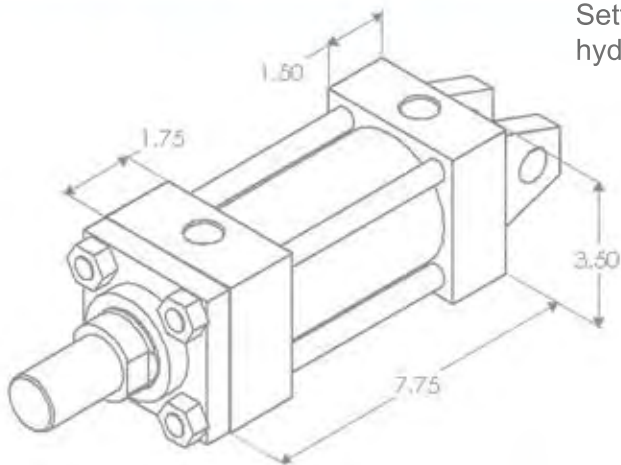


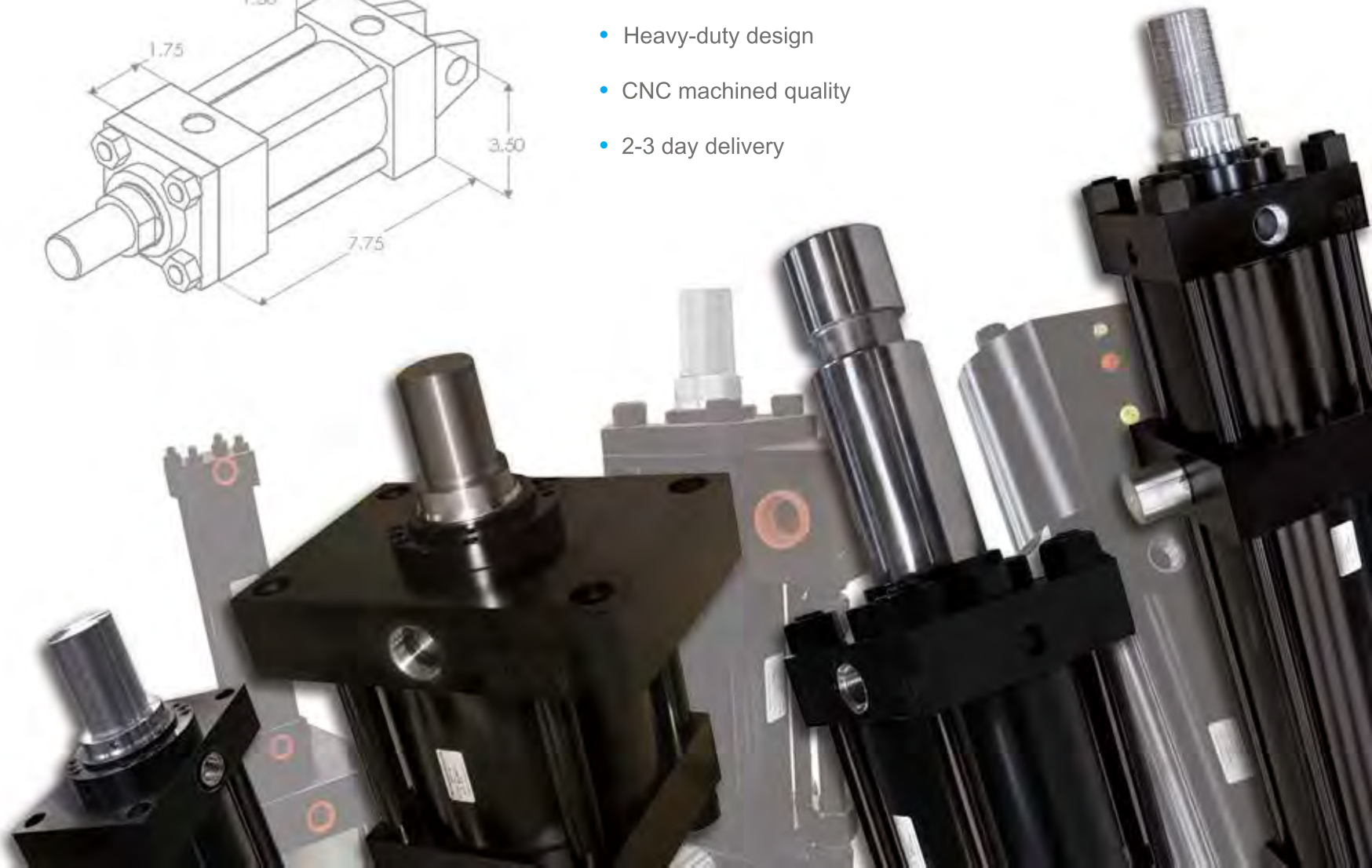


# Hydraulic Catalog



Setting a new standard for NFPA hydraulic cylinders in:

- Heavy-duty design
- CNC machined quality
- 2-3 day delivery





### The TRD difference...

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



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

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

- **Port size, type or location along with cushion locations can be made to your specifications (all NFPA, BSP or SAE sizes available).**
- **Rod End Styles and Designs:**
  - (6) NFPA Standard rod end styles available
  - Custom or other thread lengths available
  - Metric or other thread styles available
  - Custom rod end styles available - *just send us a sketch!*
  - Hollow rod designs can be gun-drilled to your specifications
- **Most Cylinder Options *Ship in 2-3 Days!***

**Quick response on all requests.** Most requests are answered the day they are received.

Visit us on the web: [www.trdmfg.com](http://www.trdmfg.com) e-mail: [sales@trdmfg.com](mailto:sales@trdmfg.com)

'HH' Series - 2D DXF & DWG CAD files available, 3D Step files available for download online

'MH' & 'TAS' Series - Contact TRD for drawings

### NEW THREE YEAR WARRANTY

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

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

A complete explanation of defects is required with the returned product. The TRD warranty applies only to products used properly and under normal operating conditions. All products are to be used in a safe manner, in properly designed systems. Safeguards to prevent personal injury or equipment damage must be used and are the sole responsibility of the user.

In no event shall TRD Manufacturing, Inc. be liable for any consequential damages or installation costs resulting from delay or failure of delivery, defective material/workmanship or out of a breach by TRD Manufacturing, Inc. of any contract.

# TABLE OF CONTENTS

---

	<u>PAGE</u>
Warranty & Returns . . . . .	2
Quick Guide . . . . .	4
SERIES 'HH' (Heavy-Duty Hydraulics) . . . . .	5-39
Hydraulic Rod Lock . . . . .	40-46
SERIES 'HH' Options . . . . .	47-57
SERIES 'MH' (Medium-Duty Hydraulics) . . . . .	58-91
SERIES 'MH' Options . . . . .	92-100
SERIES 'TAS' (Heavy-Duty Pneumatics) . . . . .	101-117
SERIES 'TAS' Options . . . . .	118-128
Accessories . . . . .	129-134
Balluff End of Stroke Sensors . . . . .	135-139
Balluff Transducers . . . . .	140-141
MTS Temposonics® Transducers . . . . .	142
Technical Data: Seal Kits . . . . .	143-149
Technical Data: Force, Torque & Rating Charts . . . . .	150-152
Technical Data: Hydraulic Cylinder Speeds . . . . .	153
Technical Data: Cylinder & Accessories Weight Charts . . . . .	154-155
Technical Data: Seal Compatibility . . . . .	156
Conversion Charts & Common Fluid Power Formulas . . . . .	157-158
TRD Application Checklist . . . . .	159
Delivery Schedule . . . . .	Back Cover

## QUICK GUIDE – Design the Right Cylinder for Your Application

TRD offers a wide range of cylinder customizations and options to provide the best cylinders in the industry for any application. Here's a brief overview of common cylinder design and option considerations to assist in choosing the right cylinder for you. A cylinder that is tailored to a specific application will improve overall performance and lead to increased cylinder life.

### PISTON RODS: Rod Diameters, Rod Thread Size, Type of Thread, Rod Extensions and more...

**Each piston rod is made-to-order and typically does not affect our two to three day delivery – so why not get exactly the rod thread, rod extension and rod end design that you NEED?** In-stock rod diameters are listed in each cylinder model series. Diameters are nominal with a tolerance of  $+.000''$  to  $-.001''$

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

**All NFPA rod threads are UNF fine, class 2 threads** (the catalog standard on all cylinders).

**KK1 (Small Male Thread)** - The KK1 is the default rod thread (if no other thread call out is made).

**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.

**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 size thread as a KK1, but a female thread. 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. **Standard on 'MH' and 'HH' Series rods from .625" to 2.00" diameter.**

**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 is 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.**

### 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, NFPA cylinders on the market today are not considered to have "close tolerance" strokes. Due to the stack-up of cylinder parts and tolerances, it is common to see stroke lengths vary from  $-.000''$  to  $+.060''$ . TRD typically holds each cylinder component to a close tolerance, minimizing the "stack-up of tolerance" that effect the cylinder stroke.

### Port Size, Thread Type and Port Locations...

**Any port size that can fit in a cylinder and any thread type can be provided. The most common are NPTF but BSPP, BSPT and SAE are also available (for additional cost). Delivery: 2-3 days standard!**

Many times, a smaller port size will be used to limit the 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).

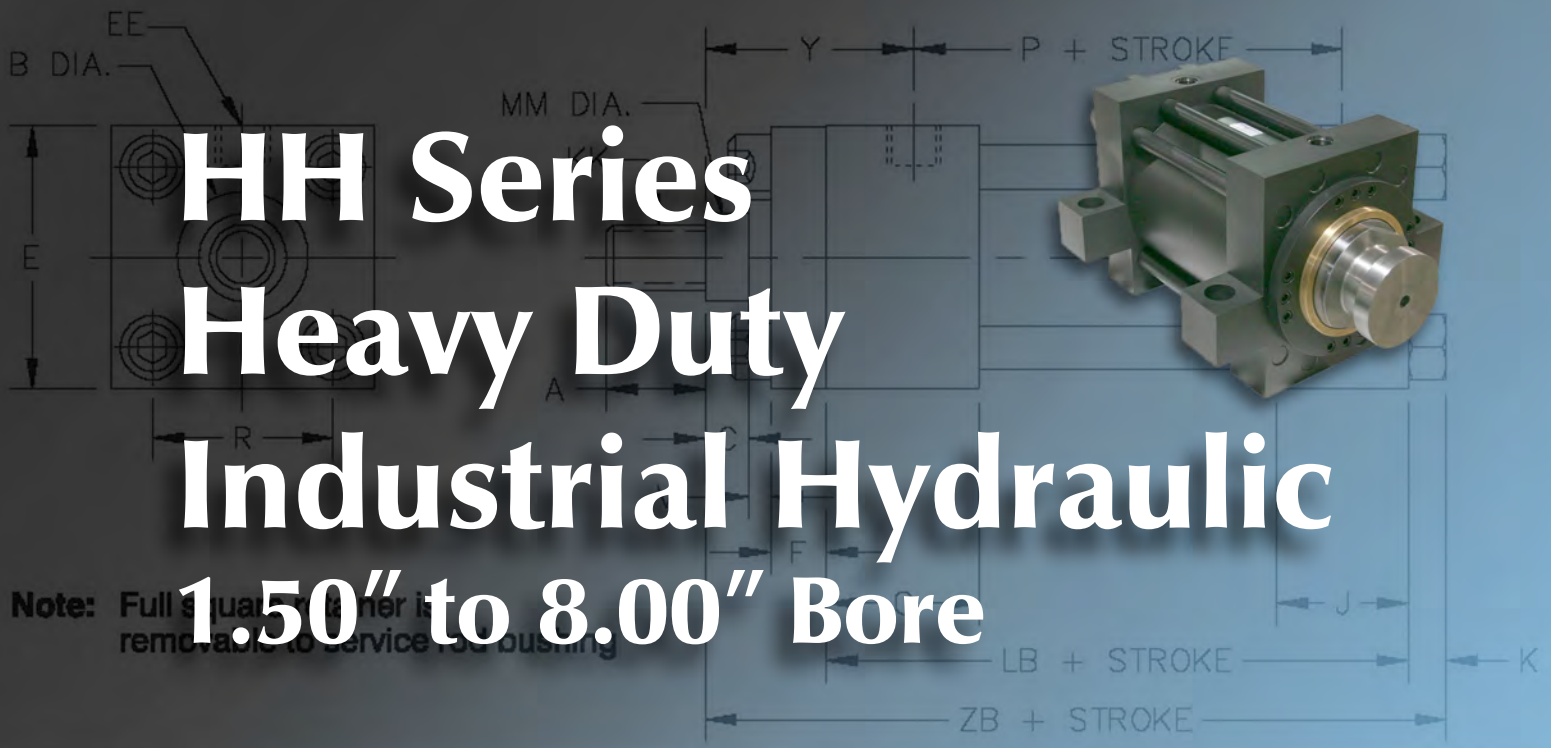
### Rod "Extensions" Also Known as "C" Dimensions in the Catalog – What is Possible?

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. 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. Note: refer to Piston Rod Sizing Charts to ensure adequate column strength.

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

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





# HH Series Heavy Duty Industrial Hydraulic 1.50" to 8.00" Bore

Single Rod End Page 8

Double Rod End Page 27



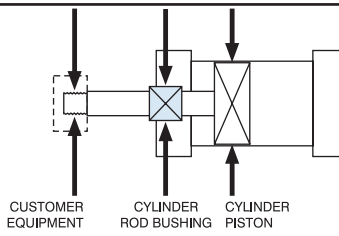
95% OF OUR CYLINDERS SHIP IN 2-3 DAYS!  
ONE DAY RUSH SERVICE AVAILABLE ON ALL CATALOGED CYLINDER MODELS!

# SERIES 'HH' (NFPA) CYLINDER

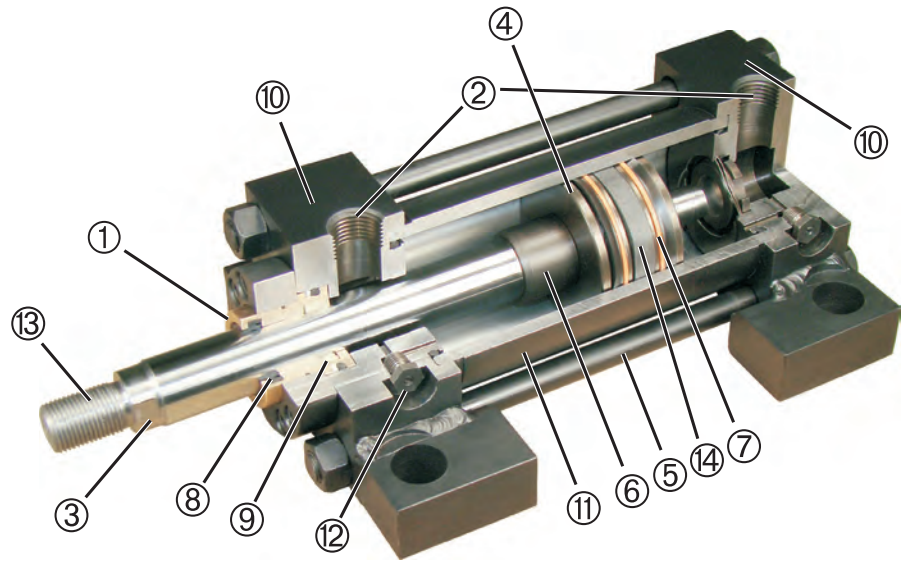
## Floating Rod Bushing

### SELF ALIGNMENT FEATURE

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



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



## HEAVY-DUTY DESIGN FOR RELIABLE, CONSISTENT OPERATION

- 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 SEALS** – Heavy lip design, Carboxilated Nitrile seals with back-up rings are pressure activated and wear compensating for extended life. Cast ring, 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 .625" - 2.00" rods (125K min. yield). Available up to two times standard "A" thread length.
  - WEAR BAND** – Wear Guard Nylon (standard); reinforced PTFE for E and V seal option.
- FINISH** – Black urethane paint.

### OPERATING PRESSURE

3000 PSI HYD (207 BAR)  
Refer to page 150 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 41-46 for more information).
- **ST** – Stop tubes are used to reduce rod bearing and piston stress (refer to page 53 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).
- **PLS** – High-impact pistons use a high strength steel Dutch Key, also known as Skotch Key, to secure piston to the rod. Refer to page 51 for more information.



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

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

SERIES	
HH	HEAVY DUTY HYDRAULIC

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	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.)
ABP=	AIR BLEED PORTS (Example ABP=15) (Refer to page 47)
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
DBB=	DRAIN BACK BUSHING (Example: DBB=1) (Refer to page 48)
EK	EXTENDED KEY PLATE (Refer to page 48 for specifications)
HLP	HIGH LOAD PISTON
HSS	HIGH SHOCK SEALS
LRB	LIFT RING BOSS
NR	NON-ROTATING (Refer to page 50 for specifications)
PLS	PISTON LOCK SCREW
RBB	ROD BUSHING MATERIAL: BRONZE
RLH	"ROD LOCK READY" CYLINDER
RLH=	ROD LOCK MODEL NUMBER Example: RLH=1002501000 (Refer to page 41-46 for ordering instructions for assembled rod locks)
SSR	STAINLESS STEEL PISTON ROD
ST=	STOP TUBE NOTE: Specify STOP TUBE length (in inches) Specify Stroke as ES (effective stroke) Example: (HH-MS2-250x48ES-H2C6-ST=3")
4WF	FOUR WRENCH FLATS (ROD SIZES: .625"-3.50")
XX=	SPECIAL VARIATION (SPECIFY)

NFPA 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)
SB	SPHERICAL BEARING (1.50" to 6.00" 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

Call out 'H' for head cushion, 'C' for cap cushion, followed by the desired location(s).

ROD END	
KK1	Small Male Thread
KK2	Large Male Thread
KK3	Female Thread
KK3M	Female Metric Rod Thread
KK3X	Female Special 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

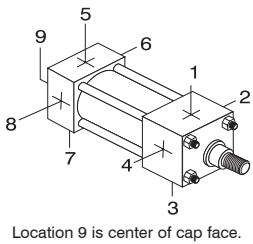
ROD SEAL	
S	STANDARD (Polyurethane)
E	EP
V	Fluorocarbon

TUBE SEAL	
S	STANDARD (Buna)
E	EP
V	Fluorocarbon

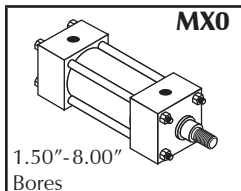
ROD WIPER*	
S	STANDARD (Flocked Nitrile)
M	Metallic Scraper
T	PTFE
V	Fluorocarbon

**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)

\*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	



## NFPA MOUNTS

MF1 1.50"-8.00" Bores	MF2 1.50"-8.00" Bores	MF5 1.50"-8.00" Bores	MF6 1.50"-8.00" Bores	ME5 1.50"-8.00" Bores	ME6 1.50"-8.00" Bores
MP1 1.50"-8.00" Bores	SB 1.50"-6.00" Bores	MS2 1.50"-8.00" Bores	MS3 1.50"-8.00" Bores	MS4 1.50"-8.00" Bores	MS7 1.50"-6.00" Bores
MT1 1.50"-8.00" Bores	MT2 1.50"-8.00" Bores	MT4 1.50"-8.00" Bores	MX1 1.50"-8.00" Bores	MX2 1.50"-8.00" Bores	MX3 1.50"-8.00" Bores



# SERIES 'HH' DIMENSIONS: THREADS

HH - Heavy Duty Hydraulic

HH Rod Lock

HH Options

MH - Medium Duty Hydraulic

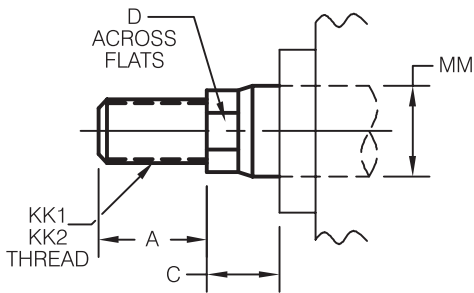
TAS - Heavy Duty Pneumatic

Accessories Page 130

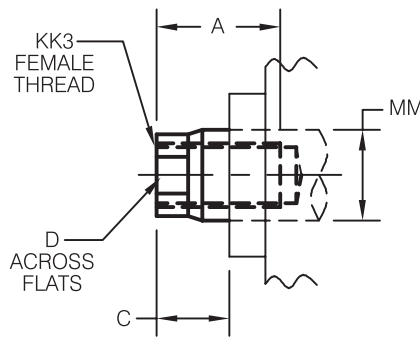
STROKEMASTER Page 136

Technical Data Page 144

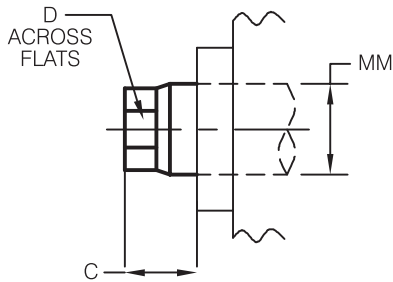
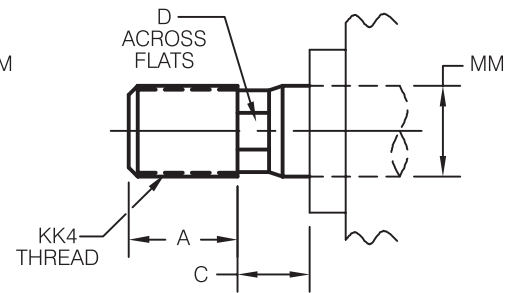
ROD END STYLE:  
KK1  
KK2



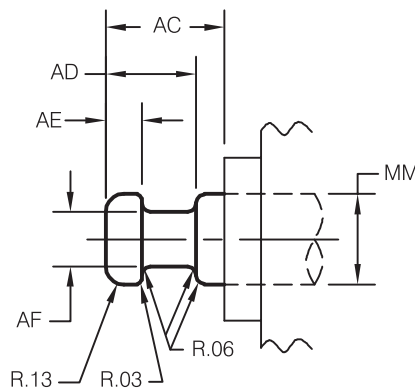
ROD END STYLE:  
KK3



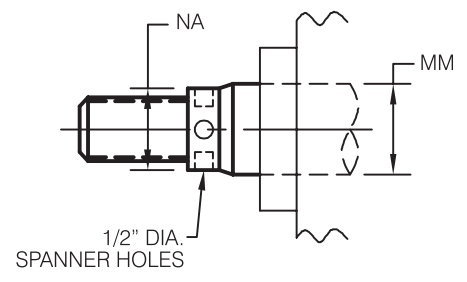
ROD END STYLE:  
KK4



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	1.063	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

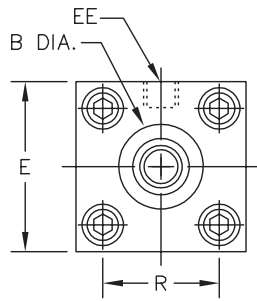
\*Studded rod end.

(4) wrench flats are an option.

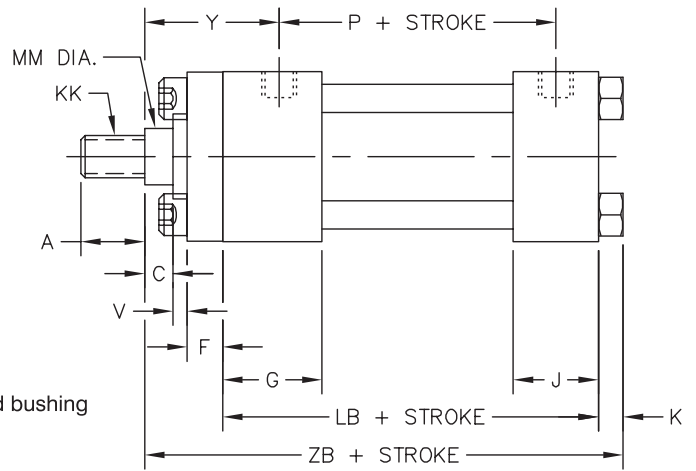
**Note:** Rods larger than 3.50" dia. utilize (4) 0.500" dia. spanner holes 0.500" deep.

# SERIES 'HH' DIMENSIONS: BASIC CYLINDER (NO MOUNT)

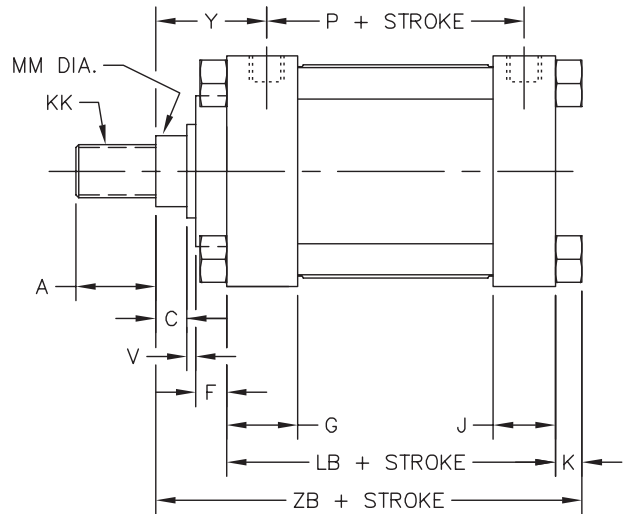
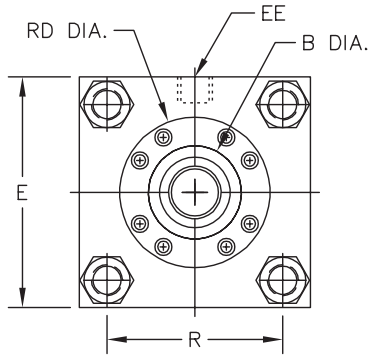
FULL SQUARE RETAINER USED ON:	
BORE	ROD DIA.
1.50	0.625
1.50	1.000
2.00	1.000
2.00	1.375
2.50	1.375
2.50	1.750
3.25	1.750
3.25	2.000
4.00	2.500
5.00	3.500



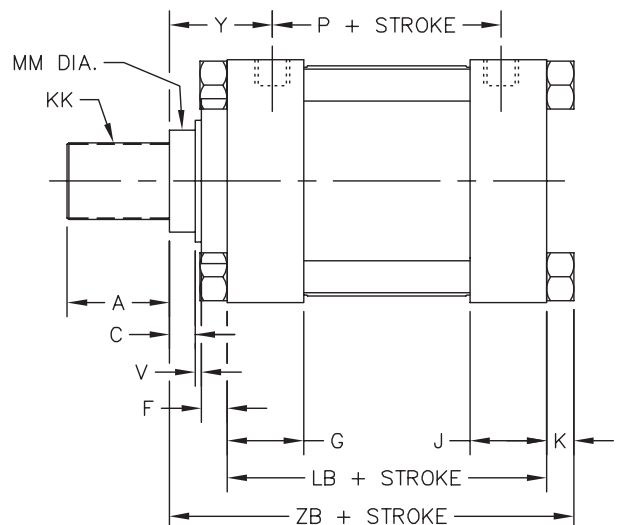
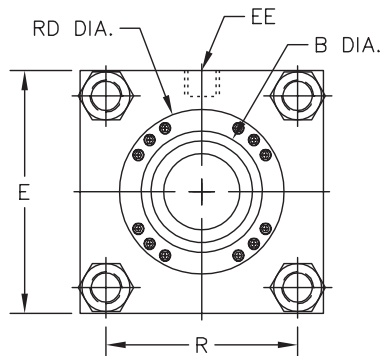
**Note:** Full square retainer is removable to service rod bushing



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

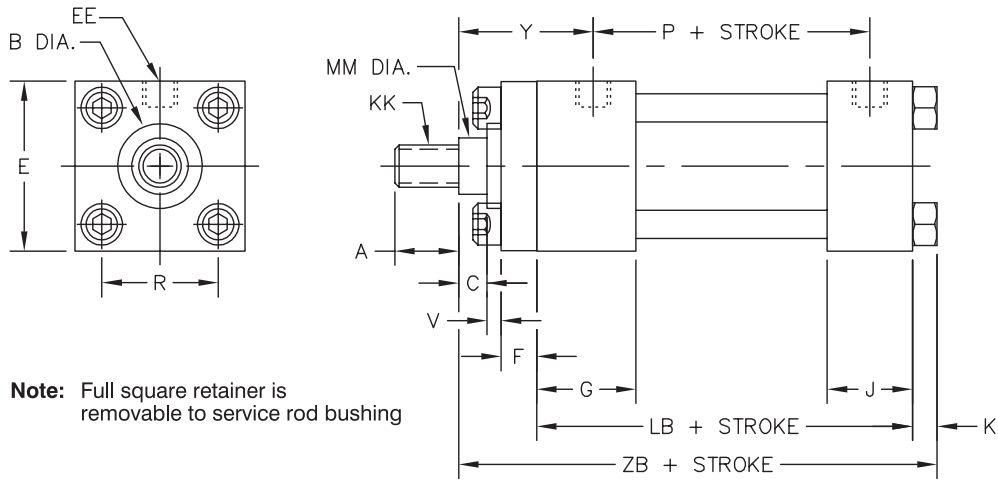


LARGE ROUND RETAINER USED ON:	
BORE	ROD DIA.
5.00	3.000
6.00	3.000
6.00	3.500
6.00	4.000
8.00	3.500
8.00	4.000
8.00	4.500
8.00	5.000
8.00	5.500



# SERIES 'HH' DIMENSIONS: BASIC CYLINDER (NO MOUNT)

EASY FLIP OUT PAGE FOR REFERENCE



BORE	ROD DIA. (MM)	① MAX PSI RATING	E	A	② B	C	④ EE		F	G	J	K	KK	R	③ RD	V	Y	ADD TO STROKE		
							NPTF	SAE										LB	P	ZB
1.50	0.625	3000	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	3000		1.125	1.499	0.500		8	0.375						—	0.500	2.375			6.375
2.00	1.000	3000	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	3000		1.625	1.999	0.625		8	0.625						—	0.375	2.625			6.688
2.50	1.000	3000	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	3000		1.625	1.999	0.625		10	0.625						—	0.375	2.625			6.813
	1.750	3000		2.000	2.374	0.750		10	0.625						—	0.500	2.875			7.063
3.25	1.375	3000	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	3000		2.000	2.374	0.750		12	0.750						—	0.375	3.000			7.938
	2.000	3000		2.250	2.624	0.875		12	0.750						—	0.375	3.125			8.063
4.00	1.750	3000	5.000	2.000	2.374	0.750	3/4	12	0.875	2.000	1.750	0.563		3.820	3.875	0.250	2.938	5.750	3.875	8.188
	2.000	3000		2.250	2.624	0.875		12	0.875						—	0.375	3.063			8.313
	2.500	3000		3.000	3.124	1.000		12	0.875						—	0.375	3.313			8.563
5.00	2.000	3000	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	3000		3.000	3.124	1.000		12	0.875						4.625	0.375	3.375			9.313
	3.000	3000		3.500	3.749	1.000		12	0.875						5.250	0.375	3.375			9.313
	3.500	3000		3.500	4.249	1.000		12	0.875						—	0.375	3.375			9.313
6.00	2.500	3000	7.500	3.000	3.124	1.000	1	16	0.875	2.250	2.250	0.875		5.730	4.625	0.375	3.500	7.375	5.000	10.500
	3.000	3000		3.500	3.749	1.000		16	0.875						5.250	0.375	3.500			10.500
	3.500	3000		3.500	4.249	1.000		16	0.875						5.625	0.375	3.500			10.500
	4.000	3000		4.000	4.749	1.000		16	1.000						6.438	0.250	3.500			10.500
8.00	3.500	3000	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	3000		4.000	4.749	1.000		24	1.000						6.438	0.250	3.938			13.000
	4.500	3000		4.500	5.249	1.000		24	1.000						7.125	0.250	3.938			13.000
	5.000	3000		5.000	5.749	1.000		24	1.000						7.625	0.250	3.938			13.000
	5.500	3000		5.500	6.249	1.000		24	1.000						8.375	0.250	3.938			13.000

SEE ROD END DETAIL CHART ON PAGE 8

① Max pressure rating (NON-SHOCK).

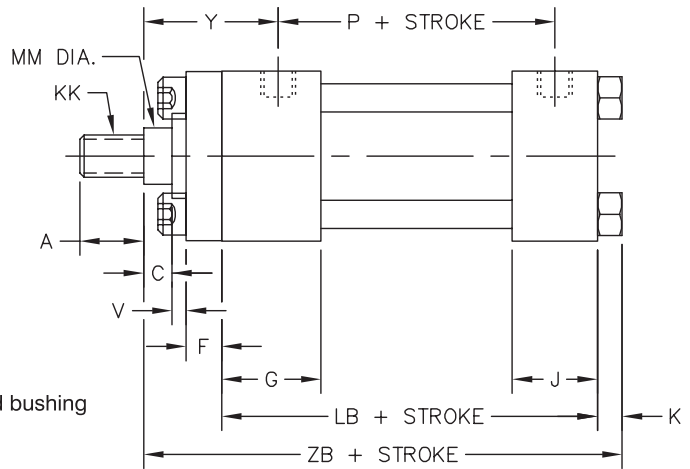
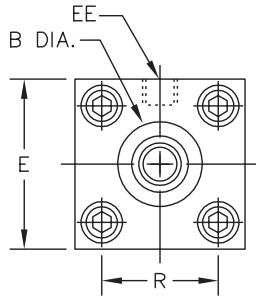
③ Where no dimension is shown, cylinder utilizes a full square retainer.

② 'B' dimension tolerance is +.000 / -.002

④ Standard port sizes.



# SERIES 'HH' DIMENSIONS: BASIC CYLINDER (NO MOUNT)



**Note:** Full square retainer is removable to service rod bushing

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	A	② B	C	④ EE		F	G	J	K	KK	R	③ RD	V	Y	ADD TO STROKE		
							NPTF	SAE										LB	P	ZB
1.50	0.625	3000	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	3000		1.125	1.499	0.500		8	0.375						—	0.500	2.375			6.375
2.00	1.000	3000	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	3000		1.625	1.999	0.625		8	0.625						—	0.375	2.625			6.688
2.50	1.000	3000	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	3000		1.625	1.999	0.625		10	0.625						—	0.375	2.625			6.813
	1.750	3000		2.000	2.374	0.750		10	0.625						—	0.500	2.875			7.063
3.25	1.375	3000	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	3000		2.000	2.374	0.750		12	0.750						—	0.375	3.000			7.938
	2.000	3000		2.250	2.624	0.875		12	0.750						—	0.375	3.125			8.063
4.00	1.750	3000	5.000	2.000	2.374	0.750	3/4	12	0.875	2.000	1.750	0.563		3.820	3.875	0.250	2.938	5.750	3.875	8.188
	2.000	3000		2.250	2.624	0.875		12	0.875						—	0.375	3.063			8.313
	2.500	3000		3.000	3.124	1.000		12	0.875						—	0.375	3.313			8.563
5.00	2.000	3000	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	3000		3.000	3.124	1.000		12	0.875						—	0.375	3.375			9.313
	3.000	3000		3.500	3.749	1.000		12	0.875						—	0.375	3.375			9.313
	3.500	3000		3.500	4.249	1.000		12	0.875						—	0.375	3.375			9.313
6.00	2.500	3000	7.500	3.000	3.124	1.000	1	16	0.875	2.250	2.250	0.875		5.730	4.625	0.375	3.500	7.375	5.000	10.500
	3.000	3000		3.500	3.749	1.000		16	0.875						—	0.375	3.500			10.500
	3.500	3000		3.500	4.249	1.000		16	0.875						—	0.375	3.500			10.500
	4.000	3000		4.000	4.749	1.000		16	1.000						—	0.250	3.500			10.500
8.00	3.500	3000	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	3000		4.000	4.749	1.000		24	1.000						—	0.250	3.938			13.000
	4.500	3000		4.500	5.249	1.000		24	1.000						—	0.250	3.938			13.000
	5.000	3000		5.000	5.749	1.000		24	1.000						—	0.250	3.938			13.000
	5.500	3000		5.500	6.249	1.000		24	1.000						—	0.250	3.938			13.000

SEE ROD END DETAIL CHART ON PAGE 8

① Max pressure rating (NON-SHOCK).

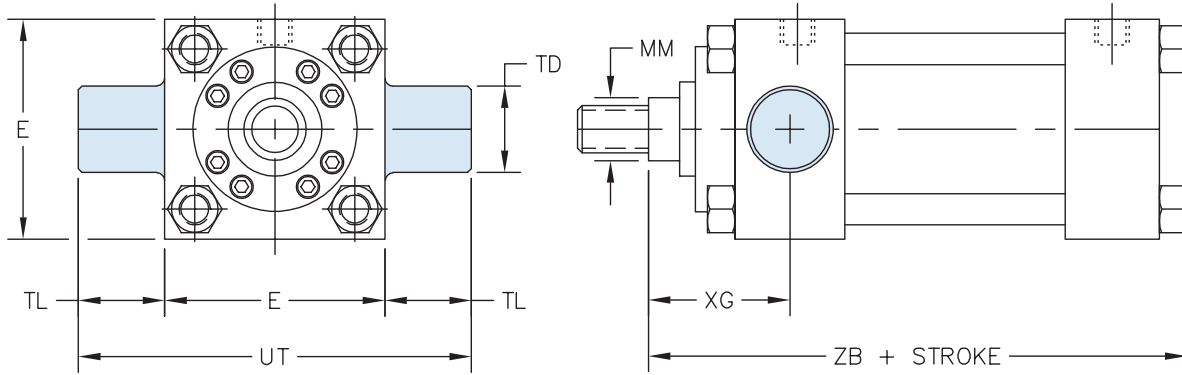
② 'B' dimension tolerance is +.000 / -.002

③ Where no dimension is shown, cylinder utilizes a full square retainer.

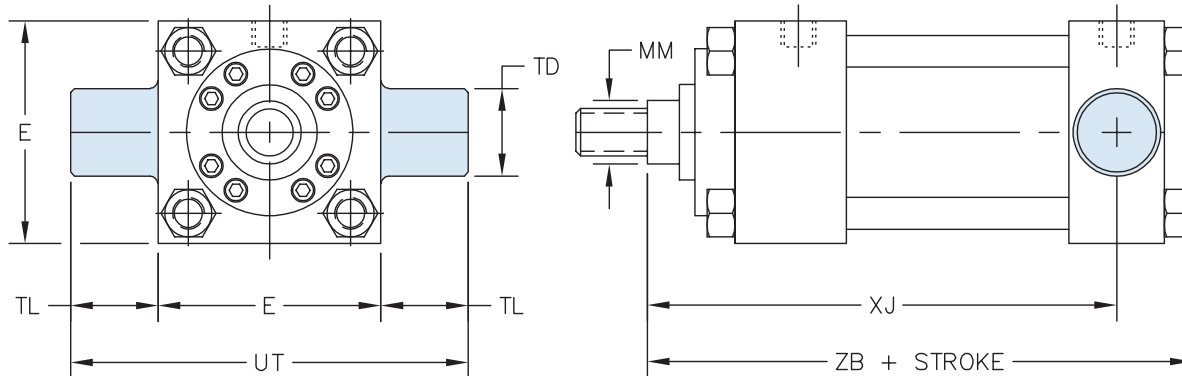
④ Standard port sizes.

# SERIES 'HH' DIMENSIONS: TRUNNION MOUNTS

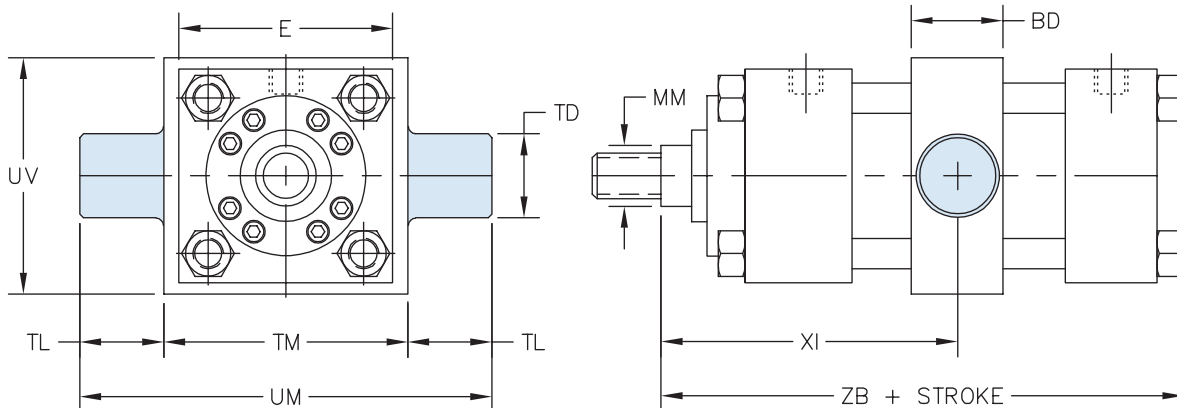
## MT1: HEAD TRUNNION



## MT2: CAP TRUNNION



## MT4: INTERMEDIATE TRUNNION



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

# SERIES 'HH' DIMENSIONS: TRUNNION MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	BD	② TD	TL	TM	UM	UT	UV	XG	③ XI	MT4 Min Stroke	ADD TO STROKE		
														XI Max	XJ	ZB
1.50	0.625	3000	2.500	1.500	1.000	1.000	3.000	5.000	4.500	3.000	1.875	3.560	0.250	3.250	4.875	6.000
	1.000	3000												3.625	5.250	6.375
2.00	1.000	3000	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
	1.375	3000												4.000	5.500	6.688
2.50	1.000	3000	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	3000												4.000	5.625	6.813
	1.750	3000												4.250	5.875	7.063
3.25	1.375	2800	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	2800												4.375	6.500	7.938
	2.000	2800												4.500	6.625	8.063
4.00	1.750	1800	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	1800												4.500	6.875	8.313
	2.500	1800												4.750	7.125	8.563
5.00	2.000	1200	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	1200												5.000	7.625	9.313
	3.000	1200												5.000	7.625	9.313
	3.500	1200												5.000	7.625	9.313
6.00	2.500	1000	7.500	3.000	2.000	2.000	8.500	12.500	11.500	8.750	3.375	6.250	1.250	5.375	8.375	10.500
	3.000	1000												5.375	8.375	10.500
	3.500	1000												5.375	8.375	10.500
	4.000	1000												5.375	8.375	10.500
8.00	3.500	1000	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	1000												6.000	10.250	13.000
	4.500	1000												6.000	10.250	13.000
	5.000	1000												6.000	10.250	13.000
	5.500	1000												6.000	10.250	13.000

① Max pressure rating (NON-SHOCK).

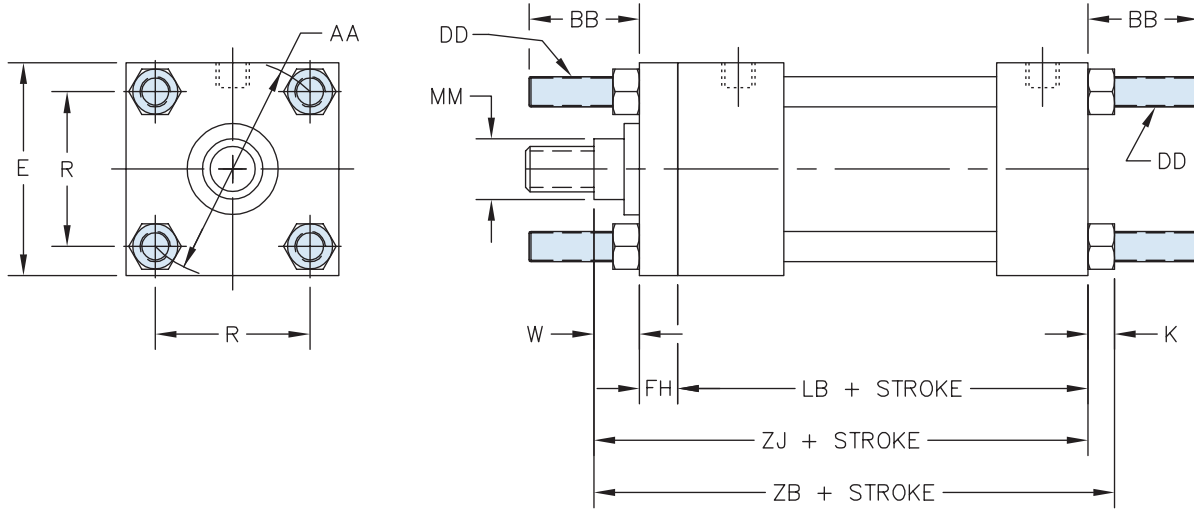
② 'TD' dimension tolerance is + .000 / - .001

③ 'XI' dimension is the minimum that can be supplied (customer to specify 'XI' dimension).

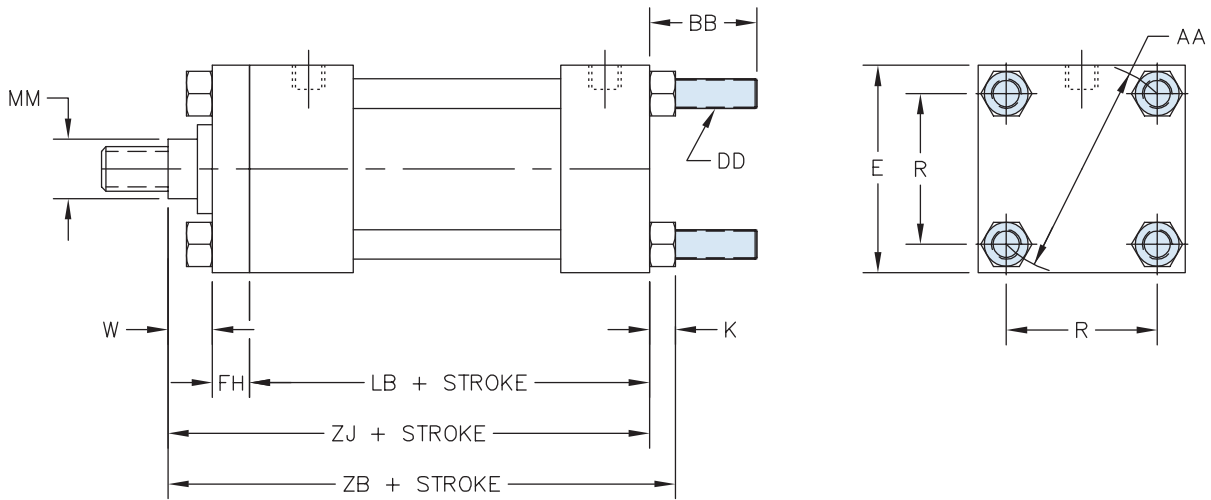


# SERIES 'HH' DIMENSIONS: EXTENDED TIE ROD MOUNTS

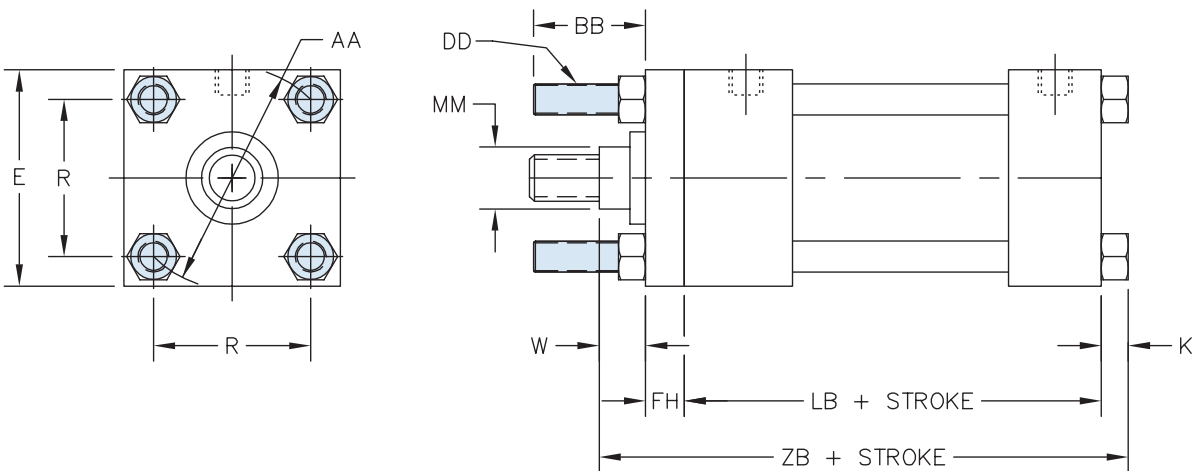
## MX1: EXTENDED TIE-RODS - HEAD & CAP



## MX2: EXTENDED TIE-RODS - CAP END



## MX3: EXTENDED TIE-RODS - HEAD END



HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 HH Options  
 MH - Medium Duty Hydraulic  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144

# SERIES 'HH' DIMENSIONS: EXTENDED TIE ROD MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	AA	BB	DD	F	FH	K	R	W	ADD TO STROKE		
												LB	ZB	ZJ
1.50	0.625	3000	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	3000					0.375				1.000		6.375	6.000
2.00	1.000	3000	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	3000					0.625				1.000		6.688	6.250
2.50	1.000	3000	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	3000					0.625				1.000		6.813	6.375
	1.750	3000					0.625				1.250		7.063	6.625
3.25	1.375	3000	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	3000					0.750				1.125		7.938	7.375
	2.000	3000					0.750				1.250		8.063	7.500
4.00	1.750	3000	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	3000					0.875				1.125		8.313	7.750
	2.500	3000					0.875				1.375		8.563	8.000
5.00	2.000	3000	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	3000					0.875				1.375		9.313	8.500
	3.000	3000					0.875				1.375		9.313	8.500
	3.500	3000					0.875				1.375		9.313	8.500
6.00	2.500	3000	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	3000					0.875*				1.250**		10.500	9.625
	3.500	3000					0.875*				1.250**		10.500	9.625
	4.000	3000					1.000				1.250		10.500	9.625
8.00	3.500	3000	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	3000					1.000				1.250		13.000	11.750
	4.500	3000					1.000				1.250		13.000	11.750
	5.000	3000					1.000				1.250		13.000	11.750
	5.500	3000					1.000				1.250		13.000	11.750

① Max pressure rating (NON-SHOCK).

\* On MX2, MX1 & MX3, a round retainer is used; a square retainer is 1.00" thick.

\*\* On MX2 mount, dimension is 1.375" with a round retainer.

# SERIES 'HH' DIMENSIONS: FLANGE MOUNTS

HH - Heavy Duty Hydraulic

HH Rod Lock

HH Options

MH - Medium Duty Hydraulic

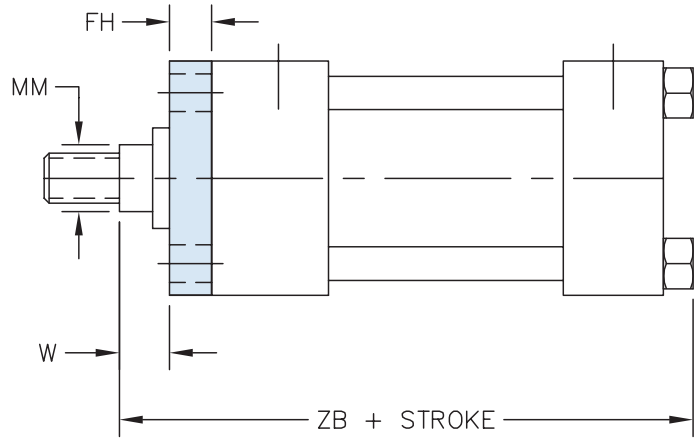
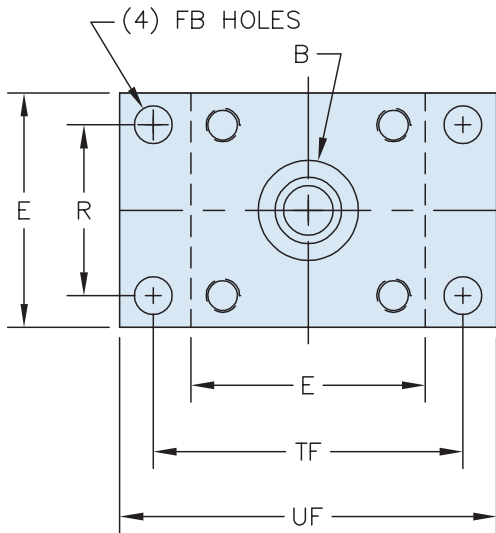
TAS - Heavy Duty Pneumatic

Accessories Page 130

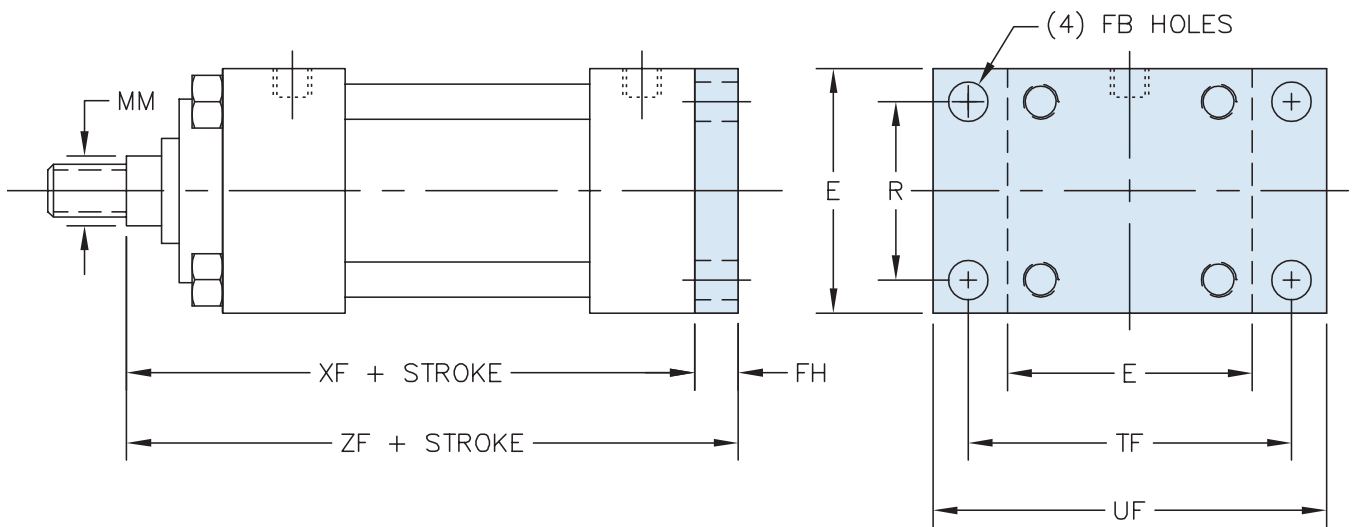
STROKEMASTER Page 136

Technical Data Page 144

## MF1: HEAD FLANGE



## MF2: CAP FLANGE





# SERIES 'HH' DIMENSIONS: FLANGE MOUNTS

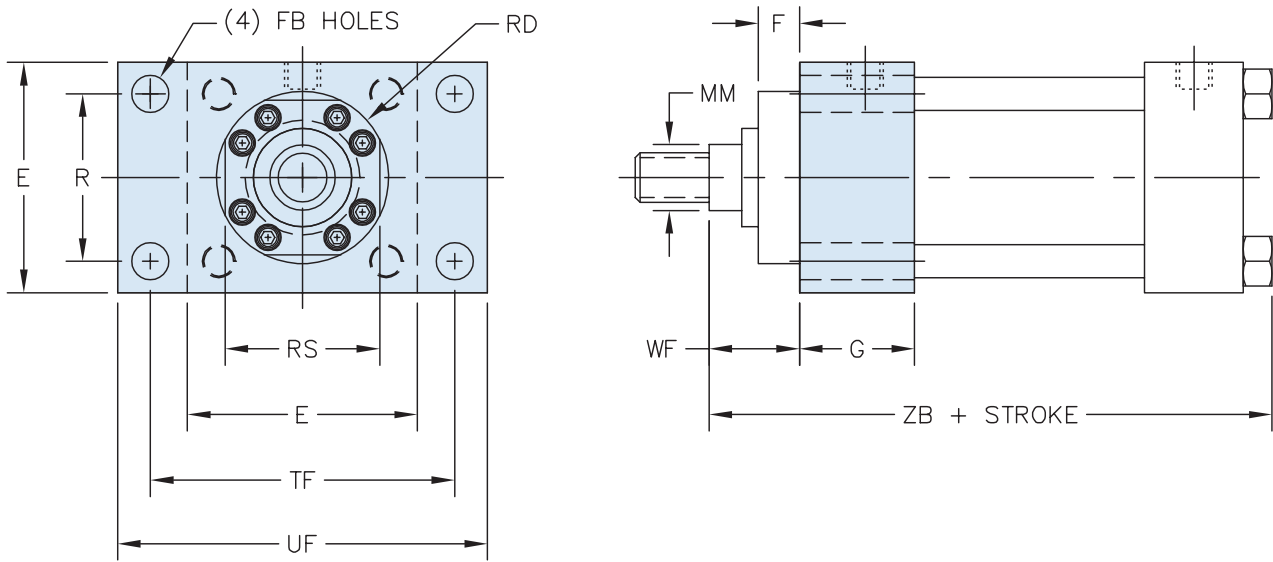
BORE	ROD DIA. (MM)	① MAX PSI RATING		② B	E	F	FB	FH	R	RD	TF	UF	W	ADD TO STROKE								
		MF1	MF2											XF	ZB	ZF						
		1.50	0.625											2600	3000	1.124	2.500	0.375	0.438	0.375	1.625	2.375
	1.000	1600	3000	1.499	0.375	2.563	1.000	6.000	6.375	6.375												
2.00	1.000	2600	3000	1.499	3.000	0.625	0.563	0.625	2.047	2.625	4.125	5.125	0.750	6.000	6.438	6.625						
		1.375	1600	3000		1.999											0.625	3.250	1.000	6.250	6.688	6.875
2.50	1.000	2600	3000	1.499	3.500	0.625	0.563	0.625	2.546	2.625	4.625	5.625	0.750	6.125	6.563	6.750						
		1.375	2000	3000		1.999											0.625	3.250	1.000	6.375	6.813	7.000
		1.750	1600	3000		2.374											0.625	3.875	1.250	6.625	7.063	7.250
3.25	1.375	2600	3000	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	2200	3000		2.374		0.750									0.875	3.875	7.375	7.943	8.125	
		2.000	1600	3000		2.624		0.750									4.250	1.250	7.500	8.063	8.250	
4.00	1.750	2600	3000	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	1900	3000		2.624											0.875	4.250	1.125	7.750	8.313	8.625
		2.500	1600	3000		3.124											0.875	4.625	1.375	8.000	8.563	8.875
5.00	2.000	2200	2000	2.624	6.500	0.875	0.943	0.875	4.953	4.250	8.188	9.750	1.125	8.250	9.063	9.125						
		2.500	1600	2500		3.124											0.875	4.625	1.375	8.500	9.313	9.375
		3.000	1200	2800		3.749											0.875	5.250	1.375	8.500	9.313	9.375
		3.500	750	3000		4.249											0.875	5.625	1.375	8.500	9.313	9.375
6.00	2.500	1800	2000	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	1450	2500		3.749											0.875	5.250	1.250	9.625	10.500	10.625
		3.500	1100	2800		4.249											0.875	5.625	1.250	9.625	10.500	10.625
		4.000	750	3000		4.749											1.000	6.438	1.250	9.625	10.500	10.625
8.00	3.500	900	1500	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	800	1700		4.749											1.000	6.438	1.250	11.750	13.000	12.750
		4.500	700	1800		5.249											1.000	7.125	1.250	11.750	13.000	12.750
		5.000	500	1900		5.749											1.000	7.625	1.250	11.750	13.000	12.750
		5.500	500	2000		6.249											1.000	8.375	1.250	11.750	13.000	12.750

① Max pressure rating (NON-SHOCK).

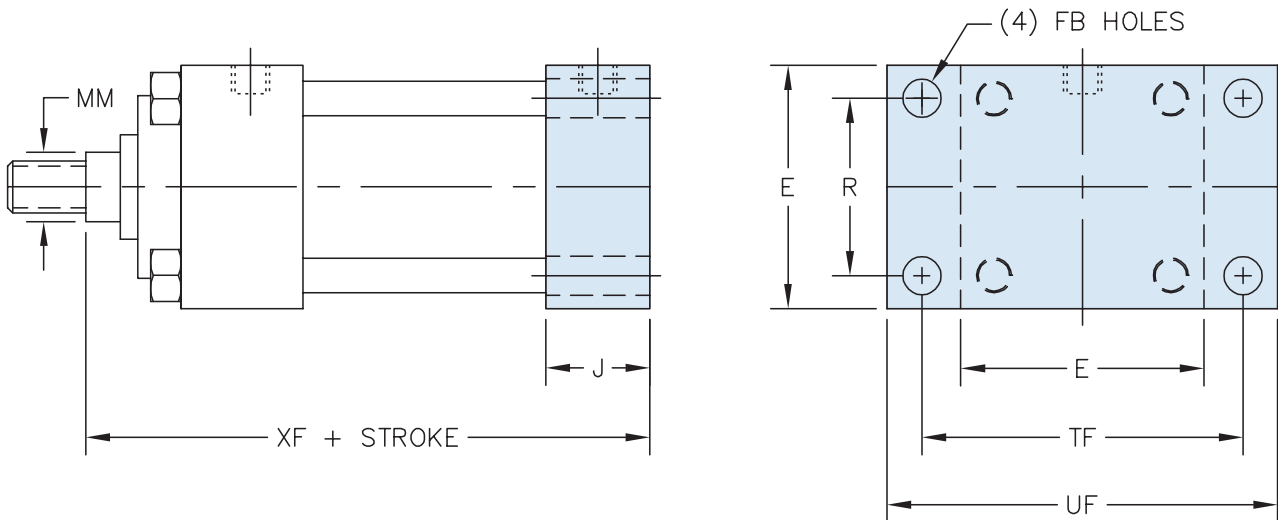
② 'B' dimension tolerance is +.000 / -.002

# SERIES 'HH' DIMENSIONS: FLANGE MOUNTS

## ME5: HEAD RECTANGULAR MOUNTING HOLES



## ME6: CAP RECTANGULAR MOUNTING HOLES



# SERIES 'HH' DIMENSIONS: FLANGE MOUNTS

BORE	ROD DIA. (MM)	Ⓢ MAX PSI RATING	E	F	FB	G	J	R	RD	RS	TF	UF	WF	ADD TO STROKE	
														XF	ZB
1.50	0.625	3000	2.500	0.375	0.438	1.750	1.500	1.625	2.375	—	3.438	4.250	1.000	5.625	6.000
	1.000	3000		0.375					2.563	2.438			1.375	6.000	6.375
2.00	1.000	3000	3.000	0.625	0.563	1.750	1.500	2.047	2.625	—	4.125	5.125	1.375	6.000	6.438
	1.375	3000		0.625					3.250	2.943			1.625	6.250	6.688
2.50	1.000	3000	3.500	0.625	0.563	1.750	1.500	2.546	2.625	—	4.625	5.625	1.375	6.125	6.563
	1.375	3000		0.625					3.250	—			1.625	6.375	6.813
	1.750	3000		0.625					3.875	3.438			1.875	6.625	7.063
3.25	1.375	3000	4.500	0.750	0.688	2.000	1.750	3.250	3.250	—	5.875	7.125	1.625	7.125	7.688
	1.750	3000		0.750					3.875	—			1.875	7.375	7.943
	2.000	3000		0.750					4.250	—			2.000	7.500	8.063
4.00	1.750	3000	5.000	0.875	0.688	2.000	1.750	3.820	3.875	—	6.375	7.625	1.875	7.625	8.188
	2.000	3000		0.875					4.250	—			2.000	7.750	8.313
	2.500	3000		0.875					4.625	—			2.250	8.000	8.563
5.00	2.000	3000	6.500	0.875	0.943	2.000	1.750	4.953	4.250	—	8.188	9.750	2.000	8.250	9.063
	2.500	3000		0.875					4.625	—			2.250	8.500	9.313
	3.000	3000		0.875					5.250	—			2.250	8.500	9.313
	3.500	3000		0.875					5.625	—			2.250	8.500	9.313
6.00	2.500	3000	7.500	0.875	1.063	2.250	2.250	5.734	4.625	—	9.438	11.250	2.250	9.625	10.500
	3.000	3000		0.875					5.250	—			2.250	9.625	10.500
	3.500	3000		0.875					5.625	—			2.250	9.625	10.500
	4.000	3000		1.000					6.438	—			2.250	9.625	10.500
8.00	3.500	3000	9.500	0.875	1.313	3.000	3.000	7.500	5.625	—	11.813	14.000	2.250	11.750	13.000
	4.000	3000		1.000					6.438	—			2.250	11.750	13.000
	4.500	3000		1.000					7.125	—			2.250	11.750	13.000
	5.000	3000		1.000					7.625	—			2.250	11.750	13.000
	5.500	3000		1.000					8.375	—			2.250	11.750	13.000

Ⓢ Max pressure rating (NON-SHOCK).

HH - Heavy Duty Hydraulic

HH Rod Lock

HH Options

MH - Medium Duty Hydraulic

TAS - Heavy Duty Pneumatic

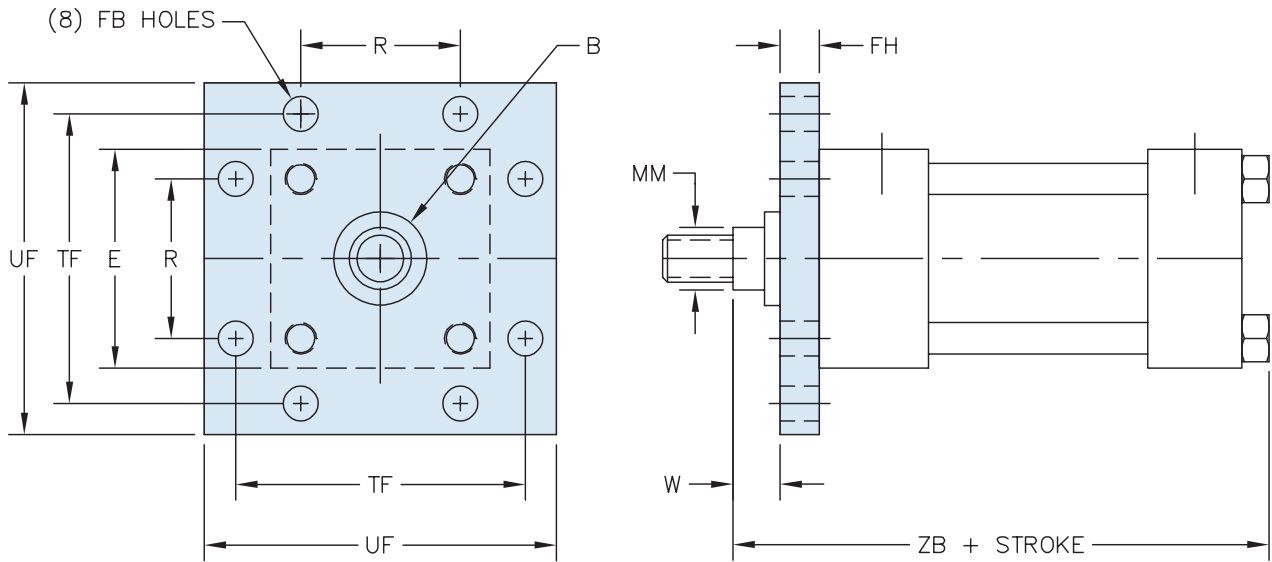
Accessories Page 130

STROKEMASTER Page 136

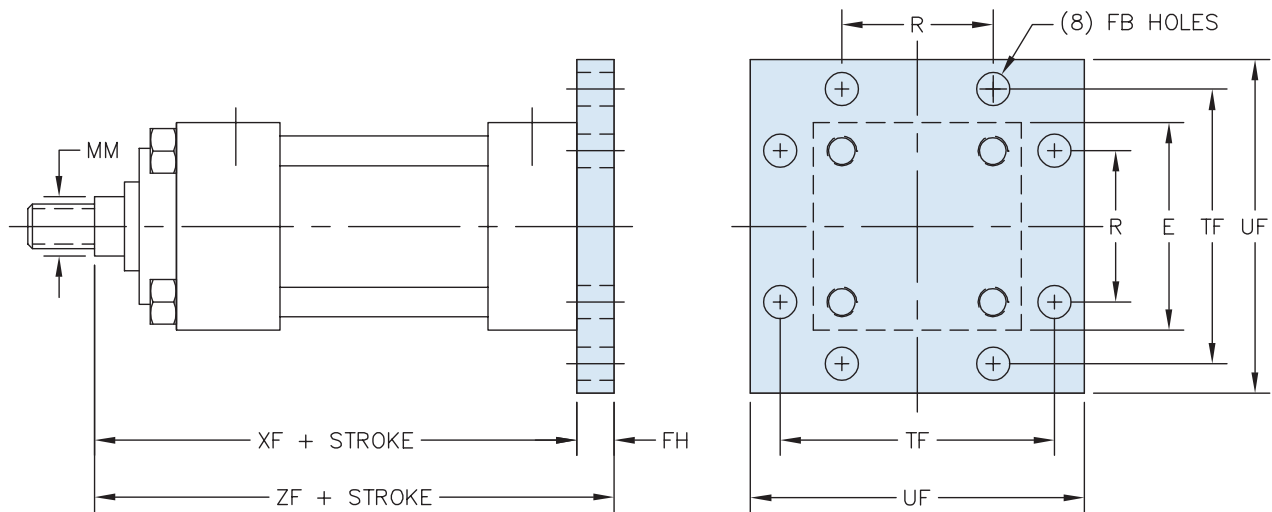
Technical Data Page 144

# SERIES 'HH' DIMENSIONS: SQUARE FLANGE MOUNTS

## MF5: HEAD SQUARE FLANGE



## MF6: CAP SQUARE FLANGE



# SERIES 'HH' DIMENSIONS: SQUARE FLANGE MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING		B	② E	F	FB	FH	R	RD	③ TF	UF	W	ADD TO STROKE			
		MF5	MF6											XF	ZB	ZF	
		1.50	0.625											3000	3000	1.124	2.500
	1.000	2500	3000	1.499	0.375	1.000	6.000	6.375	6.375								
2.00	1.000	3000	3000	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	3000	3000		1.999							0.625	1.000	6.250	6.688	6.875
2.50	1.000	3000	3000	1.499	3.500	0.625	0.563	0.625	2.547	—	4.625	5.625	0.750	6.125	6.563	6.750	
		1.375	3000	3000		1.999							0.625	1.000	6.375	6.813	7.000
		1.750	2700	3000		2.374							0.625	1.250	6.625	7.063	7.250
3.25	1.375	2900	3000	1.999	4.500	0.750	0.688	0.750	3.250	—	5.875	7.125	0.875	7.125	7.688	7.875	
		1.750	2700	3000		2.374							0.750	1.125	7.375	7.938	8.125
		2.000	2500	3000		2.624							0.750	1.250	7.500	8.063	8.250
4.00	1.750	2700	3000	2.374	5.000	0.875	0.688	0.875	3.820	—	6.375	7.625	1.000	7.625	8.188	8.500	
		2.000	2600	3000		2.624							0.875	1.125	7.750	8.313	8.625
		2.500	2400	3000		3.124							0.875	1.375	8.000	8.563	8.875
5.00	2.000	2000	2600	2.624	6.500	0.875	0.938	0.875	4.953	—	8.188	9.750	1.125	8.250	9.063	9.125	
		2.500	1800	2600		3.124							0.875	1.375	8.500	9.313	9.375
		3.000	1200	2600		3.749							0.875	1.375	8.500	9.313	9.375
		3.500	1200	2600		4.249							0.875	1.375	8.500	9.313	9.375
6.00	2.500	1700	2100	3.124	7.500	0.875	1.063	1.000	5.734	—	9.438	11.250	1.250	9.625	10.500	10.625	
		3.000	1000	2100		3.749							0.875	1.250	9.625	10.500	10.625
		3.500	1000	2100		4.249							0.875	1.250	9.625	10.500	10.625
		4.000	1000	2100		4.749							1.000	1.250	9.625	10.500	10.625
8.00	3.500	1000	1300	4.249	9.500	0.875	1.313	1.000	7.500	—	11.813	14.000	1.250	11.750	13.000	12.750	
		4.000	800	1300		4.749							1.000	1.250	11.750	13.000	12.750
		4.500	700	1300		5.249							1.000	1.250	11.750	13.000	12.750
		5.000	700	1300		5.749							1.000	1.250	11.750	13.000	12.750
		5.500	700	1300		6.249							1.000	1.250	11.750	13.000	12.750

① Max pressure rating (NON-SHOCK).

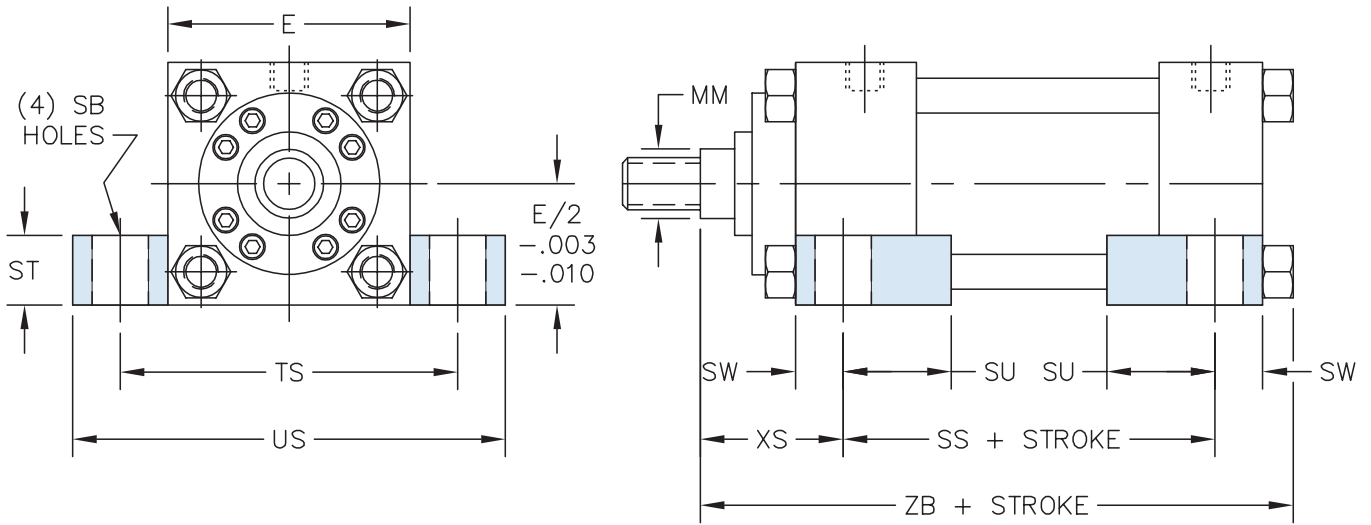
② 'B' dimension tolerance is +.000 / -.002

③ Where no dimension is shown, cylinder utilizes a full square retainer.

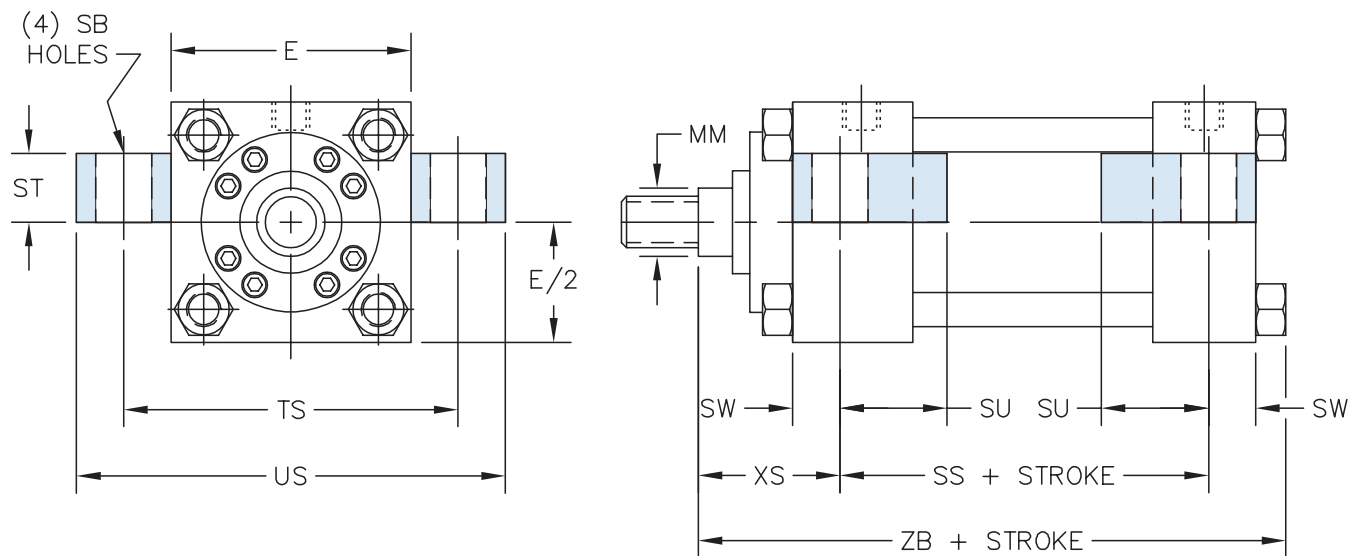


# SERIES 'HH' DIMENSIONS: LUG MOUNTS

## MS2: SIDE LUGS



## MS3: CENTER LINE LUGS



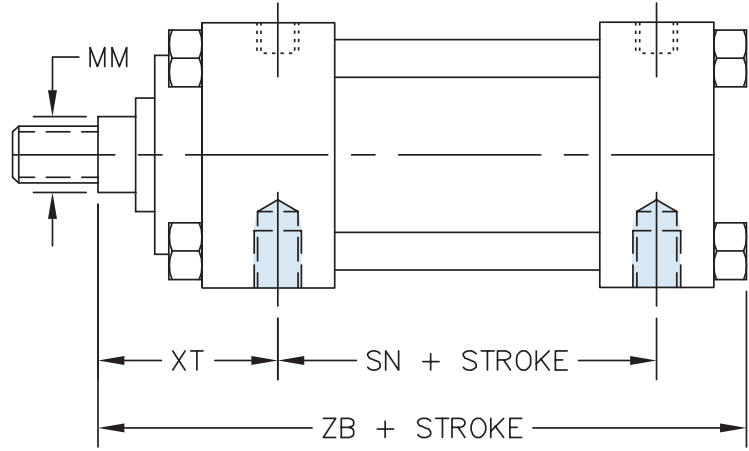
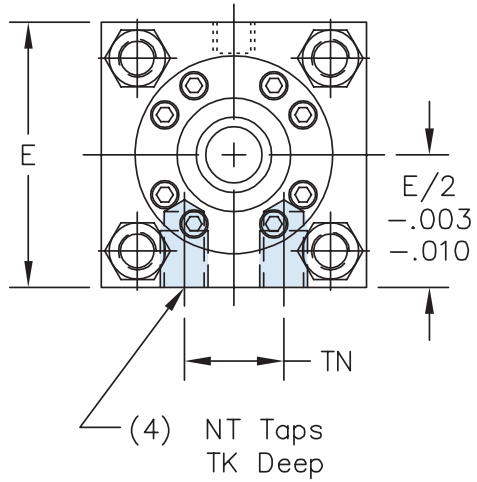
# SERIES 'HH' DIMENSIONS: LUG MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	E / 2	SB	ST	SU	SW	TS	US	XS	ADD TO STROKE	
												SS	ZB
1.50	0.625	3000	2.500	1.250	0.438	0.500	0.938	0.375	3.250	4.000	1.375	3.875	6.000
	1.000	3000									1.750		6.375
2.00	1.000	3000	3.000	1.500	0.563	0.750	1.250	0.500	4.000	5.000	1.875	3.625	6.438
	1.375	3000									2.125		6.688
2.50	1.000	3000	3.500	1.750	0.813	1.000	1.563	0.688	4.875	6.250	2.063	3.375	6.563
	1.375	3000									2.313		6.813
	1.750	3000									2.563		7.063
3.25	1.375	3000	4.500	2.250	0.813	1.000	1.563	0.688	5.875	7.250	2.313	4.125	7.688
	1.750	3000									2.563		7.943
	2.000	3000									2.688		8.063
4.00	1.750	3000	5.000	2.500	1.063	1.250	2.000	0.875	6.750	8.500	2.750	4.000	8.188
	2.000	3000									2.875		8.313
	2.500	3000									3.125		8.563
5.00	2.000	3000	6.500	3.250	1.063	1.250	2.000	0.875	8.250	10.000	2.875	4.500	9.063
	2.500	3000									3.125		9.313
	3.000	3000									3.125		9.313
	3.500	3000									3.125		9.313
6.00	2.500	3000	7.500	3.750	1.313	1.500	2.500	1.125	9.750	12.000	3.375	5.125	10.500
	3.000	3000									3.375		10.500
	3.500	3000									3.375		10.500
	4.000	3000									3.375		10.500
8.00	3.500	3000	9.500	4.750	1.563	1.750	2.875	1.375	12.250	15.000	3.625	6.750	13.000
	4.000	3000									3.625		13.000
	4.500	3000									3.625		13.000
	5.000	3000									3.625		13.000
	5.500	3000									3.625		13.000

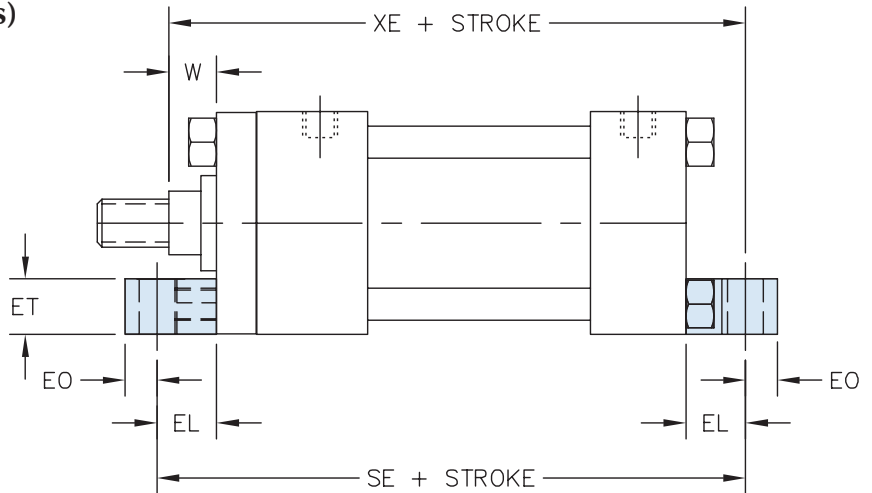
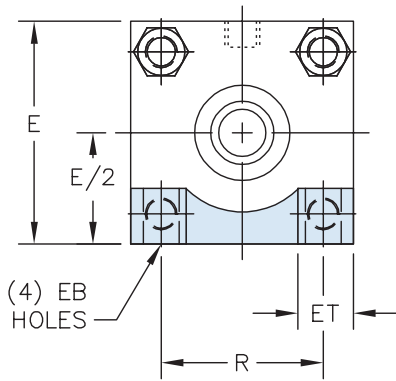
① Max pressure rating (NON-SHOCK).

# SERIES 'HH' DIMENSIONS: BOTTOM MOUNTS

## MS4: BOTTOM TAPPED HOLES



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



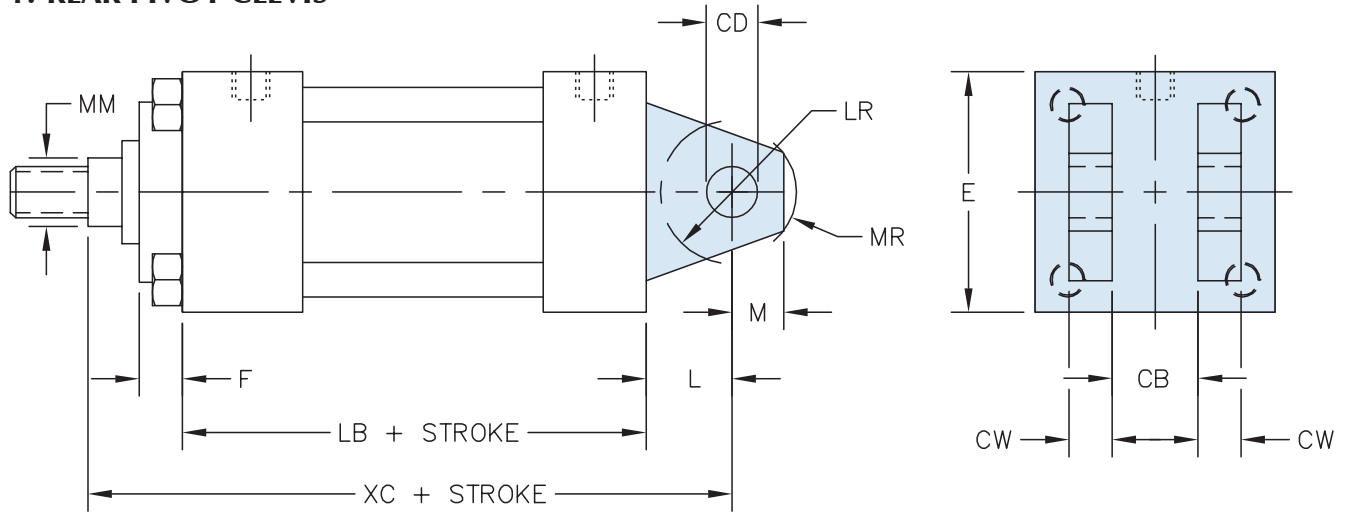
# SERIES 'HH' DIMENSIONS: BOTTOM MOUNTS

BORE	ROD DIA. (MM)	Ⓛ MAX PSI RATING	E	E / 2	MS4 DIMENSIONS						MS7 DIMENSIONS							
					NT	TK	TN	XT	ADD TO STROKE		EB	EL	EO	ET	R	W	ADD TO STROKE	
									SN	ZB							SE	XE
1.50	0.625	3000	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	6.750	6.500
	1.000	3000				0.375		2.375		6.375						1.000		6.875
2.00	1.000	3000	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	7.125	6.938
	1.375	3000				0.438		2.625		6.688						1.000		7.188
2.50	1.000	3000	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	7.250	7.063
	1.375	3000				0.625		2.625		6.813						1.000		7.313
	1.750	3000				0.500		2.875		7.063						1.250		7.563
3.25	1.375	3000	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	8.500	8.250
	1.750	3000				0.875		3.000		7.938						1.125		8.500
	2.000	3000				0.750		3.125		8.063						1.250		8.625
4.00	1.750	3000	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	8.875	8.750
	2.000	3000				0.750		3.125		8.313						1.125		8.875
	2.500	3000				0.750		3.375		8.563						1.375		9.125
5.00	2.000	3000	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	10.125	9.750
	2.500	3000				1.000		3.375		9.313						1.375		10.000
	3.000	3000				1.000		3.375		9.313						1.375		10.000
	3.500	3000				1.000		3.375		9.313						1.375		10.000
6.00	2.500	3000	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	11.750	11.313
	3.000	3000				1.250		3.500		10.500						1.250		11.313
	3.500	3000				1.250		3.500		10.500						1.250		11.313
	4.000	3000				0.750		3.500		10.500						1.250		11.313
8.00	3.500	3000	9.500	4.750	1 1/2 - 6	1.500	4.250	3.938	6.625	13.000	—	—	—	—	—	—	—	—
	4.000	3000				1.500		3.938		13.000						—		—
	4.500	3000				1.500		3.938		13.000						—		—
	5.000	3000				1.250		3.938		13.000						—		—
	5.500	3000				1.000		3.938		13.000						—		—

Ⓛ Max pressure rating (NON-SHOCK).

# SERIES 'HH' DIMENSIONS: PIVOT MOUNT

## MP1: REAR PIVOT CLEVIS



NOTE: PIVOT PIN INCLUDED WITH CYLINDER

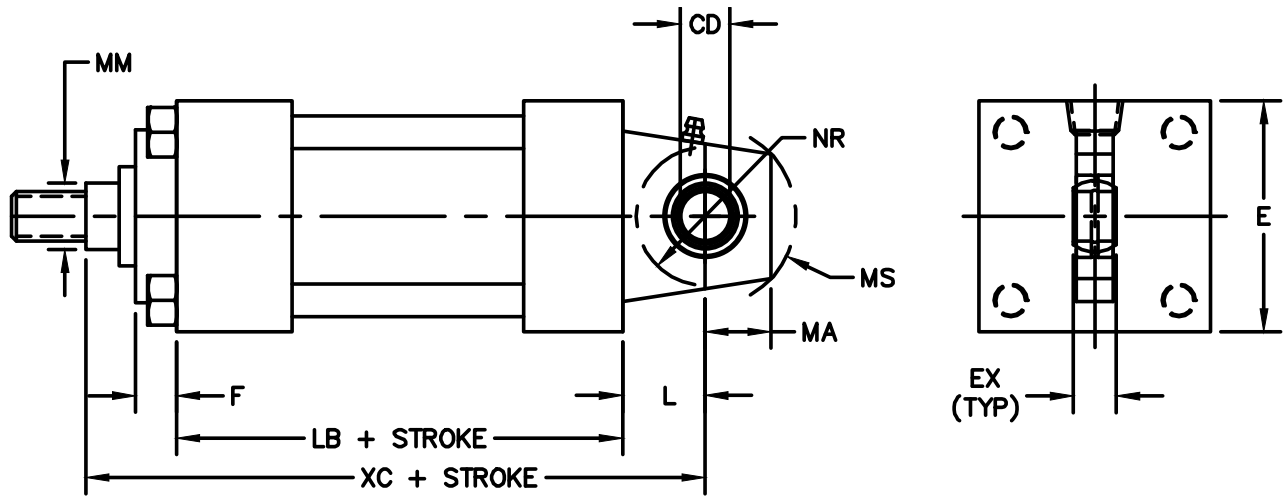
BORE	ROD DIA. (MM)	① MAX PSI RATING	E	② CB	③ CD	CW	F	L	LR	M	MR	ADD TO STROKE	
												LB	XC
1.50	0.625	3000	2.500	0.750	0.500	0.500	0.375	0.750	0.563	0.500	0.625	4.625	6.375
	1.000	3000					0.375		0.563				6.750
2.00	1.000	3000	3.000	1.250	0.750	0.625	0.625	1.250	1.000	0.750	0.938	4.625	7.250
	1.375	3000					0.625		1.000				7.500
2.50	1.000	3000	3.500	1.250	0.750	0.625	0.625	1.250	1.000	0.750	0.938	4.750	7.375
	1.375	3000					0.625		1.000				7.625
	1.750	3000					0.625		1.000				7.875
3.25	1.375	3000	4.500	1.500	1.000	0.750	0.750	1.500	1.250	1.000	1.188	5.500	8.625
	1.750	3000					0.750		1.250				8.875
	2.000	3000					0.750		1.250				9.000
4.00	1.750	3000	5.000	2.000	1.375	1.000	0.875	2.125	1.875	1.375	1.625	5.750	9.750
	2.000	3000					0.875		1.875				9.875
	2.500	3000					0.875		1.875				10.125
5.00	2.000	3000	6.500	2.500	1.750	1.250	0.875	2.250	2.000	1.750	2.125	6.250	10.500
	2.500	3000					0.875		2.000				10.750
	3.000	3000					0.875		2.000				10.750
	3.500	3000					0.875		2.000				10.750
6.00	2.500	3000	7.500	2.500	2.000	1.250	0.875	2.500	2.063	2.000	2.375	7.375	12.125
	3.000	3000					0.875		2.188				12.125
	3.500	3000					0.875		2.188				12.125
	4.000	3000					1.000		2.188				12.125
8.00	3.500	3000	9.500	3.000	3.000	1.500	0.875	3.250	2.938	2.750	3.125	9.500	15.000
	4.000	3000					1.000		2.938				15.000
	4.500	3000					1.000		2.938				15.000
	5.000	3000					1.000		2.938				15.000
	5.500	3000					1.000		2.938				15.000

① Max pressure rating (NON-SHOCK).

② 'CB' dimension tolerance is +.010 to +.030 depending on bore size.

③ 'CD' dimension tolerance for pin is ±.001.

# SERIES 'HH' DIMENSIONS: SB MOUNT



NOTE: PIVOT PIN INCLUDED WITH CYLINDER CAP END ONLY.

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	② CD	EX	F	L	NR	MA	MS	ADD TO STROKE	
											LB	XC
1.50	0.625	1650	2.500	0.500	0.437	0.375	0.750	0.625	0.750	0.938	4.625	6.375
	1.000	1650				0.375						6.750
2.00	1.000	2200	3.000	0.750	0.656	0.625	1.250	1.000	1.000	1.375	4.625	7.250
	1.375	2200				0.625						7.500
2.50	1.000	1400	3.500	0.750	0.656	0.625	1.250	1.000	1.000	1.375	4.750	7.375
	1.375	1400				0.625						7.625
	1.750	1400				0.625						7.875
3.25	1.375	1500	4.500	1.000	0.875	0.750	1.500	1.250	1.250	1.688	5.500	8.625
	1.750	1500				0.750						8.875
	2.000	1500				0.750						9.000
4.00	1.750	1750	5.000	1.375	1.188	0.875	2.125	1.625	1.875	2.438	5.750	9.750
	2.000	1750				0.875						9.875
	2.500	1750				0.875						10.125
5.00	2.000	1900	6.500	1.750	1.531	0.875	2.250	2.063	2.500	2.875	6.250	10.500
	2.500	1900				0.875						10.750
	3.000	1900				0.875						10.750
	3.500	1900				0.875						10.750
6.00	2.500	1700	7.500	2.000	1.750	0.875	2.500	2.375	2.500	3.313	7.375	12.125
	3.000	1700				0.875						12.125
	3.500	1700				0.875						12.125
	4.000	1700				1.000						12.125

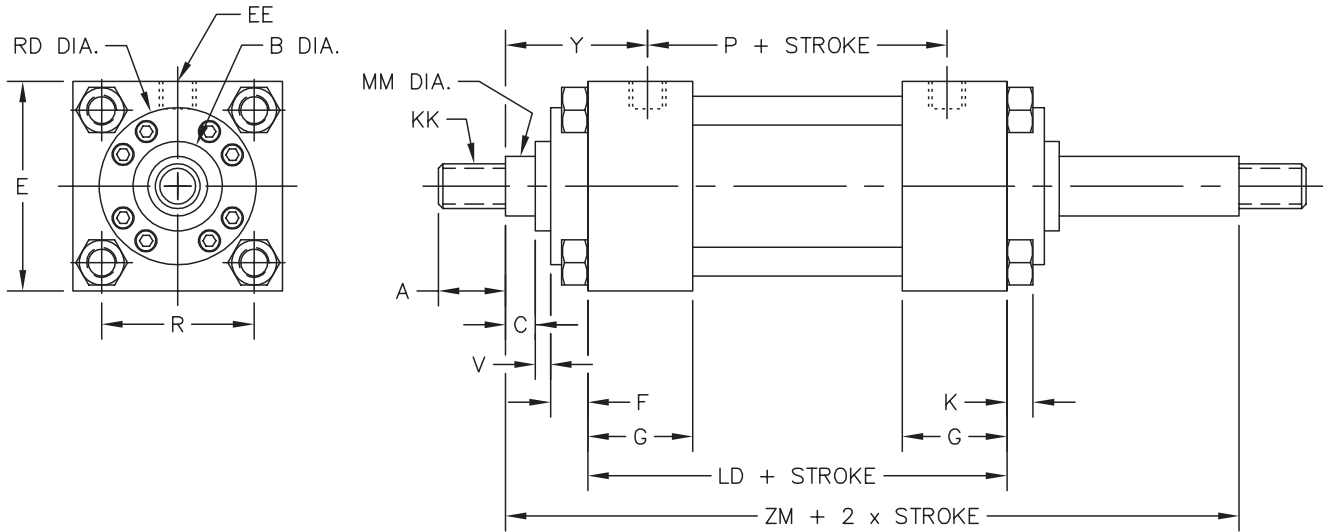
① Max pressure rating (NON-SHOCK).

② 'CD' dimension tolerance for pin is  $\pm 0.001$ .



# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

## MX0D: NO MOUNT



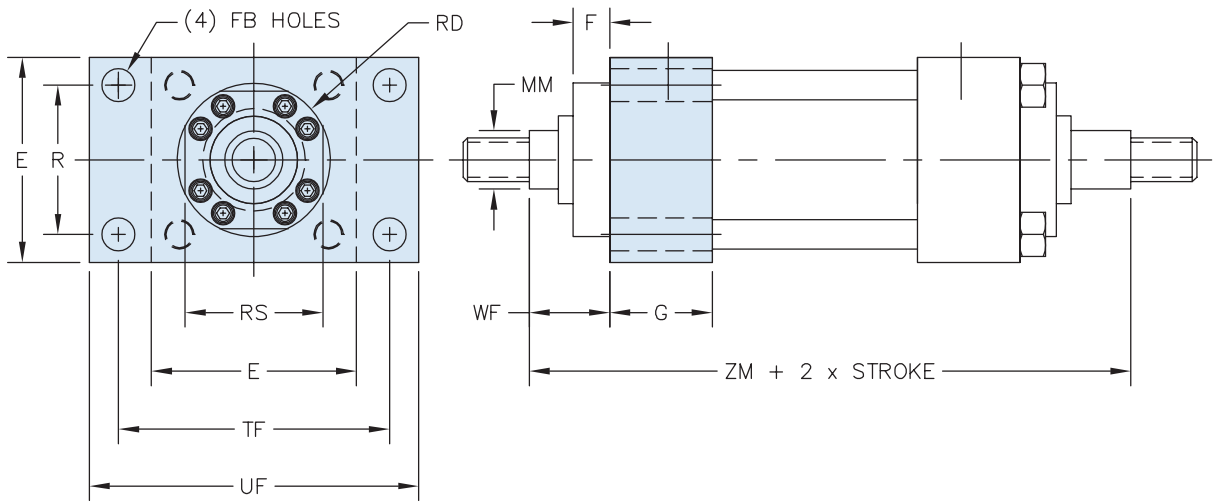
BORE	ROD DIA. (MM)	① MAX PSI RATING	E	A	B	C	EE		F	G	K	KK	R	RD	V	Y	ADD TO STROKE		ADD 2x STROKE
							NPTF	SAE									LD	P	ZM
1.50	0.625	3000	2.500	0.750	1.124	0.375	1/2	10	0.375	1.750	0.375	1.625	—	0.250	2.000	4.875	2.875	6.875	
	1.000	3000		1.125	1.499	0.500		8	0.375				—	0.500	2.375			7.625	
2.00	1.000	3000	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	3000		1.625	1.999	0.625		8	0.625				—	0.375	2.625			8.125	
2.50	1.000	3000	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	3000		1.625	1.999	0.625		10	0.625				—	0.375	2.625			8.250	
	1.750	3000		2.000	2.374	0.750		10	0.625				—	0.500	2.875			8.750	
3.25	1.375	3000	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	3000		2.000	2.374	0.750		12	0.750				—	0.375	3.000			9.500	
	2.000	3000		2.250	2.624	0.875		12	0.750				—	0.375	3.125			9.750	
4.00	1.750	3000	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	3000		2.250	2.624	0.875		12	0.875				4.250	0.250	3.063			10.000	
	2.500	3000		3.000	3.124	1.000		12	0.875				—	0.375	3.313			10.500	
5.00	2.000	3000	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	3000		3.000	3.124	1.000		12	0.875				4.625	0.375	3.375			11.000	
	3.000	3000		3.500	3.749	1.000		12	0.875				5.250	0.375	3.375			11.000	
	3.500	3000		3.500	4.249	1.000		12	0.875				—	0.375	3.375			11.000	
6.00	2.500	3000	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	3000		3.500	3.749	1.000		16	0.875				5.250	0.375	3.500			11.875	
	3.500	3000		3.500	4.249	1.000		16	0.875				5.625	0.375	3.500			11.875	
	4.000	3000		4.000	4.749	1.000		16	1.000				6.438	0.250	3.500			11.875	
8.00	3.500	3000	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	3000		4.000	4.749	1.000		24	1.000				6.438	0.250	3.938			14.000	
	4.500	3000		4.500	5.249	1.000		24	1.000				7.125	0.250	3.938			14.000	
	5.000	3000		5.000	5.749	1.000		24	1.000				7.625	0.250	3.938			14.000	
	5.500	3000	5.500	6.249	1.000	24	1.000	8.375	0.250	3.938	14.000								

SEE ROD END DETAIL CHART ON PAGE 8

- ① Max pressure rating (NON-SHOCK).
- ② 'B' dimension tolerance is +.000 / -.002
- ③ Where no dimension is shown, cylinder utilizes a full square retainer.

# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

## ME5D: HEAD RECTANGULAR MOUNTING HOLES

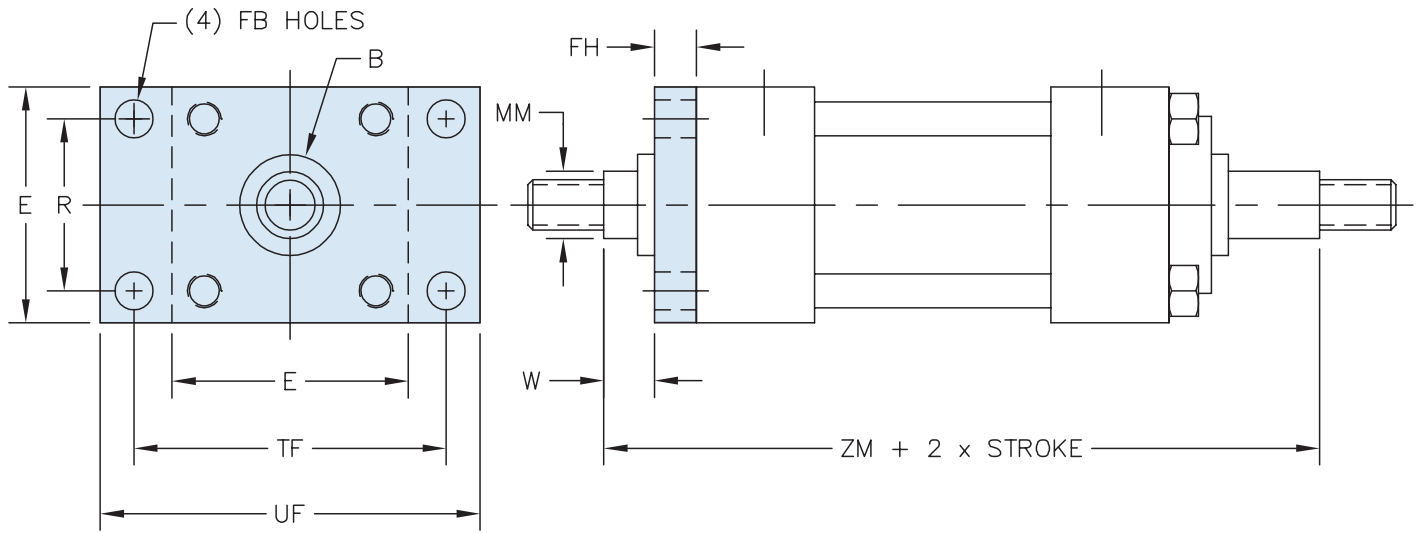


BORE	ROD DIA. (MM)	① MAX PSI RATING	E	F	FB	G	R	RD	RS	TF	UF	WF	ADD 2x STROKE	
													ZM	
1.50	0.625	3000	2.500	0.375	0.438	1.750	1.625	2.375	—	3.438	4.250	1.000	6.875	
	1.000	3000		0.375				2.563	2.438				1.375	7.625
2.00	1.000	3000	3.000	0.625	0.563	1.750	2.047	2.625	—	4.125	5.125	1.375	7.625	
	1.375	3000		0.625				3.250	2.938				1.625	8.125
2.50	1.000	3000	3.500	0.625	0.563	1.750	2.547	2.625	—	4.625	5.625	1.375	7.750	
	1.375	3000		0.625				3.250	—				1.625	8.250
	1.750	3000		0.625				3.875	3.438				1.875	8.750
3.25	1.375	3000	4.500	0.750	0.688	2.000	3.250	3.250	—	5.875	7.125	1.625	9.000	
	1.750	3000		0.750				3.875	—				1.875	9.500
	2.000	3000		0.750				4.250	—				2.000	9.750
4.00	1.750	3000	5.000	0.875	0.688	2.000	3.820	3.875	—	6.375	7.625	1.875	9.750	
	2.000	3000		0.875				4.250	—				2.000	10.000
	2.500	3000		0.875				4.625	—				2.250	10.500
5.00	2.000	3000	6.500	0.875	0.938	2.000	4.953	4.250	—	8.188	9.750	2.000	10.500	
	2.500	3000		0.875				4.625	—				2.250	11.000
	3.000	3000		0.875				5.250	—				2.250	11.000
	3.500	3000		0.875				5.625	—				2.250	11.000
6.00	2.500	3000	7.500	0.875	1.063	2.250	5.725	4.625	—	9.438	11.250	2.250	11.875	
	3.000	3000		0.875				5.250	—				2.250	11.875
	3.500	3000		0.875				5.625	—				2.250	11.875
	4.000	3000		1.000				6.438	—				2.250	11.875
8.00	3.500	3000	9.500	0.875	1.313	3.000	7.500	5.625	—	11.813	14.000	2.250	14.000	
	4.000	3000		1.000				6.438	—				2.250	14.000
	4.500	3000		1.000				7.125	—				2.250	14.000
	5.000	3000		1.000				7.625	—				2.250	14.000
	5.500	3000		1.000				8.375	—				2.250	14.000

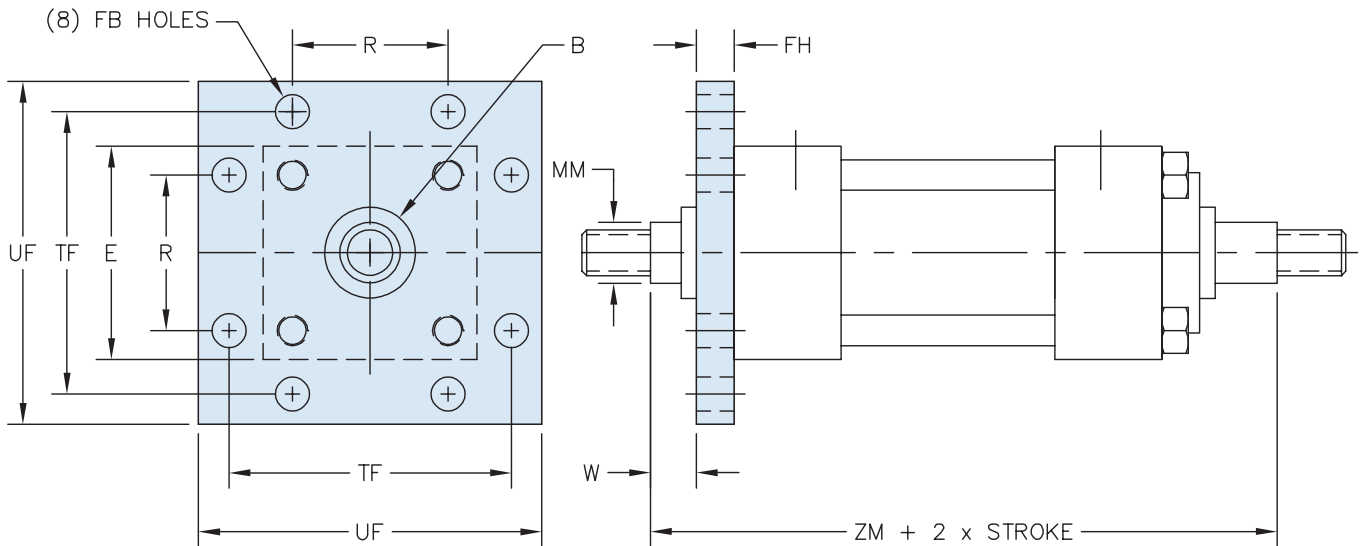
① Max pressure rating (NON-SHOCK).

# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

## MF1D: HEAD FLANGE



## MF5D: HEAD SQUARE FLANGE



HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 HH Options  
 MH - Medium Duty Hydraulic  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144

# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

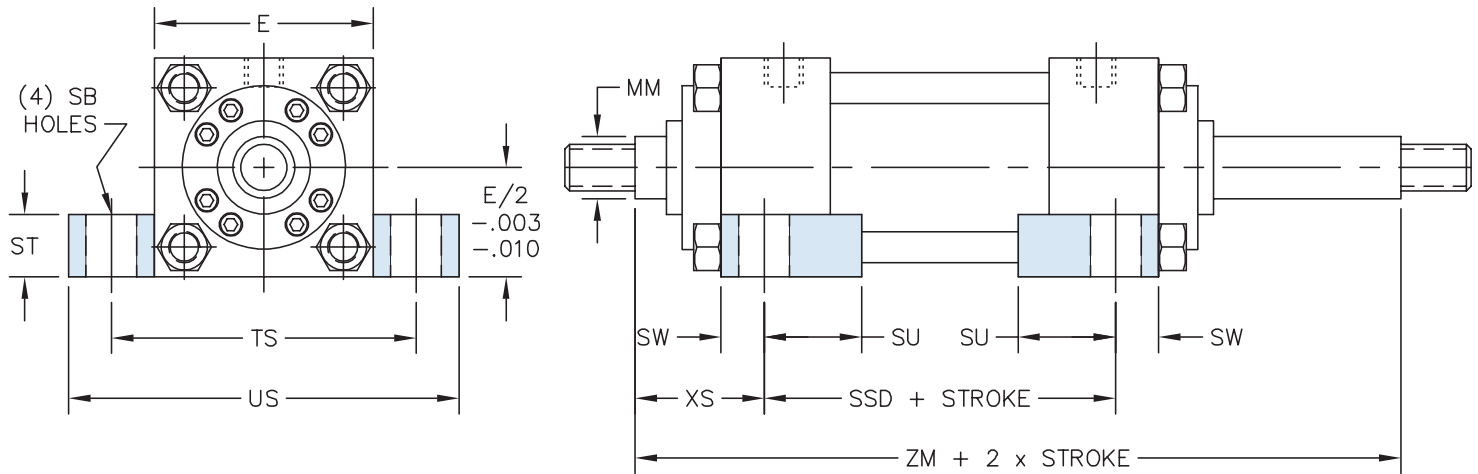
BORE	ROD DIA. (MM)	① MAX PSI RATING		E	② B	FH	FB	R	TF	UF	W	ADD 2x STROKE
		MF1D	MF5D									ZM
1.50	0.625	2600	3000	2.500	1.124	0.375	0.438	1.625	3.438	4.250	0.625	6.875
	1.000	1600	2500		1.499							7.625
2.00	1.000	2600	3000	3.000	1.499	0.625	0.563	2.047	4.125	5.125	0.750	7.625
	1.375	1600	3000		1.999						1.000	8.125
2.50	1.000	2600	3000	3.500	1.499	0.625	0.563	2.547	4.625	5.625	0.750	7.750
	1.375	2000	3000		1.999						1.000	8.250
	1.750	1600	2700		2.374						1.250	8.750
3.25	1.375	2600	2900	4.500	1.999	0.750	0.688	3.250	5.875	7.125	0.875	9.000
	1.750	2200	2700		2.374						1.125	9.500
	2.000	1600	2500		2.624						1.250	9.750
4.00	1.750	2600	2700	5.000	2.374	0.875	0.688	3.820	6.375	7.625	1.000	9.750
	2.000	1900	2600		2.624						1.125	10.000
	2.500	1600	2400		3.124						1.375	10.500
5.00	2.000	2200	2000	6.500	2.624	0.875	0.938	4.953	8.188	9.750	1.125	10.500
	2.500	1600	1800		3.124						1.375	11.000
	3.000	1200	1200		3.749						1.375	11.000
	3.500	750	1200		4.249						1.375	11.000
6.00	2.500	1800	1700	7.500	3.124	1.000	1.063	5.725	9.438	11.250	1.250	11.875
	3.000	1450	1000		3.749						1.250	11.875
	3.500	1100	1000		4.249						1.250	11.875
	4.000	750	1000		4.749						1.250	11.875
8.00	3.500	900	1000	9.500	4.249	1.000	1.313	7.500	11.813	14.000	1.250	14.000
	4.000	800	800		4.749						1.250	14.000
	4.500	700	700		5.249						1.250	14.000
	5.000	500	700		5.749						1.250	14.000
	5.500	500	700		6.249						1.250	14.000

① Maximum pressure rating

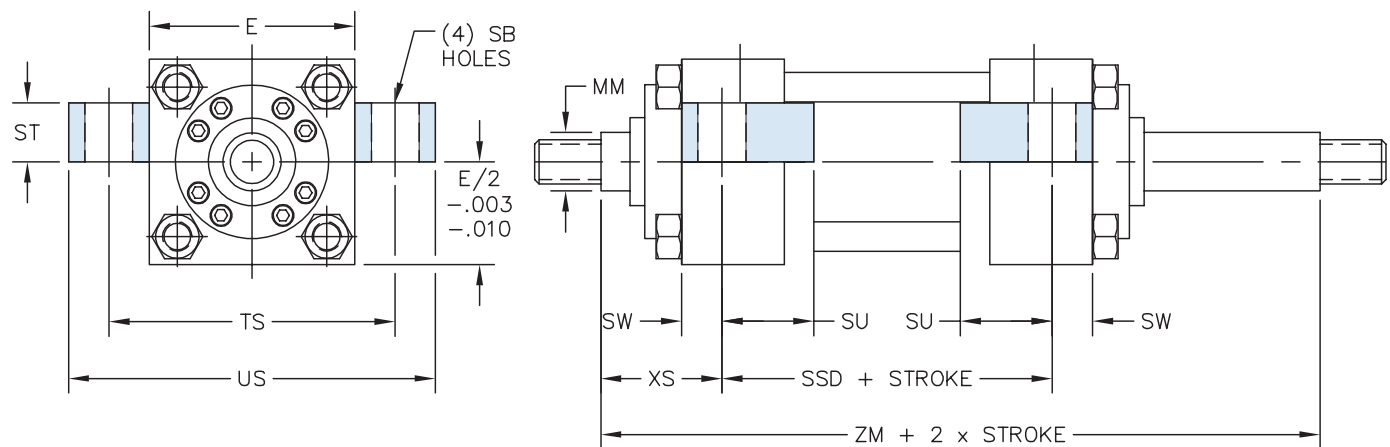
② 'B' dimension tolerance is +.000 / -.002

# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

## MS2D: SIDE LUGS



## MS3D: CENTER LINE LUGS



# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

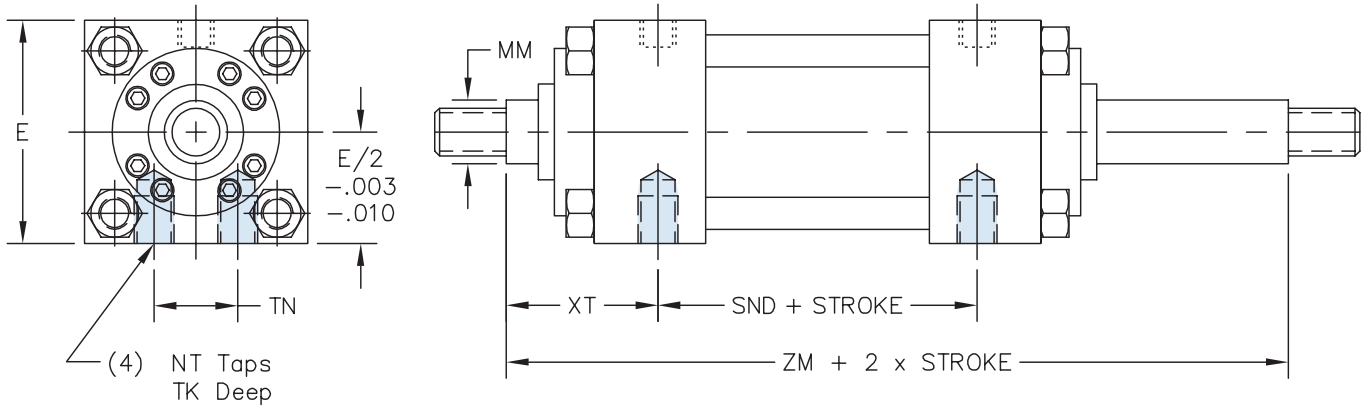
BORE	ROD DIA. (MM)	Ⓛ MAX PSI RATING	E	E / 2	SB	ST	SU	SW	TS	US	XS	ADD TO STROKE	ADD 2x STROKE
												SSD	ZM
1.50	0.625	3000	2.500	1.250	0.438	0.500	0.938	0.375	3.250	4.000	1.375	4.125	6.875
	1.000	3000									1.750		7.625
2.00	1.000	3000	3.000	1.500	0.563	0.750	1.250	0.500	4.000	5.000	1.875	3.875	7.625
	1.375	3000									2.125		8.125
2.50	1.000	3000	3.500	1.750	0.813	1.000	1.563	0.688	4.875	6.250	2.063	3.625	7.750
	1.375	3000									2.313		8.250
	1.750	3000									2.563		8.750
3.25	1.375	3000	4.500	2.250	0.813	1.000	1.563	0.688	5.875	7.250	2.313	4.375	9.000
	1.750	3000									2.563		9.500
	2.000	3000									2.688		9.750
4.00	1.750	3000	5.000	2.500	1.063	1.250	2.000	0.875	6.750	8.500	2.750	4.250	9.750
	2.000	3000									2.875		10.000
	2.500	3000									3.125		10.500
5.00	2.000	3000	6.500	3.250	1.063	1.250	2.000	0.875	8.250	10.000	2.875	4.750	10.500
	2.500	3000									3.125		11.000
	3.000	3000									3.125		11.000
	3.500	3000									3.125		11.000
6.00	2.500	3000	7.500	3.750	1.313	1.500	2.500	1.125	9.750	12.000	3.375	5.125	11.875
	3.000	3000									3.375		11.875
	3.500	3000									3.375		11.875
	4.000	3000									3.375		11.875
8.00	3.500	3000	9.500	4.750	1.563	1.750	2.875	1.375	12.250	15.000	3.625	6.750	14.000
	4.000	3000									3.625		14.000
	4.500	3000									3.625		14.000
	5.000	3000									3.625		14.000
	5.500	3000									3.625		14.000

Ⓛ Max pressure rating (NON-SHOCK).



# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

## MS4D: BOTTOM TAPPED HOLES

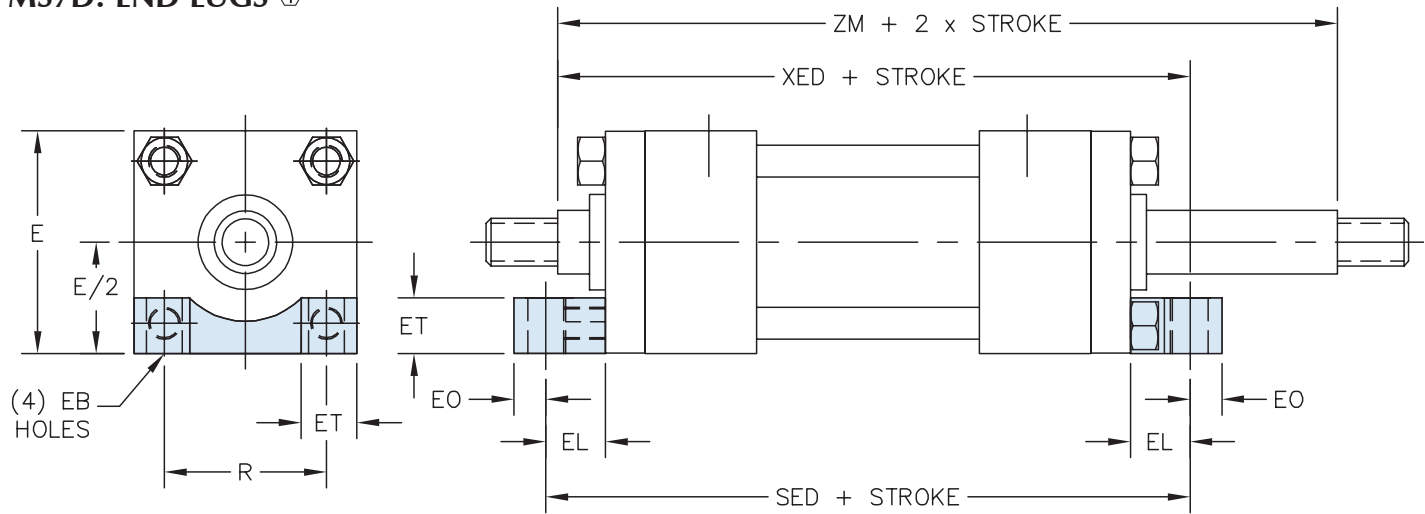


BORE	ROD DIA. (MM)	Ⓜ MAX PSI RATING	E	E / 2	NT	TK	TN	XT	ADD TO STROKE	ADD 2x STROKE
									SND	ZM
1.50	0.625	3000	2.500	1.250	3/8 - 16	0.375	0.750	2.000	2.875	6.875
	1.000	3000				0.375		2.375		7.625
2.00	1.000	3000	3.000	1.500	1/2 - 13	0.438	0.938	2.375	2.875	7.625
	1.375	3000				0.438		2.625		8.125
2.50	1.000	3000	3.500	1.750	5/8 - 11	0.750	1.313	2.375	3.000	7.750
	1.375	3000				0.625		2.625		8.250
	1.750	3000				0.500		2.875		8.750
3.25	1.375	3000	4.500	2.250	3/4 - 10	1.000	1.500	2.750	3.500	9.000
	1.750	3000				0.875		3.000		9.500
	2.000	3000				0.750		3.125		9.750
4.00	1.750	3000	5.000	2.500	1 - 8	0.875	2.063	3.000	3.750	9.750
	2.000	3000				0.750		3.125		10.000
	2.500	3000				0.750		3.375		10.500
5.00	2.000	3000	6.500	3.250	1 - 8	1.000	2.938	3.125	4.250	10.500
	2.500	3000				1.000		3.375		11.000
	3.000	3000				1.000		3.375		11.000
	3.500	3000				1.000		3.375		11.000
6.00	2.500	3000	7.500	3.750	1 1/4 - 7	1.250	3.313	3.500	4.875	11.875
	3.000	3000				1.250		3.500		11.875
	3.500	3000				1.250		3.500		11.875
	4.000	3000				0.750		3.500		11.875
8.00	3.500	3000	9.500	4.750	1 1/2 - 6	1.500	4.250	3.938	6.125	14.000
	4.000	3000				1.500		3.938		14.000
	4.500	3000				1.500		3.938		14.000
	5.000	3000				1.250		3.938		14.000
	5.500	3000				1.000		3.938		14.000

Ⓜ Max pressure rating (NON-SHOCK).

# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

## MS7D: END LUGS ①



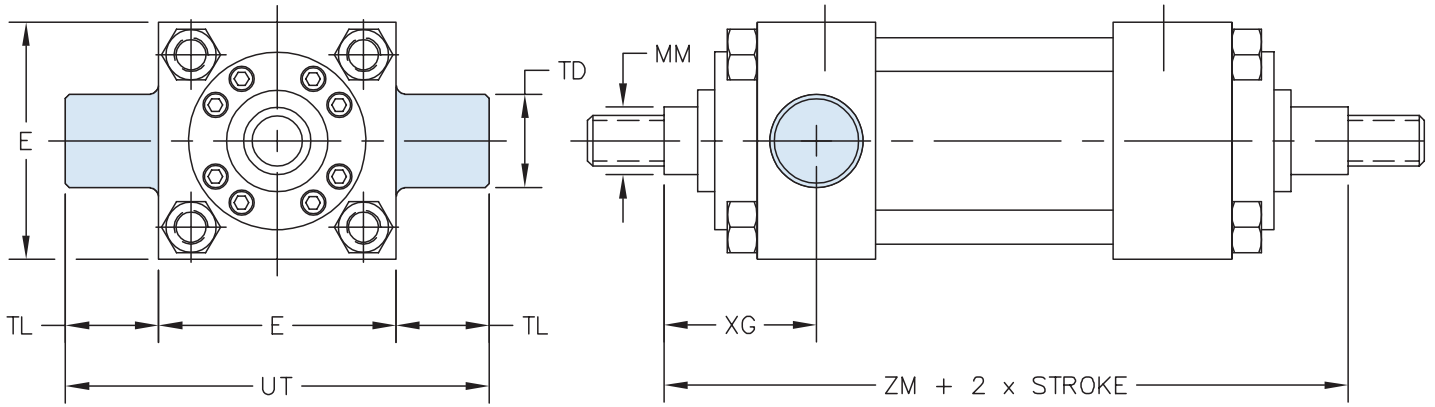
BORE	ROD DIA. (MM)	② MAX PSI RATING	E	E / 2	EB	EL	EO	ET	R	ADD TO STROKE		
										SED	XED	ZM
1.50	0.625	3000	2.500	1.250	0.438	0.875	0.375	0.750	1.625	7.375	7.125	6.875
	1.000	Not Available										
2.00	1.000	3000	3.000	1.500	0.563	0.938	0.500	0.875	2.047	8.000	7.687	7.625
	1.375	Not Available										
2.50	1.000	3000	3.500	1.750	0.563	0.938	0.500	0.875	2.547	8.125	7.938	7.750
	1.375	3000									8.188	8.250
	2.000	Not Available										
3.25	1.375	3000	4.500	2.250	0.688	1.125	0.625	1.188	3.250	9.500	9.250	9.000
	1.750	Not Available										
	2.000	Not Available										
4.00	1.750	3000	5.000	2.500	0.688	1.125	0.625	1.188	3.820	10.000	9.875	9.750
	2.000	Not Available										
	2.500	Not Available										
5.00	2.000	3000	6.500	3.250	0.938	1.500	0.750	1.500	4.953	11.250	10.875	10.500
	2.500	3000									11.125	11.000
	3.000	3000									11.125	11.000
	3.500	Not Available										
6.00	2.500	3000	7.500	3.750	1.063	1.688	0.875	1.750	5.734	12.750	12.313	11.875
	3.000	3000									12.313	11.875
	3.500	3000									12.313	11.875
	4.000	Not Available										

① When using this mount, the cylinder feet, head & cap are to be firmly supported.

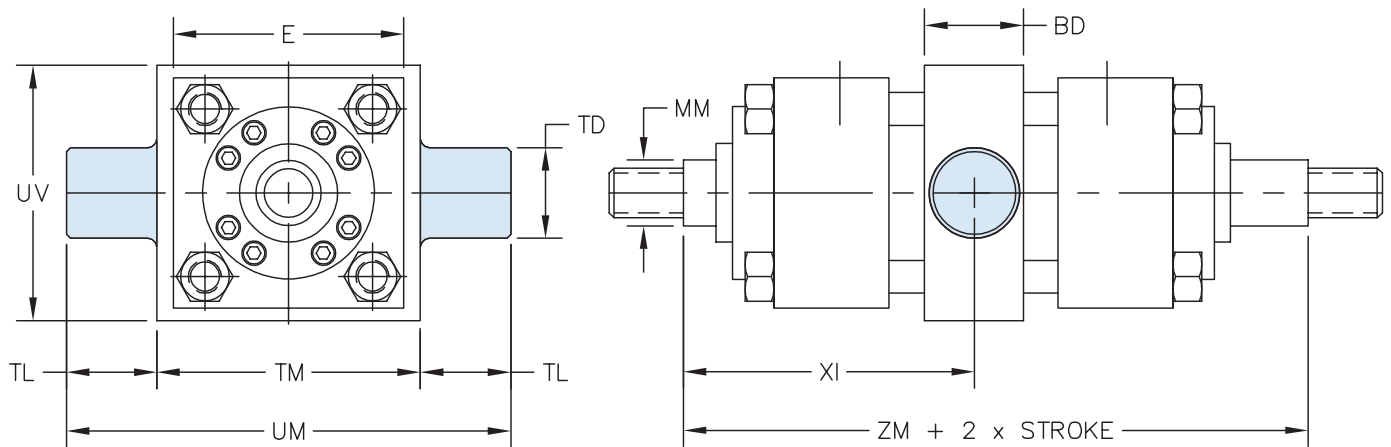
② Max pressure rating (NON-SHOCK).

# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

## MT1D: HEAD TRUNNION



## MT4D: INTERMEDIATE TRUNNION



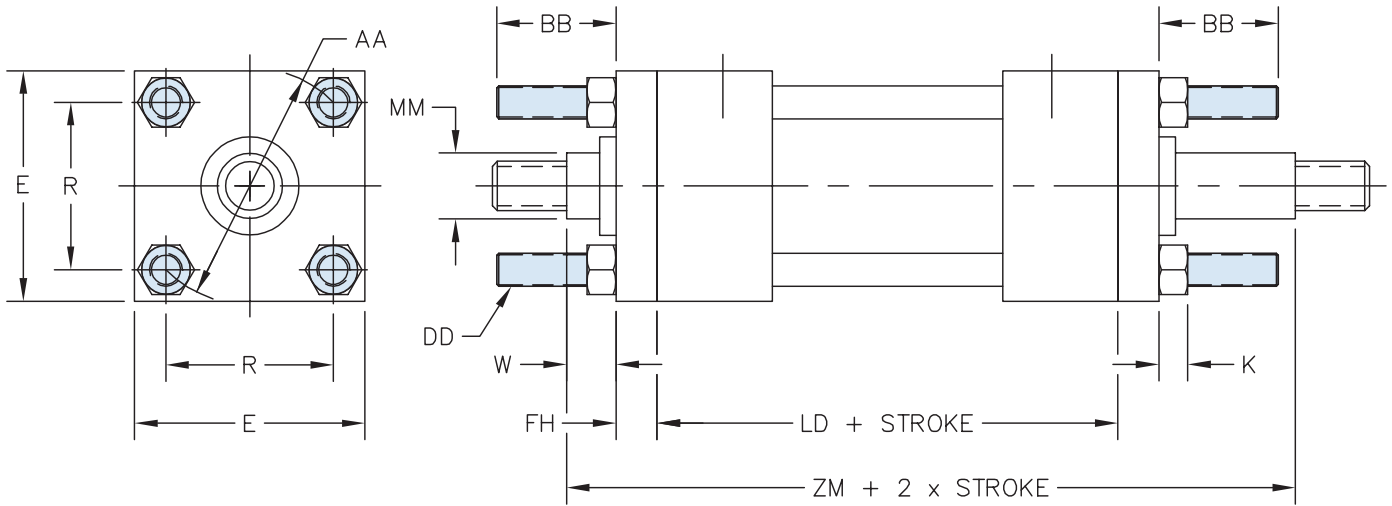
# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING		E	BD	TD	TL	TM	UM	UT	UV	XG	MT4 MIN STROKE	MT4 XI MIN	ADD TO STROKE	ADD 2x STROKE
		MT1D	MT4D												MT4 XI MAX	ZM
1.50	0.625	3000	3000	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
	1.000	3000	3000												3.875	7.625
2.00	1.000	3000	3000	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
	1.375	3000	3000												4.250	8.125
2.50	1.000	3000	3000	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
	1.375	3000	3000												4.375	8.250
	1.750	3000	3000												4.625	8.750
3.25	1.375	2800	2800	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
	1.750	2800	2800												5.250	9.500
	2.000	2800	2800												5.375	9.750
4.00	1.750	1800	1800	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
	2.000	1800	1800												5.625	10.000
	2.500	1800	1800												5.875	10.500
5.00	2.000	1200	1200	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
	2.500	1200	1200												6.125	11.000
	3.000	1200	1200												6.125	11.000
	3.500	1200	1200												6.125	11.000
6.00	2.500	1000	1000	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
	3.000	1000	1000												6.625	11.875
	3.500	1000	1000												6.625	11.875
	4.000	1000	1000												6.625	11.875
8.00	3.500	1000	1000	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
	4.000	1000	1000												8.125	14.000
	4.500	1000	1000												8.125	14.000
	5.000	1000	1000												8.125	14.000
	5.500	1000	1000												8.125	14.000

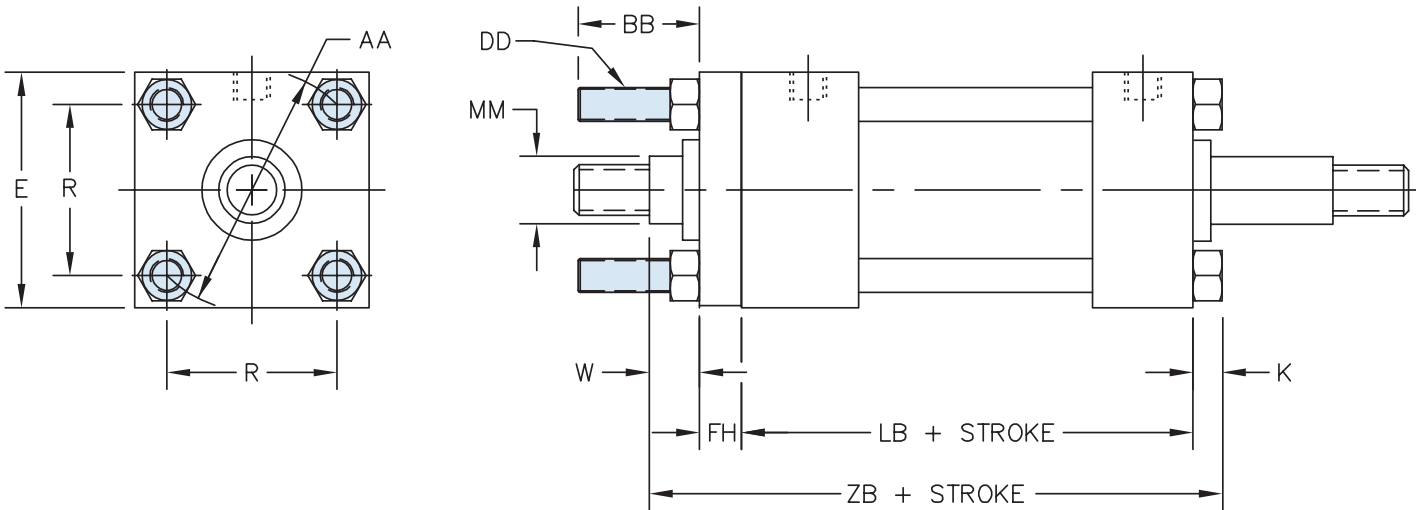
① Max pressure rating (NON-SHOCK).

# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

## MX1D: EXTENDED TIE-RODS - HEAD & CAP



## MX3D: EXTENDED TIE-RODS - HEAD END



HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 HH Options  
 MH - Medium Duty Hydraulic  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144



# SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIA. (MM)	Ⓜ MAX PSI RATING	E	AA	BB	DD	FH	K	R	W	ADD TO STROKE	ADD 2x STROKE
											LD	ZM
1.50	0.625	3000	2.500	2.300	1.375	3/8 - 24	0.375	0.375	1.625	0.625	4.875	6.875
	1.000	3000								1.000		7.625
2.00	1.000	3000	3.000	2.900	1.813	1/2 - 20	0.625	0.438	2.047	0.750	4.875	7.625
	1.375	3000								1.000		8.125
2.50	1.000	3000	3.500	3.600	1.813	1/2 - 20	0.625	0.438	2.547	0.750	5.000	7.750
	1.375	3000								1.000		8.250
	1.750	3000								1.250		8.750
3.25	1.375	3000	4.500	4.600	2.313	5/8 - 18	0.750	0.563	3.250	0.875	5.750	9.000
	1.750	3000								1.125		9.500
	2.000	3000								1.250		9.750
4.00	1.750	3000	5.000	5.400	2.313	5/8 - 18	0.875	0.563	3.820	1.000	6.000	9.750
	2.000	3000								1.125		10.000
	2.500	3000								1.375		10.500
5.00	2.000	3000	6.500	7.000	3.188	7/8 - 14	0.875	0.813	4.953	1.125	6.500	10.500
	2.500	3000								1.375		11.000
	3.000	3000								1.375		11.000
	3.500	3000								1.375		11.000
6.00	2.500	3000	7.500	8.100	3.625	1 - 14	1.000	0.875	5.734	1.250	7.375	11.875
	3.000	3000								1.250		11.875
	3.500	3000								1.250		11.875
	4.000	3000								1.250		11.875
8.00	3.500	3000	9.500	10.600	4.500	1 1/4 - 12	1.000	1.250	7.500	1.250	9.500	14.000
	4.000	3000								1.250		14.000
	4.500	3000								1.250		14.000
	5.000	3000								1.250		14.000
	5.500	3000								1.250		14.000

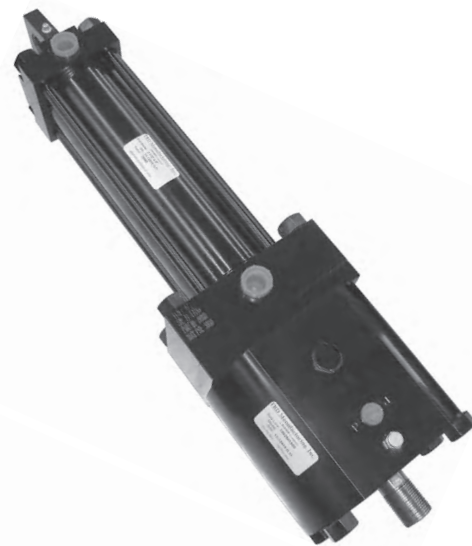
Ⓜ Max pressure rating (NON-SHOCK).

# Design Tips - 'HH' Series Rod Locks & Rod Boots

## 'HH' Series Rod Locks

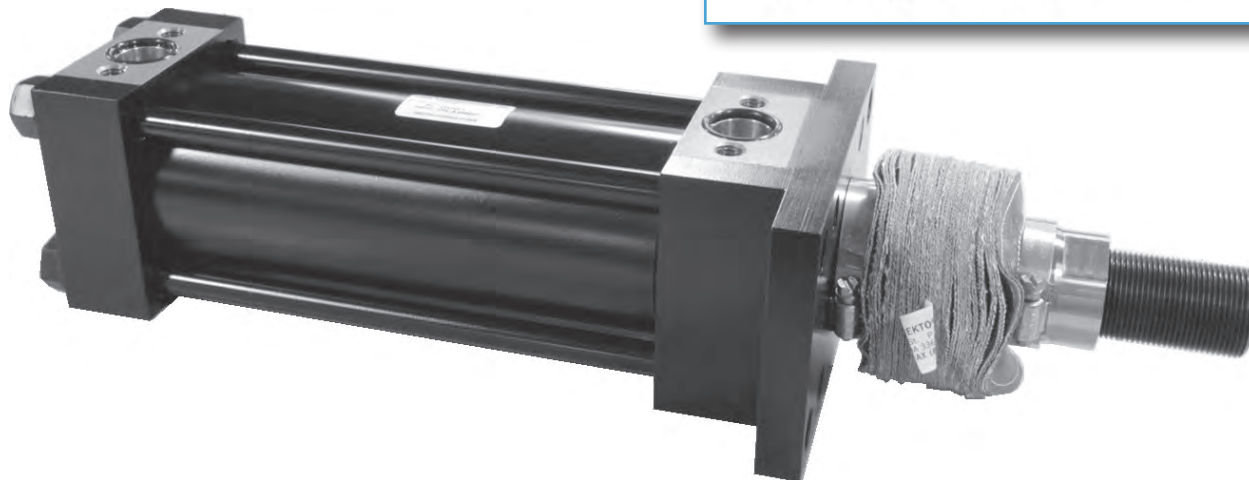
'HH' Series rod locks provide high holding force and are available in several hydraulic release pressures. The higher the release pressure, the higher the spring force available and thus the higher holding force rating.

Design Tip: By locating the rod lock on the cap of a double rod end cylinder, the rod end of the cylinder can fit in tighter spaces.



## Rod Boots

Many times, a rod boot can provide additional protection to the cylinder rod. Boots are made-to-order and are available in many different materials. Contact TRD for more information.



# HH Series with Hydraulic Rod Lock 1.50" to 8.00" Bore



HH SERIES  
HYDRAULIC  
ROD LOCK

Operating Principal Page 41

How to Order Page 42

Rod Lock Sensors Page 46



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



# SERIES 'HH' WITH HYDRAULIC ROD LOCK

## The TRD difference...

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

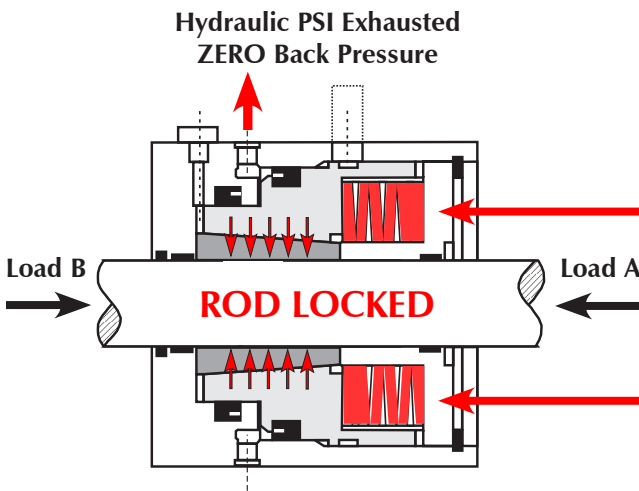
For rod locks to achieve the rated holding force and maximize cycle life, good alignment must be maintained between the locking mechanism and cylinder rod. With TRD's floating rod bushing design and accurate rod lock alignment; superior performance and trouble-free operation are assured.

**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. TRD offers each rod lock model in three different holding forces, depending on available release pressure.

Refer to page 42 for minimum release pressure and corresponding holding force.



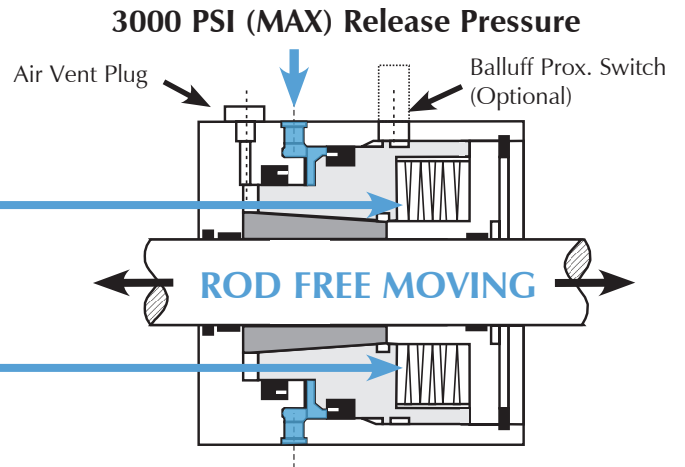
## OPERATING PRINCIPAL



### **CLAMPING (LOCKED) CONDITION:**

When hydraulic pressure is exhausted from rod lock, extreme spring force is applied to the piston/outer lock housing. This 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.

**UN-CLAMPED 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 'HH' WITH ROD LOCK

HH - \_\_\_\_\_ - 250 x 10 - H2C6 - 100 - KK1 - P15 = N375 - S S S S - \_\_\_\_\_

NFPA MOUNT (TO MOUNT CYLINDER)	
MF2	CAP RECTANGULAR FLANGE (1.50" to 6.00" Bore)
MF6	SQUARE FLANGE, CAP END (1.50" to 8.00" Bore)
MP1	FIXED CAP PIVOT CLEVIS (1.50" to 8.00" Bore)
MS4	BOTTOM TAPPED HOLES (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)
MX2	EXTENDED TIE RODS - CAP (1.50" to 8.00" Bore)

\* HEAD END SPACER THICKNESS CAN VARY AND WILL ADD LENGTH TO CYLINDER

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	150	1000	
	200	1500	V Fluorocarbon Seals
	250		X Special (Specify)
137	200		
	250		
	325		
175	250		
	325		
	400		
200	325		
	500		
250	600		
300	600		
350	800		
400	800		

Replacement rod locks can be ordered using the same methodology.

Examples:

RLH-1374001500

RLH-100250750P

See page 7 for additional cylinder how-to-order information.

Consult factory for additional mounts.

## TECHNICAL DATA: ROD LOCKS

ROD DIA.	BORE	MODEL NUMBER	① MIN RELEASE PSI	② MAX HOLDING FORCE	VOLUME OF OIL		WEIGHT (LBS)
					CM <sup>3</sup>	IN <sup>3</sup>	
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 DIA.	BORE	MODEL NUMBER	① MIN RELEASE PSI	② MAX HOLDING FORCE	VOLUME OF OIL		WEIGHT (LBS)
					CM <sup>3</sup>	IN <sup>3</sup>	
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			
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			

① Maximum hydraulic release pressure: 3000 PSI.

② Holding forces are based on dry or mineral-oil lubricated shafts.

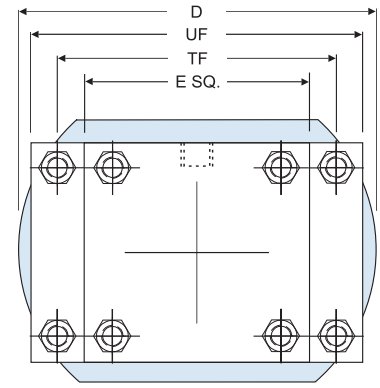


# SERIES 'HH' WITH ROD LOCK: BASIC CYLINDER (No Mount)

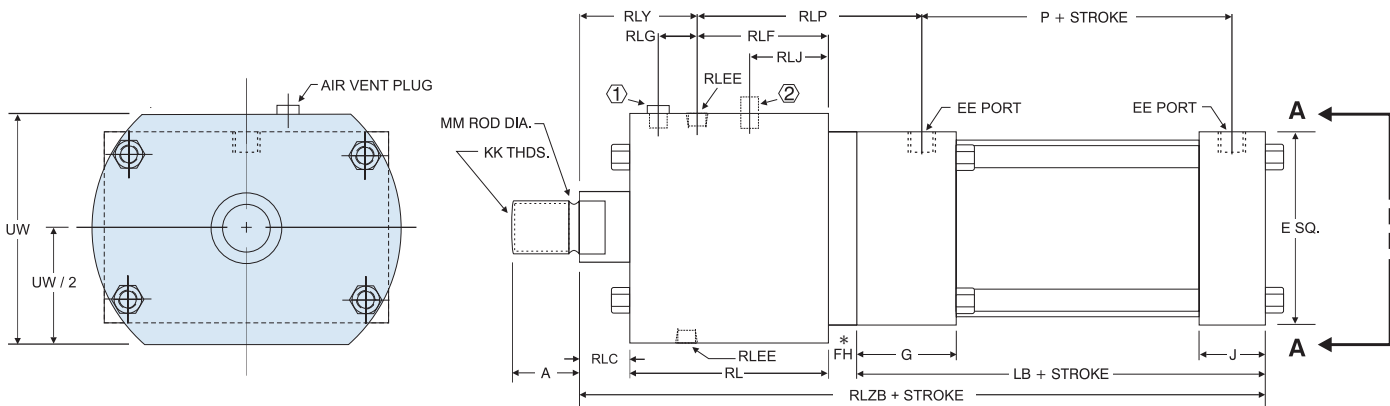
To be able to handle the high holding forces, the rod lock cylinder uses a full rectangle cylinder head and full rectangle bushing retainer plate to attach the rod lock unit to the cylinder.

Customers need to specify an additional NFPA mount to use the cylinder in any application.

*Refer to pages 8 through 26 for basic cylinder dimensions not shown.*



VIEW AA

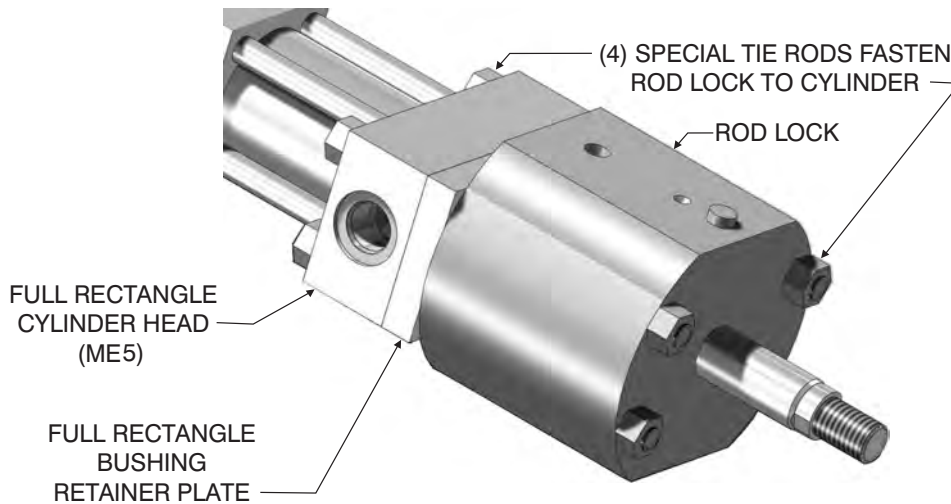


- ① Air Vent Plug.
- ② M12x1 port for optional proximity switch (indicates un-clamped condition).

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	1.000	9.438	11.250	10.000	9.000	1.000	SAE 8	6.625	1.125	3.000	8.750	3.375	18.375
3.000	6.00	12.750	7.500	1.000	9.438	11.250	10.000	9.000	1.000	SAE 8	4.875	1.100	3.110	7.000	5.125	18.375
3.500	8.00	16.140	9.500	1.000	11.813	14.000	14.000	11.500	1.000	SAE 10	8.938	1.320	5.350	11.500	3.563	23.000
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

\*May vary per mount.

# SERIES 'HH' WITH ROD LOCK: BASIC CYLINDER (No Mount)



## General Construction

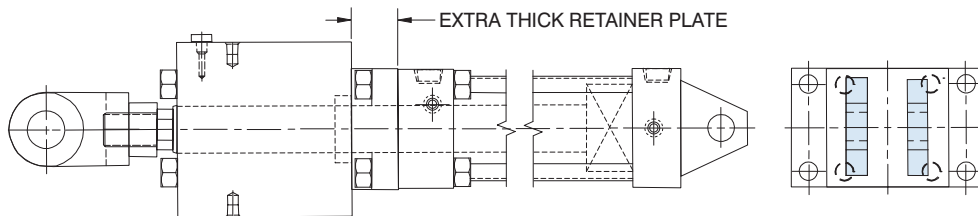
TRD 'HH' Series hydraulic cylinders are designed to be stand alone units so they can be fully serviced without the rod lock installed. Hydraulic rod locks are aligned and bolted to the cylinders using (4) special tie rods and hex nuts. This design allows for both the cylinder and the rod lock to maintain full serviceability once in use.

## CYLINDER DESIGN AND AVAILABLE MOUNTS

A full rectangle cylinder head mount is used exclusively to attach the rod lock to the cylinder. An additional mount must be specified to be able to use the cylinder.

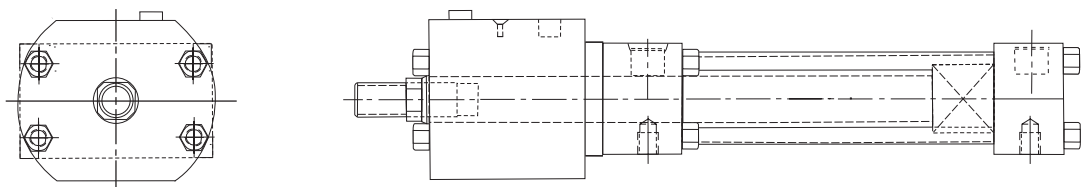
The cylinder design can vary depending on the bore size, tie rod hex nut location and desired mount. **Note: some designs will increase cylinder overall length.**

### SB mount with special recessed hex nuts at cap



MP1 mount with special, extra thick bushing retainer plate and recessed tie rod hex nuts at head.

MS4 mount with standard hex nuts at cap.

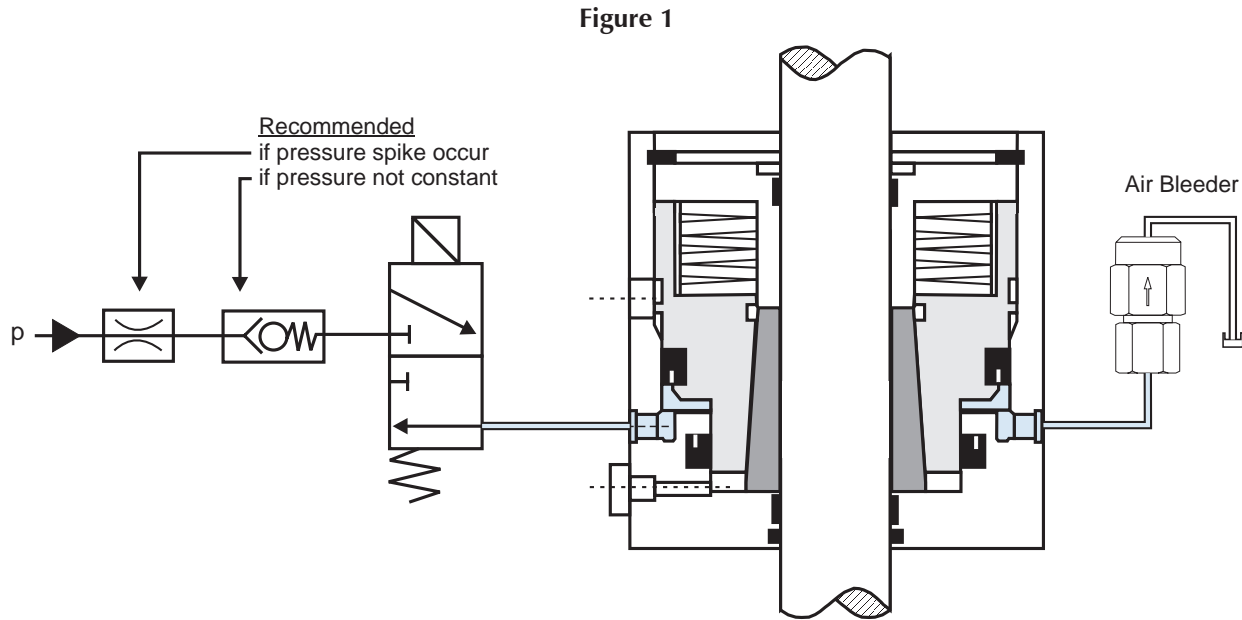


Contact your local distributor with the basic cylinder bore, stroke and desired NFPA mount information and TRD will configure a cylinder with rod lock to meet your specifications!

# 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 (un-clamp) the rod lock, the three-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.

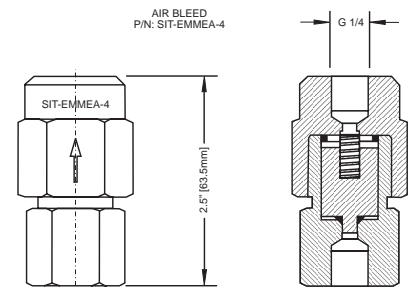
Avoid designs where the piston rod is moved while rod lock is actuated (clamped condition); piston rod and rod lock damage may occur. Do not exceed the maximum holding force of the rod lock unit.



## 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).



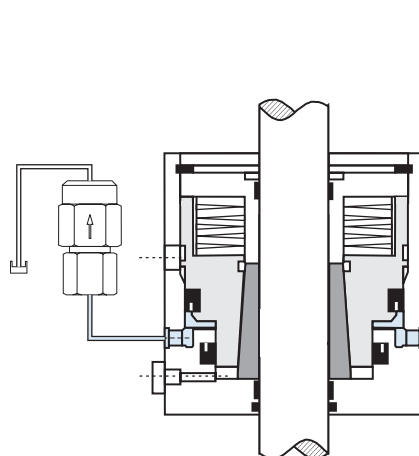
**Part Number: ABV-1**  
(Order separately)

Note: Use NPTF fittings to install

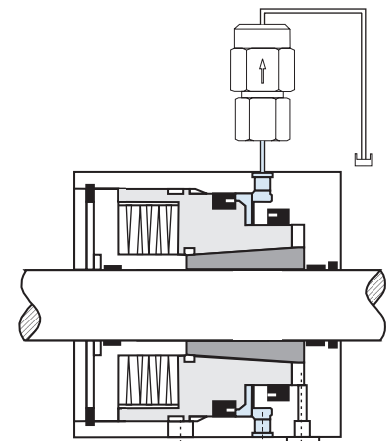
## ABV-1 Operation

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.



**Figure 2: Vertical Mount**



**Figure 3: Horizontal Mount**

HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 HH Options  
 MH - Medium Duty Hydraulic  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144

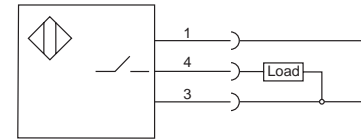
# ROD LOCK SENSORS (For Un-Clamped Condition)

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



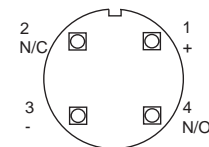
ELECTRICAL DATA	
SA Operational distance with steel	1.6 mm
Maximum switching frequency	800 Hz
Operating voltage	10 - 30 V DC
Supply voltage ripple	≤ 15% (Peak to Peak)
Load current capacity	≤ 200 mA
Protection against polarity reversal	yes
Short circuit protected	yes
Function display	LED
Output resistance	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 (un-clamped)	≤ 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 un-clamped

## SCHEMATIC



**Wiring Connections:**  
PNP Normally Open

View of Male Connector Pins



## PROXIMITY SENSOR INSTALLATION INSTRUCTIONS

- 1) Apply hydraulic pressure to rod lock (un-clamped 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 one 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" to indicate an un-clamped 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" to indicate 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 150).
- 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 TRD for service.**

# SERIES 'HH' BASIC OPTIONS

## Index To Standard Options:

	<u>PAGE</u>
• A= - Extended Piston Rod Thread . . . . .	47
• AS - Adjustable Stroke (Retract) . . . . .	47
• ABP= - Air Bleed Ports. . . . .	47
• C= - Extended Piston Rod . . . . .	47
• CS - Center Support. . . . .	48
• C or H - Cushions . . . . .	48
• DBB= - Drain Back Bushing . . . . .	48
• EK - Extended Key Plate . . . . .	48
• HLP - High Load Piston . . . . .	49
• HSS - High Shock Seals . . . . .	49
• KKX - Non-Standard Rod Threads . . . . .	49
• KK3M - Female Metric Rod Threads. . . . .	49

	<u>PAGE</u>
• KK3X - Female Special Rod Threads. . . . .	49
• LRB - Lift Ring Boss . . . . .	50
• Multiple Mounts. . . . .	51
• NR - Non-Rotating . . . . .	50
• PLS - Piston Lock Screw . . . . .	51
• Port Options (BSPP, BSPT, NPTF). . . . .	51
• RBB - Rod Bushing - Bronze (Ductile Iron is Standard). . . . .	51
• RLH - Rod Lock . . . . .	51
• SSR - Stainless Steel Piston Rod . . . . .	51
• Seals (Piston, Rod, Tube, Wiper) . . . . .	52
• ST - Stop Tube . . . . .	53
• XX - Special Modifications . . . . .	52

## Uncommon Options:

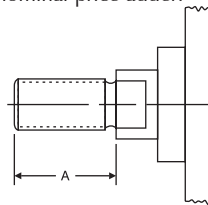
	<u>PAGE</u>
• 3-Position Cylinders . . . . .	55
• Back To Back Cylinders . . . . .	55
• Tandem Cylinders . . . . .	55

	<u>PAGE</u>
• Paint and Other Special Finishes . . . . .	55
• Flange Ports . . . . .	56
• Rod Boots . . . . .	56

### 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.

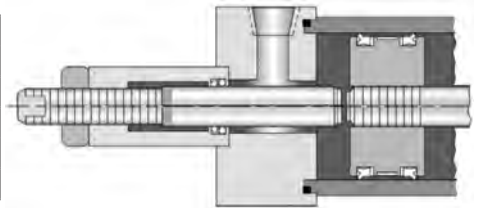


### AS Adjustable Stroke (Retract)

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").

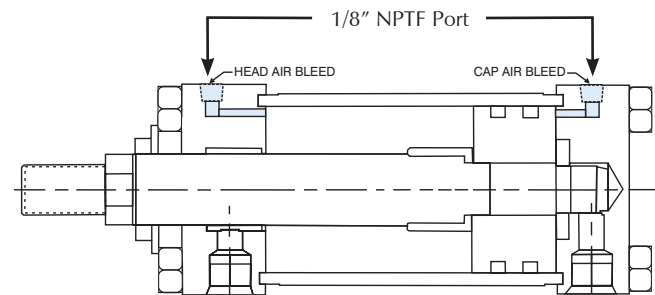
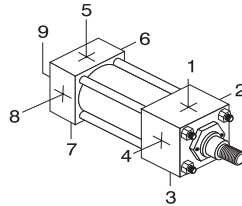
ADJUSTABLE STROKE	
BORE	MAX "AS"
1.50	Up to 8 inch
2.00-3.25	Up to 6 inch
4.00-6.00	Up to 5 inch
8.00	Up to 4 inch



### ABP= Air Bleed Ports

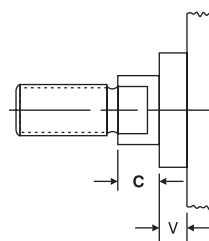
Air bleeds can be provided at either or both ends of the cylinder. Air bleeds should be located at the highest point in the cylinder for maximum effectiveness. The location needs to be specified, similar to port locations.

**Example: ABP=15**  
(Air Bleed ports at position 1 & 5) Location 9 is center of cap face.



### 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 total OAL. 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.

# SERIES 'HH' BASIC OPTIONS

**CS**

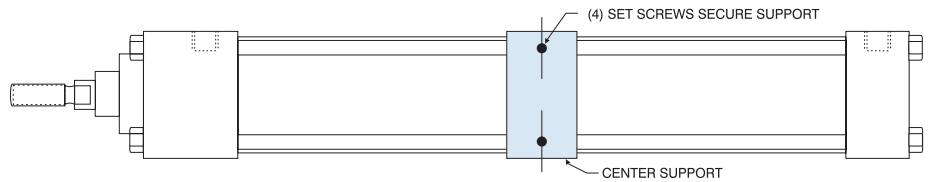
## Center Supports

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 TRD 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	



## Cushions

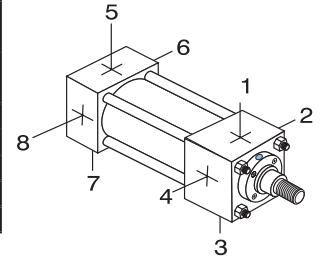
TRD's cushion design features industry proven technology and ultra fine adjustment needles for perfect deceleration and long life. Cushion adjustment needle positions need to be specified.

Example: H2C6

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

STANDARD CUSHION LOCATIONS	
MOUNT	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



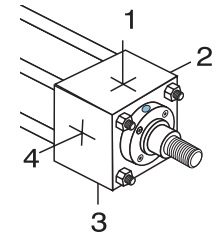
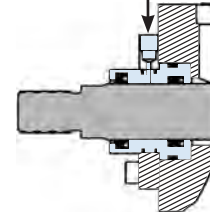
**DBB=**

## Drain Back Bushing

When oil leakage cannot 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.

Example: DBB=1 (drain port at position 1)

1/16" or 1/8" NPTF Port



**EK**

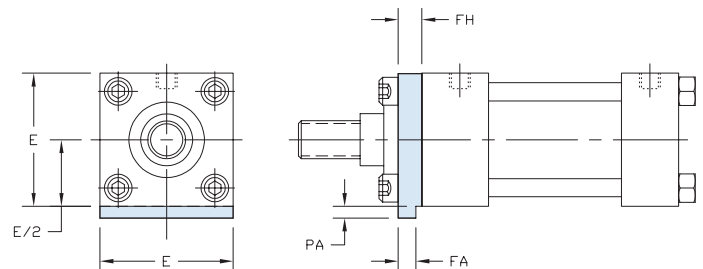
## Extended Key Plate

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: HH - 1.50" to 8.00" Bore

'HH' DIMENSIONS FOR EXTENDED KEY PLATE				
BORE	E	FA	FH	PA
1.50	2.500	0.312 / 0.314	0.375	0.188
2.00	3.000	0.562 / 0.564	0.625	0.313
2.50	3.500	0.562 / 0.564	0.625	0.313
3.25	4.500	0.687 / 0.689	0.750	0.375
4.00	5.000	0.812 / 0.814	0.875	0.438
5.00	6.500	0.812 / 0.814	0.875	0.438
6.00	7.500	0.937 / 0.939	1.000	0.500
8.00	9.500	0.937 / 0.939	1.000	0.500



HH - Heavy Duty Hydraulic

HH Rod Lock

HH Options

MH - Medium Duty Hydraulic

TAS - Heavy Duty Pneumatic

Accessories Page 130

STROKEMASTER Page 136

Technical Data Page 144



# SERIES 'HH' BASIC OPTIONS

## High Load Piston

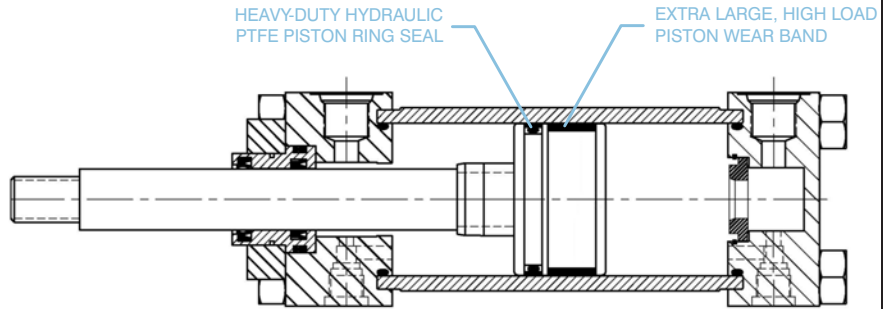
Long stroke cylinders and pivot type mounting can create severe cylinder piston-to-tube side loads. The high load piston option provides increased side load capacity without increasing the cylinder base dimensions.

### Design Benefits

- Bi-direction piston seal offers low to zero leakage rating.
- Piston seal design offers lower friction than cast iron rings or lip seals, which eliminate stick/slip breakaway issues.
- Glass filled PTFE piston seal is 20% stronger than bronze filled seals.
- High contamination tolerant; offers the longest life of any seal type.
- Temperature Rating: -20°F to 200°F (-29°C to 93°C)
- Other temperature ratings are available; contact TRD for more information

**High Load Piston Wear Band** - Our superior design is 35% to 80% wider than competitive models and we locate the wearband at the furthest point from the rod bearing to increase overall effectiveness.

**Piston Ring Seal** - Glass filled PTFE with Nitrile expander.

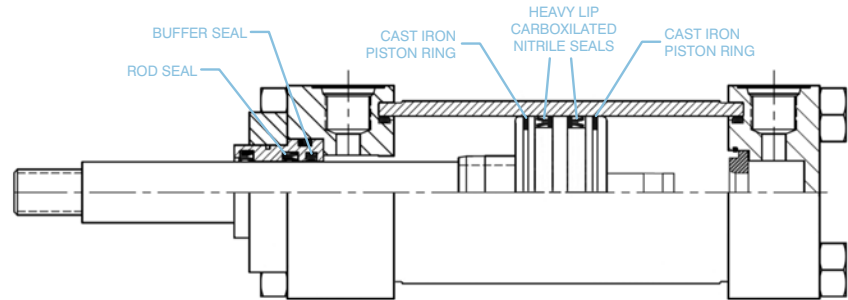


## HSS High Shock Seals

High shock seal option provides shock protection to the rod and piston seal.

**Piston Seal** - Consists of (2) bidirectional sealing, step-cut, cast iron piston rings to buffer the shock and (2) heavy-lip design Carboxylated Nitrile seals (with back-up rings), to provide near leak-free operation.

**Rod Seals** - Consists of a buffer seal to handle the shock and a double lip polyurethane block vee seal for leak free operation.



## KKX Non-Standard Rod Threads

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

**Ordering Example:** HH - MF1 - 150 X 24 - 100 - **KKX** - 7/8 - 9UNC - P15 = N375 - SSSS

↑ Add special thread to part number

## KK3M Female Metric Rod Threads

Equipment that is imported to the United States will typically contain metric tie-rod cylinders. In general, ISO 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.

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

**Ordering Example:** HH - MF1 - 150 X 24 - 100 - **KK3M** = M8 X 1 - P15 = N375 - SSSS

## KK3X Female Special Rod Threads

TRD can machine a wide range of female rod threads. Standard NFPA rod threads are UNF (fine), class 2 threads. Common alternative choices are UNC (coarse) threads.

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

**Ordering Example:** HH - MF1 - 150 X 24 - 100 - **KK3X** = 1 - 8 - P15 = N375 - SSSS



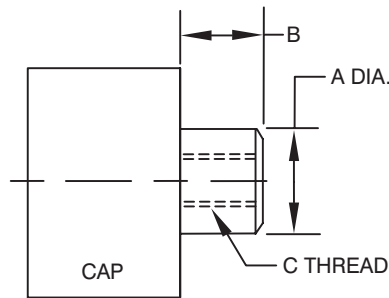
# SERIES 'HH' BASIC OPTIONS

## LRB Lift Ring Boss

A steel, tapped lug is welded to the center of the cylinder cap.

UNC coarse threads are provided to accept high load type lifting eyes (lift eyes are not provided).

Not available on MF2, MF6, ME6, MP1 & SB mounts.



LIFT LUG DIMENSIONS				
BORE	A	B	C	STRAIGHT PULL LIFTING CAPACITY*
1.50	1.120	1.000	1/2-13	2500
2.00	1.500	1.250	5/8-11	4000
2.50	1.500	1.250	5/8-11	4000
3.25	2.000	1.500	3/4-10	6000
4.00	2.000	1.500	3/4-10	6000
5.00	2.000	1.500	3/4-10	6000
6.00	2.500	2.000	1-8	9000
8.00	2.500	2.000	1-8	9000

\*Lifting capacity is the maximum capacity for intermittent lifting and placement of cylinder only. It is NOT intended to be used as the primary cylinder mount.

## 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

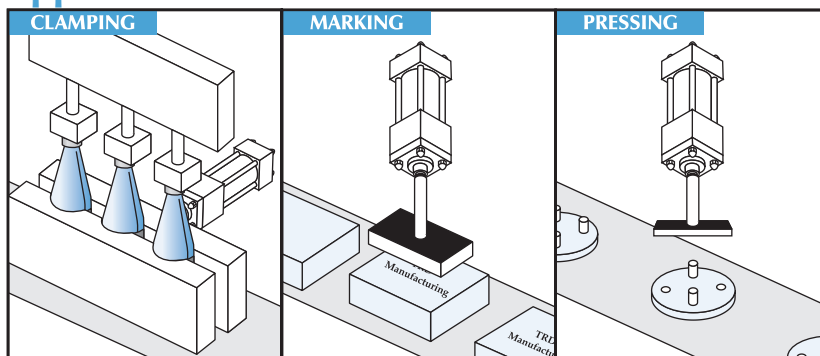
### Advantages

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



**Note: Contact factory for additional information.**

### Application Possibilities:

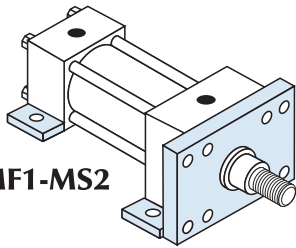


# SERIES 'HH' BASIC OPTIONS

## MULTIPLE MOUNTS

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

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



MF1-MS2

↑ Add additional mount to part number

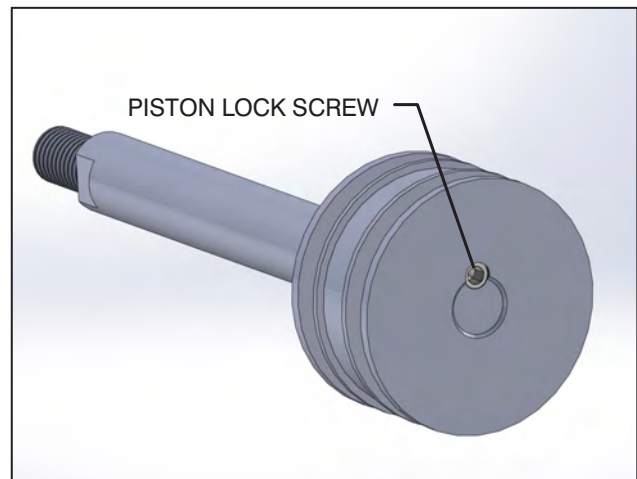


## PLS *Piston Lock Screw* (For higher shock load applications)

Hydraulic cylinders develop high forces and can also be subjected to severe shock loads in demanding applications due to piston-to-end cap impact. The Piston Lock Screw acts as a shear pin between the piston and rod threads, eliminating any chance of a piston coming loose from the rod.

All TRD hydraulic cylinders use a specified torque with a permanent anaerobic thread lock/sealant to secure pistons to the piston rod; threads are then staked. This standard connection method has proven to be very effective in almost all applications. However, in severe shock load applications, the piston lock screw option provides a 100% positive connection that cannot come apart.

Note: Also referred to as Dutch Key or Skotch Key.



PISTON LOCK SCREW

## PORT OPTIONS

Cylinders can be furnished with NPTF or SAE O-Ring Boss (SAEJ514) ports at no-charge.

Cylinders can be furnished with BSPP, BSPT or SAE Flange Ports for additional cost.

### BSPT *British Standard Pipe Taper*

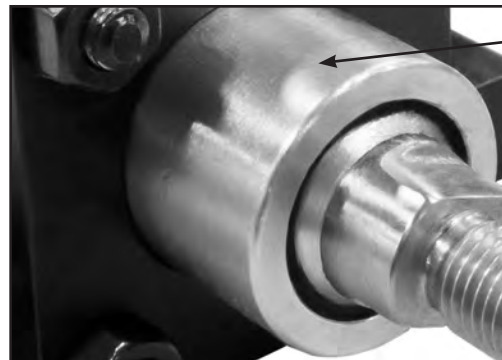
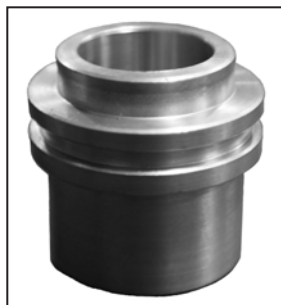
British Standard Pipe Taper (BSPT) threads have the same taper as American NPT tapered threads, but use a 55° Whitworth thread form and different diameters. (Not interchangeable with NPT)

### BSPP *British Standard Pipe Parallel*

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

## RBB *Bronze Rod Bushings*

Cylinders can be furnished with bronze rod bushings (standard material: 150,000 PSI ductile iron, PTFE coated).



Bronze Rod Bushing

HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 HH Options  
 MH - Medium Duty Hydraulic  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144

# SERIES 'HH' BASIC OPTIONS

## RLH Rod Lock

Cylinders can be furnished with Hydraulic Rod Locks. [Refer to pages 41-46 for complete specifications.](#)

## SSR 17-4 Stainless Steel Hard Chrome Plated Piston Rod

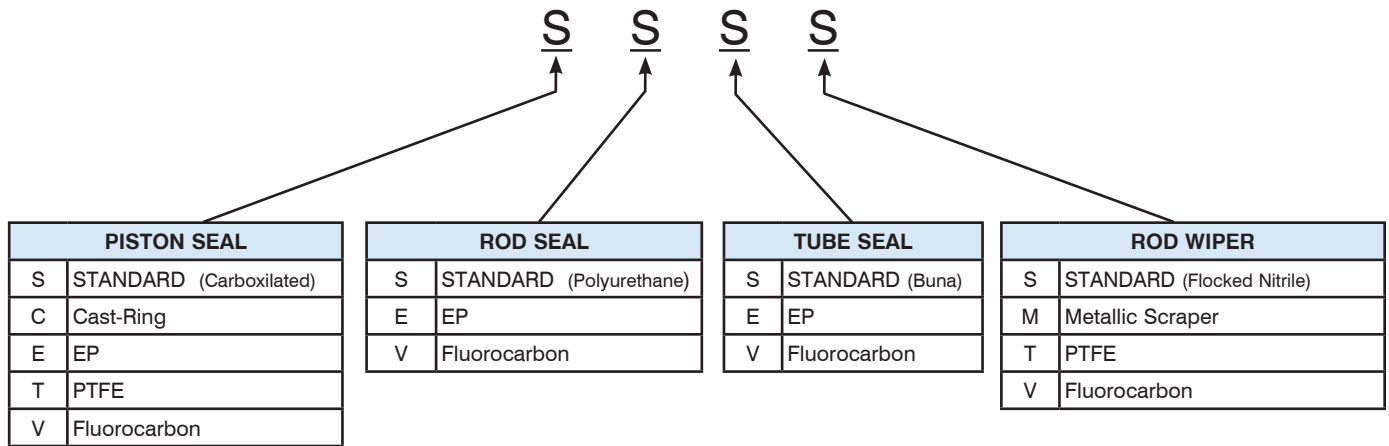
Cylinders can be furnished with hard chrome plated stainless steel piston rods.

100,000 min. yield (rods up to 5.00)  
75,000 min. yield (5.500 rod)

## SEALS

The 'HH' 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 Standard Seals

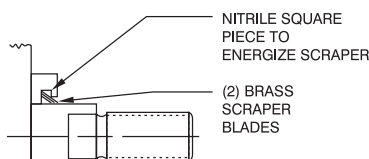
Piston: Carboxilated Nitrile      Rod Seal: Polyurethane  
Tube Seals: Buna                      Rod Wiper: Flocked Nitrile  
Temperature Rating: -20°F to 200°F (-29°C to 93°C)  
Compatible with: Mineral based hydraulic fluids

### C Cast Iron Piston Rings

Temperature Range: -20°F to 200°F (-29°C to 93°C)  
Compatible with: Virtually all fluids  
Uses: Hydraulic shock protection

### M Metallic Rod Scraper

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



### E Ethylene Propylene

Temperature Rating: -50°F to 300°F (-45°C to 149°C)  
Compatible with: Most Phosphate Ester (Skydrol 500 and 7000, type 2) fluids

### T Glass Filled PTFE

Temperature Rating: -100°F to 400°F (-73°C to 204°C)  
Compatible with: All hydraulic fluids and almost any fluid  
Contact TRD for specific compatibility  
Use: Low friction and high side load

### V Fluorocarbon

Temperature Rating: 0°F to 300°F (-18°C to 149°C)  
(Up to 400°F with reduced service life)  
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

### XX Special

Non-standard seals can be furnished.  
[Contact TRD for more information.](#)

# SERIES 'HH' 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 ensure proper cylinder performance in any given application. Stop tubes lower the cylinder bearing stress by adding length to the piston, which increases the overall length of the cylinder (Note: TRD uses a double piston design when possible).

### Stop Tube Selection

To determine the proper amount of stop tube for your application, you must first find the value of "D", which represents the stroke (*adjusted for mounting condition*). Each mounting condition creates different levels of bushing stress, which has direct impact on the amount of stop tube required (see Chart 1).

Once the value of "D" is known, refer to Chart 2 for the recommended amount of stop tube.

#### To order a stop tube:

- Add the stop tube prefix "ST=" and the stop tube length to the cylinder model number.
- Add "ES" after the cylinder stroke to indicate that the stroke is the effective stroke.

#### Example:

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

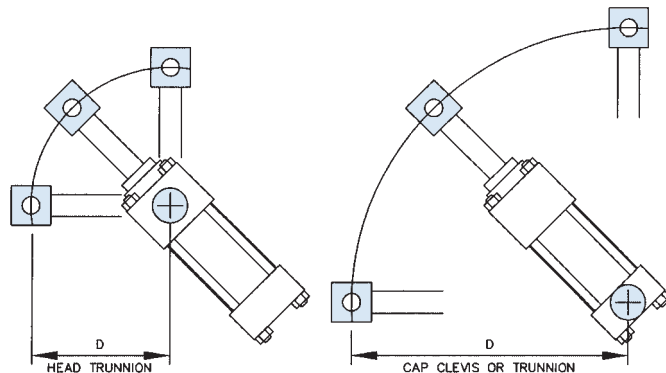
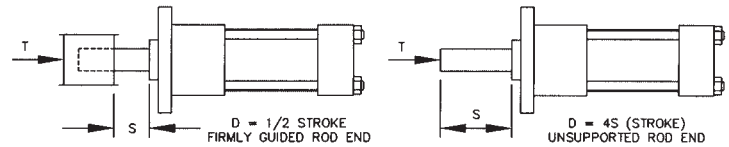
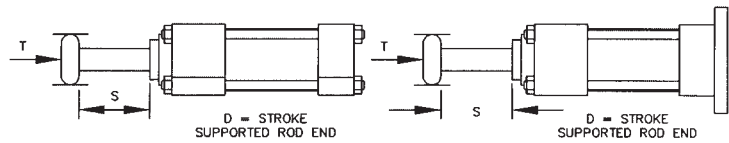
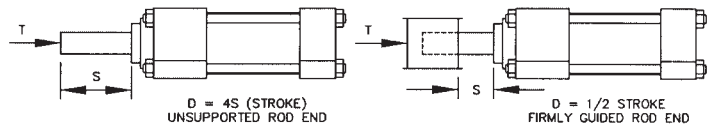
### Chart 1

Find the value of "D" for your application

"D" = Stroke, adjusted for mounting condition

"S" = Actual cylinder stroke

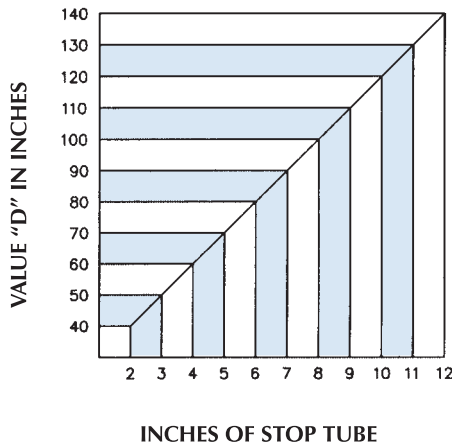
"T" = Axial thrust (refer to Chart 3)



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

### Chart 2

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



Refer to page 54 for Rod Size Selection Chart

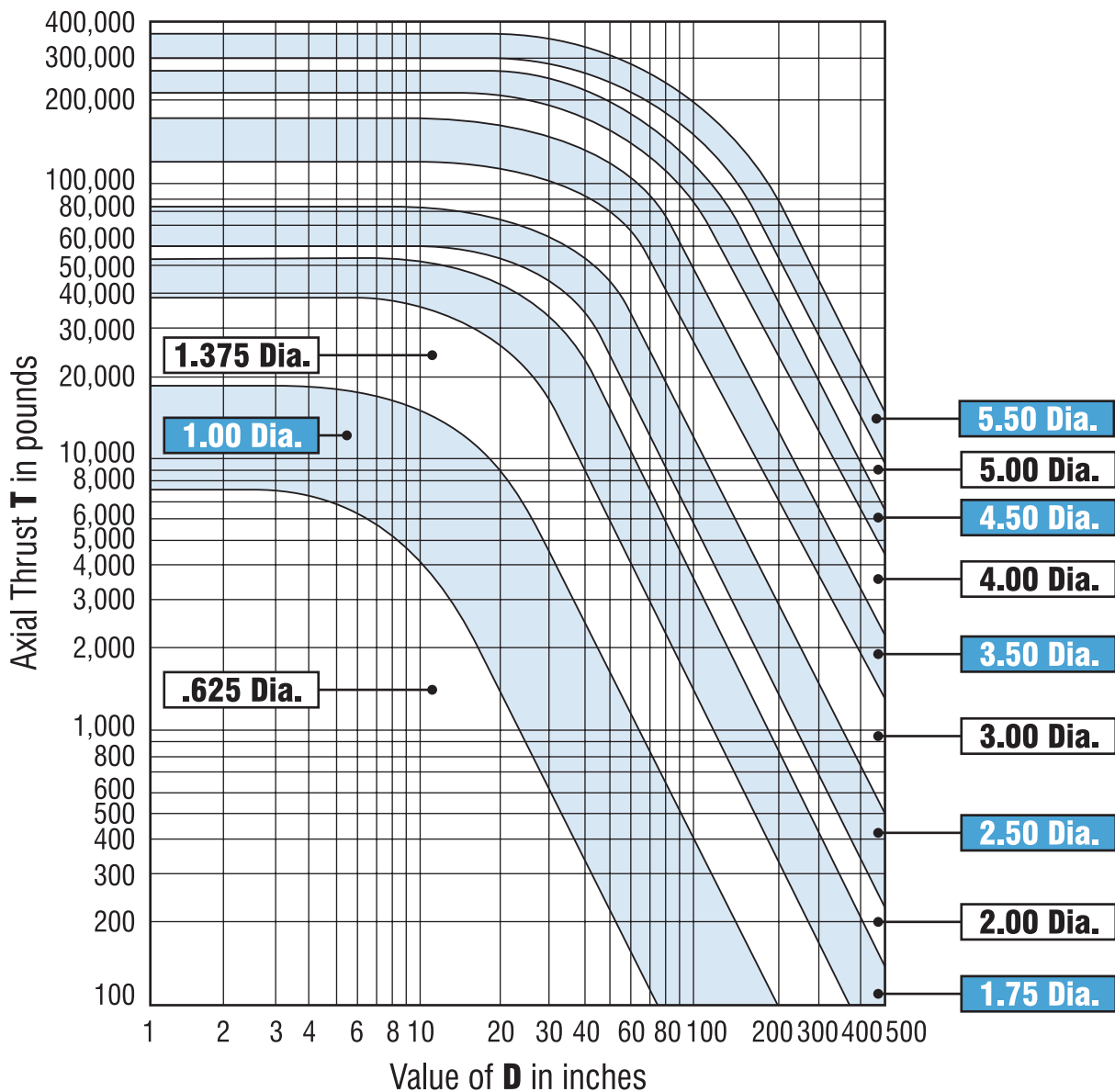
# SERIES 'HH' BASIC OPTIONS

## 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 page 150 for cylinder force chart.*
2. From page 53, 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)**





# SERIES 'HH' UNCOMMON OPTIONS

## 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 three 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 TRD for more information.

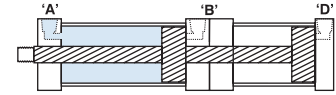
## 3-POSITION CYLINDERS

### HOW THEY WORK

■ = PRESSURE

#### POSITION 1 (RETRACT)

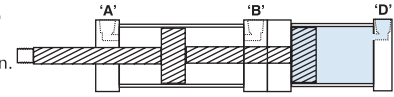
Pressure to port 'A' fully retracts cylinder.



(RETRACT)

#### POSITION 2 (MID-STROKE)

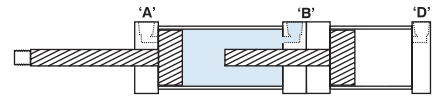
Pressure to port 'D' advances cylinder to mid-stroke position.



(MID-STROKE)

#### POSITION 3 (EXTEND)

Pressure to port 'B' fully extends cylinder.

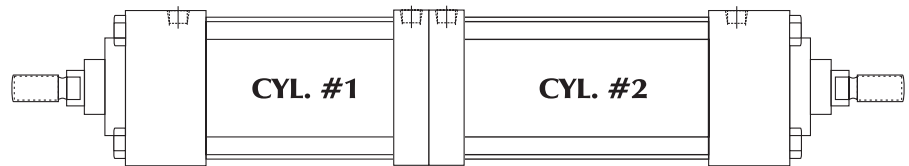


(EXTEND)

## BTB Back-To-Back Cylinders

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

Contact TRD for more information.

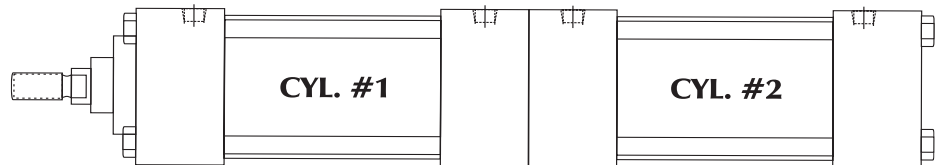


## TM Tandem Cylinders

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

**Note: Piston rods are connected.**

Contact TRD for more information.



## 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:** TRD can provide paint in any color or type.

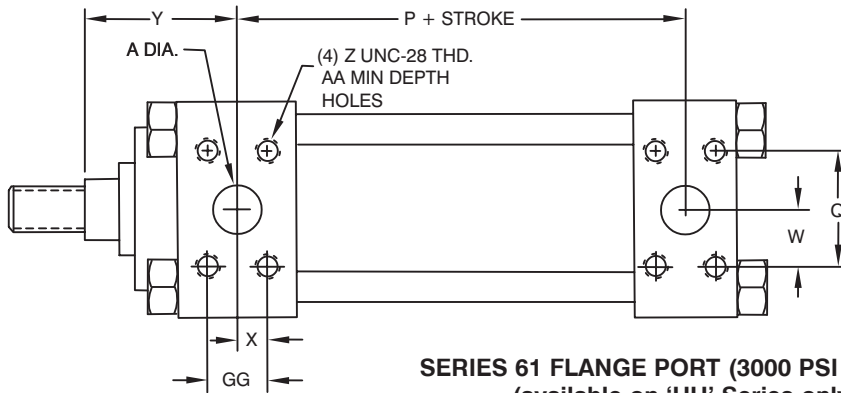
**Additional Finishes:** TRD can provide special finishes, i.e. Nutride Plate Heavy Chrome Plated Piston Rods.

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



# SERIES 'HH' UNCOMMON OPTIONS

## FLANGE PORTS



### Ref Port Call Out Information

$$P15 = FL24$$



**Note:**  
Flanges overhang caps on 2.50" through 5.00" Bore

**Affected Mounts:**  
ME5 and MF6 Mounts are not available  
MF2 Mount is not available with ports at positions 6 and/or 8

**SERIES 61 FLANGE PORT (3000 PSI Rating)**  
(available on 'HH' Series only)

BORE	ROD DIA. (MM)	MAX PSI RATING	SAE DASH NO.	Y	P	A	Q	W	X	Z	AA	GG	REF. MAIN FLANGE SIZE
2.50	1.000	3000	8	2.250	3.125	0.500	1.500	0.750	0.340	5/16 - 18	0.810	0.690	1/2
	1.375	3000	12	2.625									
3.25	1.750	3000	12	2.875	3.750	0.750	1.870	0.938	0.438	3/8 - 16	0.750	0.870	3/4
	2.000	3000	12	3.000									
4.00	1.750	3000	12	2.875	4.000	0.750	1.870	0.938	0.438	3/8 - 16	0.750	0.870	3/4
	2.000	3000	12	3.000									
	2.500	3000	12	3.250									
5.00	2.000	3000	12	3.000	4.500	0.750	1.870	0.938	0.438	3/8 - 16	0.750	0.870	3/4
	2.500	3000	12	3.250									
	3.000	3000	12	3.250									
6.00	2.500	3000	16	3.375	5.125	1.000	2.060	1.030	0.520	3/8 - 16	0.870	1.030	1
	3.000	3000	16	3.375									
	3.500	3000	16	3.375									
	4.000	3000	16	3.375									
8.00	3.500	3000	24	3.750	6.500	1.500	2.750	1.370	0.700	1/2 - 13	1.060	1.410	1 1/2
	4.000	3000	24	3.750									
	4.500	3000	24	3.750									
	5.000	3000	24	3.750									
	5.500	3000	24	3.750									

## ROD BOOTS

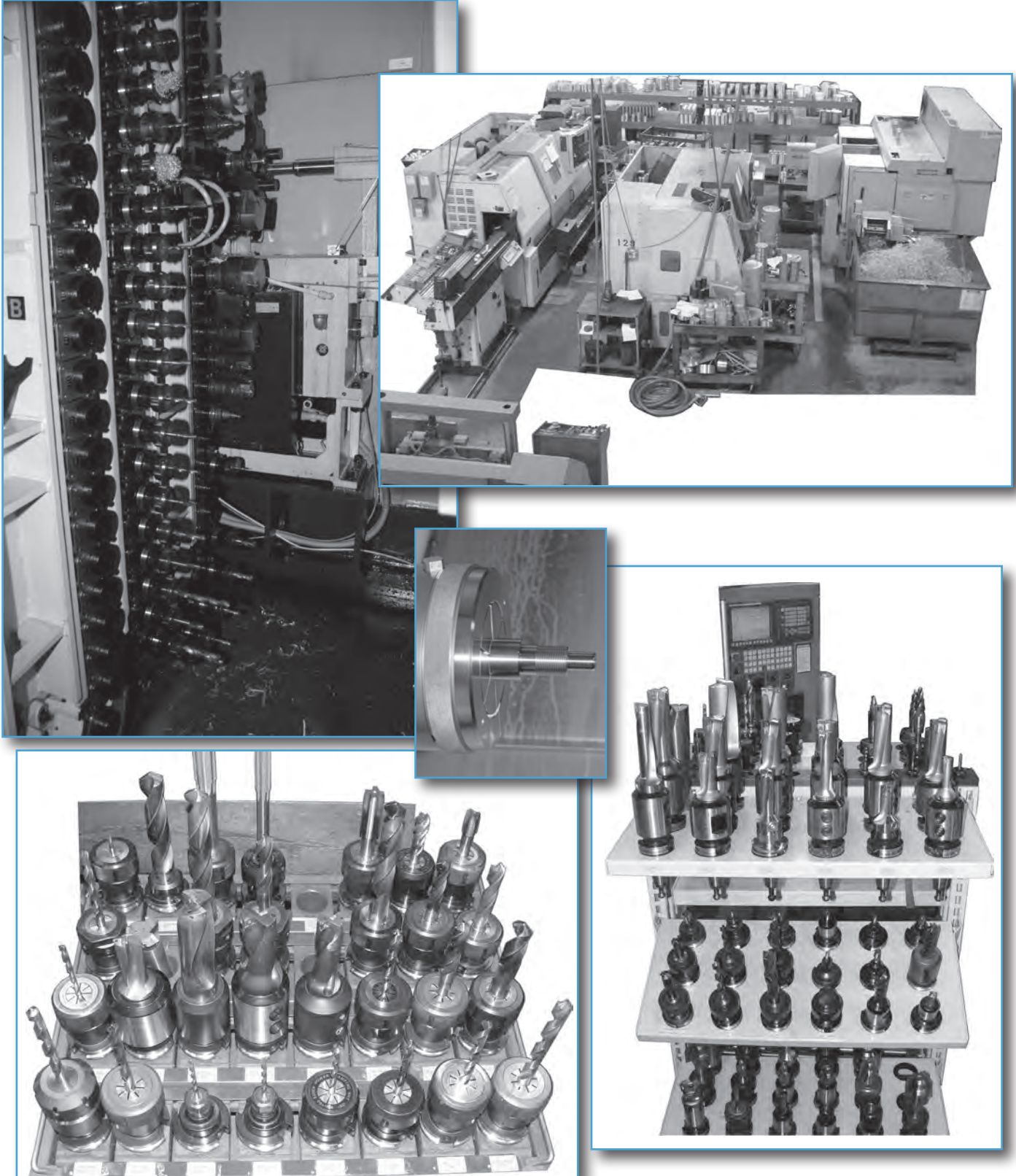
Rod boots are common in dirty environments; a standard spec for many applications (Note: Rod boots add length to cylinder rod extension).





# WHY TRD CYLINDERS CAN COST LESS THAN OTHER CYLINDERS...

Quick-change preset tooling, CNC programming and Flexible Manufacturing Systems (FMS) eliminate virtually all set-up costs. TRD doesn't have to charge for set-up or lot charges, which saves customers money.



HH - Heavy Duty Hydraulic

HH Rod Lock

HH Options

MH - Medium Duty Hydraulic

TAS - Heavy Duty Pneumatic

Accessories Page 130

STROKEMASTER Page 136

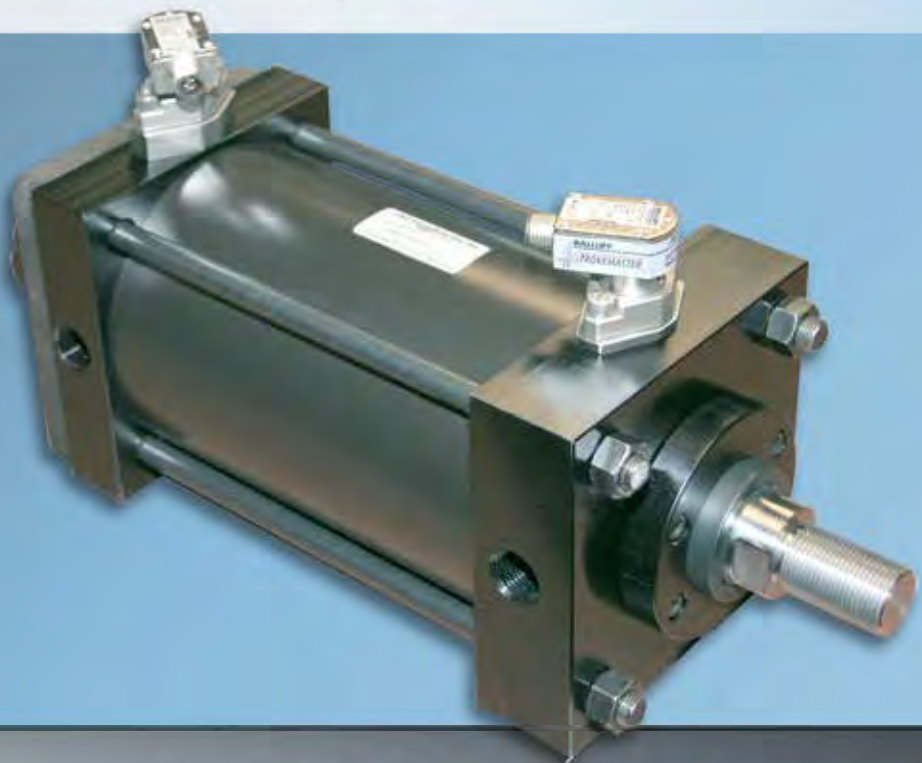
Technical Data Page 144

# MH Series Medium Duty Industrial Hydraulic 1.50" to 8.00" Bore

**Single Rod End      Page 61**



**Double Rod End      Page 80**



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

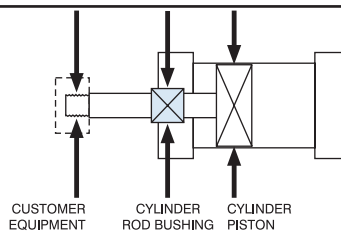


# SERIES 'MH' (NFPA) CYLINDER

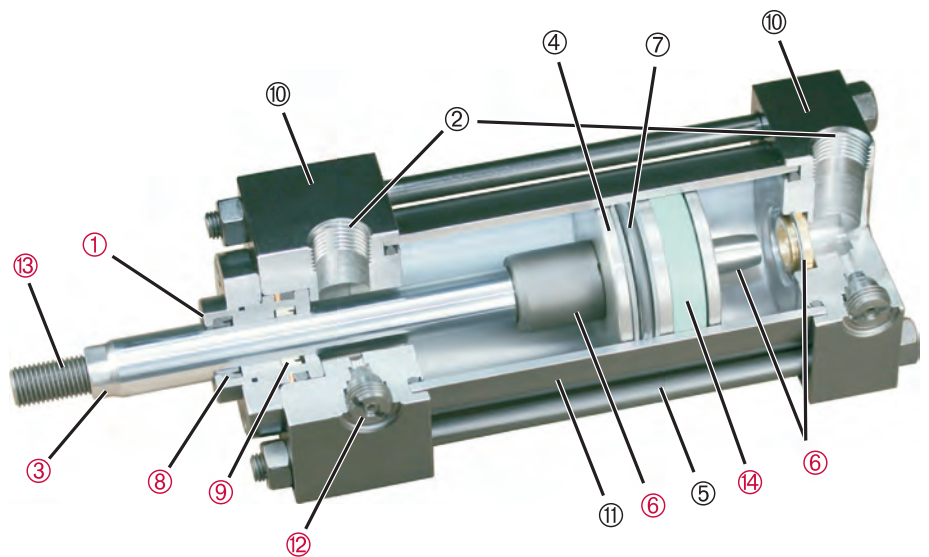
## Floating Rod Bushing

### SELF ALIGNMENT FEATURE

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



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



## HEAVY-DUTY DESIGN FOR RELIABLE, CONSISTENT OPERATION

- 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 two times standard "A" thread length.
  - WEAR BAND** – Wear Guard Nylon (standard); reinforced PTFE for E and V seal option.
- FINISH** – Black urethane paint.

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

### OPERATING PRESSURE

Refer to page 151 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 98 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 'MH' (MEDIUM DUTY HYDRAULIC CYLINDERS)

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

<b>SERIES</b> MH MEDIUM DUTY HYDRAULIC	<b>STYLE</b> (BLANK) SINGLE ROD D DOUBLE ROD	<b>STROKE</b> 0" to 120" Made-to-Order. (Use decimals for fractional strokes)	<b>ROD SIZE</b> 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.	<b>PORT LOC</b> P 1 2 3 4 5 6 7 8 9 Call out 'P' followed by all desired locations.	<b>PORT SIZE</b> 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	<b>SEALS</b> See Below for Seal Ordering Instructions	<b>OPTIONS</b> A= EXTENDED PISTON ROD THREAD (Example: A = 2") (MAX = 2 TIMES STD "A" DIM.) ABP= AIR BLEED PORTS (Example ABP=15) (Refer to page 92) 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 DBB= DRAIN BACK BUSHING (Example: DBB=1) (Refer to page 93) EK EXTENDED KEYPLATE (Refer to page 93 for specifications) HLP HIGH LOAD PISTON HSS HIGH SHOCK SEALS LRB LIFT RING BOSS NR NON-ROTATING (Refer to page 95 for specifications) PLS PISTON LOCK SCREW RBB ROD BUSHING MATERIAL: BRONZE SSR STAINLESS STEEL PISTON ROD ST= STOP TUBE NOTE: Specify STOP TUBE length (in inches) Specify Stroke as ES (effective stroke) Example: (MH-MS2-250x48ES-H2C6-ST=3)* 4WF FOUR WRENCH FLATS (ROD SIZES: 0.625" - 3.500") XX= SPECIAL VARIATION (SPECIFY)
--	--	--	---	---	--	--	---

<b>NFPA MOUNTS</b>	<b>BORE</b>	<b>CUSHIONS</b>
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 HEAD SQUARE FLANGE (1.50" to 6.00" Bore)	400 4.00" Bore	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)		

<b>ROD END</b>
KK1 Small Male Thread
KK2 Large Male Thread
KK3 Female Thread
KK3M Female Metric Rod Thread
KK3X Female Special Thread
KK4 Full Dia. Male Thread
KK5 Plain End
KK10 Rod Coupler End
KKM Metric Thread
KKX Non-Std Thread

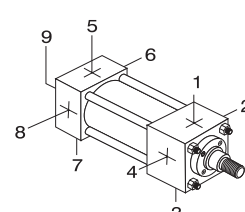
When additional thread details are required, use format "Rod End" = "Modification" Example: KKM=M12 x 1.75

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

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



Location 9 is center of cap face.

**HOW TO ORDER SEALS**

S S S S

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 65 INCHES	OVER 92 INCHES
6.00" & 8.00"	72 INCHES	OVER 72 INCHES	NOT REQUIRED

## NFPA MOUNTS

<b>MF1</b> 1.50"-6.00" Bores	<b>MF2</b> 1.50"-6.00" Bores	<b>MF5</b> 1.50"-6.00" Bores	<b>MF6</b> 1.50"-6.00" Bores	<b>ME3</b> 8.00" Bore	<b>ME4</b> 8.00" Bore	<b>MP1</b> 1.50"-8.00" Bores	<b>MP2</b> 1.50"-6.00" Bores
<b>MS2</b> 1.50"-8.00" Bores	<b>MS3</b> 1.50"-8.00" Bores	<b>MS4</b> 1.50"-8.00" Bores	<b>MS7</b> 1.50"-8.00" Bores	<b>MT1</b> 1.50"-8.00" Bores	<b>MT2</b> 1.50"-8.00" Bores	<b>MX0</b> 1.50"-8.00" Bores	<b>MX1</b> 1.50"-8.00" Bores
<b>MX2</b> 1.50"-8.00" Bores	<b>MX3</b> 1.50"-8.00" Bores	<b>SB</b> 1.50"-8.00" Bores					

HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 MH - Medium Duty Hydraulic  
 MH Options  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144

# SERIES 'MH' DIMENSIONS: THREADS

HH - Heavy Duty Hydraulic

HH Rod Lock

MH - Medium Duty Hydraulic

MH Options

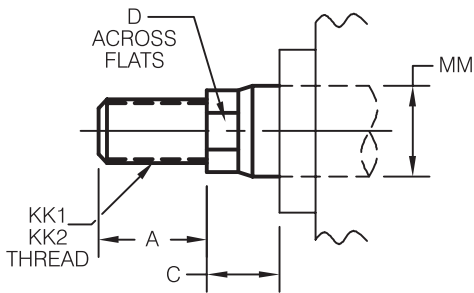
TAS - Heavy Duty Pneumatic

Accessories Page 130

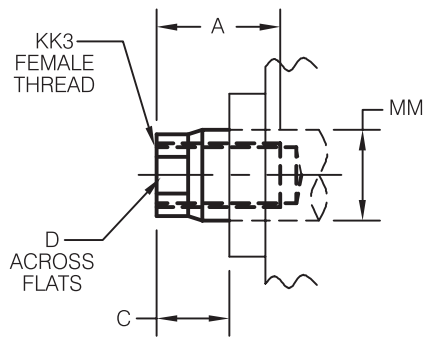
STROKEMASTER Page 136

Technical Data Page 144

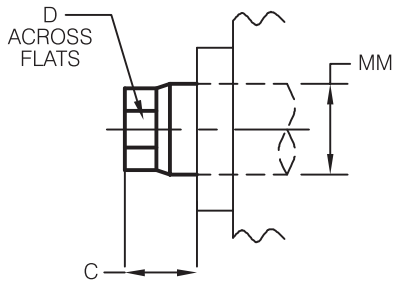
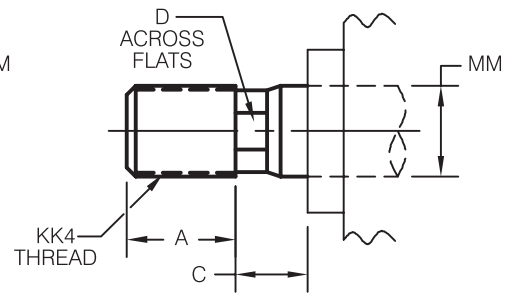
ROD END STYLE:  
KK1  
KK2



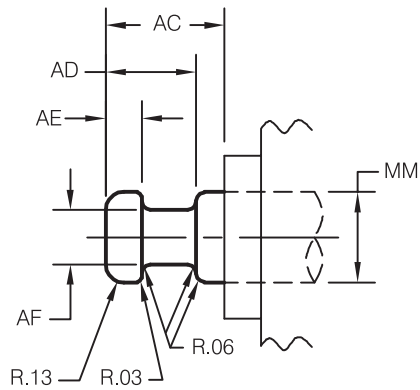
ROD END STYLE:  
KK3



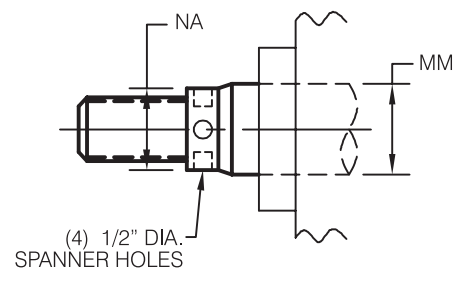
ROD END STYLE:  
KK4



ROD END STYLE:  
KK5



ROD END STYLE:  
KK10



SPANNER HOLES (4.000-5.500 RODS)  
(SHOWN ON KK1-KK4)

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.

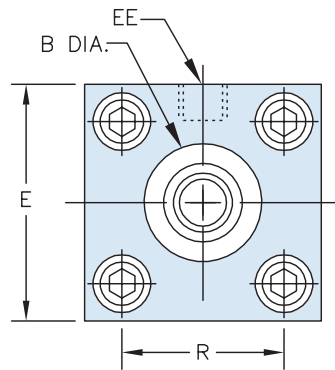
(4) Wrench flats is an option.

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

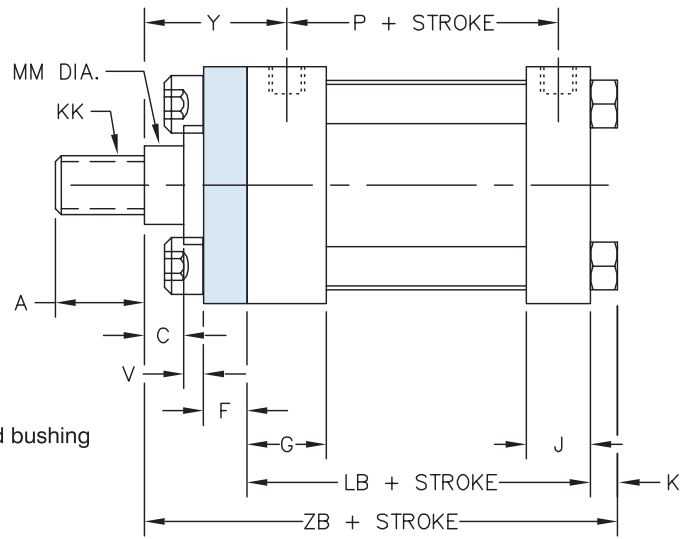
# SERIES 'MH' DIMENSIONS: BASIC CYLINDER (MX0 MOUNT)

## RETAINER CONSTRUCTION

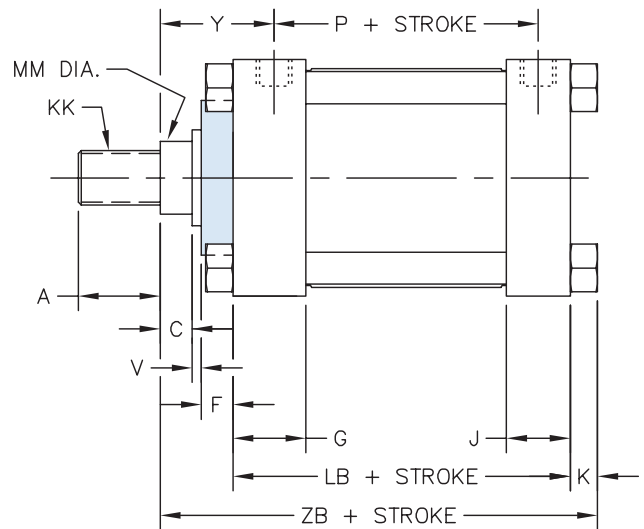
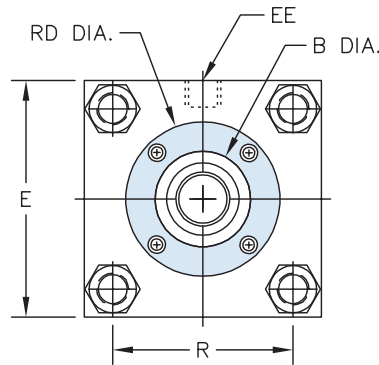
FULL SQUARE RETAINER USED ON:	
BORE	ROD DIA.
1.50	0.625
	1.000
2.00	1.000
	1.375
2.50	1.000
	1.375
	1.750
3.25	1.375
	1.750
	2.000
4.00	2.000
	2.500
5.00	2.500
	3.000
	3.500
6.00	4.000



**Note:** Full square retainer is removable to service rod bushing

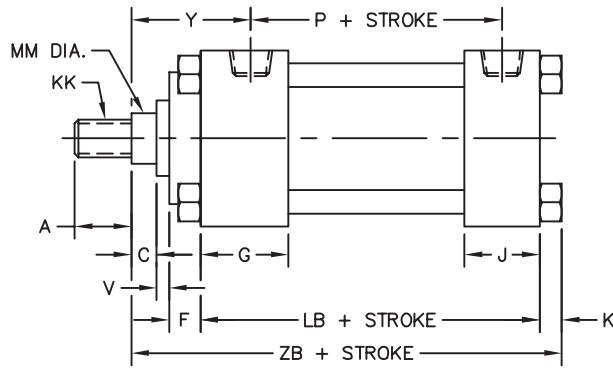
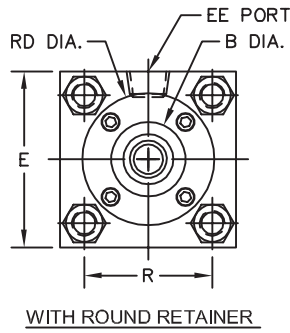
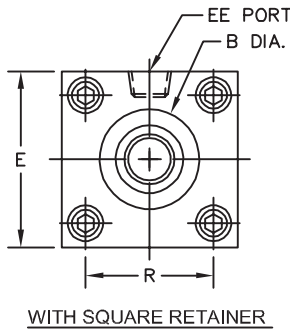


ROUND RETAINER USED ON:	
BORE	ROD DIA.
2.00	0.625
2.50	0.625
3.25	1.000
	1.375
4.00	1.000
	1.750
5.00	1.000
	1.375
	1.750
	2.000
6.00	1.375
	1.750
	2.000
	2.500
8.00	3.000
	3.500
	4.000
	4.500
	5.000
	5.500



# SERIES 'MH' DIMENSIONS: BASIC CYLINDER (MX0 MOUNT)

EASY FLIP OUT PAGE FOR REFERENCE



BORE	ROD DIA. (MM)	① MAX PSI RATING	E	A	② B	C	EE		F	G	J	K	KK	R	③ RD	V	Y	ADD TO STROKE		
							NPTF	SAE										LB	P	ZB
1.50	0.625	1500	2.000	0.750	1.124	0.375	3/8	#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	3/8	#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	3/8	#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	1/2	#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	1/2	#10	0.625	1.750	1.250	0.375	3.320	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	1/2	#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	3/4	#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	
8.00	1.375	500	8.500	1.625	1.999	0.625	3/4	#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								SQ	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 61

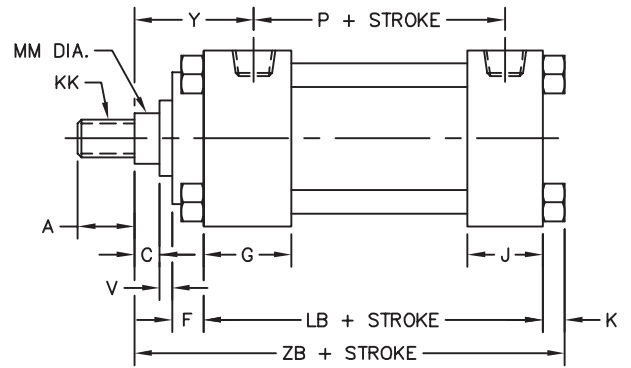
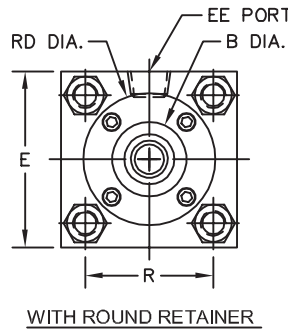
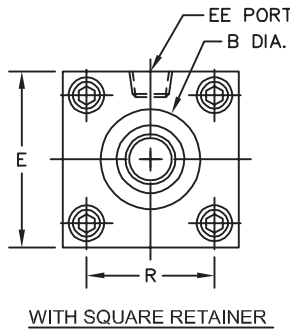
① Max pressure rating (NON-SHOCK).

② 'B' dimension tolerance is +.000 / -.002

③ Where SQ is shown in chart, cylinder utilizes a full square retainer.



# SERIES 'MH' DIMENSIONS: BASIC CYLINDER (MX0 MOUNT)



BORE	ROD DIA. (MM)	① MAX PSI RATING	E	A	② B	C	EE		F	G	J	K	KK	R	③ RD	V	Y	ADD TO STROKE		
							NPTF	SAE										LB	P	ZB
1.50	0.625	1500	2.000	0.750	1.124	0.375	3/8	#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	3/8	#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	3/8	#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	1/2	#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	1/2	#10	0.625	1.750	1.250	0.375	3.320	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	1/2	#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	3.000			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	3/4	#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	
8.00	1.375	500	8.500	1.625	1.999	0.625	3/4	#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 61

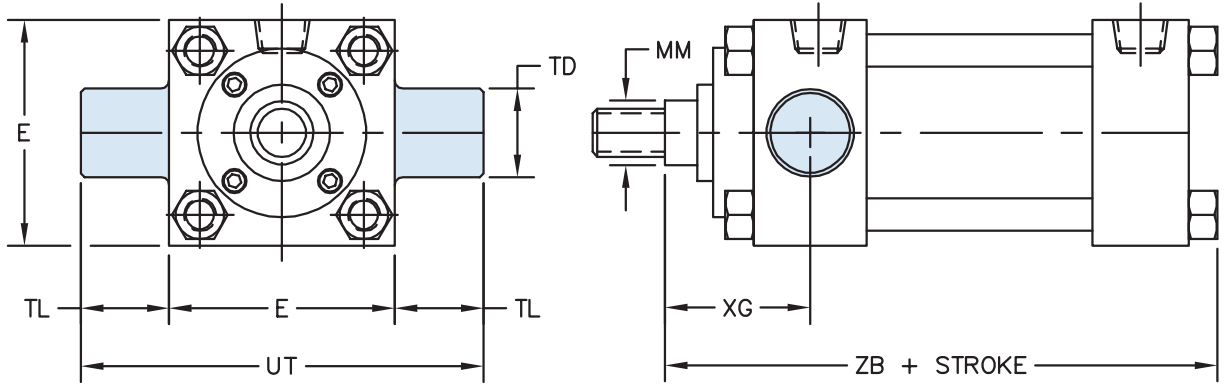
① Max pressure rating (NON-SHOCK).

② 'B' dimension tolerance is +.000 / -.002

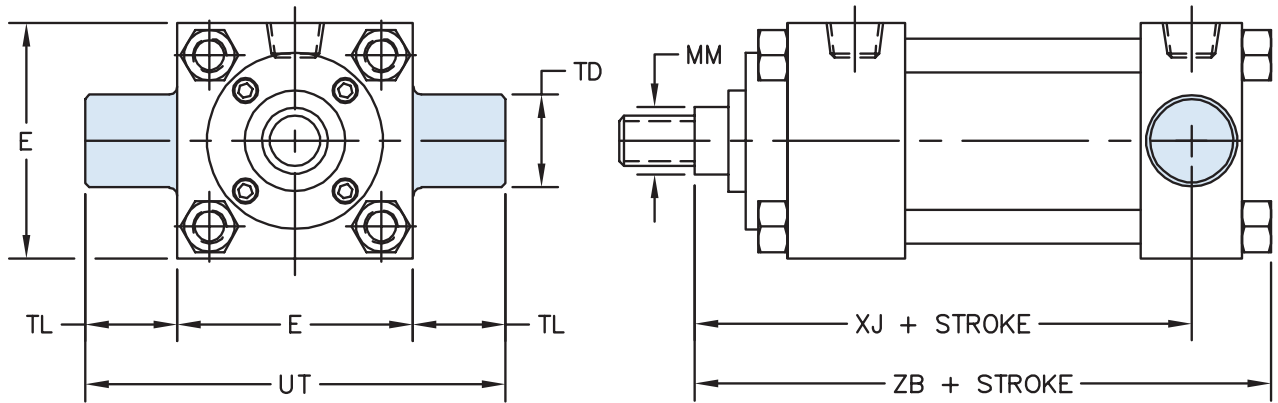
③ Where SQ is shown in chart, cylinder utilizes a full square retainer.

# SERIES 'MH' DIMENSIONS: TRUNNION MOUNTS

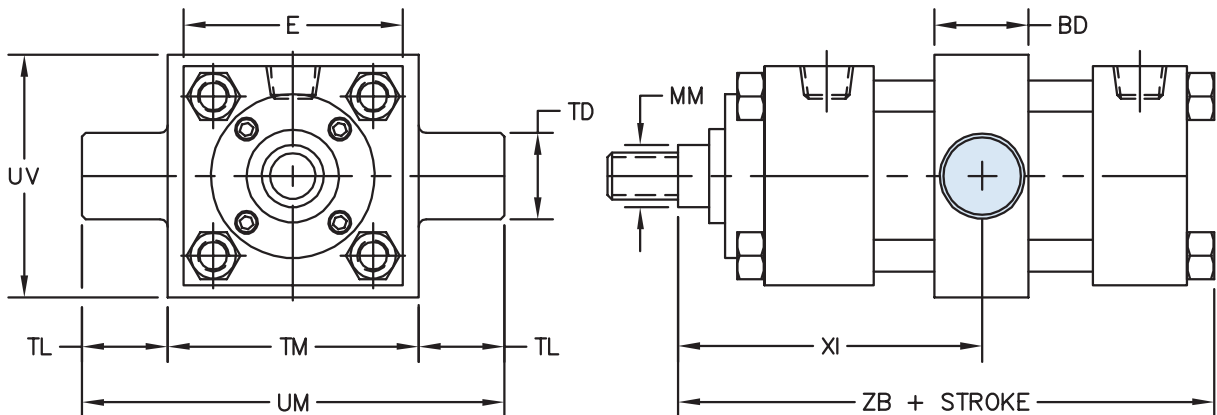
## MT1: HEAD TRUNNION



## MT2: CAP TRUNNION



## MT4: INTERMEDIATE TRUNNION



NOTE:  
'XI' DIMENSION TO BE SPECIFIED BY CUSTOMER

# SERIES 'MH' DIMENSIONS: TRUNNION MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	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

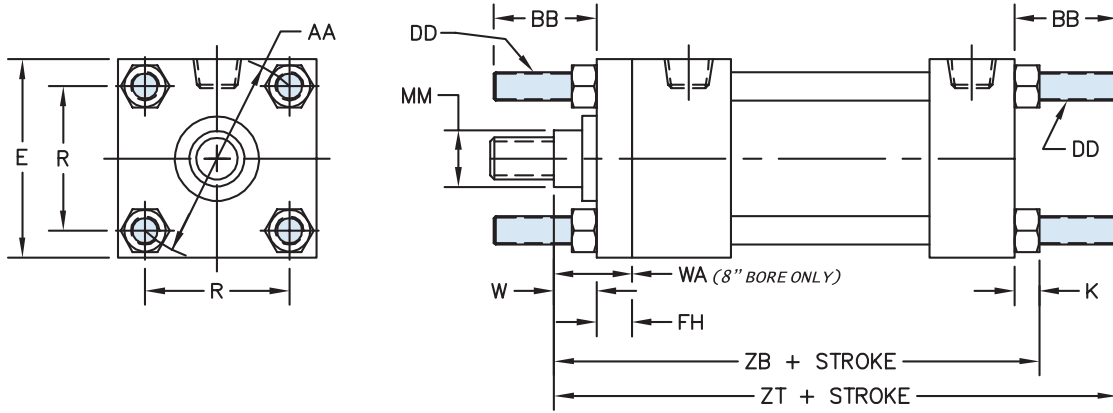
① Max pressure rating (NON-SHOCK).

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

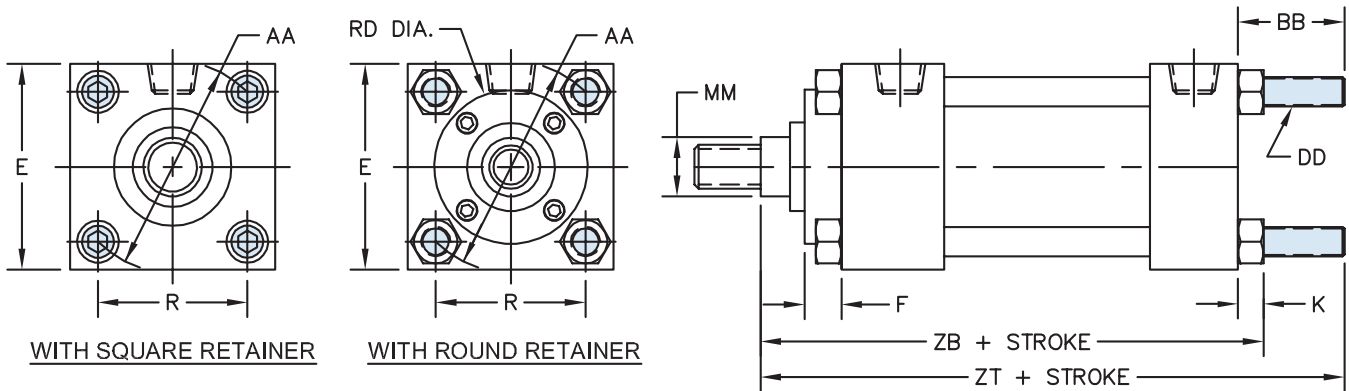
③ 'XI' dimension is the minimum that can be supplied and leaves 1/4" gap between head & trunnion block (customer to specify 'XI' dimension).

# SERIES 'MH' DIMENSIONS: EXTENDED TIE ROD MOUNTS

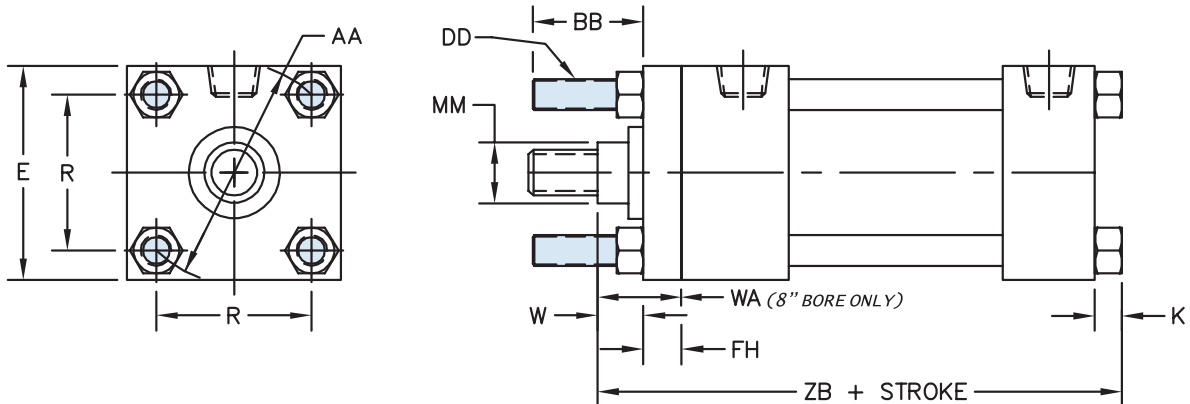
## MX1: EXTENDED TIE-RODS - HEAD & CAP



## MX2: EXTENDED TIE-RODS - CAP END



## MX3: EXTENDED TIE-RODS - HEAD END



HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 MH - Medium Duty Hydraulic  
 MH Options  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144

# SERIES 'MH' DIMENSIONS: EXTENDED TIE ROD MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	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	9.10	2.313	5/8 - 18	0.750	0.563	6.440	3.500	1.625	7.313	9.063
	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

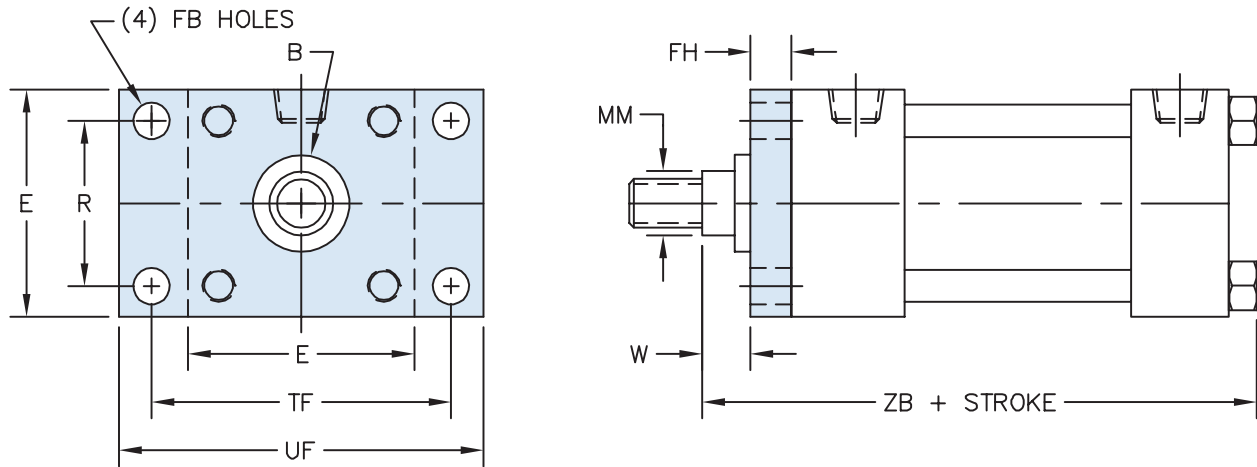
① Max pressure rating (NON-SHOCK).

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

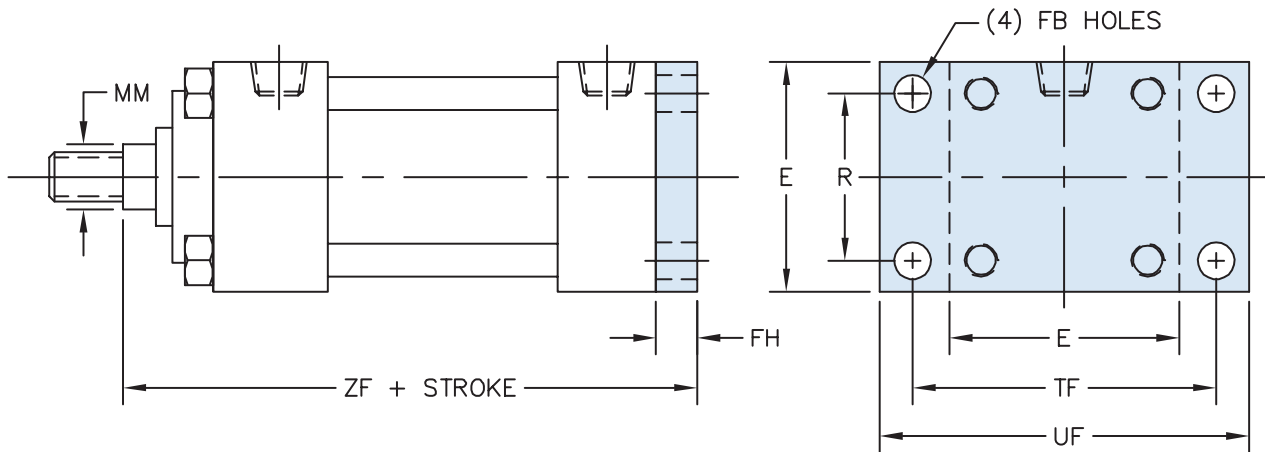
③ Round retainer used to retain bushing, not a full front plate as other bores. 'BB' is dimension from head on the 8.00" bore.

# SERIES 'MH' DIMENSIONS: FLANGE MOUNTS

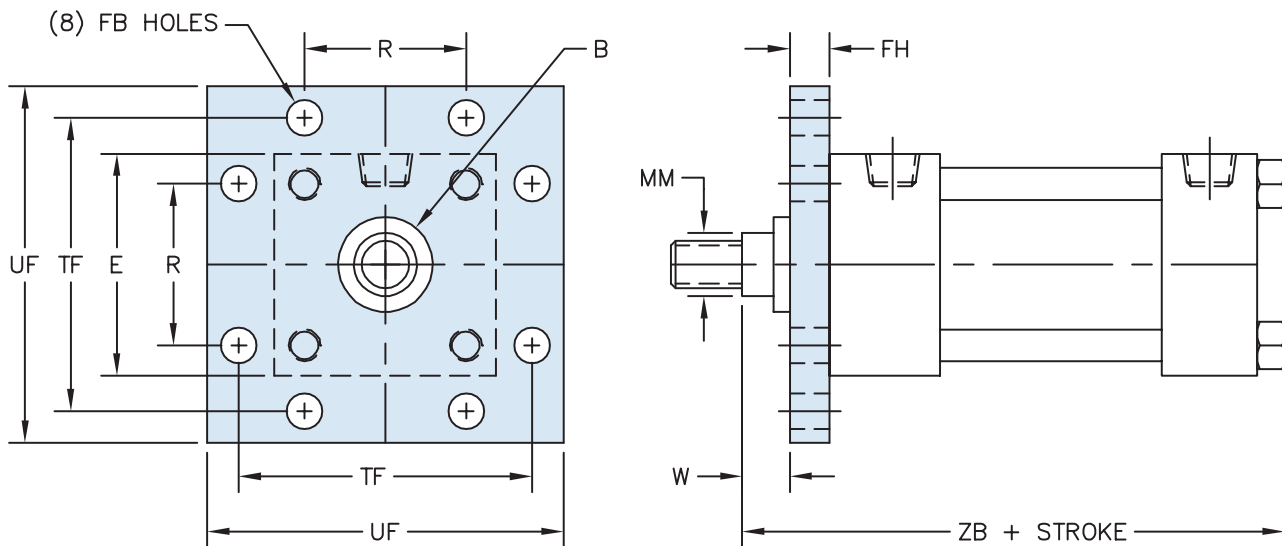
## MF1: HEAD FLANGE



## MF2: CAP FLANGE



## MF5: HEAD SQUARE FLANGE

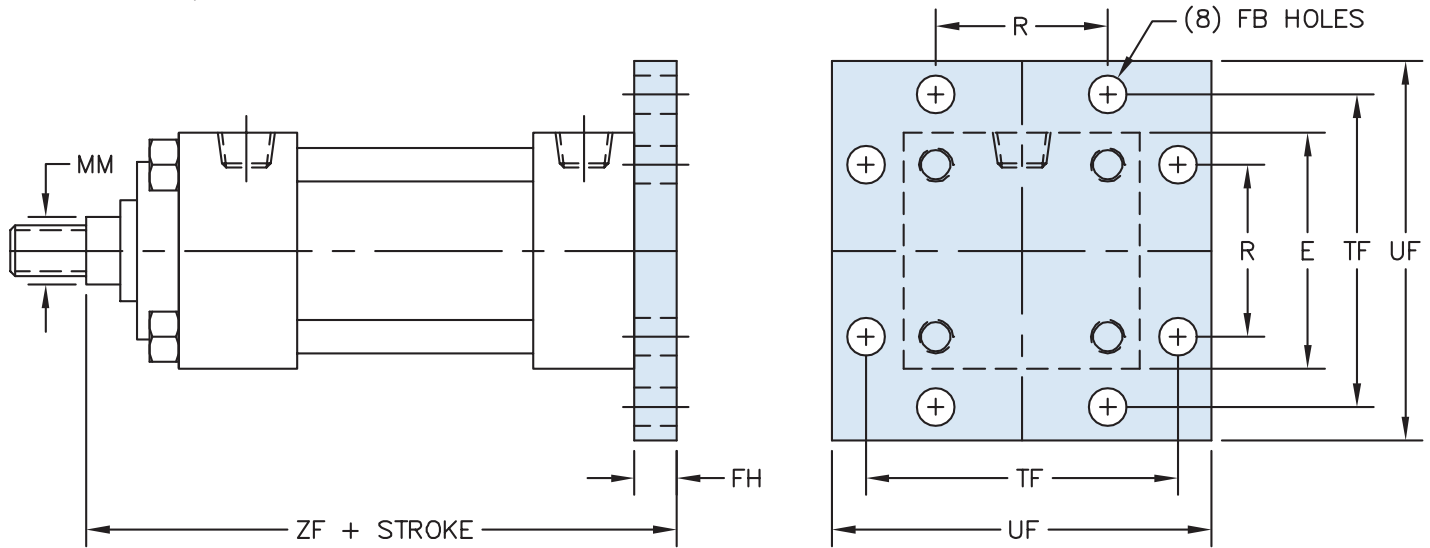


HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 MH - Medium Duty Hydraulic  
 MH Options  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144



# SERIES 'MH' DIMENSIONS: FLANGE MOUNTS

## MF6: CAP SQUARE FLANGE



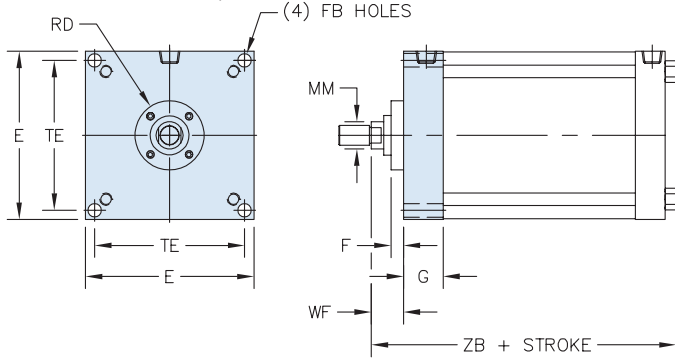
BORE	ROD DIA. (MM)	① MAX PSI RATING	② B	E	FB	FH	R	TF	UF	W	ADD TO STROKE	
											ZB	ZF
1.50	0.625	1500	1.124	2.000	0.313	0.375	1.438	2.750	3.375	0.625	4.875	5.000
	1.000	1500	1.499							1.000	5.250	5.375
2.00	0.625	1500	1.124	2.500	0.375	0.375	1.844	3.375	4.125	0.625	4.938	5.000
	1.000	1500	1.499							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
	4.000	750	4.749							1.500	7.688	8.000

① Max pressure rating (NON-SHOCK).

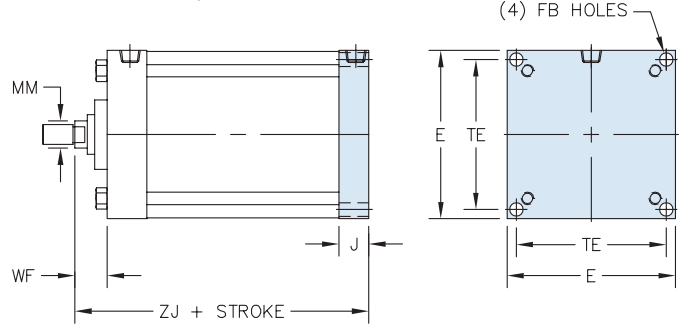
② 'B' dimension tolerance is +.000 / -.002

# SERIES 'MH' DIMENSIONS: FLANGE MOUNTS

## ME3: HEAD SQUARE MOUNTING HOLES

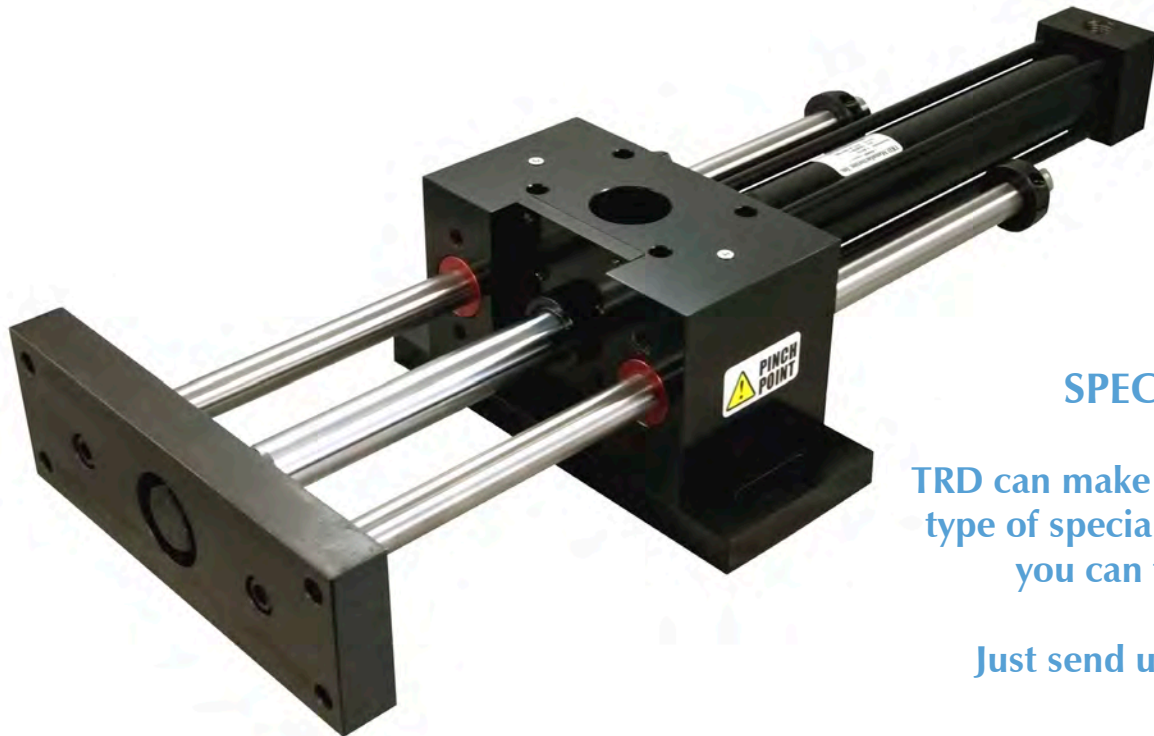


## ME4: CAP SQUARE MOUNTING HOLES



BORE	ROD DIA. (MM)	① MAX PSI RATING	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.



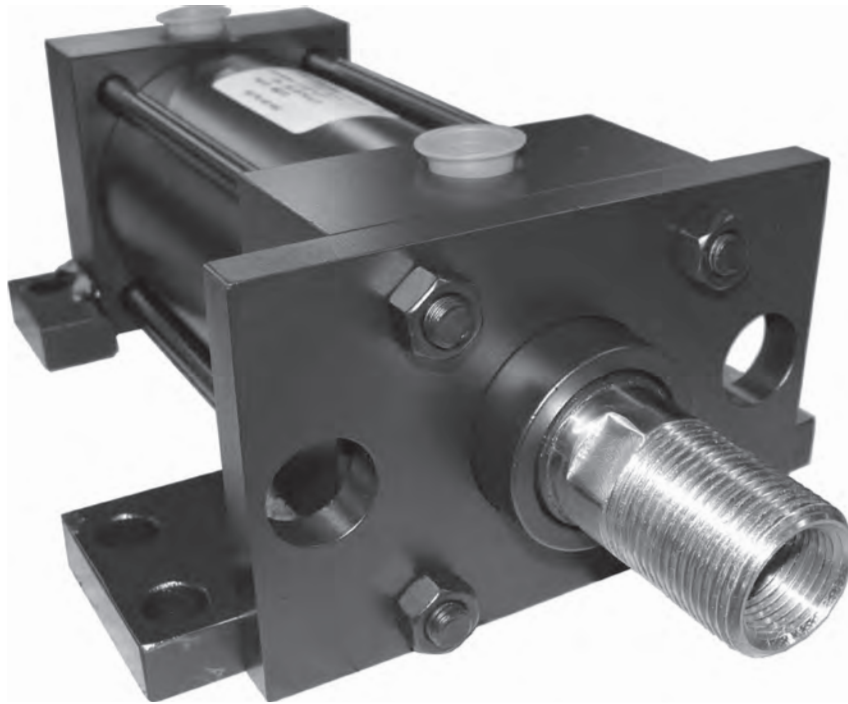
## SPECIALS

TRD can make just about any type of special cylinder that you can think of.

Just send us a sketch!

## Design Tips - Multiple Mounts on One Cylinder

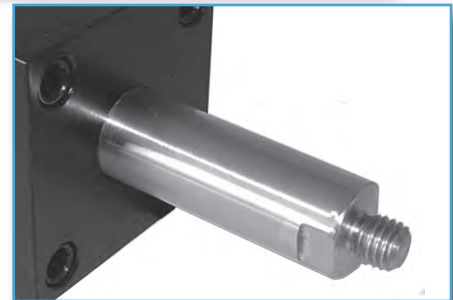
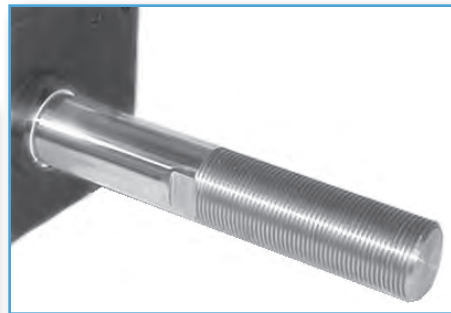
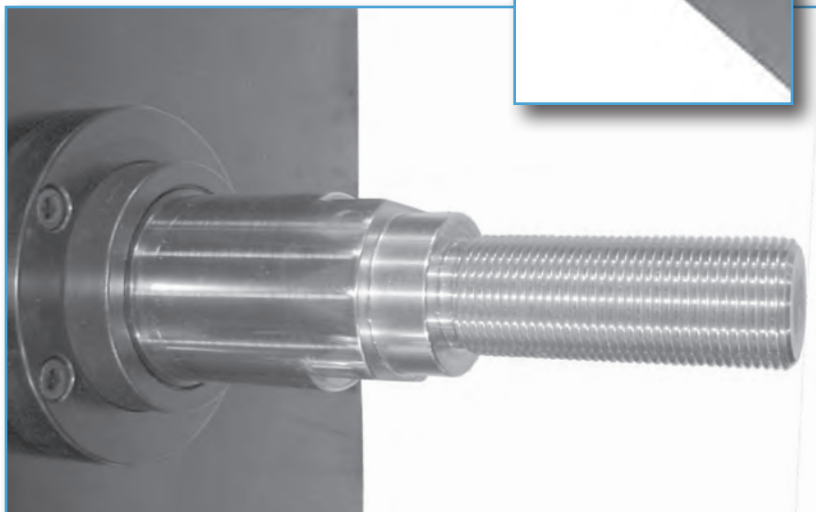
Designers and maintenance staff don't have to be limited to just one NFPA mount. Cylinders can contain multiple mounts or even special mounts to fit every possible application. Multiple mounts do not typically delay orders.



**Note: 'HH' and 'MH' Series can limit thread options. Check with factory to ensure that your special thread can handle the intended loads.**

## Design Tips - Rod Threads

NFPA standards specify UNF fine threads. UNC coarse, metric or other types of male threads are available. It is possible to utilize male and female threads on the same rod.

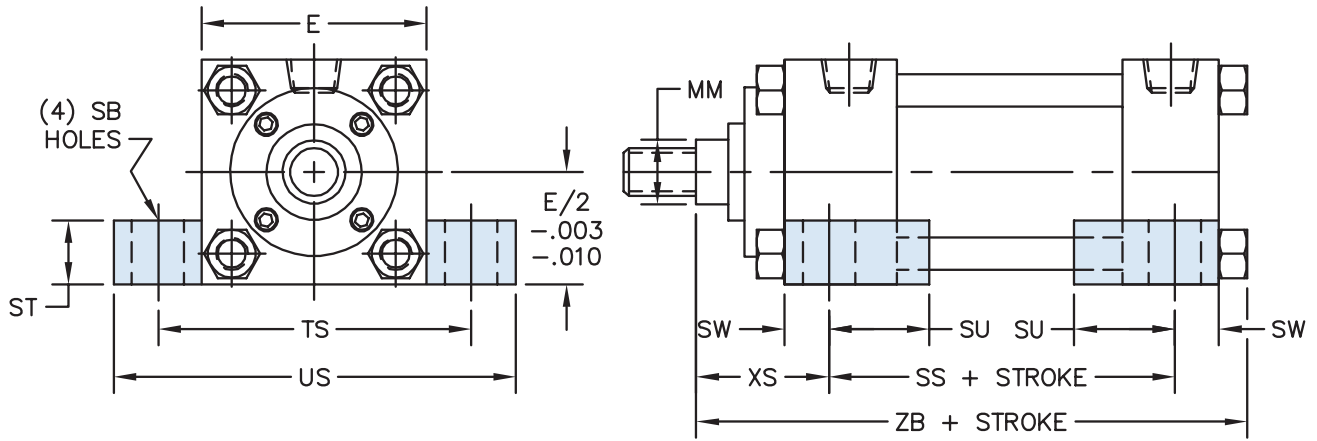


### Rod Thread Lengths

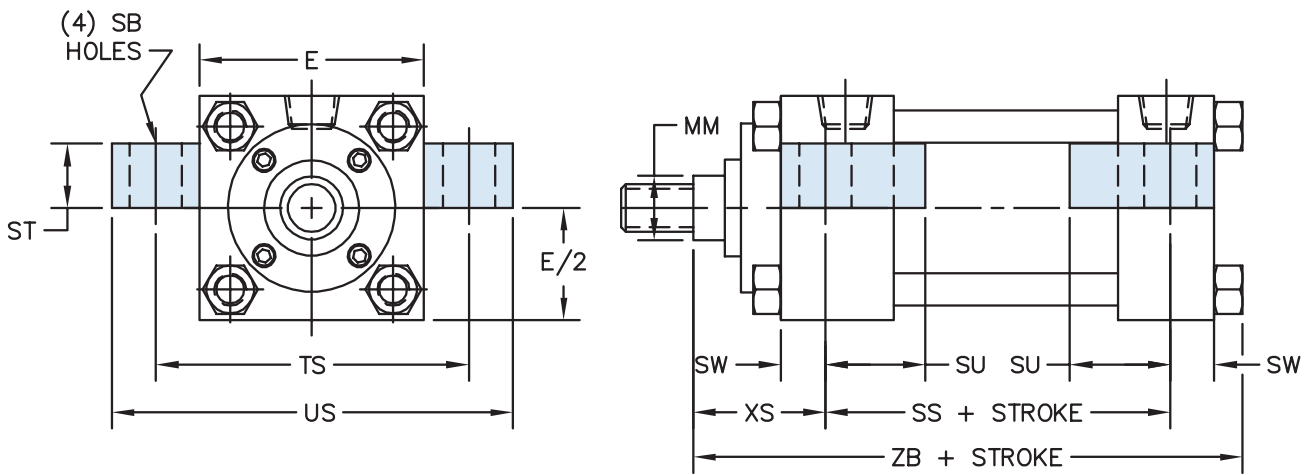
Since each piston rod is made-to-order, rod thread lengths can also be specified without delaying orders.

# SERIES 'MH' DIMENSIONS: LUG MOUNTS

## MS2: SIDE LUGS



## MS3: CENTER LINE LUGS



HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 MH - Medium Duty Hydraulic  
 MH Options  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144

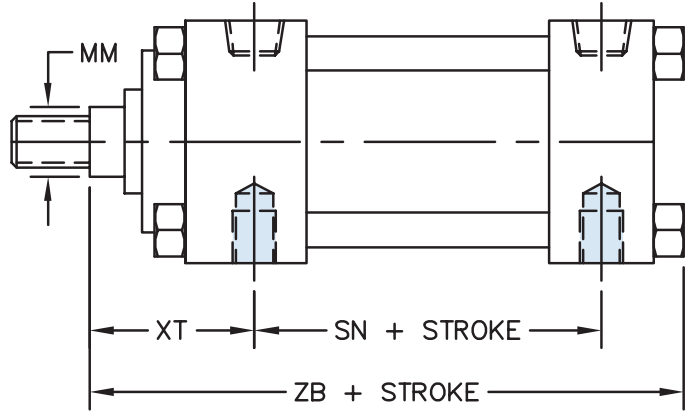
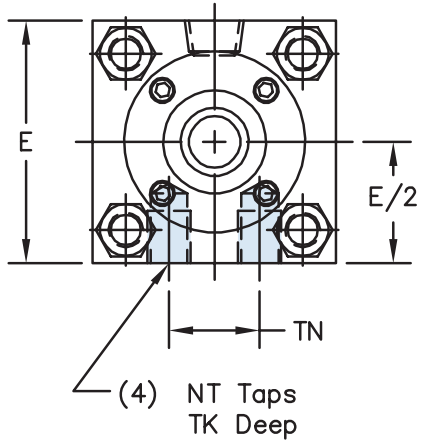
# SERIES 'MH' DIMENSIONS: LUG MOUNTS

BORE	ROD DIA. (MM)	Ⓢ MAX PSI RATING	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	4.750	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

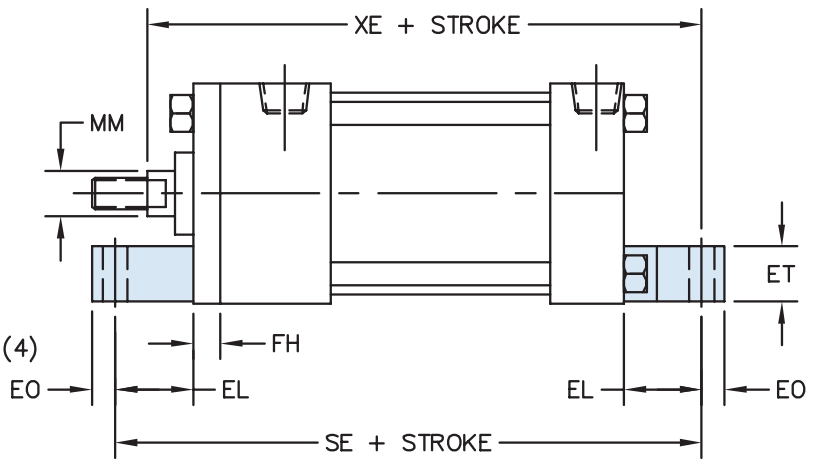
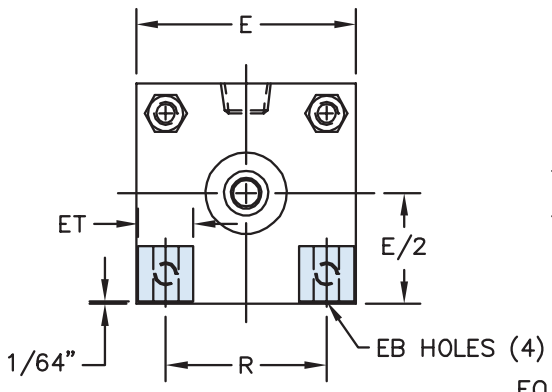
Ⓢ Max pressure rating (NON-SHOCK).

# SERIES 'MH' DIMENSIONS: BOTTOM MOUNTS

## MS4: BOTTOM TAPPED HOLES



## MS7: END LUGS



HH - Heavy Duty Hydraulic  
HH Rod Lock  
MH - Medium Duty Hydraulic  
MH Options  
TAS - Heavy Duty Pneumatic  
Accessories Page 130  
STROKEMASTER Page 136  
Technical Data Page 144



# SERIES 'MH' DIMENSIONS: BOTTOM MOUNTS

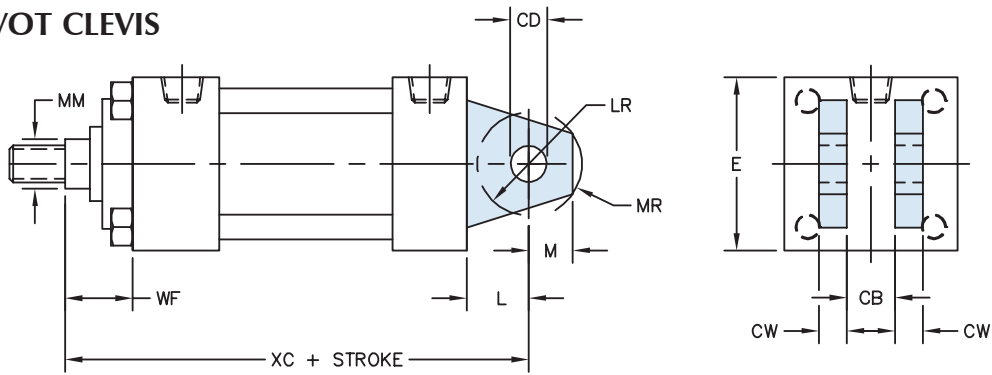
BORE	ROD DIA. (MM)	Ⓛ MAX PSI RATING	E	EB	EL	EO	ET	FH	NT	R	TN	TK	XT	ADD TO STROKE			
														SN	ZB	SE	XE
1.50	0.625	1500	2.000	0.281	0.750	0.250	0.563	0.375	1/4 - 20	1.438	0.625	0.375	1.938	2.250	4.875	5.500	5.375
	1.000	1500											2.313		5.250		5.750
2.00	0.625	1500	2.500	0.344	0.938	0.313	0.625	0.375	5/16 - 18	1.844	0.875	0.406	1.938	2.250	4.938	5.875	5.563
	1.000	1500											2.313		5.313		5.938
	1.375	1500											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
	1.000	1500											2.313		5.438		6.188
	1.375	1500											2.563		5.688		6.438
	1.750	1500											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
	1.375	1500											2.688		6.250		6.750
	1.750	1500											2.938		6.500		7.000
	2.000	1500											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
	1.375	1000											2.688		6.250		6.875
	1.750	1000											2.938		6.500		7.125
	2.000	1000											3.063		6.625		7.250
	2.500	1000											3.313		6.875		7.500
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	6.313	7.250	6.938
	1.375	1000											2.688		6.563		7.188
	1.750	1000											2.938		6.813		7.438
	2.000	1000											3.063		6.938		7.563
	2.500	1000											3.313		7.188		7.813
	3.000	1000											3.313		7.188		7.813
	3.500	1000											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
	1.750	750											3.063		7.313		7.875
	2.000	750											3.188		7.438		8.000
	2.500	750											3.438		7.688		8.250
	3.000	750											3.438		7.688		8.250
	3.500	750											3.438		7.688		8.250
	4.000	750											3.438		7.688		8.250
8.00	1.375	500	8.500	0.688	1.125	0.625	2.000	Ⓜ	3/4 - 10	6.438	4.500	1.250	2.813	3.250	7.313	7.375	7.875
	1.750	500											3.063		7.563		8.125
	2.000	675											3.188		7.688		8.250
	2.500	675											3.438		7.938		8.500
	3.000	675		3.438	7.938	8.500											
	3.500	675		3.438	7.938	8.500											
	4.000	675		N/A	7.938	N/A											
	4.500	675		N/A	7.938	N/A											
	5.000	675		N/A	7.938	N/A											
	5.500	675		N/A	7.938	N/A											

Ⓛ Max pressure rating (NON-SHOCK).

Ⓜ (1) piece MS7 brackets bolted directly to head & cap (uses round retainer).

# SERIES 'MH' DIMENSIONS: PIVOT MOUNTS

## MP1: REAR PIVOT CLEVIS



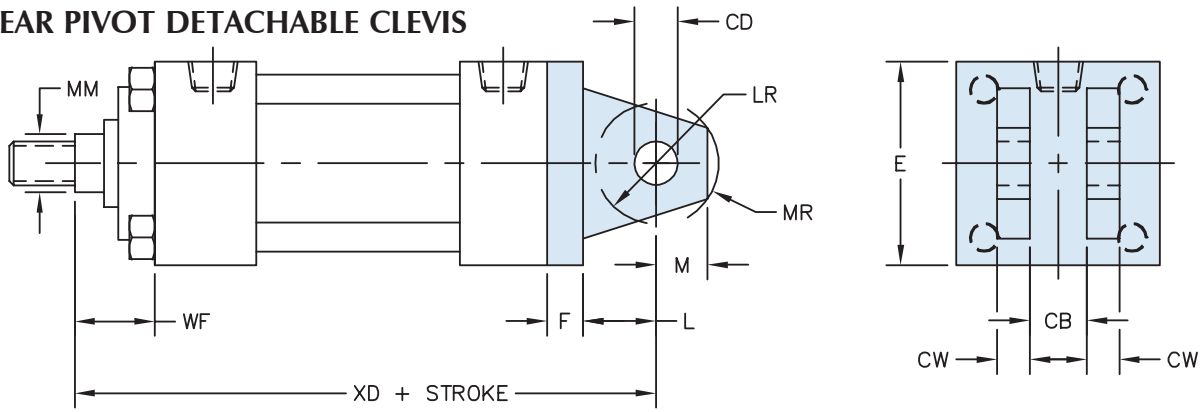
BORE	ROD DIA. (MM)	① MAX PSI RATING	CB	CD	CW	E	L	LR	M	MR	WF	ADD TO STROKE	
												XC	
1.50	0.625	1500	0.750	0.500	0.500	2.000	0.750	0.750	0.500	0.625	1.000	5.375	
	1.000	1500										1.375	5.750
2.00	0.625	1500	0.750	0.500	0.500	2.500	0.750	0.750	0.500	0.625	1.000	5.375	
	1.000	1500										1.375	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
	2.500	1000										2.250	7.750
5.00	1.000	750	1.250	0.750	0.625	5.500	1.250	1.000	0.750	0.938	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
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 'MH' DIMENSIONS: PIVOT MOUNTS

## MP2: REAR PIVOT DETACHABLE CLEVIS



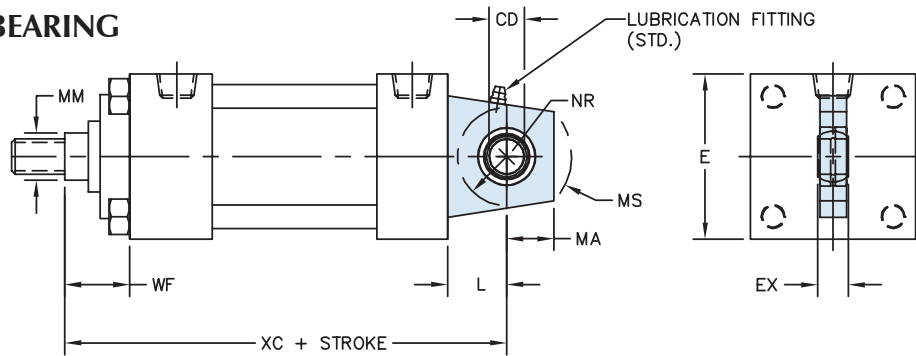
BORE	ROD DIA. (MM)	① MAX PSI RATING	CB	CD	CW	E	F	L	LR	M	MR	WF	ADD TO STROKE
													XD
1.50	0.625	1500	0.750	0.500	0.500	2.000	0.375	0.750	0.750	0.500	0.625	1.000	5.750
	1.000	1500											6.125
2.00	0.625	1500	0.750	0.500	0.500	2.500	0.375	0.750	0.750	0.500	0.625	1.000	5.750
	1.000	1500											6.125
	1.375	1500											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											6.250
	1.375	1500											6.500
	1.750	1500											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											7.750
	1.750	1500											8.000
	2.000	1500											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											7.750
	1.750	1000											8.000
	2.000	1000											8.125
	2.250	1000											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											8.000
	1.750	1000											8.250
	2.000	1000											8.375
	2.500	1000											8.625
	3.000	1000											8.625
	3.500	1000											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											9.125
	2.000	750											9.250
	2.500	750											9.500
	3.000	750											9.500
	3.500	750											9.500
	4.000	750											9.500

① Max pressure rating (NON-SHOCK).

Note: Pivot pin included with cylinder cap end only.

# SERIES 'MH' DIMENSIONS: SPHERICAL BEARING MOUNT

## SB: SPHERICAL BEARING



BORE	ROD DIA. (MM)	① 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								

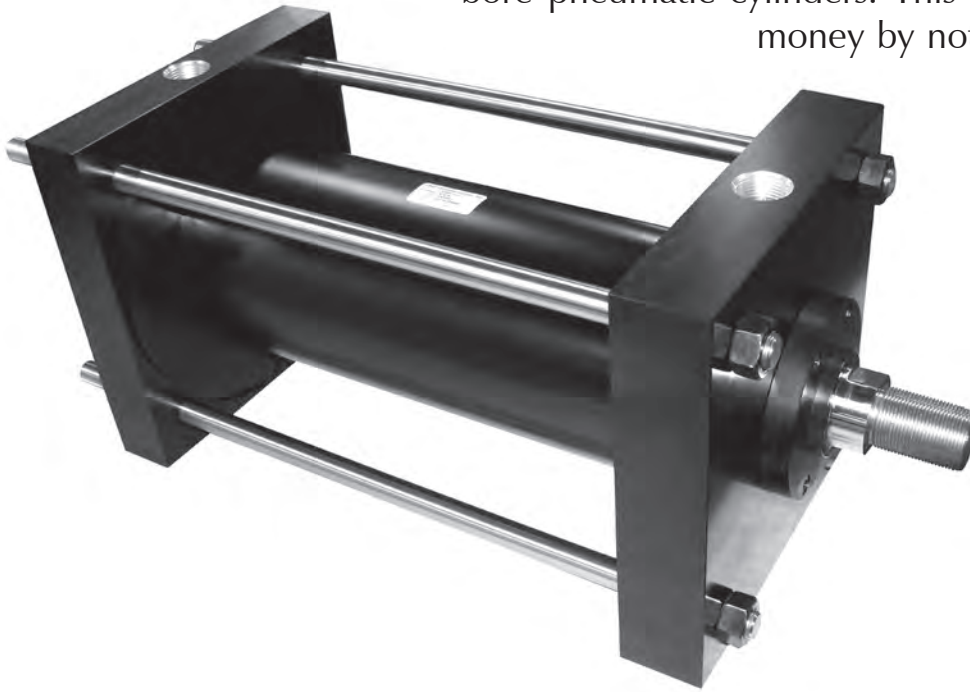
① Max pressure rating (NON-SHOCK).

Note 1: Pivot pin included with cylinder cap end only; 5.00" & 6.00" & 8.00" bores have tie rod nuts exposed on cap end.

Note 2: Must specify KK3 rod end if to be used with 'HH-MSRE' series rod eye.

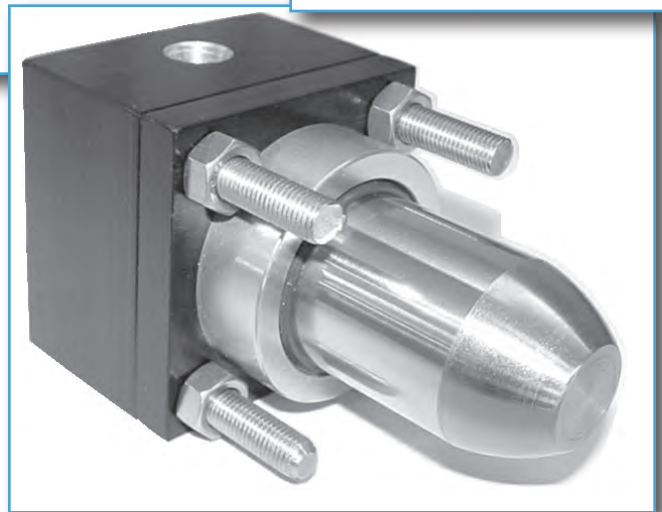
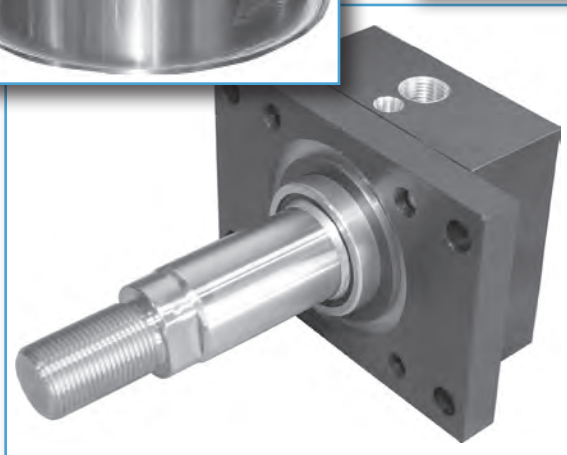
**Design Tip**

When pneumatic cylinders do not offer the required force, you don't have to change your tooling or application. TRD can provide a smaller bore 'MH' Series hydraulic cylinder that can be used as a drop-in, direct replacement to many large bore pneumatic cylinders. This saves you time and money by not having to retool as applications change over time.

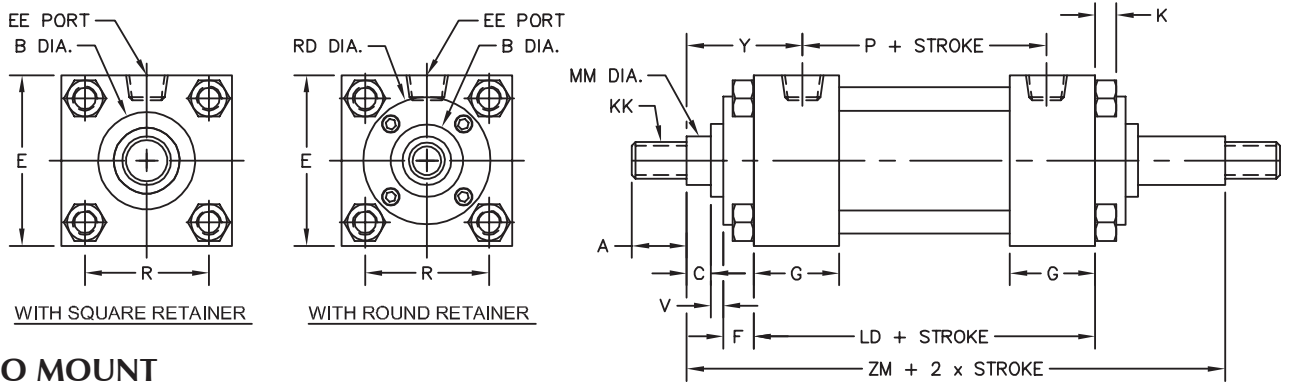


**Custom Rod Ends**

Each piston rod is made-to-order. Rod extensions are very low in cost and do not delay delivery. Custom machined rod ends can also be easily added to your cylinder!



# SERIES 'MH' DIMENSIONS: BASIC DOUBLE END (MX0 MOUNT)



## MX0D: NO MOUNT

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	A	B	C	EE		F	G	K	KK	R	③ RD	V	Y	ADD TO STROKE		ADD 2x STROKE
							NPTF	SAE									LD	P	ZM
1.50	0.625	1500	2.000	0.750	1.124	0.375	3/8	#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	3/8	#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	3/8	#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	1/2	#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	1/2	#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	2.875			8.500	
	2.000	1000		2.250	2.624	0.875							SQ	0.500	3.000			8.750	
	2.500	1000		3.000	3.124	1.000							SQ	0.625	3.250			9.250	
5.00	1.000	750	5.500	1.125	1.499	0.500	1/2	#10	0.625	1.750	0.438	4.109	2.750	0.250	2.375	5.000	3.000	7.750	
	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	0.500	3.000			9.000	
	2.500	1000		3.000	3.124	1.000							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	3/4	#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	
8.00	1.375	500	8.500	1.625	1.999	0.625	3/4	#12	0.750	2.000	0.563	6.438	3.500	0.250	2.750	5.625	3.375	8.875	
	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	

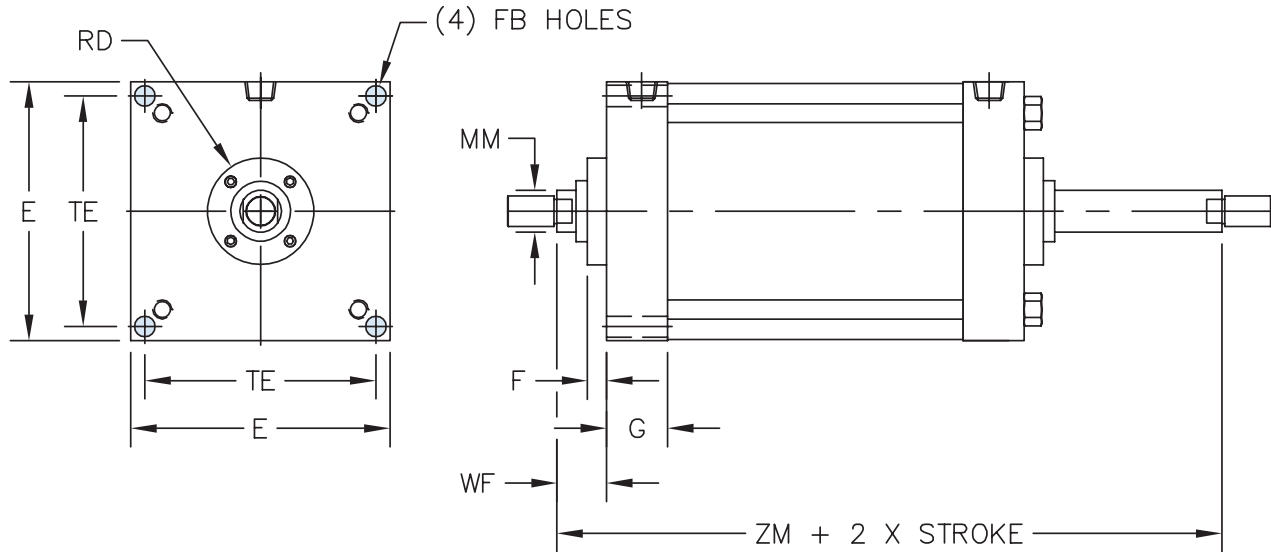
SEE ROD END DETAIL CHART ON PAGE 61

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



# SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

## ME3D: HEAD SQUARE MOUNTING HOLES



BORE	ROD DIA. (MM)	① MAX PSI RATING	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).

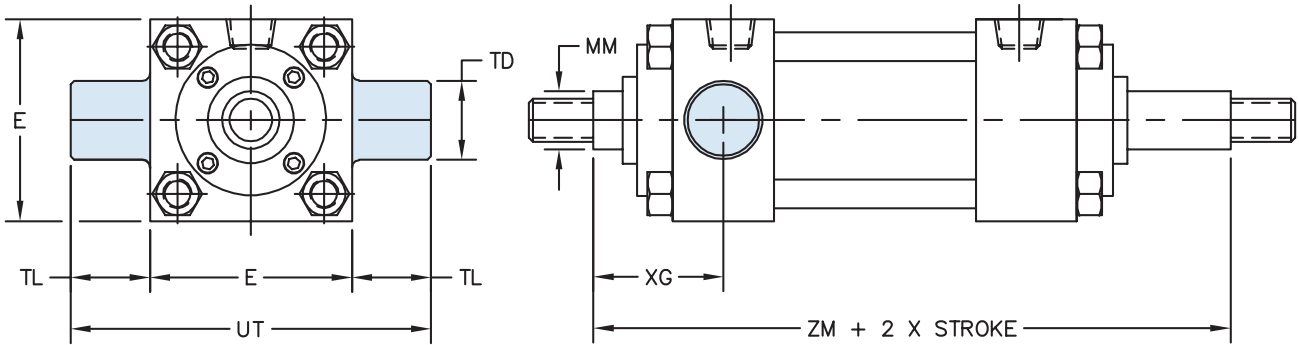
### Design Tips

TRD makes a full line of pneumatic rod locks that can be adapted to 'MH' Series hydraulic cylinders. By using multiple rod locks, higher holding forces can be achieved.

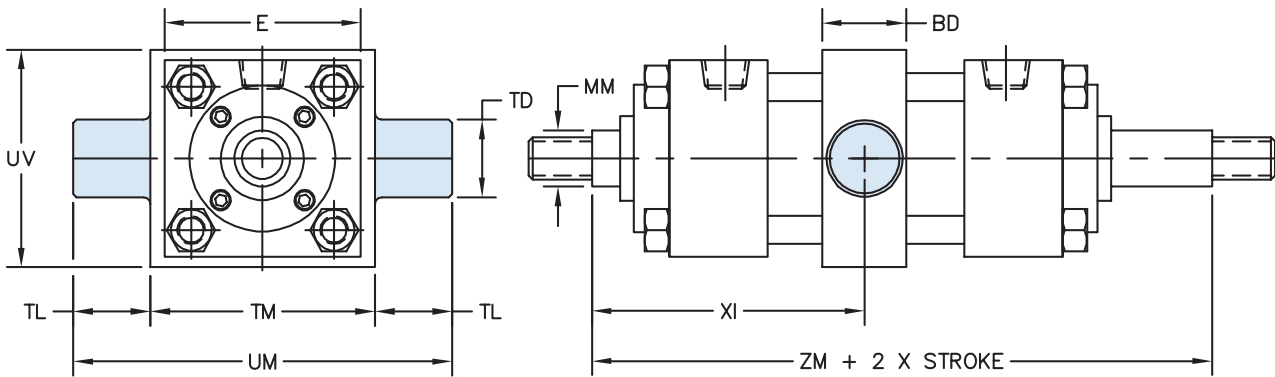


# SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

## MT1D: HEAD TRUNNION



## MT4D: INTERMEDIATE TRUNNION



**NOTE:**  
 'XI' DIMENSION TO BE SPECIFIED BY CUSTOMER

# SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	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
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

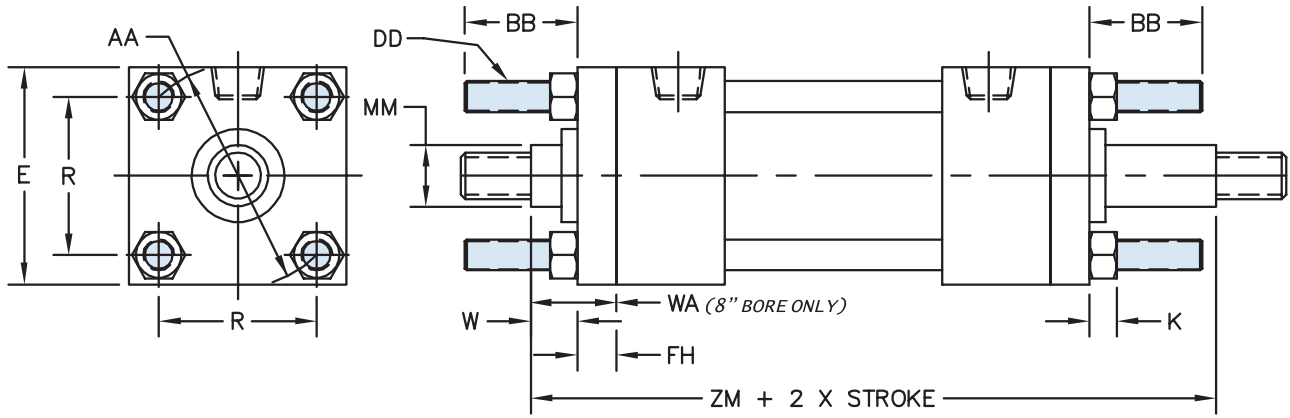
① Max pressure rating (NON-SHOCK).

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

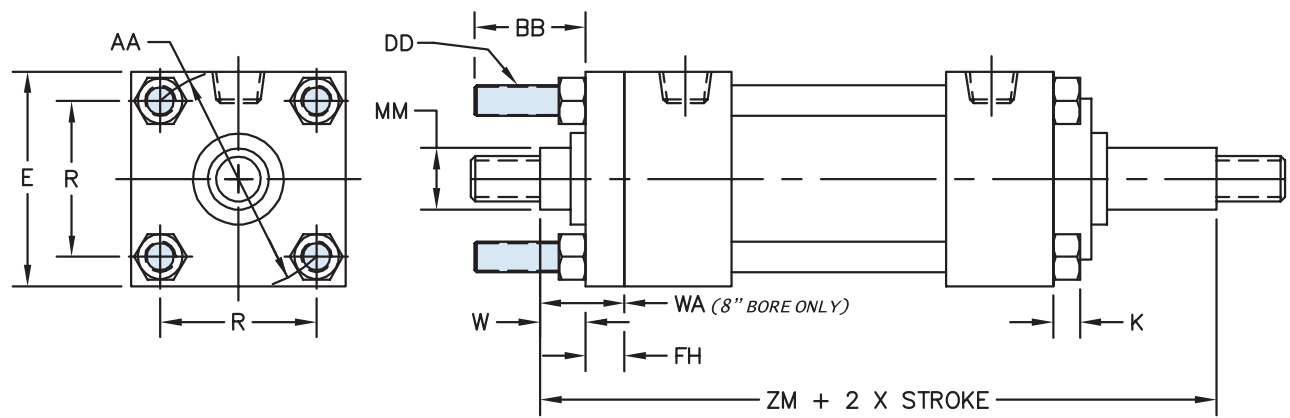
③ 'XI' dimension is the minimum that can be supplied and leaves 1/4" gap between head & trunnion block (customer to specify 'XI' dimension).

# SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

## MX1D: EXTENDED TIE RODS - HEAD & CAP



## MX3D: EXTENDED TIE RODS - HEAD END



# SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

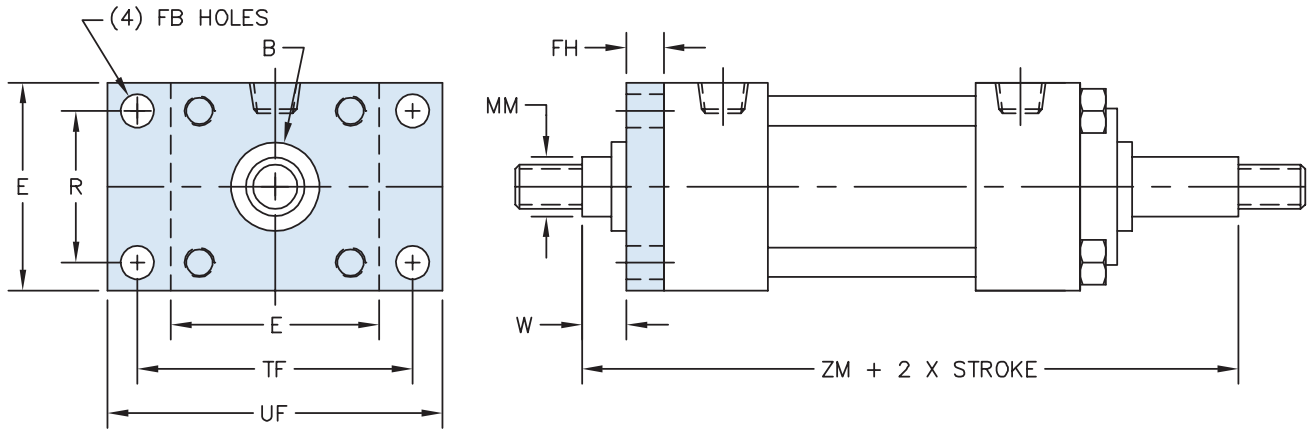
BORE	ROD DIA. (MM)	Ⓛ MAX PSI RATING	E	FH	AA	BB	DD	K	R	W or WA (8")	ADD 2x STROKE
											ZM
1.50	0.625	1500	2.000	0.375	2.020	1.000	1/4 - 28	0.250	1.430	0.625	6.125
	1.000	1500								1.000	6.875
2.00	0.625	1500	2.500	0.375	2.600	1.125	5/16 - 24	0.313	1.840	0.625	6.125
	1.000	1500								1.000	6.875
	1.375	1500								1.250	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								1.000	7.000
	1.375	1500								1.250	7.500
	1.750	1500								1.500	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								1.000	8.000
	1.750	1500								1.250	8.500
	2.000	1500								1.375	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								1.000	8.000
	1.750	1000								1.250	8.500
	2.000	1000								1.375	8.750
	2.500	1000								1.625	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								1.000	8.250
	1.750	1000								1.250	8.750
	2.000	1000								1.375	9.000
	2.500	1000								1.625	9.500
	3.000	1000								1.625	9.500
	3.500	1000								1.625	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								1.125	9.250
	2.000	750								1.250	9.500
	2.500	750								1.500	10.000
	3.000	750								1.500	10.000
	3.500	750								1.500	10.000
	4.000	750								1.500	10.000
	8.00	1.375								500	8.500
1.750		500	1.750	9.375							
2.000		675	1.875	9.625							
2.500		675	2.125	10.125							
3.000		675	2.125	10.125							
3.500		675	2.125	10.125							
4.000		675	2.125	10.125							
4.500		675	2.125	10.125							
5.000		675	2.125	10.125							
5.500		675	2.125	10.125							

Ⓛ Max pressure rating (NON-SHOCK).

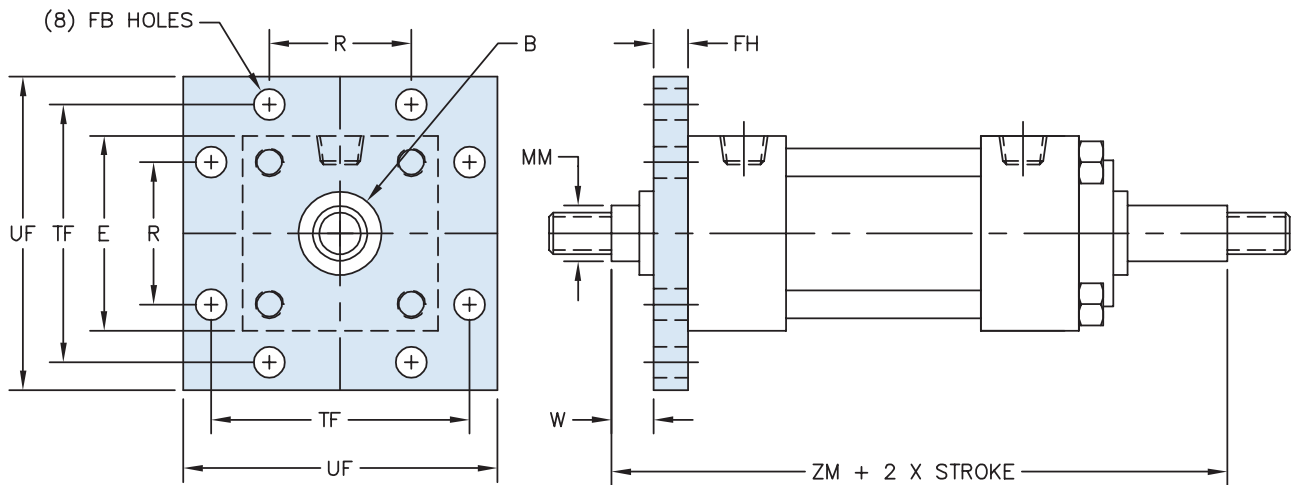
Ⓜ Round retainer used to retain bushing, not a full front plate as other bores. 'BB' is dimension from head on the 8.00" bore.

# SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

## MF1D: HEAD FLANGE



## MF5D: HEAD SQUARE FLANGE



HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 MH - Medium Duty Hydraulic  
 MH Options  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144



# SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

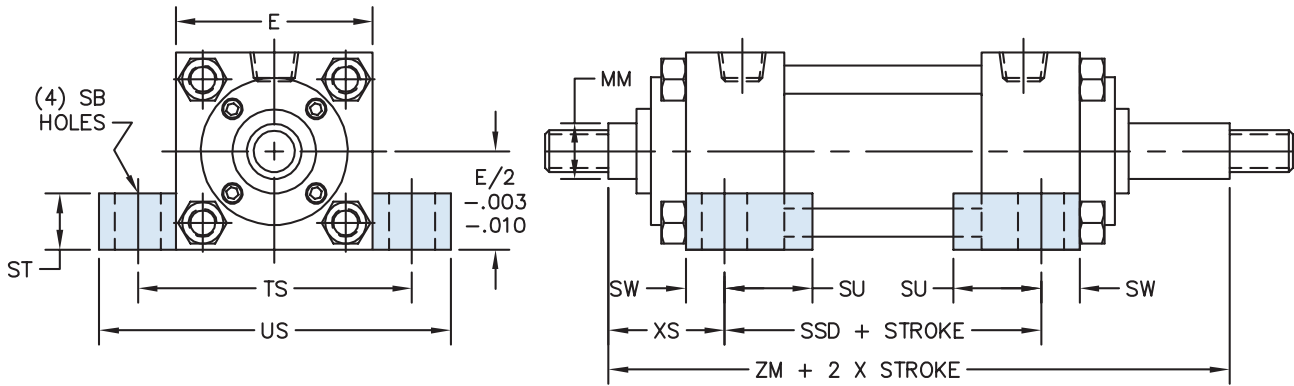
BORE	ROD DIA. (MM)	① MAX PSI RATING	② B	E	FB	FH	R	TF	UF	W	ADD 2x STROKE	
											ZM	
1.50	0.625	1500	1.124	2.000	0.313	0.375	1.430	2.750	3.375	0.625	6.125	
	1.000	1500	1.499								1.000	6.875
2.00	0.625	1500	1.124	2.500	0.375	0.375	1.840	3.375	4.125	0.625	6.125	
	1.000	1500	1.499								1.000	6.875
	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).

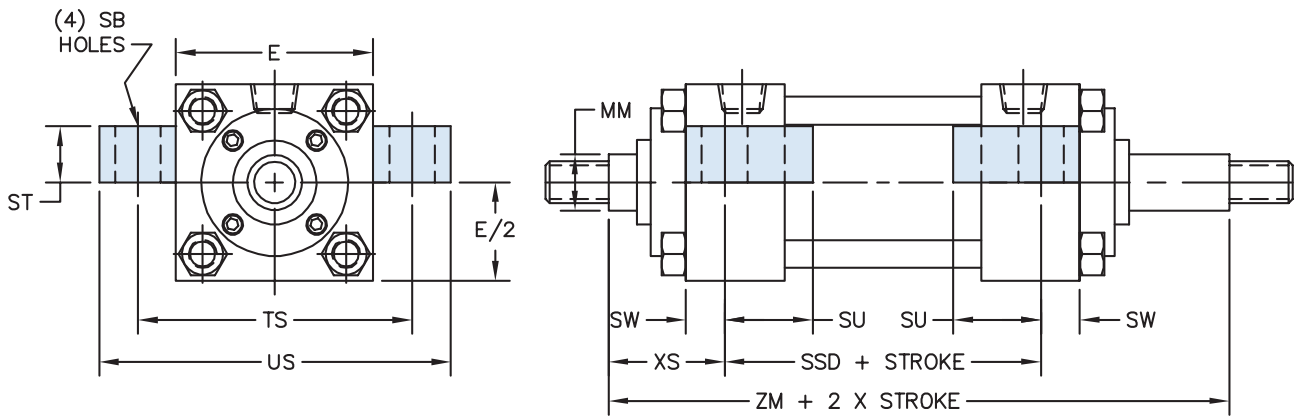
② 'B' dimension tolerance is +.000 / -.002

# SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

## MS2D: SIDE LUGS



## MS3D: CENTER LINE LUGS



HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 MH - Medium Duty Hydraulic  
 MH Options  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144

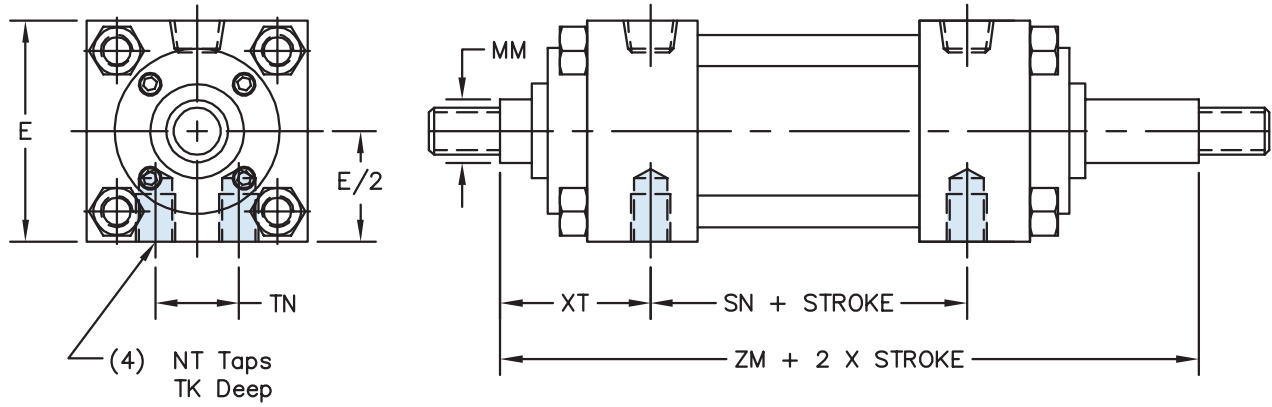
# SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIA. (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	0.813	1.000	1.313	0.688	9.875	11.250	2.313	4.250	8.875
	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

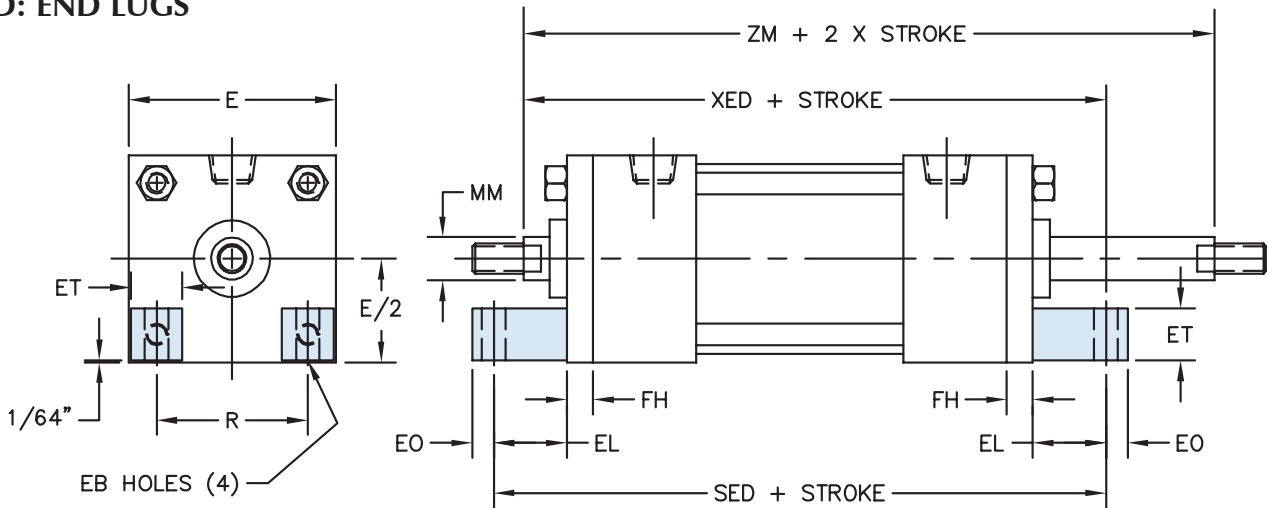
Ⓜ Max pressure rating (NON-SHOCK).

# SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

## MS4D: BOTTOM TAPPED HOLES



## MS7D: END LUGS



HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 MH - Medium Duty Hydraulic  
 MH Options  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144

# SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	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		N/A	N/A	N/A	2.313						6.813			6.875	
	1.375	1500		N/A	N/A	N/A	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		N/A	N/A	N/A	2.313						N/A		N/A	7.000	
	1.375	1500		N/A	N/A	N/A	2.563						N/A		N/A	7.500	
	1.750	1500		N/A	N/A	N/A	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		N/A	N/A	N/A	2.688						N/A		N/A	8.000	
	1.750	1500		N/A	N/A	N/A	2.938						N/A		N/A	8.500	
	2.000	1500		N/A	N/A	N/A	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		N/A	N/A	N/A	2.688						8.000			8.000	
	1.750	1000		N/A	N/A	N/A	2.938						N/A			N/A	8.500
	2.000	1000		N/A	N/A	N/A	3.063						N/A			N/A	8.750
	2.500	1000		N/A	N/A	N/A	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	3.125	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	6.438	4.500	1.250	2.813	3.250	7.875	8.375	8.875
	1.750	500											3.063			8.625	9.375
	2.000	675											3.188			8.750	9.625
	2.500	675		3.438	3.250	9.000	10.125										
	3.000	675		3.438	3.250	9.000	10.125										
	3.500	675		3.438	3.250	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).

# SERIES 'MH' BASIC OPTIONS

## Index To Standard Options:

	<u>PAGE</u>
• A= - Extended Piston Rod Thread . . . . .	92
• AS - Adjustable Stroke (Retract) . . . . .	92
• ABP= - Air Bleed Ports . . . . .	92
• C= - Extended Piston Rod . . . . .	92
• CS - Center Support . . . . .	93
• C or H - Cushions . . . . .	93
• DBB= - Drain Back Bushing . . . . .	93
• EK - Extended Key Plate . . . . .	93
• HLP - High Load Piston . . . . .	94
• HSS - High Shock Seals . . . . .	94
• KKX - Non-Standard Rod Threads . . . . .	94
• KK3M - Female Metric Rod Threads . . . . .	94

	<u>PAGE</u>
• KK3X - Female Special Rod Threads . . . . .	94
• LRB - Lift Ring Boss . . . . .	95
• Multiple Mounts . . . . .	96
• NR - Non-Rotating . . . . .	95
• PLS - Piston Lock Screw . . . . .	96
• Port Options (BSPP, BSPT, NPTF) . . . . .	96
• RBB - Rod Bushing - Bronze (Ductile Iron is Standard) . . . . .	96
• RLH - Rod Lock . . . . .	96
• SSR - Stainless Steel Piston Rod . . . . .	96
• Seals (Piston, Rod, Tube, Wiper) . . . . .	97
• ST - Stop Tube . . . . .	98
• XX - Special Modifications . . . . .	97

## Uncommon Options:

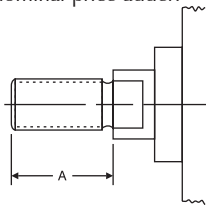
	<u>PAGE</u>
• 3-Position Cylinders . . . . .	100
• Back To Back Cylinders . . . . .	100
• Tandem Cylinders . . . . .	100

	<u>PAGE</u>
• Paint and Other Special Finishes . . . . .	100

### 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.

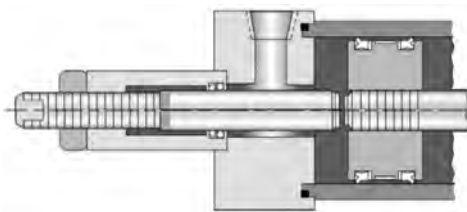


### AS Adjustable Stroke (Retract)

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").

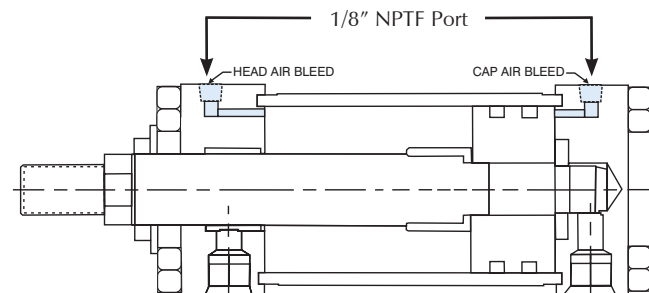
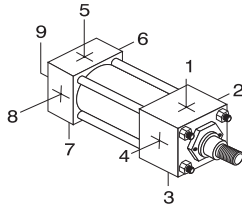
ADJUSTABLE STROKE	
BORE	MAX "AS"
1.50	Up to 8 inch
2.00-3.25	Up to 6 inch
4.00-6.00	Up to 5 inch
8.00	Up to 4 inch



### ABP= Air Bleed Ports

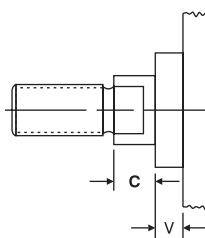
Air bleeds can be provided at either or both ends of the cylinder. Air bleeds should be located at the highest point in the cylinder for maximum effectiveness. The location needs to be specified, similar to port locations.

**Example: ABP=15**  
(Air Bleed ports at position 1 & 5) Location 9 is center of cap face.



### 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.



# SERIES 'MH' BASIC OPTIONS

## CS

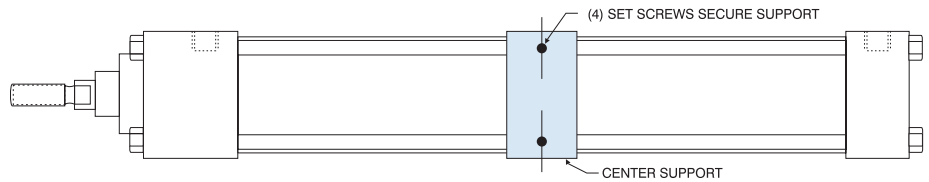
### Center Supports

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 TRD 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	



## Cushions

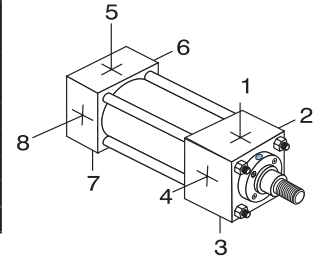
TRD's cushion design features industry proven technology and ultra fine adjustment needles for perfect deceleration and long life. Cushion adjustment needle positions need to be specified.

**Example: H2C6**

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

STANDARD CUSHION LOCATIONS	
MOUNT	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



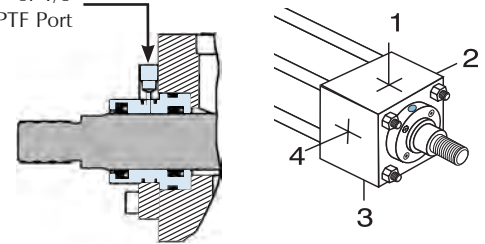
## DBB=

### Drain Back Bushing

When oil leakage cannot 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.

**Example: DBB=1** (drain port at position 1)

1/16" or 1/8" NPTF Port



## EK

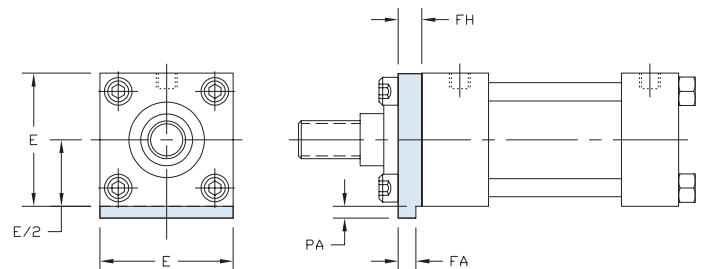
### Extended Key Plate

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: MH - 1.50" to 6.00" Bore

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



# SERIES 'MH' BASIC OPTIONS

## High Load Piston

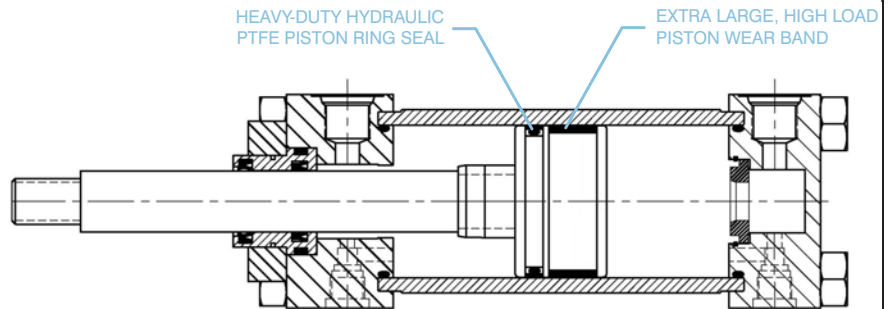
Long stroke cylinders and pivot type mounting can create severe cylinder piston-to-tube side loads. The high load piston option provides increased side load capacity without increasing the cylinder base dimensions.

### Design Benefits

- Bi-direction piston seal offers low to zero leakage rating.
- Piston seal design offers lower friction than cast iron rings or lip seals, which eliminate stick/slip breakaway issues.
- Glass filled PTFE piston seal is 20% stronger than bronze filled seals.
- High contamination tolerant; offers the longest life of any seal type.
- Temperature Rating: -20°F to 200°F (-29°C to 93°C)
- Other temperature ratings are available; contact TRD for more information

**High Load Piston Wear Band** - Our superior design is 35% to 80% wider than competitive models and we locate the wearband at the furthest point from the rod bearing to increase overall effectiveness.

**Piston Ring Seal** - Glass filled PTFE with Nitrile expander.

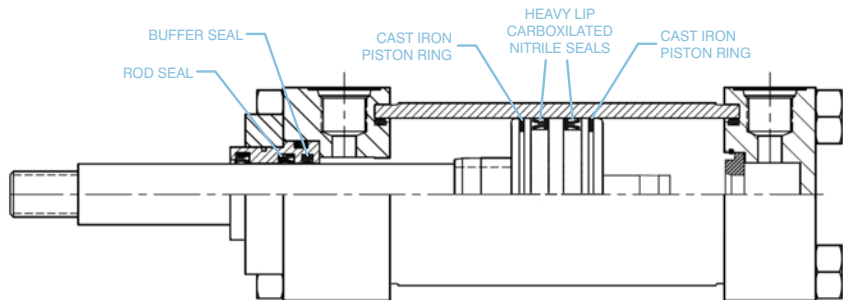


## HSS High Shock Seals

High shock seal option provides shock protection to the rod and piston seal.

**Piston Seal** - Consists of (2) bidirectional sealing, step-cut, cast iron piston rings to buffer the shock and (2) heavy-lip design Carboxylated Nitrile seals (with back-up rings), to provide near leak-free operation.

**Rod Seals** - Consists of a buffer seal to handle the shock and a double lip polyurethane block vee seal for leak free operation.



## KKX Non-Standard Rod Threads

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

**Ordering Example:** MH - MF1 - 150 X 24 - 100 - **KKX** - 7/8 - 9UNC - P15 = N375 - SSSS

↑ Add special thread to part number

## KK3M Female Metric Rod Threads

Equipment that is imported to the United States will typically contain metric tie-rod cylinders. In general, ISO 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.

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

**Ordering Example:** MH - MF1 - 150 X 24 - 100 - **KK3M** = M8 X 1 - P15 = N375 - SSSS

## KK3X Female Special Rod Threads

TRD can machine a wide range of female rod threads. Standard NFPA rod threads are UNF (fine), class 2 threads. Common alternative choices are UNC (coarse) threads.

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

**Ordering Example:** MH - MF1 - 150 X 24 - 100 - **KK3X** = 1 - 8 - P15 = N375 - SSSS

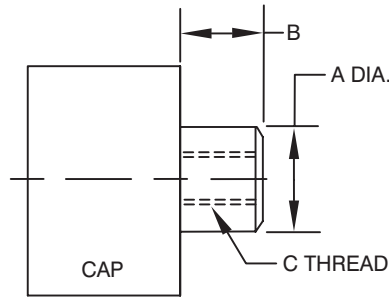
# SERIES 'MH' BASIC OPTIONS

## LRB Lift Ring Boss

A steel, tapped lug is welded to the center of the cylinder cap.

UNC coarse threads are provided to accept high load type lifting eyes (lift eyes are not provided).

Not available on MF2, MF6, ME6, MP1 & SB mounts.



LIFT LUG DIMENSIONS				
BORE	A	B	C	STRAIGHT PULL LIFTING CAPACITY*
1.50	1.120	1.000	1/2-13	2500
2.00	1.500	1.250	5/8-11	4000
2.50	1.500	1.250	5/8-11	4000
3.25	2.000	1.500	3/4-10	6000
4.00	2.000	1.500	3/4-10	6000
5.00	2.000	1.500	3/4-10	6000
6.00	2.500	2.000	1-8	9000
8.00	2.500	2.000	1-8	9000

\*Lifting capacity is the maximum capacity for intermittent lifting and placement of cylinder only. It is NOT intended to be used as the primary cylinder mount.

## 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

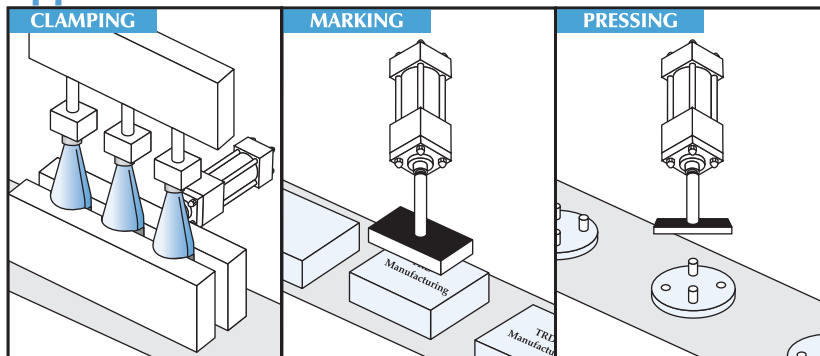
- Eliminates the need for external guide shafts in many positioning applications
- Guide rods are internal, self-cleaning and not subjected to harsh cleaners
- Compact design saves space; no larger than standard NFPA cylinders!
- Durable, self-contained construction



AVAILABLE BORE SIZES WITH 'NR' GUIDE ROD SIZES AND MAX STROKE		
BORE	ROD DIA. (MM)	CUSHIONS
4.00	1.000 & 1.375	No Cushions
5.00	1.000, 1.375, 1.750 & 2.000	Cap Cushions Only
6.00	1.375 - 3.000	Both Cushioned (3.000" Rod - Cap Only)
8.00	1.375 - 3.500	Both Cushioned (3.500" Rod - Cap Only)

Note: Cushions restricted by some mounts on ALL bore and rod sizes.

### Application Possibilities:

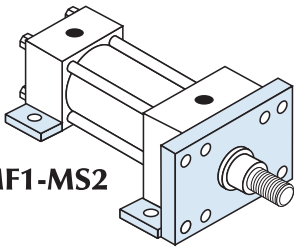


# SERIES 'MH' BASIC OPTIONS

## MULTIPLE MOUNTS

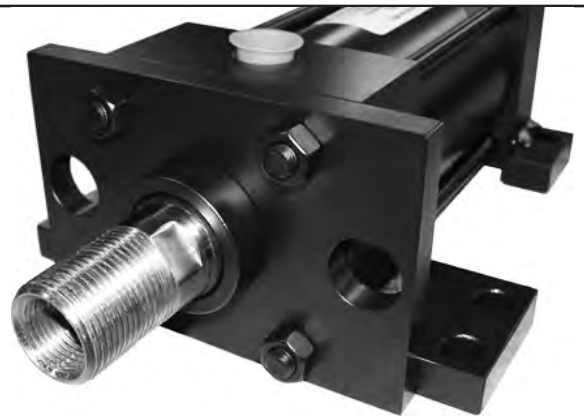
Cylinders can be furnished with a wide selection of multiple mounts.

Ordering Example: MH - MF1 - MS2 - 250 X 12 - 100 - KK1 - P15 = N375 - SSSS



MF1-MS2

↑ Add additional mount to part number

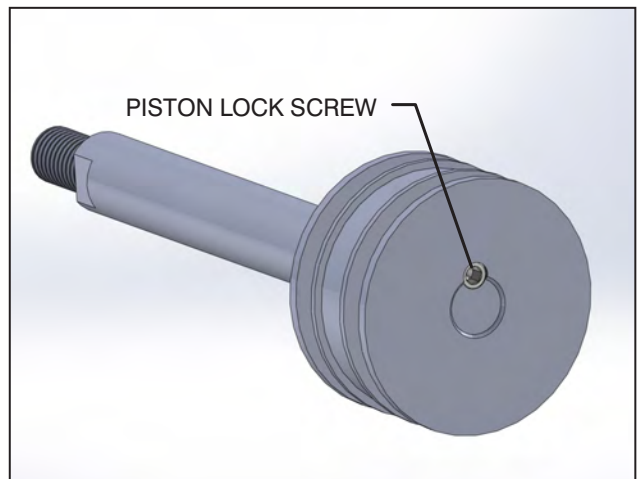


## PLS *Piston Lock Screw* (For higher shock load applications)

Hydraulic cylinders develop high forces and can also be subjected to severe shock loads in demanding applications due to piston-to-end cap impact. The Piston Lock Screw acts as a shear pin between the piston and rod threads, eliminating any chance of a piston coming loose from the rod.

All TRD hydraulic cylinders use a specified torque with a permanent anaerobic thread lock/sealant to secure pistons to the piston rod; threads are then staked. This standard connection method has proven to be very effective in almost all applications. However, in severe shock load applications, the piston lock screw option provides a 100% positive connection that cannot come apart.

Note: Also referred to as Dutch Key or Skotch Key.



PISTON LOCK SCREW

## PORT OPTIONS

Cylinders can be furnished with NPTF or SAE O-Ring Boss (SAEJ514) ports at no-charge.

Cylinders can be furnished with BSPP or BSPT for additional cost.

### BSPT *British Standard Pipe Taper*

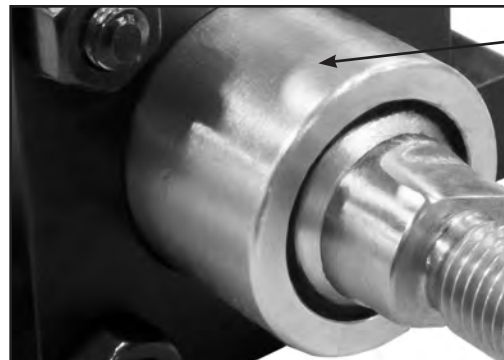
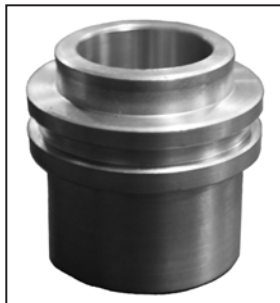
British Standard Pipe Taper (BSPT) threads have the same taper as American NPT tapered threads, but use a 55° Whitworth thread form and different diameters. (Not interchangeable with NPT)

### BSPP *British Standard Pipe Parallel*

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

## RBB *Bronze Rod Bushings*

Cylinders can be furnished with bronze rod bushings (standard material: 150,000 PSI ductile iron, PTFE coated).



Bronze Rod Bushing

HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 MH - Medium Duty Hydraulic  
 MH Options  
 TAS - Heavy Duty Pneumatic  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144

# SERIES 'MH' BASIC OPTIONS

## SSR 17-4 Stainless Steel Hard Chrome Plated Piston Rod

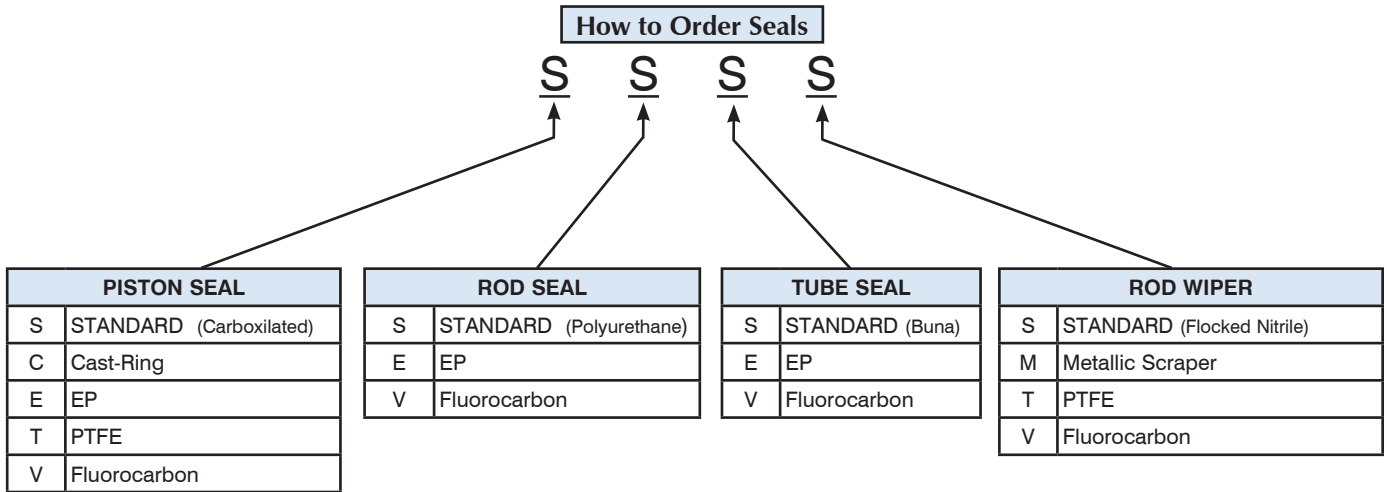
Cylinders can be furnished with hard chrome plated stainless steel piston rods.

100,000 min. yield (rods up to 5.00)  
75,000 min. yield (5.500 rod)

## SEALS

The 'HH' 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 Standard Seals

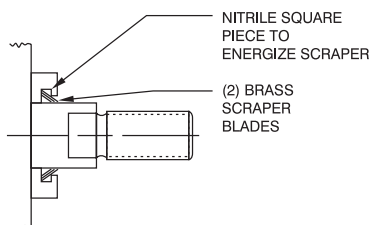
Piston: Carboxilated Nitrile      Rod Seal: Polyurethane  
Tube Seals: Buna      Rod Wiper: Flocked Nitrile  
Temperature Rating: -20°F to 200°F (-29°C to 93°C)  
Compatible with: Mineral based hydraulic fluids

### C Cast Iron Piston Rings

Temperature Range: -20°F to 200°F (-29°C to 93°C)  
Compatible with: Virtually all fluids  
Uses: Hydraulic shock protection

### M Metallic Rod Scraper

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



### E Ethylene Propylene

Temperature Rating: -50°F to 300°F (-45°C to 149°C)  
Compatible with: Most Phosphate Ester (Skydrol 500 and 7000, type 2) fluids

### T Glass Filled PTFE

Temperature Rating: -100°F to 400°F (-73°C to 204°C)  
Compatible with: All hydraulic fluids and almost any fluid.  
Contact TRD for specific compatibility.  
Use: Low friction and high side load

### V Fluorocarbon

Temperature Rating: 0°F to 300°F (-18°C to 149°C)  
(Up to 400°F with reduced service life)  
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

### XX Special

Non-standard seals can be furnished.  
[Contact TRD for more information.](#)



# SERIES 'MH' BASIC OPTIONS

HH - Heavy Duty Hydraulic

HH Rod Lock

MH - Medium Duty Hydraulic

MH Options

TAS - Heavy Duty Pneumatic

Accessories Page 130

STROKEMASTER Page 136

Technical Data Page 144

## ST Stop Tube and Rod Size Selection

Stop tubes are designed to reduce the piston rod bushing stress to within the designed range of the bearing material. This will ensure proper cylinder performance in any given application. Stop tubes lower the cylinder bearing stress by adding length to the piston, which increases the overall length of the cylinder (Note: TRD uses a double piston design when possible).

### Stop Tube Selection

To determine the proper amount of stop tube for your application, you must first find the value of "D", which represents the stroke (*adjusted for mounting condition*). Each mounting condition creates different levels of bushing stress, which has direct impact on the amount of stop tube required (see Chart 1).

Once the value of "D" is known, refer to Chart 2 for the recommended amount of stop tube.

#### To order a stop tube:

- Add the stop tube prefix "ST=" and the stop tube length to the cylinder model number.
- Add "ES" after the cylinder stroke to indicate that the stroke is the effective stroke.

#### Example:

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

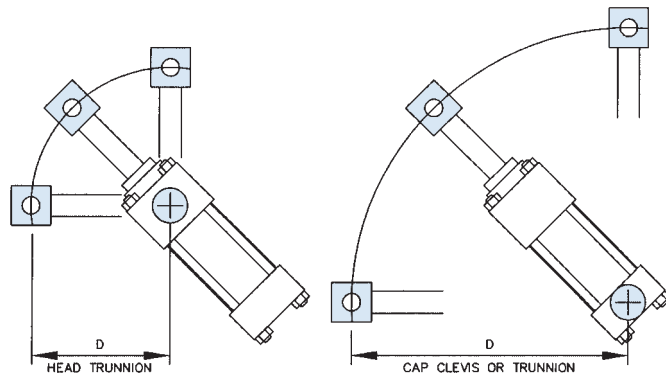
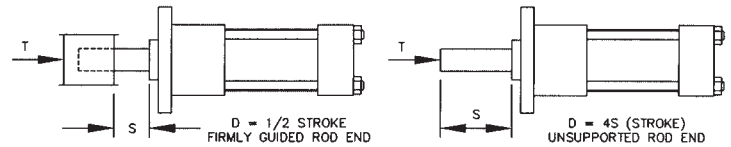
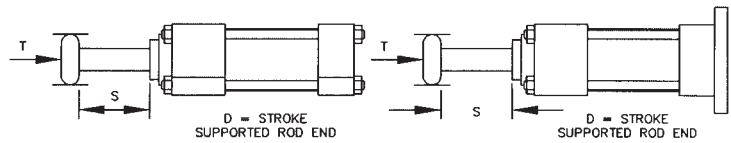
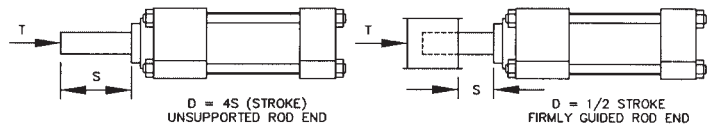
### Chart 1

Find the value of "D" for your application

"D" = Stroke, adjusted for mounting condition

"S" = Actual cylinder stroke

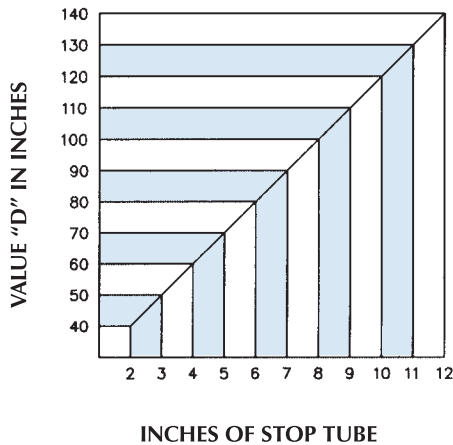
"T" = Axial thrust (refer to Chart 3)



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

### Chart 2

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



Refer to page 99 for Rod Size Selection Chart



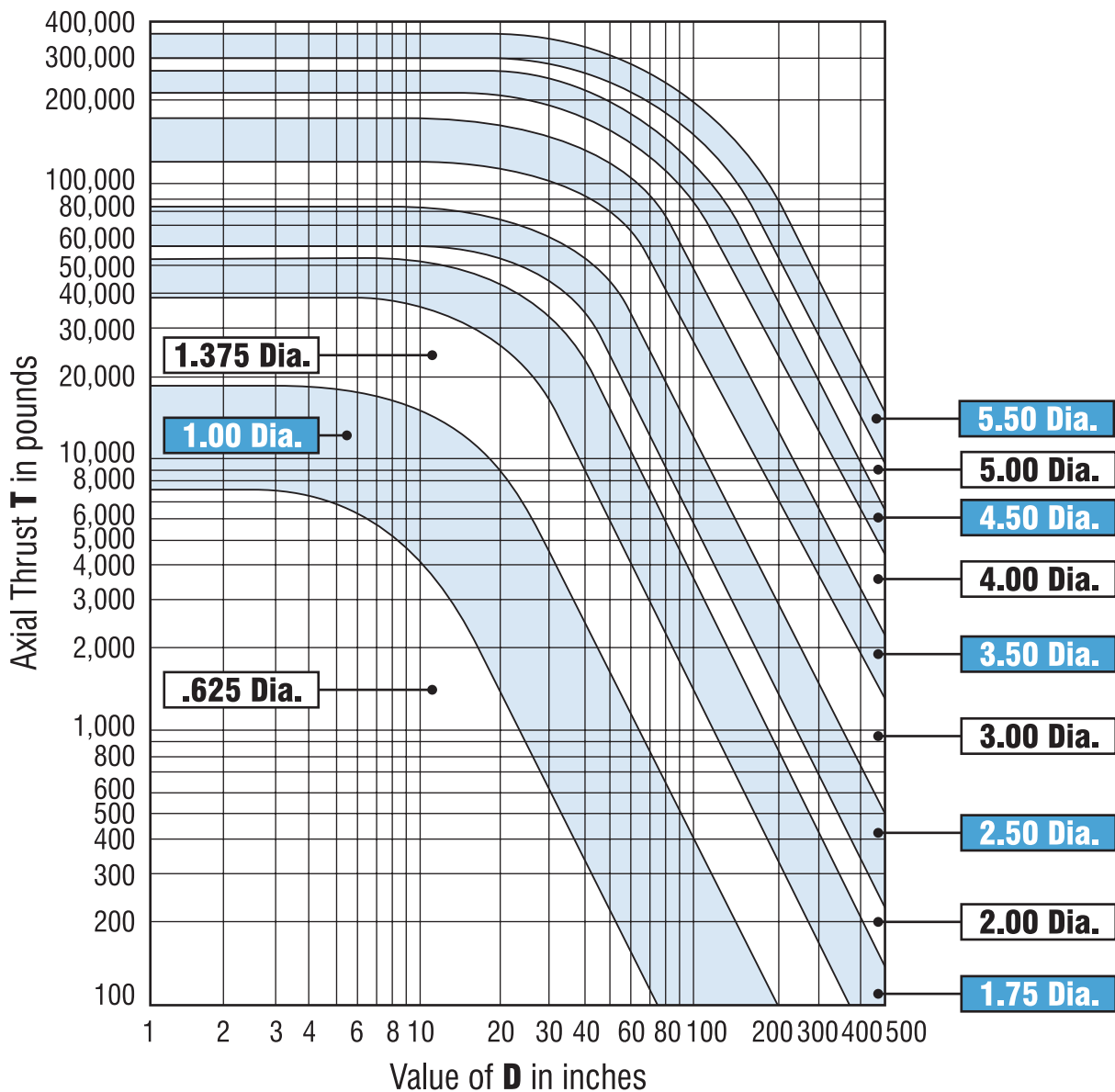
# SERIES 'MH' BASIC OPTIONS

## 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 page 151 for cylinder force chart.*
2. From page 98, 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)**



# SERIES 'MH' UNCOMMON OPTIONS

## 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 three 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 TRD for more information.

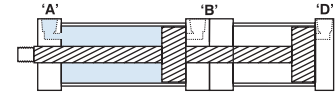
## 3-POSITION CYLINDERS

### HOW THEY WORK

■ = PRESSURE

#### POSITION 1 (RETRACT)

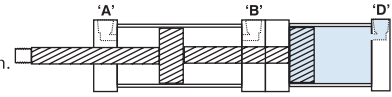
Pressure to port 'A' fully retracts cylinder.



(RETRACT)

#### POSITION 2 (MID-STROKE)

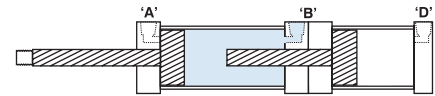
Pressure to port 'D' advances cylinder to mid-stroke position.



(MID-STROKE)

#### POSITION 3 (EXTEND)

Pressure to port 'B' fully extends cylinder.

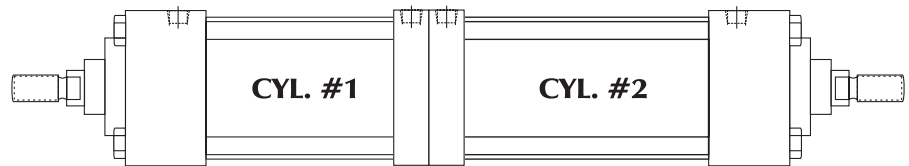


(EXTEND)

## BTB Back-To-Back Cylinders

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

Contact TRD for more information.

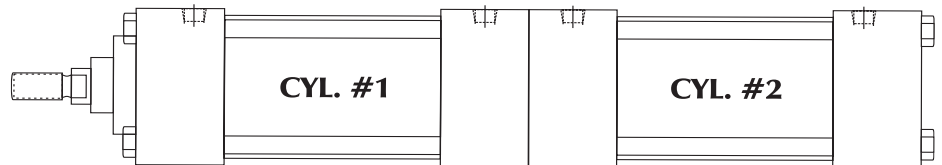


## TM Tandem Cylinders

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

**Note: Piston rods are connected.**

Contact TRD for more information.



## 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:** TRD can provide paint in any color or type.

**Additional Finishes:** TRD can provide special finishes, i.e. Nutride Plate Heavy Chrome Plated Piston Rods.

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



# TAS Series

## Medium Duty

## Industrial Pneumatic

1.50" to 8.00" Bore

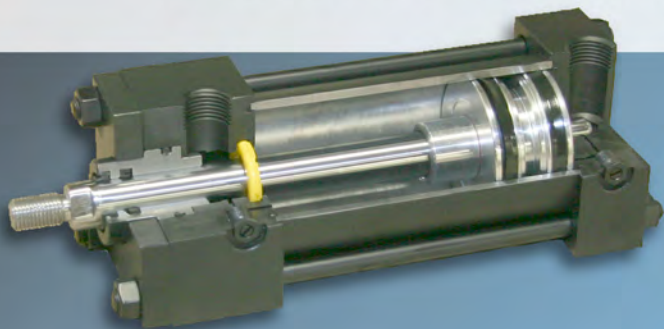
Single Rod End

Page 103



Double Rod End

Page 114



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

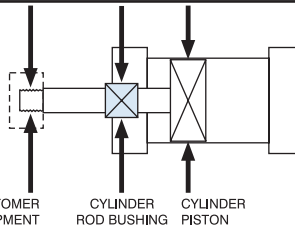


# SERIES 'TAS' (NFPA) CYLINDER

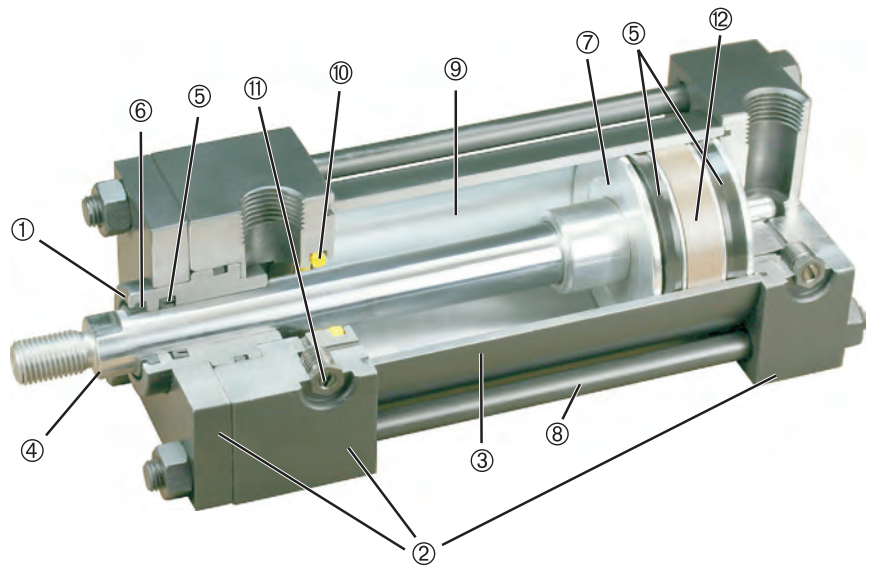
## Floating Rod Bushing

### SELF ALIGNMENT FEATURE

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



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



## HEAVY-DUTY DESIGN FOR RELIABLE, CONSISTENT OPERATION

- ① **FLOATING ROD BUSHING** – Precision machined from 150,000 PSI rated graphite filled cast iron and PTFE coated to reduce friction and extend cycle life. Bushing design traps lubrication in effective bearing area.
- ② **HEAD, CAP & RETAINER** – Precision machined steel head, cap and retainer are held to close tolerances and insure accurate alignment for a truly square cylinder.
- ③ **CYLINDER TUBE** – Precision machined steel tube with hard chrome I.D., is honed and micro finished for extended seal life and improved cycle rates.
- ④ **PISTON ROD** – Precision machined from high yield, polished and hard chrome plated steel.
- ⑤ **PISTON & ROD SEALS** – Heavy lip design Carboxilated Nitrile construction. Seals are pressure activated and wear compensating for long life (self-lubricating material).
- ⑥ **ROD WIPER** – Abrasion resistant urethane provides aggressive wiping action in all environments. External lip design prevents debris from entering cylinder.
- ⑦ **PISTON** – Precision machined from 6061-T651 alloy

aluminum, provides an excellent bearing surface for extended cylinder life.

- ⑧ **TIE RODS** – Pre-stressed high carbon steel tie rod construction eliminates axial loading of cylinder tube and maintains compression on tube and end seals.
- ⑨ **PERMANENT LUBRICATION** – Permanently lubricated with Magnalube-G PTFE based grease on all internal components. This is a non-migratory type high performance grease providing outstanding service life. No additional lubrication is required.
- ⑩ **CUSHIONS** – (Options H & C) Floating cushion seal designed for maximum cushion performance, quick return stroke break-away and extended life.
- ⑪ **CUSHION ADJUSTMENT NEEDLE** – Adjustable steel needle design has fine thread metering and is positively captured to prevent needle ejection during adjustment.
- ⑫ **WEAR BAND** – 90% Virgin PTFE and 10% Polyphenylene Sulfide material provides extended life due to extremely low wear factor.

**FINISH** – Black urethane paint.

### 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:

- **BP** – Bumper piston seals allow higher piston velocities due to rapid deceleration feature, increasing productivity.
- **ST** – Stop tubes are used to reduce rod bearing and piston stress (refer to page 125 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.
- **NR** – Non-rotating option incorporates (2) internal guide rods preventing rod rotation (NFPA dimensions).

# HOW TO ORDER: SERIES 'TAS' (HEAVY-DUTY STEEL CYLINDERS)

**TAS** - **MF1** - **2.50** x **10** - **HC** - **KK3**

SERIES	BORE	STROKE	CUSHIONS	OPTIONS
TAS 250 PSI AIR	1.50 2.00 2.50 3.25 4.00 5.00 6.00 8.00	0" to 120" Made to Order	H HEAD CUSHION POSITION 2 IS STANDARD SPECIFY FOR POSITIONS: 1, 3 & 4 LH LONG HEAD CUSHION POSITION 2 IS STANDARD SPECIFY FOR POSITIONS: 1, 3 & 4 C CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8 LC LONG CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8 FIXED CUSHIONS FCH FIXED HEAD CUSHION (NON-ADJUSTABLE, NO ADJUSTMENT NEEDLE) FCC FIXED CAP CUSHION (NON-ADJUSTABLE, NO ADJUSTMENT NEEDLE) FC FIXED HEAD AND CAP CUSHION (NON-ADJUSTABLE, NO ADJUSTMENT NEEDLE)	<b>ADDS LENGTH TO CYLINDER - "OPTION LENGTH ADDER" CHART BELOW.</b> A = EXTENDED PISTON ROD THREAD (Example: A = 2") AS ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, Example: AS = 4") A / O AIR / OIL PISTON B 0.250" URETHANE BUMPER BOTH ENDS BC 0.250" URETHANE BUMPER CAP ONLY BH 0.250" URETHANE BUMPER HEAD ONLY BP BUMPER PISTON SEALS (1.50" - 8" 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") 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") KK10 ROD COUPLER END KKM METRIC THREAD KKX NON-STANDARD THREAD LF LOW FRICTION SEALS (Refer to page 121 for specifications) MA MICRO-ADJUST (6" MAX. STROKE) Available on Double Rod End Models MAB MICRO-ADJUST WITH SOUND DAMPENING BUMPER (6" MAX. STROKE) MS METALLIC ROD SCRAPER (BRASS CONSTRUCTION) NR NON-ROTATING (Refer to page 122 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) SSA STAINLESS STEEL PISTON ROD, TIE RODS & NUTS, AND FASTENERS SSC STAINLESS STEEL CUSHION NEEDLES SSF STAINLESS STEEL FASTENERS SSR STAINLESS STEEL PISTON ROD SST STAINLESS STEEL TIE RODS & NUTS X ST STOP TUBE NOTE: Specify STOP TUBE length (in inches) Specify Stroke as ES (effective stroke) (Example: TAS MS4 2 X 24ES-ST=3") TH 400 PSI HYDRAULIC NON-SHOCK (Refer to page 124 for specifications) 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)
ME3 FRONT MOUNTING HOLES (8.00" Bore)
ME4 REAR MOUNTING HOLES (8.00" Bore)
MP1 REAR PIVOT CLEVIS (1.50"- 8.00" Bore)
MP2 REAR PIVOT CLEVIS (1.50"- 6.00" Bore)
MP4 REAR PIVOT EYE (1.50"- 6.00" Bore)
MS1 FRONT & REAR END ANGLE (1.50"- 8.00" Bore)
MS2 SIDE LUG (1.50"- 8.00" Bore)
MS4 BOTTOM TAPPED HOLES (1.50"- 8.00" Bore)
MT1 FRONT TRUNNION (1.50"- 8.00" Bore)
MT2 REAR TRUNNION (1.50"- 8.00" Bore)
MT4 INTERMEDIATE TRUNNION (1.50"- 8.00" Bore)
MX0 NO MOUNT (1.50"- 8.00" Bore)
MX1 EXTENDED TIE RODS - HEAD & CAP (1.50"- 8.00" Bore)
MX2 EXTENDED TIE RODS (CAP) (1.50"- 8.00" Bore)
MX3 EXTENDED TIE RODS (HEAD) (1.50"- 8.00" Bore)
SB SPHERICAL BEARING CAP PIVOT (1.50"- 8.00" Bore)

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

**Note:** "L" CUSHION OPTION CAN BE ORDERED AS FIXED CUSHIONS.  
**Example:** FCLH

## 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.

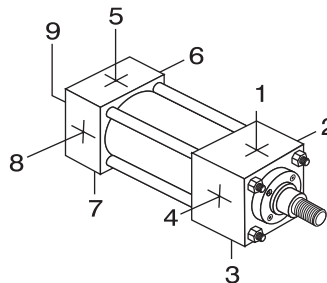
**Part Number:** TAS-MF1-2.50 x 10-HC

OPTION LENGTH ADDER (ADD TO CATALOG BASIC OVERALL LENGTH DIMENSIONS)				
BORE	OPTION			
	B	BC	BH	ST* (STOP TUBE) Example: ST=2
1.50	0.500	0.250	0.250	2
2.00	0.500	0.250	0.250	2
2.50	0.500	0.250	0.250	2
3.25	0.500	0.250	0.250	2
4.00	0.500	0.250	0.250	2
5.00	0.500	0.250	0.250	2
6.00	0.500	0.250	0.250	2
8.00	0.500	0.250	0.250	2

\*Note: The desired stop tube length adds directly to the overall cylinder length.

## STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

- Ports - Positions 1 and 5
- Cushion Adjustment - Positions 2 and 6
- Specify Non-Standard Positions When Ordering
- Port Location 9 is Center of Cap Face.

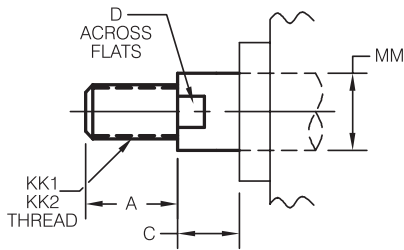


## NFPA MOUNTS

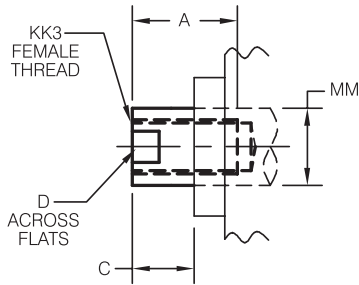
 1.50"-6.00" Bores	 1.50"-6.00" Bores	 8.00" Bore	 8.00" Bore	 1.50"-8.00" Bores	 1.50"-6.00" Bores
 1.50"-6.00" Bores	 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-8.00" Bores
 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-8.00" Bores	 1.50"-8.00" Bores

# SERIES 'TAS' DIMENSIONS: THREADS

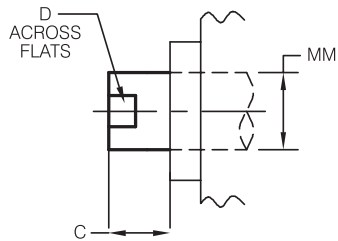
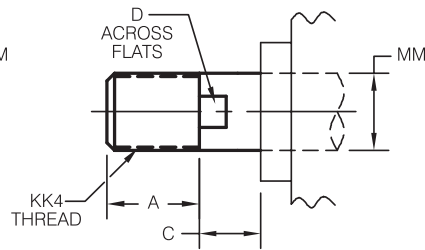
ROD END STYLE:  
KK1  
KK2



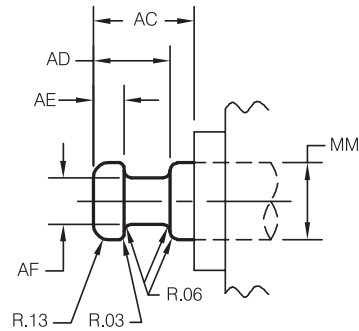
ROD END STYLE:  
KK3



ROD END STYLE:  
KK4



ROD END STYLE:  
KK5

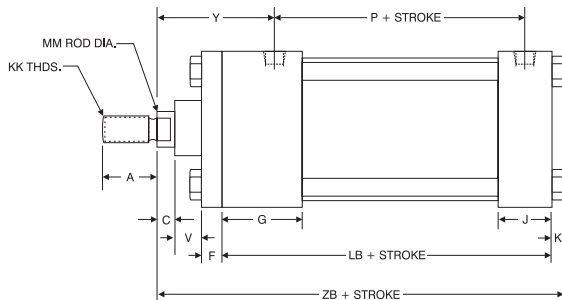
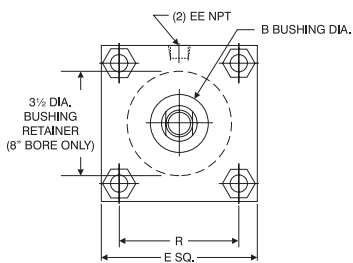


ROD END STYLE:  
KK10

ROD DIA. (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4
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

(4) Wrench flats are an option.

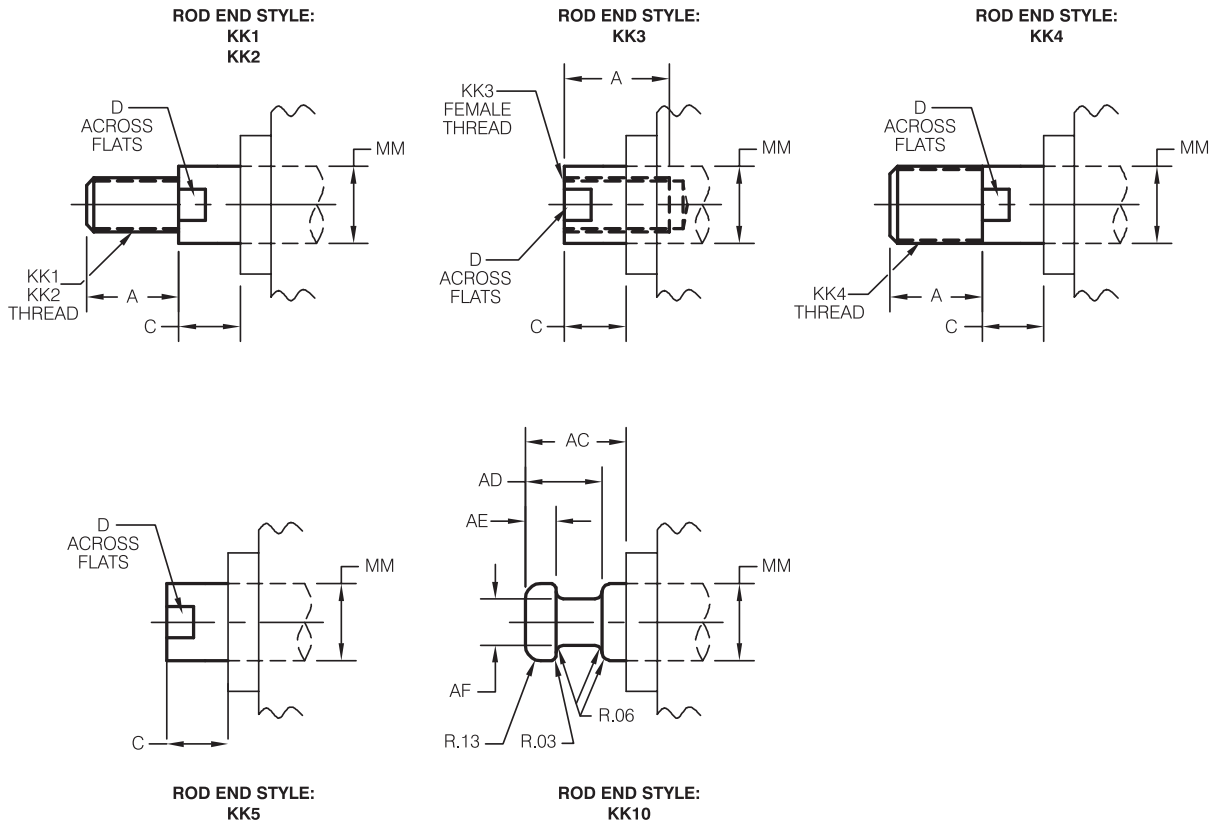
# SERIES 'TAS' DIMENSIONS: BASIC CYLINDER (NO MOUNT)



BORE	ROD DIA. (MM)	A	B	C	E	EE	F	G	J	K	KK	MM	R	V	Y	ADD TO STROKE		
																LB	P	ZB
1.50	0.625	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16 - 20	0.625	1.438	0.250	1.875	3.625	2.375	4.875
	1.000	1.125	1.500	0.500							3/4 - 16	1.000		0.500	2.250			5.250
2.00	0.625	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	7/16 - 20	0.625	1.844	0.250	1.875	3.625	2.375	4.938
	1.000	1.125	1.500	0.500							3/4 - 16	1.000		0.500	2.250			5.313
2.50	0.625	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.313	7/16 - 20	0.625	2.188	0.250	1.875	3.750	2.500	5.063
	1.000	1.125	1.500	0.500							3/4 - 16	1.000		0.500	2.250			5.438
3.25	1.000	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.375	3/4 - 16	1.000	2.766	0.250	2.375	4.250	2.750	6.000
	1.375	1.625	2.000	0.625							1 - 14	1.375		0.375	2.625			6.250
4.00	1.000	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.375	3/4 - 16	1.000	3.328	0.250	2.375	4.250	2.750	6.000
	1.375	1.625	2.000	0.625							1 - 14	1.375		0.375	2.625			6.250
5.00	1.000	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.438	3/4 - 16	1.000	4.109	0.250	2.375	4.500	3.000	6.313
	1.375	1.625	2.000	0.625							1 - 14	1.375		0.375	2.625			6.563
6.00	1.375	1.625	2.000	0.625	6.500	0.750	0.750	2.000	1.500	0.438	1 - 14	1.375	4.875	0.250	2.750	5.000	3.250	7.063
	1.750	2.000	2.375	0.750							1 1/4 - 12	1.750		0.375	3.000			7.313
8.00	1.375	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.500	0.563	1 - 14	1.375	6.438	0.375	2.750	5.125	3.375	7.313
	1.750	2.000	2.375	0.750							1 1/4 - 12	1.750		0.500	3.000			7.563



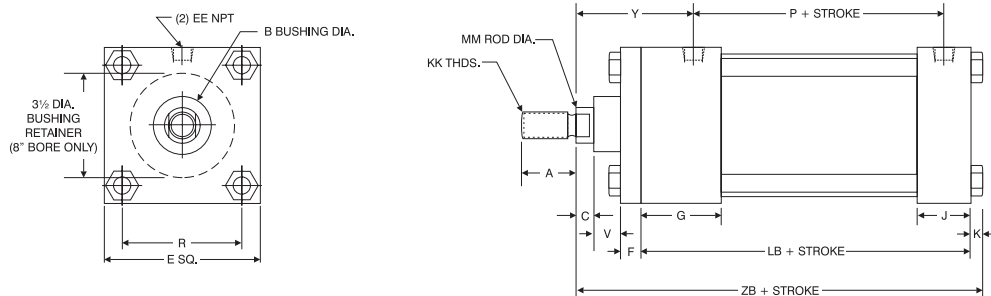
# SERIES 'TAS' DIMENSIONS: THREADS



ROD DIA. (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4
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

(4) Wrench flats are an option.

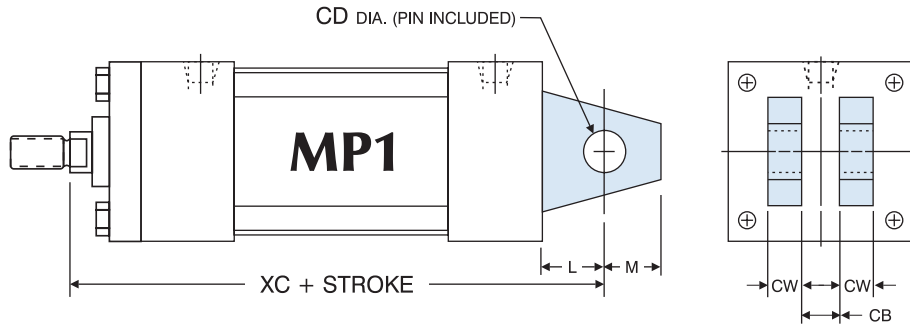
# SERIES 'TAS' DIMENSIONS: BASIC CYLINDER (NO MOUNT)



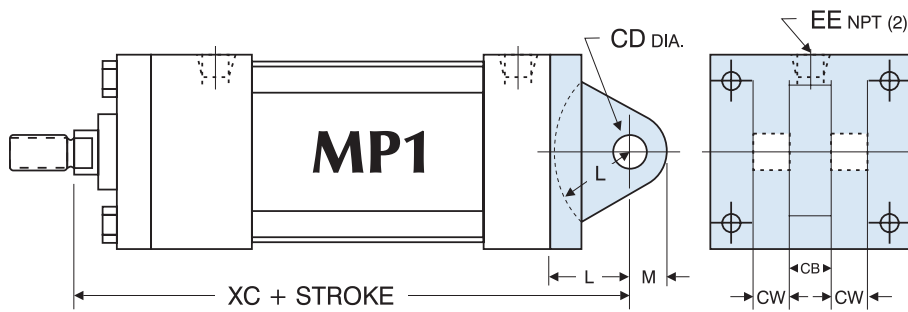
BORE	ROD DIA. (MM)	A	B	C	E	EE	F	G	J	K	KK	MM	R	V	Y	ADD TO STROKE		
																LB	P	ZB
1.50	0.625	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	7/16 - 20	0.625	1.438	0.250	1.875	3.625	2.375	4.875
	1.000	1.125	1.500	0.500							3/4 - 16	1.000		0.500	2.250			5.250
2.00	0.625	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	7/16 - 20	0.625	1.844	0.250	1.875	3.625	2.375	4.938
	1.000	1.125	1.500	0.500							3/4 - 16	1.000		0.500	2.250			5.313
2.50	0.625	0.750	1.125	0.375	3.000	0.375	0.375	1.500	1.000	0.313	7/16 - 20	0.625	2.188	0.250	1.875	3.750	2.500	5.063
	1.000	1.125	1.500	0.500							3/4 - 16	1.000		0.500	2.250			5.438
3.25	1.000	1.125	1.500	0.500	3.750	0.500	0.625	1.750	1.250	0.375	3/4 - 16	1.000	2.766	0.250	2.375	4.250	2.750	6.000
	1.375	1.625	2.000	0.625							1 - 14	1.375		0.375	2.625			6.250
4.00	1.000	1.125	1.500	0.500	4.500	0.500	0.625	1.750	1.250	0.375	3/4 - 16	1.000	3.328	0.250	2.375	4.250	2.750	6.000
	1.375	1.625	2.000	0.625							1 - 14	1.375		0.375	2.625			6.250
5.00	1.000	1.125	1.500	0.500	5.500	0.500	0.625	1.750	1.250	0.438	3/4 - 16	1.000	4.109	0.250	2.375	4.500	3.000	6.313
	1.375	1.625	2.000	0.625							1 - 14	1.375		0.375	2.625			6.563
6.00	1.375	1.625	2.000	0.625	6.500	0.750	0.750	2.000	1.500	0.438	1 - 14	1.375	4.875	0.250	2.750	5.000	3.250	7.063
	1.750	2.000	2.375	0.750							1 1/4 - 12	1.750		0.375	3.000			7.313
8.00	1.375	1.625	2.000	0.625	8.500	0.750	0.625	2.000	1.500	0.563	1 - 14	1.375	6.438	0.375	2.750	5.125	3.375	7.313
	1.750	2.000	2.375	0.750							1 1/4 - 12	1.750		0.500	3.000			7.563

# SERIES 'TAS' DIMENSIONS: PIVOT MOUNTS

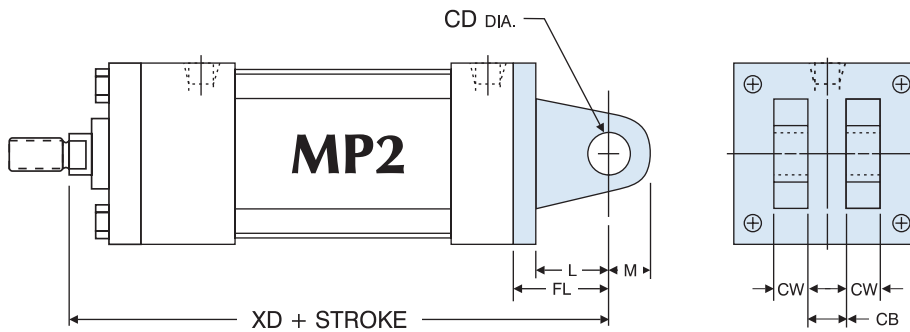
## WELDED MP1 MOUNT



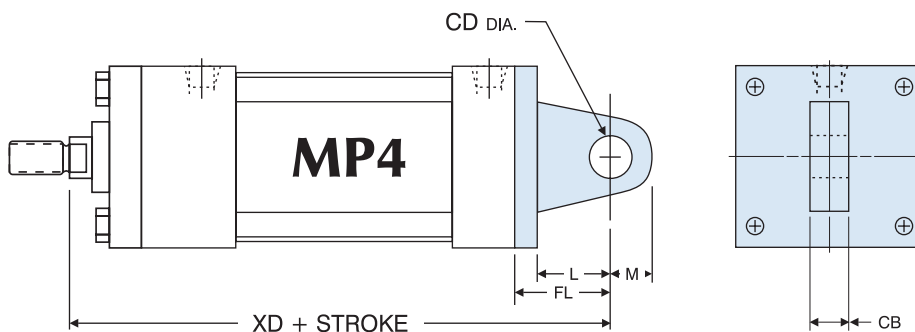
## IRON CASTING MP1 MOUNT (OPTIONAL)



## MP2 MOUNT (IRON CASTING)



## MP4 MOUNT (IRON CASTING: 1.50" - 4" BORES, WELDMENT: 5" - 6" BORES)



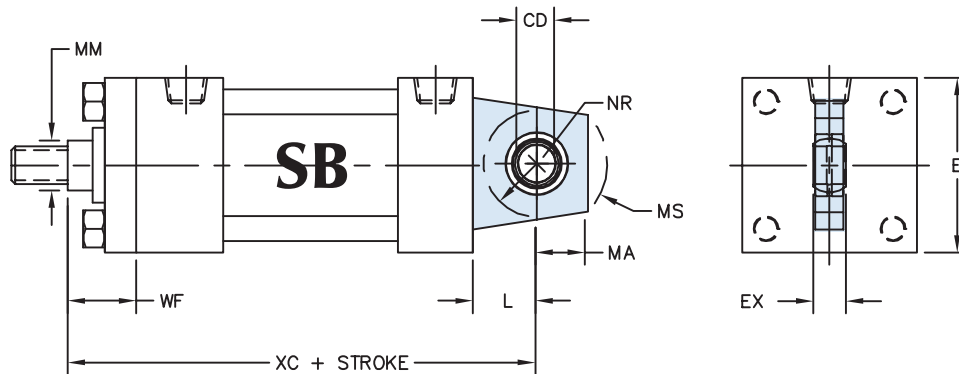
# SERIES 'TAS' DIMENSIONS: PIVOT MOUNTS

'MP1', 'MP2' CLEVIS AND 'MP4' EYE MOUNT DIMENSIONS										ACCESSORIES (SEE PAGES 130-133 FOR DIMENSIONS)						
BORE	ROD DIA. (MM)	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	0.750	0.500	0.500	1.125	0.750	0.625	5.375	5.750	RC437	RE437	CP500	EB500	CB500		
	1.000							5.750	6.125	RC750	RE750	CP750				
2.00	0.625	0.750	0.500	0.500	1.125	0.750	0.625	5.375	5.750	RC437	RE437	CP500				
	1.000							5.750	6.125	RC750	RE750	CP750				
2.50	0.625	0.750	0.500	0.500	1.125	0.750	0.625	5.500	5.875	RC437	RE437	CP500				
	1.000							5.875	6.250	RC750	RE750	CP750				
3.25	1.000	1.250	0.750	0.625	1.875	1.250	0.875	6.875	7.500	RC750	RE750	CP750			EB750	CB750
	1.375							7.125	7.750	RC1000	RE1000	CP1000				
4.00	1.000	1.250	0.750	0.625	1.875	1.250	0.875	6.875	7.500	RC750	RE750	CP750				
	1.375							7.125	7.750	RC1000	RE1000	CP1000				
5.00*	1.000	1.250	0.750	0.625	1.875	1.250	0.875	7.125	7.750	RC750	RE750	CP750				
	1.375							7.375	8.000	RC1000	RE1000	CP1000				
6.00*	1.375	1.500	1.000	0.750	2.250	1.500	1.000	8.125	8.875	RC1000	RE1000	CP1000	EB1000	CB1000		
	1.750							8.375	9.125	RC1250	RE1250	CP1375				
8.00	1.375	1.500	1.000	0.750	N/A	1.500	1.000	8.250	N/A	RC1000	RE1000	CP1000				
	1.750							8.500	N/A	RC1250	RE1250	CP1375				

Clevis pins are provided with pivot mounts.  
 \*MP4 5.00"-6.00" bores are 3-5 day delivery.  
 For dimensions not shown, see page 104.

Cast Iron removable mounts are optional and must be requested when ordering (1.50"-6.00" bores).  
 Specify "CAST MP1" when ordering.

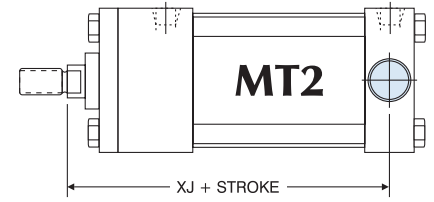
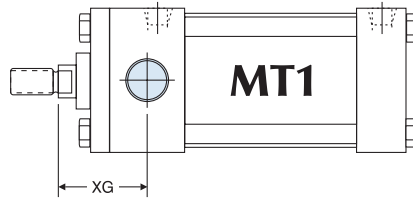
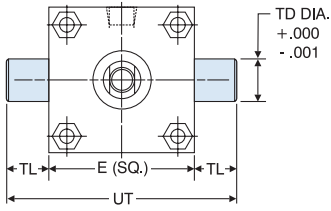
# SERIES 'TAS' DIMENSIONS: SPHERICAL BEARING MOUNT



'SB' SPHERICAL BEARING MOUNT DIMENSIONS										
BORE	ROD DIA. (MM)	CD	E	EX	L	MA	MS	NR	WF	ADD TO STROKE XC
1.50	0.625	0.500	2.000	0.437	0.750	0.750	0.938	0.625	1.000	5.375
	1.000								1.375	5.750
2.00	0.625	0.500	2.500	0.437	0.750	0.750	0.938	0.625	1.000	5.375
	1.000								1.375	5.750
2.50	0.625	0.500	3.000	0.437	0.750	0.750	0.938	0.625	1.000	5.500
	1.000								1.375	5.875
3.25	1.000	0.750	3.750	0.656	1.250	1.000	1.375	1.000	1.375	6.875
	1.375								1.625	7.125
4.00	1.000	0.750	4.500	0.656	1.250	1.000	1.375	1.000	1.375	6.875
	1.375								1.625	7.125
5.00	1.000	0.750	5.500	0.656	1.250	1.000	1.375	1.000	1.375	7.125
	1.375								1.625	7.375
6.00	1.375	1.000	6.500	0.875	1.500	1.250	1.688	1.250	1.625	8.125
	1.750								1.875	8.375
8.00	1.375	1.000	8.500	0.875	1.500	1.250	1.688	1.250	1.625	8.250
	1.750								1.875	8.500

Notes: Pivot pin included with cylinder cap end only; 3.25"- 8.00" bores have tie rod nuts exposed on cap end.  
 8.00" bore utilizes round retainer.  
 Must specify KK3 rod end if to be used with "MSRE" rod eye.

# SERIES 'TAS' DIMENSIONS: PIVOT MOUNTS

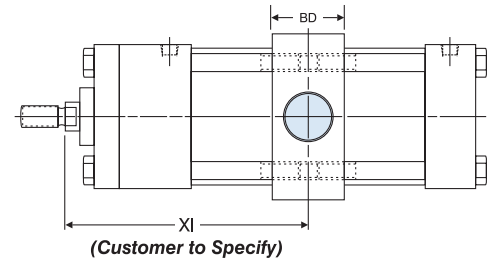
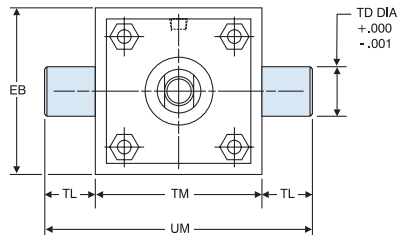


## MT1 / MT2

Note: MT1 and MT2 Trunnions are one-piece solid steel construction.

'MT1' HEAD TRUNNION AND 'MT2' CAP TRUNNION MOUNT DIMENSIONS								ACCESSORIES (SEE PAGES 130-133 FOR DIMENSIONS)		
BORE	ROD DIA. (MM)	E	TD	TL	UT	XG	ADD STROKE	ROD CLEVIS	ROD EYE	CLEVIS PIN
							XJ			
1.50	0.625	2.000	1.000	1.000	4.000	1.750	4.125	RC437	RE437	CP500
	1.000						N/A*	4.500	RC750	RE750
2.00	0.625	2.500	1.000	1.000	4.500	1.750	4.125	RC437	RE437	CP500
	1.000						2.125	4.500	RC750	RE750
2.50	0.625	3.000	1.000	1.000	5.000	1.750	4.250	RC437	RE437	CP500
	1.000						2.125	4.625	RC750	RE750
3.25	1.000	3.750	1.000	1.000	5.750	2.250	5.000	RC750	RE750	CP750
	1.375						2.500	5.250	RC1000	RE1000
4.00	1.000	4.500	1.000	1.000	6.500	2.250	5.000	RC750	RE750	CP750
	1.375						2.500	5.250	RC1000	RE1000
5.00	1.000	5.500	1.000	1.000	7.500	2.250	5.250	RC750	RE750	CP750
	1.375						2.500	5.500	RC1000	RE1000
6.00	1.375	6.500	1.375	1.375	9.250	2.625	5.875	RC1000	RE1000	CP1000
	1.750						2.875	6.125	RC1250	RE1250
8.00	1.375	8.500	1.375	1.375	11.250	2.625	6.000	RC1000	RE1000	CP1000
	1.750						2.875	6.250	RC1250	RE1250

\*No oversize rod available on 1.50" bore MT1. For dimensions not shown, see page 104.



## MT4

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

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

'MT4' INTERMEDIATE TRUNNION MOUNT DIMENSIONS							
BORE	BD	EB	TD	TL	TM	UM	XI
1.50	1.250	2.500	1.000	1.000	2.500	4.500	CUSTOMER TO SPECIFY
2.00	1.500	3.000	1.000	1.000	3.000	5.000	
2.50	1.500	3.500	1.000	1.000	3.500	5.500	
3.25	2.000	4.250	1.000	1.000	4.500	6.500	
4.00	2.000	5.000	1.000	1.000	5.250	7.250	
5.00	2.000	6.000	1.000	1.000	6.250	8.250	
6.00	2.000	7.000	1.375	1.375	7.625	10.375	
8.00	2.500	9.500	1.375	1.375	9.750	12.500	

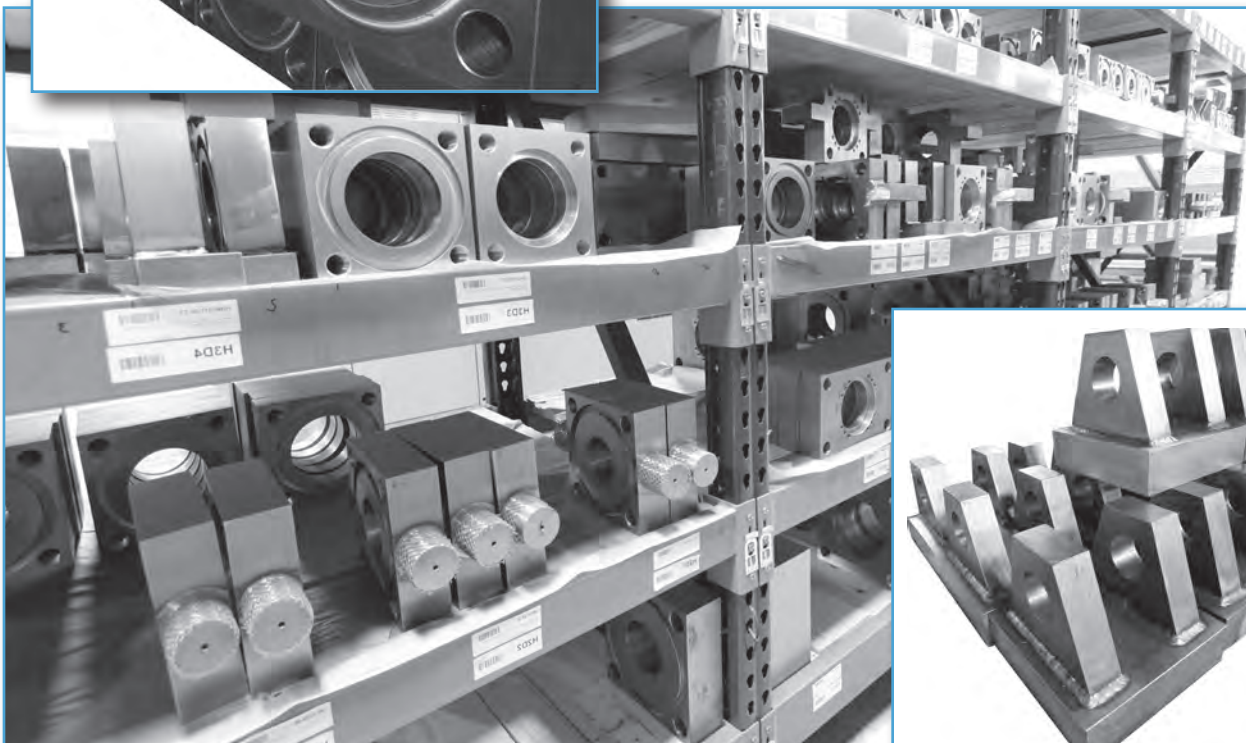
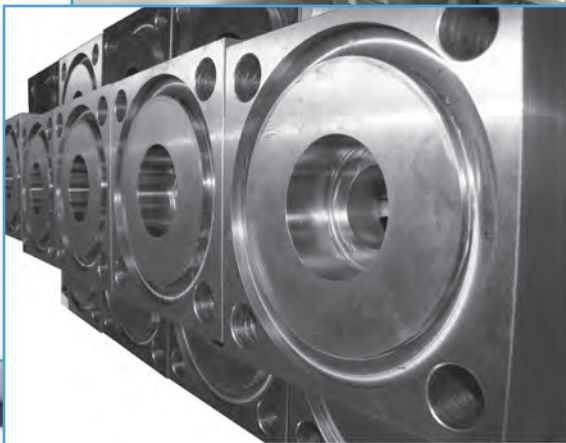
'MT1', 'MT2', 'MT4' STANDARD CUSHION LOCATIONS		
MOUNT	HEAD CUSHION	CAP CUSHION
MT1	3	6
MT2	2	7
MT4	2	6

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



TRD's extensive inventory allows customers to specify the ports, their location, made-to-order strokes and customize rod end.

*Most hydraulic cylinders with catalog options ship in 2-3 days!*



HH - Heavy Duty Hydraulic

HH Rod Lock

MH - Medium Duty Hydraulic

TAS - Heavy Duty Pneumatic

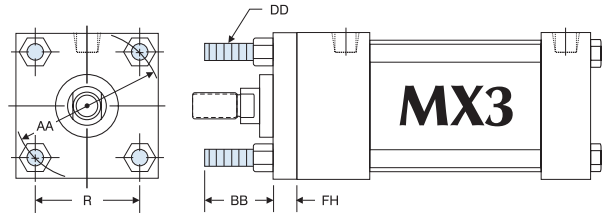
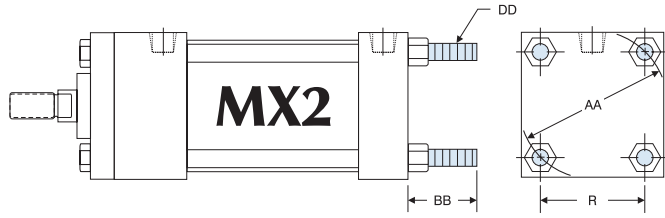
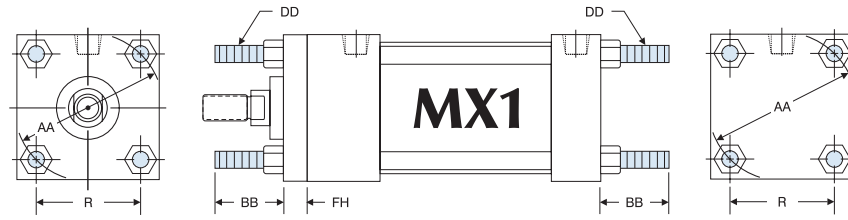
TAS Options

Accessories Page 130

STROKEMASTER Page 136

Technical Data Page 144

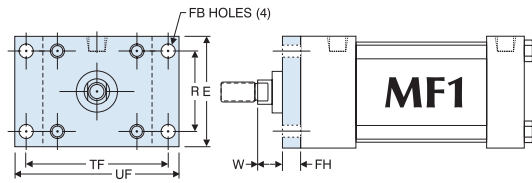
# SERIES 'TAS' DIMENSIONS: TIE ROD & FLANGE MOUNTS



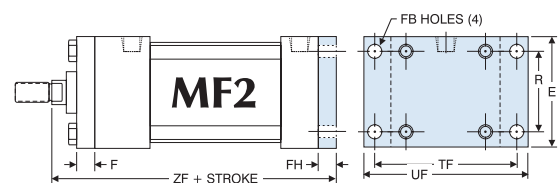
TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS						
BORE	ROD DIA. (MM)	AA	BB	DD	FH	R
1.50	0.625	2.020	1.000	1/4 - 28	0.375	1.438
	1.000					
2.00	0.625	2.600	1.125	5/16 - 24	0.375	1.844
	1.000					
2.50	0.625	3.100	1.125	5/16 - 24	0.375	2.188
	1.000					
3.25	1.000	3.900	1.375	3/8 - 24	0.625	2.766
	1.375					

TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS						
BORE	ROD DIA. (MM)	AA	BB	DD	FH	R
4.00	1.000	4.700	1.375	3/8 - 24	0.625	3.328
	1.375					
5.00	1.000	5.800	1.813	1/2 - 20	0.625	4.109
	1.375					
6.00	1.375	6.900	1.813	1/2 - 20	0.750	4.875
	1.750					
8.00	1.375	9.100	**2.313	5/8 - 18	*0.625	6.438
	1.750					

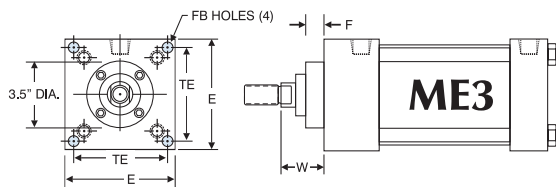
\*8.00" bore utilizes a 3.50" diameter round retainer.  
 \*\*BB dimension from face of head.  
 For dimensions not shown, see page 104.



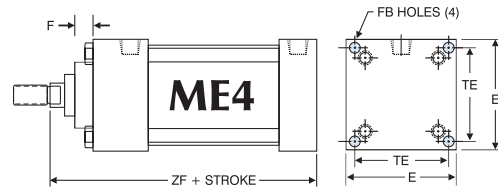
1.50" - 6" BORES



1.50" - 6" BORES



8" BORE



8" BORE

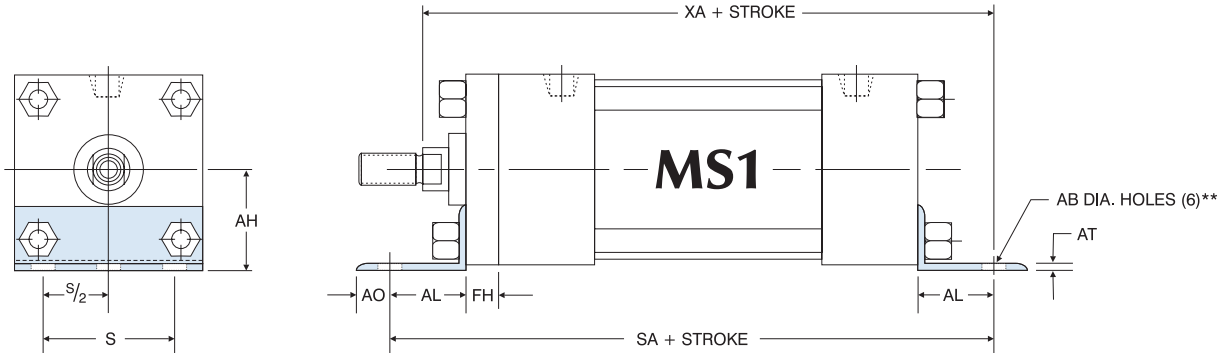
'MF1', 'MF2' FLANGE & 'ME3', 'ME4' CAP MOUNT DIMENSIONS											
BORE	ROD DIA. (MM)	E	F	FB	FH	R	TE	TF	UF	W	ADD TO STROKE
											ZF
1.50	0.625	2.000	0.375	0.313	0.375	1.438	—	2.750	3.375	0.625	5.000
	1.000										5.375
2.00	0.625	2.500	0.375	0.375	0.375	1.840	—	3.375	4.125	0.625	5.000
	1.000										5.375
2.50	0.625	3.000	0.375	0.375	0.375	2.188	—	3.875	4.625	1.000	5.125
	1.000										5.500
3.25	1.000	3.750	0.625	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 DIA. (MM)	E	F	FB	FH	R	TE	TF	UF	W	ADD TO STROKE
											ZF
4.00	1.000	4.500	0.625	0.438	0.625	3.313	—	5.438	6.250	0.750	6.250
	1.375										6.500
5.00	1.000	5.500	0.625	0.563	0.625	4.125	—	6.625	7.625	0.750	6.500
	1.375										6.750
6.00	1.375	6.500	0.625	0.563	0.750	4.875	—	7.625	8.625	0.875	7.375
	1.750										7.625
8.00	1.375	8.500	0.625	0.688	N/A	N/A	7.570	N/A	N/A	1.625	6.750
	1.750										7.000

For dimensions not shown, see page 104.

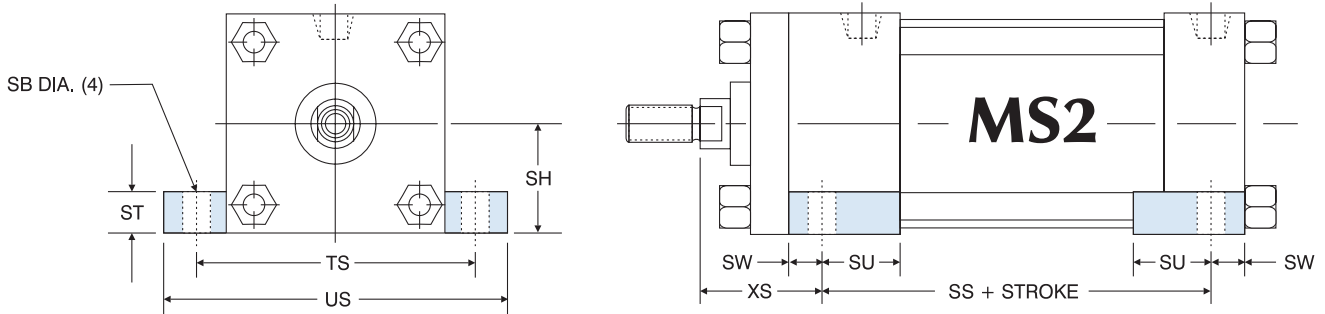


# SERIES 'TAS' DIMENSIONS: BASE MOUNTS



'MS1' ANGLE MOUNT DIMENSIONS										
BORE	ROD DIA. (MM)	AB	AH	AL	AO	AT	FH	S	ADD TO STROKE	
									SA	XA
1.50	0.625	0.438	1.188	1.000	0.375	0.188	0.375	1.250	6.000	5.625
	1.000									6.000
2.00	0.625	0.438	1.438	1.000	0.375	0.188	0.375	1.750	6.000	5.625
	1.000									6.000
2.50	0.625	0.438	1.625	1.000	0.375	0.188	0.375	2.250	6.125	5.750
	1.000									6.125
3.25	1.000	0.563	1.938	1.250	0.500	0.125	0.625	2.750	7.375	6.875
	1.375									7.125
4.00	1.000	0.563	2.250	1.250	0.500	0.125	0.625	3.500	7.375	6.875
	1.375									7.125
5.00	1.000	0.688	2.750	1.375	0.625	0.188	0.625	4.250	7.875	7.250
	1.375									7.500
6.00	1.375	0.813	3.250	1.375	0.625	0.188	0.750	5.250	8.500	8.000
	1.750									8.250
8.00	1.375	0.813	4.250	1.813	0.688	0.250	*0.625	7.125	8.750	8.563
	1.750									8.813

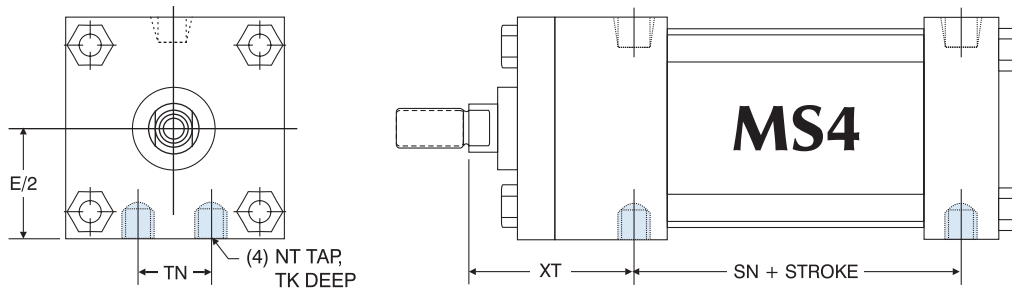
\*8.00" bore utilizes a round retainer.  
Note: 1.50" bore has (4) AB diameter holes.



'MS2' SIDE LUG MOUNT DIMENSIONS										
BORE	ROD DIA. (MM)	SB	SH	ST	SU	SW	TS	US	ADD TO STROKE	
									XS	SS
1.50	0.625	0.438	1.000	0.500	1.125	0.375	2.750	3.500	1.375	2.875
	1.000								1.750	
2.00	0.625	0.438	1.250	0.500	1.125	0.375	3.250	4.000	1.375	2.875
	1.000								1.750	
2.50	0.625	0.438	1.500	0.500	1.125	0.375	3.750	4.500	1.375	3.000
	1.000								1.750	
3.25	1.000	0.563	1.875	0.750	1.250	0.500	4.750	5.750	1.875	3.250
	1.375								2.125	
4.00	1.000	0.563	2.250	0.750	1.250	0.500	5.500	6.500	1.875	3.250
	1.375								2.125	
5.00	1.000	0.813	2.750	1.000	1.063	0.688	6.875	8.250	2.063	3.125
	1.375								2.313	
6.00	1.375	0.813	3.250	1.000	1.313	0.688	7.875	9.250	2.313	3.625
	1.750								2.563	
8.00*	1.375	0.813	4.250	1.000	1.313	0.688	9.875	11.250	2.313	3.750
	1.750								2.563	

\*8.00" bore utilizes a round retainer.  
For dimensions not shown, see page 104.

# SERIES 'TAS' DIMENSIONS: BASE MOUNTS



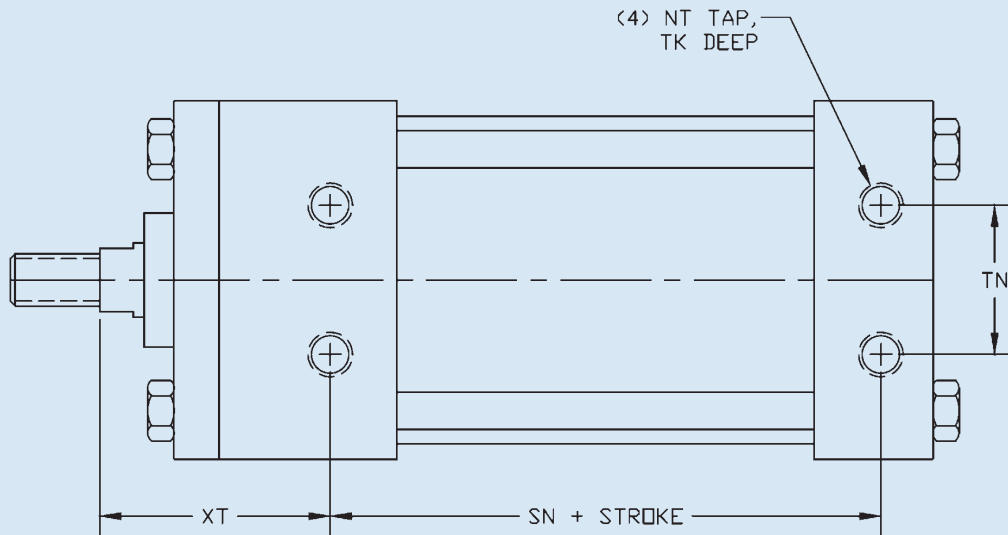
'MS4' BOTTOM TAPPED MOUNT DIMENSIONS

BORE	ROD DIA. (MM)	E/2	NT	TK	TN	XT	ADD TO STROKE
							SN
1.50	0.625	1.000	1/4 - 20	0.375	0.625	1.938	2.250
	1.000						
2.00	0.625	1.250	5/16 - 18	0.500	0.875	1.938	2.250
	1.000						
2.50	0.625	1.500	3/8 - 16	0.625	1.250	1.938	2.375
	1.000						
3.25	1.000	1.875	1/2 - 13	0.750	1.500	2.438	2.625
	1.375						
4.00	1.000	2.250	1/2 - 13	0.750	2.063	2.438	2.625
	1.375						
5.00	1.000	2.750	5/8 - 11	1.000	2.688	2.438	2.875
	1.375						
6.00	1.375	3.250	3/4 - 10	1.125	3.250	2.813	3.125
	1.750						
8.00	1.375	4.250	3/4 - 10	1.125	4.500	2.813	3.250
	1.750						

For dimensions not shown, see page 104.

## Design Tips

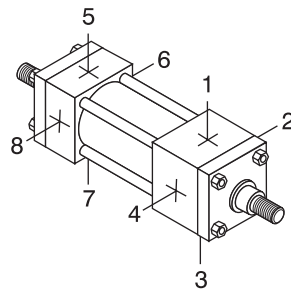
- Bottom tapped holes can be *made-to-order*. Different thread sizes or types can be specified by the customer.
- For close tolerance hole locations, cylinders can be machined after assembly.
- Note: Hole locations can vary somewhat from NFPA specs. There are limitations to relocating the tapped holes due to internal break-out concerns. *Contact TRD for more information.*



# SERIES 'TAS' DIMENSIONS: DOUBLE ROD END

## Benefits

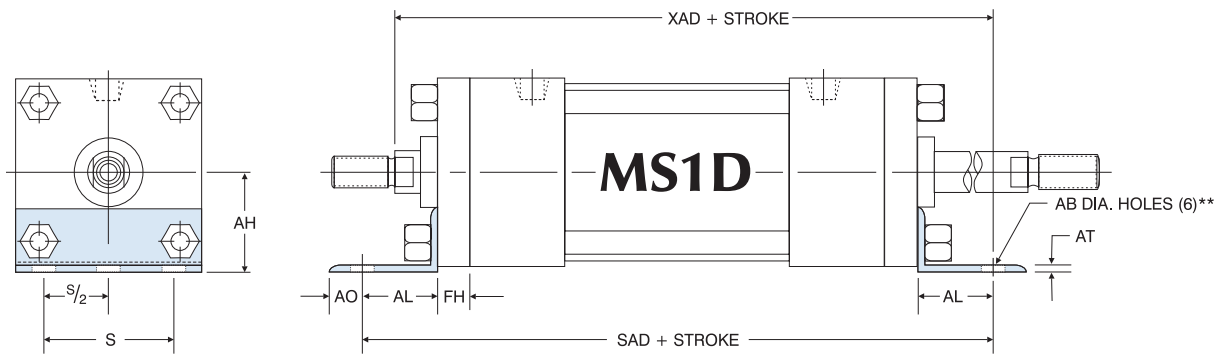
- Standard and oversize piston rods available.
- Full range of standard options.
- Durable design. Full rod bearing at each end of cylinder.
- Can be provided with hollow piston rods (gun-drilled through, to your size requirements).
- Can be used in adjustable extend stroke applications (by adding a stop collar on one rod end, or option 'MA' - Refer to page 121).



### STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

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

# SERIES 'TAS' DIMENSIONS: DOUBLE ROD END BASE MOUNTS



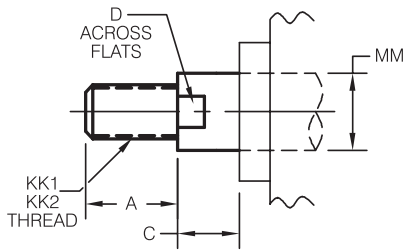
'MS1D' ANGLE MOUNT DIMENSIONS										
BORE	ROD DIA. (MM)	AB	AH	AL	AO	AT	FH	S	ADD TO STROKE	
									SAD	XAD
1.50	0.625	0.438	1.188	1.000	0.375	0.188	0.375	1.250	6.875	6.500
	1.000									6.875
2.00	0.625	0.438	1.438	1.000	0.375	0.188	0.375	1.750	6.875	6.500
	1.000									6.875
2.50	0.625	0.438	1.625	1.000	0.375	0.188	0.375	2.250	7.000	6.625
	1.000									7.000
3.25	1.000	0.563	1.98	1.250	0.500	.125	0.625	2.750	8.500	8.000
	1.375									8.250
4.00	1.000	0.563	2.250	1.250	0.500	.125	0.625	3.500	8.500	8.000
	1.375									8.250
5.00	1.000	0.688	2.750	1.375	.625	0.188	0.625	4.250	9.000	8.375
	1.375									8.625
6.00	1.375	0.813	3.250	1.375	.625	0.188	0.750	5.250	9.750	9.250
	1.750									9.500
8.00	1.375	0.813	4.250	1.813	.688	0.250	*0.625	7.125	9.250	9.063
	1.750									9.313

\*8.00" bore utilizes round retainer.  
 Note: 1.50" bore uses (4) "AB" holes.  
 For dimensions not shown, see page 113.

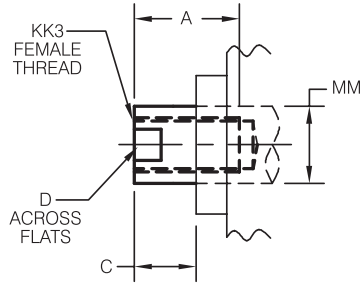
# SERIES 'TAS' DIMENSIONS: THREADS

EASY FLIP OUT PAGE FOR REFERENCE

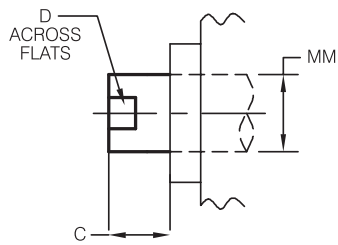
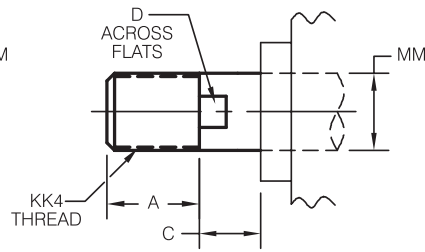
ROD END STYLE:  
KK1  
KK2



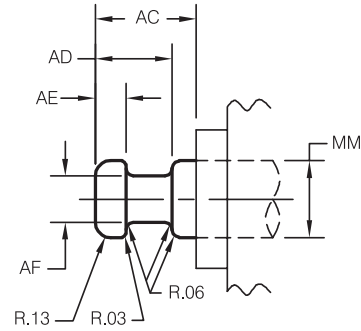
ROD END STYLE:  
KK3



ROD END STYLE:  
KK4



ROD END STYLE:  
KK5

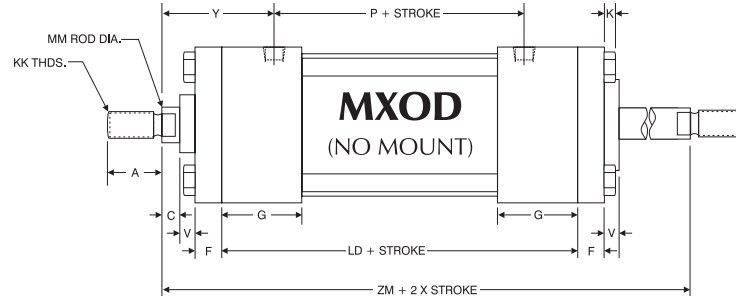
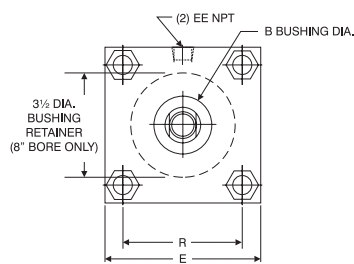


ROD END STYLE:  
KK10

ROD DIA. (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4
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

(4) Wrench flats are an option.

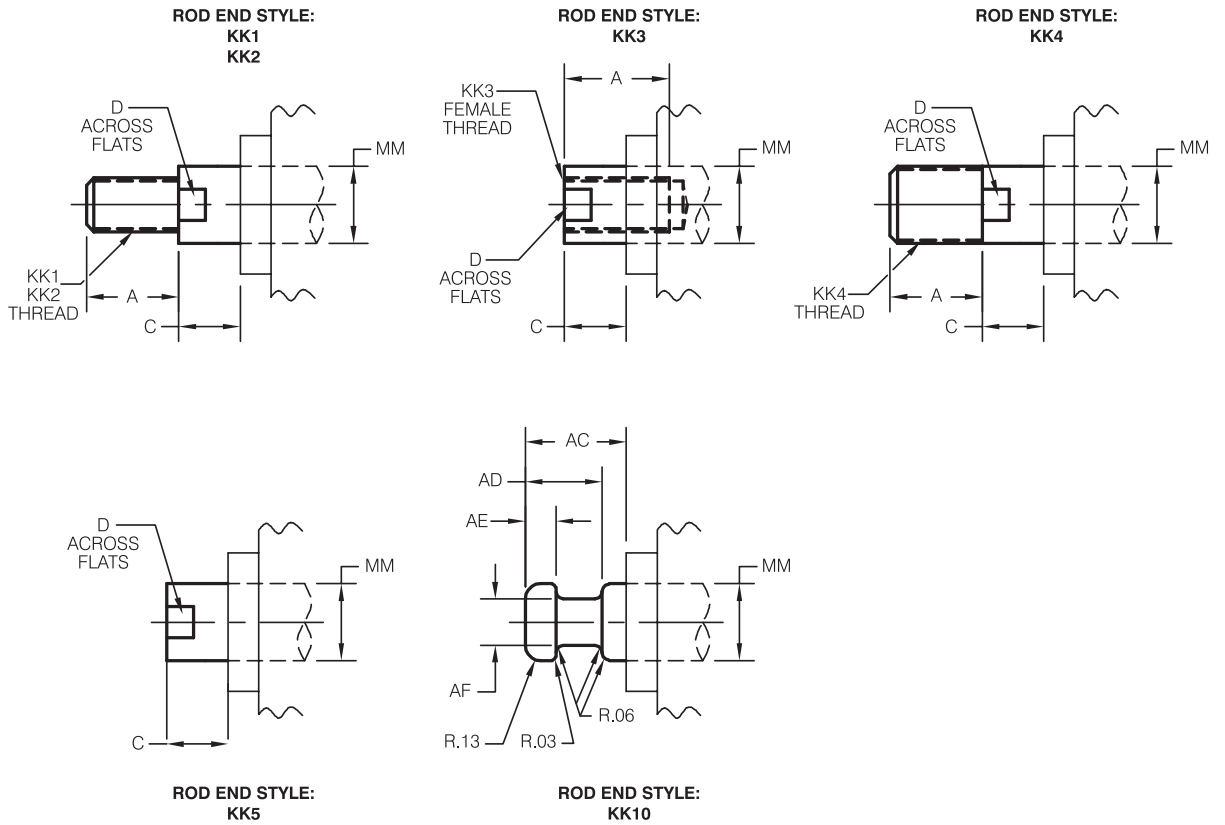
## DOUBLE ROD END DIMENSIONS: BASIC CYLINDER (NO MOUNT)



BORE	ROD DIA. (MM)	A	B	C	E	EE	F	G	K	MM	R	V	Y	ADD TO STROKE		ADD 2x STROKE ZM	
														LD	P		
1.50	0.625	0.750	1.125	0.375	2.000	0.375	0.375	1.500	0.250	7/16 - 20	0.625	1.438	0.250	1.875	4.125	2.375	6.125
	1.000	1.125	1.500	0.500													
2.00	0.625	0.750	1.125	0.375	2.500	0.375	0.375	1.500	0.313	7/16 - 20	0.625	1.844	0.250	1.875	4.125	2.375	6.125
	1.000	1.125	1.500	0.500													
2.50	0.625	0.750	1.125	0.375	3.000	0.375	0.375	1.500	0.313	7/16 - 20	0.625	2.188	0.250	1.875	4.250	2.500	6.250
	1.000	1.125	1.500	0.500													
3.25	1.000	1.125	1.500	0.500	3.750	0.500	0.625	1.750	0.375	3/4 - 16	1.000	2.766	0.250	2.375	4.750	2.750	7.500
	1.375	1.625	2.000	0.625													
4.00	1.000	1.125	1.500	0.500	4.500	0.500	0.625	1.750	0.375	3/4 - 16	1.000	3.328	0.250	2.375	4.750	2.750	7.500
	1.375	1.625	2.000	0.625													
5.00	1.000	1.125	1.500	0.500	5.500	0.500	0.625	1.750	0.438	3/4 - 16	1.000	4.109	0.250	2.375	5.000	3.000	7.750
	1.375	1.625	2.000	0.625													
6.00	1.375	1.625	2.000	0.625	6.500	0.750	0.750	2.000	0.438	1 - 14	1.375	4.875	0.250	2.750	5.500	3.250	8.750
	1.750	2.000	2.375	0.750													
8.00	1.375	1.625	2.000	0.625	8.500	0.750	0.625	2.000	0.563	1 - 14	1.375	6.438	0.375	2.750	5.625	3.375	8.875
	1.750	2.000	2.375	0.750													

'TAS' SERIES DOUBLE ROD END DIMENSIONS FLIP-OUT (PAGE 113)

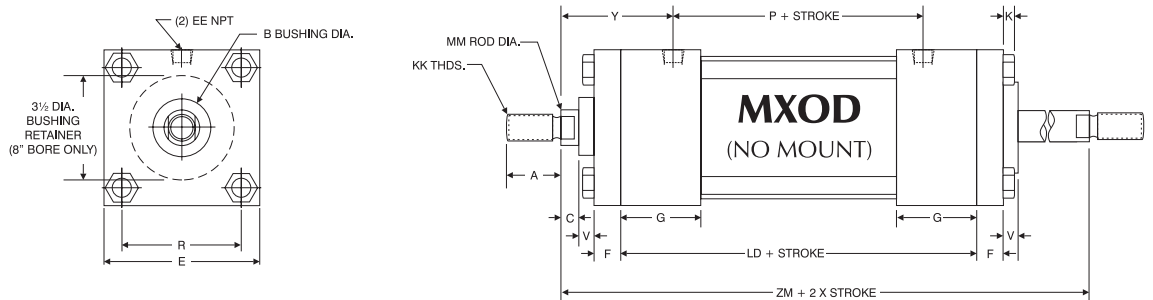
# SERIES 'TAS' DIMENSIONS: THREADS



ROD DIA. (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4
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

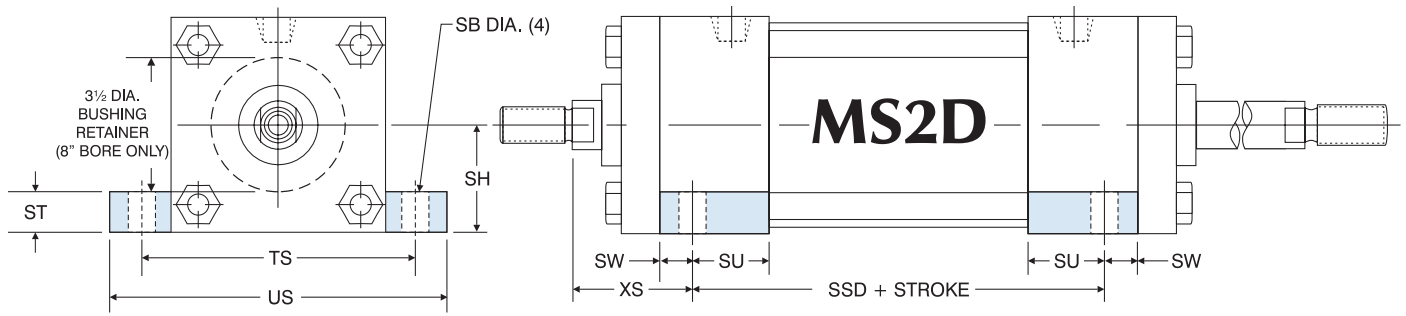
(4) Wrench flats are an option.

## DOUBLE ROD END DIMENSIONS: BASIC CYLINDER (NO MOUNT)



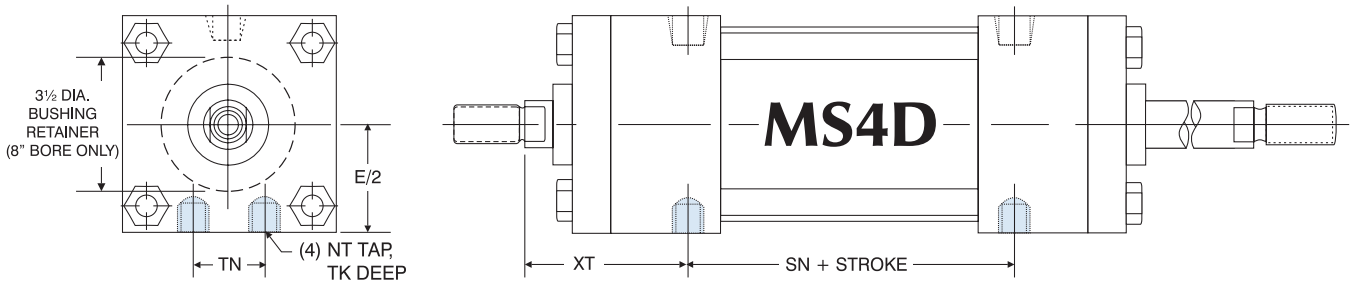
BORE	ROD DIA. (MM)	A	B	C	E	EE	F	G	K	KK	MM	R	V	Y	ADD TO STROKE		ADD 2x STROKE ZM
															LD	P	
1.50	0.625	0.750	1.125	0.375	2.000	0.375	0.375	1.500	0.250	7/16 - 20	0.625	1.438	0.250	1.875	4.125	2.375	6.125
	1.000	1.125	1.500	0.500						3/4 - 16	1.000		0.500	2.250			6.875
2.00	0.625	0.750	1.125	0.375	2.500	0.375	0.375	1.500	0.313	7/16 - 20	0.625	1.844	0.250	1.875	4.125	2.375	6.125
	1.000	1.125	1.500	0.500						3/4 - 16	1.000		0.500	2.250			6.875
2.50	0.625	0.750	1.125	0.375	3.000	0.375	0.375	1.500	0.313	7/16 - 20	0.625	2.188	0.250	1.875	4.250	2.500	6.250
	1.000	1.125	1.500	0.500						3/4 - 16	1.000		0.500	2.250			7.000
3.25	1.000	1.125	1.500	0.500	3.750	0.500	0.625	1.750	0.375	3/4 - 16	1.000	2.766	0.250	2.375	4.750	2.750	7.500
	1.375	1.625	2.000	0.625						1 - 14	1.375		0.375	2.625			8.000
4.00	1.000	1.125	1.500	0.500	4.500	0.500	0.625	1.750	0.375	3/4 - 16	1.000	3.328	0.250	2.375	4.750	2.750	7.500
	1.375	1.625	2.000	0.625						1 - 14	1.375		0.375	2.675			8.000
5.00	1.000	1.125	1.500	0.500	5.500	0.500	0.625	1.750	0.438	3/4 - 16	1.000	4.109	0.250	2.375	5.000	3.000	7.750
	1.375	1.625	2.000	0.625						1 - 14	1.375		0.375	2.625			8.250
6.00	1.375	1.625	2.000	0.625	6.500	0.750	0.750	2.000	0.438	3/4 - 16	1.000	4.875	0.250	2.750	5.500	3.250	8.750
	1.750	2.000	2.375	0.750						1 1/4 - 12	1.750		0.375	3.000			9.250
8.00	1.375	1.625	2.000	0.625	8.500	0.750	0.625	2.000	0.563	1 - 14	1.375	6.438	0.375	2.750	5.625	3.375	8.875
	1.750	2.000	2.375	0.750						1 1/4 - 12	1.750		0.500	3.000			9.375

# SERIES 'TAS' DIMENSIONS: DOUBLE ROD END BASE MOUNTS



DOUBLE ROD END 'MS2D' SIDE LUG MOUNT DIMENSIONS										
BORE	ROD DIA. (MM)	SB	SH	ST	SU	SW	TS	US	XS	ADD TO STROKE
										SSD
1.50	0.625	0.438	1.000	0.500	1.125	0.375	2.750	3.500	1.375	3.375
	1.000									
2.00	0.625	0.438	1.250	0.500	1.125	0.375	3.250	4.000	1.375	3.375
	1.000									
2.50	0.625	0.438	1.500	0.500	1.125	0.375	3.750	4.500	1.375	3.500
	1.000									
3.25	1.000	0.563	1.875	0.750	1.250	0.500	4.750	5.750	1.875	3.750
	1.375									
4.00	1.000	0.563	2.250	0.750	1.250	0.500	5.500	6.500	1.875	3.750
	1.375									
5.00	1.000	0.813	2.750	1.000	1.063	0.688	6.875	8.250	2.063	3.625
	1.375									
6.00	1.375	0.813	3.250	1.000	1.313	0.688	7.875	9.250	2.313	4.125
	1.750									
8.00	1.375	0.813	4.250	1.000	1.563	0.688	9.875	11.250	2.313	4.250
	1.750									

For dimensions not shown, see page 113.

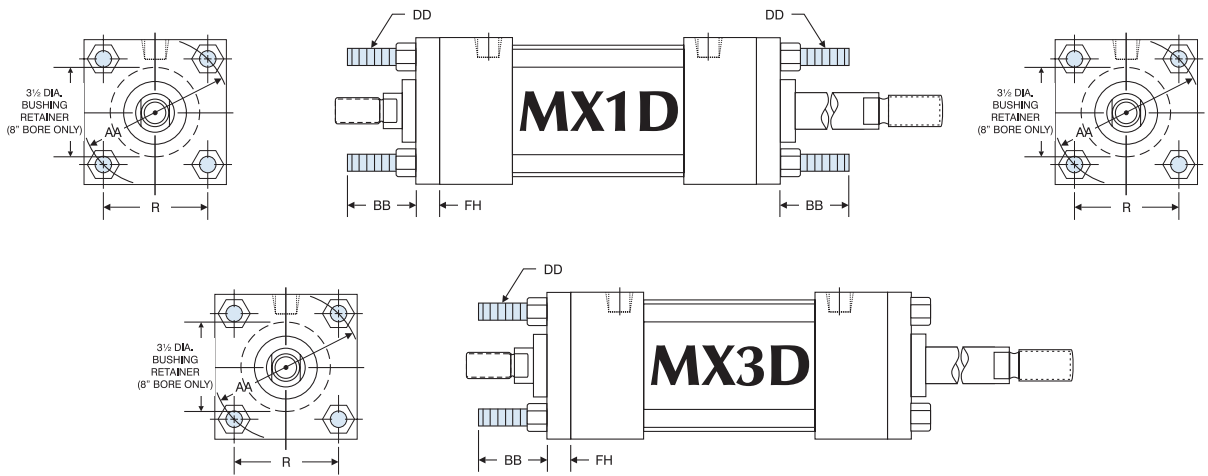


DOUBLE ROD END 'MS4D' BOTTOM TAPPED MOUNT DIMENSIONS							
BORE	ROD DIA. (MM)	E/2	NT	TK	TN	XT	ADD TO STROKE
							SN
1.50	0.625	1.000	1/4 - 20	0.375	0.625	1.938	2.250
	1.000						
2.00	0.625	1.250	5/16 - 18	0.500	0.875	1.938	2.250
	1.000						
2.50	0.625	1.500	3/8 - 16	0.625	1.250	1.938	2.375
	1.000						
3.25	1.000	1.875	1/2 - 13	0.750	1.500	2.438	2.625
	1.375						
4.00	1.000	2.250	1/2 - 13	0.750	2.063	2.438	2.625
	1.375						
5.00	1.000	2.750	5/8 - 11	1.000	2.688	2.438	2.875
	1.375						
6.00	1.375	3.250	3/4 - 10	1.125	3.250	2.813	3.125
	1.750						
8.00	1.375	4.250	3/4 - 10	1.125	4.500	2.813	3.250
	1.750						

For dimensions not shown, see page 113.



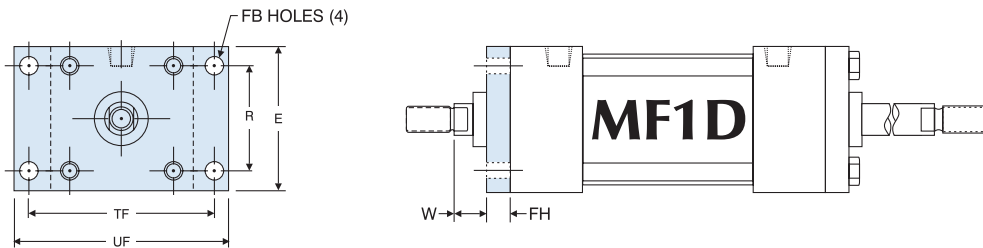
# SERIES 'TAS' DIMENSIONS: DOUBLE ROD END TIE ROD & FLANGE MOUNTS



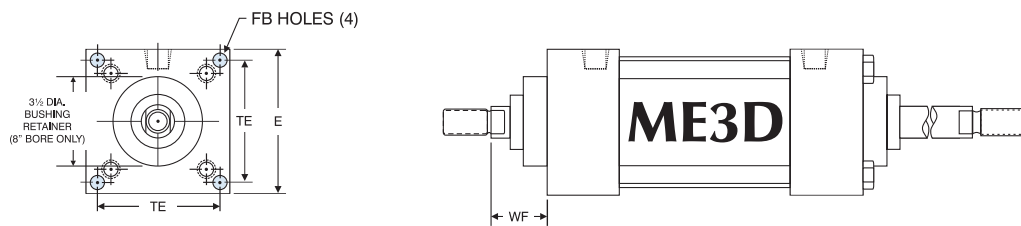
TIE ROD EXTENDED 'MX1D' & 'MX3D' MOUNT DIMENSIONS						
BORE	ROD DIA. (MM)	AA	BB	DD	FH	R
1.50	0.625	2.016	1.000	1/4 -28	0.375	1.438
	1.000					
2.00	0.625	2.594	1.125	5/16 -24	0.375	1.844
	1.000					
2.50	0.625	3.109	1.125	5/16 -24	0.375	2.188
	1.000					
3.25	1.000	3.906	1.375	3/8 -24	0.625	2.766
	1.375					

TIE ROD EXTENDED 'MX1D' & 'MX3D' MOUNT DIMENSIONS						
BORE	ROD DIA. (MM)	AA	BB	DD	FH	R
4.00	1.000	4.719	1.375	3/8 -24	0.625	3.328
	1.375					
5.00	1.000	5.813	1.813	1/2 -20	0.625	4.109
	1.375					
6.00	1.375	6.906	1.813	1/2 -20	0.750	4.875
	1.750					
8.00	1.375	9.125	*2.313	5/8 -18	*0.625	6.438
	1.750					

\*'BB' dimension from head on 8.00" bore.  
For dimensions not shown, see page 113.



## 1.50" - 6" BORES



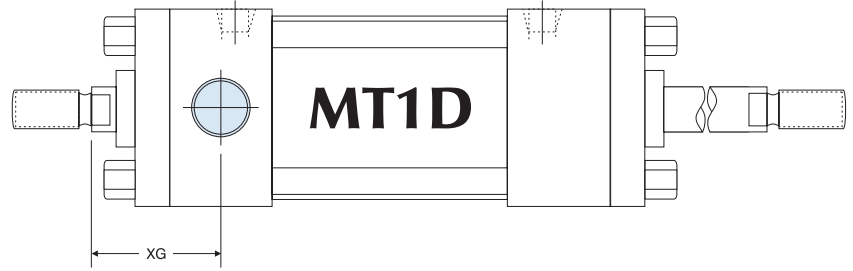
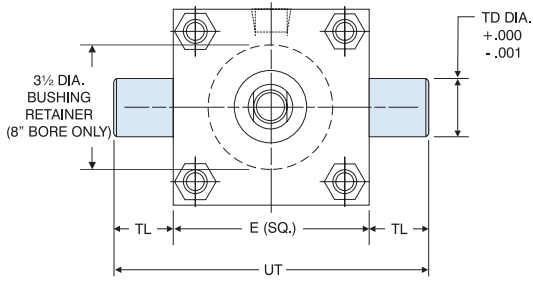
## 8" BORE ONLY

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS										
BORE	ROD DIA. (MM)	E	FB	FH	R	TE	TF	UF	W	WF
1.50	0.625	2.000	0.313	0.375	1.438	—	2.750	3.375	0.625	N/A
	1.000								N/A	
2.00	0.625	2.500	0.375	0.375	1.844	—	3.375	4.125	0.625	N/A
	1.000								N/A	
2.50	0.625	3.000	0.375	0.375	2.188	—	3.875	4.625	0.625	N/A
	1.000								N/A	
3.25	1.000	3.750	0.438	0.625	2.766	—	4.688	5.500	0.750	N/A
	1.375								N/A	

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS										
BORE	ROD DIA. (MM)	E	FB	FH	R	TE	TF	UF	W	WF
4.00	1.000	4.500	0.438	0.625	3.328	—	5.438	6.250	0.750	N/A
	1.375								N/A	
5.00	1.000	5.500	0.563	0.625	4.109	—	6.625	7.625	0.750	N/A
	1.375								N/A	
6.00	1.375	6.500	0.563	0.750	4.875	—	7.625	8.625	0.875	N/A
	1.750								N/A	
8.00	1.375	8.500	0.688	N/A	N/A	7.563	N/A	N/A	1.625	1.625
	1.750								1.875	1.875

For dimensions not shown, see page 113.

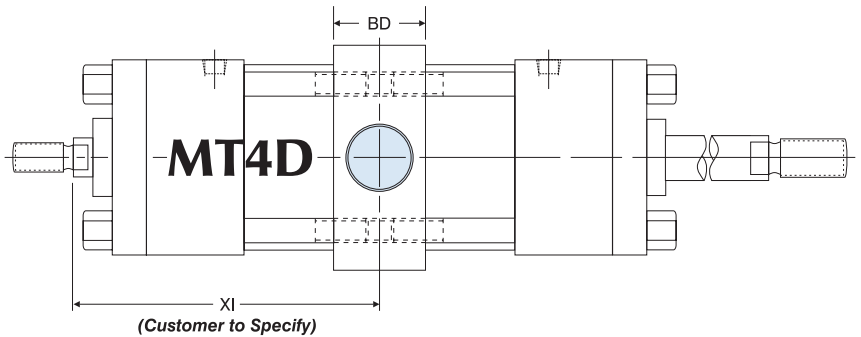
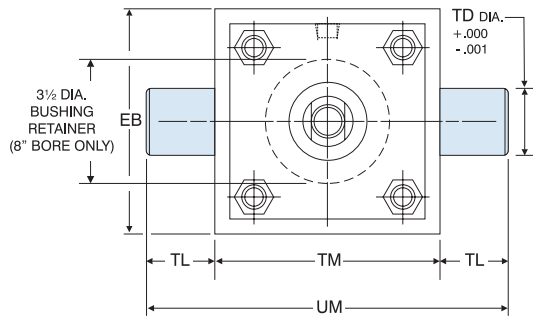
# SERIES 'TAS' DIMENSIONS: DOUBLE ROD END PIVOT MOUNTS



Note: MT1D Trunnions are one-piece solid steel construction.

DOUBLE ROD END 'MT1D' HEAD TRUNNION MOUNT DIMENSIONS						
BORE	ROD DIA. (MM)	E	TD	TL	UT	XG
1.50	0.625	2.000	1.000	1.000	4.000	1.750
	N/A*					N/A
2.00	0.625	2.500	1.000	1.000	4.500	1.750
	1.000					2.125
2.50	0.625	3.000	1.000	1.000	5.000	1.750
	1.000					2.125
3.25	1.000	3.750	1.000	1.000	5.750	2.250
	1.375					2.500
4.00	1.000	4.500	1.000	1.000	6.500	2.250
	1.375					2.500
5.00	1.000	5.500	1.000	1.000	7.500	2.250
	1.375					2.500
6.00	1.375	6.500	1.375	1.375	9.250	2.625
	1.750					2.875
8.00	1.375	8.500	1.375	1.375	11.250	2.625
	1.750					2.875

\*No oversize rod available on 1.50" bore MT1D. For dimensions not shown, see page 113.



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

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

8" bore utilizes round retainer.

HH - Heavy Duty Hydraulic  
HH Rod Lock  
MH - Medium Duty Hydraulic  
TAS - Heavy Duty Pneumatics  
TAS Options  
Accessories Page 130  
STROKEMASTER Page 136  
Technical Data Page 144

**MX1**

# TAS Series Basic Cylinder Options

**Basic Options      Page 118**

**Uncommon Options      Page 126**



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

# SERIES 'TAS' BASIC OPTIONS

## Index To Standard Options:

	<u>PAGE</u>
• A= - Extended Piston Rod Thread . . . . .	118
• AS - Adjustable Stroke (Retract) . . . . .	118
• A/O - Air/Oil Piston . . . . .	118
• B, BC, BH - Bumpers . . . . .	118
• BP - Bumper Piston Seals . . . . .	119
• H, C, LH, LC - Cushions . . . . .	120
• BSPT/BSPP - British Standard Pipe Threads . . . . .	121
• C= - Extended Piston Rod . . . . .	121
• KK3S - Studded Piston Rod . . . . .	121
• LF - Low Friction . . . . .	121
• MA - Micro-Adjust . . . . .	121
• MAB - Micro-Adjust with Urethane Bumper . . . . .	121
• MS - Metallic Rod Scraper . . . . .	122
• NR - Non-Rotating (NFPA) Cylinders . . . . .	122

	<u>PAGE</u>
• OP - Optional Port Location . . . . .	122
• Optional Port & Cushion at Same Location . . . . .	123
• OS - Oversize Rod . . . . .	123
• SAE - SAE "O"-Ring Boss Ports . . . . .	123
• SE - Spring Extend . . . . .	124
• SR - Spring Retract . . . . .	124
• SSA - Stainless Steel "All" . . . . .	124
• SSC - Stainless Steel Cushion Needle . . . . .	124
• SSF - Stainless Steel Fasteners . . . . .	124
• SSR - Stainless Steel Piston Rod . . . . .	124
• SST - Stainless Steel Tie Rods & Nuts . . . . .	124
• ST -Stop Tube . . . . .	121
• TH - 400 PSI Hydraulic (Non-Shock) . . . . .	124
• VS - Fluorocarbon Seals . . . . .	124

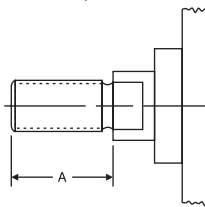
## Uncommon Options:

	<u>PAGE</u>
• AS3POS - Adjustable Mid Stroke (3-Position Cyl) . . . . .	126
• DAS - Double Rod Adjustable Stroke (Extend) . . . . .	126
• Extra Wide Multiple Wear Bands . . . . .	126
• Manifold Block or Plate . . . . .	126
• Hollow Piston Rods . . . . .	126
• Rod Boots . . . . .	126
• Paint and Other Special Finishes . . . . .	126

	<u>PAGE</u>
• Special MF1 Flange . . . . .	126
• BTB - Back To Back Cylinders . . . . .	127
• 3P - 3-Position Cylinders . . . . .	127
• TM - Tandem Cylinders . . . . .	127
• ABP - Air Bleed Port . . . . .	127
• DBB - Drain Back Bushing . . . . .	127

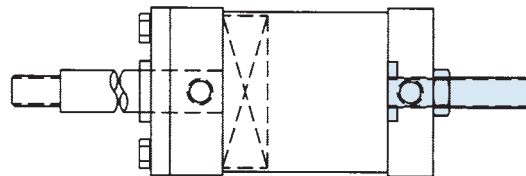
### **A=** Extended Piston Rod Thread

"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.

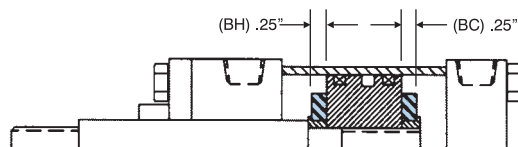
For applications that require the oil to be on the cylinder rod end, specify the "TH" option.

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)*





# SERIES 'TAS' BASIC OPTIONS

**BP**

## Bumper Piston Seals



1.50" Bore Shown



Available on 1.50" to 8" Bore

TRD'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)**

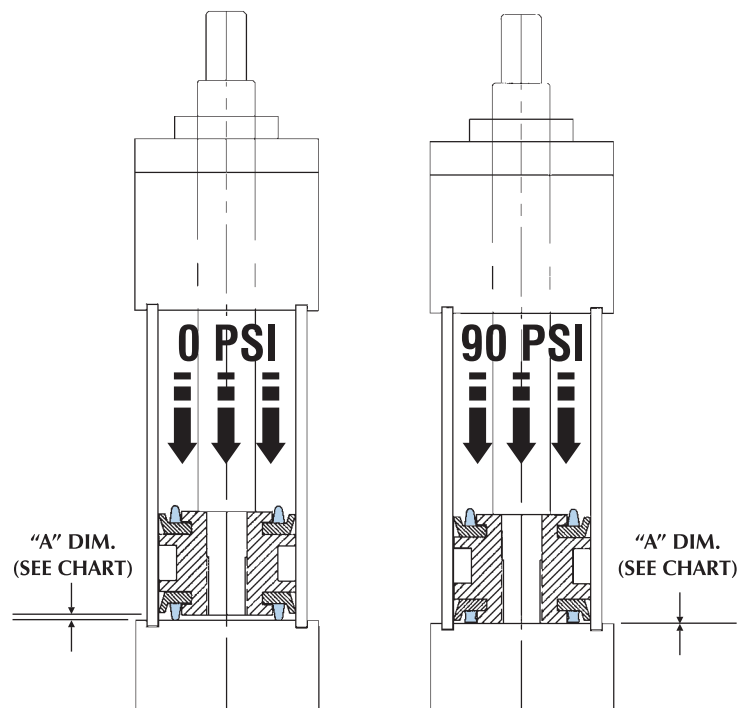
### Design Tips

- 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	



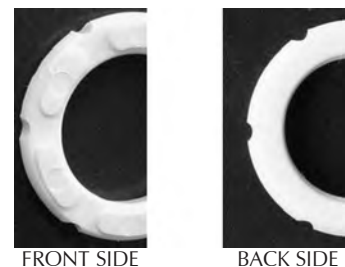
# SERIES 'TAS' BASIC OPTIONS

**H** **C** **LH** **LC** Cushions

TRD'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

## CAP CUSHIONS

**C** Standard Length Cap Cushion

**LC** Long Cap Cushion

## 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. 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, .63" piston rod, moving a 25 lb. load at 6 feet per second with 80 PSI air.

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

$$\text{Energy} = (26.25/64) \times (6^2) \text{ or } (36) + (80 \times .17)$$

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

The Maximum Energy Data Chart indicates that the long cushion at 38.6 maximum energy value would be the right choice for this application.

MAXIMUM ENERGY DATA CHART			
BORE	K	H or C	LH or LC
		Standard Cushion Series Max Energy (FT-LBS)	Long Cushion Series Max Energy (FT-LBS)
1.50	.06	8.2	12.8
2.00	.11	13.8	21.7
2.50	.17	24.6	38.6
3.25	.25	45.7	83.6
4.00	.38	57.3	137.1
5.00	.59	94.6	226.0
6.00	1.37	225.5	334.4
8.00	2.43	411.3	609.8

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 123 for details).
- BP seals provide additional impact dampening and noise reduction (refer to page 119 for details).



# SERIES 'TAS' 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).

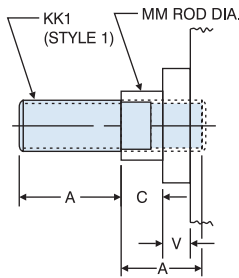
## BSPP British Standard Pipe Parallel

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

## KK3S Studded Piston Rod

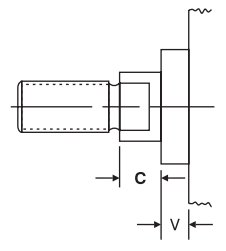
KK3S option combines the KK3 female threaded rod end design and a case-hardened stud, with permanent Loctite. When assembled, the KK3S has the same dimensions as a KK1 rod end.

This option is useful in applications that typically break standard KK1 rod ends due to high load impacting.



## 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.



## LF Low Friction

"LF" option incorporates the use of round-lip, extremely low friction Carboxylated Nitrile seals. Round-lip seals hydroplane on opposed sealing surfaces and have a lower running and break-away friction.

**BORE SIZES:** 1.50" to 8.00" Bore

**MATERIAL:** Carboxylated Nitrile

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

**OPERATING PRESSURE:** 250 PSI AIR (17 BAR)

## 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 6.00" 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	3.719	1/2 - 20	0.050
2.00	1.000	1.875	3.719	1/2 - 20	0.050
2.50	1.000	1.875	3.719	1/2 - 20	0.050
3.25	1.000	2.813	3.719	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:

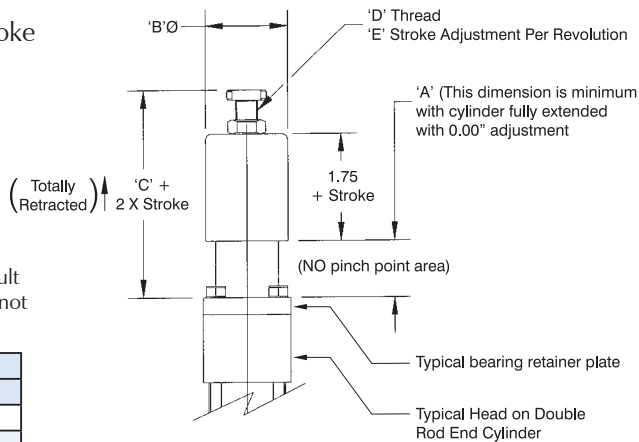
- 1) Set actuator to desired stroke
- 2) Turn stop collar until it makes contact with stop
- 3) Tighten set screw
- 4) Tighten jam nut for positive lock of stop collar

**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.**

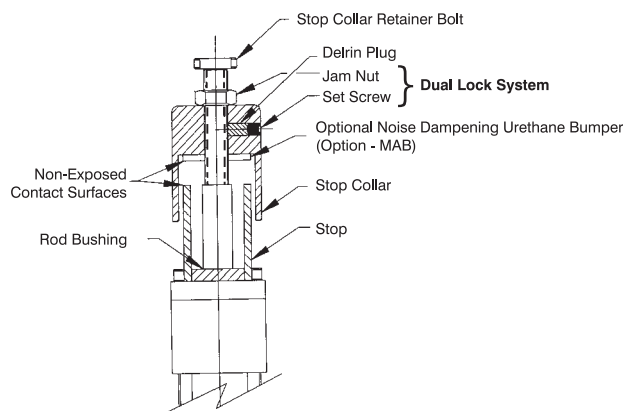
SKETCH A



TA-MF1D-MA (SHOWN)

**Construction: Anodized Aluminum**

SKETCH B



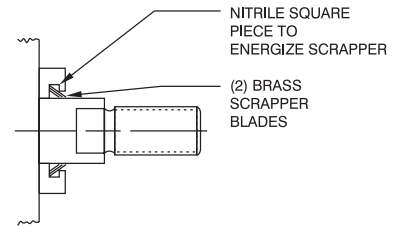
## MAB Micro-Adjust with Urethane Bumper

A noise dampening urethane bumper is added between the metal contact points, minimizing noise (see Sketch B above).

# SERIES 'TAS' BASIC OPTIONS

## 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 8.00" 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

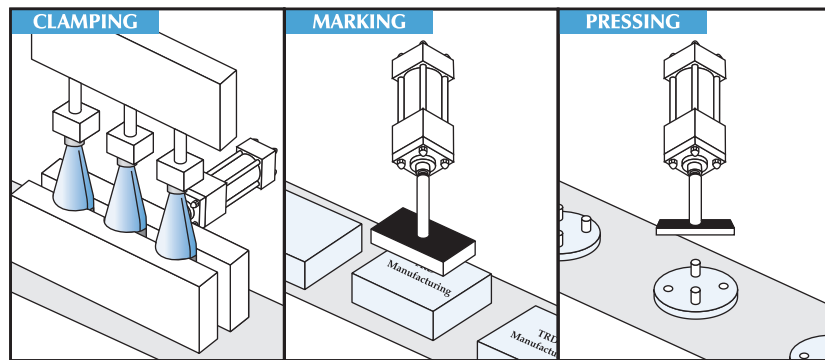
- Eliminates the need for external guide shafts in many positioning applications
- Guide rods are internal, self-cleaning and not subjected to harsh cleaners
- Compact design saves space; no larger than standard NFPA cylinders!
- Durable, self-contained construction



**FORCE CHART –**  
**Refer to page 152**

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

### Application Possibilities:



'NR' GUIDE ROD SIZES AND MAX STROKE				
BORE	ROD DIA. (MM)	CUSHIONS	GUIDE ROD DIAMETERS	MAXIMUM STROKE
2.00	0.625	Cap Only	0.250	10"
	0.625	Cap Only	0.312	12"
2.50	1.000	N/A	0.312	12"
	1.000	Available	0.375	18"
3.25	1.375	Cap Only	0.375	18"
	1.000	Available	0.625	30"
4.00	1.375	Available	0.625	30"
	1.000	Available	0.625	30"
5.00	1.375	Available	0.625	30"
	1.750	Available	0.625	30"
6.00	1.375	Available	0.625	30"
	1.750	Available	1.000	40"
8.00	1.375	Available	1.000	40"
	1.750	Available	1.000	40"

## OP Optional Port Location

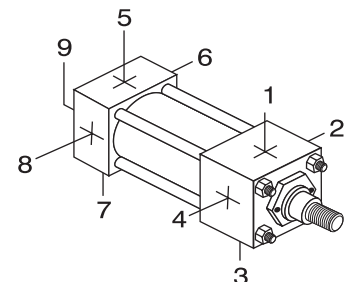
Optional port locations can be ordered simply by calling out the location numbers:

### Example:

TAS - 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 at 1 & 5
- STANDARD CUSHION POSITIONS at 2 & 6
- SPECIFY NON-STANDARD LOCATIONS WHEN ORDERING



# SERIES 'TAS' BASIC OPTIONS

## Optional Port and Cushion at Same Location ('TAS' Series)\*

Specify ports and cushions on the same cylinder side!

### Ordering Examples:

**TAS - MS4 - 2 X 10 - H1C5 - OP= 1 & 5**  
(Ports and Cushions @ 1 & 5)

**TAS - MS4 - 2 X 10 - H2C6 - OP= 2 & 6**  
(Ports and Cushions @ 2 & 6)

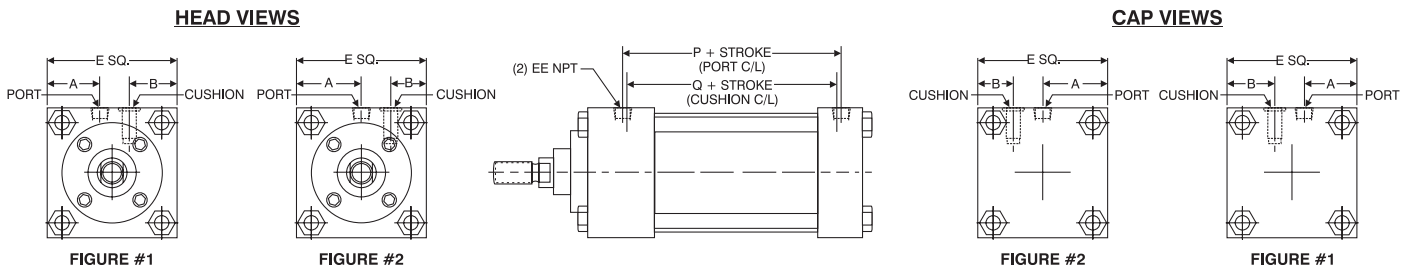
**TAS - MS4 - 2 X 10 - H1C6 - OP= 1 & 6**  
(Ports @ 1 & 6, Cushions @ 1 & 6)

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.

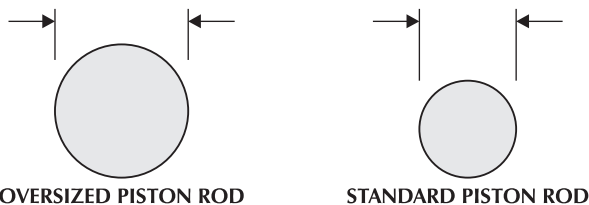


## BASIC DIMENSIONS:



BORE	ROD DIA. (MM)	FIGURE	A	B	E	P	Q	EE
1.50	0.625	1	0.750	0.625	2.000	2.375	2.125	0.250
	1.000	N/A	N/A	N/A	N/A			
2.00	0.625	1	0.875	0.938	2.500	2.375	2.125	0.375
	1.000	1	1.000	0.750	2.500			
2.50	0.625	1	1.125	1.125	3.000	2.500	2.250	0.375
	1.000	1	1.125	1.000	3.000			
3.25	1.000	1	1.500	1.375	3.750	2.750	2.500	0.500
	1.375	2	1.875	1.000	3.750			
4.00	1.000	2	2.250	1.250	4.500	2.750	2.500	0.500
	1.375	2	2.250	1.125	4.500			
5.00	1.000	2	2.750	1.750	5.500	3.000	3.000	0.500
	1.375	2	2.750	1.625	5.500			
6.00	1.375	2	3.250	1.875	6.500	3.250	3.000	0.750
	1.750	2	3.250	1.875	6.500			
8.00	1.375	2	4.250	2.750	8.500	3.375	3.125	0.750
	1.750	2	4.250	2.750	8.500			

### 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 125.

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

SAE ports can be ordered in place of NPT ports. Order by SAE number.

(Example: SAE #6)

RECOMMENDED SAE PORT SIZE BY CYLINDER BORE			
BORE	SAE#	BORE	SAE#
1.50	#4 (7/16-20)	4.00	#6 (9/16-18)
2.00	#4 (7/16-20)	5.00	#6 (9/16-18)
2.50	#4 (7/16-20)	6.00	#8 (3/4-16)
3.25	#6 (9/16-18)	8.00	#10 (7/8-14)

# SERIES 'TAS' BASIC OPTIONS

## SE Spring Extend (1.50" - 2.50" Bore)

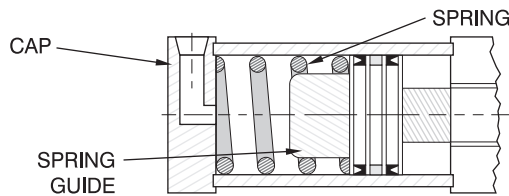
"SE" Option is designed to provide a spring bias to extend cylinder in the event of air pressure loss.

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" AND 2.50" BORE SPECS			
STROKE (INCHES)	OVERALL LENGTH ADDER FOR "SE" OPTION (INCHES)	SPRING RATE (LBS PER IN)	SPRING FORCE AT FULL EXTEND (LBS)
.50	.63	18	16
1	.88	12	13
1.50	1.13	9	12
2	1.38	7	11
2.50	1.50	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)

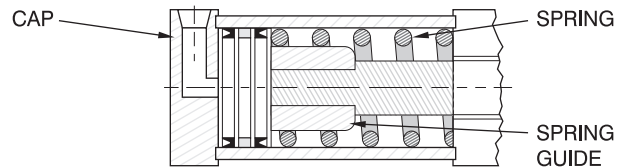
"SR" Option is designed to provide a spring bias to retract cylinder in the event of air pressure loss.

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" AND 2.50" BORE SPECS			
STROKE (INCHES)	OVERALL LENGTH ADDER FOR "SR" OPTION (INCHES)	SPRING RATE (LBS PER IN)	SPRING FORCE AT FULL RETRACT (LBS)
.50	.75	18	16
1	1	12	13
1.50	1.50	9	12
2	1.50	7	11
2.50	1.63	7	12
3	2.50	6	10
3.50	3	6	10
4	3.25	6	10
4.50	3.75	6	9
5	4	6	9
5.50	4	5	8
6	4	5	8

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



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

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

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

**SSC** Stainless Steel Cushion Needle External Adjustment Components

**SSR** Stainless Steel Piston Rod (Hard-Chrome Plated)

**SSF** Stainless Steel Fasteners (Bushing Retainer Screws)

**SST** Stainless Steel Tie Rods and Nuts

## VS Fluorocarbon Seals

**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 TRD for proper seal material selection in tough applications or environments.

## TH 400 PSI Hydraulic (Non-Shock)

**RATING:** 400 PSI Hydraulic, Non-Shock

**SEALS:**

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

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

# SERIES 'TAS' 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 ensure proper cylinder performance, in any given application. Stop tubes lower the cylinder bearing stress by adding length to the piston, which increases the overall length of the cylinder (note: TRD 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 has direct impact on the amount of stop tube required (see Chart 1).

Once the value of "D" is known, refer to Chart 2 for the recommended amount of stop tube.

**To order a stop tube, add the stop tube prefix "ST=" and the length, to the end of your cylinder model number.**

### Example:

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

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

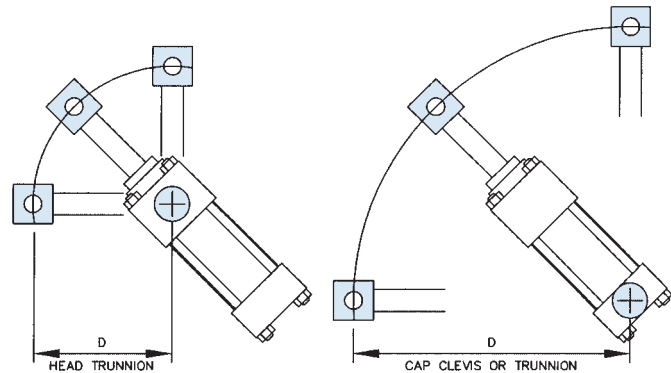
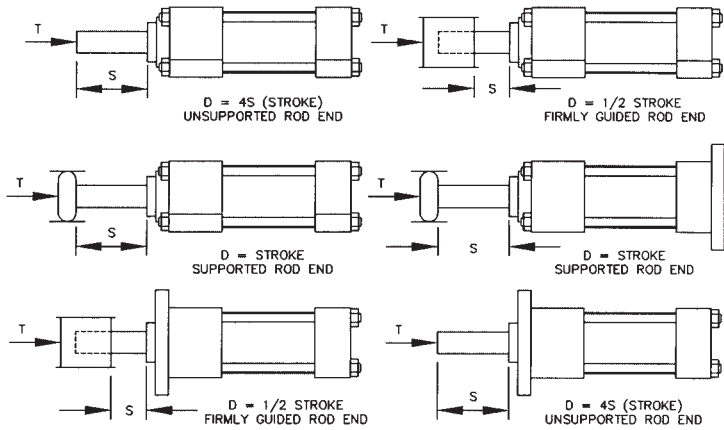
### Chart 1

Find the value of "D" for your application

"D" = Stroke, adjusted for mounting condition

"S" = Actual cylinder stroke

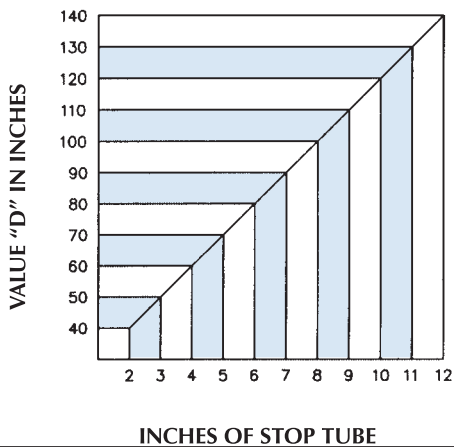
"T" = Axial thrust (refer to Chart 3)



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

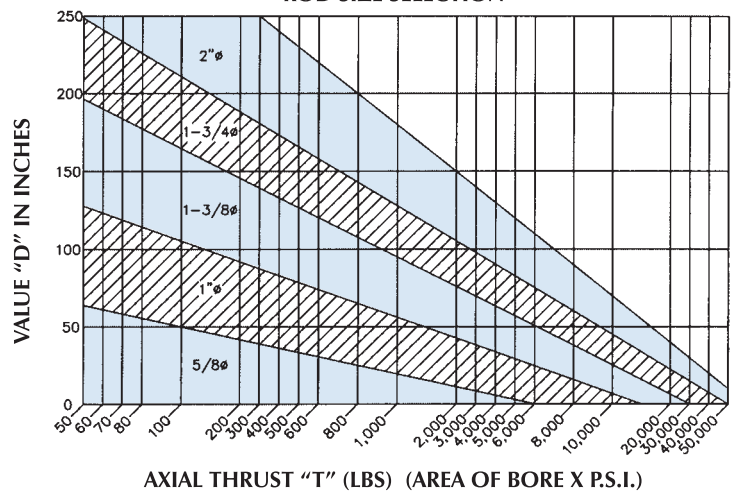
### Chart 2

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



### Chart 3

ROD SIZE SELECTION



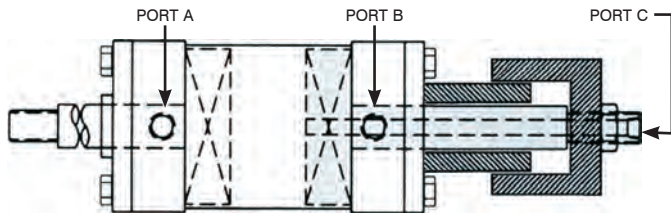


# SERIES 'TAS' UNCOMMON OPTIONS

## AS3POS Adjustable Mid Stroke (3-Position)

Double piston design allows for adjustment of the mid stroke position. Three ported cylinder with adjustable stop collar.

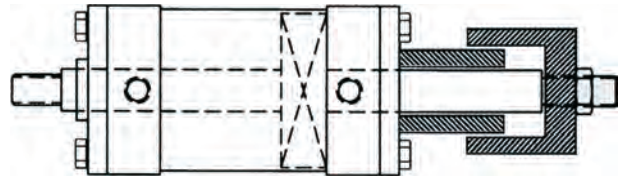
Contact TRD with your specifications.



## 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 TRD with your specifications.



## MANIFOLD BLOCK OR PLATE

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

Contact TRD with your specifications.



## EXTRA WIDE MULTIPLE WEAR BANDS

8" Piston with two 1" wide wear bands shown. (Special piston thickness shown; adds length to cylinder)

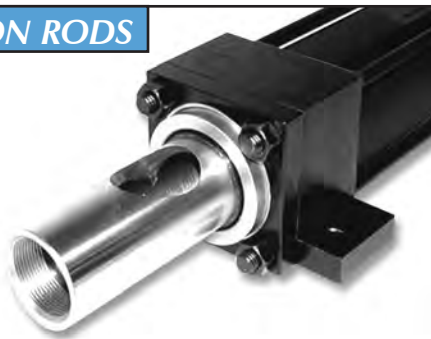


## HOLLOW PISTON RODS

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 TRD 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 TRD for specifications



## PAINT & OTHER SPECIAL FINISHES

**Standard Finish:** Black Urethane Paint (indoor/outdoor use.)

**Optional Paint:** Black Epoxy Paint (indoor use only.)

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

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

**Heavy Chrome Plated Piston Rods.**

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

## SPECIAL MF1 FLANGE

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

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



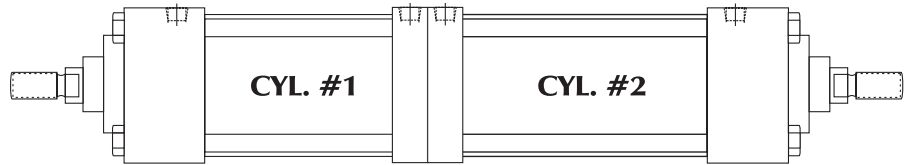


# SERIES 'TAS' UNCOMMON OPTIONS

## BTB Back-To-Back Cylinders

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

Contact TRD 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 three 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 TRD for more information.

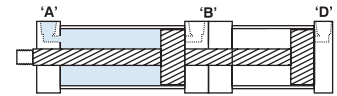
## 3-POSITION CYLINDERS

### HOW THEY WORK

■ = PRESSURE

#### POSITION 1 (RETRACT)

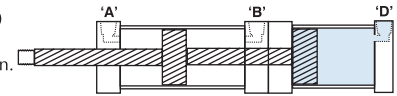
Pressure to port 'A' fully retracts cylinder.



(RETRACT)

#### POSITION 2 (MID-STROKE)

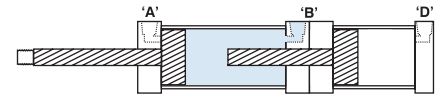
Pressure to port 'D' advances cylinder to mid-stroke position.



(MID-STROKE)

#### POSITION 3 (EXTEND)

Pressure to port 'B' fully extends cylinder.



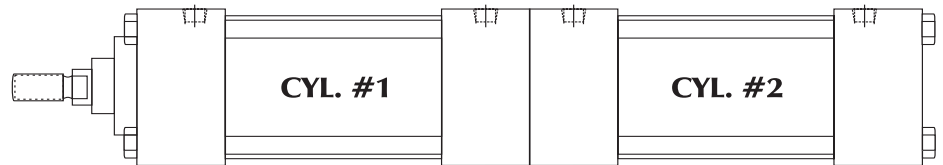
(EXTEND)

## TM Tandem Cylinders

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

**Note: Piston rods are connected.**

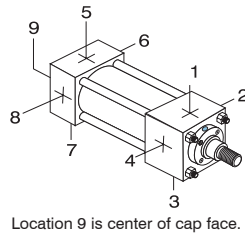
Contact TRD for more information.



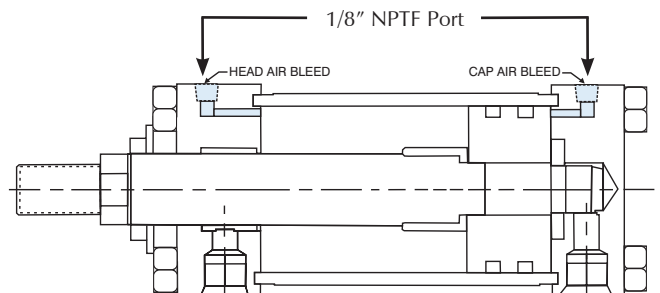
## ABP= Air Bleed Ports

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.

**Example: ABP=15**  
(Air Bleed ports at position 1 & 5)



Location 9 is center of cap face.

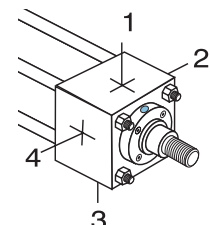
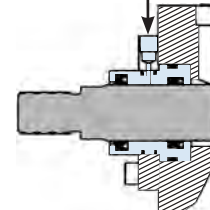


## DBB= Drain Back Bushing

When oil leakage cannot 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.

**Example: DBB=1**  
(drain port at position 1)

1/16" or 1/8" NPTF Port



Don't see an option that you need? Contact TRD! We have a multitude of options available or can manufacture what you need.

HH - Heavy Duty Hydraulic

HH Rod Lock

MH - Medium Duty Hydraulic

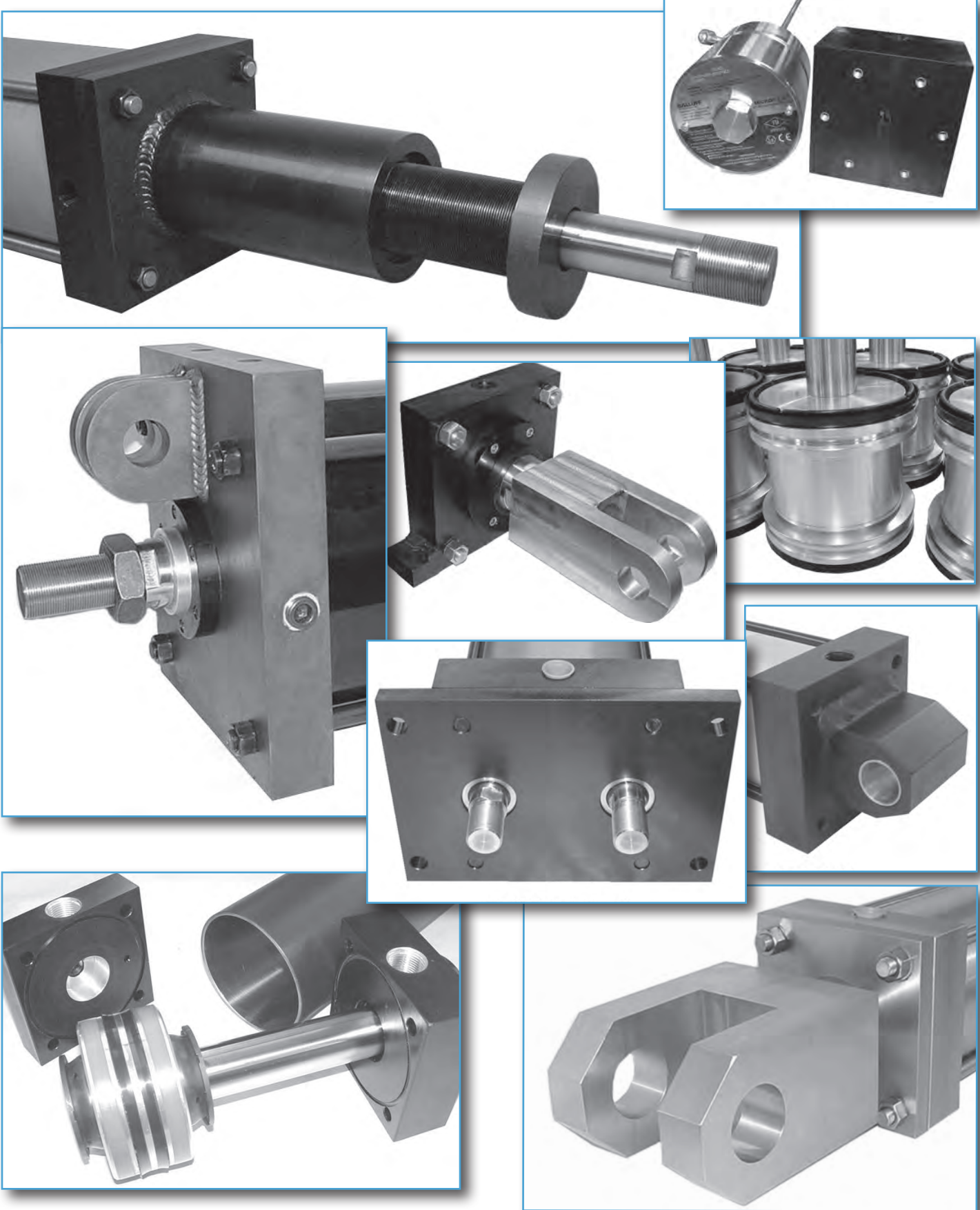
TAS - Heavy Duty Pneumatic

TAS Options

Accessories  
Page 130

STROKEMASTER  
Page 136

Technical Data  
Page 144





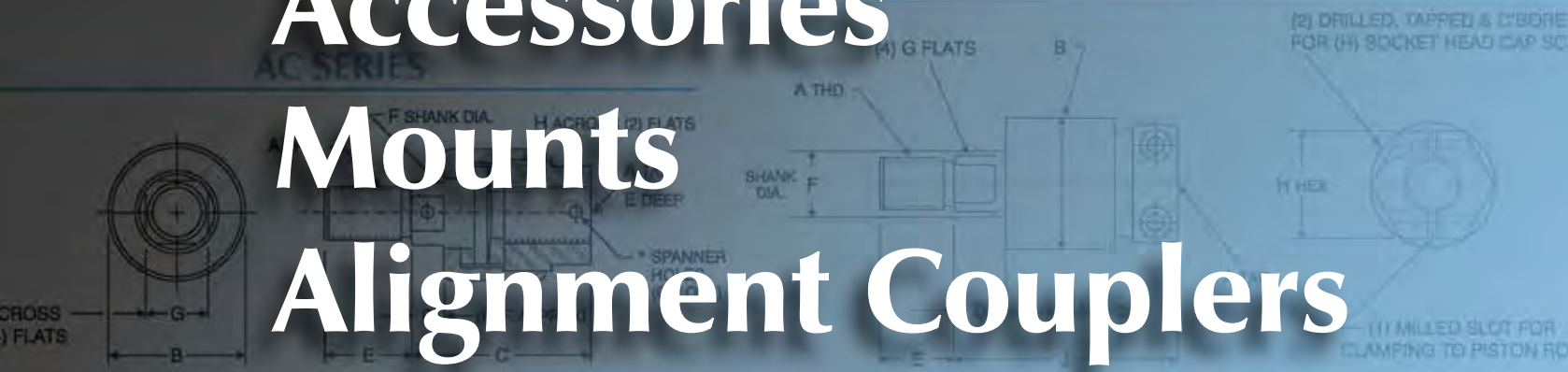
(example: 1.00" thread on 1.00 rod)

Large thread sizes can be "pinned" in tough duty applications, eliminating unwanted loosening of coupler from rod. Always use the smallest pin possible to avoid weakening the piston rod thread.

# Accessories

# Mounts

# Alignment Couplers



ALIGNMENT COUPLER DIMENSIONS											
PART NO.	A	B	C	D	E	F	G	H	H HEX	J	MAXIMUM WEIGHT

## Clevis Pins & Mounts

Page 130

AC750	3/4-16	1.750	2.313	0.438	1.125	0.968	0.813	1.125	1.750	2.500	34,000
AC875	7/8-14	1.750	2.313	0.438	1.125	0.968	0.813	1.125	1.750	2.500	40,000

Maximum weight cylinders with alignment couplers in horizontal applications

BORE	MAXIMUM STROKE
27	43
50	50

## Spherical Bearing

Page 132

AC2000	2-12	3.750	5.625	1.000	3.000	2.968	2.125	2.750	—	—	195,000
AC2250	2 1/4-12	4.500	6.375	1.000	3.500	2.968	2.625	3.175	—	—	240,000

27	43
50	50
3.25	50

## Alignment Couplers

Page 133



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

ACCESSORIES  
MOUNTS, ALIGNMENT  
COUPLERS

# ACCESSORIES: CLEVIS, PINS & MOUNTS

HH - Heavy Duty Hydraulic

HH Rod Lock

MH - Medium Duty Hydraulic

TAS - Heavy Duty Pneumatic

TAS Options

Accessories Page 130

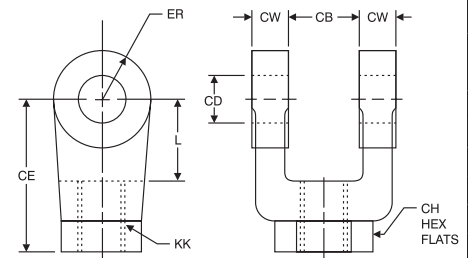
STROKEMASTER Page 136

Technical Data Page 144

ROD CLEVIS DIMENSIONS									
PART NO.	MAXLOAD (TENSION) RATED IN LBS	CB	CD (DIA.)	CE	CH	CW	ER (RADIUS)	KK	L
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
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



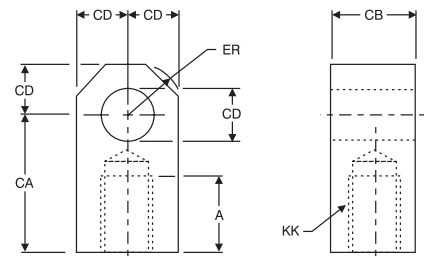
(Clevis Pins sold separately from Rod Clevises)

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.	MAXLOAD (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	1.187	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	5.812	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



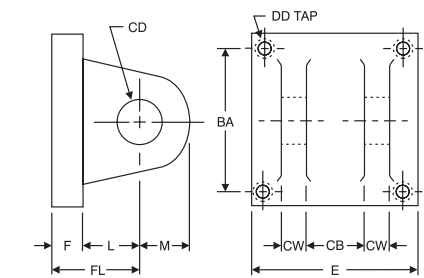
(Clevis Pins sold separately from Rod Eyes)

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.	MAXLOAD (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
CB4000		11.500	4.500	4.000	2.250	2 - 12	14.875	1.840	6.440	4.500	4.000

## CLEVIS BRACKET

MATERIAL: CAST STEEL  
FINISH: BLACK OXIDE

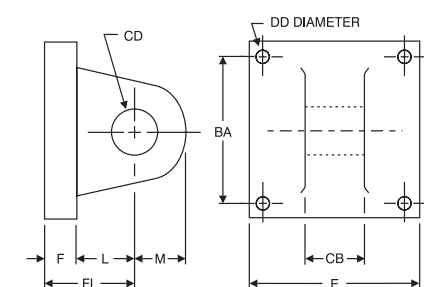


(Clevis Pins sold separately from Clevis Brackets)

EYE BRACKET DIMENSIONS										
PART NO.	MAXLOAD (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	6.440	4.500	4.000

## EYE BRACKET

MATERIAL: CAST STEEL  
FINISH: BLACK OXIDE



(Clevis Pins sold separately from Eye Brackets)

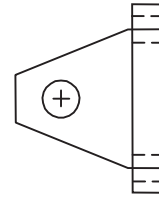
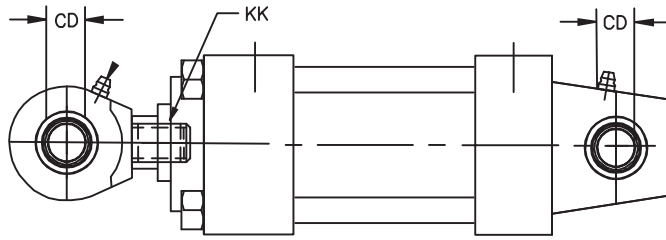
# ACCESSORIES: CLEVIS, PINS & MOUNTS

PIVOT PIN (INCLUDES COTTER PINS)		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	5.532	5.656	CP1750E	72000	1.750	5.188	5.547
CP2000C	94000	2.000	6.031	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

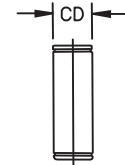
WELD PLATE		WELD PLATE DIMENSIONS									
PART NO.	ROD DIA.	E	F	G (DIA.)	H	I	K	L	M		
WP625	0.625	0.500	2.000	0.250	45.0°	90.0°	10 - 24	4	1.125		
WP1000	1.000	0.500	2.500	0.250	30.0°	60.0°	1/4 - 20	6	1.500		
WP1375	1.375	0.625	3.000	0.250	30.0°	60.0°	5/16 - 18	6	2.000		
WP1750	1.750	0.625	4.000	0.250	22.5°	45.0°	5/16 - 18	8	2.375		
WP2000	2.000	0.750	4.000	0.375	15.0°	30.0°	3/8 - 16	12	2.688		
WP2500	2.500	0.750	4.500	0.375	15.0°	30.0°	3/8 - 16	12	3.188		
WP3000	3.000	1.000	5.500	0.375	15.0°	30.0°	1/2 - 13	12	4.000		
WP3500	3.500	1.000	7.000	0.375	15.0°	30.0°	5/8 - 11	12	4.688		
WP4000	4.000	1.000	7.000	0.375	15.0°	30.0°	5/8 - 11	12	5.188		
WP4500	4.500	1.000	8.000	0.375	15.0°	30.0°	5/8 - 11	12	5.688		
WP5000	5.000	1.000	8.000	0.375	15.0°	30.0°	5/8 - 11	12	6.188		
WP5500	5.500	1.250	9.000	0.375	15.0°	30.0°	3/4 - 10	12	6.875		

FLANGE END COUPLER		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	

# ACCESSORIES: 'HH' & 'MH' SERIES SPHERICAL BEARING



Spherical Brg. Clevis Bracket



Spherical Brg. Clevis Bracket Pivot Pin & Retaining Ring

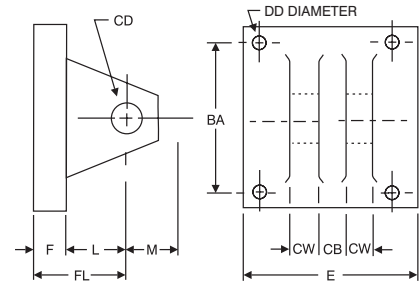
BORE	ROD DIAMETER (MM)	KK	CD	SPHERICAL BEARING ROD EYE PART NUMBER	SPHERICAL BEARING CLEVIS BRACKET PART NUMBER	SPHERICAL BEARING CLEVIS BRACKET PIVOT PIN PART NUMBER	SPHERICAL BEARING PIVOT PIN RETAINING RING PART NUMBER
1.50	0.625	7/16 - 20	0.500	HH-MSRE-500	CB500-SB	CP500-SB	SH-50 STPA
	1.000						
2.00	1.000	3/4 - 16	0.750	HH-MSRE-750	CB750-SB	CP750-SB	SH-75 STPA
	1.375						
	1.750						
2.50	1.000	3/4 - 16	0.750	HH-MSRE-750	CD750-SB	CP750-SB	SH-75 STPA
	1.375						
	1.750						
3.25	1.375	1 - 14	1.000	HH-MSRE-1000	CB1000-SB	CP1000-SB	SH-100 STPA
	1.750						
	2.000						
4.00	1.750	1 1/4 - 12	1.375	HH-MSRE-1375	CB1375-SB	CP1375-SB	SH-137 STPA
	2.000						
	2.500						
5.00	2.000	1 1/2 - 12	1.750	HH-MSRE-1750	CB1750-SB	CP1750-SB	SH-175 STPA
	2.500						
	3.000						
	3.500						
6.00	2.500	1 7/8 - 12	2.000	HH-MSRE-2000	CB2000-SB	CP2000-SB	SH-200 STPA
	3.000						
	3.500						
	4.000						

## SPHERICAL BEARING CLEVIS BRACKET DIMENSIONS

PART NO.	MAX LOAD (TENSION) RATED IN LBS	BA	CB	CD (DIA.)	CW	DD (DIA.)	E	F	FL	L	M
CB500-SB	5770	2.050	0.440	0.500	0.500	0.410	3.000	0.500	1.500	1.000	0.500
CB750-SB	9450	2.760	0.660	0.750	0.620	0.530	3.750	0.625	2.000	1.375	0.875
CB1000-SB	14300	4.100	0.880	1.000	0.750	0.530	5.500	0.750	2.500	1.750	1.000
CB1375-SB	20300	4.950	1.190	1.375	1.000	0.660	6.500	0.875	3.500	2.625	1.380
CB1750-SB	37800	6.580	1.530	1.750	1.250	0.910	8.500	1.250	4.500	3.250	1.750
CB2000-SB	50375	7.920	1.750	2.000	1.500	0.910	10.620	1.500	5.000	3.500	2.000

## CLEVIS BRACKET

MATERIAL: CAST STEEL  
FINISH: BLACK OXIDE

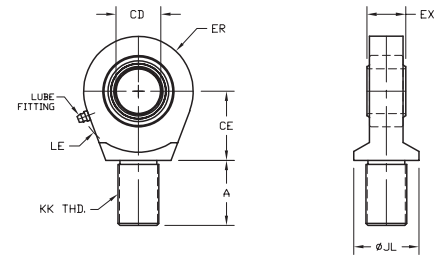


Clevis Pins sold separately from Clevis Brackets

## MALE SPHERICAL ROD EYE DIMENSIONS

PART NUMBER	BORE (REF.)	A	CD	CE	ER	EX	JL	KK	LE	LOAD CAPACITY LBS
HH-MSRE-500	1.50	0.688	0.500	0.875	0.875	0.437	0.875	7/16-20	0.750	2600
HH-MSRE-750	2.00	1.000	0.750	1.250	1.250	0.656	1.313	3/4-16	1.063	9400
HH-MSRE-750	2.50	1.000	0.750	1.250	1.250	0.656	1.313	3/4-16	1.063	9400
HH-MSRE-1000	3.25	1.500	1.000	1.875	1.375	0.875	1.500	1-14	1.438	16800
HH-MSRE-1375	4.00	2.000	1.375	2.125	1.813	1.188	2.000	1 1/4-12	1.875	28500
HH-MSRE-1750	5.00	2.125	1.750	2.500	2.188	1.531	2.250	1 1/2-12	2.125	43000
HH-MSRE-2000	6.00	2.875	2.000	2.750	2.625	1.750	2.750	1 7/8-12	2.500	70200

## MALE SPHERICAL ROD EYE



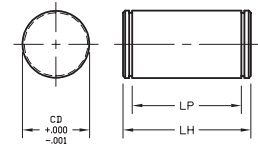
## PIVOT PIN (INCLUDES E-CLIPS)

## 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
CP500-SB	8600	0.499	1.562	1.780	CP1375-SB	65000	1.374	3.312	3.610
CP750-SB	19300	0.749	2.031	2.281	CP1750-SB	105200	1.749	4.218	4.578
CP1000-SB	34300	0.999	2.500	2.750	CP2000-SB	137400	1.999	4.937	5.295

## SPHERICAL BEARING

PIVOT PIN  
(INCLUDES E-CLIPS)





# ACCESSORIES: ALIGNMENT COUPLERS

## Solid Steel Self-Aligning Piston Rod Couplers

TRD'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!

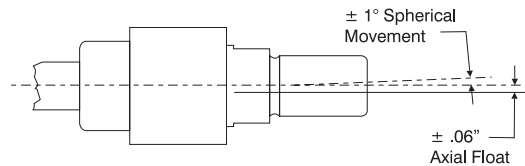
### Benefits

- Rod alignment couplers eliminate expensive machining for mounting fixed or rigid cylinders on guided or slide applications.
- 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: 1.00" thread on 1.00" rod).
- Large thread sizes can be pinned in tough duty applications, eliminating unwanted loosening of coupler from rod. Always use the smallest pin possible to avoid weakening the piston rod thread.

**MATERIAL:** 100,000 MIN. YIELD  
STRESS-PROOF™

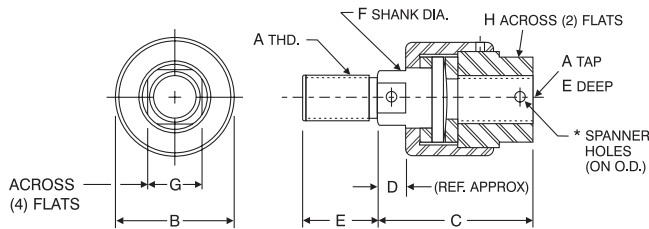


**Standard AC Coupler**  
AC250 - AC5000

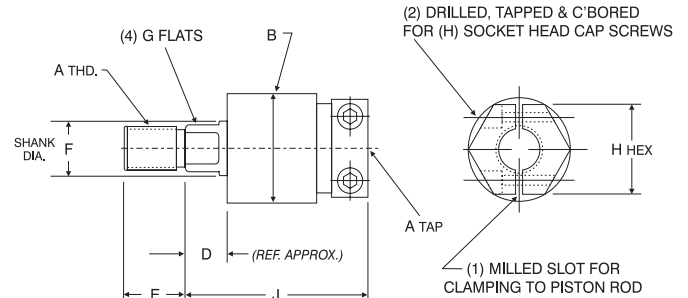


**ACH Coupler**  
ACH250 - ACH1250

### AC SERIES



### ACH SERIES



ALIGNMENT COUPLER DIMENSIONS

PART NO.	A	B	C	D	E	F	G	H	H HEX	J	MAX PULL POUNDS (3:1 SAFETY FACTOR)
AC250	1/4 -28	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	886
AC312	5/16 -24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	1,623
AC375	3/8 -24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	2,532
AC437	7/16 -20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.250	2.156	3,526
AC500	1/2 -20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.125	2.156	4,841
AC625	5/8 -18	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.250	2.156	7,862
AC750	3/4 -16	1.750	2.313	0.438	1.125	0.968	0.813	1.125	1.750	2.500	11,543
AC875	7/8 -14	1.750	2.313	0.438	1.125	0.968	0.813	1.125	1.750	2.500	15,846
AC1000	1 -14	2.500	2.938	0.438	1.625	1.344	1.156	1.625	2.500	2.938	21,206
AC1250	1 1/4 -12	2.500	2.938	0.438	1.625	1.344	1.156	1.625	2.500	2.938	34,024
AC1375	1 3/8 -12	2.500	2.938	0.438	1.625	1.344	1.156	1.625	—	—	40,710
AC1500	1 1/2 -12	3.250	4.375	0.875	2.250	1.968	1.750	2.375	—	—	49,857
AC1750	1 3/4 -12	3.250	4.375	0.875	2.250	1.968	1.750	2.375	—	—	69,558
AC1875	1 7/8 -12	3.750	5.625	1.000	3.000	2.468	2.125	2.750	—	—	79,354
AC2000	2 -12	3.750	5.625	1.000	3.000	2.468	2.125	2.750	—	—	92,531
AC2250	2 1/4 -12	4.500	6.375	1.000	3.500	2.968	2.625	3.375	—	—	118,776
AC2500	2 1/2 -12	5.000	6.563	1.000	3.500	3.938	—	—	—	—	149,543
AC2750	2 3/4 -12	5.000	6.563	1.000	3.500	3.938	—	—	—	—	182,464
AC3000	3 -12	5.000	6.563	1.000	3.500	3.938	—	—	—	—	218,658
AC3250	3 1/4 -12	6.250	8.125	1.000	4.500	4.938	—	—	—	—	258,124
AC3500	3 1/2 -12	6.250	8.125	1.000	4.500	4.938	—	—	—	—	300,863
AC3750	3 3/4 -12	6.250	8.125	1.000	4.500	4.938	—	—	—	—	346,875
AC4000	4 -12	7.500	9.500	1.000	5.500	5.938	—	—	—	—	396,158
AC4500	4 1/2 -12	7.500	9.500	1.000	5.500	5.938	—	—	—	—	504,544
AC5000	5 -12	7.500	9.500	1.000	5.500	5.938	—	—	—	—	626,019

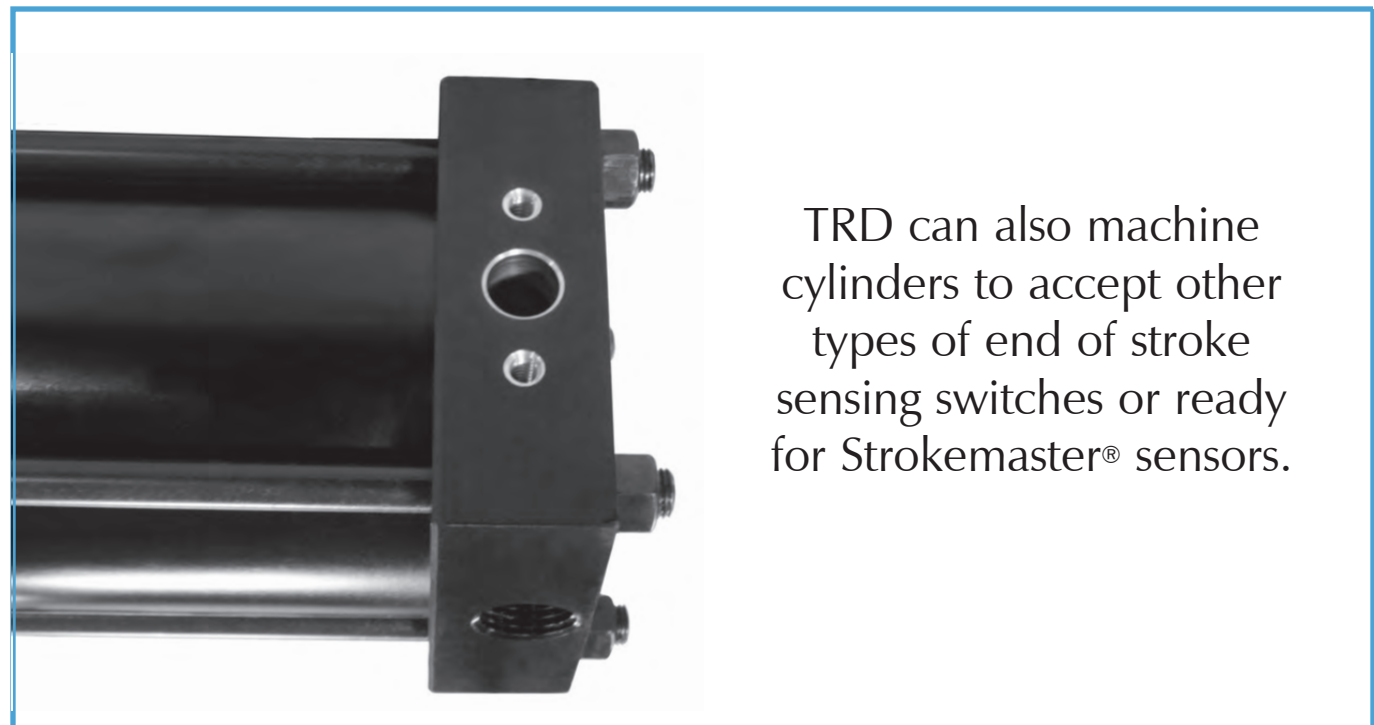
**SPANNER HOLES**

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

Notes: Please specify AC or ACH coupler when ordering; i.e.: AC750 (Std. Coupler) or ACH750 (Hex Coupler).  
Spanner holes are used on AC2500 and larger, (2) 1/2" dia. holes, 1/2" deep, 180° apart (each end).

HH - Heavy Duty Hydraulic  
HH Rod Lock  
MH - Medium Duty Hydraulic  
TAS - Heavy Duty Pneumatic  
TAS Options  
Accessories Page 130  
STROKEMASTER Page 136  
Technical Data Page 144

TRD stocks Strokemaster® sensors for quick delivery. The correct combination of sensor and spacer will be provided for proper operation.



TRD can also machine cylinders to accept other types of end of stroke sensing switches or ready for Strokemaster® sensors.

TRD's extensive inventory allows customers to specify the ports you want, where you want them, made-to-order strokes and customize your rod end.  
***Most catalog options ship in 2-3 days!***

A high-pressure, inductive proximity switch, the Strokemaster® sensor provides a 2mm (0.8") sensing range to pick up the "spud" of hydraulic cylinders and indicate their extended position. It mounts with just two screws, and seals with an O-ring. Withstanding pressures to 3000 psi (207 BAR), the embeddable design keeps most of the cylinder protected with only a 0.62" (16mm) high housing exposed outside. The rotating housing can be locked in the desired position with either one of two set screws.

Strokemaster® is CE-certified, and its housing is sealed to IP67 requirements.

# Strokemaster® BALLUFF MTS Transducers



**Strokemaster®**

**Page 136**

**Balluff Transducers**

**Page 140**

**MTS Temposonic® Transducers**

**Page 142**



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

STROKEMASTER  
BALLUFF  
MTS TRANSDUCERS



# BALLUFF INDUCTIVE SENSORS

## BALLUFF **STROKEMASTER**™ Inductive Sensors

### Flexible Solutions for an Often Inflexible World

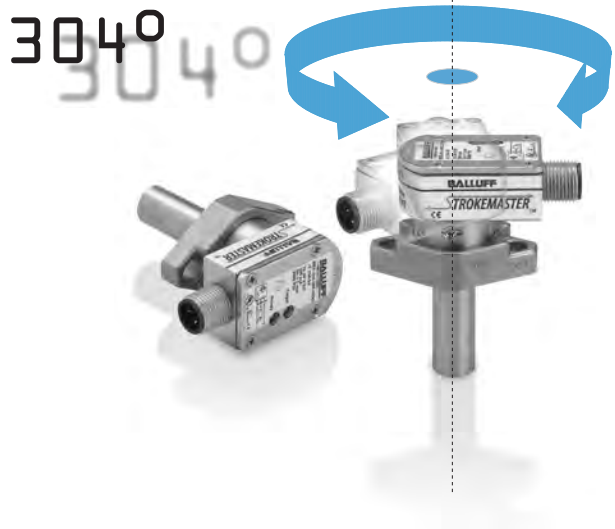
Balluff's new Strokemaster® cylinder-piston sensors provide precision end-of-stroke sensing for hydraulic cylinders. It also eliminates post-installation cable management problems with 304° of rotational freedom on the connector.

Strokemaster® sensors allow infinitely adjustable and lockable cable positioning anytime after mounting to the cylinder. Without breaking the seal, Strokemaster® enables quicker installation of the sensor *and* neat cable runs.

A high-pressure, inductive proximity switch, the Strokemaster® sensor provides a 2mm (0.8") sensing range to pick up the spud of hydraulic cylinders and indicate fully retracted or extended position. It mounts with just two screws, and seals with an 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. The rotating housing can be locked in the desired position with either one of two set screws.

Strokemaster® sensors are available in 3-wire or 4-wire DC and 3-wire AC/DC versions, mini or micro connectors. Switching frequency is 50 Hz in the AC/DC versions. All units are weld-field immune and short-circuit and reverse polarity protected. They fit all popular cylinder designs, with standard probe lengths of 0.912" - 4.560" (23.165mm - 115.8mm), along with available custom probe lengths and spacers. Probes are made of stainless steel with a ceramic face. Both DC and AC/DC sensors have all metal housings.

Strokemaster® is CE-certified, and its housing is sealed to IP67 requirements.



# BALLUFF INDUCTION SENSORS

## DC INDUCTIVE SENSORS

### Features/Advantages

Inductive cylinder switch for piston position feedback in cylinders.

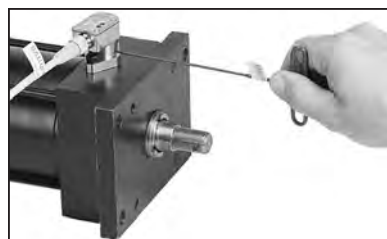
- Magnetic field immune, for use with welding equipment
- Available in DC or all current (AC/DC) versions
- Easy installation - sensor mounts to cylinder with (2) fasteners
- Sealed directly at flange, connector can be oriented after installation
- Various lengths available for different cylinder sizes



Bolt sensor to cylinder.

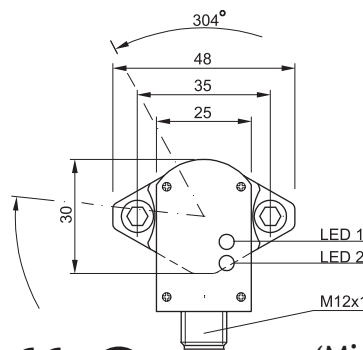


Position cable to desired orientation (even over mounting bolts).

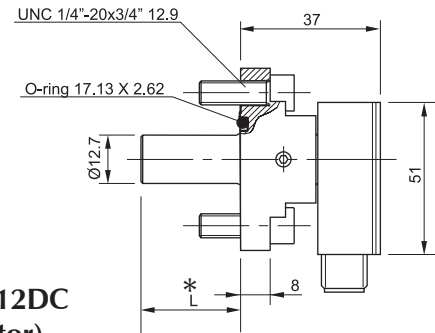


Lock chosen position with one or both of the two integral set screws.

**Refer to page 139 for available cable connector sets.**

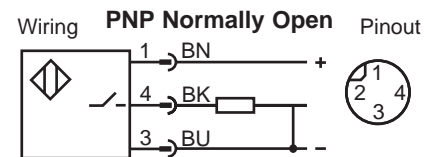


(Micro M12DC Connector)



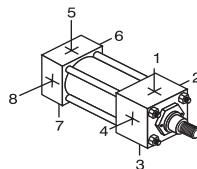
PNP	Normally-open
Rated operational voltage $U_o$	24 V DC
Supply voltage $U_s$	10...30 V DC
Voltage drop $U_d$ at $I_o$	< 2.5 V
Rated insulation voltage $U_i$	75 V DC
Rated operational current $I_o$	200 mA
No-load supply current $I_o$ damped/undamped	< 18 mA / < 10 mA
Off-state current $I_o$	< 80 $\mu$ A
Protected against polarity reversal	yes
Short circuit/overload protected	yes/yes
Load capacitance	< 1.0 $\mu$ F
Repeat accuracy R	< 5 %
Ambient temperature range $T_a$	-25...+70°C
Frequency of operating cycles f	10 Hz
Utilization categories	DC 13
Function/Operating voltage indication	yes/yes
Degree of protection per IEC 529	IP 67/connector IP 65
Housing material	stainless steel/aluminum
Material of sensing face	ceramic
Connection	Micro connector
Approvals	cULus
High pressure rated up to	207 bar (3000 PSI)
<b>Recommended connector</b>	<b>C04 AEL-00-VY-050M</b>

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 $\mu$ A
yes
yes/yes
< 1.0 $\mu$ 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)
<b>C04 AEL-00-VY-050M</b>



\*TRD will supply the correct length probe and spacer combination (if required) for each cylinder. Using the combination of standard probe lengths & spacers, will give the appropriate .030" gap between sensor and cylinder spud. The spacers supplied have the same base profile as the sensor (material: stainless steel).

### HOW TO ORDER CYLINDERS WITH BALLUFF SENSORS:



#### STANDARD LOCATIONS:

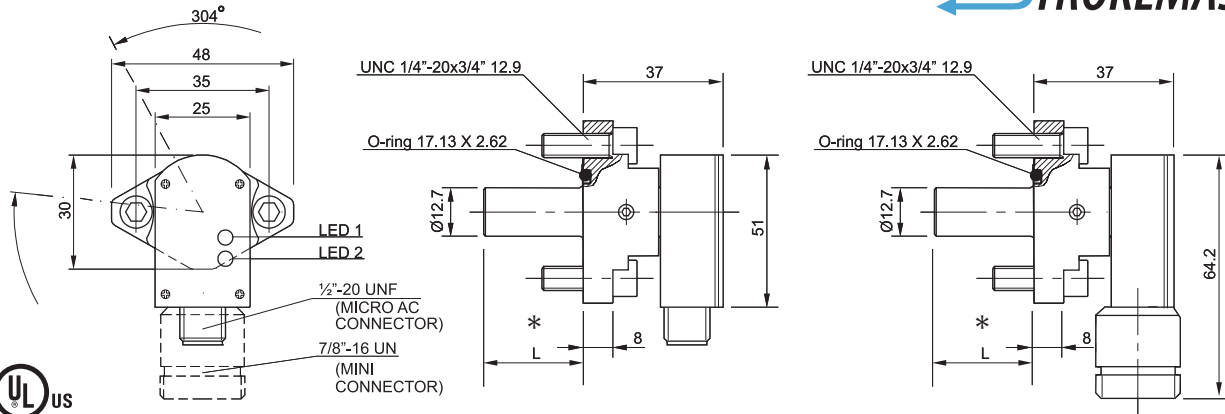
- Ports at 1 and 5
  - Cushions at 2 and 6
  - Sensors at 4 and 8
- (Specify non-standard locations)

- Cylinder Model Number ➔ HH-MS2-325-100-KK1-N500
- 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

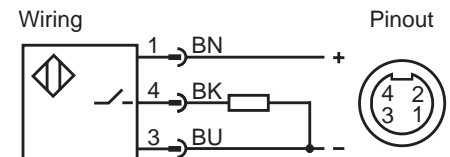
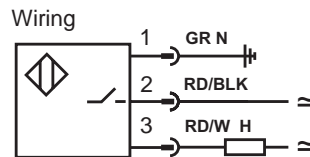
**Note:** TRD will include the Strokemaster® probe length on your order and any sensor spacers required. (Example: HH-MS2-325-100-KK1-N500- BES 516-300-S4 /1.025-S21 (Head) -BES 516-300-S4 /1.75-S21 (Cap) - Sensors at 4 & 8.

# BALLUFF INDUCTION SENSORS

## AC/DC INDUCTIVE SENSORS

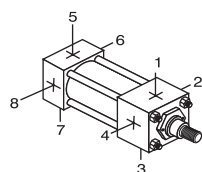


	BES 516-200-S 2-S21	BES 516-200-S 2-S5
Normally-open		
Rated operational voltage $U_e$	110 V AC	110 V AC
Supply voltage $U_B$	20...250 V AC/DC	20...250 V AC/DC
Voltage drop $U_d$ at $I_e$	< 6 V	< 6 V
Rated insulation voltage $U_i$	250 V AC	250 V AC
Rated operational current $I_e$	500 mA	500 mA
Minimum operational current $I_m$	5 mA	5 mA
Off-state current $I_o$	< 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	Mini connector	Mini connector
Approvals	cULus	cULus
High pressure rated up to	207 bar (3000 PSI)	207 bar (3000 PSI)
<b>Recommended connector</b>	<b>C21 AE1-00-VY-150F</b>	<b>C05 AE1-00-VY-150F</b>



\*TRD will supply the correct length probe and spacer combination (if required) for each cylinder. Using the combination of standard probe lengths & spacers, will give the appropriate .030" gap between sensor and cylinder spud. The spacers supplied have the same base profile as the sensor (material: stainless steel).

### 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 ➔ HH-MS2-325-100-KK1-N500
- 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:** TRD will include the Strokemaster® probe length on your order, and any sensor spacers required.  
**(Example:** HH-MS2-325-100-KK1-N500- BES 516-200-S 2 /1.025-S21 (Head) -BES 516-200-S 2 /1.75-S21 (Cap) - Sensors at 4 & 8.

Refer to page 139 for available cable connector sets.



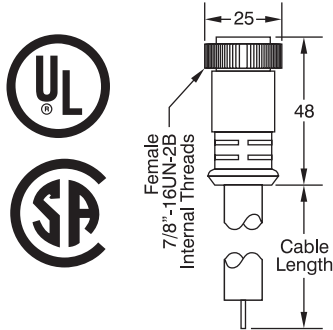
# BALLUFF INDUCTION SENSORS

## CABLE CONNECTORS



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

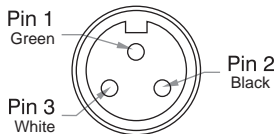
Connector	3-5 Pole Mini
Style	Mini Size A
Configuration	Straight Female
Recommended Connector	<b>C05 AE1-00-VY-150F</b>



	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

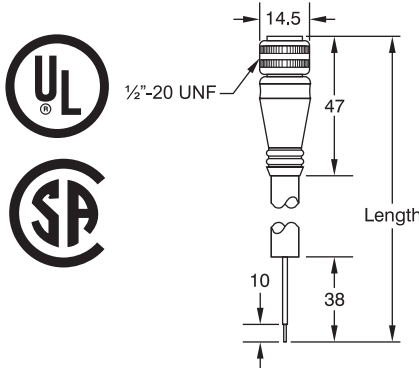
\* Insert **V** = PVC Cable  
**T** = TPE Cable  
 For 3 pole versions only

Female 3-pin - Face view



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

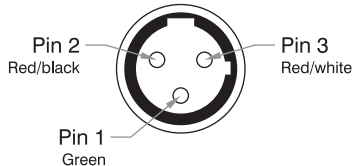
Connector	Micro AC .50" x 20 UNF
Style	3 Pin Dual Keyway
Configuration	Straight Female
Recommended Connector	<b>C21 AE3-00-VY-150F</b>



	ORDER NUMBER
3 Pin Dual Keyway	C21 AE3 00 * Y 150F
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

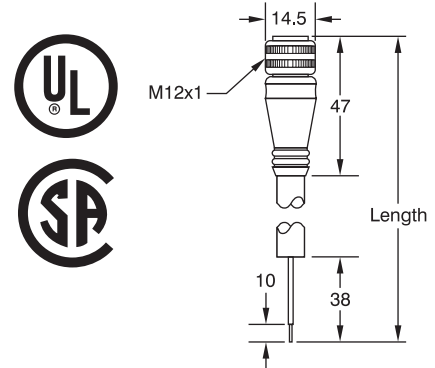
\* Insert **V** = PVC Cable  
**T** = TPE Cable  
 For 3 pole versions only

Female - Face view



### S4 - Micro Connectors (M12x1 Metric Threads)

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

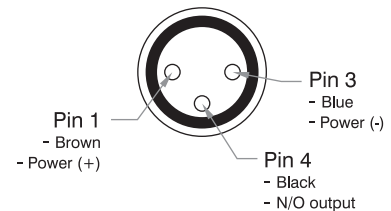


	Note	ORDER NUMBER
3 Wire DC		
3 Wire Normally Open, non-LED	<b>1,2,3</b>	C04 AEC 00 * Y 050M
3 Wire Normally Open PNP w/LED		C04 AEH 00 * Y 050M
4 Wire DC (NO/NC) Recommended		
4 Wire (Universal), non-LED	<b>1,2,3</b>	C04 AEL 00 * Y 050M
4 Wire PNP w/LED	<b>1,3</b>	C04 AEM 00 * Y 050M
Voltage Rating		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

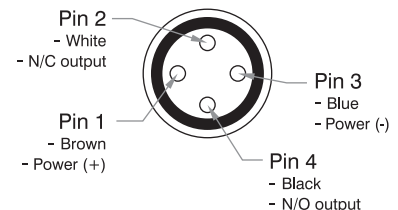
\* Insert **V** = PVC Cable  
**T** = TPE Cable  
 For 3 pole versions only

Notes: 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 Coupling Nut: Change E to S, i.e. C04ASC00TY050M

Female - Face view



Female - Face view



Refer to Balluff Catalog for additional cable connectors.

# BALLUFF TRANSDUCERS



## BALLUFF

### Enhanced Magnetostrictive Technology

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

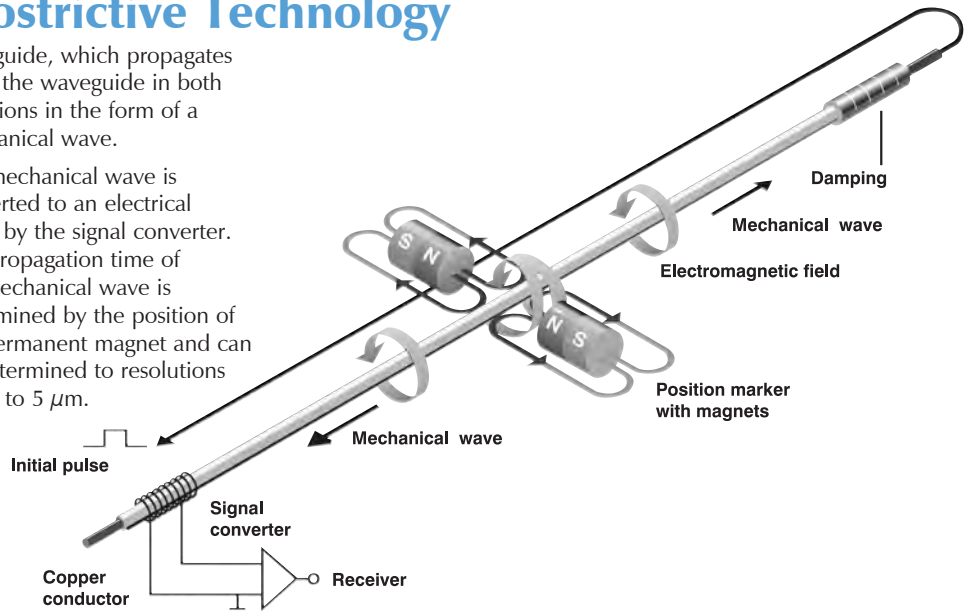
A copper conductor is introduced through the length of this tube. The start of measurement is initiated by a short current pulse. This current generates a circular magnetic field which rotates around the waveguide.

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  $\mu\text{m}$ .



**Balluff has the right transducer for any application!**

- Rod styles
- Profile styles
- Tubular styles
- Embeddable style
- Explosion-proof style

**Rod Style**

**Z**

- 3/4" x 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
- Eliminates the need for protective cover
- Designed for demanding applications
- 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

	Z	W	K
<b>Sensor Output Options</b>			
<b>Analog</b>			
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	•	•	•
<b>Digital</b>			
Start/Stop, RS422	•	•	•
Pulse-Width Modulated, RS422	•	•	•
PWM (w/ recirculations), RS422	•	•	•
<b>Specialized</b>			
Synchronous Serial Interface*	•	•	•
CANopen	•	•	•
Profibus DP	•	•	•
Quadrature	•	•	•
<b>Resolution</b>			
0.1 mV (analog)	•	•	•
0.2 $\mu\text{A}$ (analog)	•	•	•
16 bit (analog)	•	•	•
Controller-dependent (Start/Stop & PWM)	•	•	•
1,2,3,5,10 $\mu\text{m}$ selectable (Quadrature output)	•	•	•
1,5,10,20,40 $\mu\text{m}$ selectable (SSI output)	•	•	•
5 $\mu\text{m}$ increments selectable (CANopen & Profibus)	•	•	•
<b>Stroke Length</b>			
Active measurement area: 2" to 156" (Consult factory for longer lengths)	2" - 156"	2" - 156"	2" - 156"
<b>Wiring Options</b>			
Quick disconnect	•	•	•
Cable-out	•	•	•
<b>Operating Voltage</b>			
24 V DC ( $\pm 20\%$ )	•	•	•
$\pm 15$ V DC ( $\pm 2\%$ )	•	•	•

\*(24 or 25 bit binary or gray code)

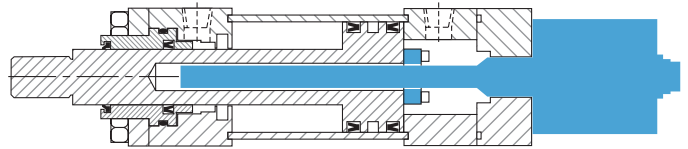
# BALLUFF TRANSDUCERS

TRD 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 TRD before shipping.*

## INTERNAL MODELS (BALLUFF Z, W, K SERIES)

- Not available on MP1 and MP2 Mounts
- 1.50" to 8.00" Bores
- Gun-drilled piston rod (Requires 1" piston rod or larger)
- Balluff Magnet (Installed on piston)
- May require additional cap length

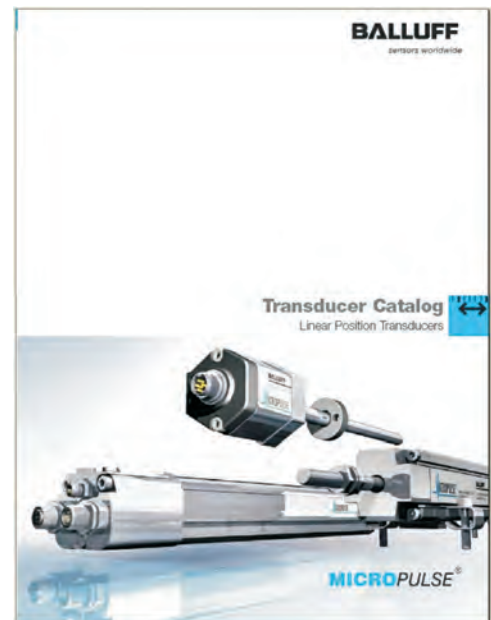
SERIES "Z" SHOWN



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

Visit [www.balluff.com](http://www.balluff.com)

- Other Balluff models are available. Call TRD Mfg. (800-654-2535) for information and cylinder design assistance.



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

PRODUCTS SOLUTIONS NEWS ABOUT BALLUFF SALES & SERVICE HOME

2008 Photoelectrics

**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



# MTS Temposonics® TRANSDUCERS

TRD will provide hydraulic cylinders built to your specifications and can incorporate MTS Temposonics® Transducers in a wide variety of models.

Visit [www.mtssensors.com](http://www.mtssensors.com) for detailed product information or call TRD for more information.

	<b>R-SERIES</b> A smart sensor for fast, high precision and synchronized position control applications.	<b>G-SERIES</b> Programmable sensors with built in diagnostics.
		
	<b>H STYLE</b> Hydraulic/pneumatic sensor housing with integral electronics	
<b>DIRECT SENSOR OUTPUTS</b>	Voltage 0 to +10V, +10 to 0V -10 to +10V, +10 to -10V (1)	Voltage 0 to +10V, +10 to 0V -10 to +10V, +10 to -10V (1)
	Current 0 or 4 to 20 mA, 20 to 4 or 0 mA	Current 0 or 4 to 20 mA, 20 to 4 or 0 mA
	SSI, Synchronous Serial Interface, (absolute encoder format)	
	Fieldbus - CANbus (2), DeviceNet, Profibus DP	
		Digital Pulse Start/Stop or PWM
<b>STROKE LENGTH</b>	50 to 7,620 mm (2 to 300 in.)	Voltage or Current 50 to 2,540 mm (2 to 100 in.) Digital Pulse 50 to 7,620 mm (2 to 300 in.)
<b>RESOLUTION</b>	16 bit, as low as 0.01 mm (0.0004 in.) (Analog)	Infinite (6)
	as low as 0.002mm (0.00008 in.) (Digital) (5)	Controller Dependent (Digital Pulse)
<b>MEASUREMENT FEATURES</b>	Position / Displacement	Position / Displacement
	Velocity	
	Multiple magnets to 15	Multiple magnets to 15
	Analog Zero and Span Scale Adjustment	Analog Zero and Span Scale Adjustment
<b>EXTERNAL INTERFACES</b>		TDU-200 Digital Display (for digital pulse outputs)
		MK-292 (Parallel 24 Bit Binary, BCD or Gray Code)

Hydraulic/Pneumatic "H Style"

- Sensing element pressure housing threads into standard size port on cylinder end cap.
- Industry standard for position feedback in fluid power cylinders.
- Convenient sensor cartridge field replacement without need to break oil seal.
- High pressure flange and isolation tube (5000 PSI static, 10,000 PSI spike).

- (1) Additional output ranges available.
- (2) Includes CANOpen and MTS multiple-magnet position, velocity and programmable limit switch output.
- (3) R-Series SSI available with 0.001mm (0.00004 in.) resolution.
- (4) Analog (Voltage or Current) resolution restricted by output ripple.

HH - Heavy Duty Hydraulic  
HH Rod Lock  
MH - Medium Duty Hydraulic  
TAS - Heavy Duty Pneumatic  
TAS Options  
Accessories Page 130  
STROKEMASTER Page 136  
Technical Data Page 144



# Technical Data

**Parts Lists & Seal Kits**      **Page 144**

**Force Charts**      **Page 150**

**Cylinder Speeds**      **Page 153**

**Weight Charts**      **Page 154**

**Seal Compatibility**      **Page 156**

**Conversion Charts**      **Page 157**

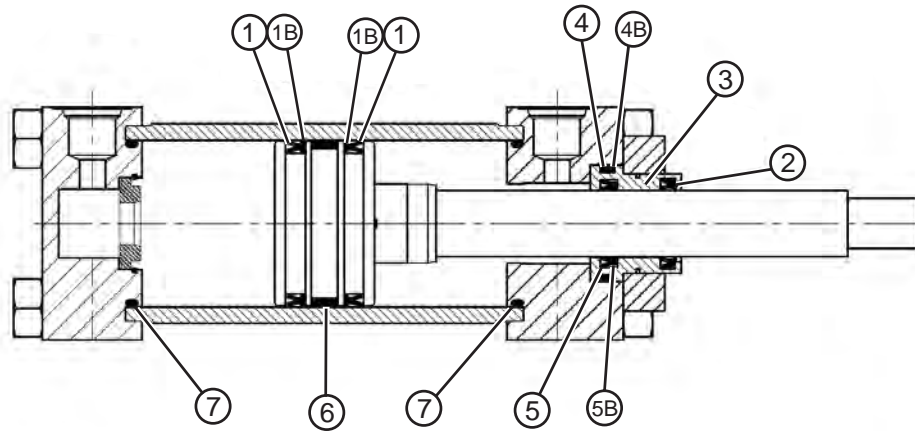
**Fluid Power Formulas**      **Page 158**

**TRD Application Checklist**      **Page 159**

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

# 'HH' PART LIST & SEAL KITS

PARTS WITH THIS COLOR SCHEME ARE NON-STOCK ITEMS. CONTACT FACTORY FOR DELIVERY.



(1) PISTON SEAL					
BORE	CARBOXILATED NITRILE (STANDARD)	FLUOROCARBON (V OPTION)	ETHYLENE PROPYLENE (E OPTION)	CAST IRON RINGS (C OPTION)	PTFE W/ GLASS (T OPTION)
1.50	HH-PS-15-CN	HH-PS-15-V	HH-PS-15-EP	HH-PS-CR-15-TFP	HH-PS-R5-15-T-B
2.00	HH-PS-20-CN	HH-PS-20-V	HH-PS-20-EP	HH-PS-CR-20-TFP	HH-PS-R5-20-T-B
2.50	HH-PS-25-CN	HH-PS-25-V	HH-PS-25-EP	HH-PS-CR-25-TFP	HH-PS-R5-25-T-B
3.25	HH-PS-32-CN	HH-PS-32-V	HH-PS-32-EP	HH-PS-CR-32-TFP	HH-PS-R5-32-T-B
4.00	HH-PS-40-CN	HH-PS-40-V	HH-PS-40-EP	HH-PS-CR-40-TFP	HH-PS-R5-40-T-B
5.00	HH-PS-50-CN	HH-PS-50-V	HH-PS-50-EP	HH-PS-CR-50-TFP	HH-PS-R5-50-T-B
6.00	HH-PS-60-CN	HH-PS-60-V	HH-PS-60-EP	HH-PS-CR-60-TFP	HH-PS-R5-60-T-B
8.00	HH-PS-80-CN	HH-PS-80-V	HH-PS-80-EP	HH-PS-CR-80-TFP	HH-PS-R5-80-T-B

(1B) PISTON SEAL BACKUP		
BORE	HYTREL (BACKUP FOR S)	PTFE (BACKUP FOR E & V)
1.50	HH-BU-PS-15-PM	HH-BU-PS-15-T
2.00	HH-BU-PS-20-PM	HH-BU-PS-20-T
2.50	HH-BU-PS-25-PM	HH-BU-PS-25-T
3.25	HH-BU-PS-32-PM	HH-BU-PS-32-T
4.00	HH-BU-PS-40-PM	HH-BU-PS-40-T
5.00	HH-BU-PS-50-PM	HH-BU-PS-50-T
6.00	HH-BU-PS-60-PM	HH-BU-PS-60-T
8.00	HH-BU-PS-80-PM	HH-BU-PS-80-T

(3) ROD BUSHING (DUCTILE IRON)			
ROD DIA.	DUCTILE IRON BUSHING (STANDARD)	METALLIC SCRAPER (M OPTION)	PTFE WIPER (E OPTION)
0.625	HH-30-625	HH-30-625-MS	HH-30-625-T
1.000	HH-30-1000	HH-30-1000-MS	HH-30-1000-T
1.375	HH-30-1375	HH-30-1375-MS	HH-30-1375-T
1.750	HH-30-1750	HH-30-1750-MS	HH-30-1750-T
2.000	HH-30-2000	HH-30-2000-MS	HH-30-2000-T
2.500	HH-30-2500	HH-30-2500-MS	HH-30-2500-T
3.000	HH-30-3000	HH-30-3000-MS	HH-30-3000-T
3.500	HH-30-3500	HH-30-3500-MS	HH-30-3500-T
4.000	HH-30-4000	HH-30-4000-MS	HH-30-4000-T
4.500	HH-30-4500	HH-30-4500-MS	HH-30-4500-T
5.000	HH-30-5000	HH-30-5000-MS	HH-30-5000-T
5.500	HH-30-5500	HH-30-5500-MS	HH-30-5500-T

(4) ROD BUSHING O-RING			
ROD DIA.	BUNA (STANDARD)	FLUOROCARBON (V OPTION)	ETHYLENE PROPYLENE (E OPTION)
0.625	HH-BO-625-B	HH-BO-625-V	HH-BO-625-EP
1.000	HH-BO-1000-B	HH-BO-1000-V	HH-BO-1000-EP
1.375	HH-BO-1375-B	HH-BO-1375-V	HH-BO-1375-EP
1.750	HH-BO-1750-B	HH-BO-1750-V	HH-BO-1750-EP
2.000	HH-BO-2000-B	HH-BO-2000-V	HH-BO-2000-EP
2.500	HH-BO-2500-B	HH-BO-2500-V	HH-BO-2500-EP
3.000	HH-BO-3000-B	HH-BO-3000-V	HH-BO-3000-EP
3.500	HH-BO-3500-B	HH-BO-3500-V	HH-BO-3500-EP
4.000	HH-BO-4000-B	HH-BO-4000-V	HH-BO-4000-EP
4.500	HH-BO-4500-B	HH-BO-4500-V	HH-BO-4500-EP
5.000	HH-BO-5000-B	HH-BO-5000-V	HH-BO-5000-EP
5.500	HH-BO-5500-B	HH-BO-5500-V	HH-BO-5500-EP

(4B) ROD BUSHING O-RING BACKUP		
ROD DIA.	POLYMYTE (BACKUP FOR S)	PTFE (BACKUP FOR E&V)
0.625	HH-BU-BO-625-PM	HH-BU-BO-625-T
1.000	HH-BU-BO-1000-PM	HH-BU-BO-1000-T
1.375	HH-BU-BO-1375-PM	HH-BU-BO-1375-T
1.750	HH-BU-BO-1750-PM	HH-BU-BO-1750-T
2.000	HH-BU-BO-2000-PM	HH-BU-BO-2000-T
2.500	HH-BU-BO-2500-PM	HH-BU-BO-2500-T
3.000	HH-BU-BO-3000-PM	HH-BU-BO-3000-T
3.500	HH-BU-BO-3500-PM	HH-BU-BO-3500-T
4.000	HH-BU-BO-4000-PM	HH-BU-BO-4000-T
4.500	HH-BU-BO-4500-PM	HH-BU-BO-4500-T
5.000	HH-BU-BO-5000-PM	HH-BU-BO-5000-T
5.500	HH-BU-BO-5500-PM	HH-BU-BO-5500-T

(3) ROD BUSHING (BRONZE)			
ROD DIA.	BRONZE BUSHING (RBB OPTION)	METALLIC SCRAPER (M OPTION)	PTFE WIPER (E OPTION)
0.625	HH-30-625-BZ	HH-30-625-BZ-MS	HH-30-625-BZ-T
1.000	HH-30-1000-BZ	HH-30-1000-BZ-MS	HH-30-1000-BZ-T
1.375	HH-30-1375-BZ	HH-30-1375-BZ-MS	HH-30-1375-BZ-T
1.750	HH-30-1750-BZ	HH-30-1750-BZ-MS	HH-30-1750-BZ-T
2.000	HH-30-2000-BZ	HH-30-2000-BZ-MS	HH-30-2000-BZ-T
2.500	HH-30-2500-BZ	HH-30-2500-BZ-MS	HH-30-2500-BZ-T
3.000	HH-30-3000-BZ	HH-30-3000-BZ-MS	HH-30-3000-BZ-T
3.500	HH-30-3500-BZ	HH-30-3500-BZ-MS	HH-30-3500-BZ-T
4.000	HH-30-4000-BZ	HH-30-4000-BZ-MS	HH-30-4000-BZ-T
4.500	HH-30-4500-BZ	HH-30-4500-BZ-MS	HH-30-4500-BZ-T
5.000	HH-30-5000-BZ	HH-30-5000-BZ-MS	HH-30-5000-BZ-T
5.500	HH-30-5500-BZ	HH-30-5500-BZ-MS	HH-30-5500-BZ-T

(5) PART LIST - ROD SEAL			
ROD DIA.	POLYURETHANE (STANDARD)	FLUOROCARBON (V OPTION)	ETHYLENE PROPYLENE (E OPTION)
0.625	HH-RS-625-HT	HH-RS-625-V	HH-RS-625-EP
1.000	HH-RS-1000-HT	HH-RS-1000-V	HH-RS-1000-EP
1.375	HH-RS-1375-HT	HH-RS-1375-V	HH-RS-1375-EP
1.750	HH-RS-1750-HT	HH-RS-1750-V	HH-RS-1750-EP
2.000	HH-RS-2000-HT	HH-RS-2000-V	HH-RS-2000-EP
2.500	HH-RS-2500-HT	HH-RS-2500-V	HH-RS-2500-EP
3.000	HH-RS-3000-HT	HH-RS-3000-V	HH-RS-3000-EP
3.500	HH-RS-3500-HT	HH-RS-3500-V	HH-RS-3500-EP
4.000	HH-RS-4000-HT	HH-RS-4000-V	HH-RS-4000-EP
4.500	HH-RS-4500-HT	HH-RS-4500-V	HH-RS-4500-EP
5.000	HH-RS-5000-HT	HH-RS-5000-V	HH-RS-5000-EP
5.500	HH-RS-5500-HT	HH-RS-5500-V	HH-RS-5500-EP

(5B) ROD SEAL BACKUP		
ROD DIA.	POLYMYTE	PTFE (BACKUP FOR E&V)
0.625	HH-BU-RS-625-PM	HH-BU-RS-625-T
1.000	HH-BU-RS-1000-PM	HH-BU-RS-1000-T
1.375	HH-BU-RS-1375-PM	HH-BU-RS-1375-T
1.750	HH-BU-RS-1750-PM	HH-BU-RS-1750-T
2.000	HH-BU-RS-2000-PM	HH-BU-RS-2000-T
2.500	HH-BU-RS-2500-PM	HH-BU-RS-2500-T
3.000	HH-BU-RS-3000-PM	HH-BU-RS-3000-T
3.500	HH-BU-RS-3500-PM	HH-BU-RS-3500-T
4.000	HH-BU-RS-4000-PM	HH-BU-RS-4000-T
4.500	HH-BU-RS-4500-PM	HH-BU-RS-4500-T
5.000	HH-BU-RS-5000-PM	HH-BU-RS-5000-T
5.500	HH-BU-RS-5500-PM	HH-BU-RS-5500-T

HH - Heavy Duty Hydraulic  
 HH Rod Lock  
 MH - Medium Duty Hydraulic  
 TAS - Heavy Duty Pneumatic  
 TAS Options  
 Accessories Page 130  
 STROKEMASTER Page 136  
 Technical Data Page 144



# 'HH' PART LIST & SEAL KITS

PARTS WITH THIS COLOR SCHEME ARE NON-STOCK ITEMS. CONTACT FACTORY FOR DELIVERY.

(2) PART LIST - ROD WIPER

ROD DIA.	FLOCKED NITRILE (STANDARD)	FLUOROCARBON (V OPTION)	ETHYLENE PROPYLENE (E OPTION)	METALLIC SCRAPPER (M OPTION)	PTFE WIPER (T OPTION)
0.625	HH-RW-625-FN	HH-RW-625-V	ETHYLENE PROPYLENE ROD WIPER IS NOT AVAILABLE.  WHEN CYLINDER DESIGN CALLS FOR EP ROD WIPERS, TRD RECOMMENDS: 'T' PTFE ROD WIPER.	HH-RW-625-MS	HH-RW-625-T
1.000	HH-RW-1000-FN	HH-RW-1000-V		HH-RW-1000-MS	HH-RW-1000-T
1.375	HH-RW-1375-FN	HH-RW-1375-V		HH-RW-1375-MS	HH-RW-1375-T
1.750	HH-RW-1750-FN	HH-RW-1750-V		HH-RW-1750-MS	HH-RW-1750-T
2.000	HH-RW-2000-FN	HH-RW-2000-V		HH-RW-2000-MS	HH-RW-2000-T
2.500	HH-RW-2500-FN	HH-RW-2500-V		HH-RW-2500-MS	HH-RW-2500-T
3.000	HH-RW-3000-FN	HH-RW-3000-V		HH-RW-3000-MS	HH-RW-3000-T
3.500	HH-RW-3500-FN	HH-RW-3500-V		HH-RW-3500-MS	HH-RW-3500-T
4.000	HH-RW-4000-FN	HH-RW-4000-V		HH-RW-4000-MS	HH-RW-4000-T
4.500	HH-RW-4500-FN	HH-RW-4500-V		HH-RW-4500-MS	HH-RW-4500-T
5.000	HH-RW-5000-FN	HH-RW-5000-V		HH-RW-5000-MS	HH-RW-5000-T
5.500	HH-RW-5500-FN	HH-RW-5500-V		HH-RW-5500-MS	HH-RW-5500-T

(6) PART LIST - WEAR BAND

BORE	GLASS REINFORCED NYLON (FOR PISTON SEAL S)	GLASS REINFORCED NYLON WIDE (FOR PISTON SEAL T)	BRONZE FILLED PTFE (FOR PISTON SEAL E & V)
1.50	HH-PWR-15-WG	HH-PWR-15-WG-1	HH-PWR-15-T
2.00	HH-PWR-20-WG	HH-PWR-20-WG-1	HH-PWR-20-T
2.50	HH-PWR-25-WG	HH-PWR-25-WG-1	HH-PWR-25-T
3.25	HH-PWR-32-WG	HH-PWR-32-WG-1	HH-PWR-32-T
4.00	HH-PWR-40-WG	HH-PWR-40-WG-1	HH-PWR-40-T
5.00	HH-PWR-50-WG	HH-PWR-50-WG-1	HH-PWR-50-T
6.00	HH-PWR-60-WG	HH-PWR-60-WG	HH-PWR-60-T
8.00	HH-PWR-80-WG	HH-PWR-80-WG	HH-PWR-80-T

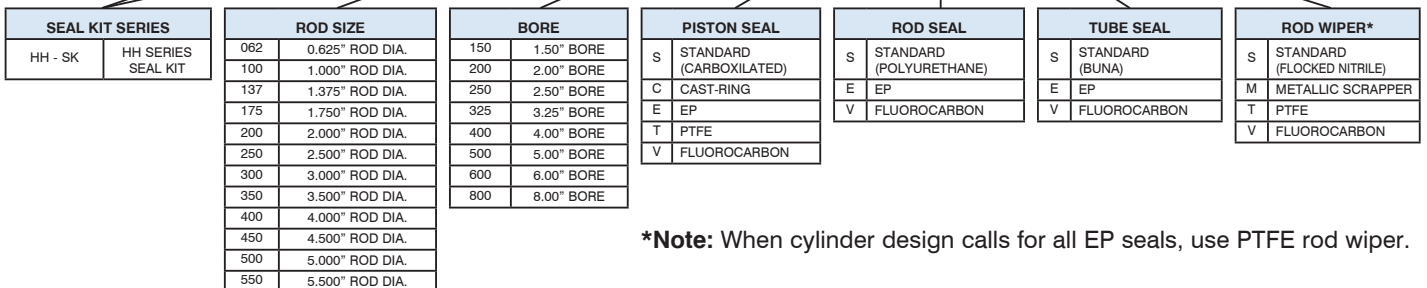
(7) PART LIST - TUBE SEAL

BORE	BUNA (STANDARD)	FLUOROCARBON (V OPTION)	ETHYLENE PROPYLENE (E OPTION)
1.50	HH-OTS-15-B	HH-OTS-15-V	HH-OTS-15-EP
2.00	HH-OTS-20-B	HH-OTS-20-V	HH-OTS-20-EP
2.50	HH-OTS-25-B	HH-OTS-25-V	HH-OTS-25-EP
3.25	HH-OTS-32-B	HH-OTS-32-V	HH-OTS-32-EP
4.00	HH-OTS-40-B	HH-OTS-40-V	HH-OTS-40-EP
5.00	HH-OTS-50-B	HH-OTS-50-V	HH-OTS-50-EP
6.00	HH-OTS-60-B	HH-OTS-60-V	HH-OTS-60-EP
8.00	HH-OTS-80-B	HH-OTS-80-V	HH-OTS-80-EP

## HOW TO ORDER: SEAL KITS

NOTE: To insure proper seals are supplied for all models, ALWAYS supply TRD serial number.

HH - SK 137 - 250 - S S S S

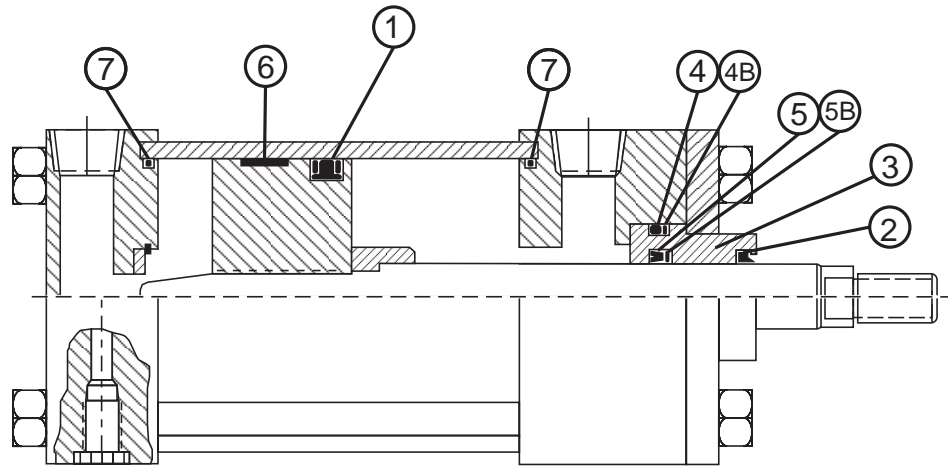


\*Note: When cylinder design calls for all EP seals, use PTFE rod wiper.

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:  
HH-SK137-400-SSSS  
HH-SK100-250-VVVT  
HH-SK-300-600-CSSM

# SERIES 'MH' PART LIST & SEAL KITS



(1) PISTON SEALS

BORE	CARBOXILATED NITRILE (Standard)	FLUOROCARBON (V OPTION)	ETHYLENE PROPYLENE (E OPTION)	CAST IRON RINGS (C OPTION)
1.50	MH-PS-15-TP	MH-PS-15-TP-V	MH-PS-15-TP-EP	HH-PS-CR-15-TFP
2.00	MH-PS-20-TP	MH-PS-20-TP-V	MH-PS-20-TP-EP	HH-PS-CR-20-TFP
2.50	MH-PS-25-TP	MH-PS-25-TP-V	MH-PS-25-TP-EP	HH-PS-CR-25-TFP
3.25	MH-PS-32-TP	MH-PS-32-TP-V	MH-PS-32-TP-EP	HH-PS-CR-32-TFP
4.00	MH-PS-40-TP	MH-PS-40-TP-V	MH-PS-40-TP-EP	HH-PS-CR-40-TFP
5.00	MH-PS-50-TP	MH-PS-50-TP-V	MH-PS-50-TP-EP	HH-PS-CR-50-TFP
6.00	MH-PS-60-TP	MH-PS-60-TP-V	MH-PS-60-TP-EP	HH-PS-CR-60-TFP
8.00	MH-PS-80-TP	MH-PS-80-TP-V	MH-PS-80-TP-EP	HH-PS-CR-80-TFP

(3) ROD BUSHING (CAST IRON)

ROD DIAMETER	CAST IRON BUSHING (STANDARD)	METALLIC SCRAPER (M OPTION)	PTFE WIPER (E OPTION)
0.625	HH-30-625	HH-30-625-MS	HH-30-625-T
1.000	MH-30-1000	MH-30-1000-MS	MH-30-1000-T
1.375	MH-30-1375	MH-30-1375-MS	MH-30-1375-T
1.750	MH-30-1750	MH-30-1750-MS	MH-30-1750-T
2.000	HH-30-2000	HH-30-2000-MS	HH-30-2000-T
2.500	HH-30-2500	HH-30-2500-MS	HH-30-2500-T
3.000	HH-30-3000	HH-30-3000-MS	HH-30-3000-T
3.500	HH-30-3500	HH-30-3500-MS	HH-30-3500-T
4.000	MH-30-4000	MH-30-4000-MS	MH-30-4000-T
4.500	MH-30-4500	MH-30-4500-MS	MH-30-4500-T
5.000	MH-30-5000	MH-30-5000-MS	MH-30-5000-T
5.500	MH-30-5500	MH-30-5500-MS	MH-30-5500-T

(4) ROD BUSHING O-RINGS

ROD DIAMETER	BUNA (STANDARD)	FLUOROCARBON (V OPTION)	ETHYLENE PROPYLENE (E OPTION)
0.625	HH-BO-625-B	HH-BO-625-V	HH-BO-625-EP
1.000	MH-BO-1000-B	MH-BO-1000-V	MH-BO-1000-EP
1.375	MH-BO-1375-B	MH-BO-1375-V	MH-BO-1375-EP
1.750	MH-BO-1750-B	MH-BO-1750-V	MH-BO-1750-EP
2.000	HH-BO-2000-B	HH-BO-2000-V	HH-BO-2000-EP
2.500	HH-BO-2500-B	HH-BO-2500-V	HH-BO-2500-EP
3.000	HH-BO-3000-B	HH-BO-3000-V	HH-BO-3000-EP
3.500	HH-BO-3500-B	HH-BO-3500-V	HH-BO-3500-EP
4.000	HH-BO-4000-B	HH-BO-4000-V	HH-BO-4000-EP
4.500	HH-BO-4500-B	HH-BO-4500-V	HH-BO-4500-EP
5.000	HH-BO-5000-B	HH-BO-5000-V	HH-BO-5000-EP
5.500	MH-BO-5500-B	MH-BO-5500-V	MH-BO-5500-EP

(4B) ROD BUSHING O-RING BACKUP

ROD DIAMETER	POLYMYTE (BACKUP FOR S)	PTFE (BACKUP FOR E&V)
0.625	HH-BU-BO-625-PM	HH-BU-BO-625-T
1.000	MH-BU-BO-1000-PM	MH-BU-BO-1000-T
1.375	MH-BU-BO-1375-PM	MH-BU-BO-1375-T
1.750	MH-BU-BO-1750-PM	MH-BU-BO-1750-T
2.000	HH-BU-BO-2000-PM	HH-BU-BO-2000-T
2.500	HH-BU-BO-2500-PM	HH-BU-BO-2500-T
3.000	HH-BU-BO-3000-PM	HH-BU-BO-3000-T
3.500	HH-BU-BO-3500-PM	HH-BU-BO-3500-T
4.000	HH-BU-BO-4000-PM	HH-BU-BO-4000-T
4.500	HH-BU-BO-4500-PM	HH-BU-BO-4500-T
5.000	HH-BU-BO-5000-PM	HH-BU-BO-5000-T
5.500	MH-BU-BO-5500-PM	MH-BU-BO-5500-T

(3) ROD BUSHING (BRONZE)

ROD DIAMETER	BRONZE BUSHING (RBB OPTION)	METALLIC SCRAPER (M OPTION)	PTFE WIPER (E OPTION)
0.625	HH-30-625-BZ	HH-30-625-BZ-MS	HH-30-625-BZ-T
1.000	MH-30-1000-BZ	MH-30-1000-BZ-MS	MH-30-1000-BZ-T
1.375	MH-30-1375-BZ	MH-30-1375-BZ-MS	MH-30-1375-BZ-T
1.750	MH-30-1750-BZ	MH-30-1750-BZ-MS	MH-30-1750-BZ-T
2.000	HH-30-2000-BZ	HH-30-2000-BZ-MS	HH-30-2000-BZ-T
2.500	HH-30-2500-BZ	HH-30-2500-BZ-MS	HH-30-2500-BZ-T
3.000	HH-30-3000-BZ	HH-30-3000-BZ-MS	HH-30-3000-BZ-T
3.500	HH-30-3500-BZ	HH-30-3500-BZ-MS	HH-30-3500-BZ-T
4.000	MH-30-4000-BZ	MH-30-4000-BZ-MS	MH-30-4000-BZ-T
4.500	MH-30-4500-BZ	MH-30-4500-BZ-MS	MH-30-4500-BZ-T
5.000	MH-30-5000-BZ	MH-30-5000-BZ-MS	MH-30-5000-BZ-T
5.500	MH-30-5500-BZ	MH-30-5500-BZ-MS	MH-30-5500-BZ-T

(5) PART LIST - ROD SEALS

ROD DIAMETER	POLYURETHANE (STANDARD)	FLUOROCARBON (V OPTION)	ETHYLENE PROPYLENE (E OPTION)
0.625	HH-RS-625-HT	HH-RS-625-V	HH-RS-625-EP
1.000	HH-RS-1000-HT	HH-RS-1000-V	HH-RS-1000-EP
1.375	HH-RS-1375-HT	HH-RS-1375-V	HH-RS-1375-EP
1.750	HH-RS-1750-HT	HH-RS-1750-V	HH-RS-1750-EP
2.000	HH-RS-2000-HT	HH-RS-2000-V	HH-RS-2000-EP
2.500	HH-RS-2500-HT	HH-RS-2500-V	HH-RS-2500-EP
3.000	HH-RS-3000-HT	HH-RS-3000-V	HH-RS-3000-EP
3.500	HH-RS-3500-HT	HH-RS-3500-V	HH-RS-3500-EP
4.000	HH-RS-4000-HT	HH-RS-4000-V	HH-RS-4000-EP
4.500	HH-RS-4500-HT	HH-RS-4500-V	HH-RS-4500-EP
5.000	HH-RS-5000-HT	HH-RS-5000-V	HH-RS-5000-EP
5.500	HH-RS-5500-HT	HH-RS-5500-V	HH-RS-5500-EP

(5B) ROD SEAL BACKUPS

ROD DIAMETER	POLYMYTE	PTFE (BACKUP FOR E&V)
0.625	HH-BU-RS-625-PM	HH-BU-RS-625-T
1.000	HH-BU-RS-1000-PM	HH-BU-RS-1000-T
1.375	HH-BU-RS-1375-PM	HH-BU-RS-1375-T
1.750	HH-BU-RS-1750-PM	HH-BU-RS-1750-T
2.000	HH-BU-RS-2000-PM	HH-BU-RS-2000-T
2.500	HH-BU-RS-2500-PM	HH-BU-RS-2500-T
3.000	HH-BU-RS-3000-PM	HH-BU-RS-3000-T
3.500	HH-BU-RS-3500-PM	HH-BU-RS-3500-T
4.000	HH-BU-RS-4000-PM	HH-BU-RS-4000-T
4.500	HH-BU-RS-4500-PM	HH-BU-RS-4500-T
5.000	HH-BU-RS-5000-PM	HH-BU-RS-5000-T
5.500	HH-BU-RS-5500-PM	HH-BU-RS-5500-T

# SERIES 'MH' PART LIST & SEAL KITS

(2) PART LIST - ROD WIPER					
ROD DIAMETER	FLOCKED NITRILE (STANDARD)	FLUOROCARBON (V OPTION)	ETHYLENE PROPYLENE (E OPTION)	METALLIC SCRAPER (M OPTION)	PTFE WIPER (T OPTION)
0.625	HH-RW-625-FN	HH-RW-625-V	ETHYLENE PROPYLENE ROD WIPER IS NOT AVAILABLE.  WHEN CYLINDER DESIGN CALLS FOR EP ROD WIPERS, TRD RECOMMENDS: 'T' PTFE ROD WIPER.	HH-RW-625-MS	HH-RW-625-T
1.000	HH-RW-1000-FN	HH-RW-1000-V		HH-RW-1000-MS	HH-RW-1000-T
1.375	HH-RW-1375-FN	HH-RW-1375-V		HH-RW-1375-MS	HH-RW-1375-T
1.750	HH-RW-1750-FN	HH-RW-1750-V		HH-RW-1750-MS	HH-RW-1750-T
2.000	HH-RW-2000-FN	HH-RW-2000-V		HH-RW-2000-MS	HH-RW-2000-T
2.500	HH-RW-2500-FN	HH-RW-2500-V		HH-RW-2500-MS	HH-RW-2500-T
3.000	HH-RW-3000-FN	HH-RW-3000-V		HH-RW-3000-MS	HH-RW-3000-T
3.500	HH-RW-3500-FN	HH-RW-3500-V		HH-RW-3500-MS	HH-RW-3500-T
4.000	HH-RW-4000-FN	HH-RW-4000-V		HH-RW-4000-MS	HH-RW-4000-T
4.500	HH-RW-4500-FN	HH-RW-4500-V		HH-RW-4500-MS	HH-RW-4500-T
5.000	HH-RW-5000-FN	HH-RW-5000-V	HH-RW-5000-MS	HH-RW-5000-T	
5.500	HH-RW-5500-FN	HH-RW-5500-V	HH-RW-5500-MS	HH-RW-5500-T	

(6) PART LIST - WEAR BANDS			
BORE	GLASS REINFORCED NYLON (FOR PISTON SEAL S)	GLASS REINFORCED NYLON WIDE (FOR PISTON SEAL T)	BRONZE FILLED PTFE (FOR PISTON SEAL E & V)
1.50	HH-PWR-15-WG	HH-PWR-15-WG-1	HH-PWR-15-T
2.00	HH-PWR-20-WG	HH-PWR-20-WG-1	HH-PWR-20-T
2.50	HH-PWR-25-WG	HH-PWR-25-WG-1	HH-PWR-25-T
3.25	HH-PWR-32-WG	HH-PWR-32-WG-1	HH-PWR-32-T
4.00	HH-PWR-40-WG	HH-PWR-40-WG-1	HH-PWR-40-T
5.00	HH-PWR-50-WG	HH-PWR-50-WG-1	HH-PWR-50-T
6.00	HH-PWR-60-WG	HH-PWR-60-WG	HH-PWR-60-T
8.00	HH-PWR-80-WG	HH-PWR-80-WG	HH-PWR-80-T

(7) PART LIST - TUBE SEALS			
BORE	BUNA (STANDARD)	FLUOROCARBON (V OPTION)	ETHYLENE PROPYLENE (E OPTION)
1.50	MH-OTS-15-B	MH-OTS-15-V	MH-OTS-15-EP
2.00	MH-OTS-20-B	MH-OTS-20-V	MH-OTS-20-EP
2.50	MH-OTS-25-B	MH-OTS-25-V	MH-OTS-25-EP
3.25	MH-OTS-32-B	MH-OTS-32-V	MH-OTS-32-EP
4.00	MH-OTS-40-B	MH-OTS-40-V	MH-OTS-40-EP
5.00	MH-OTS-50-B	MH-OTS-50-V	MH-OTS-50-EP
6.00	MH-OTS-60-B	MH-OTS-60-V	MH-OTS-60-EP
8.00	MH-OTS-80-B	MH-OTS-80-V	MH-OTS-80-EP

## HOW TO ORDER: SEAL KITS

NOTE: To insure proper seals are supplied for all models, ALWAYS supply TRD serial number.

**MH - SK 137 - 250 - S S S S**

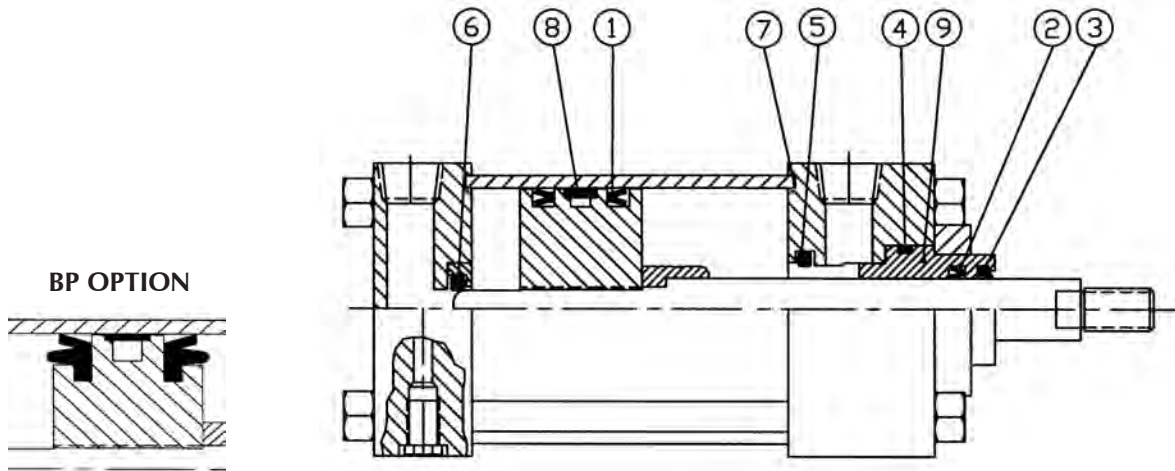
SEAL KIT SERIES		ROD SIZE		BORE		PISTON SEALS		ROD SEALS		TUBE SEALS		ROD WIPER*	
MH - SK	MH SERIES SEAL KIT	062	0.625" ROD DIA.	150	1.50" BORE	S	STANDARD (CARBOXYLATED)	S	STANDARD (POLYURETHANE)	S	STANDARD (BUNA)	S	STANDARD (FLOCKED NITRILE)
		100	1.000" ROD DIA.	200	2.00" BORE	C	CAST-RING	E	EP	E	EP	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:  
MH-SK137-400-SSSS  
MH-SK100-250-VVVT  
MH-SK-300-600-CSSM

# SERIES 'TAS' PART LIST & SEAL KITS



(1) PISTON SEALS				
BORE	STANDARD	BP OPTION	AO OR TH OPTION	LF OPTION
1.50	(2) PS-15	(2) BPS-15B	(1) PSP-15, (1) PS-15	(2) PS-15-LF
2.00	(2) PS-20	(2) BPS-20B	(1) PSP-20, (1) PS-20	(2) PS-20-LF
2.50	(2) PS-25	(2) BPS-25B	(1) PSP-25, (1) PS-25	(2) PS-25-LF
3.25	(2) PS-32	(2) BPS-32B	(1) PSP-32, (1) PS-32	(2) PS-32-LF
4.00	(2) PS-40	(2) BPS-40B	(1) PSP-40, (1) PS-40	(2) PS-40-LF
5.00	(2) PS-50	(2) BPS-50B	(1) PSP-50, (1) PS-50	(2) PS-50-LF
6.00	(2) PS-60	(2) BPS-60B	(1) PSP-60, (1) PS-60	(2) PS-60-LF
8.00	(2) PS-80	(2) BPS-80B	(1) PSP-80, (1) PS-80	(2) PS-80-LF

(1) PISTON SEALS WITH VS OPTION				
BORE	STANDARD	BP OPTION	AO OR TH OPTION	LF OPTION
1.50	(2) PS-15-V	(2) BPS-15-V	(1) PSP-15-V, (1) PS-15-V	N/A
2.00	(2) PS-20-V	(2) BPS-20-V	(1) PSP-20-V, (1) PS-20-V	N/A
2.50	(2) PS-25-V	(2) BPS-25-V	(1) PSP-25-V, (1) PS-25-V	N/A
3.25	(2) PS-32-V	(2) BPS-32-V	(1) PSP-32-V, (1) PS-32-V	N/A
4.00	(2) PS-40-V	(2) BPS-40-V	(1) PSP-40-V, (1) PS-40-V	N/A
5.00	(2) PS-50-V	(2) BPS-50-V	(1) PSP-50-V, (1) PS-50-V	N/A
6.00	(2) PS-60-V	(2) BPS-60-V	(1) PSP-60-V, (1) PS-60-V	N/A
8.00	(2) PS-80-V	(2) BPS-80-V	(1) PSP-80-V, (1) PS-80-V	N/A

(2) ROD SEAL				
ROD DIAMETER	STANDARD	VS OPTION	TH OPTION	TH OPTION & VS OPTION
0.625	RS-625	RS-625-V	RSP-625	RSP-625-V
1.000	RS-1000	RS-1000-V	RSP-1000	RSP-1000-V
1.375	RS-1375	RS-1375-V	RSP-1375	RSP-1375-V
1.750	RS-1750	RS-1750-V	RSP-1750	RSP-1750-V

(3) ROD WIPER				
ROD DIAMETER	STANDARD	VS OPTION	TH OPTION	TH OPTION & VS OPTION
0.625	RW-625	RW-625-V	QRW-625	QRW-625-V
1.000	RW-1000	RW-1000-V	QRW-1000	QRW-1000-V
1.375	RW-1375	RW-1375-V	QRW-1375	QRW-1375-V
1.750	RW-1750	RW-1750-V	QRW-1750	QRW-1750-V

(4) ROD BUSHING O-RINGS			
BORE SIZE	ROD SIZE	STANDARD	VS OPTION
All Bore Sizes	0.625	BO-1	BO-1-V
1.50" Bore Only	1.000	BO-2-OS	BO-2-OS-V
All except 1.50"	1.000	BO-2	BO-2-V
All Bore Sizes	1.375	BO-3	BO-3-V
All Bore Sizes	1.750	BO-4	BO-4-V

CUSHIONS				
ROD DIAMETER	Head (5)	CAP (6)	HEAD WITH VS OPTION (5)	CAP WITH VS OPTION (6)
0.625	CS-3	CS-1	CS-3-V	CS-1-V
1.000	CS-4	CS-2	CS-4-V	CS-2-V
1.375	CS-5	CS-3	CS-5-V	CS-3-V
1.750	CS-6	CS-3	CS-6-V	CS-3-V

# SERIES 'TAS' PART LIST & SEAL KITS

(7) TUBE SEALS		
BORE	STANDARD	VS OPTION
1.50	(2) OTS-15	(2) OTS-15-V
2.00	(2) OTS-20	(2) OTS-20-V
2.50	(2) OTS-25	(2) OTS-25-V
3.25	(2) OTS-32	(2) OTS-32-V
4.00	(2) OTS-40	(2) OTS-40-V
5.00	(2) OTS-50	(2) OTS-50-V
6.00	(2) OTS-60	(2) OTS-60-V
8.00	(2) OTS-80	(2) OTS-80-V

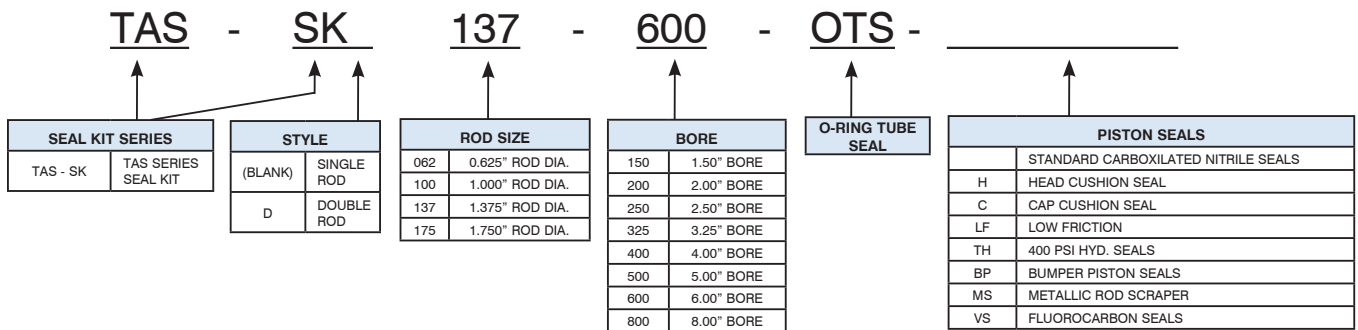
(8) WEARBAND	
BORE	PART
1.50	TWB-15
2.00	TWB-20
2.50	TWB-25
3.25	TWB-32
4.00	TWB-40
5.00	TWB-50
6.00	TWB-60
8.00	TWB-80

(9) BUSHING				
BORE SIZE	ROD SIZE	STANDARD	MS OPTION	TH OPTION
All Bore Sizes	0.625	A-30-1	A-30-1-MS-C	TH-30-1-C
1.50" Bore Only	1.000	A-30-2-OS	A-30-2-MS-C-OS	TH-30-2-OS-C
All except 1.50"	1.000	A-30-2	A-30-2-MS-C	TH-30-2-C
All Bore Sizes	1.375	A-30-3	A-30-3-MS-C	TH-30-3-C
All Bore Sizes	1.750	A-30-4	A-30-4-MS-C	TH-30-4-C

(9) BUSHING - RBB OPTION				
BORE SIZE	ROD SIZE	STANDARD	MS OPTION	TH OPTION
All Bore Sizes	0.625	A-30-1-BZ	A-30-1-MS-BZ	TH-30-1-BZ
1.50" Bore Only	1.000	A-30-2-OS-BZ	A-30-2-MS-BZ-OS	TH-30-2-OS-BZ
All except 1.50"	1.000	A-30-2-BZ	A-30-2-MS-BZ	TH-30-2-BZ
All Bore Sizes	1.375	A-30-3-BZ	A-30-3-MS-BZ	TH-30-3-BZ
All Bore Sizes	1.750	A-30-4-BZ	A-30-4-MS-BZ	TH-30-4-BZ

## HOW TO ORDER: SEAL KITS

NOTE: To insure proper seals are supplied for all models, ALWAYS supply TRD serial number.



All seal kits come with proper backup rings when required.

To order replacement seal kits, call out the rod size, bore size, and the seal selection from the original order.

Examples:

TAS-SK 137-400-OTS

TAS-SK 100-250-OTS-HC

TAS-SKD 100-600-OTS



# 'HH' SERIES HYDRAULIC TECHNICAL DATA

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
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.

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

Torque Tolerance: -0% to +5%

# 'MH' SERIES HYDRAULIC TECHNICAL DATA

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
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
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
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
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
6.00	EXTEND	28.274	7069	9896	12441	14137	15551	17813	19085	21206	23467	27709	28274	36756	42411	0.1224
	1.000	26.789	6697	9376	11787	13395	14734	16877	18083	20092	22235	26253	26789	34826	40184	0.1159
	1.375	25.869	6467	9054	11382	12935	14228	16297	17462	19402	21471	25352	25869	33630	38804	0.1112
8.00	EXTEND	50.265	12566	17593	22117	25133	27646	31667	33929	37699	41720	49260	50265	65345	75398	0.2176
	1.000	48.780	12195	17073	21463	24390	26829	30731	32927	36585	40487	47804	48780	63414	73170	0.2111
	1.375	47.860	11965	16751	21058	23930	26323	30152	32306	35895	39724	46903	47860	62218	71790	0.2072

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

## CYLINDER TORQUE CHARTS

'MH' MEDIUM DUTY HYDRAULIC 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

'MH' MEDIUM DUTY HYDRAULIC 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

'MH' MEDIUM DUTY HYDRAULIC 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.

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

Torque Tolerance: -0% to +5%

# 'TAS' SERIES TECHNICAL DATA

BORE	ROD DIA. (MM)	STROKE TYPE	EFFECTIVE PISTON AREA	POUNDS OF FORCE AT PSI						DISPLACEMENT PER INCH OF STROKE (GALLONS)
				60	80	100	200	250	400	
1.50	ALL	PUSH	1.767	106	142	177	353	442	706	0.00102
	0.625	PULL	1.460	88	117	146	292	365	584	0.00084
	1.000	PULL	0.982	59	79	98	196	246	392	0.00057
2.00	ALL	PUSH	3.142	188	251	314	628	785	1256	0.0182
	0.625	PULL	2.835	170	227	284	567	708	1134	0.0164
	1.000	PULL	2.357	141	189	236	471	589	942	0.0136
2.50	ALL	PUSH	4.909	295	393	491	981	1227	1962	0.0284
	0.625	PULL	4.602	276	368	460	920	1150	1840	0.0266
	1.000	PULL	4.124	247	330	412	825	1031	1650	0.0239
3.25	ALL	PUSH	8.296	498	664	830	1659	2074	3318	0.0480
	1.000	PULL	7.511	451	601	751	1502	1877	3004	0.0435
	1.375	PULL	6.811	409	545	681	1362	1702	2724	0.0394
4.00	ALL	PUSH	12.566	754	1005	1257	2513	3141	5026	0.0727
	1.000	PULL	11.781	707	942	1178	2356	2945	4712	0.0682
	1.375	PULL	11.081	665	886	1108	2216	2770	4432	0.0641
5.00	ALL	PUSH	19.635	1178	1571	1964	3927	4908	7854	0.01136
	1.000	PULL	18.850	1131	1508	1885	3770	4712	7540	0.01090
	1.375	PULL	18.150	1089	1452	1815	3630	4537	7260	0.01050
6.00	ALL	PUSH	28.274	1696	2262	2827	5655	7068	11310	0.01636
	1.375	PULL	26.789	1607	2144	2679	5358	6697	10716	0.01550
	1.750	PULL	25.869	1552	2070	2587	5174	6467	10348	0.01497
8.00	ALL	PUSH	50.265	3016	4021	5026	10053	12566	20106	0.02908
	1.375	PULL	48.780	2927	3902	4878	9756	12195	19512	0.02832
	1.750	PULL	47.860	2872	3829	4786	9572	11965	19144	0.02770

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

## CYLINDER TORQUE CHARTS

'TAS' HYDRAULIC TIE ROD TORQUE SPECS		
BORE	TIE ROD THREAD SIZE	TORQUE (FT-LBS)
1.50	1/4 - 28	7 FT-LBS
2.00	5/16 - 24	12 FT-LBS
2.50	5/16 - 24	14 FT-LBS
3.25	3/8 - 24	30 FT-LBS
4.00	3/8 - 24	35 FT-LBS
5.00	1/2 - 20	45 FT-LBS
6.00	1/2 - 20	50 FT-LBS
8.00	5/8 - 18	125 FT-LBS

'TAS' HYDRAULIC RETAINER PLATE TORQUE SPECS		
BORE	SOCKET HEAD CAP SCREW SIZE	TORQUE (FT-LBS)
2 & 2.50	#10 - 32	5 FT-LBS
3.25 TO 8	1/4 - 28	12 FT-LBS

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

TRD SPEC: LPS Premium Copper Anti-Seize

Temperature Rating: -65°F to 1800°F

Military Spec: MIL-PRF-907-E

Torque Tolerance: -0% to +5%

# 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

## 'HH' SERIES BASIC CYLINDER WEIGHT CHART

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
	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
4.00	1.750	44	47.3	50.6	49.8	47	52.5	53	57	50	50	43	47	54	45	3.1
	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
5.00	2.000	79	87	89	88	83.5	93	92	100	86.5	85	78	80	93	82	4.8
	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
6.00	2.500	124	134	140	140	131	145	145	153	137	136	122	127	143	128	6.5
	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

Note: Add 20% to mount and stroke weight for double rod end cylinders.

## ACCESSORIES WEIGHT CHART

WEIGHT IN POUNDS

ROD CLEVIS		ROD EYES		EYE BRACKETS		CLEVIS BRACKETS		CLEVIS PINS				WELD PLATE		FLNG. END CPL.	
PART NO.	WEIGHT	PART NO.	WEIGHT	PART NO.	WEIGHT	PART NO.	WEIGHT	PART NO.	WEIGHT	PART NO.	WEIGHT	PART NO.	WEIGHT	PART NO.	WEIGHT
RC437	.40	RE437	.30	EB500	.86	CB500	.90	CP500C	.12	CP500E	.12	WP625	.45	FEC625	.41
RC500	.40	RE500	.30	EB750	3.00	CB750	3.10	CP750C	.38	CP750E	.38	WP1000	.69	FEC1000	.65
RC750	1.22	RE625	.30	EB1000	6.36	CB1000	6.20	CP1000C	.80	CP1000E	.80	WP1375	1.26	FEC1375	1.22
RC1000	2.58	RE750	1.10	EB1375	11.22	CB1375	9.70	CP1375C	1.22	CP1375E	1.22	WP1750	2.25	FEC1750	2.25
RC1250	6.28	RE1000	2.40	EB1750	17.5	CB1750	17	CP1750C	4.1	CP1750E	3.78	WP2000	2.67	FEC2000	2.59
RC1375	6.28	RE1250	5.58	EB2000	25	CB2000	26	CP2000C	5.36	CP2000E	4.93	WP2500	3.38	FEC2500	3.30
RC1500	11.6	RE1375	5.58	EB2500	39	CB2500	37	CP2500C	9.42	CP2500E	9.22	WP3000	6.74	FEC3000	6.66
RC1750	12.7	RE1500	10.52	EB3000	44	CB3000	44	CP3000C	13.69	CP3000E	13.57	WP3500	10.91	FEC3500	10.83
RC1875	18	RE1875	11.5	EB3500	113	CB3500	113	CP3500C	24.42	CP3500E	24.12	WP4000	10.91	FEC4000	10.83
RC2250	27	RE2250	23	EB4000	179	CB4000	—	CP4000C	35.45	CP4000E	35.06	WP4500	14.26	FEC4500	14.86
RC2500	36	RE2500	32	—	—	—	—	—	—	—	—	WP5000	14.26	FEC5000	14.86
RC3250	71	RE3250	36	—	—	—	—	—	—	—	—	WP5500	22.55	FEC5500	22.47
RC4000	107	RE3500	36	—	—	—	—	—	—	—	—	—	—	—	—
—	—	RE4000	84	—	—	—	—	—	—	—	—	—	—	—	—



# TECHNICAL DATA

## 'MH' & 'TAS' SERIES BASIC CYLINDER WEIGHT CHART

WEIGHT IN POUNDS

BORE	ROD DIA. (MM)	MOUNT													ADD PER INCH OF STROKE
		MS4 MXO	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
	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
6.00	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
	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
8.00	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

Note: Add 20% to mount and stroke weight for double rod end cylinders. Add 1% for cushions.

## 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

# 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 Emulsion	1		Houghto-Safe 5000 Series	white	R	U	R	U	R	—	S	U	U	U
	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	R	R	M/U
Water-Salt	—		—	—	R	R	R	R	R	R	M	R	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	U	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	M	U	U	U	U
	2		Skydrol 7000	green	U	S	U	R	U	M	U	U	U	U
	2		Pydraul 312, 135 (2)	blue gr.	U	M	M	M	R	R	U	U	U	—
	2		Pydraul AC	cloudy bl.	U	S	M/U	S	R	R	U	U	U	M/U
	2		Pydraul 60	cloudy bl.	U	R	M/U	R	U	S	U	U	U	M/U
	8		Pydraul 210 (3)	yellow	U	M	—	M	R	R	U	U	U	M/U
Diester	—	MIL-H-7808	Lube Oil-Aircraft	amber	S	U	R	U	R	U	U	U	U	U
Chlorinat. 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	U	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	M/U	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	M/U	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	S	S	R
Petroleum Base	—	MIL-H-5606	Aircraft Hyd. Fluid	red	R	U	R	U	R	U	S	U	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
	4.	Union Carbide & Chemical
	5.	Stauffer Chemical
	6.	Standard Oil (Ortho Chemical)
	7.	Shell Chemical
	8.	Mobile Oil
	9.	Bray Oil - Royal Lubricant
	10.	Texaco

## ELASTOMER CHARACTERISTICS

ELASTOMER	STYRENE BUTADIENE	BUTYL	CHLOROSULFONATED POLYETHYLENE	ETHYLENE PROPYLENE	FLUOROCARBON	FLUOROSILICONE	NATURAL	POLYCHLOROPRENE	NITRILE	POLYACRYLIC	POLYSULPHIDE	POLYURETHANE	SILICONE	EPICHLOROHYDRIN	POLYIMIDE	POLYTETRAFLUOROETHYLENE
SYMBOL	SBR	IIR	CSM	EPM	V	FPM	FSI	NR	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	R
COMPRESSION SET RESIST.	•	•	U	M	M	S	U	R	S	R	U	U	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 MANUFACTURER

# 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° = (F° - 32) ÷ 1.8

F° = C° x 1.8 + 32

## PRESSURE CONVERSIONS

PSI	KG/CM <sub>2</sub>	BARS	KG/CM <sub>2</sub>	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<sup>2</sup> = PSI x .0703

PSI = Kg/cm<sup>2</sup> x 14.22

Bars = PSI x .0689

Bars = Kg/cm<sup>2</sup> x .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	1778.0	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. x 2.54 mm = in. x 25.4

in. = cm x .394

# TECHNICAL DATA

## COMMON FLUID POWER FORMULAS

PROPERTY	WORD FORMULA	MATHEMATIC EQUATION
<b>FLUID PRESSURE</b> PSI (POUNDS PER SQUARE INCH)	Pressure = $\frac{\text{Force (lbs)}}{\text{Area (in}^2\text{)}}$	$P = \frac{F}{A}$
<b>CYLINDER AREA EXTEND</b> IN <sup>2</sup> (SQUARE INCHES)	Area = $\frac{\pi}{4} \times \text{Diameter}^2$ (inches)	$A = .7854 D^2$
<b>CYLINDER AREA RETRACT</b> IN <sup>2</sup> (SQUARE INCHES)	Area = $(\frac{\pi}{4} \times \text{Bore Diameter}^2) - (\frac{\pi}{4} \times \text{Rod Diameter}^2)$	$A = (.7854 D_b^2) - (.7854 D_r^2)$
<b>CYLINDER FORCE</b> LBS. (POUNDS OF FORCE)	Force = Pressure (PSI) x Net Area (in <sup>2</sup> )	$F = PA$
<b>CYLINDER VELOCITY</b> FT/S (FEET PER SECOND)	Velocity = $\frac{231 \times \text{Flow Rate (GPM)}}{12 \times 60 \times \text{Net Area (in}^2\text{)}}$	$v = \frac{.3208 Q}{A}$
<b>CYLINDER VOLUME</b> G (GALLONS OF FLUID)	Volume = $\frac{\text{Net Area (in}^2\text{) x Stroke (in)}}{231}$	$V = \frac{A L}{231}$
<b>CYLINDER FLOW RATE</b> GPM (GALLONS PER MINUTE)	Flow Rate = $\frac{12 \times 60 \times \text{Velocity (ft/s)} \times \text{Net Area (in}^2\text{)}}{231}$	$Q = 3.117 v A$
<b>CYLINDER POWER</b> HP (HORSEPOWER)	Horsepower = $\frac{\text{Pressure (PSI)} \times \text{Flow Rate (GPM)}}{1714}$	$hp = \frac{P Q}{1714}$
<b>FLUID MOTOR TORQUE</b> LB-IN (INCH POUNDS)	Torque = $\frac{\text{Pressure (PSI)} \times \text{F.M. Displacement (in}^3\text{/rev.)}}{2\pi}$	$T = \frac{P d}{2\pi}$
	Torque = $\frac{\text{Horsepower} \times 63025}{\text{RPM}}$	$T = \frac{63025 hp}{n}$
	Torque = $\frac{\text{Flow Rate (GPM)} \times \text{Pressure (PSI)} \times 36.77}{\text{RPM}}$	$T = \frac{36.77 Q P}{N}$
<b>FLUID MOTOR SPEED</b> RPM (REVOLUTIONS PER MINUTE)	Speed = $\frac{231 \times \text{Flow Rate (GPM)}}{\text{F.M. Displacement (in}^3\text{/rev.)}}$	$n = \frac{231 Q}{d}$
<b>FLUID MOTOR POWER</b> HP (HORSEPOWER)	Horsepower = $\frac{\text{Torque (lbs-in)} \times \text{RPM}}{63025}$	$hp = \frac{T n}{63025}$
<b>PUMP OUTLET FLOW</b> GPM (GALLONS PER MINUTE)	Flow = $\frac{\text{RPM} \times \text{Pump Displacement (in}^3\text{/rev.)}}{231}$	$Q = \frac{n d}{231}$
<b>FLOW RATE THROUGH PIPING</b> FT/S VELOCITY (FEET PER SECOND)	Velocity = $\frac{.3208 \times \text{Flow Rate Through I.D. (GPM)}}{\text{Internal Area (in}^2\text{)}}$	$v = \frac{.3208 Q}{A}$
<b>TORQUE REQUIREMENT</b> LB-IN (INCH POUNDS)	Torque = Lever Length (in.) x Pull (lbs.)	$T = L \times F$

# TECHNICAL DATA: TRD APPLICATION CHECK LIST

Date / /
-------------

Need help selecting the right cylinder for your application? Just fill out as much information about your application and contact your local distributor or TRD. TRD Customer Service fax: 815-654-0690 E-mail: [techsupport@trdmfg.com](mailto:techsupport@trdmfg.com)

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: _____	
_____	
_____	
_____	

<b>Sketch:</b> (include dimensions)	
--	--



## High Capacity Machining

TRD's flexible manufacturing systems provide capacity to handle any size order and also meet customer's expected delivery schedules. For the last five years, TRD's on-time delivery performance has been 98% or better!



HH - Heavy Duty Hydraulic

HH Rod Lock

MH - Medium Duty Hydraulic

TAS - Heavy Duty Pneumatic

TAS Options

Accessories  
Page 130

STROKEMASTER  
Page 136

Technical Data  
Page 144



**Worldwide distribution means there is a Professional Distributor Representative nearby - wherever you are - ready to service your needs.**



**Ask your local distributor about TRD's Full Line of NFPA Pneumatic Actuators**



## **Full Line NFPA Interchangeable Pneumatic Cylinders**

**1.50" to 12.00" Bore  
250 PSI Pneumatic  
Stroke to 120 inches  
Permanent Lubrication  
Temperatures to 200°F Standard  
Double Acting, Multi-Stage, Multi-Position, Triple Rod, Flush  
Mount, Back-to-Back, Air/Oil, Tandem**

**QUICK 2-3 DAY DELIVERY!**

Visit [www.trdmfg.com](http://www.trdmfg.com) for more information.

**TRD offers a complete range of custom solutions for all your actuator needs.**



**4.5" BORE ROUND STEEL**



**SPECIAL MOUNTS**



**15" BORE MULTI-STAGE DEVELOPES OVER 100,000 POUNDS OF FORCE at 100 PSI AIR**

# TRD DELIVERIES (F.O.B. Factory)

<u>SERIES</u>	<u>DELIVERY SCHEDULE</u>
MH (Medium-Duty Industrial Hydraulic) . . . . .	2-3 Days
HH (Heavy-Duty Industrial Hydraulic) . . . . .	2-3 Days
HH (Heavy-Duty Industrial Hydraulic) with Rod Lock . . . . .	3-4 Weeks
TAS (Heavy-Duty Industrial Pneumatic - 250 PSI Air) . . . . .	2-3 Days
TA, TD, FM, TRA, MSE, MSR . . . . .	2-3 Days
BTB, TM, 3P . . . . .	2-3 Days
Air Boosters, Air/Oil Tanks, BTP . . . . .	2-3 Days
SS, TAS (excluding MP1, MP4, MS2 mounts) . . . . .	2-3 Days
SS, TAS with MP1, MP4, MS2 mounts . . . . .	3-5 Days
SS-MSE, SS-MSR . . . . .	3-5 Days
RS (1.50" to 8.00" Bore) . . . . .	4-6 Days
TC . . . . .	5-7 Days
PFLF . . . . .	7-10 Days
TRD Switches . . . . .	1 Day
Rod Clevis, Pins & Mounts, Alignment Couplers . . . . .	1 Day
Balluff Strokemaster/Micropulse . . . . .	5-7 Days
MTS Temposonics . . . . .	10-12 Days

*STANDARD OPTIONS INCLUDED IN ABOVE DELIVERIES*

## RUSH SERVICE

RUSH SERVICES ARE AVAILABLE FOR ALL TRD PRODUCTS.  
CONTACT YOUR LOCAL TRD DISTRIBUTOR FOR DETAILS.

Your Local Distributor:



Worldwide distribution means there is a professional stocking Bimba distributor nearby ready to service your needs.



TRD Manufacturing Company  
10914 North 2nd Street  
Machesney Park, Illinois 61115-1400  
Phone: 815-654-7775  
Fax: 815-654-0690  
Email: sales@trdmfg.com  
www.trdmfg.com

HYD-0514



Bimba Manufacturing Company  
P.O. Box 68  
Monee, Illinois 60449-0068  
Phone: 708-534-8544  
Toll Free: 800-44-BIMBA  
Fax: 708-235-2014  
Email: support@bimba.com  
www.bimba.com