



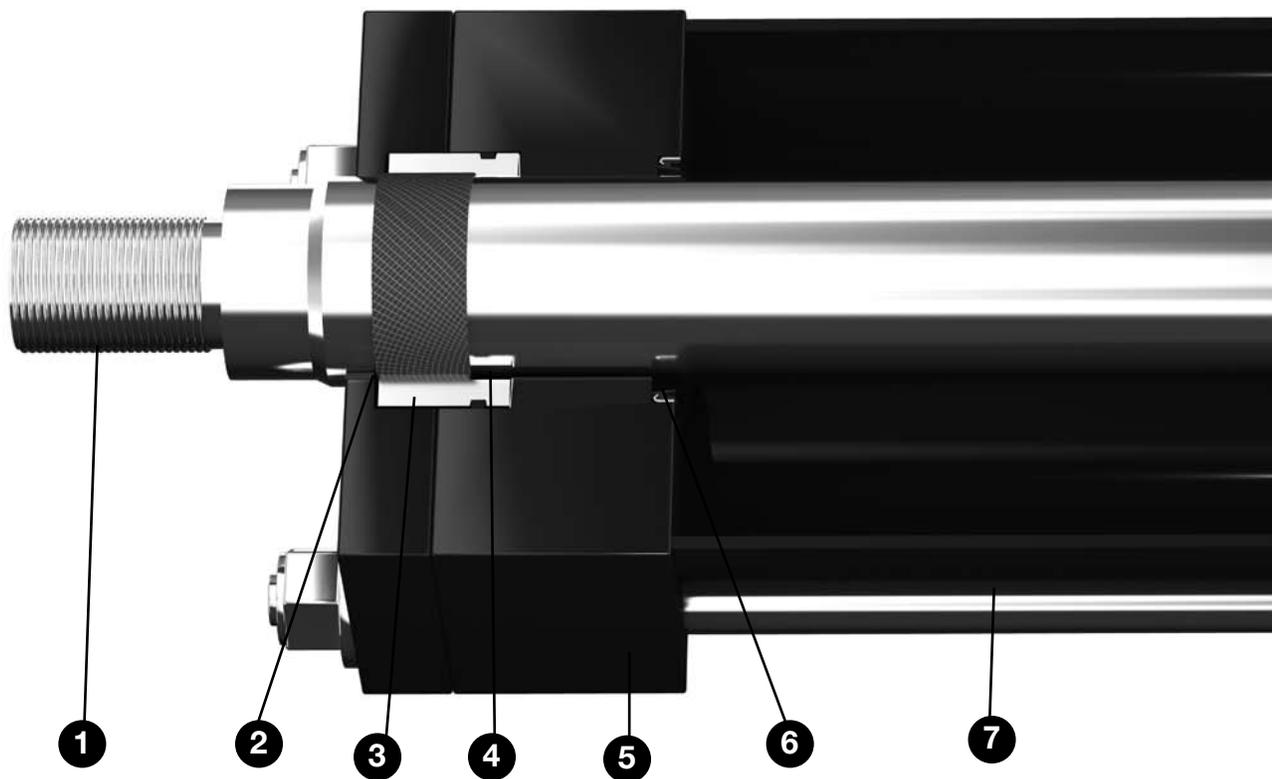
Series CA Composite Pneumatic Cylinders

- Corrosion Resistance
- High-Tech Duralon® Rod Bearing
- Advance-Design Rod and Piston Sealing System
- Heavy-Duty Piston-to-Rod Connection
- 1.50" – 6.00" Bores
- 150 PSI Pressure Ratings
- 11 N.F.P.A. Mounting Styles
- Lightweight, Easy to Install
- Optional AWWA Construction Available

SERIES CA COMPOSITE PNEUMATIC CYLINDERS

1.50" THRU 6.00" BORES

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Series CA Features and Benefits

1. Piston Rod End

Integral thread construction, precision-machined for close concentricity.

2. Duralon® Rod Bearing

Hanna's high-tech Duralon rod bearing is designed to perform under poorly lubricated, high load conditions. The exact combination of woven Teflon® and Dacron®, plus the fiberglass structural shell, increases load-carrying capabilities and eliminates "cold-flow" associated with Teflon. Because Duralon bearings are non-metallic, they minimize potential galling. In addition, they are capable of sustaining much higher compressive loads than either bronze or cast iron, have an extremely low coefficient of friction, require no lubrication to the bearing surface and are impervious to corrosion.

3. Gland Construction

Two-piece (gland plus retainer plate) with full-face retainer design for easy maintenance should the need for bearing or seal replacement arise. Made from corrosion-resistant stainless steel.

4. Rod Seal

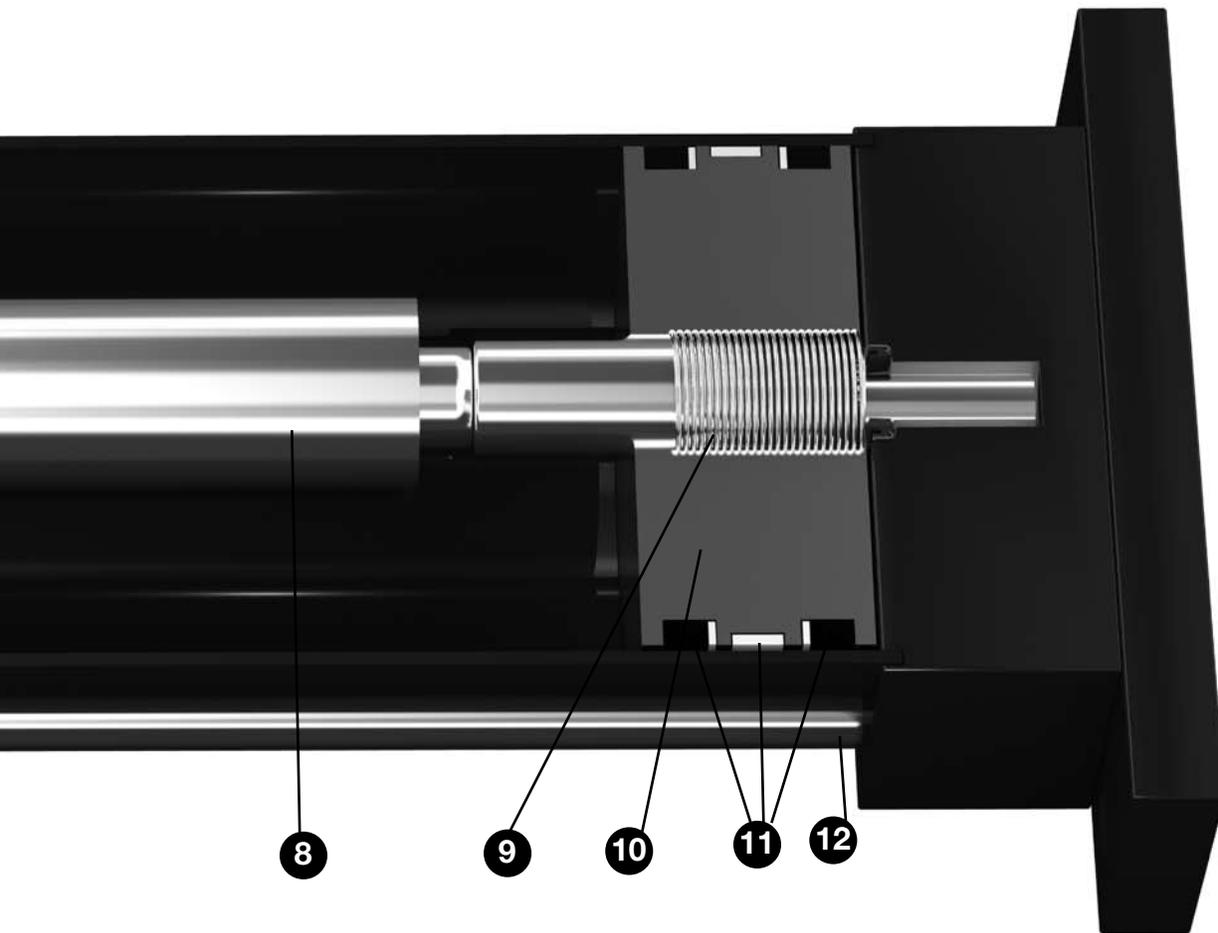
Series CA cylinders incorporate a heavy cross-section polyurethane U-cup piston rod seal, assuring zero leakage and outstanding wear resistance.

5. Heads

Heads are made from laminated phenolic with enhanced strength and corrosion-resistant properties. Hanna's precision machining assures accurate alignment and close concentricity between piston, tube, piston rod and rod bearing, thus prolonging cylinder service life.

6. Cushion Check Seals

Series CA cushion check seals are closely fitted to cushion sleeve and spear. The seals serve as both cushion seal and check valve, providing effective cushioning and fast, smooth breakaway.



7. Tubing

Fiberglass tubing provides the combination of high strength and corrosion resistance needed for service in harsh environments. Inside diameter of tubing has a 12 micro-inch finish. Non-metallic piston bearing contact prevents galling, and provides for extremely low coefficient of friction.

8. Piston Rod

All piston rod sizes are made of Series 303 stainless steel, and are hard-chrome plated for scratch and corrosion resistance. To maximize seal and bearing life, plated surface is polished to a 6-8 micro-inch finish. The rods are machined to a close tolerance with minimum stock removal to maximize shank size and reduce stress concentration.

9. Piston-to-Rod Connection

Piston rods are piloted to the piston to ensure concentricity, then bonded by an anaerobic adhesive, torqued and pinned.

10. Piston

One-piece piston is made of high-strength, non-corrosive, impact-resistant aluminum. Threaded to the piston rod, the piston is furnished with break-away spirals on each side. For AWWA-approved water service, optional cadmium-plated piston is available.

11. Piston Sealing System

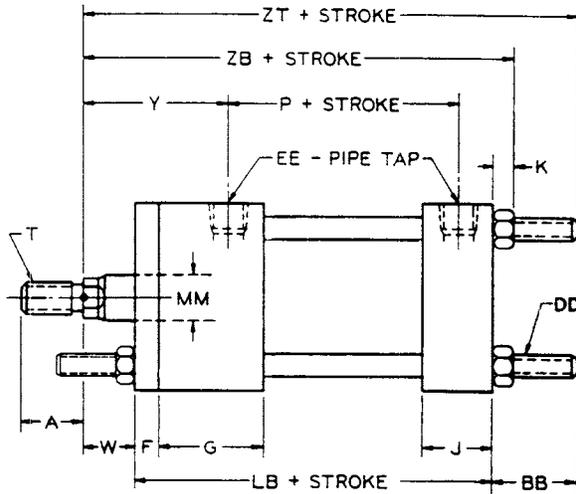
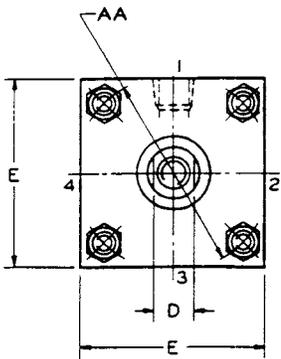
Two Buna U-cups with a bronze-filled Teflon bearing strip are standard. The wear strip provides a non-metallic bearing point on the piston, assuring long life and extremely low friction. For non-lubricated service, an optional glass-filled Teflon, O-ring energized piston seal, with wear strip, is available.

12. Tie Rods

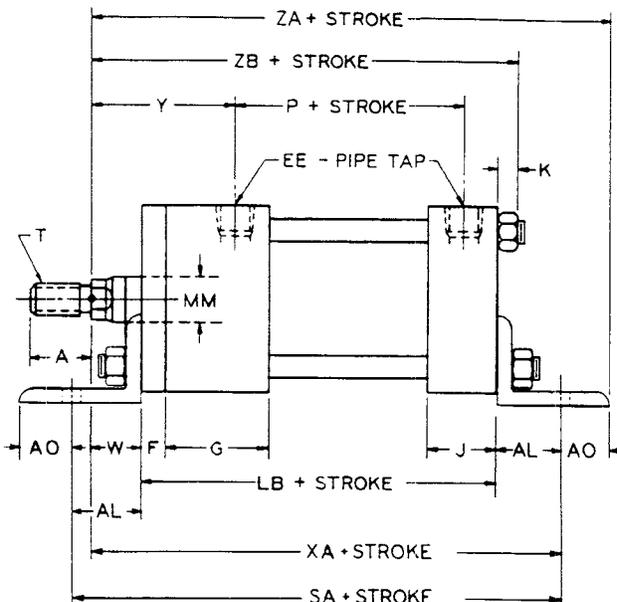
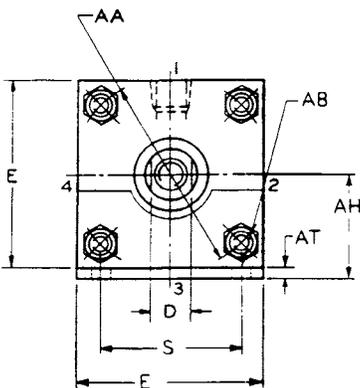
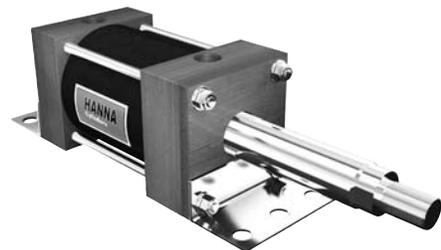
Made from high-strength, corrosion-resistant Series 303 stainless steel. Tie rod nuts, washers and all other fasteners are also made of stainless steel for corrosion resistance and low maintenance.

SERIES CA 1.50" – 6.00" BORES

MX0, MX1, MX2, MX3, MX4 Tie Rod Mounts



MS1 End Angle Mount



MX0, MX1, MX2, MX3, MX4, MS1

These Dimensions are Constant Regardless of Rod Diameter

BORE	AA	AB	AH	AL	AO	AT	BB	DD	E	EE (NPTF)	F	G	J	K	LB	P	S	SA
1.50	2.02	.41	1.19	1.00	.50	.12	1.00	.25-20	2.00	1/4	.38	1.50	1.00	.38	4.00	2.31	1.25	6.00
2.00	2.60	.41	1.44	1.00	.50	.12	1.12	.31-18	2.50	1/4	.38	1.50	1.00	.41	4.00	2.31	1.75	6.00
2.50	3.10	.41	1.62	1.00	.50	.19	1.12	.31-18	3.00	1/4	.38	1.50	1.00	.41	4.12	2.44	2.25	6.12
3.25	3.90	.53	1.94	1.25	.75	.19	1.38	.38-16	3.75	3/8	.62	1.75	1.25	.53	4.88	2.69	2.75	7.38
4.00	4.70	.53	2.25	1.25	.75	.19	1.38	.38-16	4.50	3/8	.62	1.75	1.25	.53	4.88	2.69	3.50	7.38
5.00	5.80	.66	2.75	1.38	.62	.19	1.81	.50-13	5.50	3/8	.62	1.75	1.25	.69	5.12	2.94	4.25	7.88
6.00	6.90	.78	3.25	1.38	1.12	.19	1.81	.50-13	6.50	1/2	.75	2.00	1.50	.69	5.75	3.19	5.25	8.50

NOTE: Specify Tie Rod Extension. "BB" dimension if other than standard.
 MX0 = No Tie Rods Extended
 MX1 = 4 Tie Rods Extended Both Ends
 MX2 = 4 Tie Rods Extended Cap End
 MX3 = 4 Tie Rods Extended Head End
 MX4 = 2 Tie Rods Extended Both Ends

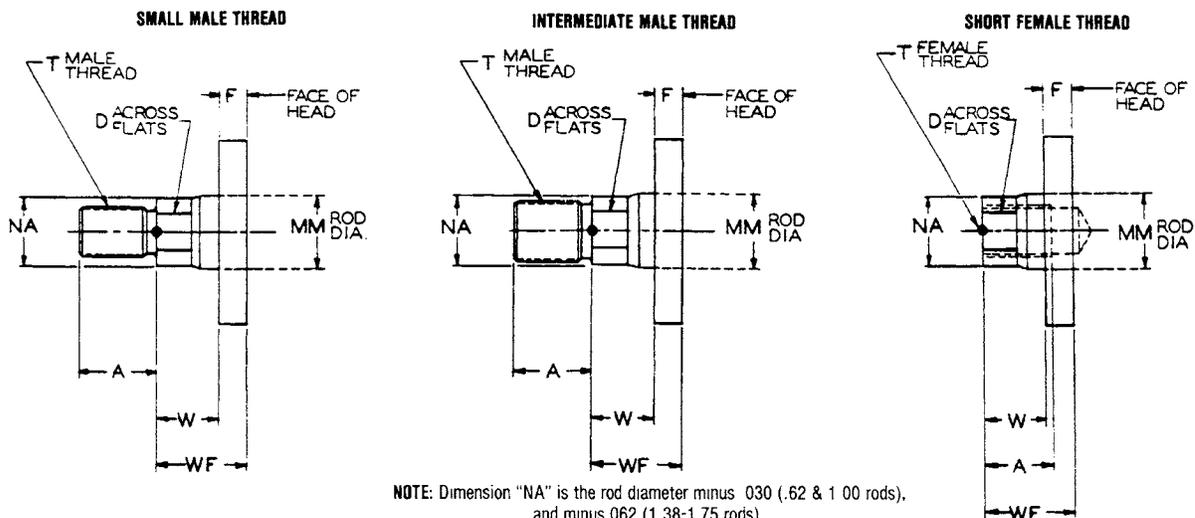
Dimensions are Affected by the Rod Diameter

BORE	CYLINDER		A	D	T (THREAD)			W	XA	Y	ZA	ZB	ZT
	ROD DIA. CODE	MM ROD DIA.			SMALL MALE SM	INTER-MEDIATE MALE IM	SHORT FEMALE SF						
1.50	D	.62	.75	.50	.44-20	.50-20	.44-20	.62	5.62	1.88	6.12	5.00	5.62
	F	1.00	1.12	.88	.75-16	.88-14	.75-16	1.00	6.00	2.25	6.50	5.41	6.12
2.00	D	.62	.75	.50	.44-20	.50-20	.44-20	.62	5.62	1.88	6.12	5.03	5.75
	F	1.00	1.12	.88	.75-16	.88-14	.75-16	1.00	6.00	2.25	6.50	5.41	6.12
2.50	D	.62	.75	.50	.44-20	.50-20	.44-20	.62	5.75	1.88	6.25	5.16	5.88
	F	1.00	1.12	.88	.75-16	.88-14	.75-16	1.00	6.12	2.25	6.62	5.53	6.25
3.25	F	1.00	1.12	.88	.75-16	.88-14	.75-16	.75	6.88	2.38	7.62	6.16	7.00
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	7.12	2.62	7.88	6.41	7.25
4.00	F	1.00	1.12	.88	.75-16	.88-14	.75-16	.75	6.88	2.38	7.62	6.16	7.00
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	7.12	2.62	7.88	6.41	7.25
5.00	F	1.00	1.12	.88	.75-16	.88-14	.75-16	.75	7.25	2.38	7.88	6.56	7.69
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	7.50	2.62	8.12	6.81	7.94
6.00	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	.88	8.00	2.75	9.12	7.31	8.44
	H	1.75	2.00	1.50	1.25-12	1.50-12	1.25-12	1.12	8.25	3.00	9.38	7.56	8.69

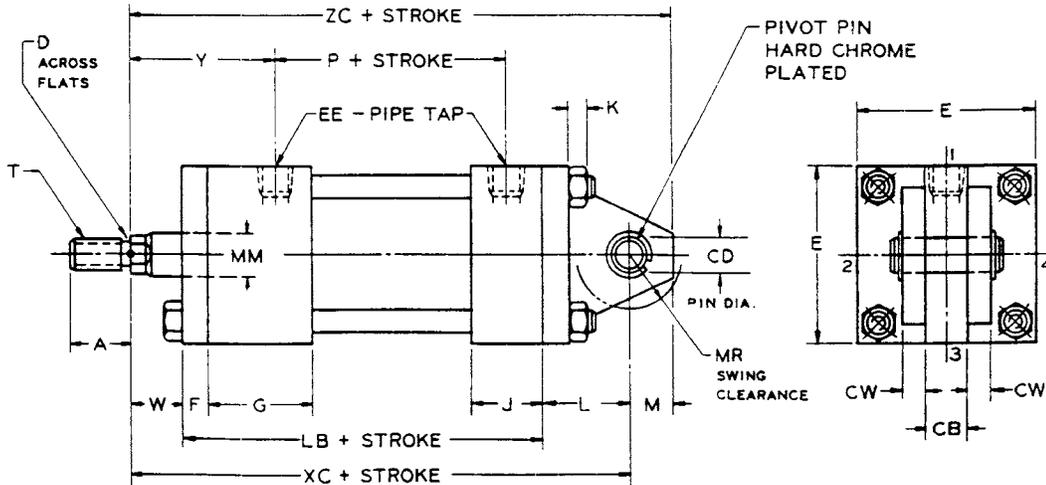
PRESSURE RATING: 150 P.S.I. maximum operating pressure. Check Stroke Limitation Data (Page 250) which may reduce maximum operating pressure. Check Stop Tube Data (Page 251) to see if stop tube is required.

NOTE: Dimensions are nominal except where specifically tolerated. Tolerances on "Plus Stroke" dimensions will vary slightly from dimensions shown due to manufacturing tolerances and tube compression.

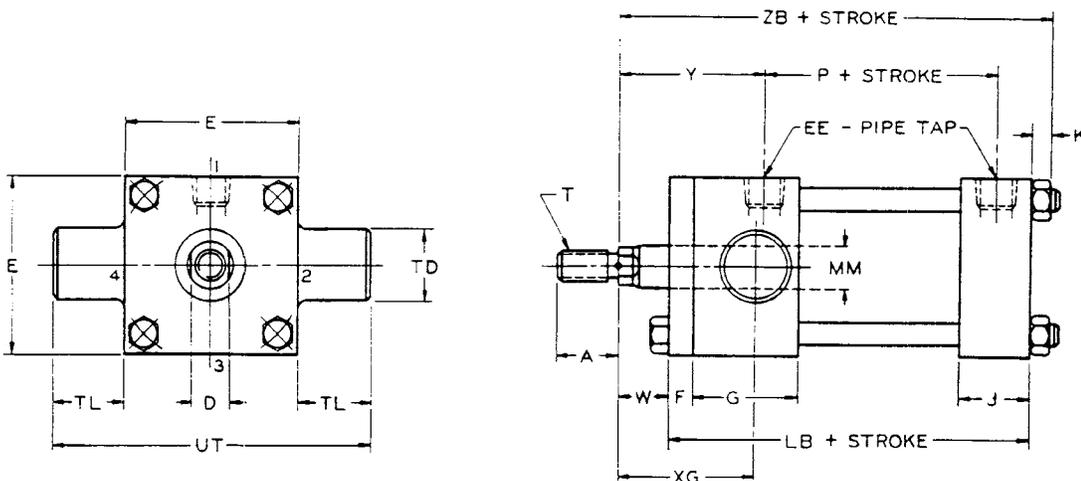
STANDARD ROD END STYLES



MP1 Fixed Clevis Mount



MT1 Head Trunnion Mount



NOTE: Align and mount pillow blocks to avoid bending moments in trunnions

MP1, MT1

These Dimensions are Constant Regardless of Rod Diameter

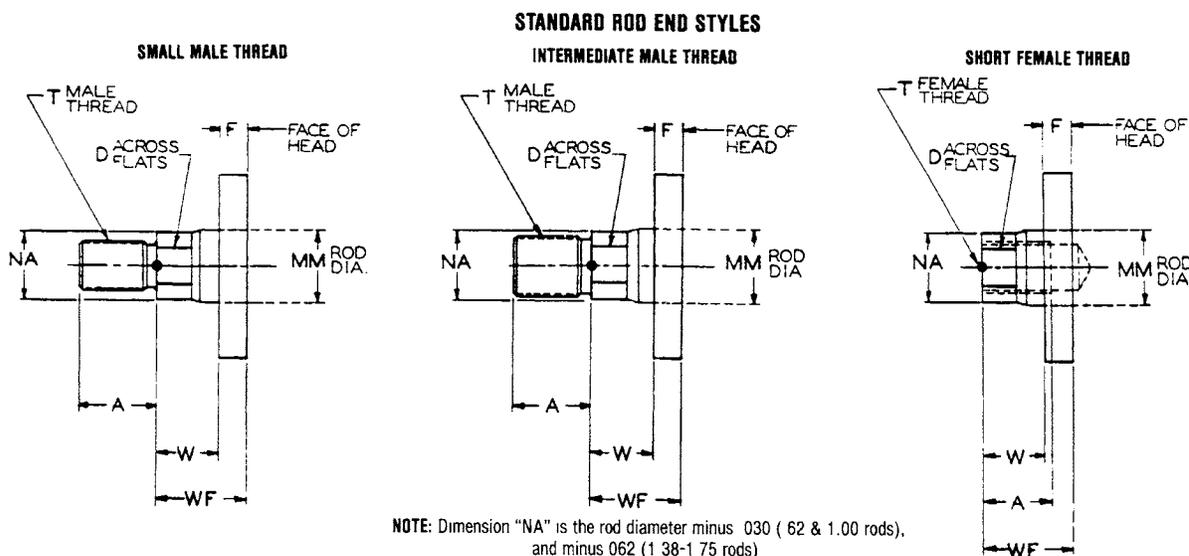
BORE	CB +0.16 +0.47	CD	CW	E	EE (NPTF)	F	G	J	K	L	LB	M	MR	P	TD +0.000 -0.002	TL	UT
1.50	.750	500	19	2.00	1/4	.38	1.50	1.00	38	75	4.00	50	62	2.31	1.000	1.00	4.00
2.00	.750	500	.19	2.50	1/4	.38	1.50	1.00	41	75	4.00	50	62	2.31	1.000	1.00	4.00
2.50	.750	500	.19	3.00	1/4	.38	1.50	1.00	41	75	4.12	.50	62	2.44	1.000	1.00	5.00
3.25	1.250	750	38	3.75	3/8	.62	1.75	1.25	53	1.25	4.88	75	1.12	2.69	1.000	1.00	5.75
4.00	1.250	750	38	4.50	3/8	.62	1.75	1.25	53	1.25	4.88	75	1.12	2.69	1.000	1.00	6.50
5.00	1.250	750	.38	5.50	3/8	.62	1.75	1.25	.69	1.25	5.12	.75	1.12	2.94	1.000	1.00	7.50
6.00	1.500	1.000	38	6.50	1/2	.75	2.00	1.50	69	1.50	5.75	1.00	1.38	3.19	1.375	1.38	9.25

Dimensions are Affected by the Rod Diameter

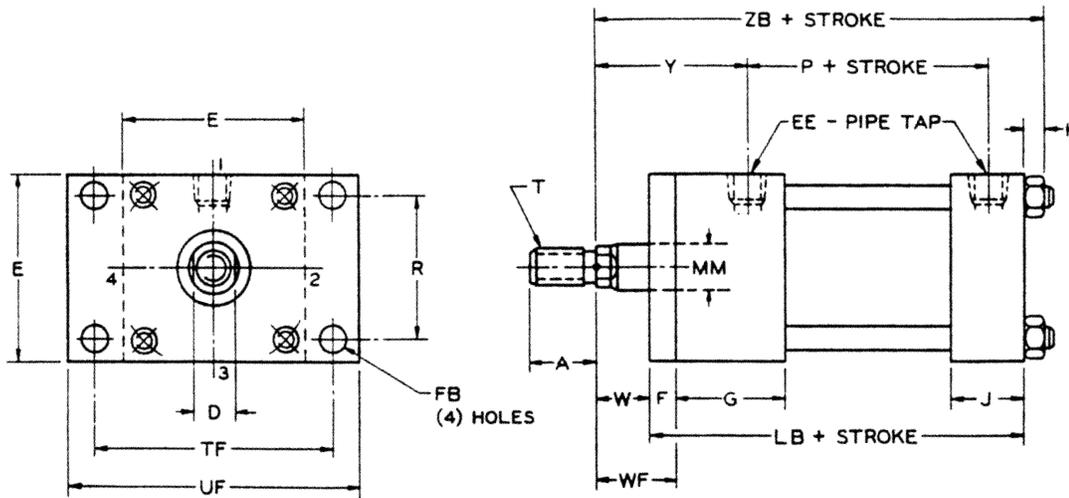
BORE	CYLINDER		A	O	T (THREAD)			W	XC	XG	Y	ZB	ZC
	ROD DIA. CODE	MM ROD DIA.			SMALL MALE SM	INTER-MEDIATE MALE IM	SHORT FEMALE SF						
1.50	D	.62	.75	.50	44-20	50-20	44-20	.62	5.38	1.75	1.88	5.00	5.88
2.00	D	.62	.75	.50	44-20	50-20	44-20	.62	5.38	1.75	1.88	5.03	5.88
	F	1.00	1.12	.88	75-16	88-14	75-16	1.00	5.75	2.12	2.25	5.41	6.25
2.50	D	.62	.75	.50	44-20	50-20	44-20	.62	5.50	1.75	1.88	5.16	6.00
	F	1.00	1.12	.88	75-16	88-14	75-16	1.00	5.88	2.12	2.25	5.53	6.38
3.25	F	1.00	1.12	.88	75-16	88-14	75-16	.75	6.88	2.25	2.38	6.16	7.62
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	7.12	2.50	2.62	6.41	7.88
4.00	F	1.00	1.12	.88	75-16	88-14	75-16	.75	6.88	2.25	2.38	6.16	7.62
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	7.12	2.50	2.62	6.41	7.88
5.00	F	1.00	1.12	.88	75-16	88-14	75-16	.75	7.12	2.25	2.38	6.56	7.88
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	7.38	2.50	2.62	6.81	8.12
6.00	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	.88	8.12	2.62	2.75	7.31	9.12
	H	1.75	2.00	1.50	1.25-12	1.50-12	1.25-12	1.12	8.38	2.88	3.00	7.56	9.38

PRESSURE RATING: 150 P.S.I. maximum operating pressure. Check Stroke Limitation Data (Page 250) which may reduce maximum operating pressure. Check Stop Tube Data (Page 251) to see if stop tube is required.

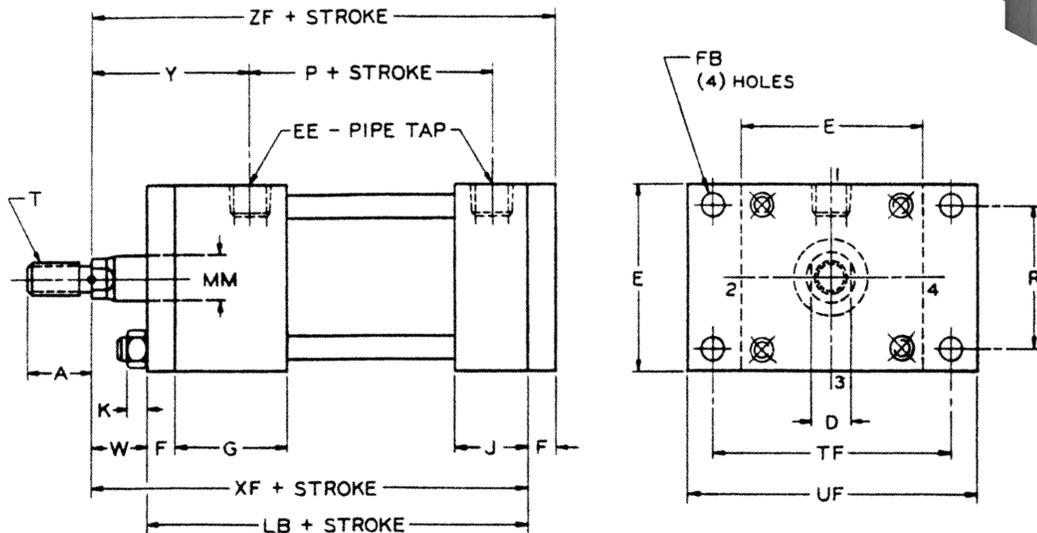
NOTE: Dimensions are nominal except where specifically toleranced. Tolerances on "Plus Stroke" dimensions will vary slightly from dimensions shown due to manufacturing tolerances and tube compression.



MF1 Head Rectangular Flange Mount



MF2 Cap Rectangular Flange Mount



MF1, MF2

These Dimensions are Constant Regardless of Rod Diameter

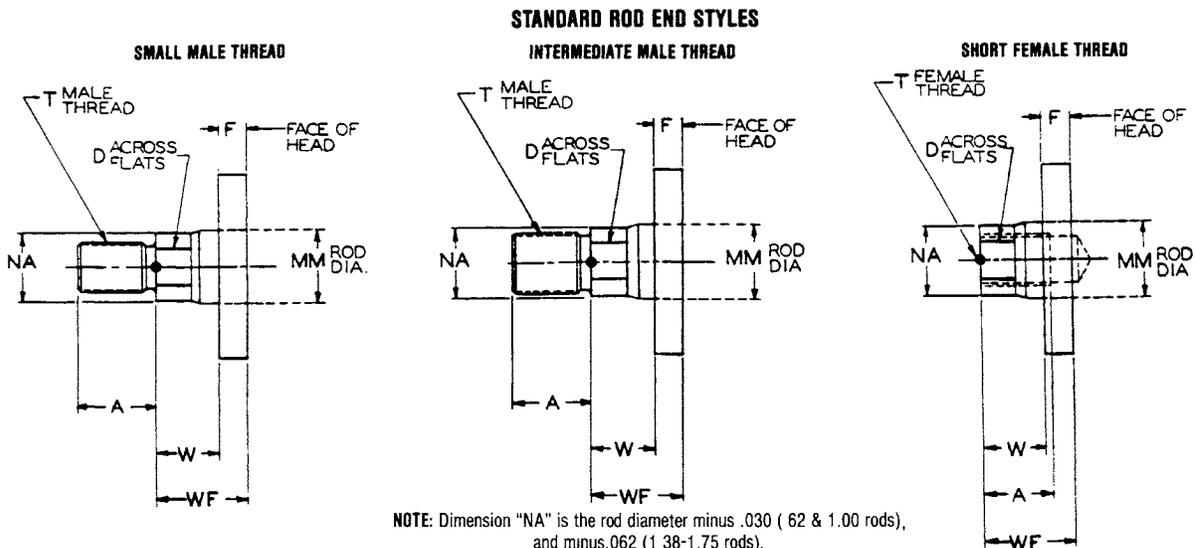
BORE	E	EE (NPTF)	F	FB +.005 - .000	G	J	K	LB	P	R ±0.10	TF ±0.10	UF
1.50	2.00	1/4	.38	.312	1.50	1.00	.38	4.00	2.31	1.43	2.75	3.38
2.00	2.50	1/4	.38	.375	1.50	1.00	.41	4.00	2.31	1.84	3.38	4.12
2.50	3.00	1/4	.38	.375	1.50	1.00	.41	4.12	2.44	2.19	3.88	4.62
3.25	3.75	3/8	.62	.438	1.75	1.25	.53	4.88	2.69	2.76	4.69	5.50
4.00	4.50	3/8	.62	.438	1.75	1.25	.69	4.88	2.69	3.32	5.44	6.25
5.00	5.50	3/8	.62	.562	1.75	1.25	.69	5.12	2.94	4.10	6.62	7.62
6.00	6.50	1/2	.75	.438	2.00	1.50	.84	5.75	3.19	4.88	7.62	8.62

Dimensions are Affected by the Rod Diameter

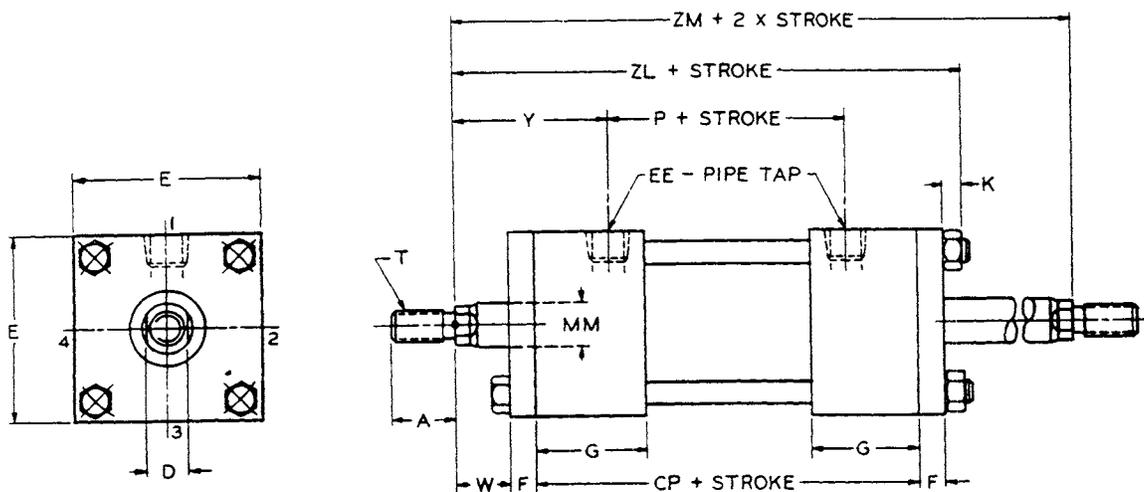
BORE	CYLINDER			A	D	T (THREAD)			W	WF	Y	ZB	ZF	ZJ
	ROD DIA. CODE	MM ROD DIA.				SMALL MALE SM	INTER-MEDIATE MALE IM	SHORT FEMALE SF						
1.50	D	.62	.75	.50	.44-20	.50-20	.44-20	.62	1.00	1.88	5.00	5.00	4.62	
	F	1.00	1.12	.88	.75-16	.88-14	.75-16	1.00	1.38	2.25	5.41	5.38	5.00	
2.50	D	.62	.75	.50	.44-20	.50-20	.44-20	.62	1.00	1.88	5.16	5.12	4.75	
	F	1.00	1.12	.88	.75-16	.88-14	.75-16	1.00	1.38	2.25	5.53	5.50	5.12	
3.25	F	1.00	1.12	.88	.75-16	.88-14	.75-16	.75	1.38	2.38	6.16	6.25	5.62	
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	1.62	2.62	6.41	6.50	5.88	
4.00	F	1.00	1.12	.88	.75-16	.88-14	.75-16	.75	1.38	2.38	6.16	6.25	5.62	
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	1.62	2.62	6.41	6.50	5.88	
5.00	F	1.00	1.12	.88	.75-16	.88-14	.75-16	.75	1.38	2.38	6.56	6.50	5.88	
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	1.62	2.62	6.81	6.75	6.12	
6.00	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	.88	1.62	2.75	7.31	7.38	6.62	
	H	1.75	2.00	1.50	1.25-12	1.50-12	1.25-12	1.12	1.88	3.00	7.56	7.62	6.88	

PRESSURE RATING: 150 P S I maximum operating pressure. Check Stroke Limitation Data (Page 250) which may reduce maximum operating pressure. Check Stop Tube Data (Page 251) to see if stop tube is required.

NOTE: Dimensions are nominal except where specifically toleranced. Tolerances on "Plus Stroke" dimensions will vary slightly from dimensions shown due to manufacturing tolerances and tube compression.



MXO-D Double Rod End†



These Dimensions are Constant Regardless of Rod Diameter

BORE	CP	E	EE NPTF	F	G	K	P
1.50	4.12	2.00	1/4	.38	1.50	.38	2.31
2.00	4.12	2.50	1/4	.38	1.50	.41	2.31
2.50	4.25	3.00	1/4	.38	1.50	.41	2.44
3.25	4.75	3.75	3/8	.62	1.75	.53	2.69
4.00	4.75	4.50	3/8	.62	1.75	.53	2.69
5.00	5.00	5.50	3/8	.62	1.75	.69	2.94
6.00	5.50	6.50	1/2	.75	2.00	.69	3.19

Dimensions are Affected by the Rod Diameter

CYLINDER			A	D	T (THREAD)			W	Y	ZL	ZM
BORE	ROD DIA. CODE	MM ROD DIA.			SMALL MALE SM	INTER-MEDIATE MALE IM	SHORT FEMALE SF				
1.50	D	.62	.75	.50	44-20	50-20	44-20	.62	1.88	5.88	6.12
	F	1.00	1.12	.88	75-16	.88-14	75-16	1.00	2.25	6.31	6.88
2.50	D	.62	.75	.50	44-20	50-20	44-20	.62	1.88	6.06	6.25
	F	1.00	1.12	.88	75-16	.88-14	75-16	1.00	2.25	6.42	7.00
3.25	F	1.00	1.12	.88	.75-16	.88-14	.75-16	.75	2.38	7.28	7.50
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	2.62	7.53	8.00
4.00	F	1.00	1.12	.88	75-16	88-14	75-16	.75	2.38	7.28	7.50
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	2.62	7.53	8.00
5.00	F	1.00	1.12	.88	75-16	88-14	.75-16	.75	2.38	7.69	7.75
	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	1.00	2.62	7.94	8.25
6.00	G	1.38	1.62	1.12	1.00-14	1.25-12	1.00-14	.88	2.75	8.56	8.75
	H	1.75	2.00	1.50	1.25-12	1.50-12	1.25-12	1.12	3.00	8.81	9.25

† Available in MX0, MX1, MX2, MX3, MX4, MT1 and MF1 mounting styles. See single rod pages for mounting instructions

PRESSURE RATING: 150 P S I maximum operating pressure. Check Stroke Limitation Data (Page 250) which may reduce maximum operating pressure. Check Stop Tube Data (Page 251) to see if stop tube is required

NOTE: Dimensions are nominal except where specifically toleranced. Tolerances on "Plus Stroke" dimensions will vary slightly from dimensions shown due to manufacturing tolerances and tube compression.

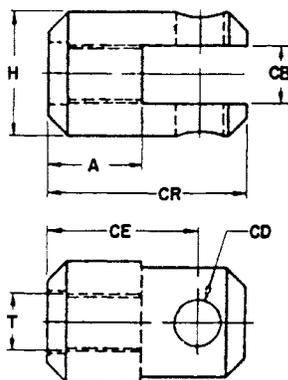
MOUNTING ACCESSORIES

These are standard accessories matched to bore size and piston rod code. The Mounting Bracket fits the cap end of Model MP1. The Bracket also fits the piston Rod Clevis with the same number (i.e. SB-1 Bracket fits SV-1 Rod Clevis). The pin is furnished with Model MP1 and fits the bracket, however, specify if additional pins are required. Pins also fit rod clevis and rod eyes. If you require accessories other than standard for that bore size or piston rod, specify the item number on your order.

*** CAUTION:**

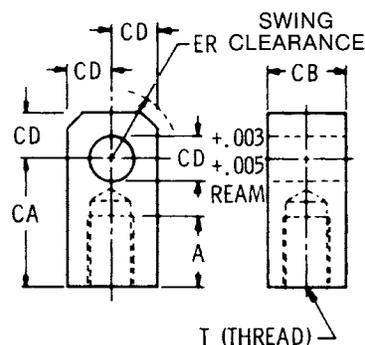
Accessory load rating may be lower than maximum force available from cylinder. Accessories load ratings are in pounds. Before specifying, compare maximum operating pull force in pounds developed by cylinder with load rating of accessory. Accessory load rating is the maximum recommended operating load for that accessory.

Rod Clevis



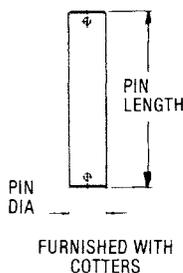
ROD CLEVIS ITEM NO.	PISTON ROD CODE	A	CB	CD	CE	CR	H	T	*LBS. CAPACITY
SV-1	D	.75	.75	.50	1.50	2.00	1.50	.44-20	2,700
SV-2	F	1.12	1.25	.75	2.38	3.12	2.38	75-16	7,500
SV-3	G	1.62	1.50	1.00	3.12	4.12	3.00	1.00-14	13,000
SV-4	H	2.00	2.00	1.37	4.12	5.50	4.00	1.25-12	21,000

Rod Eye



ROD CLEVIS ITEM NO.	PISTON ROD CODE	A	CA	CB	CD	ER	T	*LBS. CAPACITY
SY-1	D	.75	1.50	.75	.50	.75	.44-20	2,700
SY-2	F	1.12	2.06	1.25	.75	1.12	75-16	7,500
SY-3	G	1.62	2.81	1.50	1.00	1.44	1.00-14	13,000
SY-4	H	2.00	3.44	2.00	1.37	2.00	1.25-12	21,000

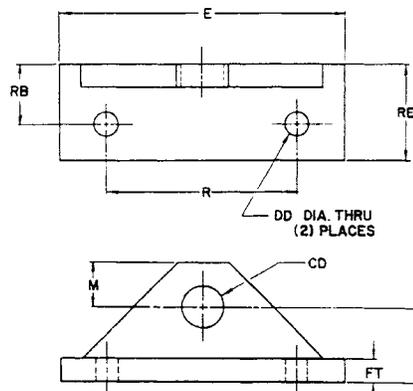
Pin



FURNISHED WITH COTTERS

PIN ITEM NO.	LENGTH	DIAMETER	*LBS. CAPACITY
SP1	2.28	.50	2,700
SP2	3.09	.75	7,500
SP3	3.60	1.00	13,000
SP4	4.66	1.37	21,000

Brackets



†BRACKET ITEM	PISTON ROD CODE	CA SERIES BORE DIA.	CD	DD	E	FT	L	M	R	RB	RE	*LBS. CAPACITY
SB-1	D	1.50 2.00 2.50	500	33	2.50	.19	.75	50	1.84	.53	88	1,425
SB-2	F	3.25 4.00 5.00	750	39	3.75	.38	1.25	75	2.76	.74	1.25	4,200
SB-3	G	6.00	1,000	52	6.50	.38	1.50	.75	4.88	1.68	2.50	7,550
SB-4	H	6.00	1,375	.52	6.50	.38	1.50	1.00	4.88	1.68	2.50	8,000

† 2 required

TECHNICAL INFORMATION

STROKE LIMITATION DATA

The rod diameter has to be capable of withstanding any compressive force developed by the cylinder working against the load. A piston rod diameter with adequate column strength to handle the compressive force of the application can be selected from the convenient pre-calculated chart at right.

To use this chart find the force value, developed by the application, in the left column. Next, select the figure which resembles your application and then multiply "D" times the factor given in that figure. Finally, opposite the corresponding force value, find the value of "L" which is equal to, or greater than, the figure derived from factoring "D". Directly above is the rod diameter which is capable of withstanding the forces developed in the application.

EXAMPLE: Cylinder Bore = 4.00" Operating PSI = 150
 Force Value - 1885 lbs.
 Application - Resembles Fig. 2 - End Angle Mtg.
 Stroke = 40"
 "L" — .07 x 40; L = 28"
 Correct Rod Diameter = 1.00"

The total force is 1885 lbs., and the value of "L" is 28 inches in this application. The smallest diameter rod capable of handling this situation is 1.00 inch.

If a stop tube is required for the application, be sure to include the stop tube length when determining the length of "D".

FORCE VALUE in pounds	VALUE OF "L" IN INCHES PISTON ROD DIAMETER			
	.62	1.00	1.38	1.75
100	66			
200	47			
400	33	85		
600	27	70	132	
800	24	60	114	184
1000	21	54	102	165
1300	18	47	90	145
1700	16	41	78	127
2100	14	37	71	114
2500	13	34	65	104
3000	12	31	58	95
4000	10	27	51	83
5000	9	24	46	74
6000	8	22	42	67
8000	7	19	36	58

NOTE: SEE APPLICATION FIGURES
 AT RIGHT.

FORCE DATA

BORE	ROD CODE	ROD DIA.	CYL. WORK ACTION	WORK AREA SQ. IN.	PNEUMATIC PRESSURE					FLUID Required PER INCH OF STROKE CU. FT.
					50	70	90	100	150	
1.50	D	.62	PUSH	1.77	89	124	160	177	266	.00102
			PULL	1.46	73	102	131	146	219	.00084
2.00	D F	.62 1.00	PUSH	3.14	157	220	283	314	471	.00182
			PULL	2.83 2.36	142 118	198 165	255 212	283 236	424 354	.00164 .00136
2.50	D F	.62 1.00	PUSH	4.91	245	344	442	491	736	.00284
			PULL	4.60 4.13	230 206	322 289	414 372	460 413	690 620	.00266 .00239
			PUSH	8.29	414	580	746	829	1244	.00480
3.25	F G	1.00 1.38	PULL	7.51	375	525	676	751	1126	.00435
			PULL	6.81	340	477	613	681	1022	.00394
4.00	F G	1.00 1.38	PUSH	12.57	628	880	1131	1257	1886	.00727
			PULL	11.78 11.08	589 554	825 776	1060 997	1178 1108	1767 1662	.00682 .00641
			PUSH	19.64	982	1375	1768	1964	2946	.01136
5.00	F G	1.00 1.38	PULL	18.85	942	1319	1696	1885	2827	.01091
			PULL	18.15	908	1270	1633	1815	2722	.01050
6.00	G H	1.38 1.75	PUSH	28.27	1413	1979	2544	2827	4240	.01636
			PULL	26.79 25.86	1339 1293	1875 1810	2411 2327	2679 2586	4018 3879	.01550 .01497

STOP TUBE DATA

Long stroke cylinders can be subjected to a buckling action and excessive bearing wear due to the weight of the exposed rod. To reduce wear a stop tube is recommended.

To determine if a stop tube is required, find the total value of "L" using the stroke limitation chart. Compare this value with the stop tube chart. If the value of "L" exceeds 40 inches, you can find the recommendation for stop tube length at the bottom of the chart.

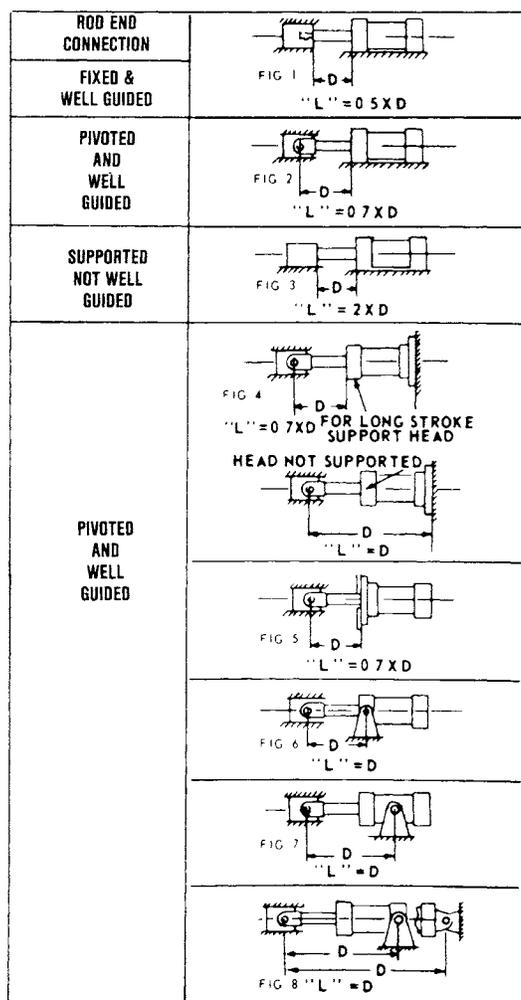
EXAMPLE PROBLEM:
 Cylinder Model MP1-CA-NC-4.00 x 27.00 - GSM-1G
 Accessory - SV-3 Clevis
 Pressure - 150 PSI
 Clevis Mount - Horizontal

From the description, the cylinder falls into Fig. 8. To determine the value of "L":

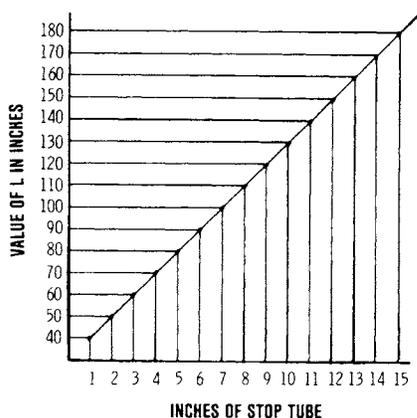
ADD:	MP1	"XC" Dimension	7.12"
	SV-3	"CE" Dimension	3.12"
		Two times stroke (2 x 27)	54.00"
		Total Value of "L"	64.24"

Looking this up on the chart, you'll find a recommended stop tube length of 4 inches.

The amount of stop tube will increase the stroke-plus dimensions of the cylinder by the same value. Add length of the stop tube to the value of "L" and recheck column strength on stroke limitation chart.



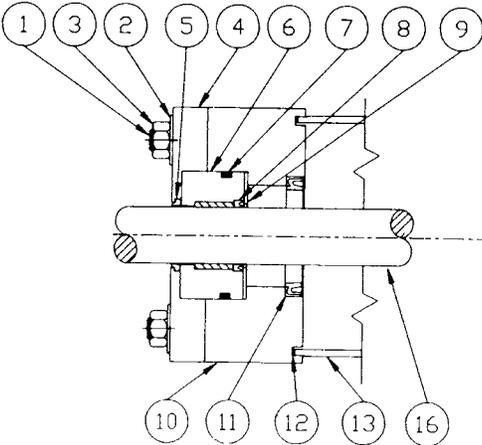
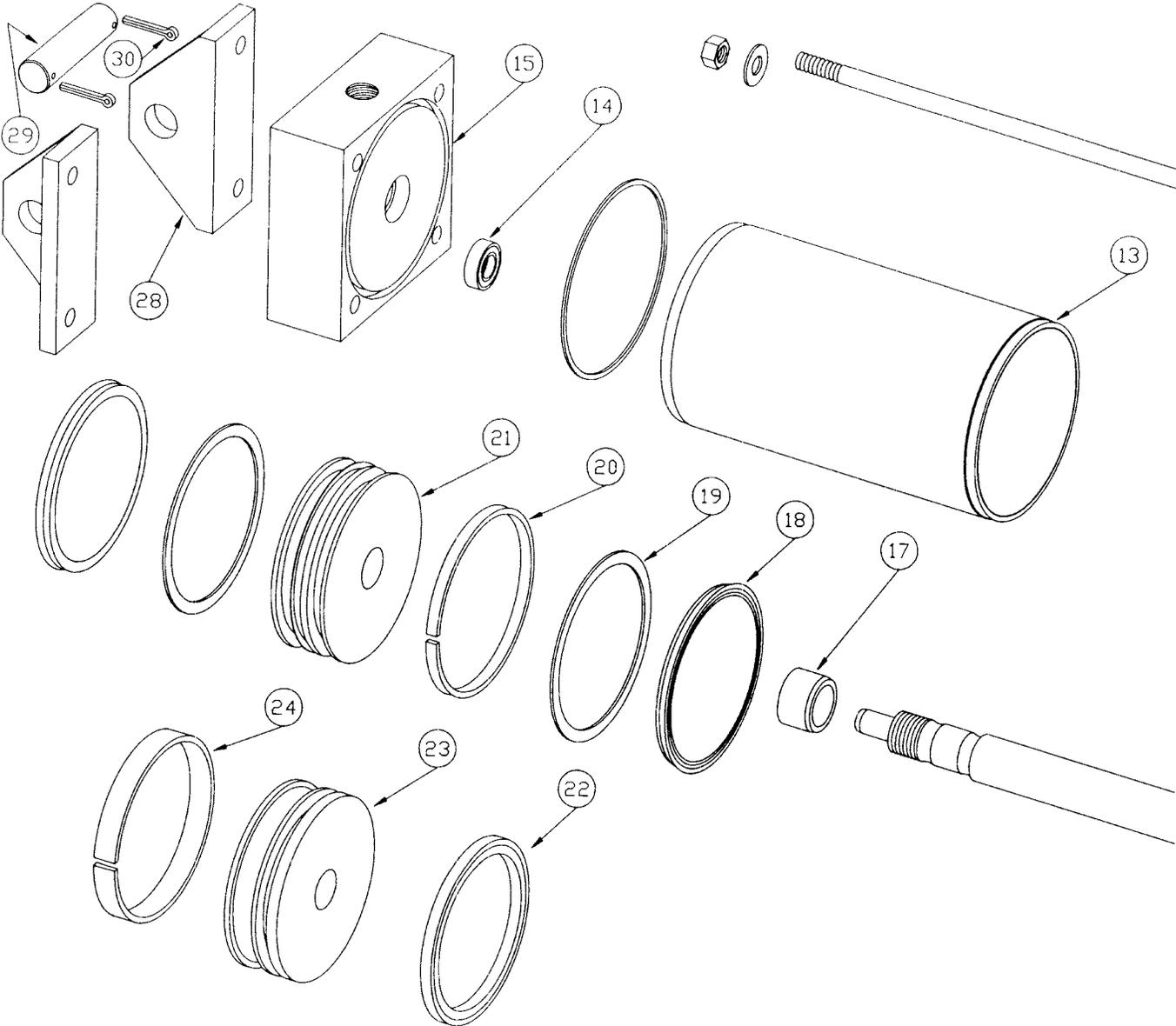
STOP TUBE CHART



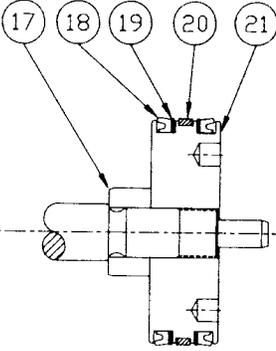
CYLINDER WEIGHTS

CYLINDER BORE	BASE WEIGHT AT ZERO STROKE	BODY WEIGHT PER INCH OF STROKE	ROD DIAMETER	ROD WEIGHT PER INCH OF STROKE
1.50	1.200 lbs.	0.100 lbs	0.625	0.052 lbs.
2.00	2.100	0.150	1.000	0.223
2.50	2.760	0.160	1.375	0.421
3.25	5.500	0.220	1.750	0.682
4.00	7.000	0.240		
5.00	9.750	0.370		
6.00	16.300	0.390		

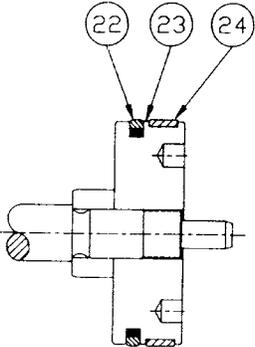
PARTS LIST



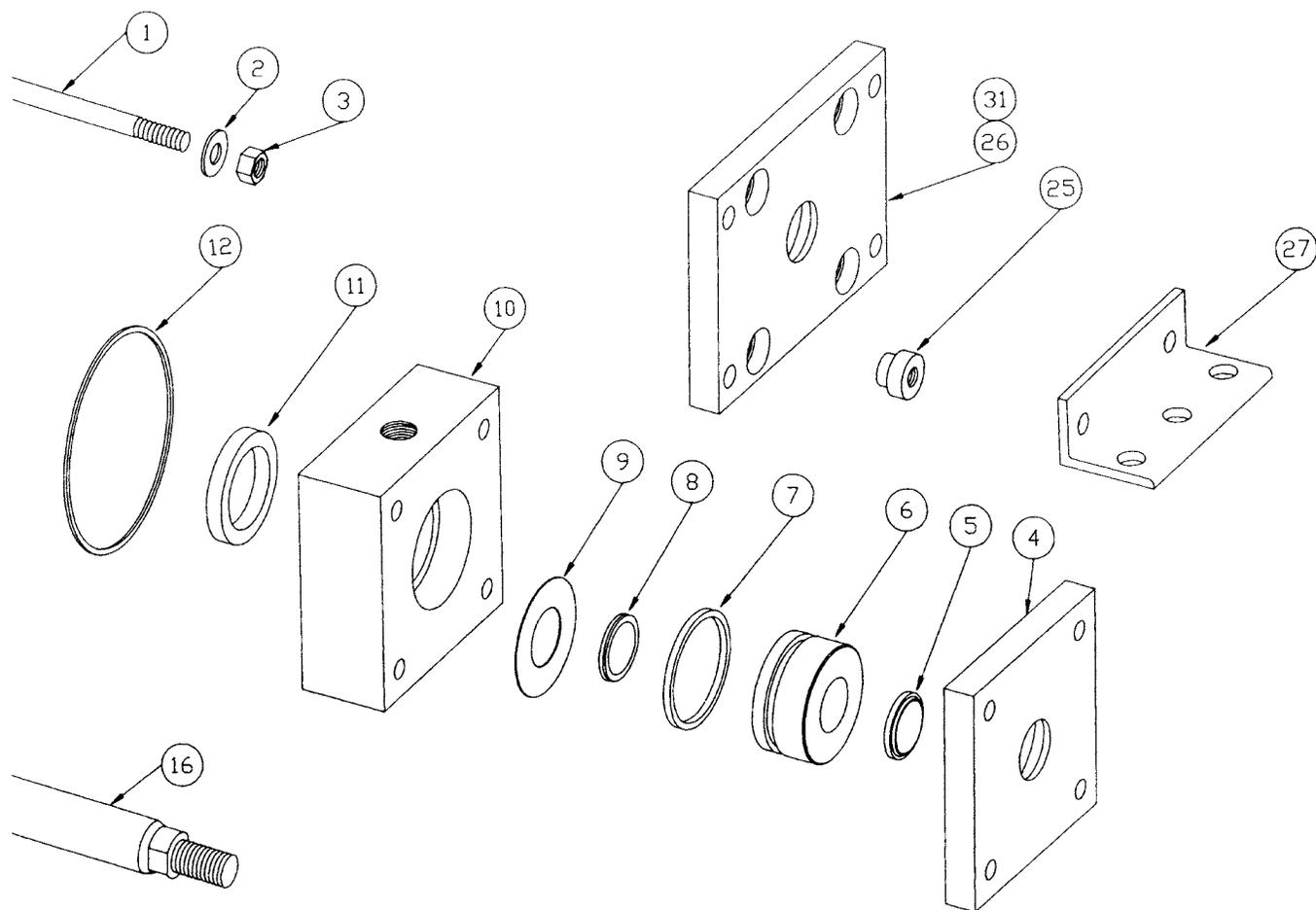
GLAND CONFIGURATION



**STANDARD PISTON
(Code A)**



**OPTIONAL PISTON
(Code G)**



When ordering replacement parts, identify Model Number, Serial Number and Part Number, as shown below.

PART NO.	NO. REQ'D.	DESCRIPTION	PART NO.	NO. REQ'D.	DESCRIPTION
1	4	Tie Rod	17	1	Cushion Sleeve
2	4/8	Tie Rod Washer	18	2	Piston Seal
3	4/8	Tie Rod Nut	19	2	Back-Up Washer (1.5" - 4" Bores Only)
4	1	Retainer Plate	20	1	Wear Strip
5	1	Rod Wiper	21	1	Piston
6	1	Gland	22	1	Filled Teflon Seal with Buna Expander*
7	1	O-Ring (Gland)	23	1	Optional Piston*
8	1	Rod Packing	24	1	Wear Strip
9	1	Rod Washer	25	4	Tie Rod Insert (Flange Mounts)
10	1	Front Head	26	1	Front Flange
11	1	Front Cushion Seal	27	2	End Angle Bar
12	2	Gasket	28	2	Clevis Bracket
13	1	Tube	29	1	Pivot Pin
14	1	Rear Cushion Seal	30	2	Cotter Pin
15	1	Back Head	31	1	Rear Flange
16	1	Piston Rod			

*Optional Part

STORAGE, INSTALLATION AND MAINTENANCE DATA

STORAGE:

Hanna Series CA Composite Cylinders are delivered with colored plastic port plugs which protect the inside of the cylinder from external contamination. Keep these protective port plugs in the cylinders until the time of installation. Store the cylinders indoors in a clean, dry environment, keeping them in a vertical position with the rod up, whenever practical.

INSTALLATION:

Proper mounting alignment, mounting fasteners, torque and cleanliness are essential to assure efficient operation and long service life of your CA cylinders. Special care should be taken, as follows:

Trunnion Mount (MT1): Lubricated pillow blocks with bearing tolerances, rigidly mounted and properly aligned, should be used. Make sure the cylinder is free to swing without interference or binding.

Tie Rod Mounts (MX0, MX1, MX2, MX3, MX4): Refer to **Tie Rod Torque** chart for proper thread size and recommended torque value.

Cap Fixed Clevis Mount (MP1): Remove cotter pin, align cylinder pin holes with mounting member hole, insert cylinder pin, and replace cotter pin. Make sure the cylinder moves through its required arc without binding or interference. Properly align piston rod parallel to blind end.

Flange Mounts (MF1, MF2): Washers *must* be used to mount all flange mount cylinders! Refer to **Flange Mount Cylinder Torque** chart.

Pipe Ports and Connections: Series CA Composite Cylinders are furnished with standard NPTF pipe ports. Refer to **Recommended Pipe Torques** chart for proper torque value by port size. **The use of Teflon tape is not recommended.**

MAINTENANCE:

By following Hanna's Storage and Installation recommendations, you can expect long service life from your Series CA Composite Cylinders.

To replace rod seals and rod wiper, relieve the front end tie rod torque, and remove retainer plate and gland. Position the new rod seal and rod wiper in the appropriate grooves. Use only genuine Hanna replacement parts. Replace gland, retainer plate and tie rods. Tighten tie-rod nuts to proper torque value as shown in the **Tie Rod Torque** chart.

To replace piston seals, disassemble the entire cylinder. Then, for **Standard Piston Seals (Code A)**, cut and remove the old U-cup seals from the piston grooves. When installing the new U-cups, be careful not to cut the seals, or damage the sealing lips.

For Optional Piston Seals (Code G), cut the old piston seal, and remove it and the O-ring from the groove. Install new O-ring. Next, slightly stretch the Teflon piston seal and work it into the groove. Carefully insert the ram assembly into the tube — this will assure the Teflon seal is reshaped equally.

When replacing either **Code A or Code G** Piston Seals, also replace gaskets at both tube ends.

FASTENER TORQUES

TIE ROD TORQUES		
BORE	SIZE	TORQUE
1.50	.25-20	3 ft-lbs.
2.00	.31-18	7 ft-lbs.
2.50	.31-18	7 ft-lbs.
3.25	.38-16	15 ft-lbs.
4.00	.38-16	15 ft-lbs.
5.00	.50-13	25 ft-lbs.
6.00	.50-13	25 ft-lbs.

RECOMMENDED MOUNTING BOLT TORQUE FOR FLANGE MOUNTS	
BORE	TORQUE
1.50	4 ft-lbs.
2.00	10 ft-lbs.
2.50	10 ft-lbs.
3.25	20 ft-lbs.
4.00	20 ft-lbs.
5.00	30 ft-lbs.
6.00	30 ft-lbs.

RECOMMENDED PIPE TORQUES	
NPTF SIZE	TORQUE MAX.
1/4"	15 ft-lbs.
3/8"	25 ft-lbs.
1/2"	40 ft-lbs.

EXCELLENT CORROSION RESISTANCE ASSURES LONG SERVICE LIFE IN THE HARSHTEST ENVIRONMENTS. COST EFFECTIVELY.

Traditionally, buyers of air cylinders have faced a dilemma when selecting units for service in hostile environments. Typical air cylinders offered at competitive prices just don't provide the corrosion-resistant properties demanded by such applications.

The purchase decision, therefore, generally comes down to a choice from several high-cost, yet less-than-adequate options: all stainless steel cylinders; models made from brass, bronze or other non-ferrous metals; cylinders plated with nickel, cadmium, or zinc; and those coated with epoxy paint, among others, have all been employed in the attempt to conquer the problem of corrosion.

Nor only does the user pay a stiff price in the initial purchase. Often, these high-cost cylinders fail to provide an effective solution to the problem. Just a minor scratch, dent or crack in the plating or coating, and the cylinder is vulnerable to corrosive attack—and ultimate failure.

Hanna innovates a better answer

Hanna Corporation recognized that the marketplace desperately required a better choice, and thus set out to innovate an air cylinder that would provide long service life in corrosive environments—and at an affordable price.

In selecting the materials to be used for this cylinder, Hanna's Design Engineers sought the optimum balance between corrosion resistance, high strength, operating performance and cost.

Series CA — a truly new concept

The result of Hanna's extensive research and development program is the Series CA Composite Pneumatic Cylinder line. These unique models are manufactured entirely of materials that meet the required cost/performance balance goals.

Series CA cylinders are designed and precision-manufactured to be impervious to most types of corrosion—from atmospheric conditions, galvanic reactions and microbiological attack, as well as localized corrosion typically caused by pitting, surface scratches, plating or coating defects.

CA cylinders also provide excellent resistance to a wide range of chemicals. They are not attacked by common solvents such as alcohol or petroleum products. They may be used in environments with low concentrations of mineral acids, and with fruit acids such as citric, acetic and lactic. In addition, the cylinders are unaffected by most salt solutions.

Caution: Some of the materials used in the manufacture of CA cylinders are attacked by oxidizing acids such as chromic and nitric. Contact with alkali solutions should also be avoided, unless the solutions are in very dilute concentrations.

In cases where the composite materials used in standard CA cylinders are not appropriate, extensive engineering knowledge of composite materials enables Hanna to provide the proper material selection for specific operating environments.

With minor factory modifications*, CA cylinders meet **American Water Works Association (AWWA)** specifications **C504/C540** for non-metallic water hydraulic and pneumatic cylinder applications.

Wide range of applications

The unique combination of utmost corrosion resistance and affordability makes Hanna Series CA Composite Cylinders ideal for a wide range of low-pressure air cylinder applications. Typical operating environments include:

- Municipal and industrial waste treatment plants
- Food processing plants
- Pulp and paper mills
- Textile mills
- Dairies and bottling plants
- Chemical and petrochemical plants
- Car washes
- Other corrosive environments

Excellent design flexibility

Series CA cylinders provide outstanding flexibility in machinery design. Developed for pressure ratings of 150 p.s.i., they are offered in bore sizes from 1.50" through 6.00". 11 N.F.P.A. mounting styles are available.

Hanna also offers a selection of electrical controls for CA cylinders. Proximity switches, totally unaffected by harsh environments, are available for mounting on bore sizes from 2.50" through 6.00". In addition, standard and 3-Amp Reed switches, also well suited for hostile environment use, are available on CA cylinders, 1.50" through 5.00" bores.

Add up the advantages of Hanna's CA Composite Pneumatic Cylinders. Corrosion resistance, high strength, low-maintenance service *and* affordable cost combine to make them the best value in cylinders that stand up to the toughest conditions.

* Consult Hanna Corporation

HOW TO ORDER

MF1-CA-CC-2.00"-9.00"-FSM1A

MOUNTING STYLE

- Tie Rods **MX0, MX1, MX2, MX3, MX4**
- End Angle **MS1**
- Cap Fixed Clevis **MP1**
- Head Trunnion **MT1**
- Head Rectangular Flange **MF1**
- Cap Rectangular Flange **MF2**
- Double Rod (Available in most mounting styles) **MX0-D**

SERIES

- Composite Pneumatic **CA**

CUSHION

- Non-Cushion **NC**
- Cushion, Both Ends **CC**
- Cushion, Cap End Only **CB**
- Cushion, Head End Only **CR**

All cushions are non-adjustable.

BORE SIZE
(Specify)

STROKE*
(Specify)

ROD END STYLE

- Small Male **SM**
- Intermediate Male **IM**
- Short Female **SF**
- Alternate Male (specify) **AL**
- Alternate Female (specify) **AF**

PISTON ROD PACKING, GLAND O-RING, ROD WIPER

STANDARD—Polyurethane Packing, Buna O-Ring, Polyurethane Wiper **I**

PISTON PACKING AND TUBE SEALS

- STANDARD**—Temperature Range -20°F. to +200°F. Buna Packings with Teflon Back-Ups, Wear Strip, Buna Tube Seals **A**
- OPTIONAL**—Temperature Range +32°F. to +200°F. Filled Teflon Seal with Buna Expander, Wear Strip, Buna Tube Seals **G**

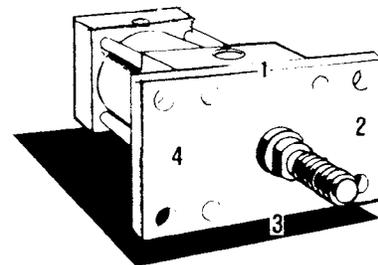
ROD DIAMETER

(Specify Piston Rod Code from dimensional chart)

* Maximum stroke is 9 ft. Consult factory for longer stroke lengths.

NOTE: For optional AWWA construction, specify Cadmium-Plated Piston with Standard Piston Packing and Tube Seals. (Code A).

When ordering a stop tube, specify actual (working) stroke and nominal stroke. State length of stop tube.



Port location: if other than position 1, must be specified. Mounting accessories and switches must be specified if required.