CATALOG 8201HE

HYDRAULIC CYLINDERS

MEDIUM PRESSURE HYDRAULIC CYLINDERS

PRESSURE RATED PER BORE SIZE TO 2,000 PSI

STANDARD BRASS AND STEEL CONSTRUCTION

ALL-STAINLESS STEEL CONSTRUCTION

NFPA TIE-ROD DESIGN

CUSTOM DESIGNS

ALSO:

- SPRING EXTEND AND RETRACT
- POSITION SENSING CYLINDERS
- BOOSTERS

FEATURING

TIE-ROD MOUNT LIMIT SWITCHES!

LEHIGH®
FLUID POWER, INC.

www.lehighfluidpower.com

FLUID POWER . . .

Pneumatic and Hydraulic Power!

You are sure to note some special features on our industrial pneumatic and hydraulic cylinders. Like our exclusive Miracalube® lubricant on our air cylinders. And our unique ability to mount tie-rod limit switches on hydraulic cylinders. And then there's our line of stainless steel cylinders.

Industrial Pneumatic and Hydraulic Cylinders

We have been manufacturing cylinders since the 1940's. Our standard materials include brass tubing for our air and medium duty hydraulics, steel for high pressure, and stainless steel for any application. With our capabilities your engineering application gets focused and expert attention, and your purchasing gets competitive pricing.

We welcome the one-of-a-kind special as well as the OEM quantity. So whether your requirements are frequent or few, standard or custom, we are here to help.

Better By Design

Among our innovations: The Miracalube® self-lubricated air cylinder. Its lubricant is made of FDA approved materials and does not mist into the atmosphere. Over 50 million linear feet of piston travel have been reported in case histories!

Among our features: Limit switches can be tie-rod mounted on our medium duty hydraulic cylinders! This is unique in the industry, allowing sensing to be set anywhere along the stroke without external mechanisms.

And… These cylinders are offered from the catalog in bore sizes from 3/4" to 20" in pressures up to 250 PSI in air and up to 3,000 PSI hydraulic, with custom design for specials!

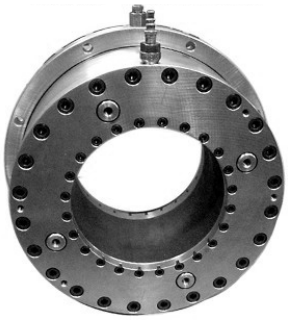
SOME OF OUR CUSTOM DESIGNS

Specials are welcome!

We have a long history of producing custom design cylinders that are specific to a customer's application. This includes such special features as:

- Unique mounting requirements
- Composite materials
- High-temperature cylinders
- Alternate media cylinders
- Larger bore cylinders
- Position sensing cylinders
- Engineered spring extend or retract cylinders
- Non-rotating rods
- Tandem force cylinders
- Underwater operation
- Higher pressure cylinders
- Locking cylinders

12” Bore x 2” Stroke
9” Dia. Piston w/8” Bore Thru
with (4) 1” Dia. Ejector Rods



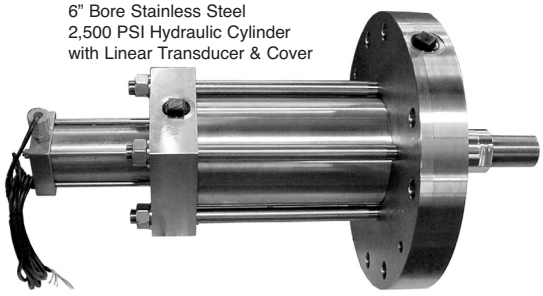
20” Bore Pneumatic Cylinder
Tandem Force Multiplier

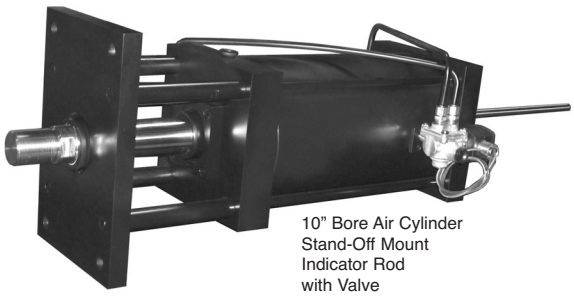
14” Bore Air Cylinder
Double Rod End
with Manual Override, Extend & Retract

1” x 6” Electro-Hydraulic
Transducer Cylinder

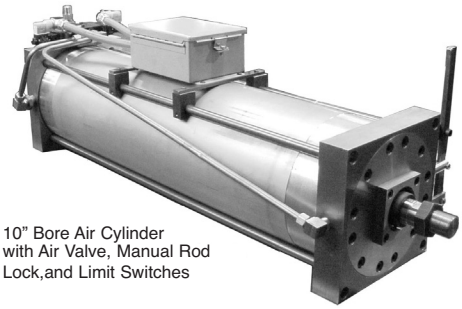
2” Bore Air Cylinder
Extended Double Rods, Special Nose Mount

6” Bore Stainless Steel
2,500 PSI Hydraulic Cylinder
with Linear Transducer & Cover





10” Bore Air Cylinder
Stand-Off Mount
Indicator Rod
with Valve



10” Bore Air Cylinder
with Air Valve, Manual Rod
Lock,and Limit Switches

Air & Hydraulic Cylinder
Rod-within-Rod

SERIES JHDH
MEDIUM PRESSURE HYDRAULIC CYLINDER
PRESSURE RATED BY BORE SIZE

The Lehigh Medium Pressure Hydraulic Cylinder Uniquely Qualified for Demanding Work

BENEFITS!

Based on the material sizes of our air cylinder, this hydraulic-fitted cylinder provides an economical design for hydraulic applications when a full 3,000 PSI working pressure is not required. (See our High Pressure Hydraulic catalog for cylinders of all bore sizes rated to 3,000 PSI.)

JHDH Medium Pressure Hydraulic Cylinder Series
Bore VS. Maximum Working Pressure Rating

Bore	Pressure	Bore	Pressure
1"	2,000 PSI	**3 1/4"**	1,000 PSI
1 1/2"	1,500 PSI	**4"**	700 PSI
2"	1,200 PSI	**5"**	600 PSI
2 1/2"	1,000 PSI	**6"**	600 PSI

Note: Pressure ratings are reduced for #06 and #07 mounting styles.
See ratings on applicable data pages.

This JHDH Series offers pressure ratings starting at 2,000 PSI with the 1" dia. bore. The pressure is then rated per size as the bore increases. (See the chart below.) The construction of this series enables the system designer to select a cylinder more closely matched to a circuit pressure, rather than opting for the bigger, more expensive high pressure cylinder design. Not only are there cost savings, but space and weight savings as well.

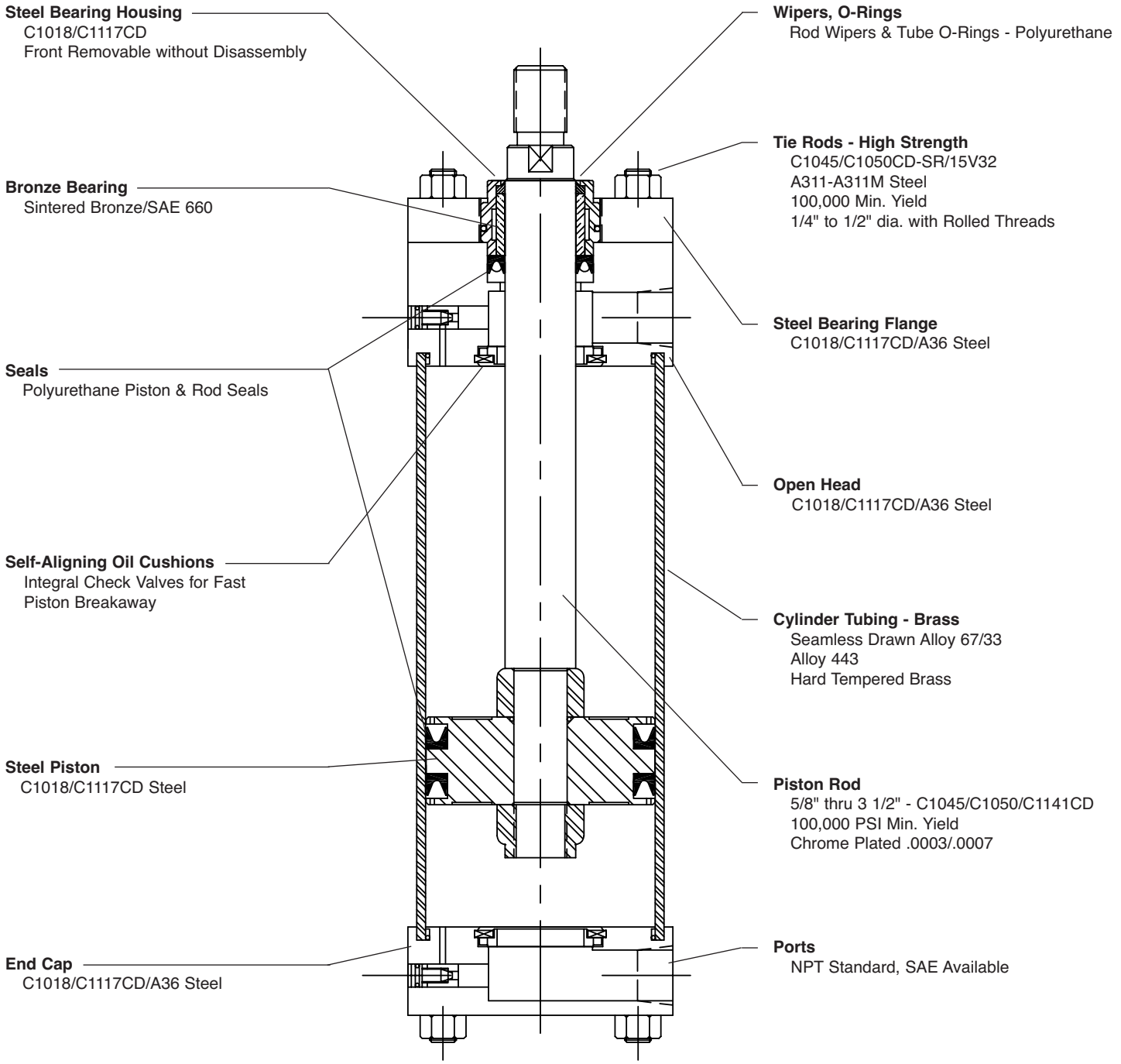
A truly unique benefit of our JHDH Series hydraulic cylinder is the ability of the system designer to specify tie-rod mount limit switches in the machine design. As pneumatic system designers already know, this is an economical position sensing technology as compared to end-of-stroke proximity sensors or linear displacement transducers. However, this has not been an option on hydraulic cylinders until our own unique construction design allowed it.

We are able to offer the lower cost tie-rod mount limit switch design on our medium pressure hydraulic series because of our construction materials. Competitors' air cylinders typically use aluminum tubes and can offer limit switches on them; but when they change to steel tubes for their medium pressure designs, they lose the ability to use magnetic switches. The tubing for both our air and medium pressure hydraulic cylinders is hard-tempered brass - has been since the 1940's. This material enables us to feature the same magnetic piston sensing option in hydraulics that is common in pneumatics.

SERIES JHDH MEDIUM DUTY HYDRAULIC CYLINDER

FEATURES!

The Series JHDH Hydraulic Cylinder Comes Standard with the Following Design Features:



Other… Operating Pressure to 2,000 PSI (Rated per Bore Size) … Operating Temp. from 0° to 165°F (Standard), to 400°F (Optional Seals)

Custom Hydraulic Cylinders

An important part of our business is the custom cylinder design. The Series JHDH hydraulic cylinder is available in virtually any configuration required by your special application. When you contact us with your design challenges, chances are that our engineering will meet the requirements of your special mounting, material, seal, temperature, sensing or other needs.

SERIES LSSE
ALL-STAINLESS STEEL CYLINDER
MEDIUM PRESSURE HYDRAULIC
PRESSURE RATED BY BORE SIZE

The Lehigh LSSE Medium Pressure Hydraulic Cylinder
All Stainless Steel

BENEFITS!

Look inside our Series LSSE hydraulic stainless steel cylinder and you will see that we build more quality and features in ... to get more productivity out.

The benefits of improved corrosion resistance coupled with the integrity of stainless steel make the Lehigh Series LSSE a truly unique cylinder for standard or special applications.

Lehigh stainless cylinders use broached stainless steel blocks and precision bored and honed stainless tubing. Chrome plated stainless steel rods are used to improve resistance to scratches and dents.

Our Series LSSE hydraulic cylinders are a vailable in bore sizes from 1" to 6", with pressure ratings starting at 1,000 PSI with the 1" dia. bore. The pressure is then rated per size as the bore increases. (See the chart below.) The construction of this series enables the system designer to select a cylinder more closely matched to a circuit pressure, rather than opting for the bigger, more expensive high pressure cylinder design. Not only are there cost savings, but space and weight savings as well.

As with our JHDH Series hydraulic cylinder, the system designer has the option of specifying tie-rod mount limit switches in the machine design. As pneumatic system designers already know, this is an economical position sensing technology as compared to end-of-stroke proximity sensors or linear displacement transducers.

The best feature of a Lehigh stainless steel cylinder is the long term savings in both reduced downtime and maintenance. Let Lehigh's sales and engineering departments help you select the best product for your application needs.

LSSE Medium Pressure Stainless Steel Hydraulic Cylinder Series Bore VS. Maximum Working Pressure Rating

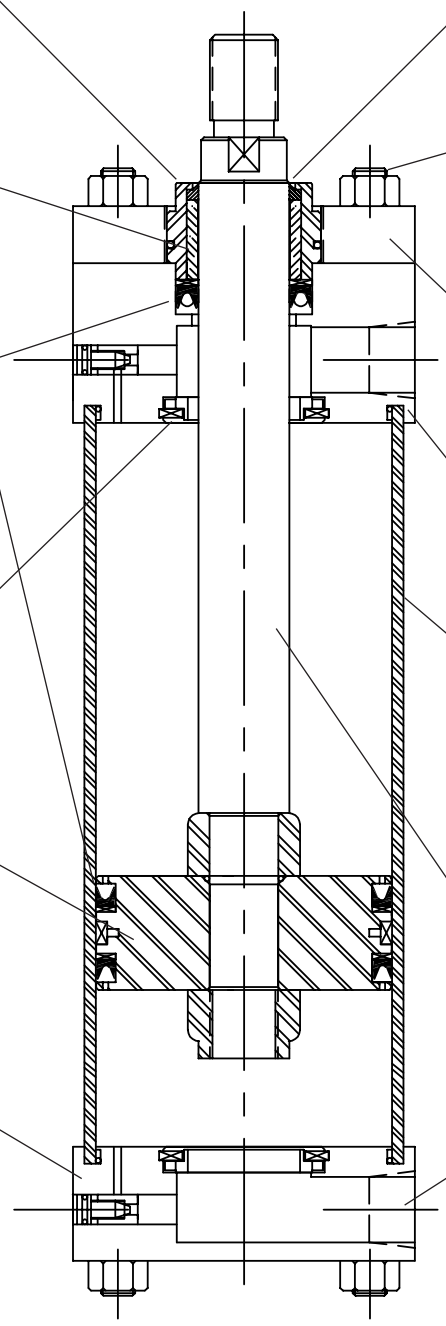
Bore	Pressure	Bore	Pressure
1"	1,500 PSI	**3 1/4"**	1,000 PSI
1 1/2"	1,500 PSI	**4"**	700 PSI
2"	1,250 PSI	**5"**	600 PSI
2 1/2"	1,000 PSI	**6"**	600 PSI

Notes: 1) Pressure ratings are reduced for #06 and #07 mounting styles. See ratings on applicable data pages.
2) Consult factory for pressure ratings for cylinders of all-316 stainless steel construction.

THE SERIES LSSE HYDRAULIC CYLINDER
ALL-STAINLESS STEEL

FEATURES!

The LSSE Stainless Steel Hydraulic Cylinder Comes Standard with the Following Design Features:



Bearing Housing
303/304/316 Stainless Steel
Front Removable without
Cylinder Disassembly

Bearing
Rulon® Rod Bearing

Seals
Polyurethane Piston and Rod Seals

Self-Aligning Oil Cushions
Integral Check Valves for
Fast Piston Breakaway

Piston
303/304/316 Stainless Steel
with Wear Band

End Cap
303/304/316 Stainless Steel

Wipers, O-Rings
Polyurethane Rod Wipers
& Tube O-Rings

Tie Rods, Tie Rod Nuts
17-4PH Stainless Steel

Bearing Flange
303/304/316 Stainless Steel

Open Head
303/304/316 Stainless Steel

Cylinder Tubing
1 1/2" to 6" Bore - 316 Stainless Steel
1" Bore - 303/304/316 Stainless Steel

Piston Rod
17-4PH Stainless Steel
Chrome Plated .0003/.0007

Ports
NPT Standard, SAE Available

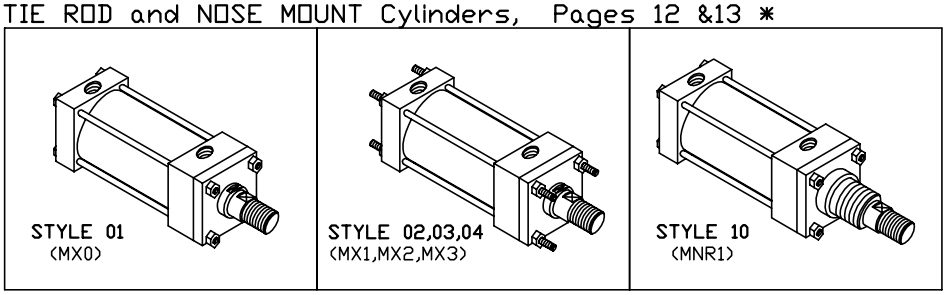
Other… Operating Pressure to 1,500 PSI (Rated per Bore Size) … Operating Temp. from 0° to 165°F (Standard), to 400°F (Optional Seals)

Custom Stainless Steel Hydraulic Cylinders

An important part of our business is the custom cylinder design. The Series LSSE stainless steel hydraulic cylinder is available in virtually any configuration required by your special application. When you contact us with your design challenges, chances are that our engineering will meet the requirements of your special mounting, material, seal, temperature, sensing or other needs.

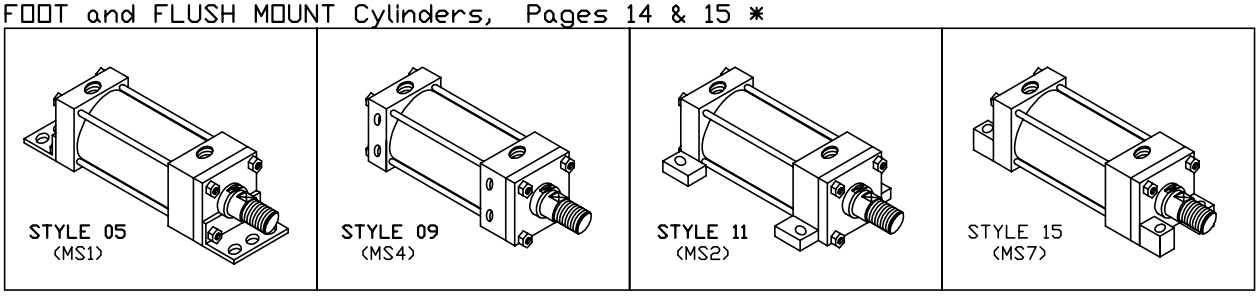
MOUNTING STYLES

TIE ROD and NOSE MOUNT Cylinders, Pages 12 &13 *

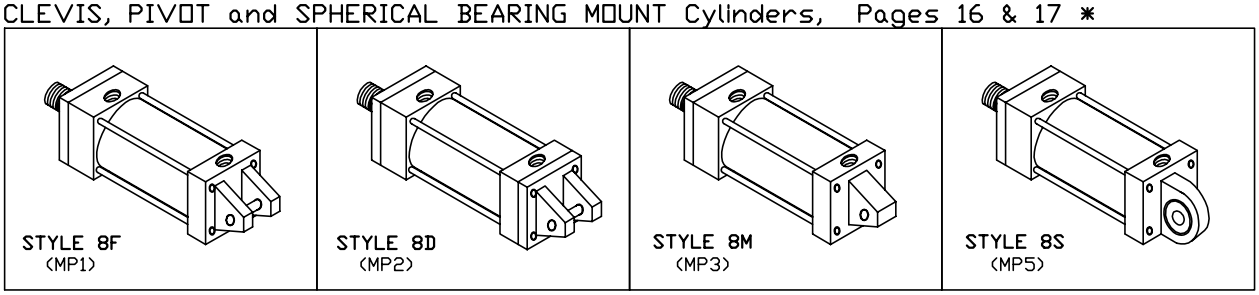


Lehigh Style No.
(NFPA Standard No.)

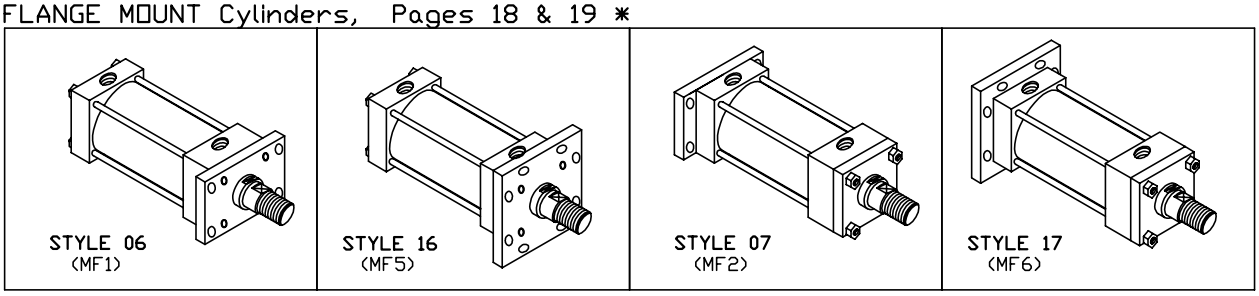
FOOT and FLUSH MOUNT Cylinders, Pages 14 & 15 *



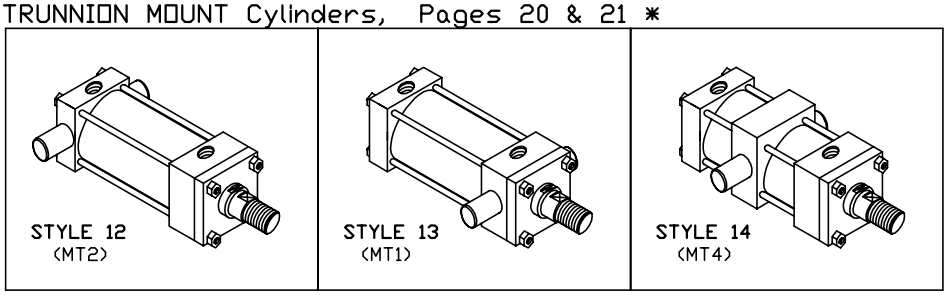
CLEVIS, PIVOT and SPHERICAL BEARING MOUNT Cylinders, Pages 16 & 17 *



FLANGE MOUNT Cylinders, Pages 18 & 19 *



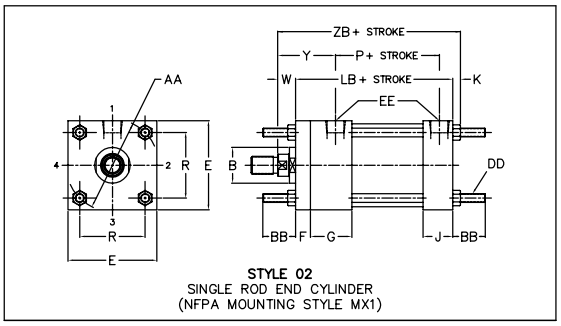
TRUNNION MOUNT Cylinders, Pages 20 & 21 *



* ALL 1.00 BORE MOUNTINGS
SEE PAGES 10 & 11

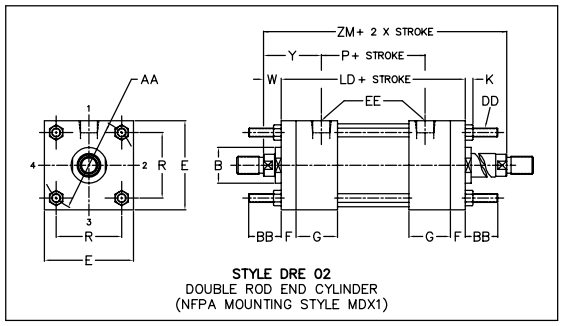
TABLE OF CONTENTS

TIE ROD, FLUSH, NOSE AND FOOT MOUNTED CYLINDERS
1" BORE SERIES JHDH AND LSSE
PRESSURE RATED HYDRAULIC CYLINDERS
STANDARD IN BRASS TUBE DESIGN AND ALL STAINLESS STEEL DESIGN!



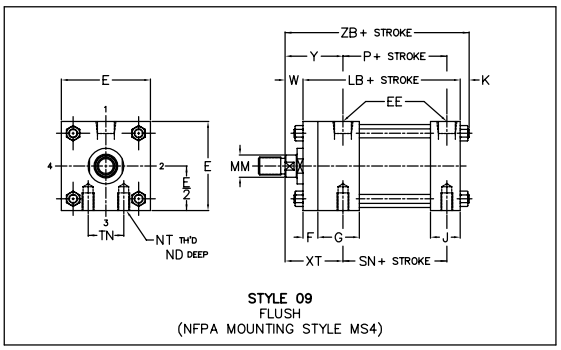
STYLE 02
SINGLE ROD END CYLINDER
(NFPA MOUNTING STYLE MX1)

Standard Port location is Position 1.
Standard Cushion location Position 2.



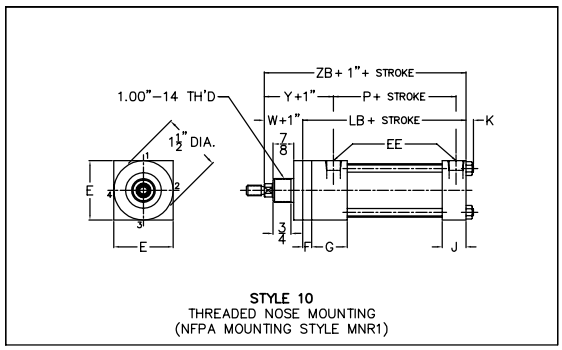
STYLE DRE 02
DOUBLE ROD END CYLINDER
(NFPA MOUNTING STYLE MDX1)

Standard Port location is Position 1.
Standard Cushion location Position 2.



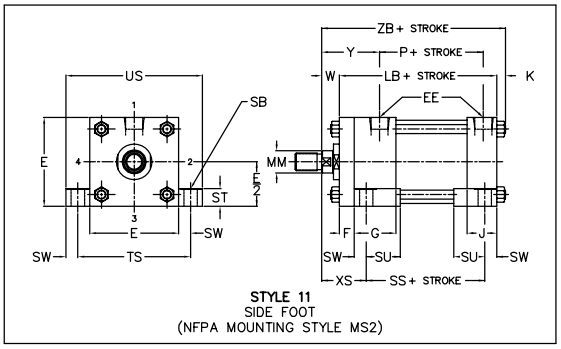
STYLE 09
FLUSH
(NFPA MOUNTING STYLE MS4)

Standard Port location is Position 1.
Standard Cushion location Position 2.



STYLE 10
THREADED NOSE MOUNTING
(NFPA MOUNTING STYLE MNR1)

Standard Port location is Position 1.
Standard Cushion location Position 2.

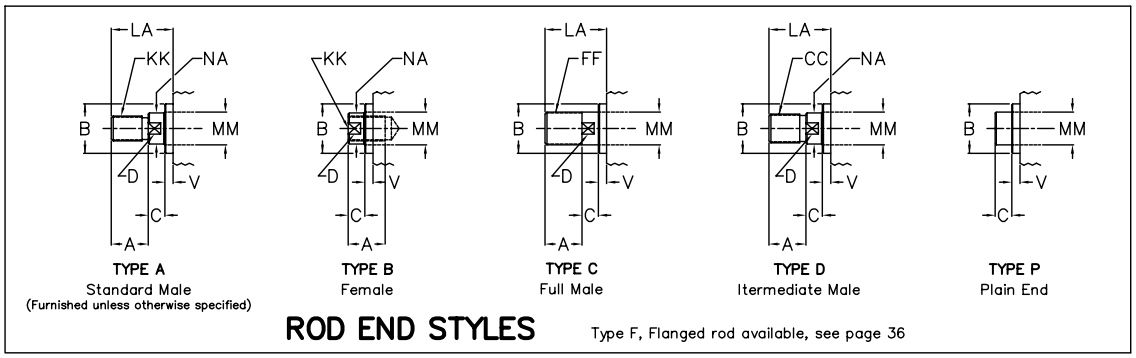


STYLE 11
SIDE FOOT
(NFPA MOUNTING STYLE MS2)

Standard Port location is Position 1.
Standard Cushion location Position 2.

TIE ROD MOUNTING DESCRIPTION

MOUNTING STYLE	NFPA MOUNTING STYLE	DESCRIPTION
01	MX0	NO TIE ROD EXTENSIONS
02	MX1	TIE RODS EXTENDED BOTH ENDS
03	MX2	TIE RODS EXTENDED CAP END
04	MX3	TIE RODS EXTENDED ROD END
DRE 01	MDX0	NO TIE ROD EXTENSIONS
DRE 02	MDX1	TIE RODS EXTENDED BOTH ENDS
DRE 03	MDX3	TIE RODS EXTENDED ONE END



TYPE A
Standard Male
(Furnished unless otherwise specified)

TYPE B
Female

TYPE C
Full Male

TYPE D
Itermediate Male

TYPE P
Plain End

ROD END STYLES

Type F, Flanged rod available, see page 36

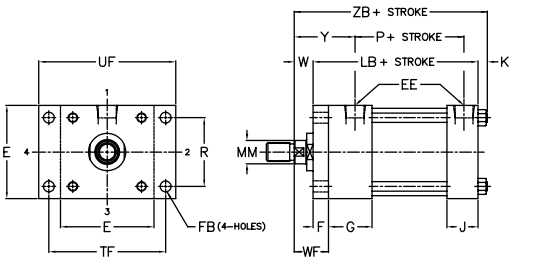
DIMENSIONS AFFECTED BY ROD DIAMETER

BORE	ROD DIA. MM	THREAD SIZE			ROD EXTENSIONS & PILOT DIMENSIONS						
		KK STD	CC	FF	A	B +.000 -.002	C	D	LA	NA	V
1	1/2	5/16-24	7/16-20	1/2-20	5/8	.999	3/8	3/8	1 1/4	7/16	1/4
	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4

FLANGE, CLEVIS PIVOT AND TRUNNION MOUNTED CYLINDERS

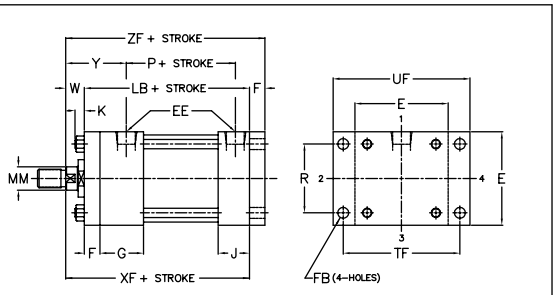
1" BORE SERIES JHDH AND LSSE

PRESSURE RATED HYDRAULIC CYLINDERS (Cont.)



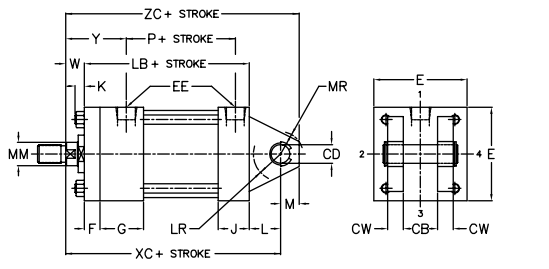
STYLE 06
RECTANGULAR FLANGE ROD END
(NFPA MOUNTING STYLE MF1)

Standard Port location is Position 1.
Standard Cushion location Position 2.



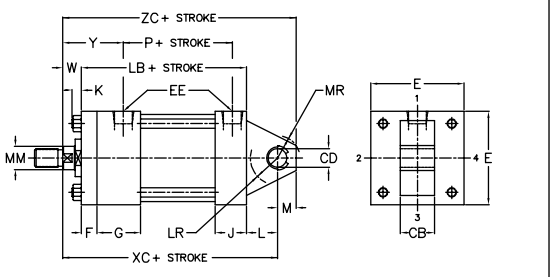
STYLE 07
RECTANGULAR FLANGE CAP END
(NFPA MOUNTING STYLE MF2)

Standard Port location is Position 1.
Standard Cushion location Position 2.



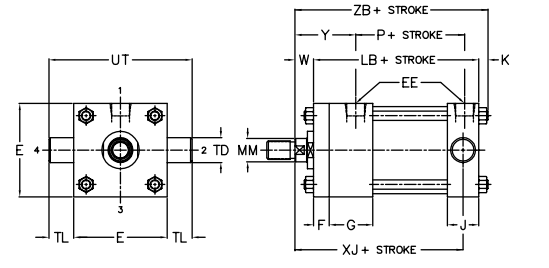
STYLE 8F
FIXED CLEVIS CAP END
(NFPA MOUNTING STYLE MP1)

Standard Port location is Position 1.
Standard Cushion location Position 2.



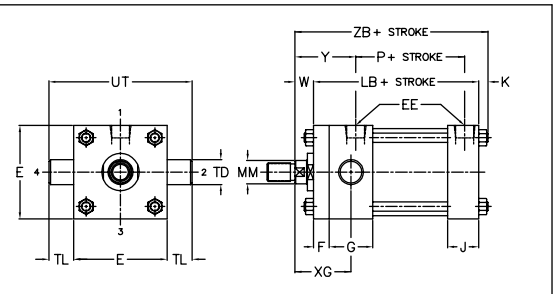
STYLE 8M
FIXED PIVOT CAP END
(NFPA MOUNTING STYLE MP3)

Standard Port location is Position 1.
Standard Cushion location Position 2.



STYLE 12
TRUNNION CAP END
(NFPA MOUNTING STYLE MT2)

Standard Port location is Position 1.
Standard Cushion location Position #2, ROD END, Position #3, CAP END



STYLE 13
TRUNNION ROD END
(NFPA MOUNTING STYLE MT1)

Standard Port location is Position 1.
Standard Cushion location Position #3, ROD END, Position #2, CAP END

1.00 BORE SERIES JHDH & LSSE MEDIUM PRESSURE HYDRAULIC CYLINDERS MAXIMUM NON-SHOCK PRESSURE RATING			
#06 AND #07 MOUNTS		ALL OTHER MOUNTS	
JHDH PRESSURE	LSSE PRESSURE	JHDH PRESSURE	LSSE PRESSURE
1,500 PSI	1,500 PSI	2,000 PSI	1,500 PSI

ENVELOPE AND MOUNTING DIMENSIONS NOT AFFECTED BY ROD DIAMETER

BORE	AA	BB	CB	CD* +.000 -.002	CW	DD	E	EE * NPT	EE * SAE	F	FB	G	J	K	L	LR	M	MR
1	1.53	3/4	7/16	.437	.375	#10-32	1 1/2	1/4	4	3/8	1/4	1 1/2	1	1/8	1/2	7/16	7/16	1/2

BORE	ND	NT	R	SB	ST	SU	SW	TD +.000 -.002	TF	TL	TN	TS	UF	US	UT	W
1	1/4	#10-24	1.08	9/32	5/16	3/4	5/16	.750	2	3/4	9/16	2 1/8	2 1/2	2 3/4	3	5/8

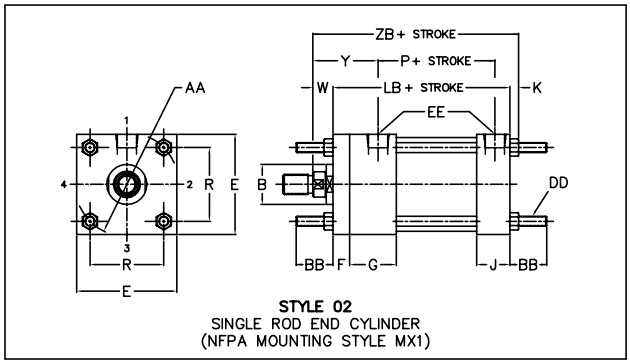
BORE	XG	XS	XT	Y	LB	LD	P	SN	SS	XC	XF	XJ	ZB	ZC	ZF	ZM ADD 2X STROKE
					ADD STROKE											
1	1 3/4	1 5/16	1 15/16	1 15/16	3 7/8	4 3/4	2 1/8	2 1/8	2 7/8	5	4 1/2	4	4 5/8	5 7/16	4 7/8	6

* CD IS PIN DIAMETER
** NPT PORTS FURNISHED UNLESS OTHERWISE SPECIFIED
NOTES: NON ADJUSTABLE CUSHIONS ARE AVAILABLE IN ALL MOUNTINGS FOR BOTH ROD AND CAP ENDS

TIE ROD AND NOSE MOUNTED CYLINDERS

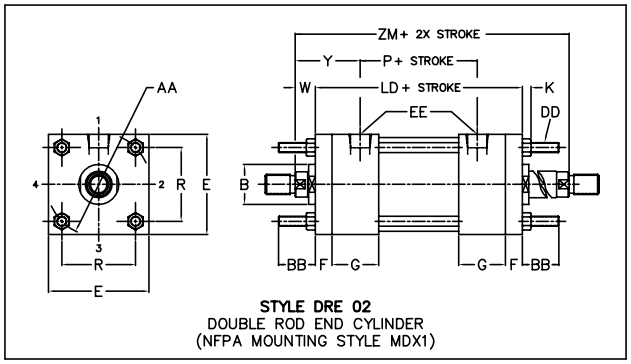
1 1/2" TO 6" BORE SERIES JHDH AND LSSE
PRESSURE RATED HYDRAULIC CYLINDERS

STANDARD IN BRASS TUBE DESIGN AND ALL STAINLESS STEEL DESIGN!



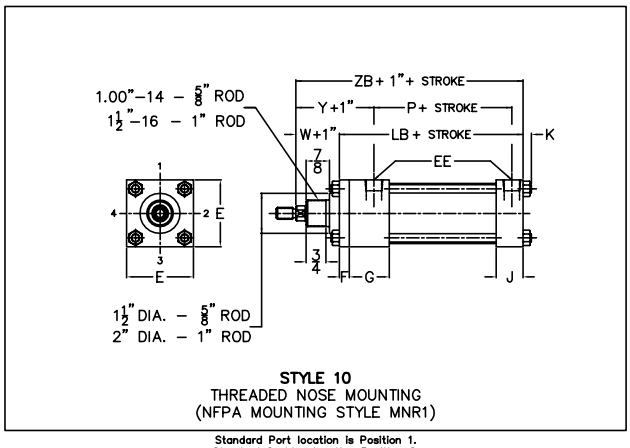
STYLE 02
SINGLE ROD END CYLINDER
(NFPA MOUNTING STYLE MX1)

Standard Port location is Position 1.
Standard Cushion location Position 2.



STYLE DRE 02
DOUBLE ROD END CYLINDER
(NFPA MOUNTING STYLE MDX1)

Standard Port location is Position 1.
Standard Cushion location Position 2.



STYLE 10
THREADED NOSE MOUNTING
(NFPA MOUNTING STYLE MNR1)

Standard Port location is Position 1.
Standard Cushion location Position 2.

NOTE: For 1–1/2", 2", 2–1/2" cylinder only with 5/8" and 1" rod sizes only

TIE ROD MOUNTING DESCRIPTION

MOUNTING STYLE	NFPA MOUNTING STYLE	DESCRIPTION
01	MX0	NO TIE ROD EXTENSIONS
02	MX1	TIE RODS EXTENDED BOTH ENDS
03	MX2	TIE RODS EXTENDED CAP END
04	MX3	TIE RODS EXTENDED ROD END
DRE 01	MDX0	NO TIE ROD EXTENSIONS
DRE 02	MDX1	TIE RODS EXTENDED BOTH ENDS
DRE 03	MDX3	TIE RODS EXTENDED ONE END

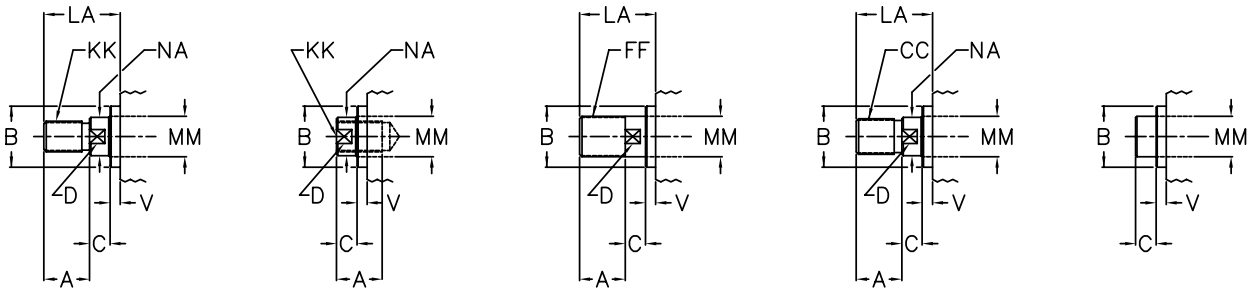
ENVELOPE AND MOUNTING DIMENSIONS NOT AFFECTED BY ROD DIAMETER

BORE	AA	BB	DD	E	EE *		F	G	J	K	R	LB	LD	P
					NPTF	SAE						ADD STROKE		
1 1/2	2.02	1	1/4-28	2	3/8	6	3/8	1 1/2	1	1/4	1.43	4	4 7/8	2 1/4
2	2.60	1 1/8	5/16-24	2 1/2	3/8	6	3/8	1 1/2	1	5/16	1.84	4	4 7/8	2 1/4
2 1/2	3.10	1 1/8	5/16-24	3	3/8	6	3/8	1 1/2	1	5/16	2.19	4 1/8	5	2 3/8
3 1/4	3.90	1 3/8	3/8-24	3 3/4	1/2	10	5/8	1 3/4	1 1/4	3/8	2.76	4 7/8	6	2 5/8
4	4.70	1 3/8	3/8-24	4 1/2	1/2	10	5/8	1 3/4	1 1/4	3/8	3.32	4 7/8	6	2 5/8
5	5.80	1 13/16	1/2-20	5 1/2	1/2	10	5/8	1 3/4	1 1/4	7/16	4.10	5 1/8	6 1/4	2 7/8
6	6.90	1 13/16	1/2-20	6 1/2	3/4	12	3/4	2	1 1/2	7/16	4.88	5 3/4	7	3 1/8

*** NPTF PORTS FURNISHED UNLESS OTHERWISE SPECIFIED**

Note: These medium pressure hydraulic cylinders are rated for maximum working pressure by bore size. For pressure ratings, see page 4 for the JHDH Series, and page 6 for the LSSE Series.

TIE ROD AND NOSE MOUNTED CYLINDERS (Cont.)



TYPE A
Standard Male
(Furnished unless otherwise specified)

TYPE B
Female

TYPE C
Full Male

TYPE D
Itermediate Male

TYPE P
Plain End

ROD END STYLES

Type F, Flanged rod available, see page 36

DIMENSIONS AFFECTED BY ROD DIAMETER

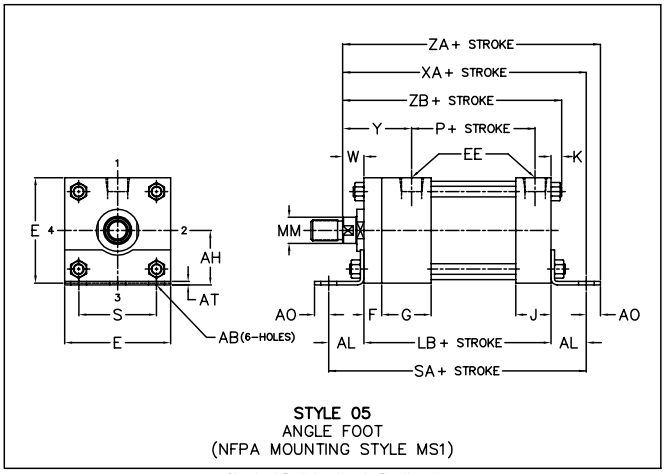
BORE	ROD DIA. MM	THREAD SIZE			ROD AND PILOT DIMENSIONS							ENVELOPE DIMENSIONS			
		KK STD	CC	FF	A	B +.000 -.002	C	D	LA	NA	V	W	Y	ZB ADD STROKE	ZM ADD 2X STROKE
1 1/2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	4 7/8	6 1/8
	1 *	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	5 1/4	6 7/8
2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	4 15/16	6 1/8
	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	5 5/16	6 7/8
	1 3/8 *	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2 9/16	5 9/16	7 3/8
2 1/2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	5 1/16	6 1/4
	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	5 7/16	7
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2 9/16	5 11/16	7 1/2
	1 3/4 *	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/2	1 11/16	3/4	1 1/2	2 13/16	5 15/16	8
3 1/4	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16	6	7 1/2
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	6 1/4	8
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	6 1/2	8 1/2
	2 *	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	6 5/8	8 3/4
4	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16	6	7 1/2
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	6 1/4	8
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	6 1/2	8 1/2
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	6 5/8	8 3/4
5	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16	6 5/16	7 3/4
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	6 9/16	8 1/4
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	6 13/16	8 3/4
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	6 15/16	9
6	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	2 13/16	7 1/16	8 3/4
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	3 1/16	7 5/16	9 1/4
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	3 3/16	7 7/16	9 1/2
	2 1/2	1 7/8-12	2 1/4-12	2 1/2-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	3 7/16	7 11/16	10

FIRST ROD SIZE SHOWN FOR EACH BORE SIZE IS STANDARD ROD
*** ROD END CUSHIONS AVAILABLE ONLY AS NON-ADJUSTABLE TYPE - CONSULT LEHIGH**

FOOT AND FLUSH MOUNTED CYLINDERS

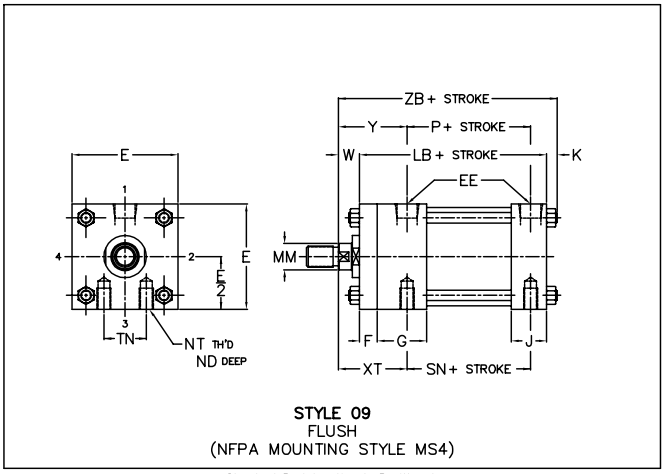
1 1/2" TO 6" BORE SERIES JHDH AND LSSE
PRESSURE RATED HYDRAULIC CYLINDERS

STANDARD IN BRASS TUBE DESIGN AND ALL STAINLESS STEEL DESIGN!



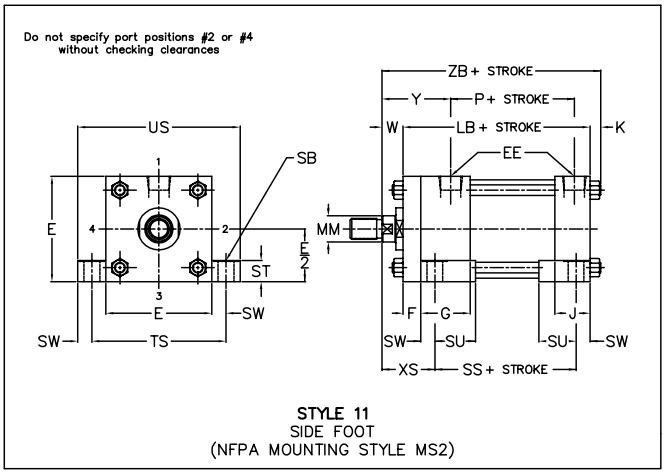
STYLE 05
ANGLE FOOT
(NFPA MOUNTING STYLE MS1)

Standard Port location is Position 1.
Standard Cushion location Position 2.



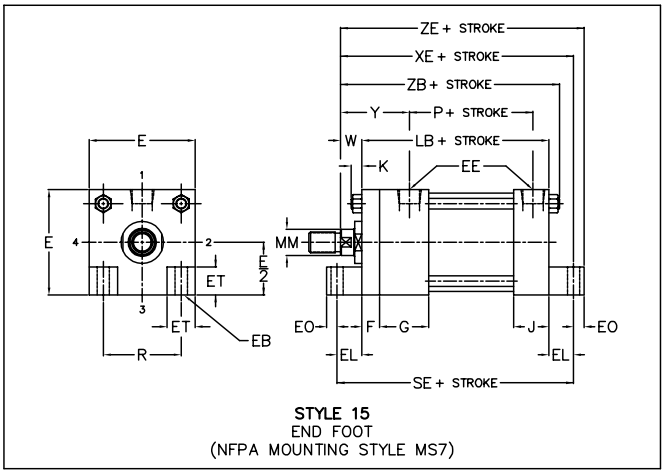
STYLE 09
FLUSH
(NFPA MOUNTING STYLE MS4)

Standard Port location is Position 1.
Standard Cushion location Position 2.



STYLE 11
SIDE FOOT
(NFPA MOUNTING STYLE MS2)

Standard Port location is Position 1.
Standard Cushion location Position 2.



STYLE 15
END FOOT
(NFPA MOUNTING STYLE MS7)

Standard Port location is Position 1.
Standard Cushion location Position 2.

ENVELOPE AND MOUNTING DIMENSIONS NOT AFFECTED BY ROD DIAMETER

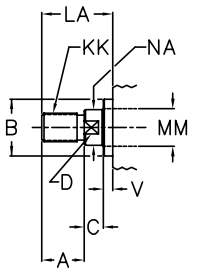
BORE	AB	AH	AL	AO	AT	E	EB	EE *		EL	EO	ET	F	G	J	K	ND
								NPTF	SAE								MIN
1 1/2	7/16	1 3/16	1	3/8	1/8	2	5/16	3/8	6	3/4	1/4	9/16	3/8	1 1/2	1	1/4	1/4
2	7/16	1 7/16	1	3/8	1/8	2 1/2	3/8	3/8	6	15/16	5/16	11/16	3/8	1 1/2	1	5/16	3/8
2 1/2	7/16	1 5/8	1	3/8	1/8	3	3/8	3/8	6	1 1/16	5/16	13/16	3/8	1 1/2	1	5/16	7/16
3 1/4	9/16	1 15/16	1 1/4	1/2	1/8	3 3/4	7/16	1/2	10	7/8	3/8	1	5/8	1 3/4	1 1/4	3/8	1/2
4	9/16	2 1/4	1 1/4	1/2	1/8	4 1/2	7/16	1/2	10	1	3/8	1 3/16	5/8	1 3/4	1 1/4	3/8	5/8
5	11/16	2 3/4	1 3/8	5/8	3/16	5 1/2	9/16	1/2	10	1 1/16	1/2	1 3/8	5/8	1 3/4	1 1/4	7/16	3/4
6	13/16	3 1/4	1 3/8	5/8	3/16	6 1/2	9/16	3/4	12	1	1/2	1 5/8	3/4	2	1 1/2	7/16	7/8

*** NPTF PORTS FURNISHED UNLESS OTHERWISE SPECIFIED**

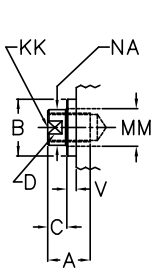
BORE	NT	R	S	SB	ST	SU	SW	TN	TS	US	LB	P	SA	SE	SN	SS
											ADD STROKE					
1 1/2	1/4-20	1.43	1 1/4	7/16	1/2	15/16	3/8	5/8	2 3/4	3 1/2	4	2 1/4	6	5 1/2	2 1/4	2 7/8
2	5/16-18	1.84	1 3/4	7/16	1/2	15/16	3/8	7/8	3 1/4	4	4	2 1/4	6	5 7/8	2 1/4	2 7/8
2 1/2	3/8-16	2.19	2 1/4	7/16	1/2	15/16	3/8	1 1/4	3 3/4	4 1/2	4 1/8	2 3/8	6 1/8	6 1/4	2 3/8	3
3 1/4	1/2-13	2.76	2 3/4	9/16	3/4	1 1/4	1/2	1 1/2	4 3/4	5 3/4	4 7/8	2 5/8	7 3/8	6 5/8	2 5/8	3 1/4
4	1/2-13	3.32	3 1/2	9/16	3/4	1 1/4	1/2	2 1/16	5 1/2	6 1/2	4 7/8	2 5/8	7 3/8	6 7/8	2 5/8	3 1/4
5	5/8-11	4.10	4 1/4	13/16	1	1 9/16	11/16	2 11/16	6 7/8	8 1/4	5 1/8	2 7/8	7 7/8	7 1/4	2 7/8	3 1/8
6	3/4-10	4.88	5 1/4	13/16	1	1 9/16	11/16	3 1/4	7 7/8	9 1/4	5 3/4	3 1/8	8 1/2	7 3/4	3 1/8	3 5/8

Note: These medium pressure hydraulic cylinders are rated for maximum working pressure by bore size.
For pressure ratings, see page 4 for the JHDH Series, and page 6 for the LSSE Series.

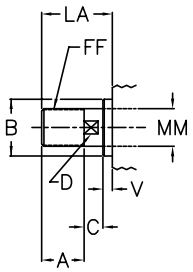
FOOT AND FLUSH MOUNTED CYLINDERS (Cont.)



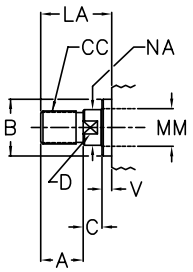
TYPE A
Standard Male
(Furnished unless otherwise specified)



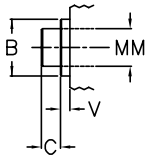
TYPE B
Female



TYPE C
Full Male



TYPE D
Itermediate Male



TYPE P
Plain End

ROD END STYLES

Type F, Flanged rod available, see page 36

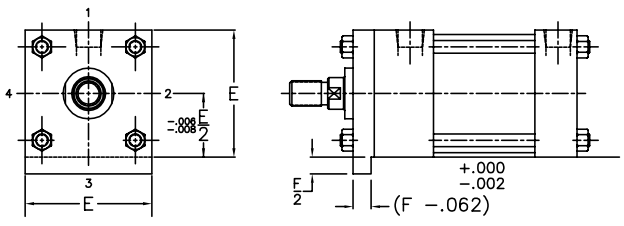
DIMENSIONS AFFECTED BY ROD DIAMETER

BORE	ROD DIA. MM	THREAD SIZE			ROD AND PILOT DIMENSIONS							ENVELOPE DIMENSIONS								
		KK STD	CC	FF	A	B +.000 -.002	C	D	LA	NA	V	W	XS	XT	Y	XA	XE	ZA	ZB	ZE
																ADD STROKE				
1 1/2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 3/8	1 15/16	1 15/16	5 5/8	5 3/8	6	4 7/8	5 5/8
	1 *	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	1 3/4	2 5/16	2 5/16	6	5 3/4	6 3/8	5 1/4	6
2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 3/8	1 15/16	1 15/16	5 5/8	5 9/16	6	4 15/16	5 7/8
	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	1 3/4	2 5/16	2 5/16	6	5 15/16	6 3/8	5 5/16	6 1/4
	1 3/8 *	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2	2 9/16	2 9/16	6 1/4	6 3/16	6 5/8	5 9/16	6 1/2
2 1/2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 3/8	1 15/16	1 15/16	5 3/4	5 13/16	6 1/8	5 1/16	6 1/8
	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	1 3/4	2 5/16	2 5/16	6 1/8	6 3/16	6 1/2	5 7/16	6 1/2
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2	2 9/16	2 9/16	6 3/8	6 7/16	6 3/4	5 11/16	6 3/4
	1 3/4 *	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/2	1 11/16	3/4	1 1/2	2 1/4	2 13/16	2 13/16	6 5/8	6 11/16	7	5 15/16	7
3 1/4	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	1 7/8	2 7/16	2 7/16	6 7/8	6 1/2	7 3/8	6	6 7/8
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 1/8	2 11/16	2 11/16	7 1/8	6 3/4	7 5/8	6 1/4	7 1/8
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 3/8	2 15/16	2 15/16	7 3/8	7	7 7/8	6 1/2	7 3/8
	2 *	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	2 1/2	3 1/16	3 1/16	7 1/2	7 1/8	8	6 5/8	7 1/2
4	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	1 7/8	2 7/16	2 7/16	6 7/8	6 5/8	7 3/8	6	7
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 1/8	2 11/16	2 11/16	7 1/8	6 7/8	7 5/8	6 1/4	7 1/4
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 3/8	2 15/16	2 15/16	7 3/8	7 1/8	7 7/8	6 1/2	7 1/2
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	2 1/2	3 1/16	3 1/16	7 1/2	7 1/4	8	6 5/8	7 5/8
5	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 1/16	2 7/16	2 7/16	7 1/4	6 15/16	7 7/8	6 5/16	7 7/16
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 5/16	2 11/16	2 11/16	7 1/2	7 3/16	8 1/8	6 9/16	7 11/16
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 9/16	2 15/16	2 15/16	7 3/4	7 7/16	8 3/8	6 13/16	7 15/16
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	2 11/16	3 1/16	3 1/16	7 7/8	7 9/16	8 1/2	6 15/16	8 1/16
6	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	2 5/16	2 13/16	2 13/16	8	7 5/8	8 5/8	7 1/16	8 1/8
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	2 9/16	3 1/16	3 1/16	8 1/4	7 7/8	8 7/8	7 5/16	8 3/8
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	2 11/16	3 3/16	3 3/16	8 3/8	8	9	7 7/16	8 1/2
	2 1/2	1 7/8-12	2 1/4-12	2 1/2-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	2 15/16	3 7/16	3 7/16	8 5/8	8 1/4	9 1/4	7 11/16	8 3/4

FIRST ROD SIZE SHOWN FOR EACH BORE SIZE IS STANDARD ROD

* ROD END CUSHIONS AVAILABLE ONLY AS NON-ADJUSTABLE TYPE - CONSULT LEHIGH

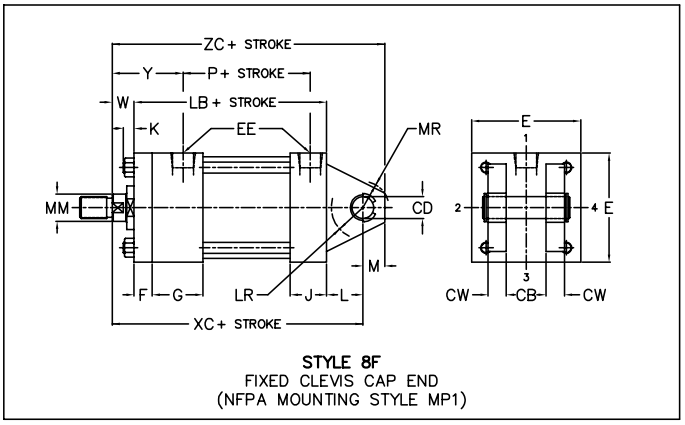
THRUST KEY MOUNTING ADAPTION
FOR STYLES 9, 11, AND 15
SEE PAGE 14



CLEVIS, PIVOT AND SPHERICAL BEARING MOUNT

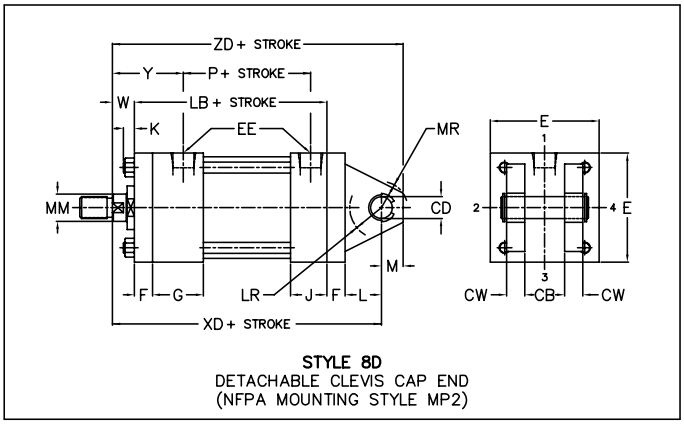
1 1/2" TO 6" BORE SERIES JHDH AND LSSE
PRESSURE RATED HYDRAULIC CYLINDERS

STANDARD IN BRASS TUBE DESIGN AND ALL STAINLESS STEEL DESIGN!



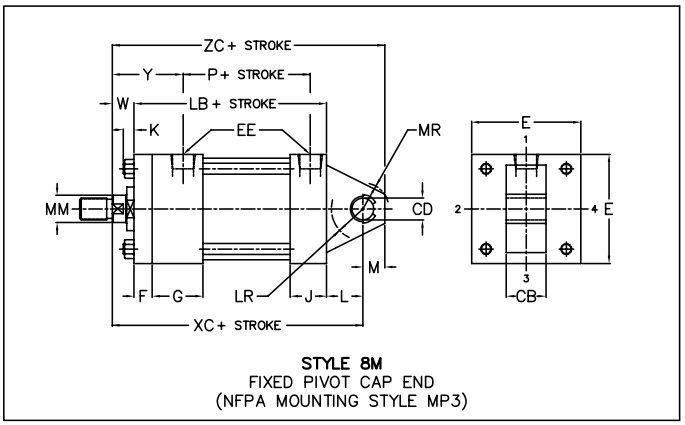
STYLE 8F
FIXED CLEVIS CAP END
(NFPA MOUNTING STYLE MP1)

Standard Port location is Position 1.
Standard Cushion location Position 2.



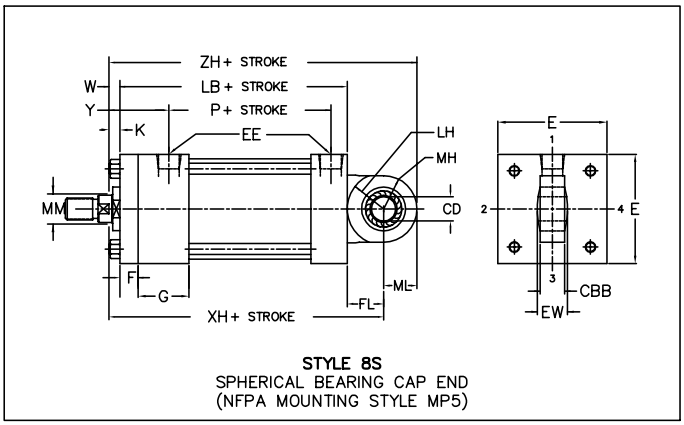
STYLE 8D
DETACHABLE CLEVIS CAP END
(NFPA MOUNTING STYLE MP2)

Standard Port location is Position 1.
Standard Cushion location Position 2.



STYLE 8M
FIXED PIVOT CAP END
(NFPA MOUNTING STYLE MP3)

Standard Port location is Position 1.
Standard Cushion location Position 2.



STYLE 8S
SPHERICAL BEARING CAP END
(NFPA MOUNTING STYLE MP5)

Standard Port location is Position 1.
Standard Cushion location Position 2.

ENVELOPE AND MOUNTING DIMENSIONS NOT AFFECTED BY ROD DIAMETER

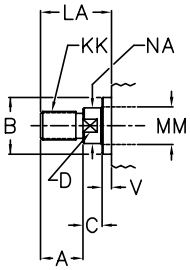
BORE	CB	CBB	CD** +.000 -.002	CW	E	EE *		EW +.005 -.010	F	FL	G	J	K	L	LH	LR	M	MH	ML	MR	LB	P
						NPTF	SAE														ADD STROKE	
1 1/2	3/4	3/8	.500	1/2	2	3/8	6	7/16	3/8	3/4	1 1/2	1	1/4	3/4	5/8	3/4	1/2	7/8	15/16	5/8	4	2 1/4
2	3/4	3/8	.500	1/2	2 1/2	3/8	6	7/16	3/8	3/4	1 1/2	1	5/16	3/4	5/8	3/4	1/2	7/8	15/16	5/8	4	2 1/4
2 1/2	3/4	3/8	.500	1/2	3	3/8	6	7/16	3/8	3/4	1 1/2	1	5/16	3/4	5/8	3/4	1/2	7/8	15/16	5/8	4 1/8	2 3/8
3 1/4	1 1/4	9/16	.750	5/8	3 3/4	1/2	10	21/32	5/8	1 1/4	1 3/4	1 1/4	3/8	1 1/4	1	1	3/4	1 3/8	1 5/16	15/16	4 7/8	2 5/8
4	1 1/4	9/16	.750	5/8	4 1/2	1/2	10	21/32	5/8	1 1/4	1 3/4	1 1/4	3/8	1 1/4	1	1	3/4	1 3/8	1 5/16	15/16	4 7/8	2 5/8
5	1 1/4	9/16	.750	5/8	5 1/2	1/2	10	21/32	5/8	1 1/4	1 3/4	1 1/4	7/16	1 1/4	1	1	3/4	1 3/8	1 5/16	15/16	5 1/8	2 7/8
6	1 1/2	3/4	1.000	3/4	6 1/2	3/4	12	7/8	3/4	1 1/2	2	1 1/2	7/16	1 1/2	1 1/4	1 1/4	1	1 1/2	1 1/2	1 3/16	5 3/4	3 1/8

* NPTF PORTS FURNISHED UNLESS OTHERWISE SPECIFIED
** CD IS PIN DIAMETER

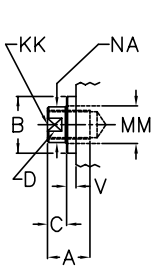
Notes: Clevis Pin comes standard with 8F and 8D Mounts
Type "B" rod end style is preferred on the 8S style mount cylinder due to the availability of mounting accessories.
See pages 38-41 for mounting accessories

These medium pressure hydraulic cylinders are rated for maximum working pressure by bore size.
For pressure ratings, see page 4 for the JHDH Series, and page 6 for the LSSE Series.

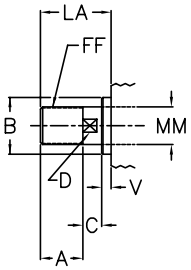
CLEVIS, PIVOT AND SPHERICAL BEARING MOUNT (Cont.)



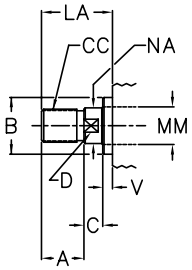
TYPE A
Standard Male
(Furnished unless otherwise specified)



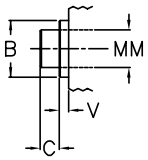
TYPE B
Female



TYPE C
Full Male



TYPE D
Itermediate Male



TYPE P
Plain End

ROD END STYLES

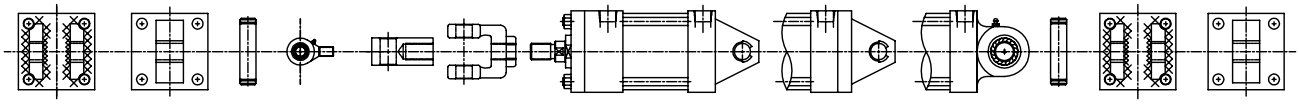
Type F, Flanged rod available, see page 36

DIMENSIONS AFFECTED BY ROD DIAMETER

BORE	ROD DIA. MM	THREAD SIZE			ROD AND PILOT DIMENSIONS							ENVELOPE DIMENSIONS							
		KK STD	CC	FF	A	B +.000 -.002	C	D	LA	NA	V	W	Y	XC	XD	XH	ZC	ZD	ZH
														ADD STROKE					
1 1/2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	5 3/8	5 3/4	5 3/8	5 7/8	6 1/4	6 5/16
	1 *	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	5 3/4	6 1/8	5 3/4	6 1/4	6 5/8	6 11/16
2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	5 3/8	5 3/4	5 3/8	5 7/8	6 1/4	6 5/16
	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	5 3/4	6 1/8	5 3/4	6 1/4	6 5/8	6 11/16
	1 3/8 *	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2 9/16	6	6 3/8	6	6 1/2	6 7/8	6 15/16
2 1/2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	5 1/2	5 7/8	5 1/2	6	6 3/8	6 7/16
	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	5 7/8	6 1/4	5 7/8	6 3/8	6 3/4	6 13/16
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2 9/16	6 1/8	6 1/2	6 1/8	6 5/8	7	7 1/16
	1 3/4 *	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/2	1 11/16	3/4	1 1/2	2 13/16	6 3/8	6 3/4	6 3/8	6 7/8	7 1/4	7 5/16
3 1/4	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16	6 7/8	7 1/2	6 7/8	7 5/8	8 1/4	8 3/16
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	7 1/8	7 3/4	7 1/8	7 7/8	8 1/2	8 7/16
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	7 3/8	8	7 3/8	8 1/8	8 3/4	8 11/16
	2 *	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	7 1/2	8 1/8	7 1/2	8 1/4	8 7/8	8 13/16
4	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16	6 7/8	7 1/2	6 7/8	7 5/8	8 1/4	8 3/16
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	7 1/8	7 3/4	7 1/8	7 7/8	8 1/2	8 7/16
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	7 3/8	8	7 3/8	8 1/8	8 3/4	8 11/16
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	7 1/2	8 1/8	7 1/2	8 1/4	8 7/8	8 13/16
5	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16	7 1/8	7 3/4	7 1/8	7 7/8	8 1/2	8 7/16
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	7 3/8	8	7 3/8	8 1/8	8 3/4	8 11/16
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	7 5/8	8 1/4	7 5/8	8 3/8	9	8 15/16
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	7 3/4	8 3/8	7 3/4	8 1/2	9 1/8	9 1/16
6	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	2 13/16	8 1/8	8 7/8	8 1/8	9 1/8	9 7/8	9 5/8
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	3 1/16	8 3/8	9 1/8	8 3/8	9 3/8	10 1/8	9 7/8
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	3 3/16	8 1/2	9 1/4	8 1/2	9 1/2	10 1/4	10
	2 1/2	1 7/8-12	2 1/4-12	2 1/2-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	3 7/16	8 3/4	9 1/2	8 3/4	9 3/4	10 1/2	10 1/4

FIRST ROD SIZE SHOWN FOR EACH BORE SIZE IS STANDARD ROD

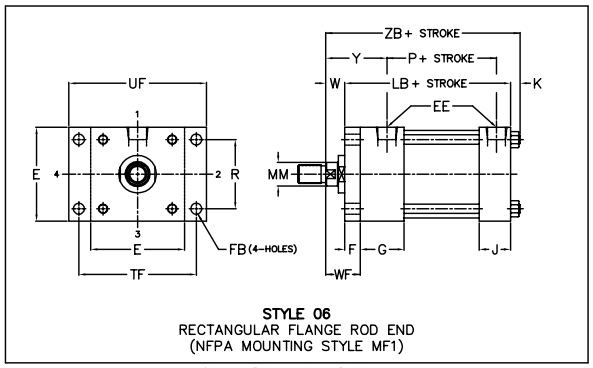
* ROD END CUSHIONS AVAILABLE ONLY AS NON-ADJUSTABLE TYPE - CONSULT LEHIGH



See pp. 38-41 for Mounting Accessories

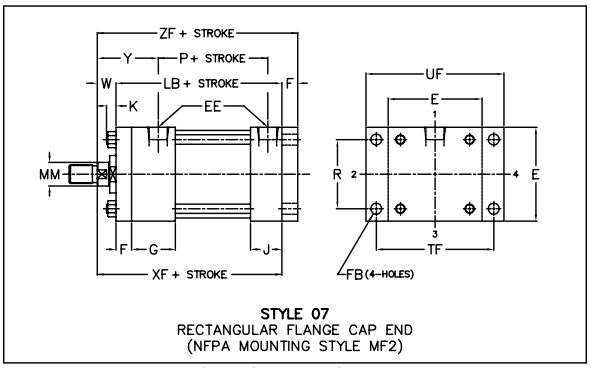
FLANGE MOUNTED CYLINDERS
1 1/2" TO 6" BORE SERIES JHDH AND LSSE
PRESSURE RATED HYDRAULIC CYLINDERS

STANDARD IN BRASS TUBE DESIGN AND ALL STAINLESS STEEL DESIGN!



STYLE 06
RECTANGULAR FLANGE ROD END
(NFPA MOUNTING STYLE MF1)

Standard Port location is Position 1.
Standard Cushion location Position 2.

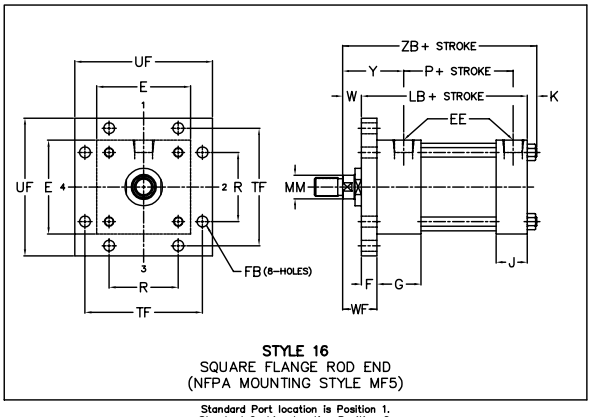


STYLE 07
RECTANGULAR FLANGE CAP END
(NFPA MOUNTING STYLE MF2)

Standard Port location is Position 1.
Standard Cushion location Position 2.

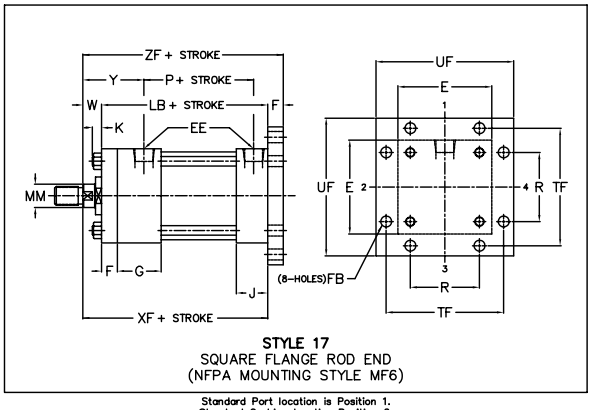
MEDIUM PRESSURE HYDRAULIC CYLINDER SERIES JHDH & LSSE
BORE vs MAXIMUM WORKING PRESSURE RATING #06 & #07 MOUNTS

Bore	JHDH PRESSURE	LSSE PRESSURE	Bore	JHDH PRESSURE	LSSE PRESSURE
1 1/2	1,350 PSI Non-Shock	1,350 PSI Non-Shock	**3 1/4**	1,000 PSI Non-Shock	1,000 PSI Non-Shock
2	1,200 PSI Non-Shock	1,200 PSI Non-Shock	**4**	700 PSI Non-Shock	700 PSI Non-Shock
2 1/2	1,000 PSI Non-Shock	1,000 PSI Non-Shock	**5 & 6**	500 PSI Non-Shock	500 PSI Non-Shock



STYLE 16
SQUARE FLANGE ROD END
(NFPA MOUNTING STYLE MF5)

Standard Port location is Position 1.
Standard Cushion location Position 2.



STYLE 17
SQUARE FLANGE ROD END
(NFPA MOUNTING STYLE MF6)

Standard Port location is Position 1.
Standard Cushion location Position 2.

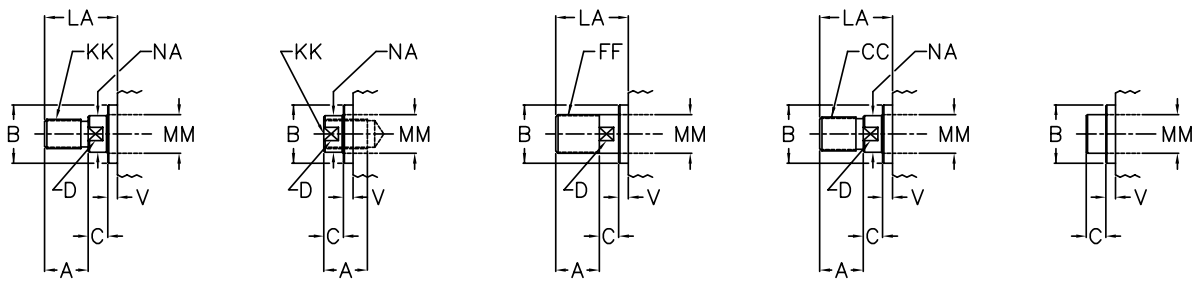
Note: For pressure ratings for mounting styles 16 and 17, see page 4 for the JHDH series, and page 6 for the LSSE Series

ENVELOPE AND MOUNTING DIMENSIONS NOT AFFECTED BY ROD DIAMETER

BORE	E	EE *		F	FB	G	J	K	R	TF	UF	LB	P
		NPTF	SAE									ADD STROKE	
1 1/2	2	3/8	6	3/8	5/16	1 1/2	1	1/4	1.43	2 3/4	3 3/8	4	2 1/4
2	2 1/2	3/8	6	3/8	3/8	1 1/2	1	5/16	1.84	3 3/8	4 1/8	4	2 1/4
2 1/2	3	3/8	6	3/8	3/8	1 1/2	1	5/16	2.19	3 7/8	4 5/8	4 1/8	2 3/8
3 1/4	3 3/4	1/2	10	5/8	7/16	1 3/4	1 1/4	3/8	2.76	4 11/16	5 1/2	4 7/8	2 5/8
4	4 1/2	1/2	10	5/8	7/16	1 3/4	1 1/4	3/8	3.32	5 7/16	6 1/4	4 7/8	2 5/8
5	5 1/2	1/2	10	5/8	9/16	1 3/4	1 1/4	7/16	4.10	6 5/8	7 5/8	5 1/8	2 7/8
6	6 1/2	3/4	12	3/4	9/16	2	1 1/2	7/16	4.88	7 5/8	8 5/8	5 3/4	3 1/8

*** NPTF PORTS FURNISHED UNLESS OTHERWISE SPECIFIED**

FLANGE MOUNTED CYLINDERS (Cont.)



ROD END STYLES

Type F, Flanged rod available, see page 36

DIMENSIONS AFFECTED BY ROD DIAMETER

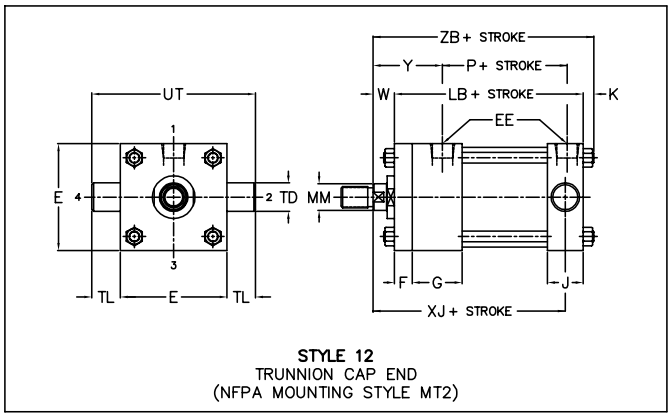
BORE	ROD DIA. MM	THREAD SIZE			ROD AND PILOT DIMENSIONS							ENVELOPE DIMENSIONS					
		KK STD	CC	FF	A	B +.000 -.002	C	D	LA	NA	V	W	WF	Y	XF	ZB	ZF
															ADD STROKE		
1 1/2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1	1 15/16	4 5/8	4 7/8	5
	1 *	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	1 3/8	2 5/16	5	5 1/4	5 3/8
2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1	1 15/16	4 5/8	4 15/16	5
	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	1 3/8	2 5/16	5	5 5/16	5 3/8
	1 3/8 *	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	1 5/8	2 9/16	5 1/4	5 9/16	5 5/8
2 1/2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1	1 15/16	4 3/4	5 1/16	5 1/8
	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	1 3/8	2 5/16	5 1/8	5 7/16	5 1/2
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	1 5/8	2 9/16	5 3/8	5 11/16	5 3/4
	1 3/4 *	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/2	1 11/16	3/4	1 1/2	1 7/8	2 13/16	5 5/8	5 15/16	6
3 1/4	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	1 3/8	2 7/16	5 5/8	6	6 1/4
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	1 5/8	2 11/16	5 7/8	6 1/4	6 1/2
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	1 7/8	2 15/16	6 1/8	6 1/2	6 3/4
	2 *	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	2	3 1/16	6 1/4	6 5/8	6 7/8
4	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	1 3/8	2 7/16	5 5/8	6	6 1/4
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	1 5/8	2 11/16	5 7/8	6 1/4	6 1/2
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	1 7/8	2 15/16	6 1/8	6 1/2	6 3/4
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	2	3 1/16	6 1/4	6 5/8	6 7/8
5	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	1 3/8	2 7/16	5 7/8	6 5/16	6 1/2
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	1 5/8	2 11/16	6 1/8	6 9/16	6 3/4
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	1 7/8	2 15/16	6 3/8	6 13/16	7
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	2	3 1/16	6 1/2	6 15/16	7 1/8
6	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	1 5/8	2 13/16	6 5/8	7 1/16	7 3/8
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	1 7/8	3 1/16	6 7/8	7 5/16	7 5/8
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	2	3 3/16	7	7 7/16	7 3/4
	2 1/2	1 7/8-12	2 1/4-12	2 1/2-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	2 1/4	3 7/16	7 1/4	7 11/16	8

FIRST ROD SIZE SHOWN FOR EACH BORE SIZE IS STANDARD ROD

* ROD END CUSHIONS AVAILABLE ONLY AS NON-ADJUSTABLE TYPE - CONSULT LEHIGH

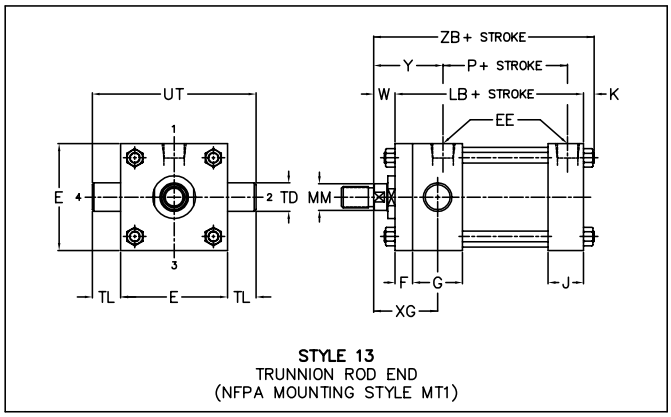
TRUNNION MOUNTED CYLINDERS
1 1/2" TO 6" BORE SERIES JHDH AND LSSE
PRESSURE RATED HYDRAULIC CYLINDERS

STANDARD IN BRASS TUBE DESIGN AND ALL STAINLESS STEEL DESIGN!



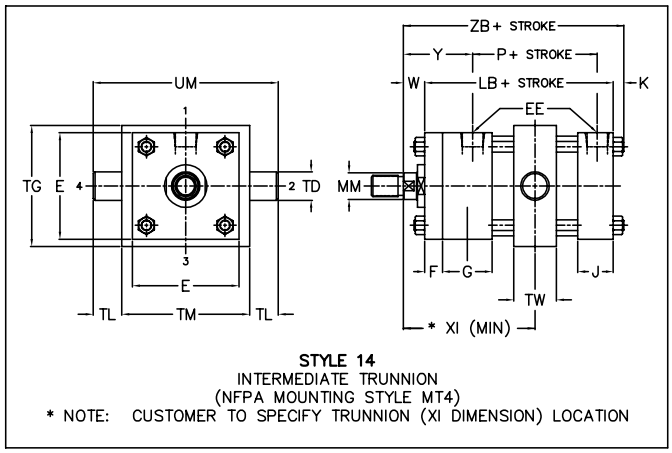
STYLE 12
TRUNNION CAP END
(NFPA MOUNTING STYLE MT2)

Standard Port location is Position 1.
Standard Cushion location is Position 2 Rod End, and Psition 3 Cap End.



STYLE 13
TRUNNION ROD END
(NFPA MOUNTING STYLE MT1)

Standard Port location is Position 1.
Standard Cushion location is Position 3 Rod End, and Psition 2 Cap End.



STYLE 14
INTERMEDIATE TRUNNION
(NFPA MOUNTING STYLE MT4)
* NOTE: CUSTOMER TO SPECIFY TRUNNION (XI DIMENSION) LOCATION

Standard Port location is Position 1.
Standard Cushion location is Position 2.

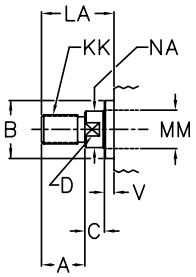
ENVELOPE AND MOUNTING DIMENSIONS NOT AFFECTED BY ROD DIAMETER

BORE	E	EE *		F	G	J	K	TD ** +000 -.001	TG	TL	TM	TW	UM	UT	LB	P
		NPTF	SAE												ADD STROKE	
1 1/2	2	3/8	6	3/8	1 1/2	1	1/4	1.000	2 1/2	1	2 1/2	1 1/4	4 1/2	4	4	2 1/4
2	2 1/2	3/8	6	3/8	1 1/2	1	5/16	1.000	3	1	3	1 1/2	5	4 1/2	4	2 1/4
2 1/2	3	3/8	6	3/8	1 1/2	1	5/16	1.000	3 1/2	1	3 1/2	1 1/2	5 1/2	5	4 1/8	2 3/8
3 1/4	3 3/4	1/2	10	5/8	1 3/4	1 1/4	3/8	1.000	4 1/4	1	4 1/2	2	6 1/2	5 3/4	4 7/8	2 5/8
4	4 1/2	1/2	10	5/8	1 3/4	1 1/4	3/8	1.000	5	1	5 1/4	2	7 1/4	6 1/2	4 7/8	2 5/8
5	5 1/2	1/2	10	5/8	1 3/4	1 1/4	7/16	1.000	6	1	6 1/4	2	8 1/4	7 1/2	5 1/8	2 7/8
6	6 1/2	3/4	12	3/4	2	1 1/2	7/16	1.375	7	1 3/8	7 5/8	2 1/2	10 3/8	9 1/4	5 3/4	3 1/8

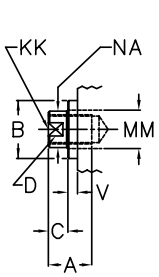
*** NPTF PORTS FURNISHED UNLESS OTHERWISE SPECIFIED**
**** TD IS TRUNNION PIN DIAMETER**

Note: These medium pressure hydraulic cylinders are rated for maximum working pressure by bore size.
For pressure ratings, see page 4 for the JHDH Series, and page 6 for the LSSE Series.

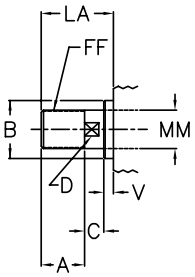
TRUNNION MOUNTED CYLINDERS (Cont.)



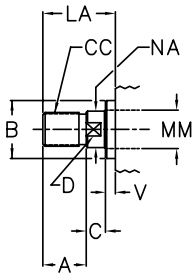
TYPE A
Standard Male
(Furnished unless otherwise specified)



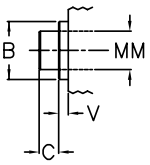
TYPE B
Female



TYPE C
Full Male



TYPE D
Itermediate Male



TYPE P
Plain End

ROD END STYLES

Type F, Flanged rod available, see page 36

DIMENSIONS AFFECTED BY ROD DIAMETER

BORE	ROD DIA. MM	THREAD SIZE			ROD AND PILOT DIMENSIONS							ENVELOPE DIMENSIONS					
		KK STD	CC	FF	A	B +.000 -.002	C	D	LA	NA	V	W	Y	XG	XI MIN.	XJ ADD STROKE	ZB ADD STROKE
1 1/2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	1 3/4	3 1/8	4 1/8	4 7/8
	1 *	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	2 1/8	3 1/2	4 1/2	5 1/4
2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	1 3/4	3 1/4	4 1/8	4 15/16
	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	2 1/8	3 5/8	4 1/2	5 5/16
	1 3/8 *	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2 9/16	2 3/8	3 7/8	4 3/4	5 9/16
2 1/2	5/8	7/16-20	1/2-20	5/8-18	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	1 3/4	3 1/4	4 1/4	5 1/16
	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	2 1/8	3 5/8	4 5/8	5 7/16
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2 9/16	2 3/8	3 7/8	4 7/8	5 11/16
	1 3/4 *	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/2	1 11/16	3/4	1 1/2	2 13/16	2 5/8	4 1/8	5 1/8	5 15/16
3 1/4	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16	2 1/4	4 1/8	5	6
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	2 1/2	4 3/8	5 1/4	6 1/4
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	2 3/4	4 5/8	5 1/2	6 1/2
	2 *	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	2 7/8	4 3/4	5 5/8	6 5/8
4	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16	2 1/4	4 1/8	5	6
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	2 1/2	4 3/8	5 1/4	6 1/4
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	2 3/4	4 5/8	5 1/2	6 1/2
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	2 7/8	4 3/4	5 5/8	6 5/8
5	1	3/4-16	7/8-14	1-14	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16	2 1/4	4 1/8	5 1/4	6 5/16
	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	2 1/2	4 3/8	5 1/2	6 9/16
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	2 3/4	4 5/8	5 3/4	6 13/16
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	2 7/8	4 3/4	5 7/8	6 15/16
6	1 3/8	1-14	1 1/4-12	1 3/8-12	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	2 13/16	2 5/8	4 7/8	5 7/8	7 1/16
	1 3/4	1 1/4-12	1 1/2-12	1 3/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	3 1/16	2 7/8	5 1/8	6 1/8	7 5/16
	2	1 1/2-12	1 3/4-12	2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	3 3/16	3	5 1/4	6 1/4	7 7/16
	2 1/2	1 7/8-12	2 1/4-12	2 1/2-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	3 7/16	3 1/4	5 1/2	6 1/2	7 11/16

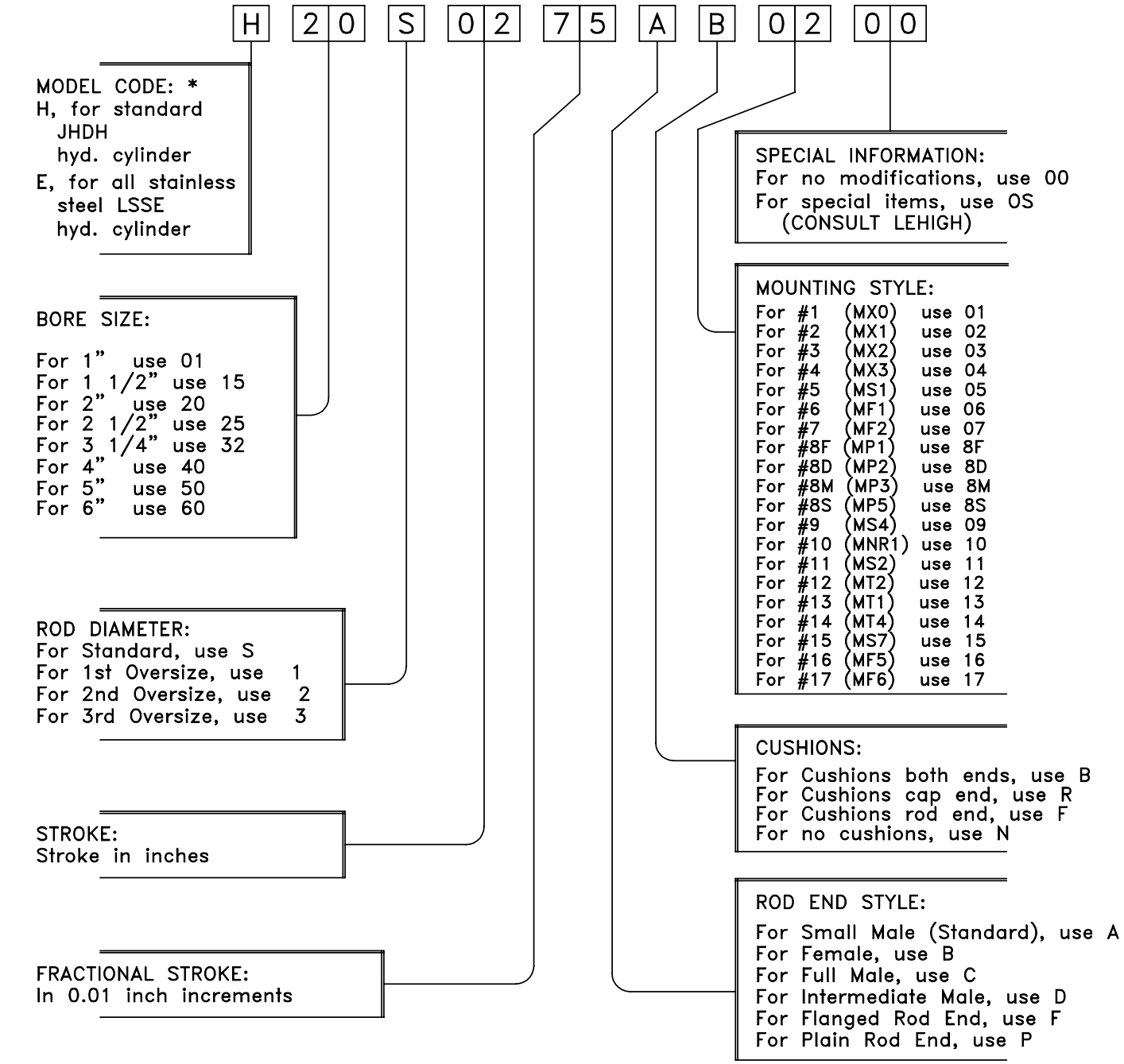
FIRST ROD SIZE SHOWN FOR EACH BORE SIZE IS STANDARD ROD

* ROD END CUSHIONS AVAILABLE ONLY AS NON-ADJUSTABLE TYPE - CONSULT LEHIGH

ORDERING INFORMATION

PART NUMBER CODE FOR PRESSURE RATED HYDRAULIC CYLINDERS

SERIES JHDH STANDARD CONSTRUCTION CYLINDER
SERIES LSSE ALL-STAINLESS STEEL CYLINDER



* SEE APPLICABLE PRODUCT SECTION FOR ALL OTHER PRODUCTS; e.g. POSITION SENSING, BOOSTER, INTENSIFIER, SPRING CYLINDER

Cylinder Designation for Sample Code Above

Series JHDH Standard Construction Hydraulic Cylinder – 2" Dia. Bore
5/8" Dia. Rod – 2.75" Stroke – Standard Small Male Rod End (7/16–20)
Cushioned Both Ends – #2 (MX1) Mounting

PRESSURE-RATED HYDRAULIC CYLINDER SERIES JHDH
STAINLESS STEEL PRESSURE-RATED HYDRAULIC CYLINDER SERIES LSSE
1 1/2" BORE TO 6" BORE

Bore Size	Body Weight at Zero Stroke	Weight Adder per Inch of Stroke by Rod Diameter					
		5/8"	1"	1 3/8"	1 3/4"	2"	2 1/2"
1 1/2"	4.03	0.28	0.42				
2"	6.40	0.36	0.50	0.70			
2 1/2"	9.49	0.43	0.56	0.76	1.02		
3 1/4"	17.90		0.64	0.84	1.10	1.30	
4"	25.99		0.82	1.02	1.28	1.49	
5"	40.44		0.91	1.11	1.37	1.58	
6"	64.54			1.52	1.79	1.99	2.49

The cylinder TOTAL WEIGHT in pounds is the BODY WEIGHT plus the WEIGHT ADDER PER INCH OF STROKE BY ROD DIAMETER

The WEIGHT ADDER includes the weight of the tube and the respective rod

All weights are for cylinders with basic #01 tie-rod mount

All weights are approximate and based on volumetric calculations

SPRING CYLINDERS

FAIL-SAFE OPTION FOR EXTEND OR RETRACT POSITION

AVAILABLE IN ALL SERIES OF CYLINDERS, INCLUDING STAINLESS STEEL!

SPRING CYLINDERS

Fail-safe positioning – a condition where force is provided to the cylinder to move a load to a predetermined point when pressure is removed.

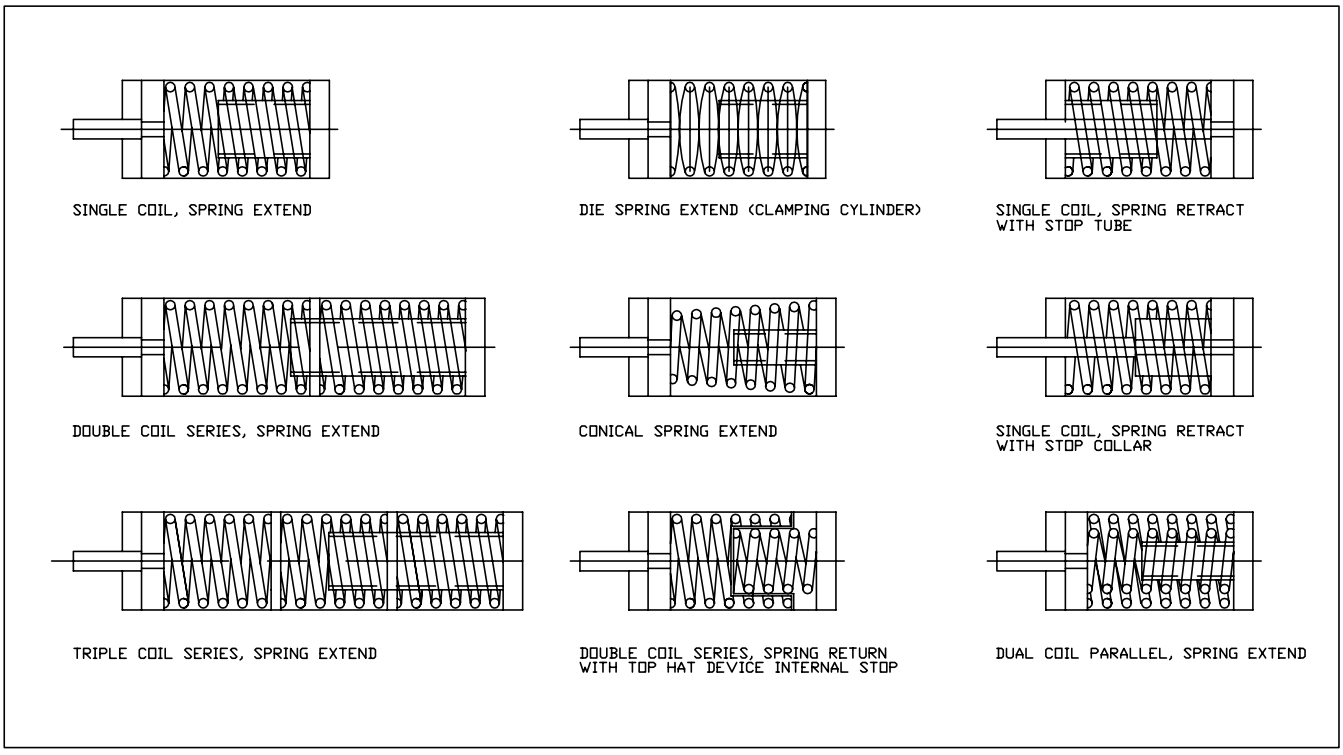
Spring designed cylinders may be the simplest way to accomplish this.

In most cases, a mechanical spring is the only device that can be coupled to a cylinder to consistently deliver a specific design force to hold a desired position when input pressure is lost – and retain that force for as long as the integrity of the cylinder assembly is maintained.

Spring extend – a spring is used so that a cylinder will stroke to the fully extended position when input pressure is removed from the rod end port. Likewise, for *spring retract*, the cylinder will stroke to the fully retracted position when pressure is removed from the cap end port.

Applications for cylinders designed with springs are virtually unlimited, many involving the important fail-safe function. Examples of uses include process-valve operators, conveyor-shift positioners, damper controls, collating machines, steam-control devices, and others where safety requires that some process absolutely must stop if system power is lost.

EXAMPLES OF SPRING CYLINDER DESIGN



SPRING CYLINDERS

FAIL-SAFE OPTION FOR EXTEND OR RETRACT POSITION (Cont.)

DESIGNING THE SPRING CYLINDER

In a *Spring Extend* or a *Spring Retract* cylinder, a spring is installed inside the cylinder tube. The spring is compressed when the cylinder is assembled. The *Spring Preload* is the force this initial compression develops. The *Spring Preload* is the force the cylinder will develop in the fail-safe position without system pressure.

It is important to correctly identify all external forces acting upon the cylinder. These external forces could include linkage friction, seal friction external to the cylinder, or process loads that act only in the extend or retract stroke. If the external forces are under-estimated, the system pressure may not be sufficient to stroke the cylinder.

It is also important to accurately determine the minimum system pressure available. The system pressure determines the bore of the spring-loaded cylinder. If the system pressure is over-estimated, the cylinder may not fully stroke.

Correctly applying the spring cylinder requires some thoughtful design decisions. Yet, the design process is not complicated if complete preliminary information is provided. Such information should include:

Operating Medium – Hydraulic media; e.g., Oil, Synthetic Fluid, Fire-Resistant Fluid, Water, etc.

Minimum Available System Pressure – Affects the bore size

Required Cylinder Working Stroke – The resultant cylinder length depends on the bore, stroke, and spring combination. As a rule-of-thumb, a spring cylinder's total stroke will be approximately twice the actual working stroke required. Longer lengths are not uncommon.

Spring Preload – The force (lbs) the cylinder develops in the fail-safe position

Other usual design elements of the cylinder also need to be specified; i.e., rod diameter, rod end style, mounting style, port type and port positions.

There are two additional useful terms that need not be supplied as application data, but are calculated for the design:

Spring Rate – The amount of force (lbs) developed by the spring per inch of compression

Spring Final Load – The force (lbs) developed by the spring when the cylinder is fully stroked away from its fail-safe position

ORDERING INFORMATION

The spring cylinder is a product engineered for a specific application. Please note, however, that this design is essentially a modification of any of our standard products. Therefore, you can consider the basic designs of our any of our cylinder series in your application, from our 1" diameter bore on up to our largest bore, including the all-stainless steel cylinder (LSSE). Contact Lehigh sales and engineering for help in selecting the best product solution for your requirement.

POSITION SENSING CYLINDERS

There are a number of different position sensing devices for fluid power cylinders. Described below are four main types:

1. Tie rod mounted limit switches that are actuated by a magnetic piston
2. End-of-stroke proximity switches that are actuated by the cylinder cushion boss
3. Linear displacement transducer constructed as a probe inside the cylinder rod
4. Servo-type positioner for an air cylinder operating by force-balance

Each is briefly described below. Ordering instructions are provided for the tie rod mount limit switches. Please contact Lehigh sales and engineering for application assistance to define the ordering information for other positioning systems.

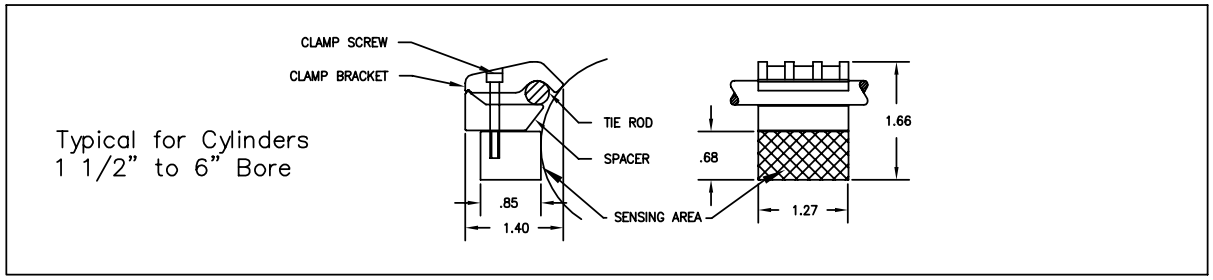
TIE ROD MOUNTED LIMIT SWITCHES

This series of compact reed and hall effect switches is designed specifically as a rugged yet cost effective product to electrically sense cylinder stroke position.

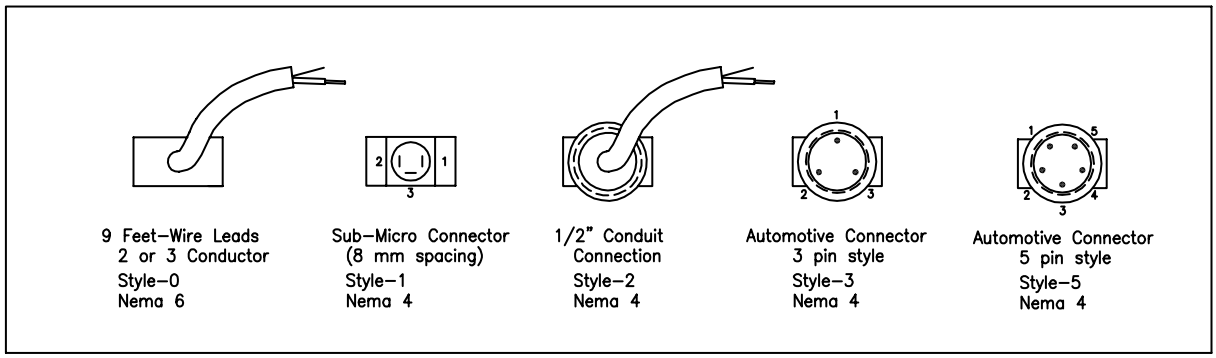
Mounting is accomplished by clamping the switch to the cylinder tie rod with the self-adjusting clamp that comes with the switch.

A large number of custom circuits are featured to match your application requirements.

DIMENSIONAL INFORMATION



TERMINATION INFORMATION



POSITION SENSING CYLINDERS

TIE ROD MOUNTED LIMIT SWITCHES (Cont.)

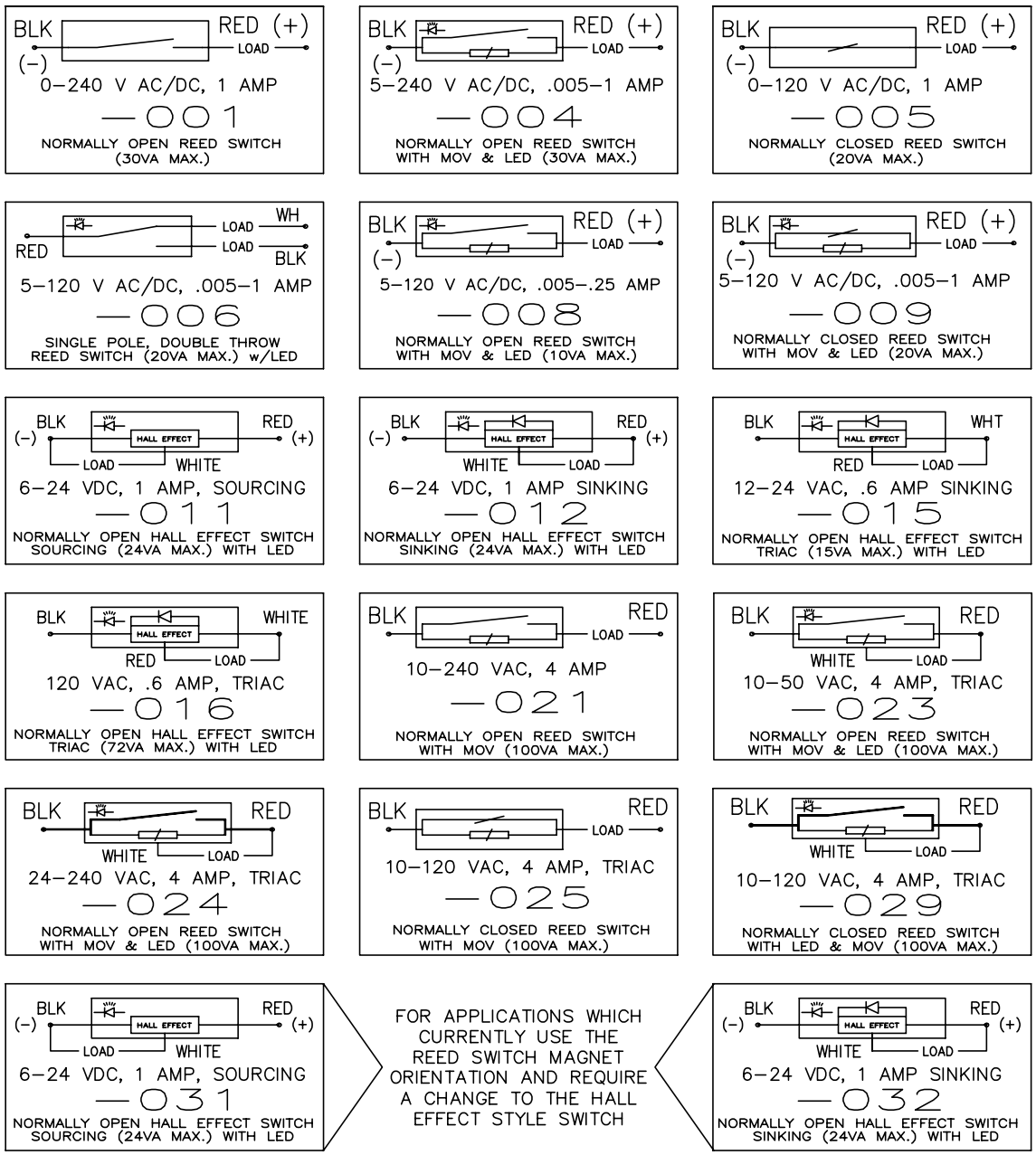
TECHNICAL INFORMATION

Working Temperature: -22°F to +176°F
Vibration Resistance: 10 to 55 Hz
Life Expectancy at Full Load: 10,000,000 Cycles
Max. Switch Current: .25 amp to 4 amp
Repeatability: 0.001"

Shock Resistance: 30g @ 11 ms
Operating Time: OPERATE = 1.5 usec - .6 msec
RELEASE = .5 usec - .05 msec
NEMA Rating: NEMA 6 with Wire Lead Cables, Style 0
NEMA 4 with Connectors, Styles 1,2,3,5

CAUTION - LOADS: Failure to put a load in the line when testing or operating a switch can result in instantaneous failure! The typical application load for the switches is a Programmable Logic Controller (PLC). To test the switch prior to installation the following should apply: (A) For 24 VDC use a 2,000 Ohm, 1/2 Watt resister or equivalent. (B) For 120 VAC/DC use a 12,000 Ohm, 2 Watt resister or equivalent. (C) For a 240 VAC/DC use a 20,000 Ohm, 2 Watt resister or equivalent.

SWITCH MODULE TYPES



POSITION SENSING CYLINDERS
TIE ROD MOUNTED LIMIT SWITCHES (Cont.)

ORDERING INFORMATION

721–□00–□□□

Tie Rod Clamp Size

0	– 1 1/2" to 6" Bore Cylinders
9	– 8" to 14" Bore Cylinders

Termination Style

0	– Wire Leads, 2 or 3 Conductor, 9 Feet Long
1	– Sub Micro DIN Connector w/Female connector
2	– 1/2" Female Conduit Connector
3	– 3 Pin Automotive Connector
5	– 5 Pin Automotive Connector

Switch Module Type

01	– Reed Switch, Normally Open, 0–240 VAC/VDC
04	– Reed Switch, Normally Open, 5–240 VAC/VDC, w/Surge Suppression and LED
05	– Reed Switch, Normally Closed, 0–120 VAC/VDC
06	– Reed Switch, Single Pole, Double Throw, 5–120 VAC/VDC, with LED
08	– Reed Switch, Normally Open, 5–120 VAC/VDC, w/Surge Suppression and LED
09	– Reed Switch, Normally Closed, 0–120 VAC/VDC, w/Surge Suppression and LED
11	– Hall Effect, Sourcing (Magneto Resistive), with LED, 6–24 VDC
12	– Hall Effect, Sinking (Magneto Resistive), with LED, 6–24 VDC
15	– Hall Effect, Reed Switch, Triac Output, 12–24 VAC, with LED
16	– Hall Effect, Reed Switch, Triac Output, 120 VAC, with LED
21	– Reed Switch, Normally Open, 10–240 VAC, w/Surge Supression (4 amp)
23	– Reed Switch, Normally Open, Triac Output, 10–50 VAC, w/Surge Suppression and LED (4 amp)
24	– Reed Switch, Normally Open, Triac Output, 24–240 VAC, w/Surge Supression and LED (4 amp)
25	– Reed Switch, Normally Closed, Triac Output, 10–120 VAC, with Surge Suppression (4 amp)
29	– Reed Switch, Normally Closed, Triac Output, 10–120 VAC with Surge Suppression and LED (4 amp)
31	– Hall Effect, Normally Open, Sourcing, w/LED, 6–24 VDC, to replace Reed Switches (1 amp)
32	– Hall Effect, Normally Open, Sinking, w/LED, 6–24 VDC, to replace Reed Switches (1 amp)

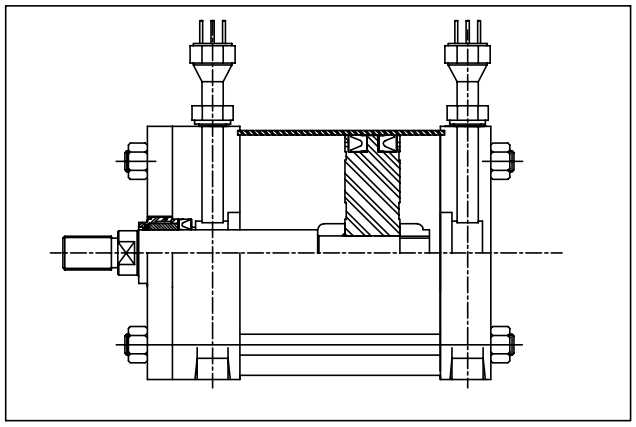
Note: When ordering a pneumatic cylinder for use with tie rod mount limit switches, in addition to the cylinder part number, specify "with magnetic piston for reed switch" and reference the reed switch P/N, or "with magnetic piston for hall effect switch" and reference the hall effect switch P/N. Switch not included in cylinder pricing. Order switch separately.

INSTALLATION TIPS

1. Always use a load when testing the switches. Failure to use a load will permanently damage the switch.
2. Never test using a filament light bulb as a load. The severe inrush currents can cause switch failure or premature failure.
3. There are three types of loads (See "CAUTION - LOADS" on page 27):
   a. Resistive loads - the inputs to a PC or PLC
   b. Capacitive loads - long wire runs
   c. Inductive loads - low power solenoids
4. To control the loads, the following may be necessary:
   a. Resistive loads - confirm input parameters and compare to switch specifications
   b. Capacitive loads - keep wire runs as short as possible and route wires away from current-carrying conductors
   c. Inductive loads - use surge suppression versions of the switches or surge suppression coil connectors
5. Keep the area around the switch free from dirt and magnetic particles. The particles can affect the operation of the switch.
6. The switches can be used to indicate the end of piston travel or as intermediate stroke position indicators.
7. Be sure the sensing area of the switch is installed completely against the cylinder tube for proper operation.

END-OF-STROKE PROXIMITY SENSOR, THREADED MOUNT

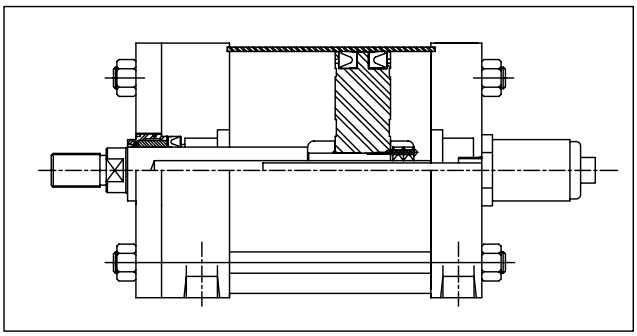
This type of switch signals the end-of stroke of the cylinder by sensing the ferrous cushion bosses on each side of the piston. The switch contains an internal magnet that operates a conventional single pole, double throw, form C switch. These O.D. threaded switches are mounted through the cylinder heads on approximately the same axial centerline as the ports.



Contact Rating:	2 Amp @ 240 VAC 3 Amp @ 24 VDC
Response Time:	0.008 seconds
Repeatability:	0.002" of set operating point under identical conditions
Approvals:	UL, CSA, BASEEFA and SA

LINEAR DISPLACEMENT TRANSDUCER

Linear position sensing provides a non-contact displacement transducer that offers a high degree of accuracy. This type of unit is mounted axially through the cylinder closed head with the probe extending into a clearance in the piston rod.



Linearity:	±0.02% or better
Repeatability:	±0.001% or 0.0001" of full stroke, whichever is greater
Control Interface:	Digital or Analog output
Approvals:	UL and CE

Various models and protocols are available.

Ordering: Contact Lehigh sales and engineering for application assistance to define ordering information. Specifications are subject to change without notice.

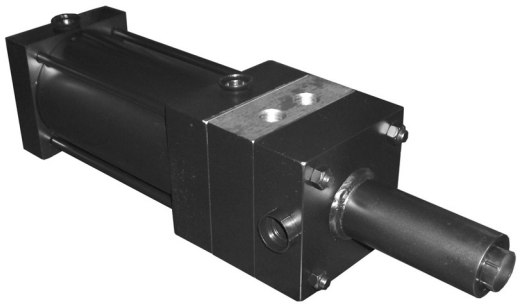
DESIGNING WITH BOOSTERS: AIR-TO-OIL and OIL-TO-OIL

The terms BOOSTER and INTENSIFIER are used interchangeably to describe these practical devices that typically multiply standard shop air into higher hydraulic pressure (air-to-oil), although hydraulic fluid may also be the input medium (oil-to-oil). INTENSIFIERS tend to describe those products that provide very high pressure ratios. BOOSTERS generally provide lower pressure ratings and higher volume.

There are two basic styles of BOOSTERS and INTENSIFIERS. They are the "single" and the "dual" pressure styles. The SINGLE pressure device increases the pressure in the entire non-obstructed circuit. The DUAL pressure device increases the pressure only in the portion of the circuit after the high pressure output port.

BOOSTER AND INTENSIFIER SELECTION

Proper selection of a booster or intensifier requires the following information:



1. The input air (fluid) pressure
2. The desired output pressure
3. The bore and stroke of the high pressure cylinder in the application
4. The desired output force from the high pressure cylinder
5. A sketch of the fluid power circuit (see page 48 for examples)
6. The type of line conductors and fitting connectors used in the circuit
7. How fast the system must operate (cycles per minute)
8. Booster or intensifier mounting style
9. General description of the application and environment (temperature, wash down, etc.)

SELECTION FORMULAS

Using the above information, calculate the required values:

$$\frac{\text{HIGH PRESS. CYL. FORCE}}{\text{HIGH PRESS. CYL. AREA}} = \text{OUTPUT PRESSURE}$$

$$\frac{\text{OUTPUT PRESSURE X 1.05}}{\text{INPUT PRESSURE X .8}} = \text{PRESSURE RATIO}$$

HIGH PRESSURE CYLINDER STROKE X HIGH PRESSURE CYLINDER AREA = HIGH PRESSURE CYLINDER VOLUME

$$\frac{\text{HIGH PRESS. CYL. VOLUME}}{\text{RAM ROD AREA X .95}} = \text{MINIMUM STROKE LENGTH}$$

MINIMUM STROKE LENGTH + .25 = EFFECTIVE STROKE LENGTH (ROUND UP TO NEAREST .25 INCH)

The .95 and 1.05 multipliers allow for friction and expansion in the hydraulic system. The .8 multiplier allows for normal variations in air line pressure. These values are general guidelines and must be adjusted accordingly.

BOOSTERS, INTENSIFIERS, AIR-OIL TANKS (Cont.)

SAMPLE CALCULATION: BOOSTER / INTENSIFIER SIZING

Assume a 2-1/2" dia. bore cylinder with 6" stroke. The cylinder must push 10,000 pounds for .250 inches. The cylinder must extend and retract on pressurized air or oil at 100 PSI.

What size intensifier is required?
What size air-oil tank?

$$\frac{\text{HIGH PRESS. CYL. FORCE}}{\text{HIGH PRESS. CYL. AREA}} = \text{OUTPUT PRESSURE} \qquad \frac{10{,}000 \text{ POUNDS}}{2.5^2 \text{ X } .7854} = 2{,}037 \text{ PSIG}$$

$$\frac{\text{OUTPUT PRESSURE X } 1.05}{\text{INPUT PRESSURE X } .8} = \text{PRESSURE RATIO} \qquad \frac{2{,}037 \text{ PSIG X } 1.05)}{(100 \text{ PSIG X } .8)} = 26.74$$

HIGH PRESSURE CYLINDER STROKE X HIGH PRESSURE CYLINDER AREA = HIGH PRESSURE CYLINDER VOLUME
The high pressure cylinder stroke is .250 x .490 square inches = 1.23 cubic inches

$$\frac{\text{HIGH PRESS. CYL. VOLUME}}{\text{RAM ROD AREA X } .95} = \text{MINIMUM STOKE LENGTH} \qquad \frac{1.23 \text{ Cubic Inch}}{.31 \text{ (from Ratio Chart below) x } .95} = 4.17 \text{ Inches}$$

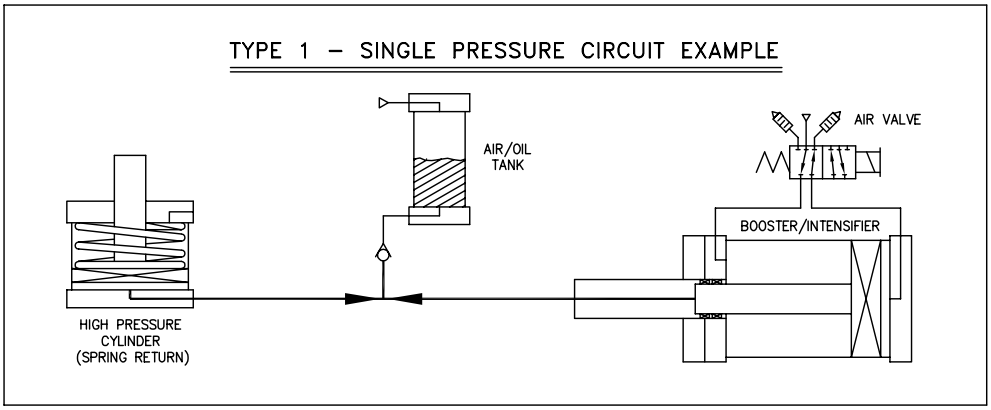
MINIMUM STROKE LENGTH + .25 = EFFECTIVE STROKE LENGTH (ROUND UP TO NEAREST .25 INCH)
The minimum stroke length 4.17 plus .25 = 4.42 inch effective stroke, rounding up to 4.5 inches total stroke

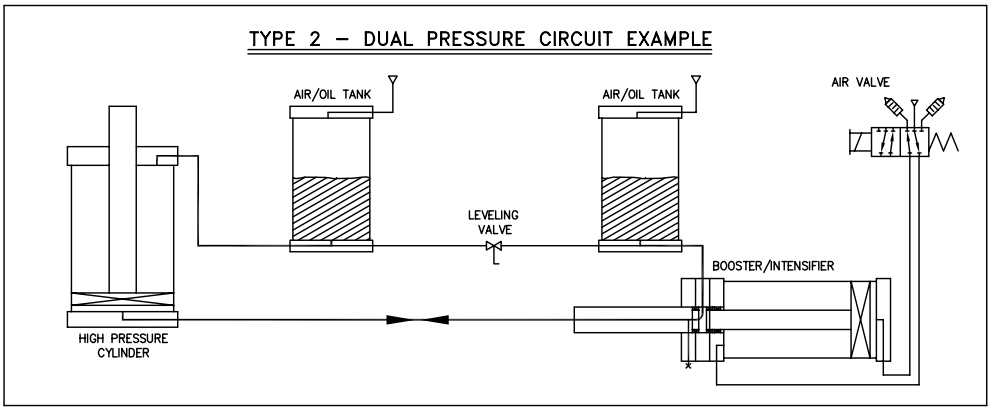
The following intensifiers can be used for this sample application. Choose among the three by the space available for the intensifier. Consult Lehigh for additional application assistance. (See page 48 for air-oil tank selection.)

3-1/4" dia. bore x 5/8" ram dia. x 4-1/2" stroke
4" dia. bore x 5/8" ram dia. x 4-1/2" stroke
6" dia. bore x 1" ram dia. x 2" stroke

RAM ROD DIA.	RAM ROD AREA (SQ. IN.)	PRESSURE RATIOS (BORE AREA / RAM AREA) BORE SIZE (BORE AREA)						
		3 1/4 (8.29 SQ. IN.)	4.0 (12.57 SQ. IN.)	5.0 (19.64 SQ. IN.)	6.0 (28.27 SQ. IN.)	8.0 (50.27 SQ. IN.)	10.0 (78.54 SQ. IN.)	12.0 (113.10 SQ. IN.)
5/8	.31	26.74	40.55	63.35	- - -	- - -	- - -	- - -
1	.79	10.49	15.91	24.86	35.78	63.63	- - -	- - -
1 3/8	1.49	5.56	8.44	13.18	18.97	33.75	52.71	- - -
1 3/4	2.41	3.44	5.22	8.15	11.73	20.86	32.59	46.93
2	3.14	2.64	4.00	6.25	9.00	16.00	25.01	36.02
2 1/2	4.91	- - -	- - -	- - -	5.76	10.24	15.99	23.03
3	7.06	- - -	- - -	- - -	- - -	- - -	11.12	16.02
3 1/2	9.62	- - -	- - -	- - -	- - -	- - -	- - -	11.76

BOOSTERS, INTENSIFIERS, AIR-OIL TANKS (Cont.)





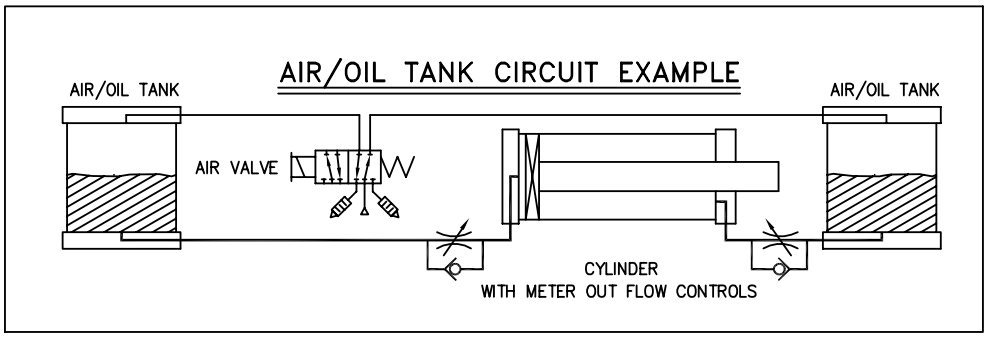
SAMPLE CALCULATION: AIR-OIL TANK SIZING

$$\frac{\text{BORE}^2 \text{ X } .7854 \text{ X STROKE X TANK FACTOR}^*}{\text{TANK VOLUME PER INCH}} = \text{MINIMUM TANK LENGTH} \qquad \frac{2.5^2 \text{ X } .7854 \text{ X } 6 \text{ X } 2.5}{8.3 \text{ (from chart on p. 34)}} = 8.87 \text{ INCHES}$$

(Use the bore diameter of the working cylinder for *BORE*^{2}. Use the stroke of the working cylinder for *STROKE*. The *TANK VOLUME PER INCH* is from the chart on p.34. The volume selected for the formula yields the minimum tank length for the associated tank bore.)

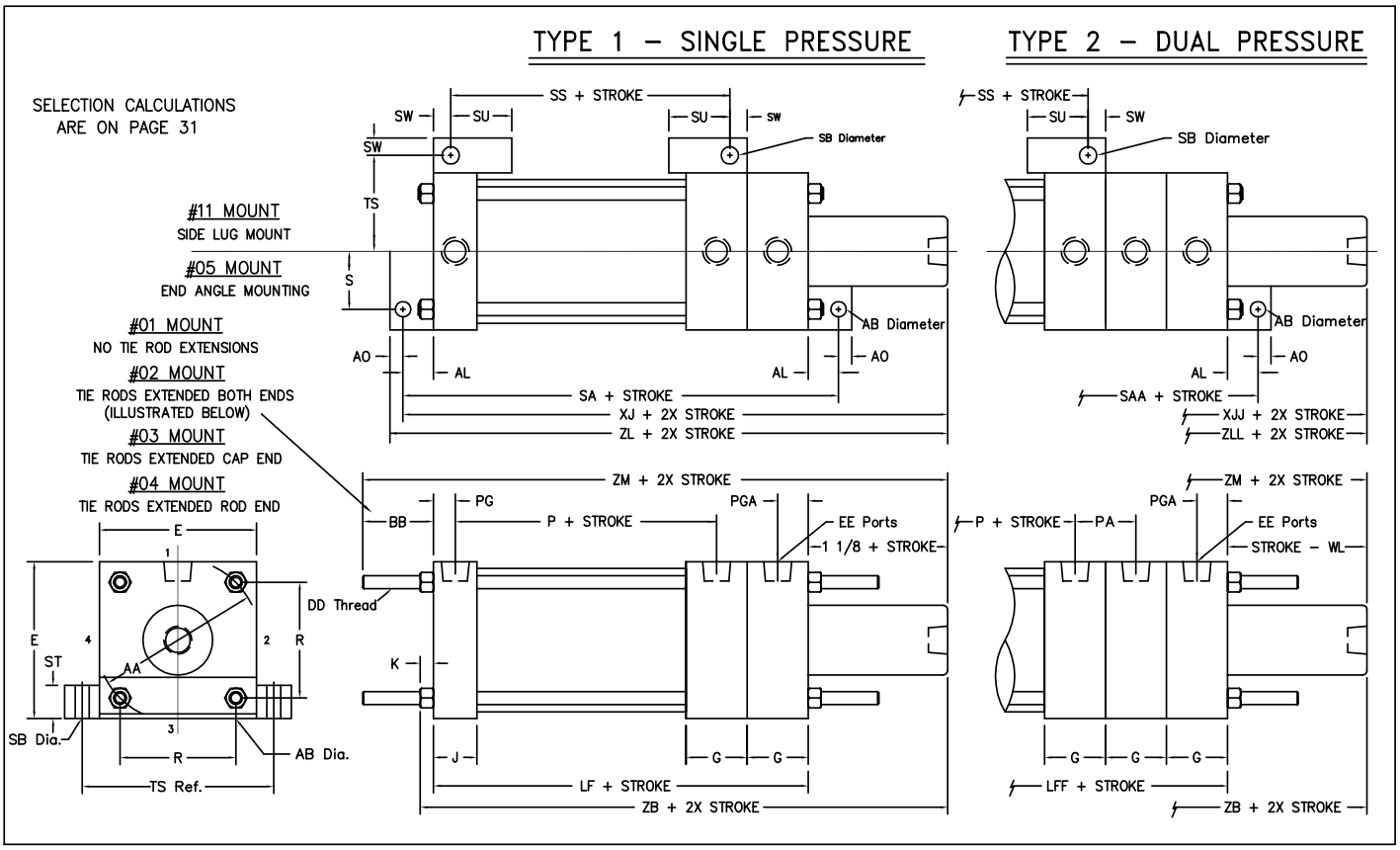
ROUND THE TANK LENGTH UPWARD TO THE NEAREST WHOLE INCH: 8.87 rounds to 9.0 inches long

*The "Tank Factor" varies with tank length, but is generally between 2 and 3 depending on the tank application.



Note: Sample circuits are for concept illustration purposes only. Additional safety devices, controls and lockouts are required for safe operation.

BOOSTERS, INTENSIFIERS, AIR-OIL TANKS (Cont.)



ENVELOPE AND MOUNTING DIMENSIONS

BORE	AA	AB	AL	AO	BB	DD	E	EE NPT	G	J	K	ADD STROKE LF	LFF	P	SA	SAA	SS
3 1/4	3.90	9/16	1 1/4	1/2	1 3/8	3/8-24	3 3/4	1/2	1 3/4	1 1/4	3/8	6	7 3/4	2 5/8	8 1/2	10 1/4	3 1/4
4	4.70	9/16	1 1/4	1/2	1 3/8	3/8-24	4 1/2	1/2	1 3/4	1 1/4	3/8	6	7 3/4	2 5/8	8 1/2	10 1/4	3 1/4
5	5.80	11/16	1 3/8	5/8	1 13/16	1/2-20	5 1/2	1/2	1 3/4	1 1/4	7/16	6 1/4	8	2 7/8	9	10 3/4	3 1/8
6	6.90	13/16	1 3/8	5/8	1 13/16	1/2-20	6 1/2	3/4	2	1 1/2	7/16	7	9	3 1/8	9 3/4	11 3/4	3 5/8
8	9.10	13/16	1 13/16	11/16	2 5/16	5/8-18	8 1/2	3/4	2	1 1/2	9/16	7 1/8	9 1/8	3 1/4	10 3/4	12 3/4	3 3/4
10	11.20	1 1/16	2 1/8	7/8	2 11/16	3/4-16	10 5/8	1	2 1/4	2	11/16	8 5/8	10 7/8	4 1/8	12 7/8	15 1/8	4 5/8
12	13.30	1 1/16	2 1/8	7/8	2 11/16	3/4-16	12 3/4	1	2 1/4	2	11/16	9 1/8	11 3/8	4 5/8	13 3/8	15 5/8	5 1/8

BORE	R	PA	PG	PGA	S	SB	ST	SU	SW	TS	STROKE MINUS WL	ADD 2X STROKE XJ	XJJ	ZB	ZL	ZLL	ZM
3 1/4	2.76	2 1/8	9/16	11/16	2 3/4	9/16	3/4	1 1/4	1/2	4 3/4	5/8	8 3/8	8	7 1/2	8 7/8	8 3/8	8 1/2
4	3.32	2 1/8	9/16	11/16	3 1/2	9/16	3/4	1 1/4	1/2	5 1/2	5/8	8 3/8	8 1/8	7 1/2	8 7/8	8 1/2	8 1/2
5	4.10	2 1/8	9/16	11/16	4 1/4	13/16	1	1 9/16	11/16	6 7/8	5/8	8 3/4	8 7/16	7 13/16	9 3/8	8 15/16	9 3/16
6	4.88	2 3/8	11/16	13/16	5 1/4	13/16	1	1 9/16	11/16	7 7/8	7/8	9 1/2	9 1/8	8 9/16	10 1/8	9 5/8	9 15/16
8	6.44	2 3/8	11/16	13/16	7 1/8	13/16	1	1 9/16	11/16	9 7/8	7/8	10 1/16	9 3/8	8 13/16	10 3/4	10	10 9/16
10	7.92	2 1/2	1	1	8 7/8	1 1/16	1 1/4	2	7/8	12 3/8	1 1/8	11 7/8	11 1/16	10 7/16	12 3/4	11 11/16	12 7/16
12	9.40	2 1/2	1	1	11	1 1/16	1 1/4	2	7/8	14 1/2	1 1/8	12 3/8	11 9/16	10 15/16	13 1/4	12 3/16	12 15/16

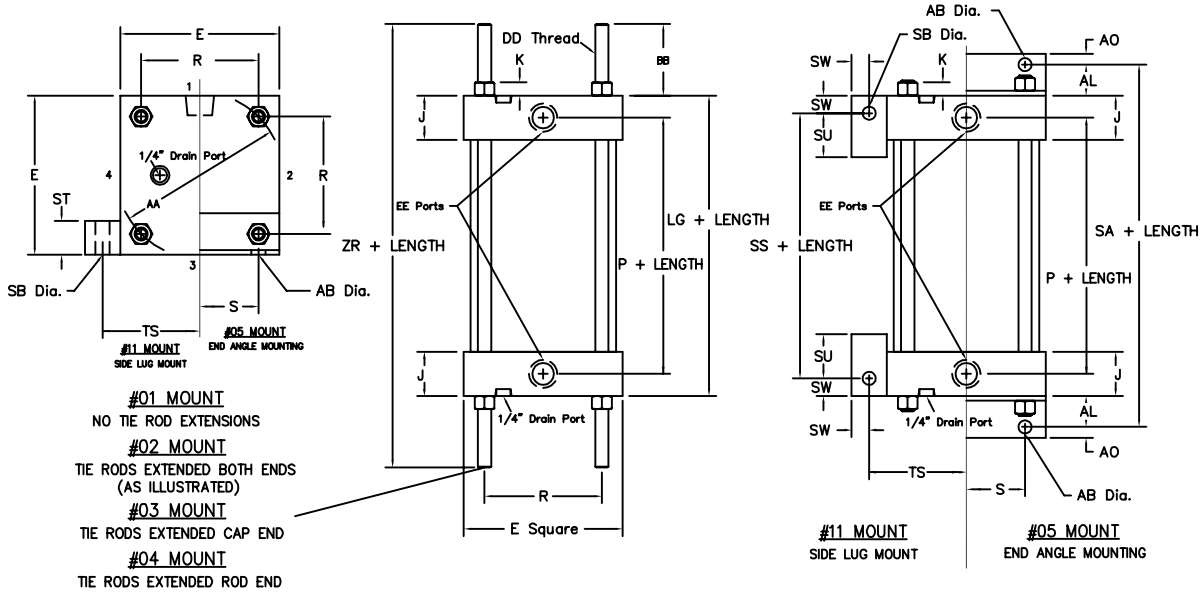
NPT PORTS FURNISHED UNLESS OTHERWISE SPECIFIED

BOOSTERS, INTENSIFIERS, AIR-OIL TANKS (Cont.)

AIR – OIL TANKS

TYPE 1 = TRANSLUCENT TUBE
TYPE 2 = OPAQUE TUBE & SIGHT TUBE

SELECTION CALCULATIONS ON PAGE 32



#01 MOUNT
NO TIE ROD EXTENSIONS

#02 MOUNT
TIE RODS EXTENDED BOTH ENDS
(AS ILLUSTRATED)

#03 MOUNT
TIE RODS EXTENDED CAP END

#04 MOUNT
TIE RODS EXTENDED ROD END

MATERIALS OF CONSTRUCTION TYPICALLY ARE STEEL HEADS, TIE RODS AND MOUNTS, WITH TRANSLUCENT PLASTIC TUBES. OPTIONS INCLUDE METALLIC AND NON–METALLIC TUBES, SIGHT GLASSES, ADDITIONAL PORTS, ALL STAINLESS STEEL, COMPOSITE MATERIALS, GLASS TUBES, ETC. PLEASE CONSULT THE FACTORY FOR MATERIALS COMPATABILITY WITH BOTH THE STANDARD TANKS AND SPECIAL APPLICATIONS.

ENVELOPE AND MOUNTING DIMENSIONS

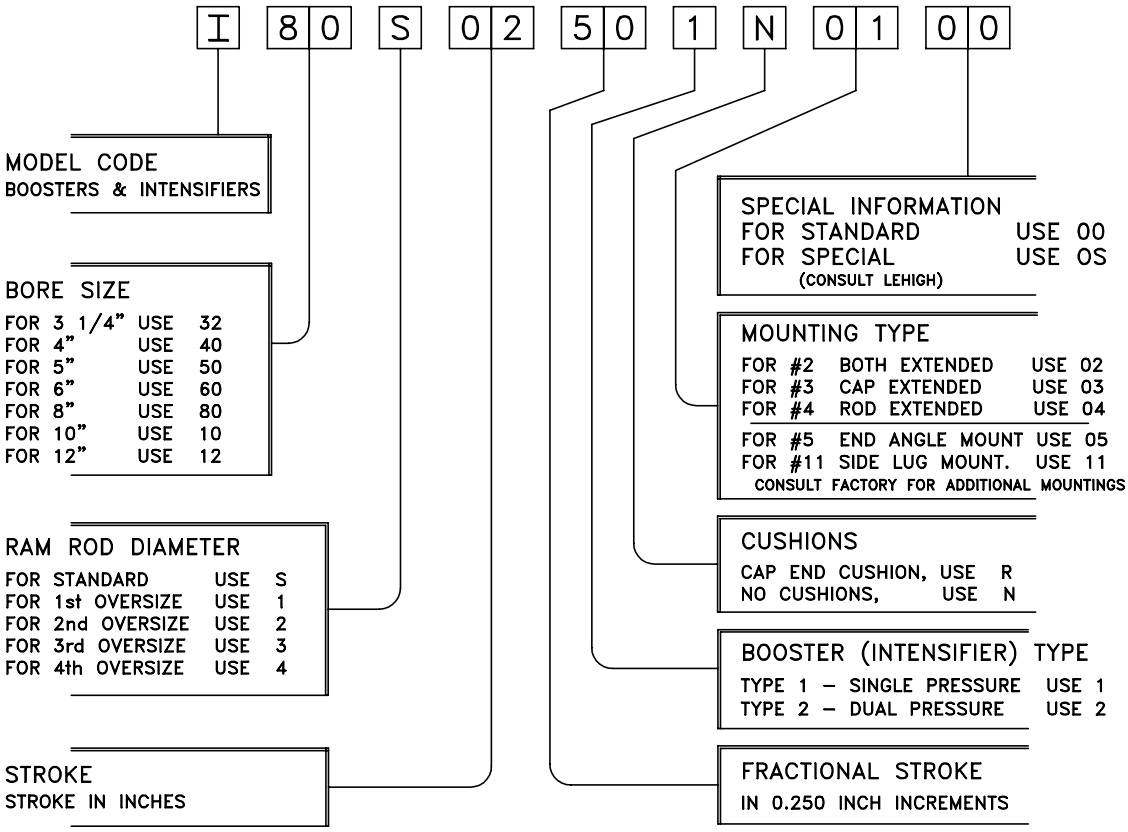
BORE	VOL. PER IN.	AA	AB	AL	AO	BB	DD	E	EE NPT	J	K	PG
3 1/4	8.29 CU. IN.	3.90	9/16	1 1/4	1/2	1 3/8	3/8-24	3 3/4	1/2	1 1/4	3/8	9/16
4	12.56 CU. IN.	4.70	9/16	1 1/4	1/2	1 3/8	3/8-24	4 1/2	1/2	1 1/4	3/8	9/16
5	19.63 CU. IN.	5.80	11/16	1 3/8	5/8	1 13/16	1/2-20	5 1/2	1/2	1 1/4	7/16	9/16
6	28.27 CU. IN.	6.90	13/16	1 3/8	5/8	1 13/16	1/2-20	6 1/2	3/4	1 1/2	7/16	11/16
8	50.26 CU. IN.	9.10	13/16	1 13/16	11/16	2 5/16	5/8-18	8 1/2	3/4	1 1/2	9/16	11/16

								ADD TANK LENGTH				
BORE	R	S	SB	ST	SU	SW	TS	LG	P	SA	SS	ZR
3 1/4	2.76	2 3/4	9/16	3/4	1 1/4	1/2	4 3/4	2 1/2	1 3/8	5	1 1/2	5 1/4
4	3.32	3 1/2	9/16	3/4	1 1/4	1/2	5 1/2	2 1/2	1 3/8	5	1 1/2	5 1/4
5	4.10	4 1/4	13/16	1	1 9/16	11/16	6 7/8	2 1/2	1 3/8	5 1/4	1 1/8	6 1/8
6	4.88	5 1/4	13/16	1	1 9/16	11/16	7 7/8	3	1 5/8	5 3/4	1 5/8	6 5/8
8	6.44	7 1/8	13/16	1	1 9/16	11/16	9 7/8	3	1 5/8	6 5/8	1 5/8	7 5/8

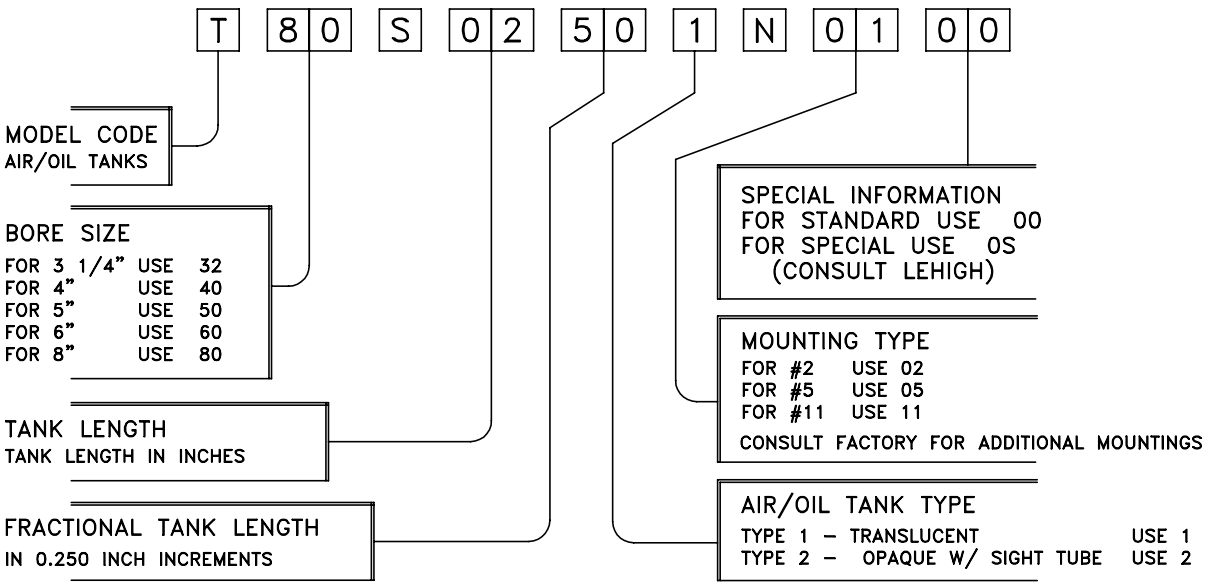
NPT PORTS FURNISHED UNLESS OTHERWISE SPECIFIED

ORDERING INFORMATION

BOOSTERS & INTENSIFIERS

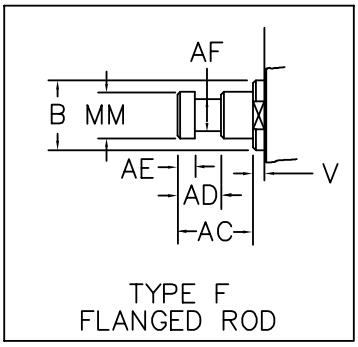


AIR / OIL TANKS



FLANGED ROD END AND COUPLING

TYPE F FLANGED ROD END

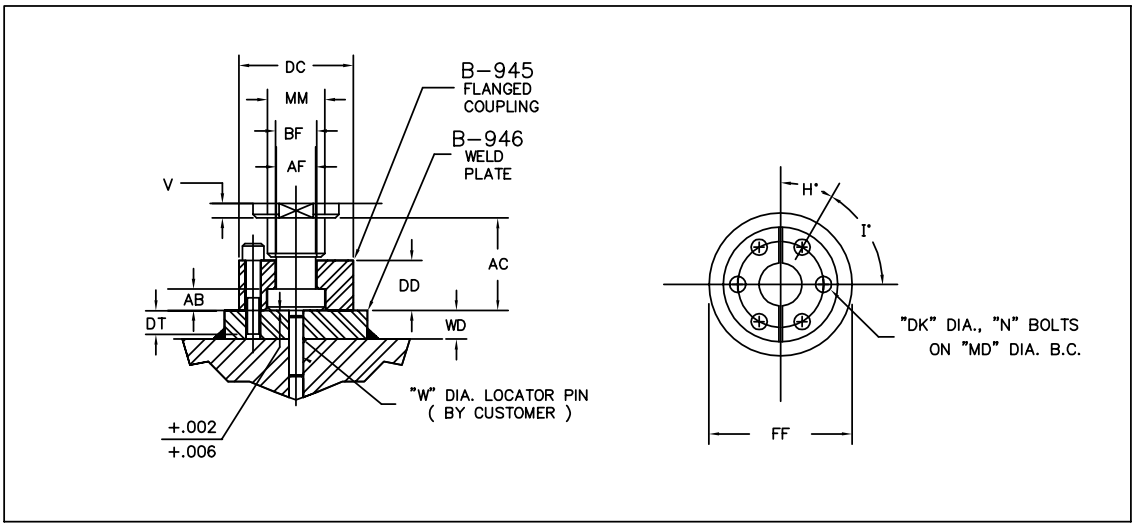


Note: "V" dimension varies per bore size. See data in mounting dimension tables of the respective cylinder mounts.

DIMENSIONS

ROD DIA. MM	AC	AD	AE +.000 -.003	AF DIA.	B DIA. +.000 -.002
5/8	1 1/8	5/8	.250	3/8	1.124
1	1 5/8	15/16	.375	11/16	1.499
1 3/8	1 3/4	1 1/16	.375	7/8	1.999
1 3/4	2	1 5/16	.500	1 1/8	2.374
2	2 5/8	1 11/16	.625	1 3/8	2.624
2 1/2	3 1/4	1 15/16	.750	1 3/4	3.124
3	3 5/8	2 7/16	.875	2 1/4	3.749
3 1/2	4 3/8	2 11/16	1.000	2 1/2	4.249
4	4 1/2	2 11/16	1.000	3	4.749
4 1/2	5 1/4	3 3/16	1.500	3 1/2	5.249
5	5 3/8	3 3/16	1.500	3 7/8	5.749
5 1/2	6 1/4	3 15/16	1.875	4 3/8	6.249
7	6 1/2	4 1/16	2.000	5 3/4	7.999
8	6 1/2	4 1/16	2.000	6 1/2	8.999
8 1/2	6 1/2	4 1/16	2.000	6 1/2	9.499
10	7 1/4	4 5/8	2.375	8	10.999

FLANGED ROD END COUPLING

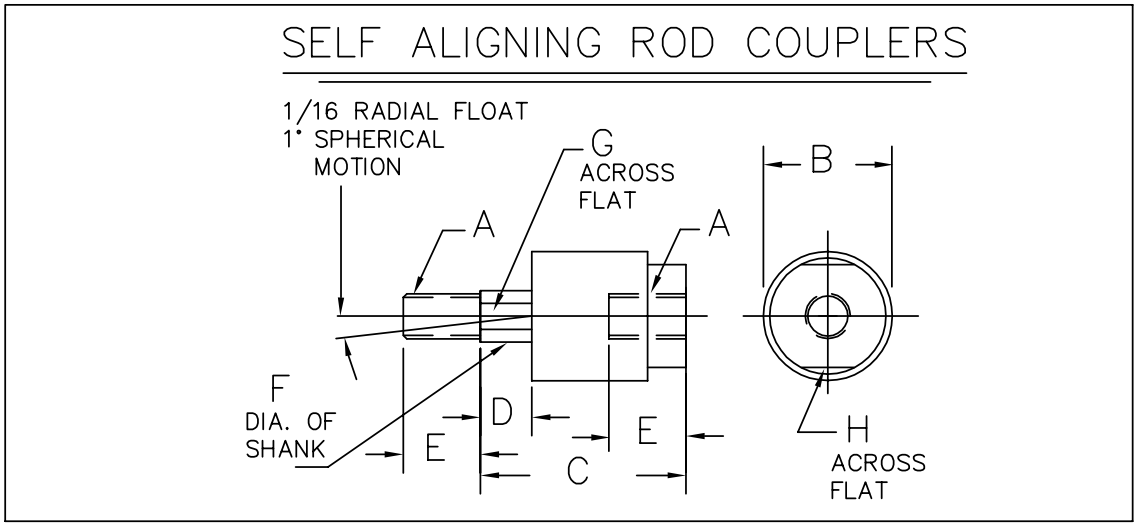


DIMENSIONS

PART NO.	ROD DIA. MM	AB .002 -.000	AF DIA.	BF DIA.	DC DIA.	DD	DK THREAD	DT	FF DIA.	H DEGREE	I DEGREE	MD DIA.	N	WELD PLATE NO.	W DIA.	WD	BOLT TORQUE FT. LBS
B-945-1	5/8	.250	3/8	13/32	1 1/2	9/16	#10-24	3/8	2	45	90	1.12	4	**B-946-1**	1/4	1/2	5
B-945-2	1	.375	11/16	3/4	2	7/8	1/4-20	3/8	2 1/2	30	60	1.50	6	**B-946-2**	1/4	1/2	12
B-945-3	1 3/8	.375	7/8	15/16	2 1/2	1	5/16-18	1/2	3	30	60	2.00	6	**B-946-3**	1/4	5/8	25
B-945-4	1 3/4	.500	1 1/8	1 3/16	3	1 1/4	5/16-18	1/2	4	22 1/2	45	2.38	8	**B-946-4**	1/4	5/8	25
B-945-5	2	.625	1 3/8	1 7/16	3 1/2	1 5/8	3/8-16	5/8	4	15	30	2.69	12	**B-946-5**	3/8	3/4	50
B-945-6	2 1/2	.750	1 3/4	1 7/8	4	1 7/8	3/8-16\	5/8	4 1/2	15	30	3.19	12	**B-946-6**	3/8	3/4	50
B-945-7	3	.875	2 1/4	2 3/8	5	2 3/8	1/2-13	7/8	5 1/2	15	30	4.00	12	**B-946-7**	3/8	1	125
B-945-8	3 1/2	1.000	2 1/2	2 5/8	5 7/8	2 5/8	5/8-11	7/8	7	15	30	4.69	12	**B-946-8**	3/8	1	245
B-945-9	4	1.000	3	3 1/8	6 3/8	2 5/8	5/8-11	7/8	7	15	30	5.19	12	**B-946-9**	3/8	1	245
B-945-10	4 1/2	1.500	3 1/2	3 5/8	6 7/8	3 1/8	5/8-11	7/8	8	15	30	5.69	12	**B-946-10**	3/8	1	245
B-945-11	5	1.500	3 7/8	4	7 3/8	3 1/8	5/8-11	7/8	8	15	30	6.19	12	**B-946-11**	3/8	1	245
B-945-12	5 1/2	1.875	4 3/8	4 1/2	8 1/4	3 7/8	3/4-10	1 1/8	9	15	30	6.88	12	**B-946-12**	3/8	1 1/4	425
B-945-13	7	2.000	5 3/4	5 15/16	10 3/8	4	1-8	1 1/2	11	15	30	8.75	12	**B-946-13**	1/2	1 3/4	1090
B-945-14	8	2.000	6 1/2	6 11/16	11 3/8	4	1-8	1 1/2	12	11 1/4	22 1/2	9.75	16	**B-946-14**	1/2	2	1090
B-945-14	8 1/2	2.000	6 1/2	6 11/16	11 3/8	4	1-8	1 1/2	12	11 1/4	22 1/2	10.25	16	**B-946-14**	1/2	2	1090
B-945-15	10	2.375	8	8 1/4	14 1/8	4 1/2	1 1/4-7	2	15	11 1/4	22 1/2	12.12	16	**B-946-15**	1/2	2 1/2	2180

SELF-ALIGNING ROD COUPLERS

This accessory is used when precise stroke alignment of the installed cylinder is questionable. Installation is simplified, assembly costs are reduced, and cylinder life is extended because wear is reduced on rod bearing and seals.



DIMENSIONS

MODEL NO.	A	B DIA.	C	D	E	F DIA.	G	H	MAX # PULL AT YIELD
B-947-1	1/4-28	7/8	1 1/4	1/4	5/8	.245	3/16	13/16	4,000#
B-947-2	5/16-24	7/8	1 1/4	1 /4	5/8	.308	1/4	13/16	4,000#
B-947-3	3/8-24	7/8	1 1/4	1/4	5/8	.370	5/16	13/16	5,000#
B-947-4	7/16-20	1 1/4	2	1/2	3/4	.62	9/16	1 1/8	10,000#
B-947-5	1/2-20	1 1/4	2	1/2	3/4	.62	9/16	1 1/8	14,000#
B-947-6	5/8-18	1 1/4	2	1/2	3/4	.62	1/2	1 1/8	14,000#
B-947-7	3/4-16	1 3/4	2 5/16	1/2	1 1/8	.97	7/8	1 1/2	34,000#
B-947-8	7/8-14	1 3/4	2 5/16	1/2	1 1/8	.97	7/8	1 1/2	34,000#
B-947-9	1-14	2 1/2	2 15/16	1/2	1 5/8	1.38	1 1/4	2 1/4	64,000#
B-947-10	1 1/4-12	2 1/2	2 15/16	1/2	1 5/8	1.38	1 1/4	2 1/4	64,000#
B-947-11	1 3/8-12	2 1/2	2 15/16	1/2	1 5/8	1.38	1 1/4	2 1/4	64,000#
B-947-12	1 1/2-12	3 1/4	4 3/8	13/16	2 1/4	1.75	1 1/2	3	120,000#
B-947-13	1 3/4-12	3 1/4	4 3/8	13/16	2 1/4	1.75	1 1/2	3	120,000#
B-947-14	1 7/8-12	3 3/4	5 7/16	11/16	3	2.25	1 7/8	3 1/2	240,000#
B-947-15	2-12	3 3/4	5 7/16	11/16	3	2.25	1 7/8	3 1/2	240,000#
B-947-16	2 1/4-12	6 3/4	6 3/8	N/A	3 1/2	2.75	2 3/8	2 7/8	397,000#
B-947-17	2 1/2-12	7	6 1/2	N/A	3 1/2	3.25	2 7/8	3 3/8	495,000#
B-947-18	2 3/4-12	7	6 1/2	N/A	3/12	3.25	2 7/8	3 3/8	603,800#
B-947-19	3-12	7	6 1/2	N/A	3 1/2	3.25	2 7/8	3 3/8	723,400#
B-947-20	3 1/4-12	9 1/4	8 1/2	N/A	4 1/2	4.00	3 3/8	4 1/2	853,800#
B-947-21	4 1/4-12	12 7/8	11 1/4	N/A	4 1/2	5.50	4 7/8	7	1,483,400#

N/A = NOT APPLICABLE TO THIS SIZE

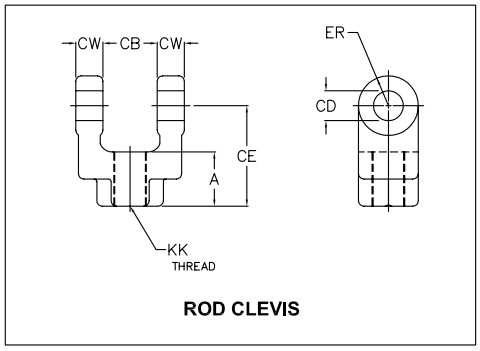
CAP AND ROD END MOUNTING ACCESSORIES

STANDARD AND STAINLESS STEEL

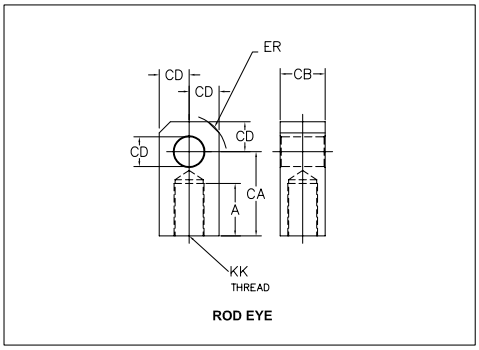
ROD END ACCESSORIES

ROD THREAD SIZE KK	ROD CLEVIS	ROD EYE	EYE BRACKET	PIVOT PIN	CLEVIS BRACKET
7/16-20	MACCL01	MACRE01	MACEB01	MACPN01	MACCB01
3/4-16	MACCL02	MACRE02	MACEB02	MACPN02	MACCB02
1-14	MACCLO3	MACRE03	MACEB03	MACPN03	MACCB03
1 1/4-12	MACCL04	MACRE04	MACEB04	MACPN04	MACCB04
1 1/2-12	MACCL05	MACRE05	MACEB05	MACPN05	MACCB05
1 7/8-12	MACCL06	MACRE06	MACEB06	MACPN06	MACCB06
2 1/4-12	MACCL07	MACRE07	MACEB07	MACPN07	MACCB07
2 1/2-12	MACCL08	MACRE08	MACEB08	MACPN08	MACCB08
3 1/4-12	MACCL09	MACRE09	MACEB09	MACPN09	MACCB09
4-12	MACCL10	MACRE10	MACEB10	MACPN10	MACCB10

1. Rod Clevises and Rod Eyes are stocked to fit the standard "KK" rod thread (style A, Small Male). The "CC" thread for Type D (Intermediate Male) can be supplied on special order.
2. Rod Clevises are supplied with Pivot Pins as standard. Pivot Pins are not supplied with Rod Eyes or Eye Brackets. They must be ordered as separate items if desired.



ROD CLEVIS

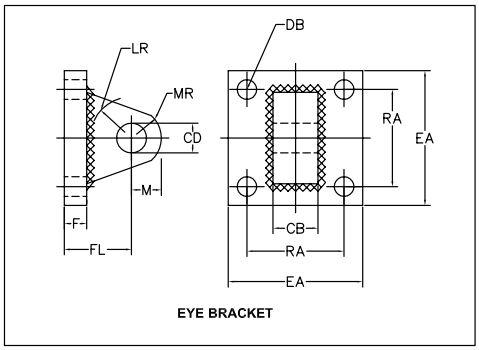


ROD EYE

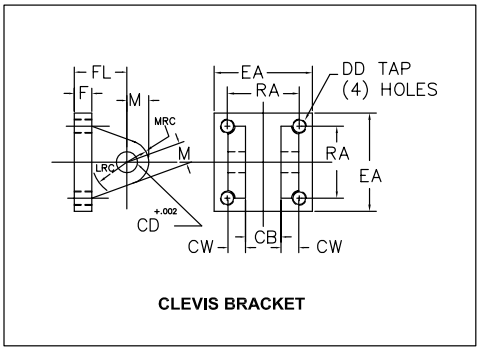
CAP END ACCESSORIES

CYLINDER BORE	EYE BRACKET	PIVOT PIN	CLEVIS BRACKET
1 1/2, 2, & 2 1/2	MACEB01	MACPN01	MACCB01
3 1/4, 4, & 5	MACEB02	MACPN02	MACCB02
6 & 8	MACEB03	MACPN03	MACCB03
10	MACEB04	MACPN04	MACCB04
12	MACEB05	MACPN05	MACCB05
14	MACEB06	MACPN06	MACCB06
16	MACEB07	MACPN07	MACCB07
18 & 20	MACEB08	MACPN08	MACCB08

1. Pivot Pins are not supplied with Eye Brackets. They must be ordered as separate items if desired.
2. Eye Brackets are designed to mate with cylinder mounting Style 8F (NFPA MP1) and Style 8D (NFPA MP2).
3. Clevis Brackets are designed to mate with cylinder mounting Style 8M (NFPA MP3) and Rod Eyes.



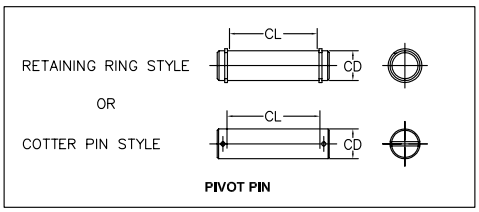
EYE BRACKET



CLEVIS BRACKET

NOTE: STAINLESS STEEL

Part Numbers in the above charts are for standard Rod End and Cap End Accessories. All items are also available in **stainless steel**. For stainless steel accessories, add "S" to the end of the Part Number: e.g.; MACCL01 for standard Rod Clevis, MACCL01S for stainless steel Rod Clevis.



PIVOT PIN

CAP AND ROD END MOUNTING ACCESSORIES (Cont.)

STANDARD AND STAINLESS STEEL

ROD CLEVIS PART NUMBER

	MACCLO1	MACCL02	MACCL03	MACCL04	MACCL05	MACCL06	MACCL07	MACCL08	MACCL09	MACCL10
A	3/4	1 1/8	1 5/8	2	2 1/4	3	3 1/2	3 1/2	4 1/2	5 1/2
CB	3/4	1 1/4	1 1/2	2	2 1/2	2 1/2	3	3	4	4 1/2
CD	1 /2	3/4	1	1 3/8	1 3/4	2	2 1/2	3	3 1/2	4
CE	1 1/2	2 3/8	3 1/8	4 1/8	4 1/2	5 1/2	6 1/2	6 3/4	8 1/2	10
CW	1/2	5/8	3/4	1	1 1/4	1 1/4	1 1/2	1 1/2	2	2 1/4
ER	1/2	3/4	1	1 3/8	1 3/4	2	2 1/2	3	3 1/2	4
KK	7/16-20	3/4-16	1-14	1 1/4-12	1 1/2-12	1 7/8-12	2 1/4-12	2 1/2-12	3 1/4-12	4-12

ROD EYE PART NUMBER

	MACRE01	MACRE02	MACRE03	MACRE04	MACRE05	MACRE06	MACRE07	MACRE08	MACRE09	MACRE10
A	3/4	1 1/8	1 5/8	2	2 1/4	3	3 1/2	3 1/2	4 1/2	5 1/2
CA	1 1/2	2 1/16	2 13/16	3 7/16	4	5	5 13/16	6 1/8	7 5/8	9 1/8
CB	3/4	1 1/4	1 1/2	2	2 1/2	2 1/2	3	3	4	4 1/2
CD	1/2	3/4	1	1 3/8	1 3/4	2	2 1/2	3	3 1/2	4
ER	5/8	7/8	1 3/16	1 9/16	2	2 1/2	2 13/16	3 1/4	3 7/8	4 7/16
KK	7/16-20	3/4-16	1-14	1 1/4-12	1 1/2-12	1 7/8-12	2 1/4-12	2 1/2-12	3 1/4-12	4-12

EYE BRACKET PART NUMBER (MACEB) OR CLEVIS BRACKET PART NUMBER (MACCB)

	MACCB01	MACCB02	MACCB03	MACCB04	MACCB05	MACCB06	MACCB07	MACCB08	MACCB09	MACCB10
	MACEB01	MACEB02	MACEB03	MACEB04	MACEB05	MACEB06	MACEB07	MACEB08	MACEB09	MACEB10
CB	3/4	1 1/4	1 1/2	2	2 1/2	2 1/2	3	3	4	4 1/2
CD	1/2	3/4	1	1 3/8	1 3/4	2	2 1/2	3	3 1/2	4
CW	1/2	5/8	3/4	1	1 1/4	1 1/4	1 1/2	1 1/2	2	2 1/4
DB	13/32	17/32	21/32	21/32	29/32	1 1/16	1 3/16	1 5/16	1 13/16	2 1/16
DD	3/8-24	1/2-20	5/8-18	5/8-18	7/8-14	1-14	1 1/8-12	1 1/4-12	1 3/4-12	2-12
EA	2 1/2	3 1/2	4 1/2	5	6 1/2	7 1/2	8 1/2	9 1/2	12 5/8	14 7/8
F	3/8	5/8	3/4	7/8	7/8	1	1	1	1 11/16	1 15/16
FL	1 1/8	1 7/8	2 1/4	3	3 1/8	3 1/2	4	4 1/4	5 11/16	6 7/16
LR	3/4	1 1/4	1 1/2	2 1/8	2 1/4	2 1/2	3	3 1/4	4	4 1/2
LRC	1/2	1 1/16	1 1/4	1 7/8	2	2 1/8	2 5/8	2 7/8	3 5/8	4
M	1/2	3/4	1	1 3/8	1 3/4	2	2 1/2	3	3 1/2	4
MR	9/16	7/8	1 1/4	1 5/8	2 1/8	2 7/16	3	3 1/4	3 7/8	5 1/4
MRC	9/16	1 1/16	1 1/8	1 3/4	1 7/8	2 1/8	2 1/2	2 3/4	3 1/2	4
RA	1.63	2.55	3.25	3.82	4.95	5.73	6.58	7.50	9.62	11.45

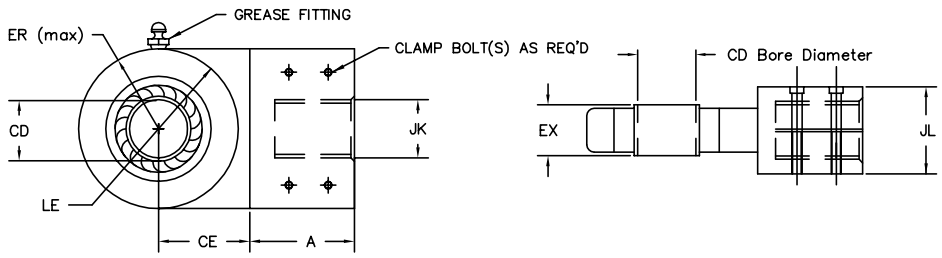
PIVOT PIN PART NUMBER

	MACPN01	MACPN02	MACPN03	MACPN04	MACPN05	MACPN06	MACPN07	MACPN08	MACPN09	MACPN10
CD	1/2	3/4	1	1 3/8	1 3/4	2	2 1/2	3	3 1/2	4
CL	1 3/4	2 1/2	3	4	5	5	6	6	8	9

SPHERICAL CAP AND ROD END MOUNTING ACCESSORIES

STANDARD AND STAINLESS STEEL

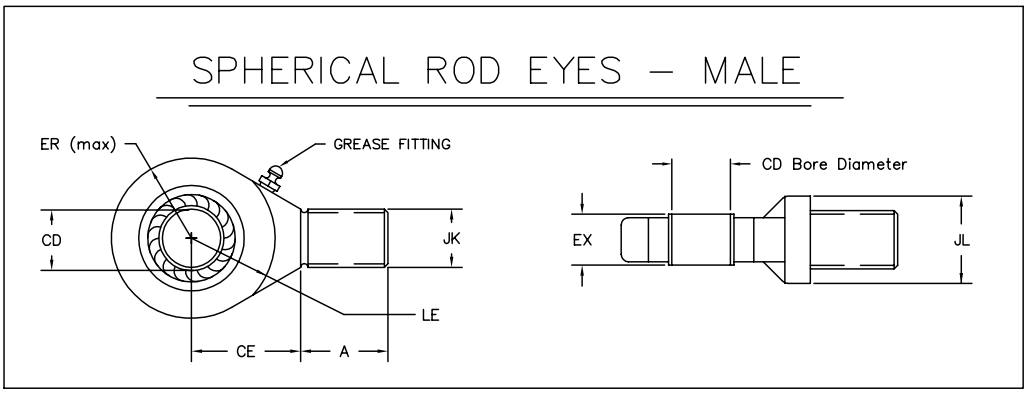
SPHERICAL ROD EYES – FEMALE



MOUNTING DIMENSIONS

PART NO.	CD +.0000 -.0005	A	CE	EX	ER	LE	JK	JL	CLAMP BOLTS QUANTITY SIZE	MAX HYD. CYLINDER BORE & PSIG	MAX LOAD CAPACITY IN POUNDS
LSRE-05F	.5000	1 1/2	3/4	.437	1	5/8	7/16-20	1 1/4	(2) #10-32	1 1/2 @ 1,400	2,600
LSRE-07F	.7500	2	1 1/4	.656	1	1	7/16-20	1 1/4	(2) #10-32	1 1/2 @ 3,000	9,400
LSRE-08F	.7500	2	1 1/4	.656	1 1/4	1	3/4-16	2	(2) #10-32	2 @ 3,000	9,400
LSRE-10F	1.0000	2	1 1/2	.875	1 1/2	1 1/4	3/4-16	2	(2) #10-32	2 1/2 @ 3,000	16,800
LSRE-13F	1.3750	2 1/2	2 1/8	1.187	1 7/8	1 7/8	1.00-14	2	(2) #10-32	3 1/4 @ 3,000	28,600
LSRE-17F	1.7500	2 3/4	2 1/4	1.531	2 1/4	2	1 1/4-12	2 3/4	(2) 1/4-28	4 @ 3,000	43,000
LSRE-20F	2.0000	3	2 1/2	1.750	2 3/4	2 1/4	1 1/2-12	2 3/4	(2) 1/4-28	5 @ 3,000	70,000
LSRE-25F	2.5000	3 5/8	3	2.187	3 1/4	2 3/4	1 7/8-12	3	(2) 1/4-28	6 @ 3,000	85,000
LSRE-30F	3.0000	4 3/8	3 3/4	2.625	4	3 1/2	2 1/4-12	3 1/2	(4) 1/4-28	7 @ 3,000	87,700
LSRE-35F	3.5000	4 3/4	4 3/8	3.062	4 1/2	4 1/8	2 1/2-12	3 3/4	(4) 5/16-24	8 @ 3,000	119,200
LSRE-45F	4.5000	6 1/4	5 5/8	3.937	6	5 1/4	3 1/2-12	4 3/4	(4) 3/8-24	10 @ 3,000	210,500
LSRE-50F	5.0000	6 3/4	6 1/4	4.375	7	5 7/8	4.00-12	5 1/2	(4) 3/8-24	12 @ 3,000	245,500

SPHERICAL ROD EYES – MALE



MOUNTING DIMENSIONS

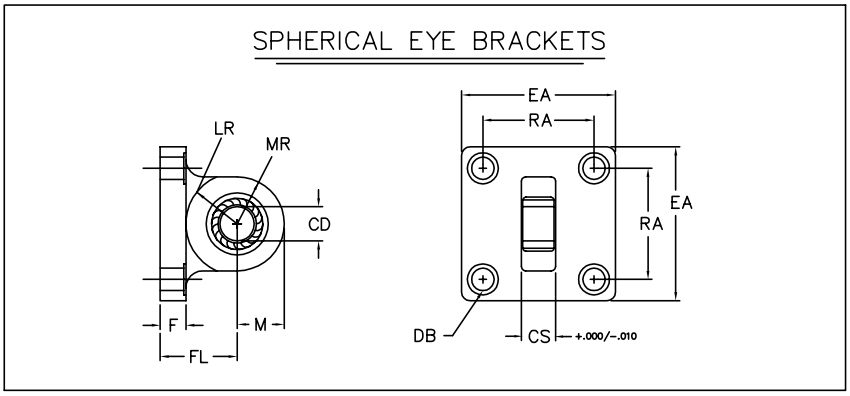
PART NO.	CD +.0000 -.0005	A	CE	EX	ER	LE	JK	JL	MAX HYD. CYLINDER BORE & PSIG	MAX LOAD CAPACITY IN POUNDS
LSRE-05M	.5000	11/16	7/8	.437	7/8	3/4	7/16-20	7/8	1 1/2 @ 1,200	2,600
LSRE-07M	.7500	1	1 1/4	.656	1 1/4	1 1/16	3/4-16	1 5/16	2 1/2 @ 1,400	9,400
LSRE-10M	1.0000	1 1/2	1 7/8	.875	1 3/8	1 7/16	1-14	1 1/2	3 1/4 @ 1,500	16,800
LSRE-13M	1.3750	2	2 1/8	1.187	1 13/16	1 7/8	1 1/4-12	2	4 @ 1,800	28,600
LSRE-17M	1.7500	2 1/8	2 1/2	1.531	2 3/16	2 1/8	1 1/2-12	2 1/4	5 @ 1,200	43,000
LSRE-20M	2.0000	2 7/8	2 3/4	1.750	2 5/8	2 1/2	1 7/8-12	2 3/4	6 @ 1,800	70,000

NOTE: STAINLESS STEEL

Part Numbers in the charts above and on page 41 are for standard Spherical Rod End and Cap End Accessories. All items are also available in **stainless steel**. For stainless steel accessories, add "S" to the end of the Part Number: e.g.; LSRE-05M for standard Male Spherical Rod Eye, LSRE-05MS for stainless steel Male Spherical Rod Eye.

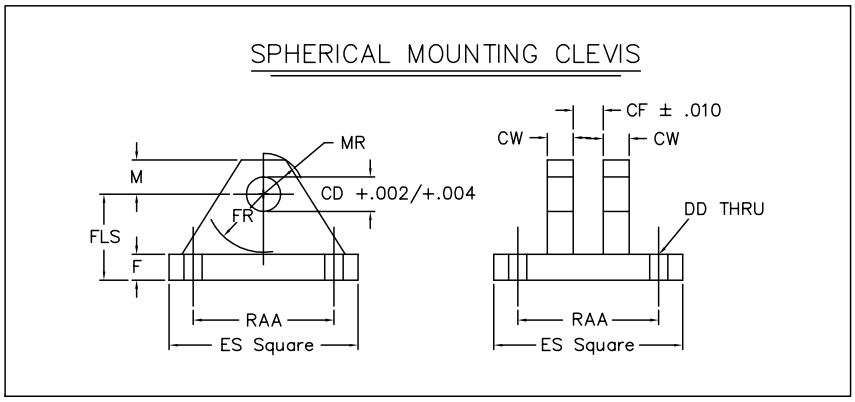
SPHERICAL CAP AND ROD END MOUNTING ACCESSORIES (Cont.)

STANDARD AND STAINLESS STEEL



MOUNTING DIMENSIONS

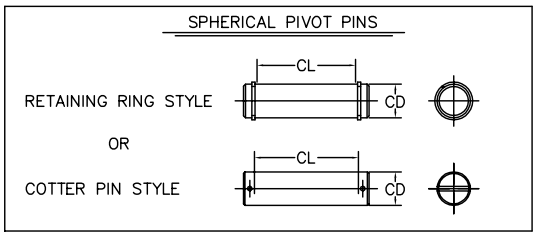
PART NO.	CD	CS	DB	EA	F	FL	LR	M	MR	RA
LSEB-05	.500	.50	13/32	2 1/2	3/8	1 1/8	3/4	11/16	11/16	1.62
LSEB-07	.750	.75	17/32	3 1/2	5/8	1 7/8	1 1/4	1 3/16	1 3/16	2.56
LSEB-10	1.000	1.00	21/32	4 1/2	3/4	2 1/4	1 1/2	1 3/8	1 3/8	3.25
LSEB-13	1.375	1.38	21/32	5	7/8	3	2 1/8	2	2	3.88
LSEB-17	1.750	1.50	29/32	6 1/2	7/8	3 1/8	2 1/4	2 1/8	2 1/8	4.94
LSEB-20	2.000	1.75	1 1/32	7 1/2	1	3 1/2	2 1/2	2 3/8	2 3/8	5.75



MOUNTING DIMENSIONS

PART NO.	CD	CF	CW	DD	ES	F	FLS	FR	M	MR	RAA
LCBS-05	.500	.44	1/2	13/32	3	1/2	1 1/2	15/16	1/2	5/8	2.05
LCBS-07	.750	.66	5/8	17/32	3 3/4	5/8	2	1 3/8	7/8	1	2.76
LCBS-10	1.000	.88	3/4	17/32	5 1/2	3/4	2 1/2	1 11/16	1	1 3/16	4.10
LCBS-13	1.375	1.19	1	21/32	6 1/2	7/8	3 1/2	2 7/16	1 3/8	1 5/8	4.95
LCBS-17	1.750	1.53	1 1/4	29/32	8 1/2	1 1/4	4 1/2	2 7/8	1 3/4	2 1/16	6.58
LCBS-20	2.000	1.75	1 1/2	29/32	10 5/8	1 1/2	5	3 5/16	2	2 3/8	7.92

Note: Spherical mounting clevises are designed to mate with spherical cylinder mounting style 8S and with spherical rod eyes.

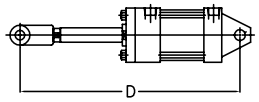
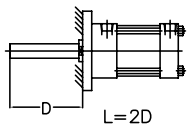
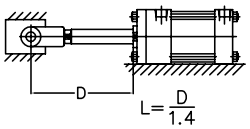
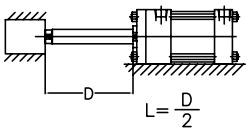
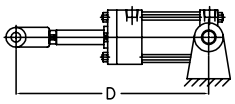
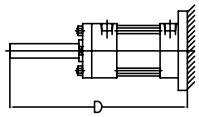
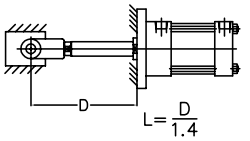
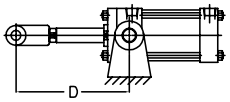
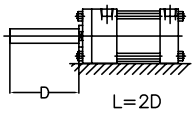
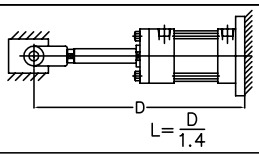
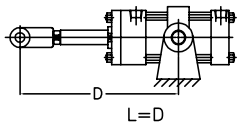


Note: Pivot pin is not supplied with any spherical rod end or cap end mounting accessory. It must be ordered as separate item if required.

MOUNTING DIMENSIONS

PART NO.	CD	CL
LSPP-05	.500	1 1/2
LSPP-07	.750	2
LSPP-10	1.000	2 7/16
LSPP-13	1.375	3 1/4
LSPP-17	1.750	4 3/32
LSPP-20	2.000	4 13/16

PISTON ROD SELECTION CHART
FOR SERIES JHDH AND LSSE
PRESSURE RATED HYDRAULIC CYLINDERS

CATEGORY A BOTH ENDS PIVOTED	CATEGORY B ONE END FIXED; ONE END FREE	CATEGORY C ONE END FIXED; ONE END FREE, BUT GUIDED	CATEGORY D BOTH ENDS FIXED
			
			
			
			

SELECTION CHART

ROD DIA.	5/8	1	1 3/8	1 3/4	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2
Thrust in Pounds	VALUE OF "L" IN INCHES											
50	67											
100	59	110										
150	53	103										
250	43	94	146									
400	37	83	134	186								
700	30	68	118	168	202	275						
1,000	27	60	105	155	190	257	330					
1,400	24	53	92	142	174	244	308	385				
1,800	23	48	82	127	160	230	296	366	440			
2,400	19	45	75	114	145	213	281	347	415	488		
3,200	16	41	67	103	130	194	261	329	400	461		
4,000	13	38	63	94	119	175	240	310	378	446		
5,000	9	34	60	87	110	163	225	289	360	426	494	
6,000		30	56	82	102	152	208	274	342	410	476	
8,000		26	50	76	93	137	188	245	310	375	447	
10,000		21	45	70	89	125	172	222	279	349	412	482
15,000			36	61	78	114	154	197	248	326	388	454
20,000			28	52	68	103	136	172	218	292	350	420
25,000			20	45	61	95	128	164	203	270	326	385
30,000				39	55	87	120	156	189	230	285	330
40,000				22	43	74	108	142	177	210	248	294
50,000					30	66	96	130	165	200	234	269
60,000						57	88	119	154	190	225	256
80,000						36	71	104	137	170	204	240
100,000							57	90	120	154	199	222

DETERMINING PROPER PISTON ROD DIAMETER

To determine proper piston rod diameter for your specific application, follow the sequence outlined below:

Step 1) Determine the maximum extension thrust (push) in pounds that your selected bore cylinder will develop.

Step 2) Using the drawings above, locate your mounting category, noting the value of "L" in relation to extended cylinder dimension "D".

Step 3) Prior to determining the final "D" dimension in inches, check to see if cylinder stop is necessary for proper cylinder operation. As a general rule, whenever stroke length exceeds 40", use 1" of stop tube length for each additional 10" of stroke.

Example: If stroke is 54", the stop tube length should be 2"

Cylinders in categories C and D normally do not require stop tube due to the guided loads.

Step 4) Determine final value of "D" in inches, including stop tube addition if applicable. Convert "D" dimension to chart value "L" in inches, using formula shown on applicable drawing.

Step 5) From the Selection Chart, locate the line showing the maximum "Thrust in Pounds" and read to the right until the approximate value of "L" is located. Read vertically upward to find the necessary rod diameter in inches. *Example: If the maximum thrust is 5,000 lbs., and value of "L" has been determined as 110", the minimum rod diameter recommended would be 2"*

Step 6) Note that in some cases the recommended minimum rod diameter may exceed that which is possible for the cylinder bore size selected. In such cases it may be necessary to select a larger bore size cylinder operating at a lower pressure which will still provide the required operation thrust. The larger cylinder may accommodate a larger rod size which will meet the minimum requirement.

PUSH AND PULL FORCES FOR HYDRAULIC CYLINDERS

THEORETICAL PUSH FORCE, IN POUNDS

BORE	PISTON AREA SQ. IN.	PUSH FORCE IN LBS OBTAINED AT FOLLOWING PRESSURES						FLUID REQUIRED PER INCH OF STROKE	
		100 PSI	250 PSI	500 PSI	700 PSI	1000 PSI	1500 PSI	CUBIC INCH	GALLON
1 1/2	1.77	177	443	885	1239	1770	2655	1.77	.008
2	3.14	314	785	1570	2198	3140	4710	3.14	.014
2 1/2	4.91	491	1228	2455	3437	4910	N/A	4.91	.021
3 1/4	8.30	830	2075	4150	5810	8300	N/A	8.30	.036
4	12.57	1257	3143	6285	8799	N/A	N/A	12.57	.054
5	19.64	1964	4910	9820	N/A	N/A	N/A	19.64	.085
6	28.27	2827	7068	14135	N/A	N/A	N/A	28.27	.122

This table lists full piston areas and push force values on the extend stroke at various input pressures.
The formula used is : F = PA (Force = Pressure x Area).

Also listed are displacement values in cubic feet by bore size and the corresponding value of gallons required to move the piston one inch.
The formulae used are: $In^3 = A \times 1$ (Cubic Inches = Area x 1")
$G = In^3 / 231$ (Gallons = Cubic Inches / 231)

DEDUCTIONS FOR PULL FORCE, IN POUNDS, PER ROD DIAMETER

PISTON ROD DIA.	PISTON ROD AREA SQ. IN.	FOR PULL STROKE FORCE, DEDUCT FROM THE PUSH FORCE THE FORCE CORRESPONDING TO ROD SIZE AND PRESSURE						FLUID REQUIRED PER INCH OF STROKE	
		100 PSI	250 PSI	500 PSI	700 PSI	1000 PSI	1500 PSI	CUBIC INCH	GALLON
5/8	.306	31	77	153	214	306	459	.306	.001
1	.785	79	196	393	550	785	1178	.785	.003
1 3/8	1.485	149	371	743	1040	1485	2228	1.485	.006
1 3/4	2.405	241	601	1203	1684	2405	N/A	2.405	.010
2	3.142	314	786	1571	2199	3142	N/A	3.142	.014
2 1/2	4.909	491	1227	2455	N/A	N/A	N/A	4.909	.021
3	7.069	707	1767	N/A	N/A	N/A	N/A	7.069	.031
3 1/2	9.621	962	2405	N/A	N/A	N/A	N/A	9.621	.042
4	12.566	1257	3142	N/A	N/A	N/A	N/A	12.566	.054

This table lists the rod areas and the corresponding force and displacement values calculated in the same manner as those for pistons in the top table. To determine the values of the pull force and the gallons per inch on the retract stroke, deduct those values in the table for the rod size of your cylinder.

Example: Assume a 4" bore cylinder with a 2" diameter rod operating at 700 PSI.
Using the charts, the following theoretical values are obtained:
Push (or Extend) Force = 8,799 lbs.
Pull (or Retract) Force = 6,600 lbs (8,799 lbs from the top table, less 2,199 lbs from the bottom table)

WARRANTY

Seller warrants its products free from defects in material and workmanship for a period of one year from date of shipment. This warranty excludes normal wear attributable to the particular application in which the product is used.

Further, this warranty is limited exclusively to the replacement or repair of defective products, which, in the opinion of Lehigh Fluid Power, Inc., have not been modified, misused, misapplied, repaired or altered by the user.

Lehigh Fluid Power, Inc. accepts no responsibility or liability for damages to the purchaser arising out of a delay in or failure of delivery or resulting from any breach of any other term or obligation of Lehigh under this contract.

In order to make a claim, buyer must notify Lehigh within the warranty period. Promptly after receiving such notification, Lehigh will either examine the product at the user's site or issue shipping instructions for return to it, transportation costs prepaid by buyer. All items returned must be accompanied by a copy of this acknowledgment.

The above warranty comprises Lehigh's sole and entire obligation and liability to buyer and all of those claiming under buyer as to the products sold hereunder. All other warranties, express or implied, including but not limited to, warranties of merchantability and fitness, are expressly excluded.

These terms and conditions of sale constitute the complete and exclusive statement of agreement superseding all oral or written communications and any prior agreements between the parties relating to its subject matter.

THE COMPANY'S ACCEPTANCE OF THIS ORDER IS MADE EXPRESSLY CONDITIONAL UPON THE FOREGOING TERMS AND CONDITIONS.

Manufacturer of NFPA Industrial Pneumatic and Hydraulic Tie Rod Cylinders

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