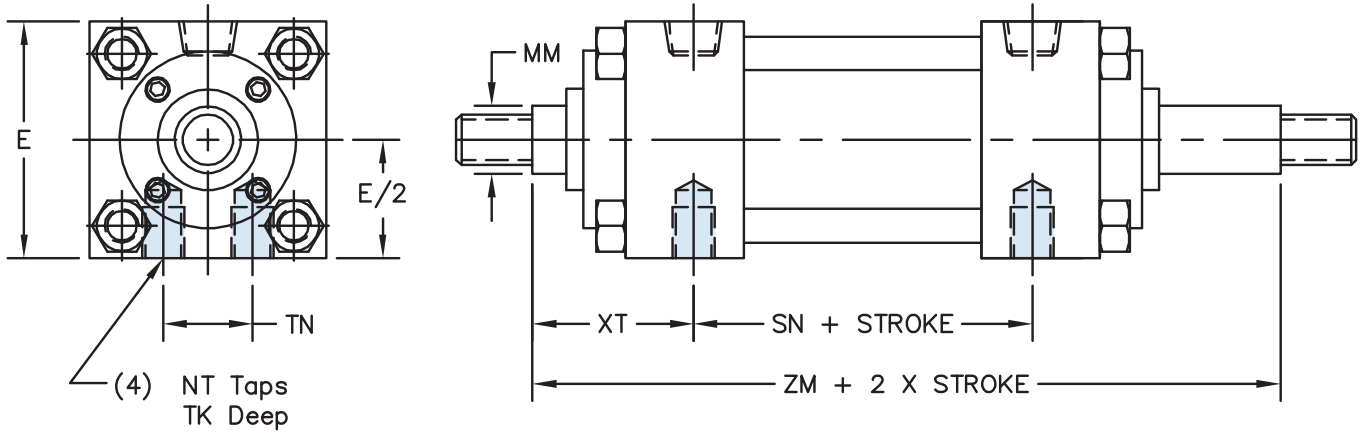
SERIES 'HMD' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING (Ⓜ)	E	SB	ST	SU	SW	TS	US	XS	ADD TO STROKE	ADD 2x STROKE
											SSD	ZM
1.50	0.625	1500	2.000	0.438	0.500	1.125	0.375	2.750	3.500	1.375	3.375	6.125
	1.000	1500								1.750		6.875
2.00	0.625	1500	2.500	0.438	0.500	1.125	0.375	3.250	4.000	1.375	3.375	6.125
	1.000	1500								1.750		6.875
	1.375	1500								2.000		7.375
2.50	0.625	1000	3.000	0.438	0.500	1.125	0.375	3.750	4.500	1.375	3.500	6.250
	1.000	1500								1.750		7.000
	1.375	1500								2.000		7.500
	1.750	1500								2.250		8.000
3.25	1.000	1500	3.750	0.563	0.750	1.250	0.500	4.75	5.750	1.875	3.750	7.500
	1.375	1500								2.125		8.000
	1.750	1500								2.375		8.500
	2.000	1500								2.500		8.750
4.00	1.000	1000	4.500	0.563	0.750	1.250	0.500	5.500	6.500	1.875	3.750	7.500
	1.375	1000								2.125		8.000
	1.750	1000								2.375		8.500
	2.000	1000								2.500		8.750
	2.500	1000								2.750		9.250
5.00	1.000	750	5.500	0.813	1.000	1.063	0.688	6.875	8.250	2.063	3.625	7.750
	1.375	1000								2.313		8.250
	1.750	1000								2.563		8.750
	2.000	1000								2.688		9.000
	2.500	1000								2.938		9.500
	3.000	1000								2.938		9.500
	3.500	1000								2.938		9.500
6.00	1.375	750	6.500	0.813	1.000	1.313	0.688	7.875	9.250	2.313	4.125	8.750
	1.750	750								2.563		9.250
	2.000	750								2.688		9.500
	2.500	750								2.938		10.000
	3.000	750								2.938		10.000
	3.500	750								2.938		10.000
	4.000	750								2.938		10.000
	8.00	1.375								500		8.500
1.750		500	2.563	9.375								
2.000		675	2.688	9.625								
2.500		675	2.938	10.125								
3.000		675	2.938	10.125								
3.500		675	2.938	10.125								
4.000		675	2.938	10.125								
4.500		675	2.938	10.125								
5.000		675	2.938	10.125								
5.500		675	2.938	10.125								

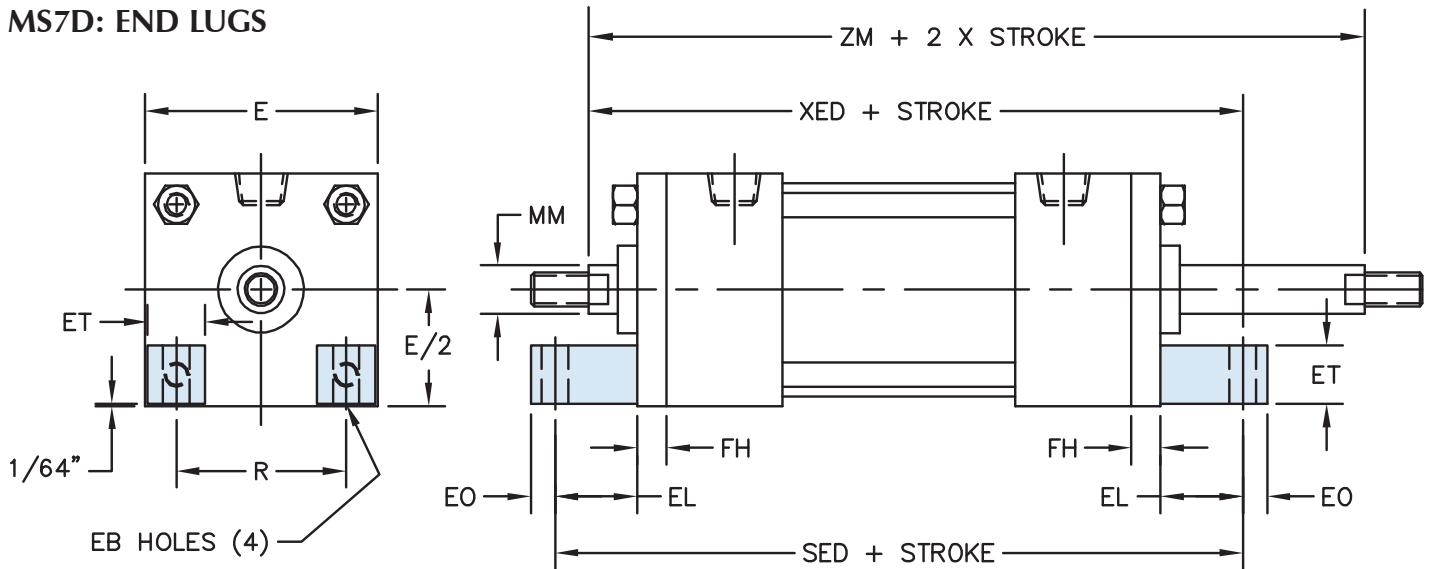
(Ⓜ) Max. pressure rating. (NON-SHOCK)

SERIES 'HMD' DIMENSIONS: DOUBLE END MOUNTS

MS4D: BOTTOM TAPPED HOLES



MS7D: END LUGS



SERIES 'HMD' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	EB	EL	EO	ET	FH	NT	R	TN	TK	XT	ADD TO STROKE			ADD 2x STROKE
														SN	SED	XED	ZM
1.50	0.625	1500	2.000	N/A	N/A	N/A	N/A	0.375	1/4 - 20	1.438	0.625	0.375	1.938	2.250	N/A	N/A	6.125
	2.313	N/A											6.875				
2.00	0.625	1500	2.500	0.344	0.938	0.313	0.375	0.375	5/16 - 18	1.844	0.875	0.406	1.938	2.250	6.750	6.438	6.125
	1.000	1500		2.313	6.813	6.875											
	1.375	1500		2.563	N/A	N/A	7.375										
2.50	0.625	1000	3.000	0.344	1.063	0.313	0.750	0.375	3/8 - 16	2.188	1.250	0.438	1.938	2.375	7.125	6.688	6.250
	1.000	1500		2.313	N/A	N/A	7.000										
	1.375	1500		2.563	N/A	N/A	7.500										
	1.750	1500		2.813	N/A	N/A	8.000										
3.25	1.000	1500	3.750	0.406	0.875	0.375	0.938	0.625	1/2 - 13	2.766	1.500	0.500	2.438	2.625	7.750	7.625	7.500
	1.375	1500		2.688	N/A	N/A	8.000										
	1.750	1500		2.938	N/A	N/A	8.500										
	2.000	1500		3.063	N/A	N/A	8.750										
4.00	1.000	1000	4.500	0.406	1.000	0.375	1.125	0.625	1/2 - 13	3.328	2.063	0.625	2.438	2.625	8.000	7.750	7.500
	1.375	1000		2.688	N/A	N/A	8.000										
	1.750	1000		2.938	N/A	N/A	8.500										
	2.000	1000		3.063	N/A	N/A	8.750										
	2.500	1000		3.313	N/A	N/A	9.250										
5.00	1.000	750	5.500	0.531	1.063	0.500	1.375	0.625	5/8 - 11	4.109	2.688	0.750	2.438	2.875	8.375	8.063	7.750
	1.375	1000											2.688			8.313	8.250
	1.750	1000		2.938	8.563	8.750											
	2.000	1000		3.063	N/A	N/A	9.000										
	2.500	1000		3.313	N/A	N/A	9.500										
	3.000	1000		3.313	N/A	N/A	9.500										
	3.500	1000		3.313	N/A	N/A	9.500										
6.00	1.375	750	6.500	0.531	1.000	0.500	1.563	0.750	3/4 - 10	4.875	3.250	1.000	2.813	3.125	9.000	8.875	8.750
	1.750	750											3.063			9.125	9.250
	2.000	750											3.188			9.250	9.500
	2.500	750											3.438			9.500	10.000
	3.000	750		3.438	N/A	N/A	10.000										
	3.500	750		3.438	N/A	N/A	10.000										
	4.000	750		3.438	N/A	N/A	10.000										
	8.00	1.375		500	8.500	0.688	1.125						0.625		2.000	②	3/4 - 10
1.750		500	3.063	8.625				9.375									
2.000		675	3.188	8.750				9.625									
2.500		675	3.438	9.000				10.125									
3.000		675	3.438	9.000				10.125									
3.500		675	3.438	9.000		10.125											
4.000		675	3.438	N/A		N/A	10.125										
4.500		675	3.438	N/A		N/A	10.125										
5.000		675	3.438	N/A		N/A	10.125										
5.500		675	3.438	N/A		N/A	10.125										

① Max. pressure rating. (NON-SHOCK)

② MS7 bracket bolted directly to head. (Uses round retainer)



NASON

NEW THINKING

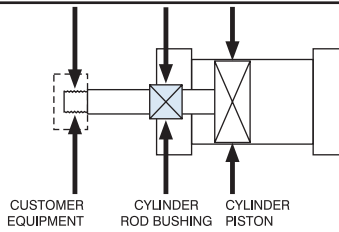


SERIES 'HHD' (NFPA) CYLINDER

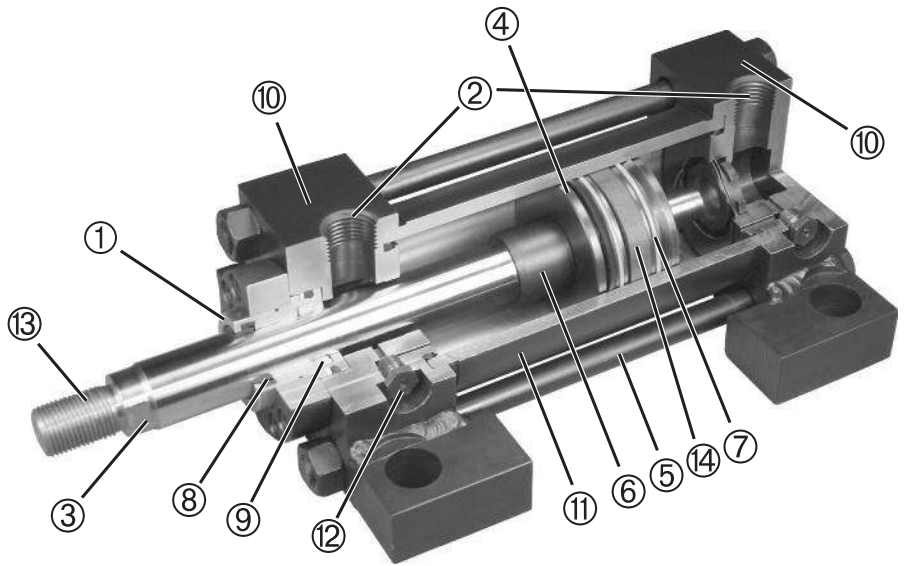
Floating Rod Bushing

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 ductile iron and PTFE coated to reduce friction and extend cycle life. Bushing design "traps" lubrication in effective bearing area. Bronze bushings also available.
- ② **PORTS** – NPTF and SAE ports available standard. Non-standard locations, sizes, and other port styles can be made to order to fit any application needs.
- ③ **PISTON ROD** – Steel piston rod provides high strength and damage resistance. Induction hardened and chrome plated for maximum wear resistance and long life. (100K min. yield up to 5" rod; 75K min. yield for 5½" rod)
- ④ **PISTON** – Precision machined ductile iron provides high strength and an excellent bearing surface for extended cylinder life.
- ⑤ **TIE RODS** – Pre-stressed high carbon steel tie rod construction eliminates axial loading of cylinder tube and maintains compression on tube. (100K min. yield)
- ⑥ **CUSHION** – Precision machined cushions are available at either end and provide smooth deceleration which helps reduce end of stroke shock.
- ⑦ **PISTON SEALS** – Heavy lip design Carboxylated Nitrile

seals with back-up rings are pressure activated and wear compensating for extended life. Cast ring, EP, PTFE, and fluorocarbon designs available.

- ⑧ **ROD WIPER** – Flocked nitrile wiper removes contaminants on retract stroke, helping insure long life for all internal components.
- ⑨ **ROD SEALS** – Polyurethane seals offer high abrasion resistance and strength. Pressure activated double lip and wear compensating for extended life.
- ⑩ **HEAD & CAP** – Precision machined steel head and cap are held to tight tolerances and insure accurate alignment for a truly "square" cylinder.
- ⑪ **TUBE** – Precision machined steel tube with hard chrome I.D. is honed and micro finished for extended seal life and improved cycle rates.
- ⑫ **CUSHION ADJUSTMENT NEEDLE** – Adjustable steel needle design has fine thread metering and is positively captured to prevent needle ejection during adjustment.
- ⑬ **PISTON ROD STUD** – Standard on KK1 and KK2 threads for ¾" - 2" rods (125K min. yield). Available up to 2 times standard "A" thread length.
- ⑭ **WEAR BAND** – Wear Guard Nylon (standard); reinforced PTFE for E and V seal option.

OPERATING PRESSURE

3000 PSI HYD (207 BAR)
Refer to page 204 for specific PSI

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:

- **RLH** – Rod locks are used to hold linear cylinder loads stationary in any mounting orientation during "power off" condition. See pages 138-141 for more information.
- **ST** – Stop tubes are used to reduce rod bearing and piston stress (refer to page 167 for cylinder design guidance).
- **CS** – Center Supports are recommended for cylinders with long strokes in horizontal applications to prevent buckling of the cylinder and extend cylinder life.
- **SSR** – 17-4 Chrome Plated Stainless Steel Piston Rod provide corrosion resistance in outdoor applications and wet environments. (100K min. yield up to 5" rod; 75K min. yield 5½" rod)
- **HP** – High impact pistons use a high strength steel nut retained piston for fatigue resistance and additional strength in demanding applications.

HOW TO ORDER: SERIES 'HHD' (HEAVY DUTY HYDRAULIC CYLINDERS)

HHD - MF1 - 250 x 10 - H2C6 - 100 - KK1 - P15 = N375 - S S S S -

SERIES	
HHD	HYDRAULIC HEAVY DUTY

STYLE	
(BLANK)	SINGLE ROD
D	DOUBLE ROD

STROKE	
0" to 120" Made to Order. (Use decimals for fractional strokes)	

ROD SIZE	
062	0.625" Rod Dia.
100	1.000" Rod Dia.
137	1.375" Rod Dia.
175	1.750" Rod Dia.
200	2.000" Rod Dia.
250	2.500" Rod Dia.
300	3.000" Rod Dia.
350	3.500" Rod Dia.
400	4.000" Rod Dia.
450	4.500" Rod Dia.
500	5.000" Rod Dia.
550	5.500" Rod Dia.

PORT LOC	
P	1
	2
	3
	4
	5
	6
	7
	8
	9

PORT SIZE	
N062	1/16" NPTF
N125	1/8" NPTF
N250	1/4" NPTF
N375	3/8" NPTF
N500	1/2" NPTF
N750	3/4" NPTF
N1000	1" NPTF
N1500	1 1/2" NPTF
S2	#2 SAE
S3	#3 SAE
S4	#4 SAE
S5	#5 SAE
S6	#6 SAE
S8	#8 SAE
S10	#10 SAE
S12	#12 SAE
S16	#16 SAE
S24	#24 SAE

See Below for Seal Ordering Instructions

OPTIONS	
A=	EXTENDED PISTON ROD THREAD (Example: A = 2") (MAX = 2 TIMES STD "A" DIM.)
AS=	ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, Example: AS = 4")
C=	EXTENDED PISTON ROD (Example: IF C = 0.50", THEN 1" ROD EXTENSION IS C = 1.50")
CS	CENTER SUPPORT
EK	EXTENDED KEYPLATE (Refer to page 128 and 164 for specifications)
EN	ELECTROLESS NICKEL PLATED (Refer to page 164 for specifications)
HP	HIGH IMPACT PISTON
NR	NON-ROTATING (Refer to page 165 for specifications)
RBB	ROD BUSHING MATERIAL: BRONZE
RLH	"ROD LOCK READY" CYLINDER
RLH=	ROD LOCK MODEL NUMBER Example: RLH=1002501000 (Refer to page 138-141 for ordering instructions for assembled rod locks)
SSR	STAINLESS STEEL PISTON ROD
ST=	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) Example: (HHD-MS2-250x48ES-H2C6-ST=3")
4WF	FOUR WRENCH FLATS (ROD SIZES: 5/8"-3")
XX=	SPECIAL VARIATION (SPECIFY)

NPPA MOUNTS	
MX0	NO MOUNT (1.50" to 8.00" Bore)
MF1	HEAD RECTANGULAR FLANGE (1.50" to 8.00" Bore)
MF2	CAP RECTANGULAR FLANGE (1.50" to 8.00" Bore)
MF5	HEAD SQUARE FLANGE (1.50" to 8.00" Bore)
MF6	CAP SQUARE FLANGE (1.50" to 8.00" Bore)
ME5	HEAD RECTANGULAR MOUNTING HOLES (1.50" to 8.00" Bore)
ME6	CAP RECTANGULAR MOUNTING HOLES (1.50" to 8.00" Bore)
MP1	FIXED CAP PIVOT CLEVIS (1.50" to 8.00" Bore)
MS2	SIDE LUGS (1.50" to 8.00" Bore)
MS3	CENTER LINE LUGS (1.50" to 8.00" Bore)
MS4	BOTTOM TAPPED HOLES (1.50" to 8.00" Bore)
MS7	END LUGS (1.50" to 6.00" Bore)
MT1	HEAD TRUNNION (1.50" to 8.00" Bore)
MT2	CAP TRUNNION (1.50" to 8.00" Bore)
MT4	INTERMEDIATE (CENTER) TRUNNION (1.50" to 8.00" Bore)
MX1	EXTENDED TIE RODS - HEAD & CAP (1.50" to 8.00" Bore)
MX2	EXTENDED TIE RODS - CAP (1.50" to 8.00" Bore)
MX3	EXTENDED TIE RODS - HEAD (1.50" to 8.00" Bore)

BORE	
150	1.50" Bore
200	2.00" Bore
250	2.50" Bore
325	3.25" Bore
400	4.00" Bore
500	5.00" Bore
600	6.00" Bore
800	8.00" Bore

CUSHIONS	
H	1
	2
	3
	4
C	5
	6
	7
	8

ROD END	
KK1	Small Male Thread
KK2	Large Male Thread
KK3	Female Thread
KK4	Full Dia. Male Thread
KK5	Plain End
KK10	Rod Coupler End
KKM	Metric Thread
KKX	Non-Std Thread

When additional thread details are required, use format "Rod End" = "Modification". Example: KKM=1.00x8

HOW TO ORDER SEALS

S S S S

PISTON SEAL	
S	STANDARD (Carboxylated)
C	Cast-Ring
E	EP
T	PTFE
V	Fluorocarbon

ROD SEAL	
S	STANDARD (Polyurethane)
E	EP
V	Fluorocarbon

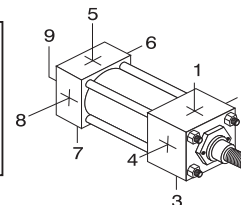
TUBE SEAL	
S	STANDARD (Buna)
E	EP
V	Fluorocarbon

ROD WIPER *	
S	STANDARD (Flocked Nitrile)
M	Metallic Scraper
T	PTFE
V	Fluorocarbon

*Note: When cylinder design calls for all EP seals, use PTFE rod wiper.

MAXIMUM STROKE RECOMMENDATIONS			
BORE	NO CENTER SUPPORT	WITH CENTER SUPPORTS (CS OPTION)	
		ONE SUPPORT	TWO SUPPORTS
1.50"	44 INCHES	STROKES OVER 44 INCHES	STROKES OVER 89 INCHES
2.00"	74 INCHES	STROKES OVER 74 INCHES	STROKES OVER 99 INCHES
2.50"	84 INCHES	STROKES OVER 84 INCHES	NOT REQUIRED
3.25" - 8.00"	99 INCHES	STROKES OVER 99 INCHES	NOT REQUIRED

Port Note: For complex port designs, multiple port locations & sizes can be ordered. Call out locations and sizes for all sets using the following format. Example: P15=N375 -P26=N500 (3/8" NPTF Ports at 1 & 5 and 1/2" NPTF Ports at 2 & 6)



Location 9 is center of cap face.

NPPA MOUNTS

 1.50"-8.00" Bores Page 123	 1.50"-8.00" Bores Page 123	 1.50"-8.00" Bores Page 125	 1.50"-8.00" Bores Page 125	 1.50"-8.00" Bores Page 123	 1.50"-8.00" Bores Page 124
 1.50"-8.00" Bores Page 128	 1.50"-8.00" Bores Page 126	 1.50"-8.00" Bores Page 126	 1.50"-8.00" Bores Page 127	 1.50"-6.00" Bores Page 127	 1.50"-8.00" Bores Page 119
 1.50"-8.00" Bores Page 119	 1.50"-8.00" Bores Page 119	 1.50"-8.00" Bores Page 118	 1.50"-8.00" Bores Page 121	 1.50"-8.00" Bores Page 121	 1.50"-8.00" Bores Page 121

SERIES 'HHD' DIMENSIONS: THREADS

HHD - How to Order

HHD - Base Dimensions

HHD - Mount Dimensions

HHD with Rod Lock

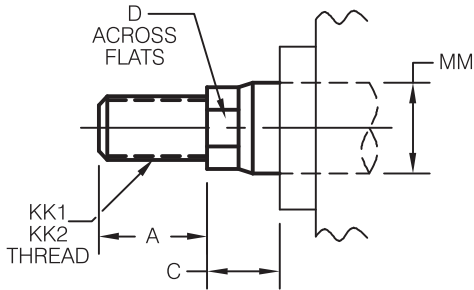
Options Page 142

Accessories Page 172

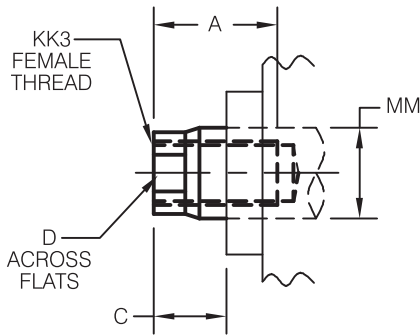
Switches Page 184

Technical Data Page 198

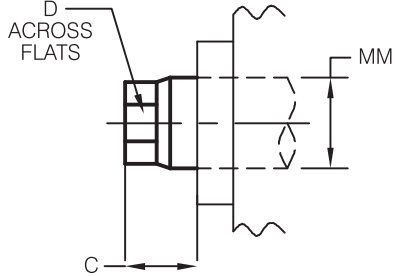
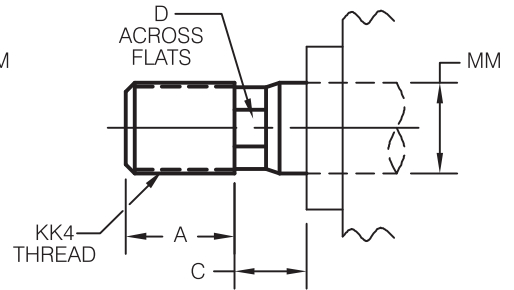
ROD END STYLE:
KK1
KK2



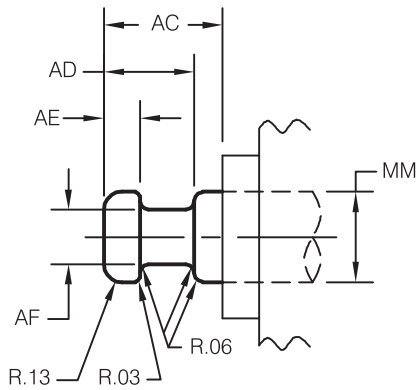
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KK3



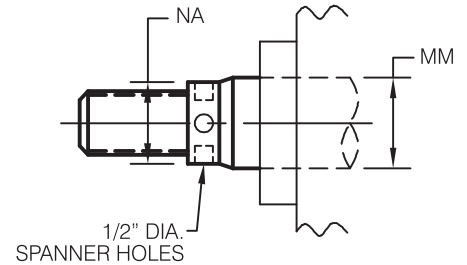
ROD END STYLE:
KK4



ROD END STYLE:
KK5



ROD END STYLE:
KK10



SPANNER HOLES (4.000-5.500 RODS)
(SHOWN ON KK1-KK2)

ROD DIA (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	1.063	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	2.125	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	3.937
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	4.421
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	4.921
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	5.421

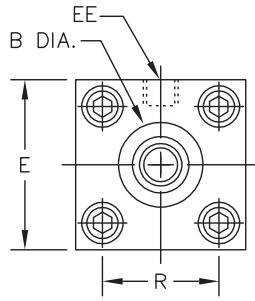
* Studded rod end.

(4) Wrench flats is an option.

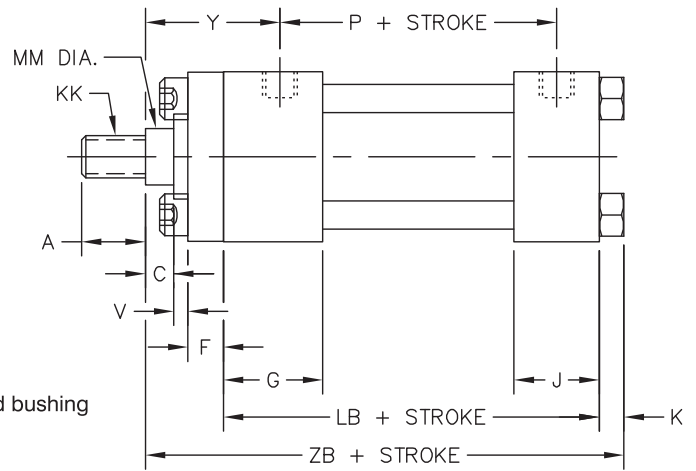
Note: Rods larger than 3.50" dia. utilize (4) 0.500" dia. spanner holes 0.500" deep.

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

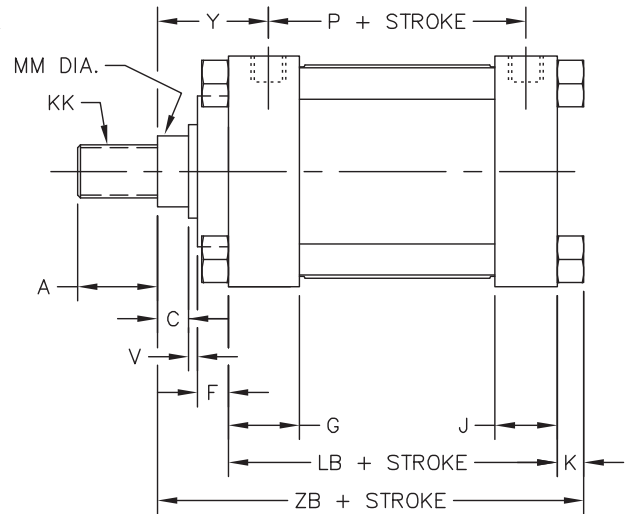
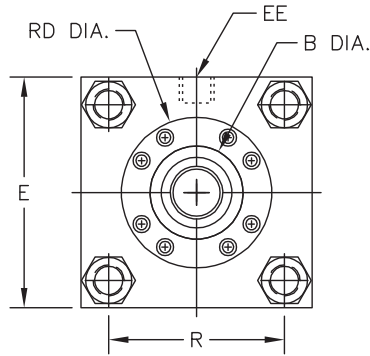
FULL SQUARE RETAINER USED ON:	
BORE	ROD DIA.
1.50	0.625
1.50	1.000
2.00	1.000
2.00	1.375
2.50	1.375
2.50	1.750
3.25	1.750
3.25	2.000
4.00	2.500
5.00	3.500



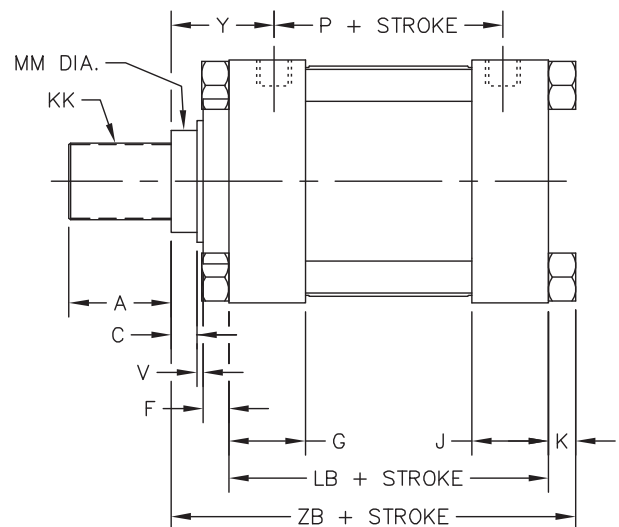
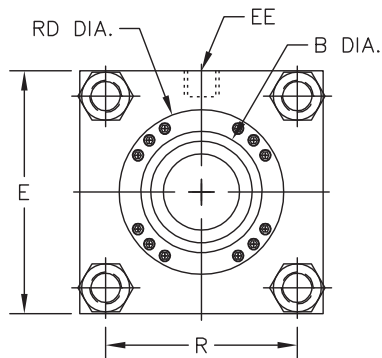
Note: Full square retainer is removable to service rod bushing



ROUND RETAINER USED ON:	
BORE	ROD DIA.
2.50	1.000
3.25	1.375
4.00	1.750
4.00	2.000
5.00	2.000
5.00	2.500
6.00	2.500

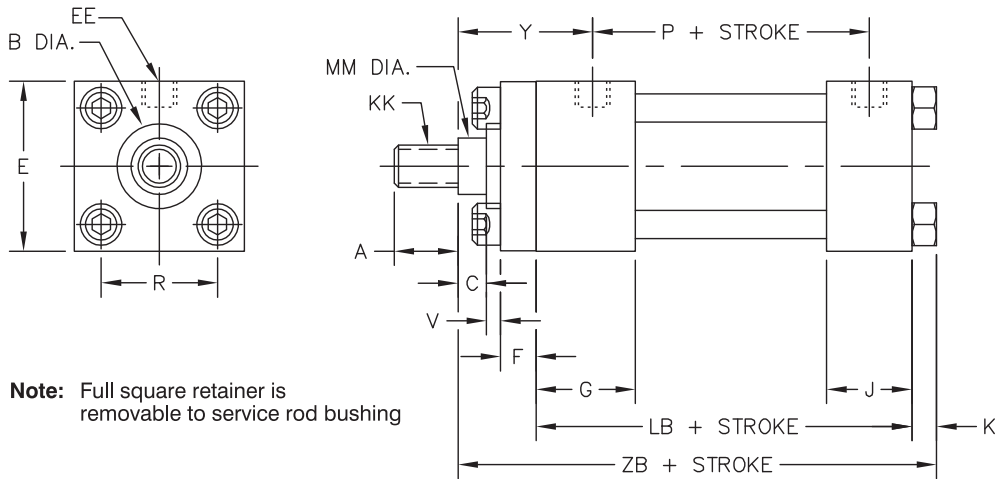


LARGE ROUND RETAINER USED ON:	
BORE	ROD DIA.
5.00	3.000
6.00	3.000
6.00	3.500
6.00	4.000
8.00	3.500
8.00	4.000
8.00	4.500
8.00	5.000
8.00	5.500



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

EASY FLIP OUT PAGE FOR REFERENCE



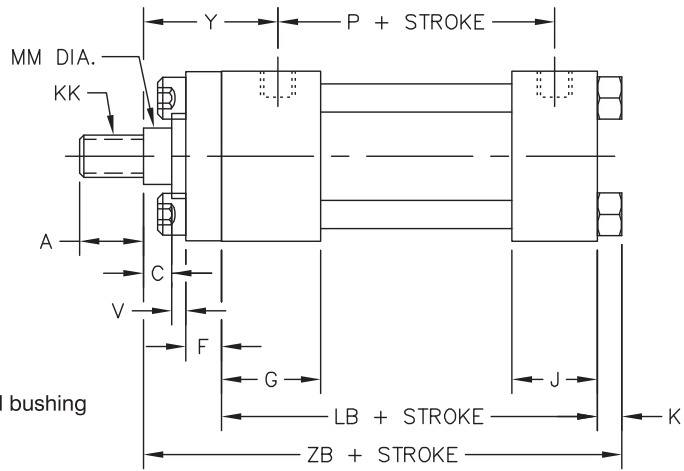
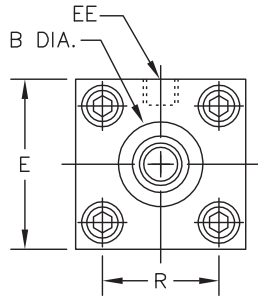
Note: Full square retainer is removable to service rod bushing

BORE	ROD DIA (MM)	E	A	B	C	EE ¹		F	G	J	K	KK	R	RD ²	V	Y	ADD TO STROKE		
						NPTF	SAE										LB	P	ZB
1.50	0.625	2.500	0.750	1.124	0.375	1/2	10	0.375	1.750	1.500	0.375		1.625	—	0.250	2.000	4.625	2.938	6.000
	1.000		1.125	1.499	0.500		8	0.375						0.500	2.375	6.375			
2.00	1.000	3.000	1.125	1.499	0.500	1/2	10	0.625	1.750	1.500	0.438		2.050	—	0.250	2.375	4.625	2.938	6.438
	1.375		1.625	1.999	0.625		8	0.625						0.375	2.625	6.688			
2.50	1.000	3.500	1.125	1.499	0.500	1/2	10	0.625	1.750	1.500	0.438		2.550	2.625	0.250	2.375	4.750	3.063	6.563
	1.375		1.625	1.999	0.625		10	0.625						—	0.375	2.625			6.813
	1.750		2.000	2.374	0.750		10	0.625						—	0.500	2.875			7.063
3.25	1.375	4.500	1.625	1.999	0.625	3/4	12	0.750	2.000	1.750	0.563		3.250	3.250	0.250	2.750	5.500	3.500	7.688
	1.750		2.000	2.374	0.750		12	0.750						—	0.375	3.000			7.938
	2.000		2.250	2.624	0.875		12	0.750						—	0.375	3.125			8.063
4.00	1.750	5.000	2.000	2.374	0.750	3/4	12	0.875	2.000	1.750	0.563		3.820	3.880	0.250	2.938	5.750	3.875	8.188
	2.000		2.250	2.624	0.875		12	0.875						4.250	0.250	3.063			8.313
	2.500		3.000	3.124	1.000		12	0.875						—	0.375	3.313			8.563
5.00	2.000	6.500	2.250	2.624	0.875	3/4	12	0.875	2.000	1.750	0.813		4.950	4.250	0.250	3.125	6.250	4.250	9.063
	2.500		3.000	3.124	1.000		12	0.875						4.625	0.375	3.375			9.313
	3.000		3.500	3.749	1.000		12	0.875						5.250	0.375	3.375			9.313
	3.500		3.500	4.249	1.000		12	0.875						—	0.375	3.375			9.313
6.00	2.500	7.500	3.000	3.124	1.000	1	16	0.875	2.250	2.250	0.875		5.730	4.625	0.375	3.50	7.375	5.000	10.500
	3.000		3.500	3.749	1.000		16	0.875						5.250	0.375	3.50			10.500
	3.500		3.500	4.249	1.000		16	0.875						5.625	0.375	3.50			10.500
	4.000		4.000	4.749	1.000		16	1.000						6.438	0.250	3.50			10.500
8.00	3.500	9.500	3.500	4.249	1.000	1 1/2	24	0.875	3.000	3.000	1.250		7.500	5.625	0.375	3.938	9.500	6.313	13.000
	4.000		4.000	4.749	1.000		24	1.000						6.438	0.250	3.938			13.000
	4.500		4.500	5.249	1.000		24	1.000						7.125	0.250	3.938			13.000
	5.000		5.000	5.749	1.000		24	1.000						7.625	0.250	3.938			13.000
	5.500		5.500	6.249	1.000		24	1.000						8.375	0.250	3.938			13.000

SEE ROD END DETAIL CHART ON PAGE 117

¹ 'B' dimension tolerance is +.000 / -.002
² Where no dimension is shown, cylinder utilizes a full square retainer.
³ Standard port sizes.

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



Note: Full square retainer is removable to service rod bushing

BORE	ROD DIA (MM)	E	A	B	C	EE ¹		F	G	J	K	KK	R	RD ²	V	Y	ADD TO STROKE		
						NPTF	SAE										LB	P	ZB
1.50	0.625	2.500	0.750	1.124	0.375	1/2	10	0.375	1.750	1.500	0.375		1.625	—	0.250	2.000	4.625	2.938	6.000
	1.000		1.125	1.499	0.500	1/2	8	0.375						—	0.500	2.375			6.375
2.00	1.000	3.000	1.125	1.499	0.500	1/2	10	0.625	1.750	1.500	0.438		2.050	—	0.250	2.375	4.625	2.938	6.438
	1.375		1.625	1.999	0.625	1/2	8	0.625						—	0.375	2.625			6.688
2.50	1.000	3.500	1.125	1.499	0.500	1/2	10	0.625	1.750	1.500	0.438		2.550	2.625	0.250	2.375	4.750	3.063	6.563
	1.375		1.625	1.999	0.625	1/2	10	0.625						—	0.375	2.625			6.813
	1.750		2.000	2.374	0.750	1/2	10	0.625						—	0.500	2.875			7.063
3.25	1.375	4.500	1.625	1.999	0.625	3/4	12	0.750	2.000	1.750	0.563		3.250	3.250	0.250	2.750	5.500	3.500	7.688
	1.750		2.000	2.374	0.750	3/4	12	0.750						—	0.375	3.000			7.938
	2.000		2.250	2.624	0.875	3/4	12	0.750						—	0.375	3.125			8.063
4.00	1.750	5.000	2.000	2.374	0.750	3/4	12	0.875	2.000	1.750	0.563		3.820	3.88	0.250	2.938	5.750	3.875	8.188
	2.000		2.250	2.624	0.875	3/4	12	0.875						4.250	0.250	3.063			8.313
	2.500		3.000	3.124	1.000	3/4	12	0.875						—	0.375	3.313			8.563
5.00	2.000	6.500	2.250	2.624	0.875	3/4	12	0.875	2.000	1.750	0.813		4.950	4.250	0.250	3.125	6.250	4.250	9.063
	2.500		3.000	3.124	1.000	3/4	12	0.875						4.625	0.375	3.375			9.313
	3.000		3.500	3.749	1.000	3/4	12	0.875						5.250	0.375	3.375			9.313
	3.500		3.500	4.249	1.000	3/4	12	0.875						—	0.375	3.375			9.313
6.00	2.500	7.500	3.000	3.124	1.000	1	16	0.875	2.250	2.250	0.875		5.730	4.625	0.375	3.50	7.375	5.000	10.500
	3.000		3.500	3.749	1.000	1	16	0.875						5.250	0.375	3.50			10.500
	3.500		3.500	4.249	1.000	1	16	0.875						5.625	0.375	3.50			10.500
	4.000		4.000	4.749	1.000	1	16	1.000						6.438	0.250	3.50			10.500
8.00	3.500	9.500	3.500	4.249	1.000	1 1/2	24	0.875	3.000	3.000	1.250		7.500	5.625	0.375	3.938	9.500	6.313	13.000
	4.000		4.000	4.749	1.000	1 1/2	24	1.000						6.438	0.250	3.938			13.000
	4.500		4.500	5.249	1.000	1 1/2	24	1.000						7.125	0.250	3.938			13.000
	5.000		5.000	5.749	1.000	1 1/2	24	1.000						7.625	0.250	3.938			13.000
	5.500		5.500	6.249	1.000	1 1/2	24	1.000						8.375	0.250	3.938			13.000

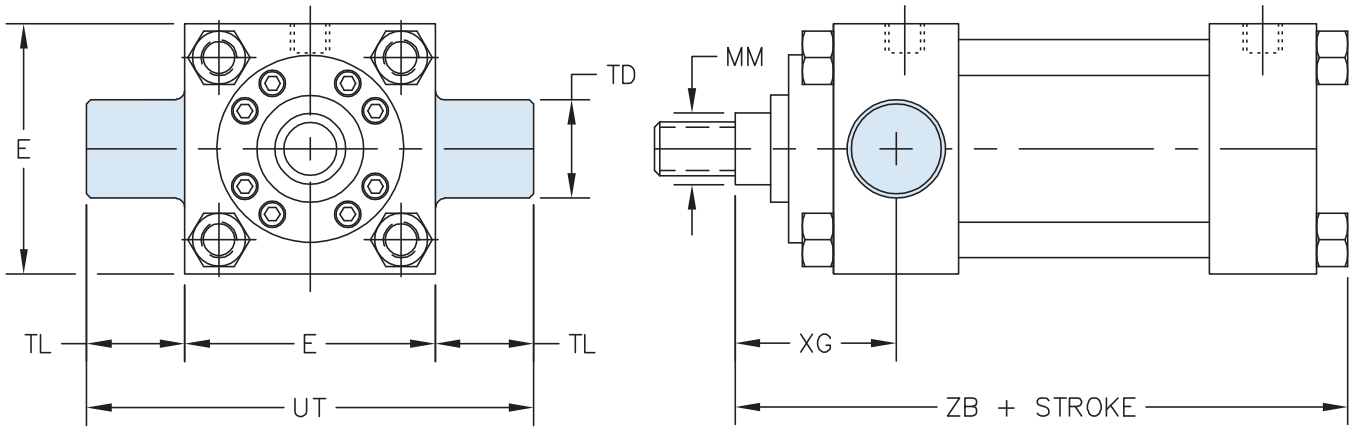
SEE ROD END DETAIL CHART ON PAGE 117

¹ 'B' dimension tolerance is +.000 / -.002
² Where no dimension is shown, cylinder utilizes a full square retainer.
³ Standard port sizes.

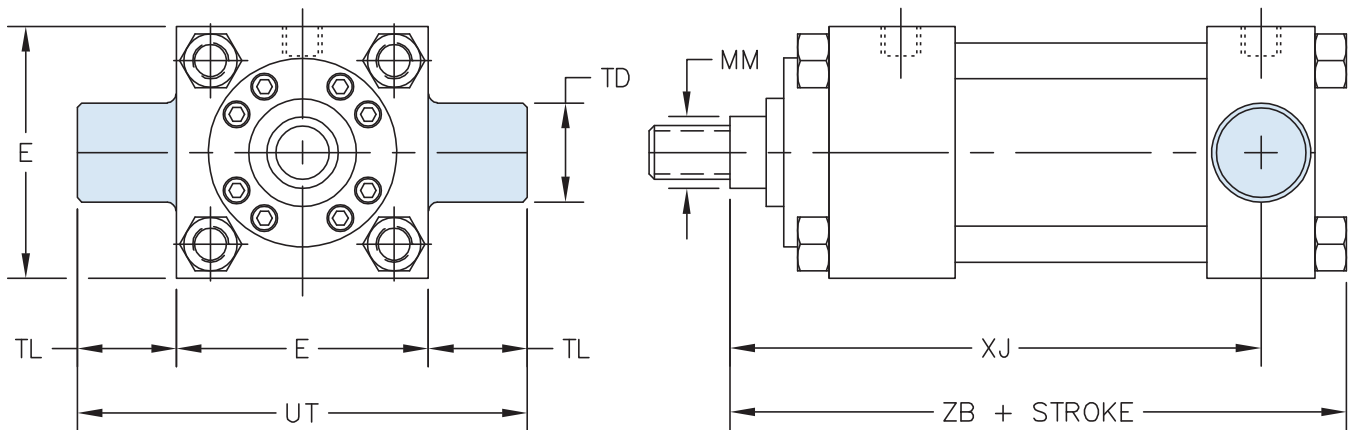
SERIES 'HHD' DIMENSIONS: TRUNNION MOUNTS

MAXIMUM PRESSURE PER BORE SIZE								
MOUNT	1.50	2.00	2.50	3.25	4.00	5.00	6.00	8.00
MT1 MT2 MT4	3000	3000	3000	2800	1800	1200	1000	1000

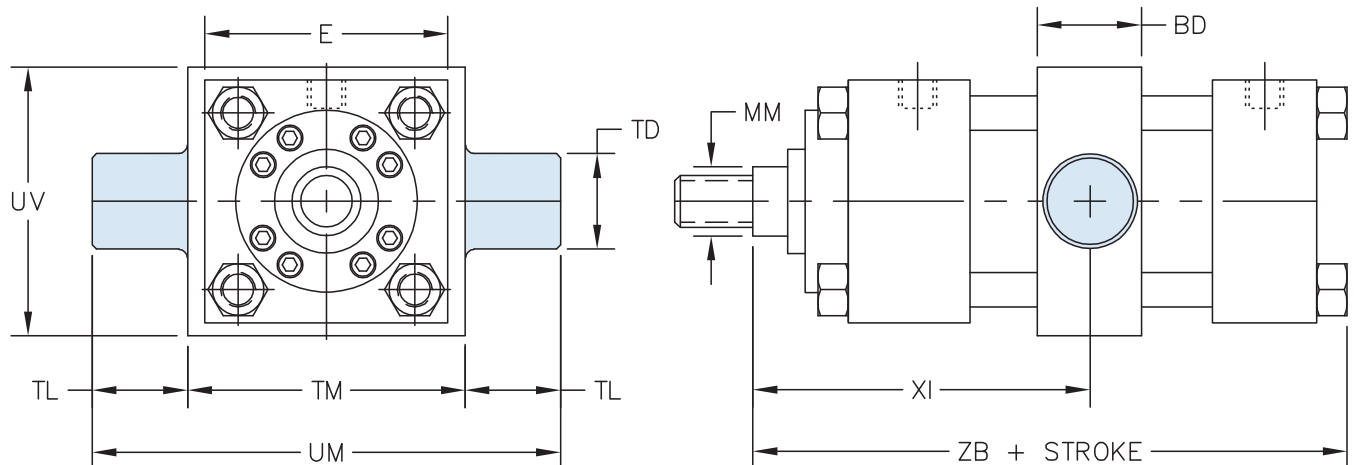
MT1: HEAD TRUNNION



MT2: CAP TRUNNION



MT4: INTERMEDIATE TRUNNION



NOTE:
 'XI' DIMENSION TO BE SPECIFIED AT END OF PART NUMBER

SERIES 'HHD' DIMENSIONS: TRUNNION MOUNTS

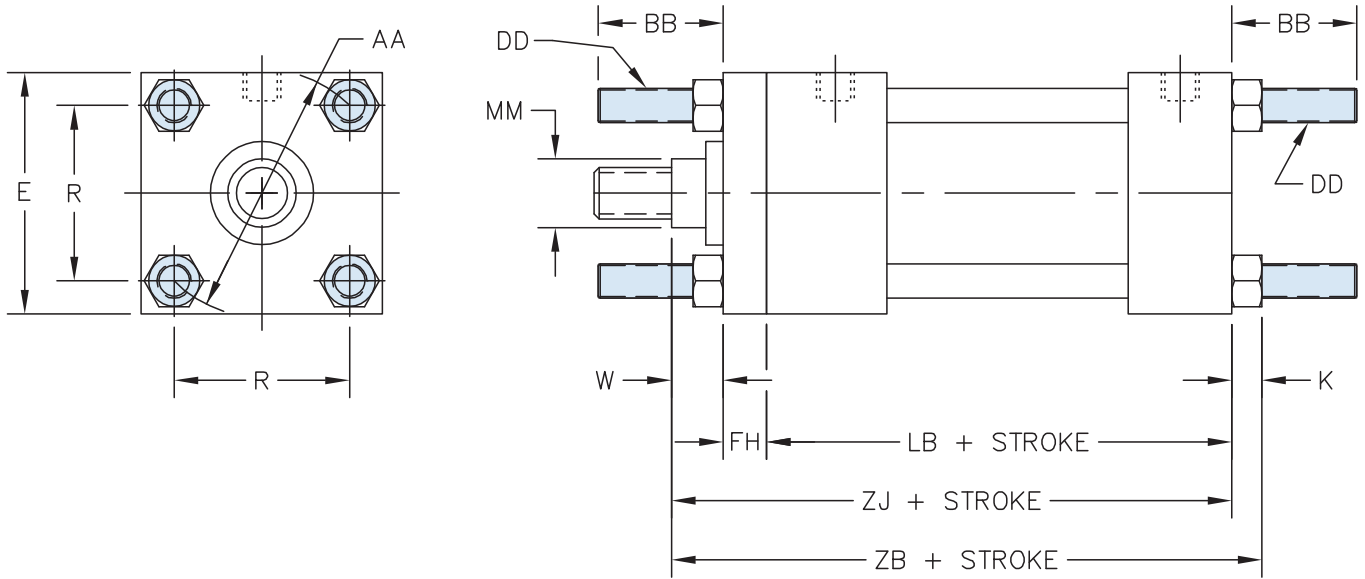
BORE	ROD DIAM (MM)	E	BD	TD	TL	TM	UM	UT	UV	XG	XI	MT4 Min Stroke	ADD TO STROKE		
													XI Max	XJ	ZB
1.50	0.625	2.500	1.500	1.000	1.000	3.000	5.000	4.500	3.000	1.875	3.500	0.250	3.250	4.875	6.000
	2.250									3.875	3.625		5.250	6.375	
2.00	1.000	3.000	1.500	1.375	1.375	3.500	6.250	5.750	3.500	2.250	4.000	0.250	3.750	5.250	6.438
	2.500									4.250	4.000		5.500	6.688	
2.50	1.000	3.500	1.500	1.375	1.375	4.000	6.750	6.250	4.000	2.250	4.125	0.375	3.750	5.375	6.563
	1.375									4.375	4.000		5.625	6.813	
	1.750									4.625	4.250		5.875	7.063	
3.25	1.375	4.500	2.000	1.750	1.750	5.000	8.500	8.000	5.000	2.625	5.000	0.875	4.125	6.250	7.688
	1.750									5.250	4.375		6.500	7.938	
	2.000									5.375	4.500		6.625	8.063	
4.00	1.750	5.000	2.000	1.750	1.750	5.500	9.000	8.500	5.500	2.875	5.500	1.125	4.375	6.750	8.188
	2.000									5.625	4.500		6.875	8.313	
	2.500									5.875	4.750		7.125	8.563	
5.00	2.000	6.500	2.500	1.750	1.750	7.000	10.500	10.000	7.250	3.000	5.875	1.125	4.750	7.375	9.063
	2.500									6.125	5.000		7.625	9.313	
	3.000									6.125	5.000		7.625	9.313	
	3.500									6.125	5.000		7.625	9.313	
6.00	2.500	7.500	3.000	2.000	2.000	8.500	12.500	11.500	8.750	3.375	6.625	1.250	5.375	8.375	10.500
	3.000									6.625	5.375		8.375	10.500	
	3.500									6.625	5.375		8.375	10.500	
	4.000									6.625	5.375		8.375	10.500	
8.00	3.500	9.500	3.500	3.000	3.000	11.000	17.000	15.500	11.750	3.750	8.125	2.125	6.000	10.250	13.000
	4.000									8.125	6.000		10.250	13.000	
	4.500									8.125	6.000		10.250	13.000	
	5.000									8.125	6.000		10.250	13.000	
	5.500									8.125	6.000		10.250	13.000	

△ TD DIMENSION TOLERANCE IS + .000 / - .001

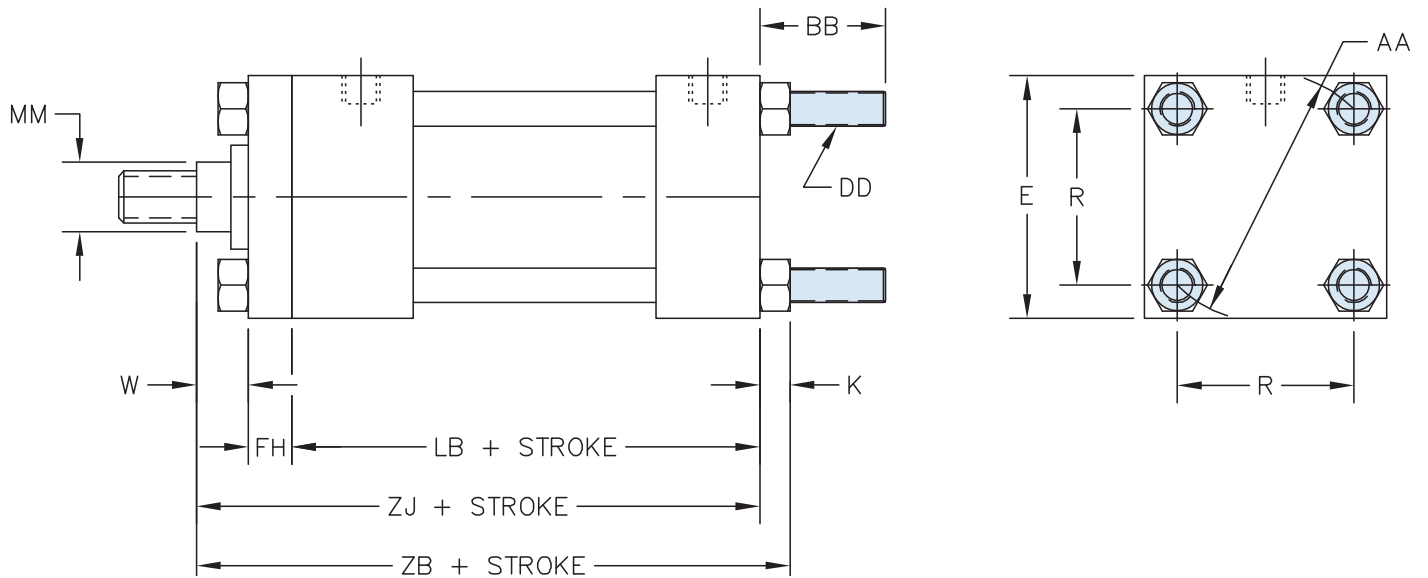
△ XI DIMENSION IS THE MINIMUM THAT CAN BE SUPPLIED (CUSTOMER TO SPECIFY XI DIMENSION).

SERIES 'HHD' DIMENSIONS: EXTENDED TIE ROD MOUNTS

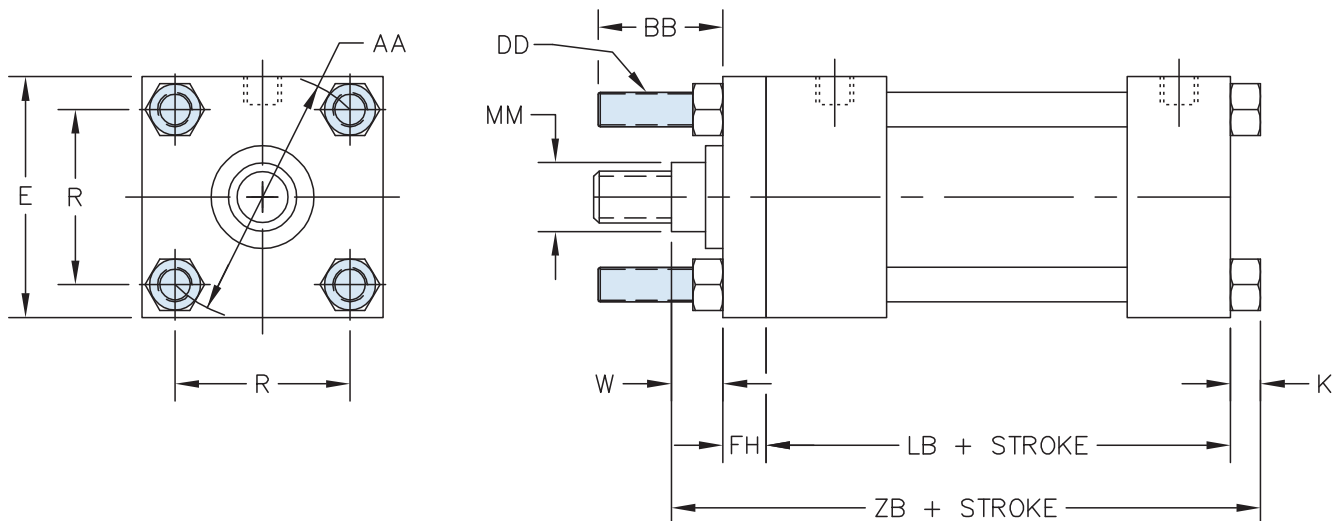
MX1: EXTENDED TIE-RODS - HEAD & CAP



MX2: EXTENDED TIE-RODS - CAP END



MX3: EXTENDED TIE-RODS - HEAD END



SERIES 'HHD' DIMENSIONS: EXTENDED TIE ROD MOUNTS

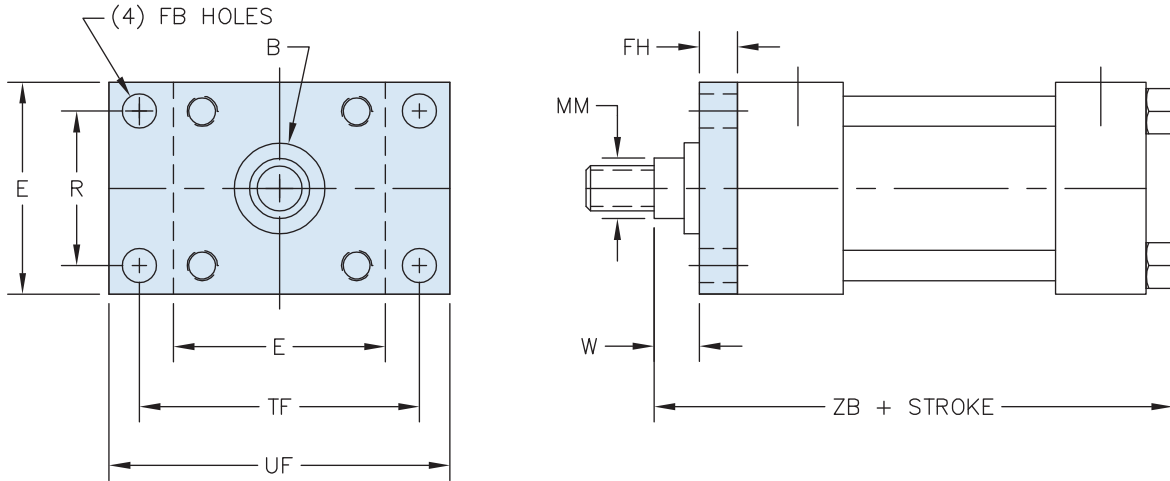
BORE	ROD DIAM (MM)	E	AA	BB	DD	F	FH	K	R	W	ADD TO STROKE		
											LB	ZB	ZJ
1.50	0.625	2.500	2.300	1.375	3/8 - 24	0.375	0.375	0.375	1.625	0.625	4.625	6.000	5.625
	1.000					1.000				6.375		6.000	
2.00	1.000	3.000	2.900	1.813	1/2 - 20	0.625	0.625	0.438	2.047	0.750	4.625	6.438	6.000
	1.375					1.000				6.688		6.250	
2.50	1.000	3.500	3.600	1.813	1/2 - 20	0.625	0.625	0.438	2.547	0.750	4.750	6.563	6.128
	1.375					1.000				6.813		6.375	
	1.750					1.250				7.063		6.625	
3.25	1.375	4.500	4.600	2.313	5/8 - 18	0.750	0.750	0.563	3.250	0.875	5.500	7.688	7.125
	1.750					1.125				7.938		7.375	
	2.000					1.250				8.063		7.500	
4.00	1.750	5.000	5.400	2.313	5/8 - 18	0.875	0.875	0.563	3.813	1.000	5.750	8.188	7.625
	2.000					1.125				8.313		7.750	
	2.500					1.375				8.563		8.000	
5.00	2.000	6.500	7.000	3.188	7/8 - 14	0.875	0.875	0.813	4.953	1.125	6.250	9.063	8.250
	2.500					1.375				9.313		8.500	
	3.000					1.375				9.313		8.500	
	3.500					1.375				9.313		8.500	
6.00	2.500	7.500	8.100	3.625	1 - 14	0.875	1.000	0.875	5.734	1.250	7.375	10.500	9.625
	3.000					1.250				10.500		9.625	
	3.500					1.250				10.500		9.625	
	4.000					1.250				10.500		9.625	
8.00	3.500	9.500	10.600	4.500	1 1/4 - 12	0.875	1.000	1.250	7.500	1.250	9.500	13.000	11.750
	4.000					1.250				13.000		11.750	
	4.500					1.250				13.000		11.750	
	5.000					1.250				13.000		11.750	
	5.500					1.250				13.000		11.750	

SERIES 'HHD' DIMENSIONS: FLANGE MOUNTS

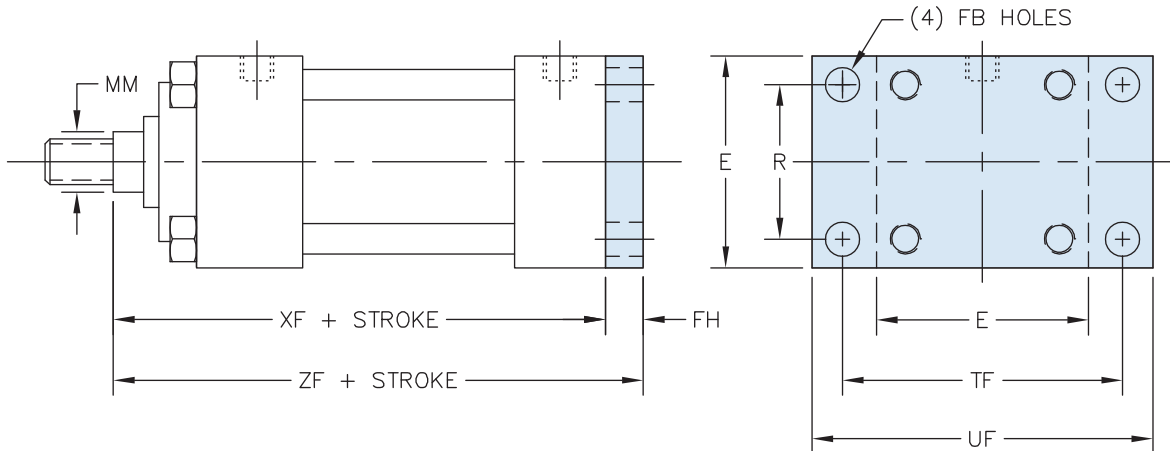
BORE	1.50		2.00		2.50			3.25			4.00		
ROD DIA.	0.625	1.000	1.000	1.375	1.000	1.375	1.750	1.375	1.750	2.000	1.750	2.000	2.500
MF1 MAX PSI RATING	2600	1600	2600	1600	2600	2000	1600	2600	2200	1600	2600	1900	1600
MF2 MAX PSI RATING	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000

BORE	5.00				6.00				8.00				
ROD DIA.	2.000	2.500	3.000	3.500	2.500	3.000	3.500	4.000	3.500	4.000	4.500	5.000	5.500
MF1 MAX PSI RATING	2200	1600	1200	750	1800	1450	1100	750	900	800	700	500	500
MF2 MAX PSI RATING	2000	2500	2800	3000	2000	2500	2800	3000	1500	1700	1800	1900	2000

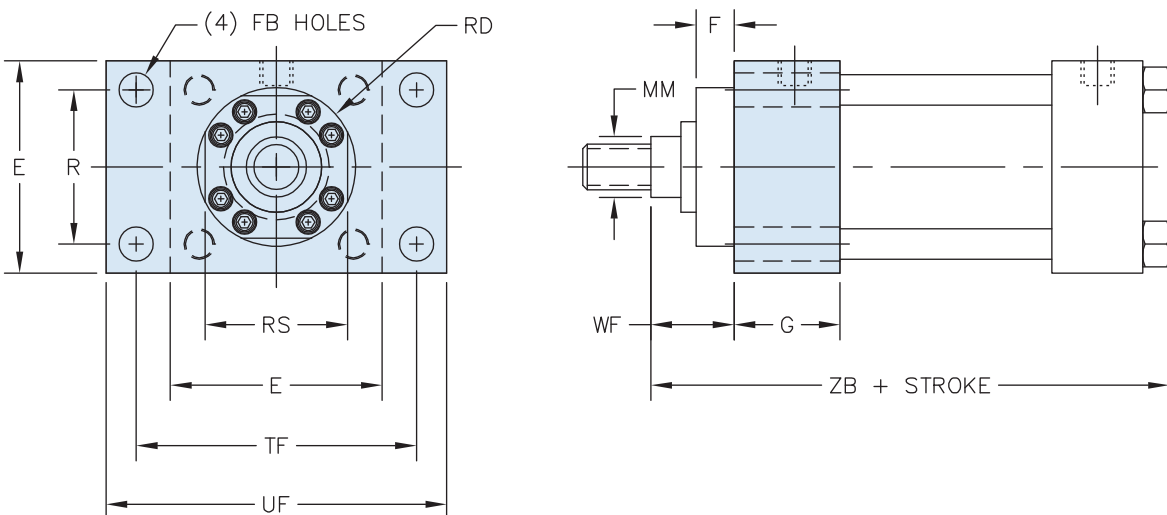
MF1: HEAD FLANGE



MF2: CAP FLANGE

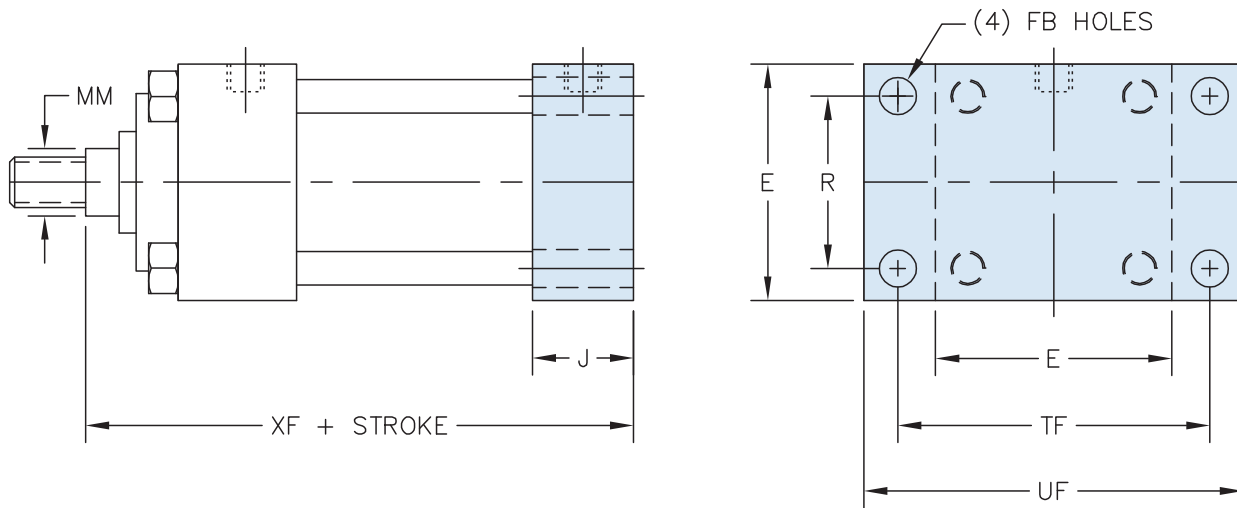


ME5: HEAD RECTANGULAR MOUNTING HOLES



SERIES 'HHD' DIMENSIONS: FLANGE MOUNTS

ME6: CAP RECTANGULAR MOUNTING HOLES

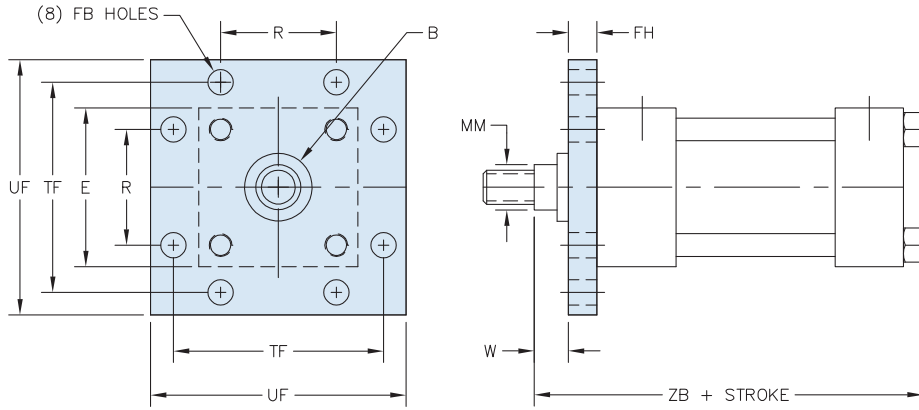


BORE	ROD DIAM (MM)	△ B	E	F	FB	FH	G	J	R	RD	RS	TF	UF	W	WF	ADD TO STROKE		
																XF	ZB	ZF
1.50	0.625	1.124	2.500	0.375	0.438	0.375	1.750	1.500	1.625	2.375	—	3.438	4.250	0.625	1.000	5.625	6.000	6.000
	1.000	1.499		0.375						2.563	2.438			1.000	1.375	6.000	6.375	6.375
2.00	1.000	1.499	3.000	0.625	0.563	0.625	1.750	1.500	2.047	2.625	—	4.125	5.125	0.750	1.375	6.000	6.438	6.625
	1.375	1.999		0.625						3.250	2.943			1.000	1.625	6.250	6.688	6.875
2.50	1.000	1.499	3.500	0.625	0.563	0.625	1.750	1.500	2.546	2.625	—	4.625	5.625	0.750	1.375	6.125	6.563	6.750
	1.375	1.999		0.625						3.250	—			1.000	1.625	6.375	6.813	7.000
	1.750	2.374		0.625						3.875	3.438			1.250	1.875	6.625	7.063	7.250
3.25	1.375	1.999	4.500	0.750	0.688	0.750	2.000	1.750	3.250	3.250	—	5.875	7.125	0.875	1.625	7.125	7.688	7.875
	1.750	2.374		0.750						3.875	—			1.125	1.875	7.375	7.943	8.125
	2.000	2.624		0.750						4.250	—			1.250	2.000	7.500	8.063	8.250
4.00	1.750	2.374	5.000	0.875	0.688	0.875	2.000	1.750	3.820	3.875	—	6.375	7.625	1.000	1.875	7.625	8.188	8.500
	2.000	2.624		0.875						4.250	—			1.125	2.000	7.750	8.313	8.625
	2.500	3.124		0.875						4.625	—			1.375	2.250	8.000	8.563	8.875
5.00	2.000	2.624	6.500	0.875	0.943	0.875	2.000	1.750	4.953	4.250	—	8.188	9.750	1.125	2.000	8.250	9.063	9.125
	2.500	3.124		0.875						4.625	—			1.375	2.250	8.500	9.313	9.375
	3.000	3.749		0.875						5.250	—			1.375	2.250	8.500	9.313	9.375
	3.500	4.249		0.875						5.625	—			1.375	2.250	8.500	9.313	9.375
6.00	2.500	3.124	7.500	0.875	1.063	1.000	2.250	2.250	5.734	4.625	—	9.438	11.250	1.250	2.250	9.625	10.500	10.625
	3.000	3.749		0.875						5.250	—			1.250	2.250	9.625	10.500	10.625
	3.500	4.249		0.875						5.625	—			1.250	2.250	9.625	10.500	10.625
	4.000	4.749		1.000						6.438	—			1.250	2.250	9.625	10.500	10.625
8.00	3.500	4.249	9.500	0.875	1.313	1.000	3.000	3.000	7.500	5.625	—	11.813	14.000	1.250	2.250	11.750	13.000	12.750
	4.000	4.749		1.000						6.438	—			1.250	2.250	11.750	13.000	12.750
	4.500	5.249		1.000						7.125	—			1.250	2.250	11.750	13.000	12.750
	5.000	5.749		1.000						7.625	—			1.250	2.250	11.750	13.000	12.750
	5.500	6.249		1.000						8.375	—			1.250	2.250	11.750	13.000	12.750

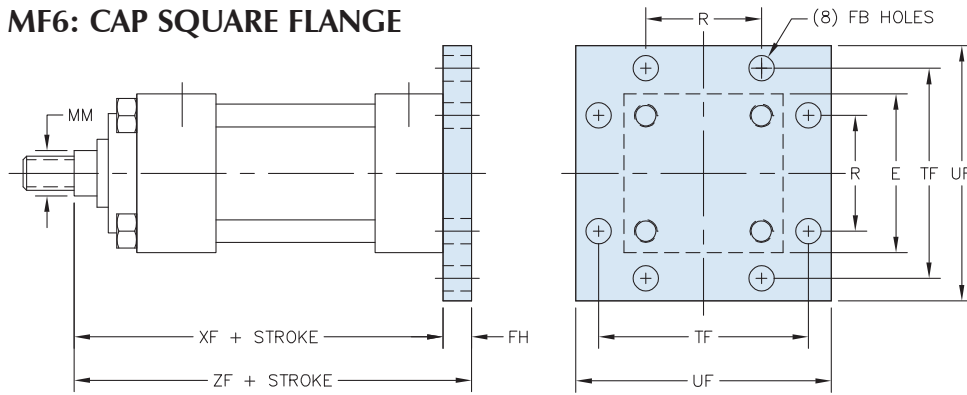
△ 'B' dimension tolerance is +.000 / -.002

SERIES 'HHD' DIMENSIONS: SQUARE FLANGE MOUNTS

MF5: HEAD SQUARE FLANGE



MF6: CAP SQUARE FLANGE



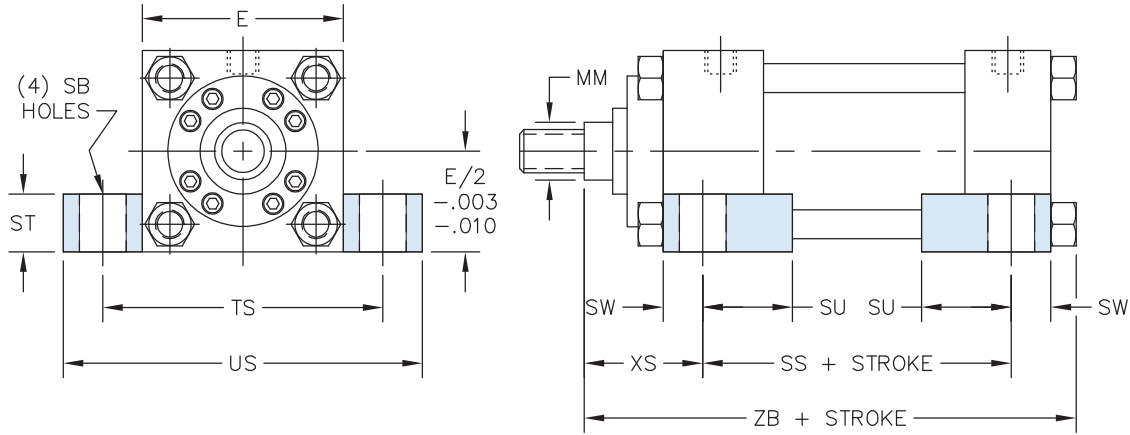
BORE	ROD DIAM.	MF5 MAX PSI RATING	MF6 MAX PSI RATING
1.50	0.625	1800	1800
	1.000	1800	1800
2.00	1.000	1800	1800
	1.375	1800	1800
2.50	1.000	1000	1400
	1.375	1000	1400
	1.750	1000	1400
3.25	1.375	1300	1300
	1.750	1300	1300
	2.000	1300	1300
4.00	1.750	900	900
	2.000	900	900
	2.500	900	900
5.00	2.000	750	1000
	2.500	750	1000
	3.000	550	1000
	3.500	550	1000
6.00	2.500	750	750
	3.000	750	750
	3.500	600	750
	4.000	600	750
8.00	3.500	500	500
	4.000	500	500
	4.500	500	500
	5.000	500	500
	5.500	500	500

BORE	ROD DIAM (MM)	△ B	E	F	FB	FH	R	△ RD	TF	UF	W	ADD TO STROKE		
												XF	ZB	ZF
1.50	0.625	1.124	2.500	0.375	0.438	0.375	1.625	—	3.438	4.250	0.625	5.625	6.000	6.000
	1.000	1.499		—				1.000			6.000	6.375	6.375	
2.00	1.000	1.499	3.000	0.625	0.563	0.625	2.047	—	4.125	5.125	0.750	6.000	6.438	6.625
	1.375	1.999		—				1.000			6.250	6.688	6.875	
2.50	1.000	1.499	3.500	0.625	0.563	0.625	2.547	2.625	4.625	5.625	0.750	6.125	6.563	6.750
	1.375	1.999		—				1.000			6.375	6.813	7.000	
	1.750	2.374		—				1.250			6.625	7.063	7.250	
3.25	1.375	1.999	4.500	0.750	0.688	0.750	3.250	3.250	5.875	7.125	0.875	7.125	7.688	7.875
	1.750	2.374		—				1.125			7.375	7.938	8.125	
	2.000	2.624		—				1.250			7.500	8.063	8.250	
4.00	1.750	2.374	5.000	0.875	0.688	0.875	3.820	3.875	6.375	7.625	1.000	7.625	8.188	8.500
	2.000	2.624		4.250				1.125			7.750	8.313	8.625	
	2.500	3.124		—				1.375			8.000	8.563	8.875	
5.00	2.000	2.624	6.500	0.875	0.938	0.875	4.953	4.250	8.188	9.750	1.125	8.250	9.063	9.125
	2.500	3.124		4.625				1.375			8.500	9.313	9.375	
	3.000	3.749		5.250				1.375			8.500	9.313	9.375	
	3.500	4.249		—				1.375			8.500	9.313	9.375	
6.00	2.500	3.124	7.500	0.875	1.063	1.000	5.734	4.625	9.438	11.250	1.250	9.625	10.500	10.625
	3.000	3.749		5.250				1.250			9.625	10.500	10.625	
	3.500	4.249		5.625				1.250			9.625	10.500	10.625	
	4.000	4.749		6.438				1.250			9.625	10.500	10.625	
8.00	3.500	4.249	9.500	0.875	1.313	1.000	7.500	5.625	11.813	14.000	1.250	11.750	13.000	12.750
	4.000	4.749		6.438				1.250			11.750	13.000	12.750	
	4.500	5.249		7.125				1.250			11.750	13.000	12.750	
	5.000	5.749		7.625				1.250			11.750	13.000	12.750	
	5.500	6.249		8.375				1.250			11.750	13.000	12.750	

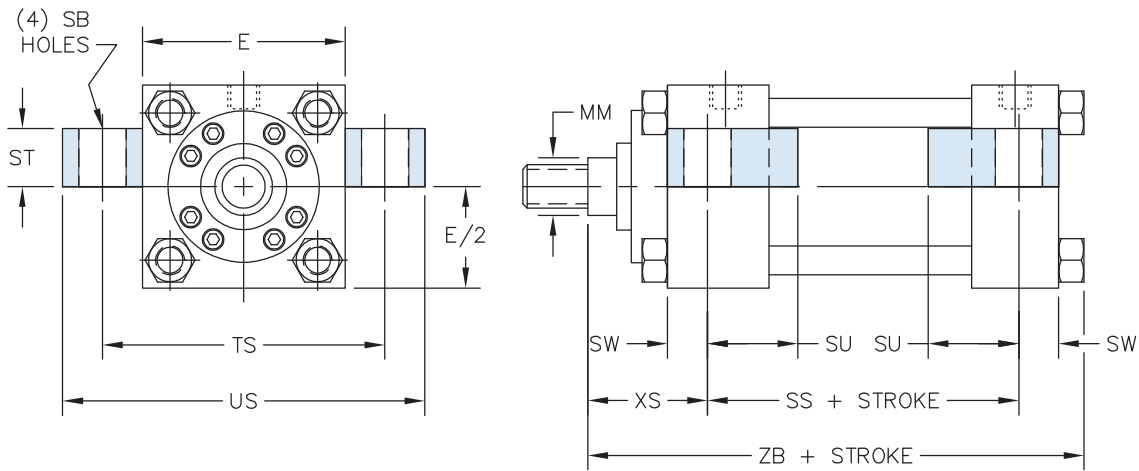
△ 'B' dimension tolerance is +.000 / -.002
 △ Where no dimension is shown, cylinder utilizes a full square retainer.

SERIES 'HHD' DIMENSIONS: LUG MOUNTS

MS2: SIDE LUGS



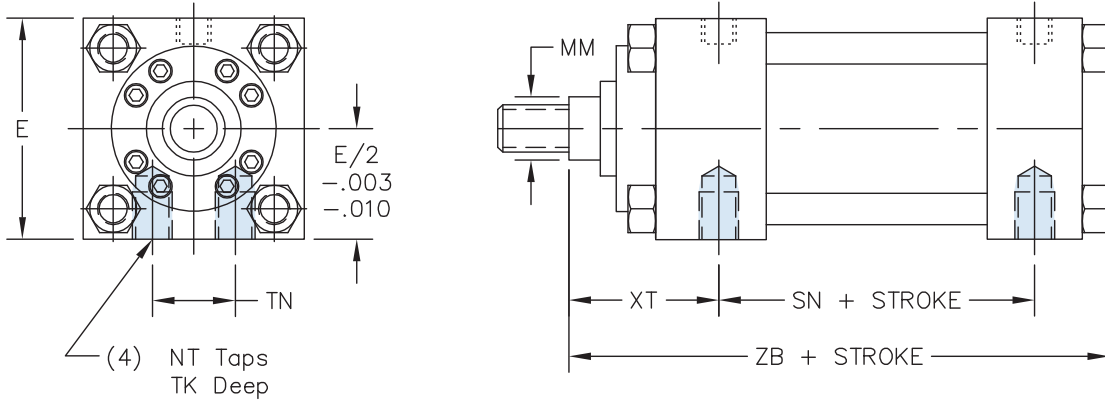
MS3: CENTER LINE LUGS



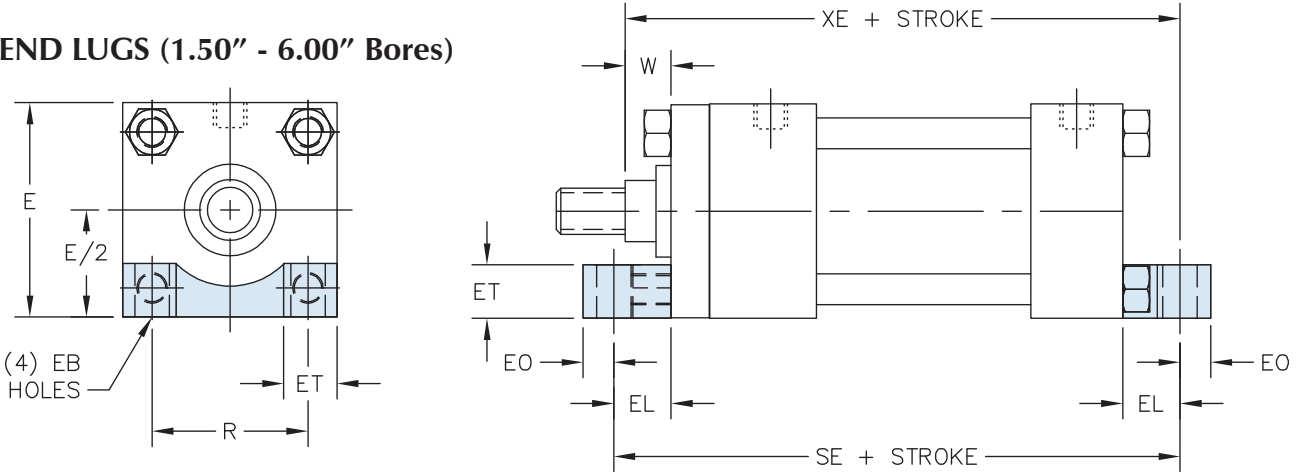
BORE	ROD DIAM (MM)	E	E / 2	SB	ST	SU	SW	TS	US	XS	ADD TO STROKE	
											SS	ZB
1.50	0.625	2.500	1.250	0.438	0.500	0.938	0.375	3.250	4.000	1.375	3.875	6.000
	1.000											6.375
2.00	1.000	3.000	1.500	0.563	0.750	1.250	0.500	4.000	5.000	1.875	3.625	6.438
	1.375											6.688
2.50	1.000	3.500	1.750	0.813	1.000	1.563	0.688	4.875	6.250	2.063	3.375	6.563
	1.375									2.313		6.813
	1.750									2.563		7.063
3.25	1.375	4.500	2.250	0.813	1.000	1.563	0.688	5.875	7.250	2.313	4.125	7.688
	1.750									2.563		7.943
	2.000									2.688		8.063
4.00	1.750	5.000	2.500	1.063	1.250	2.000	0.875	6.750	8.500	2.750	4.000	8.188
	2.000									2.875		8.313
	2.500									3.125		8.563
5.00	2.000	6.500	3.250	1.063	1.250	2.000	0.875	8.250	10.000	2.875	4.500	9.063
	2.500									3.125		9.313
	3.000									3.125		9.313
	3.500									3.125		9.313
6.00	2.500	7.500	3.750	1.313	1.500	2.500	1.125	9.750	12.000	3.375	5.125	10.500
	3.000									3.375		10.500
	3.500									3.375		10.500
	4.000									3.375		10.500
8.00	3.500	9.500	4.750	1.563	1.750	2.875	1.375	12.250	15.000	3.625	6.750	13.000
	4.000									3.625		13.000
	4.500									3.625		13.000
	5.000									3.625		13.000

SERIES 'HHD' DIMENSIONS: BOTTOM MOUNTS

MS4: BOTTOM TAPPED HOLES



MS7: END LUGS (1.50" - 6.00" Bores)

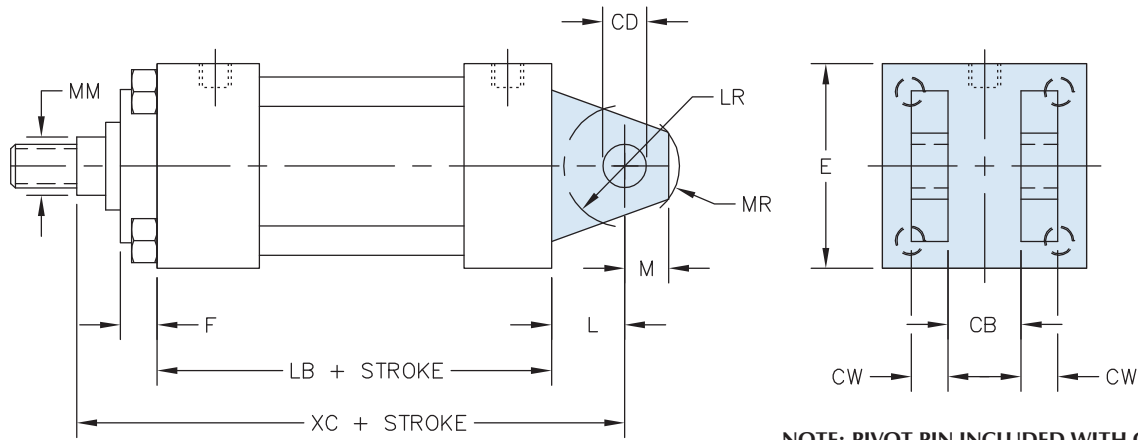


BORE	ROD DIAM (MM)	E	E / 2	MS4 DIMENSIONS						MS7 DIMENSIONS							
				NT	TK	TN	XT	SN	ZB	EB	EL	EO	ET	R	W	SE	XE
1.50	0.625	2.500	1.250	3/8-16	0.375	0.750	2.000	2.875	6.000	0.438	0.875	0.375	0.750	1.625	0.625	6.500	
	0.375				6.375				1.000						6.875		
2.00	1.000	3.000	1.500	1/2-13	0.438	0.938	2.375	2.875	6.438	0.563	0.938	0.500	0.875	2.047	0.750	6.938	
	0.438				6.688				1.000						7.188		
2.50	1.000	3.500	1.750	5/8-11	0.750	1.313	2.375	3.000	6.563	0.563	0.938	0.500	0.875	2.550	0.750	7.063	
	0.625				2.625		3.000		6.813						1.000	7.313	
	0.500				2.875		3.000		7.063						1.250	7.563	
3.25	1.375	4.500	2.250	3/4-10	1.000	1.500	2.750	3.500	7.688	0.688	1.125	0.625	1.188	3.250	0.875	8.250	
	0.875				3.000		3.500		7.938						1.125	8.500	
	0.750				3.125		3.500		8.063						1.250	8.625	
4.00	1.750	5.000	2.500	1 - 8	0.875	2.063	3.000	3.750	8.188	0.688	1.125	0.625	1.188	3.820	1.000	8.750	
	0.750				3.125		3.750		8.313						1.125	8.875	
	0.750				3.375		3.750		8.563						1.375	9.125	
5.00	2.000	6.500	3.250	1 - 8	1.000	2.938	3.125	4.250	9.063	0.938	1.500	0.750	1.500	4.953	1.125	9.750	
	1.000				3.375		4.250		9.313						1.375	10.000	
	1.000				3.375		4.250		9.313						1.375	10.000	
	1.000				3.375		4.250		9.313						1.375	10.000	
6.00	2.500	7.500	3.750	1 1/4-7	1.250	3.313	3.500	5.125	10.500	1.063	1.688	0.875	1.750	5.734	1.250	11.313	
	1.250				3.500		5.125		10.500						1.250	11.313	
	1.250				3.500		5.125		10.500						1.250	11.313	
	0.750				3.500		5.125		10.500						1.250	11.313	
8.00	3.500	9.500	4.750	1 1/2-6	1.500	4.250	3.938	6.625	13.000	—	—	—	—	—	—	—	
	1.500				3.938		6.625		13.000						—	—	
	1.500				3.938		6.625		13.000						—	—	
	1.250				3.938		6.625		13.000						—	—	
	1.000				3.938		6.625		13.000						—	—	

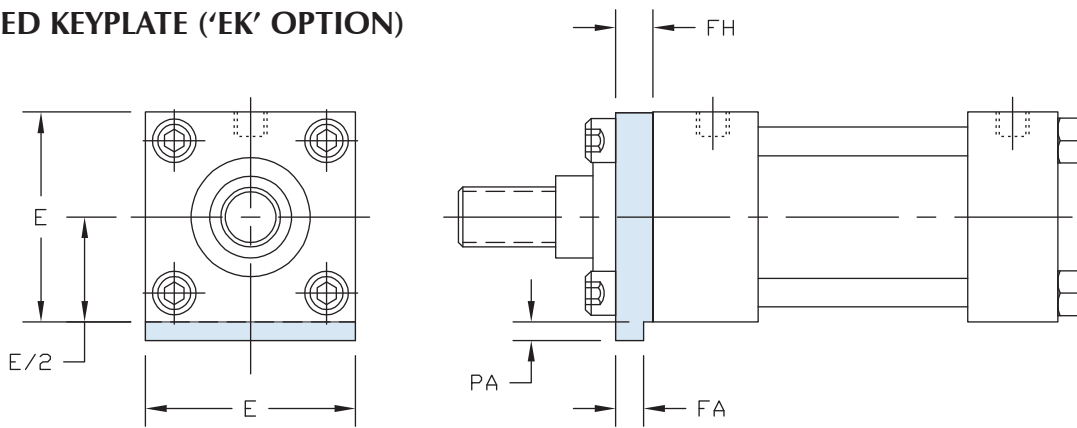
HHD - How to Order
 HHD - Base Dimensions
 HHD - Mount Dimensions
 HHD with Rod Lock
 Options Page 142
 Accessories Page 172
 Switches Page 184
 Technical Data Page 198

SERIES 'HHD' DIMENSIONS: PIVOT MOUNT & EXTENDED KEYPLATE

MP1: REAR PIVOT CLEVIS



EXTENDED KEYPLATE ('EK' OPTION)



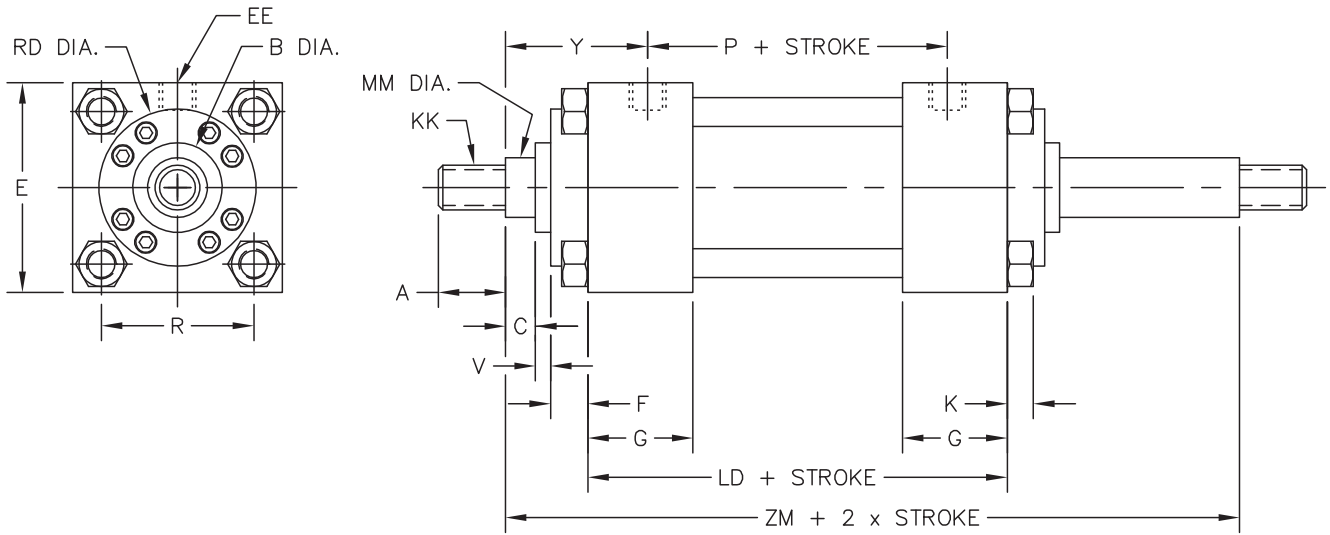
BORE	ROD DIAM (MM)	E	EXTENDED KEYPLATE			MP1 DIMENSIONS									
			FA	FH	PA	CB [△]	CD [△]	CW	F	L	LR	M	MR	LB	XC
1.50	0.625	2.500	0.312 / 0.314	0.375	0.188	0.750	0.500	0.500	0.375	0.750	0.563	0.500	0.625	4.625	6.375
	0.375								0.563		6.750				
2.00	1.000	3.000	0.562 / 0.564	0.625	0.313	1.250	0.750	0.625	0.625	1.250	1.000	0.750	0.938	4.625	7.250
	0.625								1.000		7.500				
2.50	1.000	3.500	0.562 / 0.564	0.625	0.313	1.250	0.750	0.625	0.625	1.250	1.000	0.750	0.938	4.750	7.375
	0.625								1.000		7.625				
	0.625								1.000		7.875				
3.25	1.375	4.500	0.687 / 0.689	0.750	0.375	1.500	1.000	0.750	0.750	1.500	1.250	1.000	1.188	5.500	8.625
	0.750								1.250		8.875				
	0.750								1.250		9.000				
4.00	1.750	5.000	0.812 / 0.814	0.875	0.438	2.000	1.375	1.000	0.875	2.125	1.875	1.375	1.625	5.750	9.750
	0.875								1.875		9.875				
	0.875								1.875		10.125				
5.00	2.000	6.500	0.812 / 0.814	0.875	0.438	2.500	1.750	1.250	0.875	2.250	2.000	1.750	2.125	6.250	10.500
	0.875								2.000		10.750				
	0.875								2.000		10.750				
	0.875								2.000		10.750				
6.00	2.500	7.500	0.937 / 0.939	1.000	0.500	2.500	2.000	1.250	0.875	2.500	2.063	2.000	2.375	7.375	12.125
	0.875								2.188		12.125				
	0.875								2.188		12.125				
	1.000								2.188		12.125				
8.00	3.500	9.500	0.937 / 0.939	1.000	0.500	3.000	3.000	1.500	0.875	3.250	2.938	2.750	3.125	9.500	15.000
	1.000								2.938		15.000				
	1.000								2.938		15.000				
	1.000								2.938		15.000				
	1.000								2.938		15.000				

[△] 'CB' dimension tolerance is +.010 to +.030 depending on bore size.

[△] 'CD' dimension tolerance for pin is ±.001.

SERIES 'HHD' DIMENSIONS: DOUBLE END MOUNTS

MX0D: NO MOUNT



BORE	ROD DIA (MM)	E	A	B [△]	C	EE		F	G	K	KK	R	RD [△]	V	Y	ADD TO STROKE		ADD 2x STROKE ZM
						NPTF	SAE									LD	P	
1.50	0.625	2.500	0.750	1.124	0.375	1/2	10	0.375	1.750	0.375		1.625	—	0.250	2.000	4.875	2.875	6.875
	1.000		1.125	1.499	0.500		8	0.375					—	0.500	2.375			7.625
2.00	1.000	3.000	1.125	1.499	0.500	1/2	10	0.625	1.750	0.438		2.047	—	0.250	2.375	4.875	2.875	7.625
	1.375		1.625	1.999	0.625		8	0.625					—	0.375	2.625			8.125
2.50	1.000	3.500	1.125	1.499	0.500	1/2	10	0.625	1.750	0.438		2.547	2.625	0.250	2.375	5.000	3.000	7.750
	1.375		1.625	1.999	0.625		10	0.625					—	0.375	2.625			8.250
	1.750		2.000	2.374	0.750		10	0.625					—	0.500	2.875			8.750
3.25	1.375	4.500	1.625	1.999	0.625	3/4	12	0.750	2.000	0.563		3.250	3.250	0.250	2.750	5.750	3.500	9.000
	1.750		2.000	2.374	0.750		12	0.750					—	0.375	3.000			9.500
	2.000		2.250	2.624	0.875		12	0.750					—	0.375	3.125			9.750
4.00	1.750	5.000	2.000	2.374	0.750	3/4	12	0.875	2.000	0.563		3.820	3.875	0.250	2.938	6.000	3.875	9.750
	2.000		2.250	2.624	0.875		12	0.875					4.250	0.250	3.063			10.000
	2.500		3.000	3.124	1.000		12	0.875					—	0.375	3.313			10.500
5.00	2.000	6.500	2.250	2.624	0.875	3/4	12	0.875	2.000	0.813		4.953	4.250	0.250	3.125	6.500	4.250	10.500
	2.500		3.000	3.124	1.000		12	0.875					4.625	0.375	3.375			11.000
	3.000		3.500	3.749	1.000		12	0.875					5.250	0.375	3.375			11.000
	3.500		3.500	4.249	1.000		12	0.875					—	0.375	3.375			11.000
6.00	2.500	7.500	3.000	3.124	1.000	1	16	0.875	2.250	0.875		5.734	4.625	0.375	3.500	7.375	4.875	11.875
	3.000		3.500	3.749	1.000		16	0.875					5.250	0.375	3.500			11.875
	3.500		3.500	4.249	1.000		16	0.875					5.625	0.375	3.500			11.875
	4.000		4.000	4.749	1.000		16	1.000					6.438	0.250	3.500			11.875
8.00	3.500	9.500	3.500	4.249	1.000	1 1/2	24	0.875	3.000	1.250		7.500	5.625	0.375	3.938	9.500	6.125	14.000
	4.000		4.000	4.749	1.000		24	1.000					6.438	0.250	3.938			14.000
	4.500		4.500	5.249	1.000		24	1.000					7.125	0.250	3.938			14.000
	5.000		5.000	5.749	1.000		24	1.000					7.625	0.250	3.938			14.000
	5.500		5.500	6.249	1.000		24	1.000					8.375	0.250	3.938			14.000

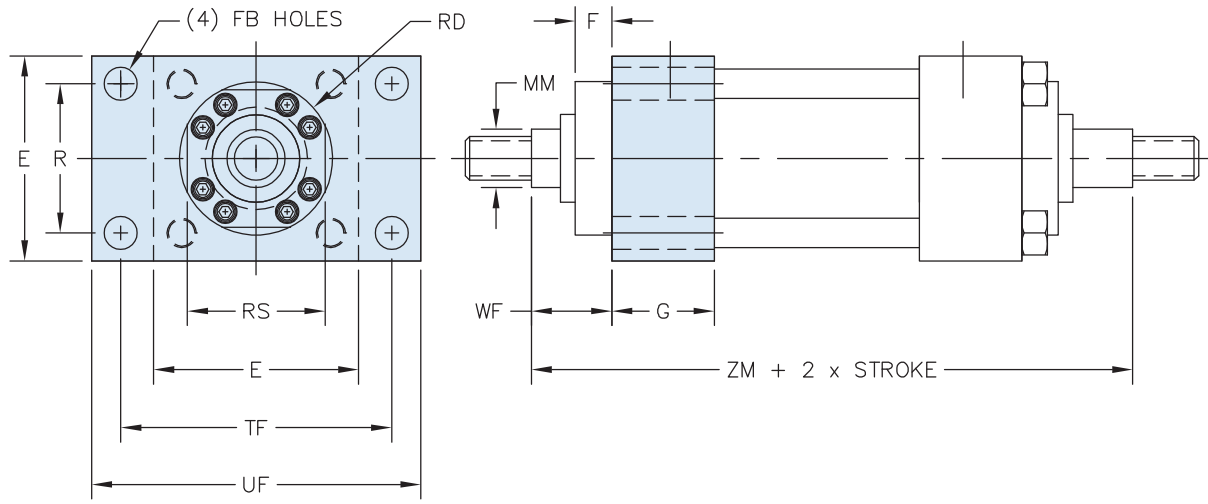
SEE ROD END DETAIL CHART ON PAGE 117

[△] 'B' dimension tolerance is +.000 / -.002

[△] Where no dimension is shown, cylinder utilizes a full square retainer.

SERIES 'HHD' DIMENSIONS: DOUBLE END MOUNTS

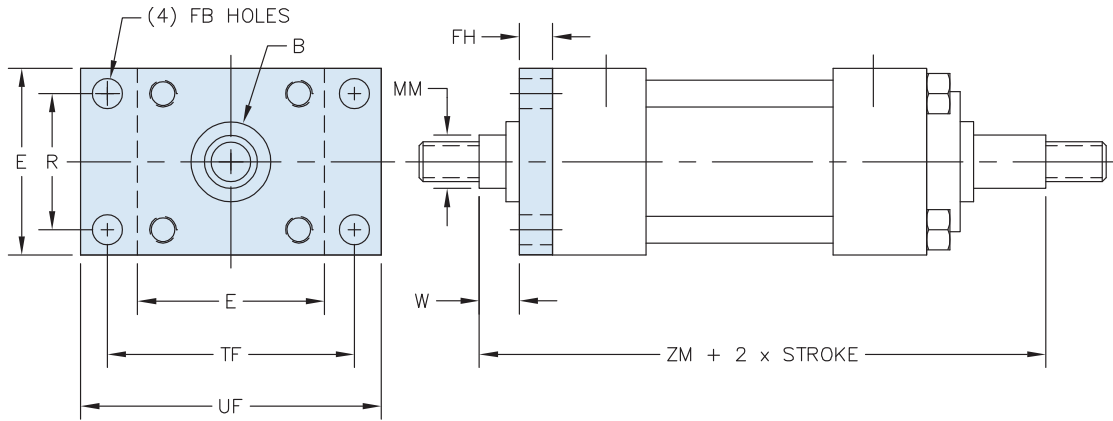
ME5D: HEAD RECTANGULAR MOUNTING HOLES



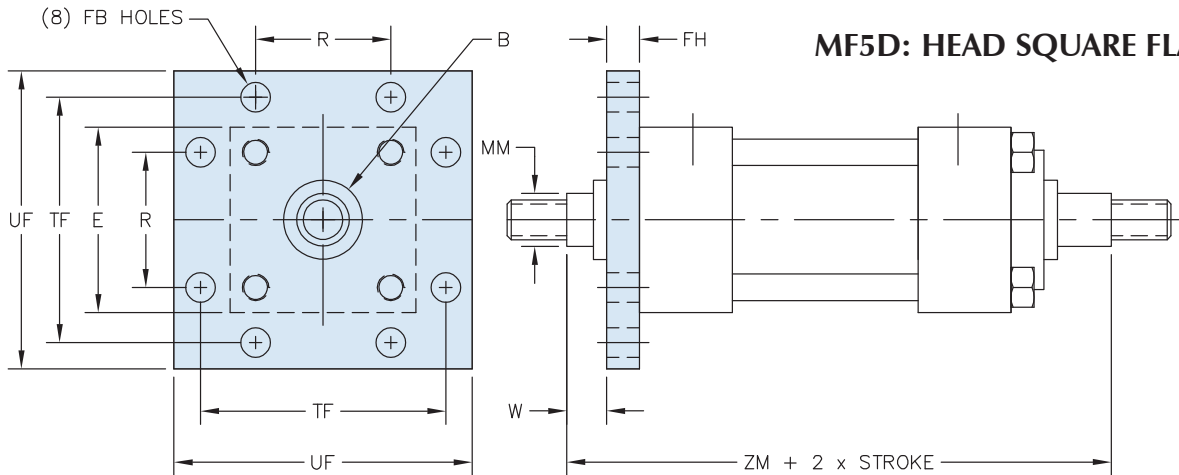
BORE	ROD DIA (MM)	E	F	FB	G	R	RD	RS	TF	UF	WF	ADD 2x STROKE
												ZM
1.50	0.625	2.500	0.375	0.438	1.750	1.625	2.375	—	3.438	4.250	1.000	6.875
	1.000		0.375				2.438	7.625				
2.00	1.000	3.000	0.625	0.563	1.750	2.047	2.625	—	4.125	5.125	1.375	7.625
	1.375		0.625				2.938	8.125				
2.50	1.000	3.500	0.625	0.563	1.750	2.547	2.625	—	4.625	5.625	1.375	7.750
	1.375		0.625				—	1.625				8.250
	1.750		0.625				3.438	1.875				8.750
3.25	1.375	4.500	0.750	0.688	2.000	3.250	3.250	—	5.875	7.125	1.625	9.000
	1.750		0.750				—	1.875				9.500
	2.000		0.750				—	2.000				9.750
4.00	1.750	5.000	0.875	0.688	2.000	3.820	3.875	—	6.375	7.625	1.875	9.750
	2.000		0.875				—	2.000				10.000
	2.500		0.875				—	2.250				10.500
5.00	2.000	6.500	0.875	0.938	2.000	4.953	4.250	—	8.188	9.750	2.000	10.500
	2.500		0.875				—	2.250				11.000
	3.000		0.875				—	2.250				11.000
	3.500		0.875				—	2.250				11.000
6.00	2.500	7.500	0.875	1.063	2.250	5.725	4.625	—	9.438	11.250	2.250	11.875
	3.000		0.875				—	2.250				11.875
	3.500		0.875				—	2.250				11.875
	4.000		1.000				—	2.250				11.875
8.00	3.500	9.500	0.875	1.313	3.000	7.500	5.625	—	11.813	14.000	2.250	14.000
	4.000		1.000				—	2.250				14.000
	4.500		1.000				—	2.250				14.000
	5.000		1.000				—	2.250				14.000
	5.500		1.000				—	2.250				14.000

SERIES 'HHD' DIMENSIONS: DOUBLE END MOUNTS

MF1D: HEAD FLANGE



MF5D: HEAD SQUARE FLANGE

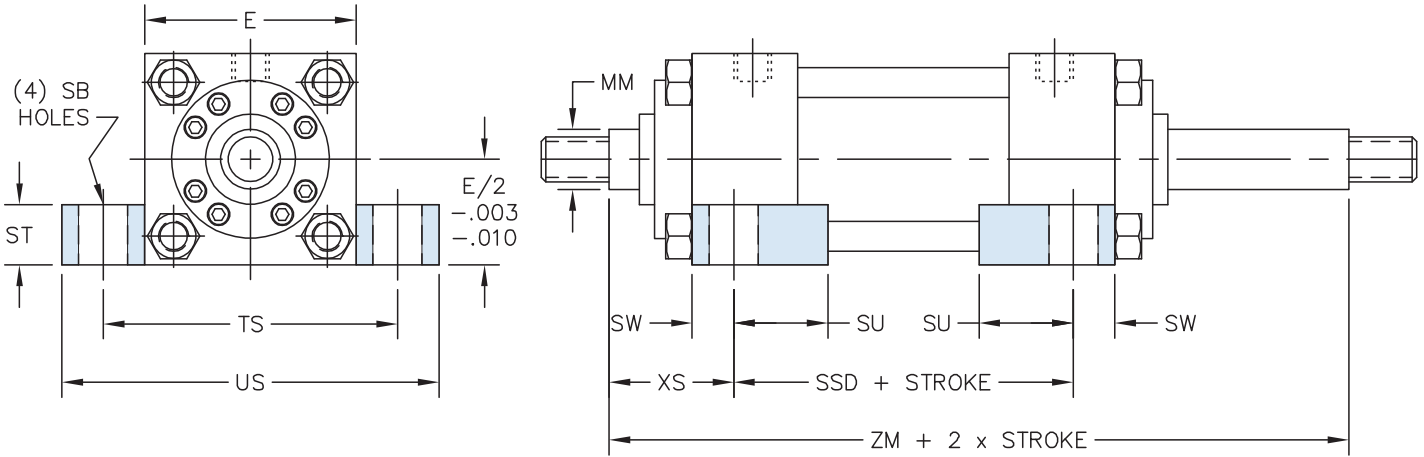


BORE	ROD DIA (MM)	MAX PSI RATING ^Δ		E	B	FH	FB	R	TF	UF	W	ADD 2x STROKE	
		MF1D	MF5D									ZM	
1.50	0.625	2600	1800	2.500	1.124	0.375	0.438	1.625	3.438	4.250	0.625	6.875	
	1.000	1600	1800		1.499							1.000	7.625
2.00	1.000	2600	1800	3.000	1.499	0.625	0.563	2.047	4.125	5.125	0.750	7.625	
	1.375	1600	1800		1.999							1.000	8.125
2.50	1.000	2600	1000	3.500	1.499	0.625	0.563	2.547	4.625	5.625	0.750	7.750	
	1.375	2000	1000		1.999							1.000	8.250
	1.750	1600	1000		2.374							1.250	8.750
3.25	1.375	2600	1300	4.500	1.999	0.750	0.688	3.250	5.875	7.125	0.875	9.000	
	1.750	2200	1300		2.374							1.125	9.500
	2.000	1600	1300		2.624							1.250	9.750
4.00	1.750	2600	900	5.000	2.374	0.875	0.688	3.820	6.375	7.625	1.000	9.750	
	2.000	1900	900		2.624							1.125	10.000
	2.500	1600	900		3.124							1.378	10.500
5.00	2.000	2200	750	6.500	2.624	0.875	0.938	4.953	8.188	9.750	1.125	10.500	
	2.500	1600	750		3.124							1.375	11.000
	3.000	1200	550		3.749							1.375	11.000
	3.500	750	550		4.249							1.375	11.000
6.00	2.500	1800	750	7.500	3.124	1.000	1.063	5.725	9.438	11.250	1.250	11.875	
	3.000	1450	750		3.749							1.250	11.875
	3.500	1100	600		4.249							1.250	11.875
	4.000	750	600		4.749							1.250	11.875
8.00	3.500	900	500	9.500	4.249	1.000	1.313	7.500	11.813	14.000	1.250	14.000	
	4.000	800	500		4.749							1.250	14.000
	4.500	700	500		5.249							1.250	14.000
	5.000	500	500		5.749							1.250	14.000
	5.500	500	500		6.249							1.250	14.000

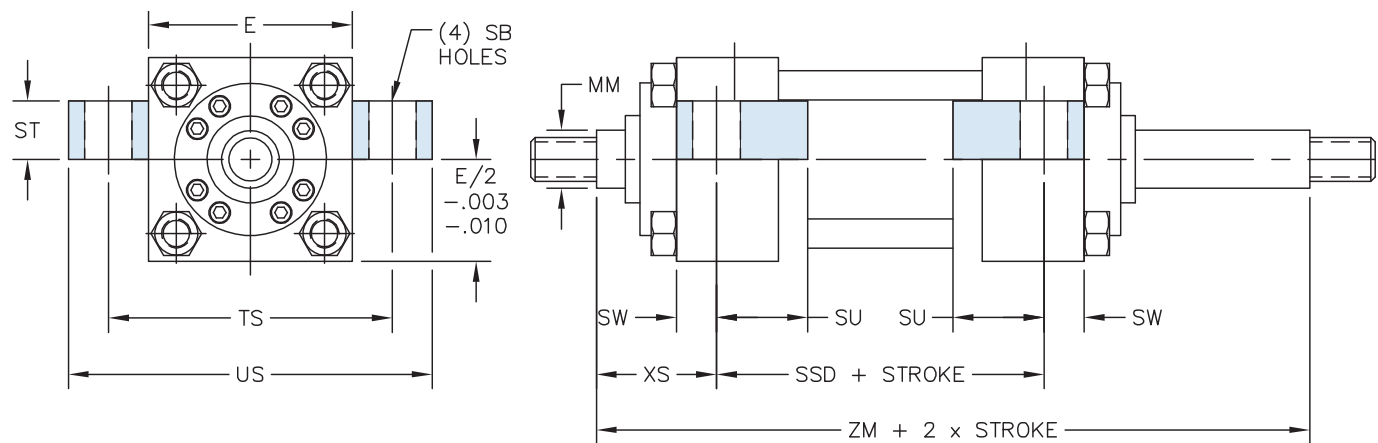
^Δ Maximum pressure rating
^Δ 'B' dimension tolerance is +.000 / -.002

SERIES 'HHD' DIMENSIONS: DOUBLE END MOUNTS

MS2D: SIDE LUGS



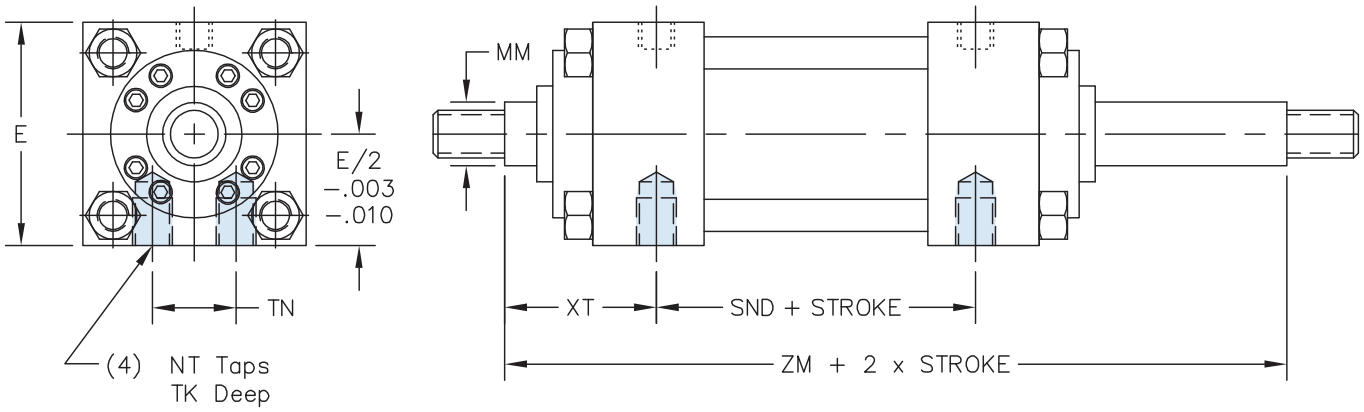
MS3D: CENTER LINE LUGS



BORE	ROD DIAM (MM)	E	E / 2	SB	ST	SU	SW	TS	US	XS	ADD TO STROKE SSD	ADD 2x STROKE ZM
1.50	0.625	2.500	1.250	0.438	0.500	0.938	0.375	3.250	4.000	1.375	4.125	6.875
	1.000									7.625		
2.00	1.000	3.000	1.500	0.563	0.750	1.250	0.500	4.000	5.000	1.875	3.875	7.625
	1.375									8.125		
2.50	1.000	3.500	1.750	0.813	1.000	1.563	0.688	4.875	6.250	2.063	3.625	7.750
	1.375									2.313		8.250
	1.750									2.563		8.750
3.25	1.375	4.500	2.250	0.813	1.000	1.563	0.688	5.875	7.250	2.313	4.375	9.000
	1.750									2.563		9.500
	2.000									2.688		9.750
4.00	1.750	5.000	2.500	1.063	1.250	2.000	0.875	6.750	8.500	2.750	4.250	9.750
	2.000									2.875		10.000
	2.500									3.125		10.500
5.00	2.000	6.500	3.250	1.063	1.250	2.000	0.875	8.250	10.000	2.875	4.750	10.500
	2.500									3.125		11.000
	3.000									3.125		11.000
	3.500									3.125		11.000
6.00	2.500	7.500	3.750	1.313	1.500	2.500	1.125	9.750	12.000	3.375	5.125	11.875
	3.000									3.375		11.875
	3.500									3.375		11.875
	4.000									3.375		11.875
8.00	3.500	9.500	4.750	1.563	1.750	2.875	1.375	12.250	15.000	3.625	6.750	14.000
	4.000									3.625		14.000
	4.500									3.625		14.000
	5.000									3.625		14.000
	5.500									3.625		14.000

SERIES 'HHD' DIMENSIONS: DOUBLE END MOUNTS

MS4D: BOTTOM TAPPED HOLES

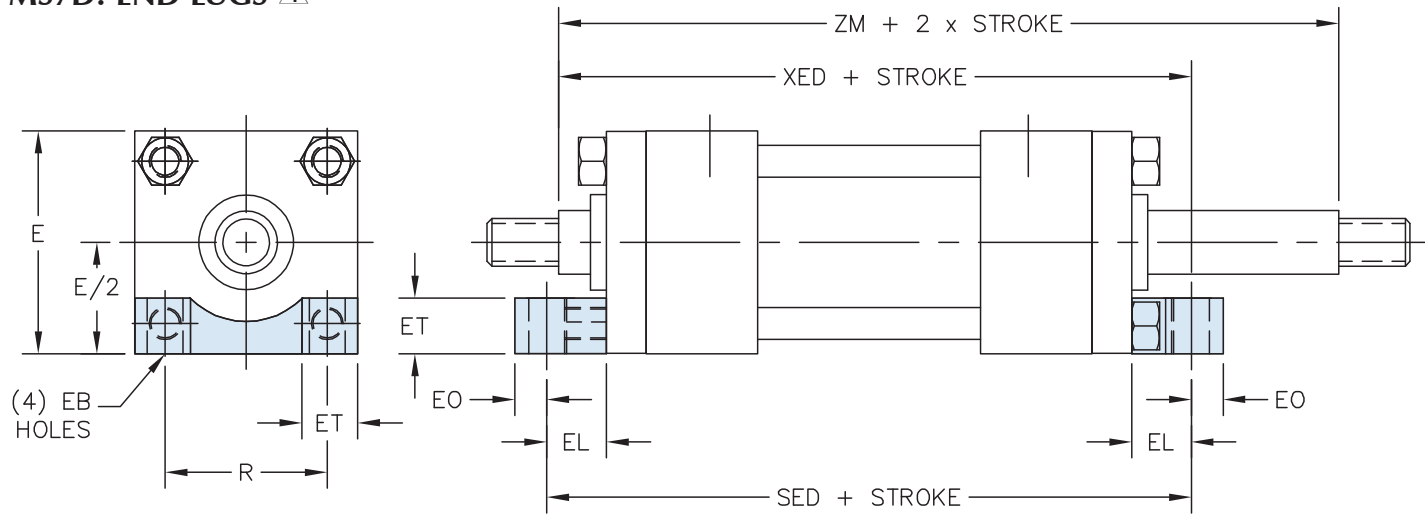


BORE	ROD DIAM (MM)	E	E / 2	NT	TK	TN	XT	ADD TO STROKE	ADD 2x STROKE
								SND	ZM
1.50	0.625	2.500	1.250	3/8 - 16	0.375	0.750	2.000	2.875	6.875
	1.000				0.375		2.375		7.625
2.00	1.000	3.000	1.500	1/2 - 13	0.438	0.938	2.375	2.875	7.625
	1.375				0.438		2.625		8.125
2.50	1.000	3.500	1.750	5/8 - 11	0.750	1.313	2.375	3.000	7.750
	1.375				0.625		2.625		8.250
	1.750				0.500		2.875		8.750
3.25	1.375	4.500	2.250	3/4 - 10	1.000	1.500	2.750	3.500	9.000
	1.750				0.875		3.000		9.500
	2.000				0.750		3.125		9.750
4.00	1.750	5.000	2.500	1 - 8	0.875	2.063	3.000	3.750	9.750
	2.000				0.750		3.125		10.000
	2.500				0.750		3.375		10.500
5.00	2.000	6.500	3.250	1 - 8	1.000	2.938	3.125	4.250	10.500
	2.500				1.000		3.375		11.000
	3.000				1.000		3.375		11.000
	3.500				1.000		3.375		11.000
6.00	2.500	7.500	3.750	1 1/4 - 7	1.250	3.313	3.500	4.875	11.875
	3.000				1.250		3.500		11.875
	3.500				1.250		3.500		11.875
	4.000				0.750		3.500		11.875
8.00	3.500	9.500	4.750	1 1/2 - 6	1.500	4.250	3.938	6.125	14.000
	4.000				1.500		3.938		14.000
	4.500				1.500		3.938		14.000
	5.000				1.250		3.938		14.000
	5.500				1.000		3.938		14.000


HHD - How to Order
 HHD - Base Dimensions
 HHD - Mount Dimensions
 HHD with Rod Lock
 Options Page 142
 Accessories Page 172
 Switches Page 184
 Technical Data Page 198

SERIES 'HHD' DIMENSIONS: DOUBLE END MOUNTS

MS7D: END LUGS

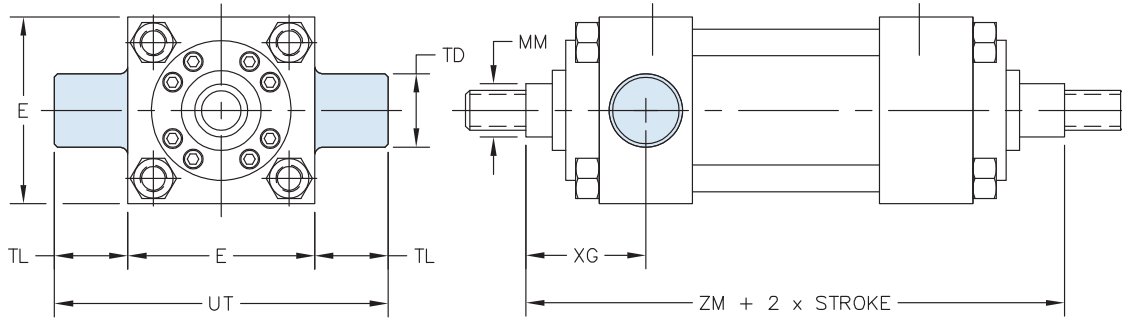


BORE	ROD DIAM (MM)	E	E / 2	EB	EL	EO	ET	R	ADD TO STROKE		ADD 2x STROKE
									SED	XED	ZM
1.50	0.625	2.500	1.250	0.438	0.875	0.375	0.750	1.625	7.375	7.125	6.875
	1.000										
2.00	1.000	3.000	1.500	0.563	0.938	0.500	0.875	2.047	8.000	7.688	7.625
	1.375										
2.50	1.000	3.500	1.750	0.563	0.938	0.500	0.875	2.547	8.125	7.938	7.750
	1.375									8.188	8.250
	2.000									Not Available	
3.25	1.375	4.500	2.250	0.688	1.125	0.625	1.188	3.250	9.500	9.250	9.000
	1.750									9.500	9.500
	2.000									9.625	9.750
4.00	1.750	5.000	2.500	0.688	1.125	0.625	1.188	3.820	10.000	9.875	9.750
	2.000									10.000	10.000
	2.500									Not Available	
5.00	2.000	6.500	3.250	0.938	1.500	0.750	1.500	4.953	11.250	10.875	10.500
	2.500									11.125	11.000
	3.000									11.125	11.000
	3.500									Not Available	
6.00	2.500	7.500	3.750	1.063	1.688	0.875	1.750	5.734	12.750	12.313	11.875
	3.000									12.313	11.875
	3.500									12.313	11.875
	4.000									12.313	11.875

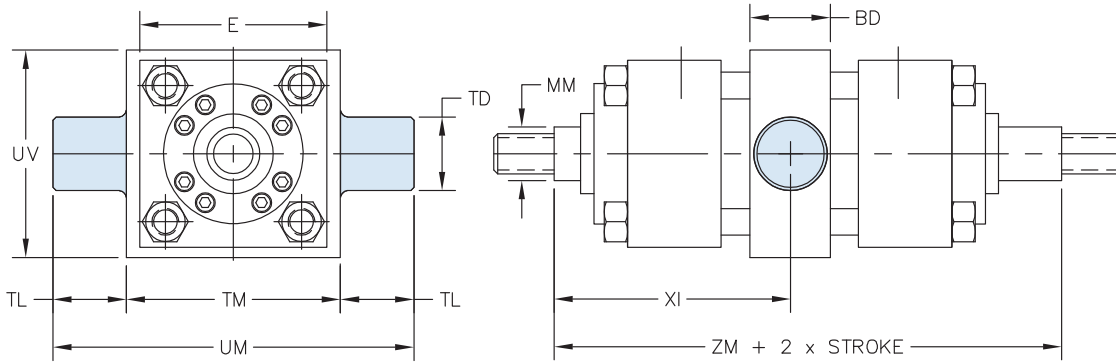
 When using this mount, the cylinder feet, head & cap are to be firmly supported.

SERIES 'HHD' DIMENSIONS: DOUBLE END MOUNTS

MT1D: HEAD TRUNNION



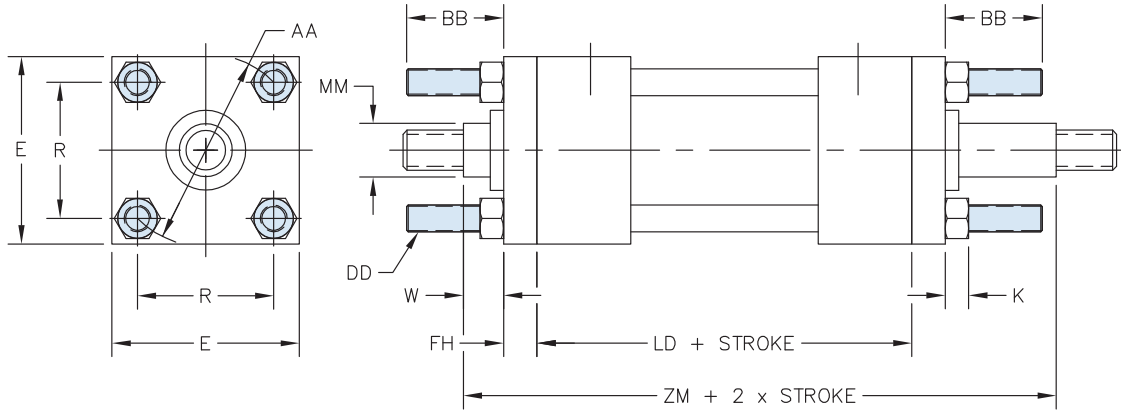
MT4D: INTERMEDIATE TRUNNION



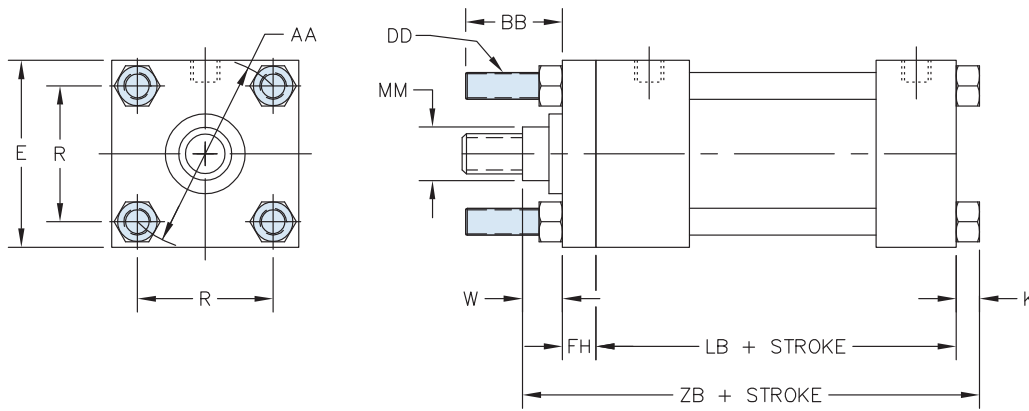
BORE	ROD DIA (MM)	E	BD	TD	TL	TM	UM	UT	UV	XG	MT4 MIN STROKE	MT4 XI MIN	ADD STROKE	ADD 2x STROKE
													MT4 XI MAX	ZM
1.50	0.625	2.500	1.500	1.000	1.000	3.000	5.000	4.500	3.000	1.875	0.250	3.500	3.250	6.875
	2.250									3.875		7.625		
2.00	1.000	3.000	1.500	1.375	1.375	3.500	6.250	5.750	3.500	2.250	0.250	4.000	3.750	7.625
	2.500									4.250		8.125		
2.50	1.000	3.500	1.500	1.375	1.375	4.000	6.750	6.250	4.000	2.250	0.375	4.102	3.750	7.750
	2.500									4.375		8.250		
	2.750									4.625		8.750		
3.25	1.375	4.500	2.000	1.750	1.750	5.000	8.500	8.000	5.000	2.625	0.875	5.000	4.125	9.000
	2.875									5.250		9.500		
	3.000									5.375		9.750		
4.00	1.750	5.000	2.000	1.750	1.750	5.500	9.000	8.500	5.500	2.875	1.125	5.500	4.375	9.750
	3.000									5.625		10.000		
	3.250									5.875		10.500		
5.00	2.000	6.500	2.500	1.750	1.750	7.000	10.500	10.000	7.250	3.000	1.125	5.875	4.750	10.500
	3.250									6.125		11.000		
	3.250									6.125		11.000		
	3.250									6.125		11.000		
6.00	2.500	7.500	3.000	2.000	2.000	8.500	12.500	11.500	8.750	3.375	1.250	6.625	5.375	11.875
	3.375									6.625		11.875		
	3.375									6.625		11.875		
	3.375									6.625		11.875		
8.00	3.500	9.500	3.500	3.000	3.000	11.000	17.000	15.500	11.750	3.750	2.125	8.125	6.000	14.000
	3.750									8.125		14.000		
	3.750									8.125		14.000		
	3.750									8.125		14.000		
	3.750									8.125		14.000		

SERIES 'HHD' DIMENSIONS: DOUBLE END MOUNTS

MX1D: EXTENDED TIE-RODS - HEAD & CAP



MX3D: EXTENDED TIE-RODS - HEAD END



BORE	ROD DIA (MM)	E	AA	BB	DD	FH	K	R	W	ADD TO STROKE	ADD 2x STROKE
										LD	ZM
1.50	0.625	2.500	2.300	1.375	3/8 - 24	0.375	0.375	1.625	0.625	4.875	6.875
	1.000										7.625
2.00	1.000	3.000	2.900	1.813	1/2 - 20	0.625	0.438	2.047	0.750	4.875	7.625
	1.375										8.125
2.50	1.000	3.500	3.600	1.813	1/2 - 20	0.625	0.438	2.547	0.750	5.000	7.750
	1.375										8.250
	1.750										8.750
3.25	1.375	4.500	4.600	2.313	5/8 - 18	0.750	0.563	3.250	0.875	5.750	9.000
	1.750										9.500
	2.000										9.750
4.00	1.750	5.000	5.400	2.313	5/8 - 18	0.875	0.563	3.820	1.000	6.000	9.750
	2.000										10.000
	2.500										10.500
5.00	2.000	6.500	7.000	3.188	7/8 - 14	0.875	0.813	4.953	1.125	6.500	10.500
	2.500										11.000
	3.000										11.000
	3.500										11.000
6.00	2.500	7.500	8.100	3.625	1 - 14	1.000	0.875	5.734	1.250	7.375	11.875
	3.000										11.875
	3.500										11.875
	4.000										11.875
8.00	3.500	9.500	10.600	4.500	1 1/4 - 12	1.000	1.250	7.500	1.250	9.500	14.000
	4.000										14.000
	4.500										14.000
	5.000										14.000
	5.500										14.000

SERIES 'HHD' WITH HYDRAULIC ROD LOCK

The Nason difference...

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

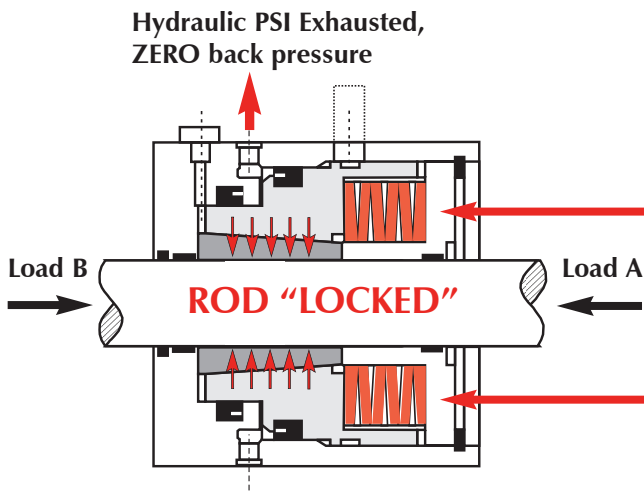
For rod locks to achieve the rated holding force and maximize cycle life, good alignment must be maintained between the locking mechanism and cylinder rod. With Nason's Floating Rod Bushing design and accurate rod lock alignment - superior performance and trouble-free operation are assured.

Rod locks are used to hold linear cylinder loads stationary in any mounting orientation during "power off" condition. 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. Nason offers each rod lock model in three different holding force, depending on available release pressure.

Refer to page 138 for minimum release pressure and corresponding holding force.

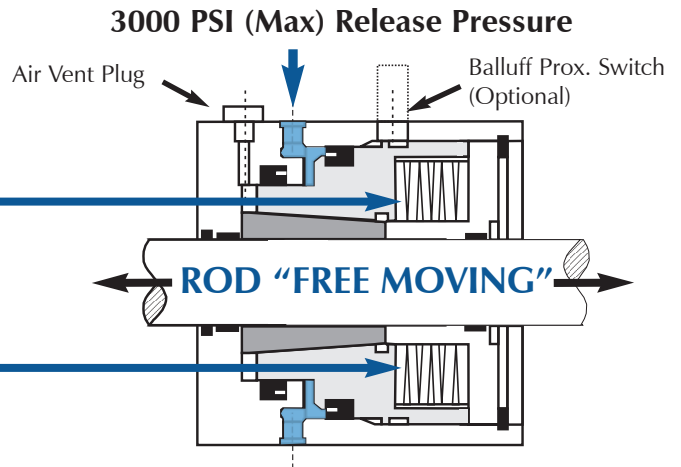


OPERATING PRINCIPAL



CLAMPING (Locked) CONDITION:

When hydraulic pressure is exhausted from rod lock, extreme spring force is applied to the piston/outer lock housing which utilizes an ultra-fine tapered wedge, transferring the spring force directly to the rod. Clamping action does not move or disturb the rod, maintaining rod position during actuation.



UNCLAMPED CONDITION:

When hydraulic pressure is applied to rod lock, the hydraulic pressure overcomes the spring force, moving Piston Outer Locking Housing. This movement provides clearance between the rod lock and piston rod which allows free rod movement.

OPERATING PRESSURE

Cylinder	Refer to Cylinder Mount Rating
Rod Lock (Low PSI)	750 to 3000 PSI HYD.
Rod Lock (Med PSI)	1000 to 3000 PSI HYD.
Rod Lock (High PSI)	1500 to 3000 PSI HYD.

AXIAL MOVEMENT (CLAMPED) *

Load Direction A	.000"
Load Direction B	.012" Max.

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

OPERATING TEMPERATURE

Standard Seals	20° F to 200° F (-29° C to 93° C)
Fluorocarbon Seals	0° F to 400° F (-18° C to 204° C)

ROD MATERIAL REQUIREMENTS

Diameter	+ .000" to -.002" Nominal Diameter
Hardened Shaft	.0005" Minimum hard chrome
Finish	6 to 10 micro-inch

CLAMP SPECIFICATIONS

Response Time	100 ms (Clamp); 100 ms (Un-clamp)
Average Life	1,000,000 Clamp Cycles

HOW TO ORDER: SERIES 'HHD' WITH ROD LOCK

HHD - ME5 - _____ - 2.50 x 10 - H2C6 - 100 - KK1 - P15 = N375 - S S S S - _____

REQUIRED MOUNT	
ME5	HEAD RECTANGULAR MOUNT (1.50" to 8.00" Bore)

NFPA MOUNT (TO MOUNT CYLINDER)	
MF2	CAP RECTANGULAR FLANGE (1.50" to 8.00" Bore)
MF5	SQUARE FLANGE, HEAD END (1.50" to 8.00" Bore)
MF6	SQUARE FLANGE, CAP END (1.50" to 8.00" Bore)
MP1	FIXED CAP PIVOT CLEVIS (1.50" to 8.00" Bore)
MS2	SIDE LUGS (1.50" to 8.00" Bore)
MS3	CENTER LINE LUGS (1.50" to 8.00" Bore)
MS4	BOTTOM TAPPED HOLES (1.50" to 8.00" Bore)
MS7	END LUGS (1.50" to 8.00" Bore)
MT1	HEAD TRUNNION (1.50" to 8.00" Bore)
MT2	CAP TRUNNION (1.50" to 8.00" Bore)
MT4	INTERMEDIATE (CENTER) TRUNNION (1.50" to 8.00" Bore)

OPTIONS	
RLH	ROD LOCK READY CYLINDER NO ROD LOCK INSTALLED
RLH=MODEL NUMBER	CYLINDER WITH INSTALLED ROD LOCK Example: RLH=100250750

Rod Lock Model Numbers

RLH = 100 250 750 _____

ROD SIZE	BORE	RELEASE PSI	OPTIONS
062	150	750	P Proximity Switch Ready
100	200	1000	V Fluorocarbon Seals
137	250	1500	X Special (Specify)
175	325		
200	400		
	500		
	600		
	800		

Replacement Rod Locks can be ordered using the same methodology.

Examples:

RLH-1374001500

RLH-100250750P

See page 115 for additional cylinder How-to-Order information.

TECHNICAL DATA: ROD LOCKS

ROD SIZE	BORE	MODEL NUMBER	MIN. RELEASE PSI	MAX HOLDING FORCE	VOLUME OF OIL		WEIGHT (LBS)
					CM ³	IN ³	
0.625	1.50	RLH-625150750	750	1,100	6	0.4	11.5
		RLH-6251501000	1000	1,800			
		RLH-6251501500	1500	2,250			
1.000	1.50	RLH-100150750	750	1,200	6	0.4	10.5
		RLH-1001501000	1000	2,000			
		RLH-1001501500	1500	2,300			
1.000	2.00	RLH-100200750	750	2,900	16	1.0	20.8
		RLH-1002001000	1000	5,200			
		RLH-1002001500	1500	5,600			
1.000	2.50	RLH-100250750	750	2,900	16	1.0	31.0
		RLH-1002501000	1000	5,200			
		RLH-1002501500	1500	6,000			
1.375	2.00	RLH-137200750	750	2,700	10	0.6	20.0
		RLH-1372001000	1000	2,700			
		RLH-1372001500	1500	5,200			
1.375	2.50	RLH-137250750	750	2,700	16	1.0	30.2
		RLH-1372501000	1000	5,200			
		RLH-1372501500	1500	6,000			
1.375	3.25	RLH-137325750	750	8,200	30	1.8	66.0
		RLH-1373251000	1000	11,500			
		RLH-1373251500	1500	16,000			
1.750	2.50	RLH-175250750	750	3,500	16	1.0	29.5
		RLH-1752501200	1200	5,200			
		RLH-1752502000	2000	7,500			

ROD SIZE	BORE	MODEL NUMBER	MIN. RELEASE PSI	MAX HOLDING FORCE	VOLUME OF OIL		WEIGHT (LBS)
					CM ³	IN ³	
1.750	3.25	RLH-175325750	750	8,200	30	1.8	65.1
		RLH-1753251000	1000	11,500			
		RLH-1753251500	1500	16,000			
1.750	4.00	RLH-175400750	750	8,200	39	2.4	75.5
		RLH-1754001000	1000	12,000			
		RLH-1754001500	1500	17,000			
2.000	3.25	RLH-200325750	750	8,200	39	2.4	64.0
		RLH-2003251000	1000	11,500			
		RLH-2003251500	1500	16,000			
2.000	5.00	RLH-200500750	750	8,200	39	2.4	114.0
		RLH-2005001000	1000	12,000			
		RLH-2005001500	1500	17,000			
2.500	6.00	RLH-250600750	750	30,000	129	7.9	270.0
		RLH-2506001000	1000	36,000			
		RLH-2506001500	1500	50,000			
3.000	6.00	RLH-300600750	750	17,000	129	7.9	260.0
		RLH-3006001000	1000	22,500			
		RLH-3006001500	1500	30,000			
3.500	8.00	RLH-350800750	750	40,000	181	11.0	550.0
		RLH-3508001000	1000	55,000			
		RLH-3508001500	1500	80,000			
4.000	8.00	RLH-400800750	750	40,000	230	14.0	530.0
		RLH-4008001000	1000	55,000			
		RLH-4008001500	1500	80,000			

⚠ Maximum hydraulic release pressure: 3000 PSI.

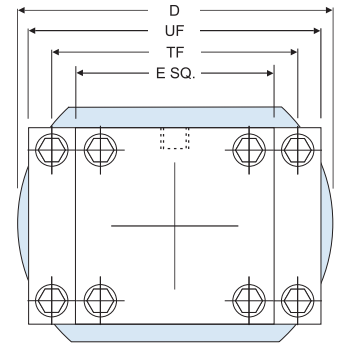
⚠ Holding forces are based on dry or mineral-oil lubricated shafts.

SERIES HHD WITH ROD LOCK: BASIC CYLINDER ME5 (No Mount)

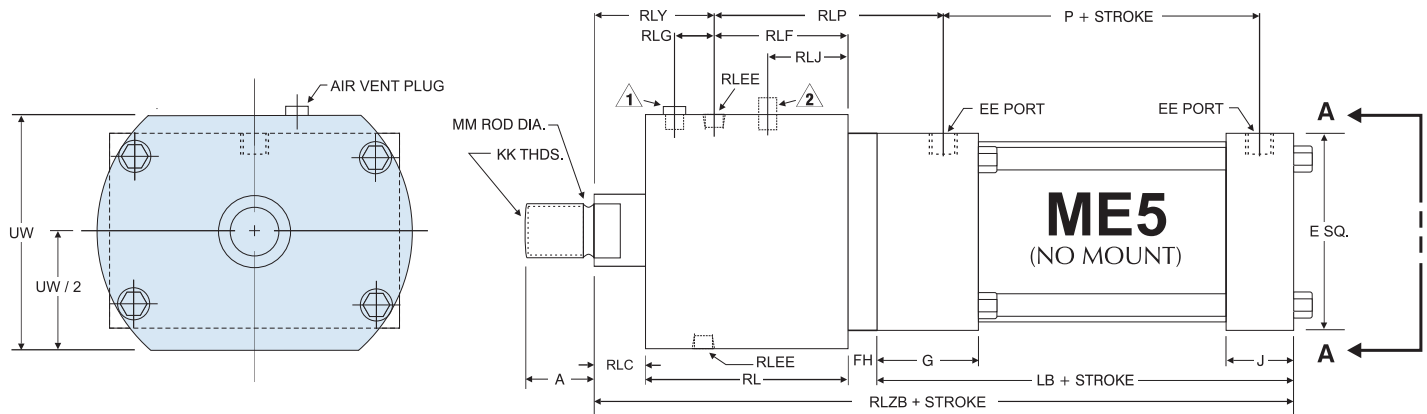
To be able to handle the high holding forces, the rod lock cylinder uses a ME5 full rectangle cylinder head and full rectangle bushing retainer plate to mount the rod lock unit to the cylinder.

Customers need to specify an additional mount to attach cylinder in the application.

Refer to pages 117 through 127 for basic cylinder dimensions not shown.



VIEW AA



△ Air Vent Plug.

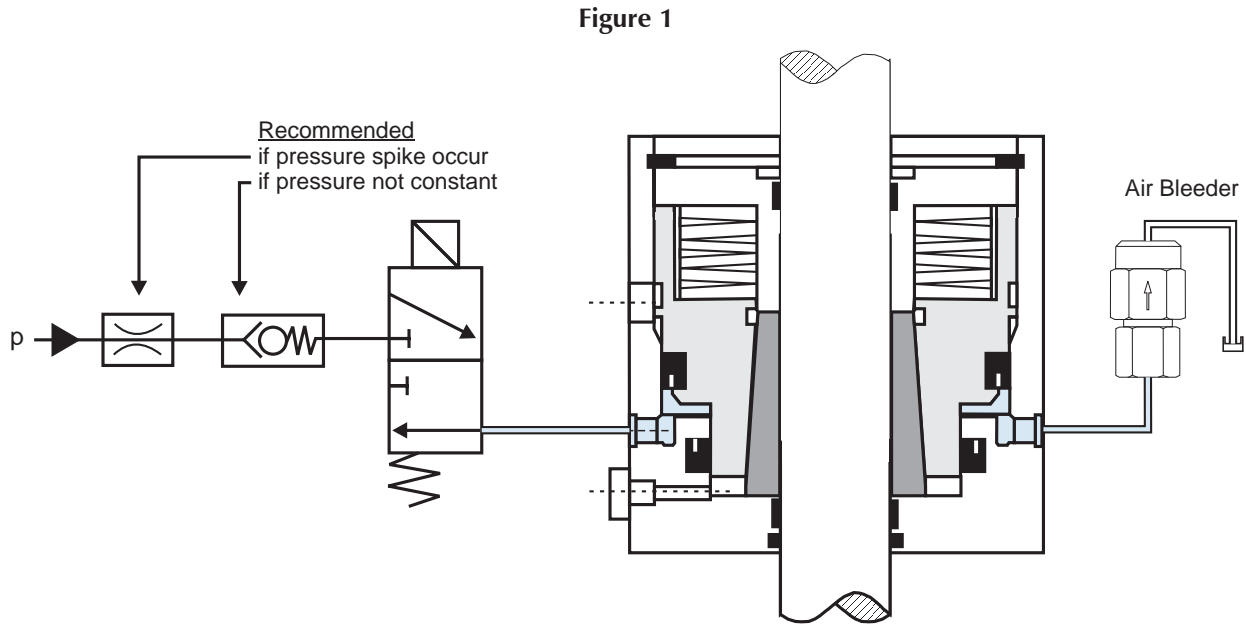
△ M12x1 port for optional proximity switch (indicates unclamped condition).

ROD DIA (MM)	BORE	D	E	FH	TF	UF	UW	RL	RLC	RLEE	RLF	RLG	RLJ	RLP	RLY	ADD TO STROKE
																RLZB
0.625	1.50	4.370	2.500	0.375	3.438	4.250	3.250	3.547	0.375	SAE 4	2.125	0.750	0.790	3.500	1.740	8.930
1.000	1.50	4.370	2.500	0.375	3.438	4.250	3.500	3.453	0.500	SAE 4	1.875	0.870	0.790	3.250	2.010	8.947
1.000	2.00	5.375	3.000	0.625	4.125	5.125	4.500	4.375	0.500	SAE 4	2.900	0.850	1.000	4.531	1.910	10.120
1.000	2.50	5.984	3.500	0.625	4.625	5.625	5.000	5.125	0.500	SAE 4	3.400	1.000	1.500	5.031	2.160	11.000
1.375	2.00	5.370	3.000	0.625	4.125	5.125	4.500	4.650	0.625	SAE 4	3.000	1.000	1.500	4.625	2.210	10.531
1.375	2.50	5.984	3.500	0.625	4.625	5.625	5.000	5.125	0.625	SAE 4	3.400	0.900	1.500	5.031	2.280	11.120
1.375	3.25	7.750	4.500	0.750	5.875	7.125	6.500	6.500	0.625	SAE 4	4.500	1.100	2.600	6.375	2.625	13.375
1.750	2.50	5.984	3.500	0.625	4.625	5.625	5.000	5.900	0.750	SAE 4	3.900	0.960	2.438	5.531	2.700	12.040
1.750	3.25	7.750	4.500	0.750	5.875	7.125	6.500	6.500	0.750	SAE 4	4.672	0.930	2.600	6.547	2.580	13.500
1.750	4.00	8.375	5.000	0.875	6.375	7.625	7.000	6.500	0.750	SAE 4	4.375	1.230	2.200	6.313	2.810	13.875
2.000	3.25	7.750	4.500	0.750	5.875	7.125	6.500	6.500	0.875	SAE 4	4.438	1.160	2.600	6.313	2.938	13.625
2.000	5.00	11.250	6.500	0.875	8.188	9.750	7.000	6.500	0.875	SAE 4	4.375	1.230	2.200	6.375	3.000	14.500
2.500	6.00	12.750	7.500	0.875	9.438	11.250	10.000	9.000	1.000	SAE 8	6.625	1.125	3.000	8.750	3.375	18.250
3.000	6.00	12.750	7.500	0.875	9.438	11.250	10.000	9.000	1.000	SAE 8	4.875	1.100	3.110	7.000	5.125	18.250
3.500	8.00	16.140	9.500	0.875	11.813	14.000	14.000	11.500	1.000	SAE 10	8.938	1.320	5.350	11.500	3.563	22.875
4.000	8.00	16.140	9.500	1.000	11.813	14.000	14.000	11.500	1.000	SAE 10	8.875	1.370	5.350	11.563	3.625	23.000

Rod Lock Hydraulic Circuit and Automatic Air Bleed Valve

In most applications, the sample circuit in figure 1 is used to actuate the rod lock. To “release” (unclamp) the rod lock, the 3-way valve is energized, supplying pressure to the rod lock. In power failure modes, E-Stop, loss of hydraulic pressure, etc., pressure is removed from the rod lock- spring energized rod lock “clamps” the rod holding it in place.

Avoid designs where the piston rod is moved while rod lock is actuated (clamped condition); piston rod and rod lock damage may occur. Do not exceed the maximum holding force of the rod lock unit.



Automatic Air Bleed Valve ABV-1

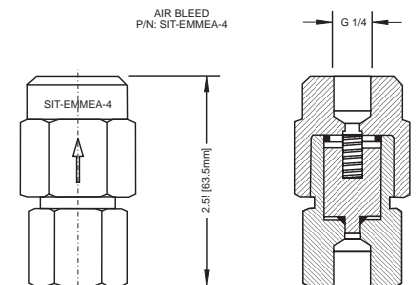
All rod lock units have a very short activation stroke and quick (100ms) response. It is highly recommended that all air be removed from the rod lock unit. Trapped air at high pressure and frequent cycling can cause ignition of the air-oil mixture, causing mini explosions (dieseling) to occur- which will lead to seal failure.

To avoid trapped air, an Automatic Air Bleed Valve (or similar component) should be installed between the rod lock and the oil reservoir. Locate the ABV-1 as near as possible to the rod lock, in the port with the highest elevation (see figures 2 and 3).

ABV-1 Operation

The Automatic Air Bleed Valve (ABV-1) opens slightly each time pressure is removed from the rod lock, allowing air to escape back to the oil reservoir.

For proper operation, back pressure exceeding 30 PSI (2 bar) should be avoided between the ABV-1 and oil reservoir.



Part Number: ABV-1

(Order separately)

Note: Use NPTF fittings to install

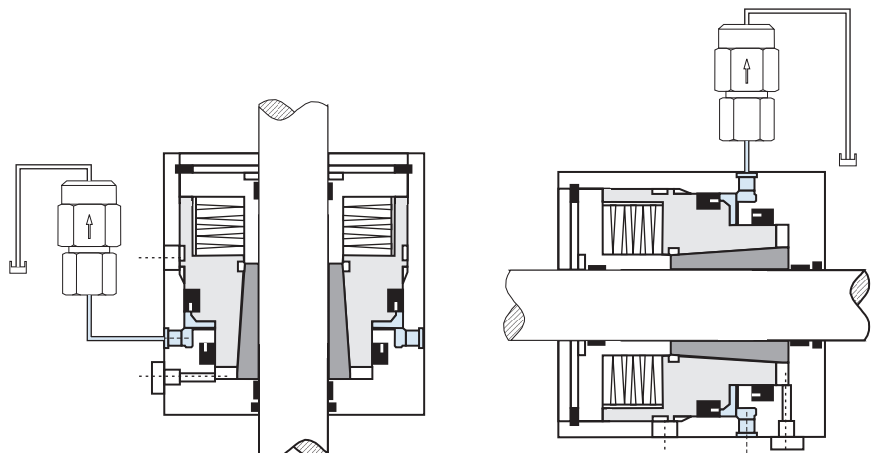


Figure 2: Vertical Mount

Figure 3: Horizontal Mount

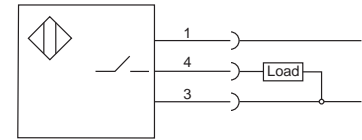
ROD LOCK SENSORS (For Unclamped Condition)

An inductive proximity switch (with M12 x 1 thread) can be used to sense the rod lock “unclamped” (free moving rod) condition.
(BALLUFF Model: BES 516325S4)



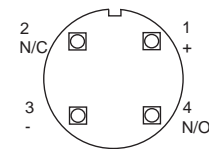
ELECTRICAL DATA	
SA Operational distance with steel	1.6 mm
Maximum switching frequency	800 Hz
Operating voltage	10 - 30 V DC
Supply voltage ripple	≤ 15% (Peak to Peak)
Load current capacity	≤ 200 mA
Protection against polarity reversal	yes
Short circuit protected	yes
Function display	LED
Output resistance	2.2 K + Diode + LED
Ambient temperature range	-25°C to 70°C (-13°F to 158°F)
Temperature of switch point	≤ 4 mm / °C
Parallel cap to load permitted	1 mF at 24 V DC
Residual voltage (unclamped)	≤ 0.8 V
Voltage drop (clamped)	≤ 2.5 V
Voltage rise on switching	
Switching hysteresis	≤ 15% Sensing distance
Repeatability	≤ 5% Sensing distance
Current Consumption	≤ 25 mA clamped / ≤ 12 mA unclamped

SCHEMATIC



Wiring Connections:
 PNP Normally Open

View of Male Connector Pins



PROXIMITY SENSOR INSTALLATION INSTRUCTIONS

- 1) Apply hydraulic pressure to rod lock (unclamped condition).
- 2) Assemble the proximity sensor jam nut and lock tooth washer to the proximity sensor. Thread the proximity sensor (by hand) into the M12 x 1 rod lock threaded port until it contacts the internal steel piston.
- 3) Back the proximity sensor out 1 full turn. While holding the proximity sensor’s position, tighten the jam nut to 15 ft-lbs (do not over torque).
- 4) With electrical power off, connect the proximity sensor electric wiring per the diagram included with the sensor. When the electrical power is on, the proximity sensor LED should be “On”, indicating an unclamped condition. Slight adjustments may be necessary to set proximity sensor for proper operation.
- 5) Remove the hydraulic pressure to the rod lock, the proximity sensor LED should go “Off”, indicating the “clamped” conditions.

ROD LOCK INSTALLATION INSTRUCTIONS

- 1) Using a flexible hydraulic rated hose, apply hydraulic pressure to the rod lock unit (*refer to model number for specific rod lock hydraulic release pressure.*)
- 2) With the rod lock counter-bored end facing the cylinder rod end, align rod lock to rod. Using care not to damage rod lock seals or bearings, slide the rod lock onto the piston rod until it contacts the cylinder mounting surface. Rod lock should fully contact the cylinder.
- 3) Remove the hydraulic pressure to the rod lock. Torque cylinder tie rod nuts a little at a time, in a clockwise rotation, finishing with the proper cylinder tie rod torque. *Refer to torque charts on page 204.*
- 4) Cycle the rod lock unit on and off several times. With pressure applied, the cylinder rod should move freely by hand.
- 5) If the cylinder rod does not move freely, remove the rod lock and repeat installation instructions. If the piston rod still drags, check the squareness of the rod lock to the cylinder and make adjustments as needed.

WARNING! DO NOT DISASSEMBLE ROD LOCK — UNIT CONTAINS HIGH SPRING FORCE THAT COULD CAUSE PERSONAL INJURY. Return to Nason for service.



NASON

NEW THINKING



BASIC OPTIONS

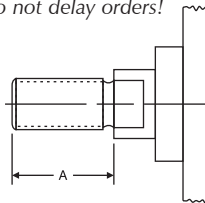
Index To Options:

	<u>PAGE</u>		<u>PAGE</u>
• A= - Extended Piston Rod Thread	143	• MS - Metallic Rod Scraper	151
• AS - Adjustable Stroke (Retract)	143	• NR - Non-Rotating (NFPA) Cylinders	151
• A/O - Air/Oil Piston	143	• OP - Optional Port Location	152
• B, BC, BH - Bumpers	143	• Optional Port & Cushion at Same Location	152
• BP - Bumper Piston Seals	144	• Optional Piston & Rod Bushing Materials (PMB, PMC, PMD, SSP, RBB, RBC, RBD, RBS)	153
• H, C, LH, LC, ELH, ELC - Cushions	145	• Seals (LF, LT, LTE, OTS, TH, RWV, VS)	154
• ELH, ELC - Dimensions for Extra Long Cushions	146	• OS - Oversize Rod	155
• FC, FCH, FCC - Fixed Cushions	146	• SAE - SAE "O"-Ring Boss Ports	155
• Custom Length Cushions	146	• SE - Spring Extend	155
• BSPT/BSPP - British Standard Pipe Threads	147	• SR - Spring Retract	155
• C= - Extended Piston Rod	147	• SSA - Stainless Steel "All"	155
• DC, DCH, DCC - Dampening Cushions	147	• SSC - Stainless Steel Cushion Needle	155
• EN - Electroless Nickel	147	• SSF - Stainless Steel Fasteners	155
• HP - High Impact Piston	148	• SSR - Stainless Steel Piston Rod	155
• KK3S - Studded Piston Rod	148	• SST - Stainless Steel Tie Rods & Nuts	155
• KK10 - Rod Coupler End	148	• ST - Stop Tube	156
• KKX - Special Rod Thread	148	• TMS - Tube Material - Steel	157
• KKM - Metric Rod Thread	148	• TMSS - Tube Material - Stainless Steel	157
• Lubricants (L001, L002, L003, L004, L005, L006, L007, L008, L011, L012, L013)	149	• WB - Piston Wear Band	157
• MA - Micro-Adjust	150	• Special Wear Bands	157
• MAB - Micro-Adjust with Urethane Bumper	150	• Private Labeling	158
• MPR, MPH - Magnetic Piston	151	• Uncommon Options	159-161

A= Extended Piston Rod Thread

"A=" refers to the length of piston rod thread.

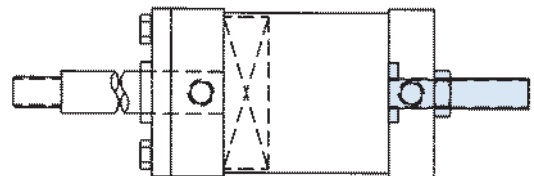
Shorter than standard lengths can be furnished at no charge. Longer than standard lengths can be furnished at a nominal price adder. *Special length threads do not delay orders!*



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")



A/O 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.

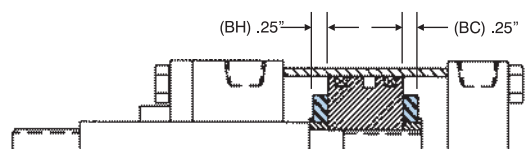
Note: Due to the nature of oil to remain in the tubing finish recesses, a condition called "collaring" will allow oil to seep past the A/O seal over time, escaping in the air valve exhaust.

B BC BH Bumpers

Urethane impact dampening bumpers, 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)



BASIC OPTIONS

BP Bumper Piston Seals (Note: "BP" Seals are Standard on Series 'HDC' Tough Duty)



Nason's Bumper Piston Seal, 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 (-25°C to 90°C)

Optional Material: Fluorocarbon

Available in 1.50"-8.00" Bores

Operating Temp: 0°F to 400°F (-18°C to 205°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 (1.50" to 8.00" Bore)**

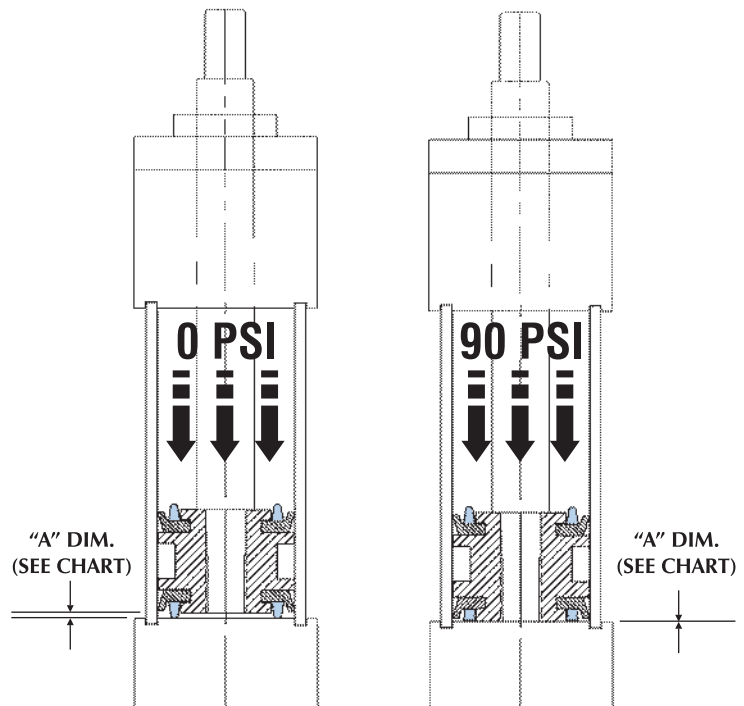
Design Tips

- 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	



BASIC OPTIONS: ADJUSTABLE CUSHIONS

H

C

LH

LC

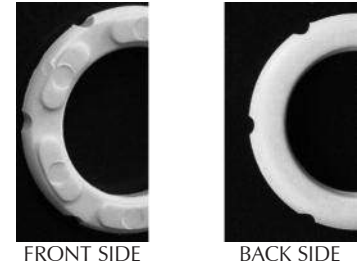
ELH

ELC

Cushions

Nason's 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.

SEAL DESIGN



HEAD CUSHIONS

H Standard Length Head Cushion

LH Long Head Cushion

ELH Extra-Long Head Cushion*

*NOTE: Extra-Long Cushions add length to cylinder. Refer to page 146 for details.

CAP CUSHIONS

C Standard Length Cap Cushion

LC Long Cap Cushion

ELC Extra-Long Cap Cushion*

*NOTE: Extra-Long Cushions add length to cylinder. Refer to page 146 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 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.*

- STEP 1:** Determine the total load to be stopped by the cylinder. Include the piston rod weight (see *piston rod weight chart* below).
- STEP 2:** Determine the velocity (in feet per second) at which the load impacts the cylinder end caps.
- STEP 3:** Use the following formula to calculate the energy the cylinder generates.
- STEP 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.

$$P=80 \text{ PSI} \quad W=26.25 \text{ lbs.} \quad V=6 \text{ FPS.} \quad K=.17$$

$$\text{Energy} = (26.25/64) \times (6^2) + (80 \times .17)$$

$$\text{Energy} = 28.36 \text{ ft/lbs.}$$

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

*Double Weight for double rod end cylinders.

Design Tips:

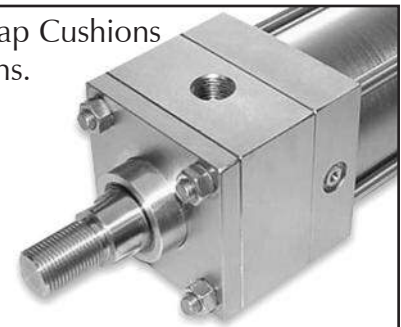
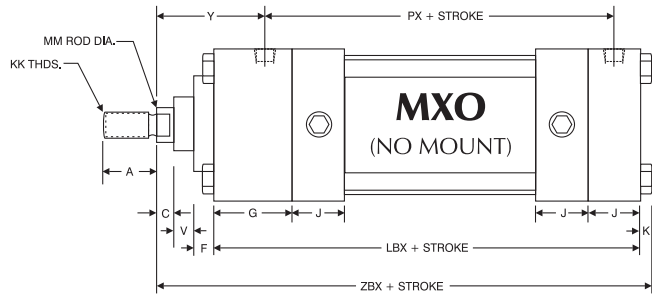
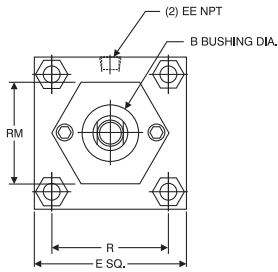
- Cushions Adjustment screws can be ordered on same side as ports. Refer to page 152 for details.
- BP Seals provide additional impact dampening and noise reduction. (Refer to page 144 for details).

BASIC OPTIONS

ELH

ELC

“ELH” Extra-Long Head Cushions and “ELC” Extra-Long Cap Cushions add length to the cylinder. Refer to the chart for dimensions.



(NAC-MS4-1.50" X 6" ELH - EN) Shown

BASIC DIMENSIONS 'MXO' STANDARD & OVERSIZE RODS

BORE	ROD DIAMETER	A	B	C	E	EE	F	G	J	K	KK	LBX	MM	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	0.625	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						
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	0.625	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		1.000			2.50 SQ.	0.500		
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	0.625	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		1.000			3.00 SQ.	0.500		
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	1.000	5.250	2.760	2.75 DIA.	0.250	2.375	8.500
	1.375 Oversize	1.625	2.000	0.625							1-14		1.375			3.75 SQ.	0.375		
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	1.000	5.250	3.320	2.75 DIA.	0.250	2.375	8.500
	1.375 Oversize	1.625	2.000	0.625							1-14		1.375			3.50 DIA.	0.375		
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	1.000	5.500	4.100	2.75 DIA.	0.250	2.375	8.813
	1.375 Oversize	1.625	2.000	0.625							1-14		1.375			3.50 DIA.	0.375		
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	1.375	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		1.750			0.500	3.000		
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	1.375	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		1.750			0.500	3.000		
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	1.750	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		2.000			0.375	3.188		
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	2.000	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		2.500			0.500	3.438		

FC

FCH

FCC

Fixed Head & Cap Cushions

NEW

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

CUSTOM LENGTH CUSHIONS

Custom length cushions can be designed for your application.

Contact Nason 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. Nason developed a 3.50" long head and cap cushion to meet the operating specifications.



BASIC OPTIONS

BSPT British Standard Pipe Taper

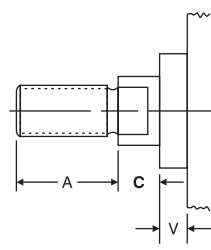
British Standard Pipe Taper (BSPT) threads have the same taper as American NPT tapered threads, but use a 55° Whitworth thread form and different diameters. (Not interchangeable with NPT)

BSPP British Standard Pipe Parallel

British Standard Pipe Parallel (BSPP), also referred to as BSP "Straight" Thread. (Not interchangeable with NPT)

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.

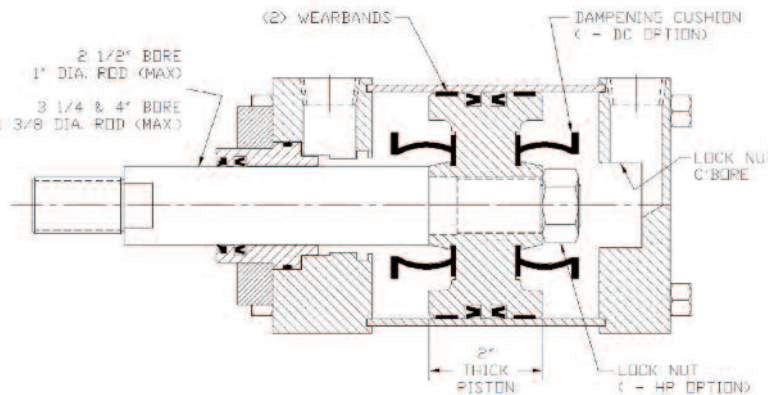


DC **DCH** **DCC** Dampening Cushions (ACE Controls NuCushions)

NEW The DC option, available on 2.50", 3.25" and 4.00" bore cylinders, greatly expand the range of available cylinder internal cushioning options. The DC option incorporates dual NuCushion bumpers, dual wear bands, and an extended length piston to achieve outstanding performance.

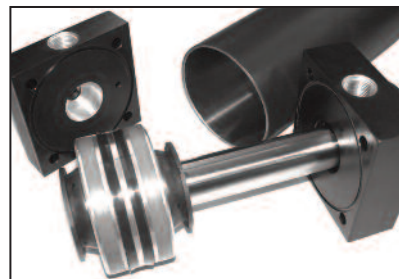
Application

The DC option has proven itself in the lumber industry. The "log kick out cylinder" application is one of the most demanding in a typical lumber mill. The industry has tried a variety of expensive custom cylinder designs to "cope" with the abuse the kickout cylinders see. Recent test cylinders at mills running 24/7 average 3 1/2 years of trouble free service.



DAMPENING CUSHIONS

- DC** Dampening Cushion at Head & Cap
- DCH** Dampening Cushion at Head
- DCC** Dampening Cushion at Cap



EN Electroless Nickel

EN or Electroless Nickel plating was invented in 1946, and has gained worldwide commercial usage since 1964. Common usages include aircraft landing gear, automotive brake cylinder and components, fuel injector parts, gas turbine parts, spray nozzles for chemical applications and many electronic devices including hard drives.

The properties of Electroless Nickel contribute to the multitude of uses. The coating provides an attractive finish, while exhibiting high abrasion and corrosion resistance. It's ability to uniformly coat blind holes, threads, internal surfaces and sharp edges contributes to its effectiveness. It has a very high bonding strength to the base metal (100,000-200,000 PSI), so much so that gas turbines use electroless nickel plating as a base to braze broken blades to.

NEW NASON PART NUMBER REVISION:

The "EN" Series used to be ordered as:
EN - MS4 - 2 X 10.

(Note: The "EN" Series was the "NAC" Series with "EN" feature)

By offering "EN" as an option, you can now make any Nason Series an Electroless Nickel Plated cylinder!

New Part Number: NAC - MS4 - 2 X 10 - EN

EN CYLINDER SPECIFICATIONS

EN PLATED PARTS:

Tube, Head, Cap, Bushing Retainer, Mounts (excluding MT1/MT2 which is hard chrome plated stainless steel).

OTHER COMPONENTS:

303/304 Stainless Steel: Tie Rods & Nuts, Retainer Screws, Piston Rod (hard chrome plated), Rod Bushing with PTFE Wear Band and Rod Wiper. (Optional: SAE 660 Bronze Rod Bushing)

EN PLATING SPECIFICATIONS:

HIGH PHOSPHORUS (highest corrosion resistant Electroless Nickel plating available)

COMPOSITION: 87-90% Nickel, 10-13% Phosphorus

HARDNESS: Rc 46-48

THICKNESS: .0005"-.0007"

LUBRICITY: Excellent (Similar to chrome)

COEFFICIENT OF FRICTION:

FRICITION: Low

FINISH: Bright and very smooth

Other types of EN plating are available. Contact Nason with your specifications for a prompt quote.

BASIC OPTIONS

HP High Impact Piston

NEW

Nason 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, ect.) a more robust connection may be needed.

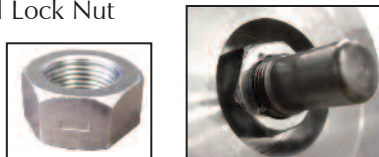
The "high impact" piston option consists of a steel castellated hex locking nut in addition to the standard piston to rod connection. The castle hex nut is also staked to the piston rod for added durability.

Special Features

Counter bored Piston, Zinc Plated Steel Lock Nut

Standard Features

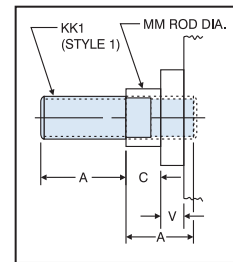
Staked Rod End, Permanent Loctite®, Threaded Piston to Rod Connection



KK3S Studded Piston Rod

KK3S option combines the KK3 female threaded rod end design and a case-hardened stud, with permanent Loctite®. 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.



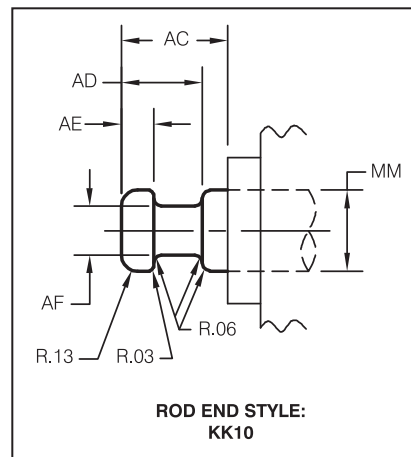
KK10 Rod Coupler End

NEW

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.

Example: NAC-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



KKX Special Rod Thread

NEW

Nason can machine virtually any diameter and type of rod thread on the piston rod end. Standard NFPA 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.

Note: Unless otherwise specified, the rod thread will be standard catalog "A" dimension lengths.

Example: NAC-MX0-2 x 6-KKX = 1/2-13 UNC

KKM Metric Rod Thread

NEW

ISO 6431 is a very popular European tie rod cylinder design. Equipment that is imported from outside the United States typically will contain metric tie-rod cylinders. In general, ISO 6431 tie rod cylinders are not as robust as NFPA cylinder designs and some customers prefer to replace the metric cylinders with NFPA designs that will provide longer life.

Nason can provide cylinders with metric piston rod end threads to assist customers in mating replacement cylinders to existing equipment.

Example: NAC-MX0-2.5 x 3.937-KKM = M10X1

BASIC OPTIONS: LUBE

L001 Magnalube G Grease

Magnalube G Grease is our standard lubricant used for all products except for WDN 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 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 for more information.

Color: Green

Recommended temperature range: -20°F to 200°F (-25°C to 90°C)

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)

L003 Low Temperature Grease

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)

L004 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 (-25°C to 90°C)

L005 USDA FOOD GRADE Grease

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)

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)

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 Nason for assistance.

Color: White-Grey

Recommended temperature range: -20°F to 375°F (-25°C to 190°C)

L008 WDN 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)

L011 EPDM Seal Lube

A silicone (Dimethyl Siloxane Polymer) based, tacky-stiff lubricant used specifically with EPDM type special seal materials. Note: this lube is not compatible with Nitrile seals.

Color: Clear

Recommended temperature range: -40°F to 300°F (-40°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: White

Recommended temperature range: 0°F to 300°F (-18°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-Grey Liquid

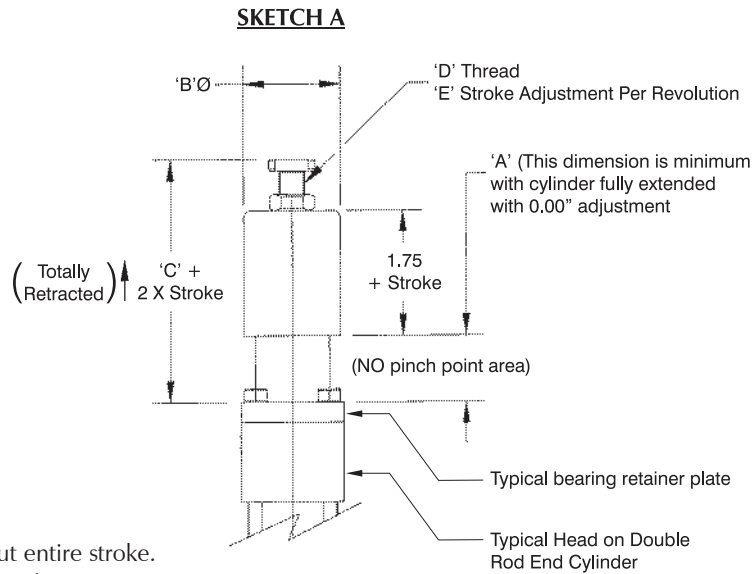
Recommended temperature range: -30°F to 300°F (-34°C to 149°C)

BASIC OPTIONS

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 6" stroke and adjustment*

*Note: The adjustment range is throughout entire stroke. Consult factory for longer stroke requirements or modifications not listed.



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.

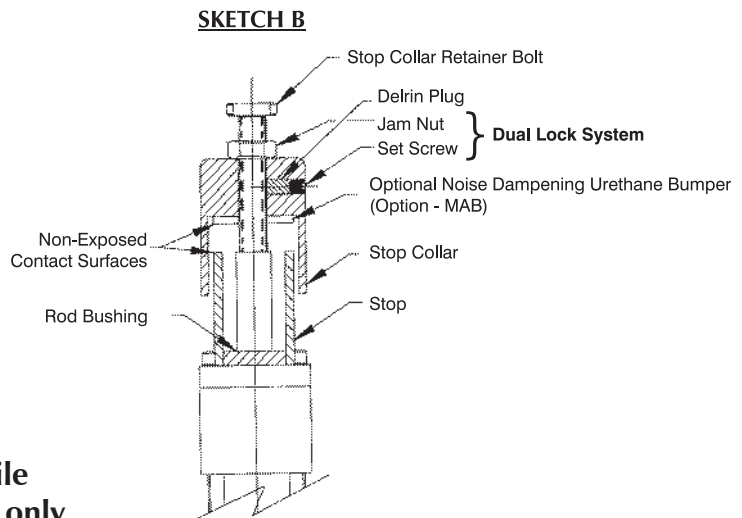
MICRO-ADJUST SET-UP INSTRUCTIONS:

- 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

A Noise dampening urethane bumper is added between the metal contact points, minimizing noise. (See sketch B)

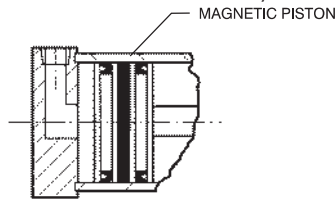
If the option you need isn't listed, just call Nason! We can accommodate most requests.

BASIC OPTIONS

MPR MPH Magnetic Piston

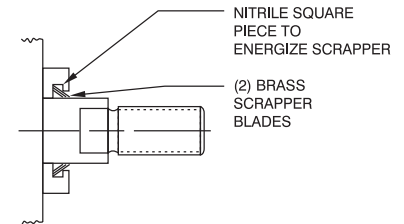
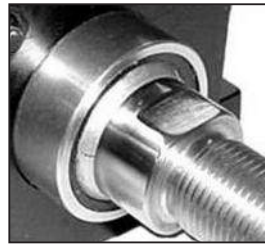
"MPR" Magnetic Pistons are used in conjunction with Nason R10, R10P, RHT, RAC Reed and MSS Solid State Switches. (See pages 194-199 for switches)

"MPH" Magnetic Pistons are used with Nason "Old Style" HE011, HE03SK and HE04SC Hall Effect Switches **Only**.



MS Metallic Rod Scraper

Aggressively scrapes the piston rod, removing foreign material such as spatter, sprays and powders. (Brass construction)



NR Non-Rotating (NFPA) Cylinders

2.00" through 12.00" Bore
200 PSI Air, 400 PSI Hydraulic
(Non-Shock)

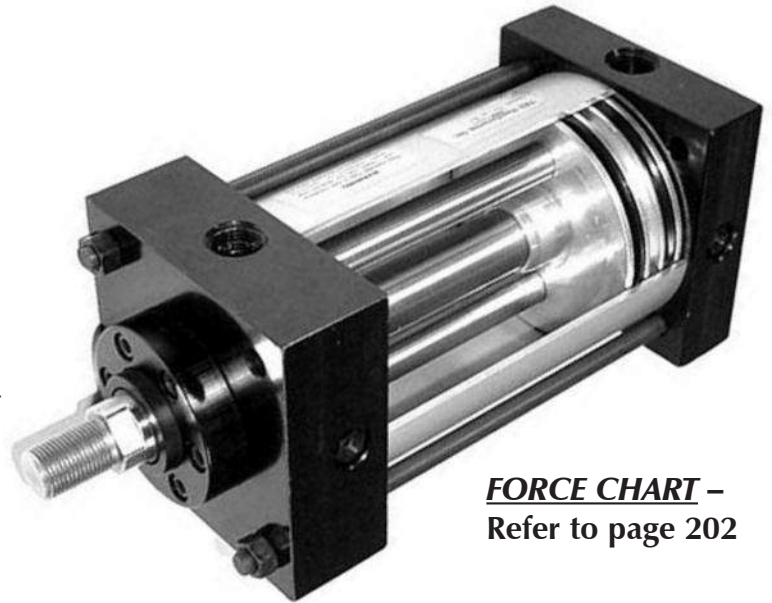
Benefits

- 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, not subjected to harsh cleaners
- Compact design saves space, no larger than standard NFPA cylinders!
- Durable, self-contained construction

Note: "NR" option not available in combination with "BP" bumper piston seal option.



FORCE CHART –
Refer to page 202

NEW

NASON PART NUMBER REVISION:

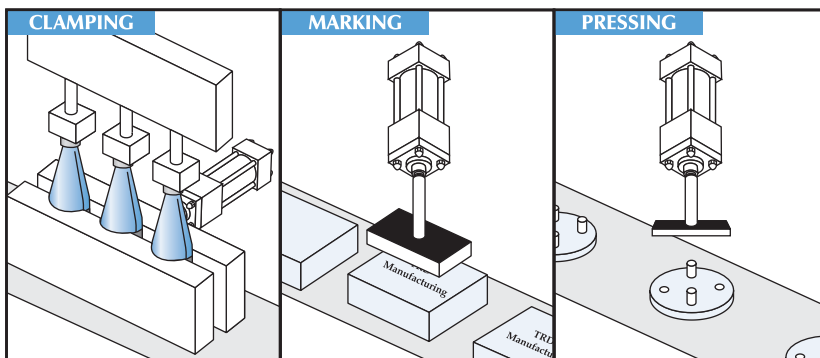
The "NR" Series used to be ordered as:
 NR - MS4 - 2 X 10.

(Note: The "NR" Series was the "NAC" Series with "NR" feature)

By offering "NR" as an option, you can now make any Nason Series a Non-Rotating cylinder!

New Part Number: NAC - MS4 - 2 X 10 - NR

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 Oversize	N/A	0.312	12"
	1.000 Standard	Available	0.375	18"
3.25	1.375 Oversize	Cap Only	0.375	18"
	1.000 Standard	Available	0.625	30"
4.00	1.375 Oversize	Available	0.625	30"
	1.000 Standard	Available	0.625	30"
5.00	1.375 Standard	Available	0.625	30"
	1.750 Oversize	Available	0.625	30"
6.00	1.375 Standard	Available	1.000	40"
	1.750 Oversize	Available	1.000	40"
8.00	1.750 Standard	Available	1.000	40"
	2.000 Oversize	Available	1.000	40"
10.00	2.000 Standard	Available	1.000	40"
	2.500 Oversize	Available	1.000	40"

BASIC OPTIONS

OP Optional Port Location

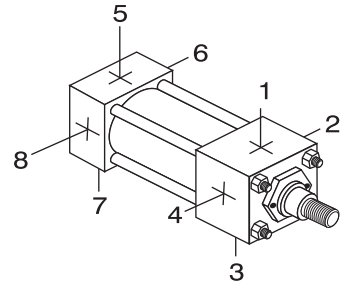
Optional port locations can be ordered simply by calling out the location numbers:

Example:

NAC - MS4 - 2 X 10 - 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 @ 1 & 5
- STANDARD CUSHION POSITIONS @ 2 & 6
- SPECIFY NON-STANDARD LOCATIONS WHEN ORDERING



NEW Optional Port and Cushion at Same Location ('NAC' Series)*

Now available, the ability to specify Ports and Cushions on the same cylinder side!

Ordering Examples:

NAC - MS4 - 2 X 10 - H1C5 - OP= 1 & 5

(Ports and Cushions @ 1 & 5)

NAC - MS4 - 2 X 10 - H2C6 - OP= 2 & 6

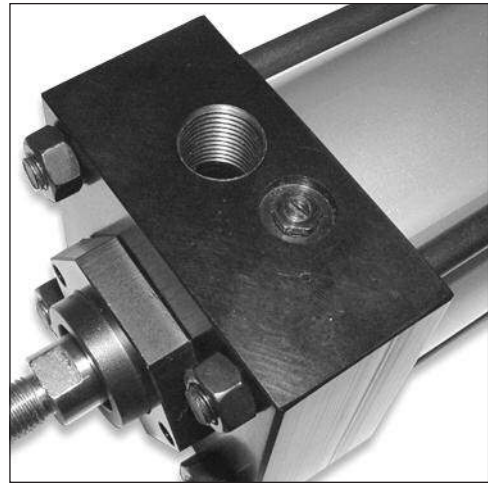
(Ports and Cushions @ 2 & 6)

NAC - MS4 - 2 X 10 - H1C6 - OP= 1 & 6

(Ports @ 1 & 6, Cushions @ 1 & 6)

Note: When optional port & cushion locations are ordered. Specify **both** port & cushion locations, even if a port or cushion is in the standard location.

*Check with factory for availability on other series.



BASIC DIMENSIONS:

HEAD VIEWS

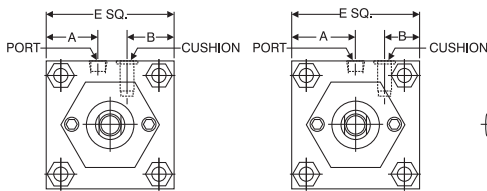
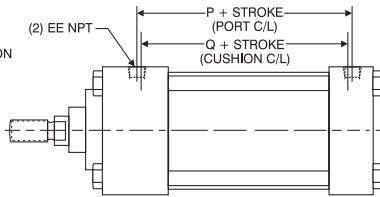


FIGURE #1

FIGURE #2



CAP VIEWS

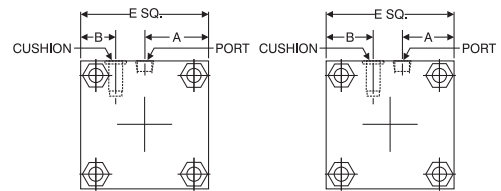


FIGURE #2

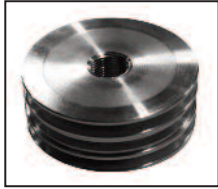
FIGURE #1

BORE	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			

BASIC OPTIONS:

OPTIONAL PISTON & ROD BUSHING MATERIALS

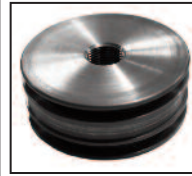
PMB Solid Brass Pistons



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.

PMC Solid Cast Iron Pistons



Solid cast iron pistons are standard in the HHD and MHD series. They can be ordered as an option for any other Nason 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.

PMD Solid Delrin® Pistons

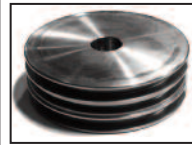


The most common use for solid Delrin® pistons are in moderate side load, high frequency applications to reduce heat build-up and also provide higher piston to tube contact than a wear band can provide.

Note: Solid Delrin® pistons must be used in conjunction with HP option.

Available bore sizes: 1.50" to 6.00" This option may require additional time for delivery depending on bore size and quantity.

SSP Solid Stainless Steel Pistons



Material: 303 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.

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 - Nason can provide special length rod bushings; contact Nason for details

RBC Solid G2 Durabar Cast Iron Rod Bushing, PTFE baked finish



This is our standard rod bushing material, used in all series (except for CRN and WDN 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 - Nason can provide special length rod bushings; contact Nason for details.

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 CRN Series cylinders, in food processing applications. The Delrin® material has a natural lubricity that extends the rod bushing life in repeated wear applications and requires no further lubrication. This material has exceptionally long bearing life in food processing applications.

RBS Solid Stainless Steel Rod Bushings (with PTFE wear band)



Material: 303 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 CRN Series.

BASIC OPTIONS: SEALS

LF Low Friction

"LF" Low Friction 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 (-25°C to 90°C)

OPERATING PRESSURE: 250 PSI AIR (17 BAR)

NASON PART NUMBER REVISION:

The "LF" Series used to be ordered as: LF - MS4 - 2 X 10.
(Note: The "LF" Series was the "NAC" Series with "LF" Low Friction feature.)

By offering "LF" as an option, you can now make the "NAC" or "SNC" Series a Low Friction Cylinder!

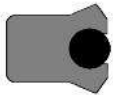
New Part Number: NAC - MS4 - 2 X 10 - LF

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 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.

Note: The piston will only contain one of these type seals since a "pressure trap" between two seals may occur.

MUST ALSO SPECIFY **LTG** (Low Temperature Grease) OPTION

How to order LT seal kit: SK100-325-LT (1" Rod, 3.25" Bore)

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)



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 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.

Note: The piston will only contain one of these type seals since a "pressure trap" between two seals may occur.

MUST ALSO SPECIFY **LTG** (Low Temperature Grease) OPTION

How to order LTE seal kit: SK137-500-LTE (1.375" Rod, 5" 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, rubberish 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.

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 (-25°C to 90°C)

PRESSURE RATING: 0 to 250 PSI Air (17 Bar);

0-400 PSI Hydraulic (27.6 Bar)

MATERIAL: Nitrile

TH 400 PSI Hydraulic (Non-Shock)

"NAC" and "SNC" Series can be ordered with the "TH" option.

RATING: 400 PSI Hydraulic, Non-Shock

SEALS: PISTON SEALS - (1) POLY-PAK, (1) Square-lip Rod Seal - POLY-PAK

NASON PART NUMBER REVISION:

The "TH" Series used to be ordered as:
TH - MS4 - 2 X 10.

(Note: The "TH" Series was the "NAC" Series with "TH" 400 PSI feature)

By offering "TH" as an option, you can now make the "NAC" or "SNC" Series a 400 PSI Hydraulic cylinder!

New Part Number: NAC - MS4 - 2 X 10 - TH

RWV Rod Wiper made of Viton

RWV Option contains - Fluorocarbon rod wiper

VS

Fluorocarbon Seals

VS Option contains- (2) Fluorocarbon U-Cup piston seals, Bushing O-Ring, rod seal and 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.

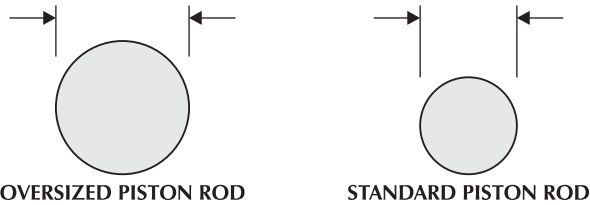
Benefits of Fluorocarbon Seals:

- Higher temperature performance: 0°F to 400°F (-20°C to 200°C)
- Higher chemical resistance: Resists most wash down solutions

Many other seal materials are available. Contact Nason for proper seal material selection in tough applications or environments.

BASIC OPTIONS

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 156.

SAE SAE "O"-Ring Boss Ports (SAE J514)

SAE ports can be ordered in place of NPT ports. Order by SAE number. (Example: SAE #10)

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)

SE Spring Extend (1.50" - 2.50" Bore)

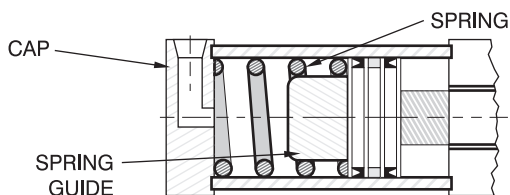
"SE" Option is designed to provide a spring bias to extend cylinder in the event of air pressure loss.

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

Note: Spring rates are for reference only - actual rates may vary from spring to spring.



SR Spring Retract (1.50" - 2.50" Bore)

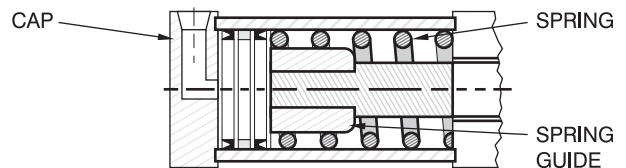
"SR" Option is designed to provide a spring bias to retract cylinder in the event of air pressure loss.

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

Note: Spring rates are for reference only - actual rates may vary from spring to spring.



Stainless Steel, when used in conjunction with Anodized Aluminum Heads, Caps and Tube, provide corrosion resistance in outdoor applications and wet environments.

Customize your cylinder by choosing from Stainless Steel Fasteners, Piston Rod, or Tie Rods & Nuts.

SSA Stainless Steel Piston Rod (Hard-Chrome Plated), Stainless Steel Fasteners, Stainless Steel Tie Rods & Nuts

SSF Stainless Steel Fasteners (Bushing Retainer Screws)

SSR Stainless Steel Piston Rod (Hard-Chrome Plated)

SST Stainless Steel Tie Rods and Nuts

SSC Stainless Steel Cushion Needle (External Adjustment Components)

SSN Stainless Steel Sleeve Nuts (SNC Series head end)

BASIC OPTIONS

ST Stop Tube

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 the cylinder bearing stress by adding length to the piston, which increases the overall length of the cylinder. (Note: Nason uses a double piston design for 2" and longer stop tubes.)

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 have 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 length, to the end of your cylinder model number.

Example:

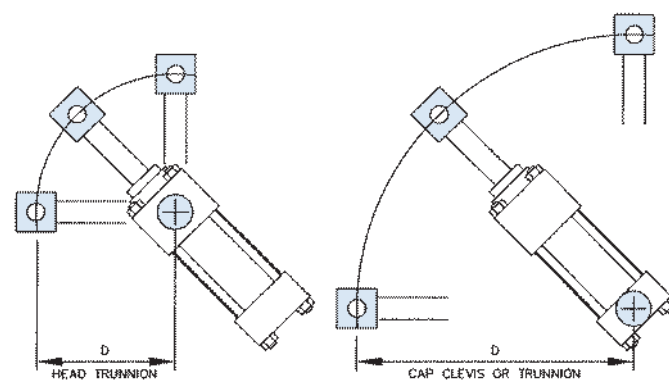
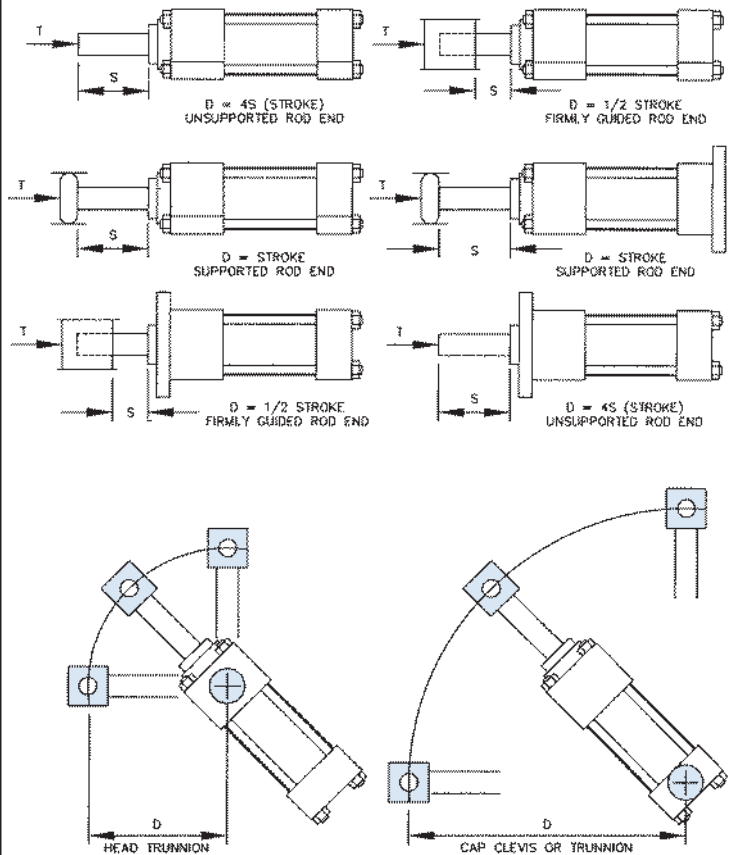
NAC - MP1 - 3.25" X 40" effective stroke - ST=2

As noted, the effective stroke must be included when ordering.

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.

Chart 2

Using the value of "D", find the recommended amount of stop tube

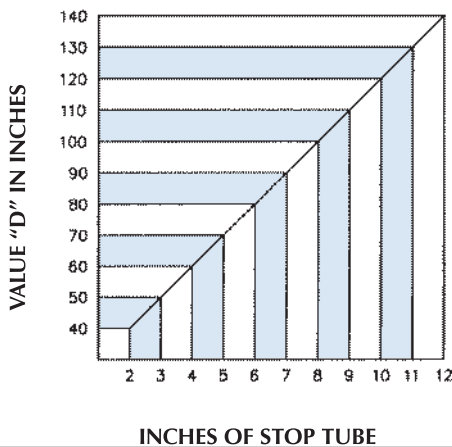
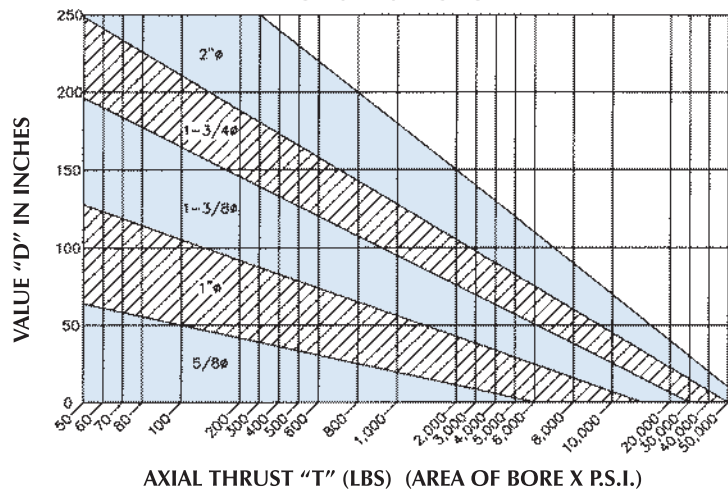


Chart 3

ROD SIZE SELECTION



BASIC OPTIONS

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 I.D. aluminum tube cylinders can offer. Nason 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.

STEEL TUBE SPEC: Hydraulic grade chrome plated I.D. and honed steel tubing, black epoxy paint finished O.D.

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 I.D. 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 "NAC" Series mounts are standard, they may not offer adequate strength to replace 1-piece all steel pivot style mount applications. As an option, Nason can furnish 1-piece steel mounts on request.
- Since hard chrome plating is not a 100% homogenous 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 pages 194-196 for Balluff Proximity end of stroke Sensors.



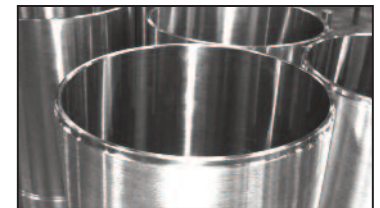
STEEL TUBE

TMSS Tube Material - Stainless Steel

NEW

Since Nason uses the exact same design in our basic NAC, SNC, and CRN 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 basically the same wall thickness as the aluminum tubes in our standard product lines. The stainless steel tubing I.D. is "stainless steel" (not hard chrome plated) and is honed to close tolerances.

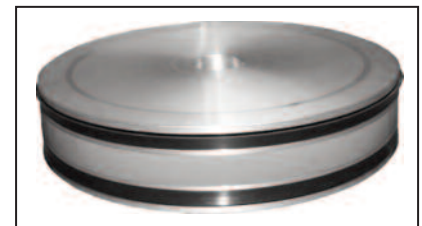


WB Piston Wear Band

Piston wear bands are standard on all Nason 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

WEAR BAND WIDTHS	
BORE	WEAR BAND WIDTH
1.50 - 8.00	0.375
10.00	0.750
12.00	1.000



SPECIAL WEAR BANDS

Nason 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.

Note: Special wear band widths will increase the overall cylinder length.



Special 1" width dual wear band



ST option with dual wear bands

BASIC OPTIONS

PRIVATE LABELING

Nason is pleased to announce the availability of affordable, custom made private labels. Thanks to recent capital expenditures, Nason has new label printers which can produce full color labels at no additional cost over standard labels. Private labels can feature your customer's logo (instead of the Nason logo), and provide additional information such as a customer's part number or contact information. These labels will increase your customer's replacement cylinder business!

Nason has offered some means of private label for years, however cost has always been a limiting factor. Commercial printing setup costs would often run several hundred dollars, and all label orders were subject to minimum quantities at expensive per labels rates. Initial setup could sometimes take weeks, and all reorders were subject to printing delays.


Nason's new printing method makes it easy to do private labeling. All private labels will be printed on the same machines our standard labels use, so there is no additional per label cost. The labels are setup and maintained by Nason staff, so creation times is measured in hours, not days or weeks. Minor changes to a label design, like updating a customer's address or telephone number, can be made by quickly modifying the database. There are no old, outdated pre-printed labels being wasted. Private labeling is now easier, faster and better than ever before.

New private labels can be setup for a one-time charge of \$75 NET per customer, per label size. Two sizes are available, 2" x 1" and 2" x 2" labels. Contact Nason for more information on setting up private labels for your customers.



**LION'S HEAD
BOTTLING**

P/N: AE4-MR3-0407 Bore/Stroke: 2" x 1"
S/N: 07-07145 125 PSI AIR MAX



INFINITY AIR

P/N: 3 1/4" x 6"
S/N: 07-01487
250 PSI AIR MAX



Bore / Stroke:
2 1/2" x 28"
S/N:
06-16469 (L1)
250 PSI AIR MAX



**STEEL WORKS
MACHINES**

7800 Beverly Blvd
Los Angeles, CA 90036
(323) 575-2458
www.steelworksmachines.com


P/N: SS0324-AC
S/N: 07-04195
8" x 36"
250 PSI AIR MAX




**HASTINGS
ROBOTICS**

123 Washington St
Dallas, TX 75201
(214) 987-6500

P/N:
C15.500.150.AB
S/N:
06-06278 / 0806
250 PSI AIR MAX



Bore / Stroke:
2 1/2" x 28"
S/N:
06-16469 (L1)
250 PSI AIR MAX



CHI TEC
1-800-765-4321

Bore/Stroke: 2 1/2" x 12"
S/N: 07-57421
250 PSI AIR MAX

AE-175-600-BK
07-14213
AUG2007
125 PSI Air Max

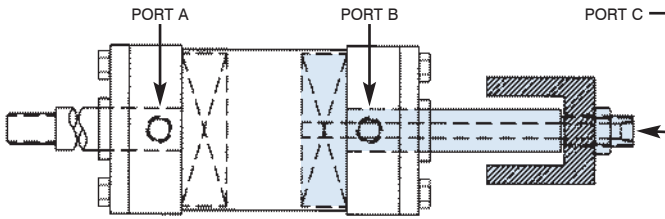


UNCOMMON OPTIONS

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.

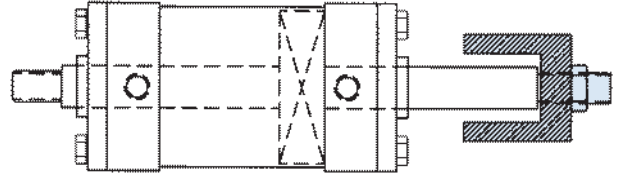
To order, specify "AS3POS" and length of adjustment.
(Example: AS3POS = 4")



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: Nason can provide paint in any color or type.

Contact Nason with your specifications.

Additional Finishes: Nason can provide special finishes, i.e., Nutride Plate

Contact Nason with your specifications — we would be pleased to provide a quote!

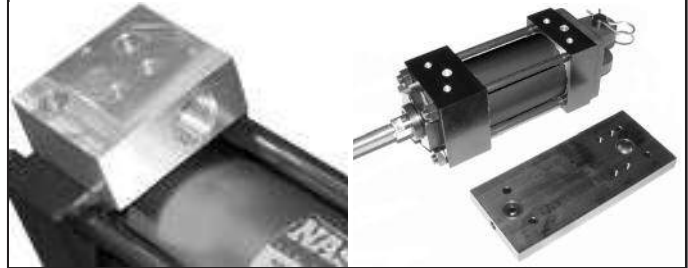
Heavy Chrome Plated Piston Rods.

Contact Nason for more information.

MANIFOLD BLOCK or PLATE

For OEM's, Nason can design and provide custom made manifolds in high quantity.

Contact Nason with your specifications.



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.



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 Nason for specifications)



SPECIAL MF1 FLANGE

Customer needed front flange mounting, but didn't have the room for the standard flanges.

Nason provided flanges that were notched for a more compact design.



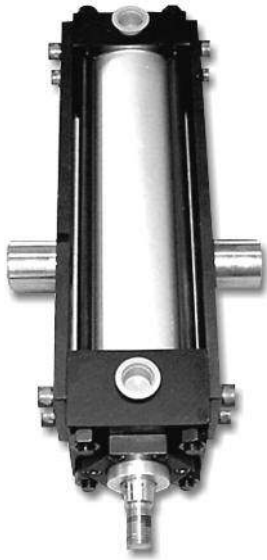
SPECIAL SHORT TAP WITH ORIFICE

Customer required a special short pipe tape, and different size drilled orifices at each end of cylinder, for built-in speed control.



UNCOMMON OPTIONS AND SPECIALS

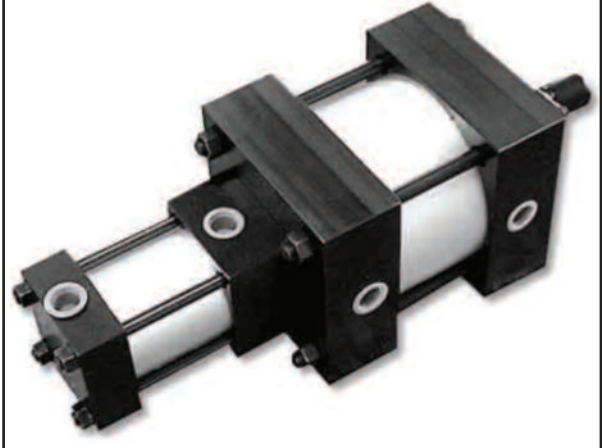
**MT4X BOLT-ON
SIDE PLATES**



**'SNC' WITH FLUSH
ROD BUSHING**



TANDEM WITH DIFFERENT SIZE BORES



SPECIAL STEEL MOUNTS



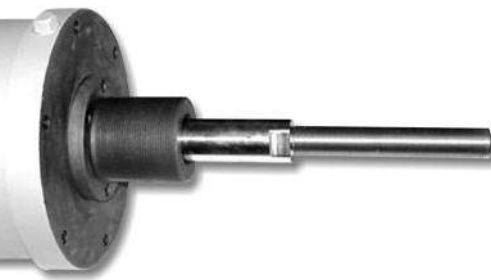
GREASE ZERKS (FOR HIGH CYCLE APPLICATIONS)



168" STROKE STAINLESS STEEL



**7.00" BORE STEEL NON-TIE ROD
DESIGN WITH "STEEL-IT" PAINT
(FOOD GRADE DESIGN)**



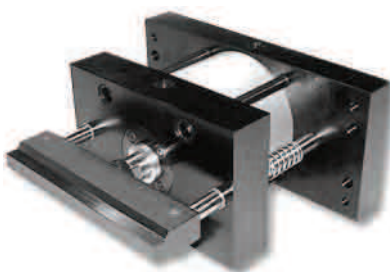
8.00" BORE - FRONT EXTENSION ADJUSTABLE STROKE



12.00" BORE STEEL, RATED FOR -40° F BELOW ZERO



**EXTERNAL NON-ROTATING
WITH SPECIAL TOOL PLATE**

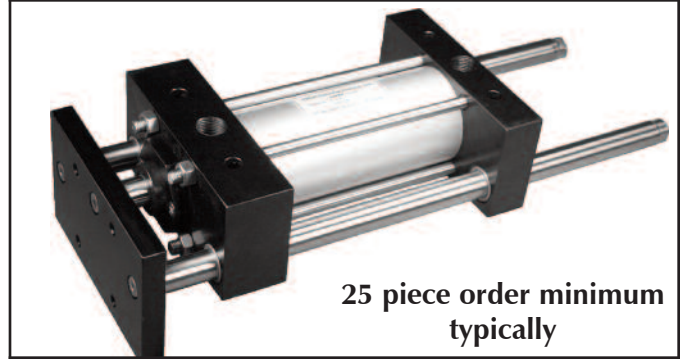


UNCOMMON OPTIONS AND SPECIALS

**TWIN PISTON ROD 6.00" BORE,
NON-ROTATING**

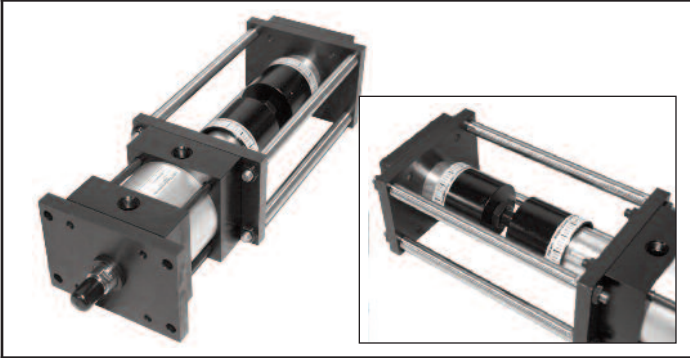


**2.00" BORE WITH EXTERNAL GUIDE RODS AND
TOOL PLATE, SS HARDWARE FOR WASHDOWN**

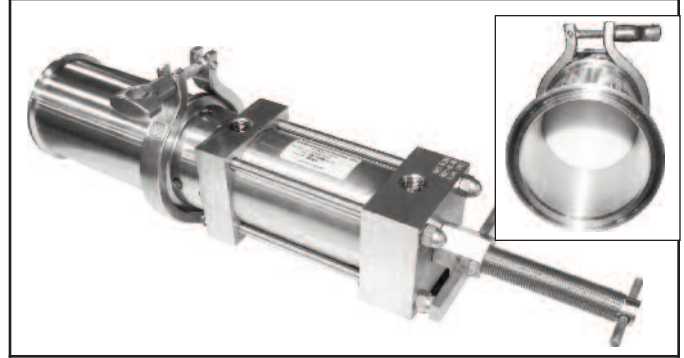


25 piece order minimum typically

**"MA" MICRO ADJUST ON EXTEND AND RETRACT
STROKE FOR PROCESS WEB CONTROL**



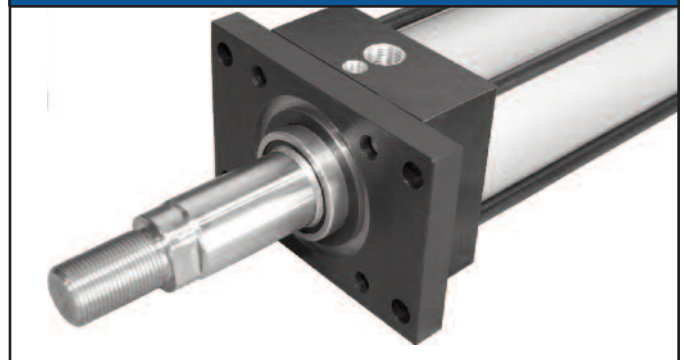
**3A SANITARY SS COUPLING WITH CYLINDER
FOR MEASURING AND DISPENSING FOOD**



**CLOSE TOLERANCE PISTON ROD MACHINING
AFTER CYLINDER IS ASSEMBLED**



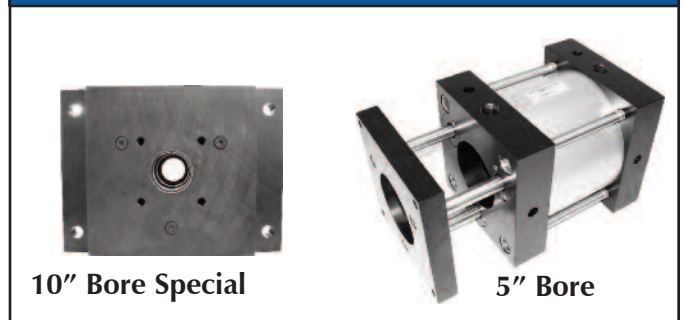
**VACUUM SEAL FACE WITH BUSHING VENT
(FOR FURNACE AND SILICON WAFER PROCESSES)**



AIR/OIL BOOSTER PUMP



TRIPLE ROD WITH THROUGH HOLE



10" Bore Special

5" Bore



NASON

NEW THINKING



HYDRAULIC SERIES 'HHD' & 'HMD' BASIC OPTIONS

Index To Standard Options:

	<u>PAGE</u>
• A= - Extended Piston Rod Thread	163
• AS - Adjustable Stroke (Retract)	163
• C= - Extended Piston Rod	163
• CS - Center Support.	163
• C or H - Cushions	164
• EK - Extended Key Plate	164
• EN - Electroless Nickel Plating	164
• HP - High Impact Piston (nut on piston rod)	164
• KKK - Non-Standard Rod Threads	165

	<u>PAGE</u>
• Multiple Mounts	165
• NR - Non-Rotating.	165
• Port Options (BSPP, BSPT, NPTF, SAE, Flange)	166
• RBB - Rod Bushing - Bronze (Ductile Iron is Standard)	166
• RLH - Rod Lock.	166
• SSR - Stainless Steel Piston Rod	166
• Seals (Piston, Rod, Tube, Wiper).	166
• ST - Stop Tube	167
• XX - Special Modifications	166

Uncommon Options:

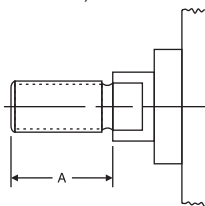
	<u>PAGE</u>
• AS3POS - Adjustable Mid Stroke (3 Position Cyl.)	169
• DAS - Double Rod Adjustable Stroke (Extend)	169
• Spherical Bearing (cap pivot mount).	169
• Extra Wide Multiple Wear Bands	169
• Hollow Piston Rods	169
• Rod Boots	169

	<u>PAGE</u>
• Paint and Other Special Finishes	169
• Back To Back Cylinders	170
• 3-Position Cylinders	170
• Tandem Cylinders	170
• Head & Cap Air Bleeds	170
• Rod Gland Drain	170

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!*

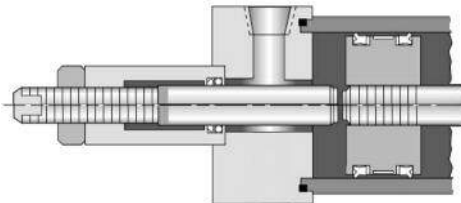
Note: Maximum thread length is double the standard "A" length.



AS Adjustable Stroke (Retract)

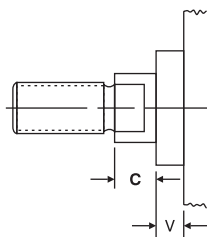
Consists of a threaded rod in the cylinder cap, non-removable. Provides an adjustable positive stop on the cylinder retract. *To order, specify "AS" and length of adjustment (Example: AS=3")*

ADJUSTABLE STROKE	
BORE	MAX. "AS"
1.50	Up to 8 inch
2.00-3.25	Up to 6 inch
4.00-6.00	Up to 5 inch
8.00	Up to 4 inch



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.



TIP

Piston rods can be made to any length up to 120 inches. Rods can be easily extended to move a cylinder to a more accessible location, or away from a less desirable environment.

Be sure to check piston rod column strength charts to properly size the rod and prevent buckling.

Extended piston rods do not delay delivery.

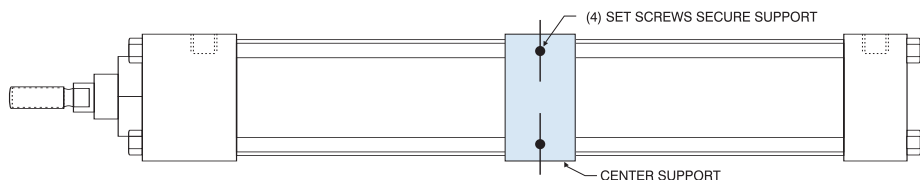
CS Center Supports

Center Supports are recommended for long stroke cylinders to support tube and prevent the tie rods from sagging. Properly supported cylinders will eliminate premature cylinder wear and eliminate tie rod vibration.

Center Supports can include MS2 mounts.

Contact Nason for more information.

CENTER SUPPORT RECOMMENDATIONS		
BORE	ONE SUPPORT	TWO SUPPORTS
1.50"	STROKES OVER 44 INCHES	STROKES OVER 89 INCHES
2.00"	STROKES OVER 74 INCHES	STROKES OVER 99 INCHES
2.50"	STROKES OVER 84 INCHES	NOT REQUIRED
3.25" - 8.00"	STROKES OVER 99 INCHES	



HYDRAULIC SERIES 'HHD' & 'HMD' BASIC OPTIONS

Cushions

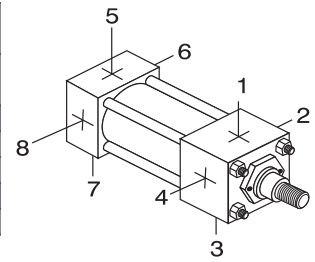
Nason's cushion design features industry proven technology and ultra fine adjustment needles for perfect deceleration and long life. Cushion adjustment needle positions need to be specified.

Example: H2C6

CUSHION LOCATIONS	
HEAD CUSHION	CAP CUSHION
H1	C5
H2	C6
H3	C7
H4	C8

STANDARD CUSHION LOCATIONS	
MOST MOUNTS	H2 C6
MS3 MOUNT	H3 C7
MT1 MOUNT	H3 C6
MT2 MOUNT	H2 C7

UNAVAILABLE CUSHION LOCATIONS BY MOUNT		
MOUNT	HEAD CUSHION	CAP CUSHION
ME5	H2, H4	
ME6		C6, C8
MS3	H2, H4	C6, C8
MT1	H2, H4	
MT2		C6, C8

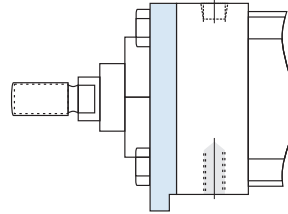


EK Extended Key Plate

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: 1.5" to 8" Bore



Refer to page 128 for all dimensions and details

EN Electroless Nickel

EN or Electroless Nickel plating was invented in 1946, and has gained worldwide commercial usage since 1964. Common usages include aircraft landing gear, automotive brake cylinder and components, fuel injector parts, gas turbine parts, spray nozzles for chemical applications and many electronic devices including hard drives.

The properties of Electroless Nickel contribute to the multitude of uses. The coating provides an attractive finish, while exhibiting high abrasion and corrosion resistance. It's ability to uniformly coat blind holes, threads, internal surfaces and sharp edges contributes to its effectiveness. It has a very high bonding strength to the base metal (100,000-200,000 PSI), so much so that gas turbines use electroless nickel plating as a base to braze broken blades to.

COMMON USAGES:

- **FOOD PROCESSING** — EN plating has been used to handle such diverse products as sodium hydroxide, food grade acids and fish oils. Excellent resistance to mild sanitizing caustics, chlorine, and chlorides in general. The natural smooth finish ensures cleanliness in food processing equipment.
- **PETROLEUM AND CHEMICAL** — The petroleum and chemical industry are large users of electroless nickel plating for corrosion protection. Design tip: Submit the list of chemicals and concentration levels to Nason for evaluation and recommendations. In some instances, Stainless Steel cylinders provide the best value and long cylinder life.
- **MEDICAL AND PHARMACEUTICAL** — The medical industry uses EN plated cylinders in clean-rooms, on equipment used to make plasma or IV bags, since it is critical that cylinder components need to be sterilized and particle "flake free". The pharmaceutical industry typically can be harsh on equipment, even abusive-but the equipment must remain completely reliable. EN cylinders provide the most reliable and cost effective choice.

EN CYLINDER SPECIFICATIONS

EN PLATED PARTS:

Tube, Head, Cap, Bushing Retainer, Mounts, Tie Rods and Nuts

OTHER COMPONENTS:

303/304 Stainless Steel: Rod Bushing Retainer
Screws, Piston Rod (hard chrome plated), SAE 660
Bronze Rod Bushing

EN PLATING SPECIFICATIONS:

HIGH PHOSPHORUS (highest corrosion resistant Electroless Nickel plating available)

COMPOSITION: 87-90% Nickel,
10-13% Phosphorus

HARDNESS: Rc 46-48

THICKNESS: .0005"-.0007"

LUBRICITY: Excellent (Similar to chrome)

COEFFICIENT OF FRICTION:

FRICITION: Low

FINISH: Bright and very smooth

MAX. STROKE = 50"

Other types of EN plating are available. Contact Nason with your specifications for a quote.

NOTE: Due to the lower yield strength, Stainless Steel piston rods should be sized for proper column strength.

HP "HP" Option

Heavy-Duty hex nut to retain piston to piston rod.

HYDRAULIC SERIES 'HHD' & 'HMD' BASIC OPTIONS

KKX Non-Standard Rod Threads

Cylinders piston rods can be furnished with non-standard rod threads.

Ordering Example: HHD - MF1 - 150 X 24 - 100 - KKX - .875 - 9UNC - P15 - SSSS

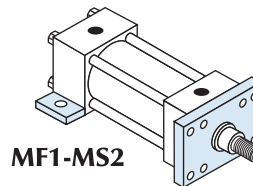
↑ Custom Rod Thread Size

MULTIPLE MOUNTS

Cylinders can be furnished with a wide selection of multiple mounts.

Ordering Example: HMD -MF1 -MS2 - 250 X 12 - 100 - KK1 - P15 - SSSS

↑ Add additional mount to part number



MF1-MS2

NR Non-Rotating (NFPA) Cylinders

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



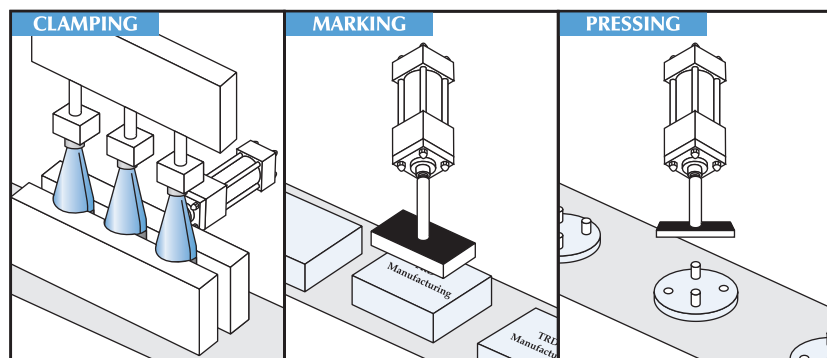
Advantages

- Eliminates the need for external guide shafts in many positioning applications
- Guide rods are internal, self-cleaning, not subjected to harsh cleaners
- Compact design saves space, no larger than standard NFPA cylinders!
- Durable, self-contained construction

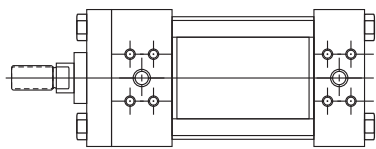
AVAILABLE BORE SIZES WITH 'NR' GUIDE ROD SIZES AND MAX. STROKE			
BORE	ROD DIA. (MM)	CUSHIONS	MAXIMUM STROKE
3.25	1.375	Cap Only	18"
5.00	2.000	Available	30"
6.00	2.500	Available	30"
	3.000		30"
8.00	3.500	Available	40"

Note: External guide rod models are available with rectangular head and cap. Contact Nason for more information.

Application Possibilities:



HYDRAULIC SERIES 'HHD' & 'HMD' BASIC OPTIONS

<p>PORT OPTIONS</p> <p>Cylinders can be furnished with NPTF or SAE O-Ring Boss (SAEJ514) ports at no-charge.</p> <p>Cylinders can be furnished with BSPP, BSPT, or SAE Flange Ports for additional cost.</p>	<p>BSPT <i>British Standard Pipe Taper</i></p> <p>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)</p>	<p>SAE FLANGE PORT</p>  <p><i>Contact Nason for more information.</i></p>
	<p>BSPP <i>British Standard Pipe Parallel</i></p> <p>British Standard Pipe Parallel (BSPP), also referred to as BSP "Straight" Thread. (Not interchangeable with NPT)</p>	

<p>RBB <i>Bronze Rod Bushings</i></p> <p>Cylinders can be furnished with Bronze (RBB) Rod Bushings (standard material: 150,000 PSI ductile iron, PTFE coated)</p>

<p>RLH <i>Rod Lock</i></p> <p>Cylinders can be furnished with Hydraulic Rod Locks. <i>Refer to pages 137-141 for complete specifications.</i></p>

<p>SSR <i>17-4 Stainless Steel Hard Chrome Plated Piston Rod</i></p> <p>Cylinders can be furnished with Hard Chrome plated Stainless Steel Piston Rods.</p> <p><i>Due to lower yield strength, stainless steel piston rods should be sized for proper column strength.</i></p>	<p>100,000 min. yield (rods up to 5.00) 75,000 min. yield (5.500 rod)</p>
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------

SEALS *The HHD & HMD Series allows for the use of different types of seal design and material compounds in every area, for maximum flexibility and performance.*

How to Order Seals

S S S S

PISTON SEAL	ROD SEAL	TUBE SEAL	ROD WIPER
S STANDARD (Carboxilated)	S STANDARD (Polyurethane)	S STANDARD (Buna)	S STANDARD (Flocked Nitrile)
C Cast-Ring	E EP	E EP	M Metallic Scraper
E EP	V Fluorocarbon	V Fluorocarbon	T PTFE
T PTFE			V Fluorocarbon
V Fluorocarbon			

<p>S <i>Standard Seals</i></p> <p>Piston: Carboxilated Nitrile Rod Seal: Polyurethane Tube Seals: Buna Rod Wiper: Flocked Nitrile</p> <p>Temperature Rating: -20°F to 200°F (-29°C to 93°C)</p> <p>Compatible with: Mineral based hydraulic fluids</p>

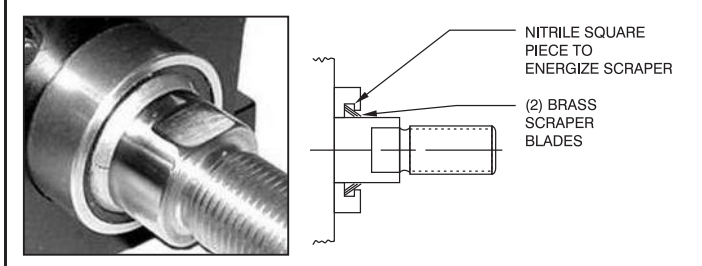
<p>E <i>Ethylene Propylene</i></p> <p>Temperature Rating: -50°F to 300°F (-45°C to 149°C)</p> <p>Compatible with: Most Phosphate Ester (Skydrol 500 and 7000, type 2) fluids</p>

<p>C <i>Cast Iron Piston Rings</i></p> <p>Temperature Range: Compatible with: Virtually all fluids</p>

<p>T <i>Glass Filled PTFE</i></p> <p>Temperature Rating: -100°F to 400°F (-73°C to 204°C)</p> <p>Compatible with: All Hydraulic fluids, and almost any fluid. Contact Nason for specific compatibility.</p>

<p>MS <i>Metallic Rod Scraper</i></p> <p>Aggressively scrapes the piston rod, removing foreign material such as spatter, sprays and powders. (Brass construction)</p>

<p>V <i>Fluorocarbon</i></p> <p>Temperature Rating: 0°F to 300°F (-18°C to 149°C) (Up to 400°F with reduced service life)</p> <p>Compatible with: Some Phosphate Ester (Houghto-Safe 1000, 1120; Pyrogard 42, 43, 53, 55) fluids; mineral based petroleum, halogenated hydrocarbons, silicate ester and diester fluids</p>



<p>XX <i>Special</i></p> <p>Non-standard seals can be furnished.</p> <p><i>Contact Nason for more information.</i></p>

HYDRAULIC SERIES 'HHD' & 'HMD' BASIC OPTIONS

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 insure 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: Nason 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 have 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:

HHD-MS2-2.50 X 42ES-100-KK2-
P15 = N375-SSSS-ST = 2

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)

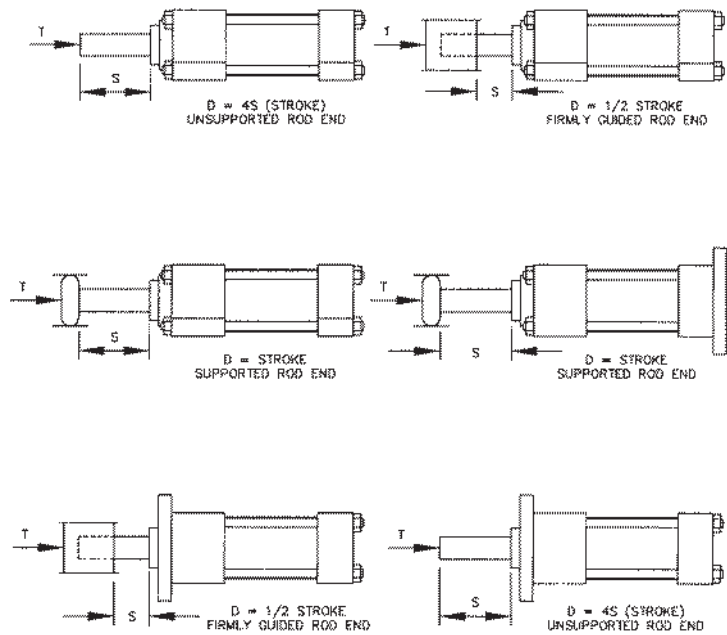
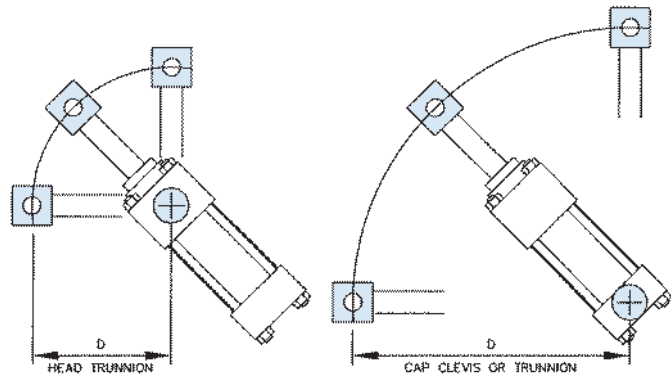
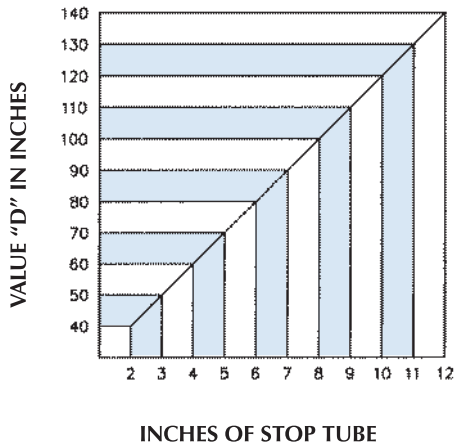


Chart 2

Using the value of "D", find the recommended amount of stop tube



Note: Measure "D" when cylinder is fully extended.

Refer to page 168 for Rod Size Selection Chart

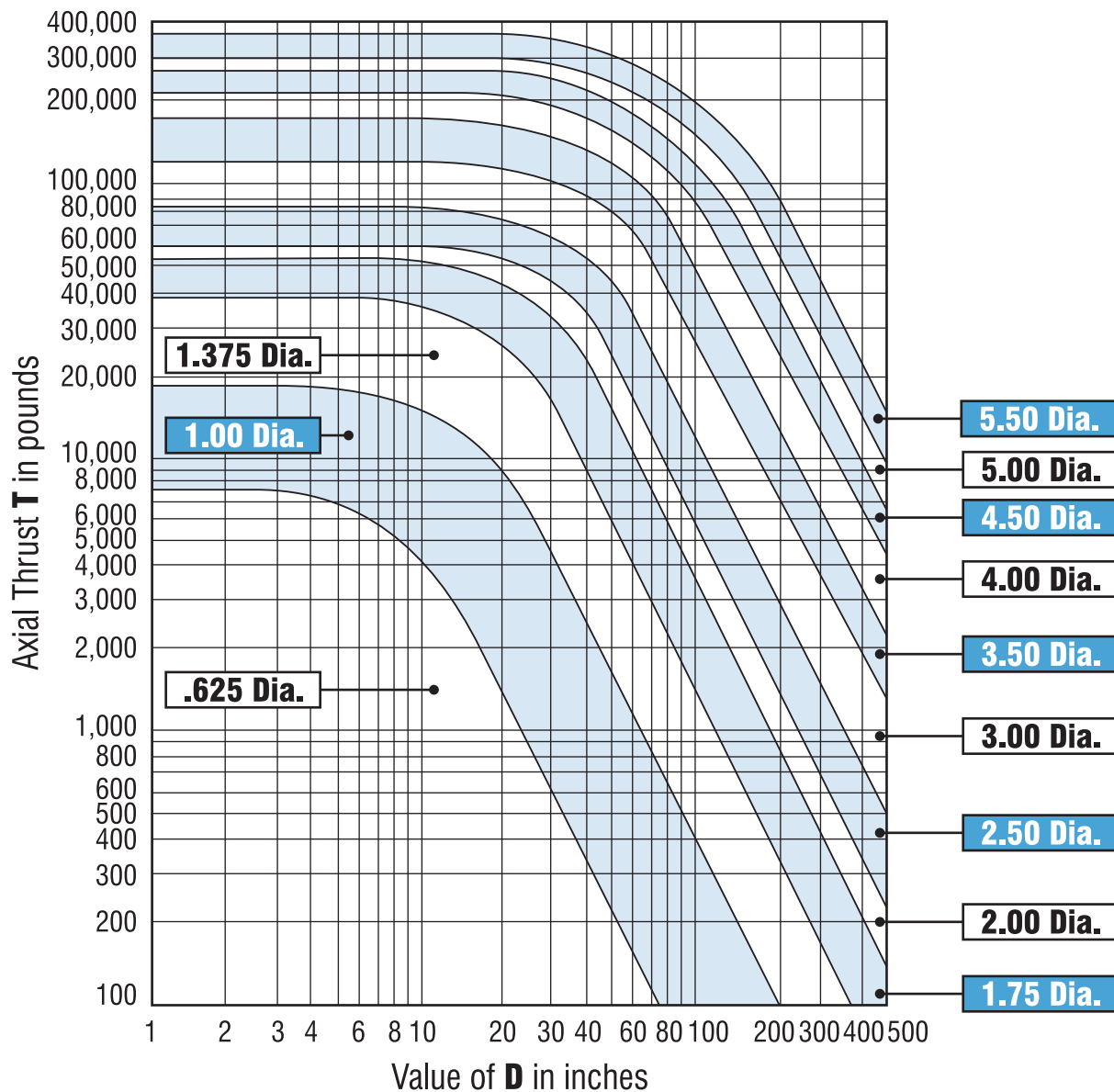
HYDRAULIC SERIES 'HHD' & 'HMD' BASIC OPTIONS

Piston Rod Size Selection

Standard rod sizes are usually suitable for shorter stroke applications at lower hydraulic 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). *Refer to pages 207 & 208 for cylinder force chart.*
2. From page 167, 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)

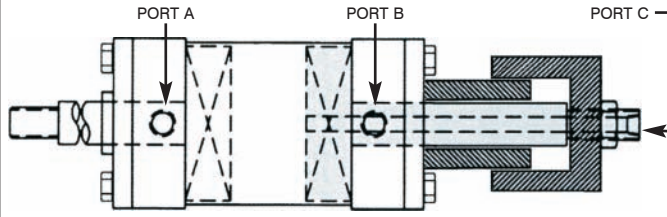


HYDRAULIC SERIES 'HHD' & 'HMD' UNCOMMON OPTIONS

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.

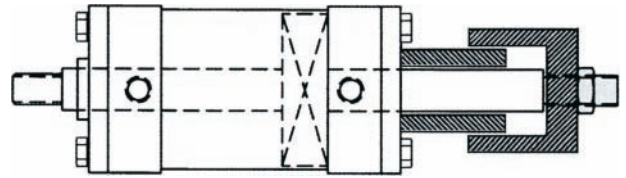
Contact Nason with your specifications.



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.

Contact Nason with your specifications.

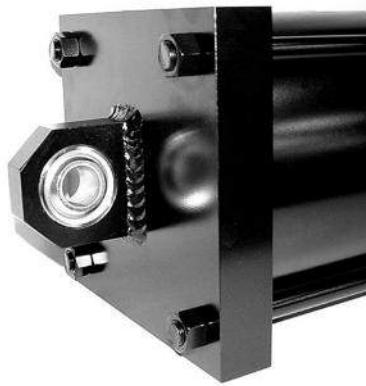


SPHERICAL PIVOT BEARINGS

Spherical pivot bearing mounts can be furnished as a weldment.

MP4SP
Spherical Mount.

Contact Nason with your specifications.



EXTRA WIDE MULTIPLE WEAR BANDS

8" Piston with two 1" wide wear bands shown.

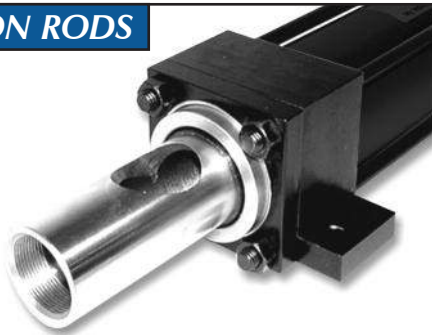


HOLLOW PISTON RODS

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.

Contact Nason for rod column strength limitations and more information.



ROD BOOTS

Rod Boots are common in dirty environments — a standard spec for many applications.

(Note: Rod Boots add length to cylinder rod extension — contact Nason for specifications)



SPECIAL FINISHES

Standard Finish: Black Urethane Paint (suitable for indoor or outdoor use.)

Optional Paint: Black Epoxy Paint (suitable for indoor use only.)

Additional Paint Choices: Nason can provide paint in any color or type.

Contact Nason with your specifications.

Additional Finishes: Nason can provide special finishes, i.e., Nutride Plate

Contact Nason with your specifications — we would be pleased to provide a quote!

Heavy Chrome Plated Piston Rods.

Contact Nason for more information.

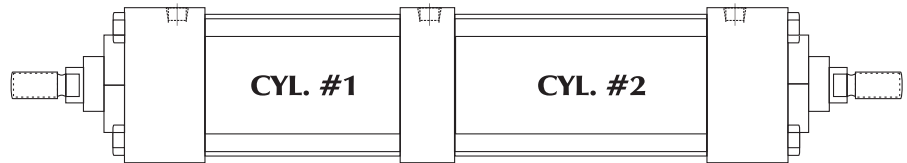


HYDRAULIC SERIES 'HHD' & 'HMD' UNCOMMON OPTIONS

BTB Back-To-Back Cylinders

Back to Back cylinders consist of two individual cylinders built as one unit. These cylinders can act as a 4 position cylinder.

Contact Nason for more information.



3P Three-Position Cylinder

You can create a 3-Position cylinder from two of the same bore size cylinders.

3-Position cylinders consist of multiple cylinders built as one unit having ONE exposed working rod end, capable of delivering 3 rod positions.

3-POSITION BENEFITS:

- **3-POSITIONS IN ONE CYLINDER** — One cylinder produces three different rod end positions. By varying stroke lengths, a multitude of positions can be created.
- **SIMPLIFIES MACHINE DESIGNS** — Eliminates the need for an additional cylinder to create a third position. 3-Position cylinders reduce space and the cost to mount multiple cylinders.

Note: Piston rods are not connected.

Contact Nason for more information..

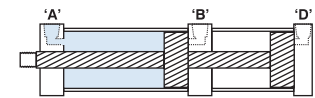
3-POSITION CYLINDERS

HOW THEY WORK

■ = PRESSURE

POSITION 1 (RETRACT)

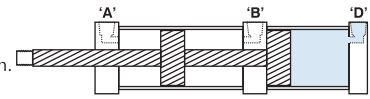
Pressure to port 'A' fully retracts cylinder.



(RETRACT)

POSITION 2 (MID-STROKE)

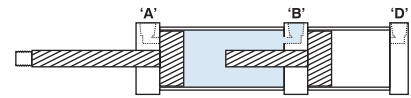
Pressure to port 'D' advances cylinder to mid-stroke position.



(MID-STROKE)

POSITION 3 (EXTEND)

Pressure to port 'B' fully extends cylinder.



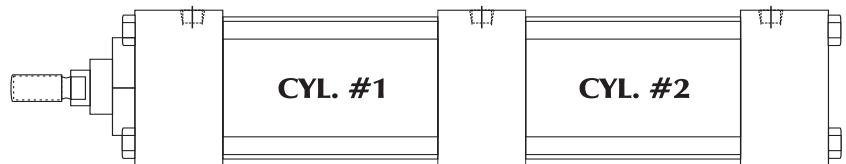
(EXTEND)

TM Tandem Cylinders

You can tandem different cylinders together to create unlimited design possibilities.

Note: Piston rods are connected.

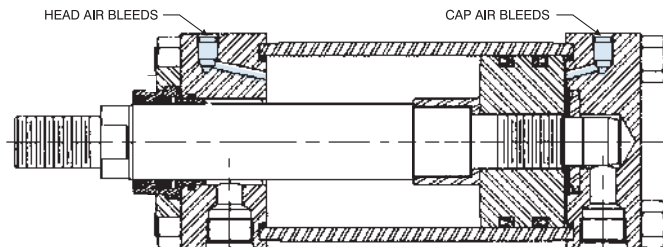
Contact Nason for more information.



HEAD & CAP AIR BLEEDS

Air bleeds can be provided at either or both ends of the 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.

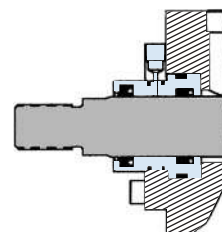
Contact Nason for more information..



ROD DRAIN

When no oil leakage can be tolerated, a rod bushing Drain port can be provided. Since there isn't any pressure in the drain line, clear tubing can offer a visual inspection of any leakage. A constant leak indicates that the rod seal is worn and needs to be replaced.

Contact Nason for more information.



NOTES

Basic Options - Hydraulic

Uncommon Options - Hydraulic

Accessories
Page 172

Switches
Page 184

Technical Data
Page 198



NASON

NEW THINKING

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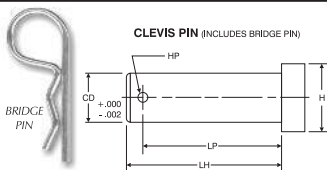
Accessories, Mounts, Alignment Couplers, Flow Controls

ACCESSORIES: CLEVIS, PINS & MOUNTS

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	
12.00	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)					
PART NO.	CD	H	HP	LH	LP
CP500	0.500	0.625	0.156	2.250	2.094
CP750	0.750	0.938	0.156	3.000	2.844
CP1000	1.000	1.188	0.203	3.500	3.313

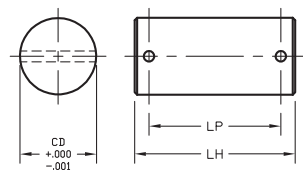


CLEVIS PIN (INCLUDES BRIDGE PIN)

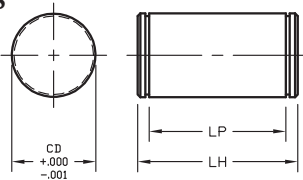
MATERIAL: 1018 CRS
FINISH: BLACK OXIDE

PIVOT PIN (INCLUDES COTTER PINS)					PIVOT PIN (INCLUDES E-CLIPS)				
PART NO	MAX LOAD (TENSION) RATED IN LBS	CD	LP	LH	PART NO	MAX LOAD (TENSION) RATED IN LBS	CD	LP	LH
CP500C	5800	0.500	1.938	2.281	CP500E	5800	0.500	1.875	2.094
CP750C	13250	0.750	2.719	3.094	CP750E	13250	0.750	2.625	2.938
CP1000C	23500	1.000	3.219	3.594	CP1000E	23500	1.000	3.125	3.375
CP1375C	44500	1.375	4.250	4.656	CP1375E	44500	1.375	4.188	4.484
CP1750C	72000	1.750	5.250	5.656	CP1750E	72000	1.750	5.188	5.547
CP2000C	94000	2.000	5.281	5.719	CP2000E	94000	2.000	5.188	5.547
CP2500C	145000	2.500	6.313	6.781	CP2500E	145000	2.500	6.188	6.641
CP3000C	210000	3.000	6.348	6.844	CP3000E	210000	3.000	6.188	6.781
CP3500C	285000	3.500	8.406	8.969	CP3500E	285000	3.500	8.188	8.859
CP4000C	375000	4.000	9.406	9.969	CP4000E	375000	4.000	9.188	9.859

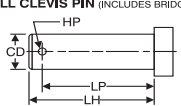
PIVOT PIN (INCLUDES COTTER PINS)



PIVOT PIN (INCLUDES E-CLIPS)



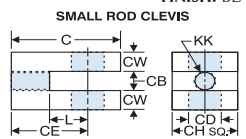
SMALL CLEVIS PIN (WITH BRIDGE PIN)				
PART NO.	CD	HP	LH	LP
CP500CCS	0.500	0.156	1.375	1.250
CP750CCS	0.750	0.156	2.000	1.875



SMALL CLEVIS PIN (INCLUDES BRIDGE PIN)

MATERIAL: 1018 CRS
FINISH: BLACK OXIDE

SMALL ROD CLEVIS									
PART NO.	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



SMALL ROD CLEVIS

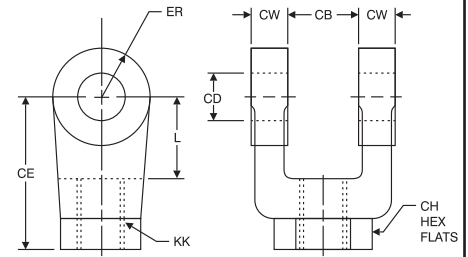
MATERIAL: 1018 CRS
FINISH: BLACK OXIDE

ACCESSORIES: CLEVIS, PINS & MOUNTS

ROD CLEVIS DIMENSIONS									
PART NO	MAX LOAD (TENSION)	CB	CD (DIA.)	CE	CH	CW	ER (RADIUS)	KK	
RC437	2950	0.750	0.500	1.500	1.000	0.500	0.500	7/16-20	0.750
RC500	4000	0.750	0.500	1.500	1.000	0.500	0.500	1/2-20	0.750
RC750	11200	1.250	0.750	2.375	1.250	0.625	0.750	3/4-16	1.250
RC875	11200	1.250	0.750	2.375	1.250	0.625	0.750	7/8-14	1.250
RC1000	19500	1.500	1.000	3.125	1.500	0.750	1.000	1-14	1.500
RC1250	26800	2.000	1.375	4.125	2.000	1.000	1.375	1 1/4-12	2.125
RC1375	26800	2.000	1.375	4.125	2.000	1.000	1.375	1 3/8-12	2.125
RC1500	39500	2.500	1.750	4.500	2.375	1.250	1.750	1 1/2-12	2.250
RC1750	54700	2.500	1.750	4.500	2.375	1.250	1.750	1 3/4-12	2.250
RC1875	56000	2.500	2.000	5.500	3.000	1.250	2.000	1 7/8-12	2.500
RC2250	84000	3.031	2.500	6.500	3.500	1.500	2.500	2 1/4-12	3.000
RC2500	84000	3.031	3.000	6.750	3.875	1.500	2.750	2 1/2-12	3.250
RC3250	155000	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

ROD CLEVIS

MATERIAL: CAST STEEL
FINISH: BLACK OXIDE



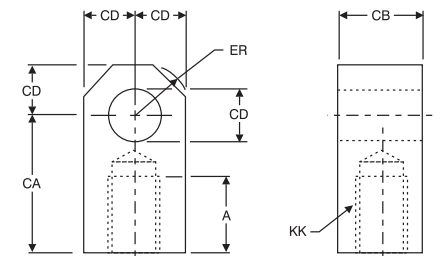
(Clevis Pins sold separately from Rod Clevises)

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 EYE DIMENSIONS							
PART NO	MAX LOAD (TENSION) RATED IN LBS	A	CA	CB	CD (DIA.)	ER (RADIUS)	KK
RE437	2950	0.750	1.500	0.750	0.500	0.625	7/16-20
RE500	3350	0.750	1.500	0.750	0.500	0.625	1/2-20
RE750	8400	1.125	2.063	1.250	0.750	0.875	3/4-16
RE1000	13500	1.625	2.813	1.500	1.000	1.813	1-14
RE1250	24500	2.000	3.438	2.000	1.375	1.563	1 1/4-12
RE1500	39000	2.250	4.000	2.500	1.750	2.000	1 1/2-12
RE1875	45000	3.000	5.000	2.500	2.000	2.500	1 7/8-12
RE2250	67000	3.500	5.810	3.000	2.500	2.813	2 1/4-12
RE2500	81000	3.500	6.125	3.000	3.000	3.250	2 1/2-12
RE3250	125000	4.500	7.625	4.000	3.500	3.875	3 1/4-12
RE3500	125000	5.000	7.625	4.000	3.500	3.875	3 1/2-12
RE4000	162000	5.500	9.125	4.500	4.000	4.438	4-12

ROD EYE

MATERIAL: 1018 CRS
FINISH: BLACK OXIDE



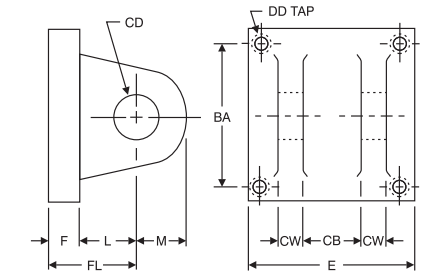
(Clevis Pins sold separately from Rod Eyes)

Note: When using a Rod Eye in combination with a Clevis Bracket, the operating angle is +/-90° from the bracket center line.

CLEVIS BRACKET DIMENSIONS											
PART NO.	MAX LOAD (TENSION) RATED IN LBS	BA	CB	CD (DIA.)	CW	DD	E	F	FL	L	M
CB500	4500	1.625	0.750	0.500	0.500	3/8-24	2.500	0.375	1.125	0.750	0.500
CB750	8400	2.563	1.250	0.750	0.625	1/2-20	3.500	0.625	1.875	1.250	0.750
CB1000	13500	3.250	1.500	1.000	0.750	5/8-18	4.500	0.750	2.250	1.500	1.000
CB1375	34000	3.813	2.000	1.375	1.000	5/8-18	5.000	0.875	3.000	2.125	1.375
CB1750	54000	4.938	2.500	1.750	1.250	7/8-14	6.500	0.875	3.125	2.250	1.750
CB2000	89000	5.750	2.500	2.000	1.250	1-14	7.500	1.000	3.500	2.500	2.000
CB2500	124000	6.594	3.000	2.500	1.500	1 1/8-12	8.500	1.000	4.000	3.000	2.500
CB3000	126000	7.500	3.000	3.000	1.500	1 1/4-12	9.500	1.000	4.250	3.250	2.750
CB3500	126000	9.625	4.000	3.500	2.000	1 3/4-12	12.625	1.688	5.688	4.000	3.500

CLEVIS BRACKET

MATERIAL: CAST STEEL
FINISH: BLACK OXIDE

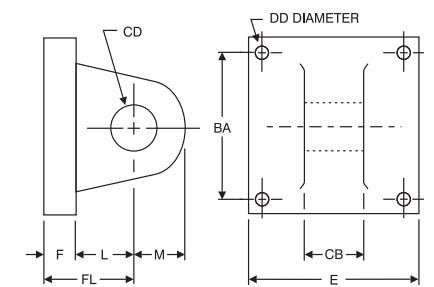


(Clevis Pins sold separately from Clevis Brackets)

EYE BRACKET DIMENSIONS										
PART NO	MAX LOAD (TENSION) RATED IN LBS	BA	CB	CD (DIA.)	DD	E	F	FL	L	M
EB500	3375	1.625	0.750	0.500	0.406	2.500	0.375	1.125	0.750	0.500
EB750	8400	2.563	1.250	0.750	0.531	3.500	0.625	1.875	1.250	0.750
EB1000	13500	3.250	1.500	1.000	0.656	4.500	0.750	2.250	1.500	1.000
EB1375	25000	3.813	2.000	1.375	0.656	5.000	0.875	3.000	2.125	1.375
EB1750	45000	4.938	2.500	1.750	0.906	6.500	0.875	3.125	2.250	1.750
EB2000	45000	5.750	2.500	2.000	1.063	7.500	1.000	3.500	2.500	2.000
EB2500	67000	6.594	3.000	2.500	1.188	8.500	1.000	4.000	3.000	2.500
EB3000	115000	7.500	3.000	3.000	1.313	9.500	1.000	4.250	3.250	2.750
EB3500	162000	9.625	4.000	3.500	1.813	12.625	1.688	5.688	4.000	3.500
EB4000	200000	11.500	4.500	4.000	2.063	14.875	1.938	6.480	4.500	4.000

EYE BRACKET

MATERIAL: CAST STEEL
FINISH: BLACK OXIDE



(Clevis Pins sold separately from Eye Brackets)

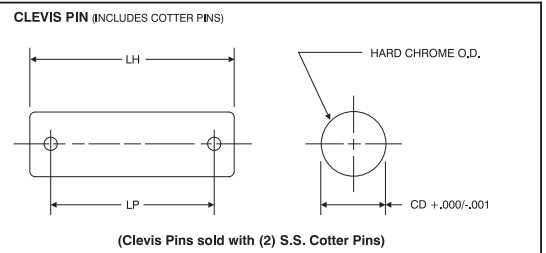
ACCESSORIES: STAINLESS STEEL CLEVIS, PINS & MOUNTS

Stainless Steel Accessories Cross Reference Chart

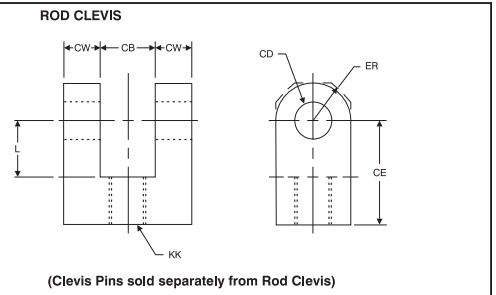
CYLINDER MODEL				ACCESSORIES					
BORE	ROD SIZE	ROD STYLE (KK)		ROD THREAD	ROD CLEVIS	ROD EYE	CLEVIS PIN	CLEVIS BRACKET	EYE BRACKET
1.50, 2.00, 2.50	0.625	#1 (STANDARD)	KK1	7/16 -20	SS-RC437	SS-RE437	SS-CP500	SS-CB500	SS-EB500
		#2	KK2	1/2 -20	SS-RC500	SS-RE500	SS-CP500		
	1.000	#1 (ST'D-OVERSIZE)	KK1	3/4 -16	SS-RC750	SS-RE750	SS-CP750		
		#4	KK4	1 -14	SS-RC1000	SS-RE1000	SS-CP1000		
3.25, 4.00, 5.00	1.000	#1 (STANDARD)	KK1	3/4 -16	SS-RC750	SS-RE750	SS-CP750	SS-CB750	SS-EB750
		#4	KK4	1 -14	SS-RC1000	SS-RE1000	SS-CP1000		
	1.375	#1 (ST'D-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 (ST'D-OVERSIZE)	KK1	1 1/4 -12	SS-RC1250	N/A	SS-CP1375		
		#2	KK2	1 1/2 -12	SS-RC1500	N/A	SS-CP1750		

Accessories (303 Stainless Steel)

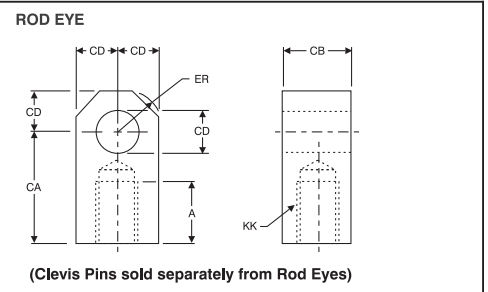
CLEVIS PIN (WITH COTTER PINS)			
PART NO.	CD	LH	LP
SS-CP500	0.500	2.250	1.938
SS-CP750	0.750	3.000	2.719
SS-CP1000	1.000	3.500	3.219
SS-CP1375	1.375	5.000	4.250
SS-CP1750	1.750	6.000	5.500



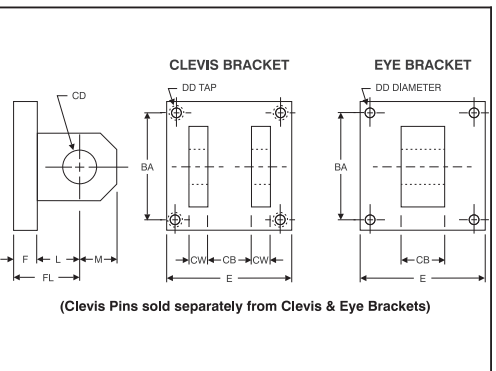
ROD CLEVIS							
PART NO.	CB	CD	CE	CW	ER	KK	L
SS-RC437	0.750	0.500	1.500	0.500	0.500	7/16 -20	0.750
SS-RC500						1/2 -20	
SS-RC750	1.250	0.750	2.375	0.625	0.750	3/4 -16	1.250
SS-RC1000	1.500	1.000	3.125	0.750	1.000	1 -14	1.500
SS-RC1250	2.000	1.375	4.125	1.000	1.375	1 1/4 -12	2.125
SS-RC1500	2.500	1.750	4.500	1.250	1.750	1 1/2 -12	2.250



ROD EYE						
PART NO.	A	CA	CB	CD	ER	KK
SS-RE437	0.750	1.500	0.750	0.500	0.625	7/16 -20
SS-RE500						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



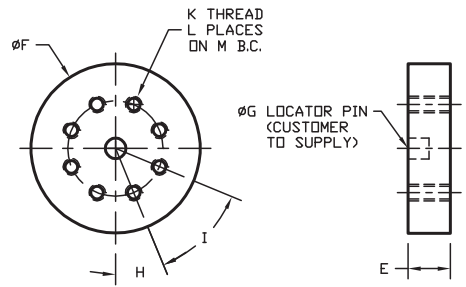
CLEVIS BRACKETS AND EYE BRACKETS											
PART NO.	BA	CB	CD	CW	DD	E	F	FL	L	M	
SS-CB500	1.625	0.750	0.500	0.500	3/8 -24	2.500	0.375	1.125	0.750	0.625	
SS-CB750	2.563	1.250	0.750	0.625	1/2 -20	3.500	0.625	1.875	1.250	0.750	
SS-CB1000	3.250	1.500	1.000	0.750	5/8 -18	4.500	0.750	2.250	1.500	1.000	
SS-CB1375	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



ACCESSORIES: CLEVIS, PINS & MOUNTS

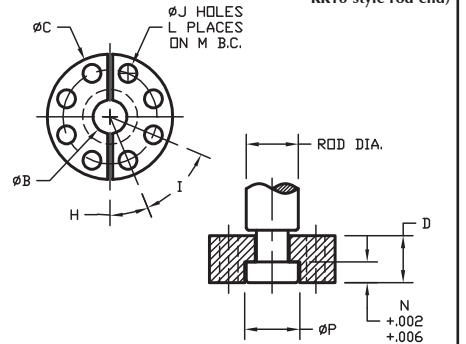
WELD PLATE DIMENSIONS									
PART NO	ROD DIA.	E	F	G (DIA.)	H	I	K	L	M
WP625	0.625	0.500	2.000	0.250	45.0°	90.0°	10 -20	4	1.125
WP1000	1.000	0.500	2.500	0.250	30.0°	60.0°	1/4 -20	6	1.500
WP1375	1.375	0.625	3.000	0.250	30.0°	60.0°	5/16 -18	6	2.000
WP1750	1.750	0.625	4.000	0.250	22.5°	45.0°	5/16 -18	8	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

WELD PLATE



FLANGE END COUPLER DIMENSIONS											
PART NO	ROD DIA.	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

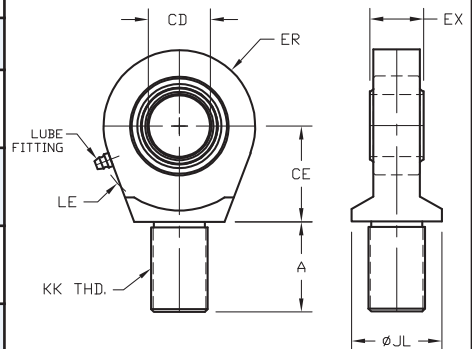
FLANGE END COUPLER



(To be used with KK10 style rod end)

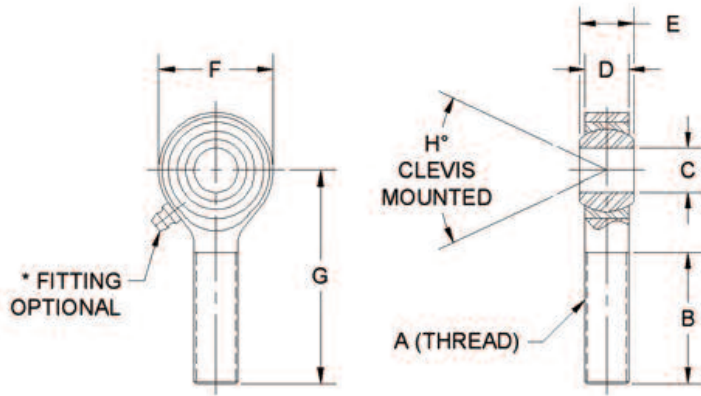
MALE SPHERICAL ROD EYE DIMENSIONS											
PART NO	BORE (REF.)	ROD DIA.	A	CD	CE	ER	EX	JL	KK	LE	LOAD CAPACITY LBS
HH-MSRE-500	1.50	0.625	0.688	0.500	0.875	0.875	0.437	0.875	7/16 -20	0.750	2600
		1.000									
HH-MSRE-750	2.00	1.000	1.000	0.750	1.250	1.250	0.656	1.313	3/4 -16	1.063	9400
		1.375									
HH-MSRE-750	2.50	1.000	1.000	0.750	1.250	1.250	0.656	1.313	3/4 -16	1.063	9400
		1.375									
		1.750									
HH-MSRE-1000	3.25	1.375	1.500	1.000	1.875	1.375	0.875	1.500	1 -14	1.438	16800
		1.750									
		2.000									
HH-MSRE-1375	4.00	1.750	2.000	1.375	2.125	1.813	1.188	2.000	1 1/4 -12	1.875	28500
		2.000									
		2.500									
HH-MSRE-1750	5.00	2.000	2.125	1.750	2.500	2.188	1.531	2.250	1 1/2 -12	2.125	43000
		2.500									
		3.000									
		3.500									
HH-MSRE-2000	6.00	2.500	2.875	2.000	2.750	2.625	1.750	2.750	1 7/8 -12	2.500	70200
		3.000									
		3.500									
		4.000									

MALE SPHERICAL ROD EYE



ACCESSORIES: SPHERICAL ROD EYES

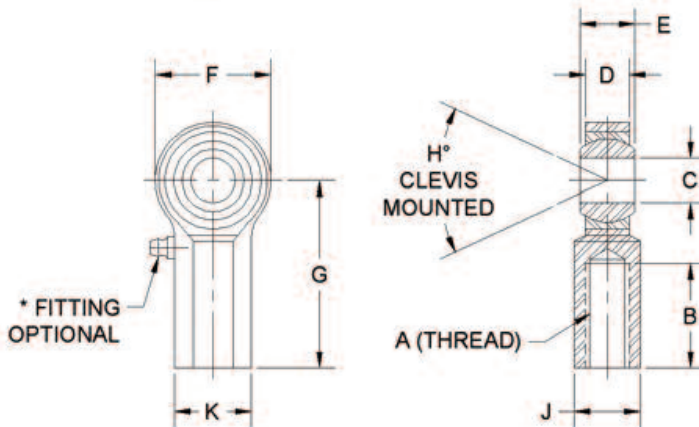
MALE SPHERICAL ROD EYE



Assortment of Male Spherical Eyes.

MALE SPHERICAL ROD EYE										
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	2.125
MSRE-1250	1 1/4 -12	2.125	1.0000	1.000	1.375	2.750	4.125	17	43,540	2.413

FEMALE SPHERICAL ROD EYE



Assortment of Female Spherical Eyes.

FEMALE SPHERICAL ROD EYE										
PART NUMBER	A	B	C +.0015 -.0005	D	E	F	G	H*	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	3,130	.09
FSRE-437	7/16 -20	1.188	0.5000	0.500	0.625	1.313	2.125	12	6,660	.33
FSRE-500	1/2 -20	1.188	0.5000	0.500	0.625	1.313	2.125	12	6,660	.33
FSRE-750	3/4 -16	1.750	0.7500	0.688	0.875	1.750	2.875	14	11,515	.72
FSRE-1000	1 -14	2.125	1.0000	1.000	1.375	2.750	4.125	17	43,540	2.413
*FSRE-1250	1 1/4 -12	2.125	1.0000	1.000	1.375	2.750	4.125	17	43,540	2.413

* Consult factory for delivery.

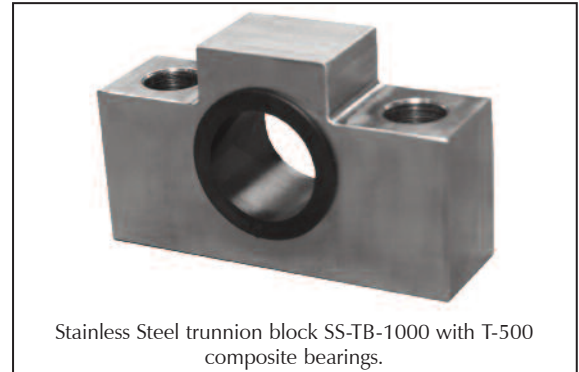
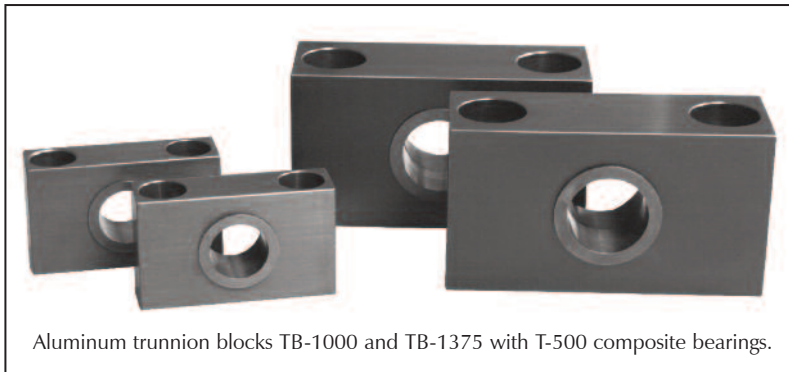
ACCESSORIES: TRUNNION BLOCKS

Nason is making it easier to set up trunnion style actuation solutions. Nason now 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.

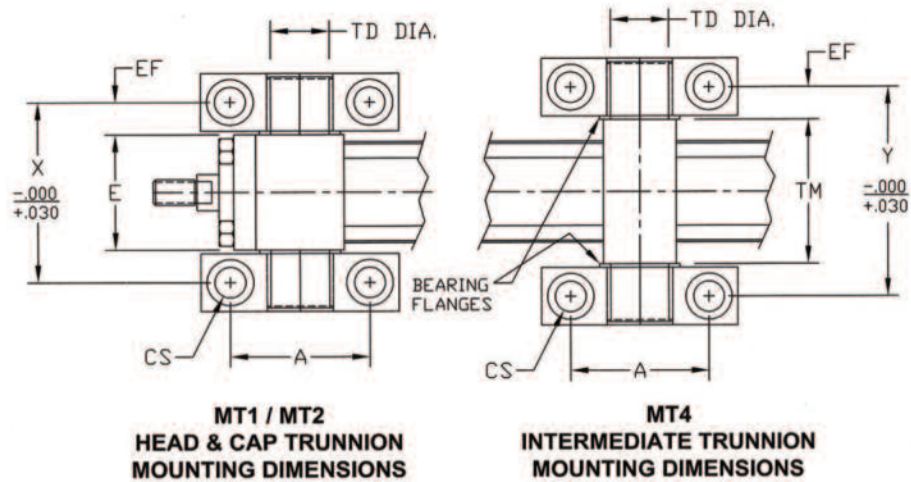
Trunnion supports can be used with all NFPA mounts MT1, MT2, and MT4 as well as Nason solid one-piece steel trunnion styles SMT1 and SMT2.

All trunnion blocks are in stock and available for immediate order. Contact Factory for delivery for large orders or special requirements.



TRUNNION BLOCK ORDERING INFORMATION			
Part Number	Bore Size	Block Material	Bearing Material
TB-1000	1.50 to 5.00	Aluminum w/ Black Anodize	T-500 Composite
TB-1375	6.00 to 8.00	Aluminum w/ Black Anodize	T-500 Composite
SS-TB-1000	1.50 to 5.00	303 Stainless Steel	T-500 Composite
SS-TB-1375	6.00 to 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 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 and SS-TB-1000	T-500 Composite
TB-30-2	2	TB-1375 and SS-TB-1375	T-500 Composite

ACCESSORIES: TRUNNION BLOCKS

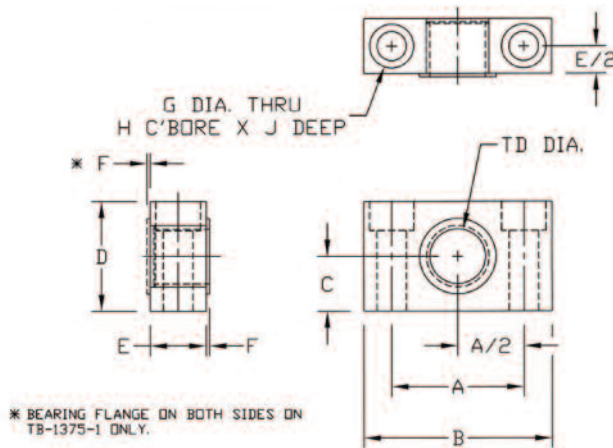


Note: Shown with bearing flanges on inside of blocks facing cylinder

BORE	PART NO.	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 capscrew size (Capscrews not supplied)

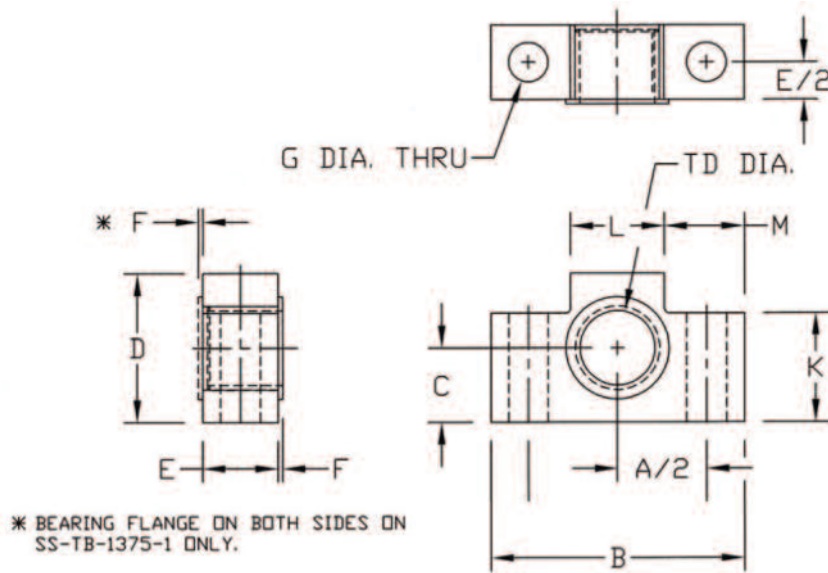
STANDARD ALUMINUM TRUNNION BLOCKS WITH BEARING



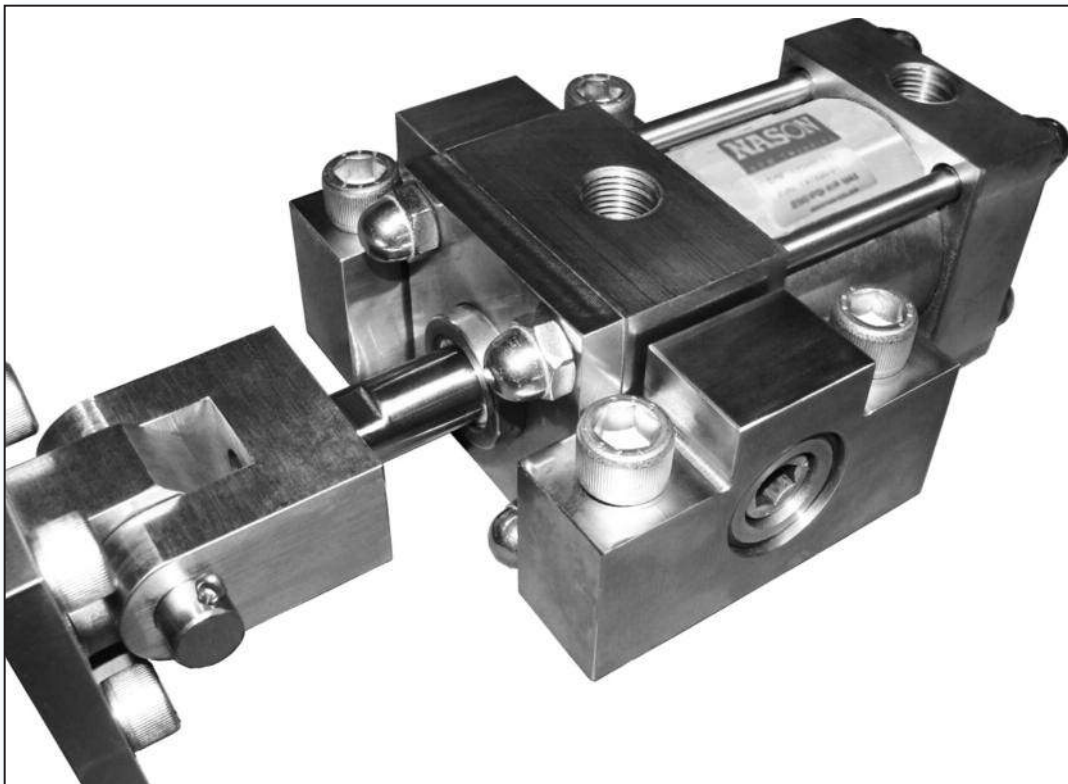
PART NO.	A	B	C	D	E	F	G	H	J	TB
TB-1000-1	2.375	3.375	1.000	2.000	1.000	0.062	0.531	0.797	0.531	1.000
TB-1375-1	4.000	5.500	1.500	3.000	2.000	0.078	0.781	1.187	0.781	1.375

ACCESSORIES: TRUNNION BLOCKS

STAINLESS STEEL TRUNNION BLOCKS WITH BEARING



PART NO.	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

Solid Steel self-aligning piston rod couplers

Nason's alignment couplers can virtually pay for themselves by eliminating the need to precisely mount cylinders in your applications. Our couplers prevent binding and erratic movement that misalignment causes, extending the bearing and seal life of your cylinders. Proper use of alignment couplers will allow cylinders to stroke in the shortest time possible, increasing production!

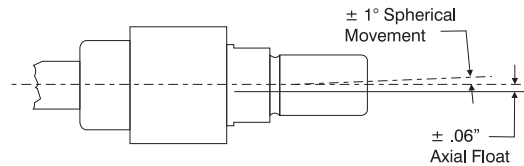
Benefits

- 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 - AC5000



ACH Coupler
ACH250 - ACH1250



Stainless Steel Standard AC Coupler
SS-AC250 - SS-AC5000

How to Order:

AC	250	(Optional alternative size*) - 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

*You can order different thread sizes within the same size of coupler housing DIA. (Refer to "B" Diameter in dimension chart)

Ordering Examples:

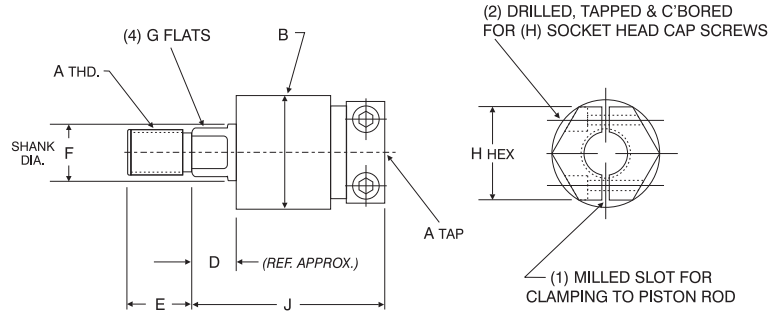
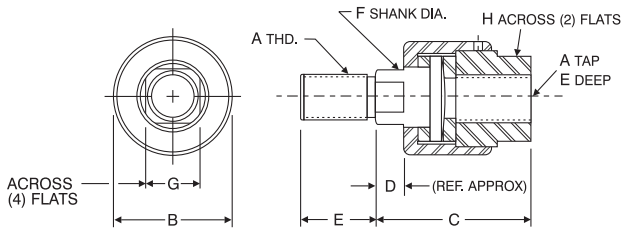
AC250 (AC with male & female 1/4-28 thread)
ACH500 (ACH with male & female 1/2-20 thread)
AC437-625 FEMALE (AC with 7/16-20 male and 5/8-18 female thread)

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

ACCESSORIES: ALIGNMENT COUPLERS

AC SERIES

ACH SERIES



ALIGNMENT COUPLER DIMENSIONS											
PART NO.	A	B	C	D	E	F	G	H	H HEX	J	MAX PULL AT YIELD
AC250	1/4-28	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	6,000
AC312	5/16-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	8,300
AC375	3/8-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	8,300
AC437	7/16-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.250	2.156	10,000
AC500	1/2-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.125	2.156	14,000
AC625	5/8-18	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.250	2.156	19,000
AC750	3/4-16	1.750	2.313	0.438	1.125	0.969	0.813	1.125	1.750	2.500	34,000
AC875	7/8-14	1.750	2.313	0.438	1.125	0.969	0.813	1.125	1.750	2.500	39,000
AC1000	1-14	2.500	2.938	0.438	1.625	1.344	1.156	1.625	2.500	2.938	64,000
AC1250	1 1/4-12	2.500	2.938	0.438	1.625	1.344	1.156	1.625	2.500	2.938	78,000
AC1375	1 3/8-12	2.500	2.938	0.438	1.625	1.344	1.156	1.625	—	—	78,000
AC1500	1 1/2-12	3.250	4.375	0.875	2.250	1.969	1.750	2.375	—	—	134,000
AC1750	1 3/4-12	3.250	4.375	0.875	2.250	1.969	1.750	2.375	—	—	134,000
AC1875	1 7/8-12	3.750	5.625	1.000	3.000	2.469	2.125	2.750	—	—	134,000
AC2000	2-12	3.750	5.625	1.000	3.000	2.469	2.125	2.750	—	—	195,000
AC2250	2 1/4-12	4.500	6.375	1.000	3.500	2.969	2.625	3.375	—	—	240,000
AC2500	2 1/2-12	5.000	6.563	1.000	3.500	3.938	S P A N N E R	H O L E S	—	—	344,000
AC2750	2 3/4-12	5.000	6.563	1.000	3.500	3.938			—	—	344,000
AC3000	3-12	5.000	6.563	1.000	3.500	3.938			—	—	344,000
AC3250	3 1/4-12	6.250	8.125	1.000	4.500	4.938			—	—	536,000
AC3500	3 1/2-12	6.250	8.125	1.000	4.500	4.938			—	—	536,000
AC3750	3 3/4-12	6.250	8.125	1.000	4.500	4.938			—	—	536,000
AC4000	4-12	7.500	9.500	1.000	5.500	5.938			—	—	776,000
AC4500	4 1/2-12	7.500	9.500	1.000	5.500	5.938			—	—	776,000
AC5000	5-12	7.500	9.500	1.000	5.500	5.938			—	—	776,000

*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, (2) 0.500" dia. holes, 0.500" deep, 180° apart (each end).

STAINLESS STEEL ALIGNMENT COUPLERS

ALIGNMENT COUPLERS - STAINLESS STEEL									
PART NO.	A	B	C	D	E	F	G	H	MAX PULL AT YIELD
SS-AC250	1/4-28	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1,000 LBS.
SS-AC312	5/16-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1,800 LBS.
SS-AC375	3/8-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	2,900 LBS.
SS-AC437	7/16-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	4,000 LBS.
SS-AC500	1/2-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	5,500 LBS.
SS-AC625	5/8-18	1.250	2.000	0.438	0.750	0.625	0.500	0.813	7,000 LBS.
SS-AC750	3/4-16	1.750	2.313	0.438	1.125	0.969	0.813	1.125	10,300 LBS.
SS-AC875	7/8-14	1.750	2.313	0.438	1.125	0.969	0.813	1.125	12,000 LBS.
SS-AC1000	1-14	2.500	2.938	0.438	1.625	1.344	1.156	1.625	15,000 LBS.
SS-AC1250	1 1/4-12	2.500	2.938	0.438	1.625	1.344	1.156	1.625	17,000 LBS.
SS-AC1500	1 1/2-12	3.250	4.375	0.875	2.250	1.969	1.750	2.375	20,000 LBS.

NOTES

Technical Data
Page 198

Switches
Page 184

Options
Page 142

Alignment Couplers

Trunnion Blocks

Spherical Rod
Eyes

Clevis, Pins & Mounts

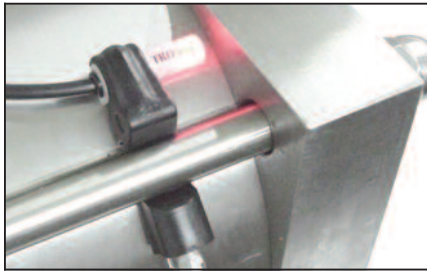


NASON

NEW THINKING



ACCESSORIES: SWITCHES



- Miniature AC/DC Reed
- High Power AC Reed
- Miniature DC Solid State
- RoHS
- Miniature AC/DC Reed with built-in Circuit Protection
- Extended Temperature Range Reed

Nason offers Reed, High Power AC Reed, DC Solid State and Reed Switches with built-in Circuit Protection to meet a wide variety of customer needs.

Advantages:

- Compact low profile Switch/Bracket Assembly
- Switches and Brackets are Nylon and Stainless Steel Hardware construction – suitable for wash down or corrosive environments (IP67)
- Quick, Simple Set-up: Requires Standard (slotted) Screwdriver
- High visibility LED can be seen up to 20 feet
- Suitable for all bore sizes (1.50" to 12.00")
- Magnetically operated, can be located anywhere in the actuator stroke range
- **One magnet type (MPR) for both Reed AND Solid State Nason Switches.**
- Can be used with all Nason Aluminum Series Actuators (NAC, HDC, SNC), Electroless Nickel Plated Series (EN), and Corrosion Resistant Series (CRN)

Benefits of REED Switch

- Internal Circuit Protection Option
- Lower Cost
- Low or High Current Models available, AC or DC, and TRIAC type switch for inductive loads
- High Visibility Red LED (on Low Current Models)
- Choice of lead lengths available on all models
- Optional 8mm Quick Connect on Low Current Model

R10 Miniature REED Switch

- 120 Volts Max. (AC or DC)
- Cable options include 24 inch or 120 inch plain cable leads, and 8mm Threaded Quick Connect
- High visibility LED

RAC High Power AC REED Switch

- 12-240 Volts AC, 800 mA current rating, TRIAC output
- Cable options include 24 inch or 120 inch plain cable leads

MSS Miniature Solid State Switch

- 10-30 Volts DC, 4-300 mA current rating
- Can be wired Current Sinking (NPN) or Current Sourcing (PNP)

Benefits of SOLID STATE Switch

- Shock Proof
- GMR Technology - Giant Magneto Resistive Design
- Reverse Polarity and Over Voltage Protection
- High Visibility Red LED (All Models)
- Choice of lead lengths available or 8mm Quick Connect
- Cable options include 24 inch or 120 inch plain cable leads, and 8mm Threaded Quick Connect
- High Visibility LED

R10P Miniature AC/DC REED Switch with built-in Circuit Protection

- 120 Volts Max. (AC or DC), 150 mA current rating (MAX.)
- Cable options include 24 inch or 120 inch plain cable leads
- High visibility LED

RHT Miniature Extended Temperature Range Reed Switch

- -40°F to 260°F (-40°C to 125°C)
- Cable options include 24 inch or 120 inch plain cable leads

Switch Application Selection Guide - For selecting the right switch 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 POWERED REED SWITCHES**	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 = 80mA

Specify 'MPR' Option for ALL switch models when ordering actuators.

ACCESSORIES: SWITCHES — REED

Electrical Specifications



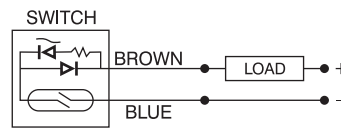
- R10** Miniature Reed Switch, 24" (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)
- R10X** Miniature Reed Switch, 120" (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)
- R10Q** Miniature Reed Switch, 8mm Male Quick Connect, 24 AWG Wire, PVC Jacket (2 wire Switch)

Contacts	SPST Form A (Normally Open)
Contact Rating	10 Watts Max.
Input Voltage	120 Volts Max. (AC or DC)
Maximum Load Current	500 mA Max. (Resistive)
Actuating Time Average	1.0 millisecond
LED Indicator	High Luminescence Housing
Temperature Range	-20°C to 70°C (-4°F to 158°F)
Protection Rating	IP67

Schematics

R10 / R10X

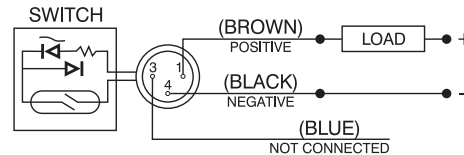
Miniature Reed Switch, Cable Type, (2 Wire Switch)



Input Voltage	120 Volts Max. AC/DC
Maximum Load Current	500 mA Max. (Resistive)

R10Q

Miniature Reed Switch, 8mm Male Quick Connect, (2 Wire Switch)



Input Voltage	120 Volts Max. AC/DC
Maximum Load Current	500 mA Max. (Resistive)



- 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)

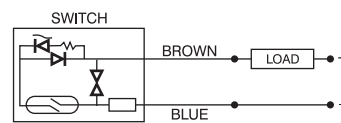
Contacts	SPST Form A (Normally Open)
Contact Rating	10 Watts Max.
Input Voltage	120 Volts Max. (AC or DC)
Maximum Load Current	150 mA Max.
Actuating Time Average	1.0 millisecond
LED Indicator	High Luminescence Housing
Temperature Range	-20°C to 70°C (-4°F to 158°F)
Protection Rating	IP67

Circuit Protection

Varistor	138 Volts
Choke	680 μH

R10P / R10PX

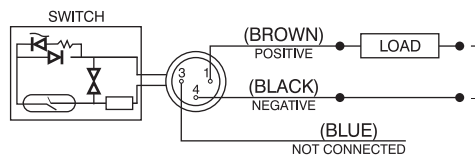
Miniature Reed Switch, Cable Type, (2 Wire Switch)



Input Voltage	120 Volts Max. AC/DC
Maximum Load Current	150 mA Max.

R10PQ

Miniature Reed Switch, 8mm Male Quick Connect, (2 Wire Switch)



Input Voltage	120 Volts Max. AC/DC
Maximum Load Current	150 mA Max.

Note: 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.

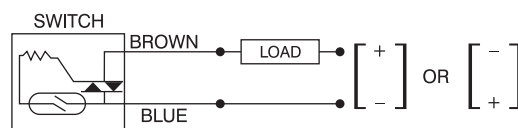


- RAC** High Power AC Reed Switch, 24" (20 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)
- RACX** High Power AC Reed Switch, 120" (20 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)

Contacts	TRIAC Output
Contact Rating	200 Watts Max.
Input Voltage	12 to 240 Volts (AC only)
Minimum Load Current	80 mA
Maximum Load Current	800 mA
Actuating Time Average	2.0 milliseconds
LED Indicator	Not Available
Temperature Range	-20°C to 70°C (-4°F to 158°F)
Protection Rating	IP67

RAC / RACX

High Power AC Reed Switch, Cable Type, (2 Wire Switch)



Contact Rating	200 Watts Max.
Input Voltage	12 to 240 Volts (AC only)
Minimum Load Current	80 mA
Maximum Load Current	800 mA

Specify 'MPR' Option for ALL switch models when ordering actuators.

ACCESSORIES: SWITCHES — REED

Electrical Specifications



RHT Extended Temperature Range Miniature Reed Switch, 24" (24 AWG Wire, Silicone rubber insulation with gray outer sheath, 4.5mm O.D.) Plain Cable Lead, (2 wire Switch)

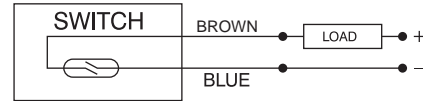
RHTX Extended Temperature Range Miniature Reed Switch, 120" (24 AWG Wire, Silicone rubber insulation with gray outer sheath, 4.5mm O.D.) Plain Cable Lead, (2 wire Switch)

Contacts SPST Form A (Normally Open)
 Contact Rating 10 Watts Max.
 Input Voltage 120 Volts Max. (AC or DC)
 Maximum Load Current 500 mA Max. (Resistive)
 Actuating Time Average 1.0 millisecond
 LED Indicator Not Available
 Temperature Range -40°C to 125°C (-40°F to 260°F)
 Protection Rating IP67

Schematics

RHT / RHTX

Miniature Reed Switch, Cable Type, Extended Temperature Range (2 Wire Switch)



Input Voltage 120 Volts Max. AC/DC
Maximum Load Current 500 mA Max. (Resistive)

SWITCHES — SOLID STATE



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 to 30 Volts DC
 Current Consumption (not sensing) 1mA
 Minimum Load Current 4 mA
 Maximum Load Current 300 mA
 "ON" Voltage Drop 2.5 Volts @ 4 mA
 3.5 Volts @ 300 mA
 LED Indicator High Luminescence Housing
 Temperature Range -20°C to 70°C (-4°F to 158°F)
 Actuating Time Average 2.0 microseconds
 Protection Rating IP67
 Reverse Polarity Protected yes
 Transient (over voltage) Protected yes

MSS / MSSX

Miniature Solid State Switch, Cable Type, (2 Wire Switch)



Typical Current Sourcing (PNP) Configuration



Typical Current Sinking (NPN) Configuration

***NOTE:** This is a (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 from the solid state switch.

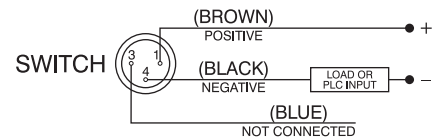


MSSQ Miniature Solid State Switch, 8mm Male Quick Connect, 24 AWG Wire, PVC Jacket (2 wire Switch)

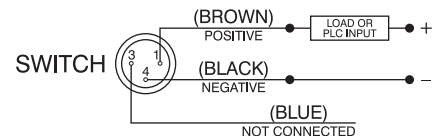
*Output Type Current Sinking or Current Sourcing
 Input Voltage 10 to 30 Volts DC
 Current Consumption (not sensing) 1mA
 Minimum Load Current 4 mA
 Maximum Load Current 300 mA
 "ON" Voltage Drop 2.5 Volts @ 4 mA
 3.5 Volts @ 300 mA
 LED Indicator High Luminescence Housing
 Temperature Range -20°C to 70°C (-4°F to 158°F)
 Actuating Time Average 2.0 microseconds
 Protection Rating IP67
 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

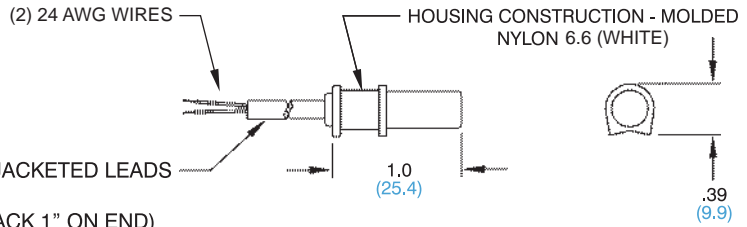
***NOTE:** This is a (2) wire switch used in series with the load. Therefore, this switch can be used with devices requiring either a current sinking (NPN) output or a current sourcing (PNP) output from the solid state switch.

Specify 'MPR' Option for ALL switch models when ordering actuators.

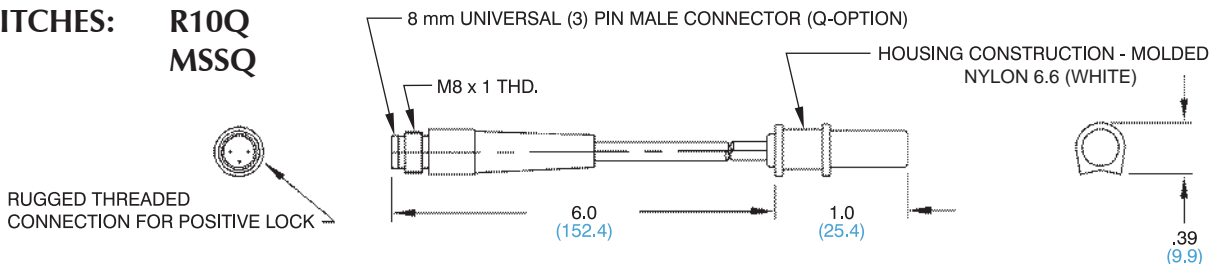
ACCESSORIES: SWITCHES AND BRACKET DIMENSIONS

FOR SWITCHES: R10 / R10X
RHT / RHTX
MSS / MSSX

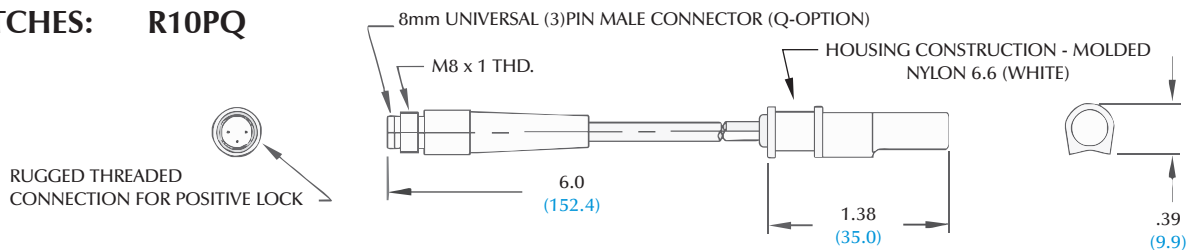
PLAIN CABLE LEADS
R10 / RHT / MSS = 24" (0.6m) PVC JACKETED LEADS
R10X / RHTX / MSSX = 120" (3.0m)
(JACKET CUT BACK 1" ON END)
(25.4)



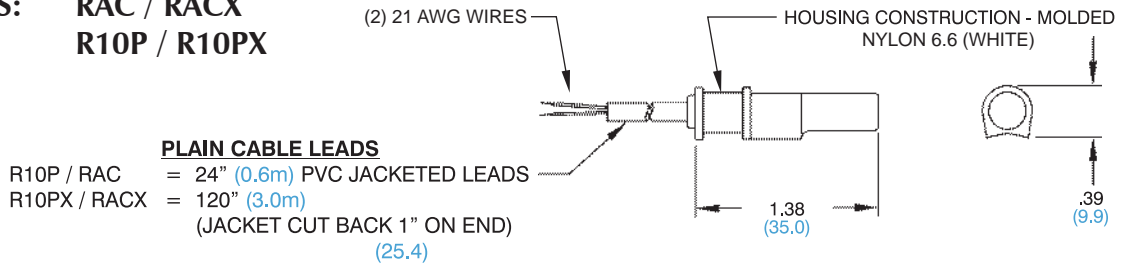
FOR SWITCHES: R10Q
MSSQ



FOR SWITCHES: R10PQ

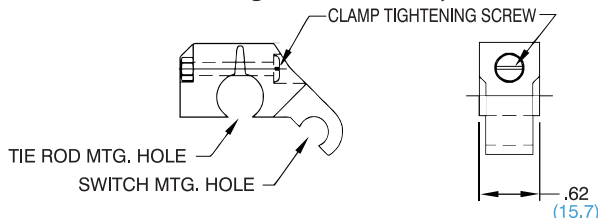


FOR SWITCHES: RAC / RACX
R10P / R10PX



SWITCH BRACKET: SB15

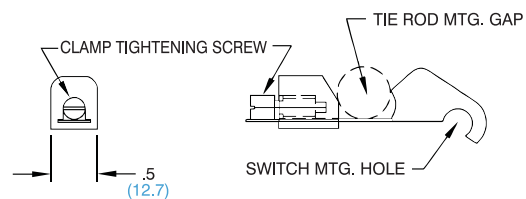
(For 1.50" Through 2.50" Bore Cylinders)



Bracket Construction: Molded Nylon 6 (Black) and Stainless Steel Hardware

SWITCH BRACKET: SB32

(For 3.25" Through 12.00" Bore Cylinders)



Bracket Construction: Molded Nylon 6 (Black) and Stainless Steel Hardware

QUICK CONNECT CORD SETS

(Used with "Q" Type Switch Leads)

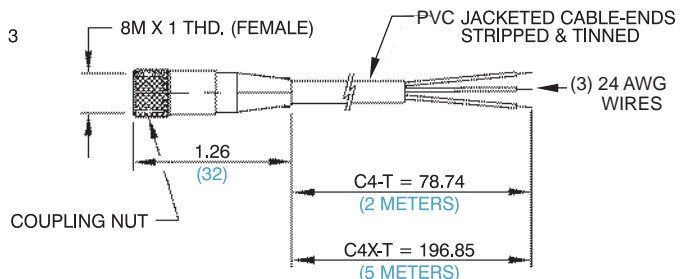
FOR CABLES:

C4-T (2 METER CABLE LENGTH)

C4X-T (5 METER CABLE LENGTH)

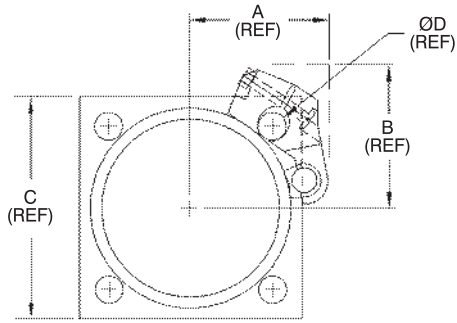
All Dimensions are in INCHES
(mm in parentheses)

CONDUCTOR COLORS:
1. BROWN
3. BLUE
4. BLACK

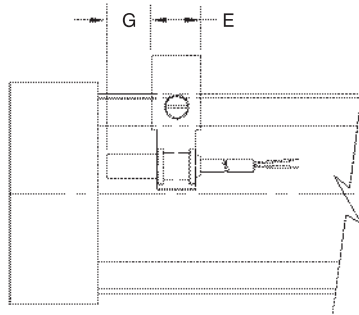


Specify 'MPR' Option for ALL switch models when ordering actuators.

ACCESSORIES: SWITCH MOUNTING DIMENSIONS



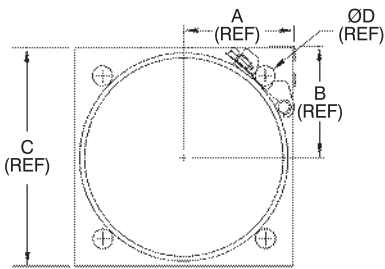
SB15



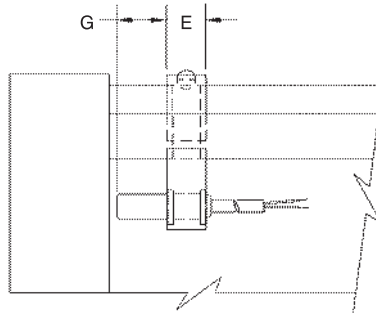
SB15

SWITCH BRACKET LETTER DIMENSIONS							
PART NO.	BORE	A	B	C	D	E	G
SB15	1.50	1.375	1.406	2.000	0.250	0.625	0.500
	2.00	1.625	1.656	2.500	0.313	0.625	0.500
	2.50	1.875	1.875	3.000	0.313	0.625	0.500
SB32	3.25	2.125	2.125	3.750	0.375	0.500	0.563
	4.00	2.438	2.375	4.500	0.375	0.500	0.563
	5.00	2.875	2.750*	5.500	0.500	0.500	0.563
	6.00	3.250*	3.250*	6.500	0.500	0.500	0.563
	8.00	4.250*	4.250*	8.500	0.625	0.500	0.563
	10.00	5.313*	5.313*	10.625	0.750	0.500	0.563
	12.00	6.375*	6.375*	12.750	0.750	0.500	0.563

*THESE DIMENSIONS ARE 0.500" OF THE 'C' DIMENSION. THE SWITCH BRACKET **DOES NOT** PROTRUDE BEYOND STANDARD HEAD/CAP.



SB32

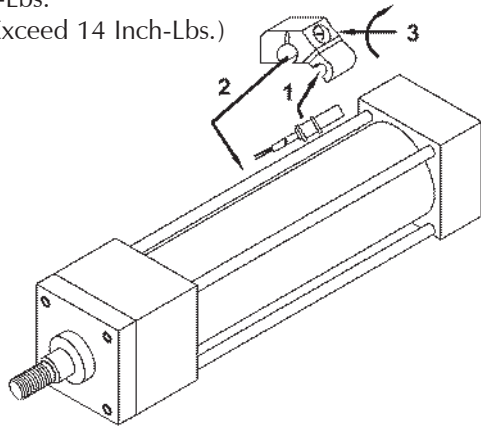


SB32

How To Assemble Switch and Brackets

Recommended Torque:

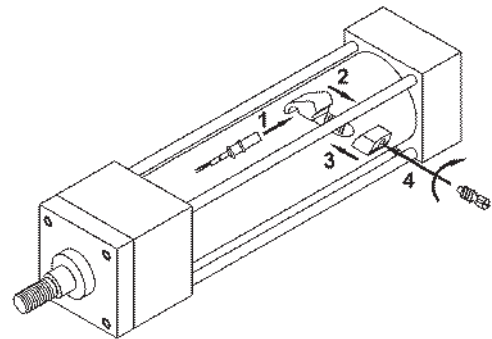
6-10 Inch-Lbs.
(Do Not Exceed 14 Inch-Lbs.)



SB15 SWITCH BRACKET
(MOUNTING ILLUSTRATION)

Recommended Torque:

8-12 Inch-Lbs.
(Do Not Exceed 14 Inch-Lbs.)



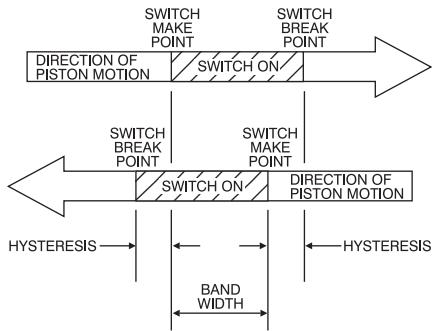
SB32 SWITCH BRACKET
(MOUNTING ILLUSTRATION)

Specify 'MPR' Option for ALL switch models when ordering actuators.

ACCESSORIES: SWITCHES HYSTERESIS & BAND WIDTH

HYSTERESIS:

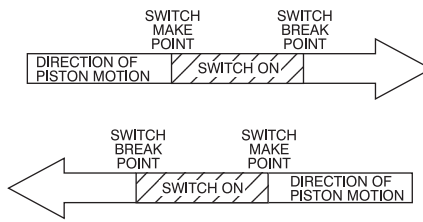
THE DISTANCE BETWEEN THE SWITCH BREAK POINT MOVING IN ONE DIRECTION, AND THE SWITCH MAKE POINT MOVING IN THE OPPOSITE DIRECTION.



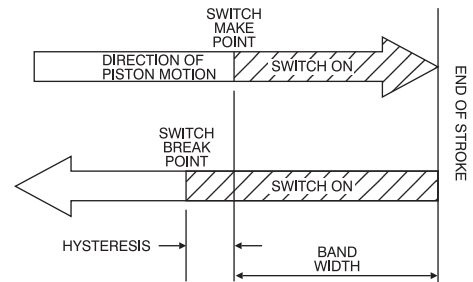
MID STROKE OPERATION

BAND WIDTH:

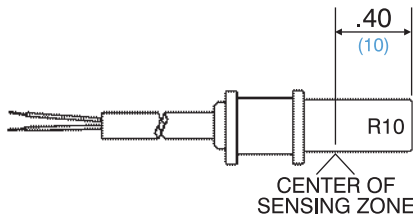
THE DISTANCE THE PISTON MOVES WHILE THE SWITCH IS MADE (IN EITHER DIRECTION), LESS THE HYSTERESIS.



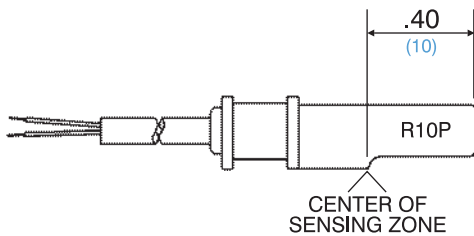
TERMINOLOGY ILLUSTRATION



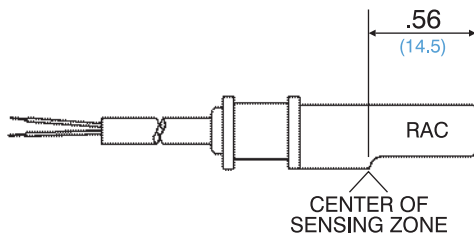
END OF STROKE OPERATION



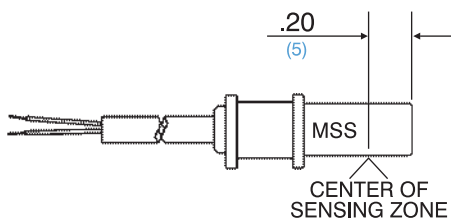
Switch	Repeatability	Hysteresis (Maximum)	Band Width (Minimum)
R10 RHT R10X RHTX R10Q	$\pm .010''$ ($\pm .25$)	.040" (1)	.200" (5)



Switch	Repeatability	Hysteresis (Maximum)	Band Width (Minimum)
R10P R10PQ R10PX	$\pm .010''$ ($\pm .25$)	.040" (1)	.200" (5)



Switch	Repeatability	Hysteresis (Maximum)	Band Width (Minimum)
RAC RACX	$\pm .010''$ ($\pm .25$)	.085" (2.1)	.345" (8.8)



Switch	Repeatability	Hysteresis (Maximum)	Band Width (Minimum)
MSS MSSX MSSQ	$\pm .010''$ ($\pm .25$)	.075" (1.9)	.315" (8)

Note:

Dimensions are in inches, (mm in parentheses).

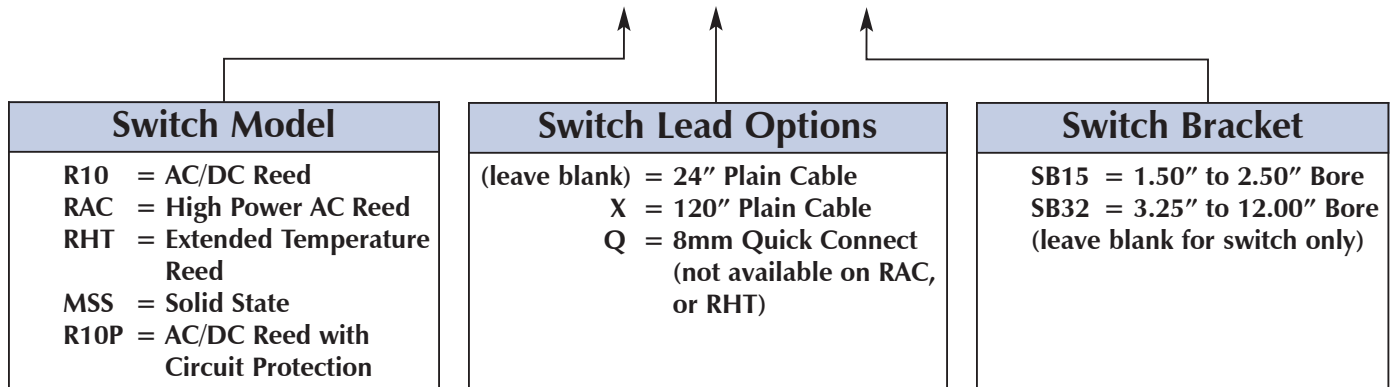
Results are based upon Nason piston and magnet assemblies. Results may vary if used with other manufacturers cylinder products.

Specify 'MPR' Option for ALL switch models when ordering actuators.

ACCESSORIES: SWITCH ORDERING INSTRUCTIONS

TO ORDER, SPECIFY: Switch Model, Lead Type, and Bracket Size

R10 X - SB15



Switch Accessories	
Quick Connect Cord Sets	
<u>MODEL</u>	<u>DESCRIPTION</u>
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.

Nason designed our magnet to have 50-100% more power than required to operate our switch! The combination of Nason 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, 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), 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!

Other switches available:

- 12mm Quick Connect
- Special Length Cable
- Weld Immune Switch
- Pulse Extension Switch (For Sensing Mid-Stroke Positions)
- Change Over Switch (SPDT)

(Consult factory for details.)

Specify 'MPR' Option for ALL switch models when ordering actuators.

SERIES: BALLUFF INDUCTIVE SENSORS

BALLUFF **STROKEMASTER**™ Inductive Sensors

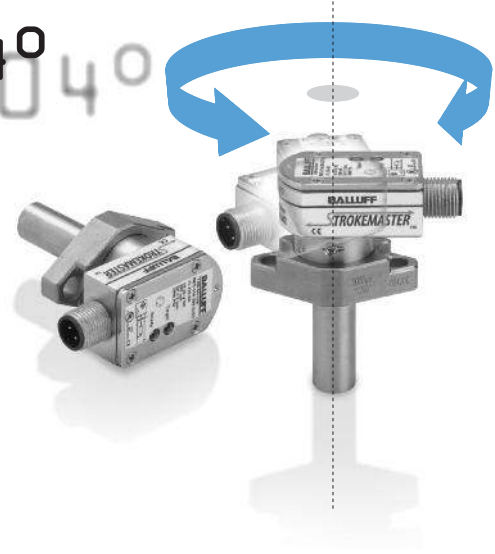
Flexible Solutions for an Often Inflexible World

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 Viton 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 Nason 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 Nason 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 IP67 requirements.

304°



SERIES: BALLUFF INDUCTION SENSORS

DC INDUCTIVE SENSORS



Features/Advantages

Inductive cylinder switch for piston position feedback in cylinders.

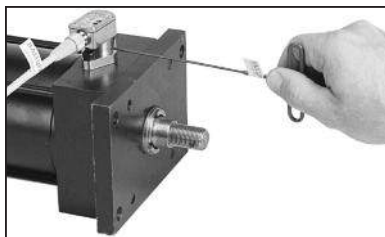
- Magnetic field immune, for use with welding equipment
- Available in DC or all current (AC/DC) versions
- Easy installation - sensor mounts to cylinder with (2) fasteners
- Sealed directly at flange, connector can be oriented after installation
- Various lengths available for different cylinder sizes



Bolt sensor to cylinder.

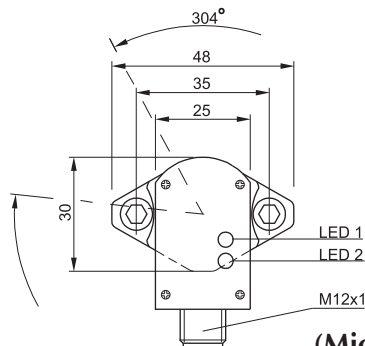


Position cable to desired orientation (even over mounting bolts).

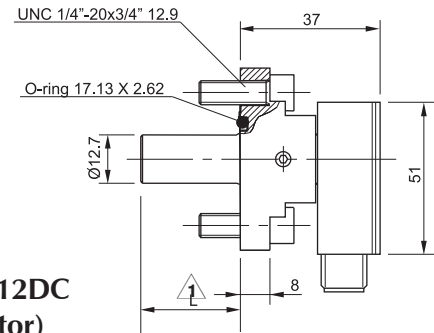


Lock chosen position with one or both of the two integral set screws.

Refer to page 230 for available cable connector sets.

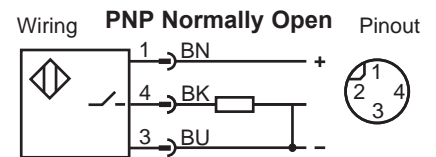


(Micro M12DC Connector)



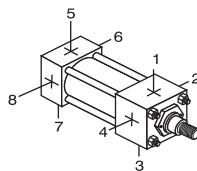
PNP	Normally-open
Rated operational voltage U_o	
Supply voltage U_s	
Voltage drop U_d at I_o	
Rated insulation voltage U_i	
Rated operational current I_o	
No-load supply current I_o d./und.	
Off-state current I_o	
Protected against polarity reversal	
Short circuit/overload protected	
Load capacitance	
Repeat accuracy R	
Ambient temperature range T_a	
Frequency of operating cycles f	
Utilization categories	
Function/Operating voltage indication	
Degree of protection per IEC 529	
Housing material	
Material of sensing face	
Connection	
Approvals	
High pressure rated up to	
Recommended connector	

BES 516-300-S 295-S 4
24 V DC
10...30 V DC
≤ 2.5 V
75 V DC
200 mA
≤ 18 mA/≤ 10 mA
≤ 80 μ A
yes
yes/yes
≤ 1.0 μ F
≤ 5 %
-25...+70°C
10 Hz
DC 13
yes/yes
IP 67/connector IP 65
stainless steel/aluminum
ceramic
Micro connector
cULus
207 bar (3000 PSI)
C04 AEL-00-VY-050M



Δ Nason will supply the correct length probe and spacer combination (if req'd.) for each cylinder. Using the combination of std. 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)

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)

How To Order:

Cylinder Model Number ➔ NAC - MS2 3.25 X 6 - HC

SENSOR MODEL (HEAD) ➔ -BES 516-300-S 295-S4 (Head)

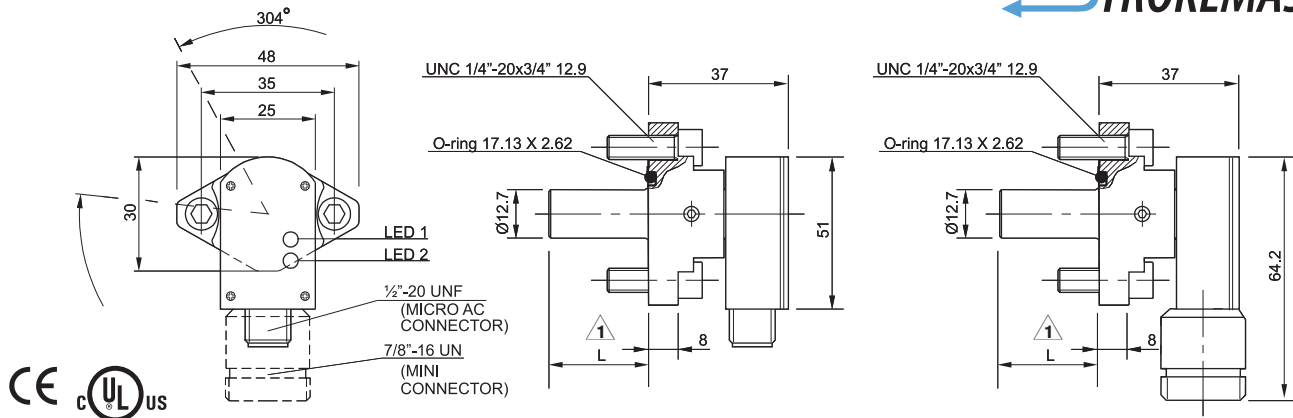
SENSOR MODEL (CAP) ➔ -BES 516-300-S 295-S4 (Cap)

(Include ALL Sensor positions) ➔ -Sensors at 4 & 8

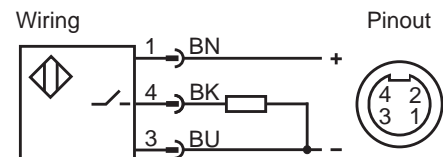
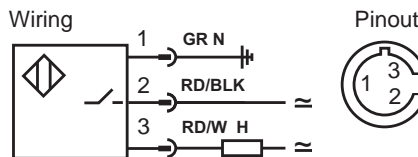
Note: Nason will include the STROKEMASTER probe length on your order, and any sensor spacers required. (Example: NAC-MS2 4 X 6-HC- BES 516-300-S4 /1.025-S21 (Head) -BES 516-300-S4 /1.75-S21 (Cap)- Sensors at 4 & 8.

SERIES: BALLUFF INDUCTION SENSORS

AC/DC INDUCTIVE SENSORS

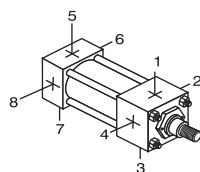


	BES 516-200-S 2-S21	BES 516-200-S 2-S5
Normally-open		
Rated operational voltage U_o	110 V AC	110 V AC
Supply voltage U_a	20...250 V AC/DC	20...250 V AC/DC
Voltage drop U_d at I_e	≤ 6 V	≤ 6 V
Rated insulation voltage U_i	250 V AC	250 V AC
Rated operational current I_e	500 mA	500 mA
Minimum operational current I_m	5 mA	5 mA
Off-state current I_r	≤ 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	≤ 5 %	≤ 5 %
Ambient temperature range T_a	-25...+70°C	-25...+70°C
Frequency of operating cycles f	≤ 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	C21 AE3-00-VY-150F	C05 AE1-00-VY-150F



△ Nason will supply the correct length probe and spacer combination (if req'd.) for each cylinder. Using the combination of std. 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)

Refer to page 195 for available cable connector sets.



STANDARD LOCATIONS:

- Ports at 1 and 5
- Cushions at 2 and 6
- Sensors at 4 and 8

(Specify non-standard locations)

How To Order:

Cylinder Model Number → NAC - MS2 3.25 X 6 - HC

SENSOR MODEL (HEAD) → -BES 516-200-S 2-S21 (Head)

SENSOR MODEL (CAP) → -BES 516-200-S 2-S21 (Cap)

(Include ALL Sensor positions) → -Sensors at 4 & 8

Note: Nason will include the STROKEMASTER probe length on your order, and any sensor spacers required.
(Example: NAC-MS2 4 X 6-HC- BES 516-200-S 2 /1.025-S21 (Head) -BES 516-200-S 2 /1.75-S21 (Cap)- Sensors at 4 & 8.

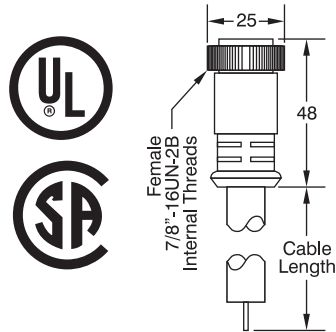
SERIES: BALLUFF INDUCTION SENSORS

CABLE CONNECTORS



S5 - Mini Connectors (7/8"-16 UNF Threads)

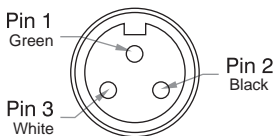
Connector	3-5 Pole Mini
Style	Mini Size A
Configuration	Straight Female
Recommended Connector	C05 AE1-00-VY-150F



	ORDER NUMBER
3 Pole	C05 AE1 00 * Y 150
Voltage Rating	300 V AC/DC
Amperage	10A
Wire Gauge	16 AWG
Jacket	PVC
Coupling Nut	Black Epoxy Coated Zinc
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-4 - 221°F (-21 to 105°C)
UL Listed	Yes
CSA Certified	Yes

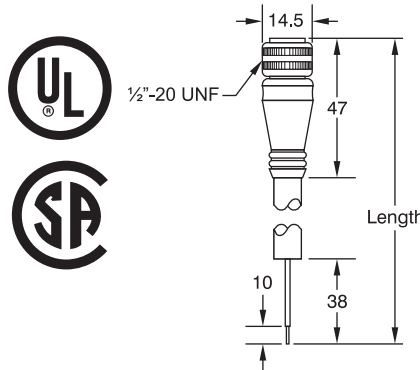
* Insert **V** = PVC Cable
T = TPE Cable
 For 3 pole versions only

Female 3-pin - Face view



S21 - Micro Connectors (1/2"-20 UNF Threads)

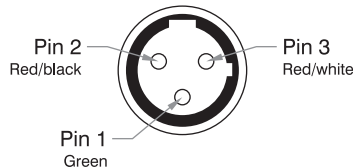
Connector	Micro AC 1/2" x 20 UNF
Style	3 Pin Dual Keyway
Configuration	Straight Female
Recommended Connector	C21 AE3-00-VY-150F



	ORDER NUMBER
Ordering Code	C21 AE3 00 * Y 150F
3 Pin Dual Keyway	
Voltage Rating	250 V AC/DC
Amperage	4A
Wire Gauge	22 AWG
Jacket	Yellow PVC or TPE
Coupling Nut	Black Epoxy Coated Zinc
O-Ring	Viton
Overmold Head	TPE
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-4 - 221°F (-21 to 105°C)
UL Listed	Yes
CSA Certified	Yes

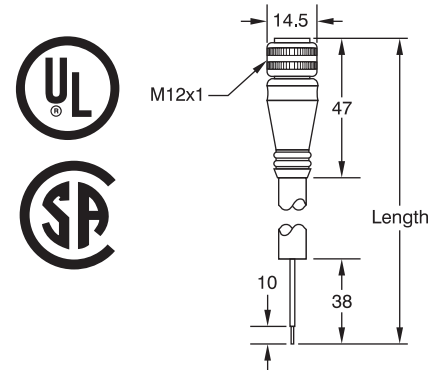
Note: 15 ft cable is standard (other lengths available - contact factory) For 3 pole versions only

Female - Face view



S4 - Micro Connectors (M12x1 Metric Threads)

Connector	Micro
Style	M12 DC Single Keyway
Configuration	Straight Female
Recommended Connector	C04 AEL-00-VY-050M



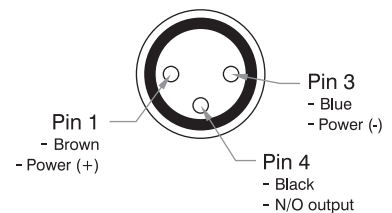
	Note	ORDER NUMBER
3 Wire DC		
3 Wire Normally Open, non-LED	1,2,3	C04 AEC 00 * Y 050M
3 Wire Normally Open PNP w/ LED		C04 AEH 00 * Y 050M
4 Wire DC (NO/NC)		
4 Wire (Universal), non-LED	1,2,3	C04 AEL 00 * Y 050M
4 Wire PNP w/LED	1,3	C04 AEM 00 * Y 050M
Voltage Rating		10 - 30 V DC
Amperage		4 Amps
Wire Gauge		22 AWG
Jacket		Yellow PVC or TPE
Coupling Nut		Black Epoxy Coated Zinc
*Optional Stainless Steel		*Stainless Type 303
Protection		IP68 / NEMA 6P
Ambient Operating Temp.		-4 - 221°F (-21 to 105°C)
UL Listed		Yes
CSA Certified		Yes

Note: 5 meter cable is standard (other lengths available - contact factory)

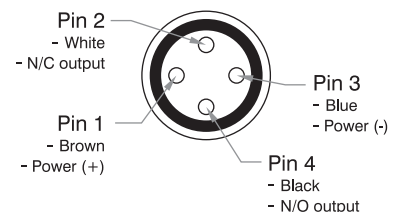
* Insert **V** = PVC Cable
T = TPE Cable
 For 3 pole versions only

Note: 1 Add **B** = Braided 80% Metallic Braid, i.e. 050 MB
 2 Add **S** = S-Shielded 360 Degree Shield through Coupling Nut, i.e. 050 MS
 3 Stainless Steel Couple Nut: Change **E** to **S**, i.e. C04ASC00TY050M

Female - Face view



Female - Face view



Refer to Balluff Catalog for additional cable connectors.

Enhanced Magnetostrictive Technology

The waveguide consists of a special nickel-iron alloy with 0.7 mm O.D. and 0.5 mm I.D.

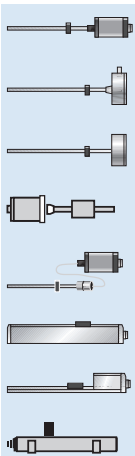
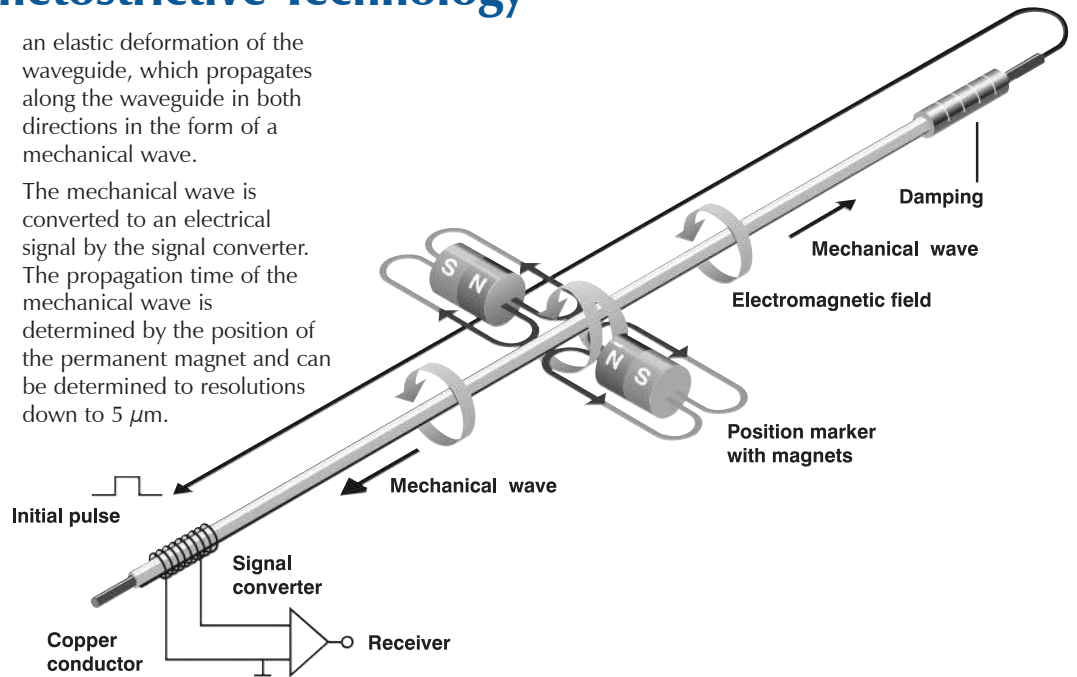
A copper conductor is introduced through the length of this tube. The start of measurement is initiated by a short current pulse. This current generates a circular magnetic field which rotates around the waveguide.

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.

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 μm .



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	Z	W	K
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/ recirculations), 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: 2" to 156" (Consult factory for longer lengths)	2" - 156"	2" - 156"	2" - 156"
Wiring Options			
Quick disconnect	•	•	•
Cable-out	•	•	•
Operating Voltage			
24 V DC ($\pm 20\%$)	•	•	•
± 15 V DC ($\pm 2\%$)	•	•	•
*(24 or 25 bit binary or gray code)	•	•	•

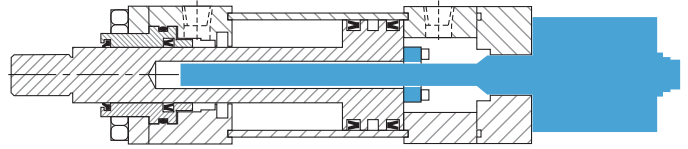
BALLUFF TRANSDUCERS

Nason will build your cylinder with the proper magnet, spacer plates (if required), drilling and tapping, intermediate supports (if required) and furnish the transducer as a complete unit. *All cylinder/transducer assemblies are 100% tested at Nason before shipping.*

INTERNAL MODELS (BALLUFF Z, W, K SERIES)

- Not available on MP1 and MP2 Mounts
- 1.50" to 8" Bores
- Gun-drilled piston rod (Requires 1" piston rod or larger)
- Balluff Magnet (Installed on piston)
- May require additional cap length

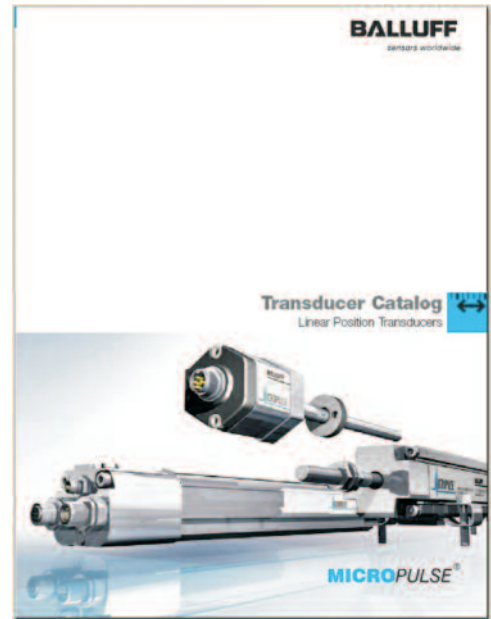
SERIES "Z" SHOWN



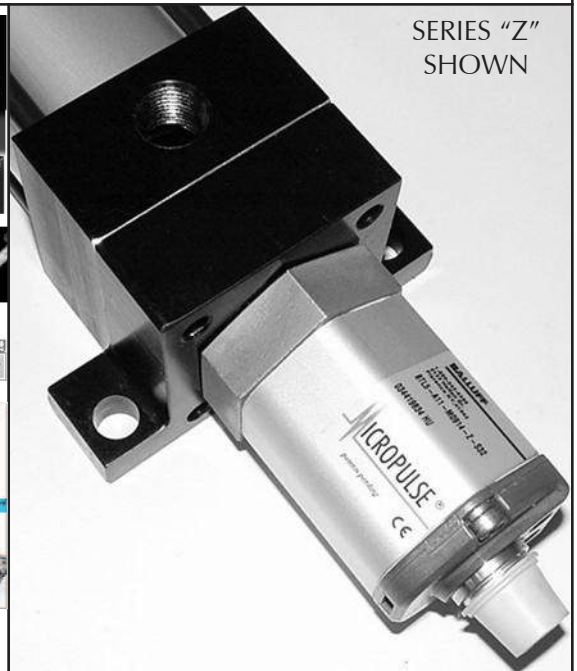
- Complete BALLUFF MICROPULSE™ Transducer information is available in catalog form or electronic PDF downloads.

Visit www.balluff.com

- Other Balluff models are available. Call Nason for information and cylinder design assistance.



SERIES "Z" SHOWN



BALLUFF Sensor Solutions Superior Service Dedicated to our Customer's Success
1-800-543-8390

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2008 Photoelectrics

PRODUCTS SOLUTIONS SALES & SERVICE

MICROPULSE

Micropulse Linear Position Transducers Catalog

- Product Description
- Rod Style Series: BTL Z
- Compact, Rugged Rod Style Thread-in: BTL W
- Compact, Rugged Rod Style Bolt-in: BTL K
- Explosion Proof Rod Style Series: BTL EX
- Embeddable Rod Style Series: BTL E
- Profile Series: BTL P
- Low Profile Series: BTL R

Micropulse Catalog Contents



NASON

NEW THINKING



TECHNICAL DATA

How to determine the right size Cylinder for the job

To determine what size cylinder 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 4 in/sec) require 25% more force than the load, moderate speeds (4 to 16 in/sec) about 50% more, and high speeds (greater than 16 in/sec) about 100% more force. So, for that 100 lb. 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 lbs.) 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. So, 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

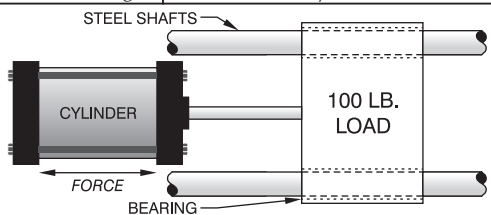
Once you've determined the force you need to move the load at the desired velocity and allow for friction, here's how to find the cylinder bore that meets your specifications.

The force generated by a cylinder is determined by the effective piston area times the air pressure. The force chart on page 203 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 4 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 258 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)*

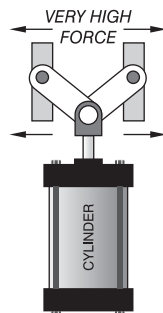
Plain Bearing Material	Cylinder Force	
	Dry Bearing	Oiled Bearing
PTFE	10 lbs.	10 lbs.
UHMW	20 lbs.	20 lbs.
Hardened Steel	25 lbs.	20 lbs.
Brass	40 lbs.	25 lbs.
Cast Iron	45 lbs.	25 lbs.
Steel (soft)	85 lbs.	25 lbs.
Ball Bearing	5-10 lb. Cylinder Force	



General Mechanics

TOGGLE

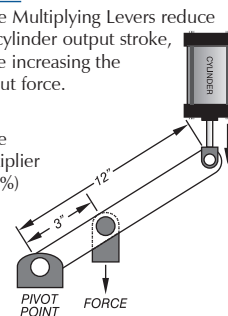
Toggles are complex mechanisms that can achieve very high force.



FORCE MULTIPLYING LEVER

Force Multiplying Levers reduce the cylinder output stroke, while increasing the output force.

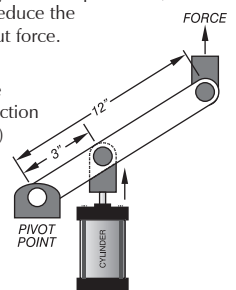
4:1 Force Multiplier (400%)



FORCE REDUCING LEVER

Force Reducing Levers increase the cylinder output stroke, but reduce the output force.

1:4 Force Reduction (25%)

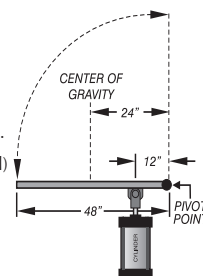


EXAMPLE

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 (assume 25%).



$$\text{LOAD CENTER OF GRAVITY} = \frac{48''}{2} = 24''$$

$$\text{LEVER} = \frac{24''}{12''} = 2:1$$

$$\text{FORCE} = 2 \times 2,000 \text{ LBS.} = 4,000 \text{ LBS.}$$

$$\text{FORCE (INCLUDING } = 4,000 \times 1.25 = 5,000 \text{ LBS. FRICTION)}$$

AT 100 PSI AIR PRESSURE, THE FORCE CHART (ON PAGE 119) SHOWS THAT AN 8" BORE HAS 5,026 LBS. FORCE.

General How To Info
Force Charts
Weight Charts
Seal Kits
Conversion Charts
Fluid Power Formulas
Application Checklist
Options Page 142
Accessories Page 172
Switches Page 184

TECHNICAL DATA

How the right mounting and careful installation help 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.

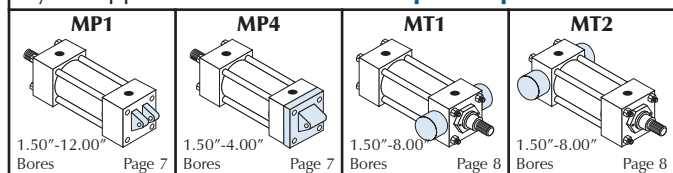
There are cylinder mounts and options to suit virtually every application.

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 Nason 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 page 156 to determine if a stop tube is needed for your application).

Samples of pivot mounts.

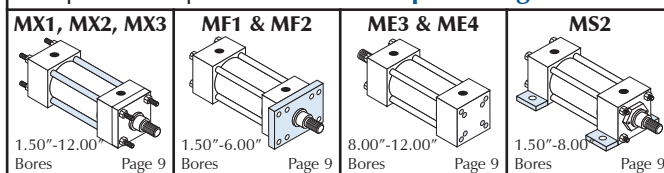


Rigid Mount Cylinders

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. Nason offers a full line of Rod Alignment Couplers to solve misalignment issues (refer to page 181 for details). 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 advice 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.

Wear band. A .063" thick X 0.375" wide (for 1.50" to 8.00" bore, larger strips for bigger bores) PTFE composite material strip is added to the piston diameter to eliminate metal to metal contact between the piston and the tube. Since wear band materials are compressive in nature, they can provide some cylinder side load protection. As side load pressure is applied, the wear band contact area with the tube increases, enabling a higher transfer of load due to the high amount of contact area.

Even though wear bands contain a high percentage of PTFE, they do add additional internal "drag" in the cylinder. Additional drag can effect cycle rates, and at

times, lower overall production in high speed applications.

Fluorocarbon Seals. 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", at time of order.

FDA Lubricant. 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. Refer to pages 186-193 for more details.

TECHNICAL DATA: FORCE CHART

BASIC CYLINDER FORCE CHART* (NAC, HDC, SNC)

BORE	ROD DIA.	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.

TECHNICAL DATA: FORCE & TORQUE CHART

'NR' NON-ROTATING CYLINDER FORCE CHART*

BORE	ROD DIA.	GUIDE RODS DIA.	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
2.50	ALL	0.313	PUSH	4.755	285	380	475	951	1188	1902	.00275
	0.625		PULL	4.448	266	355	444	889	1112	1779	.00257
	1.000		PULL	3.970	238	317	397	794	992	1588	.00229
3.25	ALL	0.375	PUSH	8.076	484	646	807	1613	2016	3226	.00466
	1.000		PULL	7.291	437	583	729	1458	1822	2916	.00422
	1.375		PULL	6.591	395	527	659	1318	1647	2636	.00381
4.00	ALL	0.625	PUSH	11.952	717	956	1195	2390	2988	4780	.00692
	1.000		PULL	11.167	670	893	1116	2233	2791	4466	.00646
	1.375		PULL	11.467	628	837	1046	2093	2616	4186	.00606
5.00	ALL	0.625	PUSH	19.021	1141	1521	1902	3804	4755	7608	.01100
	1.000		PULL	18.236	1094	1458	1823	3647	4559	7294	.01050
	1.375		PULL	17.536	1052	1402	1753	3507	4384	7014	.01010
6.00	ALL	0.625	PUSH	27.660	1659	2212	2766	5532	6915	11064	.01600
	1.375		PULL	26.175	1570	2094	2617	5235	6543	10470	.01510
	1.750		PULL	25.255	1515	2020	2525	5051	6313	10102	.01460
8.00	ALL	1.000	PUSH	48.694	2921	3895	4869	9738	12173	19477	.02810
	1.375		PULL	47.209	2832	3776	4720	9441	11802	18883	.02730
	1.750		PULL	46.289	2777	3703	4628	9257	11572	18515	.02670
10.00	ALL	1.000	PUSH	76.969	4618	6157	7696	15393	19242	30787	.04450
	1.750		PULL	74.564	4473	5965	7456	14912	18641	29825	.04310
	2.000		PULL	73.829	4429	5906	7382	14765	18457	29531	.04270
12.00	ALL	1.000	PUSH	111.527	6691	8922	11152	22305	27881	44610	.06450
	2.000		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.

*Theoretical force. Actual force will be reduced by friction.

TORQUE CHARTS: CYLINDER TIE RODS

(Aluminum, Stainless Steel & Steel Tubing)

(Fiberglass AIR/OIL TANK Tubing Only)

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

CYLINDER BORE	TIE ROD THREAD SIZE	TORQUE IN FT.-LBS.
2.50	5/16-24	10-12
3.25	3/8-24	20
4.00	3/8-24	25
5.00	1/2-20	35
8.00	5/8-18	75

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

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 S.H.C.S.	5
3.25 TO 12.00	1/4-28 S.H.C.S.	12

TECHNICAL DATA: FORCE CHART

'HMD' CYLINDER FORCE CHART*

BORE	ROD DIA. (MM)	EFFECTIVE PISTON AREA	POUNDS OF FORCE AT PSI													DISPLACEMENT PER INCH OF STROKE (GALLONS)
			250	350	440	500	550	630	675	750	830	980	1000	1300	1500	
1.50	EXTEND	1.767	442	618	777	884	972	1113	1193	1325	1467	1732	1767	2297	2651	0.00765
	0.625	1.460	365	511	642	730	803	920	986	1095	1212	1431	1460	1898	2190	0.00635
	1.000	0.982	246	344	432	491	540	619	663	737	815	962	982	1277	1473	0.00425
2.00	EXTEND	3.142	786	1100	1382	1571	1728	1979	2121	2357	2608	3079	3142	4085	4713	0.0136
	0.625	2.835	709	992	1247	1418	1559	1786	1914	2126	2353	2778	2835	3686	4253	0.0123
	1.000	2.357	589	825	1037	1179	1296	1485	1591	1768	1956	2310	2357	3064	3536	0.0102
	1.375	1.657	414	580	729	829	911	1044	1118	1243	1375	1624	1657	2154	2486	0.0071
2.50	EXTEND	4.909	1227	1718	2160	2455	2700	3093	3314	3682	4074	4811	4909	6382	7364	0.0213
	0.625	4.602	1151	1611	2025	2301	2531	2899	3106	3452	3820	4510	4602	5983	6903	0.0200
	1.000	4.124	1031	1443	1815	2062	2268	2598	2784	3093	3423	4042	4124	5361	6186	0.0179
	1.375	3.424	856	1198	1507	1712	1883	2157	2311	2568	2842	3356	3424	4451	5136	0.0148
	1.750	2.504	626	876	1102	1252	1377	1578	1690	1878	2078	2454	2504	3255	3756	0.0109
3.25	EXTEND	8.296	2074	2904	3650	4148	4563	5226	5600	6222	6886	8130	8296	10785	12444	0.0359
	1.000	7.511	1878	2629	3305	3756	4131	4732	5070	5633	6234	7361	7511	9764	11267	0.0325
	1.375	6.811	1703	2384	2997	3406	3746	4291	4597	5108	5653	6675	6811	8854	10217	0.0294
	1.750	5.891	1473	2062	2592	2946	3240	3711	3976	4418	4890	5773	5891	7658	8837	0.0255
4.00	EXTEND	12.566	3142	4398	5529	6283	6911	7917	8482	9425	10430	12315	12566	16336	18849	0.0544
	1.000	11.781	2945	4123	5184	5891	6480	7422	7952	8836	9778	11545	11781	15315	17672	0.0510
	1.375	11.081	2770	3878	4876	5541	6095	6981	7480	8311	9197	10859	11081	14405	16622	0.0479
	1.750	10.161	2540	3556	4471	5081	5589	6401	6859	7621	8434	9958	10161	13209	15242	0.0440
	2.000	9.424	2356	3298	4147	4712	5183	5937	6361	7068	7822	9236	9424	12251	14136	0.0408
	2.500	7.657	1914	2680	3369	3829	4211	4824	5168	5743	6355	7504	7657	9954	11486	0.0331
5.00	EXTEND	19.635	4909	6872	8639	9818	10799	12370	13254	14726	16297	19242	19635	25526	29453	0.0850
	1.000	18.850	4713	6598	8294	9425	10368	11876	12724	14138	15646	18473	18850	24505	28275	0.0816
	1.375	18.150	4538	6353	7986	9075	9983	11435	12251	13613	15065	17787	18150	23595	27225	0.0785
	1.750	17.230	4308	6031	7581	8615	9477	10855	11630	12923	14301	16885	17230	22399	25845	0.0746
	2.000	16.493	4123	5773	7257	8247	9071	10391	11133	12370	13689	16163	16493	21441	24740	0.0714
	2.500	14.726	3682	5154	6479	7363	8099	9277	9940	11045	12223	14431	14726	19144	22089	0.0637
	3.000	12.566	3142	4398	5529	6283	6911	7917	8482	9425	10430	12315	12566	16336	18849	0.0544
6.00	EXTEND	28.274	7069	9896	12441	14137	15551	17813	19085	21206	23467	27709	28274	36756	42411	0.1224
	1.375	26.789	6697	9376	11787	13395	14734	16877	18083	20092	22235	26253	26789	34826	40184	0.1159
	1.750	25.869	6467	9054	11382	12935	14228	16297	17462	19402	21471	25352	25869	33630	38804	0.1112
	2.000	25.132	6283	8796	11058	12566	13823	15833	16964	18849	20860	24629	25132	32672	37698	0.1088
	2.500	23.365	5841	8178	10281	11683	12851	14720	15771	17524	19393	22898	23365	30375	35048	0.1011
	3.000	21.205	5301	7422	9330	10603	11663	13359	14313	15904	17600	20781	21205	27567	31808	0.0918
	3.500	18.653	4663	6529	8207	9327	10259	11751	12591	13990	15482	18280	18653	24249	27980	0.0808
	4.000	15.708	3927	5498	6912	7854	8639	9896	10603	11781	13038	15394	15708	20420	23562	0.0680
8.00	EXTEND	50.265	12566	17593	22117	25133	27646	31667	33929	37699	41720	49260	50265	65345	75398	0.2176
	1.375	48.780	12195	17073	21463	24390	26829	30731	32927	36585	40487	47804	48780	63414	73170	0.2111
	1.750	47.860	11965	16751	21058	23930	26323	30152	32306	35895	39724	46903	47860	62218	71790	0.2072
	2.000	47.123	11781	16493	20734	23562	25918	29687	31808	35342	39112	46181	47123	61260	70685	0.2040
	2.500	45.356	11339	15875	19957	22678	24946	28574	30615	34017	37645	44449	45356	58963	68034	0.1963
	3.000	43.196	10799	15119	19006	21598	23758	27213	29157	32397	35853	42332	43196	56155	64794	0.1870
	3.500	40.644	10161	14225	17883	20322	22354	25606	27435	30483	33735	39831	40644	52837	60966	0.1760
	4.000	37.699	9425	13195	16588	18850	20734	23750	25447	28274	31290	36945	37699	49009	56549	0.1632
	4.500	34.361	8590	12026	15119	17181	18899	21647	23194	25771	28520	33674	34361	44669	51542	0.1488
5.000	30.630	7658	10721	13477	15315	16847	19297	20675	22973	25423	30017	30630	39819	45945	0.1326	
5.500	26.507	6627	9277	11663	13254	14579	16699	17892	19880	22001	25977	26507	34459	39761	0.1148	

CYLINDER TORQUE CHARTS

'HMD' HYDRAULIC MEDIUM DUTY TIE ROD TORQUE SPECS	
BORE	TORQUE (FT-LBS)
1.50	8 FT-LBS
2.00	15 FT-LBS
2.50	15 FT-LBS
3.25	30 FT-LBS
4.00	30 FT-LBS
5.00	55 FT-LBS
6.00	60 FT-LBS
7.00	140 FT-LBS
8.00	140 FT-LBS

'HMD' HYDRAULIC MEDIUM DUTY SQUARE RETAINER PLATE TORQUE SPECS	
HEX HEAD SCREW SIZE	TORQUE (FT-LBS)
1/4 - 28	7 FT-LBS
5/16 - 24	12 FT-LBS
3/8 - 24	30 FT-LBS
1/2 - 20	50 FT-LBS
5/8 - 18	50 FT-LBS

'HMD' HYDRAULIC MEDIUM DUTY ROUND RETAINER PLATE TORQUE SPECS	
SOCKET HEAD CAP SCREW SIZE	TORQUE (FT-LBS)
10 - 32	5 FT-LBS
1/4 - 28	15 FT-LBS
5/16 - 24	20 FT-LBS

All Torque Specs are based upon using anti-seize thread lubricant. Tighten cylinders using an "X" tightening pattern on tie rods.

Nason SPEC: LPS Premium Copper Anti-Seize
 Temperature Rating: -65°F to 1800°F
 Military Spec: MIL-PRF-907-E

Torque Tolerance: -0% to +5%

General How To Info
 Force Charts
 Weight Charts
 Seal Kits
 Conversion Charts
 Fluid Power Formulas
 Application Checklist
 Options Page 142
 Accessories Page 172
 Switches Page 184

TECHNICAL DATA: FORCE CHART

'HHD' CYLINDER FORCE CHART*

BORE	ROD DIA. (MM)	EFFECTIVE PISTON AREA	POUNDS OF FORCE AT PSI										DISPLACEMENT PER INCH OF STROKE (GALLONS)
			100	150	200	250	500	1000	1500	2000	2500	3000	
1.50	EXTEND	1.77	177	265	353	442	884	1767	2651	3534	4418	5301	.00765
	0.625	1.46	146	219	292	365	730	1460	2191	2921	3651	4381	.00635
	1.000	0.98	98	147	196	245	491	982	1473	1964	2454	2945	.00425
2.00	EXTEND	3.14	314	471	628	785	1571	3142	4712	6283	7854	9425	.0136
	1.000	2.36	236	353	471	589	1178	2356	3534	4712	5891	7069	.0102
	1.375	1.66	166	249	331	414	828	1657	2485	3313	4142	4970	.0071
2.50	EXTEND	4.91	491	736	982	1227	2454	4909	7363	9818	12272	14726	.0213
	1.000	4.12	412	619	825	1031	2062	4123	6185	8247	10308	12370	.0179
	1.375	3.42	342	514	685	856	1712	3424	5136	6848	8560	10272	.0148
	1.750	2.50	250	376	501	626	1252	2503	3755	5007	6259	7510	.0109
3.25	EXTEND	8.30	830	1244	1659	2074	4148	8296	12444	16592	20739	24887	.0359
	1.375	6.81	681	1022	1362	1703	3405	6811	10216	13622	17027	20433	.0294
	1.750	5.89	589	884	1178	1473	2945	5891	8836	11781	14726	17672	.0255
	2.000	5.15	515	773	1031	1289	2577	5154	7731	10308	12885	15463	.0223
4.00	EXTEND	12.57	1257	1885	2513	3142	6283	12566	18850	25133	31416	37699	.0544
	1.750	10.16	1016	1524	2032	2540	5081	10161	15242	20322	25403	30483	.0440
	2.000	9.42	942	1414	1885	2356	4712	9425	14137	18850	23562	28274	.0408
	2.500	7.66	766	1149	1532	1914	3829	7658	11486	15315	19144	22973	.0331
5.00	EXTEND	19.64	1964	2945	3927	4909	9818	19635	29453	39270	49088	58905	.0850
	2.000	16.49	1649	2474	3299	4123	8247	16493	24740	32987	41234	49480	.0714
	2.500	14.73	1473	2209	2945	3682	7363	14726	22089	29453	36816	44179	.0637
	3.000	12.57	1257	1885	2513	3142	6283	12566	18850	25133	31416	37699	.0544
	3.500	10.02	1002	1503	2004	2505	5009	10019	15028	20038	25047	30056	.0434
6.00	EXTEND	28.27	2827	4241	5655	7069	14137	28274	42412	56549	70686	84823	.1224
	2.500	23.37	2337	3505	4673	5841	11683	23366	35048	46731	58414	70097	.1011
	3.000	21.21	2121	3181	4241	5301	10603	21206	31809	42412	53015	63617	.0918
	3.500	18.65	1865	2798	3730	4663	9325	18650	27975	37300	46625	55950	.0808
	4.000	15.70	1570	2355	3140	3925	7850	15700	23550	31400	39250	47100	.0680
8.00	EXTEND	50.27	5027	7540	10053	12566	25133	50266	75398	100531	125664	150797	.2176
	3.500	40.64	4064	6097	8129	10161	20322	40644	60967	81289	101611	121933	.1760
	4.000	37.70	3770	5655	7540	9425	18850	37699	56549	75398	94248	113098	.1632
	4.500	34.36	3436	5154	6872	8590	17181	34361	51542	68723	85903	103084	.1488
	5.000	30.63	3063	4595	6126	7658	15315	30631	45946	61261	76577	91892	.1326
	5.500	26.51	2651	3976	5301	6627	13254	26507	39761	53015	66268	79522	.1148

*Theoretical force. Actual force will be reduced by friction.

CYLINDER TORQUE CHARTS

TIE ROD TORQUE SPECS		
BORE	TIE ROD SIZE	TORQUE (FT-LBS)
1.50	.375 Dia.	25 FT-LBS
2.00	.500 Dia.	50 FT-LBS
2.50	.500 Dia.	50 FT-LBS
3.25	.625 Dia.	120 FT-LBS
4.00	.625 Dia.	130 FT-LBS
5.00	.875 Dia.	300 FT-LBS
6.00	1.000 Dia.	450 FT-LBS
8.00	1.250 Dia.	900 FT-LBS

BUSHING RETAINER SCREWS TORQUE SPECS	
SHCS SIZE	TORQUE (FT-LBS)
1/4" Thread	15 FT-LBS
5/16" Thread	20 FT-LBS
3/8" Thread	30 FT-LBS
7/16" Thread	40 FT-LBS

BUSHING RETAINER HEX HEAD SCREWS TORQUE SPECS	
HEX HEAD SCREW SIZE	TORQUE (FT-LBS)
3/8" Thread	30 FT-LBS
1/2" Thread	40 FT-LBS
5/8" Thread	50 FT-LBS
7/8" Thread	90 FT-LBS
1" Thread	125 FT-LBS

All Torque Specs are based upon using anti-seize thread lubricant.

Nason SPEC: LPS Premium Copper Anti-Seize

Temperature Rating: -65°F to 1800°F

Military Spec: MIL-PRF-907-E

Torque Tolerance: -0% to +5%

PRESSURE RATING CHART

BORE	ROD DIA. (MM)	PRESSURE RATING PER MOUNT (PSI)					
		MF1	MF2	MF5	MT1	MT2	MT4
1.500	0.625	2600	3000	3000	3000	3000	3000
	1.000	1600	3000	3000	3000	3000	3000
2.000	1.000	2600	3000	3000	3000	3000	3000
	1.375	1600	3000	3000	3000	3000	3000
2.500	1.000	2600	3000	3000	3000	3000	3000
	1.375	2000	3000	3000	3000	3000	3000
	1.750	1600	3000	3000	3000	3000	3000
3.250	1.375	2600	3000	3000	2800	2800	2800
	1.750	2200	3000	3000	2800	2800	2800
	2.000	1600	3000	3000	2800	2800	2800
4.000	1.750	2600	3000	3000	1800	1800	1800
	2.000	1900	3000	3000	1800	1800	1800
	2.500	1600	3000	3000	1800	1800	1800
5.000	2.000	2200	2000	3000	1200	1200	1200
	2.500	1600	2500	3000	1200	1200	1200
	3.000	1200	2800	3000	1200	1200	1200
6.000	3.500	750	3000	3000	1200	1200	1200
	2.500	1800	2000	3000	1000	1000	1000
	3.000	1450	2500	3000	1000	1000	1000
	3.500	1100	2800	3000	1000	1000	1000
8.000	4.000	750	3000	3000	1000	1000	1000
	3.500	900	1500	3000	1000	1000	1000
	4.000	800	1700	3000	1000	1000	1000
	4.500	700	1800	3000	1000	1000	1000
	5.000	500	1900	3000	1000	1000	1000
	5.500	500	2000	3000	1000	1000	1000

TECHNICAL DATA: WEIGHT CHARTS

NAC, HDC, SNC BASIC CYLINDERS (with standard rod size)

WEIGHT IN POUNDS

CYLINDER BORE	MODEL								ADD PER IN. OF STROKE
	MXO	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	N/A	20.0	17.5	.59
6.00	21.5	25.2	21.5	29.7	32.2	N/A	32.2	27.2	.84
8.00	35.4	36.5	35.4	43.5	N/A	N/A	35.4	N/A	1.25
10.00	70.3	N/A	70.0	72.0	N/A	N/A	70.3	N/A	1.60
12.00	107.9	N/A	N/A	109.9	N/A	N/A	107.5	N/A	2.30

All weights are in pounds. For oversize rod series add 10%.
*Weight includes clevis pins.

SNC CYLINDERS WITH ROD LOCK MOUNTED

WEIGHT IN POUNDS

CYLINDER WITH ROD LOCK											ADD PER IN. OF STROKE	ROD LOCK UNIT ONLY
BORE	ROD DIA	MXO	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	
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	6.3	6.8	6.8	7.5	7.6	7.5	7.5	7.9	0.28	2.40	
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	

HMD HYDRAULIC CYLINDERS

WEIGHT IN POUNDS

BORE	ROD DIA. (MM)	MOUNT													ADD PER INCH OF STROKE	
		MXO	MXO with KP	ME5	ME6	MF1	MF2	MF5	MF6	MP1	MS2 MS3 MS7	MS4	MT1 MT2	MT4		MX1 MX2 MX3
1.50	0.625	7.2	7.3	9.1	8.8	7.6	8.2	8.6	9.0	7.6	7.8	7.2	7.6	9.5	7.4	.6
	1.000	7.6	7.7	9.5	9.2	7.9	8.6	8.9	9.3	8.0	8.0	7.6	8.0	10	7.8	.8
2.00	1.000	11.5	11.7	14.2	13.8	12.6	13.9	14.7	15.6	12.7	12.8	11.4	12.7	16.5	12.1	1.0
	1.375	12.3	12.5	15.2	14.6	13.7	14.7	15.5	16.4	13.5	13.6	12.2	13.5	17.0	12.9	1.4
2.50	1.000	16.1	17.3	19.3	18.8	17.1	19.5	19.4	20.8	17.3	19.4	15.8	17.2	22	16.8	1.3
	1.375	16.7	16.9	19.9	19.4	17.7	19.9	19.6	21.3	17.9	19.9	16.4	17.8	22.5	17.2	1.8
	1.750	18.1	18.3	21.3	20.8	19.1	21.3	21.2	22.7	19.3	21.2	17.5	19.2	24	18.6	2.3
3.25	1.375	32.8	35.3	38.6	37.9	35	38.9	39.6	42.5	36.2	36	32.2	35.4	42	33.7	2.3
	1.750	33.7	34	39.5	38.8	35.9	39.8	40.5	43.4	37	37	33.1	36.1	43	34.6	2.9
4.00	2.000	34.3	34.6	40.1	39.4	36.5	40.4	41.1	44.0	37.7	38	33.7	36.7	43	35.3	3.2
	1.750	44	47.3	50.6	49.8	47	52.5	53	57	50	50	43	47	54	45	3.1
5.00	2.000	45	47.7	51.6	50.8	48	53.5	54	58	51	51	44	48	55	46	3.4
	2.500	47	47.5	54	53	50	55	56	60	52.5	53	46	49	56	48	4.4
	2.000	79	87	89	88	83.5	93	92	100	86.5	85	78	80	93	82	4.8
6.00	2.500	81	88	91	90	85.5	95	94	102	90	87	80	83	96	84	5.2
	3.000	85	90	95	94	89	99	98	105	92	91	84	87	99	88	7.0
	3.500	86	87	96	95	90	100	99	106	93	92	85	88	100	89	8.4
	2.500	124	134	140	140	131	145	145	153	137	136	122	127	143	128	6.5
8.00	3.000	126	135	142	142	133	147	147	159	139	138	124	129	145	130	7.8
	3.500	128	136	144	144	135	149	149	160	141	140	126	131	147	132	9.2
	4.000	132	139	148	148	139	153	152	164	145	144	130	135	151	136	10.9
8.00	3.500	256	275	288	288	266	290	285	305	282	277	253	263	288	265	11.7
	4.000	261	277	293	293	271	295	290	310	286	282	258	268	293	270	13.3
	4.500	264	279	296	296	274	298	293	313	289	285	261	271	296	273	14.4
	5.000	268	281	300	300	278	302	297	317	294	289	265	275	301	277	17.5
5.500	276	285	308	308	285	309	304	324	301	297	273	282	308	285	19.7	

All weights are in pounds.
Note: Add 20% to mount and stroke weight for double rod end cylinders.

General How To Info
Force Charts
Weight Charts
Seal Kits
Conversion Charts
Fluid Power Formulas
Application Checklist
Options Page 142
Accessories Page 172
Switches Page 184

TECHNICAL DATA: WEIGHT CHARTS

HHD HYDRAULIC CYLINDERS

WEIGHT IN POUNDS

BORE	ROD DIA. (MM)	MOUNT													ADD PER INCH OF STROKE	
		MS4 MX0	MX1 MX2 MX3	MF1	MF2	MF5	MF6	MP1	MP2	MS2 MS3 MS7	MT1 MT2	MT4	ME3 ME4	SB		
1.50	0.625	3.9	4.3	4.6	4.6	5.0	4.2	4.8	4.4	4.4	5.8			4.1	0.6	
	1.000	4.7	5.0	5.4	5.4	5.8	5.0	5.6	5.2	5.2	6.6			4.9	0.8	
2.00	0.625	6.4	6.9	7.3	7.4	8.0	6.7	7.3	6.9	7.0	8.7			6.6	1.0	
	1.000	6.9	7.3	7.8	7.9	8.5	7.2	7.8	7.4	7.5	9.2			7.1	1.3	
	1.375	8.4	8.7	9.3	9.4	10.0	8.7	9.3	8.9	9.0	10.7			8.6	1.5	
2.50	0.625	8.9	9.6	10.2	10.0	11.0	9.3	9.8	9.4	9.6	11.7			9.2	1.2	
	1.000	9.4	10.0	10.7	10.5	11.5	9.8	10.3	9.9	10.1	12.2			9.7	1.4	
	1.375	11.0	11.5	12.3	12.1	13.1	11.4	11.9	11.5	11.7	13.8			11.3	1.6	
	1.750	13.1	13.6	14.4	14.2	15.2	13.5	14.0	13.6	13.8	15.9			13.4	1.9	
3.25	1.000	16.4	18.4	19.9	19.1	21.6	17.8	19.5	17.7	17.8	20.0			17.2	1.6	
	1.375	16.9	18.8	20.4	19.5	22.1	18.3	20.0	18.2	18.3	20.5			17.7	1.8	
	1.750	19.1	20.9	22.6	21.5	24.3	20.5	22.2	20.4	20.5	22.7			19.9	2.1	
	2.000	26.8	28.5	30.3	29.1	32.0	28.2	29.9	28.1	28.2	30.4			27.6	2.3	
4.00	1.000	25.9	28.7	30.7	29.0	32.6	27.3	29.0	27.2	27.3	29.8			26.7	2.0	
	1.375	26.3	28.9	31.1	29.1	33.0	27.7	29.4	27.6	27.7	30.2			27.1	2.2	
	1.750	28.6	31.0	33.4	31.3	35.3	30.0	31.7	29.9	30.0	32.5			29.4	2.5	
	2.000	32.5	34.7	37.3	35.1	39.2	33.9	35.6	33.8	33.9	36.4			33.3	2.7	
	2.500	35.8	37.9	40.6	38.3	42.5	37.2	38.9	37.1	37.2	39.7			36.6	3.2	
5.00	1.000	38.8	42.8	45.8	43.4	48.7	40.5	41.9	41.9	40.2	44.5			39.7	2.2	
	1.375	39.3	42.9	46.3	43.7	49.2	41.0	42.4	42.4	40.7	45.0			40.2	2.4	
	1.750	41.9	45.1	48.9	46.1	51.8	43.6	45.0	45.0	43.3	47.6			42.8	2.7	
	2.000	45.5	48.5	52.5	49.4	55.4	47.2	48.6	48.6	46.9	51.2			46.4	2.9	
	2.500	49.5	52.3	56.5	53.1	59.4	51.2	52.6	52.6	50.9	55.2			50.4	3.4	
	3.000	56.3	58.9	63.3	59.4	66.2	58.0	59.4	59.4	57.7	62.0			57.2	4.0	
6.00	3.500	62.7	65.1	69.7	65.3	72.6	64.4	65.8	65.8	64.1	68.4			63.6	4.7	
	1.375	67.8	74.8	79.3	74.2	83.2	69.9	74.0	70.9	69.5	78.3			68.9	3.0	
	1.750	72.0	78.6	83.5	78.2	87.4	74.1	78.2	75.1	73.7	82.5			73.1	3.3	
	2.000	75.0	81.2	86.5	80.9	90.4	77.1	81.2	78.1	76.7	85.5			76.1	3.5	
	2.500	77.7	83.5	89.2	82.6	93.1	79.8	83.9	80.8	79.4	88.2			78.8	4.0	
	3.000	84.9	90.3	96.4	89.3	100.3	87.0	91.1	88.0	86.6	95.4			86.0	4.6	
	3.500	92.3	97.3	103.8	96.2	107.7	94.4	98.5	95.4	94.0	102.8			93.4	5.3	
8.00	4.000	99.7	104.3	111.2	103.1	115.1	101.8	105.9	102.8	101.4	110.2			100.8	6.3	
	1.375	96.0					99.0		99.5	98.0	113.0			95.0	97.7	4.0
	1.750	103.0					106.0		106.5	105.0	120.0			102.0	104.7	4.3
	2.000	111.0					114.0		114.5	113.0	128.0			110.0	112.7	4.5
	2.500	121.0					124.0		124.5	123.0	138.0			120.0	122.7	5.0
	3.000	133.0					136.0		136.5	135.0	150.0			132.0	134.7	5.6
	3.500	139.0					142.0		142.5	141.0	156.0			138.0	140.7	6.4
	4.000	145.0					148.0		148.5	147.0	162.0			144.0	146.7	7.3
	4.500	152.0					155.0		155.5	154.0	169.0			151.0	153.7	8.2
	5.000	160.0					163.0		163.5	162.0	177.0			159.0	161.7	9.2
5.500	168.0					171.0		171.5	170.0	185.0	167.0	169.7	10.5			

All weights are in pounds. **Note:** Add 20% to mount and stroke weight for double rod end cylinders. Add 1% for cushions.

'CRN' SERIES BASIC CYLINDERS

WEIGHT IN POUNDS

BORE	ROD DIAMETER	MODEL				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

BORE	ROD DIAMETER	MODEL				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

TECHNICAL DATA: 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
RC750	1.22	RE625	.30	EB1000	6.36	CB1000	6.20
RC1000	2.58	RE750	1.10	EB1375	11.22	CB1375	9.70
RC1250	6.28	RE1000	2.40	EB1750	17.5	CB1750	17
RC1375	6.28	RE1250	5.58	EB2000	25	CB2000	26
RC1500	11.6	RE1375	5.58	EB2500	39	CB2500	37
RC1750	12.7	RE1500	10.52	EB3000	44	CB3000	44
RC1875	18	RE1875	11.5	EB3500	113	CB3500	113
RC2250	27	RE2250	23	EB4000	179	—	—
RC2500	36	RE2500	32	—	—	—	—
RC3250	71	RE3250	36	—	—	—	—
RC4000	107	RE3500	36	—	—	—	—
—	—	RE4000	84	—	—	—	—

CLEVIS PINS		WELD PLATE		FLANGE END COUPLER	
PART NO.	WEIGHT	PART NO.	WEIGHT	PART NO.	WEIGHT
CP500C	.12	CP500E	.12	WP625	.45
CP750C	.38	CP750E	.38	WP1000	.69
CP1000C	.80	CP1000E	.80	WP1375	1.26
CP1375C	1.22	CP1375E	1.22	WP1750	2.25
CP1750C	4.1	CP1750E	3.78	WP2000	2.67
CP2000C	5.36	CP2000E	4.93	WP2500	3.38
CP2500C	9.42	CP2500E	9.22	WP3000	6.74
CP3000C	13.69	CP3000E	13.57	WP3500	10.91
CP3500C	24.42	CP3500E	24.12	WP4000	10.91
CP4000C	35.45	CP4000E	35.06	WP4500	14.26
—	—	—	—	WP5000	14.26
—	—	—	—	WP5500	22.55
				FEC625	.41
				FEC1000	.65
				FEC1375	1.22
				FEC1750	2.25
				FEC2000	2.59
				FEC2500	3.30
				FEC3000	6.66
				FEC3500	10.83
				FEC4000	10.83
				FEC4500	14.86
				FEC5000	14.86
				FEC5500	22.47

ALIGNMENT COUPLERS WEIGHT CHART

WEIGHT IN POUNDS

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

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 NO.	WEIGHT	PART NO.	WEIGHT	PART NO.	WEIGHT	PART NO.	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	-	-

General How To Info
Force Charts
Weight Charts
Seal Kits
Conversion Charts
Fluid Power Formulas
Application Checklist
Options Page 142
Accessories Page 172
Switches Page 184

TECHNICAL DATA

HYDRAULIC CYLINDER SPEEDS

BORE	ROD DIA. (MM)	1 GPM	3 GPM	5 GPM	8 GPM	12 GPM	15 GPM	20 GPM	25 GPM	30 GPM	40 GPM	50 GPM	75 GPM
1.50	NONE	130	392	654	1034	—	—	—	—	—	—	—	—
	0.625	158	476	792	1265	—	—	—	—	—	—	—	—
	1.000	235	706	1176	1880	—	—	—	—	—	—	—	—
2.00	NONE	73	221	368	588	883	1120	—	—	—	—	—	—
	1.000	97	294	490	782	1175	1465	—	—	—	—	—	—
	1.375	139	418	697	1115	1673	2090	—	—	—	—	—	—
2.50	NONE	47	131	235	376	565	675	940	1175	—	—	—	—
	1.000	56	168	280	448	672	840	1120	1400	—	—	—	—
	1.375	67	203	339	542	813	1015	1355	1695	—	—	—	—
	1.750	92	277	463	740	1110	1385	1850	2310	—	—	—	—
3.25	NONE	28	83	139	223	334	417	557	696	836	1115	—	—
	1.375	34	102	170	271	407	510	680	850	1020	1360	—	—
	1.750	39	118	196	313	472	588	784	980	1176	1568	—	—
	2.000	44	134	224	358	537	672	896	1120	1344	1792	—	—
4.00	NONE	18	55	92	147	220	276	368	460	552	736	920	—
	1.750	22	68	113	182	273	339	452	565	678	904	1130	—
	2.000	24	73	122	196	294	366	488	610	732	976	1220	—
	2.500	30	90	150	241	362	450	600	750	900	1200	1500	—
5.00	NONE	12	35	58	94	141	174	232	290	348	464	580	870
	2.000	14	42	70	112	168	210	280	350	420	560	700	1050
	2.500	16	47	78	125	188	235	315	390	470	630	780	1170
	3.000	18	55	92	147	220	275	365	460	550	730	920	1380
	3.500	22	66	111	178	266	333	444	555	665	888	1110	1665
6.00	NONE	8	24	41	65	98	123	162	202	245	320	405	606
	2.500	10	30	50	79	118	150	200	250	300	400	495	750
	3.000	11	33	54	87	130	165	206	270	325	435	545	810
	3.500	12	37	62	99	148	185	245	310	370	495	615	830
	4.000	15	44	73	117	176	220	295	365	440	585	735	1095
8.00	NONE	4	14	23	36	55	69	92	115	135	185	230	345
	3.500	5.5	17	28	45	68	85	115	140	170	230	285	420
	4.000	6	18	30	49	73	90	122	150	180	240	305	450
	4.500	6.5	20	33	53	80	100	135	165	200	265	335	495
	5.000	7.5	22	38	60	90	114	150	185	225	300	375	555
	5.500	8.5	26	43	70	104	129	172	215	255	345	430	645

Data shown are cylinder rod travel speeds in inches per minute. The extension speeds represent the net piston area for rod diameters shown.

TECHNICAL DATA: SEAL KITS

SERIES 'NAC', 'EN' & 'SNC'

NOTE: To insure proper seals are supplied for all models, **ALWAYS** supply Nason 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	SK 625-150	SK 625-150H	SK 625-150C	SK 625-150HC	SKD 625-150	SKD 625-150H	SKD 625-150HC
2.00	SK 625-200	SK 625-200H	SK 625-200C	SK 625-200HC	SKD 625-200	SKD 625-200H	SKD 625-200HC
2.50	SK 625-250	SK 625-250H	SK 625-250C	SK 625-250HC	SKD 625-250	SKD 625-250H	SKD 625-250HC
3.25	SK 100-325	SK 100-325H	SK 100-325C	SK 100-325HC	SKD 100-325	SKD 100-325H	SKD 100-325HC
4.00	SK 100-400	SK 100-400H	SK 100-400C	SK 100-400HC	SKD 100-400	SKD 100-400H	SKD 100-400HC
5.00	SK 100-500	SK 100-500H	SK 100-500C	SK 100-500HC	SKD 100-500	SKD 100-500H	SKD 100-500HC
6.00	SK 137-600	SK 137-600H	SK 137-600C	SK 137-600HC	SKD 137-600	SKD 137-600H	SKD 137-600HC
8.00	SK 137-800	SK 137-800H	SK 137-800C	SK 137-800HC	SKD 137-800	SKD 137-800H	SKD 137-800HC
10.00	SK 175-1000	SK 175-1000H	SK 175-1000C	SK 175-1000HC	SKD 175-1000	SKD 175-1000H	SKD 175-1000HC
12.00	SK 200-1200	SK 200-1200H	SK 200-1200C	SK 200-1200HC	SKD 200-1200	SKD 200-1200H	SKD 200-1200HC

BORE	OVERSIZE SINGLE ROD END				OVERSIZE DOUBLE ROD END		
	PART NO.	WITH CUSHIONS			PART NO.	WITH CUSHIONS	
		H	C	HC		H	HC
1.50	SK 100-150	N/A	SK 100-150C	N/A	SKD 100-150	N/A	N/A
2.00	SK 100-200	SK 100-200H	SK 100-200C	SK 100-200HC	SKD 100-200	SKD 100-200H	SKD 100-200HC
2.50	SK 100-250	SK 100-250H	SK 100-250C	SK 100-250HC	SKD 100-250	SKD 100-250H	SKD 100-250HC
3.25	SK 137-325	SK 137-325H	SK 137-325C	SK 137-325HC	SKD 137-325	SKD 137-325H	SKD 137-325HC
4.00	SK 137-400	SK 137-400H	SK 137-400C	SK 137-400HC	SKD 137-400	SKD 137-400H	SKD 137-400HC
5.00	SK 137-500	SK 137-500H	SK 137-500C	SK 137-500HC	SKD 137-500	SKD 137-500H	SKD 137-500HC
6.00	SK 175-600	SK 175-600H	SK 175-600C	SK 175-600HC	SKD 175-600	SKD 175-600H	SKD 175-600HC
8.00	SK 175-800	SK 175-800H	SK 175-800C	SK 175-800HC	SKD 175-800	SKD 175-800H	SKD 175-800HC
10.00	SK 200-1000	SK 200-1000H	SK 200-1000C	SK 200-1000HC	SKD 200-1000	SKD 200-1000H	SKD 200-1000HC
12.00	SK 250-1200	SK 250-1200H	SK 250-1200C	SK 250-1200HC	SKD 250-1200	SKD 250-1200H	SKD 250-1200HC

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 (2) of the above kits.

SERIES 'NAC', 'EN' & 'SNC' (WITH 'TH' OPTION)

NOTE: To insure proper seals are supplied for all models, **ALWAYS** supply Nason 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	THSK 625-150	THSK 625-150H	THSK 625-150C	THSK 625-150HC	THSKD 625-150	THSKD 625-150H	THSKD 625-150HC
2.00	THSK 625-200	THSK 625-200H	THSK 625-200C	THSK 625-200HC	THSKD 625-200	THSKD 625-200H	THSKD 625-200HC
2.50	THSK 625-250	THSK 625-250H	THSK 625-250C	THSK 625-250HC	THSKD 625-250	THSKD 625-250H	THSKD 625-250HC
3.25	THSK 100-325	THSK 100-325H	THSK 100-325C	THSK 100-325HC	THSKD 100-325	THSKD 100-325H	THSKD 100-325HC
4.00	THSK 100-400	THSK 100-400H	THSK 100-400C	THSK 100-400HC	THSKD 100-400	THSKD 100-400H	THSKD 100-400HC
5.00	THSK 100-500	THSK 100-500H	THSK 100-500C	THSK 100-500HC	THSKD 100-500	THSKD 100-500H	THSKD 100-500HC
6.00	THSK 137-600	THSK 137-600H	THSK 137-600C	THSK 137-600HC	THSKD 137-600	THSKD 137-600H	THSKD 137-600HC
8.00	THSK 137-800	THSK 137-800H	THSK 137-800C	THSK 137-800HC	THSKD 137-800	THSKD 137-800H	THSKD 137-800HC
10.00	THSK 175-1000	THSK 175-1000H	THSK 175-1000C	THSK 175-1000HC	THSKD 175-1000	THSKD 175-1000H	THSKD 175-1000HC
12.00	THSK 200-1200	THSK 200-1200H	THSK 200-1200C	THSK 200-1200HC	THSKD 200-1200	THSKD 200-1200H	THSKD 200-1200HC

BORE	OVERSIZE SINGLE ROD END				OVERSIZE DOUBLE ROD END		
	PART NO.	WITH CUSHIONS			PART NO.	WITH CUSHIONS	
		H	C	HC		H	HC
1.50	THSK 100-150	N/A	THSK 100-150C	N/A	THSKD 100-150	N/A	N/A
2.00	THSK 100-200	THSK 100-200H	THSK 100-200C	THSK 100-200HC	THSKD 100-200	THSKD 100-200H	THSKD 100-200HC
2.50	THSK 100-250	THSK 100-250H	THSK 100-250C	THSK 100-250HC	THSKD 100-250	THSKD 100-250H	THSKD 100-250HC
3.25	THSK 137-325	THSK 137-325H	THSK 137-325C	THSK 137-325HC	THSKD 137-325	THSKD 137-325H	THSKD 137-325HC
4.00	THSK 137-400	THSK 137-400H	THSK 137-400C	THSK 137-400HC	THSKD 137-400	THSKD 137-400H	THSKD 137-400HC
5.00	THSK 137-500	THSK 137-500H	THSK 137-500C	THSK 137-500HC	THSKD 137-500	THSKD 137-500H	THSKD 137-500HC
6.00	THSK 175-600	THSK 175-600H	THSK 175-600C	THSK 175-600HC	THSKD 175-600	THSKD 175-600H	THSKD 175-600HC
8.00	THSK 175-800	THSK 175-800H	THSK 175-800C	THSK 175-800HC	THSKD 175-800	THSKD 175-800H	THSKD 175-800HC
10.00	THSK 200-1000	THSK 200-1000H	THSK 200-1000C	THSK 200-1000HC	THSKD 200-1000	THSKD 200-1000H	THSKD 200-1000HC
12.00	THSK 250-1200	THSK 250-1200H	THSK 250-1200C	THSK 250-1200HC	THSKD 250-1200	THSKD 250-1200H	THSKD 250-1200HC

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 (2) of the above kits.

General How To Info
Force Charts
Weight Charts
Seal Kits
Conversion Charts
Fluid Power Formulas
Application Checklist
Options Page 142
Accessories Page 172
Switches Page 184

TECHNICAL DATA: SEAL KITS

NOTE: To insure proper seals are supplied for all models, **ALWAYS** supply Nason serial number.

SERIES 'HDC'

STANDARD SINGLE ROD END		
BORE	PART NO.	KITS INCLUDE CUSHION SEALS AND WEAR BAND
1.50	BPSK 625-150	
2.00	BPSK 625-200	
2.50	BPSK 625-250	
3.25	BPSK 100-325	
4.00	BPSK 100-400	
5.00	BPSK 100-500	
6.00	BPSK 137-600	
8.00	BPSK 137-800	

OVERSIZE SINGLE ROD END		
BORE	PART NO.	KITS INCLUDE CUSHION SEALS AND WEAR BAND
1.50	BPSK 100-150	
2.00	BPSK 100-200	
2.50	BPSK 100-250	
3.25	BPSK 137-325	
4.00	BPSK 137-400	
5.00	BPSK 137-500	
6.00	BPSK 175-600	
8.00	BPSK 175-800	

SERIES 'NR'

(Internally Guided Non-Rotating)

BORE	PISTON ROD DIA.	PART NUMBER
2.00	0.625	NRSK 625-200
2.50	0.625	NRSK 625-250
	1.000	NRSK 100-250
3.25	1.000	NRSK 100-325
	1.375	NRSK 137-325
4.00	1.000	NRSK 100-400
	1.375	NRSK 137-400
5.00	1.000	NRSK 100-500
	1.375	NRSK 137-500
6.00	1.375	NRSK 137-600
	1.750	NRSK 175-600
8.00	1.375	NRSK 137-800
	1.750	NRSK 175-800
10.00	1.750	NRSK 175-1000
	2.000	NRSK 200-1000
12.00	2.000	NRSK 200-1200
	2.500	NRSK 250-1200

NOTE: Add suffix H and/or C to indicate if cushion seals are required on Head and/or Cap.

Example: NRSK 625-200HC

SERIES 'CRN'

NOTE: To insure proper seals are supplied for all models, **ALWAYS** supply Nason 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 625-150H	SSSK 625-150C	SSSK 625-150HC	SSSKD 625-150	SSSKD 625-150H	SSSKD 625-150HC
2.00	SSSK 625-200	SSSK 625-200H	SSSK 625-200C	SSSK 625-200HC	SSSKD 625-200	SSSKD 625-200H	SSSKD 625-200HC
2.50	SSSK 625-250	SSSK 625-250H	SSSK 625-250C	SSSK 625-250HC	SSSKD 625-250	SSSKD 625-250H	SSSKD 625-250HC
3.25	SSSK 100-325	SSSK 100-325H	SSSK 100-325C	SSSK 100-325HC	SSSKD 100-325	SSSKD 100-325H	SSSKD 100-325HC
4.00	SSSK 100-400	SSSK 100-400H	SSSK 100-400C	SSSK 100-400HC	SSSKD 100-400	SSSKD 100-400H	SSSKD 100-400HC
5.00	SSSK 100-500	SSSK 100-500H	SSSK 100-500C	SSSK 100-500HC	SSSKD 100-500	SSSKD 100-500H	SSSKD 100-500HC
6.00	SSSK 137-600	SSSK 137-600H	SSSK 137-600C	SSSK 137-600HC	SSSKD 137-600	SSSKD 137-600H	SSSKD 137-600HC
8.00	SSSK 137-800	SSSK 137-800H	SSSK 137-800C	SSSK 137-800HC	SSSKD 137-800	SSSKD 137-800H	SSSKD 137-800HC

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 100-150C	N/A	SSSKD 100-150	N/A	N/A
2.00	SSSK 100-200	SSSK 100-200H	SSSK 100-200C	SSSK 100-200HC	SSSKD 100-200	SSSKD 100-200H	SSSKD 100-200HC
2.50	SSSK 100-250	SSSK 100-250H	SSSK 100-250C	SSSK 100-250HC	SSSKD 100-250	SSSKD 100-250H	SSSKD 100-250HC
3.25	SSSK 137-325	SSSK 137-325H	SSSK 137-325C	SSSK 137-325HC	SSSKD 137-325	SSSKD 137-325H	SSSKD 137-325HC
4.00	SSSK 137-400	SSSK 137-400H	SSSK 137-400C	SSSK 137-400HC	SSSKD 137-400	SSSKD 137-400H	SSSKD 137-400HC
5.00	SSSK 137-500	SSSK 137-500H	SSSK 137-500C	SSSK 137-500HC	SSSKD 137-500	SSSKD 137-500H	SSSKD 137-500HC
6.00	SSSK 175-600	SSSK 175-600H	SSSK 175-600C	SSSK 175-600HC	SSSKD 175-600	SSSKD 175-600H	SSSKD 175-600HC
8.00	SSSK 175-800	SSSK 175-800H	SSSK 175-800C	SSSK 175-800HC	SSSKD 175-800	SSSKD 175-800H	SSSKD 175-800HC

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 (2) of the above kits.

TECHNICAL DATA: SEAL KITS

SERIES 'HMD' SEAL KIT: HOW TO ORDER

NOTE: To insure proper seals are supplied for all models, ALWAYS supply Nason serial number.

HMD - SK 137 - 250 - S S S S

SEAL KIT SERIES		ROD SIZE		BORE		PISTON SEALS		ROD SEALS		TUBE SEALS		ROD WIPER *	
HMD - SK	HMD Series Seal Kit	062	0.625" Rod Dia.	150	1.50" Bore	S	STANDARD (Carboxilated)	S	STANDARD (Polyurethane)	S	STANDARD (Buna)	S	STANDARD (Flocked Nitrile)
		100	1.000" Rod Dia.	200	2.00" Bore	C	Cast-Ring	E	EP	E	EP	M	Metallic Scrapper
		137	1.375" Rod Dia.	250	2.50" Bore	E	EP	V	Fluorocarbon	V	Fluorocarbon	T	PTFE
		175	1.750" Rod Dia.	325	3.25" Bore	T	PTFE					V	Fluorocarbon
		200	2.000" Rod Dia.	400	4.00" Bore	V	Fluorocarbon						
		250	2.500" Rod Dia.	500	5.00" Bore								
		300	3.000" Rod Dia.	600	6.00" Bore								
		350	3.500" Rod Dia.	800	8.00" Bore								
		400	4.000" Rod Dia.										
		450	4.500" Rod Dia.										
		500	5.000" Rod Dia.										
		550	5.500" Rod Dia.										

*Note: When cylinder design calls for all EP seals, use PTFE rod wiper.

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:

HMD-SK137-400-SSSS

HMD-SK100-250-VVVT

HMD-SK-300-600-CSSM

SERIES 'HHD' SEAL KIT: HOW TO ORDER

NOTE: To insure proper seals are supplied for all models, ALWAYS supply Nason serial number.

HHD - SK 137 - 250 - S S S S

SEAL KIT SERIES		ROD SIZE		BORE		PISTON SEAL		ROD SEAL		TUBE SEAL		ROD WIPER *	
HHD - SK	HHD Series Seal Kit	062	0.625" Rod Dia.	150	1.50" Bore	S	STANDARD (Carboxilated)	S	STANDARD (Polyurethane)	S	STANDARD (Buna)	S	STANDARD (Flocked Nitrile)
		100	1.000" Rod Dia.	200	2.00" Bore	C	Cast-Ring	E	EP	E	EP	M	Metallic Scrapper
		137	1.375" Rod Dia.	250	2.50" Bore	E	EP	V	Fluorocarbon	V	Fluorocarbon	T	PTFE
		175	1.750" Rod Dia.	325	3.25" Bore	T	PTFE					V	Fluorocarbon
		200	2.000" Rod Dia.	400	4.00" Bore	V	Fluorocarbon						
		250	2.500" Rod Dia.	500	5.00" Bore								
		300	3.000" Rod Dia.	600	6.00" Bore								
		350	3.500" Rod Dia.	800	8.00" Bore								
		400	4.000" Rod Dia.										
		450	4.500" Rod Dia.										
		500	5.000" Rod Dia.										
		550	5.500" Rod Dia.										

*Note: When cylinder design calls for all EP seals, use PTFE rod wiper.

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:

HHD-SK137-400-SSSS

HHD-SK100-250-VVVT

HHD-SK-300-600-CSSM

TECHNICAL DATA: SEAL COMPATIBILITY

SEAL COMPATIBILITY WITH COMMON FLUIDS

R = Recommended S = Satisfactory M = Marginal U = Unsatisfactory — = Insufficient Data

FLUID NAME	MFG. CODE	MILITARY SPECIFICATION	TRADE NAME/NUMBER	COLOR	TYPE OF SEAL COMPOUND - COMMON NAME									
					BUNA-N	BUTYL	CORFAM	EP	VITON	SILICONE	NEOPRENE	NAT. RUBBER	POLYURENE	
Water-Glycol	1		Houghto-Safe 600 Series	red	R	R	R	R	R	R	S	S	R	U
	1		Houghto-Safe 500 Series	red	R	R	R	R	R	R	S	S	R	U
	1	MIL-H22072	Houghto-Safe 271	red	R	R	R	R	R	R	S	S	—	U
	4		Ucon Hydrolube	yel. or red	R	R	R	R	R	R	R/S	S	R	U
	4		Ucon M1	yellow	R	R	R	R	R	R	S	S	S	U
	5		Cellugard	red	R	R	R	R	R	R	S	S	—	U
	10		Safety Fluid 200	bright pink	R	R	R	R	R	R	S	S	—	U
Water/Oil	1		Houghto-Safe 5000 Series	white	R	U	R	U	R	—	S	U	U	U
Emulsion	3		FR	creamy	R	U	R	U	R	—	S	U	U	U
	7		Irus 902	yellow	R	U	R	U	R	U	S	U	U	M
	8		Pyrogard C & D	pale yellow	R	U	R	U	R	—	S	U	U	U
Water-Soluble Oil	—		—	milky	R	M	R	—	R	—	S	S	S	M/U
Water-Fresh	—		—	—	R	R	R	R	R	R	M	M	R	M/U
Water-Salt	—		—	—	R	R	R	R	R	R	M	M	R	M/U
Phosphate Ester	1		Houghto-Safe 1000 Series	green	U	R	M/U	R	R	R	M	U	U	M
	1	MIL-H-19547B	Houghto-Safe 1120	green	U	R	M/U	R	R	R	M	U	U	M
	2		Pydraul F-9, 150, 625	cloudy bl.	U	R/S	M/U	S	R	R	R	U	U	S
	5		Fyrquel	lt. green	U	R	M/U	R	R	R	M	U	U	M
	7		Shell SRF B.C.D.	aqua gr.	U	R	M/U	R	R	R	M	U	U	M
	8		Pyrogard 42, 43, 53, 55, 190, 600	pale yel.	U	R	M/U	R	R/S	R	M	U	U	M
	2		Skydrol 500B	purple	U	S	U	R	U	U	M	U	U	U
	2		Skydrol 7000	green	U	S	U	R	U	U	M	U	U	U
	2		Pydraul 312, 135 (2)	blue gr.	U	M	M	M	R	R	R	U	U	—
	2		Pydraul AC	cloudy bl.	U	S	M/U	S	R	R	R	U	U	M/U
	2		Pydraul 60	cloudy bl.	U	R	M/U	R	U	U	S	U	U	M/U
	8		Pydraul 210 (3)	yellow	U	M	—	M	R	R	R	U	U	M/U
Diester	—	MIL-H-7808	Lube Oil-Aircraft	amber	S	U	R	U	R	U	U	U	U	U
Clorinat. Hydrocarb	2		Aroclor 1200 Series 1	clear	M	S	—	S	R	S	U	U	U	U
	2		Pydraul A-200	cloudy bl.	U	M	M	M	R	R	R	U	U	M/U
Silicate Ester	2		OS-45 Type 4	clear	S	U	—	S	R	U	R	U	U	R
	6	MIL-O-8200	Oronite 8200	clear	S	U	—	U	R	U	R	U	U	R
	6	MIL-8515	Oronite 8515	clear	S	U	—	U	R	U	R	U	U	R
	9	MIL-H-8446B	Brayco 846	red brown	S	U	—	U	R	U	R	U	U	R
Kerosene	—		—	clear	R	U	R	U	R	U	U	M/U	U	R
Jet Fuel	—	MIL-J-5624	JP-3, 4, 5 (RP-1)	lt. straw	R	U	R	U	R	U	U	U	U	S
Diesel Fuel	—		—	clear	R	U	R	U	R	U	U	M/U	U	R
Gasoline	—		Gasoline	various	R	U	R/S	U	R	U	U	U	U	R
Petroleum Base	—	MIL-H-6083	Preservative Oil	red	R	U	R	U	R	U	R	U	S	R
Petroleum Base	—	MIL-H-5606	Aircraft Hyd. Fluid	red	R	U	R	U	R	U	U	S	U	R

- Notes: (1) Halogenated
 (2) Petroleum and halogenated hydrocarbon and phosphate ester mixture
 (3) Chlorinated phosphate ester

Manufacturer's Code Numbers	No. Manufacturer	Manufacturer
1.	E.F. Houghton	Union Carbide & Chemical
2.	Monsanto	Stauffer Chemical
3.	Gulf	Standard Oil (Ortho Chemical)
4.	Union Carbide & Chemical	Mobile Oil
5.	Stauffer Chemical	Bray Oil - Royal Lubricant
6.	Standard Oil (Ortho Chemical)	Texaco
7.	Shell Chemical	

ELASTOMER CHARACTERISTICS

ELASTOMER	STYRENE BUTADIENE	BUTYL	CHLOROSULPHONATED POLYETHYLENE	ETHYLENE PROPYLENE	FLUOROCARBON	FLUOROSILICONE	NATURAL	POLYCHLOROPRENE	NITRILE	POLYACRYLIC	POLYSULPHIDE	POLYURETHANE	SILICONE	EPICHLOROHYDRIN	POLYIMIDE	PONTAFLUOROETHYLENE
SYMBOL	SBR	IIR	TFE	CSM	EPM	FPM	FSI	NR	CR	NBR	ACM	TR	AU-EU	SI	ECD	
UPPER TEMP. LIMIT °F	194	500	212	248	284	347	392	176	230	266	320	221	212	392	284	896
LOWER TEMP. LIMIT °F	-58	-148	-22	-4	-49	5	-76	-76	-40	-49	-4	-67	-58	-76	-40	-400
ABRASION RESISTANCE	S	U	M	R	•	S	•	R	R	S	•	•	R	•	S	•
COMPRESSION SET RESIST.	•	•	U	M	M	S	U	R	S	R	•	•	S	S	M	•
RESILIENCE	M	U	U	U	U	M	U	R	S	M	M	U	S	U	S	U
RADIATION	U	U	•	•	•	•	M	•	•	•	•	•	S	U	U	R
WEATHER RESISTANCE	M	R	R	R	R	R	R	U	U	U	R	R	R	R	S	R
OZONE RESISTANCE	M	R	R	R	R	R	R	M	•	M	R	S	R	R	S	•
ADHESION TO METAL	R	S	S	R	S	R	R	R	•	R	S	R	R	R	S	S

R = RECOMMENDED S = SATISFACTORY M = MARGINAL U = UNSATISFACTORY • = CONSULT MFG.

CONVERSION CHARTS

FRACTION EQUIVALENTS											
FRACTION (INCHES)	DECIMAL (INCHES)	METRIC (MM) (x 25.4)	FRACTION (INCHES)	DECIMAL (INCHES)	METRIC (MM) (x 25.4)	FRACTION (INCHES)	DECIMAL (INCHES)	METRIC (MM) (x 25.4)	FRACTION (INCHES)	DECIMAL (INCHES)	METRIC (MM) (x 25.4)
1/64	.016	.4	17/64	.266	6.8	33/64	.516	13.1	49/64	.766	19.5
1/32	.031	.8	9/32	.281	7.1	17/32	.531	13.5	25/32	.781	19.8
3/64	.047	1.2	19/64	.297	7.5	35/64	.547	13.9	51/64	.797	20.2
1/16	.062	1.6	5/16	.312	7.9	9/16	.562	14.3	13/16	.812	20.6
5/64	.078	2.0	21/64	.328	8.3	37/64	.578	14.7	53/64	.828	21.0
3/32	.094	2.4	11/32	.344	8.7	19/32	.594	15.1	27/32	.844	21.4
7/64	.109	2.8	23/64	.359	9.1	39/64	.609	15.5	55/64	.859	21.8
1/8	.125	3.2	3/8	.375	9.5	5/8	.625	15.9	7/8	.875	22.2
9/64	.141	3.6	25/64	.391	9.9	41/64	.641	16.3	57/64	.891	22.6
5/32	.156	4.0	13/32	.406	10.3	21/32	.656	16.7	29/32	.906	23.0
11/64	.172	4.4	27/64	.422	10.7	43/64	.672	17.1	59/64	.922	23.4
3/16	.187	4.7	7/16	.437	11.1	11/16	.687	17.4	15/16	.937	23.8
13/64	.203	5.2	29/64	.453	11.5	45/64	.703	17.9	61/64	.953	24.2
7/32	.219	5.6	15/32	.469	11.9	23/32	.719	18.3	31/32	.969	24.6
15/64	.234	5.9	31/64	.484	12.3	47/64	.734	18.6	63/64	.984	25.0
1/4	.250	6.3	1/2	.500	12.7	3/4	.750	19.0	1	1.000	25.4

TEMPERATURE EQUIVALENTS							
FAHRENHEIT TO CELSIUS CONVERSION				CELSIUS TO FAHRENHEIT CONVERSION			
F°	C°	F°	C°	C°	F°	C°	F°
-30	-34.4	130	54.4	-30	-22	65	149
-20	-28.9	140	60.0	-20	-4	70	158
-10	-23.3	150	65.6	-10	14	75	167
0	-17.8	160	71.1	0	32	80	176
10	-12.2	170	76.7	5	41	85	185
20	-6.7	180	82.2	10	50	90	194
30	-1.1	190	87.8	15	59	95	203
40	4.4	200	93.3	20	68	100	212
50	10.0	210	98.9	25	77	105	221
60	15.6	220	104.4	30	86	110	230
70	21.1	230	110.0	35	95	115	239
80	26.7	240	115.6	40	104	120	248
90	32.2	250	121.1	45	113	125	257
100	37.8	300	148.9	50	122	130	266
110	43.3	350	176.7	55	131	150	302
120	48.9	400	204.4	60	140	200	392

$C^{\circ} = (F^{\circ} - 32) \div 1.8$

$F^{\circ} = C^{\circ} \times 1.8 + 32$

PRESSURE CONVERSIONS					
PSI	KG/CM ²	BARS	KG/CM ²	PSI	BARS
60	4.2	4.1	4	56.9	3.9
70	4.9	4.8	5	71.1	4.9
80	5.6	5.5	6	85.3	5.9
90	6.3	6.2	7	99.5	6.9
100	7.0	6.9	8	113.8	7.8
150	10.5	10.3	9	128.0	8.8
200	14.0	13.8	10	142.2	9.8
250	17.6	17.2	20	284.4	19.6
300	21.1	20.7	30	426.6	29.4
350	24.6	24.1	40	568.8	39.2
400	28.1	27.6	50	711.0	49.0
450	31.6	31.0	60	853.2	58.8
500	35.1	34.4	70	995.4	68.6
550	38.7	37.9	80	1137.6	78.4
600	42.2	41.3	90	1279.8	88.2
650	45.7	44.8	100	1422.0	98.0
700	49.2	48.2	150	2133.0	147.0
750	52.7	51.7	200	2844.0	196.0
800	56.2	55.1	250	3555.0	245.0
850	59.8	58.6	300	4266.0	294.0
900	63.3	62.0	350	4977.0	343.0
950	66.8	65.5	—	—	—
1000	70.3	68.9	—	—	—
1500	105.5	103.4	—	—	—
2000	140.6	137.8	—	—	—
2500	175.8	172.3	—	—	—
3000	210.9	206.7	—	—	—
3500	246.1	241.2	—	—	—
4000	281.2	275.6	—	—	—
4500	316.4	310.1	—	—	—
5000	351.5	344.5	—	—	—

$Kg/cm^2 = PSI \times .0703$
 $Bars = PSI \times .0689$

$PSI = Kg/cm^2 \times 14.22$
 $Bars = Kg/cm^2 \times .98$

MEASUREMENT CONVERSIONS					
INCHES	CM	MM	CM	INCHES	
1	2.5	25.4	1	.4	
2	5.1	50.8	2	.8	
3	7.6	76.2	3	1.2	
4	10.2	101.6	4	1.6	
5	12.7	127.0	5	2.0	
6	15.2	152.4	6	2.4	
7	17.8	177.8	7	2.8	
8	20.3	203.2	8	3.1	
9	22.9	228.6	9	3.5	
10	25.4	254.0	10	3.9	
15	38.1	381.0	20	7.9	
20	50.8	508.0	30	11.8	
25	63.5	635.0	40	15.8	
30	76.2	762.0	50	19.7	
35	88.9	889.0	60	23.6	
40	101.6	1016.0	70	27.6	
45	114.3	1143.0	80	31.5	
50	127.0	1270.0	90	35.5	
55	139.7	1397.0	100	39.4	
60	152.4	1524.0	110	43.3	
65	165.1	1651.0	120	47.3	
70	177.8	1778.00	130	51.2	
75	190.5	1905.0	140	55.2	
80	203.2	2032.0	150	59.1	
85	215.9	2159.0	160	63.0	
90	228.6	2286.0	170	67.0	
95	241.3	2413.0	180	70.9	
100	254.0	2540.0	190	74.9	
—	—	—	200	78.8	
—	—	—	210	82.7	
—	—	—	220	86.7	
—	—	—	230	90.6	
—	—	—	240	94.6	
—	—	—	250	98.5	
—	—	—	260	102.4	

$cm = in. \times 2.54$ $mm = in. \times 25.4$ $in. = cm \times .394$

General How To Info
 Force Charts
 Weight Charts
 Seal Kits
 Conversion Charts
 Fluid Power Formulas
 Application Checklist
 Options Page 142
 Accessories Page 172
 Switches Page 184

TECHNICAL DATA

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 ² (Square Inches)	Area = $\frac{\pi}{A4}$ x Diameter ² (inches)	$A = .7854 D^2$
CYLINDER AREA RETRACT in ² (Square Inches)	Area = ($\frac{\pi}{A4}$ x Bore Diameter ²) - ($\frac{\pi}{A4}$ x Rod Diameter ²)	$A = (.7854 D_b^2) - (.7854 D_r^2)$
CYLINDER FORCE lbs. (Pounds of Force)	Force = Pressure (psi) x Net Area (in ²)	$F = PA$
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 = $\frac{\text{Net Area (in}^2\text{) x Stroke (in)}}{231}$	$V = \frac{A L}{231}$
CYLINDER FLOW RATE GPM (Gallons per Minute)	Flow Rate = $\frac{12 \times 60 \times \text{Velocity (ft/s) x Net Area (in}^2\text{)}}{231}$	$Q = 3.117 v A$
CYLINDER POWER hp (Horsepower)	Horsepower = $\frac{\text{Pressure (psi) x Flow Rate (GPM)}}{1714}$	$hp = \frac{P Q}{1714}$
FLUID MOTOR TORQUE lb-in (Inch Pounds)	Torque = $\frac{\text{Pressure (psi) x F.M. Displacement (in}^3\text{/rev.)}}{2\pi}$	$T = \frac{P d}{2\pi}$
	Torque = $\frac{\text{Horsepower x 63025}}{\text{RPM}}$	$T = \frac{63025 \text{ hp}}{n}$
	Torque = $\frac{\text{Flow Rate (GPM) x Pressure (psi) x 36.77}}{\text{RPM}}$	$T = \frac{36.77 Q P}{N}$
FLUID MOTOR SPEED RPM (Revolutions per Minute)	Speed = $\frac{231 \times \text{Flow Rate (GPM)}}{\text{F.M. Displacement (in}^3\text{/rev.)}}$	$n = \frac{231 Q}{d}$
FLUID MOTOR POWER hp (Horsepower)	Horsepower = $\frac{\text{Torque (lbs-in) x RPM}}{63025}$	$hp = \frac{T n}{63025}$
PUMP OUTLET FLOW GPM (Gallons per Minute)	Flow = $\frac{\text{RPM x Pump Displacement (in}^3\text{/rev.)}}{231}$	$Q = \frac{n d}{231}$
FLOW RATE THROUGH PIPING ft/s Velocity (Feet per Second)	Velocity = $\frac{.3208 \times \text{Flow Rate Through I.D. (GPM)}}{\text{Internal Area (in}^2\text{)}}$	$v = \frac{.3208 Q}{A}$
TORQUE REQUIREMENT lb-in (Inch Pounds)	Torque = Lever Length (in.) x Pull (lbs.)	$T = L \times F$

TECHNICAL DATA: NASON APPLICATION CHECK LIST

General How To Info

Force Charts

Weight Charts

Seal Kits

Conversion Charts

Fluid Power Formulas

Application Checklist

Options Page 142

Accessories Page 172

Switches Page 184

Need help selecting the right cylinder for your application? Just fill out as much information about your application and contact your local distributor or Nason.

Date / /

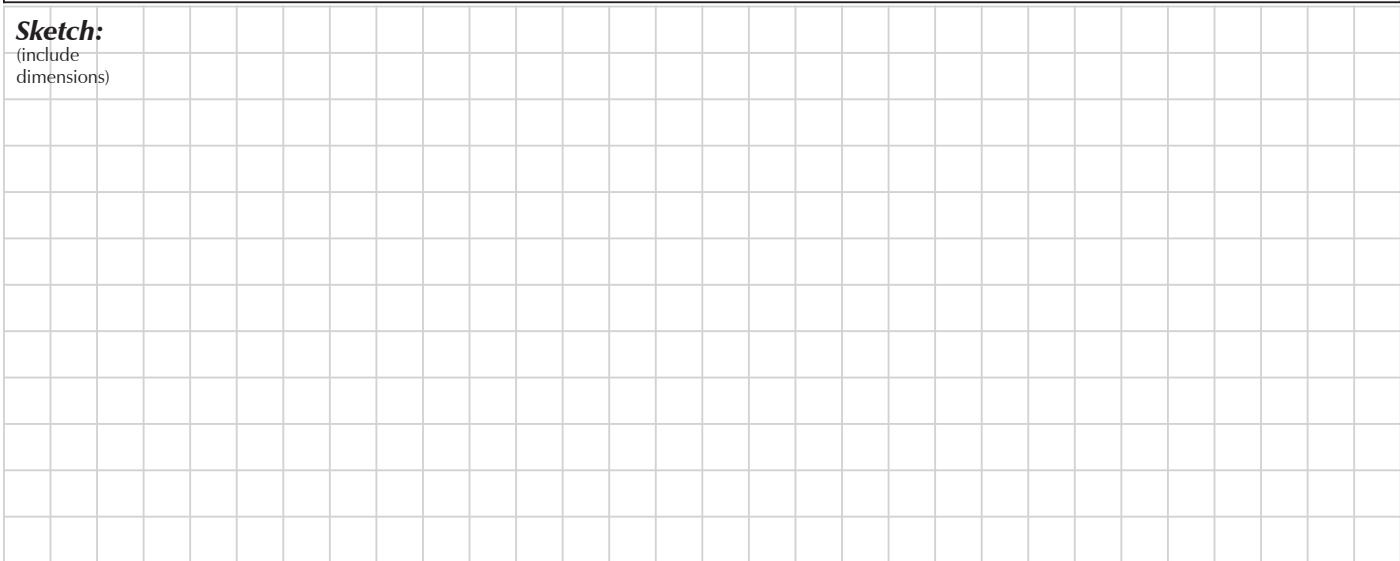
DISTRIBUTOR INFORMATION		
Distributor: _____	Branch Office: _____	Contact: _____
<i>How do you want to be contacted?</i>		
Phone: _____	Fax: _____	E-Mail: _____

CUSTOMER INFORMATION		
Customer: _____	Contact: _____	
<i>How do you want to be contacted?</i>		
Phone: _____	Fax: _____	E-Mail: _____

APPLICATION INFORMATION	
<i>Do you have a basic cylinder description?</i>	
Bore: _____	Stroke: _____
Mount: _____	Options: _____
Modification: _____	
Cylinder Operating Pressure: <input type="checkbox"/> Pneumatic _____ PSI <input type="checkbox"/> Hydraulic _____ PSI (Non-Shock)	
Ambient Temperature: <input type="checkbox"/> Normal Indoor Industrial <input type="checkbox"/> Cold: _____ °F <input type="checkbox"/> Hot: _____ °F	
Cylinder Velocity: _____ inches/second	Cycles per Minute: _____
Cylinder Orientation: <input type="checkbox"/> Horizontal <input type="checkbox"/> Vertical: <input type="checkbox"/> Rod Up <input type="checkbox"/> Rod Down <input type="checkbox"/> Angle: _____ (Degrees)	
Describe the load (including weight). Is the load guided? How is the cylinder rod attached to the load? Any side load?	

Application: _____	

Sketch:
(include dimensions)



NASON

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