Unit 11 Sketchley Meadows
Sketchley Meadows Industrial Estate
Hinckley, Leicestershire LE10 3EN

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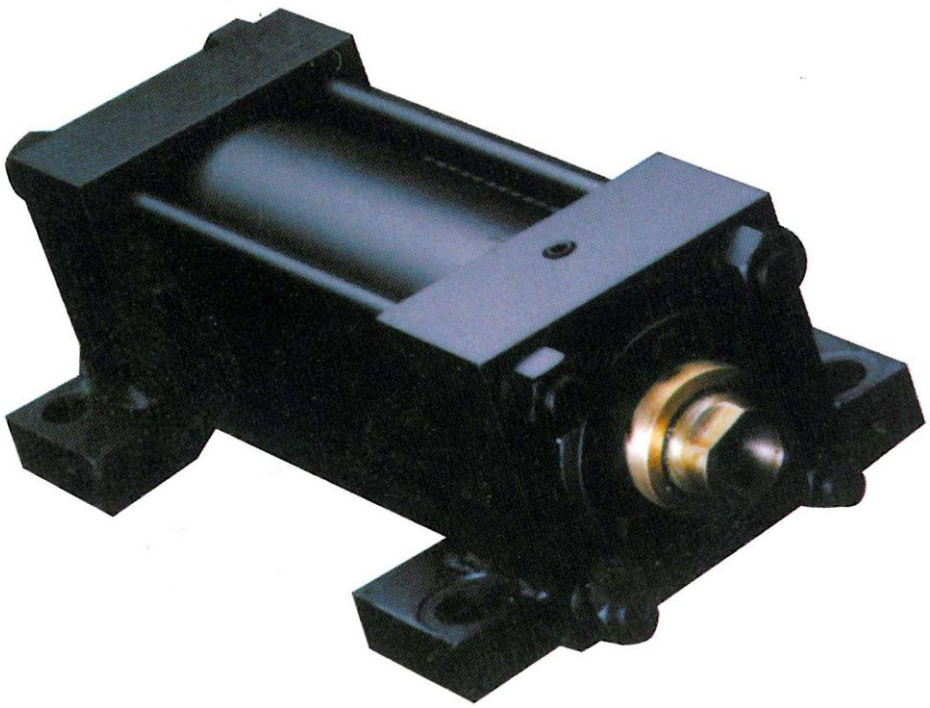


HY Series Cylinders

JIC/NFPA INTERCHANGEABLE
3000/5000 PSI RATED
1 ½” THRU 14” BORE

HOW TO ORDER

TO INSURE ACCURACY, PLEASE FILL IN THE APPROPRIATE INFORMATION WHEN PLACING AN ORDER OR INQUIRY.

5	HY	MPI	SR	04.00	015.50	CC	01.750	#2	U	NPT	3000
QUANTITY	SERIES	MOUNT	SNGL ROD OR DBL ROD	BORE SIZE IN INCHES	STROKE LENGTH	CUSHIONS	ROD DIA. IN INCHES	ROD END	PISTON SEALS	PORT	PSI

MOUNT:
MP1, MP2, MP3, MPU3
MT1, MT2, MT4
MF1, MF2, MF5, MF6
IH3, IH4, ME5, ME6
MS2, MS3, MS4
MX0, MX1, MX2, MX3
or XXX if special

BORE SIZE IN INCHES:
01.50
02.00
02.50
03.25
04.00
05.00
06.00
07.00
08.00
10.00
12.00
14.00

ROD DIA. IN INCHES:
00.625
01.000
01.375
01.750
02.000
02.500
03.000
03.500
04.000
04.500
05.000
05.500
07.000
08.000
10.000

PORT:
BSP
NPT
SAE
or
XXX
if SPECIAL

PSI:
OPERATING PRESSURE

DOUBLE ROD CYL:
"DE" if DOUBLE ROD,
"SR" if SINGLE ROD CYL.

NET STROKE:
INDICATE IN "INCHES,"

CUSHIONS:
"CC": CUSHION BOTH ENDS
"CR": CUSHION ROD END
"CB": CUSHION BLIND END
"NC": NON-CUSHIONED

ROD END STYLE:
#1, FULL MALE
#2, SMALL MALE STNDRD
#3, FEMALE
#4, PLAIN
#5, INTERMEDIATE MALE
#6, COLLAR TYPE
#7, METRIC (CALLOUT THRD REQ'D.)
"X" if special

PISTON SEALS:
"U": U-CUP SEALS
"R": CAST IRON RINGS
"X": if SPECIAL

NOTES:

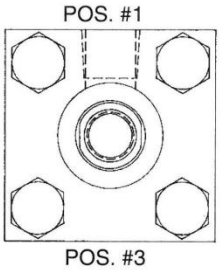
OTHER MODIFICATIONS AVAILABLE
(Please list in body of cylinder description:)

- ☐ Drainback Pos. ____
- ☐ Extended Key. Plate
- ☐ _____ Stop Tube Length
  _____ Gross Stroke
- ☐ Tie Rod Supports
- ☐ Tie Rod Mounting Supports
- ☐ Protective Rod Boot
- ☐ Oversize Ports (Welded Boss)
- ☐ 4-Bolt 3000 PSI Flange Fitted Ports
- ☐ Air Bleeders, Both Ends, Pos. _____
- ☐ Air Bleed, Rod End, Pos. _____
- ☐ Air Bleed, Blind End, Pos. _____
- ☐ Any Other Modifications

PORT POSITION:

ROD END _____

BLIND END _____

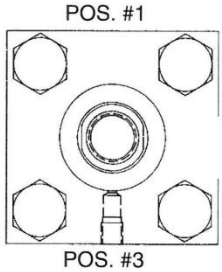


CUSHION ADJUSTMENT POSITION:

ROD END _____

BLIND END _____

NORMAL CUSHION ADJUSTMENT (MOUNTING PERMITING) IS OPPOSITE THE PORT POSITION



Fluids and Seals Data

FLUIDS

Hydraulic fluid heats, cools, lubricates, and sometimes corrodes mechanical components; picks up and releases gases; and forces sludge into otherwise free clearances. A major portion of hydraulic problems stem from the use of improper types of fluids or fluids containing dirt and other contaminants.

To understand the fluids used in today's industry, you have to divide them into two general areas: petroleum fluids and fire resistant fluids. These in turn break down into a number of different types with different properties. Not all fluids are compatible with the standard seal materials offered.

In the chart below is a small sample of the fluids available and the seals with which they are compatible. Specific information on seal compatibility is available from either the fluid suipplier or SWP.

SEALS

Buna Seals

This seal is generally recommended for:
• Petroleum • Water • Water-Glycol

This type of seal is excellent with petroleum products. Buna is rated for a temperature range from -65°F to +250°F, but when used for low temperatures, it is necessary to sacrifice some low temperature resiliency. It is superior material for compression set, cold flow, tear and abrasion resistance.

Polyurethane Seals

This seal is generally recommended for:
• Petroleum • Water/Oil • Phosphate Ester

The polyurethane seal provides excellent mechanical and physical properties. Polyurethane does not provide a good low pressure seal, due to its poor compression and permanent set properties. Polyurethane seals are rated from -30°F to +225°F.

Ethylene Propylene Seals

This seal is generally recommended for:
• Phosphate Ester • Steam (to 400°F)
• Water • Brake Fluids

This seal is excellent when used with Skydrol 500 and Phosphate Ester Fluids. EPR is rated for a temperature range from -65°F to +350°F.

Viton Seals

This seal is generally recommended for:
• Petroleum • Silicate Ester • Most Phosphate Esters
• Ethylene Glycol • Silicone Oils

Viton seals are compatible with a wide range of fluids and are rated for a temperature range from -20°F to +400°F.

HIGH PRESSURE HYDRAULIC CYLINDER INTERCHANGEABILITY CHART

MOUNTING DESCRIPTION	NFPA CODE	AIR-DRO	PARKER	MILLER	HYDRO-LINE	VICKERS/TJ	SHEFFER	ORTMAN	MILWAUKEE	HANNA
PLAIN NO TIE ROD EXTENSION	MXO	HY-MX0	2H-T	H-50	N2K or N5K	SH-9 TG-24	HH-NX	3TH	H-11	H-MX0
SIDE TAPPED	MS4	HY-MS4	2H-F	H-74	N2B or N5B	SH-1A TG-02	HH-SF	3THH	H-41	H-MS4
SIDE LUGS	MS2	HY-MS2	2H-C	H-72	N2A or N5A	SH-1 TG-01	HH-SL	3THJ	H-42	H-MS2
CENTERLINE LUGS	MS3	HY-MS3	2H-E	H-73	N2H or N5H	----	HH-CL	3THK	H-51	H-MS3
SIDE END LUGS	MS7	HY-MS7	2H-G	H-77	N2E or N5E	----	----	3THCC	H-43	H-MS7
HEAD RECTANGULAR FLANGE	MF1	HY-MF1	2H-J	H-61	N2F or N5F	SH-2 TG-07	HH-FF	3THB	H-31	H-MF1
HEAD RECTANGULAR	ME5	HY-ME5	----	---	N2G or N5G	---- TG-09	HH-FHF	----	H-35	H-ME5
CAP RECTANGULAR FLANGE	MF2	HY-MF2	2H-H	H-62	N2R or N5R	SH-4 TG-12	HH-RF	3THA	H-32	H-MF2
CAP RECTANGULAR	ME6	HY-ME6	----	---	N2P or N5P	---- TG-14	HH-RHF	----	H-36	H-ME6
HEAD SQUARE FLANGE	MF5	HY-MF5	2H-JB	H-65	N2J or N5J	SH-2B TG-08	HH-FFX	3THBB	H-21	H-MF5
CAP SQUARE FLANGE	MF6	HY-MF6	2H-HB	H-66	N2S or N5S	SH-4B TG-13	HH-RFX	3THAA	H-22	H-MF6
BOTH ENDS TIE RODS EXTENDED	MX1	HY-MX1	2H-TD	H-51	N2L or N5L	SH-9BE TG-23	HH-BX	3THL	H-10	H-MX1
HEAD TIE RODS EXTENDED	MX3	HY-MX3	2H-TB	H-53	N2M or N5M	SH-9R TG-22	HH-FX	3THM	H-12	H-MX3
CAP TIE RODS EXTENDED	MX2	HY-MX2	2H-TC	H-52	N2N or N5N	SH-9B TG-21	HH-RX	3THN	H-13	H-MX2
HEAD TRUNNION	MT1	HY-MT1	2H-D	H-81	N2U or N5U	SH-5R TG-17	HH-TF	3THER	H-71	H-MT1
CAP TRUNNION	MT2	HY-MT2	2H-DB	H-82	N2W or N5W	SH-5B TG-16	HH-TR	3THEB	H-72	H-MT2
INTERMEDIATE FIXED TRUNNION	MT4	HY-MT4	2H-DD	---	N2TT or N5TT	---- TG-15	HH-T Except on 4	3THE	----	----
CAP FIXED CLEVIS	MP1	HY-MP1	2H-BB	H-84	N2C or N5C	TG-10	HH-C	3THG	H-61	H-MP1
CAP DETACHABLE	MP2	HY-MP2	2H-BC	H-86	N2DC or N5DC	----	----	----	----	----
HEAD SQUARE	1H3	HY-1H3	----	---	----	----	----	----	----	----
CAP SQUARE	1H4	HY-1H4	----	---	----	----	----	----	----	----

SEAL COMPATIBILITY WITH COMMON FLUIDS

Fluid Name	Trade Name	Buna	Polyurethane	EPR	Viton
Automotive Brake Fluids	–	3	4	1	4
Diesel Oil	–	1	3	4	1
Ethylene Glycol	–	1	2	1	1
Gasoline	–	1	2	4	1
Jet Fuel	JP-4, 5, 6	1	2	4	1
Kerosene	–	1	1	4	1
Petroleum Oil < 250ºF	Preservation Oil	1	2	4	1
> 250ºF	AIRCRAFT HYD. FLUID	4	4	4	2
Phosphate Ester	Houghto-Safe 1010 Series	4	X	1	1
	Houghto-Safe 1120 Series	4	4	2	1
	Pyrogard 53	4	4	1	1
	Skydrol 500 B4	4	4	1	4
	Skydrol LD-4	4	4	1	4
Silicate Esters	–	2	1	4	1
Silicone Oils	–	1	1	1	1
Water (Fresh)	–	1	4	1	2
Water (Salt)	–	1	4	1	2
Water Glycol	Houghto Safe 600 Series	1	4	1	2
	Houghto Safe 500 Series	1	X	1	X
	Houghto-Safe 271 Series	1	4	1	2
	Ucon Hydrolube	1	X	1	1
	Celluguard	1	4	1	1
WaterOi/Emulsion	Houghto-Safe 5040	1	4	4	1
	Gulf FR Fluids	1	1	4	1

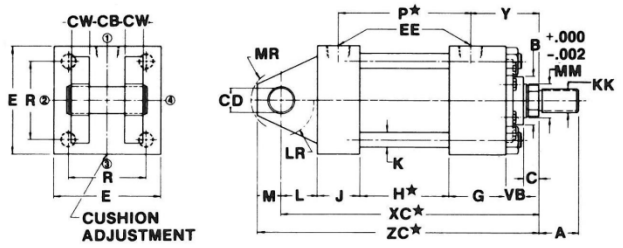
SEAL COMPATIBILITY CODE

1. Satisfactory
2. Fair (usually ok for a static seal)
3. Doubtful (sometimes ok for a static seal)
4. Unsatisfactory

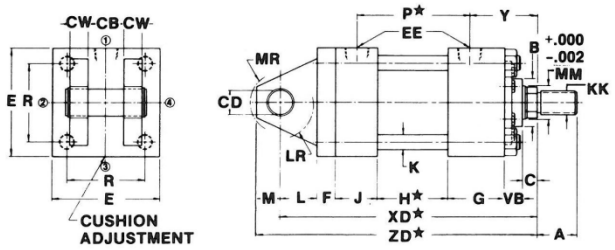
X. Insufficient Data

All Dimensions in Inches

HY-MP1

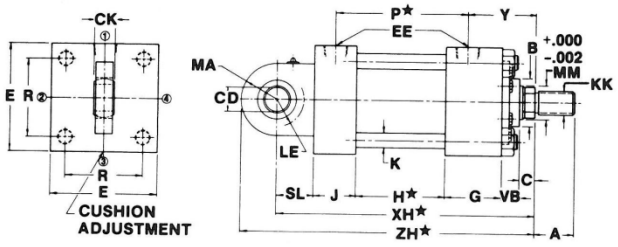


HY-MP2



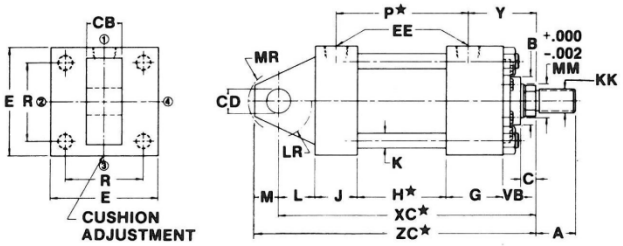
1½ THRU 8" BORE ONLY

HY-MPU3



1½ THRU 6" BORE ONLY

HY-MP3



HY-MPU3	PRESSURE RATING
1½	1675
2	2100
2½	1400
3¼	1400
4	1475
5	1850
6	1700

PRESSURE RATING IS BASED ON DYNAMIC LOAD RATING OF BEARING AND REFLECTS THE PRESSURE RATING AT WHICH YOU CAN EXPECT MAXIMUM LIFE.

PLEASE OPEN GATEFOLD ON PAGE 16 FOR ALL DIMENSION RELATED TO, OR AFFECTED BY, THE ROD DIAMETER OR ROD END. IF THIS GATEFOLD IS LEFT OPEN, THOSE DIMENSIONS WILL ALWAYS BE VISIBLE, REGARDLESS OF THE PAGE YOU TURN TO.

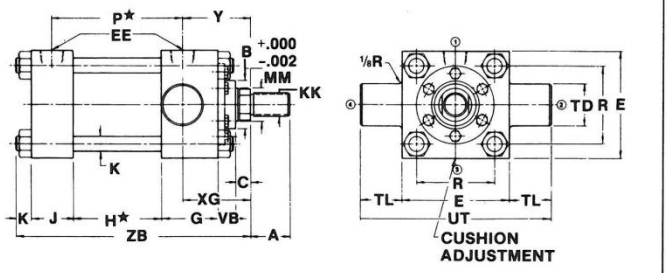
BORE	BD	CB	CD	CK	CW	E	EE NPT or BSP	EE SAE	F	G	H	J	K	L
1½	1½	¾	.500	7/16	½	2½	½	#8	⅜	1¾	1⅜	1½	⅜	¾
2	1½	1¼	.750	21/32	⅝	3	½	#8	⅝	1¾	1⅜	1½	½	1¼
2½	1½	1¼	.750	21/32	⅝	3½	½	#8	⅝	1¾	1½	1½	½	1¼
3¼	2	1½	1.000	⅞	¾	4½	¾	#12	¾	2¼	1¾	1¾	⅝	1½
4	2	2	1.375	1 3/16	1	5	¾	#12	⅞	2¼	2	1¾	⅝	2⅛
5	2	2½	1.750	1 17/32	1¼	6½	¾	#12	⅞	2¼	2½	1¾	⅞	2¼
6	3	2½	2.000	1¾	1¼	7½	1	#16	1	2½	2⅞	2¼	1	2½
7	2¾	3	2.500	•••	1½	8½	1¼	#20	1	3	3	2¾	1⅛	3
8	3½	3	3.000	•••	1½	9½	1½	#24	1	3¼	3½	3	1¼	3¼
10	4	4	3.500	•••	2	12⅝	2	#32	•	3 15/16	4¾	3 11/16	1	4
12	5	4½	4.000	•••	2¼	14⅞	2½	#32	•	4⅞	5⅝	4 7/16	1	4½
14	5½	6	5.000	•••	3	17¼	2½	#32	•	5⅜	5⅞	4⅞	1	5¾

• CONSULT FACTORY

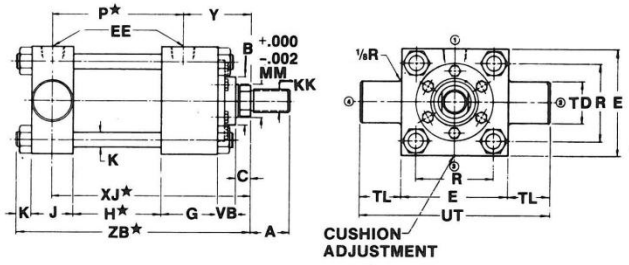
★ ADD STROKE TO THESE DIMENSIONS

All Dimensions in Inches

HY-MT1



HY-MT2



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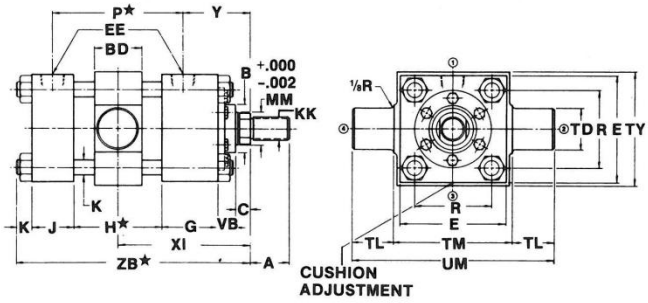


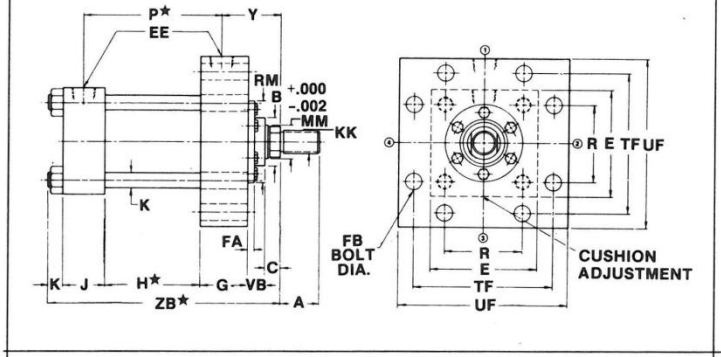
PLEASE OPEN GATEFOLD ON PAGE 16 FOR ALL DIMENSION RELATED TO, OR AFFECTED BY, THE ROD DIAMETER OR ROD END. IF THIS GATEFOLD IS LEFT OPEN, THOSE DIMENSIONS WILL ALWAYS BE VISIBLE, REGARDLESS OF THE PAGE YOU TURN TO.

BORE	LE	LR	M	MA	MR	P	R	SL	TD	TL	TM	TY	UM	UT
1½	9/16	9/16	½	¾	⅝	2 27/32	1.63	13/16	1.000	1	4	3¼	6	4½
2	⅞	15/16	¾	1¼	⅞	2⅞	2.06	1 3/16	1.375	1⅜	5	4	7¾	5¾
2½	⅞	15/16	¾	1¼	⅞	3	2.56	1 3/16	1.375	1⅜	5½	4½	8¼	6¼
3¼	1⅛	1⅜	1	1½	1¼	3½	3.25	1 9/16	1.750	1¾	7	5¾	10½	8
4	1½	1⅞	1⅜	1¾	1⅝	3 25/32	3.82	1 15/16	1.750	1¾	7½	6½	11	8½
5	1 15/16	2	1¾	2¼	1⅞	4¼	4.94	2 7/16	1.750	1¾	9	8	12½	10
6	2 3/16	2¼	2	2¾	2 3/32	4⅞	5.73	2 11/16	2.000	2	10½	9½	14½	11½
7	•••	2¼	2½	•••	2⅝	5⅜	6.58	•••	2.500	2½	12	11	17	13½
8	•••	3	2¾	•••	2⅞	6⅛	7.50	•••	3.000	3	13	12	19	15½
10	•••	3⅝	3½	•••	3⅝	8	•••	•••	3.500	3½	14	13	21	19⅝
12	•••	4⅛	4	•••	4⅛	9⅜	•••	•••	4.000	4	16½	15½	24¼	22⅞
14	•••	5⅛	5	•••	5½	10⅜	•••	•••	4.500	4½	19½	18½	28½	26¼

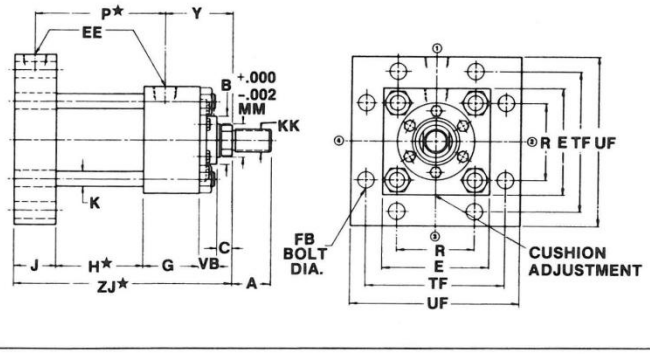
★ ADD STROKE TO THESE DIMENSIONS

All Dimensions in Inches

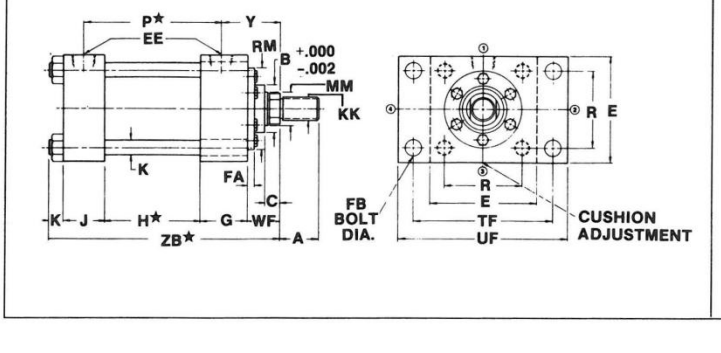
HY-IH3



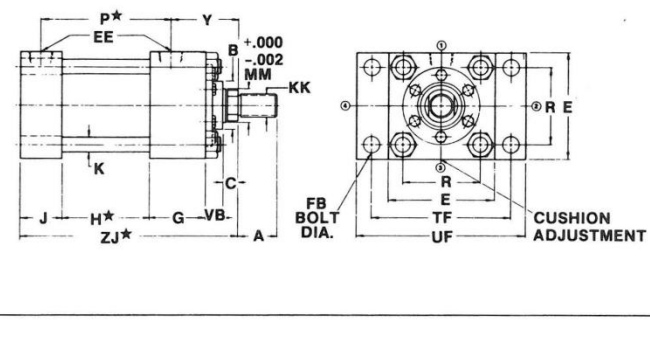
HY-IH4



HY-ME5



HY-ME6



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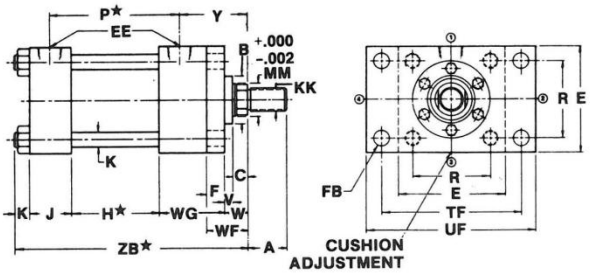
BORE	E	NPT or BSP EE	SAE EE	FB	G	H	J	K	P	R	TF	UF
1½	2½	½	#8	⅜	1¾	1⅜	1½	⅜	2 27/32	1.63	3 7/16	4¼
2	3	½	#8	½	1¾	1⅜	1½	½	2⅞	2.06	4⅛	5⅛
2½	3½	½	#8	½	1¾	1½	1½	½	3	2.56	4⅝	5⅝
3¼	4½	¾	#12	⅝	2¼	1¾	1¾	⅝	3½	3.25	5⅞	7⅛
4	5	¾	#12	⅝	2¼	2	1¾	⅝	3 25/32	3.82	6⅜	7⅝
5	6½	¾	#12	⅞	2¼	2½	1¾	⅞	4¼	4.94	8 3/16	9¾
6	7½	1	#16	1	2½	2⅞	2¼	1	4⅞	5.73	9 7/16	11¼
7	8½	1¼	#20	1⅛	3	3	2¾	1⅛	5⅜	6.58	10⅝	12⅝
8	9½	1½	#24	1¼	3¼	3½	3	1¼	6⅛	7.50	11 13/16	14
10	12⅝	2	#32	1¾	3 15/16	4¾	3 11/16	1	8	9.63	15⅞	19
12	14⅞	2½	#32	2	4⅞	5⅝	4 7/16	1	9⅜	11.44	18½	22
14	17¼	2½	#32	2¼	5⅜	5⅞	4⅞	1	10⅜	13.22	21⅜	25¼

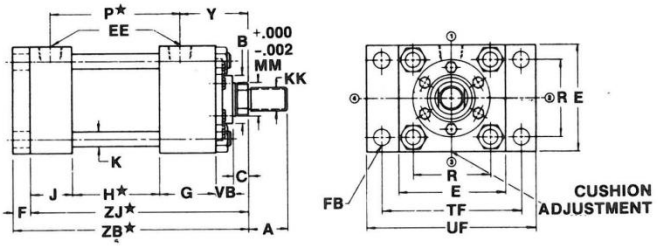
★ ADD STROKE TO THESE DIMENSIONS

All Dimensions in Inches

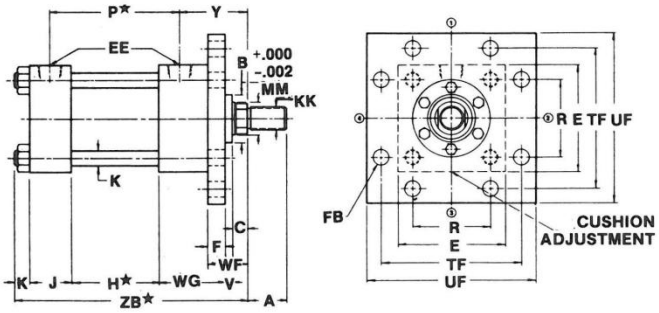
HY-MF1
(SEE NOTE BELOW)



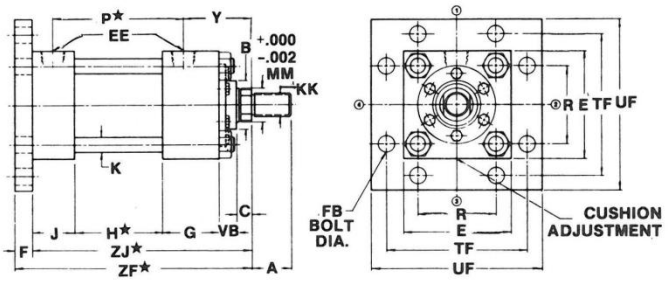
HY-MF2
(SEE NOTE BELOW)



HY-MF5



HY-MF6



MAXIMUM OPERATING PRESSURE IN PSI FOR MF1 IN PUSH & MF2 IN PULL APPLICATIONS

CYLINDER BORE	MF1 & MF2 WITH STANDARD ROD		MF1 WITH LARGEST ROD	
	HEAVY DUTY	NON SHOCK	HEAVY DUTY	NON SHOCK
5	2,000	3,000	1,450	2,350
6	1,900	3,000	1,450	2,350
7	1,400	2,300	1,000	1,600
8	1,100	1,800	900	1,500

NOTE: WHEN PRESSURE REQUIREMENTS MUST EXCEED THE LIMITATIONS SHOWN ABOVE, SPECIFY HY-ME5 OR HY-ME6.

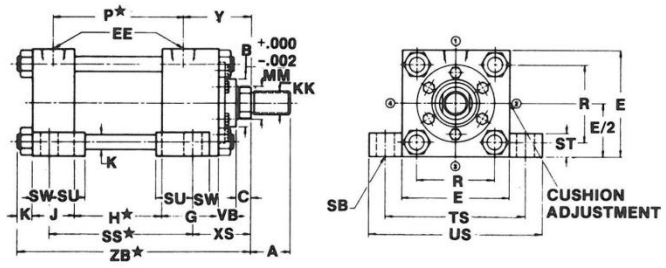
PLEASE OPEN GATEFOLD ON PAGE 16 FOR ALL DIMENSION RELATED TO, OR AFFECTED BY, THE ROD DIAMETER OR ROD END. IF THIS GATEFOLD IS LEFT OPEN, THOSE DIMENSIONS WILL ALWAYS BE VISIBLE, REGARDLESS OF THE PAGE YOU TURN TO.

		NPT or BSP	SAE											
BORE	E	EE	EE	F	FB	G	H	J	K	P	R	TF	UF	WG
1½	2½	½	#8	⅜	⅜	1¾	1⅜	1½	⅜	2 27/32	1.63	3 7/16	4¼	2⅛
2	3	½	#8	⅝	½	1¾	1⅜	1½	½	2⅞	2.06	4⅛	5⅛	2⅜
2½	3½	½	#8	⅝	½	1¾	1½	1½	½	3	2.56	4⅝	5⅝	2⅜
3¼	4½	¾	#12	¾	⅝	2¼	1¾	1¾	⅝	3½	3.25	5⅞	7⅛	2¾
4	5	¾	#12	⅞	⅝	2¼	2	1¾	⅝	3 25/32	3.82	6⅜	7⅝	2⅞
5	6½	¾	#12	⅞	⅞	2¼	2½	1¾	⅞	4¼	4.94	8 3/16	9¾	2⅞
6	7½	1	#16	1	1	2½	2⅞	2¼	1	4⅞	5.73	9 7/16	11¼	3¼
7	8½	1¼	#20	•••	1⅛	3	3	2¾	1⅛	5⅜	6.58	10⅝	12⅝	3¾
8	9½	1½	#24	•••	1¼	3¼	3½	3	1¼	6⅛	7.50	11 13/16	14	4
10	12⅝	2	#32	•••	1¾	3 15/16	4¾	3 11/16	1	8	9.63	15⅞	19	•••
12	14⅞	2½	#32	•••	2	4⅞	5⅝	4 7/16	1	9⅜	11.44	18½	22	•••
14	17¼	2½	#32	•••	2¼	5⅜	5⅞	4⅞	1	10⅜	13.22	21⅜	25¼	•••

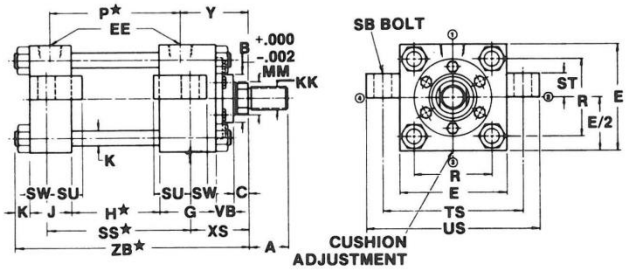
★ ADD STROKE TO THESE DIMENSIONS

All Dimensions in Inches

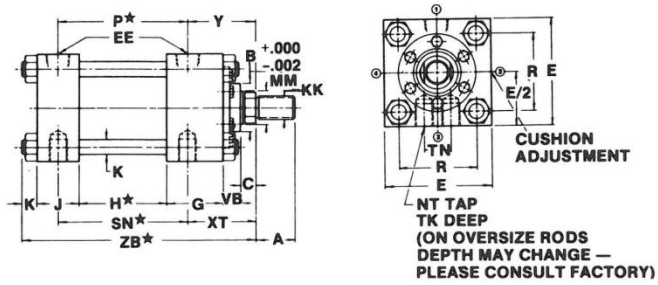
HY-MS2



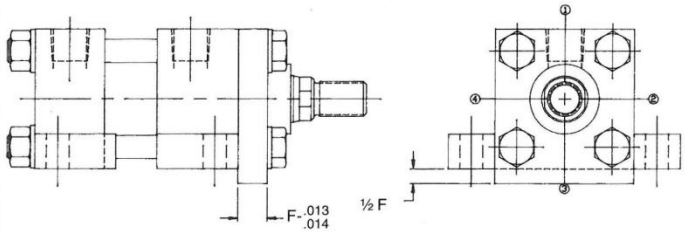
HY-MS3



HY-MS4



EXTENDED KEYPLATE MOUNTING



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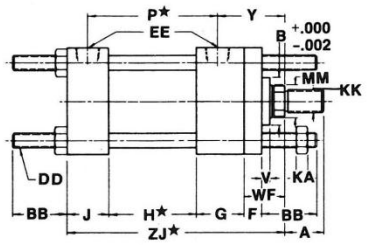
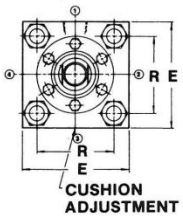
				NPT or BSP	SAE						
BORE	BB	DD	E	EE	EE	F	G	H	J	K	NT
1½	1⅜	⅜-24	2½	½	#8	⅜	1¾	1⅜	1½	⅜	⅜-16
2	1 13/16	½-20	3	½	#8	⅝	1¾	1⅜	1½	½	½-13
2½	1 13/16	½-20	3½	½	#8	⅝	1¾	1½	1½	½	⅝-11
3¼	2 5/16	⅝-18	4½	¾	#12	¾	2¼	1¾	1¾	⅝	¾-10
4	2 5/16	⅝-18	5	¾	#12	⅞	2¼	2	1¾	⅝	1-8
5	3 3/16	⅞-14	6½	¾	#12	⅞	2¼	2½	1¾	⅞	1-8
6	3⅝	1-14	7½	1	#16	1	2½	2⅞	2¼	1	1¾-7
7	•••	•••	8½	1¼	#20	•••	3	3	2¾	1⅛	1½-6
8	•••	•••	9½	1½	#24	•••	3¼	3½	3	1¼	1½-6
10	•••	•••	12⅝	2	#32	•••	3 15/16	4¾	3 11/16	1	•••
12	•••	•••	14⅞	2½	#32	•••	4⅞	5⅝	4 7/16	1	•••
14	•••	•••	17¼	2½	#32	•••	5⅜	5⅞	4⅞	1	•••

★ ADD STROKE TO THESE DIMENSIONS

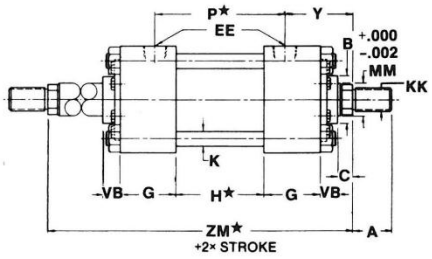
All Dimensions in Inches

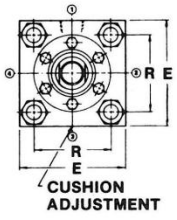




HY-MX0	NO TIE RODS EXTENDED
HY-MX1	TIE RODS EXTENDED BOTH ENDS
HY-MX2	TIE RODS EXTENDED BLIND END
HY-MX3	TIE RODS EXTENDED ROD END
	1½-6" BORES ONLY

HY-DE

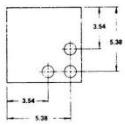




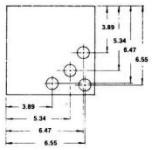
MOUNTING AVAILABLE IN DOUBLE END MODELS:

HY-MXO	HY-MX3	HY-IH3
HY-MX1	HY-MS4	HY-ME5
HY-MX3	HY-MF1	HY-MT1
HY-MS2	HY-MF5	HY-MT4

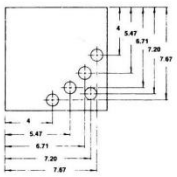
TIE ROD INFORMATION **10", 12" & 14" BORES**



10" BORE



12" BORE



14" BORE

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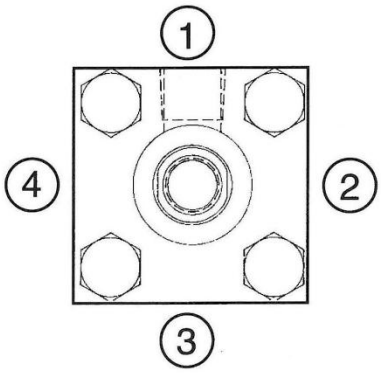
BORE	P	R	SB	SN	SS	ST	SU	SW	TN	TS	US	TK
1½	2 27/32	1.63	3/8	2 7/8	3 7/8	½	15/16	3/8	¾	3¼	4	½
2	2 7/8	2.06	½	2 7/8	3 5/8	¾	1¼	½	15/16	4	5	½
2½	3	2.56	¾	3	3 3/8	7/8	1 9/16	1 1/16	1 5/16	4 7/8	6¼	¾
3¼	3½	3.25	¾	3½	4⅛	1	1 9/16	1 1/16	1½	5 7/8	7¼	¾
4	3 25/32	3.82	1	3¾	4	1¼	2	7/8	2 1/16	6¾	8½	1
5	4¼	4.94	1	4¼	4½	1¼	2	7/8	2 15/16	8¼	10	1⅛
6	4 7/8	5.73	1¼	5⅛	5⅛	1½	2½	1⅛	3 5/16	9¾	12	1¼
7	5⅜	6.58	1½	5 7/8	5¾	1¾	2 7/8	1⅜	3¾	11¼	14	2⅛
8	6⅛	7.50	1½	6⅝	6¾	1¾	2 7/8	1⅜	4¼	12¼	15	2¼
10	8	•••	1½	•••	8 7/8	2¼	3½	1⅝	•••	15 7/8	19⅛	•••
12	9⅜	•••	1½	•••	10½	3	4¼	2	•••	18 7/8	22 7/8	•••
14	10⅜	•••	1½	•••	10⅝	4	5	2½	•••	22¼	27¼	•••

★ ADD STROKE TO THESE DIMENSIONS

PORT LOCATIONS, TYPES & SIZES

PORT LOCATIONS



Port locations are identified by clockwise position as viewed from the rod end head. Unless otherwise specified, ports will be in position #1.

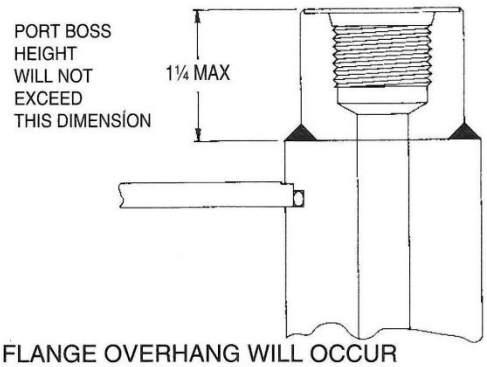
MOUNT	ROD END POSITION				BLIND END POSITION			
	①	②	③	④	①	②	③	④
IH3	Y	Y	Y	Y	Y	Y	Y	Y
IH4	Y	Y	Y	Y	Y	Y	Y	Y
ME5	Y	Y	Y	Y	Y	Y	Y	Y
ME6	Y	Y	Y	Y	Y	Y	Y	Y
MF1	Y	Y	Y	Y	Y	Y	Y	Y
MF2	Y	Y	Y	Y	Y	Y	Y	Y
MF5	Y	Y	Y	Y	Y	Y	Y	Y
MF6	Y	Y	Y	Y	Y	Y	Y	Y
MP1	Y	Y	Y	Y	Y	Y	Y	Y
MP2	Y	Y	Y	Y	Y	Y	Y	Y
MP3	Y	Y	Y	Y	Y	Y	Y	Y
MPU3	Y	Y	Y	Y	Y	Y	Y	Y
MS2	Y	Q	Q	Q	Y	Q	Q	Q
MS3	Y	N	Y	N	Y	N	Y	N
MS4	Y	Y	N	Y	Y	Y	N	Y
MT1	Y	N	Y	N	Y	Y	Y	Y
MT2	Y	Y	Y	Y	Y	N	Y	N
MT4	Y	Y	Y	Y	Y	Y	Y	Y
MX0	Y	Y	Y	Y	Y	Y	Y	Y
MX1	Y	Y	Y	Y	Y	Y	Y	Y
MX2	Y	Y	Y	Y	Y	Y	Y	Y
MX3	Y	Y	Y	Y	Y	Y	Y	Y

Y=AVAILABLE IN THIS POSITION
N= NOT AVAILABLE IN THIS POSITION
Q=AVAILABLE, BUT QUESTIONS NEED TO BE ASKED ABOUT FITTINGS OR MANIFOLD CLEARANCES, AND/OR MOUNTING BOLT ACCESS

PORT TYPES & SIZES

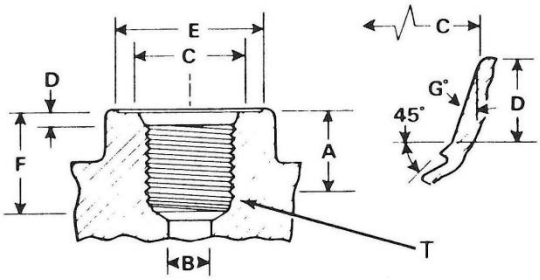
Cylinder Bore Dia. (Inches)	Cylinder Rod Dia. (Inches)	SAE			NPT & BSP			
			Oversize *			Oversize *		
		Std.	Rod End	Blind End	Std.	Rod End	Blind End	4-BOLT SAE▲
1½	⅝	#8	#10	#10	½	¾	¾	N/A
	1	#8	#10	#10	½	¾	¾	N/A
2	1	#8	#10	#10	½	¾	¾	N/A
	1⅜	#8	#10	#10	½	¾	¾	N/A
2½	1	#8	#10	#10	½	¾	¾	N/A
	1⅜	#8	#10	#10	½	¾	¾	N/A
	1¾	#8	#10	#10	½	¾	¾	N/A
3¼	1⅜	#12	#16	#16	¾	1	1	¾
	1¾	#12	#16	#16	¾	1	1	¾
	2	#12	#16	#16	¾	1	1	¾
4	1¾	#12	#16	#16	¾	1	1	¾
	2	#12	#16	#16	¾	1	1	¾
	2½	#12	#16	#16	¾	1	1	¾
5	2	#12	#16	#16	¾	1	1	¾
	2½	#12	#16	#16	¾	1	1	¾
	3	#12	#16	#16	¾	1	1	¾
	3½	#12	#16	#16	¾	1	1	¾
6	2½	#16	#20	#20	1	1¼	1¼	1
	3	#16	#20	#20	1	1¼	1¼	1
	3½	#16	#20	#20	1	1¼	1¼	1
	4	#16	#20	#20	1	1¼	1¼	1
7	3	#20	#24	#24	1¼	1½	1½	1¼
	3½	#20	#24	#24	1¼	1½	1½	1¼
	4	#20	#24	#24	1¼	1½	1½	1¼
	4½	#20	#24	#24	1¼	1½	1½	1¼
	5	#20	#24	#24	1¼	1½	1½	1¼
8	3½	#24	N/A	N/A	1½	2	2	1½
	4	#24	N/A	N/A	1½	2	2	1½
	4½	#24	N/A	N/A	1½	2	2	1½
	5	#24	N/A	N/A	1½	2	2	1½
	5½	#24	N/A	N/A	1½	2	2	1½
10	4½	#32	N/A	N/A	2	2½	2½	2
	5	#32	N/A	N/A	2	2½	2½	2
	5½	#32	N/A	N/A	2	2½	2½	2
	7	#32	N/A	N/A	2	2½	2½	2
12	5½	#32	N/A	N/A	2½	3	3	2½
	7	#32	N/A	N/A	2½	3	3	2½
	8	#32	N/A	N/A	2½	3	3	2½
14	7	#32	N/A	N/A	2½	3	3	2½
	8	#32	N/A	N/A	2½	3	3	2½
	10	#32	N/A	N/A	2½	3	3	2½

* PORT BOSSES WILL BE UTILIZED IN THESE SIZES



▲ SOME FLANGE OVERHANG WILL OCCUR ON ROD END OR BLIND END. OVERHANG MAY INTERFERE WITH SOME MOUNTINGS.

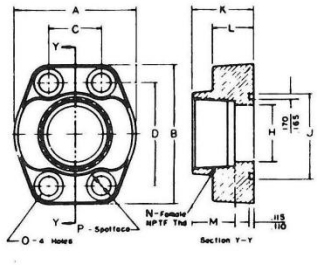
SAE O-RING PORT DIMENSIONS



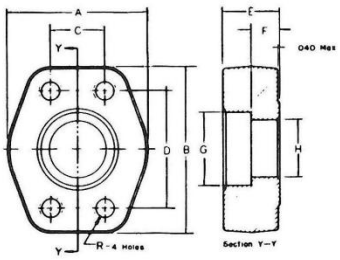
PORT DIMENSIONS

SIZE		STRAIGHT THREAD "T"			A	B	C	D	E	F	G
NOMINAL TUBE OD	TUBE DASH NO.	SIZE	PITCH DIAM.	MINOR DIAM.	MIN. THREAD DEPTH	MIN. DIAM.	+.005 -.000 DIAM.	+.015 -.000	MIN. DIAM.	MIN.	±1°
1/8	-2	5/16-24	.2854 .2902	.267 .277	.390	.062	.358	.074	.672	.468	12°
3/16	-3	3/8-24	.3479 .3528	.330 .340	.390	.125	.421	.074	.750	.468	12°
1/4	-4	7/16-20	.4050 .4104	.383 .395	.454	.172	.487	.093	.828	.547	12°
5/16	-5	1/2-20	.4765 .4731	.446 .457	.454	.234	.550	.093	.906	.547	12°
3/8	-6	9/16-18	.5264 .5323	.502 .515	.500	.297	.616	.097	.969	.609	12°
1/2	-8	3/4-16	.7094 .7159	.682 .696	.562	.391	.811	.100	1.188	.688	15°
5/8	-10	7/8-14	.8286 .8356	.798 .814	.656	.484	.942	.100	1.344	.781	15°
3/4	-12	1 1/16-12	1.0084 1.0158	.972 .990	.750	.609	1.148	.130	1.625	.906	15°
7/8	-14	1 3/16-12	1.1334 1.1409	1.097 1.115	.750	.719	1.273	.130	1.765	.906	15°
1	-16	1 5/16-12	1.2584 1.2659	1.222 1.240	.750	.844	1.398	.130	1.910	.906	15°
1 1/4	-20	1 5/8-12	1.5709 1.5785	1.535 1.553	.750	1.078	1.713	.132	2.270	.906	15°
1 1/2	-24	1 7/8-12	1.8209 1.8287	1.785 1.803	.750	1.312	1.962	.132	2.560	.906	15°
2	-32	2 1/2-12	2.4459 2.4540	2.410 2.428	.750	1.781	2.587	.132	3.480	.906	15°

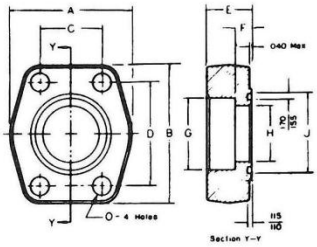
PIPE THREADED O-RING FLANGE



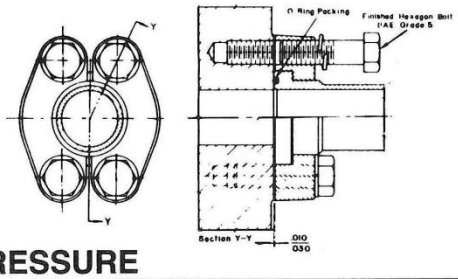
SOCKET WELD FLANGE



SOCKET WELD O-RING FLANGE



FOUR BOLT SPLIT FLANGE



3000 PSI RECOMMENDED WORKING PRESSURE

NOMINAL FLANGE SIZE	A	B	C ±.010	D ±.010	E	F	G DIA.	H DIA.	J DIA.	K	L	M	N NPTF THREAD	O DIA.	P SPOTFACE DIA.	R THREAD	SOC HD CAP SCREW (Threaded Flange)	HEX OR SOC HD CAP SCREW (Socket Weld)	"O" RING
1/2	1.87	2.12	0.688	1.500	.75	.19	0.855	0.50	1.005 1.000	1.25	.91	.87	1/2	.344	.469	5/16-18	5/16-18x1 1/2" Lg.	5/16-18x1 1/2" Lg.	-210
3/4	2.06	2.56	0.875	1.875	.75	.19	1.063	0.75	1.255 1.250	1.25	.84	.87	3/4	.406	.594	3/8-16	3/8-16x1 1/2" Lg.	3/8-16x1 1/2" Lg.	-214
1	2.31	2.75	1.031	2.062	.87	.25	1.328	1.00	1.565 1.560	1.37	.97	1.12	1	.406	.594	3/8-16	3/8-16x1 3/4" Lg.	3/8-16x1 3/4" Lg.	-219
1 1/4	2.88	3.12	1.188	2.312	.94	.25	1.672	1.25	1.755 1.750	1.50	1.03	1.12	1 1/4	.469	.656	7/16-14	7/16-14x1 3/4" Lg.	7/16-14x1 3/4" Lg.	-222
1 1/2	3.25	3.69	1.406	2.750	1.19	.44	1.923	1.50	2.125 2.115	1.62	1.09	1.12	1 1/2	.531	.781	1/2-13	1/2-13x2" Lg.	1/2-13x2 1/4" Lg.	-225
2	3.81	4.00	1.688	3.062	1.37	.50	2.406	2.00	2.500 2.490	1.62	1.09	1.12	2	.531	.781	1/2-13	1/2-13x2" Lg.	1/2-13x2 1/2" Lg.	-228
2 1/2	4.28	4.50	2.000	3.500	1.75	.75	2.906	2.50	3.005 2.995	2.00	1.47	1.56	2 1/2	.531	.781	1/2-13	1/2-13x2 1/2" Lg.	1/2-13x2 3/4" Lg.	-232
3	5.16	5.31	2.438	4.188	2.12	.87	3.547	3.00	3.625 3.615	2.00	1.59	1.72	3	.656	.937	5/8-11	5/8-11x2 3/4" Lg.	5/8-11x3" Lg.	-237

PRESSURE TABLE

This chart lists theoretical push and pull forces that cylinders will exert when supplied with various working pressures.

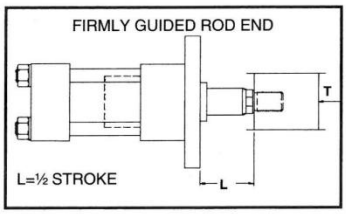
CYL BORE DIA.	PRESSURE RATINGS HEAVY DUTY SERVICE	NON SHOCK FACTOR	HYD 4-1 SAFETY FACTOR	PISTON ROD DIA	CYL. WORK ACTION	WORK AREA SQ. IN.	HYDRAULIC WORKING PRESSURE PSI* 350	500	750	1000	1500	2000	3000	FLUID REQUIRED PER IN. OF STROKE U.S. GAL.	CU. FT
1 1/2	3000	5000	2200	5/8	Push	1.767	618	883	1325	1767	2651	3534	5301	.00765	.00102
				1	Pull	1.460	511	730	1025	1460	2190	2929	4380	.00632	.00084
					Pull	.982	344	491	736	982	1473	1964	2946	.00425	.00057
2	3000	5000	2150	1	Push	3.141	1099	1571	2356	3141	4711	6283	9423	.01360	.00182
				1 3/8	Pull	2.356	825	1178	1767	2356	3534	4712	7068	.01020	.00136
					Pull	1.656	580	828	1242	1656	2484	3312	4968	.00717	.00096
2 1/2	3000	5000	1900	1	Push	4.909	1718	2454	3682	4909	7363	9818	14727	.02125	.00284
				1 3/8	Pull	4.124	1443	2062	3093	4124	6186	9248	12372	.01785	.00239
				1 3/4	Pull	3.424	1198	1712	2568	3424	5136	6848	10272	.01482	.00198
					Pull	2.504	876	1252	1878	2504	3756	5008	7512	.01084	.00145
3 1/4	3000	5000	2200	1 3/8	Push	8.296	2904	4148	6222	8296	1244	16592	24888	.0359	.00480
				1 3/4	Pull	6.811	2384	3405	5188	6811	10216	13622	20433	.0295	.00394
				2	Pull	5.891	2062	2945	4418	5891	8836	11782	17673	.0255	.00341
					Pull	5.154	1804	2577	3865	5154	7731	10308	15462	.0223	.00298
4	2700	4500	1700	1 3/4	Push	12.566	4398	6283	9425	12566	18849	25132	37698	.0544	.00727
				2	Pull	10.161	3556	5080	7621	10161	15241	20322	30483	.0440	.00588
				2 1/2	Pull	9.424	3298	4712	7068	9424	14136	18848	28272	.0408	.00545
					Pull	7.657	2680	3828	5743	7657	11485	15314	22971	.0331	.00443
5	3000	5000	1900	2	Push	19.635	6872	9818	14726	19635	29453	32970	58905	.0850	.01136
				2 1/2	Pull	16.492	5772	8246	12369	16492	24738	32984	49476	.0714	.00954
				3	Pull	14.726	5154	7393	11044	14726	22089	29452	44178	.0637	.00852
				3 1/2	Pull	12.566	4398	6283	9424	12566	18849	25132	37698	.0544	.00728
					Pull	10.014	3505	5007	7510	10014	15021	20028	30042	.0433	.00580
6	2700	4500	1750	2 1/2	Push	28.274	9896	14137	21205	28274	42411	56548	84822	.1224	.01636
				3	Pull	23.365	8178	11682	17524	23365	35047	46730	70095	.1011	.01352
				3 1/2	Pull	21.205	7422	10602	15904	21205	31807	42410	63615	.0918	.01227
				4	Pull	18.653	6258	9326	13990	18653	27979	37306	55959	.0808	01079
					Pull	15.708	5498	7854	11781	15708	23562	31416	47124	.0680	.00909
7	3000	5000	1950	3	Push	38.485	13470	19242	28864	38485	57728	76970	115455	.1666	.02227
				3 1/2	Pull	31.416	10996	15708	23562	31416	47124	62832	94248	.1360	.01818
				4	Pull	28.864	10102	14432	21648	28864	43296	57728	86592	.1250	.01670
				4 1/2	Pull	25.916	9070	12957	19436	25916	38872	51830	77745	.1122	.01500
				5	Pull	22.585	7905	11292	16939	22585	33877	45170	67755	.0977	.01307
					Pull	18.850	6598	9425	14137	18850	28275	37700	56550	.0816	.01091
8	3000	5000	1900	3 1/2	Push	50.265	17593	25133	37699	50265	75398	100530	150795	.2176	.02909
				4	Pull	40.644	14225	20322	30483	40644	60966	81288	121932	.1759	.02352
				4 1/2	Pull	37.699	13195	18850	38274	37699	56548	75398	113097	.1632	.02182
				5	Pull	34.365	12028	17182	25773	34365	51548	68730	103095	.1488	.01989
				5 1/2	Pull	30.630	10720	15315	22973	30630	45945	61260	91890	.1326	.01772
					Pull	26.507	9277	13253	19880	26507	39760	53014	79521	.1147	.01534
10	3000	5000	2100	4 1/2	Push	78.540	27489	39270	58905	78540	117810	157080	235620	.3400	.04545
				5	Pull	62.636	21923	31318	46977	62636	93954	125272	187908	.2712	.03625
				5 1/2	Pull	58.905	20617	29453	44179	58905	88357	117810	176715	.2549	.03408
				7	Pull	54.782	19174	27391	41086	54782	82173	109564	164346	.2372	.03170
					Pull	40.055	14019	20027	30041	40055	60082	80110	120165	.1740	.02319
12	3000	5000	2300	5 1/2	Push	113.10	39585	56550	84825	113100	169650	226200	339300	.4896	.06545
				7	Pull	89.339	31269	44670	67005	89340	134010	178680	268020	.3868	.05170
				8	Pull	74.613	26117	37310	55965	74620	111930	142240	223860	.3230	.04333
					Pull	62.830	21990	31415	47122	62830	94245	125660	188490	.2719	.03636
14	3000	5000	1950	7	Push	153.933	53878	76969	115453	153938	230907	307876	461814	.6664	.0891
				8	Pull	115.454	40409	57727	86591	115454	173181	230908	346362	.4998	.0668
				10	Pull	103.672	36285	51836	77754	103672	155508	207344	311016	.4488	.0600
					Pull	75.398	26389	37699	56549	75398	113097	150796	226195	.3264	.0436

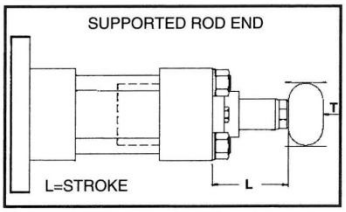
*** To convert PSI to Bars, divide by 14.5**

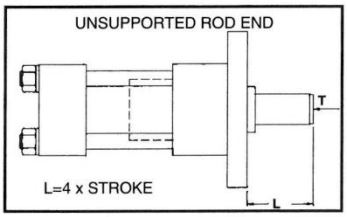
QUICK CONVERSION REFERENCE

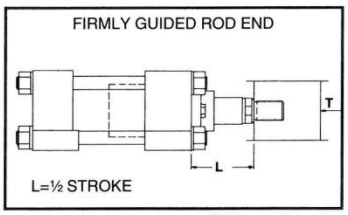
	Cubic Inches	Cubic Feet	Cubic Yards	Liters	U.S. Gallons	Imperial Gallons	Water at Max. Density 39.2° F 4° C Pounds of Water	Kilograms of Water
Cu Inches	1	.0005787	.00002143	.016384	.004329	.0036065	.0361275	.0163872
Cu Feet	1728	1	.037037	28.317	7.48052	6.23210	62.4283	28.3170
Cu Yards	46,656	27	1	764.56	201.974	168.266	1685.56	764.559
Liters	61.0234	.0353145	.001308	1	.264170	.220083	2.20462	1
U.S. Gallons	231	.133681	.004951	3.78543	1	.833111	8.34545	3.78543
Imp. Gallons	277.274	.160459	.0059429	4.54374	1.20032	1	10.0172	4.54373
Lbs. Water	27.6798	.0160184	.0005929	.453592	.119825	.0998281	1	.453593

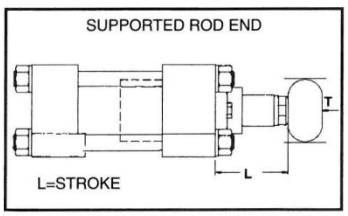
ROD SIZE AND STOP TUBE SELECTION

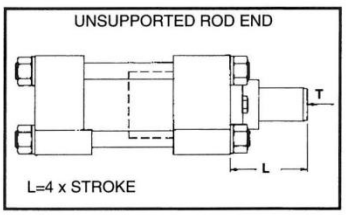












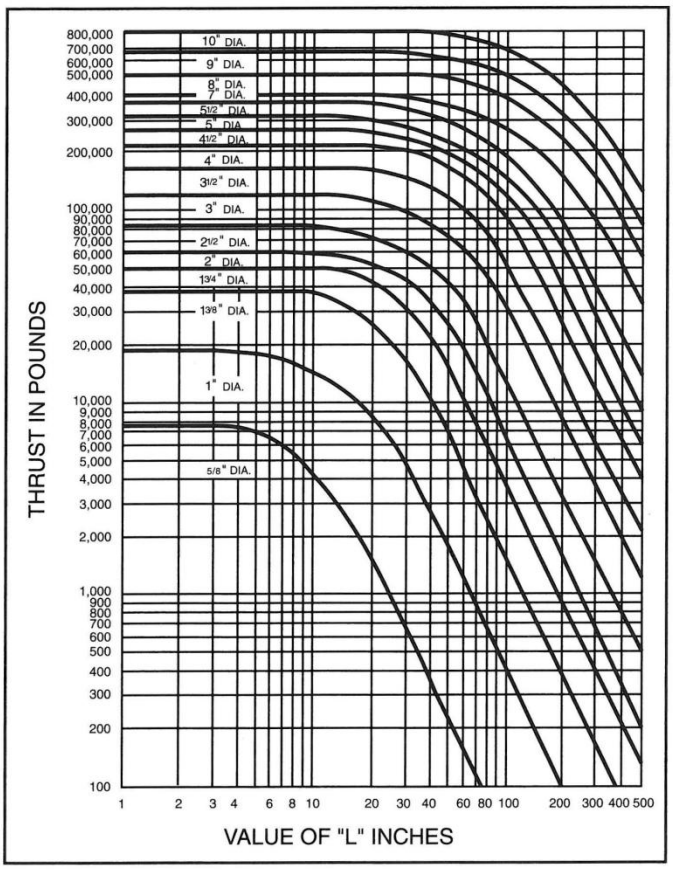
ROD SIZE SELECTION:

To determine the rod size necessary for the required stroke and thrust, the following procedure is recommended:

1.) Determine the maximum thrust load that will be imposed on the rod, and the corresponding "L" dimension for the cylinder mounting to be used.

2.) Find the value of "L" at the bottom of the graph and follow its line vertically until it intercepts the horizontal line representing the push thrust of your cylinder. The intersection of these two lines will fall within a band representing the minimum recommended rod diameter for your application.

3). This graph is not suitable if the load is eccentric.

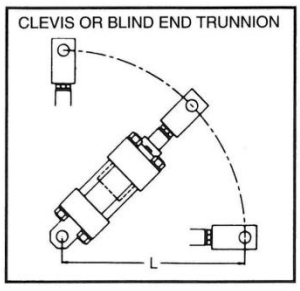


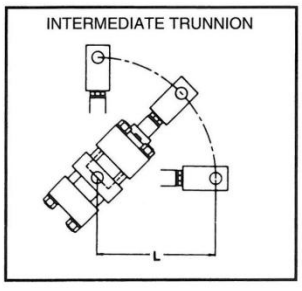
STOP TUBE SELECTION:

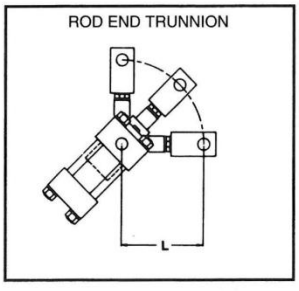
For push stroke cylinders, it is advisable to use stop tubes to prevent rod buckling. Stop tubes are located between the piston and the rod end head of the cylinder, and reduce bearing loads by separating further the piston from the rod bushing. To determine if a stop tube is required, and the length of the stop tube, use the following procedure:

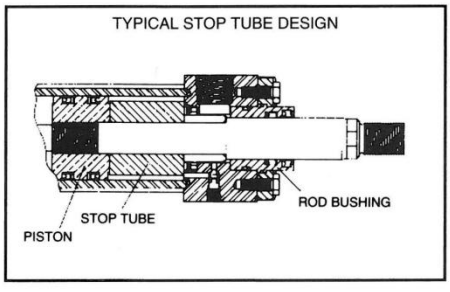
1) Determine the value of "L", with the piston rod fully extended.

2) If the value of "L" is under 40", no stop tube is needed. If "L" is greater than 40", one inch of stop tube is recommended for each 10" (or fraction thereof) beyond 40". Do not forget to add the stop tube length to the "L" dimension when determining the final value of "L" for the assembly.







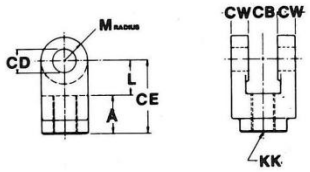


NOTE: • ALL RODS SHOWN FULLY EXTENDED
• WHEN SPECIFYING STROKE AND STOP TUBE; PLEASE CALL-OUT THE **NET WORKING STROKE, THE STOP TUBE LENGTH & THE GROSS STROKE.**

MOUNTING ACCESSORIES

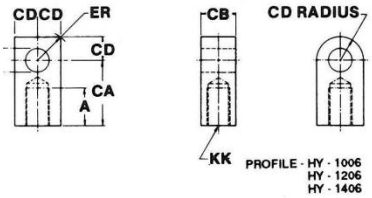
All Dimensions in Inches

FEMALE ROD CLEVIS



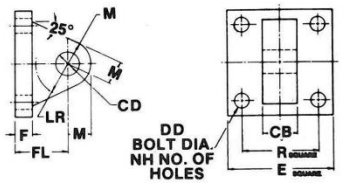
FEMALE ROD CLEVIS											
PART	AS-1526	AS-426	AS-626	AS-1026	HY-526	HY-626	HY-726	HY-826	HY-1026	HY-1226	HY-1426
A	¾	1⅛	1⅝	2	2¼	3	3½	3½	4½	5½	7
CB	¾	1¼	1½	2	2½	2½	3	3	4	4½	6
CD	½	¾	1	1⅜	1¾	2	2½	3	3½	4	5
CE	1½	2⅜	3⅛	4⅛	4½	5½	6½	6¾	8½	10	12¾
CW	½	⅝	¾	1	1¼	1¼	1½	1½	2	2¼	3
KK	7/16-20	¾-16	1-14	1¼-12	1½-12	1⅞-12	2¼-12	2½-12	3¼-12	4-12	5½-12
L	¾	1¼	1½	2⅛	2¼	2½	3	3¼	4	4½	5¾
M	½	¾	1	1⅜	1¾	2	2½	2¾	3½	4	5
LOAD RATING LBS.	2935	9325	12765	26820	39485	54750	84350	84350	157485	202485	240143

FEMALE ROD EYE



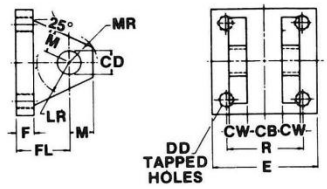
FEMALE ROD EYE											
PART	AS-1506	AS-406	AS-606	AS-1006	HY-506	HY-606	HY-706	HY-806	HY-1006	HY-1206	HY-1406
A	¾	1¼	1⅝	2	2¼	3	3½	3½	4½	5½	7
CA	1½	2 1/16	2 13/16	3 7/16	4	5	5 13/16	6⅛	7⅝	9⅛	11¾
CB	¾	1¼	1½	2	2½	2½	3	3	4	4½	6
CD	½	¾	1	1⅜	1¾	2	2½	3	3½	4	5
ER	11/16	1 1/16	1¼	1⅞	2½	2 13/16	3 17/32	4¼	•••	•••	•••
KK	7/16-20	¾-16	1-14	1¼-12	1½-12	1⅞-12	2¼-12	2½-12	3¼-12	4-12	5½-12
LOAD RATING LBS.	2935	8420	12680	24750	39350	45100	67550	81050	126000	162100	245000

MOUNTING BRACKET



MOUNTING BRACKET											
PART	AS-1525	AS-425	AS-625	AS-1025	HY-525	HY-625	HY-725	HY-825	HY-1025	HY-1225	HY-1425
CB	¾	1¼	1½	2	2½	2½	3	3	4	4½	6
CD	½	¾	1	1⅜	1¾	2	2½	3	3½	4	5
DD	⅜	½	⅝	⅝	⅞	1	1⅛	1¼	1	1	1
E	2½	3½	4½	5	6½	7½	8½	9½	12⅝	14⅞	17¼
F	⅜	⅝	¾	⅞	⅞	1	1	1	1 1/16	1 15/16	2 3/16
FL	1⅛	1⅞	2¼	3	3⅛	3½	4	4¼	5 1/16	6 7/16	7 15/16
R	1.63	2.55	3.25	3.82	4.95	5.73	6.58	7.50	•••	•••	•••
M	½	¾	1	1⅜	1¾	2	2½	3	3½	4	5
NH	4	4	4	4	4	4	4	4	12	16	20
LOAD RATING LBS.	3350	8450	13550	24375	39350	45050	67535	•••	•••	•••	•••

CLEVIS BRACKET

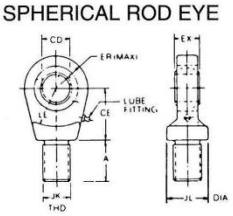


CLEVIS BRACKET										
PART	AS-1530	AS-2030	AS-2530	AS-3230	AS-4030	AS-5030	AS-6030	AS-7030	AS-8030	AS-1030	AS-1230
CB	25/32	1 9/32	1 9/32	17/32	2 1/32	2 17/32	2 17/32	3 1/32	3 1/32	4 1/16	4 9/16
CD	½	¾	¾	1	1⅜	1¾	2	2½	3	3½	4
CW	½	⅝	⅝	¾	1	1¼	1¼	1½	1½	2	2¼
DD	⅜-24	½-20	½-20	⅝-18	⅝-18	⅞-14	1-14	1⅛-12	1¼-12	1¾-12	2-12
E	2½	3	3½	4½	5	6½	7½	8½	9½	12⅝	14⅞
F	⅜	⅝	⅝	¾	⅞	⅞	1	1	1	1 1/16	1 15/16
FL	1⅛	1⅞	1⅞	2¼	3	3⅛	3½	4	4¼	5 1/16	6 7/16
LR	½	1	1 1/16	1¼	1⅞	2	2⅛	2⅝	2⅞	3⅝	4
M	½	¾	¾	1	1⅜	1¾	2	2½	2¾	3½	4
MR	9/16	1 1/16	1 1/16	1⅛	1¾	1⅞	2⅛	2½	2¾	3½	4
R	1.63	2.06	2.56	3.25	3.82	4.94	5.75	6.59	7.50	9.63	11.50

SWIVEL PIN

SWIVEL PIN										
PART	AS-1538	AS-438	AS-638	HY-438	HY-538	HY-638	HY-738	HY-838	HY-1038	HY-1238	HY-1438
CD	½	¾	1	1⅜	1¾	2	2½	3	3½	4	5
CL	1⅞	2 ⅝	3⅛	4⅛	5⅛	5⅛	6⅛	6⅛	8⅛	9⅛	12
L	2.109	2.901	3.401	4.461	5.545	5.545	6.641	6.742	8.845	9.845	12.500
LOAD RATING LBS.	5830	13265	23550	44575	72200	94250	147235	212000	288650	377500	510000

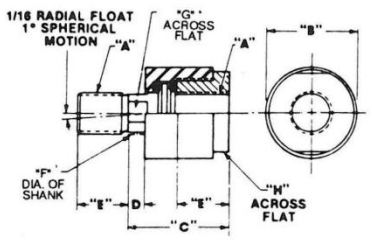
SPHERICAL ROD EYE



SPHERICAL ROD EYE									
PART NO.	A	CD	CE	ER	EX	JL REF.	KK	LE	LOAD CAP.
AS-1506-SRE	11/16	½	⅞	⅞	7/16	⅞	7/16-20	¾	2600
AS-3206-SRE	1	¾	1¼	1¼	21/32	1 5/16	¾-16	1 1/16	9400
AS-606-SRE	1½	1	1⅞	1⅜	⅞	1½	1-14	1 7/16	16800
AS-1006-SRE	2	1⅜	2⅛	1 3/16	1 3/16	2	1¼ -12	1⅞	28600
HY-506-SRE	2⅛	1¾	2½	2 3/16	1 17/32	2¼	1½-12	2⅛	43000
HY-606-SRE	2⅞	2	2¾	2⅝	1¾	2¾	1⅞-12	2½	70000

SELF ALIGNING ROD COUPLER

All dimensions in inches



MODEL NO.	ROD COUPLER "A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	MAX. PULL AT YIELD
* .250 F	1/4-28	7/8	1 1/4	1/4	5/8	5/16	3/16	3/4	6,000
* .312 F	5/16-24	7/8	1 1/4	1/4	5/8	5/16	1/4	3/4	8,300
* .375 F	3/8-24	7/8	1 1/4	1/4	5/8	5/16	5/16	3/4	8,300
* .375 C	3/8-16	7/8	1 1/4	1/4	5/8	5/16	5/16	3/4	5,000
.437 F	7/16-20	1 1/4	2	1/2	3/4	5/8	1/2	1	10,000
.500 F	1/2-20	1 1/4	2	1/2	3/4	5/8	1/2	1	14,000
.500 C	1/2-13	1 1/4	2	1/2	3/4	5/8	1/2	1	14,000
.625 F	5/8-18	1 1/4	2	1/2	3/4	5/8	1/2	1	19,000
.750 F	3/4-16	1 3/4	2 5/16	1/2	1 1/8	31/32	13/16	1 1/2	34,000
.750 C	3/4-10	1 3/4	2 5/16	1/2	1 1/8	31/32	13/16	1 1/2	34,000
.875 F	7/8-14	1 3/4	2 5/16	1/2	1 1/8	31/32	13/16	1 1/2	39,000
1.000 F	1-14	2 1/2	2 15/16	1/2	1 5/8	1 3/8	1 5/32	2 1/4	64,000
1.000 C	1-8	2 1/2	2 15/16	1/2	1 5/8	1 3/8	1 5/32	2 1/4	64,000
1.250 F	1 1/4-12	2 1/2	2 15/16	1/2	1 5/8	1 3/8	1 5/32	2 1/4	78,000
1.375 F	1 3/8-12	2 1/2	2 15/16	1/2	1 5/8	1 3/8	1 5/32	2 1/4	78,000
1.500 F	1 1/2-12	3 1/4	4 3/8	13/16	2 1/4	1 3/4	1 1/2	3	134,000
1.750 F	1 3/4-12	3 1/4	4 3/8	13/16	2 1/4	1 3/4	1 1/2	3	134,000
1.875 F	1 7/8-12	3 3/4	5 7/16	7/8	3	2	1 7/8	3 1/2	240,000
2.000 F	2-12	3 3/4	5 7/16	7/8	3	2	1 7/8	3 1/2	240,000

* 2 Flats on these couplers only.

"HY" TIE ROD AND/OR MOUNTING SUPPORTS

BORE DIAMETER	SUGGESTED NUMBER OF SUPPORTS FOR STROKE LENGTHS LISTED BELOW						
	30	40	50	60	80	100	120
1 1/2	1	1	1	2	2	3	4
2		1	1	1	2	2	3
2 1/2			1	1	1	2	2
3 1/4				1	1	1	2
4					1	1	1
5						1	1
6							1

NOTE: Suggested by Manufacturer, but may be eliminated if low pressure, slow speed application.

*** Stroke length in excess of 132" consult factory**

Tie rod and/or mounting supports are used to improve the structural rigidity of long stroke cylinders.

The tie rod support allows the tie rods thru, yet keeps them positioned appropriately around the center line of the cylinder. Tie rod supports are held in position by set screws thru to the tie rods. Mounting supports, typically have the tie rods threaded into them, which then locates the mounting support as required by the customer.

HY CHART (IN POUNDS)*

BORE	ROD DIA.	MP2	IH3	IH4	ME5	ME6	HY-MS2 HY-MS3	HY-MF1	HY-MF5	HY-MPU3 HY-MP3 HY-MP1	HY-MF2	HY-MF6	HY-MT4	HY-MT1 HY-MT2	HM-MXO HY-MS4 HY-MX2 HY-MX3	HY-MX1	ADD PER In. Stroke	DOUBLE END
1½	⅝	8.57	15.04	16.04	11.74	12.14	7.8	7.6	8.0	7.9	8.0	9.0	11.0	7.7	7.7	7.7	.49	.58
2	1	14.60	22.38	24.38	17.80	18.9	13.1	12.9	14.0	13.0	14.0	16.0	18.0	13.0	12.0	12.0	.80	1.00
2½	1	20.07	29.09	31.09	23.28	25.28	19.3	17.0	19.0	17.9	19.0	21.0	23.0	17.0	16.5	16.5	1.07	1.30
3¼	1⅜	38.31	55.79	59.99	46.63	50.63	34.0	33.0	36.0	34.0	37.0	40.2	46.0	32.9	31.7	32.0	1.76	2.20
4	1¾	56.20	72.16	77.66	60.36	65.06	49.0	45.5	49.5	50.0	50.2	55.0	59.0	44.0	42.3	43.0	2.25	2.90
5	2	102.68	128.26	135.26	108.70	104.70	84.0	84.0	91.2	92.2	80.0	98.2	100	79.1	80.0	81.0	4.00	4.80
6	2½	156	196	203	166	179	136.0	131.0	143	141	144	154	155	124.9	124	127	5.19	6.56
7	3	234	301	311	254	270	203	194	211	214	210	221	234	190	187	191	6.45	8.50
8	3½	320	411	425	346	369	273	262	286	295	285	300	325	260	255	265	8.90	11.65
10	4½	686	775	760	640	633	574			610			725	555	550	540	15.67	20.15
12	5½	1101	1253	1221	1036	1024	952			980			1187	900	890	887	21.90	28.60
14	7	1729	1848	1800	1540	1521	1475			1540			1940	1360	1330	1330	30.50	41.40

* To convert pounds to kilograms, multiply by .4536

All Dimensions In Inches

BORE	ROD DIA. MM	A	B	C	CC	D	FA	JJ	JC	JD	JE	JF	KK	RM	V	VB	W	WF	XC	XD	XG	XH	XI**	XJ	XS	XT	Y	ZB	ZC	ZD	ZF	ZH	ZJ	ZM
1½	5/8	3/4	1.124	3/8	5/8-18	1/2	9/16▲	1/2-20	1½	5/8	1/4	3/8	7/16-20	2¼	1/4	5/8	5/8	1	6 3/8	6 3/4	1 7/8	6 7/16	3 7/16	4 7/8	1 3/8	2	2 1/32	6	6 7/8	7 1/4	6	7 3/16	5 5/8	6 7/8
	1	1 1/8	1.499	1/2	1-14	7/8	5/8▲	7/8-14	1½	15/16	3/8	11/16	3/4-16	2½ SØ***	1/2	7/8	1	1 3/8	6 3/4	7 1/8	2 1/4	6 13/16	3 13/16	5 1/4	1 3/4	2 3/8	2 13/32	6 3/8	7 1/4	7 5/8	6 3/8	7 9/16	6	7 5/8
2	1	1 1/8	1.499	1/2	1-14	7/8	9/16	7/8-14	1½	15/16	3/8	11/16	3/4-16	2 7/8	1/4	7/8	3/8	1 3/8	7 1/4	7 7/8	2 1/4	7 3/16	3 13/16	5 1/4	1 7/8	2 3/8	2 3/8	6 1/2	8	8 5/8	6 5/8	8 7/16	6	7 5/8
	1 3/8	1 5/8	1.999	5/8	1 3/8-12	1 1/8	9/16	1 1/4-12	1 3/4	1 1/16	3/8	7/8	1-14	3	3/8	1	1	1 5/8	7 1/2	8 1/8	2 1/2	7 7/16	4 1/16	5 1/2	2 1/8	2 5/8	2 5/8	6 3/4	8 1/4	8 7/8	6 7/8	8 11/16	6 1/4	8 1/8
2½	1	1 1/8	1.499	1/2	1-14	7/8	9/16	7/8-14	1½	15/16	3/8	11/16	3/4-16	2 7/8	1/4	7/8	3/4	1 3/8	7 3/8	8	2 1/4	7 5/16	3 7/8	5 3/8	2 1/16	2 3/8	2 3/8	6 5/8	8 1/8	8 3/4	6 3/4	8 9/16	6 1/8	7 3/4
	1 3/8	1 5/8	1.999	5/8	1 3/8-12	1 1/8	9/16	1 1/4-12	1 3/4	1 1/16	3/8	7/8	1-14	3 3/8	3/8	1	1	1 5/8	7 5/8	8 1/4	2 1/2	7 9/16	4 1/8	5 5/8	2 5/16	2 5/8	2 5/8	6 7/8	8 3/8	9	7	8 13/16	6 3/8	8 1/4
	1 3/4	2	2.374	3/4	1 3/4-12	1 1/2	9/16	1 1/2-12	1 3/4	1 5/16	1/2	1 1/8	1 1/4-12	3 3/8	1/2	1 1/8	1 1/4	1 7/8	7 7/8	8 1/2	2 3/4	7 13/16	4 3/8	5 7/8	2 9/16	2 7/8	2 7/8	7 1/8	8 5/8	9 1/4	7 1/4	9 1/16	6 5/8	8 3/4
3¼	1 3/8	1 5/8	1.999	5/8	1 3/8-12	1 1/8	13/16▲	1 1/4-12	1 3/4	1 1/16	3/8	7/8	1-14	3 3/8	1/2	3/4	7/8	1 5/8	8 5/8	9 3/8	2 5/8	8 11/16	4 1/2	6 1/4	2 5/16	2 3/4	2 3/4	7 3/4	9 5/8	10 3/8	7 7/8	10 3/16	7 1/8	9
	1 3/4	2	2.374	3/4	1 3/4-12	1 1/2	7/8▲	1 1/2-12	1 3/4	1 5/16	1/2	1 1/8	1 1/4-12	3 3/4	3/8	7/8	1 1/8	1 7/8	8 7/8	9 5/8	2 7/8	8 15/16	4 3/4	6 1/2	2 9/16	3	3	8	9 7/8	10 5/8	8 1/8	10 7/16	7 3/8	9 1/2
	2	2 1/4	2.624	7/8	2-12	1 11/16	13/16▲	1 3/4-12	2 5/8	1 11/16	5/8	1 3/8	1 1/2-12	3 5/8	3/8	7/8	1 1/4	2	9	9 3/4	3	9 1/16	4 7/8	6 5/8	2 11/16	3 1/8	3 1/8	8 1/8	10	10 3/4	8 1/4	10 9/16	7 1/2	9 3/4
4	1 3/4	2	2.374	3/4	1 3/4-12	1 1/2	7/8	1 1/2-12	1 3/4	1 5/16	1/2	1 1/8	1 1/4-12	3 3/4	1/4	7/8	1	1 7/8	9 3/4	10 5/8	2 7/8	9 9/16	4 7/8	6 3/4	2 3/4	3	2 31/32	8 1/4	11 1/8	12	8 1/2	11 5/16	7 5/8	9 3/4
	2	2 1/4	2.624	7/8	2-12	1 11/16	7/8	1 3/4-12	2 5/8	1 11/16	5/8	1 3/8	1 1/2-12	4	•••	7/8	1 1/8	2	9 7/8	10 3/4	3	9 11/16	5	6 7/8	2 7/8	3 1/8	3 3/32	8 3/8	11 1/4	12 1/8	8 5/8	11 7/16	7 3/4	10
	2 1/2	3	3.124	1	2 1/2-12	2 1/16	7/8	2 1/4-12	3 1/4	1 15/16	3/4	1 3/4	1 7/8-12	4 1/2	3/8	1	1 3/8	2 1/4	10 1/8	11	3 1/4	9 15/16	5 1/4	7 1/8	3 1/8	3 3/8	3 11/32	8 5/8	11 1/2	12 3/8	8 7/8	11 11/16	8	10 1/2
5	2	2 1/4	2.624	7/8	2-12	1 11/16	7/8	1 3/4-12	2 5/8	1 11/16	5/8	1 3/8	1 1/2-12	4	1/4	7/8	1 1/8	2	10 1/2	11 3/8	3	10 11/16	5 1/4	7 3/8	2 7/8	3 1/8	3 1/8	9 1/8	12 1/4	13 1/8	9 1/8	12 15/16	8 1/4	10 1/2
	2 1/2	3	3.124	1	2 1/2-12	2 1/16	7/8	2 1/4-12	3 1/4	1 15/16	3/4	1 3/4	1 7/8-12	4 1/2	3/8	1	1 3/8	2 1/4	10 3/4	11 5/8	3 1/4	10 15/16	5 1/2	7 5/8	3 1/8	3 3/8	3 3/8	9 3/8	12 1/2	13 3/8	9 3/8	13 3/16	8 1/2	11
	3	3 1/2	3.749	1	3-12	2 5/8	1▲	2 3/4-12	3 5/8	2 7/16	7/8	2 1/4	2 1/4-12	5 1/2	3/8	1	1 3/8	2 1/4	10 3/4	11 5/8	3 1/4	10 15/16	5 1/2	7 5/8	3 1/8	3 3/8	3 3/8	9 3/8	12 1/2	13 3/8	9 3/8	13 3/16	8 1/2	11
	3 1/2	3 1/2	4.249	1	3 1/2-12	3	1▲	3 1/4-12	4 3/8	2 11/16	1	2 1/2	2 1/2-12	5 7/8	3/8	1	1 3/8	2 1/4	10 3/4	11 5/8	3 1/4	10 15/16	5 1/2	7 5/8	3 1/8	3 3/8	3 3/8	9 3/8	12 1/2	13 3/8	9 3/8	13 3/16	8 1/2	11
6	2 1/2	3	3.124	1	2 1/2-12	2 1/16	7/8	2 1/4-12	3 1/4	1 15/16	3/4	1 3/4	1 7/8-12	4 1/2	1/4	1	1 1/4	2 1/4	12 1/8	13 1/8	3 3/8	12 5/16	5 15/16	8 3/8	3 3/8	3 1/2	3 1/2	10 5/8	14 1/8	15 1/8	10 5/8	15 1/16	9 5/8	11 7/8
	3	3 1/2	3.749	1	3-12	2 5/8	1	2 3/4-12	3 5/8	2 7/16	7/8	2 1/4	2 1/4-12	5 1/2	1/4	1	1 1/4	2 1/4	12 1/8	13 1/8	3 3/8	12 5/16	5 15/16	8 3/8	3 3/8	3 1/2	3 1/2	10 5/8	14 1/8	15 1/8	10 5/8	15 1/16	9 5/8	11 7/8
	3 1/2	3 1/2	4.249	1	3 1/2-12	3	1	3 1/4-12	4 3/8	2 11/16	1	2 1/2	2 1/2-12	5 7/8	1/4	1	1 1/4	2 1/4	12 1/8	13 1/8	3 3/8	12 5/16	5 15/16	8 3/8	3 3/8	3 1/2	3 1/2	10 5/8	14 1/8	15 1/8	10 5/8	15 1/16	9 5/8	11 7/8
	4	4	4.749	1	4-12	3 3/8	1	3 3/4-12	4 1/2	2 11/16	1	3	3-12	6 3/8	1/4	1	1 1/4	2 1/4	12 1/8	13 1/8	3 3/8	12 5/16	5 15/16	8 3/8	3 3/8	3 1/2	3 1/2	10 5/8	14 1/8	15 1/8	10 5/8	15 1/16	9 5/8	11 7/8
7	3	3 1/2	3.749	1	3-12	2 5/8	1	2 3/4-12	3 5/8	2 7/16	7/8	2 1/4	2 1/4-12	5 1/2	1/4	1	1 1/4	2 1/4	13 3/4	14 3/4	3 5/8	•••	6 1/2	9 3/8	3 5/8	3 13/16	3 13/16	11 7/8	16 1/4	17 1/4	11 3/4	•••	10 3/4	13
	3 1/2	3 1/2	4.249	1	3 1/2-12	3	1	3 1/4-12	4 3/8	2 11/16	1	2 1/2	2 1/2-12	5 7/8	1/4	1	1 1/4	2 1/4	13 3/4	14 3/4	3 5/8	•••	6 1/2	9 3/8	3 5/8	3 13/16	3 13/16	11 7/8	16 1/4	17 1/4	11 3/4	•••	10 3/4	13
	4	4	4.749	1	4-12	3 3/8	1	3 3/4-12	4 1/2	2 11/16	1	3	3-12	6 3/8	1/4	1	1 1/4	2 1/4	13 3/4	14 3/4	3 5/8	•••	6 1/2	9 3/8	3 5/8	3 13/16	3 13/16	11 7/8	16 1/4	17 1/4	11 3/4	•••	10 3/4	13
	4 1/2	4 1/2	5.249	1	4 1/2-12	3 7/8	1	4 1/4-12	5 1/4	3 3/16	1 1/2	3 1/2	3 1/4-12	7	1/4	1	1 1/4	2 1/4	13 3/4	14 3/4	3 5/8	•••	6 1/2	9 3/8	3 5/8	3 13/16	3 13/16	11 7/8	16 1/4	17 1/4	11 3/4	•••	10 3/4	13
	5	5	5.749	1	5-12	4 1/4	1	4 3/4-12	5 3/8	3 3/16	1 1/2	3 7/8	3 1/2-12	7 3/8	1/4	1	1 1/4	2 1/4	13 3/4	14 3/4	3 5/8	•••	6 1/2	9 3/8	3 5/8	3 13/16	3 13/16	11 7/8	16 1/4	17 1/4	11 3/4	•••	10 3/4	13
8	3 1/2	3 1/2	4.249	1	3 1/2-12	3	1	3 1/4-12	4 3/8	2 11/16	1	2 1/2	2 1/2-12	5 7/8	1/4	1	1 1/4	2 1/4	15	16	3 3/4	•••	7	10 1/4	3 5/8	3 15/16	3 15/16	12 3/4	17 3/4	18 3/4	12 3/4	•••	11 3/4	14
	4	4	4.749	1	4-12	3 3/8	1	3 3/4-12	4 1/2	2 11/16	1	3	3-12	6 3/8	1/4	1	1 1/4	2 1/4	15	16	3 3/4	•••	7	10 1/4	3 5/8	3 15/16	3 15/16	12 3/4	17 3/4	18 3/4	12 3/4	•••	11 3/4	14
	4 1/2	4 1/2	5.249	1	4 1/2-12	3 7/8	1	4 1/4-12	5 1/4	3 3/16	1 1/2	3 1/2	3 1/4-12	7	1/4	1	1 1/4	2 1/4	15	16	3 3/4	•••	7	10 1/4	3 5/8	3 15/16	3 15/16	12 3/4	17 3/4	18 3/4	12 3/4	•••	11 3/4	14
	5	5	5.749	1	5-12	4 1/4	1	4 3/4-12	5 3/8	3 3/16	1 1/2	3 7/8	3 1/2-12	7 3/8	1/4	1	1 1/4	2 1/4	15	16	3 3/4	•••	7	10 1/4	3 5/8	3 15/16	3 15/16	12 3/4	17 3/4	18 3/4	12 3/4	•••	11 3/4	14
	5 1/2	5 1/2	6.249	1	5 1/2-12	4 5/8	1	5 1/4-12	6 1/4	3 15/16	1 7/8	4 3/8	4-12	8 3/32	1/4	1	1 1/4	2 1/4	15	16	3 3/4	•••	7	10 1/4	3 5/8	3 15/16	3 15/16	12 3/4	17 3/4	18 3/4	12 3/4	•••	11 3/4	14
10	4 1/2	4 1/2	5.249	1 11/16	4 1/2-12	3 7/8	1	4 1/4-12	5 1/4	3 15/16	1 1/2	3 1/2	3 1/4-12	7	•••	1	•••	2 15/16	19 1/16	•••	4 3/4	•••	9	13 1/4	4 9/16	•••	5	16 1/16	22 9/16	•••	16 3/4	•••	15 1/16	18
	5	5	5.749	1 11/16	5-12	4 1/4	1	4 3/4-12	5 3/4	3 3/16	1 1/2	3 7/8	3 1/2-12	7 3/8	•••	1	•••	2 15/16	19 1/16	•••	4 3/4	•••	9	13 1/4	4 9/16	•••	5	16 1/16	22 9/16	•••	16 3/4	•••	15 1/16	18
	5 1/2	5 1/2	6.249	1 15/16	5 1/2-12	4 5/8	1	5 1/4-12	6 1/4	3 15/16	1 7/8	4 3/8	4-12	8 3/32	•••	1	•••	3 3/16	19 5/16	•••	5	•••	9 1/4	13 1/2	4 13/16	•••	5 1/4	16 5/16	22 13/16	•••	17	•••	15 5/16	18 1/2
	7	7	7.749	1	6 1/2-12	•••	1	6 1/2-12	6 7/8	4 5/16	1 7/8	5 3/4	5 1/2-12	9 7/8	•••	1 15/16	•••	3 3/16	19 5/16	•••	5	•••	9 1/4	13 1/2	4 13/16	•••	5 1/4	16 5/16	22 13/16	•••	17	•••	15 5/16	18 1/2
12	5 1/2	5 1/2	6.249	1 3/4	5 1/2-12	4 5/8	1	5 1/4-12	6 1/4	3 15/16	1 7/8	4 3/8	4-12	8 3/32	•••	1	•••	2 3/4	22 3/16	•••	5 3/8	•••	10 7/16	15 1/2	5 3/16	•••	5 3/4	18 11/16	26 3/16	•••	19 5/8	•••	17 11/16	20 7/8
	7	7	7.749	1 1/16	6 1/2-12	•••	1 1/8	6 1/2-12	6 7/8	4 5/16	1 7/8	5 3/4	5 1/2-12	9 7/8	•••	1 15/16	•••	3	22 7/16	•••	5 5/8	•••	10 11/16	15 3/4	5 7/16	•••	6	18 15/16	26 7/16	•••	19 7/8	•••	17 15/16	21 3/8
	8	8	9.249	1 1/2	7 1/2-12	•••	1 7/8	7 1/2-12	5 3/4	3 3/16	1 1/2	6 3/8	6-12	•	•••	2 1/2	•••	4	23 7/16	•••	6 5/8	•••	11 11/16	16 3/4	6 7/16	•••	7	19 15/16	27 7/16	•••	20 7/8	•••	18 15/16	23 3/8
14	7	7	7.749	1	6 1/2-12	•••	1 1/8	6 1/2-12	6 7/8	4 5/16	1 7/8	5 3/4	5 1/2-12	9 7/8	•••	1 15/16	•••	2 15/16	24 13/16	•••	5 13/16	•••	11 1/4	16 11/16	5 15/16	•••	6 1/16	20 1/16	29 13/16	•••	21 1/4	•••	19 1/16	22 1/2
	8	8	9.249	1 11/16	7 1/2-12	•••	1 7/8	7 1/2-12	5 3/4	3 3/16	1 1/2	6 3/8	6-12	•	•••	2 1/2	•••	4 3/16	16 1/16	•••	7 1/16	•••	12 1/2	17 15/16	7 3/16	•••	7 5/16	21 5/16	31 1/16	•••	22 1/2	•••	20 5/16	25
	10	10	11.499	1 1/2	9-12	•••	2 11/16	9 1/2-12	4 3/8	2 1/16	1	8 1/2	7 1/2-12	•	•••	3 3/16	•••	4 11/16	26 9/16	•••	7 9/16	•••	13	18 7/16	7 5/16	•••	7 13/16	21 13/16	31 9/16	•••	22 3/4	•••	20 13/16	26

** $\frac{\text{STROKE}}{2}$ + XI Dim

• CONSULT FACTORY

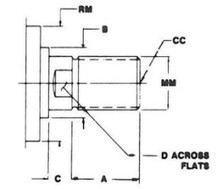
▲ DIMENSIONS UNIQUE TO AIR-DRO

*** ON HY-IH3 & HY-ME5, CORNERS WILL BE REDUCED TO A 3" DIAMETER.

ROD END SELECTION

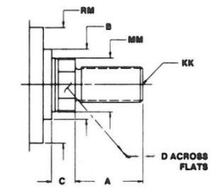
All Dimensions In Inches

STYLE #1 (NFPA-FM)

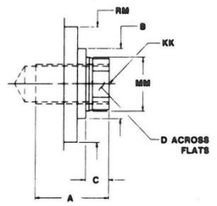


STANDARD STYLE #2 ROD END

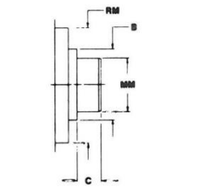
(⅝ DIA. THRU 5½ DIA. RODS HAVE WRENCH FLATS)



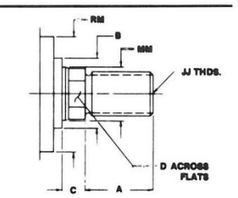
STYLE #3 (NFPA-SF)



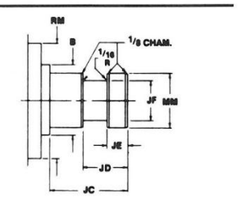
STYLE #4



STYLE #5



STYLE #6



- All hydraulic cylinders shown in this catalog are shown with the AIR-DRO style #2 rod end.
- All rod end accessories are designed to be mounted on the style #2 rod end.
- AIR-DRO will be happy to supply special customer rod ends. Just advise us of your requirement.

Application Guide

- **Clevis Mounts**

Clevis Mounts are used in applications where the machine component travels in a curved path. This mount can be used in both push and pull, with care being applied to prevent rod buckling in push applications. See Rod Size and Stop Tube selection page for proper rod sizing and/or stop tube requirements. The center line of the machine component attached to the swivel pin must be perpendicular to the center line of the rod and the curved path must be in one plane only. Any misalignment will induce side loading on the bearing and piston, which will cause premature cylinder failure. For applications slightly misaligned, use the MPU3 Mount and Spherical Rod Eye.

- **Rod End, Blind End & Intermediate Trunnion Mounts**

Like the Clevis Mount, Rod End and Blind End Trunnion Mounts are used in applications where the machine component travels in a curved path in one plane. Either Rod End or Blind End Trunnion mounts can be used in both push or pull, but Rod End Trunnion mounts will allow a longer maximum stroke without stop tubing vs. the Blind End Trunnion mount. Intermediate Trunnion Mounts can be positioned between the rod end and blind end of a cylinder, and can be used for strokes longer than Blind End Trunnion, but shorter than a Rod End Trunnion. Air-Dro's trunnion ears are a precisely toleranced integral part of the end cap, or intermediate trunnion, and may be used in applications that require controlled linear and arc movement. We recommend that rigidly mounted pillow blocks (with bearings as long as the trunnion ear) be used; and that the pillow block be installed as close to the side of the end cap or intermediate trunnion block as possible.

- **Rod End Flange Mounts (whether square, rectangular or integral)***

These mounts are excellent for straight line pull applications. The mounting surface should be flat and the toleranced rod bearings should be piloted into the mounting surface. Care should be exercised to insure the cylinder mounting surface is rigid enough to resist deflection induced by cylinder operation. The force of the load should be perpendicular to the face of the mounting surface, and parallel to the center line of the rod. For loads mounted eccentrically, use the largest rod dia. and incorporate a stop tube as calculated on the stop tube selection page. Integral rod end flange mounts are recommended for heavy duty applications, and where removable flange mount ratings are exceeded.

- **Blind End Flange Mounts (whether square, rectangular or integral)***

These mounts are excellent for straight line push applications. Care should be exercised to insure the cylinder mounting surface is rigid enough to resist deflection induced by cylinder operation. Additionally, rod dia. and stop tube need to be calculated as shown on the Rod Size and Stop Tube selection page. Integral Blind End Flange Mounts are recommended for heavy duty applications, and where removable flange mount ratings are exceeded.

- **Side Lug and Side Tapped Mounts***

These mounts are used when moving a load along a flat, guided surface, that is parallel to the centerline of the rod, and where the load is guided to move along the centerline of the rod. Care should be exercised to insure the cylinder mounting surface is rigid enough to resist deflection induced by cylinder operation. When loads are not guided, use the largest rod dia. and incorporate a stop tube as calucalated in the Stop Tube selection page. For high speed and shock applications, dowel pins and extended keyplate should be used.

- **Extended Tie Rod Mounts**

These mounts, like the flange mounts, are excellent for straight line push or pull applications. The Rod End extended tie rod mount is recommended in pull applications, and the blind end extended tie rod mount is recommended for push applications. Tie rods extended on both ends are designed for both push & pull applications, or where additional components are to be mounted to the cylinder. Care should be exercised to insure the cylinder mounting surface is rigid enough to resist deflection induced by cylinder operation. On Rod End extended Tie Rod mounts, the toleranced rod bearing may be piloted into the mounting surface. The force of the load should be perpendicular to the face of the mounting surface, and on the same centerline as the rod. For loads mounted eccentrically, use the largest Rod Dia. and incorporate a stop tube as calculated on the stop tube selection page. Once mounted, torque tie rod nuts to the following values:

Bore	1 1/2	2	2 1/2	3 1/4	4	5	6	7	8	10	12	14
Tie Rod Dia.	3/8	1/2	1/2	5/8	5/8	7/8	1	1 1/8	1 1/4	1	1	1
Torque (Ft. lbs.)	30	40	80	190	190	550	700	950	1250	700	700	700

* Use high strength socket head cap screws, or hex head bolts, properly torqued, to hold these cylinder mounts to their mounting surface.

HYDRAULIC CYLINDER SPEED

A Guide for Selection of Valve Port Size

Figures in the body of thls chart are cylinder rod travel speeds in "inches per minute." Lines with rod diameter as NONE are extension speeds, using the full piston area. Lines with rod diameters are retraction speeds, using "net" piston area.

CYL Bore	ROD DIA.	1 GPM*	3 GPM*	5 GPM*	8 GPM*	12 GPM*	15 GPM*	20 GPM*	25 GPM*	30 GPM*	40 GPM*	50 GPM*	75 GPM*
1 1/2	NONE	130	392	654	1034								
	5/8	158	476	792	1265								
	1	235	706	1176	1880								
2	NONE	73	221	368	588	883	1120						
	1	97	294	490	782	1175	1465						
	1 3/8	139	418	697	1115	1673	2090						
2 1/2	NONE	47	141	235	376	565	675	940	1175				
	1	56	168	280	448	672	840	1120	1400				
	1 3/8	67	203	339	542	813	1015	1355	1695				
	1 3/4	92	277	463	740	1110	1385	1850	2310				
3 1/4	NONE	28	83	139	223	334	417	557	696	836	1115		
	1 3/8	34	102	170	271	407	510	680	850	1020	1360		
	1 3/4	39	118	196	313	472	588	784	980	1176	1568		
	2	44	134	224	358	537	672	896	1120	1344	1792		
4	NONE	18	55	92	147	220	276	368	460	552	736	920	
	1 3/4	22	68	113	182	273	339	452	565	678	904	1130	
	2	24	73	133	196	294	366	488	610	732	976	1220	
	2 1/2	30	90	150	241	362	450	600	750	900	1200	1500	
5	NONE	12	35	58	94	141	174	232	290	348	464	500	870
	2	14	42	70	112	168	210	280	350	420	560	700	1050
	2 1/2	16	47	78	125	188	235	315	390	470	630	780	1170
	3	18	55	92	147	221	276	368	460	551	735	919	1379
	3 1/2	22	66	111	178	226	333	444	555	665	888	1110	1665
6	NONE	8	24	41	65	98	123	162	202	245	320	405	606
	2 1/2	10	30	50	79	118	150	200	250	300	420	495	750
	3	11	33	54	87	130	165	217	270	325	435	545	810
	3 1/2	12	37	63	99	149	186	248	310	372	495	619	929
	4	15	44	73	117	176	220	295	365	440	585	735	1095
7	NONE	6	18	30	48	72	90	120	150	180	240	300	450
	3	7	22	37	59	88	110	145	185	220	295	365	555
	3 1/2	8	24	40	64	96	120	160	200	240	320	400	600
	4	9	27	45	71	107	134	178	223	267	357	446	688
	4 1/2	10	31	51	82	123	185	205	256	307	409	512	767
	5	12	37	61	98	147	185	245	305	370	490	615	915
8	NONE	4	14	23	36	55	69	92	115	135	185	230	345
	3 1/2	5.5	17	28	45	68	85	115	140	170	230	285	420
	4	6	18	30	49	73	90	122	150	180	240	305	450
	4 1/2	7	20	34	54	81	101	134	168	202	269	336	504
	5	8	23	38	60	90	113	151	189	226	302	377	566
	5 1/2	8.5	26	43	70	104	129	172	215	255	345	430	645
10	NONE	3	9	15	23	35	44	60	73	88	115	145	220
	4 1/2	3.5	11	18	29	44	55	75	92	111	150	185	275
	5	4	12	20	31	47	59	78	98	118	157	196	294
	5 1/2	4.5	13	21	34	50	63	84	105	132	165	210	315
	7	5.5	17	29	46	69	87	115	145	174	230	285	435
12	NONE	2	6	10	16	25	31	41	51	61	82	102	153
	5 1/2	2.5	8	13	21	31	39	52	65	78	103	129	194
	7	3	9	15	25	37	46	62	77	93	124	155	232
	8	3.5	11	18	29	44	55	74	92	110	147	184	276
	9	4	12	20	33	49	61	82	102	123	164	205	307
14	NONE	.7	4.5	7.5	12	18	22.5	30	37.5	45	60	75	112.5
	7	2	6	10	16	24	30	40	50	60	80	100	150
	8	2.2	6.7	11	17.8	26.7	33.4	44.6	55.7	66.8	89	111.4	167
	10	3	9	15.3	24.5	36.8	46	61.3	76.6	92	122.5	153	229.8

*** U.S. gallons; to convert to liters, multiply by 3.785**

Temperature Conversion Chart

Enter the table in the column marked "Temp" with the temperature either Fahrenheit or Celsius (Centigrade) that you wish to convert. If converting into Celsius, read the equivalent value in the column to the left. If converting into Fahrenheit, read the equivalent in the column to the right.

Enter this column with the temperature you wish to convert.

°C	Temp	°F	°C	Temp	°F	°C	Temp	°F
-17.7	0	32.0	15.6	60	140.0	143	290	554
-17.2	1	33.8	16.1	61	141.8	149	300	572
-16.6	2	35.6	16.6	62	143.6	154	310	590
-16.1	3	37.4	17.1	63	145.4	160	320	608
-15.5	4	39.2	17.7	64	147.2	165	330	626
-15.0	5	41.0	18.2	65	149.0	171	340	644
-14.4	6	42.8	18.8	66	150.8	177	350	662
-13.9	7	44.6	19.3	67	152.6	182	360	680
-13.3	8	46.4	19.9	68	154.4	188	370	698
-12.7	9	48.2	20.4	69	156.2	193	380	716
-12.2	10	50.0	21.0	70	158.0	199	390	734
-11.6	11	51.8	21.5	71	159.8	204	400	752
-11.1	12	53.6	22.2	72	161.6	210	410	770
-10.5	13	55.4	22.7	73	163.4	215	420	788
-10.0	14	57.2	23.3	74	165.2	221	430	806
-9.4	15	59.0	23.8	75	167.0	226	440	824
-8.8	16	60.8	24.4	76	168.8	232	450	842
-8.3	17	62.6	25.0	77	170.6	238	460	860
-7.7	18	64.4	25.5	78	172.4	243	470	878
-7.2	19	66.2	26.2	79	174.2	249	480	896
-6.6	20	68.0	26.8	80	176.0	254	490	914
-6.1	21	69.8	27.3	81	177.8	260	500	932
-5.5	22	71.6	27.7	82	179.6	265	510	950
-5.0	23	73.4	28.2	83	181.4	271	520	968
-4.4	24	75.2	28.8	84	183.2	276	530	986
-3.9	25	77.0	29.3	85	185.0	282	540	1004
-3.3	26	78.8	29.9	86	186.8	288	550	1022
-2.8	27	80.6	30.4	87	188.6	293	560	1040
-2.2	28	82.4	31.0	88	190.4	299	570	1058
-1.6	29	84.2	31.5	89	192.2	304	580	1076
-1.1	30	86.0	32.1	90	194.0	310	590	1094
-0.6	31	87.8	32.6	91	195.8	315	600	1112
0	32	89.6	33.3	92	197.6	321	610	1130
0.5	33	91.4	33.8	93	199.4	326	620	1148
1.1	34	93.2	34.4	94	201.2	332	630	1166
1.6	35	95.0	34.9	95	203.0	338	640	1184
2.2	36	96.8	35.5	96	204.8	343	650	1202
2.7	37	98.6	36.1	97	206.8	349	660	1220
3.3	38	100.4	36.6	98	208.4	354	670	1238
3.8	39	102.2	37.1	99	210.2	360	680	1256
4.4	40	104.0	38	100	212	365	690	1274
4.9	41	105.8	43	110	230	371	700	1292
5.5	42	107.6	49	120	248	376	710	1310
6.0	43	109.4	54	130	266	382	720	1328
6.6	44	111.2	60	140	284	387	730	1346
7.1	45	113.0	65	150	302	393	740	1364
7.7	46	114.8	71	160	320	399	750	1382
8.2	47	116.6	76	170	338	404	760	1400
8.8	48	118.4	83	180	356	410	770	1418
9.3	49	120.2	88	190	374	415	780	1436
9.9	50	122.0	93	200	392	421	790	1454
10.4	51	123.8	99	210	410	426	800	1472
11.1	52	125.6	100	212	413	432	810	1490
11.5	53	127.4	104	220	428	438	820	1508
12.1	54	129.2	110	230	446	443	830	1526
12.6	55	131.0	115	240	464	449	840	1544
13.2	56	132.8	121	250	482	454	850	1562
13.7	57	134.6	127	260	500	460	860	1580
14.3	58	136.4	132	270	518	465	870	1598
14.8	59	138.2	138	280	536	471	880	1616

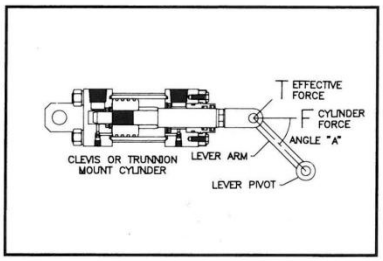
Cylinder Formulas

FORMULA FOR:	WORD FORMULA	LETTER FORMULA
CYLINDER AREA In Square Inches	**AREA** = π x RADIUS ^{2} *(Inches)*	$A = \pi r^2$
	AREA = $\frac{\pi}{4}$ x DIAMETER ^{2} *(Inches)*	$A = \frac{\pi D^2}{4}$ or $A = .785D^2$
CYLINDER FORCE *In Pounds, Push Or Pull*	**FORCE** = PRESSURE *(psi)* x NET AREA *(Square Inches)*	$F =$ psi x A or $F = PA$
CYLINDER VELOCITY or SPEED *In Feet/Second*	**VELOCITY** = $\frac{231 \times \text{FLOW RATE } (GPM)}{12 \times 60 \text{ NET AREA } (\text{Square Inches})}$	$v = \frac{231Q}{720A}$ or $v = \frac{.3208Q}{A}$
CYLINDER VOLUME CAPACITY *In Gallons of Fluid*	**VOLUME** = $\frac{\pi \times \text{RADIUS}^2 \text{ (Inches)} \times \text{STROKE (inches)}}{231}$	$v = \frac{\pi r^2 L}{231}$ L = Length of Stroke in Inches
	= $\frac{\text{NET AREA (Square Inches)} \times \text{STROKE (inches)}}{231}$	$v = \frac{AL}{231}$
CYLINDER FLOW RATE *In Gallons Per Minute*	**FLOW RATE** = $\frac{12 \times 60 \times \text{VELOCITY (Feet/Sec)} \times \text{NET AREA (Square Inches)}}{231}$	$Q = \frac{720VA}{231}$ or $Q = 3.117VA$
VELOCITY THROUGH PIPING *In Feet/Second Velocity*	**VELOCITY** = $\frac{.3208 \times \text{FLOW RATE THROUGH I.D. } (GPM)}{\text{INTERNAL AREA (Square Inches)}}$	$v = \frac{.3208Q}{A}$
COMPRESSIBILITY OF OIL *In Additional Required Oil To Reach Pressure*	**ADDITIONAL VOLUME** = $\frac{\text{PRESSURE (psi)} \times \text{VOLUME OF OIL UNDER PRESSURE}}{250{,}000 \text{ (approx.)}}$	$V_A = \frac{PV^*}{250{,}000 \text{ (approx.)}}$ *Approximately 1/2% Per 1000 psi

Cylinders Working At An Angle

To find the effective force exerted by a cylinder pushing at an angle to the machine travel.

Cylinder thrust, F, is horizontal in this figure. Only that portion, T, which is at right angles to the lever axis is effective for turning the lever. The value of T varies with the acute angle "A" between cylinder and lever axes. To calculate T, multiply cylinder thrust times the power factor taken from the table below.

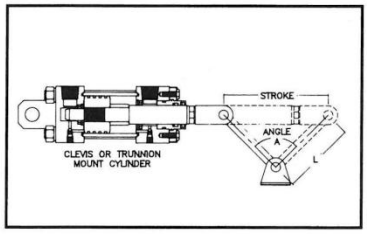


Angle A Degrees	Pwr. Factor (sin A)	Angle A Degrees	Pwr. Factor (sin A)	Angle A Degrees	Pwr. Factor (sin A)
5	0.087	35	0.573	**65**	**0.906**
10	0.174	40	0.643	**70**	**0.940**
15	0.259	45	0.707	**75**	**0.966**
20	0.342	50	0.766	**80**	**0.985**
25	0.423	55	0.819	**85**	**0.966**
30	0.500	60	0.867	**90**	**1.000**

EXAMPLE: A 4-inch bore cylinder working at 750 PSI will develop a 9425-lb. thrust (12.5664 sq. in. area x 750). Effective thrust when working at 65° angle is: 9425 x 0.906 (from above table) = 8539 lbs.

To find the cylinder stroke for operating a hinged lever, using the chord factor method.

If the cylinder is rotating the lever an equal angle each side of perpendicular, as in this figure, the length of stroke can very easily be determined by multiplying "L" (lever length, pin-to-pin) times the chord factor from the table below



A cylinder which operates any hinged device must be free to swing with the motion. It may have a clevis or Trunnion mounting on the rear end. Its rod must have a clevis with a throat deep enough so the lever will not touch the bottom of the slot on extreme angular movements.

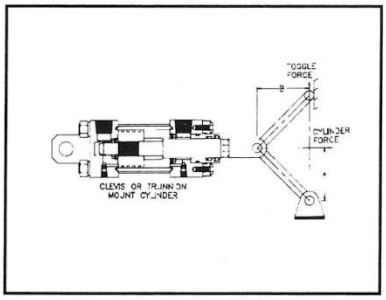
Angle A Degrees	Chord Factor	Angle A Degrees	Chord Factor	Angle A Degrees	Chord Factor	Angle A Degrees	Chord Factor
5	0.087	45	0.765	85	1.351	125	1.774
10	0.174	50	0.845	90	1.414	130	1.813
15	0.261	55	0.923	95	1.475	135	1.848
20	0.347	60	1.000	100	1.532	140	1.879
25	0.433	65	1.075	105	1.587	145	1.907
30	0.518	70	1.147	110	1.638	150	1.932
35	0.601	75	1.217	115	1.687	155	1.953
40	0.684	80	1.286	120	1.732	160	1.970

EXAMPLE: The cylinder stroke needed to swing a 14-inch lever through a 105° arc, when mounted as in this figure, is found by taking the factor 1.587 from the chart times 14-inch lever = 22.218-inch stroke length. Many times a stock cylinder with standardized stroke length can be used by lengthening or shortening the lever arm for the desired travel.

Toggle Mechanism Operated with a Cylinder

For operations such as coining and marking requiring exact depths and requiring extremely high forces for a very short distance, the toggle lever system is useful.

In this figure, cylinder thrust is horizontal and toggle force is taken off vertically. Bearings at each end of the toggle lever must be closely fitted and heavy enough to carry the full toggle thrust.



A calculation of toggle force can be made with the following formula, with T and F in the same units, and A and B in the same units. Note that dimension A is not the lever length, but for high leverage toggle calculations it can be used for lever length, with only small error, since the lever is nearly vertical.

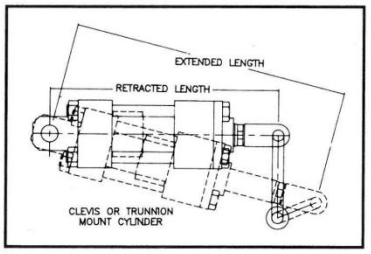
$$T(\text{Toggle Force}) = \frac{F(\text{Cylinder Thrust}) \times A}{2B}$$

EXAMPLE: Find the toggle force from a cylinder thrust of 5,600 lbs., if the toggle lever is 15 inches long and is ½ inch from vertical (Distance B).

SOLUTION: T=5,600 x 15 ÷ 2 x ½ = 84,000 lbs. This is a multiplication of 15 times the direct cylinder thrust. The remaining travel distance of the toggle arm at any point in the cylinder stroke is twice the difference between distance A and the true length, pin-to-pin, of the toggle arm. Distance A can be found by geometry or from a scale layout.

To find the cylinder stroke for operating a hinged lever, using the following scale layout method.

In all cases, a sketch should be made, showing the length and angular travel of the lever, and showing the mounting position of the cylinder.



If desired, an exact solution can be worked out by mathematics. For those not familiar with mathematical methods, an easy solution is to lay out all parts to exact scale. Pin-to-pin centers on the proposed cylinder can be obtained from pages throughout this catalog. A ruler, tape, or scale can be used to measure the distance from the cylinder rear hinge to the starting and ending points of the lever travel. These will be retracted and extended cylinder lengths. The travel of the cylinder piston (or stroke) will be the difference between these two measurements.

It may be necessary to experiment with different hinge point locations until the best mounting position for the cylinder can be determined. As a matter of interest, for a given amount of angular travel, the longest cylinder stroke is required when the cylinder is mounted at right angles to the lever center position. All other cylinder mounting locations will need a shorter stroke.

And, Other Miscellaneous Data

RULES-OF-THUMB

Compressibility of hydraulic oil;
Volume reduction is approximately 1/2% for every 1000 PSI of fluid pressure.

Compressibility of water:
Volume reduction is about 1/3% for every 1000 PSI pressure.

Wattage for heating hydraulic oil:
Each watt will raise the temperature of 1 gallon of oil by 1°F per hour.

Flow velocity in hydraulic lines:
Pump suction lines 2 to 4 feet per second; pressure lines up to 500 PSI, 10 to 15 feet/sec; presure lines 500 to 3000 PSI, 15 to 20 ft/sec; pressure lines over 3000 PSI, 25 ft/sec; all oil lines in air-over-oil system, 4 ft/sec.

Force for piercing or shearing sheet metal:

$$F = P \times T \times PSI$$

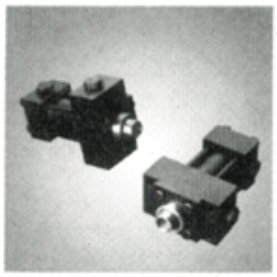
F is force required in pounds,

P is perimeter around area to be sheared, in inches,

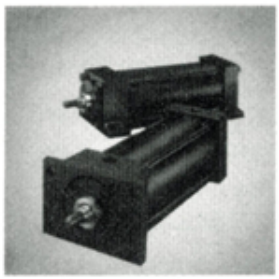
T is sheet thickness in inches;

PSI is the shear strength rating of the material in pounds per square inch.

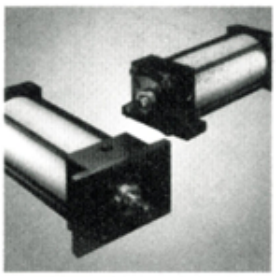
AC offers the following product lines and services



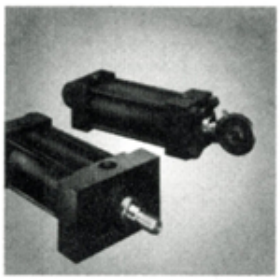
HY SERIES
- NFPA Interchangeable
- 3000/5000 psi rated
- All steel construction



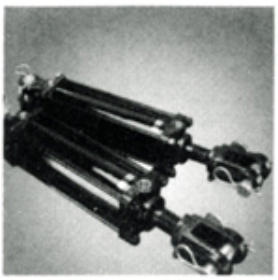
ASL/ASH SERIES
- NFPA Interchangeable
- ASL – to 250 psi pneumatic
- ASH – 1500 psi nominal hydraulic



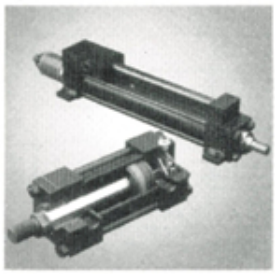
ASQ SERIES
- NFPA Interchangeable
- ASQ – to 250 psi pneumatic
- AHQ – to 400 psi hydraulic
- Aluminum construction



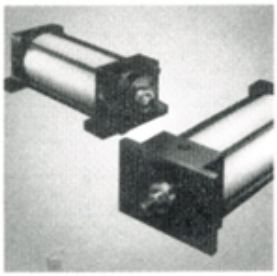
MHI/MHD SERIES
- Conform to international metric specifications
- IHM – ISO 6020/2
- DHM – DIN 24 554
- 210 BAR nominal hydraulic
- All steel construction



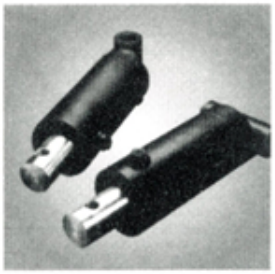
AG SERIES
- WorkHorse Line
- ASAE Interchangeable agricultural cylinders
- Non ASAE also available
- 2500 psi hydraulic



ECS SERIES
- Hydraulic or pneumatic cylinders incorporate various stroke sensing and feedback devices.
- Available in all models.
- Manifold designs also available.

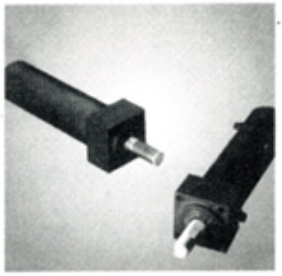


ASV SERIES
- NFPA Interchangeable
- To 200 psi pneumatic
- Aluminum construction

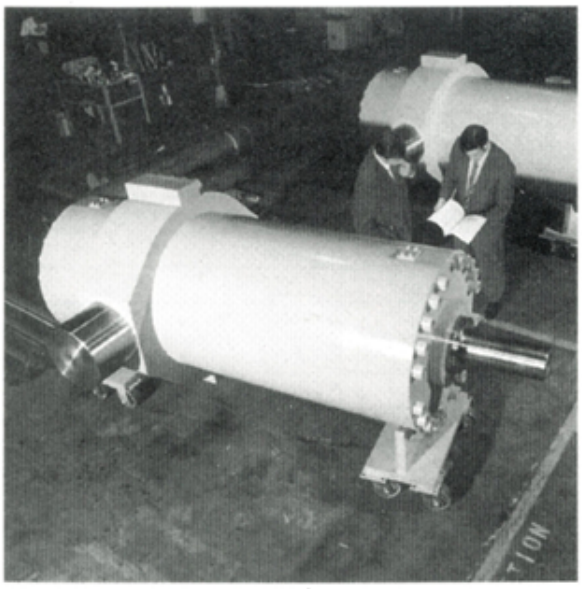


WH SERIES
- Welded construction
- WH – Industrial grade, 3000 psi hydraulic
- WHM– WorkHorse Line, mobile grade, to 3000 psi hydraulic

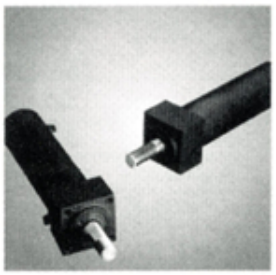
SMMA & SMMB SERIES
- Mill duty contruction to CETOP RP58H and RP73H standards



SS/HSS SERIES
- SpaceSaver series cylinders
- Threaded Body, Round Line construction
- HSS – to 1000 psi hydraulic
- SS – to 200 psi pneumatic



CUSTOM CYLINDER
- Custom cylinders to meet all special requirements.
- Bores to 60" (1500mm)
- Strokes to 65 feet (20 meters)
- Pressures to 10,000 psi (700 BAR) or higher



SMM/SMI SERIES
- Mill duty construction
- Conform to international metric specifications
- SMM – ISO 3320 and DIN 24 334, hydraulic 250/350 BAR
- SMI – ISO 6022, hydraulic 250 BAR

ALTIOX®/HYPOS® SERIES
- Altiox 300® metal oxide rod coating for superior corrosion protection.
- Hypos® stroke sensing for up to 60 feet.

Extensive repair & rebuild facility for all makes of cylinder.

OTHER ACTUATOR TYPES
- Rotary Actuators
- Boosters
- Air/Oil Tanks
- Plastic/Composite Cylinders
- Food Service Cylinders
- Stainless Steel Cylinders
- Water Service Cylinders
- Low Friction Cylinders
- Ram Type Cylinders
- Custom Cylinders

SPECIFICATIONS MANUFACTURED TO:
NFPA, ISO 6020/2, ISO 6022, ISO 3220, DIN 24 334, DIN 24 554, ABS, DNV, USCG, AASHTO, JIS, ANSI, AWS, ASTM, CETOP RP58H & RP73H