



# TRA Series Cylinders

Bimba's TRA series features heavy duty triple rod cylinders perfect for intense applications that require a sturdy pneumatic actuator and maximized load handling capabilities.



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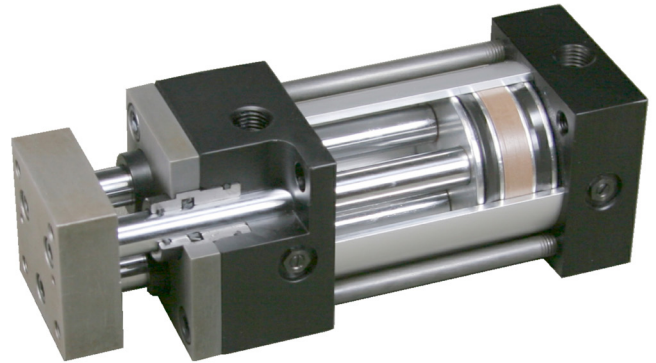
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## Triple Rod: Heavy-Duty Triple Rod Design

### Benefits

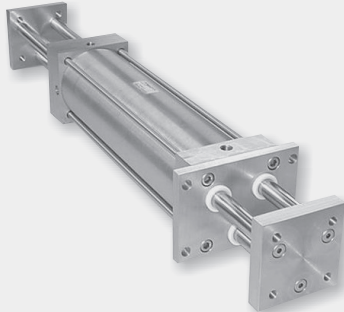
- > **Extended Heavy-Duty Rod Bearings** — Cast iron material is rated at 150,000 PSI compressive strength. Extended bearing design maximizes Load handling abilities without compromising design.
- > **Piston Wear Band Standard** — PTFE material rated for high loads and non-lube service.
- > **Non Lube Service** — PTFE coated bushings, Carboxilated Nitrile Seal material and PTFE based lube provide permanent lubrication for long life.
- > **Longer Strokes Available** — The heavy-duty design allows for longer strokes (see page 94 for details).
- > **Load and End Play Charts Available** — Refer to pages 95-99 for charts.



## Other Models Available:

### SS-TRA

300 Series Stainless Steel



### MA Option (Micro-Adjust)

Available on all "D1" Double Rod End models.

Allows for extended stroke adjustment in .001" increments.

(Note: up to 12" strokes)



## Operating Temperature

**Carboxilated Nitrile:** -20°F to 200°F (-29°C to 93°C)

**Fluorocarbon:** 0°F to 400°F (-18°C to 204°C)

## Operating Pressure

250 PSI (17 bar)

# How to Order

## TRA - MF1 - 3.25 x 10 - HC - MPR

| Series |             |
|--------|-------------|
| TRA    | 250 PSI Air |

| NFPA Mounts |                                                  |
|-------------|--------------------------------------------------|
| MX0         | No Mount                                         |
| MS4         | Bottom Tapped Holes (1.50" - 8.00" Bore)         |
| MS2         | Side Lug (1.50" - 8.00" Bore)                    |
| Base Bar    | Side Lug (1.50" - 4.00" Bore)                    |
| MP1         | Rear Pivot Clevis (Extruded)                     |
| MP2         | Rear Pivot Clevis (Casting) (1.50" - 6.00" Bore) |
| MP4         | Rear Pivot Eye (Casting) (1.50" - 4.00" Bore)    |
| MF1         | Front Flange (1.50" - 6.00" Bore)                |
| MF2         | Rear Flange (1.50" - 6.00" Bore)                 |
| ME4         | Rear Mounting Holes (8.00" Bore)                 |
| ME5         | Front Mounting Holes (8.00" Bore)                |

| Style   |                                                                                  |
|---------|----------------------------------------------------------------------------------|
| (Blank) | Single End                                                                       |
| D3      | Double End - 3 Rods                                                              |
| D1      | Double End - 1 Rod (KK1 Standard Rod End - See Options For Other Rod End Styles) |

**Example:** A Triple Rod Cylinder with a 3.25" Bore, 10" Stroke, Front Flange Mount, Head & Cap Cushions, Magnetic Piston for Reed or Solid State Switches.

**Part Number:**  
TRA-MF1-3.25 x 10-HC-MPR

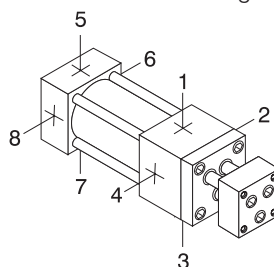
| Bore |
|------|
| 1.50 |
| 2.00 |
| 2.50 |
| 3.25 |
| 4.00 |
| 5.00 |
| 6.00 |
| 8.00 |

| Stroke                                         |
|------------------------------------------------|
| See Stroke Options on page 94<br>Made-to-Order |

| Cushions |                                                                       |
|----------|-----------------------------------------------------------------------|
| H        | Head Cushion Position 2 Is Standard<br>Specify For Positions: 1 & 4   |
| C        | Cap Cushion Position 6 Is Standard<br>Specify For Positions: 5, 7 & 8 |

### Standard Port and Cushion Adjustment Positions

- > Ports - Positions 1 and 5 (Ports not available at position 3)
- > Cushion Adjustment - Positions 2 and 6 (Cushions not available at position 3)
- > Specify Non-Standard Positions When Ordering



Note: Ports or Cushions NOT available at position 3

| Options  |                                                                                                                                |
|----------|--------------------------------------------------------------------------------------------------------------------------------|
| AS       | Adjustable Stroke - Retract<br>(Specify Length, Example: AS = 4")                                                              |
| AO       | Air / Oil Piston                                                                                                               |
| » B      | .250" Urethane Bumper Both Ends                                                                                                |
| » BC     | .250" Urethane Bumper Cap Only                                                                                                 |
| » BH     | .250" Urethane Bumper Head Only                                                                                                |
| BSPP     | British Standard Pipe Taper<br>(Specify Size, Example: BSP = .250")                                                            |
| BSPT     | British Standard Pipe Parallel<br>(Specify Size, Example: BSP = .250")                                                         |
| C        | Extended Piston Rod (Example: If C = 0.50", Then 1" Rod Extension Is C = 1.50")                                                |
| MA       | Micro-Adjust (12" Max Stroke) Available On Double Rod End Models                                                               |
| MAB      | Micro-Adjust W/ Sound Dampening Bumper (12" Max Stroke)                                                                        |
| MPR*     | Magnetic Piston for Reed or Solid State Switches (R10, R10P, RAC, RHT & MSS)                                                   |
| » MPR-WB | Combination Magnetic Piston & Wear-Band<br>(Specify On 1.50"-2.50" Bore Only)                                                  |
| OP       | Optional Port Location (Example: Ports @ 3 & 7)                                                                                |
| SAE      | SAE Ports (Specify Size, Example: SAE #10)                                                                                     |
| SSA      | Stainless Steel Piston Rod, Tie Rods, Nuts & Fasteners                                                                         |
| SSF      | Stainless Steel Fasteners                                                                                                      |
| SSN      | Stainless Steel Tie Rod Nuts                                                                                                   |
| SSR      | Stainless Steel Piston Rod                                                                                                     |
| SST      | Stainless Steel Tie Rods                                                                                                       |
| » ST     | Stop Tube - Specify Stop Tube Length (In Inches)<br>Specify Stroke as ES (Effective Stroke)<br>(Example: TA MS4 2 X 24ES-ST=3) |
| TMS      | Steel Cylinder Tube*, Black Epoxy Paint Finish                                                                                 |
| TMSS     | Stainless Steel Cylinder Tube*                                                                                                 |
| TH       | 400 PSI Hydraulic Non-Shock                                                                                                    |
| VS       | Fluorocarbon Seals                                                                                                             |
| XX       | Special Variation (Specify)                                                                                                    |

Note: Refer to Options for specifications.

\* If "MPR" option is ordered on 1.50"-2.50" bore models, the wear-band is eliminated and must be ordered separately (if needed (see MPR-WB option)).

\*\* Steel tubes do not work with MPR magnetic pistons. Refer to Balluff end of stroke sensors within Switches.

» Refer to Option Length Adder

### Options For "D1" Double Rod End Model - Single Rod

|      |                                                         |
|------|---------------------------------------------------------|
| KK2  | Large Male Rod Thread                                   |
| KK3  | Female Rod Thread                                       |
| KK3S | Studded Piston Rod<br>(KK3 With Stud, Loctite In Place) |
| KK4  | Full Diameter Male Rod Thread                           |
| KK5  | Blank Rod End (No Threads, "A" = 0")                    |

### Option Length Adder (Add To Catalog Basic Overall Length Dimensions)

| Bore | Option |       |       |                                                                                    |                            |                                  |
|------|--------|-------|-------|------------------------------------------------------------------------------------|----------------------------|----------------------------------|
|      | B      | BC    | BH    | MPR (Without "WB" Wearband)                                                        | MPR-WB (Magnet & Wearband) | ST* (Stop Tube)<br>Example: ST=2 |
| 1.50 | 0.500  | 0.250 | 0.250 | 0                                                                                  | 0.500                      | 2                                |
| 2.00 | 0.500  | 0.250 | 0.250 | 0                                                                                  | 0.500                      | 2                                |
| 2.50 | 0.500  | 0.250 | 0.250 | 0                                                                                  | 0.500                      | 2                                |
| 3.25 | 0.500  | 0.250 | 0.250 |                                                                                    |                            | 2                                |
| 4.00 | 0.500  | 0.250 | 0.250 |                                                                                    |                            | 2                                |
| 5.00 | 0.500  | 0.250 | 0.250 | Note: There is no length adder for MPR Option and Wear Band on 3.25" - 8.00" Bore. |                            |                                  |
| 6.00 | 0.500  | 0.250 | 0.250 |                                                                                    |                            |                                  |
| 8.00 | 0.500  | 0.250 | 0.250 |                                                                                    |                            |                                  |

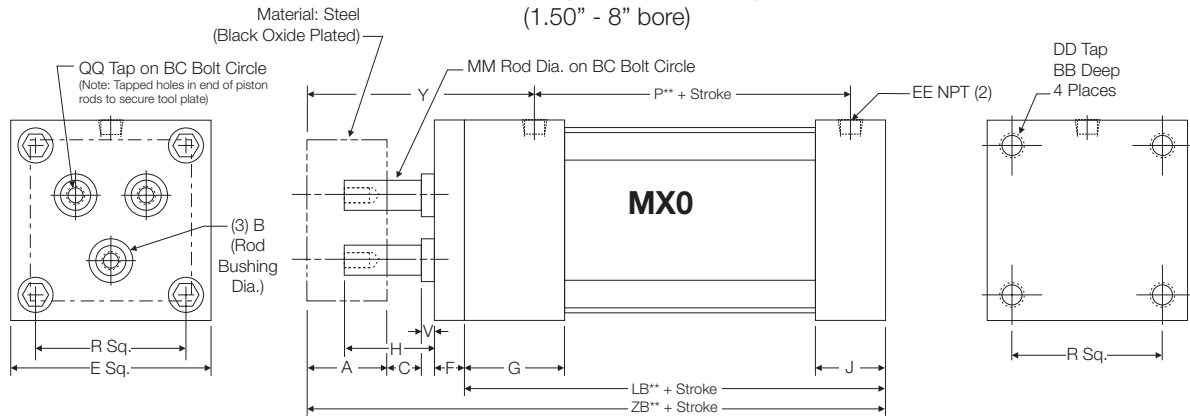
\*The desired Stop Tube length adds directly to the overall cylinder length.

Note: If a stop tube is used on 1.50" - 2.50" bore with a minimum stop tube length of 0.5", there is no length adder for MPR-WB option other than the stop tube length.

## TRA Series Heavy-Duty: Triple Piston Rod

### MX0 (No Mount)

(1.50" - 8" bore)



MX0 (No Mount)

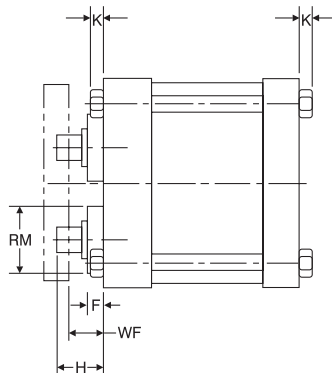
| Bore | A     | B     | BB    | BC    | C     | DD       | E     | EE    | F     | G     | H     | J     | LB      | MM    | P       | QQ       | R     | V     | Y     | ZB      |
|------|-------|-------|-------|-------|-------|----------|-------|-------|-------|-------|-------|-------|---------|-------|---------|----------|-------|-------|-------|---------|
| 1.50 | 0.750 | 0.563 | 0.500 | 0.891 | 0.500 | 1/4 -28  | 2.000 | 0.250 | 0.375 | 1.500 | 1.100 | 1.000 | 3.625** | 0.313 | 2.375** | 10-32    | 1.438 | 0.250 | 2.750 | 5.500** |
| 2.00 | 0.750 | 0.813 | 0.500 | 1.195 | 0.500 | 5/16 -24 | 2.500 | 0.250 | 0.375 | 1.500 | 1.100 | 1.000 | 3.625** | 0.500 | 2.375** | 1/4 -28  | 1.844 | 0.250 | 2.750 | 5.500** |
| 2.50 | 1.000 | 1.016 | 0.500 | 1.500 | 0.500 | 5/16 -24 | 3.000 | 0.250 | 0.375 | 1.500 | 1.350 | 1.000 | 3.750** | 0.625 | 2.500** | 5/16 -24 | 2.188 | 0.250 | 3.000 | 5.875** |
| 3.25 | 1.000 | 1.125 | 0.625 | 2.075 | 0.500 | 3/8 -24  | 3.750 | 0.375 | 0.625 | 1.750 | 1.100 | 1.250 | 4.250   | 0.625 | 2.750   | 3/8 -24  | 2.766 | 0.250 | 3.375 | 6.625   |
| 4.00 | 1.000 | 1.125 | 0.625 | 2.825 | 0.500 | 3/8 -24  | 4.500 | 0.375 | 0.625 | 1.750 | 1.100 | 1.250 | 4.250   | 0.625 | 2.750   | 3/8 -24  | 3.320 | 0.250 | 3.375 | 6.625   |
| 5.00 | 1.000 | 1.500 | 0.625 | 3.375 | 1.000 | 1/2 -20  | 5.500 | 0.375 | 0.625 | 1.750 | 1.844 | 1.250 | 4.500   | 1.000 | 3.000   | 1/2 -20  | 4.100 | 0.250 | 3.875 | 7.375   |
| 6.00 | 1.000 | 1.500 | 0.750 | 3.938 | 1.000 | 1/2 -20  | 6.500 | 0.500 | 0.750 | 2.000 | 1.844 | 1.500 | 5.000   | 1.000 | 3.250   | 1/2 -20  | 4.875 | 0.250 | 4.125 | 8.000   |
| 8.00 | 1.000 | 1.500 | —     | 5.750 | 1.375 | —        | 8.500 | 0.750 | —     | 2.000 | 2.844 | 1.500 | 5.125   | 1.000 | 3.375   | 1/2 -20  | 6.438 | 0.250 | 4.375 | 8.375*  |

\*"ZB" does not include "K" hex nut dimension (see below for dimensions).

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

### MX0 (No Mount)

(8.00" Bore)



MX0 (No Mount)

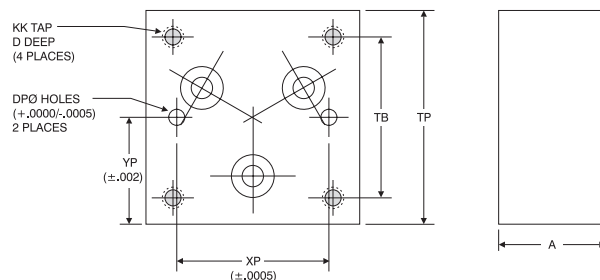
| Bore | F     | H     | K     | RM    | WF    |
|------|-------|-------|-------|-------|-------|
| 8.00 | 0.625 | 2.844 | 0.563 | 2.750 | 2.250 |

"8.00" bore has three (3) round retainers, 0.625" thick, 2.75" dia. and uses hex nuts on both ends for MX0 mount.

### Tooling Plate

Material: Steel (Black Oxide Plated)

Note: standard tool plate includes (2) dowel pin holes included with cylinder (dowel pins not included).



Tooling Plate Dimensions

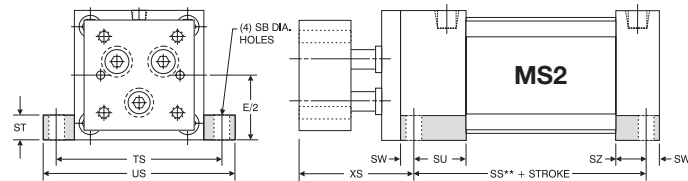
| Standard |       |       |          |       |       | Dowel Pin Dimensions |       |       |       |
|----------|-------|-------|----------|-------|-------|----------------------|-------|-------|-------|
| Bore     | A     | D     | KK       | TB    | TP    | Bore                 | DP Ø  | XP    | YP    |
| 1.50     | 0.750 | 0.750 | 10-32    | 1.125 | 1.500 | 1.50                 | 0.125 | 1.125 | 0.750 |
| 2.00     | 0.750 | 0.750 | 1/4 -28  | 1.438 | 2.000 | 2.00                 | 0.125 | 1.375 | 1.000 |
| 2.50     | 1.000 | 1.000 | 5/16 -24 | 1.844 | 2.500 | 2.50                 | 0.188 | 1.750 | 1.250 |
| 3.25     | 1.000 | 1.000 | 3/8 -24  | 2.188 | 3.250 | 3.25                 | 0.250 | 2.250 | 1.625 |
| 4.00     | 1.000 | 1.000 | 3/8 -24  | 2.766 | 4.000 | 4.00                 | 0.250 | 2.750 | 2.000 |
| 5.00     | 1.000 | 1.000 | 1/2 -20  | 3.313 | 5.000 | 5.00                 | 0.313 | 3.250 | 2.500 |
| 6.00     | 1.000 | 1.000 | 1/2 -20  | 4.100 | 6.000 | 6.00                 | 0.313 | 4.000 | 3.000 |
| 8.00     | 1.000 | 1.000 | 1/2 -20  | 4.875 | 8.000 | 8.00                 | 0.375 | 4.875 | 4.000 |

# How To Specify

## Base & Pivot Mounts

### Base Mounts (1.50" - 8.00" Bore)

MS2

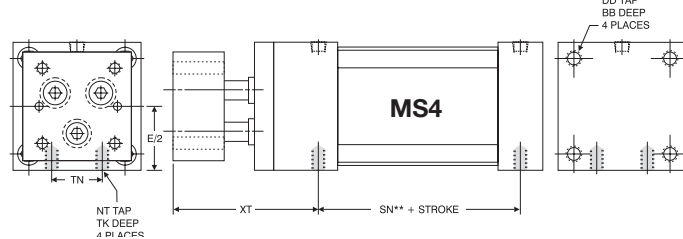


**MS2 Mount**

| Bore | SB    | E/2   | SS      | ST    | SU    | SW    | SZ    | TS    | US     | XS    |
|------|-------|-------|---------|-------|-------|-------|-------|-------|--------|-------|
| 1.50 | 0.438 | 1.000 | 2.875** | 0.500 | 1.125 | 0.375 | 0.625 | 2.750 | 3.500  | 2.250 |
| 2.00 | 0.438 | 1.250 | 2.875** | 0.500 | 1.125 | 0.375 | 0.625 | 3.250 | 4.000  | 2.250 |
| 2.50 | 0.438 | 1.500 | 3.000** | 0.500 | 1.125 | 0.375 | 0.625 | 3.750 | 4.500  | 2.500 |
| 3.25 | 0.563 | 1.875 | 3.250   | 0.750 | 1.250 | 0.500 | 0.750 | 4.750 | 5.750  | 2.875 |
| 4.00 | 0.563 | 2.250 | 3.250   | 0.750 | 1.250 | 0.500 | 0.750 | 5.500 | 6.500  | 2.875 |
| 5.00 | 0.813 | 2.750 | 3.125   | 1.000 | 1.063 | 0.688 | 0.563 | 6.875 | 8.250  | 3.563 |
| 6.00 | 0.813 | 3.250 | 3.625   | 1.000 | 1.313 | 0.688 | 0.813 | 7.875 | 9.250  | 3.688 |
| 8.00 | 0.813 | 4.250 | 3.750   | 1.000 | 1.313 | 0.688 | 0.813 | 9.875 | 11.250 | 3.938 |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

MS4

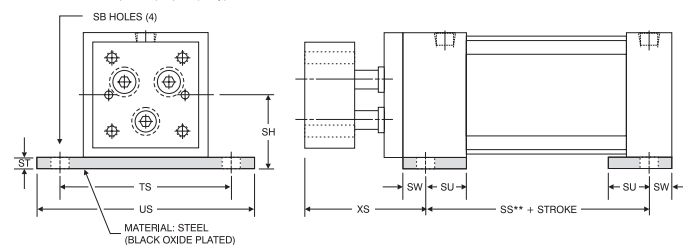


**MS4 Mount**

| Bore | E/2   | NT      | TK    | TN    | XT    | SN      |
|------|-------|---------|-------|-------|-------|---------|
| 1.50 | 1.000 | 1/4-20  | 0.375 | 0.625 | 2.813 | 2.250** |
| 2.00 | 1.250 | 5/16-18 | 0.500 | 0.875 | 2.813 | 2.250** |
| 2.50 | 1.500 | 3/8-16  | 0.625 | 1.250 | 3.063 | 2.375** |
| 3.25 | 1.875 | 1/2-13  | 0.750 | 1.500 | 3.438 | 2.625   |
| 4.00 | 2.250 | 1/2-13  | 0.750 | 2.063 | 3.438 | 2.625   |
| 5.00 | 2.750 | 5/8-11  | 1.000 | 2.688 | 3.938 | 2.875   |
| 6.00 | 3.250 | 3/4-10  | 1.125 | 3.250 | 4.188 | 3.125   |
| 8.00 | 4.250 | 3/4-10  | 1.125 | 4.500 | 4.438 | 3.250   |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

Base Bar (Non-NFPA)



**Base Bar (Non-NFPA)**

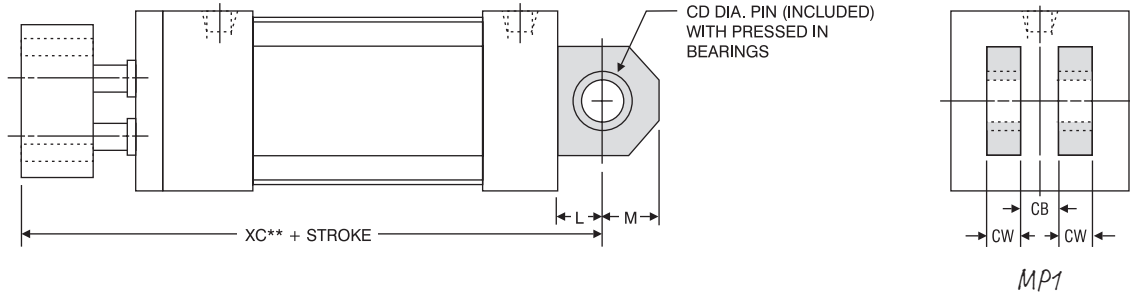
| Bore | SB    | SH    | SS      | ST    | SU    | SW    | TS    | US    | XS    |
|------|-------|-------|---------|-------|-------|-------|-------|-------|-------|
| 1.50 | 0.438 | 1.250 | 2.875** | 0.250 | 1.125 | 0.375 | 2.750 | 3.500 | 2.250 |
| 2.00 | 0.438 | 1.500 | 2.875** | 0.250 | 1.125 | 0.375 | 3.250 | 4.000 | 2.250 |
| 2.50 | 0.438 | 1.875 | 3.000** | 0.375 | 1.125 | 0.375 | 3.750 | 4.500 | 2.500 |
| 3.25 | 0.563 | 2.375 | 3.250   | 0.500 | 1.250 | 0.500 | 4.750 | 5.750 | 2.875 |
| 4.00 | 0.563 | 2.750 | 3.250   | 0.500 | 1.250 | 0.500 | 5.500 | 6.500 | 2.875 |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

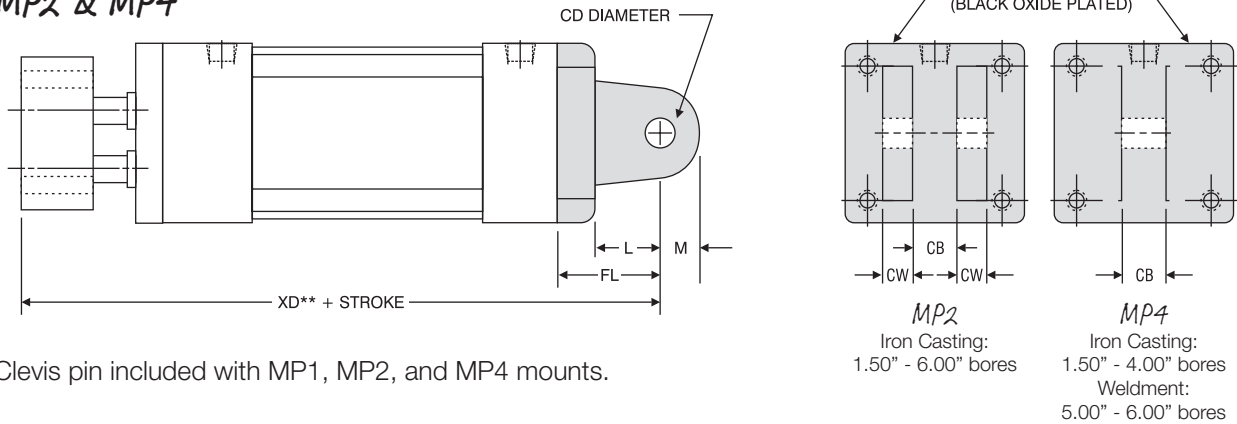
## Base & Pivot Mounts

### Pivot Mounts (1.50" - 8.00" Bore)

#### MP1 (Extruded Mount)



#### MP2 & MP4



Clevis pin included with MP1, MP2, and MP4 mounts.

| MP1, MP2 & MP4 Mounts ▲ |       |       |       |       |       |       |         |         |
|-------------------------|-------|-------|-------|-------|-------|-------|---------|---------|
| Bore                    | CB    | CD    | CW    | FL    | L     | M     | XC      | XD      |
| 1.50                    | 0.750 | 0.500 | 0.500 | 1.125 | 0.750 | 0.625 | 6.250** | 6.625** |
| 2.00                    | 0.750 | 0.500 | 0.500 | 1.125 | 0.750 | 0.625 | 6.250** | 6.625** |
| 2.50                    | 0.750 | 0.500 | 0.500 | 1.125 | 0.750 | 0.625 | 6.625** | 7.000** |
| 3.25                    | 1.250 | 0.750 | 0.625 | 1.875 | 1.250 | 0.875 | 7.875   | 8.500   |
| 4.00                    | 1.250 | 0.750 | 0.625 | 1.875 | 1.250 | 0.875 | 7.875   | 8.500   |
| 5.00                    | 1.250 | 0.750 | 0.625 | 1.875 | 1.250 | 0.875 | 8.625   | 9.250   |
| 6.00                    | 1.500 | 1.000 | 0.750 | 2.250 | 1.500 | 1.000 | 9.500   | 10.250  |
| 8.00                    | 1.500 | 1.000 | 0.750 | N/A   | 1.500 | 1.000 | 9.875   | N/A     |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

Note: 8.00" bore is a welded mount with through holes and tie rod nuts.

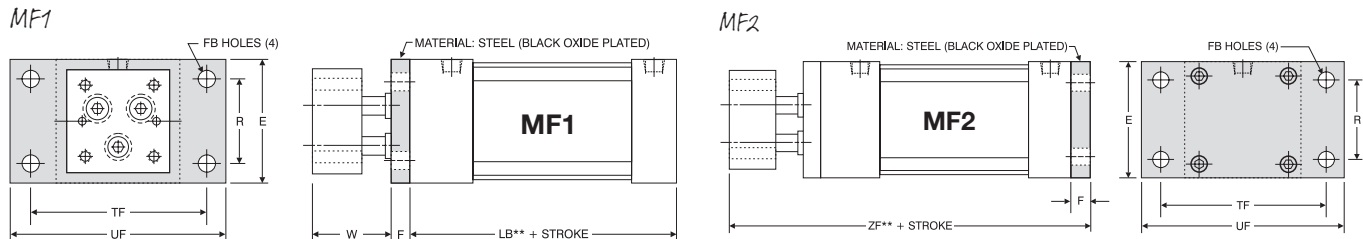
▲ MP4 available as specials in 5.00" and 6.00" bores; delivery for 5.00" and 6.00" bore MP4 models is 5-7 days.

Note: Extruded MP1 mounts are standard (1.50" - 8.00" bores) Cast Iron removable mounts are optional and must be requested when ordering (1.50" - 6.00" bores).

# How To Specify

## Flange Mounts

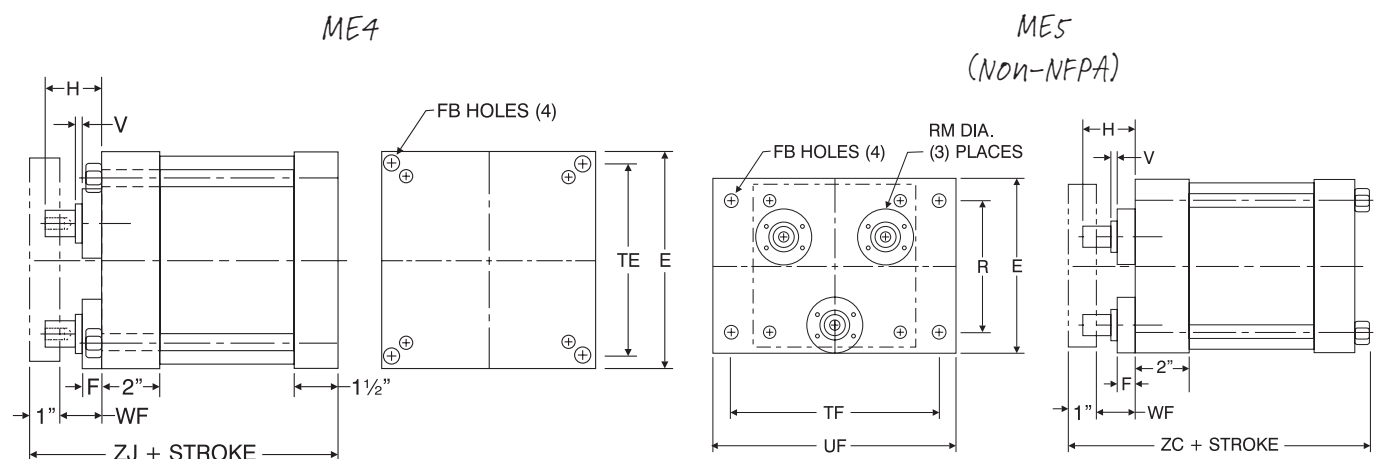
### Flange Mounts (1.50" - 6.00" Bore)



| MF1 & MF2 Mounts |       |       |       |         |       |       |       |       |         |
|------------------|-------|-------|-------|---------|-------|-------|-------|-------|---------|
| Bore             | E     | F     | FB    | LB      | R     | TF    | UF    | W     | ZF      |
| 1.50             | 2.000 | 0.375 | 0.313 | 3.625** | 1.430 | 2.750 | 3.375 | 1.500 | 5.875** |
| 2.00             | 2.500 | 0.375 | 0.375 | 3.625** | 1.844 | 3.375 | 4.125 | 1.500 | 5.875** |
| 2.50             | 3.000 | 0.375 | 0.375 | 3.750** | 2.188 | 3.875 | 4.625 | 1.750 | 6.250** |
| 3.25             | 3.750 | 0.625 | 0.438 | 4.250   | 2.760 | 4.688 | 5.500 | 1.750 | 7.250   |
| 4.00             | 4.500 | 0.625 | 0.438 | 4.250   | 3.320 | 5.438 | 6.250 | 1.750 | 7.250   |
| 5.00             | 5.500 | 0.625 | 0.563 | 4.500   | 4.100 | 6.625 | 7.625 | 2.250 | 8.000   |
| 6.00             | 6.500 | 0.750 | 0.563 | 5.000   | 4.875 | 7.625 | 8.625 | 2.250 | 8.750   |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.  
For dimensions not shown, see page 84

### Flange Mounts (8.00" Bore)



| ME4 & ME5 Mounts |       |       |       |       |       |       |       |        |        |       |       |       |       |
|------------------|-------|-------|-------|-------|-------|-------|-------|--------|--------|-------|-------|-------|-------|
| Bore             | E     | F     | FB    | H     | R     | RM    | TE    | TF     | UF     | V     | WF    | ZC    | ZJ    |
| 8.00             | 8.500 | 0.625 | 0.688 | 2.844 | 6.438 | 2.750 | 7.570 | 10.250 | 12.000 | 0.250 | 2.250 | 8.938 | 8.375 |

Note: Three (3) 1.00" diameter rods on 5.750 B.C.

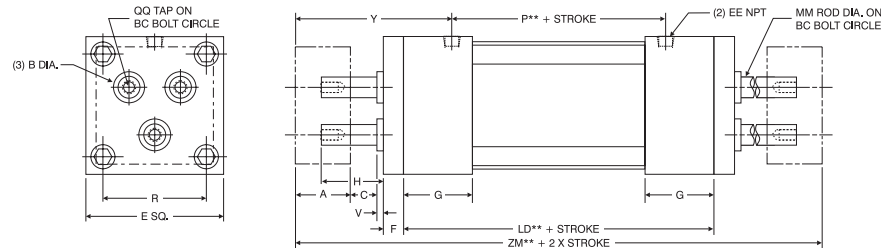


## Double Rod End

### Benefits

- > Durable Design. Full rod bearing(s) at each end of cylinder.
- > Single Rod (D1) and Triple Rod (D3) models available.
- > Full range of options available.
- > Reduces Tool Plate End Play
- > Increases Load Ratings

## MX0D3 (Triple Rod Both Ends) Basic Dimensions (No Mount)



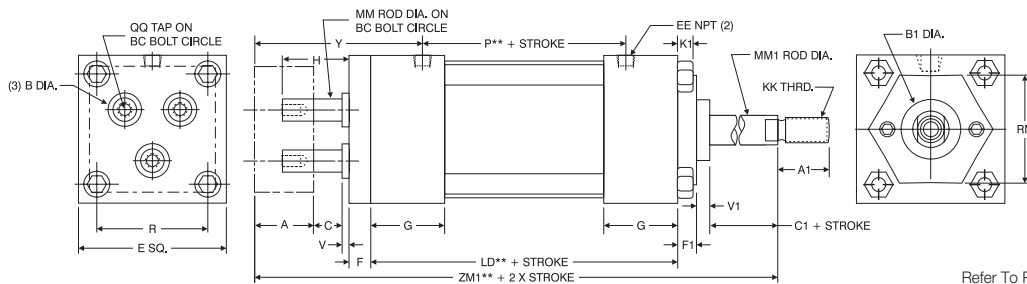
Tool Plates Included –

| Twin Tooling Plate - MX0D3 |       |       |       |       |       |       |        |       |       |         |       |         |         |       |       |       |         |
|----------------------------|-------|-------|-------|-------|-------|-------|--------|-------|-------|---------|-------|---------|---------|-------|-------|-------|---------|
| Bore                       | A     | B     | BC    | C     | E     | EE    | F      | G     | H     | LD      | MM    | P       | QQ      | R     | V     | Y     | ZM      |
| 1.50                       | 0.750 | 0.563 | 0.891 | 0.500 | 2.000 | 0.250 | 0.375  | 1.500 | 1.100 | 4.125** | 0.313 | 2.375** | 10-32   | 1.430 | 0.250 | 2.750 | 7.875** |
| 2.00                       | 0.750 | 0.813 | 1.195 | 0.500 | 2.500 | 0.250 | 0.375  | 1.500 | 1.100 | 4.125** | 0.500 | 2.375** | 1/4-28  | 1.844 | 0.250 | 2.750 | 7.875** |
| 2.50                       | 1.000 | 1.016 | 1.500 | 0.500 | 3.000 | 0.250 | 0.375  | 1.500 | 1.350 | 4.250** | 0.625 | 2.500** | 5/16-24 | 2.188 | 0.250 | 3.000 | 8.500** |
| 3.25                       | 1.000 | 1.125 | 2.075 | 0.500 | 3.750 | 0.375 | 0.625  | 1.750 | 1.100 | 4.750   | 0.625 | 2.750   | 3/8-24  | 2.760 | 0.250 | 3.375 | 9.500   |
| 4.00                       | 1.000 | 1.125 | 2.825 | 0.500 | 4.500 | 0.375 | 0.625  | 1.750 | 1.100 | 4.750   | 0.625 | 2.750   | 3/8-24  | 3.320 | 0.250 | 3.375 | 9.500   |
| 5.00                       | 1.000 | 1.500 | 3.375 | 1.000 | 5.500 | 0.375 | 0.625  | 1.750 | 1.844 | 5.000   | 1.000 | 3.000   | 1/2-20  | 4.100 | 0.250 | 3.875 | 10.750  |
| 6.00                       | 1.000 | 1.500 | 3.937 | 1.000 | 6.500 | 0.500 | 0.750  | 2.000 | 1.844 | 5.500   | 1.000 | 3.250   | 1/2-20  | 4.875 | 0.250 | 4.125 | 11.500  |
| 8.00                       | 1.000 | 1.500 | 5.750 | 1.375 | 8.500 | 0.750 | 0.625* | 2.000 | 2.844 | 5.625   | 1.000 | 3.375   | 1/2-20  | 6.438 | 0.250 | 4.375 | 12.125  |

\*8.00" bore has three (3) round retainers, 0.625" thick, 2.750" dia. and uses hex nuts on ends (see page 84).

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

## MX0D1 (Triple Rod with Single Rod) Basic Dimensions (No Mount)



Tool Plate Included –  
Refer To Page 82 For Tool Plate Detail

| Twin Tooling Plate Basic - MX0D1 |       |       |       |       |       |       |       |       |       |        |       |       |       |       |         |         |       |       |         |         |       |           |       |       |       |         |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|---------|---------|-------|-------|---------|---------|-------|-----------|-------|-------|-------|---------|
| Bore                             | A     | A1    | B     | B1    | BC    | C     | C1    | E     | EE    | F      | F1    | G     | H     | K1    | KK      | LD      | MM    | MM1   | P       | QQ      | R     | RM        | V     | V1    | Y     | ZM1     |
| 1.50                             | 0.750 | 0.750 | 0.563 | 1.125 | 0.891 | 0.500 | 0.375 | 2.000 | 0.250 | 0.375  | 0.375 | 1.500 | 1.100 | 0.250 | 7/16-20 | 4.125** | 0.313 | 0.625 | 2.375** | 10      | 1.438 | 2.00 Sq.  | 0.250 | 0.250 | 2.750 | 7.000** |
| 2.00                             | 0.750 | 0.750 | 0.816 | 1.125 | 1.195 | 0.500 | 0.375 | 2.500 | 0.250 | 0.375  | 0.375 | 1.500 | 1.100 | 0.313 | 7/16-20 | 4.125** | 0.500 | 0.625 | 2.375** | 1/4-28  | 1.844 | 1.75 Hex. | 0.250 | 0.250 | 2.750 | 7.000** |
| 2.50                             | 1.000 | 0.750 | 1.016 | 1.125 | 1.500 | 0.500 | 0.375 | 3.000 | 0.250 | 0.375  | 0.375 | 1.500 | 1.350 | 0.313 | 7/16-20 | 4.250** | 0.625 | 0.625 | 2.500** | 5/16-24 | 2.188 | 1.75 Hex. | 0.250 | 0.250 | 3.000 | 7.375** |
| 3.25                             | 1.000 | 1.125 | 1.125 | 1.500 | 2.075 | 0.500 | 0.500 | 3.750 | 0.375 | 0.625  | 0.625 | 1.750 | 1.100 | 0.375 | 3/4-16  | 4.750   | 0.625 | 1.000 | 2.750   | 3/8-24  | 2.760 | 2.75 Dia. | 0.250 | 0.250 | 3.375 | 8.500   |
| 4.00                             | 1.000 | 1.125 | 1.125 | 1.500 | 2.825 | 0.500 | 0.500 | 4.500 | 0.375 | 0.625  | 0.625 | 1.750 | 1.100 | 0.375 | 3/4-16  | 4.750   | 0.625 | 1.000 | 2.750   | 3/8-24  | 3.320 | 2.75 Dia. | 0.250 | 0.250 | 3.375 | 8.500   |
| 5.00                             | 1.000 | 1.125 | 1.500 | 1.500 | 3.375 | 1.000 | 0.500 | 5.500 | 0.375 | 0.625  | 0.625 | 1.750 | 1.844 | 0.438 | 3/4-16  | 5.000   | 1.000 | 1.000 | 3.000   | 1/2-20  | 4.100 | 2.75 Dia. | 0.250 | 0.250 | 3.875 | 9.250   |
| 6.00                             | 1.000 | 1.625 | 1.500 | 2.000 | 3.937 | 1.000 | 0.625 | 6.500 | 0.500 | 0.750  | 0.625 | 2.000 | 1.844 | 0.438 | 1-14    | 5.500   | 1.000 | 1.375 | 3.250   | 1/2-20  | 4.875 | 3.50 Dia. | 0.250 | 0.375 | 4.125 | 10.125  |
| 8.00                             | 1.000 | 1.625 | 1.500 | 2.000 | 5.750 | 1.375 | 0.625 | 8.500 | 0.750 | 0.625* | 0.625 | 2.000 | 2.844 | 0.563 | 1-14    | 5.625   | 1.000 | 1.375 | 3.375   | 1/2-20  | 6.438 | 3.50 Dia. | 0.250 | 0.375 | 4.375 | 10.500  |

\*8.00" bore has three (3) round retainers, 0.625" thick, 2.750" dia. and uses hex nuts on ends (see page 84).

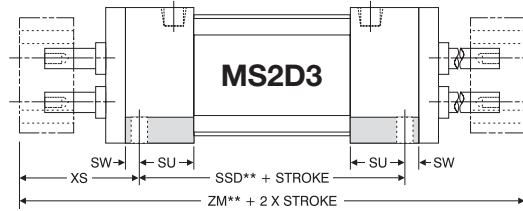
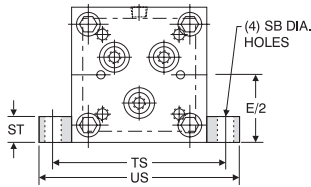
\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

# How To Specify

## TRA Series Dimensions: Double Rod End

### Base Mounts

MS2D3

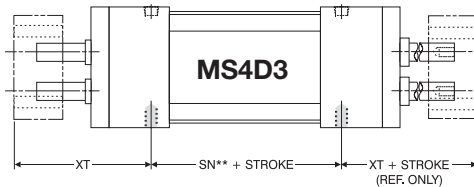
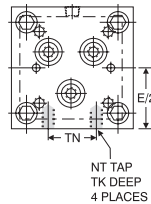


MS2D3 Mount

| Bore | SB    | E/2   | SSD     | ST    | SU    | SW    | TS    | US     | XS    | ZM      |
|------|-------|-------|---------|-------|-------|-------|-------|--------|-------|---------|
| 1.50 | 0.438 | 1.000 | 3.375** | 0.500 | 1.125 | 0.375 | 2.750 | 3.500  | 2.250 | 7.875** |
| 2.00 | 0.438 | 1.250 | 3.375** | 0.500 | 1.125 | 0.375 | 3.250 | 4.000  | 2.250 | 7.875** |
| 2.50 | 0.438 | 1.500 | 3.500** | 0.500 | 1.125 | 0.375 | 3.750 | 4.500  | 2.500 | 8.500** |
| 3.25 | 0.563 | 1.875 | 3.750   | 0.750 | 1.250 | 0.500 | 4.750 | 5.750  | 2.875 | 9.500   |
| 4.00 | 0.563 | 2.250 | 3.750   | 0.750 | 1.250 | 0.500 | 5.500 | 6.500  | 2.875 | 9.500   |
| 5.00 | 0.813 | 2.750 | 3.625   | 1.000 | 1.063 | 0.688 | 6.875 | 8.250  | 3.563 | 10.750  |
| 6.00 | 0.813 | 3.250 | 4.125   | 1.000 | 1.313 | 0.688 | 7.875 | 9.250  | 3.688 | 11.500  |
| 8.00 | 0.813 | 4.250 | 4.250   | 1.000 | 1.313 | 0.688 | 9.875 | 11.250 | 3.938 | 12.125  |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

MS4D3



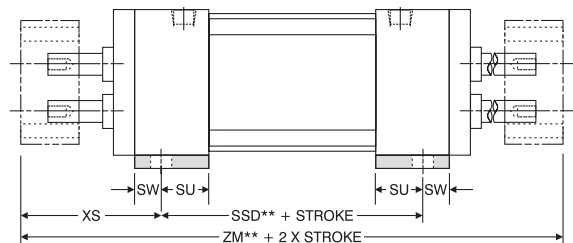
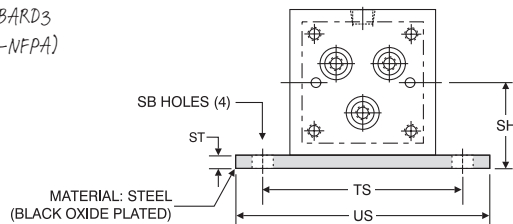
MS4D3 Mount

| Bore | E/2   | NT      | TK    | TN    | XT    | SN      |
|------|-------|---------|-------|-------|-------|---------|
| 1.50 | 1.000 | 1/4-20  | 0.375 | 0.625 | 2.813 | 2.250** |
| 2.00 | 1.250 | 5/16-18 | 0.500 | 0.875 | 2.813 | 2.250** |
| 2.50 | 1.500 | 3/8-16  | 0.625 | 1.250 | 3.063 | 2.375** |
| 3.25 | 1.875 | 1/2-13  | 0.750 | 1.500 | 3.438 | 2.625   |
| 4.00 | 2.250 | 1/2-13  | 0.750 | 2.063 | 3.438 | 2.625   |
| 5.00 | 2.750 | 5/8-11  | 1.000 | 2.688 | 3.938 | 2.875   |
| 6.00 | 3.250 | 3/4-10  | 1.125 | 3.250 | 4.188 | 3.125   |
| 8.00 | 4.250 | 3/4-10  | 1.125 | 4.500 | 4.438 | 3.250   |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

BASEBARD3

(Non-NFPA)



BASEBARD3 (Non-NFPA) Mount

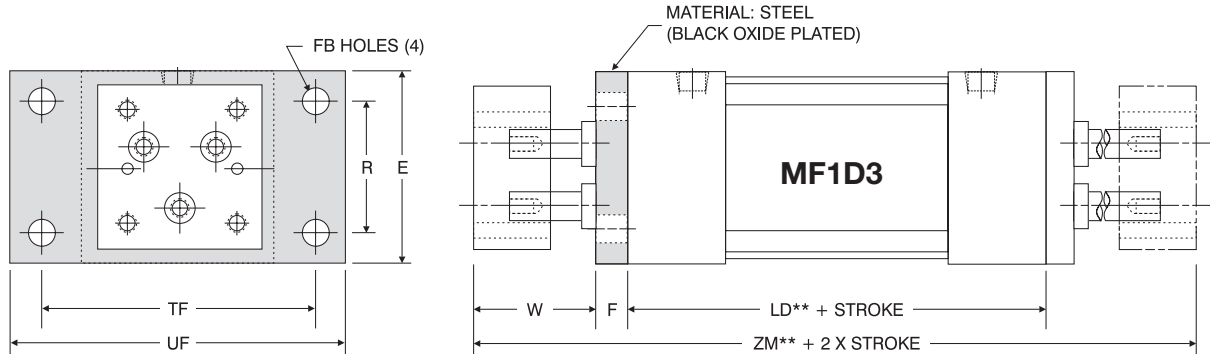
| Bore | SB    | SH    | SSD     | ST    | SU    | SW    | TS    | US    | XS    | ZM      |
|------|-------|-------|---------|-------|-------|-------|-------|-------|-------|---------|
| 1.50 | 0.438 | 1.250 | 3.375** | 0.250 | 1.125 | 0.375 | 2.750 | 3.500 | 2.250 | 7.875** |
| 2.00 | 0.438 | 1.500 | 3.375** | 0.250 | 1.125 | 0.375 | 3.250 | 4.000 | 2.250 | 7.875** |
| 2.50 | 0.438 | 1.875 | 3.500** | 0.375 | 1.125 | 0.375 | 3.750 | 4.500 | 2.500 | 8.500** |
| 3.25 | 0.563 | 2.375 | 3.750   | 0.500 | 1.250 | 0.500 | 4.750 | 5.750 | 2.875 | 9.500   |
| 4.00 | 0.563 | 2.750 | 3.750   | 0.500 | 1.250 | 0.500 | 5.500 | 6.500 | 2.875 | 9.500   |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

## TRA Series Dimensions: Double Rod End

### Flange Mounts (1.50" - 6.00" Bore)

MF1D3



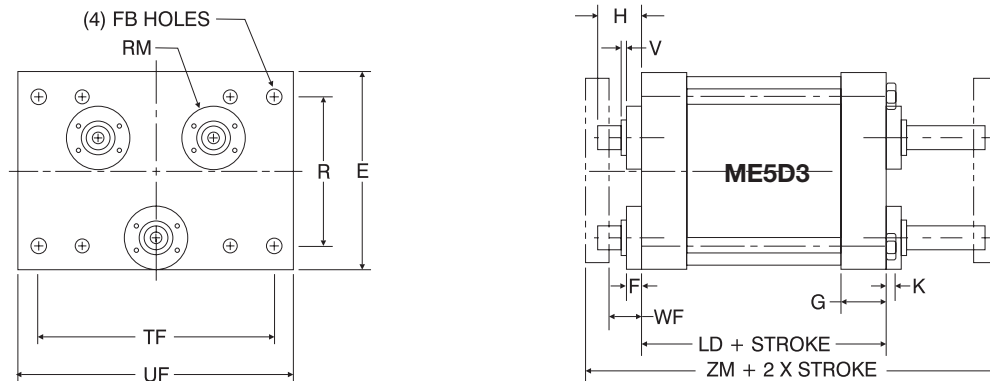
MF1D3 Mount

| Bore | E     | F     | FB    | LD      | R     | TF    | UF    | W     | ZM      |
|------|-------|-------|-------|---------|-------|-------|-------|-------|---------|
| 1.50 | 2.000 | 0.375 | 0.313 | 4.125** | 1.438 | 2.750 | 3.375 | 1.500 | 7.875** |
| 2.00 | 2.500 | 0.375 | 0.375 | 4.125** | 1.844 | 3.375 | 4.125 | 1.500 | 7.875** |
| 2.50 | 3.000 | 0.375 | 0.375 | 4.250** | 2.188 | 3.875 | 4.625 | 1.750 | 8.500** |
| 3.25 | 3.750 | 0.625 | 0.438 | 4.750   | 2.760 | 4.688 | 5.500 | 1.750 | 9.500   |
| 4.00 | 4.500 | 0.625 | 0.438 | 4.750   | 3.320 | 5.438 | 6.250 | 1.750 | 9.500   |
| 5.00 | 5.500 | 0.625 | 0.563 | 5.000   | 4.100 | 6.625 | 7.625 | 2.250 | 10.750  |
| 6.00 | 6.500 | 0.750 | 0.563 | 5.500   | 4.875 | 7.625 | 8.625 | 2.250 | 11.500  |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

### Flange Mounts (8.00" Bore)

ME5D3



ME5D3 Mount

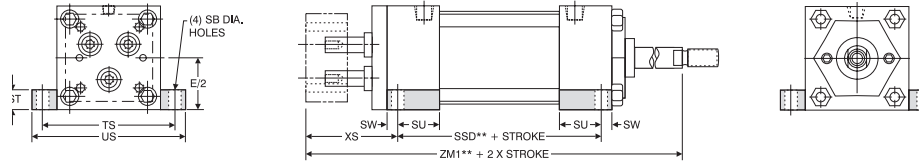
| Bore | E     | F     | FB    | G     | H     | K     | LD    | R     | RM    | TE    | TF     | UF     | V    | WF    | ZM     |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|------|-------|--------|
| 8.00 | 8.500 | 0.625 | 0.688 | 2.000 | 2.844 | 0.563 | 5.625 | 6.438 | 2.750 | 7.563 | 10.250 | 12.000 | .250 | 2.250 | 12.125 |

Note: Three (3) 1.00" diameter rods on 5.750 B.C.

# How To Specify

## TRA Series Dimensions: Double Rod End (With Single Rod) Base Mounts

### MS2D1 (Triple Rod With Single Rod)

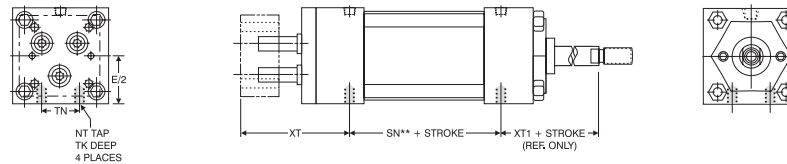


MS2D1 Mount

| Bore | SB    | E/2   | SSD     | ST    | SU    | SW    | TS    | US     | XS    | ZM1     |
|------|-------|-------|---------|-------|-------|-------|-------|--------|-------|---------|
| 1.50 | 0.438 | 1.000 | 3.375** | 0.500 | 1.125 | 0.375 | 2.750 | 3.500  | 2.250 | 7.000** |
| 2.00 | 0.438 | 1.250 | 3.375** | 0.500 | 1.125 | 0.375 | 3.250 | 4.000  | 2.250 | 7.000** |
| 2.50 | 0.438 | 1.500 | 3.500** | 0.500 | 1.125 | 0.375 | 3.750 | 4.500  | 2.500 | 7.375** |
| 3.25 | 0.563 | 1.875 | 3.750   | 0.750 | 1.250 | 0.500 | 4.750 | 5.750  | 2.875 | 8.500   |
| 4.00 | 0.563 | 2.250 | 3.750   | 0.750 | 1.250 | 0.500 | 5.500 | 6.500  | 2.875 | 8.500   |
| 5.00 | 0.813 | 2.750 | 3.625   | 1.000 | 1.063 | 0.688 | 6.875 | 8.250  | 3.563 | 9.250   |
| 6.00 | 0.813 | 3.250 | 4.125   | 1.000 | 1.313 | 0.688 | 7.875 | 9.250  | 3.688 | 10.125  |
| 8.00 | 0.813 | 4.250 | 4.250   | 1.000 | 1.313 | 0.688 | 9.875 | 11.250 | 3.938 | 10.500  |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

### MS4D1 (Triple Rod With Single Rod)

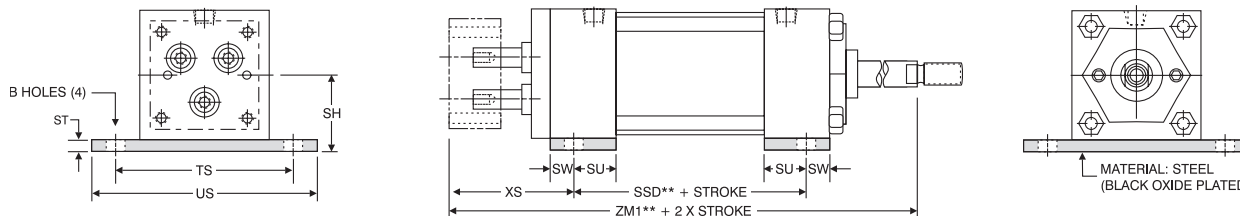


MS4D1 Mount

| Bore | E/2   | NT       | TK    | TN    | XT    | SN      | XT1   |
|------|-------|----------|-------|-------|-------|---------|-------|
| 1.50 | 1.000 | 1/4 -20  | 0.375 | 0.625 | 2.813 | 2.250** | 1.938 |
| 2.00 | 1.250 | 5/16 -18 | 0.500 | 0.875 | 2.813 | 2.250** | 1.938 |
| 2.50 | 1.500 | 3/8 -16  | 0.625 | 1.250 | 3.063 | 2.375** | 1.938 |
| 3.25 | 1.875 | 1/2 -13  | 0.750 | 1.500 | 3.438 | 2.625   | 2.438 |
| 4.00 | 2.250 | 1/2 -13  | 0.750 | 2.063 | 3.438 | 2.625   | 2.438 |
| 5.00 | 2.750 | 5/8 -11  | 1.000 | 2.688 | 3.938 | 2.875   | 2.438 |
| 6.00 | 3.250 | 3/4 -10  | 1.125 | 3.250 | 4.188 | 3.125   | 2.813 |
| 8.00 | 4.250 | 3/4 -10  | 1.125 | 4.500 | 4.438 | 3.250   | 2.813 |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

### BASEBARD1 (Triple Rod With Single Rod) (Non-NFPA)



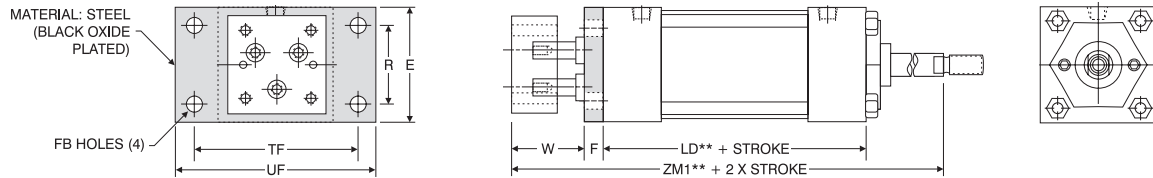
BASEBARD1 (Non-NFPA) Mount

| Bore | SB    | SH    | SSD     | ST    | SU    | SW    | TS    | US    | XS    | ZM1     |
|------|-------|-------|---------|-------|-------|-------|-------|-------|-------|---------|
| 1.50 | 0.438 | 1.250 | 3.375** | 0.250 | 1.125 | 0.375 | 2.750 | 3.500 | 2.250 | 7.000** |
| 2.00 | 0.438 | 1.500 | 3.375** | 0.250 | 1.125 | 0.375 | 3.250 | 4.000 | 2.250 | 7.000** |
| 2.50 | 0.438 | 1.875 | 3.500** | 0.375 | 1.125 | 0.375 | 3.750 | 4.500 | 2.500 | 7.375** |
| 3.25 | 0.563 | 2.375 | 3.750   | 0.500 | 1.250 | 0.500 | 4.750 | 5.750 | 2.875 | 8.500   |
| 4.00 | 0.563 | 2.750 | 3.750   | 0.500 | 1.250 | 0.500 | 5.500 | 6.500 | 2.875 | 8.500   |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

## TRA Series Dimensions: Double Rod End (With Single Rod) Base Mounts

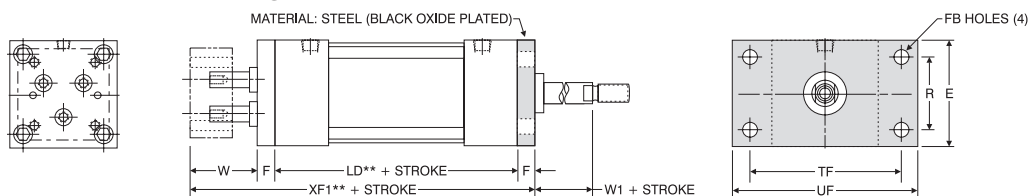
### MF1D1 (Triple Rod With Single Rod)



| MF1D1 Mount |       |       |       |         |       |       |       |       |         |
|-------------|-------|-------|-------|---------|-------|-------|-------|-------|---------|
| Bore        | E     | F     | FB    | LD      | R     | TF    | UF    | W     | ZM1     |
| 1.50        | 2.000 | 0.375 | 0.313 | 4.125** | 1.438 | 2.750 | 3.375 | 1.500 | 7.000** |
| 2.00        | 2.500 | 0.375 | 0.375 | 4.125** | 1.844 | 3.375 | 4.125 | 1.500 | 7.000** |
| 2.50        | 3.000 | 0.375 | 0.375 | 4.250** | 2.188 | 3.875 | 4.625 | 1.750 | 7.375** |
| 3.25        | 3.750 | 0.625 | 0.438 | 4.750   | 2.760 | 4.688 | 5.500 | 1.750 | 8.500   |
| 4.00        | 4.500 | 0.625 | 0.438 | 4.750   | 3.320 | 5.438 | 6.250 | 1.750 | 8.500   |
| 5.00        | 5.500 | 0.625 | 0.563 | 5.000   | 4.100 | 6.625 | 7.625 | 2.250 | 9.250   |
| 6.00        | 6.500 | 0.750 | 0.563 | 5.500   | 4.875 | 7.625 | 8.625 | 2.250 | 10.125  |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

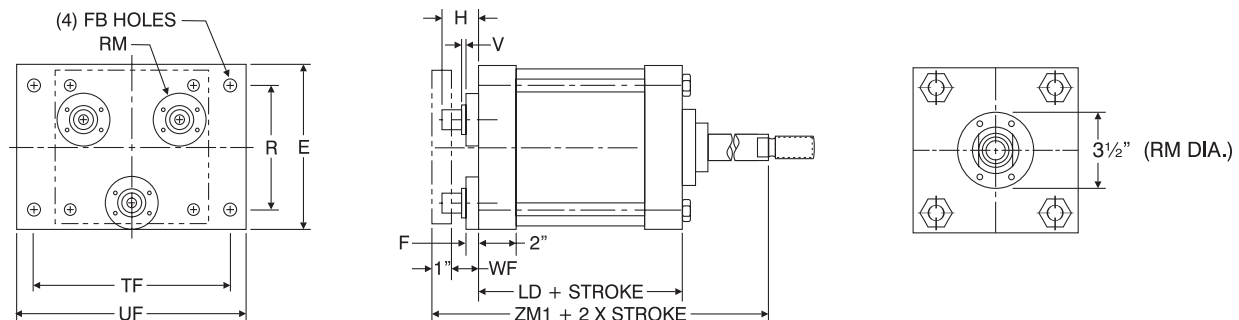
### MF2D1 (Triple Rod With Single Rod)



| MF2D1 Mount |       |       |       |         |       |       |       |       |         |       |
|-------------|-------|-------|-------|---------|-------|-------|-------|-------|---------|-------|
| Bore        | E     | F     | FB    | LD      | R     | TF    | UF    | W     | XF1     | W1    |
| 1.50        | 2.000 | 0.375 | 0.313 | 4.125** | 1.438 | 2.750 | 3.375 | 1.500 | 6.375** | 0.625 |
| 2.00        | 2.500 | 0.375 | 0.375 | 4.125** | 1.844 | 3.375 | 4.125 | 1.500 | 6.375** | 0.625 |
| 2.50        | 3.000 | 0.375 | 0.375 | 4.250** | 2.188 | 3.875 | 4.625 | 1.750 | 6.750** | 0.625 |
| 3.25        | 3.750 | 0.625 | 0.438 | 4.750   | 2.760 | 4.688 | 5.500 | 1.750 | 7.750   | 0.750 |
| 4.00        | 4.500 | 0.625 | 0.438 | 4.750   | 3.320 | 5.438 | 6.250 | 1.750 | 7.750   | 0.750 |
| 5.00        | 5.500 | 0.625 | 0.563 | 5.000   | 4.100 | 6.625 | 7.625 | 2.250 | 8.500   | 0.750 |
| 6.00        | 6.500 | 0.750 | 0.563 | 5.500   | 4.875 | 7.625 | 8.625 | 2.250 | 9.250   | 0.875 |

\*\*Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

### ME5D1 (Triple Rod With Single Rod)



| ME5D1 Mount |       |       |       |       |       |       |        |        |       |       |       |        |
|-------------|-------|-------|-------|-------|-------|-------|--------|--------|-------|-------|-------|--------|
| Bore        | E     | F     | FB    | H     | R     | RM    | TF     | UF     | V     | WF    | LD    | ZM1    |
| 8.00        | 8.500 | 0.625 | 0.688 | 2.844 | 6.438 | 2.750 | 10.250 | 12.000 | 0.250 | 2.250 | 5.625 | 10.500 |

Note: Three (3) 1.00" diameter rods on 5.750 B.C.

# How to Customize

## Options

### ST=2 • ST=4

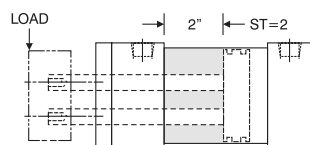
#### Stop Tubes

Stop Tubes are designed to reduce the piston rod bushing stress to within the designed range of the bearing material. This will insure proper cylinder performance, in any given application. Stop Tubes lower cylinder bearing stress by adding length to the piston, which increases the overall length of the cylinder.

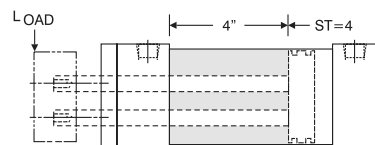
Ordering Example: TRA MS4 2.00 x 10ES-ST=2

**The effective stroke (ES) must be included when ordering.**

ST=2



ST=4



Note: 2" and 4" are recommended stop tube lengths. Other lengths can be specified, but will not increase side load tolerance or reduce tool plate end play.

### Strokes

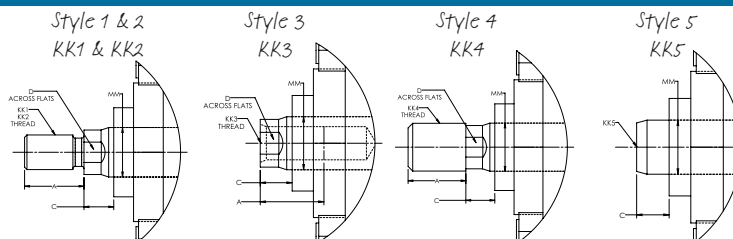
| Bore | Recommended Maximum* Stroke Lengths |           |           |                       |               |               |
|------|-------------------------------------|-----------|-----------|-----------------------|---------------|---------------|
|      | Single Rod End Models               |           |           | Double Rod End Models |               |               |
|      | TRA                                 | TRA ST=2" | TRA ST=4" | TRA "D"               | TRA "D" ST=2" | TRA "D" ST=4" |
| 1.50 | 10                                  | 12        | 14        | 12                    | 14            | 16            |
| 2.00 | 14                                  | 18        | 24        | 18                    | 24            | 30            |
| 2.50 | 20                                  | 24        | 30        | 30                    | 38            | 40            |
| 3.25 | 24                                  | 28        | 36        | 34                    | 42            | 46            |
| 4.00 | 24                                  | 30        | 38        | 36                    | 44            | 48            |
| 5.00 | 26                                  | 34        | 42        | 40                    | 52            | 56            |
| 6.00 | 28                                  | 36        | 44        | 42                    | 54            | 58            |
| 8.00 | 30                                  | 38        | 46        | 42                    | 54            | 60            |

\*Maximum Stroke For Horizontal Applications.

### "D1" Rod End Options

KK1 is standard (leave blank). Specify at end of part number for -KK2, -KK3, -KK4 or -KK5.

Piston rod end styles apply to single rod end of cylinder only.



| Bore             | MM1 Rod Diameter | Standard       |       | Optional       |       |                  |       |                |       |                 | C1*   | V1    |
|------------------|------------------|----------------|-------|----------------|-------|------------------|-------|----------------|-------|-----------------|-------|-------|
|                  |                  | Style 1 - Male |       | Style 2 - Male |       | Style 3 - Female |       | Style 4 - Male |       | Style 5 - Blank |       |       |
|                  |                  | KK1            | A     | KK2            | A     | KK3              | A     | KK4            | A     | KK5             |       |       |
| 1.50, 2.00, 2.50 | 0.625 Standard   | 7/16 -20       | 0.750 | 1/2 -20        | 0.750 | 7/16 -20         | 0.750 | 5/8 -18        | 0.750 | No Threads      | 0.375 | 0.250 |
| 3.25, 4.00, 5.00 | 1.000 Standard   | 3/4 -16        | 1.125 | 7/8 -14        | 1.125 | 3/4 -16          | 1.125 | 1 -14          | 1.125 | No Threads      | 0.500 | 0.250 |
| 6.00 & 8.00      | 1.375 Standard   | 1 -14          | 1.625 | 1 1/4 -12      | 1.625 | 1 -14            | 1.625 | 1 3/8 -12      | 1.625 | No Threads      | 0.625 | 0.375 |

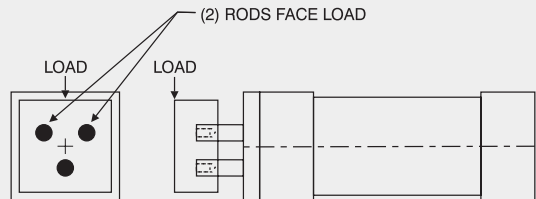
\*Dimension is with single rod fully retracted.

## Technical Data – Load Charts: 1.50" - 4.00" Bore

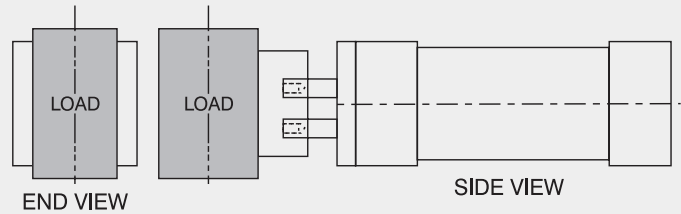
### How To Use Load Charts:

1. Determine weight of Load (pounds)
2. Refer to Load Charts for model selection

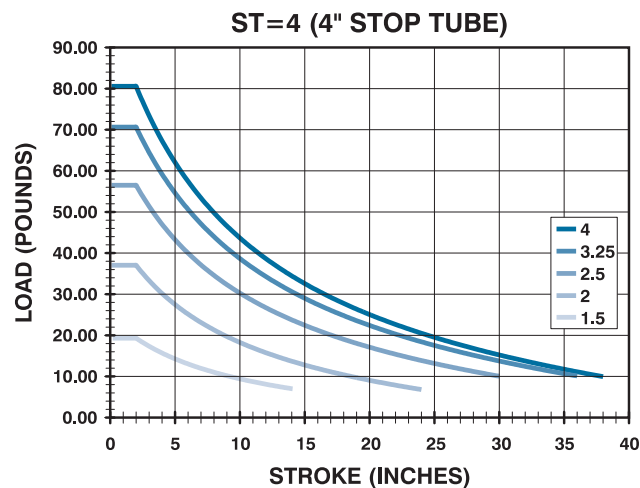
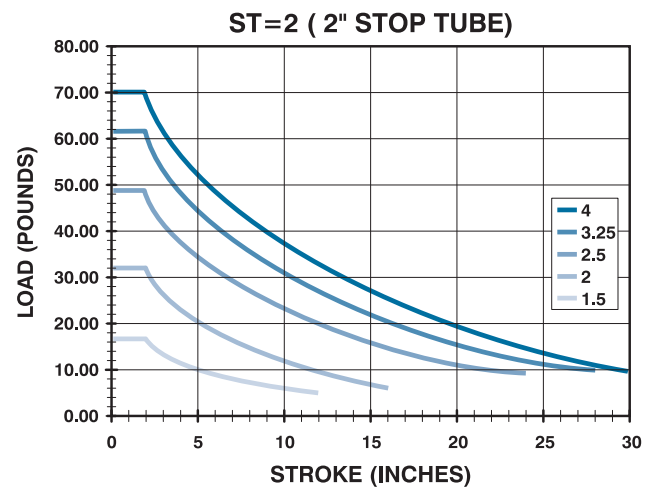
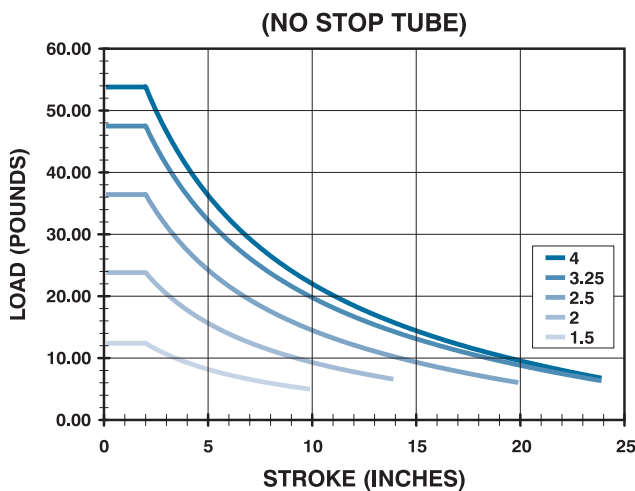
### Triple Rod Mounting To Load:



Example 1



## Single Rod End: 1.50" - 4.00" Bore Maximum Recommended Load



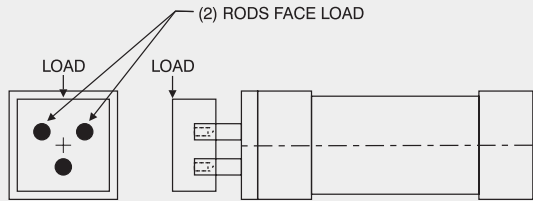
# How To Specify

## Technical Data – Load Charts: 5.00" - 8.00" Bore

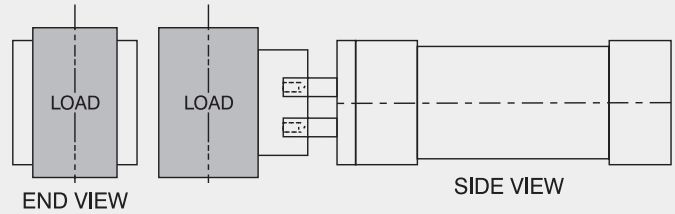
### How To Use Load Charts:

1. Determine weight of Load (pounds)
2. Refer to Load Charts for model selection

### Triple Rod Mounting To Load:

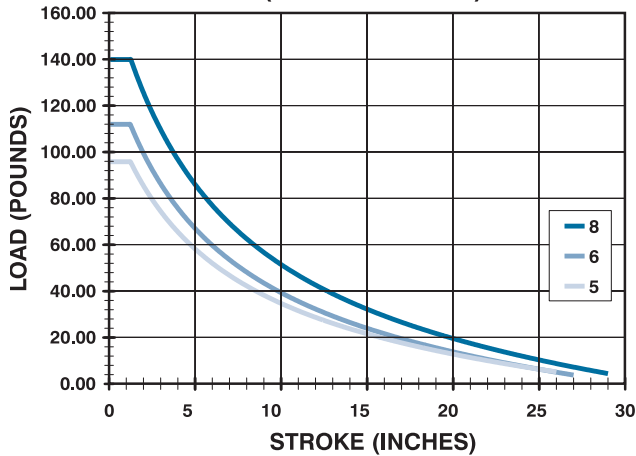


Example 1

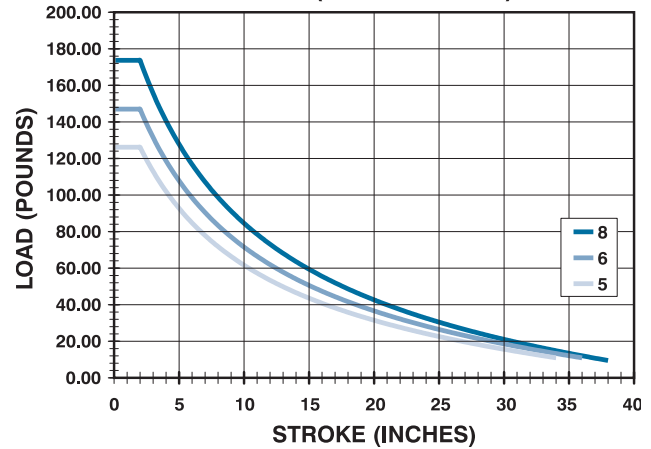


## Single Rod End: 5.00" - 8.00" Bore Maximum Recommended Load

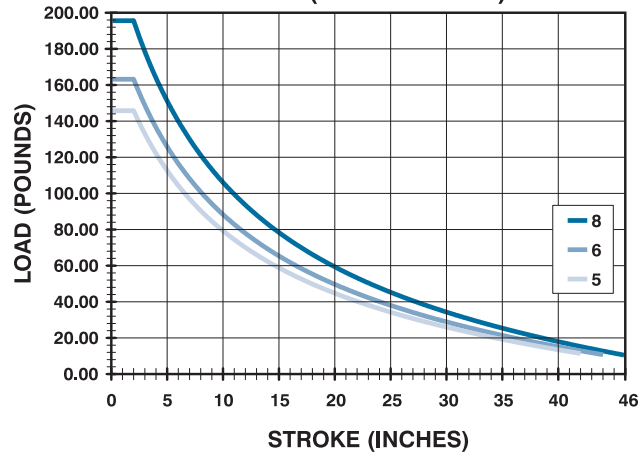
(NO STOP TUBE)



ST=2 (2" STOP TUBE)



ST=4 (4" STOP TUBE)



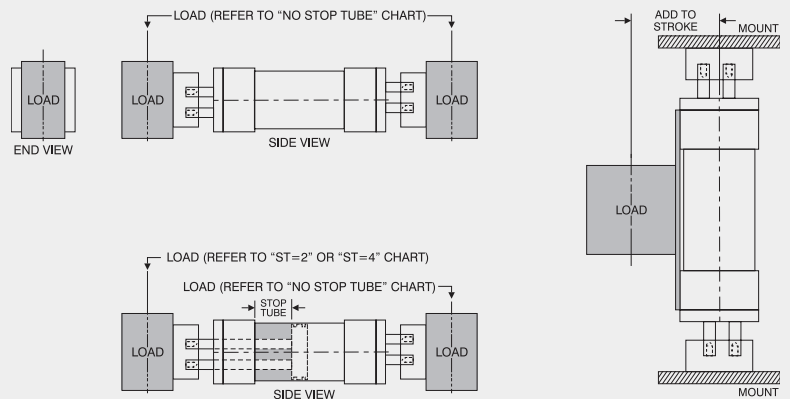
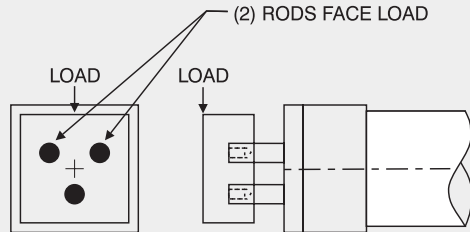


## Technical Data (D3 Models) – Load Charts: 1.50" - 4.00" Bore – Double Rod End

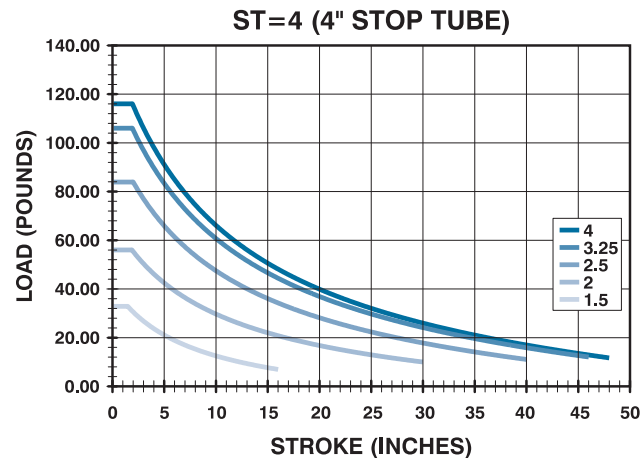
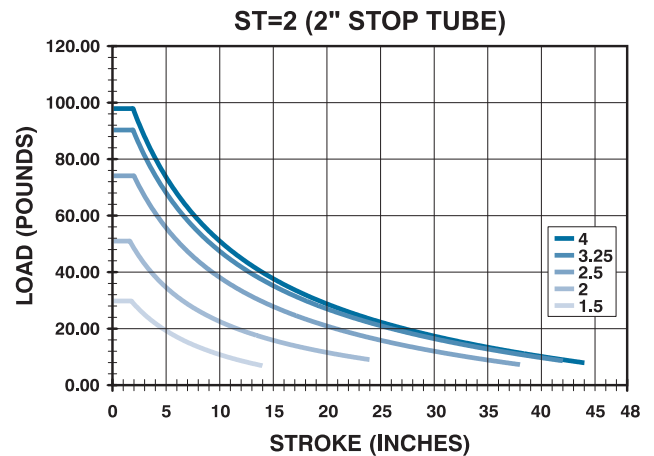
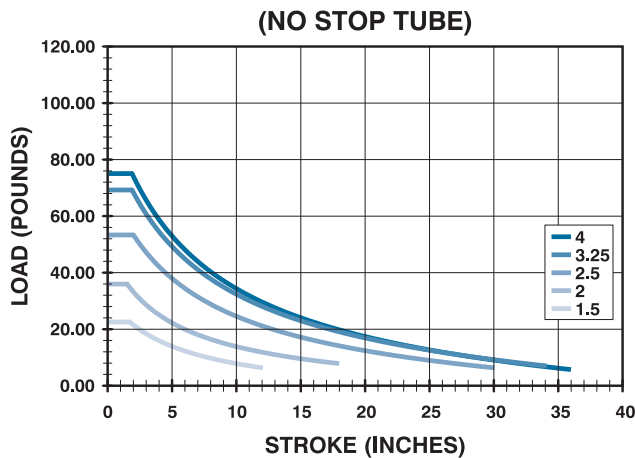
### How To Use Load Charts:

1. Determine weight of Load (pounds)
2. Refer to Load Charts for model selection

### Triple Rod Mounting To Load:



## Double Rod End: 1.50" - 4.00" Bore Maximum Recommended Load



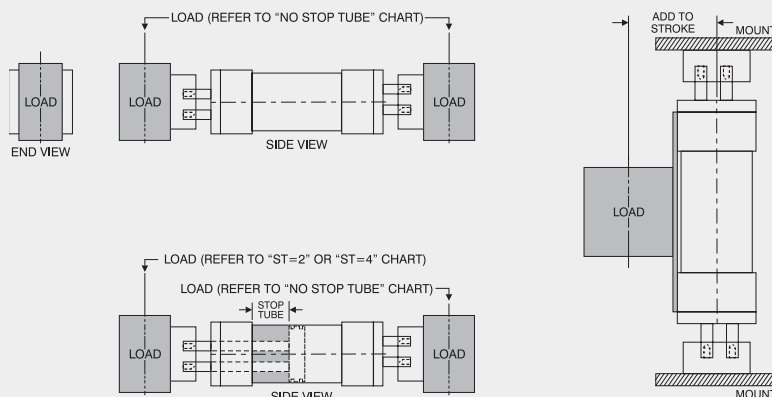
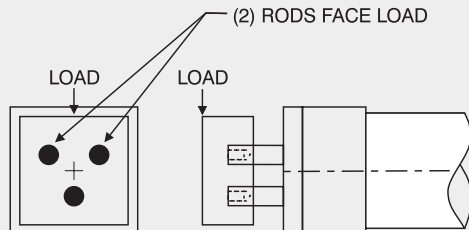
# How To Specify

## Technical Data (D3 Models) – Load Charts: 5.00" - 8.00" Bore – Double Rod End

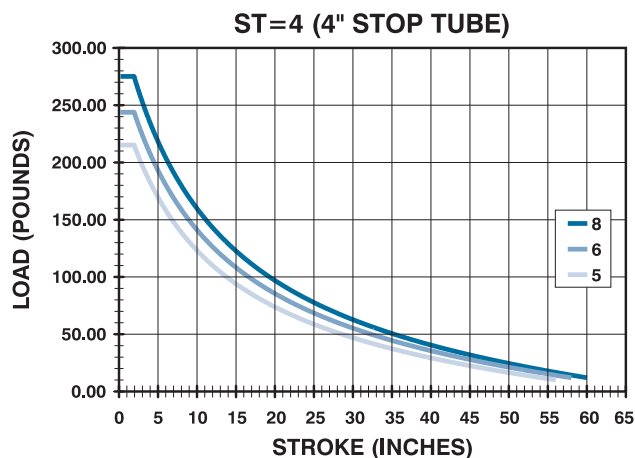
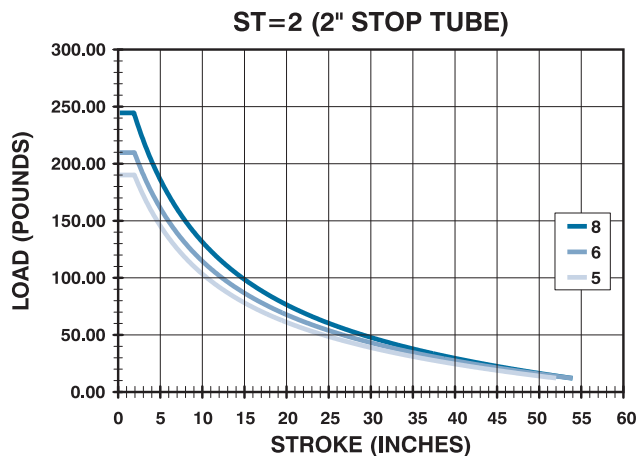
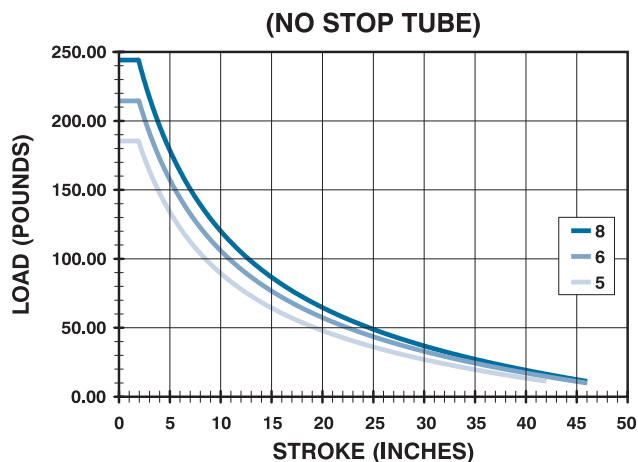
### How To Use Load Charts:

1. Determine weight of Load (pounds)
2. Refer to Load Charts for model selection

### Triple Rod Mounting To Load:



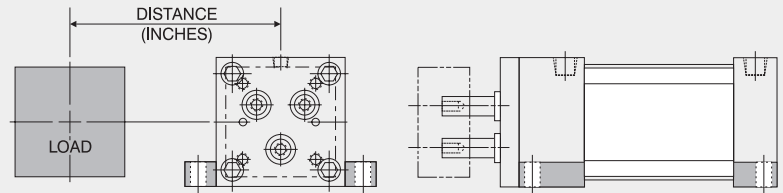
## Double Rod End: 5.00" - 8.00" Bore Maximum Recommended Load



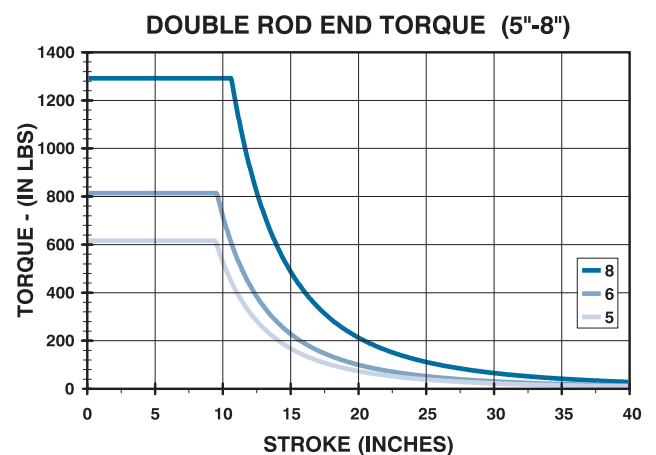
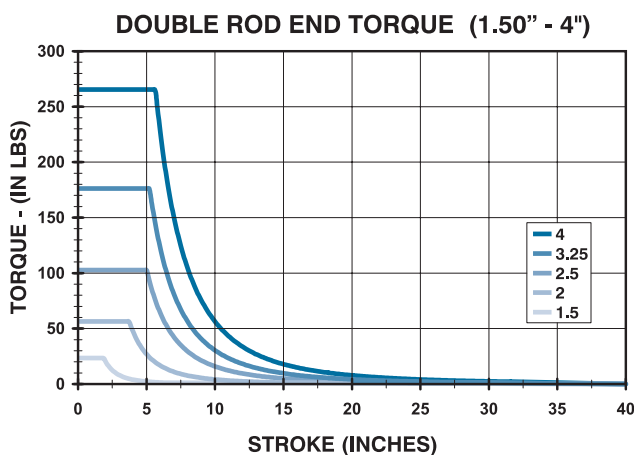
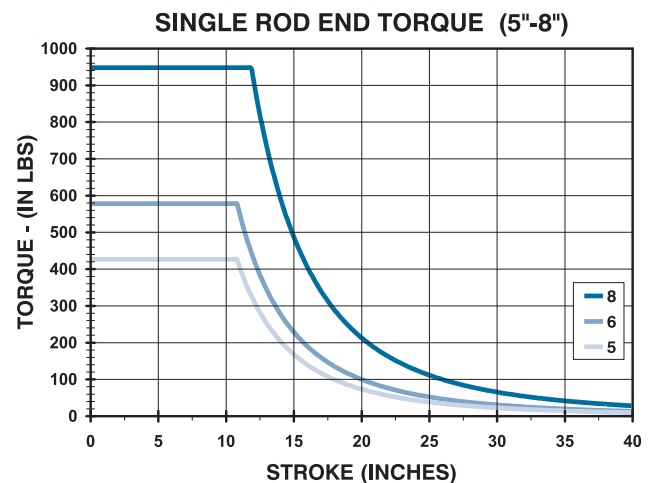
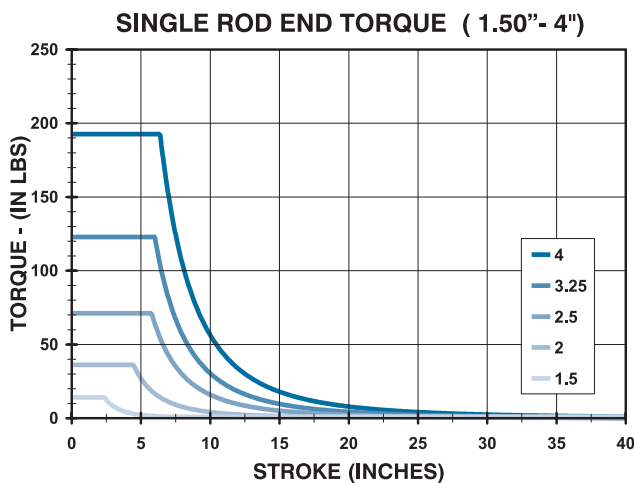
## Technical Data – Torque Charts

### How To Use Torque Charts:

1. Determine weight of Load (pounds)
2. Determine DISTANCE (inches) of Load off center of Cylinder
3. Multiply:  
Load (in pounds) X DISTANCE (inches)  
= Inch-Pounds of TORQUE
4. Refer to Torque Charts for model selection



### Torque (Inch-Pounds) – (For No Stop Tube, ST=2" & ST=4" Models)



# How To Specify

## Technical Data – Tooling Plate End Play Charts

Note: Tooling Plate End Play values include rod deflection due to weight of rods and tool plate only (no load), parts clearance and maximum manufacturing tolerances.

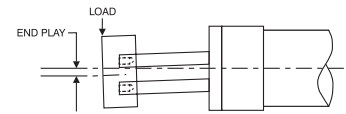
### Single Rod End Cylinders - No Stop Tube

| 1.50" - 8.00" Bore Single Rod End Cylinders - No Stop Tube |       |       |       |       |       |       |       |       |
|------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Stroke                                                     | 1.50  | 2.00  | 2.50  | 3.25  | 4.00  | 5.00  | 6.00  | 8.00  |
| 0                                                          | 0.006 | 0.006 | 0.006 | 0.006 | 0.009 | 0.010 | 0.010 | 0.007 |
| 2                                                          | 0.015 | 0.017 | 0.013 | 0.013 | 0.022 | 0.024 | 0.023 | 0.018 |
| 4                                                          | 0.024 | 0.027 | 0.021 | 0.021 | 0.034 | 0.038 | 0.037 | 0.030 |
| 6                                                          | 0.033 | 0.037 | 0.029 | 0.028 | 0.047 | 0.051 | 0.051 | 0.042 |
| 8                                                          | 0.042 | 0.047 | 0.037 | 0.036 | 0.059 | 0.065 | 0.065 | 0.053 |
| 10                                                         | 0.051 | 0.058 | 0.044 | 0.044 | 0.071 | 0.079 | 0.079 | 0.065 |
| 12                                                         | —     | 0.068 | 0.052 | 0.051 | 0.084 | 0.092 | 0.093 | 0.077 |
| 14                                                         | —     | 0.078 | 0.060 | 0.059 | 0.096 | 0.106 | 0.106 | 0.088 |
| 16                                                         | —     | —     | 0.067 | 0.066 | 0.109 | 0.120 | 0.120 | 0.100 |
| 18                                                         | —     | —     | 0.075 | 0.074 | 0.121 | 0.133 | 0.134 | 0.112 |
| 20                                                         | —     | —     | 0.083 | 0.081 | 0.134 | 0.147 | 0.148 | 0.123 |
| 22                                                         | —     | —     | —     | 0.089 | 0.146 | 0.161 | 0.162 | 0.135 |
| 24                                                         | —     | —     | —     | 0.097 | 0.158 | 0.174 | 0.176 | 0.147 |
| 26                                                         | —     | —     | —     | —     | —     | 0.188 | 0.190 | 0.158 |
| 28                                                         | —     | —     | —     | —     | —     | —     | 0.203 | 0.170 |
| 30                                                         | —     | —     | —     | —     | —     | —     | —     | 0.182 |

### Single Rod End Cylinders - 4" Stop Tube

| 1.50" - 8.00" Bore Single Rod End Cylinders - 4.00" Stop Tube |       |       |       |       |       |       |       |       |
|---------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Stroke                                                        | 1.50  | 2.00  | 2.50  | 3.25  | 4.00  | 5.00  | 6.00  | 8.00  |
| 0                                                             | 0.002 | 0.003 | 0.003 | 0.003 | 0.005 | 0.006 | 0.008 | 0.005 |
| 2                                                             | 0.006 | 0.007 | 0.006 | 0.007 | 0.012 | 0.015 | 0.015 | 0.014 |
| 4                                                             | 0.009 | 0.012 | 0.010 | 0.011 | 0.019 | 0.023 | 0.025 | 0.022 |
| 6                                                             | 0.013 | 0.016 | 0.014 | 0.015 | 0.026 | 0.032 | 0.034 | 0.031 |
| 8                                                             | 0.016 | 0.021 | 0.017 | 0.019 | 0.033 | 0.040 | 0.043 | 0.039 |
| 10                                                            | 0.020 | 0.025 | 0.021 | 0.023 | 0.040 | 0.049 | 0.052 | 0.048 |
| 12                                                            | 0.024 | 0.030 | 0.024 | 0.027 | 0.047 | 0.057 | 0.061 | 0.057 |
| 14                                                            | 0.027 | 0.035 | 0.028 | 0.031 | 0.054 | 0.066 | 0.070 | 0.065 |
| 16                                                            | —     | 0.039 | 0.032 | 0.035 | 0.061 | 0.074 | 0.080 | 0.074 |
| 18                                                            | —     | 0.044 | 0.035 | 0.039 | 0.068 | 0.083 | 0.089 | 0.083 |
| 20                                                            | —     | 0.048 | 0.039 | 0.043 | 0.075 | 0.091 | 0.098 | 0.091 |
| 22                                                            | —     | 0.053 | 0.043 | 0.047 | 0.082 | 0.100 | 0.107 | 0.100 |
| 24                                                            | —     | 0.057 | 0.046 | 0.050 | 0.089 | 0.108 | 0.116 | 0.109 |
| 26                                                            | —     | —     | 0.050 | 0.054 | 0.096 | 0.117 | 0.125 | 0.117 |
| 28                                                            | —     | —     | 0.053 | 0.058 | 0.103 | 0.125 | 0.135 | 0.126 |
| 30                                                            | —     | —     | 0.057 | 0.062 | 0.110 | 0.134 | 0.144 | 0.135 |
| 32                                                            | —     | —     | —     | 0.066 | 0.117 | 0.142 | 0.153 | 0.143 |
| 34                                                            | —     | —     | —     | 0.070 | 0.124 | 0.151 | 0.162 | 0.152 |
| 36                                                            | —     | —     | —     | 0.074 | 0.131 | 0.159 | 0.171 | 0.161 |
| 38                                                            | —     | —     | —     | —     | 0.138 | 0.168 | 0.180 | 0.169 |
| 40                                                            | —     | —     | —     | —     | —     | 0.176 | 0.190 | 0.178 |
| 42                                                            | —     | —     | —     | —     | —     | 0.185 | 0.199 | 0.187 |
| 44                                                            | —     | —     | —     | —     | —     | —     | 0.208 | 0.195 |
| 46                                                            | —     | —     | —     | —     | —     | —     | —     | 0.204 |

### TOOLING PLATE END PLAY



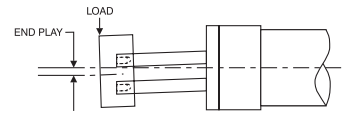
### Single Rod End Cylinders - 2" Stop Tube

| 1.50" - 8.00" Bore Single Rod End Cylinders - 2.00" Stop Tube |       |       |       |       |       |       |       |       |
|---------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Stroke                                                        | 1.50  | 2.00  | 2.50  | 3.25  | 4.00  | 5.00  | 6.00  | 8.00  |
| 0                                                             | 0.006 | 0.004 | 0.004 | 0.004 | 0.007 | 0.008 | 0.008 | 0.007 |
| 2                                                             | 0.009 | 0.011 | 0.009 | 0.009 | 0.016 | 0.019 | 0.019 | 0.016 |
| 4                                                             | 0.014 | 0.017 | 0.014 | 0.015 | 0.026 | 0.030 | 0.031 | 0.026 |
| 6                                                             | 0.019 | 0.024 | 0.019 | 0.020 | 0.035 | 0.041 | 0.042 | 0.036 |
| 8                                                             | 0.024 | 0.030 | 0.024 | 0.026 | 0.044 | 0.052 | 0.054 | 0.047 |
| 10                                                            | 0.030 | 0.037 | 0.029 | 0.031 | 0.054 | 0.063 | 0.065 | 0.057 |
| 12                                                            | 0.035 | 0.043 | 0.035 | 0.036 | 0.063 | 0.074 | 0.076 | 0.067 |
| 14                                                            | —     | 0.049 | 0.040 | 0.042 | 0.072 | 0.084 | 0.088 | 0.077 |
| 16                                                            | —     | 0.056 | 0.045 | 0.047 | 0.082 | 0.095 | 0.099 | 0.088 |
| 18                                                            | —     | 0.062 | 0.050 | 0.053 | 0.091 | 0.106 | 0.111 | 0.098 |
| 20                                                            | —     | —     | 0.055 | 0.058 | 0.100 | 0.117 | 0.122 | 0.108 |
| 22                                                            | —     | —     | 0.060 | 0.064 | 0.110 | 0.128 | 0.134 | 0.118 |
| 24                                                            | —     | —     | 0.065 | 0.069 | 0.119 | 0.139 | 0.145 | 0.129 |
| 26                                                            | —     | —     | —     | 0.074 | 0.128 | 0.150 | 0.156 | 0.139 |
| 28                                                            | —     | —     | —     | 0.080 | 0.138 | 0.161 | 0.168 | 0.149 |
| 30                                                            | —     | —     | —     | —     | 0.147 | 0.172 | 0.179 | 0.159 |
| 32                                                            | —     | —     | —     | —     | —     | 0.183 | 0.191 | 0.170 |
| 34                                                            | —     | —     | —     | —     | —     | 0.193 | 0.202 | 0.180 |
| 36                                                            | —     | —     | —     | —     | —     | —     | 0.214 | 0.190 |
| 38                                                            | —     | —     | —     | —     | —     | —     | —     | 0.200 |

## Technical Data – Tooling Plate End Play Charts (D3 Models)

Note: Tooling Plate End Play values include rod deflection due to weight of rods and tool plate only (no load), parts clearance and maximum manufacturing tolerances.

### TOOLING PLATE END PLAY



### Double Rod End Cylinders - No Stop Tube

| 1.50" - 8.00" Bore Double Rod End Cylinders - No Stop Tube |       |       |       |       |       |       |       |       |
|------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Stroke                                                     | 1.50  | 2.00  | 2.50  | 3.25  | 4.00  | 5.00  | 6.00  | 8.00  |
| 0                                                          | 0.003 | 0.003 | 0.003 | 0.003 | 0.004 | 0.005 | 0.005 | 0.004 |
| 2                                                          | 0.007 | 0.008 | 0.006 | 0.006 | 0.011 | 0.012 | 0.011 | 0.009 |
| 4                                                          | 0.012 | 0.013 | 0.010 | 0.010 | 0.017 | 0.019 | 0.018 | 0.015 |
| 6                                                          | 0.017 | 0.018 | 0.014 | 0.014 | 0.023 | 0.025 | 0.025 | 0.021 |
| 8                                                          | 0.021 | 0.023 | 0.018 | 0.018 | 0.029 | 0.032 | 0.032 | 0.026 |
| 10                                                         | 0.026 | 0.029 | 0.022 | 0.022 | 0.035 | 0.039 | 0.039 | 0.032 |
| 12                                                         | 0.031 | 0.034 | 0.026 | 0.025 | 0.042 | 0.046 | 0.046 | 0.038 |
| 14                                                         | —     | 0.038 | 0.030 | 0.029 | 0.048 | 0.053 | 0.053 | 0.044 |
| 16                                                         | —     | 0.044 | 0.033 | 0.033 | 0.054 | 0.060 | 0.060 | 0.050 |
| 18                                                         | —     | 0.050 | 0.037 | 0.037 | 0.060 | 0.066 | 0.067 | 0.056 |
| 20                                                         | —     | —     | 0.041 | 0.040 | 0.067 | 0.073 | 0.074 | 0.061 |
| 22                                                         | —     | —     | 0.045 | 0.044 | 0.073 | 0.080 | 0.081 | 0.067 |
| 24                                                         | —     | —     | 0.049 | 0.048 | 0.079 | 0.087 | 0.088 | 0.073 |
| 26                                                         | —     | —     | 0.053 | 0.052 | 0.085 | 0.094 | 0.095 | 0.079 |
| 28                                                         | —     | —     | 0.057 | 0.056 | 0.091 | 0.100 | 0.101 | 0.085 |
| 30                                                         | —     | —     | 0.060 | 0.059 | 0.098 | 0.107 | 0.108 | 0.091 |
| 32                                                         | —     | —     | —     | 0.063 | 0.104 | 0.114 | 0.115 | 0.096 |
| 34                                                         | —     | —     | —     | —     | 0.110 | 0.121 | 0.122 | 0.102 |
| 36                                                         | —     | —     | —     | —     | 0.116 | 0.128 | 0.129 | 0.108 |
| 38                                                         | —     | —     | —     | —     | —     | 0.135 | 0.136 | 0.114 |
| 40                                                         | —     | —     | —     | —     | —     | —     | 0.143 | 0.120 |
| 42                                                         | —     | —     | —     | —     | —     | —     | 0.150 | 0.126 |

### Double Rod End Cylinders - 4" Stop Tube

| 1.50" - 8.00" Bore Double Rod End Cylinders - 4.00" Stop Tube |       |       |       |       |       |       |       |       |
|---------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Stroke                                                        | 1.50  | 2.00  | 2.50  | 3.25  | 4.00  | 5.00  | 6.00  | 8.00  |
| 0                                                             | 0.002 | 0.003 | 0.003 | 0.003 | 0.004 | 0.004 | 0.004 | 0.003 |
| 2                                                             | 0.003 | 0.004 | 0.004 | 0.004 | 0.006 | 0.007 | 0.007 | 0.007 |
| 4                                                             | 0.004 | 0.006 | 0.005 | 0.005 | 0.009 | 0.011 | 0.012 | 0.011 |
| 6                                                             | 0.006 | 0.008 | 0.007 | 0.007 | 0.013 | 0.016 | 0.017 | 0.015 |
| 8                                                             | 0.008 | 0.010 | 0.008 | 0.009 | 0.016 | 0.020 | 0.021 | 0.019 |
| 10                                                            | 0.010 | 0.012 | 0.010 | 0.011 | 0.020 | 0.024 | 0.026 | 0.024 |
| 12                                                            | 0.012 | 0.015 | 0.012 | 0.013 | 0.023 | 0.028 | 0.030 | 0.028 |
| 14                                                            | 0.014 | 0.017 | 0.014 | 0.015 | 0.027 | 0.033 | 0.035 | 0.032 |
| 16                                                            | 0.016 | 0.020 | 0.016 | 0.017 | 0.030 | 0.037 | 0.040 | 0.037 |
| 18                                                            | —     | 0.022 | 0.017 | 0.019 | 0.034 | 0.041 | 0.044 | 0.041 |
| 20                                                            | —     | 0.024 | 0.019 | 0.021 | 0.038 | 0.045 | 0.049 | 0.045 |
| 22                                                            | —     | 0.026 | 0.021 | 0.023 | 0.041 | 0.050 | 0.053 | 0.050 |
| 24                                                            | —     | 0.028 | 0.023 | 0.025 | 0.044 | 0.054 | 0.058 | 0.054 |
| 26                                                            | —     | 0.031 | 0.025 | 0.027 | 0.048 | 0.058 | 0.062 | 0.058 |
| 28                                                            | —     | 0.033 | 0.026 | 0.029 | 0.051 | 0.062 | 0.067 | 0.063 |
| 30                                                            | —     | 0.035 | 0.028 | 0.031 | 0.055 | 0.067 | 0.072 | 0.067 |
| 32                                                            | —     | —     | 0.030 | 0.033 | 0.058 | 0.071 | 0.076 | 0.071 |
| 34                                                            | —     | —     | 0.032 | 0.035 | 0.062 | 0.075 | 0.081 | 0.076 |
| 36                                                            | —     | —     | 0.034 | 0.037 | 0.065 | 0.079 | 0.085 | 0.080 |
| 38                                                            | —     | —     | 0.036 | 0.039 | 0.069 | 0.084 | 0.090 | 0.084 |
| 40                                                            | —     | —     | 0.038 | 0.041 | 0.072 | 0.088 | 0.095 | 0.089 |
| 42                                                            | —     | —     | —     | 0.043 | 0.076 | 0.092 | 0.099 | 0.093 |
| 44                                                            | —     | —     | —     | 0.045 | 0.079 | 0.096 | 0.104 | 0.097 |
| 46                                                            | —     | —     | —     | 0.047 | 0.083 | 0.101 | 0.108 | 0.102 |
| 48                                                            | —     | —     | —     | —     | 0.086 | 0.105 | 0.113 | 0.106 |
| 50                                                            | —     | —     | —     | —     | —     | 0.109 | 0.117 | 0.110 |
| 52                                                            | —     | —     | —     | —     | —     | 0.113 | 0.122 | 0.115 |
| 54                                                            | —     | —     | —     | —     | —     | 0.117 | 0.127 | 0.119 |
| 56                                                            | —     | —     | —     | —     | —     | 0.122 | 0.131 | 0.123 |
| 58                                                            | —     | —     | —     | —     | —     | —     | 0.136 | 0.128 |
| 60                                                            | —     | —     | —     | —     | —     | —     | —     | 0.132 |

### Double Rod End Cylinders - 2" Stop Tube

| 1.50" - 8.00" Bore Double Rod End Cylinders - 2.00" Stop Tube |       |       |       |       |       |       |       |       |
|---------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Stroke                                                        | 1.50  | 2.00  | 2.50  | 3.25  | 4.00  | 5.00  | 6.00  | 8.00  |
| 0                                                             | 0.003 | 0.003 | 0.003 | 0.003 | 0.004 | 0.004 | 0.004 | 0.003 |
| 2                                                             | 0.005 | 0.005 | 0.005 | 0.005 | 0.008 | 0.009 | 0.009 | 0.008 |
| 4                                                             | 0.007 | 0.009 | 0.007 | 0.008 | 0.013 | 0.015 | 0.015 | 0.013 |
| 6                                                             | 0.009 | 0.012 | 0.009 | 0.010 | 0.017 | 0.020 | 0.021 | 0.018 |
| 8                                                             | 0.012 | 0.015 | 0.012 | 0.013 | 0.022 | 0.026 | 0.027 | 0.023 |
| 10                                                            | 0.015 | 0.018 | 0.014 | 0.015 | 0.027 | 0.031 | 0.032 | 0.028 |
| 12                                                            | 0.018 | 0.021 | 0.017 | 0.018 | 0.031 | 0.037 | 0.038 | 0.033 |
| 14                                                            | 0.020 | 0.025 | 0.020 | 0.021 | 0.036 | 0.042 | 0.044 | 0.038 |
| 16                                                            | —     | 0.028 | 0.022 | 0.023 | 0.041 | 0.047 | 0.049 | 0.044 |
| 18                                                            | —     | 0.031 | 0.025 | 0.026 | 0.045 | 0.053 | 0.055 | 0.049 |
| 20                                                            | —     | 0.034 | 0.027 | 0.029 | 0.050 | 0.058 | 0.061 | 0.054 |
| 22                                                            | —     | 0.037 | 0.030 | 0.032 | 0.055 | 0.064 | 0.067 | 0.059 |
| 24                                                            | —     | 0.041 | 0.032 | 0.034 | 0.059 | 0.069 | 0.072 | 0.064 |
| 26                                                            | —     | —     | 0.035 | 0.037 | 0.064 | 0.075 | 0.078 | 0.069 |
| 28                                                            | —     | —     | 0.037 | 0.040 | 0.069 | 0.080 | 0.084 | 0.074 |
| 30                                                            | —     | —     | 0.040 | 0.042 | 0.073 | 0.086 | 0.089 | 0.079 |
| 32                                                            | —     | —     | 0.043 | 0.045 | 0.078 | 0.091 | 0.095 | 0.085 |
| 34                                                            | —     | —     | 0.045 | 0.048 | 0.083 | 0.096 | 0.101 | 0.090 |
| 36                                                            | —     | —     | 0.048 | 0.050 | 0.088 | 0.102 | 0.107 | 0.095 |
| 38                                                            | —     | —     | 0.051 | 0.053 | 0.092 | 0.107 | 0.112 | 0.100 |
| 40                                                            | —     | —     | —     | 0.056 | 0.097 | 0.113 | 0.118 | 0.105 |
| 42                                                            | —     | —     | —     | 0.059 | 0.101 | 0.118 | 0.124 | 0.110 |
| 44                                                            | —     | —     | —     | —     | 0.106 | 0.124 | 0.129 | 0.115 |
| 46                                                            | —     | —     | —     | —     | —     | 0.129 | 0.135 | 0.120 |
| 48                                                            | —     | —     | —     | —     | —     | 0.135 | 0.141 | 0.126 |
| 50                                                            | —     | —     | —     | —     | —     | 0.140 | 0.147 | 0.131 |
| 52                                                            | —     | —     | —     | —     | —     | 0.145 | 0.152 | 0.136 |
| 54                                                            | —     | —     | —     | —     | —     | —     | 0.158 | 0.141 |

# How To Specify

## Technical Data

### Weight Chart - Triple Rod Double End

(Weight in Pounds)

| Bore | MX0  | MS4  | MS2<br>BASE<br>BAR | *<br>MP1 | *<br>MP2 | *<br>MP4 | MF1 ME4    | MF2  | ME5  | Add Per Inch<br>of Stroke |
|------|------|------|--------------------|----------|----------|----------|------------|------|------|---------------------------|
| 1.50 | 2.2  | 2.2  | 2.5                | 2.7      | 2.8      | 2.8      | 2.8        | 2.9  | N/A  | 0.19                      |
| 2.00 | 3.7  | 3.7  | 4.0                | 4.5      | 4.6      | 4.6      | 4.5        | 4.7  | N/A  | 0.34                      |
| 2.50 | 6.0  | 6.0  | 6.5                | 7.0      | 7.2      | 7.2      | 7.1        | 7.4  | N/A  | 0.45                      |
| 3.25 | 10.1 | 10.1 | 11.0               | 12.8     | 13.7     | 13.7     | 13.1       | 13.5 | N/A  | 0.52                      |
| 4.00 | 15.0 | 15.0 | 16.2               | 18.3     | 19.5     | 19.5     | 19.3       | 19.7 | N/A  | 0.55                      |
| 5.00 | 24.0 | 24.0 | 25.3               | 28.6     | 30.7     | N/A      | 30.5       | 31.1 | N/A  | 1.10                      |
| 6.00 | 35.2 | 35.2 | 36.6               | 43.4     | 45.9     | N/A      | 45.8       | 46.7 | N/A  | 1.15                      |
| 8.00 | 50.8 | 50.8 | N/A                | 58.9     | N/A      | N/A      | 50.8 (ME4) | N/A  | 56.7 | 1.50                      |

All weights are in pounds & include tooling plate.  
\*Weight includes clevis pins.

### Weight Chart - Triple Rod Double End (D3 Models)

(Weight in Pounds)

| Bore | MX0D | MS4D | MS2D<br>BASE<br>BAR | MF1D<br>ME4D | Add Per Inch<br>of Stroke |
|------|------|------|---------------------|--------------|---------------------------|
| 1.50 | 4.3  | 4.3  | 4.6                 | 4.9          | 0.30                      |
| 2.00 | 6.2  | 6.2  | 6.5                 | 7            | 0.55                      |
| 2.50 | 11.2 | 11.2 | 11.7                | 12.3         | 0.75                      |
| 3.25 | 18.5 | 18.5 | 19.4                | 21.5         | 0.82                      |
| 4.00 | 26.4 | 26.4 | 27.6                | 30.7         | 0.85                      |
| 5.00 | 42.9 | 42.9 | 44.3                | 49.4         | 1.83                      |
| 6.00 | 59.8 | 59.8 | 61.4                | 70.4         | 1.95                      |
| 8.00 | 75.8 | 75.8 | N/A                 | 75.0 (ME4D)  | 2.45                      |

All weights are in pounds & include tooling plate.

### Weight Chart - Tooling Plate

(Weight in Pounds)

| Bore | Weight | Bore | Weight | Bore | Weight | Bore | Weight |
|------|--------|------|--------|------|--------|------|--------|
| 1.50 | 0.45   | 2.50 | 1.5    | 4.00 | 4.16   | 6.00 | 9.30   |
| 2.00 | 0.70   | 3.25 | 2.7    | 5.00 | 6.25   | 8.00 | 17.0   |

### Torque Chart - Cylinder Tie Rods

| Bore | Tie Rod Thread Size | Torque in Ft. - Lbs. |
|------|---------------------|----------------------|
| 1.50 | 1/4-28              | 7                    |
| 2.00 | 5/16-24             | 12                   |
| 2.50 | 5/16-24             | 14                   |
| 3.25 | 3/8-24              | 30                   |
| 4.00 | 3/8-24              | 35                   |
| 5.00 | 1/2-20              | 45                   |
| 6.00 | 1/2-20              | 50                   |
| 8.00 | 5/8-18              | 125                  |

1.50" - 6.00" bore have full square retainer plate, 8.00" bore as three (3) separate round retainer plates.

Tighten cylinders using an "X" tightening pattern on tie rods.

### Torque Chart - Retainer Screws

| Bore | Retainer Screw Thread Size | Torque in Ft. - Lbs. |
|------|----------------------------|----------------------|
| 1.50 | 1/4-28                     | 7                    |
| 2.00 | 5/16-24                    | 12                   |
| 2.50 | 5/16-24                    | 12                   |
| 3.25 | 3/8-24                     | 22                   |
| 4.00 | 3/8-24                     | 22                   |
| 5.00 | 1/2-20                     | 35                   |
| 6.00 | 1/2-20                     | 35                   |
| 8.00 | 1/4-28                     | 7                    |

1.50" - 6.00" bore have full square retainer plate, 8.00" bore as three (3) separate round retainer plates.

Tighten cylinders using an "X" tightening pattern on tie rods.

### Triple Rod Force/Volume Chart

| Bore | Stroke<br>Type | Effective<br>Piston Area | Pounds of Force at PSI |      |      |       |       |       | Cu. Ft. Displacement<br>per In. of Stroke |
|------|----------------|--------------------------|------------------------|------|------|-------|-------|-------|-------------------------------------------|
|      |                |                          | 60                     | 80   | 100  | 200   | 250   | 400   |                                           |
| 1.50 | Push           | 1.767                    | 106                    | 142  | 177  | 353   | 442   | 706   | .00102                                    |
|      | Pull           | 1.536                    | 92                     | 123  | 154  | 308   | 384   | 614   | .00089                                    |
| 2.00 | Push           | 3.142                    | 188                    | 251  | 314  | 628   | 785   | 1256  | .00182                                    |
|      | Pull           | 2.553                    | 153                    | 204  | 255  | 510   | 638   | 1021  | .00147                                    |
| 2.50 | Push           | 4.909                    | 295                    | 393  | 491  | 982   | 1227  | 1962  | .00284                                    |
|      | Pull           | 3.989                    | 239                    | 319  | 399  | 798   | 997   | 1595  | .00231                                    |
| 3.25 | Push           | 8.296                    | 498                    | 664  | 830  | 1660  | 2074  | 3318  | .00480                                    |
|      | Pull           | 7.376                    | 442                    | 590  | 738  | 1476  | 1844  | 2950  | .00427                                    |
| 4.00 | Push           | 12.566                   | 754                    | 1005 | 1257 | 2514  | 3141  | 5026  | .00727                                    |
|      | Pull           | 11.646                   | 699                    | 932  | 1165 | 2330  | 2911  | 4658  | .00674                                    |
| 5.00 | Push           | 19.635                   | 1178                   | 1571 | 1964 | 3928  | 4908  | 7854  | .01136                                    |
|      | Pull           | 17.279                   | 1037                   | 1382 | 1728 | 3456  | 4320  | 6911  | .00999                                    |
| 6.00 | Push           | 28.274                   | 1696                   | 2262 | 2827 | 5654  | 7068  | 11310 | .01636                                    |
|      | Pull           | 25.918                   | 1555                   | 2073 | 2592 | 5184  | 6479  | 10367 | .01499                                    |
| 8.00 | Push           | 50.265                   | 3016                   | 4021 | 5026 | 10052 | 12566 | 20106 | .02908                                    |
|      | Pull           | 47.909                   | 2874                   | 3832 | 4791 | 9582  | 11977 | 19163 | .02773                                    |



