

# NFPA Aluminum & Steel Cylinders

## NFPA Series A Aluminum & J Steel Cylinders

1-1/2 to 12 inch bore size

**Impact dampening seals**

**Adjustable captive cushion needle**

**Ecology cylinders meet OSHA noise standards**

**Constructed of the finest materials**

### Technical data

Medium:

Filtered compressed air to 250 PSI

Petroleum based hydraulic fluid to 400 PSI\*

Operating temperature:

Series A & J -20°F to 200°F

with Viton Seals -20°F to 400°F

Operating Pressure:

250 PSIG Air, 400 PSIG Hydraulic\* non-shock.

NOTE: EA and EJ max pressure rating: 150 psi.

Bore Sizes: 1-1/2", 2", 2-1/2", 3-1/4", 4", 5", 6", 7", 8", 10", 12"

Lubrication:

None required

Norgren Air Cylinders are rated for "no lube added" service. All internal components are lubricated at time of assembly with a Teflon® based grease.

Materials

Head and End Caps:

(A and EA Series)

black anodized aluminum alloy

(J and EJ Series)

precision machined steel\*

Tube:

A & EA Series 1/2" to 8"

J & EJ Series 1-1/2" to 2-1/2"

Aluminum alloy, clear anodized O.D., hard coat anodized I.D.

J & EJ Series 3-1/4" to 12" has steel tube, with hard chrome plated I.D.

Piston:

A & EA series: machined high-strength aluminum alloy.

J & EJ series: steel

Piston rod: hard chrome plated steel

Rod Bearing: oil impregnated sintered iron

Seals: nitrile rod seal, urethane rod wiper, nitrile piston seals, nitrile tube end seals

Tie Rods: high-tensile strength steel

\* J and EJ series only



**1 Ultra Cushion® Seals:** Advanced design features a unique, one-piece, compound seal of nitrile\* captured within a precision machined groove. Linear and radial "float" of the cushion seals eliminates misalignment. Ultra Cushions provide exceptionally fast "out of cushion" stroke reversal. (Head and Cap Cushions are optional.)

\*Nitrile seals on the 5/8" & 1" rod diameter. For rod sizes 1-3/4" and larger, urethane seals are standard.

**2 O-Ring Tube Seal:** Nitrile is standard. (Viton is optional.)

**3 Adjustable Captive Cushion Needle:** A one-piece, precision threaded brass cushion adjustment screw with a threaded steel capture ring. It provides safe and precise cushion adjustment.



**4 Wiper Seal:** Lip-type urethane wiper seal keeps contaminants from getting into cylinder by aggressively wiping foreign materials from the piston rod, enhancing the rod seal life.

**6 Rod Seal:** Nitrile lip type seal is pressure energized and wear compensating for durability and long life.

**5 Wear Ring:** Reinforced Teflon® compounded with polyphenylene sulfide provides supreme wear and excellent bearing support.

# NFPA Aluminum & Steel Cylinders

## Cylinder Order Information

EJ 01 7 7 A 1 - HR-L(14)-MS-P(1/4) V - 2" x 6"

Bore and Stroke (write out)

Series	
Series A Cylinder (Aluminum)	A
Series A Double Rod End Cylinder	DA
Series EA Cylinder	EA
Series EA Double Rod End Cylinder	EDA
Series J Cylinder (Steel)	J
Series J Double Rod End Cylinder	DJ
Series EJ Cylinder	EJ
Series EJ Double Rod End Cylinder	EDJ

Mounting Options	
Side Tapped (MS4)	01
Head Rectangular Flange (MF1)	03
Head Square (ME3) - 7" & 8" Bores	03
Cap Rectangular Flange (MF2)	04
Cap Square (ME4) - 7" & 8" Bores	04
Basic Cylinder No Mounting (MX0)	05
Both Ends (4) Tie Rods Ext. (MX1)	06
Both Ends (2) Tie Rods Ext. (MX4)	6B
Cap Tie Rods Ext. (MX2)	6C
Head Tie Rods Ext. (MX3)	6R
Removable Head Trunnion (MT1) - A & EA	7R
Head Trunnion (MT1) - J & EJ	07
Removable Cap Trunnion (MT2) - A & EA	8R
Cap Trunnion (MT2) - J & EJ	08
Side Lugs (MS2)	09
Center Trunnion (MT4)	10
Side End Angles (MS1)	11
Cap Fixed Clevis (MP1)	12
Side End Lugs (MS7)	15
Sleeve Nut Construction (Universal)	16
Head Square Flange (MF5)	20
Cap Square Flange (MF6)	21
Detachable Cap Clevis (MP2)	22
Cap Fixed Eye (MP3)	32
Detachable Cap Eye (MP4)	42
Spherical Bearing	52
Base Bar (Not NFPA A & EA Only)	60

Cushion in Head	
None	3
Non-Adjustable Cushion	†5
Adjustable Cushion (Position 2)	7
Decel Cushion	9

† Standard with EA & EJ

Cushion in Cap	
None	3
Non-Adjustable Cushion	†5
Adjustable Cushion (Position 2)	7
Decel Cushion	9

† Standard with EA & EJ

Additional Options – order alphabetically – More on page ??	
Case Hardened (50 Rc)	HR
Port Location position 1 standard: L(Head Cap) (specify position 1 thru 4 for head and/or cap)	L( )
Rod Lock (passive)	LE
Low Friction	LF
Stroke Adjustment	A
Metal Rod Scraper	MS
Cushion Adjust Screw Location position 2 standard: N(Head Cap) (specify position 1 thru 4 for head and/or cap)	N( )
Non-Standard Port Sizes: [specify port size for P(H) head only, P(C) cap only, or P( ) both head & cap]	*P( )
Magnetic Piston – includes aluminum tube option - J & EJ	PS
Rod Stud	RS
Rod Extensions (specify length of additional rod extension)	RX
Stainless Steel tie-rods	S
303 Stainless Steel (Hard Chrome Plated)	SS
Stainless Steel bushing	SB
Stop Tube (Rod End) (specify stop tube length)	ST( R)
Special Rod Threads (specify rod thread)	T
Thread Extensions (specify length of thread extension)	TX
Viton® Seals	V

\* 1-1/2", 2", 2-1/2" bore cylinders have 3/8" NPT Standard, 1/2" NPT oversize.  
3-1/4", 4", 5" bore cylinders have 1/2" NPT Standard, 3/4" NPT oversize.

Piston Rod Threads	Type	Dim ref
Small Male (Solid) (std)	1	KK
Intermediate Thread Male (Solid)	2	CC
Female	3	KK
Full Thread Male (Solid)	6	FF
Plain Rod End	7	-

Cyl bore	rod itr.	rod dia. (mm)	Cyl bore	rod itr.	rod dia. (mm)
1-1/2	A	5/8	6	C	1-3/8
2	B+	1		D	1-3/4
	A	5/8		E	2
2-1/2	B	1	F	2-1/2	
	C+	1-3/8	C	1-3/8	
	A	5/8	D	1-3/4	
	B	1	E	2	
3-1/4	C	1-3/8	F	2-1/2	
	D	1-3/4	C	1-3/8	
	E	2	D	1-3/4	
4	B	1	E	2	
	C	1-3/8	F	2-1/2	
	D	1-3/4	D	1-3/4	
	E	2	E	2	
	F	2-1/2	F	2-1/2	
5	B	1	12	E	2
	C	1-3/8		F	2-1/2
	D	1-3/4		F	2-1/2

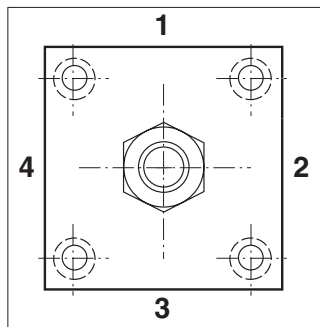
Notes

+ Head cushion not available on these bore and piston rod combinations.

Additional rod sizes available upon request.

Dimensions for thread sizes available on following pages.

Port and Cushion Adjustment Positions  
(As viewed from rod end: Port standard position 1, Cushion Adjustment standard position 2.)  
NOTE: A Port and a Cushion Adjustment cannot be in the same position.



# NFPA Aluminum & Steel Cylinders

## NFPA Series A Aluminum & J Steel Cylinders

1-1/2 to 12 inch bore size

A, EA, J, and EJ Standard and special cylinder options

Option Code	Description
A(-)	Stroke adjustment single piston (specify adjustment length)
AA(-)	Stroke adjustment double piston (specify adjustment length)
AN	Acorn tie rod nuts (stainless steel)
AP	Air/Oil piston (piston supplied with O-ring hooded U-cup on cap end for air/oil operation)
BL	Removable piston rod stud (installed with removable adhesive sealant)
EN**	Electroless nickel plated cylinder
EV(-)	Pneumatic stroke signal valve(s): EV(Head Cap) (specify position)
FG	Black fiberglass cylinder tube
H	Piston rod seals O-ring loaded U-cups – (A & J Only)
HR	Case hardened piston rod
L(-)	Non-standard port location position 1 standard: L (Head Cap) (specify position 1 thru 4 for head and/or cap)
LF	Low friction cylinder (Nitrile compounded with Teflon® rod and piston seals) (Not available with Ecology series)
MS	Metal scraper
N(-)	Cushion adjust screw location position 2 standard:N(Head Cap) (specify position 1 thru 4 for head and/or cap)
P(-)	Non-standard port sizes – [specify port size for P(-H) head only, P(-C) cap only, or P(-) both head & cap]
PP	Seals in cylinder O-ring loaded U-cups (rod and piston seals) – (A & J Only)
PN	Pinned piston and rod assembly
PS	Magnetic piston modification
RS	Studded male piston rod end
RX(-)	Piston rod extension over standard (specify additional "C" length)
S	303/304 Stainless steel tie rods & nuts
SB	Stainless steel rod bushing nut
SC†	Single acting spring extend cap end of cylinder
SL	Steel cylinder tubing
SR†	Single acting spring retract rod end of cylinder
SS	303 Stainless steel piston rod
ST(-C)	Stop tube on cap end (C) of cylinder: ST (stop tube length C)
ST(-R)	Stop tube on rod end (R) of cylinder: ST (stop tube length R)
SV(-)	Stroke signal valve(s): SV (head cap)
T(-)	Non-standard piston rod thread (specify thread)
TF(-)	Piston rod thread depth over standard (Female) (specify additional "A" length)
TS	Stainless cylinder tubing
TX(-)	Piston rod thread extension over standard (Male) (specify additional "A" length)
V	Viton® seals in cylinder
XI(-)	Type #10 trunnion set dimension (MT4 model only) (customer must specify length)

†Standard available for 11/2", 2", 2-1/2" bores, 12" max stroke. (Stroke length doubles – 24" max); 12 lbs. force preload, 30 lbs. force compressed.

Cushions not available on spring end. For other spring forces, bore sizes or longer strokes, consult factory.

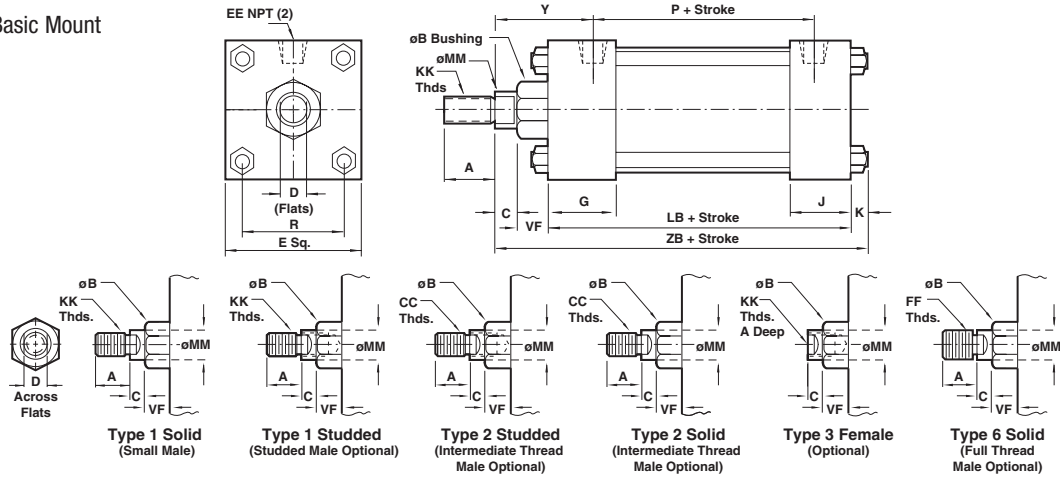
\*\* When ordering "EN" option specify S, SS, TS, and SB options.

### Consult Factory for These Options:

Option Code	Description
AS	Airsaver stroke adjustment
BB	Cylinders mounted back to back
CT	Close tolerance on cylinder stroke
LA	Low friction cylinder (Pak-Lap™ style seals)
NI	Nituff® coated cylinder
NS	No silicone used in cylinder assembly
OE	Zero stroke/pneumatic stroke signal valve(s)
OV	Zero stroke/stroke signal valve(s)
RB	Rod boot over piston rod
TE	Nituff® coated cylinder tubing
TK	Thrust key plate mounting – [01 (MS4), 09 (MS2), and 15 (MS7)]
VM	Valve mounting only

# NFPA Aluminum & Steel Cylinders

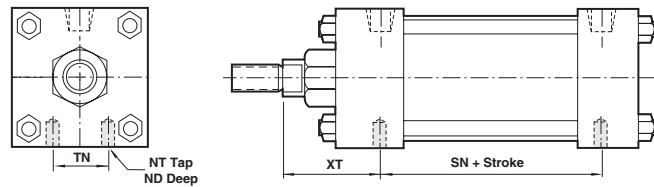
## NFPA (MX0) 05 Basic Mount



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
ø Rod Std.	5/8"	5/8"	5/8"	1"	1"	1"	1-3/8"	1-3/8"	1-3/8"	1-3/4"	2"
MM O.S.	1"	1"	1"	1-3/8"	1-3/8"	1-3/8"	1-3/4"	1-3/4"	1-3/4"	2"	2-1/2"
A Std.	.750	.750	.750	1.125	1.125	1.125	1.625	1.625	1.625	2.000	2.250
A O.S.	1.125	1.125	1.125	1.625	1.625	1.625	2.000	2.000	2.000	2.250	3.000
B +.000 Std.	1.124	1.124	1.124	1.499	1.499	1.499	1.999	1.999	1.999	2.374	2.624
B -.002 O.S.	1.499	1.499	1.499	1.999	1.999	1.999	2.374	2.374	2.374	2.624	3.124
C Std.	.375	.375	.375	.500	.500	.500	.625	.625	.625	.750	.875
C O.S.	.500	.500	.500	.625	.625	.625	.750	.750	.750	.875	1.000
CC Std.	1/2 - 20	1/2 - 20	1/2 - 20	7/8 - 14	7/8 - 14	7/8 - 14	1-1/4 - 12	1-1/4 - 12	1-1/4 - 12	1-1/2 - 12	1-3/4 - 12
CC O.S.	7/8 - 14	7/8 - 14	7/8 - 14	1-1/4 - 12	1-1/4 - 12	1-1/4 - 12	1-1/2 - 12	1-1/2 - 12	1-1/2 - 12	1-3/4 - 12	2-1/4 - 12
D Std.	.500	.500	.500	.813	.813	.813	1.125	1.125	1.125	1.500	1.688
D O.S.	.813	.813	.813	1.125	1.125	1.125	1.500	1.500	1.500	1.688	2.063
E	2.000	2.500	3.000	3.750	4.500	5.500	6.500	7.500	8.500	10.625	12.750
EE	.375	.375	.375	.500	.500	.500	.750	.750	.750	1.000	1.000
FF Std.	5/8-18	5/8-18	5/8-18	1 - 14	1 - 14	1 - 14	1-3/8-12	1-3/8-12	1-3/8-12	1-3/4-12	2-12
FF O.S.	1 - 14	1 - 14	1 - 14	1-3/8-12	1-3/8-12	1-3/8-12	1-3/4-12	1-3/4-12	1-3/4-12	2-12	2-1/2-12
G	1.500	1.500	1.500	1.750	1.750	1.750	2.000	2.000	2.000	2.250	2.250
J	1.000	1.000	1.000	1.250	1.250	1.250	1.500	1.500	1.500	2.000	2.000
K	.250	.313	.313	.375	.375	.438	.438	.563	.563	.688	.688
KK Std.	7/16 - 20	7/16 - 20	7/16 - 20	3/4 - 16	3/4 - 16	3/4 - 16	1 - 14	1 - 14	1 - 14	1-1/4 - 12	1-1/2 - 12
KK O.S.	3/4 - 16	3/4 - 16	3/4 - 16	1 - 14	1 - 14	1 - 14	1-1/4 - 12	1-1/4 - 12	1-1/4 - 12	1-1/2 - 12	1-7/8 - 12
LB	3.625	3.625	3.750	4.250	4.250	4.500	5.000	5.125	5.125	6.375	6.875
P	2.340	2.340	2.470	2.690	2.690	2.940	3.125	3.250	3.250	4.125	4.625
R	1.428	1.838	2.192	2.758	3.323	4.101	4.87	5.730	6.442	7.969	9.4069
VF Std.	.625	.625	.625	.875	.875	.875	1.000	1.000	1.000	1.125	1.125
VF O.S.	.875	.875	.875	1.000	1.000	1.000	1.125	1.125	1.125	1.125	1.250
Y Std.	1.840	1.840	1.840	2.380	2.380	2.380	2.813	2.813	2.813	3.125	3.250
Y O.S.	2.220	2.220	2.220	2.630	2.630	2.630	3.063	3.063	3.063	3.250	3.500
ZB Std.	4.875	4.938	5.063	6.000	6.000	6.313	7.063	7.313	7.313	8.938	9.563
ZB O.S.	5.250	5.313	5.438	6.250	6.250	6.563	7.313	7.563	7.563	9.063	9.813

All dimensions ± .015 unless otherwise noted.

## NFPA (MS4) 01 Side Tapped Mount

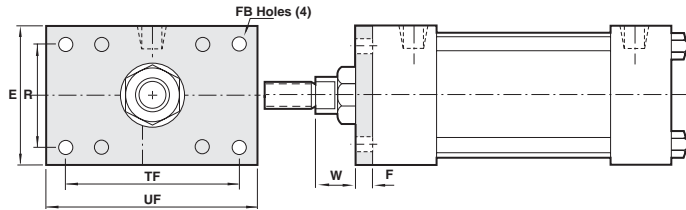


Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
ND	.375	.375	.500	.750	.750	.938	1.125	1.125	1.125	1.500	1.500
NT	1/4 - 20	5/16 - 18	3/8 - 16	1/2 - 13	1/2 - 13	5/8 - 11	3/4 - 10	3/4 - 10	3/4 - 10	1 - 8	1 - 8
SN	2.250	2.250	2.375	2.625	2.625	2.875	3.125	3.250	3.250	4.125	4.625
TN	.625	.875	1.250	1.500	2.063	2.688	3.250	3.500	4.500	5.500	7.250
XT Std.	1.938	1.938	1.938	2.438	2.438	2.438	2.813	2.813	2.813	3.125	3.250
XT O.S.	2.313	2.313	2.313	2.688	2.688	2.688	3.063	3.063	3.063	3.250	3.500

All dimensions ± .015 unless otherwise noted.

# NFPA Aluminum & Steel Cylinders

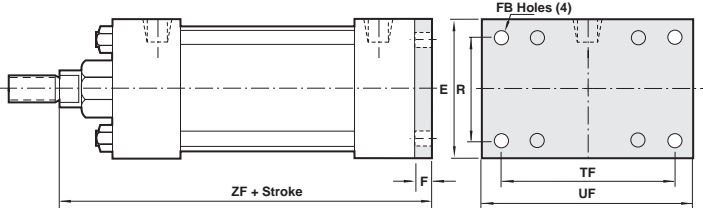
NFPA (MF1) 03 Head Rectangular Flange Mount



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"
E	2.000	2.500	3.000	3.750	4.500	5.500	6.500
F	.375	.375	.375	.625	.625	.625	.750
FB	.313	.375	.375	.438	.438	.563	.563
R	1.428	1.838	2.192	2.758	3.323	4.101	4.879
TF	2.750	3.375	3.875	4.688	5.438	6.625	7.625
UF	3.375	4.125	4.625	5.500	6.250	7.625	8.625
W	Std. .625	.625	.625	.750	.750	.750	.875
	O.S. 1.000	1.000	1.000	1.000	1.000	1.000	1.125

All dimensions ± .015 unless otherwise noted.

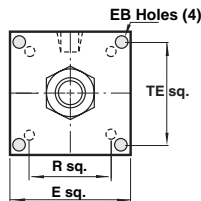
NFPA (MF2) 04 Cap Rectangular Flange Mount



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"
E	2.000	2.500	3.000	3.750	4.500	5.500	6.500
F	.375	.375	.375	.625	.625	.625	.750
R	1.428	1.838	2.192	2.758	3.323	4.101	4.879
TF	2.750	3.375	3.875	4.687	5.438	6.625	7.625
UF	3.375	4.125	4.625	5.500	6.250	7.625	8.625
ZF	Std. 5.000	5.000	5.125	6.250	6.250	6.500	7.375
	O.S. 5.375	5.375	5.500	6.500	6.500	6.750	7.625

All dimensions ± .015 unless otherwise noted.

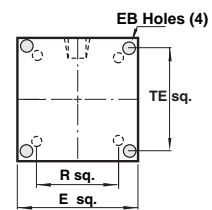
NFPA (ME3) 03 Head Square Mount



Bore	7"	8"	10"	12"
E	7.500	8.500	10.625	12.750
EB	.563	.688	.813	.813
R	5.730	6.442	7.969	9.406
TE	6.750	7.570	9.406	11.109

All dimensions ± .015 unless otherwise noted.

NFPA (ME4) 04 Cap Square Mount



Bore	7"	8"	10"	12"
E	7.500	8.500	10.625	12.750
EB	.563	.688	.813	.813
R	5.730	6.442	7.969	9.406
TE	6.750	7.570	9.406	11.109

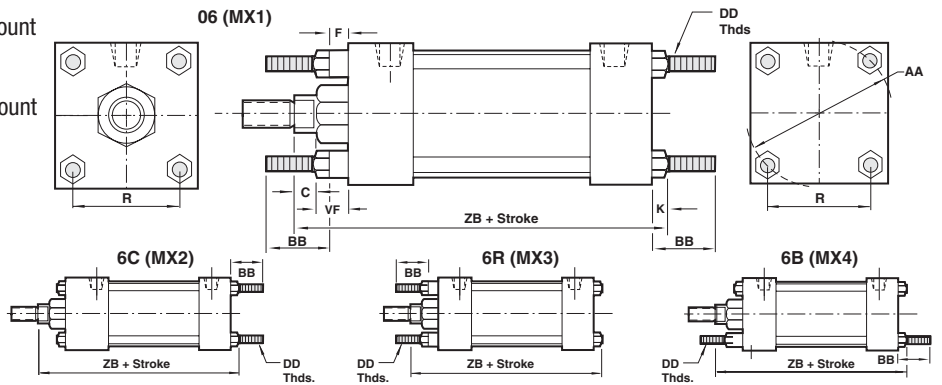
All dimensions ± .015 unless otherwise noted.

NFPA (MX1) 06 (4) Extended Tie Rods Both Ends Mount

NFPA (MX2) 6C Cap Tie Rods Extended Mount

NFPA (MX3) 6R Head Tie Rods Extended Mount

NFPA (MX4) 6B (2) Extended Tie Rods Both Ends Mount

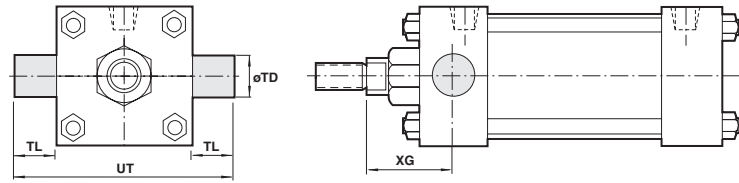


Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
AA	2.020	2.600	3.100	3.900	4.700	5.800	6.900	8.100	9.100	11.313	13.313
BB	1.000	1.125	1.125	1.375	1.375	1.813	1.813	2.313	2.313	2.688	2.688
C	Std. .375	.375	.375	.500	.500	.500	.625	.625	.625	.750	.875
	O.S. .500	.500	.500	.625	.625	.625	.750	.625	.750	.875	1.000
DD	1/4 - 28	5/16 - 24	5/16 - 24	3/8 - 24	3/8 - 24	1/2 - 20	1/2 - 20	5/8 - 18	5/8 - 18	3/4 - 16	3/4 - 16
F	.375	.375	.375	.625	.625	.625	.750	—	—	—	—
K	.250	.313	.313	.375	.375	.438	.438	.563	.563	.688	.688
R	1.428	1.838	2.192	2.758	3.323	4.101	4.879	5.730	6.442	7.969	9.406
VF	Std. .625	.625	.625	.875	.875	.875	1.000	1.000	1.000	1.125	1.125
	O.S. .875	.875	.875	1.000	1.000	1.000	1.125	1.125	1.125	1.125	1.250
ZB	Std. 4.875	4.938	5.063	6.000	6.000	6.313	7.063	7.313	7.313	8.938	9.563
	O.S. 5.250	5.313	5.438	6.250	6.250	6.563	7.313	7.563	7.563	9.063	9.813

All dimensions ± .015 unless otherwise noted.

# NFPA Aluminum & Steel Cylinders

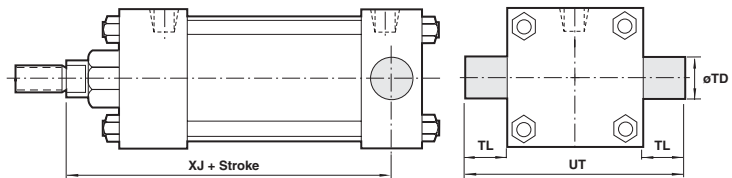
NFPA (MT1) 07 Head Trunnion Mount



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
TD +.000 -0.001	1.000	1.000	1.000	1.000	1.000	1.000	1.375	1.375	1.375	1.750	1.750
TL	1.000	1.000	1.000	1.000	1.000	1.000	1.375	1.375	1.375	1.750	1.750
UT	4.000	4.500	5.000	5.750	6.500	7.500	9.250	10.250	11.250	14.125	16.250
XG Std.	1.750	1.750	1.750	2.250	2.250	2.250	2.625	2.625	2.625	3.000	3.125
O.S.	2.125	2.125	2.125	2.500	2.500	2.500	2.875	2.875	2.875	3.125	3.375

All dimensions ± .015 unless otherwise noted.

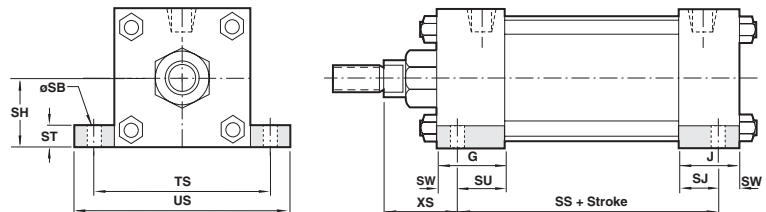
NFPA (MT2) 8R & 08 Cap Trunnion Mount



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
TD +.000 -0.001	1.000	1.000	1.000	1.000	1.000	1.000	1.375	1.375	1.375	1.750	1.750
TL	1.000	1.000	1.000	1.000	1.000	1.000	1.375	1.375	1.375	1.750	1.750
UT	4.000	4.500	5.000	5.750	6.500	7.500	9.250	10.250	11.250	14.125	16.250
XJ Std.	4.125	4.125	4.250	5.000	5.000	5.250	5.875	6.000	6.000	7.250	7.875
O.S.	4.500	4.500	4.625	5.250	5.250	5.500	6.125	6.250	6.250	7.375	8.125

All dimensions ± .015 unless otherwise noted.

NFPA (MS2) 09 Side Lug Mount

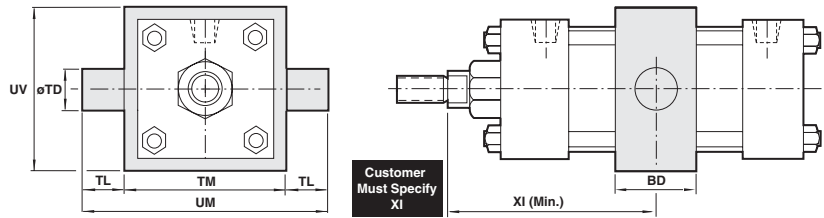


Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
G	1.500	1.500	1.500	1.750	1.750	1.750	2.000	2.000	2.000	2.250	2.250
J	1.000	1.000	1.000	1.250	1.250	1.250	1.500	1.500	1.500	2.000	2.000
SB	.438	.438	.438	.563	.563	.813	.813	.813	.813	1.063	1.063
SH	1.000	1.250	1.500	1.875	2.250	2.750	3.250	3.750	4.250	5.313	6.375
SJ	.625	.625	.625	.750	.750	.813	.813	.813	.813	2.000	2.000
SS	2.875	2.875	3.000	3.250	3.250	3.125	3.625	3.750	3.750	4.625	5.125
ST	.500	.500	.500	.750	.750	1.000	1.000	1.000	1.000	1.250	1.250
SU	1.125	1.125	1.125	1.250	1.250	1.063	1.313	1.563	1.563	2.000	2.000
SW	.375	.375	.375	.500	.500	.688	.688	.688	.688	.875	.875
TS	2.750	3.250	3.750	4.750	5.500	6.875	7.875	8.875	9.875	12.375	14.500
US	3.500	4.000	4.500	5.750	6.500	8.250	9.250	10.250	11.250	14.125	16.250
XS Std.	1.375	1.375	1.375	1.875	1.875	2.062	2.313	2.313	2.313	2.750	2.875
O.S.	1.750	1.750	1.750	2.125	2.125	2.313	2.562	2.563	2.563	2.875	3.125

All dimensions ± .015 unless otherwise noted.

# NFPA Aluminum & Steel Cylinders

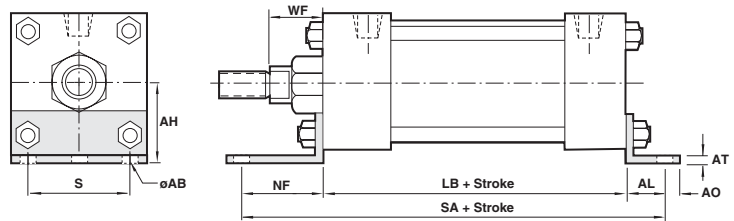
NFPA (MT4) 10 Center Trunnion Mount



Bore		1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
BD		1.250	1.500	1.500	2.000	2.000	2.000	2.500	2.500	2.500	3.000	3.000
TD	+ .000 - .001	1.000	1.000	1.000	1.000	1.000	1.000	1.375	1.375	1.375	1.750	1.750
TL		1.000	1.000	1.000	1.000	1.000	1.000	1.375	1.375	1.375	1.750	1.750
TM		2.500	3.000	3.500	4.500	5.250	6.250	7.625	8.750	9.750	12.000	14.000
UM		4.500	5.000	5.500	6.500	7.250	8.250	10.375	11.500	12.500	15.500	17.500
UV		2.500	3.000	3.500	4.250	5.000	6.000	7.000	8.500	9.500	11.750	13.750
XI min.	Std.	3.125	3.250	3.250	4.125	4.125	4.125	4.625	4.875	4.875	5.625	5.750
	O.S.	3.500	3.625	3.625	4.375	4.375	4.375	4.875	5.125	5.125	5.750	6.000

All dimensions ± .015 unless otherwise noted.

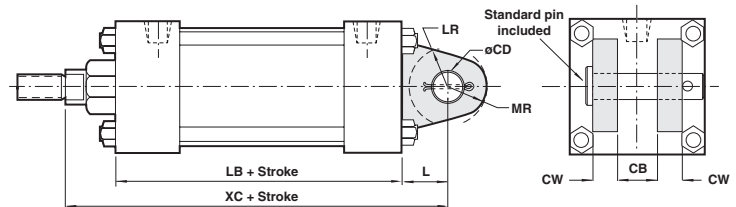
NFPA (MS1) 11 Side End Angle Mount



Bore		1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
AB		.438	.438	.438	.563	.563	.688	.813	.813	.813	1.063	1.063
AH		1.188	1.438	1.625	1.938	2.250	2.750	3.250	3.750	4.250	5.313	6.375
AL		1.000	1.000	1.000	1.250	1.250	1.375	1.375	1.813	1.813	2.125	2.125
AO		.375	.375	.375	.500	.500	.625	.625	.688	.688	.875	.875
AT		.125	.125	.125	.125	.125	.187	.187	.250	.250	.250	.250
LB		3.625	3.625	3.750	4.250	4.250	4.500	5.000	5.125	5.125	6.375	6.875
NF		1.375	1.375	1.375	1.875	1.875	2.000	2.125	1.813	1.813	1.813	1.813
S		1.250	1.750	2.250	2.750	3.500	4.250	5.250	6.125	7.125	8.875	11.000
SA		6.000	6.000	6.125	7.375	7.375	7.875	8.500	8.750	8.750	10.625	11.125
WF	STD.	1.000	1.000	1.000	1.375	1.375	1.375	1.625	1.625	1.625	1.875	2.000
	O.S.	1.375	1.375	1.375	1.625	1.625	1.625	1.875	1.875	1.875	2.000	2.250

All dimensions ± .015 unless otherwise noted.

NFPA (MP1) 12 Cap Fixed Clevis Mount



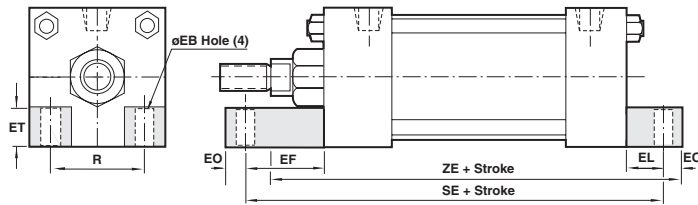
Bore		1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
CB		.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500	2.000	2.500
CD		.500	.500	.500	.750	.750	.750	1.000	1.000	1.000	1.375	1.750
CW		.500	.500	.500	.625	.625	.625	.750	.750	.750	1.000	1.250
L		.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500	2.125	2.250
LB		3.625	3.625	3.750	4.250	4.250	4.500	5.000	5.125	5.125	6.375	6.875
LR		.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500	1.875	2.125
MR		.625	.625	.625	.938	.938	.938	1.188	1.188	1.188	1.625	2.125
XC	Std.	5.375	5.375	5.500	6.875	6.875	7.125	8.125	8.250	8.250	10.375	11.125
	O.S.	5.750	5.750	5.875	7.125	7.125	7.375	8.375	8.500	8.500	10.500	11.375

All dimensions ± .015 unless otherwise noted.

# NFPA Aluminum & Steel Cylinders

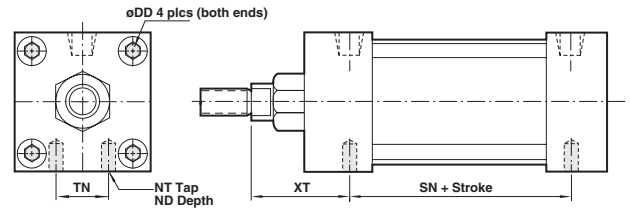
All dimensions ± .015 unless otherwise noted.

### NFPA (MS7) 15 End Lug Mount



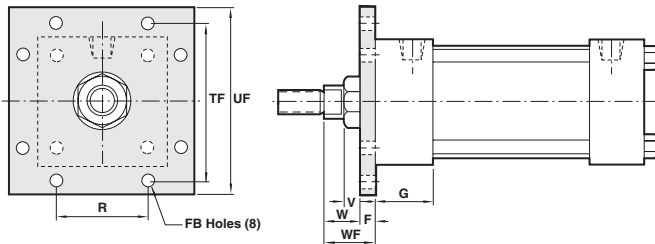
Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"
EB	.313	.375	.375	.438	.438	.563	.563	.688	.688
EF	1.125	1.313	1.438	1.500	1.625	1.688	1.750	1.750	1.750
EL	.750	.938	1.063	.875	1.000	1.063	1.000	1.125	1.125
EO	.250	.313	.313	.375	.375	.500	.500	.625	.625
ET	.500	.750	.750	1.000	1.250	1.500	1.500	1.750	2.063
R	1.428	1.838	2.192	2.758	3.323	4.101	4.879	5.730	6.442
SE	5.500	5.875	6.250	6.625	6.875	7.250	7.750	7.375	7.375
ZE	Std. 5.625	5.875	6.125	6.875	7.000	7.438	8.125	8.500	8.500
O.S.	6.000	6.250	6.500	7.125	7.250	7.688	8.375	8.750	8.750

### 16 Sleeve Nut Construction Side Tapped (Universal Mount)



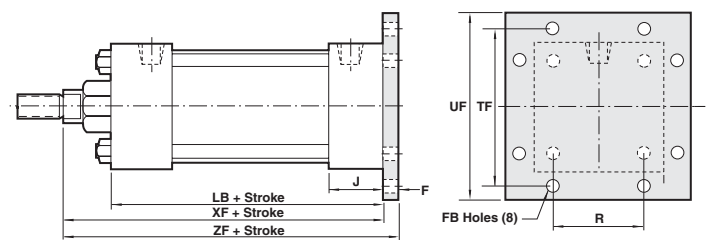
Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"
DD	1/4-28	5/16-24	5/16-24	3/8-24	3/8-24	1/2-20	1/2-20
NT	1/4 - 20	5/16 - 18	3/8 - 16	1/2 - 13	1/2 - 13	5/8 - 11	3/4 - 10
ND	.375	.375	.500	.750	.750	.938	1.125
SN	2.250	2.250	2.375	2.625	2.625	2.875	3.125
TN	.625	.875	1.250	1.500	2.063	2.688	3.250
XT	Std. 1.938	1.938	1.938	2.438	2.438	2.438	2.813
O.S.	2.313	2.313	2.313	2.688	2.688	2.688	3.063

### NFPA (MF5) 20 Head Square Flange Mount



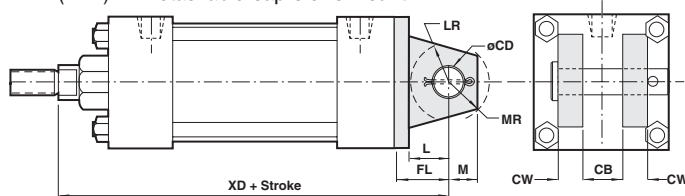
Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"
F	.375	.375	.375	.625	.625	.625	.750
FB	.313	.375	.375	.438	.438	.563	.563
G	1.500	1.500	1.500	1.750	1.750	1.750	2.000
R	1.428	1.838	2.192	2.758	3.323	4.101	4.879
TF	2.750	3.375	3.875	4.688	5.438	6.625	7.625
UF	3.375	4.125	4.625	5.500	6.250	7.625	8.625
V	Std. .250	.250	.250	.250	.250	.250	.250
O.S.	.500	.500	.500	.375	.375	.375	.375
W	Std. .625	.625	.625	.750	.750	.750	.875
O.S.	1.000	1.000	1.000	1.000	1.000	1.000	1.125
WF	Std. 1.000	1.000	1.000	1.375	1.375	1.375	1.625
O.S.	1.375	1.375	1.375	1.625	1.625	1.625	1.875

### NFPA (MF6) 21 Cap Square Flange Mount



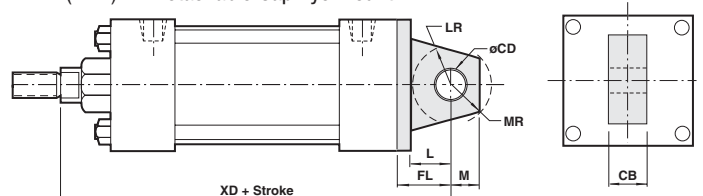
Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"
F	.375	.375	.375	.625	.625	.625	.750
FB	.313	.375	.375	.438	.438	.563	.563
J	1.000	1.000	1.000	1.250	1.250	1.250	1.500
LB	3.625	3.625	3.750	4.250	4.250	4.500	5.000
R	1.428	1.838	2.192	2.758	3.323	4.101	4.879
TF	2.750	3.375	3.875	4.688	5.438	6.625	7.625
UF	3.375	4.125	4.625	5.500	6.250	7.625	8.625
XF	Std. 4.625	4.625	4.750	5.625	5.625	5.875	6.625
O.S.	5.000	5.000	5.125	5.875	5.875	6.125	6.875
ZF	Std. 5.000	5.000	5.125	6.250	6.250	6.500	7.375
O.S.	5.375	5.375	5.500	6.500	6.500	6.750	7.625

### NFPA (MP2) 22 Detachable Cap Clevis Mount



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"
CB	.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500
CD	.500	.500	.500	.750	.750	.750	1.000	1.000	1.000
CW	.500	.500	.500	.625	.625	.625	.750	.750	.750
FL	1.125	1.125	1.125	1.875	1.875	1.875	2.250	2.250	2.250
L	.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500
LR	.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500
M	.500	.500	.500	.750	.750	.750	1.000	1.000	1.000
MR	.625	.625	.625	.938	.938	.938	1.188	1.188	1.188
XD	Std. 5.750	5.750	5.875	7.500	7.500	7.750	8.875	9.000	9.000
O.S.	6.125	6.125	6.250	7.750	7.750	8.000	9.125	9.250	9.250

### NFPA (MP4) 42 Detachable Cap Eye Mount

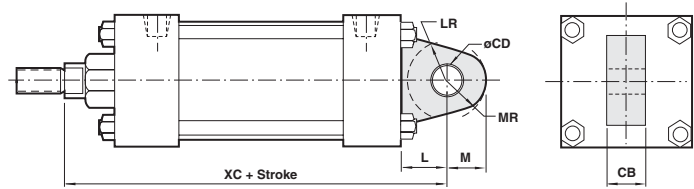


Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"
CB	.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500
CD	.500	.500	.500	.750	.750	.750	1.000	1.000	1.000
FL	1.125	1.125	1.125	1.875	1.875	1.875	2.250	2.250	2.250
L	.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500
LR	.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500
M	.500	.500	.500	.750	.750	.750	1.000	1.000	1.000
MR	.625	.625	.625	.938	.938	.938	1.188	1.188	1.188
XD	Std. 5.750	5.750	5.875	7.500	7.500	7.750	8.875	9.000	9.000
O.S.	6.125	6.125	6.250	7.750	7.750	8.000	9.125	9.250	9.250



# NFPA Aluminum & Steel Cylinders

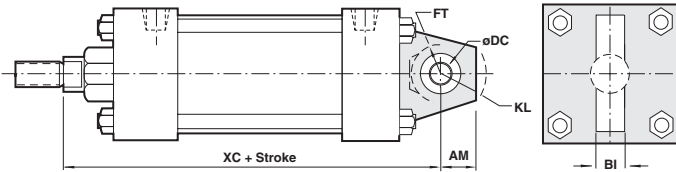
NFPA (MP3) 32 Cap Fixed Eye



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
CB	.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500	2.000	2.500
CD	.500	.500	.500	.750	.750	.750	1.000	1.000	1.000	1.375	1.750
L	.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500	2.125	2.250
LR	.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500	1.875	2.125
M	.500	.500	.500	.750	.750	.750	1.000	1.000	1.000	1.375	1.750
MR	.625	.625	.625	.938	.938	.938	1.188	1.188	1.188	1.625	2.125
XC Std.	5.375	5.375	5.500	6.875	6.875	7.125	8.125	8.250	8.250	10.375	11.125
O.S.	5.750	5.750	5.875	7.125	7.125	7.375	8.375	8.500	8.500	10.500	11.375

All dimensions ± .015 unless otherwise noted.

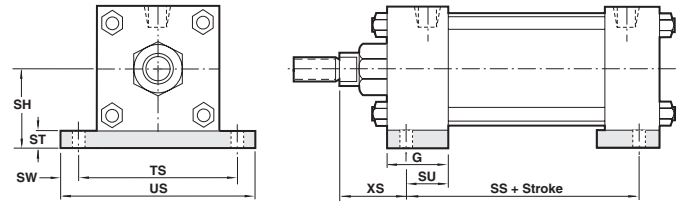
52 (Not NFPA) Spherical Bearing Mount



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"
AM	.750	.750	.750	1.000	1.000	1.000	1.250	1.250	1.250
BI	.438	.438	.438	.656	.656	.656	.875	.875	.875
DC	.500	.500	.500	.750	.750	.750	1.000	1.000	1.000
FT	.625	.625	.625	1.000	1.000	1.000	1.250	1.250	1.250
KL	.969	.969	.969	1.406	1.406	1.406	1.719	1.719	1.719
XC Std.	5.375	5.375	5.500	6.875	6.875	7.125	8.125	8.250	8.250
O.S.	5.750	5.750	5.875	7.125	7.125	7.375	8.375	8.500	8.500

All dimensions ± .015 unless otherwise noted.

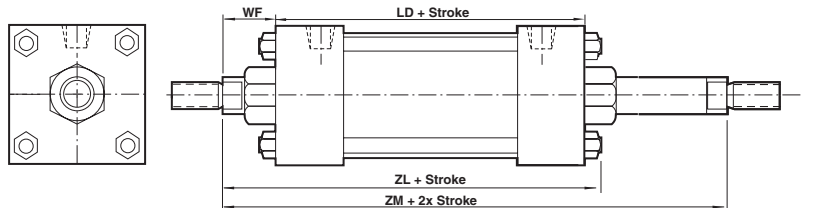
60 Base (Not NFPA) Bar Mount



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"
G	1.500	1.500	1.500	1.750	1.750	1.750	2.000
SH	1.250	1.500	1.875	2.375	2.750	3.500	4.000
SS	2.875	2.875	3.000	3.250	3.250	3.125	3.625
ST	.250	.250	.375	.500	.500	.750	.750
SU	1.125	1.125	1.125	1.250	1.250	1.063	1.313
SW	.375	.375	.375	.500	.500	.688	.688
TS	2.750	3.250	3.750	4.750	5.500	6.875	7.875
US	3.500	4.000	4.500	5.750	6.500	8.250	9.250
XS Std.	1.375	1.375	1.375	1.875	1.875	2.063	2.313
O.S.	1.750	1.750	1.750	2.125	2.125	2.313	2.563

All dimensions ± .015 unless otherwise noted.

NFPA (MX0) 05 Basic with Double Rod End Cylinder



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
LD	4.125	4.125	4.250	4.750	4.750	5.000	5.500	5.625	5.625	6.625	7.125
WF Std.	1.000	1.000	1.000	1.375	1.375	1.375	1.625	1.625	1.625	1.875	2.000
O.S.	1.375	1.375	1.375	1.625	1.625	1.625	1.875	1.875	1.875	2.000	2.250
ZL Std.	5.375	5.438	5.563	6.500	6.500	6.813	7.563	7.813	7.813	10.375	11.125
O.S.	5.750	5.813	5.938	6.750	6.750	7.063	7.813	8.125	8.125	10.625	11.625
ZM Std.	6.125	6.125	6.250	7.500	7.500	7.750	8.750	8.875	8.875	9.250	9.675
O.S.	6.875	6.875	7.000	8.000	8.000	8.200	9.250	9.375	9.375	9.375	10.375

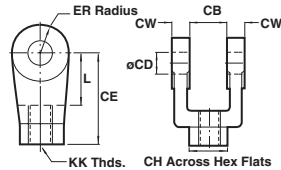
All dimensions ± .015 unless otherwise noted.

# NFPA Aluminum & Steel Cylinders

All dimensions ± .015 unless otherwise noted.

## NFPA Rod Clevis

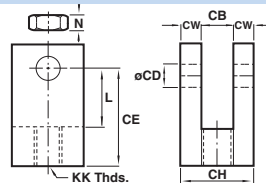
Note: Rod Clevis Assembly 49102A and 49103A are supplied with NFPA Pin. All others are with Standard Pin



Rod Clevis	Rod Clevis Assy.	KK	CB	CD	CE	CH	CW	ER	L
49028	49028A	7/16 - 20	.750	.500	1.500	1.000	.500	.500	.750
49029	49029A	1/2 - 20	.750	.500	1.500	1.000	.500	.500	.750
49097	49097A	5/8 - 18	.750	.500	1.500	1.000	.500	.500	.750
49030	49030A	3/4 - 16	1.250	.750	2.375	1.250	.625	.750	1.250
49098	49098A	7/8 - 14	1.250	.750	2.375	1.250	.625	.750	1.250
49032	49032A	1 - 14	1.500	1.000	3.125	1.500	.750	1.000	1.500
49033	49033A	1-1/4 - 12	2.000	1.375	4.125	2.000	1.000	1.375	2.125
49099	49099A	1-3/8 - 12	2.000	1.375	4.125	2.000	1.000	1.000	2.125
49034	49034A	1-1/2 - 12	2.500	1.750	4.500	2.375	1.250	1.750	2.250
49100	49100A	1-3/4 - 12	2.500	1.750	4.500	2.375	1.250	1.750	2.250
49036	49036A	1-7/8 - 12	2.500	2.000	5.500	2.937	1.250	2.000	2.500
49101	49101A	2 - 12	2.500	2.000	5.500	2.937	1.250	2.000	2.500
49102	49102A	2-1/4 - 12	3.000	2.500	6.500	3.500	1.500	2.750	3.000
49103	49103A	2-1/2 - 12	3.000	3.000	6.750	3.875	1.500	2.750	3.250

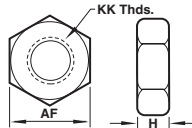
## Small Rod Clevis & Jam Nut

Note: Rod Clevis Assembly is supplied with Jam Nut and Standard Pin.



Rod Clevis	Rod Clevis Assy.	KK	CB	CD	CE	CH	CW	L	N
49218	49218A	1/2 - 20	.500	.500	1.375	1.000	.250	.750	.375
49219	49219A	3/4 - 16	.750	.750	1.750	1.500	.375	1.000	.500

## Rod Jam Nut



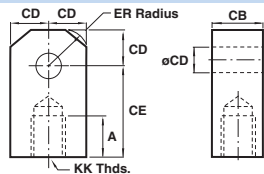
	52025	52026	52027	52010	52029	52030	52085
KK	7/16 - 20	1/2 - 20	5/8 - 18	3/4 - 16	7/8 - 14	1 - 14	1-1/4 - 12
AF	.688	.750	.938	1.125	1.313	1.500	1.875
H	.250	.313	.375	.422	.484	.547	.719

	52092	52068	52082	52070	52093	52083	52075
KK	1-3/8 - 12	1-1/2 - 12	1-3/4 - 12	1-7/8 - 12	2 - 12	2-1/4 - 12	2-1/2 - 12
AF	2.063	2.250	2.625	2.938	3.125	3.500	3.875
H	.781	.844	.969	1.031	1.094	1.203	1.453

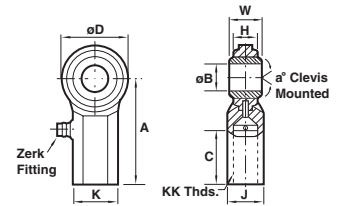
## NFPA Rod Eye

Note: Rod Eye Assembly 49062A and 49096A are supplied with NFPA Pin. All others are supplied with Standard Pin



Rod Eye	Rod Eye Assy.	KK	A	CB	CD	CE	ER
49015	49015A	7/16 - 20	.750	.750	.500	1.500	.563
49014	49014A	1/2 - 20	.750	.750	.500	1.500	.563
49091	49091A	5/8 - 18	.750	1.250	.750	2.063	.500
49013	49013A	3/4 - 16	1.125	1.250	.750	2.063	.938
49092	49092A	7/8 - 14	1.125	1.250	.750	2.063	.750
49011	49011A	1 - 14	1.625	1.500	1.000	2.813	1.125
49010	49010A	1-1/4 - 12	2.000	2.000	1.375	3.438	1.563
49093	49093A	1-3/8 - 12	1.625	2.000	1.375	3.438	1.375
49009	49009A	1-1/2 - 12	2.250	2.500	1.750	4.000	2.500
49094	49094A	1-3/4 - 12	2.250	2.500	1.750	4.000	2.500
49007	49007A	1-7/8 - 12	3.000	2.500	2.000	5.000	2.875
49095	49095A	2 - 12	2.250	2.500	2.000	5.000	2.875
49062	49062A	2-1/4 - 12	3.000	3.000	2.500	5.813	3.250
49096	49096A	2-1/2 - 12	3.000	3.000	3.000	6.125	3.250

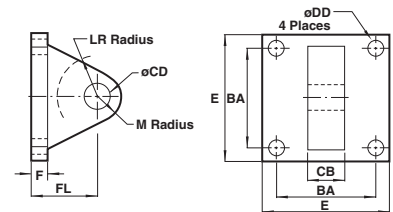
## Spherical Rod Eye



Spherical Rod Eye	49220	49221	49222
Spherical Rod Eye Assy.	49220A	49221A	49222A
Bore	1-1/2, 2 & 2-1/2	3-1/4, 4 & 5	6 & 8
KK	UNF-2B	1/2 - 20	3/4 - 16
a°	Misalignment Angle	12	14
A		± .015	2.125
B		+.0025 / -.0005	.500
C		+.062 / -.031	1.063
D		± .010	1.313
H	Reference	.453	.593
J		± .010	.750
K		± .010	.875
W		+.000 / -.005	.625

## NFPA Eye Bracket

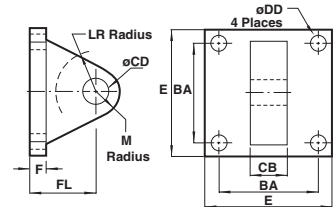
Note: NFPA Eye Bracket Assembly is supplied with Standard Pin.



NFPA Eye Bracket	49021	49020	49019	49016	49017	49018
Eye Bracket Assembly	49021A	49020A	49019A	49016A	49017A	49018A
BA	1.625	2.563	3.250	3.813	4.937	5.750
CB	.750	1.250	1.500	2.000	2.500	2.500
CD	.500	.750	1.000	1.375	1.750	2.000
DD	.406	.531	.656	.656	.906	1.026
E	2.500	3.500	4.500	5.000	6.500	7.500
F	.375	.625	.750	.875	.875	1.000
FL	1.125	1.875	2.250	3.000	3.125	3.500
LR	.750	1.250	1.500	2.125	2.250	2.500
M	.500	.750	1.000	1.375	1.750	2.000

## Norgren Eye Bracket

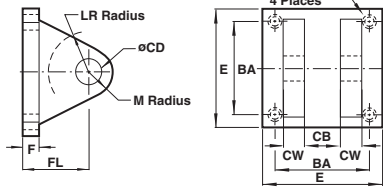
Note: Norgren Eye Bracket Assembly is supplied with Standard Pin.



Norgren Eye Bracket	49240	49241	49242	49243	49244	49019	49016	49017	49018
Eye Bracket Assembly	49240A	49241A	49242A	49243A	49244A	49019A	49016A	49017A	49018A
BA	1.438	1.844	2.188	2.938	3.563	3.250	3.813	4.950	5.730
CB	.750	.750	.750	1.250	1.250	1.500	2.000	2.500	2.500
CD	.500	.500	.500	.750	.750	1.000	1.375	1.750	2.000
DD	.281	.344	.344	.469	.469	.656	.656	.906	1.062
E	2.000	2.500	3.000	3.750	4.500	4.500	5.000	6.500	7.500
F	.375	.375	.375	.500	.500	.750	.875	.875	1.000
FL	1.125	1.125	1.125	1.750	1.750	2.250	3.000	3.125	3.500
LR	.563	.563	.563	1.000	1.000	1.500	2.125	2.250	2.500
M	.625	.625	.625	.875	.875	1.000	1.375	1.750	2.000

# NFPA Aluminum & Steel Cylinders

## NFPA Clevis Bracket

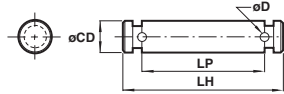


Note: NFPA Clevis Bracket Assembly is supplied with Standard Pin.

NFPA Clevis Bracket Clevis Bracket Assembly	49250 49250A	49251 49251A	49252 49252A
BA	1.625	2.563	3.250
CB	.750	1.250	1.500
CD	.500	.750	1.000
CW	.500	.625	.750
DD	3/8 - 24	1/2 - 20	5/8 - 18
E	2.500	3.500	4.500
F	.375	.625	.750
FL	1.125	1.875	2.250
LR	.750	1.250	1.500
M	.500	.813	1.000

All dimensions ± .015 unless otherwise noted.

## NFPA Pin

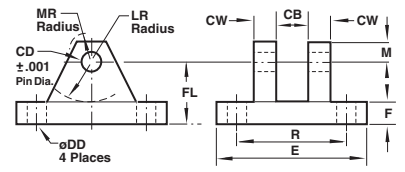


Note: ø.500, .750, 1.000 are Retainer type design ø1.375 and larger are Cotter Pin design.

NFPA Pin	49006-R	49005-R	49004-R	49003	49002	49001	49000	49126	49127
CD	.500	.750	1.000	1.375	1.750	2.000	2.000	2.500	3.000
LH	2.219	3.125	3.750	4.750	5.812	6.312	6.312	6.875	6.875
LP	1.875	2.750	3.250	4.250	5.250	5.281	5.770	6.312	6.344
D	-	-	-	.173	.173	.204	.204	.219	.250

All dimensions ± .015 unless otherwise noted.

## Norgren Clevis Bracket

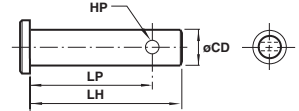


Note: Norgren Clevis Bracket Assembly is supplied with Standard Pin.

Norgren Clevis Bracket Clevis Bracket Assembly	49022 49022A	49023 49023A	49024 49024A	49027 49027A	49025 49025A	49026 49026A
CB	.750	1.250	1.500	2.000	2.500	2.500
CD	.500	.750	1.000	1.375	1.750	2.000
CW	.500	.625	.750	1.000	1.250	1.500
DD	.406	.531	.656	.656	.906	1.026
E	3.500	5.000	6.500	8.000	10.000	12.000
F	.500	.625	.750	.875	.875	1.000
FL	1.500	1.875	2.250	3.000	3.625	4.520
LR	.750	1.188	1.500	2.000	2.750	3.188
M	.500	.750	1.000	1.375	1.750	2.250
MR	.625	.906	1.250	1.656	2.219	2.781
R	2.547	3.828	4.953	5.734	7.500	9.938

All dimensions ± .015 unless otherwise noted.

## Standard Pin

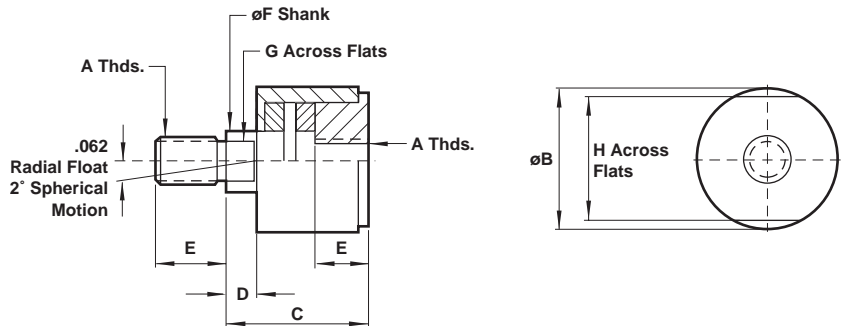


Std. Pin	49207*	49208*	49206	49205	49204	49203	49202	49201
CD	.500	.750	.500	.750	1.000	1.375	1.750	2.000
HP	.156	.156	.156	.156	.203	.250	.250	.250
LH	1.421	2.000	2.250	3.000	3.500	5.000	6.000	6.000
LP	1.266	1.843	2.093	2.843	3.297	4.500	5.500	5.500

All dimensions ± .015 unless otherwise noted.

## Rod Alignment Coupler

The Rod Alignment Coupler allows 1/16" of radial float and 2° of spherical movement. This prevents cylinder binding due to misalignment thus extending bearing and seal life, and permits greater tolerance between the centerline of the cylinder and mating part for simplified installation.



## Rod Alignment Coupler Dimensions

	CC-1-07 7/16 - 20	CC-1-08 1/2 - 20	CC-1-10 5/8 - 18	CC-1-12 3/4 - 16	CC-1-14 7/8 - 14	CC-1-16 1 - 14	CC-1-20 1 1/4 - 12	CC-1-24 1 1/2 - 12	CC-1-28 1 3/4 - 12
A	1.250 (31.75)	1.250 (31.75)	1.250 (31.75)	1.750 (44.45)	1.750 (44.45)	2.500 (63.50)	2.500 (63.50)	3.250 (82.50)	3.250 (82.50)
B	2.000 (50.80)	2.000 (50.80)	2.000 (50.80)	2.312 (58.72)	2.312 (58.72)	2.937 (74.60)	2.937 (74.60)	4.375 (111.13)	4.375 (111.13)
C	.500 (12.70)	.500 (12.70)	.500 (12.70)	.500 (12.70)	.500 (12.70)	.500 (12.70)	.500 (12.70)	.812 (20.62)	.812 (20.62)
D	.750 (19.05)	.750 (19.05)	.750 (19.05)	1.125 (28.58)	1.125 (28.58)	1.625 (41.28)	1.625 (41.28)	2.250 (57.15)	2.250 (57.15)
E	.625 (28.58)	.625 (28.58)	.625 (28.58)	.969 (24.61)	.969 (24.61)	1.375 (34.93)	1.375 (34.93)	1.750 (44.45)	1.750 (44.45)
F	.500 (12.70)	.500 (12.70)	.500 (12.70)	.812 (20.62)	.812 (20.62)	1.156 (29.36)	1.156 (29.36)	1.500 (38.10)	1.500 (38.10)
G	1.125 (28.58)	1.125 (28.58)	1.125 (28.58)	1.500 (38.10)	1.500 (38.10)	2.250 (57.15)	2.250 (57.15)	3.000 (76.20)	3.000 (76.20)
H	10,000	14,000	19,000	34,000	39,000	64,000	78,000	134,000	134,000

## NFPA Aluminum & Steel Cylinders

### Norgren Ecology Cylinders offer these advantages:

#### 1 Norgren Guarantees Non-lubricated Operation for a Full Year!

The piston rod is self-lubricated by the oil-impregnated rod bearing during operation. Lubrication between piston and cylinder barrel is derived from the polishing qualities of the reinforced Teflon® wear ring.

The low friction surfaces extend the life of the seals beyond normal expectations, permitting Norgren to unconditionally guarantee non-lubricated operation for one full year.

Series EJ cylinders are NFPA interchangeable and are available in many different mounting styles.

#### 2 Operates Quietly to Meet OSHA Specifications.

Series EJ cylinders provide substantial reductions in impact noise, which reduces overall machine noise and helps meet government regulations.

The summary of sound decibels chart illustrates the operating sound levels.

The impact dampening qualities of the Piston Seals are guaranteed for ONE FULL YEAR!

#### Summary of Sound Levels in Decibels

PSI Air Sound Pressure Level+		Cylinder Model			
		J133B3 5" x 6"	EJ155B3 5" x 6"	J1133A3 2" x 6"	EJ1155A3 2" x 6"
95 PSI+	End++	108	73	110	74
	Side++	112	84	110	81
50 PSI+	End++	108	73	113	74
	Side++	113	85	110	81

+ Peak sound pressure is given in decibels (dB) re: 2 x 10<sup>5</sup> N/m<sup>2</sup>.

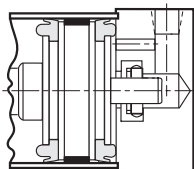
++End position of mike was 3' on centerline from end of cylinder; side position of mike was 3' perpendicular to centerline abeam of end of cylinder.

Note: At 5 feet, cylinder sound levels would be less by 9 dB from side figure and 13 dB from end figure. The total noise emitted will depend on the structure to which the cylinder is attached. If it is mounted on a thin flat plate of considerable area, the noise will be increased by a sounding board effect.

#### 3 Energy Absorption Capacity of the Impact Dampening Seals

The impact-dampening Piston Seals in the Series EJ cylinder allow for guaranteed, repeatable cushioning. The compressive qualities of the piston seals are predictable. The degree of seal compression at various supply pressures is documented. (See Energy Absorption Chart.) This allows you to compute the exact cylinder size required by knowing the weight (pounds) you are stopping at a given speed.

Series EJ cylinders have a impact dampening piston seal that accomplishes 80% of the actual load stopping. The air cushion accounts for only 20%. (A conventional air cushioning cylinder depends 100% on the compressibility of air to do the stopping.) The EJ seal absorbs high impact loads allowing the effect of the air cushion to be reduced by using a larger air cushion bleed orifice. As a result the piston can move at a faster speed for a longer period of time before the EJ seal does the final stopping. Note: 1-1/2", 2", 2-1/2", 3-1/4", 4" and 5" bore cylinders with 1/2" to 2" strokes will be furnished with a short head cushion sleeve and short cap cushion spear. Only available on 5/8" and 1" rods. This specification applies to Series EA cylinders with standard non-adjustable or optional adjustable cushions.



Piston and rod assembly for 1-1/2" thru 5" bore cylinders with 1/2" to 2" stroke

#### Energy Absorption Capacity of the Impact Dampening Seals

\*Usable Pounds Stoppable at the Following Piston Speeds

This chart features the energy absorption capacity of the impact dampening piston seals with a Non-Adjustable cushions. For higher loads and velocities please refer to the Decel- Air Cushion option.

In/Sec	Cylinder Bore										
	1-1/2	2	2-1/2	3-1/4	4	5	6	7	8	10	12
6	155.6	275.5	499.8	969.3	1505.4	2603.2	4159.8	5794.2	8067.6	12,242	20,139
12	38.4	68.1	123.4	239.7	372.6	644.8	1030.2	1435.8	2000.4	3026	4971
18	16.7	29.7	53.7	104.6	162.8	282.1	450.6	628.7	876.8	1319.3	2162.1
24	9.2	16.3	29.4	57.3	89.4	155.2	247.8	346.2	483.6	722	1179
30	5.6	10.0	18.1	35.4	55.4	96.4	153.9	215.4	301.6	445.5	724
36	3.7	6.7	11.9	23.5	37.0	64.5	102.9	144.4	202.7	295.3	476.8
42	2.6	4.6	8.2	16.3	25.8	45.3	72.2	101.6	143.1	204.8	327.7
48	1.8	3.2	5.8	11.7	18.6	32.8	52.2	73.8	104.4	146	231
54	1.3	2.4	4.2	8.5	13.6	24.2	38.5	54.7	77.9	105.7	164.7
60	1.0	1.8	3.0	6.2	10.1	18.1	28.7	41.1	58.9	76.9	117.2

\*The weight of the cylinder piston has been deducted from the figures shown above.

Note: The use of Viton® Seals limits the absorption of the impact dampening seals by 50%.

#### Energy absorption capacity of the impact dampening piston seals with an adjustable cushion.

In/Sec	Cylinder Bore										
	1-1/2	2	2-1/2	3-1/4	4	5	6	7	8	10	12
6	279	495	899	1,744	2,709	4,685	7,486	10,429	4,520	22,035	36,250
12	68	122	221	430	699	1,159	1,854	2,583	3,800	5,446	8,947
18	30	53	95	187	291	507	810	1,130	1,576	2,374	3,891
24	16	29	52	102	160	279	444	622	869	1,299	1,414
30	10	18	32	63	99	172	275	387	541	801	1,303
36	6.7	12	21.6	42	66	116	183	259	363	531	856
42	4.7	8.3	14.7	29	46	81	129	181	257	367	588
48	3.4	5.7	10.4	21	33	59	93	131	187	262	415
54	2.3	4.3	7.6	15.3	24	43	68	97	138	189	295
60	1.8	3.2	5.4	11	18	33	52	74	106	138	211

#### Effect of Impact Dampening Seals on Total Stroke of Cylinders

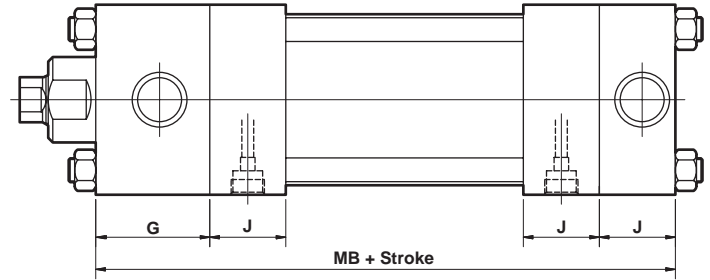
PSI	Cylinder Bore										
	1-1/2	2	2-1/2	3-1/4	4	5	6	7	8	10	12
0	.14	.15	.17	.19	.22	.25	.28	.32	.32	.36	.40
20	.10	.10	.12	.14	.16	.18	.20	.22	.22	.24	.26
40	.07	.07	.08	.09	.10	.12	.13	.14	.14	.15	.16
60	.04	.04	.05	.05	.06	.07	.07	.08	.08	.09	.10
80	.02	.02	.02	.02	.03	.03	.03	.04	.04	.04	.04
100	0	0	0	0	0	0	0	0	0	0	0

Note: Figures are for new cylinders. Impact dampening seals will take some compression set during operation and the stroke loss will decrease. Also, the pressure at zero stroke loss will decrease to about 80 psi. At pressures above those of zero stroke loss, a slight clicking sound may be produced during impact. To determine the stroke loss for either the head or cap end, divide the value shown by 2.

# NFPA Aluminum & Steel Cylinders

## Decel-Air™ Cushion

**Explanation of Decel-Air Cushion:**  
 Norgren's Decel Cushioned cylinder was designed for applications where high velocity, low mass, material transfer or machine function is required, and where the kinetic energy to be absorbed during cushioning exceeds the parameters of our standard Series EA or EJ air cylinders equipped with non-adjustable or adjustable cushions. Decel cushions employ longer-than-standard air cushions to assist our Impact Dampening Piston Seal.



**Decel Cushioned Cylinder**  
 Fully Cushioned Load Stopping Capacity in Pounds\*

In/ Sec	Cylinder Bore										
	1-1/2	2	2-1/2	3-1/4	4	5	6	7	8	10	12
6	558	990	1.798	3.488	5.418	9.370	14.972	20.040	20.858	44.070	72.500
12	136	244	442	860	1.338	2.318	3.708	5.166	7.600	10.892	17.894
18	60	106	190	374	582	1.014	1.620	2.260	3.152	4.748	7.782
24	32	58	104	204	320	558	888	1.244	1.738	2.598	2.828
30	20	36	64	126	198	344	550	774	1.082	1.602	2.606
36	13.4	24	43	84	132	232	366	518	726	1.062	1.712
42	9.4	16.6	29	58	92	162	258	362	514	734	1.176
48	6.8	11.4	20.8	42	66	118	186	262	374	524	830
54	4.6	8.6	10.8	30	48	86	136	194	276	378	590

\*Include piston rod weight in total load to be stopped.

**Basic Envelope Dimensions and weights**

Cyl. Bore	G	J	+ Stroke MB	Piston Rod Dia. Weights*
1-1/2	1-1/2	1	5-5/8	5/8" .30 lb. + 0.09 lb./in. stroke
2	1-1/2	1	5-5/8	1" .90 lb. + 0.22 lb./in. stroke
2-1/2	1-1/2	1	5-3/4	1-3/8" 2.2 lb. + 0.42 lb./in. stroke
3-1/4	1-3/4	1-1/4	6-3/4	1-3/4" 4.0 lb. + 0.68 lb./in. stroke
4	1-3/4	1-1/4	6-3/4	2" 5.5 lb. + 0.90 lb./in. stroke
5	1-3/4	1-1/4	7	2-1/2" 10.1 lb. + 1.40 lb./in. stroke
6	2	1-1/2	8	
7	2	1-1/2	8-1/8	
8	2	1-1/2	8-1/8	

\*Double Weight for double rod end cylinders

### Air-Oil Tank

Available in 5 practical bore sizes: 1-1/8", 2", 3-1/4", 5", and 8", the Air-Oil Tank includes a translucent fiberglass tube which permits viewing of the tank oil level from any position, internal baffles that reduce foaming and aeration of the system oil resulting in maximum cylinder control, and standard angle mounting brackets (except 1-1/8" bore) easily removed for convenient fluid port positioning.

### How to Figure Length of Volume

Use these equations to select the right air/oil tank volume for your particular application.

#### Volume of Cylinder:

- Cap End Cylinder Bore Area x Stroke = Volume
- Head End Cylinder Bore Area - (Piston Rod Area) x Stroke = Volume

$$\text{Length of Tank} = \frac{\text{Volume of Cylinder} \times 1.3^*}{\text{Tank Bore Area}}$$

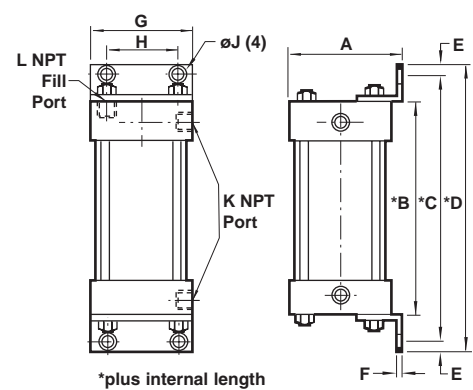
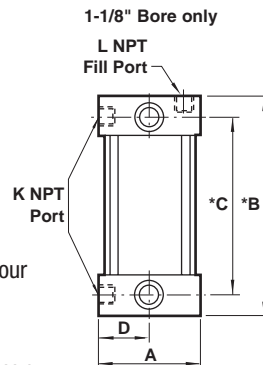
(See chart below.) \*30% minimum recommended reserve working volume.

**Final Length of Volume of Tank** = Working length of tank + 2" minimum safety factor to prevent aeration of oil. Note: Length must be at least 3".

### Air-Oil Tank Dimensions

Bore	Air-Oil Tank Dimensions				
	1-1/8" AOT-225	2" AOT-04	3-1/4" AOT-065	5" AOT-10	8" AOT-16
A	1.500 (38.10)	2.687 (68.25)	4.000 (101.60)	5.625 (142.88)	8.625 (219.08)
B	1.250 (31.75)	2.000 (50.80)	2.500 (63.50)	2.500 (63.50)	3.000 (76.20)
C	.750 (19.05)	4.000 (101.60)	5.000 (127.00)	5.250 (127.00)	6.625 (168.28)
D	.750 (19.05)	4.750 (120.65)	6.000 (152.40)	6.500 (152.40)	8.000 (203.20)
E	.375 (9.53)	.500 (12.70)	.500 (12.70)	.500 (12.70)	.687 (17.45)
F	.125 (3.18)	.187 (4.75)	.187 (4.75)	.250 (6.35)	
G	2.500 (63.50)	3.750 (95.25)	5.500 (139.70)	8.500 (215.90)	
H	1.750 (44.45)	2.750 (69.85)	.690 (107.95)	7.125 (180.98)	
øJ	.437 (11.10)	.562 (14.27)	.562 (14.27)	.812 (20.62)	
K	.125 (3.18)	.375 (9.53)	.500 (12.70)	.500 (12.70)	.750 (19.05)
L	.125 (3.18)	.250 (6.35)	.375 (9.53)	.375 (9.53)	.500 (12.70)

Note: Maximum operating pressure 250 PSI.



### Air-Oil Tank Volumes (cubic inches)

Internal Length of Tank	Air-Oil Tank Volumes (cubic inches)				
	Bore Area .995 sq. in.	2" 3.14 sq. in.	3-1/4" 8.30 sq. in.	5" 19.64 sq. in.	8" 50.26 sq. in.
6"	5.9	18.6	49.8	117.8	301.5
8"	7.9	25.1	66.4	157.1	402.0
10"	9.9	31.4	83.0	196.4	502.6
12"	11.9	37.6	99.6	235.6	603.1
14"	13.9	43.9	116.2	274.9	703.6
16"	15.9	50.2	132.8	314.2	804.1
18"	17.9	56.5	149.4	353.5	904.5
20"	19.9	62.8	166.0	392.8	1005.2

How to Order: Specify air-oil tank part number and internal length.  
 Example: 2" bore with 6" internal length = AOT-04 x 6

# NFPA Aluminum & Steel Cylinders

## Piston Rod Diameter Selection

Applications requiring long extend (push) strokes may require oversize piston rod diameters to prevent buckling.

To determine the correct rod diameter for your application follow these simple steps:

1. Select the force from the Cylinder Force and Volume Chart that is required for your application. For pressures not shown use:  
**Force = Piston Surface Area x Operating Pressure**

2. From the Cylinder Mounting Diagram Chart (next page) select the mounting style being used.
3. To obtain effective length "L", multiply cylinder stroke by appropriate stroke factor located in Cylinder Mounting Diagram Chart. If cylinder has extra rod extension add this to the stroke length before obtaining effective length. **Effective Length = Actual Stroke x Stroke Factor**
4. To determine adequate rod diameter locate calculated effective length "L" on Rod Selection chart (below).

## Cylinder Force and Volume Charts Extend Forces in pounds (newtons)

All Dimensions in Inches (mm)  
All Forces in Pounds (Newtons)

Bore	Piston Area	PSI (bar)												Volume Cu Ft (cm3) Displacement Per Inch
		40 (3)	60 (4)	80 (6)	100 (7)	150 (10)	200 (14)							
1-1/2"	1.77 (11.40)	71 (315)	106 (472)	142 (629)	177 (786)	266 (1179)	353 (1570)	.00102 (29)						
2"	3.14 (20.27)	126 (559)	189 (839)	251 (1119)	314 (1398)	471 (2097)	628 (2793)	.00182 (52)						
2-1/2"	4.91 (31.67)	196 (874)	295 (1311)	393 (1748)	491 (2185)	737 (3277)	982 (4368)	.00284 (80)						
3-1/4"	8.30 (53.32)	332 (1477)	498 (2215)	664 (2953)	830 (3692)	1245 (5538)	1659 (7379)	.00480 (136)						
4"	12.57 (81.07)	503 (2237)	754 (3355)	1005 (4473)	1257 (5592)	1886 (8388)	2513 (11178)	.00727 (206)						
5"	19.64 (126.71)	785 (3491)	1178 (5240)	1571 (6988)	1964 (8736)	2946 (13104)	3928 (17472)	.01137 (322)						
6"	28.27 (182.39)	1130 (5026)	1696 (7544)	2262 (10061)	2827 (12574)	4240 (18860)	5654 (25149)	.01636 (463)						
7"	38.49 (247.91)	1540 (6831)	2309 (10242)	3079 (13658)	3849 (17074)	5774 (25613)	7698 (34148)	.02227 (631)						
8"	50.26 (324.26)	2010 (8940)	3015 (13411)	4020 (17881)	5026 (22356)	7539 (33533)	10052 (44711)	.02909 (829)						
10"	78.54 (506.74)	3141 (13974)	4712 (20961)	6283 (27948)	7854 (34935)	11781 (52402)	15700 (69834)	.04545 (1282)						
12"	113.10 (729.72)	4524 (20123)	6786 (30184)	9048 (40246)	11310 (50307)	16965 (75460)	22620 (100614)	.06545 (1852)						

## Deduct these Forces for Retract Strokes

Rod	Rod Area	PSI (bar)												Volume Cu Ft (cm3) Displacement Per Inch
		40 (3)	60 (4)	80 (6)	100 (7)	150 (10)	200 (14)							
5/8"	.307 (1.98)	12 (53)	18 (80)	25 (111)	31 (138)	46 (205)	61 (271)	.00018 (5)						
1"	.785 (5.06)	31 (138)	47 (209)	63 (280)	78 (351)	118 (525)	157 (698)	.00045 (13)						
1-3/8"	1.485 (9.58)	59 (262)	89 (396)	119 (529)	149 (663)	222 (997)	297 (1321)	.00086 (24)						
1-3/4"	2.404 (15.51)	96 (423)	144 (641)	192 (854)	240 (1068)	360 (1601)	480 (2135)	.00139 (39)						
2"	3.142 (20.16)	126 (559)	189 (839)	251 (1118)	314 (1398)	471 (2096)	628 (2795)	.00182 (52)						
2-1/2"	4.909 (31.67)	196 (873)	295 (1310)	393 (1747)	491 (2184)	736 (3275)	981 (4367)	.00284 (80)						

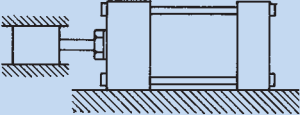
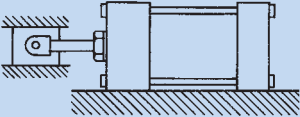
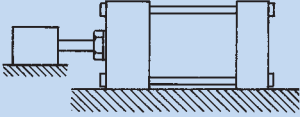
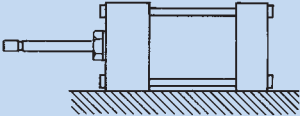
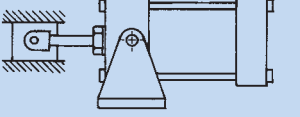
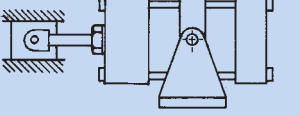
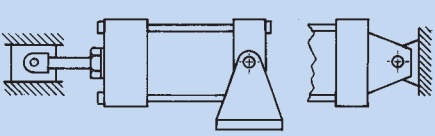
## Rod Selection Chart

Extended Force (lbs)	Maximum effective length "L" recommended for rod diameters					
	5/8"	1"	1-3/8"	1-3/4"	2"	2-1/2"
50	95	-	-	-	-	-
100	65	170	-	-	-	-
150	50	135	260	-	-	-
200	43	115	220	-	-	-
300	34	93	180	300	-	-
500	25	70	135	250	-	-
750	20	56	110	185	250	-
1000	17	48	94	160	220	-
1500	13	38	80	130	170	260
2000	11	33	64	110	140	225
3000	9	26	51	90	115	180
4000	7	22	44	75	100	155
5000	-	20	39	66	88	140
6000	-	18	35	60	79	125
8000	-	15	30	52	68	110
10000	-	12	26	46	60	95
12500	-	10	22	41	52	86
15000	-	-	19	37	48	79
20000	-	-	14	29	41	68

Note: In some cases it may be necessary to use a larger bore cylinder than is required for force in order to obtain an adequate rod diameter.

# NFPA Aluminum & Steel Cylinders

## Cylinder Mounting Diagram Chart

Cylinder Mounting	Rod End Connection	Mounting Style	Stroke Factor
Side Tapped, Head or Cap Flange, Tie Rod, Center or Side Lug	Fixed and Rigidly Guided		.50
Side Tapped, Head or Cap Flange, Tie Rod, Center or Side Lug	Pivoted and Rigidly Guided		.70
Side Tapped, Head or Cap Flange, Tie Rod, Center or Side Lug	Supported but not Rigidly Guided		2.00
Side Tapped, Head or Cap Flange, Tie Rod, Center or Side Lug	None		5.00
Head Trunnion	Pivoted and Rigidly Guided		1.00
Center Trunnion	Pivoted and Rigidly Guided		1.50
Cap Trunnion or Clevis	Pivoted and Rigidly Guided		2.00

### Tie Rod Supports:

For long strokes, tie rod supports are provided. These supports are of the same envelope dimensions as the cylinder end caps.  
NOTE: See chart for number of tie rod supports required.

### Number of Tie Rod Supports Required

Cylinder Bore	Cylinder Stroke (in)				
	60	75	95	115	135
1-1/2"	1	1	2	2	3
2"	-	1	1	2	2
2-1/2"	-	-	1	1	1
3-1/4"	-	-	-	1	1
4"	-	-	-	-	1
5" and over	-	-	-	-	-

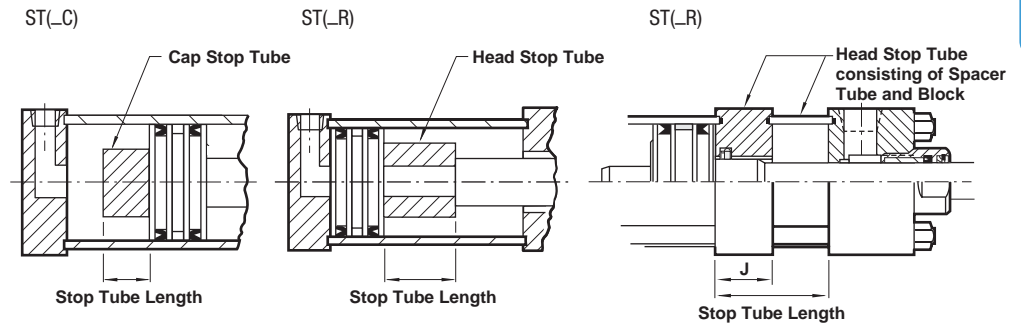
# NFPA Aluminum & Steel Cylinders

1. **Selecting Stop Tubes:** Stop tubes enhance the transverse load carrying capability of a long stroke cylinder by increasing the distance between the piston and rod bearing at full extension. When the calculated "L" value (effective length = actual stroke x stroke factor) is less than 40" a stop tube is **not** required. However, if "L" is 40" or more, 1" of stop tube is recommended for every 10" (or fraction thereof) over 40".
2. **Recommended Mounting Styles for Maximum Stroke and Thrust Load:** Multiply cylinder stroke by appropriate stroke factor to obtain effective length "L".

## Stop Tube

Enhances the transverse load carrying capability of a long stroke cylinder by increasing the distance between the piston and rod bearing at full extension when placed on head end. Ideal for those applications requiring longer strokes or where additional rod stability is desired. TO ORDER: Enter option code ST(-C) Cap End or ST(-R) Rod End. Specify stop tube length.

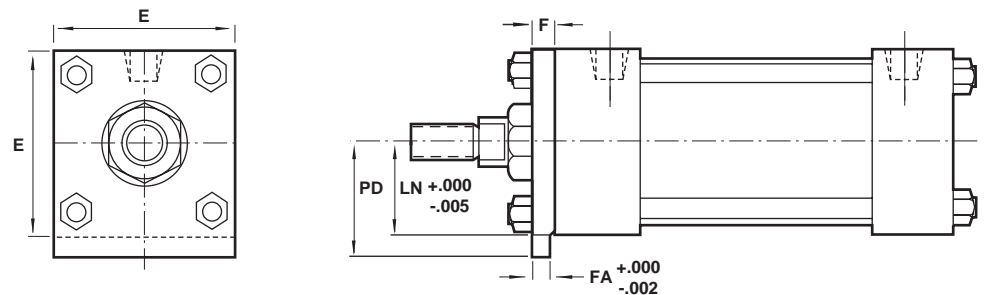
NOTE: ST(-R) Alternate design: the stop tube rod end design changes when the stop tube exceeds J lengths in the chart.



Bore	1-1/2" (38.10)	2" (50.80)	2-1/2" (63.50)	3-1/4" (82.55)	4" (101.60)	5" (127.00)	6" (152.40)	7" (177.80)	8" (203.20)
J	1 (25.40)	1 (25.40)	1 (25.40)	1.250 (31.75)	1.250 (31.75)	1.250 (31.75)	1.500 (38.10)	1.500 (38.10)	1.500 (38.10)

## Norgren's Standard Thrust Key Plate

Thrust key plates eliminate the use of fitted bolts or dowel pins on side mountings. They prevent movement of the cylinder under shock loading, which might otherwise occur due to normal clearance between mounting holes and bolt diameters. Option code TK available on 01(MS4), 09(MS2) and 15(MS7) mounts. NOTE: Other manufacturers' thrust key plates can vary. Consult factory for information.



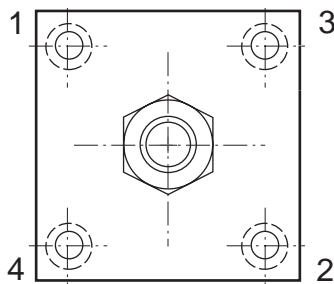
Bore	1-1/2" (38.10)	2" (50.80)	2-1/2" (63.50)	3-1/4" (82.55)	4" (101.60)	5" (127.00)	6" (152.40)
E	2.0 (50.80)	2.5 (63.50)	3 (76.20)	3.75 (95.25)	4.5 (114.30)	5.5 (139.70)	6.5 (165.10)
F	0.375 (9.53)	0.375 (9.53)	0.375 (9.53)	0.625 (15.88)	0.625 (15.88)	0.625 (15.88)	0.75 (19.05)
FA	0.313 (7.94)	0.313 (7.94)	0.313 (7.94)	0.563 (14.29)	0.563 (14.29)	0.563 (14.29)	0.688 (17.46)
LN	1.0 (25.40)	1.25 (31.75)	1.5 (38.10)	1.875 (47.63)	2.25 (57.15)	2.75 (69.85)	3.25 (82.55)
PD	1.188 (30.18)	1.438 (36.53)	1.688 (42.88)	2.188 (55.78)	2.563 (65.10)	3.063 (77.80)	3.625 (92.08)

NOTE: Care should be taken in machining the keyway slot for a tight fit. Only one keyway should be used per cylinder.

## Tie Rod Tightening:

In order to reduce the possibility of cylinder binding or damage, tighten to quarter unit increments of the final torque value in the following order: #1, #2, #3, #4.

Then torque fully to the recommended foot pounds in the same order.



## Recommended Torques for Tightening Tie Rods

Cylinder Bore	Standard Steel Tie Rods	Stainless Steel Tie Rods
1-1/2"	6.6 ft. lbs.	3.75 ft. lbs.
2"	11 ft. lbs.	7.5 ft. lbs.
2-1/2"	13 ft. lbs.	7.5 ft. lbs.
3-1/4"	20 ft. lbs.	13-14 ft. lbs.
4"	24 ft. lbs.	13-14 ft. lbs.
5"	40 ft. lbs.	33 ft. lbs.
6"	48 ft. lbs.	33 ft. lbs.
7" & 8"	100 ft. lbs.	65 ft. lbs.
10"	150 ft. lbs.	75 ft. lbs.
12"	175 ft. lbs.	87.5 ft. lbs.



# NFPA Aluminum & Steel Cylinders

## Series A & EA Cylinder Weights lbs (kg)

Bore Inch (mm)	Rod Inch (mm)	Mounting Code										Add Per Inch of Stroke
		01, 05, 16	03	04	06	7R, 8R, 09, 60	11	12	15	20, 21, 22, 32	10, 42, 52	
1-1/2" (38.10)	5/8" (15.88)	1.9 (.86)	2.6 (1.18)	2.7 (.23)	2.1 (.95)	2.5 (1.13)	2.3 (1.04)	2.8 (1.27)	2.5 (1.13)	3.0 (1.36)	2.8 (1.27)	0.18 (.08)
	5/8" (15.88)	2.8 (1.27)	3.9 (.77)	4.0 (1.81)	3.1 (1.41)	3.5 (1.59)	3.3 (1.50)	4.0 (1.81)	3.8 (1.72)	4.2 (1.91)	3.9 (1.77)	0.21 (.10)
2" (50.80)	1" (25.40)	3.4 (1.54)	4.4 (2.00)	4.6 (2.09)	3.7 (1.68)	4.1 (1.86)	3.9 (1.77)	4.6 (2.09)	4.4 (2.00)	4.8 (2.18)	4.5 (2.04)	0.35 (.16)
	5/8" (15.88)	3.9 (1.77)	5.3 (2.40)	5.5 (2.49)	4.1 (1.86)	4.6 (2.09)	4.4 (2.00)	5.3 (2.40)	5.3 (2.40)	5.5 (2.49)	5.3 (2.40)	0.23 (.10)
2-1/2" (63.50)	1" (25.40)	4.5 (2.04)	5.9 (2.68)	6.1 (2.77)	4.7 (2.13)	5.2 (2.36)	5.1 (2.31)	5.9 (2.68)	6.0 (2.72)	6.1 (2.77)	5.9 (2.68)	0.38 (.17)
	5/8" (15.88)	3.9 (1.77)	5.3 (2.40)	5.5 (2.49)	4.1 (1.86)	4.6 (2.09)	4.4 (2.00)	5.3 (2.40)	5.3 (2.40)	5.5 (2.49)	5.3 (2.40)	0.23 (.10)
3-1/4" (82.55)	1" (25.40)	7.3 (3.31)	10.8 (4.90)	11.1 (5.03)	7.7 (3.49)	8.9 (4.04)	8.2 (3.72)	11.1 (5.03)	9.7 (4.40)	11.8 (5.35)	11.4 (5.17)	0.42 (.19)
	1-3/8" (34.93)	8.2 (3.72)	11.5 (5.22)	12.1 (5.49)	8.7 (3.95)	9.9 (4.50)	9.2 (4.17)	12.1 (5.49)	10.7 (4.85)	12.8 (5.80)	12.4 (5.62)	0.63 (.29)
4" (101.60)	1" (25.40)	9.8 (4.45)	14.8 (6.71)	15.1 (6.85)	10.2 (4.63)	11.5 (5.22)	10.9 (4.94)	14.8 (6.71)	13.3 (6.03)	15.5 (7.03)	15.2 (6.89)	0.45 (.20)
	1-3/8" (34.93)	10.8 (4.90)	15.5 (7.03)	16.1 (7.30)	11.2 (5.08)	12.5 (5.67)	11.9 (5.40)	15.8 (7.17)	14.3 (6.49)	16.5 (7.48)	16.2 (7.35)	0.66 (.30)
5" (127.00)	1" (25.40)	15.1 (6.85)	22.7 (10.30)	23.1 (10.48)	16.1 (7.30)	18.7 (8.48)	17.6 (7.98)	22.2 (10.07)	20.8 (9.43)	22.8 (10.34)	22.5 (10.21)	0.51 (.23)
	1-3/8" (34.93)	16.2 (7.35)	23.5 (10.66)	24.1 (10.93)	17.2 (7.80)	19.7 (8.94)	18.6 (8.44)	23.2 (10.52)	21.9 (9.93)	23.9 (10.84)	23.5 (10.70)	0.73 (.33)
6" (152.40)	1-3/8" (34.93)	23.5 (16.19)	35.6 (16.15)	36.3 (16.47)	24.5 (11.11)	27.3 (12.38)	26.6 (12.07)	35.7 (10.66)	32.1 (14.56)	37.0 (16.78)	36.3 (16.47)	0.77 (.35)
	1-3/4" (44.45)	24.8 (11.27)	36.9 (16.77)	37.6 (17.09)	25.8 (11.73)	28.3 (12.86)	27.9 (12.68)	37.0 (16.82)	33.4 (15.18)	38.3 (17.41)	37.6 (17.09)	1.03 (.47)
7" (177.80)	1-3/8" (34.93)	32.1 (14.56)	32.1 (14.56)	32.1 (14.56)	33.4 (15.15)	33.5 (15.20)	36.8 (16.69)	35.2 (15.97)	32.1 (14.56)	48.9 (22.18)	48.2 (21.86)	1.00 (.45)
	1-3/4" (44.45)	33.4 (15.18)	33.4 (15.18)	33.4 (15.18)	34.7 (15.77)	34.8 (15.82)	38.1 (17.32)	36.5 (16.59)	33.4 (15.18)	50.2 (22.82)	49.5 (22.50)	1.26 (.57)
8" (203.20)	1-3/8" (34.93)	40.0 (18.14)	40.0 (18.14)	40.0 (18.14)	41.3 (18.73)	41.4 (18.78)	45.7 (20.73)	43.0 (19.50)	40.0 (18.14)	60.5 (27.44)	59.7 (27.08)	1.06 (.48)
	1-3/4" (44.45)	47.3 (21.50)	41.3 (18.77)	41.3 (18.77)	42.6 (19.36)	42.7 (19.41)	47.0 (21.36)	44.3 (20.14)	41.3 (18.77)	61.8 (28.09)	61.0 (27.73)	1.32 (.60)

## Series J & EJ Cylinder Weights lbs (kg)

Bore Inch (mm)	Rod Inch (mm)	Mounting Code										Add Per Inch of Stroke
		01, 05, 16	03	04	06	07, 08, 09	11	12	15	20, 21, 22, 32	10, 42, 52	
1-1/2" (38.10)	5/8" (15.88)	3.1 (1.42)	3.7 (1.67)	3.7 (1.67)	3.2 (1.48)	3.8 (1.73)	4.9 (2.24)	3.9 (1.76)	3.1 (1.42)	4.1 (1.87)	4.9 (2.24)	.18 (.08)
	5/8" (15.88)	5.0 (2.27)	5.9 (2.67)	5.9 (2.67)	5.2 (2.35)	5.7 (2.58)	7.6 (3.46)	5.8 (2.61)	5.0 (2.27)	6.2 (2.82)	7.6 (3.46)	.28 (.13)
2" (50.80)	1" (25.40)	5.1 (2.33)	6.0 (2.73)	6.0 (2.73)	5.3 (2.42)	5.8 (2.64)	7.8 (3.52)	5.9 (2.67)	5.1 (2.33)	6.4 (2.89)	7.8 (3.52)	.42 (.19)
	5/8" (15.88)	7.2 (3.26)	8.1 (3.68)	8.1 (3.68)	7.4 (3.35)	7.9 (3.57)	10.3 (4.68)	7.9 (3.60)	7.2 (3.26)	9.3 (4.20)	10.3 (4.68)	.40 (.18)
2-1/2" (63.50)	1" (25.40)	7.3 (3.32)	8.3 (3.75)	8.3 (3.75)	7.5 (3.41)	8.0 (3.64)	10.5 (4.74)	8.1 (3.66)	7.3 (3.32)	9.4 (4.26)	10.5 (4.74)	.54 (.25)
	5/8" (15.88)	7.2 (3.26)	8.1 (3.68)	8.1 (3.68)	7.4 (3.35)	7.9 (3.57)	10.3 (4.68)	7.9 (3.60)	7.2 (3.26)	9.3 (4.20)	10.3 (4.68)	.40 (.18)
3-1/4" (82.55)	1" (25.40)	11.1 (5.02)	14.3 (6.50)	14.3 (6.50)	11.4 (5.16)	11.7 (5.30)	16.8 (7.63)	12.6 (5.70)	11.1 (5.02)	16.0 (7.26)	16.8 (7.63)	.72 (.33)
	1-3/8" (34.93)	11.3 (5.11)	14.5 (6.59)	14.5 (6.59)	11.6 (5.25)	11.9 (5.39)	17.0 (7.72)	12.8 (5.79)	11.3 (5.11)	16.2 (7.35)	17.0 (7.72)	.92 (.42)
4" (101.60)	1" (25.40)	20.3 (9.22)	24.9 (11.29)	24.9 (11.29)	20.6 (9.36)	20.8 (9.45)	27.4 (12.43)	21.8 (9.90)	20.3 (9.22)	26.9 (12.20)	27.4 (12.43)	.81 (.37)
	1-3/8" (34.93)	20.5 (9.31)	25.1 (11.38)	25.1 (11.38)	20.8 (9.45)	21.0 (9.54)	27.6 (12.52)	22.0 (9.99)	20.5 (9.31)	27.1 (12.29)	27.6 (12.52)	1.1 (.50)
5" (127.00)	1" (25.40)	34.6 (15.72)	40.4 (18.33)	40.4 (18.33)	35.2 (15.97)	38.0 (17.25)	43.2 (19.60)	36.3 (16.49)	34.6 (15.72)	43.2 (19.60)	43.2 (19.60)	.98 (.45)
	1-3/8" (34.93)	34.8 (15.81)	40.6 (18.42)	40.5 (18.42)	35.4 (16.06)	38.2 (17.34)	43.4 (19.69)	36.5 (16.58)	34.8 (15.81)	43.4 (19.69)	43.4 (19.69)	1.18 (.54)
6" (152.40)	1-3/8" (34.93)	53.1 (24.09)	63.9 (29.02)	63.9 (29.02)	54.3 (24.66)	56.4 (25.59)	65.3 (29.65)	57.1 (25.93)	53.1 (24.09)	68.1 (30.93)	65.3 (29.65)	1.68 (.76)
	1-3/4" (44.45)	53.3 (24.21)	64.2 (31.41)	64.2 (31.41)	54.6 (24.78)	56.7 (25.72)	65.6 (29.77)	57.4 (26.05)	53.3 (24.21)	68.1 (30.93)	65.6 (29.77)	1.94 (.88)
7" (177.80)	1-3/8" (34.93)	73.0 (33.14)	73.0 (33.14)	73.0 (33.14)	74.0 (33.60)	76.5 (34.73)	96.0 (43.58)	85.0 (38.59)	73.0 (33.14)	—	96.0 (43.58)	1.75 (.80)
	1-3/4" (44.45)	73.3 (33.26)	73.3 (33.26)	73.3 (33.26)	74.3 (33.71)	76.8 (34.85)	96.3 (43.70)	85.3 (38.71)	73.3 (33.26)	—	96.3 (43.70)	2.01 (.91)
8" (203.20)	1-3/8" (34.93)	92.3 (41.88)	92.3 (41.88)	92.3 (41.88)	93.6 (42.50)	95.8 (43.47)	120.0 (54.48)	97.8 (44.41)	92.3 (41.88)	—	120.0 (54.48)	2.18 (.99)
	1-3/4" (44.45)	92.5 (42.00)	92.5 (42.00)	92.5 (42.00)	93.9 (42.62)	96.0 (43.59)	120.3 (54.60)	98.1 (44.52)	92.5 (42.00)	—	120.3 (54.60)	2.44 (1.11)
10" (254.00)	1-3/4" (44.45)	179.9 (81.66)	179.9 (81.66)	179.9 (81.66)	181.6 (82.46)	184.3 (83.65)	228.0 (103.51)	186.1 (84.50)	179.9 (81.66)	—	228.0 (103.51)	3.43 (1.56)
	2" (50.80)	180.0 (81.72)	180.1 (81.76)	180.1 (81.76)	181.8 (82.55)	184.5 (83.74)	228.2 (103.61)	186.3 (84.59)	180.1 (81.76)	—	228.2 (103.61)	3.64 (1.65)
12" (304.80)	2" (50.80)	288.0 (130.75)	288.0 (130.75)	288.0 (130.75)	289.0 (131.21)	293.0 (133.02)	380.0 (172.52)	297.0 (134.84)	288.0 (130.75)	—	380.0 (172.52)	4.12 (1.87)
	2-1/2" (63.50)	288.5 (130.98)	288.5 (130.98)	288.5 (130.98)	289.5 (131.43)	293.5 (133.25)	380.5 (172.75)	297.5 (135.20)	288.5 (130.98)	—	380.5 (172.75)	4.62 (2.10)

## Series A & J Breakaway pressures

Bore	Series J		Low Friction Seals (LF)	
	Extend	Retract	Extend	Retract
1-1/2", 2", 2-1/2"	5	6	3	4
3-1/4", 4"	4	5	2	3
5", 6", 7", 8"	3	4	1	2
10"	3	4	1	2
12"	3	4	1	2

Note: Breakaway pressures were established with the cylinders mounted horizontally and no load on the piston rod.

# NFPA Aluminum & Steel Cylinders

NFPA Rodlock (LE option)  
Passive

- Precision operation maintains accurate positioning
- Large clamping surface ensures consistent performance
- Spring-engaged units engage in power-off situations
- Sealed to withstand harsh environments



## Technical data

Bore sizes

NFPA cylinders: 1-1/2" to 6" (see chart at right for bore/rod combinations)

Rod lock release pressure: 60 to 120 psi (4 to 8 bar)

**Caution:** Rodlock will not hold a load when mounted to cylinders with operating pressures in excess of 100 psi (7 bar). Refer to holding force for rod lock chart.

Temperature range: 33°F to 150°F (0.5°C to 66°C)

Viton seal option available

Rod lock inlet port: 1/8 NPT

Rod lock mounting: Any position

Holding: Operates in both directions

### Notes

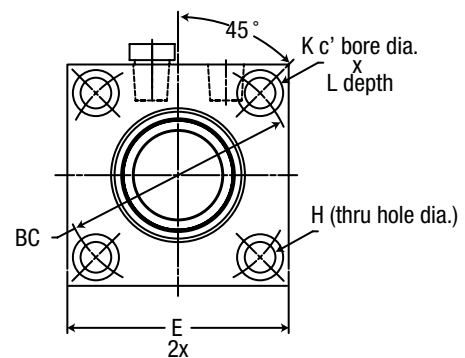
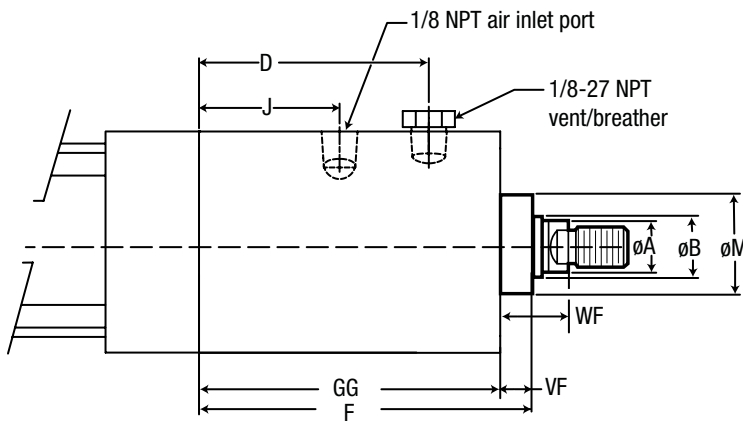
If personal safety is required, an unrelated, redundant safety system should be used.

Rod locks require clean, dry, pressure regulated air, lubrication is not required.

The rod must be kept clean and dry to maintain optimum holding forces.

Rod rotation is not allowed when rod lock is engaged (not intended for torsional braking).

(Dimensions in inches)



## Holding force for rod lock

Rod Diameter	Bore Size	Holding* Force
0.625 in	1.500 in	180 lbs
0.625 in	2.000 in	314 lbs
0.625 in	2.500 in	491 lbs
1.000 in	3.250 in	830 lbs
1.000 in	4.000 in	1257 lbs
1.000 in	5.000 in	1960 lbs
1.375 in	6.000 in	2825 lbs

\* Oversize rod diameters available upon request.

\* Air assist manual override rod lock available upon request.

**\*CAUTION: Rated holding force corresponds to static load conditions. If the rated value is exceeded, slipping may occur.**

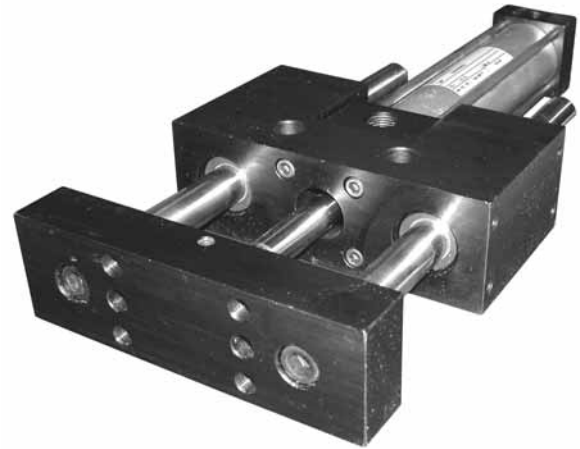
Bore Dia.	øA	øBC	E	D	GG	F	VF	øB -.001 -.003	J	øH	K	L	øM -.001 -.003	WF
1.50	0.625	2.022	2.00	1.95	2.337	2.77	0.375	1.125	0.91	0.281	0.438	0.909	1.125	1.00
2.00	0.625	2.602	2.50	2.08	2.422	2.80	0.375	1.125	1.02	0.344	0.516	1.03	1.125	1.00
2.50	0.625	3.097	3.00	2.13	2.540	2.91	0.375	1.125	1.02	0.344	0.516	1.03	1.125	1.00
3.25	1.000	3.903	3.75	2.99	3.976	4.48	0.500	1.500	1.56	0.406	0.719	1.28	1.500	1.375
4.00	1.000	4.695	4.50	2.99	3.976	4.48	0.500	1.500	1.56	0.406	0.719	1.28	1.500	1.375
5.00	1.000	5.798	5.50	2.99	4.189	4.69	0.500	1.500	1.56	0.531	0.844	1.50	1.500	1.375
6.00	1.375	6.901	6.50	3.54	4.740	5.36	0.625	2.000	1.68	0.531	0.844	1.50	2.000	1.625

## LS Series NFPA cylinder

Improved load carrying qualities

Ecology seal improves load dampening

Alignment coupler installed in tooling plate for self-alignment of cylinder rod to tooling plate connection prevents binding.



### Technical data

NFPA tie rod cylinder

Bore sizes: 1-1/2" and 2"

Operating pressure: 250 psi max.

Temperature range: -20°F to 200°F (-29°C to 107°C)

Porting: 3/8 NPT

Ecology piston seals available (fixed cushion, adjustable or extra long Decel-Air™ cushions)

Universal mounting (sleeve nut construction): Ease of cylinder removal (modular)

### Linear thruster materials of construction

Body and tooling plate: Anodized aluminum alloy.

Guide rods: Hardened high carbon bearing quality steel.

Bushings: Composite (Teflon lined) self-lubricating or linear roller bearing.

Felt washers: oil impregnated

Retaining rings: to ensure bearing location.

Alignment coupler: carbon steel

### Cylinder materials of construction

Piston rod: Chrome plated high strength carbon steel

Tie rods: High strength carbon steel

Seals: Nitrile piston, piston rod and tube seals,

Urethane piston rod wiper.

Wearband: Teflon and graphite composite

Cylinder tube: Aluminum with hardcoat anodize

Rod bearing: Oil impregnated sintered iron

Endcaps: A and EA Series cylinder - aluminum

J and EJ Series cylinder - steel

### Decel-Air™ Cushions

Norgren's Decel cushioned cylinder was designed for applications where high velocity, low mass, material function or machine function is required, and where the kinetic energy to be absorbed during cushioning exceeds the parameters of standard cylinders equipped with Ecology piston seals and fixed or adjustable cushions. Decel cushions employ longer-than-standard air cushions to assist our Impact Dampening Piston Seal.

## Energy Absorption Capacity of the Impact Dampening Seals

### \*Usable Pounds Stoppable at the Following Piston Speeds

This chart features the energy absorption capacity of the impact dampening piston seals with Non-Adjustable cushions.

Velocity In./Sec	1-1/2" Bore				2.0" Bore			
	Load (LBS.) Short Body		Load (LBS.) Long Body		Load (LBS.) Short Body		Load (LBS.) Long Body	
	Standard Guide Shaft	Oversize Guide Shaft	Standard Guide Shaft	Oversize Guide Shaft	Standard Guide Shaft	Oversize Guide Shaft	Standard Guide Shaft	Oversize Guide Shaft
6	151.3	149.1	150.8	148.2	267.0	261.9	265.7	259.4
12	34.1	31.9	33.6	31.0	59.6	54.5	58.3	52.0
18	12.4	10.2	11.9	9.3	7.8	16.1	20.0	13.6
24	4.9	2.7	4.44	1.8	7.8	2.7	6.5	0.2
30	1.3	0	0	0	1.5	0	0.2	0.0

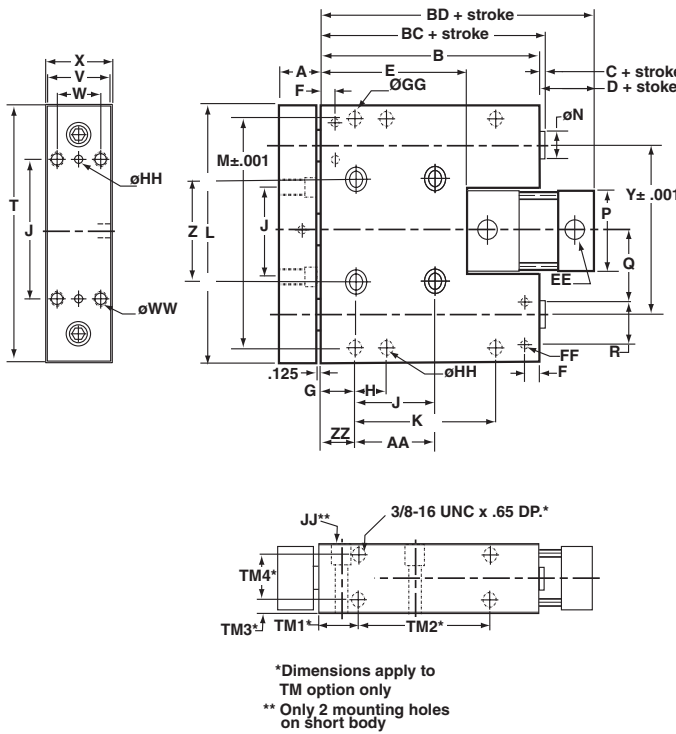
\*The weight of the cylinder piston has been deducted from the figures shown above.

Note: The use of Viton® Seals limits the absorption of the impact dampening seals by 50%.

\*\* Series J & EJ only

NOTE: The weight of a tooling plate, guide rods, and 1 extend and 1 retract stop collar has been added. (Guide rod weight is based on a 6.0" stroke cylinder.)

# NFPA Aluminum & Steel Cylinders



## Dimensional data

Dimension	Size 3 (1-1/2" Bore)		Size 4 (2" Bore)	
	Long body	Short body	Long body	Short body
A	1.200	1.200	1.450	1.450
AA	2.375	NA	3.125	NA
B	5.765	3.650	8.000	5.000
BD	7.375	5.150	8.385	5.385
C	0.160	0.160	0.175	0.175
BC	5.925	3.810	8.175	5.175
D	1.450	1.340	0.385	0.385
E	3.750	1.500	4.760	1.760
EE	3/8 NPT	3/8 NPT	3/8 NPT	3/8 NPT
F	0.291	0.291	0.447	0.447
FF	1/4-20 x .40	1/4-20 x .40	1/4-20 x .50	1/4-20 x .50
G	0.875	0.875	1.000	1.000
GG	3/8-16 x .75DP	3/8-16 x .75DP	3/8-16 x .75DP	3/8-16 x .75DP
H	0.875	0.875	1.500	1.500
HH	.3764 x .47DP	.3764 x .47DP	.3764 x .50DP	.3764 x .50DP
J	2.375		3.125	3.125
JJ	.41 thru .59 C/B x .66DP		.53 thru .81 C/B x .66DP	
K	4.000	1.750	6.000	3.000
L	6.450	6.450	8.380	8.380
M	5.875	5.875	7.750	7.750
N (Standard)	0.750	0.750	1.000	1.000
N (Oversize)	1.000	1.000	1.375	1.375
P	2.000	2.000	2.500	2.500
Q	1.775	1.775	2.265	2.265
R	1.063	1.063	1.375	1.375
T	6.550	6.550	8.500	8.500
TM1*	1.313	1.313	1.500	1.500
TM2*	3.125	0.875	5.000	2.000
TM3*	0.350	0.350	0.375	0.375
TM4*	1.500	1.500	2.000	2.000
V	2.000	2.000	2.500	2.500
W	1.300	1.300	1.625	1.625
WW	3/8-16	3/8-16	1/2-13	1/2-13
X	2.200	2.200	2.750	2.750
Y	4.250	4.250	5.750	5.750
Z	2.375	2.375	3.125	3.125
ZZ	0.875	0.875	1.000	1.000

## LS product ordering information

LS 3 A 3 3 S S C S - Stroke - Options

1 2 3 4 5 6 7 8 9

**1- Product**  
LS Linear slide unit

**2 Size**  
3 1-1/2"  
4 2"

**3 Cylinder Type**  
A aluminum (NFPA tie rod)  
EA aluminum (NFPA tie rod Ecology Seal)  
J steel (NFPA tie rod)  
EJ steel (NFPA tie rod Ecology Seal)

**4 Cushions - Extend Stroke**  
3 non-cushioned\*  
5 fixed cushions  
7 adjustable cushions\*\*  
9 decel adjustable cushions\*\*

**5 Cushions - Retract Stroke**  
3 non-cushioned\*  
5 fixed cushions  
7 adjustable cushions\*\*  
9 decel adjustable cushions\*\*

**9 - Guide Rod Diameter**  
S standard  
O oversize

**8 - Guide Rod Bearing Type**  
C composite  
R Roller +, ++

**7 - Slide Body Length**  
S short  
L long

**6 - Slide Body Width**  
S standard

**Maximum Stroke**

	size 3 (1-1/2" bore)	size 4 (2" bore)
short body	18"	22"
long body	24"	28"

Options

AE = stroke adjustment (collar & bumper) - extend stroke  
AR = stroke adjustment (collar & bumper) - retract stroke  
CR = corrosion resistance (includes linear slide and cylinder)  
GL = guide rod lubrication (includes oiler cups installed)  
GM = guide rod lubrication modification for oiler cups  
L() = non-standard port location  
ME = shock absorber mounting block - extend stroke  
MR = shock absorber mounting block - retract stroke  
N() = non-standard adjustable cushion needle location  
P() = non-standard port size (down one size = 1/4 NPT, up one size = 1/2 NPT)  
PS = magnetic piston (cylinder)  
PX() = tooling plate extension  
TM = side tapped mounting  
WC = linear thruster assembly without cylinder  
WS = replacement cylinder without slide  
V = high temperature viton seals

\* Non-cushioned cylinders will have U-cup seals as standard. Ecology seals are not available as non-cushioned.  
\*\* Standard cushion adjustment location is side 1 and adds 1" to the overall length of the cylinder per end with standard port sizes.  
+ Roller bearings are not available with oversized guide rods.  
++ Roller bearing not available with CR (corrosion resistance) option.