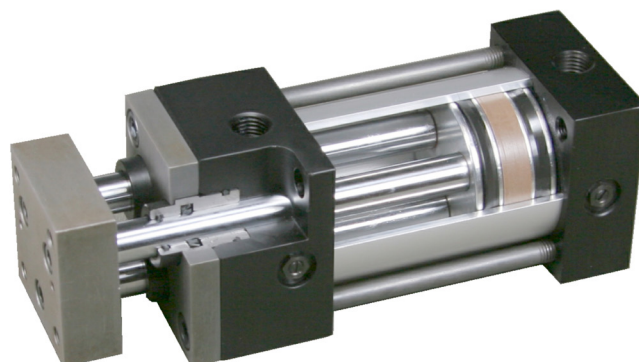


TRA Series Cylinders

Triple Rod: Heavy-Duty Triple Rod Design

Benefits

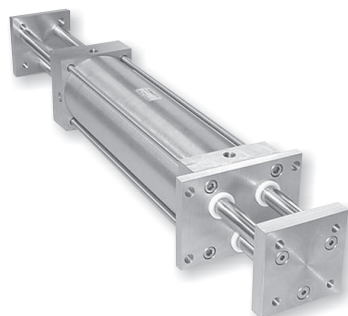
- **Extended Heavy-Duty Rod Bearings** — Cast iron material is rated at 150,000 PSI compressive strength. Extended bearing design maximizes Load handling abilities without compromising design.
- **Piston Wear Band Standard** — PTFE material rated for high loads and non-lube service.
- **Non Lube Service** — 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.
- **Load and End Play Charts Available**



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 Specifications

Operating Pressure	Operating Temperature
250 PSI Air (17 BAR)	Carboxilated Nitrile: -20°F to 200°F (-29°C to 93°C)
	Fluorocarbon: 0°F to 400°F (-18°C to 204°C)

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

Bore

1.5	1.50"
2	2.00"
2.5	2.50"
3.25	3.25"
4	4.00"
5	5.00"
6	6.00"
8	8.00"

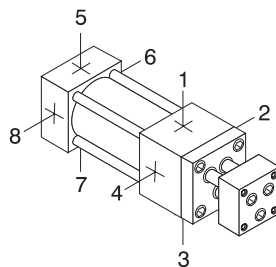
Stroke

Cushions

H	Head Cushion Position 2 Is Standard Specify For Positions: 1, & 4
C	Cap Cushion Position 6 Is Standard 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

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

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

*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.

Options

AS	Adjustable Stroke - Retract (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 (specify size, example: BSP = 1/4)
BSPT	British Standard Pipe Parallel (specify size, example: BSP = 1/4)
C	Extended Piston Rod (example: if C = 0.50", then 1" Rod Extension is C = 1.50")
MPR ¹	Magnetic Piston for Reed or Solid State Switches (R10, R10P, RAC, RHT & MSS)
» MPR-WB	Combination Magnetic Piston & Wear-Band (specify on 1.50"-2.50" bores only)
OP	Optional Port Location (example: OP=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) Specify Stroke as ES (Effective Stroke) (example: TA MS4 2 X 24ES-ST=3)
TMS	Steel Cylinder Tube ¹ , Black Urethane Paint Finish
TMSS	Stainless Steel Cylinder Tube ¹
TH	400 PSI Hydraulic Non-Shock
VS	Fluorocarbon Seals
XX	Special Variation (specify)

Note: Refer to Options for specifications.

¹ 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)).

² Steel tubes do not work with MPR magnetic pistons. Refer to Balluff end of stroke sensors within Switches.

» Refer to Option Length Adder

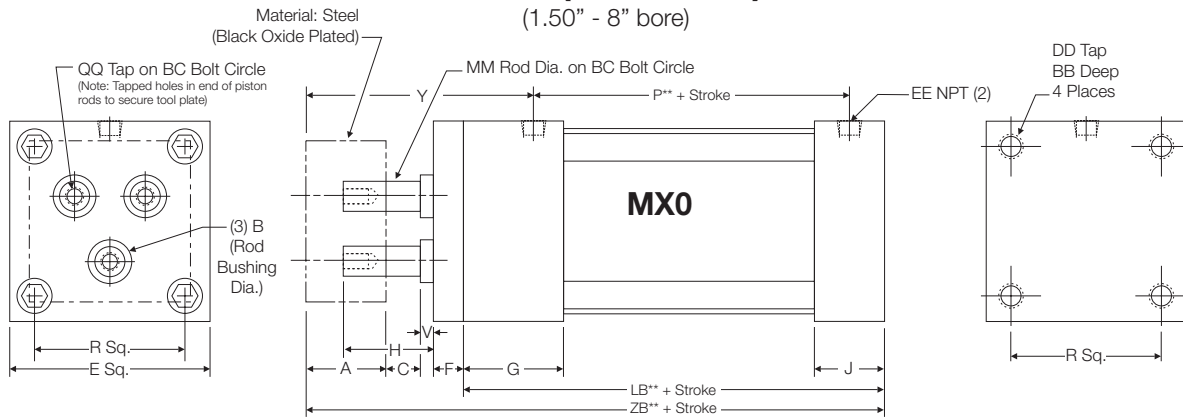
Options For "D1" Double Rod End Model - Single Rod

KK2	Large Male Rod Thread
KK3	Female Rod Thread
KK3S	Studded Piston Rod (KK3 With Stud, Loctite In Place)
KK4	Full Diameter Male Rod Thread
KK5	Blank Rod End (No Threads, "A" = 0")
MA	Micro-Adjust (12" max stroke) Available On Double Rod End Models
MAB	Micro-Adjust W/ Sound Dampening Bumper (12" max stroke)

TRA Series Heavy-Duty: Triple Piston Rod

MX0 (No Mount)

(1.50" - 8" bore)



MX0 (No Mount)

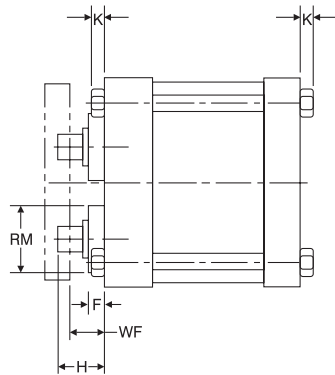
Bore	A	B	BB	BC	C	DD	E	EE	F	G	H	J	LB	MM	P	QQ	R	V	Y	ZB
1.50	0.750	0.563	0.500	0.891	0.500	1/4-28	2.000	0.250	0.375	1.500	1.100	1.000	3.625**	0.313	2.375**	10-32	1.438	0.250	2.750	5.500**
2.00	0.750	0.813	0.500	1.195	0.500	5/16-24	2.500	0.250	0.375	1.500	1.100	1.000	3.625**	0.500	2.375**	1/4-28	1.844	0.250	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)



Tooling Plate Dimensions

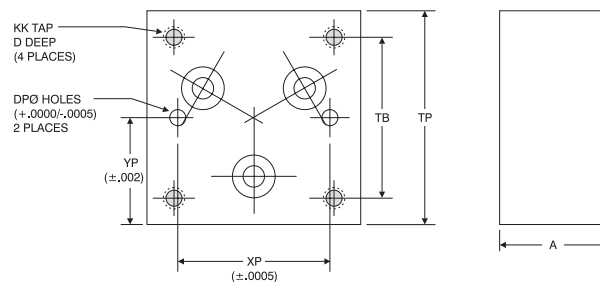
Bore	F	H	K	RM	WF
8.00	0.625	2.844	0.563	2.750	2.250

*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).



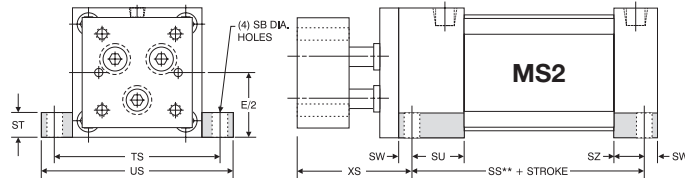
Tooling Plate Dimensions

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

Base & Pivot Mounts

Base Mounts (1.50" - 8.00" Bore)

MS2

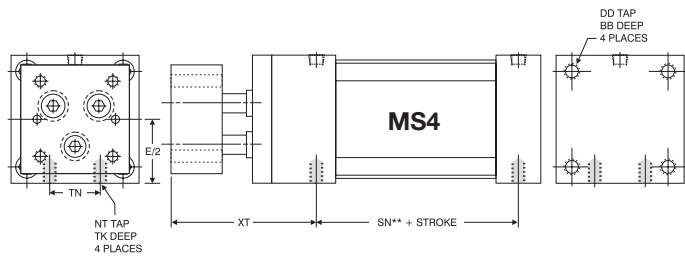


MS2 Mount

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

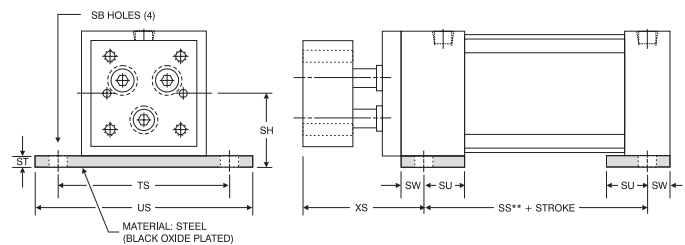


MS4 Mount

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)



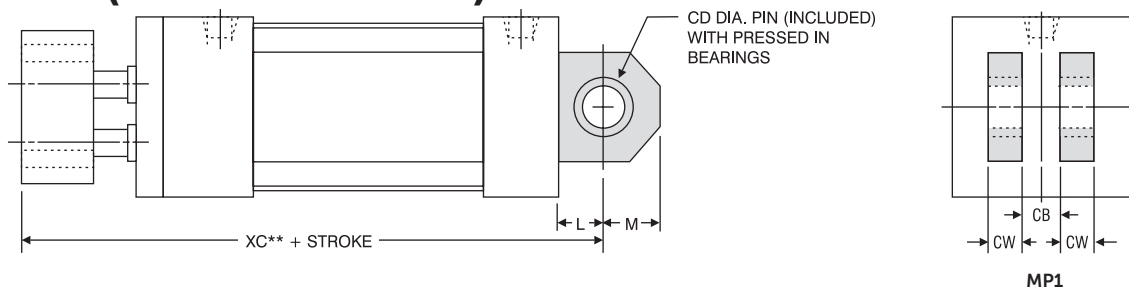
Base Bar (Non-NFPA)

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

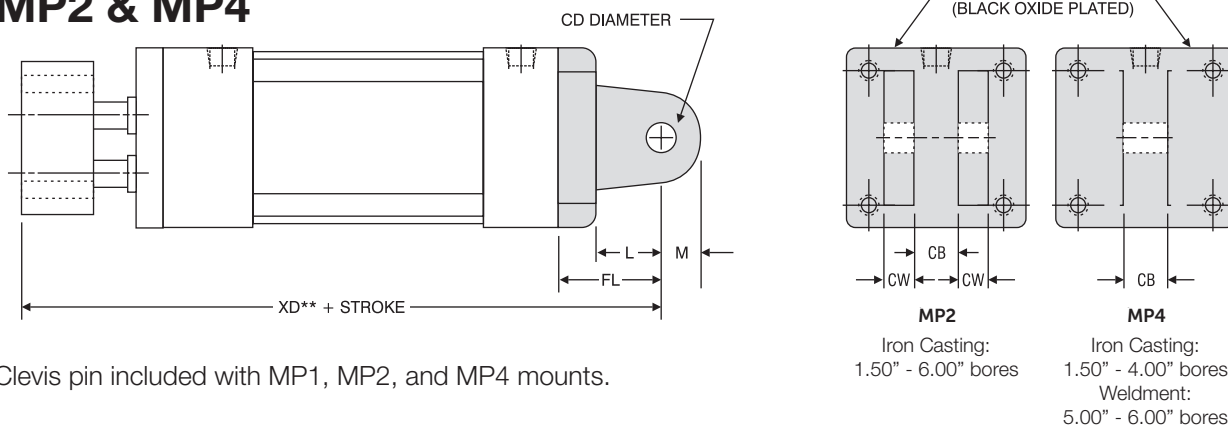
**Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

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.

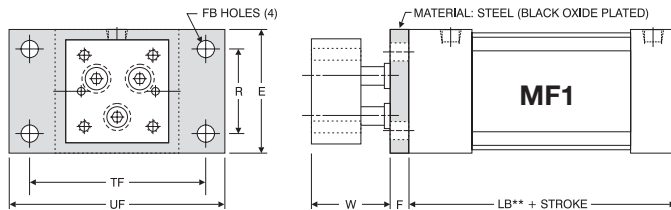
▲ MP4 available as specials in 5.00" and 6.00" bores; delivery for 5.00" and 6.00" bore MP4 models is 5-7 days.

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).

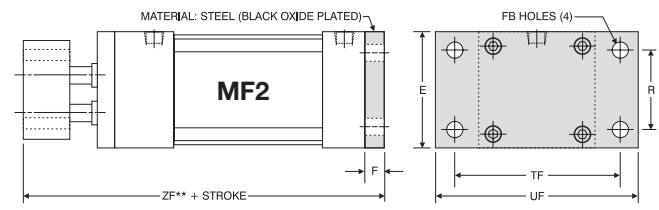
Flange Mounts

Flange Mounts (1.50" - 6.00" Bore)

MF1



MF2



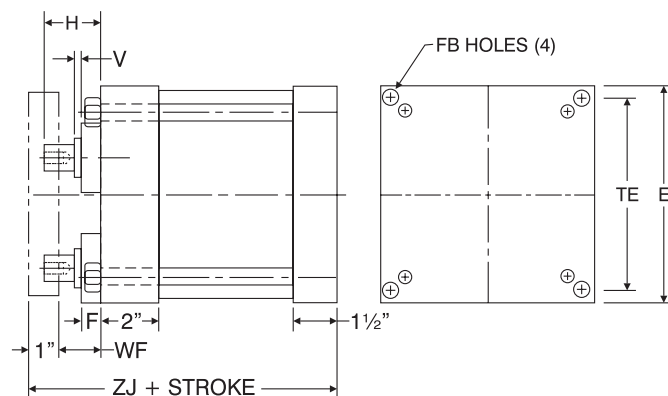
MF1 & MF2 Mounts

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

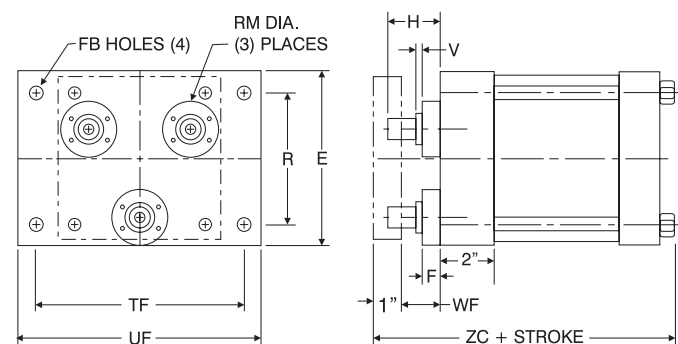
**Option MPR-WB will add 0.500" to overall cylinder length - 1.50", 2.00" & 2.50" bores only.

Flange Mounts (8.00" Bore)

ME4



ME5
(Non-NFPA)



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

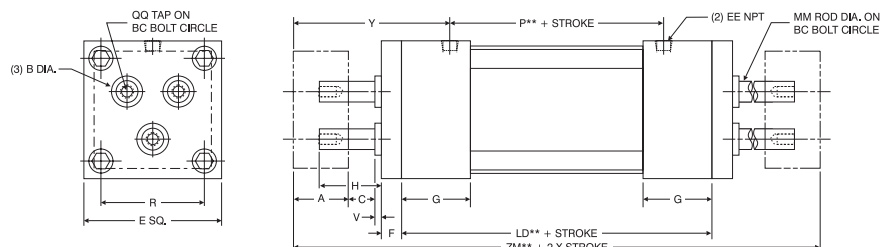
Note: Three (3) 1.00" diameter rods on 5.750 B.C.

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)



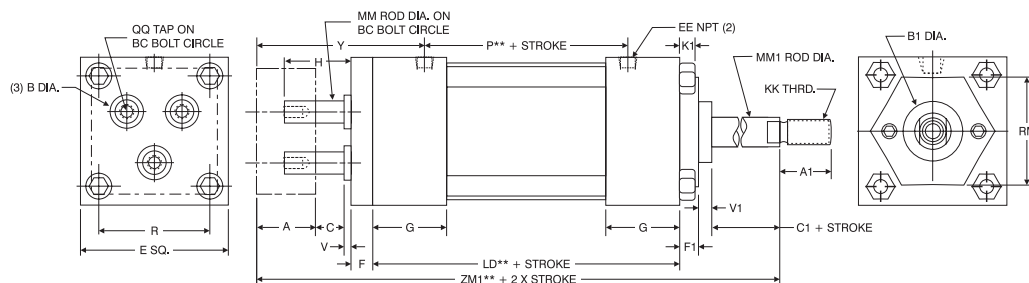
Tool Plates Included –

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

**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

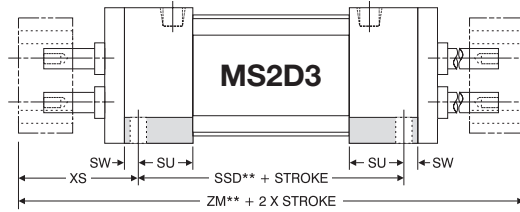
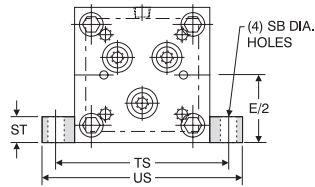
Twin Tooling Plate - MX0D1																										
Bore	A	A1	B	B1	BC	C	C1	E	EE	F	F1	G	H	K1	KK	LD	MM	MM1	P	QQ	R	RM	V	V1	Y	ZM1
1.50	0.750	0.750	0.563	1.125	0.891	0.500	0.375	2.000	0.250	0.375	0.375	1.500	1.100	0.250	7/16-20	4.125**	0.313	0.625	2.375**	10	1.438	2.00 Sq.	0.250	0.250	2.750	7.000**
2.00	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.

**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

Base Mounts MS2D3

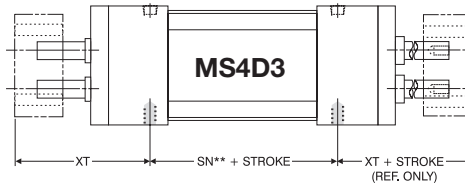
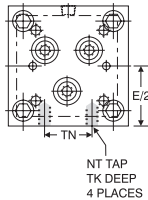


MS2D3 Mount

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

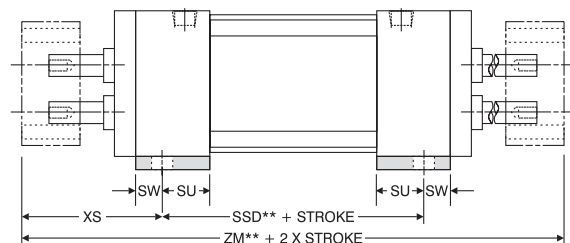
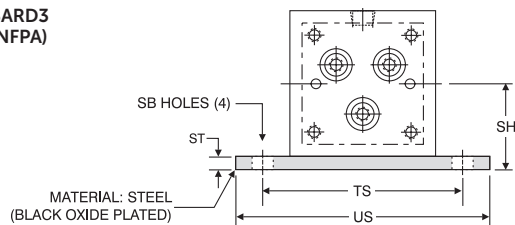


MS4D3 Mount

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

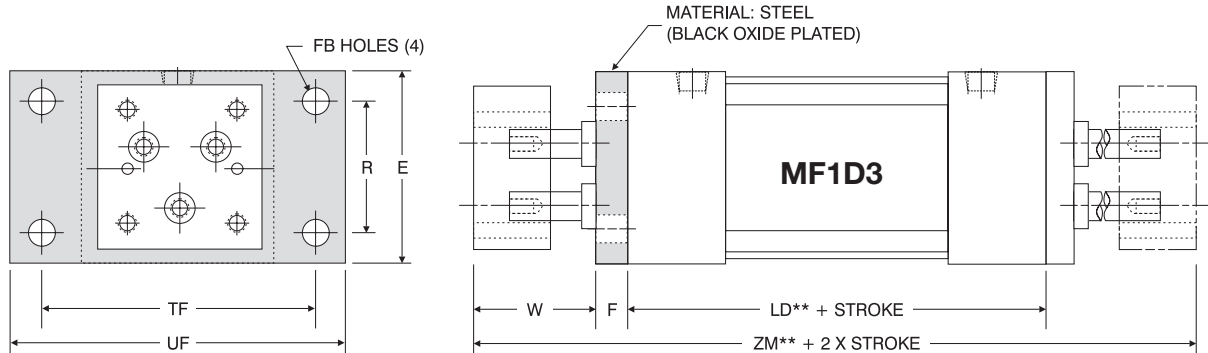
Bore	SB	SH	SSD	ST	SU	SW	TS	US	XS	ZM
1.50	0.438	1.250	3.375**	0.250	1.125	0.375	2.750	3.500	2.250	7.875**
2.00	0.438	1.500	3.375**	0.250	1.125	0.375	3.250	4.000	2.250	7.875**
2.50	0.438	1.875	3.500**	0.375	1.125	0.375	3.750	4.500	2.500	8.500**
3.25	0.563	2.375	3.750	0.500	1.250	0.500	4.750	5.750	2.875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

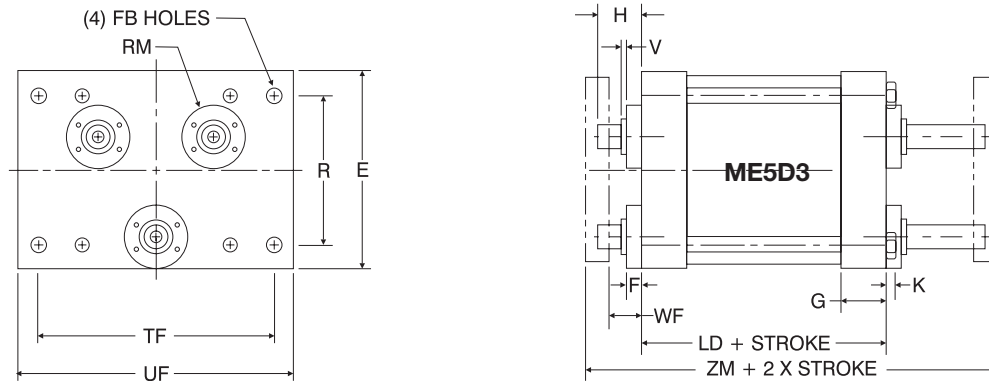


MF1D3 Mount									
Bore	E	F	FB	LD	R	TF	UF	W	ZM
1.50	2.000	0.375	0.313	4.125**	1.438	2.750	3.375	1.500	7.875**
2.00	2.500	0.375	0.375	4.125**	1.844	3.375	4.125	1.500	7.875**
2.50	3.000	0.375	0.375	4.250**	2.188	3.875	4.625	1.750	8.500**
3.25	3.750	0.625	0.438	4.750	2.760	4.688	5.500	1.750	9.500
4.00	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

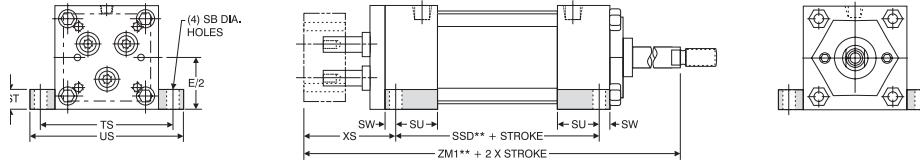


ME5D3 Mount															
Bore	E	F	FB	G	H	K	LD	R	RM	TE	TF	UF	V	WF	ZM
8.00	8.500	0.625	0.688	2.000	2.844	0.563	5.625	6.438	2.750	7.563	10.250	12.000	.250	2.250	12.125

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

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

MS2D1 (Triple Rod With Single Rod)

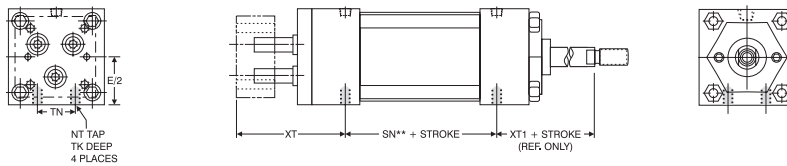


MS2D1 Mount

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)

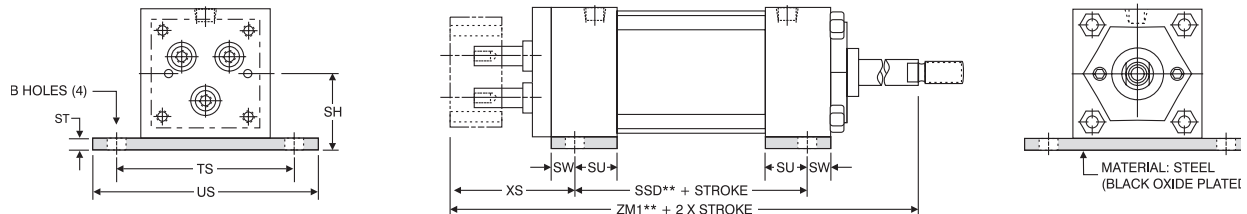


MS4D1 Mount

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)



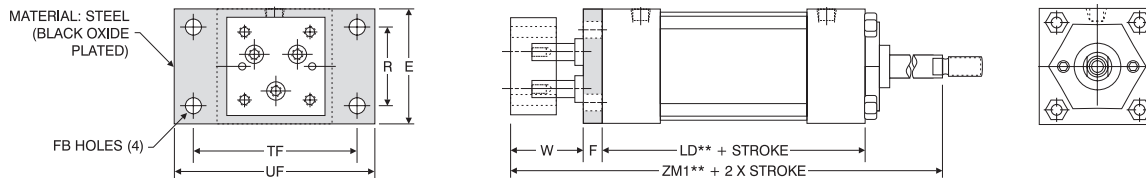
BASEBARD1 (Non-NFPA) Mount

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

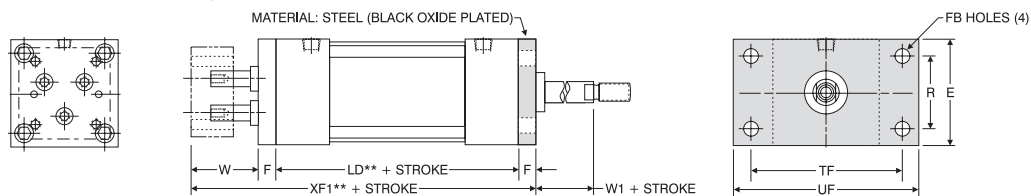
MF1D1 (Triple Rod With Single Rod)



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.

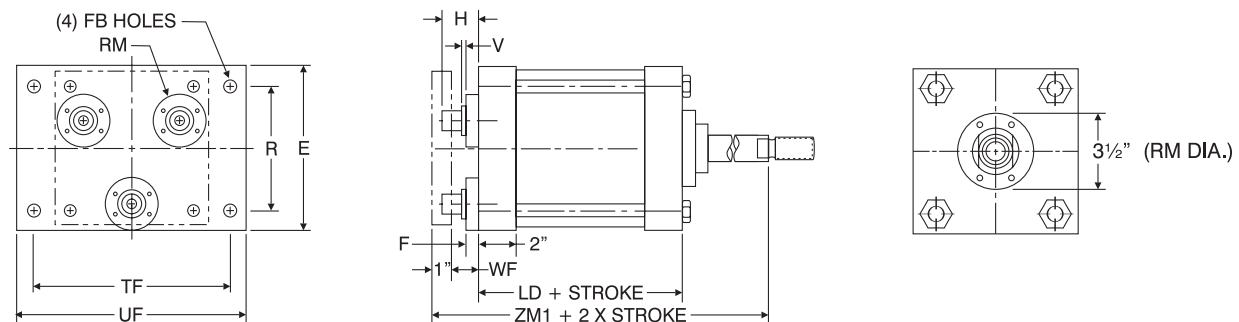
MF2D1 (Triple Rod With Single Rod)



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.

Options

ST=2 • ST=4

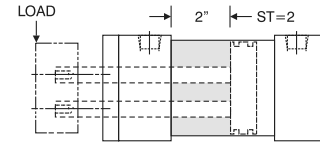
Stop Tubes

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.

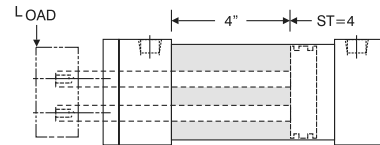
Ordering Example: TRA MS4 2.00 x 10ES-ST=2

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

Recommended Maximum* Stroke Lengths						
Bore	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

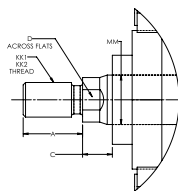
*Maximum Stroke For Horizontal Applications.

"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.

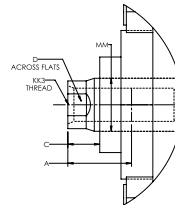
Style 1 & 2

KK1 & KK2



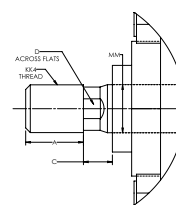
Style 3

KK3



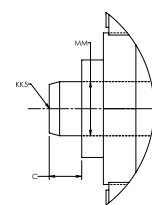
Style 4

KK4



Style 5

KK5



Bore	MM1 Rod Diameter	Standard		Optional		Style 3 - Female		Style 4 - Male		Style 5 - Blank		C1*	V1
		Style 1 - Male		Style 2 - Male		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

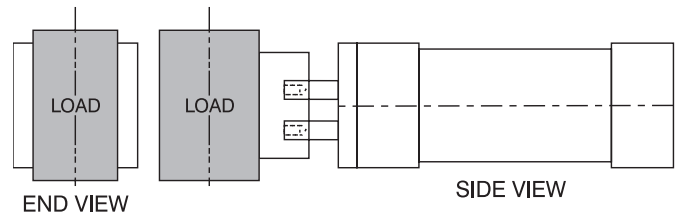
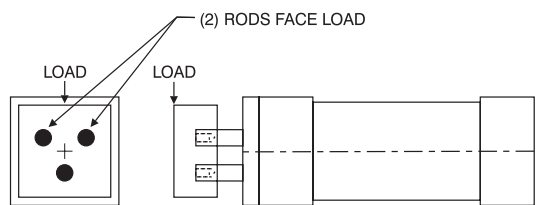
*Dimension is with single rod fully retracted.

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

How To Use Load Charts:

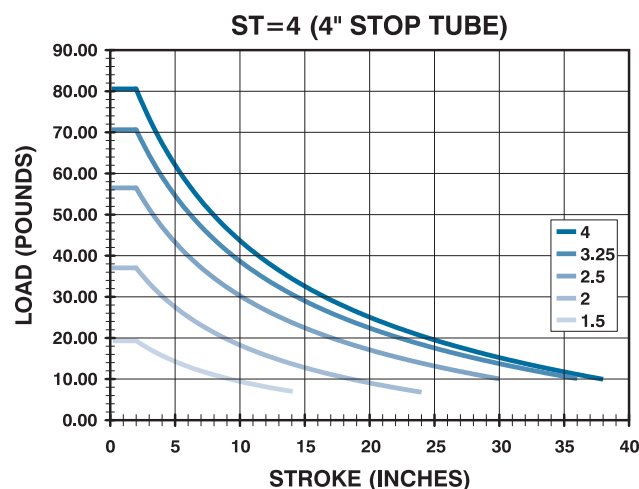
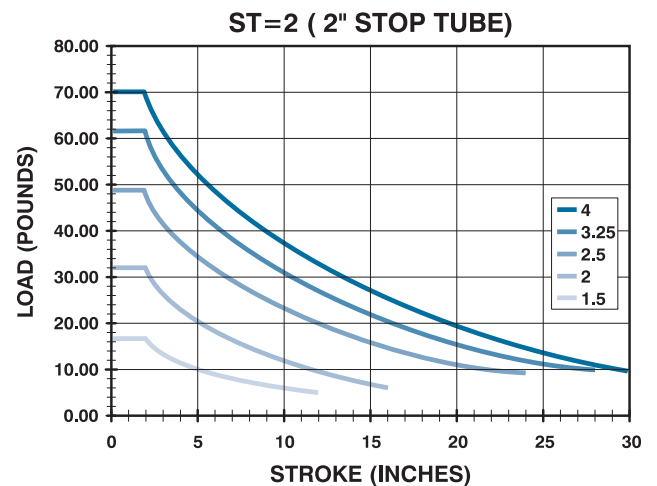
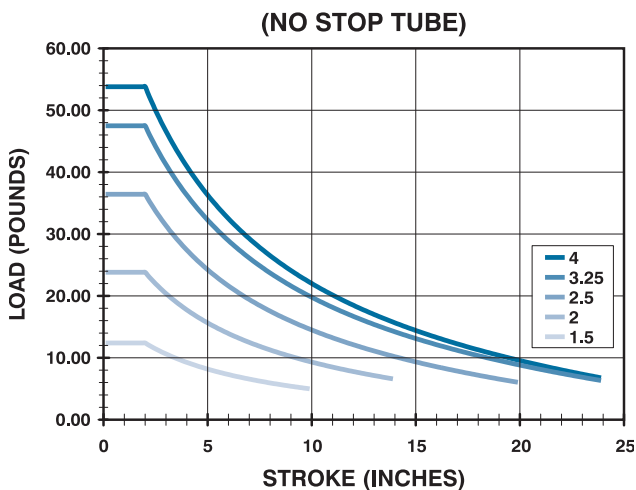
1. Determine weight of Load (pounds)
2. Refer to Load Charts for model selection

Triple Rod Mounting To Load:



Example 1

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

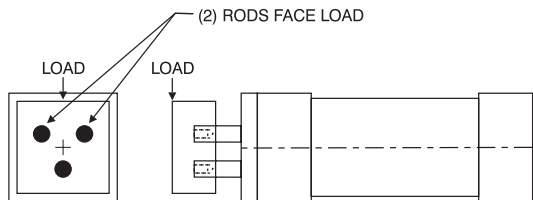


Technical Data – Load Charts: 5.00" - 8.00" Bore

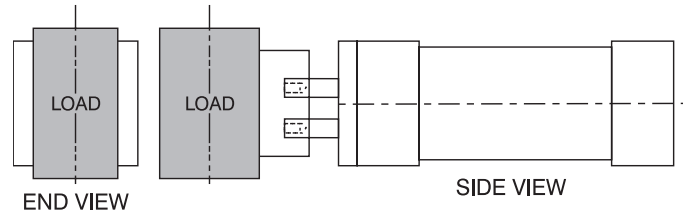
How To Use Load Charts:

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

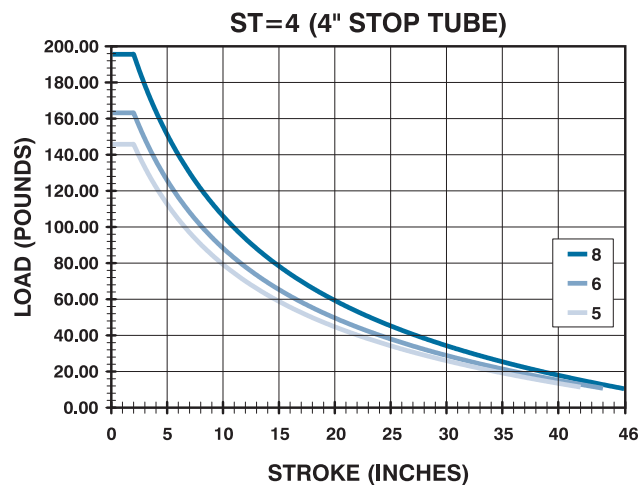
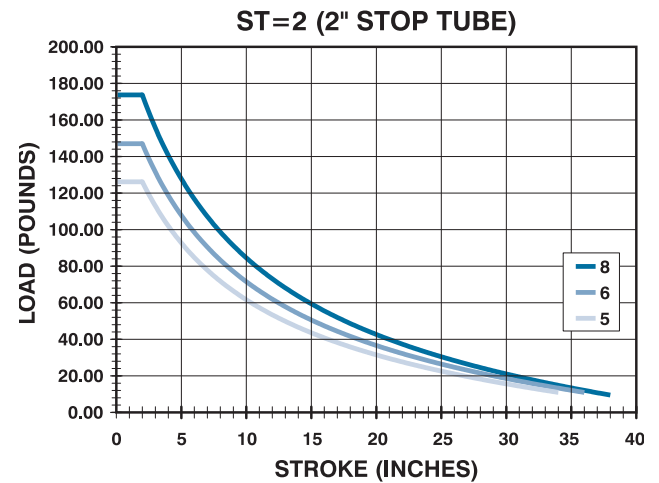
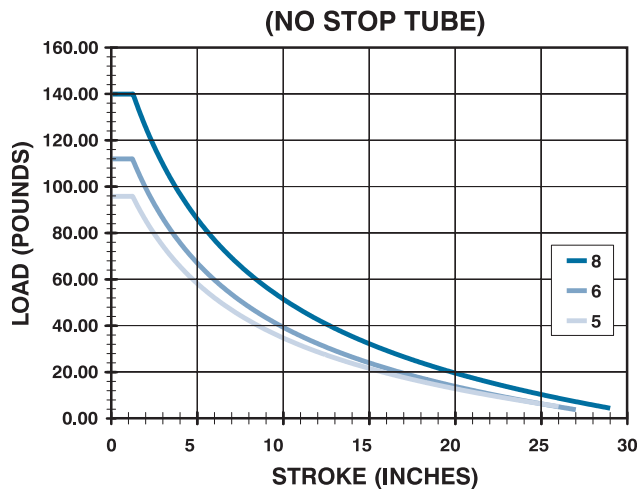
Triple Rod Mounting To Load:



Example 1



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

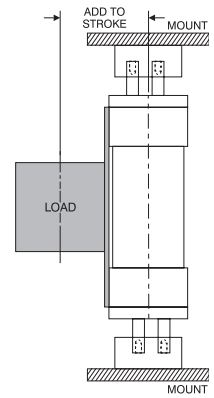
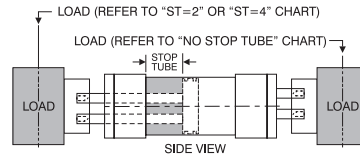
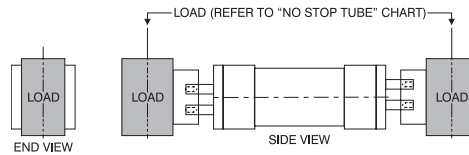
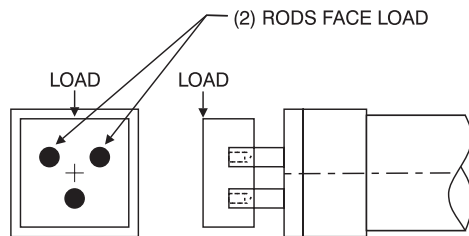


Technical Data (D3 Models) – Load Charts: 1.50" - 4.00" Bore – Double Rod End

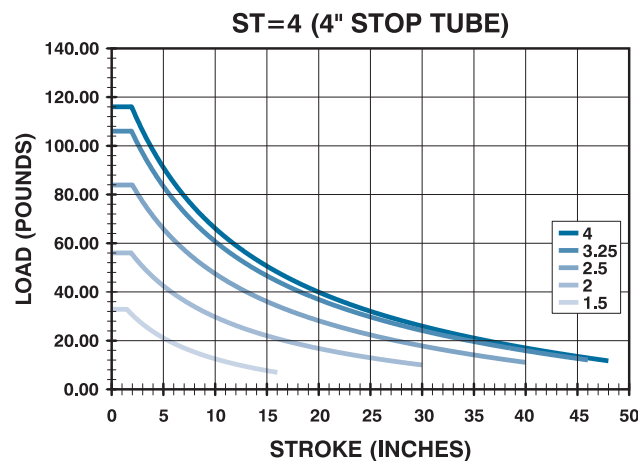
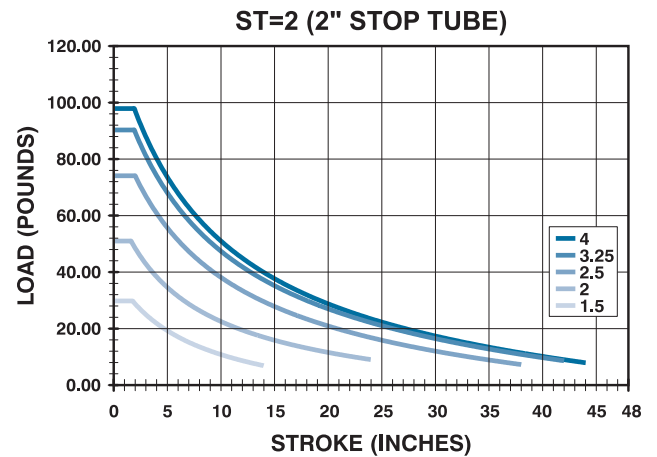
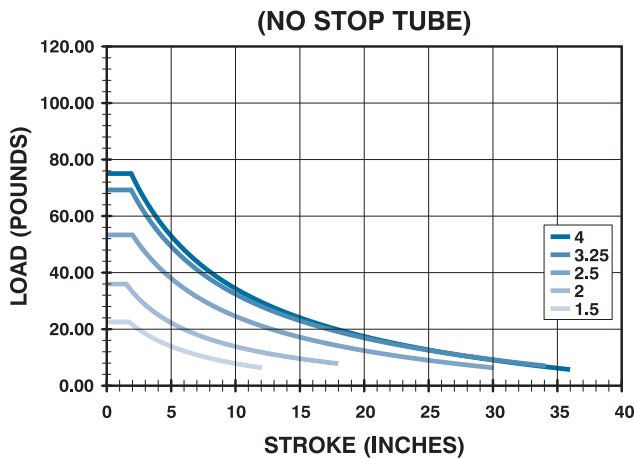
How To Use Load Charts:

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

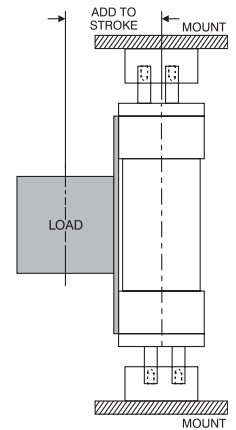
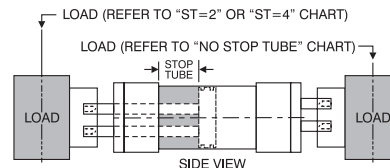
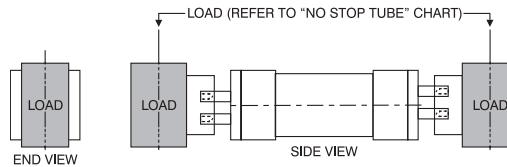
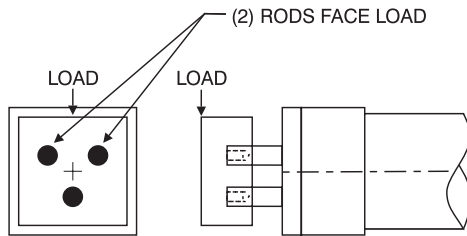


Technical Data (D3 Models) – Load Charts: 5.00" - 8.00" Bore – Double Rod End

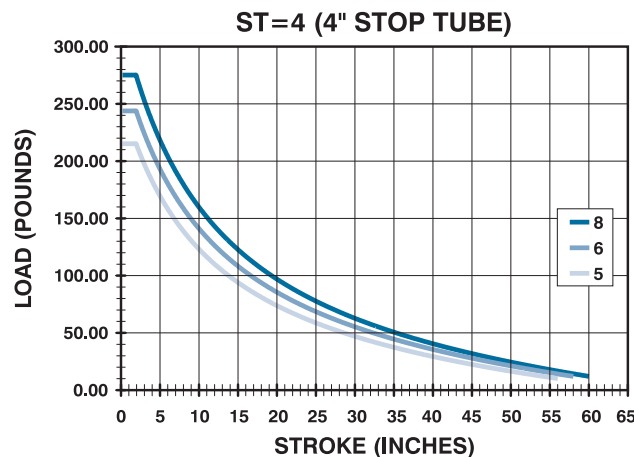
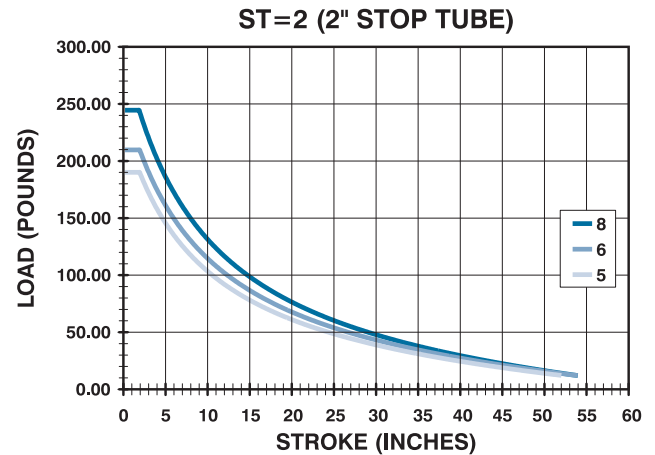
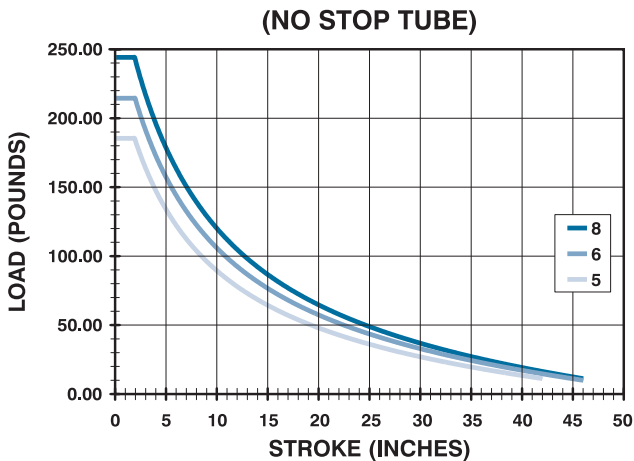
How To Use Load Charts:

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

Triple Rod Mounting To Load:



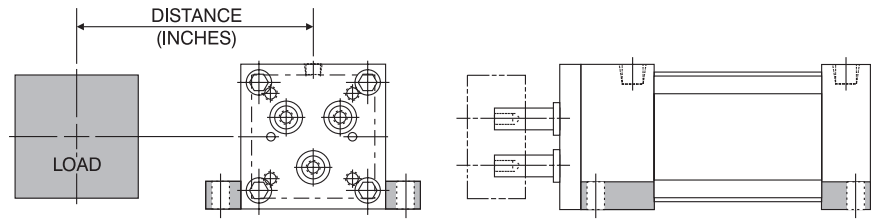
Double Rod End: 5.00" - 8.00" Bore Maximum Recommended Load



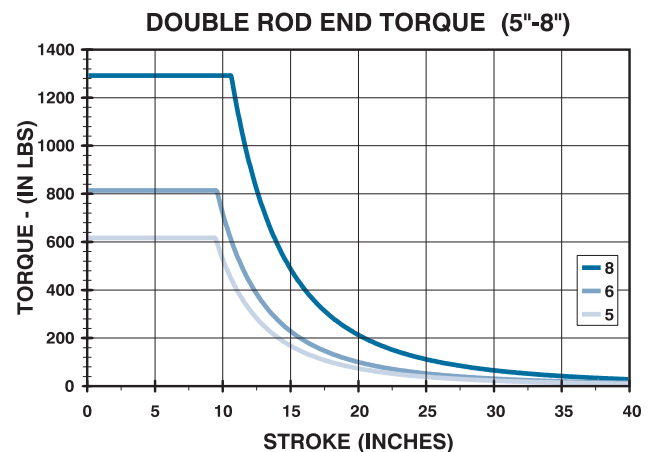
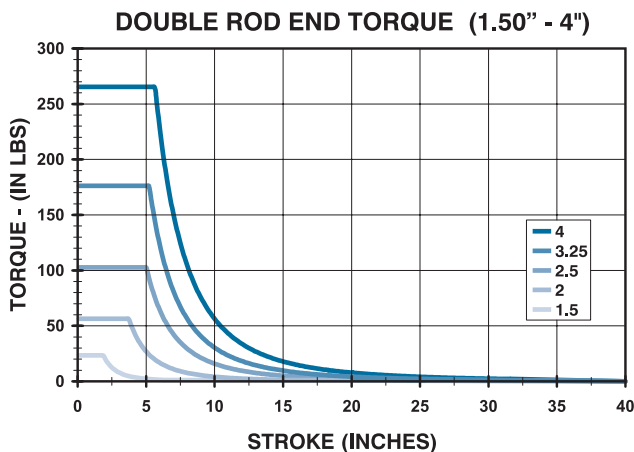
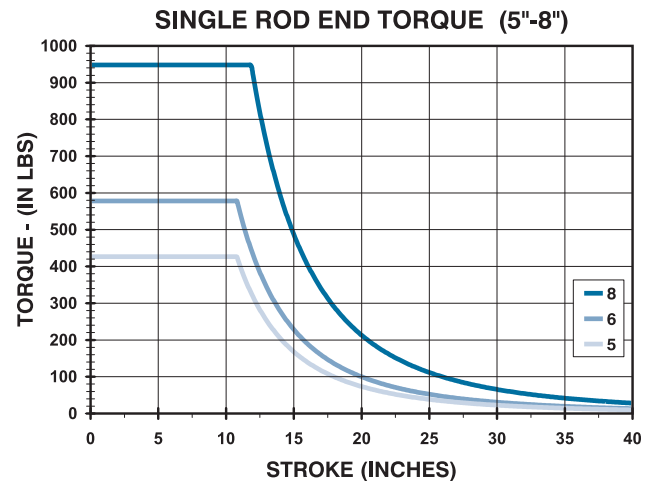
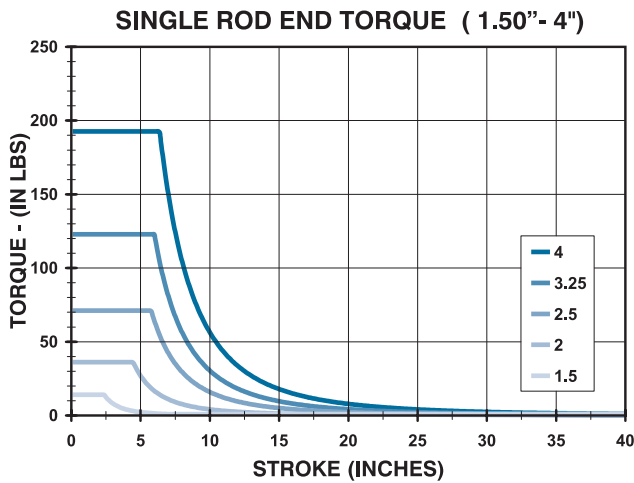
Technical Data – Torque Charts

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

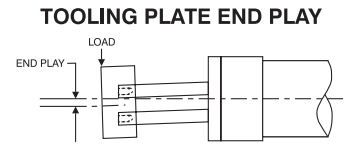


Torque (Inch-Pounds) – (For No Stop Tube, ST=2" & ST=4" Models)



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 - 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

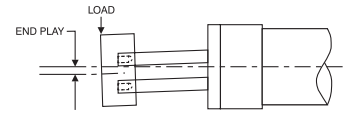
Single Rod End Cylinders - 4" Stop Tube

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

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 - 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

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



Technical Data

Weight Chart - Single Rod Double End

(Weight in Pounds)

Bore	MX0	MS4	MS2 BASE BAR	* MP1	* MP2	* MP4	MF1 ME4	MF2	ME5	Add Per Inch 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 BASE BAR	MF1D ME4D	Add Per Inch 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 Type	Effective Piston Area	Pounds of Force at PSI						Cu. Ft. Displacement 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