

Cunningham

SINCE 1949

HYDRAULIC CYLINDERS

MEDIUM PRESSURE



MODEL AO

1 1/2" THRU 6" BORES

MEDIUM DUTY CYLINDERS

Cunningham Heavy-Duty Cylinders are ruggedly built and are recommended where "pull" and "thrust" impact loads are above average and where operation is continuous and under "full" load operation.

HEAVY DUTY SPECIFICATIONS

- Steel Ends
- High Tensile Steel Piston Rods (Hard Chrome Plated)
- High Tensile Tie Rods
- Hytel Rod Wiper
- J I C Standard Construction and Dimensions
- NFPA Standards
- Urethane Rod and Piston Seals

CATALOG NO. 302 AO

Cunningham Manufacturing Co.

318 SOUTH WEBSTER STREET • SEATTLE, WASHINGTON 98108 • (206) 767-3713 • FAX (206) 762-3457

www.cunninghamcylinders.com

Cylinder Model Numbering System

FEATURE	DESCRIPTION	SYMBOL	EXAMPLE
BORE	IN INCHES.....		5 AO C P1 C 56-1 3 S 1000
SERIES	MEDIUM PRESSURE HYDRAULIC	AO	
CUSHIONS HEAD END	IF NO CUSHION IS REQUIRED IF CUSHION IS REQUIRED	N C	
MOUNTING STYLE	PARTIAL LISTING, SEE CATALOG. CAP FIXED CLEVIS CAP FIXED PIVOT HEAD TRUNNION CAP END TRUNNION ETC.	P1 P3 T1 T2	
CUSHIONS CAP END	IF NO CUSHION IS REQUIRED IF CUSHION IS REQUIRED	N C	
STROKE	IN INCHES	—	
ROD SIZE	STANDARD ROD DIAMETER FIRST OVERSIZE ROD OPTION SECOND OVERSIZE ROD OPTION THIRD OVERSIZE ROD OPTION ETC.	1 2 3 4	
ROD THREAD	“KK” STANDARD ROD THREAD “CC” FIRST OVERSIZE THD. “KK” FEMALE THREAD ANY NON-STANDARD THD.	1 2 3 4	
SPECIAL	USE FOR DOUBLE ROD END, ROD BOOT, STAINLESS ROD, STOP TUBE, ETC.	S	
WORKING PRESSURE	MODEL AO 1½" - 2" 2½" and 3¼" 4" - 6"	1500 1200 1000	

CMC does not authorize the approval of CMC cylinders in any of the following applications: aircraft, personnel lifts, aerial ladders, or amusement park devices.

Ordering Data Required for Model AO

QUANTITY

MOUNTING: Type

BORE: Diameter

STROKE: Length

ROD DIAMETER: See Table 3.

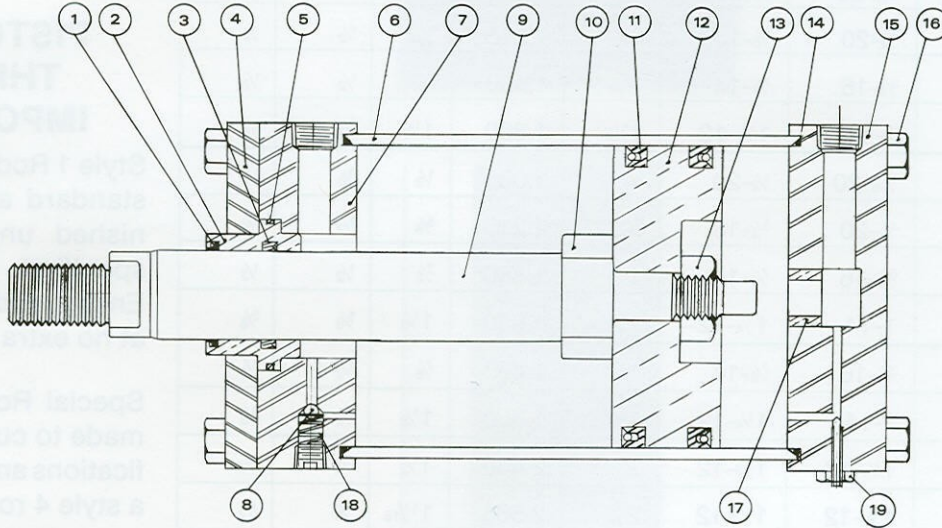
ROD THREAD: "KK" will be furnished unless otherwise specified.

CUSHIONING: Non-cushioned is standard. Self regulating cushions are optional.

PORT LOCATION: Standard No. 1 (top) position as indicated. 2, 3 and 4 Optional.

ROD END ATTACHMENTS: If desired.

SPECIAL FEATURES: Rod Boots, Stainless Rod, Water Service, etc.



MODEL AO – PARTS LIST

- AO-1 Rod wiper
- AO-2 Rod guide bushing
- AO-3 Rod packing
- AO-4 Clamp plate
- AO-5 Bushing seal
- AO-6 Cylinder tube
- AO-7 Rod end cap
- AO-8 Stainless ball
- AO-9 Piston rod

- AO-10 Rod cushion bushing
- AO-11 Piston seals
- AO-12 Piston
- AO-13 Piston nut
- AO-14 Tube seals
- AO-15 Blind end cap
- AO-16 Tie rod nut and tie rods
- AO-17 Blind end cushion bushing
- AO-18 Check valve spring
- AO-19 Cushion adjusting screw (optional)

IMPORTANT: When ordering parts, please give complete nameplate data as to bore, stroke, rod diameter, if cushioned.

Items 8, 10, 17, and 18 are for cushioned cylinders only.

MODEL AO CYLINDER PRESSURE RATING

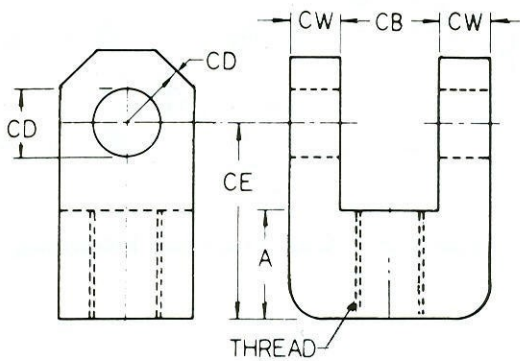
1½ & 2 inch Bores @ 1500 psi 2½ & 3¼ inch Bores @ 1200 psi

4, 5 & 6 inch Bores @ 1000 psi

RECOMMENDED TIE ROD TORQUE FOR MODEL "AO" CYLINDERS

BORE	1½	2	2½	3	3¼	4	5	6
TORQUE (Foot Lbs.)	12	22	22	35	35	40	65	75
TIE ROD DIA.	¼	5/16	5/16	3/8	3/8	3/8	½	½

MOUNTING ACCESSORIES



Rod End Clevis – Table 5C

Table 5-C
ROD CLEVIS DIMENSIONS

CLEVIS NO.	THREAD	A	CE	CD	CB	CW
211	7/16-20	3/4	1 1/2	1/2	13/16	1/2
212	1/2-20	3/4	1 1/2	1/2	13/16	1/2
213	5/8-18	3/4	1 1/2	1/2	13/16	1/2
221	3/4-16	1 1/8	2 1/8	3/4	1 5/16	5/8
222	7/8-14	1 1/8	2 1/8	3/4	1 5/16	5/8
223	1-14	1 1/8	2 1/8	3/4	1 5/16	5/8
221N	3/4-16	1 1/8	2 3/8	3/4	1 5/16	5/8
231N	1-14	1 5/8	3 1/8	1	1 9/16	3/4
231	1-14	1 5/8	2 15/16	1	1 9/16	3/4
232	1 1/4-12	1 5/8	2 15/16	1	1 9/16	3/4
233	1 1/2-12	1 5/8	2 15/16	1	1 9/16	3/4
241	1 1/4-12	2	3 3/4	1 3/8	2 1/16	1
242	1 1/2-12	2	3 3/4	1 3/8	2 1/16	1
243	1 3/4-12	2	3 3/4	1 3/8	2 1/16	1
251	1 1/2-12	2 1/4	4 1/2	1 3/4	2 9/16	1 1/4
252	1 3/4-12	2 1/4	4 1/2	1 3/4	2 9/16	1 1/4
253	1 7/8-12	2 1/4	4 1/2	1 3/4	2 9/16	1 1/4
254	2-12	2 1/4	4 1/2	1 3/4	2 9/16	1 1/4

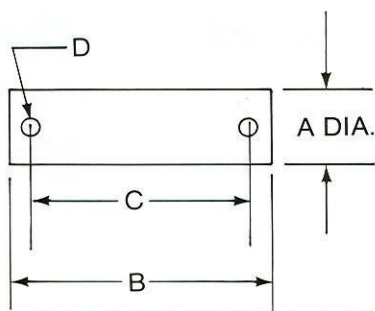
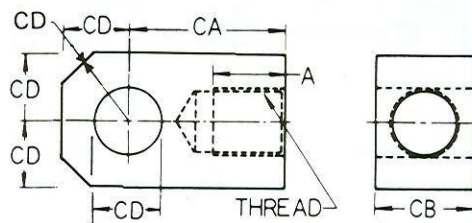


Table 5-D
CLEVIS PIN DIMENSIONS

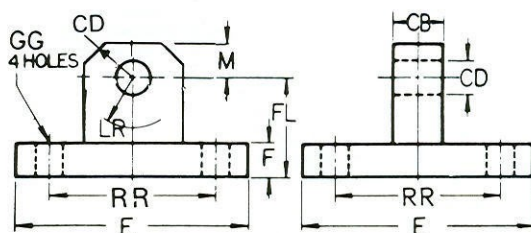
A DIA.	PIN NO.	B	C	D
1/2"	1	2 3/8	2	9/64
3/4"	2	3 1/8	2 3/4	9/64
1"	3	3 3/4	3 1/4	13/64
1 3/8"	4	4 3/4	4 1/4	13/64
1 3/4"	5	6	5 1/2	13/64
2"	6	6	5 1/2	13/64



Rod End Eye – Table 5A

Table 5-A
PIVOT ROD EYE DIMENSIONS

EYE NO.	THREAD	A	CA	CD	CB
111	7/16-20	3/4	1 1/2	1/2	3/4
112	1/2-20	3/4	1 1/2	1/2	3/4
121	3/4-16	1 1/8	2 1/16	3/4	1 1/4
122	7/8-14	1 1/8	2 1/16	3/4	1 1/4
132	7/8-14	1 1/8	2 3/8	1	1 1/2
133	1-14	1 5/8	2 13/16	1	1 1/2
134	1 1/4-12	1 5/8	2 13/16	1	1 1/2
141	1 1/4-12	2	3 7/16	1 3/8	2
142	1 1/2-12	2	3 7/16	1 3/8	2
151	1 1/2-12	2 1/4	4	1 3/4	2 1/2
152	1 3/4-12	2 1/4	4	1 3/4	2 1/2
161	1 7/8-12	3	5	2	2 1/2



Pivot Bracket Base – Table 5B

NOTE: Clevis Bracket Base also Available.

Table 5-B
PIVOT BRACKET BASE DIMENSIONS

BRACKET NO.	CD	CB	F	FL	M	E	RR	LR	GG
1	1/2	3/4	3/8	1 1/8	1/2	2 1/2	1.63	3/4	13/32
2	3/4	1 1/4	5/8	1 7/8	3/4	3 1/2	2.55	1 1/4	17/32
3	1	1 1/2	3/4	2 1/4	1	4 1/2	3.25	1 1/2	21/32
4	1 3/8	2	7/8	3	1 3/8	5	3.82	2 1/8	21/32
5	1 3/4	2 1/2	7/8	3 1/8	1 3/4	6 1/2	4.95	2 1/4	29/32
6	2	2 1/2	1	3 1/2	2	7 1/2	5.73	2 1/2	1 1/16

**Table 3
ROD END DIMENSIONS**

BORE	ROD DIA. 'MM'	STD. KK THD.	OPT. CC THD.	A	B +.000 - .002	D	ROD DIM. C	BRG. DIM. V
1½	⅝	7/16-20	½-20	¾	1.085	½	¾	¼
	¾	½-20	⅝-18	¾	1.210	⅝	½	¼
	1"	¾-16	⅞-14	1⅛	1.460	⅞	½	½
2	⅝	7/16-20	½-20	¾	1.085	½	¾	¼
	¾	½-20	⅝-18	¾	1.210	⅝	½	¼
	1"	¾-16	⅞-14	1⅛	1.460	⅞	½	½
	1⅜	1-14	1¼-12	1⅝	1.860	1⅛	⅝	⅝
2½	⅝	7/16-20	½-20	¾	1.085	½	¾	¼
	¾	½-20	⅝-18	¾	1.210	⅝	½	¼
	1	¾-16	⅞-14	1⅛	1.460	⅞	½	½
	1⅜	1-14	1¼-12	1⅝	1.860	1⅛	⅝	⅝
3¼	1	¾-16	⅞-14	1⅛	1.460	⅞	½	¼
	1⅜	1-14	1¼-12	1⅝	1.860	1⅛	⅝	⅝
	1¾	1¼-12	1½-12	2	2.460	1½	¾	½
	2	1½-12	1¾-12	2¼	2.585	1⅞	⅞	½
4	1	¾-16	⅞-14	1⅛	1.460	⅞	½	¼
	1⅜	1-14	1¼-12	1⅝	1.860	1⅛	⅝	⅝
	1¾	1¼-12	1½-12	2	2.460	1½	¾	½
	2	1½-12	1¾-12	2¼	2.585	1⅞	⅞	½
	2½	1⅞-12	2-12	3	3.085	2⅞	1	⅝
5	1	¾-16	⅞-14	1⅛	1.460	⅞	½	¼
	1⅜	1-14	1¼-12	1⅝	1.860	1⅛	⅝	⅝
	1¾	1¼-12	1½-12	2	2.460	1½	¾	½
	2	1½-12	1¾-12	2¼	2.585	1⅞	⅞	½
	2½	1⅞-12	2-12	3	3.085	2⅞	1	⅝
6	1⅜	1-14	1¼-12	1⅝	1.860	1⅛	⅝	¼
	1¾	1¼-12	1½-12	2	2.460	1½	¾	⅝
	2	1½-12	1¾-12	2¼	2.585	1⅞	⅞	⅝
	2½	1⅞-12	2-12	3	3.085	2⅞	1	⅝

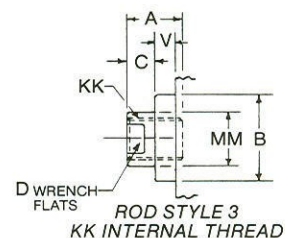
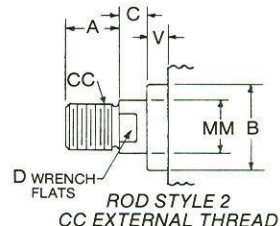
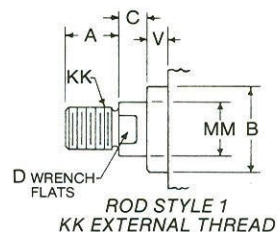
PORT LOCATION:

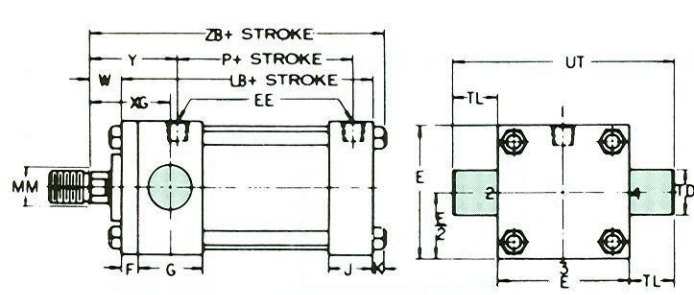
Standard No. 1 Position as shown. Other positions, 2, 3, or 4 optional, no charge. "AN" and SAE Ports available.

**PISTON ROD THREADS
IMPORTANT:**

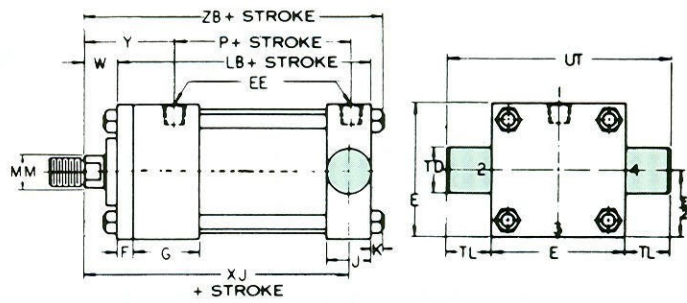
Style 1 Rod Thread (KK) is standard and will be furnished unless otherwise specified. Alternate Rod Ends 2 and 3 are available at no extra charge.

Special Rod Ends will be made to customer's specifications and designated as a style 4 rod end.

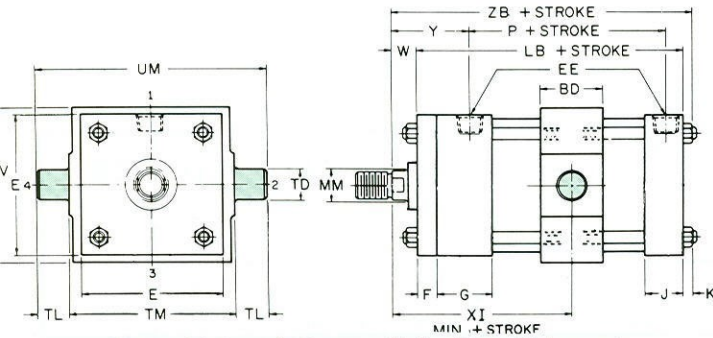




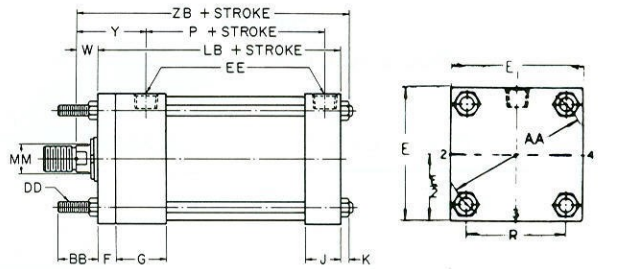
Type T-1 — Head Trunnion Mounting



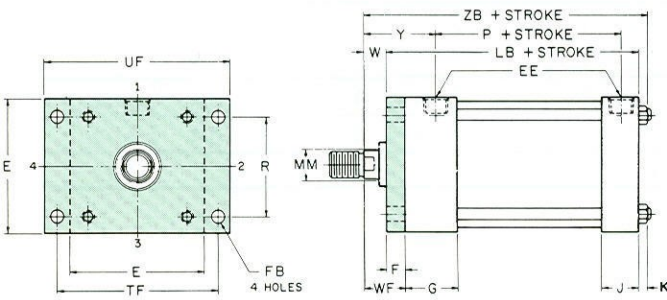
Type T-2 — Cap Trunnion Mounting



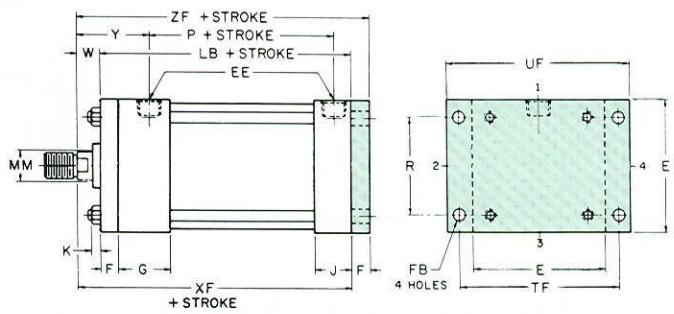
Type T-4 — Intermediate Fixed Trunnion Mounting



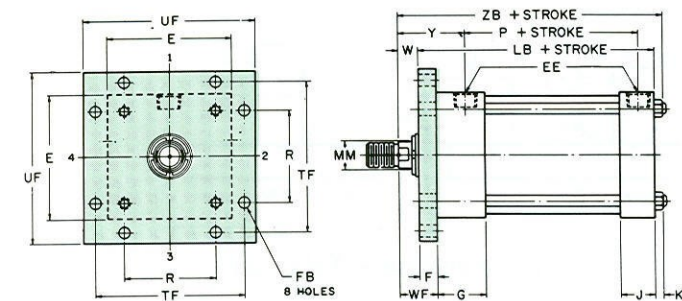
Type X3 — Head Tie Rods Extended Mounting
Type X1 — BOTH ENDS **Type X2 — CAP END**



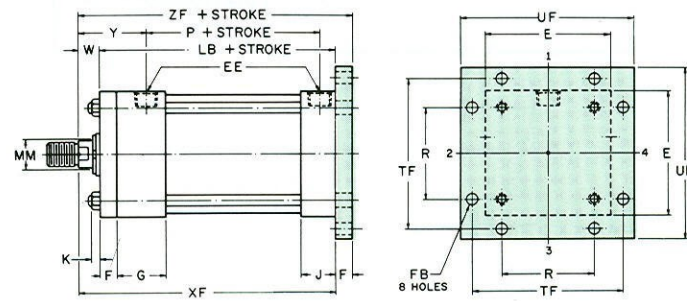
Type F-1 — Head Rectangular Flange Mounting



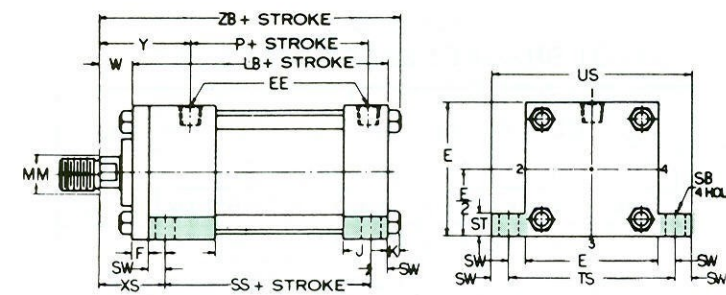
Type F-2 — Cap Rectangular Flange Mounting



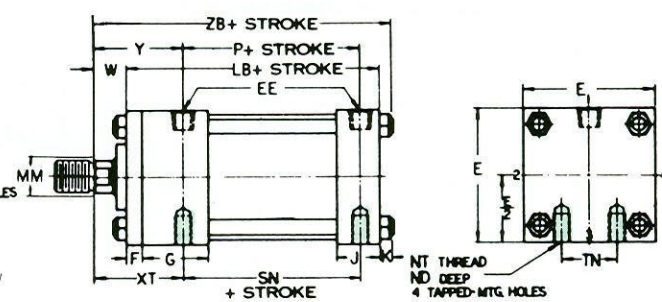
Type F-5 — Head Square Flange



Type F-6 — Cap Square Flange



Type S-2 — Side Lugs Mounting



Type S-4 — Side Tapped Mounting



MODEL AO HYDRAULIC CYLINDERS

1½" THRU 6" BORE

(7" Bores and Larger are available)

QUALITY FEATURES

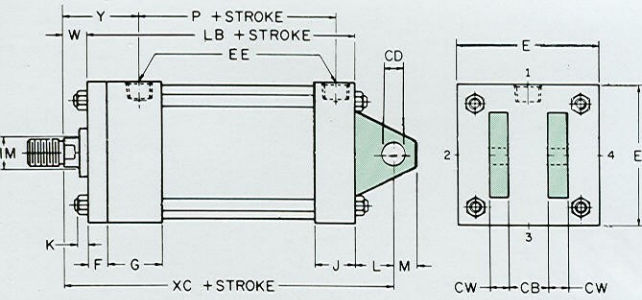
- 660 bronze rod bearing.
- 100,000 PSI min. yield, hard chrome plated rod.
- 68,000 min. yield, steel tube, honed on ID to 16 RMS finish.
- Hytrel or brass rod wiper.
- Urethane rod seal with 'O' ring expander.
- 100,000 psi min. yield tie rods with Grade 8 tie rod nuts.
- Precision finished steel end caps machined on CNC turret lathes.
- Non-ferrous pistons for excellent wear characteristics.
- Oversize cushion ball check standard.
- Piston seals are urethane "U" cups with "O" ring expander for positive sealing and long life.
- Cushions on the Model AO are the self-regulating type, adjustable cushions are available as an option.

Table 2
ENVELOPE & MOUNTING DIMENSIONS

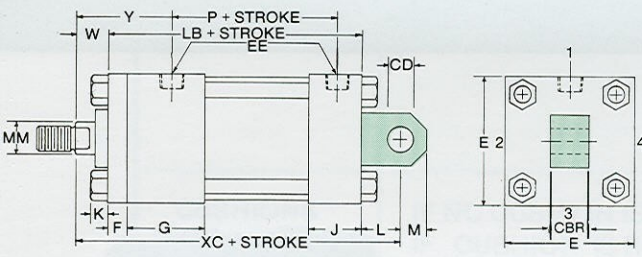
Bore	Rods	Y	W	XA	XC	XF	XG	Min. XI	XJ	XS	XT	ZB	ZF	ZL	ZM
1 1/2	5/8*	1 15/16	5/8	5 5/8	5 3/8	4 5/8	1 3/4	3 1/8	4 1/8	1 3/8	1 15/16	4 7/8	5	5 3/4	6 1/8
	3/4	2 1/16	3/4	5 3/4	5 1/2	4 3/4	1 7/8	3 1/4	4 1/4	1 1/2	2 1/16	5	5 1/8	5 7/8	6 3/8
	1**	2 5/16	1	6	5 3/4	5	2 1/8	3 1/2	4 1/2	1 3/4	2 5/16	5 1/4	5 3/8	5 3/4	6 7/8
2	5/8*	1 15/16	5/8	5 5/8	5 3/8	4 5/8	1 3/4	3 1/4	4 1/8	1 3/8	1 15/16	4 15/16	5	5 13/16	6 1/8
	3/4	2 1/16	3/4	5 3/4	5 1/2	4 3/4	1 7/8	3 3/8	4 1/4	1 1/2	2 1/16	5 1/16	5 1/8	5 15/16	6 3/8
	1	2 5/16	1	6	5 3/4	5	2 1/8	3 5/8	4 1/2	1 3/4	2 5/16	5 5/16	5 3/8	6 3/16	6 7/8
	1 3/8**	2 9/16	1 1/4	6 1/4	6	5 1/4	2 3/8	3 7/8	4 3/4	2	2 9/16	5 9/16	5 5/8	6 7/16	7 3/8
2 1/2	5/8*	1 15/16	5/8	5 3/4	5 1/2	4 3/4	1 3/4	3 1/4	4 1/4	1 3/8	1 15/16	5 1/16	5 1/8	5 15/16	6 1/4
	3/4	2 1/16	3/4	5 7/8	5 5/8	4 7/8	1 7/8	3 3/8	4 3/8	1 1/2	2 1/16	5 3/16	5 1/4	6 1/16	6 1/2
	1	2 5/16	1	6 1/8	5 7/8	5 1/8	2 1/8	3 5/8	4 5/8	1 3/4	2 5/16	5 7/16	5 1/2	6 5/16	7
	1 3/8	2 9/16	1 1/4	6 3/8	6 1/8	5 3/8	2 3/8	3 7/8	4 7/8	2	2 9/16	5 11/16	5 3/4	6 9/16	7 1/2
3 1/4	1*	2 7/16	3/4	6 7/8	6 7/8	5 5/8	2 1/4	4 1/8	5	1 7/8	2 7/16	6	6 1/4	7 1/8	7 1/2
	1 3/8	2 11/16	1	7 1/8	7 1/8	5 7/8	2 1/2	4 3/8	5 1/4	2 1/8	2 11/16	6 1/4	6 1/2	7 3/8	8
	1 3/4	2 15/16	1 1/4	7 3/8	7 3/8	6 1/8	2 3/4	4 5/8	5 1/2	2 3/8	2 15/16	6 1/2	6 3/4	7 5/8	8 1/2
	2	3 1/16	1 3/8	7 1/2	7 1/2	6 1/4	2 7/8	4 3/4	5 5/8	2 1/2	3 1/16	6 5/8	6 7/8	7 3/4	8 3/4
4	1*	2 7/16	3/4	6 7/8	6 7/8	5 5/8	2 1/4	4 1/8	5	1 7/8	2 7/16	6	6 1/4	7 1/8	7 1/2
	1 3/8	2 11/16	1	7 1/8	7 1/8	5 7/8	2 1/2	4 3/8	5 1/4	2 1/8	2 11/16	6 1/4	6 1/2	7 3/8	8
	1 3/4	2 15/16	1 1/4	7 3/8	7 3/8	6 1/8	2 3/4	4 5/8	5 1/2	2 3/8	2 15/16	6 1/2	6 3/4	7 5/8	8 1/2
	2	3 1/16	1 3/8	7 1/2	7 1/2	6 1/4	2 7/8	4 3/4	5 5/8	2 1/2	3 1/16	6 5/8	6 7/8	7 3/4	8 3/4
	2 1/2	3 5/16	1 5/8	7 3/4	7 3/4	6 1/2	3 1/8	5	5 7/8	2 3/4	3 5/16	6 7/8	7 1/8	8	9 1/4
5	1*	2 7/16	3/4	7 1/4	7 1/8	5 7/8	2 1/4	4 1/8	5 1/4	2 1/16	2 7/16	6 5/16	6 1/2	7 7/16	7 3/4
	1 3/8	2 11/16	1	7 1/2	7 3/8	6 1/8	2 1/2	4 3/8	5 1/2	2 5/16	2 11/16	6 9/16	6 3/4	7 11/16	8 1/4
	1 3/4	2 15/16	1 1/4	7 3/4	7 5/8	6 3/8	2 3/4	4 5/8	5 3/4	2 9/16	2 15/16	6 13/16	7	7 15/16	8 3/4
	2	3 1/16	1 3/8	7 7/8	7 3/4	6 1/2	2 7/8	4 3/4	5 7/8	2 11/16	3 1/16	6 15/16	7 1/8	8 1/16	9
	2 1/2	3 5/16	1 5/8	8 1/8	8	6 3/4	3 1/8	5	6 1/8	2 15/16	3 5/16	7 3/16	7 3/8	8 5/16	9 1/2
6	1 3/8*	2 13/16	7/8	8	8 1/8	6 5/8	2 5/8	4 7/8	5 7/8	2 5/16	2 13/16	7 1/16	7 3/8	8 5/16	8 3/4
	1 3/4	3 1/16	1 1/8	8 1/4	8 3/8	6 7/8	2 7/8	5 1/8	6 1/8	2 9/16	3 1/16	7 5/16	7 5/8	8 9/16	9 1/4
	2	3 3/16	1 1/4	8 3/8	8 1/2	7	3	5 1/4	6 1/4	2 11/16	3 3/16	7 7/16	7 3/4	8 11/16	9 1/2
	2 1/2	3 7/16	1 1/2	8 5/8	8 3/4	7 1/4	3 1/4	5 1/2	6 1/2	2 15/16	3 7/16	7 11/16	8	8 15/16	10

*Standard Rod Diameter

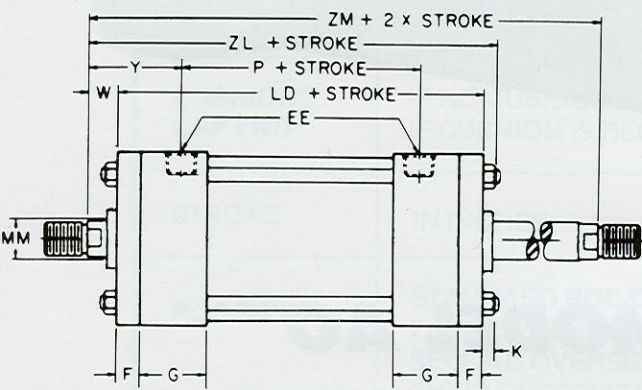
**Cushion Not Available Rod End



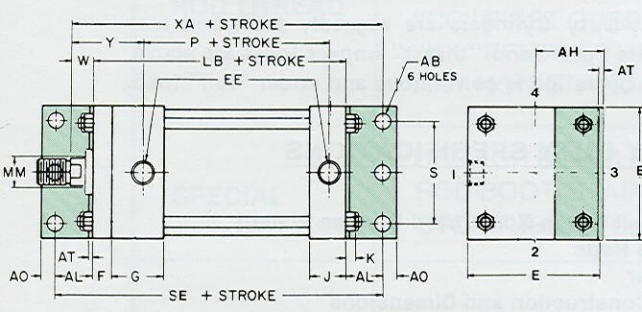
Type P-1 — Cap Fixed Clevis Mounting



Type P-3 — Cap Fixed Pivot



Type DRE — Basic Double Rod Extension



Type S-1 — Side End Angles Mounting

MODEL AO: Non-Cushioned Standard. Self regulating cushions are optional.

Adjustable cushions are also an option.

**Table 1
ENVELOPE & MOUNTING DIMENSIONS**

CYLINDER BORE							
	1½	2	2½	3¼	4	5	6
AA	2.02	2.60	3.10	3.90	4.70	5.80	6.90
AB	7/16	7/16	7/16	9/16	9/16	11/16	13/16
AH	13/16	1 7/16	1 5/8	1 15/16	2 1/4	2 3/4	3 1/4
AL	1	1	1	1 1/4	1 1/4	1 3/8	1 3/8
AO	3/8	3/8	3/8	1/2	1/2	5/8	5/8
AT	1/8	1/8	1/8	1/8	1/8	3/16	3/16
BB	1	1 1/8	1 1/8	1 3/8	1 3/8	1 13/16	1 13/16
BD	1 1/4	1 1/2	1 1/2	2	2	2	2 1/2
CB	13/16	13/16	13/16	1 5/16	1 5/16	1 5/16	1 9/16
CBR	3/4	3/4	3/4	1 1/4	1 1/4	1 1/4	1 1/2
±CD	.501	.501	.501	.751	.751	.751	1.001
CW	1/2	1/2	1/2	5/8	5/8	5/8	3/4
DD	1/4-28	5/16-24	5/16-24	3/8-24	3/8-24	1/2-20	1/2-20
E	2	2 1/2	3	3 3/4	4 1/2	5 1/2	6 1/2
EE	3/8	3/8	3/8	1/2	1/2	1/2	3/4
NPT(F)							
F	3/8	3/8	3/8	5/8	5/8	5/8	3/4
FB	5/16	3/8	3/8	7/16	7/16	9/16	9/16
G	1 1/2	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	2
J	1	1	1	1 1/4	1 1/4	1 1/4	1 1/2
K	1/4	5/16	5/16	3/8	3/8	7/16	7/16
L	3/4	3/4	3/4	1 1/4	1 1/4	1 1/4	1 1/2
LB	4	4	4 1/8	4 7/8	4 7/8	5 1/8	5 3/4
LD	4 7/8	4 7/8	5	6	6	6 1/4	7
M	1/2	1/2	1/2	3/4	3/4	3/4	1
ND	3/8	3/8	1/2	3/4	3/4	15/16	1 1/8
NT	1/4-20	5/16-18	3/8-16	1/2-13	1/2-13	5/8-11	3/4-10
P	2 1/4	2 1/4	2 3/8	2 5/8	2 5/8	2 7/8	3 1/8
R	1.43	1.84	2.19	2.76	3.32	4.10	4.88
S	1 1/4	1 3/4	2 1/4	2 3/4	3 1/2	4 1/4	5 1/4
SB	7/16	7/16	7/16	9/16	9/16	13/16	13/16
SE	6	6	6 1/8	7 3/8	7 3/8	7 7/8	8 1/2
SN	2 1/4	2 1/4	2 3/8	2 5/8	2 5/8	2 7/8	3 1/8
SS	2 7/8	2 7/8	3	3 1/4	3 1/4	3 1/8	3 5/8
ST	1/2	1/2	1/2	3/4	3/4	1	1
SW	3/8	3/8	3/8	1/2	1/2	11/16	11/16
*TD	1.000	1.000	1.000	1.000	1.000	1.000	1.375
TF	2 3/4	3 3/8	3 7/8	4 11/16	5 7/16	6 5/8	7 5/8
TL	1	1	1	1	1	1	1 3/8
TM	2 1/2	3	3 1/2	4 1/2	5 1/4	6 1/4	7 5/8
TN	5/8	7/8	1 1/4	1 1/2	2 1/16	2 11/16	3 1/4
TS	2 3/4	3 1/4	3 3/4	4 3/4	5 1/2	6 7/8	7 7/8
UF	3 3/8	4 1/8	4 5/8	5 1/2	6 1/4	7 5/8	8 5/8
UM	4 1/2	5	5 1/2	6 1/2	7 1/4	8 1/4	10 3/8
US	3 1/2	4	4 1/2	5 3/4	6 1/2	8 1/4	9 1/4
UT	4	4 1/2	5	5 3/4	6 1/2	7 1/2	9 1/4
UV	2 1/2	3	3 1/2	4 1/4	5	6	7

ALL DIMENSIONS IN INCHES

± .006 — .000

* Oversize Trunnion Journals available on request.

Journal Tolerance +.000" Standard
-.002"