RAX hYdraulics

# Hydraulic Cylinders Type R3 - Square heads with counter flanges

Conforms to ISO 6020-2: Nominal pressure of 160 bar and max 250 bar

Series R3 hydraulic cylinders are designed for heavy mill duty application and conforms to ISO 6020-2 It is completely inter-changeable among manufacturers. It allows manufacturers of hydraulic equipments flexibility in the design of cylinders while it does not restrict technical development; however, it does provide basic guidelines.

## Standard Specifications :

- Heavy duty construction
- Double Acting Design
- Bore Sizes: **63** mm to **200** mm
- Rod Sizes: **28** mm to **140** mm
- Strokes up to **5000** mm
- **Three** rod diameters per bore
- **Two** seals options
- **Air Bleed** at both ends
- **Male** & **Female** rod end threads
- **Seven** standard mounting styles
- **Adjustable** or **Fixed** cushioning
- **Oversized** oil port options

## Ordering Instructions :

| R3 | D | - | 063 | / | 028 | / | 028 | / | 0500 | - | 0 | K | 0 | S | 0 | - | B1X1 | - | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Cylinder Series:**
**R3** [ISO 6020-2]

**Mounting Style:** see section 1

| | REF. ISO |
|---|---|
| **D** - Fixed Eye | MP3* |
| **E** - Foot | MS2 |
| **G** - Front Trunnion | MT1 |
| **H** - Rear Trunnion | MT2* |
| **N** - Front Rectangular Flange | ME5 |
| **P** - Rear Rectangular Flange | ME6* |
| **S** - Fixed Eye with Spherical Bearing | MP5* |

**Bore Size:** From Ø63 - 200 mm, see section 13

**Rod Size:** From Ø28 - 140 mm, see section 13

**Second Rod Size** (for double rod): From Ø28 - 140 mm [skip if single rod], see section 13

**Stroke:** Up to 5000 mm, see section 5

**Rod End:** see section 13
**1** - Male Thread
**2** - Female Thread

**Oil Port Positions:** see section 3
**B1;B2;B3 & B4** - Front Head Oil Port at Location 1;2;3 & 4
**X1;X2;X3 & X4** - Rear Head Oil Port at Location 1;2;3 & 4

**Oil Port options:** see section 2
**0** - Standard
**1** - Front & Rear Oversized Oil Ports
**D** - Front Oversized Oil Port
**Y** - Rear Oversized Oil Port

**Sealing System:**
**S** - Standard [NBR + PTFE + PU] [-20˚C to 85˚C]
**V** - Viton, For High Temp. [FKM + PTFE] [-20˚C to 120˚C]

**Spacer:** see section 6
**0** - None; **2** - 50 mm; **4** - 100 mm; **6** - 150 mm; **8** - 200 mm

**Rod Treatment:** see section 7
**K** - Ground & hard chrome plated
**T** - Induction hardened, Ground & hard chrome plated

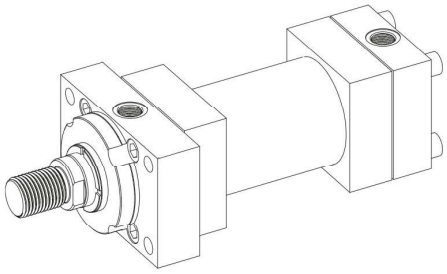
**Cushioning:** see section 4
**0** - None

| Fast Adjustable | Slow Adjustable | Fast Fixed |
|---|---|---|
| **1** - Rear end | **4** - Rear end | **7** - Rear end |
| **2** - Front end | **5** - Front end | **8** - Front end |
| **3** - Both ends | **6** - Both ends | **9** - Both ends |

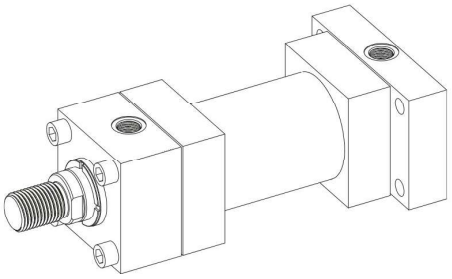
* Double Rod not available for styles- **D**, **H**, **P** & **S**

## 1 Mounting Style :

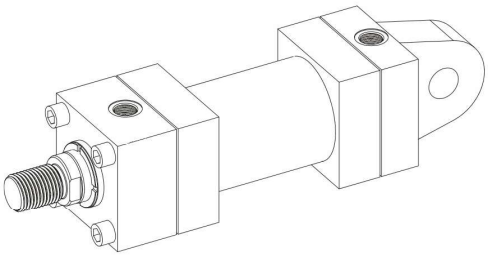
- 7 different standard styles of mounting as shown below
- Browse through subsequent pages for technical details and mounting dimensions
- Piston Rod End dimensions are given separately in section 13



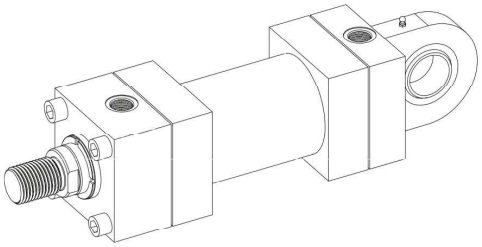
**ISO ME5**
**Style N [**Front Rectangular Flange**]**



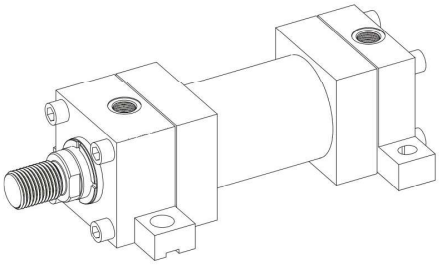
**ISO ME6**
**Style P [**Rear Rectangular Flange**]**



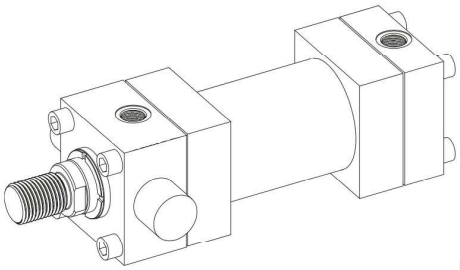
**ISO MP3**
**Style D [**Fixed Eye**]**



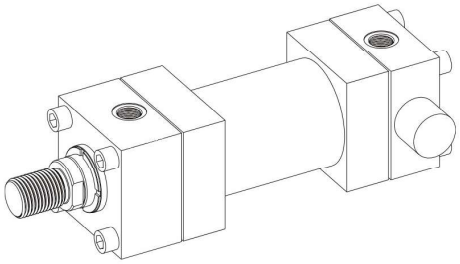
**ISO MF2**
**Style S [**Rear Fixed Eye with Spherical Bearing**]**



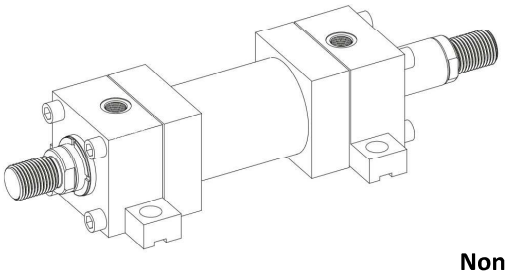
**ISO MS2**
**Style E [**Foot Mounting**]**



**ISO MT1**
**Style G [**Front Trunnion**]**



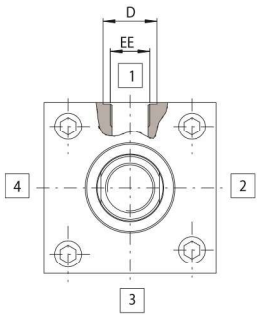
**ISO MT2**
**Style H [**Rear Trunnion**]**



**Non - ISO**
**Style E [**Foot mounting for Double Rod**]**

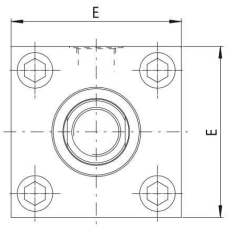
## 2 Size Of Oil Ports & Square Head Dimension [mm]:

| Bore Ø | | 63 | 80 | 100 | 125 | 160 | 200 |
|---|---|---|---|---|---|---|---|
| Standard Oil Ports | D min | 29 | 36 | 36 | 42 | 42 | 52 |
| | EE (BSPP) | G ½ | G ¾ | G ¾ | G 1 | G 1 | G 1 ¼ |
| Oversized Oil Ports | D1 min | 36 | 42 | 42 | 52 | 52 | 58 |
| | EE1 (BSPP) | G ¾ | G 1 | G 1 | G 1 ¼ | G 1 ¼ | G 1 ½ |




- Oil ports **EE** are threaded according to GAS standard with counter bore dimension **D.**
- When oversized oil ports are selected dimensions **D** and **EE** are respectively modified into **D1** and **EE1**.

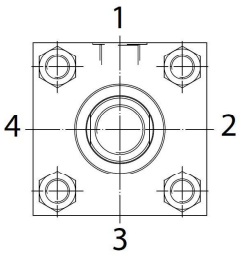
| Bore Ø | 63 | 80 | 100 | 125 | 160 | 200 |
|---|---|---|---|---|---|---|
| E | 90 ±1.5 | 115 ±1.5 | 130 ±2 | 155 ±2 | 205 ±2 | 245 ±2 |




- If not otherwise specified, **E** is the value of the front and rear square heads dimension for all the mounting styles.

- **SAE 3000 flanges are available on request. Contact our Technical office.**

## 3 Position of Oil Ports:




- FRONT HEAD: **B*** = oil port position;
- REAR HEAD: **X*** = oil port position;

*Selected position (1, 2, 3 or 4)

The oil ports and cushioning adjustments positions are available, respectively on sides 1 and 3 for all styles except E (see the figure at side): the style E has the cushioning adjustments on side 2.

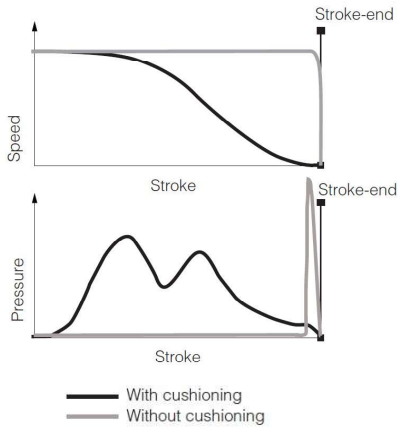
Unless otherwise specified by customer, the standard oil port position remains as shown in figure at side, i.e. B1 & X1**.**

## 4 Cushioning:

Cushioning is recommended for applications where:

- The piston makes a full stroke with speed over than 0.05 m/s;
- It is necessary to reduce undesirable noise and mechanical shocks;
- Vertical application with heavy loads.

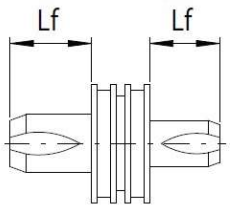
The stroke-end cushioning are hydraulic dampers specifically designed to dissipate the energy of the mass connected to the cylinder rod, by progressively increasing the pressure in the cushioning chamber and thus reducing the rod speed before the cylinder's mechanical stroke-end (see the graphics at side). The regulating screws are supplied fully screwed in (max cushioning effect).




In case of high masses and/or very high operating speeds it is recommended to back them off to optimize the cushioning effect. The adjustment screw has a special design to prevent unlocking and expulsion. The cushioning effect is highly ensured even in case of variation of the fluid viscosity.

**Cushioning Length:**

Lf is the total cushioning length. When the stroke-end cushioning are used as safety devices, to mechanically preserve the cylinder and the system, it is advisable to select the cylinder's stroke longer than the operating one by an amount equal to the cushioning length Lf; in this way the cushioning effect does not influence the movement during the operating stroke.




| Bore Ø | | 63 | | 80 | | 100 | | 125 | | 160 | | 200 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rod Ø | | 28 | 36<br>45 | 36 | 45<br>56 | 45 | 56<br>70 | 56 | 70<br>90 | 70 | 90<br>110 | 90<br>140 | 110 |
| Cushioning Length [mm] | Lf Front | 28 | 27 | 27 | 29 | 35 | 27 | 28 | 25 | 34 | 34 | 49 | 34 |
| | Lf Rear | 30 | | 32 | | 32 | | 32 | | 41 | | 56 | |

## 5 Stroke Selection:

Stroke has to be selected a few mm longer than the working stroke, to prevent to use the cylinder heads as mechanical stroke-end.

Minimum stroke [mm]: see table at side

Maximum stroke: 5000 mm

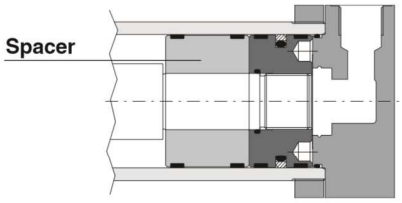
Stroke tolerances:

- 0 +2 mm for strokes up to 1250 mm
- 0 +5 mm for strokes from 1250 to 3150 mm
- 0 +8 mm for strokes over 3150 mm

| Bore Ø | 63 | 80 | 100 | 125 | 160 | 200 |
|---|---|---|---|---|---|---|
| Min. Stroke [mm] | 55 | 70 | 70 | 75 | 70 | 85 |

## 6 Spacer:

For strokes longer than 1000 mm, proper spacers have to be introduced in the cylinder's construction to increase the rod and piston guide and to protect them from overloads and premature wear. Spacers can be omitted for cylinders working in traction mode. The introduction of spacers increases the overall cylinder's dimensions: spacers' length has to be added to all stroke dependent dimensions.



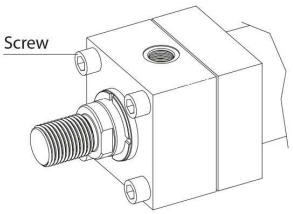

| Stroke [mm] | 1001 to 1500 | 1501 to 2000 | 2001 to 2500 | 2501 to 5000 |
|---|---|---|---|---|
| **Spacer Code** | **2** | **4** | **6** | **8** |
| Length [mm] | 50 | 100 | 150 | 200 |

## 7 Rod Features & options:

The rods materials have high strength - EN8D / C45 & the rod surface is chrome plated: diameter tolerances f7, roughness Ra ≤ 0.25 µm.
Rod hardness can be improved selecting the options **T** :
**K** = Ground and hard chrome plated (for rods from 22 to 110mm)
**T** = Induction surface hardening, ground & hard chrome plated
• 56-60 HRC (613-697 HV) hardness.

## 8 Screw Tightening Torque:

Mounting screws must to be a minimum strength of ISO 898/2 grade 12.9.




| **Bore Ø** | **63** | **80** | **100** | **125** | **160** | **200** |
|---|---|---|---|---|---|---|
| **MT [Nm]** | 70 | 160 | 160 | 460 | 820 | 1160 |
| **Screw** | M12 | M16 | M16 | M22 | M27 | M30 |

## 9 Cylinder's Housing Features:

The cylinder's housings are made in "cold drawn and stressed steel" & "Hot rolled steel"; the internal surfaces are lapped: diameter tolerance H8, roughness Ra ≤ 0.25 µm.

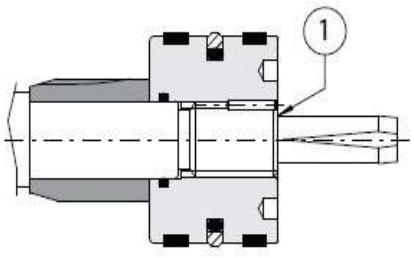
## 10 Fluid Requirements:

Cylinders and servo cylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters). The fluid must have a viscosity within 15 and 100 mm2/s, a temperature within 0 and 70°C and fluid contamination class ISO 20/18/15 according to ISO 4406 NAS1638 class 9.

## 11 Rod - Piston Coupling:

The rod and piston are mechanically coupled by a threaded connection in which the thread on the rod is at least equal to the external thread KK. The piston is screwed to the rod by a pre- fixed tightening torque in order to improve the fatigue resistance. The Grub screw **1** avoids the piston unscrewing.

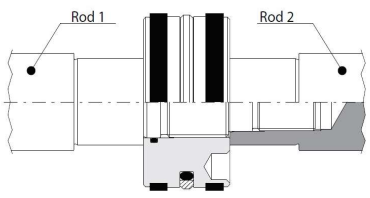
Single Rod




## 12 Double Rod:

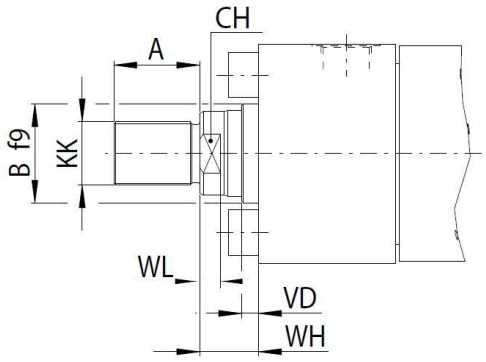
Double rod cylinders ensure the same pushing and pulling areas, thus the same speeds and forces. Rod2 is screwed into the male thread of Rod1(see figure at side), consequently the Rod2 is weaker than the other and it is strongly recommended to use this one only to compensate the areas; the stronger rod is identified by the number '1' stamped on its end. For double rod cylinders, rod end dimensions indicated in section-13 are valid for both the rods.

Double Rod

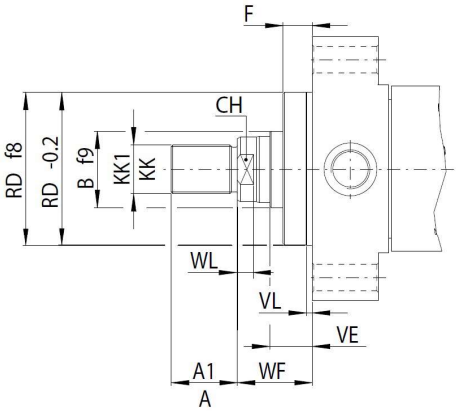


## 13 Piston Rod End Data :

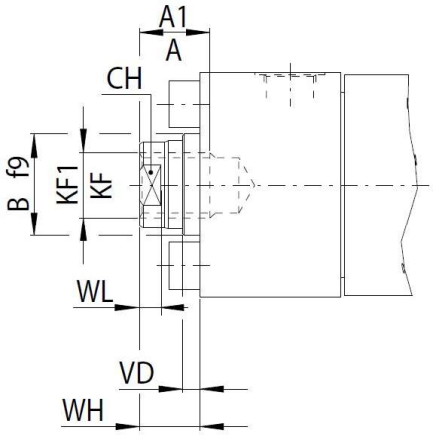
**Rod End [Male] Code 1**
For all styles except N



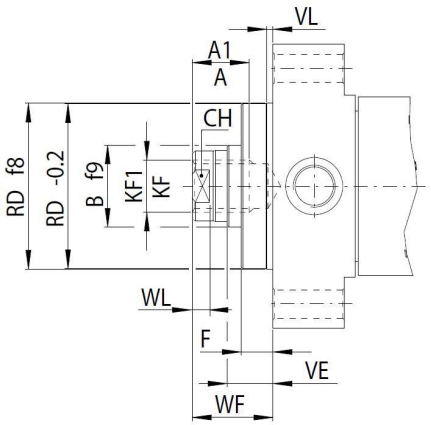

**Rod End [Male] Code 3**
For style N




**Rod End [Female] Code 2**
For all styles except N




**Rod End [Female] Code 4**
For style N




## Rod End Dimensions :

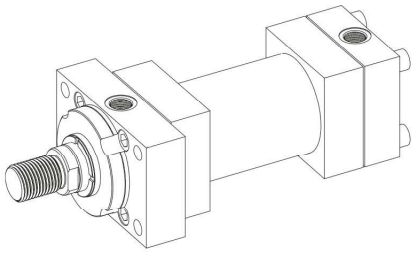
| Bore Ø | Rod Ø | Male Thread KK 6g Code 1,3 | Male Thread KK1 6g Code 3 | Female Thread KF 6H Code 2,4 | Female Thread KF1 6H Code 2,4 | A (KK or KF) | A1 (KK1 or KF1) | B f9 | CH H14 | F max | RD f8 | VD | VE max | VL min | WF ±2 | WH ±2 | WL min |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 | 28 | M20 X 1.5 | NA | M20 X 1.5 | NA | 28 | NA | 42 | 22 | 16 | 75 | 13 | 29 | 4 | 48 | 32 | 7 |
| | 36 | M27 X 2 | M20 X 1.5 | M27 X 2 | NA | 36 | 28 | 50 | 30 | 16 | 88 | 13 | 29 | 4 | 48 | 32 | 8 |
| | 45 | M33 X 2 | M20 X 1.5 | M33 X 2 | M20 X 1.5 | 45 | 28 | 60 | 39 | 16 | 88 | 13 | 29 | 4 | 48 | 32 | 10 |
| 80 | 36 | M27 X 2 | NA | M27 X 2 | NA | 36 | NA | 50 | 30 | 20 | 82 | 9 | 29 | 4 | 51 | 31 | 8 |
| | 45 | M33 X 2 | M27 X 2 | M33 X 2 | NA | 45 | 36 | 60 | 39 | 20 | 105 | 9 | 29 | 4 | 51 | 31 | 10 |
| | 56 | M42 X 2 | M27 X 2 | M42 X 2 | M27 X 2 | 56 | 36 | 72 | 48 | 20 | 105 | 9 | 29 | 4 | 51 | 31 | 10 |
| 100 | 45 | M33 X 2 | NA | M33 X 2 | NA | 45 | NA | 60 | 39 | 22 | 92 | 10 | 32 | 5 | 57 | 35 | 10 |
| | 56 | M42 X 2 | M33 X 2 | M42 X 2 | NA | 56 | 45 | 72 | 48 | 22 | 125 | 10 | 32 | 5 | 57 | 35 | 10 |
| | 70 | M48 X 2 | M33 X 2 | M48 X 2 | M33 X 2 | 63 | 45 | 88 | 62 | 22 | 125 | 10 | 32 | 5 | 57 | 35 | 10 |
| 125 | 56 | M42 X 2 | NA | M42 X 2 | NA | 56 | NA | 72 | 48 | 22 | 105 | 10 | 32 | 5 | 57 | 35 | 10 |
| | 70 | M48 X 2 | M42 X 2 | M48 X 2 | NA | 63 | 56 | 88 | 62 | 22 | 150 | 7 | 29 | 5 | 57 | 35 | 10 |
| | 90 | M64 X 3 | M42 X 2 | M64 X 3 | M42 X 2 | 85 | 56 | 108 | 80 | 22 | 150 | 7 | 29 | 5 | 57 | 35 | 15 |
| 160 | 70 | M48 X 2 | NA | M48 X 2 | NA | 63 | NA | 88 | 62 | 25 | 125 | 7 | 32 | 5 | 57 | 32 | 10 |
| | 90 | M64 X 3 | M48 X 2 | M64 X 3 | NA | 85 | 63 | 108 | 80 | 25 | 170 | 7 | 32 | 5 | 57 | 32 | 15 |
| | 110 | M80 X 3 | M48 X 2 | M80 X 3 | M48 X 2 | 95 | 63 | 133 | 100 | 25 | 170 | 7 | 32 | 5 | 57 | 32 | 15 |
| 200 | 90 | M64 X 3 | NA | M64 X 3 | NA | 85 | NA | 108 | 80 | 25 | 150 | 7 | 32 | 5 | 57 | 32 | 15 |
| | 110 | M80 X 3 | M64 X 3 | M80 X 3 | NA | 95 | 85 | 133 | 100 | 25 | 210 | 7 | 32 | 5 | 57 | 32 | 15 |
| | 140 | M100 X 3 | M64 X 3 | M100 X 3 | M64 X 3 | 112 | 85 | 163 | 128 | 25 | 210 | 7 | 32 | 5 | 57 | 32 | 15 |

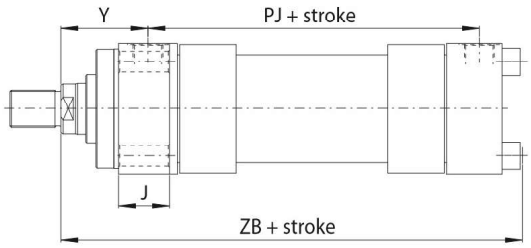
All dimensions are in mm .

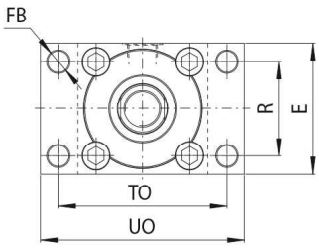
**NOTE:**

- Dimensions A & A1 are according to ISO 4395 short type.
- Tolerances: max for male thread; min for female thread.

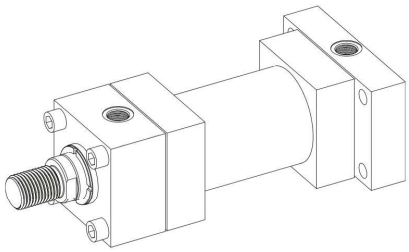
## 14 Rectangular Flange Mountings :

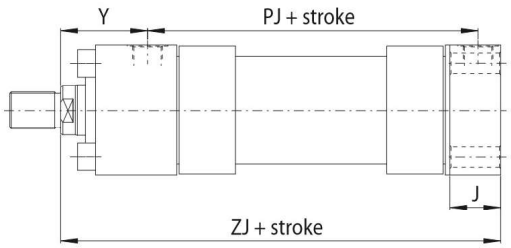


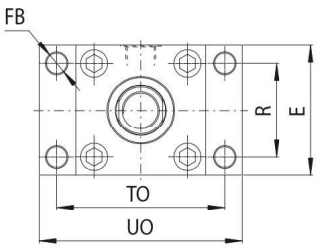



**Style N**
**ISO ME5**
Front Rectangular Flange






**Style P**
**ISO ME6**
Rear Rectangular Flange

### Installation Dimensions - ME5 & ME6

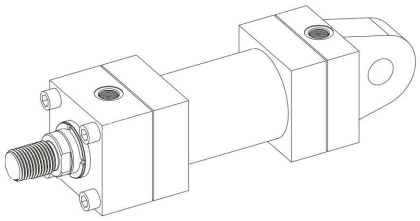
| Bore Ø | Rod Ø | E | FB H13 | J ref | R js13 | TO js13 | UO max | Y | Y1 | +Stroke PJ | +Stroke PJ2 | +Stroke ZB max | +Stroke ZJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 | 28<br>36<br>45 | 90 | 14 | 38 | 65 | 117 | 145 | 71 | 70 | 80 | 80 | 185 | 168 |
| 80 | 36<br>45<br>56 | 115 | 18 | 45 | 83 | 149 | 180 | 77 | 75.5 | 93 | 93 | 212 | 190 |
| 100 | 45<br>56<br>70 | 130 | 18 | 45 | 97 | 162 | 200 | 82 | 83 | 101 | 99 | 225 | 203 |
| 125 | 56<br>70<br>90 | 165 | 22 | 58 | 126 | 208 | 250 | 86 | 84 | 117 | 121 | 260 | 232 |
| 160 | 70<br>90<br>110 | 205 | 26 | 58 | 155 | 253 | 300 | 86 | 79.5 | 130 | 143 | 279 | 245 |
| 200 | 90<br>110<br>140 | 245 | 33 | 76 | 190 | 300 | 360 | 98 | 97 | 165 | 167 | 336 | 299 |

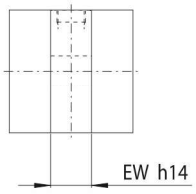
All dimensions are in mm .

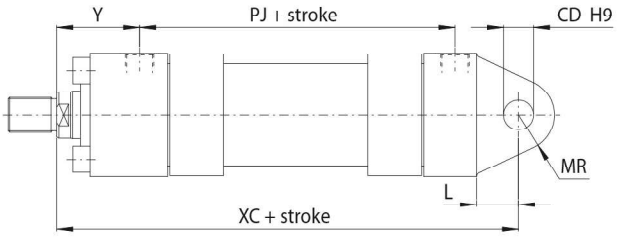
**NOTE:**

- For oversized oil ports, dimensions **PJ** & **Y** are respectively modified to **PJ2** & **Y1**.
- For Rod End Dimensions refer to the section 13

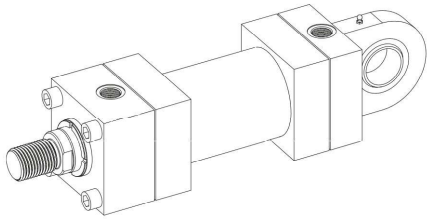
## 15 Pivot Mountings :

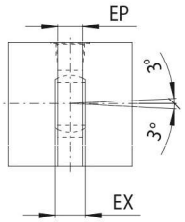


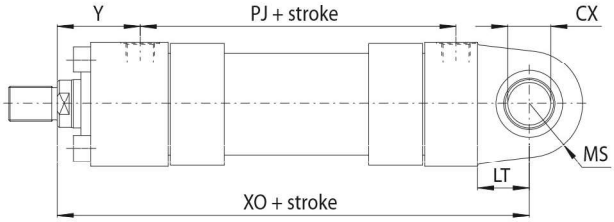



**Style D**
**ISO MP3**
Fixed Eye






**Style S**
**ISO MP5**
Fixed Eye with Spherical Bearing

### Installation Dimensions - MP3 & MP5

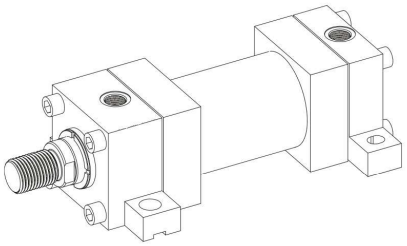
| Bore Ø | Rod Ø | CD H9 | CX | EP max | EW h14 | EX | L min | LT min | MR max | MS max | Y | Y1 | +Stroke PJ | +Stroke PJ2 | +Stroke XO | +Stroke XC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 | 28<br>36<br>45 | 20 | 30 -0.012 | 19 | 30 | 22 -0.12 | 32 | 38 | 29 | 40 | 71 | 70 | 80 | 80 | 206 | 200 |
| 80 | 36<br>45<br>56 | 28 | 40 -0.012 | 23 | 40 | 28 -0.12 | 39 | 48 | 34 | 50 | 77 | 75.5 | 93 | 93 | 238 | 229 |
| 100 | 45<br>56<br>70 | 36 | 50 -0.012 | 30 | 50 | 35 -0.12 | 54 | 58 | 50 | 62 | 82 | 83 | 101 | 99 | 261 | 257 |
| 125 | 56<br>70<br>90 | 45 | 60 -0.015 | 38 | 60 | 44 -0.15 | 57 | 72 | 53 | 80 | 86 | 84 | 117 | 121 | 304 | 289 |
| 160 | 70<br>90<br>110 | 56 | 80 -0.015 | 47 | 70 | 55 -0.15 | 63 | 92 | 59 | 100 | 86 | 79.5 | 130 | 143 | 337 | 308 |
| 200 | 90<br>110<br>140 | 70 | 100 -0.020 | 57 | 80 | 70 -0.20 | 82 | 116 | 78 | 120 | 98 | 97 | 165 | 167 | 415 | 381 |

All dimensions are in mm .

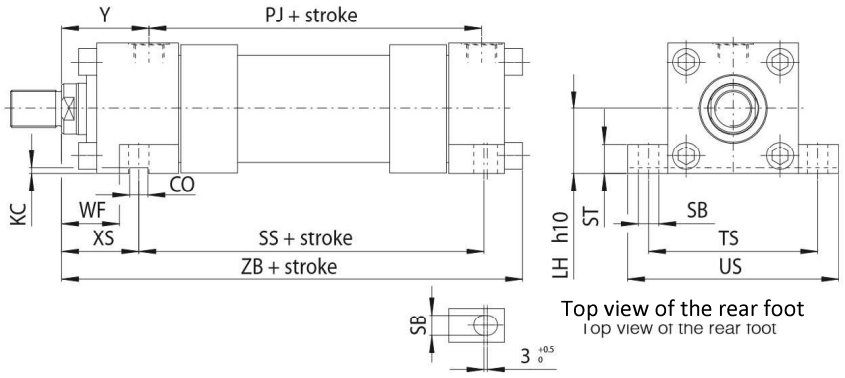
**NOTE:**

- For oversized oil ports, dimensions **PJ** & **Y** are respectively modified to **PJ2** & **Y1**.
- For Rod End Dimensions refer to the section 13

## 16 Foot Mounting :



**Style E**
**ISO MS2**
Foot Mounting




## Installation Dimensions - MS2

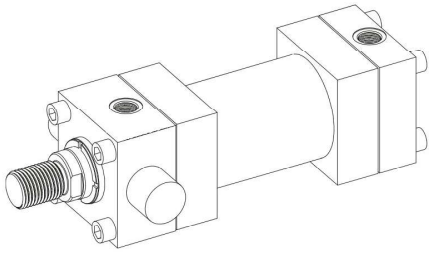
| Bore Ø | Rod Ø | CO N9 | KC min | LH h10 | SB H13 | ST js13 | TS js13 | US max | WF ±2 | XS | Y | Y1 | +Stroke PJ | +Stroke PJ2 | +Stroke SS | +Stroke ZB max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 | 28<br>36<br>45 | 16 | 4.5 | 44 | 18 | 26 | 124 | 161 | 48 | 65 | 71 | 70 | 80 | 80 | 85 | 185 |
| 80 | 36<br>45<br>56 | 16 | 5 | 57 | 18 | 26 | 149 | 186 | 51 | 68 | 77 | 75.5 | 93 | 93 | 104 | 212 |
| 100 | 45<br>56<br>70 | 16 | 6 | 63 | 26 | 32 | 172 | 216 | 57 | 79 | 82 | 83 | 101 | 99 | 101 | 225 |
| 125 | 56<br>70<br>90 | 20 | 6 | 82 | 26 | 32 | 210 | 254 | 57 | 79 | 86 | 84 | 117 | 121 | 130 | 260 |
| 160 | 70<br>90<br>110 | 30 | 8 | 101 | 33 | 38 | 260 | 318 | 57 | 86 | 86 | 79.5 | 130 | 143 | 129 | 279 |
| 200 | 90<br>110<br>140 | 40 | 8 | 122 | 39 | 44 | 311 | 381 | 57 | 92 | 98 | 97 | 165 | 167 | 171 | 336 |

All dimensions are in mm .

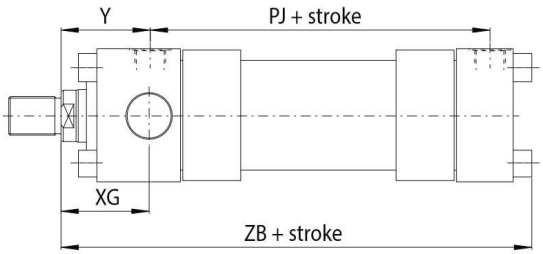
**NOTE:**

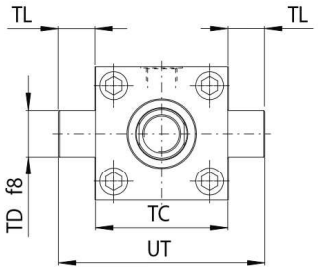
- For oversized oil ports, dimensions **PJ** & **Y** are respectively modified to **PJ2** & **Y1**.
- For Rod End Dimensions refer to the section 13

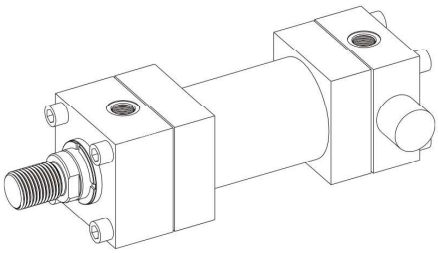
## 17 Trunnion Mountings :



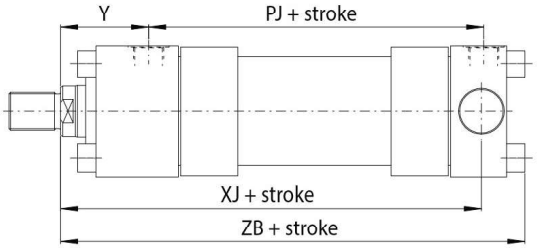
**Style G**
**ISO MT1**
Front Trunnion

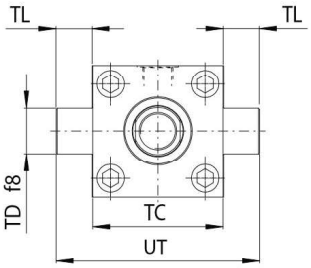


**Style H**
**ISO MT2**
Rear Trunnion




### Installation Dimensions - MT1 & MT2

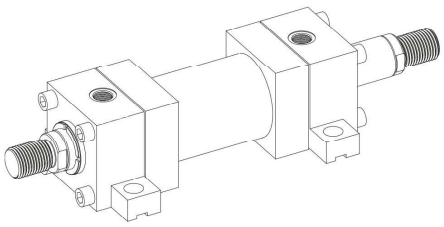
| Bore Ø | Rod Ø | TC h14 | TD f8 | TL js13 | UT ref | XG | Y | Y1 | +Stroke PJ | PJ2 | XJ | ZB max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 | 28<br>36<br>45 | 89 | 32 | 25 | 139 | 70 | 71 | 70 | 80 | 80 | 149 | 185 |
| 80 | 36<br>45<br>56 | 114 | 40 | 32 | 178 | 76 | 77 | 75.5 | 93 | 93 | 168 | 212 |
| 100 | 45<br>56<br>70 | 127 | 50 | 40 | 207 | 71 | 82 | 83 | 101 | 99 | 187 | 225 |
| 125 | 56<br>70<br>90 | 165 | 63 | 50 | 265 | 75 | 86 | 84 | 117 | 121 | 209 | 260 |
| 160 | 70<br>90<br>110 | 203 | 80 | 63 | 329 | 75 | 86 | 79.5 | 130 | 143 | 230 | 279 |
| 200 | 90<br>110<br>140 | 241 | 100 | 80 | 401 | 85 | 98 | 97 | 165 | 167 | 276 | 336 |

All dimensions are in mm .

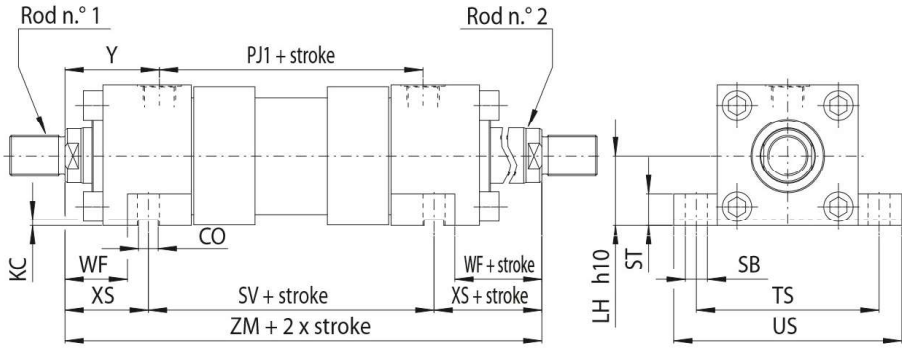
**NOTE:**

- For oversized oil ports, dimensions **PJ** & **Y** are respectively modified to **PJ2** & **Y1**.
- For Rod End Dimensions refer to the section 13

## 18 Double Rod Cylinders :



**Style E**
**Non - ISO**
Foot Mounting
Available with Styles N,E,G




### Installation Dimensions -

| Bore Ø | Rod Ø | CO N9 | KC min | LH h10 | SB H13 | ST js13 | TS js13 | US max | Y | +(2xStroke) ZM | +Stroke PJ1 | +Stroke XS | +Stroke SV | +Stroke WF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 | 28<br>36<br>45 | 16 | 4.5 | 44 | 18 | 26 | 124 | 161 | 71 | 223 | 81 | 65 | 93 | 48 |
| 80 | 36<br>45<br>56 | 16 | 5 | 57 | 18 | 26 | 149 | 186 | 77 | 246 | 92 | 68 | 110 | 51 |
| 100 | 45<br>56<br>70 | 16 | 6 | 63 | 26 | 32 | 172 | 216 | 82 | 265 | 101 | 79 | 107 | 57 |
| 125 | 56<br>70<br>90 | 20 | 6 | 82 | 26 | 32 | 210 | 254 | 86 | 289 | 117 | 79 | 131 | 57 |
| 160 | 70<br>90<br>110 | 30 | 8 | 101 | 33 | 38 | 260 | 318 | 86 | 302 | 130 | 86 | 130 | 57 |
| 200 | 90<br>110<br>140 | 40 | 8 | 122 | 39 | 44 | 311 | 381 | 98 | 356 | 160 | 92 | 172 | 57 |

All dimensions are in mm .

**NOTE:**

- For oversized oil ports, dimensions **PJ** & **Y** are respectively modified to **PJ2** & **Y1**.
- For Rod End Dimensions refer to the section 13