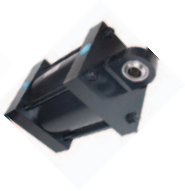
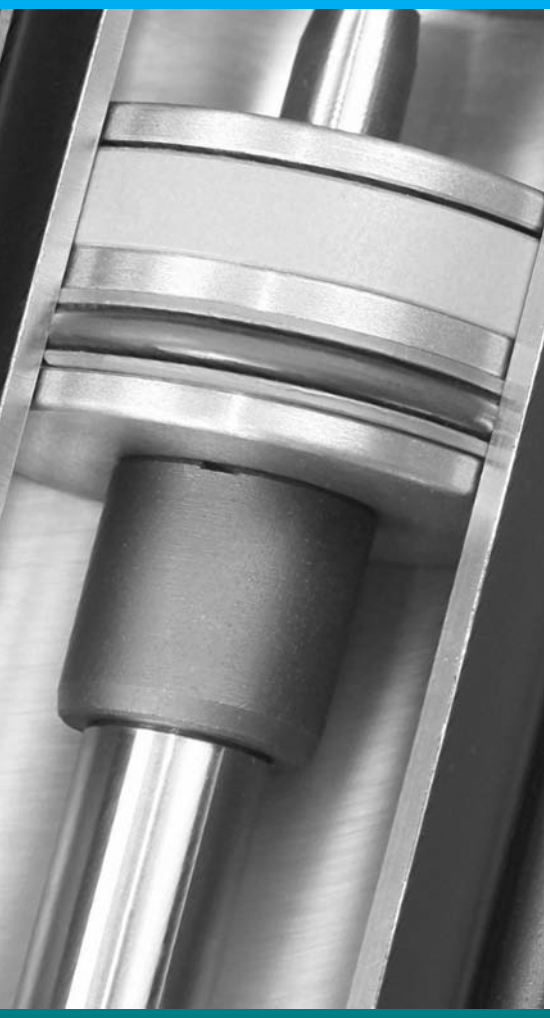
MH SERIES: MEDIUM DUTY INDUSTRIAL HYDRAULIC

TAS SERIES: HEAVY DUTY INDUSTRIAL PNEUMATIC



TRD Manufacturing, Inc.



TRD

a BIMBA company

The TRD difference...

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



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

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

- **Port size, type or location along with cushion locations can be made to your specifications.** *(All NFPA, BSP or SAE Sizes available)*
- **Rod End Styles and Designs:**
  - (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: http://www.trdmfg.com e-mail:sales@trdmfg.com

CAD FILES: CONTACT TRD FOR SPECIFIC HYDRAULIC CYLINDER MODEL DRAWINGS

3 YEAR WARRANTY

TRD Manufacturing Incorporated, A Bimba Company, is an employee owned company. We take great pride in our products. TRD Manufacturing, Inc. warranties its cylinders for a full 3 years to be free from defects in material and workmanship. TRD Manufacturing, Inc. must be notified prior to returning product for warranty evaluation. Contact your local TRD distributor to obtain an RGA (Returned Goods Authorization Number) for proper tracking and expedited service on all warranty evaluations. TRD will repair or replace free of charge any products returned to the factory within 3 years of shipment that is proven to be defective in material and/or workmanship.

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

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

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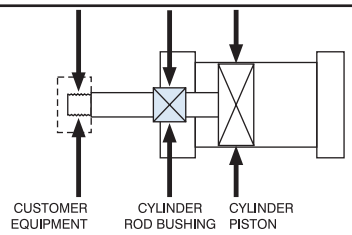
TECHNICAL DATA

SERIES 'MH' (NFPA) CYLINDER

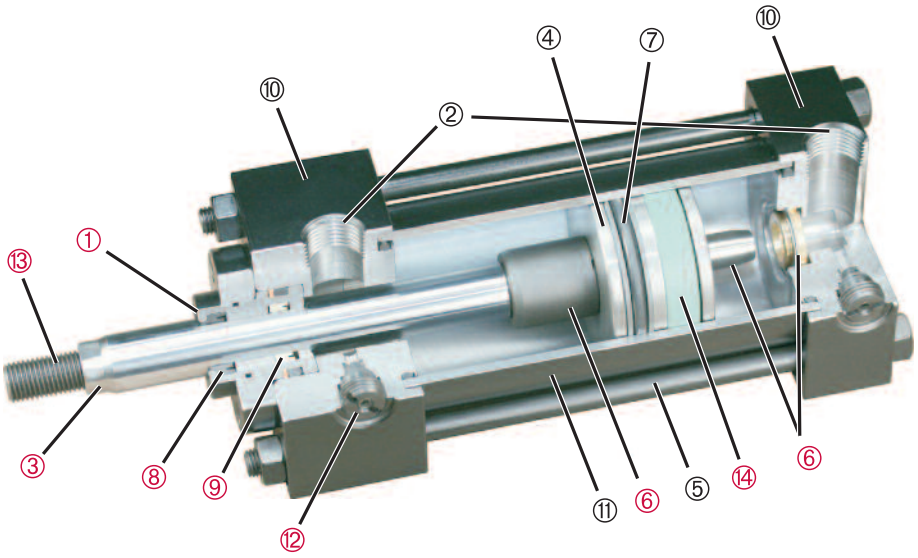
Floating Rod Bushing

SELF ALIGNMENT FEATURE

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



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



HEAVY-DUTY DESIGN FOR RELIABLE, CONSISTENT OPERATION

① ***FLOATING ROD BUSHING*** – Precision machined from 150,000 PSI rated graphite filled ductile iron and PTFE coated to reduce friction and extend cycle life. Bushing design "traps" lubrication in effective bearing area. Bronze bushings also available.

② ***PORTS*** – NPTF and SAE ports available standard. Non-standard locations, sizes, and other port styles can be made to order to fit any application needs.

③ ***PISTON ROD*** – Steel piston rod provides high strength and damage resistance. Induction hardened and chrome plated for maximum wear resistance and long life. (100K min. yield up to 5" rod; 75K min. yield for 5½" rod)

④ ***PISTON*** – Precision machined ductile iron provides high strength and an excellent bearing surface for extended cylinder life.

⑤ ***TIE RODS*** – Pre-stressed high carbon steel tie rod construction eliminates axial loading of cylinder tube and maintains compression on tube. (100K min. yield)

⑥ ***CUSHION*** – Precision machined cushions are available at either end and provide smooth deceleration which helps reduce end of stroke shock.

⑦ ***PISTON SEAL*** – Heavy-Duty, bi-directional Carboxilated Nitrile T-Seal with double back-up. Rated for shock loads and incorporates anti-extrusion technology. EP, PTFE, and fluorocarbon designs available.

⑧ ***ROD WIPER*** – Flocked nitrile wiper removes contaminants on retract stroke, helping insure long life for all internal components.

⑨ ***ROD SEALS*** – Polyurethane seals offer high abrasion resistance and strength. Pressure activated double lip and wear compensating for extended life.

⑩ ***HEAD & CAP*** – Precision machined steel head and cap are held to tight tolerances and insure accurate alignment for a truly "square" cylinder.

⑪ ***TUBE*** – Precision machined steel tube with hard chrome I.D. is honed and micro finished for extended seal life and improved cycle rates.

⑫ ***CUSHION ADJUSTMENT NEEDLE*** – Adjustable steel needle design has fine thread metering and is positively captured to prevent needle ejection during adjustment.

⑬ ***PISTON ROD STUD*** – Standard on KK1 and KK2 threads for ⅝" - 2" rods (125K min. yield). Available up to 2 times standard "A" thread length.

⑭ ***WEAR BAND*** – Wear Guard Nylon (standard); reinforced PTFE for E and V seal option.

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 77 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 34 for cylinder design guidance).
- ***CS*** – Center Supports are recommended for cylinders with long strokes in horizontal applications to prevent buckling of the cylinder and extend cylinder life.
- ***SSR*** – 17-4 Chrome Plated Stainless Steel Piston Rod provide corrosion resistance in outdoor applications and wet environments. (100K min. yield up to 5" rod; 75K min. yield 5½" rod)
- ***HP*** – High impact pistons use a high strength steel nut retained piston for fatigue resistance and additional strength in demanding applications.

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

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

SERIES	
MH	MEDIUM 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	0.063" NPTF
N125	0.125" NPTF
N250	0.250" NPTF
N375	0.375" NPTF
N500	0.500" NPTF
N750	0.750" NPTF
S6	#6 SAE
S8	#8 SAE
S10	#10 SAE
S12	#12 SAE

SEALS
See Below for Seal Ordering Instructions

OPTIONS	
A=	EXTENDED PISTON ROD THREAD (Example: A = 2") (MAX = 2 TIMES ST'D "A" DIM.)
AS=	ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, Example: AS = 4")
C=	EXTENDED PISTON ROD (Example: IF C = 0.500", THEN 1" ROD EXTENSION IS C = 1.500")
CS	CENTER SUPPORT
EK	EXTENDED KEYPLATE *(Refer to page 14 for specifications)*
HP	HIGH IMPACT PISTON
NR	NON-ROTATING *(Refer to page 35 for specifications)*
RBB	ROD BUSHING MATERIAL: BRONZE
SSR	STAINLESS STEEL PISTON ROD
ST=	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) Example: (HH-MS2-250x48**ES**-H2C6-**ST=3***)
4WF	FOUR WRENCH FLATS (ROD SIZES: 0.625"- 3.500")
XX=	SPECIAL VARIATION (SPECIFY)

NFPA MOUNTS	
MX0	NO MOUNT (1.50" to 8.00" Bore)
MF1	HEAD RECTANGULAR FLANGE (1.50" to 6.00" Bore)
MF2	CAP RECTANGULAR FLANGE (1.50" to 6.00" Bore)
MF5	HEAD SQUARE FLANGE (1.50" to 6.00" Bore)
MF6	CAP SQUARE FLANGE (1.50" to 6.00" Bore)
ME3	HEAD MOUNTING HOLES (8.00" Bore)
ME4	CAP MOUNTING HOLES (8.00" Bore)
MP1	FIXED CAP PIVOT CLEVIS (1.50" to 8.00" Bore)
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)

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
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

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)

HOW TO ORDER SEALS

S S S S

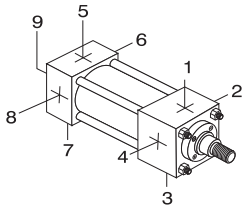
PISTON SEAL	
S	STANDARD (Carboxilated)
C	Cast-Ring
E	EP
T	PTFE
V	Fluorocarbon

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	Metalic Scrapper
T	PTFE
V	Fluorocarbon

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

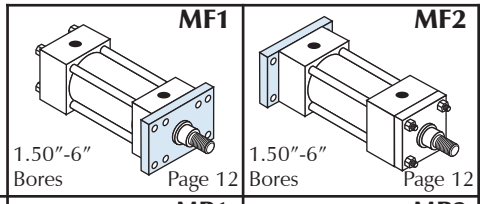


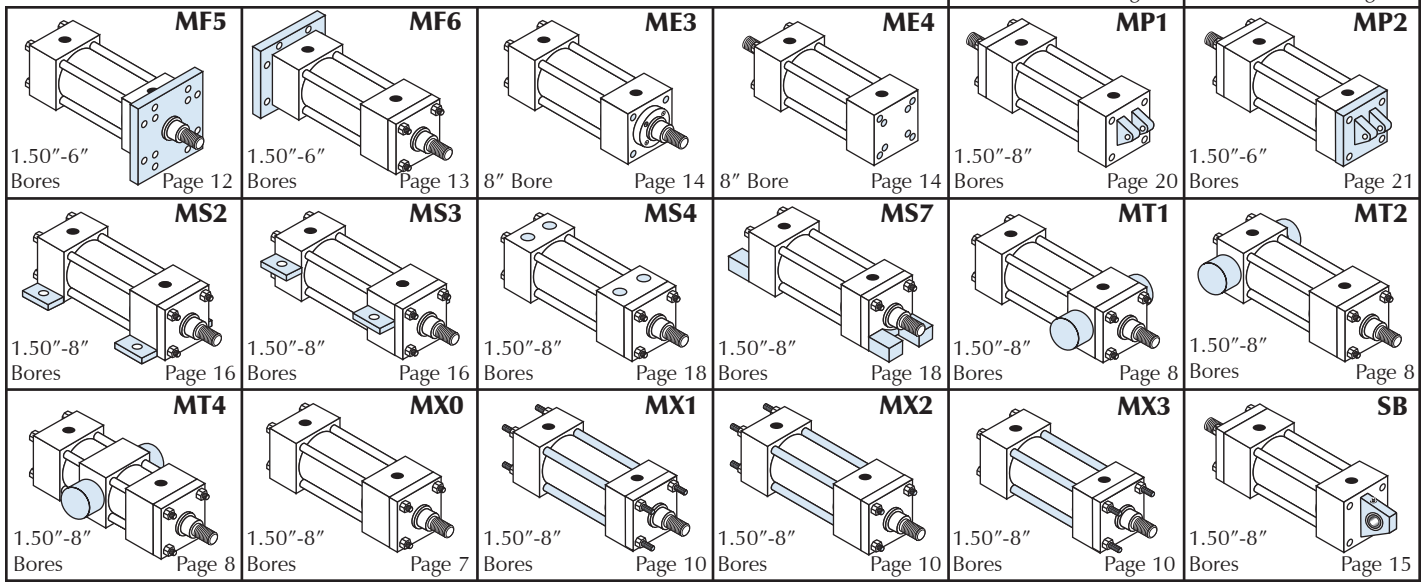
Location 9 is center of cap face.

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

MAXIMUM STROKE RECOMMENDATIONS			
BORE	NO CENTER SUPPORT	WITH CENTER SUPPORTS (CS OPTION)	
		ONE SUPPORT	TWO SUPPORTS
1.50", 2.00" & 2.50"	48 INCHES	OVER 48 INCHES	OVER 72 INCHES
3.25", 4.00" & 5.00"	65 INCHES	OVER 75 INCHES	OVER 92 INCHES
6.00" & 8.00"	72 INCHES	OVER 72 INCHES	NOT REQUIRED

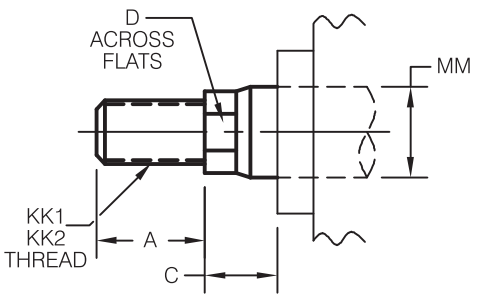
NFPA MOUNTS



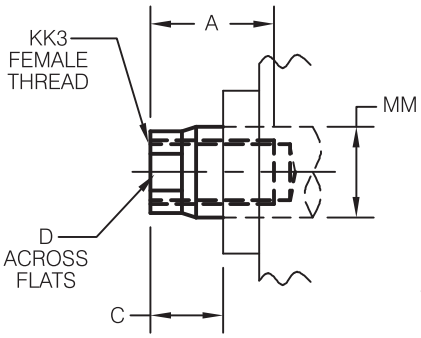


SERIES 'MH' DIMENSIONS: THREADS

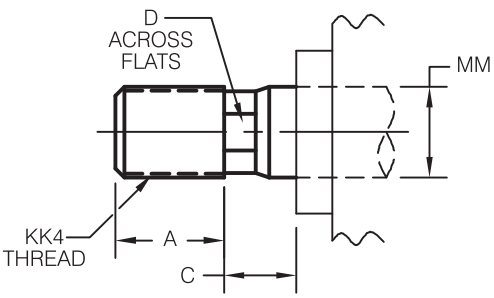
ROD END STYLE: KK1 KK2

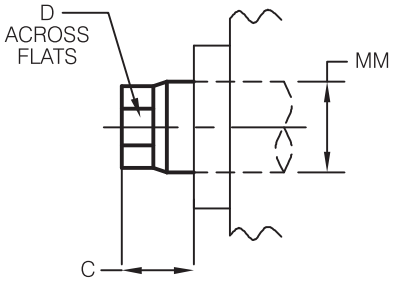


ROD END STYLE: KK3

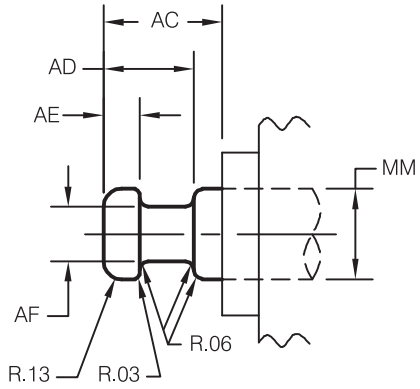


ROD END STYLE: KK4

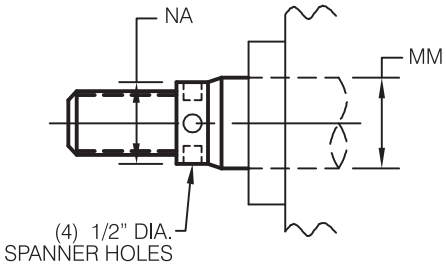




ROD END STYLE: KK5



ROD END STYLE: KK10



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

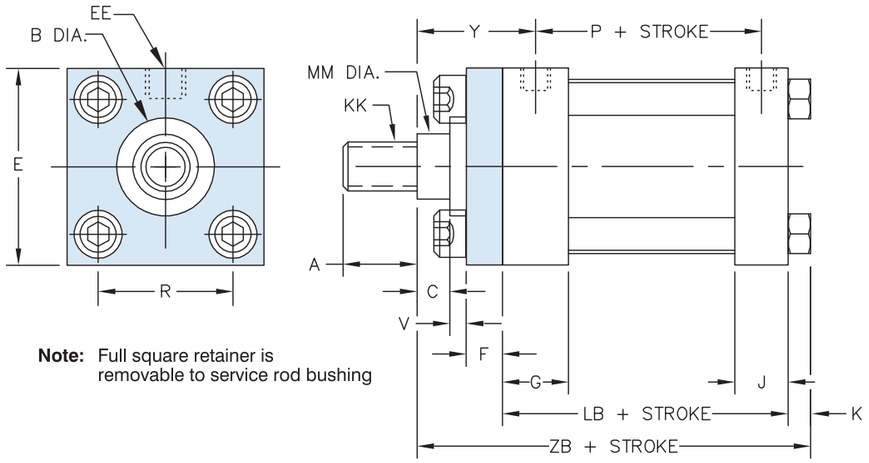
ROD DIA (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4	NA ±.002
0.625	0.750	0.375	0.500	1.125	0.625	0.250	0.375	0.437 - 20*	0.500 - 20*	0.438 - 20	0.625 - 18	—
1.000	1.125	0.500	0.875	1.625	0.938	0.375	0.688	0.750 - 16*	0.875 - 14	0.750 - 16	1.000 - 14	—
1.375	1.625	0.625	1.125	1.750	1.062	0.375	0.875	1.000 - 14*	1.250 - 12*	1.000 - 14	1.375 - 12	—
1.750	2.000	0.750	1.500	2.000	1.313	0.500	1.125	1.250 - 12*	1.500 - 12*	1.250 - 12	1.750 - 12	—
2.000	2.250	0.875	1.750	2.625	1.688	0.625	1.375	1.500 - 12*	1.750 - 12*	1.500 - 12	2.000 - 12	—
2.500	3.000	1.000	2.125	3.250	1.938	0.750	1.750	1.875 - 12	2.250 - 12	1.875 - 12	2.500 - 12	—
3.000	3.500	1.000	2.625	3.625	2.438	0.875	2.250	2.250 - 12	2.750 - 12	2.250 - 12	3.000 - 12	—
3.500	3.500	1.000	3.000	4.375	2.688	1.000	2.500	2.500 - 12	3.250 - 12	2.500 - 12	3.500 - 12	—
4.000	4.000	1.000	—	4.500	2.688	1.000	3.000	3.000 - 12	3.750 - 12	3.000 - 12	4.000 - 12	3.937
4.500	4.500	1.000	—	5.250	3.188	1.500	3.500	3.250 - 12	4.250 - 12	3.250 - 12	4.500 - 12	4.421
5.000	5.000	1.000	—	5.375	3.188	1.500	3.875	3.500 - 12	4.750 - 12	3.500 - 12	5.000 - 12	4.921
5.500	5.500	1.000	—	6.250	3.938	1.875	4.375	4.000 - 12	5.250 - 12	4.000 - 12	5.500 - 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)

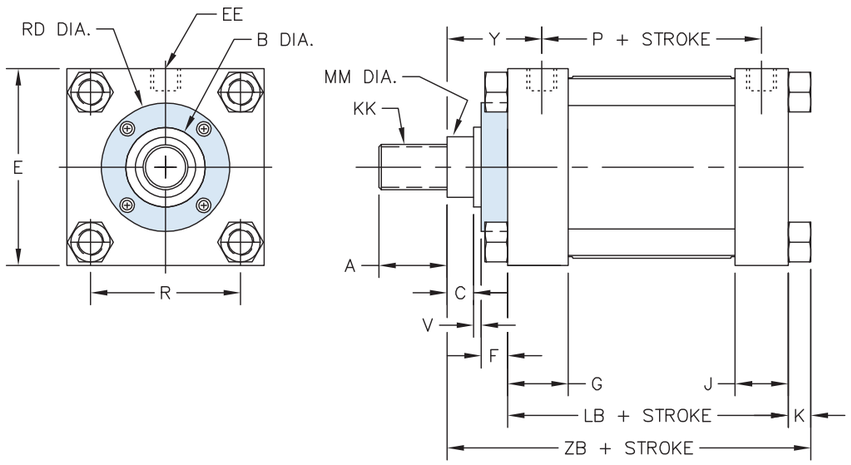
RETAINER CONSRUCTION

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

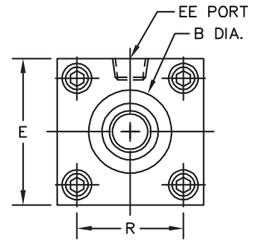


Note: Full square retainer is removable to service rod bushing

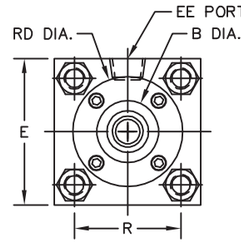
ROUND RETAINER USED ON:	
BORE	ROD DIA.
2.00	0.625
2.50	0.625
3.25	1.000
4.00	1.000
	1.375
	1.750
5.00	1.000
	1.375
	1.750
	2.000
6.00	1.375
	1.750
	2.000
	2.500
	3.000
	3.500
8.00	1.375
	1.750
	2.000
	2.500
	3.000
	3.500
	4.000
	4.500
	5.000
	5.500



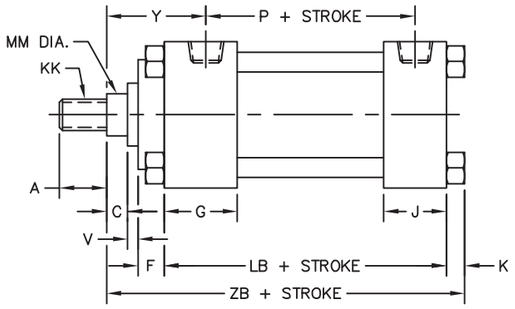
SERIES 'MH' DIMENSIONS: BASIC CYLINDER (MX0 MOUNT)



WITH SQUARE RETAINER



WITH ROUND RETAINER



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

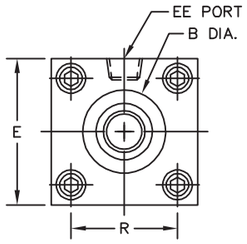
SEE ROD END DETAIL CHART ON PAGE 6

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

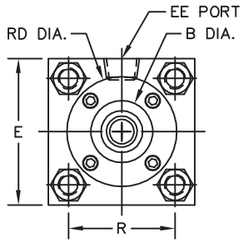
BASE DIMENSION FOLD-OUT

EASY FLIP OUT PAGE FOR REFERENCE

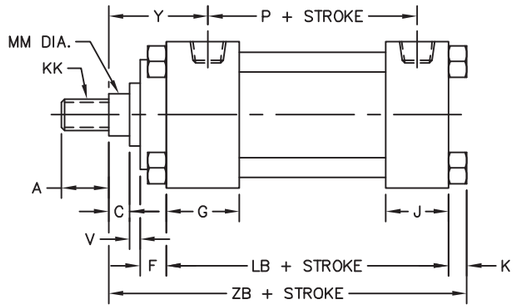
SERIES 'MH' DIMENSIONS: BASIC CYLINDER (MX0 MOUNT)



WITH SQUARE RETAINER



WITH ROUND RETAINER



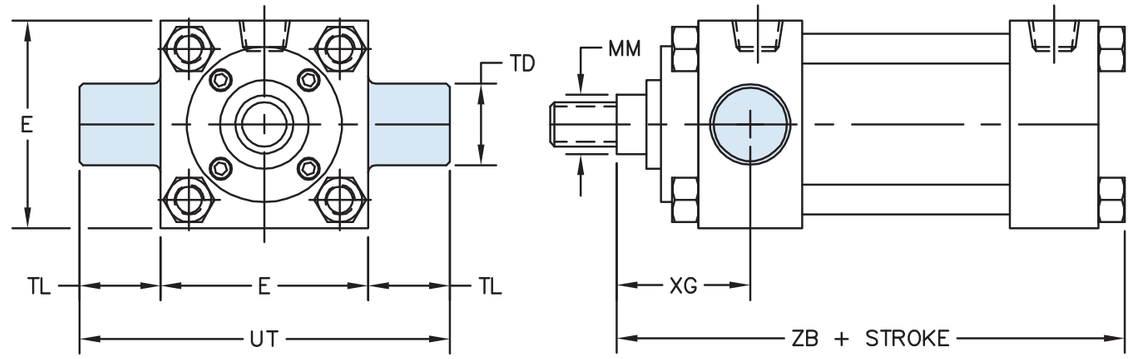
BORE	ROD DIA (MM)	MAX. PSI RATING ③	E	A	① B	C	EE NPTF	EE SAE	F	G	J	K	KK	R	② RD	V	Y	ADD TO STROKE LB	ADD TO STROKE P	ADD TO STROKE ZB
1.50	0.625	1500	2.000	0.750	1.124	0.375	0.375	#6	0.375	1.500	1.000	0.250	SEE ROD END DETAIL CHART ON PAGE 6	1.430	SQ	0.250	1.875	3.625	2.375	4.875
	1.000	1500		1.125	1.499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

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

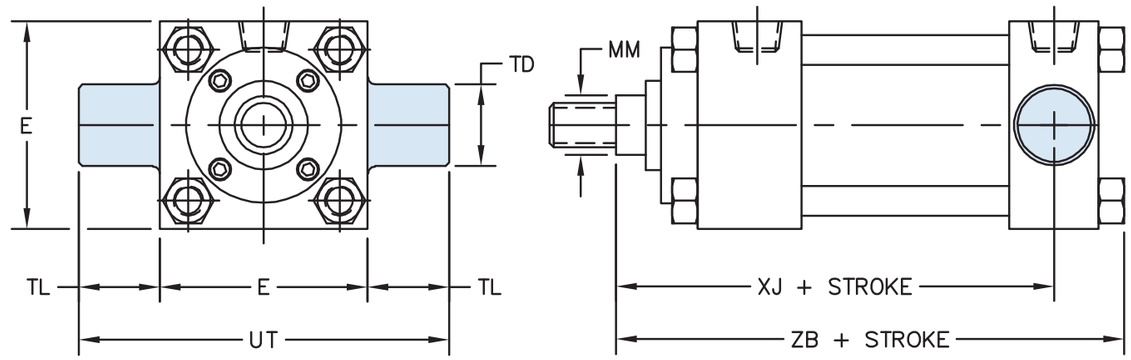
BASE DIMENSION FOLD-OUT

SERIES 'MH' DIMENSIONS: TRUNNION MOUNTS

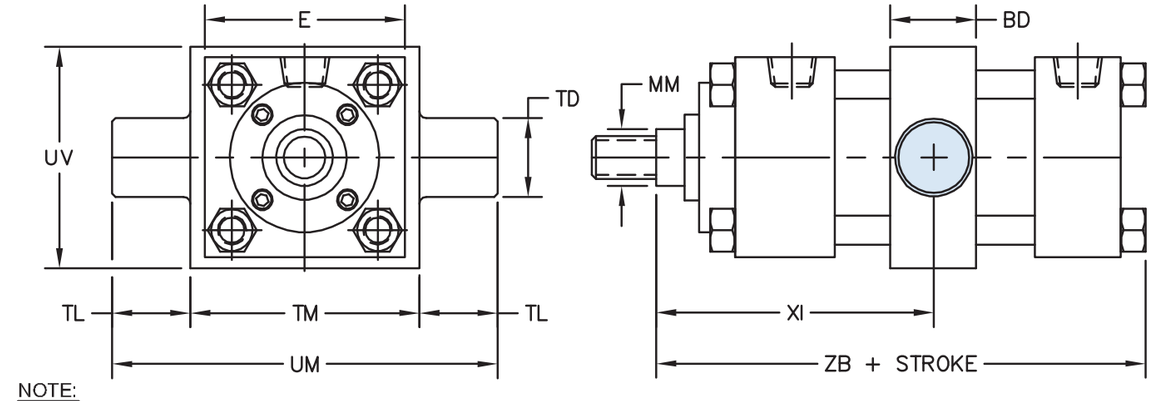
MT1: HEAD TRUNNION



MT2: CAP TRUNNION



MT4: INTERMEDIATE TRUNNION



NOTE:
'XI' DIMENSION TO BE SPECIFIED BY CUSTOMER

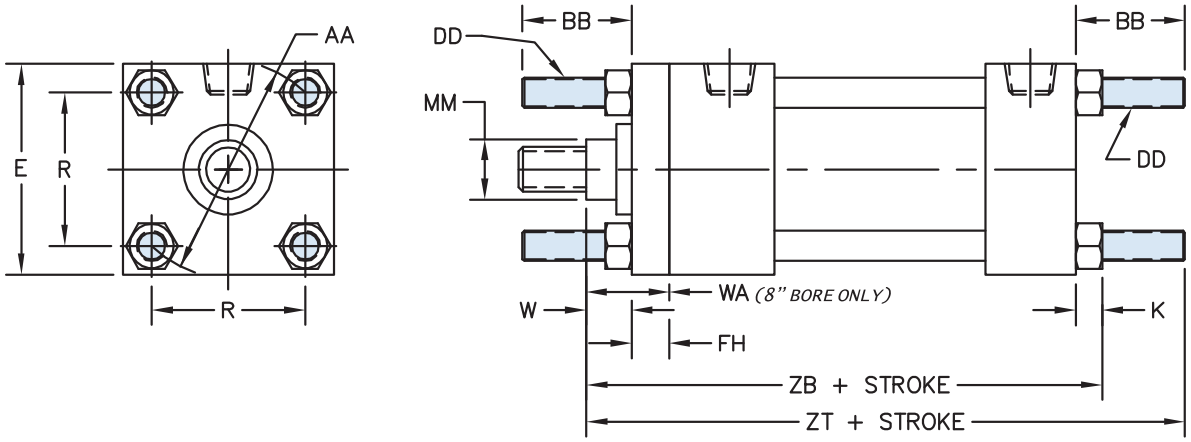
SERIES 'MH' DIMENSIONS: TRUNNION MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	BD	② TD	TL	TM	UM	UT	UV	XG	③ XI	MT4 Min Stroke	ADD TO STROKE XJ	ADD TO STROKE 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
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

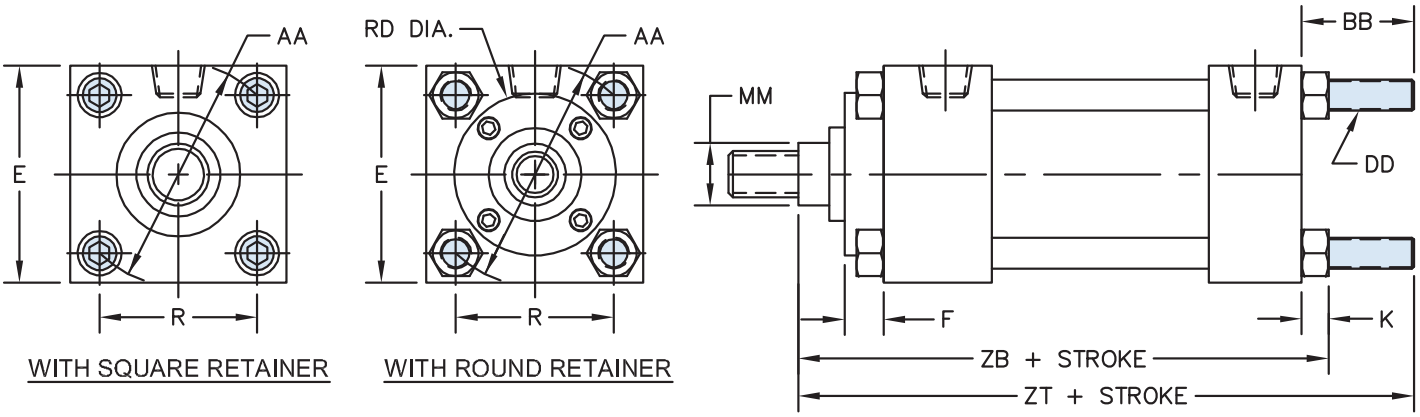
① Max. pressure rating. (NON-SHOCK)
② 'TD' dimension tolerance is + .000 / - .001
③ 'XI' dimension is the minimum that can be supplied and leaves 1/4" gap between head & trunnion block. (customer to specify 'XI' dimension).

SERIES 'MH' DIMENSIONS: EXTENDED TIE ROD MOUNTS

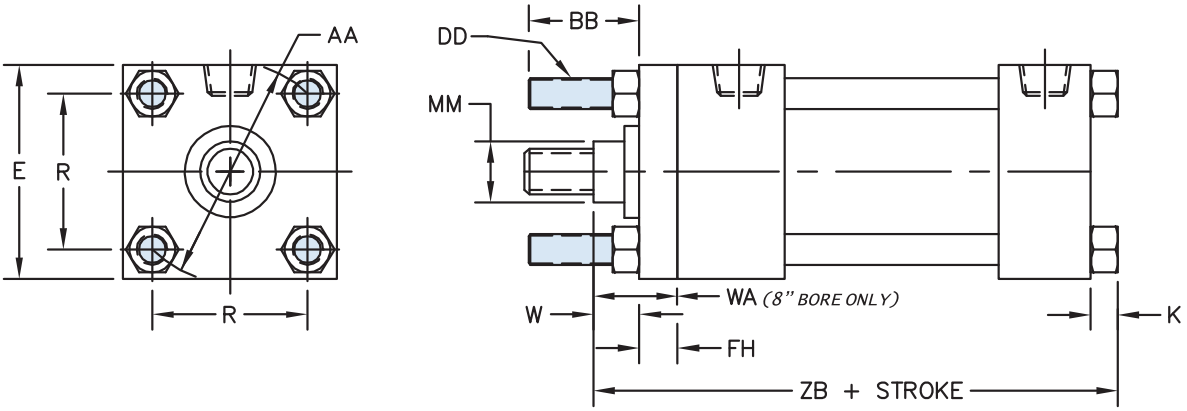
MX1: EXTENDED TIE-RODS - HEAD & CAP



MX2: EXTENDED TIE-RODS - CAP END



MX3: EXTENDED TIE-RODS - HEAD END



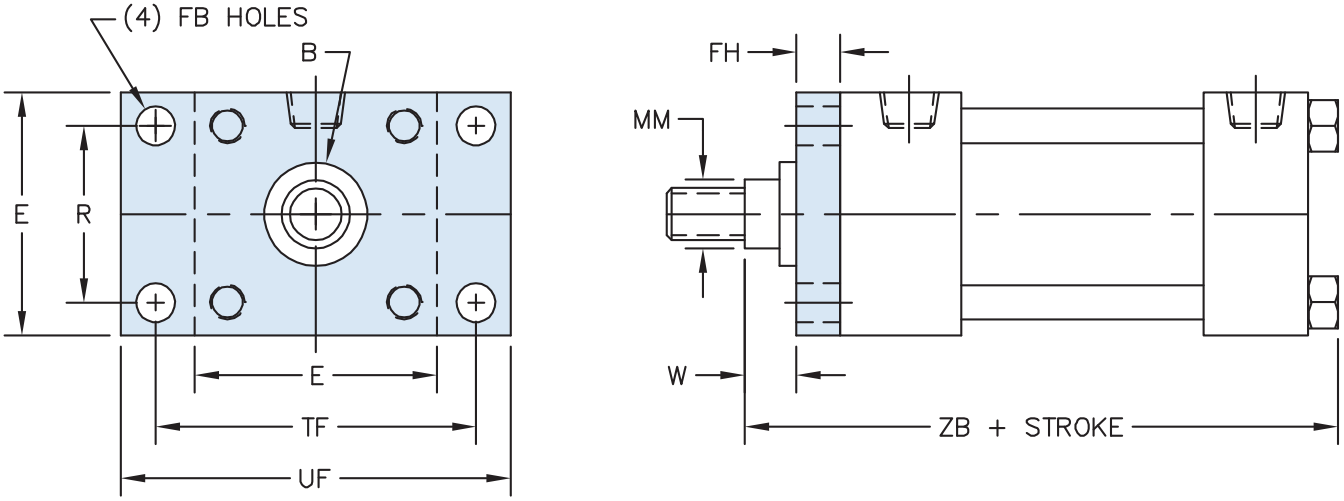
SERIES 'MH' DIMENSIONS: EXTENDED TIE ROD MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING ⟨1⟩	E	FH	AA	BB	DD	F	K	R	⟨2⟩ RD	W or WA (8")	ADD TO STROKE ZB	ADD TO STROKE ZT
1.50	0.625	1500	2.000	0.375	2.020	1.000	0.250 - 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	0.313 - 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	0.313 - 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	0.375 - 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	0.375 - 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	0.500 - 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	0.500 - 20	0.750	0.438	4.880	3.500	0.875	7.063	8.438
	1.750	750									3.875	1.125	7.313	8.688
	2.000	750									4.250	1.250	7.438	8.813
	2.500	750									4.625	1.500	7.688	9.063
	3.000	750									5.250	1.500	7.688	9.063
	3.500	750									5.750	1.500	7.688	9.063
	4.000	750									SQ	1.500	7.688	9.063
8.00	1.375	500	8.500	*0.625 ⟨3⟩	9.10	2.313 ⟨3⟩	0.625 - 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

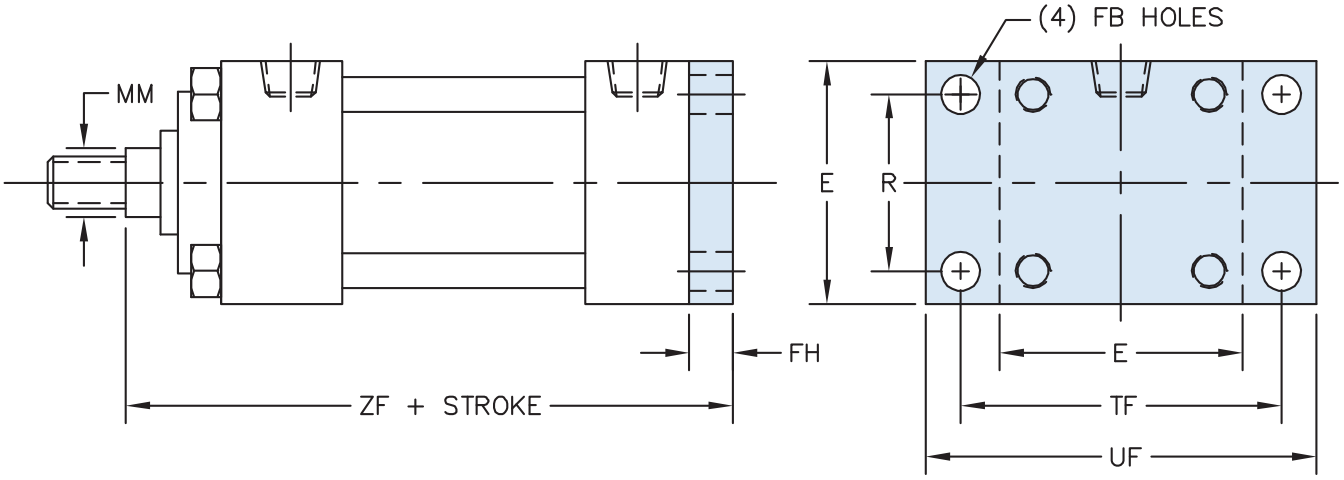
⟨1⟩ Max. pressure rating. (NON-SHOCK)
⟨2⟩ Where SQ is shown in chart, cylinder utilizes a full square retainer. ALL MX1 & MX3 MOUNTS USE FULL SQ. RETAINER.
⟨3⟩ *Round retainer used to retain bushing, not a full front plate as other bores. 'BB' is dimension from head on the 8" bore.

SERIES 'MH' DIMENSIONS: FLANGE MOUNTS

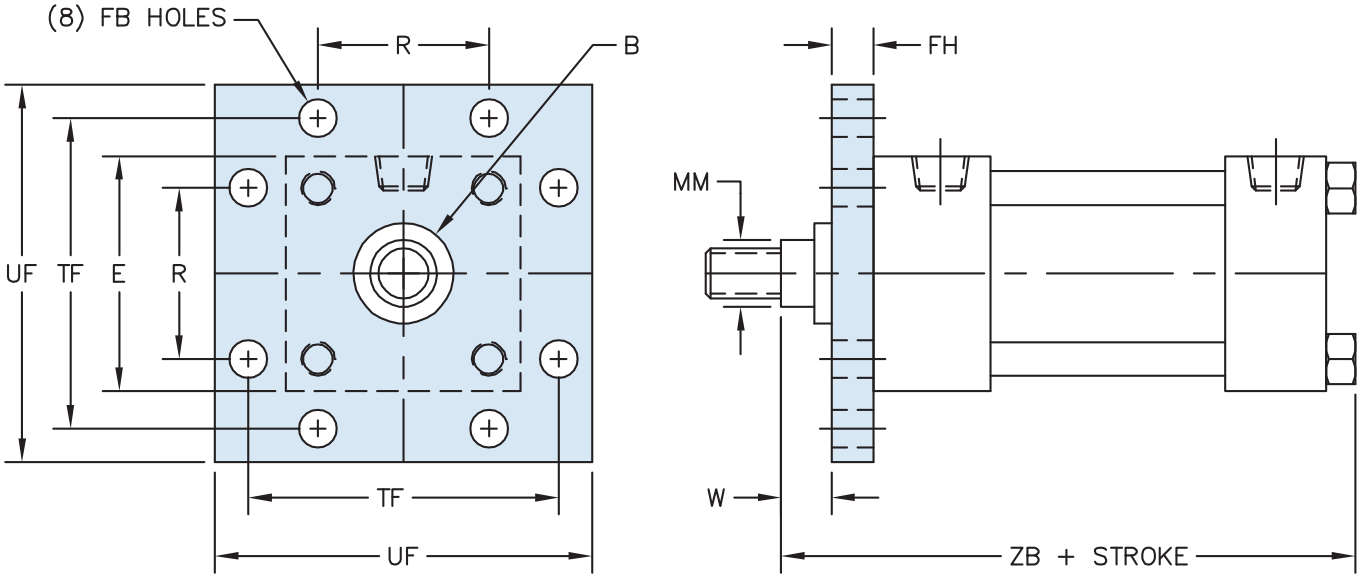
MF1: HEAD FLANGE



MF2: CAP FLANGE

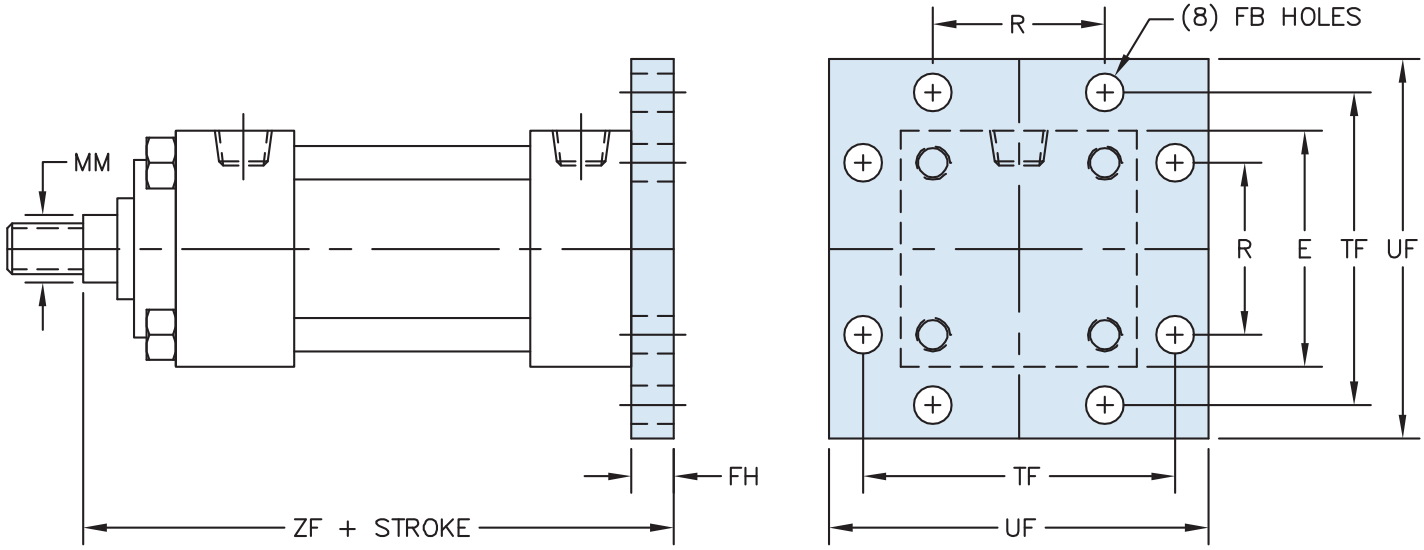


MF5: HEAD SQUARE FLANGE



SERIES 'MH' DIMENSIONS: FLANGE MOUNTS

MF6: CAP SQUARE FLANGE

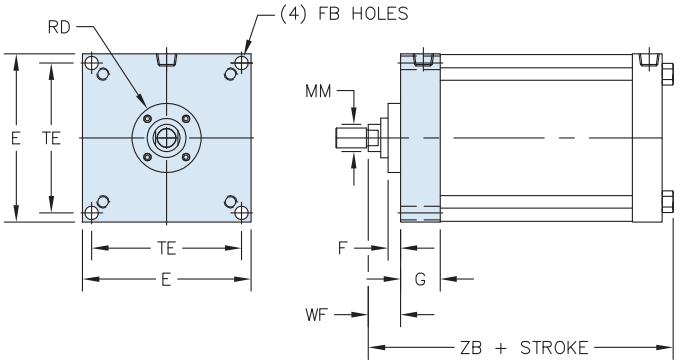


BORE	ROD DIAM (MM)	MAX. PSI RATING ①	② B	E	FB	FH	R	TF	UF	W	ADD TO STROKE ZB	ADD TO STROKE ZF
1.50	0.625	1500	1.124	2.000	0.313	0.375	1.438	2.750	3.375	0.625	4.875	5.000
	1.000	1500	1.499							1.000	5.250	5.375
2.00	0.625	1500	1.124	2.500	0.375	0.375	1.844	3.375	4.125	0.625	4.938	5.000
	1.000	1500	1.499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

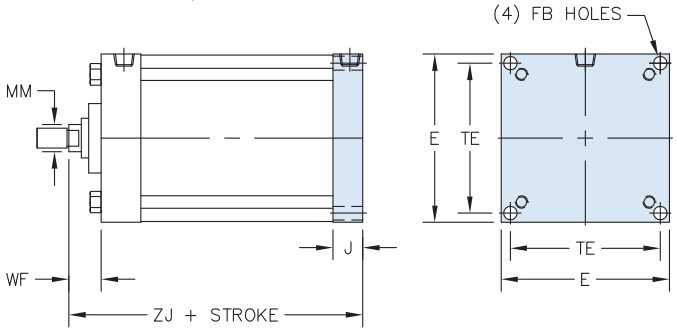
① Max. pressure rating. (NON-SHOCK)
② 'B' dimension tolerance is +.000 / -.002

SERIES 'MH' DIMENSIONS: FLANGE MOUNTS

ME3: HEAD SQUARE MOUNTING HOLES



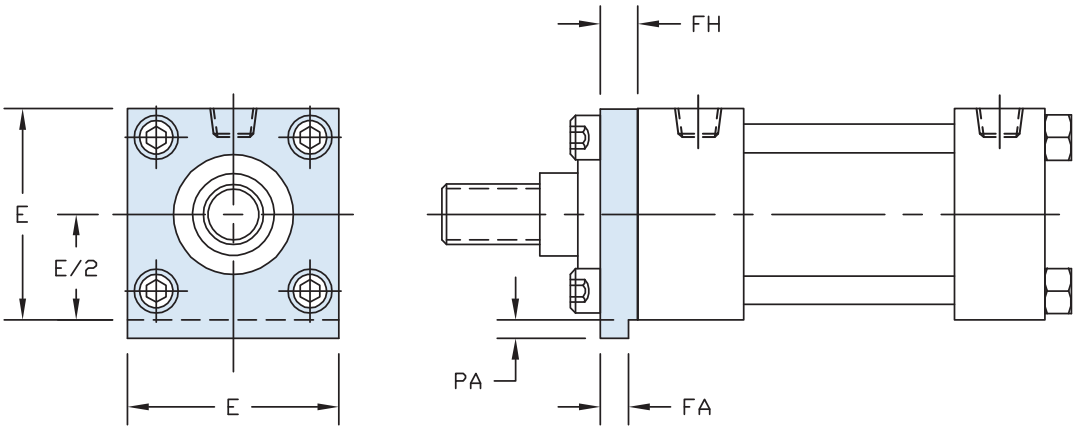
ME4: CAP SQUARE MOUNTING HOLES



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

① Max. pressure rating.

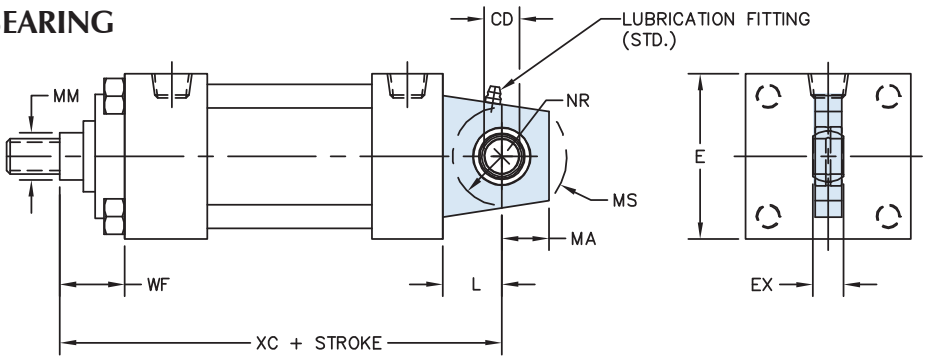
EXTENDED KEYPLATE ('EK' OPTION)



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

SERIES 'MH' DIMENSIONS: SPHERICAL BEARING MOUNT

SB: SPHERICAL BEARING



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

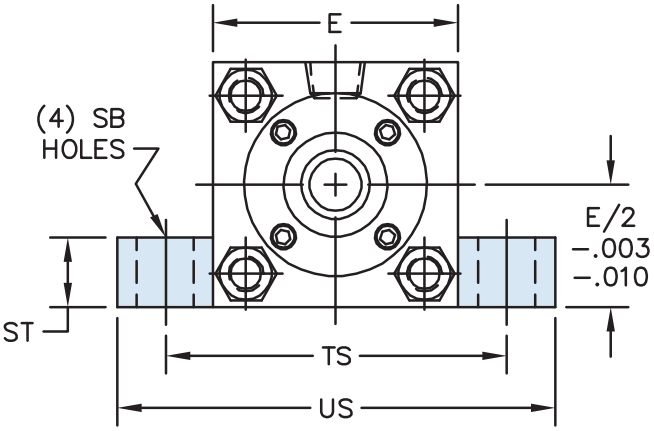
① Max. pressure rating. (NON-SHOCK)

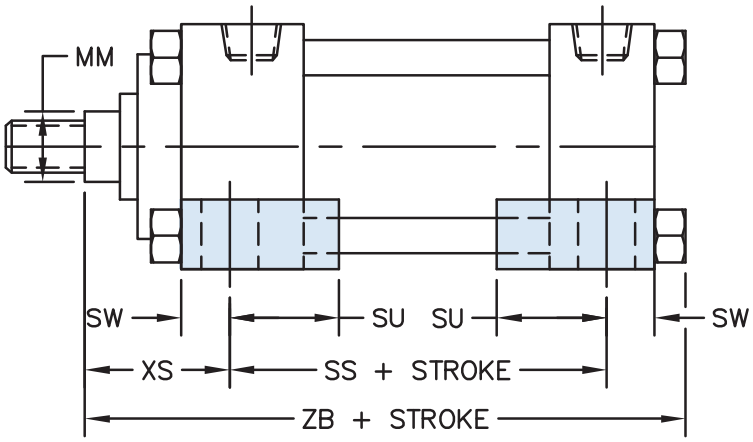
Note: Pivot pin included with cylinder cap end only. 5", 6" & 8" bores have tie rod nuts exposed on cap end.

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

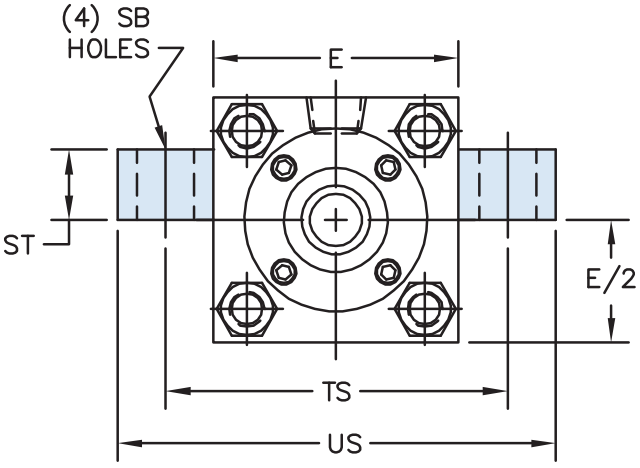
SERIES 'MH' DIMENSIONS: LUG MOUNTS

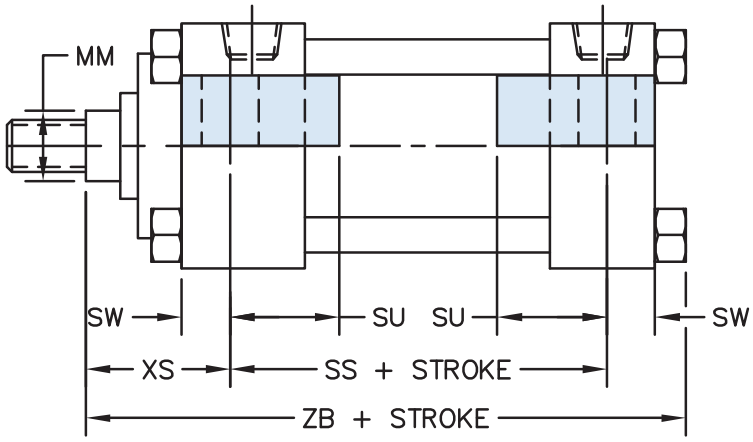
MS2: SIDE LUGS





MS3: CENTER LINE LUGS





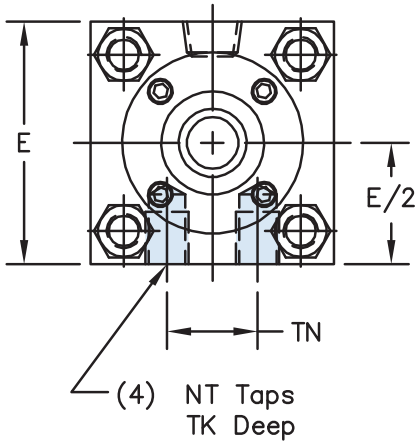
SERIES 'MH' DIMENSIONS: LUG MOUNTS

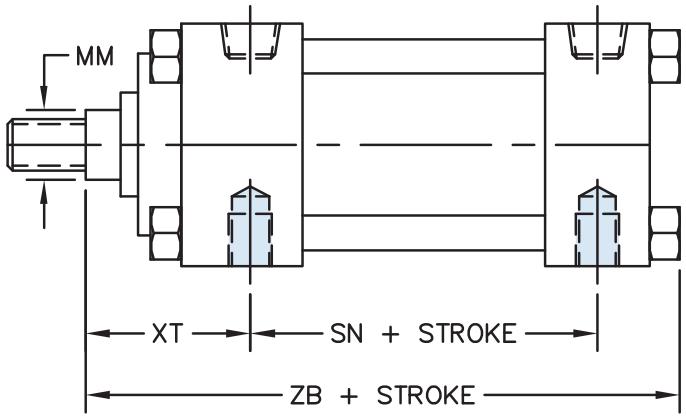
BORE	ROD DIAM (MM)	MAX. PSI RATING ⟨1⟩	E	SB	ST	SU	SW	TS	US	XS	ADD TO STROKE	
											SS	ZB
1.50	0.625	1500	2.000	0.438	0.500	1.125	0.375	2.750	3.500	1.375	2.875	4.875
	1.000	1500								1.750		5.25
2.00	0.625	1500	2.500	0.438	0.500	1.125	0.375	3.250	4.000	1.375	2.875	4.938
	1.000	1500								1.750		5.313
	1.375	1500								2.000		5.563
2.50	0.625	1000	3.000	0.438	0.500	1.125	0.375	3.750	4.500	1.375	3.000	5.063
	1.000	1500								1.750		5.438
	1.375	1500								2.000		5.688
	1.750	1500								2.250		5.938
3.25	1.000	1500	3.750	0.563	0.750	1.250	0.500	4.75	5.750	1.875	3.250	6.000
	1.375	1500								2.125		6.250
	1.750	1500								2.375		6.500
	2.000	1500								2.500		6.625
4.00	1.000	1000	4.500	0.563	0.750	1.250	0.500	5.500	6.500	1.875	3.250	6.000
	1.375	1000								2.125		6.250
	1.750	1000								2.375		6.500
	2.000	1000								2.500		6.625
	2.500	1000								2.750		6.875
5.00	1.000	750	5.500	0.813	1.000	1.063	0.688	6.875	8.250	2.063	3.125	6.313
	1.375	1000								2.313		6.563
	1.750	1000								2.563		6.813
	2.000	1000								2.688		6.938
	2.500	1000								2.938		7.188
	3.000	1000								2.938		7.188
	3.500	1000								2.938		7.188
6.00	1.375	750	6.500	0.813	1.000	1.313	0.688	7.875	9.250	2.313	3.625	7.063
	1.750	750								2.563		7.313
	2.000	750								2.688		7.438
	2.500	750								2.938		7.688
	3.000	750								2.938		7.688
	3.500	750								2.938		7.688
	4.000	750								2.938		7.688
8.00	1.375	500	8.500	0.813	1.000	1.313	0.688	9.875	11.250	2.313	3.750	7.313
	1.750	500								2.563		7.563
	2.000	675								2.688		7.688
	2.500	675								2.938		7.938
	3.000	675								2.938		7.938
	3.500	675								2.938		7.938
	4.000	675								2.938		7.938
	4.500	675								2.938		7.938
	5.000	675								2.938		7.938
	5.500	675								2.938		7.938

⟨1⟩ Max. pressure rating. (NON-SHOCK)

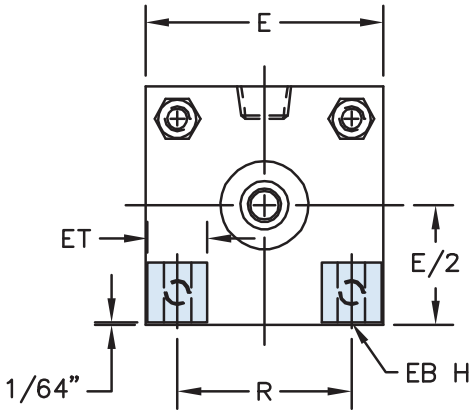
SERIES 'MH' DIMENSIONS: BOTTOM MOUNTS

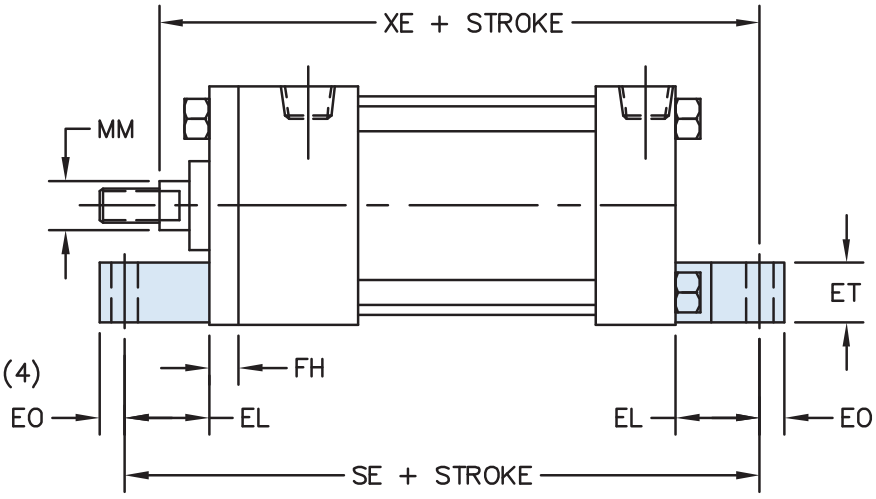
MS4: BOTTOM TAPPED HOLES





MS7: END LUGS





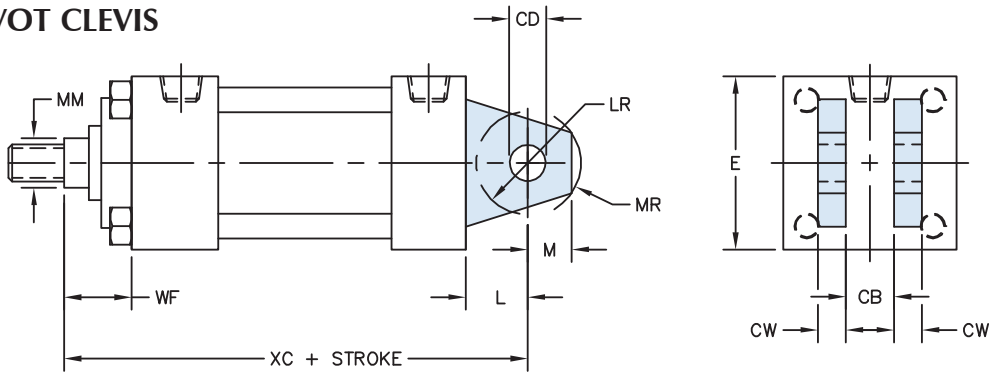
SERIES 'MH' DIMENSIONS: BOTTOM MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	EB	EL	EO	ET	FH	NT	R	TN	TK	XT	ADD TO STROKE			
														SN	ZB	SE	XE
1.50	0.625	1500	2.000	0.281	0.750	0.250	0.563	0.375	0.250 - 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	0.313 - 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	0.375 - 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	0.500 - 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	0.500 - 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	0.625 - 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	0.750 - 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	②	0.750 - 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	N/A	N/A	N/A						3.438		7.938		N/A
	4.500	675		N/A	N/A	N/A	N/A						3.438		7.938		N/A
	5.000	675		N/A	N/A	N/A	N/A						3.438		7.938		N/A
	5.500	675		N/A	N/A	N/A	N/A						3.438		7.938		N/A

① Max. pressure rating. (NON-SHOCK)
② (1) piece MS7 brackets bolted directly to head & cap. (Uses round retainer)

SERIES 'MH' DIMENSIONS: PIVOT MOUNTS

MP1: REAR PIVOT CLEVIS

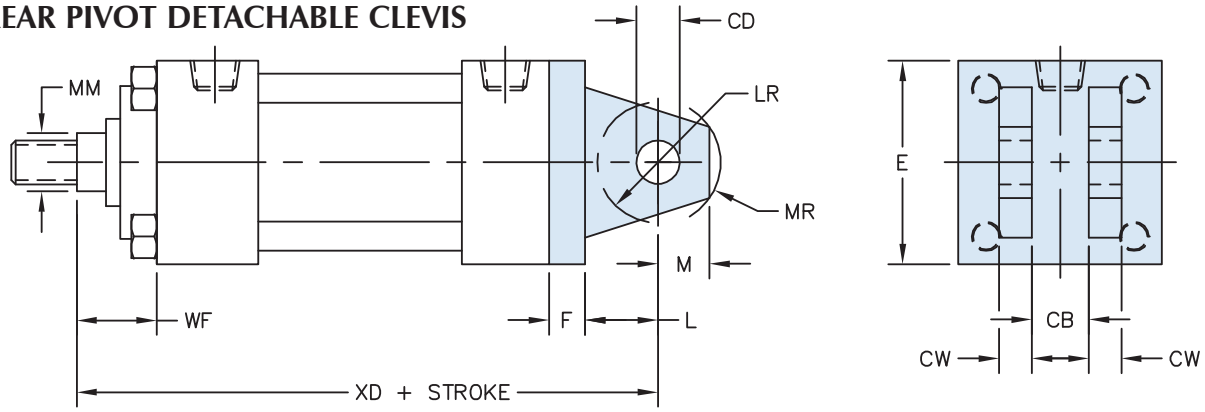


BORE	ROD DIAM (MM)	MAX. PSI RATING ①	CB	CD	CW	E	L	LR	M	MR	WF	ADD TO STROKE XC
1.50	0.625	1500	0.750	0.500	0.500	2.000	0.750	0.750	0.500	0.625	1.000	5.375
	1.000	1500									1.375	5.750
2.00	0.625	1500	0.750	0.500	0.500	2.500	0.750	0.750	0.500	0.625	1.000	5.375
	1.000	1500									1.375	5.750
	1.375	1500									1.625	6.000
2.50	0.625	1000	0.750	0.500	0.500	3.000	0.750	0.750	0.500	0.625	1.000	5.500
	1.000	1500									1.375	5.875
	1.375	1500									1.625	6.125
	1.750	1500									1.875	6.375
3.25	1.000	1500	1.250	0.750	0.625	3.750	1.250	1.000	0.750	0.938	1.375	6.875
	1.375	1500									1.625	7.125
	1.750	1500									1.875	7.375
	2.000	1500									2.000	7.500
4.00	1.000	1000	1.250	0.750	0.625	4.500	1.250	1.000	0.750	0.938	1.375	6.875
	1.375	1000									1.625	7.125
	1.750	1000									1.875	7.375
	2.000	1000									2.000	7.500
	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
	3.500	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
	4.000	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

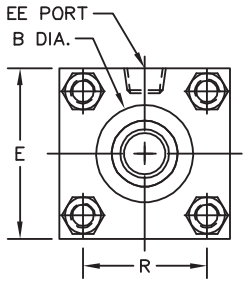
MP2: REAR PIVOT DETACHABLE CLEVIS



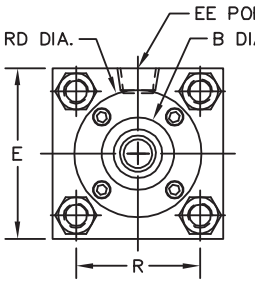
BORE	ROD DIAM (MM)	MAX. PSI RATING ①	CB	CD	CW	E	F	L	LR	M	MR	WF	ADD TO STROKE XD
1.50	0.625	1500	0.750	0.500	0.500	2.000	0.375	0.750	0.750	0.500	0.625	1.000	5.750
	1.000	1500										1.375	6.125
2.00	0.625	1500	0.750	0.500	0.500	2.500	0.375	0.750	0.750	0.500	0.625	1.000	5.750
	1.000	1500										1.375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

① Max. pressure rating. (NON-SHOCK)
Note: Pivot pin included with cylinder cap end only.

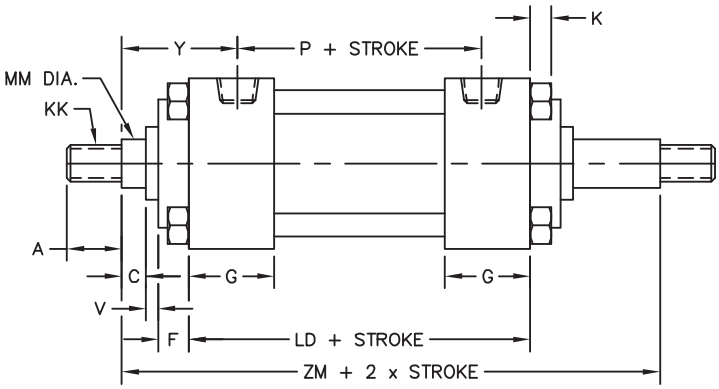
SERIES 'MH' DIMENSIONS: BASIC DOUBLE END (MX0 MOUNT)



WITH SQUARE RETAINER



WITH ROUND RETAINER



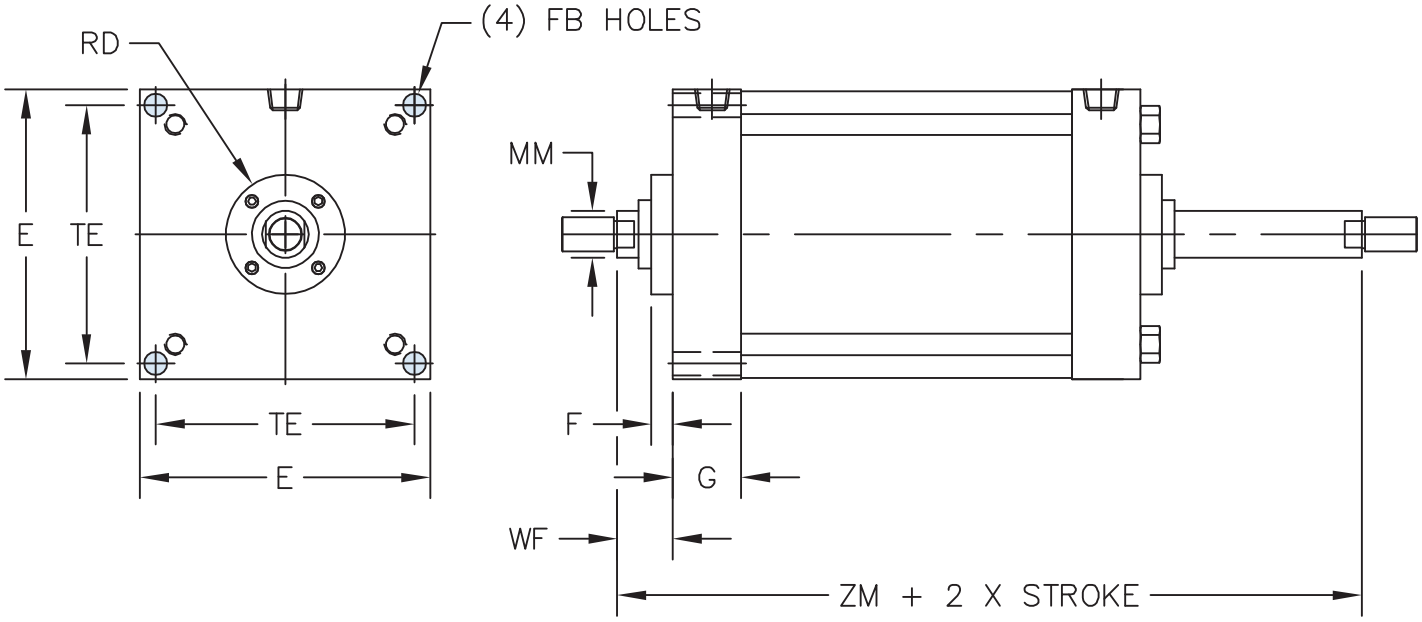
MX0D: NO MOUNT

BORE	ROD DIA (MM)	MAX. PSI RATING ③	E	A	① B	C	EE NPTF	EE SAE	F	G	K	KK	R	② RD	V	Y	ADD TO STROKE LD	ADD TO STROKE P	ADD 2x STROKE ZM
1.50	0.625	1500	2.000	0.750	1.124	0.375	0.375	#6	0.375	1.500	0.250	SEE ROD END DETAIL CHART ON PAGE 6	1.438	SQ	0.250	1.875	4.125	2.375	6.125
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			6.875
2.00	0.625	1500	2.500	0.750	1.124	0.375	0.375	#6	0.375	1.500	0.313		1.844	2.000	0.250	1.875	4.125	2.375	6.125
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			6.875
	1.375	1500		1.625	1.999	0.625								SQ	0.625	2.500			7.375
2.50	0.625	1000	3.000	0.750	1.124	0.375	0.375	#6	0.375	1.500	0.313		2.188	2.000	0.250	1.875	4.250	2.500	6.250
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			7.000
	1.375	1500		1.625	1.999	0.625								SQ	0.625	2.500			7.500
	1.750	1500		2.000	2.374	0.750								SQ	0.750	2.750			8.000
3.25	1.000	1500	3.750	1.125	1.499	0.500	0.500	#10	0.625	1.750	0.375		2.766	2.750	0.250	2.375	4.750	2.750	7.500
	1.375	1500		1.625	1.999	0.625								SQ	0.375	2.625			8.000
	1.750	1500		2.000	2.374	0.750								SQ	0.500	2.875			8.500
	2.000	1500		2.250	2.624	0.875								SQ	0.500	3.000			8.750
4.00	1.000	1000	4.500	1.125	1.499	0.500	0.500	#10	0.625	1.750	0.375		3.328	2.750	0.250	2.375	4.750	2.750	7.500
	1.375	1000		1.625	1.999	0.625								3.500	0.375	2.625			8.000
	1.750	1000		2.000	2.374	0.750								3.500	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	0.500	#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								4.250	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
	3.500	1000		3.500	4.249	1.000								SQ	0.625	3.250			9.500
6.00	1.375	750	6.500	1.625	1.999	0.625	0.750	#12	0.750	2.000	0.438		4.875	3.500	0.250	2.750	5.500	3.250	8.750
	1.750	750		2.000	2.374	0.750								3.875	0.375	3.000			9.250
	2.000	750		2.250	2.624	0.875								4.250	0.375	3.125			9.500
	2.500	750		3.000	3.124	1.000								4.625	0.500	3.375			10.000
	3.000	750		3.500	3.749	1.000								5.250	0.500	3.375			10.000
	3.500	750		3.500	4.249	1.000								5.750	0.500	3.375			10.000
	4.000	750		4.000	4.749	1.000								SQ	0.500	3.375			10.000
8.00	1.375	500	8.500	1.625	1.999	0.625	0.750	#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

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

SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

ME3D: HEAD SQUARE MOUNTING HOLES

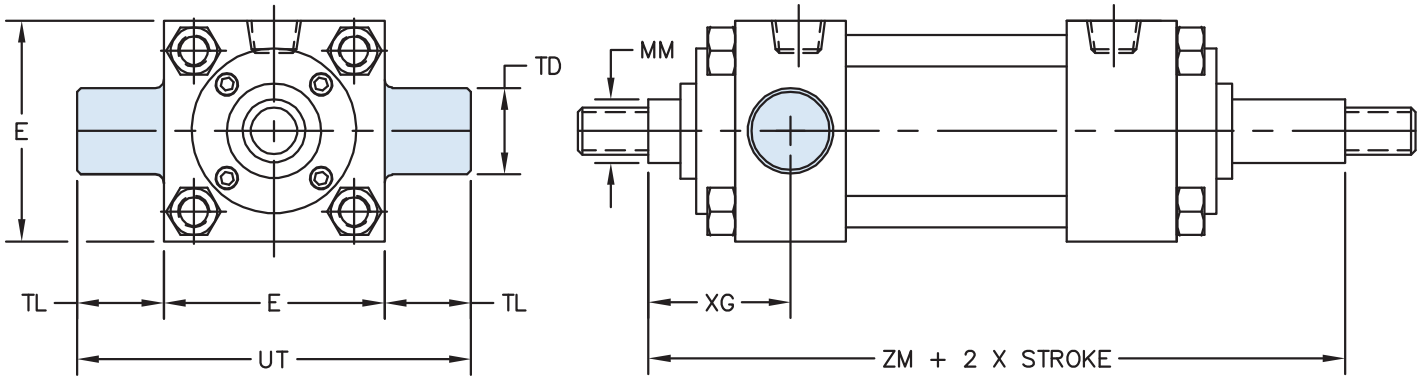


BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	F	FB	G	TE	RD	WF	ADD 2x STROKE ZM
8.00	1.375	500	8.500	0.750	0.688	2.000	7.570	3.500	1.625	8.875
	1.750	500						3.875	1.875	9.375
	2.000	675						4.250	2.000	9.625
	2.500	675						4.625	2.250	10.125
	3.000	675						5.250	2.250	10.125
	3.500	675						5.750	2.250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

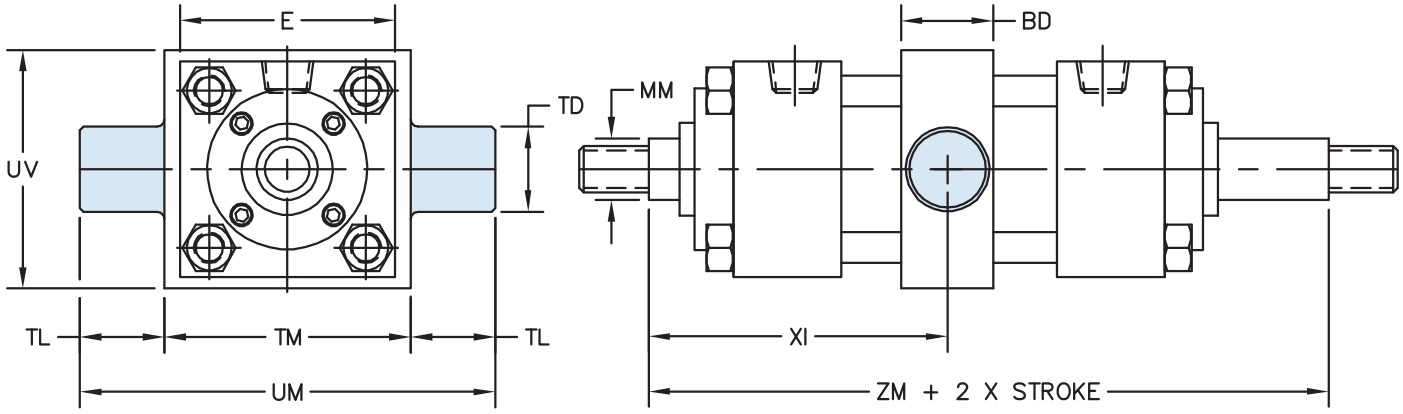
① Max. pressure rating. (NON-SHOCK)

SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

MT1D: HEAD TRUNNION



MT4D: INTERMEDIATE TRUNNION



NOTE:
'XI' DIMENSION TO BE SPECIFIED BY CUSTOMER

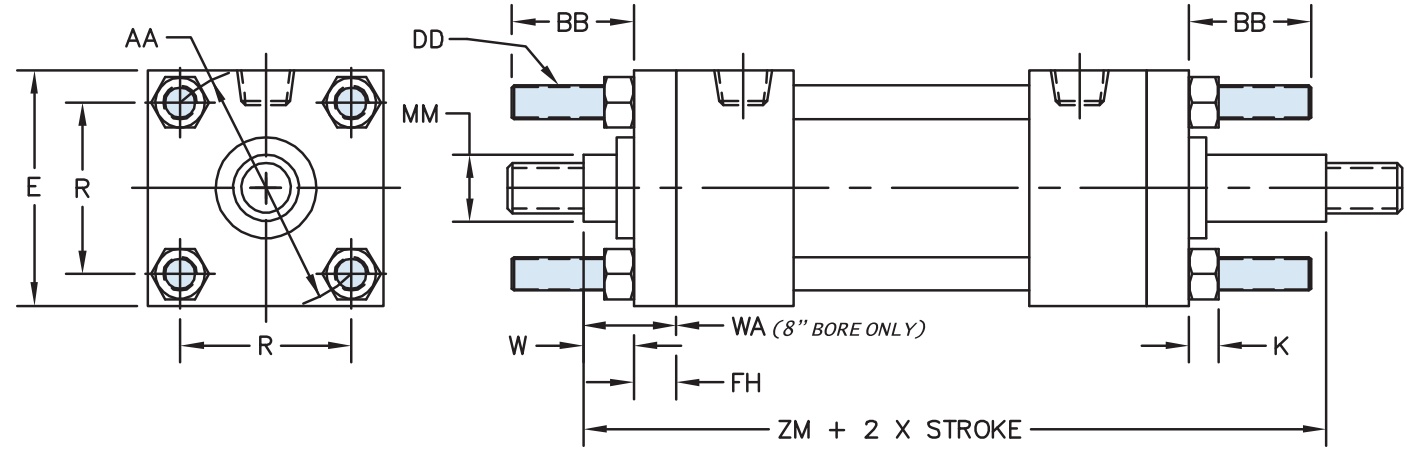
SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

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

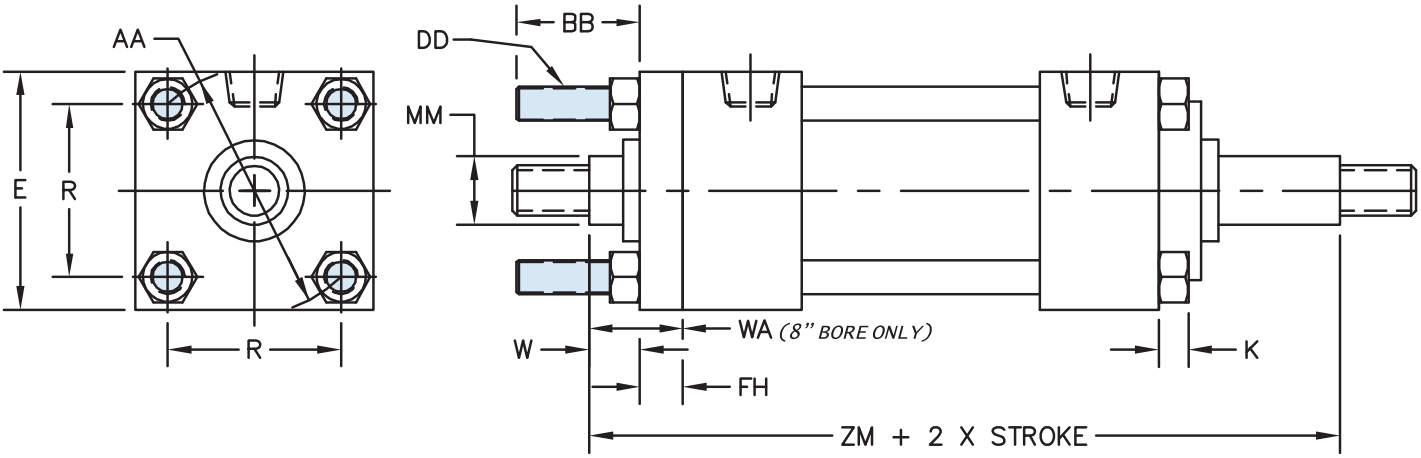
① Max. pressure rating. (NON-SHOCK)
② 'TD' dimension tolerance is + .000 / - .001
③ 'XI' dimension is the minimum that can be supplied and leaves 1/4" gap between head & trunnion block. (customer to specify 'XI' dimension).

SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

MX1D: EXTENDED TIE RODS - HEAD & CAP



MX3D: EXTENDED TIE RODS - HEAD END



SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

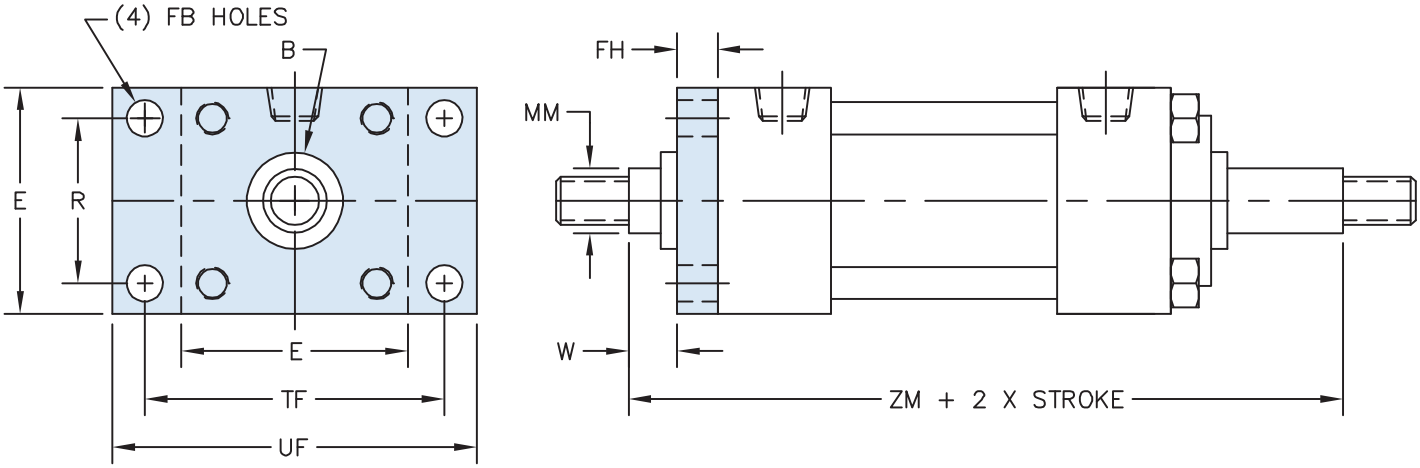
BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	FH	AA	BB	DD	K	R	W or WA (8")	ADD 2x STROKE ZM
1.50	0.625	1500	2.000	0.375	2.020	1.000	0.250 - 28	0.250	1.430	0.625	6.125
	1.000	1500								1.000	6.875
2.00	0.625	1500	2.500	0.375	2.600	1.125	0.313 - 24	0.313	1.840	0.625	6.125
	1.000	1500								1.000	6.875
	1.375	1500								1.250	7.375
2.50	0.625	1000	3.000	0.375	3.100	1.125	0.313 - 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	0.375 - 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	0.375 - 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	0.500 - 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	0.500 - 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	*0.625 ②	9.10	2.313	0.625 - 18	0.563	6.440	1.500	8.875
	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

① Max. pressure rating. (NON-SHOCK)

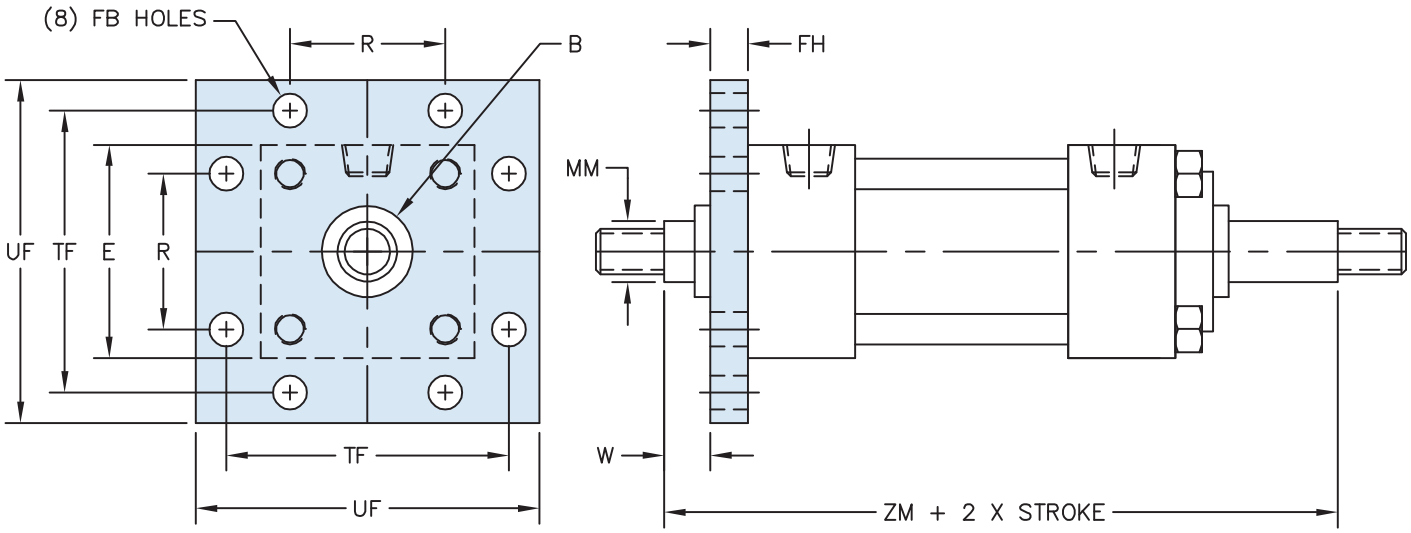
② *Round retainer used to retain bushing, not a full front plate as other bores. 'BB' is dimension from head on the 8" bore.

SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

MF1D: HEAD FLANGE



MF5D: HEAD SQUARE FLANGE



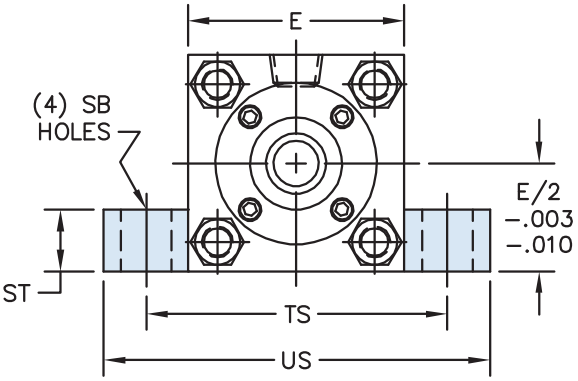
SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

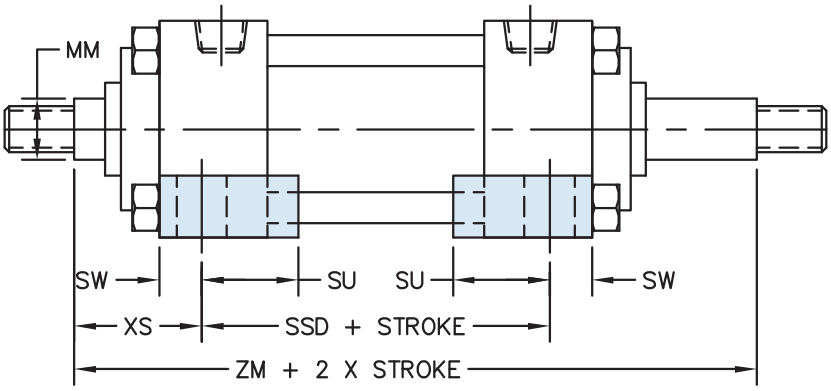
BORE	ROD DIAM (MM)	MAX. PSI RATING ①	② B	E	FB	FH	R	TF	UF	W	ADD 2x STROKE ZM
1.50	0.625	1500	1.124	2.000	0.313	0.375	1.430	2.750	3.375	0.625	6.125
	1.000	1500	1.499							1.000	6.875
2.00	0.625	1500	1.124	2.500	0.375	0.375	1.840	3.375	4.125	0.625	6.125
	1.000	1500	1.499							1.000	6.875
	1.375	1500	1.999							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

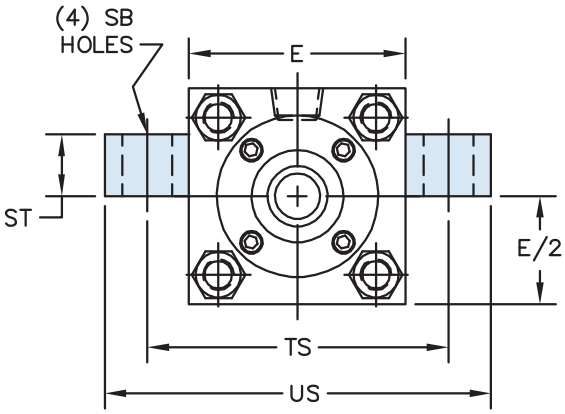
SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

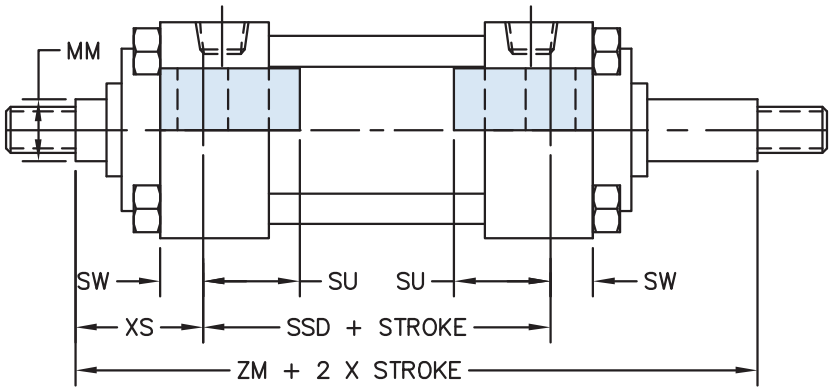
MS2D: SIDE LUGS





MS3D: CENTER LINE LUGS





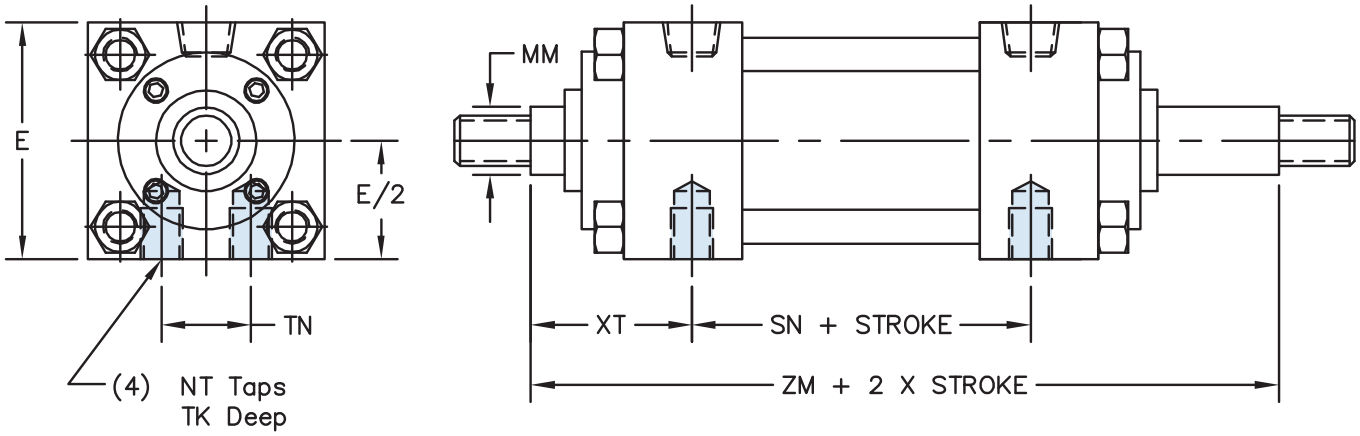
SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING ⟨1⟩	E	SB	ST	SU	SW	TS	US	XS	ADD TO STROKE SSD	ADD 2x STROKE 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

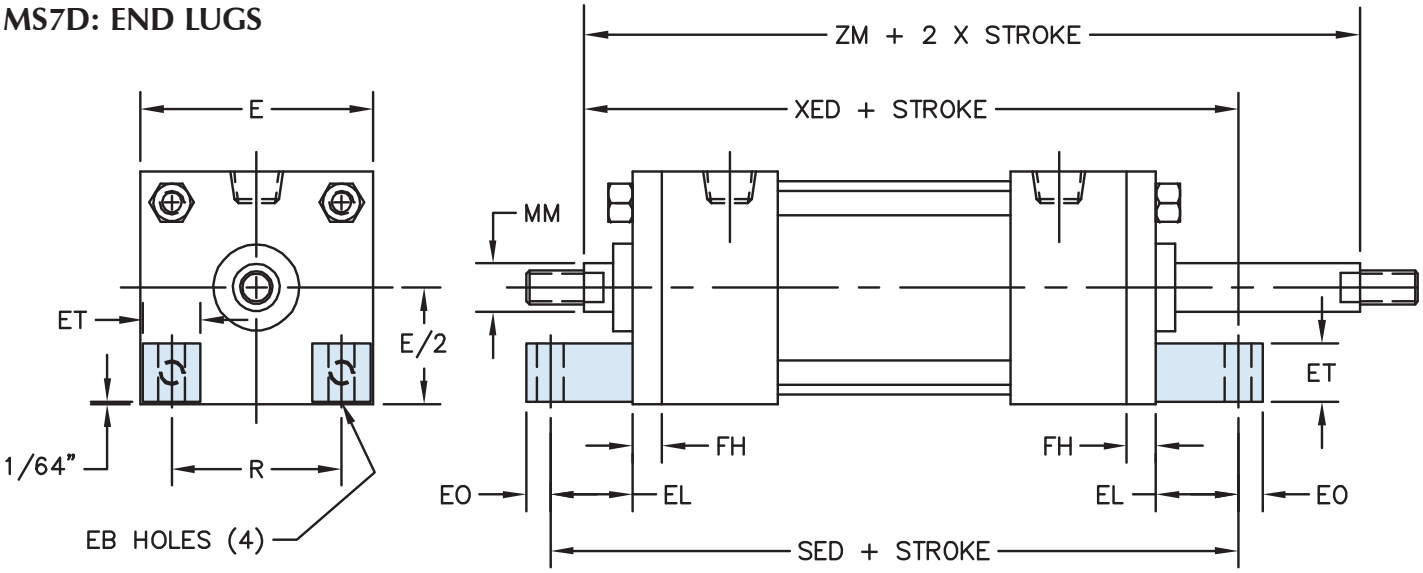
⟨1⟩ Max. pressure rating. (NON-SHOCK)

SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

MS4D: BOTTOM TAPPED HOLES



MS7D: END LUGS



SERIES 'MH' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIAM (MM)	MAX. PSI RATING ①	E	EB	EL	EO	ET	FH	NT	R	TN	TK	XT	ADD TO STROKE			ADD 2x STROKE
														SN	SED	XED	ZM
1.50	0.625	1500	2.000	N/A	N/A	N/A	N/A	0.375	0.250 - 20	1.438	0.625	0.375	1.938	2.250	N/A	N/A	6.125
	1.000	1500											2.313			N/A	6.875
2.00	0.625	1500	2.500	0.344	0.938	0.313	0.375	0.375	0.313 - 18	1.844	0.875	0.406	1.938	2.250	6.750	6.438	6.125
	1.000	1500											2.313			6.813	6.875
	1.375	1500		N/A	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	0.375 - 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	N/A						2.313		N/A	N/A	7.000
	1.375	1500		N/A	N/A	N/A	N/A						2.563		N/A	N/A	7.500
	1.750	1500		N/A	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	0.500 - 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	N/A						2.688		N/A	N/A	8.000
	1.750	1500		N/A	N/A	N/A	N/A						2.938		N/A	N/A	8.500
	2.000	1500		N/A	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	0.500 - 13	3.328	2.063	0.625	2.438	2.625	8.000	7.750	7.500
	1.375	1000											2.688			8.000	8.000
	1.750	1000		N/A	N/A	N/A	N/A						2.938		N/A	N/A	8.500
	2.000	1000		N/A	N/A	N/A	N/A						3.063		N/A	N/A	8.750
	2.500	1000		N/A	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	0.625 - 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		N/A	N/A	N/A	N/A						3.063		N/A	N/A	9.000
	2.500	1000		N/A	N/A	N/A	N/A						3.313		N/A	N/A	9.500
	3.000	1000		N/A	N/A	N/A	N/A						3.313		N/A	N/A	9.500
	3.500	1000		N/A	N/A	N/A	N/A						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	0.750 - 10	4.875	3.250	1.000	2.813	3.125	9.000	8.875	8.750
	1.750	750											3.063			9.125	9.250
	2.000	750											3.188			9.250	9.500
	2.500	750											3.438			9.500	10.000
	3.000	750		N/A	N/A	N/A	N/A						3.438		N/A	N/A	10.000
	3.500	750		N/A	N/A	N/A	N/A						3.438		N/A	N/A	10.000
	4.000	750		N/A	N/A	N/A	N/A						3.438		N/A	N/A	10.000
8.00	1.375	500	8.500	0.688	1.125	0.625	2.000	②	0.750 - 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			9.000	10.125
	3.000	675											3.438			9.000	10.125
	3.500	675											3.438			9.000	10.125
	4.000	675		N/A	N/A	N/A	N/A						3.438		N/A	N/A	10.125
	4.500	675		N/A	N/A	N/A	N/A						3.438		N/A	N/A	10.125
	5.000	675		N/A	N/A	N/A	N/A						3.438		N/A	N/A	10.125
	5.500	675		N/A	N/A	N/A	N/A						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

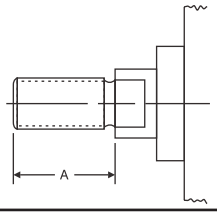
Index To Standard Options:

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 on 'MH' series.

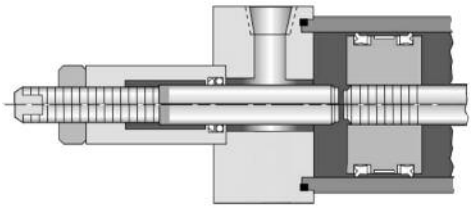


AS Adjustable Stroke (Retract)

Consists of a threaded rod in the cylinder cap, non-removable. Provides an adjustable positive stop on the cylinder retract.

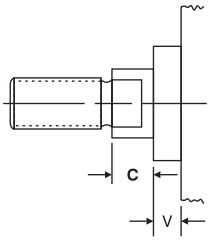
To order, specify "AS" and length of adjustment (Example: AS=3")

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



C= Extended Piston Rod

"C=" is commonly referred to as Piston Rod Extension. Piston rods can be extended to any length up to 120" total piston rod length, including stroke portion. Cylinders with long "C" lengths can be mounted away from obstacles or outside hazardous environments.



TIP

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

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

Extended piston rods do not delay delivery.

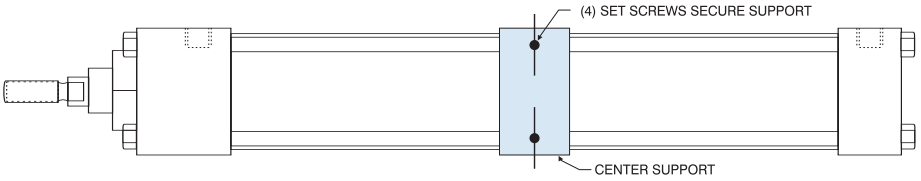
CS Center Supports

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

Center Supports can include MS2 mount.

Contact TRD for more information.

MAXIMUM STROKE RECOMMENDATIONS WITH CENTER SUPPORT (CS OPTION)		
BORE	ONE SUPPORT	TWO SUPPORTS
1.50", 2.00" & 2.50"	OVER 48 INCHES	OVER 72 INCHES
3.25", 4.00" & 5.00"	OVER 65 INCHES	OVER 92 INCHES
6.00" & 8.00"	OVER 72 INCHES	NOT REQUIRED



SERIES 'MH' BASIC OPTIONS

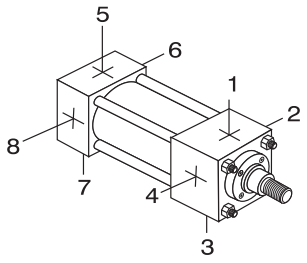
Cushions

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

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

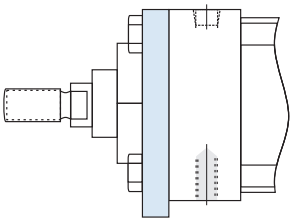


EK Extended Key Plate

Extended Key Plate or "thrust key" is made from a full square bushing retainer plate. The "key" is designed to fit in a milled slot on the equipment to prevent the cylinder from shifting.

An additional mount needs to be specified to secure cylinder.

Available bore sizes: 1.5" to 8" Bore



Refer to page 14 for all dimensions and details

HP "HP" Option

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

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 - .875 - 9UNC - P15 - SSSS

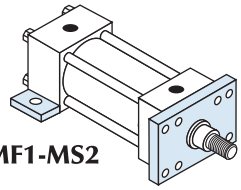
Custom Rod Thread Size

MULTIPLE MOUNTS

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

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

Add additional mount to part number



MF1-MS2

NR Non-Rotating (NFPA) Cylinders

Benefits

- Two internal guide rods throughout stroke.
- High repeatability at each end of stroke (+/- 1 degree).
- External dimensions are the same as standard cylinder (no additional length or width required). Guide Rod tapped into head; hex nuts on cap to tighten Guide Rods.
- Standard Diameter Guide Rod Seals & Bronze Bearings for long life and reliable operation.

AVAILABLE BORE SIZES WITH 'NR' GUIDE ROD SIZES		
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)

* Cushions restricted by some mounts on ALL bore & rod sizes.

SERIES 'MH' BASIC OPTIONS

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.

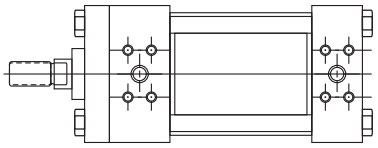
BSPT British Standard Pipe Taper

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)

SAE FLANGE PORT



Contact TRD for more information.

RBB Bronze Rod Bushings

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

SSR 17-4 Stainless Steel Hard Chrome Plated Piston Rod

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

Cylinders can be furnished with Hard Chrome plated Stainless Steel Piston Rods.

Due to lower yield strength, stainless steel piston rods should be sized for proper column strength.

SEALS

The MH Series allows for the use of different types of seal design and material compounds in every area, for maximum flexibility and performance.

How to Order Seals

S S S S

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

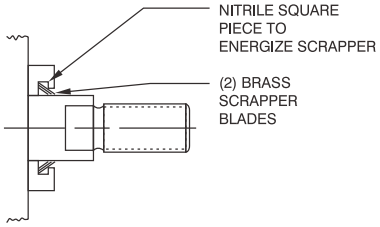
C Cast Iron Piston Rings

Temperature Rating: -20°F to 200°F (-29°C to 93°C)

Compatible with: Virtually all fluids

MS Metallic Rod Scraper

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



S Standard Seals

Piston: Carboxilated Nitrile
Tube Seals: Buna
Rod Seal: Polyurethane
Rod Wiper: Flocked Nitrile

Temperature Rating: -20°F to 200°F (-29°C to 93°C)

Compatible with: Mineral based hydraulic fluids

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.

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.

ST Stop Tube and Rod Size Selection

Stop Tubes are designed to reduce the piston rod bushing stress to within the designed range of the bearing material. This will insure proper cylinder performance, in any given application. Stop Tubes lower the cylinder bearing stress by adding length to the piston, which increases the overall length of the cylinder. (Note: 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 have direct impact on the amount of stop tube required. (See Chart 1)

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

To order a Stop Tube:

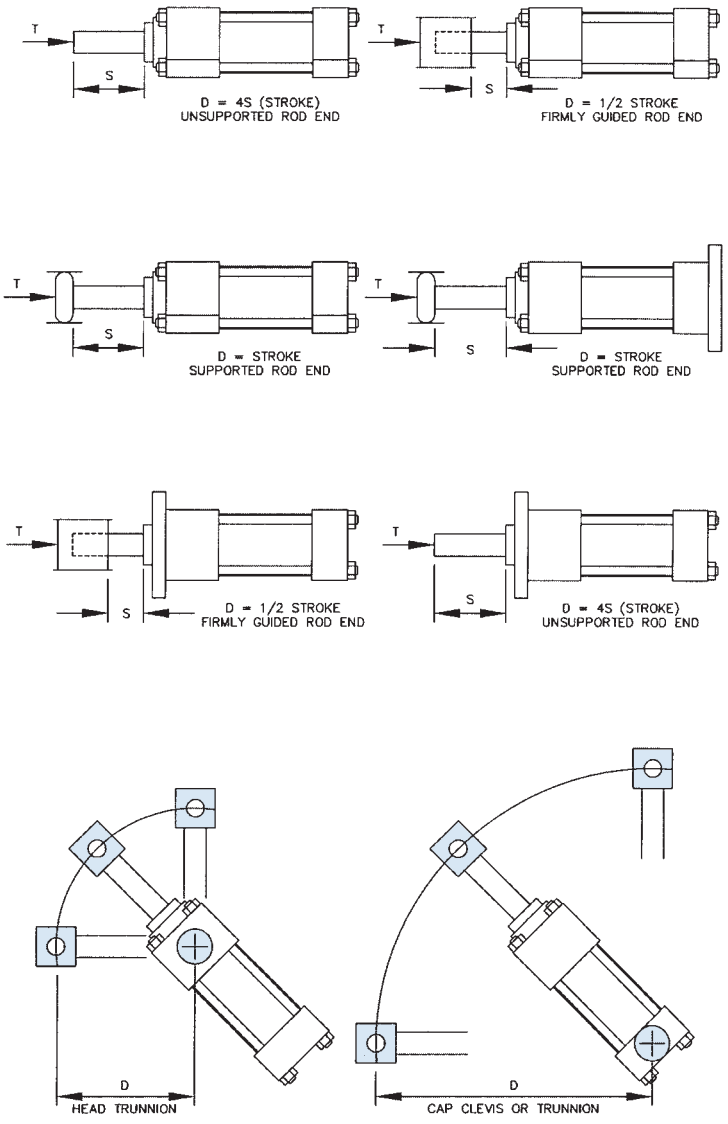
- **Add the stop tube prefix "ST=" and the stop tube length to the cylinder model number.**
- **Add "ES" after the cylinder stroke to indicate that the stroke is the "effective stroke".**

Example:
MH-MS2-2.50 X 42ES-100-KK2-P15=N375-SSSS-ST=2

Chart 1

Find the value of "D" for your application

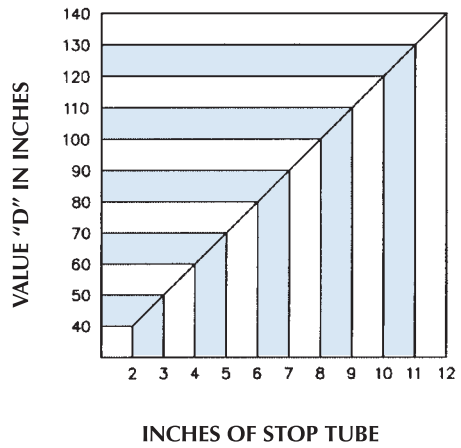
"D" = Stroke, adjusted for mounting condition
"S" = Actual cylinder stroke
"T" = Axial thrust (refer to Chart 3)



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 38 for Rod Size Selection Chart

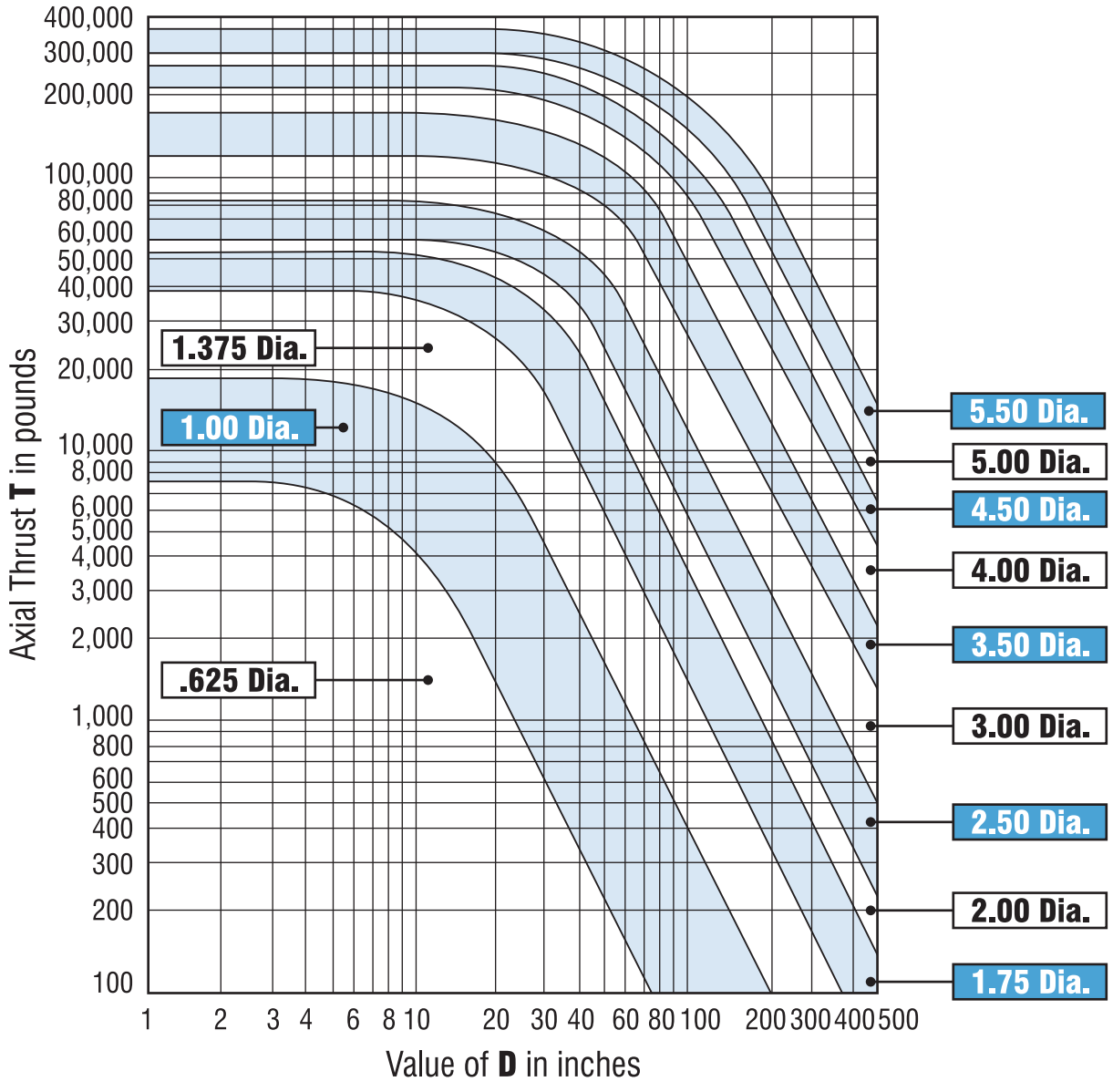
SERIES 'MH' BASIC OPTIONS

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 77 for cylinder force chart.*
2. From page 37, 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)

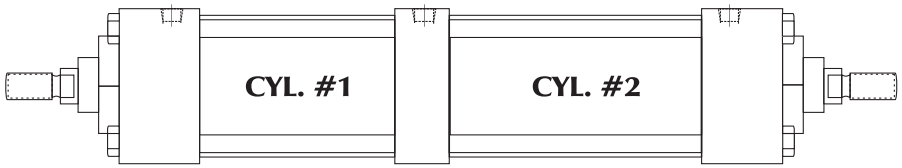


SERIES 'MH' UNCOMMON OPTIONS

BTB Back-To-Back Cylinders

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

Contact 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 3 rod positions.

3-POSITION BENEFITS:

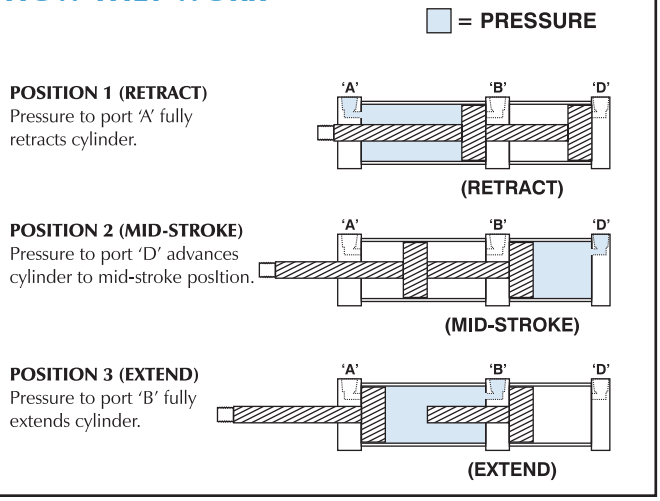
- **3-POSITIONS IN ONE CYLINDER —** One cylinder produces three different rod end positions. By varying stroke lengths, a multitude of positions can be created.
- **SIMPLIFIES MACHINE DESIGNS —** Eliminates the need for an additional cylinder to create a third position. 3-Position cylinders reduce space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

Note: Piston rods are not connected.

Contact TRD for more information.

3-POSITION CYLINDERS

HOW THEY WORK

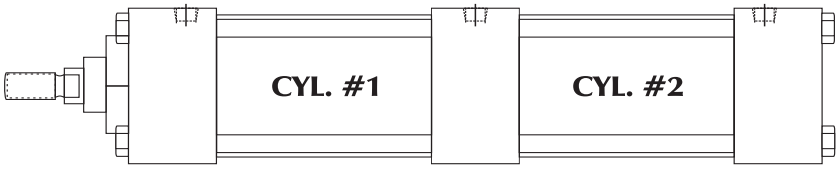


TM Tandem Cylinders

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

Note: Piston rods are connected.

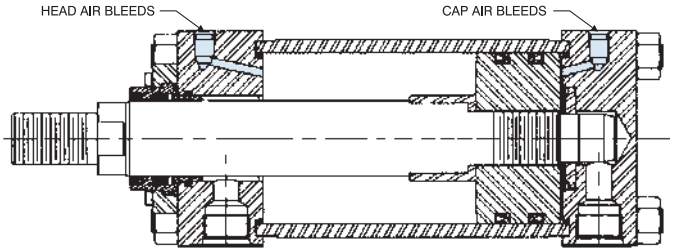
Contact TRD for more information.



HEAD & CAP AIR BLEEDS

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

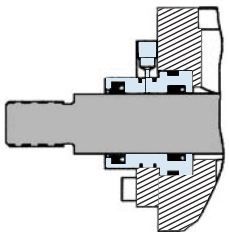
Contact TRD for more information.



ROD DRAIN

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

Contact TRD for more information.

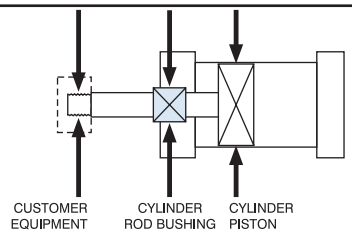


SERIES 'TAS' (NFPA) CYLINDER

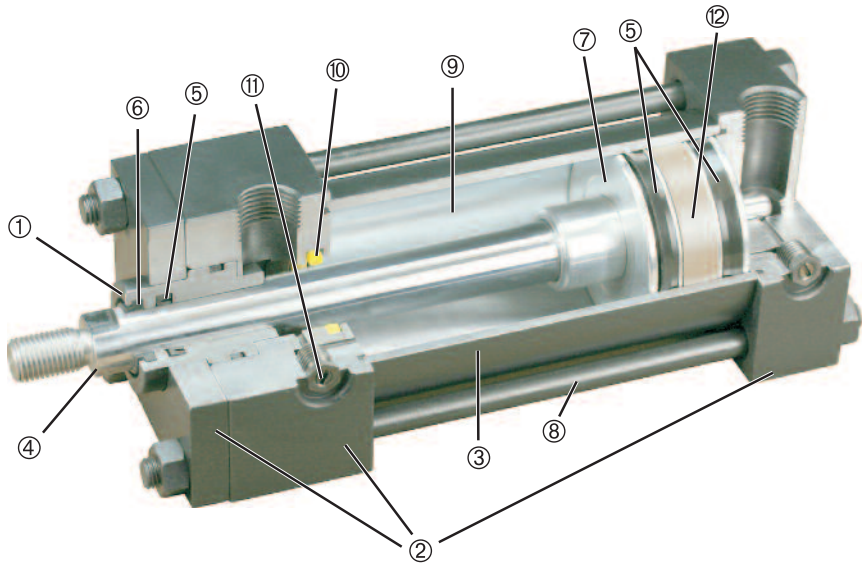
Floating Rod Bushing

SELF ALIGNMENT FEATURE

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



- ***Reduces cylinder drag and erractic 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*** – Prestressed high carbon steel tie rod construction eliminates axial loading of cylinder tube and maintains compression on tube and end seals.

⑨ ***PERMANENT LUBRICATION*** – Permanently lubricated with Magna-Lube G PTFE based grease on all internal components. This is a non-migratory type high performance grease providing outstanding service life. No additional lubrication is required.

⑩ ***CUSHIONS*** – (Options H & C) Floating cushion seal designed for maximum cushion performance, quick return stroke break-away and extended life.

⑪ ***CUSHION ADJUSTMENT NEEDLE*** – Adjustable steel needle design has fine thread metering and is positively captured to prevent needle ejection during adjustment.

⑫ ***WEAR BAND*** – 90% Virgin PTFE and 10% Polyphenylene Sulfide material provides extended life due to extremely low wear factor.

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 58 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	
TAS	250 PSI AIR

NFPA MOUNTS	
MF1	FRONT FLANGE (1.50"-6" Bore)
MF2	REAR FLANGE (1.50"-6" Bore)
ME3	FRONT MOUNTING HOLES (8" Bore)
ME4	REAR MOUNTING HOLES (8" Bore)
MP1	REAR PIVOT CLEVIS (1.50"-8" Bore)
MP2	REAR PIVOT CLEVIS (1.50"-6" Bore)
MP4	REAR PIVOT EYE (1.50"-6" Bore)
MS1	FRONT & REAR END ANGLE (1.50"-8" Bore)
MS2	SIDE LUG (1.50"-8" Bore)
MS4	BOTTOM TAPPED HOLES (1.50"-8" Bore)
MT1	FRONT TRUNNION (1.50"-8" Bore)
MT2	REAR TRUNNION (1.50"-8" Bore)
MT4	INTERMEDIATE TRUNNION (1.50"-8" Bore)
MX0	NO MOUNT (1.50"-8" Bore)
MX1	EXTENDED TIE RODS - HEAD & CAP (1.50"-8" Bore)
MX2	EXTENDED TIE RODS (CAP) (1.50"-8" Bore)
MX3	EXTENDED TIE RODS (HEAD) (1.50"-8" Bore)
SB	SPHERICAL BEARING CAP PIVOT (1.50"-8" Bore)

BORE	
1.50	2
2.50	3.25
4	5
6	8

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

STROKE
0" to 120" Made to Order

CUSHIONS	
H	HEAD CUSHION POSITION 2 IS *STANDARD SPECIFY* FOR POSITIONS: 1, 3 & 4
LH	**LONG** HEAD CUSHION POSITION 2 IS *STANDARD SPECIFY* FOR POSITIONS: 1, 3 & 4
C	CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8
LC	**LONG** CAP CUSHION POSITION 6 IS STANDARD SPECIFY FOR POSITIONS: 5, 7 & 8
FIXED CUSHIONS	
FCH	FIXED HEAD CUSHION (NON-ADJUSTABLE, NO ADJUSTMENT NEEDLE)
FCC	FIXED CAP CUSHION (NON-ADJUSTABLE, NO ADJUSTMENT NEEDLE)
FC	FIXED HEAD AND CAP CUSHION (NON-ADJUSTABLE, NO ADJUSTMENT NEEDLE)

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

Example: FCLH

OPTIONS		
ADDS LENGTH TO CYLINDER - SEE "OPTION LENGTH ADDER" CHART BELOW.		
	A =	EXTENDED PISTON ROD THREAD (Example: A = 2")
	AS	ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, Example: AS = 4")
	A / O	AIR / OIL PISTON
X	B	.25" URETHANE BUMPER BOTH ENDS
X	BC	.25" URETHANE BUMPER CAP ONLY
X	BH	.25" URETHANE BUMPER HEAD ONLY
	BP	BUMPER PISTON SEALS (1.50" - 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	STUDDED 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 54 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 55 for specifications)*
	OP	OPTIONAL PORT LOCATION (Example: Ports @ 3 & 7)
	OS	OVERSIZE ROD DIAMETER (SPECIFY SIZE, Example: OS = 1.38")
	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 (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) (Example: TAS MS4 2 X 24" EFFECTIVE STROKE-ST=3)
	TH	**400 PSI HYDRAULIC NON-SHOCK** *(Refer to page 57 for specifications)*
	VS	FLUOROCARBON SEALS
	XX	SPECIAL VARIATION (SPECIFY)

About our Part Number System

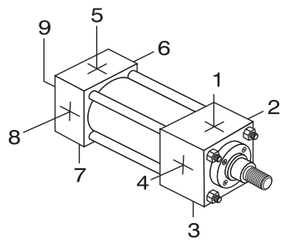
- Simple, easy to understand
- No excessive codes!
- Eliminates mistakes when ordering

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

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

STANDARD PORT AND CUSHION ADJUSTMENT POSITIONS

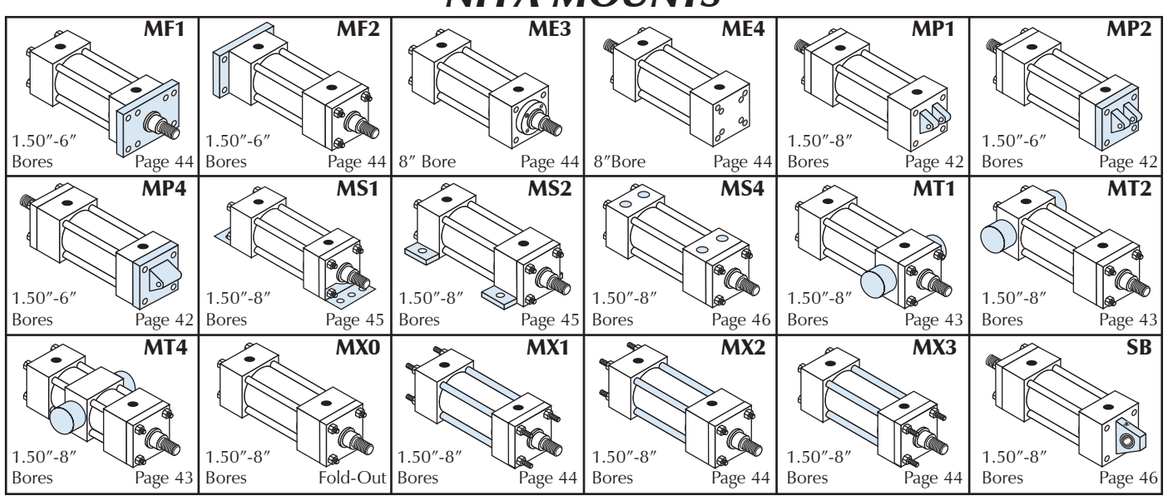
- Ports - Positions 1 and 5
- Cushion Adjustment - Positions 2 and 6
- Specify Non-Standard Positions When Ordering
- Port Location 9 is center of cap face.



OPTION LENGTH ADDER (ADD TO CATALOG BASIC OVERALL LENGTH DIMENSIONS)				
BORE	OPTION			
	B	BC	BH	ST* (STOP TUBE) Example: ST=2
1.50	.50	.25	.25	2
2	.50	.25	.25	2
2.50	.50	.25	.25	2
3.25	.50	.25	.25	2
4	.50	.25	.25	2
5	.50	.25	.25	2
6	.50	.25	.25	2
8	.50	.25	.25	2

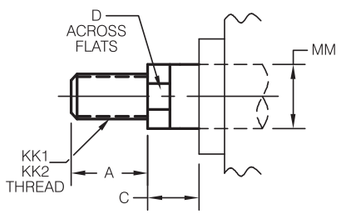
***Note:** The desired Stop Tube length adds directly to the overall cylinder length.

NFPA MOUNTS

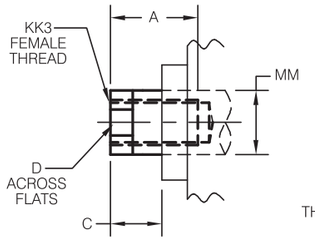


SERIES 'TAS' DIMENSIONS: THREADS

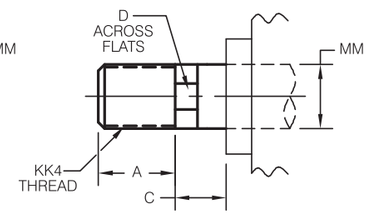
ROD END STYLE: KK1 KK2

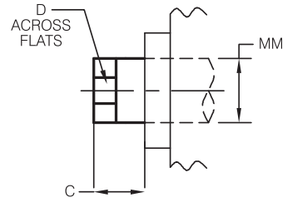


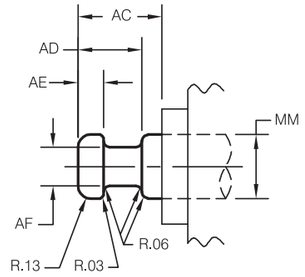
ROD END STYLE: KK3



ROD END STYLE: KK4







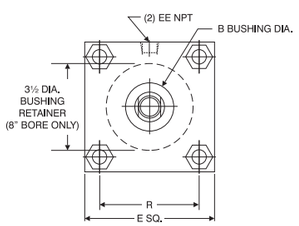
ROD END STYLE: KK5

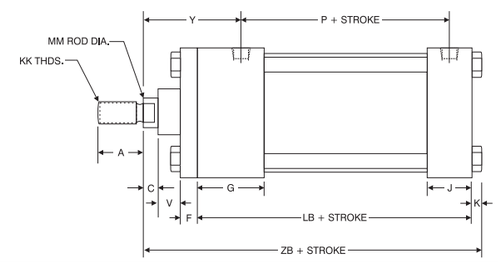
ROD END STYLE: KK10

ROD DIA (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4
0.625	0.75	0.38	0.50	1.13	0.63	0.25	0.38	0.437 - 20	0.500 - 20	0.437 - 20	0.625 - 18
1.000	1.13	0.50	0.88	1.63	0.94	0.38	0.69	0.750 - 16	0.875 - 14	0.750 - 16	1.000 - 14
1.375	1.63	0.63	1.13	1.75	1.06	0.38	0.88	1.000 - 14	1.250 - 12	1.000 - 14	1.375 - 12
1.750	2.00	0.75	1.50	2.00	1.31	0.50	1.13	1.250 - 12	1.500 - 12	1.250 - 12	1.750 - 12

(4) Wrench flats is an option.

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





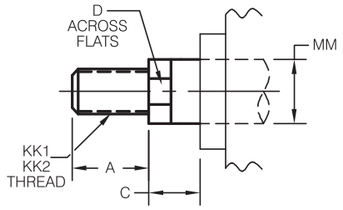
BORE	ROD DIA (MM)	A	B	C	E	EE	F	G	J	K	KK	MM	R	V	Y	ADD TO STROKE LB	ADD TO STROKE P	ADD TO STROKE ZB
1.50	0.625	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	0.437-20	0.625	1.438	0.250	1.875	3.625	2.375	4.875
	1.000	1.125	1.500	0.500							0.750-16	1.000		0.500	2.250			5.250
2.00	0.625	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	0.437-20	0.625	1.844	0.250	1.875	3.625	2.375	4.938
	1.000	1.125	1.500	0.500							0.750-16	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	0.437-20	0.625	2.188	0.250	1.875	3.750	2.500	5.063
	1.000	1.125	1.500	0.500							0.750-16	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	0.750-16	1.000	2.766	0.250	2.375	4.250	2.750	6.000
	1.375	1.625	2.000	0.625							1.000-14	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	0.750-16	1.000	3.328	0.250	2.375	4.250	2.750	6.000
	1.375	1.625	2.000	0.625							1.000-14	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	0.750-16	1.000	4.109	0.250	2.375	4.500	3.000	6.313
	1.375	1.625	2.000	0.625							1.000-14	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	1.000-14	1.375	4.875	0.250	2.750	5.000	3.250	7.063
	1.750	2.000	2.375	0.750							1.250-12	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	1.000-14	1.375	6.438	0.375	2.750	5.125	3.375	7.313
	1.750	2.000	2.375	0.750							1.250-12	1.750		0.500	3.000			7.563

BASE DIMENSION FOLD-OUT

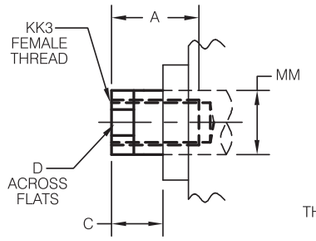
EASY FLIP OUT PAGE FOR REFERENCE

SERIES 'TAS' DIMENSIONS: THREADS

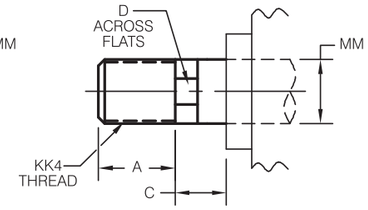
ROD END STYLE: KK1 KK2



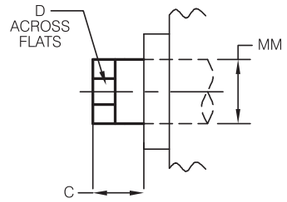
ROD END STYLE: KK3



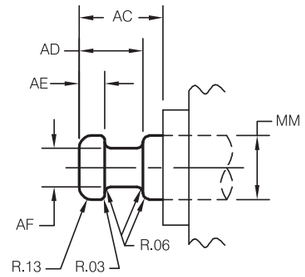
ROD END STYLE: KK4



ROD END STYLE: KK5



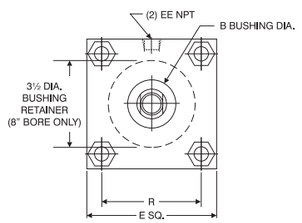
ROD END STYLE: KK10

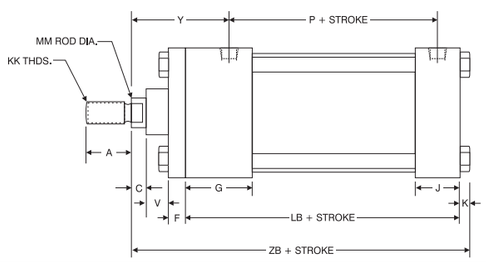


ROD DIA (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4
0.625	0.75	0.38	0.50	1.13	0.63	0.25	0.38	0.437 - 20	0.500 - 20	0.437 - 20	0.625 - 18
1.000	1.13	0.50	0.88	1.63	0.94	0.38	0.69	0.750 - 16	0.875 - 14	0.750 - 16	1.000 - 14
1.375	1.63	0.63	1.13	1.75	1.06	0.38	0.88	1.000 - 14	1.250 - 12	1.000 - 14	1.375 - 12
1.750	2.00	0.75	1.50	2.00	1.31	0.50	1.13	1.250 - 12	1.500 - 12	1.250 - 12	1.750 - 12

(4) Wrench flats is an option.

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

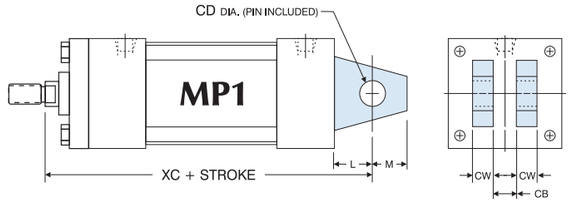




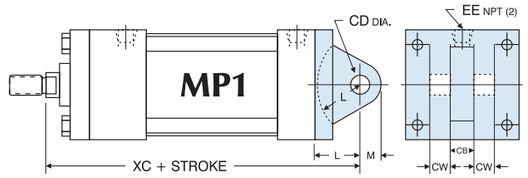
BORE	ROD DIA (MM)	A	B	C	E	EE	F	G	J	K	KK	MM	R	V	Y	ADD TO STROKE LB	P	ZB
1.50	0.625	0.750	1.125	0.375	2.000	0.375	0.375	1.500	1.000	0.250	0.437-20	0.625	1.438	0.250	1.875	3.625	2.375	4.875
	1.000	1.125	1.500	0.500							0.750-16	1.000		0.500	2.250			5.250
2.00	0.625	0.750	1.125	0.375	2.500	0.375	0.375	1.500	1.000	0.313	0.437-20	0.625	1.844	0.250	1.875	3.625	2.375	4.938
	1.000	1.125	1.500	0.500							0.750-16	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	0.437-20	0.625	2.188	0.250	1.875	3.750	2.500	5.063
	1.000	1.125	1.500	0.500							0.750-16	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	0.750-16	1.000	2.766	0.250	2.375	4.250	2.750	6.000
	1.375	1.625	2.000	0.625							1.000-14	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	0.750-16	1.000	3.328	0.250	2.375	4.250	2.750	6.000
	1.375	1.625	2.000	0.625							1.000-14	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	0.750-16	1.000	4.109	0.250	2.375	4.500	3.000	6.313
	1.375	1.625	2.000	0.625							1.000-14	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	1.000-14	1.375	4.875	0.250	2.750	5.000	3.250	7.063
	1.750	2.000	2.375	0.750							1.250-12	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	1.000-14	1.375	6.438	0.375	2.750	5.125	3.375	7.313
	1.750	2.000	2.375	0.750							1.250-12	1.750		0.500	3.000			7.563

BASE DIMENSION FOLD-OUT

SERIES 'TAS' DIMENSIONS: PIVOT MOUNTS

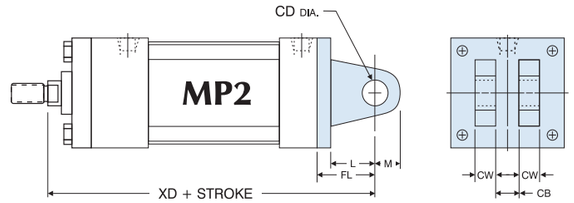


WELDED MP1 MOUNT



IRON CASTING MP1 MOUNT

*(OPTIONAL)***



MP2 MOUNT

(IRON CASTING)

MP4 MOUNT

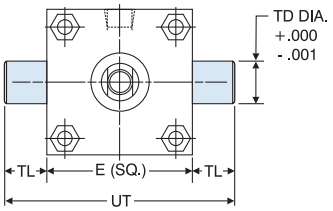
(IRON CASTING: 1.50" - 4" BORES, WELDMENT: 5" - 6" BORES)*

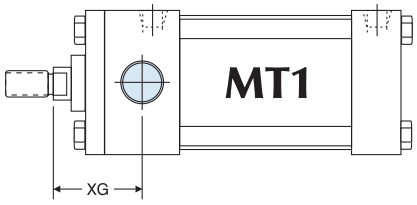
'MP1', 'MP2' CLEVIS AND 'MP4' EYE MOUNT DIMENSIONS										ACCESSORIES *(SEE PAGES 62-63 FOR DIMENSIONS)*				
BORE	ROD DIA (MM)	CB	CD	CW	FL	L	M	XC	XD	ROD CLEVIS	ROD EYE	CLEVIS PIN	EYE BRACKET *(FOR MP1)*	CLEVIS BRKT *(FOR MP4)*
1.50	0.625	0.750	0.500	0.500	1.125	0.750	0.625	5.375	5.750	RC437	RE437	CP500	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		RC1250	RE1250	CP1375		

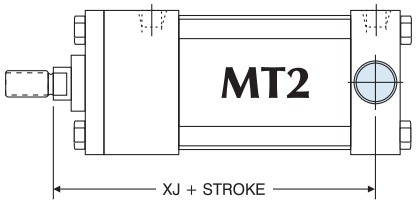
Clevis pins are provided with pivot mounts.
*MP4 5"-6" bores are 3-5 day delivery.
For dimensions not shown, see base dimension fold-out.

**Cast Iron removable mounts are optional, and must be requested when ordering (1.50"-6" bores).
Specify "CAST MP1" when ordering.

SERIES 'TAS' DIMENSIONS: PIVOT MOUNTS





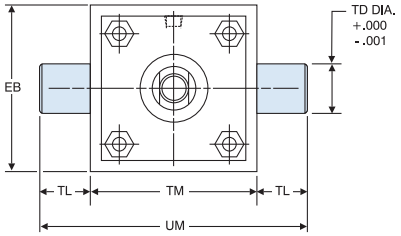


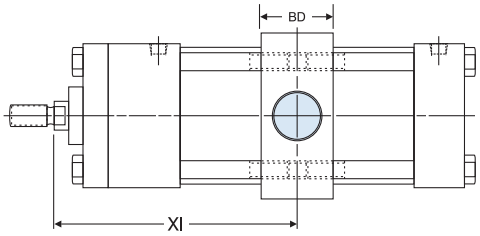
MT1 / MT2

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

'MT1' HEAD TRUNNION AND 'MT2' CAP TRUNNION MOUNT DIMENSIONS								ACCESSORIES *(SEE PAGES 00-00 FOR DIMENSIONS)*		
BORE	ROD DIA (MM)	E	TD	TL	UT	XG	ADD STROKE XJ	ROD CLEVIS	ROD EYE	CLEVIS PIN
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	CP750
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	CP750
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	CP750
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	CP1000
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	CP1000
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	CP1000
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	CP1375
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	CP1375

*No oversize rod available on 1.50" bore MT1.
For dimensions not shown, see base dimension fold-out.





(Customer to Specify)

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

MT4

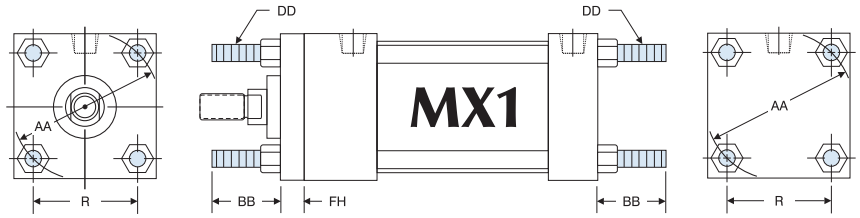
Note: MT4 Trunnions and Intermediate Section are one-piece solid steel construction.

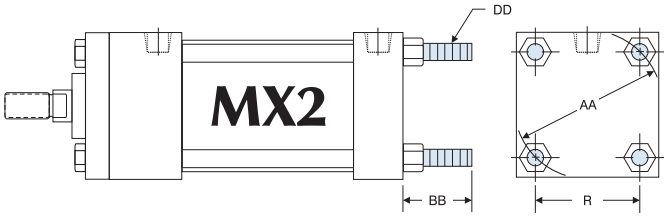
'MT4' INTERMEDIATE TRUNNION MOUNT DIMENSIONS							
BORE	BD	EB	TD	TL	TM	UM	XI
1.50	1.250	2.500	1.000	1.000	2.500	4.500	CUSTOMER TO SPECIFY
2.00	1.500	3.000	1.000	1.000	3.000	5.000	
2.50	1.500	3.500	1.000	1.000	3.500	5.500	
3.25	2.000	4.250	1.000	1.000	4.500	6.500	
4.00	2.000	5.000	1.000	1.000	5.250	7.250	
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	

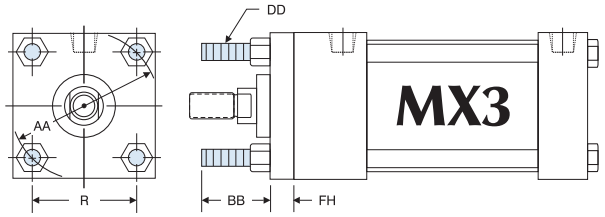
'MT1', 'MT2', 'MT4' STANDARD CUSHION LOCATIONS		
MOUNT	HEAD CUSHION	CAP CUSHION
MT1	3	6
MT2	2	7
MT4	2	6

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

SERIES 'TAS' DIMENSIONS: TIE ROD & FLANGE MOUNTS



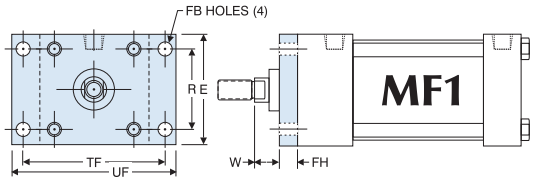




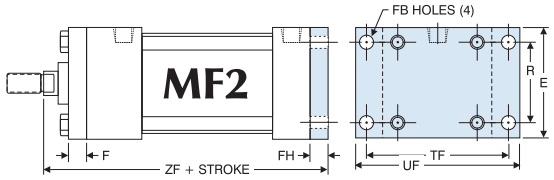
TIE ROD EXTENDED 'MX1', 'MX2' & 'MX3' MOUNT DIMENSIONS						
BORE	ROD DIA (MM)	AA	BB	DD	FH	R
1.50	0.625	2.020	1.000	0.250-28	0.375	1.438
	1.000					
2.00	0.625	2.600	1.125	0.313-24	0.375	1.844
	1.000					
2.50	0.625	3.100	1.125	0.313-24	0.375	2.188
	1.000					
3.25	1.000	3.900	1.375	0.375-24	0.625	2.766
	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	0.375-24	0.625	3.328
	1.375					
5.00	1.000	5.800	1.813	0.500-20	0.625	4.109
	1.375					
6.00	1.375	6.900	1.813	0.500-20	0.750	4.875
	1.750					
8.00	1.375	9.100	**2.313	0.625-18	*0.625	6.438
	1.750					

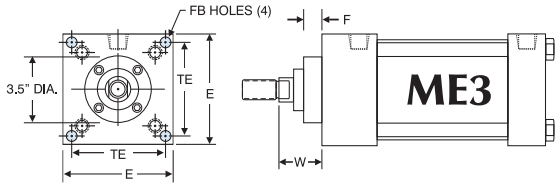
*8" bore utilizes a 3.50" diameter round retainer.
**BB dimension from face of head.
For dimensions not shown, see base dimension fold-out.



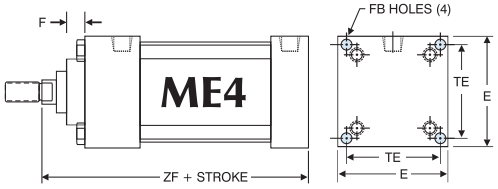
1.50" - 6" BORES



1.50" - 6" BORES



8" BORE



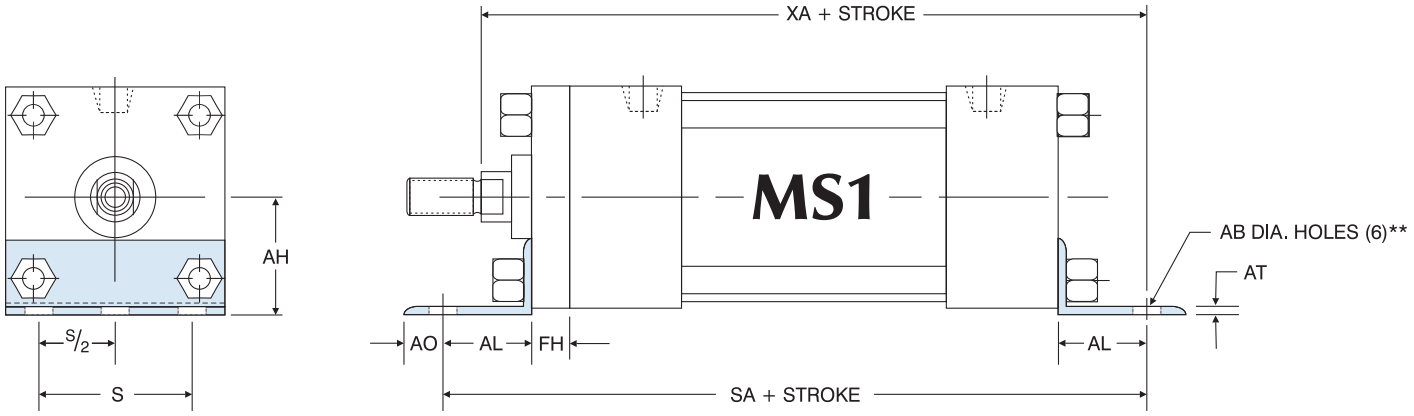
8" BORE

'MF1', 'MF2' FLANGE & 'ME3', 'ME4' CAP MOUNT DIMENSIONS											
											ADD TO STROKE
BORE	ROD DIA (MM)	E	F	FB	FH	R	TE	TF	UF	W	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									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									1.00	5.375
2.50	0.625	3.000	0.375	0.375	0.375	2.188	—	3.875	4.625	0.625	5.125
	1.000									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									1.000	6.500

'MF1', 'MF2' FLANGE & 'ME3', 'ME4' CAP MOUNT DIMENSIONS											
											ADD TO STROKE
BORE	ROD DIA (MM)	E	F	FB	FH	R	TE	TF	UF	W	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									1.000	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									1.000	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									1.125	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									1.875	7.000

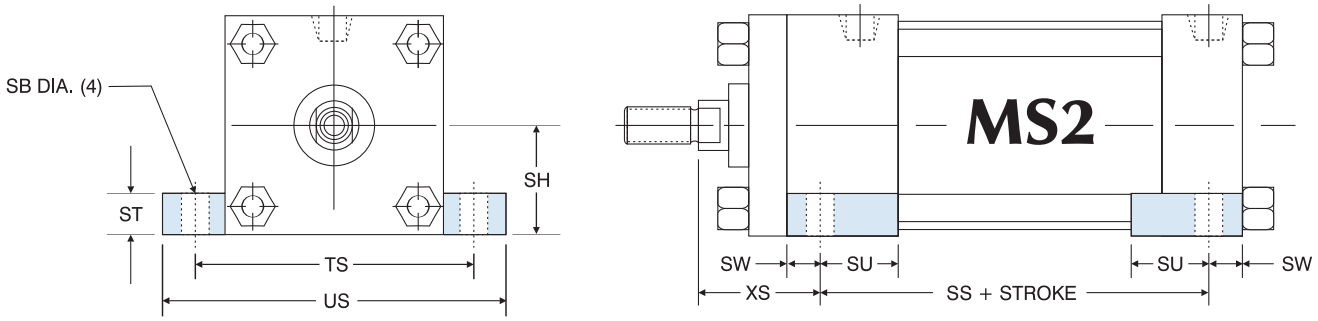
For dimensions not shown, see base dimension fold-out.

SERIES 'TAS' DIMENSIONS: BASE MOUNTS



'MS1' ANGLE MOUNT DIMENSIONS										
BORE	ROD DIA (MM)	AB	AH	AL	AO	AT	FH	S	ADD TO STROKE SA	ADD TO STROKE 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

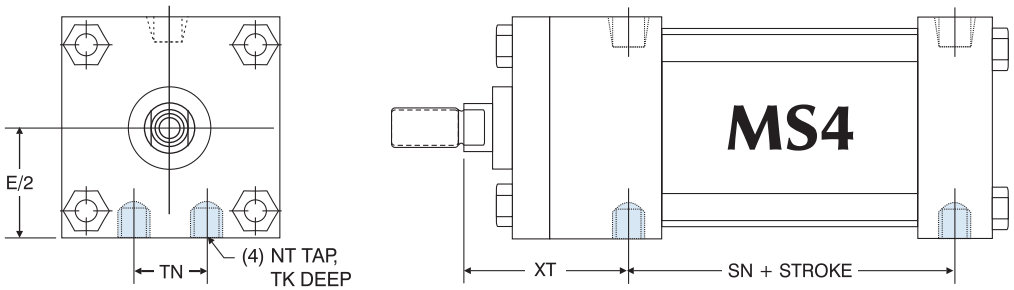
**1.50" bore has (4) AB diameter holes.
*8" bore utilizes a round retainer.



'MS2' SIDE LUG MOUNT DIMENSIONS										
BORE	ROD DIA (MM)	SB	SH	ST	SU	SW	TS	US	XS	ADD TO STROKE 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" bore utilizes a round retainer.
For dimensions not shown, see base dimension fold-out.

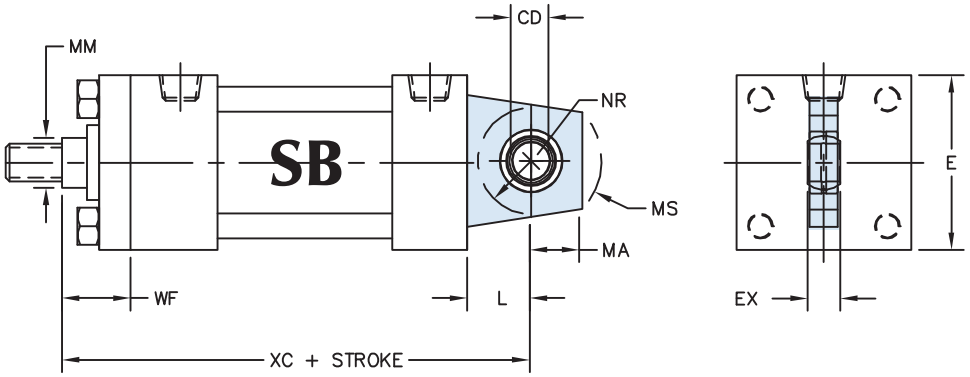
SERIES 'TAS' DIMENSIONS: BASE MOUNTS



'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	0.250-20	0.375	0.625	1.938	2.250
	1.000					2.313	
2.00	0.625	1.250	0.313-18	0.500	0.875	1.938	2.250
	1.000					2.313	
2.50	0.625	1.500	0.375-16	0.625	1.250	1.938	2.375
	1.000					2.313	
3.25	1.000	1.875	0.500-13	0.750	1.500	2.438	2.625
	1.375					2.688	
4.00	1.000	2.250	0.500-13	0.750	2.063	2.438	2.625
	1.375					2.688	
5.00	1.000	2.750	0.625-11	1.000	2.688	2.438	2.875
	1.375					2.688	
6.00	1.375	3.250	0.750-10	1.125	3.250	2.813	3.125
	1.750					3.063	
8.00	1.375	4.250	0.750-10	1.125	4.500	2.813	3.250
	1.750					3.063	

For dimensions not shown, see base dimension fold-out.

SERIES 'TAS' DIMENSIONS: SPHERICAL BEARING MOUNT



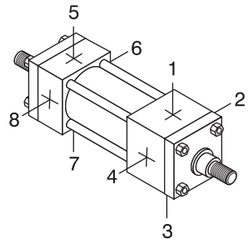
'SB' SPHERICAL BEARING MOUNT DIMENSIONS										
BORE	ROD DIA (MM)	CD	E	EX	L	MA	MS	NR	WF	ADD TO STROKE XC
1.50	0.625	0.500	2.000	0.437	0.750	0.750	0.938	0.625	1.000	5.375
	1.000								1.375	5.750
2.00	0.625	0.500	2.500	0.437	0.750	0.750	0.938	0.625	1.000	5.375
	1.000								1.375	5.750
2.50	0.625	0.500	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

Note: Pivot pin included with cylinder cap end only. 3.25"- 8" bores have tie rod nuts exposed on cap end.
8" bore utilizes round retainer.
*Must specify KK3 rod end if to be used with "MSRE" rod eye.

SERIES 'TAS' DIMENSIONS: DOUBLE ROD END

Benefits

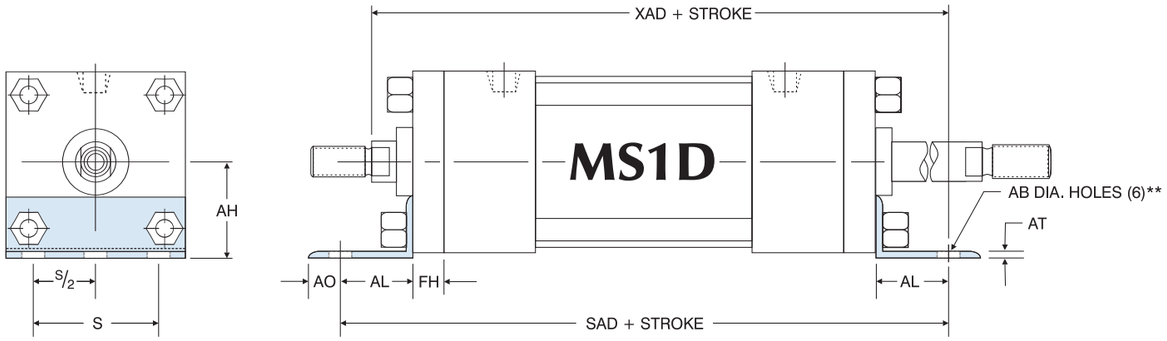
- Standard and Oversize Piston Rods available.
- Full range of Standard Options.
- Durable design. Full Rod Bearing at each end of cylinder.
- Can be provided with Hollow Piston Rods (gun-drilled through, to your size requirements).
- Can be used in adjustable extend stroke applications (by adding a stop collar on one rod end, or option "MA" - *Refer to page 54*).



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

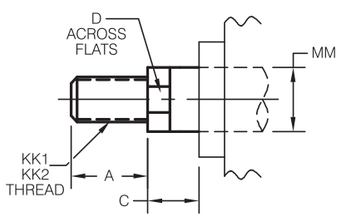


'MS1D' ANGLE MOUNT DIMENSIONS										
BORE	ROD DIA (MM)	AB	AH	AL	AO	AT	FH	S	ADD TO STROKE SAD	ADD TO STROKE XAD
1.50	0.625	0.438	1.188	1.000	0.375	0.188	0.375	1.250	6.875	6.500
	1.000									6.875
2.00	0.625	0.438	1.438	1.000	0.375	0.188	0.375	1.750	6.875	6.500
	1.000									6.875
2.50	0.625	0.438	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

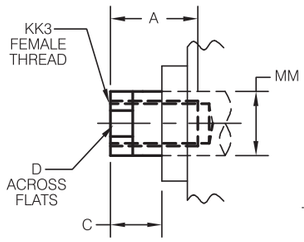
*8" bore utilizes round retainer.
**1.5" bore uses (4) "AB" holes.
For dimensions not shown, see base dimension fold-out.

SERIES 'TAS' DIMENSIONS: THREADS

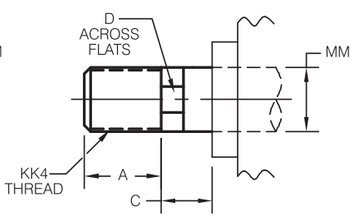
ROD END STYLE: KK1 KK2

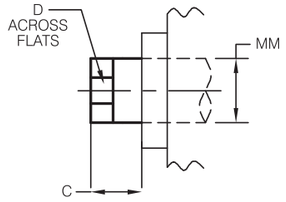


ROD END STYLE: KK3

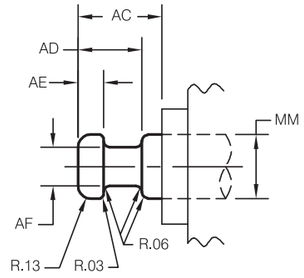


ROD END STYLE: KK4





ROD END STYLE: KK5

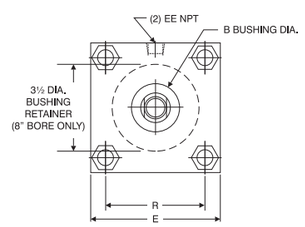


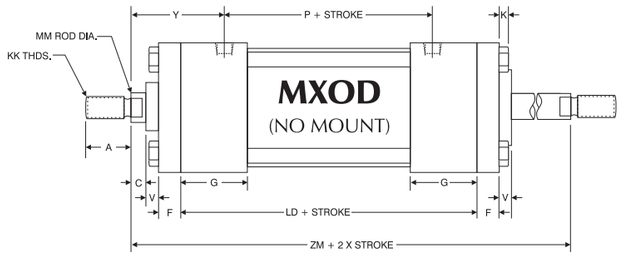
ROD END STYLE: KK10

ROD DIA (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4
0.625	0.75	0.38	0.50	1.13	0.63	0.25	0.38	0.437 - 20	0.500 - 20	0.437 - 20	0.625 - 18
1.000	1.13	0.50	0.88	1.63	0.94	0.38	0.69	0.750 - 16	0.875 - 14	0.750 - 16	1.000 - 14
1.375	1.63	0.63	1.13	1.75	1.06	0.38	0.88	1.000 - 14	1.250 - 12	1.000 - 14	1.375 - 12
1.750	2.00	0.75	1.50	2.00	1.31	0.50	1.13	1.250 - 12	1.500 - 12	1.250 - 12	1.750 - 12

(4) Wrench flats is an option.

DOUBLE ROD END DIMENSIONS: BASIC CYLINDER (NO MOUNT)



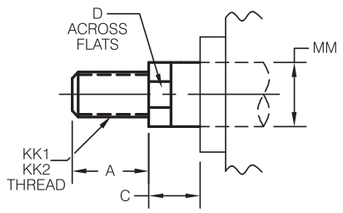


BORE	ROD DIA (MM)	A	B	C	E	EE	F	G	K	KK	MM	R	V	Y	ADD TO STROKE LD	ADD TO STROKE P	ADD 2x STROKE ZM
1.50	0.625	0.750	1.125	0.375	2.000	0.375	0.375	1.500	0.250	0.437-20	0.625	1.438	0.250	1.875	4.125	2.375	6.125
	1.000	1.125	1.500	0.500						0.750-16	1.000		0.500	2.250			6.875
2.00	0.625	0.750	1.125	0.375	2.500	0.375	0.375	1.500	0.313	0.437-20	0.625	1.844	0.250	1.875	4.125	2.375	6.125
	1.000	1.125	1.500	0.500						0.750-16	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	0.437-20	0.625	2.188	0.250	1.875	4.250	2.500	6.250
	1.000	1.125	1.500	0.500						0.750-16	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	0.750-16	1.000	2.766	0.250	2.375	4.750	2.750	7.500
	1.375	1.625	2.000	0.625						1.000-14	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	0.750-16	1.000	3.328	0.250	2.375	4.750	2.750	7.500
	1.375	1.625	2.000	0.625						1.000-14	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	0.750-16	1.000	4.109	0.250	2.375	5.000	3.000	7.750
	1.375	1.625	2.000	0.625						1.000-14	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	1.000-14	1.375	4.875	0.250	2.750	5.500	3.250	8.750
	1.750	2.000	2.375	0.750						1.250-12	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	1.000-14	1.375	6.438	0.375	2.750	5.625	3.375	8.875
	1.750	2.000	2.375	0.750						1.250-12	1.750		0.500	3.000			9.375

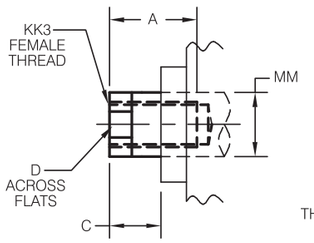
BASE DIMENSION FOLD-OUT

SERIES 'TAS' DIMENSIONS: THREADS

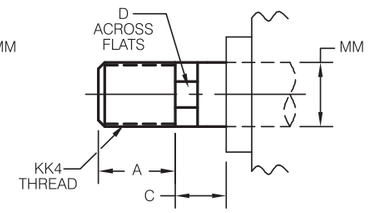
ROD END STYLE: KK1 KK2



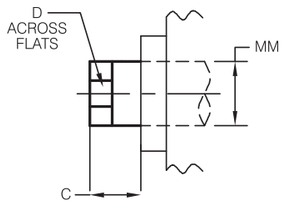
ROD END STYLE: KK3



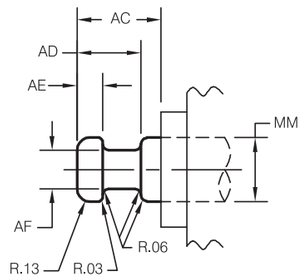
ROD END STYLE: KK4



ROD END STYLE: KK5



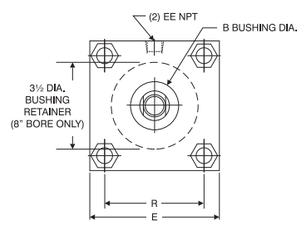
ROD END STYLE: KK10

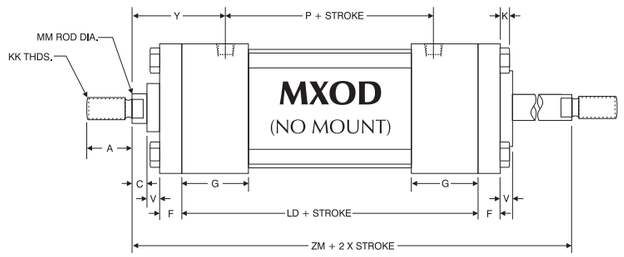


ROD DIA (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4
0.625	0.75	0.38	0.50	1.13	0.63	0.25	0.38	0.437 - 20	0.500 - 20	0.437 - 20	0.625 - 18
1.000	1.13	0.50	0.88	1.63	0.94	0.38	0.69	0.750 - 16	0.875 - 14	0.750 - 16	1.000 - 14
1.375	1.63	0.63	1.13	1.75	1.06	0.38	0.88	1.000 - 14	1.250 - 12	1.000 - 14	1.375 - 12
1.750	2.00	0.75	1.50	2.00	1.31	0.50	1.13	1.250 - 12	1.500 - 12	1.250 - 12	1.750 - 12

(4) Wrench flats is an option.

DOUBLE ROD END DIMENSIONS: BASIC CYLINDER (NO MOUNT)

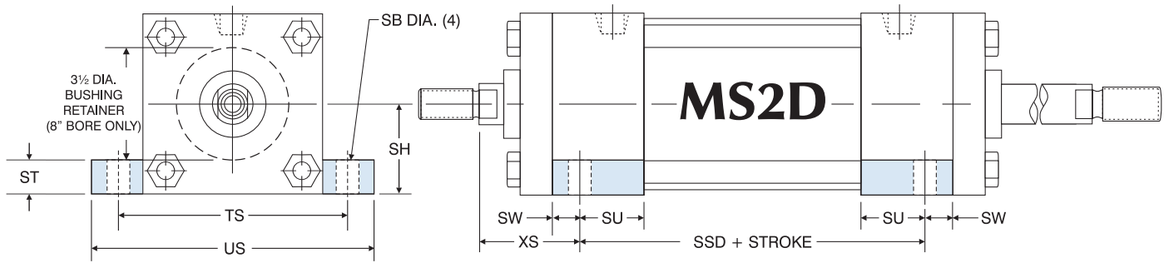




BORE	ROD DIA (MM)	A	B	C	E	EE	F	G	K	KK	MM	R	V	Y	ADD TO STROKE LD	ADD TO STROKE P	ADD 2x STROKE ZM
1.50	0.625	0.750	1.125	0.375	2.000	0.375	0.375	1.500	0.250	0.437-20	0.625	1.438	0.250	1.875	4.125	2.375	6.125
	1.000	1.125	1.500	0.500						0.750-16	1.000		0.500	2.250			6.875
2.00	0.625	0.750	1.125	0.375	2.500	0.375	0.375	1.500	0.313	0.437-20	0.625	1.844	0.250	1.875	4.125	2.375	6.125
	1.000	1.125	1.500	0.500						0.750-16	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	0.437-20	0.625	2.188	0.250	1.875	4.250	2.500	6.250
	1.000	1.125	1.500	0.500						0.750-16	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	0.750-16	1.000	2.766	0.250	2.375	4.750	2.750	7.500
	1.375	1.625	2.000	0.625						1.000-14	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	0.750-16	1.000	3.328	0.250	2.375	4.750	2.750	7.500
	1.375	1.625	2.000	0.625						1.000-14	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	0.750-16	1.000	4.109	0.250	2.375	5.000	3.000	7.750
	1.375	1.625	2.000	0.625						1.000-14	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	1.000-14	1.375	4.875	0.250	2.750	5.500	3.250	8.750
	1.750	2.000	2.375	0.750						1.250-12	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	1.000-14	1.375	6.438	0.375	2.750	5.625	3.375	8.875
	1.750	2.000	2.375	0.750						1.250-12	1.750		0.500	3.000			9.375

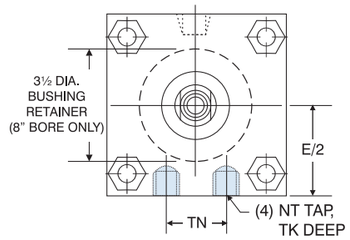
BASE DIMENSION FOLD-OUT

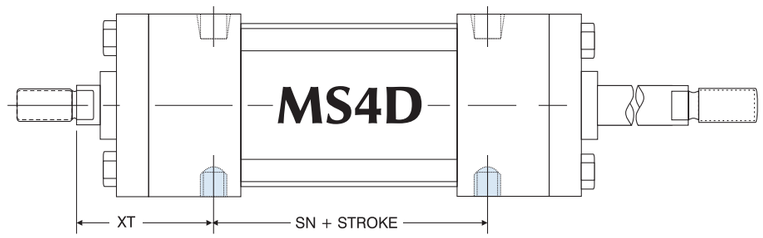
SERIES 'TAS' DIMENSIONS: DOUBLE ROD END BASE MOUNTS



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								1.750	
2.00	0.625	0.438	1.250	0.500	1.125	0.375	3.250	4.000	1.375	3.375
	1.000								1.750	
2.50	0.625	0.438	1.500	0.500	1.125	0.375	3.750	4.500	1.375	3.500
	1.000								1.750	
3.25	1.000	0.563	1.875	0.750	1.250	0.500	4.750	5.750	1.875	3.750
	1.375								2.125	
4.00	1.000	0.563	2.250	0.750	1.250	0.500	5.500	6.500	1.875	3.750
	1.375								2.125	
5.00	1.000	0.813	2.750	1.000	1.063	0.688	6.875	8.250	2.063	3.625
	1.375								2.313	
6.00	1.375	0.813	3.250	1.000	1.313	0.688	7.875	9.250	2.313	4.125
	1.750								2.563	
8.00	1.375	0.813	4.250	1.000	1.563	0.688	9.875	11.250	2.313	4.250
	1.750								2.563	

For dimensions not shown, see base dimension fold-out.

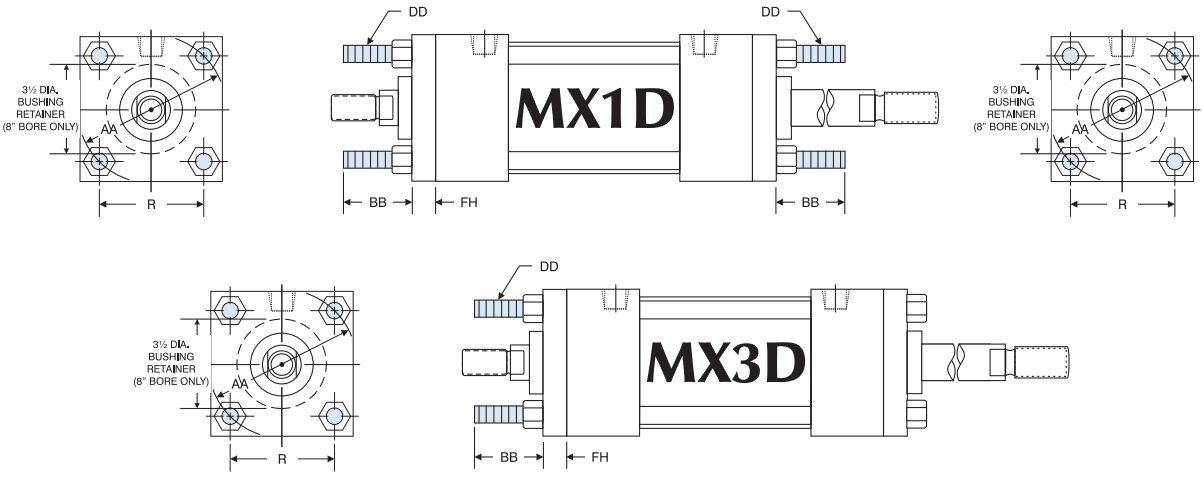




BORE	ROD DIA (MM)	E/2	NT	TK	TN	XT	ADD TO STROKE SN
1.50	0.625	1.000	0.250-20	0.375	0.625	1.938	2.250
	1.000					2.313	
2.00	0.625	1.250	0.313-18	0.500	0.875	1.938	2.250
	1.000					2.313	
2.50	0.625	1.500	0.375-16	0.625	1.250	1.938	2.375
	1.000					2.313	
3.25	1.000	1.875	0.500-13	0.750	1.500	2.438	2.625
	1.375					2.688	
4.00	1.000	2.250	0.500-13	0.750	2.063	2.438	2.625
	1.375					2.688	
5.00	1.000	2.750	0.625-11	1.000	2.688	2.438	2.875
	1.375					2.688	
6.00	1.375	3.250	0.750-10	1.125	3.250	2.813	3.125
	1.750					3.063	
8.00	1.375	4.250	0.750-10	1.125	4.500	2.813	3.250
	1.750					3.063	

For dimensions not shown, see base dimension fold-out.

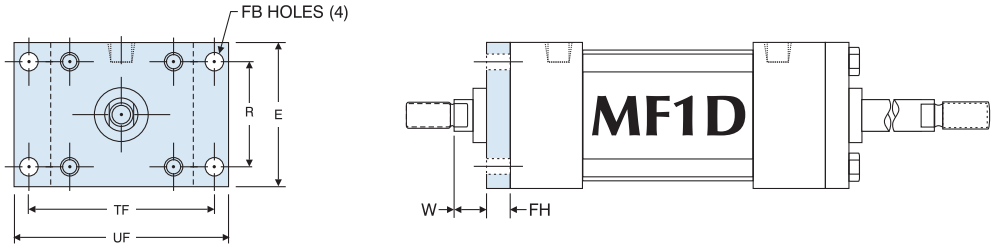
SERIES 'TAS' DIMENSIONS: DOUBLE ROD END TIE ROD & FLANGE MOUNTS



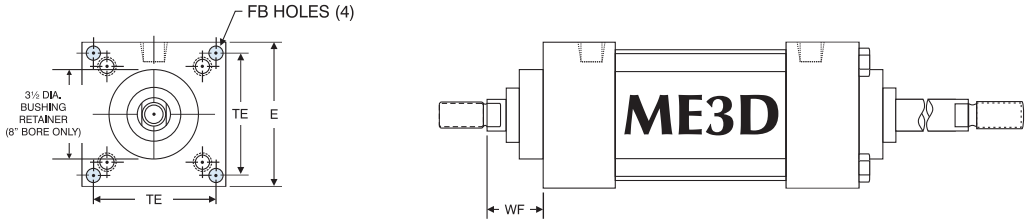
TIE ROD EXTENDED 'MX1D' & 'MX3D' MOUNT DIMENSIONS						
BORE	ROD DIA (MM)	AA	BB	DD	FH	R
1.50	0.625	2.016	1.000	0.250-28	0.375	1.438
	1.000					
2	0.625	2.594	1.125	0.313-24	0.375	1.844
	1.000					
2.50	0.625	3.109	1.125	0.313-24	0.375	2.188
	1.000					
3.25	1.000	3.906	1.375	0.375-24	0.625	2.766
	1.375					

TIE ROD EXTENDED 'MX1D' & 'MX3D' MOUNT DIMENSIONS						
BORE	ROD DIA (MM)	AA	BB	DD	FH	R
4.00	1.000	4.719	1.375	0.375-24	0.625	3.328
	1.375					
5.00	1.000	5.813	1.813	0.500-20	0.625	4.109
	1.375					
6.00	1.375	6.906	1.813	0.500-20	0.750	4.875
	1.750					
8.00	1.375	9.125	**2.313	0.625-18	*0.625	6.438
	1.750					

**"BB" dimension from head on 8" bore.
For dimensions not shown, see base dimension fold-out.



1.50" - 6" BORES



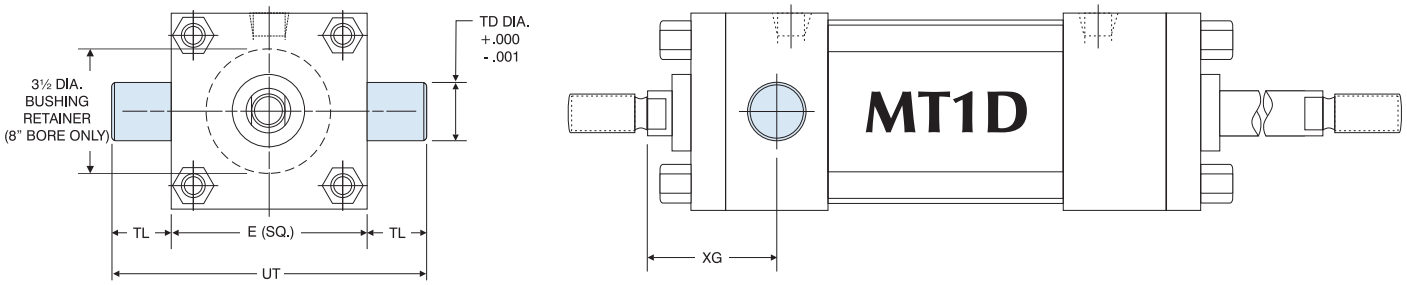
8" BORE ONLY

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS										
BORE	ROD DIA	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								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								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								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								1.000	N/A

'MF1D' FLANGE & 'ME3D' CAP MOUNT DIMENSIONS										
BORE	ROD DIA	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								1.000	N/A
5.00	1.000	5.500	0.563	0.625	4.109	—	6.625	7.625	0.750	N/A
	1.375								1.000	N/A
6.00	1.375	6.500	0.563	0.750	4.875	—	7.625	8.625	0.875	N/A
	1.750								1.125	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 base dimension fold-out.

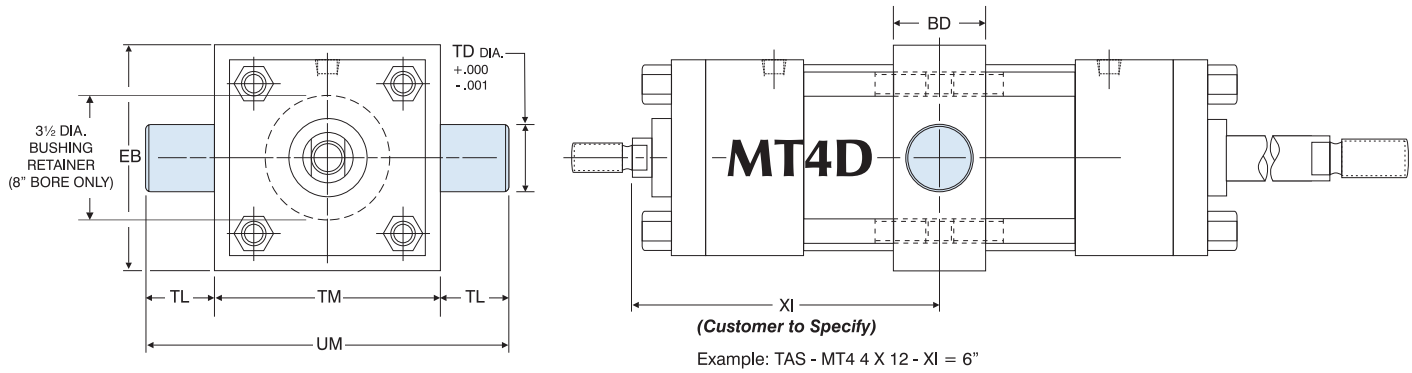
SERIES 'TAS' DIMENSIONS: DOUBLE ROD END PIVOT MOUNTS



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

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 base dimension fold-out.



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	

8" bore utilizes round retainer.

'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.

SERIES 'TAS' BASIC OPTIONS

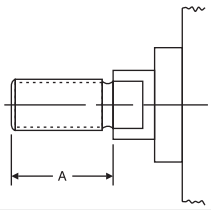
Index To Standard Options:

Uncommon Options:

A= Extended Piston Rod Thread

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

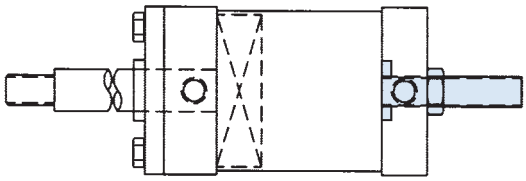
Shorter than standard lengths can be furnished at no charge. Longer than standard lengths can be furnished at a nominal price adder. *Special length threads do not delay orders!*



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.

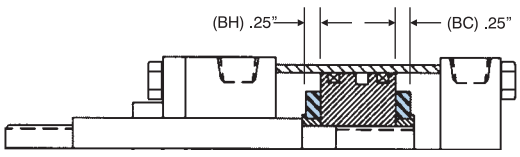
Note: Due to the nature of oil to remain in the tubing finish recesses, a condition called "collaring" will allow oil to seep past the A/O seal over time, escaping in the air valve exhaust.

B BC BH Bumpers

Urethane impact dampening bumpers, used when cylinder speeds do not allow for standard cushions.

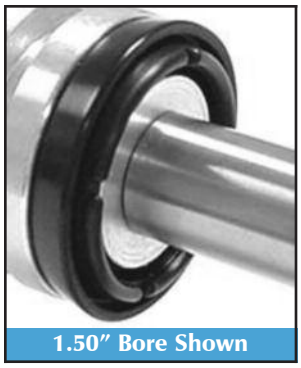
BC=Cap Bumper **BH**=Head Bumper **B**=Head & Cap Bumper

(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" 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" 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.

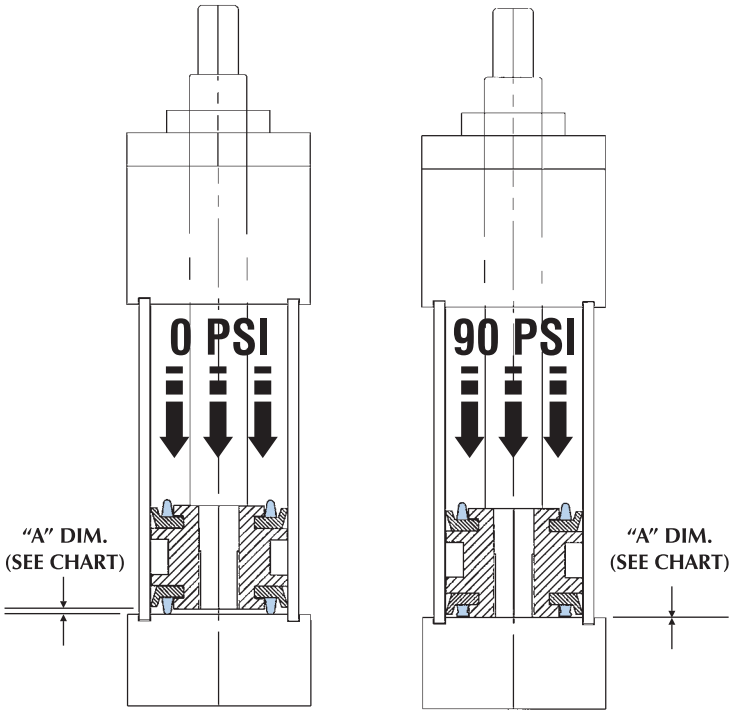
Bumper Piston Seals will shorten the cylinder stroke when operated at less than 90 PSI supply air. The charts below show the approximate (average) stroke reduction, at various pressure (for new cylinders). As the cylinders are cycled, the seals will take a slight set. Tests have shown that after 1,500,000 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

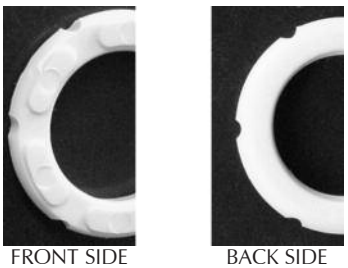


SERIES 'TAS' BASIC OPTIONS

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



FRONT SIDE BACK SIDE

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. Note: You can choose a larger bore size to increase cushion capacities.

CUSHION SIZING FORMULA:

$$energy = \left(\frac{W}{64} \times v^2\right) + (p \times k)$$

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 PSI W=26.25 lbs. V=6 FPS. K=.17

Energy = (26.25/64) X (6^2) or (36) + (80 X .17)
Energy = 28.36 ft/lbs.

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

MAXIMUM ENERGY DATA			
BORE	K	H or C	LH or LC
		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 56 for details.***
- **BP** Seals provide additional impact dampening and noise reduction. *(Refer to page 52 for details).*

SERIES 'TAS' BASIC OPTIONS

BSPT British Standard Pipe Taper

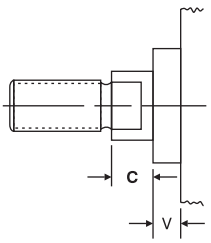
British Standard Pipe Taper **(BSPT)** threads have the same taper as American NPT tapered threads, but use a 55° Whitworth thread form and different diameters. (Not interchangeable with NPT)

BSPP British Standard Pipe Parallel

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

C= Extended Piston Rod

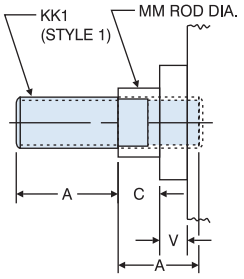
"C=" is commonly referred to as Piston Rod Extension. Piston rods can be extended to any length up to 120" total piston rod length, including stroke portion. Cylinders with long "C" lengths can be mounted away from obstacles or outside hazardous environments.



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.



LF Low Friction

"LF" Low Friction option incorporates the use of round-lip, extremely low friction carboxilated 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" Bore

MATERIAL: Carboxilated Nitrile

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

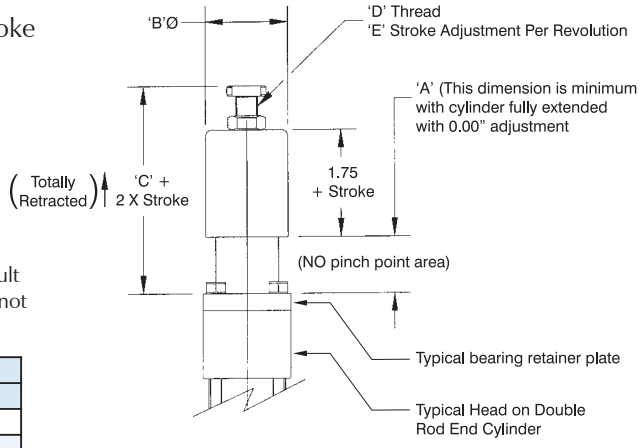
OPERATING PRESSURE: 250 PSI AIR (17 BAR)

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" stroke and adjustment*

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

SKETCH A



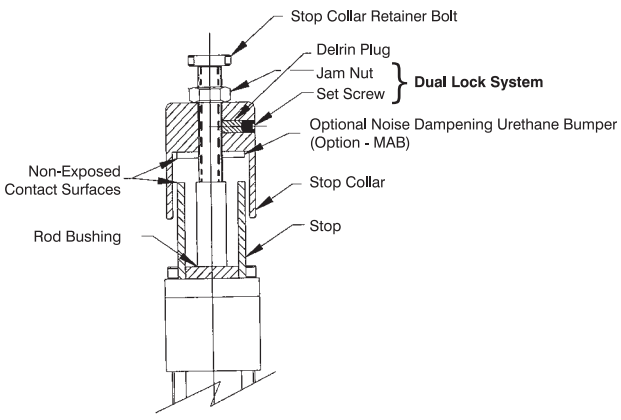
TA-MF1D-MA (SHOWN)

Construction: Annodized Aluminum

MICRO-ADJUST DIMENSIONS					
BORE	A	B	C	D	E
1.50	1.000	1.875	3.719	0.500-20	0.050
2.00	1.000	1.875	3.719	0.500-20	0.050
2.50	1.000	1.875	3.719	0.500-20	0.050
3.25	1.000	2.813	3.719	0.750-16	0.063
4.00	0.750	2.813	3.469	0.750-16	0.063
5.00	0.750	2.813	3.469	0.750-16	0.063
6.00	0.750	3.750	3.469	0.750-16	0.063
8.00	0.750	3.750	3.469	0.750-16	0.063

Note: See double rod end cylinder drawings for dimensions not shown.

SKETCH B



MICRO-ADJUST SET-UP INSTRUCTIONS:

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

NOTE: Do NOT apply torque to stop collar retainer bolt.

Hold stop collar by hand to tighten jam nut.

Stroke adjustments to be made while cylinder is in the "retract" position only.

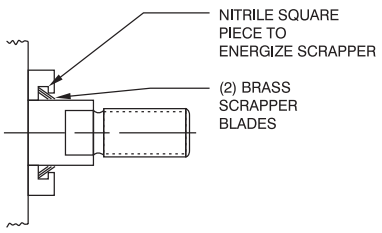
MAB Micro-Adjust with Urethane Bumper

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

SERIES 'TAS' BASIC OPTIONS

MS Metallic Rod Scapper

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



NR Non-Rotating (NFPA) Cylinders

2" through 8" Bore
200 PSI Air, 400 PSI Hydraulic
(Non-Shock)

Benefits

- Two internal guide rods throughout stroke
- High repeatability at each end of stroke (+/- 1 degree)
- All external dimensions are the same as standard cylinder (no additional length or width required)
- Standard Diameter Guide Rod Seals & Bronze Bearings for long life and reliable operation
- Available in Double Rod End Models

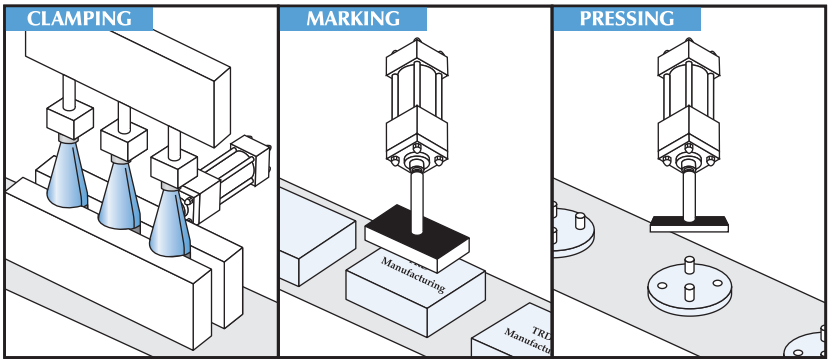
Advantages

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

FORCE CHART **– Refer to page 78**

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 DIAMTERS	MAXIMUM STROKE
2.00	0.625	Cap Only	0.250	10"
2.50	0.625	Cap Only	0.312	12"
	1.000	N/A	0.312	12"
3.25	1.000	Available	0.375	18"
	1.375	Cap Only	0.375	18"
4.00	1.000	Available	0.625	30"
	1.375		0.625	30"
5.00	1.000	Available	0.625	30"
	1.375		0.625	30"
6.00	1.375	Available	0.625	30"
	1.750		0.625	30"
8.00	1.375	Available	1.000	40"
	1.750		1.000	40"

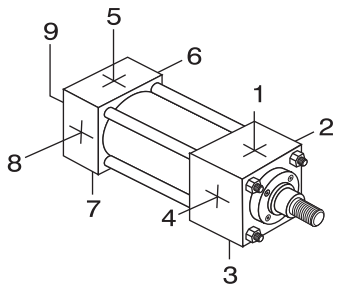
OP Optional Port Location

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 @ 1 & 5**
- **STANDARD CUSHION POSITIONS @ 2 & 6**
- SPECIFY NON-STANDARD LOCATIONS WHEN ORDERING



SERIES 'TAS' BASIC OPTIONS

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

Now available, the ability to 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:

HEAD VIEWS

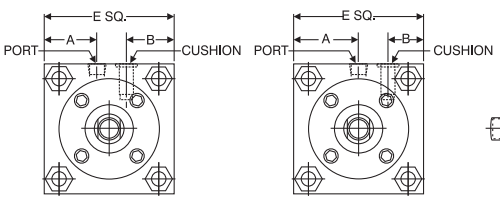
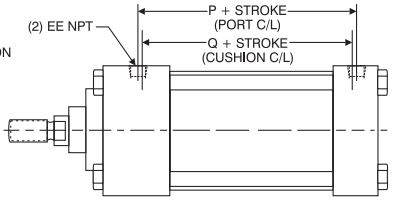


FIGURE #1

FIGURE #2



CAP VIEWS

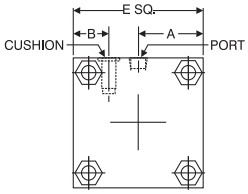


FIGURE #2

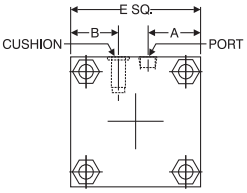
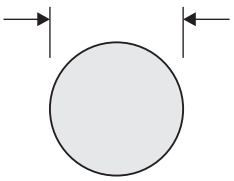


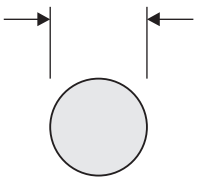
FIGURE #1

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



OVERSIZED PISTON ROD



STANDARD PISTON ROD

Applications requiring long strokes may require oversize piston rod diameters to prevent sagging or buckling. To determine the recommended rod diameter, refer to Chart 3 on page 58.

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 (.44-20)	4.00	#6 (.56-18)
2.00	#4 (.44-20)	5.00	#6 (.56-18)
2.50	#4 (.44-20)	6.00	#8 (.75-16)
3.25	#6 (.56-18)	8.00	#10 (.875-14)

SERIES 'TAS' BASIC OPTIONS

SE Spring Extend (1.50" - 2.50" Bore)

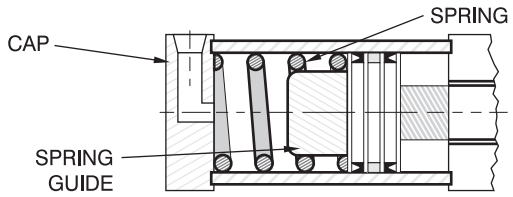
"SE" Option is designed to provide a spring bias to extend cylinder in the event of air pressure loss.

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 inch)	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)

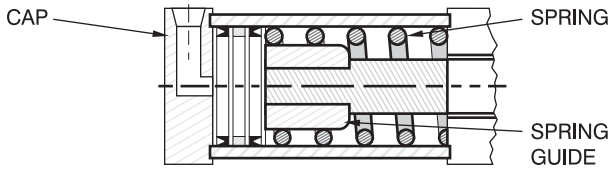
"SR" Option is designed to provide a spring bias to retract cylinder in the event of air pressure loss.

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 inch)	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 insure proper cylinder performance, in any given application. Stop Tubes lower the cylinder bearing stress by adding length to the piston, which increases the overall length of the cylinder. (Note: 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 have direct impact on the amount of stop tube required. (See Chart 1)

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

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

Example:

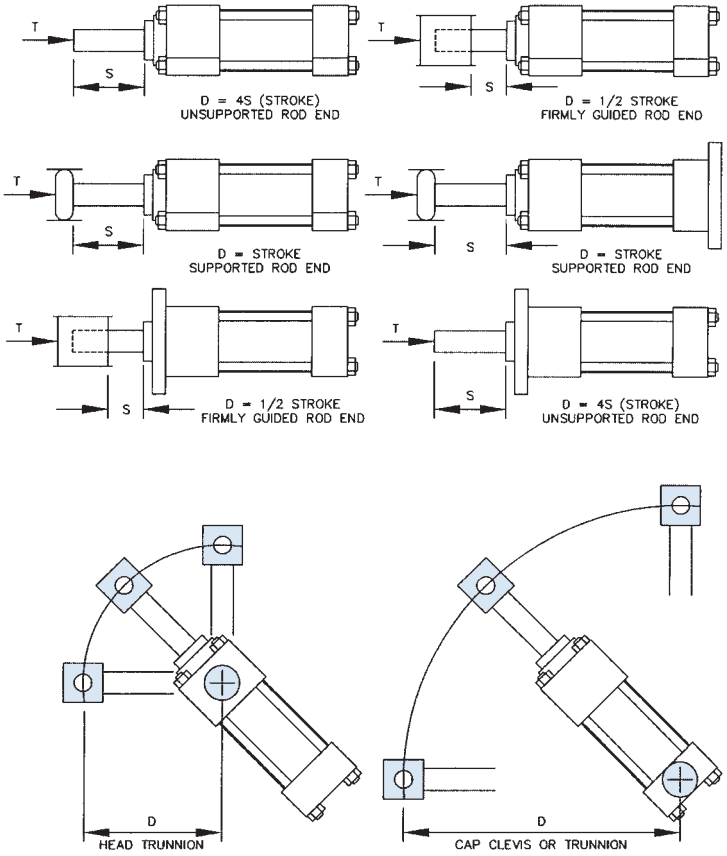
TAS-MP1- 3.25" X 40" effective stroke - ST=2

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

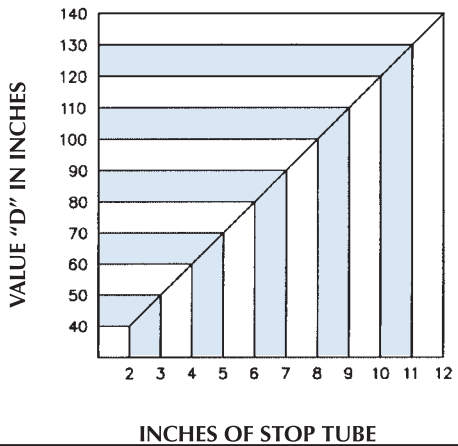
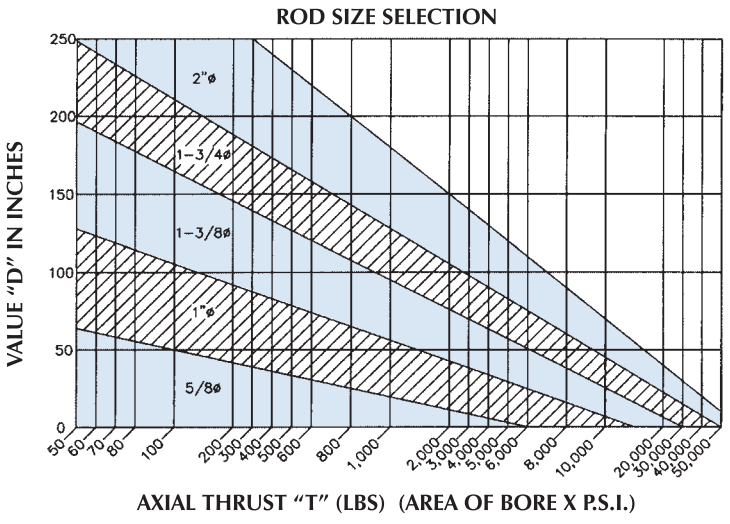


Chart 3

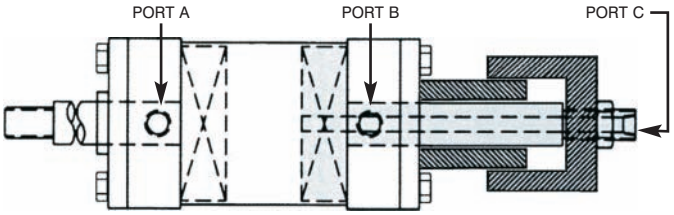


SERIES 'TAS' UNCOMMON OPTIONS

AS3POS Adjustable Mid Stroke (3 Position Cyl.)

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

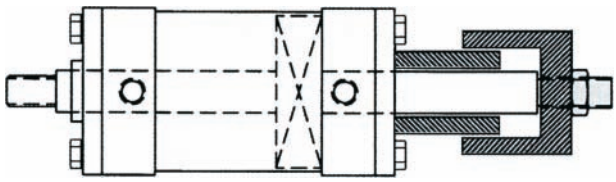
Contact TRD with your specifications.



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.

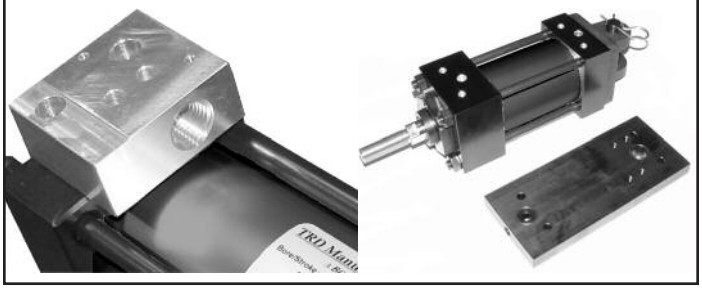
Contact TRD with your specifications.



MANIFOLD BLOCK or PLATE

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

Contact TRD with your specifications.



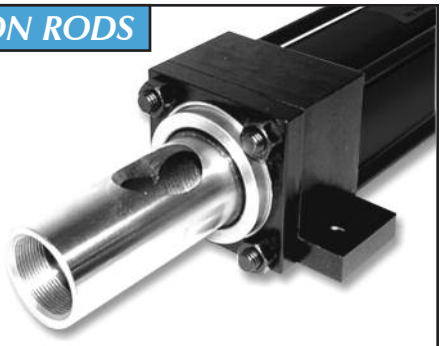
EXTRA WIDE MULTIPLE WEAR BANDS

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.
Contact TRD with your specifications.

Additional Finishes: TRD can provide special finishes, i.e., Nutride Plate
Contact TRD with your specifications — we would be pleased to provide a quote!

Heavy Chrome Plated Piston Rods.
Contact TRD for more information.

SPECIAL MF1 FLANGE

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

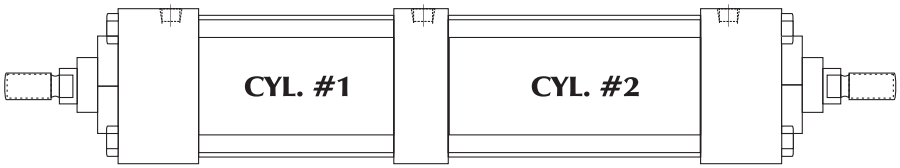
TRD provided flanges that were notched for a more compact design.

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 4 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 3 rod positions.

3-POSITION BENEFITS:

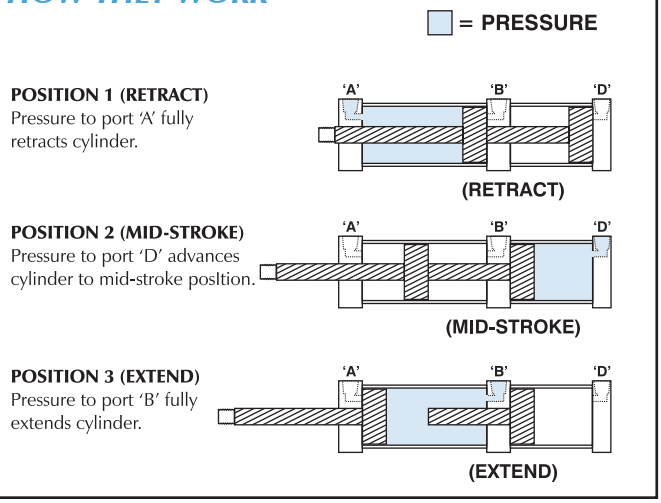
- **3-POSITIONS IN ONE CYLINDER —** One cylinder produces three different rod end positions. By varying stroke lengths, a multitude of positions can be created.
- **SIMPLIFIES MACHINE DESIGNS —** Eliminates the need for an additional cylinder to create a third position. 3-Position cylinders reduce space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

Note: Piston rods are not connected.

Contact TRD for more information.

3-POSITION CYLINDERS

HOW THEY WORK

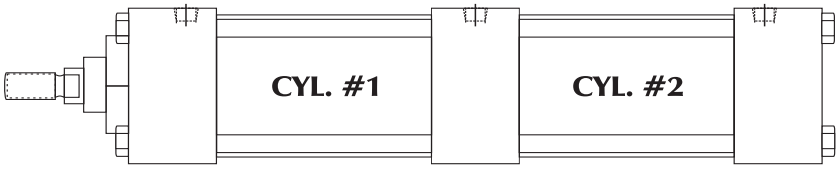


TM Tandem Cylinders

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

Note: Piston rods are connected.

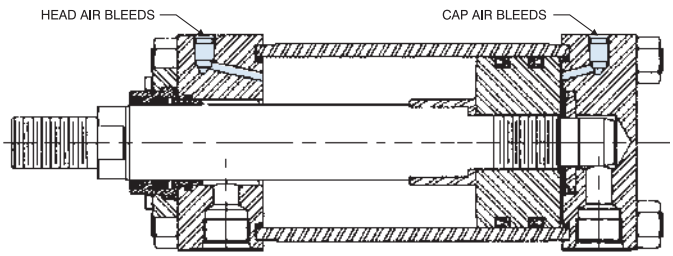
Contact TRD for more information.



HEAD & CAP AIR BLEEDS

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

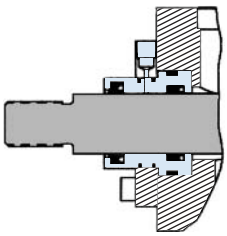
Contact TRD for more information.



ROD DRAIN

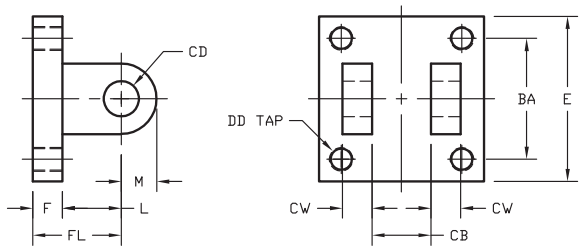
When no oil leakage can be tolerated, a rod bushing Drain port can be provided. Since there isn't any pressure in the drain line, clear tubing can offer a visual inspection of any leakage. A constant leak indicates that the rod seal is worn and needs to be replaced.

Contact TRD for more information.



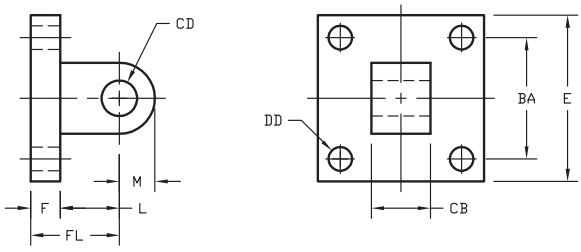
SERIES 'MH' & 'TAS' ACCESSORIES: CLEVIS, PINS & MOUNTS

CLEVIS BRACKET



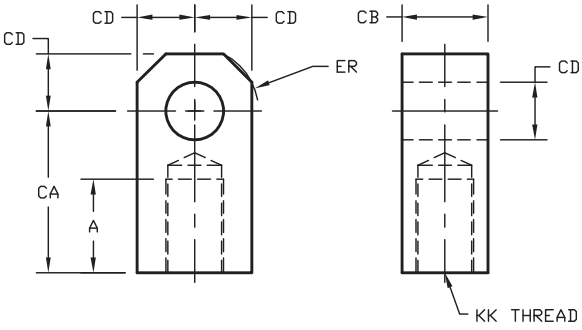
CLEVIS BRACKET DIMENSIONS											
PART NO	MAX LOAD (TENSION) RATED IN LBS	BA	CB	CD (DIA.)	CW	DD	E	F	FL	L	M
CB500	4500	1.625	0.750	0.500	0.500	0.375 - 24	2.500	0.375	1.125	0.750	0.500
CB750	8400	2.563	1.250	0.750	0.625	0.500 - 20	3.500	0.625	1.875	1.250	0.750
CB1000	13500	3.250	1.500	1.000	0.750	0.625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

EYE BRACKET



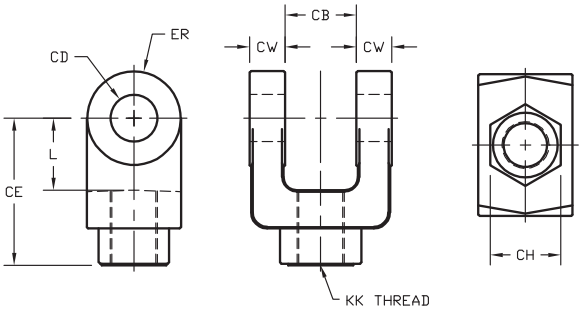
EYE BRACKET DIMENSIONS										
PART NO	MAX LOAD (TENSION) RATED IN LBS	BA	CB	CD (DIA.)	DD	E	F	FL	L	M
EB500	3375	1.625	0.750	0.500	0.406	2.500	0.375	1.125	0.750	0.500
EB750	8400	2.563	1.250	0.750	0.531	3.500	0.625	1.875	1.250	0.750
EB1000	13500	3.250	1.500	1.000	0.656	4.500	0.750	2.250	1.500	1.000
EB1375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

ROD EYE



ROD EYE DIMENSIONS							
PART NO	MAX LOAD (TENSION) RATED IN LBS	A	CA	CB	CD (DIA.)	ER (RADIUS)	KK
RE437	2950	0.750	1.500	0.750	0.500	0.625	0.438 - 20
RE500	3350	0.750	1.500	0.750	0.500	0.625	0.500 - 20
RE750	8400	1.125	2.063	1.250	0.750	0.875	0.750 - 16
RE1000	13500	1.625	2.813	1.500	1.000	1.813	1.000 - 14
RE1250	24500	2.000	3.438	2.000	1.375	1.563	1.250 - 12
RE1500	39000	2.250	4.000	2.500	1.750	2.000	1.500 - 12
RE1875	45000	3.000	5.000	2.500	2.000	2.500	1.875 - 12
RE2250	67000	3.500	5.810	3.000	2.500	2.813	2.250 - 12
RE2500	81000	3.500	6.125	3.000	3.000	3.250	2.500 - 12
RE3250	125000	4.500	7.625	4.000	3.500	3.875	3.250 - 12
RE3500	125000	5.000	7.625	4.000	3.500	3.875	3.500 - 12
RE4000	162000	5.500	9.125	4.500	4.000	4.438	4.000 - 12

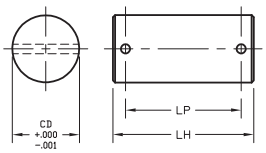
ROD CLEVIS



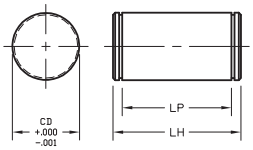
ROD CLEVIS DIMENSIONS									
PART NO	MAX LOAD (TENSION) RATED IN LBS	CB	CD (DIA.)	CE	CH	CW	ER (RADIUS)	KK	L
RC437	2950	0.750	0.500	1.500	1.000	0.500	0.500	0.438 - 20	0.750
RC500	4000	0.750	0.500	1.500	1.000	0.500	0.500	0.500 - 20	0.750
RC750	11200	1.250	0.750	2.375	1.250	0.625	0.750	0.750 - 16	1.250
RC1000	19500	1.500	1.000	3.125	1.500	0.750	1.000	1.000 - 14	1.500
RC1250	26800	2.000	1.375	4.125	2.000	1.000	1.375	1.250 - 12	2.125
RC1375	26800	2.000	1.375	4.125	2.000	1.000	1.375	1.375 - 12	2.125
RC1500	39500	2.500	1.750	4.500	2.375	1.250	1.750	1.500 - 12	2.250
RC1750	54700	2.500	1.750	4.500	2.375	1.250	1.750	1.750 - 12	2.250
RC1875	56000	2.500	2.000	5.500	3.000	1.250	2.000	1.875 - 12	2.500
RC2250	84000	3.031	2.500	6.500	3.500	1.500	2.500	2.250 - 12	3.000
RC2500	84000	3.031	3.000	6.750	3.875	1.500	2.750	2.500 - 12	3.250
RC3250	155000	4.031	3.500	8.500	5.000	2.000	3.500	3.250 - 12	4.000
RC4000	200000	4.531	4.000	10.000	6.125	2.250	4.000	4.000 - 12	4.500

SERIES 'MH' & 'TAS' ACCESSORIES: CLEVIS, PINS & MOUNTS

PIVOT PIN
(INCLUDES COTTER PINS)

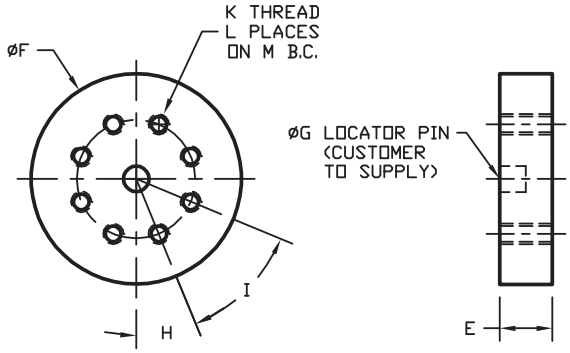


PIVOT PIN
(INCLUDES E-CLIPS)



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

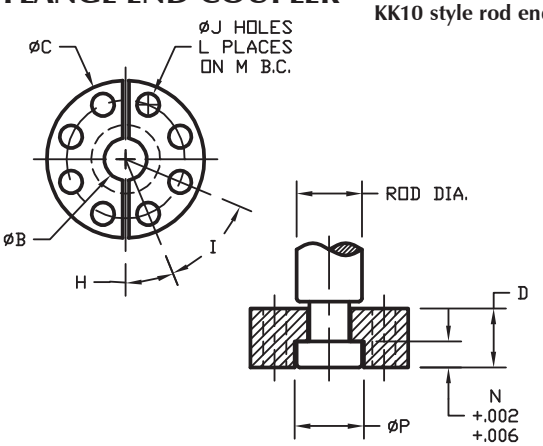
WELD PLATE



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 - 20	4	1.125
WP1000	1.000	0.500	2.500	0.250	30.0°	60.0°	0.250 - 20	6	1.500
WP1375	1.375	0.625	3.000	0.250	30.0°	60.0°	0.313 - 18	6	2.000
WP1750	1.750	0.625	4.000	0.250	22.5°	45.0°	0.313 - 18	8	2.375
WP2000	2.000	0.750	4.000	0.375	15.0°	30.0°	0.375 - 16	12	2.688
WP2500	2.500	0.750	4.500	0.375	15.0°	30.0°	0.375 - 16	12	3.188
WP3000	3.000	1.000	5.500	0.375	15.0°	30.0°	0.500 - 13	12	4.000
WP3500	3.500	1.000	7.000	0.375	15.0°	30.0°	0.625 - 11	12	4.688
WP4000	4.000	1.000	7.000	0.375	15.0°	30.0°	0.625 - 11	12	5.188
WP4500	4.500	1.000	8.000	0.375	15.0°	30.0°	0.625 - 11	12	5.688
WP5000	5.000	1.000	8.000	0.375	15.0°	30.0°	0.625 - 11	12	6.188
WP5500	5.500	1.250	9.000	0.375	15.0°	30.0°	0.750 - 10	12	6.875

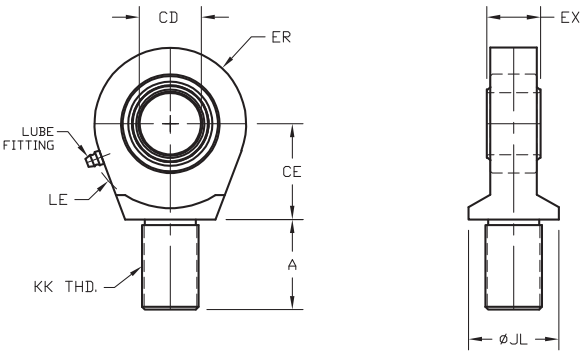
FLANGE END COUPLER

(To be used with KK10 style rod end)



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

MALE SPHERICAL ROD EYE



MALE SPHERICAL ROD EYE DIMENSIONS											
PART NO	BORE (REF.)	ROD DIA.	A	CD	CE	ER	EX	JL	KK	LE	LOAD CAPACITY LBS
HH-MSRE-500	1.50	0.625 1.000	0.688	0.500	0.875	0.875	0.437	0.875	0.438-20	0.750	2600
HH-MSRE-750	2.00	1.000 1.375	1.000	0.750	1.250	1.250	0.656	1.313	0.750-16	1.063	9400
HH-MSRE-750	2.50	1.000 1.375 1.750	1.000	0.750	1.250	1.250	0.656	1.313	0.750-16	1.063	9400
HH-MSRE-1000	3.25	1.375 1.750 2.000	1.500	1.000	1.875	1.375	0.875	1.500	1.000-14	1.438	16800
HH-MSRE-1375	4.00	1.750 2.000 2.500	2.000	1.375	2.125	1.813	1.188	2.000	1.250-12	1.875	28500
HH-MSRE-1750	5.00	2.000 2.500 3.000 3.500	2.125	1.750	2.500	2.188	1.531	2.250	1.500-12	2.125	43000
HH-MSRE-2000	6.00	2.500 3.000 3.500 4.000	2.875	2.000	2.750	2.625	1.750	2.750	1.875-12	2.500	70200

SERIES 'MH' & 'TAS' 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!

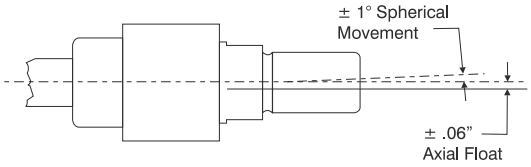
Standard AC Coupler
AC250 - AC5000

ACH Coupler
ACH250 - ACH1250

Benefits

- Rod alignment couplers eliminate expensive machining for mounting fixed or rigid cylinders on guided or slide applications.
- Simplifies alignment problems in the field.

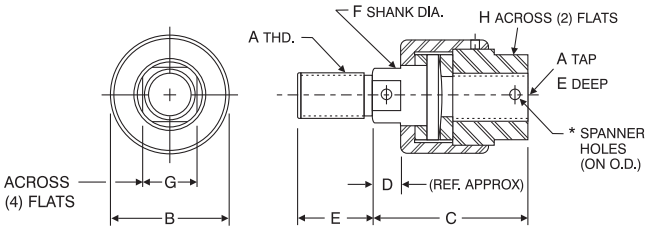
MATERIAL: 100,000 MIN. YIELD
STRESS-PROOF™



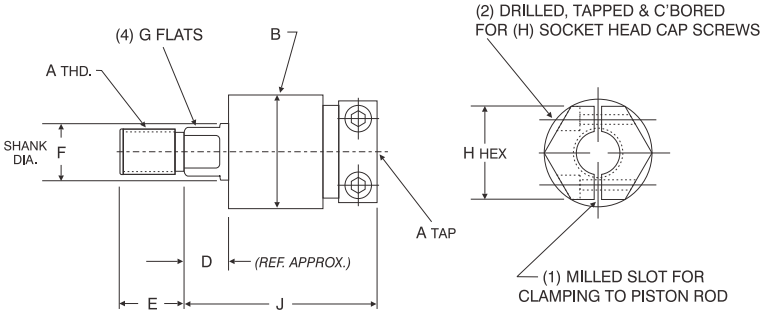
Design Tips

- 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.

AC SERIES



ACH SERIES



ALIGNMENT COUPLER DIMENSIONS											
PART NO.	A	B	C	D	E	F	G	H	H HEX	J	MAX PULL AT YIELD
AC250	0.250-28	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	6,000
AC312	0.313-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	8,300
AC375	0.375-24	1.125	1.750	0.375	0.500	0.500	0.375	0.688	1.250	2.000	8,300
AC437	0.438-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.250	2.156	10,000
AC500	0.500-20	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.125	2.156	14,000
AC625	0.625-18	1.250	2.000	0.438	0.750	0.625	0.500	0.813	1.250	2.156	19,000
AC750	0.750-16	1.750	2.313	0.438	1.125	0.969	0.813	1.125	1.750	2.500	34,000
AC875	0.875-14	1.750	2.313	0.438	1.125	0.969	0.813	1.125	1.750	2.500	39,000
AC1000	1.000-14	2.500	2.938	0.438	1.625	1.344	1.156	1.625	2.500	2.938	64,000
AC1250	1.250-12	2.500	2.938	0.438	1.625	1.344	1.156	1.625	2.500	2.938	78,000
AC1375	1.375-12	2.500	2.938	0.438	1.625	1.344	1.156	1.625	—	—	78,000
AC1500	1.500-12	3.250	4.375	0.875	2.250	1.969	1.750	2.375	—	—	134,000
AC1750	1.750-12	3.250	4.375	0.875	2.250	1.969	1.750	2.375	—	—	134,000
AC1875	1.875-12	3.750	5.625	1.000	3.000	2.469	2.125	2.750	—	—	134,000
AC2000	2.000-12	3.750	5.625	1.000	3.000	2.469	2.125	2.750	—	—	195,000
AC2250	2.250-12	4.500	6.375	1.000	3.500	2.969	2.625	3.375	—	—	240,000
AC2500	2.500-12	5.000	6.563	1.000	3.500	3.938	SPANNER HOLES		—	—	344,000
AC2750	2.750-12	5.000	6.563	1.000	3.500	3.938			—	—	344,000
AC3000	3.000-12	5.000	6.563	1.000	3.500	3.938			—	—	344,000
AC3250	3.250-12	6.250	8.125	1.000	4.500	4.938			—	—	536,000
AC3500	3.500-12	6.250	8.125	1.000	4.500	4.938			—	—	536,000
AC3750	3.750-12	6.250	8.125	1.000	4.500	4.938			—	—	536,000
AC4000	4.000-12	7.500	9.500	1.000	5.500	5.938			—	—	776,000
AC4500	4.500-12	7.500	9.500	1.000	5.500	5.938			—	—	776,000
AC5000	5.000-12	7.500	9.500	1.000	5.500	5.938			—	—	776,000

*Please specify AC or ACH coupler when ordering: i.e.: AC750 (Std. Coupler) or ACH750 (Hex Coupler).
*Spanner holes are used on AC2250 and larger,
(2) 1/2" dia. holes, 1/2" deep, 180° apart (each end).

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

SERIES: BALLUFF INDUCTIVE SENSORS

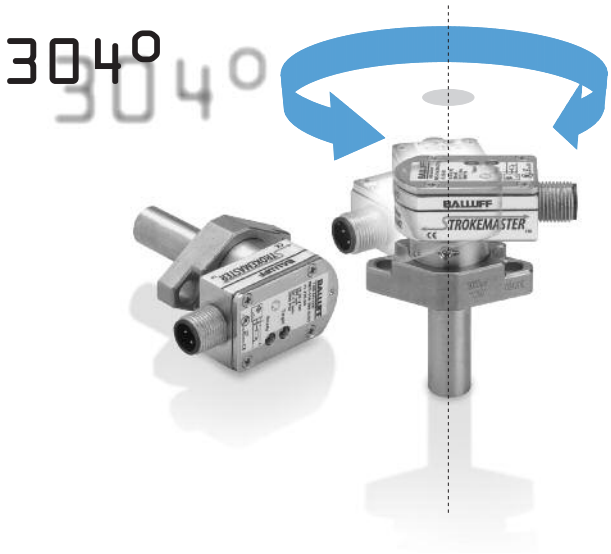
BALLUFF STROKEMASTER™ Inductive Sensors

Flexible Solutions for an Often Inflexible World

Balluff's Strokemaster® cylinder-piston sensors provide precision end-of-stroke sensing for hydraulic cylinders. The sensor body allows 304° of rotation to eliminate the hassle of post-installation cable management, which in some competitive designs requires unbolting the flange and breaking the hydraulic seal.

A high-pressure inductive proximity sensor, the Strokemaster® provides a 2mm (0.08") sensing range to detect the "spud" of hydraulic/pneumatic cylinders and indicate fully retracted or extended position. It mounts with two socket-head cap screws and seals with a Viton O-ring. Withstanding cylinder pressures to 3000 psi (207 BAR), the embeddable design keeps most of the switch protected within the cylinder, with only a 0.62" (16mm) high housing exposed outside.

Strokemaster® sensors are available in 3-wire DC and 2-wire AC/DC versions, both with mini or micro connectors. Switching frequency is 50 Hz for the AC/DC versions. All units are weld-field immune, short-circuit, and reverse polarity protected. They fit 'MH' & 'TAS' series cylinder designs, with standard available probe lengths of 0.912" - 4.560" (23.165mm - 115.8mm). Custom probe lengths can be achieved by using TRD supplied spacer kits. Probes are made of stainless steel with a high-strength ceramic face. Both DC and AC/DC sensors have all-metal housings. The Strokemaster® sensor is UL-listed, CE-certified, and its housing is sealed to IP67 requirements.



CE c UL us

SERIES: BALLUFF INDUCTION SENSORS

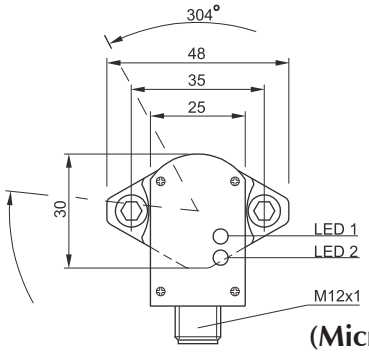
DC INDUCTIVE SENSORS

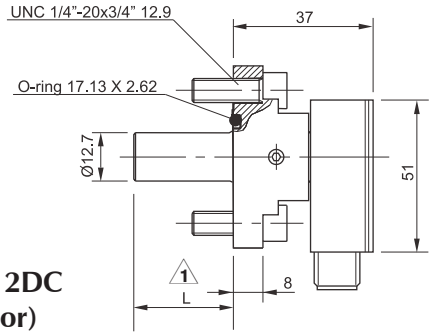
Features/Advantages

Inductive cylinder switch for piston position feedback in cylinders.

- Magnetic field immune, for use with welding equipment
- 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

BALLUFF STROKEMASTER™



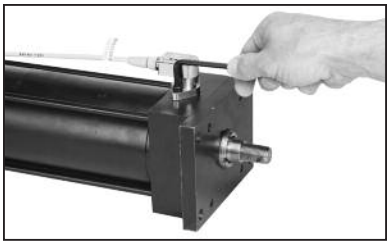


(Micro M12DC Connector)

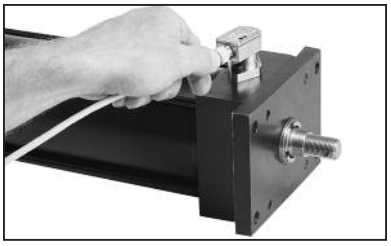
CE cULus

PNP Normally-open	BES 516-300-S 295-S 4
High Pressure Rated up to	3000 PSI (207 BAR)
Rated operational voltage U_e	24 V DC
Supply voltage U_B	10...30 V DC
Voltage drop U_d at I_e	≤ 2.5 V
Rated insulation voltage U_i	75 V DC
Rated operational current I_e	200 mA
No-load supply current I_r damped/undamped	≤ 18 mA/≤ 10 mA
Off-state current I_r	≤ 80 µA
Protected against polarity reversal	yes
Short circuit/overload protected	yes/yes
Load capacitance	≤ 1.0 µF
Repeat accuracy R	≤ 5 %
Ambient temperature range 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 60529	IP 67 (connector IP 65)
Housing material	stainless steel/aluminum
Material of sensing face	ceramic
Connection	micro connector
Recommended connector	Micro M12DC (see page 67for cables)
Approvals	CE, cULus

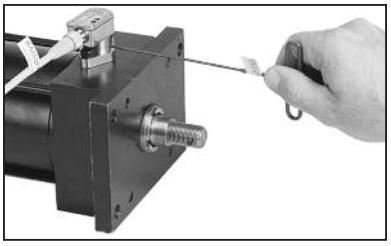
⚠1 TRD will supply the correct length probe and spacer combination (if req'd.) for each cylinder. Using the combination of std. probe lengths & spacers will give the appropriate .030" gap between sensor and cylinder spud.
The spacers supplied have the same base profile as the sensor. (Material: Stainless Steel)



Bolt sensor to cylinder.



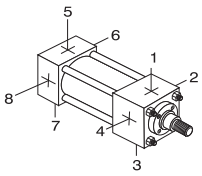
Position cable to desired orientation (even over mounting bolts).



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

Refer to page 67 for available cable connector sets.

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:

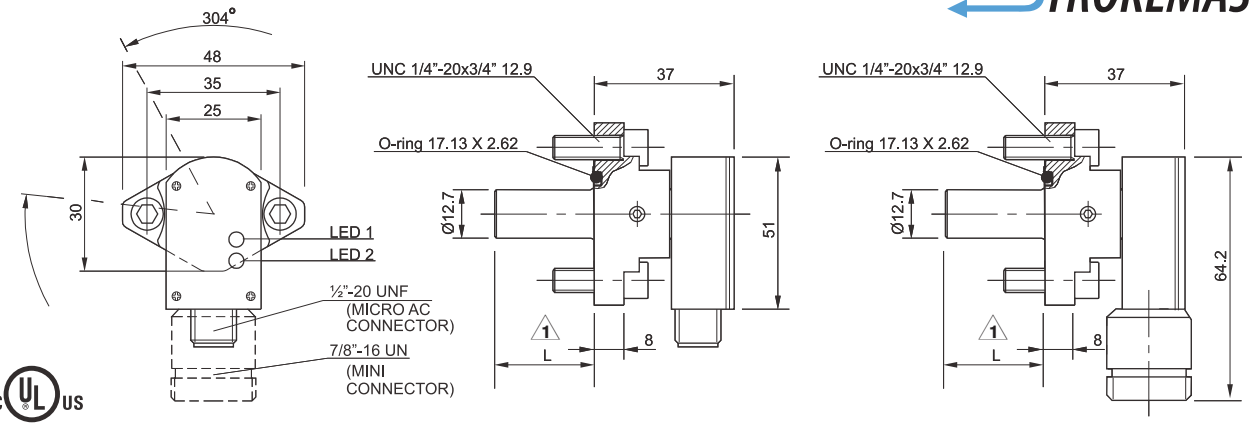
Cylinder Model Number ➡	**MH-MS2-325-100-KK1-N500**
SENSOR MODEL (HEAD) ➡	**-BES 516-300-S 295-S4 (Head)**
SENSOR MODEL (CAP) ➡	**-BES 516-300-S 295-S4 (Cap)**
(Include ALL Sensor positions) ➡	**-Sensors at 4 & 8**

Note: TRD will include the STROKEMASTER probe length on your order, and any sensor spacers required. (**Example:** MH-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.

SERIES: BALLUFF INDUCTION SENSORS

AC/DC INDUCTIVE SENSORS

BALLUFF STROKEMASTER™

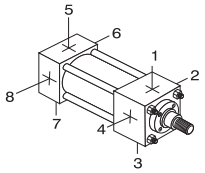


Normally-open	BES 516-200-S 2-S21	BES 516-200-S 2-S5
High Pressure Rated up to	3000 PSI (207 BAR)	3000 PSI (207 BAR)
Rated operational voltage U_e	110 V DC	110 V DC
Supply voltage U_B	20...250 V AC/DC	20...250 V AC/DC
Voltage drop U_d at I_e	≤ 6 V	≤ 6 V
Rated insulation voltage U_i	250 V AC	250 V AC
Rated operational current I_e	500 mA	500 mA
Minimum operational current I_m	5 mA	5 mA
Off-state current I_r	≤ 1.7 mA @ 110 V AC	≤ 1.7 mA @ 110 V AC
Inrush current I_k (t = 20 ms)	3 A max./1 Hz	3 A max./1 Hz
Protected against polarity reversal	yes	yes
Short circuit protected	yes	yes
Repeat accuracy R	≤ 5 %	≤ 5 %
Ambient temperature range T_a	-25...+70°C	-25...+70°C
Frequency of operating cycles f	≤ 50 Hz	≤ 50 Hz
Utilization categories	AC 140/DC 13	AC 140/DC 13
Function/Operating voltage indication	yes/yes	yes/yes
Degree of protection per IEC 60529	IP 67	IP 67
Insulation class	1	1
Housing material	stainless steel/aluminum	stainless steel/aluminum
Material of sensing face	ceramic	ceramic
Connection	micro connector	mini connector
Recommended connector	Micro AC (see page 67 for cables)	Mini (see page 67 for cables)
Approvals	CE, cULus	CE, cULus

⚠1 TRD will supply the correct length probe and spacer combination (if req'd.) for each cylinder. Using the combination of std. probe lengths & spacers will give the appropriate .030" gap between sensor and cylinder spud.
The spacers supplied have the same base profile as the sensor. (Material: Stainless Steel)

Refer to page 67 for available cable connector sets.

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 ➡	**MH-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:** MH-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.

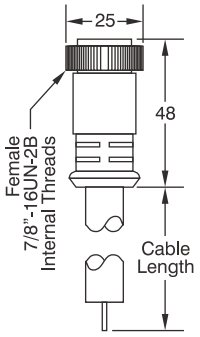
SERIES: BALLUFF INDUCTION SENSORS

CABLE CONNECTORS

BALLUFF STROKEMASTER™

Mini Connectors

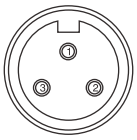
Connector	3-5 Pole Mini
Style	Mini Size A
Configuration	Straight Female



	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

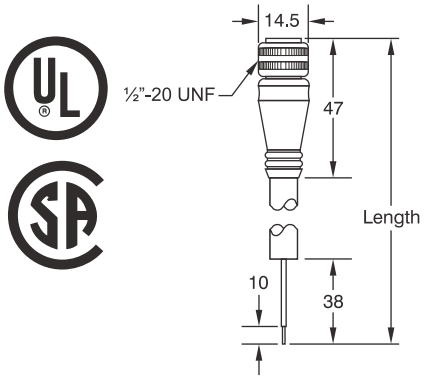
* Insert **V** = PVC Cable
T = TPE Cable
For 3 pole versions only

Female 3-pin - Face view



Micro AC .50" x 20 UNF Connectors

Connector	Micro AC .50" x 20 UNF
Style	3 Pin Dual Keyway
Configuration	Straight Female

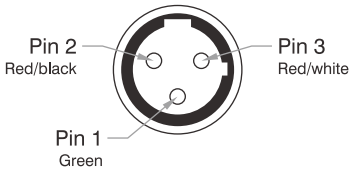


	ORDER NUMBER
Ordering Code	
3 Pin Dual Keyway	C21 AE3 00 * Y 150F
4 Pin Dual Keyway	
Voltage Rating	250 V AC/DC
Amperage	4A
Wire Gauge	22 AWG
Jacket	Yellow PVC or TPE
Coupling Nut	Black Epoxy Coated Zinc
O-Ring	Viton
Overmold Head	TPE
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-4 - 221°F (-21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

Note: 15 ft cable is standard (other lengths available - contact factory)

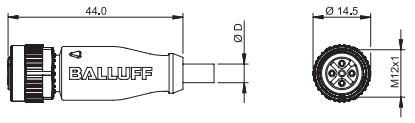
* Insert **V** = PVC Cable
T = TPE Cable
For 3 pole versions only

Female - Face view

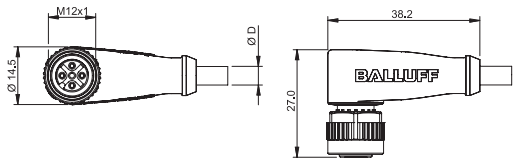


Micro M12 DC Connectors

Connector	Micro
Style	M12 DC Single Keyway
Configuration	Straight Female



Configuration	Right Angle Female

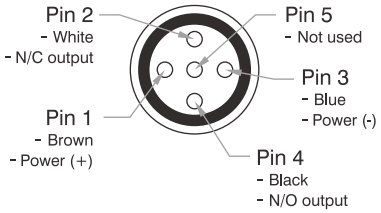


	ORDER NUMBER
4 Wire DC (NO/NC)	
4 Wire (straight)	BCC M415-0000-1A-003-*X44T2-050
4 Wire PNP w/LED (straight)	BCC M415-0000-1A-008-*X44T2-050
4 Wire (right angle)	BCC M425-0000-1A-003-*X44T2-050
4 Wire PNP w/LED (right angle)	BCC M425-0000-1A-008-*X44T2-050
Voltage Rating	250 V AC/DC
Amperage	4 Amps
Wire Gauge	22 AWG
Jacket	Yellow PVC, PUR or TPE
Coupling Nut	Gadolinium-Zinc (Gd-Zn)
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-40 - 221°F (-40 to 105°C)
UL Listed	Pending
CSA Certified	Pending

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

* Insert **V** = PVC Cable
E = TPE Cable
P = PUR Cable

Female - Face view



Refer to Balluff Catalog for additional cable connectors.

BALLUFF TRANSDUCERS

BALLUFF

MICROPULSE Linear Position Transducers

Enhanced Magnetostrictive Technology

MICROPULSE®

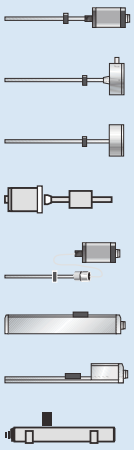
Balluff's Micropulse® linear position transducers have acheived a worldwide reputation for accuracy, stability, and rock-solid reliability.

Micropulse® linear transducers use field-proven, non-contact magnetostrictive technology to provide precise, absolute linear position feedback. Whether installed internally or externally, Micropulse® transducers are ideal for use in hydraulic or pneumatic cylinder position applications.

Available in a wide variety of physical form factors and output signal configurations, Micropulse® transducers are available to meet the needs of diverse application requirements.

Key to System Performance

Users and installers know that accurate and reliable position data critical to getting maximum performance from a hydraulic or pneumatic position system. The proper operation of all other components - the cylinder, the servo or proportional valve, and the control electronics - depends on the validity of the position signal from linear position transducer. Micropulse® magnetostrictive technology is wear-free and provides position data you can depend on.



Balluff has the right transducer for any application!

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

Rod Style

Z

- .75″ 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
- Designed for demanding applications
- Eliminates the need for protective cover
- .75″ - 16 UNF or M18 x 1.5 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

OUTPUT SIGNAL OPTIONS	BTL5 Z-SERIES	BTL7 + Z-SERIES	BTL5 W-SERIES	BTL5 PRO-COMPACT
Analog Voltage (0...10V, -10...+10V, -5...+5V)		●	●	●
Analog Current (4...20 mA, 0...20 mA)		●	●	●
Field-configurable analog output	Local pushbutton stroke scaling	Streamlined local pushbutton stroke scaling, advanced PC-based configuration	No	No
Digital Start/Stop Pulse	●		●	●
Digital PWM Pulse	●		●	●
Synchronous Serial Interface (SSI)		●	●	●
CANopen	●			
Profibus DP	●			
Devicenet				
Quadrature	●			
Available Stroke Lengths	up to 200"	up to 300"	up to 200"	up to 200"
Protection Class	IP67	IP67 IP68	IP67 IP68	IP69K
Features	• 3/4"-16 UNF or M18 x 1.5 threads • Pressure rated to 8700 psi	• 3/4"-16 UNF or M18 x 1.5 threads • Pressure rated to 8700 psi • Position and/or velocity outputs • Advanced PC-based configuration	• 3/4"-16 UNF or M18 x 1.5 threads • Pressure rated to 8700 psi • Rugged, compact, stainless steel housing	• 3/4"-16 UNF or M18 x 1.5 threads • Pressure rated to 8700 psi • Welded, hermetically-sealed housing • Rated to IP69K

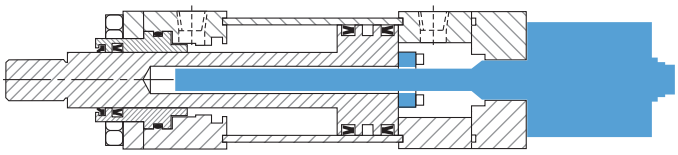
BALLUFF TRANSDUCERS

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″ Bores
- Gun-drilled piston rod (Requires 1″ piston rod or larger)
- Balluff Magnet (Installed on piston)
- May require additional cap length

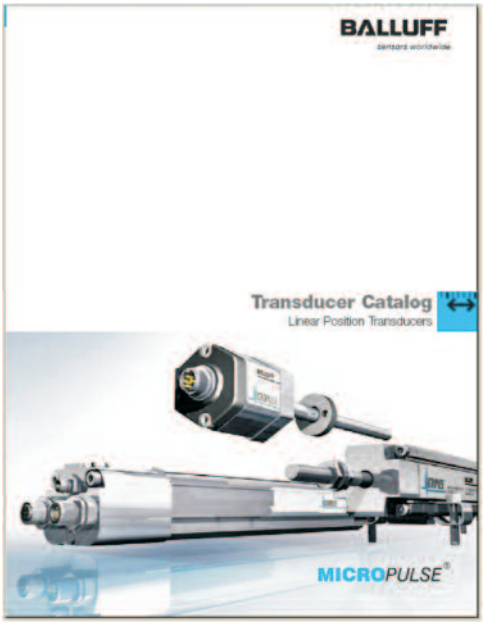
SERIES "Z" SHOWN

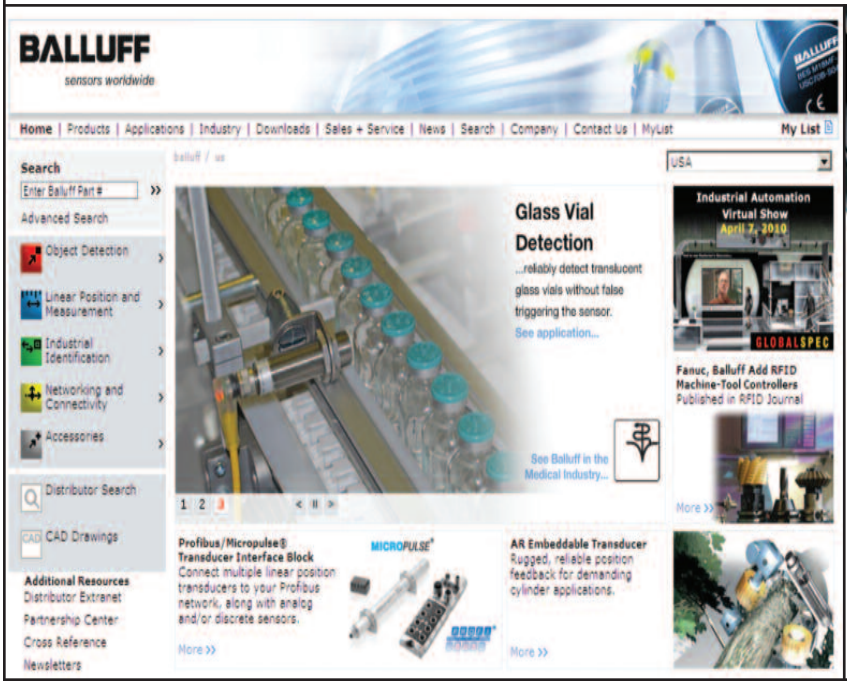


- Complete BALLUFF MICROPULSE™ Transducer information is available in catalog form or electronic PDF downloads.

  Visit www.balluff.com

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





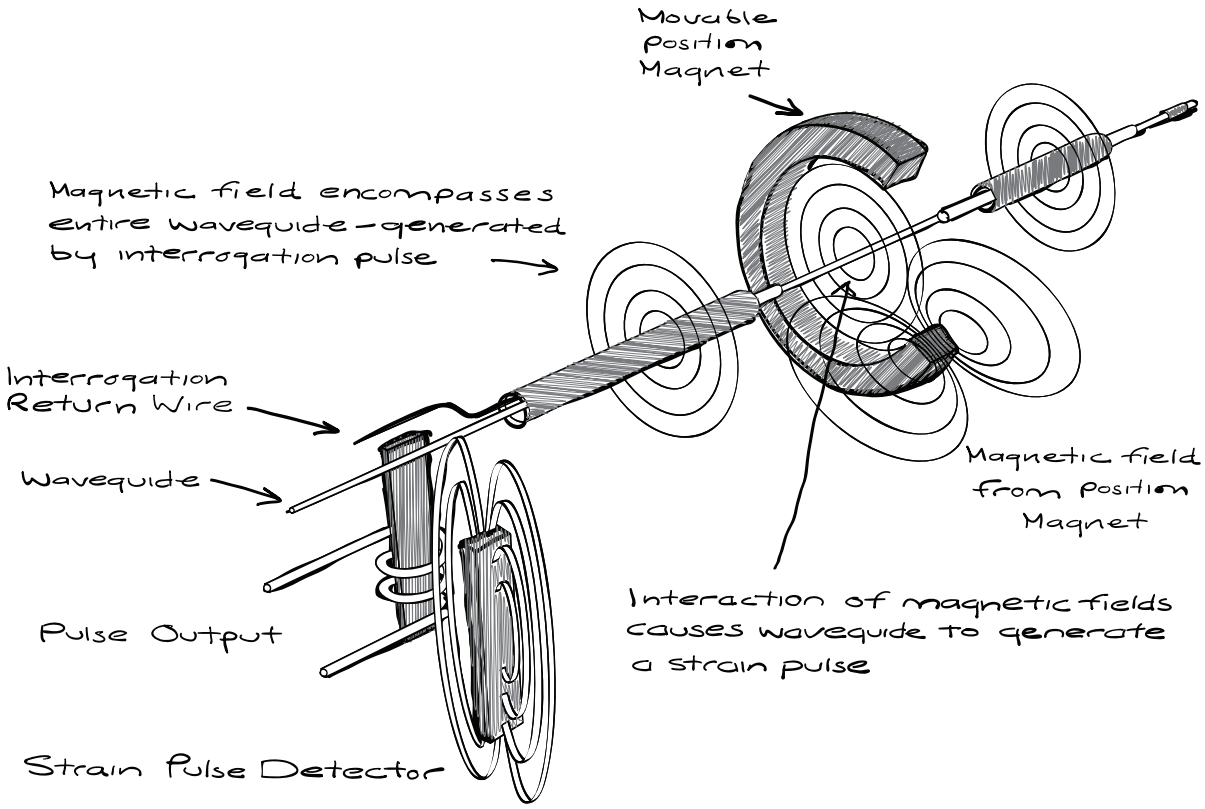
SERIES "Z" SHOWN

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 for detailed product information or call TRD for more information.

MAGNETOSTRICTIVE PRINCIPLE



Technology at its best

The best linear-position sensors provide absolute position measurement giving higher productivity and greater safety for machine and automation devices. MTS linear-position sensors outperform the competition, deliver accuracy and reliability under the most difficult conditions, providing excellent value for our customers. Our success is a result of 30 years of technology leadership, vertically integrated manufacturing processes and unsurpassed levels of customer support.

MTS Sensors was the first to realize the promising advantages for linear-position measurement contained in the magnetostrictive measuring principle developed by J. Tellermann. Tellerman's original design was used to develop Temposonics brand sensors: the first magnetostrictive position sensors, a technology that guarantees precision and reliability without equal.

Magnetostriction - how it works

The heart of MTS sensors is the ferromagnetic measuring element, also known as the waveguide, and a movable position magnet that generates a direct-axis magnetic field in the waveguide.

When a current or interrogation pulse passes through the waveguide, a second magnetic field is created radially around the waveguide. The interaction between the magnetic field in the waveguide and the magnetic field produced by the position magnet generates a strain pulse which travels at a constant ultrasonic speed from its point of generation, the measurement point, to the end of the waveguide where it is detected by the sensor electronics. The position of the magnet is determined with high precision and speed by accurately measuring the time elapsed between the application of the interrogation pulse and the arrival of the resulting strain pulse with a high speed counter. Using the elapsed time to determine position of the permanent magnet provides an absolute position reading that never needs recalibration or re-homing after a power loss. Non-contact sensing eliminates wear, and guarantees the best durability and output repeatability.

With our extensive know-how of ferromagnetic materials, magnetic effects and ultrasonic processes, MTS remains unrivaled in performance standards for non-contacting position measurement of the highest precision.

R-SERIES

A smart sensor for fast, high precision, and synchronized position control applications.

G-SERIES

Programmable sensors with built in diagnostics.

E-SERIES

Sensors designed for applications requiring simple and economical position feedback.

MTS® SENSORS

	H STYLE Hydraulic/pneumatic sensor housing with integral electronics	P STYLE Aluminum extrusion Profile sensor housing with integral electronics	F STYLE Flexible sensing element housing with integral electronics	H STYLE Hydraulic/pneumatic sensor housing with integral electronics	P STYLE Aluminum extrusion Profile sensor housing with integral electronics	P STYLE Aluminum extrusion profile sensor housing with integral electronics	R STYLE Profile sensors with "Rod and Cylinder" actuation and integral electronics	EP2 STYLE Aluminum extrusion Profile sensor housing with integral electronics
DIRECT SENSOR OUTPUTS	**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)	**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)	**Voltage 0 to +10V, +10 to 0V -10 to +10V, +10 to -10V** (1)	**Voltage 0 to +10V, +10 to 0V**	**Voltage 0 to +10V, +10 to 0V**	**Voltage 0 to +10V**
	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**	**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**	**Current 0 or 4 to 20 mA, 20 to 4 or 0 mA**	**Current 4 to 20 mA, 20 to 4 mA**	**Current 4 to 20 mA, 20 to 4 mA**	—
	SSI, Synchronous Serial Interface, (absolute encoder format)	**SSI, Synchronous Serial Interface, (absolute encoder format)**	**SSI, Synchronous Serial Interface, (absolute encoder format)**	—	—	—	—	—
	Fieldbus - CANbus (2)**, DeviceNet, Profibus DP**	**Fieldbus - CANbus** (2)**, DeviceNet, Profibus DP**	**Fieldbus - CANbus** (2)**, DeviceNet, Profibus DP**	—	—	—	—	—
				Digital Pulse Start/Stop or PWM	**Digital Pulse Start/Stop or PWM**	**Digital Pulse Start/Stop**	**Digital Pulse Start/Stop**	**Digital Pulse Start/Stop**
STROKE LENGTH	**50 to 7,620 mm (2 to 300 in.)**	**50 to 5,080 mm (2 to 200 in.)**	**250 to 10,060 mm (10 to 396 in.)** (3)	**Voltage or Current 50 to 2,540 mm (2 to 100 in.) Digital Pulse 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 5,080 mm (2 to 200 in.)**	**50 to 1,525 mm (2 to 60 in.)**	**75 to 1,525 mm (3 to 60 in.)** (4)	**4, 6, 9, 12, 15, 18, 21, 24, 30, 36, 42 48, 54, and 60 in.**
RESOLUTION	**16 bit, as low as 0.01 mm (0.0004 in.) (Analog)**	**16 bit, as low as 0.01 mm (0.0004 in.) (Analog)**	**16 bit, as low as 0.01 mm (0.0004 in.) (Analog)**	**Infinite** (6)	**Infinite** (6)	**Infinite** (6)	**Infinite** (6)	**Infinite** (6)
	as low as 0.002mm (0.00008 in.) (Digital) (5)	**as low as 0.002mm (0.00008 in.) (Digital)** (5)	**as low as 0.002mm (0.00008 in.) (Digital)** (5)	**Controller Dependent (Digital Pulse)**	**Controller Dependent (Digital Pulse)**	**Controller Dependent (Digital Pulse)**	**Controller Dependent (Digital Pulse)**	—
MEASUREMENT FEATURES	**Position / Displacement**	**Position / Displacement**	**Position / Displacement**	**Position / Displacement**	**Position / Displacement**	**Position / Displacement**	**Position / Displacement**	**Position / Displacement**
	Velocity	**Velocity**	**Velocity**	—	—	—	—	—
	Multiple magnets to 15	**Multiple magnets to 15**	**Multiple magnets to 15**	**Multiple magnets to 15**	**Multiple magnets to 15**	—	—	—
	Analog Zero and Span Scale Adjustment	**Analog Zero and Span Scale Adjustment**	**Analog Zero and Span Scale Adjustment**	**Analog Zero and Span Scale Adjustment**	**Analog Zero and Span Scale Adjustment**	—	—	—
EXTERNAL INTERFACES	—	—	—	**TDU-200 Digital Display (for digital pulse outputs)**	**TDU-200 Digital Display (for digital pulse outputs)**	**TDU-200 Digital Display (for digital pulse outputs)**	**TDU-200 Digital Display (for digital pulse outputs)**	—
	—	—	—	**MK-292 (Parallel 24 Bit Binary, BCD, or Gray Code)**	**MK-292 (Parallel 24 Bit Binary, BCD, or Gray Code)**	**MK-292 (Parallel 24 Bit Binary, BCD, or Gray Code)**	**MK-292 (Parallel 24 Bit Binary, BCD, or Gray Code)**	—

(1) Additional output ranges available.

(2) Includes CANOpen and MTS multiple-magnet position, velocity and programmable limit switch output.

(3) Consult factory for stroke lengths greater than 10,060 mm (396 in.).

(4) ER stroke length range is 75 to 1,500 mm (3 to 60 in.). Articulated or unsupported sensor applications (e.g. using dual rod ends), must be limited to a maximum of 750 mm (30 in.) stroke length.

(5) R-Series SSI available with 0.001mm (0.00004 in.) resolution.

(6) Analog (Voltage or Current) resolution restricted by output ripple.

Hydraulic/pneumatic "H Style"

- Sensing element pressure housing threads into standard size port on cylinder endcap.
- 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).

Profile "P Style"

- Extruded aluminum housing designed for convenient machine surface mounting.
- Ideal for precision sensing external to fluid power cylinders.
- Guided or "floating" position magnets Single or multiple magnet operation.

Flexible "F Style"

- Durable sensing element flexible to an 8 inch minimum bend radius
- Ideal for position measurement along an arc Stroke lengths from 10 to 396 inches (consult factory for longer lengths)
- Convenient packaging and shipping for long stroke lengths
- Facilitates use of long sensors in applications with limited installation space

Rod and Cylinder "R Style"

- Rod actuated position feedback in an extruded aluminum cylinder housing
- Reliable alternative to linear potentiometers
- Provides mounting alternative for articulated motion
- Eliminates need for complex mounting mechanisms
- Dust, debris and moisture tolerant

EASY FLIP OUT PAGE FOR REFERENCE

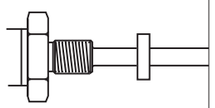
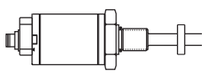
SELECT BY APPLICATION MECHANICS OUTSIDE CYLINDER

APPLICATION HOUSING		ELECTRONIC INTERFACE	SENSOR MODEL	STROKE RANGE
FLOATING MAGNET ▸ Ideal for: • Flange mounted magnets • Single or multiple magnets • Zero backlash • Dirty environments		Analog or Digital Pulse	EP2 EPM	2-60 in.
			GP M	2-200 in.
		Digital Serial (SSI) Fieldbus Analog with Position and Velocity	RP M	2-200 in.
CAPTIVE SLIDING MAGNET ▸ Ideal for: • Situations where flange mounting the magnet is impractical • Simplifying guidance mechanism for the magnet		Analog or Digital Pulse	EPS EPV	2-60 in.
			GPS GPV	2-200 in.
		Digital Serial (SSI) Fieldbus Analog with Position and Velocity	RPS RPV	2-200 in.
ROD AND CYLINDER ▸ Ideal for: • Articulated motion using rod-end attachments • Dirty environments • Linear potentiometer upgrades		Analog or Digital Pulse	ER	3-60 in.*
FLEXIBLE SENSING ELEMENT ▸ Ideal for: • Curvilinear positioning • Short installation heights • Long stroke sensing (>300") • Single or multiple magnets		Digital Serial (SSI) Fieldbus Analog with Position and Velocity	RF	10-396 in.**

* Articulated or unsupported sensor applications must be limited to a maximum of 30 in. stroke length

** Consult factory for stroke lengths >396 in.

SELECT BY APPLICATION MECHANICS INSIDE CYLINDER

FLANGE TYPE	ELECTRONICS HOUSING	ELECTRONIC INTERFACE	SENSOR MODEL	STROKE RANGE
Threaded ▸ Ideal for installation from outside cylinder 	**Standard** ▸ • Integral Electronics • IP67 Housing • Easy sensor cartridge replacement w/o breaking the hydraulic seal 	Analog or Digital Pulse	GH	2-300 in.
		Digital Serial (SSI) Fieldbus Analog with Position and Velocity	RH	2-300 in.

SELECT BY APPLICATION ELECTRONICS

OUTPUT VARIABLES	ELECTRONIC INTERFACE	MODEL SERIES	STROKE RANGE	MODEL NOTES
SINGLE POSITION ▸	Analog	E Series	Profile 2-60 in.	
		G Series	Rod 2-100 in. Profile 2-100 in.	100% Null & Span Adjust
	Digital Pulse	E Series	Profile 2-60 in.	
		G Series	Rod 2-300 in. Profile 2-200 in.	Programmable PWM Parameters
	Digital Serial (SSI)	R Series	Rod 2-300 in. Profile 2-200 in. Flex 10-396 in.*	Software Programmable
	Fieldbus	R Series	Rod 2-300 in. Profile 2-200 in. Flex 10-396 in.*	Software Programmable
POSITION + VELOCITY ▸	Analog	R Series	Rod 2-300 in. Profile 2-200 in. Flex 10-396 in.*	100% Null & Span Adjust
	Fieldbus	R Series	Rod 2-300 in. Profile 2-200 in. Flex 10-396 in.*	CANbus and Profibus only
MULTIPLE POSITION MAGNETS ▸	Analog	R Series	Rod 2-300 in. Profile 2-200 in. Flex 10-396 in.*	100% Null & Span Adjust. Up to two magnets
	Digital Pulse	G Series	Rod 2-300 in. Profile 2-200 in.	Start/Stop only. Max. 15 magnets
	Fieldbus	R Series	Rod 2-300 in. Profile 2-200 in. Flex 10-396 in.*	CANbus and Profibus only. Consult Factory for > 15 magnets

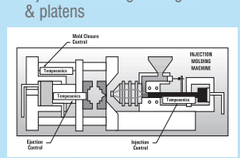
* Consult Factory for stroke lengths >396 in.

TYPICAL APPLICATION MECHANICS: OUTSIDE CYLINDER

FLOATING MAGNET
Positioning for:
- Shearing and forming
- Paper & film slitters
- Die casting machines

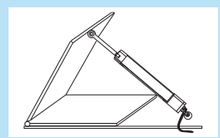

Paper Slitter

CAPTIVE SLIDING MAGNET
Positioning for:
- Presses
- Injection molding carriages & platens

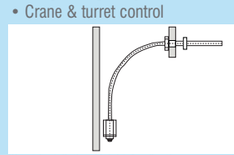


Injection Molding

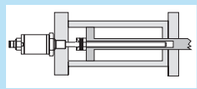
ROD AND CYLINDER
Positioning for:
- Wood & metal finishing
- Packaging machinery
- Doors and gates


Hood Door Positioning

FLEXIBLE SENSING ELEMENT
Positioning for:
- Paper & film converting
- Long dam-gate cylinders
- Crane & turret control

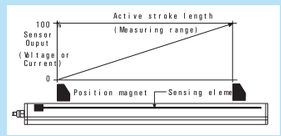

Short Installation Height Application

IN-CYLINDER STANDARD THREADED HOUSING
Used for:
- Hydraulic or pneumatic flange or trunion mounted cylinders
- Rugged externally mounted IP67 housing

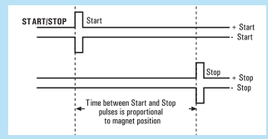


ELECTRONIC OUTPUT OPTIONS

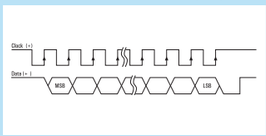
ANALOG
Voltage and Current



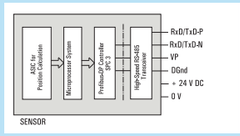
DIGITAL PULSE
PWM & Start/Stop



DIGITAL SERIAL
Synchronous Serial Interface (SSI)



FIELDBUS
CANbus, DeviceNet & Profibus



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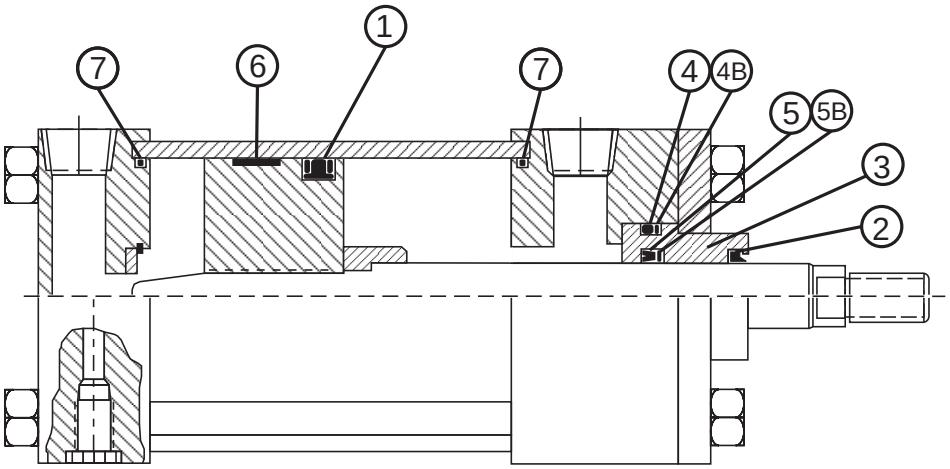
SERIES 'MH' PART LIST & SEAL KITS



(1) PISTON SEALS				
Bore	(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)	Metalic Scrapper (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)	Metalic Scrapper (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-V
1.000	HH-BU-RS-1000-PM	HH-BU-RS-1000-V
1.375	HH-BU-RS-1375-PM	HH-BU-RS-1375-V
1.750	HH-BU-RS-1750-PM	HH-BU-RS-1750-V
2.000	HH-BU-RS-2000-PM	HH-BU-RS-2000-V
2.500	HH-BU-RS-2500-PM	HH-BU-RS-2500-V
3.000	HH-BU-RS-3000-PM	HH-BU-RS-3000-V
3.500	HH-BU-RS-3500-PM	HH-BU-RS-3500-V
4.000	HH-BU-RS-4000-PM	HH-BU-RS-4000-V
4.500	HH-BU-RS-4500-PM	HH-BU-RS-4500-V
5.000	HH-BU-RS-5000-PM	HH-BU-RS-5000-V
5.500	HH-BU-RS-5500-PM	HH-BU-RS-5500-V

SERIES 'MH' PART LIST & SEAL KITS

(2) PART LIST - ROD WIPER					
Rod Diameter	Flocked Nitrile (Standard)	Fluorocarbon (V option)	Ethylene Propylene (E option)	Metalic 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 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	
MH - SK	MH Series Seal Kit

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.

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

PISTON SEALS	
S	STANDARD (Carboxilated)
C	Cast-Ring
E	EP
T	PTFE
V	Fluorocarbon

ROD SEALS	
S	STANDARD (Polyurethane)
E	EP
V	Fluorocarbon

TUBE SEALS	
S	STANDARD (Buna)
E	EP
V	Fluorocarbon

ROD WIPER *	
S	STANDARD (Flocked Nitrile)
M	Metalic Scrapper
T	PTFE
V	Fluorocarbon

***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

TECHNICAL DATA

'MH' SERIES CYLINDER FORCE CHART*

BORE	ROD DIA. (MM)	EFFECTIVE PISTON AREA	POUNDS OF FORCE AT PSI													DISPLACEMENT PER INCH OF STROKE (GALLONS)
			250	350	440	500	550	630	675	750	830	980	1000	1300	1500	
1.50	EXTEND	1.767	442	618	777	884	972	1113	1193	1325	1467	1732	1767	2297	2651	0.00765
	0.625	1.460	365	511	642	730	803	920	986	1095	1212	1431	1460	1898	2190	0.00635
	1.000	0.982	246	344	432	491	540	619	663	737	815	962	982	1277	1473	0.00425
2.00	EXTEND	3.142	786	1100	1382	1571	1728	1979	2121	2357	2608	3079	3142	4085	4713	0.0136
	0.625	2.835	709	992	1247	1418	1559	1786	1914	2126	2353	2778	2835	3686	4253	0.0123
	1.000	2.357	589	825	1037	1179	1296	1485	1591	1768	1956	2310	2357	3064	3536	0.0102
	1.375	1.657	414	580	729	829	911	1044	1118	1243	1375	1624	1657	2154	2486	0.0071
2.50	EXTEND	4.909	1227	1718	2160	2455	2700	3093	3314	3682	4074	4811	4909	6382	7364	0.0213
	0.625	4.602	1151	1611	2025	2301	2531	2899	3106	3452	3820	4510	4602	5983	6903	0.0200
	1.000	4.124	1031	1443	1815	2062	2268	2598	2784	3093	3423	4042	4124	5361	6186	0.0179
	1.375	3.424	856	1198	1507	1712	1883	2157	2311	2568	2842	3356	3424	4451	5136	0.0148
	1.750	2.504	626	876	1102	1252	1377	1578	1690	1878	2078	2454	2504	3255	3756	0.0109
3.25	EXTEND	8.296	2074	2904	3650	4148	4563	5226	5600	6222	6886	8130	8296	10785	12444	0.0359
	1.000	7.511	1878	2629	3305	3756	4131	4732	5070	5633	6234	7361	7511	9764	11267	0.0325
	1.375	6.811	1703	2384	2997	3406	3746	4291	4597	5108	5653	6675	6811	8854	10217	0.0294
	1.750	5.891	1473	2062	2592	2946	3240	3711	3976	4418	4890	5773	5891	7658	8837	0.0255
	2.000	5.154	1289	1804	2268	2577	2835	3247	3479	3866	4278	5051	5154	6700	7731	0.0223
4.00	EXTEND	12.566	3142	4398	5529	6283	6911	7917	8482	9425	10430	12315	12566	16336	18849	0.0544
	1.000	11.781	2945	4123	5184	5891	6480	7422	7952	8836	9778	11545	11781	15315	17672	0.0510
	1.375	11.081	2770	3878	4876	5541	6095	6981	7480	8311	9197	10859	11081	14405	16622	0.0479
	1.750	10.161	2540	3556	4471	5081	5589	6401	6859	7621	8434	9958	10161	13209	15242	0.0440
	2.000	9.424	2356	3298	4147	4712	5183	5937	6361	7068	7822	9236	9424	12251	14136	0.0408
	2.500	7.657	1914	2680	3369	3829	4211	4824	5168	5743	6355	7504	7657	9954	11486	0.0331
5.00	EXTEND	19.635	4909	6872	8639	9818	10799	12370	13254	14726	16297	19242	19635	25526	29453	0.0850
	1.000	18.850	4713	6598	8294	9425	10368	11876	12724	14138	15646	18473	18850	24505	28275	0.0816
	1.375	18.150	4538	6353	7986	9075	9983	11435	12251	13613	15065	17787	18150	23595	27225	0.0785
	1.750	17.230	4308	6031	7581	8615	9477	10855	11630	12923	14301	16885	17230	22399	25845	0.0746
	2.000	16.493	4123	5773	7257	8247	9071	10391	11133	12370	13689	16163	16493	21441	24740	0.0714
	2.500	14.726	3682	5154	6479	7363	8099	9277	9940	11045	12223	14431	14726	19144	22089	0.0637
	3.000	12.566	3142	4398	5529	6283	6911	7917	8482	9425	10430	12315	12566	16336	18849	0.0544
	3.500	10.014	2504	3505	4406	5007	5508	6309	6759	7511	8312	9814	10014	13018	15021	0.0434
6.00	EXTEND	28.274	7069	9896	12441	14137	15551	17813	19085	21206	23467	27709	28274	36756	42411	0.1224
	1.375	26.789	6697	9376	11787	13395	14734	16877	18083	20092	22235	26253	26789	34826	40184	0.1159
	1.750	25.869	6467	9054	11382	12935	14228	16297	17462	19402	21471	25352	25869	33630	38804	0.0112
	2.000	25.132	6283	8796	11058	12566	13823	15833	16964	18849	20860	24629	25132	32672	37698	0.1088
	2.500	23.365	5841	8178	10281	11683	12851	14720	15771	17524	19393	22898	23365	30375	35048	0.1011
	3.000	21.205	5301	7422	9330	10603	11663	13359	14313	15904	17600	20781	21205	27567	31808	0.0918
	3.500	18.653	4663	6529	8207	9327	10259	11751	12591	13990	15482	18280	18653	24249	27980	0.0808
	4.000	15.708	3927	5498	6912	7854	8639	9896	10603	11781	13038	15394	15708	20420	23562	0.0680
8.00	EXTEND	50.265	12566	17593	22117	25133	27646	31667	33929	37699	41720	49260	50265	65345	75398	0.2176
	1.375	48.780	12195	17073	21463	24390	26829	30731	32927	36585	40487	47804	48780	63414	73170	0.2111
	1.750	47.860	11965	16751	21058	23930	26323	30152	32306	35895	39724	46903	47860	62218	71790	0.2072
	2.000	47.123	11781	16493	20734	23562	25918	29687	31808	35342	39112	46181	47123	61260	70685	0.2040
	2.500	45.356	11339	15875	19957	22678	24946	28574	30615	34017	37645	44449	45356	58963	68034	0.1963
	3.000	43.196	10799	15119	19006	21598	23758	27213	29157	32397	35853	42332	43196	56155	64794	0.1870
	3.500	40.644	10161	14225	17883	20322	22354	25606	27435	30483	33735	39831	40644	52837	60966	0.1760
	4.000	37.699	9425	13195	16588	18850	20734	23750	25447	28274	31290	36945	37699	49009	56549	0.1632
	4.500	34.361	8590	12026	15119	17181	18899	21647	23194	25771	28520	33674	34361	44669	51542	0.1488
	5.000	30.630	7658	10721	13477	15315	16847	19297	20675	22973	25423	30017	30630	39819	45945	0.1326
	5.500	26.507	6627	9277	11663	13254	14579	16699	17892	19880	22001	25977	26507	34459	39761	0.1148

*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)
.250-28	7 FT-LBS
.312-24	12 FT-LBS
.375-24	30 FT-LBS
.500-20	50 FT-LBS
.625-18	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
.250-28	15 FT-LBS
.312-24	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%

TECHNICAL DATA

'TAS' SERIES CYLINDER FORCE CHART*

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	.25-28	7 FT-LBS
2.00	.31-24	12 FT-LBS
2.50	.31-24	14 FT-LBS
3.25	.38-24	30 FT-LBS
4.00	.38-24	35 FT-LBS
5.00	.50-20	45 FT-LBS
6.00	.50-20	50 FT-LBS
8.00	.63-18	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	.25-28	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.

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

All weights are in pounds. **Note:** Add 20% to mount and stroke weight for double rod end cylinders. Add 1% for cushions.

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	—	—	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	—	—	—	—	—	—	—	—	—	—	—	—

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	POLYURE'NE
Water-Glycol	1		Houghto-Safe 600 Series	red	R	R	R	R	R	S	S	R	U
	1		Houghto-Safe 500 Series	red	R	R	R	R	R	S	S	R	U
	1	MIL-H22072	Houghto-Safe 271	red	R	R	R	R	R	S	S	—	U
	4		Ucon Hydrolube	yel. or red	R	R	R	R	R	R/S	S	R	U
	4		Ucon M1	yellow	R	R	R	R	R	S	S	S	U
	5		Celluguard	red	R	R	R	R	R	S	S	—	U
	10		Safety Fluid 200	bright pink	R	R	R	R	R	S	S	—	U
Water/Oil	1		Houghto-Safe 5000 Series	white	R	U	R	U	R	—	S	U	U
Emulsion	3		FR	creamy	R	U	R	U	R	—	S	U	U
	7		Irus 902	yellow	R	U	R	U	R	U	S	U	M
	8		Pyrogard C & D	pale yellow	R	U	R	U	R	—	S	U	U
Water-Soluble Oil	—		—	milky	R	M	R	—	R	—	S	S	M/U
Water-Fresh	—		—	—	R	R	R	R	R	R	M	R	M/U
Water-Salt	—		—	—	R	R	R	R	R	R	M	R	M/U
Phosphate Ester	1		Houghto-Safe 1000 Series	green	U	R	M/U	R	R	M	U	U	M
	1	MIL-H-19547B	Houghto-Safe 1120	green	U	R	M/U	R	R	M	U	U	M
	2		Pydraul F-9, 150, 625	cloudy bl.	U	R/S	M/U	S	R	R	U	U	S
	5		Fyrquel	lt. green	U	R	M/U	R	R	M	U	U	M
	7		Shell SRF B.C.D.	aqua gr.	U	R	M/U	R	R	M	U	U	M
	8		Pyrogard 42, 43, 53, 55, 190, 600	pale yel.	U	R	M/U	R	R/S	M	U	U	M
	2		Skydrol 500B	purple	U	S	U	R	U	M	U	U	U
	2		Skydrol 7000	green	U	S	U	R	U	M	U	U	U
	2		Pydraul 312, 135 (2)	blue gr.	U	M	M	M	R	R	U	U	—
	2		Pydraul AC	cloudy bl.	U	S	M/U	S	R	R	U	U	M/U
	2		Pydraul 60	cloudy bl.	U	R	M/U	R	U	S	U	U	M/U
	8		Pydraul 210 (3)	yellow	U	M	—	M	R	R	U	U	M/U
Diester	—	MIL-H-7808	Lube Oil-Aircraft	amber	S	U	R	U	R	U	U	U	U
Clorinat. Hydrocarb	2		Aroclor 1200 Series 1	clear	M	S	—	S	R	S	U	U	U
	2		Pydraul A-200	cloudy bl.	U	M	M	M	R	R	U	U	M/U
Silicate Ester	2		OS-45 Type 4	clear	S	U	—	S	R	U	R	U	R
	6	MILO-8200	Oronite 8200	clear	S	U	—	U	R	U	R	U	R
	6	MIL-8515	Oronite 8515	clear	S	U	—	U	R	U	R	U	R
	9	MIL-H-8446B	Brayco 846	red brown	S	U	—	U	R	U	R	U	R
Kerosene	—			clear	R	U	R	U	R	U	M/U	U	R
Jet Fuel	—	MIL-J-5624	JP-3, 4, 5 (RP-1)	lt. straw	R	U	R	U	R	U	U	U	S
Diesel Fuel	—	—	—	clear	R	U	R	U	R	U	M/U	U	R
Gasoline	—	—	Gasoline	various	R	U	R/S	U	R	U	U	U	R
Petroleum Base	—	MIL-H-6083	Preservative Oil	red	R	U	R	U	R	U	R	S	R
Petroleum Base	—	MIL-H-5606	Aircraft Hyd. Fluid	red	R	U	R	U	R	U	S	U	R

Notes: (1) Halogenated
(2) Petroleum and halogenated hydrocarbon and phosphate ester mixture
(3) Chlorinated phosphate ester

Manufacturer's Code Numbers

No.	Manufacturer
1.	E.F. Houghton
2.	Monsanto
3.	Gulf
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	CHLOROSULPHONATED POLYETHYLEN	ETHYLENE PROPYLENE	FLUOROCARBON	FLUOROSILICONE	NATURAL	POLYCHLOROPRENE	NITRILE	POLYACRYLIC	POLYSULPHIDE	POLYURETHANE	SILICONE	EPICHLOROHYDRIN	POLYMIDE	POLYTETRAFLUOROETHYLENE
SYMBOL	**SBR**	**IIR**	**TFE**	**CSM**	**EPM**	**FPM**	**FSI**	**NR**	**CR**	**NBR**	**ACM**	**TR**	**AU-EU**	**SI**	**ECD**	
UPPER TEMP. LIMIT °F	194	500	212	248	284	347	392	176	230	266	320	221	212	392	284	896
LOWER TEMP. LIMIT °F	-58	-148	-22	-4	-49	5	-76	-76	-40	-49	-4	-67	-58	-76	-40	-400
ABRASION RESISTANCE	S	U	M	R	•	S	•	R	R	S	•	•	R	•	S	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 MFGR.

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

F°	C°	F°	C°
-30	-34.4	130	54.4
-20	-28.9	140	60.0
-10	-23.3	150	65.6
0	-17.8	160	71.1
10	-12.2	170	76.7
20	-6.7	180	82.2
30	-1.1	190	87.8
40	4.4	200	93.3
50	10.0	210	98.9
60	15.6	220	104.4
70	21.1	230	110.0
80	26.7	240	115.6
90	32.2	250	121.1
100	37.8	300	148.9
110	43.3	350	176.7
120	48.9	400	204.4

C° = (F° - 32) ÷ 1.8

CELSIUS TO FAHRENHEIT CONVERSION

C°	F°	C°	F°
-30	-22	65	149
-20	-4	70	158
-10	14	75	167
0	32	80	176
5	41	85	185
10	50	90	194
15	59	95	203
20	68	100	212
25	77	105	221
30	86	110	230
35	95	115	239
40	104	120	248
45	113	125	257
50	122	130	266
55	131	150	302
60	140	200	392

F° = C° x 1.8 + 32

PRESSURE CONVERSIONS

PSI	KG/CM²	BARS	KG/CM²	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/cm² = PSI x .0703
Bars = PSI x .0689

PSI = Kg/cm² x 14.22
Bars = Kg/cm² 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	1778.00	130	51.2
75	190.5	1905.0	140	55.2
80	203.2	2032.0	150	59.1
85	215.9	2159.0	160	63.0
90	228.6	2286.0	170	67.0
95	241.3	2413.0	180	70.9
100	254.0	2540.0	190	74.9
—	—	—	200	78.8
—	—	—	210	82.7
—	—	—	220	86.7
—	—	—	230	90.6
—	—	—	240	94.6
—	—	—	250	98.5
—	—	—	260	102.4

cm = in. x 2.54 mm = in. x 25.4 in. = cm x .394

TECHNICAL DATA

COMMON FLUID POWER FORMULAS

PROPERTY	WORD FORMULA	MATHEMATIC EQUATION
FLUID PRESSURE psi (Pounds per Square Inch)	$\text{Pressure} = \frac{\text{Force (lbs)}}{\text{Area (in}^2\text{)}}$	$P = \frac{F}{A}$
CYLINDER AREA EXTEND in^2 (Square Inches)	$\text{Area} = \frac{\pi}{A4} \times \text{Diameter}^2 \text{ (inches)}$	$A = .7854\ D^2$
CYLINDER AREA RETRACT in^2 (Square Inches)	$\text{Area} = (\frac{\pi}{A4} \times \text{Bore Diameter}^2) - (\frac{\pi}{A4} \times \text{Rod Diameter}^2)$	$A = (.7854\ D_b^2) - (.7854\ D_r^2)$
CYLINDER FORCE lbs. (Pounds of Force)	Force = Pressure (psi) x Net Area (in^2)	$F = PA$
CYLINDER VELOCITY ft/s (Feet per Second)	$\text{Velocity} = \frac{231 \times \text{Flow Rate (GPM)}}{12 \times 60 \times \text{Net Area (in}^2\text{)}}$	$v = \frac{.3208\ Q}{A}$
CYLINDER VOLUME G (Gallons of Fluid)	$\text{Volume} = \frac{\text{Net Area (in}^2\text{)} \times \text{Stroke (in)}}{231}$	$V = \frac{A\ L}{231}$
CYLINDER FLOW RATE GPM (Gallons per Minute)	$\text{Flow Rate} = \frac{12 \times 60 \times \text{Velocity (ft/s)} \times \text{Net Area (in}^2\text{)}}{231}$	$Q = 3.117\ v\ A$
CYLINDER POWER hp (Horsepower)	$\text{Horsepower} = \frac{\text{Pressure (psi)} \times \text{Flow Rate (GPM)}}{1714}$	$hp = \frac{P\ Q}{1714}$
FLUID MOTOR TORQUE lb-in (Inch Pounds)	$\text{Torque} = \frac{\text{Pressure (psi)} \times \text{F.M. Displacement (in}^3\text{/rev.)}}{2\pi}$	$T = \frac{P\ d}{2\pi}$
	$\text{Torque} = \frac{\text{Horsepower} \times 63025}{\text{RPM}}$	$T = \frac{63025\ hp}{n}$
	$\text{Torque} = \frac{\text{Flow Rate (GPM)} \times \text{Pressure (psi)} \times 36.77}{\text{RPM}}$	$T = \frac{36.77\ Q\ P}{N}$
FLUID MOTOR SPEED RPM (Revolutions per Minute)	$\text{Speed} = \frac{231 \times \text{Flow Rate (GPM)}}{\text{F.M. Displacement (in}^3\text{/rev.)}}$	$n = \frac{231\ Q}{d}$
FLUID MOTOR POWER hp (Horsepower)	$\text{Horsepower} = \frac{\text{Torque (lbs-in)} \times \text{RPM}}{63025}$	$hp = \frac{T\ n}{63025}$
PUMP OUTLET FLOW GPM (Gallons per Minute)	$\text{Flow} = \frac{\text{RPM} \times \text{Pump Displacement (in}^3\text{/rev.)}}{231}$	$Q = \frac{n\ d}{231}$
FLOW RATE THROUGH PIPING ft/s Velocity (Feet per Second)	$\text{Velocity} = \frac{.3208 \times \text{Flow Rate Through I.D. (GPM)}}{\text{Internal Area (in}^2\text{)}}$	$v = \frac{.3208\ Q}{A}$
TORQUE REQUIREMENT lb-in (Inch Pounds)	Torque = Lever Length (in.) x Pull (lbs.)	$T = L \times F$

TECHNICAL DATA: 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)

DISTRIBUTOR INFORMATION

Distributor: _____ Branch Office: _____ Contact: _____

How do you want to be contacted?

Phone: _____ Fax: _____ E-Mail: _____

CUSTOMER INFORMATION

Customer: _____ Contact: _____

How do you want to be contacted?

Phone: _____ Fax: _____ E-Mail: _____

APPLICATION INFORMATION

Do you have a basic cylinder description?

Bore: _____ Stroke: _____ Mount: _____ Options: _____

Modification: _____

Cylinder Operating Pressure: ❑ Pneumatic _____ PSI ❑ Hydraulic _____ PSI (Non-Shock)

Ambient Temperature: ❑ Normal Indoor Industrial ❑ Cold: _____ °F ❑ Hot: _____ °F

Cylinder Velocity: _____ inches/second Cycles per Minute: _____

Cylinder Orientation: ❑ Horizontal ❑ Vertical: ❑ Rod Up ❑ Rod Down ❑ Angle: _____ (Degrees)

Describe the load (including weight). Is the load guided? How is the cylinder rod attached to the load? Any side load?

_____

_____

_____

_____

Application: _____

_____

_____

_____

_____

Sketch:
(include dimensions)

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- 1.5″ thru 12″ Bores
- Strokes up to 120 inches
- Permanent Lubrication

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NFPA Stainless Steel Cylinders
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- Permanent Lubrication

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- 1.5″ thru 8″ Bores
- Strokes up to 24 inches
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- Permanent Lubrication

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- 1.50″ thru 6″ Bores
- Strokes up to 120 inches
- Permanent Lubrication

Series: FM, RL

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TRD-RL-1008

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- Permanent Lubrication
- Positioning Systems

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- 32mm thru 100mm Bores
- Strokes up to 2800mm
- Permanent Lubrication

Series: AB

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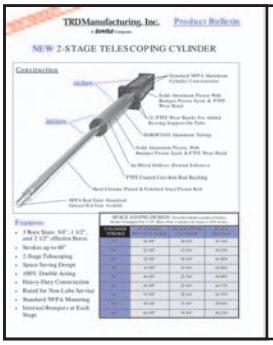
CAT-ISO-1006



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- Permanent Lubrication

Series: TC

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- 1.2 ton to 5 ton
- Strokes up to 6 inches
- Permanent Lubrication

Series: BTP

Request Catalog:
TRD-BTP-0905

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HH (HEAVY-DUTY INDUSTRIAL HYDRAULIC)	2-3 DAYS
TAS (HEAVY-DUTY INDUSTRIAL PNEUMATIC - 250 PSI AIR)	2-3 DAYS
TA (ALUMINUM - 250 PSI AIR)	2-3 DAYS
TD (ALUMINUM - 250 PSI AIR)	2-3 DAYS
TRA (ALUMINUM - TRIPLE ROD)	2-3 DAYS
FM (ALUMINUM - FLUSH MOUNT) WITH ROD LOCK	2-3 DAYS
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3-POSITION (ALUMINUM - 250 PSI AIR)	2-3 DAYS
TANDEM (ALUMINUM - 250 PSI AIR OR 400 PSI HYD.)	2-3 DAYS
MSE/MSR (ALUMINUM - MULTI-STAGE)	2-3 DAYS
AIR BOOSTERS	2-3 DAYS
AIR/OIL TANKS	2-3 DAYS
TRD SWITCHES (R10, R10P, RAC, RHT, MSS)	1 DAY
BALLUFF STROKEMASTER / MICROPULSE	5-7 DAYS
ROD CLEVIS, PINS, MOUNTS	1 DAY
ALIGNMENT COUPLERS	1 DAY
SS (STAINLESS STEEL) WELDED MOUNTS	3-5 DAYS, ALL OTHERS 2-3 DAYS
SS-MS (STAINLESS STEEL - MULTI-STAGE)	3-5 DAYS

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