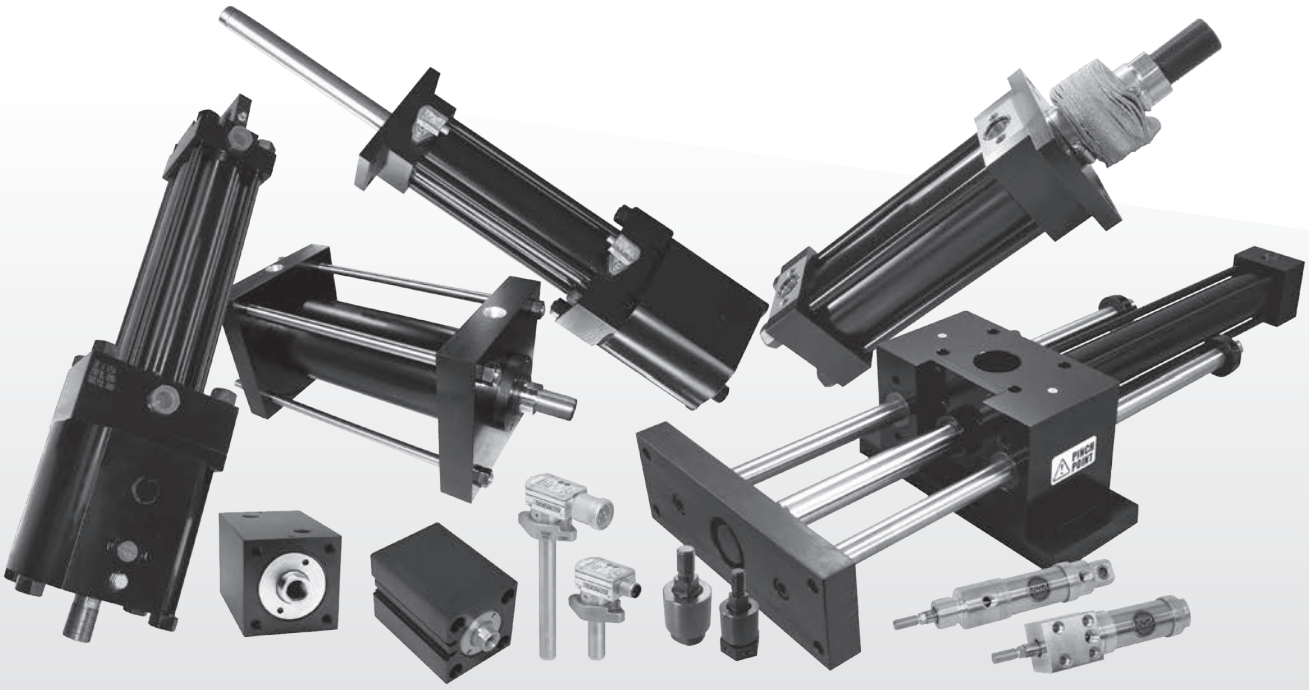


We make things MOVE

Hydraulic Cylinders & Accessories Catalog

Bimba is part of IMI Precision Engineering



We Make Things Move®

A forward-thinking innovator, Bimba provides industry-leading pneumatic, hydraulic and electric motion solutions that are easy-to-use, reliable and ready for your engineering challenges.

Doing whatever it takes to help you get the job done is what the Bimba companies do best. With an extensive line of industry-leading air cylinders, rotary actuators, linear thrusters, rodless cylinders, NFPA, hydraulics, flow controls, position-sensing cylinders, valves, switches and air preparation equipment, the people of Bimba are ready to tackle your toughest applications.

Bimba is part of IMI Precision Engineering, a world leader in motion and fluid control technologies. Wherever precision, speed and engineering reliability are essential, we deliver exceptional solutions which improve the productivity and efficiency of customers' equipment.

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Part of IMI plc, we have a sales and service network in 75 countries, as well as manufacturing capability in the USA, Germany, China, UK, Switzerland.

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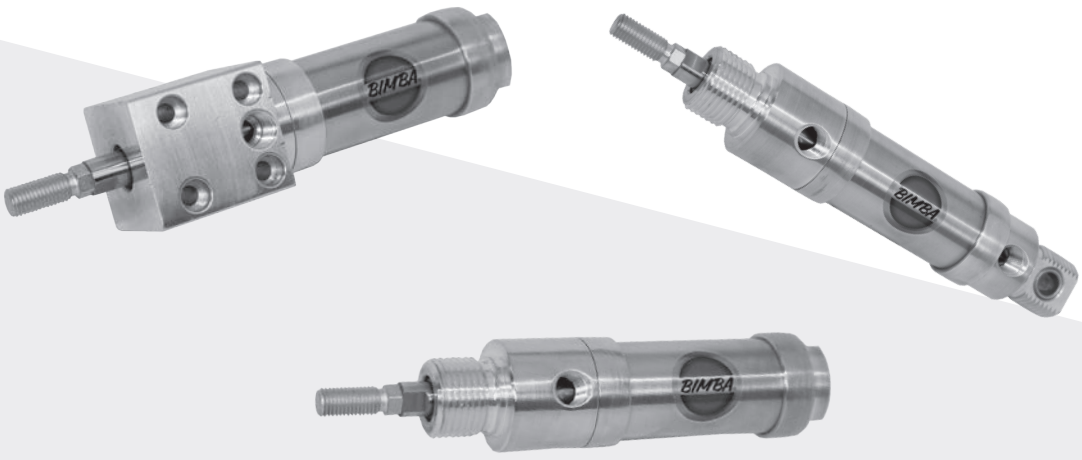
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500 Series Original Line®

The 500 Series offers the quality of the Bimba Original Line® in a hydraulic design rated for 500 PSI service. This durable hydraulic design offers the advantage of a repairable rod due to the removable hardened steel HEX STUD™ rod end that can be replaced if it is damaged. The 500 Series is available in three bore sizes 1-1/16", 1-1/2", 2" for simple installation.



Contents

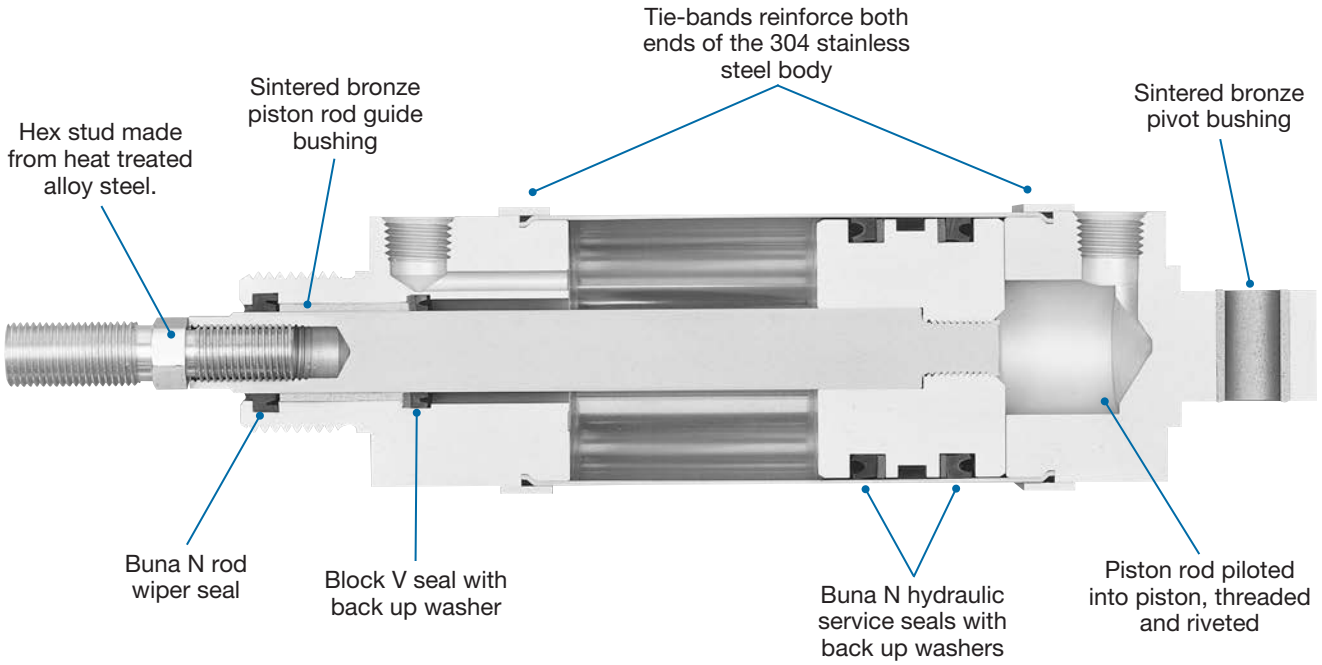
05 500 Series Low Pressure Hydraulics

06 How to Specify, Dimensions
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08 – 2” Bore

09 How to Accessorize
09 – 1-1/16” Bore
09 – 1-1/2” Bore
10 – 2” Bore
11 – Hex Stud

12 How to Order

Product Features



Materials of Construction

- Hex stud made from heat treated alloy steel. In case of failure due to overload, the hexagon portion will remain in the rod and can be easily removed
- Tie-bands reinforce both ends of type 304 stainless steel body rolled in a groove on the periphery of each end cap doubling joint strength
- Buna N rod wiper seal assures dry drip free piston rod
- Piston rod is hard chrome plated
- High strength aluminum alloy end caps and piston
- Filled PTFE bearing
- Sintered bronze piston rod guide bushing

Operating Pressure

500 PSI HYD

Bore Sizes

1-1/16”, 1-1/2’, 2”

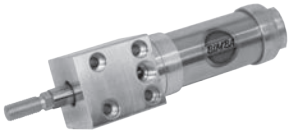
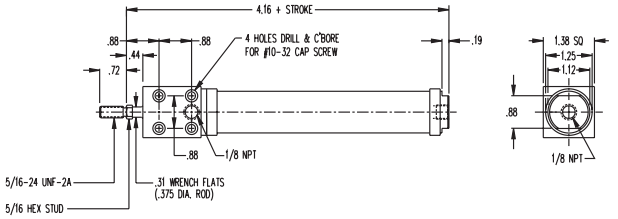
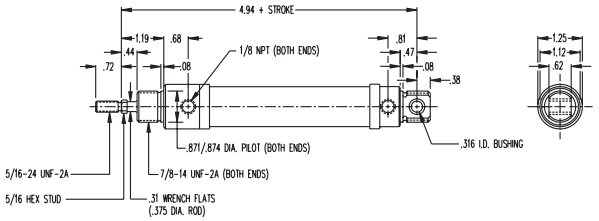
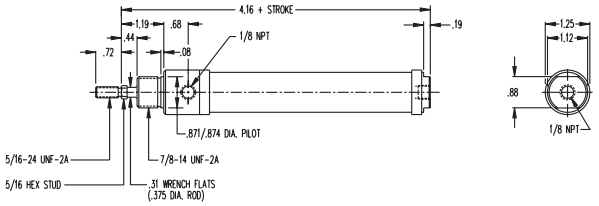
Performance Options

- Extra extension (EE), per inch of extension:
- Ports rotated 90° (K) (no charge)
- Magnet (prefix M) Example: HM-096-DZ
  - 4” stroke or greater required
  - Overall length increases by 0.25”
- Fluoroelastomer seals (V)
  - Specify for compatibility

1-1/16” Bore Hydraulic Cylinders

Push Force = .886 x PSI Pull Force = .776 x PSI

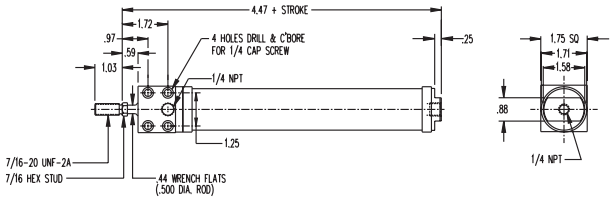
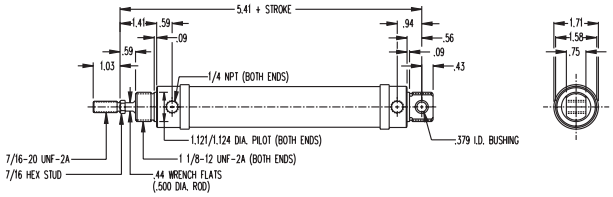
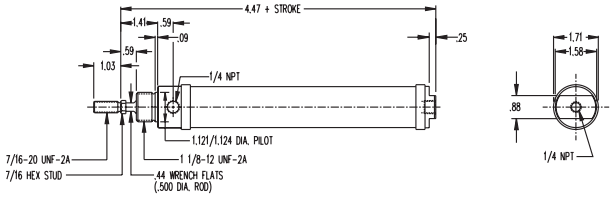
☐ Enter Stroke Length as 3rd Digit

Model	Description/Weight (Lbs)	Dimensions
H-09☐-DBZ 	Front Block Mount Standard Stroke Lengths: 1", 2", 3", 4", 5", 6" Maximum Stroke – 12" Base Weight: .57 Adder Per Inch of Stroke: .06	
H-09☐-DUZ 	Universal Mount – Double End or Rear Pivot Standard Stroke Lengths: 1”, 2”, 3”, 4”, 5”, 6”, 7”, 8”, 9”, 10”, 11”, 12” Maximum Stroke – 32" Optional Accessories: D-8316 Mounting Bracket D-8322-A Pivot Bracket D-8309-A Clevis Base Weight: .50 Adder Per Inch of Stroke: .06	
H-09☐-DZ 	Nose Mount Standard Stroke Lengths: 1”, 2”, 3”, 4”, 5”, 6”, 7” Maximum Stroke – 12" Optional Accessory: D-8316 Mounting Bracket Base Weight: .43 Adder Per Inch of Stroke: .06	

1-1/2” Bore Hydraulic Cylinders

Push Force = 1.77 x PSI Pull Force = 1.57 x PSI

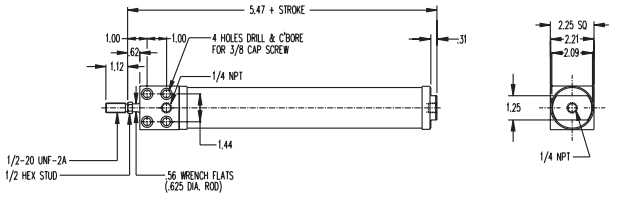
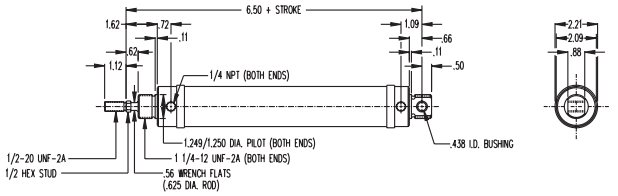
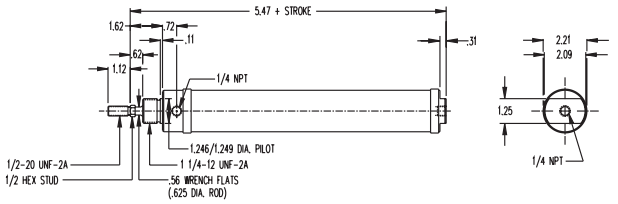
☐ Enter Stroke Length as 3rd Digit

Model	Description/Weight (Lbs)	Dimensions
H-17☐-DBZ 	Front Block Mount Standard Stroke Lengths: 1", 2", 3", 4", 5", 6" Maximum Stroke – 12" Base Weight: 1.00 Adder Per Inch of Stroke: .10	
H-17☐-DUZ 	Universal Mount – Double End or Rear Pivot Standard Stroke Lengths: 1”, 2”, 3”, 4”, 5”, 6”, 7”, 8”, 9”, 10”, 11”, 12” Maximum Stroke – 32" Optional Accessories: D-8318 Mounting Bracket D-8324-A Pivot Bracket D-8311-A Clevis Base Weight: .95 Adder Per Inch of Stroke: .10	
H-17☐-DZ 	Nose Mount Standard Stroke Lengths: 1”, 2”, 3”, 4”, 5”, 6”, 7”, 8”, 9”, 10”, 11”, 12” Maximum Stroke – 12" Optional Accessory: D-8318 Mounting Bracket Base Weight: .84 Adder Per Inch of Stroke: .10	

2” Bore Hydraulic Cylinders

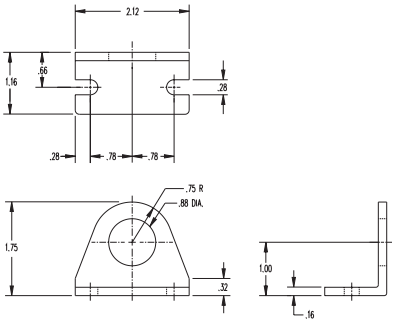
Push Force = 3.14 x PSI Pull Force = 2.83 x PSI

☐ Enter Stroke Length as 3rd Digit

Model	Description/Weight (Lbs)	Dimensions
H-31 ☐ -DBZ 	Front Block Mount Standard Stroke Lengths: 1", 2", 3", 4", 5", 6" Maximum Stroke – 12" Base Weight: 1.90 Adder Per Inch of Stroke: .24	
H-31 ☐ -DUZ 	Universal Mount – Double End or Rear Pivot Standard Stroke Lengths: 1”, 2”, 3”, 4”, 5”, 6”, 7”, 8”, 9”, 10”, 11”, 12” Maximum Stroke – 32" Optional Accessories: D-8319 Mounting Bracket D-8325-A Pivot Bracket D-8313-A Clevis Base Weight: 1.75 Adder Per Inch of Stroke: .24	
H-31 ☐ -DZ 	Nose Mount Standard Stroke Lengths: 1”, 2”, 3”, 4”, 5”, 6” Maximum Stroke – 12" Optional Accessory: D-8319 Mounting Bracket Base Weight: 1.63 Adder Per Inch of Stroke: .24	

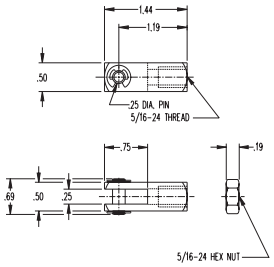
1-1/16” Bore Accessories

D-8316



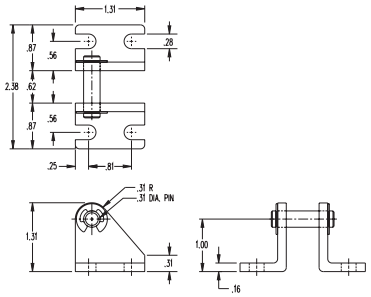
Mounting Bracket

D-8309-A



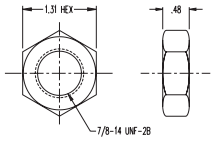
Rod Clevis

D-8322-A



Pivot Brackets

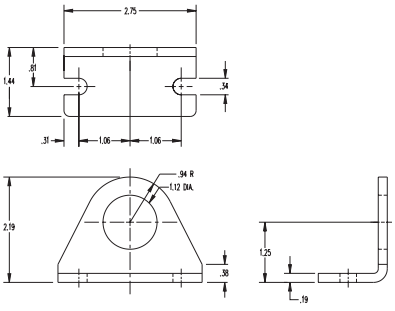
D-2545



Mounting Nut

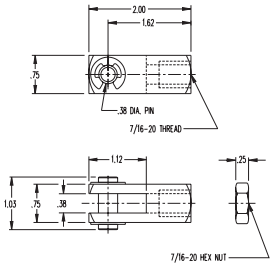
1-1/2” Bore Accessories

D-8318



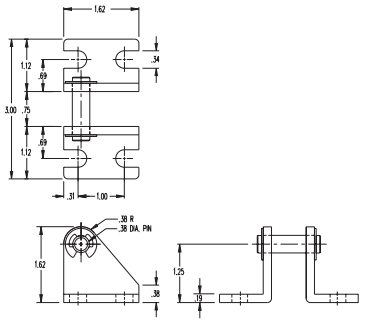
Mounting Bracket

D-8311-A



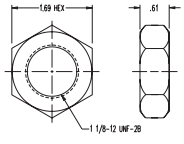
Rod Clevis

D-8324-A



Pivot Brackets

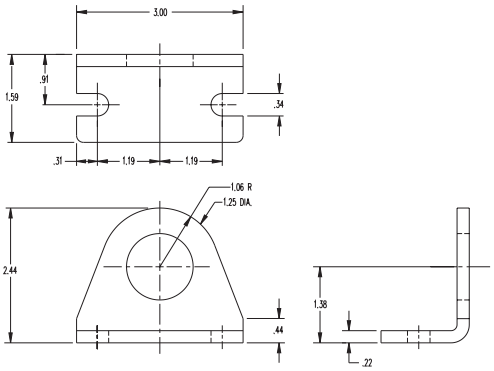
D-8484



Mounting Nut

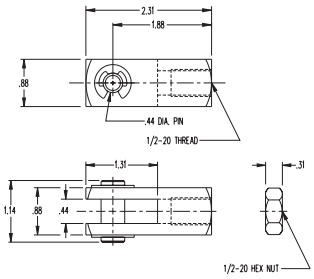
2” Bore Accessories

D-8319



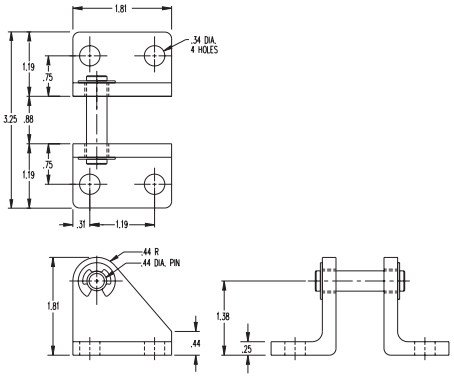
Mounting Bracket

D-8313-A



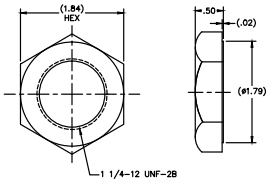
Rod Clevis

D-8325-A



Pivot Brackets

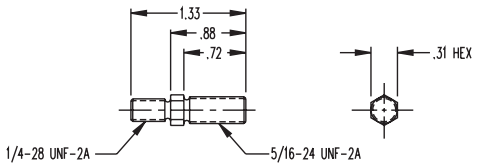
D-508



Mounting Nut

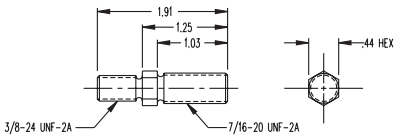
Hex Stud Accessory

1-1/16” Bore



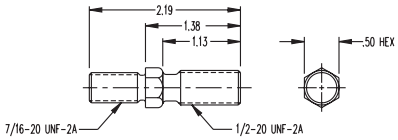
D-6583

1-1/2” Bore



D-6636

2” Bore



D-6637

How to Order

The model number of all Original Line hydraulic actuators consists of an alphanumeric cluster designating product type, bore size, stroke length, mounting styles, and other optional components that together make up the complete part number to use when ordering. Use the ordering information below to build a valid part number.

An example of a double-acting 500 Series hydraulic unit with a front block, 1-1/16" bore, 3" stroke, and additional options is shown below.

Stroke Length
XX (in)

Mounting Style	
DBZ	Front block
DUZ	Universal double end or rear pivot
DZ	Nose

H - 09 3 - DBZ EE0.5

Model	
H	Hydraulic cylinder
HL	Low pressure Hydraulic (250 PSI maximum)
M	Magnet option for standard cylinders

Bore Size/Power Factor	
09	1-1/16"
17	1-1/2"
31	2"

Options*	
K	Ports rotated 90°
Q	Side ported rear head
V	High temperature seals and lubrication
EEX.XX	Extra rod extension of X.XX

Approximate Power Factors		
1-1/16"	=	0.90
1-1/2"	=	1.7
2"	=	3.10

Bimba has made sizing a cylinder as easy as knowing the model number. Each base model number is developed by calculating the area of the cylinder bore. This area, or Power Factor, will provide the force the cylinder will exert when multiplied by the airline pressure.

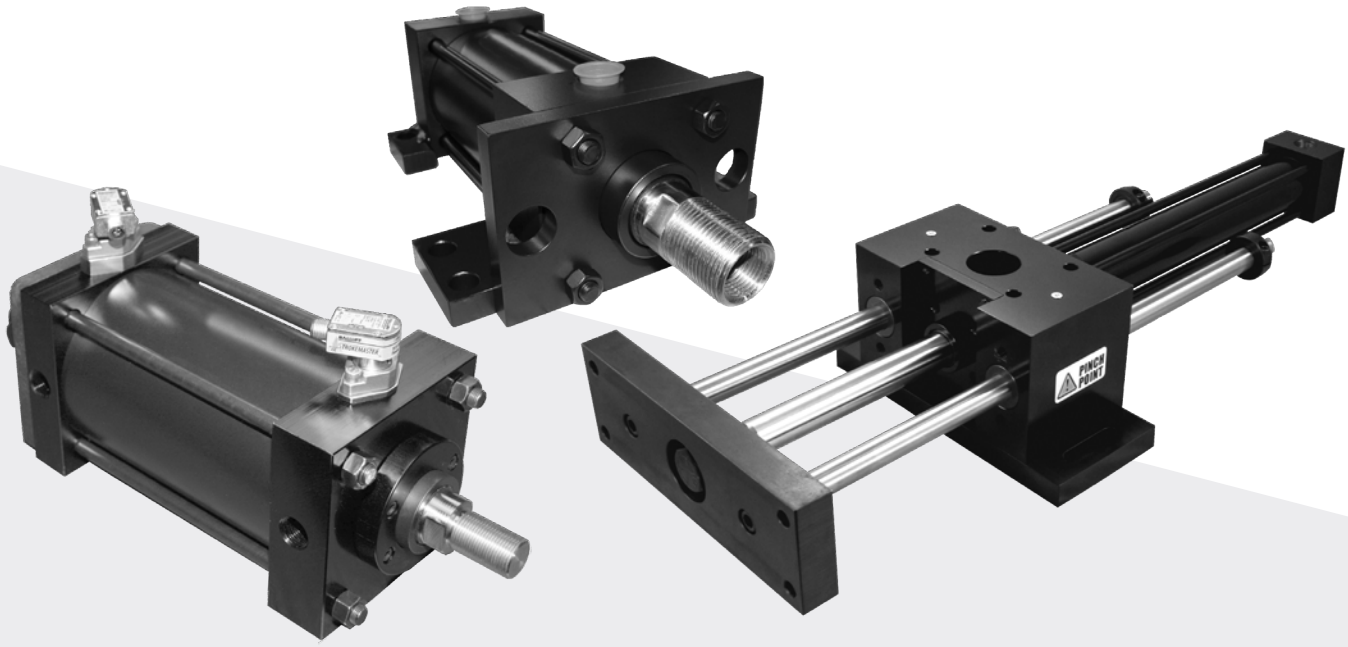
FORCE = Airline Pressure x Piston Area

PISTON AREA = Bimba Power Factor

FORCE = Airline Pressure x Bimba Power Factor

MH Series Medium Pressure Hydraulics

MH Series actuators are designed specifically for medium pressure applications up to 1500 PSI, offering a cost savings over the HH Series models. Designed with single bi-directional piston seals and extended width wearband for superior side load carrying capabilities. The MH Series offers 8 bore sizes, 18 NFPA mounts and 6 NFPA standard rod end styles for optimal customization.



Contents

15 MH Series Medium Pressure Hydraulics

16 How it Works
16 – Port Locations
16 – Maximum Stroke
17 – Force Chart
18 – Torque Charts
19 – Weight Chart

20 How to Specify, Dimensions
20 – NFPA Mounting Styles
21 – Threads
22 – Basic Cylinder
24 – Trunnion Mounts
26 – Extended Tie Rod Mounts
28 – Flange Mounts
31 – Spherical Bearing Mount
32 – Lug Mounts
34 – Bottom Mounts
36 – Pivot Mounts
38 – Double Rod End Mounts

50 How to Order
50 – Cylinder
51 – Seal Kits

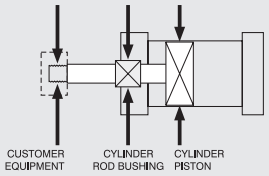
52 Options

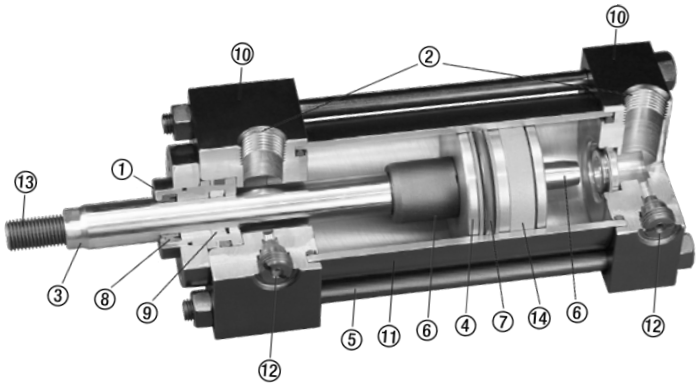
Features & Benefits

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.





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-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 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" rods (125K min. yield). Available up to two times standard "A" thread length.
14. **Wear Band** – Wear Guard; Glass Reinforced Nylon (standard). PTFE for E and V seal option.
    Finish – Black urethane paint.

Operating Pressure

1500 PSI HYD (103 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 Seals:	0°F to 400°F (-18°C to 204°C)
Ethylene Propylene Seals:	-50°F to 300°F (-45°C to 149°C)

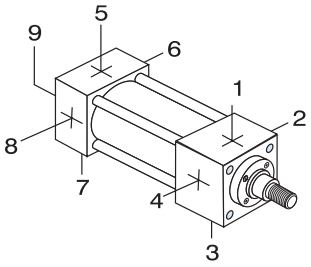
Performance Options

ST – Stop tubes are used to reduce rod bearing and piston stress for cylinder design guidance).
CS – Center supports are recommended for cylinders with long strokes in horizontal applications to prevent buckling of the cylinder and extend cylinder life.

SSR – 17-4 Chrome Plated Stainless Steel Piston Rod provide corrosion resistance in outdoor applications and wet environments (100K min. yield up to 5" rod; 75K min. yield 5 1/2" rod).
HP – High-impact pistons use a high strength steel nut retained piston for fatigue resistance and additional strength in demanding applications.

Technical Data

Port Locations



Note: Location 9 is center of cap face.

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 Options)	
		One Support	Two Supports
1.50", 2.00" & 2.50"	48 inches	Strokes over 48 inches	Strokes over 72 inches
3.25", 4.00" & 5.00"	65 inches	Strokes over 65 inches	Strokes over 92 inches
6.00"	72 inches	Strokes over 72 inches	not required

Force Chart

Bore	Rod Dia. (MM)	Effective Piston Area	Pounds of Force at PSI													Displacement per Inches 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

Note: Theoretical force. Actual force will be reduced by friction.

Cylinder Torque Charts

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
8.00	140 ft-lbs

Square Retainer Plate Torque Specs	
Hex Head Screw Size	**Torque (ft-lbs)**
1/4-28	7 ft-lbs
5/16-24	12 ft-lbs
3/8-24	30 ft-lbs
1/2-20	50 ft-lbs
5/8-18	50 ft-lbs

Round Retainer Plate Torque Specs	
SHCS Size	**Torque (ft-lbs)**
#10-32	5 ft-lbs
1/4-28	15 ft-lbs
5/16-24	20 ft-lbs

All torque specs are based upon using anti-seize thread lubricant. Tighten cylinders using an “X” tightening pattern on tie rods.

Bimba Spec: LPS Premium Copper Anti-Seize
Temperature Rating: -65°F to 1800°F
Military Spec: MIL-PRF-907-E
Torque Tolerance: -0% to +5%

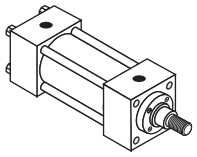
Basic Cylinder Weight Chart (in lbs.)

Bore	Rod Dia. (MM)	Mount												Add per Inch of Stroke
		MX0 MS4 ME3 ME4	MF1	MF2	MF5	MF6	MP1	MP2	MS2 MS3 MS7	MT1 MT2	MT4	MX1 MX2 MX3	SB	
1.50	0.625	3.8	4.2	4.5	4.7	5.0	4.2	4.6	4.1	4.3	5.6	3.9	4.1	0.31
	1.000	4.0	4.4	4.7	4.9	5.2	4.3	4.7	4.3	4.4	5.8	4.0	4.2	0.45
2.00	0.625	5.9	6.7	6.9	7.4	7.7	6.2	6.8	6.2	6.3	8.4	5.9	6.1	0.39
	1.000	6.3	6.9	7.4	7.7	8.1	6.7	7.3	6.6	6.8	8.9	6.4	6.6	0.53
	1.375	6.6	7.4	7.7	8.1	8.4	7.0	7.6	7.0	7.1	9.2	6.7	6.9	0.73
2.50	0.625	8.6	9.9	10.1	10.7	10.9	9.0	9.9	9.0	9.1	11.8	8.7	8.9	0.45
	1.000	9.4	10.1	10.9	10.9	11.7	9.7	10.7	9.7	9.9	12.5	9.5	9.7	0.59
	1.375	9.7	10.6	11.2	11.4	12.0	10.0	11.0	10.0	10.2	12.8	9.8	10.0	0.78
	1.750	10.5	11.5	12.0	12.3	12.8	10.8	11.8	10.8	10.9	13.6	10.6	10.7	1.04
3.25	1.000	15.5	19.1	19.2	20.8	20.9	16.6	19.1	16.3	16.0	21.4	15.7	16.4	0.70
	1.375	17.7	19.4	21.4	21.1	23.1	18.8	21.3	18.5	18.2	23.5	17.9	18.6	0.90
	1.750	18.3	20.3	22.0	22.0	23.7	19.4	21.9	19.1	18.8	24.2	18.5	19.2	1.16
	2.000	19.0	21.1	22.6	22.8	24.3	20.1	22.6	19.7	19.4	24.8	19.1	19.8	1.37
4.00	1.000	23.0	27.3	28.0	29.2	29.9	24.1	27.7	23.8	23.5	30.3	23.2	23.9	0.79
	1.375	23.8	27.6	28.8	29.6	30.7	24.9	28.5	24.5	24.2	31.1	23.9	24.6	0.99
	1.750	24.4	28.5	29.4	30.4	31.3	25.5	29.1	25.2	24.9	31.7	24.6	25.3	1.25
	2.000	26.9	29.3	31.9	31.2	33.9	28.0	31.6	27.7	27.4	34.2	27.1	27.8	1.45
	2.500	29.2	32.0	34.2	33.9	36.2	30.3	33.9	30.0	29.7	36.5	29.4	30.1	1.95
5.00	1.000	35.8	42.5	43.3	45.4	46.1	36.9	42.3	37.2	36.3	45.3	36.2	36.7	0.98
	1.375	36.6	42.9	44.0	45.7	46.9	37.7	43.1	38.0	37.1	46.0	37.0	37.5	1.18
	1.750	37.2	43.7	44.7	46.6	47.5	38.3	43.7	38.6	37.7	46.6	37.6	38.1	1.44
	2.000	38.7	44.6	46.1	47.4	49.0	39.8	45.1	40.0	39.1	48.1	39.0	39.5	1.65
	2.500	43.8	47.3	51.2	50.1	54.1	44.9	50.3	45.2	44.3	53.2	44.2	44.7	2.15
	3.000	46.3	50.3	53.7	53.2	56.6	47.4	52.7	47.7	46.7	55.7	46.6	47.1	2.76
	3.500	48.8	53.4	56.2	56.2	59.1	49.9	55.3	50.2	49.2	58.2	49.1	49.7	3.48
6.00	1.375	56.7	67.2	68.6	71.1	72.4	58.6	67.6	58.2	57.8	70.7	57.0	58.3	1.29
	1.750	57.7	68.0	69.6	71.9	73.5	59.6	68.6	59.2	58.8	71.7	58.0	59.3	1.55
	2.000	58.8	68.8	70.7	72.7	74.5	60.7	69.7	60.3	59.9	72.8	59.1	60.4	1.76
	2.500	61.5	71.4	73.4	75.3	77.3	63.5	72.4	63.0	62.6	75.5	61.8	63.2	2.26
	3.000	64.7	74.4	76.6	78.3	80.5	66.7	75.7	66.3	65.9	78.7	65.1	66.4	2.87
	3.500	68.0	77.4	79.9	81.3	83.8	70.0	78.9	69.5	69.1	82.0	68.3	69.7	3.59
	4.000	76.0	82.7	87.9	86.5	91.7	77.9	86.9	77.5	77.1	90.0	76.3	77.6	4.43
8.00	1.375	98.9	—	—	—	—	100.9	—	100.5	100.0	126.6	99.6	100.6	2.09
	1.750	99.9	—	—	—	—	101.9	—	101.5	101.1	127.6	100.6	101.6	2.35
	2.000	101.0	—	—	—	—	103.0	—	102.5	102.1	128.7	101.7	102.7	2.56
	2.500	103.7	—	—	—	—	105.7	—	105.3	104.9	131.4	104.4	105.4	3.06
	3.000	107.0	—	—	—	—	108.9	—	108.5	108.1	134.7	107.7	108.6	3.67
	3.500	110.2	—	—	—	—	112.2	—	111.8	111.4	137.9	110.9	111.9	4.39
	4.000	116.3	—	—	—	—	118.3	—	117.8	117.4	144.0	117.0	117.9	5.23
	4.500	123.9	—	—	—	—	125.9	—	125.4	125.0	151.6	124.6	125.6	6.17
	5.000	131.9	—	—	—	—	133.9	—	133.5	133.1	159.6	132.6	133.6	7.23
	5.500	141.0	—	—	—	—	143.0	—	142.6	142.2	168.7	141.7	142.7	8.39

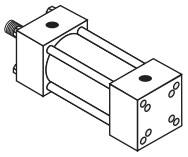
Note: Add 20% to mount and stroke weight for double rod end cylinders. Add 1% for cushions.

How to Specify

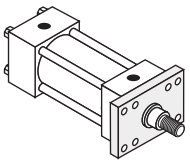
NFPA Mounting Styles



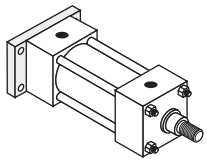
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8.00" Bore



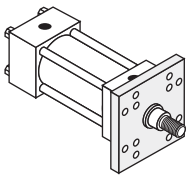
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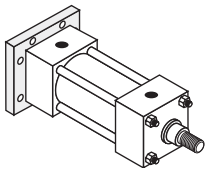
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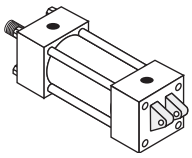
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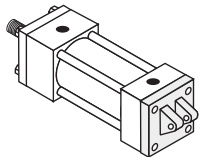
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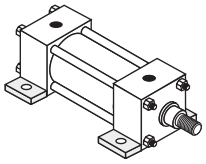
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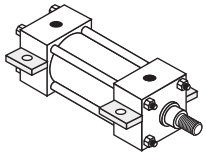
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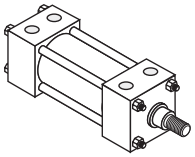
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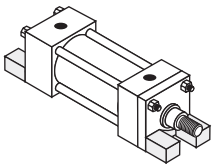
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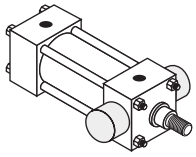
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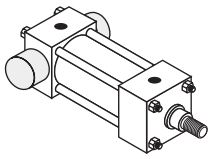
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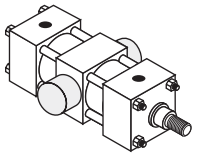
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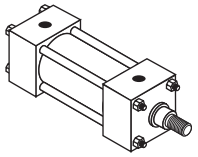
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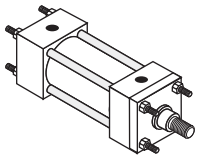
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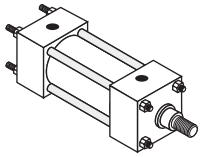
MT4
1.50"–8.00" Bores



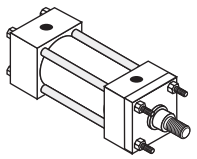
MX0
1.50"–8.00" Bores



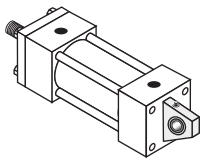
MX1
1.50"–8.00" Bores



MX2
1.50"–8.00" Bores



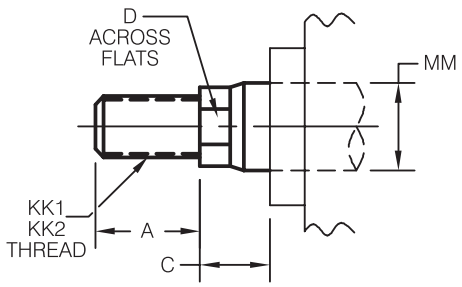
MX3
1.50"–8.00" Bores



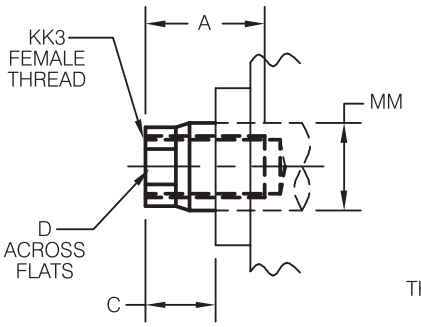
SB
1.50"–8.00" Bores

Dimensions – Threads

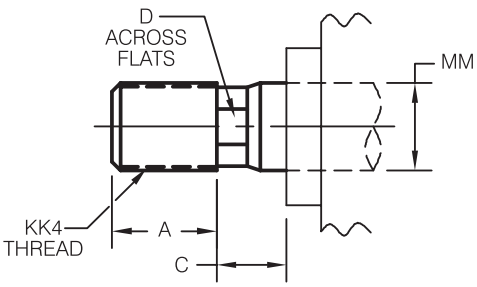
ROD END STYLE:
KK1
KK2

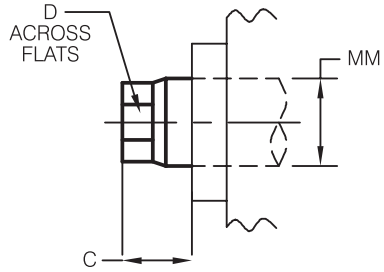


ROD END STYLE:
KK3

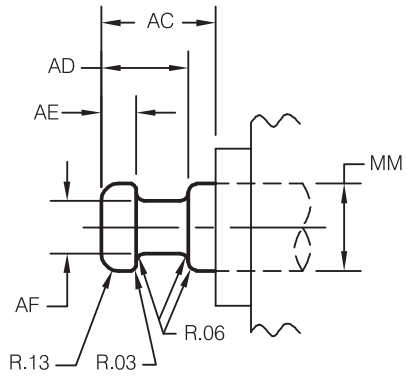


ROD END STYLE:
KK4

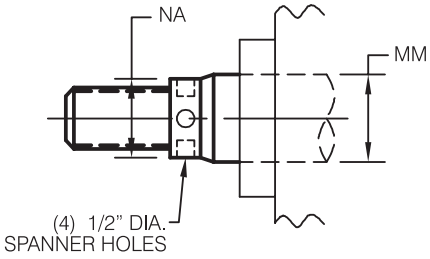




ROD END STYLE:
KK5



ROD END STYLE:
KK10



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

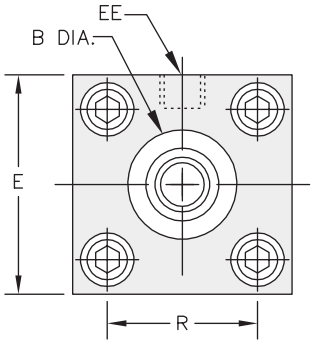
Rod Dia. (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4	NA ±.002
0.625	0.750	0.375	0.500	1.125	0.625	0.250	0.375	7/16- 20*	1/2 - 20*	7/16- 20	5/8 - 18	—
1.000	1.125	0.500	0.875	1.625	0.938	0.375	0.688	3/4- 16*	7/8 - 14*	3/4 - 16	1- 14	—
1.375	1.625	0.625	1.125	1.750	1.062	0.375	0.875	1- 14*	11/4- 12*	1- 14	1 3/8 - 12	—
1.750	2.000	0.750	1.500	2.000	1.313	0.500	1.125	1 1/4- 12*	11/2 - 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	17/8 - 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

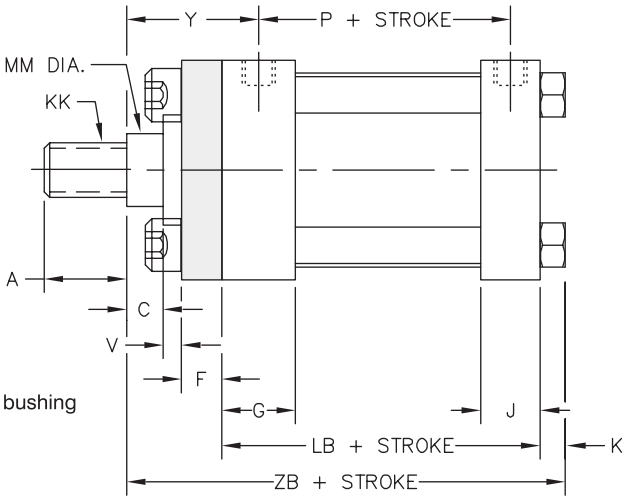
*Studded rod end.
(4) wrench flats are an option.
Note: Rods larger than 3.50" dia. utilize (4) 0.500" dia. spanner holes 0.500" deep.

Dimensions – Basic Cylinder (MX0 Mount)

Square Retainer Construction

Full Square Retainer Used On	
Bore	**Rod Diameter**
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

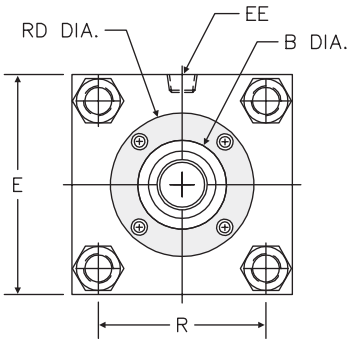


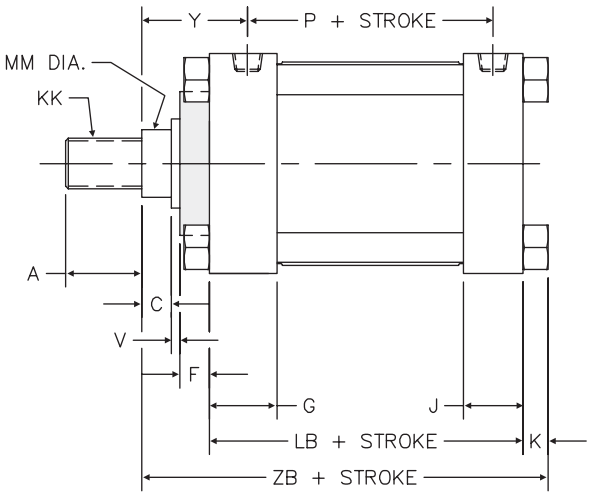


Note: Full square retainer is removable to service rod bushing

Round Retainer Construction

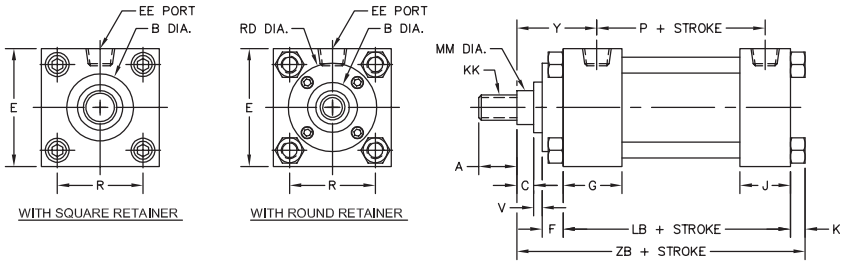
Round Retainer Used On	
Bore	**Rod Diameter**
2.00	0.625
2.50	0.625
3.25	1.000
4.00	1.000
	1.375
	1.750
5.00	1.000
	1.375
	1.750
	2.000
6.00	1.375
	1.750
	2.000
	2.500
	3.000
	3.500
8.00	1.375
	1.750
	2.000
	2.500
	3.000
	3.500
	4.000
	4.500
	5.000
	5.500





Note: Round retainer is removable to service rod bushing.

Dimensions – Basic Cylinder (MX0 Mount)

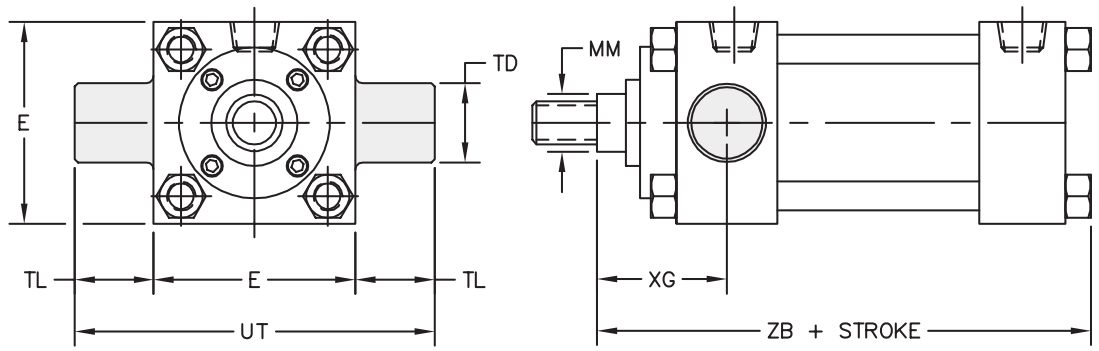


Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	A	B[2]	C	EE		F	G	J	K	KK	R	RD[3]	V	Y	Add to Stroke		
							NPTF	SAE										LB	P	ZB
1.50	0.625	1500	2.000	0.750	1.124	0.375	3/8	#6	0.375	1.500	1.000	0.250	See rod end detail chart on page 21	1.430	SQ	0.250	1.875	3.625	2.375	4.875
	1.000	1500		1.125	1.499	0.500									SQ	0.500	2.250			5.250
2.00	0.625	1500	2.500	0.750	1.124	0.375	3/8	#6	0.375	1.500	1.000	0.313		1.840	2.000	0.250	1.875	3.625	2.375	4.938
	1.000	1500		1.125	1.499	0.500									SQ	0.500	2.250			5.313
	1.375	1500		1.625	1.999	0.625									SQ	0.625	2.500			5.563
2.50	0.625	1000	3.000	0.750	1.124	0.375	3/8	#6	0.375	1.500	1.000	0.313		2.190	2.000	0.250	1.875	3.750	2.500	5.063
	1.000	1500		1.125	1.499	0.500									SQ	0.500	2.250			5.438
	1.375	1500		1.625	1.999	0.625									SQ	0.625	2.500			5.688
	1.750	1500		2.000	2.374	0.750									SQ	0.750	2.750			5.938
3.25	1.000	1500	3.750	1.125	1.499	0.500	1/2	#10	0.625	1.750	1.250	0.375		2.760	2.750	0.250	2.375	4.250	2.750	6.000
	1.375	1500		1.625	1.999	0.625									SQ	0.375	2.625			6.250
	1.750	1500		2.000	2.374	0.750									SQ	0.500	2.875			6.500
	2.000	1500		2.250	2.624	0.875									SQ	0.500	3.000			6.625
4.00	1.000	1000	4.500	1.125	1.499	0.500	1/2	#10	0.625	1.750	1.250	0.375		3.320	2.750	0.250	2.375	4.250	2.750	6.000
	1.375	1000		1.625	1.999	0.625									3.500	0.375	2.625			6.250
	1.750	1000		2.000	2.374	0.750									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	1/2	#10	0.625	1.750	1.250	0.438		4.100	2.750	0.250	2.375	4.500	3.000	6.313
	1.375	1000		1.625	1.999	0.625									3.500	0.375	2.625			6.563
	1.750	1000		2.000	2.374	0.750									3.500	0.500	2.875			6.813
	2.000	1000		2.250	2.624	0.875									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	3/4	#12	0.750	2.000	1.500	0.438		4.880	3.500	0.250	2.750	5.000	3.250	7.063
	1.750	750		2.000	2.374	0.750									3.875	0.375	3.000			7.313
	2.000	750		2.250	2.624	0.875									4.250	0.375	3.125			7.438
	2.500	750		3.000	3.124	1.000									4.625	0.500	3.375			7.688
	3.000	750		3.500	3.749	1.000									5.250	0.500	3.375			7.688
	3.500	750		3.500	4.249	1.000									5.750	0.500	3.375			7.688
	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	3/4	#12	0.750	2.000	1.500	0.563		6.440	3.500	0.250	2.750	5.125	3.375	7.313
	1.750	500		2.000	2.374	0.750									3.875	0.375	3.000			7.563
	2.000	675		2.250	2.624	0.875									4.250	0.375	3.125			7.688
	2.500	675		3.000	3.124	1.000									4.625	0.500	3.375			7.938
	3.000	675		3.500	3.749	1.000									5.250	0.500	3.375			7.938
	3.500	675		3.500	4.249	1.000									5.750	0.500	3.375			7.938
	4.000	675		4.000	4.749	1.000									6.500	0.500	3.375			7.938
	4.500	675		4.500	5.249	1.000									7.250	0.500	3.375			7.938
	5.000	675		5.000	5.749	1.000									7.500	0.500	3.375			7.938
	5.500	675		5.500	6.249	1.000									7.500	0.500	3.375			7.938

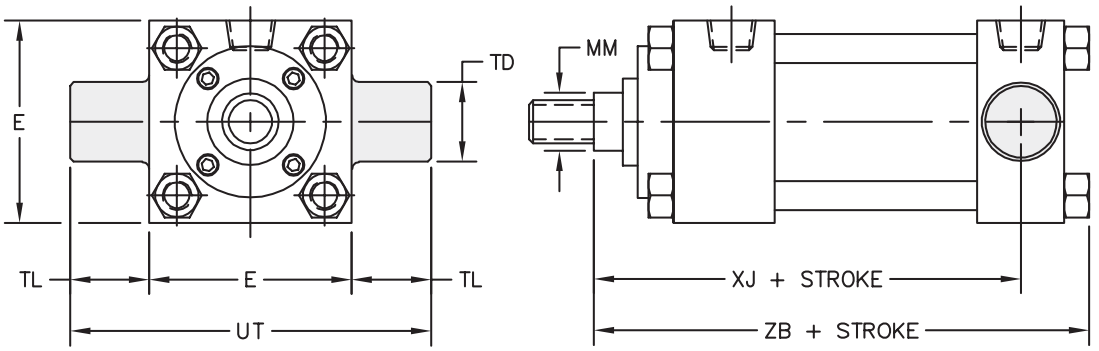
1. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).
2. B dimension tolerance is +.000 / -.002
3. Where SQ is shown in chart, cylinder utilizes a full square retainer.

Dimensions – Trunnion Mounts

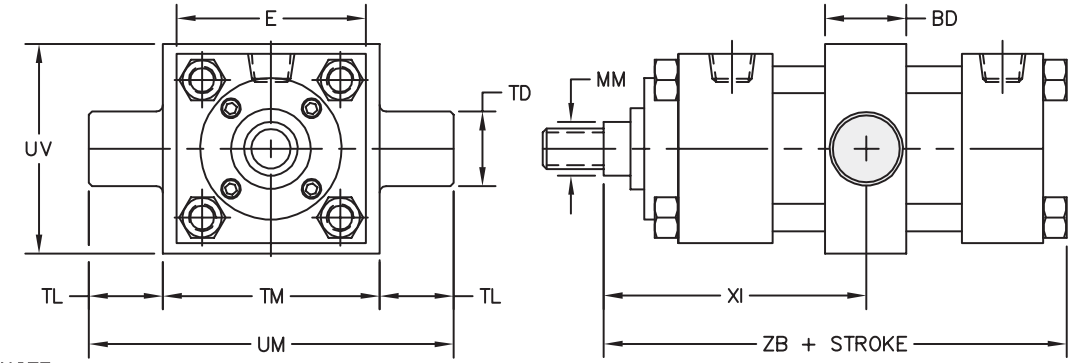
MT1: Head Trunnion



MT2: Cap Trunnion



MT4: Intermediate Trunnion



NOTE:
'XI' DIMENSION TO BE SPECIFIED BY CUSTOMER

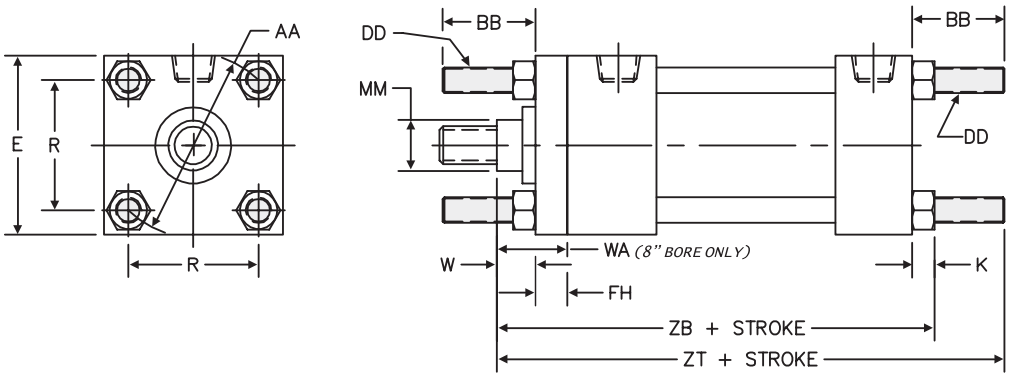
Dimensions – Trunnion Mounts

Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	BD	TD[2]	TL	TM	UM	UT	UV	XG	XI[3]	MT4 Min Stroke	Add to Stroke	
														XJ	ZB
1.50	0.625	1500	2.000	1.250	1.000	1.000	2.500	4.500	4.000	2.500	1.750	3.250	0.375	4.125	4.875
	1.000	1500									2.125	3.625		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	3.375	0.625	4.125	4.938
	1.000	1500									2.125	3.750		4.500	5.313
	1.375	1500									2.375	4.000		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	3.375	0.500	4.250	5.063
	1.000	1500									2.125	3.750		4.625	5.438
	1.375	1500									2.375	4.000		4.875	5.688
	1.750	1500									2.625	4.250		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	4.250	1.000	5.000	6.000
	1.375	1500									2.500	4.500		5.250	6.250
	1.750	1500									2.750	4.750		5.500	6.500
	2.000	1500									2.875	4.875		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	4.250	1.000	5.000	6.000
	1.375	1000									2.500	4.500		5.250	6.250
	1.750	1000									2.750	4.750		5.500	6.500
	2.000	1000									2.875	4.875		5.625	6.625
	2.500	1000									3.125	5.125		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	4.250	0.750	5.250	6.313
	1.375	1000									2.500	4.500		5.500	6.563
	1.750	1000									2.750	4.750		5.750	6.813
	2.000	1000									2.875	4.875		5.875	6.938
	2.500	1000									3.125	5.125		6.125	7.188
	3.000	1000									3.125	5.125		6.125	7.188
	3.500	1000									3.125	5.125		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	4.750	0.750	5.875	7.063
	1.750	750									2.875	5.000		6.125	7.313
	2.000	750									3.000	5.125		6.250	7.438
	2.500	750									3.250	5.375		6.500	7.688
	3.000	750									3.250	5.375		6.500	7.688
	3.500	750									3.250	5.375		6.500	7.688
	4.000	750									3.250	5.375		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	5.000	1.125	6.000	7.313
	1.750	500									2.875	5.250		6.250	7.563
	2.000	675									3.000	5.375		6.375	7.688
	2.500	675									3.250	5.625		6.625	7.938
	3.000	675									3.250	5.625		6.625	7.938
	3.500	675									3.250	5.625		6.625	7.938
	4.000	675									3.250	5.625		6.625	7.938
	4.500	675									3.250	5.625		6.625	7.938
	5.000	675									3.250	5.625		6.625	7.938
	5.500	675									3.250	5.625		6.625	7.938

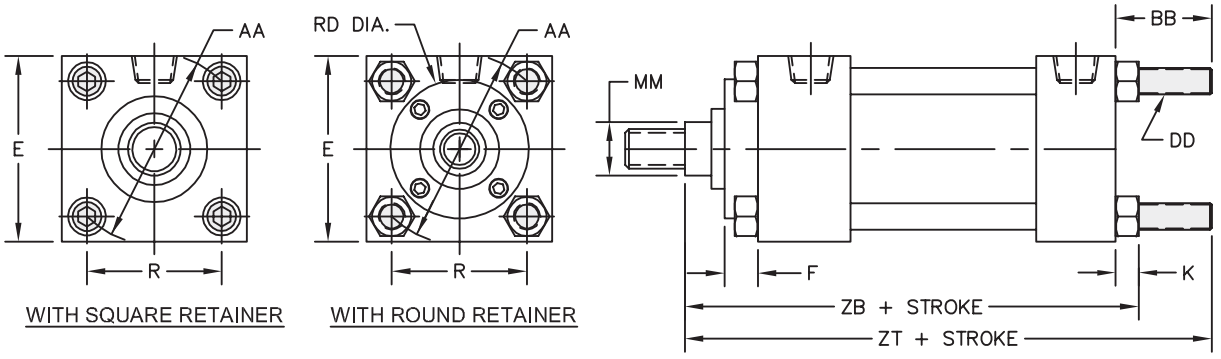
1. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).
2. TD dimension tolerance is + .000 / - .001
3. XI dimension is the minimum that can be supplied and leaves 1/4" gap between head & trunnion block (customer to specify XI dimension).

Dimensions – Extended Tie Rod Mounts

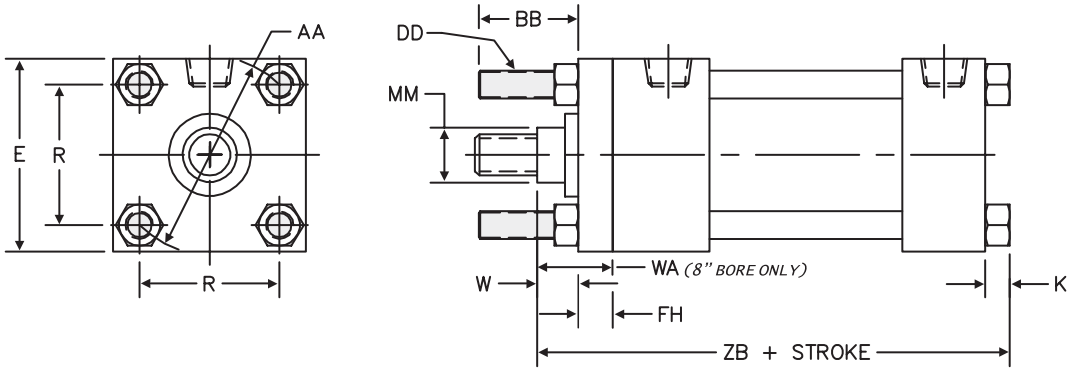
MX1: Head & Cap



MX2: Cap End



MX3: Head End



Dimensions – Extended Tie Rod Mounts

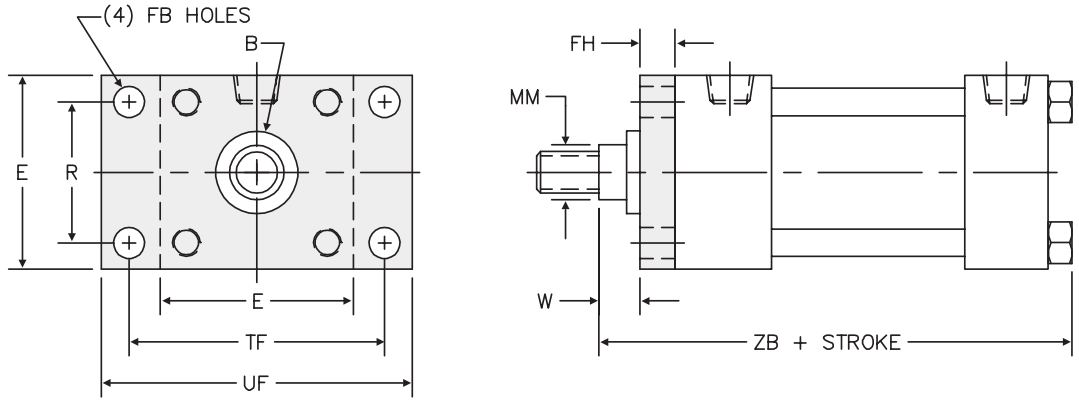
Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	FH	AA	BB	DD	F	K	R	RD[2]	W or WA (8")	Add to Stroke	
													ZB	ZJ
1.50	0.625	1500	2.000	0.375	2.020	1.000	1/4 - 28	0.375	0.250	1.430	SQ	0.625	4.875	5.625
	1.000	1500									SQ	1.000	5.250	6.000
2.00	0.625	1500	2.500	0.375	2.600	1.125	5/16 - 24	0.375	0.313	1.840	2.000	0.625	4.938	5.750
	1.000	1500									SQ	1.000	5.313	6.125
	1.375	1500									SQ	1.250	5.563	6.375
2.50	0.625	1000	3.000	0.375	3.100	1.125	5/16 - 24	0.375	0.313	2.190	2.000	0.625	5.063	5.875
	1.000	1500									SQ	1.000	5.438	6.250
	1.375	1500									SQ	1.250	5.688	6.500
	1.750	1500									SQ	1.500	5.938	6.750
3.25	1.000	1500	3.750	0.625	3.900	1.375	3/8 - 24	0.625	0.375	2.760	2.750	0.750	6.000	7.000
	1.375	1500									SQ	1.000	6.250	7.250
	1.750	1500									SQ	1.250	6.500	7.500
	2.000	1500									SQ	1.375	6.625	7.625
4.00	1.000	1000	4.500	0.625	4.700	1.375	3/8 - 24	0.625	0.375	3.320	2.750	0.750	6.000	7.000
	1.375	1000									3.500	1.000	6.250	7.250
	1.750	1000									3.500	1.250	6.500	7.500
	2.000	1000									SQ	1.375	6.625	7.625
	2.500	1000									SQ	1.625	6.875	7.875
5.00	1.000	750	5.500	0.625	5.800	1.813	1/2 - 20	0.625	0.438	4.100	2.750	0.750	6.313	7.688
	1.375	1000									3.500	1.000	6.563	7.938
	1.750	1000									3.500	1.250	6.813	8.188
	2.000	1000									4.250	1.375	6.938	8.313
	2.500	1000									SQ	1.625	7.188	8.563
	3.000	1000									SQ	1.625	7.188	8.563
	3.500	1000									SQ	1.625	7.188	8.563
6.00	1.375	750	6.500	0.750	6.900	1.813	1/2 - 20	0.750	0.438	4.880	3.500	0.875	7.063	8.438
	1.750	750									3.875	1.125	7.313	8.688
	2.000	750									4.250	1.250	7.438	8.813
	2.500	750									4.625	1.500	7.688	9.063
	3.000	750									5.250	1.500	7.688	9.063
	3.500	750									5.750	1.500	7.688	9.063
	4.000	750									SQ	1.500	7.688	9.063
8.00	1.375	500	8.500	0.625[3]	9.100	2.313[3]	5/8 - 18	0.750	0.563	6.440	3.500	1.625	7.313	9.063
	1.750	500									3.875	1.875	7.563	9.313
	2.000	675									4.250	2.000	7.688	9.438
	2.500	675									4.625	2.250	7.938	9.688
	3.000	675									5.250	2.250	7.938	9.688
	3.500	675									5.750	2.250	7.938	9.688
	4.000	675									6.500	2.250	7.938	9.688
	4.500	675									7.250	2.250	7.938	9.688
	5.000	675									7.500	2.250	7.938	9.688
	5.500	675									7.500	2.250	7.938	9.688

1. Max 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. Where SQ is shown in chart, cylinder utilizes a full square retainer.
All MX1 & MX3 Mounts use full square retainer.

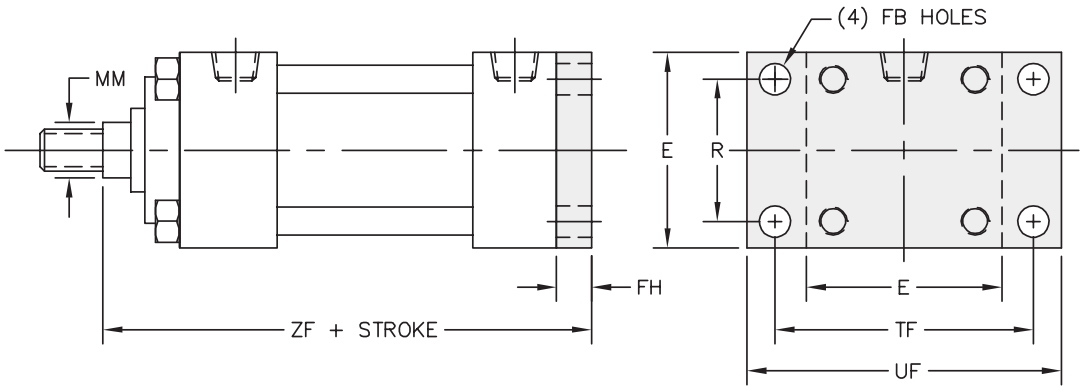
3. Round retainer used to retain bushing, not a full front plate as other bores. 'BB' is dimension from head on the 8.00" bore.

Dimensions – Flange Mounts

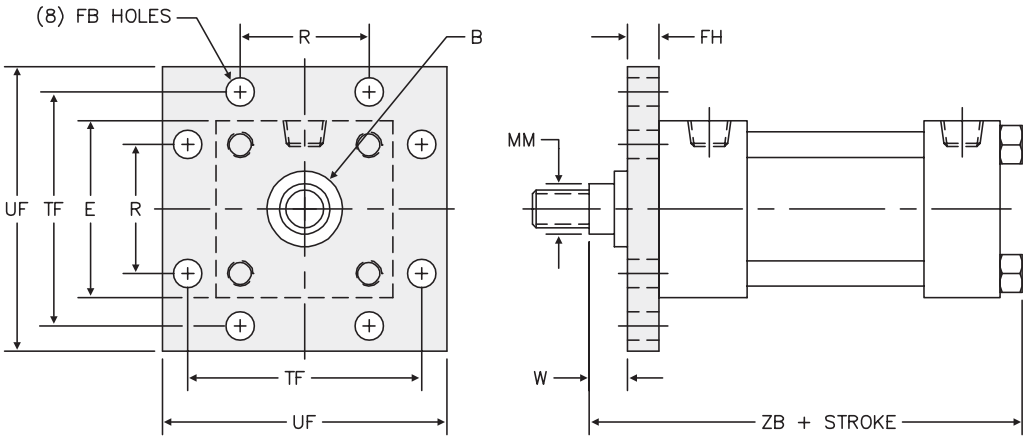
MF1: Head Flange



MF2: Cap Flange

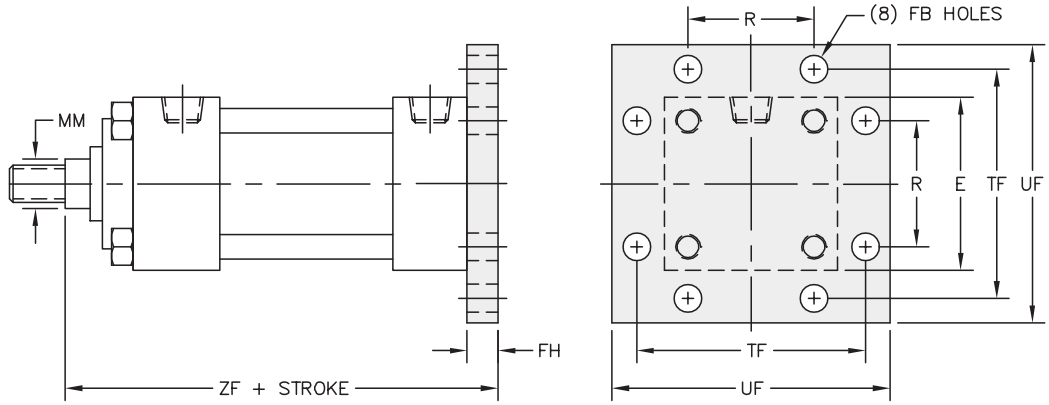


MF5: Head Square Flange



Dimensions – Flange Mounts

MF6: Cap Square Flange



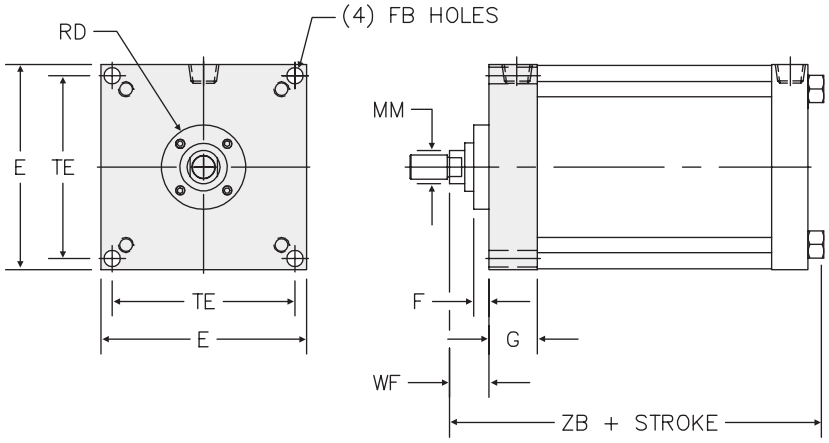
Bore	Rod Dia. (MM)	Max PSI Rating[1]	B[2]	E	FB	FH	R	TF	UF	W	Add to Stroke	
											ZB	ZF
1.50	0.625	1500	1.124	2.000	0.313	0.375	1.438	2.750	3.375	0.625	4.875	5.000
	1.000	1500	1.499							1.000	5.250	5.375
2.00	0.625	1500	1.124	2.500	0.375	0.375	1.844	3.375	4.125	0.625	4.938	5.000
	1.000	1500	1.499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

1. Max 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).

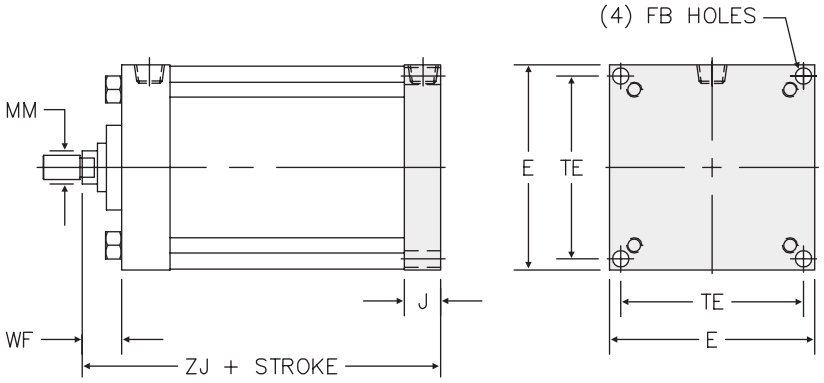
2. B dimension tolerance is +.000 / -.002

Dimensions – Flange Mounts

ME3: Head Square Mounting Holes



ME4: Cap Square Mounting Holes

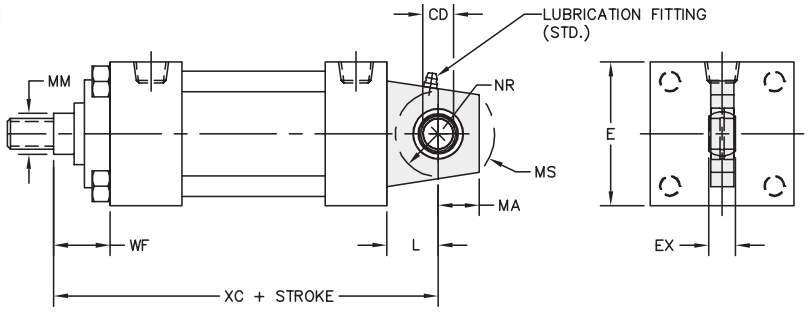


Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	F	FB	G	J	TE	RD	WF	Add to Stroke	
											ZB	ZJ
8.00	1.375	500	8.500	0.750	0.688	2.000	1.500	7.570	3.500	1.625	7.313	6.750
	1.750	500							3.875	1.875	7.563	7.000
	2.000	675							4.250	2.000	7.688	7.125
	2.500	675							4.625	2.250	7.938	7.375
	3.000	675							5.250	2.250	7.938	7.375
	3.500	675							5.750	2.250	7.938	7.375
	4.000	675							6.500	2.250	7.938	7.375
	4.500	675							7.250	2.250	7.938	7.375
	5.000	675							7.500	2.250	7.938	7.375
	5.500	675							7.500	2.250	7.938	7.375

1. Max 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).

Dimensions – Spherical Bearing Mount

SB: Spherical Bearing



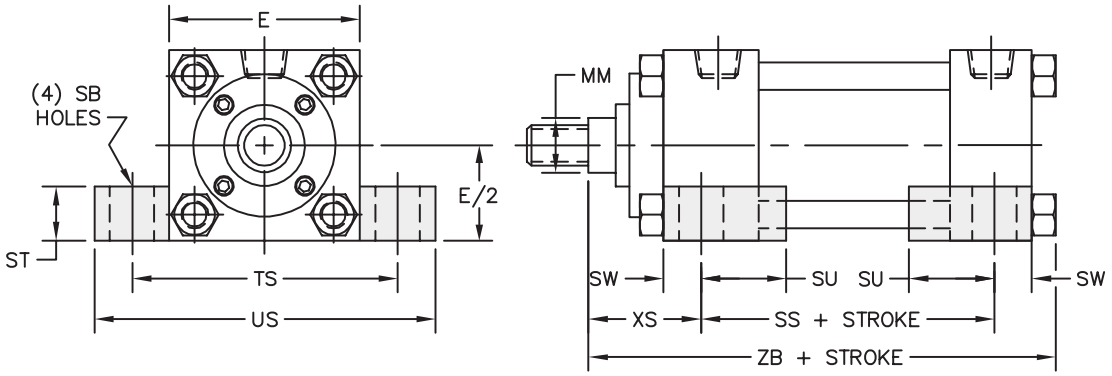
Bore	Rod Dia. (MM)	Max PSI Rating[1]	CD	E	EX	L	MA	MS	NR	WF	Add to Stroke XC
1.50	0.625	1500	0.500	2.000	0.437	0.750	0.750	0.938	0.625	1.000	5.375
	1.000	1500								1.375	5.750
2.00	0.625	980	0.500	2.500	0.437	0.750	0.750	0.938	0.625	1.000	5.375
	1.000	980								1.375	5.750
	1.375	980								1.625	6.000
2.50	0.625	630	0.500	3.000	0.437	0.750	0.750	0.938	0.625	1.000	5.500
	1.000	630								1.375	5.875
	1.375	630								1.625	6.125
	1.750	630								1.875	6.375
3.25	1.000	830	0.750	3.750	0.656	1.250	1.000	1.375	1.000	1.375	6.875
	1.375	830								1.625	7.125
	1.750	830								1.875	7.375
	2.000	830								2.000	7.500
4.00	1.000	550	0.750	4.500	0.656	1.250	1.000	1.375	1.000	1.375	6.875
	1.375	550								1.625	7.125
	1.750	550								1.875	7.375
	2.000	550								2.000	7.500
	2.500	550								2.250	7.750
5.00	1.000	350	0.750	5.500	0.656	1.250	1.000	1.375	1.000	1.375	7.125
	1.375	350								1.625	7.375
	1.750	350								1.875	7.625
	2.000	350								2.000	7.750
	2.500	350								2.250	8.000
	3.000	350								2.250	8.000
	3.500	350								2.250	8.000
6.00	1.375	440	1.000	6.500	0.875	1.500	1.250	1.688	1.250	1.625	8.125
	1.750	440								1.875	8.375
	2.000	440								2.000	8.500
	2.500	440								2.250	8.750
	3.000	440								2.250	8.750
	3.500	440								2.250	8.750
	4.000	440								2.250	8.750
8.00	1.375	250	1.000	8.500	0.875	1.500	1.250	1.688	1.250	1.625	8.250
	1.750	250								1.875	8.500
	2.000	250								2.000	8.625
	2.500	250								2.250	8.875
	3.000	250								2.250	8.875
	3.500	250								2.250	8.875
	4.000	250								2.250	8.875
	4.500	250								2.250	8.875
	5.000	250								2.250	8.875
	5.500	250								2.250	8.875

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

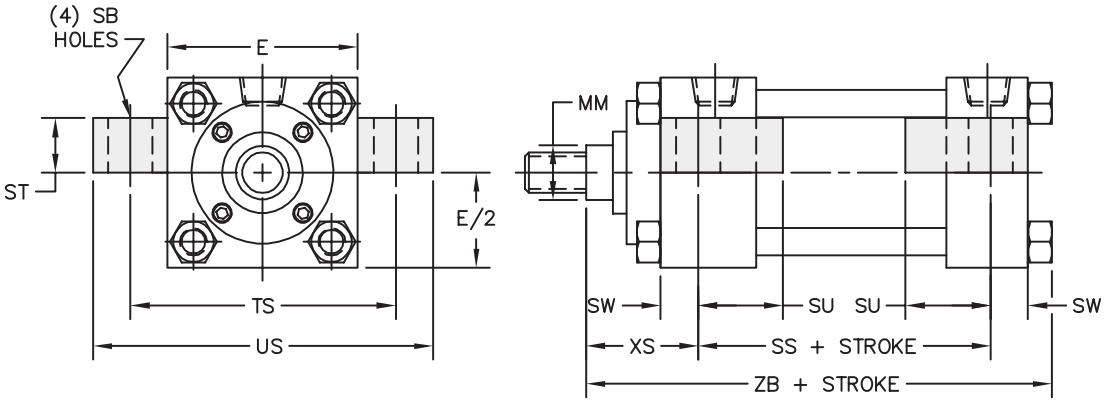
Note 2: Must specify KK3 rod end if to be used with HH-MSRE Series rod eye.

Dimensions – Lug Mounts

MS2: Side Lugs



MS3: Center Line Lugs



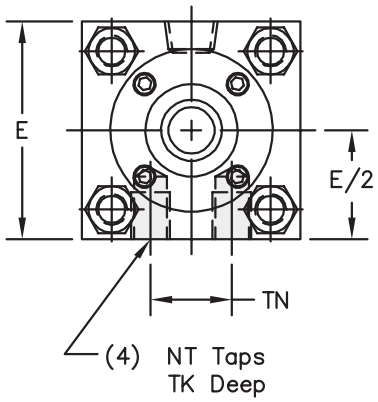
Dimensions – Lug Mounts

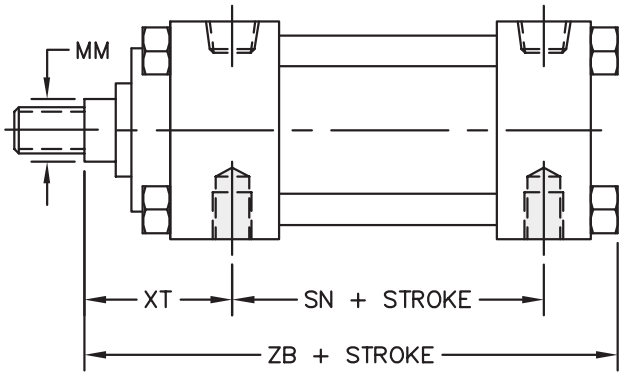
Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	SB	ST	SU	SW	TS	US	XS	Add to Stroke	
											SS	ZB
1.50	0.625	1500	2.000	0.438	0.500	1.125	0.375	2.750	3.500	1.375	2.875	4.875
	1.000	1500								1.750		5.250
2.00	0.625	1500	2.500	0.438	0.500	1.125	0.375	3.250	4.000	1.375	2.875	4.938
	1.000	1500								1.750		5.313
	1.375	1500								2.000		5.563
2.50	0.625	1000	3.000	0.438	0.500	1.125	0.375	3.750	4.500	1.375	3.000	5.063
	1.000	1500								1.750		5.438
	1.375	1500								2.000		5.688
	1.750	1500								2.250		5.938
3.25	1.000	1500	3.750	0.563	0.750	1.250	0.500	4.750	5.750	1.875	3.250	6.000
	1.375	1500								2.125		6.250
	1.750	1500								2.375		6.500
	2.000	1500								2.500		6.625
4.00	1.000	1000	4.500	0.563	0.750	1.250	0.500	5.500	6.500	1.875	3.250	6.000
	1.375	1000								2.125		6.250
	1.750	1000								2.375		6.500
	2.000	1000								2.500		6.625
	2.500	1000								2.750		6.875
5.00	1.000	750	5.500	0.813	1.000	1.063	0.688	6.875	8.250	2.063	3.125	6.313
	1.375	1000								2.313		6.563
	1.750	1000								2.563		6.813
	2.000	1000								2.688		6.938
	2.500	1000								2.938		7.188
	3.000	1000								2.938		7.188
	3.500	1000								2.938		7.188
6.00	1.375	750	6.500	0.813	1.000	1.313	0.688	7.875	9.250	2.313	3.625	7.063
	1.750	750								2.563		7.313
	2.000	750								2.688		7.438
	2.500	750								2.938		7.688
	3.000	750								2.938		7.688
	3.500	750								2.938		7.688
	4.000	750								2.938		7.688
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 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).

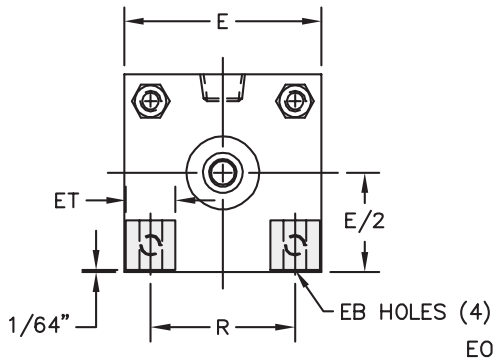
Dimensions – Bottom Mounts

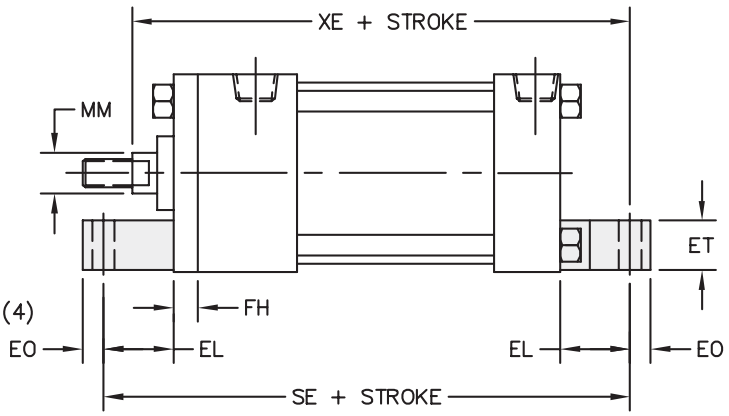
MS4: Bottom Tapped Holes





MS7: End Lugs





Dimensions – Bottom Mounts

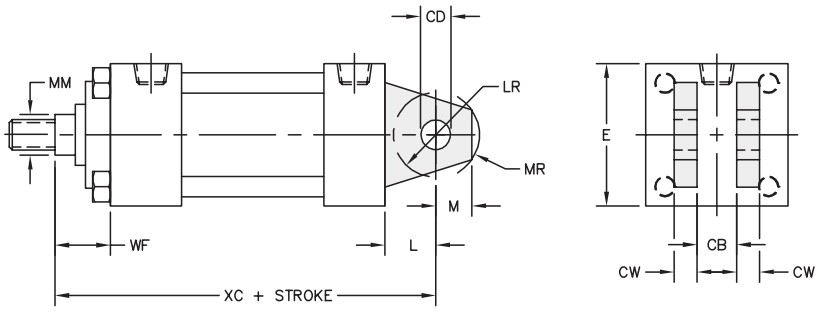
Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	EB	EL	EO	ET	FH	NT	R	TN	TK	XT	Add to Stroke			
														SN	ZB	SE	XE
1.50	0.625	1500	2.000	0.281	0.750	0.250	0.563	0.375	1/4 - 20	1.438	0.625	0.375	1.938	2.250	4.875	5.500	5.375
	1.000	1500											2.313		5.250		5.750
2.00	0.625	1500	2.500	0.344	0.938	0.313	0.625	0.375	5/16 - 18	1.844	0.875	0.406	1.938	2.250	4.938	5.875	5.563
	1.000	1500											2.313		5.313		5.938
	1.375	1500											2.563		5.563		6.188
2.50	0.625	1000	3.000	0.344	1.063	0.313	0.750	0.375	3/8 - 16	2.188	1.250	0.438	1.938	2.375	5.063	6.250	5.813
	1.000	1500											2.313		5.438		6.188
	1.375	1500											2.563		5.688		6.438
	1.750	1500											2.813		5.938		6.688
3.25	1.000	1500	3.750	0.406	0.875	0.375	0.938	0.625	1/2 - 13	2.766	1.500	0.500	2.438	2.625	6.000	6.625	6.500
	1.375	1500											2.688		6.250		6.750
	1.750	1500											2.938		6.500		7.000
	2.000	1500											3.063		6.625		7.125
4.00	1.000	1000	4.500	0.406	1.000	0.375	1.125	0.625	1/2 - 13	3.328	2.063	0.625	2.438	2.625	6.000	6.875	6.625
	1.375	1000											2.688		6.250		6.875
	1.750	1000											2.938		6.500		7.125
	2.000	1000											3.063		6.625		7.250
	2.500	1000											3.313		6.875		7.500
5.00	1.000	750	5.500	0.531	1.063	0.500	1.375	0.625	5/8 - 11	4.109	2.688	0.750	2.438	2.875	6.313	7.250	6.938
	1.375	1000											2.688		6.563		7.188
	1.750	1000											2.938		6.813		7.438
	2.000	1000											3.063		6.938		7.563
	2.500	1000											3.313		7.188		7.813
	3.000	1000											3.313		7.188		7.813
	3.500	1000											3.313		7.188		7.813
6.00	1.375	750	6.500	0.531	1.000	0.500	1.563	0.750	3/4 - 10	4.875	3.250	1.000	2.813	3.125	7.063	7.750	7.625
	1.750	750											3.063		7.313		7.875
	2.000	750											3.188		7.438		8.000
	2.500	750											3.438		7.688		8.250
	3.000	750											3.438		7.688		8.250
	3.500	750											3.438		7.688		8.250
	4.000	750											3.438		7.688		8.250
8.00	1.375	500	8.500	0.688	1.125	0.625	2.000	[2]	3/4 - 10	6.438	4.500	1.250	2.813	3.250	7.313	7.375	7.875
	1.750	500											3.063		7.563		8.125
	2.000	675											3.188		7.688		8.250
	2.500	675											3.438		7.938		8.500
	3.000	675											3.438		7.938		8.500
	3.500	675											3.438		7.938		8.500
	4.000	675		N/A	N/A	N/A	N/A	N/A		N/A			3.438		7.938	N/A	N/A
	4.500	675		N/A	N/A	N/A	N/A	N/A		N/A			3.438		7.938	N/A	N/A
	5.000	675		N/A	N/A	N/A	N/A	N/A		N/A			3.438		7.938	N/A	N/A
	5.500	675		N/A	N/A	N/A	N/A	N/A		N/A			3.438		7.938	N/A	N/A

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. Uses round retainer. MS7 Bracket bolted directly to head & cap.

Dimensions – Pivot Mounts

MP1: Rear Pivot Clevis



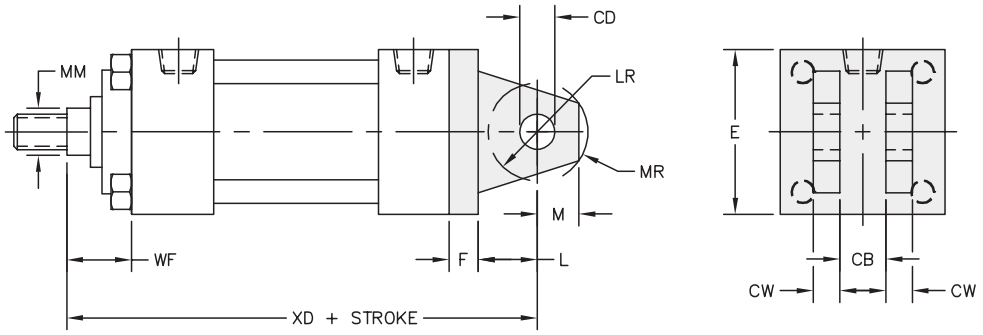
Bore	Rod Dia. (MM)	Max PSI Rating[1]	CB	CD	CW	E	L	LR	M	MR	WF	Add to Stroke XC
1.50	0.625	1500	0.750	0.500	0.500	2.000	0.750	0.563	0.500	0.625	1.000	5.375
	1.000	1500									1.375	5.750
2.00	0.625	1500	0.750	0.500	0.500	2.500	0.750	0.563	0.500	0.625	1.000	5.375
	1.000	1500									1.375	5.750
	1.375	1500									1.625	6.000
2.50	0.625	1000	0.750	0.500	0.500	3.000	0.750	0.563	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 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).

Note: Pivot pin included with cylinder cap end only.

Dimensions – Pivot Mounts

MP2: Rear Pivot Detachable Clevis



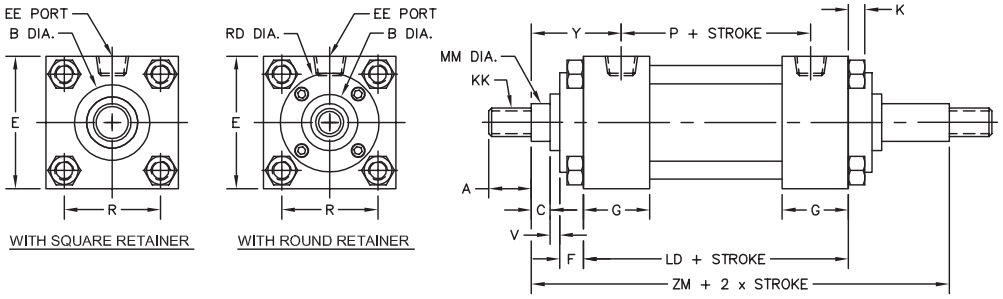
Bore	Rod Dia. (MM)	Max PSI Rating[1]	CB	CD	CW	E	F	L	LR	M	MR	WF	Add to Stroke XD
1.50	0.625	1500	0.750	0.500	0.500	2.000	0.375	0.750	0.563	0.500	0.625	1.000	5.750
	1.000	1500										1.375	6.125
2.00	0.625	1500	0.750	0.500	0.500	2.500	0.375	0.750	0.563	0.500	0.625	1.000	5.750
	1.000	1500										1.375	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	0.563	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 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).

Note: Pivot pin included with cylinder cap end only.

Dimensions – Basic Double End (MX0 Mount)

MX0D: No Mount

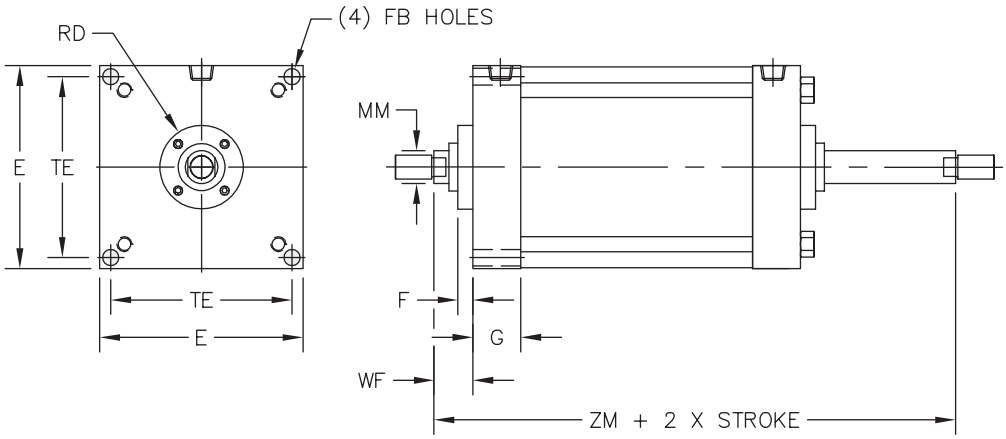


Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	A	B[2]	C	EE		F	G	K	KK	R	RD[3]	V	Y	Add to Stroke		Add 2x Stroke
							NPTF	SAE									LD	P	ZM
1.50	0.625	1500	2.000	0.750	1.124	0.375	3/8	#6	0.375	1.500	0.250	See rod end detail chart on page 21	1.438	SQ	0.250	1.875	4.125	2.375	6.125
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			6.875
2.00	0.625	1500	2.500	0.750	1.124	0.375	3/8	#6	0.375	1.500	0.313		1.844	2.000	0.250	1.875	4.125	2.375	6.125
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			6.875
	1.375	1500		1.625	1.999	0.625								SQ	0.625	2.500			7.375
2.50	0.625	1000	3.000	0.750	1.124	0.375	3/8	#6	0.375	1.500	0.313		2.188	2.000	0.250	1.875	4.250	2.500	6.250
	1.000	1500		1.125	1.499	0.500								SQ	0.500	2.250			7.000
	1.375	1500		1.625	1.999	0.625								SQ	0.625	2.500			7.500
	1.750	1500		2.000	2.374	0.750								SQ	0.750	2.750			8.000
3.25	1.000	1500	3.750	1.125	1.499	0.500	1/2	#10	0.625	1.750	0.375		2.766	2.750	0.250	2.375	4.750	2.750	7.500
	1.375	1500		1.625	1.999	0.625								SQ	0.375	2.625			8.000
	1.750	1500		2.000	2.374	0.750								SQ	0.500	2.875			8.500
	2.000	1500		2.250	2.624	0.875								SQ	0.500	3.000			8.750
4.00	1.000	1000	4.500	1.125	1.499	0.500	1/2	#10	0.625	1.750	0.375		3.328	2.750	0.250	2.375	4.750	2.750	7.500
	1.375	1000		1.625	1.999	0.625								3.500	0.375	2.625			8.000
	1.750	1000		2.000	2.374	0.750								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	1/2	#10	0.625	1.750	0.438		4.109	2.750	0.250	2.375	5.000	3.000	7.750
	1.375	1000		1.625	1.999	0.625								3.500	0.375	2.625			8.250
	1.750	1000		2.000	2.374	0.750								3.500	0.500	2.875			8.750
	2.000	1000		2.250	2.624	0.875								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	3/4	#12	0.750	2.000	0.438		4.875	3.500	0.250	2.750	5.500	3.250	8.750
	1.750	750		2.000	2.374	0.750								3.875	0.375	3.000			9.250
	2.000	750		2.250	2.624	0.875								4.250	0.375	3.125			9.500
	2.500	750		3.000	3.124	1.000								4.625	0.500	3.375			10.000
	3.000	750		3.500	3.749	1.000								5.250	0.500	3.375			10.000
	3.500	750		3.500	4.249	1.000								5.750	0.500	3.375			10.000
	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	3/4	#12	0.750	2.000	0.563		6.438	3.500	0.250	2.750	5.625	3.375	8.875
	1.750	500		2.000	2.374	0.750								3.875	0.375	3.000			9.375
	2.000	675		2.250	2.624	0.875								4.250	0.375	3.125			9.625
	2.500	675		3.000	3.124	1.000								4.625	0.500	3.375			10.125
	3.000	675		3.500	3.749	1.000								5.250	0.500	3.375			10.125
	3.500	675		3.500	4.249	1.000								5.750	0.500	3.375			10.125
	4.000	675		4.000	4.749	1.000								6.500	0.500	3.375			10.125
	4.500	675		4.500	5.249	1.000								7.250	0.500	3.375			10.125
	5.000	675		5.000	5.749	1.000								7.500	0.500	3.375			10.125
	5.500	675		5.500	6.249	1.000								7.500	0.500	3.375			10.125

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

Dimensions – Double End Mounts

ME3D: Head Square Mounting Holes

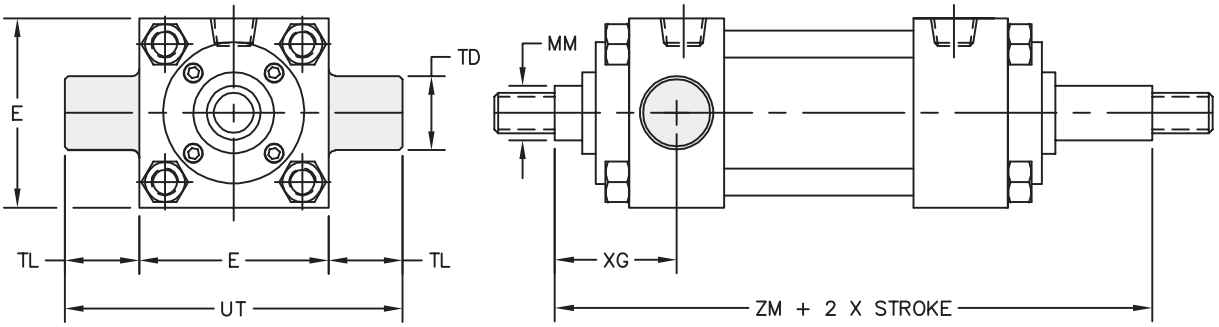


Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	F	FB	G	TE	RD	WF	Add to Stroke
										ZM
8.00	1.375	500	8.500	0.750	0.688	2.000	7.570	3.500	1.625	8.875
	1.750	500						3.875	1.875	9.375
	2.000	675						4.250	2.000	9.625
	2.500	675						4.625	2.250	10.125
	3.000	675						5.250	2.250	10.125
	3.500	675						5.750	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

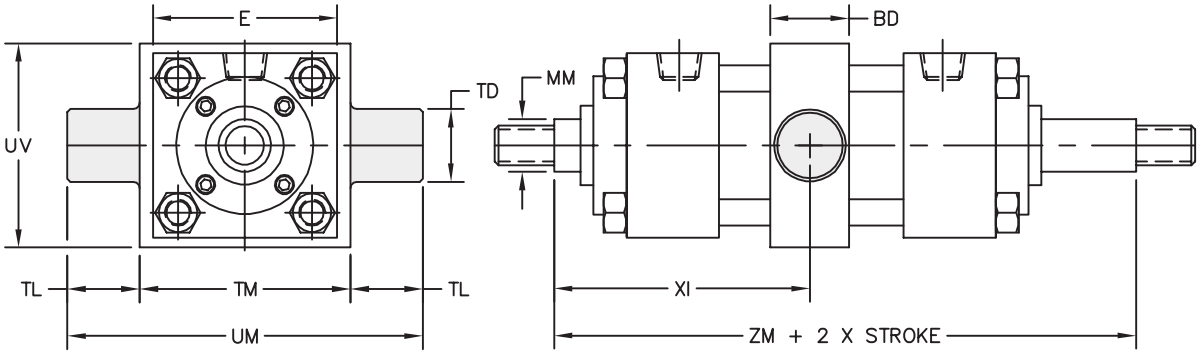
1. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

Dimensions – Double End Mounts

MT1D: Head Trunnion



MT4D: Intermediate Trunnion



NOTE:
'XI' DIMENSION TO BE SPECIFIED BY CUSTOMER

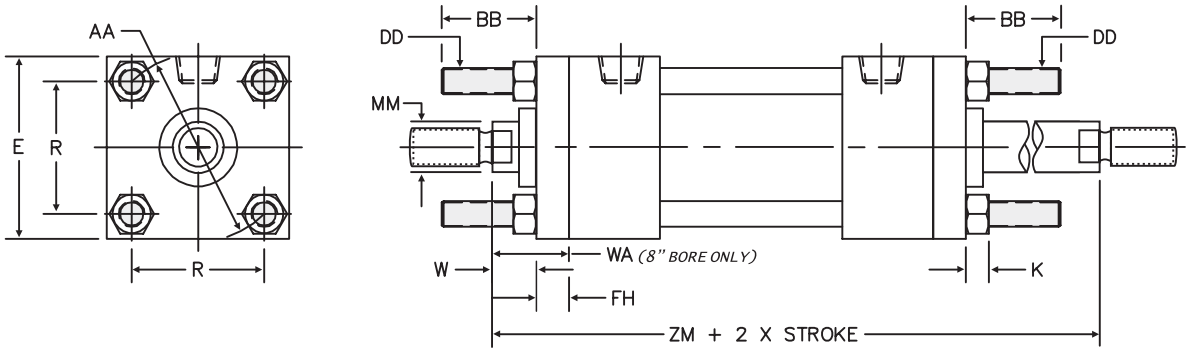
Dimensions – Double End Mounts

Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	BD	TD[2]	TL	TM	UM	UT	UV	XG	XI[3]	MT4 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	3.250	0.375	6.125
	1.000	1500									2.125	3.625		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	3.375	0.625	6.125
	1.000	1500									2.125	3.750		6.875
	1.375	1500									2.375	4.000		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	3.375	0.500	6.250
	1.000	1500									2.125	3.750		7.000
	1.375	1500									2.375	4.000		7.500
	1.750	1500									2.625	4.250		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	4.250	1.000	7.500
	1.375	1500									2.500	4.500		8.000
	1.750	1500									2.750	4.750		8.500
	2.000	1500									2.875	4.875		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	4.250	1.000	7.500
	1.375	1000									2.500	4.500		8.000
	1.750	1000									2.750	4.750		8.500
	2.000	1000									2.875	4.875		8.750
	2.500	1000									3.125	5.125		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	4.250	0.750	7.750
	1.375	1000									2.500	4.500		8.250
	1.750	1000									2.750	4.750		8.750
	2.000	1000									2.875	4.875		9.000
	2.500	1000									3.125	5.125		9.500
	3.000	1000									3.125	5.125		9.500
	3.500	1000									3.125	5.125		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	4.750	0.750	8.750
	1.750	750									2.875	5.000		9.250
	2.000	750									3.000	5.125		9.500
	2.500	750									3.250	5.375		10.000
	3.000	750									3.250	5.375		10.000
	3.500	750									3.250	5.375		10.000
	4.000	750									3.250	5.375		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	5.000	1.125	8.875
	1.750	500									2.875	5.250		9.375
	2.000	675									3.000	5.375		9.625
	2.500	675									3.250	5.625		10.125
	3.000	675									3.250	5.625		10.125
	3.500	675									3.250	5.625		10.125
	4.000	675									3.250	5.625		10.125
	4.500	675									3.250	5.625		10.125
	5.000	675									3.250	5.625		10.125
	5.500	675									3.250	5.625		10.125

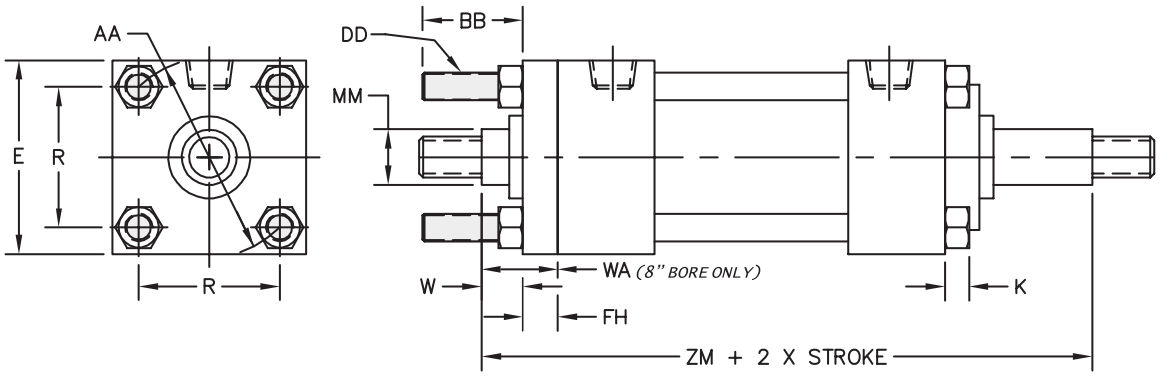
1. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).
2. TD dimension tolerance is + .000 / - .001
3. XI dimension is the minimum that can be supplied and leaves 1/4" gap between head & trunnion block (customer to specify XI dimension).

Dimensions – Double End Mounts

MX1D: Extended Tie Rods - Head & Cap



MX3D: Extended Tie Rods - Head End



Dimensions – Double End Mounts

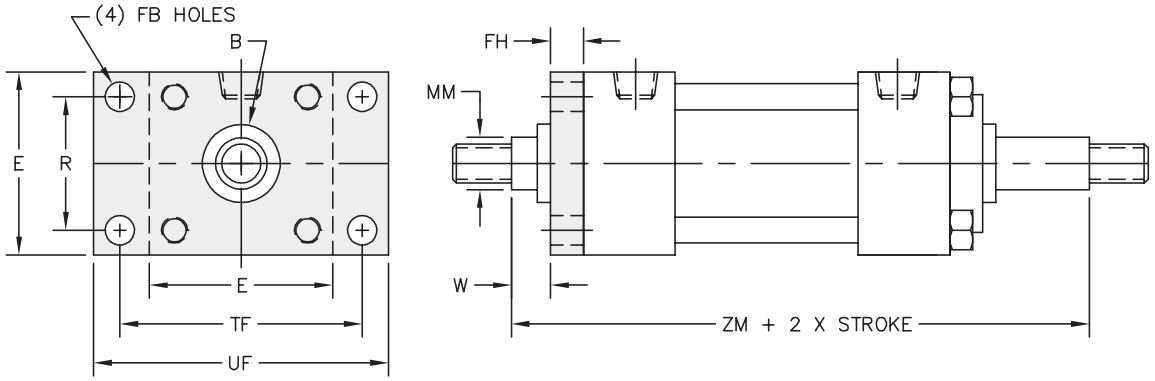
Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	FH	AA	BB[2]	DD	K	R	W or WA (8")	Add 2x Stroke ZM
1.50	0.625	1500	2.000	0.375	2.020	1.000	1/4 - 28	0.250	1.430	0.625	6.125
	1.000	1500								1.000	6.875
2.00	0.625	1500	2.500	0.375	2.600	1.125	5/16 - 24	0.313	1.840	0.625	6.125
	1.000	1500								1.000	6.875
	1.375	1500								1.250	7.375
2.50	0.625	1000	3.000	0.375	3.100	1.125	5/16 - 24	0.313	2.190	0.625	6.250
	1.000	1500								1.000	7.000
	1.375	1500								1.250	7.500
	1.750	1500								1.500	8.000
3.25	1.000	1500	3.750	0.625	3.900	1.375	3/8 - 24	0.375	2.760	0.750	7.500
	1.375	1500								1.000	8.000
	1.750	1500								1.250	8.500
	2.000	1500								1.375	8.750
4.00	1.000	1000	4.500	0.625	4.700	1.375	3/8 - 24	0.375	3.320	0.750	7.500
	1.375	1000								1.000	8.000
	1.750	1000								1.250	8.500
	2.000	1000								1.375	8.750
	2.500	1000								1.625	9.250
5.00	1.000	750	5.500	0.625	5.800	1.813	1/2 - 20	0.438	4.100	0.750	7.750
	1.375	1000								1.000	8.250
	1.750	1000								1.250	8.750
	2.000	1000								1.375	9.000
	2.500	1000								1.625	9.500
	3.000	1000								1.625	9.500
	3.500	1000								1.625	9.500
6.00	1.375	750	6.500	0.750	6.900	1.813	1/2 - 20	0.438	4.880	0.875	8.750
	1.750	750								1.125	9.250
	2.000	750								1.250	9.500
	2.500	750								1.500	10.000
	3.000	750								1.500	10.000
	3.500	750								1.500	10.000
	4.000	750								1.500	10.000
8.00	1.375	500	8.500	0.625	9.100	2.313	5/8 - 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 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).

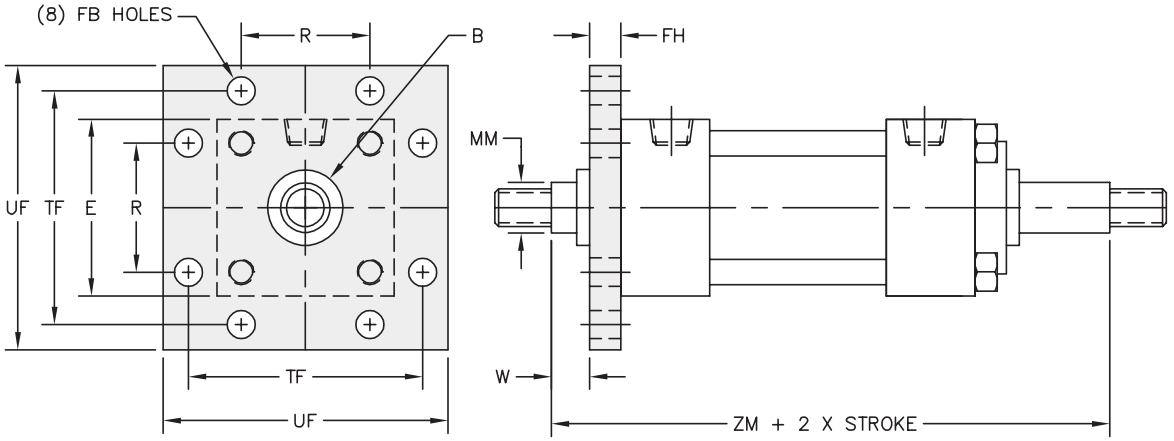
2. Round retainer used to retain bushing, not a full front plate as other bores. 'BB' is dimension from head on the 8.00" bore.

Dimensions – Double End Mounts

MF1D: Head Flange



MF5D: Head Square Flange



Dimensions – Double End Mounts

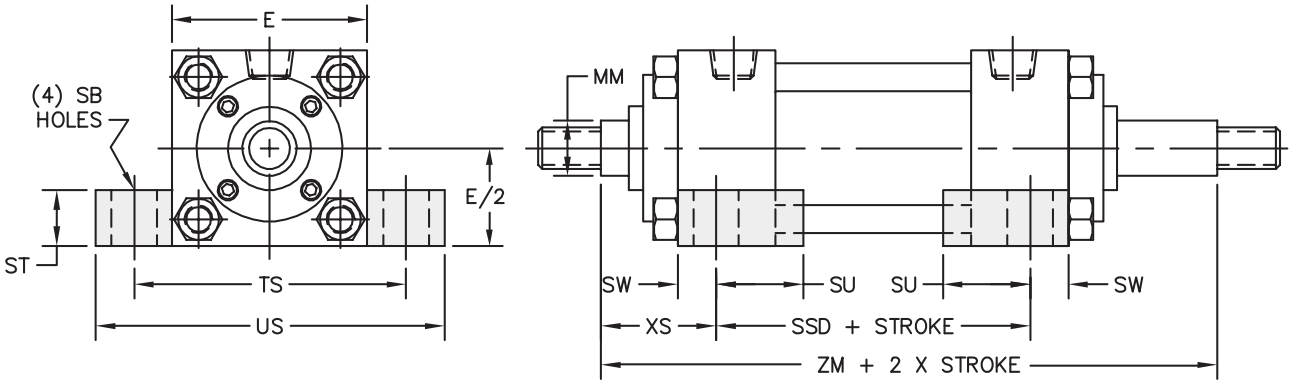
Bore	Rod Dia. (MM)	Max PSI Rating[1]	B[2]	E	FB	FH	R	TF	UF	W	Add 2x Stroke ZM
1.50	0.625	1500	1.124	2.000	0.313	0.375	1.430	2.750	3.375	0.625	6.125
	1.000	1500	1.499							1.000	6.875
2.00	0.625	1500	1.124	2.500	0.375	0.375	1.840	3.375	4.125	0.625	6.125
	1.000	1500	1.499							1.000	6.875
	1.375	1500	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 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).

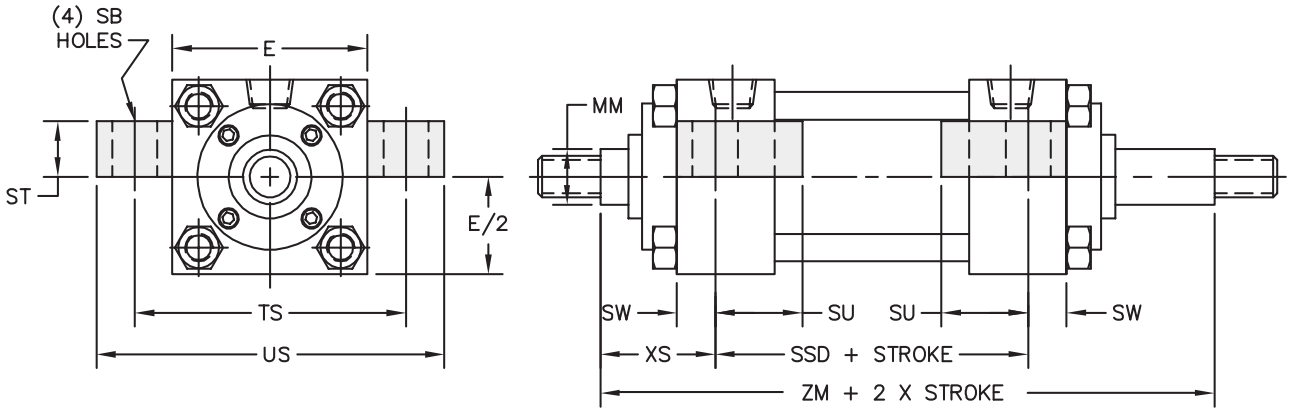
2. B dimension tolerance is +.000 / -.002

Dimensions – Double End Mounts

MS2D: Side Lugs



MS3D: Center Line Lugs



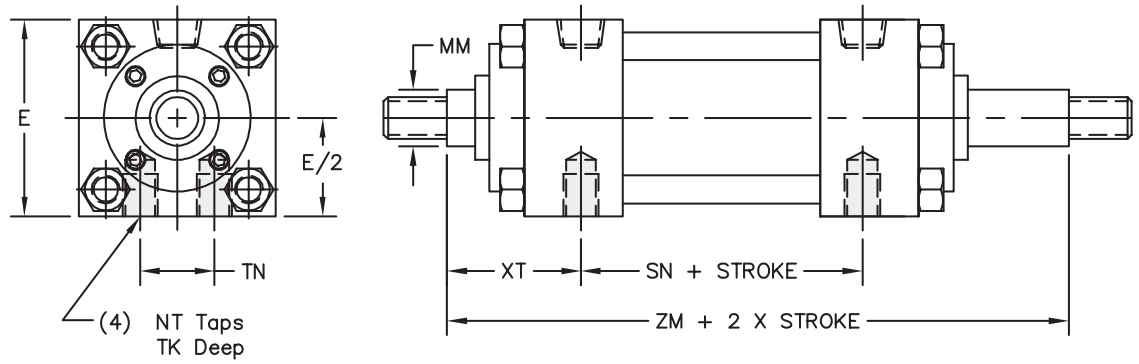
Dimensions – Double End Mounts

Bore	Rod Dia. (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	4.750	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

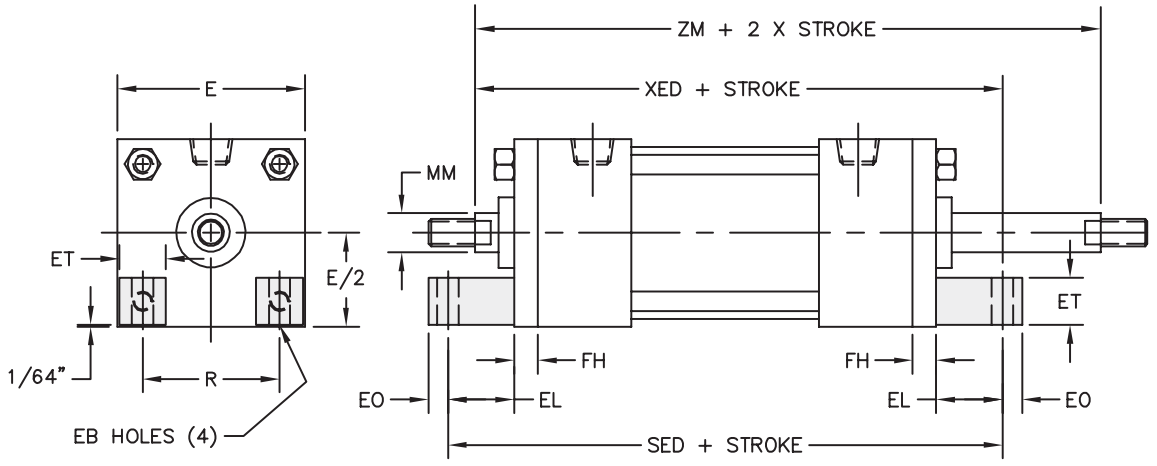
1. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

Dimensions – Double End Mounts

MS4D: Bottom Tapped Holes



MS7D: End Lugs



Dimensions – Double End Mounts

Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	EB	EL	EO	ET	FH	NT	R	TN	TK	XT	Add to Stroke			Add 2x Stroke
														SN	ZB	SE	XE
1.50	0.625	1500	2.000	N/A	N/A	N/A	N/A	N/A	1/4 - 20	N/A	0.625	0.375	1.938	2.250	N/A	N/A	6.125
	1.000	1500											2.313				6.875
2.00	0.625	1500	2.500	0.344	0.938	0.313	0.375	0.375	5/16 - 18	1.844	0.875	0.406	1.938	2.250	6.750	6.438	6.125
	1.000	1500		N/A	N/A	N/A	N/A	N/A		N/A			2.313		N/A	N/A	6.875
	1.375	1500		N/A	N/A	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	3/8 - 16	2.188	1.250	0.438	1.938	2.375	7.125	6.688	6.250
	1.000	1500		N/A	N/A	N/A	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	N/A		N/A			2.563		N/A	N/A	7.500
	1.750	1500		N/A	N/A	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	1/2 - 13	2.766	1.500	0.500	2.438	2.625	7.750	7.625	7.500
	1.375	1500		N/A	N/A	N/A	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	N/A		N/A			2.938		N/A	N/A	8.500
	2.000	1500		N/A	N/A	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	1/2 - 13	3.328	2.063	0.625	2.438	2.625	8.000	7.750	7.500
	1.375	1000		0.406	1.000	0.375	1.125	0.625		3.328			2.688		8.000	8.000	8.000
	1.750	1000		N/A	N/A	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	N/A		N/A			3.063		N/A	N/A	8.750
	2.500	1000		N/A	N/A	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	5/8 - 11	4.109	2.688	0.750	2.438	2.875	8.375	8.063	7.750
	1.375	1000		0.531	1.063	0.500	1.375	0.625		4.109			2.688		8.375	8.313	8.250
	1.750	1000		0.531	1.063	0.500	1.375	0.625		4.109			2.938		8.375	8.563	8.750
	2.000	1000		N/A	N/A	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	N/A		N/A			3.313		N/A	N/A	9.500
	3.000	1000		N/A	N/A	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	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	3/4 - 10	4.875	3.250	1.000	2.813	3.125	9.000	8.875	8.750
	1.750	750		0.531	1.000	0.500	1.563	0.750		4.875			3.063		9.000	9.125	9.250
	2.000	750		0.531	1.000	0.500	1.563	0.750		4.875			3.188		9.000	9.250	9.500
	2.500	750		0.531	1.000	0.500	1.563	0.750		4.875			3.438		9.000	9.500	10.000
	3.000	750		N/A	N/A	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	N/A		N/A			3.438		N/A	N/A	10.000
	4.000	750		N/A	N/A	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]	3/4 - 10	6.438	4.500	1.250	2.813	3.250	7.875	8.375	8.875
	1.750	500		0.688	1.125	0.625	2.000	[2]		6.438			3.063		7.875	8.625	9.375
	2.000	675		0.688	1.125	0.625	2.000	[2]		6.438			3.188		7.875	8.750	9.625
	2.500	675		0.688	1.125	0.625	2.000	[2]		6.438			3.438		7.875	9.000	10.125
	3.000	675		0.688	1.125	0.625	2.000	[2]		6.438			3.438		7.875	9.000	10.125
	3.500	675		0.688	1.125	0.625	2.000	[2]		6.438			3.438		7.875	9.000	10.125
	4.000	675		N/A	N/A	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	N/A		N/A			3.438		N/A	N/A	10.125
	5.000	675		N/A	N/A	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	N/A		N/A			3.438		N/A	N/A	10.125

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. Uses round retainer. MS7 Bracket bolted directly to head & cap.

How to Order

MH Cylinders

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

Product Series

MH	Medium Pressure Hydraulic

Style

	Single Rod
D	Double Rod

Stroke

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

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"
200	2.00"
250	2.50"
325	3.25"
400	4.00"
500	5.00"
600	6.00"
800	8.00"

Cushions[1]

H	1
	2
	3
	4
C	5
	6
	7
	8

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.

Rod End[2]

KK1	Small Male Thread
KK2	Large Male Thread
KK3	Female Thread
KK3M	Female Metric Rod Thread
KK3X	Female Special Thread
KK4	Full Diameter Male Thread
KK5	Plain End
KK10	Rod Coupler End
KKM	Metric Thread
KKX	Male Special Thread

Port Loc[3]

P	1
	2
	3
	4
	5
	6
	7
	8
	9

Port Size

N062	1/16" NPTF
N125	1/8" NPTF
N250	1/4" NPTF
N375	3/8" NPTF
N500	1/2" NPTF
N750	3/4" NPTF
S6	#6 SAE
S8	#8 SAE
S10	#10 SAE
S12	#12 SAE

Piston Seal

S	Standard (Carboxilated)
C	Cast-Ring
E	EP
T	PTFE[4]
V	Fluorocarbon

Rod Seal

S	Standard (Polyurethane)
E	EP
V	Fluorocarbon

Tube Seal

S	Standard (Buna)
E	EP
V	Fluorocarbon

Rod Wiper[4]

S	Standard (Flocked Nitrile)
M	Metallic Scraper
T	PTFE
V	Fluorocarbon

Options

A=	Extended Piston Rod Thread (Example: A = 2") (Max = 2 Times ST'D "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
DBB=	Drain Back Bushing (Example: DBB=1)
EK	Extended Key Plate
HLP	High Load Piston
HSS	High Shock Seals
LRB	Lift Ring Boss
NR	Non-Rotating
PLS	Piston Lock Screw (Standard)
RBB	Rod Bushing Material: Bronze
SSR	Stainless Steel Piston Rod
ST=[5]	Stop Tube Note: Specify Stop Tube Length (in inches) Specify Stroke as ES (effective stroke) Example: MH-MS2-250x48 ES-H2C6-ST=36
4WF	Four Wrench Flats (Rod Sizes: .625"-3.50")
XX=	Special Variation (Specify)

1. Call out 'H' for head cushion, 'C' for cap cushion, followed by the desired location(s).
2. When additional thread details are required, use format: Rod End = Modification Example: KKM=M12 x 1.75
3. Call out 'P' followed by all desired locations.
4. When cylinder design calls for all EP seals, use PTFE rod wiper.
5. The desired stop tube length adds directly to the overall cylinder length.

Note: Refer to MH Options for specifications.

MH Seal Kits

To ensure proper seals are supplied for all models, ALWAYS supply Bimba serial number.

MH-SK 137 - 250 - S S S S

Seal Kit Series	
MH-SK	Seal Kit
MH-SKD	Double Rod

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 Seal	
C	Cast Ring
E	EP
S	Standard (Carboxilated)
T	PTFE
V	Fluorocarbon

Rod Seal	
E	EP
S	Standard (Polyurethane)
V	Fluorocarbon

Tube Seal	
E	EP
S	Standard (Buna)
V	Fluorocarbon

Rod Wiper[1]	
C	Metallic Scrapper
E	Standard (Flocked Nitrile)
T	PTFE
V	Fluorocarbon

[1] When cylinder design calls for all EP seals, use PTFE rod wiper.

Examples:

MH-SK175-400-SSSS
MH-SK100-250-VVVT

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.

Index to Options

53 A = Extended Piston Rod Thread

53 AS = Adjustable Stroke (Retract)

53 ABP = Air Bleed Ports

53 C = Extended Piston Rod

54 CS = Center Support

54 C or H = Cushions

54 DBB = Drain Back Bushing

55 EK = Extended Key Plate

55 T = PTFE Piston Seal

56 HSS = High Shock Seals

56 KKX = Non-Standard Rod Threads

56 KKM = Male Metric Rod Threads

56 KK3M = Female Metric Rod Threads

56 KK3X = Female Special Rod Threads

56 LRB = Lift Ring Boss

57 NR = Non-Rotating

57 Multiple Mounts

58 Port Options (BSPP, BSPT, NPTF)

58 RBB = Rod Bushing - Bronze (Ductile Iron is standard)

58 SSR = Stainless Steel Piston Rod

59 Seals (Piston, Rod, Tube, Wiper)

60 ST = Stop Tube & Rod Size Selection

61 Piston Rod Size Selection

62 3P = Three-Position Cylinders

62 BTB = Back-To-Back Cylinders

62 TM = Tandem Cylinders

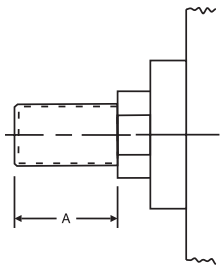
62 Special Finishes

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.



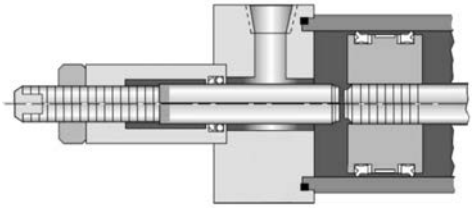
AS Adjustable Stroke (Retract)

AS = 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").

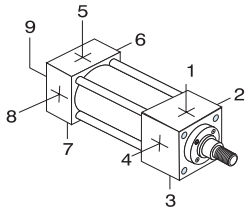
Adjustable Stroke	
Bore	**Max “AS”**
1.50	Up to 8 inch
2.00-3.25	Up to 6 inch
4.00-6.00	Up to 5 inch
8.00	Up to 4 inch

Consult factory for additional adjustable strokes offerings.



ABP Air Bleed Ports

ABP = 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.

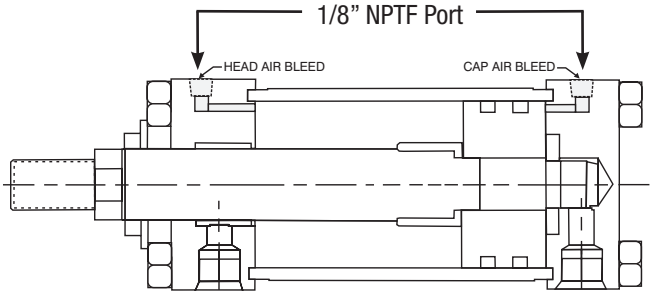


Location 9 is center of cap face.

Bore & Rod Size Limits: Consult factory

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

Plugged from factory.

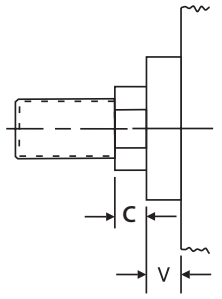


C Extended Piston Rod

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.



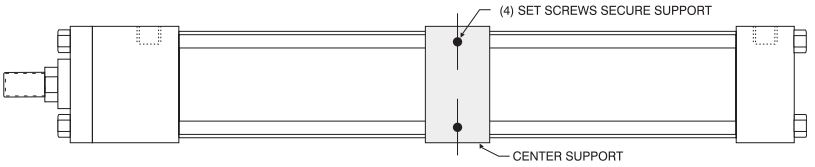
How to Customize

CS Center Supports

CS = 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 Bimba for more information.

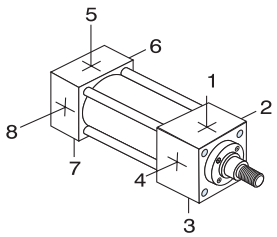


Maximum Stroke Recommendations			
Bore	No Center Support	With Center Supports (CS Option)	
		One Support	Two Supports
1.50", 2.00" & 2.50"	48 inches	Strokes over 48 inches	Strokes over 72 inches
3.25", 4.00" & 5.00"	65 inches	Strokes over 65 inches	Strokes over 92 inches
6.00"	72 inches	Strokes over 72 inches	Not Required

H/C Head & Cap Cushions

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

Example: H2C6



Cushion Locations	
Head Cushion	Cap Cushion
H1	C5
H2	C6
H3	C7
H4	C8

Standard Cushion Locations	
Most Mounts	H2 C6
MS3 Mount	H3 C7
MT1 Mount	H3 C6
MT2 Mount	H2 C7

Unavailable Cushion Locations by Mount		
Mount	Head Cushion	Cap Cushion
ME5	H2, H4	–
ME6	–	C6, C8
MS3	H2, H4	C6, C8
MT1	H2, H4	–
MT2	–	C6, C8

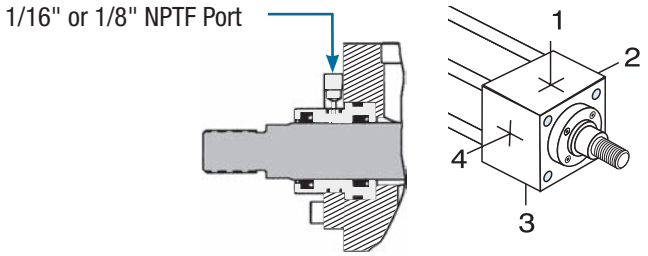
Note: Cylinders with a short stroke (value varies with bore/rod diameter and cushion combinations) may result in improper cylinder operation. Consult factory for availability.

DBB Drain Back Bushing

DBB = 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.

Note: Some bore and rod sizes are not available or may require special thickness retainers.

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



EK Extended Key Plate

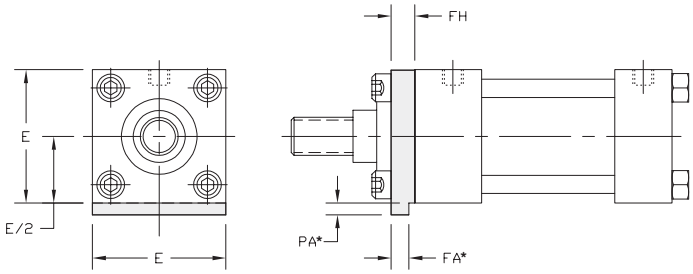
EK = Extended key plate or thrust key is made from a full square bushing retainer plate. The key is designed to fit in a milled slot on the equipment to prevent the cylinder from shifting.

An additional mount needs to be specified to secure cylinder.

Available Bore Sizes: 1.50" to 6.00"

MH Dimensions Extended Key Plate				
Bore	**E**	**FA***	**FH**	**PA***
1.50	2.000	0.312 / 0.310	0.375	0.188
2.00	2.500	0.312 / 0.310	0.375	0.188
2.50	3.000	0.312 / 0.310	0.375	0.188
3.25	3.750	0.562 / 0.560	0.625	0.313
4.00	4.500	0.562 / 0.560	0.625	0.313
5.00	5.500	0.562 / 0.560	0.625	0.313
6.00	6.500	0.687 / 0.685	0.750	0.375

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



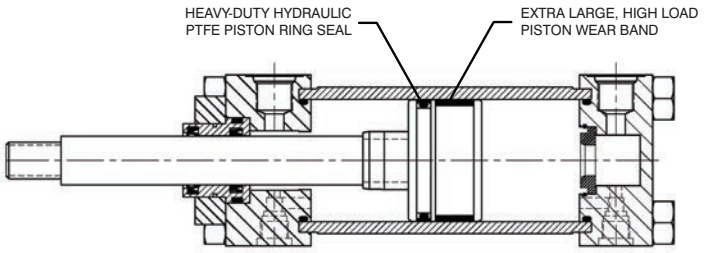
Option T (PTFE) Piston Seal - Recommended for High Load & Low Friction Applications

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 (FKM): 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.

How to Customize

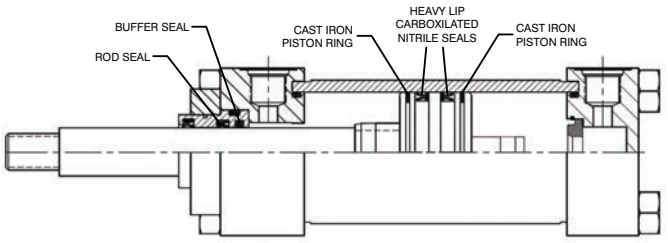
HSS High Shock Seals

HSS = 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 Carboxilated 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.

Note: Some bore and rod sizes are not available.



KKX Non-Standard Rod Threads

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

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

Add special thread to part number

KK3M Female Metric Rod Threads

KK3M = 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.

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

Ordering Example: MH - MF1 - 150 X 24 - 100 - KK3M = M18 x 1.5 - P15 = N375 - SSSS

KKM Male Metric Rod Threads

KKM = 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.

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

Ordering Example: MH - MF1 - 150 X 24 - 100 - KKM = M18 x 1.5 - P15 = N375 - SSSS

KK3X Female Special Rod Threads

KK3X = Bimba can machine a wide range of female rod threads. Standard NFPA rod threads are UNF (fine), class 2 threads. Common alternative choices are UNC (coarse) threads. Note: unless otherwise specified, the rod thread will be standard catalog “A” dimension lengths.

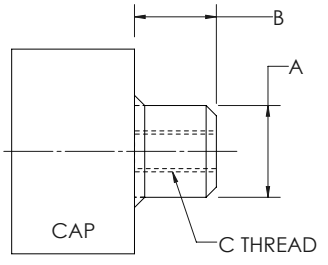
Ordering Example: MH - MF1 - 150 X 24 - 100 - KK3X = 3/4-10 - P15 = N375 - SSSS

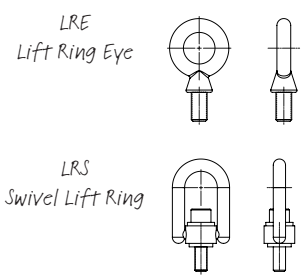
LRB Lift Ring Boss

LRB = 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 options to the right).

Also available in additional locations and styles.





Lift Lug Dimensions				
Bore	A	B	C	Straight Pull Lifting Capacity *
1.50	1.120	1.000	1/2-13	2500
2.00	1.500	1.250	5/8-11	4000
2.50	1.500	1.250	5/8-11	4000
3.25	2.000	1.500	3/4-10	6000
4.00	2.000	1.500	3/4-10	6000
5.00	2.000	1.500	3/4-10	6000
6.00	2.500	2.000	1-8	9000
8.00	2.500	2.000	1-8	9000

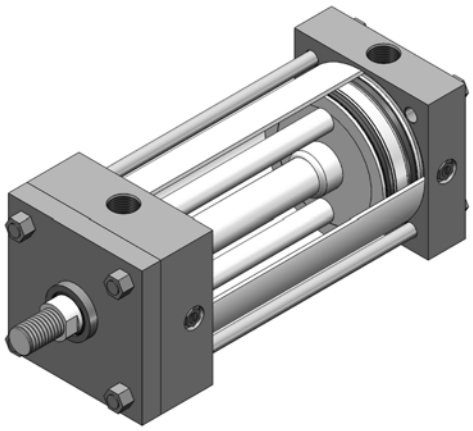
* Lifting capacity is the maximum capacity for intermittent lifting and placement of cylinder only. It is NOT intended to be used as the primary cylinder mount.
Note: Not available on MF2, MF6, ME6, MP1 and SB mounts.

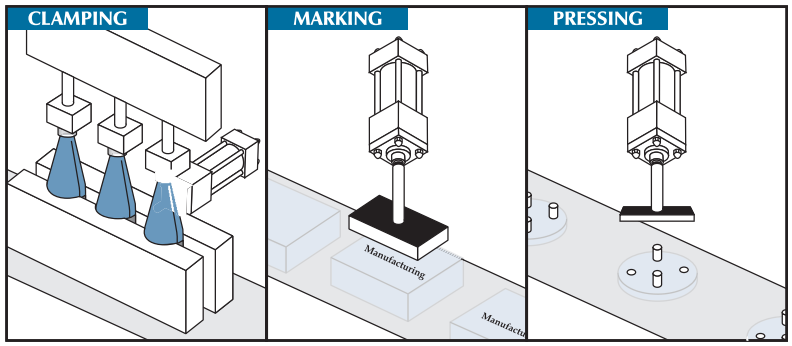
NR Non-Rotating Cylinders - NFPA

> 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 NFPA cylinders
- » Durable, self-contained construction

> Application Possibilities





Available Bore Sizes with 'NR' Guide Rod Sizes and Max. Stroke

Bore	Rod Dia. (MM)	Cushions
4.00	1.000 & 1.375	No Cushions
5.00	1.000, 1.375, 1.750 & 2.000	Cap Cushions Only
6.00	1.375 - 3.000	Both Cushioned (3.000" Rod - Cap Only)
8.00	1.375 - 3.500	Both Cushioned (3.500" Rod - Cap Only)

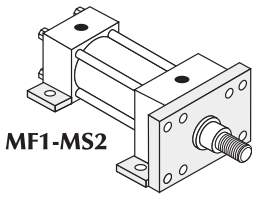
Note: External guide rod models are available with rectangular head and cap. Contact factory for additional information.

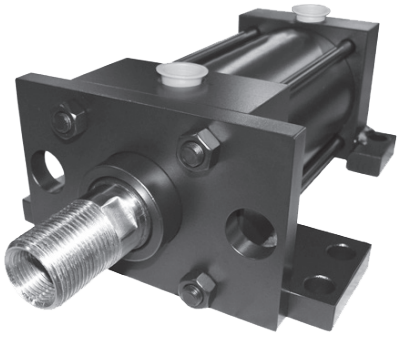
Multiple Mounts

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

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

Add additional mount to part number





How to Customize

Port Options

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

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

BSPT = British Standard Pipe Taper

British Standard Pipe Taper (BSPT) threads have the same taper as American NPT tapered threads, but use a 55° Whitworth thread form and different diameters.

(Not interchangeable with NPT)

BSPP = British Standard Pipe Parallel

British Standard Pipe Parallel (BSPP), also referred to as BSP “Straight” Thread.

(Not interchangeable with NPT)

RBB Solid Bronze Rod Bushing

RBB = 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.

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

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.

SSR 17-4 Stainless Steel Hard Chrome Plated Piston Rod

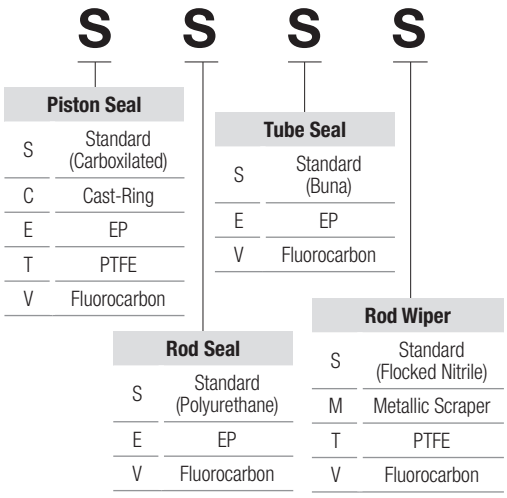
SSR = Cylinders can be furnished with hard chrome plated stainless steel piston rods.

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

75,000 min. yield (5.500 rod)

Seals

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



S Standard Seals

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

E Ethylene Propylene

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

Note: Requires a PTFE rod wiper and L011 lubricant option for EP compilable seal grease.

T Glassed 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 (FKM):	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

V Fluorocarbon

Temperature Range:	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 Bimba for more information.

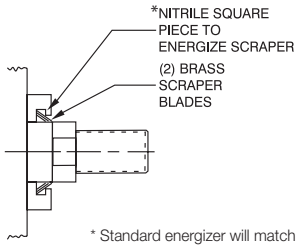
C Cast Iron Piston Rings

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

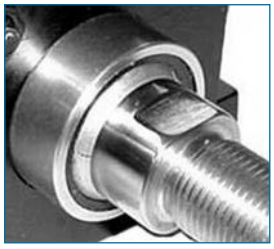
* When cylinder is equipped with FKM seals.

M Metallic Rod Scraper

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



* Standard energizer will match cylinder seals.



ST Stop Tube and Rod Size Selection

ST = 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: Bimba 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 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-MS2-250X42 ES-100-KK2-P15=N375-SSSS-ST=2

Chart 2

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

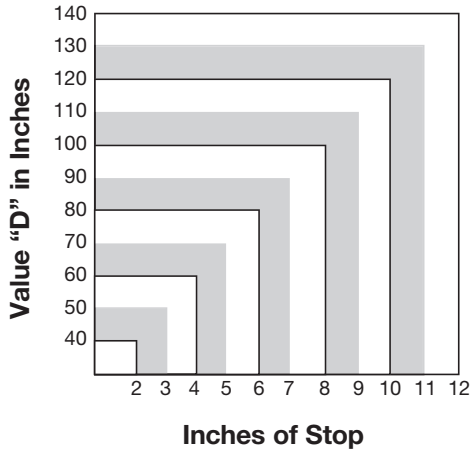
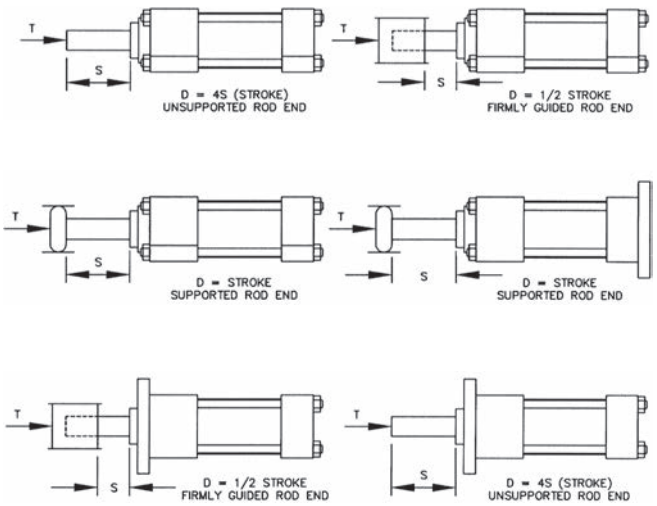
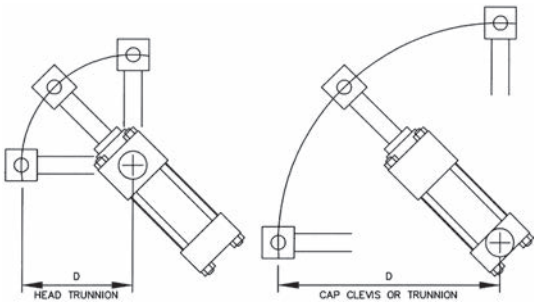


Chart 1

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 on page 61)





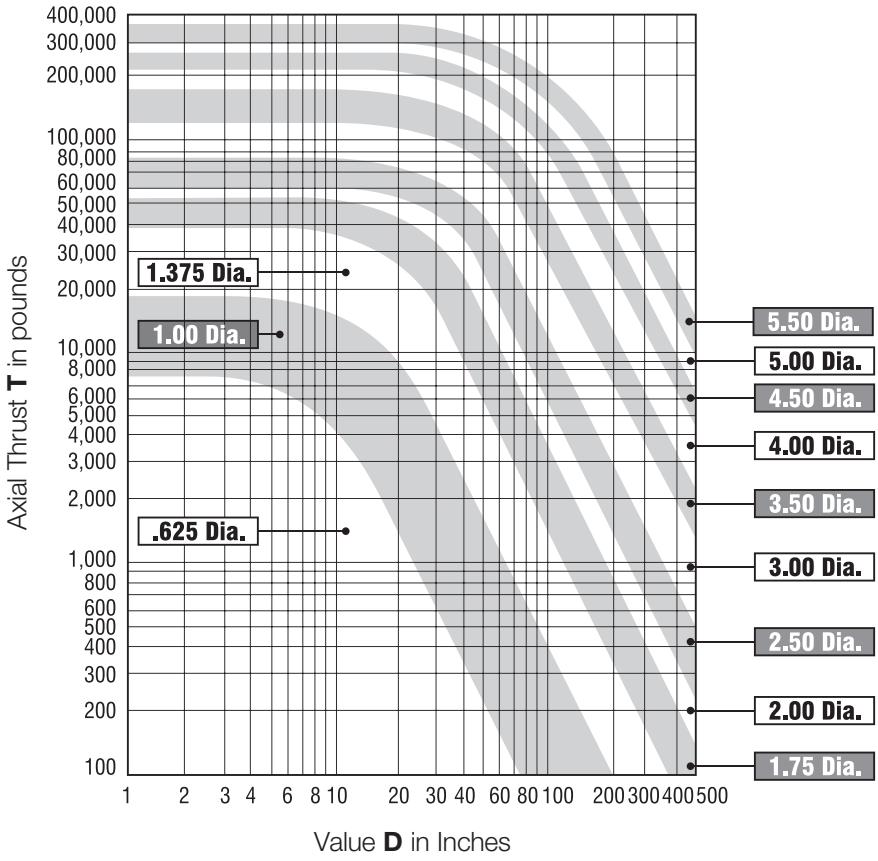
Note: Measure "D" when cylinder is fully extended.
Refer to page 61 for Rod Size Selection Chart.

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 60, determine the value of “D” for the application.
3. Find the value of “D” in the chart to the right. 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)



How to Customize

3P Three-Position Cylinders

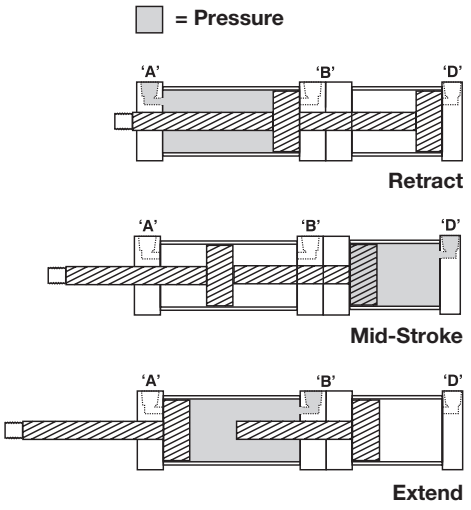
3P = You can create a 3-Position cylinder from two of the same bore size cylinders.

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 design — 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 Bimba for more information.



How They Work

Position 1 (retract): Pressure to port "A" fully retracts cylinder

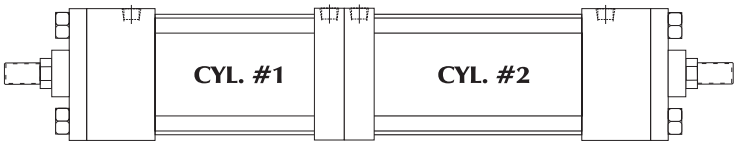
Position 2 (mid-stroke): Pressure to port "D" advances cylinder to mid-stroke position

Position 3 (extend): Pressure to port "B" fully extends cylinder

BTB Back-To-Back Cylinders

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

Contact Bimba for more information.

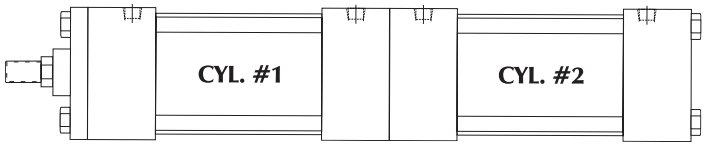


TM Tandem Cylinders

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

Note: Piston rods are connected.

Contact Bimba for more information.



Special Finishes

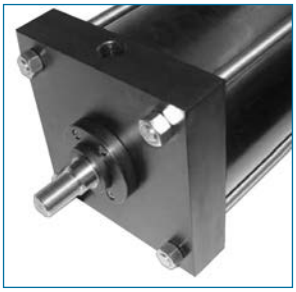
Standard Finish: Black Urethane Paint (suitable for indoor or outdoor use)

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

Additional Paint Choices: Bimba can provide paint in any color or type with customer supplied paint specification and color code.

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

Contact Bimba with your specifications – we would be pleased to provide a quote!



HH Series High Pressure Hydraulics

HH Series actuators are designed specifically for high pressure and robust applications up to 3000 PSI. Heavy wall hard chrome-plated steel body tubing provides superior seal wear characteristics to prolong actuator life. The HH Series offers 9 bore sizes, 19 NFPA mounts and 6 NFPA standard rod end styles for optimal customization.



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102 – Cylinder
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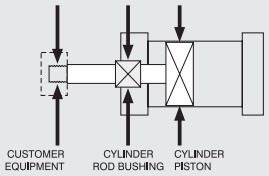
104 Options

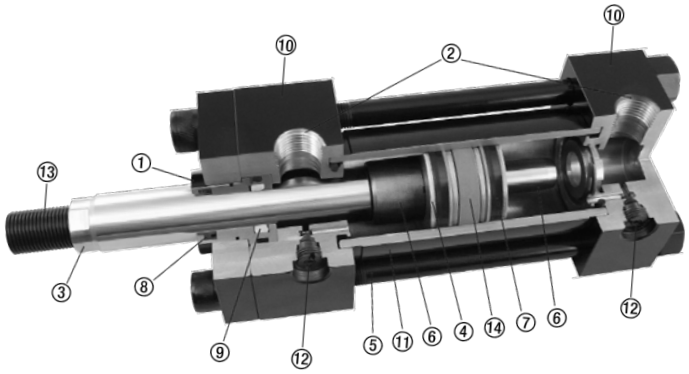
Features & Benefits

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.





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, Carboxilated 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; Glass Reinforced Nylon (standard). 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 Seals:	0°F to 400°F (-18°C to 204°C)
Ethylene Propylene Seals:	-50°F to 300°F (-45°C to 149°C)

Performance Options

RLH – Rod locks are used to hold linear cylinder loads stationary in any mounting orientation during power off condition (see HH Series with Rod Lock section for more information).

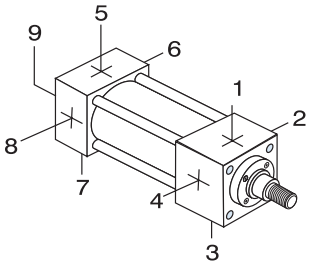
ST – Stop tubes are used to reduce rod bearing and piston stress (refer to HH Options for cylinder design guidance).

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).

Technical Data

Port Locations



Note: Location 9 is center of cap face.

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 Options)	
		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

Force Chart

Bore	Rod Dia. (MM)	Effective Piston Area	Pounds of Force at PSI										Displacement per Inches of Stroke (gallons)
			100	150	200	250	500	1000	1500	2000	2500	3000	
1.50	Extend	1.77	177	265	353	442	884	1767	2651	3534	4418	5301	.00765
	0.625	1.46	146	219	292	365	730	1460	2191	2921	3651	4381	.00635
	1.000	0.98	98	147	196	245	491	982	1473	1964	2454	2945	.00425
2.00	Extend	3.14	314	471	628	785	1571	3142	4712	6283	7854	9425	.0136
	1.000	2.36	236	353	471	589	1178	2356	3534	4712	5891	7069	.0102
	1.375	1.66	166	249	331	414	828	1657	2485	3313	4142	4970	.0071
2.50	Extend	4.91	491	736	982	1227	2454	4909	7363	9818	12272	14726	.0213
	1.000	4.12	412	619	825	1031	2062	4123	6185	8247	10308	12370	.0179
	1.375	3.42	342	514	685	856	1712	3424	5136	6848	8560	10272	.0148
	1.750	2.50	250	376	501	626	1252	2503	3755	5007	6259	7510	.0109
3.25	Extend	8.30	830	1244	1659	2074	4148	8296	12444	16592	20739	24887	.0359
	1.375	6.81	681	1022	1362	1703	3405	6811	10216	13622	17027	20433	.0294
	1.750	5.89	589	884	1178	1473	2945	5891	8836	11781	14726	17672	.0255
	2.000	5.15	515	773	1031	1289	2577	5154	7731	10308	12885	15463	.0223
4.00	Extend	12.57	1257	1885	2513	3142	6283	12566	18850	25133	31416	37699	.0544
	1.750	10.16	1016	1524	2032	2540	5081	10161	15242	20322	25403	30483	.0440
	2.000	9.42	942	1414	1885	2356	4712	9425	14137	18850	23562	28274	.0408
	2.500	7.66	766	1149	1532	1914	3829	7658	11486	15315	19144	22973	.0331
5.00	Extend	19.64	1964	2945	3927	4909	9818	19635	29453	39270	49088	58905	.0850
	2.000	16.49	1649	2474	3299	4123	8247	16493	24740	32987	41234	49480	.0714
	2.500	14.73	1473	2209	2945	3682	7363	14726	22089	29453	36816	44179	.0637
	3.000	12.57	1257	1885	2513	3142	6283	12566	18850	25133	31416	37699	.0544
	3.500	10.02	1002	1503	2004	2505	5009	10019	15028	20038	25047	30056	.0434
6.00	Extend	28.27	2827	4241	5655	7069	14137	28274	42412	56549	70686	84823	.1224
	2.500	23.37	2337	3505	4673	5841	11683	23366	35048	46731	58414	70097	.1011
	3.000	21.21	2121	3181	4241	5301	10603	21206	31809	42412	53015	63617	.0918
	3.500	18.65	1865	2798	3730	4663	9325	18650	27975	37300	46625	55950	.0808
	4.000	15.70	1570	2355	3140	3925	7850	15700	23550	31400	39250	47100	.0680
7.00	Extend	38.48	3848	5773	7697	9621	19242	38485	57727	76969	96211	115454	.1666
	3.000	31.42	3142	4712	6283	7854	15708	31416	47124	62832	78540	94248	.1360
	3.500	28.86	2886	4330	5773	7216	14432	28863	43295	57727	72158	86590	.1249
	4.000	25.92	2592	3888	5184	6480	12959	25918	38877	51836	64795	77754	.1122
	4.500	22.58	2258	3387	4516	5645	11290	22580	33870	45160	56450	67741	.0977
	5.000	18.85	1885	2827	3770	4712	9425	18850	28274	37699	47124	56549	.0816
8.00	Extend	50.27	5027	7540	10053	12566	25133	50266	75398	100531	125664	150797	.2176
	3.500	40.64	4064	6097	8129	10161	20322	40644	60967	81289	101611	121933	.1760
	4.000	37.70	3770	5655	7540	9425	18850	37699	56549	75398	94248	113098	.1632
	4.500	34.36	3436	5154	6872	8590	17181	34361	51542	68723	85903	103084	.1488
	5.000	30.63	3063	4595	6126	7658	15315	30631	45946	61261	76577	91892	.1326
	5.500	26.51	2651	3976	5301	6627	13254	26507	39761	53015	66268	79522	.1148

Note: Theoretical force. Actual force will be reduced by friction.

Cylinder Torque Charts

Tie Rod Torque Specs		
Bore	**Tie Rod Size**	**Torque (ft-lbs)**
1.50	.375 Diameter	25 ft-lbs
2.00	.500 Diameter	50 ft-lbs
2.50	.500 Diameter	50 ft-lbs
3.25	.625 Diameter	120 ft-lbs
4.00	.625 Diameter	130 ft-lbs
5.00	.875 Diameter	300 ft-lbs
6.00	1.000 Diameter	450 ft-lbs
7.00	1.125 Diameter	675 ft-lbs
8.00	1.250 Diameter	900 ft-lbs

Bushing Retainer Hex Head Screws Torque Specs	
Hex Head Screw Size	**Torque (ft-lbs)**
3/8-24	30 ft-lbs
1/2-20	40 ft-lbs
5/8-18	50 ft-lbs
7/8-14	90 ft-lbs
1-14	125 ft-lbs

Bushing Retainer Screws Torque Specs	
SHCS Size	**Torque (ft-lbs)**
1/4-28	15 ft-lbs
5/16-24	20 ft-lbs
3/8-24	30 ft-lbs
7/16-20	40 ft-lbs

All Torque Specs are based upon using anti-seize thread lubricant.

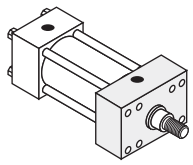
Bimba Spec: LPS Premium Copper Anti-Seize
Temperature Rating: -65°F to 1800°F
Military Spec: MIL-PRF-907-E
Torque Tolerance: -0% to +5%

Cylinder Weight Chart (in lbs.)

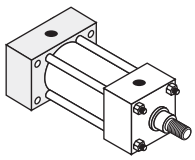
Bore	Rod Dia. (MM)	Mount													Add per Inch of Stroke
		MX0 MS4	ME5	ME6	MF1	MF2	MF5	MF6	MP1	MS2 MS3 MS7	MT1 MT2	MT4	MX1 MX2 MX3	SB	
1.50	0.625	7.3	9.5	9.2	7.9	8.5	8.7	9.2	7.7	7.6	7.8	10.4	7.5	7.6	0.47
	1.000	7.5	9.6	9.3	8.1	8.6	8.9	9.4	7.8	7.7	7.9	10.6	7.6	7.7	0.61
2.00	1.000	11.5	14.6	14.2	12.9	14.2	14.9	16.1	12.6	12.2	12.6	16.0	11.8	12.3	0.78
	1.375	11.6	14.8	14.3	13.3	14.3	15.2	16.2	12.7	12.3	12.8	16.1	11.9	12.5	0.98
2.50	1.000	15.2	18.9	18.4	18.1	18.7	20.2	20.8	16.3	17.0	16.4	20.2	15.6	16.1	1.02
	1.375	16.5	20.1	19.6	18.3	19.9	20.5	22.1	17.6	18.2	17.6	21.4	16.8	17.3	1.22
	1.750	17.1	20.8	20.3	19.2	20.6	21.3	22.7	18.2	18.8	18.2	22.0	17.4	18.0	1.48
3.25	1.375	28.7	35.4	34.6	34.4	35.5	38.4	39.5	30.7	30.5	31.1	39.0	29.4	30.4	1.50
	1.750	31.8	38.5	37.6	35.2	38.6	39.2	42.6	33.8	33.5	34.2	42.1	32.5	33.5	1.76
	2.000	32.4	39.1	38.2	36.0	39.2	40.0	43.2	34.4	34.1	34.8	42.7	33.1	34.1	1.97
4.00	1.750	39.9	47.3	46.4	47.5	49.3	52.4	54.3	45.1	43.4	42.2	49.3	40.6	44.7	2.44
	2.000	41.0	48.4	47.5	48.3	50.4	53.2	55.4	46.3	44.6	43.4	50.5	41.7	45.9	2.65
	2.500	45.7	53.2	52.3	50.9	55.2	55.9	60.1	51.0	49.3	48.1	55.2	46.5	50.6	3.15
5.00	2.000	70.4	82.3	80.8	83.9	86.1	91.7	93.9	78.3	73.9	72.8	88.7	72.5	79.1	4.01
	2.500	73.1	85.0	83.6	86.5	88.8	94.4	96.6	81.0	76.7	75.5	91.4	75.3	81.8	4.51
	3.000	76.3	88.3	86.8	89.4	92.0	97.3	99.9	84.3	79.9	78.7	94.6	78.5	85.1	5.13
	3.500	83.6	95.6	94.1	92.4	99.3	100.2	107.2	91.6	87.2	86.0	101.9	85.8	92.4	5.85
6.00	2.500	111.9	129.8	129.8	130.5	132.7	140.9	143.2	121.7	118.8	115.4	145.9	115.1	122.7	5.17
	3.000	115.0	132.9	132.9	133.3	135.9	143.7	146.4	124.9	121.9	118.6	149.0	118.2	125.8	5.78
	3.500	118.0	135.9	135.9	136.2	138.9	146.7	149.3	127.9	124.9	121.5	152.0	121.2	128.8	6.50
	4.000	124.0	141.9	141.9	141.3	144.9	151.7	155.4	133.9	131.0	127.6	158.1	127.3	134.9	7.33
7.00	3.000	167.5	194.8	194.8	191.4	194.0	204.3	206.9	184.8	179.0	174.4	214.5	172.1	—	6.46
	3.500	170.3	197.6	197.6	194.3	196.9	207.2	209.8	187.7	181.9	177.3	217.4	175.0	—	7.18
	4.000	176.8	204.1	204.1	203.0	207.2	217.8	222.0	194.2	188.4	183.8	223.9	181.5	—	8.02
	4.500	184.4	211.7	211.7	209.6	214.7	224.3	229.5	201.7	195.9	191.3	231.4	189.0	—	8.96
	5.000	191.7	219.0	219.0	217.7	222.1	232.5	236.8	209.1	203.3	198.7	238.8	196.4	—	10.02
8.00	3.500	232.6	268.9	268.9	262.9	265.6	278.5	281.2	251.2	244.2	244.6	309.6	238.9	—	7.89
	4.000	239.1	275.4	275.4	272.5	276.7	290.4	294.6	257.6	250.7	251.1	316.1	245.3	—	8.72
	4.500	246.6	282.9	282.9	279.0	284.2	296.9	302.0	265.1	258.1	258.6	323.6	252.8	—	9.67
	5.000	255.1	291.4	291.4	287.2	292.7	305.0	310.6	273.7	266.7	267.1	332.1	261.4	—	10.72
	5.500	266.3	302.6	302.6	297.1	304.0	314.9	321.8	284.9	277.9	278.3	343.4	272.6	—	11.89

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

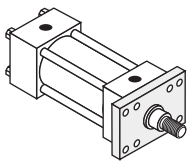
NFPA Mounting Styles



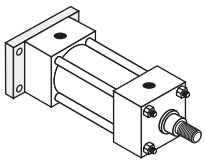
ME5
1.50"–8.00" Bores



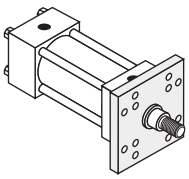
ME6
1.50"–8.00" Bores



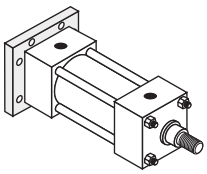
MF1
1.50"–8.00" Bores



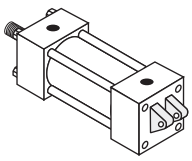
MF2
1.50"–8.00" Bores



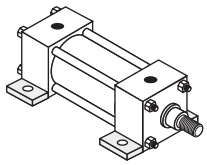
MF5
1.50"–8.00" Bores



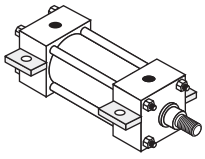
MF6
1.50"–8.00" Bores



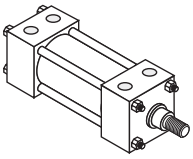
MP1
1.50"–8.00" Bores



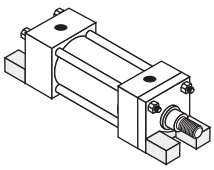
MS2
1.50"–8.00" Bores



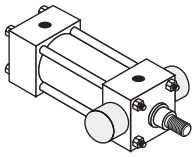
MS3
1.50"–8.00" Bores



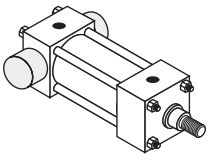
MS4
1.50"–8.00" Bores



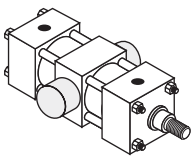
MS7
1.50"–6.00" Bores



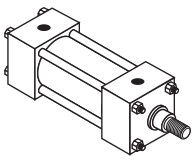
MT1
1.50"–8.00" Bores



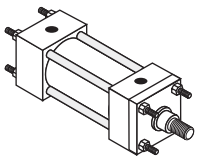
MT2
1.50"–8.00" Bores



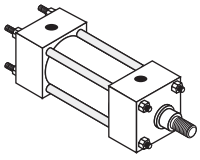
MT4
1.50"–8.00" Bores



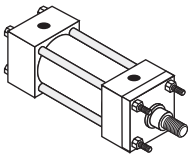
MX0
1.50"–8.00" Bores



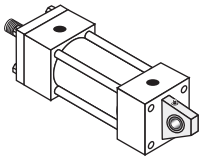
MX1
1.50"–8.00" Bores



MX2
1.50"–8.00" Bores



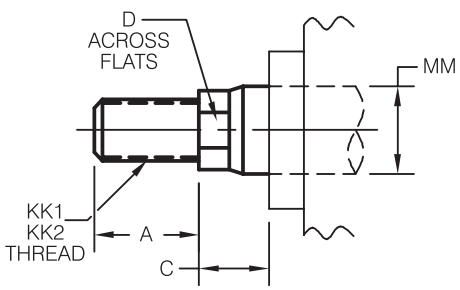
MX3
1.50"–8.00" Bores



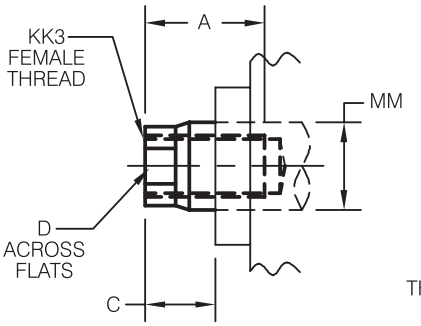
SB
1.50"–6.00" Bores

Dimensions – Threads

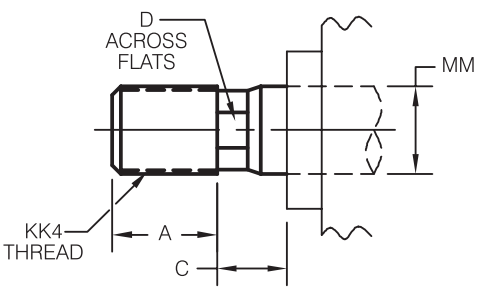
ROD END STYLE: KK1 KK2



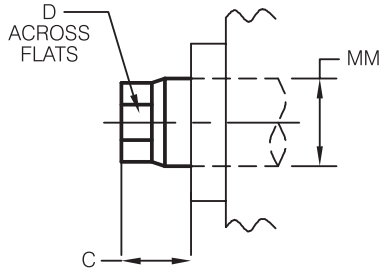
ROD END STYLE: KK3



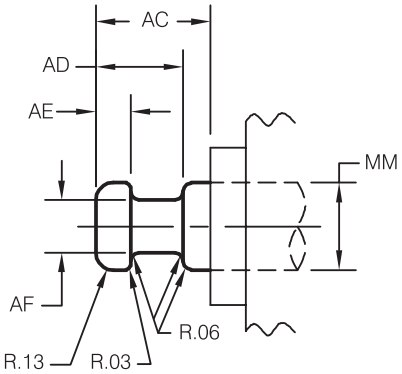
ROD END STYLE: KK4



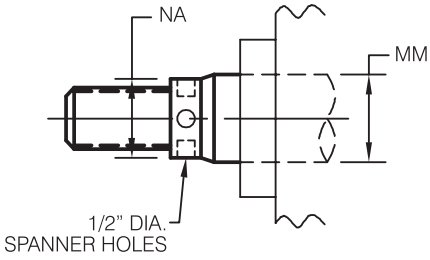
ROD END STYLE: KK5



ROD END STYLE: KK10



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



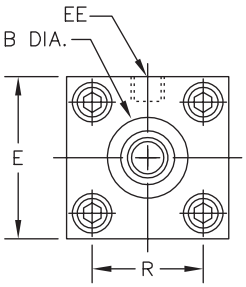
Rod Dia. (MM)	A	C	D	AC	AD	AE	AF	KK1	KK2	KK3	KK4	NA ±.002
0.625	0.750	0.375	0.500	1.125	0.625	0.250	0.375	7/16- 20*	1/2 - 20*	7/16- 20	5/8 - 18	—
1.000	1.125	0.500	0.875	1.625	0.938	0.375	0.688	3/4- 16*	7/8 - 14*	3/4 - 16	1- 14	—
1.375	1.625	0.625	1.125	1.750	1.063	0.375	0.875	1- 14*	11/4- 12*	1- 14	1 3/8 - 12	—
1.750	2.000	0.750	1.500	2.000	1.313	0.500	1.125	1 1/4- 12*	11/2 - 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	17/8 - 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.

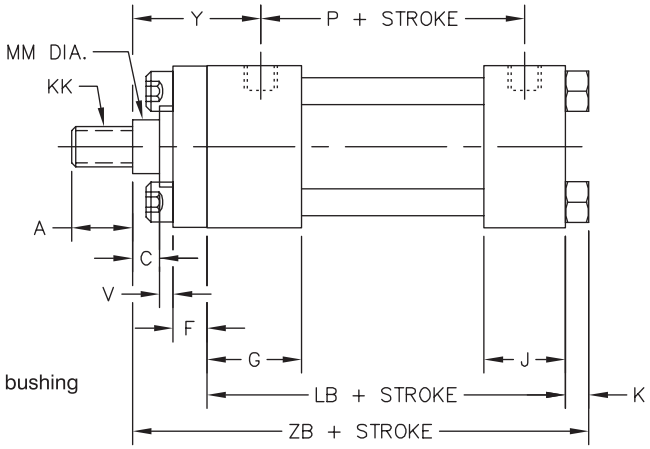
Dimensions – Basic Cylinder (MX0 Mount)

Square Retainer Construction

Full Square Retainer Used On	
Bore	**Rod Diameter**
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

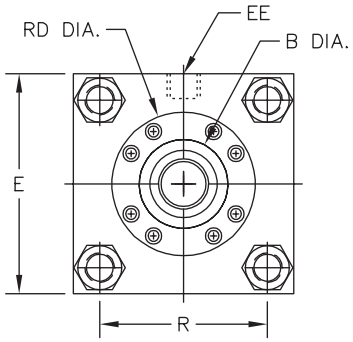


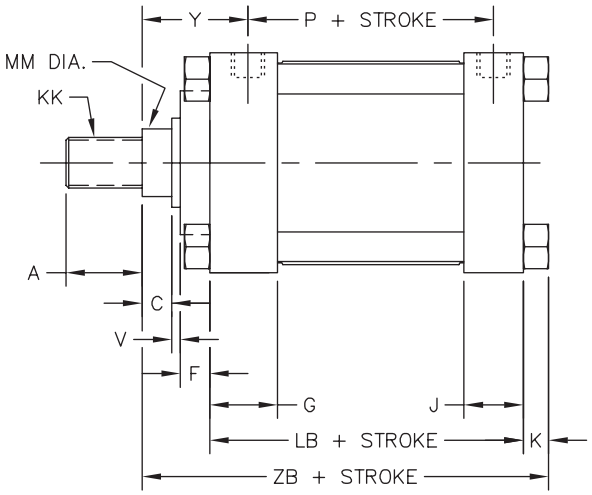
Note: Full square retainer is removable to service rod bushing



Round Retainer Construction

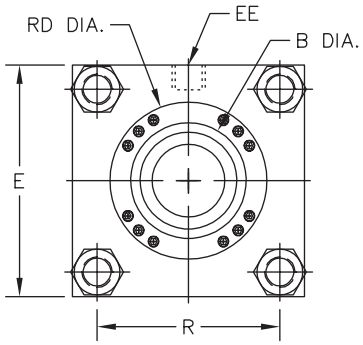
Round Retainer Used On	
Bore	**Rod Diameter**
2.50	1.000
3.25	1.375
4.00	1.750
4.00	2.000
5.00	2.000
5.00	2.500
6.00	2.500

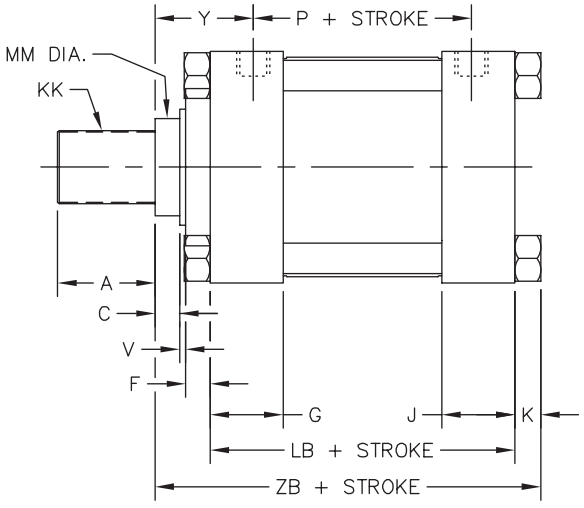




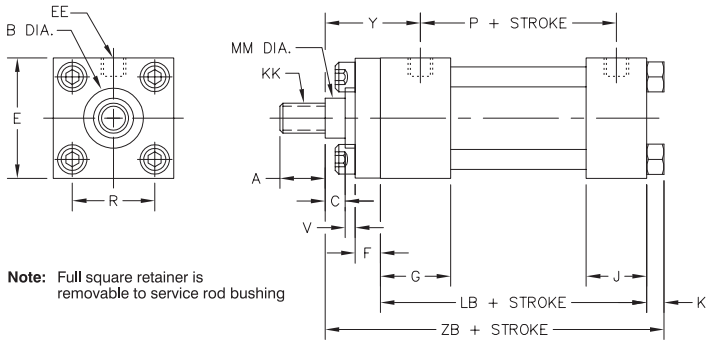
Large Round Retainer Construction

Large Round Retainer Used On	
Bore	**Rod Diameter**
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





Dimensions – Basic Cylinder (MX0 Mount)



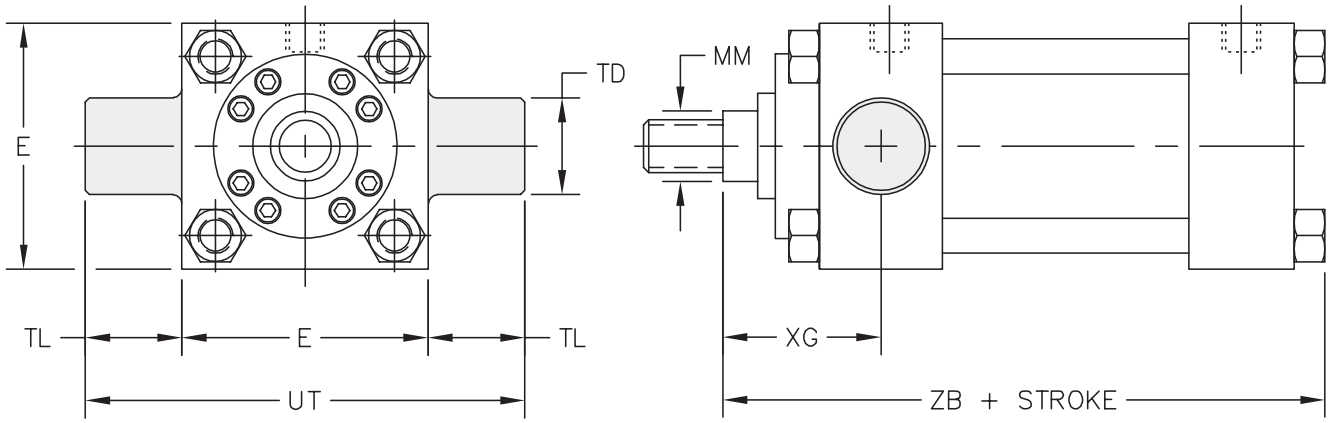
Note: Full square retainer is removable to service rod bushing

Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	A	B[2]	C	EE[3]		F	G	J	K	KK	R	RD[4]	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	See rod end detail chart on page 71	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				
	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	3.000	1.250		7.500	5.625	0.375	3.938	9.500	6.313	13.000
	4.000			4.000	4.749				1.000						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				

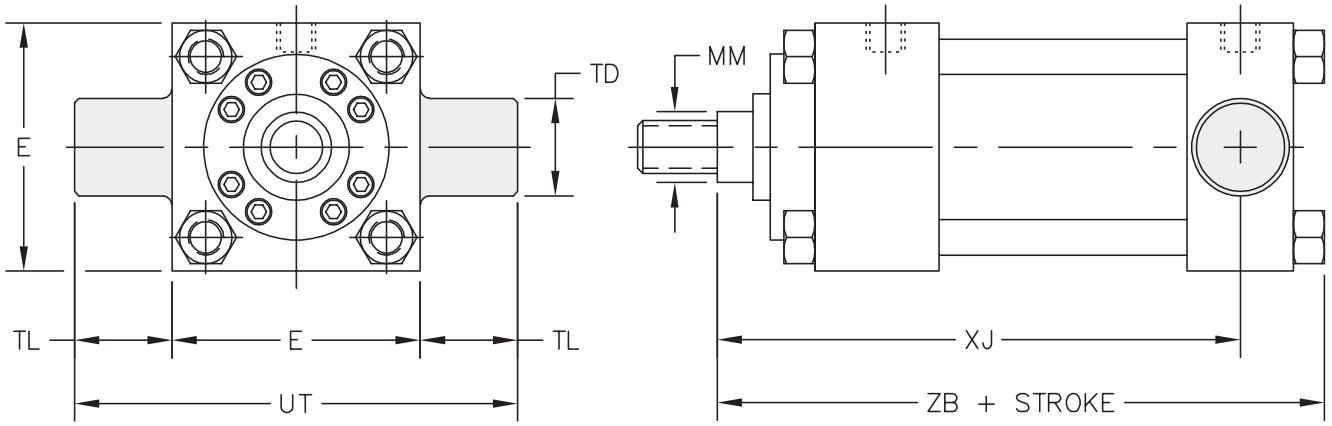
1. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).
2. B dimension tolerance is +.000 / -.002
3. Standard port sizes.
4. Where no dimension is shown, cylinder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

Dimensions – Trunnion Mounts

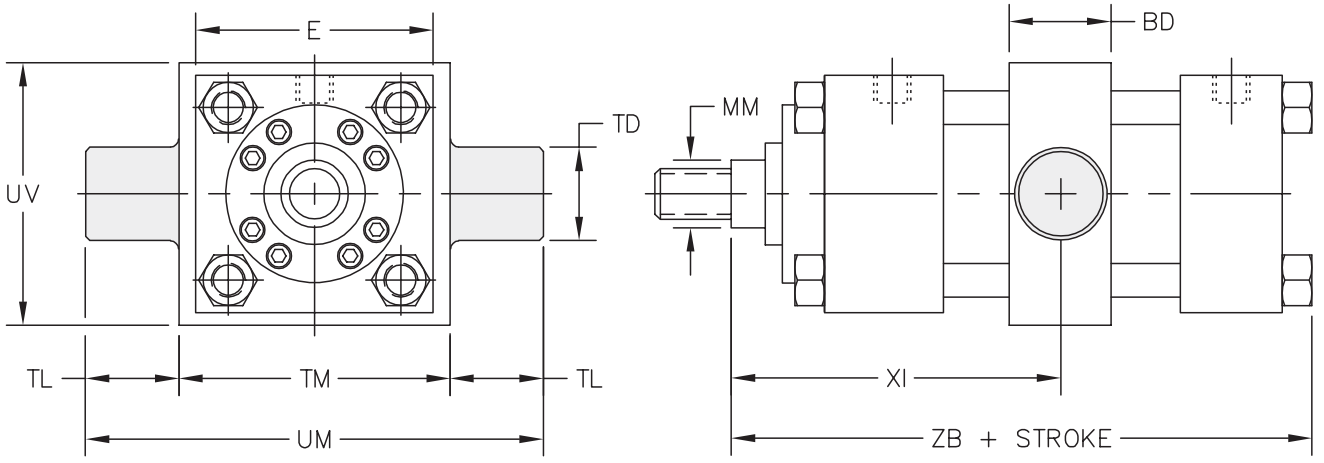
MT1: Head Trunnion



MT2: Cap Trunnion



MT4: Intermediate Trunnion



Note: XI dimension to be specified at end of cylinder description.

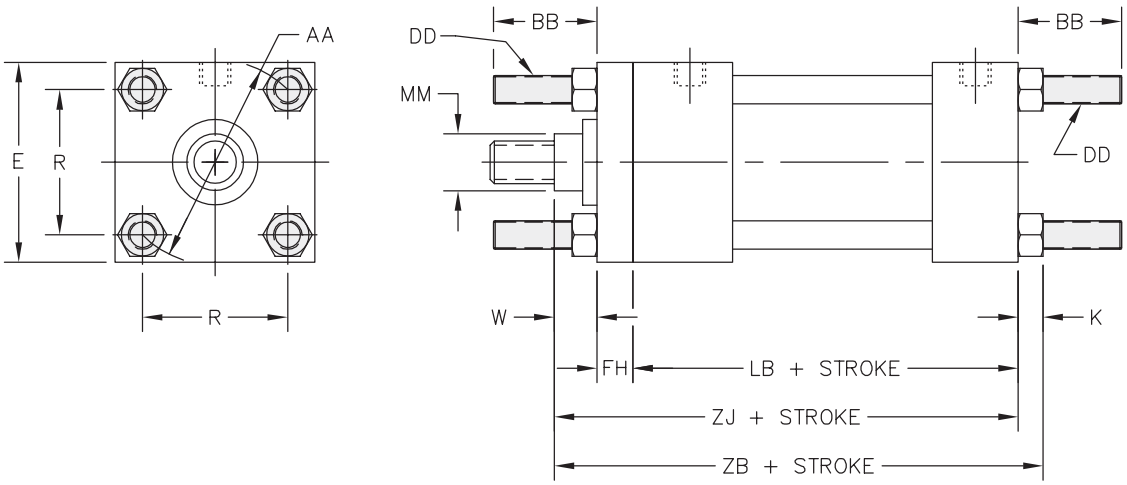
Dimensions – Trunnion Mounts

Bore	Rod Dia. (MM)	Max PSI Rating[1]		E	BD	TD[2]	TL	TM	UM	UT	UV	XG	MT4 XI Min	MT4 Min Stroke	Add to Stroke		
		MT1 MT2	MT4												MT4 XI Max[3]	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
	1.000											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
	1.375											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																

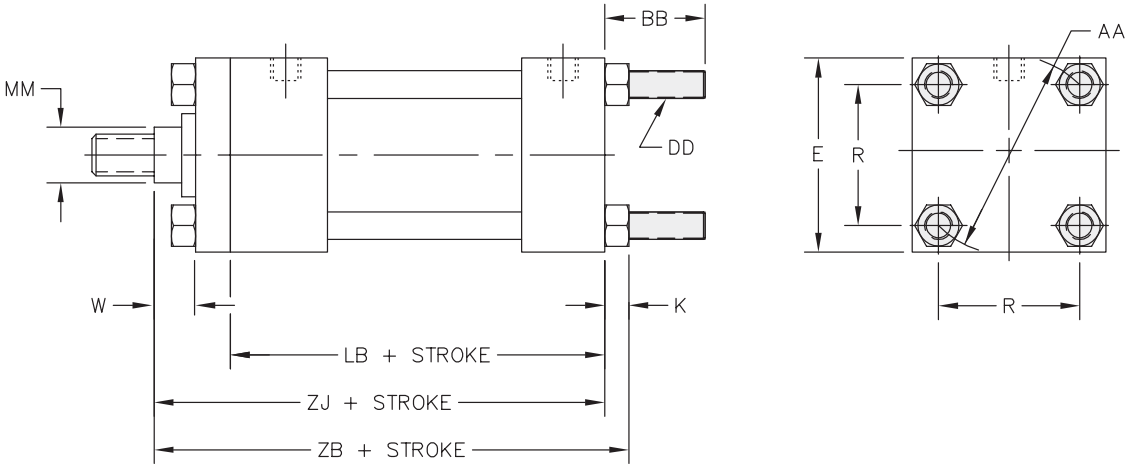
1. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).
2. TD dimension tolerance is + .000 / - .001
3. XI dimension is the minimum that can be supplied (customer to specify XI dimension).

Dimensions – Extended Tie Rod Mounts

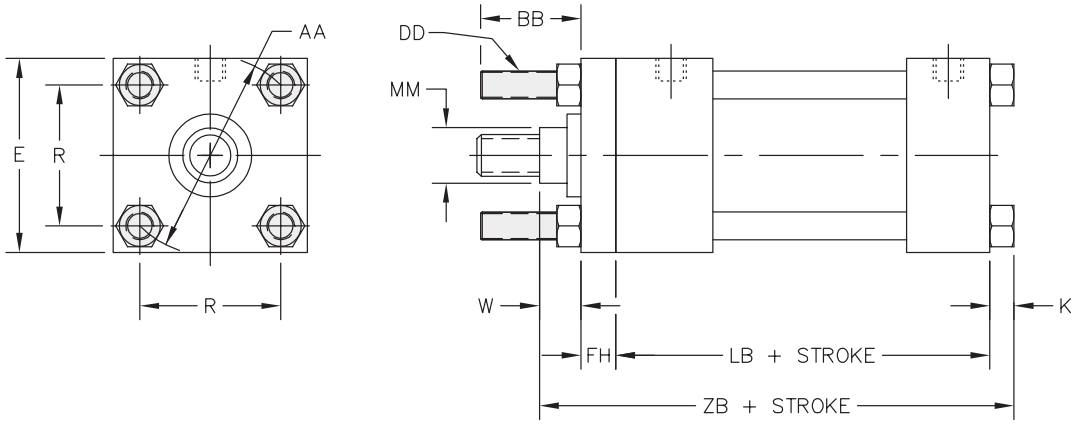
MX1: Head & Cap



MX2: Cap End



MX3: Head End



Dimensions – Extended Tie Rod Mounts

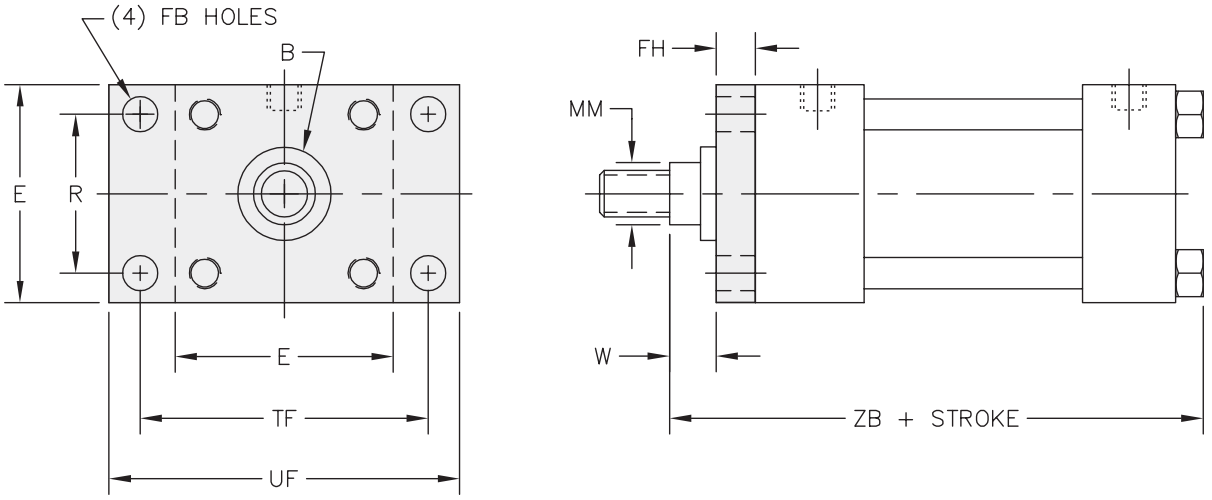
Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	AA	BB	DD	FH	K	R	W	Add to Stroke		
											LB	ZB	ZJ
1.50	0.625	3000	2.500	2.300	1.375	3/8 - 24	0.375	0.375	1.625	0.625	4.625	6.000	5.625
	1.000									1.000		6.375	6.000
2.00	1.000	3000	3.000	2.900	1.813	1/2 - 20	0.625	0.500	2.047	0.750	4.625	6.500	6.000
	1.375									1.000		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									1.000		6.875	6.375
	1.750									1.250		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									1.125		8.000	7.375
	2.000									1.250		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									1.125		8.375	7.750
	2.500									1.375		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									1.375		9.375	8.500
	3.000									1.375		9.375	8.500
	3.500									1.375		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			

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).

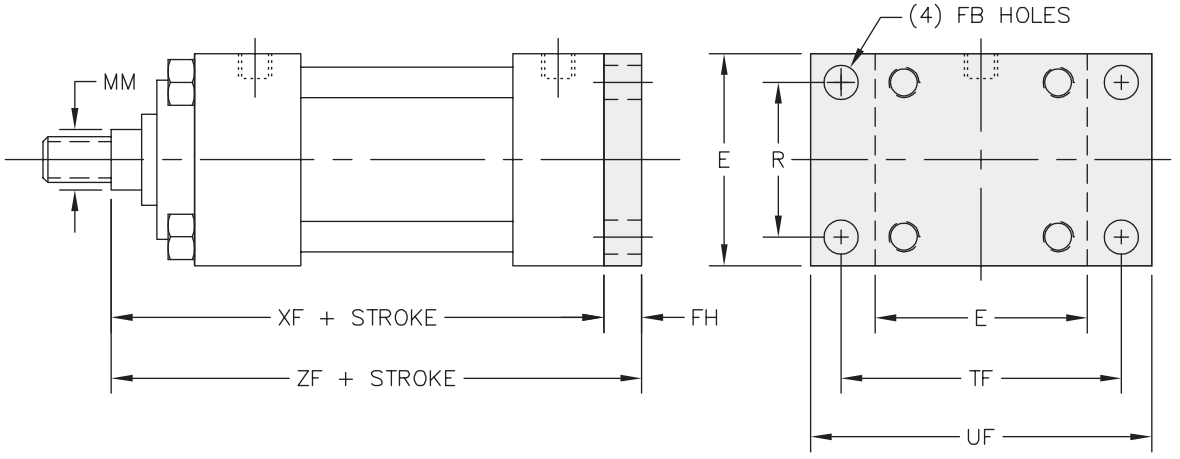
* On MX2 mount, dimension is 1.375" with a round retainer.

Dimensions – Flange Mounts

MF1: Head Flange



MF2: Cap Flange



Dimensions – Flange Mounts

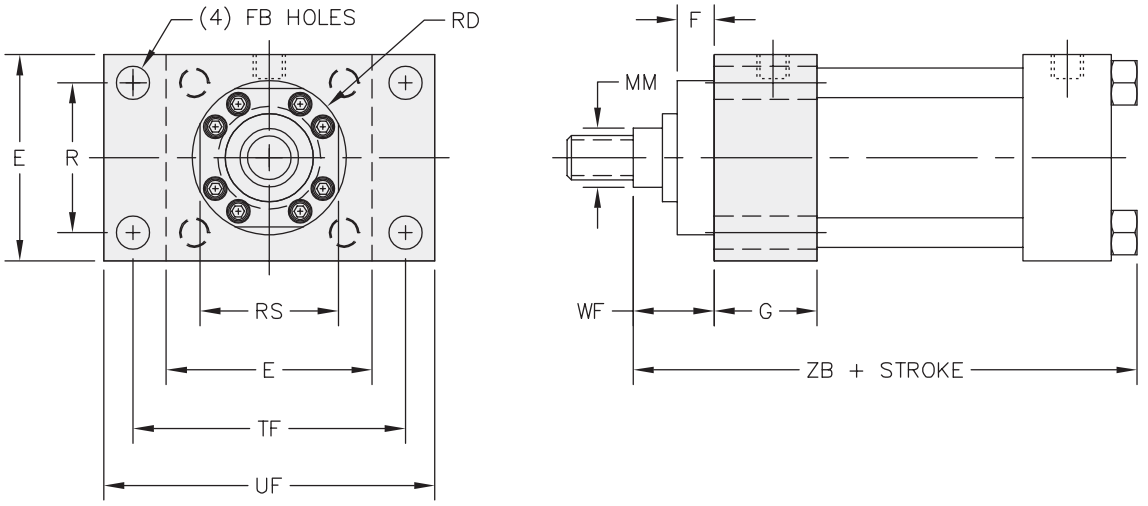
Bore	Rod Dia. (MM)	Max PSI Rating[1]		B[2]	E	FB	FH	R	RD	TF	UF	W	Add to Stroke		
		MF1	MF2										XF	ZB	ZF
1.50	0.625	3000	3000	1.124	2.500	0.438	0.375	1.625	2.375	3.438	4.250	0.625	5.625	6.000	6.000
	1.000			1.499					2.563			1.000	6.000	6.375	6.375
2.00	1.000	3000	3000	1.499	3.000	0.563	0.625	2.047	2.625	4.125	5.125	0.750	6.000	6.500	6.625
	1.375			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
	1.375			1.999					3.250			1.000	6.375	6.875	7.000
	1.750			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
	1.750			2.374					3.875			1.125	7.375	8.000	8.125
	2.000			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
	2.000			2.624					4.250			1.125	7.750	8.375	8.625
	2.500			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
	2.500			3.124					4.625			1.375	8.500	9.375	9.375
	3.000			3.749					5.250			1.375	8.500	9.375	9.375
	3.500			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
	3.000			3.749					5.250						
	3.500			4.249					5.625						
	4.000			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).

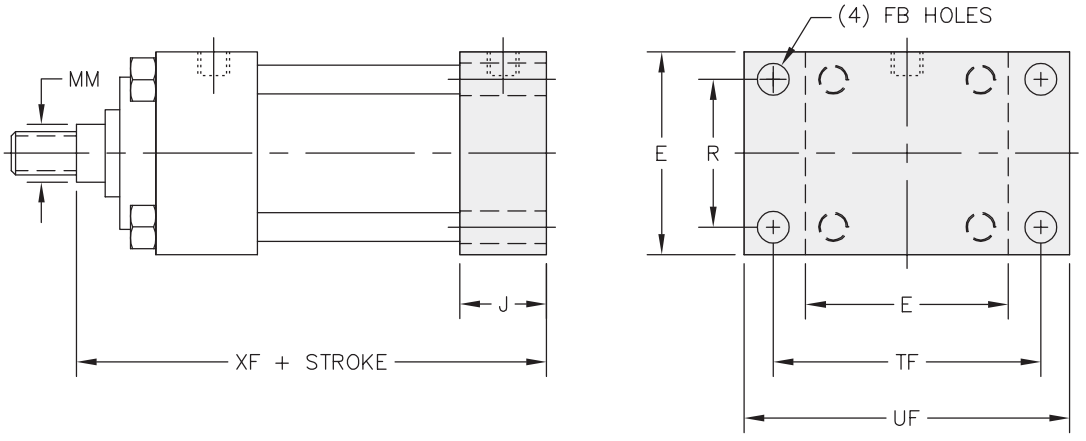
2. B dimension tolerance is +.000 / -.002

Dimensions – Flange Mounts

ME5: Head Rectangular Mounting Holes



ME6: Cap Rectangular Mounting Holes



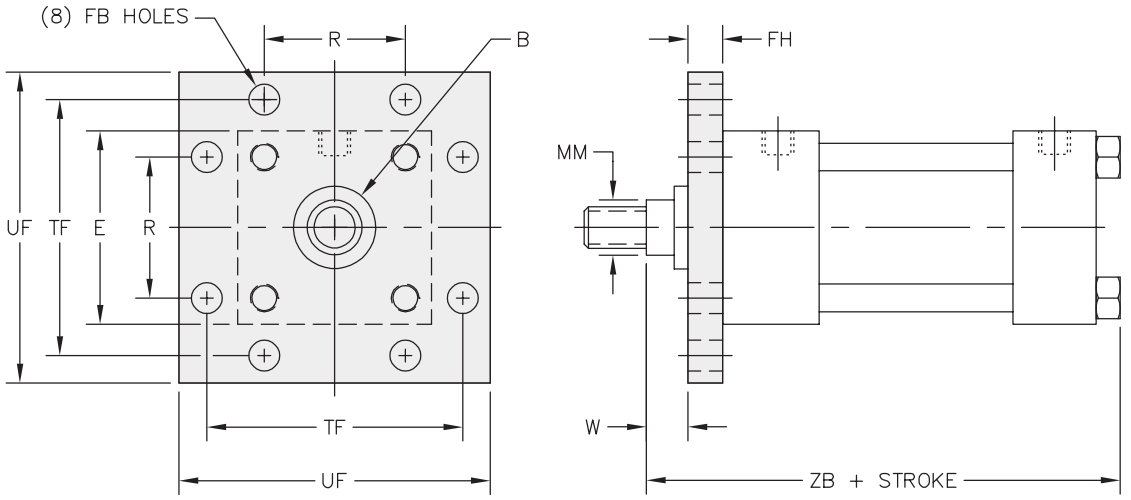
Dimensions – Flange Mounts

Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	F	FB	G	J	R	RD	RS	TF	UF	WF	Add to Stroke	
														XF	ZB
1.50	0.625	3000	2.500	0.375	0.438	1.750	1.500	1.625	2.375	—	3.438	4.250	1.000	5.625	6.000
	1.000								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
	1.375								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
	1.375								3.250	—			1.625	6.375	6.875
	1.750								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				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						
	3.500			0.875					5.625						
	4.000			1.000					6.438						
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						
	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	3.000	7.500	5.625	—	11.813	14.000	2.250	11.750	13.000
	4.000			1.000					6.438						
	4.500			1.000					7.125						
	5.000			1.000					7.625						
	5.500			1.000					8.375						

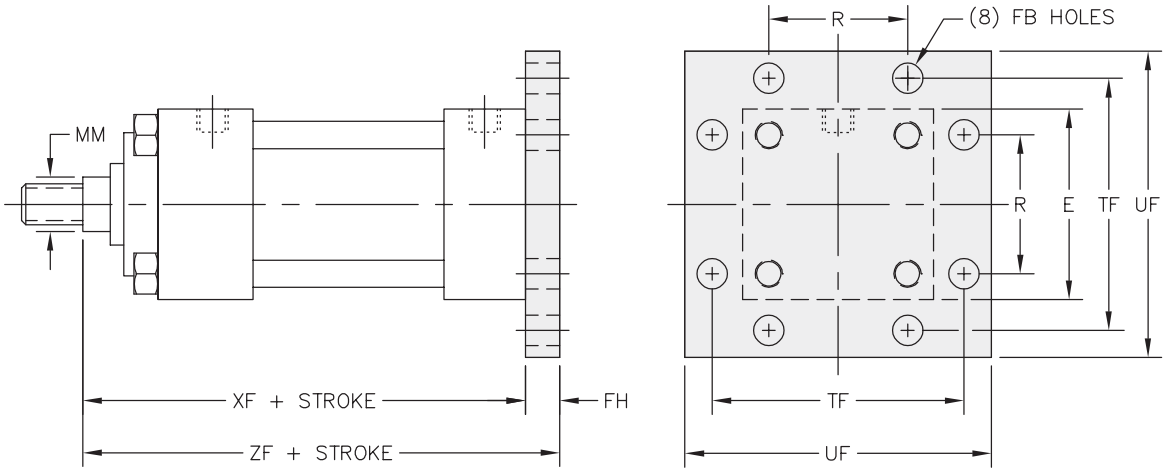
1. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

Dimensions – Square Flange Mounts

MF5: Head Square Flange



MF6: Cap Square Flange



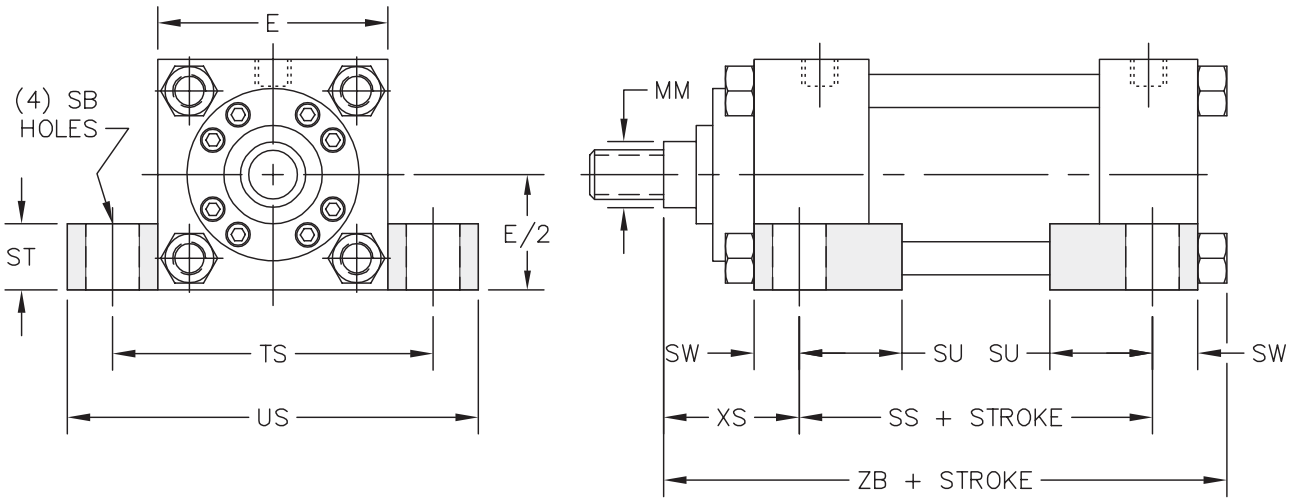
Dimensions – Square Flange Mounts

Bore	Rod Dia (MM)	Max PSI Rating[1]	B[2]	E	FB	FH	R	RD[3]	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		1.499					—			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		1.999					—			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		1.999					—			1.000	6.375	6.875	7.000
	1.750		2.374					—			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		2.374					—			1.125	7.375	8.000	8.125
	2.000		2.624					—			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		2.624					4.250			1.125	7.750	8.375	8.625
	2.500		3.124					—			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		3.124					4.625			1.375	8.500	9.375	9.375
	3.000		3.749					5.250			1.375	8.500	9.375	9.375
	3.500		4.249					—			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		3.749					5.250						
	3.500		4.249					5.625						
	4.000		4.749					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	11.750
	3.500		4.249					5.625						
	4.000		4.749					6.438						
	4.500		5.249					7.125						
	5.000		5.749					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		4.749					6.438						
	4.500		5.249					7.125						
	5.000		5.749					7.625						
	5.500		6.249					8.375						

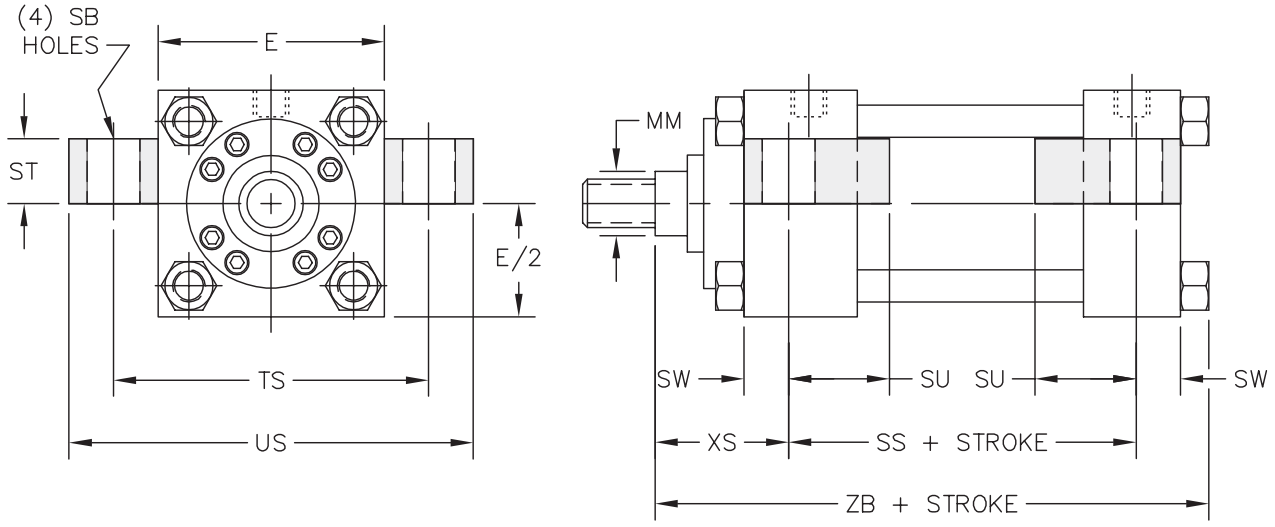
1. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).
2. 'B dimension tolerance is +.000 / -.002
3. Where no dimension is shown, cylinder utilizes a full square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

Dimensions – Lug Mounts

MS2: Side Lugs



MS3: Center Line Lugs



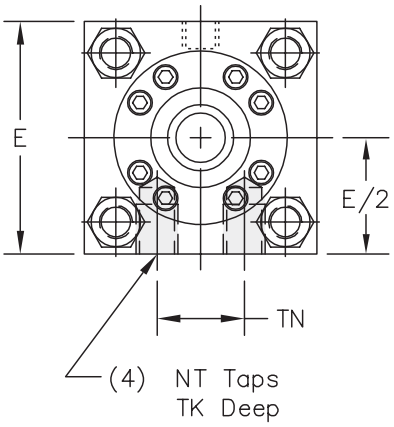
Dimensions – Lug Mounts

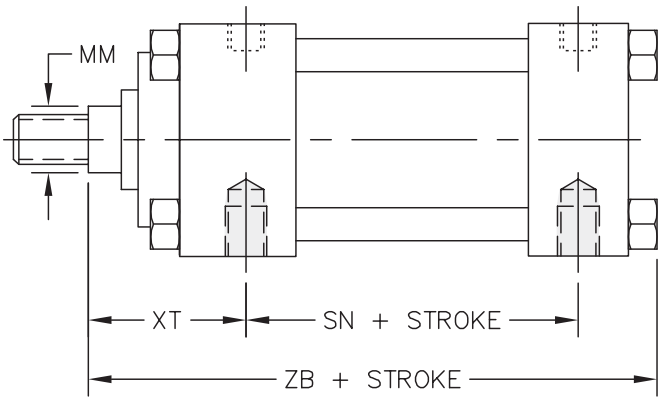
Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	E / 2	SB	ST	SU	SW	TS	US	XS	Add to Stroke	
												SS	ZB
1.50	0.625	3000	2.500	1.250	0.438	0.500	0.938	0.375	3.250	4.000	1.375	3.875	6.000
	1.000										1.750		6.375
2.00	1.000	3000	3.000	1.500	0.563	0.750	1.250	0.500	4.000	5.000	1.875	3.625	6.500
	1.375										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										2.313		6.875
	1.750										2.563		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										2.563		8.000
	2.000										2.688		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										2.875		8.375
	2.500										3.125		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										3.125		9.375
	3.000										3.125		9.375
	3.500										3.125		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).

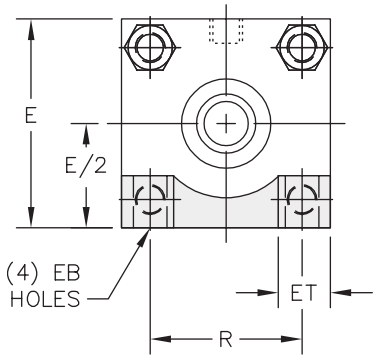
Dimensions – Bottom Mounts

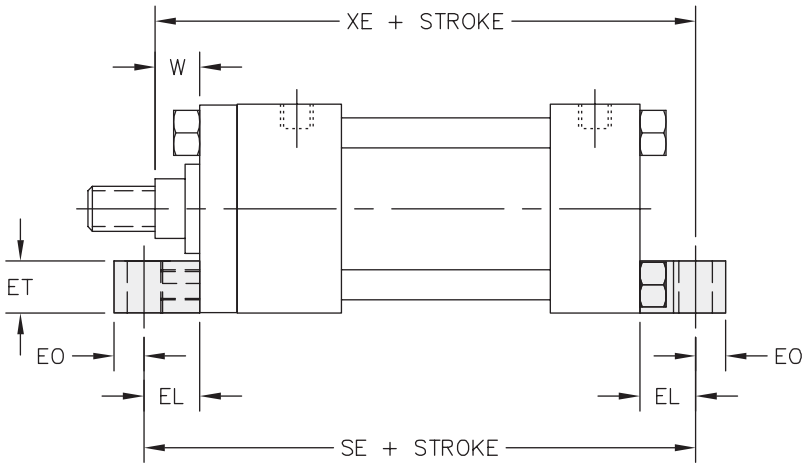
MS4: Bottom Tapped Holes





MS7: End Lugs (1.50" - 6.00" Bores)





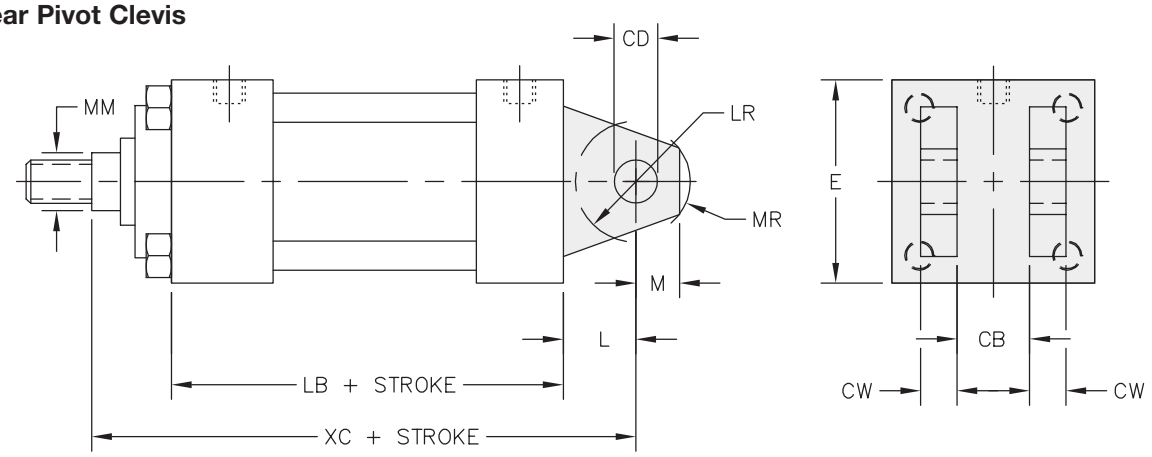
Dimensions – Bottom Mounts

Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	E / 2	MS4 Dimensions						MS7 Dimensions							
					NT	TK	TN	XT	Add to Stroke		EB	EL	EO	ET	R	W	Add to Stroke	
									SN	ZB							SE	XE
1.50	0.625	3000	2.500	1.250	3/8-16	0.375	0.750	2.000	2.875	6.000	0.438	0.875	0.375	0.750	1.625	0.625	6.750	6.500
	1.000							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
	1.375							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
	1.375					0.625		2.625		6.875						1.000		7.313
	1.750					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
	1.750					0.875		3.000		8.000						1.125		8.500
	2.000					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
	2.000					0.750		3.125		8.375						1.125		8.875
	2.500					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
	2.500							3.375		9.375						1.375		10.000
	3.000							3.375		9.375						1.375		10.000
	3.500							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
	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	5.875	11.875	—	—	—	—	—	—	—	—
	3.500					1.125												
	4.000					1.125												
	4.500					1.125												
	5.000					0.875												
8.00	3.500	3000	9.500	4.750	1 1/2-6	1.500	4.250	3.938	6.625	13.000	—	—	—	—	—	—	—	—
	4.000					1.500												
	4.500					1.500												
	5.000					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).

Dimensions – Pivot Mounts

MP1: Rear Pivot Clevis



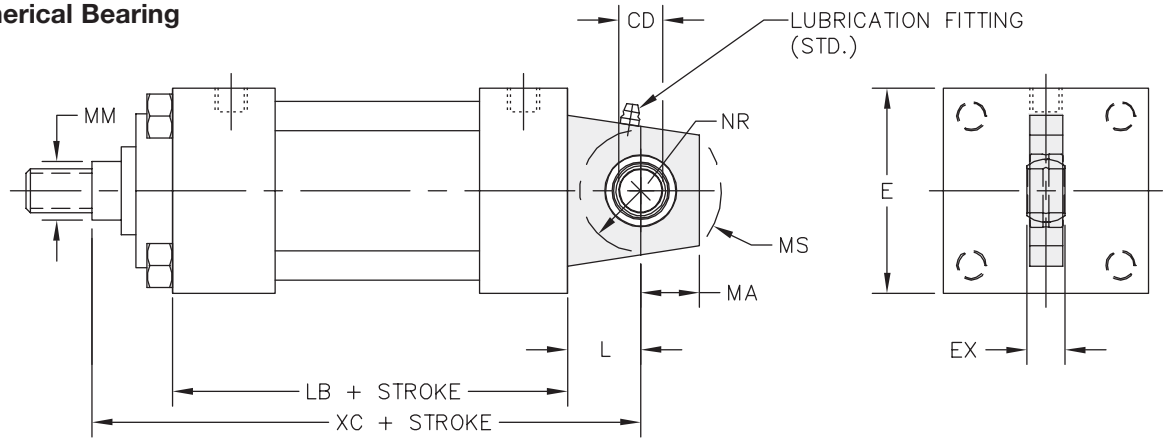
Note: Pivot Pin included with Cylinder

Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	CB[2]	CD[3]	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											
	4.500											
	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											
	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. CB dimension tolerance is +.010 to +.030 depending on bore size.
3. CD dimension tolerance for pin is ±.001.

Dimensions – SB Mounts

SB: Spherical Bearing



Note: Spherical bearing pivot pin included with cylinder cap end only.

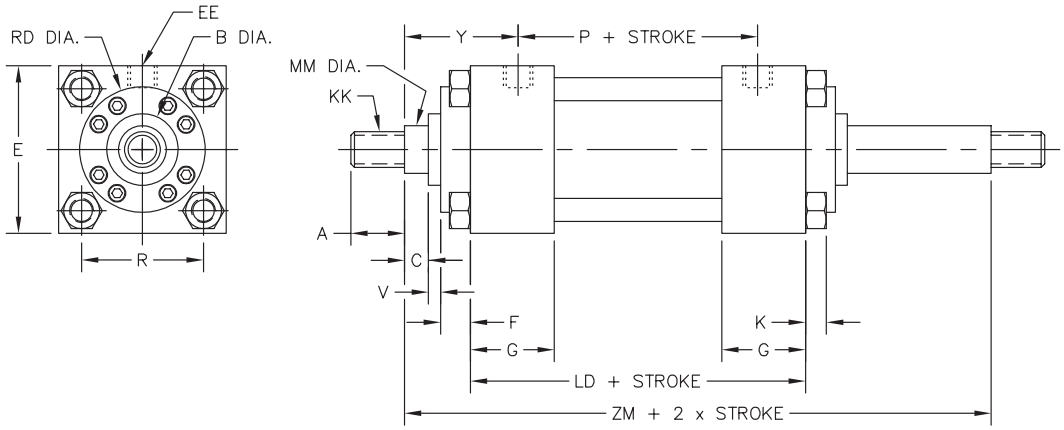
Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	CD[2]	EX	L	NR	MA	MS	Add to Stroke	
										LB	XC
1.50	0.625	1650	2.500	0.500	0.437	0.750	0.625	0.750	0.938	4.625	6.375
	1.000	1650									6.750
2.00	1.000	2200	3.000	0.750	0.656	1.250	1.000	1.000	1.375	4.625	7.250
	1.375	2200									7.500
2.50	1.000	1400	3.500	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.

Dimensions – Double End Mounts

MX0D: No Mount

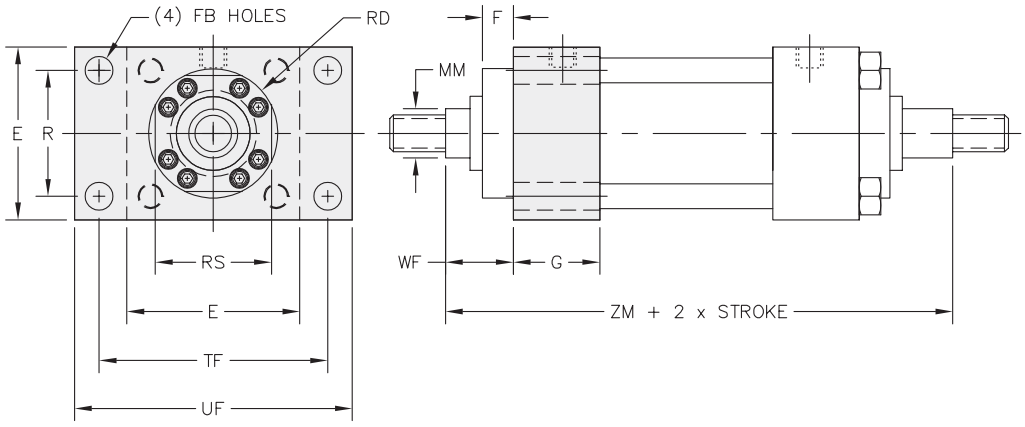


Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	A	B[2]	C	EE		F	G	K	KK	R	RD[3]	V	Y	Add to Stroke		Add 2x Stroke
							NPTF	SAE									LD	P	ZM
1.50	0.625	3000	2.500	0.750	1.124	0.375	1/2	10	0.375	1.750	0.375	See rod end detail chart on page 71	1.625	—	0.250	2.000	4.875	2.875	6.875
	1.000			1.125	1.499	0.500		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								4.250	0.250	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				

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.

Dimensions – Double End Mounts

ME5D: Head Rectangular Mounting Holes

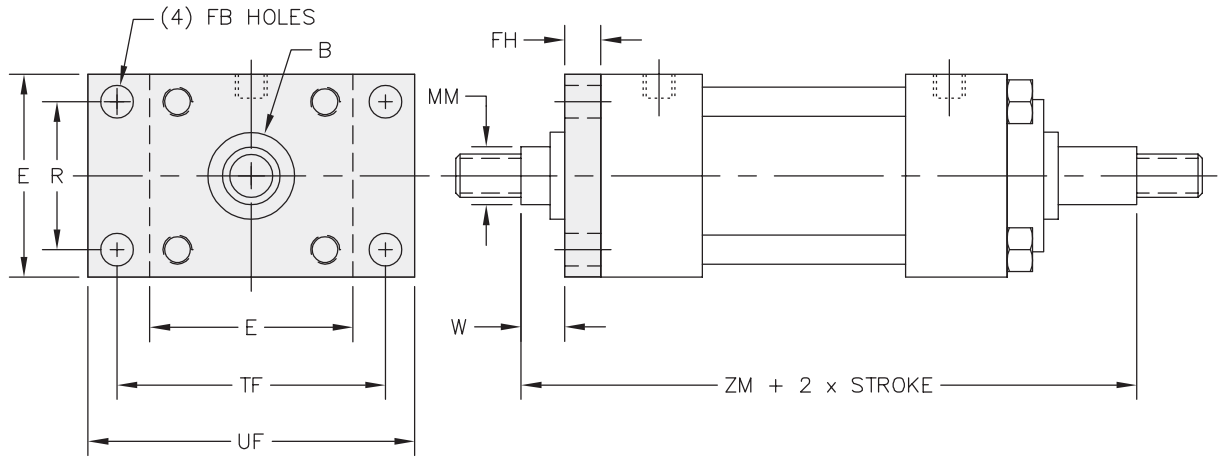


Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	F	FB	G	R	RD	RS	TF	UF	WF	Add 2x Stroke ZM
1.50	0.625	3000	2.500	0.375	0.438	1.750	1.625	2.375	—	3.438	4.250	1.000	6.875
	1.000							2.563	2.438			1.375	7.625
2.00	1.000	3000	3.000	0.625	0.563	1.750	2.047	2.625	—	4.125	5.125	1.375	7.625
	1.375							3.250	2.938			1.625	8.125
2.50	1.000	3000	3.500	0.625	0.563	1.750	2.547	2.625	—	4.625	5.625	1.375	7.750
	1.375							3.250	—			1.625	8.250
	1.750							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					

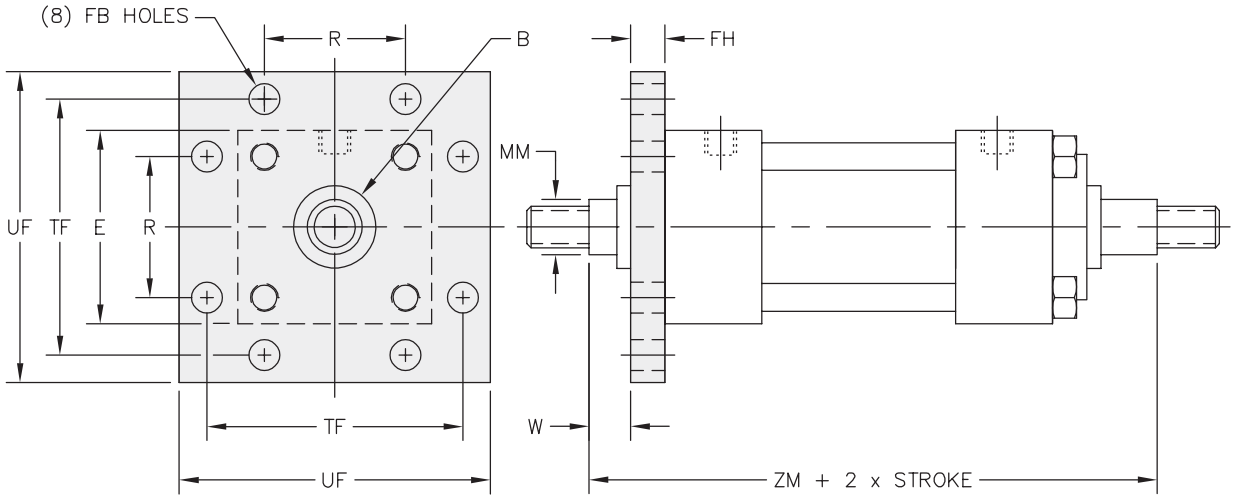
1. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

Dimensions – Double End Mounts

MF1D: Head Flange



MF5D: Head Square Flange



Dimensions – Double End Mounts

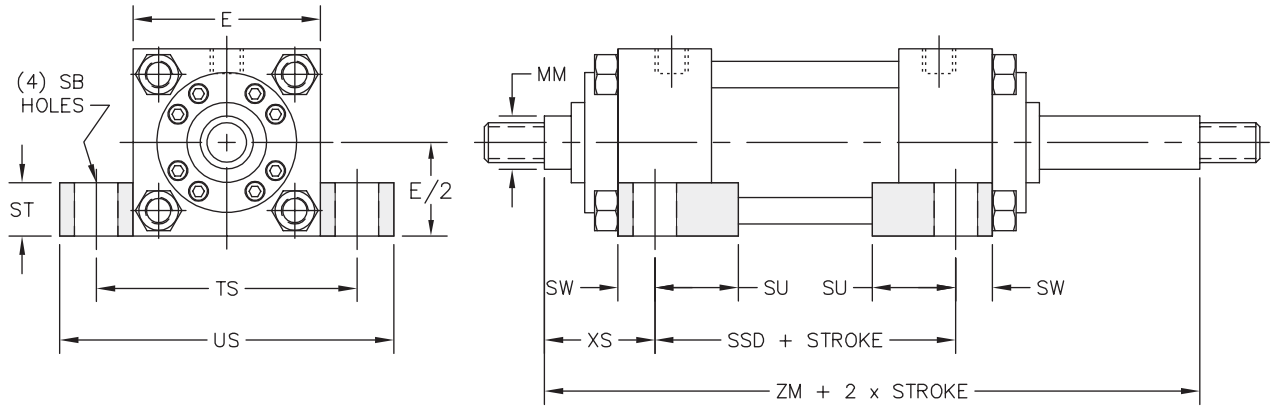
Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	B[2]	FH	FB	R	TF	UF	W	Add 2x Stroke ZM
1.50	0.625	3000	2.500	1.124	0.375	0.438	1.625	3.438	4.250	0.625	6.875
	1.000			1.499						1.000	7.625
2.00	1.000	3000	3.000	1.499	0.625	0.563	2.047	4.125	5.125	0.750	7.625
	1.375			1.999						1.000	8.125
2.50	1.000	3000	3.500	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).

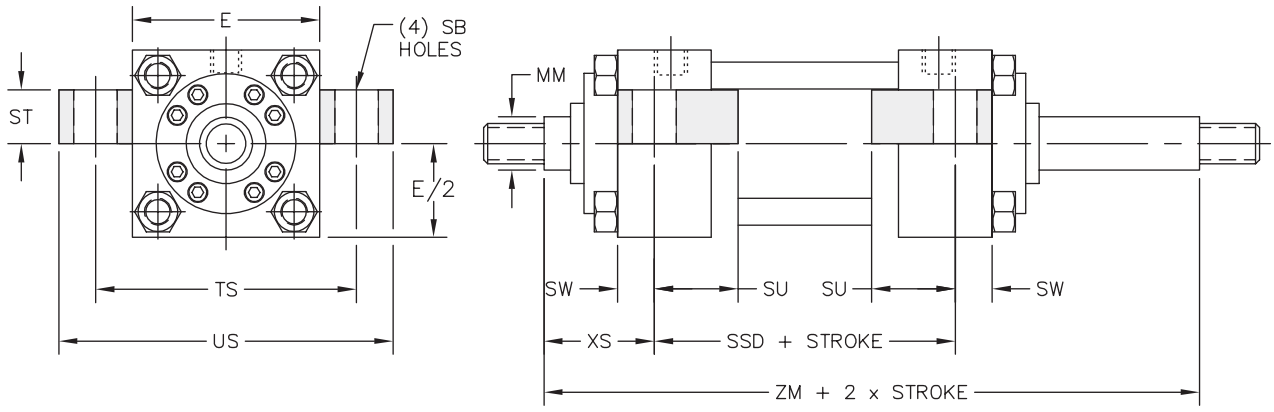
2. B dimension tolerance is +.000 / -.002.

Dimensions – Double End Mounts

MS2D: Side Lugs



MS3D: Center Line Lugs



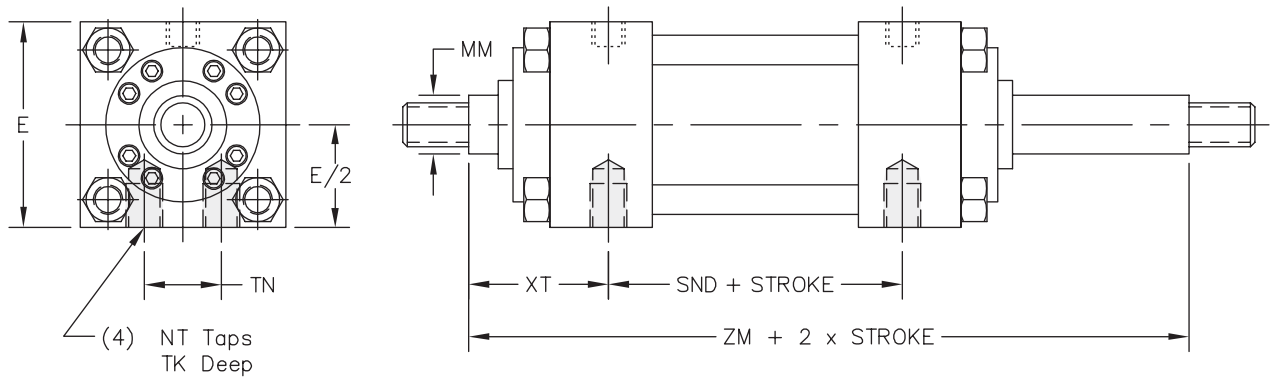
Dimensions – Double End Mounts

Bore	Rod Dia. (MM)	Max PSI Rating[1]	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										1.750		7.625
2.00	1.000	3000	3.000	1.500	0.563	0.750	1.250	0.500	4.000	5.000	1.875	3.875	7.625
	1.375										2.125		8.125
2.50	1.000	3000	3.500	1.750	0.813	1.000	1.563	0.688	4.875	6.250	2.063	3.625	7.750
	1.375										2.313		8.250
	1.750										2.563		8.750
3.25	1.375	3000	4.500	2.250	0.813	1.000	1.563	0.688	5.875	7.250	2.313	4.375	9.000
	1.750										2.563		9.500
	2.000										2.688		9.750
4.00	1.750	3000	5.000	2.500	1.063	1.250	2.000	0.875	6.750	8.500	2.750	4.250	9.750
	2.000										2.875		10.000
	2.500										3.125		10.500
5.00	2.000	3000	6.500	3.250	1.063	1.250	2.000	0.875	8.250	10.000	2.875	4.750	10.500
	2.500										3.125		11.000
	3.000										3.125		11.000
	3.500										3.125		11.000
6.00	2.500	3000	7.500	3.750	1.313	1.500	2.500	1.125	9.750	12.000	3.375	5.125	11.875
	3.000												
	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												

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).

Dimensions – Double End Mounts

MS4D: Bottom Tapped Holes

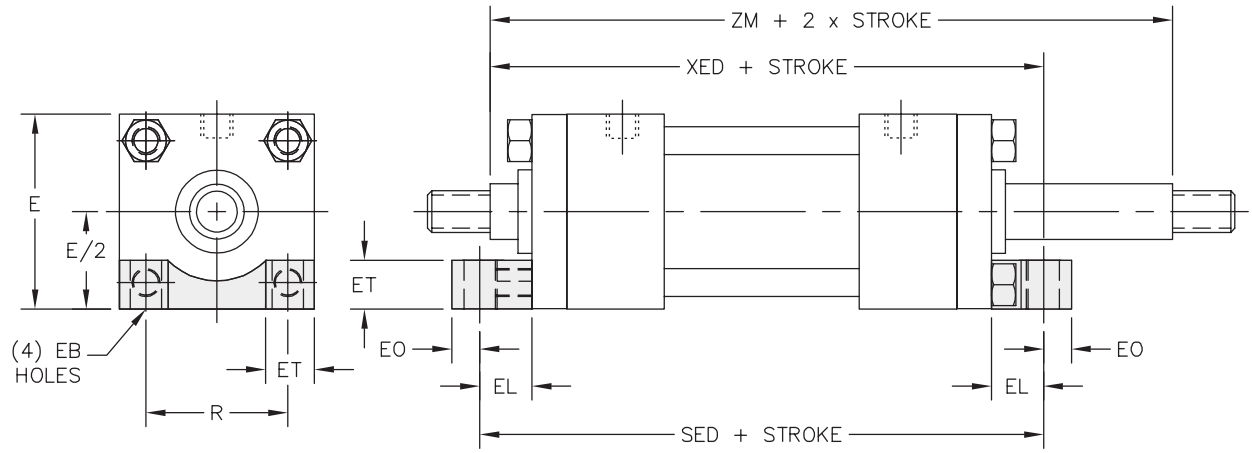


Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	E / 2	NT	TK	TN	XT	Add to Stroke	Add 2x Stroke
									SND	ZM
1.50	0.625	3000	2.500	1.250	3/8 - 16	0.375	0.750	2.000	2.875	6.875
	1.000					0.375		2.375		7.625
2.00	1.000	3000	3.000	1.500	1/2 - 13	0.438	0.938	2.375	2.875	7.625
	1.375					0.438		2.625		8.125
2.50	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									
	5.000									
8.00	3.500	3000	9.500	4.750	1 1/2 - 6	1.500	4.250	3.938	6.125	14.000
	4.000					1.500				
	4.500					1.500				
	5.000					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).

Dimensions – Double End Mounts

MS7D: End Lugs[1]

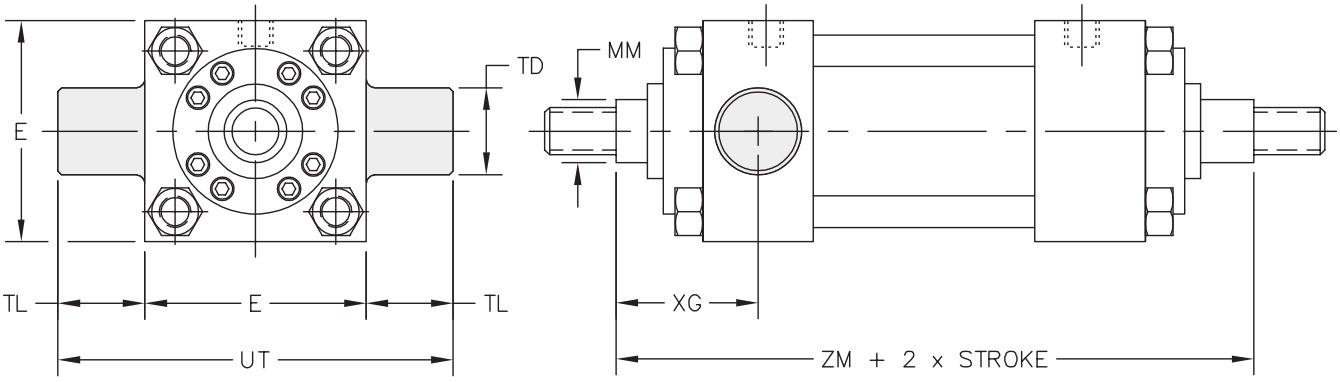


Bore	Rod Dia. (MM)	Max PSI Rating[2]	E	E / 2	EB	EL	EO	ET	R	Add to Stroke		Add 2x Stroke
										SED	XED	ZM
1.50	0.625	3000	2.500	1.250	0.438	0.875	0.375	0.750	1.625	7.375	7.125	6.875
	1.000	Not Available										
2.00	1.000	3000	3.000	1.500	0.563	0.938	0.500	0.875	2.047	8.000	7.687	7.625
	1.375	Not 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											
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											
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										

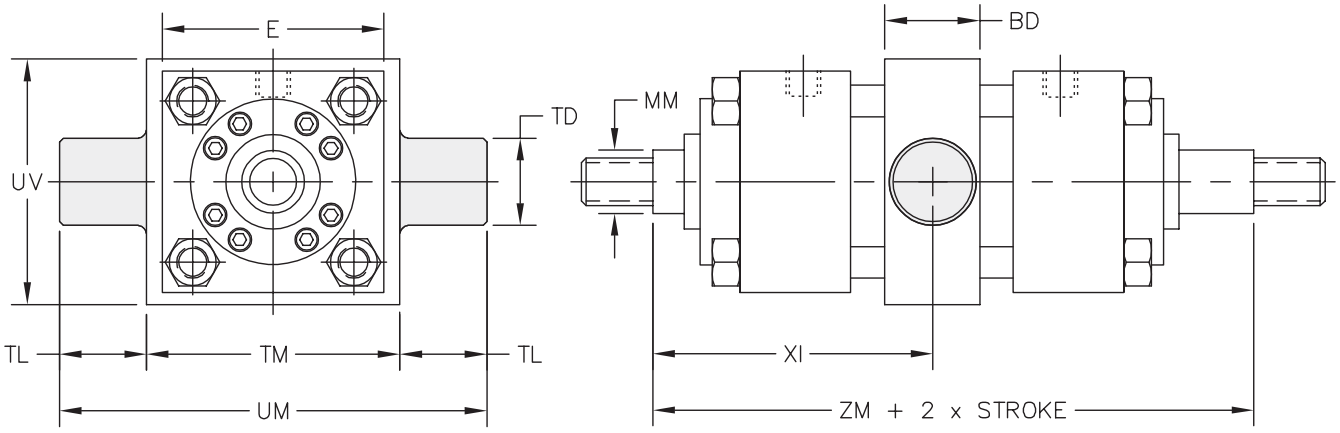
1. When using this mount, the cylinder feet, head & cap are to be firmly supported.
2. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

Dimensions – Double End Mounts

MT1D: Head Trunnion



MT4D: Intermediate Trunnion



Dimensions – Double End Mounts

Bore	Rod Dia. (MM)	Max PSI Rating[1]	E	BD	TD[2]	TL	TM	UM	UT	UV	XG	MT4 XI Min[3]	MT4 Min Stroke	Add To Stroke MT4 XI Max	Add 2x Stroke 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										2.250	4.000		3.625	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										2.500	4.250		3.875	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										2.500	4.250		4.000	8.250
	1.750										2.750	4.500		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										2.875	5.000		4.500	9.500
	2.000										3.000	5.125		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										3.000	5.125		4.875	10.000
	2.500										3.250	5.375		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										3.250	5.625		5.375	11.000
	3.000										3.250	5.625		5.375	11.000
	3.500										3.250	5.625		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														

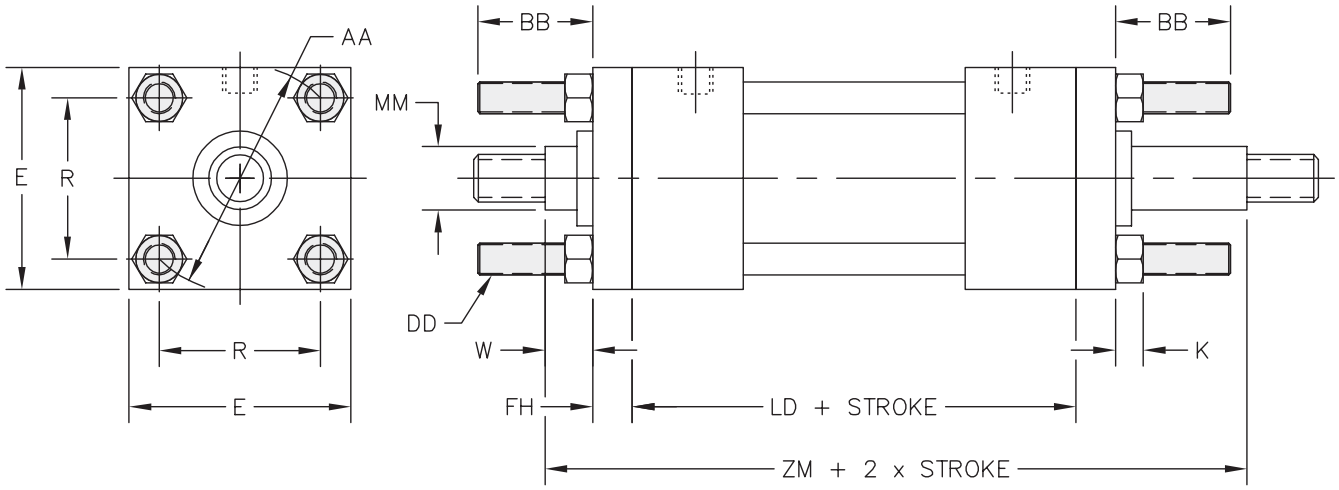
1. Max single acting pressure rating (non-shock). Any additional opposed intensified pressure related to varying impact area within the cylinder is not taken into consideration (ram cylinders).

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

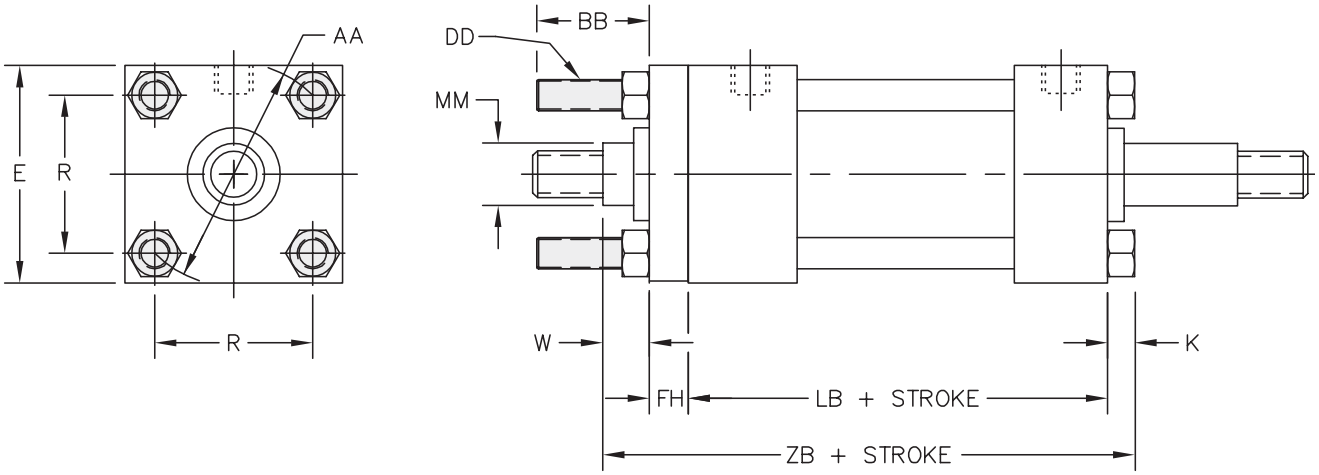
3. XI dimension is the minimum that can be supplied (customer to specify XI dimension).

Dimensions – Double End Mounts

MX1D: Extended Tie Rods – Head & Cap



MX3D: Extended Tie Rods – Head End



Dimensions – Double End Mounts

Bore	Rod Dia. (MM)	Max PSI Rating[1]	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									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									1.000		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									1.000		8.250
	1.750									1.250		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									1.125		9.500
	2.000									1.250		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									1.125		10.000
	2.500									1.375		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									1.375		11.000
	3.000									1.375		11.000
	3.500									1.375		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											

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).

How to Order

HH Cylinders

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

Product Series

HH	High Pressure Hydraulic

NFPA Mounts

MX0	No Mount (1.50" to 8.00" Bore)
MF1	Head Rectangular Flange (1.50" to 8.00" Bore)
MF2	Cap Rectangular Flange (1.50" to 8.00" Bore)
MF5	Head Square Flange (1.50" to 8.00" Bore)
MF6	Cap Sqaure Flange (1.50" to 8.00" Bore)
ME5	Head Rectangular Mounting Holes (1.50" to 8.00" Bore)
ME6	Cap Rectangular Mounting Holes (1.50" to 8.00" Bore)
MP1	Fixed Cap Pivot Clevis (1.50" to 8.00" Bore)
MS2	Side Lugs (1.50" to 8.00" Bore)
MS3	Center Line Lugs (1.50" to 8.00" Bore)
MS4	Bottom Tapped Holes (1.50" to 8.00" Bore)
MS7	End Lugs (1.50" to 6.00" Bore)
MT1	Head Trunnion (1.50" to 8.00" Bore)
MT2	Cap Trunnion (1.50" to 8.00" Bore)
MT4	Intermediate (Center) Trunnion (1.50" to 8.00" Bore)1
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)

Style

	Single Rod
D	Double Rod

Bore

150	1.50"
200	2.00"
250	2.50"
325	3.25"
400	4.00"
500	5.00"
600	6.00"
700	7.00"
800	8.00"

Stroke

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

Cushions[1]

H	1
	2
	3
	4
C	5
	6
	7
	8

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.

Rod End[2]

KK1	Small Male Thread
KK2	Large Male Thread
KK3	Female Thread
KK3M	Female Metric Rod Thread
KK3X	Female Special Thread
KK4	Full Diameter Male Thread
KK5	Plain End
KK10	Rod Coupler End
KKM	Metric Thread
KKX	Male Special Thread

Port Loc[3]

P	1
	2
	3
	4
	5
	6
	7
	8
	9

Port Size

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

Piston Seal

S	Standard (Carboxilated)
C	Cast-Ring
E	EP
T	PTFE[5]
V	Fluorocarbon

Rod Seal

S	Standard (Polyurethane)
E	EP
V	Fluorocarbon

Tube Seal

S	Standard (Buna)
E	EP
V	Fluorocarbon

Rod Wiper[4]

S	Standard (Flocked Nitrile)
M	Metallic Scraper
T	PTFE
V	Fluorocarbon

Options

A=	Extended Piston Rod Thread (Example: A = 2") (Max = 2 Times ST'D "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
DBB=	Drain Back Bushing (Example: DBB=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
ST=[5]	Stop Tube (Specify Stop Tube Length (in inches). Specify Stroke as ES (effective stroke).Example: HH-MS2-250x48 ES-H2C6-ST=37)
4WF	Four Wrench Flats (Rod Sizes: .625"-3.50")
XX=	Special Variation (Specify)

1. Call out 'H' for head cushion, 'C' for cap cushion, followed by the desired location(s).
2. When additional thread details are required, use format: Rod End = Modification Example: KKX=1.00x8
3. Call out 'P' followed by all desired locations.
4. When cylinder design calls for all EP seals, use PTFE rod wiper.
5. The desired stop tube length adds directly to the overall cylinder length.

Note: Refer to HH Options for specifications.

HH Seal Kits

To ensure proper seals are supplied for all models, ALWAYS supply Bimba serial number.

HH-SK 137 - 250 - S S S S

Seal Kit Series	
HH-SK	HH Series Seal Kit
HH-SKD	Double Rod

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
700	7.00" Bore
800	8.00" Bore

Piston Seal	
C	Cast Ring
E	EP
S	Standard (Carboxilated)
T	PTFE
V	Fluorocarbon

Rod Seal	
E	EP
S	Standard (Polyurethane)
V	Fluorocarbon

Tube Seal	
E	EP
S	Standard (Buna)
V	Fluorocarbon

Rod Wiper*	
C	Metallic Scrapper
E	Standard (Flocked Nitrile)
T	PTFE
V	Fluorocarbon

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

Examples:
HH-SK175-400-SSSS
HH-SK100-250-VVVT

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.

Index to Options

105 A = Extended Piston Rod Thread

105 AS = Adjustable Stroke (Retract)

105 ABP = Air Bleed Ports

105 C = Extended Piston Rod

106 CS = Center Support

106 C or H = Cushions

106 DBB = Drain Back Bushing

107 EK = Extended Key Plate

107 T = PTFE Piston Seal

108 HSS = High Shock Seals

108 KKX = Non-Standard Rod Threads

108 KKM = Male Metric Rod Threads

108 KK3M = Female Metric Rod Threads

108 KK3X = Female Special Rod Threads

108 Multiple Mounts

109 LRB = Lift Ring Boss

109 NR = Non-Rotating

110 RBB = Rod Bushing - Bronze (Ductile Iron is standard)

110 RLH = Rod Lock

110 SSR = Stainless Steel Piston Rod

110 Rod Boots

111 Port Options (BSPP, BSPT, NPTF)

112 Seals (Piston, Rod, Tube, Wiper)

113 ST = Stop Tube & Rod Size Selection

114 Piston Rod Size Selection

115 3P = Three-Position Cylinders

115 BTB = Back-To-Back Cylinders

115 TM = Tandem Cylinders

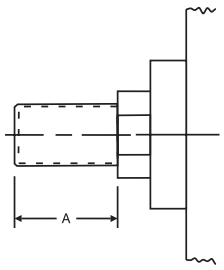
115 Special Finishes

A Extended Piston Rod Thread

A = refers to the length of piston rod thread.

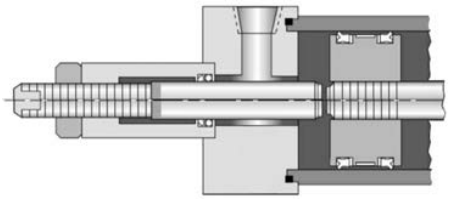
Shorter than standard lengths can be furnished at no charge. Longer than standard lengths can be furnished at a nominal price adder. Special length threads do not delay orders!

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



AS Adjustable Stroke (Retract)

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



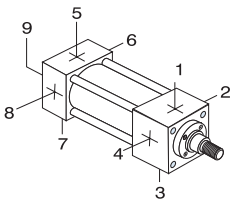
To order, specify "AS" and length of adjustment (Example: AS=3").

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

ABP = 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.

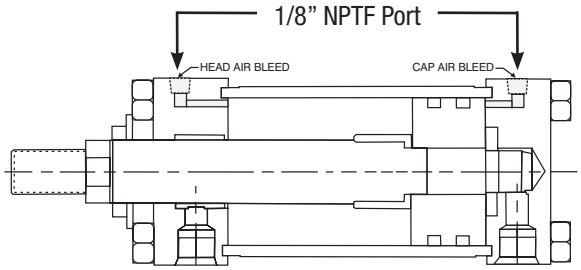


Location 9 is center of cap face.

Bore & Rod Size Limits: Air bleed ports not available on the head end for 1.5" bore with 1" rod, 2" bore with 1.375" rod, and 2.5" bore with 1.75" rod.

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

Plugged from factory.

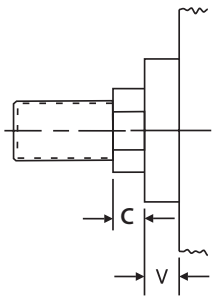


C Extended Piston Rod

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.



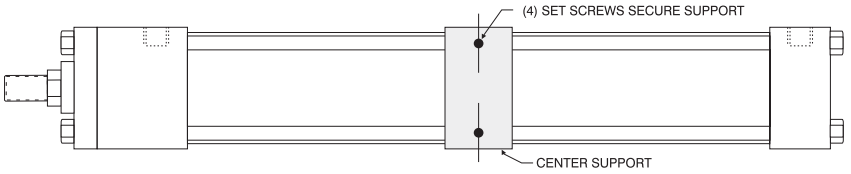
How to Customize

CS Center Supports

CS = 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 Bimba for more information.

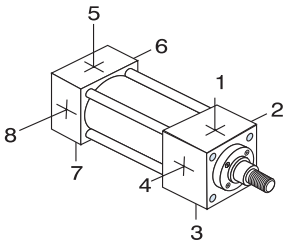


Center Support Recommendations		
Bore	**One Support**	**Two Supports**
1.50"	Strokes over 44 inches	Strokes over 89 inches
2.00"	Strokes over 74 inches	Strokes over 99 inches
2.50"	Strokes over 84 inches	Not Required
3.25" - 8.00"	Strokes over 99 inches	

H/C Head & Cap Cushions

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

Example: H2C6



Cushion Locations	
Head Cushion	**Cap Cushion**
H1	C5
H2	C6
H3	C7
H4	C8

Standard Cushion Locations	
Most Mounts	H2 C6
MS3 Mount	H3 C7
MT1 Mount	H3 C6
MT2 Mount	H2 C7

Unavailable Cushion Locations by Mount		
Mount	**Head Cushion**	**Cap Cushion**
ME5	H2, H4	–
ME6	–	C6, C8
MS3	H2, H4	C6, C8
MT1	H2, H4	–
MT2	–	C6, C8

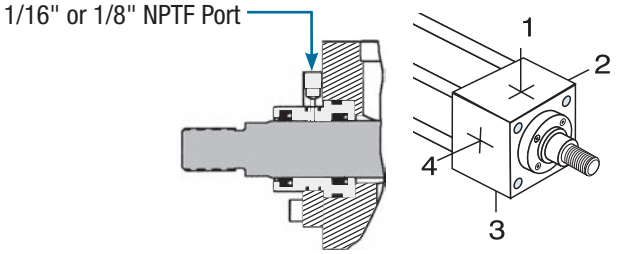
Note: Cylinders with a short stroke (value varies with bore/rod diameter and cushion combinations) may result in improper cylinder operation. Consult factory for availability.

DBB Drain Back Bushing

DBB = 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.

Note: Some bore and rod sizes are not available or may require special thickness retainers.

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



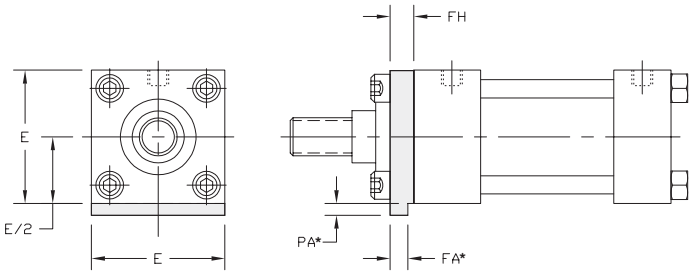
EK Extended Key Plate

EK = 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.

HH Dimensions 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.

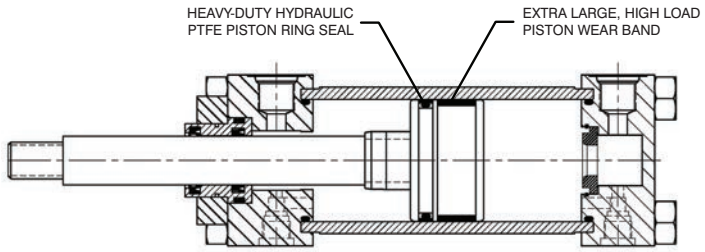


Option T (PTFE) Piston Seal - Recommended for High Load & Low Friction Applications

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 (FKM): 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.



How to Customize

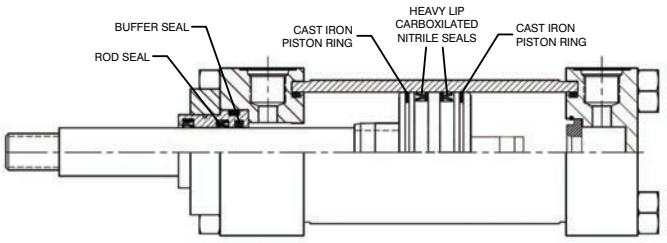
HSS High Shock Seals

HSS = 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 Carboxilated 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.

Note: Some bore and rod sizes are not available.



KKX Non-Standard Rod Threads

KKX = 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

KK3M = 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.

Bimba 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 = M18 x 1.5 - P15 = N375 - SSSS

KKM Male Metric Rod Threads

KKM = 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.

Bimba 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 - KKM = M18 x 1.5 - P15 = N375 - SSSS

KK3X Female Special Rod Threads

KK3X = Bimba 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.

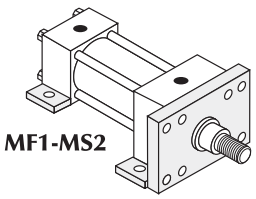
Ordering Example: HH - MF1 - 150 X 24 - 100 - KK3X = 3/4-10 - P15 = N375 - SSSS

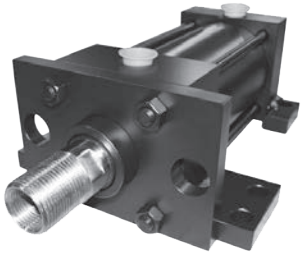
Multiple Mounts

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

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

Add additional mount to part number



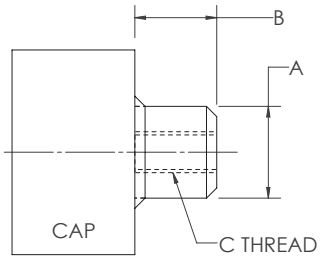


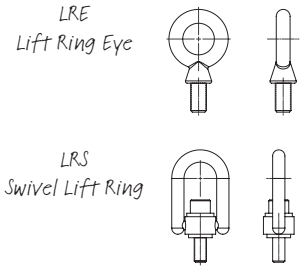
LRB Lift Ring Boss

LRB = 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 options to the right).

Also available in additional locations and styles.





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

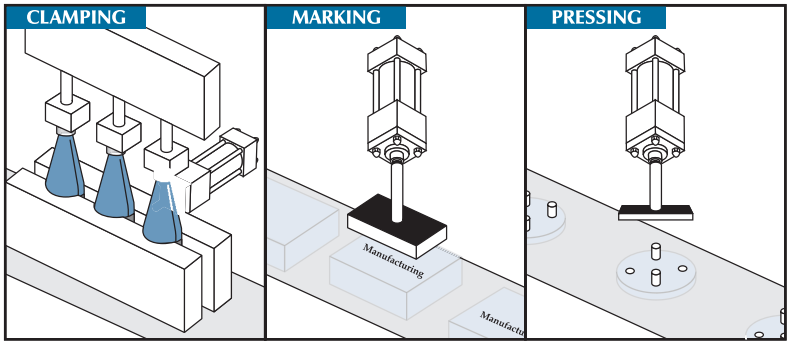
* Lifting capacity is the maximum capacity for intermittent lifting and placement of cylinder only. It is NOT intended to be used as the primary cylinder mount.
Note: Not available on MF2, MF6, ME6, MP1 and SB mounts.

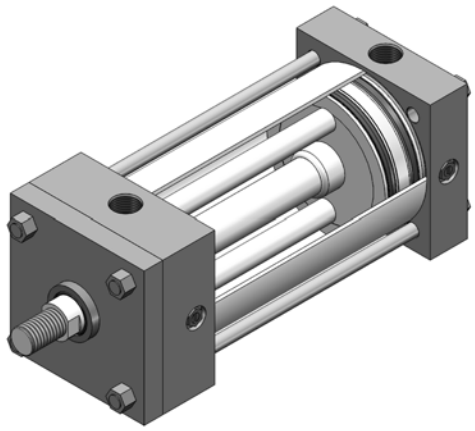
NR Non-Rotating Cylinders - NFPA

> 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 NFPA cylinders!
- » Durable
- » Great when rod end rotation is not wanted

> Application Possibilities





Available Bore Sizes with 'NR' Guide Rod Sizes and Max. Stroke

Bore	Rod Dia. (MM)	Guide Rod	Cushions	Max. Stroke
3.25	1.375	.375	Cap Only	18"
5.00	2.000	.625	Available	30"
6.00	2.500	.625	Available	30"
	3.000			
8.00	3.500	1.000	Available	40"

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

How to Customize

RBB Solid Bronze Rod Bushing

RBB = 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: Bimba can provide special length rod bushings; contact your local distributor for details.

RLH Rod Lock

RLH = Cylinders can be furnished with Hydraulic Rod Locks. Refer to HH Series Rod Locks for complete specifications.

SSR 17-4 Stainless Steel Hard Chrome Plated Piston Rod

SSR = 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)

Rod Boots

Rod boots are common in dirty environments; a standard spec for many applications.

Note: Rod boots add length to cylinder rod extension.





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)

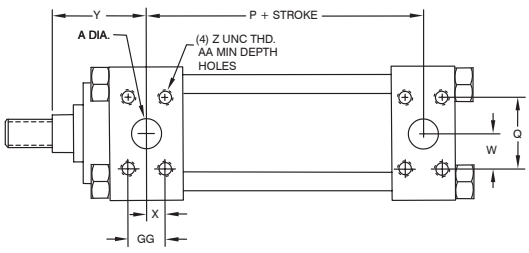
BSPP = British Standard Pipe Parallel

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

Flange Ports

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	3.250	0.500	1.500	0.750	0.344	5/16 - 18	0.813	0.688	1/2
3.25	1.375	3000	12	2.625	3.750	0.750	1.875	0.938	0.438	3/8 - 16	0.750	0.875	3/4
	1.750			2.875									
	2.000			3.000									
4.00	1.750	3000	12	2.875	4.000	0.750	1.875	0.938	0.438	3/8 - 16	0.750	0.875	3/4
	2.000			3.000									
	2.500			3.250									
5.00	2.000	3000	12	3.000	4.500	0.750	1.875	0.938	0.438	3/8 - 16	0.750	0.875	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	2.063	1.031	0.515	3/8 - 16	0.875	1.031	1
	3.000												
	3.500												
	4.000												
7.00	3.000	3000	20	3.688	5.625	1.250	2.313	1.156	0.594	7/16 - 14	1.000	1.188	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	1.375	0.703	1/2 - 13	1.063	1.406	1 1/2
	4.000												
	4.500												
	5.000												
	5.500												

Port Call Out Information



Series 61 Flange Port (3000 PSI Rating)
(Available on HH Series Only)

P15 = FL24

Port Loc[1]	
P	1
	2
	3
	4
	5
	6
	7
	8
	9

[1]Call out "P" followed by all desired locations.

FL = Flange Port

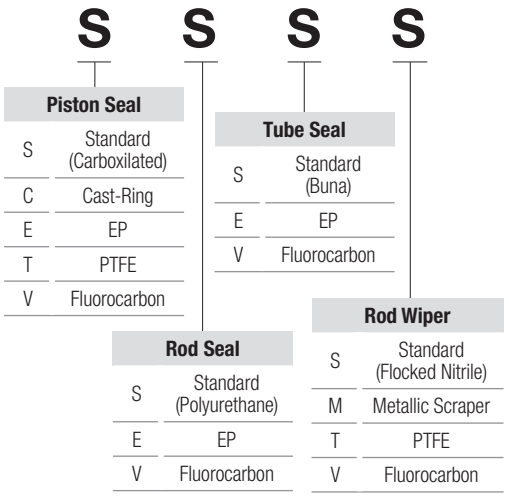
Port Size	
8	#8 SAE
10	#10 SAE
12	#12 SAE
16	#16 SAE
20	#20 SAE
24	#24 SAE

Affected Mounts:
ME5 and MF6 Mounts are not available.
MF2 Mount is not available with ports at positions 6 and/or 8.
Note: Flanges overhang caps on 2.50" through 5.00" Bore.

How to Customize

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.



S Standard Seals

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

E Ethylene Propylene

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

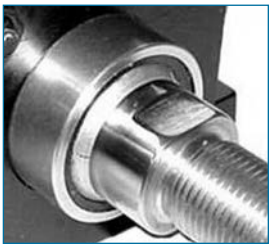
Note: Requires a PTFE rod wiper and L011 lubricant option for EP compilable seal grease.

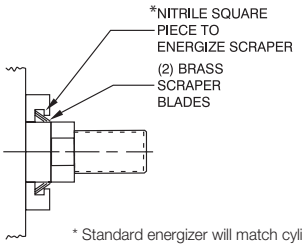
T Glassed Filled PTFE

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 (FKM):	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

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





* Standard energizer will match cylinder seals.

XX Special

Non-standard seals can be furnished.

Contact Bimba for more information.

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 FKM seals.

V Fluorocarbon

Temperature Range:	0°F to 400°F (-18°C to 204°C)
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

(Up to 400°F with reduced service life)

Stop Tube and Rod Size Selection

ST = 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: Bimba 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 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-MS2-250X42 ES-100-KK2-P15=N375-SSSS-ST=2

Chart 2

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

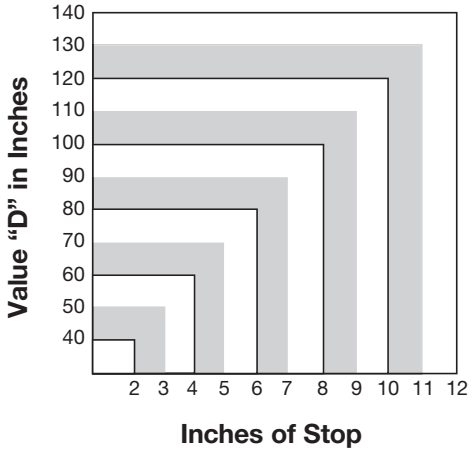
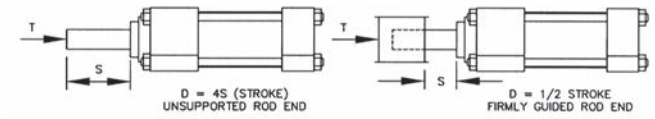
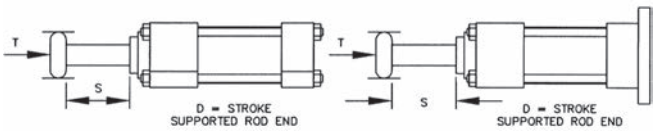


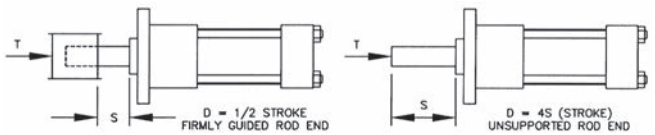
Chart 1

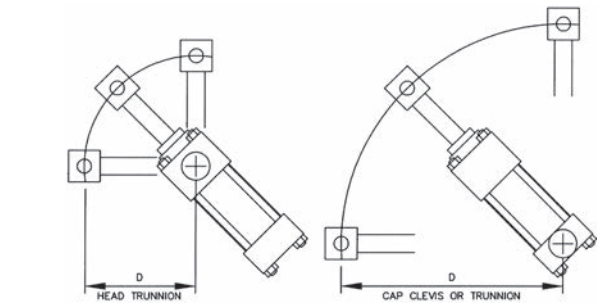
Find the value of "D" for your application

D = Stroke, adjusted for mounting condition
S = Actual cylinder stroke
T = Axial thrust (refer to Chart 3 on page 114)









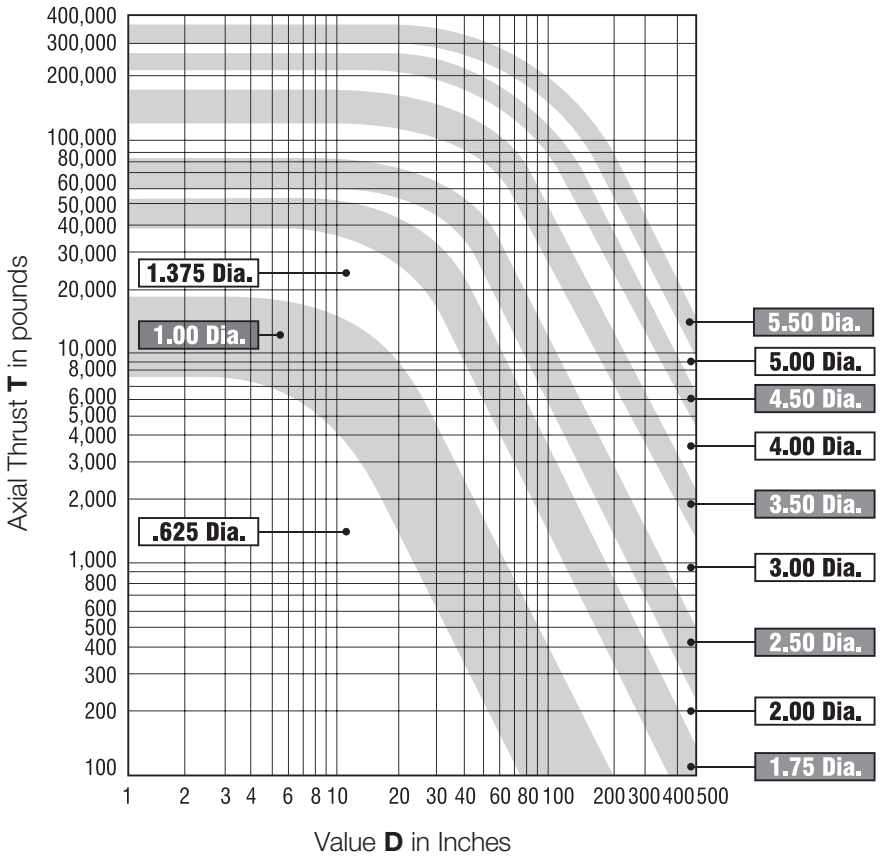
Note: Measure "D" when cylinder is fully extended.
Refer to page 114 for Rod Size Selection Chart.

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 113, determine the value of "D" for the application.
3. Find the value of "D" in the chart to the right. 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)



3P Three-Position Cylinders

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

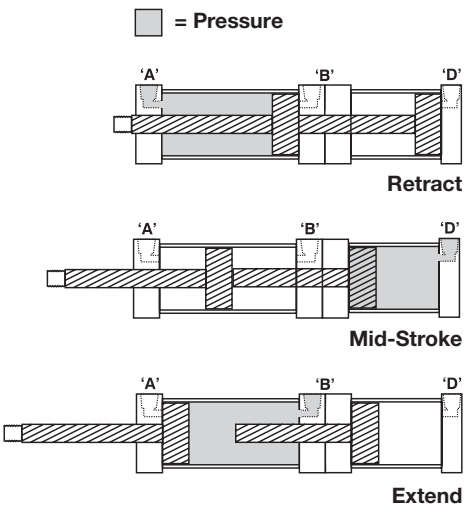
3-Position cylinders consist of multiple cylinders built as one unit having one exposed working rod end, capable of delivering three rod positions.

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 design — 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 Bimba for more information.



How They Work

Position 1 (retract): Pressure to port "A" fully retracts cylinder

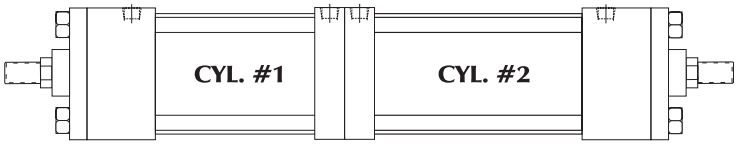
Position 2 (mid-stroke): Pressure to port "D" advances cylinder to mid-stroke position

Position 3 (extend): Pressure to port "B" fully extends cylinder

BTB Back-To-Back Cylinders

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

Contact Bimba for more information.

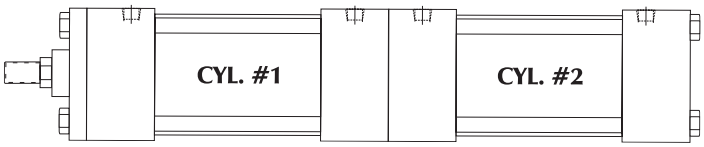


TM Tandem Cylinders

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

Note: Piston rods are connected.

Contact Bimba for more information.



Special Finishes

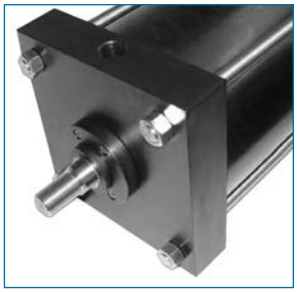
Standard Finish: Black Urethane Paint (suitable for indoor or outdoor use)

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

Additional Paint Choices: Bimba can provide paint in any color or type with customer supplied paint specification and color code.

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

Contact Bimba with your specifications – we would be pleased to provide a quote!



Notes

HH Series Rod Locks

HH Series Rod Locks provide high holding force and are available in three different holding forces, depending on available release pressure. The higher the release pressure, the higher the spring force available and thus the higher holding force rating.



Contents

117 HH Series Rod Locks

120 How it Works
120 – Operating Principal
121 – Technical Data

123 How to Specify
123 – Basic Cylinder Dimensions
125 – Hydraulic Circuit
125 – Automatic Air Bleed Valve
126 – Rod Lock Sensors

127 How to Order

Features & Benefits

HH Series Rod Locks

Bimba's floating rod bushing design and RL Series Rod Lock equal optimized results and superior performance.

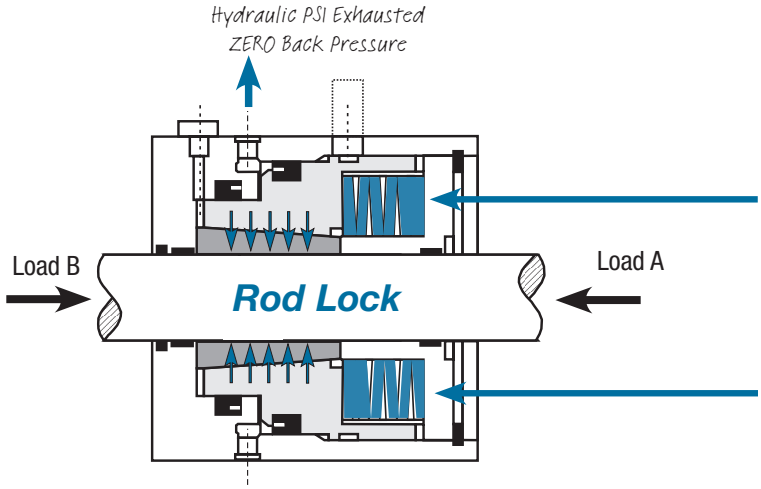
For rod locks to achieve the rated holding force and maximize cycle life, good alignment must be maintained between the locking mechanism and cylinder rod. Superior performance and trouble-free operation are assured with Bimba's floating rod bushing design and accurate rod lock alignment.

Rod locks are used to hold linear cylinder loads stationary in any mounting orientation during power off condition. Units will lock in both directions to rated holding force. They are not designed to withstand rotational loads or to brake the load in dynamic applications. Bimba offers each rod lock model in three different holding forces, depending on available release pressure.

Refer to page 122 for minimum release pressure and corresponding holding force.

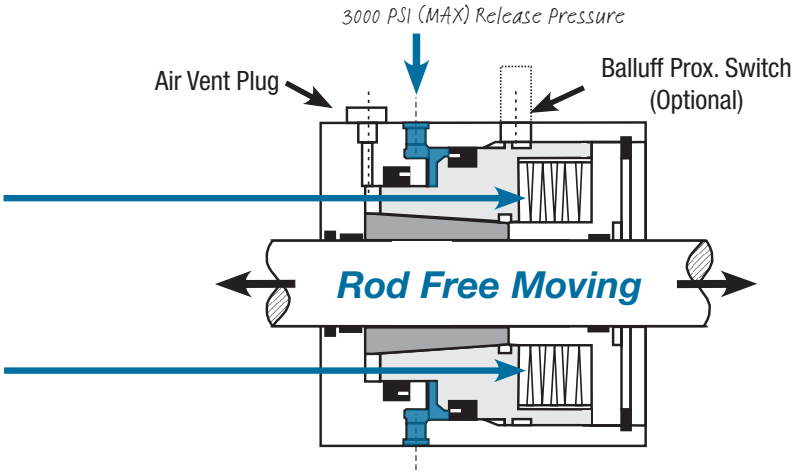


Operating Principal



Clamped (Locked) Condition

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



Un-Clamped Condition

When hydraulic pressure is applied to rod lock, the hydraulic pressure overcomes the spring force, moving piston outer locking housing. This movement provides clearance between the rod lock and piston rod, which allows free rod movement.

Technical Data

Operating Pressure

Cylinder	Rod Lock (low PSI)	Rod Lock (medium PSI)	Rod Lock (high PSI)
Refer to Cylinder Mount Rating	750 to 3000 PSI HYD	1000 to 3000 PSI HYD	1500 to 3000 PSI HYD

Axial Movement (Clamped)*

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

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

Operating Temperature

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

Rod Material Requirements

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

Clamp Specifications

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

Note: Rod lock is for camp and hold operation. It is not designed for use as a dynamic brake; braking will decrease lifespan.

Technical Data

Rod Diameter	Bore	Model Number	Min Release PSI[1]	Max Holding Force[2]	Volume of Oil		Weight (lbs)
					cm^3	in^3	
0.625	1.50	RLH-625150750	750	1,100	6	0.4	11.5
		RLH-6251501000	1000	1,800			
		RLH-6251501500	1500	2,250			
1.000	1.50	RLH-100150750	750	1,200	6	0.4	10.5
		RLH-1001501000	1000	2,000			
		RLH-1001501500	1500	2,300			
1.000	2.00	RLH-100200750	750	2,900	16	1.0	20.8
		RLH-1002001000	1000	5,200			
		RLH-1002001500	1500	5,600			
1.000	2.50	RLH-100250750	750	2,900	16	1.0	31.0
		RLH-1002501000	1000	5,200			
		RLH-1002501500	1500	6,000			
1.375	2.00	RLH-137200750	750	2,700	10	0.6	20.0
		RLH-1372001000	1000	2,700			
		RLH-1372001500	1500	5,200			
1.375	2.50	RLH-137250750	750	2,700	16	1.0	30.2
		RLH-1372501000	1000	5,200			
		RLH-1372501500	1500	6,000			
1.375	3.25	RLH-137325750	750	8,200	30	1.8	66.0
		RLH-1373251000	1000	11,500			
		RLH-1373251500	1500	16,000			
1.750	2.50	RLH-175250750	750	3,500	16	1.0	29.5
		RLH-1752501200	1200	5,200			
		RLH-1752502000	2000	7,500			
1.750	3.25	RLH-175325750	750	8,200	30	1.8	65.1
		RLH-1753251000	1000	11,500			
		RLH-1753251500	1500	16,000			
1.750	4.00	RLH-175400750	750	8,200	39	2.4	75.5
		RLH-1754001000	1000	12,000			
		RLH-1754001500	1500	17,000			
2.000	3.25	RLH-200325750	750	8,200	39	2.4	64.0
		RLH-2003251000	1000	11,500			
		RLH-2003251500	1500	16,000			
2.000	5.00	RLH-200500750	750	8,200	39	2.4	114.0
		RLH-2005001000	1000	12,000			
		RLH-2005001500	1500	17,000			
2.500	6.00	RLH-250600750	750	30,000	129	7.9	270.0
		RLH-2506001000	1000	36,000			
		RLH-2506001500	1500	50,000			
3.000	6.00	RLH-300600750	750	17,000	129	7.9	260.0
		RLH-3006001000	1000	22,500			
3.000	7.00	RLH-300700750	750	30,000	144	8.8	380.0
		RLH-3007001000	1000	36,000			
		RLH-3007001500	1500	50,000			
3.500	8.00	RLH-350800750	750	40,000	181	11.0	550.0
		RLH-3508001000	1000	55,000			
		RLH-3508001500	1500	80,000			
4.000	8.00	RLH-400800750	750	40,000	230	14.0	530.0
		RLH-4008001000	1000	55,000			
		RLH-4008001500	1500	80,000			

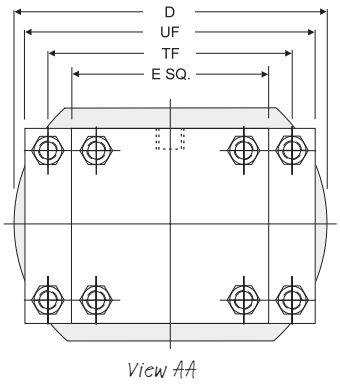
1. Maximum hydraulic release pressure: 3000 PSI.
2. Holding forces are based on dry or mineral-oil lubricated shafts.

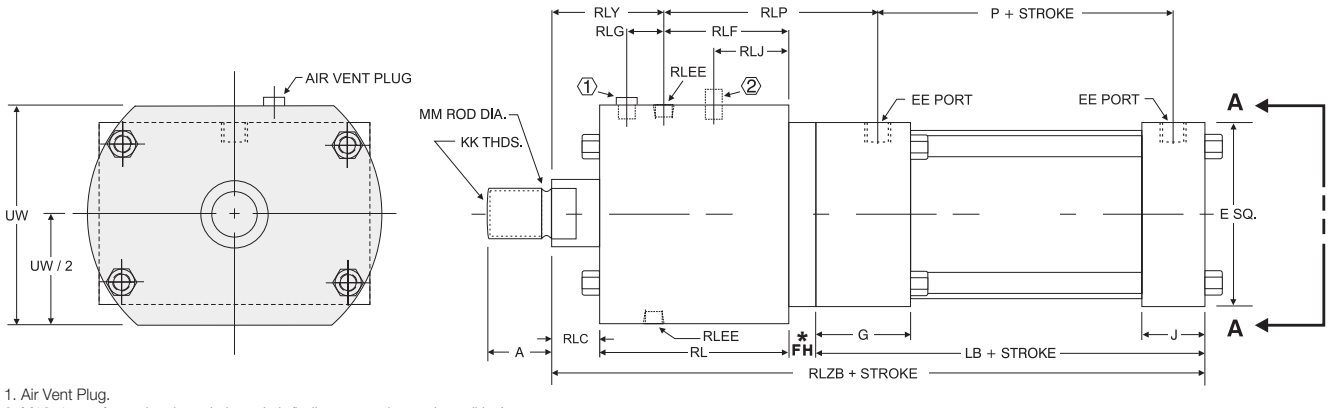
Dimensions – Basic Cylinder (No Mount)

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

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

Refer to HH Series pages for basic cylinder dimensions not shown.





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

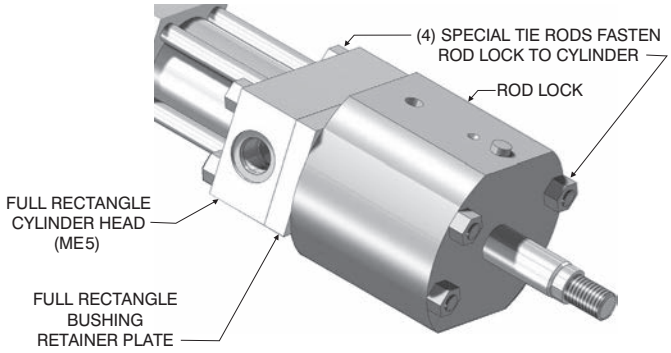
Rod Dia. (MM)	Bore	D	E	FH*	TF	UF	UW	RL	RLC	RLEE	RLF	RLG	RLJ	RLP	RLY	Add To Stroke
																RLZB
0.625	1.50	4.370	2.500	0.375	3.438	4.250	3.250	3.547	0.375	SAE 4	2.125	0.750	0.790	3.500	1.740	8.930
1.000	1.50	4.370	2.500	0.375	3.438	4.250	3.500	3.453	0.500	SAE 4	1.875	0.870	0.790	3.250	2.010	8.947
1.000	2.00	5.375	3.000	0.625	4.125	5.125	4.500	4.375	0.500	SAE 4	2.900	0.850	1.000	4.531	1.910	10.120
1.000	2.50	5.984	3.500	0.625	4.625	5.625	5.000	5.125	0.500	SAE 4	3.480	1.000	1.500	5.031	2.160	11.000
1.375	2.00	5.370	3.000	0.625	4.125	5.125	4.500	4.650	0.625	SAE 4	3.000	1.000	1.500	4.625	2.210	10.531
1.375	2.50	5.984	3.500	0.625	4.625	5.625	5.000	5.125	0.625	SAE 4	3.500	0.900	1.500	5.031	2.280	11.120
1.375	3.25	7.750	4.500	0.750	5.875	7.125	6.500	6.500	0.625	SAE 4	4.500	1.100	2.600	6.375	2.625	13.375
1.750	2.50	5.984	3.500	0.625	4.625	5.625	5.000	5.900	0.750	SAE 4	3.900	0.960	2.438	5.531	2.700	12.040
1.750	3.25	7.750	4.500	0.750	5.875	7.125	6.500	6.500	0.750	SAE 4	4.672	0.930	2.600	6.547	2.580	13.500
1.750	4.00	8.375	5.000	0.875	6.375	7.625	7.000	6.500	0.750	SAE 4	4.375	1.230	2.200	6.313	2.810	13.875
2.000	3.25	7.750	4.500	0.750	5.875	7.125	6.500	6.500	0.875	SAE 4	4.438	1.160	2.600	6.313	2.938	13.625
2.000	5.00	11.250	6.500	0.875	8.188	9.750	7.000	6.500	0.875	SAE 4	4.375	1.230	2.200	6.375	3.000	14.500
2.500	6.00	12.750	7.500	1.000	9.438	11.250	10.000	9.000	1.000	SAE 8	6.625	1.125	3.000	8.750	3.375	18.375
3.000	6.00	12.750	7.500	1.000	9.438	11.250	10.000	9.000	1.000	SAE 8	4.875	1.100	3.110	7.000	5.125	18.375
3.000	7.00	14.750	8.500	1.000	10.625	12.625	13.000	10.000	1.000	SAE 8	7.325	1.375	4.730	9.825	3.675	20.500
3.500	8.00	16.140	9.500	1.000	11.813	14.000	14.000	11.500	1.000	SAE 10	8.938	1.320	5.350	11.625	3.563	23.000
4.000	8.00	16.140	9.500	1.000	11.813	14.000	14.000	11.500	1.000	SAE 10	8.875	1.370	5.350	11.563	3.625	23.000

* May vary per mount, consult factory for details.

Dimensions – Basic Cylinder (No Mount)

General Construction

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

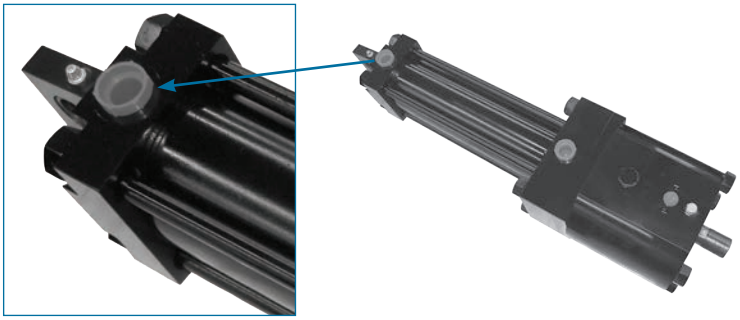


Cylinder Design and Available Mounts

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

The cylinder design can vary depending on the bore size, tie rod hex nut location and desired mount.

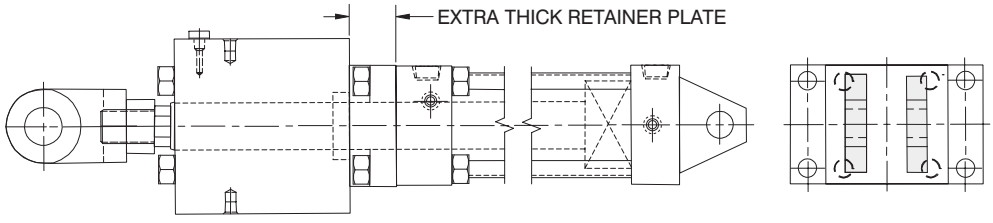
Note: some designs will increase cylinder overall length.



SB mount with special recessed hex nuts at cap

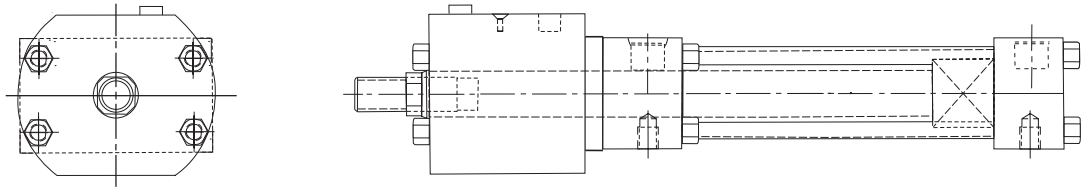
MP1 Mount

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



MS4 Mount

MS4 mount with standard hex nuts at cap.



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

Rod Lock Hydraulic Circuit and Automatic Air Bleed Valve

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

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

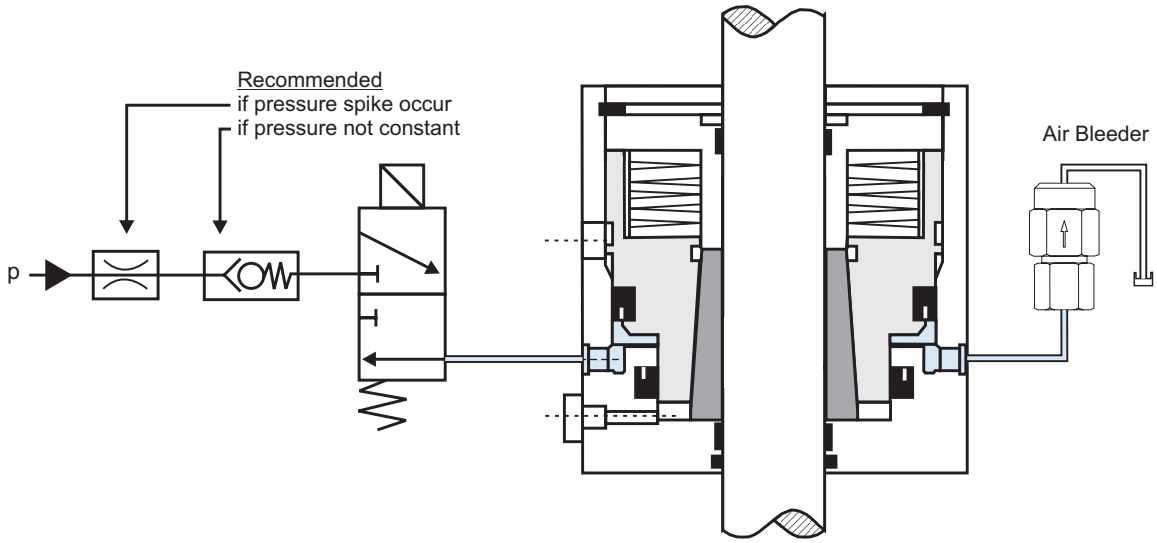
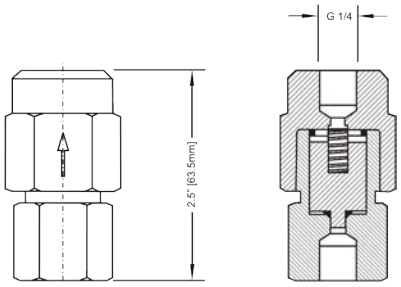


Figure 1

Automatic Air Bleed Valve ABV-1

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

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



Part Number: ABV-1
(Order separately)

ABV-1 Operation

The automatic air bleed valve (ABV-1) opens slightly each time pressure is removed from the rod lock, allowing air to escape back to the oil reservoir.

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

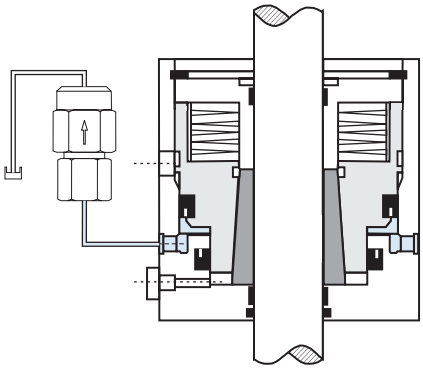


Figure 2: Vertical Mount

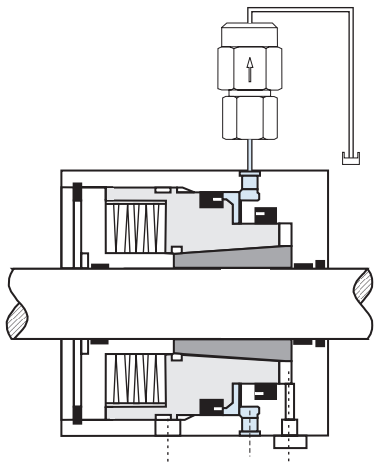


Figure 3: Horizontal Mount

Rod Lock Sensors (For Un-Clamped Condition)

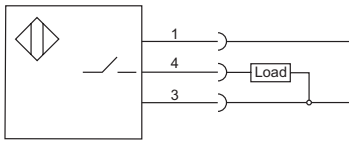
An inductive proximity switch (with M12 x 1 thread) can be used to sense the rod lock un-clamped (free moving rod) condition. (Balluff Model: BES 516-325-S4-C)



Electrical Data

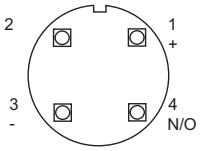
SA Operational distance with steel:	1.6 mm
Maximum switching frequency:	3000 Hz
Operating voltage:	10 - 30 V DC
Supply voltage ripple:	24 V DC max
Load current capacity:	≤ 200 mA
Protection against polarity reversal:	yes
Short circuit protected:	yes
Function display:	LED
Ambient temperature range:	-40°C to 85°C
Voltage drop (clamped):	1.5 V
Switching hysteresis:	≤ 15% Sensing distance
Repeatability:	≤ 5% Sensing distance
Current Consumption:	≤ 8 mA clamped / ≤ 10 mA un-clamped

Schematic



Wiring Connections:
PNP Normally Open

View of Male Connector Pins



Proximity Sensor Installation Instructions

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

Rod Lock Installation Instructions

1. Using a flexible hydraulic rated hose, apply hydraulic pressure to the rod lock unit (refer to model number for specific rod lock hydraulic release pressure).
2. With the rod lock counter-bored end facing the cylinder rod end, align rod lock to rod. Using care not to damage rod lock seals or bearings, slide the rod lock onto the piston rod until it contacts the cylinder mounting surface. Rod lock should fully contact the cylinder.
3. Remove the hydraulic pressure to the rod lock. Torque cylinder tie rod nuts a little at a time, in a clockwise rotation, finishing with the proper cylinder tie rod torque (refer to torque charts on page 68).
4. Cycle the rod lock unit on and off several times. With pressure applied, the cylinder rod should move freely by hand.
5. If the cylinder rod does not move freely, remove the rod lock and repeat installation instructions. If the piston rod still drags, check the squareness of the rod lock to the cylinder and make adjustments as needed.
6. WARNING! Do not disassemble Rod Lock – unit contains high spring force that could cause personal injury. Return to Bimba for service.

How To Order

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

NFPA Mount (to Mount Cylinder)	
ME6	Cap Rectangular Mounting Holes (1.50" to 8.00" Bore) *
MF2	Cap Rectangular Flange (1.50" to 6.00" Bore) *
MF6	Square Flange, Cap End (1.50" to 8.00" Bore) *
MP1	Fixed Cap Pivot Clevis (1.50" to 8.00" Bore) *
MS4	Bottom Tapped Holes (1.50" to 8.00" Bore)
MT2	Cap Trunnion (1.50" to 8.00" Bore)
MT4	Intermediate (Center) Trunnion (1.50" to 8.00" Bore)
MX2	Extended Tie Rods - Cap (1.50" to 8.00" Bore)

* Head End Spacer thickness can vary and will add length to cylinder

Options	
RLH	Rod Lock ready Cylinder no Rod Lock installed
RLH-Model Number	Cylinder with installed Rod Lock Example: RLH-100250750

Rod Lock Model Number

RLH-100 250 750 ___

Rod Size	Bore
062	150
100	150
	200
	250
137	200
	250
	325
175	250
	325
	400
200	325
	500
250	600
300	600
300	700
350	800
400	800

Release PSI
750
1000
1500

Options	
P	Proximity Switch
V	Fluorocarbon Seals
X	Special (specify)

Replacement rod locks can be ordered using the same methodology.

Examples:

RLH-1374001500
RLH-100250750P

See page 102 for additional cylinder how-to-order information.
Consult factory for additional mounts.

Notes

Accessories

Bimba offers a wide range of cylinder accessories for hassle-free installation and prolonged cylinder life. Proper mounting provides alignment with the driven mechanism, while avoiding side loads that restrict the free operation of the cylinder. Self-aligning rod couplers permit greater tolerances, reduce rod seal and bearing wear, and are well-suited for push or pull applications.



Contents

129 Accessories

131 How to Specify, Dimensions
- 131 – Rod Clevis
- 131 – Rod Eye
- 132 – Clevis Bracket
- 132 – Eye Bracket
- 132 – Pivot Pin
- 133 – Flange End Coupler
- 133 – Weld Plate
- 134 – HH & MH Series Spherical Bearings
- 134 – Spherical Bearing Clevis Bracket
- 135 – Male Spherical Rod Eye
- 135 – Spherical Bearing Pivot Pin

136 Alignment Couplers
- 136 – Features & Benefits
- 137 – Dimensions

138 Accessories Weight Chart

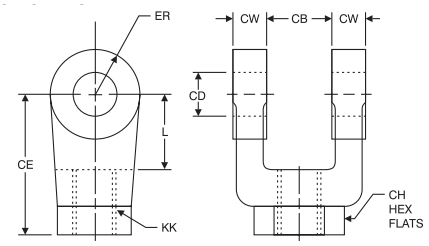
Dimensions – Clevis, Pins & Mounts

Rod Clevis

Material: Cast Steel
Finish: Black Oxide

Note: When using a rod clevis in combination with an eye bracket, the operating angle is limited to +/-75° from the bracket center line.

Rod Clevis Dimensions									
Part No.	Max Load in lbs. (Tension)	CB	CD (Dia.)	CE	CH	CW	ER (Radius)	KK	L
RC437	5667	0.750	0.500	1.500	1.000	0.500	0.500	7/16 - 20	0.750
RC500	6533	0.750	0.500	1.500	1.000	0.500	0.500	1/2 - 20	0.750
RC625		0.750	0.500	1.500	1.000	0.500	0.500	5/8 - 18	0.750
RC750	14933	1.250	0.750	2.375	1.250	0.625	0.750	3/4 - 16	1.250
RC875		1.250	0.750	2.375	1.250	0.625	0.750	7/8 - 14	1.250
RC1000	26000	1.500	1.000	3.125	1.500	0.750	1.000	1 - 14	1.500
RC1250	44667	2.000	1.375	4.125	2.000	1.000	1.375	1 1/4 - 12	2.125
RC1375	44667	2.000	1.375	4.125	2.000	1.000	1.375	1 3/8 - 12	2.125
RC1500	60800	2.500	1.750	4.500	2.375	1.250	1.750	1 1/2 - 12	2.250
RC1750	60800	2.500	1.750	4.500	2.375	1.250	1.750	1 3/4 - 12	2.250
RC1875	87467	2.500	2.000	5.500	3.000	1.250	2.000	1 7/8 - 12	2.500
RC2250	130933	3.031	2.500	6.500	3.500	1.500	2.500	2 1/4 - 12	3.000
RC2500	130933	3.031	3.000	6.750	3.875	1.500	2.750	2 1/2 - 12	3.250
RC3250	208933	4.031	3.500	8.500	5.000	2.000	3.500	3 1/4 - 12	4.000
RC4000	294933	4.531	4.000	10.000	6.125	2.250	4.000	4 - 12	4.500



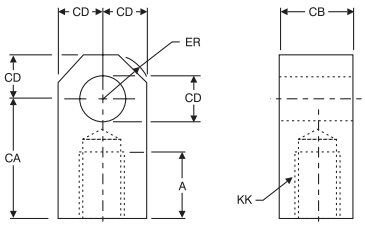
(Clevis Pins sold separately from Rod Clevises)

Rod Eye

Material: 1018 CRS
Finish: Black Oxide

Note: When using a rod eye in combination with a clevis bracket, the operating angle is +/-90° from the bracket center line

Rod Eye Dimensions							
Part No.	Max Load in lbs. (Tension)	A	CA	CB	CD (Dia.)	ER (Radius)	KK
RE437	6667	0.750	1.500	0.750	0.500	0.625	7/16 - 20
RE500	7600	0.750	1.500	0.750	0.500	0.625	1/2 - 20
RE750	16133	1.125	2.063	1.250	0.750	0.875	3/4 - 16
RE875	16133	1.125	2.063	1.250	0.750	0.875	7/8-14
RE1000	28933	1.625	2.813	1.500	1.000	1.187	1 - 14
RE1250	44667	2.000	3.438	2.000	1.375	1.563	1 1/4 - 12
RE1500	60000	2.250	4.000	2.500	1.750	2.000	1 1/2 - 12
RE1875	71333	3.000	5.000	2.500	2.000	2.500	1 7/8 - 12
RE2250	131600	3.500	5.812	3.000	2.500	2.813	2 1/4 - 12
RE2500	146667	3.500	6.125	3.000	3.000	3.250	2 1/2 - 12
RE3250	215067	4.500	7.625	4.000	3.500	3.875	3 1/4 - 12
RE3500	289733	5.000	7.625	4.000	3.500	3.875	3 1/2 - 12
RE4000	365067	5.500	9.125	4.500	4.000	4.438	4 - 12



(Clevis Pins sold separately from Rod Eyes)

Dimensions – Clevis, Pins & Mounts

Clevis Bracket

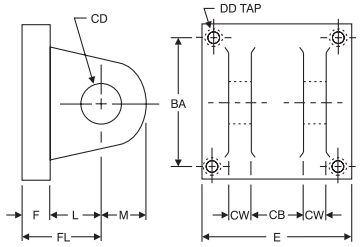
Material: Cast Steel
Finish: Black Oxide

Note: When using a rod clevis in combination with an eye bracket, the operating angle is limited to +/-75° from the bracket center line.

Clevis Bracket Dimensions

Part No.	Max Load in lbs. (Tension)	BA	CB	CD (Dia.)	CW	DD	E	F	FL	L	M
CB500	9733	1.625	0.750	0.500	0.500	3/8 - 24	2.500	0.375	1.125	0.750	0.500
CB750	18667	2.563	1.250	0.750	0.625	1/2 - 20	3.500	0.625	1.875	1.250	0.750
CB1000	25600	3.250	1.500	1.000	0.750	5/8 - 18	4.500	0.750	2.250	1.500	1.000
CB1375	49200	3.813	2.000	1.375	1.000	5/8 - 18	5.000	0.875	3.000	2.125	1.375
CB1750	45333	4.938	2.500	1.750	1.250	7/8 - 14	6.500	0.875	3.125	2.250	1.750
CB2000	44000	5.750	2.500	2.000	1.250	1 - 14	7.500	1.000	3.500	2.500	2.000
CB2500	46533	6.594	3.000	2.500	1.500	1 1/8 - 12	8.500	1.000	4.000	3.000	2.500
CB3000	45067	7.500	3.000	3.000	1.500	1 1/4 - 12	9.500	1.000	4.250	3.250	2.750
CB3500	111333	9.625	4.000	3.500	2.000	1 3/4 - 12	12.625	1.688	5.688	4.000	3.500
CB4000	136800	11.500	4.500	4.000	2.250	2 - 12	14.875	1.840	6.440	4.500	4.000

CLEVIS BRACKET



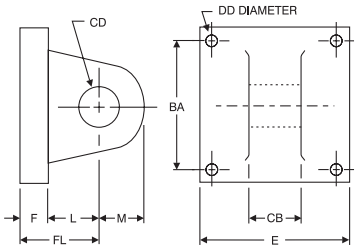
(Clevis Pins sold separately from Clevis Brackets)

Eye Bracket

Material: Cast Steel
Finish: Black Oxide

Eye Bracket Dimensions

Part No.	Max Load in lbs. (Tension)	BA	CB	CD (Dia.)	DD	E	F	FL	L	M
EB500	5467	1.625	0.750	0.500	0.406	2.500	0.375	1.125	0.750	0.500
EB750	14000	2.563	1.250	0.750	0.531	3.500	0.625	1.875	1.250	0.750
EB1000	27200	3.250	1.500	1.000	0.656	4.500	0.750	2.250	1.500	1.000
EB1375	28267	3.813	2.000	1.375	0.656	5.000	0.875	3.000	2.125	1.375
EB1750	65973	4.938	2.500	1.750	0.906	6.500	0.875	3.125	2.250	1.750
EB2000	93333	5.750	2.500	2.000	1.063	7.500	1.000	3.500	2.500	2.000
EB2500	125600	6.594	3.000	2.500	1.188	8.500	1.000	4.000	3.000	2.500
EB3000	162533	7.500	3.000	3.000	1.313	9.500	1.000	4.250	3.250	2.750
EB3500	76533	9.625	4.000	3.500	1.813	12.625	1.688	5.688	4.000	3.500
EB4000	100000	11.500	4.500	4.000	2.063	14.875	1.938	6.440	4.500	4.000

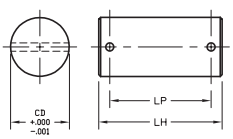


(Clevis Pins sold separately from Eye Brackets)

Pivot Pin (Includes Cotter Pins)

Pivot Pin (Includes Cotter Pins)

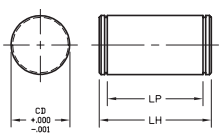
Part No.	Max Load in lbs. (Tension)	CD	LP	LH
CP500C	5800	0.500	1.97	2.33
CP750C	13250	0.750	2.75	3.15
CP1000C	23500	1.000	3.25	3.60
CP1375C	44500	1.375	4.28	4.63
CP1750C	72000	1.750	5.53	6.09
CP2000C	94000	2.000	5.53	6.09
CP2500C	145000	2.500	6.31	6.78
CP3000C	210000	3.000	6.35	6.84
CP3500C	285000	3.500	8.41	8.97
CP4000C	375000	4.000	9.41	9.97



Pivot Pin (Includes E-Clips)

Pivot Pin (Includes E-Clips)

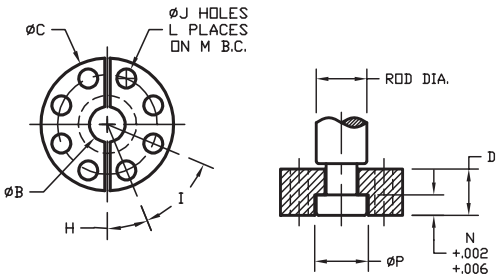
Part No.	Max Load in lbs. (Tension)	CD	LP	LH
CP500E	5800	0.500	1.88	2.13
CP750E	13250	0.750	2.63	2.88
CP1000E	23500	1.000	3.13	3.38
CP1375E	44500	1.375	4.13	4.50
CP1750E	72000	1.750	5.19	5.55
CP2000E	94000	2.000	5.19	5.55
CP2500E	145000	2.500	6.19	6.63
CP3000E	210000	3.000	6.25	6.78
CP3500E	285000	3.500	8.13	8.85
CP4000E	375000	4.000	9.19	9.86



Dimensions – KK10 Rod End Coupler & Weld Plate

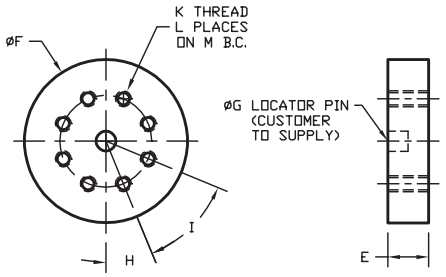
Flange End Coupler

Flange End 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



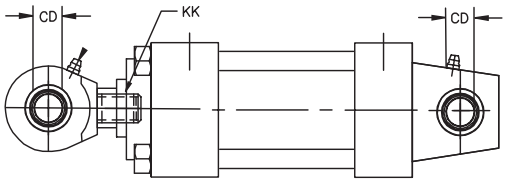
Weld Plate

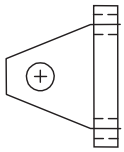
Weld Plate Dimensions									
Part No.	Rod Dia.	E	F	G (Dia.)	H	I	K	L	M
WP625	0.625	0.500	2.000	0.250	45.0°	90.0°	10 - 24	4	1.125
WP1000	1.000	0.500	2.500	0.250	30.0°	60.0°	1/4 - 20	6	1.500
WP1375	1.375	0.625	3.000	0.250	30.0°	60.0°	5/16 - 18	6	2.000
WP1750	1.750	0.625	4.000	0.250	22.5°	45.0°	5/16 -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



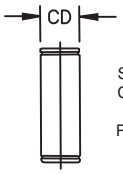
To be used with KK10 style rod end

Dimensions – MH & HH Series Spherical Bearings





Spherical Brg.
Clevis Bracket



Spherical Brg.
Clevis Bracket
Pivot Pin &
Retaining Ring

Note: Lube fittings for cylinder and spherical rod eye on picture.

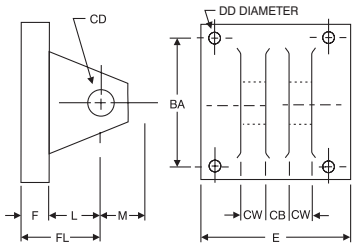
Bore	Rod Diameter (MM)	KK	CD	Spherical Bearing Rod Eye Part Number	Spherical Bearing Clevis Bracket Part Number	Spherical Bearing Clevis Bracket Pivot Pin Part Number	Spherical Bearing Pivot Pin Retaining Ring Part Number
1.50	0.625	7/16 - 20	0.500	HH-MSRE-500	CB500-SB	CP500-SB	SH-50 STPA
	1.000						
2.00	1.000	3/4 - 16	0.750	HH-MSRE-750	CB750-SB	CP750-SB	SH-75 STPA
	1.375						
2.50	1.000	3/4 - 16	0.750	HH-MSRE-750	CD750-SB	CP750-SB	SH-75 STPA
	1.375						
	1.750						
3.25	1.375	1- 14	1.000	HH-MSRE-1000	CB1000-SB	CP1000-SB	SH-100 STPA
	1.750						
	2.000						
4.00	1.750	1 1/4 - 12	1.375	HH-MSRE-1375	CB1375-SB	CP1375-SB	SH-137 STPA
	2.000						
	2.500						
5.00	2.000	1 1/2 - 12	1.750	HH-MSRE-1750	CB1750-SB	CP1750-SB	SH-175 STPA
	2.500						
	3.000						
	3.500						
6.00	2.500	1 7/8 - 12	2.000	HH-MSRE-2000	CB2000-SB	CP2000-SB	SH-200 STPA
	3.000						
	3.500						
	4.000						

Spherical Bearing Clevis Bracket

Note: For use with spherical bearing cylinder mounts and MH & HH Series Spherical Rod Eye.

Material: Cast Steel
Finish: Black Oxide

Clevis Bracket Dimensions											
Part No.	Max Load in lbs. (Tension)	BA	CB	CD (Dia.)	CW	DD (Dia.)	E	F	FL	L	M
CB500-SB	5770	2.050	0.440	0.500	0.500	0.410	3.000	0.500	1.500	1.000	0.500
CB750-SB	9450	2.760	0.660	0.750	0.620	0.530	3.750	0.625	2.000	1.375	0.875
CB1000-SB	14300	4.100	0.880	1.000	0.750	0.530	5.500	0.750	2.500	1.750	1.000
CB1375-SB	20300	4.950	1.190	1.375	1.000	0.660	6.500	0.875	3.500	2.625	1.380
CB1750-SB	37800	6.580	1.530	1.750	1.250	0.910	8.500	1.250	4.500	3.250	1.750
CB2000-SB	50375	7.920	1.750	2.000	1.500	0.910	10.620	1.500	5.000	3.500	2.000

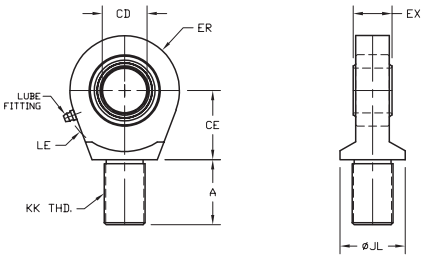


(Clevis Pins sold separately from Clevis Brackets)

Dimensions – MH & HH Series Spherical Bearings

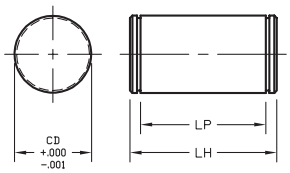
Male Spherical Rod Eye

Eye Bracket Dimensions										
Part No.	Bore Reference	A	CD	CE	ER	EX	JL	KK	LE	Load Capacity (lbs.)
HH-MSRE-500	1.50	0.688	0.500	0.875	0.875	0.437	0.875	7/16-20	0.750	2600
HH-MSRE-750	2.00	1.000	0.750	1.250	1.250	0.656	1.313	3/4-16	1.063	9400
HH-MSRE-750	2.50	1.000	0.750	1.250	1.250	0.656	1.313	3/4-16	1.063	9400
HH-MSRE-1000	3.25	1.500	1.000	1.875	1.375	0.875	1.500	1-14	1.438	16800
HH-MSRE-1375	4.00	2.000	1.375	2.125	1.813	1.188	2.000	1 1/4-12	1.875	28500
HH-MSRE-1750	5.00	2.125	1.750	2.500	2.188	1.531	2.250	1 1/2-12	2.125	43000
HH-MSRE-2000	6.00	2.875	2.000	2.750	2.625	1.750	2.750	1 7/8-12	2.500	70200



Spherical Bearing Pivot Pin (Includes E-Clips)

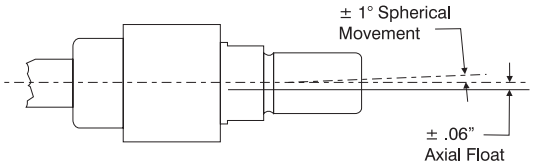
Pivot Pin (Includes E-Clips)				
Part No.	Max Load in lbs. (Tension)	CD	LP	LH
CP500-SB	8600	0.499	1.56	1.78
CP750-SB	19300	0.749	2.03	2.28
CP1000-SB	34300	0.999	2.50	2.75
CP1375-SB	65000	1.374	3.31	3.61
CP1750-SB	105200	1.749	4.22	4.58
CP2000-SB	137400	1.999	4.94	5.30



Alignment Couplers

Solid Steel Self-Aligning Piston Rod Couplers

Bimba'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!



Material: 100,000 minimum yield. Stress-Proof™

- Benefits
  - Rod alignment couplers eliminate expensive machining for mounting fixed or rigid cylinders on guided or slide applications.
  - Simplifies alignment problems in the field.
- Design Tips
  - Alignment couplers can be exposed to high stresses that are not apparent in an application. Always use the largest thread size practical in your application (see chart for maximum pull yields)
  - Use jam nut to lock coupler to rod when used with full diameter threads (example: 1.00" thread on 1.00" rod)
  - Large thread sizes can be pinned in tough duty applications, eliminating unwanted loosening of coupler from rod. Always use the smallest pin possible to avoid weakening the piston rod thread



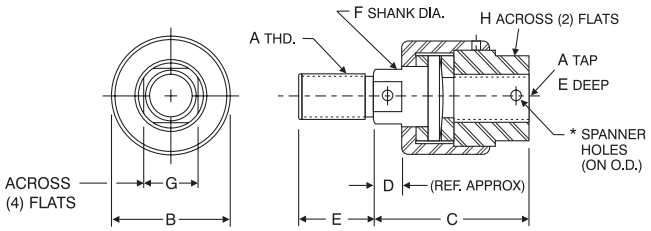
Standard AC Coupler
AC250 – AC5000



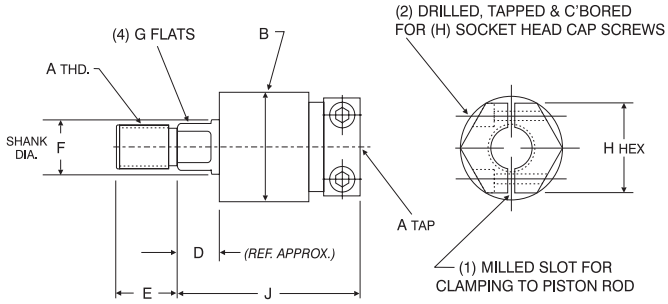
ACH Coupler
ACH250 – ACH1250

Dimensions – Alignment Couplers

AC Series



ACH Series



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

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

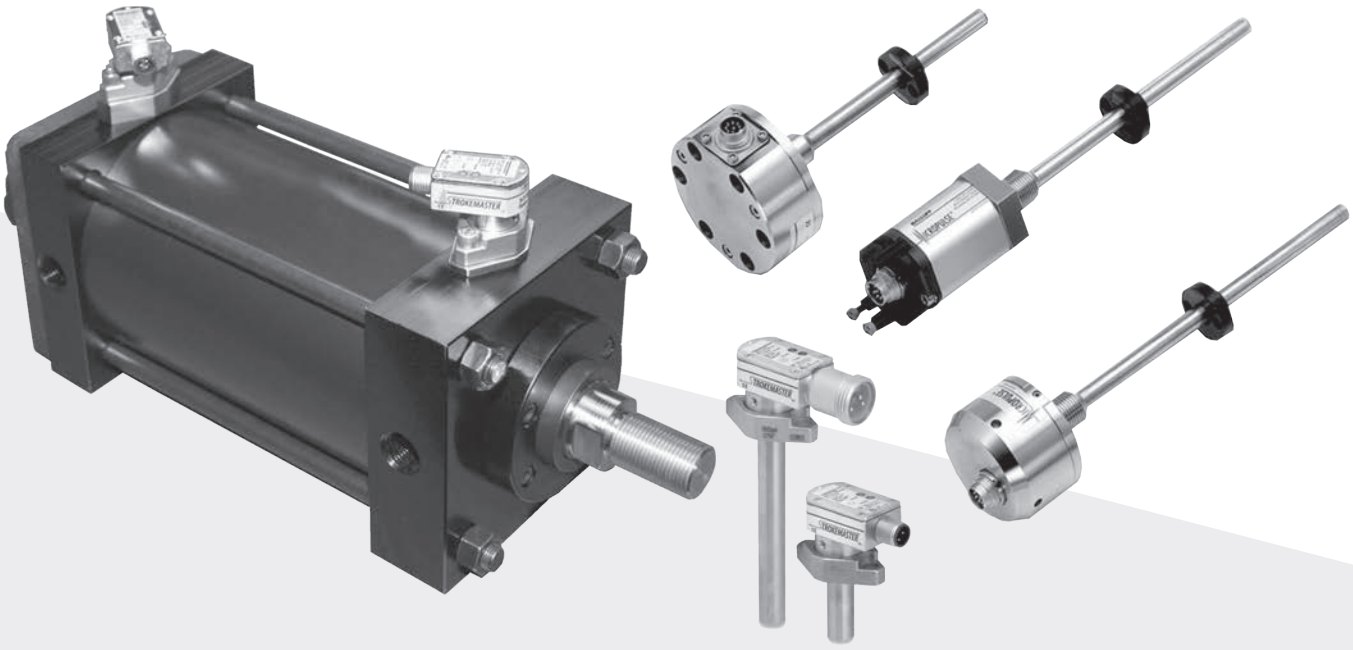
Recommended Max. Stroke for Cylinders with Alignment Couplers in Horizontal Applications	
Bore	**Maximum Stroke**
1.50	27
2.00	43
2.50	50
3.25	50
4.00	55
5.00	55
6.00	55
8.00	55

Accessories Weight Chart (in lbs.)

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

Sensors & Transducers

Bimba offers a variety of positioning sensing options to accommodate your unique application needs, including reed switches, solid state switches, inductive sensors, and magnetostrictive transducers.



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142 DC Inductive Sensors

143 AC/DC Inductive Sensors

144 Cable Connectors

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145 – How it Works
146 – Rod Styles Technical Data

147 Temposonics® Transducers

Features & Benefits

Strokemaster™ Inductive Sensors

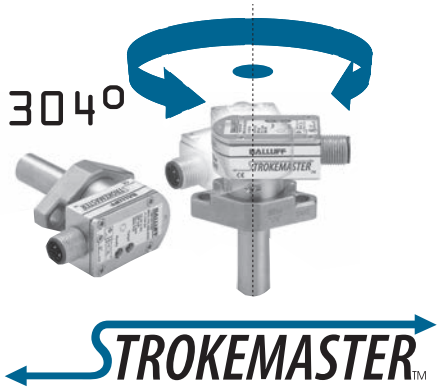


Flexible Solutions for an Often Inflexible World

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

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

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



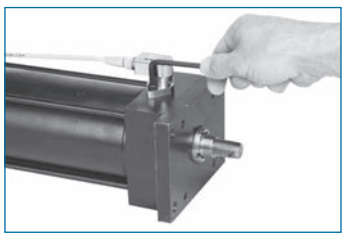
Strokemaster® sensors are available in 3-wire or 4-wire DC and 3-wire AC/DC versions, mini or micro connectors. Switching frequency is 50 Hz in the AC/DC versions. All units are weld-field immune and short-circuit and reverse polarity protected. They fit all popular cylinder designs, with standard probe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

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

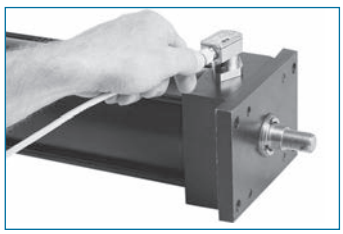
Inductive cylinder switch for piston position feedback in cylinders.

Features/Advantages

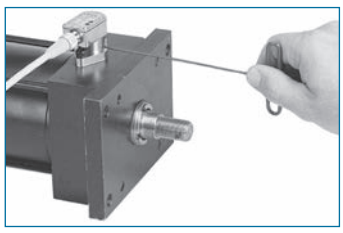
- > Magnetic field immune, for use with welding equipment
- > Available in DC or all current (AC/DC) versions
- > Easy installation - sensor mounts to cylinder with two fasteners
- > Sealed directly at flange, connector can be oriented after installation
- > Various lengths available for different cylinder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



Bolt sensor to cylinder.



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

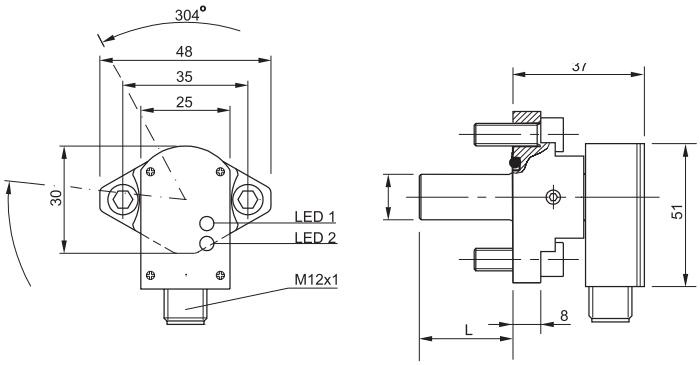


Lock chosen position with one or both of the two integral set screws.

How to Specify

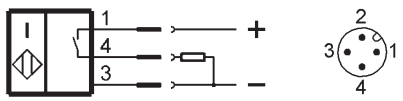
Technical Data – DC Inductive Sensor

PNP Normally-Open	BES 516-300-S 295-S 4
Rated operational voltage Ue	24 VDC
Supply voltage UB	10-30 VDC
Voltage drop Ud at Ie	< 2.5 V
Rated insulation voltage Ui	75 VDC
Rated operational current Ie	200 mA
No-load supply current Ir d./und.	< 18 mA/< 10 mA
Off-state current Ir	< 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 Ta	-25...+70°C
Frequency of operating cycles f	10 Hz
Utilization categories	DC 13
Function/Operating voltage indication	Yes/Yes
Degree of protection per IEC 529	IP 67/connector IP 65
Housing material	Stainless steel/aluminum
Material of sensing face	Ceramic
Connection	Micro connector
Approvals	cULus
High pressure rated up to	207 bar (3000 PSI)
Recommended connector	BCC M415-0000-1A-003-VX44T2-050



Micro M12DC Connector

Wiring Diagram – PNP Normally Closed

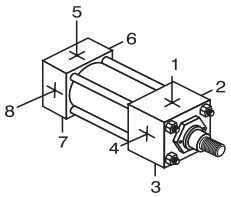


Bimba will supply the correct length probe and spacer combination (if required) for each cylinder. Using the combination of standard probe lengths and spacers will give the appropriate .030" gap between sensor and cylinder spud. The spacers supplied have the same base profile as the sensor.

Material: Stainless Steel

How To Order

Cylinders with Strokemaster® Inductive Sensors



Standard Locations

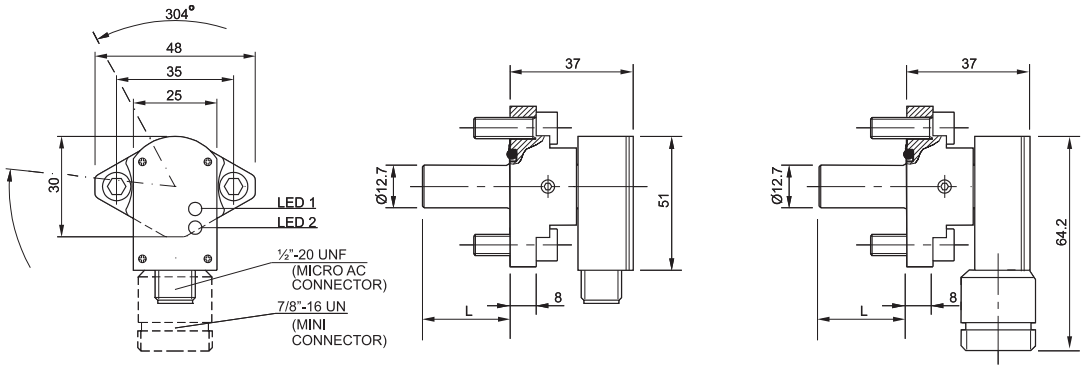
Ports at 1 and 5
Cushions at 2 and 6
Sensors at 4 and 8

Specify non-standard locations

Cylinder Model Number:	HH-MS4-325x6-H2C6-100-KK1-P15=N500-SSSS
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

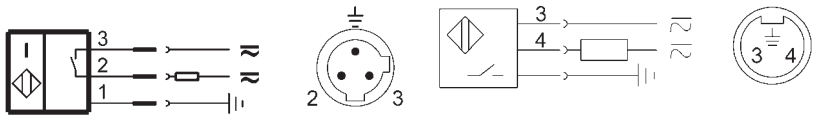
Note: Bimba will include the Strokemaster® probe length on your order and any sensor spacers required.
Example: HH-MS4-325x6-H2C6-100-KK1-P15=N500-SSSS-BES 516-300-S4 /1.025-S21 (Head) -BES 516-300-S4 /1.75-S21 (Cap) - Sensors at 4 & 8.

Technical Data – AC/DC Inductive Sensor



Normally-open	BES 516-200-S 2-S21	BES 516-200-S 2-S5
Rated operational voltage Ue	110 VAC	110 VAC
Supply voltage UB	20-250 V AC/DC	20-250 V AC/DC
Voltage drop Ud at Ie	< 6 V	< 6 V
Rated insulation voltage Ui	250 VAC	250 VAC
Rated operational current Ie	500 mA	500 mA
Minimum operational current Im	5 mA	5 mA
Off-state current Ir	< 1.7 mA @ 110 VAC	< 1.7 mA @ 110 VAC
Inrush current Ik (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 Ta	-25...+70°C	-25...+70°C
Frequency of operating cycles f	< 50 Hz	< 50 Hz
Utilization categories	AC 140/DC 13	AC 140/DC 13
Function/Operating voltage indication	Yes/Yes	Yes/Yes
Degree of protection per IEC 529	IP 67	IP 67
Insulation class	1	1
Housing material	Stainless steel/aluminum	Stainless steel/aluminum
Material of sensing face	Ceramic	Ceramic
Connection	Micro connector	Mini connector
Approvals	cULus	cULus
High pressure rated up to	207 bar (3000 PSI)	207 bar (3000 PSI)
Recommended connector	BCC A213-0000-1C-123-EX43T2-050	BCC A313-0000-10-071-VX43W6-050

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

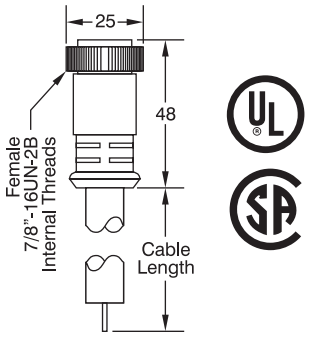


Material: Stainless Steel

How to Specify

Technical Data – Cable Connectors

S5 – Mini Connectors
7/8"-16 UNF Threads

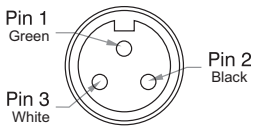


Recommended Connector	BCC A313-0000-10-071-VX43W6-050
Connector	3-5 Pole Mini
Style	Mini Size A
Configuration	Straight Female

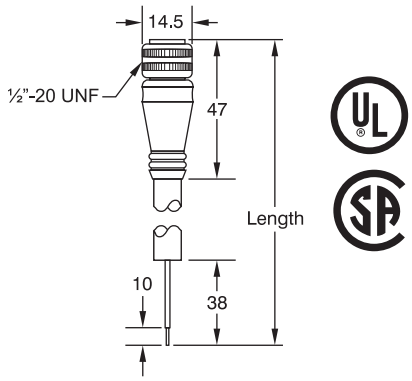
	Order Number
3 Pole	**BCC A313-0000-10-071-VX43W6-050**
Voltage Rating	300 V AC/DC
Current	10 A
Wire Gauge	16 AWG
Jacket	PVC
Coupling Nut	Black Epoxy Coated Zinc
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-4°F - 221°F (-21°C - 105°C)
UL Listed	Yes
CSA Certified	Yes

For 3 pole versions only

Female 3-pin - Face view



S21 – Micro Connectors
1/2"-20 UNF Threads



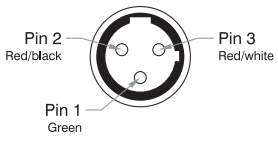
Recommended Connector	BCC A213-0000-1C-123-EX43T2-050
Connector	Micro AC 1/2" x 20 UNF
Style	3 Pin Dual Keyway
Configuration	Straight Female

	Order Number
3 Pin Dual Keyway	**BCC A213-0000-1C-123-EX43T2-050**
Voltage Rating	250 V AC/DC
Current	4 A
Wire Gauge	22 AWG
Jacket	TPE
Coupling Nut	Black Epoxy Coated Zinc
O-Ring	FKM
Overmold Head	TPE
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-4°F - 221°F (-21°C - 105°C)
UL Listed	Yes
CSA Certified	Yes

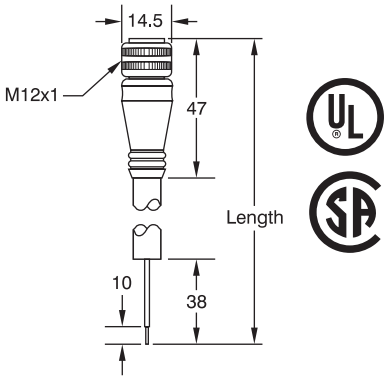
Note: 15 ft (5 m) cable is standard (other lengths available - consult factory)

For 3 pole versions only

Female - Face view



S4 – Micro Connectors
M12x1 Metric Threads



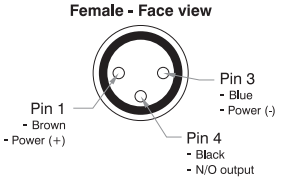
Recommended Connector	BCC M415-0000-1A-003-VX44T2-050
Connector	Micro
Style	M12 DC Single Keyway
Configuration	Straight Female

Note	Order Number
3 Wire DC	
3 Wire Normally Open, non-LED	**BCC M415-0000-1A-001-*X43T2-050**
3 Wire Normally Open PNP w/ LED	**BCC M415-0000-1A-004-*X43T2-050**
4 Wire DC (NO/NC)	
4 Wire, non-LED	**BCC M415-0000-1A-003-*X44T2-050**
4 Wire PNP w/LED	**BCC M415-0000-1A-008-*X44T2-050**
Voltage Rating	10 - 30 VDC
Current	4 A
Wire Gauge	22 AWG
Jacket	Yellow PVC or TPE
Coupling Nut	Black Epoxy Coated Zinc
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-4°F - 221°F (-21°C - 105°C)
UL Listed	Yes
CSA Certified	Yes

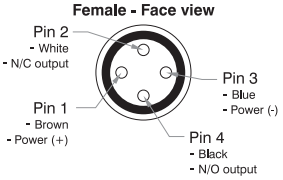
Note: 15 ft (5 m) cable is standard (other lengths available - consult factory)

* Insert V = PVC Cable
E = TPE Cable

Female - Face view



Female - Face view



Balluff Micropulse™ Linear Position Transducers

Transducers For Any Application

> Rod Styles
> Tubular Styles
> Embeddable Style
> Explosion-Proof Style (For J Series & Z-DEX Series, consult factory for details)

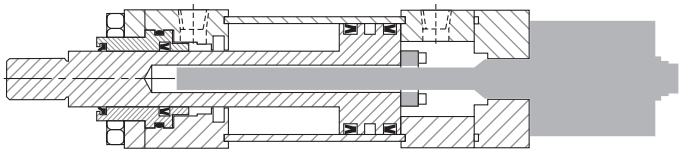


Internal Models – Z, W & K Series

> Not available on MP1 and MP2 Mounts. Consult factory for special applications.
> 1.50" to 8.00" Bores
> May require additional cap length
> Gun-drilled piston rod (Requires 1" piston rod or larger)
> Magnet (Installed on piston)

Bimba 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 Bimba before shipping (some exceptions apply).





Z Series Shown

How It Works

Enhanced Magnetostrictive Technology

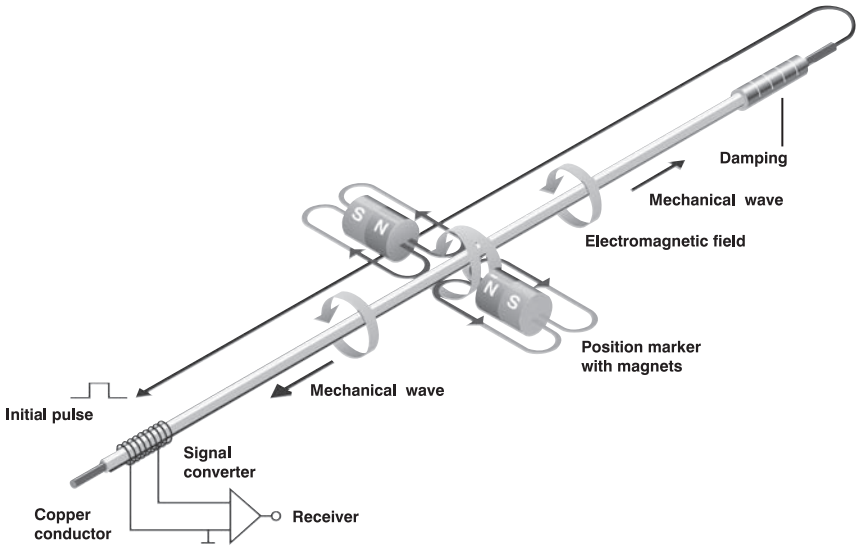
The waveguide consists of a special nickel-iron alloy with 0.7 mm O.D. and 0.5 mm I.D.

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

A permanent magnet at the point of measurement is used as the marker element, whose lines of field run at right angles to the electromagnetic field.

In the area on the waveguide where the two fields intersect, a magnetostrictive effect causes an elastic deformation of the waveguide, which propagates along the waveguide in both directions in the form of a mechanical wave.

The mechanical wave is converted to an electrical signal by the signal converter. The propagation time of the mechanical wave is determined by the position of the permanent magnet and can be determined to resolutions down to 5 µm.



Technical Data - Transducer Rod Styles

Rod Style



> Z Series
- » 3/4" x 16 UNF threads
- » Pressure rated to 8700 PSI for use in hydraulic cylinders
- » Replaceable electronics head
- » Analog signal adjustable in field

Rugged, Compact Rod Style



> W Series
- » Rugged all stainless steel housing
- » Eliminates the need for protective cover
- » Designed for demanding applications
- » 3/4" - 16 UNF threads
- » Pressure rated to 8700 PSI

Compact, Bolt-In Rod Style



> K Series
- » Rugged all stainless steel housing
- » Bolt in design
- » Pressure rated to 8700 PSI
- » Eliminates the need for protective cover

Sensor Output Options			
Analog			
0...10 V and 10...0 V	•	•	•
-5...+5 V and +5...-5 V	•	•	•
-10...+10 V and +10...-10 V	•	•	•
4...20 mA or 20...4 mA	•	•	•
0...20 mA or 20...0 mA	•	•	•
Digital			
Start/Stop, RS422	•	•	•
Pulse-Width Modulated, RS422	•	•	•
PWM (w/ recirculation), RS422	•	•	•
Specialized			
Synchronous Serial Interface*	•	•	•
CANopen	•		
Profibus DP	•		
Quadrature	•		
Resolution			
0.1 mV (analog)		•	•
0.2 µA (analog)		•	•
16 bit (analog)	•		
Controller-dependent (Start/Stop & PWM)	•	•	•
1,2,3,5,10 µm selectable (Quadrature output)	•		
1,5,10,20,40 µm selectable (SSI output)	•	•	•
5 µm increments selectable (CANopen & Profibus)	•		
Stroke Length			
Active measurement area: 1" to 156"	1" - 156"	1" - 156"	1" - 156"
(Consult factory for longer lengths)			
Wiring Options			
Quick disconnect	•	•	•
Cable-out	•	•	•
Operating Voltage			
24 V DC (±20%)	•	•	•
±15 V DC (±2%)	•	•	•

* 24 or 25 bit binary or gray code

Temposonics® Transducers

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

Hydraulic/Pneumatic H Style

- > Sensing element pressure housing threads into standard size port on cylinder end cap
- > Industry standard for position feedback in fluid power cylinders
- > Convenient sensor cartridge field replacement without need to break oil seal
- > High pressure flange and isolation tube (5000 PSI static, 10,000 PSI spike)
- > Additional output ranges available
- > (2) Includes CANOpen and MTS multiple-magnet position, velocity and programmable limit switch output
- > (3) R-Series SSI available with 0.001mm (0.00004 in.) resolution
- > (4) Analog (Voltage or Current) resolution restricted by output ripple

Technical Data

R Series



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

G Series



Programmable sensors with built in diagnostics.

	H Style – Hydraulic/Pneumatic 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)
	Current 0 or 4 to 20 mA, 20 to 4 or 0 mA	Current 0 or 4 to 20 mA, 20 to 4 or 0 mA
	SSI, Synchronous Serial Interface, (absolute encoder format)	–
	Fieldbus - CANbus (2), DeviceNet, Profibus DP	–
	–	Digital Pulse Start/Stop or PWM
Stroke Length	50 to 7,620 mm (2 to 300 in.)	Voltage or Current 50 to 2,540 mm (2 to 100 in.) Digital Pulse 50 to 7,620 mm (2 to 300 in.)
Resolution	16 bit, as low as 0.01 mm (0.0004 in.) (Analog)	Infinite (6)
	as low as 0.002mm (0.00008 in.) (Digital) (5)	Controller Dependent (Digital Pulse)
Measurement Features	Position / Displacement	Position / Displacement
	Velocity	–
	Multiple magnets to 15	Multiple magnets to 15
	Analog Zero and Span Scale Adjustment	Analog Zero and Span Scale Adjustment
External Interfaces	–	TDU-200 Digital Display (for digital pulse outputs)
	–	MK-292 (Parallel 24 Bit Binary, BCD or Gray Code)

Notes

Technical Data

The Technical Data catalog section allows customers to order Bimba cylinders with ease and confidence. Reference charts include cylinder speeds, conversion charts, seal compatibility, and common fluid power formulas.



Contents

149 Technical Data

151 Hydraulic Cylinder Speeds

152 Seal Compatibility with Common Fluids

153 Elastomer Characteristics

154 Conversion Charts

155 Common Fluid Power Formulas

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
7.00	None	6	18	30	48	72	90	120	150	180	240	300	450
	3.000	7.5	22	37	59	88	110.5	147	184	220.5	294	367.5	551.5
	3.500	8	24	40	64	96	120	160	200	240	320	400	600
	4.000	9	26.5	44.5	71.5	107	133.5	178.5	223	267.5	356.5	445.5	668.5
	4.500	10	30.5	51	82	123	153.5	204.5	256	307	409	511.5	767.5
	5.000	12.5	37	61.5	98	147	184	245	306.5	367.5	490	612.5	919
8.00	None	4	14	23	36	55	69	92	115	135	185	230	345
	3.500	5.5	17	28	45	68	85	115	140	170	230	285	420
	4.000	6	18	30	49	73	90	122	150	180	240	305	450
	4.500	6.5	20	33	53	80	100	135	165	200	265	335	495
	5.000	7.5	22	38	60	90	114	150	185	225	300	375	555
	5.500	8.5	26	43	70	104	129	172	215	255	345	430	645

Data shown are cylinder rod travel speeds in inches per minute. The extension speeds represent the net piston area for rod diameters shown.

Seal Compatibility With Common Fluids

Fluid Name	Mfg. Code[1]	Military Specification	Trade Name/ Number	Color	Type of Seal Compound - Common Name[2]								
					Buna-n	Butyl	Corfam	EP	FKM	Silicone	Neoprene	Natural Rubber	Polyurethane
Water-Glycol	1	—	Houghto-Safe 600 Series	red	R	R	R	R	R	S	S	R	U
	1	—	Houghto-Safe	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

1. Manufacturer Code/Number

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. 10. Texaco

2. R = Recommended S = Satisfactory M = Marginal U = Unsatisfactory (dash) = Insufficient Data

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

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	CSM	EPM	V	FPM	FSI	NR	NBR		ACM	TR	AU-EU	SI	ECD	
Upper Temp. Limit °F	194	500	212	248	284	347	392	176	230	266	320	221	212	392	284	896
Lower Temp. Limit °F	-58	-148	-22	-4	-49	5	-76	-76	-40	-49	-4	-67	-58	-76	-40	-400
Abrasion Resistance	S	U	M	R	•	S	•	R	R	S	•	•	R	•	S	R
Compression Set Resistance	•	•	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 Metals	R	S	S	R	S	R	R	R	•	R	S	R	R	R	S	S

R = Recommended S = Satisfactory M = Marginal U = Unsatisfactory • = Insufficient Data

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/cm^2 = PSI x .0703
PSI = Kg/cm^2 x 14.22

Bars = PSI x .0689
Bars = Kg/cm^2 x .98

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

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

Common Fluid Power Formulas

Property	Word Formula	Mathematic Equation
Fluid Pressure PSI (Pounds Per Square Inch)	Pressure = $\frac{\text{Force (lbs)}}{\text{Area (in}^2\text{)}}$	$P = \frac{F}{A}$
Cylinder Area Extend In^2 (Square Inches)	Area = $\frac{\pi}{4}$ x Diameter^2 (inches)	$A = .7854\ D^2$
Cylinder Area Retract In^2 (Square Inches)	Area = ($\frac{\pi}{4}$ x Bore Diameter^2) – ($\frac{\pi}{4}$ x Rod Diameter^2)	$A = (.7854\ D_1^2) – (.7854\ D^2)$
Cylinder Force Lbs. (Pounds Of Force)	Force = Pressure (PSI) x Net Area (in^2)	$F = PA$
Cylinder Velocity Ft/S (Feet Per Second)	Velocity = $\frac{231 \times \text{Flow Rate (GPM)}}{12 \times 60 \times \text{Net Area (in}^2\text{)}}$	$v = \frac{.3208\ Q}{A}$
Cylinder Volume G (Gallons Of Fluid)	Volume = $\frac{\text{Net Area (in}^2\text{)} \times \text{Stroke (in)}}{231}$	$V = \frac{A\ L}{231}$
Cylinder Flow Rate GPM (Gallons Per Minute)	Flow Rate = $\frac{12 \times 60 \times \text{Velocity (ft/s)} \times \text{Net Area (in}^2\text{)}}{231}$	$Q = 3.117\ v\ A$
Cylinder Power hp (Horsepower)	Horsepower = $\frac{\text{Pressure (PSI)} \times \text{Flow Rate (GPM)}}{1714}$	$hp = \frac{P\ Q}{1714}$
Fluid Motor Torque Lb-In (Inch Pounds)	Torque = $\frac{\text{Pressure (PSI)} \times \text{FM Displacement (in}^3\text{/rev.)}}{2\ \pi}$	$T = \frac{P\ d}{2\ \pi}$
	Torque = $\frac{\text{Horsepower} \times 63025}{\text{RPM}}$	$T = \frac{63025\ hp}{n}$
	Torque = $\frac{\text{Flow Rate (GPM)} \times \text{Pressure (PSI)} \times 36.77}{\text{RPM}}$	$T = \frac{36.77\ Q\ P}{N}$
Fluid Motor Speed RPM (Revolutions Per Minute)	Speed = $\frac{231 \times \text{Flow Rate (GPM)}}{\text{FM Displacement (in}^3\text{/rev.)}}$	$n = \frac{231\ Q}{d}$
Fluid Motor Power hp (Horsepower)	Horsepower = $\frac{\text{Torque (lbs-in)} \times \text{RPM}}{63025}$	$hp = \frac{T\ n}{63025}$
Pump Outlet Flow GPM (Gallons Per Minute)	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)	Velocity = $\frac{.3208 \times \text{Flow Rate Through ID (GPM)}}{\text{Internal Area (in}^2\text{)}}$	$v = \frac{.3208\ Q}{A}$
Torque Requirement Lb-In (Inch Pounds)	Torque = Lever Length (in.) x Pull (lbs.)	$T = L\ F$

Notes

Compact Hydraulic Cylinders

Compact Hydraulic cylinders are designed to be space-saving, longlasting devices for demanding design requirements. They offer heavyduty power in a small package without sacrificing performance. The Medium-Duty (CMH) incorporates thick-walled, black anodized aluminum housing with optional switch groove, while the Heavy-Duty (CHH) is made of thick-walled, black oxide steel housing. Both models have high yield chrome-plated steel rods riding in electroless nickel-plated ductile cast iron rod bearings. Compact Hydraulic cylinders are metric in design (bore and rod sizes) and are offered in inch or metric mounting and porting. Due to their 100% machined design, they can be easily customized for today's automation equipment in mind.





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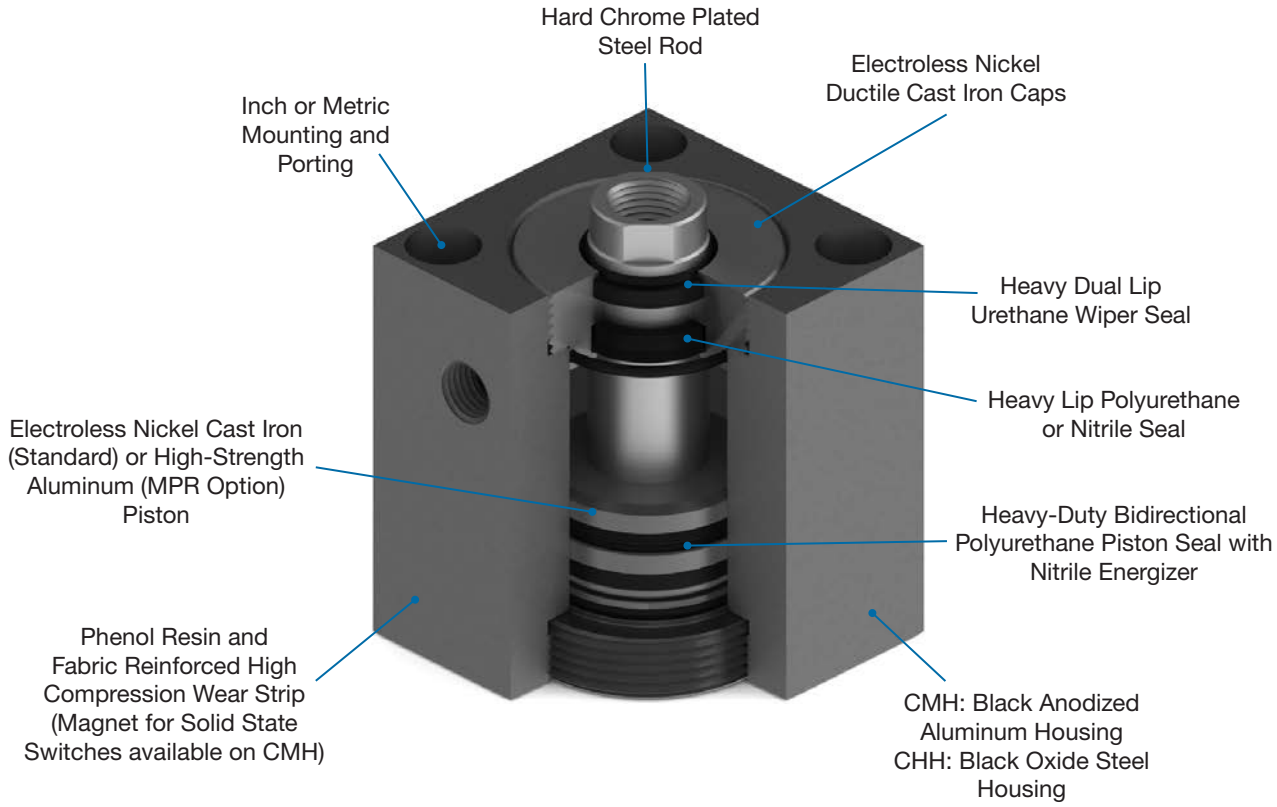
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Product Features



Features and Benefits

- Permanently lubricated with Magnalube-G grease on all internal components. This non-migratory high performance grease provides outstanding service life.
- Electroless Nickel (EN) plated cast iron piston and end caps provide excellent bearing surface and corrosion resistance for extended cylinder life.
- Piston rod is machined from a high yield, polished and hard chrome plated steel to reduce wear on the rod wiper and seal.
- Includes heavy lip polyurethane or nitrile seals, which are pressure activated and wear-compensating for longevity.
- Heavy dual lip urethane wiper seal removes contaminants on the retract stroke to ensure long life for all internal components.
- **CMH:** Precision machined from high strength aluminum and black anodized for corrosion resistance. Honed and work hardened I.D. finish (optional magnet).
- **CHH:** Precision machined from steel with a hot dipped black oxide coating for corrosion resistance. Honed and work hardened I.D. with a micro finish for extended seal life.

How It Works



MX0 Mount



MXF Mount



MXR Mount



MXE Mount

Materials of Construction

End Caps:	Electroless Nickel Plated Ductile Cast Iron
Body:	CMH - Black Anodized Aluminum CHH - Black Oxide Steel
Piston Rod:	Hard Chrome Plated Steel
Lubrication:	Magnalube-G
Seals:	Buna-N and Urethane Standard

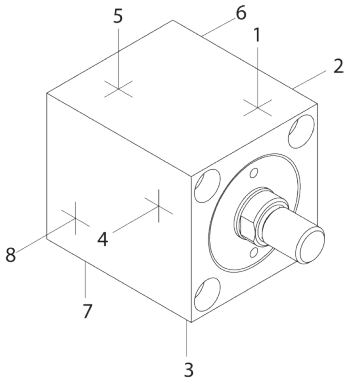
Engineering Specifications

Temperature:	-10°F to 212°F (-23°C to 100°C)
Pressure Rating:	CMH – Up to 140 Bar (2030 PSI)[1] CHH – Up to 206 Bar (3000 PSI)[1]
Stroke Tolerance:	+1mm / -0mm (+0.04" / -0.00")

[1]Depending on bore size

Technical Data

Standard Port Position



Notes
Label at Positions 1 and 5
Ports at Positions 2 and 6
Specify non-standard positions when ordering

Maximum Stroke in mm (in)

Bore	CMH	CHH
25mm (0.98)	75 (2.95)	60 (2.36)
32mm (1.26)	100 (3.93)	75 (2.95)
40mm (1.57)	125 (4.92)	115 (4.53)
50mm (1.97)	125 (4.92)	115 (4.53)
63mm (2.48)	125 (4.92)	125 (4.92)
76mm (3.00)	125 (4.92)	125 (4.92)
101mm (4.00)	125 (4.92)	—

Technical Data

CMH Approximate Cylinder Weights kg (lb)

Bore (in)	Single Rod Zero Stroke			Double Rod Zero Stroke			Piston Rod Per mm
	Standard Piston	Magnet Piston	Per mm Stroke	Standard Piston	Magnet Piston	Per mm Stroke	To Calculate Extra Rod Extensions
25mm (0.98)	0.47 (1.03)	0.43 (0.95)	0.007 (0.016)	0.48 (1.05)	0.44 (0.97)	0.009 (0.019)	0.0013 (0.0028)
32mm (1.26)	0.85 (1.87)	0.79 (1.73)	0.011 (0.024)	0.87 (1.91)	0.80 (1.77)	0.013 (0.028)	0.0020 (0.0044)
40mm (1.57)	1.24 (2.74)	1.13 (2.48)	0.013 (0.029)	1.28 (2.81)	1.16 (2.55)	0.016 (0.036)	0.0031 (0.0068)
50mm (1.97)	1.92 (4.24)	1.72 (3.78)	0.019 (0.042)	1.98 (4.36)	1.77 (3.90)	0.024 (0.053)	0.0049 (0.0108)
63mm (2.48)	3.11 (6.85)	2.78 (6.12)	0.024 (0.054)	3.21 (7.08)	2.88 (6.35)	0.033 (0.072)	0.0082 (0.0180)
76mm (3.00)	5.20 (11.46)	4.57 (10.07)	0.036 (0.080)	5.41 (11.93)	4.78 (10.54)	0.049 (0.108)	0.0127 (0.0280)
101mm (4.00)	9.03 (19.91)	9.03 (19.91)	0.051 (0.112)	9.54 (21.02)	9.54 (21.02)	0.070 (0.155)	0.0196 (0.0432)

CHH Approximate Cylinder Weights kg (lb)

Bore (in)	Single Rod Zero Stroke		Double Rod Zero Stroke		Piston Rod Per mm
	Standard Piston	Per mm Stroke	Standard Piston	Per mm Stroke	To Calculate Extra Rod Extensions
25mm (0.98)	0.92 (2.02)	0.018 (0.040)	0.93 (2.04)	0.020 (0.043)	0.001 (0.0028)
32mm (1.26)	1.63 (3.60)	0.027 (0.060)	1.65 (3.64)	0.029 (0.064)	0.002 (0.0044)
40mm (1.57)	2.13 (4.70)	0.032 (0.070)	2.16 (4.77)	0.035 (0.077)	0.003 (0.0068)
50mm (1.97)	3.26 (7.18)	0.045 (0.100)	3.31 (7.30)	0.050 (0.111)	0.005 (0.0108)
63mm (2.48)	4.87 (10.73)	0.054 (0.120)	4.97 (10.96)	0.063 (0.138)	0.008 (0.0180)
76mm (3.00)	8.21 (18.10)	0.082 (0.180)	8.42 (18.57)	0.094 (0.208)	0.013 (0.0280)

Technical Data

Force Specifications

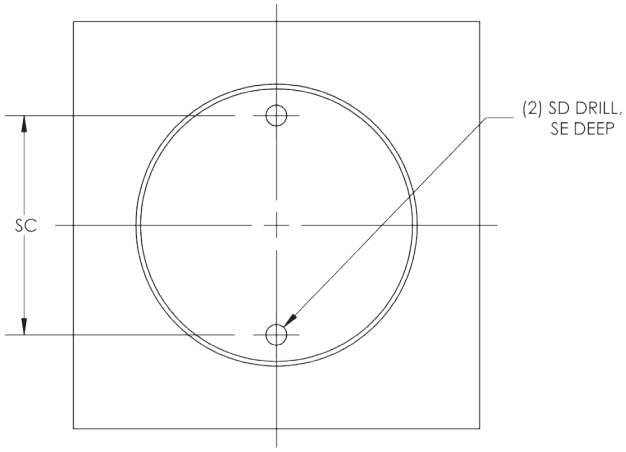
Bore (in)	Rod Diameter (in)	Effective Piston Area mm^2 (in^2)	Newtons (Pounds) of Force at Bar (PSI)										Displacement per mm (in) of Stroke in Liters (gal)
			7 (100)	17 (250)	35 (500)	52 (750)	69 (1000)	100 (1450)	120 (1740)	140 (2030)	172 (2500)	206 (3000)	
25mm (0.98)	Extend	490 (0.76)	340 (80)	840 (190)	1690 (380)	2540 (570)	3380 (760)	4910 (1100)	5890 (1320)	6870 (1540)	8460 (1900)	10150 (2280)	0.00049 (0.0033)
	14 (0.55)	340 (0.52)	230 (50)	580 (130)	1160 (260)	1740 (390)	2320 (520)	3370 (760)	4040 (910)	4720 (1060)	5810 (1310)	6970 (1570)	0.00034 (0.0023)
32mm (1.26)	Extend	800 (1.25)	550 (120)	1380 (310)	2770 (620)	4160 (930)	5540 (1250)	8040 (1810)	9650 (2170)	11260 (2530)	13870 (3120)	16630 (3740)	0.0008 (0.0054)
	18 (0.71)	550 (0.85)	380 (90)	950 (210)	1900 (430)	2840 (640)	3790 (850)	5500 (1240)	6600 (1480)	7700 (1730)	9480 (2130)	11370 (2560)	0.00055 (0.0037)
40mm (1.57)	Extend	1260 (1.95)	870 (190)	2160 (490)	4340 (970)	6500 (1460)	8660 (1950)	12570 (2820)	15080 (3390)	17590 (3960)	21660 (4870)	25990 (5840)	0.00126 (0.0084)
	22 (0.87)	880 (1.36)	600 (140)	1510 (340)	3020 (680)	4530 (1020)	6040 (1360)	8770 (1970)	10520 (2360)	12270 (2760)	15110 (3400)	18130 (4070)	0.00088 (0.0059)
50mm (1.97)	Extend	1960 (3.04)	1350 (300)	3380 (760)	6770 (1520)	10150 (2280)	13530 (3040)	19630 (4410)	23560 (5300)	27490 (6180)	33850 (7610)	40610 (9130)	0.00196 (0.0132)
	28 (1.10)	1350 (2.09)	930 (210)	2320 (520)	4650 (1050)	6970 (1570)	9290 (2090)	13480 (3030)	16170 (3640)	18870 (4240)	23240 (5220)	27870 (6270)	0.00135 (0.00904)
63mm (2.48)	Extend	3120 (4.83)	2150 (480)	5360 (1210)	10750 (2420)	16120 (3620)	21480 (4830)	31170 (7010)	37410 (8410)	43640 (9810)	53740 (12080)	64460 (14490)	0.00312 (0.0209)
	36 (1.42)	2100 (3.25)	1450 (330)	3610 (810)	7240 (1630)	10850 (2440)	14460 (3250)	20990 (4720)	25190 (5660)	29390 (6610)	36190 (8140)	43410 (9760)	0.0021 (0.0141)
76mm (3.00)	Extend	4540 (7.03)	3130 (700)	7800 (1750)	15650 (3520)	23450 (5270)	31260 (7030)	45360 (10200)	54440 (12240)	63510 (14280)	78210 (17580)	93810 (21090)	0.00454 (0.0304)
	45 (1.77)	2950 (4.57)	2030 (460)	5070 (1140)	10160 (2280)	15230 (3420)	20300 (4560)	29460 (6620)	35350 (7950)	41240 (9270)	50790 (11420)	60920 (13700)	0.00295 (0.0198)
101mm (4.00)	Extend	8010 (12.42)	5530 (1240)	13780 (3100)	27640 (6210)	41420 (9310)	55200 (12410)	80120 (18010)	96140 (21610)	112170 (25220)	—	—	0.00801 (0.0538)
	56 (2.20)	5550 (8.60)	3830 (860)	9540 (2150)	19140 (4300)	28690 (6450)	38230 (8590)	55490 (12470)	66590 (14970)	77680 (17460)	—	—	0.00555 (0.0372)

Technical Data

Head and Cap Torque in N-m (ft-lb)

Bore (in)	CMH	CHH
25mm (0.98)	16 (12)	20 (15)
32mm (1.26)	48 (35)	61 (45)
40mm (1.57)	75 (55)	95 (70)
50mm (1.97)	115 (85)	170 (125)
63mm (2.48)	190 (140)	292 (215)
76mm (3.00)	339 (250)	529 (390)
101mm (4.00)	529 (390)	—

Spanner Holes in mm (in)

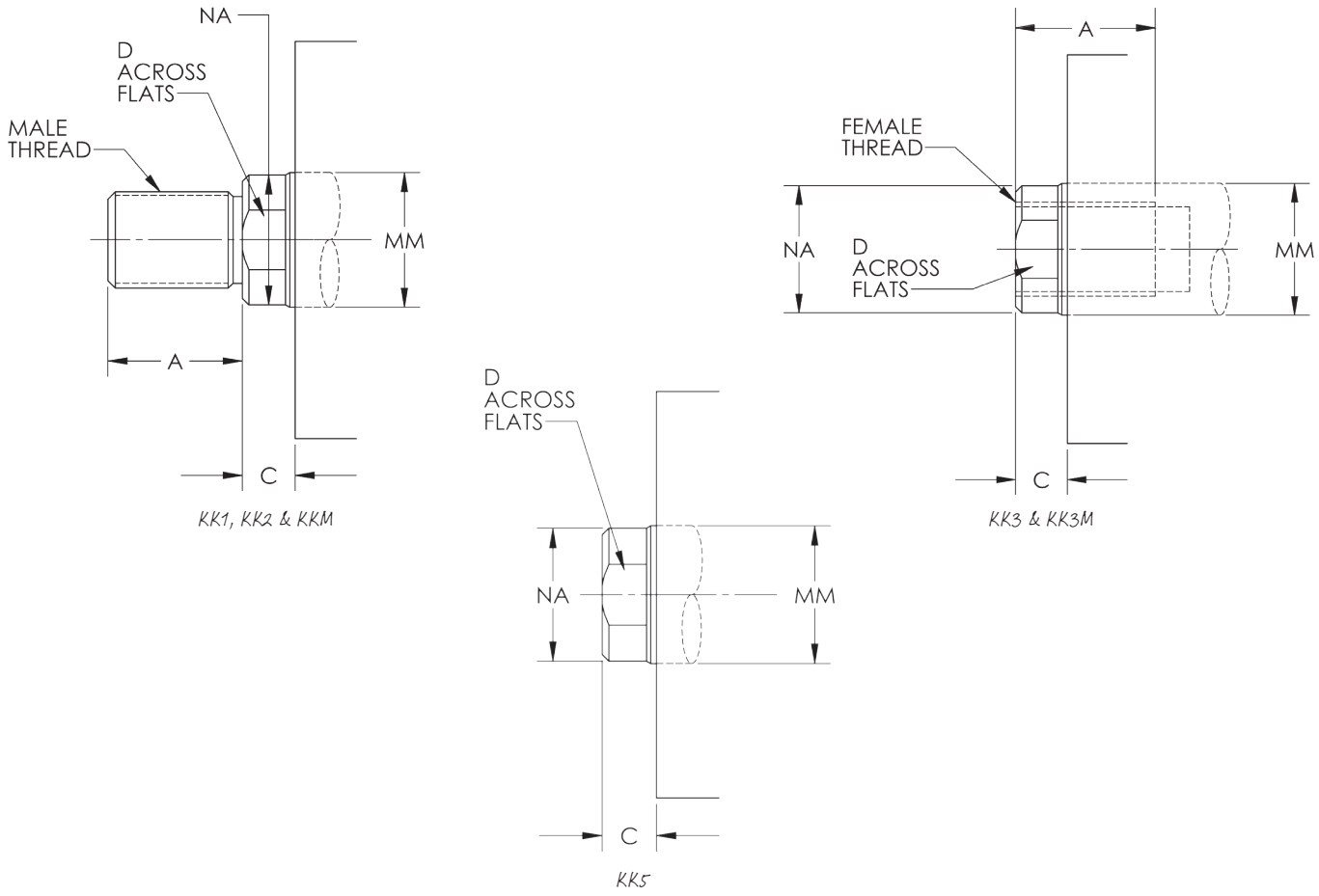


Note: Spanner Hole Orientation May Vary

Bore	SC	SD Ø	SE
25mm (0.98)	25 (0.98)	3 (0.12)	4 (0.16)
32mm (1.26)	30 (1.18)	4 (0.16)	4.5 (0.18)
40mm (1.57)	38 (1.50)	4 (0.16)	5 (0.20)
50mm (1.97)	50 (1.97)	5 (0.20)	5 (0.20)
63mm (2.48)	57 (2.24)	5 (0.20)	7 (0.28)
76mm (3.00)	70 (2.76)	5 (0.20)	7 (0.28)
101mm (4.00)	89 (3.50)	5 (0.20)	7.5 (0.30)

Product Information

Dimensions – Piston Rod End Styles

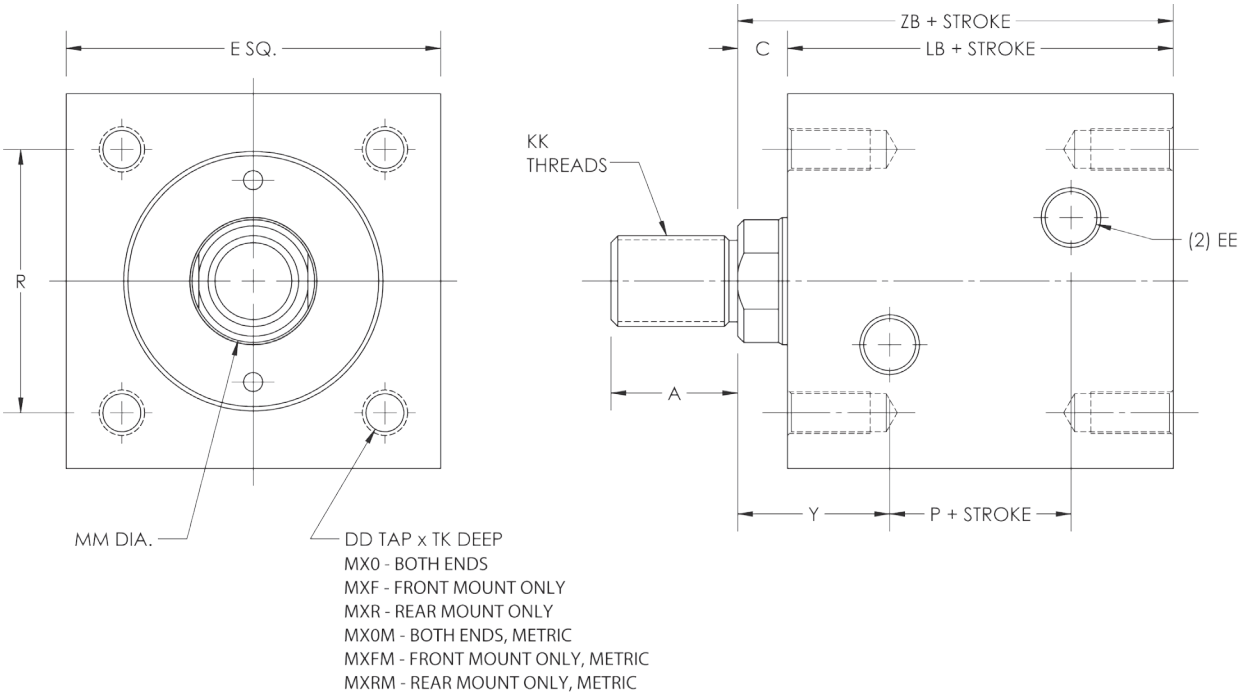


Rod Diameter MM	A		C	D	NA	KK1	KK2	KK3	KKM	KK3M
	KK_	KK_M								
14 (0.55)	18.0 (0.71)	16.0 (0.63)	8.0 (0.32)	12.0 (0.47)	13.0 (0.51)	3/8-24	1/2-20	3/8-24	M10x1.25	M10x1.5
18 (0.71)	25.0 (0.98)	18.0 (0.71)	10.0 (0.39)	15.0 (0.59)	17.0 (0.67)	7/16-20	9/16-18	7/16-20	M12x1.25	M12x1.75
22 (0.87)	30.0 (1.18)	22.0 (0.87)	10.0 (0.39)	19.0 (0.75)	21.0 (0.83)	5/8-18	3/4-16	5/8-18	M16x1.5	M16x2
28 (1.10)	35.0 (1.38)	28.0 (1.10)	11.0 (0.43)	24.0 (0.94)	27.0 (1.06)	3/4-16	7/8-14	3/4-16	M20x1.5	M20x2.5
36 (1.42)	45.0 (1.77)	36.0 (1.42)	13.0 (0.51)	32.0 (1.26)	35.0 (1.38)	1-14	1 1/4-12	1-14	M27x2	M27x3
45 (1.77)	56.0 (2.20)	45.0 (1.77)	17.0 (0.67)	39.0 (1.54)	43.0 (1.69)	1 1/4-12	1 1/2-12	1 1/4-12	M33x2	M33x3.5
56 (2.20)	70.0 (2.76)	56.0 (2.20)	26.0 (1.02)	48.0 (1.89)	54.0 (2.13)	1 1/2-12	1 3/4-12	1 1/2-12	M42x2	M42x4.5

Note: Dimensions are in mm; (inches in parentheses).

Dimensions

Model MX0 – Double Acting Single End Rod



Note: Spanner Hole Orientation May Vary

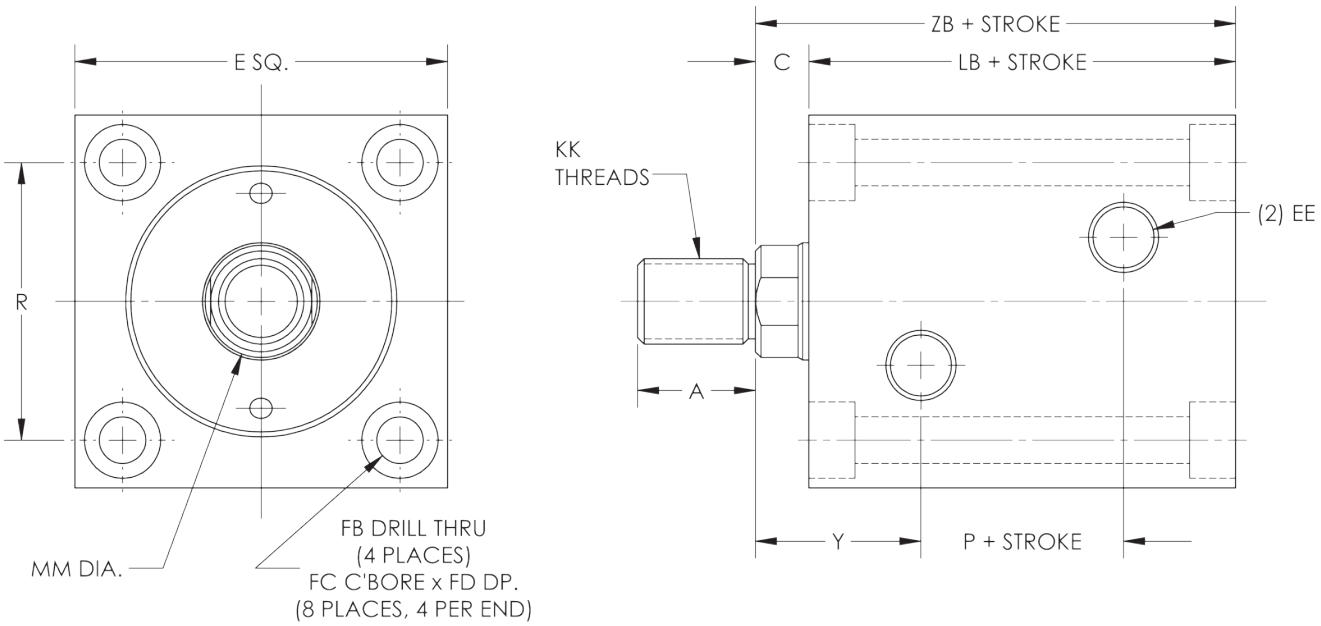
Bore	Rod Diameter MM	E	C	EE			KK	R	Y	DD		TK	Add to Stroke		
				NPTF	SAE	G				MX_	MX_M		LB	P	ZB
25mm (0.98)	14 (0.55)	50.8 (2.00)	8.0 (0.32)	1/8	2	1/8	See piston rod end styles on page 165	36.0 (1.42)	25.5 (1.00)	10-32	M5x0.8	10.5 (0.41)	45.0 (1.77)	10.0 (0.39)	53.0 (2.09)
32mm (1.26)	18 (0.71)	63.5 (2.50)	10.0 (0.39)	1/4	4	1/4		47.0 (1.85)	30.5 (1.20)	1/4-28	M6x1.0	12.5 (0.49)	51.0 (2.01)	10.0 (0.39)	61.0 (2.40)
40mm (1.57)	22 (0.87)	69.9 (2.75)	10.0 (0.39)	1/4	4	1/4		52.0 (2.05)	31.0 (1.22)	5/16-24	M8x1.25	16.6 (0.65)	55.0 (2.17)	13.0 (0.51)	65.0 (2.56)
50mm (1.97)	28 (1.10)	82.6 (3.25)	11.0 (0.43)	1/4	4	1/4		58.0 (2.28)	33.5 (1.32)	3/8-24	M10x1.5	20.8 (0.82)	60.0 (2.36)	15.0 (0.59)	71.0 (2.80)
63mm (2.48)	36 (1.42)	95.3 (3.75)	13.0 (0.51)	1/4	4	1/4		69.0 (2.72)	39.0 (1.54)	1/2-20	M12x1.75	24.9 (0.98)	67.0 (2.64)	15.0 (0.59)	80.0 (3.15)
76mm (3.00)	45 (1.77)	114.3 (4.50)	17.0 (0.67)	3/8	6	3/8		86.0 (3.39)	46.5 (1.83)	5/8-18	M14x2	29.0 (1.14)	78.0 (3.07)	19.0 (0.75)	95.0 (3.74)
101mm (4.00)	56 (2.20)	139.7 (5.50)	26.0 (1.02)	3/8	6	3/8		106.0 (4.17)	61.0 (2.40)	5/8-18	M16x2	39.0 (1.54)	96.0 (3.78)	26.0 (1.02)	122.0 (4.80)

Bore	CHH Max BAR (PSI) Rating	CMH Max BAR (PSI) Rating
25mm (0.98)	206 (3000)	140 (2030)
32mm (1.26)	206 (3000)	140 (2030)
40mm (1.57)	206 (3000)	140 (2030)
50mm (1.97)	206 (3000)	120 (1740)
63mm (2.48)	206 (3000)	100 (1450)
76mm (3.00)	206 (3000)	100 (1450)
101mm (4.00)	—	100 (1450)

Note: Dimensions are in mm; (inches in parentheses).

Dimensions

Model MXE – Double Acting Single End Rod



Note: Spanner Hole Orientation May Vary

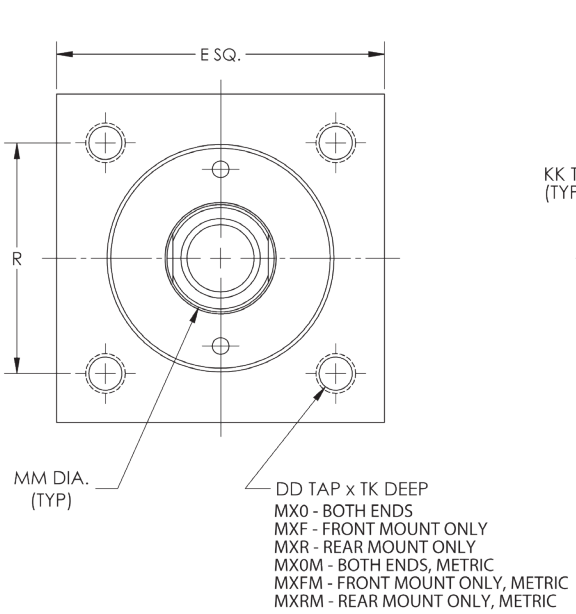
Bore	Rod Diameter MM	E	C	EE			KK	R	Y	FB	FC	FD	Add to Stroke		
				NPTF	SAE	G							LB	P	ZB
25mm (0.98)	14 (0.55)	50.8 (2.00)	8.0 (0.32)	1/8	2	1/8	See piston rod end styles on page 165	36.0 (1.42)	25.5 (1.00)	5.5 (0.22)	9.5 (0.37)	5.4 (0.21)	45.0 (1.77)	10.0 (0.39)	53.0 (2.09)
32mm (1.26)	18 (0.71)	63.5 (2.50)	10.0 (0.39)	1/4	4	1/4		47.0 (1.85)	30.5 (1.20)	7.0 (0.28)	11.0 (0.43)	6.5 (0.26)	51.0 (2.01)	10.0 (0.39)	61.0 (2.40)
40mm (1.57)	22 (0.87)	69.9 (2.75)	10.0 (0.39)	1/4	4	1/4		52.0 (2.05)	31.0 (1.22)	9.0 (0.35)	14.0 (0.55)	8.6 (0.34)	55.0 (2.17)	13.0 (0.51)	65.0 (2.56)
50mm (1.97)	28 (1.10)	82.6 (3.25)	11.0 (0.43)	1/4	4	1/4		58.0 (2.28)	33.5 (1.32)	11.0 (0.43)	17.5 (0.69)	10.8 (0.43)	60.0 (2.36)	15.0 (0.59)	71.0 (2.80)
63mm (2.48)	36 (1.42)	95.3 (3.75)	13.0 (0.51)	1/4	4	1/4		69.0 (2.72)	39.0 (1.54)	13.5 (0.53)	20.0 (0.79)	13.0 (0.51)	67.0 (2.64)	15.0 (0.59)	80.0 (3.15)
76mm (3.00)	45 (1.77)	114.3 (4.50)	17.0 (0.67)	3/8	6	3/8		86.0 (3.39)	46.5 (1.83)	16.0 (0.63)	23.0 (0.91)	15.2 (0.60)	78.0 (3.07)	19.0 (0.75)	95.0 (3.74)
101mm (4.00)	56 (2.20)	139.7 (5.50)	26.0 (1.02)	3/8	6	3/8		106.0 (4.17)	61.0 (2.40)	18.0 (0.71)	26.0 (1.02)	17.5 (0.69)	96.0 (3.78)	26.0 (1.02)	122.0 (4.80)

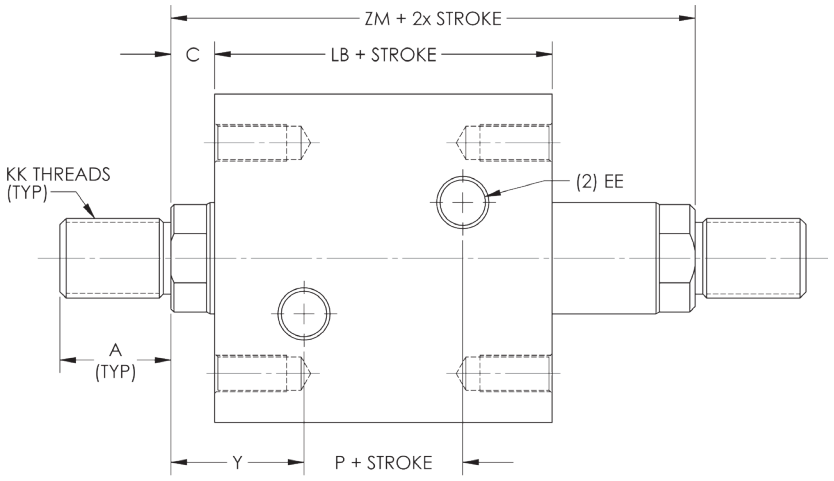
Bore	CHH Max BAR (PSI) Rating	CMH Max BAR (PSI) Rating
25mm (0.98)	206 (3000)	140 (2030)
32mm (1.26)	206 (3000)	140 (2030)
40mm (1.57)	206 (3000)	140 (2030)
50mm (1.97)	206 (3000)	120 (1740)
63mm (2.48)	206 (3000)	100 (1450)
76mm (3.00)	206 (3000)	100 (1450)
101mm (4.00)	—	100 (1450)

Note: Dimensions are in mm; (inches in parentheses).

Dimensions

Model MX0D – Double Acting Double End Rod





Note: Spanner Hole Orientation May Vary

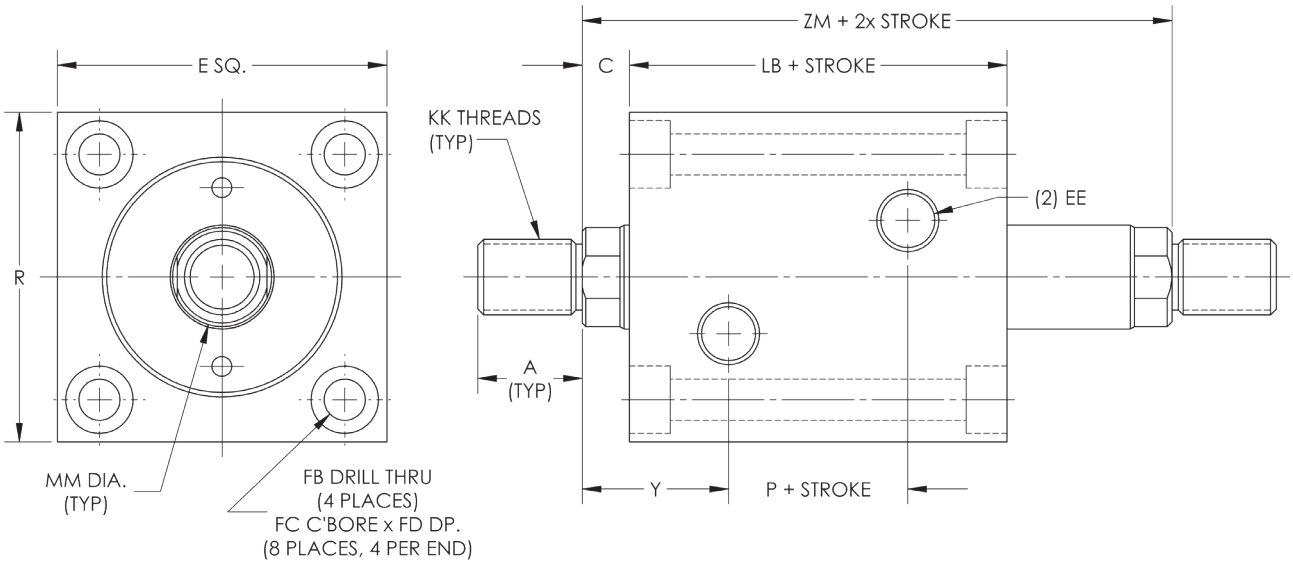
Bore	Rod Diameter MM	E	C	EE			KK	R	Y	DD		TK	Add to Stroke		
				NPTF	SAE	G				MX_	MX_M		LB	P	ZM
25mm (0.98)	14 (0.55)	50.8 (2.00)	8.0 (0.32)	1/8	2	1/8	See piston rod end styles on page 165	36.0 (1.42)	25.5 (1.00)	10-32	M5x0.8	10.5 (0.41)	45.0 (1.77)	10.0 (0.39)	61.0 (2.40)
32mm (1.26)	18 (0.71)	63.5 (2.50)	10.0 (0.39)	1/4	4	1/4		47.0 (1.85)	30.5 (1.20)	1/4-28	M6x1.0	12.5 (0.49)	51.0 (2.01)	10.0 (0.39)	71.0 (2.80)
40mm (1.57)	22 (0.87)	69.9 (2.75)	10.0 (0.39)	1/4	4	1/4		52.0 (2.05)	31.0 (1.22)	5/16-24	M8x1.25	16.6 (0.65)	55.0 (2.17)	13.0 (0.51)	75.0 (2.95)
50mm (1.97)	28 (1.10)	82.6 (3.25)	11.0 (0.43)	1/4	4	1/4		58.0 (2.28)	33.5 (1.32)	3/8-24	M10x1.5	20.8 (0.82)	60.0 (2.36)	15.0 (0.59)	82.0 (3.23)
63mm (2.48)	36 (1.42)	95.3 (3.75)	13.0 (0.51)	1/4	4	1/4		69.0 (2.72)	39.0 (1.54)	1/2-20	M12x1.75	24.9 (0.98)	67.0 (2.64)	15.0 (0.59)	93.0 (3.66)
76mm (3.00)	45 (1.77)	114.3 (4.50)	17.0 (0.67)	3/8	6	3/8		86.0 (3.39)	46.5 (1.83)	5/8-18	M14x2	29.0 (1.14)	78.0 (3.07)	19.0 (0.75)	112.0 (4.41)
101mm (4.00)	56 (2.20)	139.7 (5.50)	26.0 (1.02)	3/8	6	3/8		106.0 (4.17)	61.0 (2.40)	5/8-18	M16x2	39.0 (1.54)	96.0 (3.78)	26.0 (1.02)	148.0 (5.83)

Bore	CHH Max BAR (PSI) Rating	CMH Max BAR (PSI) Rating
25mm (0.98)	206 (3000)	140 (2030)
32mm (1.26)	206 (3000)	140 (2030)
40mm (1.57)	206 (3000)	140 (2030)
50mm (1.97)	206 (3000)	120 (1740)
63mm (2.48)	206 (3000)	100 (1450)
76mm (3.00)	206 (3000)	100 (1450)
101mm (4.00)	—	100 (1450)

Note: Dimensions are in mm; (inches in parentheses).

Dimensions

Model MXED – Double Acting Double End Rod



Note: Spanner Hole Orientation May Vary

Bore	Rod Diameter MM	E	C	EE			KK	R	Y	FB	FC	FD	Add to Stroke		
				NPTF	SAE	G							LB	P	ZM
25mm (0.98)	14 (0.55)	50.8 (2.00)	8.0 (0.32)	1/8	2	1/8	See piston rod end styles on page 165	36.0 (1.42)	25.5 (1.00)	5.5 (0.22)	9.5 (0.37)	5.4 (0.21)	45.0 (1.77)	10.0 (0.39)	61.0 (2.40)
32mm (1.26)	18 (0.71)	63.5 (2.50)	10.0 (0.39)	1/4	4	1/4		47.0 (1.85)	30.5 (1.20)	7.0 (0.28)	11.0 (0.43)	6.5 (0.26)	51.0 (2.01)	10.0 (0.39)	71.0 (2.80)
40mm (1.57)	22 (0.87)	69.9 (2.75)	10.0 (0.39)	1/4	4	1/4		52.0 (2.05)	31.0 (1.22)	9.0 (0.35)	14.0 (0.55)	8.6 (0.34)	55.0 (2.17)	13.0 (0.51)	75.0 (2.95)
50mm (1.97)	28 (1.10)	82.6 (3.25)	11.0 (0.43)	1/4	4	1/4		58.0 (2.28)	33.5 (1.32)	11.0 (0.43)	17.5 (0.69)	10.8 (0.43)	60.0 (2.36)	15.0 (0.59)	82.0 (3.23)
63mm (2.48)	36 (1.42)	95.3 (3.75)	13.0 (0.51)	1/4	4	1/4		69.0 (2.72)	39.0 (1.54)	13.5 (0.53)	20.0 (0.79)	13.0 (0.51)	67.0 (2.64)	15.0 (0.59)	93.0 (3.66)
76mm (3.00)	45 (1.77)	114.3 (4.50)	17.0 (0.67)	3/8	6	3/8		86.0 (3.39)	46.5 (1.83)	16.0 (0.63)	23.0 (0.91)	15.2 (0.60)	78.0 (3.07)	19.0 (0.75)	112.0 (4.41)
101mm (4.00)	56 (2.20)	139.7 (5.50)	26.0 (1.02)	3/8	6	3/8		106.0 (4.17)	61.0 (2.40)	18.0 (0.71)	26.0 (1.02)	17.5 (0.69)	96.0 (3.78)	26.0 (1.02)	148.0 (5.83)

Bore	CHH Max BAR (PSI) Rating	CMH Max BAR (PSI) Rating
25mm (0.98)	206 (3000)	140 (2030)
32mm (1.26)	206 (3000)	140 (2030)
40mm (1.57)	206 (3000)	140 (2030)
50mm (1.97)	206 (3000)	120 (1740)
63mm (2.48)	206 (3000)	100 (1450)
76mm (3.00)	206 (3000)	100 (1450)
101mm (4.00)	—	100 (1450)

Note: Dimensions are in mm; (inches in parentheses).

How to Accessorize

Solid State Switch Options and Dimensions - For CMH only

Solid State Switches are designed to signal when an actuator with an integrated magnet has reached a set point in its travel. These switches are a two-wire device recommended for low current DC loads such as interfacing with a programmable controller. It provides compact, reliable sensing for virtually infinite life and is based on giant magnetoresistive (GMR) technology.

Solid State Switches are pretested for use with the Compact Medium-Duty Hydraulic (CMH), eliminating the costly and time-consuming design and fabrication required to integrate third party switches. Switches are available in multiple configurations to meet your application needs.

Features

- Solid state reliability
- Faster response time
- Integrated LED
- Compact size
- Straight
- Quick disconnect or flying lead cable ends
- Track or band mounted

Benefits

- Small operating window enables precise control of machine and processes
- Solid State switches have longer life than mechanical switches, reducing downtime
- Multiple cable length options simplify installation
- LED provides visual confirmation of switch function
- Compact size enables multiple switches to be installed on one actuator

Switch Specifications

Mounting Style	Model	Description	Sensor Type	Output Type	Operating Voltage	Actuating Time (mS)	Maximum Load Current (mA)	Temperature Rating	Enclosure
Track Mounted	MHF	4mm round (C-Slot), EdgeSwitch	Solid State	Normally open solid state	10V to 28V, DC	1.0	50	-10° C to 70° C	IP67

Switch Application Information

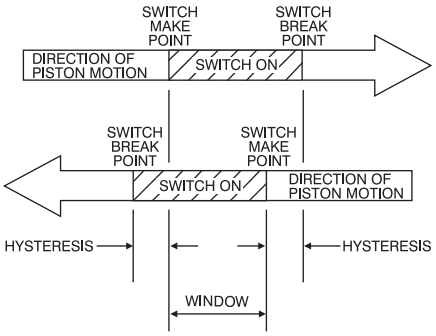
Mounting Style	Model	Operating Window	Maximum Hysteresis	Repeatability
Track Mounted	MHF	0.055"	0.030"	±0.005"

Hysteresis

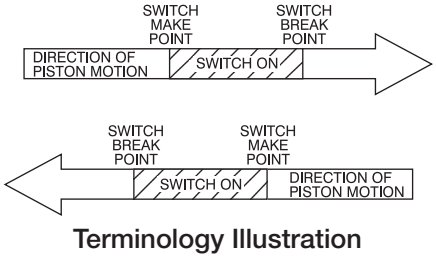
The distance between the switch break point moving in one direction and the switch make point moving in the opposite direction.

Operating Window

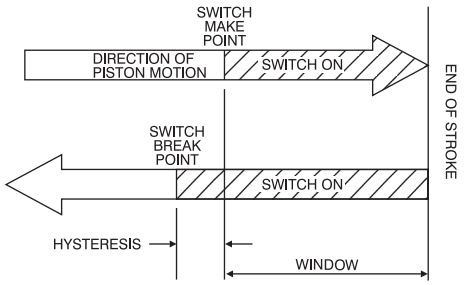
The distance the piston moves while the switch is made (in either direction), less the hysteresis.



Mid Stroke Operation

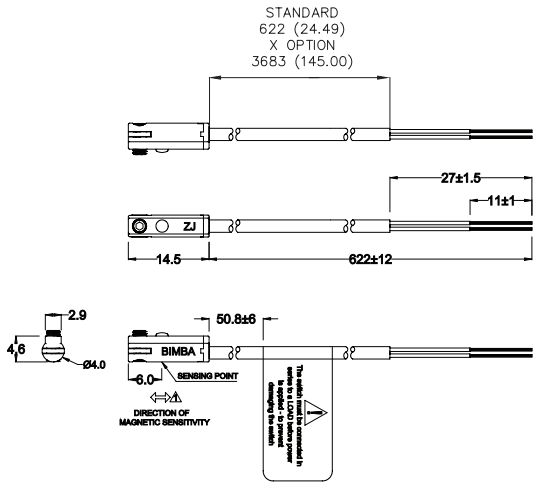


Terminology Illustration

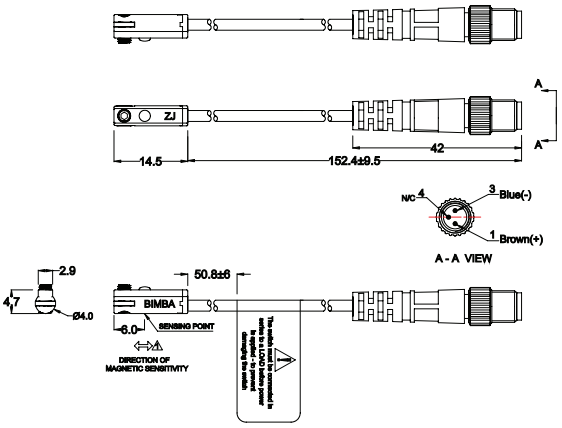


End of Stroke Operation

Mini 4mm Round (C-Slot) Track Mounted Switches



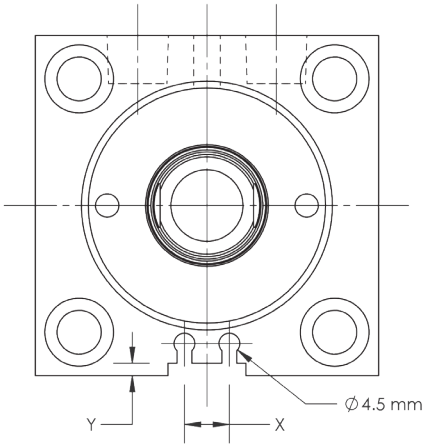
MHF, MHFX, MHK, MHKX, MHC, MHCX



MHFQS, MHFQCS, MHFQCXS
MHKQS, MHKQCS, MHKQCXS
MHCQS, MHCQCS, MHCQCXS

Dimensions

Switch Groove



Note: Switch groove is located 180° from the port and is machined in housing only when MPR option is designated.

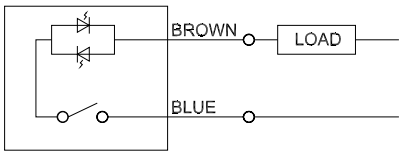
Bore	X	Y
25mm (0.98)	9.1 (0.36)	4.1 (0.16)
32mm (1.26)	9.1 (0.36)	4.8 (0.19)
40mm (1.57)	9.1 (0.36)	2.5 (0.10)
50mm (1.97)	12.5 (0.49)	3.6 (0.14)
63mm (2.48)	12.5 (0.49)	3.3 (0.13)
76mm (3.00)	17.3 (0.68)	5.1 (0.20)
101mm (4.00)	19.8 (0.78)	2.0 (0.08)

Note: Dimensions are in mm; (inches in parentheses).

Switch Wiring Diagram

Mini 4mm Round (C-Slot) Track Mounted Switch

MHF (all types)

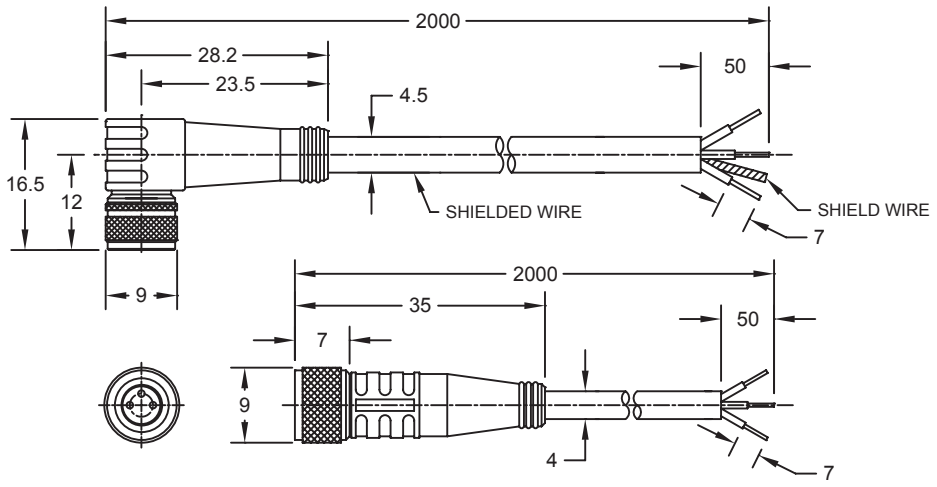


Reverse Polarity Not Protected

On Quick Connect switch models, connect only the Blue and Brown wires on the mating cable and cut back the Black wire. Do not connect switch to a mating cable that has been previously wired for a three-wire solid state switch as it will short the MHFQ switch.

Dimensions

M8 Female Quick Connect Cables – C4 and C5

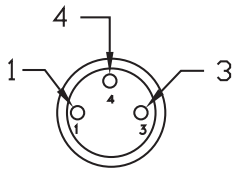


Wiring Diagrams

Pin and Wire Assignments for Quick Connect

Switch "Q" Option Male Connector

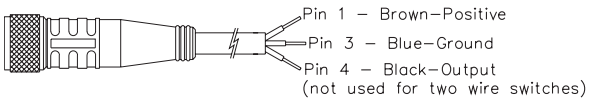
Face View of M8 Male Connector



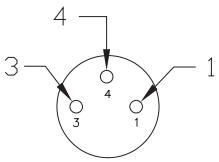
1. POSITIVE / HOT
3. NEGATIVE / NEUTRAL
4. OUTPUT
   NOT CONNECTED
   FOR 2 WIRE SWITCH
   MODELS

Optional C4 and C5 Cable Female Connector

Side View of M8 Female Connector



Face View of M8 Female Connector



Quick Connect Cable Specifications

Contact Carrier Material	Conductors	Molded Connector Head	Contact Material	Power Rating	Wire Insulation Material	Jacket Material	Temperature Range	Protection Class	Insulation Resistance
Nylon	3 x 24 AWG	Polyurethane (PUR)	Gold plated brass	125 V @ 3A	Polyvinyl Chloride (PVC)	Polyurethane (PUR)	-4° F to 200° F (-20° C to 90° C)	NEMA 1, 3, 4, 6, and IEC IP67	10^9

How to Order

How to Order Accessories

Mini 4mm Round (C-Slot) Track Mounted Switch

MHFQ - 90

Model	
MH	Mini EdgeSwitch solid state

Output	
F	2 wire solid state

Cable Take Out	
	Straight
90	90 Degree

Cable End	
	24" (0.6m) with flying leads
X	144" (3.6m) with flying leads
Q	6" (0.15m) M8 male connector
QC	6" (0.15m) M8 male connector with 2m mating cable
QCX	6" (0.15m) M8 male connector with 5m mating cable

Optional M8 Female Quick Connect Cables – C4 and C5

C4X - S

Model	
C	Cable

Length	
	2 meter
X	5 meter

Shielding	
	Unshielded cable[1]
S	Shielded cable

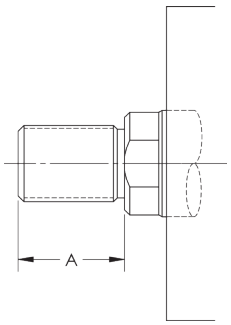
[1] Not available with right angle connector

Cable End	
4	Straight 3-pin M8 female connector
5	Right angle 3-pin M8 female connector

A = Extended Piston Rod Thread Option

A = refers to the length of piston rod thread. Shorter or longer than standard lengths can be furnished. Special length threads do not delay orders.

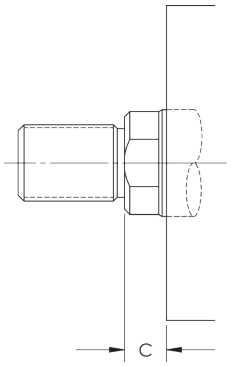
Note: Maximum thread length is double the standard “A” length. Consult factory for special “A” dimensions on female rod ends.



C = Extended Piston Rod Option

C = is commonly referred to as piston rod extension. Piston rods can be extended to any length up to 35mm. Cylinders with long “C” lengths can be mounted away from obstacles or outside hazardous environments. Extended piston rods do not delay delivery.

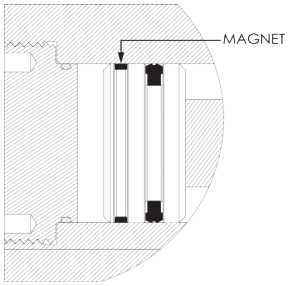
Example: If C = 10mm, then 15mm rod extension is C = 25mm



MPR = Magnetic Piston Option

Magnetic Pistons (MPR) are used in conjunction with Mini 4mm Round (C-Slot) Solid State Switches

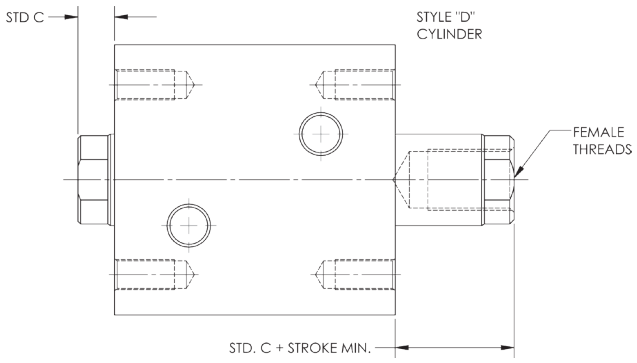
Note: Must be used with aluminum CMH series.



Style D = Minimum Rod Extension for Double Rod Option

Due to the construction of double rod end cylinders, style “D”, there will be a minimum C + stroke value for the rear rod. If the C + stroke value is less than the chart below, the cylinder will need the difference added onto the C value of the rear rod.

Note: Only applies to female rod ends for the rear rod.



Bore	Standard	C + Stroke Minimum
25mm (0.98)	8 (0.31)	23 (0.91)
32mm (1.26)	10 (0.39)	25 (0.98)
40mm (1.57)	10 (0.39)	30 (1.18)
50mm (1.97)	11 (0.43)	31 (1.22)
63mm (2.48)	13 (0.51)	38 (1.50)
76mm (3.00)	17 (0.67)	42 (1.65)
101mm (4.00)	26 (1.02)	51 (2.00)

Note: Dimensions are in mm; (inches in parentheses).

The Model Number for all Compact Hydraulic cylinders consists of nine alphanumeric clusters. These designate type, mounting option, style, bore size, stroke length, rod end style, port location and size, as well as special options.

Example:

CMH-MX0-25x75-KK1-P15=G125

This is a Compact Medium Pressure Hydraulic, double acting, 25mm bore, 75mm stroke, tapped on both ends mount cylinder.

CMH - MX0 - 25 x 75 - KK1 - P15 = G125 -

Model	
CMH	Compact Medium Pressure Hydraulic
CHH	Compact High Pressure Hydraulic

Mounting Style	
MX0	Tapped both ends
MXF	Tapped front face
MXR	Tapped rear face
MX0M	Tapped both ends, metric
MXFM	Tapped front face, metric
MXRM	Tapped rear face, metric
MXE	Drilled & c'bored faces

Style	
	Single rod end
D	Double rod end

Bore Size	
25	25mm (0.98")
32	32mm (1.26")
40	40mm (1.57")
50	50mm (1.97")
63	63mm (2.48")
76	76mm (3.00")
101[1]	101mm (4.00")

[1]CMH only

Stroke Length	
25	25mm (0.98")
50	50mm (1.97")
75	75mm (2.95")
100	100mm (3.93")

Note: 5mm increments available with additional lead times

Rod End	
KK1	Standard male inch
KK2	Large male inch
KK3	Standard female inch
KK5	Plain end
KKM	Standard male metric
KK3M	Standard female metric
KKX	Special, must specify

Port Location	
P15	1 & 5
P26	2 & 6
P37	3 & 7
P48	4 & 8

Note: Call out "P" followed by all desired locations

Port Size	
N125	0.125" NPTF
N250	0.250" NPTF
N375	0.375" NPTF
G125	0.125" G
G250	0.250" G
G375	0.375" G
S2	#2 SAE
S4	#4 SAE
S6	#6 SAE

Options *Enter in alphabetical order*	
A	Extended piston rod threads for male ends, 5mm increments, max = 2x standard length
C	Extended piston rod, 5mm increments, max = 35mm
MPR[1]	Magnetic piston, solid state switch, CMH only
XX	Special, must specify

[1] Switch groove is located 180° from the port and is machine in housing only when MPR option is designated.

Notes

Notes

IMI Precision Engineering operates four global centres of technical excellence and a sales and service network in 75 countries, as well as manufacturing capability in the USA, Germany, China, UK, Switzerland, Czech Republic, Mexico and Brazil.

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