HELIPEBS CONTROLS

# HYDRAULIC CYLINDERS
# EH SERIES

High quality range of 210bar (3,000psi) tie rod cylinders from 25mm bore to 200mm bore


PERFORMANCE UNDER PRESSURE

AGAIN. AND AGAIN. AND AGAIN.

# EH SERIES INDEX AND SPECIFICATIONS

## ISO 6020/2 and DIN 24554 160 bar series (Working Pressure suitable for up to 210 bar)

NOTE: Prior to selecting a cylinder, take a few moments to read through this catalogue. It is highly recommended that particular attention be given to the pages concerning Fluids and Temperature, Pressure and Mounting Information. Be sure to read the notes appearing on the Mounting Dimension page regarding any limitations for the mounting style selected.

## Index



## Standard Specifications

**ISO 6020/2 and DIN 24554**

Construction to square end tie rod design

Working Pressures to 210 bar

Bore sizes 25mm – 200mm

Rod diameters 12mm – 140mm

Standard fluids – Hydraulic Oil

Strokes in any practical length

Cushions optional at either or both ends

Temperatures – 45°C to +90°C with standard seals

Choice of 3 rod diameters per bore

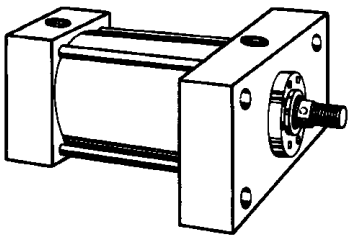
Choice of 12 mounting styles – ISO

Choice of 5 mounting styles – DIN

# MOUNTING STYLES

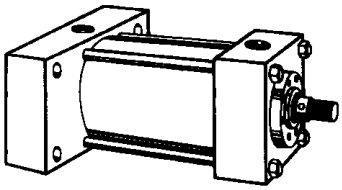
## Available mountings and where to find them

**Front Head Flange Mount – Style FHF**



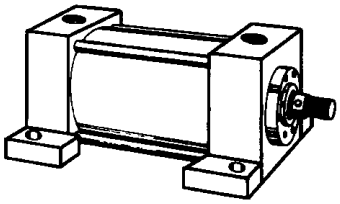
(ISO style ME5) page 16

**Rear Head Flange Mount – Style RHF**



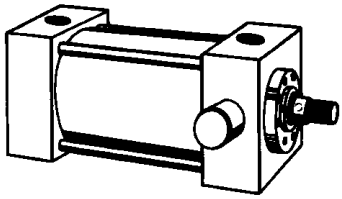
(ISO & DIN style ME2) page 16

**Side Lug Mount – Style SL**



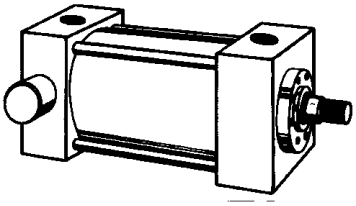
(ISO & DIN style MS2) page 16

**Trunnion Front Mount – Style TF**



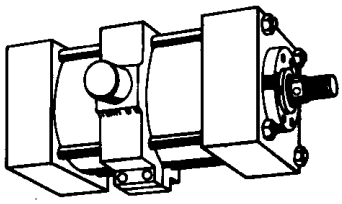
(ISO style MT1) page 18

**Trunnion Rear Mount – Style TR**



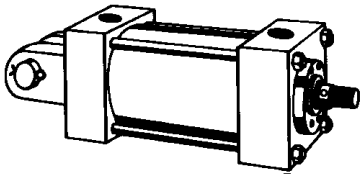
(ISO style MT2) page 18

**Trunnion Mount – Style T**



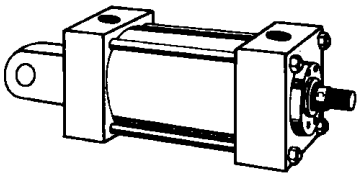
(ISO & DIN style MT4) page 18

**Clevis Mount – Style C**



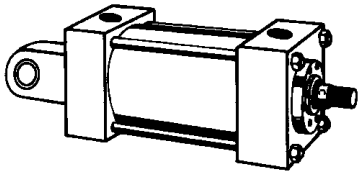
(ISO style MP1) page 20

**Pivot Mount – Style P**



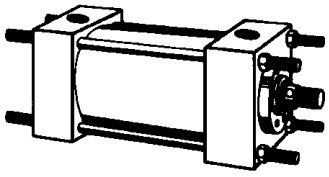
(ISO style MP3) page 20

**Pivot Mount with Spherical Bearing – Style SBp**



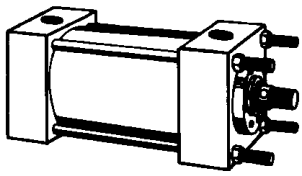
(ISO & DIN style MP5) page 20

**Tie Rods Extended Both Ends – Style BX**



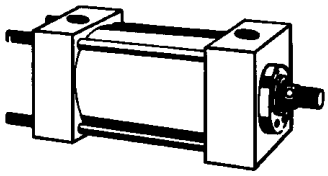
(ISO style MX1) page 22

**Tie Rods Extended Head End – Style FX**



(ISO style MX3) page 22

**Tie Rods Extended Cap End – Style RX**



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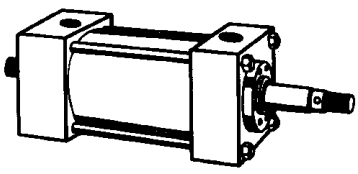
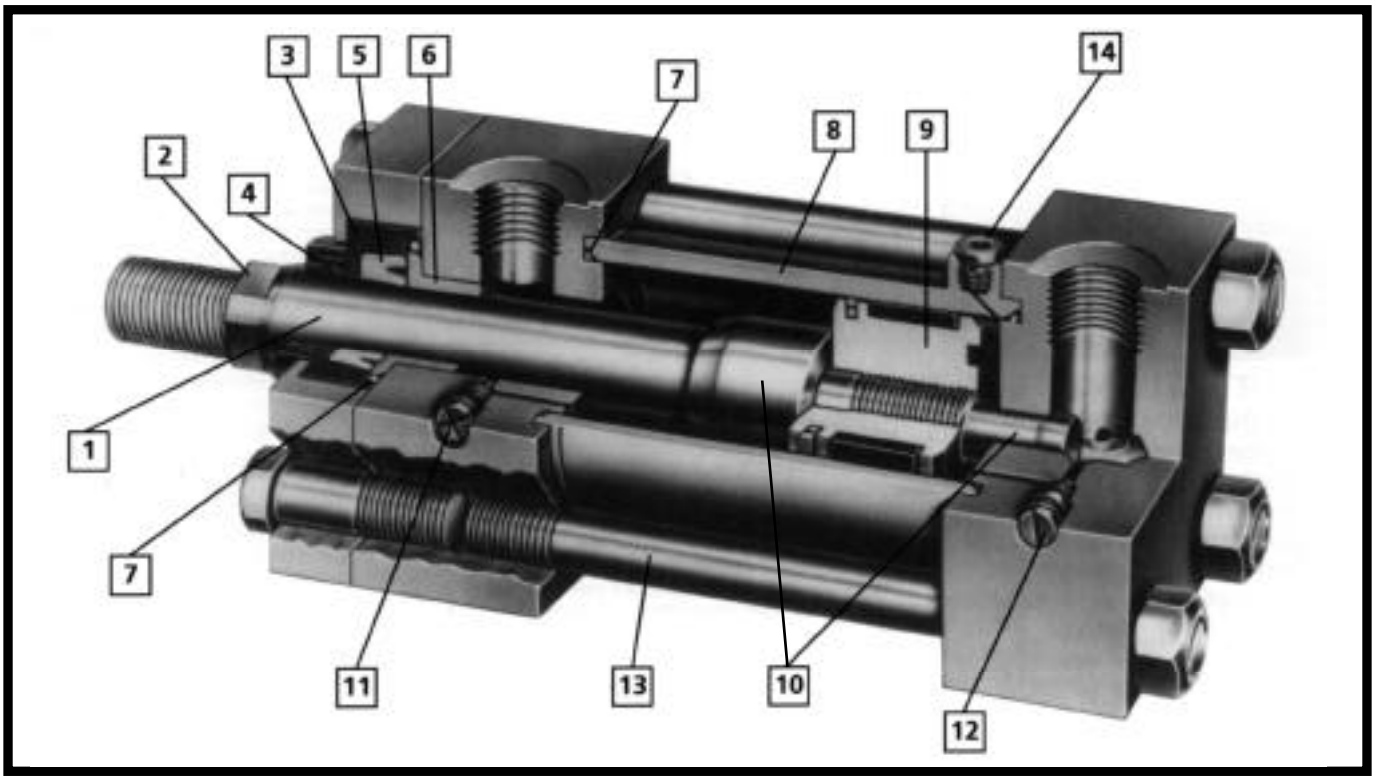
**Double Rod Extension**



Available in all mounts except "RHF", "C" and "P" page 24

# CONSTRUCTION




## 1 Piston Rod

Piston rods upto and including 100 diameter have a minimum expected yield of 690 N/mm$^2$. They are case hardened to 50-60 Rockwell "C" to a depth of .75 to 1.5 for damage resistance. They are then hard chrome plated for wear and corrosion resistance. Larger diameter rods have an expected minimum yield of 380 to 415 N/mm$^2$ depending on diameter and are hard chrome plated.

## 2 Wrench Flats

Four wrench flats are provided as standard for easy attachment on all rod diameters.

## 3 Rod Gland

Easily removable for replacement of rod packings and wiper. In most cases it is not necessary to demount or disassemble the cylinder. Easier to service since, on removal of the ductile iron gland, the piston rod remains supported by the separate rod bearing.

## 4 Rod Wiper

Synthetic wiper is designed to wipe off abrasive dust and contaminants on the retract stroke to ensure long life for packings, rod bearing, and piston rod. Where the rod will be exposed to gummy materials such as "road tar", a metallic rod scraper is available.

## 5 Rod Seal

The polyurethane rod seal has a unique design which incorporates the optimum sealing properties of a "U" configuration with the elastomeric properties of a compression-type seal. The polyurethane material was selected for toughness, abrasion resistance, and the ability to resist extrusion under rough service conditions.

## 6 Rod Bearing

High load bearing bronze piloted into the head. Located inboard of the seals to ensure a well lubricated bearing for the fastest cycling applications. It need not be removed for rod seal replacement.

## 7 Static Seals

Pressure activated "O" ring seals are used at rod gland and tube ends. Located to eliminate extrusion and to provide positive leak tight seal.

## 8 Tube

The steel tube is honed to a 0.4 micro metres $R_a$ max finish for low friction and long seal and piston bearing life. Tube ends are machined on the O.D. concentric with the I.D. They are confined by the close tolerance machining of the head and cap which provides greater hoop strength.

## 9 Pistons and Piston Seals

All pistons are machined from a fine grain alloy cast iron. They are threaded directly onto the piston rod, torqued and sealed. **The special piston seal** is an endless glass filled Teflon material with an "O", ring expander. One or more (depending on bore size) bronze filled Teflon bearing strips are also employed on this type piston to eliminate metal-to-metal contact. This type of piston offers long life, low friction, near zero leakage, and great tolerance for side loading. It can be used successfully on virtually any application and is offered as standard at no extra cost.

## 10 11 12 Cushions

Cushion pistons (10) are tapered to provide gradual deceleration and eliminate shock upon entrance. The adjusting screw with fine threads (11 ) provides a wide range of adjustment. It is interchangeable with the ball check (12) permitting field changes of position. Neither the adjusting screw nor ball check plug project beyond the head or cap surface and are held captive by a retaining ring.

## 13 Tie Rod Construction

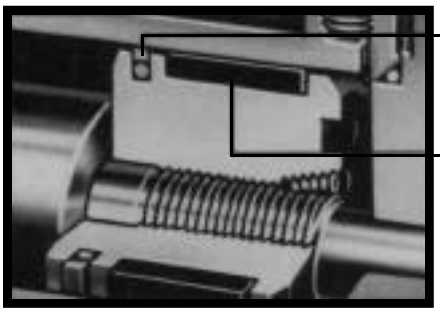
Maximum strength is obtained through a prestressed tie rod assembly. The use of high strength steel tie rods eliminates axial loading of tubes and permits higher shock loading.

## 14 Air Bleeds (Optional)

When required, air bleeds are located where they can be employed most successfully - at the tube and head juncture. The straight thread plugs are equipped with metallic "O" rings so they can be used repeatedly with a good seal every time.

# CONSTRUCTION

**Why a Slipper Seal Piston?**




**BECAUSE IT IS NEEDED!!!!**
**For years there has been a demand for a hydraulic cylinder piston that exhibited the long life of cast iron rings, the leak-tight sealing of cup seals, and the low friction of Teflon. A piston that would tolerate considerable sideloading without galling or scoring the tube; that would permit easy, but infrequent, maintenance, and would be economically feasible. A near perfect piston for virtually any application. The Slipper Seal Piston, standard on the EH Series, meets these requirements to a degree that is astounding ... and at no extra cost!**

## Near Zero Leakage

A completely honest statement of facts causes us to use this term. We know of no dynamic seal that is completely leak-tight under ALL operating conditions, but for all practical purposes, the slipper seal is leaktight. Since the higher the pressure, the better the seal, we conducted some of our Slipper Seal tests under low pressures to simulate the worst operating conditions. A good example was the testing of a 152 bore cylinder with trapped pressure of only 1.2 bar. The leakage past the piston permitted average movement of 0.25 mm per 24 hours. That represents an average piston leakage of 2.60 cu. mm per min. This test was conducted over 13 days. Other tests with pressures ranging from 35 to 500 bar showed no leakage whatever.

## Long Life – Low Friction

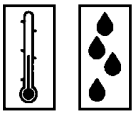
The two are closely related. Friction causes wear which determines life. We cannot state how long a Slipper Seal will last because the life of a dynamic seal depends on too many operational and environmental conditions. We can state, however, that both laboratory and field test have demonstrated a longevity that far exceeds any seal we have tested or used with the possible exception of metallic rings. Although this amazing new type of piston has been introduced as a special option by our competitors, we have been using the Slipper Seal piston for over twenty years on standard cylinders.

## No Metal-To-Metal Contact

The use of the Slipper Seal and the bronze filled Teflon bearing strip eliminates metal-to-metal contact between the piston and the tube. This feature alone will resolve many problems experienced by cylinders users.

**Results? At no additional cost, you can obtain a cylinder that will give you outstanding service on all normal applications as well as holding or locking circuits, servo circuits, modulating operations, side loaded conditions, rapid cycling operations, and most other problem applications.**

# FLUIDS AND TEMPERATURES



## Temperatures

Standard cylinders may be operated at temperatures of -45 to +90°C. For temperatures over 90°C consult the factory for specific recommendations giving operating temperature, source and characteristics of the heat, medium and cycle time. It should be noted that many seal compounds exhibit reduced life as the temperature nears their stated limit. In such applications, it is a good practice to specify high-temperature seals to assure long, satisfactory life.

## Fluids

Seal materials employed in standard EH Series cylinders are Buna-N, Polyurethane and Teflon. As such, standard cylinders are particularly suited for use with any good grade petroleum base hydraulic oil. For normal temperature ranges, an oil having a viscosity range of 250-300 S.S.U. at 38°C is recommended. The oil should be maintained at SAE Level 3-4 cleanliness, normally accomplished with a 10 micron filtration system. Standard seals are also compatible with most Water-Glycol and Water-Oil Emulsion fluids with temperatures limited to a maximum of 60°C. Whenever there is a question of compatibility, contact the factory or the fluid manufacturer. NEVER change system fluid or MIX fluids until a careful check as to compatibility has been made.

Fire Resistant Fluids such as Phosphate Esters and Chlorinated Hydrocarbons require special seal compounds. These can be supplied in lieu of the standard seals at a moderate extra charge. The specific fluid and/or seal compounds should always be given on your order.

Cylinders to be operated with raw water as the fluid medium require special plating and/or special materials. There are two general classifications of cylinders made for use with water: (1) Water-Fitted Cylinders and (2) Water-Hydraulic Cylinders.

(1) Water-Fitted Cylinders are standard cylinders that have been adapted for raw water service by plating the internal metal surfaces. This usually consists of nickel plating the head, cap and piston and hard chrome plating the tube I.D. While this is the least expensive method of provisioning a cylinder for water service, it is frequently inadequate for long, trouble-free service. Because water conditions vary greatly, we cannot accept responsibility for water-fitted cylinders where failure is caused by corrosion, electrolysis or mineral deposits. When a customer has had experience with local water conditions and finds waterfitted cylinders to work well, he should continue to specify them. If such is not the case, it is recommended that the use of Water-Hydraulic Cylinders be seriously considered.

(2) Water-Hydraulic Cylinders are cylinders designed and manufactured specifically for water service. Non-corrosive materials, such as brass, bronze and stainless steel are used instead of plating. While the initial cost is higher, this type of cylinder is invariably the least expensive in the long run. When requirements exist, request a quotation.

# FLUIDS AND TEMPERATURES

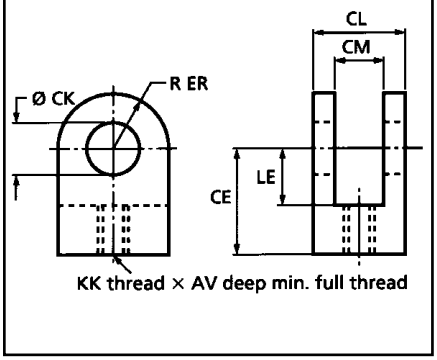
| Standard EH Cylinders Without Modifications Can Be Used With Water Base Fluids to 60˚C.<br>Compatibility Chart for Some Fluids and Seal Compounds | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Type of Seal Compound | | | | | | |
| Fluid Name | Mil. Spec. | Trade Name | Buna-N | Butyl | Poly-ure'ne | Neo-prene | EP | Viton® | Teflon® |
| **Brake Fluid** | | | U | U | U | U | R | U | R |
| **Gasoline** | | | R | U | U | U | U | R | R |
| **Transmission Fluid (ATF)** | | | R | U | R | S | U | R | R |
| **Petroleum Base** | MIL-H-6083 | Preservative Oil | R | U | R | R | U | R | R |
| **Petroleum Base** | MIL-H-5606 | Aircraft Hydraulic Fluid | R | U | R | U | U | R | R |
| **HWBF (95-5)** | | | R | U | *R | R | U | M | R |
| **Water-Glycol** | | Houghto-Safe 600 Series | R | S/M | *R | S | R | R | R |
| | | Houghto-Safe 500 Series | R | R | *R | S | R | R | R |
| | MIL-H-22072 | Houghto-Safe 271 | R | S | *R | S | R | S | R |
| | | Unicon Hydrolube-J4 | R | R | *R | S | R | R | R |
| | | Celluguard | R | R | *R | R | R | R | R |
| **Water/Oil Emulsion** | | Houghto-Safe 5000 Series | R | U | *R | S | U | R | R |
| | | Gulf FR | R | U | *R | S | U | R | R |
| | | Iris 902 | R | U | *R | S | U | R | R |
| | | Pyrogard C & D | R | U | U | S | U | R | R |
| **Water-Soluble Oil** | | | R | M | *R | S | R | R | R |
| **Phosphate Ester** | | Houghto-Safe 1000 Series | U | R | U | U | R | R | R |
| | MIL-H-19457B | Houghto-Safe 1120 | U | R | U | U | R | R | R |
| | | Fyrquell (Cellulube) | U | R | U | U | R | R | R |
| | | Pyrogard 42, 43, 53, 55, 190, 600 | U | R | U | U | R | R | R |
| | | Skydrol 500 Type 2 | U | S | U | U | R | U | R |
| | | Skydrol 7000 Type 2 | U | R | U | U | R | S | R |
| | | Pydraul 312C, 230C, 540C | U | U | U | U | U | R | R |
| | | Pydraul 10E | U | R | U | U | R | U | R |
| | | Pydraul 29ELT, 30E, 50E, 65E | U | R | U | U | R | R | R |
| **Chlorinated Hydrocarb** | | Pydraul A-200 | U | U | U | U | U | R | R |
| **Silicate Ester** | | OS-45 Types 3 & 4 | S | U | U | R | U | R | R |
| | MLO-8200 | Oronite 8200 | S | U | R | R | U | R | R |
| | MLO-8515 | Oronite 8515 | S | U | R | R | U | R | R |
| | MIL-H-8446B | Brayco 846 | S | U | R | R | U | R | R |

R = Recommended S = Satisfactory M = Marginal U = Unsatisfactory * Maximum Temperature 60°C

NOTE: The above material is for general information and should not be construed as a warranty or representation for which legal responsibility is assumed.

® Registered Trade Mark.

Rod Clevis (plain)

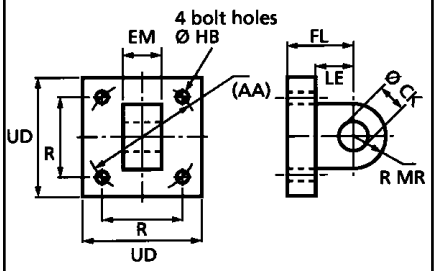



## Rod Clevis

| Part Number | AV | CE | CK | CL Max. | CM | ER Max. | KK | LE | Matching Eye Mtg Bracket |
|---|---|---|---|---|---|---|---|---|---|
| CLS-23001 | 14 | 32 | 10 | 26 | 12 | 12 | M10 X 1.25 | 15 | MBP-20001 |
| CLS-23002 | 16 | 36 | 12 | 34 | 16 | 17 | M12 X 1.25 | 19 | MBP-20002 |
| CLS-23003 | 18 | 38 | 14 | 42 | 20 | 17 | M14 X 1.5 | 19 | MBP-20003 |
| CLS-23004 | 22 | 54 | 20 | 62 | 30 | 29 | M16 X 1.5 | 32 | MBP-20004 |
| CLS-23005 | 28 | 60 | 20 | 62 | 30 | 29 | M20 X 1.5 | 32 | MBP-20005 |
| CLS-23006 | 36 | 75 | 28 | 83 | 40 | 34 | M27 X 2 | 39 | MBP-20006 |
| CLS-23007 | 45 | 99 | 36 | 103 | 50 | 50 | M33 X 2 | 54 | MBP-20007 |
| CLS-23008 | 56 | 113 | 45 | 123 | 60 | 53 | M42 X 2 | 57 | MBP-20008 |
| CLS-23009 | 63 | 126 | 56 | 143 | 70 | 59 | M48 X 2 | 63 | MBP-20009 |
| CLS-23010 | 85 | 168 | 70 | 163 | 80 | 78 | M64 X 3 | 82 | MBP-20010 |

Pivot pins and retainers are supplied with Rod Clevises.

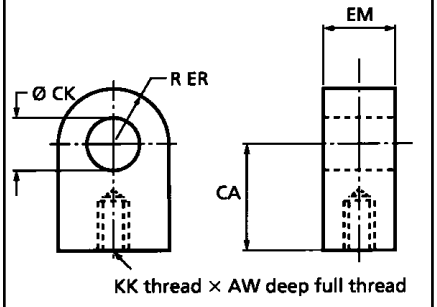
Eye Bracket (plain)




## Plain Eye Bracket

| Part Number | $CK_{h9}$ | $EM_{h13}$ | FL | MR Max. | LE Min. | AA | HB | R | UD |
|---|---|---|---|---|---|---|---|---|---|
| MBP-20001 | 10 | 12 | 23 | 12 | 13 | 40 | 5.5 | 28.3 | 38 |
| MBP-20002 | 12 | 16 | 29 | 17 | 19 | 47 | 6.6 | 33.2 | 45 |
| MBP-20003 | 14 | 20 | 29 | 17 | 19 | 59 | 9 | 41.7 | 64 |
| MBP-20004 | 20 | 30 | 48 | 29 | 32 | 74 | 13.5 | 52.3 | 76 |
| MBP-20005 | 20 | 30 | 48 | 29 | 32 | 91 | 13.5 | 64.3 | 89 |
| MBP-20006 | 28 | 40 | 59 | 34 | 39 | 117 | 17.5 | 82.7 | 115 |
| MBP-20007 | 36 | 50 | 79 | 50 | 54 | 137 | 17.5 | 96.9 | 127 |
| MBP-20008 | 45 | 60 | 87 | 53 | 57 | 178 | 26 | 125.9 | 165 |
| MBP-20009 | 56 | 70 | 103 | 59 | 63 | 219 | 30 | 154.9 | 204 |
| MBP-20010 | 70 | 80 | 132 | 78 | 82 | 269 | 33 | 190.2 | 240 |

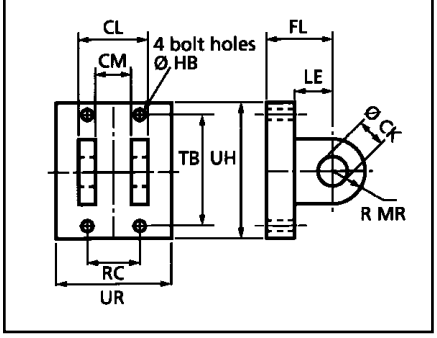
Rod Eye (plain)




## Plain Rod Eye

| Part Number | AW | CA | CK | EM | ER Max. | KK | Matching Clevis Mtg Bracket |
|---|---|---|---|---|---|---|---|
| REF-24001 | 14 | 32 | 10 | 12 | 12 | M10 X 1.25 | MBP-20001 |
| REF-24002 | 16 | 36 | 12 | 16 | 17 | M12 X 1.25 | MBP-20002 |
| REF-24003 | 18 | 38 | 14 | 20 | 17 | M14 X 1.5 | MBP-20003 |
| REF-24004 | 22 | 54 | 20 | 30 | 29 | M16 X 1.5 | MBP-20004 |
| REF-24005 | 28 | 60 | 20 | 30 | 29 | M20 X 1.5 | MBP-20005 |
| REF-24006 | 36 | 75 | 28 | 40 | 34 | M27 X 2 | MBP-20006 |
| REF-24007 | 45 | 99 | 36 | 50 | 50 | M33 X 2 | MBP-20007 |
| REF-24008 | 56 | 113 | 45 | 60 | 53 | M42 X 2 | MBP-20008 |
| REF-24009 | 63 | 126 | 56 | 70 | 59 | M48 X 2 | MBP-20009 |
| REF-24010 | 85 | 168 | 70 | 80 | 78 | M64 X 3 | MBP-20010 |

Clevis Bracket (plain)

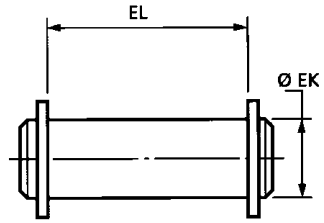



## Clevis Bracket (plain)

| Part Number | $CK_{h9}$ | CL | CM | FL | HB | LE Min. | MR Max. | RC | TB | UH | UR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MBC-21001 | 10 | 26 | 12 | 23 | 5.5 | 13 | 12 | 18 | 47 | 60 | 38 |
| MBC-21002 | 12 | 34 | 16 | 29 | 6.6 | 19 | 17 | 24 | 57 | 70 | 45 |
| MBC-21003 | 14 | 42 | 20 | 29 | 9 | 19 | 17 | 30 | 68 | 85 | 60 |
| MBC-21004 | 20 | 62 | 30 | 48 | 13.5 | 32 | 29 | 45 | 102 | 125 | 77 |
| MBC-21006 | 28 | 83 | 40 | 59 | 17.5 | 39 | 34 | 60 | 135 | 170 | 100 |
| MBC-21007 | 36 | 103 | 50 | 79 | 17.5 | 54 | 50 | 75 | 167 | 200 | 127 |
| MBC-21008 | 45 | 123 | 60 | 87 | 26 | 57 | 53 | 90 | 183 | 230 | 150 |
| MBC-21009 | 56 | 143 | 70 | 103 | 30 | 63 | 59 | 105 | 242 | 300 | 180 |
| MBC-21010 | 70 | 163 | 80 | 132 | 33 | 82 | 78 | 120 | 300 | 360 | 200 |

Pivot pins and retainers are supplied with Clevis Brackets.

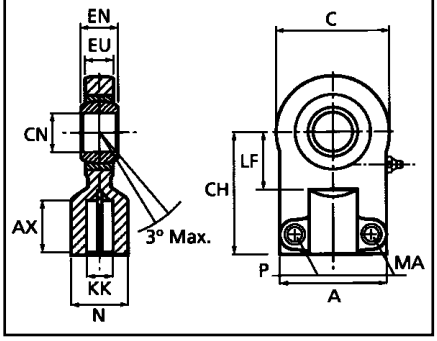
Pivot Pins (plain)




## Pivot Pin (plain)

| Part Number | $EK_{f8}$ | EL Min. | Axial Nominal Load Capacity | To Mach Rod Clevis | To Match Clevis Bracket |
|---|---|---|---|---|---|
| PPC-18141 | 10 | 29 | 8kN | CLS-23001 | MBC-21001 |
| PPC-18142 | 12 | 37 | 12.5 | CLS-23002 | MBC-21002 |
| PPC-18143 | 14 | 45 | 20 | CLS-23003 | MBC-21003 |
| PPC-18144 | 20 | 66 | 50 | CLS-23004/5 | MBC-21004 |
| PPC-18146 | 28 | 87 | 80 | CLS-23006 | MBC-21006 |
| PPC-18147 | 36 | 107 | 125 | CLS-23007 | MBC-21007 |
| PPC-18148 | 45 | 129 | 200 | CLS-23008 | MBC-21008 |
| PPC-18149 | 56 | 149 | 320 | CLS-23009 | MBC-21009 |
| PPC-18150 | 70 | 169 | 500 | CLS-23010 | MBC-21010 |

Rod Eye (Spherical plain bearing)

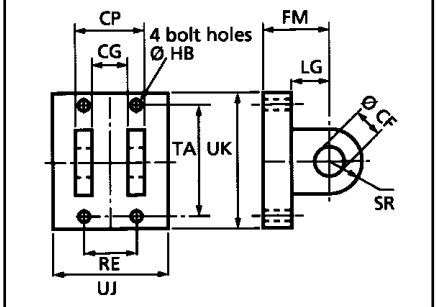



## Rod Eye (Spherical plain Bearing)

| Part Number | A Max. | AX Min. | C | CH | CN | EN | EU | KK | LF | MA* Max. | N Max. | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REB-12DO | 40 | 15 | 32 | 42 | $12^{+0}_{-0.008}$ | 10 | 8 | M10 X 1.25 | 18 | 9.5 | 17 | M6 |
| REB-16DO | 45 | 17 | 42 | 48 | $16^{+0}_{-0.008}$ | 14 | 11 | M12 X 1.25 | 22 | 9.5 | 21 | M6 |
| REB-20DO | 55 | 19 | 50 | 58 | $20^{+0}_{-0.012}$ | 16 | 13 | M14 X 1.5 | 28 | 23 | 25 | M8 |
| REB-25DO | 62 | 23 | 62 | 68 | $25^{+0}_{-0.012}$ | 20 | 17 | M16 X 1.5 | 34 | 23 | 30 | M8 |
| REB-30DO | 80 | 29 | 76 | 85 | $30^{+0}_{-0.012}$ | 22 | 19 | M20 X 1.5 | 38 | 46 | 36 | M10 |
| REB-40DO | 90 | 37 | 96 | 105 | $40^{+0}_{-0.012}$ | 28 | 23 | M27 X 2 | 48 | 46 | 45 | M10 |
| REB-50DO | 105 | 46 | 116 | 130 | $50^{+0}_{-0.012}$ | 35 | 30 | M33 X 2 | 62 | 80 | 55 | M12 |
| REB-60DO | 134 | 57 | 150 | 150 | $60^{+0}_{-0.015}$ | 44 | 38 | M42 X 2 | 74 | 195 | 68 | M16 |
| REB-80DO | 156 | 64 | 195 | 185 | $80^{+0}_{-0.015}$ | 55 | 47 | M48 X 2 | 98 | 385 | 78 | M20 |
| REB-100DO | 190 | 86 | 235 | 240 | $100^{+0}_{-0.020}$ | 70 | 57 | M64 X 3 | 122 | 660 | 100 | M24 |

*Tightening bolts torque value (Nm).

Clevis Bracket (Spherical plain bearing)

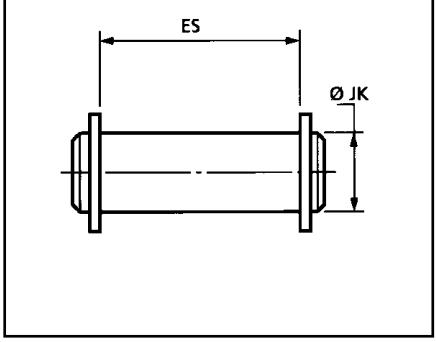



## Clevis Bracket (Sperical plain Bearing)

| Part Number | $CF_{k7}$ | $CG_{A16}$ | CP Max. | FM | HB | LG Min. | RE | SR Max. | TA | UJ Max. | UK Max. | Nominal Load Capacity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MBB-22001 | 10 | 11 | 25 | 33 | 5.5 | 23 | 17 | 9.5 | 59 | 45 | 80 | 8kN |
| MBB-22002 | 12 | 12 | 30 | 36 | 6.6 | 26 | 20 | 11 | 65 | 50 | 85 | 8kN |
| MBB-22003 | 16 | 16 | 38 | 42 | 9 | 32 | 25 | 13 | 84 | 60 | 110 | 12.5 |
| MBB-22004 | 20 | 18 | 50 | 51 | 13.5 | 35 | 33 | 18 | 106 | 85 | 140 | 20 |
| MBB-22005 | 25 | 22 | 54 | 64 | 13.5 | 48 | 37 | 23 | 130 | 85 | 165 | 32 |
| MBB-22006 | 30 | 24 | 67 | 72 | 17.5 | 52 | 44 | 30 | 137 | 110 | 175 | 50 |
| MBB-22007 | 40 | 30 | 83 | 104 | 17.5 | 79 | 55 | 39 | 191 | 135 | 235 | 80 |
| MBB-22008 | 50 | 38 | 101 | 123 | 26 | 93 | 68 | 45 | 234 | 165 | 295 | 125 |
| MBB-22009 | 60 | 47 | 120 | 144 | 30 | 104 | 82 | 57 | 288 | 190 | 355 | 200 |
| MBB-22010 | 80 | 58 | 141 | 182 | 33 | 133 | 98 | 76 | 366 | 225 | 445 | 320 |
| MBB-22011 | 100 | 73 | 174 | 220 | 33 | 140 | 98 | 100 | 366 | 225 | 445 | 500 |

Pivot pins and retainers are supplied with Clevis Brackets.

Clevis Bracket (Spherical plain bearing)




## Pivot Pin (Spherical Bearing)

| Part Number | $JK_{r7}$ | ES Min. | Axial Nominal Load Capacity | To Match Clevis Bracket |
|---|---|---|---|---|
| PPB-22041 | 10 | 26 | 8kN | MBB-22001 |
| PPB-22042 | 12 | 31 | 8kN | MBB-22002 |
| PPB-22043 | 16 | 39 | 12.5 | MBB-22003 |
| PPB-22044 | 20 | 51 | 20 | MBB-22004 |
| PPB-22045 | 25 | 55 | 32 | MBB-22005 |
| PPB-22046 | 30 | 68 | 50 | MBB-22006 |
| PPB-22047 | 40 | 84 | 80 | MBB-22007 |
| PPB-22048 | 50 | 102 | 125 | MBB-22008 |
| PPB-22049 | 60 | 121 | 200 | MBB-22009 |
| PPB-22050 | 80 | 142 | 320 | MBB-22010 |
| PPB-22051 | 100 | 175 | 500 | MBB-22011 |

## Spherical Bearings Application Limitations

The bearings fitted to the accessories listed above are sized such that adequate bearing life can be expected under normal operating conditions. However, as the service life of a spherical bearing is affected by a number of factors, these must be taken into consideration when severe or unusual working conditions prevail.

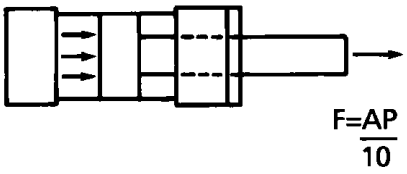
## Factors to be considered

1. Type of load - alternating, pulsating, shock.
2. Direction of load.
3. Degree of movement - swivel angle, sliding velocity, tilt angle, swivel frequency.
4. Temperature
5. Maintenance interval (lubrication)
6. Environmental conditions - contamination, erosion.

| Bore | Rod | Effective Area Push sq.mm | Effective Area Pull sq.mm | Theoretical Force in Newtons at Various Pressures (in bars) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 7 Bar | | 17 bar | | 35 bar | | 52 bar | | 70 bar | | 103 bar | | 138 bar | | 207 bar | |
| | | | | Push | Pull | Push | Pull | Push | Pull | Push | Pull | Push | Pull | Push | Pull | Push | Pull | Push | Pull |
| 25 | 12 | 491 | 378 | 344 | 265 | 835 | 643 | 1719 | 1323 | 2553 | 1966 | 3437 | 2646 | 5057 | 3893 | 6776 | 5216 | 10164 | 7825 |
| | 18 | 491 | 236 | 344 | 165 | 835 | 401 | 1719 | 826 | 2553 | 1227 | 3437 | 1652 | 5057 | 2431 | 6776 | 3257 | 10164 | 4885 |
| 32 | 14 | 804 | 650 | 563 | 455 | 1367 | 1105 | 2814 | 2275 | 4181 | 3380 | 5628 | 4550 | 8281 | 6695 | 11095 | 8970 | 16643 | 13455 |
| | 22 | 804 | 424 | 563 | 297 | 1367 | 721 | 2814 | 1484 | 4181 | 2205 | 5628 | 2968 | 8281 | 4367 | 11095 | 5851 | 16643 | 8777 |
| 40 | 18 | 1257 | 1002 | 880 | 701 | 2137 | 1703 | 4400 | 3507 | 6536 | 5210 | 8799 | 7014 | 12947 | 10321 | 17347 | 13828 | 26020 | 20741 |
| | 28 | 1257 | 641 | 880 | 449 | 2137 | 1090 | 4400 | 2244 | 6536 | 3333 | 8799 | 4487 | 12947 | 6602 | 17347 | 8846 | 26020 | 13269 |
| 50 | 22 | 1964 | 1584 | 1375 | 1109 | 3339 | 2693 | 6874 | 5544 | 10213 | 8237 | 13748 | 11088 | 20229 | 16315 | 27103 | 21859 | 40655 | 32789 |
| | 28 | 1964 | 1348 | 1375 | 944 | 3339 | 2292 | 6874 | 4718 | 10213 | 7197 | 13748 | 9436 | 20229 | 13884 | 27103 | 18602 | 40655 | 27904 |
| | 36 | 1964 | 946 | 1375 | 662 | 3339 | 1608 | 6874 | 3311 | 10213 | 4919 | 13748 | 6622 | 20229 | 9744 | 27103 | 13055 | 40655 | 19582 |
| 63 | 28 | 3117 | 2501 | 2182 | 1751 | 5299 | 4252 | 10910 | 8754 | 16208 | 13005 | 21819 | 17507 | 32105 | 25760 | 43015 | 34514 | 64522 | 51771 |
| | 36 | 3117 | 2100 | 2182 | 1470 | 5299 | 3570 | 10910 | 7350 | 16208 | 10920 | 21819 | 14700 | 32105 | 21630 | 43015 | 28980 | 64522 | 43470 |
| | 45 | 3117 | 1526 | 2182 | 1068 | 5299 | 2594 | 10910 | 5341 | 16208 | 7935 | 21819 | 10682 | 32105 | 15718 | 43015 | 21059 | 64522 | 31589 |
| 80 | 36 | 5027 | 4009 | 3519 | 2806 | 8546 | 6815 | 17595 | 14032 | 26140 | 20847 | 35189 | 28063 | 51778 | 41293 | 69373 | 55324 | 104059 | 82986 |
| | 45 | 5027 | 3436 | 3519 | 2406 | 8546 | 5842 | 17595 | 12026 | 26140 | 17867 | 35189 | 24052 | 51778 | 35391 | 69373 | 47417 | 104059 | 71125 |
| | 56 | 5027 | 2564 | 3519 | 1795 | 8546 | 4359 | 17595 | 8974 | 26140 | 13333 | 35189 | 17948 | 51778 | 26409 | 69373 | 35383 | 104059 | 53075 |
| 100 | 45 | 7854 | 6263 | 5498 | 4384 | 13352 | 10647 | 27489 | 21921 | 40841 | 32568 | 54978 | 43841 | 80896 | 64509 | 108585 | 86429 | 162578 | 129644 |
| | 56 | 7854 | 5391 | 5498 | 3774 | 13352 | 9165 | 27489 | 18869 | 40841 | 28033 | 54978 | 37737 | 80896 | 55527 | 108585 | 74396 | 162578 | 111594 |
| | 70 | 7854 | 4005 | 5498 | 2804 | 13352 | 6809 | 27489 | 14018 | 40841 | 20826 | 54978 | 28035 | 80896 | 41252 | 108585 | 55269 | 162578 | 82904 |
| 125 | 56 | 12272 | 9809 | 8590 | 6866 | 20862 | 16675 | 42952 | 34332 | 63814 | 51007 | 85904 | 68663 | 126402 | 101033 | 169354 | 135364 | 254030 | 203046 |
| | 70 | 12272 | 8423 | 8590 | 5897 | 20862 | 14320 | 42952 | 29481 | 63814 | 43800 | 85904 | 58961 | 126402 | 86757 | 169354 | 116237 | 254030 | 174356 |
| | 90 | 12272 | 5910 | 8590 | 4137 | 20862 | 10047 | 42952 | 20685 | 63814 | 30732 | 85904 | 41370 | 126402 | 60873 | 169354 | 81558 | 254030 | 122337 |
| 160 | 70 | 20106 | 16257 | 14074 | 11380 | 34180 | 27637 | 70371 | 56900 | 104551 | 84536 | 140742 | 113799 | 207092 | 167447 | 277463 | 224347 | 416194 | 336520 |
| | 90 | 20106 | 13743 | 14074 | 9622 | 34180 | 23365 | 70371 | 48100 | 104551 | 71464 | 140742 | 96201 | 207092 | 141553 | 277463 | 189653 | 416194 | 284480 |
| | 110 | 20106 | 10603 | 14074 | 7422 | 34180 | 18025 | 70371 | 37111 | 104551 | 55136 | 140742 | 74221 | 207092 | 109211 | 277463 | 146321 | 416194 | 219482 |
| 200 | 90 | 31416 | 25054 | 21991 | 17538 | 53407 | 42592 | 109956 | 87689 | 163363 | 130281 | 219912 | 175378 | 323585 | 258056 | 433541 | 345745 | 650311 | 518618 |
| | 110 | 31416 | 21911 | 21991 | 15341 | 53407 | 37251 | 109956 | 76689 | 163363 | 113937 | 219912 | 153377 | 323585 | 225683 | 433541 | 302372 | 650311 | 453556 |
| | 140 | 31416 | 16022 | 21991 | 11215 | 53407 | 27237 | 109956 | 56077 | 163363 | 83314 | 219912 | 112154 | 323585 | 165027 | 433541 | 221104 | 650311 | 331655 |

# THEORETICAL FORCES DEVELOPED BY CYLINDERS

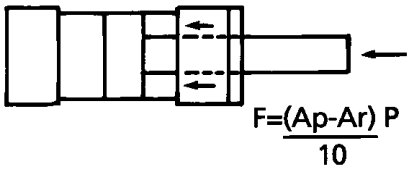
## Force Developed on Push Stroke



$$F=\frac{AP}{10}$$

Force (Newtons) = Area of Piston (in sq. mm) times Pressure (in bar) divided by 10

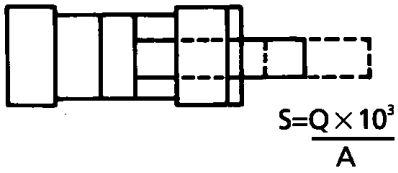
## Force Developed on Pull Stroke



$$F=\frac{(Ap-Ar)\ P}{10}$$

Force (Newtons) = Area of Piston (in sq. mm) less Area of Rod (in sq. mm) times Pressure (in bar) divided by 10

## Speed of Cylinder Travel



$$S=\frac{Q\times 10^3}{A}$$

S = Speed in metres per minute
Q = Pump delivery in litres per minute
A = Area of Piston in square mm
- Rod Extend
or
A = Area of Piston minus Area of Rod
- Rod Retract

# CUSHIONS

## Cushions

Tapered cushions, designed to provide gradual deceleration and eliminate shock upon entrance of the cushion pistons, have now been considerably improved. The tapered cushion has been married with a fine thread, wide range, adjusting screw. This new combination offers a positive, lowshock deceleration and a method to adjust the cushioning effect for speeds and loads.

## Cushion Lengths

| Bore | Rod | Cushion Length Head | Cap |
|---|---|---|---|
| 25 | All | 16 | 15 |
| 32 | All | 16 | 15 |
| 40 | All | 22 | 22 |
| 50 | All | 22 | 22 |
| 63 | All | 22 | 22 |
| 80 | All | 22 | 25 |
| 100 | All | 22 | 25 |
| 125 | All | 25 | 25 |
| 160 | All | 25 | 28 |
| 200 | All | 25 | 38 |

The adjusting screw is identified by a crossslot in the head of the screw. It does not project beyond the surface of the head (or cap) through its full range of adjustment so no clearance need be considered on close fit installations. The adjusting screw and the cushion check can be interchanged in the same cylinder end. This flexibility can be important if, after installation, it is discovered that the adjusting screw is inaccessible.

The cushion check, which does not require adjustment, has a single slot in its head. It does not project beyond the surface of the head (or cap). The cushion check plus the tapered cushion piston provides rapid acceleration out of cushioning. There is no spring in the cushion check to fatigue, hence, no worry of mechanical failure.

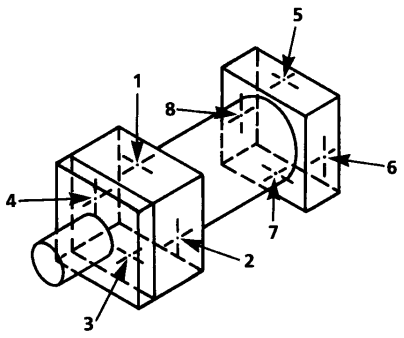
All cushion screws are held captive by a spring-loaded retaining ring. This ring is removable for maintenance or changeover purposes.

Cushioning is designed to properly cushion the cylinder and is not intended to cushion large inertia loads. Cushions do not substitute for speed controls or deceleration valves on most installations.

As indicated the standard positions for ports are 1 and 5. Where possible, the standard for cushion adjusting screws will be 2 and 6 and the standard positions for cushion checks will be 4 and 8. With some mounting styles, it is not possible to so locate the adjusting screws and checks. For example, a Trunnion Front Mount has the trunnion pins located in positions 2 and 4 on the head. With the port in position 1, the only side available for both adjusting screw and check is position 3. Since both will then be located on the same side, they will be located off-centre. This example would hold true with the TR, CL, FHF and RHF Mounts. See Chart A for standard positions that will be supplied unless otherwise specified. When requested, other positions can be supplied so long as there is no interference with mounting.

Where access to an adjusting Screw or check could be made difficult because of proximity to a mount, the locations of the screws will be slightly off-centre. An example of this would be a small bore cylinder with a side lug mount.

Because of space limitations, neither cushion adjusting screws nor cushion ball checks can be put into 25 and 32 bore sizes. Nor can they be put into 40 and 50 bore sizes for cushioned front when they are specified with 2:1 rod diameters.




POSITION DIAGRAM FOR PORTS, AIR BLEEDS, CUSHION ADJUSTING SCREWS AND CUSHION CHECKS.

## Chart A

| Mount | Cush. Adj Screw | Cush Check |
|---|---|---|
| TF and FHF | 3 and 6 | 3 and 8 |
| TR and RHF | 2 and 7 | 4 and 7 |
| All Other Mounts | 2 and 6 | 4 and 8 |

Standard Positions for Cushion Adjusting Screws and Cushion Checks in Relation to Port Positions by Style of Mounting.

For information concerning cushion lengths - please consult factory.

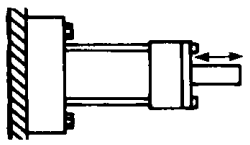
## Fixed Centreline Mounts

Centreline mounts are generally considered to be the best type of fixed mounting since the thrust from the piston rod is taken at a mounting surface that is coincident with the cylinder centreline. Use of this type of mount can eliminate possible problems resulting from cylinder sway and flexure of cylinder components.

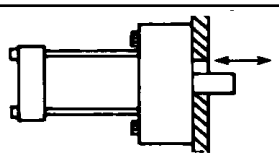
## Flange Mounts

The type of flange recommended for backside mounting is the style where the full thickness of the head or the cap serves as the flange (Styles FHF or RHF). Selection of a flange mounting style depends, in part, upon whether the major force applied to the machine member will result in tension or compression of the cylinder rod. Rear flange mounting styles are best for thrust loads (rod in compression) and front flange mounting styles are best where the rod is stressed in tension.

Regardless of mount, whenever a long stroke cylinder is employed, consideration should be given to additional support - **see page 13** for long stroke cylinder data.



Rear Head Flange Style RHF

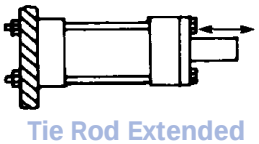


Front Head Flange Style FHF

Flange styles of mounting are dimensioned on **pages 16 and 17**.

## Tie Rod Extended Mounts

Tie Rod Extended cylinders are available with the tie rods extended front (Style FX), with the tie rods extended rear (Style RX) or both ends (Style BX). Frequently cylinders are ordered with tie rods extended on one end in addition to another mount. The extended tie rods are then utilised for the mounting of other systems or machine components.



Tie Rod Extended
Styles FX, RX & BX

## Tie Rod Extended Mounts Cont.

Should the mounting be such that the overhung weight of the cylinder is borne by the extended tie rods, additional support may be required, especially if the cylinder has a long stroke **(see page 13)**. From a thrust standpoint, tie rod extended mounts are good, stable ones. Dimensions for tie rod extended mounts are shown on **pages 22 and 23**.

## Pivoted Centreline Mounts

If the machine member moved by the piston rod travels in a curvilinear path, a pivot mount cylinder is the obvious choice. Pivotal mounts are available with the pivot points at the head (TF Mount), at the cap (TR, P & C Mounts), or centrally located at some position between the head and the cap (T Mount). In most cases, a layout of the rod end path will determine the best pivot mounting style to be used. In general, pivot mounted cylinders with the pivot points near the head (TF and T Mounts ) can use smaller diameter rods without the danger of buckling than similar cylinders with the pivot points at the cap. This can be verified by consulting our column strength chart on **page 15**.

There are times when a fixed mounting style might be indicated by an application but a pivot mount is selected to compensate for any misalignment that might occur - if the misalignment is in one plane. Where misalignment can occur in multiple planes, the cylinder should be equipped with Spherical Bearings **(see page 20)**.

## Trunnion Mounts

Pillow blocks of ample size and rigidity should be provided and should be mounted as close to the head (or cap) as possible. Bearing should be provided for the full length of the trunnion pin. Pins are intended for shear loads only, not bending loads. SELF-ALIGNING MOUNTS should NOT BE USED TO SUPPORT THE TRUNNIONS SINCE BENDING FORCES CAN ALSO BE SET UP (See Fig. C). Lubrication should be provided to the pins.

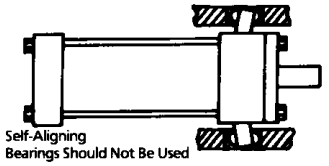


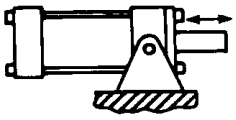

Fig. C

An intermediate trunnion (T Mount) can be located at any position between the head and cap (within limitations) at the time of cylinder manufacture, but cannot be easily changed once produced. The trunnion location (dimension XI) must be specified on the order. **See pages 18 and 19** for trunnion mount dimensions.

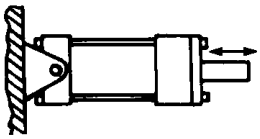
## Clevis Mount

All Clevis Mount cylinders need provision on both ends for pivoting in one direction. A clevis pin of proper length and of sufficient diameter to withstand the maximum shear load generated by the cylinder at rated operating pressure is provided. Should a rod end accessory such as a rod eye or rod clevis **(see pages 6 and 7)** be desired, select one with a pin size (or pin hole) with the same diameter as the clevis pin. You can then specify a rod end thread to match the accessory.

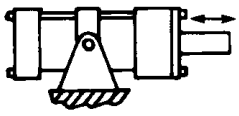
Selecting the accessory on the basis of the rod end thread normally supplied can result in an expensive and unsightly miss-match, especially when the cylinder has a large oversize or 2:1 diameter rod. Clevis mount cylinder dimensions are given on **pages 20 and 21**.



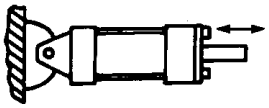
Trunnion Front Style TF



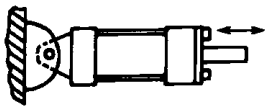
Trunnion Rear Style TR



Intermediate Trunnion Style T



Clevis Style C



Pivot Style P

# MOUNTING INFORMATION

## Fixed Non-Centreline Mounts

Cylinders with non-centreline styles of mounts tend to sway when under load. Relatively short fixed, non-centreline mounted cylinders can subject mounting bolts to large tension forces which, when combined with shear forces, can over stress standard bolts. High tensile cap screws are recommended. See Fig. D.

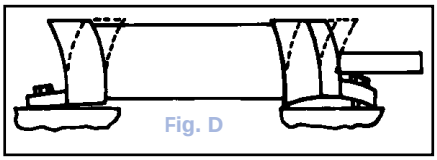
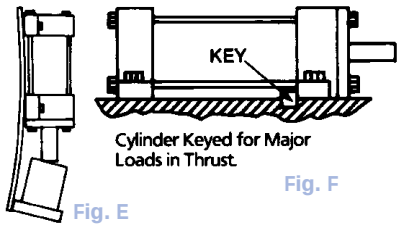


Fig. D

The rigidity of the machine frame should be considered when using cylinders with a non-centreline mount since stronger machine members are often required to resist bending moments. See Fig. E.

Fixed mounted cylinders should be held in place by keying or pinning. Cylinders with integral key mounts may be used where a keyway can be milled in a machine member **(see page 12)**. This type of arrangement takes up shear loads and provides accurate alignment of the cylinder. Shear keys should be placed at the proper end of the cylinder: at the head, if major loads are in thrust or at the cap if major loads are in tension. See Fig. F.



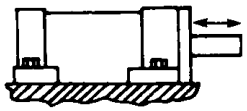

Cylinder Keyed for Major Loads in Thrust.

Fig. F

Fig. E

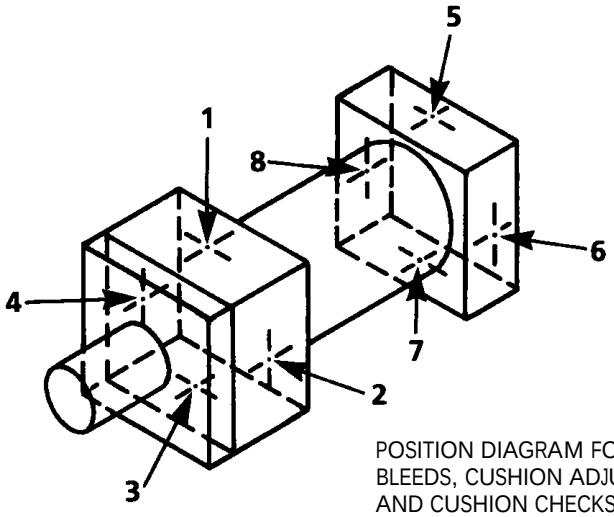
Only one end of the cylinder should be keyed. Dowel pins can be used instead of keys to help take shear loads and to obtain alignment. The side lug mount has room for dowel pins in the lugs. Cylinders may be pinned together at either end but NOT AT BOTH ENDS.

Dimensions for SL Mounts are given on **pages 16 and 17**.



Side Lug Style SL

# PORTING AND AIR BLEEDS




POSITION DIAGRAM FOR PORTS, AIR BLEEDS, CUSHION ADJUSTING SCREWS AND CUSHION CHECKS.

## Porting

BSP Ports, located in positions 1 and 5 (See "Position Diagram for Ports") are standard options and will be furnished as specified.

## Port Positions

Where mounting clearances permit, the ports can be had in any of four positions in the head and in the cap at no extra cost. Indicate both port positions desired by position number. If no preference is stated, ports will be furnished in positions 1 and 5. NOTE: The head and cap can be rotated in relation to each other as long as mounting and porting are convenient for installation.

## Air Bleeds

An air bleed may be ordered at either or both ends of the cylinder as an option. To provide for maximum bleeding of air from the cylinder, air bleeds are placed in the tube to bleed air from the tube/head or tube/cap juncture. The air is bled from the cylinder by backing out the straight thread metallic seal plug to allow air to pass by the threads. When air bubbles stop and oil starts to flow, re-tighten plug. It is recommended that bleeding be done with pressure on the opposite end of the cylinder so that the bleed plug is not subjected to pump pressure when being backed out. Air bleeds should always be positioned at the highest point of the cylinder tube. Please specify positions of air bleeds by position number from the chart. NOTE: Since air bleeds are placed in the cylinder tube, position can be changed by loosening the tie rods and rotating the tube. Line drawing shows ports in positions 1 and 5.

# PRESSURE

## Pressure and Shock

EH Series Cylinders are suitable for working pressures to 210 bar with a 3:1 safety factor based on yield and maximum pressure including any shock to 345 bar. **See page 31** for complete line of Cylinders for pressures to 550 bar.

The following factors in shock loading should be considered:

- Relief valves in the circuit do not protect the components from shock because of the time lag.
- Gauges do not necessarily register shock conditions, either because of their position in the circuit, or the short duration of shock.
- The two general types of shock loading to be considered are pressure rise caused by quick stop of the flow in the circuit and quick pressure drop. Decompression shock is particularly important in large bore cylinders and can be as destructive as compression shock.
- The magnitude of the pressure difference and the duration that the maximum pressure exists are the factors that determine the damage from shock.

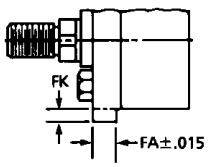
# SPECIAL VARIATIONS

**Many cylinders are manufactured with variations to meet special customer needs. In addition to those illustrated below, some of the more popular variations are:**

- **Cylinders With Gaiters**
- **Combination Mount Cylinders**
- **Locking Cylinders**
- **Precision Stroke Cylinders**
- **Precision Mount Cylinders**
- **Cylinders With Built-In Switch Actuators & Feed Back Devices**

## Thrust Key

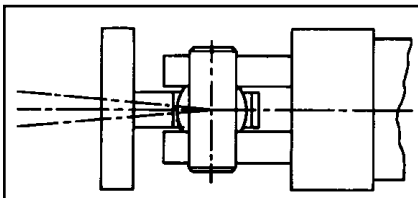
All side mounted cylinders (SL Mount) can be supplied with thrust keys. Thrust keys are available in bore sizes 25 through 200. Extending the rod gland retainer, as shown, provides a key which fits into a milled slot in the mounting surface of the machine member. Combined with the mount this key assures that the cylinder will not shift in severe service.




| Bore | FA | FK |
|---|---|---|
| 25 | 8 | 5 |
| 32 | 8 | 5 |
| 40 | 8 | 5 |
| 50 | 14 | 8 |
| 63 | 14 | 8 |
| 80 | 18 | 10 |
| 100 | 22 | 11 |
| 125 | 22 | 11 |
| 160 | 24 | 13 |
| 200 | 24 | 13 |

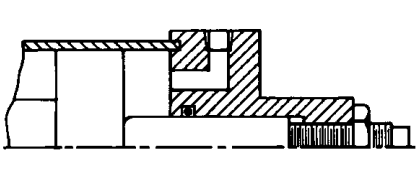
## Spherical Bearings

Clevis mounting brackets and pivot rod eyes can be provided with spherical bearings to compensate for misalignment on both ends of cylinders.



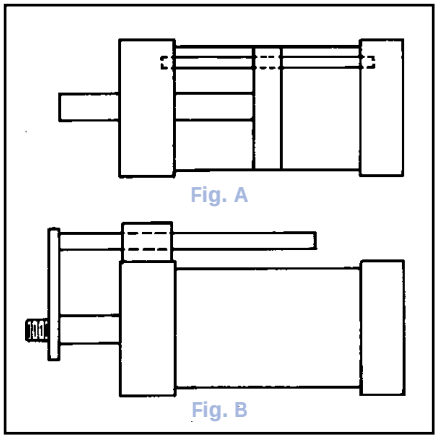
## Adjustable Stroke

Shown is an integral stroke adjustment (externally adjusted) that is accomplished by the use of a bump rod threaded into the cylinder cap. Seals are incorporated to prevent external leakage and a lock nut is included.



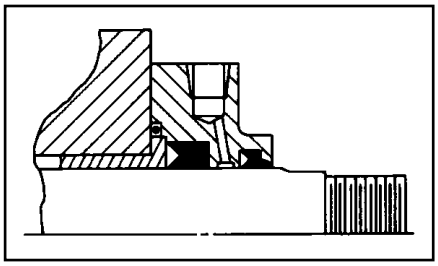
## Non-Rotating Piston Rod

Two methods of non-rotating piston rods are employed. The internal rod type (Fig. A.) is generally used since it requires less space and is neater. The type shown in Fig. B. must be used on small bore cylinders where internal space is limited.



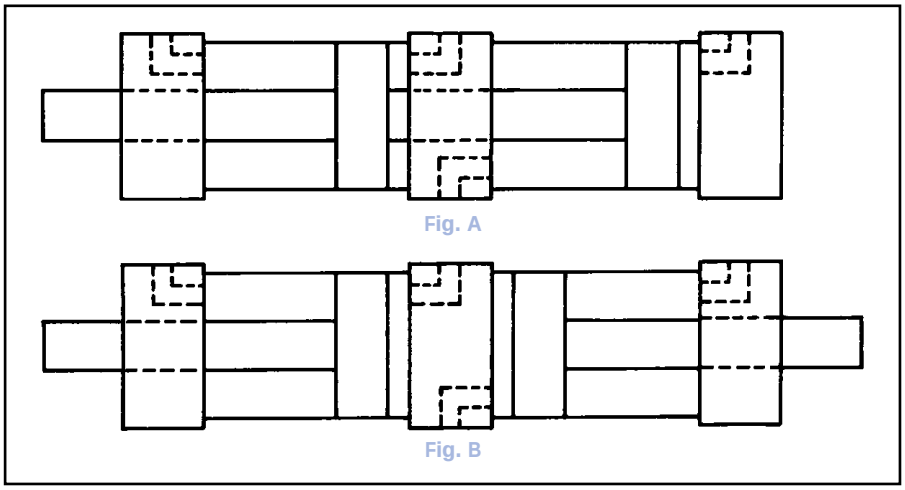

## Rod Gland Drain Back

When not even a drop of external leakage can be tolerated, the rod gland drain back provides a signal that the rod seal set has worn to the point of replacement - without the danger of contamination from leakage.



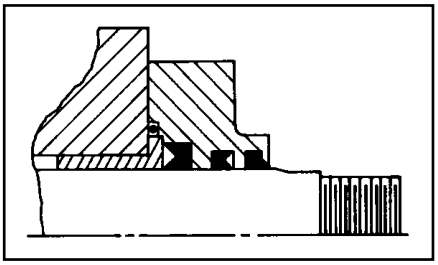
## Tandem Cylinders and Multi-Stage Cylinders

The tandem cylinder (Fig. A.) has two pistons connected to a common rod, resulting in twice the force output of a single cylinder. Multi-stage cylinders (Fig. B) offer multiple, positive strokes by pressurising one cylinder, the other, or both. Contact the factory for other variations.




## Vacuum Rod Seal

When a cylinder is to be operated under water, provision is made to prevent the water from being drawn into the cylinder at the time of valve shift or pressure differential.



## Stainless Steel Piston Rods

Many applications, especially those subjected to water spray, require the use of stainless steel piston rods. We stock 431-S29T hard chrome plated, stainless steel and will furnish that type unless otherwise specified. Other types of stainless steel can be provided on request.

PLEASE REQUEST A QUOTATION FOR ANY SPECIAL CYLINDER REQUIREMENTS.
**SEE PAGES 4 AND 5 FOR INFORMATION CONCERNING HIGH TEMPERATURE AND WATER HYDRAULIC CYLINDERS**

## Stroke Limitations

There are several considerations that may fix the Practical stroke limit of a cylinder such as mounting style, mounting attitude, column strength of the piston rod, etc. These will be discussed later in this section. There are, however, Definite stroke limitations imposed by the basic design of tie rod cylinders. Because of the tube loading required to properly prestress (torque) tie rods, the following bore size cylinders are limited to the corresponding strokes in standard, catalogued construction. Should you require a cylinder with a stroke in excess of that charted below, contact the factory for information concerning changes in construction and dimensions.

| Bore Size | Maximum Stroke |
|---|---|
| **25 & 32** | 750 |
| **40** | 1400 |
| **50** | 2600 |
| **63** | 3200 |
| **80 and larger** | 4300 |

## Supports

Relatively long cylinders often require supports to prevent excessive sag or vibration which could severely reduce the operational life of the cylinder. Depending upon bore size and mounting style, it may be necessary to specify either an intermediate mount or a tie rod support bracket. If the cylinder selected has a fixed, non-centreline mount such as side lug, the type of support to select should be an intermediate mount (see Fig. 1). This additional mount provides support for the cylinder tube and support for the tie rods. If a pivotal mount such as clevis or trunnion is selected, a tie rod support bracket should be considered (see Fig. 2). When a long stroke cylinder, with a fixed centreline mount such as a front or rear flange is specified, some form of support should be provided. An intermediate mount is often the most convenient way of doing so (see Fig. 3). The following chart provides a guide for determining the need for an additional support. It should be noted that neither a tie rod support bracket nor an intermediate mount is designed to absorb the thrust of the cylinder. They provide support only.

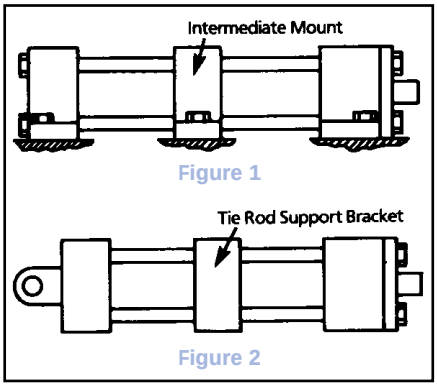



Figure 1

Figure 2

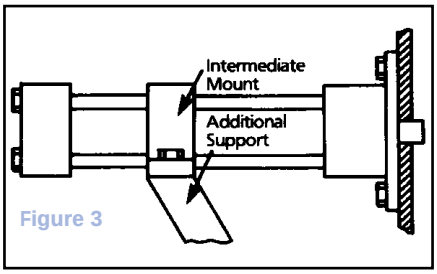



Figure 3

| Bore | Stroke Requiring Maximum Stroke |
|---|---|
| **50** | 2100 |
| **63** | 2100 |
| **80** | 2500 |
| **100** | 2500 |
| **125** | 3000 |
| **160** | 3400 |
| **200** | 3700 |

## Rod Column Strength

When considering a long stroke cylinder, it is necessary to select a piston rod size of sufficient diameter to provide the necessary column strength. If the cylinder will be performing work on the pull stroke only (rod in tension), selection of the standard rod diameter for that bore size will provide sufficient strength for operation at rated pressure or lower. If, however, the cylinder will be performing work on the push stroke (rod in compression), careful consideration must be given to column strength. Factors are the stroke length, rod extension length, mounting style, mounting attitude, force potential and rod end connection. This is simplified for you by using the charts on **pages 14 and 15**. The mounting class chart on **page 14** assigns a mounting class reference number that corresponds to the mounting style, mounting attitude and rod end connection of the cylinder selected. Referencing that number and the sum of the gross stroke plus rod extension (if any), the column strength chart on **page 15** indicates the maximum allowable force for each available rod diameter. You may find the theoretical force chart on **page 8** helpful in calculating the force requirements.

## Stop Tube and Dual Piston

A stop tube is a tube or sleeve assembled in the cylinder between the head and the piston. It provides a spread between the bearings of the rod bushing and the piston when the rod is fully extended (see Fig. 4). The use of a stop tube is an accepted method for reducing bearing pressures on long stroke cylinders and cylinders subjected to excessive side loading. A stop tube does not afford additional bearing surface, nor does it provide any benefit during operation except at full extension of effective stroke. While we will equip cylinders with stop tubes, our strong recommendation is for an alternate and superior method for reducing bearing pressures - the dual piston.

The dual piston is an assembly of two pistons on the piston rod. They are separated by a spacer of calculated length. Both pistons are equipped with bearing strips thus avoiding the metal to metal contact that causes most operational problems with competitive cylinders when subjected to side loading (see Fig. 5). The dual piston not only provides bearing spread at all times throughout the stroke cycle, but also provides important additional bearing surface. The dual piston concept was originally developed to successfully solve the most severe side loading problems when other methods had failed.

Both dual piston and stop tube equipped cylinders will be longer by the length of the stop tube or dual piston than standard cylinders of the same stroke without those devices. The desired stroke (effective stroke) must be added to the length of stop tube or dual piston to obtain the gross stroke for determining cylinder dimensions. Since the dual piston offers much greater effectiveness than a stop tube, it is usually shorter than the corresponding stop tube, hence the total cylinder length will be less; frequently a most important factor in total machine design.

To determine the length of stop tube or dual piston required, first consult the mounting class chart on **page 14** to obtain a Mounting Class Reference Number. Referencing that number and the net stroke of the cylinder, the required stop tube or dual piston length can be obtained from the chart on **page 14**.

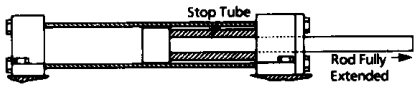



Figure 4

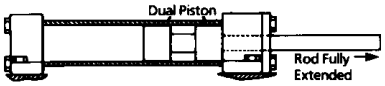
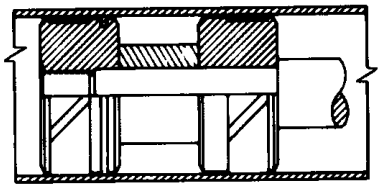
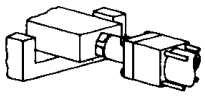
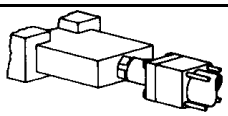
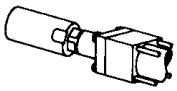
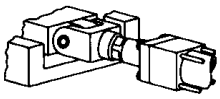
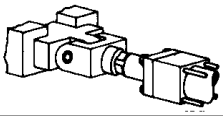



Figure 5



Dual Piston Detail

# MOUNTING CLASSES

| Type of Cylinder Rod End Connection | | |
|---|---|---|
|  | Fixed, Supported, and Unguided | Type A |
|  | Fixed, Supported, and Guided | Type B |
|  | Free, Unsupported, and Unguided | Type C |
|  | Pivoted, Supported, and Unguided | Type D |
|  | Pivoted, Supported, and Guided | Type E |

Determine the type of rod end connection to be made. Then, using the charts below, reference that connection type to the Mounting Style of the cylinder. The resulting class number is employed as a factor in determining Stop Tube, Dual Piston, and Column Strength.

| Mounting Style | Type | Class |
|---|---|---|
| Flange Mounts (FHF, RHF) | B | 1 |
| Lug Mounts (SL) | E | 2 |
| Tie Rod Extended Mounts | A, D | 3 |
| (FX, RX, BX) | C | 6 |
| Trunnion Front Mount (TF) | D, E | 3 |
| Intermediate Trunnion Mount (T) | D, E | 4 |
| Trunnion Rear Mount (TR) | D, E | 5 |
| Clevis Mount (C) | | |
| Pivot Mount (P) | | |
| Spherical Bearing (SBp) | D, E | 6 |

# STOP TUBE AND DUAL PISTON

| | Class 1 | | Class 2 | | Class 3 | | Class 4 | | Class 5 | | Class 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Net Stroke | Stop Tube | Dual Piston | Stop Tube | Dual Piston | Stop Tube | Dual Piston | Stop Tube | Dual Piston | Stop Tube | Dual Piston | Stop Tube | Dual Piston |
| 400 | | | | | | | | | | | 25 | ■ |
| 500 | | | | | | | | | | | 50 | ■ |
| 600 | | | | | | | | | | | 75 | ■ |
| 630 | | | | | | | | | 25 | ■ | 75 | ■ |
| 660 | | | | | | | | | 25 | ■ | 100 | ■ |
| 700 | | | | | | | | | 50 | ■ | 100 | ■ |
| 800 | | | | | | | | | 50 | ■ | 125 | 75 |
| 850 | | | | | | | 25 | ■ | 75 | ■ | 150 | 100 |
| 900 | | | | | | | 25 | ■ | 75 | ■ | 175 | 125 |
| 950 | | | | | | | 50 | ■ | 75 | ■ | 175 | 125 |
| 1050 | | | | | | | 50 | ■ | 100 | ■ | 200 | 125 |
| 1100 | | | | | | | 50 | ■ | 125 | 75 | 225 | 150 |
| 1150 | | | | | 25 | ■ | 75 | ■ | 125 | 75 | 250 | 175 |
| 1200 | | | | | 25 | ■ | 75 | ■ | 150 | 100 | 250 | 175 |
| 1300 | | | | | 25 | ■ | 100 | ■ | 150 | 100 | 275 | 175 |
| 1350 | | | | | 25 | ■ | 100 | ■ | 175 | 125 | 300 | 200 |
| 1400 | | | | | 50 | ■ | 100 | ■ | 175 | 125 | 325 | 225 |
| 1450 | | | | | 50 | ■ | 125 | 75 | 200 | 125 | 325 | 225 |
| 1550 | | | | | 50 | ■ | 125 | 75 | 200 | 125 | 350 | 225 |
| 1600 | | | 25 | ■ | 50 | ■ | 150 | 100 | 225 | 150 | 375 | 250 |
| 1700 | | | 25 | ■ | 75 | ■ | 150 | 100 | 225 | 150 | 400 | 275 |
| 1800 | | | 25 | ■ | 75 | ■ | 175 | 125 | 250 | 175 | 425 | 275 |
| 1900 | | | 50 | ■ | 75 | ■ | 175 | 125 | 275 | 175 | 450 | 300 |
| 2000 | | | 50 | ■ | 100 | ■ | 175 | 125 | 275 | 175 | 475 | 325 |
| 2100 | | | 50 | ■ | 100 | ■ | 200 | 125 | 300 | 200 | 500 | 325 |
| 2150 | | | 50 | ■ | 100 | ■ | 200 | 125 | 325 | 225 | 525 | 350 |
| 2250 | | | 75 | ■ | 125 | 75 | 225 | 150 | 325 | 225 | 550 | 375 |
| 2300 | | | 75 | ■ | 125 | 75 | 225 | 150 | 350 | 225 | 575 | 375 |
| 2350 | | | 75 | ■ | 125 | 75 | 250 | 175 | 350 | 225 | 575 | 375 |
| 2400 | 25 | ■ | 75 | ■ | 125 | 75 | 250 | 175 | 375 | 250 | 600 | 400 |
| 2500 | 25 | ■ | 75 | ■ | 150 | 100 | 275 | 175 | 375 | 250 | 625 | 425 |
| 2550 | 25 | ■ | 100 | ■ | 150 | 100 | 275 | 175 | 400 | 275 | 650 | 425 |
| 2600 | 25 | ■ | 100 | ■ | 150 | 100 | 275 | 175 | 400 | 275 | 650 | 425 |
| 2650 | 25 | ■ | 100 | ■ | 150 | 100 | 300 | 200 | 425 | 275 | 675 | 450 |
| 2750 | 25 | ■ | 100 | ■ | 175 | 125 | 300 | 200 | 450 | 300 | 700 | 475 |
| 2800 | 25 | ■ | 100 | ■ | 175 | 125 | 300 | 200 | 450 | 300 | 725 | 475 |
| 2850 | 50 | ■ | 100 | ■ | 175 | 125 | 325 | 225 | 450 | 300 | 750 | 500 |
| 2900 | 50 | ■ | 125 | 75 | 175 | 125 | 325 | 225 | 475 | 325 | 750 | 500 |
| 2950 | 50 | ■ | 125 | 75 | 200 | 125 | 325 | 225 | 475 | 325 | 775 | 525 |
| 3000 | 50 | ■ | 125 | 75 | 200 | 125 | 350 | 225 | 500 | 325 | 775 | 525 |
| 3050 | 50 | ■ | 125 | 75 | 200 | 125 | 350 | 225 | 500 | 325 | 800 | 525 |
| 3200 | 50 | ■ | 125 | 75 | 225 | 150 | 375 | 250 | 525 | 350 | 850 | 575 |
| 3300 | 75 | ■ | 150 | 100 | 225 | 150 | 400 | 275 | 550 | 375 | 875 | 575 |
| 3400 | 75 | ■ | 150 | 100 | 250 | 175 | 400 | 275 | 575 | 375 | 925 | 625 |

■ Dual piston not available – use Stop Tube.

# COLUMN STRENGTH CHART

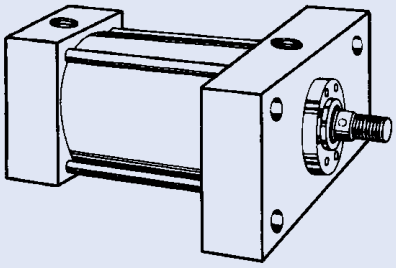
HELIPEBS CONTROLS

| Maximum Allowable Force in Newtons (Compressive Load) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stroke Plus Rod Ext. | Mount Class | Piston Rod Diameter | | | | | | | | | | | |
| | | 12 | 14 | 18 | 22 | 28 | 36 | 45 | 56 | 70 | 90 | 110 | 140 |
| 250 | 1 | 22182 | 31568 | 54673 | 83553 | 137704 | 230122 | 361709 | 562248 | 880656 | 1458266 | 1091101 | 2121364 |
| | 2 | 17420 | 26806 | 49910 | 78791 | 132942 | 225359 | 356946 | 557485 | 875893 | 1453503 | 1089910 | 2119649 |
| | 3 | 11082 | 20138 | 43242 | 72123 | 126274 | 218692 | 350278 | 550818 | 869225 | 1446836 | 1088243 | 2117249 |
| | 4 | 4926 | 9125 | 24935 | 53072 | 107223 | 199641 | 331228 | 531767 | 850175 | 1427783 | 1083481 | 2110391 |
| | 5 | 2771 | 5133 | 14026 | 31300 | 80552 | 172970 | 304557 | 505096 | 823504 | 1401114 | 1076813 | 2100789 |
| | 6 | 1231 | 2281 | 6234 | 13911 | 36500 | 99741 | 228354 | 428893 | 747301 | 1324911 | 1057762 | 2073355 |
| 375 | 1 | 17420 | 26806 | 49910 | 78791 | 132942 | 225359 | 356946 | 557483 | 875893 | 1453503 | 1089910 | 2119649 |
| | 2 | 8756 | 16222 | 39194 | 68075 | 122226 | 214643 | 346230 | 546769 | 865177 | 1442787 | 1087231 | 2115792 |
| | 3 | 4926 | 9125 | 24935 | 53072 | 107223 | 199641 | 331228 | 531767 | 850175 | 1427785 | 1083481 | 2110391 |
| | 4 | 2189 | 4056 | 11082 | 24731 | 64890 | 156777 | 288364 | 488903 | 807310 | 1384921 | 1072765 | 2094959 |
| | 5 | 1231 | 2281 | 6234 | 13911 | 36500 | 99741 | 228354 | 428893 | 747301 | 1324911 | 1057762 | 2073355 |
| | 6 | 547 | 1014 | 2771 | 6183 | 16222 | 44330 | 108226 | 259558 | 575844 | 1153454 | 1014897 | 2011630 |
| 500 | 1 | 11082 | 20138 | 43242 | 72123 | 126274 | 218692 | 350278 | 550818 | 869225 | 1446836 | 1088243 | 2117249 |
| | 2 | 4926 | 9125 | 24935 | 53072 | 107223 | 199641 | 331228 | 531767 | 850175 | 1427785 | 1083481 | 2110391 |
| | 3 | 2771 | 5133 | 14026 | 31300 | 80552 | 172970 | 304557 | 505096 | 823504 | 1401114 | 1076813 | 2100789 |
| | 4 | 1231 | 2281 | 6234 | 13911 | 36500 | 99741 | 228354 | 428893 | 747301 | 1324911 | 1057762 | 2073355 |
| | 5 | 693 | 1283 | 3507 | 7825 | 20531 | 56105 | 136974 | 322209 | 640616 | 1218227 | 1031090 | 2034948 |
| | 6 | 308 | 570 | 1558 | 3478 | 9125 | 24935 | 60877 | 146002 | 356449 | 913415 | 954886 | 1925214 |
| 625 | 1 | 7093 | 13140 | 34670 | 63550 | 117701 | 210119 | 341706 | 542245 | 860652 | 1438263 | 1086100 | 2114163 |
| | 2 | 3152 | 5840 | 15959 | 35812 | 87934 | 180352 | 311939 | 512478 | 830886 | 1408496 | 1078658 | 2103447 |
| | 3 | 1773 | 3285 | 8977 | 20032 | 52561 | 138678 | 270265 | 470804 | 789212 | 1366823 | 1068240 | 2088444 |
| | 4 | 788 | 1460 | 3990 | 8903 | 23360 | 63835 | 155846 | 351737 | 670145 | 1247755 | 1038473 | 2045579 |
| | 5 | 443 | 821 | 2244 | 5008 | 13140 | 35907 | 87663 | 210242 | 503451 | 1081061 | 996798 | 1985568 |
| | 6 | 197 | 365 | 997 | 2226 | 5840 | 15959 | 38961 | 93441 | 228127 | 623384 | 877729 | 1814109 |
| 750 | 1 | 4926 | 9125 | 24935 | 53072 | 107223 | 199641 | 331228 | 531767 | 850175 | 1427785 | 1083481 | 2110391 |
| | 2 | 2189 | 4056 | 11082 | 24731 | 64890 | 156777 | 288364 | 488903 | 807310 | 1384921 | 1072765 | 2094959 |
| | 3 | 1231 | 2281 | 6234 | 13911 | 36500 | 99741 | 228354 | 428893 | 747301 | 1324911 | 1057762 | 3073355 |
| | 4 | 547 | 1014 | 2771 | 6183 | 16222 | 44330 | 108226 | 259558 | 575844 | 1153454 | 1014897 | 2011630 |
| | 5 | 308 | 570 | 1558 | 3478 | 9125 | 24935 | 60877 | 146002 | 356449 | 913415 | 954886 | 1925214 |
| | 6 | 137 | 253 | 693 | 1546 | 4056 | 11082 | 27057 | 64890 | 158422 | 432905 | 783426 | 1678313 |
| 1000 | 1 | 2771 | 5133 | 14026 | 31300 | 80552 | 172970 | 304557 | 505096 | 823504 | 1401114 | 1076813 | 2100789 |
| | 2 | 1231 | 2281 | 6234 | 13911 | 36500 | 99741 | 228354 | 428893 | 747301 | 1324911 | 1057762 | 2073355 |
| | 3 | 693 | 1283 | 3507 | 7825 | 20531 | 56105 | 136974 | 322209 | 640616 | 1218227 | 1031090 | 2034948 |
| | 4 | 308 | 570 | 1558 | 3478 | 9125 | 24935 | 60877 | 146002 | 356449 | 913415 | 954886 | 1925214 |
| | 5 | 173 | 321 | 877 | 1956 | 5133 | 14026 | 34243 | 82126 | 200503 | 547896 | 848200 | 1771587 |
| | 6 | 77 | 143 | 390 | 869 | 2281 | 6234 | 15219 | 36500 | 89112 | 243509 | 543396 | 1332650 |
| 1250 | 1 | 1773 | 3285 | 8977 | 20032 | 52561 | 138678 | 270265 | 470804 | 789212 | 1366823 | 1068240 | 2088444 |
| | 2 | 788 | 1460 | 3990 | 8903 | 23360 | 63835 | 155846 | 351737 | 670145 | 1247755 | 1038473 | 2045579 |
| | 3 | 443 | 821 | 2244 | 5008 | 13140 | 35907 | 87663 | 210242 | 503451 | 1081061 | 996798 | 1985568 |
| | 4 | 197 | 365 | 997 | 2226 | 5840 | 15959 | 38961 | 93441 | 228127 | 623384 | 877729 | 1814109 |
| | 5 | 111 | 205 | 561 | 1252 | 3285 | 8977 | 21916 | 52561 | 128322 | 350653 | 711032 | 1574065 |
| | 6 | 49 | 91 | 249 | 556 | 1460 | 3990 | 9740 | 23360 | 57032 | 155846 | 347773 | 912510 |
| 1500 | 1 | 1231 | 2281 | 6234 | 13911 | 36500 | 99741 | 228354 | 428893 | 747301 | 1324911 | 1057762 | 2073355 |
| | 2 | 547 | 1014 | 2771 | 6183 | 16222 | 44330 | 108226 | 259558 | 575844 | 1153454 | 1014897 | 2011360 |
| | 3 | 308 | 570 | 1558 | 3478 | 9125 | 24935 | 60877 | 146002 | 356449 | 913415 | 954886 | 1925214 |
| | 4 | 137 | 253 | 693 | 1546 | 4056 | 11082 | 27057 | 64890 | 158422 | 432905 | 783426 | 1678313 |
| | 5 | 77 | 143 | 390 | 869 | 2281 | 6234 | 15219 | 36500 | 89112 | 243509 | 543396 | 1332650 |
| | 6 | 34 | 63 | 173 | 386 | 1014 | 2771 | 6764 | 16222 | 39605 | 108226 | 241509 | 633688 |
| 1750 | 1 | 905 | 1676 | 4580 | 10220 | 26817 | 73279 | 178905 | 379361 | 697769 | 1275379 | 1045379 | 2055524 |
| | 2 | 402 | 745 | 2036 | 4542 | 11918 | 32569 | 79513 | 190696 | 464397 | 1042007 | 987035 | 1971508 |
| | 3 | 226 | 419 | 1145 | 2555 | 6704 | 18320 | 44726 | 107266 | 261881 | 715619 | 905353 | 1853887 |
| | 4 | 101 | 186 | 509 | 1136 | 2980 | 8142 | 19878 | 47674 | 116392 | 318053 | 671978 | 1517827 |
| | 5 | 57 | 105 | 286 | 639 | 1676 | 4580 | 11182 | 26817 | 65470 | 178905 | 399230 | 1047524 |
| | 6 | 25 | 47 | 127 | 284 | 745 | 2036 | 4970 | 11918 | 29098 | 79513 | 177435 | 465566 |
| 2000 | 1 | 693 | 1283 | 3507 | 7825 | 20531 | 56105 | 136974 | 322209 | 640616 | 1218227 | 1031090 | 2034948 |
| | 2 | 308 | 570 | 1558 | 3478 | 9125 | 24935 | 60877 | 146002 | 356449 | 913415 | 954886 | 1925214 |
| | 3 | 173 | 321 | 877 | 1956 | 5133 | 14026 | 34243 | 82126 | 200503 | 547896 | 848200 | 1771587 |
| | 4 | 77 | 143 | 390 | 869 | 2281 | 6234 | 15219 | 36500 | 89112 | 243509 | 543396 | 1332650 |
| | 5 | 43 | 80 | 219 | 489 | 1283 | 3507 | 8561 | 20531 | 50126 | 136974 | 305660 | 802011 |
| | 6 | 19 | 36 | 97 | 217 | 570 | 1558 | 3805 | 9125 | 22278 | 60877 | 135849 | 356449 |
| 2250 | 1 | 547 | 1014 | 2771 | 6183 | 16222 | 44330 | 108226 | 259558 | 575844 | 1153454 | 1014897 | 2011630 |
| | 2 | 243 | 451 | 1231 | 2748 | 7210 | 19702 | 48101 | 115359 | 281639 | 767677 | 918451 | 1872748 |
| | 3 | 137 | 253 | 693 | 1546 | 4056 | 11082 | 27057 | 64890 | 158422 | 432905 | 783426 | 1678313 |
| | 4 | 61 | 113 | 308 | 887 | 1802 | 4926 | 12025 | 28840 | 70410 | 192402 | 429350 | 1122784 |
| | 5 | 34 | 63 | 173 | 386 | 1014 | 2771 | 6764 | 16222 | 39605 | 108226 | 241509 | 633688 |
| | 6 | 15 | 28 | 77 | 172 | 451 | 1231 | 3006 | 7210 | 17602 | 48101 | 107337 | 218639 |
| 2500 | 1 | 443 | 821 | 2244 | 5008 | 13140 | 35907 | 87663 | 210242 | 503451 | 1081061 | 996798 | 1985568 |
| | 2 | 197 | 365 | 997 | 2226 | 5840 | 15959 | 38961 | 93441 | 228127 | 623384 | 877729 | 1814109 |
| | 3 | 111 | 205 | 561 | 1252 | 3285 | 8977 | 21916 | 52561 | 128322 | 350653 | 711032 | 1574065 |
| | 4 | 49 | 91 | 249 | 556 | 1460 | 3990 | 9740 | 23360 | 57032 | 155846 | 347773 | 912510 |
| | 5 | 28 | 51 | 140 | 313 | 821 | 2244 | 5479 | 13140 | 32080 | 87663 | 195623 | 513287 |
| | 6 | 12 | 23 | 62 | 139 | 365 | 997 | 2435 | 5840 | 14258 | 38961 | 86943 | 228127 |
| 2750 | 1 | 366 | 679 | 1855 | 4139 | 10860 | 29675 | 72449 | 173754 | 424204 | 1001048 | 976795 | 1956763 |
| | 2 | 163 | 302 | 824 | 1839 | 4827 | 13189 | 32200 | 77224 | 188535 | 515193 | 832721 | 1749297 |
| | 3 | 92 | 170 | 464 | 1035 | 2715 | 7419 | 18112 | 43438 | 106051 | 289796 | 631018 | 1458844 |
| | 4 | 41 | 75 | 206 | 460 | 1207 | 3297 | 8050 | 19306 | 47134 | 128798 | 287416 | 754141 |
| | 5 | 23 | 42 | 116 | 259 | 679 | 1855 | 4528 | 10860 | 26513 | 72449 | 161671 | 424204 |
| | 6 | 10 | 19 | 52 | 115 | 302 | 824 | 2012 | 4827 | 11783 | 32200 | 71854 | 188535 |
| 3000 | 1 | 308 | 570 | 1558 | 3478 | 9125 | 24935 | 60877 | 146002 | 356449 | 913415 | 954886 | 1925214 |
| | 2 | 137 | 253 | 693 | 1546 | 4056 | 11082 | 27057 | 64890 | 158422 | 432905 | 783426 | 1678313 |
| | 3 | 77 | 143 | 390 | 869 | 2281 | 6234 | 15219 | 36500 | 89112 | 243509 | 543396 | 1332650 |
| | 4 | 34 | 63 | 173 | 386 | 1014 | 2771 | 6764 | 16222 | 39605 | 108226 | 241509 | 633688 |
| | 5 | 19 | 36 | 97 | 217 | 570 | 1558 | 3805 | 9125 | 22278 | 60877 | 135849 | 356449 |
| | 6 | 9 | 16 | 43 | 97 | 253 | 693 | 1691 | 4056 | 9901 | 27057 | 60377 | 158422 |

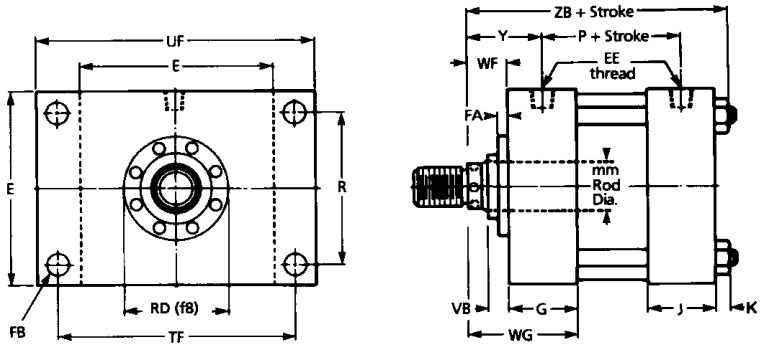
**See page 13** for instructions in the use of this chart.

# FLANGE AND LUG MOUNTINGS

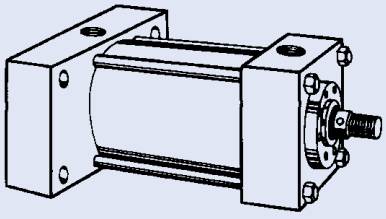
## Front Head Flange Mount – Style FHF



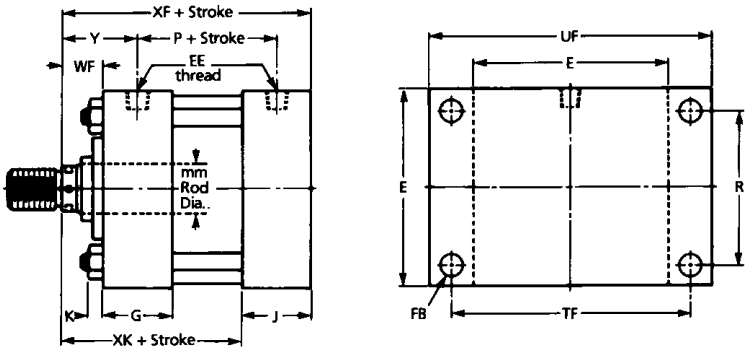
(ISO style ME5)



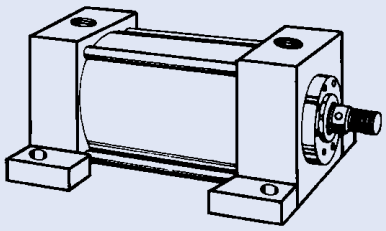

## Rear Head Flange Mount – Style RHF



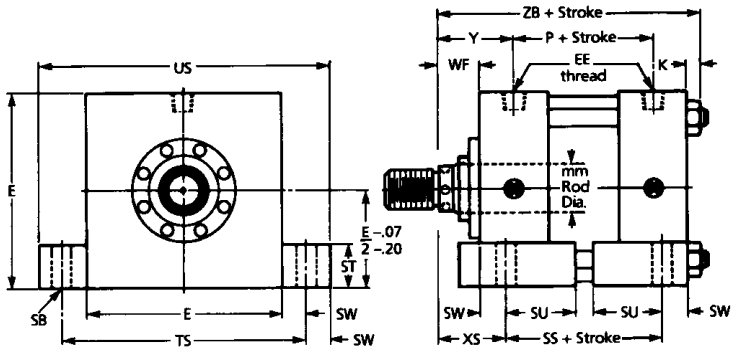
(ISO & DIN style ME6)

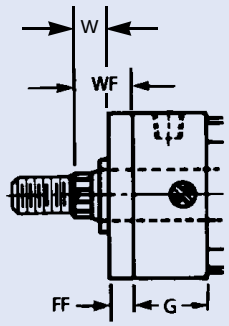



## Side Lug Mount – Style SL



(ISO & DIN style MS2)




Drawing A

### Important Notice

1. There is a construction variance in 25, 32, 40, 50 & 63 bore sizes and in the 80 bore with 45 and 56 dia. rods and 100 bore with 56 and 70 dia. rods in both RHF & SL mounts. In addition, the same applies to the FHF mount with 25, 32 and 40 bore size. The round retainer shown above is not used on these sizes. Instead, a retainer the same size as the head is used. See drawing A.

FHF Mount - The tie rods thread into the retainer. RHF Mount-The retainer is cleared for the tie rods and held in place with the tie rod nuts. In these sizes, the rod gland cannot be removed without loosening the tie rods. SL Mount - The retainer is held in place with screws that thread into the head. Dimensions are shown on the adjacent drawing. On all other sizes, a round rod gland retainer is used. It is held in place by retainer screws - independent of the tie rods, hence, the rod gland can be removed without loosening the tie rods.

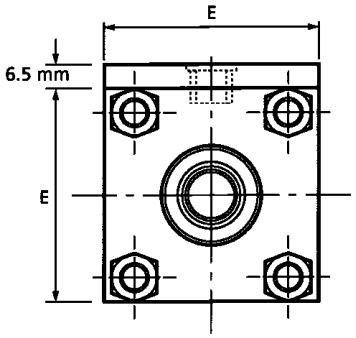
# FLANGE AND LUG DIMENSIONS

Be sure to add Stroke to these Dimensions

| Bore | MM Rod Dia. | FA | RD(f8) | VB | W | WF | WG | XF | XK | XS | FF | ZB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 12 | - | - | 16 | 15 | 25 | 55 | 114 | 89 | 33 | 10 | 118 |
| | 18 | - | - | 16 | 15 | 25 | 55 | 114 | 89 | 33 | 10 | 118 |
| 32 | 14 | - | - | 22 | 25 | 35 | 65 | 128 | 103 | 45 | 10 | 133 |
| | 22 | - | - | 22 | 25 | 35 | 65 | 128 | 103 | 45 | 10 | 133 |
| 40 | 18 | - | - | 16 | 25 | 35 | 77 | 153 | 115 | 45 | 10 | 160 |
| | 28 | - | - | 22 | 25 | 35 | 77 | 153 | 115 | 45 | 10 | 160 |
| 50 | 22 | 16** | 74** | 22 | 25 | 41 | 83 | 159 | 121 | 54 | 16 | 169 |
| | 28 | 16** | 74** | 22 | 25 | 41 | 83 | 159 | 121 | 54 | 16 | 169 |
| | 36 | 16** | 74** | 25 | 25 | 41 | 83 | 159 | 121 | 54 | 16 | 169 |
| 63 | 28 | 16** | 75** | 22 | 32 | 48 | 90 | 168 | 130 | 65 | 16 | 178 |
| | 36 | 16** | 88** | 25 | 32 | 48 | 90 | 168 | 130 | 65 | 16 | 178 |
| | 45 | 16** | 88** | 29 | 32 | 48 | 90 | 168 | 130 | 65 | 16 | 178 |
| 80 | 36 | 20 | 82 | 25 | 31 | 51 | 101 | 190 | 145 | 68 | - | 203 |
| | 45 | 20** | 105** | 29 | 31 | 51 | 101 | 190 | 145 | 68 | 20 | 203 |
| | 56 | 20** | 105** | 29 | 31 | 51 | 101 | 190 | 145 | 68 | 20 | 203 |
| 100 | 45 | 22 | 92 | 29 | 35 | 57 | 107 | 203 | 158 | 79 | - | 216 |
| | 56 | 22** | 125** | 29 | 35 | 57 | 107 | 203 | 158 | 79 | 22 | 216 |
| | 70 | 22** | 125** | 32 | 35 | 57 | 107 | 203 | 158 | 79 | 22 | 216 |
| 125 | 56 | 22 | 105 | 29 | 35 | 57† | 107 | 232 | 187 | 79 | - | 234 |
| | 70 | 22 | 150 | 32 | 35 | 57† | 107 | 232 | 187 | 79 | - | 234 |
| | 90 | 22 | 150 | 32 | 35 | 57† | 107 | 232 | 187 | 79 | - | 234 |
| 160 | 70 | 25 | 125 | 32 | 32 | 57 | 117 | 245 | 185 | 86 | - | 267 |
| | 90 | 25 | 170 | 32 | 32 | 57 | 117 | 245 | 185 | 86 | - | 267 |
| | 110 | 25 | 170 | 32 | 32 | 57 | 117 | 245 | 185 | 86 | - | 267 |
| 200 | 90 | 25 | 150 | 32 | 32 | 57 | 137 | 299 | 219 | 92 | - | 323 |
| | 110 | 25 | 210 | 32 | 32 | 57 | 137 | 299 | 219 | 92 | - | 323 |
| | 140 | 25 | 210 | 32 | 32 | 57 | 137 | 299 | 219 | 92 | - | 323 |

### § 25mm and 32mm bore

Extra height 6.5mm applies to port face at head end only.




**Refer to pages 10-11** for important information concerning the mounting of cylinders.

**Refer to page 25** for rod end information.

Be sure to add Stroke to these Dimensions

| Bore | E | EE (BSP) | FB | G | J | K | P | R | SB | SS | ST | SU | SW | TF | TS | UF | US | Y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 38§ | 1/4 | 5.5 | 30 | 25 | 4 | 62 | 27 | 6.6 | 73 | 9 | 22 | 8 | 51 | 54 | 62 | 70 | 41 |
| 32 | 45§ | 1/4 | 6.6 | 30 | 25 | 5 | 66 | 33 | 9 | 73 | 12 | 20 | 10 | 58 | 63 | 70 | 84 | 51 |
| 40 | 63 | 3/8 | 11 | 42 | 38 | 6.5 | 78 | 41 | 11 | 98 | 12 | 32 | 10 | 87 | 83 | 110 | 103 | 57 |
| 50 | 76 | 1/2 | 14 | 42 | 38 | 10 | 78 | 52 | 14 | 92 | 18.5 | 29 | 13 | 105 | 102 | 130 | 127 | 63 |
| 63 | 89 | 1/2 | 14 | 42 | 38 | 10 | 80 | 65 | 18 | 86 | 25 | 25 | 17 | 117 | 124 | 140 | 159 | 70 |
| 80 | 115 | 3/4 | 18 | 50 | 45 | 13 | 88 | 83 | 18 | 105 | 25 | 33 | 17 | 149 | 149 | 180 | 185 | 79 |
| 100 | 127 | 3/4 | 18 | 50 | 45 | 13 | 95 | 97 | 26 | 102 | 31 | 28 | 22 | 162 | 172 | 195 | 216 | 85 |
| 125 | 165 | 3/4* | 22 | 50 | 45 | 18 | 108 | 126 | 26 | 115 | 31 | 28 | 22 | 208 | 210 | 250 | 254 | 85† |
| 160 | 203 | 1 | 26 | 60 | 60 | 22 | 128 | 155 | 33 | 130 | 37.5 | 31 | 29 | 253 | 260 | 300 | 317 | 87 |
| 200 | 240 | 1 1/4 | 33 | 80 | 80 | 29 | 162 | 190 | 39 | 172 | 44 | 45 | 35 | 300 | 311 | 360 | 367 | 97 |

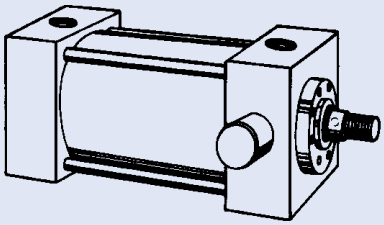
** FHF Style Mount ONLY  * Not in accordance with Standard  † Add 16mm to this dimension for RHF Style Mount ONLY.

### Important Notice

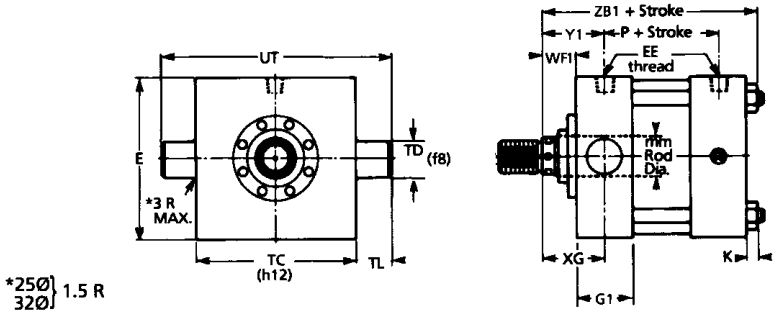
1. 25 & 32 mm bore cylinders have head height increased by 6.5 mm on port face. See diagram.
2. Due to space limitation on SL mount, ports can only be provided in positions 1 & 5 on 25 & 32 bore cylinders.
3. The dimensions offered for Front Head Flange Mount - style FHF relate to ISO dimensions only. For DIN standard details please consult factory.
4. For DIN 24554 standard please check model number composition on page 30.

# TRUNNION MOUNTINGS

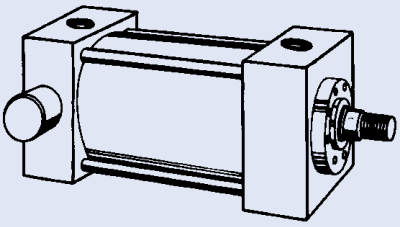
## Trunnion Front Mount – Style TF



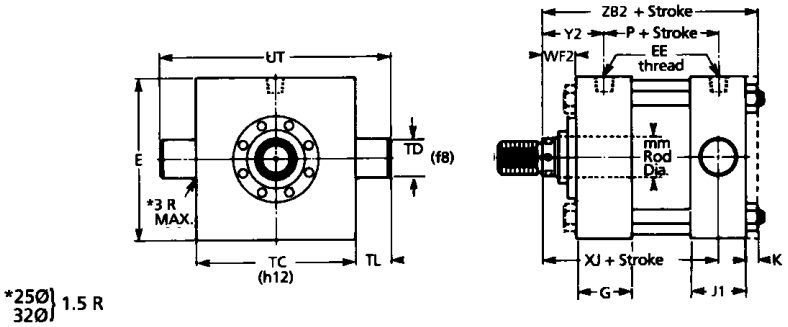
(ISO style MT1)



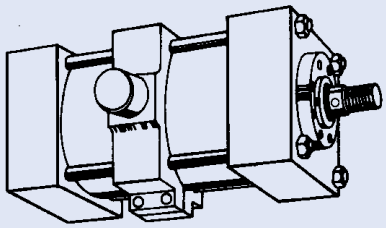

## Trunnion Rear Mount – Style TR



(ISO style MT2)

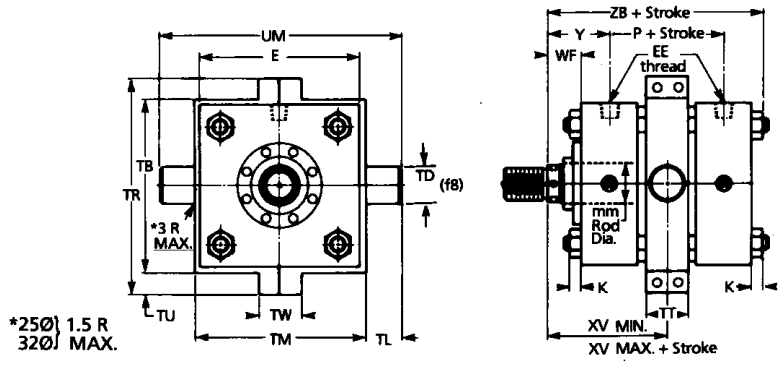



## Trunnion Mount – Style T



(intermediate-Between Heads)
Position NOT Adjustable

(ISO & DIN style MT4)




### Important Notice

1. There is a construction variance in 25, 32, 40, 50 & 63 bore sizes and the 80mm bore with 45 and 56 dia. rods. The round retainer shown above is not used on these sizes. Instead, a retainer the same size as the head is used. See drawing A on opposite page.
2. In the T mount, note 1 above also applies to the 100 bore with 56 and 70 dia. rods.
3. In the TF and TR mounts, the retainer is held in place by retainer screws that thread into the head. The rod gland can be removed without loosening the tie rods.
4. The T mount also employs a square retainer but it is held in place with the tie rod nuts. The rod gland cannot be removed without loosening the tie rods.
5. In all mounts 100 bore and above which have a round retainer, this is held in place by screws independent of the tie rods, hence, the rod gland can be removed without loosening the tie rods.
6. The TR mount upto and including 80 bore has tie rod nuts at rear and screws at the front. From 100 bore upwards, the tie rod nuts are located at the front.
7. 25 & 32 mm bore cylinders have head height increased by 6.5 mm on port face. See opposite on dimension page.

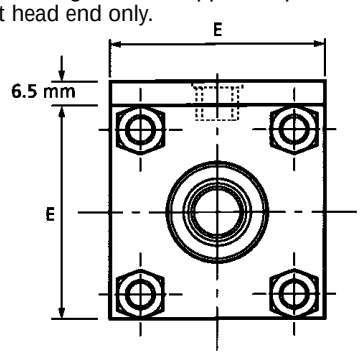
# TRUNNION DIMENSIONS

Be sure to add Stroke to these Dimensions

| Bore | MM Rod Dia. | WF | XV Min. | XV Max | XG | XJ | Y | ZB | FF |
|---|---|---|---|---|---|---|---|---|---|
| 25 | 12 | 25 | 67 | 77 | 44 | 101 | 41 | 118 | 10 |
| | 18 | 25 | 67 | 77 | 44 | 101 | 41 | 118 | 10 |
| 32 | 14 | 35 | 79 | 89 | 54 | 115 | 51 | 133 | 10 |
| | 22 | 35 | 79 | 89 | 54 | 115 | 51 | 133 | 10 |
| 40 | 18 | 35 | 93 | 99 | 57 | 134 | 57 | 160 | 10 |
| | 28 | 35 | 93 | 99 | 57 | 134 | 57 | 160 | 10 |
| 50 | 22 | 41 | 104 | 100 | 64 | 140 | 63 | 169 | 16 |
| | 28 | 41 | 104 | 100 | 64 | 140 | 63 | 169 | 16 |
| | 36 | 41 | 104 | 100 | 64 | 140 | 63 | 169 | 16 |
| 63 | 28 | 48 | 111 | 109 | 70 | 149 | 70 | 178 | 16 |
| | 36 | 48 | 111 | 109 | 70 | 149 | 70 | 178 | 16 |
| | 45 | 48 | 111 | 109 | 70 | 149 | 70 | 178 | 16 |
| 80 | 36 | 51 | 127 | 119 | 76 | 168 | 79 | 203 | - |
| | 45 | 51 | 127 | 119 | 76 | 168 | 79 | 203 | 20 |
| | 56 | 51 | 127 | 119 | 76 | 168 | 79 | 203 | 20 |
| 100 | 45 | 57 | 138 | 128 | 71 | 187 | 85 | 216 | - |
| | 56 | 57 | 138 | 128 | 71 | 187 | 85 | 216 | 22 |
| | 70 | 57 | 138 | 128 | 71 | 187 | 85 | 216 | 22 |
| 125 | 56 | 57 | 146 | 132 | 75 | 209 | 85 | 234 | - |
| | 70 | 57 | 146 | 132 | 75 | 209 | 85 | 234 | - |
| | 90 | 57 | 146 | 132 | 75 | 209 | 85 | 234 | - |
| 160 | 70 | 57 | 166 | 136 | 75 | 230 | 87 | 267 | - |
| | 90 | 57 | 166 | 136 | 75 | 230 | 87 | 267 | - |
| | 110 | 57 | 166 | 136 | 75 | 230 | 87 | 267 | - |
| 200 | 90 | 57 | 199 | 157 | 85 | 276 | 97 | 323 | - |
| | 110 | 57 | 199 | 157 | 85 | 276 | 97 | 323 | - |
| | 140 | 57 | 199 | 157 | 85 | 276 | 97 | 323 | - |

### § 25mm and 32mm bore

Extra height 6.5mm applies to port face at head end only.




**Refer to pages 10-11** for important information concerning the mounting of cylinders.

**Refer to page 25** for rod end information.

### Important Notice

For DIN 24554 standard please check model number composition on page 30.

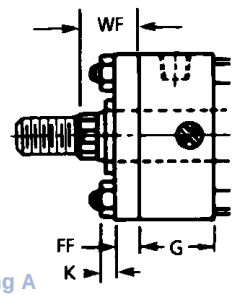
Be sure to add Stroke to these Dimensions

| Bore | E | EE (BSP) | G | J | K | P | TB | TD(f8) | TL | TM | TR | TT | TU | TW | UM | UT | TC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 38§ | 1/4 | 30 | 25 | 4 | 62 | 60 | 12 | 10 | 48 | 60 | 22 | - | 46 | 68 | 58 | 38 |
| 32 | 45§ | 1/4 | 30 | 25 | 5 | 66 | 66 | 16 | 12 | 55 | 66 | 25 | - | 54 | 79 | 68 | 44 |
| 40 | 63 | 3/8 | 42 | 38 | 6.5 | 78 | 80 | 20 | 16 | 76 | 80 | 30 | - | 74 | 108 | 95 | 63 |
| 50 | 76 | 1/2 | 42 | 38 | 10 | 78 | 105 | 25 | 20 | 89 | 105 | 40 | - | 87 | 129 | 116 | 76 |
| 63 | 89 | 1/2 | 42 | 38 | 10 | 80 | 125 | 32 | 25 | 100 | 125 | 40 | - | 98 | 150 | 139 | 89 |
| 80 | 115 | 3/4 | 50 | 45 | 13 | 88 | 120 | 40 | 32 | 127 | 160 | 50 | 20 | 64 | 191 | 178 | 114 |
| 100 | 127 | 3/4 | 50 | 45 | 13 | 95 | 136 | 50 | 40 | 140 | 178 | 60 | 21 | 64 | 220 | 207 | 127 |
| 125 | 165 | 3/4* | 50 | 45 | 18 | 108 | 168 | 63 | 50 | 178 | 210 | 76 | 21 | 64 | 278 | 265 | 165 |
| 160 | 203 | 1 | 60 | 60 | 22 | 128 | 212 | 80 | 63 | 215 | 260 | 95 | 24 | 64 | 341 | 329 | 203 |
| 200 | 240 | 1 1/4 | 80 | 80 | 29 | 162 | 277 | 100 | 80 | 279 | 330 | 120 | 26.5 | 64 | 439 | 401 | 241 |

*Not in accordance with Standard.

Be sure to add Stroke to these Dimensions

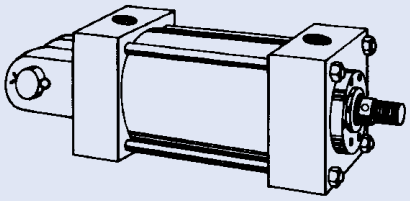
| Bore | G1 | J1 | WF1 | WF2 | Y1 | Y2 | ZB1 | ZB2 Max. |
|---|---|---|---|---|---|---|---|---|
| 25 | 30 | 25 | 25 | 25 | 41 | 41 | 118 | 121 |
| 32 | 30 | 25 | 35 | 35 | 51 | 51 | 133 | 137 |
| 40 | 42 | 38 | 35 | 35 | 57 | 57 | 160 | 166 |
| 50 | 42 | 38 | 41 | 41 | 63 | 63 | 169 | 176 |
| 63 | 42 | 38 | 48 | 48 | 70 | 70 | 178 | 185 |
| 80 | 50 | 45 | 51 | 51 | 79 | 79 | 203 | 212 |
| 100 | 58 | 58 | 42 | 57 | 78 | 85 | 209 | 225 |
| 125 | 72 | 72 | 39 | 59 | 89 | 87 | 238 | 260 |
| 160 | 90 | 90 | 30 | 57 | 90 | 87 | 270 | 279 |
| 200 | 110 | 110 | 30 | 59 | 100 | 99 | 326 | 336 |



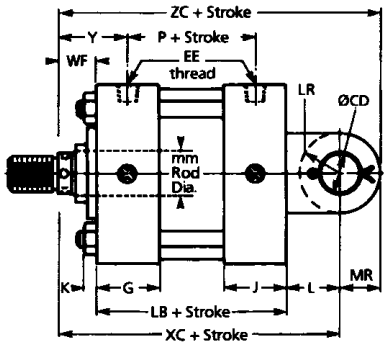

Drawing A

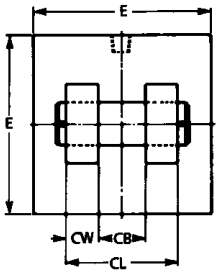
# CLEVIS AND PIVOT MOUNTINGS

## Clevis Mount – Style C



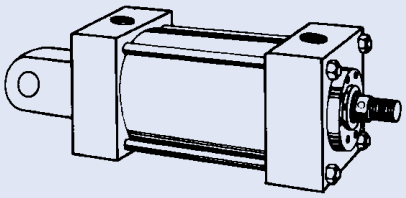
(ISO style MP1)



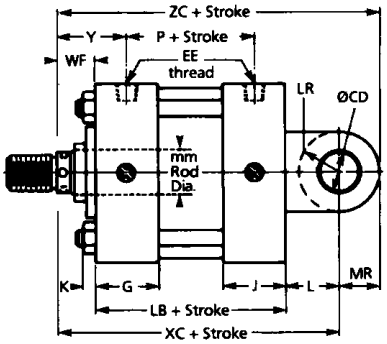



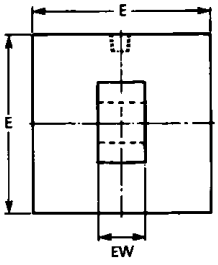

Supplied complete with Pivot pin

## Pivot Mount – Style P



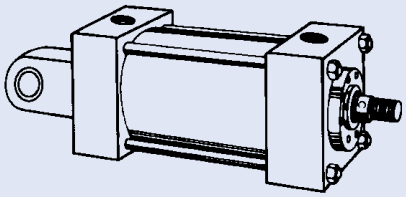
(ISO style MP3)



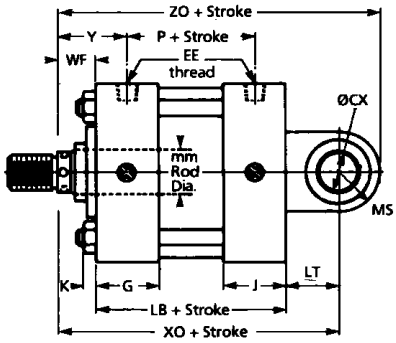



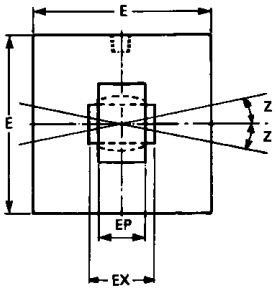

Pivot pin not supplied

## Pivot Mount with Spherical Bearing – Style SBp

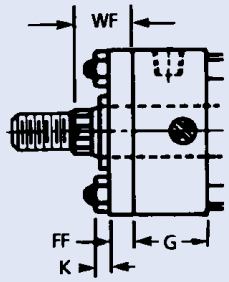


(ISO & DIN style MP5)




Pivot pin not supplied




Drawing A

### Important Notice

1. There is a construction variance in 25, 32, 40, 50 & 63 bore sizes and in the 80 bore with 45 and 56 dia. rods and 100 bore with 56 and 70 dia.rods.The round retainer shown above is not used on these sizes.

   A square retainer, the same square size as the head is used. See drawing A. The retainer is cleared for the tie rods and held in place with the tie rod nuts. In these sizes, the rod gland cannot be removed without loosening the tie rods.

   Dimensions are shown on the adjacent drawing.

   On all other sizes, a round rod gland retainer is used. It is held in place by retainer screws - independent of the tie rods, hence, the rod gland can be removed without loosening the tie rods.

2. 25 & 32 mm bore cylinders have head height increased by 6.5 mm on port face. See opposite on dimension page.

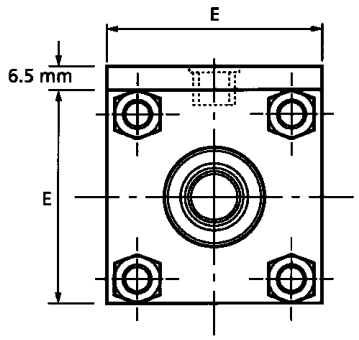
# CLEVIS AND PIVOT DIMENSIONS

Be sure to add Stroke to these Dimensions

| Bore | MM Rod Dia. | WF | XC | XO | Y | ZC | ZO | FF |
|---|---|---|---|---|---|---|---|---|
| 25 | 12 | 25 | 127 | 130 | 41 | 139 | 150 | 10 |
| | 18 | 25 | 127 | 130 | 41 | 139 | 150 | 10 |
| 32 | 14 | 35 | 147 | 148 | 51 | 163 | 170 | 10 |
| | 22 | 35 | 147 | 148 | 51 | 163 | 170 | 10 |
| 40 | 18 | 35 | 172 | 178 | 57 | 188 | 207 | 10 |
| | 28 | 35 | 172 | 178 | 57 | 188 | 207 | 10 |
| 50 | 22 | 41 | 191 | 190 | 63 | 216 | 223 | 16 |
| | 28 | 41 | 191 | 190 | 63 | 216 | 223 | 16 |
| | 36 | 41 | 191 | 190 | 63 | 216 | 223 | 16 |
| 63 | 28 | 48 | 200 | 206 | 70 | 225 | 246 | 16 |
| | 36 | 48 | 200 | 206 | 70 | 225 | 246 | 16 |
| | 45 | 48 | 200 | 206 | 70 | 225 | 246 | 16 |
| 80 | 36 | 51 | 229 | 238 | 79 | 262 | 288 | - |
| | 45 | 51 | 229 | 238 | 79 | 262 | 288 | 20 |
| | 56 | 51 | 229 | 238 | 79 | 262 | 288 | 20 |
| 100 | 45 | 57 | 257 | 261 | 85 | 302 | 323 | - |
| | 56 | 57 | 257 | 261 | 85 | 302 | 323 | 22 |
| | 70 | 57 | 257 | 261 | 85 | 302 | 323 | 22 |
| 125 | 56 | 73 | 289 | 304 | 101 | 340 | 384 | - |
| | 70 | 73 | 289 | 304 | 101 | 340 | 384 | - |
| | 90 | 73 | 289 | 304 | 101 | 340 | 384 | - |
| 160 | 70 | 57 | 308 | 337 | 87 | 365 | 437 | - |
| | 90 | 57 | 308 | 337 | 87 | 365 | 437 | - |
| | 110 | 57 | 308 | 337 | 87 | 365 | 437 | - |
| 200 | 90 | 57 | 381 | 415 | 97 | 457 | 535 | - |
| | 110 | 57 | 381 | 415 | 97 | 457 | 535 | - |
| | 140 | 57 | 381 | 415 | 97 | 457 | 535 | - |

### § 25mm and 32mm bore

Extra height 6.5mm applies to port face at head end only.




**Refer to pages 10-11** for important information concerning the mounting of cylinders.

**Refer to page 25** for rod end information.

**Important Notice**
For DIN 24554 standard please check model number composition on page 30.

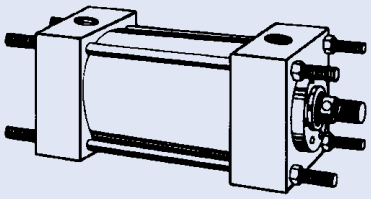
Be sure to add Stroke to these Dimensions

| Bore | CB | CD | CL Max. | CW Ref. | CX | E | EE (BSP) | EP | EW | EX | G | J | K | L | LB | LR | LT | MR | MS | P | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 12 | 10 | 26 | 7 | 12 | 38§ | 1/4 | 8 | 12 | 10 | 30 | 25 | 4 | 13 | 89 | 12 | 16 | 12 | 20 | 62 | |
| 32 | 16 | 12 | 34 | 9 | 16 | 45§ | 1/4 | 11 | 16 | 14 | 30 | 25 | 5 | 19 | 93 | 16 | 20 | 16 | 22.5 | 66 | |
| 40 | 20 | 14 | 42 | 11 | 20 | 63 | 3/8 | 13 | 20 | 16 | 42 | 38 | 6.5 | 19 | 118 | 16 | 25 | 16 | 29 | 78 | |
| 50 | 30 | 20 | 62 | 16 | 25 | 76 | 1/2 | 17 | 30 | 20 | 42 | 38 | 10 | 32 | 118 | 25 | 31 | 25 | 33 | 78 | |
| 63 | 30 | 20 | 62 | 16 | 30 | 89 | 1/2 | 19 | 30 | 22 | 42 | 38 | 10 | 32 | 120 | 25 | 38 | 25 | 40 | 80 | 3° |
| 80 | 40 | 28 | 83 | 21 | 40 | 115 | 3/4 | 23 | 40 | 28 | 50 | 45 | 13 | 39 | 139 | 33 | 48 | 33 | 50 | 88 | |
| 100 | 50 | 36 | 103 | 26 | 50 | 127 | 3/4 | 30 | 50 | 35 | 50 | 45 | 13 | 54 | 146 | 45 | 58 | 45 | 62 | 95 | |
| 125 | 60 | 45 | 123 | 31 | 60 | 165 | 3/4* | 38 | 60 | 44 | 50 | 45 | 18 | 57 | 159 | 51 | 72 | 51 | 80 | 108 | |
| 160 | 70 | 56 | 143 | 36 | 80 | 203 | 1 | 47 | 70 | 55 | 60 | 60 | 22 | 63 | 188 | 57 | 92 | 57 | 100 | 128 | |
| 200 | 80 | 70 | 163 | 41 | 100 | 240 | 1.1/4 | 57 | 80 | 70 | 80 | 80 | 29 | 82 | 242 | 76 | 116 | 76 | 120 | 162 | |

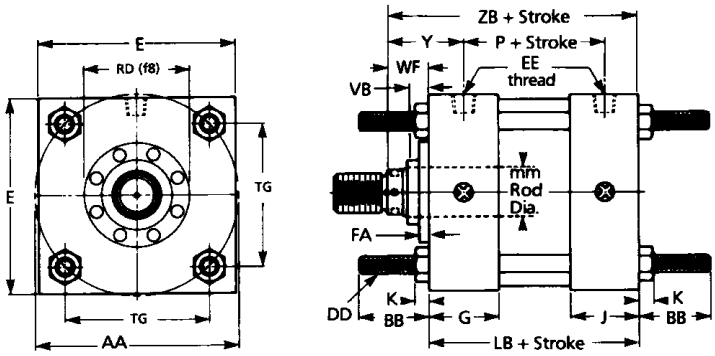
*Not in accordance with Standard.

# TIE ROD MOUNTINGS

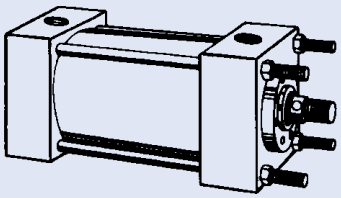
## Tie Rod Extended Both Ends – Style BX



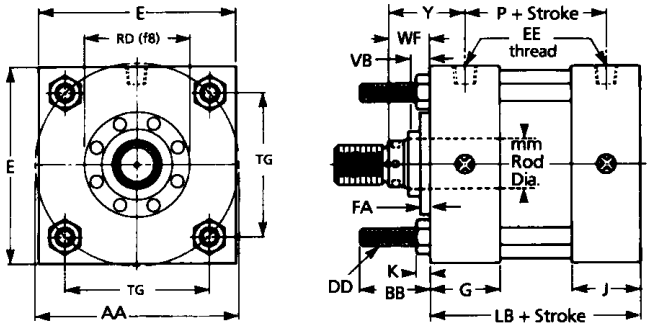
(ISO style MX1)



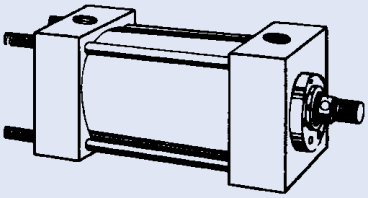

## Tie Rod Extended Head End – Style FX



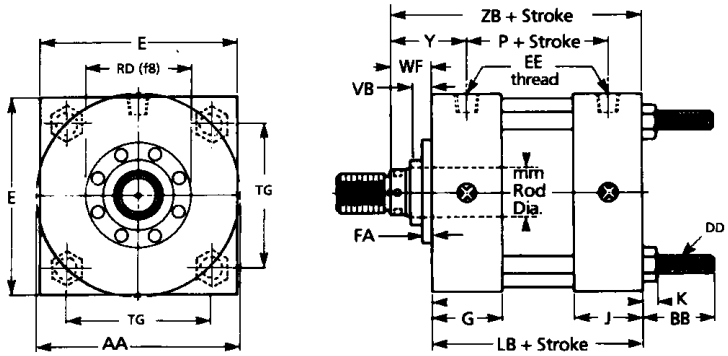
(ISO style MX3)

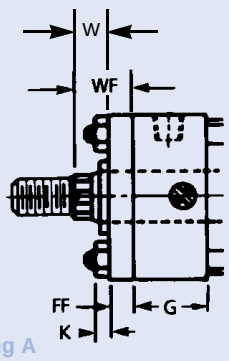



## Tie Rod Extended Cap End – Style RX



(ISO style MX2)




Drawing A

### Important Notice

1. There is a construction variance in 25, 32, 40, 50 & 63 bore sizes and in the 80 bore with 45 and 56 dia. rods and 100 bore with 56 and 70 dia.rods.The round retainer shown above is not used on these sizes. See drawing A

   The tie rod nuts are therefore tightened against the retainer instead of against the head on the FX and BX Mounts and the rod gland cannot be removed without loosening the tie rods. See adjacent drawing.

   On the NX and RX Mounts, the square retainer is also used as shown on the adjacent drawing, but the retainer is held in place with retainer screws. The tie rods thread into the head. The rod gland can be removed without loosening the tie rods in these mounts. Dimensions are shown on the adjacent drawing.

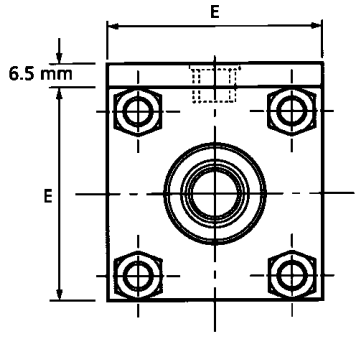
   On all other sizes, a round rod gland retainer is used. It is held in place by retainer screws - independent of the tie rods, hence, the rod gland can be removed without loosening the tie rods.
2. 25 & 32 mm bore cylinders have head height increased by 6.5 mm on port face. See opposite on dimension page.

# TIE ROD DIMENSIONS

| Bore | MM Rod Dia. | FA | RD(f8) | VB | W | WF | Y | ZB | FF |
|---|---|---|---|---|---|---|---|---|---|
| 25 | 12 | - | - | 16 | 15 | 25 | 41 | 114 | 10 |
| | 18 | - | - | 16 | 15 | 25 | 41 | 114 | 10 |
| 32 | 14 | - | - | 22 | 25 | 35 | 51 | 128 | 10 |
| | 22 | - | - | 22 | 25 | 35 | 51 | 128 | 10 |
| 40 | 18 | - | - | 16 | 25 | 35 | 57 | 153 | 10 |
| | 28 | - | - | 22 | 25 | 35 | 57 | 153 | 10 |
| 50 | 22 | - | - | 22 | 25 | 41 | 63 | 159 | 16 |
| | 28 | - | - | 22 | 25 | 41 | 63 | 159 | 16 |
| | 36 | - | - | 25 | 25 | 41 | 63 | 159 | 16 |
| 63 | 28 | - | - | 22 | 32 | 48 | 70 | 168 | 16 |
| | 36 | - | - | 25 | 32 | 48 | 70 | 168 | 16 |
| | 45 | - | - | 29 | 32 | 48 | 70 | 168 | 16 |
| 80 | 36 | 20 | 82 | 25 | 31 | 51 | 79 | 190 | - |
| | 45 | - | - | 29 | 31 | 51 | 79 | 190 | 20 |
| | 56 | - | - | 29 | 31 | 51 | 79 | 190 | 20 |
| 100 | 45 | 22 | 92 | 29 | 35 | 57 | 85 | 203 | - |
| | 56 | - | - | 29 | 35 | 57 | 85 | 203 | 22 |
| | 70 | - | - | 32 | 35 | 57 | 85 | 203 | 22 |
| 125 | 56 | 22 | 105 | 29 | 35 | 57 | 85 | 216* | - |
| | 70 | 22 | 125 | 32 | 35 | 57 | 85 | 216* | - |
| | 90 | 22 | 150 | 32 | 35 | 57 | 85 | 216* | - |
| 160 | 70 | 25 | 125 | 32 | 32 | 57 | 87 | 245 | - |
| | 90 | 25 | 170 | 32 | 32 | 57 | 87 | 245 | - |
| | 110 | 25 | 170 | 32 | 32 | 57 | 87 | 245 | - |
| 200 | 90 | 25 | 150 | 32 | 32 | 57 | 97 | 299 | - |
| | 110 | 25 | 210 | 32 | 32 | 57 | 97 | 299 | - |
| | 140 | 25 | 210 | 32 | 32 | 57 | 97 | 299 | - |

### § 25mm and 32mm bore

Extra height 6.5mm applies to port face at head end only.




**Refer to pages 10-11** for important information concerning the mounting of cylinders.

**Refer to page 25** for rod end information.

### Important Notice

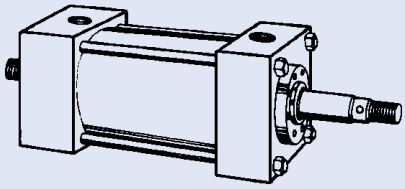
For DIN 24554 standard please check model number composition on page 30.

Be sure to add Stroke to these Dimensions

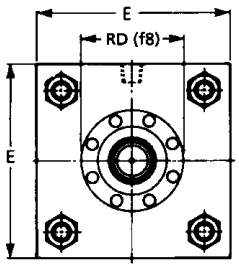
| Bore | AA | BB | DD | E | EE (BSP) | G | J | K | LB | P | TG |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 40 | 19 | M5 x 0.8 | 38§ | 1/4 | 30 | 25 | 4 | 89 | 62 | 28.3 |
| 32 | 47 | 24 | M6 x 1 | 45§ | 1/4 | 30 | 25 | 5 | 93 | 66 | 33.2 |
| 40 | 59 | 35 | M8 x 1 | 63 | 3/8 | 42 | 38 | 6.5 | 118 | 78 | 41.7 |
| 50 | 74 | 46 | M12 x 1.25 | 76 | 1/2 | 42 | 38 | 10 | 118 | 78 | 52.3 |
| 63 | 91 | 46 | M12 x 1.25 | 89 | 1/2 | 42 | 38 | 10 | 120 | 80 | 64.3 |
| 80 | 117 | 59 | M16 x 1.5 | 115 | 3/4 | 50 | 45 | 13 | 139 | 88 | 82.7 |
| 100 | 137 | 59 | M16 x 1.5 | 127 | 3/4 | 50 | 45 | 13 | 146 | 95 | 96.9 |
| 125 | 178 | 81 | M22 x 1.5 | 165 | 3/4* | 50 | 45 | 18 | 159 | 108 | 125.9 |
| 160 | 219 | 92 | M27 x 2 | 203 | 1 | 60 | 60 | 22 | 188 | 128 | 154.9 |
| 200 | 269 | 115 | M30 x 2 | 240 | 1 1/4 | 80 | 80 | 29 | 242 | 162 | 190.2 |

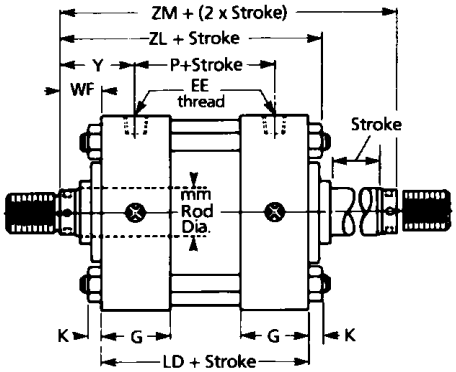
*Not in accordance with Standard.

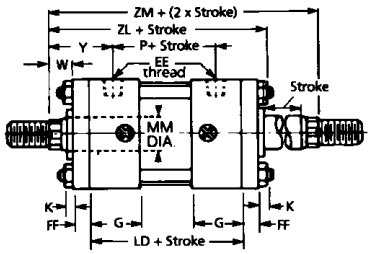
## Basic Double Rod Extension



Available in all except
C & P & RHF mounts.



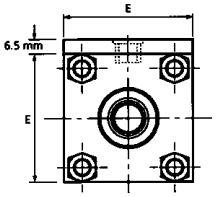




Drawing B

### § 25mm and 32mm bore

Extra height 6.5mm applies to port face at head end only.




Drawing C

### Important Notice

1. There is a construction variance in 25, 32, 40, 50 & 63 bore sizes and in the 80 bore with 45 and 56 dia. rods and 100 bore with 56 and 70 dia. rods. The round retainer shown above is not used on these sizes.

   A square retainer, the same square size as the head is employed. The retainer is cleared for the tie rods and held in place with the tie rod nuts. See drawing B. In these sizes, the rod gland cannot be removed without loosening the tie rods. Dimensions are shown on the adjacent drawing.

   On all other sizes, a round rod gland retainer is used. It is held in place by retainer screws - independent of the tie rods, hence, the rod gland can be removed without loosening the tie rods.
2. 25 & 32 mm bore cylinders have head height increased by 6.5 mm on port face. See drawing C.
3. When the rod ends of a double rod end cylinder are not to be the same, such as a style 2 on one end and a style 4 on the other, be sure to so specify and identity which end is which in relation to the mount.

   For example, on a Front Head Flange mount double rod end cylinder, specify style 2 rod end on flange end of cylinder and style 4 on opposite end.
4. For 25, 32 and 40 bore sizes one rod end is marked with the letter M. This rod can take a full load of 210 bar. The opposite end is restricted to 140 bar. Please clearly state which end full load is to be applied.
5. Refer to **page 25** for Rod End Information.

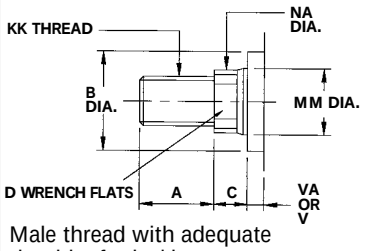
Be sure to add Stroke to these Dimensions
Add 2X Stroke to ZM Dimension

| Bore | MM Rod Dia. | E | EE (BSP) | G | K | LD | P | RD | W | WF | Y | ZL | ZM | FF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 12 | 38§ | 1/4 | 30 | 4 | 94 | 62 | - | 15 | 25 | 41 | 123 | 144 | 10 |
| | 18 | 38§ | 1/4 | 30 | 4 | 94 | 62 | - | 15 | 25 | 41 | 123 | 144 | 10 |
| 32 | 14 | 45§ | 1/4 | 30 | 5 | 98 | 66 | - | 25 | 35 | 51 | 138 | 168 | 10 |
| | 22 | 45§ | 1/4 | 30 | 5 | 98 | 66 | - | 25 | 35 | 51 | 138 | 168 | 10 |
| 40 | 18 | 63 | 3/8 | 42 | 6.5 | 122 | 78 | - | 25 | 35 | 57 | 164 | 192 | 10 |
| | 28 | 63 | 3/8 | 42 | 6.5 | 122 | 78 | - | 25 | 35 | 57 | 164 | 192 | 10 |
| 50 | 22 | 76 | 1/2 | 42 | 10 | 122 | 78 | - | 25 | 41 | 63 | 173 | 204 | 16 |
| | 28 | 76 | 1/2 | 42 | 10 | 122 | 78 | - | 25 | 41 | 63 | 173 | 204 | 16 |
| | 36 | 76 | 1/2 | 42 | 10 | 122 | 78 | - | 25 | 41 | 63 | 173 | 204 | 16 |
| 63 | 28 | 89 | 1/2 | 42 | 10 | 124 | 80 | - | 32 | 48 | 70 | 182 | 220 | 16 |
| | 36 | 89 | 1/2 | 42 | 10 | 124 | 80 | - | 32 | 48 | 70 | 182 | 220 | 16 |
| | 45 | 89 | 1/2 | 42 | 10 | 124 | 80 | - | 32 | 48 | 70 | 182 | 220 | 16 |
| 80 | 36 | 115 | 3/4 | 50 | 13 | 144 | 88 | 82 | 31 | 51 | 79 | 208 | 246 | - |
| | 45 | 115 | 3/4 | 50 | 13 | 144 | 88 | - | 31 | 51 | 79 | 208 | 246 | 20 |
| | 56 | 115 | 3/4 | 50 | 13 | 144 | 88 | - | 31 | 51 | 79 | 208 | 246 | 20 |
| 100 | 45 | 127 | 3/4 | 50 | 13 | 151 | 95 | 92 | 35 | 57 | 85 | 221 | 265 | - |
| | 56 | 127 | 3/4 | 50 | 13 | 151 | 95 | - | 35 | 57 | 85 | 221 | 265 | 22 |
| | 70 | 127 | 3/4 | 50 | 13 | 151 | 95 | - | 35 | 57 | 85 | 221 | 265 | 22 |
| 125 | 56 | 165 | 3/4* | 50 | 18 | 164 | 108 | 105 | 35 | 57 | 85 | 239 | 278 | - |
| | 70 | 165 | 3/4* | 50 | 18 | 164 | 108 | 150 | 35 | 57 | 85 | 239 | 278 | - |
| | 90 | 165 | 3/4* | 50 | 18 | 164 | 108 | 150 | 35 | 57 | 85 | 239 | 278 | - |
| 160 | 70 | 203 | 1 | 60 | 22 | 188 | 128 | 125 | 32 | 57 | 87 | 267 | 302 | - |
| | 90 | 203 | 1 | 60 | 22 | 188 | 128 | 170 | 32 | 57 | 87 | 267 | 302 | - |
| | 110 | 203 | 1 | 60 | 22 | 188 | 128 | 170 | 32 | 57 | 87 | 267 | 302 | - |
| 200 | 90 | 240 | 1 1/4 | 80 | 29 | 242 | 162 | 150 | 32 | 57 | 97 | 323 | 356 | - |
| | 110 | 240 | 1 1/4 | 80 | 29 | 242 | 162 | 210 | 32 | 57 | 97 | 323 | 356 | - |
| | 140 | 240 | 1 1/4 | 80 | 29 | 242 | 162 | 210 | 32 | 57 | 97 | 323 | 356 | - |

*Not in accordance with Standard.

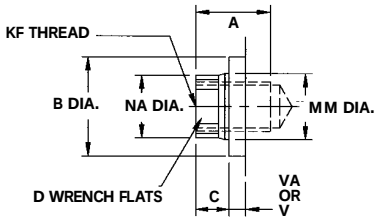
# ROD END INFORMATION

## Standard – Style 2




Male thread with adequate shoulder for locking accessory.

## Alternate – Style 4




Female thread, used with male accessories for shorter overall cylinder length.

## Important

**Specify on order**

1. Type of thread
2. Length of thread
3. Rod extension if non-standard
4. Any non standard thread please supply full details

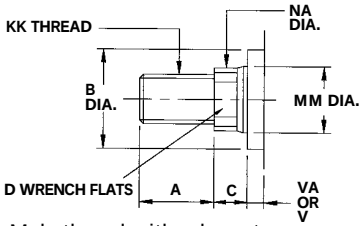
**ISO 6020/2**

| Bore | MM Rod Dia. | A | B Dia.(f8) | C | D | KK | NA $^{+0}_{-0.1}$ | V | KF |
|---|---|---|---|---|---|---|---|---|---|
| 25 | 12 | 14 | 24 | 9 | 10 | M10 x 1.25 | 11 | 6 | M8 X 1 |
| | 18 | 18 | 30 | 9 | 15 | M14 x 1.5 | 17 | 6 | M12 X 1.25 |
| 32 | 14 | 16 | 26 | 13 | 12 | M12 x 1.25 | 13 | 12 | M10 X 1.25 |
| | 22 | 22 | 34 | 13 | 18 | M16 x 1.5 | 21 | 12 | M16 X 1.5 |
| 40 | 18 | 18 | 30 | 19 | 15 | M14 x 1.5 | 17 | 6 | M12 X 1.25 |
| | 28 | 28 | 42 | 13 | 22 | M20 x 1.5 | 27 | 12 | M20 x 1.5 |
| 50 | 22 | 22 | 34 | 19 | 18 | M16 x 1.5 | 21 | 6 | M16 x 1.5 |
| | 28 | 28 | 42 | 19 | 22 | M20 x 1.5 | 27 | 6 | M20 x 1.5 |
| | 36 | 36 | 50 | 16 | 30 | M27 x 2 | 34 | 9 | M27 x 2 |
| 63 | 28 | 28 | 42 | 26 | 22 | M20 x 1.5 | 27 | 6 | M20 x 1.5 |
| | 36 | 36 | 50 | 23 | 30 | M27 x 2 | 34 | 9 | M27 x 2 |
| | 45 | 45 | 60 | 19 | 39 | M33 x 2 | 43 | 13 | M33 x 2 |
| 80 | 36 | 36 | 50 | 26 | 30 | M27 x 2 | 34 | 5 | M27 x 2 |
| | 45 | 45 | 60 | 22 | 39 | M33 x 2 | 43 | 9 | M33 x 2 |
| | 56 | 56 | 72 | 22 | 48 | M42 x 2 | 54 | 9 | M42 x 2 |
| 100 | 45 | 45 | 60 | 28 | 39 | M33 x 2 | 43 | 7 | M33 x 2 |
| | 56 | 56 | 72 | 28 | 48 | M42 x 2 | 54 | 7 | M42 x 2 |
| | 70 | 63 | 88 | 25 | 62 | M48 x 2 | 68 | 10 | M48 x 2 |
| 125 | 56 | 56 | 72 | 28 | 48 | M42 x 2 | 54 | 7 | M42 x 2 |
| | 70 | 63 | 88 | 25 | 62 | M48 x 2 | 68 | 10 | M48 x 2 |
| | 90 | 85 | 108 | 25 | 80 | M64 x 3 | 88 | 10 | M64 x 3 |
| 160 | 70 | 63 | 88 | 25 | 62 | M48 x 2 | 68 | 7 | M48 x 2 |
| | 90 | 85 | 108 | 25 | 80 | M64 x 3 | 88 | 7 | M64 x 3 |
| | 110 | 95 | 133 | 25 | 100 | M80 x 3 | 108 | 7 | M80 x 3 |
| 200 | 90 | 85 | 108 | 25 | 80 | M64 x 3 | 88 | 7 | M64 x 3 |
| | 110 | 95 | 133 | 25 | 100 | M80 x 3 | 108 | 7 | M80 x 3 |
| | 140 | 112 | 163 | 25 | 128 | M100 x 3 | 138 | 7 | M100 x 3 |

**DIN 24554 (Style 2 only)**

| Bore | MM Rod Dia. | A | B Dia.(f8) | C | D | KK | NA $^{+0}_{-0.1}$ | V |
|---|---|---|---|---|---|---|---|---|
| 25 | 12 | 14 | 24 | 9 | 10 | M10 x 1.25 | 11 | 6 |
| | 18 | 14 | 30 | 9 | 15 | M10 x 1.25 | 17 | 6 |
| 32 | 14 | 16 | 26 | 13 | 12 | M12 x 1.25 | 13 | 12 |
| | 22 | 16 | 34 | 13 | 18 | M12 x 1.25 | 21 | 12 |
| 40 | 18 | 18 | 30 | 19 | 15 | M14 x 1.5 | 17 | 6 |
| | 28 | 18 | 42 | 13 | 22 | M14 x 1.5 | 27 | 12 |
| 50 | 22 | 22 | 34 | 19 | 18 | M16 x 1.5 | 21 | 6 |
| | 28 | 22 | 42 | 19 | 22 | M16 x 1.5 | 27 | 6 |
| | 36 | 22 | 50 | 16 | 30 | M16 x 1.5 | 34 | 9 |
| 63 | 28 | 28 | 42 | 26 | 22 | M20 x 1.5 | 27 | 6 |
| | 36 | 28 | 50 | 23 | 30 | M20 x 1.5 | 34 | 9 |
| | 45 | 28 | 60 | 19 | 39 | M20 x 1.5 | 43 | 13 |
| 80 | 36 | 36 | 50 | 26 | 30 | M27 x 2 | 34 | 5 |
| | 45 | 36 | 60 | 22 | 39 | M27 x 2 | 43 | 9 |
| | 56 | 36 | 72 | 22 | 48 | M27 x 2 | 54 | 9 |
| 100 | 45 | 45 | 60 | 28 | 39 | M33 x 2 | 43 | 7 |
| | 56 | 45 | 72 | 28 | 48 | M33 x 2 | 54 | 7 |
| | 70 | 45 | 88 | 25 | 62 | M33 x 2 | 68 | 10 |
| 125 | 56 | 56 | 72 | 28 | 48 | M42 x 2 | 54 | 7 |
| | 70 | 56 | 88 | 25 | 62 | M42 x 2 | 68 | 10 |
| | 90 | 56 | 108 | 25 | 80 | M42 x 2 | 88 | 10 |
| 160 | 70 | 63 | 88 | 25 | 62 | M48 x 2 | 68 | 7 |
| | 90 | 63 | 108 | 25 | 80 | M48 x 2 | 88 | 7 |
| | 110 | 63 | 133 | 25 | 100 | M48 x 2 | 108 | 7 |
| 200 | 90 | 85 | 108 | 25 | 80 | M64 x 3 | 88 | 7 |
| | 110 | 85 | 133 | 25 | 100 | M64 x 3 | 108 | 7 |
| | 140 | 85 | 163 | 25 | 128 | M64 x 3 | 138 | 7 |

## Standard – Style 2




Male thread with adequate shoulder for locking accessory.

## Storage

If it is necessary to store a cylinder for a period of time prior to installation, the following procedures should be adhered to:

1. Do not store out of doors or in a high humidity or corrosive atmosphere without a positive method of internal and external corrosion protection.
2. Where any adverse storage conditions exist, coat all unpainted external parts, including the piston rod, with corrosion inhibitive material. Fill both ends of the cylinder with a corrosion preventative fluid compatible with the system fluid.
3. If possible, store the cylinder in a vertical position, piston rod up.
4. Dirt protector plugs should be kept in the ports during storage.

## Installation

Details on each specific mount are given in our EH Series Catalogue and reference should be made to the section on "Mountings". In addition, the following general procedures should be followed:

1. On all rigidly mounted cylinders, be sure that the part which attaches to the piston rod exactly "lines up" with the piston rod travel, or make provision for axial misalignment.
2. Flange mounted cylinders should be solidly mounted to a rigid section of the machine with high tensile bolts (socket head type recommended). When a pilot diameter cannot be used for alignment, the cylinder must be aligned to the work, tightened in place, and the flange drilled for a dowel and pinned to prevent shifting. For horizontal installations of flange mount cylinders with 1200 mm of stroke and longer, we recommend supporting both ends of the cylinder.
3. Side mounted cylinders (Style SL) used under shock conditions or at high pressure ranges (over 103 bar) should be dowelled or keyed to the machine. Style SL has room for dowel pins in the mounting lugs. Cylinders should be pinned or keyed at one end only (especially important on long stroke cylinders) due to the deflection that takes place under load. On long stroke applications, the addition of an intermediate support (between the cylinder heads to support the tube and tie rods) is very important and is recommended. Care should be exercised in fastening the intermediate support so that no "humping" of the cylinder occurs. An intermediate support is utilized to afford additional cylinder support and is not designed to absorb thrust.
4. All clevis and trunnion mount cylinders need provisions on both ends for pivoting in one direction. Alignment in the other direction is essential to avoid excessive side loading. Where alignment in one direction is not possible, the cylinder must be equipped with two direction pivoting such as can be obtained with a spherical bearing.
5. On trunnion mount cylinders, use pillow blocks of ample size, rigidly mounted as close to the cylinder heads as possible. Bearing should be provided for the full length of the trunnion pins. Lubrication should be provided to the pins.

## Bleeding

If a cylinder is equipped with optional air bleeds, after the cylinder has been fully connected and the system has been filled with fluid, cycle the cylinder and bleed the air by loosening the air bleed plugs alternately. Loosen just enough to release the air bubbles. Tighten when no more air escapes.

## Maintenance

Please note when doing maintenance work on EH series cylinders:

1. The tie rod nuts need not be loosened or removed to service the rod bearing or gland except on mounting styles, BX, C, FX, RHF and T on 25, 32, 40, 50 & 63 bores and in the 80 bore with a 56 dia. rod and 100 bore with a 70 dia. rod.
2. One piece piston construction eliminates the need for removing the piston from the piston rod.
3. All parts removed from the cylinder that are to be re-used should be thoroughly cleaned. Be sure to carefully clean all cavities and grooves prior to replacing parts. All parts, new and old, should be lightly lubricated with a clean lubricant of the same type as, or compatible with, the fluid being used in the cylinder.
4. When a cylinder is disassembled, it is a good practice to replace all static and moving seals.

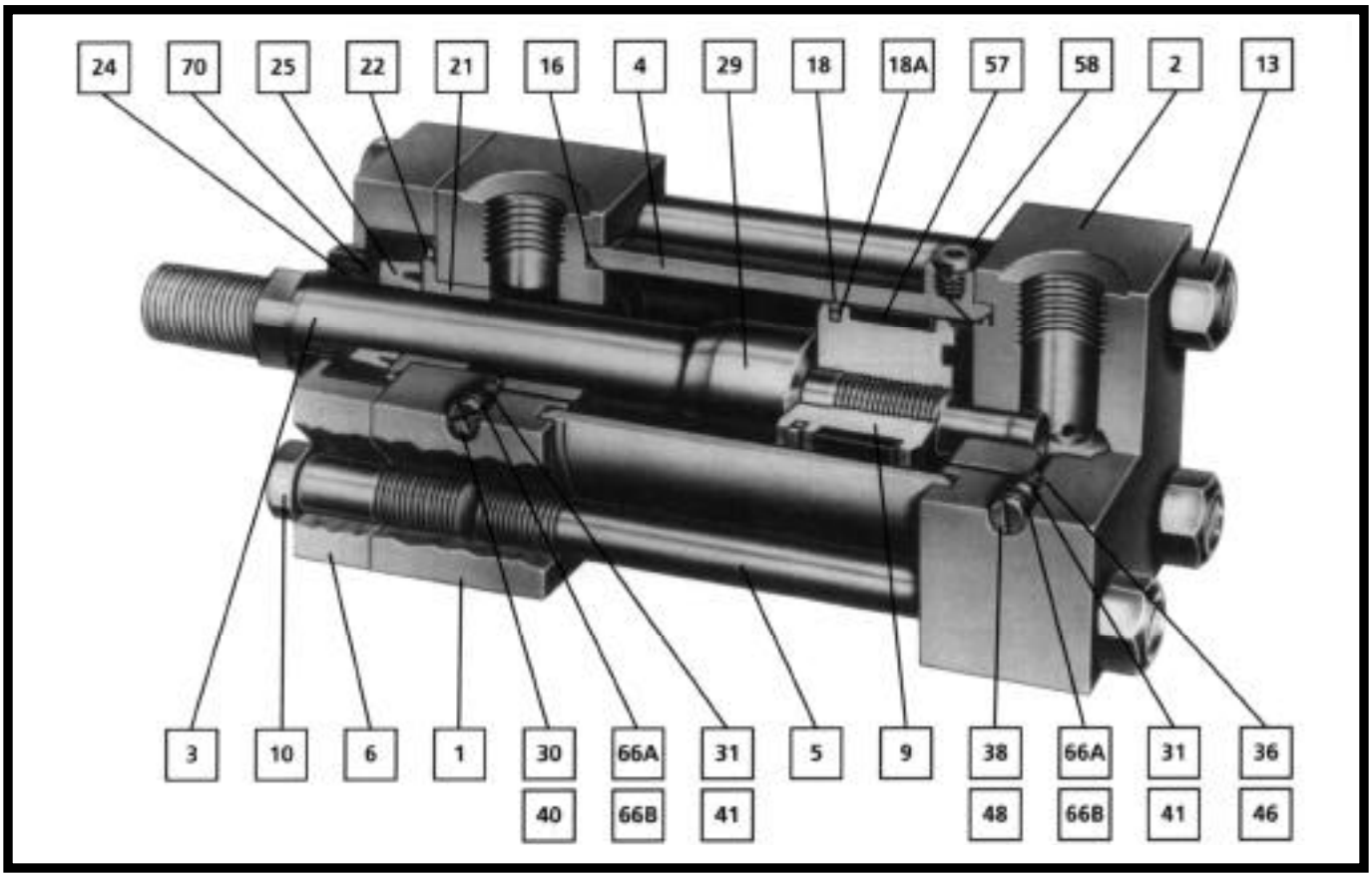
TO REPLACE ROD BEARING, ROD PACKING, ROD WIPER, OR ROD GLAND SEAL extend the piston rod (item 3) 1/4 of the stroke. CAUTION! Support the rod end at all times to prevent nicking and to avoid cocking the piston in the tube. Inspect the piston rod wrench flats for burrs. Remove any burrs to prevent damage to the rod packing, rod wiper, or bearing when it is slipped off the rod. Remove rod packing gland retainer screws (item 10) and the rod gland retainer (item 6) or the rod gland (item 6A) on the single piece construction.

After the gland or gland retainer has been removed, the rod packing may be removed from the gland. Place the rod gland on a clean, flat surface with the rod packing end up. Use a small screwdriver to remove the rod packing set (item 25) being careful not to nick or scratch the bore of the packing cavity. Remove the rod wiper in the same manner, being careful not to nick or scratch the wiper cavity. When replacing the rod wiper be sure it is fully seated in the groove. When replacing the rod packing, apply a light coating of clean lubricant to the new seal and insert it into the gland firmly with the fingers.

To remove the rod bearing (item 21), first remove the rod gland seal (item 22). This will expose the chamfer on the outside edge of the bearing against the head. Place two small pry bars or screwdrivers into the chamfer and pry the bearing gently out of the cylinder. Be sure to support the end of the rod. Inspect the bearing and rod for scoring, galling, etc. Replace any damaged parts. Replace the bearing by pushing or lightly tapping with a plastic hammer until its seated into the head. Lubricate the gland seal and place around the bearing. Slide the rod packing gland onto the rod taking care that the rod packing set is not damaged when being passed over the rod end threads and wrench flats. Be careful that the gland seal is not pinched or cut as the packing gland is brought up against the head. Replace the gland retainer screws. See chart for proper torque value for retainer screws. If the tie rod nuts have been removed, tighten them using the values shown on the tie rod torque chart. If the piston packings or tube seals are to be serviced, do not replace the rod gland or bearing until this service has been completed.

TO REPLACE TUBE SEALS, PISTON SEAL, AND PISTON BEARING STRIP. Remove the tie rod nuts (item 13) and remove the tie rods (item 5) CAUTION! Support the piston rod and piston assembly at all times. Remove the cap (item 2) and the tube (item 4). Examine the tube seals (item 16) for nicks, cuts, or grooves, and replace if necessary. The new seals should be lubricated before inserting into the grooves. (NOTE: When a cylinder has been disassembled to this degree, it is always wise to replace all seals and bearings.)

If the cylinder has a Teflon piston seal and bearing strip, cut the piston seal (item 18A) to remove from groove, being careful not to nick or scratch the sides of the groove. Remove the expander ring (item 18B) using a blunt screwdriver, again being careful not to damage bottom or sides of groove. For ease of installation and to minimise the time the piston seal is in the stretched condition, the expander and piston seal should be placed into the groove from the rod side of the piston. The leading edge of the piston at the top of the chamfer must be free of any deep nicks or burrs, before installing the piston seal. Lubricate this edge prior to putting the piston seal into the groove. Lightly lubricate the expander and stretch it over the end of the piston into the groove. Lift a segment of the piston seal over the lips of the piston and place as much of the seal into the groove as possible by pushing down on the outside of the ring to seat the I.D. on the expander. Place a small rod or screwdriver without sharp edges or points under the I.D. of the piston seal that is outside the groove. Pulling outward and inward toward the piston, stretch the seal up and over the lip to align it with the groove. Remove the screwdriver and the seal will snap into the groove. The stretching of the seal into the groove must be done rapidly due to Teflon's memory characteristics. The longer the seal remains in the stretched condition the longer it takes the seal to return to its original shape.




## Maintenance Cont.

The piston bearing strip is a single piece that has scarfed cut ends that is simply wrapped around the piston. It is not intended that the cut ends meet to make a seal.

To replace the piston and rod assembly into the tube, the end of the piston containing the bearing strip should enter first. Lubricate the O.D. of the bearing and seal before inserting it into the tube. The piston and rod assembly should enter straight into the tube, but sometimes it is helpful to rock the component being moved up and down or sideways in order to move the piston into the tube. It may be necessary to apply a pressure on the bearing strip at the leading edge in order to get it started into the tube. To do this, use a small screwdriver with rounded edges and corners and push inward on the bearing strip (toward the centre of the piston) at the point where it is entering the tube, and at the same time pushing the piston into the tube. This procedure will be helpful when the piston seal starts to enter the tube, especially if the seal was stretched a little more than need be and has not returned completely to its proper size.

If it becomes necessary to disassemble the piston rod (item 3) and the piston (item 9), remove the piston dowel screw or screws (item 15) apply heat (approximately 230°C) to break the chemical lock, and unscrew the piston. When doing so, be careful not to scratch or otherwise damage the polished surface of the piston rod or the piston.

When replacing the piston on the rod, apply a locking sealant, such as Loctite Grade 242 to the first 3-4 threads closest to the shoulder on the rod. Follow the manufacturer's recommendations for cleaning the threads prior to application of the sealant. Tighten the piston securely using the spanner wrench holes in the rear face of the piston. DO NOT ATTEMPT TO LINE UP ORIGINAL DOWEL SCREW HOLE.

After tightening the piston in place, use a hand drill and relocate the dowel screw or screws in a new position. Dowel Screw size and drilling requirements:

25 and 32bore, drill 4.2 x 10DP. half in piston and half in rod, tap M5 x 0.8p x 6 DP., bottom the dowel screw (M5 x 0.8p x 6 socket set screw).

40 through 100 bores, drill 5 x 12 DP., half in piston and half in rod tap M6 x 1p x8 DP., bottom the dowel screw (M6 x 1 p x 8 socket set screw).

125 through 200 bores, drill 8.5 x 14 DP., half in piston and half in rod, tap M10 x 1.5p x 10 DP., bottom the dowel screw (M10 x 1.5p x 10 socket set screw).

Apply Loctite Grade 242 to all dowel screw threads.

After bottoming set screw, stake set screw by centrepunching $1^1/_2$ mm from edge of screw deep enough to upset the first couple of threads. Staking should be done on the piston rod where possible.

When inserting the piston rod through the head, use care not to scrape the piston rod. Insert head and cap onto tube and replace the rods and tie rod nuts. Use the torque charts shown below.

The cushion check plug (item 38 or item 48) and the cushion adjusting screw (item 30 or item 40) are interchangeable on the same head, but not necessarily between the head and cap. Both adjusting screw and plug use a back-up washer (item 66A or item 66B) and an "O" ring seal (item 31 or item 41). If leakage occurs around the seal, replace the back-up washer and seal. First, place the back-up washer against the shoulder, then the "O" ring. Lubricate the seal before replacing the plug into the cavity.

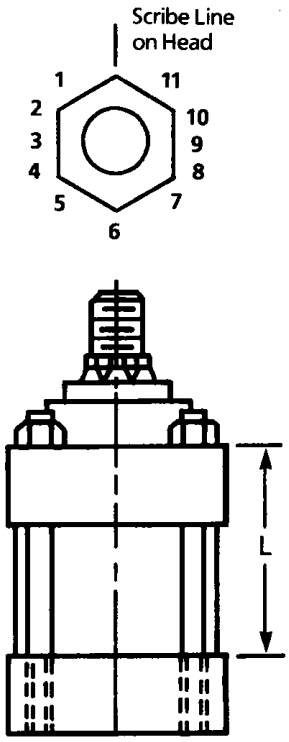
## Rod Gland Retainer (or Rod Gland) Screw Torque Information

| Screw Torque in Newton metres | | | |
|---|---|---|---|
| **Bore Size** | **Piston Road Diameter** | **Hex Head Set Screw** | **Socket Head Cap Screw** |
| **25** | ALL | 7 | - |
| **32** | ALL | 7 | - |
| **40** | ALL | 14 | - |
| **50** | ALL | 45 | - |
| **63** | ALL | 45 | - |
| **80** | ALL | 45 | 7 |
| **100** | ALL | 45 | 7 |
| **125** | ALL | - | 14 |
| **160** | 70 | - | 14 |
| **160** | 110 | - | 18 |
| **200** | 90 | - | 14 |
| **200** | 140 | - | 18 |
| **50 (DIN)** | ALL | - | 7 |
| **63 (DIN)** | ALL | - | 7 |
| **80 (DIN)** | ALL | - | 14 |
| **100 (DIN)** | ALL | - | 14 |

## Tie Rod Torque Information

| Tie Rod 25 Through 160 Bores | | | |
|---|---|---|---|
| **Bore** | **Torque in Newton metres** | **Bore** | **Torque in Newton metres** |
| **25** | 7 | **80** | 150 |
| **32** | 11 | **100** | 176 |
| **40** | 30 | **125** | 440 |
| **50** | 68 | **160** | 650 |
| **63** | 68 | **200** | see table below |

| Tie Rod Torquefor 200 Bore | | | | |
|---|---|---|---|---|
| **Column 1 Turn (T) in 12ths** | **"L" Length** | **One Full Turn plus T "L" Length** | **Two Full Turns plus T "L" Length** | **Three Full Turns plus T "L" Length** |
| **1** | 70 | 930 | 1780 | 2630 |
| **2** | 140 | 1000 | 1850 | 2705 |
| **3** | 215 | 1070 | 1920 | 2775 |
| **4** | 285 | 1140 | 1995 | 2845 |
| **5** | 355 | 1210 | 2065 | 2915 |
| **6** | 425 | 1280 | 2135 | 2990 |
| **7** | 500 | 1350 | 2205 | 3060 |
| **8** | 570 | 1420 | 2275 | 3130 |
| **9** | 640 | 1500 | 2350 | 3200 |
| **10** | 710 | 1565 | 2420 | 3270 |
| **11** | 780 | 1640 | 2490 | 3345 |
| **12** | 855 | 1710 | 2560 | 3415 |

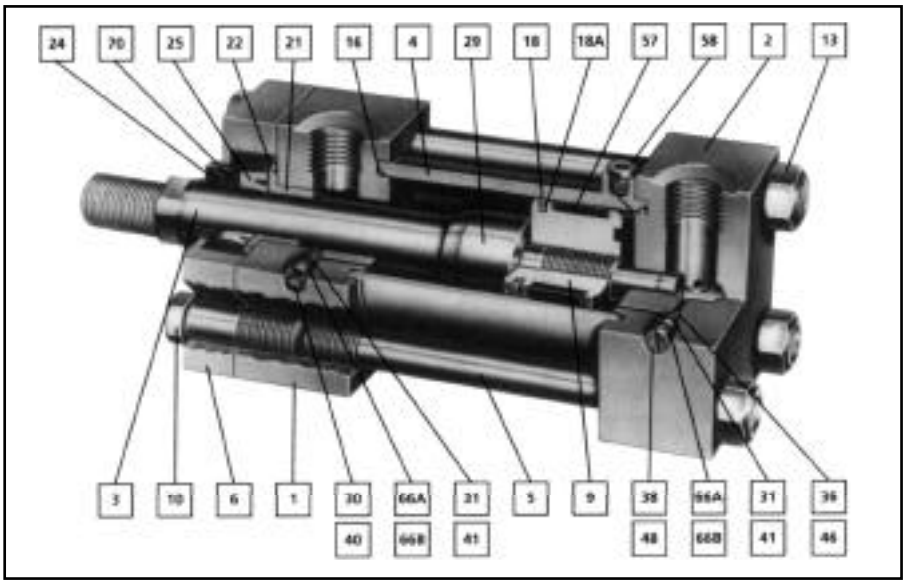



### Ordering Information

When ordering parts, the following information must be specified. Model No., Serial No., Stroke, Pressure, Pressure Medium (air, oil or water) and any special features. Give item no., name and quantity of part desired. The Model No. and Serial No. will be found on a metal plate that has been drive-screwed to either the head or the cartridge retainer.

For 200 bore cylinders, the tie rods are given an initial torque, and then the tie rod nuts are turned a calculated amount. First torque all 4 tie rod nuts to 270 Newton metres. Measure the cylinder to obtain length "L" as shown in the illustration. Scribe a line on the cylinder head at one point of each hex nut and a matching mark on the hex nut point. Using the derived "L" consult the chart for the proper number of turns or fractions (in 12ths). The figures in Column 1 shown in 12ths corresponds to the points and flats of the hex nut (see illustration). Tie rods should be tightened in cross corner rotation and in steps up to full tension, using an impact power wrench or a slogging type ring spanner.

# PARTS LIST



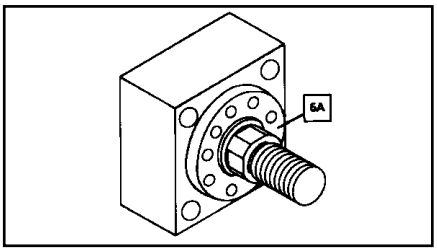

| Item No. | Description | Quantity Required |
|---|---|---|
| 1 | Head | 1 |
| 2 | Cap | 1 |
| 3 | Piston Rod | 1 |
| 4 | Tube | 1 |
| 5 | Tie Rod | 4 |
| 6 | Rod Gland Retainer | 1 |
| 6A | Rod Gland and Retainer - Single Piece | 1 |
| 9 | Piston - Slipper Seal Type | 1 |
| 10 | Retainer Screw | ◆ |
| 13 | Tie Rod Nut | 4 |
| 16† | Tube Seal | 2 |
| 18† | Piston Seal - Slipper Seal | 1 |
| 18A† | Expander - For Slipper Seal | 1 |
| 21† | Rod Bearing | 1 |
| 22† | Rod Gland Seal | 1 |
| 24† | Rod Wiper/Seal | 1 |
| 25† | Rod Seal | 1 |
| 29 | Cushion Piston - Front | ** |
| 30 | Cushion Adj. Screw - Front (Cross Slot) | ** |
| 31 | Seal - Cushion Adj. & Cush. Check - Front | ** |
| 36 | Cushion Check Ball - Front | ** |
| 38 | Cushion Check Plug - Front | ** |
| 40 | Cushion Adj. Screw - Rear (Cross Slot) | ** |
| 41 | Seal - Cush. Adj. & Cush. Check - Rear | ** |
| 46 | Cushion Check Ball - Rear | ** |
| 48 | Cushion Check Plus - Rear | ** |
| 57 | Piston Bearing Strip | * |
| 58 | Air Bleed Plug | ** |
| 66A | Back-Up Wash. - Cush. Adj. & Check - Front | ** |
| 66B | Back-Up Wash. - Cush. Adj. & Check - Rear | ** |
| 70 | Rod Gland | 1 |

◆ Retainer screws required varies by bore and mount.

† Recommended spare parts.

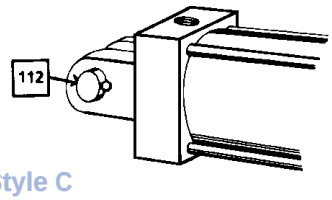
* 1 required 25 through 100 bore, 2 required 125 through 200 bore.

** As required; specify if cushioned front, cushioned rear or cushioned both ends.



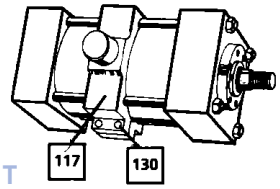

Round, Single Piece Rod Gland & Retainer used on all but some of the smaller bore sizes. Consult pages on specific mounts.

## Clevis Mount




Style C

## Intermediate Trunnion Mount




Style T

| Item No. | Description | Qty. Req'd. |
|---|---|---|
| 117 | Intermediate Trunnion | 1 |
| 130 | Intermediate Trunnion Screw | 4 |
| 112 | Clevis Pin | 1 |

Complete replacement packing kits are available. For purposes of economy and less down-time, it is recommended that replacement packing kits be stocked. They are described and priced in the current Replacement Parts Price List. Contact the factory for these lists.

## EH Series Cylinder Weight Chart

| Bore | Zero Stroke | Add per 25mm of Stroke |
|---|---|---|
| | Kilograms | |
| 25 | 1.5 | 0.12 |
| 32 | 2.7 | 0.18 |
| 40 | 3.7 | 0.23 |
| 50 | 7 | 0.37 |
| 63 | 9 | 0.60 |
| 80 | 17 | 0.82 |
| 100 | 23 | 1.15 |
| 125 | 41 | 1.90 |
| 160 | 64 | 2.70 |
| 200 | 132 | 4.10 |

**Note:**
The above weights are based on an average value for cushioning, rod size, and the various types of mountings for uncrated cylinders to establish approximate shipping weights. Add 10% of cylinder weight to determine estimate weight of crated cylinder.

# MODEL NUMBER

## Composition

| Example 63 | EH | FHF | 250 | CC | W |
|---|---|---|---|---|---|
| **Bore** | **Cylinder Series** | **Mounting** | **Stroke** | **Cushion** | **Modification** |
| As Required | Heavy Duty Hydraulic | Listed Below<br><br>Specify Suffix 'D' for DIN mounting eg: FHFD | As Required<br><br>Shown as Gross Stroke including Dual Piston or Stop Tube Length | CF – Cushion Front<br><br>CR – Cushion Rear<br><br>CC – Cushion both ends | A – Variation in Ports<br>D – Double Rod Extension<br>K – Any variation in Rod from Standard. Any variation from Standard Style 2 Rod End.<br>M – Variation in Mounting<br>S – Spring Return<br>V – Viton<br>W – Water Fitted<br>Y – Variation in Construction |

## Mounting Styles ISO

**BX** – Basic Cylinder – tie rods extended – both ends

**C** – Clevis

**FHF** – Front Head Flange

**FX** – Basic cylinder – tie rods extended – front end

**NX** – Basic cylinder – no tie rod extension

**P** – Pivot

**RHF** – Rear Head Flange

**RX** – Basic cylinder – tie rods extended – rear end

**SBp** – Pivot with Spherical Bearings

**SL** – Side Lug

**T** – Trunnion – between heads

**TF** – Trunnion – front

**TR** – Trunnion – rear

## Mounting Styles DIN

**FHFD** – Front Head Flange

**RHFD** – Rear Head Flange

**SBpD** – Pivot with Spherical Bearing

**SLD** – Side Lug

**TD** – Trunnion – between heads

## Order Information

**To insure prompt delivery, please BE SURE TO INCLUDE THIS INFORMATION WHEN ORDERING:**

1. Quantity
2. Series
3. Bore
4. Stroke – Gross Stroke always show in Model Number
5. Dual Piston or Stop Tube when necessary
6. Mounting Style
7. Cushion (front, rear, both or none)
8. Rod End Style (if other than Style 2 standard)
9. Rod Size (standard, intermediate or oversize or 2:1)
10. Extra Rod Extension (where required)
11. Port Size (if other than standard)
12. Port Positions other than standard positions 1 and 5
13. Cushion check, adjusting screw, and bleed positions (when required) if other than standard positions shown on page 9.
14. Medium (air, oil, water or other)
15. Type of fluid
16. Operating Pressure and Maximum Shock Pressure
17. Temperature
18. Double rod extension (when required)
19. XI dimension on all Trunnion (between head) cylinders
20. Delivery required, or scheduling

**Complete and correct ordering information will eliminate untimely delays. When in doubt always contact our factory.**

## Policy and Warranty

**POLICY** The policy is one of continual improvement in design and manufacture to assure still finer products, hence, specificatons are subject to change without notice.

**WARRANTIES AND LIABILITIES** Goods alleged by the Buyer to be defective or not to conform to the Contract and accepted by the Company as such during the period of 12 months after delivery will be replaced by the Company or if the Company shall so decide the total price in respect of the Goods shall be refunded to the Buyer. The total liability of the Company for any loss or damages or expenses of any description direct or indirect suffered by the Buyer and attributable to the Goods shall not exceed in total One million pounds Sterling. No claim in respect of allegedly defective Goods shall be valid unless the claim is made in writing immediately after the Buyer shall become aware of the alleged defect. Nor will such claim entitle the Buyer to cancel any outstanding part of the Order.

# SERIES LIST

## MH Series

1 1/8 (28 mm) through 8 inch (200 mm) Bore. Medium Pressure Hydraulic. Compact and dimensionally interchangeable. Tapered Cushions.

## HH Series

1 1/8 (28 mm) through 24 inch (600 mm) Bore. 210-345 bar Hydraulic. Machine Tool Precision. Most easily serviced. Dimensionally interchangeable.

## UH Series

2 (50 mm) through 12 inch (300 mm) Bore. 345-550 bar. Hydraulic.1-piece steel heads. Super-duty service. Tapered Cushions. Easily removed rod cartridge.

## EH Series

Compact Metric to ISO 6020/2 and DIN 24554. 25mm through 200mm bore. 210 bar. Hydraulic.

## ER Series

Roundline Mill Cylinder to ISO 6020/1 25mm through 200mm bore.160 bar. Hydraulic.

## Limit Switch Cylinders

### Mechanical

**Mechanically** operated switches available on square head cylinders - 10 bar air to 210 bar. hydraulic.

### Magnetic

**Magnetically** operated reed switches available on A, MA and C20 Series air cylinders. Ideal for timing - automatic control.

### Proximity

Permanent magnet ferrous material actuated proximity switches available on square head cylinders up to 550 bar. BASEEFA approved and sub-sea models available.

## MA Series

1 1/2 (38 mm) through 8 inch (200 mm) Bore. Medium duty Air Service. Popular dimensional interchangeable mounts at economy pricing. Rated for 10 bar Air. Lubed for life. Great OEM cylinder.

## A Series

1 1/8 (28 mm) through 14 inch (356 mm) Bore.17 bar Air. Double Acting. Adjustable Cushions. Dimensionally interchangeable. No lubrication required.

## C20 Series

1 1/2 (38 mm) through 8 inch (200 mm) Bore. 10 bar Air. Double Acting, cushioned and non-cushioned. Economy priced.

## CL Series

3/4 (19 mm) and 1 1/8 (28 mm) Bores. CLA for 10 bar Air Service. Heavy Duty CLH for 17 bar. Air Service or 103 bar Hydraulic Service. Double Acting and Spring Return. Universal mount with Accessories for all applications.

- Cylinders of all sizes, for all applications, pressures and fluid mediums... in almost every price range.
- Easily installed and serviced.
- Compact, rugged and reliable.
- Wide range of matched mounting accessories.
- Custom built variations of all standard cylinders at nominal cost.
- Cylinders to 750 mm bore in a variety of mountings and pressure ranges.
- Lubrication not required on standard air cylinders

# NOTES