

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

Note: Full quality finish is removable to service for bushing

Single Rod End Page 8

Double Rod End Page 27



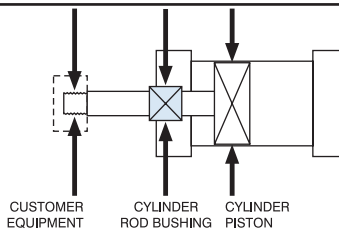
95% OF OUR CYLINDERS SHIP IN 2-3 DAYS!
ONE DAY RUSH SERVICE AVAILABLE ON ALL CATALOGED CYLINDER MODELS!

SERIES 'HH' (NFPA) CYLINDER

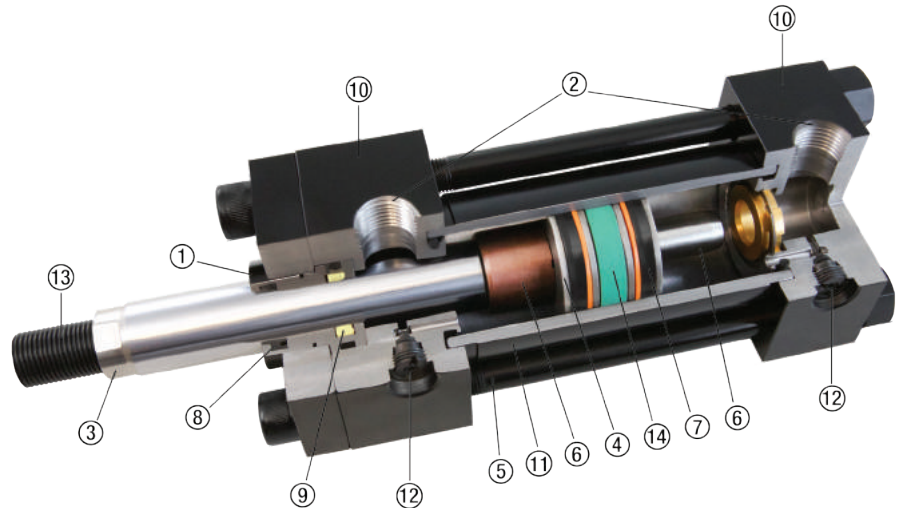
Floating Rod Bushing

SELF ALIGNMENT FEATURE

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



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



HEAVY-DUTY DESIGN FOR RELIABLE, CONSISTENT OPERATION

- 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 5 1/2" rod).
 - ④ **PISTON** – Precision machined ductile iron provides high strength and an excellent bearing surface for extended cylinder life.
PISTON LOCK SCREW (PLS) – Former option but now standard on all hydraulic cylinders. 100% securely fastened to piston rod by thread lock, Dutch (Skotch) key and staking.
 - ⑤ **TIE RODS** – Pre-stressed, high carbon steel tie rod construction eliminates axial loading of cylinder tube and maintains compression on tube (100K min. yield).
 - ⑥ **CUSHION** – Precision machined cushions are available at either end and provide smooth deceleration, which helps reduce end of stroke shock.
 - ⑦ **PISTON SEALS** – Heavy lip design, Carboxylated Nitrile seals with back-up rings are pressure activated and wear compensating for extended life. Cast ring, EP, PTFE and fluorocarbon designs available.
 - ⑧ **ROD WIPER** – Flocked nitrile wiper removes contaminants on retract stroke, helping ensure 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 ensure 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 .625" - 2.00" rods (125K min. yield). Available up to two times standard "A" thread length.
 - ⑭ **WEAR BAND** – Wear Guard Nylon (standard); reinforced PTFE for E and V seal option.
- FINISH** – Black urethane paint.

OPERATING PRESSURE

3000 PSI HYD (207 BAR)
Refer to mount section for specific PSI rating 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:

- **RLH** – Rod locks are used to hold linear cylinder loads stationary in any mounting orientation during power off condition (see pages 41-46 for more information).
- **ST** – Stop tubes are used to reduce rod bearing and piston stress (refer to page 53 for cylinder design guidance).
- **CS** – Center Supports are recommended for cylinders with long strokes in horizontal applications to prevent buckling of the cylinder and extend cylinder life.
- **SSR** – 17-4 Chrome Plated Stainless Steel Piston Rod provide corrosion resistance in outdoor applications and wet environments (100K min. yield up to 5" rod; 75K min. yield 5 1/2" rod).

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

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

SERIES HH HEAVY DUTY HYDRAULIC	STYLE (BLANK) SINGLE ROD D DOUBLE ROD	STROKE 0" to 120" Made to Order. (Use decimals for fractional strokes)	ROD SIZE 062 0.625" ROD DIA. 100 1.000" ROD DIA. 137 1.375" ROD DIA. 175 1.750" ROD DIA. 200 2.000" ROD DIA. 250 2.500" ROD DIA. 300 3.000" ROD DIA. 350 3.500" ROD DIA. 400 4.000" ROD DIA. 450 4.500" ROD DIA. 500 5.000" ROD DIA. 550 5.500" ROD DIA.	PORT LOC P 1 2 3 4 5 6 7 8 9 Call out 'P' followed by all desired locations.	PORT SIZE N062 1/16" NPTF N125 1/8" NPTF N250 1/4" NPTF N375 3/8" NPTF N500 1/2" NPTF N750 3/4" NPTF N1000 1" NPTF N1500 1 1/2" NPTF S2 #2 SAE S3 #3 SAE S4 #4 SAE S5 #5 SAE S6 #6 SAE S8 #8 SAE S10 #10 SAE S12 #12 SAE S16 #16 SAE S24 #24 SAE	SEALS See Below for Seal Ordering Instructions	OPTIONS A= EXTENDED PISTON ROD THREAD (EXAMPLE: A = 2") (MAX = 2 TIMES STD "A" DIM.) ABP= AIR BLEED PORTS (EXAMPLE: ABP=15) AS= ADJUSTABLE STROKE - RETRACT (SPECIFY LENGTH, EXAMPLE: AS = 4") C= EXTENDED PISTON ROD (EXAMPLE: IF C = 0.50", THEN 1" ROD EXTENSION IS C = 1.50") CS CENTER SUPPORT DDB= DRAIN BACK BUSHING (EXAMPLE: DDB=1) EK EXTENDED KEY PLATE HLP HIGH LOAD PISTON HSS HIGH SHOCK SEALS LRB LIFT RING BOSS NR NON-ROTATING RBB ROD BUSHING MATERIAL: BRONZE RLH "ROD LOCK READY" CYLINDER RLH= ROD LOCK MODEL NUMBER (EXAMPLE: RLH=1002501000) SSR STAINLESS STEEL PISTON ROD STOP TUBE NOTE: SPECIFY STOP TUBE LENGTH (IN INCHES) SPECIFY STROKE AS ES (EFFECTIVE STROKE) EXAMPLE: HH-MS2-250X48ES-H2C6-ST=3" ST= FOUR WRENCH FLATS (ROD SIZES: .625"-3.50") 4WF XX= SPECIAL VARIATION (SPECIFY)
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NFPA MOUNTS	BORE	CUSHIONS
MX0 NO MOUNT (1.50" to 8.00" Bore)	150 1.50"	H 1
MF1 HEAD RECTANGULAR FLANGE (1.50" to 8.00" Bore)	200 2.00"	2
MF2 CAP RECTANGULAR FLANGE (1.50" to 8.00" Bore)	250 2.50"	3
MF5 HEAD SQUARE FLANGE (1.50" to 8.00" Bore)	325 3.25"	4
MF6 CAP SQUARE FLANGE (1.50" to 8.00" Bore)	400 4.00"	5
ME5 HEAD RECTANGULAR MOUNTING HOLES (1.50" to 8.00" Bore)	500 5.00"	6
ME6 CAP RECTANGULAR MOUNTING HOLES (1.50" to 8.00" Bore)	600 6.00"	7
MP1 FIXED CAP PIVOT CLEVIS (1.50" to 8.00" Bore)	700 7.00"	8
MS2 SIDE LUGS (1.50" to 8.00" Bore)	800 8.00"	
MS3 CENTER LINE LUGS (1.50" to 8.00" Bore)		
MS4 BOTTOM TAPPED HOLES (1.50" to 8.00" Bore)		
MS7 END LUGS (1.50" to 6.00" Bore)		
MT1 HEAD TRUNNION (1.50" to 8.00" Bore)		
MT2 CAP TRUNNION (1.50" to 8.00" Bore)		
MT4 INTERMEDIATE (CENTER) TRUNNION (1.50" to 8.00" Bore)		
MX1 EXTENDED TIE RODS - HEAD & CAP (1.50" to 8.00" Bore)		
MX2 EXTENDED TIE RODS - CAP (1.50" to 8.00" Bore)		
MX3 EXTENDED TIE RODS - HEAD (1.50" to 8.00" Bore)		
SB SPHERICAL BEARING (1.50" to 6.00" Bore)		

ROD END
KK1 SMALL MALE THREAD
KK2 LARGE MALE THREAD
KK3 FEMALE THREAD
KK3M FEMALE METRIC ROD THREAD
KK3X FEMALE SPECIAL THREAD
KK4 FULL DIA. MALE THREAD
KK5 PLAIN END
KK10 ROD COUPLER END
KKM METRIC THREAD
KKX MALE SPECIAL THREAD

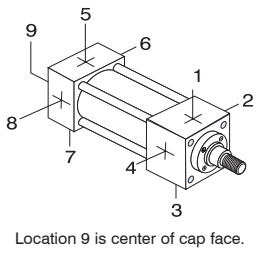
When additional thread details are required, use format: "Rod End" = "Modification" Example: KKX=1.00x8

HOW TO ORDER SEALS
S S S S

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

*When cylinder design calls for all EP seals, use PTFE rod wiper.
**See page 52 for seal specifications.

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)
BSPP & BSPT ports also available.



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

NFPA MOUNTS

MX0 1.50"-8.00" Bores	MF1 1.50"-8.00" Bores	MF2 1.50"-8.00" Bores	MF5 1.50"-8.00" Bores	MF6 1.50"-8.00" Bores	ME5 1.50"-8.00" Bores	ME6 1.50"-8.00" Bores
MP1 1.50"-8.00" Bores	SB 1.50"-6.00" Bores	MS2 1.50"-8.00" Bores	MS3 1.50"-8.00" Bores	MS4 1.50"-8.00" Bores	MS7 1.50"-6.00" Bores	
MT1 1.50"-8.00" Bores	MT2 1.50"-8.00" Bores	MT4 1.50"-8.00" Bores	MX1 1.50"-8.00" Bores	MX2 1.50"-8.00" Bores	MX3 1.50"-8.00" Bores	

HH - Heavy Duty Hydraulic
HH Rod Lock
HH Options
MH - Medium Duty Hydraulic
TAS - Heavy Duty Pneumatic
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Strokmaster® Page 153
Technical Data Page 161

SERIES 'HH' DIMENSIONS: THREADS

HH - Heavy Duty Hydraulic

HH Rod Lock

HH Options

MH - Medium Duty Hydraulic

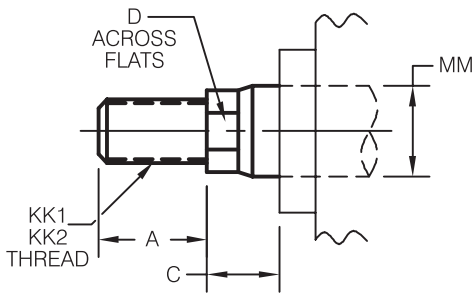
TAS - Heavy Duty Pneumatic

Accessories Page 147

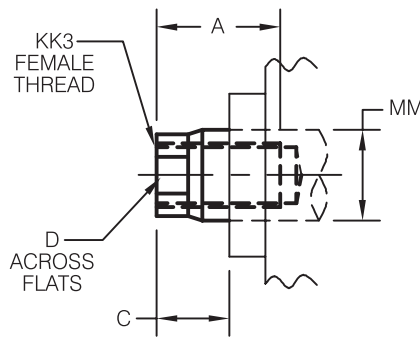
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Technical Data Page 161

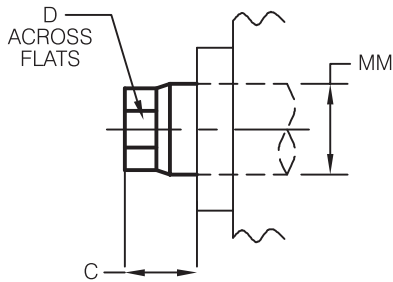
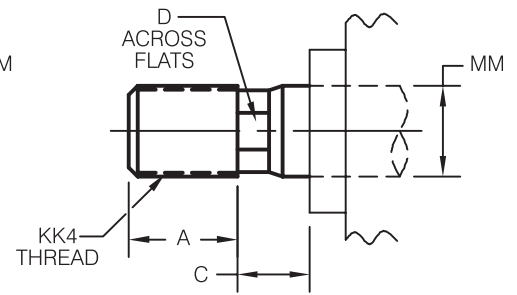
ROD END STYLE:
KK1
KK2



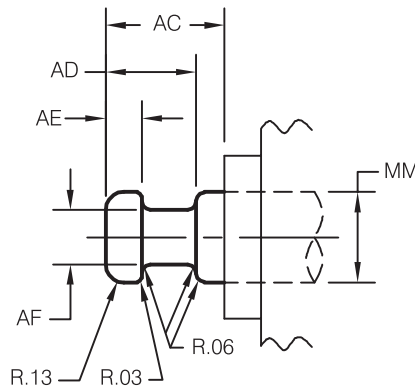
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KK3



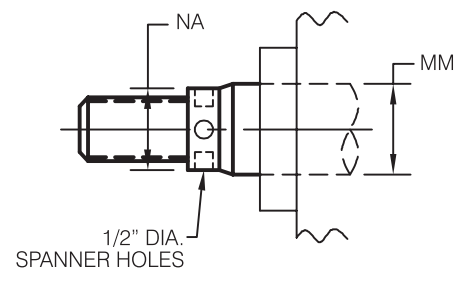
ROD END STYLE:
KK4



ROD END STYLE:
KK5



ROD END STYLE:
KK10



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

ROD DIA. (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4	NA ±.002
0.625	0.750	0.375	0.500	1.125	0.625	0.250	0.375	7/16 - 20*	1/2 - 20*	7/16 - 20	5/8 - 18	—
1.000	1.125	0.500	0.875	1.625	0.938	0.375	0.688	3/4 - 16*	7/8 - 14*	3/4 - 16	1 - 14	—
1.375	1.625	0.625	1.125	1.750	1.063	0.375	0.875	1 - 14*	1 1/4 - 12*	1 - 14	1 3/8 - 12	—
1.750	2.000	0.750	1.500	2.000	1.313	0.500	1.125	1 1/4 - 12*	1 1/2 - 12*	1 1/4 - 12	1 3/4 - 12	—
2.000	2.250	0.875	1.750	2.625	1.688	0.625	1.375	1 1/2 - 12*	1 3/4 - 12*	1 1/2 - 12	2 - 12	—
2.500	3.000	1.000	2.125	3.250	1.938	0.750	1.750	1 7/8 - 12	2 1/4 - 12	1 7/8 - 12	2 1/2 - 12	—
3.000	3.500	1.000	2.625	3.625	2.438	0.875	2.250	2 1/4 - 12	2 3/4 - 12	2 1/4 - 12	3 - 12	—
3.500	3.500	1.000	3.000	4.375	2.688	1.000	2.500	2 1/2 - 12	3 1/4 - 12	2 1/2 - 12	3 1/2 - 12	—
4.000	4.000	1.000	—	4.500	2.688	1.000	3.000	3 - 12	3 3/4 - 12	3 - 12	4 - 12	3.875
4.500	4.500	1.000	—	5.250	3.188	1.500	3.500	3 1/4 - 12	4 1/4 - 12	3 1/4 - 12	4 1/2 - 12	4.375
5.000	5.000	1.000	—	5.375	3.188	1.500	3.875	3 1/2 - 12	4 3/4 - 12	3 1/2 - 12	5 - 12	4.875
5.500	5.500	1.000	—	6.250	3.938	1.875	4.375	4 - 12	5 1/4 - 12	4 - 12	5 1/2 - 12	5.375

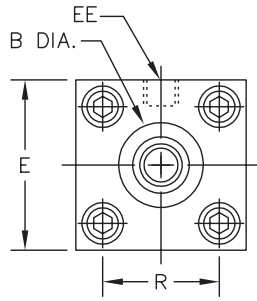
*Studded rod end.

(4) wrench flats are an option.

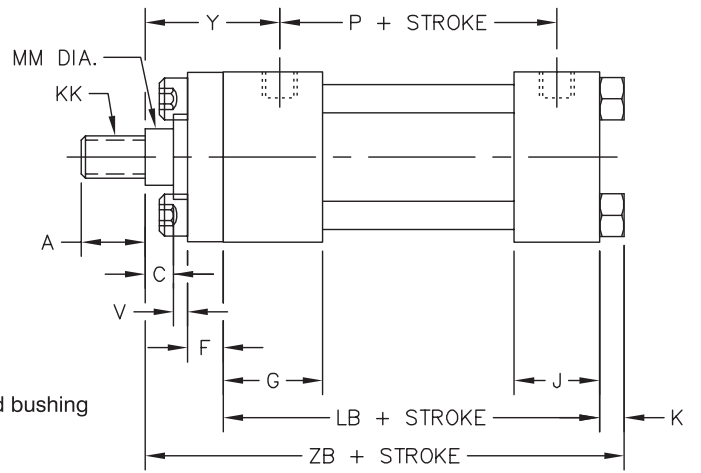
Note: Rods larger than 3.50" dia. utilize (4) 0.500" dia. spanner holes 0.500" deep.

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

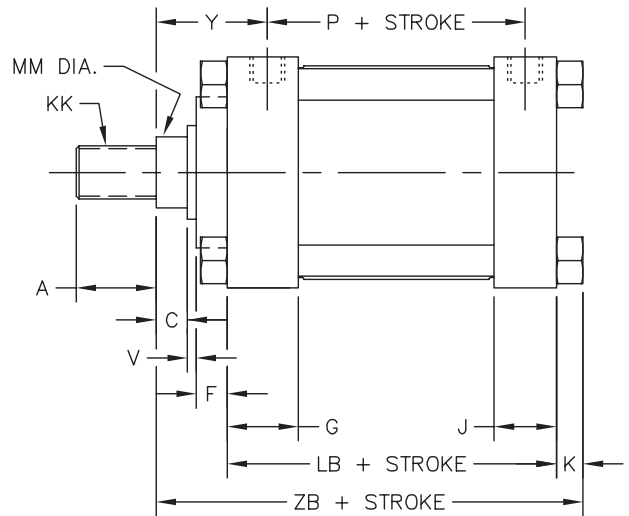
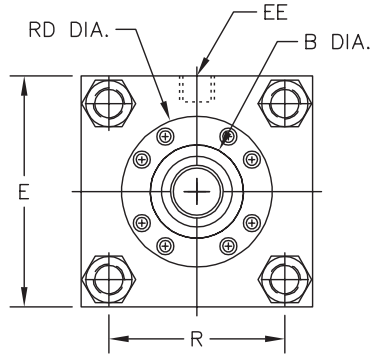
FULL SQUARE RETAINER USED ON:	
BORE	ROD DIA.
1.50	0.625
1.50	1.000
2.00	1.000
2.00	1.375
2.50	1.375
2.50	1.750
3.25	1.750
3.25	2.000
4.00	2.500
5.00	3.500



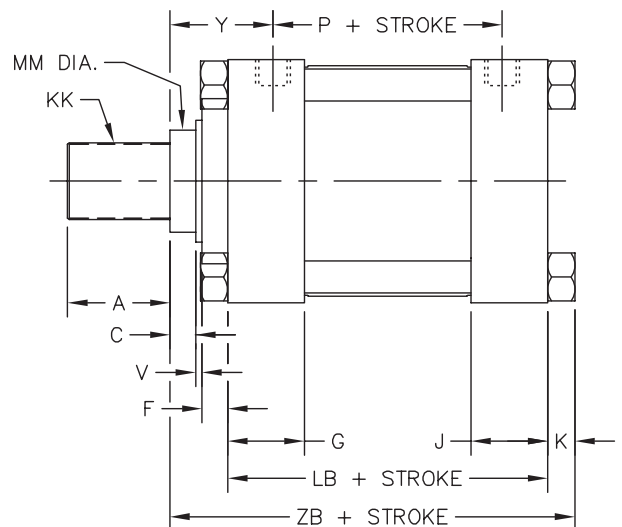
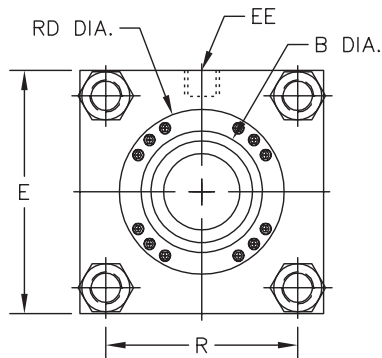
Note: Full square retainer is removable to service rod bushing



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

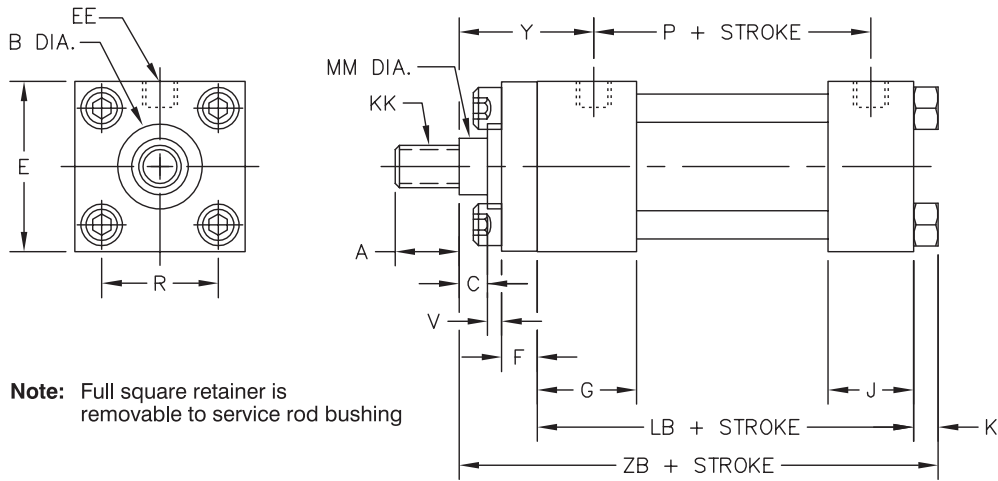


LARGE ROUND RETAINER USED ON:	
BORE	ROD DIA.
5.00	3.000
6.00	3.000
6.00	3.500
6.00	4.000
7.00	3.000
7.00	3.500
7.00	4.000
7.00	4.500
7.00	5.000
8.00	3.500
8.00	4.000
8.00	4.500
8.00	5.000
8.00	5.500



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

EASY FLIP OUT PAGE FOR REFERENCE



Note: Full square retainer is removable to service rod bushing

SEE ROD END DETAIL CHART ON PAGE 8

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	A	② B	C	③ EE		F	G	J	K	KK	R	④ RD	V	Y	ADD TO STROKE		
							NPTF	SAE										LB	P	ZB
1.50	0.625	3000	2.500	0.750	1.124	0.375	1/2	10	0.375	1.750	1.500	0.375	1.625	—	0.250	2.000	4.625	2.938	6.000	
	1.000			1.125	1.499	0.500								—	0.500	2.375			6.375	
2.00	1.000	3000	3.000	1.125	1.499	0.500	1/2	10	0.625	1.750	1.500	0.500	2.050	—	0.250	2.375	4.625	2.938	6.500	
	1.375			1.625	1.999	0.625								—	0.375	2.625			6.750	
2.50	1.000	3000	3.500	1.125	1.499	0.500	1/2	10	0.625	1.750	1.500	0.500	2.550	2.625	0.250	2.375	4.750	3.063	6.625	
	1.375			1.625	1.999	0.625								—	0.375	2.625			6.875	
	1.750			2.000	2.374	0.750								—	0.500	2.875			7.125	
3.25	1.375	3000	4.500	1.625	1.999	0.625	3/4	12	0.750	2.000	1.750	0.625	3.250	3.250	0.250	2.750	5.500	3.500	7.750	
	1.750			2.000	2.374	0.750								—	0.375	3.000			8.000	
	2.000			2.250	2.624	0.875								—	0.375	3.125			8.125	
4.00	1.750	3000	5.000	2.000	2.374	0.750	3/4	12	0.875	2.000	1.750	0.625	3.820	3.875	0.250	2.938	5.750	3.875	8.250	
	2.000			2.250	2.624	0.875								4.250	0.250	3.063			8.375	
	2.500			3.000	3.124	1.000								—	0.375	3.313			8.625	
5.00	2.000	3000	6.500	2.250	2.624	0.875	3/4	12	0.875	2.000	1.750	0.875	4.950	4.250	0.250	3.125	6.250	4.250	9.125	
	2.500			3.000	3.124	1.000								4.625	0.375	3.375			9.375	
	3.000			3.500	3.749	1.000								5.250	0.375	3.375			9.375	
	3.500			3.500	4.249	1.000								—	0.375	3.375			9.375	
6.00	2.500	3000	7.500	3.000	3.124	1.000	1	16	0.875	2.250	2.250	1.000	5.730	4.625	0.375	3.500	7.375	5.000	10.625	
	3.000			3.500	3.749				0.875					5.250	0.375					
	3.500			3.500	4.249				0.875					5.625	0.375					
	4.000			4.000	4.749				1.000					6.438	0.250					
7.00	3.000	3000	8.500	3.500	3.749	1.000	1 1/4	20	0.875	2.750	2.750	1.125	6.580	5.250	0.375	3.750	8.500	5.750	11.875	
	3.500			3.500	4.249				0.875					5.625	0.375					
	4.000			4.000	4.749				1.000					6.438	0.250					
	4.500			4.500	5.249				1.000					7.125	0.250					
8.00	5.000	3000	9.500	5.000	5.749	1.000	1 1/2	24	1.000	3.000	3.000	1.250	7.500	7.125	0.250	3.938	9.500	6.313	13.000	
	4.000			4.000	4.749				1.000					6.438	0.250					
	4.500			4.500	5.249				1.000					7.625	0.250					
	5.500			5.500	6.249				1.000					8.375	0.250					

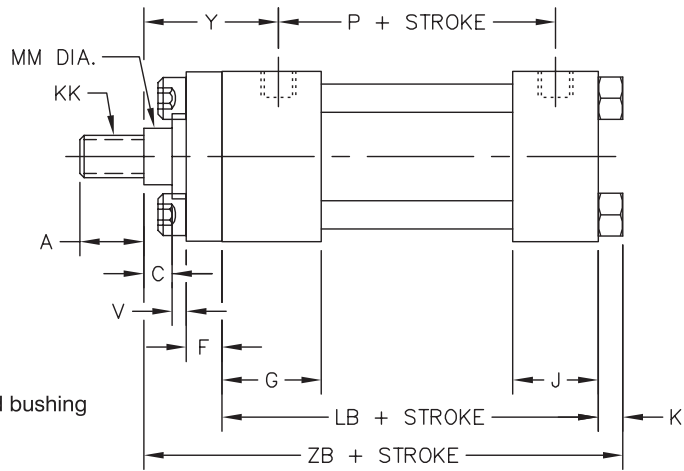
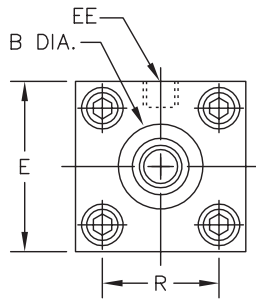
① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

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

③ Standard port sizes.

④ Where no dimension is shown, cylinder utilizes a full square retainer.

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



Note: Full square retainer is removable to service rod bushing

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	A	② B	C	③ EE		F	G	J	K	KK	R	④ RD	V	Y	ADD TO STROKE		
							NPTF	SAE										LB	P	ZB
1.50	0.625	3000	2.500	0.750	1.124	0.375	1/2	10	0.375	1.750	1.500	0.375		1.625	—	0.250	2.000	4.625	2.938	6.000
	1.000			1.125	1.499	0.500									—	0.500	2.375			6.375
2.00	1.000	3000	3.000	1.125	1.499	0.500	1/2	10	0.625	1.750	1.500	0.500		2.050	—	0.250	2.375	4.625	2.938	6.500
	1.375			1.625	1.999	0.625									—	0.375	2.625			6.750
2.50	1.000	3000	3.500	1.125	1.499	0.500	1/2	10	0.625	1.750	1.500	0.500		2.550	2.625	0.250	2.375	4.750	3.063	6.625
	1.375			1.625	1.999	0.625									—	0.375	2.625			6.875
	1.750			2.000	2.374	0.750									—	0.500	2.875			7.125
3.25	1.375	3000	4.500	1.625	1.999	0.625	3/4	12	0.750	2.000	1.750	0.625		3.250	3.250	0.250	2.750	5.500	3.500	7.750
	1.750			2.000	2.374	0.750									—	0.375	3.000			8.000
	2.000			2.250	2.624	0.875									—	0.375	3.125			8.125
4.00	1.750	3000	5.000	2.000	2.374	0.750	3/4	12	0.875	2.000	1.750	0.625		3.820	3.875	0.250	2.938	5.750	3.875	8.250
	2.000			2.250	2.624	0.875									—	0.375	3.063			8.375
	2.500			3.000	3.124	1.000									—	0.375	3.313			8.625
5.00	2.000	3000	6.500	2.250	2.624	0.875	3/4	12	0.875	2.000	1.750	0.875		4.950	4.250	0.250	3.125	6.250	4.250	9.125
	2.500			3.000	3.124	1.000									—	0.375	3.375			9.375
	3.000			3.500	3.749	1.000									—	0.375	3.375			9.375
	3.500			3.500	4.249	1.000									—	0.375	3.375			9.375
6.00	2.500	3000	7.500	3.000	3.124		1	16	0.875	2.250	2.250	1.000		5.730	4.625	0.375		7.375	5.000	10.625
	3.000			3.500	3.749	1.000			0.875						5.250	0.375				
	3.500			3.500	4.249	1.000			0.875						5.625	0.375				
	4.000			4.000	4.749	1.000			1.000						6.438	0.250				
7.00	3.000	3000	8.500	3.500	3.749		1 1/4	20	0.875	2.750	2.750	1.125		6.580	5.250	0.375		8.500	5.750	11.875
	3.500			3.500	4.249	1.000			0.875						5.625	0.375				
	4.000			4.000	4.749	1.000			1.000						6.438	0.250				
	4.500			4.500	5.249	1.000			1.000						7.125	0.250				
	5.000			5.000	5.749	1.000			1.000						7.250	0.250				
8.00	3.500	3000	9.500	3.500	4.249		1 1/2	24	0.875	3.000	3.000	1.250		7.500	5.625	0.375		9.500	6.313	13.000
	4.000			4.000	4.749	1.000			1.000						6.438	0.250				
	4.500			4.500	5.249	1.000			1.000						7.125	0.250				
	5.000			5.000	5.749	1.000			1.000						7.625	0.250				
	5.500			5.500	6.249	1.000			1.000						8.375	0.250				

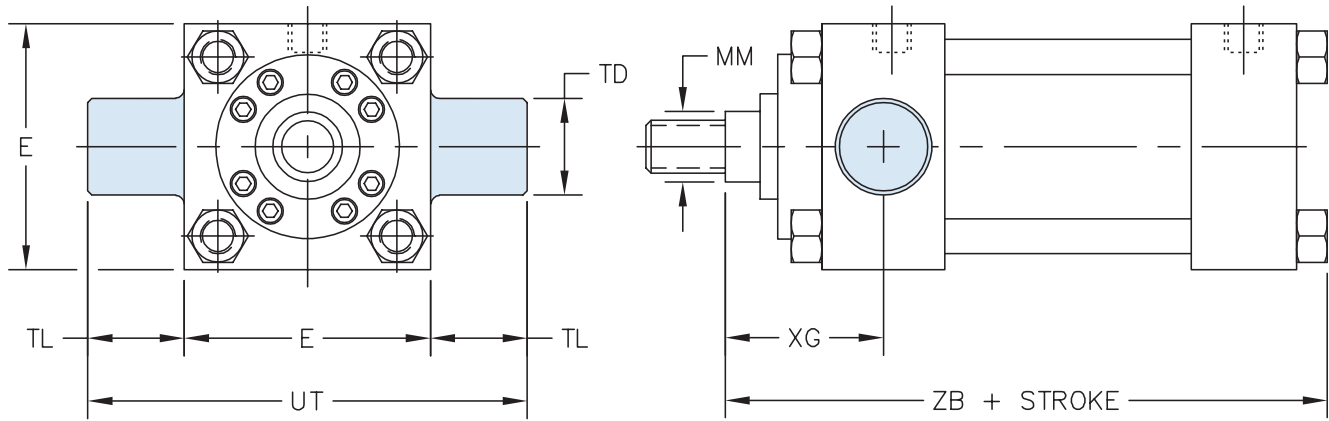
SEE ROD END DETAIL CHART ON PAGE 8

① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).
 ② 'B' dimension tolerance is +.000 / -.002
 ③ Standard port sizes.
 ④ Where no dimension is shown, cylinder utilizes a full square retainer.

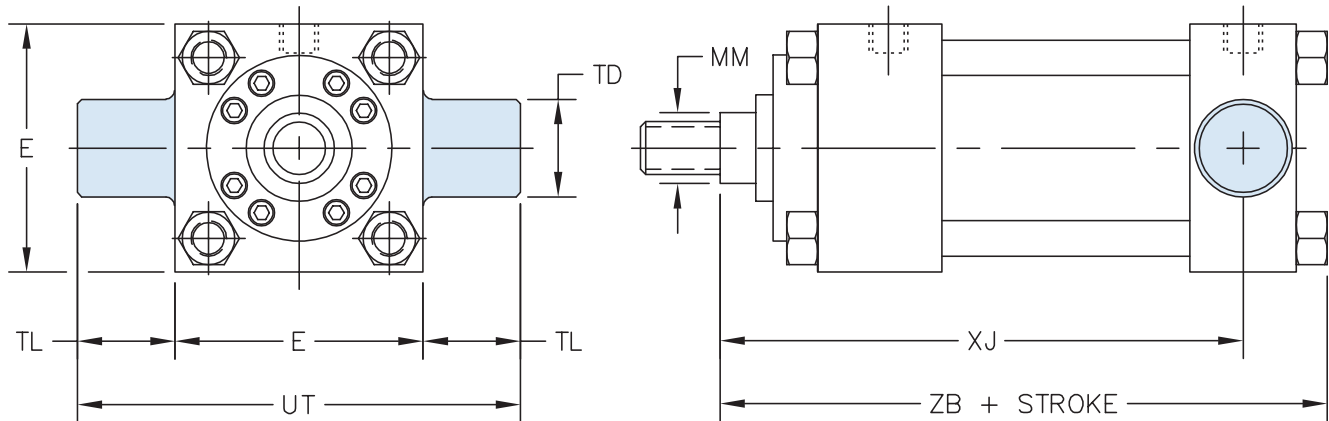
SERIES 'HH' DIMENSIONS: TRUNNION MOUNTS

HH - Heavy Duty Hydraulic
 HH Rod Lock
 HH Options
 MH - Medium Duty Hydraulic
 TAS - Heavy Duty Pneumatic
 Accessories Page 147
 Strokemaster® Page 153
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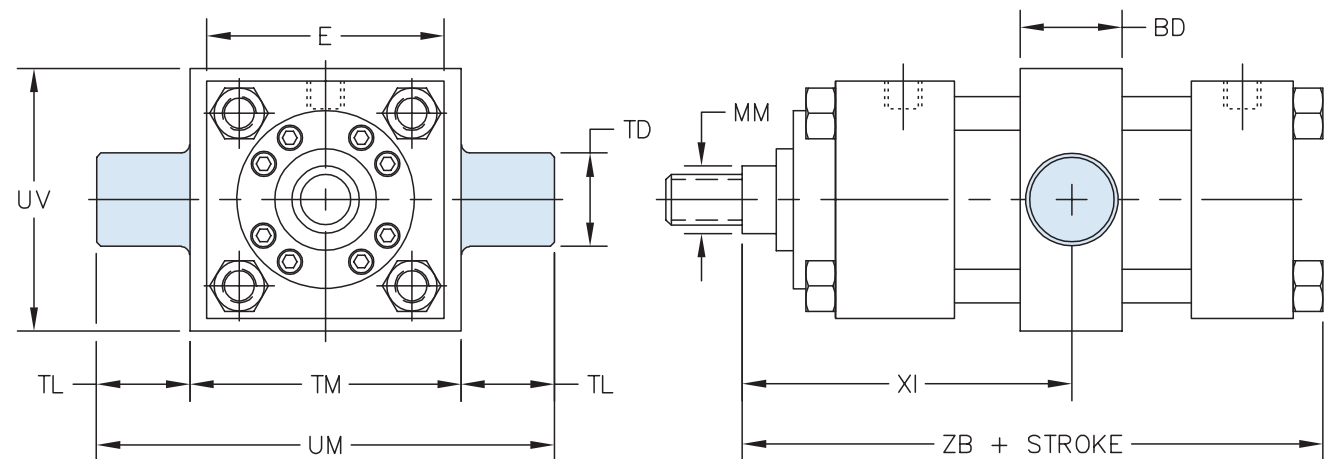
MT1: HEAD TRUNNION



MT2: CAP TRUNNION



MT4: INTERMEDIATE TRUNNION



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

SERIES 'HH' DIMENSIONS: TRUNNION MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING		E	BD	② TD	TL	TM	UM	UT	UV	XG	③ MT4 XI MIN	MT4 MIN STROKE	ADD TO STROKE		
		MT1 MT2	MT4												MT4 XI MAX	XJ	ZB
1.50	0.625	3000	3000	2.500	1.500	1.000	1.000	3.000	5.000	4.500	3.000	1.875	3.625	0.375	3.250	4.875	6.000
	2.250											4.000	3.625		5.250	6.375	
2.00	1.000	3000	3000	3.000	1.500	1.375	1.375	3.500	6.250	5.750	3.500	2.250	4.000	0.375	3.625	5.250	6.500
	2.500											4.250	3.875		5.500	6.750	
2.50	1.000	3000	3000	3.500	1.500	1.375	1.375	4.000	6.750	6.250	4.000	2.250	4.000	0.250	3.750	5.375	6.625
	1.375											2.500	4.250		4.000	5.625	6.875
	1.750											2.750	4.500		4.250	5.875	7.125
3.25	1.375	3000	3000	4.500	2.000	1.750	1.750	5.000	8.500	8.000	5.000	2.625	4.750	0.500	4.250	6.250	7.750
	1.750											2.875	5.000		4.500	6.500	8.000
	2.000											3.000	5.125		4.625	6.625	8.125
4.00	1.750	3000	3000	5.000	2.000	1.750	1.750	5.500	9.000	8.500	5.500	2.875	5.000	0.250	4.750	6.750	8.250
	2.000											3.000	5.125		4.875	6.875	8.375
	2.500											3.250	5.375		5.125	7.125	8.625
5.00	2.000	3000	3000	6.500	2.500	1.750	1.750	7.000	10.500	10.000	7.250	3.000	5.375	0.250	5.125	7.375	9.125
	2.500											3.250	5.625		5.375	7.625	9.375
	3.000											3.250	5.625		5.375	7.625	9.375
	3.500											3.250	5.625		5.375	7.625	9.375
6.00	2.500	3000	3000	7.500	3.000	2.000	2.000	8.500	12.500	11.500	8.750	3.375	6.125	0.375	5.750	8.375	10.625
	3.000																
	3.500																
	4.000																
7.00	3.000	3000	2700	8.500	3.000	2.500	2.500	9.750	14.750	13.500	10.000	3.625	6.625	0.250	6.375	9.375	11.875
	3.500																
	4.000																
	4.500																
	5.000																
8.00	3.500	3000	2500	9.500	3.500	3.000	3.000	11.000	17.000	15.500	11.750	3.750	7.125	0.250	6.875	10.250	13.000
	4.000																
	4.500																
	5.000																
	5.500																

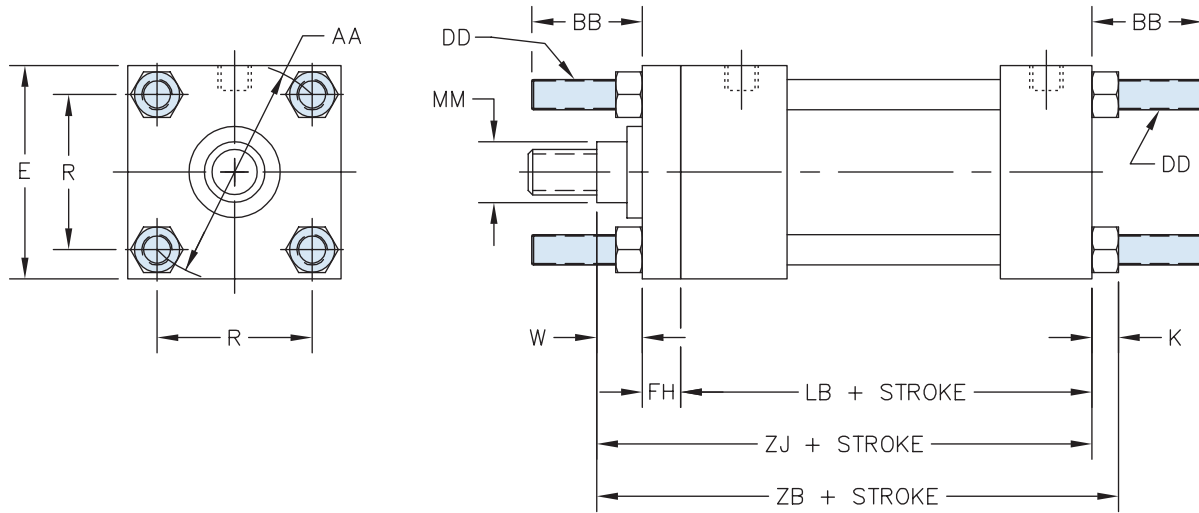
① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

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

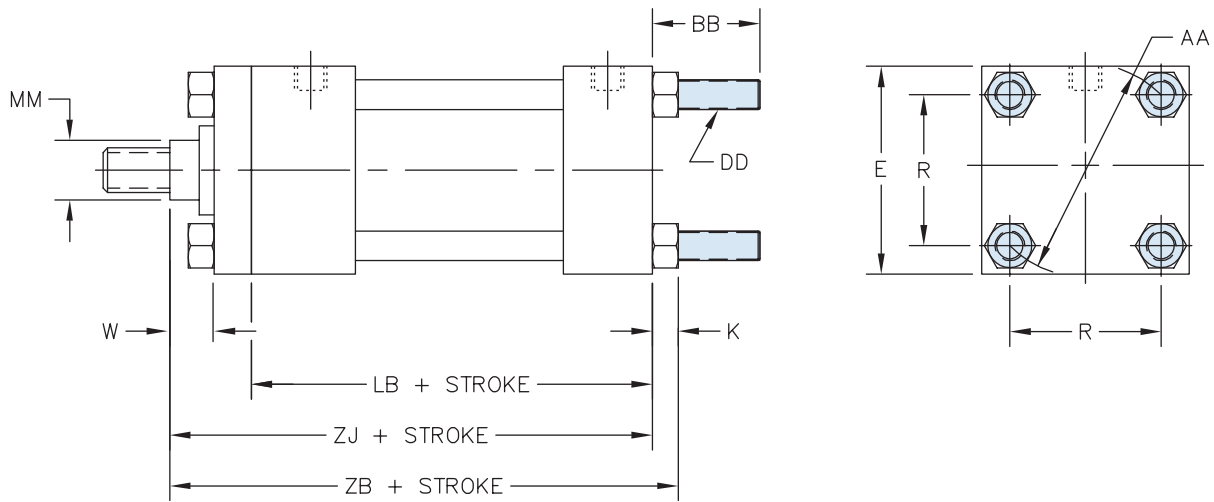
③ 'XI' dimension is the minimum that can be supplied (customer to specify 'XI' dimension).

SERIES 'HH' DIMENSIONS: EXTENDED TIE ROD MOUNTS

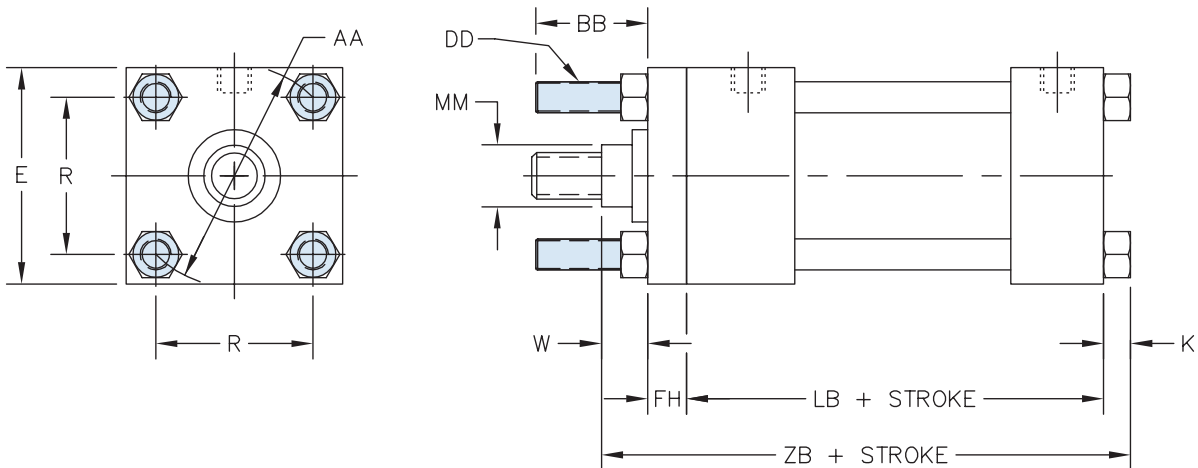
MX1: EXTENDED TIE-RODS - HEAD & CAP



MX2: EXTENDED TIE-RODS - CAP END



MX3: EXTENDED TIE-RODS - HEAD END



HH - Heavy Duty Hydraulic
 HH Rod Lock
 HH Options
 MH - Medium Duty Hydraulic
 TAS - Heavy Duty Pneumatic
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SERIES 'HH' DIMENSIONS: EXTENDED TIE ROD MOUNTS

BORE	ROD DIA. (MM)	Ⓜ MAX PSI RATING	E	AA	BB	DD	FH	K	R	W	ADD TO STROKE		
											LB	ZB	ZJ
1.50	0.625	3000	2.500	2.300	1.375	3/8 - 24	0.375	0.375	1.625	0.625	4.625	6.000	5.625
	1.000									6.375		6.000	
2.00	1.000	3000	3.000	2.900	1.813	1/2 - 20	0.625	0.500	2.047	0.750	4.625	6.500	6.000
	1.375									6.750		6.250	
2.50	1.000	3000	3.500	3.600	1.813	1/2 - 20	0.625	0.500	2.547	0.750	4.750	6.625	6.128
	1.375									6.875		6.375	
	1.750									7.125		6.625	
3.25	1.375	3000	4.500	4.600	2.313	5/8 - 18	0.750	0.625	3.250	0.875	5.500	7.750	7.125
	1.750									8.000		7.375	
	2.000									8.125		7.500	
4.00	1.750	3000	5.000	5.400	2.313	5/8 - 18	0.875	0.625	3.813	1.000	5.750	8.250	7.625
	2.000									8.375		7.750	
	2.500									8.625		8.000	
5.00	2.000	3000	6.500	7.000	3.188	7/8 - 14	0.875	0.875	4.953	1.125	6.250	9.125	8.250
	2.500									9.375		8.500	
	3.000									9.375		8.500	
	3.500									9.375		8.500	
6.00	2.500	3000	7.500	8.100	3.625	1 - 14	1.000	1.000	5.734	1.250*	7.375	10.625	9.625
	3.000									1.250*			
	3.500									1.250*			
	4.000									1.250			
7.00	3.000	3000	8.500	9.300	4.125	1 1/8 - 12	1.000	1.125	6.580	1.250*	8.500	11.875	10.750
	3.500									1.250*			
	4.000									1.250			
	4.500									1.250			
	5.000									1.250			
8.00	3.500	3000	9.500	10.600	4.500	1 1/4 - 12	1.000	1.250	7.500	1.250*	9.500	13.000	11.750
	4.000									1.250			
	4.500									1.250			
	5.000									1.250			
	5.500									1.250			

Ⓜ Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

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

SERIES 'HH' DIMENSIONS: FLANGE MOUNTS

HH - Heavy Duty Hydraulic

HH Rod Lock

HH Options

MH - Medium Duty Hydraulic

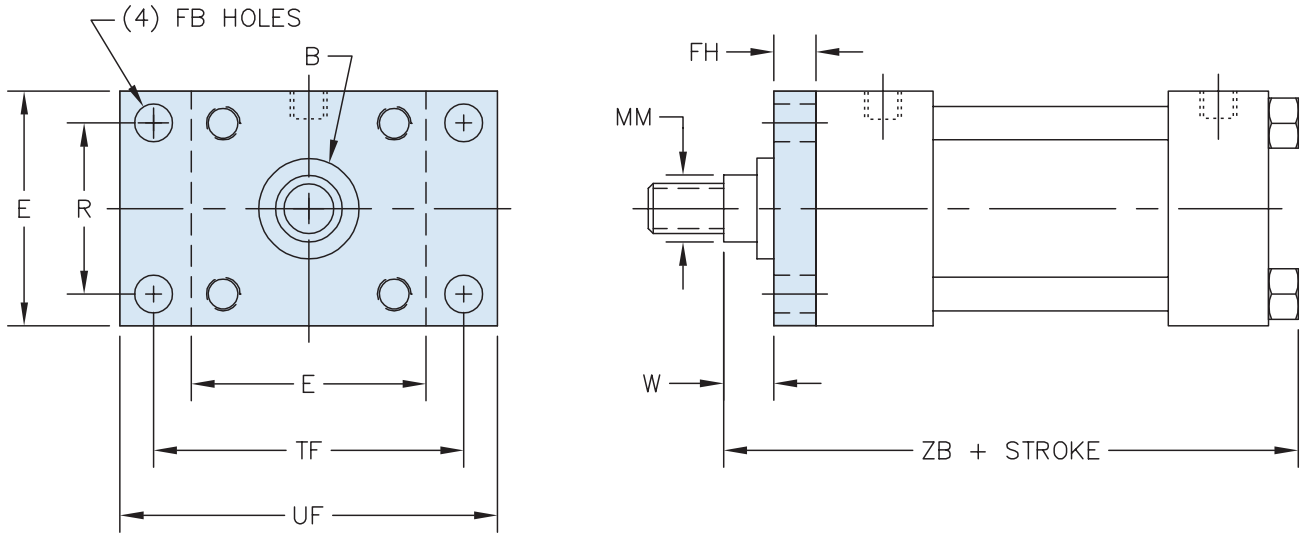
TAS - Heavy Duty Pneumatic

Accessories
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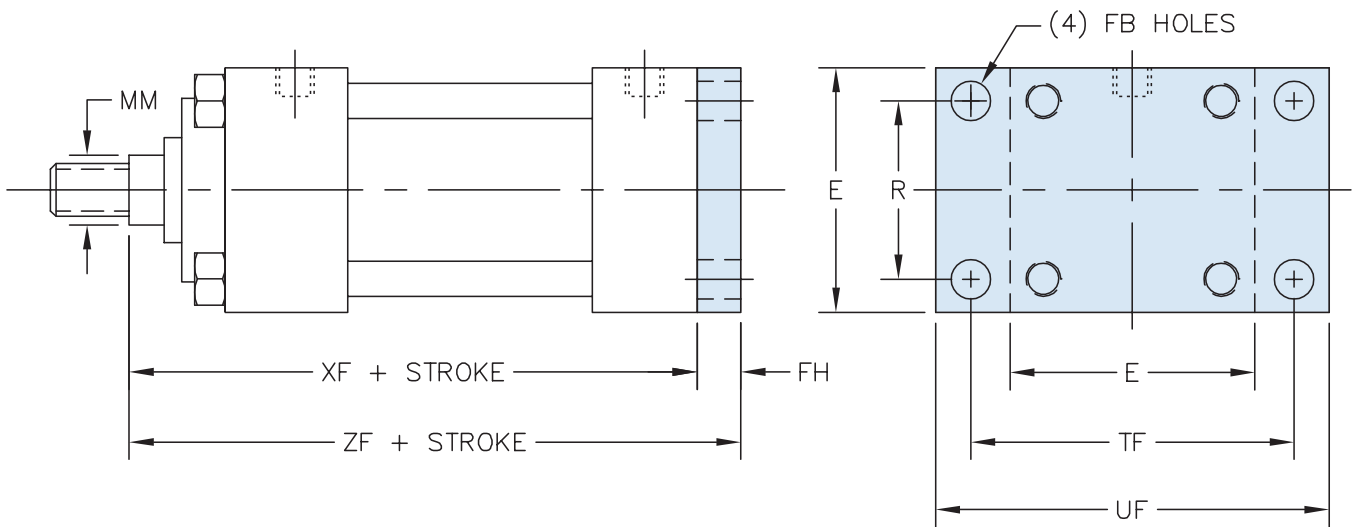
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MF1: HEAD FLANGE



MF2: CAP FLANGE



SERIES 'HH' DIMENSIONS: FLANGE MOUNTS

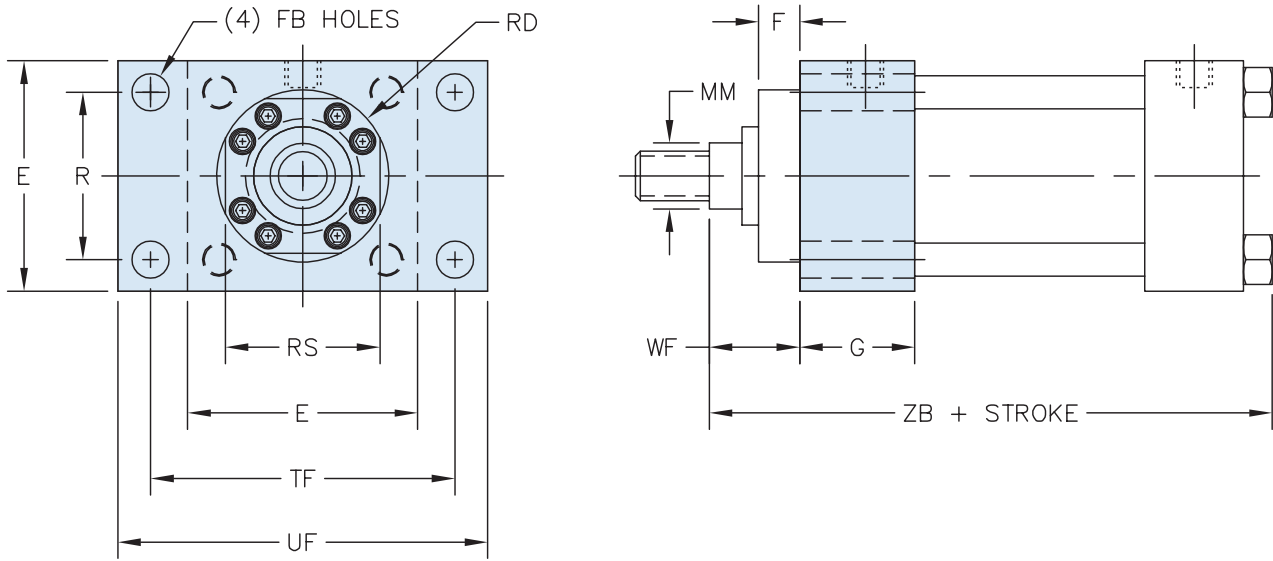
BORE	ROD DIA. (MM)	① MAX PSI RATING		② B	E	FB	FH	R	RD	TF	UF	W	ADD TO STROKE			
		MF1	MF2										XF	ZB	ZF	
1.50	0.625	3000	3000	1.124	2.500	0.438	0.375	1.625	2.375	3.438	4.250	0.625	5.625	6.000	6.000	
	1.499			2.563									1.000	6.000	6.375	6.375
2.00	1.000	3000	3000	1.499	3.000	0.563	0.625	2.047	2.625	4.125	5.125	0.750	6.000	6.500	6.625	
	1.999			3.250									1.000	6.250	6.750	6.875
2.50	1.000	3000	3000	1.499	3.500	0.563	0.625	2.546	2.625	4.625	5.625	0.750	6.125	6.625	6.750	
	1.999			3.250									1.000	6.375	6.875	7.000
	2.374			3.875									1.250	6.625	7.125	7.250
3.25	1.375	3000	3000	1.999	4.500	0.688	0.750	3.250	3.250	5.875	7.125	0.875	7.125	7.750	7.875	
	2.374			3.875									1.125	7.375	8.000	8.125
	2.624			4.250									1.250	7.500	8.125	8.250
4.00	1.750	3000	3000	2.374	5.000	0.688	0.875	3.820	3.875	6.375	7.625	1.000	7.625	8.250	8.500	
	2.624			4.250									1.125	7.750	8.375	8.625
	3.124			4.625									1.375	8.000	8.625	8.875
5.00	2.000	3000	3000	2.624	6.500	0.938	0.875	4.953	4.250	8.188	9.750	1.125	8.250	9.125	9.125	
	3.124			4.625									1.375	8.500	9.375	9.375
	3.749			5.250									1.375	8.500	9.375	9.375
	4.249			5.625									1.375	8.500	9.375	9.375
6.00	2.500	3000	3000	3.124	7.500	1.063	1.000	5.734	4.625	9.438	11.250	1.250	9.625	10.625	10.625	
	3.749			5.250												
	4.249			5.625												
	4.749			6.438												
7.00	3.000	2800	3000	3.749	8.500	1.188	1.000	6.580	5.250	10.625	12.625	1.250	10.750	11.875	11.750	
	3.500	2800		4.249												5.625
	4.000	2800		4.749												6.438
	4.500	2600		5.249												7.125
	5.000	2600		5.749												7.250
8.00	3.500	2400	3000	4.249	9.500	1.313	1.000	7.500	5.625	11.813	14.000	1.250	11.750	13.000	12.750	
	4.000	2200		4.749												6.438
	4.500	2200		5.249												7.125
	5.000	2200		5.749												7.625
	5.500	2200		6.249												8.375

① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

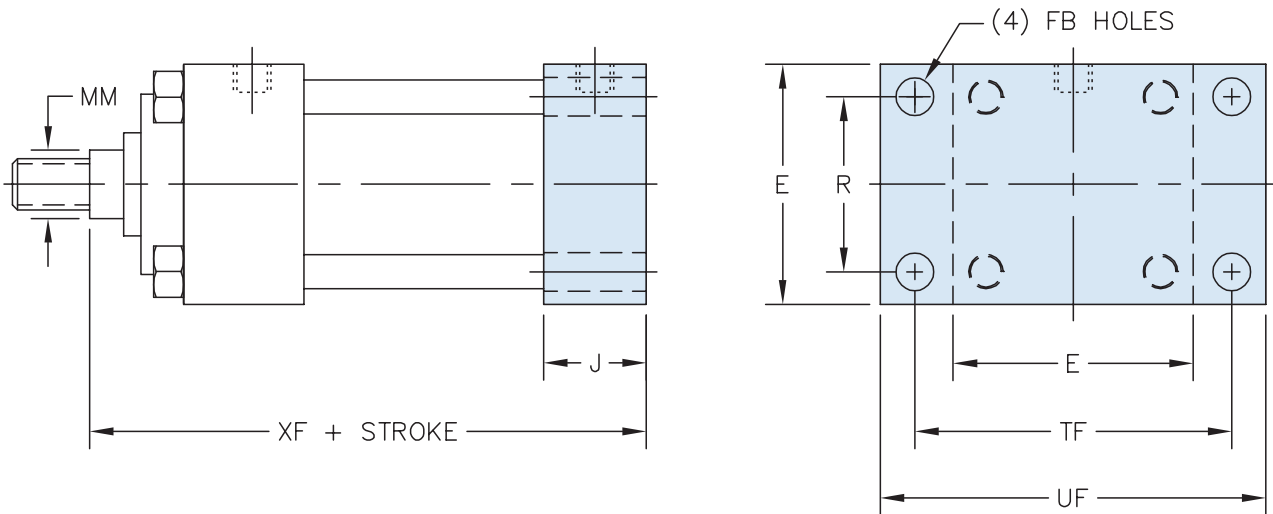
② 'B' dimension tolerance is +.000 / -.002

SERIES 'HH' DIMENSIONS: FLANGE MOUNTS

ME5: HEAD RECTANGULAR MOUNTING HOLES



ME6: CAP RECTANGULAR MOUNTING HOLES



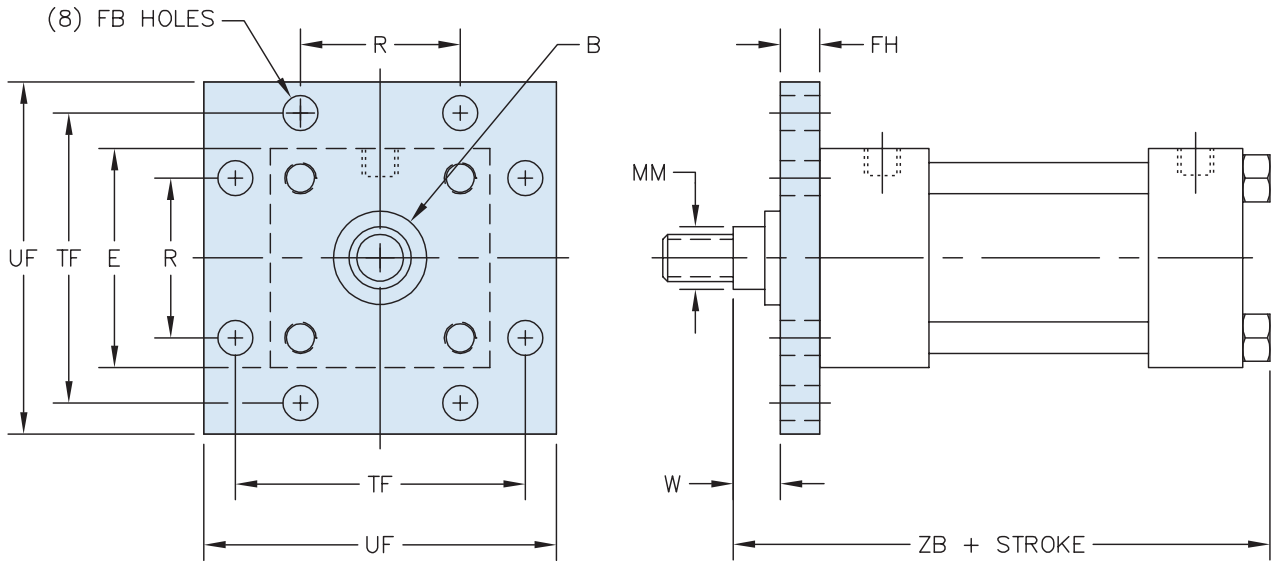
SERIES 'HH' DIMENSIONS: FLANGE MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	F	FB	G	J	R	RD	RS	TF	UF	WF	ADD TO STROKE																					
														XF	ZB																				
1.50	0.625	3000	2.500	0.375	0.438	1.750	1.500	1.625	2.375	—	3.438	4.250	1.000	5.625	6.000																				
	2.563								2.438	1.375				6.000	6.375																				
2.00	1.000	3000	3.000	0.625	0.563	1.750	1.500	2.047	2.625	—	4.125	5.125	1.375	6.000	6.500																				
	3.250								2.943	1.625				6.250	6.750																				
2.50	1.000	3000	3.500	0.625	0.563	1.750	1.500	2.546	2.625	—	4.625	5.625	1.375	6.125	6.625																				
	3.250								—	1.625				6.375	6.875																				
	3.875								3.438							1.875	6.625	7.125																	
3.25	1.375	3000	4.500	0.750	0.688	2.000	1.750	3.250	3.250	—	5.875	7.125	1.625	7.125	7.750																				
	1.750			0.875					3.875					—	5.875	7.125	1.875	7.375	8.000																
	2.000			0.875																4.250	2.000	7.500	8.125												
4.00	1.750	3000	5.000	0.875	0.688	2.000	1.750	3.820	3.875	—	6.375	7.625	1.875	7.625	8.250																				
	2.000								4.250					2.000	7.750	8.375																			
	2.500								4.625								2.250	8.000	8.625																
5.00	2.000	3000	6.500	0.875	0.938	2.000	1.750	4.953	4.250	—	8.188	9.750	2.000	8.250	9.125																				
	2.500								4.625					2.250	8.500	9.375																			
	3.000								5.250								2.250	8.500	9.375																
	3.500								5.625											2.250	8.500	9.375													
6.00	2.500	3000	7.500	0.875	1.063	2.250	2.250	5.734	4.625	—	9.438	11.250	2.250	9.625	10.625																				
	3.000			0.875					5.250							—	9.438	11.250	2.250	9.625	10.625														
	3.500			0.875																		5.625	—	9.438	11.250	2.250	9.625	10.625							
	4.000			1.000																									6.438	—	9.438	11.250	2.250	9.625	10.625
7.00	3.000	3000	8.50	0.875	1.188	2.750	2.750	6.580	5.250	—	10.625	12.625	2.250	10.750	11.875																				
	3.500			0.875					5.625							—	10.625	12.625	2.250	10.750	11.875														
	4.000			1.000																		6.438	—	10.625	12.625	2.250	10.750	11.875							
	4.500			1.000																									7.125	—	10.625	12.625	2.250	10.750	11.875
	5.000			1.000																															
8.00	3.500	3000	9.500	0.875	1.313	3.000	3.000	7.500	5.625	—	11.813	14.000	2.250	11.750	13.000																				
	4.000			1.000					6.438							—	11.813	14.000	2.250	11.750	13.000														
	4.500			1.000																		7.125	—	11.813	14.000	2.250	11.750	13.000							
	5.000			1.000																									7.625	—	11.813	14.000	2.250	11.750	13.000
	5.500			1.000																															

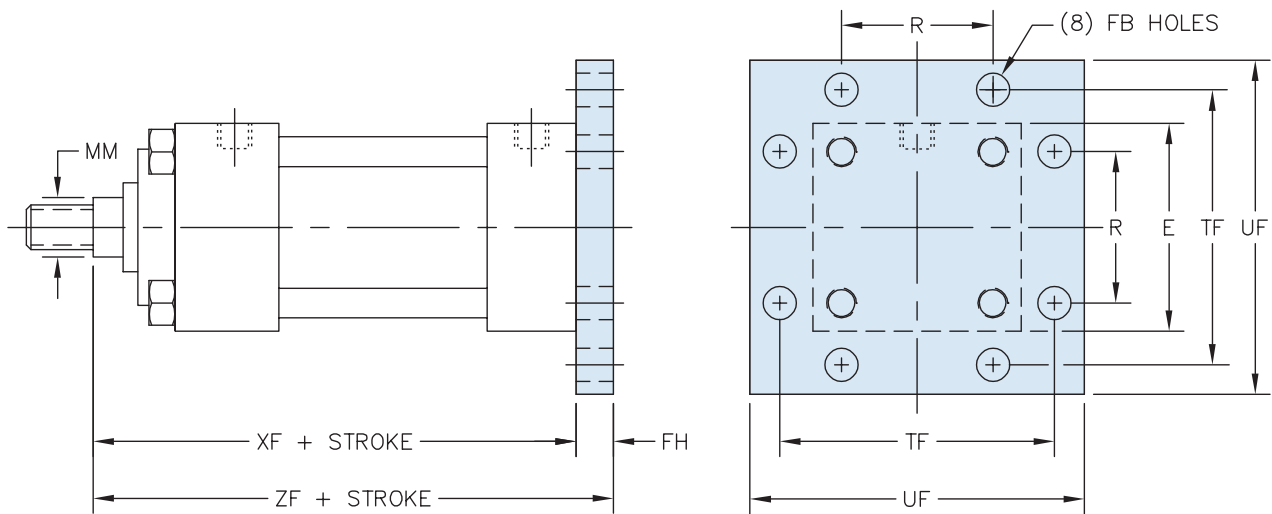
① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

SERIES 'HH' DIMENSIONS: SQUARE FLANGE MOUNTS

MF5: HEAD SQUARE FLANGE



MF6: CAP SQUARE FLANGE



SERIES 'HH' DIMENSIONS: SQUARE FLANGE MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	② B	E	FB	FH	R	③ RD	TF	UF	W	ADD TO STROKE					
												XF	ZB	ZF			
1.50	0.625	3000	1.124	2.500	0.438	0.375	1.625	—	3.438	4.250	0.625	5.625	6.000	6.000			
	1.000		—					1.000							6.000	6.375	6.375
2.00	1.000	3000	1.499	3.000	0.563	0.625	2.047	—	4.125	5.125	0.750	6.000	6.500	6.625			
	1.375		—					1.000							6.250	6.750	6.875
2.50	1.000	3000	1.499	3.500	0.563	0.625	2.547	2.625	4.625	5.625	0.750	6.125	6.625	6.750			
	1.375		—					1.000							6.375	6.875	7.000
	1.750		—					1.250							6.625	7.125	7.250
3.25	1.375	3000	1.999	4.500	0.688	0.750	3.250	3.250	5.875	7.125	0.875	7.125	7.750	7.875			
	1.750		—					1.125							7.375	8.000	8.125
	2.000		—					1.250							7.500	8.125	8.250
4.00	1.750	3000	2.374	5.000	0.688	0.875	3.820	3.875	6.375	7.625	1.000	7.625	8.250	8.500			
	2.000		—					1.125							7.750	8.375	8.625
	2.500		—					1.375							8.000	8.625	8.875
5.00	2.000	3000	2.624	6.500	0.938	0.875	4.953	4.250	8.188	9.750	1.125	8.250	9.125	9.125			
	2.500		4.625					1.375							8.500	9.375	9.375
	3.000		5.250					1.375							8.500	9.375	9.375
	3.500		—					1.375							8.500	9.375	9.375
6.00	2.500	3000	3.124	7.500	1.063	1.000	5.734	4.625	9.438	11.250	1.250	9.625	10.625	10.625			
	3.000		5.250					1.250							9.625	10.625	10.625
	3.500		5.625														
	4.000		6.438														
7.00	3.000	3000	3.749	8.500	1.188	1.000	6.580		5.250	10.625	12.625	1.250	10.750	11.875			
	3.500		5.625														
	4.000		6.438														
	4.500		7.125														
	5.000		7.250														
8.00	3.500	3000	4.249	9.500	1.313	1.000	7.500	5.625	11.813	14.000	1.250	11.750	13.000	12.750			
	4.000		6.438														
	4.500		7.125														
	5.000		7.625														
	5.500		8.375														

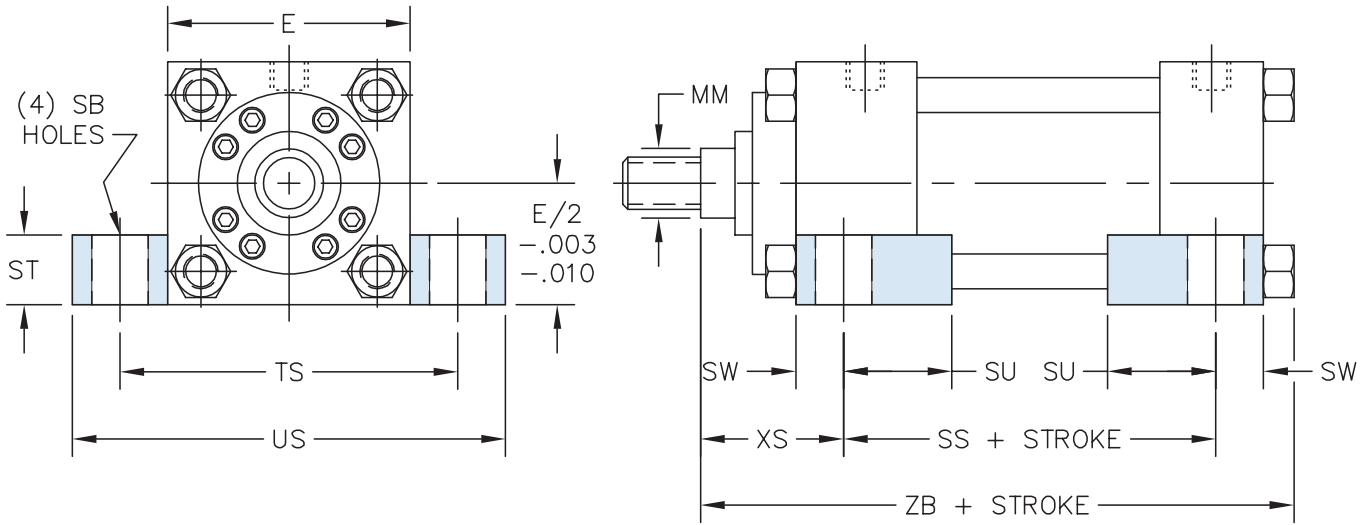
① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

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

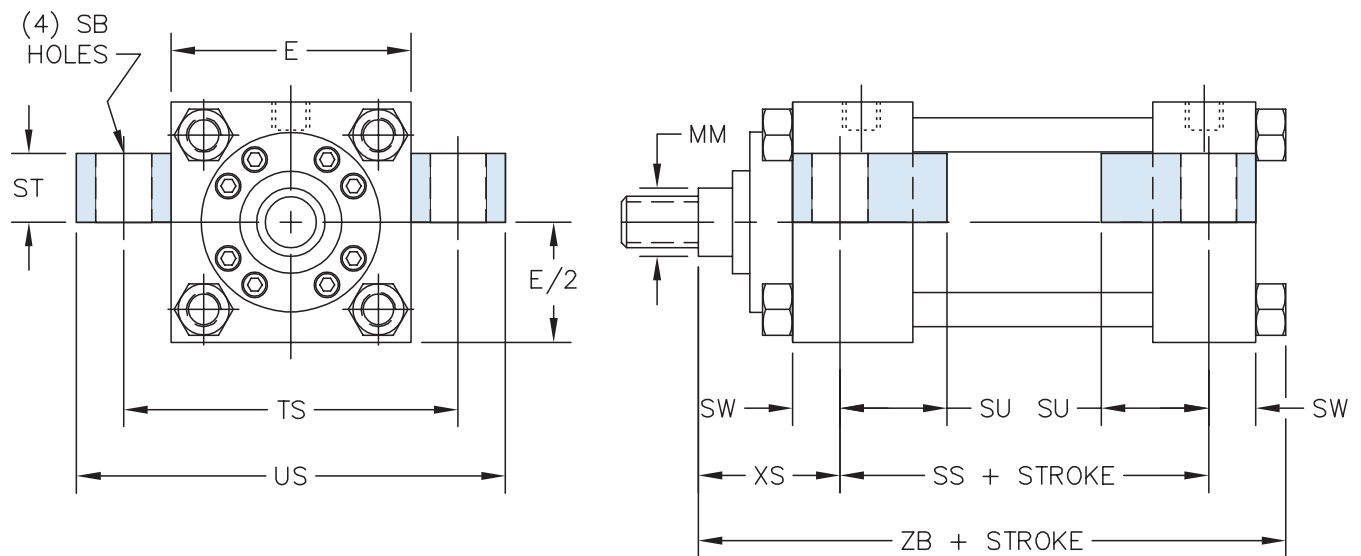
③ Where no dimension is shown, cylinder utilizes a full square retainer.

SERIES 'HH' DIMENSIONS: LUG MOUNTS

MS2: SIDE LUGS



MS3: CENTER LINE LUGS



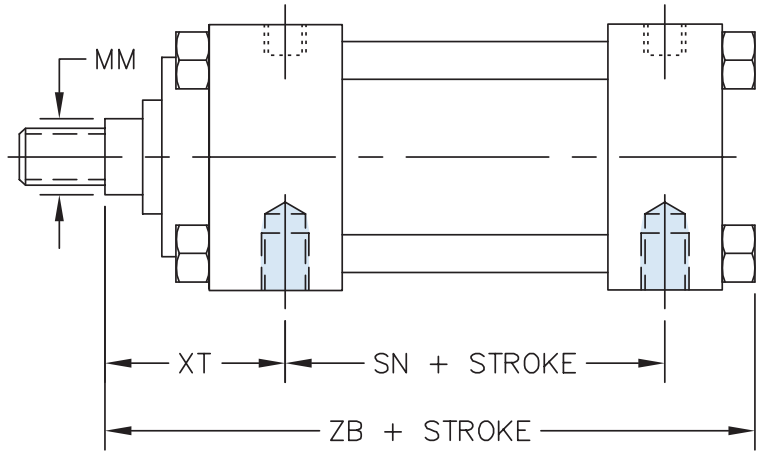
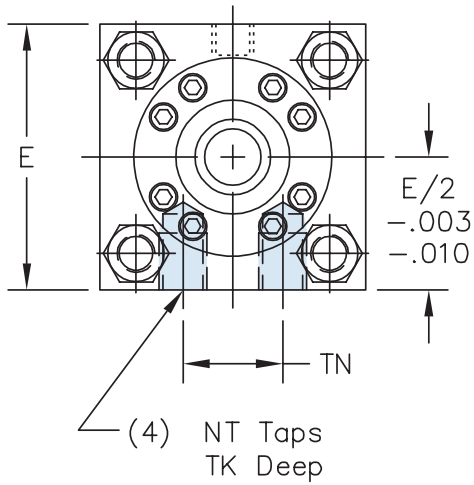
SERIES 'HH' DIMENSIONS: LUG MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	E / 2	SB	ST	SU	SW	TS	US	XS	ADD TO STROKE	
												SS	ZB
1.50	0.625	3000	2.500	1.250	0.438	0.500	0.938	0.375	3.250	4.000	1.375	3.875	6.000
	1.750										6.375		
2.00	1.000	3000	3.000	1.500	0.563	0.750	1.250	0.500	4.000	5.000	1.875	3.625	6.500
	2.125										6.750		
2.50	1.000	3000	3.500	1.750	0.813	1.000	1.563	0.688	4.875	6.250	2.063	3.375	6.625
	1.375										6.875		
	1.750										7.125		
3.25	1.375	3000	4.500	2.250	0.813	1.000	1.563	0.688	5.875	7.250	2.313	4.125	7.750
	1.750										8.000		
	2.000										8.125		
4.00	1.750	3000	5.000	2.500	1.063	1.250	2.000	0.875	6.750	8.500	2.750	4.000	8.250
	2.000										8.375		
	2.500										8.625		
5.00	2.000	3000	6.500	3.250	1.063	1.250	2.000	0.875	8.250	10.000	2.875	4.500	9.125
	2.500										9.375		
	3.000										9.375		
	3.500										9.375		
6.00	2.500	3000	7.500	3.750	1.313	1.500	2.500	1.125	9.750	12.000	3.375	5.125	10.625
	3.000												
	3.500												
	4.000												
7.00	3.000	3000	8.500	4.250	1.563	1.750	2.875	1.375	11.250	14.000	3.625	5.750	11.875
	3.500												
	4.000												
	4.500												
	5.000												
8.00	3.500	3000	9.500	4.750	1.563	1.750	2.875	1.375	12.250	15.000	3.625	6.750	13.000
	4.000												
	4.500												
	5.000												
	5.500												

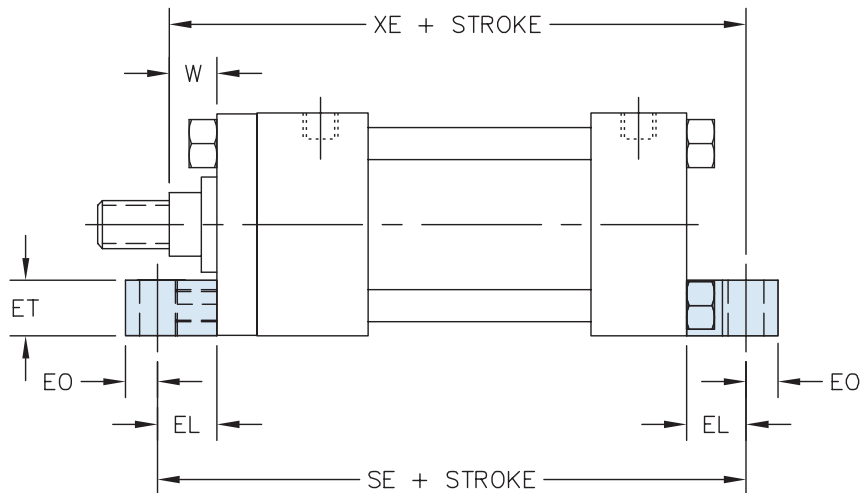
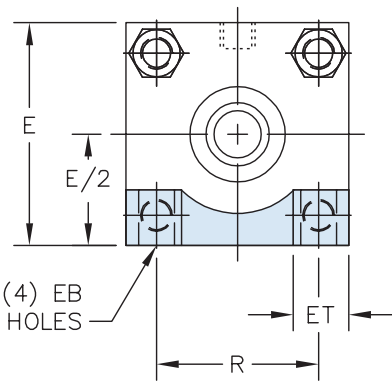
① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

SERIES 'HH' DIMENSIONS: BOTTOM MOUNTS

MS4: BOTTOM TAPPED HOLES



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



HH - Heavy Duty Hydraulic
 HH Rod Lock
 HH Options
 MH - Medium Duty Hydraulic
 TAS - Heavy Duty Pneumatic
 Accessories Page 147
 Strokemaster® Page 153
 Technical Data Page 161

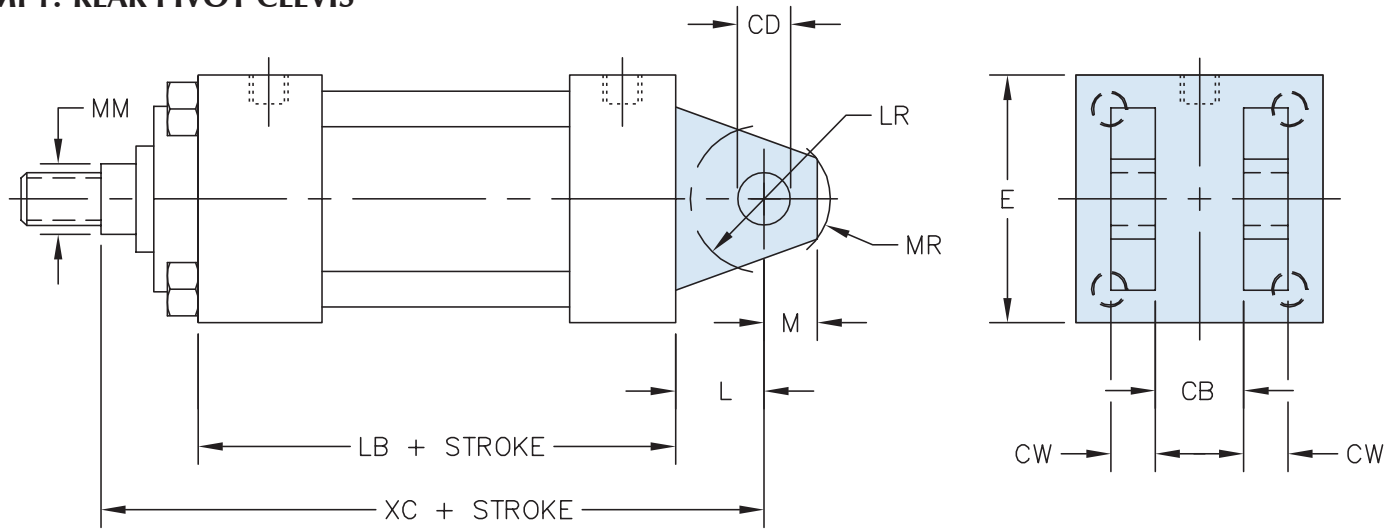
SERIES 'HH' DIMENSIONS: BOTTOM MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	E / 2	MS4 DIMENSIONS						MS7 DIMENSIONS							
					NT	TK	TN	XT	ADD TO STROKE		EB	EL	EO	ET	R	W	ADD TO STROKE	
									SN	ZB							SE	XE
1.50	0.625	3000	2.500	1.250	3/8-16	0.375	0.750	2.000	2.875	6.000	0.438	0.875	0.375	0.750	1.625	0.625	6.750	6.500
	2.375							6.375		1.000						6.875		
2.00	1.000	3000	3.000	1.500	1/2-13	0.438	0.938	2.375	2.875	6.500	0.563	0.938	0.500	0.875	2.047	0.750	7.125	6.938
	2.625							6.750		1.000						7.188		
2.50	1.000	3000	3.500	1.750	5/8-11	0.750	1.313	2.375	3.000	6.625	0.563	0.938	0.500	0.875	2.550	0.750	7.250	7.063
	0.625							2.625		6.875						1.000		7.313
	0.500							2.875		7.125						1.250		7.563
3.25	1.375	3000	4.500	2.250	3/4-10	1.000	1.500	2.750	3.500	7.750	0.688	1.125	0.625	1.188	3.250	0.875	8.500	8.250
	0.875					3.000		8.000		1.125						8.500		
	0.750					3.125		8.125		1.250						8.625		
4.00	1.750	3000	5.000	2.500	1-8	0.875	2.063	3.000	3.750	8.250	0.688	1.125	0.625	1.188	3.820	1.000	8.875	8.750
	0.750					3.125		8.375		1.125						8.875		
	0.750					3.375		8.625		1.375						9.125		
5.00	2.000	3000	6.500	3.250	1-8	1.000	2.938	3.125	4.250	9.125	0.938	1.500	0.750	1.500	4.953	1.125	10.125	9.750
	3.375							9.375		1.375						10.000		
	3.375							9.375		1.375						10.000		
	3.375							9.375		1.375						10.000		
6.00	2.500	3000	7.500	3.750	1 1/4-7	1.250	3.313	3.500	5.125	10.625	1.063	1.688	0.875	1.750	5.734	1.250	11.750	11.313
	1.250					3.500		5.125		10.625								
	1.250					3.500		5.125		10.625								
	0.750					3.500		5.125		10.625								
7.00	3.000	3000	8.500	4.250	1 1/2-6	1.125	3.750	3.813	5.875	11.875	—	—	—	—	—	—	—	—
	1.125					3.813		5.875		11.875								
	1.125					3.813		5.875		11.875								
	0.875					3.813		5.875		11.875								
	1.500					3.813		5.875		11.875								
8.00	3.500	3000	9.500	4.750	1 1/2-6	1.500	4.250	3.938	6.625	13.000	—	—	—	—	—	—	—	—
	1.500					3.938		6.625		13.000								
	1.500					3.938		6.625		13.000								
	1.250					3.938		6.625		13.000								
	1.000					3.938		6.625		13.000								

① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

SERIES 'HH' DIMENSIONS: PIVOT MOUNT

MP1: REAR PIVOT CLEVIS



NOTE: PIVOT PIN INCLUDED WITH CYLINDER

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	② CB	③ CD	CW	L	LR	M	MR	ADD TO STROKE	
											LB	XC
1.50	0.625	3000	2.500	0.750	0.500	0.500	0.750	0.563	0.500	0.625	4.625	6.375
	1.000											6.750
2.00	1.000	3000	3.000	1.250	0.750	0.625	1.250	1.000	0.750	0.938	4.625	7.250
	1.375											7.500
2.50	1.000	3000	3.500	1.250	0.750	0.625	1.250	1.000	0.750	0.938	4.750	7.375
	1.375											7.625
	1.750											7.875
3.25	1.375	3000	4.500	1.500	1.000	0.750	1.500	1.250	1.000	1.188	5.500	8.625
	1.750											8.875
	2.000											9.000
4.00	1.750	3000	5.000	2.000	1.375	1.000	2.125	1.875	1.375	1.625	5.750	9.750
	2.000											9.875
	2.500											10.125
5.00	2.000	3000	6.500	2.500	1.750	1.250	2.250	2.000	1.750	2.125	6.250	10.500
	2.500											10.750
	3.000											10.750
	3.500											10.750
6.00	2.500	3000	7.500	2.500	2.000	1.250	2.500	2.188	2.000	2.375	7.375	12.125
	3.000											
	3.500											
	4.000											
7.00	3.000	3000	8.500	3.000	2.500	1.500	3.000	2.688	2.500	2.875	8.500	13.750
	3.500											
	4.000											
	5.000											
8.00	3.500	3000	9.500	3.000	3.000	1.500	3.250	2.938	2.750	3.125	9.500	15.000
	4.000											
	4.500											
	5.000											

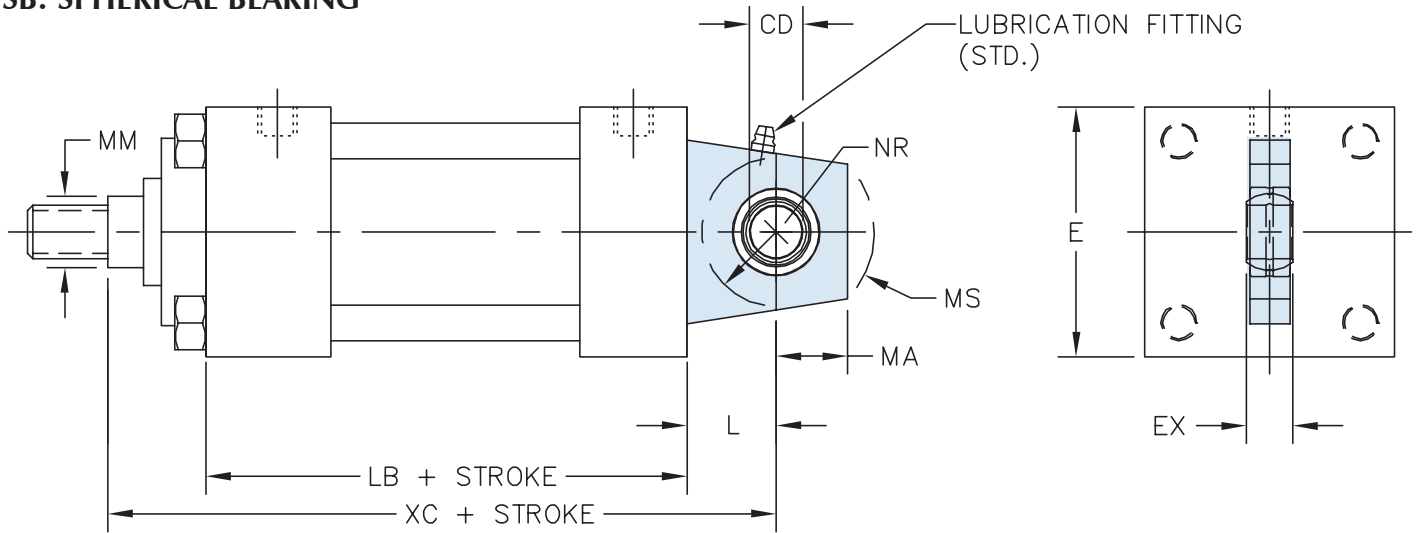
① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

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

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

SERIES 'HH' DIMENSIONS: SB MOUNT

SB: SPHERICAL BEARING



NOTE: PIVOT PIN INCLUDED WITH CYLINDER CAP END ONLY

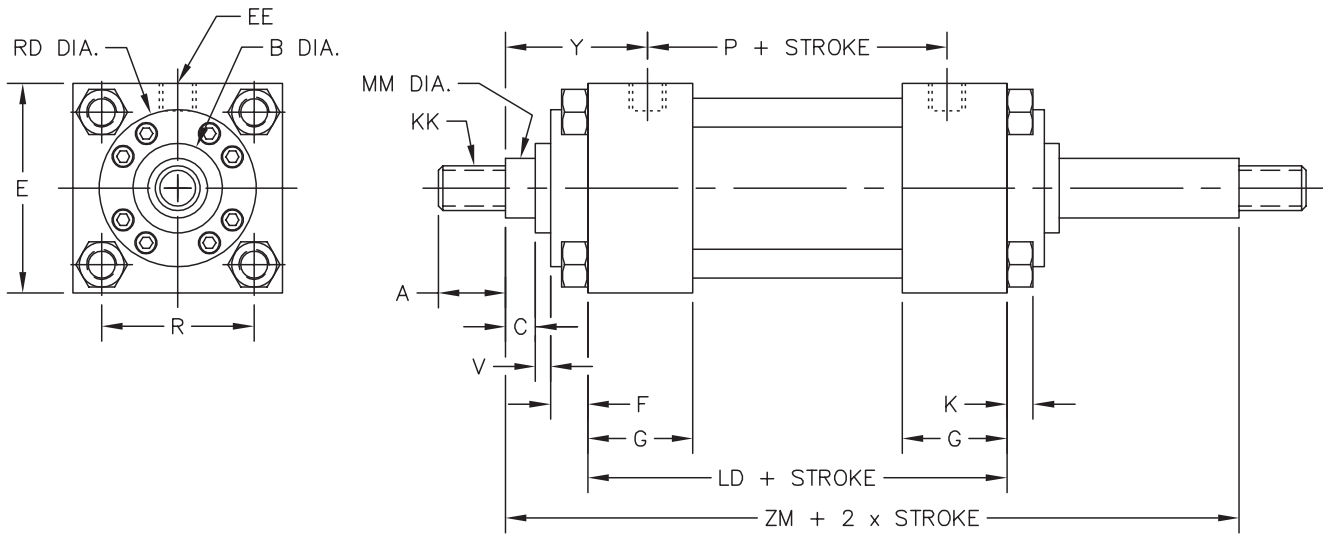
BORE	ROD DIA. (MM)	① MAX PSI RATING	E	② CD	EX	L	NR	MA	MS	ADD TO STROKE	
										LB	XC
1.50	0.625	1650	2.500	0.500	0.437	0.750	0.625	0.750	0.938	4.625	6.375
	1.000	1650									6.750
2.00	1.000	2200	3.000	0.750	0.656	1.250	1.000	1.000	1.375	4.625	7.250
	1.375	2200									7.500
2.50	1.000	1400	3.500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

① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

② 'CD' dimension tolerance for pin is -.0005 / -.001.

SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

MX0D: NO MOUNT



BORE	ROD DIA. (MM)	① MAX PSI RATING	E	A	B	C	EE		F	G	K	KK	R	③ RD	V	Y	ADD TO STROKE		ADD 2X STROKE
							NPTF	SAE									LD	P	ZM
1.50	0.625	3000	2.500	0.750	1.124	0.375	1/2	10	0.375	1.750	0.375		1.625	—	0.250	2.000	4.875	2.875	6.875
	1.000			1.125	1.499	0.500		8						—	0.500	2.375			7.625
2.00	1.000	3000	3.000	1.125	1.499	0.500	1/2	10	0.625	1.750	0.500		2.047	—	0.250	2.375	4.875	2.875	7.625
	1.375			1.625	1.999	0.625		8						—	0.375	2.625			8.125
2.50	1.000	3000	3.500	1.125	1.499	0.500	1/2	10	0.625	1.750	0.500		2.547	2.625	0.250	2.375	5.000	3.000	7.750
	1.375			1.625	1.999	0.625								—	0.375	2.625			8.250
	1.750			2.000	2.374	0.750								—	0.500	2.875			8.750
3.25	1.375	3000	4.500	1.625	1.999	0.625	3/4	12	0.750	2.000	0.625		3.250	3.250	0.250	2.750	5.750	3.500	9.000
	1.750			2.000	2.374	0.750								—	0.375	3.000			9.500
	2.000			2.250	2.624	0.875								—	0.375	3.125			9.750
4.00	1.750	3000	5.000	2.000	2.374	0.750	3/4	12	0.875	2.000	0.625		3.820	3.875	0.250	2.938	6.000	3.875	9.750
	2.000			2.250	2.624	0.875								—	0.375	3.063			10.000
	2.500			3.000	3.124	1.000								—	0.375	3.313			10.500
5.00	2.000	3000	6.500	2.250	2.624	0.875	3/4	12	0.875	2.000	0.875		4.953	4.250	0.250	3.125	6.500	4.250	10.500
	2.500			3.000	3.124	1.000								4.625	0.375	3.375			11.000
	3.000			3.500	3.749	1.000								5.250	0.375	3.375			11.000
	3.500			3.500	4.249	1.000								—	0.375	3.375			11.000
6.00	2.500	3000	7.500	3.000	3.124	1.000	1	16	0.875	2.250	1.000		5.734	4.625	0.375	3.500	7.375	4.875	11.875
	3.000			3.500	3.749				0.875					5.250	0.375				
	3.500			3.500	4.249				0.875					5.625	0.375				
	4.000			4.000	4.749				1.000					6.438	0.250				
7.00	3.000	3000	8.500	3.500	3.749	1.000	1	20	0.875	2.750	1.125		6.580	5.250	0.375	3.750	8.500	5.500	13.000
	3.500			3.500	4.249				0.875					5.625	0.375				
	4.000			4.000	4.749				1.000					6.438	0.250				
	4.500			4.500	5.249				1.000					7.125	0.250				
	5.000			5.000	5.749				1.000					7.250	0.250				
8.00	3.500	3000	9.500	3.500	4.249	1.000	1 1/2	24	0.875	3.000	1.250		7.500	5.625	0.375	3.938	9.500	6.125	14.000
	4.000			4.000	4.749				1.000					6.438	0.250				
	4.500			4.500	5.249				1.000					7.125	0.250				
	5.000			5.000	5.749				1.000					7.625	0.250				
	5.500			5.500	6.249				1.000					8.375	0.250				

SEE ROD END DETAIL CHART ON PAGE 8

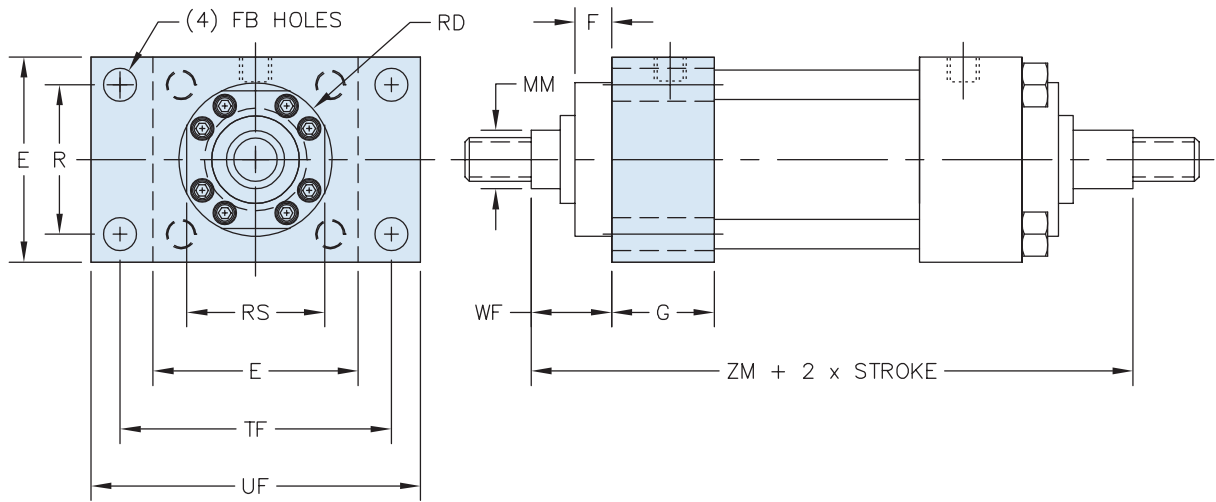
① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

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

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

SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

ME5D: HEAD RECTANGULAR MOUNTING HOLES

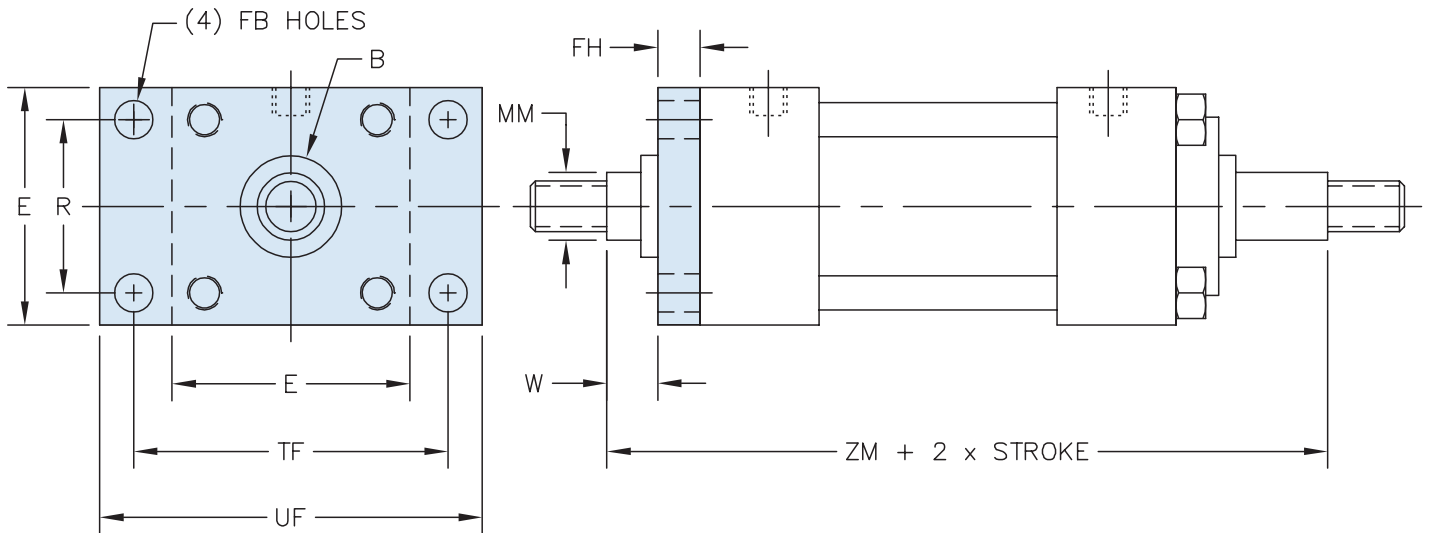


BORE	ROD DIA. (MM)	① MAX PSI RATING	E	F	FB	G	R	RD	RS	TF	UF	WF	ADD 2X STROKE
													ZM
1.50	0.625	3000	2.500	0.375	0.438	1.750	1.625	2.375	—	3.438	4.250	1.000	6.875
	2.563							2.438	1.375			7.625	
2.00	1.000	3000	3.000	0.625	0.563	1.750	2.047	2.625	—	4.125	5.125	1.375	7.625
	3.250							2.938	1.625			8.125	
2.50	1.000	3000	3.500	0.625	0.563	1.750	2.547	2.625	—	4.625	5.625	1.375	7.750
	3.250							—	1.625			8.250	
	3.875							3.438	1.875			8.750	
3.25	1.375	3000	4.500	0.750	0.688	2.000	3.250	3.250	—	5.875	7.125	1.625	9.000
	1.750			0.875				3.875	—			1.875	9.500
	2.000			0.875				4.250	—			2.000	9.750
4.00	1.750	3000	5.000	0.875	0.688	2.000	3.820	3.875	—	6.375	7.625	1.875	9.750
	2.000							4.250	—			2.000	10.000
	2.500							4.625	—			2.250	10.500
5.00	2.000	3000	6.500	0.875	0.938	2.000	4.953	4.250	—	8.188	9.750	2.000	10.500
	2.500							4.625	—			2.250	11.000
	3.000							5.250	—			2.250	11.000
	3.500							5.625	—			2.250	11.000
6.00	2.500	3000	7.500	0.875	1.063	2.250	5.725	4.625	—	9.438	11.250	2.250	11.875
	3.000			0.875				5.250	—				
	3.500			0.875				5.625	—				
	4.000			1.000				6.438	—				
7.00	3.000	3000	8.500	0.875	1.188	2.750	6.580	5.250	—	10.625	12.625	2.250	13.000
	3.500			0.875				5.625	—				
	4.000			1.000				6.438	—				
	4.500			1.000				7.125	—				
	5.000			1.000				7.250	—				
8.00	3.500	3000	9.500	0.875	1.313	3.000	7.500	5.625	—	11.813	14.000	2.250	14.000
	4.000			1.000				6.438	—				
	4.500			1.000				7.125	—				
	5.000			1.000				7.625	—				
	5.500			1.000				8.375	—				

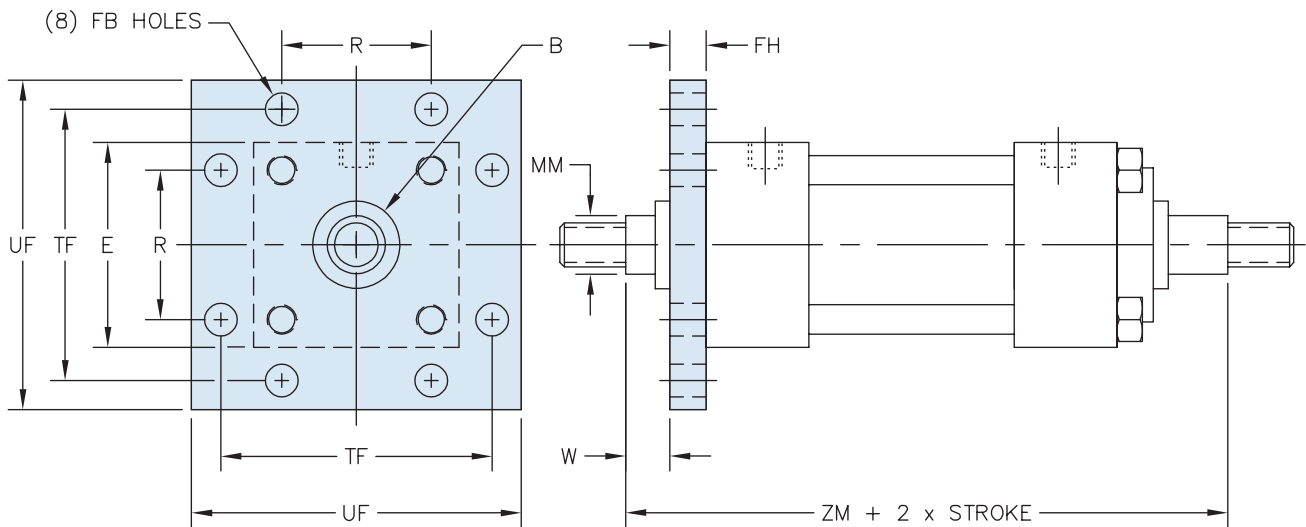
① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

MF1D: HEAD FLANGE



MF5D: HEAD SQUARE FLANGE



SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

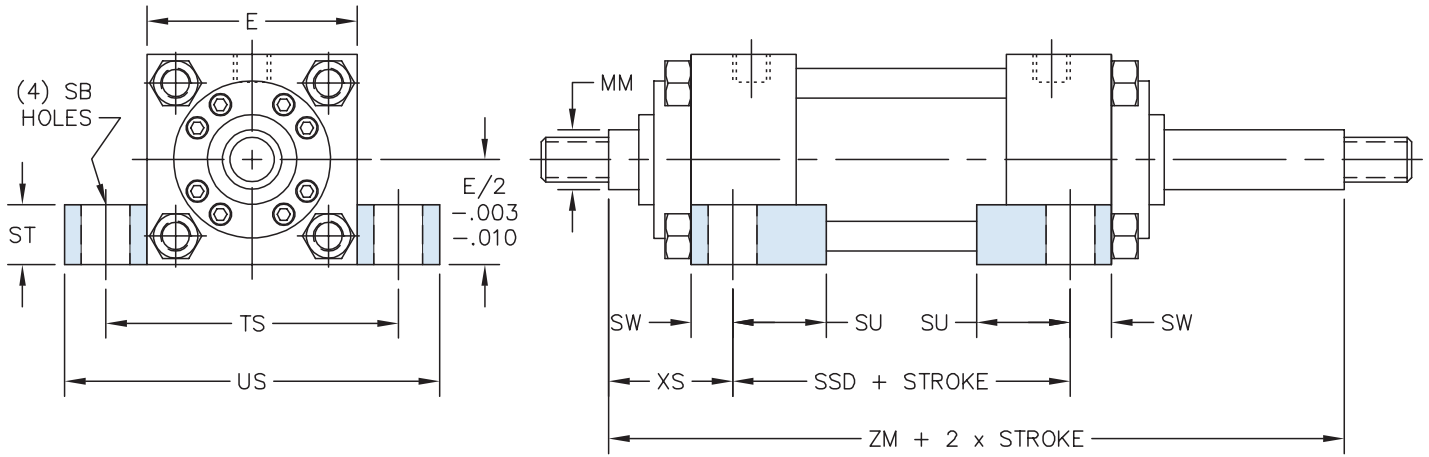
BORE	ROD DIA. (MM)	① MAX PSI RATING	E	② B	FH	FB	R	TF	UF	W	ADD 2X STROKE
											ZM
1.50	0.625	3000	2.500	1.124	0.375	0.438	1.625	3.438	4.250	0.625	6.875
	1.000			1.499							7.625
2.00	1.000	3000	3.000	1.499	0.625	0.563	2.047	4.125	5.125	0.750	7.625
	1.375			1.999						1.000	8.125
2.50	1.000	3000	3.500	1.499	0.625	0.563	2.547	4.625	5.625	0.750	7.750
	1.375			1.999						1.000	8.250
	1.750			2.374						1.250	8.750
3.25	1.375	3000	4.500	1.999	0.750	0.688	3.250	5.875	7.125	0.875	9.000
	1.750			2.374						1.125	9.500
	2.000			2.624						1.250	9.750
4.00	1.750	3000	5.000	2.374	0.875	0.688	3.820	6.375	7.625	1.000	9.750
	2.000			2.624						1.125	10.000
	2.500			3.124						1.375	10.500
5.00	2.000	3000	6.500	2.624	0.875	0.938	4.953	8.188	9.750	1.125	10.500
	2.500			3.124						1.375	11.000
	3.000			3.749						1.375	11.000
	3.500			4.249						1.375	11.000
6.00	2.500	3000	7.500	3.124	1.000	1.063	5.725	9.438	11.250	1.250	11.875
	3.000			3.749							
	3.500			4.249							
	4.000			4.749							
7.00	3.000	3000	8.500	3.749	1.000	1.188	6.580	10.625	12.625	1.250	13.000
	3.500			4.249							
	4.000			4.749							
	4.500			5.249							
	5.000			5.749							
8.00	3.500	3000	9.500	4.249	1.000	1.313	7.500	11.813	14.000	1.250	14.000
	4.000			4.749							
	4.500			5.249							
	5.000			5.749							
	5.500			6.249							

① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

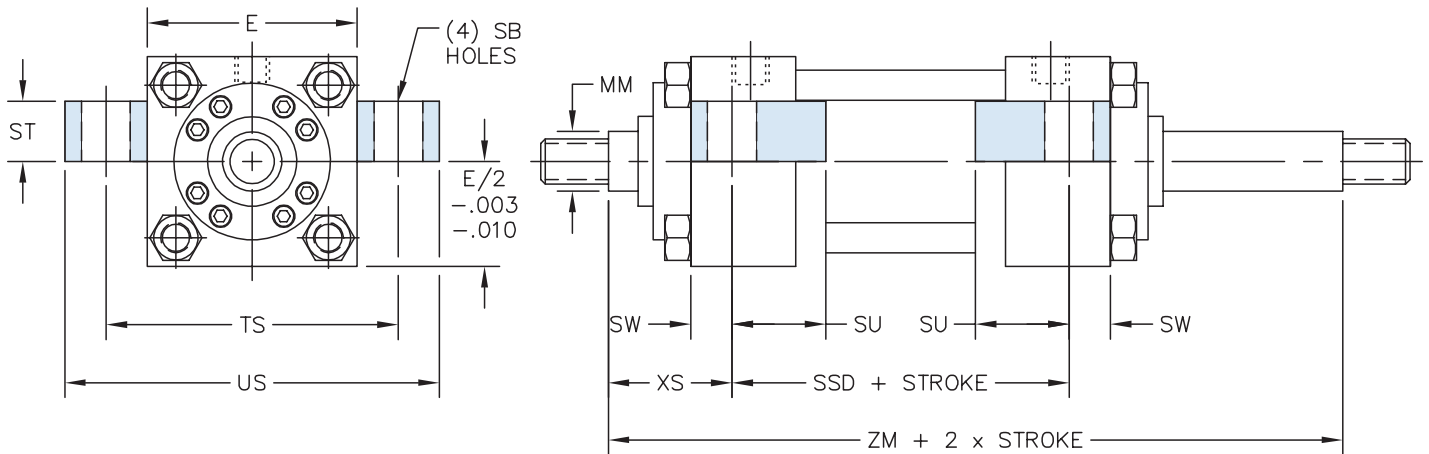
② 'B' dimension tolerance is +.000 / -.002

SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

MS2D: SIDE LUGS



MS3D: CENTER LINE LUGS



HH - Heavy Duty Hydraulic
 HH Rod Lock
 HH Options
 MH - Medium Duty Hydraulic
 TAS - Heavy Duty Pneumatic
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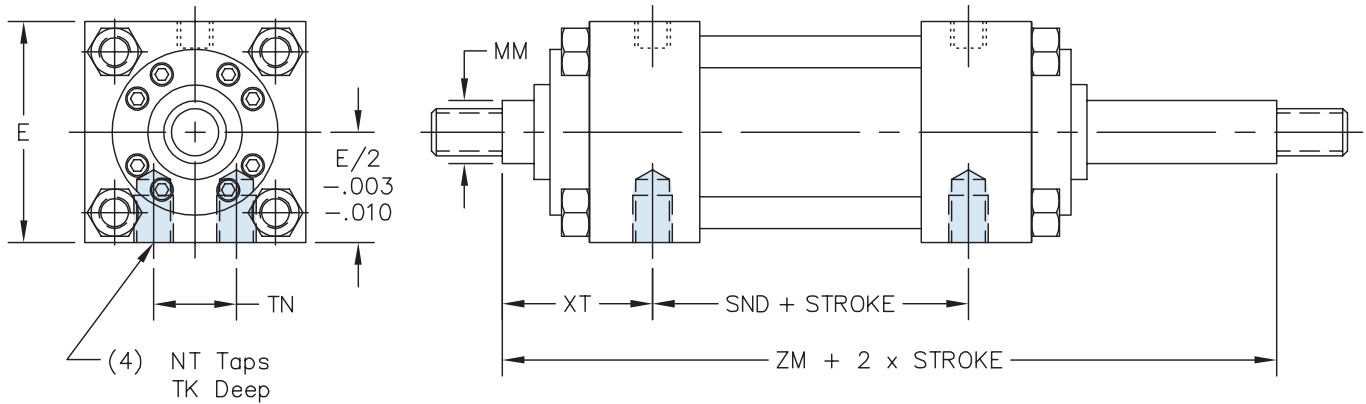
SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIA. (MM)	Ⓢ MAX PSI RATING	E	E / 2	SB	ST	SU	SW	TS	US	XS	ADD TO STROKE	ADD 2X STROKE
												SSD	ZM
1.50	0.625	3000	2.500	1.250	0.438	0.500	0.938	0.375	3.250	4.000	1.375	4.125	6.875
	1.000												7.625
2.00	1.000	3000	3.000	1.500	0.563	0.750	1.250	0.500	4.000	5.000	1.875	3.875	7.625
	1.375												8.125
2.50	1.000	3000	3.500	1.750	0.813	1.000	1.563	0.688	4.875	6.250	2.063	3.625	7.750
	1.375												8.250
	1.750												8.750
3.25	1.375	3000	4.500	2.250	0.813	1.000	1.563	0.688	5.875	7.250	2.313	4.375	9.000
	1.750												9.500
	2.000												9.750
4.00	1.750	3000	5.000	2.500	1.063	1.250	2.000	0.875	6.750	8.500	2.750	4.250	9.750
	2.000												10.000
	2.500												10.500
5.00	2.000	3000	6.500	3.250	1.063	1.250	2.000	0.875	8.250	10.000	2.875	4.750	10.500
	2.500												11.000
	3.000												11.000
	3.500												11.000
6.00	2.500	3000	7.500	3.750	1.313	1.500	2.500	1.125	9.750	12.000	3.375	5.125	11.875
	3.000												
	3.500												
	4.000												
7.00	3.000	3000	8.500	4.250	1.563	1.750	2.875	1.375	11.250	14.000	3.625	5.750	13.000
	3.500												
	4.000												
	4.500												
	5.000												
8.00	3.500	3000	9.500	4.750	1.563	1.750	2.875	1.375	12.250	15.000	3.625	6.750	14.000
	4.000												
	4.500												
	5.000												
	5.500												

Ⓢ Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

MS4D: BOTTOM TAPPED HOLES

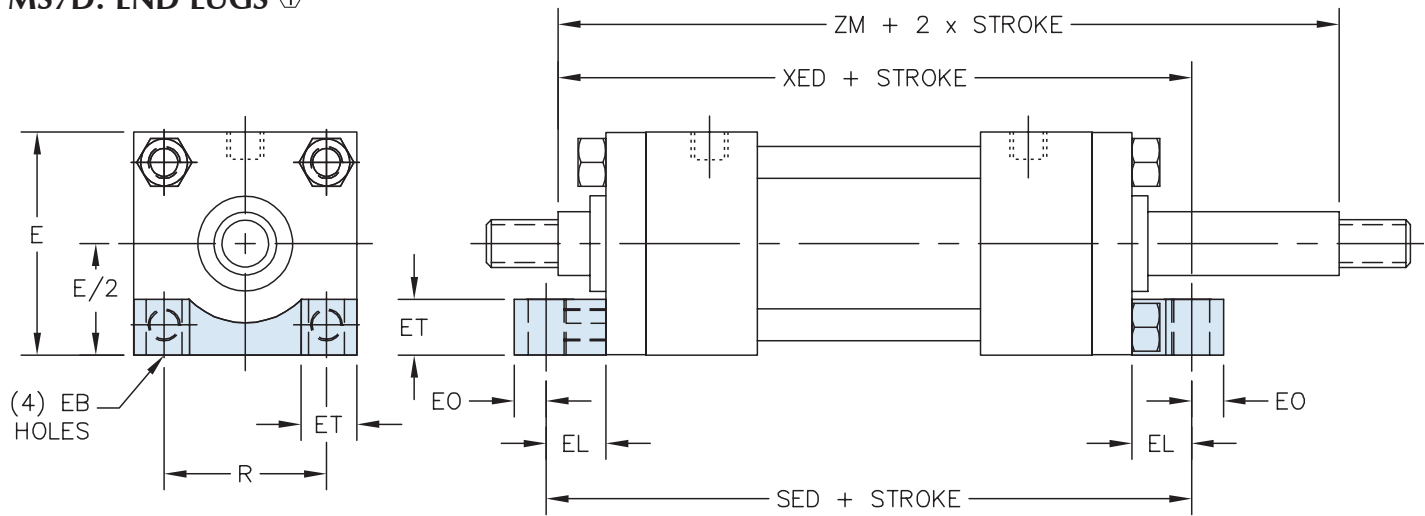


BORE	ROD DIA. (MM)	Ⓜ MAX PSI RATING	E	E / 2	NT	TK	TN	XT	ADD TO STROKE	ADD 2X STROKE	
									SND	ZM	
1.50	0.625	3000	2.500	1.250	3/8 - 16	0.375	0.750	2.000	2.875	6.875	
	1.000					0.375		2.375		7.625	
2.00	1.000	3000	3.000	1.500	1/2 - 13	0.438	0.938	2.375	2.875	7.625	
	1.375					0.438		2.625		8.125	
2.50	1.000	3000	3.500	1.750	5/8 - 11	0.750	1.313	2.375	3.000	7.750	
	1.375					0.625		2.625		8.250	
	1.750					0.500		2.875		8.750	
3.25	1.375	3000	4.500	2.250	3/4 - 10	1.000	1.500	2.750	3.500	9.000	
	1.750					0.875		3.000		9.500	
	2.000					0.750		3.125		9.750	
4.00	1.750	3000	5.000	2.500	1 - 8	0.875	2.063	3.000	3.750	9.750	
	2.000					0.750		3.125		10.000	
	2.500					0.750		3.375		10.500	
5.00	2.000	3000	6.500	3.250	1 - 8	1.000	2.938	3.125	4.250	10.500	
	2.500									11.000	
	3.000									11.000	
	3.500									11.000	
6.00	2.500	3000	7.500	3.750	1 1/4 - 7	1.250	3.313	3.500	4.875	11.875	
	3.000					1.250					
	3.500					1.250					
	4.000					0.750					
7.00	3.000	3000	8.500	4.250	1 1/2 - 6	1.125	3.750	3.813	5.375	13.000	
	3.500										
	4.000										
	4.500										
8.00	5.000	3000	9.500	4.750	1 1/2 - 6	1.500	4.250	3.938	6.125	14.000	
	3.500										1.500
	4.000										1.500
	4.500										1.250
	5.500										1.000

① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

MS7D: END LUGS ①



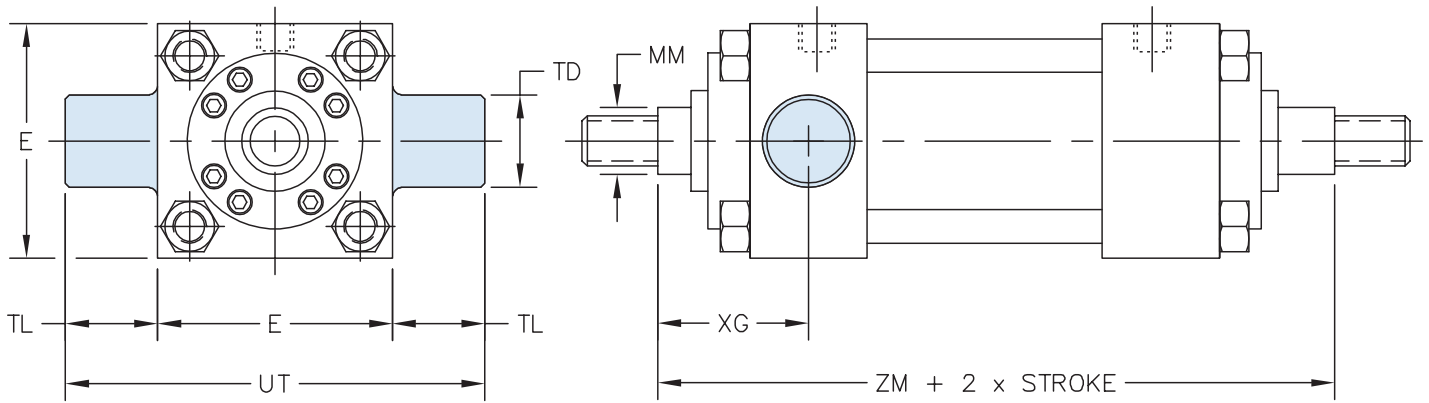
BORE	ROD DIA. (MM)	② MAX PSI RATING	E	E / 2	EB	EL	EO	ET	R	ADD TO STROKE		ADD 2X STROKE
										SED	XED	ZM
1.50	0.625	3000	2.500	1.250	0.438	0.875	0.375	0.750	1.625	7.375	7.125	6.875
	1.000	NOT AVAILABLE										
2.00	1.000	3000	3.000	1.500	0.563	0.938	0.500	0.875	2.047	8.000	7.687	7.625
	1.375	NOT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

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

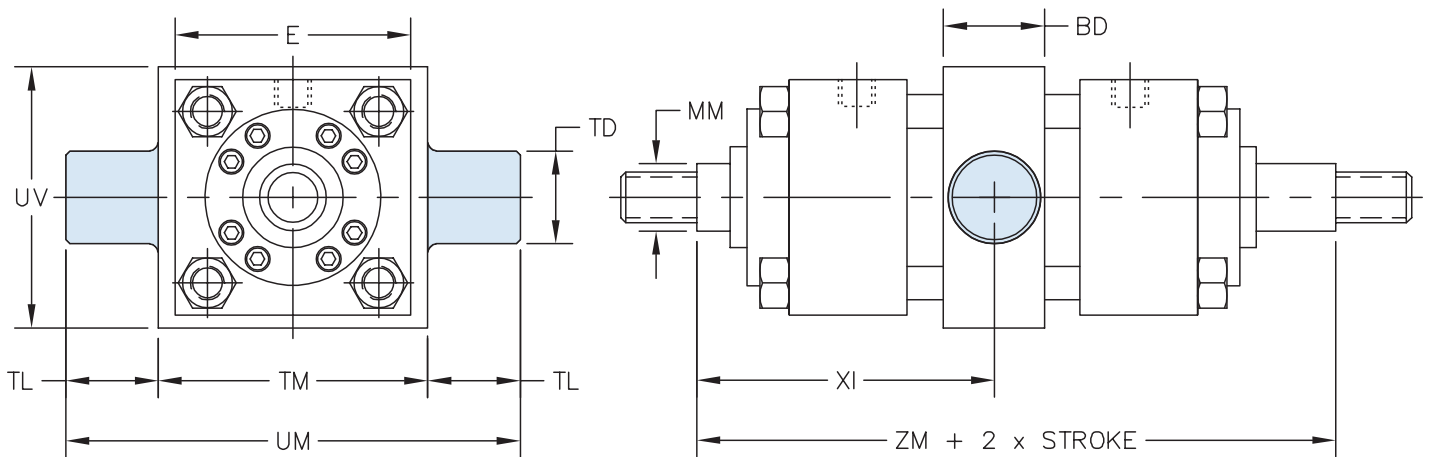
② Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

MT1D: HEAD TRUNNION



MT4D: INTERMEDIATE TRUNNION



HH - Heavy Duty Hydraulic
 HH Rod Lock
 HH Options
 MH - Medium Duty Hydraulic
 TAS - Heavy Duty Pneumatic
 Accessories Page 147
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SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIA. (MM)	① MAX PSI RATING	E	BD	② TD	TL	TM	UM	UT	UV	XG	③ MT4 XI MIN	MT4 MIN STROKE	ADD TO STROKE	ADD 2X STROKE
														MT4 XI MAX	ZM
1.50	0.625	3000	2.500	1.500	1.000	1.000	3.000	5.000	4.500	3.000	1.875	3.625	0.375	3.250	6.875
	1.000													7.625	
2.00	1.000	3000	3.000	1.500	1.375	1.375	3.500	6.250	5.750	3.500	2.250	4.000	0.375	3.625	7.625
	1.375													8.125	
2.50	1.000	3000	3.500	1.500	1.375	1.375	4.000	6.750	6.250	4.000	2.250	4.000	0.250	3.750	7.750
	1.375													4.000	8.250
	1.750													4.250	8.750
3.25	1.375	3000	4.500	2.000	1.750	1.750	5.000	8.500	8.000	5.000	2.625	4.750	0.500	4.250	9.000
	1.750													4.500	9.500
	2.000													4.625	9.750
4.00	1.750	3000	5.000	2.000	1.750	1.750	5.500	9.000	8.500	5.500	2.875	5.000	0.250	4.750	9.750
	2.000													4.875	10.000
	2.500													5.125	10.500
5.00	2.000	3000	6.500	2.500	1.750	1.750	7.000	10.500	10.000	7.250	3.000	5.375	0.250	5.125	10.500
	2.500													5.375	11.000
	3.000													5.375	11.000
	3.500													5.375	11.000
6.00	2.500	3000	7.500	3.000	2.000	2.000	8.500	12.500	11.500	8.750	3.375	6.125	0.375	5.750	11.875
	3.000														
	3.500														
	4.000														
7.00	3.000	3000	8.500	3.000	2.500	2.500	9.750	14.750	13.500	10.000	3.625	6.625	0.250	6.375	13.000
	3.500														
	4.000														
	4.500														
	5.000														
8.00	3.500	3000	9.500	3.500	3.000	3.000	11.000	17.000	15.500	11.750	3.750	7.125	0.250	6.875	14.000
	4.000														
	4.500														
	5.000														
	5.500														

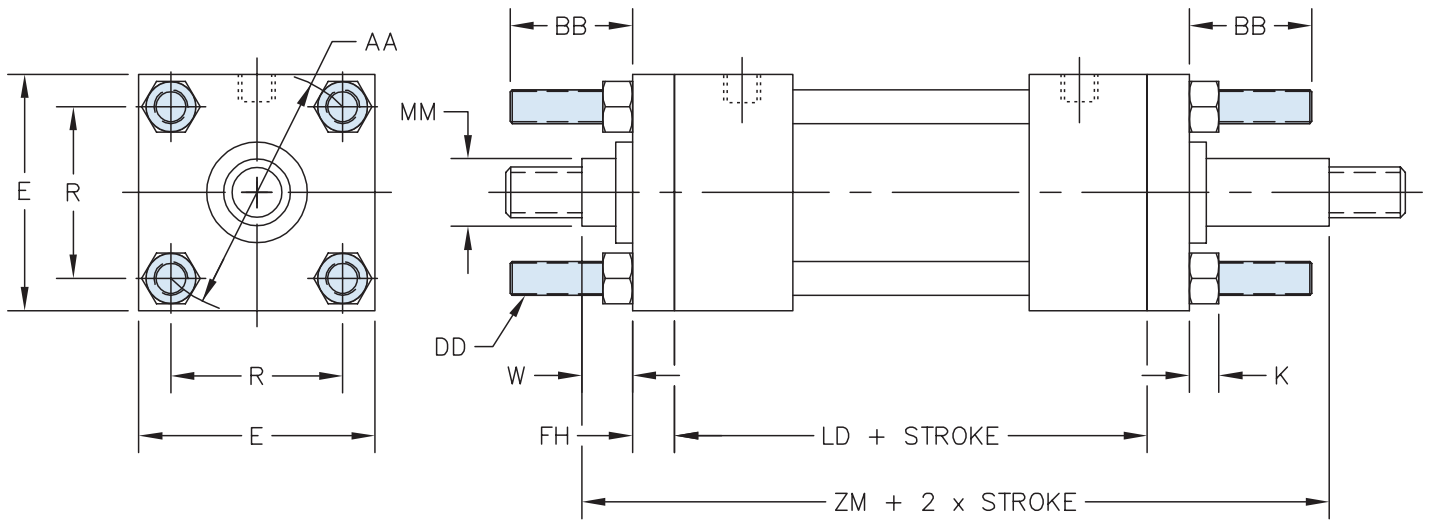
① Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

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

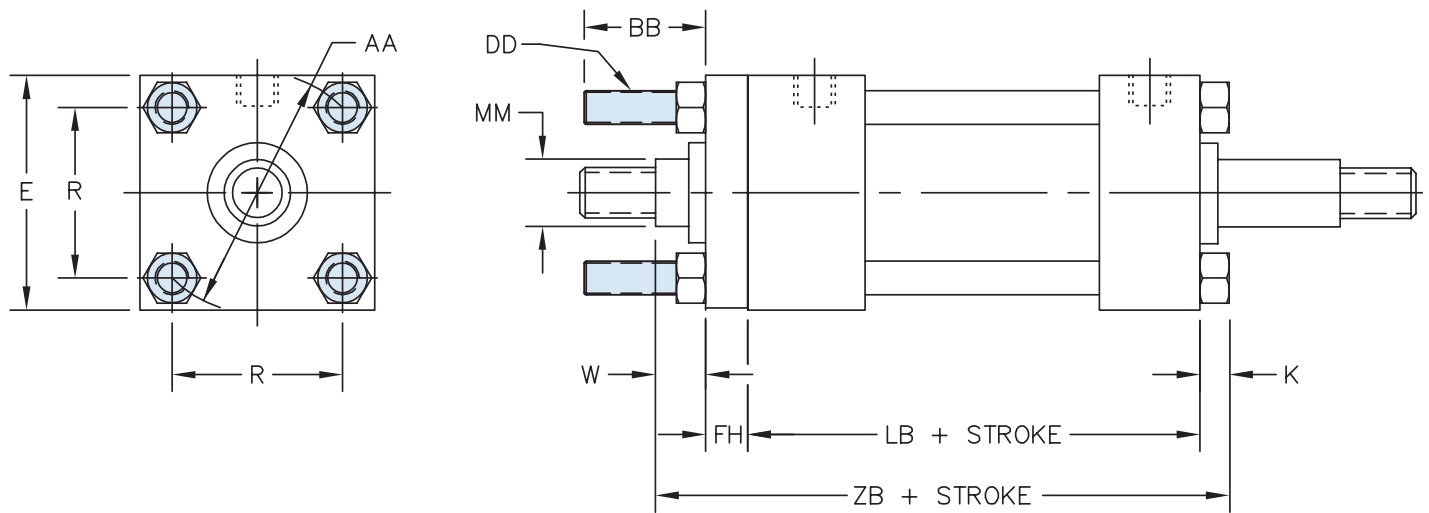
③ 'XI' dimension is the minimum that can be supplied (customer to specify 'XI' dimension).

SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

MX1D: EXTENDED TIE-RODS - HEAD & CAP



MX3D: EXTENDED TIE-RODS - HEAD END



HH - Heavy Duty Hydraulic
 HH Rod Lock
 HH Options
 MH - Medium Duty Hydraulic
 TAS - Heavy Duty Pneumatic
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SERIES 'HH' DIMENSIONS: DOUBLE END MOUNTS

BORE	ROD DIA. (MM)	Ⓜ MAX PSI RATING	E	AA	BB	DD	FH	K	R	W	ADD TO STROKE	ADD 2X STROKE
											LD	ZM
1.50	0.625	3000	2.500	2.300	1.375	3/8 - 24	0.375	0.375	1.625	0.625	4.875	6.875
	1.000									7.625		
2.00	1.000	3000	3.000	2.900	1.813	1/2 - 20	0.625	0.500	2.047	0.750	4.875	7.625
	1.375									8.125		
2.50	1.000	3000	3.500	3.600	1.813	1/2 - 20	0.625	0.500	2.547	0.750	5.000	7.750
	1.375									8.250		
	1.750									8.750		
3.25	1.375	3000	4.500	4.600	2.313	5/8 - 18	0.750	0.625	3.250	0.875	5.750	9.000
	1.750									9.500		
	2.000									9.750		
4.00	1.750	3000	5.000	5.400	2.313	5/8 - 18	0.875	0.625	3.820	1.000	6.000	9.750
	2.000									10.000		
	2.500									10.500		
5.00	2.000	3000	6.500	7.000	3.188	7/8 - 14	0.875	0.875	4.953	1.125	6.500	10.500
	2.500									11.000		
	3.000									11.000		
	3.500									11.000		
6.00	2.500	3000	7.500	8.100	3.625	1 - 14	1.000	1.000	5.734	1.250	7.375	11.875
	3.000											
	3.500											
	4.000											
7.00	3.000	3000	8.500	9.300	4.125	1 1/8 - 12	1.000	1.125	6.580	1.250	8.500	13.000
	3.500											
	4.000											
	4.500											
	5.000											
8.00	3.500	3000	9.500	10.600	4.500	1 1/4 - 12	1.000	1.250	7.500	1.250	9.500	14.000
	4.000											
	4.500											
	5.000											
	5.500											

Ⓜ Max single acting pressure rating (NON-Shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

SERIES 'HH' BASIC OPTIONS

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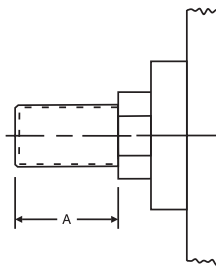
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A= Extended Piston Rod Thread

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

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

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

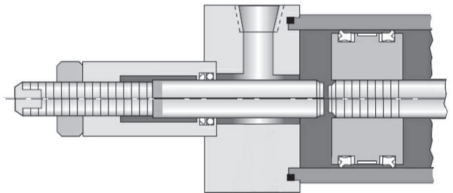


AS Adjustable Stroke (Retract)

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

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

ADJUSTABLE STROKE	
BORE	MAX "AS"
1.50	Up to 8 inch
2.00-3.25	Up to 6 inch
4.00-6.00	Up to 5 inch
7.00 & 8.00	Up to 4 inch



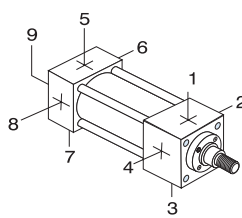
Consult factory for additional adjustable strokes offerings.

ABP= Air Bleed Ports

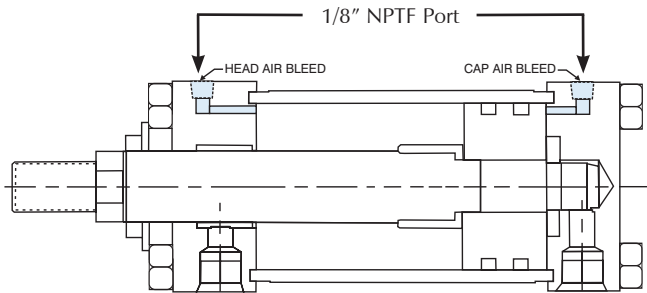
Air bleeds can be provided at either or both ends of the cylinder. Air bleeds should be located at the highest point in the cylinder for maximum effectiveness. The location needs to be specified, similar to port locations.

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

Plugged from factory.

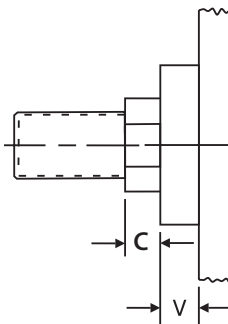


Location 9 is center of cap face.



C= Extended Piston Rod

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



Example: If C=0.50", then 1" rod extension is C=1.50"

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

Extended piston rods do not delay delivery.

SERIES 'HH' BASIC OPTIONS

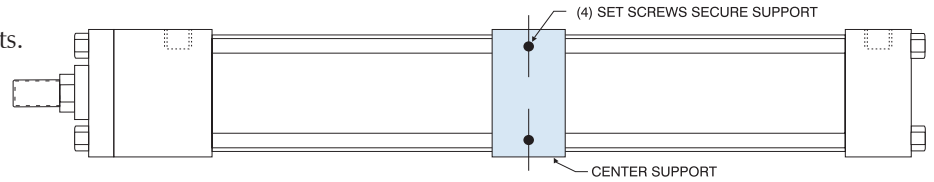
CS Center Supports

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

Center supports can include MS2 mounts.

Contact TRD for more information.

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



H C Cushions

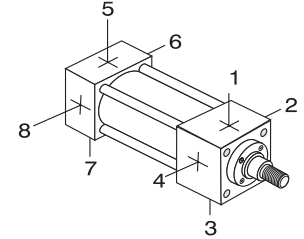
TRD's cushion design features industry proven technology and ultra fine adjustment needles for perfect deceleration and long life. Cushion adjustment needle positions need to be specified.

Example: H2C6

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

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

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



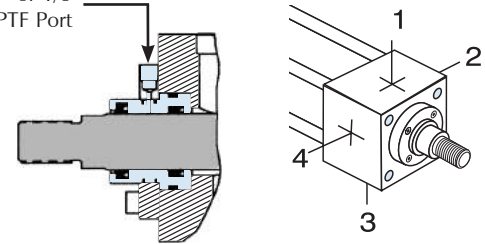
Note: Cylinders with a short stroke (value varies with bore/rod diameter and cushion combinations) may result in improper cylinder operation. Consult factory for availability.

DBB= Drain Back Bushing

When oil leakage cannot be tolerated, a rod bushing drain port can be provided. Since there isn't any pressure in the drain line, clear tubing can offer a visual inspection of any leakage. A constant leak indicates that the rod seal is worn and needs to be replaced.

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

1/16" or 1/8" NPTF Port



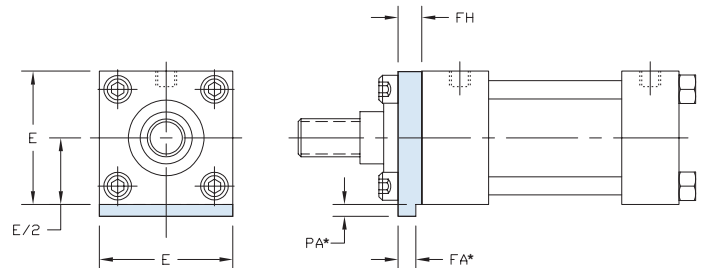
EK Extended Key Plate

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

An additional mount needs to be specified to secure cylinder.

Available bore sizes: HH - 1.50" to 8.00" Bore

'HH' DIMENSIONS FOR EXTENDED KEY PLATE				
BORE	E	FA*	FH	PA*
1.50	2.500	0.312 / 0.314	0.375	0.188
2.00	3.000	0.562 / 0.564	0.625	0.313
2.50	3.500	0.562 / 0.564	0.625	0.313
3.25	4.500	0.687 / 0.689	0.750	0.375
4.00	5.000	0.812 / 0.814	0.875	0.438
5.00	6.500	0.812 / 0.814	0.875	0.438
6.00	7.500	0.937 / 0.939	1.000	0.500
7.00	8.500	0.937 / 0.939	1.000	0.500
8.00	9.500	0.937 / 0.939	1.000	0.500



*FA & PA dimensions will have a black oxide finish and will not be painted.

SERIES 'HH' BASIC OPTIONS

Option T (PTFE) Piston Seal - Recommended for High Load & Low Friction Applications

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

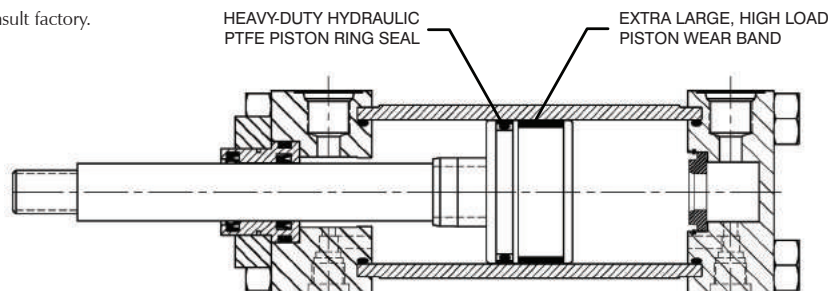
Design Benefits

- Bi-direction piston seal offers low leakage rating.
- Piston seal design offers lower friction than cast iron rings or lip seals, which eliminate stick/slip breakaway issues.
- Glass filled PTFE piston seal is 20% stronger than bronze filled seals.
- High contamination tolerant; offers the longest life of any seal type.
- Temperature Rating (PTFE): -100°F to 400°F (-73°C to 204°C)
- Temperature Rating (Nitrile): -20°F to 200°F (-29°C to 93°C)
- Temperature Rating (Viton): 0°F to 400°F (-18°C to 204°C)

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

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

*Other materials are available, consult factory.

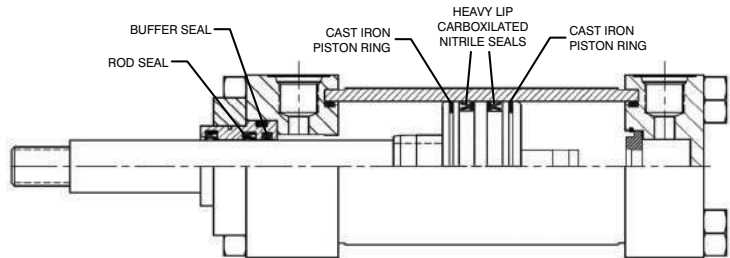


HSS High Shock Seals

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

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

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



KKX Non-Standard Rod Threads

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

Ordering Example: HH - MF1 - 150 X 24 - 100 - KKX = 3/4-10 - P15 = N375 - SSSS

↑ Add special thread to part number

KK3M Female Metric Rod Threads

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

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

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

KK3X Female Special Rod Threads

TRD can machine a wide range of female rod threads. Standard NFPA rod threads are UNF (fine), class 2 threads. Common alternative choices are UNC (coarse) threads. Note: unless otherwise specified, the rod thread will be standard catalog "A" dimension lengths.

Ordering Example: HH - MF1 - 150 X 24 - 100 - KK3X = 3/4-10 - P15 = N375 - SSSS

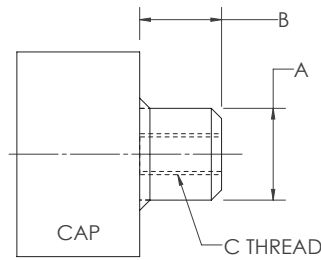
SERIES 'HH' BASIC OPTIONS

LRB Lift Ring Boss

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

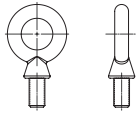
UNC coarse threads are provided to accept high load type lifting eyes (lift eyes are available with the below options).

Also available in additional locations and styles.



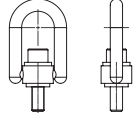
LRE

Lift Ring Eye



LRS

Swivel Lift Ring



LIFT LUG DIMENSIONS

BORE	A	B	C	STRAIGHT PULL LIFTING CAPACITY*
1.50	1.120	1.000	1/2-13	2500
2.00	1.500	1.250	5/8-11	4000
2.50	1.500	1.250	5/8-11	4000
3.25	2.000	1.500	3/4-10	6000
4.00	2.000	1.500	3/4-10	6000
5.00	2.000	1.500	3/4-10	6000
6.00	2.500	2.000	1-8	9000
7.00	2.500	2.000	1-8	9000
8.00	2.500	2.000	1-8	9000

*Lifting capacity is the maximum capacity for intermittent lifting and placement of cylinder only. It is NOT intended to be used as the primary cylinder mount.
Note: Not available on MF2, MF6, ME6, MP1 and SB mounts.

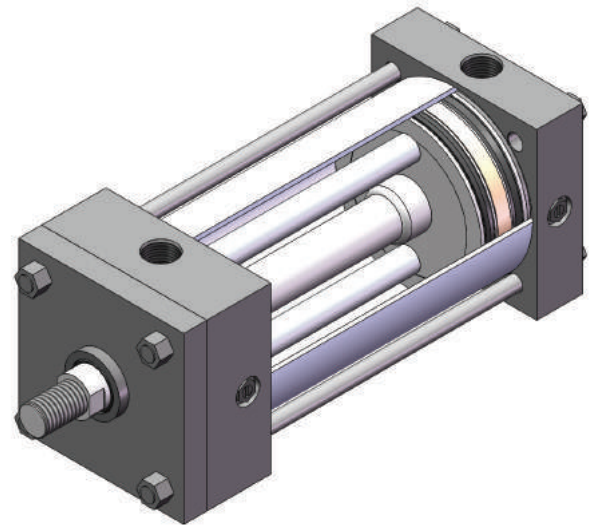
NR Non-Rotating (NFA) Cylinders

Benefits

- Two integral guide rods throughout stroke torqued with hex nuts on cap end
- 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
- Steel, hard chrome plated guide rods offer an abrasive resistant surface

Advantages

- Eliminates the need for external guide shafts in many positioning applications
- Guide rods are self-cleaning and not subjected to harsh cleaners
- Compact design saves space; no larger than standard NFA cylinders!
- Durable
- Great when rod end rotation is not wanted

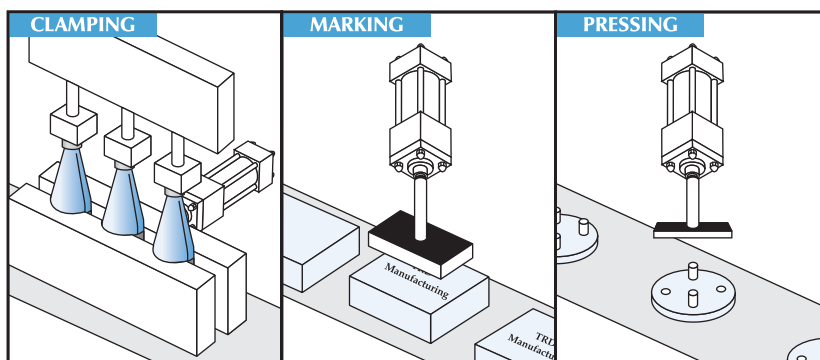


AVAILABLE BORE SIZES WITH 'NR' GUIDE ROD SIZES AND MAX. STROKE

GUIDE ROD	BORE	ROD DIA. (MM)	CUSHIONS	MAX. STROKE
.375	3.25	1.375	CAP ONLY	18"
.625	5.00	2.000	AVAILABLE	30"
.625	6.00	2.500	AVAILABLE	30"
		3.000		
1.000	8.00	3.500	AVAILABLE	40"

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

Application Possibilities:

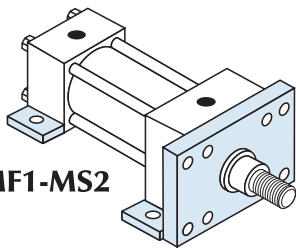


SERIES 'HH' BASIC OPTIONS

MULTIPLE MOUNTS

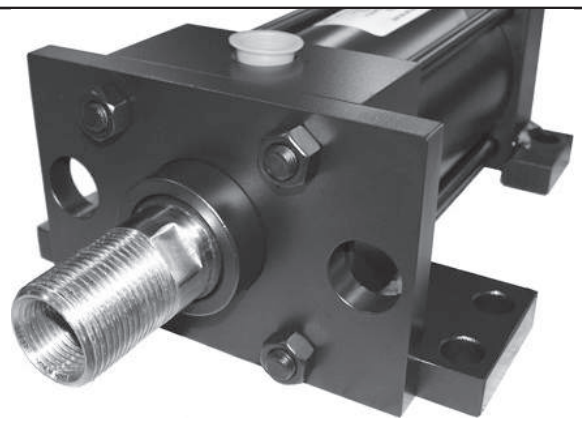
Cylinders can be furnished with a wide selection of multiple mounts.

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



MF1-MS2

↑ Add additional mount to part number



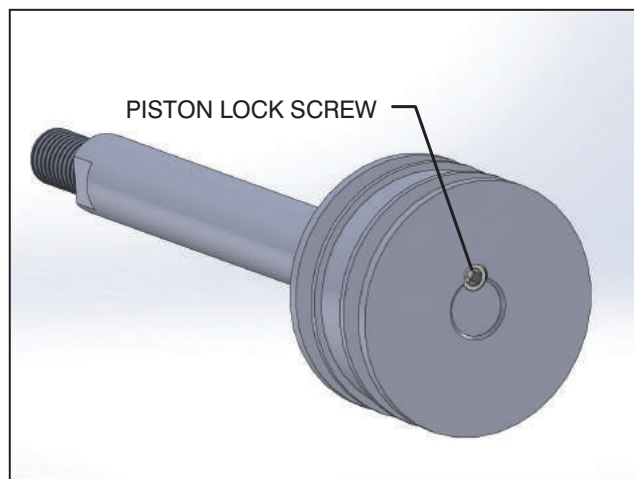
PLS **Piston Lock Screw** (For higher shock load applications)

Now standard on all hydraulic series!

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

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

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



PORT OPTIONS

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

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

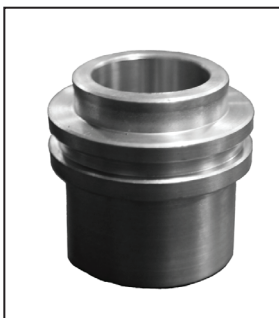
BSPT **British Standard Pipe Taper**

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

BSPP **British Standard Pipe Parallel**

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

RBB **Solid Bronze Rod Bushing**



Our standard floating rod bushing design is used in conjunction with solid SAE 660 bronze material. Material specifications: 20,000 PSI compressive strength.

Some customers prefer to use bronze rod bushings. Most common uses are in water hydraulic applications.

Note: Since the mechanical properties of bronze is much lower than cast iron, bronze rod bushings typically do not provide the same long life that our standard PTFE coated cast iron rod bushings provide.

Specials: TRD can provide special length rod bushings; contact your local distributor for details

SERIES 'HH' BASIC OPTIONS

RLH Rod Lock

Cylinders can be furnished with Hydraulic Rod Locks. *Refer to pages 41-46 for complete specifications.*

SSR 17-4 Stainless Steel Hard Chrome Plated Piston Rod

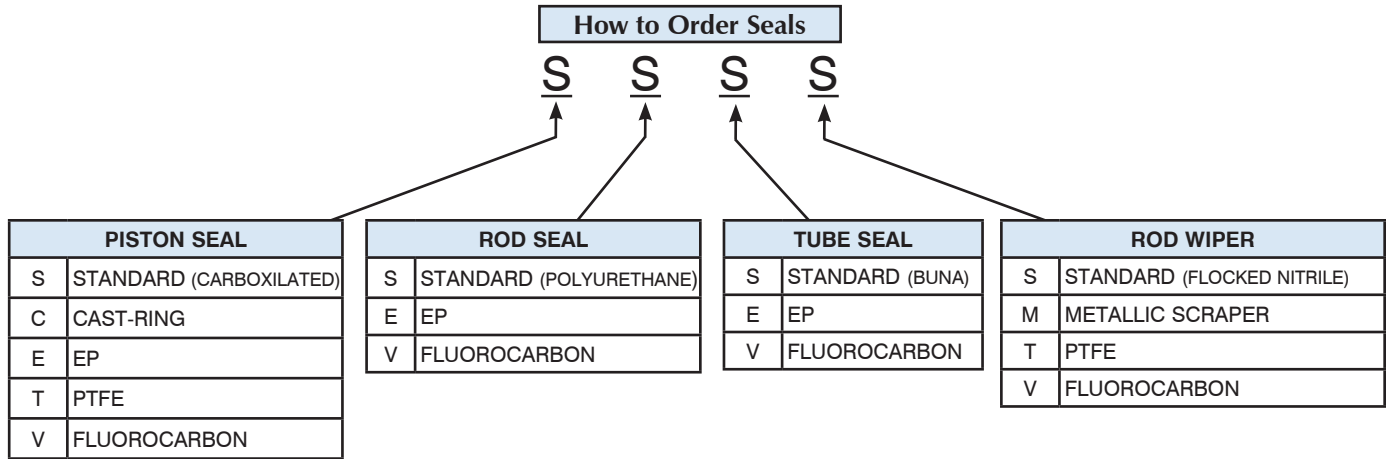
Cylinders can be furnished with hard chrome plated stainless steel piston rods.

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

SEALS

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

How to Order Seals



S Standard Seals

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

Rod Seal: Polyurethane
Rod Wiper: Flocked Nitrile

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

C Cast Iron Piston Rings

Temperature Range: -20°F to 400°F* (-29°C to 204°C)
Compatible with: Virtually all fluids
Uses: Hydraulic shock protection

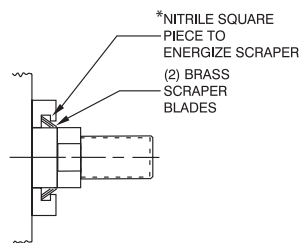
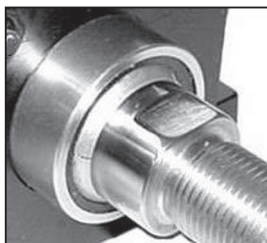
*When cylinder is equipped with Viton seals.

T Glass Filled PTFE

Temperature Rating (PTFE): -100°F to 400°F (-73°C to 204°C)
Temperature Rating (Nitrile): -20°F to 200°F (-29°C to 93°C)
Temperature Rating (Viton): 0°F to 400°F (-18°C to 204°C)
Compatible with: All hydraulic fluids and almost any fluid
Use: Low friction and high side load

M Metallic Rod Scraper

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



*Standard energizer will match cylinder seals.

V Fluorocarbon

Temperature Rating: 0°F to 400°F (-18°C to 204°C)
(Up to 400°F with reduced service life)

Compatible with: Some Phosphate Ester (Houghto-Safe 1000, 1120; Pyrogard 42, 43, 53, 55) fluids; mineral based petroleum, halogenated hydrocarbons, silicate ester and diester fluids

XX Special

Non-standard seals can be furnished.
Contact TRD for more information.

SERIES 'HH' BASIC OPTIONS

ST Stop Tube and Rod Size Selection

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

STOP TUBE SELECTION

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

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

To order a stop tube:

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

Example:

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

Chart 1

Find the value of "D" for your application

"D" = Stroke, adjusted for mounting condition

"S" = Actual cylinder stroke

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

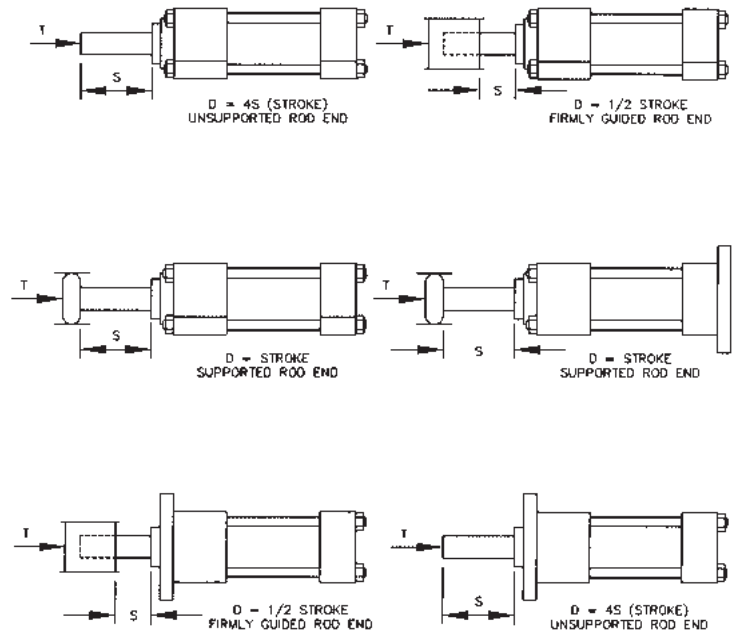
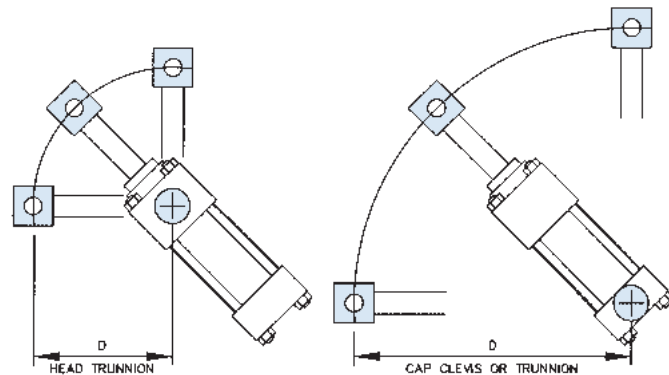
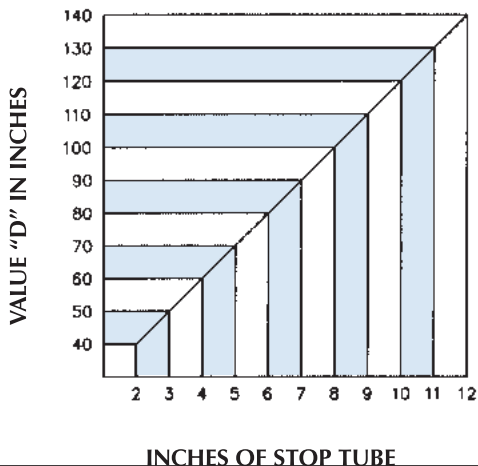


Chart 2

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



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

Refer to page 54 for Rod Size Selection Chart

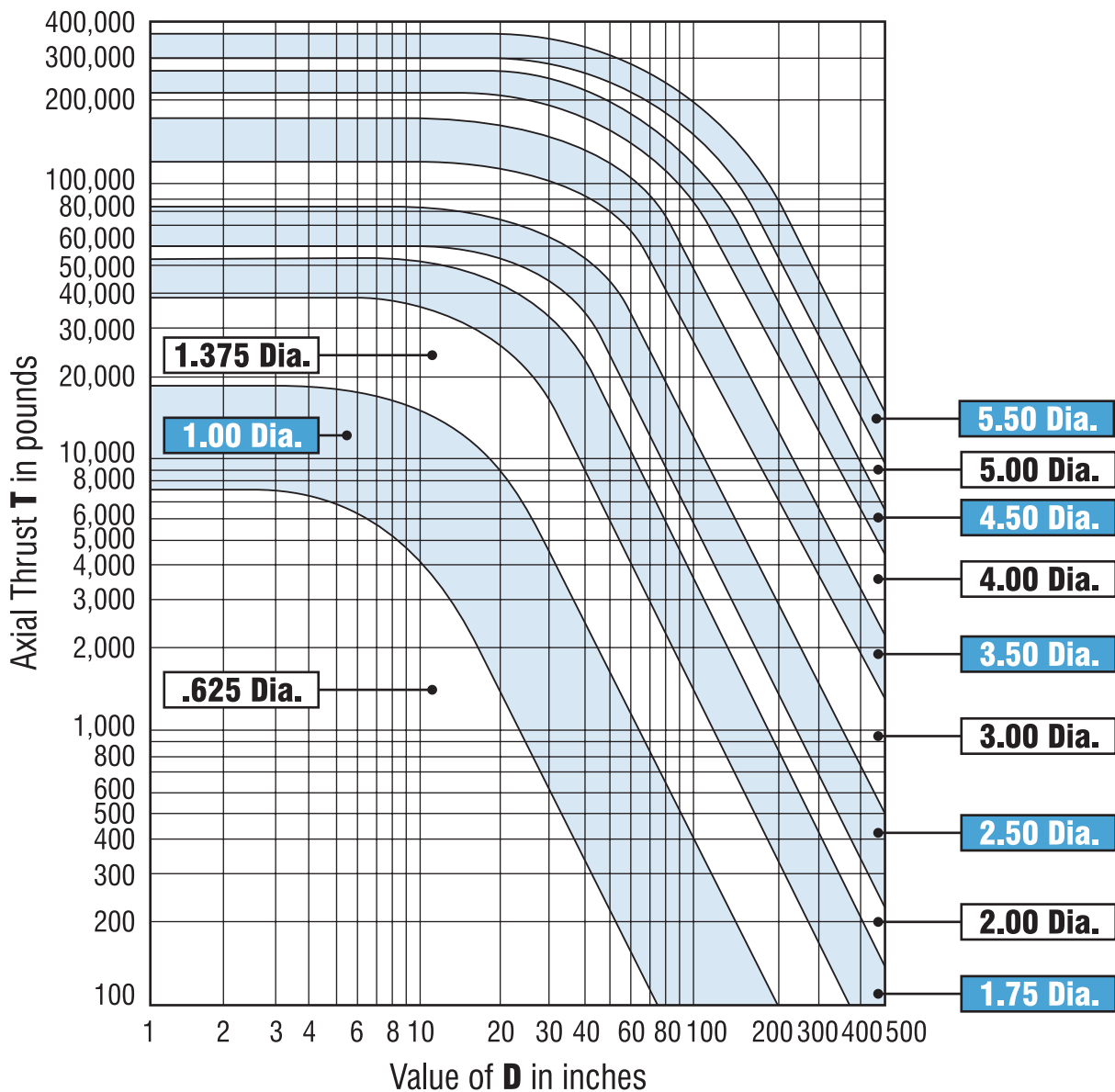
SERIES 'HH' BASIC OPTIONS

Piston Rod Size Selection

Standard rod sizes are usually suitable for shorter stroke applications at lower hydraulic pressures. With high thrust force or long stroke applications, you must check the column strength of the rod in the mounting style to determine the proper rod diameter size.

1. Determine the total axial thrust by multiplying the bore area size (in inches) by the operating pressure (in PSI).
2. From page 53, determine the value of "D" for the application.
3. Find the value of "D" in the chart below. Follow the value of "D" vertically on the graph until it intersects with the axial thrust value of the cylinder. The intersection of these two values will fall within one of the shaded areas representing the piston rod diameter size required for the application.

Chart 3 (Piston Rod Diameter Selection)



SERIES 'HH' UNCOMMON OPTIONS

3P Three-Position Cylinder

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

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

3-POSITION BENEFITS:

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

Note: Piston rods are not connected.

Contact TRD for more information.

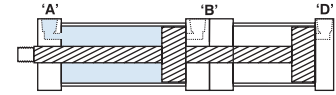
3-POSITION CYLINDERS

HOW THEY WORK

■ = PRESSURE

POSITION 1 (RETRACT)

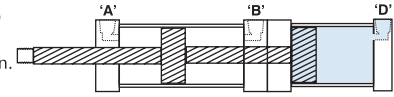
Pressure to port 'A' fully retracts cylinder.



(RETRACT)

POSITION 2 (MID-STROKE)

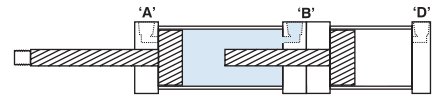
Pressure to port 'D' advances cylinder to mid-stroke position.



(MID-STROKE)

POSITION 3 (EXTEND)

Pressure to port 'B' fully extends cylinder.

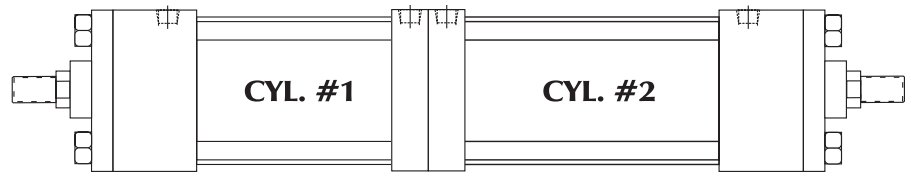


(EXTEND)

BTB Back-To-Back Cylinders

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

Contact TRD for more information.

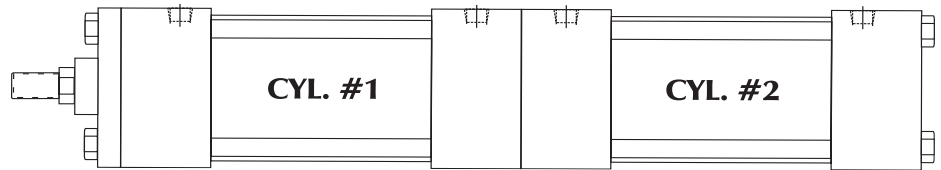


TM Tandem Cylinders

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

Note: Piston rods are connected.

Contact TRD for more information.



SPECIAL FINISHES

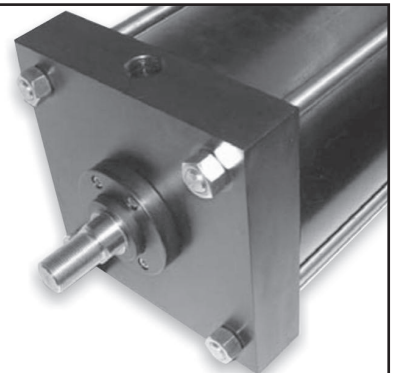
Standard Finish: Black Urethane Paint (suitable for indoor or outdoor use).

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

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

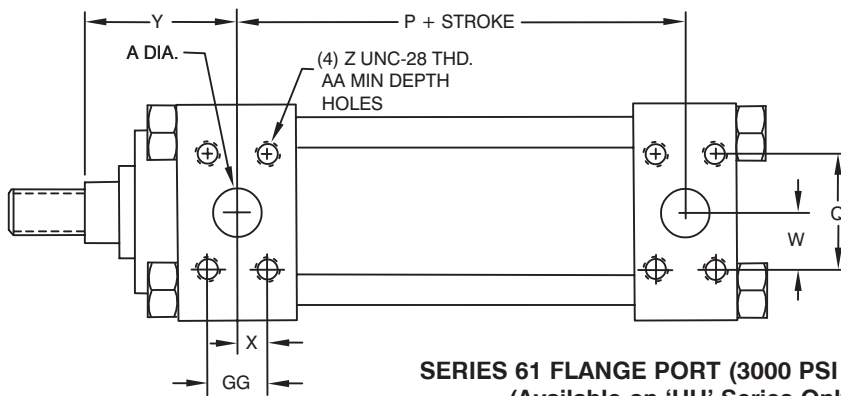
Additional Finishes: TRD can provide special finishes, i.e. Nutride Plate Heavy Chrome Plated Piston Rods.

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



SERIES 'HH' UNCOMMON OPTIONS

FLANGE PORTS



Ref Port Call Out Information

$$P15 = FL24$$



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

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

SERIES 61 FLANGE PORT (3000 PSI Rating)
(Available on 'HH' Series Only)

BORE	ROD DIA. (MM)	MAX PSI RATING	SAE DASH NO.	Y	P	A	Q	W	X	Z	AA	GG	REF. MAIN FLANGE SIZE
2.50	1.000	3000	8	2.250	3.125	0.500	1.500	0.750	0.340	5/16 - 18	0.810	0.690	1/2
3.25	1.375	3000	12	2.625	3.750	0.750	1.870	0.938	0.438	3/8 - 16	0.750	0.870	3/4
	1.750			2.875									
	2.000			3.000									
4.00	1.750	3000	12	2.875	4.000	0.750	1.870	0.938	0.438	3/8 - 16	0.750	0.870	3/4
	2.000			3.000									
	2.500			3.250									
5.00	2.000	3000	12	3.000	4.500	0.750	1.870	0.938	0.438	3/8 - 16	0.750	0.870	3/4
	2.500			3.250									
	3.000			3.250									
	3.500			3.250									
6.00	2.500	3000	16	3.375	5.125	1.000	2.060	1.030	0.520	3/8 - 16	0.870	1.030	1
	3.000												
	3.500												
	4.000												
7.00	3.000	3000	20	3.688	5.625	1.25	2.31	1.16	0.590	7/16 - 14	1.000	1.190	1 1/4
	3.500												
	4.000												
	4.500												
	5.000												
8.00	3.500	3000	24	3.750	6.500	1.500	2.750	1.370	0.700	1/2 - 13	1.060	1.410	1 1/2
	4.000												
	4.500												
	5.000												
	5.500												

ROD BOOTS

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

