

NEW DESIGN

ORDER ONLINE

## SERIES 'TRA' TRIPLE ROD

# NEW 'HEAVY-DUTY' TRIPLE ROD DESIGN

TRD's 'TR' Series has been redesigned. The new series, 'TRA' is a *Heavy-Duty* version of the 'TR' Series. The new series is a drop-in replacement of the previous model. Overall dimensions are not affected.



Universal mount, Sleeve Nut design  
Same overall materials as 'TA' & 'FM' Series

### 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 61 for details)
- **Load and End Play Charts Available** — Refer to pages 62-68 for charts.
- **'TRA' Series is a Drop-In Replacement to 'TR' Series** — New design does not require a redesign by customers since the overall dimensions are not affected.
- **Existing "TR" Series units can be upgraded to the 'TRA' Series** — Replacement parts can be ordered to field upgrade an existing 'TR' model to the new 'TRA' Series. (see page 70 for details)

### 'TR' Series — Design Upgrade

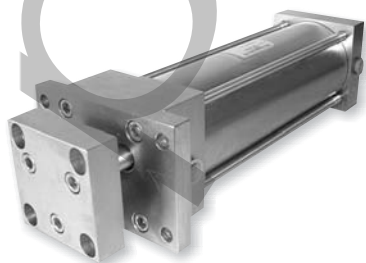
'TR' Series (250 PSI Air) is obsolete and superseded by 'TRA' Series (effective 5-12-03)

'TR-TH' Series (400 PSI Hyd.) is obsolete and superseded by 'TRA' Series with 'TH' option (effective 5-12-03)

### Other Models Available:

#### 'TRA' (with 'EN' option)

Electroless Nickel Plated with Stainless Steel fasteners, Tie-Rods, and Sleeve Nuts



#### 'SS-TRA'

303/304, or 316 Stainless Steel  
(Consult factory for details and delivery)



(Optional Delrin Rod Bushings Shown)

#### 'MA' Option (Micro-Adjust)

Available on all "D1" Double Rod End models.

Allows for extended stroke adjustment in .001" increments.

(Note: up to 6" strokes)



Basic Cylinders

Triple-Rod

Multi-Stage

Cylinder Options

Air Boosters

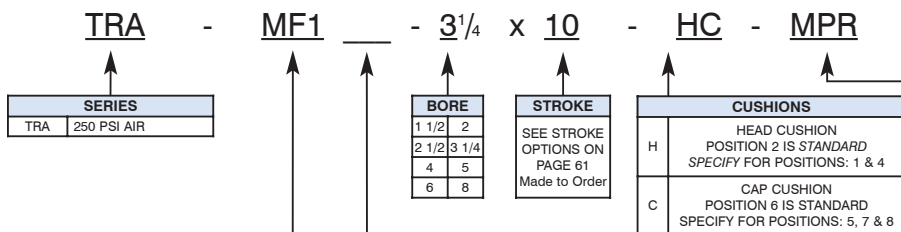
Air/Oil Tanks

Accessories

Technical Data

ORDER ONLINE

# HOW TO ORDER: SERIES 'TRA' (TRIPLE PISTON ROD)



SERIES	
TRA	250 PSI AIR

BORE	
1 1/2	2
2 1/2	3 1/4
4	5
6	8

STROKE	
SEE STROKE OPTIONS ON PAGE 61 Made to Order	

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

OPTIONS	
ADDS LENGTH TO CYLINDER - SEE "OPTION LENGTH ADDER" CHART BELOW.	
A / O	AIR / OIL PISTON

X	B	1/4" URETHANE BUMPER BOTH ENDS
X	BC	1/4" URETHANE BUMPER CAP ONLY
X	BH	1/4" URETHANE BUMPER HEAD ONLY
	BSP	BSP PORTS (SPECIFY SIZE, Example: BSP = 1/4")
	C =	EXTENDED PISTON ROD (Example: C = 3")
	EN	ELECTROLESS NICKEL PLATED (Refer to page 84 for specifications)
	MA	MICRO-ADJUST (6" MAX. STROKE)
	MAB	MICRO-ADJUST WITH SOUND DAMPENING BUMPER (6" MAX. STROKE)
	MPR*	MAGNETIC PISTON FOR REED OR SOLID STATE SWITCHES - TRD MODELS: R10, RAC, AND MSS (Refer to pages 105-111 for selection)
	MPH	MAGNETIC PISTON FOR HALL SWITCHES
X	MPR-WB	COMBINATION MAGNETIC PISTON & WEARBAND (SPECIFY ON 1 1/2"-2 1/2" BORES ONLY)
	OP	OPTIONAL PORT LOCATION (Example: Ports @ 2 & 6)
	SAE	SAE PORTS (SPECIFY SIZE, Example: SAE #10)
	SSA	STAINLESS STEEL PISTON ROD, TIE RODS & NUTS, AND FASTENERS
	SSF	STAINLESS STEEL FASTENERS
	SSR	STAINLESS STEEL PISTON ROD
	SST	STAINLESS STEEL TIE RODS & NUTS
X	ST	STOP TUBE (SPECIFY STOP TUBE LENGTH AND EFFECTIVE STROKE) (Example: TA MS4 2 X 24" EFFECTIVE STROKE-ST=3)
	STEEL TUBE	STEEL CYLINDER TUBE, BLACK EPOXY PAINT FINISH
	TH	400 PSI HYDRAULIC NON-SHOCK (Refer to page 90 for specifications)
	VS	FLUOROCARBON SEALS
	AS	ADJUSTABLE STROKE (RETRACT) (SPECIFY LENGTH, Example: AS = 3")
	XX	SPECIAL VARIATION (SPECIFY)

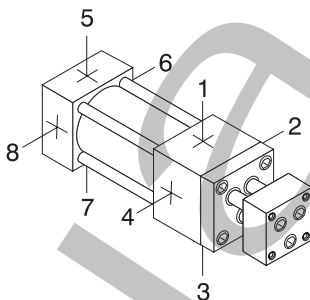
NFPA MOUNTS	
MXO	NO MOUNT
MS4	BOTTOM TAPPED HOLES (1 1/2"-8" Bore)
MS2	SIDE LUG (1 1/2"-4" Bore)
BASE BAR	SIDE LUG (1 1/2"-4" Bore)
MP1	REAR PIVOT CLEVIS (EXTRUDED)
MP2	REAR PIVOT CLEVIS (CASTING) (1 1/2"-6" Bore)
MP4	REAR PIVOT EYE (CASTING) (1 1/2"-4" Bore)
MF1	FRONT FLANGE (1 1/2"-6" Bore)
MF2	REAR FLANGE (1 1/2"-6" Bore)
ME4	REAR MOUNTING HOLES (8" Bore)
ME5	FRONT MOUNTING HOLES (8" Bore)

STYLE	
	SINGLE END (LEAVE BLANK)
D3	DOUBLE END - 3 RODS
D1	DOUBLE END - 1 ROD (KK1 STANDARD ROD END - SEE OPTIONS FOR OTHER ROD END STYLES)

## 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

## PORT & CUSHION POSITIONS



Note: Ports or Cushions **NOT** available at position 3

## About our Part Number System

- Simple, easy to understand
- No excessive codes!
- Eliminates mistakes when ordering

**Example:** A Triple Rod Cylinder with a 3 1/4" Bore, 10" Stroke, Front Flange Mount, Head & Cap Cushions, Magnetic Piston for TRD Reed or Solid State Switches.

**Part Number:** TRA-MF1-3 1/4 x 10-HC-MPR

\*STEEL TUBES do not work with MPR or MPH magnetic pistons. Refer to pages 112-115 for Bauluff end of stroke sensors.

## 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")

\*If "MPR" option is ordered on 1 1/2"-2 1/2" bore models, the wearband is eliminated and must be ordered separately if needed (see "MPR-WB" option).

## OPTION LENGTH ADDER

(ADD TO CATALOG BASIC OVERALL LENGTH DIMENSIONS)

BORE	OPTION							
	B	BC	BH	ELC	ELH	MPR (WITHOUT "WB" WEARBAND)	MPR-WB (MAGNET & WEARBAND)	ST* (STOP TUBE) Example: ST=2
1 1/2	1/2	1/4	1/4	1	1	0	1/2	2
2	1/2	1/4	1/4	1	1	0	1/2	2
2 1/2	1/2	1/4	1/4	1	1	0	1/2	2
3 1/4	1/2	1/4	1/4	1 1/4	1 1/4			2
4	1/2	1/4	1/4	1 1/4	1 1/4			2
5	1/2	1/4	1/4	1 1/4	1 1/4			2
6	1/2	1/4	1/4	1 1/2	1 1/2			2
8	1/2	1/4	1/4	1 1/2	1 1/2			2

**NOTE:** There is no length adder for MPR Option and Wear Band on 3 1/4" - 8" Bore.

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

Note: If a stop tube is used on 1 1/2" - 2 1/2" bore, there is no length adder for "MPR-WB" option other than the stop tube length.

## OPERATING TEMPERATURE

Carboxylated Nitrile: -20°F to 200°F (-25°C to 90°C)  
Fluorocarbon: 0°F to 400°F (-20°C to 200°C)

## STAINLESS STEEL 'TRA'

Consult factory for available models and delivery.

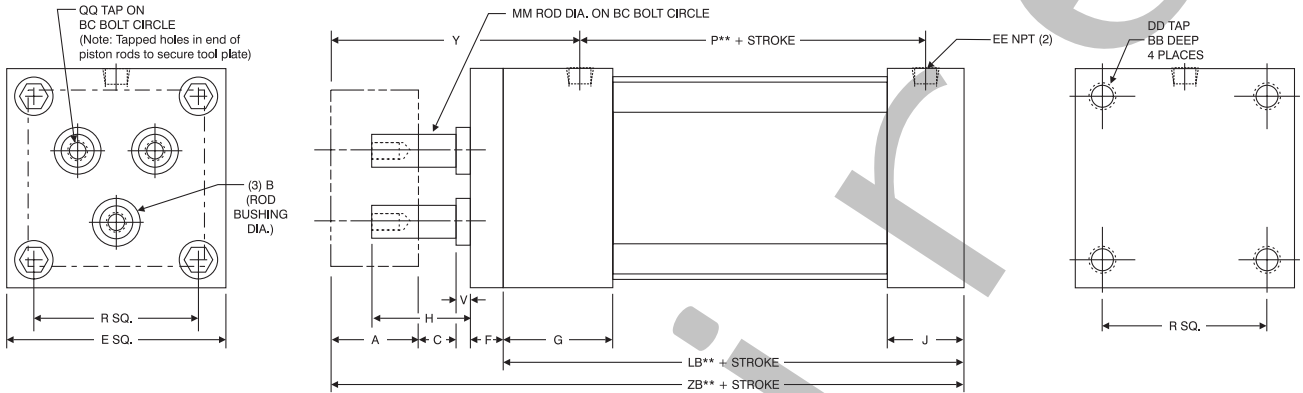
## 'TRA-MSE' & 'TRA-MSR'

Triple Rod Cylinders can be furnished in multi-stage designs. (Consult factory for available models and delivery.)

# SERIES 'TRA' HEAVY-DUTY: TRIPLE PISTON ROD

## MXO (NO MOUNT)

(1 1/2" - 8" BORE)

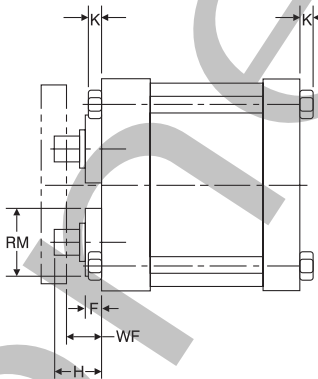


'TRA' SERIES BASIC DIMENSIONS 'MXO'																				
BORE	A	B	BB	BC	C	DD	E	EE	F	G	H	J	LB	MM	P	QQ	R	V	Y	ZB
1 1/2	3/4	9/16	1/2	.89	1/2	1/4-28	2	1/4	3/8	1 1/2	1.1	1	3 3/8**	5/16	2 3/8**	10-32	1.43	1/4	2 3/4	5 1/2**
2	3/4	13/16	1/2	1.195	1/2	5/16-24	2 1/2	1/4	3/8	1 1/2	1.1	1	3 3/8**	1/2	2 3/8**	1/4-28	1.84	1/4	2 3/4	5 1/2**
2 1/2	1	1 1/64	1/2	1.50	1/2	3/16-24	3	1/4	3/8	1 1/2	1.35	1	3 3/4**	5/8	2 1/2**	5/16-24	2.19	1/4	3	5 7/8**
3 1/4	1	1 1/8	5/8	2.075	1/2	3/8-24	3 3/4	3/8	5/8	1 3/4	1.1	1 1/4	4 1/4	5/8	2 3/4	3/8-24	2.76	1/4	3 3/8	6 7/8
4	1	1 1/8	5/8	2.825	1/2	3/8-24	4 1/2	3/8	5/8	1 3/4	1.1	1 1/4	4 1/4	5/8	2 3/4	3/8-24	3.32	1/4	3 3/8	6 7/8
5	1	1 1/2	5/8	3.375	1	1/2-20	5 1/2	3/8	5/8	1 3/4	1.84	1 1/4	4 1/2	1	3	1/2-20	4.10	1/4	3 7/8	7 3/8
6	1	1 1/2	3/4	3.937	1	1/2-20	6 1/2	1/2	3/4	2	1.84	1 1/2	5	1	3 1/4	1/2-20	4.88	1/4	4 1/8	8
8	1	1 1/2	—	5.75	1 3/8	—	8 1/2	3/4	—	2	2.84	1 1/2	5 1/8	1	3 3/8	1/2-20	6.44	1/4	4 3/8	8 3/8*

\*"ZB" does not include "K" hex nut dimension. (See below for dimensions.)  
 \*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

## MXO (NO MOUNT)

(8" BORE)

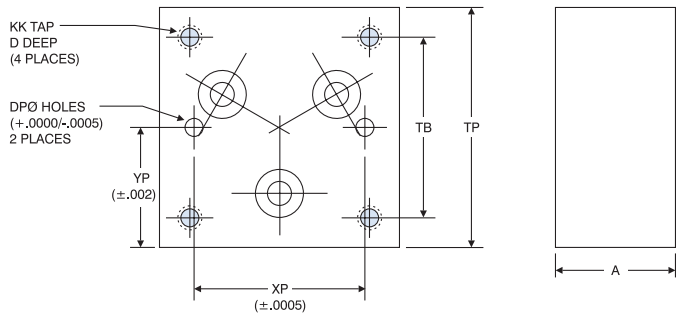


'TRA' SERIES BASIC DIMENSIONS 'MXO'					
BORE	F	H	K	RM	WF
8	5/8	2.84	9/16	2 1/4	2 1/4

\*8" bore has (3) round retainers, 5/8" thick, 2 1/4" dia., and uses hex nuts on both ends for MXO mount.

## Tooling Plate

Note: Standard Tool Plate includes (2) dowel pin holes (Included with cylinder)

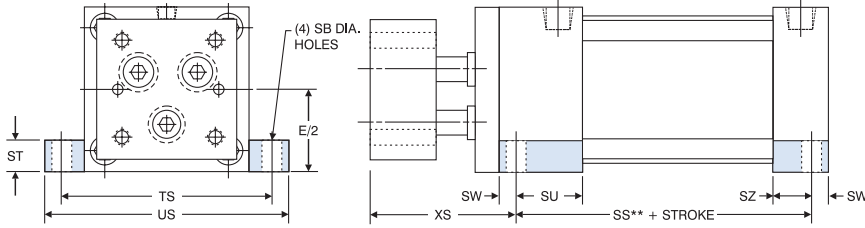


'TRA' SERIES TOOLING PLATE DIMENSIONS									
STANDARD						DOWEL PIN DIMENSIONS			
BORE	A	D	KK	TB	TP	BORE	DP Ø	XP	YP
1 1/2	3/4	3/4	10-32	1.13	1 1/2	1 1/2	1/8	1.125	.750
2	3/4	3/4	1/4-28	1.44	2	2	1/8	1.375	1.00
2 1/2	1	1	5/16-24	1.84	2 1/2	2 1/2	3/16	1.750	1.250
3 1/4	1	1	3/8-24	2.19	3 1/4	3 1/4	1/4	2.250	1.625
4	1	1	3/8-24	2.76	4	4	1/4	2.750	2.00
5	1	1	1/2-20	3.31	5	5	5/16	3.250	2.50
6	1	1	1/2-20	4.10	6	6	3/16	4.00	3.00
8	1	1	1/2-20	4.88	8	8	3/8	4.875	4.00

# SERIES 'TRA' DIMENSIONS: BASE & PIVOT MOUNTS

## BASE MOUNTS (1/2"-8" BORE)

### MS2

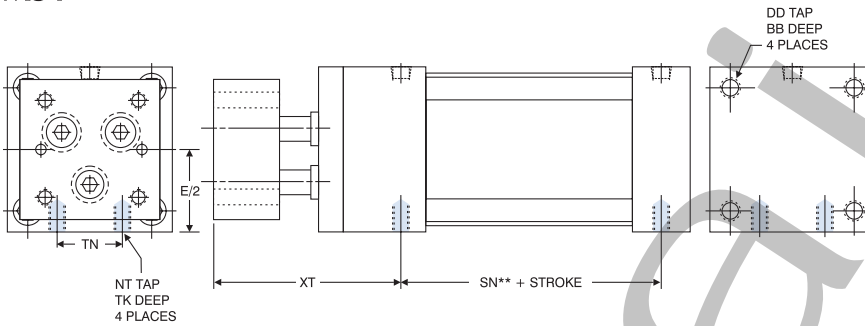


'TRA' SERIES 'MS2' DIMENSIONS										
BORE	SB	E/2	SS	ST	SU	SW	SZ	TS	US	XS
1 1/2	7/16	1	2 7/8**	1/2	1 1/8	3/8	3/8	2 3/4	3 1/2	2 1/4
2	7/16	1 1/4	2 7/8**	1/2	1 1/8	3/8	3/8	3 3/4	4	2 1/4
2 1/2	7/16	1 1/2	3**	1/2	1 1/8	3/8	5/8	3 3/4	4 1/2	2 1/2
3 1/4	9/16	1 7/8	3 1/4	3/4	1 1/4	1/2	3/4	4 3/4	5 3/4	2 7/8
4	9/16	2 1/4	3 1/4	3/4	1 1/4	1/2	3/4	5 1/2	6 1/2	2 7/8
5	13/16	2 3/4	3 3/8	1	1 1/8	11/16	9/16	6 7/8	8 1/4	3 9/16
6	13/16	3 1/4	3 5/8	1	1 5/8	11/16	13/16	7 7/8	9 1/4	3 11/16
8	13/16	4 1/4	3 3/4	1	1 5/8	11/16	13/16	9 7/8	11 1/4	3 15/16

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

For dimensions not shown, see page 51.

### MS4

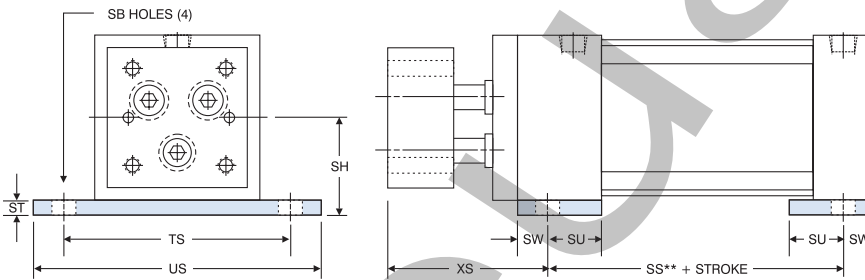


'TRA' SERIES 'MS4' DIMENSIONS						
BORE	E/2	NT	TK	TN	XT	SN
1 1/2	1	1/4-20	3/8	5/8	2 13/16	2 1/4**
2	1 1/4	5/16-18	1/2	7/8	2 13/16	2 1/4**
2 1/2	1 1/2	3/8-16	5/8	1 1/4	3 1/16	2 3/8**
3 1/4	1 7/8	1/2-13	3/4	1 1/2	3 7/16	2 5/8
4	2 1/4	1/2-13	3/4	2 1/16	3 7/16	2 5/8
5	2 3/4	5/8-11	1	2 11/16	3 15/16	2 7/8
6	3 1/4	3/4-10	1 1/8	3 1/4	4 3/16	3 1/8
8	4 1/4	3/4-10	1 1/8	4 1/2	4 7/16	3 1/4

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

For dimensions not shown, see page 51.

### BASE BAR (Non-NFPA)



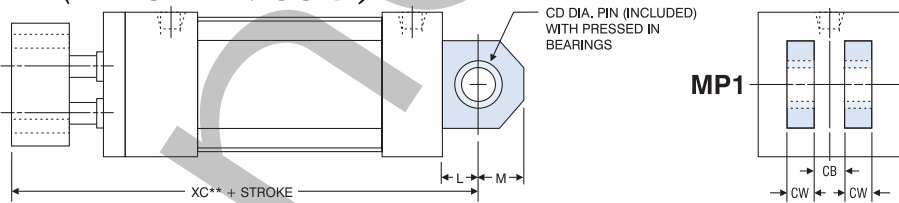
'TRA' SERIES BASE BAR (Non-NFPA) DIMENSIONS									
BORE	SB	SH	SS	ST	SU	SW	TS	US	XS
1 1/2	7/16	1 1/4	2 7/8**	1/4	1 1/8	3/8	2 3/4	3 1/2	2 1/4
2	7/16	1 1/2	2 7/8**	1/4	1 1/8	3/8	3 1/4	4	2 1/4
2 1/2	7/16	1 7/8	3**	3/8	1 1/8	3/8	3 3/4	4 1/2	2 1/2
3 1/4	9/16	2 3/8	3 1/4	1/2	1 1/4	1/2	4 3/4	5 3/4	2 7/8
4	9/16	2 3/4	3 1/4	1/2	1 1/4	1/2	5 1/2	6 1/2	2 7/8

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

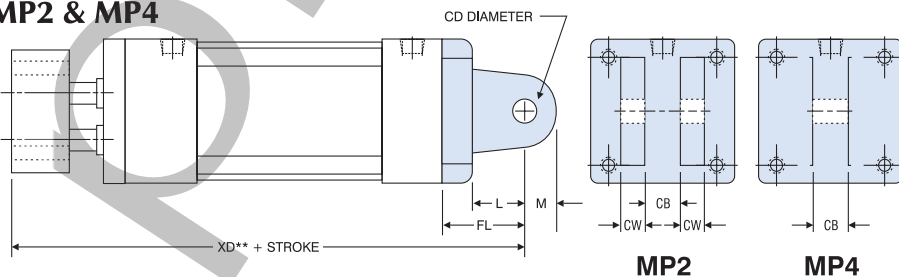
For dimensions not shown, see page 51.

## PIVOT MOUNTS (1/2"-8" BORE)

### MP1 (EXTRUDED MOUNT)



### MP2 & MP4



'TRA' SERIES 'MP1'-'MP2'-'MP4' DIMENSIONS								
BORE	CB	CD	CW	FL	L	M	XC	XD
1 1/2	3/4	1/2	1/2	1 1/8	3/4	5/8	6 1/4**	6 5/8**
2	3/4	1/2	1/2	1 1/8	3/4	5/8	6 1/4**	6 5/8**
2 1/2	3/4	1/2	1/2	1 1/8	3/4	5/8	6 5/8**	7**
3 1/4	1 1/4	3/4	5/8	1 7/8	1 1/4	7/8	7 7/8	8 1/2
4	1 1/4	3/4	5/8	1 7/8	1 1/4	7/8	7 7/8	8 1/2
5	1 1/4	3/4	5/8	1 7/8	1 1/4	7/8	8 5/8	9 1/4
6	1 1/2	1	3/4	2 1/4	1 1/2	1	9 5/8	10 1/4
8	1 1/2	1	3/4	N/A	1 1/2	1	9 7/8	N/A

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

Note: 8" bore is a welded mount.

△ MP4 available as specials in 5", 6" & 8" bores.

**Note:** Extruded MP1 mounts are standard (1 1/2"-8" bores) Cast Iron removable mounts are optional, and must be requested when ordering (1 1/2"-6" bores).

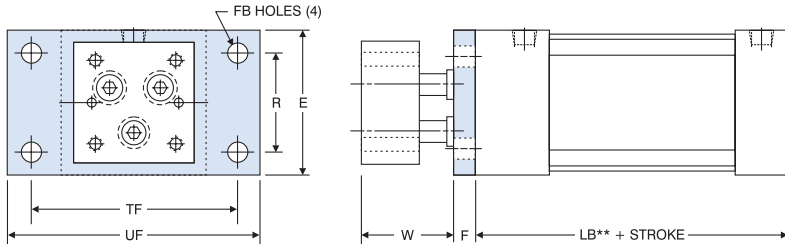
Clevis Pin included with MP1, MP2 & MP4 mounts

# SERIES 'TRA' DIMENSIONS: FLANGE MOUNTS

## FLANGE MOUNTS

(1 1/2"-6" BORE)

### MF1

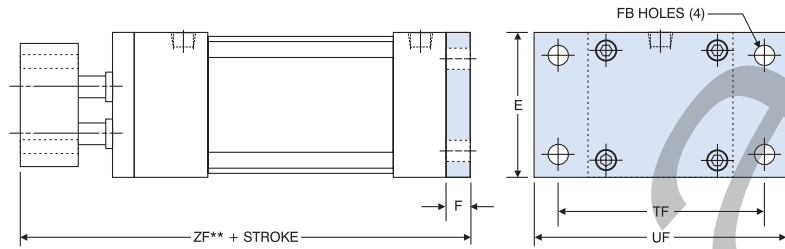


'TRA' SERIES 'MF1' & 'MF2' DIMENSIONS									
BORE	E	F	FB	LB	R	TF	UF	W	ZF
1 1/2	2	3/8	5/16	3 5/8**	1.43	2 3/4	3 3/8	1 1/2	5 7/8**
2	2 1/2	3/8	3/8	3 5/8**	1.84	3 3/8	4 1/8	1 1/2	5 7/8**
2 1/2	3	3/8	3/8	3 3/4**	2.19	3 7/8	4 7/8	1 3/4	6 1/4**
3 1/4	3 3/4	5/8	7/16	4 1/4	2.76	4 11/16	5 1/2	1 3/4	7 1/4
4	4 1/2	5/8	7/16	4 1/4	3.32	5 7/16	6 1/4	1 3/4	7 1/4
5	5 1/2	5/8	9/16	4 1/2	4.10	6 5/8	7 5/8	2 1/4	8
6	6 1/2	3/4	9/16	5	4.88	7 5/8	8 5/8	2 1/4	8 3/4

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

For dimensions not shown, see page 51.

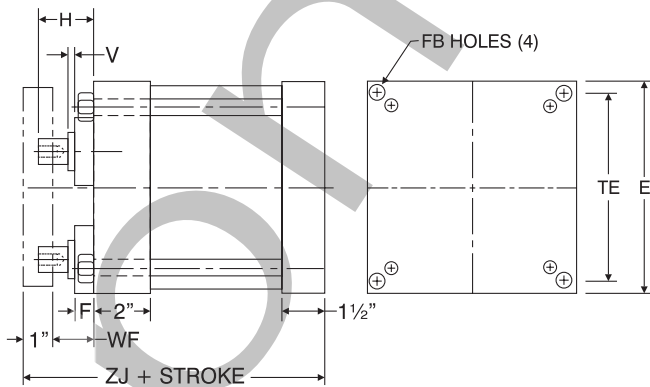
### MF2



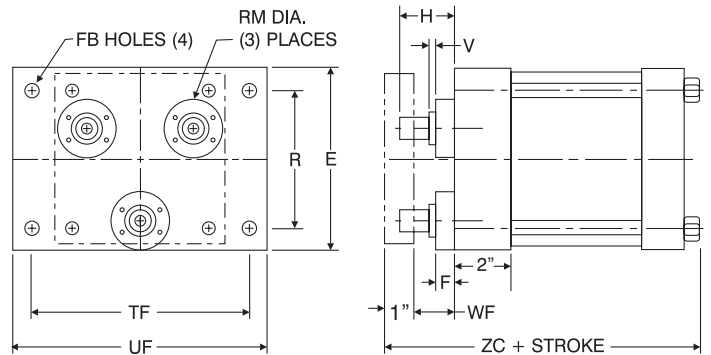
## FLANGE MOUNTS

(8" BORE)

### ME4



### ME5 (Non-NFPA)



'TRA' SERIES 'ME4' & 'ME5' DIMENSIONS													
BORE	E	F	FB	H	R	RM	TE	TF	UF	V	WF	ZC	ZJ
8	8 1/2	3/8	1 1/16	2.84	6.44	2 3/4	7.57	10 1/4	12	1/4	2 1/4	8 5/16	8 3/8

Note: (3) 1" diameter rods on 5.750 B.C.

For dimensions not shown, see page 51.

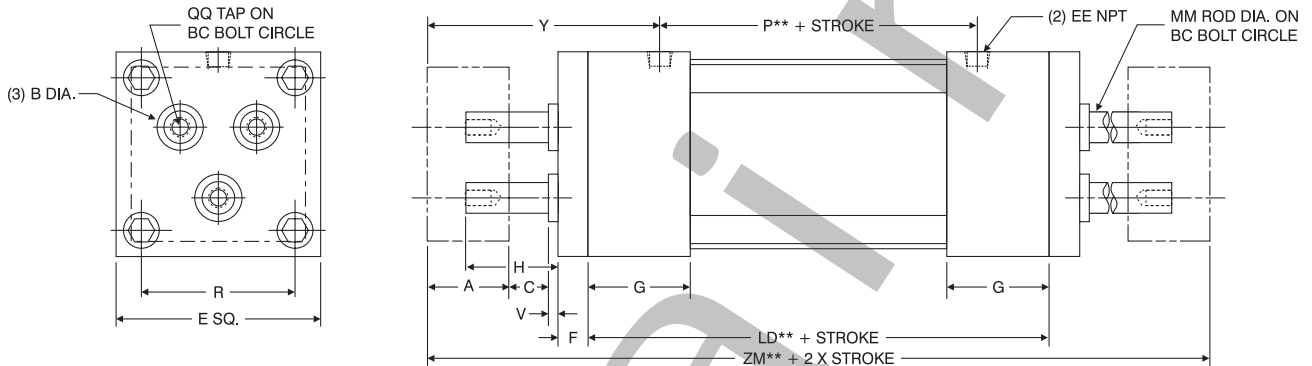
# SERIES 'TRA' DIMENSIONS: DOUBLE ROD END

## Benefits

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

## MXOD3 (TRIPLE ROD BOTH ENDS) BASIC DIMENSIONS

(NO MOUNT)

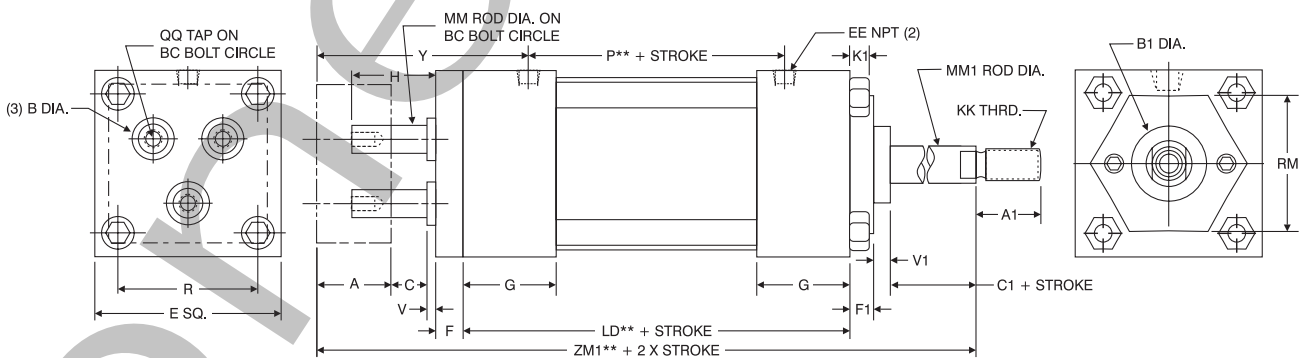


BORE	A	B	BC	C	E	EE	F	G	H	LD	MM	P	QQ	R	V	Y	ZM
1 1/2	3/4	9/16	.89	1/2	2	1/4	3/8	1 1/2	1.1	4 1/8**	5/16	2 3/8**	10-32	1.43	1/4	2 3/4	7 7/8**
2	3/4	13/16	1.195	1/2	2 1/2	1/4	3/8	1 1/2	1.1	4 1/8**	1/2	2 3/8**	1/4-28	1.84	1/4	2 3/4	7 7/8**
2 1/2	1	1 1/4	1.50	1/2	3	1/4	3/8	1 1/2	1.35	4 1/4**	5/8	2 1/2**	5/16-24	2.19	1/4	3	8 1/2**
3 1/4	1	1 1/8	2.075	1/2	3 3/4	3/8	5/8	1 3/4	1.1	4 3/4	5/8	2 3/4	3/8-24	2.76	1/4	3 3/8	9 1/2
4	1	1 1/8	2.825	1/2	4 1/2	3/8	5/8	1 3/4	1.1	4 3/4	5/8	2 3/4	3/8-24	3.32	1/4	3 3/8	9 1/2
5	1	1 1/2	3.375	1	5 1/2	3/8	5/8	1 3/4	1.84	5	1	3	1/2-20	4.10	1/4	3 7/8	10 3/4
6	1	1 1/2	3.937	1	6 1/2	1/2	3/4	2	1.84	5 1/2	1	3 1/4	1/2-20	4.88	1/4	4 1/8	11 1/2
8	1	1 1/2	5.75	1 3/8	8 1/2	3/4	5/8*	2	2.84	5 7/8	1	3 3/8	1/2-20	6.44	1/4	4 3/8	12 1/2

\*8" bore has (3) round retainers, 3/8" thick, 2 3/4" dia., and uses hex nuts on ends. (See page 51)  
 \*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

## MXOD1 (TRIPLE ROD WITH SINGLE ROD) BASIC DIMENSIONS

(NO MOUNT)



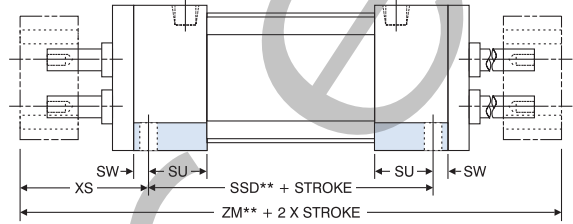
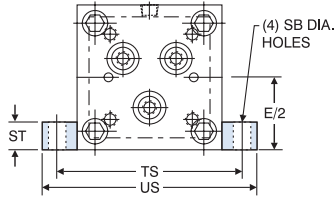
BORE	A	A1	B	B1	BC	C	C1	E	EE	F	F1	G	H	K1	KK	LD	MM	MM1	P	QQ	R	RM	V	V1	Y	ZM1
1 1/2	3/4	3/4	9/16	1 1/8	.89	1/2	3/8	2	1/4	3/8	3/8	1 1/2	1.1	1/4	7/16-20	4 1/8**	5/16	5/8	2 3/8**	10-32	1.43	2 Sq.	1/4	1/4	2 3/4	7**
2	3/4	3/4	13/16	1 1/8	1.195	1/2	3/8	2 1/2	1/4	3/8	3/8	1 1/2	1.1	5/16	7/16-20	4 1/8**	1/2	5/8	2 3/8**	1/4-28	1.84	1 3/4 Hex.	1/4	1/4	2 3/4	7**
2 1/2	1	3/4	1 1/4	1 1/8	1.50	1/2	3/8	3	1/4	3/8	3/8	1 1/2	1.35	5/16	7/16-20	4 1/4**	5/8	5/8	2 1/2**	5/16-24	2.19	1 3/4 Hex.	1/4	1/4	3	7 7/8**
3 1/4	1	1 1/8	1 1/8	1 1/2	2.075	1/2	1/2	3 3/4	3/8	5/8	5/8	1 3/4	1.1	3/8	3/4-16	4 3/4	5/8	1	2 3/4	3/8-24	2.76	2 3/4 Dia.	1/4	1/4	3 3/8	8 1/2
4	1	1 1/8	1 1/8	1 1/2	2.825	1/2	1/2	4 1/2	3/8	5/8	5/8	1 3/4	1.1	3/8	3/4-16	4 3/4	5/8	1	2 3/4	3/8-24	3.32	2 3/4 Dia.	1/4	1/4	3 3/8	8 1/2
5	1	1 1/8	1 1/2	1 1/2	3.375	1	1/2	5 1/2	3/8	5/8	5/8	1 3/4	1.84	7/16	3/4-16	5	1	1	3	1/2-20	4.10	2 3/4 Dia.	1/4	1/4	3 7/8	9 1/4
6	1	1 1/8	1 1/2	2	3.937	1	5/8	6 1/2	1/2	3/4	5/8	2	1.84	7/16	1-14	5 1/2	1	1 3/8	3 1/4	1/2-20	4.88	3 1/2 Dia.	1/4	3/8	4 1/8	10 1/8
8	1	1 1/8	1 1/2	2	5.75	1 3/8	5/8	8 1/2	3/4	5/8*	5/8	2	2.84	9/16	1-14	5 7/8	1	1 3/8	3 3/8	1/2-20	6.44	3 1/2 Dia.	1/4	3/8	4 3/8	10 1/2

\*8" bore has (3) round retainers, 3/8" thick, 2 3/4" dia., and uses hex nuts on ends. (See page 51)  
 \*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

# SERIES 'TRA' DIMENSIONS: DOUBLE ROD END BASE MOUNTS

**NEW**

**MS2D3**

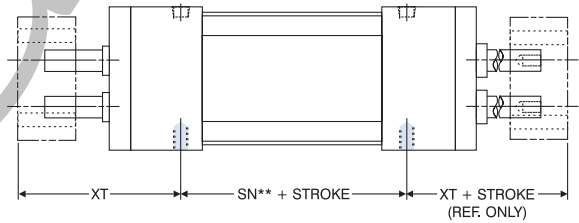
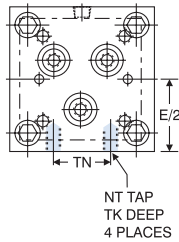


'TRA' SERIES 'MS2D' DIMENSIONS										
BORE	SB	E/2	SSD	ST	SU	SW	TS	US	XS	ZM
1 1/2	7/16	1	3 3/8**	1/2	1 1/8	3/8	2 3/4	3 1/2	2 1/4	7 7/8**
2	7/16	1 1/4	3 3/8**	1/2	1 1/8	3/8	3 1/4	4	2 1/4	7 7/8**
2 1/2	7/16	1 1/2	3 1/2**	1/2	1 1/8	3/8	3 3/4	4 1/2	2 1/2	8 1/2**
3 1/4	9/16	1 7/8	3 3/4	3/4	1 1/4	1/2	4 3/4	5 3/4	2 7/8	9 1/2
4	9/16	2 1/4	3 3/4	3/4	1 1/4	1/2	5 1/2	6 1/2	2 7/8	9 1/2
5	1 3/16	2 3/4	3 5/8	1	1 1/16	11/16	6 7/8	8 1/4	3 3/16	10 1/4
6	1 3/16	3 1/4	4 1/8	1	1 3/16	11/16	7 7/8	9 1/4	3 11/16	11 1/2
8	1 3/16	4 1/4	4 1/4	1	1 3/16	11/16	9 7/8	11 1/4	3 15/16	12 1/8

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

For dimensions not shown, see page 54.

**MS4D3**

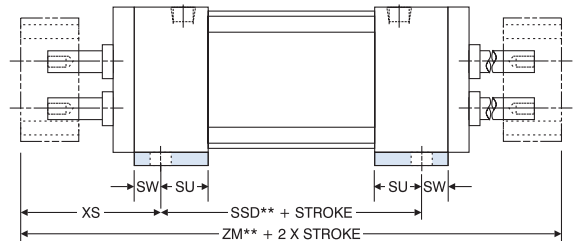
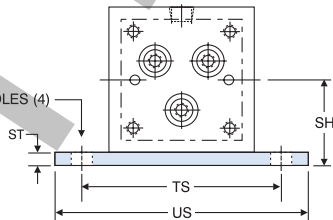


'TRA' SERIES 'MS4D1' DIMENSIONS							
BORE	E/2	NT	TK	TN	XT	SN	
1 1/2	1	1/4-20	3/8	5/8	2 13/16	2 1/4**	
2	1 1/4	3/16-18	1/2	7/8	2 13/16	2 1/4**	
2 1/2	1 1/2	3/8-16	5/8	1 1/4	3 1/16	2 3/8**	
3 1/4	1 7/8	1/2-13	3/4	1 1/2	3 7/16	2 5/8	
4	2 1/4	5/8-13	3/4	2 1/16	3 7/16	2 5/8	
5	2 3/4	3/8-11	1	2 11/16	3 15/16	2 7/8	
6	3 1/4	3/4-10	1 1/8	3 1/4	4 3/16	3 7/8	
8	4 1/4	3/4-10	1 1/8	4 1/2	4 7/16	3 3/4	

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

For dimensions not shown, see page 54.

**BASEBAR-D3 (Non-NFPA)**



'TRA' SERIES BASEBAR-D3 (Non-NFPA) DIMENSIONS										
BORE	SB	SH	SSD	ST	SU	SW	TS	US	XS	ZM
1 1/2	7/16	1 1/4	3 3/8**	1/4	1 1/8	3/8	2 3/4	3 1/2	2 1/4	7 7/8**
2	7/16	1 1/2	3 3/8**	1/4	1 1/8	3/8	3 1/4	4	2 1/4	7 7/8**
2 1/2	7/16	1 7/8	3 1/2**	3/8	1 1/8	3/8	3 3/4	4 1/2	2 1/2	8 1/2**
3 1/4	9/16	2 3/8	3 3/4	1/2	1 1/4	1/2	4 3/4	5 3/4	2 7/8	9 1/2
4	9/16	2 3/4	3 3/4	1/2	1 1/4	1/2	5 1/2	6 1/2	2 7/8	9 1/2

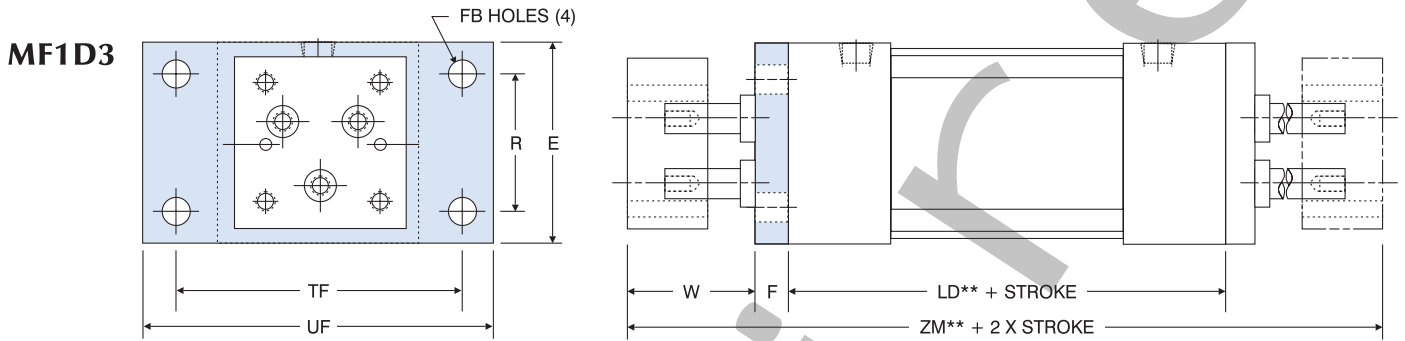
\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

For dimensions not shown, see page 54.

# SERIES 'TRA' DIMENSIONS: DOUBLE ROD END

## FLANGE MOUNTS

(1½"-6" BORE)



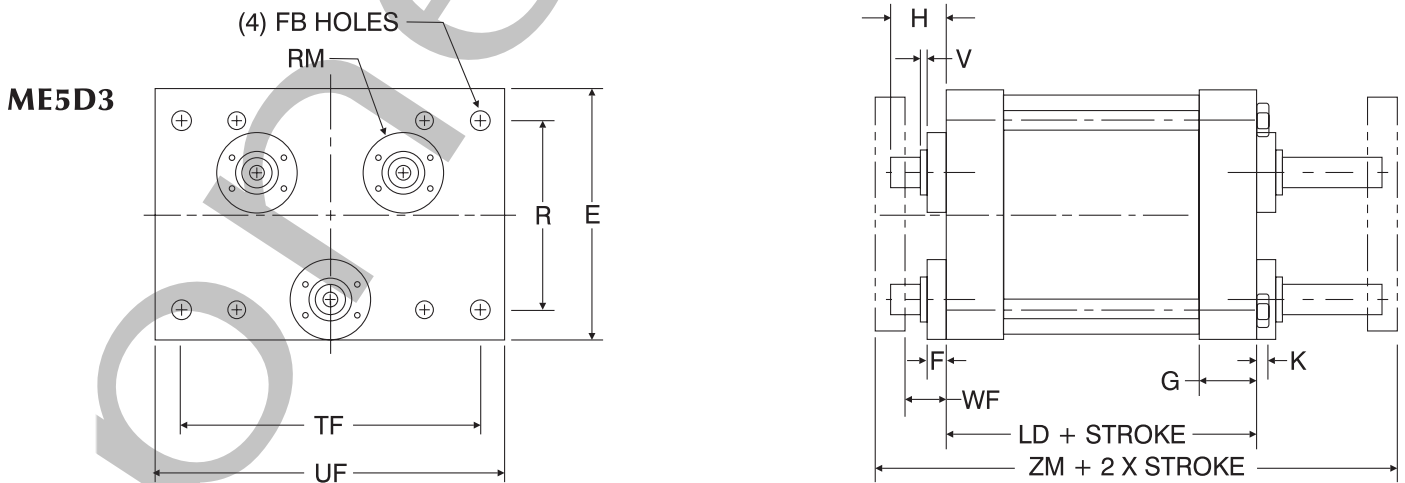
'TRA' SERIES 'MF1D3' DIMENSIONS									
BORE	E	F	FB	LD	R	TF	UF	W	ZM
1½	2	3/8	5/16	4 1/8**	1.43	2 3/4	3 3/8	1 1/2	7 7/8**
2	2 1/2	3/8	3/8	4 1/8**	1.84	3 3/8	4 1/8	1 1/2	7 7/8**
2 1/2	3	3/8	3/8	4 1/4**	2.19	3 7/8	4 5/8	1 3/4	8 1/2**
3 1/4	3 3/4	5/8	7/16	4 3/4	2.76	4 11/16	5 1/2	1 3/4	9 1/2
4	4 1/2	5/8	7/16	4 3/4	3.32	5 7/16	6 1/4	1 3/4	9 1/2
5	5 1/2	5/8	9/16	5	4.10	6 5/8	7 5/8	2 1/4	10 3/4
6	6 1/2	3/4	9/16	5 1/2	4.88	7 5/8	8 5/8	2 1/4	11 1/2

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

For dimensions not shown, see page 54.

## FLANGE MOUNTS

(8" BORE)



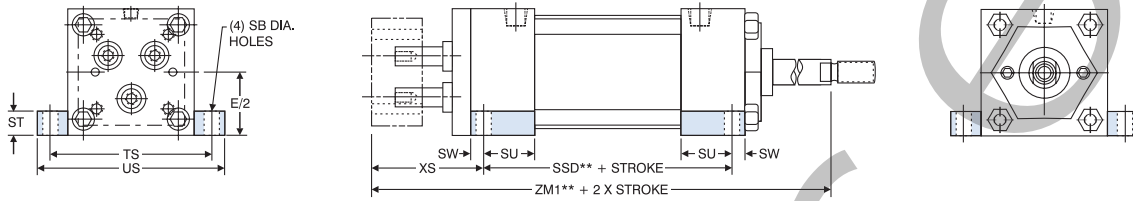
'TRA' SERIES 'ME5D3' DIMENSIONS															
BORE	E	F	FB	G	H	K	LD	R	RM	TE	TF	UF	V	WF	ZM
8	8 1/2	3/8	11/16	2	2.84	9/16	5 5/8	6.44	2 3/4	7.57	10 1/4	12	3/8	2 1/4	12 1/8

Note: (3) 1" diameter rods on 5.750 B.C.

For dimensions not shown, see page 54.



# SERIES 'TRA' DIMENSIONS: DOUBLE ROD END (WITH SINGLE ROD) BASE MOUNTS

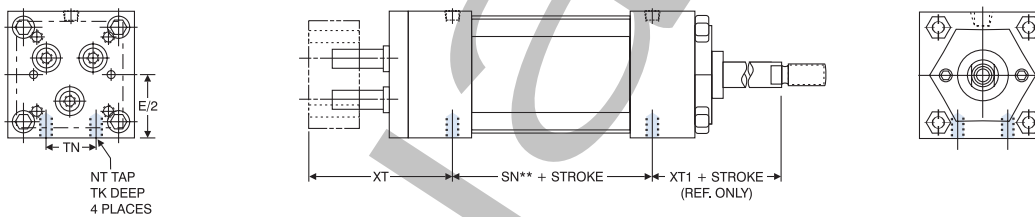


## MS2D1 (TRIPLE ROD WITH SINGLE ROD)

'TRA' SERIES 'MS2D1' DIMENSIONS										
BORE	SB	E/2	SSD	ST	SU	SW	TS	US	XS	ZM1
1 1/2	7/16	1	3 3/8**	1/2	1 1/8	3/8	2 3/4	3 1/2	2 1/4	7**
2	7/16	1 1/4	3 3/8**	1/2	1 1/8	3/8	3 1/4	4	2 1/4	7**
2 1/2	7/16	1 1/2	3 1/2**	1/2	1 1/8	3/8	3 3/4	4 1/2	2 1/2	7 3/8**
3 1/4	9/16	1 7/8	3 3/4	3/4	1 1/4	1/2	4 3/4	5 1/4	2 7/8	8 1/2
4	9/16	2 1/4	3 3/4	3/4	1 1/4	1/2	5 1/2	6 1/2	2 7/8	8 1/2
5	1 3/16	2 3/4	3 5/8	1	1 1/16	11/16	6 7/8	8 1/4	3 3/16	9 1/4
6	1 3/16	3 1/4	4 1/8	1	1 3/16	11/16	7 7/8	9 1/4	3 11/16	10 1/8
8	1 3/16	4 1/4	4 1/4	1	1 7/16	11/16	9 7/8	11 1/4	3 15/16	10 1/2

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

For single rod end dimensions not shown, see pages 54 or 61.

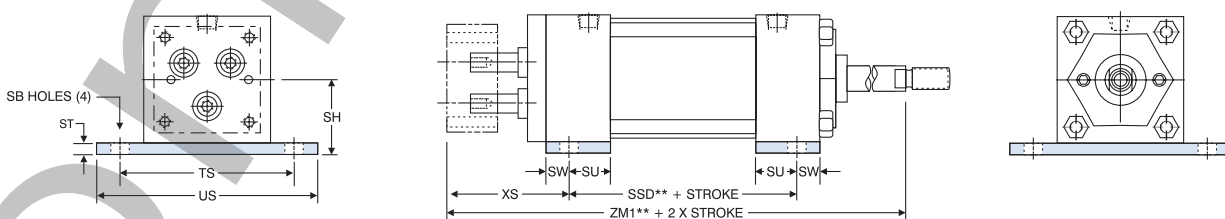


## MS4D1 (TRIPLE ROD WITH SINGLE ROD)

'TRA' SERIES 'MS4D1' DIMENSIONS							
BORE	E/2	NT	TK	TN	XT	SN	XT1
1 1/2	1	1/4-20	3/8	5/8	2 13/16	2 1/4**	1 15/16
2	1 1/4	5/16-18	1/2	7/8	2 13/16	2 1/4**	1 15/16
2 1/2	1 1/2	3/8-16	5/8	1 1/4	3 1/16	2 3/8**	1 15/16
3 1/4	1 7/8	1/2-13	3/4	1 1/2	3 7/16	2 5/8	2 7/16
4	2 1/4	1/2-13	3/4	2 1/16	3 7/16	2 5/8	2 7/16
5	2 3/4	5/8-11	1	2 11/16	3 15/16	2 7/8	2 7/16
6	3 1/4	3/4-10	1 1/8	3 1/4	4 7/16	3 1/8	2 13/16
8	4 1/4	3/4-10	1 1/8	4 1/2	4 7/16	3 1/4	2 13/16

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

For single rod end dimensions not shown, see pages 54 or 61.



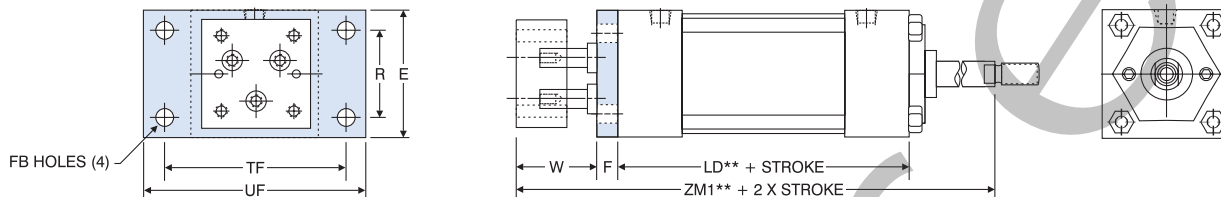
## BASEBAR-D1 (TRIPLE ROD WITH SINGLE ROD) (Non-NFPA)

'TRA' SERIES BASEBAR-D1 (Non-NFPA) DIMENSIONS										
BORE	SB	SH	SSD	ST	SU	SW	TS	US	XS	ZM1
1 1/2	7/16	1 1/4	3 3/8**	1/4	1 1/8	3/8	2 3/4	3 1/2	2 1/4	7**
2	7/16	1 1/2	3 3/8**	1/4	1 1/8	3/8	3 1/4	4	2 1/4	7**
2 1/2	7/16	1 7/8	3 1/2**	3/8	1 1/8	3/8	3 3/4	4 1/2	2 1/2	7 3/8**
3 1/4	9/16	2 3/8	3 3/4	1/2	1 1/4	1/2	4 3/4	5 3/4	2 7/8	8 1/2
4	9/16	2 3/4	3 3/4	1/2	1 1/4	1/2	5 1/2	6 1/2	2 7/8	8 1/2

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

For single rod end dimensions not shown, see pages 54 or 61.

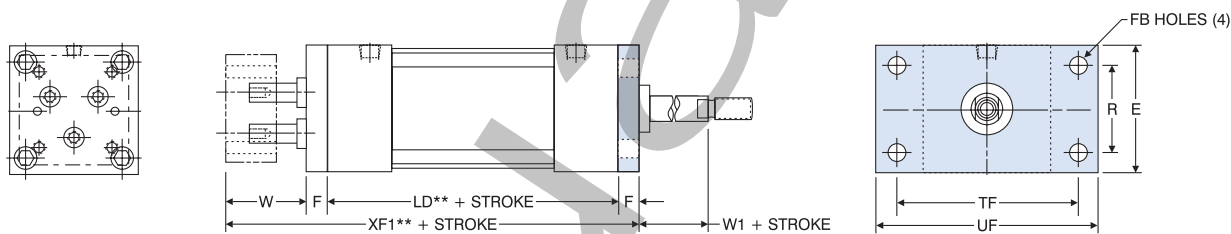
# SERIES 'TRA' DIMENSIONS: DOUBLE ROD END (WITH SINGLE ROD) BASE MOUNTS



## MF1D1 (TRIPLE ROD WITH SINGLE ROD)

'TRA' SERIES 'MF1D1' DIMENSIONS									
BORE	E	F	FB	LD	R	TF	UF	W	ZM1
1 1/2	2	3/8	5/16	4 1/8**	1.43	2 3/4	3 3/8	1 1/2	7**
2	2 1/2	3/8	3/8	4 1/8**	1.84	3 3/8	4 1/8	1 1/2	7**
2 1/2	3	3/8	3/8	4 1/4**	2.19	3 7/8	4 5/8	1 3/4	7 3/8**
3 1/4	3 3/4	5/8	7/16	4 3/4	2.76	4 11/16	5 1/2	1 3/4	8 1/2
4	4 1/2	5/8	7/16	4 3/4	3.32	5 7/16	6 1/4	1 3/4	8 1/2
5	5 1/2	5/8	9/16	5	4.10	6 5/8	7 3/8	2 1/4	9 1/4
6	6 1/2	3/4	9/16	5 1/2	4.88	7 5/8	8 5/8	2 1/4	10 1/8

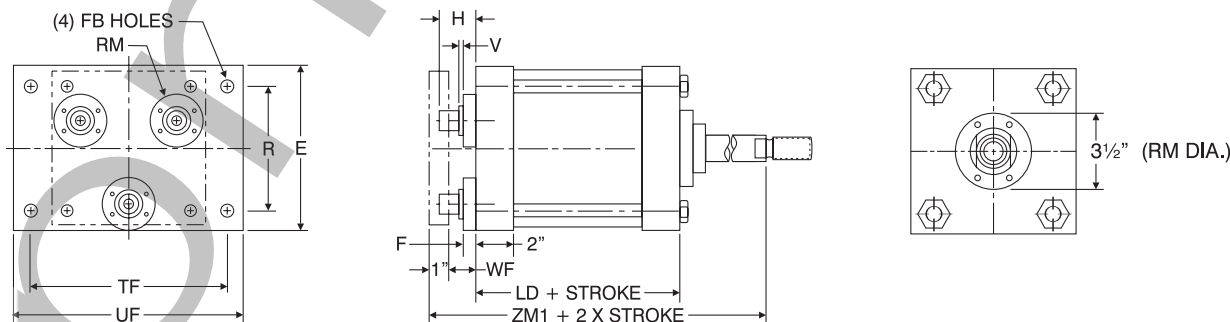
\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.  
For single rod end dimensions not shown, see pages 54 or 61.



## MF2D1 (TRIPLE ROD WITH SINGLE ROD)

'TRA' SERIES 'MF2D1' DIMENSIONS										
BORE	E	F	FB	LD	R	TF	UF	W	XF1	W1
1 1/2	2	3/8	5/16	4 1/8**	1.43	2 3/4	3 3/8	1 1/2	6 3/8**	5/8
2	2 1/2	3/8	3/8	4 1/8**	1.84	3 3/8	4 1/8	1 1/2	6 3/8**	5/8
2 1/2	3	3/8	3/8	4 1/4**	2.19	3 7/8	4 5/8	1 3/4	6 7/4**	5/8
3 1/4	3 3/4	5/8	7/16	4 3/4	2.76	4 11/16	5 1/2	1 3/4	7 3/4	3/4
4	4 1/2	5/8	7/16	4 3/4	3.32	5 7/16	6 1/4	1 3/4	7 3/4	3/4
5	5 1/2	5/8	9/16	5	4.10	6 5/8	7 3/8	2 1/4	8 1/2	3/4
6	6 1/2	3/4	9/16	5 1/2	4.88	7 5/8	8 5/8	2 1/4	9 1/4	7/8

\*\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.  
For single rod end dimensions not shown, see pages 54 or 61.



## ME5D1 (TRIPLE ROD WITH SINGLE ROD)

'TRA' SERIES 'ME5D1' DIMENSIONS											
BORE	E	F	FB	H	R	RM	TF	UF	V	WF	ZM1
8	8 1/2	5/8	1 1/16	2.84	6.44	2 3/4	10 1/4	12	1/4	2 1/4	5 5/8

Note: (3) 1" diameter rods on 5.750 B.C.  
For single rod end dimensions not shown, see pages 54 or 61.

# SERIES 'TRA': OPTIONS

**B**   **BC**   **BH**   **Bumpers**

Urethane impact dampening bumpers, used when cylinder speeds do not allow for standard cushions.

**BC**=Cap Bumper   **BH**=Head Bumper   **B**=Head & Cap Bumper  
(Note: Each bumper adds 1/4" to cylinder length)

**AS**   **Adjustable Stroke (Retract)**

Consists of a threaded rod in the cylinder cap, non-removable. Provides an adjustable positive stop on the cylinder retract.

To order, specify "AS" and length of adjustment (Example: AS=3")

**H**   **C**   **Cushions**

TRD's advanced cushion design features a unique, one piece seal that is allowed to float in a precision machined groove. This type of seal design provides consistent cushion performance and maximum seal life. Oversized flow paths molded in the periphery of the seal provide "full flow" on the return stroke without the use of ball checks.

**H**=Head Cushion   **C**=Cap Cushion

**AS3POS**   **Adjustable Mid Stroke (3 Position Cyl.)**

Double piston design allows for adjustment of the mid stroke position. Three ported cylinder with adjustable stop collar.

To order, specify "AS3POS" and length of adjustment. (Example: AS3POS = 4")

**MPR**   **Magnetic Piston**

Magnetic Pistons are used in conjunction with Reed and Solid State Switches. (R10, RAC & MSS Style Switches)

(Note: Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.)

**BACK TO BACK**

The Back to Back option consists of two separate cylinders assembled with common tie rods. For use when three or four rod positions are required, and a "double rod" style is acceptable.

To order, specify each cylinder model, with "Back to Back" note. (See page 31 for ordering information.)

**MULTIPLE POSITION**

The Multi-Position option is used when three, four or five rod positions are required in a "single rod" design. Piston rods are not connected. The back cylinder(s) achieve the mid-stroke positions.

(See page 36 for ordering information.)

**AIR/OIL TANDEM**

The Air/Oil Tandem cylinder consists of a hydraulic cylinder coupled with an air cylinder. Piston rods are connected. (Note: hydraulic unit is in front, having the exposed piston rod). Used to provide smooth, controlled stroke, even at slow speeds.

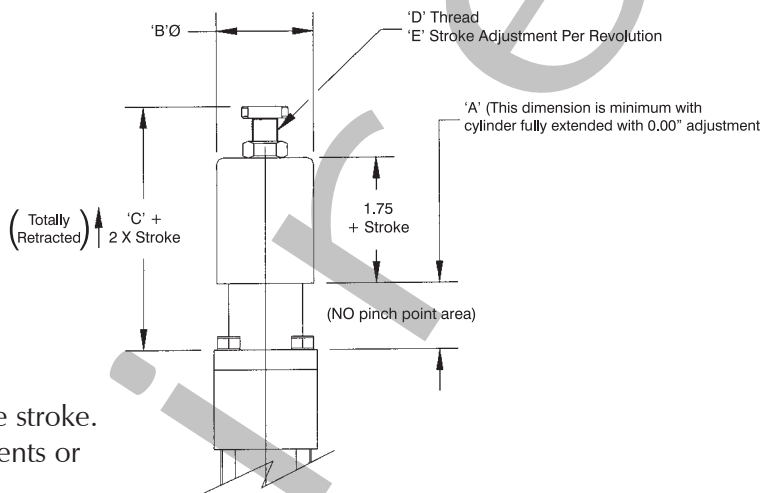
To order, specify standard model number, with "Air/Oil Tandem" note. (See page 42 for ordering information.)

**NOTE: 'TH' (400 PSI Hydraulic) option available. see page 90 for details.**

# SERIES 'TRA': OPTIONS

## MA Micro-Adjust

- Allows precise adjustment of cylinder extend stroke
- Easy to read precision scale (.001" calibration)
- Enclosed, no "pinch point" design
- Available on all cylinder models with "D1" Double Rod End option
- Up to 6" stroke and adjustment\*

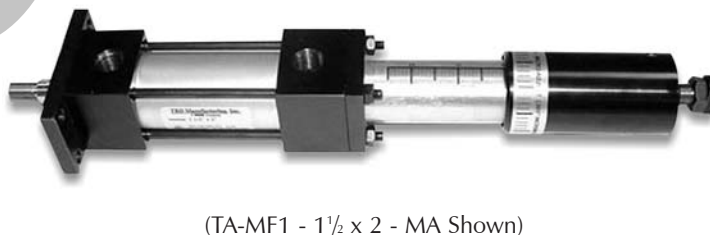
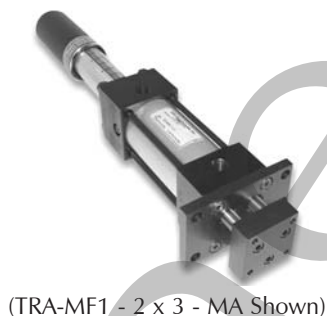


\*Note: The adjustment range is throughout entire stroke. Consult factory for longer stroke requirements or modifications not listed.

MICRO-ADJUST DIMENSIONS					
BORE	A	B	C	D	E
1½	1.00	1.88	3.71	½-20	.050
2	1.00	1.88	3.71	½-20	.050
2½	1.00	1.88	3.71	½-20	.050
3¼	1.00	2.81	3.71	¾-16	.063
4	.75	2.81	3.47	¾-16	.063
5	.75	2.81	3.47	¾-16	.063
6	.75	3.75	3.47	¾-16	.063
8	.75	3.75	3.47	¾-16	.063

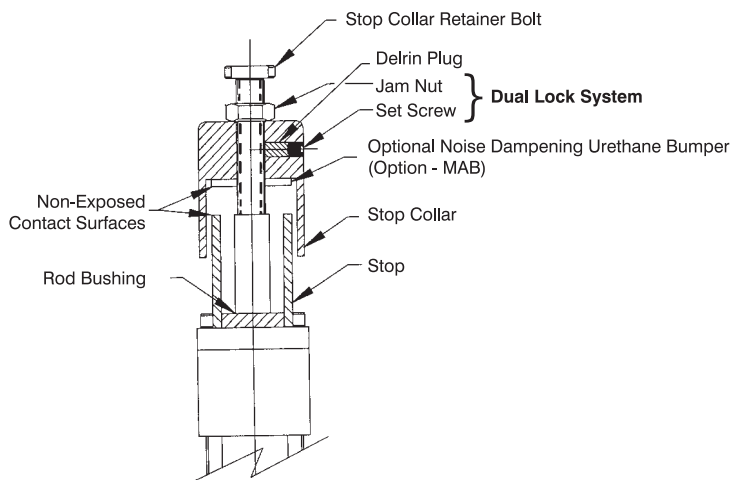
Note: See page 54 for other dimensions for model 'TRAD1'.

### Sample Micro-Adjust (Photos)



### MICRO-ADJUST SET-UP INSTRUCTIONS:

- 1) Set actuator to desired stroke
- 2) Turn stop collar until it makes contact with stop
- 3) Tighten set screw
- 4) Tighten jam nut for positive lock of stop collar



If the option you need isn't listed, just call TRD! We can accommodate most requests.

# SERIES 'TRA': OPTIONS

**ST=2**

**ST=4**

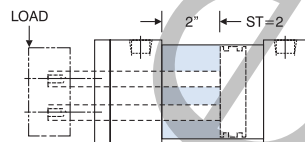
## Stop Tubes

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.

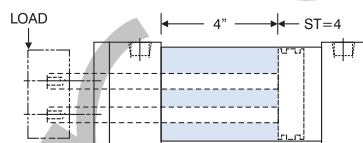
Ordering Example: TRA MS4 2 x 10 Effective Stroke-ST=2

The effective stroke must be included when ordering.

ST=2



ST=4



## STROKES

### Recommended Maximum\* Stroke Lengths

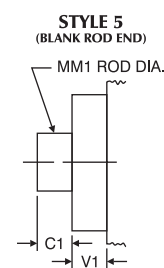
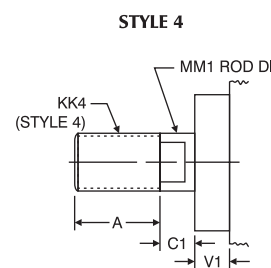
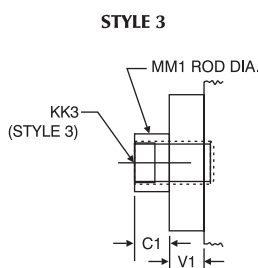
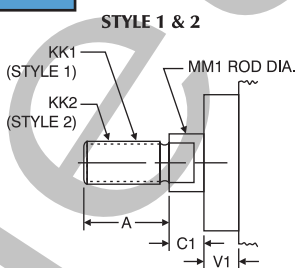
BORE	SINGLE ROD END MODELS			DOUBLE ROD END MODELS		
	TRA	TRA ST=2"	TRA ST=4"	TRA "D" ST=2"	TRA "D" ST=4"	TRA "D" ST=4"
1½	10	12	14	12	14	16
2	14	18	24	18	24	30
2½	20	24	30	30	38	40
3¼	24	28	36	34	42	46
4	24	30	38	36	44	48
5	26	34	42	40	52	56
6	28	36	44	42	54	58
8	30	38	46	42	54	60

\*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	MM ROD DIAMETER	STANDARD		OPTIONAL									
		Style 1 - Male		Style 2 - Male		Style 3 - Female		Style 4 - Male		Style 5 - Blank		C1*	V
		KK1	A	KK2	A	KK3	A	KK4	A	KK5			
1½, 2, 2½	¾ Standard	7/16-20	¾	½-20	¾	7/16-20	¾	7/16-18	¾	No Threads	7/8	¼	
3¼, 4, 5	1 Standard	7/8-16	1½	7/8-14	1½	¾-16	1½	1-14	1½	No Threads	½	¼	
6 & 8	1¾ Standard	1-14	1½	1¼-12	1½	1-14	1½	1¾-12	1½	No Threads	5/8	¾	

C1\* dimension is with single rod fully retracted.

## CUSTOM SOLUTIONS

**Still don't see what you need? No Problem!** With our extensive machining abilities, our engineering staff can assist with the design of a cylinder for your application. Call, fax or e-mail your specifications for a quick response! When it comes to delivery, TRD has the reputation as being one of the fastest. *No more long waits for your customized products!*

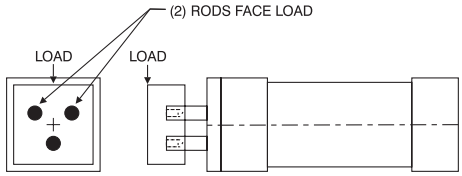
# SERIES 'TRA': TECHNICAL DATA

## LOAD CHARTS: 1½" - 4" BORE

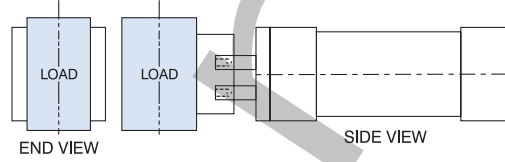
### How to use LOAD CHARTS:

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

### "Triple Rod" mounting to LOAD:

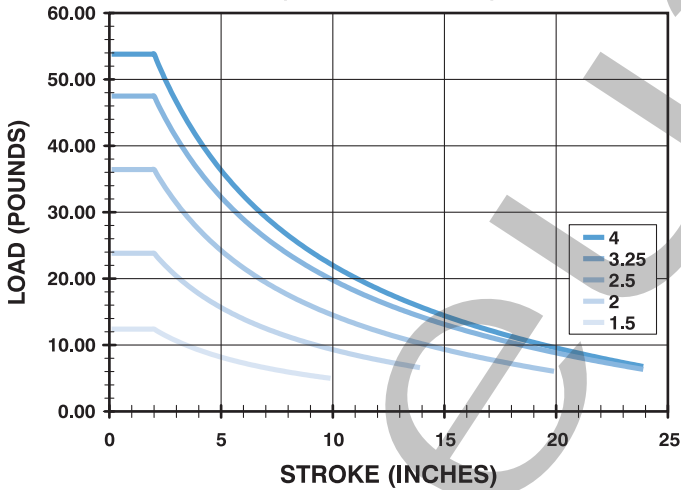


EXAMPLE 1

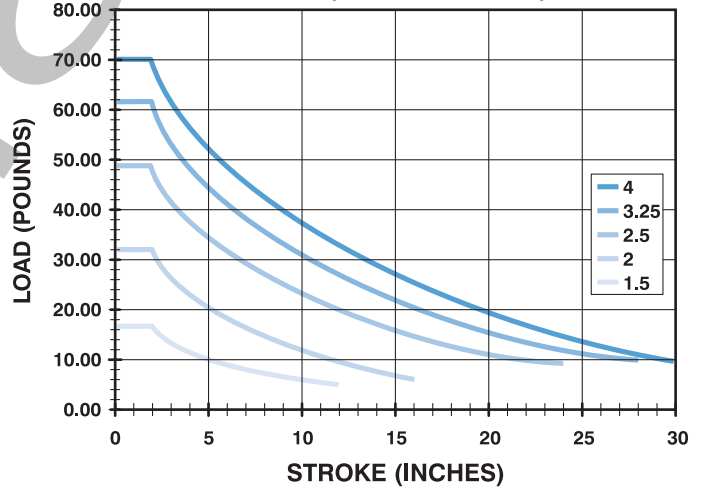


## SINGLE ROD END: 1½" - 4" Bore MAXIMUM RECOMMENDED LOAD

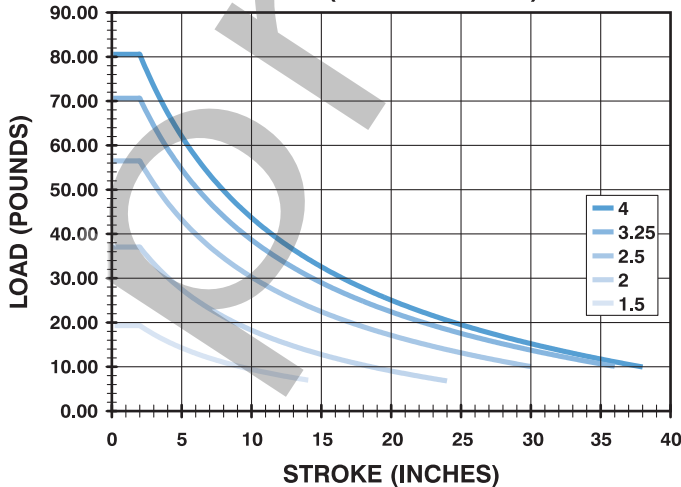
(NO STOP TUBE)



ST=2 (2" STOP TUBE)



ST=4 (4" STOP TUBE)



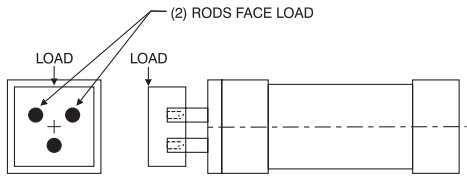
# SERIES 'TRA': TECHNICAL DATA

## LOAD CHARTS: 5" - 8" BORE

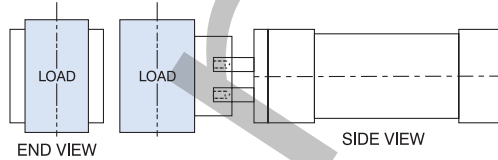
### How to use LOAD CHARTS:

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

### "Triple Rod" mounting to LOAD:

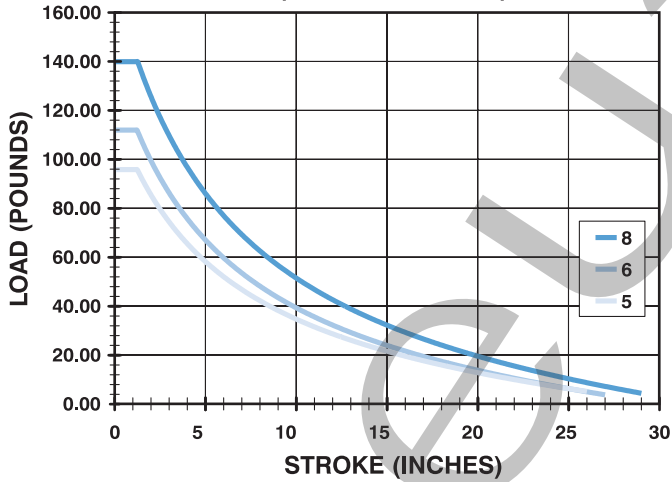


### EXAMPLE 1

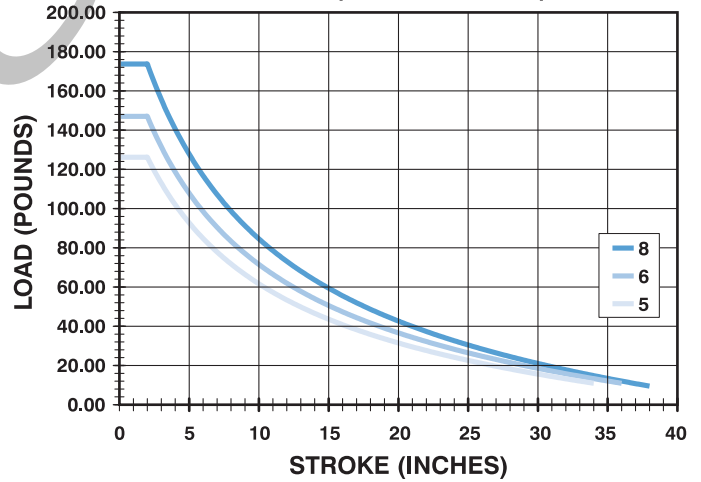


## SINGLE ROD END: 5" - 8" Bore MAXIMUM RECOMMENDED LOAD

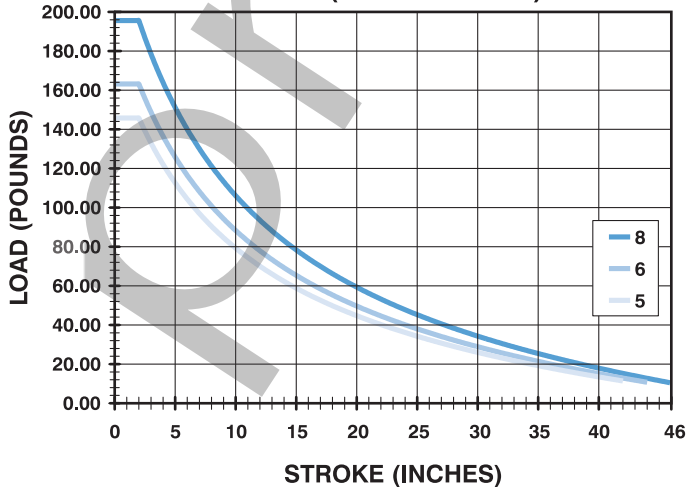
(NO STOP TUBE)



ST=2 (2" STOP TUBE)



ST=4 (4" STOP TUBE)



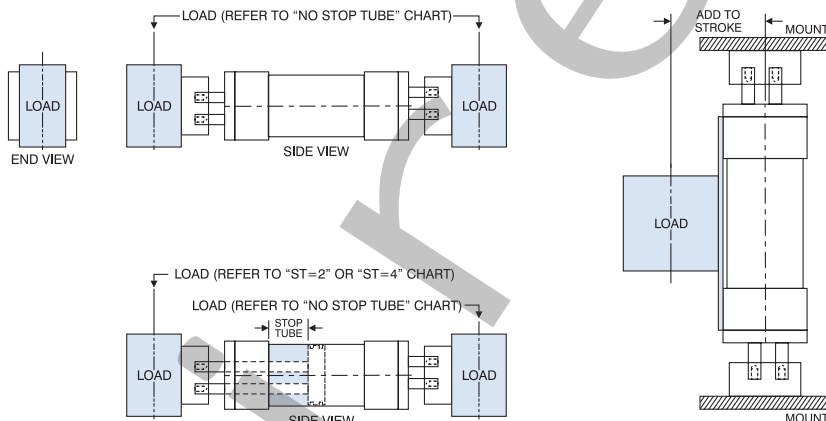
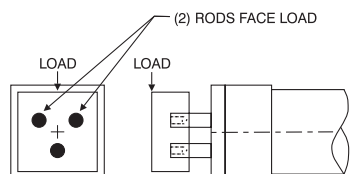
# SERIES 'TRA': TECHNICAL DATA (D3 MODELS)

## LOAD CHARTS: 1½" - 4" BORE - DOUBLE ROD END

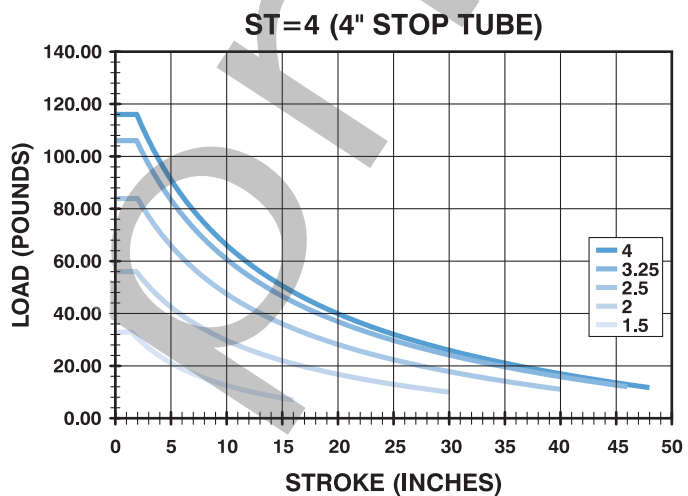
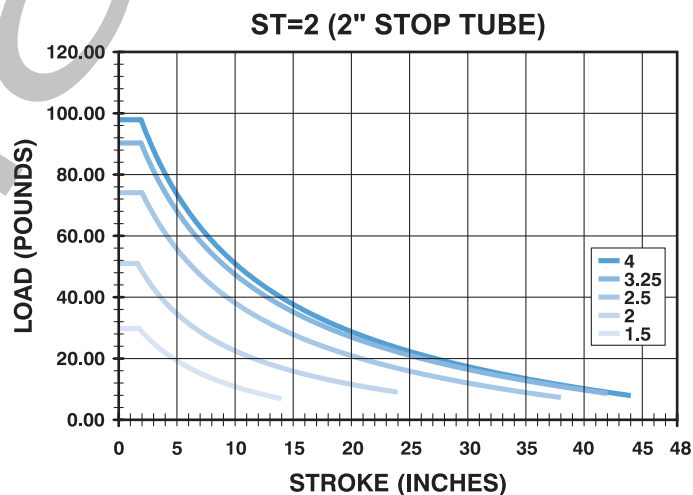
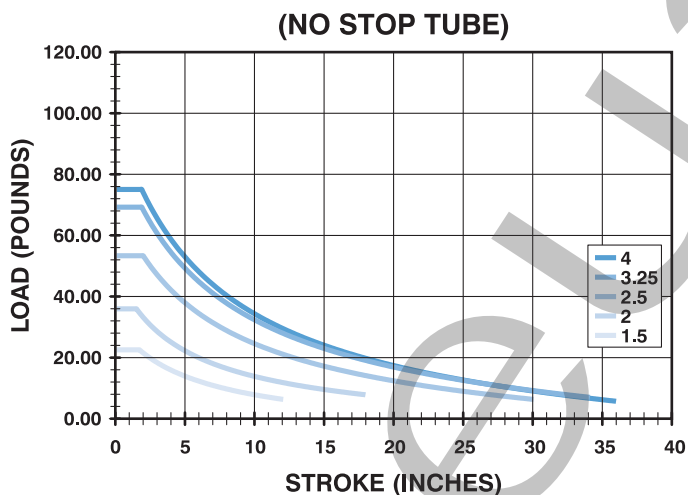
### How to use LOAD CHARTS:

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

### "Triple Rod" mounting to LOAD:



## DOUBLE ROD END: 1½" - 4" Bore MAXIMUM RECOMMENDED LOAD





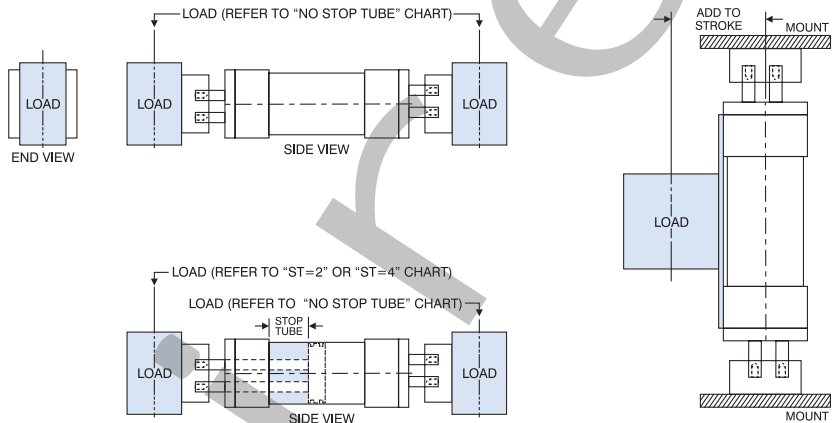
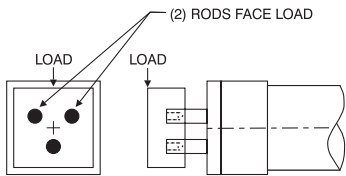
# SERIES 'TRA': TECHNICAL DATA (D3 MODELS)

## LOAD CHARTS: 5" - 8" BORE – DOUBLE ROD END

### How to use LOAD CHARTS:

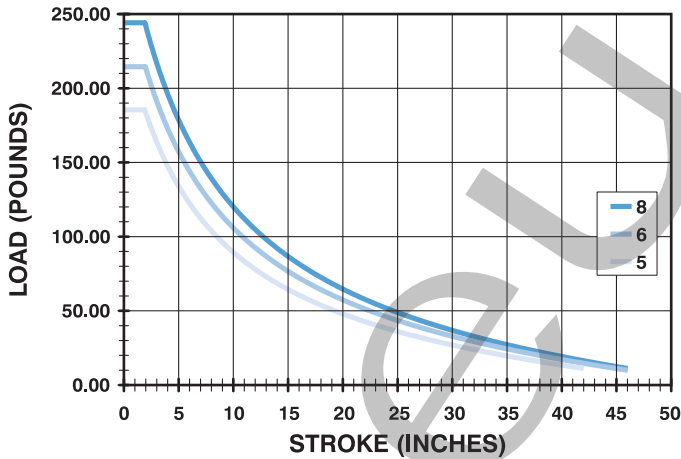
- 1.) Determine weight of LOAD (pounds)
- 2.) Refer to Load Charts for model selection

### "Triple Rod" mounting to LOAD:

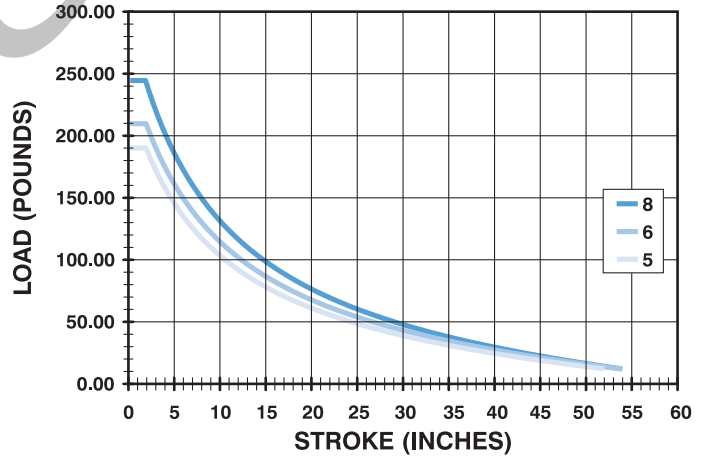


## DOUBLE ROD END: 5" - 8" Bore MAXIMUM RECOMMENDED LOAD

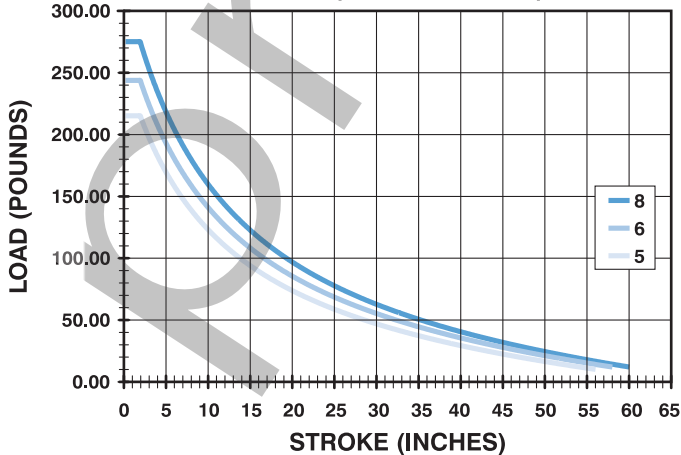
(NO STOP TUBE)



ST=2 (2" STOP TUBE)



ST=4 (4" STOP TUBE)

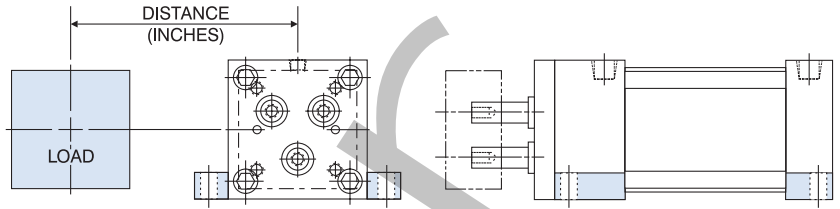


# SERIES 'TRA': TECHNICAL DATA

## TORQUE CHARTS

### How to use TORQUE CHARTS:

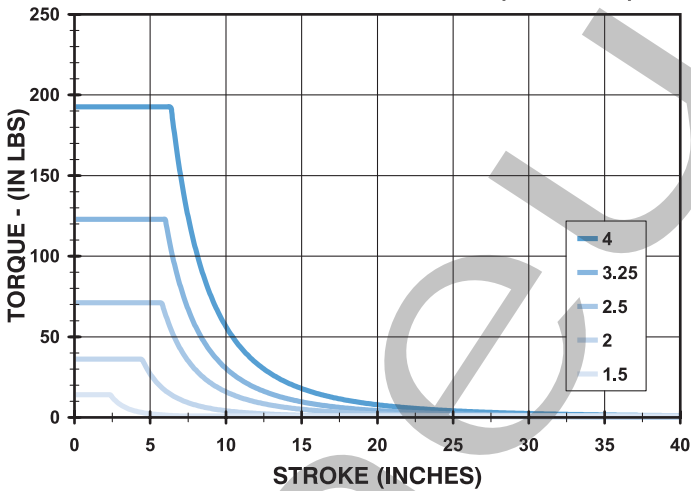
- 1.) Determine weight of LOAD (pounds)
- 2.) Determine DISTANCE (inches) of LOAD off center of Cylinder
- 3.) Multiply:  
LOAD (in pounds) X DISTANCE (inches)  
= Inch-Pounds of TORQUE
- 4.) Refer to Torque Charts for model selection



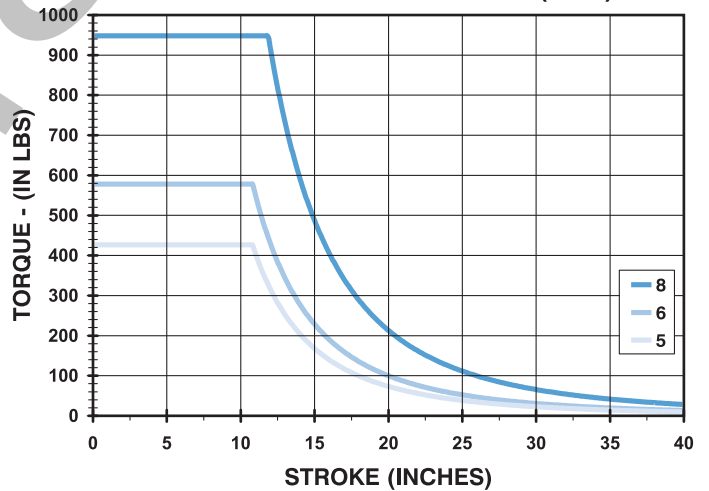
### TORQUE (INCH-POUNDS)

(FOR NO STOP TUBE, ST=2" & ST=4" MODELS)

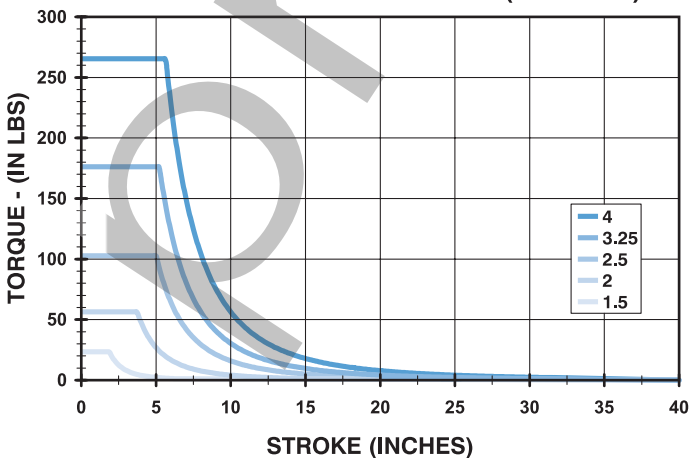
SINGLE ROD END TORQUE ( 1 1/2" - 4")



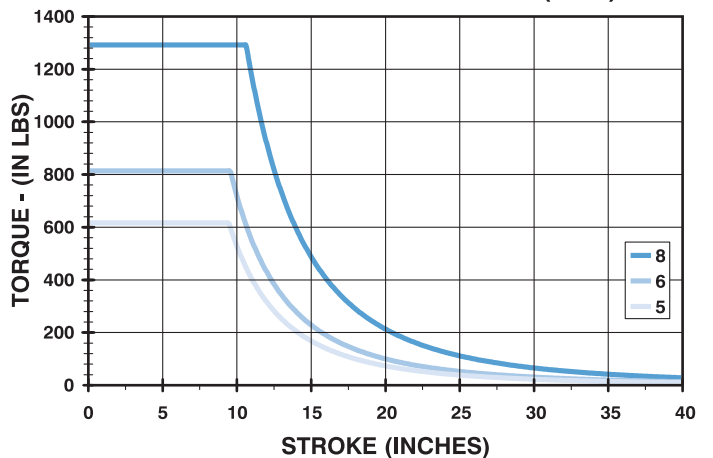
SINGLE ROD END TORQUE (5"-8")



DOUBLE ROD END TORQUE (1 1/2" - 4")



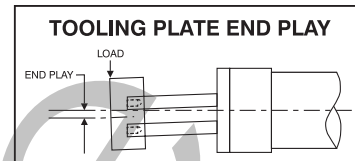
DOUBLE ROD END TORQUE (5"-8")



# SERIES 'TRA': TECHNICAL DATA

## TOOLING PLATE "END PLAY" CHARTS

(Note: Tooling Plate "End Play" values include rod deflection due to weight of rods and tool plate, parts clearance, and maximum manufacturing tolerances.)



### SINGLE ROD END CYLINDERS - NO STOP TUBE

1 1/2" - 8" BORE SINGLE ROD END CYLINDERS - NO STOP TUBE								
STROKE	1 1/2	2	2 1/2	3 1/4	4	5	6	8
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 1/2" - 8" BORE SINGLE ROD END CYLINDERS - 2" STOP TUBE								
STROKE	1 1/2	2	2 1/2	3 1/4	4	5	6	8
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

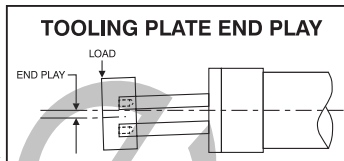
### SINGLE ROD END CYLINDERS - 4" STOP TUBE

1 1/2" - 8" BORE SINGLE ROD END CYLINDERS - 4" STOP TUBE								
STROKE	1 1/2	2	2 1/2	3 1/4	4	5	6	8
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

# SERIES 'TRA': 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, parts clearance, and maximum manufacturing tolerances.)



### DOUBLE ROD END CYLINDERS - NO STOP TUBE

STROKE	1 1/2" - 8" BORE DOUBLE ROD END CYLINDERS - NO STOP TUBE							
	1 1/2	2	2 1/2	3 1/4	4	5	6	8
0	0.003	0.003	0.003	0.003	0.003	0.004	0.005	0.004
2	0.007	0.008	0.006	0.006	0.006	0.011	0.012	0.009
4	0.012	0.013	0.010	0.010	0.010	0.017	0.019	0.015
6	0.017	0.018	0.014	0.014	0.014	0.023	0.025	0.021
8	0.021	0.023	0.018	0.018	0.018	0.029	0.032	0.026
10	0.026	0.029	0.022	0.022	0.022	0.035	0.039	0.032
12	0.031	0.034	0.026	0.025	0.025	0.042	0.046	0.038
14	—	0.038	0.030	0.029	0.029	0.048	0.053	0.044
16	—	0.044	0.033	0.033	0.033	0.054	0.060	0.050
18	—	0.050	0.037	0.037	0.037	0.060	0.066	0.056
20	—	—	0.041	0.040	0.040	0.067	0.073	0.061
22	—	—	0.045	0.044	0.044	0.073	0.080	0.067
24	—	—	0.049	0.048	0.048	0.079	0.087	0.073
26	—	—	0.053	0.052	0.052	0.085	0.094	0.079
28	—	—	0.057	0.056	0.056	0.091	0.100	0.085
30	—	—	0.060	0.059	0.059	0.098	0.107	0.091
32	—	—	—	0.063	0.063	0.104	0.114	0.096
34	—	—	—	—	0.110	0.110	0.121	0.102
36	—	—	—	—	0.116	0.116	0.128	0.108
38	—	—	—	—	—	0.135	0.135	0.114
40	—	—	—	—	—	—	0.143	0.120
42	—	—	—	—	—	—	0.150	0.126

### DOUBLE ROD END CYLINDERS - 2" STOP TUBE

STROKE	1 1/2" - 8" BORE DOUBLE ROD END CYLINDERS - 2" STOP TUBE							
	1 1/2	2	2 1/2	3 1/4	4	5	6	8
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

STROKE	1 1/2" - 8" BORE DOUBLE ROD END CYLINDERS - 4" STOP TUBE							
	1 1/2	2	2 1/2	3 1/4	4	5	6	8
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

Basic Cylinders

Triple-Rod

Multi-Stage

Cylinder Options

Air Boosters

Air/Oil Tanks

Accessories

Technical Data

# SERIES 'TRA': TECHNICAL DATA

## WEIGHT CHART - TRIPLE ROD BASIC CYLINDERS

(WEIGHT IN POUNDS)

BORE	MXO	MS4	MS2 BASE BAR	* MP1	* MP2	* MP4	MF1 ME4	MF2	ME5	ADD PER INCH OF STROKE
1½	2.2	2.2	2.5	2.7	2.8	2.8	2.8	2.9	N/A	0.19
2	3.7	3.7	4.0	4.5	4.6	4.6	4.5	4.7	N/A	0.34
2½	6.0	6.0	6.5	7.0	7.2	7.2	7.1	7.4	N/A	0.45
3¼	10.1	10.1	11.0	12.8	13.7	13.7	13.1	13.5	N/A	0.52
4	15.0	15.0	16.2	18.3	19.5	19.5	19.3	19.7	N/A	0.55
5	24.0	24.0	25.3	28.6	30.7	N/A	30.5	31.1	N/A	1.10
6	35.2	35.2	36.6	43.4	45.9	N/A	45.8	46.7	N/A	1.15
8	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

(WEIGHT IN POUNDS) (D3 MODELS)

BORE	MXOD	MS4D	MS2D BASE BAR	MF1D ME4D	ADD PER INCH OF STROKE
1½	4.3	4.3	4.6	4.9	0.30
2	6.2	6.2	6.5	7	0.55
2½	11.2	11.2	11.7	12.3	0.75
3¼	18.5	18.5	19.4	21.5	0.82
4	26.4	26.4	27.6	30.7	0.85
5	42.9	42.9	44.3	49.4	1.83
6	59.8	59.8	61.4	70.4	1.95
8	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
1½	0.45	2½	1.5	4	4.16	6	9.30
2	0.70	3¼	2.7	5	6.25	8	17.0

## TORQUE CHART - CYLINDER TIE RODS

BORE	TIE ROD THREAD SIZE	TORQUE IN FT.-LBS.
1½	¼-28	7
2	⅜-24	12
2½	⅜-24	14
3¼	⅜-24	30
4	⅜-24	35
5	½-20	45
6	½-20	50
8	⅝-18	125

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

## TORQUE CHART - RETAINER SCREWS

BORE	RETAINER SCREW THREAD SIZE	TORQUE IN FT.-LBS.
1½	¼-28	7
2	⅜-24	12
2½	⅜-24	12
3¼	⅜-24	22
4	⅜-24	22
5	½-20	35
6	½-20	35
8	¼-28	7

1½" - 6" bore have full square retainer plate, 8" bore has (3) separate round retainer plates.

## 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	
1½	PUSH	1.767	106	142	177	353	442	706	.00102
	PULL	1.536	92	123	154	308	384	614	.00089
2	PUSH	3.142	188	251	314	628	785	1256	.00182
	PULL	2.553	153	204	255	510	638	1021	.00147
2½	PUSH	4.909	295	393	491	982	1227	1962	.00284
	PULL	3.989	239	319	399	798	997	1595	.00231
3¼	PUSH	8.296	498	664	830	1660	2074	3318	.00480
	PULL	7.376	442	590	738	1476	1844	2950	.00427
4	PUSH	12.566	754	1005	1257	2514	3141	5026	.00727
	PULL	11.646	699	932	1165	2330	2911	4658	.00674
5	PUSH	19.635	1178	1571	1964	3928	4908	7854	.01136
	PULL	17.279	1037	1382	1728	3456	4320	6911	.00999
6	PUSH	28.274	1696	2262	2827	5654	7068	11310	.01636
	PULL	25.918	1555	2073	2592	5184	6479	10367	.01499
8	PUSH	50.265	3016	4021	5026	10052	12566	20106	.02908
	PULL	47.909	2874	3832	4791	9582	11977	19163	.02773

# 'TR' SERIES: DESIGN REVISION ENHANCEMENT

'TR' Series (250 PSI Air) is superseded by 'TRA' Series (effective 5/01/03)

'TR-TH' (400 PSI Hyd.) Series is superseded by 'TRA' Series with 'TH' option (effective 5/01/03)

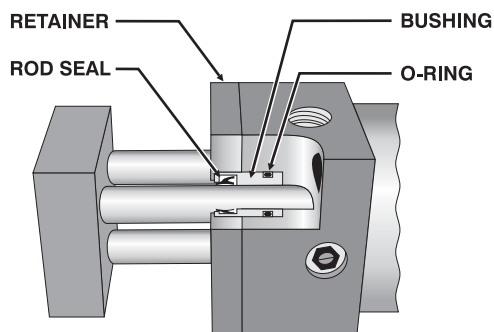
TRD's 'TR' Series has been redesigned. The new 'TRA' Series is a **Heavy-Duty** version of the obsolete 'TR' Series. The new series is a drop-in replacement of the previous model. Overall dimensions are not affected\*. The affected service parts are listed below for reference. Any existing 'TR' Series in service can be fitted with the new 'TRA' Series **Heavy-Duty** Bushing design. A new set of (3) Bushings, (3 sets) Seals and (1) Retainer are required.

(Note: A 'TR' model fitted with the **heavy-duty** bushings will not be rated for the same load capacity as the 'TRA' Series.

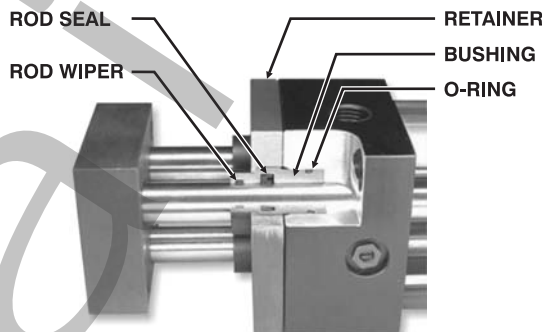
A new Piston & Rod assembly with wear band is required to receive the same load capacity rating as the 'TRA' Series.)

\*Option "MPR-WB" will add 1/2" to overall cylinder length - 1 1/2", 2" & 2 1/2" bores only.

## 'TR' Series



## 'TRA' Series



'TR' SERIES PARTS				
BORE	BUSHING (3 Req'd)	O-RING (3 Req'd)	ROD SEAL (3 Req'd)	RETAINER (1 Req'd)
1 1/2	TR-B-30-1	TR/BO-312	TR/RW-312	TR-36-15
2	TR-B-30-2	TR/BO-500	TR/RW-500	TR-36-20
2 1/2	TR-B-30-3	TR/BO-625	TR/RW-625	TR-36-25
3 1/4	TR-B-30-3	TR/BO-625	TR/RW-625	TR-36-32
4	TR-B-30-3	TR/BO-625	TR/RW-625	TR-36-40
5	TR-B-30-4	TR/BO-1000	TR/RW-1000	TR-36-50
6	TR-B-30-4	TR/BO-1000	TR/RW-1000	TR-36-60
8	TR-B-30-BZ	BO-2	RW-1000 RS-1000	A-35-2 (3 Req'd)

'TRA' SERIES PARTS						
BORE	BUSHING (3 Req'd)	O-RING (3 Req'd)	ROD SEAL (3 Req'd)	ROD WIPER (3 Req'd)	RETAINER (1 Req'd)	RETAINER KIT (RK) (3 Bushings w/ Seals & (1) Retainer Plate)
1 1/2	TR/HD-30-1	TR/BO-312	RS-312	TR/TH-312	TR/HD-36-15	TRA-15-RK
2	TR/HD-30-2	TR/BO-500	RS-500	TR/TH-500	TR/HD-36-20	TRA-20-RK
2 1/2	TR/HD-30-3	TR/BO-625	RS-625	TH-625	TR/HD-36-25	TRA-25-RK
3 1/4	TR/HD-30-4	TR/BO-625	RS-625	TH-625	TR/HD-36-32	TRA-32-RK
4	TR/HD-30-4	TR/BO-625	RS-625	TH-625	TR/HD-36-40	TRA-40-RK
5	TR/HD-30-5	TR/BO-1000	RS-1000	TH-1000	TR/HD-36-50	TRA-50-RK
6	TR/HD-30-6	TR/BO-1000	RS-1000	TH-1000	TR/HD-36-60	TRA-60-RK
8	A-30-2	BO-2	RS-1000	RW-1000	A-35-2 (3 Req'd)	N/A

'TR-TH' SERIES PARTS				
BORE	BUSHING (3 Req'd)	O-RING (3 Req'd)	ROD SEAL (3 Req'd)	RETAINER (1 Req'd)
1 1/2	TH/TR-B-30-1	TR/BO-312	TR/TH-312	TR-36-15
2	TH/TR-B-30-2	TR/BO-500	TR/TH-500	TR-36-20
2 1/2	TH/TR-B-30-3	TR/BO-625	TR/TH-625	TR-36-25
3 1/4	TH/TR-B-30-3	TR/BO-625	TR/TH-625	TR-36-32
4	TH/TR-B-30-3	TR/BO-625	TR/TH-625	TR-36-40
5	TH/TR-B-30-4	TR/BO-1000	TR/TH-1000	TR-36-50
6	TH/TR-B-30-4	TR/BO-1000	TR/TH-1000	TR-36-60
8	TH-30-2	BO-2	RS-1000 TH-1000	A-35-2 (3 Req'd)

'TRA' SERIES - WITH 'TH' OPTION - PARTS						
BORE	BUSHING (3 Req'd)	O-RING (3 Req'd)	ROD SEAL (3 Req'd)	ROD WIPER (3 Req'd)	RETAINER (1 Req'd)	RETAINER KIT (RK) (3 Bushings w/ Seals & (1) Retainer Plate)
1 1/2	TR/HD-30-1	TR/BO-312	RS-312	TR/TH-312	TR/HD-36-15	TRH-15-RK
2	TR/HD-30-2	TR/BO-500	RS-500	TR/TH-500	TR/HD-36-20	TRH-20-RK
2 1/2	TR/HD-30-3	TR/BO-625	RS-625	TH-625	TR/HD-36-25	TRH-25-RK
3 1/4	TR/HD-30-4	TR/BO-625	RS-625	TH-625	TR/HD-36-32	TRH-32-RK
4	TR/HD-30-4	TR/BO-625	RS-625	TH-625	TR/HD-36-40	TRH-40-RK
5	TR/HD-30-5	TR/BO-1000	RS-1000	TH-1000	TR/HD-36-50	TRH-50-RK
6	TR/HD-30-6	TR/BO-1000	RS-1000	TH-1000	TR/HD-36-60	TRH-60-RK
8	TH-30-2	BO-2	RS-1000	TH-1000	A-35-2 (3 Req'd)	N/A