



A

PA-2

NC9

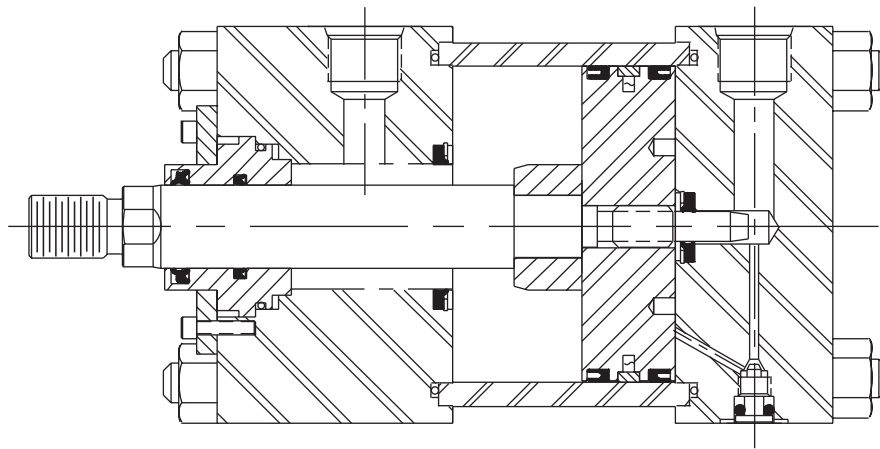
Rod Lock

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Universal™* “NC9” Series Medium Duty Pre-Lubricated Pneumatic Cylinders

* These cylinders are specified for Automotive and Foundry Applications under the brand name “UNIVERSAL”.



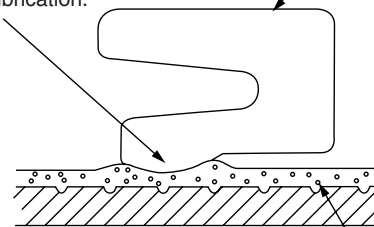
GENERAL SPECIFICATIONS NC9 Series Pneumatic Cylinders

INDUSTRY STANDARDS	Meets J.I.C. and ANSI/(NFPA) T3.6.7R3-2009 standards.
PRESSURE RATING	250 psi Air
TEMPERATURE RANGE	Buna-N Seal: -10°F to +165°F
BORE SIZES	1-1/2" through 12"
PISTON ROD DIAMETER	1" through 5-1/2"
MOUNTINGS	10 styles Ford approved
PISTON END THREAD	One standard style; Thread rolled on 1-1/2" through 8" bore size through 1" thread with rounded root radius for maximum strength.
CUSHIONS	Available at either end or both ends; all bore sizes
HEAD AND CAP ENDS	Machined from steel blocks
PISTON	Steel with non-metallic wear ring
PISTON RODS	100,000 psi minimum yield strength steel. Induction hardened to Rc54. Ground, polished and hard chrome plated to a 10 micro-inch finish.
TUBE	Steel tubing is finished to 10-15 micro-inch finish and I.D. hard chrome plated.
TIE RODS	High tensile steel with rolled threads
TIE ROD NUTS	All steel, prevailing torque type
ROUNDED LIP U-CUP	Carboxylated Nitrile standard.

Anatomy of Series NC9 Sealing and Lubricant Retention Systems

Rounded sealing lip glides over lubricant film instead of scraping it off. Reduces friction, increases life and eliminates the need for added lubrication.

Increased heel thickness and outer lip extension improve stability, resist rolling.



Drawing not to scale
 High integrity lubricant film with suspended PTFE particles

Ford NC9 Medium Duty Air Cylinder

Ordering Code

Ordering Example NC9 MF1 1.5 X 6.0 1.0A CC2-HC2 CP1-HP1 S

Ford Series
NC9

Mounting Code	Description
MX1	Tie Rods Extended Both Ends
MX2	Tie Rods Extended Cap End
MX3	Tie Rods Extended Head End
MF1	Head Rect Flange 1 1/2"-6"
MF2	Cap Rect Flange 1 1/2"-6"
ME3	Head Square 8"-12"
ME4	Cap Square 8"-12"
MS2	Side Lug
MP1	Cap Fixed Clevis
MT4	Intermediate Fixed Trunnion

Cylinder Bore and Stroke

Piston Rod Diameter and Rod End Style	
Only one rod size is specified per bore. (Other rod sizes may be specified for replacement only)	Ford Specification (see pages 52 & 88)
Piston Rod End Styles	
Style A – Special Long Male	Style IM – Intermediate Male
Style SM – Small Male	Style SM – Small Male
Style SR – Special Rod End - Specify	

Cushion Location

“C” indicates Cap End Cushion
 “H” indicates Head End Cushion
 Cushion Adjust available @ positions 1, 2, 3, or 4

Port Type and Location

“C” indicates Cap End Port
 “H” indicates Head End Port
 “P” indicates **NPTF pipe thread (standard)**
 “T” indicates SAE straight thread
 Ports available @ positions 1, 2, or 3

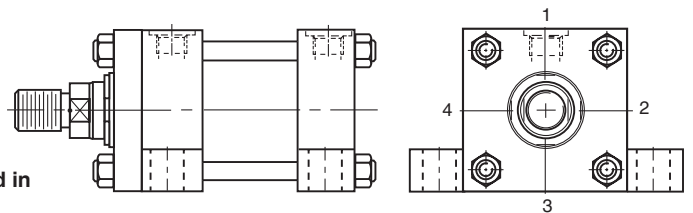
S — Special Modifications

“S” in this position is used to describe all special features that are other than standard, or advise serial number if for replacement.

NOTE: Add the letter “D” for double rod end cylinder.
 EXAMPLE: NC9-MDF2

NOTE: Add the letter “K” if key extension is required.
 EXAMPLE: NC9-MS2K

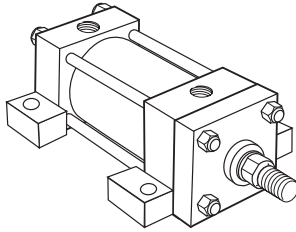
NC9 cylinders are built to Ford Motor Company Vehicle Operations Specifications. Any deviation from this standard should be approved in writing by Ford Motor Company.



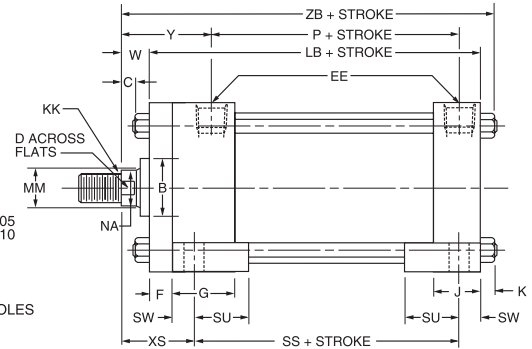
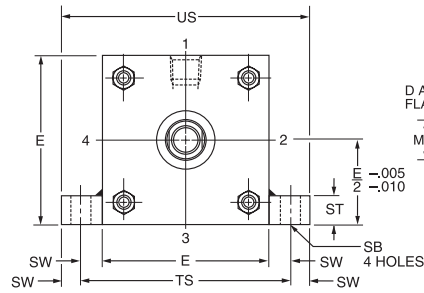
Side Lug Mount

Style MS2

1 1/2" - 2" - 2 1/2" - 5" and 6" Bore
With Maximum Oversize Rods



**Tie Rod
Retained Cartridge**

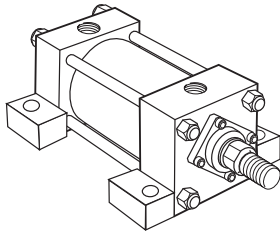


Before determining dimensions: See chart on page 87 for cylinder rod combinations that have removable cartridges.

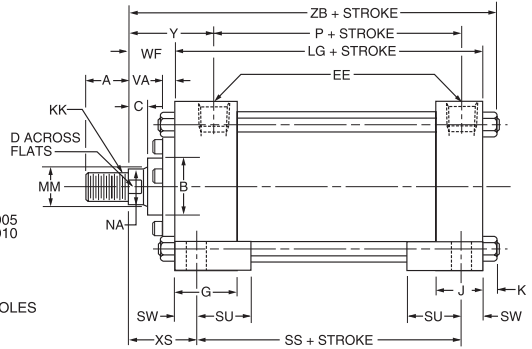
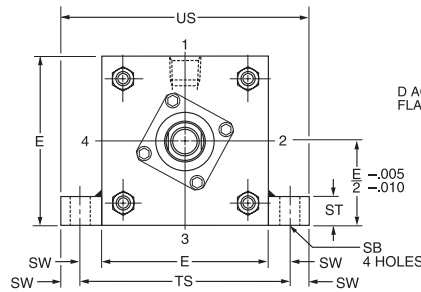
Side Lug Mount

Style MS2

1 1/2" - 6" Bore



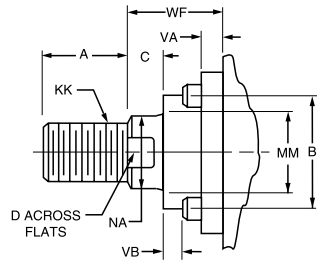
Removable Cartridge



Rod End Dimensions — see table 2

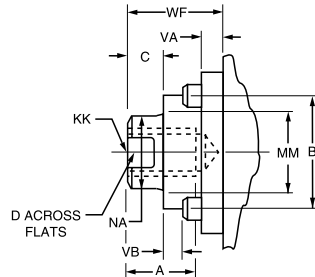
Thread Style 2

Small Male



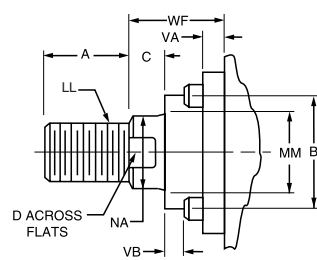
Thread Style 3

Short Female



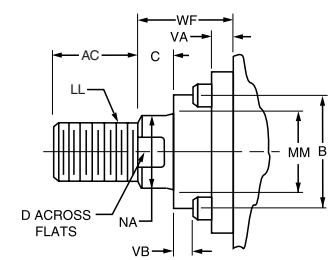
Thread Style 4

Intermediate Male



Thread Style 5

Automotive Male



"Special" Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 0" and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Table 1—Envelope and Mounting Dimensions

Bore	E	EE		F	G	J	K	SB•	ST	SU	SW	TS	US	Add Stroke			
		NPTF	SAE											LB	LG	P	SS
1½	2	¾†	#6**	¾	1½	1	¼	7/16	½	15/16	¾	2¾	3½	4	35/8	2¼	27/8
2	2½	¾†	#6	¾	1½	1	5/16	7/16	½	15/16	¾	3¼	4	4	35/8	2¼	27/8
2½	3	¾†	#6	¾	1½	1	5/16	7/16	½	15/16	¾	3¾	4½	4½	3¾	2¾	3
3¼	3¾	½	#10	—	1¾	1¼	¾	9/16	¾	1¼	½	4¾	5¾	47/8	4¼	25/8	3¼
4	4½	½	#10	—	1¾	1¼	¾	9/16	¾	1¼	½	5½	6½	47/8	4¼	25/8	3¼
5	5½	½	#10	5/8	1¾	1¼	7/16	13/16	1	19/16	11/16	67/8	8¼	5½	4½	27/8	3½
6	6½	¾	#12	¾	2	1½	7/16	13/16	1	19/16	11/16	77/8	9¼	5¾	5	3½	35/8

† On 1½", 2" and 2½" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with maximum oversize rods. Minimum of three full threads available.

• Upper surface spot-faced for socket head screws.

** Port adapter fitting furnished at head end only.

Table 2—Rod Dimensions and Envelope Dimensions Affected by Rod Size

Bore	Rod Dia. MM	Thread		Rod Extensions and Envelope Dimensions Affected By Rod Size														Add Stroke ZB
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+0.000 -0.002 B	C	D	NA	V	VA	VB	W	WF	XS	Y		
1½	5/8	1/2-20	7/16-20	¾	17/8	1.124	¾	½	9/16	—	¼	3/16	—	1	1¾	115/16	47/8	
	1	7/8-14	¾-16	11/8	17/8	1.499	½	7/8	15/16	½	—	—	1	—	1¾	25/16	5¼	
2	5/8	1/2-20	7/16-20	¾	17/8	1.124	¾	½	9/16	—	¼	3/16	—	1	1¾	115/16	415/16	
	13/8	1¼-12	1-14	15/8	2½	1.999	5/8	11/8	15/16	5/8	—	—	1¼	—	2	29/16	59/16	
2½	5/8	1/2-20	7/16-20	¾	17/8	1.124	¾	½	9/16	—	¼	3/16	—	1	1¾	115/16	51/16	
	13/4	1½-12	1¼-12	2	3	2.374	¾	1½	111/16	¾	—	—	1½	—	2¼	213/16	515/16	
3¼	1	7/8-14	¾-16	11/8	17/8	1.499	½	7/8	15/16	—	¼	7/16	—	13/8	1¾	25/16	55/16	
	13/8	1¼-12	1-14	15/8	2½	1.999	5/8	11/8	15/16	—	¼	7/16	—	13/8	1¾	25/16	55/16	
4	5/8	1/2-20	7/16-20	¾	17/8	1.124	¾	½	9/16	—	¼	3/16	—	1	1¾	115/16	51/16	
	13/4	1½-12	1¼-12	2	3	2.374	¾	1½	111/16	—	¼	7/16	—	13/8	1¾	25/16	57/16	
5	1	7/8-14	¾-16	11/8	17/8	1.499	½	7/8	15/16	—	¼	7/16	—	13/8	17/8	27/16	6	
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	111/16	115/16	—	¼	9/16	—	2	2½	31/16	65/8	
6	13/8	1¼-12	1-14	15/8	2½	1.999	5/8	11/8	15/16	—	¼	7/16	—	15/8	2½	213/16	6¼	
	13/4	1½-12	1¼-12	2	3	2.374	¾	1½	111/16	—	¼	9/16	—	17/8	23/8	215/16	6½	
7	1	7/8-14	¾-16	11/8	17/8	1.499	½	7/8	15/16	—	¼	7/16	—	13/8	17/8	27/16	6	
	2½	2¼-12	17/8-12	3	4½	3.124	1	21/16	23/8	—	¼	11/16	—	2¼	2¾	35/16	67/8	
8	13/8	1¼-12	1-14	15/8	2½	1.999	5/8	11/8	15/16	—	¼	7/16	—	15/8	2½	211/16	6¼	
	13/4	1½-12	1¼-12	2	3	2.374	¾	1½	111/16	—	¼	9/16	—	17/8	23/8	215/16	6½	
9	1	7/8-14	¾-16	11/8	17/8	1.499	½	7/8	15/16	—	¼	7/16	—	13/8	17/8	27/16	6	
	3½	3¼-12	2½-12	3½	—	4.249	1	3	33/8	5/8	—	—	15/8	—	215/16	35/16	73/16	
10	13/8	1¼-12	1-14	15/8	2½	1.999	5/8	11/8	15/16	—	¼	7/16	—	15/8	25/16	211/16	69/16	
	13/4	1½-12	1¼-12	2	3	2.374	¾	1½	111/16	—	¼	9/16	—	17/8	29/16	215/16	613/16	
11	2	1¾-12	1½-12	2¼	3½	2.624	7/8	111/16	115/16	—	¼	9/16	—	2	211/16	31/16	615/16	
	2½	2¼-12	17/8-12	3	4½	3.124	1	21/16	23/8	—	¼	11/16	—	2¼	215/16	35/16	73/16	
12	3	2¾-12	2¼-12	3½	—	3.749	1	25/8	27/8	5/8	—	—	15/8	—	215/16	35/16	73/16	
	13/8	1¼-12	1-14	15/8	2½	1.999	5/8	11/8	15/16	—	¼	7/16	—	15/8	25/16	213/16	71/16	
13	4	3¾-12	3-12	4	—	4.749	1	33/8	37/8	½	—	—	1½	—	215/16	37/16	711/16	
	13/4	1½-12	1¼-12	2	3	2.374	¾	1½	111/16	—	¼	9/16	—	17/8	29/16	31/16	75/16	
14	2	1¾-12	1½-12	2¼	3½	2.624	7/8	111/16	115/16	—	¼	9/16	—	2	211/16	33/16	77/16	
	2½	2¼-12	17/8-12	3	4½	3.124	1	21/16	23/8	—	¼	11/16	—	2¼	215/16	37/16	711/16	
15	3	2¾-12	2¼-12	3½	—	3.749	1	25/8	27/8	½	—	—	1½	—	215/16	37/16	711/16	
	3½	3¼-12	2½-12	3½	—	4.249	1	3	33/8	½	—	—	1½	—	215/16	37/16	711/16	

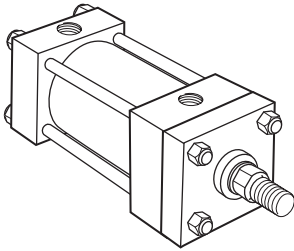
Side Tap Mount

Style MS4

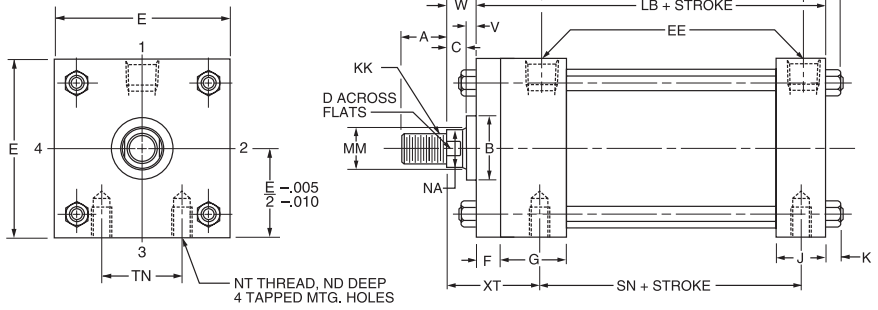
1 1/2" - 2" - 2 1/2" - 5"

and 6" Bore

With Maximum Oversize Rods



Tie Rod Retained Cartridge

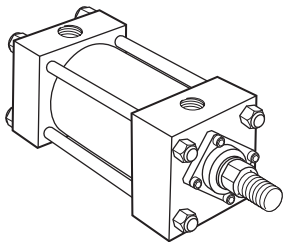


Before determining dimensions: See chart on page 87 for cylinder rod combinations that have removable cartridges.

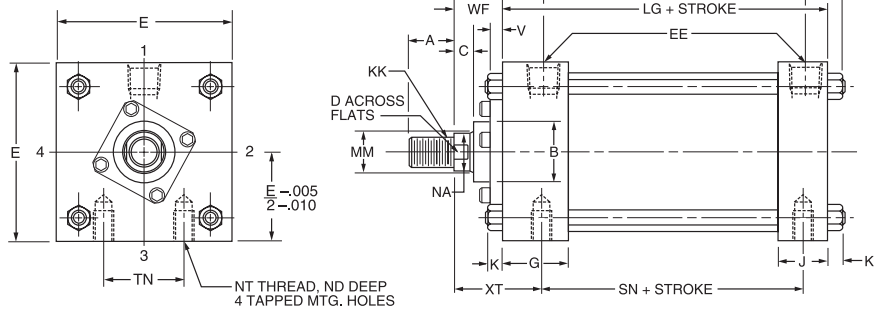
Side Tap Mount

Style MS4

1 1/2" - 6" Bore



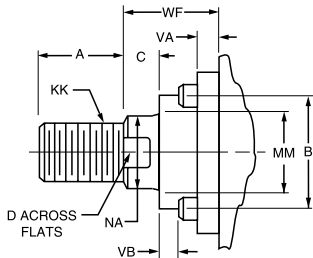
Removable Cartridge



Rod End Dimensions — see table 2

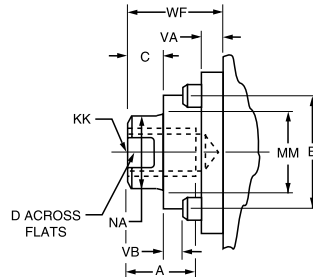
Thread Style 2

Small Male



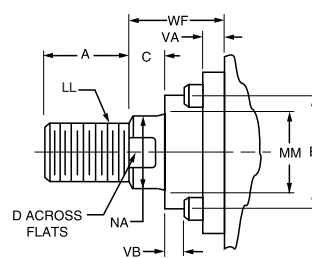
Thread Style 3

Short Female



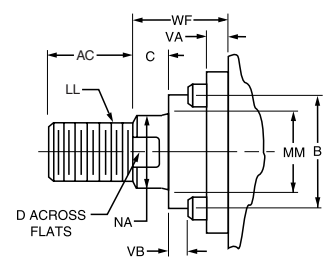
Thread Style 4

Intermediate Male



Thread Style 5

Automotive Male



“Special” Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify “Style 0” and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Mounting Information – 1½" to 6" Bore

Table 1—Envelope and Mounting Dimensions

Bore	E	EE		F	G	J	K	NT	TN	Add Stroke			
		NPT†	SAE							LB	LG	P	SN
1½	2	¾†	#6**	¾	1½	1	¼	¼-20	⅝	4	3⅝	2¼	2¼
2	2½	¾†	#6	¾	1½	1	⅝	⅝-18	⅞	4	3⅝	2¼	2¼
2½	3	¾†	#6	¾	1½	1	⅝	¾-16	1¼	4⅞	3¾	2⅜	2⅜
3¼	3¾	½	#10	⅝	1¾	1¼	¾	½-13	1½	4⅞	4¼	2⅝	2⅝
4	4½	½	#10	⅝	1¾	1¼	¾	½-13	2⅞	4⅞	4¼	2⅝	2⅝
5	5½	½	#10	⅝	1¾	1¼	⅞	⅝-11	2⅞	5⅞	4½	2⅞	2⅞
6	6½	¾	#12	¾	2	1½	⅞	¾-10	3¼	5¾	5	3⅞	3⅞

† On 1½", 2" and 2½" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with maximum oversize rods. Minimum of three full threads available.

** Port adapter fitting furnished at head end only.

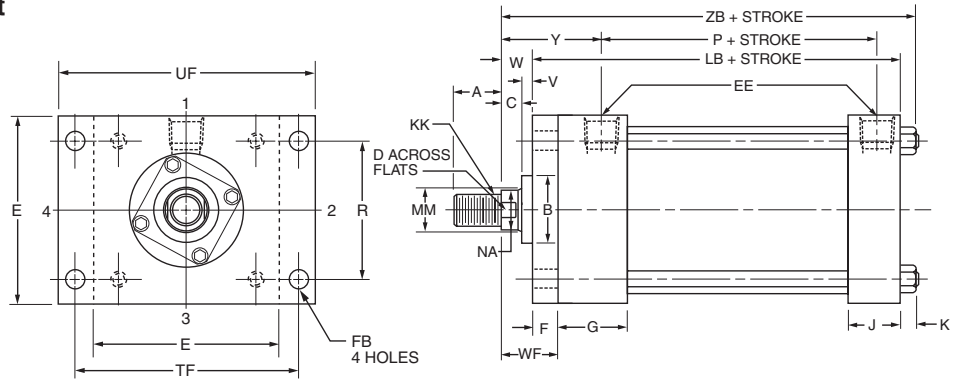
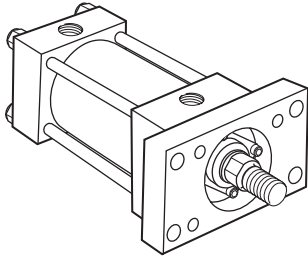
Table 2—Rod Dimensions and Envelope Dimensions Affected by Rod Size

Bore	Rod Dia. MM	Thread		Rod Extensions and Envelope Dimensions Affected By Rod Size																Add Stroke ZB
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+0.000 -0.002 B	C	D	NA	V	VA	VB	W	WF	XT	Y	ND			
1½	⅝	½-20	⅞-20	¾	1⅞	1.124	¾	½	⅞	15/16	—	¼	¾	—	1	1⅞	1⅞	⅝	4⅞	
	1	⅞-14	¾-16	1⅞	1⅞	1.499	½	⅞	15/16	—	—	—	1	—	2⅞	2⅞	⅝	5¼		
2	⅝	½-20	⅞-20	¾	1⅞	1.124	¾	½	⅞	15/16	—	¼	¾	—	1	1⅞	1⅞	⅝	4⅞	
	1	⅞-14	¾-16	1⅞	1⅞	1.499	½	⅞	15/16	—	¼	¾	—	1	2⅞	2⅞	⅝	5⅞		
2½	⅝	½-20	⅞-20	¾	1⅞	1.124	¾	½	⅞	15/16	—	¼	¾	—	1	1⅞	1⅞	⅝	5⅞	
	1	⅞-14	¾-16	1⅞	1⅞	1.499	½	⅞	15/16	—	¼	¾	—	1	2⅞	2⅞	⅝	5⅞		
3¼	⅝	½-20	⅞-20	¾	1⅞	1.124	¾	½	⅞	15/16	—	¼	¾	—	1	1⅞	1⅞	⅝	5⅞	
	1	⅞-14	¾-16	1⅞	1⅞	1.499	½	⅞	15/16	—	¼	¾	—	1	2⅞	2⅞	⅝	5⅞		
4	⅝	½-20	⅞-20	¾	1⅞	1.124	¾	½	⅞	15/16	—	¼	¾	—	1	1⅞	1⅞	⅝	5⅞	
	1	⅞-14	¾-16	1⅞	1⅞	1.499	½	⅞	15/16	—	¼	¾	—	1	2⅞	2⅞	⅝	5⅞		
5	⅝	½-20	⅞-20	¾	1⅞	1.124	¾	½	⅞	15/16	—	¼	¾	—	1	1⅞	1⅞	⅝	5⅞	
	1	⅞-14	¾-16	1⅞	1⅞	1.499	½	⅞	15/16	—	¼	¾	—	1	2⅞	2⅞	⅝	5⅞		
6	⅝	½-20	⅞-20	¾	1⅞	1.124	¾	½	⅞	15/16	—	¼	¾	—	1	1⅞	1⅞	⅝	5⅞	
	1	⅞-14	¾-16	1⅞	1⅞	1.499	½	⅞	15/16	—	¼	¾	—	1	2⅞	2⅞	⅝	5⅞		

Head Rectangular Flange Mount

Style MF1

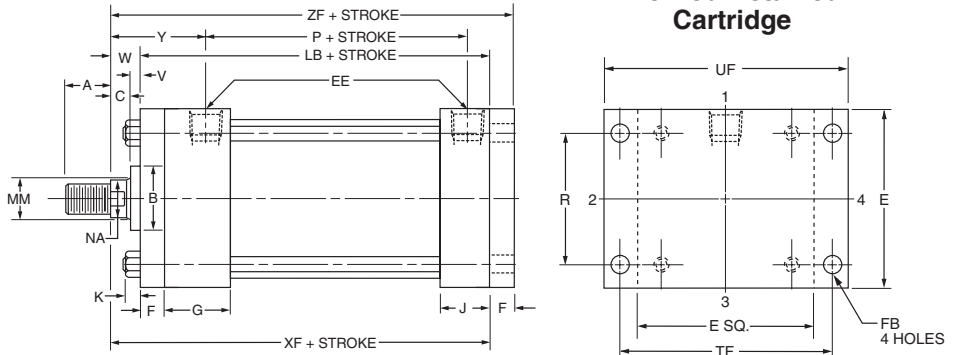
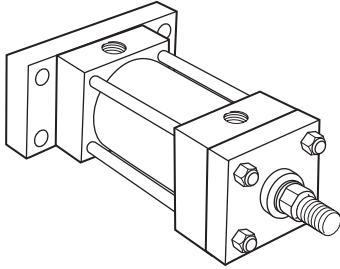
1 1/2" - 6" Bore



Cap Rectangular Flange Mount

Style MF2

1 1/2" - 2" - 2 1/2" - 5" and 6" Bore
With Maximum Oversize Rods



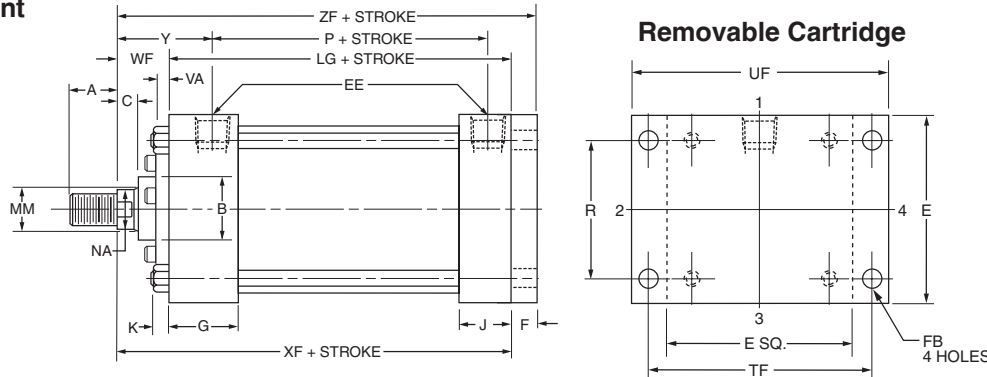
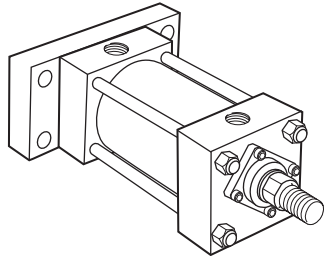
Tie Rod Retained Cartridge

Before determining dimensions: See chart on page 87 for cylinder rod combinations that have removable cartridges.

Cap Rectangular Flange Mount

Style MF2

1 1/2" - 6" Bore

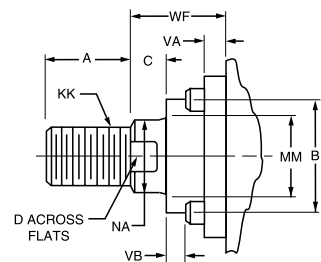


Removable Cartridge

Rod End Dimensions — see table 2

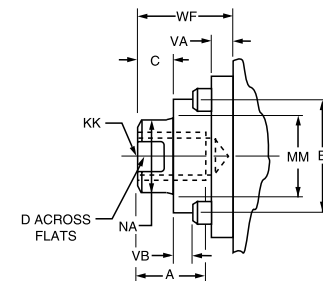
Thread Style 2

Small Male



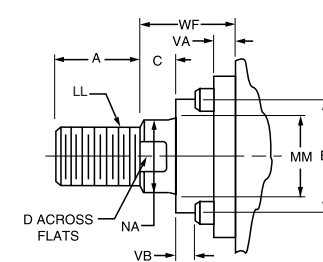
Thread Style 3

Short Female



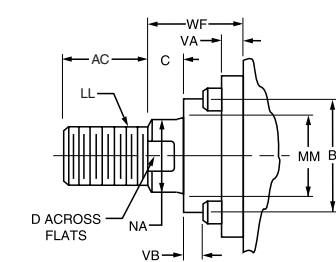
Thread Style 4

Intermediate Male



Thread Style 5

Automotive Male



"Special" Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 0" and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Mounting Information – 1½" to 6" Bore

Table 1—Envelope and Mounting Dimensions

Bore	E	EE		F	FB	G	J	K	R	TF	UF	Add Stroke		
		NPTF	SAE									LB	LG	P
1½	2	¾†	#6**	¾	5/16	1½	1	¼	1.43	2¾	3¾	4	3⅝	2¼
2	2½	¾†	#6	¾	¾	1½	1	5/16	1.84	3¾	4½	4	3⅝	2¼
2½	3	¾†	#6	¾	¾	1½	1	5/16	2.19	3¾	4⅝	4½	3¾	2⅝
3¼	3¾	½	#10	5/8	7/16	1¾	1¼	¾	2.76	4½	5½	—	4¼	2⅝
4	4½	½	#10	5/8	7/16	1¾	1¼	¾	3.32	5½	6¼	—	4¼	2⅝
5	5½	½	#10	5/8	9/16	1¾	1¼	7/16	4.10	6⅝	7⅝	5½	4½	2⅞
6	6½	¾	#12	¾	9/16	2	1½	7/16	4.88	7⅝	8⅝	5¾	5	3⅞

† On 1½", 2" and 2½" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with maximum oversize rods. Minimum of three full threads available.

** Port adapter fitting furnished at head end only.

Table 2—Rod Dimensions and Envelope Dimensions Affected by Rod Size

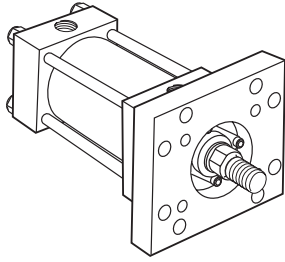
Bore	Rod Dia. MM	Thread		Rod Extensions and Envelope Dimensions Affected By Rod Size														
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+0.00 -0.002 B	C	D	NA	V	VA	VB	W	WF	Y	Add Stroke		
		XF	ZB	ZF														
1½	5/8	1/2-20	7/16-20	¾	1⅞	1.124	¾	½	9/16	—	¼	3/16	—	1	1½/16	4⅝	4⅞	5
	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	½	—	—	1	—	25/16	5	5¼	5⅝
2	5/8	1/2-20	7/16-20	¾	1⅞	1.124	¾	½	9/16	—	¼	3/16	—	1	1½/16	4⅝	4⅞	5
	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1	29/16	5¼	5⅞	5⅝
2½	5/8	1/2-20	7/16-20	¾	1⅞	1.124	¾	½	9/16	—	¼	3/16	—	1	1½/16	4⅝	5⅞	5⅝
	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1	29/16	5⅞	5⅞	5⅝
3¼	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1	29/16	5⅞	5⅞	5⅝
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	1½	1½/16	—	¼	9/16	—	2	3½/16	6¼	6	6⅞
4	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1	29/16	5⅞	5⅞	5⅝
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	1½	1½/16	—	¼	9/16	—	2	3½/16	6¼	6⅞	6⅞
5	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1	29/16	5⅞	5⅞	5⅝
	3	2¾-12	2¼-12	3½	—	3.749	1	2⅝	2⅞	5/8	—	—	1½	—	3½/16	6¼	7⅞	7⅞
6	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1	29/16	5⅞	5⅞	5⅝
	3	2¾-12	2¼-12	3½	—	3.749	1	2⅝	2⅞	5/8	—	—	1½	—	3½/16	6¼	7⅞	7⅞

Mounting Information – 1 1/2" to 6" Bore

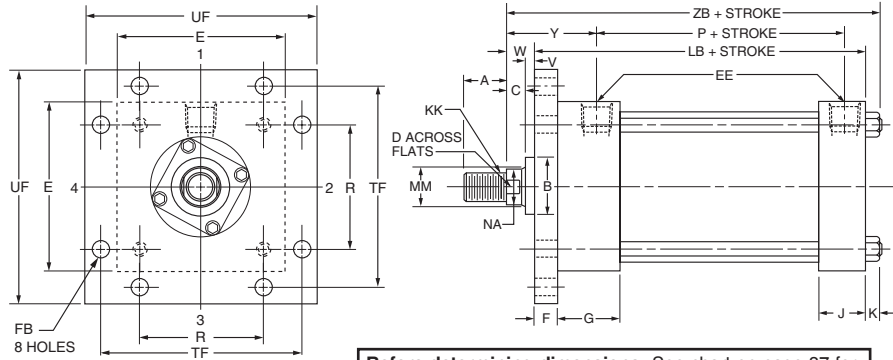
Head Square Flange Mount

Style MF5

1 1/2" - 6" Bore



Removable Cartridge

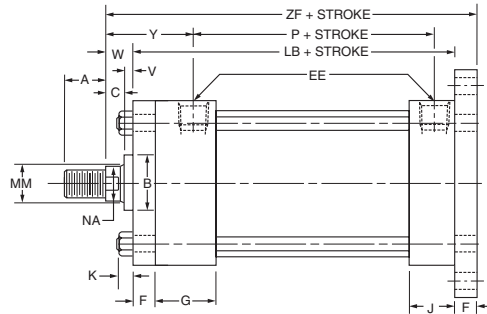
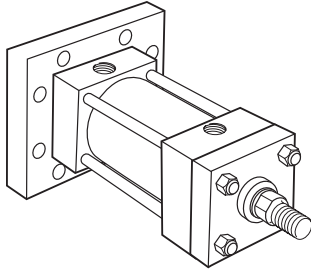


Before determining dimensions: See chart on page 87 for cylinder rod combinations that have removable cartridges.

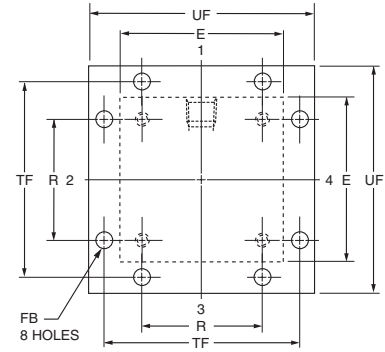
Cap Square Flange Mount

Style MF6

1 1/2" - 2" - 2 1/2" - 5" and 6" Bore
With Maximum Oversize Rods



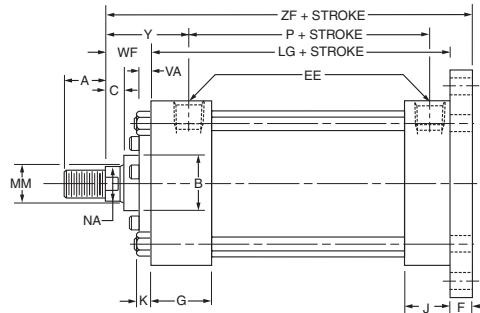
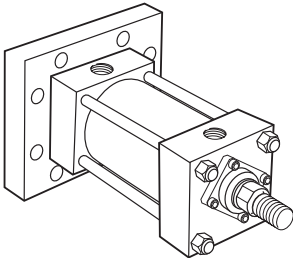
Tie Rod Retained Cartridge



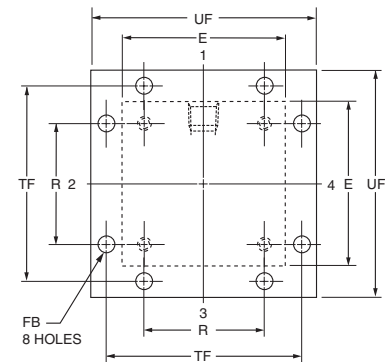
Cap Square Flange Mount

Style MF6

1 1/2" - 6" Bore



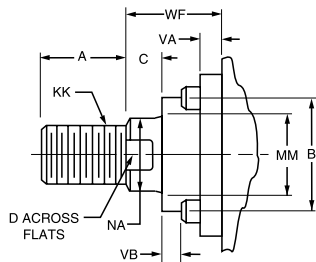
Removable Cartridge



Rod End Dimensions — see table 2

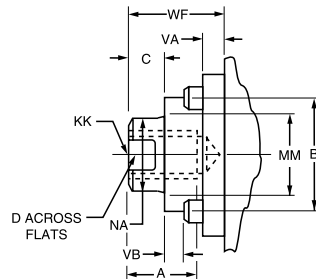
Thread Style 2

Small Male



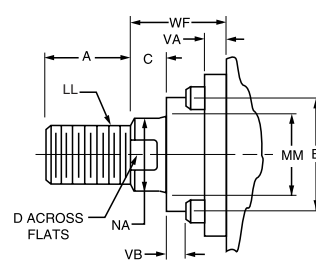
Thread Style 3

Short Female



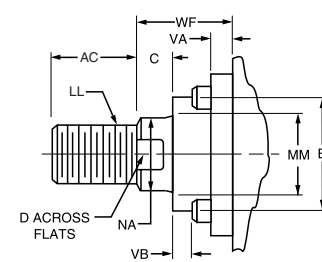
Thread Style 4

Intermediate Male



Thread Style 5

Automotive Male



“Special” Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify “Style 0” and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Mounting Information – 1½" to 6" Bore

Table 1—Envelope and Mounting Dimensions

Bore	E	EE		F	FB	G	J	K	R	TF	UF	Add Stroke		
		NPTF	SAE									LB	LG	P
1½	2	¾†	#6**	¾	5/16	1½	1	¼	1.43	2¾	3¾	4	3½	2¼
2	2½	¾†	#6	¾	¾	1½	1	5/16	1.84	3¾	4½	4	3½	2¼
2½	3	¾†	#6	¾	¾	1½	1	5/16	2.19	3¾	4½	4½	3¾	2¾
3¼	3¾	½	#10	5/8	7/16	1¾	1¼	¾	2.76	4½	5½	4¾	4¼	2½
4	4½	½	#10	5/8	7/16	1¾	1¼	¾	3.32	5½	6¼	4¾	4¼	2½
5	5½	½	#10	5/8	9/16	1¾	1¼	7/16	4.10	6½	7½	5½	4½	2¾
6	6½	¾	#12	¾	9/16	2	1½	7/16	4.88	7½	8½	5¾	5	3½

† On 1½", 2" and 2½" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with maximum oversize rods. Minimum of three full threads available.

** Port adapter fitting furnished at head end only.

Table 2—Rod End Dimensions and Envelope Dimensions Affected By Rod Size

Bore	Rod Dia. MM	Thread		Rod Extensions and Envelope Dimensions Affected By Rod Size													Add Stroke	
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+0.000 -0.002 B	C	D	NA	V	VA	VB	W	WF	Y	ZB	ZF	
1½	5/8	1/2-20	7/16-20	¾	1½	1.124	¾	½	9/16	1/4**	¼	3/16	¼	1	1½	4¾	5	
	1	7/8-14	¾-16	1½	1½	1.499	½	7/8	15/16	½	—	—	1	2½	5¼	5¾		
2	5/8	1/2-20	7/16-20	¾	1½	1.124	¾	½	9/16	1/4**	¼	3/16	5/8	1	1½	4½	5	
	13/8	1¼-12	1-14	1½	2½	1.999	5/8	1½	15/16	5/8	—	—	1¼	—	2¾	5¾	5¾	
	1	7/8-14	¾-16	1½	1½	1.499	½	7/8	15/16	1/2**	¼	7/16	1	1¾	2½	5½	5¾	
2½	5/8	1/2-20	7/16-20	¾	1½	1.124	¾	½	9/16	1/4**	¼	3/16	5/8	1	1½	5½	5½	
	13/4	1½-12	1¼-12	2	3	2.374	¾	1½	11/16	¾	—	—	1½	—	2¾	5½	6	
	1	7/8-14	¾-16	1½	1½	1.499	½	7/8	15/16	1/2**	¼	7/16	1	1¾	2½	5¾	5½	
	13/8	1¼-12	1-14	1½	2½	1.999	5/8	1½	15/16	5/8	—	—	1¼	—	2¾	5½	5¾	
3¼	1	7/8-14	¾-16	1½	1½	1.499	½	7/8	15/16	1/4**	¼	7/16	¾	1¾	2½	6	6¼	
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	11/16	15/16	1/2**	¼	9/16	1¾	2	3½	6¾	6¾	
	13/8	1¼-12	1-14	1½	2½	1.999	5/8	1½	15/16	3/8**	¼	½	1	1½	2½	6¼	6½	
	13/4	1½-12	1¼-12	2	3	2.374	¾	1½	11/16	1/2**	¼	9/16	1¼	1¾	2½	6½	6¾	
4	1	7/8-14	¾-16	1½	1½	1.499	½	7/8	15/16	1/4**	¼	7/16	¾	1¾	2½	6	6¼	
	2½	2¼-12	1¾-12	3	4½	3.124	1	2½	2¾	5/8**	¼	11/16	1½	2¼	3½	6¾	7½	
	13/8	1¼-12	1-14	1½	2½	1.999	5/8	1½	15/16	3/8**	¼	½	1	1½	2½	6¼	6½	
	13/4	1½-12	1¼-12	2	3	2.374	¾	1½	11/16	1/2**	¼	9/16	1¼	1¾	2½	6½	6¾	
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	11/16	15/16	1/2**	¼	9/16	1¾	2	3½	6¾	6¾	
5	1	7/8-14	¾-16	1½	1½	1.499	½	7/8	15/16	1/4**	¼	7/16	¾	1¾	2½	6½	6½	
	3½	3¼-12	2½-12	3½	—	4.249	1	3	3¾	5/8	—	—	1½	—	3½	7¾	7¾	
	13/8	1¼-12	1-14	1½	2½	1.999	5/8	1½	15/16	3/8**	¼	½	1	1½	2½	6¾	6¾	
	13/4	1½-12	1¼-12	2	3	2.374	¾	1½	11/16	1/2**	¼	9/16	1¼	1¾	2½	6¾	7	
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	11/16	15/16	1/2**	¼	9/16	1¾	2	3½	6½	7½	
	2½	2¼-12	1¾-12	3	4½	3.124	1	2½	2¾	5/8**	¼	11/16	1½	2¼	3½	7¾	7¾	
6	3	2¾-12	2¼-12	3½	—	3.749	1	2½	2¾	5/8	—	—	1½	—	3½	7¾	7¾	
	13/8	1¼-12	1-14	1½	2½	1.999	5/8	1½	15/16	¼	¼	7/16	7/8	1½	2¾	7½	7¾	
	4	3¾-12	3-12	4	—	4.749	1	3¾	3¾	¾	—	—	1½	—	3¾	7½	8	
	13/4	1½-12	1¼-12	2	3	2.374	¾	1½	11/16	3/8**	¼	9/16	1½	1¾	2½	7½	7¾	
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	11/16	15/16	3/8**	¼	9/16	1¼	2	3¾	7¾	7¾	
	2½	2¼-12	1¾-12	3	4½	3.124	1	2½	2¾	1/2**	¼	11/16	1½	2¼	3¾	7½	8	

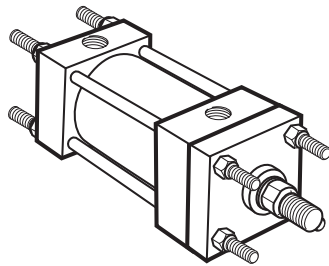
** For all MF5 mounts and MF6 mounts with maximum oversized rods.

Tie Rods Extended Mount

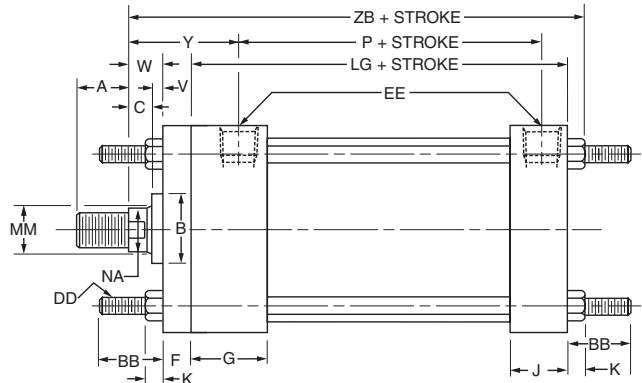
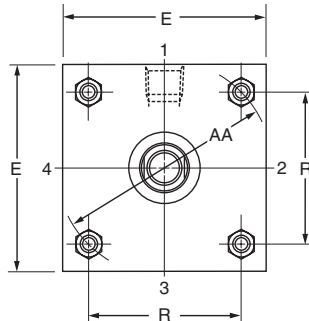
Style MX1

1 1/2" - 2" - 2 1/2" - 5" and 6" Bore

With Maximum Oversize Rods



Tie Rod Retained Cartridge



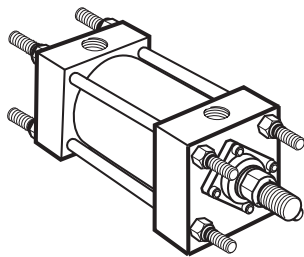
Tie Rods can be extended: Both Ends — Model MX1;
Cap End — Model MX2; Head End — Model MX3.

Before determining dimensions: See chart on page 87 for
cylinder rod combinations that have removable cartridges.

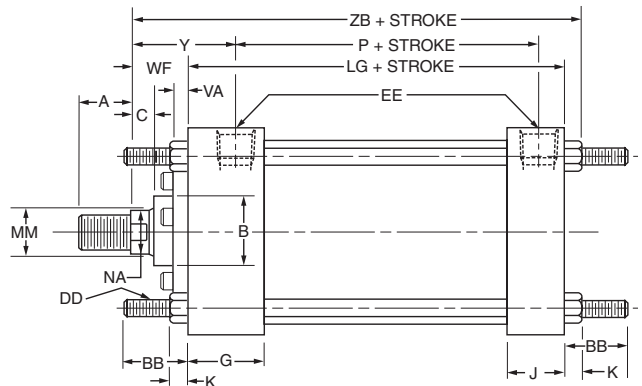
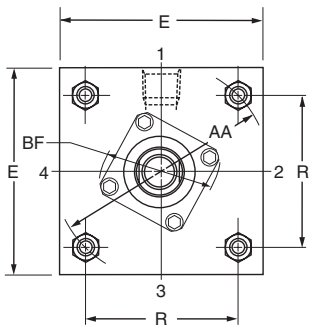
Tie Rods Extended Mount

Style MX1

1 1/2" - 6" Bore



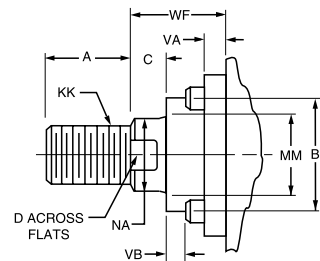
Removable Cartridge



Rod End Dimensions — see table 2

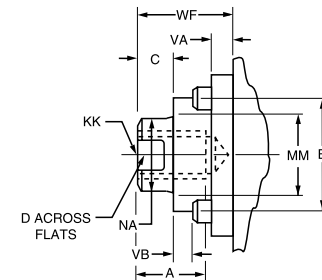
Thread Style 2

Small Male



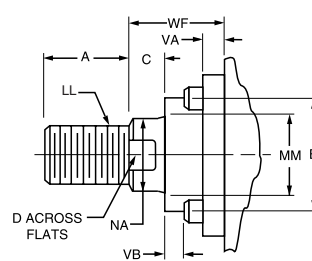
Thread Style 3

Short Female



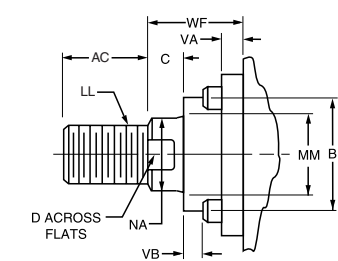
Thread Style 4

Intermediate Male



Thread Style 5

Automotive Male



“Special” Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify “Style 0” and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Mounting Information – 1½" to 6" Bore

Table 1—Envelope and Mounting Dimensions

Bore	AA	BB	DD	E	EE		F	G	J	K	R	Add Stroke	
					NPTF	SAE						LG	P
1½	2.02	1	¼-28	2	⅜†	#6**	⅜	1½	1	¼	1.43	3⅝	2¼
2	2.6	1⅝	⅝-24	2½	⅜†	#6	⅜	1½	1	⅝	1.84	3⅝	2¼
2½	3.1	1⅝	⅝-24	3	⅜†	#6	⅜	1½	1	⅝	2.19	3¾	2⅝
3¼	3.9	1⅝	⅝-24	3¾	½	#10	—	1¾	1¼	⅝	2.76	4¼	2⅝
4	4.7	1⅝	⅝-24	4½	½	#10	—	1¾	1¼	⅝	3.32	4¼	2⅝
5	5.8	1⅝	⅝-20	5½	½	#10	—	1¾	1¼	⅝	4.10	4½	2⅝
6	6.9	1⅝	⅝-20	6½	¾	#12	¾	2	1½	⅝	4.88	5	3⅝

† On 1½", 2" and 2½" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with maximum oversize rods. Minimum of three full threads available.

** Port adapter fitting furnished at head end only.

Table 2—Rod End Dimensions and Envelope Dimensions Affected By Rod Size

Bore	Rod Dia. MM	Thread		Rod Extensions and Envelope Dimensions Affected By Rod Size														Add Stroke ZB
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+0.000 -0.002 B	BF	C	D	NA	V	VA	VB	W	WF	Y		
1½	⅝	½-20	⅞-20	¾	1⅝	1.124	1.968	⅜	½	⅞	—	¼	⅜	—	1	1⅝	4⅞	
	1	⅞-14	¾-16	1⅝	1⅞	1.499	—	½	⅞	1⅝	½	—	1	—	2⅝	5¼		
2	⅝	½-20	⅞-20	¾	1⅝	1.124	1.968	⅜	½	⅞	—	¼	⅜	—	1	1⅝	4⅝	
	1⅜	1¼-12	1-14	1⅝	2½	1.999	—	⅝	1⅝	1⅝	⅝	—	1¼	—	2⅞	5⅞		
2½	⅝	½-20	⅞-20	¾	1⅝	1.124	1.968	⅜	½	⅞	—	¼	⅜	—	1	1⅝	5⅞	
	1⅜	1¼-12	1-14	1⅝	2½	1.999	—	⅝	1⅝	1⅝	⅝	—	1¼	—	2⅞	5⅝		
3¼	1	⅞-14	¾-16	1⅝	1⅞	1.499	2.468	½	⅞	1⅝	—	¼	⅞	—	1⅜	2⅞	6	
	2	1¾-12	1½-12	2¼	3½	2.624	3.735	⅞	1⅞	1⅝	—	¼	⅞	—	2	3⅞	6⅝	
4	1⅜	1¼-12	1-14	1⅝	2½	1.999	2.968	⅝	1⅝	1⅝	—	¼	½	—	1⅝	2⅞	6¼	
	1¾	1½-12	1¼-12	2	3	2.374	3.735	¾	1½	1⅞	—	¼	⅞	—	1⅞	2⅝	6½	
5	1	⅞-14	¾-16	1⅝	1⅞	1.499	2.468	½	⅞	1⅝	—	¼	⅞	—	1⅜	2⅞	6⅝	
	3½	3¼-12	2½-12	3½	—	4.249	—	1	3	3⅝	⅝	—	—	1⅝	—	3⅝	7⅞	
6	1⅜	1¼-12	1-14	1⅝	2½	1.999	2.968	⅝	1⅝	1⅝	—	¼	½	—	1⅝	2⅞	6⅝	
	1¾	1½-12	1¼-12	2	3	2.374	3.735	¾	1½	1⅞	—	¼	⅞	—	1⅞	2⅝	6⅝	
7	2	1¾-12	1½-12	2¼	3½	2.624	3.735	⅞	1⅞	1⅝	—	¼	⅞	—	2	3⅞	6⅝	
	2½	2¼-12	1¾-12	3	4½	3.124	5.000	1	2⅞	2⅝	—	¼	1⅞	—	2¼	3⅝	7⅞	
8	3	2¾-12	2¼-12	3½	—	3.749	—	1	2⅝	2⅞	⅝	—	—	1⅝	—	3⅝	7⅞	
	3⅝	3¼-12	2½-12	3½	2½	1.999	2.968	⅝	1⅝	1⅝	—	¼	⅞	—	1⅝	2⅞	7⅞	
9	4	3¼-12	3-12	4	—	4.749	—	1	3⅝	3⅞	½	—	—	1½	—	3⅞	7⅞	
	4½	3½-12	3-12	4	—	4.749	—	1	3⅝	3⅞	½	—	—	1½	—	3⅞	7⅞	
10	5	4-12	3-12	4	—	4.749	—	1	3⅝	3⅞	½	—	—	1½	—	3⅞	7⅞	
	5½	4½-12	3½-12	4½	—	4.749	—	1	3⅝	3⅞	½	—	—	1½	—	3⅞	7⅞	
11	6	5-12	4-12	5	—	4.749	—	1	3⅝	3⅞	½	—	—	1½	—	3⅞	7⅞	
	6½	5½-12	4½-12	5½	—	4.749	—	1	3⅝	3⅞	½	—	—	1½	—	3⅞	7⅞	

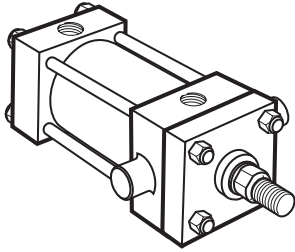
A
PA-2
NC9
Rod Lock

Head Trunnion Mount

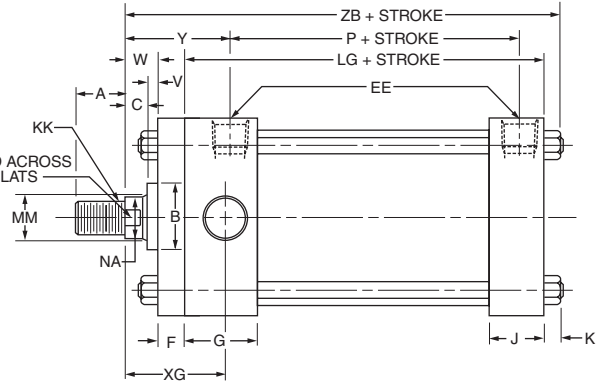
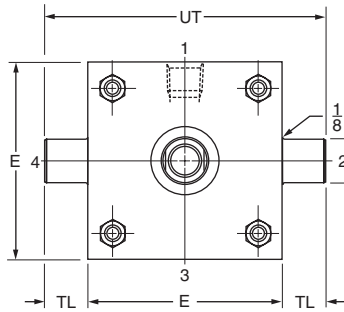
Style MT1

1 1/2" - 2" - 2 1/2" - 5" and 6" Bore

With Maximum Oversize Rods



Tie Rod Retained Cartridge

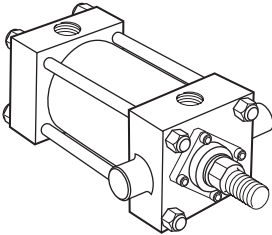


Before determining dimensions: See chart on page 87 for cylinder rod combinations that have removable cartridges.

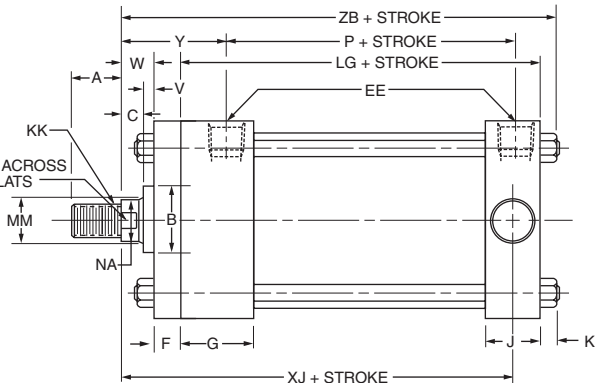
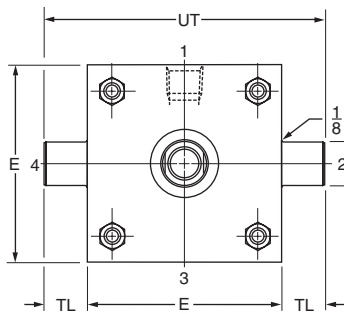
Head Trunnion Mount

Style MT1

1 1/2" - 6" Bore



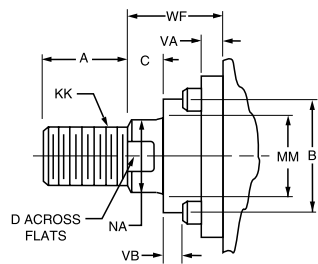
Removable Cartridge



Rod End Dimensions — see table 2

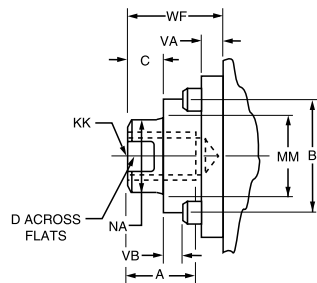
Thread Style 2

Small Male



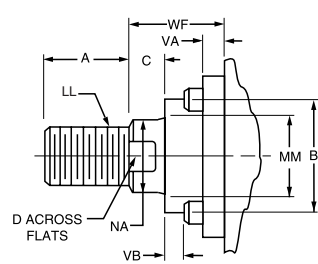
Thread Style 3

Short Female



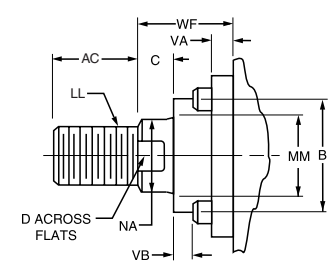
Thread Style 4

Intermediate Male



Thread Style 5

Automotive Male



“Special” Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify “Style 0” and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Table 1—Envelope and Mounting Dimensions

Bore	E	EE		F	G	J	K	+0.000 -0.001 TD	TL	UT	Add Stroke	
		NPTF	SAE**								LG	P
1½	2	¾†	#6**	¾	1½	1	¼	1.000	1	4	3⅝	2¼
2	2½	¾†	#6	¾	1½	1	⅝	1.000	1	4½	3⅝	2¼
2½	3	¾†	#6	¾	1½	1	⅝	1.000	1	5	3¾	2⅝
3¼	3¾	½	#10	—	1¾	1¼	⅜	1.000	1	5¾	4¼	2⅝
4	4½	½	#10	—	1¾	1¼	⅜	1.000	1	6½	4¼	2⅝
5	5½	½	#10	⅝	1¾	1¼	⅞	1.000	1	7½	4½	2⅞
6	6½	¾	#12	¾	2	1½	⅞	1.375	1¾	9¼	5	3⅝

† On 1½", 2" and 2½" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with maximum oversize rods. Minimum of three full threads available.

** Port adapter fitting furnished at head end only.

Table 2—Rod End Dimensions and Envelope Dimensions Affected By Rod Size

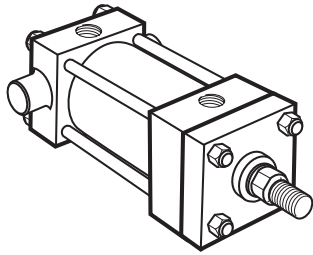
Bore	Rod Dia. MM	Thread		Rod Extensions and Envelope Dimensions Affected By Rod Size														Add Stroke ZB
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+0.000 -0.002 B	C	D	NA	V	VA	VB	W	WF	XG	Y		
1½	⅝	½-20	⅞-20	¾	1⅝	1.124	⅜	½	⅞	—	¼	⅜	—	1	1¾	1⅝	4⅞	
	1	⅞-14	¾-16	1⅝	1⅞	1.499	½	⅞	1⅝	½	—	—	1	—	2⅝	2⅝	5¼	
2	⅝	½-20	⅞-20	¾	1⅝	1.124	⅜	½	⅞	—	¼	⅜	—	1	1¾	1⅝	4⅞	
	1⅝	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅝	1⅝	⅝	—	—	1¼	—	2⅝	2⅝	5⅞	
2½	⅝	½-20	⅞-20	¾	1⅝	1.124	⅜	½	⅞	—	¼	⅜	—	1	1¾	1⅝	5⅞	
	1¾	1½-12	1¼-12	2	3	2.374	¾	1½	1⅞	¾	—	—	1½	—	2⅝	2⅝	5⅝	
3¼	1	⅞-14	¾-16	1⅝	1⅞	1.499	½	⅞	1⅝	⅝	—	¼	⅞	—	1¾	2⅞	6	
	2	1¼-12	1½-12	2¼	3½	2.624	⅞	1⅞	1⅝	—	¼	⅞	—	2	2⅞	3⅞	6⅝	
4	1⅝	1¼-12	1¼-12	2	3	2.374	¾	1½	1⅞	—	¼	⅞	—	1⅞	2¾	2⅝	6½	
	2½	2¼-12	1⅞-12	3	4½	3.124	1	2⅞	2⅞	—	¼	1⅞	—	2¼	3⅞	3⅞	6⅞	
5	1⅝	1¼-12	1¼-12	2	3	2.374	¾	1½	1⅞	—	¼	⅞	—	1⅞	2¾	2⅝	6½	
	3½	3¼-12	2½-12	3½	—	4.249	1	3	3⅞	⅝	—	—	1⅝	—	3⅞	3⅞	7⅞	
6	1⅝	1¼-12	1¼-12	2	3	2.374	¾	1½	1⅞	—	¼	⅞	—	1⅞	2¾	2⅝	6½	
	2	1¾-12	1½-12	2¼	3½	2.624	⅞	1⅞	1⅝	—	¼	⅞	—	2	3	3⅞	7⅞	

Cap Trunnion Mount

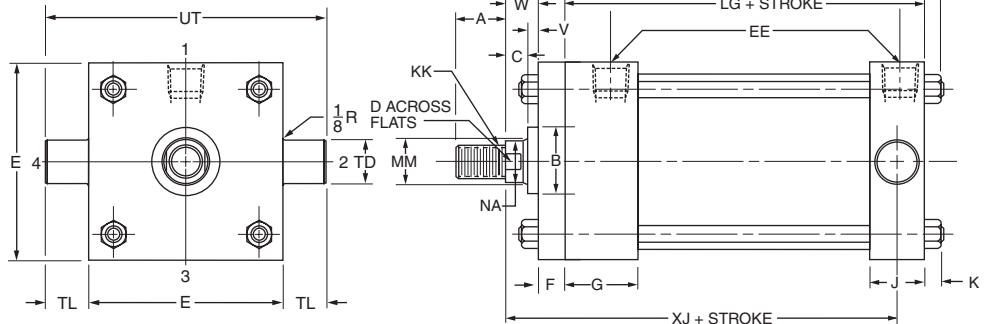
Style MT2

1 1/2" - 2" 2 1/2" - 5" and 6" Bore

With Maximum Oversize Rods



Tie Rod Retained Cartridge

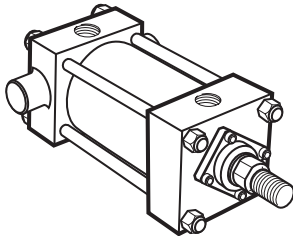


Before determining dimensions: See chart on page 87 for cylinder rod combinations that have removable cartridges.

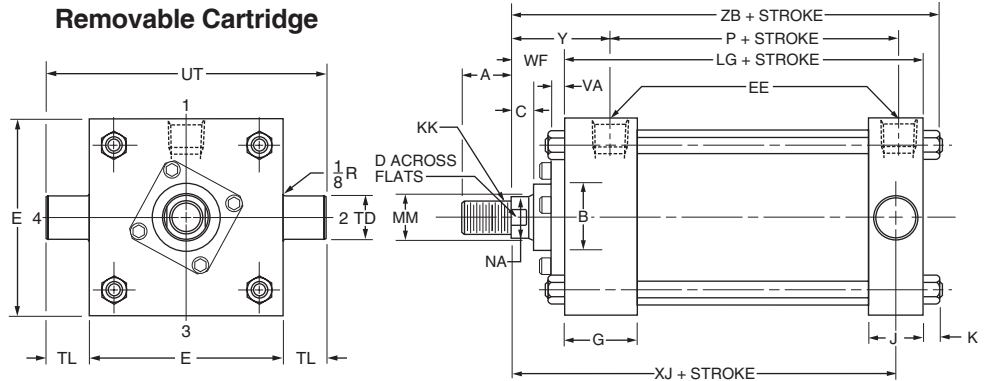
Cap Trunnion Mount

Style MT2

1 1/2" - 6" Bore



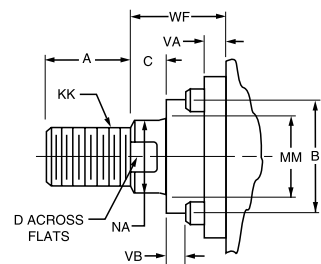
Removable Cartridge



Rod End Dimensions — see table 2

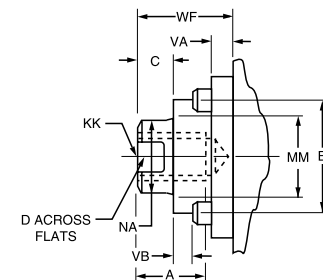
Thread Style 2

Small Male



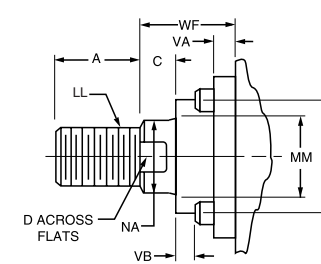
Thread Style 3

Short Female



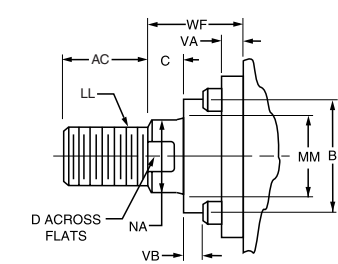
Thread Style 4

Intermediate Male



Thread Style 5

Automotive Male



"Special" Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 0" and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Table 1—Envelope and Mounting Dimensions

Bore	E	EE		F	G	J	K	+.000 -.001 TD	TL	UT	Add Stroke	
		NPTF	SAE #6**								LG	P
1½	2	¾†	#6**	¾	1½	1	¼	1.000	1	4	3⅝	2¼
2	2½	¾†	#6	¾	1½	1	⅝	1.000	1	4½	3⅝	2¼
2½	3	¾†	#6	¾	1½	1	⅝	1.000	1	5	3¾	2⅝
3¼	3¾	½	#10	—	1¾	1¼	⅜	1.000	1	5¾	4¼	2⅝
4	4½	½	#10	—	1¾	1¼	⅜	1.000	1	6½	4¼	2⅝
5	5½	½	#10	⅝	1¾	1¼	⅞	1.000	1	7½	4½	2⅞
6	6½	¾	#12	¾	2	1½	⅞	1.375	1⅜	9¼	5	3⅝

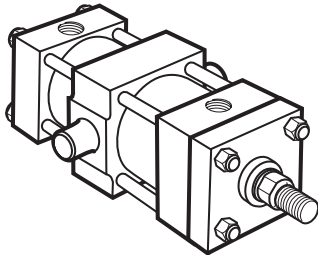
† On 1½", 2" and 2½" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with maximum oversize rods. Minimum of three full threads available.

** Port adapter fitting furnished at head end only.

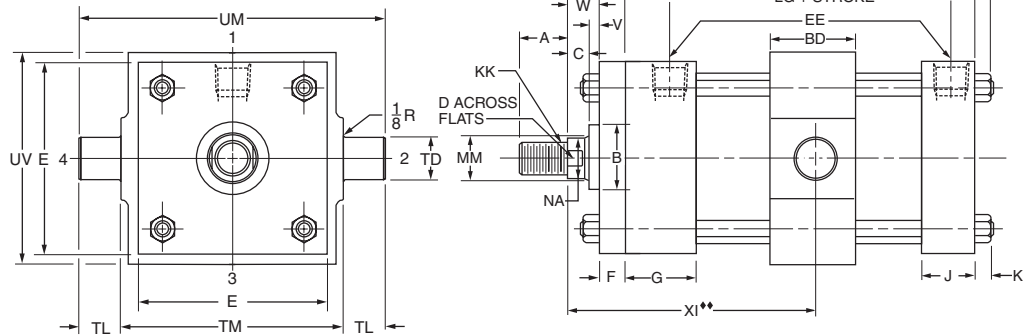
Table 2—Rod End Dimensions and Envelope Dimensions Affected By Rod Size

Bore	Rod Dia. MM	Thread		Rod Extensions and Envelope Dimensions Affected By Rod Size														Add Stroke	
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+.000 -.002 B	C	D	NA	V	VA	VB	W	WF	Y	XJ	ZB		
		1½	⅝	½-20	7/16-20	¾	1⅞	1.124	¾	½	9/16	—	¼	⅜	—	1	1⅝	4⅞	4⅞
	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	½	—	—	1	—	2⅝	4½	5¼		
2	⅝	½-20	7/16-20	¾	1⅞	1.124	¾	½	9/16	—	¼	⅜	—	1	1⅝	4⅞	4⅞		
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅞	1⅝	⅝	—	—	1¼	—	2⅞	4¾	5⅞		
2½	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1⅜	2⅝	4½	5⅞		
	⅝	½-20	7/16-20	¾	1⅞	1.124	¾	½	9/16	—	¼	⅜	—	1	1⅝	4⅞	5⅞		
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅞	1⅝	⅝	—	—	1¼	1⅝	2⅞	4⅞	5⅞		
3¼	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1⅜	2⅞	5	6		
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	1⅞	1⅝	—	¼	9/16	—	2	3⅞	5⅞	6⅝		
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅞	1⅝	—	¼	½	—	1⅝	2⅞	5¼	6¼		
	1⅜	1½-12	1¼-12	2	3	2.374	¾	1½	1⅞	—	¼	9/16	—	1⅞	2⅝	5½	6½		
4	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1⅜	2⅞	5	6		
	2½	2¼-12	1⅞-12	3	4½	3.124	1	2⅞	2⅞	—	¼	1⅞	—	2¼	3⅝	5⅞	6⅞		
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅞	1⅝	—	¼	½	—	1⅝	2⅞	5¼	6¼		
	1⅜	1½-12	1¼-12	2	3	2.374	¾	1½	1⅞	—	¼	9/16	—	1⅞	2⅝	5½	6½		
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	1⅞	1⅝	—	¼	9/16	—	2	3⅞	5⅞	6⅝		
5	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1⅜	2⅞	5¼	6⅞		
	3½	3¼-12	2½-12	3½	—	4.249	1	3	3⅞	⅝	—	—	1⅝	—	3⅝	6⅞	7⅞		
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅞	1⅝	—	¼	½	—	1⅝	2⅞	5½	6⅞		
	1⅜	1½-12	1¼-12	2	3	2.374	¾	1½	1⅞	—	¼	9/16	—	1⅞	2⅝	5¾	6⅞		
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	1⅞	1⅝	—	¼	9/16	—	2	3⅞	5⅞	6⅝		
	2½	2¼-12	1⅞-12	3	4½	3.124	1	2⅞	2⅞	—	¼	1⅞	—	2¼	3⅝	6⅞	7⅞		
6	3	2¾-12	2¼-12	3½	—	3.749	1	2⅞	2⅞	⅝	—	—	1⅝	—	3⅝	6⅞	7⅞		
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅞	1⅝	—	¼	7/16	—	1⅝	2⅞	5⅞	7⅞		
	4	3¾-12	3-12	4	—	4.749	1	3⅞	3⅞	½	—	—	1½	—	3⅞	6½	7⅞		
	1⅜	1½-12	1¼-12	2	3	2.374	¾	1½	1⅞	—	¼	9/16	—	1⅞	3⅞	6⅞	7⅞		
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	1⅞	1⅝	—	¼	9/16	—	2	3⅞	6¼	7⅞		
	2½	2¼-12	1⅞-12	3	4½	3.124	1	2⅞	2⅞	—	¼	1⅞	—	2¼	3⅞	6½	7⅞		
	3	2¾-12	2¼-12	3½	—	3.749	1	2⅞	2⅞	½	—	—	1½	—	3⅞	6½	7⅞		

Intermediate Fixed Trunnion Mount
Style MT4
1 1/2" - 2" - 2 1/2" - 5" and 6" Bore
With Maximum Oversize Rods



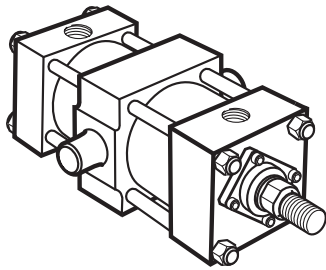
Tie Rod Retained Cartridge



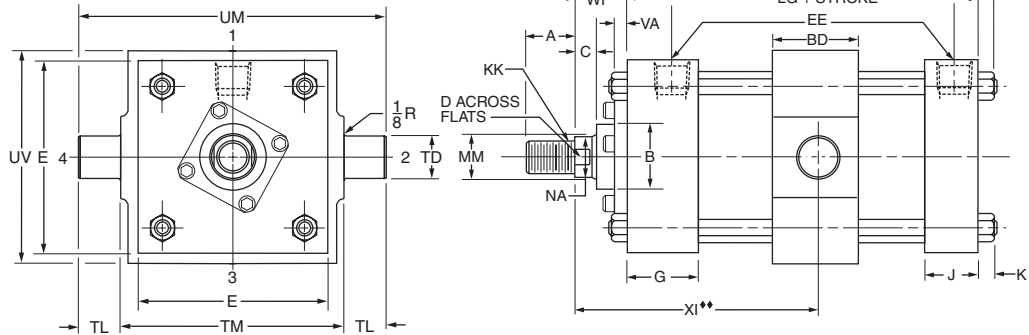
♦♦ Dimension XI to be specified by customer.

Before determining dimensions: See chart on page 87 for cylinder rod combinations that have removable cartridges.

Intermediate Fixed Trunnion Mount
Style MT4
1 1/2" - 6" Bore



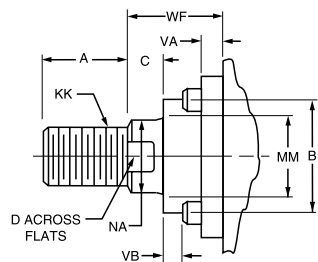
Removable Cartridge



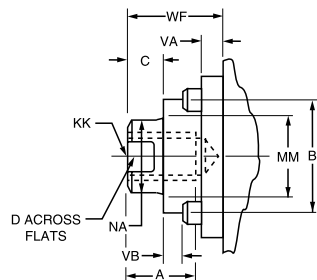
♦♦ Dimension XI to be specified by customer.

Rod End Dimensions — see table 2

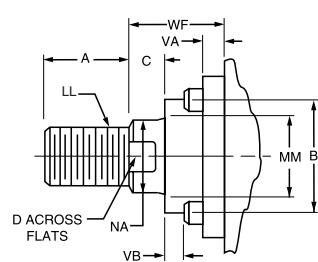
Thread Style 2
Small Male



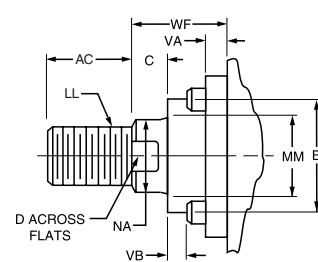
Thread Style 3
Short Female



Thread Style 4
Intermediate Male



Thread Style 5
Automotive Male



"Special" Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 0" and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Mounting Information – 1½" to 6" Bore

Table 1—Envelope and Mounting Dimensions

Bore	BD	E	EE		F	G	J	K	+.000 -.001 TD	TL	TM	UM	UV	Minimum Stroke	Add Stroke	
			NPTF	SAE											LG	P
1½	1¼	2	¾†	#6**	¾	1½	1	¼	1.000	1	2½	4½	2½	¼	3⅝	2¼
2	1½	2½	¾†	#6	¾	1½	1	5/16	1.000	1	3	5	3	½	3⅝	2¼
2½	1½	3	¾†	#6	¾	1½	1	5/16	1.000	1	3½	5½	3½	¾	3¾	2⅝
3¼	2	3¾	½	#10	5/8	1¾	1¼	¾	1.000	1	4½	6½	4¼	7/8	4¼	2⅝
4	2	4½	½	#10	—	1¾	1¼	¾	1.000	1	5¼	7¼	5	7/8	4¼	2⅝
5	2	5½	½	#10	—	1¾	1¼	7/16	1.000	1	6¼	8¼	6	5/8	4½	2⅞
6	2½	6½	¾	#12	¾	2	1½	7/16	1.375	1¾	7⅝	10¾	7	1⅞	5	3⅞

† On 1½", 2" and 2½" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with maximum oversize rods. Minimum of three full threads available.

** Port adapter fitting furnished at head end only.

Table 2—Rod End Dimensions and Envelope Dimensions Affected By Rod Size

Bore	Rod Dia. MM	Thread		Rod Extensions and Envelope Dimensions Affected By Rod Size														Add Stroke ZB
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+.000 -.002 B	C	D	NA	V	VA	VB	W	WF	Min.♦♦ XI	Y		
1½	5/8	1/2-20	7/16-20	¾	1⅞	1.124	¾	½	9/16	—	¼	3/16	—	1	3⅜	1⅞	4/8	
	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	½	—	—	1	—	3⅞	2⅞	5¼	
2	5/8	1/2-20	7/16-20	¾	1⅞	1.124	¾	½	9/16	—	¼	3/16	—	1	3⅜	1⅞	4⅞	
	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1⅞	3⅞	2⅞	5⅞	
2½	5/8	1/2-20	7/16-20	¾	1⅞	1.124	¾	½	9/16	—	¼	3/16	—	1	3⅜	1⅞	5⅞	
	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1⅞	3⅞	2⅞	5⅞	
3¼	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1⅞	3⅞	2⅞	6	
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	1⅞	15/16	—	¼	9/16	—	2	4⅞	3⅞	6⅞	
4	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1⅞	3⅞	2⅞	6	
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	1⅞	15/16	—	¼	9/16	—	2	4⅞	3⅞	6⅞	
5	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1⅞	3⅞	2⅞	6⅞	
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	1⅞	15/16	—	¼	9/16	—	2	4⅞	3⅞	6⅞	
6	1	7/8-14	¾-16	1⅞	1⅞	1.499	½	7/8	15/16	—	¼	7/16	—	1⅞	3⅞	2⅞	6⅞	
	2	1¾-12	1½-12	2¼	3½	2.624	7/8	1⅞	15/16	—	¼	9/16	—	2	4⅞	3⅞	6⅞	

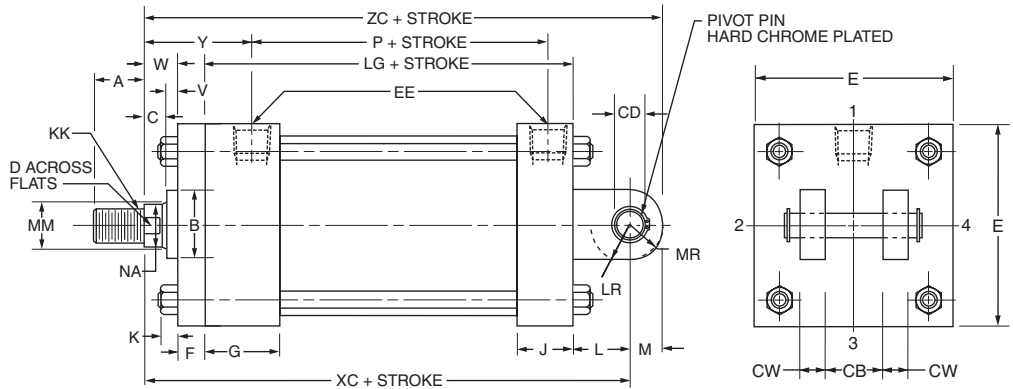
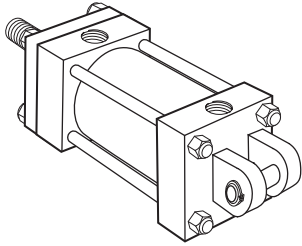
♦♦ Dimension XI to be specified by customer.

Cap Fixed Clevis Mount

Style MP1

1 1/2" - 2" - 2 1/2" - 5" and 6" Bore

With Maximum Oversize Rods



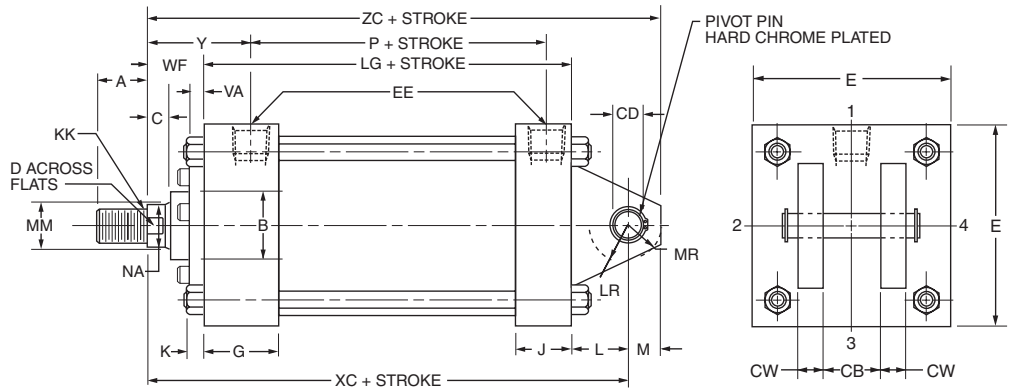
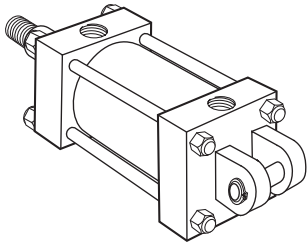
The 4", 5" and 6" bore sizes have the tie rod nuts at both ends as shown. Tie rods thread into cap on all other bore sizes.

Before determining dimensions: See chart on page 87 for cylinder rod combinations that have removable cartridges.

Cap Fixed Clevis Mount

Style MP1

1 1/2" - 6" Bore



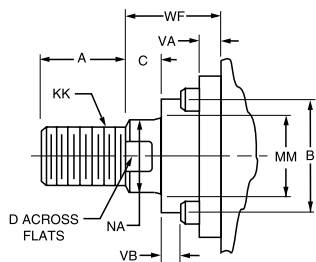
The 4", 5" and 6" bore sizes have the tie rod nuts at both ends as shown. Tie rods thread into cap on all other bore sizes.

Removable Cartridge

Rod End Dimensions — see table 2

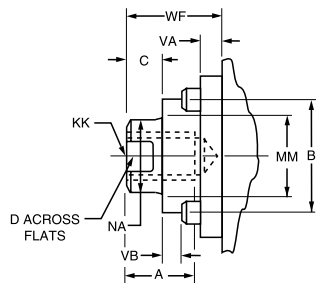
Thread Style 2

Small Male



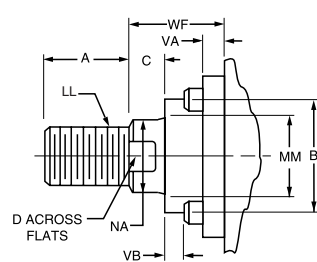
Thread Style 3

Short Female



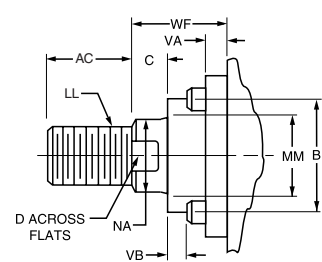
Thread Style 4

Intermediate Male



Thread Style 5

Automotive Male



"Special" Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 0" and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Mounting Information – 1½" to 6" Bore

Table 1—Envelope and Mounting Dimensions

Bore	CB	+.000 -.002 CD	CW	E	EE		F	G	J	K	L	LR	M	MR	Add Stroke	
					NPTF	SAE									LG	P
1½	¾	.501	½	2	¾†	#6**	¾	1½	1	¼	¾	¾	½	⅝	3⅝	2¼
2	¾	.501	½	2½	¾†	#6	¾	1½	1	⅝	¾	¾	½	⅝	3⅝	2¼
2½	¾	.501	½	3	¾†	#6	¾	1½	1	⅝	¾	¾	½	⅝	3¾	2⅝
3¼	1¼	.751	⅝	3¾	½	#10	—	1¾	1¼	¾	1¼	1	¾	¾	4¼	2⅝
4	1¼	.751	⅝	4½	½	#10	—	1¾	1¼	¾	1¼	1	¾	¾	4¼	2⅝
5	1¼	.751	⅝	5½	½	#10	⅝	1¾	1¼	⅞	1¼	1	¾	¾	4½	2⅞
6	1½	1.001	¾	6½	¾	#12	¾	2	1½	⅞	1½	1¼	1	1	5	3⅝

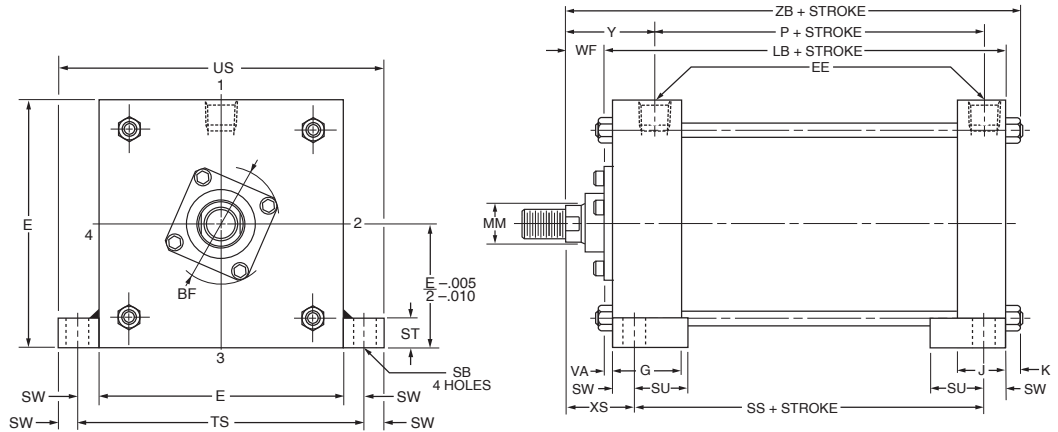
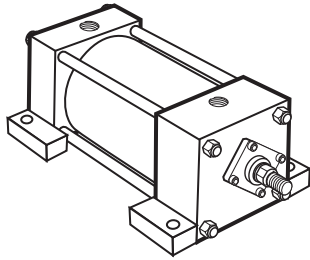
† On 1½", 2" and 2½" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with maximum oversize rods. Minimum of three full threads available.

** Port adapter fitting furnished at head end only.

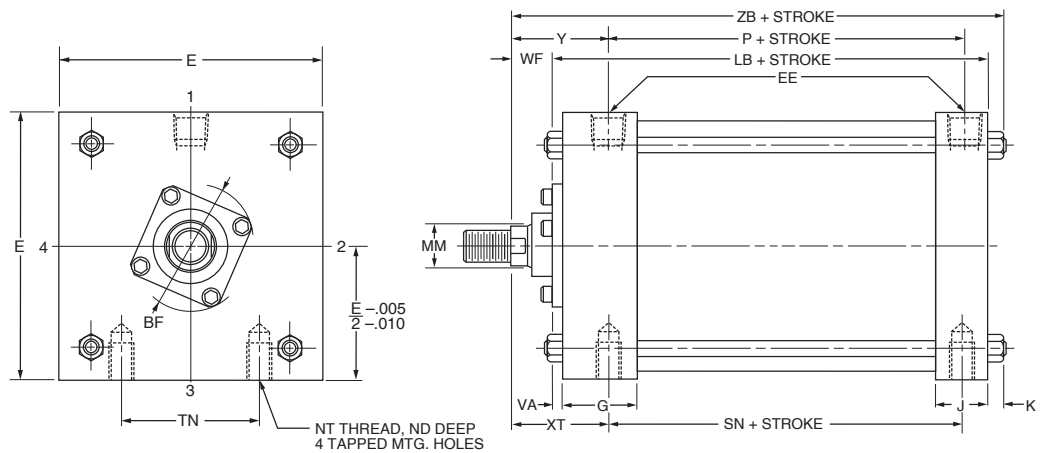
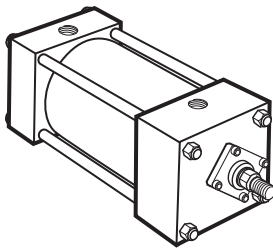
Table 2—Rod End Dimensions and Envelope Dimensions Affected By Rod Size

Bore	Rod Dia. MM	Thread		Rod Extensions and Envelope Dimensions Affected By Rod Size													Add Stroke	
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+.000 -.002 B	C	D	NA	V	VA	VB	W	WF	Y	XC	ZC	
1½	⅝	½-20	⅞-20	¾	1⅛	1.124	¾	½	⅑	—	¼	⅓	—	1	1⅕	5⅞	5⅞	
	1	⅞-14	¾-16	1⅛	1⅞	1.499	½	⅞	⅒	—	—	—	1	—	2⅕	5¾	6¼	
2	⅝	½-20	⅞-20	¾	1⅛	1.124	¾	½	⅑	—	¼	⅓	—	1	1⅕	5⅞	5⅞	
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅛	⅑	⅝	—	—	1¼	—	2⅑	6	6½	
2½	1	⅞-14	¾-16	1⅛	1⅞	1.499	½	⅞	⅒	—	¼	⅓	—	1⅝	5¾	6¼	6¼	
	⅝	½-20	⅞-20	¾	1⅛	1.124	¾	½	⅑	—	¼	⅓	—	1	1⅕	5⅞	6	
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅛	⅑	⅝	—	—	1¼	—	2⅑	6⅞	6⅞	
	1	⅞-14	¾-16	1⅛	1⅞	1.499	½	⅞	⅒	—	¼	⅓	—	1⅝	5¾	6⅞	6⅞	
3¼	1	⅞-14	¾-16	1⅛	1⅞	1.499	½	⅞	⅒	—	¼	⅓	—	1⅝	5¾	6⅞	7⅝	
	2	1¾-12	1½-12	2¼	3½	2.624	⅞	1⅞	⅑	—	¼	⅓	—	2	3⅑	7½	8¼	
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅛	⅑	—	¼	⅓	—	1⅝	5¾	7⅞	7⅞	
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅛	⅑	—	¼	⅓	—	1⅝	5¾	7⅞	7⅞	
4	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅛	⅑	—	¼	⅓	—	1⅝	5¾	7⅞	7⅞	
	2	1¾-12	1½-12	2¼	3½	2.624	⅞	1⅞	⅑	—	¼	⅓	—	2	3⅑	7½	8¼	
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅛	⅑	—	¼	⅓	—	1⅝	5¾	7⅞	7⅞	
	2½	2¼-12	1⅞-12	3	4½	3.124	1	2⅑	2⅓	—	¼	⅓	—	2¼	3⅕	7¾	8½	
5	1	⅞-14	¾-16	1⅛	1⅞	1.499	½	⅞	⅒	—	¼	⅓	—	1⅝	5¾	7⅞	7⅞	
	3½	3¼-12	2½-12	3½	—	4.249	1	3	3⅓	⅝	—	—	1⅝	—	3⅕	8	8¾	
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅛	⅑	—	¼	⅓	—	1⅝	5¾	7⅞	8⅞	
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅛	⅑	—	¼	⅓	—	1⅝	5¾	7⅞	8⅞	
	2	1¾-12	1½-12	2¼	3½	2.624	⅞	1⅞	⅑	—	¼	⅓	—	2	3⅑	7¾	8½	
	2½	2¼-12	1⅞-12	3	4½	3.124	1	2⅑	2⅓	—	¼	⅓	—	2¼	3⅕	8	8¾	
6	3	2¾-12	2¼-12	3½	—	3.749	1	2⅝	2⅞	⅝	—	—	1⅝	—	3⅕	8	8¾	
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅛	⅑	—	¼	⅓	—	1⅝	5¾	7⅞	7⅞	
	4	3¾-12	3-12	4	—	4.749	1	3⅓	3⅞	½	—	—	1½	—	3⅞	8¾	9¾	
	1⅜	1¼-12	1-14	1⅝	2½	1.999	⅝	1⅛	⅑	—	¼	⅓	—	1⅝	5¾	7⅞	7⅞	
	2	1¾-12	1½-12	2¼	3½	2.624	⅞	1⅞	⅑	—	¼	⅓	—	2	3⅑	7½	8¼	
	2½	2¼-12	1⅞-12	3	4½	3.124	1	2⅑	2⅓	—	¼	⅓	—	2¼	3⅕	8¾	9¾	

Side Lug Mount
Style MS2
8" - 12" Bore

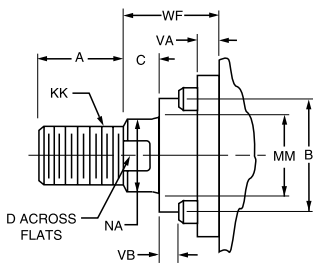


Side Tap Mount
Style MS4
8" - 12" Bore

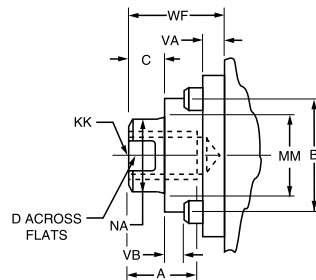


Rod End Dimensions — see table 2

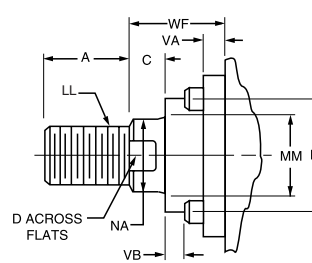
Thread Style 2
Small Male



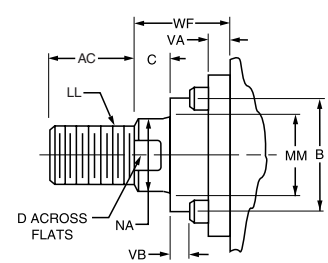
Thread Style 3
Short Female



Thread Style 4
Intermediate Male



Thread Style 5
Automotive Male



"Special" Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 0" and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Table 1—Envelope and Mounting Dimensions

Bore	E	EE		G	J	K	ND	NT	SB*	ST	SU	SW	TN	TS	US	Add Stroke			
		NPTF	SAE													LB	P	SN	SS
8	8 ¹ / ₂	³ / ₄	#12	2	1 ¹ / ₂	⁹ / ₁₆	1 ¹ / ₈	³ / ₄ -10	¹³ / ₁₆	1	¹⁹ / ₁₆	¹¹ / ₁₆	4 ¹ / ₂	9 ⁷ / ₈	11 ¹ / ₄	5 ⁷ / ₈	3 ¹ / ₄	3 ¹ / ₄	3 ³ / ₄
10	10 ⁵ / ₈	1	#16	2 ¹ / ₄	2	¹¹ / ₁₆	1 ¹ / ₂	1-8	1 ¹ / ₁₆	1 ¹ / ₄	2	⁷ / ₈	5 ¹ / ₂	12 ³ / ₈	14 ¹ / ₈	7 ¹ / ₈	4 ¹ / ₈	4 ¹ / ₈	4 ⁵ / ₈
12	12 ³ / ₄	1	#16	2 ¹ / ₄	2	¹¹ / ₁₆	1 ¹ / ₂	1-8	1 ¹ / ₁₆	1 ¹ / ₄	2	⁷ / ₈	7 ¹ / ₄	14 ¹ / ₂	16 ¹ / ₄	7 ⁵ / ₈	4 ⁵ / ₈	4 ⁵ / ₈	5 ¹ / ₈

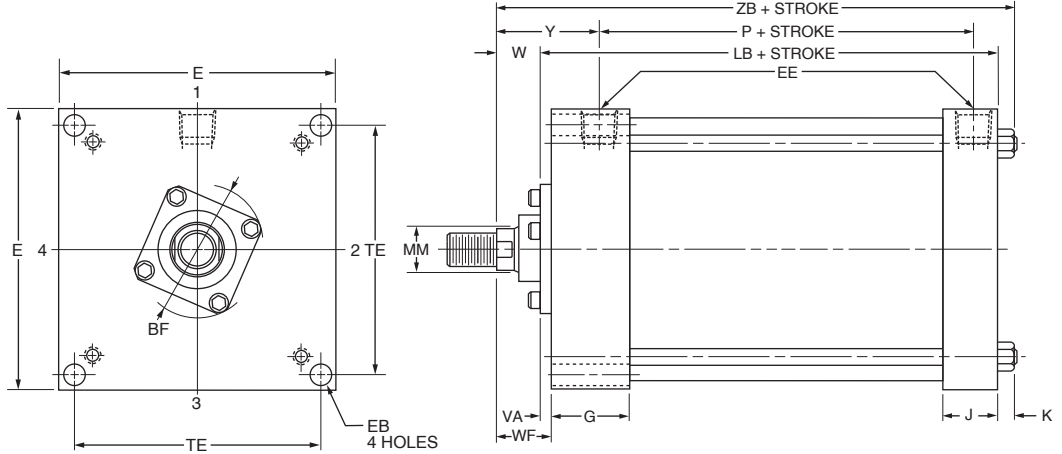
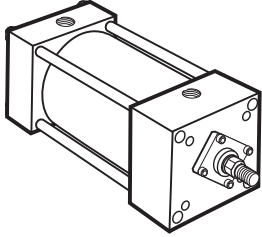
*Upper surface spotfaced for socket head screws.

Table 2—Rod End Dimensions and Envelope Dimensions Affected By Rod Size

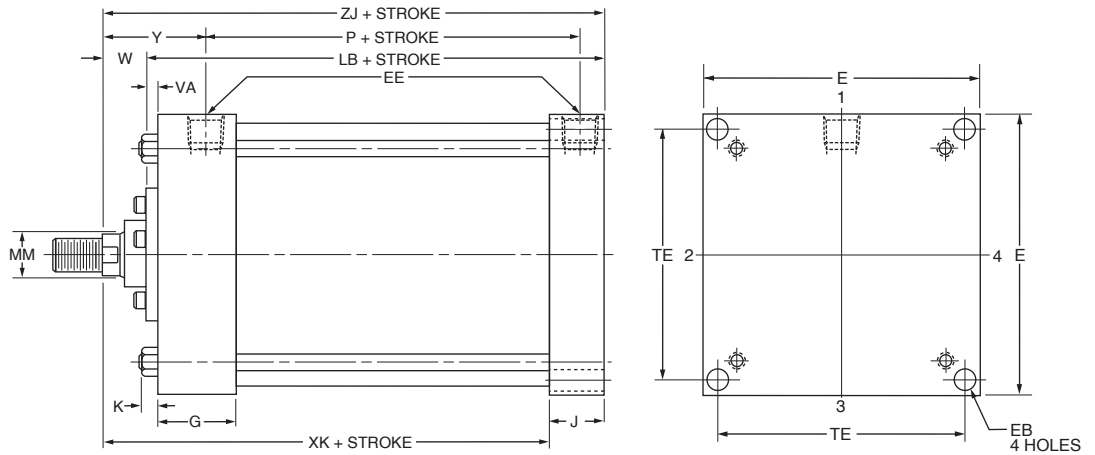
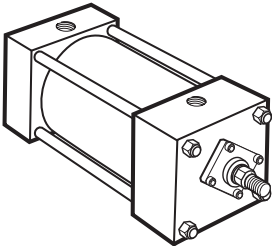
Bore	Rod Dia. MM	Thread		Rod End Dimensions and Envelope Dimensions Affected By Rod Size															Add Stroke ZB
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+0.000 -0.002 B	±.010 BF ¹	C	D	NA	VA	VB	WF	XS	XT	Y			
8	1 ³ / ₈	1 ¹ / ₄ -12	1-14	1 ⁵ / ₈	2 ¹ / ₂	1.999	3.625	⁵ / ₈	1 ¹ / ₈	1 ⁵ / ₁₆	¹ / ₄	⁷ / ₁₆	1 ⁵ / ₈	2 ⁵ / ₁₆	2 ¹³ / ₁₆	2 ¹³ / ₁₆	7 ⁵ / ₁₆		
	5 ¹ / ₂	5 ¹ / ₄ -12	4-12	5 ¹ / ₂	—	6.249	7.750	1	4 ⁵ / ₈	5 ³ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	2 ¹⁵ / ₁₆	3 ⁷ / ₁₆	3 ⁷ / ₁₆	7 ¹⁵ / ₁₆		
	1 ³ / ₄	1 ¹ / ₂ -12	1 ¹ / ₄ -12	2	3	2.374	3.625	³ / ₄	1 ¹ / ₂	1 ¹¹ / ₁₆	¹ / ₄	⁹ / ₁₆	1 ⁷ / ₈	2 ⁹ / ₁₆	3 ¹ / ₁₆	3 ¹ / ₁₆	7 ⁹ / ₁₆		
	2	1 ³ / ₄ -12	1 ¹ / ₂ -12	2 ¹ / ₄	3 ¹ / ₂	2.624	3.735	⁷ / ₈	1 ¹¹ / ₁₆	1 ⁵ / ₁₆	¹ / ₄	⁹ / ₁₆	2	2 ¹¹ / ₁₆	3 ³ / ₁₆	3 ³ / ₁₆	7 ¹¹ / ₁₆		
	2 ¹ / ₂	2 ¹ / ₄ -12	1 ⁷ / ₈ -12	3	4 ¹ / ₂	3.124	4.312	1	2 ¹ / ₁₆	2 ³ / ₈	¹ / ₄	¹¹ / ₁₆	2 ¹ / ₄	2 ¹⁵ / ₁₆	3 ⁷ / ₁₆	3 ⁷ / ₁₆	7 ¹⁵ / ₁₆		
	3	2 ³ / ₄ -12	2 ¹ / ₄ -12	3 ¹ / ₂	—	3.749	5.000	1	2 ⁵ / ₈	2 ⁷ / ₈	¹ / ₄	⁵ / ₈	2 ¹ / ₄	2 ¹⁵ / ₁₆	3 ⁷ / ₁₆	3 ⁷ / ₁₆	7 ¹⁵ / ₁₆		
	3 ¹ / ₂	3 ¹ / ₄ -12	2 ¹ / ₂ -12	3 ¹ / ₂	—	4.249	5.562	1	3	3 ³ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	2 ¹⁵ / ₁₆	3 ⁷ / ₁₆	3 ⁷ / ₁₆	7 ¹⁵ / ₁₆		
	4	3 ³ / ₄ -12	3-12	4	—	4.749	6.062	1	3 ³ / ₈	3 ⁷ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	2 ¹⁵ / ₁₆	3 ⁷ / ₁₆	3 ⁷ / ₁₆	7 ¹⁵ / ₁₆		
4 ¹ / ₂	4 ¹ / ₄ -12	3 ³ / ₄ -12	4 ¹ / ₂	—	5.249	6.750	1	3 ⁷ / ₈	4 ³ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	2 ¹⁵ / ₁₆	3 ⁷ / ₁₆	3 ⁷ / ₁₆	7 ¹⁵ / ₁₆			
5	4 ³ / ₄ -12	3 ¹ / ₂ -12	5	—	5.749	7.250	1	4 ¹ / ₄	4 ⁷ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	2 ¹⁵ / ₁₆	3 ⁷ / ₁₆	3 ⁷ / ₁₆	7 ¹⁵ / ₁₆			
10	1 ³ / ₄	1 ¹ / ₂ -12	1 ¹ / ₄ -12	2	3	2.374	3.625	³ / ₄	1 ¹ / ₂	1 ¹¹ / ₁₆	¹ / ₄	⁹ / ₁₆	1 ⁷ / ₈	2 ³ / ₄	3 ¹ / ₈	3 ¹ / ₈	8 ¹⁵ / ₁₆		
	2	1 ³ / ₄ -12	1 ¹ / ₂ -12	2 ¹ / ₄	3 ¹ / ₂	2.624	3.735	⁷ / ₈	1 ¹¹ / ₁₆	1 ⁵ / ₁₆	¹ / ₄	⁹ / ₁₆	2	2 ⁷ / ₈	3 ¹ / ₄	3 ¹ / ₄	9 ¹ / ₁₆		
	2 ¹ / ₂	2 ¹ / ₄ -12	1 ⁷ / ₈ -12	3	4 ¹ / ₂	3.124	4.312	1	2 ¹ / ₁₆	2 ³ / ₈	¹ / ₄	¹¹ / ₁₆	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ⁵ / ₁₆		
	3	2 ³ / ₄ -12	2 ¹ / ₄ -12	3 ¹ / ₂	—	3.749	5.000	1	2 ⁵ / ₈	2 ⁷ / ₈	¹ / ₄	⁵ / ₈	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ⁵ / ₁₆		
	3 ¹ / ₂	3 ¹ / ₄ -12	2 ¹ / ₂ -12	3 ¹ / ₂	—	4.249	5.562	1	3	3 ³ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ⁵ / ₁₆		
	4	3 ³ / ₄ -12	3-12	4	—	4.749	6.062	1	3 ³ / ₈	3 ⁷ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ⁵ / ₁₆		
	4 ¹ / ₂	4 ¹ / ₄ -12	3 ¹ / ₄ -12	4 ¹ / ₂	—	5.249	6.750	1	3 ⁷ / ₈	4 ³ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ⁵ / ₁₆		
5	4 ³ / ₄ -12	3 ¹ / ₂ -12	5	—	5.749	7.250	1	4 ¹ / ₄	4 ⁷ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ⁵ / ₁₆			
5 ¹ / ₂	5 ¹ / ₄ -12	4-12	5 ¹ / ₂	—	6.249	7.750	1	4 ⁵ / ₈	5 ³ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ⁵ / ₁₆			
12	2	1 ³ / ₄ -12	1 ¹ / ₂ -12	2 ¹ / ₄	3 ¹ / ₂	2.624	3.375	⁷ / ₈	1 ¹¹ / ₁₆	1 ⁵ / ₁₆	¹ / ₄	⁹ / ₁₆	2	2 ⁷ / ₈	3 ¹ / ₄	3 ¹ / ₄	9 ⁹ / ₁₆		
	2 ¹ / ₂	2 ¹ / ₄ -12	1 ⁷ / ₈ -12	3	4 ¹ / ₂	3.124	4.312	1	2 ¹ / ₁₆	2 ³ / ₈	¹ / ₄	¹¹ / ₁₆	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ¹³ / ₁₆		
	3	2 ³ / ₄ -12	2 ¹ / ₄ -12	3 ¹ / ₂	—	3.749	5.000	1	2 ⁵ / ₈	2 ⁷ / ₈	¹ / ₄	⁵ / ₈	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ¹³ / ₁₆		
	3 ¹ / ₂	3 ¹ / ₄ -12	2 ¹ / ₂ -12	3 ¹ / ₂	—	4.249	5.562	1	3	3 ³ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ¹³ / ₁₆		
	4	3 ³ / ₄ -12	3-12	4	—	4.749	6.062	1	3 ³ / ₈	3 ⁷ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ¹³ / ₁₆		
	4 ¹ / ₂	4 ¹ / ₄ -12	3 ¹ / ₄ -12	4 ¹ / ₂	—	5.249	6.750	1	3 ⁷ / ₈	4 ³ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ¹³ / ₁₆		
	5	4 ³ / ₄ -12	3 ¹ / ₂ -12	5	—	5.749	7.250	1	4 ¹ / ₄	4 ⁷ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ¹³ / ₁₆		
5 ¹ / ₂	5 ¹ / ₄ -12	4-12	5 ¹ / ₂	—	6.249	7.750	1	4 ⁵ / ₈	5 ³ / ₈	³ / ₈	¹ / ₂	2 ¹ / ₄	3 ¹ / ₈	3 ¹ / ₂	3 ¹ / ₂	9 ¹³ / ₁₆			

¹ Retainer shape is square through 4" rod and round for 4¹/₂" - 5¹/₂" rods.

Head Square Mount
Style ME3
8" - 12" Bore

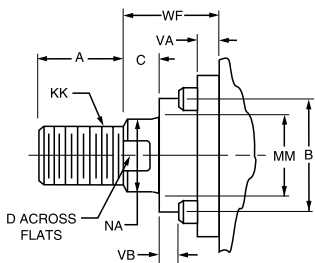


Cap Square Mount
Style ME4
8" - 12" Bore

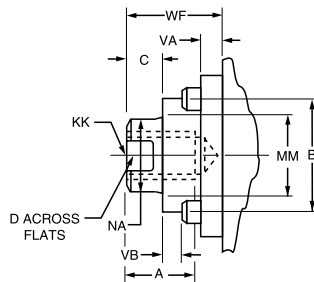


Rod End Dimensions — see table 2

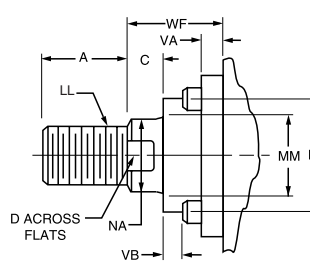
Thread Style 2
Small Male



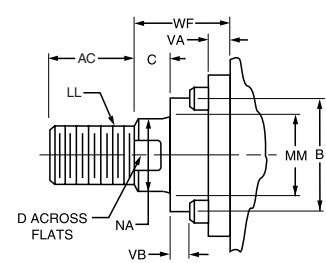
Thread Style 3
Short Female



Thread Style 4
Intermediate Male



Thread Style 5
Automotive Male



“Special” Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify “Style 0” and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Mounting Information – 8" to 12" Bore

Table 1—Envelope and Mounting Dimensions

Bore	E	EB	EE		G	J	K	TE	Add Stroke	
			NPTF	SAE					LB	P
8	8 ¹ / ₂	1 ¹ / ₁₆	3/4	#12	2	1 ¹ / ₂	9/16	7.57	5 ⁷ / ₈	3 ¹ / ₄
10	10 ⁵ / ₈	1 ³ / ₁₆	1	#16	2 ¹ / ₄	2	1 ¹ / ₁₆	9.40	7 ¹ / ₈	4 ¹ / ₈
12	12 ³ / ₄	1 ³ / ₁₆	1	#16	2 ¹ / ₄	2	1 ¹ / ₁₆	11.10	7 ⁵ / ₈	4 ⁵ / ₈

Table 2—Rod End Dimensions and Envelope Dimensions Affected By Rod Size

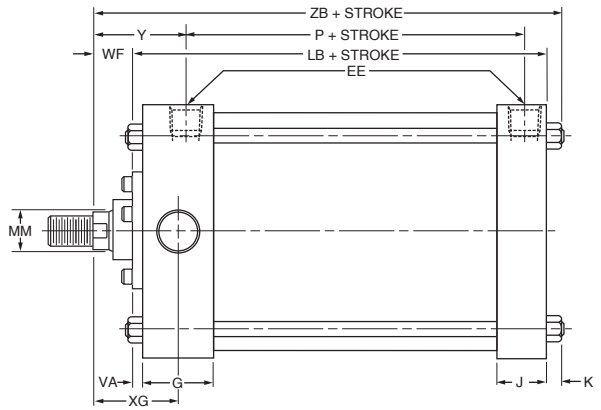
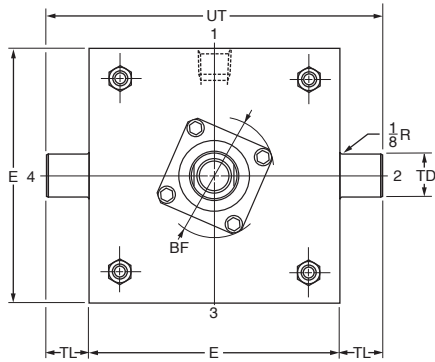
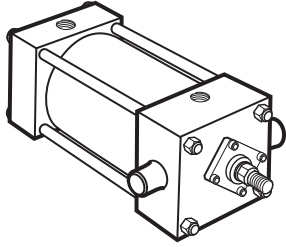
Bore	Rod Dia. MM	Thread		Rod End Dimensions and Envelope Dimensions Affected By Rod Size													Add Stroke		
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+0.000 -0.002 B	±.010 BF ¹	C	D	NA	VA	VB	W	WF	Y	XK	ZB	ZJ	
8	1 ³ / ₈	1 ¹ / ₄ -12	1-14	1 ⁵ / ₈	2 ¹ / ₂	1.999	3.625	5/8	1 ¹ / ₈	1 ⁵ / ₁₆	1/4	7/16	1 ³ / ₈	1 ⁵ / ₈	2 ¹³ / ₁₆	5 ¹ / ₄	7 ⁵ / ₁₆	6 ³ / ₄	
	5 ¹ / ₂	5 ¹ / ₄ -12	4-12	5 ¹ / ₂	—	6.249	7.750	1	4 ⁵ / ₈	5 ³ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ⁷ / ₁₆	5 ⁷ / ₈	7 ¹⁵ / ₁₆	7 ³ / ₈	
	1 ³ / ₄	1 ¹ / ₂ -12	1 ¹ / ₄ -12	2	3	2.374	3.625	3/4	1 ¹ / ₂	1 ¹¹ / ₁₆	1/4	9/16	1 ⁵ / ₈	1 ⁷ / ₈	3 ¹ / ₁₆	5 ¹ / ₂	7 ⁹ / ₁₆	7	
	2	1 ³ / ₄ -12	1 ¹ / ₂ -12	2 ¹ / ₄	3 ¹ / ₂	2.624	3.735	7/8	1 ¹¹ / ₁₆	1 ¹⁵ / ₁₆	1/4	9/16	1 ³ / ₄	2	3 ³ / ₁₆	5 ⁵ / ₈	7 ¹¹ / ₁₆	7 ¹ / ₈	
	2 ¹ / ₂	2 ¹ / ₄ -12	1 ⁷ / ₈ -12	3	4 ¹ / ₂	3.124	4.312	1	2 ¹ / ₁₆	2 ³ / ₈	1/4	1 ¹ / ₁₆	2	2 ¹ / ₄	3 ⁷ / ₁₆	5 ⁷ / ₈	7 ¹⁵ / ₁₆	7 ³ / ₈	
	3	2 ³ / ₄ -12	2 ¹ / ₄ -12	3 ¹ / ₂	—	3.749	5.000	1	2 ⁵ / ₈	2 ⁷ / ₈	1/4	5/8	2	2 ¹ / ₄	3 ⁷ / ₁₆	5 ⁷ / ₈	7 ¹⁵ / ₁₆	7 ³ / ₈	
	3 ¹ / ₂	3 ¹ / ₄ -12	2 ¹ / ₂ -12	3 ¹ / ₂	—	4.249	5.562	1	3	3 ³ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ⁷ / ₁₆	5 ⁷ / ₈	7 ¹⁵ / ₁₆	7 ³ / ₈	
	4	3 ³ / ₄ -12	3-12	4	—	4.749	6.062	1	3 ³ / ₈	3 ⁷ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ⁷ / ₁₆	5 ⁷ / ₈	7 ¹⁵ / ₁₆	7 ³ / ₈	
	4 ¹ / ₂	4 ¹ / ₄ -12	3 ³ / ₄ -12	4 ¹ / ₂	—	5.249	6.750	1	3 ⁷ / ₈	4 ³ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ⁷ / ₁₆	5 ⁷ / ₈	7 ¹⁵ / ₁₆	7 ³ / ₈	
10	5	4 ³ / ₄ -12	3 ¹ / ₂ -12	5	—	5.749	7.250	1	4 ¹ / ₄	4 ⁷ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ⁷ / ₁₆	5 ⁷ / ₈	7 ¹⁵ / ₁₆	7 ³ / ₈	
	1 ³ / ₄	1 ¹ / ₂ -12	1 ¹ / ₄ -12	2	3	2.374	3.625	3/4	1 ¹ / ₂	1 ¹¹ / ₁₆	1/4	9/16	1 ⁵ / ₈	1 ⁷ / ₈	3 ¹ / ₈	6 ¹ / ₄	8 ¹⁵ / ₁₆	8 ¹ / ₄	
	2	1 ³ / ₄ -12	1 ¹ / ₂ -12	2 ¹ / ₄	3 ¹ / ₂	2.624	3.735	7/8	1 ¹¹ / ₁₆	1 ¹⁵ / ₁₆	1/4	9/16	1 ³ / ₄	2	3 ¹ / ₄	6 ³ / ₈	9 ¹ / ₁₆	8 ³ / ₈	
	2 ¹ / ₂	2 ¹ / ₄ -12	1 ⁷ / ₈ -12	3	4 ¹ / ₂	3.124	4.312	1	2 ¹ / ₁₆	2 ³ / ₈	1/4	1 ¹ / ₁₆	2	2 ¹ / ₄	3 ¹ / ₂	6 ⁵ / ₈	9 ⁵ / ₁₆	8 ⁵ / ₈	
	3	2 ³ / ₄ -12	2 ¹ / ₄ -12	3 ¹ / ₂	—	3.749	5.000	1	2 ⁵ / ₈	2 ⁷ / ₈	1/4	5/8	2	2 ¹ / ₄	3 ¹ / ₂	6 ⁵ / ₈	9 ⁵ / ₁₆	8 ⁵ / ₈	
	3 ¹ / ₂	3 ¹ / ₄ -12	2 ¹ / ₂ -12	3 ¹ / ₂	—	4.249	5.562	1	3	3 ³ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ¹ / ₂	6 ⁵ / ₈	9 ⁵ / ₁₆	8 ⁵ / ₈	
	4	3 ³ / ₄ -12	3-12	4	—	4.749	6.062	1	3 ³ / ₈	3 ⁷ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ¹ / ₂	6 ⁵ / ₈	9 ⁵ / ₁₆	8 ⁵ / ₈	
	4 ¹ / ₂	4 ¹ / ₄ -12	3 ¹ / ₄ -12	4 ¹ / ₂	—	5.249	6.750	1	3 ⁷ / ₈	4 ³ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ¹ / ₂	6 ⁵ / ₈	9 ⁵ / ₁₆	8 ⁵ / ₈	
5	4 ³ / ₄ -12	3 ¹ / ₂ -12	5	—	5.749	7.250	1	4 ¹ / ₄	4 ⁷ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ¹ / ₂	6 ⁵ / ₈	9 ⁵ / ₁₆	8 ⁵ / ₈		
12	5 ¹ / ₂	5 ¹ / ₄ -12	4-12	5 ¹ / ₂	—	6.249	7.750	1	4 ⁵ / ₈	5 ³ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ¹ / ₂	6 ⁵ / ₈	9 ⁵ / ₁₆	8 ⁵ / ₈	
	2	1 ³ / ₄ -12	1 ¹ / ₂ -12	2 ¹ / ₄	3 ¹ / ₂	2.624	3.735	7/8	1 ¹¹ / ₁₆	1 ¹⁵ / ₁₆	1/4	9/16	1 ³ / ₄	2	3 ¹ / ₄	6 ⁷ / ₈	9 ⁹ / ₁₆	8 ⁷ / ₈	
	2 ¹ / ₂	2 ¹ / ₄ -12	1 ⁷ / ₈ -12	3	4 ¹ / ₂	3.124	4.312	1	2 ¹ / ₁₆	2 ³ / ₈	1/4	1 ¹ / ₁₆	2	2 ¹ / ₄	3 ¹ / ₂	7 ¹ / ₈	9 ¹³ / ₁₆	9 ¹ / ₈	
	3	2 ³ / ₄ -12	2 ¹ / ₄ -12	3 ¹ / ₂	—	3.749	5.000	1	2 ⁵ / ₈	2 ⁷ / ₈	1/4	5/8	2	2 ¹ / ₄	3 ¹ / ₂	7 ¹ / ₈	9 ¹³ / ₁₆	9 ¹ / ₈	
	3 ¹ / ₂	3 ¹ / ₄ -12	2 ¹ / ₂ -12	3 ¹ / ₂	—	4.249	5.562	1	3	3 ³ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ¹ / ₂	7 ¹ / ₈	9 ¹³ / ₁₆	9 ¹ / ₈	
	4	3 ³ / ₄ -12	3-12	4	—	4.749	6.062	1	3 ³ / ₈	3 ⁷ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ¹ / ₂	7 ¹ / ₈	9 ¹³ / ₁₆	9 ¹ / ₈	
	4 ¹ / ₂	4 ¹ / ₄ -12	3 ¹ / ₄ -12	4 ¹ / ₂	—	5.249	6.750	1	3 ⁷ / ₈	4 ³ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ¹ / ₂	7 ¹ / ₈	9 ¹³ / ₁₆	9 ¹ / ₈	
	5	4 ³ / ₄ -12	3 ¹ / ₂ -12	5	—	5.749	7.250	1	4 ¹ / ₄	4 ⁷ / ₈	3/8	1/2	1 ⁷ / ₈	2 ¹ / ₄	3 ¹ / ₂	7 ¹ / ₈	9 ¹³ / ₁₆	9 ¹ / ₈	

¹ Retainer shape is square through 4" rod and round for 4¹/₂" - 5¹/₂" rods.

A
PA-2
NC9
Rod Lock

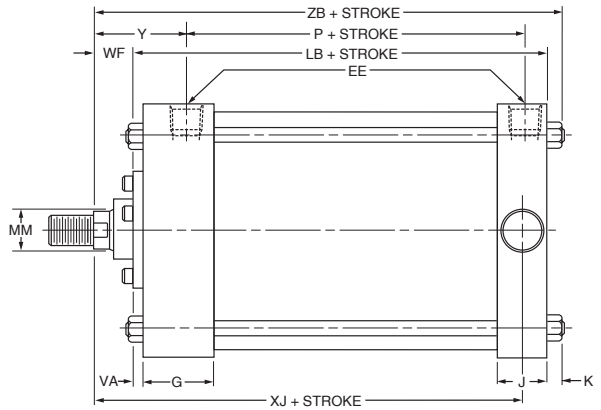
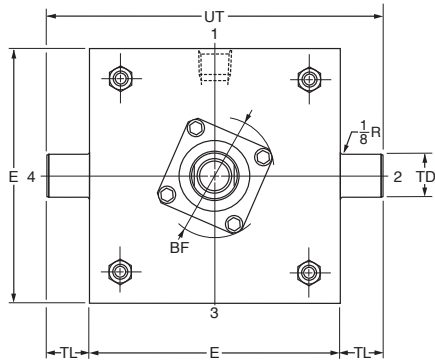
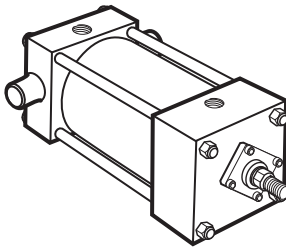
Head Trunnion Mount

Style MT1
8" - 12" Bore



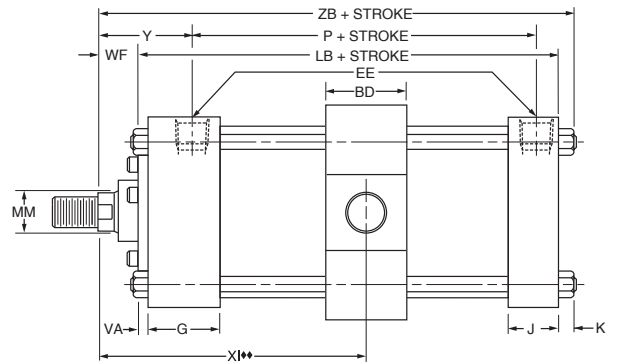
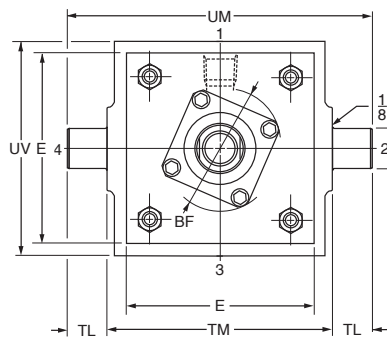
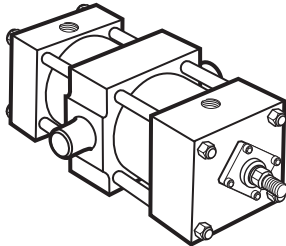
Cap Trunnion Mount

Style MT2
8" - 12" Bore



Intermediate Fixed Trunnion Mount

Model MT4
8" - 12" Bore

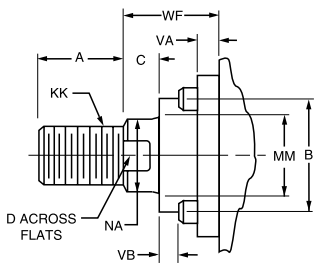


◆◆Dimension XI to be specified by customer.

Rod End Dimensions — see table 2

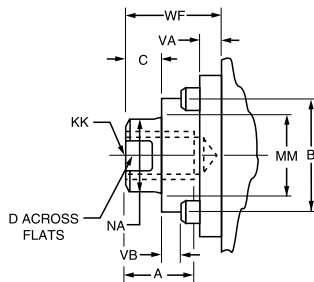
Thread Style 2

Small Male



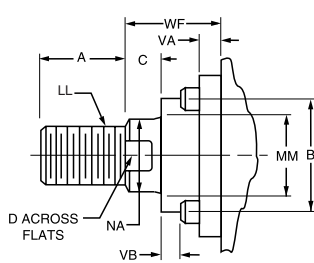
Thread Style 3

Short Female



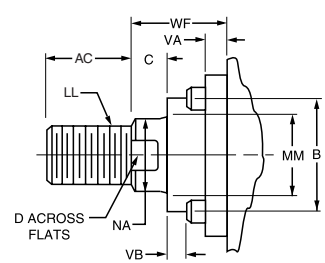
Thread Style 4

Intermediate Male



Thread Style 5

Automotive Male



"Special" Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 0" and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Table 1—Envelope and Mounting Dimensions

Bore	BD	E	EE		G	J	K	+.000 -.001 TD	TL	TM	UT	UM	UV	Add Stroke	
			NPTF	SAE										LB	P
8	2 1/2	8 1/2	3/4	#12	2	1 1/2	9/16	1.375	1 3/8	9 3/4	11 1/4	12 1/2	9 1/2	5 7/8	3 1/4
10	3	10 5/8	1	#16	2 1/4	2	1 1/16	1.750	1 3/4	12	14 1/8	15 1/2	11 3/4	7 1/8	4 1/8
12	3	12 3/4	1	#16	2 1/4	2	1 1/16	1.750	1 3/4	14	16 1/4	17 1/2	13 3/4	7 5/8	4 5/8

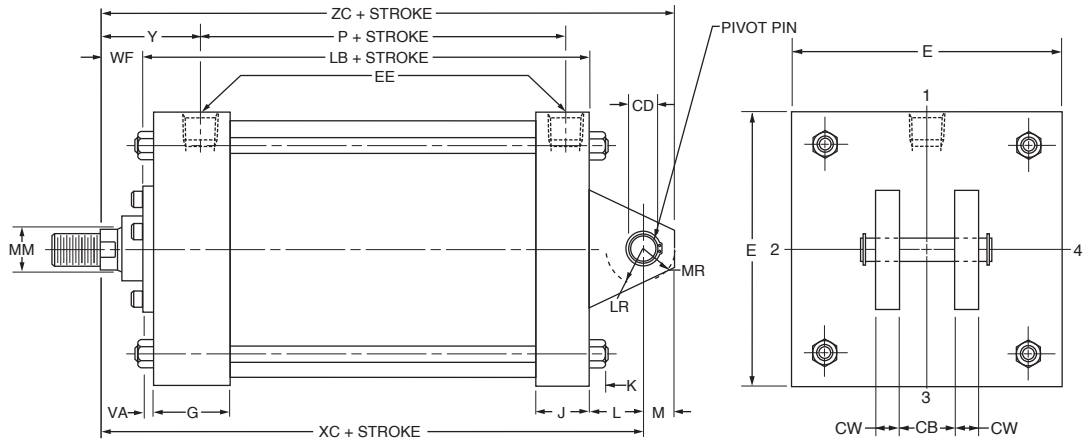
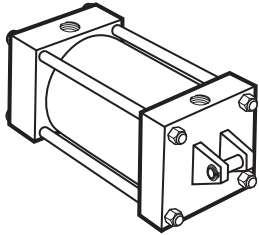
Table 2—Rod End Dimensions and Envelope Dimensions Affected By Rod Size

Bore	Rod Dia. MM	Thread		Rod End Dimensions and Envelope Dimensions Affected By Rod Size														Add Stroke	
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+.000 -.002 B	±.010 BF ¹	C	D	NA	VA	VB	WF	XG	XI ² (Min.)	Y	XJ	ZB	
8	1 3/8	1 1/4-12	1-14	1 5/8	2 1/2	1.999	3.625	1 1/8	1 5/16	4	1/4	7/16	1 5/8	2 5/8	4 15/16	2 13/16	6	7 5/16	
	5 1/2	5 1/4-12	4-12	5 1/2	—	6.249	7.750	4 5/8	5 3/8	7	3/8	1/2	2 1/4	3 1/4	5 9/16	3 7/16	6 5/8	7 5/16	
	1 3/4	1 1/2-12	1 1/4-12	2	3	2.374	3.625	1 1/2	1 11/16	4	1/4	9/16	1 7/8	2 7/8	5 3/16	3 1/16	6 1/4	7 9/16	
	2	1 3/4-12	1 1/2-12	2 1/4	3 1/2	2.624	3.735	1 11/16	1 15/16	4	1/4	9/16	2	3	5 5/16	3 3/16	6 3/8	7 11/16	
	2 1/2	2 1/4-12	1 7/8-12	3	4 1/2	3.124	4.312	2 1/16	2 3/8	4	1/4	11/16	2 1/4	3 1/4	5 9/16	3 7/16	6 5/8	7 15/16	
	3	2 3/4-12	2 1/4-12	3 1/2	—	3.749	5.000	2 5/8	2 7/8	5 1/2	1/4	5/8	2 1/4	3 1/4	5 3/16	3 7/16	6 5/8	7 15/16	
	3 1/2	3 1/4-12	2 1/2-12	3 1/2	—	4.249	5.562	3	3 3/8	5 1/2	3/8	1/2	2 1/4	3 1/4	5 9/16	3 7/16	6 5/8	7 15/16	
	4	3 3/4-12	3-12	4	—	4.749	6.062	3 3/8	3 7/8	5 1/2	3/8	1/2	2 1/4	3 1/4	5 9/16	3 7/16	6 5/8	7 15/16	
10	1 3/4	1 1/2-12	1 1/4-12	2	3	2.374	3.625	1 1/2	1 11/16	4	1/4	9/16	1 7/8	3	5 11/16	3 1/8	7 1/4	8 15/16	
	2	1 3/4-12	1 1/2-12	2 1/4	3 1/2	2.624	3.735	1 11/16	1 15/16	4	1/4	9/16	2	3 1/8	5 13/16	3 1/4	7 3/8	9 1/16	
	2 1/2	2 1/4-12	1 7/8-12	3	4 1/2	3.124	4.312	2 1/16	2 3/8	4	1/4	11/16	2 1/4	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16	
	3	2 3/4-12	2 1/4-12	3 1/2	—	3.749	5.000	2 5/8	2 7/8	5 1/2	1/4	5/8	2 1/4	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16	
	3 1/2	3 1/4-12	2 1/2-12	3 1/2	—	4.249	5.562	3	3 3/8	5 1/2	3/8	1/2	2 1/4	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16	
	4	3 3/4-12	3-12	4	—	4.749	6.062	3 3/8	3 7/8	5 1/2	3/8	1/2	2 1/4	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16	
	4 1/2	4 1/4-12	3 1/4-12	4 1/2	—	5.249	6.750	3 7/8	4 3/8	7	3/8	1/2	2 1/4	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16	
	5	4 3/4-12	3 1/2-12	5	—	5.749	7.250	4 1/4	4 7/8	7	3/8	1/2	2 1/4	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16	
12	5 1/2	5 1/4-12	4-12	5 1/2	—	6.249	7.750	4 5/8	5 3/8	7	3/8	1/2	2 1/4	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16	
	2	1 3/4-12	1 1/2-12	2 1/4	3 1/2	2.624	3.375	1 11/16	1 15/16	4	1/4	9/16	2	3 1/8	5 13/16	3 1/4	7 7/8	9 3/16	
	2 1/2	2 1/4-12	1 7/8-12	3	4 1/2	3.124	4.312	2 1/16	2 3/8	4	1/4	11/16	2 1/4	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16	
	3	2 3/4-12	2 1/4-12	3 1/2	—	3.749	5.000	2 5/8	2 7/8	5 1/2	1/4	5/8	2 1/4	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16	
	3 1/2	3 1/4-12	2 1/2-12	3 1/2	—	4.249	5.562	3	3 3/8	5 1/2	3/8	1/2	2 1/4	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16	
	4	3 3/4-12	3-12	4	—	4.749	6.062	3 3/8	3 7/8	5 1/2	3/8	1/2	2 1/4	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16	
	4 1/2	4 1/4-12	3 1/4-12	4 1/2	—	5.249	6.750	3 7/8	4 3/8	7	3/8	1/2	2 1/4	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16	

¹ Retainer shape is square through 4" rod and round for 4 1/2" - 5 1/2" rods.

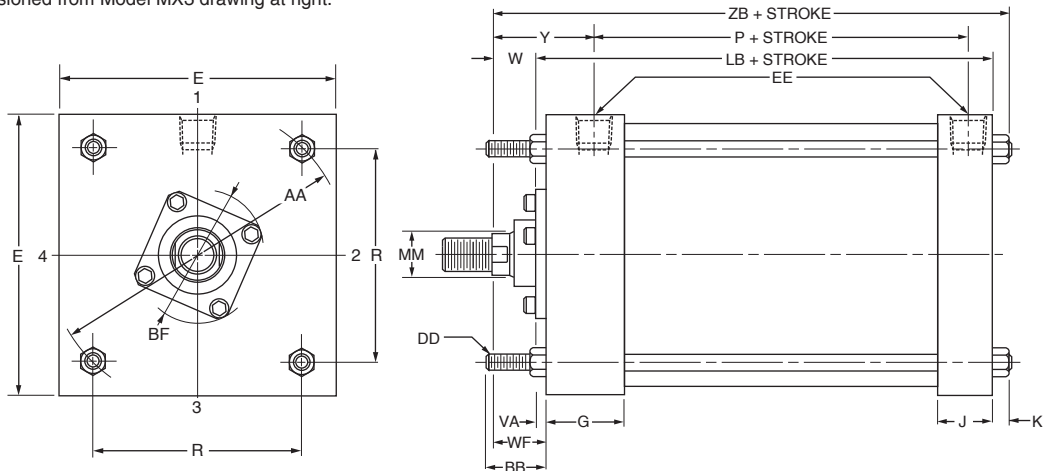
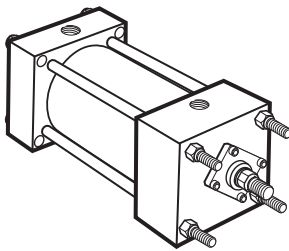
² Dimension XI to be specified by customer.

Cap Fixed Clevis Mount
Style MP1
8" - 12" Bore



Tie Rod Extended Mount
Style MX3
8" - 12" Bore

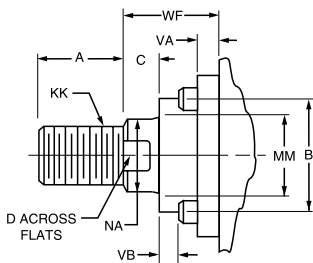
Model MX3 Head Tie Rods Extended, Illustrated. Model MX2 Cap Tie Rods Extended; and Model MX1, Both Ends Tie Rods Extended are also available. All Tie Rod Models can be dimensioned from Model MX3 drawing at right.



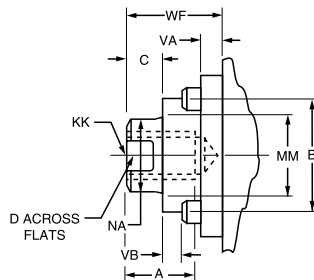
Models MX3 and MX1 not offered in 8" bore, rod diameters 4 1/2", 5" and 5 1/2".

Rod End Dimensions — see table 2

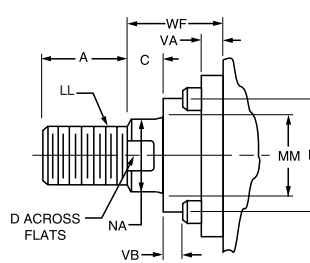
Thread Style 2
Small Male



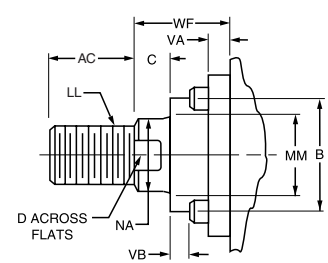
Thread Style 3
Short Female



Thread Style 4
Intermediate Male



Thread Style 5
Automotive Male



"Special" Thread Style 0

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 0" and give desired dimensions for KK, A, W or WF. If otherwise special, furnish dimensioned sketch.

Table 1—Envelope and Mounting Dimensions

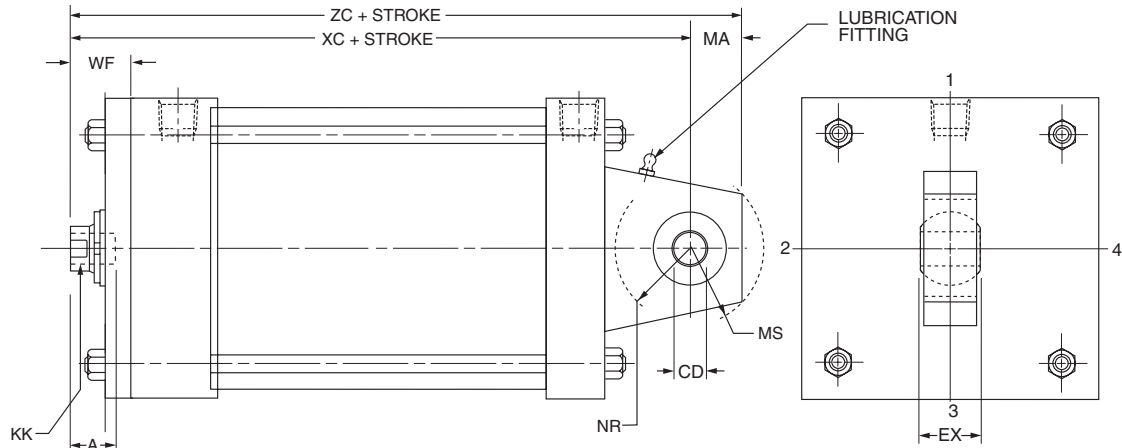
Bore	AA	BB	CB	+.000 -.002 CD	CW	DD	E	EE		G	J	K	L	LR	M	MR	R	Add Stroke	
								NPTF	SAE									LB	P
8	9.1	2 ⁵ / ₁₆	1½	1.001	³ / ₄	⁵ / ₈ -18	8½	³ / ₄	#12	2	1½	⁹ / ₁₆	1½	1¼	1	1 ³ / ₁₆	6.44	5 ⁷ / ₈	3¼
10	11.2	2 ¹¹ / ₁₆	2	1.376	1	³ / ₄ -16	10 ⁵ / ₈	1	#16	2¼	2	¹¹ / ₁₆	2½	1 ⁷ / ₈	1 ³ / ₈	1 ⁵ / ₈	7.92	7 ¹ / ₈	4 ¹ / ₈
12	13.3	2 ¹¹ / ₁₆	2½	1.751	1¼	³ / ₄ -16	12¾	1	#16	2¼	2	¹¹ / ₁₆	2¼	2½	1¾	2½	9.40	7 ⁵ / ₈	4 ⁵ / ₈

Table 2—Rod End Dimensions and Envelope Dimensions Affected By Rod Size

Bore	Rod Dia. MM	Thread		Rod End Dimensions and Envelope Dimensions Affected By Rod Size															
		Style 4 & 5 LL	Style 2 & 3 KK	A	AC	+.000 -.002 B	±.010 BF ¹	C	D	NA	VA	VB	W	WF	Y	ZB	Add Stroke		
																	XC	ZC	
8	1 ³ / ₈	1¼-12	1-14	1 ⁵ / ₈	2½	1.999	3.625	⁵ / ₈	1 ¹ / ₈	1 ⁵ / ₁₆	¹ / ₄	⁷ / ₁₆	1 ³ / ₈	1 ⁵ / ₈	2 ¹³ / ₁₆	7 ⁵ / ₁₆	8¼	9¼	
	5½	5¼-12	4-12	5½	–	6.249	7.750	1	4 ⁵ / ₈	5 ³ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ⁷ / ₁₆	7 ¹⁵ / ₁₆	8 ⁷ / ₈	9 ⁷ / ₈	
	1¾	1½-12	1¼-12	2	3	2.374	3.625	³ / ₄	1½	1 ¹¹ / ₁₆	¹ / ₄	⁹ / ₁₆	1 ⁵ / ₈	1 ⁷ / ₈	3 ¹ / ₁₆	7 ⁹ / ₁₆	8½	9½	
	2	1¾-12	1½-12	2¼	3½	2.624	3.735	⁷ / ₈	1 ¹¹ / ₁₆	1 ¹⁵ / ₁₆	¹ / ₄	⁹ / ₁₆	1¾	2	3 ³ / ₁₆	7 ¹¹ / ₁₆	8 ⁵ / ₈	9 ⁵ / ₈	
	2½	2¼-12	1 ⁷ / ₈ -12	3	4½	3.124	4.312	1	2 ¹ / ₁₆	2 ³ / ₈	¹ / ₄	¹¹ / ₁₆	2	2¼	3 ¹ / ₁₆	7 ¹⁵ / ₁₆	8 ⁷ / ₈	9 ⁷ / ₈	
	3	2¾-12	2¼-12	3½	–	3.749	5.000	1	2 ⁵ / ₈	2 ⁷ / ₈	¹ / ₄	⁵ / ₈	2	2¼	3 ⁷ / ₁₆	7 ¹⁵ / ₁₆	8 ⁷ / ₈	9 ⁷ / ₈	
	3½	3¼-12	2½-12	3½	–	4.249	5.562	1	3	3 ³ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ⁷ / ₁₆	7 ¹⁵ / ₁₆	8 ⁷ / ₈	9 ⁷ / ₈	
	4	3¾-12	3-12	4	–	4.749	6.062	1	3 ³ / ₈	3 ⁷ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ⁷ / ₁₆	7 ¹⁵ / ₁₆	8 ⁷ / ₈	9 ⁷ / ₈	
10	1¾	1½-12	1¼-12	2	3	2.374	3.625	³ / ₄	1½	1 ¹¹ / ₁₆	¹ / ₄	⁹ / ₁₆	1 ⁵ / ₈	1 ⁷ / ₈	3 ¹ / ₁₆	8 ¹⁵ / ₁₆	10 ³ / ₈	11 ³ / ₄	
	2	1¾-12	1½-12	2¼	3½	2.624	3.735	⁷ / ₈	1 ¹¹ / ₁₆	1 ¹⁵ / ₁₆	¹ / ₄	⁹ / ₁₆	1¾	2	3¼	9 ¹ / ₁₆	10½	11 ⁷ / ₈	
	2½	2¼-12	1 ⁷ / ₈ -12	3	4½	3.124	4.312	1	2 ¹ / ₁₆	2 ³ / ₈	¹ / ₄	¹¹ / ₁₆	2	2¼	3 ¹ / ₁₆	9 ⁵ / ₁₆	10¾	12½	
	3	2¾-12	2¼-12	3½	–	3.749	5.000	1	2 ⁵ / ₈	2 ⁷ / ₈	¹ / ₄	⁵ / ₈	2	2¼	3 ¹ / ₁₆	9 ⁵ / ₁₆	10¾	12½	
	3½	3¼-12	2½-12	3½	–	4.249	5.562	1	3	3 ³ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ¹ / ₁₆	9 ⁵ / ₁₆	10¾	12½	
	4	3¾-12	3-12	4	–	4.749	6.062	1	3 ³ / ₈	3 ⁷ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ¹ / ₁₆	9 ⁵ / ₁₆	10¾	12½	
	4½	4¼-12	3¼-12	4½	–	5.249	6.750	1	3 ⁷ / ₈	4 ³ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ¹ / ₁₆	9 ⁵ / ₁₆	10¾	12½	
	5	4¾-12	3½-12	5	–	5.749	7.250	1	4¼	4 ⁷ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ¹ / ₁₆	9 ⁵ / ₁₆	10¾	12½	
5½	5¼-12	4-12	5½	–	6.249	7.750	1	4 ⁵ / ₈	5 ³ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ¹ / ₁₆	9 ⁵ / ₁₆	10¾	12½		
12	2	1¾-12	1½-12	2¼	3½	2.624	3.735	⁷ / ₈	1 ¹¹ / ₁₆	1 ¹⁵ / ₁₆	¹ / ₄	⁹ / ₁₆	1¾	2	3¼	9 ⁹ / ₁₆	11½	12 ⁷ / ₈	
	2½	2¼-12	1 ⁷ / ₈ -12	3	4½	3.124	4.312	1	2 ¹ / ₁₆	2 ³ / ₈	¹ / ₄	¹¹ / ₁₆	2	2¼	3 ¹ / ₁₆	9 ¹³ / ₁₆	11¾	13½	
	3	2¾-12	2¼-12	3½	–	3.749	5.000	1	2 ⁵ / ₈	2 ⁷ / ₈	¹ / ₄	⁵ / ₈	2	2¼	3 ¹ / ₁₆	9 ¹³ / ₁₆	11¾	13½	
	3½	3¼-12	2½-12	3½	–	4.249	5.562	1	3	3 ³ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ¹ / ₁₆	9 ¹³ / ₁₆	11¾	13½	
	4	3¾-12	3-12	4	–	4.749	6.062	1	3 ³ / ₈	3 ⁷ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ¹ / ₁₆	9 ¹³ / ₁₆	11¾	13½	
	4½	4¼-12	3¼-12	4½	–	5.249	6.750	1	3 ⁷ / ₈	4 ³ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ¹ / ₁₆	9 ¹³ / ₁₆	11¾	13½	
	5	4¾-12	3½-12	5	–	5.749	7.250	1	4¼	4 ⁷ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ¹ / ₁₆	9 ¹³ / ₁₆	11¾	13½	
5½	5¼-12	4-12	5½	–	6.249	7.750	1	4 ⁵ / ₈	5 ³ / ₈	³ / ₈	¹ / ₂	1 ⁷ / ₈	2¼	3 ¹ / ₁₆	9 ¹³ / ₁₆	11¾	13½		

¹ Retainer shape is square through 4" rod and round for 4½" - 5½" rods.

Spherical Bearing Mount – Style MPU3
1 1/2" to 6" Bore Sizes

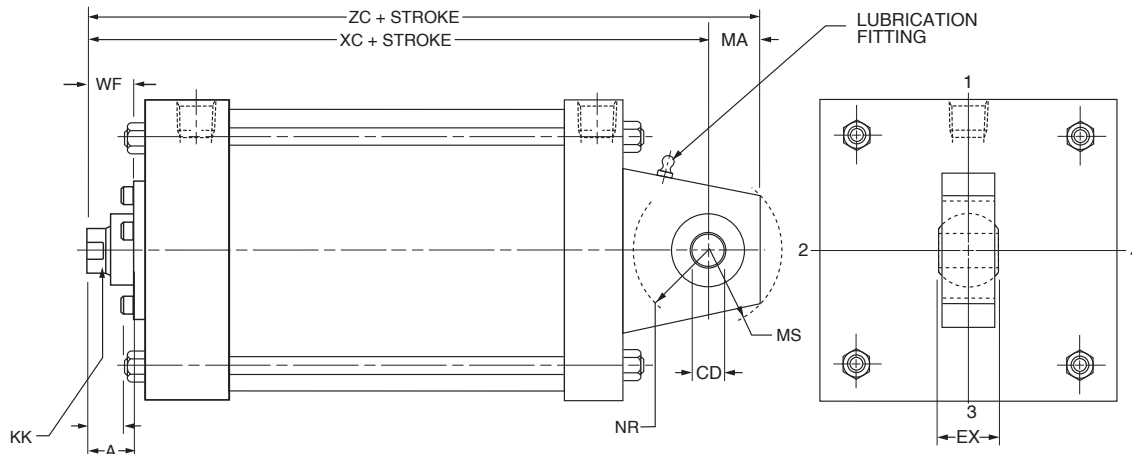


Bore	Rod Dia. MM	Thread		A	CD ²	EX	MA	MS	NR	WF	Add Stroke		Max. Oper. psi ¹	
		Style 3 KK ³	Style 7 KK ³								XC	ZC		
1½	5/8	7/16-20	—	3/4	-.0005	7/16	3/4	15/16	5/8	1	5³/₈	6¹/₈	250	
	1	—	7/16-20	3/4	.5000						1³/₈	6¹/₂		
2	5/8	7/16-20	—	3/4	-.0005	7/16	3/4	15/16	5/8	1	5³/₈	6¹/₈	250	
	1³/₈	—	7/16-20	3/4							6	6³/₄		
	1	—	7/16-20	3/4							1³/₈	6¹/₂		
2½	5/8	7/16-20	—	3/4	-.0005	7/16	3/4	15/16	5/8	1	5¹/₂	6¹/₄	250	
	1³/₄	—	7/16-20	3/4							6³/₈	7¹/₈		
	1	—	7/16-20	3/4							1³/₈	6⁵/₈		
	1³/₈	—	7/16-20	3/4							1⁵/₈	6⁷/₈		
3¼	1	¾-16	—	1¹/₈	-.0005	2¹/₃₂	1	1³/₈	1	1	1³/₈	7¹/₈	250	
	2	—	¾-16	1¹/₈							7¹/₂	8¹/₂		
	1³/₈	—	¾-16	1¹/₈							1⁵/₈	8¹/₈		
	1³/₄	—	¾-16	1¹/₈							1⁷/₈	8³/₈		
4	1	¾-16	—	1¹/₈	-.0005	2¹/₃₂	1	1³/₈	1	1	1³/₈	6⁷/₈	250	
	2¹/₂	—	¾-16	1¹/₈							7³/₄	8³/₄		
	1³/₈	—	¾-16	1¹/₈							1⁵/₈	8¹/₈		
	1³/₄	—	¾-16	1¹/₈							1⁷/₈	8³/₈		
	2	—	¾-16	1¹/₈							2	8¹/₂		
5	1	¾-16	—	1¹/₈	-.0005	2¹/₃₂	1	1³/₈	1	1	1³/₈	7¹/₈	250	
	3¹/₂	—	¾-16	1¹/₈							2¹/₄	8		
	1³/₈	—	¾-16	1¹/₈							1⁵/₈	7³/₈		8³/₈
	1³/₄	—	¾-16	1¹/₈							1⁷/₈	7⁵/₈		8⁵/₈
	2	—	¾-16	1¹/₈							2	7³/₄		8³/₄
	2¹/₂	—	¾-16	1¹/₈							2¹/₄	8		9
	3	—	¾-16	1¹/₈							2¹/₄	8		9
6	1³/₈	1-14	—	1⁵/₈	-.0005	7/8	1¼	1¹¹/₁₆	1¼	1¼	1⁵/₈	8¹/₈	250	
	4	—	1-14	1⁵/₈							2¹/₄	8³/₄		
	1³/₄	—	1-14	1⁵/₈							1⁷/₈	8³/₈		9⁵/₈
	2	—	1-14	1⁵/₈							2	8¹/₂		9³/₄
	2¹/₂	—	1-14	1⁵/₈							2¹/₄	8³/₄		10
	3	—	1-14	1⁵/₈							2¹/₄	8³/₄		10
	3¹/₂	—	1-14	1⁵/₈							2¹/₄	8³/₄		10

¹ Maximum operating pressure at 4:1 design factor is based on tensile strength of material. Pressure ratings are based on standard commercial bearing ratings.
² Dimension CD is hole diameter.
³ Threads listed are also for a spherical rod eye which match style 9 or style 7. The spherical rod eye pin diameter matches the cap pin and (if required) needs to be purchased separately; see NC9 mounting accessories for detailed information.

Spherical Bearing Mount – Style MPU3

8" to 12" Bore Sizes



Bore	Rod Dia. MM	Thread		A	CD ²	EX	MA	MS	NR	WF	Add Stroke		Max. Oper. psi ¹
		Style 3 KK ³	Style 7 KK ³								XC	ZC	
8	1 3/8	1-14	—	1 5/8	-0.0005 1.0000	7/8	1 1/4	1 11/16	1 1/4	1 5/8	8 1/4	9 1/2	250
	5 1/2	—	1-14	1 5/8						2 1/4	8 7/8	10 1/8	
	1 3/4	—	1-14	1 5/8						1 7/8	8 1/2	9 3/4	
	2	—	1-14	1 5/8						2	8 5/8	9 7/8	
	2 1/2	—	1-14	1 5/8						2 1/4	8 7/8	10 1/8	
	3	—	1-14	1 5/8						2 1/4	8 7/8	10 1/8	
	3 1/2	—	1-14	1 5/8						2 1/4	8 7/8	10 1/8	
	4	—	1-14	1 5/8						2 1/4	8 7/8	10 1/8	
	4 1/2	—	1-14	1 5/8						2 1/4	8 7/8	10 1/8	
5	—	1-14	1 5/8	2 1/4	8 7/8	10 1/8							
10	1 3/4	1 1/4-12	—	2	-0.0005 1.3750	1 3/16	1 7/8	2 7/16	1 5/8	1 7/8	10 3/8	12 1/4	250
	2	—	1 1/4-12	2						2	10 1/2	12 3/8	
	2 1/2	—	1 1/4-12	2						2 1/4	10 3/4	12 5/8	
	3	—	1 1/4-12	2						2 1/4	10 3/4	12 5/8	
	3 1/2	—	1 1/4-12	2						2 1/4	10 3/4	12 5/8	
	4	—	1 1/4-12	2						2 1/4	10 3/4	12 5/8	
	4 1/2	—	1 1/4-12	2						2 1/4	10 3/4	12 5/8	
	5	—	1 1/4-12	2						2 1/4	10 3/4	12 5/8	
5 1/2	—	1 1/4-12	2	2 1/4	10 3/4	12 5/8							
12	2	1 1/2-12	—	2 1/4	-0.0005 1.7500	1 17/32	2 1/2	2 7/8	2 1/16	2	11 1/8	13 5/8	250
	2 1/2	—	1 1/2-12	2 1/4						2 1/4	11 3/8	13 7/8	
	3	—	1 1/2-12	2 1/4						2 1/4	11 3/8	13 7/8	
	3 1/2	—	1 1/2-12	2 1/4						2 1/4	11 3/8	13 7/8	
	4	—	1 1/2-12	2 1/4						2 1/4	11 3/8	13 7/8	
	4 1/2	—	1 1/2-12	2 1/4						2 1/4	11 3/8	13 7/8	
	5	—	1 1/2-12	2 1/4						2 1/4	11 3/8	13 7/8	
	5 1/2	—	1 1/2-12	2 1/4						2 1/4	11 3/8	13 7/8	

¹ Maximum operating pressure at 4:1 design factor is based on tensile strength of material. Pressure ratings are based on standard commercial bearing ratings.

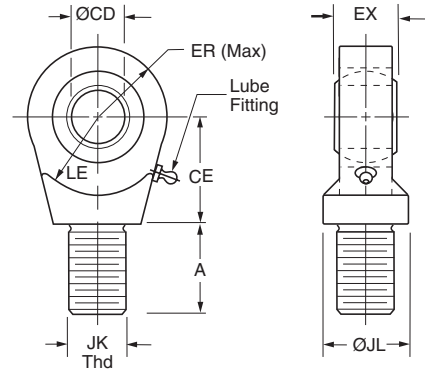
² Dimension CD is hole diameter.

³ Threads listed are also for a spherical rod eye which match style 9 or style 7. The spherical rod eye pin diameter matches the cap pin and (if required) needs to be purchased separately; see NC9 mounting accessories for detailed information.

Schrader Bellows offers a complete range of Cylinder Accessories to assure you of the greatest versatility in present or future cylinder applications. Accessories offered

for the respective cylinder include the Rod Eye, Pivot Pin and Clevis Bracket. To select the proper part number for any desired accessory refer to the charts below.

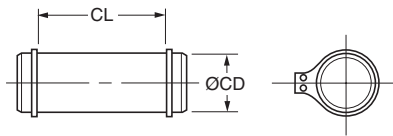
Spherical Rod Eye Dimensions



NC9 Series Bore Ø	Part Number	CD Ø	A	CE	EX	ER	LE	JK Thread	JL Ø	Load Capacity (lb)
1.50, 2.00, 2.50	0961000050	.5000 ⁻⁰⁰⁰⁵	0.72	0.86	0.44	0.80	0.78	7/16-20	0.88	2644
3.25, 4.00, 5.00	0961000075	.7500 ⁻⁰⁰⁰⁵	1.02	1.25	0.66	1.14	1.06	3/4-16	1.31	9441
6.00, 8.00	0961000100	1.0000 ⁻⁰⁰⁰⁵	1.52	1.88	0.88	1.34	1.45	1-14	1.50	16860
10.00	0961000138	1.3750 ⁻⁰⁰⁰⁵	2.02	2.13	1.19	1.67	1.91	1 1/4-12	2.00	28562
12.00	0961000175	1.7500 ⁻⁰⁰⁰⁵	2.14	2.50	1.53	2.05	2.16	1 1/2-12	2.00	43005

Order to fit Piston Rod Thread Size.

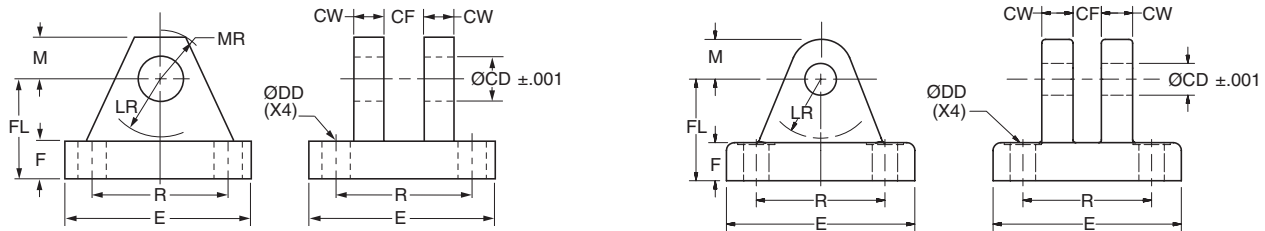
Pivot Pin Dimensions



NC9 Series Bore Ø	Part Number	CD Ø	CL	Shear Capacity (lb)
1.50, 2.00, 2.50	0839620000	.4997 ⁻⁰⁰⁰⁴	1.56	8600
3.25, 4.00, 5.00	0839630000	.7497 ⁻⁰⁰⁰⁵	2.03	19300
6.00, 8.00	0839640000	.9997 ⁻⁰⁰⁰⁵	2.50	34300
10.00	0839650000	1.3746 ⁻⁰⁰⁰⁶	3.31	65000
12.00	0839660000	1.7496 ⁻⁰⁰⁰⁶	4.22	105200

Pivot Pins are furnished with (2) Retainer Rings.

Clevis Bracket Dimensions



Fabricated Steel

Cast Ductile Iron

Order to fit Cylinder Cap or Rod Eye.

NC9 Series Bore Ø	Pin Ø	Cast Ductile Iron Part Number	Fabricated Steel Part Number	CD Ø	CF	CW	DD Ø	E	F	FL	LR	M	MR	R	Load Capacity (lb)
1.50, 2.00, 2.50	0.500	0959450000	0839470000	0.503	0.45	0.50	0.41	3.00	0.50	1.50	0.94	0.50	0.63	2.05	5770
3.25, 4.00, 5.00	0.750	0959300000	0839480000	0.753	0.67	0.63	0.53	3.75	0.63	2.00	1.38	0.88	1.00	2.76	9450
6.00, 8.00	1.000	0959310000	0839490000	1.003	0.89	0.75	0.53	5.50	0.75	2.50	1.69	1.00	1.19	4.10	14300
10.00	1.375	0959320000	0839500000	1.378	1.20	1.00	0.66	6.50	0.88	3.50	2.44	1.38	1.63	4.95	20322
12.00	1.750	0959330000	0839510000	1.753	1.55	1.25	0.91	8.50	1.25	4.50	2.88	1.75	2.06	6.58	37800

To determine dimensions for a double rod cylinder, first refer to the desired single rod mounting style cylinder shown on preceding pages of this catalog. After selecting necessary dimensions from that drawing, return to this page and supplement the single rod dimensions with those shown on the drawing and dimension table below. Note that double rod cylinders have a head (Dim. G) at both ends and that dimension LD or LF replaces LG or LB. The double rod dimensions differ from, or are in addition to those for single rod cylinders shown on preceding pages and provide the information needed to completely dimension a double rod cylinder. On a double rod cylinder where the two rod ends are different, be sure to clearly state which rod end is to be assembled at which end.

Port position 1 is standard. If other than standard, specify position 2, 3, or 4 when viewed from one end only.

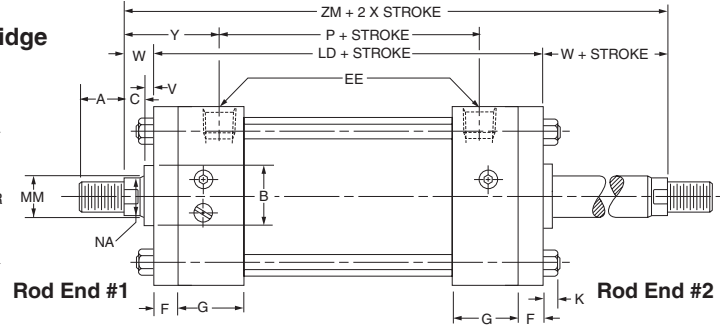
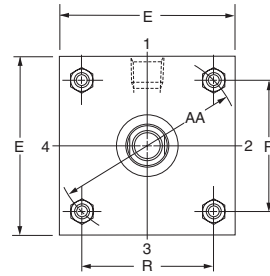
If only one end of these Double Rod Cylinders is to be cushioned, be sure to specify clearly which end this will be.

Specify XI dimension from rod end #1.

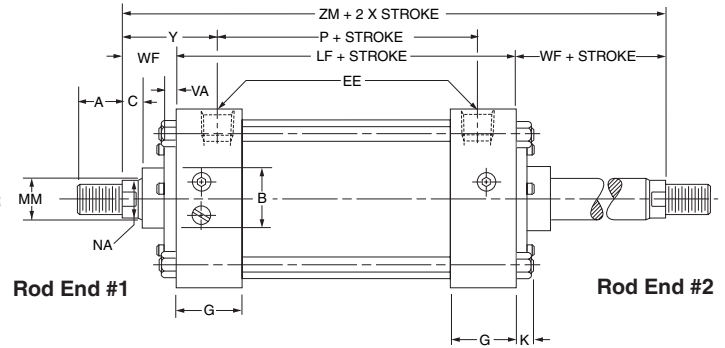
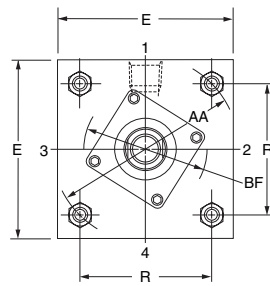
How to Use Double Rod Cylinder Dimension Drawings

1-1/2" to 6" Bores

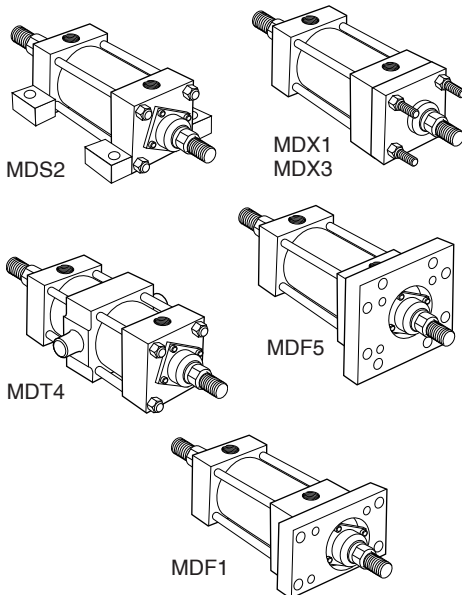
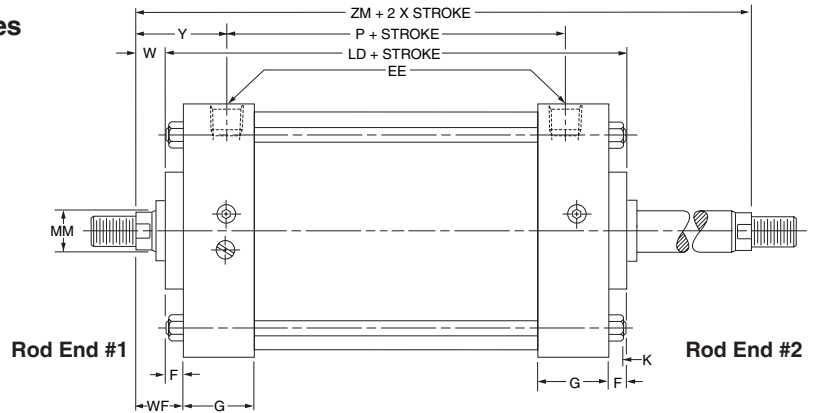
Tie Rod Retained Cartridge



**1-1/2" to 6" Bores
Removable Cartridge**



8" to 12" Bores



All dimensions are in inches and apply to standard rod sizes only. For alternate rod sizes, determine all envelope dimensions (within LD dim.) as described above and then use appropriate rod end dimensions for proper rod size from single rod cylinder.

Bore	Rod Dia. MM	Add Stroke			Add 2X Stroke
		LD	LF	SS	ZM
1 1/2	5/8	4 7/8	4 1/8	3 3/8	6 1/8
2	5/8	4 7/8	4 1/8	3 3/8	6 1/8
2 1/2	5/8	5	4 1/4	3 1/2	6 1/4
3 1/4	1	6	4 3/4	3 3/4	7 1/2
4	1	6	4 3/4	3 3/4	7 1/2
5	1	6 1/4	5	3 5/8	7 3/4
6	1 3/8	7	5 1/2	4 1/8	8 3/4
8	1 3/8	7 1/8	5 5/8	4 1/4	8 7/8
10	1 3/4	8 1/8	6 5/8	4 7/8	10 3/8
12	2	8 5/8	7 1/8	5 3/8	11 1/8
Replaces:		LB	LG	SS	—
On single rod mounting styles:		All Mtg. Styles		MS2	All Mtgs.

Alignment Coupler

See Table 1 for Part Numbers and Dimensions

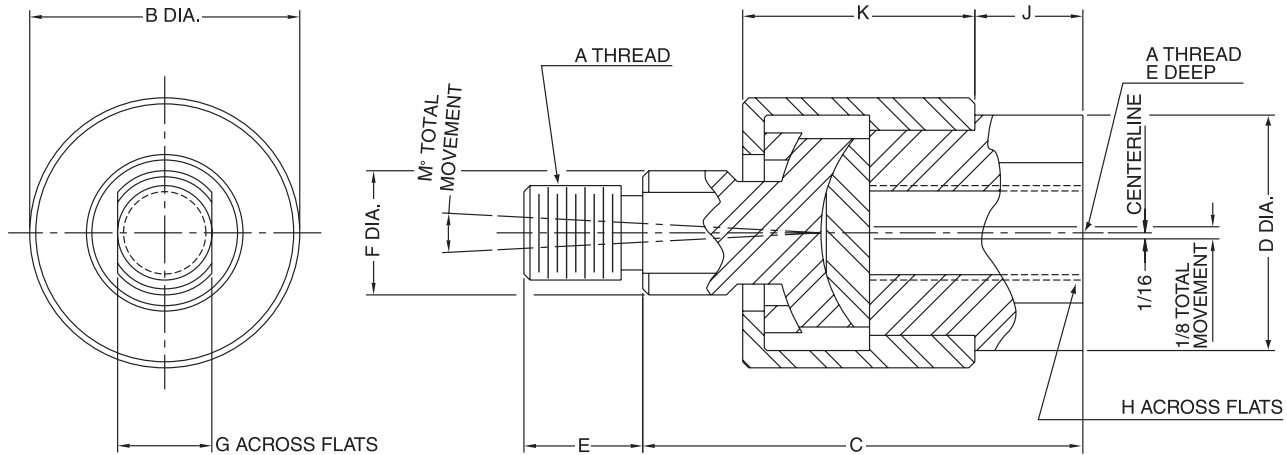


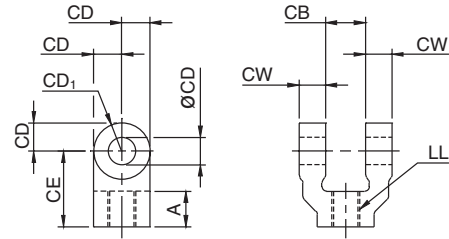
Table 1 — Part Numbers and Dimensions

Part No.	A	B Ø	C	D Ø	E	F Ø	G	H	J	K	M	Max. Pull Load (lb)	Approx. Weight (lb)
1347570031	5/16-24	1 1/8	1 3/4	15/16	1/2	1/2	3/8	3/4	3/8	15/16	6°	1200	.35
1347570038	3/8-24	1 1/8	1 3/4	15/16	1/2	1/2	3/8	3/4	3/8	15/16	6°	2425	.35
1347570044	7/16-20	1 3/8	2	1 1/8	3/4	5/8	1/2	7/8	3/8	1 3/32	6°	3250	.55
1347570050	1/2-20	1 3/8	2	1 1/8	3/4	5/8	1/2	7/8	3/8	1 3/32	6°	4450	.55
1347570063	5/8-18	1 3/8	2	1 1/8	3/4	5/8	1/2	7/8	3/8	1 3/32	6°	6800	.55
1347570075	3/4-16	2	2 5/16	1 5/8	1 1/8	15/16	3/4	1 5/16	7/16	1 9/32	6°	9050	1.4
1347570088	7/8-14	2	2 5/16	1 5/8	1 1/8	15/16	3/4	1 5/16	7/16	1 9/32	6°	14450	1.4
1347570100	1-14	3	3	2 3/8	1 5/8	1 7/16	1 1/4	1 7/8	3/4	1 25/32	6°	19425	4.8
1347570125	1 1/4-12	3	3	2 3/8	1 5/8	1 7/16	1 1/4	1 7/8	3/4	1 25/32	6°	30500	4.8
1337390125	1 1/4-12	3 1/2	4	2	2	1 1/2	1 1/4	1 11/16	3/4	2 1/2	10°	30500	6.9
1337390150	1 1/2-12	4	4 3/8	2 1/4	2 1/4	1 3/4	1 1/2	1 15/16	7/8	2 3/4	10°	45750	9.8
1337390175	1 3/4-12	4	4 3/8	2 1/4	2 1/4	1 3/4	1 1/2	1 15/16	7/8	2 3/4	10°	58350	9.8
1337390188	1 7/8-12	5	5 5/8	3	3	2 1/4	2	2 5/8	1 3/8	3 3/8	10°	67550	19.8

How to Order Linear Alignment Couplers — When ordering a cylinder with a threaded male rod end, specify the coupler of equal thread size by part number as listed in Table 1, i.e.; Piston Rod “KK” or “LL” dimension is 3/4” - 16”, specify coupler part number 1347570075.

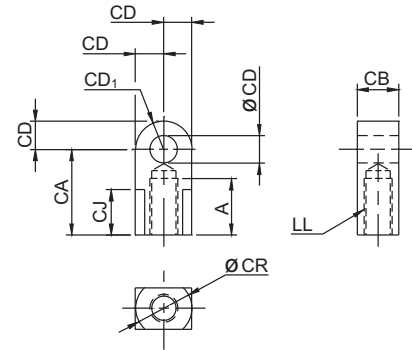
Rod Clevis — Order to Fit Thread Size of Piston Rod*

NC9 Part Number	Rod Dia.	Dimensions in Inches							Schrader Part Number
		Thread Size LL	A	CB	CD	CE	CW	CD ₁	
NC9-3402A	1	7/8-14	1 1/8	1 1/4	3/4	2 3/8	5/8	3/4	031970875
NC9-3404	1 3/8	1 1/4-12	2	2	1 3/8	4 1/8	1	1 1/4	031971250
NC9-3405	1 3/4	1 1/2-12	2 1/4	2 1/2	1 3/4	4 1/2	1 1/4	1 3/4	031971500
NC9-3405A	2	1 3/4-12	2 1/4	2 1/2	1 3/4	4 1/2	1 1/4	1 3/4	031971750
NC9-3406A	2 1/2	2 1/4-12	3	2 1/2	2	5 1/2	1 1/4	2	031977987



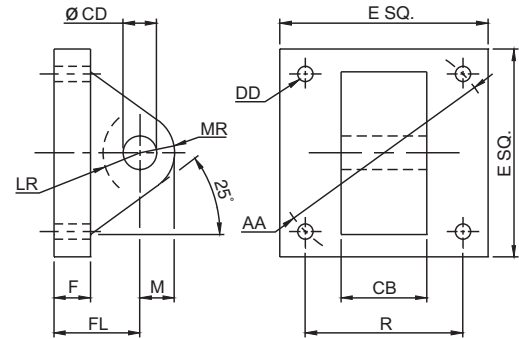
Rod Eye — Order to Fit Thread Size of Piston Rod*

NC9 Part Number	Rod Dia.	Dimensions in Inches								Schrader Part Number
		Thread Size LL	A	CA	CB	CD	CJ	CD ₁	CR	
NC9-3305A	1	7/8-14	1 1/8	2 1/16	1 1/4	3/4	3/4	3/4	1 1/2	031960875
NC9-3307	1 3/8	1 1/4-12	2	3 7/16	2	1 3/8	—	1 3/8	—	031961250
NC9-3308	1 3/4	1 1/2-12	2 1/4	4	2 1/2	1 3/4	—	1 3/4	—	031961500
NC9-3308A	2	1 3/4-12	2 1/4	4	2 1/2	1 3/4	—	1 3/4	—	031961750
NC9-3309A	2 1/2	2 1/4-12	3	5	2 1/2	2	—	2	—	031967999



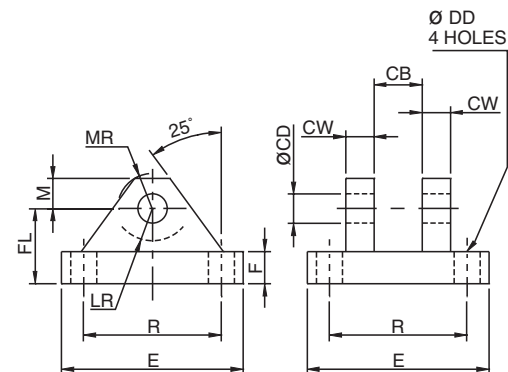
Eye Bracket — Order to Fit Pivot Pin Size (CD)*

NC9 Part Number	Dimensions in Inches										Schrader Part Number
	CD	CB	AA	DD	E	F	FL	LR	R	MR	
NC9-3201	1/2	3/4	2.3	1 13/32	2 1/2	3/8	1 1/8	2 1/32	1.62	1/2	0691950000
NC9-3202	3/4	1 1/4	3.6	1 17/32	3 1/2	5/8	1 7/8	1 1/8	2.56	3/4	0691960000
NC9-3203	1	1 1/2	4.6	2 21/32	4 1/2	3/4	2 1/4	1 1/16	3.25	1	031951000
NC9-3210	1 3/8	2	5.4	2 21/32	5	7/8	3	1 5/8	3.82	1 3/8	0691980000
NC9-3212	1 3/4	2 1/2	7	2 15/16	6 1/2	7/8	3 3/8	1 7/8	4.95	1 3/4	0691990000
NC9-3213	2	2 1/2	8.1	2 11/16	7 1/2	1	3 1/2	2 1/8	5.73	2	031952000



Clevis Bracket for Rod Eye — Order to Fit Pivot Pin Size (CD)*

NC9 Part Number	Dimensions in Inches										Schrader Part Number	
	CB	CD	CW	DD	E	F	FL	LR	M	MR		R
NC9-3204	3/4	1/2	1/2	1 13/32	3	3/8	1 1/8	9/16	1/2	1/2	2.05	031940500
NC9-3205	1 1/4	3/4	5/8	1 17/32	4 1/2	5/8	1 7/8	1 15/16	3/4	3/4	3.25	031940750
NC9-3206	1 1/2	1	3/4	2 1/32	5	3/4	2 1/4	1	1	1 3/16	3.82	031941000
NC9-3207	2	1 3/8	1	2 1/32	7 1/2	7/8	3	2	1 3/8	1 21/32	5.73	0692080000
NC9-3208	2 1/2	1 3/4	1 1/4	2 29/32	9 1/2	7/8	3 5/8	2 3/4	1 3/4	2 27/32	7.50	0692090000
NC9-3209	2 1/2	2	1 1/2	2 11/16	12 3/4	1	4 1/4	3 3/16	2 1/4	2 25/32	9.40	0692100000



* Accessories listed on this page will attach current Ford specification rod thread and bore sizes. For sizes outside the current for specification see page 40.

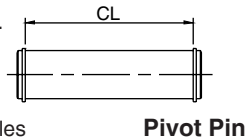
Pivot Pins and Jam Nuts

Sizes to fit current Ford specification cylinders

Pivot Pins with Retaining Rings

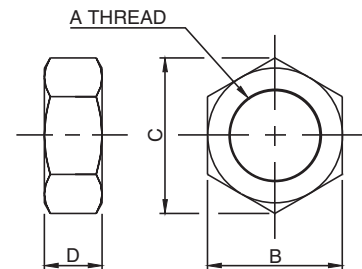
Ford Part Number	Dimensions in inches		Schrader Part Number
	CD	CL	
NC9-3310	1/2	1 7/8	0683680000
NC9-3311	3/4	2 5/8	0683690000
NC9-3312	1	3 1/8	0683700000
NC9-3313	1 3/8	4 1/8	0683710000
NC9-3314	1 3/4	5 3/16	0683720000
NC9-3315	2	5 9/16	0683730000

1. Pivot Pins are furnished with Clevis Mounted Cylinders as standard.
2. Pivot Pins are furnished with (2) retaining rings.
3. Pivot Pins must be ordered as a separate item if to be used with Knuckles Rod Clevises or Clevis Brackets.



Jam Nut

Ford Part Number	Dimensions in inches				Schrader Part Number
	Thd. A	B	C	D	
N/A	7/8-14	1 5/16	1 15/32	31/64	034451017
N/A	1 1/4-12	1 7/8	2 1/8	35/64	034451023
N/A	1 1/2-12	2 1/4	2 17/32	27/32	034451027
N/A	1 3/4-12	2 5/8	2 15/16	31/32	034451030
N/A	2 1/4-12	3 1/8	3 5/8	1 1/8	034451033



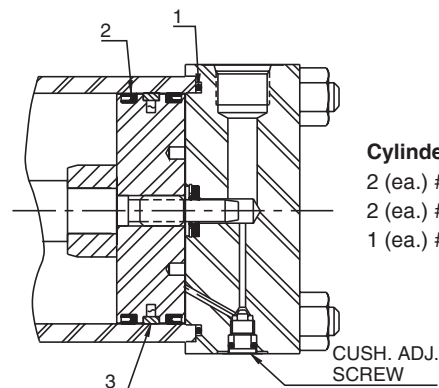
Cylinder Kits

For current Ford specification cylinders

Bore Ø	Cylinder Seal Kit▲	Schrader Part Number▲▲
1 1/2	NC9-4201	190208003
2	NC9-4202	190408003
2 1/2	NC9-4203	190508003
3 1/4	NC9-4204	190708003
4	NC9-4205	190808003
5	NC9-4206	191008003
6	NC9-4207	191108003
8	NC9-4208	191308003
10	NC9-4209	191408003
12	NC9-4210	191508003

▲ Contain Items 1 through 3

▲▲ Contain Items 1 through 3 & Retaining Ring, Cushion Insert and Cushion Adj. Seal

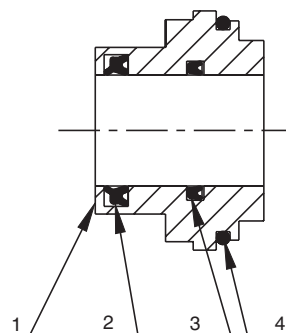


Cartridge Assembly

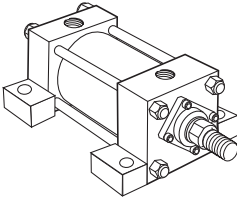
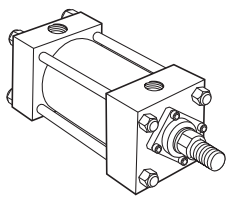
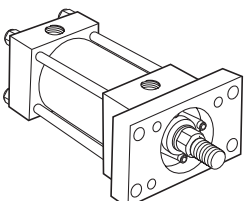
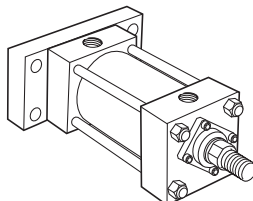
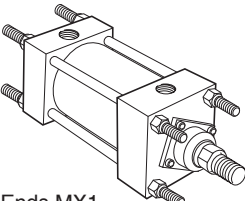
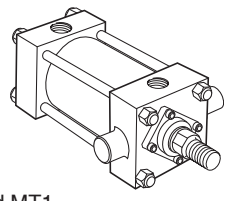
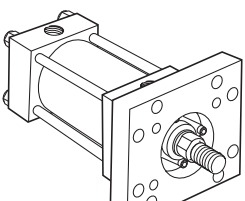
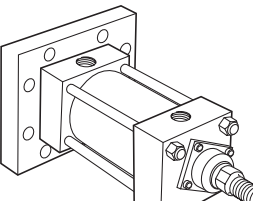
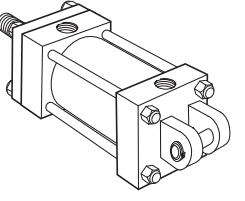
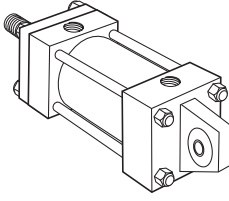
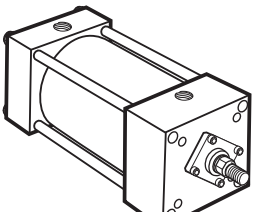
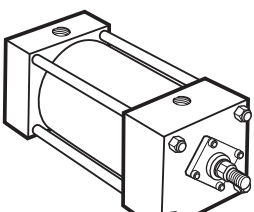
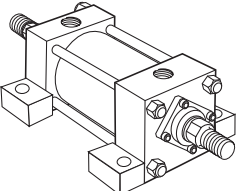
Bore Ø	Rod Ø	Cartridge Assembly	Schrader Part Number
1 1/2, 2	5/8	NC9-4001	190208014
2 1/2	5/8	NC9-4002	190518014
1 1/2, 2, 2 1/2	1	NC9-4003	190218014
3 1/4, 4, 5	1	NC9-4004	190718014
3 1/4, 4, 5	1 3/8	NC9-4005	190428014
2, 5, 6, 8	1 3/8	NC9-4006	191118014
2 1/2, 6, 8	1 3/4	—	190538014
3 1/4, 4, 5, 10	1 3/4	NC9-4007	191418014
3 1/4, 4, 5, 10	2	—	190738014
6, 8	2	NC9-4008	191518014
4, 8, 10, 12	2 1/2	NC9-4009	190848014

Cartridge Assembly Contains:

- 1 (ea.) #1 Rod Cartridge
- 1 (ea.) #2 Rod Wiper
- 1 (ea.) #3 Rod Seal
- 1 (ea.) #4 Rod Cartridge Seal



In line with our policy of continuing product improvement, specifications in this catalog are subject to change.

Mounting Styles and Ordering Notes																																																																																																																																																	
Available in all bore and rod combinations.		Available in all bore and rod combinations through 6" bore. 8"-12" bores supplied as Head Square (ME3) and Cap Square (ME4) mounts.																																																																																																																																															
<p>Side Lug</p>  <p>MS2</p>	<p>Side Tap</p>  <p>MS4</p>	<p>Head Rectangular Flange</p>  <p>MF1</p>	<p>Cap Rectangular Flange</p>  <p>MF2</p>																																																																																																																																														
<p>Tie Rods Extended</p>  <p>Both Ends MX1 Cap End MX2 Head End MX3</p>	<p>Trunnion Mounts</p>  <p>Head MT1 Cap MT2 Intermediate Fixed MT4</p>	<p>Head Square Flange</p>  <p>MF5</p>	<p>Cap Square Flange</p>  <p>MF6</p>																																																																																																																																														
<p>Cap Fixed Clevis</p>  <p>MP1 Pivot Pin Included</p>	<p>Spherical Bearing</p>  <p>MPU3</p>	<p>Rod Bearing Cartridges</p> <p>R = Removable Cartridge T = Tie Rod Retained Cartridge</p> <p>*MF5, MF6, MF1, MF2 not available in these bore sizes. ME3 and ME4 available in 8-12" bore only.</p> <table border="1"> <thead> <tr> <th rowspan="2">Bore</th> <th rowspan="2">Rod Dia.</th> <th colspan="2">MX1 MX3 MX2 MS4 MS2 MF6 MF2 MT2 MT1 MT4</th> <th rowspan="2">MF1 MF5</th> <th rowspan="2">ME3 ME4</th> </tr> <tr> <th>MPU3</th> <th>MP1</th> </tr> </thead> <tbody> <tr> <td rowspan="2">1 1/2</td> <td>5/8</td> <td></td> <td>R</td> <td>T</td> <td>N/A</td> </tr> <tr> <td>1</td> <td></td> <td>T</td> <td>T</td> <td>N/A</td> </tr> <tr> <td rowspan="2">2</td> <td>5/8</td> <td></td> <td>R</td> <td>R</td> <td>N/A</td> </tr> <tr> <td>1</td> <td></td> <td>R</td> <td>T</td> <td>N/A</td> </tr> <tr> <td rowspan="2"></td> <td>1 3/8</td> <td></td> <td>T</td> <td>T</td> <td>N/A</td> </tr> <tr> <td>5/8</td> <td></td> <td>R</td> <td>R</td> <td>N/A</td> </tr> <tr> <td rowspan="2">2 1/2</td> <td>1</td> <td></td> <td>R</td> <td>R</td> <td>N/A</td> </tr> <tr> <td>1 3/8</td> <td></td> <td>T</td> <td>T</td> <td>N/A</td> </tr> <tr> <td rowspan="2"></td> <td>1 3/4</td> <td></td> <td>T</td> <td>T</td> <td>N/A</td> </tr> <tr> <td>1</td> <td></td> <td>R</td> <td>R</td> <td>N/A</td> </tr> <tr> <td rowspan="2">3 1/4</td> <td>1 3/8</td> <td></td> <td>R</td> <td>R</td> <td>N/A</td> </tr> <tr> <td>1 3/4, 2</td> <td></td> <td>R</td> <td>T</td> <td>N/A</td> </tr> <tr> <td rowspan="2">4</td> <td>1, 1 3/8</td> <td></td> <td>R</td> <td>R</td> <td>N/A</td> </tr> <tr> <td>1 3/4, 2</td> <td></td> <td>R</td> <td>R</td> <td>N/A</td> </tr> <tr> <td rowspan="2"></td> <td>2 1/2</td> <td></td> <td>R</td> <td>T</td> <td>N/A</td> </tr> <tr> <td>1, 2</td> <td></td> <td>R</td> <td>R</td> <td>N/A</td> </tr> <tr> <td rowspan="2">5</td> <td>2 1/2, 3</td> <td></td> <td>R</td> <td>T</td> <td>N/A</td> </tr> <tr> <td>3 1/2</td> <td></td> <td>T</td> <td>T</td> <td>N/A</td> </tr> <tr> <td rowspan="2">6</td> <td>1 3/8 - 2 1/2</td> <td></td> <td>R</td> <td>R</td> <td>N/A</td> </tr> <tr> <td>3 - 4</td> <td></td> <td>T</td> <td>T</td> <td>N/A</td> </tr> <tr> <td rowspan="2">8*</td> <td>1 3/8 - 4 1/2</td> <td></td> <td>R</td> <td>N/A</td> <td>R</td> </tr> <tr> <td>5, 5 1/2</td> <td></td> <td>R</td> <td>N/A</td> <td>R</td> </tr> <tr> <td>10*</td> <td>1 3/4 - 5 1/2</td> <td></td> <td>R</td> <td>N/A</td> <td>R</td> </tr> <tr> <td>12*</td> <td>2 - 5 1/2</td> <td></td> <td>R</td> <td>N/A</td> <td>R</td> </tr> </tbody> </table>			Bore	Rod Dia.	MX1 MX3 MX2 MS4 MS2 MF6 MF2 MT2 MT1 MT4		MF1 MF5	ME3 ME4	MPU3	MP1	1 1/2	5/8		R	T	N/A	1		T	T	N/A	2	5/8		R	R	N/A	1		R	T	N/A		1 3/8		T	T	N/A	5/8		R	R	N/A	2 1/2	1		R	R	N/A	1 3/8		T	T	N/A		1 3/4		T	T	N/A	1		R	R	N/A	3 1/4	1 3/8		R	R	N/A	1 3/4, 2		R	T	N/A	4	1, 1 3/8		R	R	N/A	1 3/4, 2		R	R	N/A		2 1/2		R	T	N/A	1, 2		R	R	N/A	5	2 1/2, 3		R	T	N/A	3 1/2		T	T	N/A	6	1 3/8 - 2 1/2		R	R	N/A	3 - 4		T	T	N/A	8*	1 3/8 - 4 1/2		R	N/A	R	5, 5 1/2		R	N/A	R	10*	1 3/4 - 5 1/2		R	N/A	R	12*	2 - 5 1/2		R	N/A	R
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<p>Head Square</p>  <p>ME3</p>	<p>Cap Square</p>  <p>ME4</p>																																																																																																																																																
<p>Double End Construction</p>  <p>Available in all bore and rod combinations in the following mounting styles: MDS2, MDS4, MDX1, MDX3, MDT1, MDT4, and MDF1 (1"-6"). MDF5 (1"-6") and MDE3 (8"-12").</p>																																																																																																																																																	

A

PA-2

NC9

Rod Lock

**How To Order
By Model Number**

NC9 Pneumatic Cylinders can be specified by model number by using the tables shown at right.

Selections in bold type indicate current Ford standard.

1. Type

Select the Model Number Code which identifies single, double end.

2. Bore & Rod Diameter

Select the Model Number Code which identifies the desired bore size and rod diameter combination.

3. Mounting & Cushioning

Select the Model Number Code which identifies the desired mounting style and cushioning option.

4. Rod End Style

Select the Model Number Code which identifies the desired rod end thread style.

5. Seal Type

Complete the Model Number by selecting the type of seals desired.

6. Stroke Length

It is necessary to specify the stroke length desired following the Model Number. For example: FAA110851 with 6" stroke.

Specifying the Desired Trunnion Location

For cylinders with intermediate trunnion mounting, the dimension specified should be the distance from the piston rod reference point to the center-line of the pin.

The Example Would Identify:

A single end pneumatic cylinder, 1-1/2" bore size, 1" piston rod diameter, side lug mount, cushioned both ends, with automotive male rod thread, Buna N Seals, and a 6" stroke.

Optional Mounting Accessories

Specify separately the part number for desired optional mounting accessories.

1	Model Number
Type	Pneumatic Steel Tube
Single End with NPT port	FA
Double End with NPT port	FB
Single End with SAE port	NA
Double End with SAE port	NB

Model Number Example:

FA A11 08 5 1 S W/6"Stroke

2	Bore Size	Rod Dia.	Model No. Code	Bore Size	Rod Dia.	Model No. Code
1 1/2"	5/8"	A10	8"	1 3/8"	J12	
	1"	A11		1 3/4"	J13	
2"	5/8"	B10	10"	2"	J14	
	1"	B11		2 1/2"	J15	
	1 3/8"	B12		3"	J16	
2 1/2"	5/8"	C10	12"	3 1/2"	J17	
	1"	C11		4"	J18	
	1 3/8"	C12		4 1/2"	J19	
	1 3/4"	C13		5"	J41	
3 1/4"	1"	D11	14"	5 1/2"	J42	
	1 3/8"	D12		10"	1 3/4"	K13
	1 3/4"	D13		2"	K14	
	2"	D14		2 1/2"	K15	
4"	1"	E11	16"	3"	K16	
	1 3/8"	E12		3 1/2"	K17	
	1 3/4"	E13		4"	K18	
	2"	E14		4 1/2"	K19	
	2 1/2"	E15		5"	K41	
5"	1"	F11	18"	5 1/2"	K42	
	1 3/8"	F12		2"	L14	
	1 3/4"	F13		2 1/2"	L15	
	2"	F14		3"	L16	
	2 1/2"	F15		3 1/2"	L17	
	3"	F16		4"	L18	
	3 1/2"	F17		4 1/2"	L19	
6"	1 3/8"	G12	20"	5"	L41	
	1 3/4"	G13		5 1/2"	L42	
	2"	G14				
	2 1/2"	G15				
	3"	G16				
	3 1/2"	G17				
4"	G18					

3	Mounting Style	Model Number Code				
		NFPA Style	Non-Cush.	Cush. Head	Cush. Cap	Cush. Both
	Side Lug	MS2	05	06	07	08
	Side Tap	MS4	13	14	15	16
	Head Rectangular Flange (1 1/2-6)	MF1	21	22	23	24
	Cap Rectangular Flange (1 1/2-6)	MF2	25	26	27	28
	Head Square Flange (1 1/2-6)	MF5	29	30	31	32
	Cap Square Flange (1 1/2-6)	MF6	33	34	35	36
	Head Square (8-14)	ME3	37	38	39	40
	Cap Square (8-14)	ME4	41	42	43	44
	Tie Rods Extended Both Ends	MX1	53	54	55	56
	Tie Rods Extended Cap End	MX2	57	58	59	60
	Tie Rods Extended Head End	MX3	61	62	63	64
	Head Trunnion	MT1	69	70	71	72
	Cap Trunnion	MT2	73	74	75	76
	Intermediate Fixed Trunnion	MT4	77	78	79	80
	Cap Fixed Clevis	MP1	81	82	83	84
	Spherical Bearing	MPU3	89	90	91	92
	NO MOUNT	MX0	93	94	95	96

4	Rod End Style	Model Number Code
	Small Male	2
	Short Female	3
	Intermediate Male	4
	Automotive Male	5
	Special Specify	0

5	Seal Type	Model Number Code
	Buna N Seals	1
	Fluorocarbon Seals	2

6	Special Features	S
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7	Specify Stroke Length	6.00"
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Safety Guide for Selecting and Using Hydraulic, Pneumatic Cylinders and Their Accessories

WARNING: ⚠ **FAILURE OF THE CYLINDER, ITS PARTS, ITS MOUNTING, ITS CONNECTIONS TO OTHER OBJECTS, OR ITS CONTROLS CAN RESULT IN:**

- Unanticipated or uncontrolled movement of the cylinder or objects connected to it.
- Falling of the cylinder or objects held up by it.
- Fluid escaping from the cylinder, potentially at high velocity.

THESE EVENTS COULD CAUSE DEATH OR PERSONAL INJURY BY, FOR EXAMPLE, PERSONS FALLING FROM HIGH LOCATIONS, BEING CRUSHED OR STRUCK BY HEAVY OR FAST MOVING OBJECTS, BEING PUSHED INTO DANGEROUS EQUIPMENT OR SITUATIONS, OR SLIPPING ON ESCAPED FLUID.

Before selecting or using Parker (The Company) cylinders or related accessories, it is important that you read, understand and follow the following safety information. Training is advised before selecting and using The Company's products.

1.0 General Instructions

1.1 Scope – This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) cylinder products. This safety guide is a supplement to and is to be used with the specific Company publications for the specific cylinder products that are being considered for use.

1.2 Fail Safe – Cylinder products can and do fail without warning for many reasons. All systems and equipment should be designed in a fail-safe mode so that if the failure of a cylinder product occurs people and property won't be endangered.

1.3 Distribution – Provide a free copy of this safety guide to each person responsible for selecting or using cylinder products. Do not select or use The Company's cylinders without thoroughly reading and understanding this safety guide as well as the specific Company publications for the products considered or selected.

1.4 User Responsibility – Due to very wide variety of cylinder applications and cylinder operating conditions, The Company does not warrant that any particular cylinder is suitable for any specific application. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The hydraulic and pneumatic cylinders outlined in this catalog are designed to The Company's design guidelines and do not necessarily meet the design guideline of other agencies such as American Bureau of Shipping, ASME Pressure Vessel Code etc. The user, through its own analysis and testing, is solely responsible for:

- Making the final selection of the cylinders and related accessories.
- Determining if the cylinders are required to meet specific design requirements as required by the Agency(s) or industry standards covering the design of the user's equipment.
- Assuring that the user's requirements are met, OSHA requirements are met, and safety guidelines from the applicable agencies such as but not limited to ANSI are followed and that the use presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the cylinders are used.

1.5 Additional Questions – Call the appropriate Company technical service department if you have any questions or require any additional information. See the Company publication for the product being considered or used, or call 1-847-298-2400, or go to www.parker.com, for telephone numbers of the appropriate technical service department.

2.0 Cylinder and Accessories Selection

2.1 Seals – Part of the process of selecting a cylinder is the selection of seal compounds. Before making this selection, consult the "seal information page(s)" of the publication for the series of cylinders of interest.

The application of cylinders may allow fluids such as cutting fluids, wash down fluids etc. to come in contact with the external area of the cylinder. These fluids may attack the piston rod wiper and or the primary seal and must be taken into account when selecting and specifying seal compounds.

Dynamic seals will wear. The rate of wear will depend on many operating factors. Wear can be rapid if a cylinder is mis-aligned or if the cylinder has been improperly serviced. The user must take seal wear into consideration in the application of cylinders.

2.2 Piston Rods – Possible consequences of piston rod failure or separation of the piston rod from the piston include, but are not limited to are:

- Piston rod and or attached load thrown off at high speed.
- High velocity fluid discharge.
- Piston rod extending when pressure is applied in the piston retract mode.

Piston rods or machine members attached to the piston rod may move suddenly and without warning as a consequence of other conditions occurring to the machine such as, but not limited to:

- Unexpected detachment of the machine member from the piston rod.

- Failure of the pressurized fluid delivery system (hoses, fittings, valves, pumps, compressors) which maintain cylinder position.
- Catastrophic cylinder seal failure leading to sudden loss of pressurized fluid.
- Failure of the machine control system.

Follow the recommendations of the "Piston Rod Selection Chart and Data" in the publication for the series of cylinders of interest. The suggested piston rod diameter in these charts must be followed in order to avoid piston rod buckling.

Piston rods are not normally designed to absorb bending moments or loads which are perpendicular to the axis of piston rod motion. These additional loads can cause the piston rod to fail. If these types of additional loads are expected to be imposed on the piston rod, their magnitude should be made known to our engineering department.

The cylinder user should always make sure that the piston rod is securely attached to the machine member.

On occasion cylinders are ordered with double rods (a piston rod extended from both ends of the cylinder). In some cases a stop is threaded on to one of the piston rods and used as an external stroke adjuster. On occasions spacers are attached to the machine member connected to the piston rod and also used as a stroke adjuster. In both cases the stops will create a pinch point and the user should consider appropriate use of guards. If these external stops are not perpendicular to the mating contact surface, or if debris is trapped between the contact surfaces, a bending moment will be placed on the piston rod, which can lead to piston rod failure. An external stop will also negate the effect of cushioning and will subject the piston rod to impact loading. Those two (2) conditions can cause piston rod failure. Internal stroke adjusters are available with and without cushions. The use of external stroke adjusters should be reviewed with our engineering department.

The piston rod to piston and the stud to piston rod threaded connections are secured with an anaerobic adhesive. The strength of the adhesive decreases with increasing temperature. Cylinders which can be exposed to temperatures above +250°F (+121°C) are to be ordered with a non studded piston rod and a pinned piston to rod joint.

2.3 Cushions – Cushions should be considered for cylinder applications when the piston velocity is expected to be over 4 inches/second.

Cylinder cushions are normally designed to absorb the energy of a linear applied load. A rotating mass has considerably more energy than the same mass moving in a linear mode. Cushioning for a rotating mass application should be reviewed by our engineering department.

2.4 Cylinder Mountings – Some cylinder mounting configurations may have certain limitations such as but not limited to minimum stroke for side or foot mounting cylinders or pressure de-ratings for certain mounts. Carefully review the catalog for these types of restrictions.

Always mount cylinders using the largest possible high tensile alloy steel socket head cap screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

2.5 Port Fittings – Hydraulic cylinders applied with meter out or deceleration circuits are subject to intensified pressure at piston rod end.

The rod end pressure is approximately equal to:

$$\frac{\text{operating pressure} \times \text{effective cap end area}}{\text{effective rod end piston area}}$$

Contact your connector supplier for the pressure rating of individual connectors.

3.0 Cylinder and Accessories Installation and Mounting

3.1 Installation

3.1.1 – Cleanliness is an important consideration, and cylinders are shipped with the ports plugged to protect them from contaminants entering the ports. These plugs should not be removed until the piping is to be installed. Before making the connection to the cylinder ports, piping should be thoroughly cleaned to remove all chips or burrs which might have resulted from threading or flaring operations.

3.1.2 – Cylinders operating in an environment where air drying materials are present such as fast-drying chemicals, paint, or weld splatter, or other hazardous conditions such as excessive heat, should have shields installed to prevent damage to the piston rod and piston rod seals.

3.1.3 – Proper alignment of the cylinder piston rod and its mating component on the machine should be checked in both the extended and retracted positions. Improper alignment will result in excessive rod gland and/or cylinder bore wear. On fixed mounting cylinders attaching the piston rod while the rod is retracted will help in achieving proper alignment.

3.1.4 – Sometimes it may be necessary to rotate the piston rod in order to thread the piston rod into the machine member. This operation must always be done with zero pressure being applied to either side of the piston. Failure to follow this procedure may result in loosening the piston to rod-threaded connection. In some rare cases the turning of the piston rod may rotate a threaded piston rod gland and loosen it from the cylinder head. Confirm that this condition is not occurring. If it does, re-tighten the piston rod gland firmly against the cylinder head.

For double rod cylinders it is also important that when attaching or detaching the piston rod from the machine member that the torque be applied to the piston rod end of the cylinder that is directly attaching to the machine member with the opposite end unrestrained. If the design of the machine is such that only the rod end of the cylinder opposite to where the rod attaches to the machine member can be rotated, consult the factory for further instructions.

3.2 Mounting Recommendations

3.2.1 – Always mount cylinders using the largest possible high tensile alloy steel socket head screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

3.2.2 – Side-Mounted Cylinders – In addition to the mounting bolts, cylinders of this type should be equipped with thrust keys or dowel pins located so as to resist the major load.

3.2.3 – Tie Rod Mounting – Cylinders with tie rod mountings are recommended for applications where mounting space is limited. The standard tie rod extension is shown as BB in dimension tables. Longer or shorter extensions can be supplied. Nuts used for this mounting style should be torqued to the same value as the tie rods for that bore size.

3.2.4 – Flange Mount Cylinders – The controlled diameter of the rod gland extension on head end flange mount cylinders can be used as a pilot to locate the cylinders in relation to the machine. After alignment has been obtained, the flanges may be drilled for pins or dowels to prevent shifting.

3.2.5 – Trunnion Mountings – Cylinders require lubricated bearing blocks with minimum bearing clearances. Bearing blocks should be carefully aligned and rigidly mounted so the trunnions will not be subjected to bending moments. The rod end should also be pivoted with the pivot pin in line and parallel to axis of the trunnion pins.

3.2.6 – Clevis Mountings – Cylinders should be pivoted at both ends with centerline of pins parallel to each other. After cylinder is mounted, be sure to check to assure that the cylinder is free to swing through its working arc without interference from other machine parts.

4.0 Cylinder and Accessories Maintenance, Troubleshooting and Replacement

4.1 Storage – At times cylinders are delivered before a customer is ready to install them and must be stored for a period of time. When storage is required the following procedures are recommended.

4.1.1 – Store the cylinders in an indoor area which has a dry, clean and noncorrosive atmosphere. Take care to protect the cylinder from both internal corrosion and external damage.

4.1.2 – Whenever possible cylinders should be stored in a vertical position (piston rod up). This will minimize corrosion due to possible condensation which could occur inside the cylinder. This will also minimize seal damage.

4.1.3 – Port protector plugs should be left in the cylinder until the time of installation.

4.1.4 – If a cylinder is stored full of hydraulic fluid, expansion of the fluid due to temperature changes must be considered. Installing a check valve with free flow out of the cylinder is one method.

4.1.5 – When cylinders are mounted on equipment that is stored outside for extended periods, exposed unpainted surfaces, e.g. piston rod, must be coated with a rust-inhibiting compound to prevent corrosion.

4.2 Cylinder Trouble Shooting

4.2.1 – External Leakage

4.2.1.1 – Rod seal leakage can generally be traced to worn or damaged seals. Examine the piston rod for dents, gouges or score marks, and replace piston rod if surface is rough.

Rod seal leakage could also be traced to gland wear. If clearance is excessive, replace rod bushing and seal. Rod seal leakage can also be traced to seal deterioration. If seals are soft or gummy or brittle, check compatibility of seal material with lubricant used if air cylinder, or operating fluid if hydraulic cylinder. Replace with seal material, which is compatible with these fluids. If the seals are hard or have lost elasticity, it is usually due to exposure to temperatures in excess of 165°F. (+74°C). Shield the cylinder from the heat source to limit temperature to 350°F. (+177°C.) and replace with fluorocarbon seals.

4.2.1.2 – Cylinder body seal leak can generally be traced to loose tie rods. Torque the tie rods to manufacturer's recommendation for that bore size.

Excessive pressure can also result in cylinder body seal leak. Determine maximum pressure to rated limits. Replace seals and retorque tie rods as in paragraph above. Excessive pressure can also result in cylinder body seal leak. Determine if the pressure rating of the cylinder has been exceeded. If so, bring the operating pressure down to the rating of the cylinder and have the tie rods replaced.

Pinched or extruded cylinder body seal will also result in a leak. Replace cylinder body seal and retorque as in paragraph above.

Cylinder body seal leakage due to loss of radial squeeze which shows up in the form of flat spots or due to wear on the O.D. or I.D. – Either of these are symptoms of normal wear due to high cycle rate or length of service. Replace seals as per paragraph above.

4.2.2 – Internal Leakage

4.2.2.1 – Piston seal leak (by-pass) 1 to 3 cubic inches per minute leakage is considered normal for piston ring construction. Virtually no static leak with lipseal type seals on piston should be expected. Piston seal wear is a usual cause of piston seal leakage. Replace seals as required.

4.2.2.2 – With lipseal type piston seals excessive back pressure due to over-adjustment of speed control valves could be a direct cause of rapid seal wear. Contamination in a hydraulic system can result in a scored cylinder bore, resulting in rapid seal wear. In either case, replace piston seals as required.

4.2.2.3 – What appears to be piston seal leak, evidenced by the fact that the cylinder drifts, is not always traceable to the piston. To make sure, it is suggested that one side of the cylinder piston be pressurized and the fluid line at the opposite port be disconnected. Observe leakage. If none is evident, seek the cause of cylinder drift in other component parts in the circuit.

4.2.3 – Cylinder Fails to Move the Load

4.2.3.1 – Pneumatic or hydraulic pressure is too low. Check the pressure at the cylinder to make sure it is to circuit requirements.

4.2.3.2 – Piston Seal Leak – Operate the valve to cycle the cylinder and observe fluid flow at valve exhaust ports at end of cylinder stroke. Replace piston seals if flow is excessive.

4.2.3.3 – Cylinder is undersized for the load – Replace cylinder with one of a larger bore size.

4.3 Erratic or Chatter Operation

4.3.1 – Excessive friction at rod gland or piston bearing due to load misalignment – Correct cylinder-to-load alignment.

4.3.2 – Cylinder sized too close to load requirements – Reduce load or install larger cylinder.

4.3.3 – Erratic operation could be traced to the difference between static and kinetic friction. Install speed control valves to provide a back pressure to control the stroke.

4.4 Cylinder Modifications, Repairs, or Failed Component – Cylinders as shipped from the factory are not to be disassembled and or modified. If cylinders require modifications, these modifications must be done at company locations or by The Company's certified facilities. The Industrial Cylinder Division Engineering Department must be notified in the event of a mechanical fracture or permanent deformation of any cylinder component (excluding seals). This includes a broken piston rod, tie rod, mounting accessory or any other cylinder component. The notification should include all operation and application details. This information will be used to provide an engineered repair that will prevent recurrence of the failure.

It is allowed to disassemble cylinders for the purpose of replacing seals or seal assemblies. However, this work must be done by strictly following all the instructions provided with the seal kits.

Offer of Sale

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods, services or work described will be referred to as "Products".

1. Terms and Conditions. Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is subject to these Terms and Conditions or any newer version of the terms and conditions found on-line at www.parker.com/saleterms/. Seller objects to any contrary or additional terms or conditions of Buyer's order or any other document issued by Buyer.

2. Price Adjustments; Payments. Prices stated on Seller's quote or other documentation offered by Seller are valid for 30 days, and do not include any sales, use, or other taxes unless specifically stated. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and is due 30 days from the date of invoice or such other term as required by Seller's Credit Department, after which Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. Delivery Dates; Title and Risk; Shipment. All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon placement of the products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyer's request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

4. Warranty. Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of eighteen months from the date of delivery to Buyer. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 30 days after the date the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for an amount due on any invoice) must be commenced within 12 months from the date of the breach without regard to the date breach is discovered.

6. LIMITATION OF LIABILITY. UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

7. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

8. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, will be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer ordering the items manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

11. Improper use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright

infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

12. Cancellations and Changes. Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

13. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

15. Waiver and Severability. Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. Seller may immediately terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement (b) appoints a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or by a third party (d) makes an assignment for the benefit of creditors, or (e) dissolves or liquidates all or a majority of its assets.

17. Governing Law. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

18. Indemnity for Infringement of Intellectual Property Rights. Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

20. Compliance with Law, U. K. Bribery Act and U.S. Foreign Corrupt Practices Act. Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or countries of the Territory in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA") and the U.S. Anti-Kickback Act (the "Anti-Kickback Act"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that they are familiar with the provisions of the U. K. Bribery Act, the FCPA and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase products or otherwise benefit the business of Seller.