

HANNA
cylinders

Series CA Composite Pneumatic Cylinders



Advantages

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

HANNA
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SERIES CA

**COMPOSITE
PNEUMATIC
CYLINDERS**





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.

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.

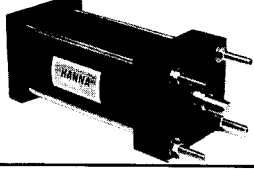
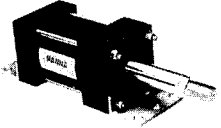


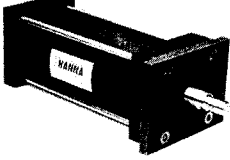


* Consult Hanna Corporation

SERIES CA COMPOSITE PNEUMATIC CYLINDERS

1.50" thru 6.00" Bores

Description

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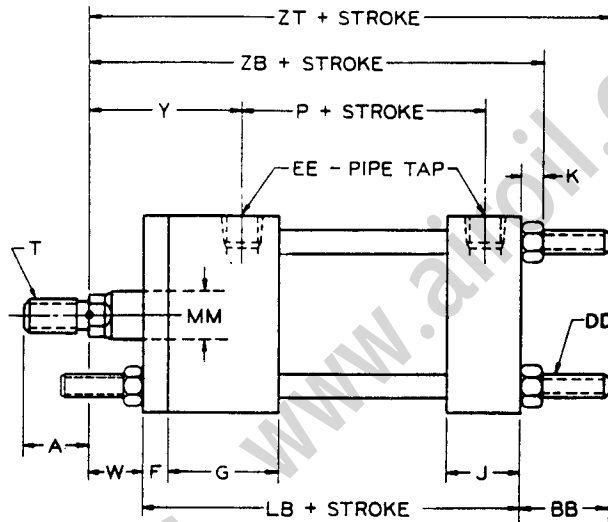
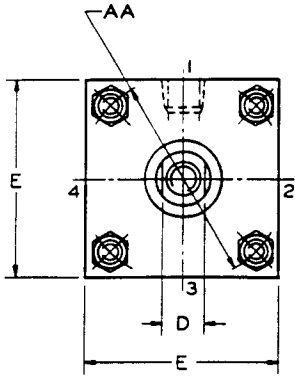
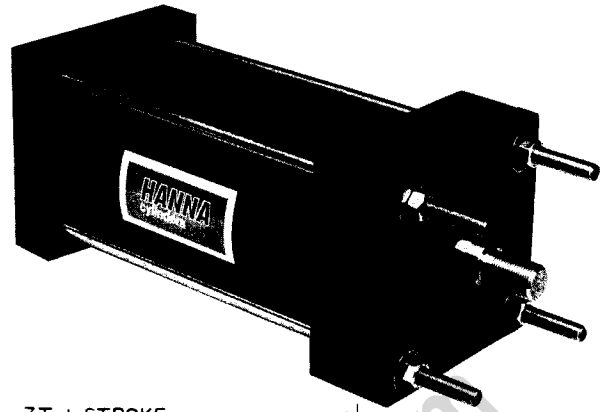
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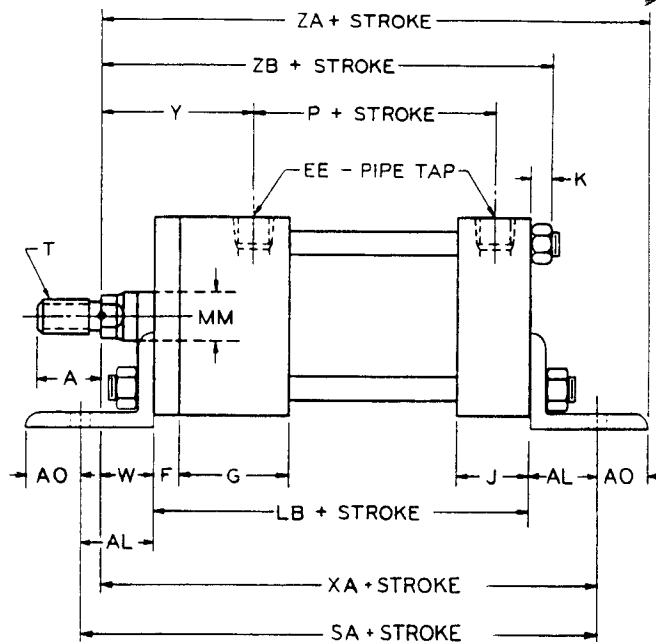
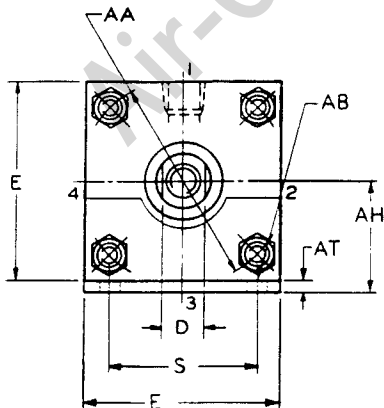
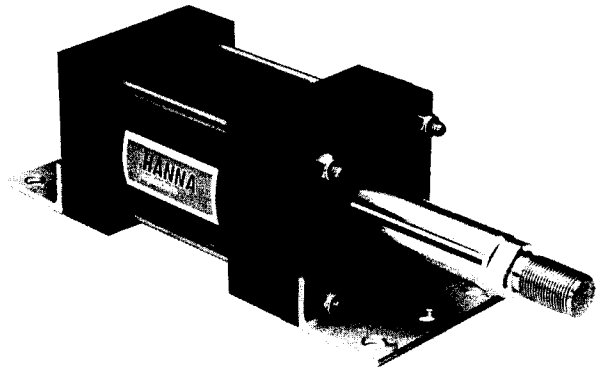
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SERIES CA 1.50"-6.00" Bores

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 | .12 | 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

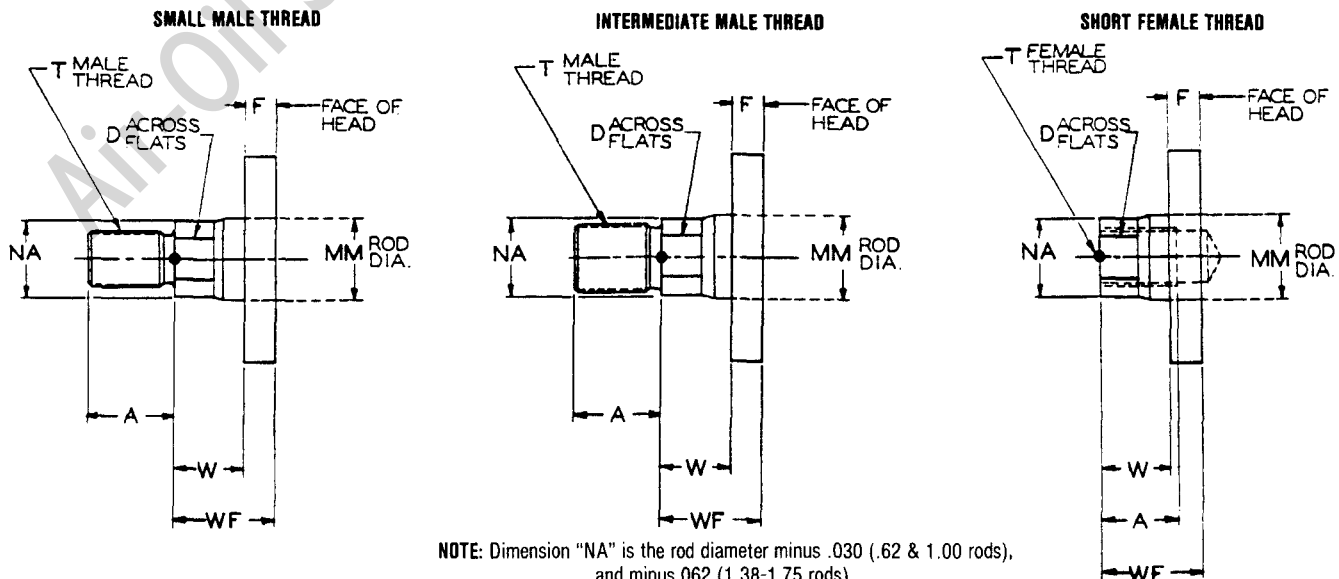
Dimensions are Affected by the Rod Diameter

| 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 |
| 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 12) which may reduce maximum operating pressure. Check Stop Tube Data (Page 13) to see if stop tube is required.

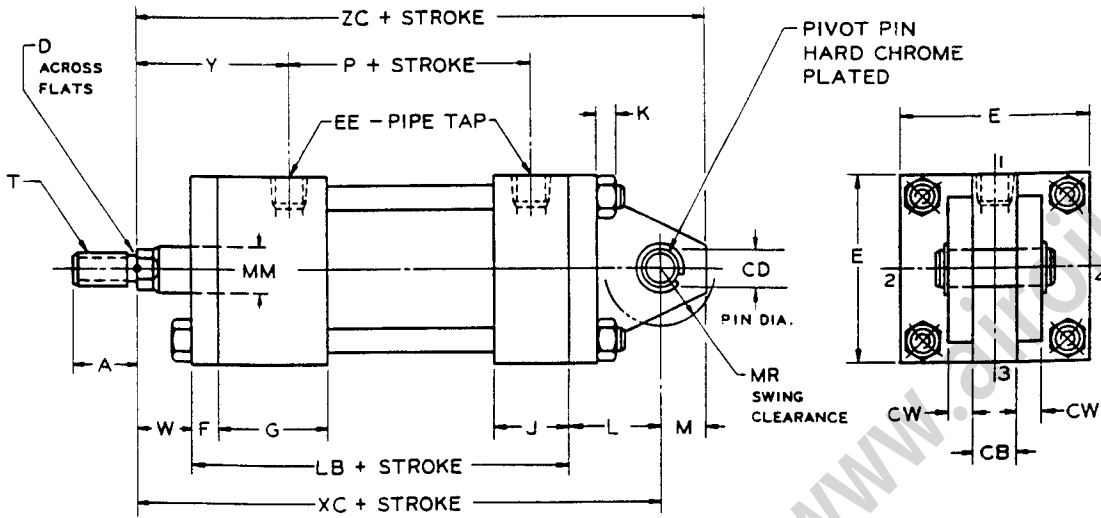
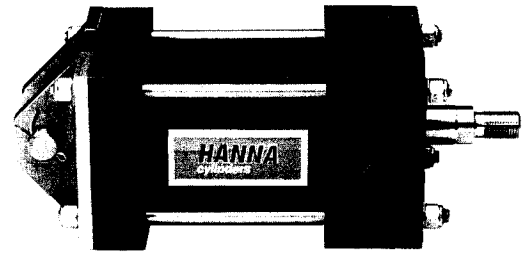
NOTE: Dimensions are nominal except where specifically toleranced. Tolerances on "Plus Stroke" dimensions will vary slightly from dimensions shown due to manufacturing tolerances and tube compression.

STANDARD ROD END STYLES

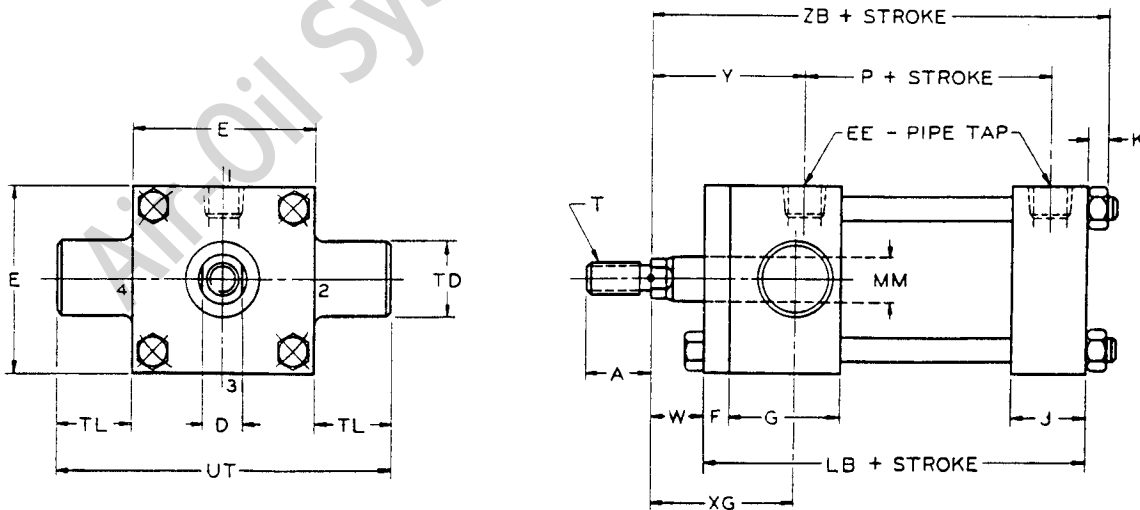
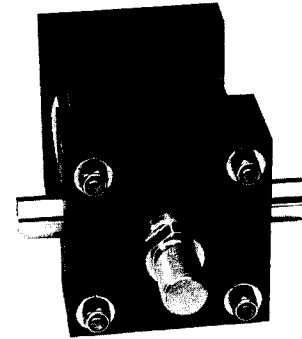


SERIES CA 1.50"-6.00" Bores

MP1 Fixed Clevis Mount



MT1 Head Trunnion Mount



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

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 +.000 -.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 |

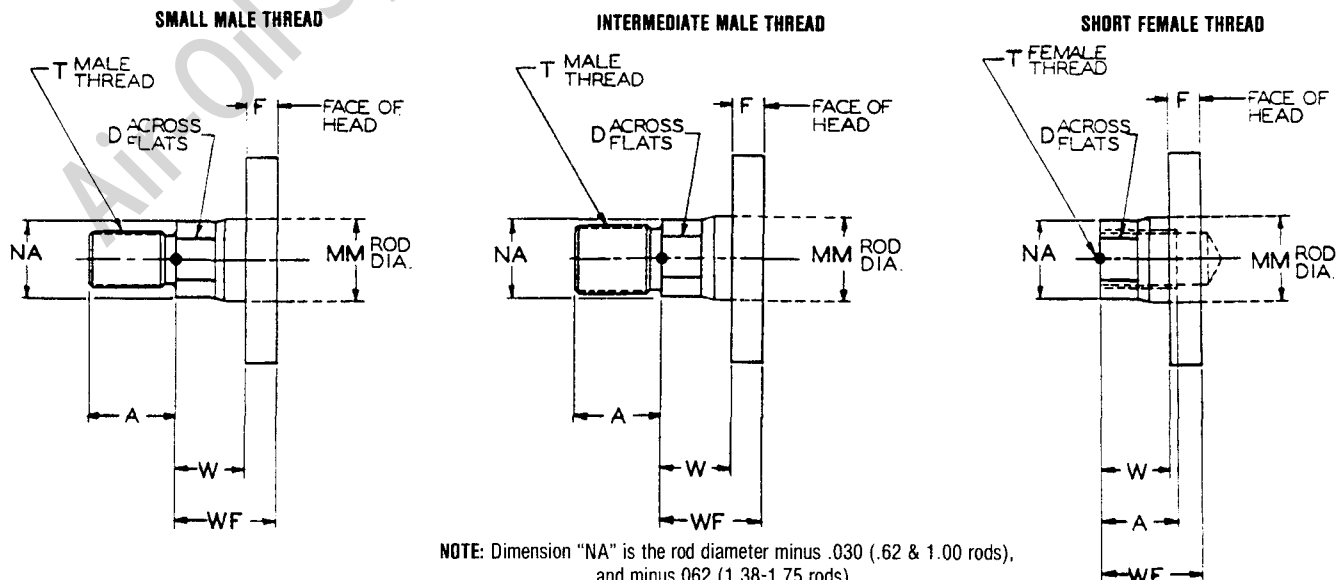
Dimensions are Affected by the Rod Diameter

| BORE | CYLINDER | | A | D | 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 F | .62 1.00 | .75 1.12 | .50 .88 | .44-20 .75-16 | .50-20 .88-14 | .44-20 .75-16 | .62 1.00 | 5.38 5.75 | 1.75 2.12 | 1.88 2.25 | 5.03 5.41 | 5.88 6.25 |
| 2.50 | D F | .62 1.00 | .75 1.12 | .50 .88 | .44-20 .75-16 | .50-20 .88-14 | .44-20 .75-16 | .62 1.00 | 5.50 5.88 | 1.75 2.12 | 1.88 2.25 | 5.16 5.53 | 6.00 6.38 |
| 3.25 | F G | 1.00 1.38 | 1.12 1.62 | .88 1.12 | .75-16 1.00-14 | .88-14 1.25-12 | .75-16 1.00-14 | .75 1.00 | 6.88 7.12 | 2.25 2.50 | 2.38 2.62 | 6.16 6.41 | 7.62 7.88 |
| 4.00 | F G | 1.00 1.38 | 1.12 1.62 | .88 1.12 | .75-16 1.00-14 | .88-14 1.25-12 | .75-16 1.00-14 | .75 1.00 | 6.88 7.12 | 2.25 2.50 | 2.38 2.62 | 6.16 6.41 | 7.62 7.88 |
| 5.00 | F G | 1.00 1.38 | 1.12 1.62 | .88 1.12 | .75-16 1.00-14 | .88-14 1.25-12 | .75-16 1.00-14 | .75 1.00 | 7.12 7.38 | 2.25 2.50 | 2.38 2.62 | 6.56 6.81 | 7.88 8.12 |
| 6.00 | G H | 1.38 1.75 | 1.62 2.00 | 1.12 1.50 | 1.00-14 1.25-12 | 1.25-12 1.50-12 | 1.00-14 1.25-12 | .88 1.12 | 8.12 8.38 | 2.62 2.88 | 2.75 3.00 | 7.31 7.56 | 9.12 9.38 |

PRESSURE RATING: 150 P.S.I. maximum operating pressure. Check Stroke Limitation Data (Page 12) which may reduce maximum operating pressure. Check Stop Tube Data (Page 13) to see if stop tube is required.

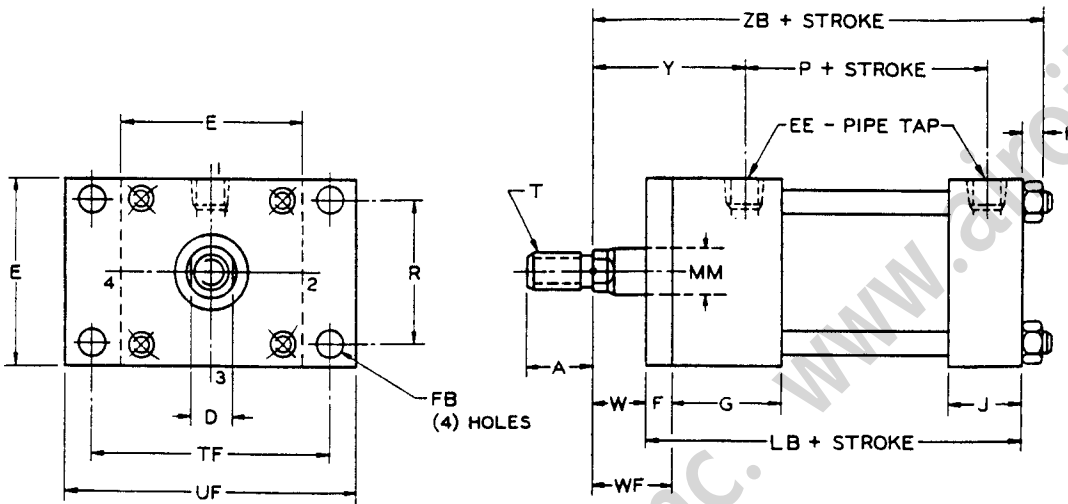
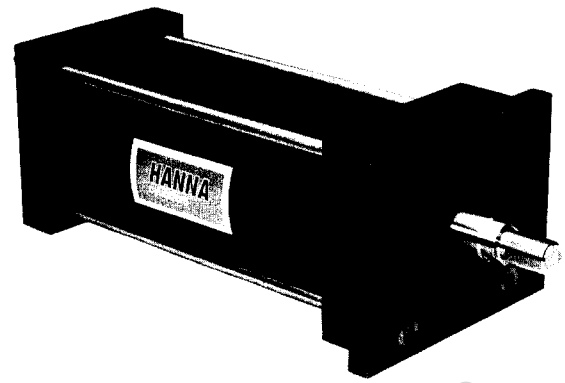
NOTE: Dimensions are nominal except where specifically toleranced. Tolerances on "Plus Stroke" dimensions will vary slightly from dimensions shown due to manufacturing tolerances and tube compression.

STANDARD ROD END STYLES

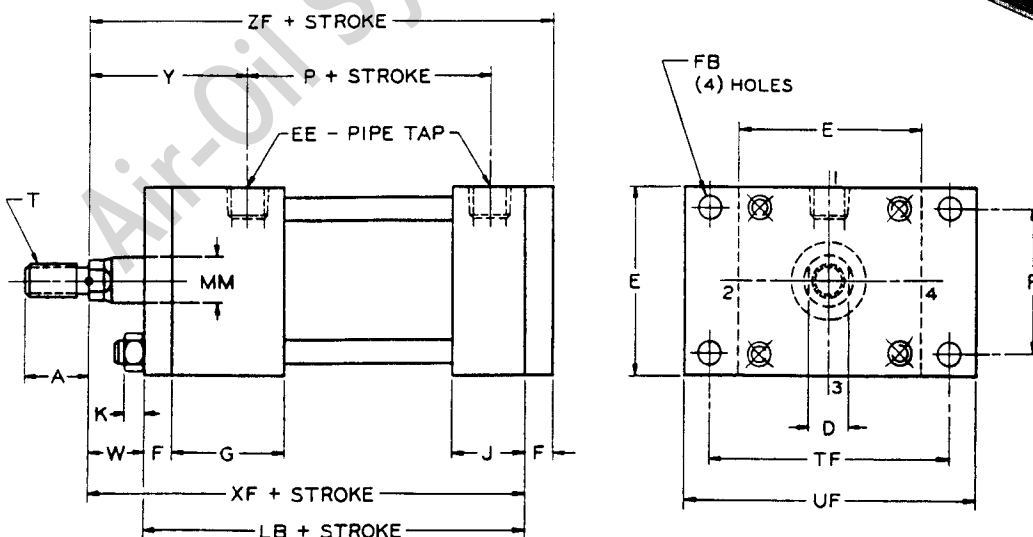
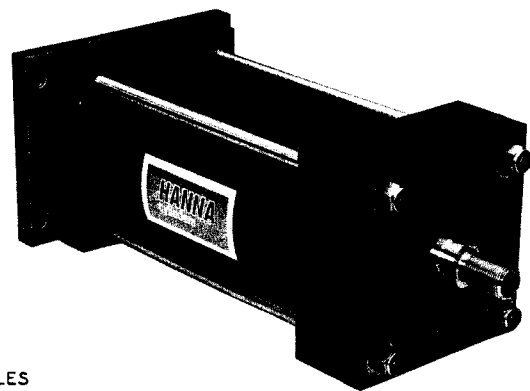


SERIES CA 1.50"-6.00" Bores

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

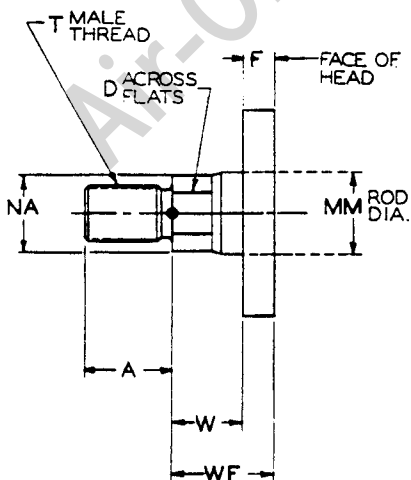
| BORE | CYLINDER | | A | D | T (THREAD) | | | W | WF | Y | ZB | ZF | ZJ |
|------|---------------|-------------|------|------|---------------|-----------------------|-----------------|------|------|------|------|------|------|
| | ROD DIA. CODE | MM ROD DIA. | | | SMALL MALE SM | INTER-MEDIATE MALE 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 |
| 2.00 | D | .62 | .75 | .50 | .44-20 | .50-20 | .44-20 | .62 | 1.00 | 1.88 | 5.03 | 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 12) which may reduce maximum operating pressure. Check Stop Tube Data (Page 13) to see if stop tube is required.

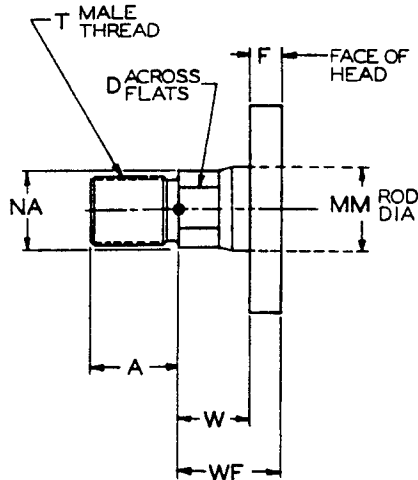
NOTE: Dimensions are nominal except where specifically toleranced. Tolerances on "Plus Stroke" dimensions will vary slightly from dimensions shown due to manufacturing tolerances and tube compression.

STANDARD ROD END STYLES

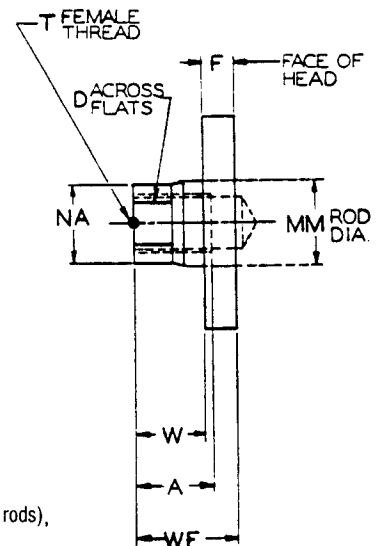
SMALL MALE THREAD



INTERMEDIATE MALE THREAD



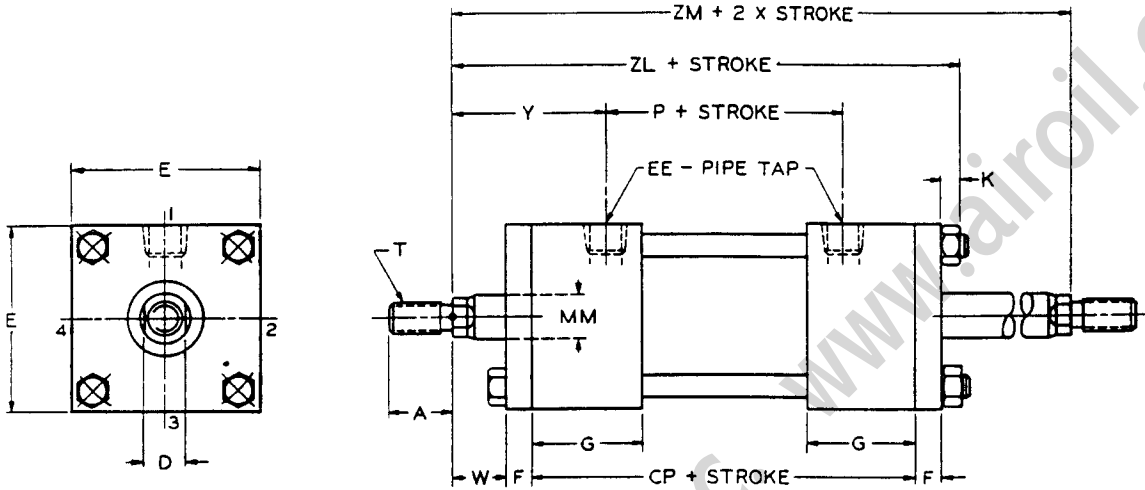
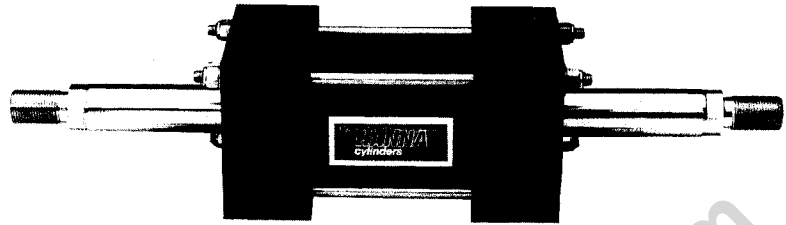
SHORT FEMALE THREAD



NOTE: Dimension "NA" is the rod diameter minus .030 (.62 & 1.00 rods), and minus .062 (1.38-1.75 rods).

SERIES CA 1.50"-6.00" Bores

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 |
| 2.00 | 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 12) which may reduce maximum operating pressure. Check Stop Tube Data (Page 13) 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.

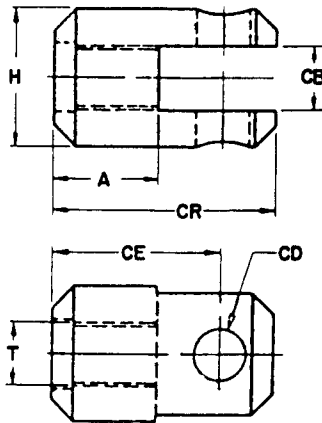
MOUNTING ACCESSORIES

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:**

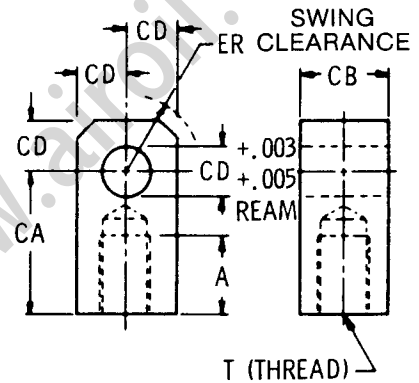
Accessory load rating may be lower than maximum force available from cylinder. Accessories load ratings are in pounds. Before specifying, compare maximum operating pull force in pounds developed by cylinder with load rating of accessory. Accessory load rating is the maximum recommended operating load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

Rod Clevis



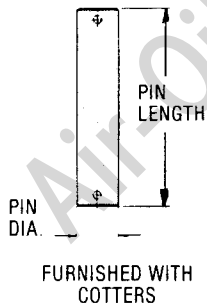
| ROD CLEVIS ITEM NO. | PISTON ROD CODE | A | CB | CD | CE | CR | H | T | *LBS. CAPACITY |
|---------------------|-----------------|------|------|------|------|------|------|---------|----------------|
| SV-1 | D | .75 | .75 | .50 | 1.50 | 2.00 | 1.50 | .44-20 | 2,700 |
| SV-2 | F | 1.12 | 1.25 | .75 | 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



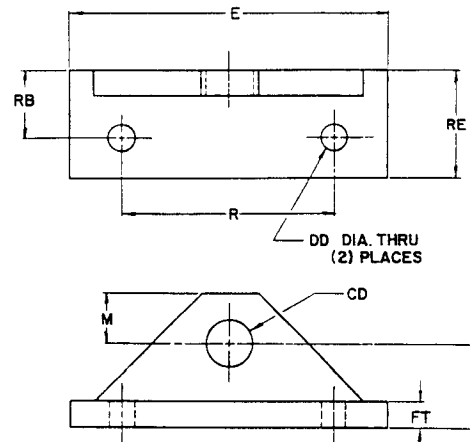
| ROD CLEVIS ITEM NO. | PISTON ROD CODE | A | CA | CB | CD | ER | T | *LBS. CAPACITY |
|---------------------|-----------------|------|------|------|------|------|---------|----------------|
| SY-1 | D | .75 | 1.50 | .75 | .50 | .75 | .44-20 | 2,700 |
| SY-2 | F | 1.12 | 2.06 | 1.25 | .75 | 1.12 | .75-16 | 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



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

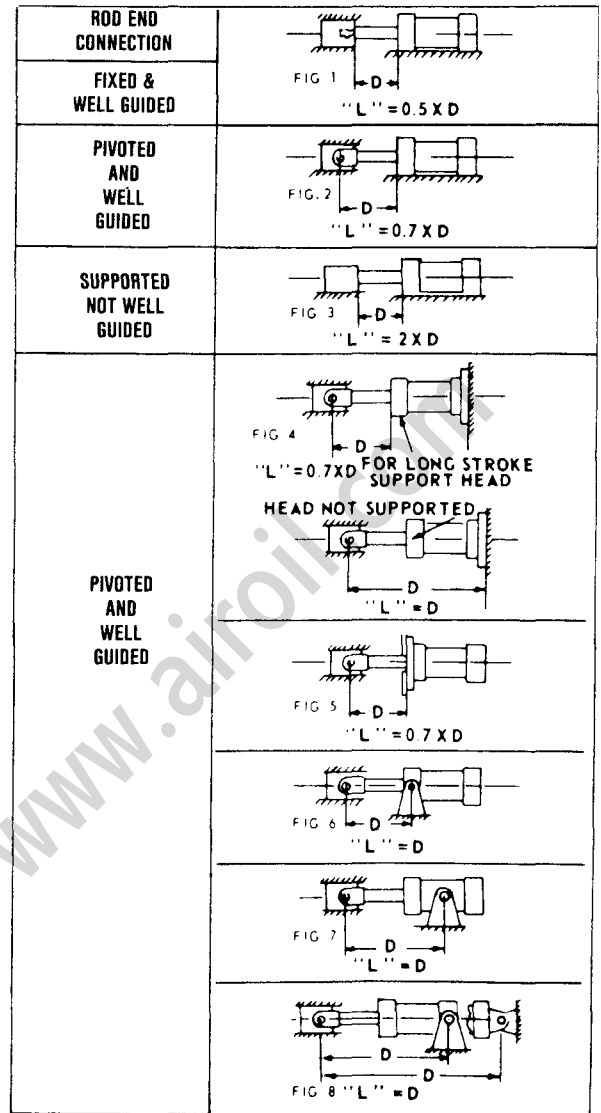
From the description, the cylinder falls into Fig. 8. To determine the value of "L":

| | | | |
|------|------|---------------------------|--------|
| ADD: | MP1 | "XC" Dimension | 7.12" |
| | SV-3 | "CE" Dimension | 3.12" |
| | | Two times stroke (2 x 27) | 54.00" |

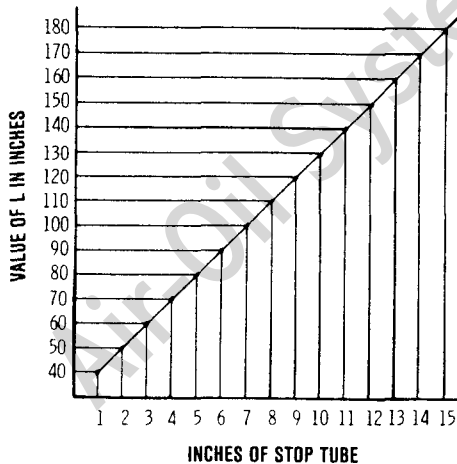
Total Value of "L" 64.24"

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.



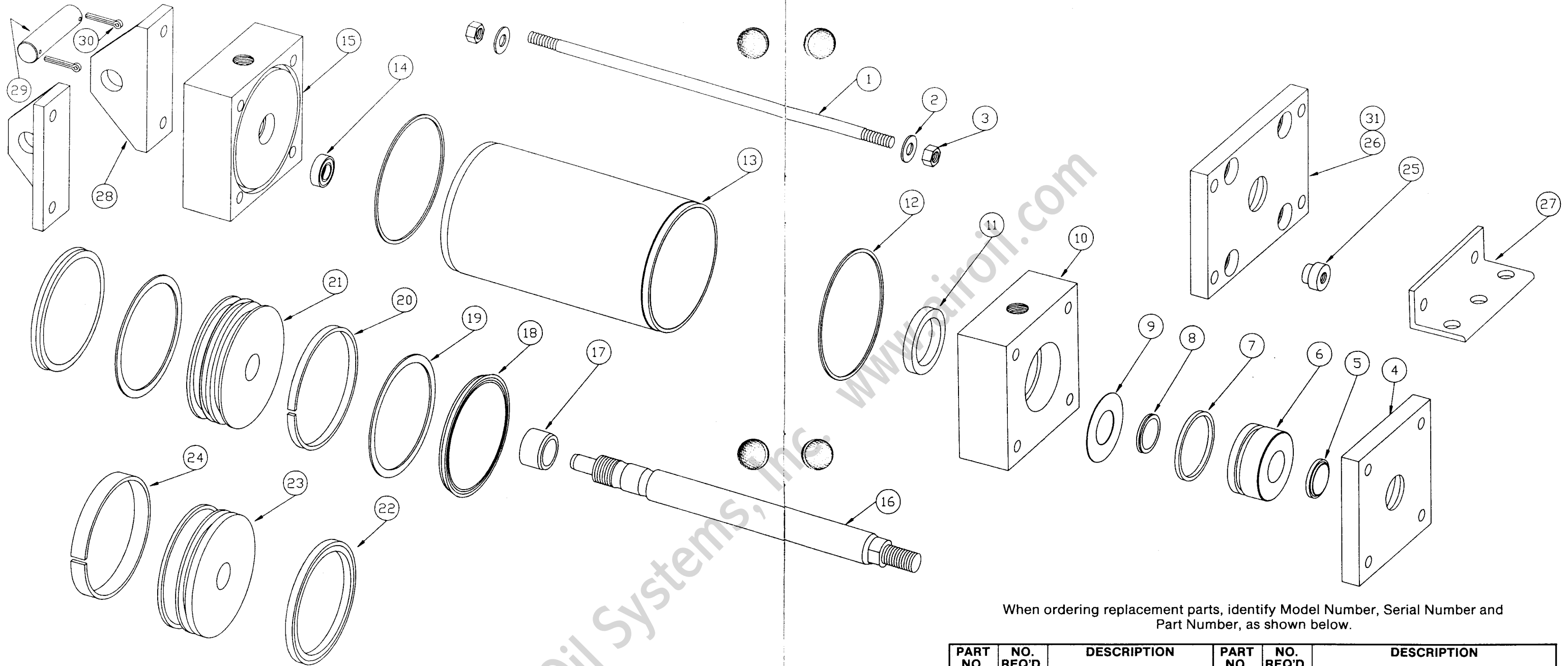
STOP TUBE CHART



CYLINDER WEIGHTS

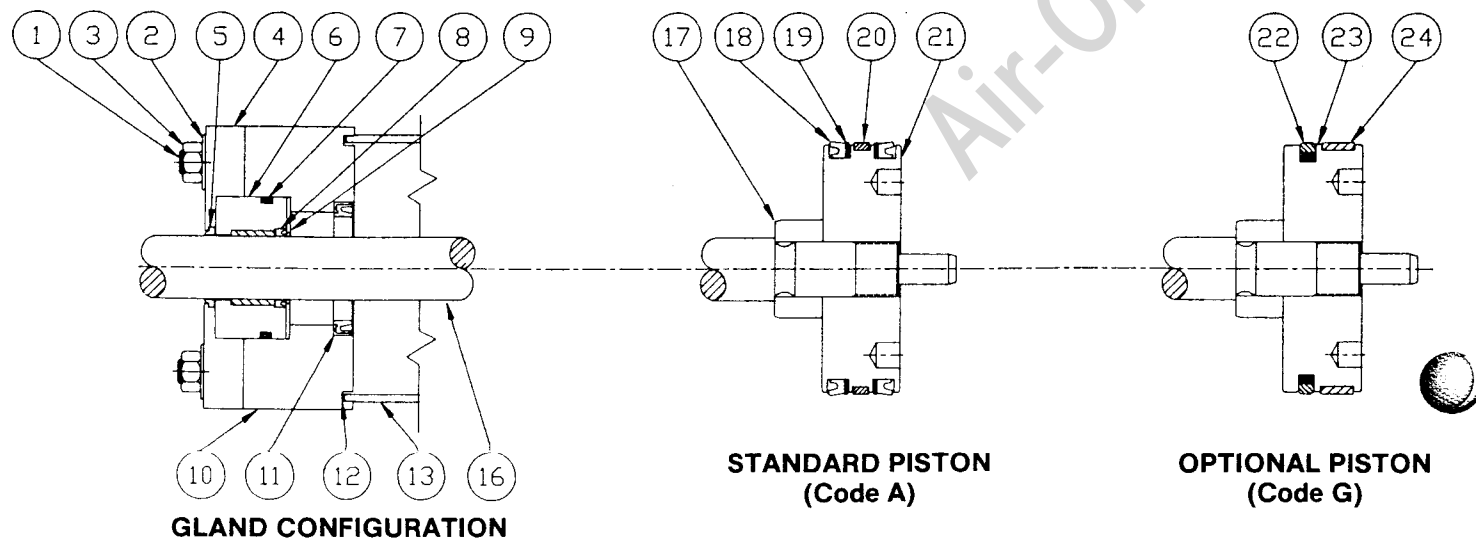
| CYLINDER BORE | BASE WEIGHT AT ZERO STROKE | BODY WEIGHT PER INCH OF STROKE | ROD DIAMETER | ROD WEIGHT PER INCH OF STROKE |
|---------------|----------------------------|--------------------------------|--------------|-------------------------------|
| 1.50 | 1.200 lbs. | 0.100 lbs. | 0.625 | 0.052 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



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 & 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. |

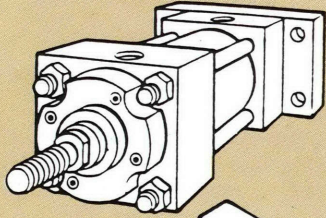
WARRANTY

HANNA warrants that products it manufactures or designs are merchantable, are free from defects in material and workmanship, conform to any drawing and/or specifications furnished by purchaser and agreed to by *HANNA* in writing. As to products not manufactured by *HANNA*, *HANNA* will extend the manufacturer's warranty. (We will provide a copy upon request.) This warranty and extended manufacturer's warranty is subject to the remedy clause stated herein. Except for the foregoing, it is agreed that there are no warranties, expressed or implied which extend beyond the description on the face hereof.

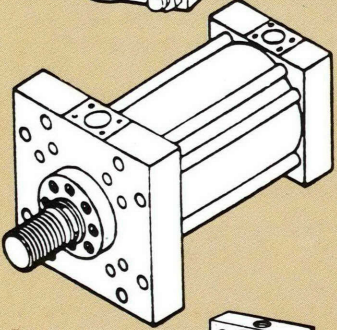
REMEDY: All claims must be made within twelve (12) months of delivery to the original user. Upon satisfactory proof of claim by purchaser, *HANNA* will within a reasonable time, make any necessary repairs or supply replacement parts, or where the foregoing is deemed by *HANNA* to be commercially impractical, refund the purchase price upon return of the products. Repair or replacement parts provided under this remedy will be supplied by *HANNA* free of charge, F.O.B. shipping point, freight prepaid and allowed at the lowest available commercial rate. Purchaser charges for repairs, replacements or returns for credit will not be allowed unless authorized by *HANNA* in writing. *HANNA* will not be liable for any other purchaser costs, damages or expenses that may result from a breach of this contract. The foregoing remedy is sole and exclusive and states the full extent of *HANNA*'s liability. No other remedy will be allowed, whether in contract or tort (including strict liability and negligence).

HANNA FLUID POWER PRODUCTS

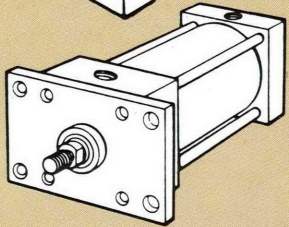
Hydraulic Cylinders



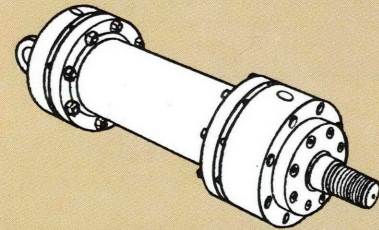
Series 2H
Heavy-duty (3000 p.s.i.) hydraulic cylinders. 22 NFPA mounting styles. 1.50" through 14.00" bores.



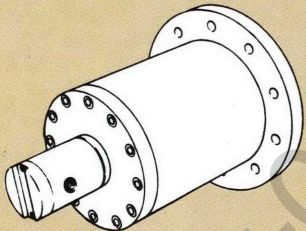
Series 3H
Heavy-duty (3000 p.s.i.) large bore cylinders (10.00" through 24.00"). 7 mounting styles.



Series 3L
Medium-duty (1800 p.s.i.) hydraulic cylinders. 24 NFPA mounting styles. 1.50" through 6.00" bores.

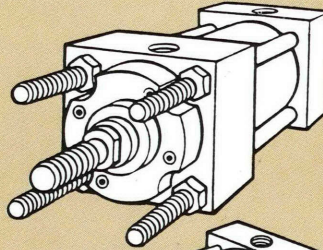


Mill Cylinders
Extra-rugged, heavy-duty (2000 p.s.i.). 7 mounting styles, 2.00" through 16.00" bores.

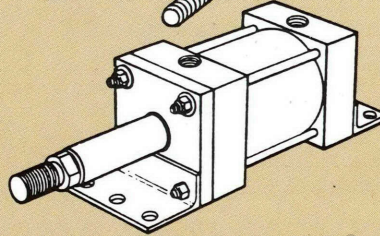


Rotating Cylinders
Hydraulic service to 1500 p.s.i., 500 RPM. Flush or flange mounts. Bore sizes from 4.50" through 16.00".

Pneumatic Cylinders



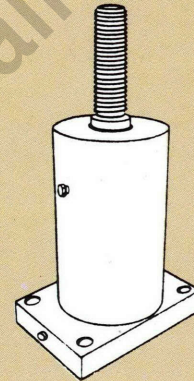
Series 3A and 3AN
For air service to 250 p.s.i. 23 NFPA mounting styles. 1.50" through 14.00" bores. Specify 3AN for non-lube service.



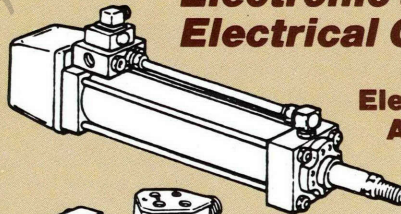
Series CA
Composite air cylinders for corrosive environment service to 150 p.s.i. 11 NFPA mounting styles, 1.50" thru 6.00" bores. Available to meet AWWA specifications.

Custom-Welded Cylinders

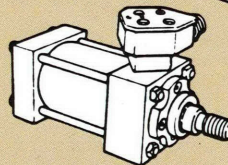
For a wide range of mobile, marine and industrial applications. Standard bore sizes through 12.00"; specials through 30.00" bores—strokes to 25' and beyond.



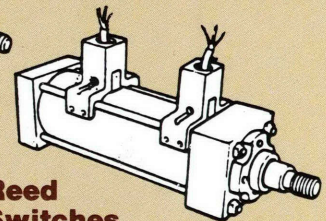
Electronic and Electrical Controls



Electronic Feedback Actuator System



Proximity Switches



Reed Switches

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