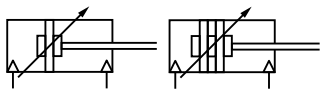
ISO/VDMA Cylinders

DA/8000

Double acting

Ø 32 ... 320 mm



Conforms to ISO 6431, VDMA 24562 and NFE 49-003-1

High performance, ruggedness and reliability

Extensive range of mountings

Technical data

Medium:

Compressed air, filtered, lubricated or non-lubricated

Standard:

ISO 6431, VDMA 24562, NFE 49-003-1 and corresponding BS

Operation:

RA/8000 double acting, adjustable cushioning

RA/8000/M double acting, magnetic piston, adjustable cushioning

Operating pressure:

15 to 232 psig (1 to 16 bar) 15 to 145 psig [1 to 10 bar] for Ø 250 and 320 mm

Operating temperature:

-4°F to +176°F (-20°C to +80°C) max.

Consult our Technical Service for use below +35°F (+2°C)

Strokes:

Standard, see table

Non-standard strokes up to 3000 mm maximum

Materials

Barrel: anodized aluminum

End covers: pressure diecast aluminium (Ø 200 to 320 mm gravity cast aluminum)

Piston rod: stainless steel (Martensitic)

Piston rod seals: polyurethane (Ø 125 to 320 mm nitrile rubber)

Piston seals: polyurethane (Ø 125 to 320 mm nitrile rubber)

'O'-rings: nitrile rubber

Standard models

Ø	Piston rod Ø	ISO Port size	Model non-magnetic	Model magnetic	NPT Port size	Model non-magnetic	Model magnetic	Service kit
32	12	G1/8	DA/8032/*	DA/8032/M/*	1/8"	DC/8032/*	DC/8032/M/*	**QA/8032/00**
40	16	G1/4	DA/8040/*	DA/8040/M/*	1/4"	DC/8040/*	DC/8040/M/*	**QA/8040/00**
50	20	G1/4	DA/8050/*	DA/8050/M/*	1/4"	DC/8050/*	DC/8050/M/*	**QA/8050/00**
63	20	G3/8	DA/8063/*	DA/8063/M/*	3/8"	DC/8063/*	DC/8063/M/*	**QA/8063/00**
80	25	G3/8	DA/8080/*	DA/8080/M/*	3/8"	DC/8080/*	DC/8080/M/*	**QA/8080/00**
100	25	G1/2	DA/8100/*	DA/8100/M/*	1/2"	DC/8100/*	DC/8100/M/*	**QA/8100/00**
125	32	G1/2	DA/8125/*	DA/8125/M/*	1/2"	DC/8125/*	DC/8125/M/*	**QA/8125/00**
160	40	G3/4	DA/8160/*	DA/8160/M/*	3/4"	DC/8160/*	DC/8160/M/*	**QA/8160/00**
200	40	G3/4	DA/8200/*	DA/8200/M/*	3/4"	DC/8200/*	DC/8200/M/*	**QA/8200/00**
250	50	G1	DA/8250/*	DA/8250/M/*	1"	DC/8250/*	DC/8250/M/*	**QA/8250/00**
320	63	G1	DA/8320/*	DA/8320/M/*	1"	DC/8320/*	DC/8320/M/*	**QA/8320/00**

* Insert stroke length in mm.

Options selector

★DC/8050/M★/★★★★

Special variants	Substitute
Heat resistant seals, 150°C max.	T

Piston rod material	Substitute
Chrome plated stainless steel	D

Threads	Substitute
Metric ports: ISO 228 (G 1/8 to G 1)	A
NPT ports	C

Series	Substitute
8000	8

Cylinder diameters (mm)	Substitute
032, 040, 050, 063, 080, 100, 125, 160, 200, 250, 320	

Variants (magnetic piston)	Substitute
Standard	M
Special wiper/seal	W2
Low friction	X2
Piston rod bellow	MG
Without cushioning	MW
Without cushioning, low friction	X4
Double ended piston rod	JM
Double ended piston rod, special wiper/seal	W4
Four position	MT
Non-rotating piston rod	N2*
Locking unit	L4
Extended piston rod	MU
Extended piston rod, special wiper/seal	W6

A/8000/MU//***/***
/W6/ → Extension (mm)

Strokes (mm)
3000 max.

Variants (non-magnetic piston)	Substitute
Standard	None
Special wiper/seal	W1
Low friction	X1
Piston rod bellow	G
Without cushioning	W
Without cushioning, low friction	X3
Double ended piston rod	J
Double ended piston rod, special wiper/seal	W3
Four position	IT
Non-rotating piston rod	N1*
Locking unit	L2
Extended piston rod	IU
Extended piston rod, special wiper/seal	W5

A/8000/IU//***/***
/W5/ → Extension (mm)

* N1 and N2 option built using non chrome plate, stainless steel piston rods

Note: If option is not required, disregard option position within part number eg. RA/8100/100

For combinations of cylinder variants consult our Technical Service.

ISO/VDMA Cylinders

DA/8000

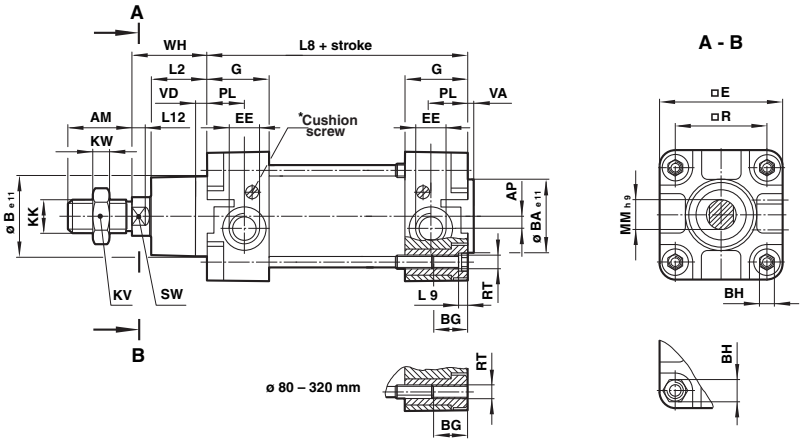
Double acting

Ø 32 ... 320 mm

Dimensions in mm

Standard cylinders

DA/8000, DA/8000/M

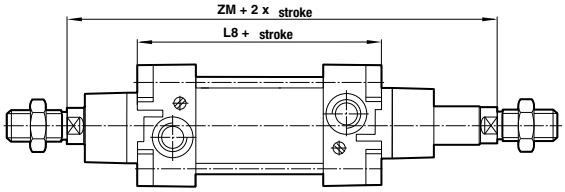


Ø	AM	AP	Ø B e11	Ø BA e11	BG	BH (A/F)	❑ E	EE	G	KK	KV (A/F)	KW	L2
32	22	3.5	30	30	18	6	47	G 1/8	27.5	M10x1.25	17	5	20
40	24	4.5	35	35	18	6	53	G 1/4	32	M12x1.25	19	6	22
50	32	6	40	40	18	8	65	G 1/4	31	M16x1.5	24	8	27
63	32	10	45	45	17.5	8	75	G 3/8	33	M16x1.5	24	8	29
80	40	8.5	45	45	21.5	19	95	G 3/8	33	M20x1.5	30	10	33
100	40	9	55	55	21.5	19	115	G 1/2	37	M20x1.5	30	10	36
125	54	10	60	60	30	24	140	G 1/2	46	M27x2	41	13.5	45
160	72	18	65	65	28.5	32	183.5	G 3/4	50	M36x2	55	18	58
200	72	18	75	75	28.5	32	224	G 3/4	50	M36x2	55	18	67
250	84	22.5	90	90	35	36	280	G 1	58	M42x2	65	21	80
320	96	22.5	110	110	30	46	350	G 1	60	M48x2	75	24	90

Ø	L8	L9	L12	Ø MM h9	PL	❑ R	RT	SW (A/F)	VA	VD	WH	Cylinder weight lbs. at 0 mm	Cylinder weight lbs/25 mm
32	94	4	6	12	13	32.5	M 6	10	3	6	26	1.12 lb	0.13 lb
40	105	4	6.5	16	15	38	M 6	13	3.5	6	30	1.76 lb	0.18 lb
50	106	5	8	20	18.5	46.5	M 8	17	3.5	6	37	2.93 lb	0.26 lb
63	121	5	8	20	19	56.5	M 8	17	4	6	37	3.97 lb	0.29 lb
80	128	-	10	25	19	72	M 10	22	4	6	46	7.17 lb	0.44 lb
100	138	-	10	25	18	89	M 10	22	4	6	51	10.6 lb	0.51 lb
125	160	-	13	32	22.5	110	M 12	27	6	15.5	65	17.6 lb	0.73 lb
160	180	-	16	40	21	140	M 16	36	4	15	80	32.9 lb	1.21 lb
200	180	-	16	40	21	175	M 16	36	5	15	95	47.8 lb	1.32 lb
250	200	-	20	50	29	220	M 20	41	7	13	105	71.9 lb	2.03 lb
320	220	-	24	63	30	270	M 24	55	7	13	120	131.9 lb	3.22 lb

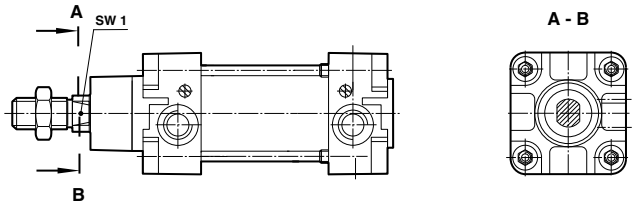
Cylinder variants

DA/8000/J, DA/8000/JM – Cylinders with double ended piston rod



Ø	ZM	L8
32	146	94
40	165	105
50	180	106
63	195	121
80	220	128
100	240	138
125	290	160
160	340	180
200	370	180

DA/8000/N1, DA/8000/N2 – Cylinders with non-rotating piston rod



Ø	SW1 (A/F)
32	10
40	13
50	16
63	16
80	21
100	21

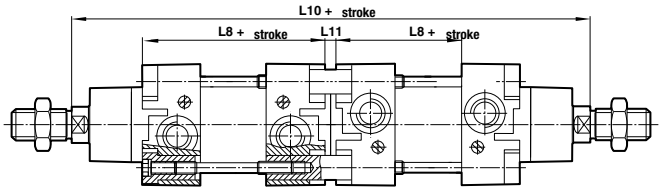
ISO/VDMA Cylinders

DA/8000

Double acting

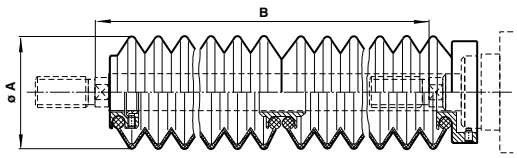
Ø 32 ... 320 mm

DA/8000/IT, DA/8000/MT – Four position cylinders



Ø	L 8	L 10	L 11
32	94	247	7
40	105	278	8
50	106	294	8
63	121	325	9
80	128	357	9
100	138	387	9
125	160	462	12
160	180	530	10
200	180	560	10

DA/8000/G, DA/8000/MG – Cylinders with piston rod gaiter



Ø	Ø A	Maximum stroke per gaiter	Piston rod extension B First gaiter	Further gaiter
32	40	60	30	25
40	63	145	50	32
50	63	145	40	32
63	63	145	40	32
80	80	250	50	45
100	80	250	50	45
125	80	250	50	45
160	116	350	70	60
200	116	350	70	60
250	116	350	70	60
320	143	500	110	100

ISO/VDMA Cylinders

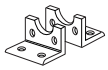
DA/8000

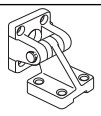
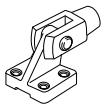
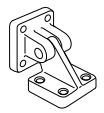
Double acting

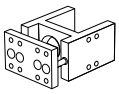
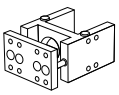
Ø 32 ... 320 mm

Dimensions in mm

Mountings

Ø	A	AK	B, G	C	D	D2	F	FH	H
									
32	QM/8032/35	QM/8025/38	QA/8032/22	QA/8032/21	QA/8032/23	QA/8032/42	QM/8025/25	QA/8032/34	QM/8032/28
40	QM/8032/35	QM/8040/38	QA/8040/22	QA/8040/21	QA/8040/23	QA/8040/42	QM/8040/25	QA/8040/34	QM/8040/28
50	QM/8050/35	QM/8050/38	QA/8050/22	QA/8050/21	QA/8050/23	QA/8050/42	QM/8050/25	QA/8050/34	QM/8050/28
63	QM/8050/35	QM/8050/38	QA/8063/22	QA/8063/21	QA/8063/23	QA/8063/42	QM/8050/25	QA/8063/34	QM/8063/28
80	QM/8080/35	QM/8080/38	QA/8080/22	QA/8080/21	QA/8080/23	QA/8080/42	QM/8080/25	QA/8080/34	QM/8080/28
100	QM/8080/35	QM/8080/38	QA/8100/22	QA/8100/21	QA/8100/23	QA/8100/42	QM/8080/25	QA/8100/34	QM/8100/28
125	QM/8125/35	QM/8125/38	QM/8125/22	QM/8125/21	QM/8125/23	QA/8125/42	QM/8125/25	QA/8125/34	QM/8125/28
160	QM/8160/35	QM/8160/38	QM/8160/22	QM/8160/21	QM/8160/23	QA/8160/42	QM/8160/25	–	QM/8160/28
200	QM/8160/35	QM/8160/38	QM/8200/22	QM/8200/21	QM/8200/23	QA/8200/42	QM/8160/25	–	QM/8200/28
250	QM/8250/35	–	QM/8250/22	QM/8250/21	QM/8250/23	–	QM/8250/25	–	QM/8250/28
320	QM/8320/35	–	QM/8320/22	QM/8320/21	QM/8320/23	–	QM/8320/25	–	QM/8320/28

Ø	L	M	R	S	SS	SW	UF	UH	UL
									
32	QA/8032/24	QM/8032/26	QA/8032/27	QA/8032/41	M/P19931	M/P19493	QM/8025/32	QA/8032/40	QA/8032/43
40	QA/8040/24	QM/8040/26	QA/8040/27	QA/8040/41	M/P19932	M/P19494	QM/8040/32	QA/8040/40	QA/8040/43
50	QA/8050/24	QM/8050/26	QA/8050/27	QA/8040/41	M/P19933	M/P19495	QM/8050/32	QA/8050/40	QA/8050/43
63	QA/8063/24	QM/8063/26	QA/8063/27	QA/8063/41	M/P19934	M/P19496	QM/8050/32	QA/8063/40	QA/8063/43
80	QA/8080/24	QM/8080/26	QA/8080/27	QA/8063/41	M/P19935	M/P19497	QM/8080/32	QA/8080/40	QA/8080/43
100	QA/8100/24	QM/8100/26	QA/8100/27	QA/8100/41	M/P19936	M/P19498	QM/8080/32	QA/8100/40	QA/8100/43
125	QM/8125/24	QM/8125/26	QM/8125/27	QA/8100/41	M/P19937	M/P19499	QM/8125/32	QA/8125/40	QA/8125/43
160	QM/8160/24	QM/8160/26	QM/8160/27	QM/8160/41	M/P19938	M/P19679	QM/8160/32	QA/8160/40	QM/8160/43
200	QM/8200/24	QM/8200/26	QM/8200/27	QM/8160/41	M/P19939	M/P19683	QM/8160/32	QA/8200/40	QM/8200/43
250	QM/8250/24	–	–	–	–	M/P19446	QM/8250/32	–	–
320	QM/8320/24	–	–	–	–	M/P19447	QM/8320/32	–	–

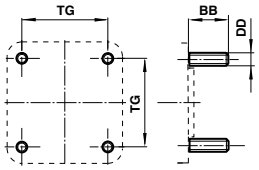
Ø	UR	US	Guide blocks	Guide blocks	Locking unit (passive)
					
32	QA/8032/33	M/P40310	QA/8032/51/*	QA/8032/61/*	QA/8032/59
40	QA/8040/33	M/P40311	QA/8040/51/*	QA/8040/61/*	QA/8040/59
50	QA/8050/33	M/P40312	QA/8050/51/*	QA/8050/61/*	QA/8050/59
63	QA/8063/33	M/P40313	QA/8063/51/*	QA/8063/61/*	QA/8063/59
80	QA/8080/33	M/P40314	QA/8080/51/*	QA/8080/61/*	QA/8080/59
100	QA/8100/33	M/P40315	QA/8100/51/*	QA/8100/61/*	QA/8100/59
125	QM/8125/33	M/P71355	–	–	QA/8125/59
160	QM/8160/33	M/P71356	–	–	–
200	QM/8200/33	M/P71357	–	–	–

ISO/VDMA Cylinder mountings

For DA/8000; RA/191000; RA/192000; RA/193000; PVA/8000/M

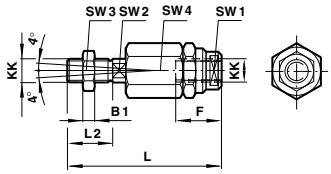
Dimensions in mm

Front or rear stud – A
ISO 6431



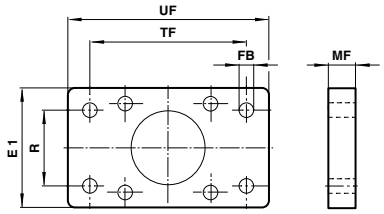
Ø	BB	DD	TG	lb
32	17	M6	32.5	0.04
40	17	M6	38	0.04
50	23	M8	46.5	0.11
63	23	M8	56.5	0.11
80	28	M10	72	0.18
100	28	M10	89	0.18
125	34	M12	110	0.31
160	42	M16	140	0.68
200	42	M16	175	0.68
250	50	M20	220	2.03
320	60	M24	270	3.22

Piston rod swivel – AK



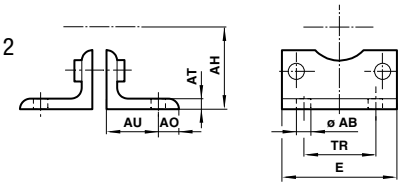
Thread KK	B1	F	L	L2	SW1	SW2	SW3	SW4	lb
M10x1.25	5	26	73	20	19	12	17	30	0.44
M12x1.25	6	26	77	24	19	12	19	30	0.44
M16x1.5	8	34	106	32	30	19	24	42	1.43
M20x1.5	10	42	122	40	30	19	30	42	1.59
M27x2	13.5	40	147	54	40	24	41	55	3.75
M36x2	18	78	251	72	50	36	55	75	11.91

Rear flange – B
Front flange – G
ISO 6431 and
VDMA 24562 Part 2



Ø	E1	Ø FB	MF	R	TF	UF	lb
20	36	6.6	10	0	55	70	0.35
25	40	6.6	10	0	60	76	0.44
32	50	7	10	32	64	80	0.55
40	55	9	10	36	72	90	0.77
50	65	9	12	45	90	110	1.54
63	75	9	12	50	100	125	1.76
80	100	12	16	63	126	154	2.98
100	120	14	16	75	150	186	4.85
125	140	16	20	90	180	224	3.75
160	180	18	20	115	230	280	6.84
200	220	22	25	135	270	320	10.14
250	280	26	25	165	330	395	16.32
320	350	33	30	200	400	475	29.0

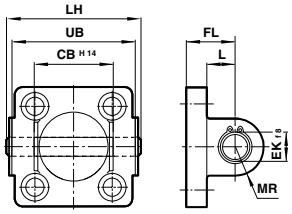
Foot – C
ISO 6431 and
VDMA 24562 Part 2



Ø	Ø AB	AH	AO	AT	AU	E	TR	lb
20	6.6	27	6	4	16	36	22	0.07
25	6.6	30	7	4	16	40	26	0.09
32	7	32	8 (11)	4	24	48	32	0.33
40	9	36	9 (12)	4 (5)	28	53	36	0.40
50	9	45	10 (13)	5	32	64	45	0.66
63	9	50	12 (13)	5	32	74	50	0.86
80	12	63	19	5 (6)	41	98	63	1.76
100	14	71	19	5 (6)	41	115	75	2.09
125	16	90	20 (25)	9 (7)	45	140	90	5.30
160	18	115	20	8	60	180	115	7.72
200	22	135	30	9	70	220	135	11.58
250	26	165	35	10	75	280	165	20.94
320	33	200	45	16	85	350	200	48.51

( ) stainless steel, weight on request

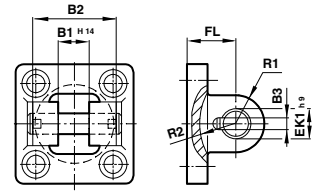
Rear clevis – D
ISO 6431 and
VDMA 24562 Part 2



Ø	CB H14	Ø EK f8	FL	L	LH	MR	UB	lb
32	26	10	22	13	52	9	45	0.24
40	28	12	25	16	60	12	52	0.35
50	32	12	27	17	68	12	60	0.49
63	40	16	32	22	79	15	70	0.75
80	50	16	36	22	99	15	90	1.19
100	60	20	41	27	119	20	110	1.98
125	70	25	50	31	139 (40)	25	130	5.95
160	90	30	55	35.5	181	30	170	9.48
200	90	30	60	36	181	30	170	13.45
250	110	40	70	45	218	40	200	4.19
320	120	45	80	50	238	45	220	67.25

( ) Stainless steel, weight on request

Rear clevis – D2
VDMA 24562 Part 2



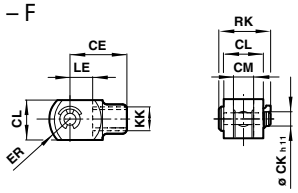
Ø	B1 H14	B2	B3	Ø EK h9	FL	R1	R2	lb
32	14	34	3.3	10	22	11	17	0.44
40	16	40	4.3	12	25	12	20	0.51
50	21	45	4.3	16	27	14.5	22	0.79
63	21	51	4.3	16	32	18	25	1.21
80	25	65	4.3	20	36	22	30	1.98
100	25	75	6.3	20	41	22	32	3.20
125	37	97	6.3	30	50	30	42	5.95
160	43	122	6.3	35	55	36	46	9.48
200	43	122	6.3	35	60	38	49	13.45

ISO/VDMA Cylinder mountings

For DA/8000; KA/8000; RA/191000; RA/192000; RA/193000; PVA/8000/M

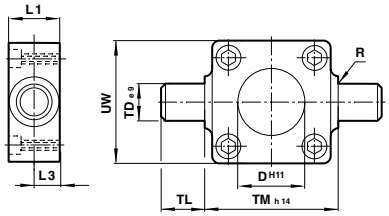
Dimensions in mm

Piston rod clevis – F



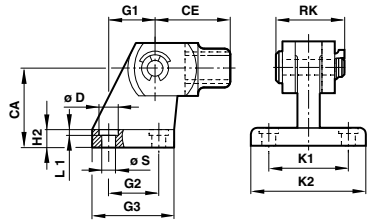
Thread KK	CE	Ø CK h11	CL	CM	ER	LE	RK	lb
M10x1.25	40	10	20	10	16	20	28	0.20
M12x1.25	48	12	24	12	19	24	32	0.29
M16x1.5	64	16	32	16	25	32	41.5	0.73
M20x1.5	80	20	40	20	32	40	50	1.48
M27x2	110	30	55	30	45	54	62	2.98
M36x2	144	35	70	35	57	72	95	6.62
M42x2	168	40	85	40	68	84	106	14.11
M48x2	192	50	96	50	85	96	121	19.18

Front or rear detachable trunnion – FH



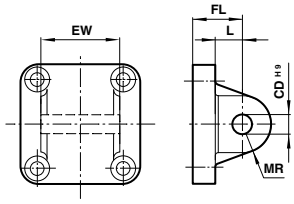
Ø	Ø D H11	L1	L3	R	ØTD e9	TL	TM h14	UW1	lb
32	30	16	8	1	12	12	50	50	0.44
40	35	20	10	1.6	16	16	63	55	0.84
50	40	24	12	1.6	16	16	75	65	1.32
63	45	24	12	1.6	20	20	90	75	2.43
80	45	28	14	1.6	20	20	110	100	4.19
100	55	38	19	2	25	25	132	120	7.72
125	60	50	25	2	25	25	160	145	14.33

Front hinge – M



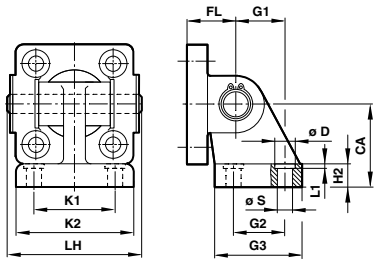
Thread KK	Ø	CA	CE	Ø D	G1	G2	G3	H2	K1	K2	L1	RK	Ø S	lb
M10x1.25	32	32	40	11	21	18	31	8	38	51	1.6	28	6.6	0.53
M12x1.25	40	36	48	11	24	22	35	10	41	54	1.6	32	6.6	0.73
M16x1.5	50	45	64	15	33	30	45	12	50	65	1.6	41.5	9	1.79
M16x1.5	63	50	64	15	37	35	50	12	52	67	1.6	41.5	9	1.83
M20x1.5	80	63	80	18	47	40	60	14	66	86	2.5	50	11	3.13
M20x1.5	100	71	80	18	55	50	70	15	76	96	2.5	50	11	4.12
M27x2	125	90	110	20	70	60	90	20	94	124	3.2	62	14	8.49
M36x2	160	115	144	20	97	88	126	25	118	156	4	95	14	19.85
M36x2	200	135	144	24	105	90	130	30	122	162	4	95	16	23.37

Rear eye – R
ISO 6431 and VDMA 24562 Part 2

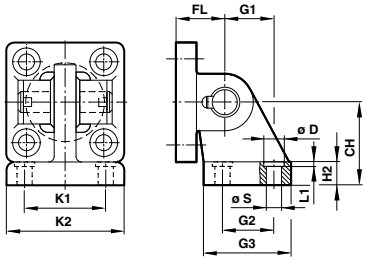


Ø	Ø CD H9	EW	FL	L	MR	lb
20	8	15.8	20	14	8	0.04
25	8	15.8	20	14	8	0.07
32	10	25.8	22	13	9	0.20
40	12	27.8	25	16	12	0.24
50	12	31.7	27	17	12	0.37
63	16	39.7	32	22	15	0.53
80	16	49.7	36	22	15	0.82
100	20	59.7	41	27	20	1.30
125	25	69.7	50	33	25	7.06
160	30	89.7	55	35.5	30	13.45
200	30	89.7	60	37	30	14.99

Rear hinge – L



Rear hinge – UL
VDMA 24562 Part 2



Ø	CA	CH	Ø D	FL	G1	G2	G3	H2	K1	K2	L1	LH	Ø S	L–lb	UL–lb
32	32	32	11	22	21	18	31	8	38	51	1.6	52	6.6	0.35	5.27
40	36	36	11	25	24	22	35	10	41	54	1.6	60	6.6	0.51	1.04
50	45	45	15	27	33	30	45	12	50	65	1.6	68	9	0.79	1.81
63	50	50	15	32	37	35	50	12	52	67	1.6	79	9	1.15	2.51
80	63	63	18	36	47	40	60	14	66	86	2.5	99	11	1.81	4.26
100	71	71	18	41	55	50	70	15	76	96	2.5	119	11	2.91	6.28
125	90	90	20	50	70	60	90	20	94	124	3.2	139	14	11.91	12.79
160	115	115	20	55	97	88	126	25	118	156	4	181	14	23.37	23.59
200	135	135	24	60	105	90	130	30	122	162	4	181	18	31.09	33.52
250*	165	–	33	70	128	110	160	35	150	200	2	218	22	71.44	–
320*	200	–	40	80	150	122	186	40	170	234	2	238	26	115.76	–

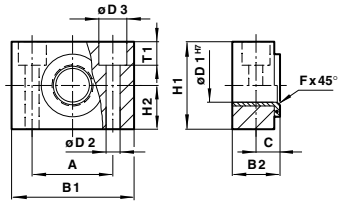
* Stainless steel, weight on request

ISO/VDMA Cylinder mountings

For DA/8000; KA/8000; RA/191000; RA/192000; RA/193000; PVA/8000/M

Dimensions in mm

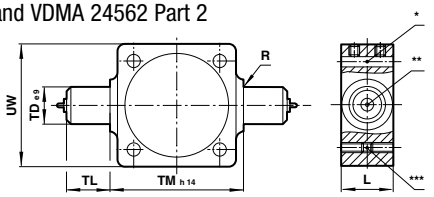
Trunnion support – S
VDMA 24562
Part 2



Ø	A	B1	B2	C	ØH7	ØD2	ØD3	fx45°	H1	H2	T1	lb
32	32	46	18	10.5	12	6.6	11	1	30	15	6.8	0.22
40	36	55	21	12	16	9	15	1.6	36	18	9	0.31
50	36	55	21	12	16	9	15	1.6	36	18	9	0.31
63	42	65	23	13	20	11	18	1.6	40	20	11	0.42
80	42	65	23	13	20	11	18	1.6	40	20	11	0.42
100	50	75	28.5	16	25	14	20	2	50	25	13	0.75
125	50	75	28.5	16	25	14	20	2	50	25	13	0.75
160	60	92	39	21.5	32	18	26	2.5	60	25	15.5	4.19
200	60	92	39	21.5	32	18	26	2.5	60	25	15.5	4.19

For use with mountings style H, FH and UH. Stainless steel, weight on request.

Center trunnion – H (for tie rod types)
ISO 6431 and VDMA 24562 Part 2



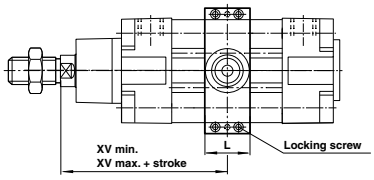
*Type – UH ***Type – H
**Grease nipple up to Ø 125 mm

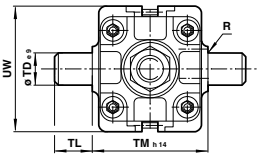
Ø	L	R	ØTD e9	TL	TM h14	UW	XV min.	XV max.	lb	Torque in. lb.
32	20	1	12	12	50	50	66	80	0.35	53.1
40	24	1.6	16	16	63	58	76	89	0.77	53.1
50	28	1.6	16	16	75	70	82	98	0.77	53.1
63	28	1.6	20	20	90	80	88	107	1.87	88.5
80	28	1.6	20	20	110	100	97	123	1.87	88.5
100	38	2	25	25	132	126	112	128	5.07	132.75
125	50	2	25	25	160	152	136	154	7.28	221.25
160	50	2.5	32	32	200	192	155	185	11.69	354
200	50	2.5	32	32	250	240	170	200	20.73	354
250	60	3.2	40	40	320	318	193	217	39.69	–
320	70	3.2	50	50	400	400	215	245	66.15	–

Note: Style 'H': These mountings are only supplied assembled complete with the cylinder. Unless otherwise specified, units will be supplied with dimension 'XV' plus half the stroke length. 'XV' = Distance from the piston rod shoulder to the center of the mounting.

Style 'UH': It is most important that the locking screws which secure the mounting to the tie rod are tightened to the torque figures shown in the table below. For maximum energy input, consult our Technical Service.

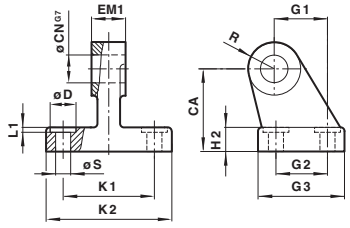
Adjustable center trunnion – UH (for profile types)



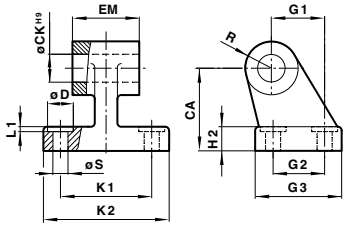


Ø	L	R	Ø TD e9	TL	TM h14	UW	lb	Torque in. lb.
32	25	1	12	12	50	58	0.77	17.70
40	28	1.6	16	16	63	65	1.10	30.98
50	28	1.6	16	16	75	80	1.76	30.98
63	36	1.6	20	20	90	96	3.09	44.25
80	36	1.6	20	20	110	116	4.19	53.10
100	48	2	25	25	132	140	5.07	53.10
125	50	2	25	25	160	163	7.28	53.10

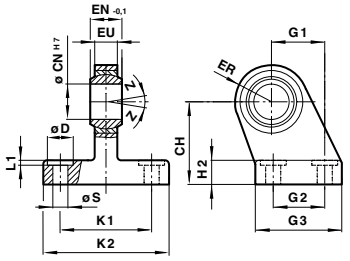
Narrow hinge – SS



Wide hinge – SW



Swivel hinge – US



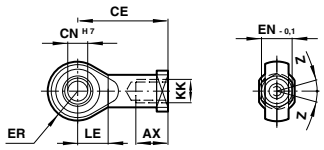
Ø	CA	CH CN H7	Ø CK H9	Ø D	H2	EM	EM1	EN-0.1	ER	EU	G1	G2	G3	H6	K1	K2	L1	R1	Ø S	Z	SW lb	SS lb	US lb
32	32	32	10	10	11	26	10	14	16	10.5	21	18	31	8	38	51	1.6	10	6.6	13°	0.11	0.33	0.42
40	36	36	12	12	11	28	12	16	18	12	24	22	35	10	41	54	1.6	11	6.6	13°	0.15	0.44	0.53
50	45	45	16	12	11	32	16	21	21	15	33	30	45	10	50	65	1.6	13	6.6	13°	0.31	1.06	1.01
63	50	50	16	16	15	40	16	21	23	15	37	35	50	12	52	67	1.6	15	9	15°	0.40	1.10	1.30
80	63	63	20	16	18	50	20	25	28	18	47	40	60	14	66	86	2.5	15	11	15°	0.62	1.65	2.27
100	71	7	20	20	18	60	20	25	30	18	55	50	70	15	76	96	2.5	19	11	15°	3.13	2.65	3.09
125	90	90	30	–	20	70	30	37	40	25	70	60	90	20	94	124	–	22	14	15°	5.95	5.51	6.84
160	115	115	35	30	20	90	35	43	44	28	97	88	126	25	118	156	4	31	14	15°	13.89	13.23	14.11
200	135	135	35	30	24	90	35	43	47	28	105	90	130	30	122	162	4	31	16	15°	17.64	16.76	20.07
250	165	–	–	40	33	110	–	–	–	–	128	110	160	35	150	200	2	40	22	–	29.55	–	–
320	200	–	–	45	40	120	–	–	–	–	150	122	186	40	170	234	2	45	26	–	48.51	–	–

ISO/VDMA Cylinder mountings

For DA/8000; KA/8000; RA/191000; RA/192000; RA/193000,.../M; PVA/8000/M

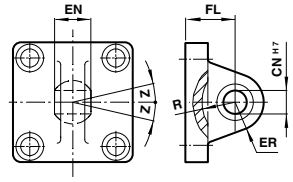
Dimensions in mm

Universal piston rod eye – UF
DIN ISO 8139



Thread KK	AX	CE	Ø CN H7	EN -0.1	ER	LE	Z	lb
M10x1.25	20	43	10	14	14	15	13°	0.20
M12x1.25	22	50	12	16	16	17	13°	0.29
M16x1.5	28	64	16	21	21	22	15°	0.73
M20x1.5	33	77	20	25	25	26	15°	1.48
M27x2	51	110	30	37	35	36	15°	2.98
M36x2	56	125	35	43	40	41	16°	6.62
M42x2	60	142	40	49	45	46	17°	14.11
M48x2	65	160	50	60	58	59	12°	19.18

Universal rear eye – UR



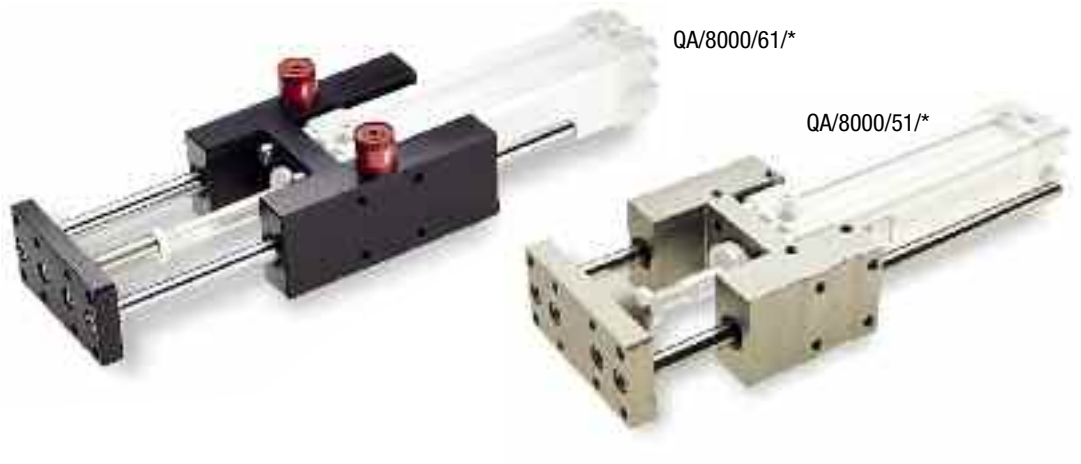
Ø	Ø CN H7	EN	ER	FL	R	Z	lb
32	10	14	16	22	14.5	13°	0.33
40	12	16	19	25	18	13°	0.55
50	16	21	21	27	19	13°	0.88
63	16	21	24	32	24	15°	1.21
80	20	25	28	36	24	15°	1.98
100	20	25	30	41	29	15°	3.31
125	30	37	40	50	36	15°	5.95
160	35	43	44	55	41	16°	10.14
200	35	43	48	60	42	16°	16.10

Guide blocks for ISO/VDMA cylinders

QA/8000/51/*

QA/8000/61/*

Ø 32 ... 100mm



Conforms to ISO 6431, VDMA 24562 and NFE 49 003 1

Ensures protection against external rotary and bending forces

Guide rods run through bearings protected by wiper rings

Provides accurate guidance for unsupported loads

Technical data

Operating temperature:

+32°F to +176°F (0°C to +80°C) maximum

Materials

Guide block, nut & mounting plate: anodized aluminum

Plain bearings:
Sintered bronze QA/8***/51/*
Steel roller bearing QA/8***/61/*

Rods: Stainless steel

Wiper rings: nitrile rubber

Standard models QA/8000/51/* (plain bearing)

Ø	Guide rod Ø	Model	Suitable for cylinders Magnetic	Non-magnetic
32	12	QA/8032/51/*	DA/8032/M, PDA/182032/M	DA/8032, PDA/182032
40	16	QA/8040/51/*	DA/8040/M, PDA/182040/M	DA/8040, PDA/182040
50	20	QA/8050/51/*	DA/8050/M, PDA/182050/M	DA/8050, PDA/182050
63	20	QA/8063/51/*	DA/8063/M, PDA/182063/M	DA/8063, PDA/182063
80	25	QA/8080/51/*	DA/8080/M, PDA/182080/M	DA/8080, PDA/182080
100	25	QA/8100/51/*	DA/8100/M, PDA/182100/M	DA/8100, PDA/182100

* Insert stroke length in mm.

Standard models QA/8000/61/* (roller bearing)

Ø	Piston rod Ø	Model	Passive locking cartridge	Locking force (N)	Suitable for cylinders Magnetic #	Non-magnetic #
32	12	QA/8032/61/*	QA/8032/63	600	DA/8032/M, PDA/182032/MIL #	DA/8032, PDA/182032/IIL #
40	16	QA/8040/61/*	QA/8040/63	1000	DA/8040/M, PDA/182040/MIL #	DA/8040, PDA/182040/IIL #
50	20	QA/8050/61/*	QA/8050/63	1500	DA/8050/M, PDA/182050/MIL #	DA/8050, PDA/182050/IIL #
63	20	QA/8063/61/*	QA/8050/63	1500	DA/8063/M, PDA/182063/MIL #	DA/8063, PDA/182063/IIL #
80	25	QA/8080/61/*	QA/8080/63	3000	DA/8080/M, PDA/182080/MIL #	DA/8080, PDA/182080/IIL #
100	25	QA/8100/61/*	QA/8080/63	3000	DA/8100/M, PDA/182100/MIL #	DA/8100, PDA/182100/IIL #

* Insert stroke length in mm.

Locking cartridges should be ordered separately. Active – pressure applied to lock, passive – pressure released to lock. 2 required per guide block.

Note: For all applications please consult our Technical Service

When using guide blocks (QA/8000/61) for profile cylinders PDA/182000 you have to order a model with a barrel which is turned at 90° so that the port threads are in line with the two switch grooves.

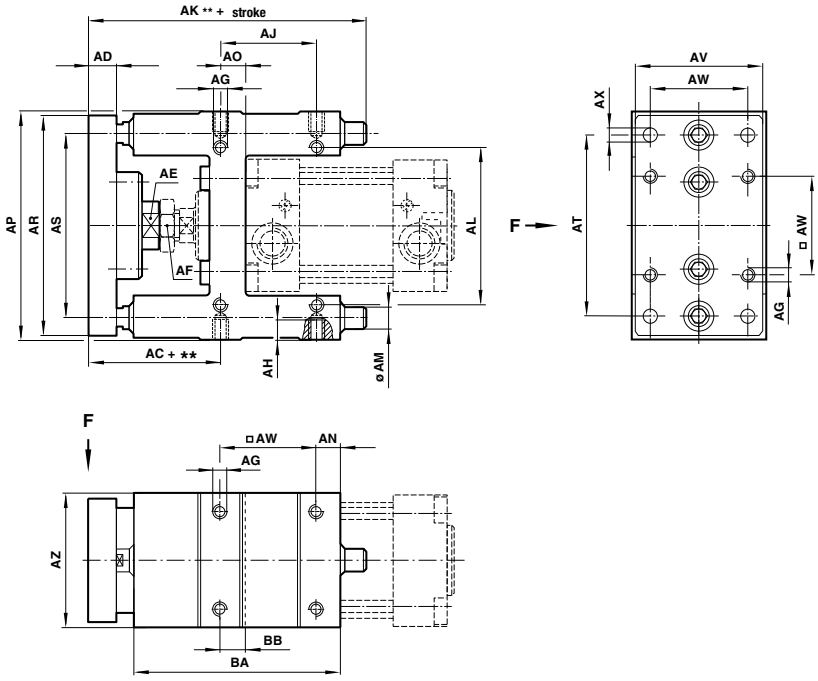
Guide blocks with plain bearings

QA/8000/51/*

Ø 32 ... 100 mm

Dimensions in mm

QA/8000/51/* – Guide blocks (plain bearing)



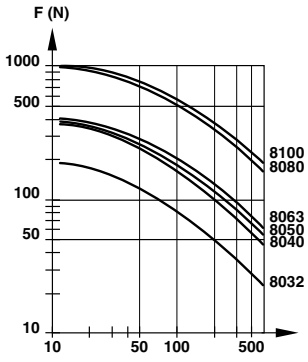
** Adjustment range

Ø	AC + **	AD	AE (A/F)	AF (A/F)	AG	AH	AJ	AK**	AL	Ø AM	AN	AO
32	69 + 2	12	15	17	M 6	10	32.5	110	58	10	6	9
40	74 + 2	12	15	19	M 6	10	38	122	64	12	6	11
50	91.5 + 4	15	22	24	M 8	12	46.5	135	80	12	6	19
63	92 + 4	15	22	24	M 8	12	56.5	153	95	12	7	15
80	106 + 6	15	27	30	M 10	15	50	180	130	16	9	14
100	111 + 6	15	27	30	M 10	15	70	199	150	16	9	19
Ø	**AP**	**AR**	**AS**	**AT**	**AV**	**❑ AW**	**Ø AX**	**AZ**	**BA**	**BB**	**at 0 mm**	**per 100**
32	100	90	74	78	45	32.5	6.6	48	76	9	2.20 lb	0.13 lb
40	106	100	80	84	50	38	6.6	56	85	11	2.65 lb	0.20 lb
50	125	120	96	100	60	46.5	9	66	99	19	3.97 lb	0.20 lb
63	132	125	104	105	70	56.5	9	76	114	15	4.90 lb	0.20 lb
80	165	155	130	130	90	72	11	98	134.5	25	9.04 lb	0.35 lb
100	185	175	150	150	110	89	11	118	153.5	28.5	12.80 lb	0.35 lb

** Adjustment ranges

Note: Supplied complete with mounting screws for cylinder.

Load capacity



Outstroke (mm)

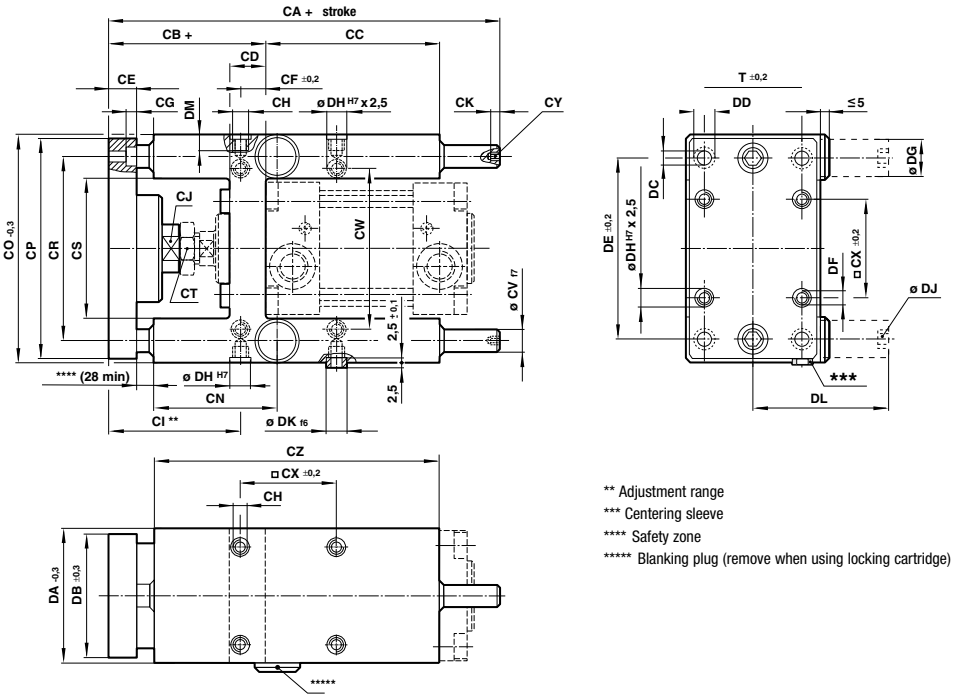
Guide blocks with roller bearings

QA/8000/61/*

Ø 32 ... 100 mm

Dimensions in mm

QA/8000/61/* – Guide blocks (roller bearing)



** Adjustment range
*** Centering sleeve
**** Safety zone
***** Blanking plug (remove when using locking cartridge)

Ø	CA**	CB + **	CC	CD	CE	CF ±0.2	CG	CH	CI**	CJ (A/F)	CK	CN
32	177	100 + 5	65	28	12	15.3	6.5	M 6	84.5	13	5	61
40	192	111 + 5	69	33	12	23	6.5	M 6	88	15	6	67
50	237	128 + 10	65	40	15	33.8	9	M 8	94	22	6	75.5
63	237	128 + 10	97	40	15	29.3	9	M 8	98.5	22	6	80
80	280	151 + 10	112	50	20	37	11	M 10	114	27	7	92
100	280	156 + 10	112	55	20	40.5	11	M 10	115.5	27	7	93
-	CO -0.3	CP	CR	CS	CT (A/F)	¯CV f7	CW	É CX ±0.2	CY (A/F)	CZ	DA -0.3	DB ±0.3
32	97	90	74	50.5	17	12	61	32.5	5	125	50	45
40	115	110	87	58.5	19	16	69	38	6	140	58	54
50	137	130	104	70.5	24	20	85	46.5	6	150	70	63
63	152	145	119	85.5	24	20	100	56.5	6	182	85	80
80	189	180	148	105.5	30	25	130	72	8	215	105	100
100	213	200	172	130.5	30	25	150	89	8	220	130	120

Ø	C	Ø DD	DE ±0.2	DF	Ø DG	Ø DH H7	DJ	Ø DK f6	DL	DM	T	at 0 mm	per 100 mm
32	6.6	11	78	M 6	22.5	9	M 5	9	70.5	14	32.5	2.65 lb	0.40 lb
40	6.6	11	84	M 6	27.5	9	G 1/8	9	74.5	14	38.0	4.85 lb	0.71 lb
50	9	15	100	M 8	32.5	11	G 1/8	11	91.5	16	46.5	7.94 lb	1.08 lb
63	9	15	105	M 8	32.5	11	G 1/8	11	91.5	16	56.5	10.14 lb	1.08 lb
80	11	18	130	M 10	54.5	13	G 1/8	13	141.5	20	72.0	19.18 lb	1.70 lb
100	11	18	150	M 10	54.5	13	G 1/8	13	141.5	20	87.0	24.26 lb	1.70 lb

** Adjustment range

Note: Supplied complete with mounting screws for cylinders and two centering sleeves.

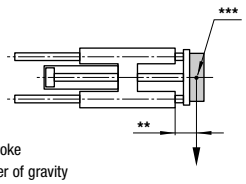
Attention

When using guide blocks (QA/8000/61) for profile cylinders PDA/182000 you have to order a model with a barrel which is turned at 90° (PDA/182000/IIL, .../MIL) so that the port threads are in line with the two switch grooves.

Guide blocks with roller bearings

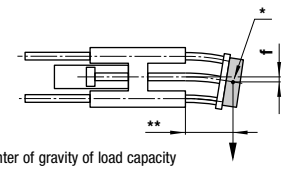
QA/8000/61/*

Ø 32 ... 100 mm



** Outstroke
*** Center of gravity

Maximum load capacity is dependent on the outstroke of a horizontally installed guide unit. In the case of short stroke operation, the load capacity figures taken from the diagram must be multiplied by the correction factor (diagram 2). In the curves of load capacity (diagram 1), the short stroke corrections have already been taken into account for an outstroke > 60 mm.

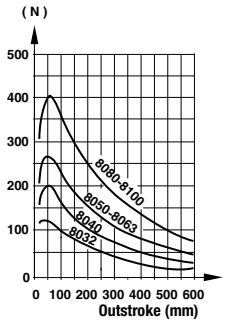


* Center of gravity of load capacity
** Outstroke

The total deflection of guide rods will be determined by the addition of that due to own weight (diagram 3) and that due to load capacity (diagram 4).

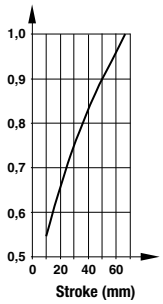
Maximum load capacity depending on outstroke (diagram 1)

Load capacity



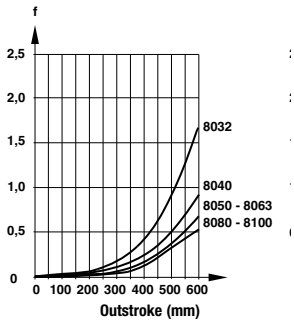
(diagram 2)

Correction factor



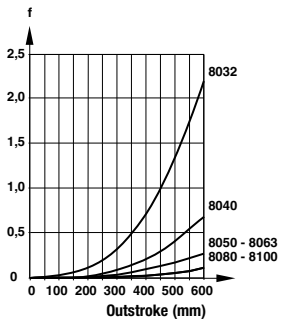
Deflection caused by own weight (diagram 3)

Deflection (mm)



Deflection caused by a load of 10 N (diagram 4)

Deflection (mm)



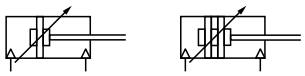
In the case of shock load applications, the figures given in the diagrams above must be reduced by a factor of 2.

ISO/VDMA Profile cylinders

PDA/182000, PDA/182000/M

Double acting

Ø 32 ... 125 mm



Conforms to ISO 6431, VDMA 24562 and NFE 49-003-1

Profile barrel with concealed tie rods

High performance, stability and reliability

Polyurethane seals ensure efficient low friction operation and long life

Switches can be mounted flush with the profile barrel

Comprehensive range of standard mountings

Technical data

Medium:

Compressed air, filtered, lubricated or non-lubricated

Operation:

PDA/182000: Adjustable cushioning
PDA/182000/M: Magnetic piston, adjustable cushioning

Operating pressure:

15 to 232 psig (1 to 16 bar)

Operating temperature:

-4°F to +176°F
(-20°C to +80°C) max.
High temperature versions:
302°F (150°C) max.
Consult our Technical Service for use below +35°F (+2°C)

Strokes:

Standard: see next page
Non-standard strokes available (10 to 3000 mm)

Materials:

Profile barrel: anodized aluminum

End covers: pressure diecast aluminum

Piston rod: stainless steel (Martensitic)

Piston rod seals: polyurethane
Piston seals: polyurethane

'O-rings: nitrile rubber

Standard models

Ø	Piston rod Ø	Port size	Magnetic Standard	Non-rotating	Non-magnetic Standard	Non-rotating	Service kit Standard	Non-rotating
32	12	G1/8	PDA/182032/M/*	PDA/182032/N2/*	PDA/182032/*	PDA/182032/N1/*	QA/8032/00	QA/8032/N1/00
40	16	G1/4	PDA/182040/M/*	PDA/182040/N2/*	PDA/182040/*	PDA/182040/N1/*	QA/8040/00	QA/8040/N1/00
50	20	G1/4	PDA/182050/M/*	PDA/182050/N2/*	PDA/182050/*	PDA/182050/N1/*	QA/8050/00	QA/8050/N1/00
63	20	G3/8	PDA/182063/M/*	PDA/182063/N2/*	PDA/182063/*	PDA/182063/N1/*	QA/8063/00	QA/8063/N1/00
80	25	G3/8	PDA/182080/M/*	PDA/182080/N2/*	PDA/182080/*	PDA/182080/N1/*	QA/8080/00	QA/8080/N1/00
100	25	G1/2	PDA/182100/M/*	PDA/182100/N2/*	PDA/182100/*	PDA/182100/N1/*	QA/8100/00	QA/8100/N1/00
125	32	G1/2	PDA/182125/M/*	–	PDA/182125/*	–	QA/8125/00	–

*Insert stroke length in mm.

Options selector

★P★A/182★★★/★★/★★★★

Special variants	Substitute
Heat resistant seals, 150°C max.	T
Hydraulic	H

Piston rod material	Substitute
Chrome plated stainless steel	D

Threads	Substitute
Metric ports: ISO 228 (G 1/8 to G 1)	A
NPT ports	C

Cylinder diameters (mm)	Substitute
032, 040, 050, 063, 080, 100, 125	

Variants (magnetic piston)	Substitute
Standard	M
Special wiper/seal	W2
Low friction	X2
Piston rod bellow	MG
Without cushioning	MW
Without cushioning, low friction	X4
Double ended piston rod	JM
Double ended piston rod & special wiper/seal	W4
Four-position	MT
Non-rotating piston rod	N2
Locking unit	L4
Barrel turned at 90° for use with guide blocks	MIL
Extended piston rod	MU
Extended piston rod & special wiper/seal	W6

P*A/182***/MU/****/***
/W6/ → Extension (mm)

Strokes (mm)
3000 max.

Variants (non-magnetic piston)	Substitute
Standard	None
Special wiper/seal	W1
Low friction	X1
Piston rod bellow	G
Without cushioning	W
Without cushioning, low friction	X3
Double ended piston rod	J
Double ended piston rod, special wiper/seal	W3
Four-position	IT
Non-rotating piston rod	N1
Locking unit	L2
Barrel turned at 90° for use with guide blocks QA/8000/61/*	IIL
Extended piston rod	IU
Extended piston rod, special wiper/seal	W5

P*A/182***/IU/****/***
/W5/ → Extension (mm)

Note: Disregard option positions not used.
For combinations of cylinder variants consult our Technical Service.

ISO/VDMA Profile cylinders

PDA/182000, PDA/182000/M

Double acting

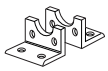
Ø 32 ... 125 mm

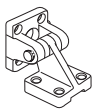
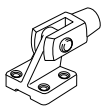
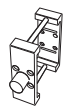
Theoretical forces

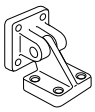
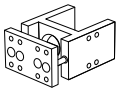
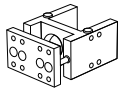
Theoretical forces (lbs) at 87 psig

Cylinder Ø	Outstroke	Instroke
32	108	93
40	170	142
50	265	223
63	421	378
80	679	612
100	1060	994
125	1657	1548

Mountings

Ø	A	AK	B, G	C	D	D2	F
							
32	QM/8032/35	**QM/8025/38**	**QA/8032/22**	**QA/8032/21**	**QA/8032/23**	**QA/8032/42**	**QM/8025/25**
40	QM/8032/35	QM/8040/38	**QA/8040/22**	**QA/8040/21**	**QA/8040/23**	**QA/8040/42**	**QM/8040/25**
50	QM/8050/35	**QM/8050/38**	**QA/8050/22**	**QA/8050/21**	**QA/8050/23**	**QA/8050/42**	**QM/8050/25**
63	QM/8050/35	**QM/8050/38**	**QA/8063/22**	**QA/8063/21**	**QA/8063/23**	**QA/8063/42**	**QM/8050/25**
80	QM/8080/35	QM/8080/38	**QA/8080/22**	**QA/8080/21**	**QA/8080/23**	**QA/8080/42**	**QM/8080/25**
100	QM/8080/35	QM/8080/38	**QA/8100/22**	**QA/8100/21**	**QA/8100/23**	QA/8100/42	**QM/8080/25**
125	QM/8125/35	QM/8125/38	**QM/8125/22**	QM/8125/21	**QM/8125/23**	QA/8125/42	**QM/8125/25**

Ø	L	M	R	S	SS	SW	UF	UH
								
32	**QA/8032/24**	**QM/8032/26**	**QA/8032/27**	QA/8032/41	**M/P19931**	**M/P19493**	**QM/8025/32**	PQA/182032/40
40	**QA/8040/24**	**QM/8040/26**	**QA/8040/27**	**QA/8040/41**	**M/P19932**	**M/P19494**	**QM/8040/32**	PQA/182040/40
50	**QA/8050/24**	**QM/8050/26**	**QA/8050/27**	**QA/8040/41**	**M/P19933**	**M/P19495**	**QM/8050/32**	PQA/182050/40
63	**QA/8063/24**	**QM/8063/26**	**QA/8063/27**	**QA/8063/41**	**M/P19934**	**M/P19496**	**QM/8050/32**	PQA/182063/40
80	**QA/8080/24**	QM/8080/26	**QA/8080/27**	**QA/8063/41**	**M/P19935**	**M/P19497**	**QM/8080/32**	PQA/182080/40
100	**QA/8100/24**	QM/8100/26	**QA/8100/27**	QA/8100/41	M/P19936	**M/P19498**	**QM/8080/32**	PQA/182100/40
125	**QM/8125/24**	QM/8125/26	**QM/8125/27**	QA/8100/41	M/P19937	M/P19499	QM/8125/32	PQA/182125/40

Ø	UL	UR	US	Guide blocks*	Guide blocks*	Locking unit* (passive)	Groove-key
							
32	**QA/8032/43**	**QA/8032/33**	**M/P40310**	QA/8032/51/*	QA/8032/61/*	**QA/8032/59**	Ø32 M/P72816
40	QA/8040/43	QA/8040/33	M/P40311	QA/8040/51/*	QA/8040/61/*	**QA/8040/59**	Ø40 M/P72816
50	**QA/8050/43**	**QA/8050/33**	**M/P40312**	QA/8050/51/*	QA/8050/61/*	**QA/8050/59**	Ø50 M/P72816
63	QA/8063/43	**QA/8063/33**	M/P40313	QA/8063/51/*	QA/8063/61/*	**QA/8063/59**	Ø63 M/P72816
80	QA/8080/43	**QA/8080/33**	**M/P40314**	QA/8080/51/*	QA/8080/61/*	**QA/8080/59**	Ø80 M/P72816
100	QA/8100/43	QA/8100/33	M/P40315	QA/8100/51/*	QA/8100/61/*	QA/8100/59	Ø100 M/P72816
125	QA/8125/43	QM/8125/33	M/P71355	–	–	QA/8125/59	

ISO/VDMA Profile cylinders

PDA/182000, PDA/182000/M

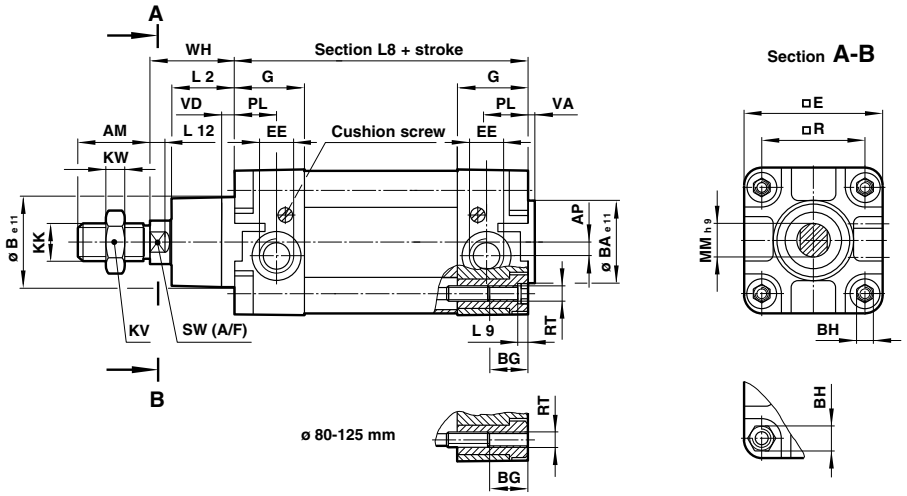
Double acting

Ø 32 ... 125 mm

Dimensions in mm

Standard cylinders

PDA/182000, PDA/182000/M



Ø	AM	AP	Ø B e11	Ø BA e11	BG	BH (A/F)	❑ E	EE	G	KK	KV (A/F)	KW	L2
32	22	3.5	30	30	18	6	47	G 1/8	27.5	M10 x 1.25	17	5	20
40	24	4.5	35	35	18	6	53	G 1/4	32	M12 x 1.25	19	6	22
50	32	6	40	40	18	8	65	G 1/4	31	M16 x 1.5	24	8	27
63	32	10	45	45	17.5	8	75	G 3/8	33	M16 x 1.5	24	8	29
80	40	8.5	45	45	21.5	19	95	G 3/8	33	M20 x 1.5	30	10	33
100	40	9	55	55	21.5	19	115	G 1/2	37	M20 x 1.5	30	10	36
125	54	10	60	60	30	24	140	G 1/2	46	M27 x 2	41	13.5	45

Ø	L8	L9	L12	Ø MM h9	PL	❑ R	RT	SW (A/F)	VA	VD	WH	at 0 mm	per 25 mm
32	94	4	6	12	13	32.5	M 6	10	3	6	26	1.12 lb	0.13 lb
40	105	4	6.5	16	15	38	M 6	13	3.5	6	30	1.80 lb	0.18 lb
50	106	5	8	20	18.5	46.5	M 8	17	3.5	6	37	2.93 lb	0.26 lb
63	121	5	8	20	19	56.5	M 8	17	4	6	37	3.97 lb	0.29 lb
80	128	–	10	25	19	72	M 10	22	4	6	46	7.17 lb	0.44 lb
100	138	–	10	25	18	89	M 10	22	4	6	51	10.6 lb	0.51 lb
125	160	–	13	32	22.5	110	M 12	27	6	15.5	65	17.6 lb	0.73 lb

ISO/VDMA Profile cylinders

PDA/182000, PDA/182000/M

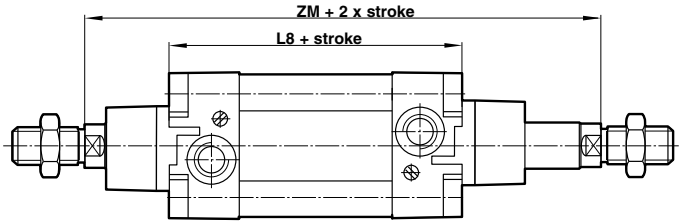
Double acting

Ø 32 ... 125 mm

Dimensions in mm

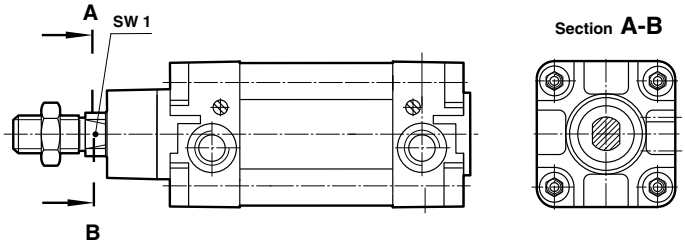
Cylinder variants

PDA/182000/J, PDA/182000/JM — Cylinders with double ended piston rod



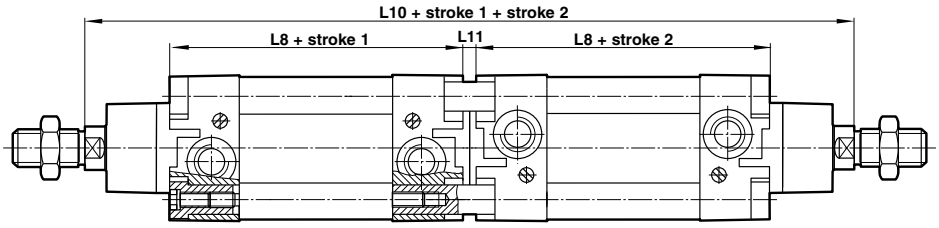
Ø	ZM	L8
32	146	94
40	165	105
50	180	106
63	195	121
80	220	128
100	240	138
125	290	160

PDA/182000/N1, PDA/182000/N2 — Cylinders with non-rotating piston rod



Ø	SW1 (A/F)
32	10
40	13
50	16
63	16
80	21
100	21

PDA/182000/IT, PDA/182000/MT – Four-position cylinders

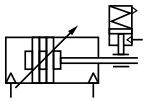


Ø	L 8	L 10	L 11
32	94	247	7
40	105	278	8
50	106	294	8
63	121	325	9
80	128	357	9
100	138	387	9
125	160	462	12

Cylinders with piston rod locking units (ISO/VDMA/NFE)

PDA/182000/L2 & L4, RA/8000/L2 & L4

Ø 32 ... 125 mm



Passive

Magnetic and non-magnetic piston conforms to ISO 6431, VDMA 24562 and NFE 49-003-1

Secure locking of piston rod in any position

Passive locking models

Compact, maintenance-free design

Ø	Magnetic ISO/VDMA/NFE Profile cylinder	ISO/VDMA/NFE Tie-rod cylinder	Non-magnetic ISO/VDMA/NFE Profile cylinder	ISO/VDMA/NFE Tie-rod cylinder
32	PDA/182032/L4/*	DA/8032/L4/*	PDA/182032/L2/*	DA/8032/L2/*
40	PDA/182040/L4/*	DA/8040/L4/*	PDA/182040/L2/*	DA/8040/L2/*
50	PDA/182050/L4/*	DA/8050/L4/*	PDA/182050/L2/*	DA/8050/L2/*
63	PDA/182063/L4/*	DA/8063/L4/*	PDA/182063/L2/*	DA/8063/L2/*
80	PDA/182080/L4/*	DA/8080/L4/*	PDA/182080/L2/*	DA/8080/L2/*
100	PDA/182100/L4/*	DA/8100/L4/*	PDA/182100/L2/*	DA/8100/L2/*
125	PDA/182125/L4/*	DA/8125/L4/*	PDA/182125/L2/*	DA/8125/L2/*

* Insert stroke length in mm.

Locking unit includes cartridge

For non-magnetic versions substitute L2 for L4.

For all applications please consult our Technical Service.

Technical data

Medium:

Compressed air, filtered, lubricated or non-lubricated

Type:

Passive model – pressure applied to release

Operating pressure:

58 to 145 psig (4 to 10 bar)

Operating temperature:

+32°F to 176°F (0°C to +80°C). Consult our Technical Service for use below +35°F (+2°C).

Materials

Body: hard anodised diecast aluminum

Seals: polyurethane & nitrile

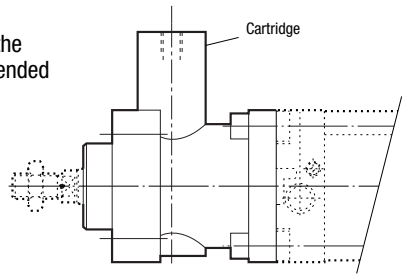
Cartridge: anodized aluminum body

Locking wedges: hardened steel

Ø	Locking unit Passive	Spare cartridge only Passive
32	QA/8032/59	QA/8032/63
40	QA/8040/59	QA/8040/63
50	QA/8050/59	QA/8050/63
63	QA/8063/59	QA/8063/63
80	QA/8080/59	QA/8100/63
100	QA/8100/59	QA/8100/63
125	QA/8125/59	QA/8125/63

Locking unit

If retro fitting locking unit the cylinder must be of an extended piston rod design.

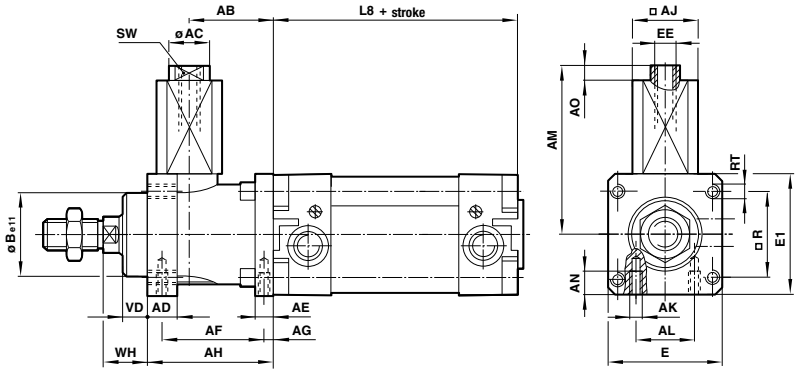


Cylinders with piston rod locking units (ISO/VDMA/NFE)

PDA/182000/L2 & L4, RA/8000/L2 & L4

Ø 32 ... 125 mm

Dimensions in mm



Ø	AB	Ø AC	AD	AE	AF	AG	AH	❑ AJ	AK	AL	AM	AN
32	32	10	12	8	40	4	48	22.5	M 5	20	71	8
40	35.5	10	12	10	46	4.5	55	27.5	M 5	24	74.5	10
50	49	15	16	15	54	11.5	70	32.5	M 6	30	91.5	12
63	49	15	15	15	55	7.5	70	41	M 8	38	108.5	12
80	62	19	16	16	.70	10	90	53	M 8	48	141.5	16
100	65	19	18	16	70	10	92	53	M 8	48	141.5	16
125	85	19	27	25	95	11	122	65	M 10	65	152	20

Ø	AO	Ø B e11	E	E 1	EE	L 8	❑ R	RT	SW (A/F)	VD	WH
32	4	30	48	50	M 5	94	32.5	M 6	8	10	16
40	4	35	56	58	G 1/8	105	38	M 6	8	10	18
50	4	40	68	70	G 1/8	106	46.5	M 8	13	12	22
63	4	45	82	85	G 1/8	121	56.5	M 8	13	12	20
80	4	45	100	105	G 1/8	128	72	M 10	17	20	33
100	4	55	120	130	G 1/8	138	89	M 10	17	23	38
125	4	60	140	150	G 1/8	160	110	M 12	17	32	65

Lock retention forces

Ø	Locking forces
32	135 lbs
40	225 lbs
50	338 lbs
63	495 lbs
80	1125 lbs
100	1125 lbs
125	1575 lbs

C/146000, C/146100, C/146200

LINTRA®PLUS rodless cylinders
Magnetic piston
Double acting
Ø 16 to 80 mm

New lightweight design extrusion with universal mounting grooves

Proven and patented sealing system

Dust protection as standard (Ø 25 to 63 mm)

Interchangeability with series C/46000

Technical data

Medium:
Compressed air. filtered.
lubricated or non-lubricated

Operation:
C/146000/M, C/146100/M, C/146200/M
Double acting with adjustable cushioning and magnetic piston

Models:
C/146000 with internal guide
C/146100 with external adjustable guide
C/146200 with precision roller guide

Operating pressure:
14.5 to 116 psi (1 to 8 bar)

Operating temperature:
-22°F to 176°F (-30°C to +80°C) max.
(consult our Technical Service for use below 36°F [+2°C])

Cylinder diameter:
16, 20, 25, 32, 40, 50, 63, 80 mm

Max strokes:
Ø 16 to 40 mm: 27.9' (8500 mm)
Ø 50 and 63 mm: 26.2' (8000 mm)
Ø 80 mm: 18' (5500 mm)

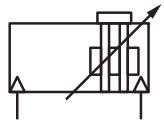
Materials:

End covers: aluminum diecast, molded plastic (Ø 16) and anodized aluminum (Ø 20 & 80)
Yoke: anodized aluminum, molded plastic (Ø 16 & 20)
Carriage, closer & cover: aluminum diecast
Guiding bridge and profile barrel: anodized aluminum
Seal strip, wiper and piston seal: polyurethane
Cover strip: polyamide
Other seals: nitrile rubber

Ordering example
see page 2

Mountings and switches
see page 3 & 4

Cylinder with linear position sensor C/146000/F1
see page 2 & 20



Magnetic piston

Symbol	Type (magnetic piston)	Description	Page
	C/146000/M	With internal guide	7
	C/146100/M	With external adjustable guide	9, 10
	C/146200/M	With precision roller guide (ø 25 ... 63 mm)	13
	C/146200/PM	With added caged ball linear motion guide (ø 25 ... 63 mm)	15
	C/146000/MC	With alternative ports (ø 25...63 mm)	29
	C/146100/MC		
	C/146200/MC		
		Cylinder with double carriages	
	C/146100/MD	With external adjustable guide (ø 16 ... 80 mm)	11, 12
	C/146200/MD	With precision roller guide (ø 25 ... 63 mm)	14
	C/146000/L3	Active holding brake (ø 25 ... 63 mm) Applying pressure activates the brake The brake lining is pushed against a stainless steel strip. To release, depressurize.	16, 17
	C/146000/L4	Passive holding brake; (ø 25 ... 63 mm) Applying pressure releases the brake. When the pressure is released the brake lining is pushed against the stainless steel strip by a spring loaded plate.	18, 19
	C/146000/F1	With internal guide and linear position sensor (ø 32 ... 63 mm) Electrical data of linear position sensor: Operating voltage: 10 ... 30 V d.c.. resolution 16 bit. Repeat accuracy 0.006 %. output 4 ... 20 mA. short-circuit protection Linearity 0.05 % of measuring range. protection class IP67	20
	C/146100/F1	With external adjustable guide and linear position sensor (ø 32 ... 63 mm)	21
	C/146200/F1	With precision roller guide and linear position sensor (ø 32 ... 63 mm)	21

Options selector

C / 146 ★★★ / MC / ★★★★

Optional finish	Substitute
Standard non-anodized caps	Blank
Black anodized caps and carriage	A
Black anodized caps and carriage with stainless steel hardware	AS

Note: Options A and AS available only on metric port.

Ports	Substitute
NPT ports (Ø 20 to 80 mm)	C
Metric ports (Ø 16 to 80 mm)	M

Guiding system	Substitute
Internal	0
External	1
Roller	2

Cylinder Ø (mm)	Substitute
16	16
20	20
25	25
32	32
40	40
50	50
63	63
80	80

Note: Disregard option positions not used.
For combinations of cylinder variants consult our Technical Service.
This options selector explains only the cylinder variants.
Additional variants/options are not possible.

Strokes (on request)	
Provide in Inches	C version
Provide in Metric	M version

Options (magnetic piston) STD.	Substitute
Magnetic piston (standard on 16, 20, and 80 mm bores)	M
Alternative ports (standard 25, 32, 40, 50, 63 mm bores)	MC[1]
Active brake (25 to 63 mm bores)	L3
Passive brake (25 to 63 mm bores)	L4
With added caged ball linear motion guide	PM†
With linear position sensor (32 to 63 mm bores)	F1
Double carriages *	MD**

* For C/146100 & C/146200 only
** MD option available in 1461** External and 1462** Roller guided carriage

C/146***/MD/****/****
Effective stroke
Distance between carriage centers (inches)

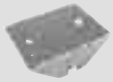
1 Not available on 16, 20, 80 mm bores.
† Order PM option as 1462**

Ordering information

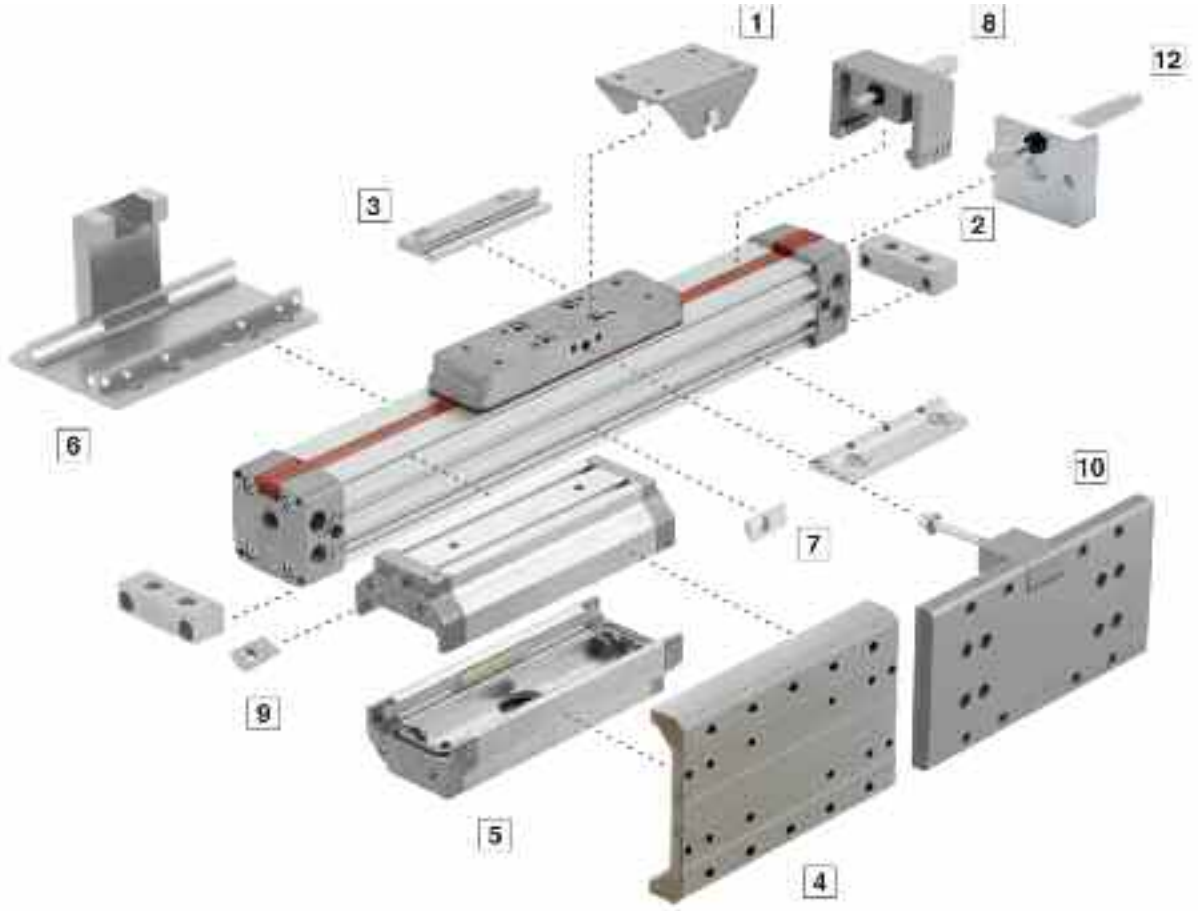
Cylinder

LINTRA® cylinder with internal guiding system.
Ø 32 mm cylinder diameter and 10' (3000 mm) stroke length with magnetic piston, and NPT ports.
Quote: **C/146032/MC/120**

Mountings

	Type C Foot Mount  2	Type S Swinging Bridge  1	Type UV Carriage Bracket  6	Type UW Side Mounting Plate  4	Type V Center Support  3	Type W Secondary Carriage  5
Ø mm	**Page 21**	**Page 23**	**Page 22**	**Page 24**	**Page 21**	**Page 24**
16	QM/146016/21	QM/146016/37	QM/146016/34	-	QM/146016/32	QM/146116/35
20	QM/146020/21	QM/146020/37	QM/146020/34	QM/146120/36	QM/146020/32	QM/146120/35
25	QM/146025/21	QM/146025/37	QM/146025/34	QM/146125/36	QM/146025/32	QM/146125/35
32	QM/146032/21	QM/146032/37	QM/146032/34	QM/146132/36	QM/146032/32	QM/146132/35
40	QM/146040/21	QM/146032/37	QM/146040/34	QM/146140/36	QM/146040/32	QM/146140/35
50	QM/146050/21	QM/146050/37	QM/146050/34	QM/146150/36	QM/146050/32	QM/146150/35
63	QM/146063/21	QM/146050/37	QM/146063/34	QM/146163/36	QM/146063/32	QM/146163/35
80	QM/146080/21	QM/146080/37	QM/146080/34	-	QM/146080/32	QM/146180/35

	Assembly kit for caged ball linear motion guide  10	Adjustable stop  8	Assembly kit for shock absorbers  12	Groove key for profile barrel  7	Groove key for guiding bridge  9
Ø mm	**Page 16**	**Page 24**	**Page 25**	**Page 22**	**Page 22**
25	QM/146225/P/70	QM/146125/75	QM/146125/67	M/P74065	M/P74065
32	QM/146232/P/70	QM/146132/75	QM/146132/67	M/P74065	M/P74065
40	QM/146240/P/70	QM/146140/75	QM/146140/67	M/P74065	M/P74066
50	QM/146250/P/70	–	QM/146150/67	M/P74065	M/P41858
63	QM/146263/P/70	–	QM/146163/67	M/P74065	M/P41858



NORGREN

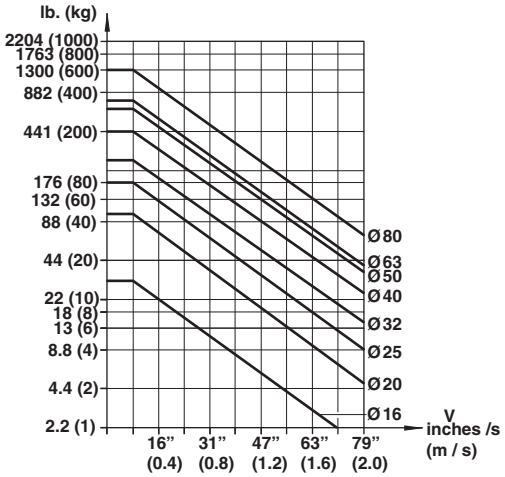
Switches

	With cable		With connector (M8x1)					Cable		Cable with	
Type		Voltage		Current	Temperature	LED	Features	Connector	Cable	connector	
Reed	Solid state	V AC	V DC	max.	°F			length	type	straight	Datasheet
M/50/LSU/*V	–	10 to 240	10 to 170	180 mA	-4 to +176	•	–	8', 33'	PVC 2 x 0.25	–	N/en **4.3**.005
M/50/LSU/5U	–	10 to 240	10 to 170	180 mA	-4 to +176	•	–	16'	PUR 2 x 0.25	–	N/en **4.3**.005
TM/50/RAU/2S	–	10 to 240	10 to 170	180 mA	-4 to +302	–	–	6.5'	Silicone 2 x 0.25	–	N/en **4.3**.005
M/50/RAC/5V	–	10 to 240	10 to 170	180 mA	-4 to +176	–	Changeover	16'	PVC 3 x 0.25	–	N/en **4.3**.005
M/50/LSU/CP	–	10 to 60	10 to 75	180 mA	-4 to +176	•	Plug M8x1	16'	PVC 3 x 0.25	M/P73001/5	N/en **4.3**.005
–	M/50/EAP/*V	–	10 to 30	150 mA	-4 to +176	•	PNP	8', 33'	PVC 3 x 0.25	–	N/en **4.3**.007
–	M/50/EAP/CP	–	10 to 30	150 mA	-4 to +176	•	PNP, plug M8x1	16'	PVC 3 x 0.25	M/P73001/5	N/en **4.3**.007
–	M/50/EAP/CC	–	10 to 30	150 mA	-4 to +176	•	PNP, plug M12x1	16'	PVC 3 x 0.25	M/P34614/5	N/en **4.3**.007
–	M/50/EAN/*V	–	10 to 30	150 mA	-4 to +176	•	NPN	8', 33'	PVC 3 x 0.25	–	N/en **4.3**.007
–	M/50/EAN/CP	–	10 to 30	150 mA	-4 to +176	•	NPN, plug M8x1	16'	PVC 3 x 0.25	M/P73001/5	N/en **4.3**.007

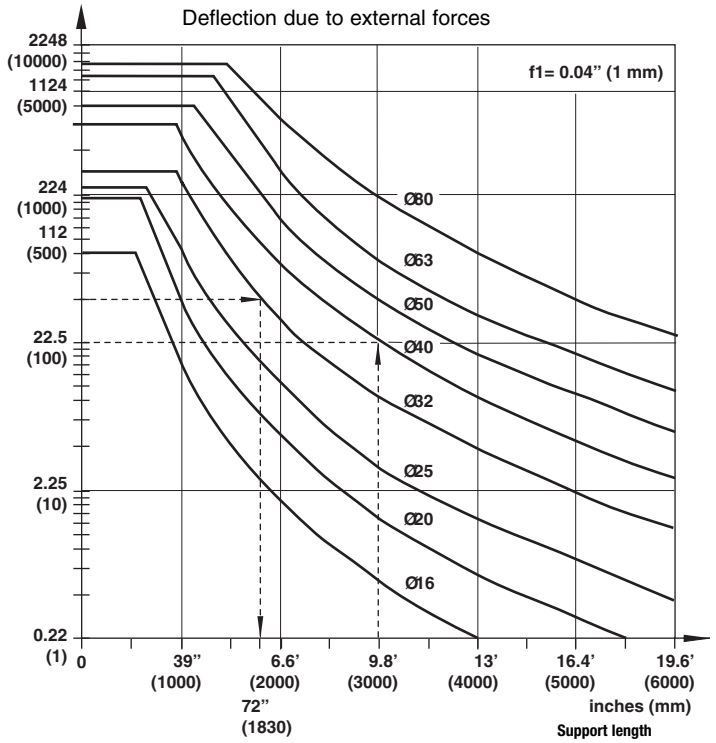
* Please insert cable length

Cushioning Performance

The dynamic energy of a LINTRA® cylinder is caused by direct or partial external loads which must be absorbed by pneumatic cushioning.
The cushioning ability depends to a large extent on the pneumatic circuit (e. g. counter pressure, pre-exhaust). The values given in the diagram were tested with an operation pressure of 87 psi (6 bar) using a 5/2 control valve. When installed horizontally, depending upon the speed, dynamic energy can be absorbed by the cylinder. Whenever the values given in the diagram are exceeded, the transported mass must be cushioned by additional shock absorbers. These have to be located at the center of gravity of the mass.

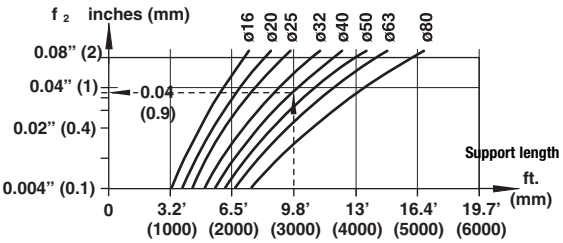


Cylinder deflection



Example:
Cylinder Ø 32 mm, stroke length 11' (3500 mm), external load 45 lbf. (200 N) and a deflection about 0.04 (1 mm).
Maximum distance between supports = 6' (1830 mm) (see diagrams).
Therefore an additional support is required.

Deflection due to cylinder weight



Example:
Cylinder Ø 40 mm. external force 40 lbf (180 N), distance between supports 10' (3000 mm)
Required: total deflection
1. Deflection due to external force (f1)
see Diagram 1 (1mm/100 N) · 40 lbf (180 N)

0.07"(1.8 mm)

2. Deflection due to cylinder weight diagram 2 **+ 0.04"(0.9 mm)**

Total deflection: **0.2" (2.7 mm)**

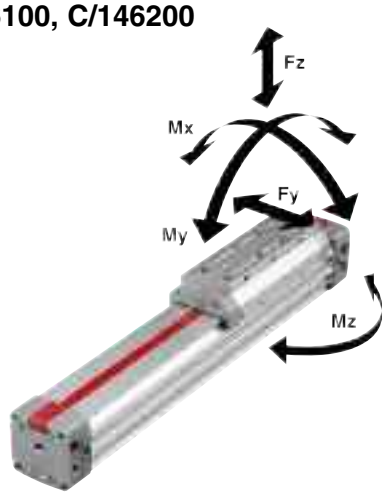
Max. permitted deflection (f1 + f2) **< 0.04"(1 mm)**
39"(1000 mm) Stroke

A deflection of more than 0.12" (3 mm) is not permitted.

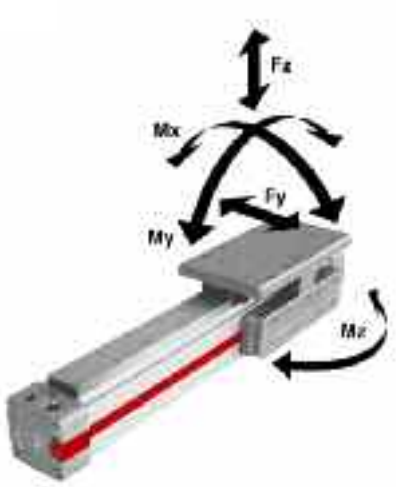
Theoretical forces, air consumption, cushioning length, holding forces

Cylinder Ø mm	Theoretical forces lbf (N) at 87 psi (6 bar)	Air consumption ft^3/in. (l/cm) of stroke at 87 psi (6 bar)	Cushioning length inches (mm)	Holding forces lbf. (N) of brake (on dry braking surface) active (L3) at 87 psi (6 bar)	passive (L4)
16	27 (120)	0.001 (0.014)	0.5 (12)	–	–
20	42 (188)	0.002 (0.022)	1 (26)	–	–
25	66 (294)	0.003 (0.035)	1 (26)	112 (5000	50 (220)
32	108 (482)	0.005 (0.056)	1.4 (35)	202 (900)	84 (375)
40	170 (754)	0.008 (0.088)	2 (50)	337 (1500)	141 (630)
50	265 (1178)	0.012 (0.137)	2.3 (60)	562 (2500)	225 (1000)
63	420 (1870)	0.02 (0.218)	2.8 (70)	899 (4000)	371 (1650)
80	678 (3016)	0.03 (0.350)	3 (75)	–	–

C/146000, C/146100, C/146200



C/146200/P



	Internal guide C/146000					External adjustable guide C/146100			Precision roller guide C/146200				Added caged ball linear motion guide C/146200/P		
Ø mm	Fy lbf. (N)	Fz lbf. (N)	Mx lbf in. (Nm)	My lbf in. (Nm)	Mz lbf in. (Nm)	Fy, Fz lbf. (N)	Mx lbf in. (Nm)	My, Mz lbf in. (Nm)	Fy lbf. (N)	Fz lbf. (N)	Mx lbf in. (Nm)	My, Mz lbf in. (Nm)	Fy, Fz lbf. (N)	Mx lbf in. (Nm)	My, Mz lbf in. (Nm)
16	9	27	2.7	33.6	9.7	45	17.7	48.7	–	–	–	–	–	–	–
	(40)	(120)	(0.3)	(3.8)	(1.1)	(200)	(2)	(5.5)	–	–	–	–	–	–	–
20	20	63	8.0	106.2	31.9	106	53.1	159.3	–	–	–	–	–	–	–
	(90)	(280)	(0.9)	(12)	(3.6)	(470)	(6)	(18)	–	–	–	–	–	–	–
25	28	87	13.3	168.2	49.6	133	79.7	247.8	133	266	115.1	371.7	450	283	1770
	(125)	(385)	(1.5)	(19)	(5.6)	(590)	(9)	(28)	(590)	(1180)	(13)	(42)	(2000)	(32)	(200)
32	37	113	26.6	292.1	88.5	176	150.5	380.6	176	351	221.3	566.5	899	566	3540
	(165)	(500)	(3)	(33)	(10)	(780)	(17)	(43)	(780)	(1560)	(25)	(64)	(4000)	(64)	(400)
40	74	223	57.5	743.5	212.4	360	345.2	973.6	338	676	513.4	1416.2	899	566	3540
	(330)	(990)	(6.5)	(84)	(24)	(1600)	(39)	(110)	(1500)	(3000)	(58)	(160)	(4000)	(64)	(400)
50	99	297	97.4	1062.1	309.8	450	575.3	1416.2	450	901	858.6	2124.3	1798	1593	7080
	(440)	(1320)	(11)	(120)	(35)	(2000)	(65)	(160)	(2000)	(4000)	(97)	(240)	(8000)	(180)	(800)
63	155	450	177.0	2124.3	619.6	721	1062.1	3097.9	721	1441	1593.2	4602.6	1798	1593	7966
	(690)	(2000)	(20)	(240)	(70)	(3200)	(120)	(350)	(3200)	(6400)	(180)	(520)	(8000)	(180)	(900)
80	176	518	239.0	3186.4	885.1	878	1593.2	4602.6							
	(780)	(2300)	(27)	(360)	(100)	(3900)	(180)	(520)	–	–	–	–	–	–	–

Loading values applicable to a speed of ⩽0.2 m/s. Maximum working life is normally reached below a speed of 1 m/s.
* The forces and moments refers to the center of the guide. They must not be exceeded in dynamic applications.

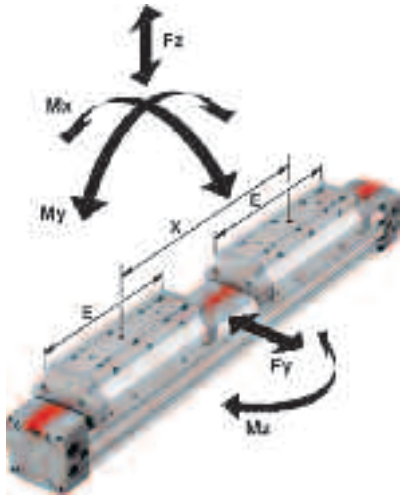
Loading values for LINTRA® cylinders with double carriages

The values given in the table below show the single forces in the directions Fy and Fz and the maximum moments Mx, My and Mz. All values are applicable only for speeds of max. 0.2 m/s.
A requirement for using these values is a constant movement (no jerking) of the mass over the whole stroke length of the cylinder.
The reference point from which the moments for all cylinders should be calculated is the center line of the pistons.

When a LINTRA® cylinder has to take several loads and moments. an additional calculation is necessary using this formula:

$$\frac{Mx}{Mx\ max} + \frac{My}{My\ max} + \frac{Mz}{Mz\ max} + \frac{Fy}{Fy\ max} + \frac{Fz}{Fz\ max} \leq 1$$

C/146100/MD



Ø mm	External adjustable guide. C/146100/MD Fy. Fz lbf (N)	Mx lbf in (Nm)	My. Mz (Nm) x min.=E lbf in (Nm)	x=4" (100 mm) lbf in (Nm)	x=6" (150 mm) lbf in (Nm)	x=8" (200 mm) lbf in (Nm)	x=10" (250 mm) lbf in (Nm)	x=12" (300 mm) lbf in (Nm)	x=14" (350 mm) lbf in (Nm)	x=16" (400 mm) lbf in (Nm)	x=18" (450 mm) lbf in (Nm)	x=20" (500 mm) lbf in (Nm)
16	90	36	120	156	204	252	312	360	420	480	528	588
	(400)	(4)	(14)	(17)	(23)	(29)	(35)	(41)	(48)	(54)	(60)	(66)
20	211.33	1296	6768	–	8496	10512	1272	1236	1404	1572	1740	1920
	(940)	(12)	(64)	–	(80)	(99)	(119)	(139)	(158)	(178)	(197)	(217)
25	265.29	156	852	–	936	1164	1368	1596	1812	2040	2256	2472
	(1180)	(18)	(96)	–	(106)	(131)	(155)	(180)	(205)	(230)	(255)	(279)
32	350.72	300	1368	–	–	1596	1884	2172	2460	2748	3036	3324
	(1560)	(34)	(155)	–	–	(181)	(213)	(246)	(278)	(310)	(343)	(375)
40	674.46	696	3480	–	–	–	3852	4392	4932	5472	6012	6552
	(3000)	(78)	(393)	–	–	–	(435)	(496)	(557)	(618)	(679)	(740)
50	899.28	1152	4044	–	–	–	4044	4584	5124	5652	6192	6732
	(4000)	(130)	(457)	–	–	–	(457)	(518)	(579)	(639)	(700)	(761)
63	1438.85	2124	11328	–	–	–	–	–	12036	13272	14424	15660
	(6400)	(240)	(1280)	–	–	–	–	–	(1360)	(1500)	(1630)	(1770)
80	1753.60	3192	16908	–	–	–	–	–	–	17172	18672	20088
	(7800)	(360)	(1910)	–	–	–	–	–	–	(1940)	(2110)	(2270)

Ø mm	Precision roller guide C/146200/MD Fy. Fz lbf (N)	Mx lbf in (Nm)	My. Mz x min.=E lbf in (Nm)	x=4" (100 mm) lbf in (Nm)	x=6" (150 mm) lbf in (Nm)	x=8" (200 mm) lbf in (Nm)	x=10" (250 mm) lbf in (Nm)	x=12" (300 mm) lbf in (Nm)	x=14" (350 mm) lbf in (Nm)	x=16" (400 mm) lbf in (Nm)	x=18" (450 mm) lbf in (Nm)	x=20" (500 mm) lbf in (Nm)
25	265	228	1104	–	1224	1500	1788	2076	2364	2652	2940	3216
	(1180)	(26)	(125)	–	(138)	(170)	(202)	(234)	(267)	(299)	(332)	(363)
32	351	444	1788	–	–	2076	2448	2832	3192	3564	3948	4320
	(1560)	(50)	(202)	–	–	(235)	(277)	(320)	(361)	(403)	(446)	(488)
40	674	1032	4524	–	–	–	5004	5712	6408	7104	7812	8520
	(3000)	(116)	(511)	–	–	–	(566)	(645)	(724)	(803)	(883)	(962)
50	899	1716	5256	–	–	–	5256	5952	6660	7356	8052	8748
	(4000)	(194)	(594)	–	–	–	(594)	(673)	(753)	(831)	(910)	(989)
63	1439	3192	14724	–	–	–	–	–	15648	16368	18756	20364
	(6400)	(360)	(1664)	–	–	–	–	–	(1768)	(1850)	(2119)	(2301)

Loading values applicable to a speed of ⩽0.2 m/s. Maximum working life is normally reached below a speed of 1 m/s.
* The forces and moments refers to the center of the guide. They must not be exceeded in dynamic applications.

Loading values for LINTRA® cylinders with double carriages

The values given in the table below show the single forces in the directions Fy and Fz and the maximum moments Mx, My and Mz. All values are applicable only for speeds of max. 0.2 m/s.
A requirement for using these values is a constant movement (no jerking) of the mass over the whole stroke length of the cylinder.
The reference point from which the moments for all cylinders should be calculated is the center line of the pistons.

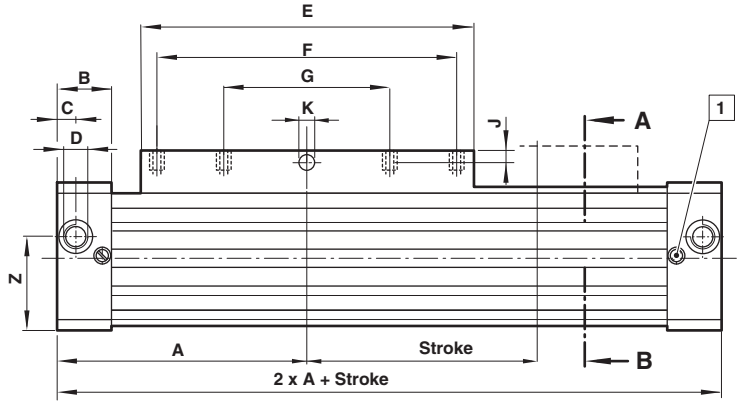
For speeds up to 2 m/s please use our calculation program LINTRA® PNEUCALC. It is available upon request.
When a LINTRA® cylinder has to take several loads and moments. an additional calculation is necessary using this formula:

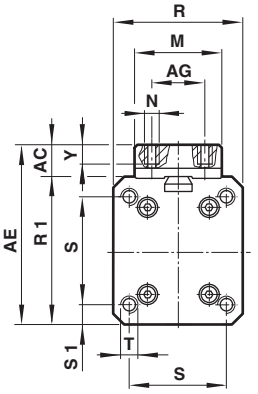
$$\frac{Mx}{Mx\ max} + \frac{My}{My\ max} + \frac{Mz}{Mz\ max} + \frac{Fy}{Fy\ max} + \frac{Fz}{Fz\ max} \leq 1$$

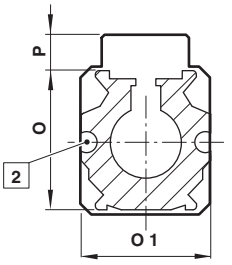
Cylinder with internal guide

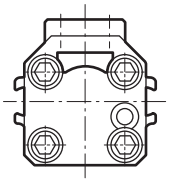
C/146000 cylinder ø 20 to 80 mm
M/146000 cylinder ø 16 to 80 mm

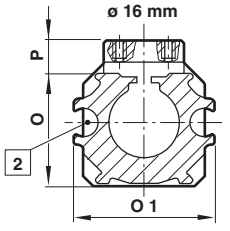
C/146000 – cylinder with internal guide (ø 20 mm)
M/146000 – cylinder with internal guide (ø 16 and 20 mm)











1 **Cushion screw**

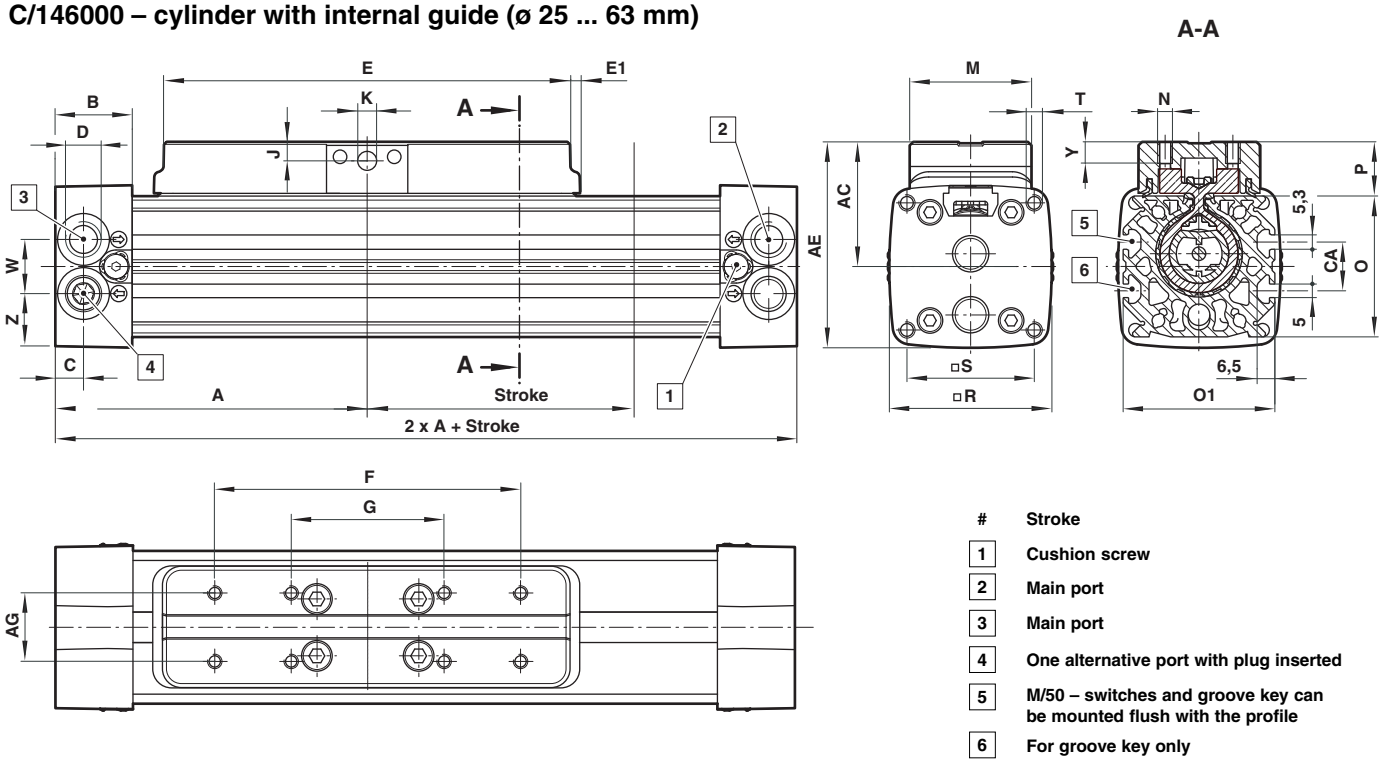
2 **M/50 – switches and groove key can be mounted flush with the profile**

Type	Ø	A	AC	AE	AG	B	C	D	E	F	G	J	Ø K^{D7}
M/146016/...	16	2.46	0.28	1.50	0.31	0.69	0.31	M5	3.15	2.36	–	0.10	0.12
		(62.5)	(7)	(38)	(8)	(17.5)	(8)	M5	(80)	(60)	–	(2.5)	(3)
C/146020/...	20	3.34	0.55	2.13	0.71	0.91	0.31	1/8 NPT	4.33	3.15	1.57	0.14	0.17
		(85)	(14)	(54)	(18)	(23)	(8)	G1/8	(110)	(80)	(40)	(3.5)	(4.2)

Type	Ø	M	N	O	O 1	P	R	R 1	S	S 1	T	Y	Z	Weight at 0 mm	Weight per 100 mm
M/146016/...	16	0.71	M3	0.98	1.26	0.47	1.06	1.22	0.63	0.22	M3-5*	0.16	0.65	0.35 lbs..	0.22 lbs.
		(18)	M3	(25)	(32)	(12)	(27)	(31)	(16)	(5.5)	M3-5*	(4)	(16.5)	(0.35 kg)	(0.10 kg)
C/146020/...	20	1.06	M5	1.26	1.50	0.73	1.57	1.57	1.26	0.16	M5-12*	0.47	0.81	1.10 lbs.	0.33 lbs.
		(27)	M5	(32)	(38)	(18.5)	(40)	(40)	(32)	(4)	M5-12*	(12)	20.5	(0.50 kg)	(0.15 kg)

* deep

C/146000 – cylinder with internal guide (ø 25 ... 63 mm)



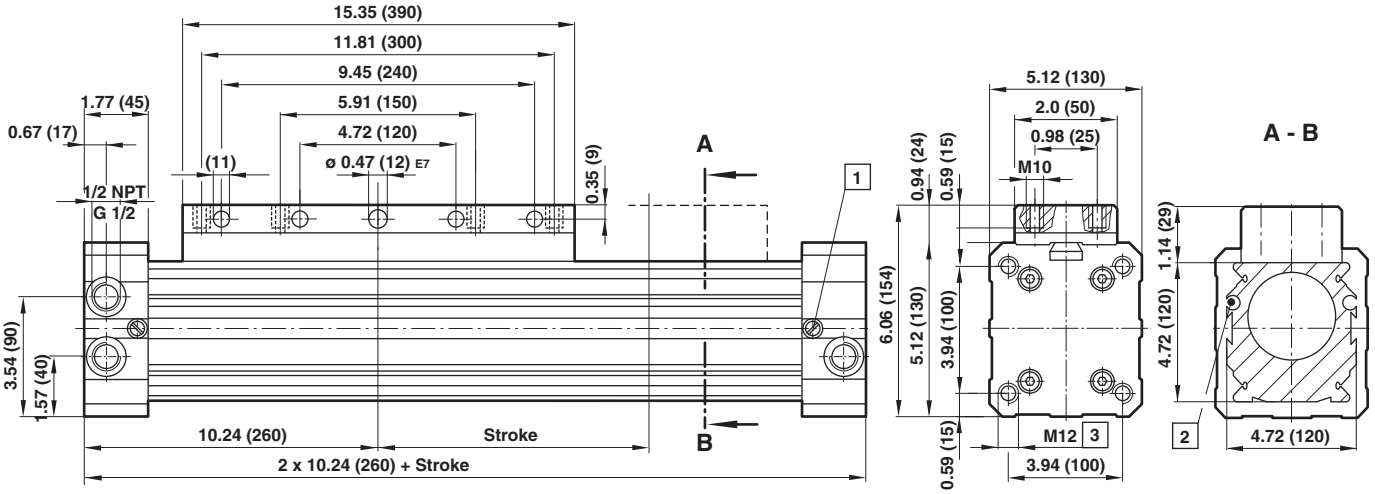
#	Stroke
1	Cushion screw
2	Main port
3	Main port
4	One alternative port with plug inserted
5	M/50 – switches and groove key can be mounted flush with the profile
6	For groove key only

Type	Ø	A	AC	AE	AG	B	C	CA	D	E	E1	F	G	J	Ø K^{D7}
C/146025/...	25	3.94	1.42	2.20	0.78	0.91	0.33	–	1/8 NPT	5.12	–	3.54	1.77	0.19	0.20
		(100)	(36)	(56)	(20)	(23)	(8.5)	–	G1/8	(130)	–	(90)	(45)	(4.7)	(5)
C/146032/...	32	4.72	1.81	2.99	0.98	1.12	0.41	0.71	1/4 NPT	6.30	0.14	4.72	2.36	0.28	0.28
		(120)	(46)	(76)	(25)	(28.5)	(10.5)	(18)	G1/4	(160)	(3.5)	(120)	(60)	(7)	(7)
C/146040/...	40	5.91	2.07	3.54	0.98	1.12	0.45	0.71	1/4 NPT	8.46	–	6.30	3.15	0.28	0.28
		(150)	(52.5)	(90)	(25)	(28.5)	(11.5)	(18)	G1/4	(215)	–	(160)	(80)	(7)	(7)
C/146050/...	50	7.09	2.58	4.33	0.98	1.50	0.59	0.94	3/8 NPT	9.84	–	7.48	3.74	0.37	0.35
		(180)	(65.5)	(110)	(25)	(38)	(15)	(24)	G3/8	(250)	–	(190)	(95)	(9.5)	(9)
C/146063/...	63	8.46	3.25	4.92	0.98	1.50	0.67	–	1/2 NPT	12.60	–	9.45	4.72	0.37	0.35
		(215)	(82.5)	(125)	(25)	(38)	(17)	–	G1/2	(320)	–	(240)	(120)	(9.5)	(9)

Type	Ø	M	N	O	O 1	P	R	S	T	W	Y	Z	Weight at 0 mm	Weight per 100 mm
C/146025/...	25	1.26	M5	1.57	1.81	0.63	1.89	1.46	M5-13*	0.63	0.28	0.63	1.5 lbs.	0.55 lbs.
		(32)	M5	(40)	(46)	(16)	(48)	(37)	M5-13*	(16)	(7)	(16)	0.7 kg	0.25 kg
C/146032/...	32	1.77	M5	2.05	2.20	0.79	2.36	1.85	M6-17*	0.79	0.31	0.79	3 lbs.	0.66 lbs.
		(45)	M5	(52)	(56)	(20)	(60)	(47)	M6-17*	(20)	(8)	(20)	1.40 kg	0.30 kg
C/146040/...	40	1.77	M6	2.56	2.68	0.79	2.93	2.28	M8-20*	0.98	0.31	0.98	5.5 lbs.	0.93 lbs.
		(45)	M6	(65)	(68)	(20)	(74.5)	(58)	M8-20*	(25)	(8)	(25)	2.50 kg	0.42 kg
C/146050/...	50	1.97	M8	3.15	3.31	1.00	3.50	2.76	M8-20*	1.18	0.43	1.16	9.7 lbs.	1.3 lbs.
		(50)	M8	(80)	(84)	(25.5)	(89)	(70)	M8-20*	(30)	(11)	(29.5)	4.40 kg	0.62 kg
C/146063/...	63	1.97	M8	3.74	3.82	0.98	4.13	3.31	M10-24*	1.38	0.43	1.38	15.2 lbs.	2 lbs.
		(50)	M8	(95)	(97)	(25)	(105)	(84)	M10-24*	(35)	(11)	(35)	6.90 kg	0.9 kg

* deep

C/146080 – cylinder with internal guide (ø 80 mm)



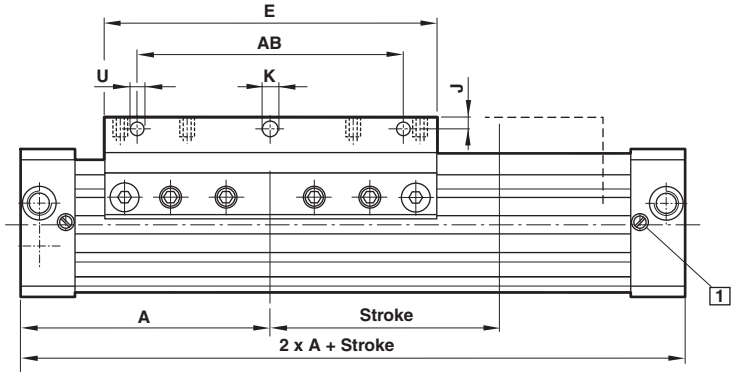
Type	Ø	Weight at 0 mm	Weight per 100 mm
C/146080/	80	29 lbs. (13.20 kg)	3 lbs. (1.50 kg)

1 Cushion screw
2 M/50 – switches and groove key can be mounted flush with the profile
3 26 deep

Cylinder with external adjustable guide

C/146100 cylinder ø 20 to 80 mm
M/146100 cylinder ø 16 to 80 mm

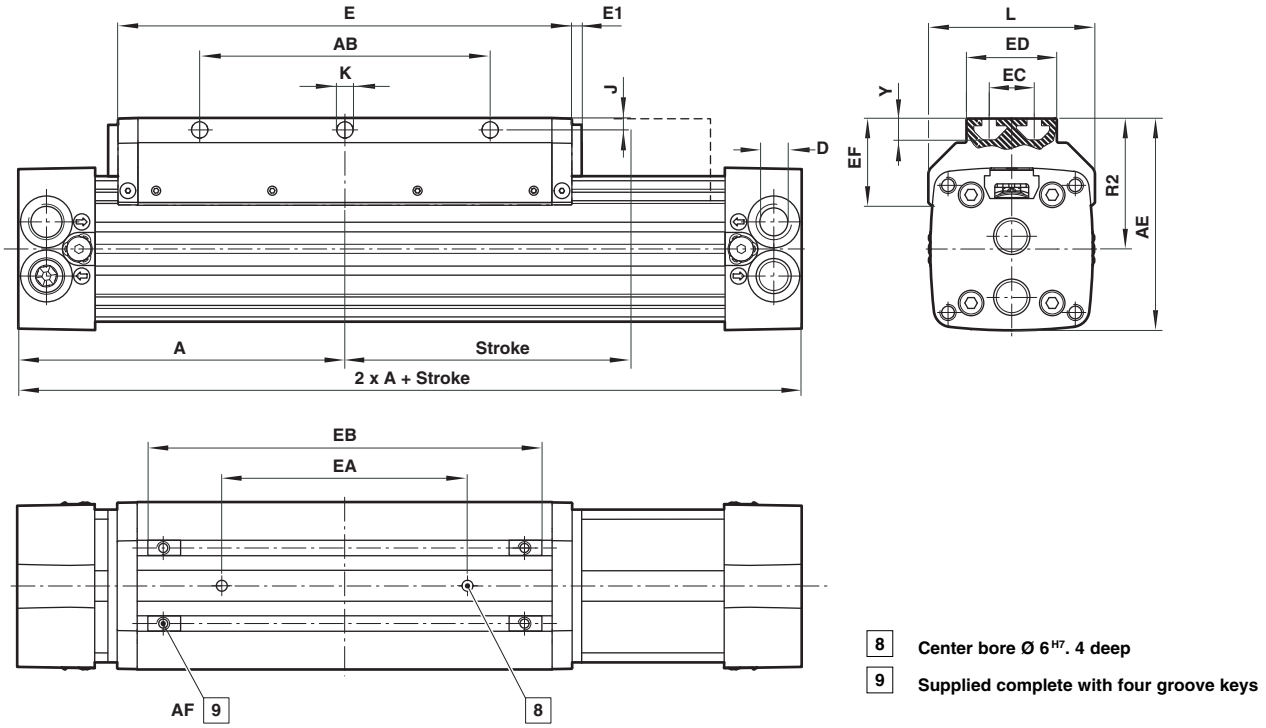
C/146100 – cylinder with external guide (ø 20 mm)
M/146100 – cylinder with external guide (ø 16 & 20 mm)



1 Cushion screw

Type	Ø	A	AB	AE	AD	E	M	J	Ø K	L	R 2	U	Y	Weight at 0 mm	Weight per 100 mm
M/146116/...	16	2.46	–	1.50	0.30	3.15	0.71	–	–	1.22	0.73	–	0.20	0.31 oz.	0.22 lbs.
		(62.5)	–	(38)	(7.5)	(80)	(18)	–	–	(31)	(18.5)	–	(5)	0.18 kg	0.10 kg
C/146120/...	20	3.35	2.36	2.32	0.26	4.33	1.06	0.30	0.22	1.65	0.94	0.22	0.47	1.3 oz.	0.33 lbs.
		(85)	(60)	(59)	(6.5)	(110)	(27)	(7.5)	(5.5)	(42)	(24)	(5.5)	(12)	0.60 kg	0.15 kg

C/146100 – cylinder with external adjustable guide (ø 25 ... 63 mm)

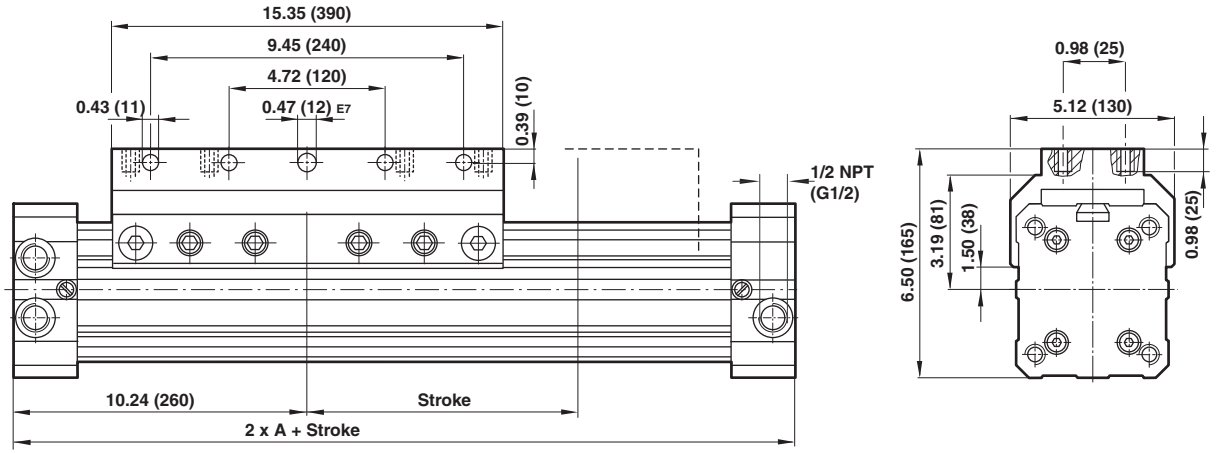


8 Center bore Ø 6 H7. 4 deep

9 Supplied complete with four groove keys

Type	Ø	A	AB	AE	AF	D	E	E1	EA ±0.05	EB	ED	EC	EF	J	Ø K	L	R 2	Y	Weight at 0 mm	Weight per 100 mm
C/146125/..	25	3.94	2.76	2.66	M5	1/8 NPT	5.12	–	1.97	4.02	1.26	0.79	1.34	0.20	0.22	2.05	–	0.37	1.7 lbs.	0.44 lbs.
		(100)	(70)	(67.5)		G1/8	(130)	–	(50)	(102)	(32)	(20)	(34)	(5)	(5.5)	(52)	–	(9.5)	0.75kg	0.20 kg
C/146132/..	32	4.72	3.54	3.23	M5	1/4 NPT	6.30	0.16	2.76	5.43	1.77	0.98	1.44	0.20	0.22	2.52	2.05	0.26	3.3 lbs.	0.66 lbs.
		(120)	(90)	(82)		G1/4	(160)	(4)	(70)	(138)	(45)	(25)	(36.5)	(5)	(5.5)	(64)	(52)	(6.5)	1.50 kg	0.30 kg
C/146140/..	40	5.91	4.72	3.84	M6	1/4 NPT	8.46	–	4.13	7.60	1.77	0.98	1.69	0.20	0.26	3.11	2.36	0.37	5.7 lbs.	0.93 lbs.
		(150)	(120)	(97.5)		G1/4	(215)	–	(105)	(193)	(45)	(25)	(43)	(5)	(6.6)	(79)	(60)	(9.5)	2.60 kg	0.42 kg
C/146150/..	50	7.09	6.30	4.59	M8	3/8 NPT	9.84	–	5.31	8.98	1.97	0.98	1.87	0.26	0.35	3.62	2.83	0.45	10 lbs.	1.4 lbs.
		(180)	(160)	(116.5)		G3/8	(250)	–	(135)	(228)	(50)	(25)	(47.5)	(6.5)	(9)	(92)	(72)	(11.5)	4.50 kg	0.62 kg
C/146163/..	63	8.46	7.48	5.39	M8	1/2 NPT	12.60	–	5.91	11.50	1.97	0.98	2.32	0.30	0.35	4.33	3.33	0.65	16 lbs.	2 lbs.
		(215)	(190)	(137)		G1/2	(320)	–	(150)	(292)	(50)	(25)	(59)	(7.5)	(9)	(110)	(84.5)	(16.5)	7.20kg	0.90 kg

C/146180 – cylinder with external adjustable guide (ø 80 mm)

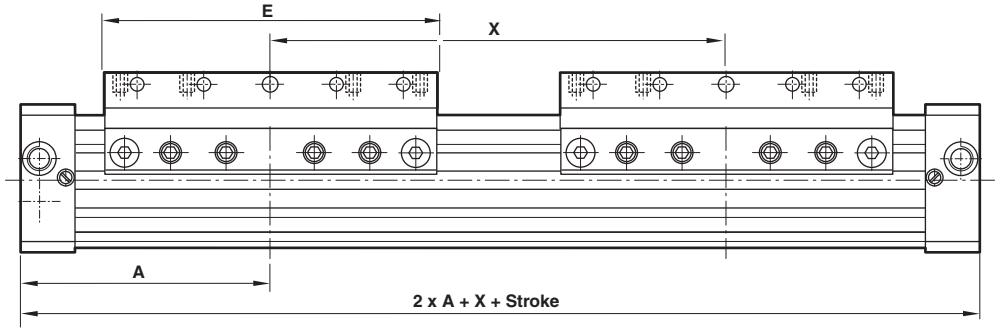


Type	Ø	Weight at 0 mm	Weight per 100 mm
C/146180/	80	29.5 lbs. (13.40 kg)	3.3 lbs. (1.50 kg)

Cylinder with external adjustable guide and double carriages

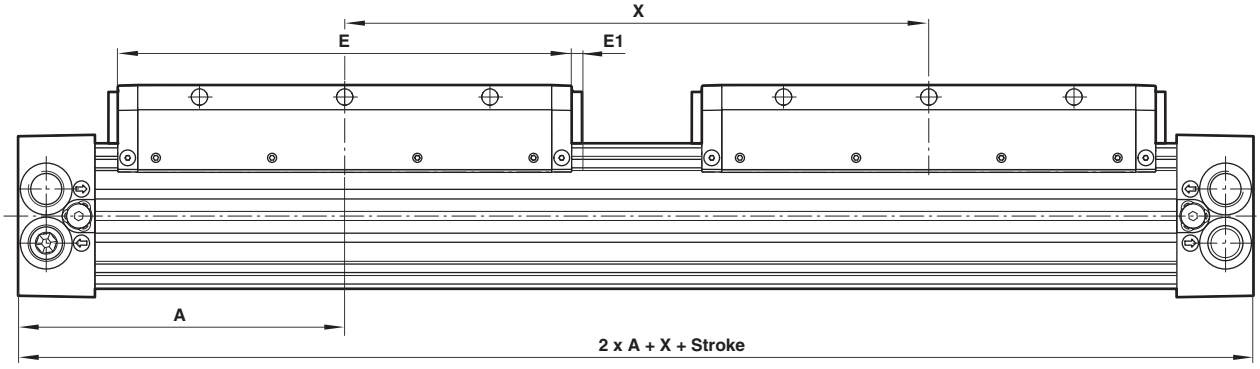
C/146100 cylinder ø 20 to 80 mm
M/146100 cylinder ø 16 to 80 mm

C/146100/MD – cylinder with external adjustable guide and double carriages(ø 20 mm)
M/146100/MD – cylinder with external adjustable guide and double carriages(ø 16 and 20 mm)



Type	Ø	A	E	X min.	X max.	Weight at 0 mm	Weight per 100 mm
M/146116/D	16	2.46	3.15	3.15	19.69	0.44 lbs.	0.22 lbs.
		(62.5)	(80)	(80)	(500)	0.20 kg	0.10 kg
C/146120/D	20	3.35	4.33	4.33	19.69	1.75 lbs.	0.33 lbs.
		(85)	(110)	(110)	(500)	0.80 kg	0.15kg

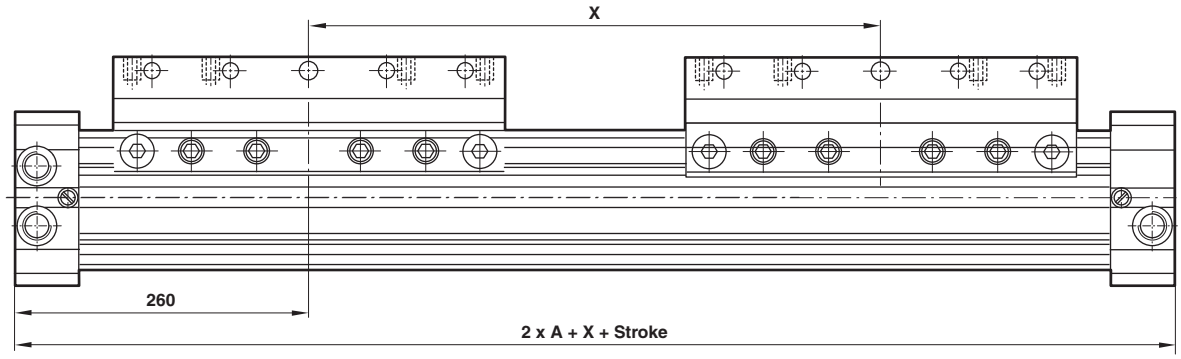
C/146100/MD – cylinder with external adjustable guide and double carriages (ø 25 ... 63 mm)



Type	Ø	A	E	E1	X min.=E*	X max.	Weight at 0 mm	Weight per 100 mm
C/146125/MD	25	3.94	5.12	–	5.12	19.69	3.3 lbs.	0.44 lbs.
		(100)	(130)	–	(130)	(500)	1.50 kg	0.20 kg
C/146132/MD	32	4.72	6.30	0.16	6.61	19.69	4.4 lbs.	0.66 lbs.
		(120)	(160)	(4)	(168)	(500)	2.00 kg	0.30 kg
C/146140/MD	40	5.91	8.46	–	8.46	19.69	7 lbs.	0.93 lbs.
		(150)	(215)	–	(215)	(500)	3.20 kg	0.42 kg
C/146150/MD	50	7.09	9.84	–	9.84	19.69	12 lbs.	1.4 lbs.
		(180)	(250)	–	(250)	(500)	5.40 kg	0.62 kg
C/146163/MD	63	8.46	12.60	–	12.60	19.69	18.5 lbs.	2.2 lbs.
		(215)	(320)	–	(320)	(500)	8.40 kg	1.00 kg

* For 32 mm bore X min = E + (2 x E1)

C/146180/MD – cylinder with external adjustable guide and double carriages (ø 80 mm)

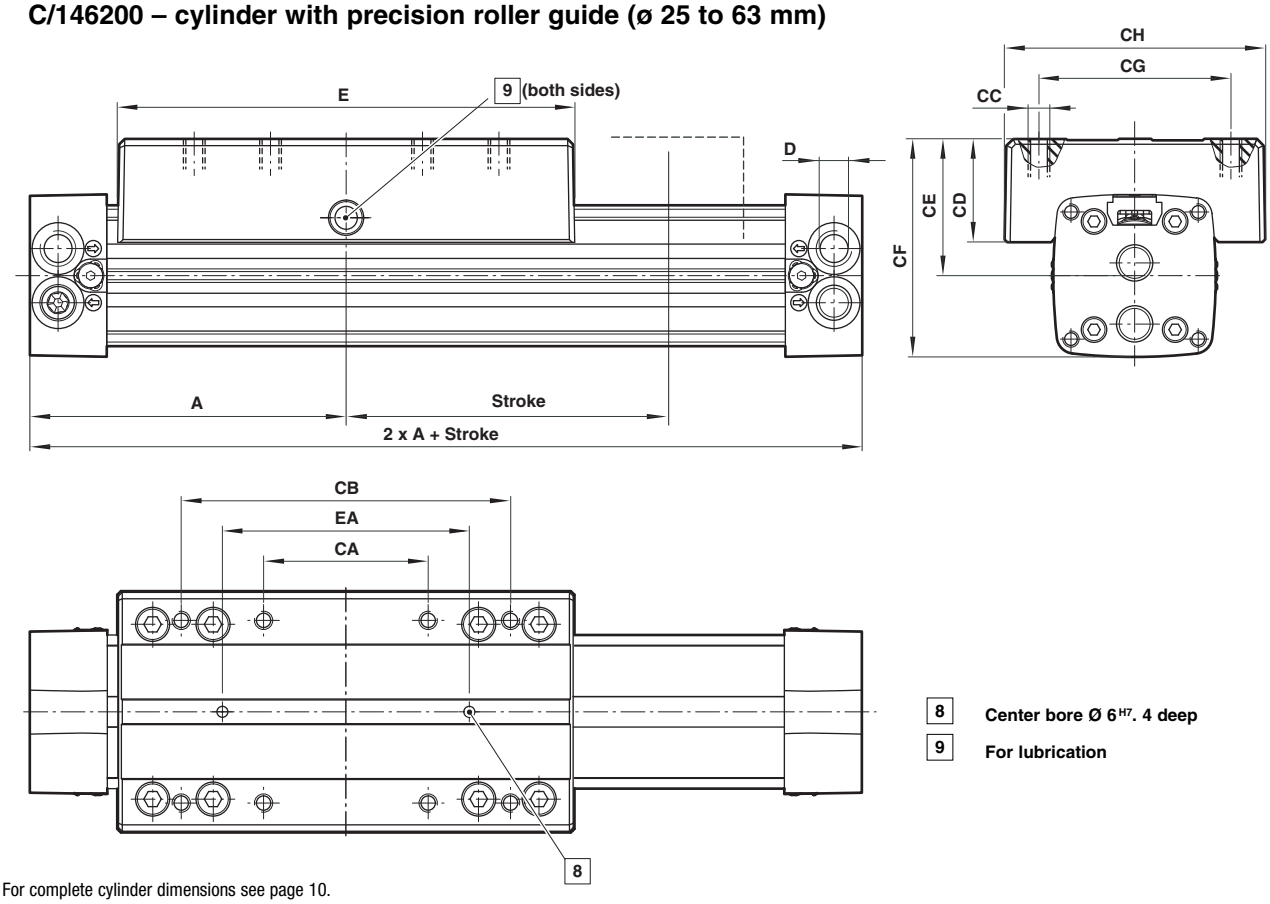


Type	Ø	A	X min.	X max.	Weight at 0 mm	Weight per 100 mm
C/146180/D	80	10.53 (260)	15.4 (390)	19.7 (500)	35 lbs. (15.90 kg)	3.3 lbs. (1.50 kg)

Cylinder with precision roller guide

C/146200 cylinder ø 25 to 63 mm

C/146200 – cylinder with precision roller guide (ø 25 to 63 mm)



8 Center bore Ø 6 H7. 4 deep

9 For lubrication

For complete cylinder dimensions see page 10.

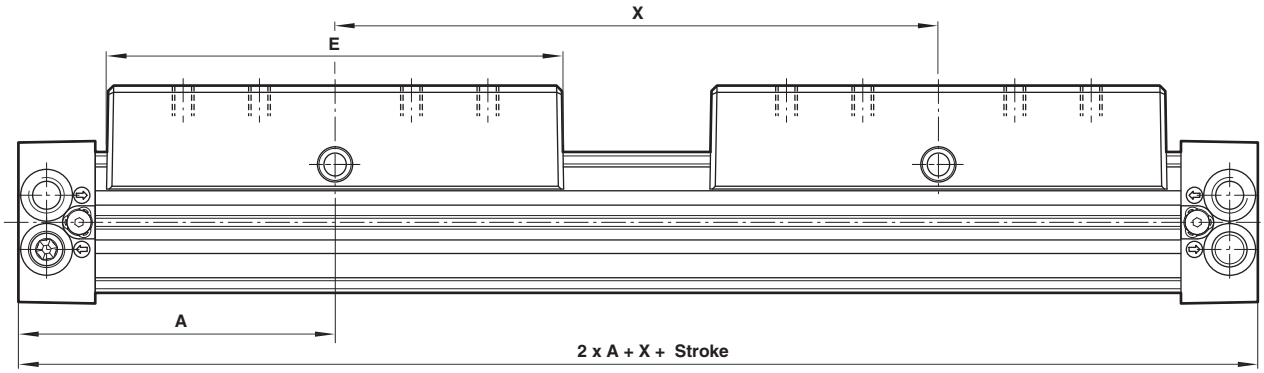
Type	Ø	A	CA	CB	CC	CD	CE	CF	CG	CH	D	E	EA ±0.05	Weight at 0 mm	Weight per 100 mm
C/146225/...	25	3.94	1.77	3.54	M6-14*	1.42	1.65	2.60	2.36	3.35	1/8 NPT	5.91	2.76	3.3 lbs.	0.44 lbs.
		(100)	(45)	(90)	M6-14*	(36)	(42)	(66)	(60)	(85)	G1/8	(150)	(70)	1.50 kg	0.20 kg
C/146232/...	32	4.72	2.36	4.72	M8-16*	1.50	1.97	3.15	2.95	3.86	1/4 NPT	7.09	3.54	6 lbs.	0.88 lbs.
		(120)	(60)	(120)	M8-16*	(38)	(50)	(80)	(75)	(98)	G1/4	(180)	(90)	2.80 kg	0.40 kg
C/146240/...	40	5.91	3.15	5.91	M8-16*	1.65	2.26	3.74	3.62	4.65	1/4 NPT	8.46	4.53	10 lbs.	1 lbs.
		(150)	(80)	(150)	M8-16*	(42)	(57.5)	(95)	(92)	(118)	G1/4	(215)	(115)	4.50 kg	0.45 kg
C/146250/...	50	7.09	3.54	7.09	M10-20*	1.73	2.64	4.39	3.94	5.20	3/8 NPT	9.84	5.31	18 lbs.	2 lbs.
		(180)	(90)	(180)	M10-20*	(44)	(67)	(111.5)	(100)	(132)	G3/8	(250)	(135)	8.20 kg	0.90 kg
C/146263/...	63	8.46	4.72	9.45	M10-20*	1.85	2.93	5.00	4.33	5.51	1/2 NPT	12.60	7.87	28 lbs.	2.2 lbs.
		(215)	(120)	(240)	M10-20*	(47)	(74.5)	(127)	(110)	(140)	G1/2	(320)	(200)	12.50 kg	1.00 kg

*1 deep

Cylinder with precision roller guide and double carriages

C/146200/MD
ø 25 to 63 mm

C/146200/MD – cylinder with precision roller guide and double carriages

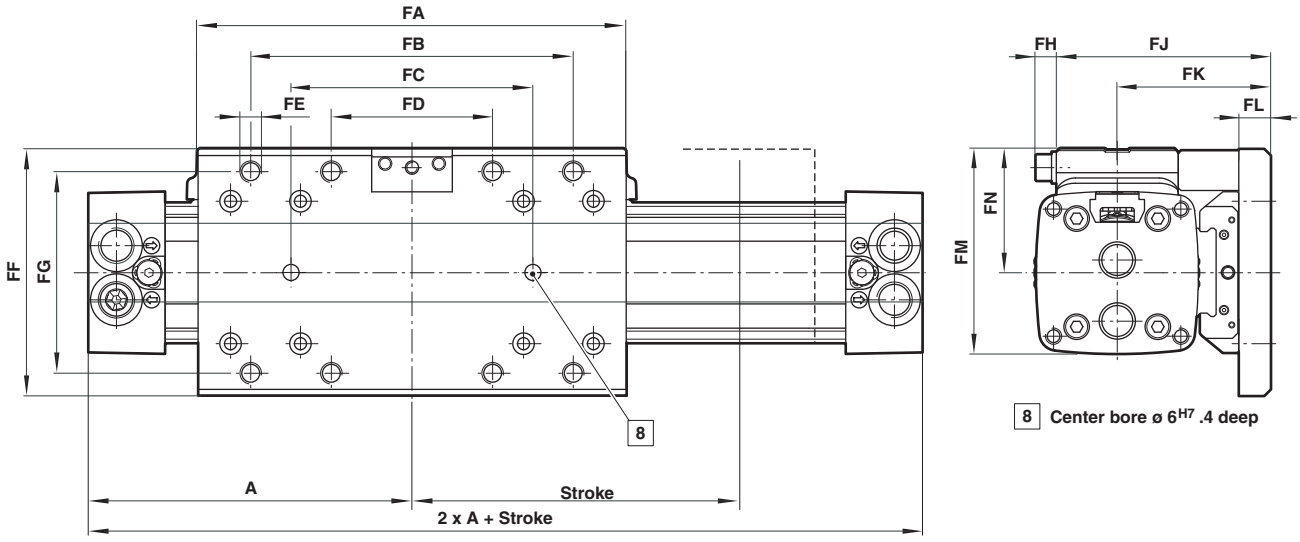


Type	Ø	A	E	X min.	X max.	Weight at 0 mm	Weight per 100 mm
C/146225/MD/...	25	3.94	5.91	5.91	19.69	5.7 lbs.	0.44 lbs.
		(100)	(150)	(150)	(500)	2.60 kg	0.20 kg
C/146232/MD/...	32	4.72	7.09	7.09	19.69	9.3 lbs.	0.88 lbs.
		(120)	(180)	(180)	(500)	4.20 kg	0.40 kg
C/146240/MD/...	40	5.91	8.46	8.46	19.69	15 lbs.	1 lbs.
		(150)	(215)	(215)	(500)	7.00 kg	0.45 kg
C/146250/MD/...	50	7.09	9.84	9.84	19.69	24 lbs.	2 lbs.
		(180)	(250)	(250)	(500)	11.1 kg	0.90 kg
C/146263/MD/...	63	8.46	12.60	12.60	19.69	45 lbs.	2.2 lbs.
		(215)	(320)	(320)	(500)	20.6 kg	1.00 kg

Cylinder with added caged ball linear motion guide

C/146200/PM

ø 25 to 63 mm



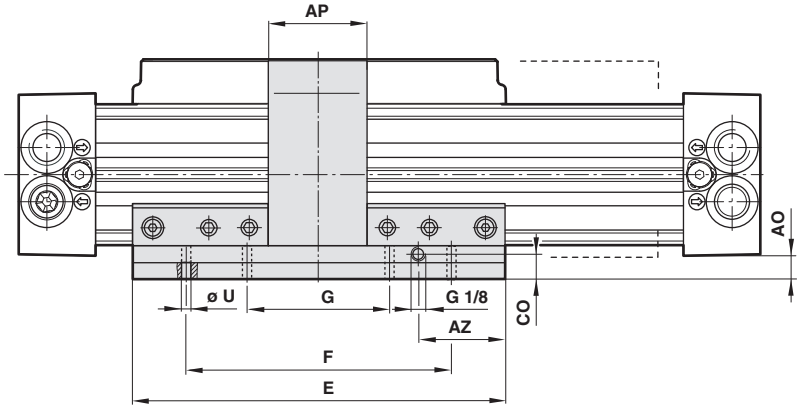
Type	Ø	A	FA	FB	FC ±0.05	FD	FE	FF	FG	FH	FJ	FK	FL	FM	FN	Weight at 0 mm	Weight per 100 mm
C/146225/PM/..	25	3.94	5.12	3.54	2.76	1.77	M6	2.83	2.36	0.28	2.40	1.77	0.39	2.36	1.42	4 lbs.	0.88 lbs.
		(100)	(130)	(90)	(70)	(45)	M6	(72)	(60)	(7)	(61)	(45)	(10)	(60)	(36)	1.90 kg	0.40 kg
C/146232/PM/..	32	4.72	6.30	4.72	3.54	2.36	M8	3.62	2.95	0.30	3.13	2.24	0.47	2.99	1.81	6.4 lbs.	1.1 lbs.
		(120)	(160)	(120)	(90)	(60)	M8	(92)	(75)	(7.5)	(79.5)	(57)	(12)	(76)	(46)	2.90 kg	0.50 kg
C/146240/PM/..	40	5.91	8.46	5.91	4.53	3.15	M8	4.13	3.62	0.30	3.37	2.48	0.47	3.52	2.07	10.4 lbs.	1.4 lbs.
		(150)	(215)	(150)	(115)	(80)	M8	(105)	(92)	(7.5)	(85.5)	(63)	(12)	(89.5)	(52.5)	4.70 kg	0.65 kg
C/146250/PM/..	50	7.09	9.84	7.09	5.31	3.54	M10	5.16	3.94	0.37	4.29	3.31	0.59	4.33	2.58	18.7 lbs.	2.5 lbs.
		(180)	(250)	(180)	(135)	(90)	M10	(131)	(100)	(9.5)	(109)	(84)	(15)	(110)	(65.5)	8.50 kg	1.10 kg
C/146263/PM/..	63	8.46	12.60	9.45	3.94	4.72	M10	5.51	4.33	0.37	4.55	3.56	0.59	4.92	2.95	24 lbs.	3 lbs.
		(215)	(320)	(240)	(100)	(120)	M10	(140)	(110)	(9.5)	(115.5)	(90.5)	(15)	(125)	(75)	11.0 kg	1.40 kg

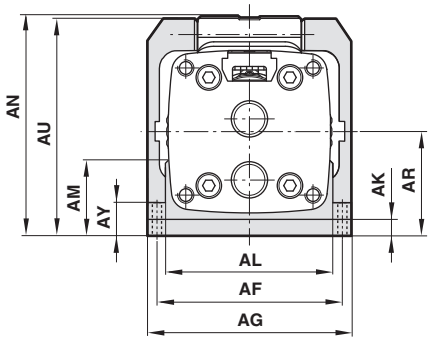
Note: stroke max. ø 25 = 900. ø 32 & 40 = 1500. ø 50 & 63 = 2600

Cylinder with active brake

C/146000/L3
ø 25 to 63 mm

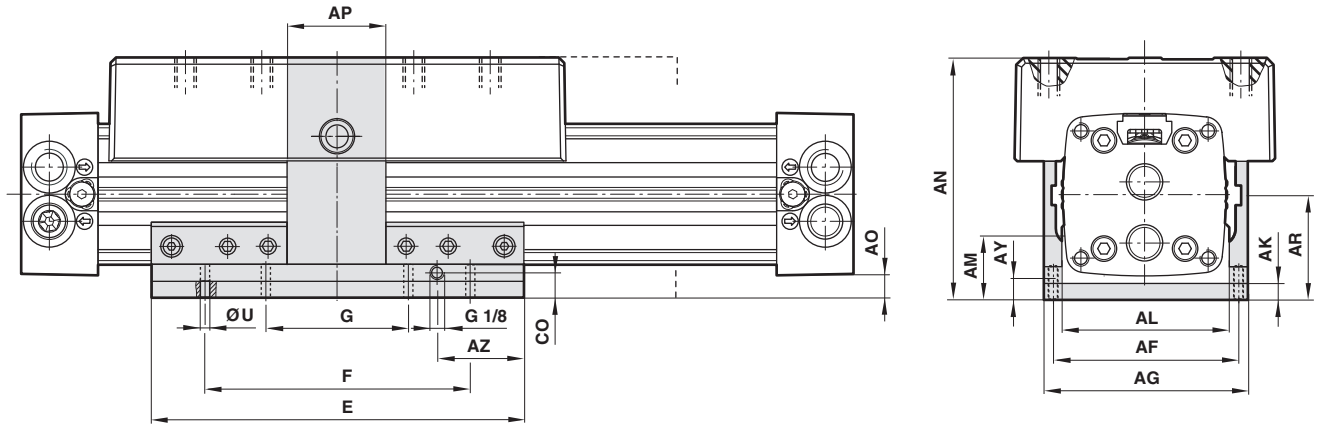
C/146000/L3 – cylinder with active brake (ø 25 ... 63 mm)





Type	Ø	AF	AG	AK	AL	AM	AN	AO	AP	AR	AU	AY	AZ	CO	E	F	G	Ø U	Weight at 0 mm	Weight per 100 mm
C/146025/L3	25	2.44	2.95	0.47	2.05	1.12	2.89	0.53	1.77	1.48	2.87	0.65	1.18	0.24	5.12	3.54	1.77	0.26	3.5 lbs.	0.44 lbs.
		(62)	(75)	(12)	(52)	(28.5)	(73.5)	(13.5)	(45)	(37.5)	(73)	(16.5)	(30)	(6)	(130)	(90)	(45)	(6.6)	1.60 kg	0.2 kg
C/146032/L3	32	3.07	3.62	0.47	2.52	1.14	3.54	0.55	2.17	1.73	3.52	0.69	1.28	0.24	6.30	4.72	2.36	0.35	5.5 lbs.	0.75 lbs.
		(78)	(92)	(12)	(64)	(29)	(90)	(14)	(55)	(44)	(89.5)	(17.5)	(32.5)	(6)	(160)	(120)	(60)	(9)	2.50 kg	0.35 kg
C/146040/L3	40	3.70	4.41	0.47	3.19	1.36	4.07	0.53	2.56	2.01	4.06	0.71	2.07	0.24	8.46	6.30	3.15	0.35	9.3 lbs.	1.1 lbs.
		(94)	(112)	(12)	(81)	(34.5)	(103.5)	(13.5)	(65)	(51)	(103)	(18)	(52.5)	(6)	(215)	(160)	(80)	(9)	4.20 kg	0.50 kg
C/146050/L3	50	4.41	5.20	0.47	3.70	1.40	4.90	0.57	2.95	2.34	4.88	0.73	2.56	0.24	9.84	7.48	3.74	0.43	15 lbs.	1.7 lbs.
		(112)	(132)	(12)	(94)	(35.5)	(124.5)	(14.5)	(75)	(59.5)	(124)	(18.5)	(65)	(6)	(250)	(190)	(95)	(11)	6.90 kg	0.75 kg
C/146063/L3	63	4.45	5.91	0.47	4.41	1.67	5.53	0.61	3.54	2.68	5.51	0.81	4.53	0.24	12.60	9.45	4.72	0.51	25 lbs.	2.2 lbs.
		(113)	(150)	(12)	(112)	(42.5)	(140.5)	(15.5)	(90)	(68)	(140)	(20.5)	(115)	(6)	(320)	(240)	(120)	(13)	11.5 kg	1.0 kg

C/146200/L3 – cylinder with precision roller guide and active brake (ø 25 ... 63 mm)



Missing cylinder dimensions see pages 10 and 13.

Type	Ø	AF	AG	AK	AL	AM	AN	AO	AP	AR	AU	AY	AZ	CO	E	F	G	Ø U	Weight at 0 mm	Weight per 100 mm
C/146225/L3	25	2.44	2.95	0.47	2.05	1.12	3.13	0.53	1.57	1.48	2.87	0.65	1.18	0.24	5.12	3.54	1.77	0.26	3.4 lbs.	0.44 lbs.
		(62)	(75)	(12)	(52)	(28.5)	(79.5)	(13.5)	(40)	(37.5)	(73)	(16.5)	(30)	(6)	(130)	(90)	(45)	(6.6)	1.55 kg	0.2 kg
C/146232/L3	32	3.07	3.62	0.47	2.52	1.14	3.70	0.55	2.17	1.73	3.52	0.69	1.28	0.24	6.30	4.72	2.36	0.35	8.6 lbs.	0.75 lbs.
		(78)	(92)	(12)	(64)	(29)	(94)	(14)	(55)	(44)	(89.5)	(17.5)	(32.5)	(6)	(160)	(120)	(60)	(9)	3.90 kg	0.35 kg
C/146240/L3	40	3.70	4.41	0.47	3.19	1.36	4.27	0.53	2.56	2.01	4.06	0.71	2.07	0.24	8.46	6.30	3.15	0.35	13.7 lbs.	1.1 lbs.
		(94)	(112)	(12)	(81)	(34.5)	(108.5)	(13.5)	(65)	(51)	(103)	(18)	(52.5)	(6)	(215)	(160)	(80)	(9)	6.20 kg	0.50 kg
C/146250/L3	50	4.41	5.20	0.47	3.70	1.40	4.98	0.57	2.95	2.34	4.88	0.73	2.56	0.24	9.84	7.48	3.74	0.43	23.6 lbs.	1.7 lbs.
		(112)	(132)	(12)	(94)	(35.5)	(126.5)	(14.5)	(75)	(59.5)	(124)	(18.5)	(65)	(6)	(250)	(190)	(95)	(11)	10.70 kg	0.75 kg
C/146263/L3	63	5.20	5.91	0.47	4.41	1.67	5.61	0.61	3.15	2.68	5.51	0.81	4.53	0.24	12.60	9.45	4.72	0.51	25.4 lbs.	2.2 lbs.
		(132)	(150)	(12)	(112)	(42.5)	(142.5)	(15.5)	(80)	(68)	(140)	(20.5)	(115)	(6)	(320)	(240)	(120)	(13)	11.50 kg	1.00 kg

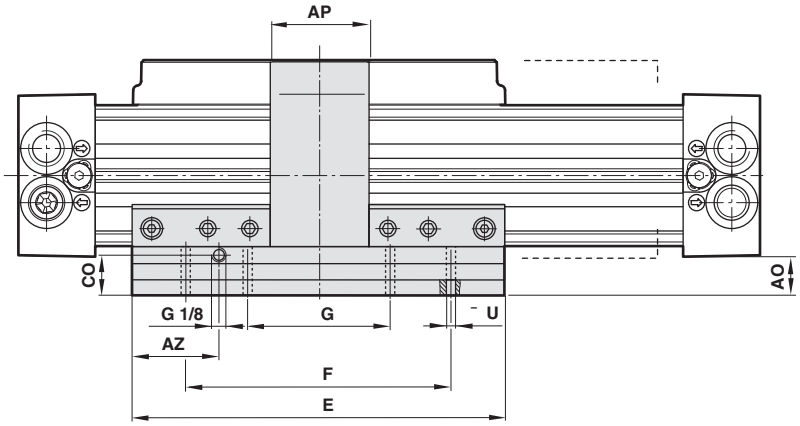
Theoretical forces, air consumption, cushioning length, holding forces for active brake

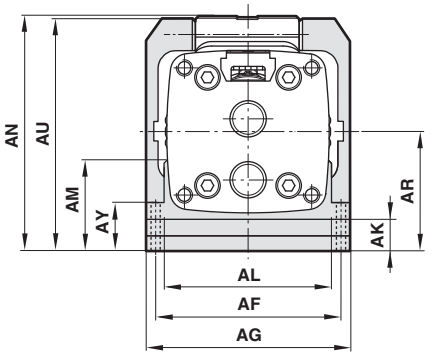
Cylinder Ø mm	Theoretical forces lbf (N) at 87 psi (6 bar)	Air consumption ft^3/in. (l/cm) of stroke at 87 psi (6 bar)	Cushioning length inches (mm)	Holding forces lbf. (N) of brake (on dry braking surface) active (L3) at 87 psi (6 bar)
25	66 (294)	0.003 (0.035)	1 (26)	112 (5000
32	108 (482)	0.005 (0.056)	1.4 (35)	202 (900)
40	170 (754)	0.008 (0.088)	2 (50)	337 (1500)
50	265 (1178)	0.012 (0.137)	2.3 (60)	562 (2500)
63	420 (1870)	0.02 (0.218)	2.8 (70)	899 (4000)

Cylinder with passive brake

C/146000/L4
ø 25 to 63 mm

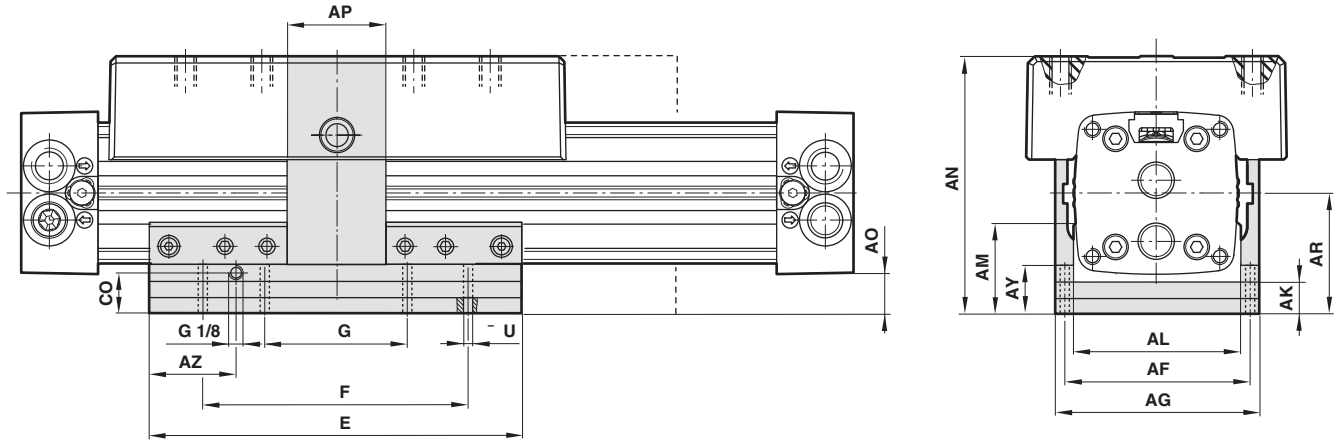
C/146000/L4 – cylinder with passive brake (ø 25 ... 63 mm)





Type	Ø	AF	AG	AK	AL	AM	AN	AO	AP	AR	AU	AY	AZ	CO	E	F	G	Ø U	Weight at 0 mm	Weight per 100 mm
C/146025/L4	25	2.44	2.95	0.87	2.05	1.52	3.29	0.93	1.77	1.87	3.27	1.04	1.18	0.63	5.12	3.54	1.77	0.26	4.2 lbs.	0.44 lbs.
		(62)	(75)	(22)	(52)	(38.5)	(83.5)	(23.5)	(45)	(47.5)	(83)	(26.5)	(30)	(16)	(130)	(90)	(45)	(6.6)	1.90 kg	0.2 kg
C/146032/L4	32	3.07	3.62	0.94	2.52	1.61	4.02	1.02	2.17	2.20	4.00	1.16	1.28	0.71	6.30	4.72	2.36	0.35	5.7 lbs.	0.77 lbs.
		(78)	(92)	(24)	(64)	(41)	(102)	(26)	(55)	(56)	(101.5)	(29.5)	(32.5)	(18)	(160)	(120)	(60)	(9)	2.60 kg	0.35 kg
C/146040/L4	40	3.70	4.41	0.94	3.19	1.83	4.55	1.00	2.56	2.48	4.53	1.18	2.07	0.71	8.46	6.30	3.15	0.35	10.4 lbs.	1.1 lbs.
		(94)	(112)	(24)	(81)	(46.5)	(115.5)	(25.5)	(65)	(63)	(115)	(30)	(52.5)	(18)	(215)	(160)	(80)	(9)	4.70 kg	0.50 kg
C/146050/L4	50	4.41	5.20	1.18	3.70	2.11	5.61	1.28	2.95	3.05	5.59	1.44	2.56	0.94	9.84	7.48	3.74	0.43	15.9 lbs.	1.7 lbs.
		(112)	(132)	(30)	(94)	(53.5)	(142.5)	(32.5)	(75)	(77.5)	(142)	(36.5)	(65)	(24)	(250)	(190)	(95)	(11)	7.20 kg	0.75 kg
C/146063/L4	63	5.20	5.91	1.18	4.41	2.38	6.24	1.32	3.54	3.39	6.22	1.52	4.53	1.65	12.60	9.45	4.72	0.51	27.3 lbs.	2.2 lbs.
		(132)	(150)	(30)	(112)	(60.5)	(158.5)	(33.5)	(90)	(86)	(158)	(38.5)	(115)	(42)	(320)	(240)	(120)	(13)	12.40 kg	1.0 kg

C/146200/L4 – cylinder with precision roller guide and passive brake (ø 25 ... 63 mm)



Type	Ø	AF	AG	AK	AL	AM	AN	AO	AP	AR	AU	AY	AZ	CO	E	F	G	Ø U	Weight at 0 mm	Weight per 100 mm
C/146225/L4	25	2.44	2.95	0.87	2.05	1.52	3.52	0.93	1.57	1.87	3.27	1.04	1.18	0.63	5.12	3.54	1.77	0.26	4.2 lbs.	0.44 lbs.
		(62)	(75)	(22)	(52)	(38.5)	(89.5)	(23.5)	(40)	(47.5)	(83)	(26.5)	(30)	(16)	(130)	(90)	(45)	(6.6)	1.90 kg	0.20 kg
C/146232/L4	32	3.07	3.62	0.94	2.52	1.61	4.17	1.02	2.17	2.20	4.00	1.16	1.28	0.71	6.30	4.72	2.36	0.35	8.8 lbs.	0.77 lbs.
		(78)	(92)	(24)	(64)	(41)	(106)	(26)	(55)	(56)	(101.5)	(29.5)	(32.5)	(18)	(160)	(120)	(60)	(9)	4.00 kg	0.35 kg
C/146240/L4	40	3.70	4.41	0.94	3.19	1.83	4.74	1.00	2.56	2.48	4.53	1.18	2.07	0.71	8.46	6.30	3.15	0.35	14.8 lbs.	1.1 lbs.
		(94)	(112)	(24)	(81)	(46.5)	(120.5)	(25.5)	(65)	(63)	(115)	(30)	(52.5)	(18)	(215)	(160)	(80)	(9)	6.70 kg	0.50 kg
C/146250/L4	50	4.41	5.20	1.18	3.70	2.11	5.69	1.28	2.95	3.05	5.59	1.44	2.56	0.94	9.84	7.48	3.74	0.43	24 lbs.	1.7 lbs.
		(112)	(132)	(30)	(94)	(53.5)	(144.5)	(32.5)	(75)	(77.5)	(142)	(36.5)	(65)	(24)	(250)	(190)	(95)	(11)	11.00 kg	0.75 kg
C/146263/L4	63	5.20	5.91	1.18	4.41	2.38	6.32	1.32	3.15	3.39	6.22	1.52	4.53	0.94	12.60	9.45	4.72	0.51	27 lbs.	2.2 lbs.
		(132)	(150)	(30)	(112)	(60.5)	(160.5)	(33.5)	(80)	(86)	(158)	(38.5)	(115)	(24)	(320)	(240)	(120)	(13)	12.40 kg	1.00 kg

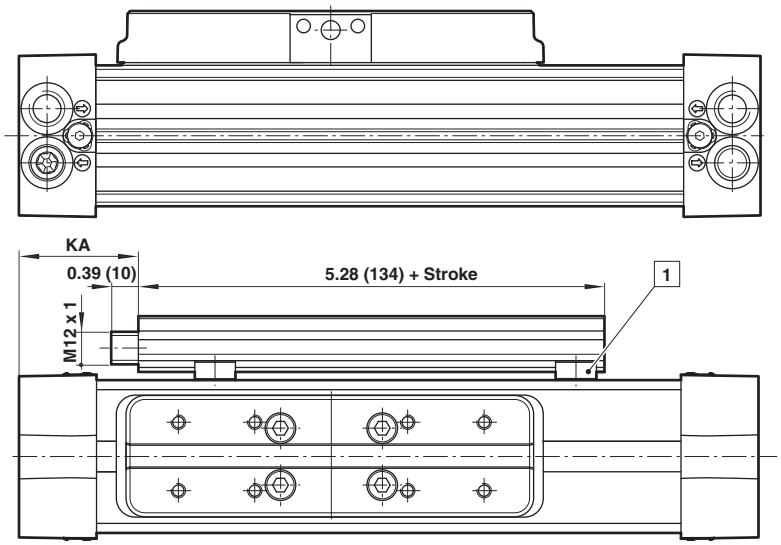
Theoretical forces, air consumption, cushioning length, holding forces for passive brake

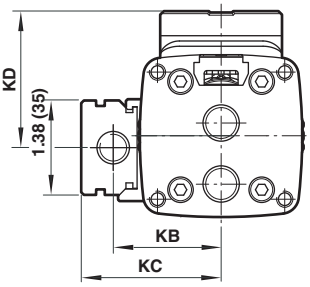
Cylinder Ø mm	Theoretical forces lbf (N) at 87 psi (6 bar)	Air consumption ft^3/in. (l/cm) of stroke at 87 psi (6 bar)	Cushioning length inches (mm)	Holding forces lbf. (N) of brake (on dry braking surface) passive (L4)
25	66 (294)	0.003 (0.035)	1 (26)	50 (220)
32	108 (482)	0.005 (0.056)	1.4 (35)	84 (375)
40	170 (754)	0.008 (0.088)	2 (50)	141 (630)
50	265 (1178)	0.012 (0.137)	2.3 (60)	225 (1000)
63	420 (1870)	0.02 (0.218)	2.8 (70)	371 (1650)

Cylinder with linear sensor and internal guide

C/146000/F1
ø 32 to 63 mm

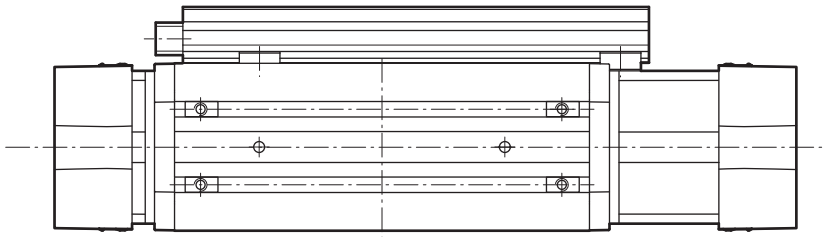
C/146000/F1 – cylinder with linear sensor and internal guide

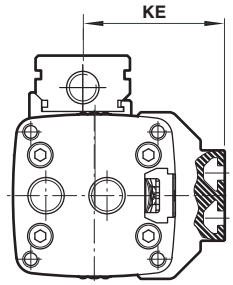




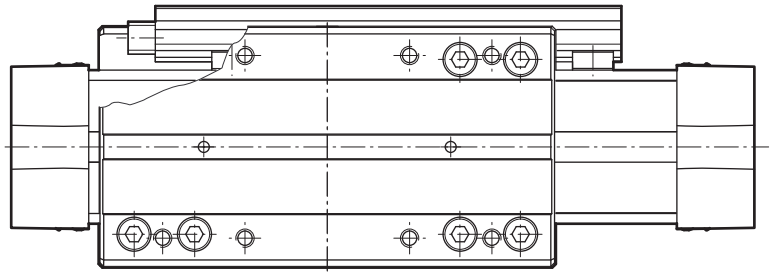
1 Bracket

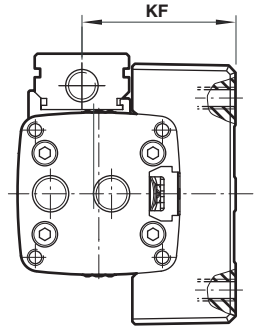
C/146100/F1 – cylinder with linear sensor and external adjustable guide



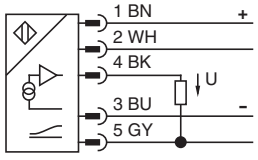


C/146200/F1 – cylinder with linear sensor and precision roller guide





Type	Ø	KA	KB	KC	KD	KE	KF
C/146.32/F1/...	32	1.73	1.57	2.03	1.99	2.20	2.22
		(44)	(40)	(51.5)	(50.5)	(56)	(56.5)
C/146.40/F1/...	40	2.91	1.81	2.26	2.22	2.52	2.46
		(74)	(46)	(57.5)	(56.5)	(64)	(62.5)
C/146.50/F1/...	50	4.09	2.13	2.58	2.70	2.95	2.76
		(104)	(54)	(65.5)	(68.5)	(75)	(70)
C/146.63/F1/...	63	5.47	2.40	2.83	2.66	3.13	2.74
		(139)	(61)	(72)	(67.5)	(79.5)	(69.5)

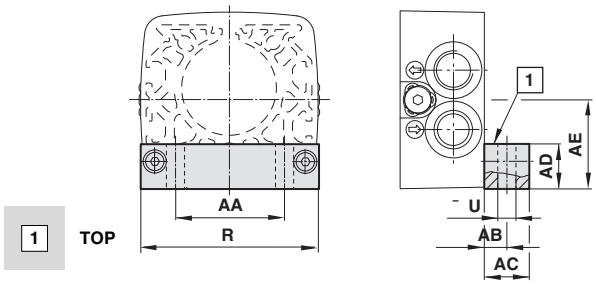


Connector details

Pin-No.	Colour	Function
1	Brown	+
2	White	Program input
3	Blue	-
4	Black	Output +
5	Grey	Output -

Electrical data of linear position sensor:
Operating voltage: 10 ... 30 V d.c.. resolution 16 bit.
Repeat accuracy 0.006 %. output 4 ... 20 mA. short-circuit protection
Linearity 0.05 % of measuring range. protection class IP67

Mountings (ø 16 ... 80 mm)
Foot mounting C
QM/1460XX/21



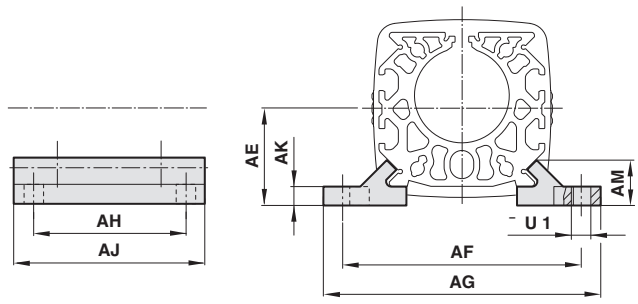
Type*	Ø	AA	AB	AC	AD	AE	R	Ø U	Wt.
QM/146016/21	16	0.63	0.39	0.59	0.12	0.63	1.06	0.22	0.03 lbs.
		(16)	(10)	(15)	(3)	(16)	(27)	(5.5)	0.01 kg.
QM/146020/21	20	0.67	0.20	0.39	0.39	0.85	1.57	0.22	0.06 lbs.
		(17)	(5)	(10)	(10)	(21.5)	(40)	(5.5)	0.03 kg.
QM/146025/21	25	0.71	0.28	0.59	0.53	0.94	1.89	0.28	0.22 lbs.
		(18)	(7)	(15)	(13.5)	(24) (26.5)	(48)	(7)	0.1 kg.
QM/146032/21	32	1.02	0.43	0.87	0.65	1.20	2.36	0.35	0.22 lbs.
		(26)	(11)	(22)	(16.5)	(30.5) (33)	(60)	(9)	0.1 kg.
QM/146040/21	40	1.18	0.43	0.87	0.77	1.48	2.95	0.35	0.44 lbs.
		(30)	(11)	(22)	(19.5)	(37.5) (40.5)	(75)	(9)	0.2 kg.
QM/146050/21	50	1.65	0.47	0.98	0.94	1.77	3.54	0.43	0.66 lbs.
		(42)	(12)	(25)	(24)	(45) (49)	(90)	(11)	0.3 kg.
QM/146063/21	63	1.89	0.51	0.98	1.08	2.13	4.13	0.51	0.88 lbs.
		(48)	(13)	(25)	(27.5)	(54) (57.5)	(105)	(13)	0.4 kg.
QM/146080/21	80	2.52	0.49	0.98	1.38	2.76	5.12	0.55	0.88 lbs.
		(64)	(12.5)	(25)	(35)	(70)	(130)	(14)	0.4 kg.

Attention: When Foot mounts are used with a Center support mounting the word **TOP** should be visible on the top face of the mount. This will change the "AE" dimension as shown below.

Type*	Ø	AE
QM/146025/21	25	1.04
		(26.5)
QM/146032/21	32	1.30
		(33)
QM/146040/21	40	1.59
		(40.5)
QM/146050/21	50	1.93
		(49)
QM/146063/21	63	2.26
		(57.5)

* Each part number includes (2) foot mount brackets.

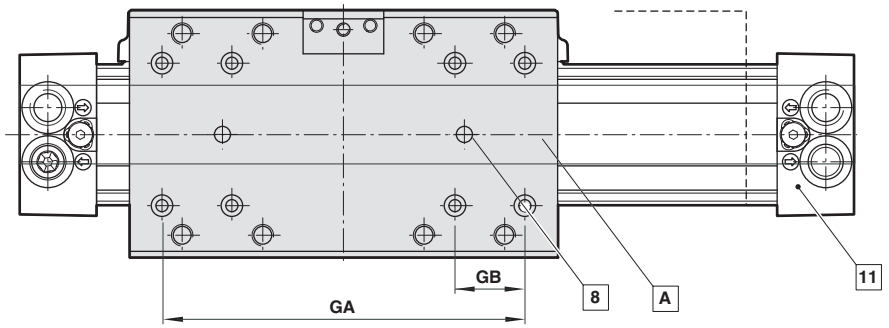
Center support V
QM/1460XX/32

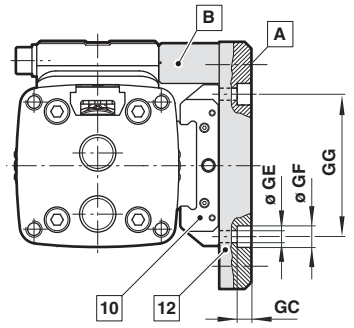


Type**	Ø	AE	AF	AG	AH	AJ	AK	AM	Ø U1	Wt.
QM/146016/32	16	0.63	1.57	1.97	0.79	1.18	0.14	0.35	0.22	0.03 lbs.
		(16)	(40)	(50)	(20)	(30)	(3.5)	(9)	(5.5)	0.01 kg.
QM/146020/32	20	0.85	2.05	2.44	1.77	2.36	0.18	0.47	0.22	0.07 lbs.
		(21.5)	(52)	(62)	(45)	(60)	(4.5)	(12)	(5.5)	0.03 kg.
QM/146025/32	25	1.04	2.36	2.83	2.36	3.15	0.22	0.51	0.26	0.09 lbs.
		(26.5)	(60)	(72)	(60)	(80)	(5.5)	(13)	(6.6)	0.04 kg.
QM/146032/32	32	1.20	2.99	3.62	2.76	3.94	0.26	0.53	0.35	0.16 lbs.
		(30.5)	(76)	(92)	(70)	(100)	(6.5)	(13.5)	(9)	0.07 kg.
QM./146040/32	40	1.48	3.62	4.25	3.54	4.72	0.30	0.73	0.35	0.44 lbs.
		(37.5)	(92)	(108)	(90)	(120)	(7.5)	(18.5)	(9)	0.2 kg.
QM/146050/32	50	1.77	4.33	5.04	4.33	5.51	0.30	0.73	0.43	0.44 lbs.
		(45)	(110)	(128)	(110)	(140)	(7.5)	(18.5)	(11)	0.2 kg.
QM/146063/32	63	2.13	5.20	6.06	4.72	6.30	0.35	0.98	0.51	0.66 lbs.
		(54)	(132)	(154)	(120)	(160)	(9)	(25)	(13)	0.3 kg.
QM/146080/32	80	2.76	6.10	7.09	5.51	7.09	0.47	1.11	0.55	0.88 lbs.
		(70)	(155)	(180)	(140)	(180)	(12)	(28.3)	(14)	0.4 kg.

** Each part number includes left and right support brackets.

QC/146200/PM/70 – assembly kit for caged ball linear motion guide (ø 25 ... 63 mm)





Kit consists of:

A Adapter plate

B Driver and mounting hardware

8 Center bore Ø 6^{H7}. 4 deep

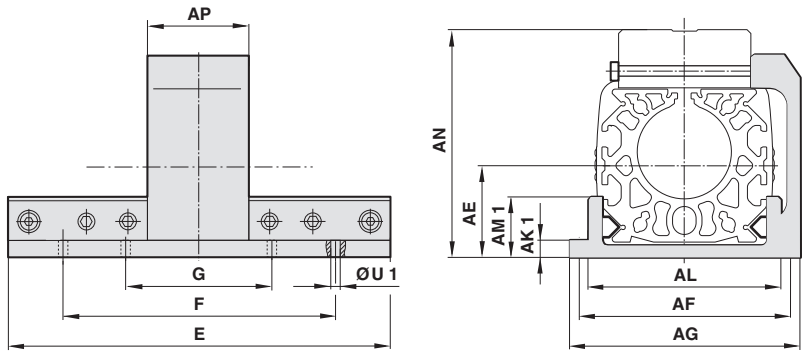
10 Not included: Recommended supplier/series for caged ball linear motion guide
Cylinder Ø 25
THK/SHW12CAM
Cylinder Ø 32 and 40
IKO/LWFF33
NSK/LW17ELZ
THK/SHW17CAM
Cylinder Ø 50 & 63
IKO/LWFF42
NSK/LW27ELZ
THK/SHW27CA

11 Standard cylinder C/146000

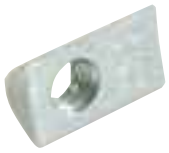
12 Assembly kit for caged ball linear motion guide

Type	Ø	GA	GB	GC	Ø GE	Ø GF	GG	Weight
QM/146225/P/70	25	4.37	0.71	0.20	0.13	0.26	1.38	0.62 lbs.
		(111)	(18)	(5)	(3.4)	(6.5)	(35)	0.28 kg.
QM/146232/P/70	32	5.31	1.02	0.18	0.18	0.31	2.09	1.04 lbs.
		(135)	(26)	(4.5)	(4.5)	(8)	(53)	0.47 kg.
QM/146240/P/70	40	6.97	1.02	0.18	0.18	0.31	2.09	1.04 lbs.
		(177)	(26)	(4.5)	(4.5)	(8)	(53)	0.47 kg.
QM/146250/P/70	50	8.46	1.57	0.26	0.26	0.43	2.76	2.91 lbs.
		(215)	(40)	(6.5)	(6.6)	(11)	(70)	1.32 kg.
QM/146263/P/70	63	11.22	1.57	0.26	0.26	0.43	2.76	3.97 lbs.
		(285)	(40)	(6.5)	(6.6)	(11)	(70)	1.80 kg.

Carriage plate mounting UV

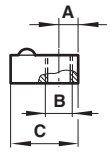


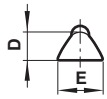
Type	Ø	AE	AF	AG	AK1	AL	AM1	AN	AP	E	F	G	ØU1	Wt
QM/146016/34	16	0.63	1.57	1.97	0.14	1.22	0.33	1.59	1.18	3.15	2.36		0.22	0.22 lbs.
		(16)	(40)	(50)	(3.5)	(31)	(8.5)	(40.5)	(30)	(80)	(60)	–	(5.5)	0.1 kg.
QM/146020/34	20	0.85	2.05	2.44	0.22	1.65	0.57	2.20	1.42	4.33	3.15	1.57	0.22	0.44 lbs.
		(21.5)	(52)	(62)	(5.5)	(42)	(14.5)	(56)	(36)	(110)	(80)	(40)	(5.5)	0.2 kg.
QM/146025/34	25	1.04	2.36	2.95	0.22	2.05	0.69	2.46	1.77	5.12	3.54	1.77	0.26	0.66 lbs.
		(26.5)	(60)	(75)	(5.5)	(52)	(17.5)	(62.5)	(45)	(130)	(90)	(45)	(6.6)	0.3 kg.
QM/146032/34	32	1.30	3.07	3.62	0.26	2.52	0.71	3.11	2.17	6.30	4.72	2.36	0.35	0.88 lbs.
		(33)	(78)	(92)	(6.5)	(64)	(18)	(79)	(55)	(160)	(120)	(60)	(9)	0.4 kg.
QM/146040/34	40	1.59	3.70	4.41	0.30	3.19	0.94	3.66	2.56	8.46	6.30	3.15	0.35	1.76 lbs.
		(40.5)	(94)	(112)	(7.5)	(81)	(24)	(93)	(65)	(215)	(160)	(80)	(9)	0.8 kg.
QM/146050/34	50	1.93	4.41	5.20	0.31	3.70	0.98	4.49	2.95	9.84	7.48	3.74	0.43	2.5 lbs.
		(49)	(112)	(132)	(8)	(94)	(25)	(114)	(75)	(250)	(190)	(95)	(11)	1.2 kg.
QM/146063/34	63	2.26	5.20	5.91	0.39	4.41	1.26	5.12	3.54	12.60	9.45	4.72	0.51	4.4 lbs.
		(57.5)	(132)	(150)	(10)	(112)	(32)	(130)	(90)	(320)	(240)	(120)	(13)	2 kg.
QM/146080/34	80	2.76	6.10	7.09	0.39	5.20	1.26	6.26	3.94	15.35	11.81	5.91	0.55	6.4 lbs.
		(70)	(155)	(180)	(10)	(132)	(32)	(159)	(100)	(390)	(300)	(150)	(14)	2.9 kg.



Groove key for carriage

Type	Ø	A	B	C	D	E	Weight
M/P74065	25	0.16	M5	0.47	0.17	0.31	0.02 lbs.
		(4)	M5	(12)	(4.25)	(8)	0.01 kg.
M/P74065	32	0.16	M5	0.47	0.17	0.31	0.02 lbs.
		(4)	M5	(12)	(4.25)	(8)	0.01 kg.
M/P74066	40	0.18	M6	0.67	0.25	0.41	0.04 lbs.
		(4.5)	M6	(17)	(6.25)	(10.5)	0.02 kg.
M/P41858	50	0.30	M8	0.91	0.30	0.53	0.07 lbs.
		(7.5)	M8	(23)	(7.5)	(13.5)	0.03 kg.
M/P41858	63	0.30	M8	0.91	0.30	0.53	0.07 lbs.
		(7.5)	M8	(23)	(7.5)	(13.5)	0.03 kg.

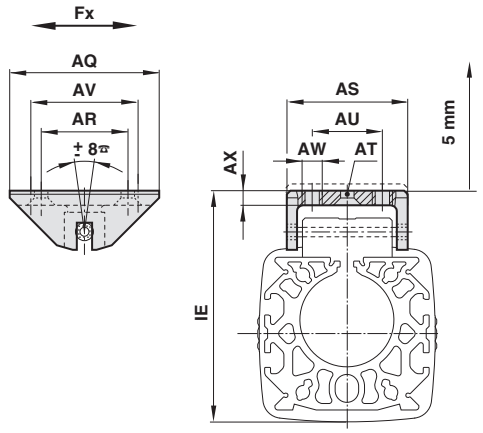




Groove key for profile barrel

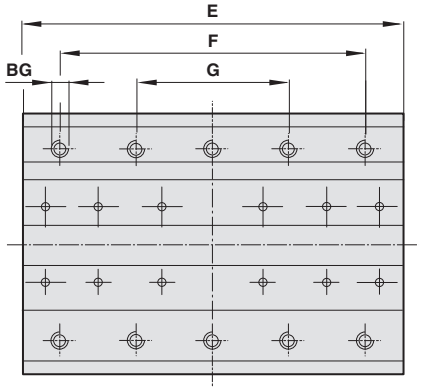
Type	Ø	A	B	C	D	E	Weight
M/P74065	25 - 63	0.16	M5	0.47	0.17	0.31	0.02 lbs.
		(4)	M5	(12)	(4.25)	(8)	0.01 kg.

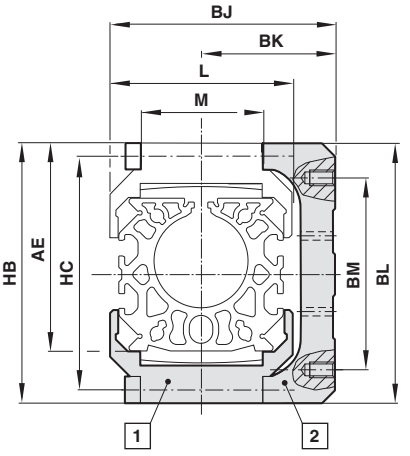
Swinging bridge S
QM/1460XX/37
For cylinders with internal guiding only



Type	Ø	AQ	AR	AS	AT	AU	AV	AW	AX	IE	Fx (N)	Wt.
QM/146016/37	16	1.57	–	1.02	–	0.47	1.18	M4	0.16		22 lbf.	0.04 lbs.
		(40)	–	(26)	–	(12)	(30)	M4	(4)	48+4	100 N	0.02 kg.
QM/146020/37	20	1.97	1.38	1.50		0.79	1.57	M5	0.20		34 lbf.	0.22 lbs.
		(50)	(35)	(38)	DIN74-Bm5	(20)	(40)	M5	(5)	65.5+5	150 N	0.1 kg.
QM/146025/37	25	2.36	1.57	1.73		0.79	1.77	M5	0.20		56 lbf.	0.44 lbs.
		(60)	(40)	(44)	DIN74-Bm5	(20)	(45)	M5	(5)	70+5	250 N	0.2 kg.
QM/146032/37	32	3.15	1.97	2.32		1.18	2.36	M6	0.22		92 lbf.	0.66 lbs.
		(80)	(50)	(59)	DIN74-Bm6	(30)	(60)	M6	(5.5)	88.5+5	410 N	0.3 kg.
QM/146032/37	40	3.15	1.97	2.32		1.18	2.36	M6	0.22		144 lbf.	0.66 lbs.
		(80)	(50)	(59)	DIN74-Bm6	(30)	(60)	M6	(5.5)	102.5+5	640 N	0.3 kg.
QM/146050/37	50	3.94	2.36	2.56		1.57	3.15	M8	0.26		225 lbf.	1.1 lbs.
		(100)	(60)	(65)	DIN74-Bm8	(40)	(80)	M8	(6.5)	124+5	1000 N	0.5 kg
QM/146050/37	63	3.94	2.36	2.56		1.57	3.15	M8	0.26		337 lbf.	1.1 lbs.
		(100)	(60)	(65)	DIN74-Bm8	(40)	(80)	M8	(6.5)	139+5	1500 N	0.5 kg.
QM/146080/37	80	3.94	2.36	2.56		1.57	3.15	M8	0.26		540 lbf.	1.1 lbs.
		(100)	(60)	(65)	DIN74-Bm8	(40)	(80)	M8	(6.5)	168.5+5	2400 N	0.5 kg.

Secondary carriage W QM/461XX/35
Side mounting plate UW QM/461XX/36



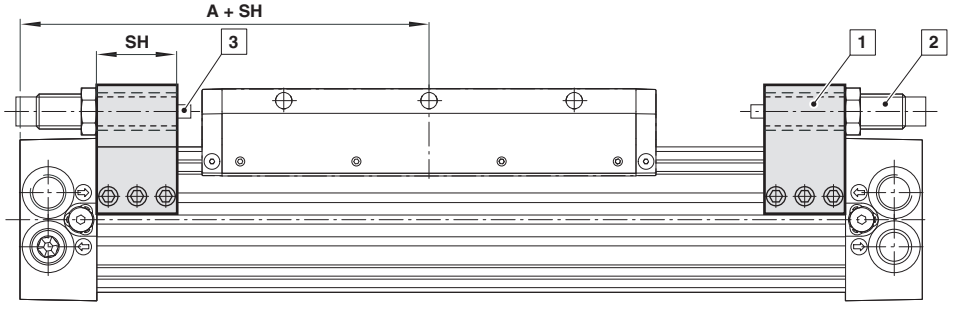


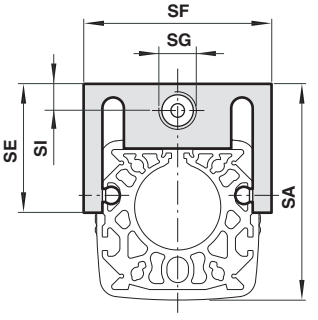
1 Secondary carriage – W
2 Side mounting plate – UW

Type (W)	Type (UW)	Ø	AE	BG	BJ	BK	BL	BM	E	F	G	HB	HC	L	M	W	UW
QM/146120/35	QM/146120/36	20	2.32		2.13	1.30	3.07	2.17	4.33	3.15	1.57	3.11	2.52	1.65	1.06	0.42 lb.	0.55 lbs.
			(59)	M 5 x 10*	(54)	(33)	(78)	(55)	(110)	(80)	(40)	(79)	(64)	(42)	(27)	0.19 kg	0.25 kg
QM/146125/35	QM/146125/36	25	2.66		2.48	1.46	3.39	2.56	5.12	3.54	1.77	3.43	3.03	2.05	1.26	0.60 lbs.	0.73 lbs.
			(67.5)	M 5 x 10*	(63)	(37)	(86)	(65)	(130)	(90)	(45)	(87)	(77)	(52)	(32)	0.27 kg	0.33 kg
QM/146132/35	QM/146132/36	32	3.23		3.03	1.77	4.06	3.15	6.30	4.72	2.36	4.09	3.70	2.52	1.77	1.10 lbs.	1.10 lbs.
			(82)	M 5 x 12*	(77)	(45)	(103)	(80)	(160)	(120)	(60)	(104)	(94)	(64)	(45)	0.50 kg	0.50 kg
QM/146140/35	QM/146140/36	40	3.84		3.03	2.30	4.69	3.54	8.46	6.30	3.15	4.72	4.33	3.11	1.77	1.43 lbs.	2.38 lbs.
			(97.5)	M 6 x 12*	(77)	(58.5)	(119)	(90)	(215)	(160)	(80)	(120)	(110)	(79)	(45)	0.65 kg	1.08 kg
QM/146150/35	QM/146150/36	50	4.61		3.86	2.81	5.63	4.72	9.84	7.48	3.74	5.67	5.16	3.62	1.97	2.43 lbs.	4.08 lbs.
			(117)	M 6 x 15*	(98)	(71.5)	(143)	(120)	(250)	(190)	(95)	(144)	(131)	(92)	(50)	1.10 kg	1.85 kg
QM/146163/35	QM/146163/36	63	5.39		4.63	3.33	7.01	5.51	12.60	9.45	4.72	6.65	6.06	4.33	1.97	4.19 lbs.	7.63 lbs.
			(137)	M 8 x 20*	(117.5)	(84.5)	(178)	(140)	(320)	(240)	(120)	(169)	(154)	(110)	(50)	1.90 kg	3.46 kg

*1 deep

Adjustable stop
For C/146100. /... .../M. C/146200/.... .../M





Type	Ø	A	SA	SE	SF	SG	SH	SI	Weight
QM/146125/75	25	3.94	2.64	1.89	2.48	M14x1.5	1.18	0.41	0.26 lbs.
		(100)	(67)	(48)	(63)	M14x1.5	(30)	(10.5)	0.12 kg
QM/146132/75	32	4.72	3.15	1.89	2.76	M14x1.5	1.18	0.41	0.37 lbs.
		(120)	(80)	(48)	(70)	M14x1.5	(30)	(10.5)	0.17 kg
QM/146140/75	40	5.91	4.02	2.44	3.27	M20x1.5	1.18	0.59	0.49 lbs.
		(150)	(102)	(62)	(83)	M20x1.5	(30)	(15)	0.22 kg

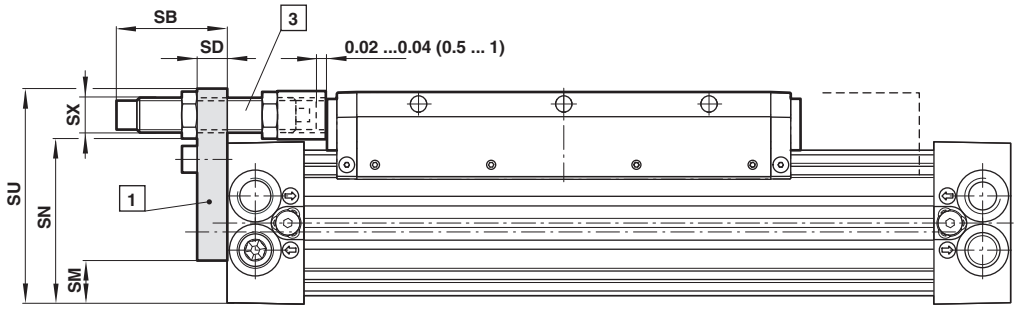
1 Assembly kit

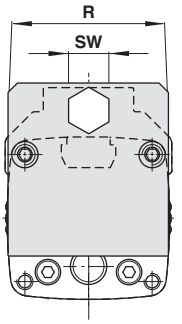
2 Please order shock absorber separately. see ACE program

3 Reaction forces (Q max)
ø 25 = 1200 N. ø 32 = 1500 N.
ø 40 = 1850 N

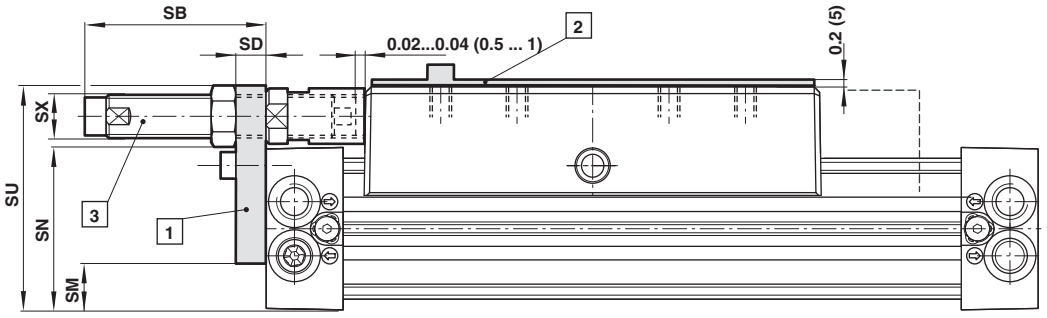
Assembly kit for shock absorber

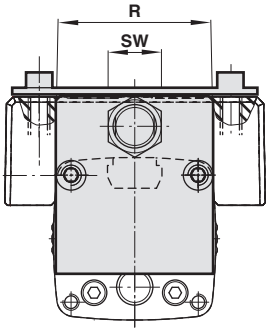
For cylinder series C/146100/M





For cylinder series C/146200/M





1 **Assembly kit**

2 **Plate ø 40 to 63 mm bores only**

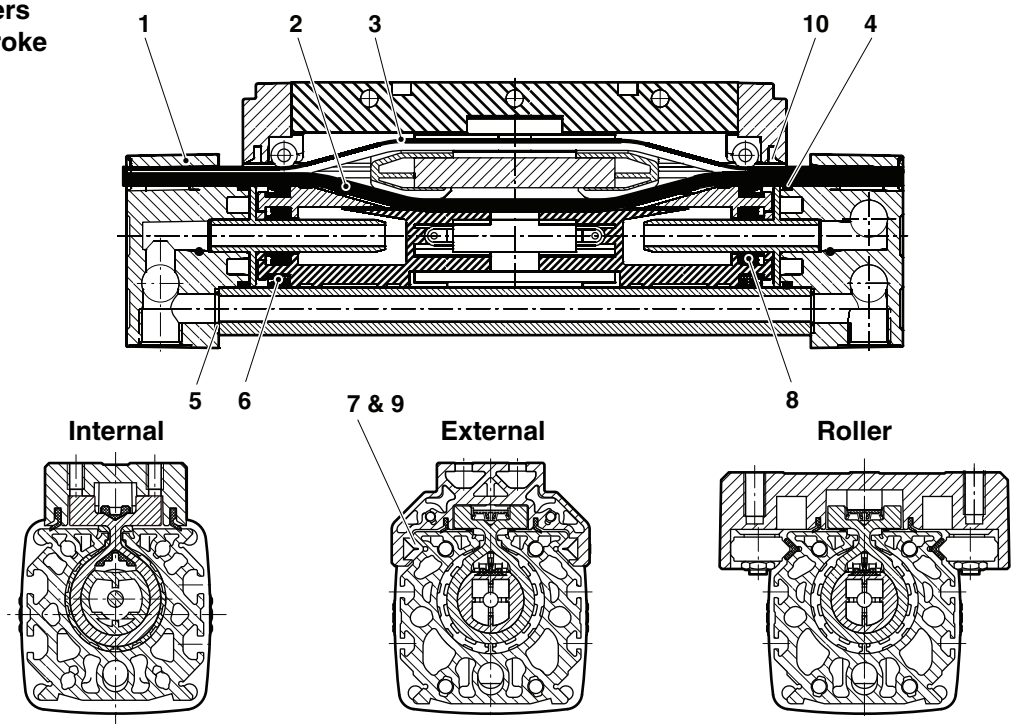
3 **Please order shock absorber separately. see ACE program**

Cylinder External guide	Ø	Assembly kit for shock absorber Position 1	Plate Position 2	R	SB	SD	SC	SM	SN	SU	SW	SX
C/146125	25	QM/146125/67	–	1.89	1.79	0.47	–	0.75	1.93	2.74	0.67	M14x1.5
			–	(48)	(45.5)	(12)	–	(19)	(49)	(69.5)	(17)	M14x1.5
C/146132	32	QM/146132/67	–	2.36	1.59	0.47	–	0.94	2.40	3.21	0.67	M14x1.5
			–	(60)	(40.5)	(12)	–	(24)	(61)	(81.5)	(17)	M14x1.5
C/146140	40	QM/146140/67	–	2.95	3.21	0.59	–	1.14	2.91	4.31	1.18	M25x1.5
			–	(75)	(81.5)	(15)	–	(29)	(74)	(109.5)	(30)	M25x1.5
C/146150	50	QM/146150/67	–	3.54	2.72	0.59	–	1.30	3.58	5.02	1.18	M25x1.5
			–	(90)	(69)	(15)	–	(33)	(91)	(127.5)	(30)	M25x1.5
C/146163	63	QM/146163/67	–	4.13	2.72	0.59	–	1.61	4.15	5.57	1.18	M25x1.5
			–	(105)	(69)	(15)	–	(41)	(105.5)	(141.5)	(30)	M25x1.5
C/146180	80	QM/146180/67	–	5.12	3.35	0.79	–	2.09	5.14	6.83	1.57	M33x1.5
			–	(130)	(85)	(20)	–	(53)	(130.5)	(173.5)	Ø (40)	M33x1.5
Cylinder Roller guide	**Ø**	**Assembly kit for shock absorber Position 1**	**Plate Position 2**	**R**	**SB**	**SD**	**SC**	**SM**	**SN**	**SU**	**SW**	**SX**
C/146225	25	QM/146125/67	–	1.89	1.79	0.47	–	0.75	1.93	2.74	0.67	M14x1.5
			–	(48)	(45.5)	(12)	–	(19)	(49)	(69.5)	(17)	M14x1.5
C/146232	32	QM/146132/67	–	2.36	1.59	0.47	–	0.94	2.40	3.21	0.67	M14x1.5
			–	(60)	(40.5)	(12)	–	(24)	(61)	(81.5)	(17)	M14x1.5
C/146240	40	QM/146140/67	M/P41434	2.95	3.21	0.59	1.22	1.14	2.91	4.31	1.18	M25x1.5
			–	(75)	(81.5)	(15)	(31)	(29)	(74)	(109.5)	(30)	M25x1.5
C/146250	50	QM/146150/67	M/P41435	4.13	2.72	0.59	1.42	1.30	3.58	5.02	1.18	M25x1.5
			–	(105)	(69)	(15)	(36)	(33)	(91)	(127.5)	(30)	M25x1.5
C/146263	63	QM/146163/67	M/P41436	5.12	2.72	0.59	1.38	1.61	4.15	5.57	1.18	M25x1.5
			–	(130)	(69)	(15)	(35)	(41)	(105.5)	(141.5)	(30)	M25x1.5

Please order shock absorber and plate separately.

Attention: When using M/146200 cylinders (Ø 40 to 63 mm) an extra top plate must be mounted onto the carriage as the center line of the shock absorbers has to be within the surface of the carriage.

Spares Kits for cylinders with NPT ports and stroke in inches



For C/146000. .../M. C/146200. .../M Internally and Roller guided models

Ø	Type	NPT spares kit	Spares kit w/seal and cover strip	Comprising Item	Description	Quantity	Seal strip Item 2	Cover strip Item 3
20	C/146020..../M	QM/146020/00	QC/146020/88/*	1	Clamping lever (ø 25 ... 63)	2	C/P 40262/*	C/P 74223/*
25	C/146025..../M. C/146225..../M	QM/146025/00	QC/146025/88/*	2 + 3	Seal-/cover strip	1	C/P 40262/*	C/P 74131/*
32	C/146032..../M. C/146232..../M	QM/146032/00	QC/146032/88/*	4 + 5	O-ring	2	C/P 40344/*	C/P73936/*
40	C/146040..../M. C/146240..../M	QM/146040/00	QC/146040/88/*	6	Seal	2	C/P 40263/*	C/P73945/*
50	C/146050..../M. C/146250..../M	QM/146050/00	QC/146050/88/*	8	Seal	2	C/P 40626/*	C/P73946/*
63	C/146063..../M. C/146263..../M	QM/146063/00	QC/146063/88/*	10	Wiper	1	C/P 40626/*	C/P73946/*
80	C/146080..../M	QM/146080/00	QC/146080/88/*		Grease	1	C/P 40715/*	C/P 74232/*

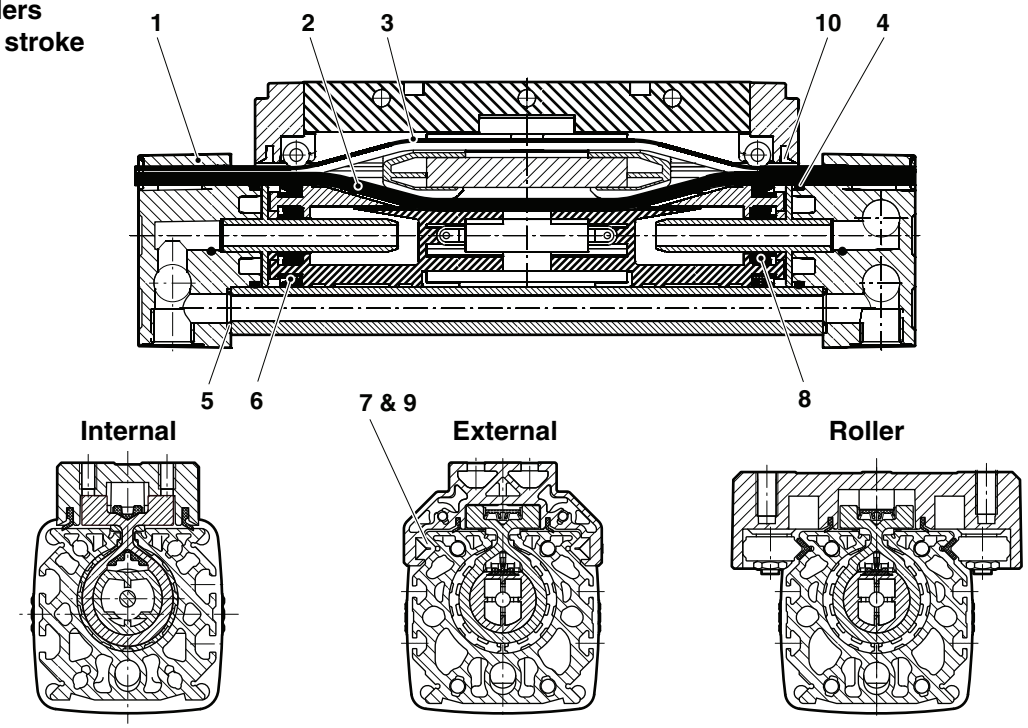
* Insert stroke length in inches
Note: Please quote the cylinder type number when ordering spare parts

For C/146100. .../M Externally guided models

Ø	Type	NPT spares kit	Spares kit w/seal and cover strip	Comprising Item	Description	Quantity	Seal strip Item 2	Cover strip Item 3
20	C/146120..../M	QM/146120/00	QC/146120/88/*	1	Clamping lever (ø 25 ... 63)	2	C/P 40262/*	C/P 74223/*
25	C/146125..../M	QM1/46125/00	QC/146125/88/*	2 + 3	Seal-/cover strip	1	C/P 40262/*	C/P 74131/*
32	C/146132..../M	QM/146132/00	QC/146132/88/*	4 + 5	O-ring	2	C/P 40344/*	C/P73936/*
40	C/146140..../M	QM/146140/00	QC/146140/88/*	6	Seal	2	C/P 40263/*	C/P73945/*
50	C/146150..../M	QM/146150/00	QC/146150/88/*	7	Guide bar	4	C/P 40626/*	C/P73946/*
63	C/146163..../M.	QM/146163/00	QC/146163/88/*	8	Seal	2	C/P 40626/*	C/P 73946/*
80	C/146180..../M	QM/146180/00	QC/146180/88/*	9	Felt	2	C/P 40715/*	C/P 74232/*
				10	Wiper	1		
					Grease	1		

* Insert stroke length in inches
Note: Please quote the cylinder type number when ordering spare parts

Spares Kits for cylinders with Metric ports and stroke in millimeters



For M/146000. .../M. M/146200. .../M Internally and Roller guided models

Ø	Type	Metric spares kit	Spares kit w/seal and cover strip	Comprising Item	Description	Quantity	Seal strip Item 2	Cover strip Item 3
16	M/146016..../M	QM/146016/00	QM/146016/88/*	1	Clamping lever (ø 25 ... 63)	2	M/P 40262/*	M/P 74223/*
20	M/146020..../M	QM/146020/00	QM/146020/88/*	2 + 3	Seal-/cover strip	1	M/P 40262/*	M/P 74223/*
25	M/146025..../M. M/146225..../M	QM/146025/00	QM/146025/88/*	4 + 5	O-ring	2	M/P 40262/*	M/P 74131/*
32	M/146032..../M. M/146232..../M	QM/146032/00	QM/146032/88/*	6	Seal	2	M/P 40344/*	M/P73936/*
40	M/146040..../M. M/146240..../M	QM/146040/00	QM/146040/88/*	8	Seal	2	M/P 40263/*	M/P73945/*
50	M/146050..../M. M/146250..../M	QM/146050/00	QM/146050/88/*	10	Wiper	1	M/P 40626/*	M/P73946/*
63	M/146063..../M. M/146263..../M	QM/146063/00	QM/146063/88/*		Grease	1	M/P 40626/*	M/P73946/*
80	M/146080..../M	QM/146080/00	QM/146080/88/*				M/P 40715/*	M/P 74232/*

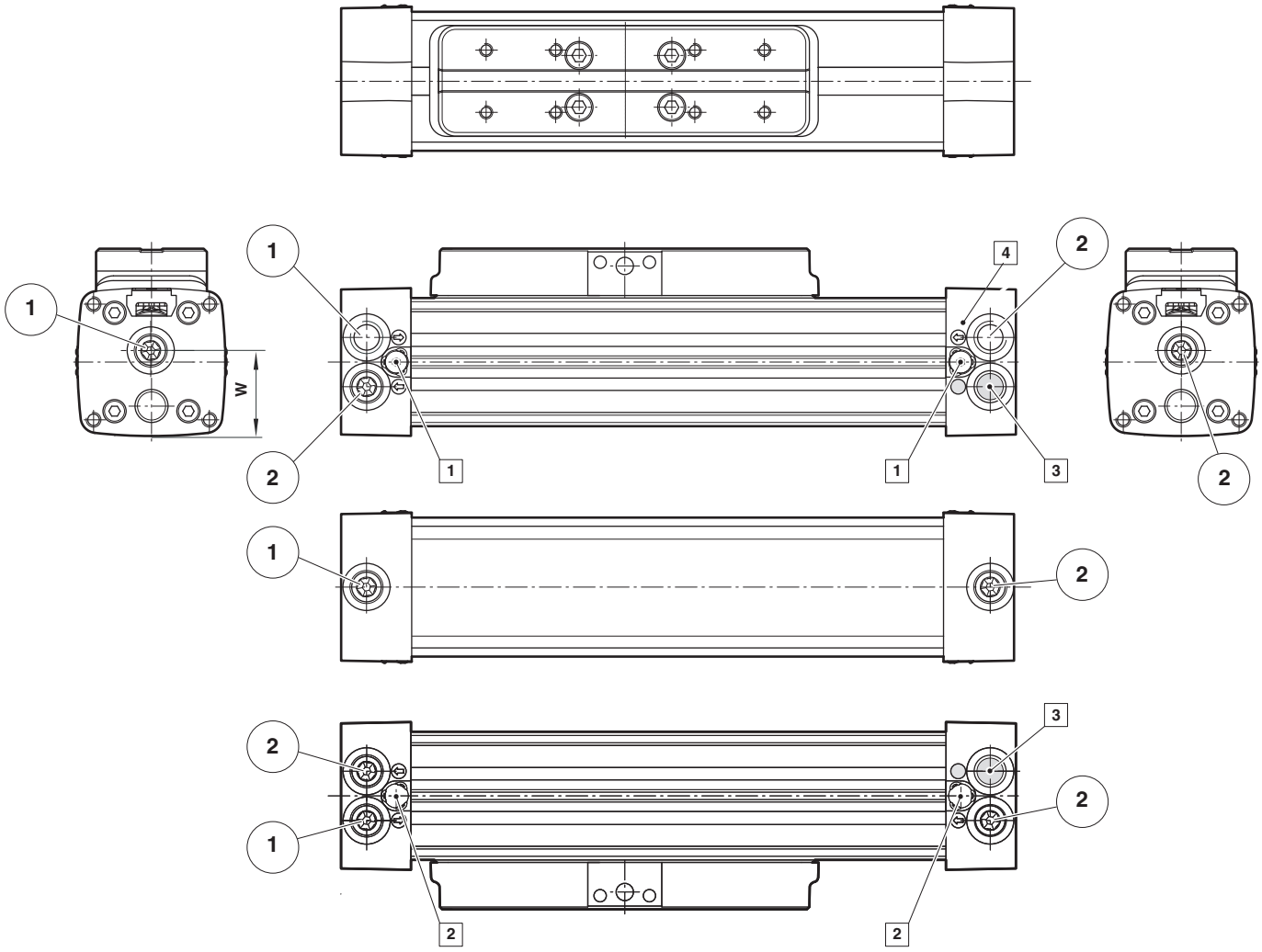
* Insert stroke length in millimeters
Note: Please quote the cylinder type number when ordering spare parts

For M/146100. .../M Externally guided models

Ø	Type	Metric spares kit	Spares kit w/seal and mover strip	Comprising Item	Desmription	Quantity	Seal strip Item 2	Mover strip Item 3
16	M/146116..../M	QM/146116/00	QM/146120/88/*	1	Clamping lever (ø 25 ... 63)	2	M/P 40270/*	M/P 74216/*
20	M/146120..../M	QM/146120/00	QM/146120/88/*	2 + 3	Seal-/cover strip	1	M/P 40262/*	M/P 74223/*
25	M/146125..../M	QM1/46125/00	QM/146125/88/*	4 + 5	O-ring	2	M/P 40262/*	M/P 74131/*
32	M/146132..../M	QM/146132/00	QM/146132/88/*	6	Seal	2	M/P 40344/*	M/P73936/*
40	M/146140..../M	QM/146140/00	QM/146140/88/*	7	Guide bar	4	M/P 40263/*	M/P73945/*
50	M/146150..../M	QM/146150/00	QM/146150/88/*	8	Seal	2	M/P 40626/*	M/P73946/*
63	M/146163..../M.	QM/146163/00	QM/146163/88/*	9	Felt	2	M/P 40626/*	M/P 73946/*
80	M/146180..../M	QM/146180/00	QM/146180/88/*	10	Wiper	1	M/P 40715/*	M/P 74232/*
					Grease	1		

* Insert stroke length in millimeters
Note: Please quote the cylinder type number when ordering spare parts

C/146000/MC – cylinder with alternative ports (ø 25 ... 63 mm)



Type	Ø	W
C/146.25/..	25	1.10 (28)
C/146.32/..	32	1.36 (34.5)
C/146.40/..	40	1.71 (43.5)
C/146.50/..	50	2.09 (53)
C/146.63/..	63	2.34 (59.5)

1. Pressurrize port (2) to move carriage right to left.
2. Pressurize port (1) to move carriage left to right.
3. Port [3] lower port on right end cap is non-functioning.

[1] **Cushion screw**
[2] **Hole without thread**
[3] **Port without function**
[4] **Moving direction**

Warning

These products are intended for use in industrial compressed air systems only. Do not use these products where pressures and temperatures can exceed those listed under '**Technical Data**'.

Before using these products with fluids other than those specified. for non-industrial applications. life-support systems. or other applications not within published specifications. consult NORGREN.

Through misuse. age. or malfunction. components used in fluid power systems can fail in various modes.

The system designer is warned to consider the failure modes of all component parts used in fluid power systems and to provide adequate safeguards to prevent personal injury or damage to equipment in the event of such failure.
System designers must provide a warning to end users in the system instructional manual if protection against a failure mode cannot be adequately provided.
System designers and end users are cautioned to review specific warnings found in instruction sheets packed and shipped with these products.

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

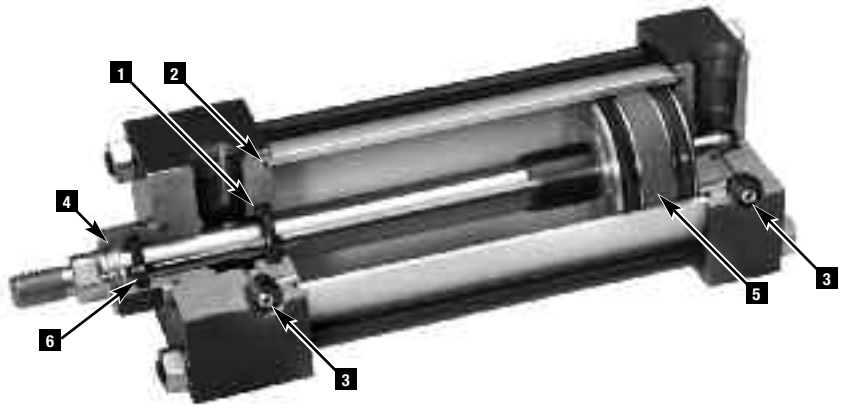
Head and End Caps:
(A and EA Series)
black anodized aluminum alloy
(J and EJ Series)
precision machined steel*
Tube:
A & EA Series 1/2" to 12"
J & EJ Series 1-1/2" to 2-1/2"
Aluminum alloy, clear anodized O.D., hard coat anodized I.D.
J & EJ Series 3-1/4" to 12" has steel tube, with hard chrome plated 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 contaminates from getting into cylinder by aggressively wiping foreign materials from the piston rod, enhancing the rod seal life.

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

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

Series A Cylinders are constructed with the finest materials for each component!

1 Piston Rod: Hard chrome plated high-tensile steel, ground and polished.

2 Rod Bearing: External removable threaded steel bearing housing (black oxide finish), with an oil-impregnated sintered iron rod bearing.

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

4 Head/Cap: Precision machined from alloy aluminum, then anodized for corrosion resistance (black finish).

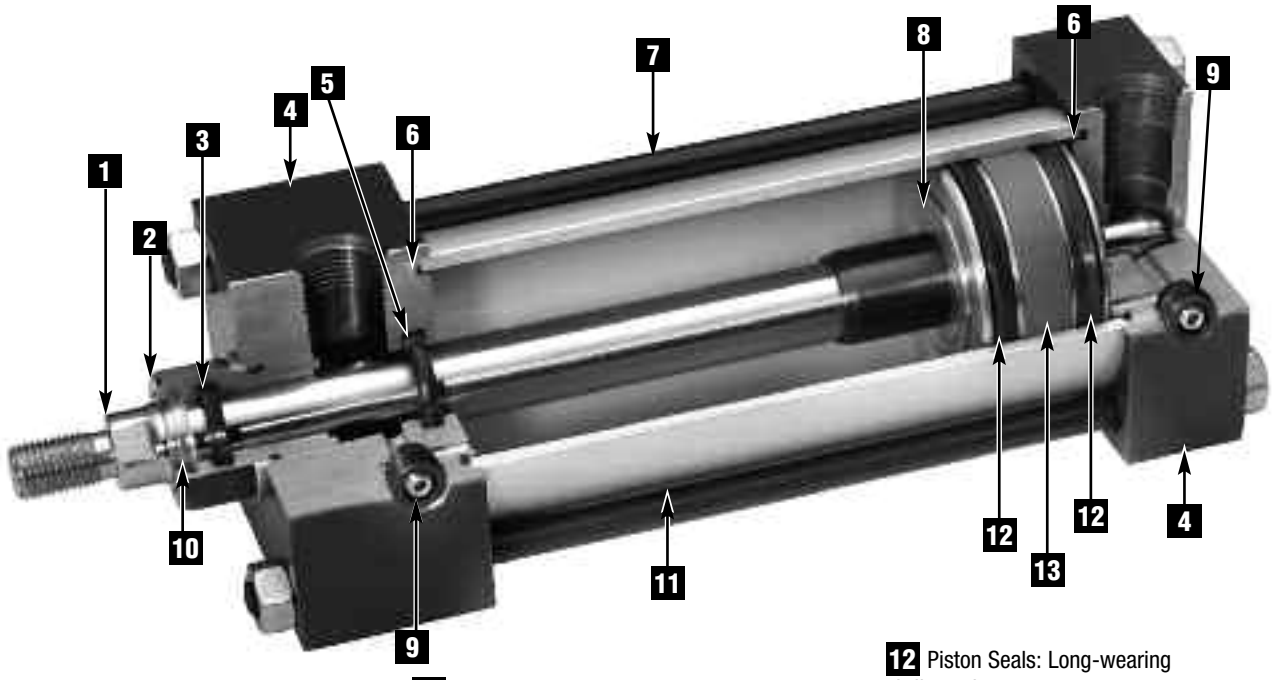
5 Ultra Cushion® Seals: Advanced design features a unique, one-piece, compound seal of nitrile* captured within a precision machined groove. Linear and radial "float" of the cushion seals eliminates misalignment. Ultra Cushions provide exceptionally fast "out of cushion" stroke reversal. (Head and Cap Cushions are optional.)
*Nitrile seals on the 5/8" & 1" rod diameter.
For rod sizes 1-3/8" and larger, urethane seals are standard.

6 O-Ring Tube Seal: Buna is standard. (Viton is optional.)

7 Tie Rods: High-strength steel maintains uniform compression on tube end seals.

8 Piston: Machined solid aluminum alloy, light-weight for low inertia, yet strong. Threaded piston is installed with high strength threadlocker adhesive then staked to the piston rod.

9 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.



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

11 Cylinder Tube: High-strength aluminum alloy ideally suited for air service. The tube is clear anodized on the O.D. and hard anodic coated on the I.D., resulting in a smooth, file hard (60RC), corrosion and score resistant surface finish.

12 Piston Seals: Long-wearing nitrile seals.

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

Application Information
Series A NFPA interchangeable aluminum air cylinders are offered with a variety of accessories, standard and optional equipment to meet your application needs.

The addition of a Teflon® wear ring to the outer perimeter of the piston permits us to guarantee its operation against failure due to lack of lubrication for ONE FULL YEAR, regardless of cycles! See page ACT-1-98 for complete warranty.

Standard non-cushioned Series A cylinders are recommended for applications that require full bottoming of the piston and where the noise emitted by the metal-to-metal impact between the piston and cylinder end caps is tolerable. We recommend that optional non-adjustable cushions be added for piston speeds (moving light tools) ranging from 15 to 30 in/sec. For speeds exceeding 30 in/sec, the cylinders should be equipped with adjustable air cushions.

NFPA Aluminum & Steel Cylinders

Series EA Ecology Cylinders are constructed with the finest materials for each component!

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 1-3/8" and larger, urethane seals are standard.

2 Impact Dampening Piston Seals: Our impact dampening piston seals, in conjunction with our advanced cushion design, decelerate and reduce end-of-stroke noise.

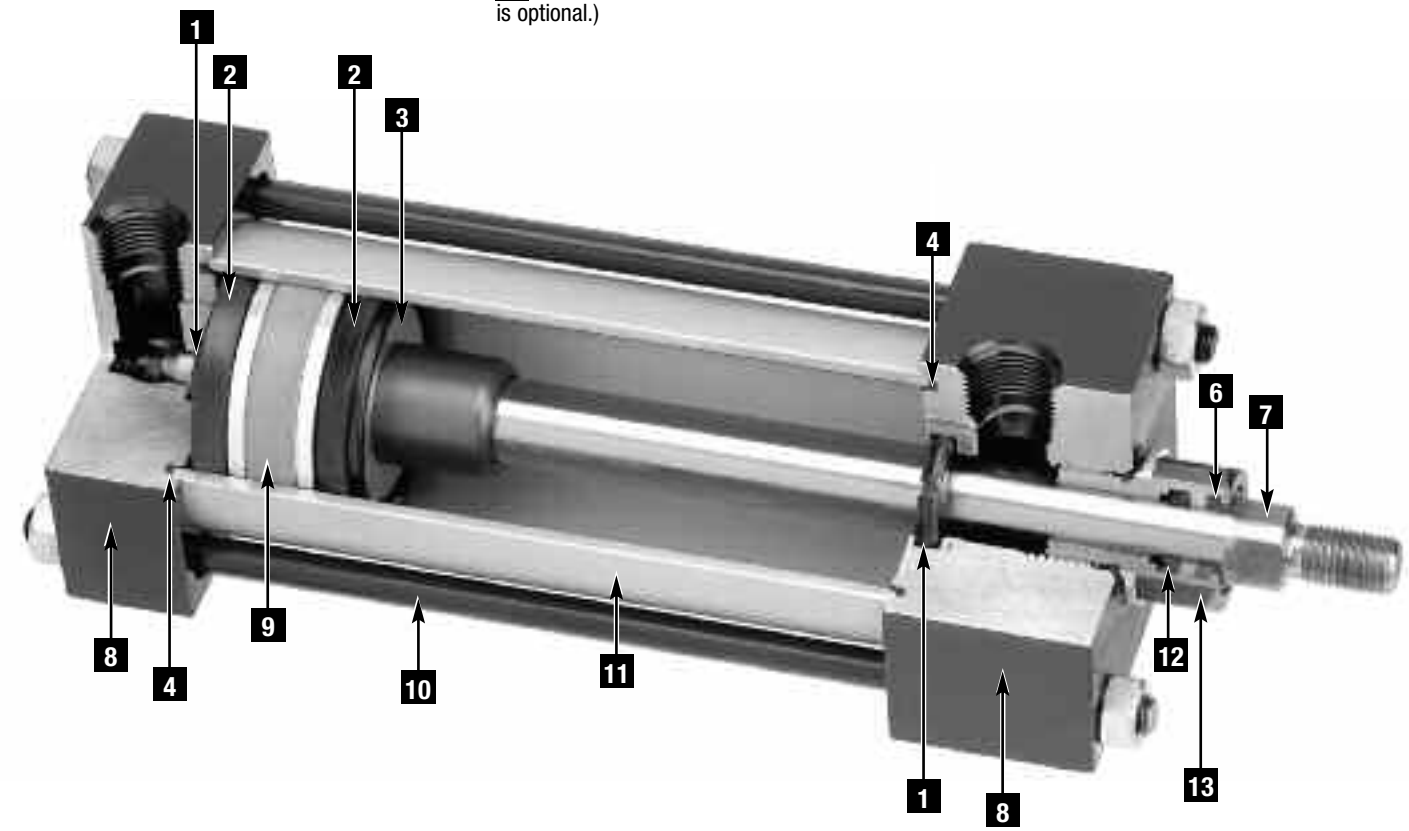
3 Piston: Machined solid aluminum alloy, light-weight for low inertia, yet strong. Threaded piston is installed with high strength threadlocker adhesive then staked to the piston rod.

4 O-Ring Tube Seal: Buna is standard. (Viton is optional.)

5 Adjustable Captive Cushion Needle (not shown): Fine thread allows for safe and precision adjustment of cushion. (See ACT-5.)

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

7 Piston Rod: Hard chrome plated high-tensile steel, ground and polished.



8 Head/Cap: Precision machined from alloy aluminum, then anodized for corrosion resistance (black finish).

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

10 Tie Rods: High-strength steel maintains uniform compression on tube end seals.

11 Cylinder Tube: High-strength aluminum alloy ideally suited for air service. The tube is clear anodized on the O.D. and hard anodic coated on the I.D., resulting in a smooth, file hard (60RC), corrosion and score resistant surface finish.

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

13 Rod Bearing: External removable steel bearing housing (black oxide finish), with an oil-impregnated sintered iron rod bearing.

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

2 Operates Quietly to Meet OSHA Specifications.

Series EA 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 A133B3 5" x 6"	EA155B3 5" x 6"	A1133A3 2" x 6"	EA1155A3 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^{5} N/m^{2}.

++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 EA 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 EA 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 EA 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 EA seal does the final stopping. See illustration at top of ACT-4 for cushion operation.

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. For higher loads and velocities please refer to the Decel-Air™ Cushion Option on ACT-1-9.

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

*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
6	279	495	899	1,744	2,709	4,685	7,486	10,429	4,520
12	68	122	221	430	699	1,159	1,854	2,583	3,800
18	30	53	95	187	291	507	810	1,130	1,576
24	16	29	52	102	160	279	444	622	869
30	10	18	32	63	99	172	275	387	541
36	6.7	12	21.6	42	66	116	183	259	363
42	4.7	8.3	14.7	29	46	81	129	181	257
48	3.4	5.7	10.4	21	33	59	93	131	187
54	2.3	4.3	7.6	15.3	24	43	68	97	138
60	1.8	3.2	5.4	11	18	33	52	74	106

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
0	.14	.15	.17	.19	.22	.25	.28	.32	.32
20	.10	.10	.12	.14	.16	.18	.20	.22	.22
40	.07	.07	.08	.09	.10	.12	.13	.14	.14
60	.04	.04	.05	.05	.06	.07	.07	.08	.08
80	.02	.02	.02	.02	.03	.03	.03	.04	.04
100	0	0	0	0	0	0	0	0	0

Note: These figures are for new cylinders. The impact dampening seals will take some compression set during operation of the cylinder 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

Cushion Function

As the cushion spear enters the cushion cavity, the exhaust port becomes sealed off creating an air brake. This provides the initial deceleration in piston speed. The oversized air cushion bleed orifice permits the cushion pressure to exhaust with minimal restriction. This allows the piston to move quickly and smoothly through the cushion length.

As the piston continues its travel to the point of impact with the end caps, the compressive qualities of the EJ seal provide the final decelerating force. This action compresses the EJ seal and absorbs the remaining kinetic shock vibration and noise created by the impact.

On the reverse stroke the EJ seal releases its compressive energy to propel the piston away from the end caps, producing an immediate breakaway.

Operating Temperatures:

Series EA	-20˚F to 200˚F (-29˚C to 107˚C)
with Viton Seals	-20˚F to 400˚F (-29˚C to 204˚C)

Operating Pressure:

250 PSIG Air (17 Bar)
EA Cylinders cannot be used in hydraulic applications.
Bore Sizes: 1-1/2", 2", 2-1/2", 3-1/4", 4", 5", 6", 7", 8"

Supply:

Filtered compressed air to 250 PSI

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: black anodized 6061-T6 aluminum
Tube: 6063-T832 aluminum, clear anodized O.D., hardcoat anodized I.D.
Rod: hard chrome plated steel
Piston: machined high-strength aluminum alloy
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

Side Loading:

Cylinders are specifically designed to push and pull. Side loading(misalignment)of the piston rod should be avoided to ensure maximum operating performance and life.

Care should be taken during installation to properly align the load to be moved with the center line of the cylinder.
The use of a rod alignment coupler (see page ACT-1-94) is strongly recommended whenever possible.

Air Cylinder Selection:

The proper application and selection of an air cylinder requires full consideration of the following: the fluid medium, operating pressures, mounting style, length of stroke, type of rod connection to the load, thrust or mounting tension on the rod, mounting attitude, speed of the stroke and how the load motion will be stopped.

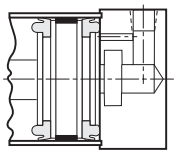
The data that follows provides the necessary information in the evaluation of an average application and will help you in selecting the proper cylinder model and size for your particular application.

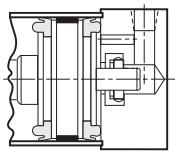
Note: 1-1/2", 2", 2-1/2", 3-1/4", 4" and 5" bore cylinders with 1/2" to 2" strokes will be furnished with a short head cushion sleeve and short cap cushion spear.
Only available on 5/8" and 1" rods.

The above specification applies to Series EA cylinders with standard non-adjustable or optional adjustable cushions.

Series EA Fixed Cushions

Piston and rod assembly for 1-1/2" thru 5" bore cylinders with less than 1/2" stroke, and 6" thru 8" bore cylinders with less than 2" stroke.





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

Ultra Cushion®

A Major Design and Performance Breakthrough in Air Cylinder Cushioning Systems!

Norgren's advanced cushion design features a unique, one-piece, nitrile compound seal that is captured within a precision machined groove. This allows both linear and radial "float" of the cushion seal which virtually eliminates problems associated with misalignment. Integral flow paths molded in the periphery of the seal provide exceptionally fast "out of cushion" stroke reversal without the use of ball checks.

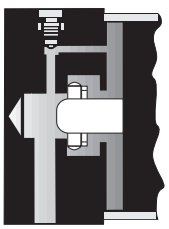


Figure 1

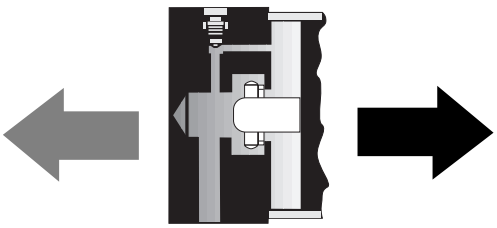


Figure 2 shows spear exiting cushion seal.

NFPA Aluminum & Steel Cylinders

Series J Cylinders are constructed with the finest materials for each component!

1 Piston Rod: Hard chrome plated high-tensile steel, ground and polished.

2 Rod Bearing: External removable threaded steel bearing housing (black oxide finish), with an oil-impregnated sintered iron rod bearing.

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

4 Head/Cap: Precision machined from steel, then black oxide finished 1-1/2" to 2-1/2" bores. Painted black finish on 3-1/4" to 12" bores.

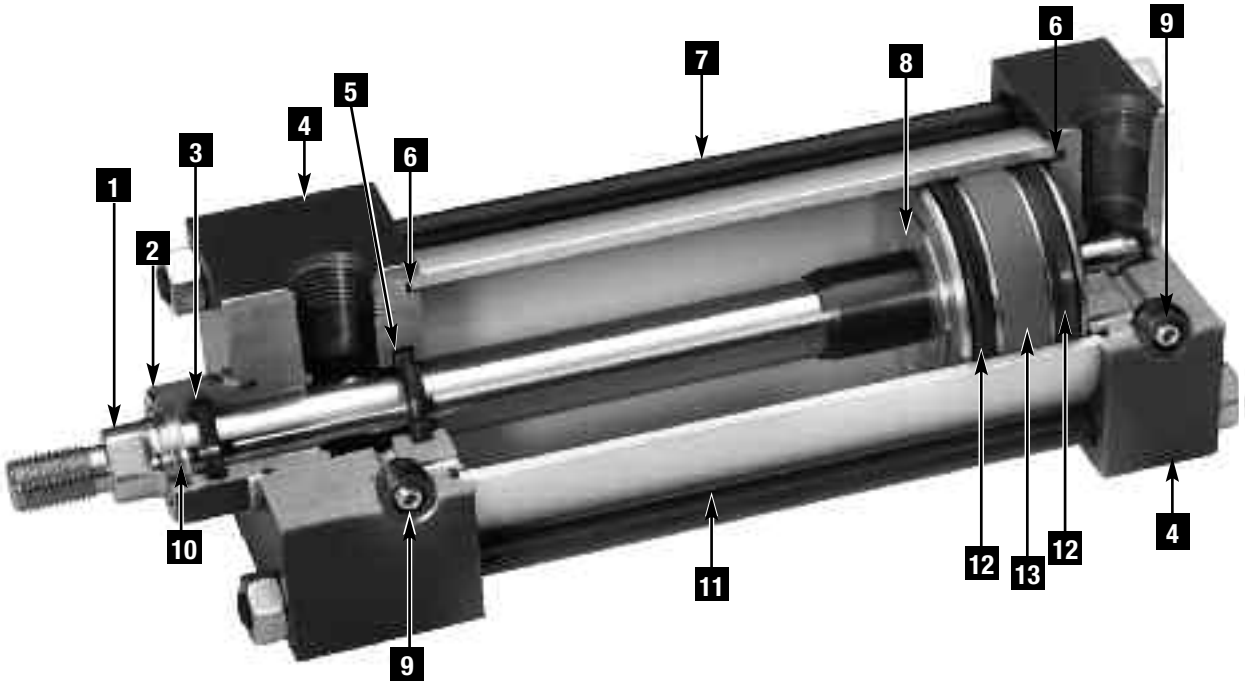
5 Ultra Cushion® Seals: Advanced design features a unique, one-piece, compound seal of nitrile* captured within a precision machined groove. Linear and radial "float" of the cushion seals eliminates misalignment. Ultra Cushions provide exceptionally fast "out of cushion" stroke reversal. (Head and Cap Cushions are optional.)
*Nitrile seals on the 5/8" & 1" rod diameter.
For rod sizes 1-3/8" and larger, urethane seals are standard.

6 O-Ring Tube Seal: Buna is standard. (Viton is optional.)

7 Rods: High-strength steel maintains uniform compression on tube end seals.

8 Piston: Machined solid steel, for high strength. Threaded piston is installed with high strength threadlocker adhesive then staked to the piston rod.

9 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.



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

11 Cylinder Tube: High-strength aluminum alloy 1-1/2", 2", 2-1/2" bore anodized on the O.D. and hard coat I.D. Steel cylinder tube hard chrome plated I.D. 3-1/4" to 12" bore.

12 Piston Seals: Long-wearing nitrile seals.

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

Application Information
Series J NFPA interchangeable steel air cylinders are offered with a variety of accessories, standard and optional equipment to meet your application needs.

The addition of a Teflon® wear ring to the outer perimeter of the piston permits us to guarantee its operation against failure due to lack of lubrication for ONE FULL YEAR, regardless of cycles! See page ACT-1-98 for complete warranty.

Standard non-cushioned Series J cylinders are recommended for applications that require full bottoming of the piston and where the noise emitted by the metal-to-metal impact between the piston and cylinder end caps is tolerable. We recommend that optional non-adjustable cushions be added for piston speeds (moving light tools) ranging from 15 to 30 in/sec. For speeds exceeding 30 in/sec, the cylinders should be equipped with adjustable air cushions.

Series EJ Ecology Cylinders are constructed with the finest materials for each component!

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 1-3/8" and larger, urethane seals are standard.

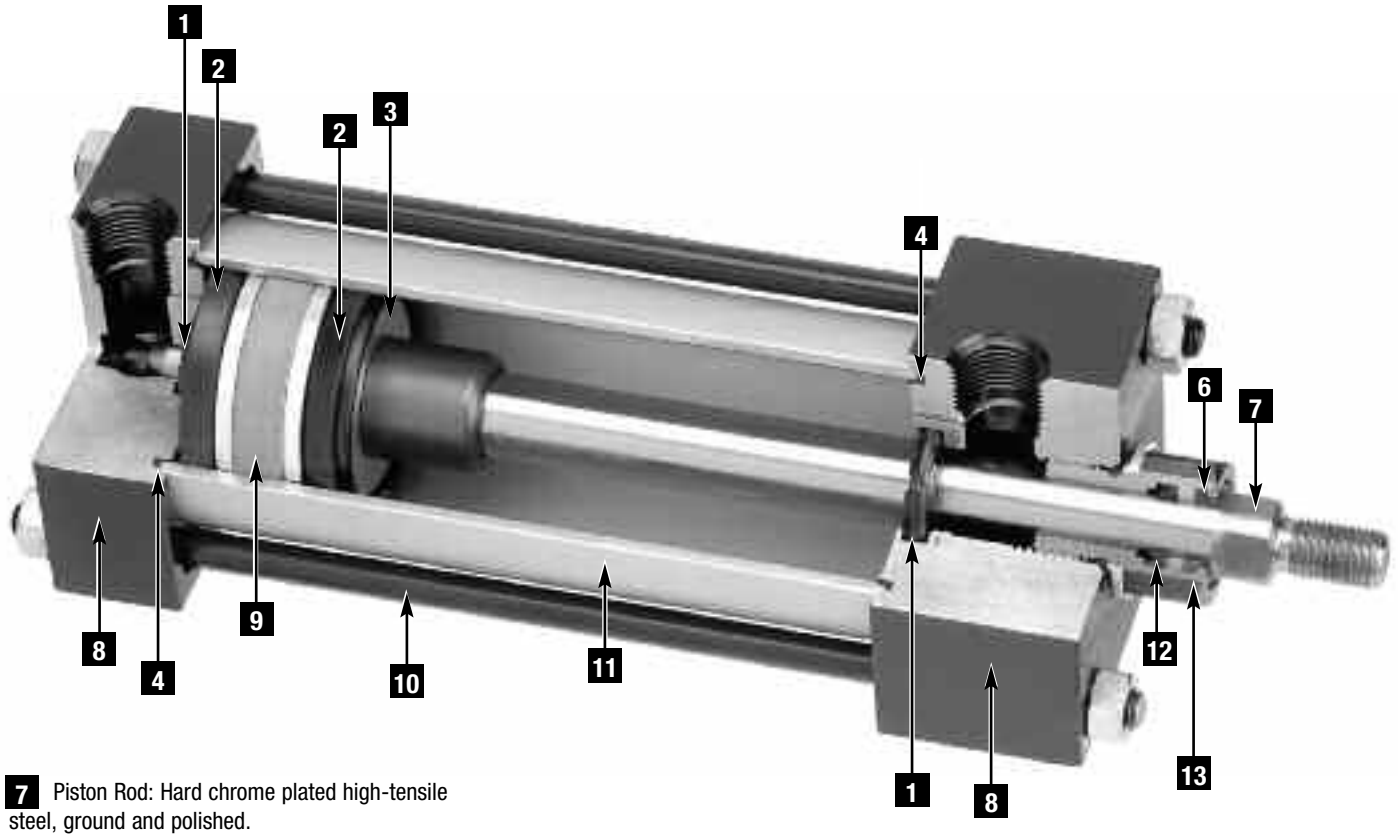
2 Impact Dampening Piston Seals: Our impact dampening piston seals, in conjunction with our advanced cushion design, decelerate and reduce end-of-stroke noise.

3 Piston: Machined solid steel, for high strength. Threaded piston is installed with high strength threadlocker adhesive then staked to the piston rod.

4 O-Ring Tube Seal: Buna is standard. (Viton is optional.)

5 Adjustable Captive Cushion Needle (not shown): Fine thread allows for safe and precision adjustment of cushion. (See page ACT-1-6.)

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



7 Piston Rod: Hard chrome plated high-tensile steel, ground and polished.

8 Head/Cap: Precision machined from steel, then black oxide finished 1-1/2" to 2-1/2" bores. Painted black finish 3-1/4" to 12" bores.

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

10 Tie Rods: High-strength steel maintains uniform compression on tube end seals.

11 Cylinder Tube: High-strength aluminum alloy 1-1/2", 2". 2-1/2" bore anodized on the O.D. and hard coat I.D. Steel cylinder tube hard chrome plated I.D. 3-1/4" to 12" bore.

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

13 Rod Bearing: External removable steel bearing housing (black oxide finish), with an oil-impregnated sintered iron rod bearing.

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 10^5 N/m^2.

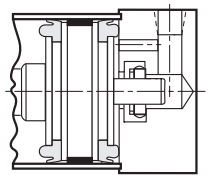
++End position of mike was 3' on centerline from end of cylinder; side position of mike was 3' perpendicular to centerline abeam of end of cylinder.

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.



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.

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 impact dampening piston seals w/ 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: These figures are for new cylinders. The impact dampening seals will take some compression set during operation of the cylinder 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

Cushion Function

As the cushion spear enters the cushion cavity, the exhaust port becomes sealed off creating an air brake. This provides the initial deceleration in piston speed. The oversized air cushion bleed orifice permits the cushion pressure to exhaust with minimal restriction. This allows the piston to move quickly and smoothly through the cushion length.

As the piston continues its travel to the point of impact with the end caps, the compressive qualities of the EJ seal provide the final decelerating force. This action compresses the EJ seal and absorbs the remaining kinetic shock vibration and noise created by the impact.

On the reverse stroke the EJ seal releases its compressive energy to propel the piston away from the end caps, producing an immediate breakaway.

Operating Temperatures:

Series J	-20°F to 200°F (-29°C to 107°C)
with Viton Seals	-20°F to 400°F (-29°C to 204°C)

Operating Pressure:

250 PSIG Air (17.2 Bar)
400 PSIG Hydraulic (27.6 Bar)
Bore Sizes: 1-1/2", 2", 2-1/2", 3-1/4", 4", 5", 6", 7", 8", 10", 12"

Supply:

Filtered compressed air to 250 PSI Petroleum based hydraulic fluid to 400 PSI

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: precision machined steel
Tube: 6063-T832 aluminum, clear anodized O.D., hard coat anodized I.D.
Rod: hard chrome plated steel
Piston: machined high-strength aluminum alloy
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

Side Loading:

Cylinders are specifically designed to push and pull. Side loading (misalignment) of the piston rod should be avoided to ensure maximum operating performance and life.

Care should be taken during installation to properly align the load to be moved with the center line of the cylinder.
The use of a rod alignment coupler (see page ACT-1-22 is strongly recommended whenever possible.

Air Cylinder Selection:

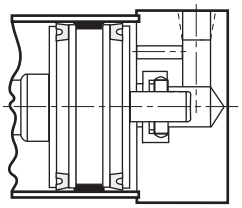
The proper application and selection of an air cylinder requires full consideration of the following: the fluid medium, operating pressures, mounting style, length of stroke, type of rod connection to the load, thrust or mounting tension on the rod, mounting attitude, speed of the stroke and how the load motion will be stopped.

The data that follows provides the necessary information in the evaluation of an average application and will help you in selecting the proper cylinder model and size for your particular application.

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.

The above specification applies to Series J cylinders with optional non-adjustable or adjustable cushions.

Series J Fixed Cushions



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

Ultra Cushion®

A Major Design and Performance Breakthrough in Air Cylinder Cushioning Systems!

Norgren's advanced cushion design features a unique, one-piece, nitrile compound seal that is captured within a precision machined groove. This allows both linear and radial "float" of the cushion seal which virtually eliminates problems associated with misalignment. Integral flow paths molded in the periphery of the seal provide exceptionally fast "out of cushion" stroke reversal without the use of ball checks.

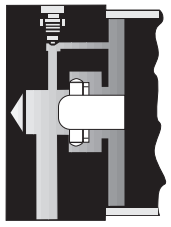


Figure 1

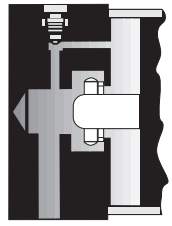
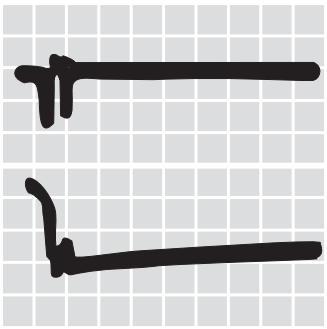


Figure 2 shows spear exiting cushion seal.

Tests by the Milwaukee School of Engineering confirm Ecology Cylinder Cushions are more efficient, faster acting and bounce less!

NORGREN ECOLOGY CYLINDERS with Non-Adjustable Cushions

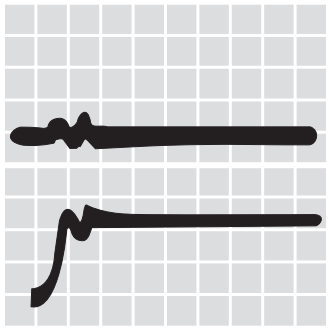
2" Bore Rod End Cushion Test
Average deceleration force = 15 G's
Time consumed during cushioning = 0.030 sec.
Number of bounces: 1 Pneumatic – 1 Metallic



Acceleration: 1 div. = 10 G's
X Axis: 1 div. = .03 seconds

Velocity: 1 div. = 20 in/sec.
14.5 lbs. added to rod

2" Bore Cap End Cushion Test
Average deceleration force = 17.5 G's
Time consumed during cushioning = 0.025 sec.
Number of bounces: 1 Pneumatic – 1 Metallic

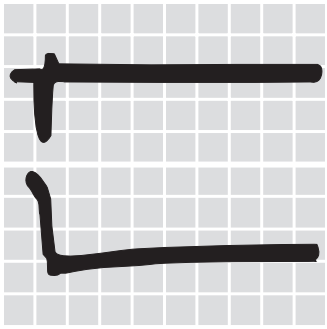


Acceleration: 1 div. = 10 G's
X Axis: 1 div. = .03 seconds

Velocity: 1 div. = 20 in/sec.
14.5 lbs. added to rod

NORGREN ECOLOGY CYLINDERS with Adjustable Cushions

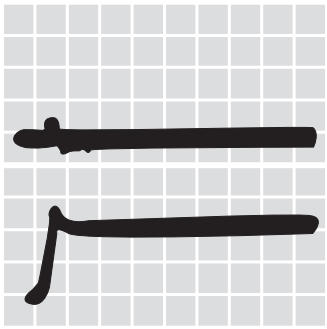
2" Bore Rod End Cushion Test
Average deceleration force = 20 G's
Time consumed during cushioning = 0.015 sec.
Number of bounces: 1/2 Pneumatic – 0 Metallic



Acceleration: 1 div. = 10 G's
X Axis: 1 div. = .03 seconds

Velocity: 1 div. = 20 in/sec.
2.5 lbs. added to rod

2" Bore Cap End Cushion Test
Average deceleration force = 10 G's
Time consumed during cushioning = 0.020 sec.
Number of bounces: 1/2 Pneumatic – 0 Metallic

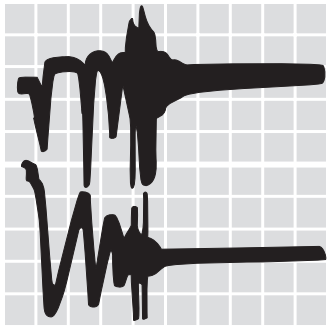


Acceleration: 1 div. = 10 G's
X Axis: 1 div. = .03 seconds

Velocity: 1 div. = 20 in/sec.
2.5 lbs. added to rod

COMPETITIVE CYLINDERS with Adjustable Cushions

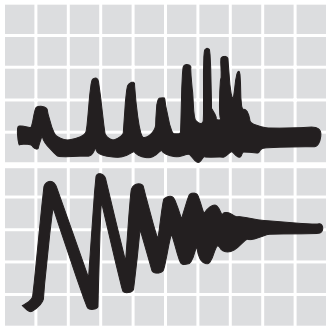
2" Bore Rod End Cushion Test
Average deceleration force = 78 G's
Time consumed during cushioning = 0.120 sec.
Number of bounces: 2 Pneumatic – 4 Metallic



Acceleration: 1 div. = 10 G's
X Axis: 1 div. = .03 seconds

Velocity: 1 div. = 20 in/sec.
14.5 lbs. added to rod

2" Bore Cap End Cushion Test
Average deceleration force = 60 G's
Time consumed during cushioning = 0.120 sec.
Number of bounces: 3 Pneumatic – 4 Metallic



Acceleration: 1 div. = 10 G's
X Axis: 1 div. = .02 seconds

Velocity: 1 div. = 20 in/sec.
14.5 lbs. added to rod

2" Bore Cylinder Tests Results

Figures shown are average and not the result of each individual test. Piston velocity was regulated at 45 in/sec.

Cylinders with Cushions	Weight attached to Piston Rod (lbs)	Cushion Efficiency (G's* Created)	Cushioning Time (Ms)	Bounce Cycles During Cushioning
Norgren Ecology Adjustable	8.5	14.50	25.00	1.00
Norgren Ecology Non-Adjustable	8.5	17.50	26.25	1.75
Competitor A Adjustable	8.5	48.00	107.50	7.25
Competitor B Adjustable	8.5	32.75	102.50	6.50
Competitor C Adjustable	8.5	50.50	81.25	9.25

*Measured in G's of deceleration force created. All cylinders tested were NFPA types, front flange mounting, 6" stroke with standard diameter piston rods.

4" Bore Cylinder Tests Results

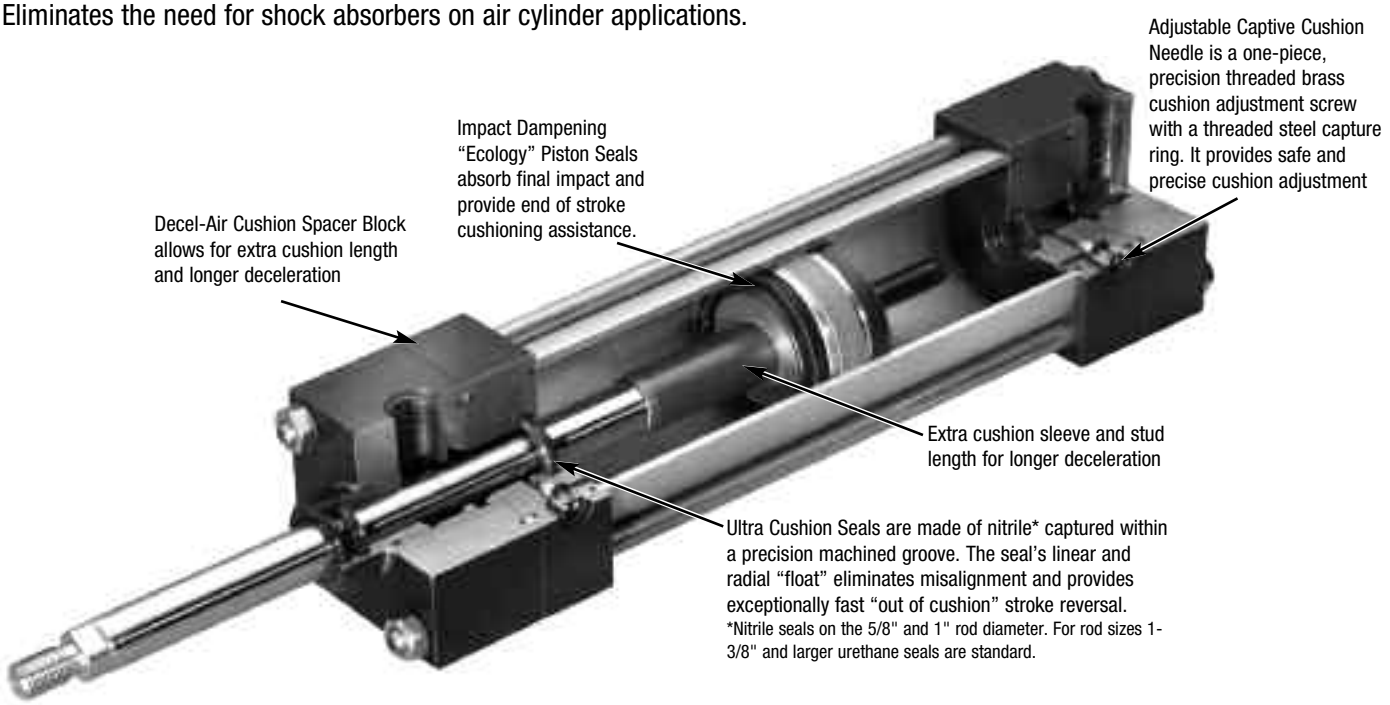
Figures shown are average and not the result of each individual test. Piston velocity was regulated at 25 in/sec.

Cylinders with Cushions	Weight attached to Piston Rod (lbs)	Cushion Efficiency (G's* Created)	Cushioning Time (Ms)	Bounce Cycles During Cushioning
Norgren Ecology Adjustable	54	5.25	40.00	3.25
Norgren Ecology Non-Adjustable	54	12.00	28.75	2.75
Competitor A Adjustable	54	11.50	92.50	6.75
Competitor B Adjustable	54	8.00	77.50	5.25
Competitor C Adjustable	54	6.50	67.50	6.25

*Measured in G's of deceleration force created. All cylinders tested were NFPA types, front flange mounting, 6" stroke with standard diameter piston rods.

NFPA Aluminum & Steel Cylinders
Decel-Air™ Cushioned Cylinder

Eliminates the need for shock absorbers on air cylinder applications.



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.

Why does our Decel-Air Cushion work?

The extra cushion length of the Decel cushioned cylinder provides an additional deceleration capability to slow the cylinder's moving mass to a point where the positive cushioning effect of our Impact Dampening Piston Seals can perform the final cushioning.

Norgren's Decel-Air Cushioned Cylinders Versus Cylinder Mounted Shock Absorbers

The first extensive evaluation of pneumatic cylinder cushion performance was undertaken by the Mechanical Engineering Department of The Ohio State University. The test was conducted on 2-1/2" bore, 12" stroke.

The OSU tests found the Decel Cushioned cylinders absorbed almost three times as much kinetic energy with a lower level of peak cushion as a standard Ecology seal configured cylinder.

Because air is compressible and is exhausted out of the cylinder each cycle, the internal heat buildup is minimized. The **"Maximum Inch Pounds Per Hour"** rating which is essential in determining the effectiveness of shock absorber performance is **not needed** to judge Decel cushion performance.

The test indicated that Norgren Decel-Air Cushioned cylinders could prove to be superior to a hydralic shock absorber assisted cylinder for high cycle, high velocity applications with light to moderate loading (precisely the area where most severe cylinder applications exist). The cycle rates and the cushioning times of the Decel-Air Cushioned cylinders and the hydraulic shock absorber assisted cylinders were comparable.*

Decel-Air Cushioned cylinders are also less costly than shock absorber mounted cylinders and are self-contained units.

*For comparative evaluation, a well-known hydraulic shock absorber was chosen. The OSU tests showed a smooth shock-absorbing operation was achieved at very low velocities using the shock absorbers, but at comparable Decel Cushion cylinder velocities, a high mechanical impact took place on the shock absorber mounted cylinder.

Potential Decel-Air Cushion Applications

1. Conveyors & Material Handling Equipment
2. Transfer Machines & Shuttle Tables
3. Packaging Machinery
4. Foundry Equipment
5. Automatic Gate Opening & Closing

NFPA Aluminum & Steel Cylinders

The Decel Cushioned cylinder increases the kinetic energy absorption capability by increasing the effective cushion spear length in the cylinder.

The Decel Cushioned cylinder increases the standard cushion spear length by 100%, allowing an increase in kinetic energy absorption capability by two times.

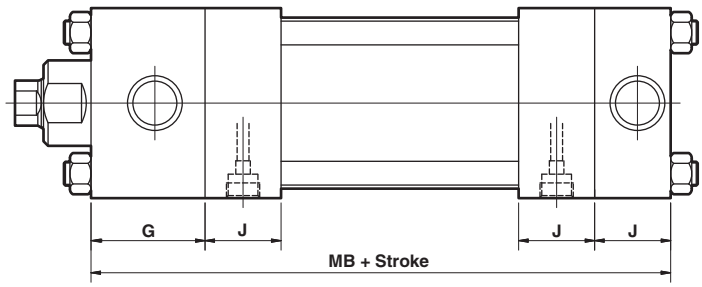
Decel Cushioned Cylinder
Fully Cushioned Load Stopping Capacity in Pounds*

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 wight in total load to be stopped.

Piston Rod Dia.	Weights*
5/8"	- .30 lb. + 0.09 lb./in. stroke
1"	- .90 lb. + 0.22 lb./in. stroke
1-3/8"	- 2.2 lb. + 0.42 lb./in. stroke
1-3/4"	- 4.0 lb. + 0.68 lb./in. stroke
2"	- 5.5 lb. + 0.90 lb./in. stroke
2-1/2"	- 10.1 lb. + 1.40 lb./in. stroke

Double Weight for double rod end cylinders



NOTE:
- All dimensions not shown are per STD NFPA dimensions
- For cylinders with (1) Decel Cushion AOL dimension wil be "MB"-"J".

Decel Cushioned cylinder envelope dimensions are not NFPA dimensionally interchangeable over the stroke length.

NOTE: See page ACT-1-7 for "Effect of Impact Dampening Seals on Total Stroke of Cylinders," and page ACT-1-15 for Rod End Dimensions.

Basic Envelope Dimensions

Cyl. Bore	G	J	Add Stroke MB
1-1/2	1-1/2	1	5-5/8
2	1-1/2	1	5-5/8
2-1/2	1-1/2	1	5-3/4
3-1/4	1-3/4	1-1/4	6-3/4
4	1-3/4	1-1/4	6-3/4
5	1-3/4	1-1/4	7
6	2	1-1/2	8
7	2	1-1/2	8-1/8
8	2	1-1/2	8-1/8

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	
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.

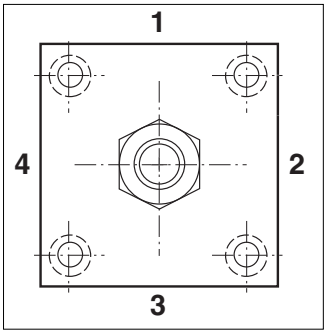
Piston Rod Threads	Type	Dim ref
Small Male (Solid) (std)	1	KK
Intermediate Thread Male (Solid)	2	CC
Female	3	KK
Full Thread Male (Solid)	6	FF
Plain Rod End	7	–

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

Notes
+ Head cushion not availale 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(– –)	Pneulectric 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)
LD	Rodlock with manual release
LE	Rodlock
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)
UB*	Head and cap bumpers
UC*	Cap bumper
UH*	Head bumper (Adds 1/4" per bumper to overall 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.

*UA Unit Air Assembly

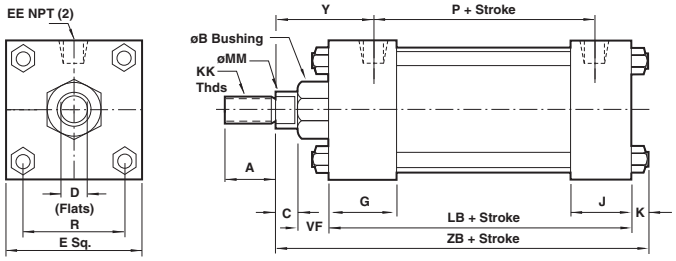
** When ordering “EN” option specify S, SS, TS, and SB options.

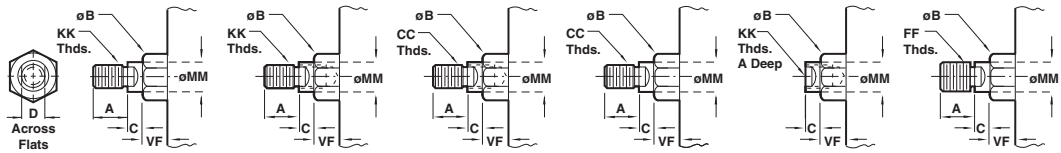
Consult Factory for These Options:

Option Code	Description
AS	Airsaver stroke adjustment
BB	Cylinders mounted back to back
CT	Close tolerance on cylinder stroke
LA	Low friction cylinder (Pak-LapTM style seals)
NI	Nituff® coated cylinder
NS	No silicone used in cylinder assembly
OE	Zero stroke/pneulectric 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



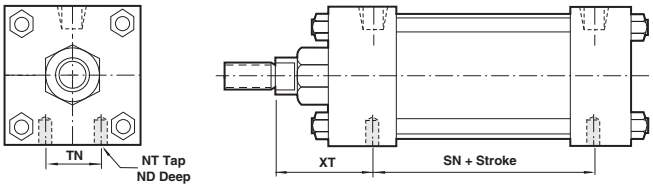


Type 1 Solid (Small Male) | Type 1 Studded (Studded Male Optional) | Type 2 Studded (Intermediate Thread Male Optional) | Type 2 Solid (Intermediate Thread Male Optional) | Type 3 Female (Optional) | Type 6 Solid (Full Thread Male Optional)

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
	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 -.002	Std.	1.124	1.124	1.124	1.499	1.499	1.499	1.999	1.999	1.999	2.374	2.624
	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
	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
	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
	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
	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
	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	8.004	9.4069
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
Y	Std.	1.840	1.840	1.840	2.380	2.380	2.380	2.813	2.813	2.813	3.125	3.250
	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
	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

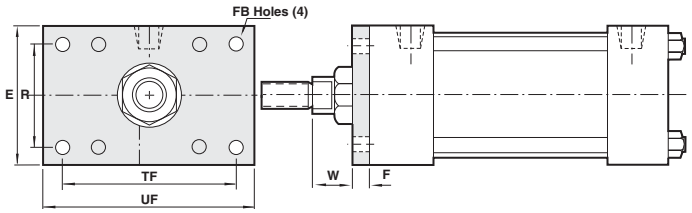


Bore		1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
ND		.375	.375	.500	.750	.750	.938	1.125	1.125	1.125	1.500	1.500
NT		1/4 – 20	5/16 – 18	3/8 – 16	1/2 – 13	1/2 – 13	5/8 – 11	3/4 – 10	3/4 – 10	3/4 – 10	1 – 8	1 – 8
SN		2.250	2.250	2.375	2.625	2.625	2.875	3.125	3.250	3.250	4.125	4.625
TN		.625	.875	1.250	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
	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

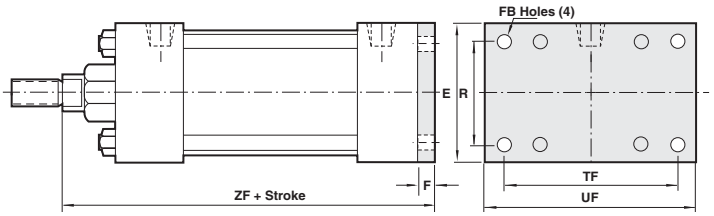
NFPA (MF1) 03 Head Rectangular Flange Mount



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.

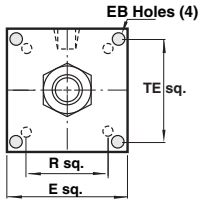
NFPA (MF2) 04 Cap Rectangular Flange Mount



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.

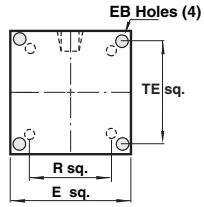
NFPA (ME3) 03 Head Square Mount



Bore	7"	8"	10"	12"
E	7.500	8.500	10.625	12.750
EB	.563	.688	.813	.813
R	5.730	6.442	8.004	9.406
TE	6.750	7.570	9.406	11.109

All dimensions ± .015 unless otherwise noted.

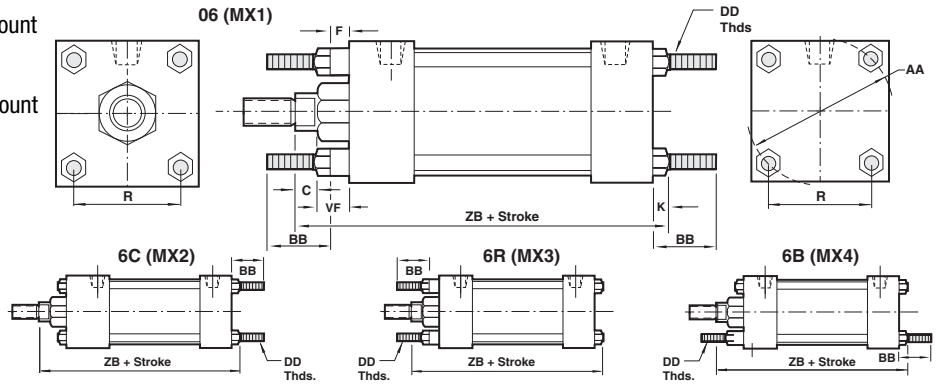
NFPA (ME4) 04 Cap Square Mount



Bore	7"	8"	10"	12"
E	7.500	8.500	10.625	12.750
EB	.563	.688	.813	.813
R	5.730	6.442	8.004	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

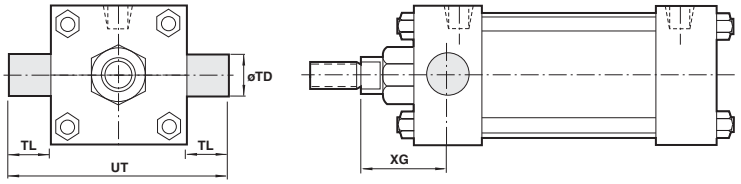


Bore		1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
AA		2.020	2.600	3.100	3.900	4.700	5.800	6.900	8.100	9.100	11.313	13.313
BB		1.000	1.125	1.125	1.375	1.375	1.813	1.813	2.313	2.313	2.688	2.688
C	Std.	.375	.375	.375	.500	.500	.500	.625	.625	.625	.750	.875
	O.S.	.500	.500	.500	.625	.625	.625	.750	.625	.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	8.004	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

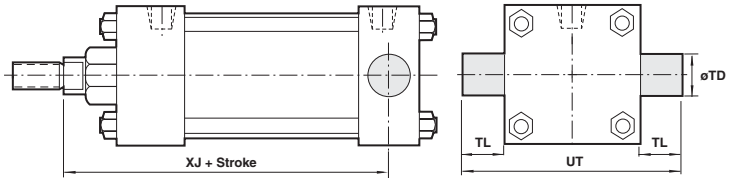
NFPA (MT1) 07 Head Trunnion Mount



Bore		1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
TD +.000 -.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.

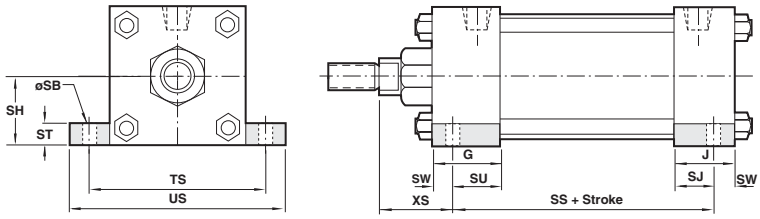
NFPA (MT2) 8R & 08 Cap Trunnion Mount



Bore		1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
TD +.000 -.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.

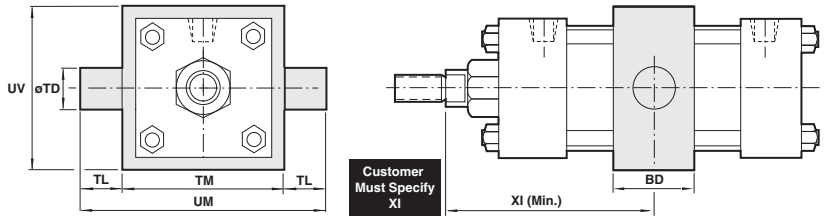
NFPA (MS2) 09 Side Lug Mount



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.

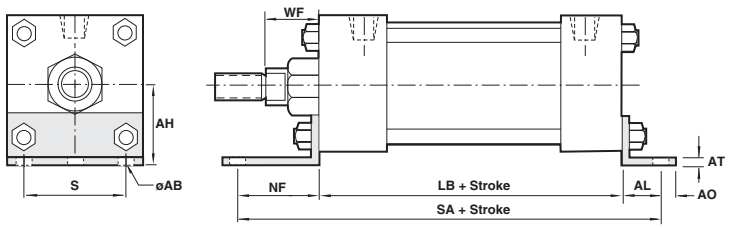
NFPA (MT4) 10 Center Trunnion Mount



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.

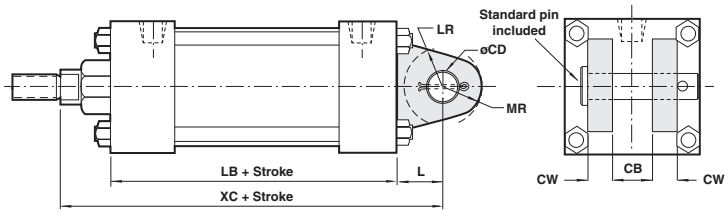
NFPA (MS1) 11 Side End Angle Mount



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



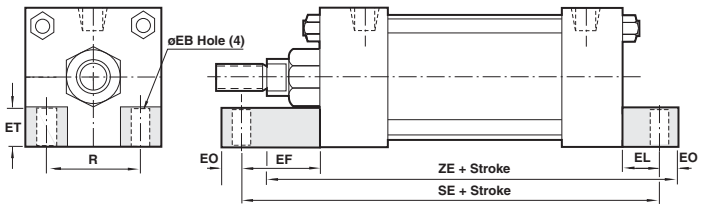
Bore		1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
CB		.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500	2.000	2.500
CD		.500	.500	.500	.750	.750	.750	1.000	1.000	1.000	1.375	1.750
CW		.500	.500	.500	.625	.625	.625	.750	.750	.750	1.000	1.250
L		.750	.750	.750	1.250	1.250	1.250	1.500	1.500	1.500	2.125	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

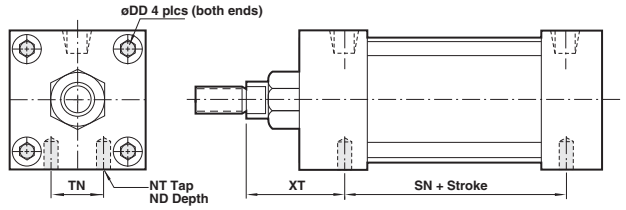
All dimensions ± .015 unless otherwise noted.

NFPA (MS7) 15 End Lug Mount



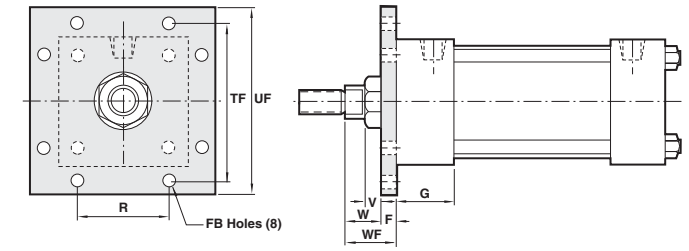
Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"
EB	.313	.375	.375	.438	.438	.563	.563	.688	.688
EF	1.125	1.313	1.438	1.500	1.625	1.688	1.750	1.750	1.750
EL	.750	.938	1.063	.875	1.000	1.063	1.000	1.125	1.125
EO	.250	.313	.313	.375	.375	.500	.500	.625	.625
ET	.500	.750	.750	1.000	1.250	1.500	1.500	1.750	2.063
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)



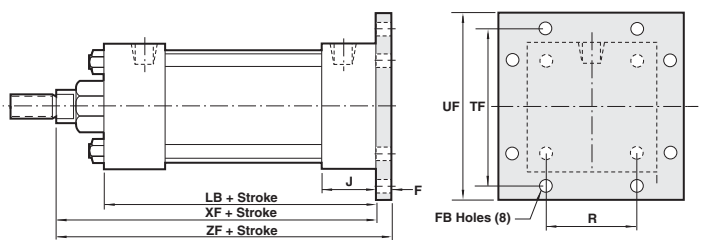
Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"
DD	1/4-28	5/16-24	5/16-24	3/8-24	3/8-24	1/2-20	1/2-20
NT	1/4 – 20	5/16 – 18	3/8 – 16	1/2 – 13	1/2 – 13	5/8 – 11	3/4 – 10
ND	.375	.375	.500	.750	.750	.938	1.125
SN	2.250	2.250	2.375	2.625	2.625	2.875	3.125
TN	.625	.875	1.250	1.500	2.063	2.688	3.250
XT Std.	1.938	1.938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



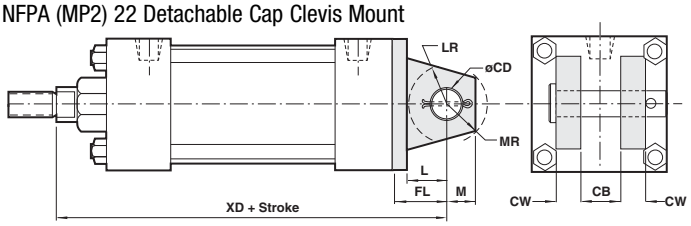
Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"
F	.375	.375	.375	.625	.625	.625	.750
FB	.313	.375	.375	.438	.438	.563	.563
G	1.500	1.500	1.500	1.750	1.750	1.750	2.000
R	1.428	1.838	2.192	2.758	3.323	4.101	4.879
TF	2.750	3.375	3.875	4.688	5.438	6.625	7.625
UF	3.375	4.125	4.625	5.500	6.250	7.625	8.625
V Std.	.250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



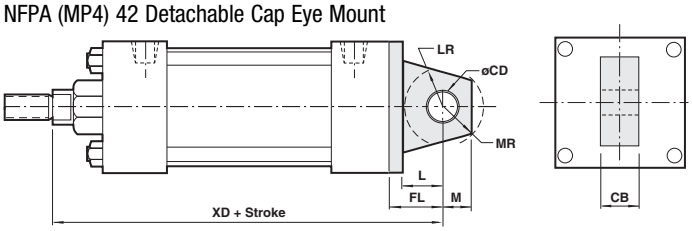
Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"
F	.375	.375	.375	.625	.625	.625	.750
FB	.313	.375	.375	.438	.438	.563	.563
J	1.000	1.000	1.000	1.250	1.250	1.250	1.500
LB	3.625	3.625	3.750	4.250	4.250	4.500	5.000
R	1.428	1.838	2.192	2.758	3.323	4.101	4.879
TF	2.750	3.375	3.875	4.688	5.438	6.625	7.625
UF	3.375	4.125	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

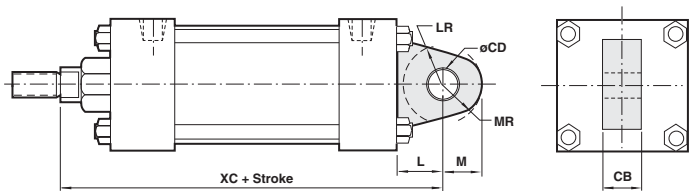
NFPA (MP4) 42 Detachable Cap Eye Mount



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

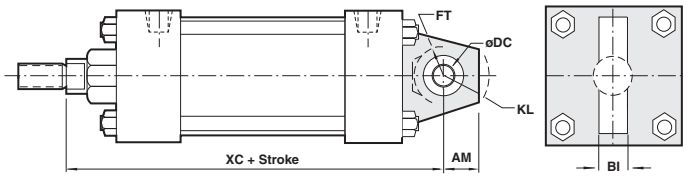
NFPA (MP3) 32 Cap Fixed Eye



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.

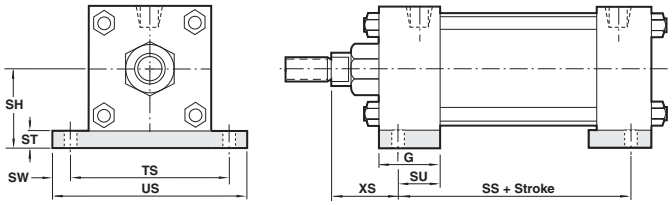
52 (Not NFPA) Spherical Bearing Mount



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.

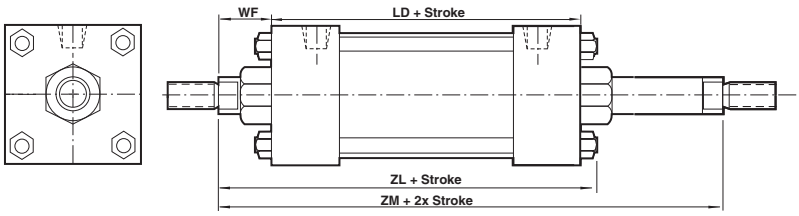
60 Base (Not NFPA) Bar Mount



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



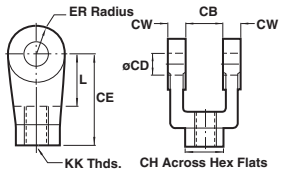
Bore		1-1/2"	2"	2-1/2"	3-1/4"	4"	5"	6"	7"	8"	10"	12"
LD		4.125	4.125	4.250	4.750	4.750	5.000	5.500	5.625	5.625	6.625	7.125
WF	Std.	1.000	1.000	1.000	1.375	1.375	1.375	1.625	1.625	1.625	1.875	2.000
	O.S.	1.375	1.375	1.375	1.625	1.625	1.625	1.875	1.875	1.875	2.000	2.250
ZL	Std.	5.375	5.438	5.563	6.500	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	8.250	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.

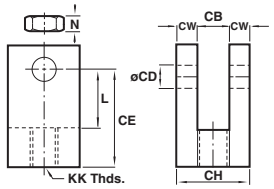
NFPA Rod Clevis



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

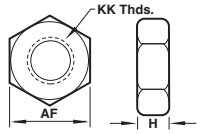
Small Rod Clevis & Jam Nut



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

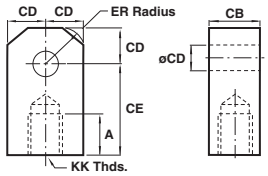
Rod Clevis	Rod Clevis Assy.	KK	CB	CD	CE	CH	CW	L	N
49218	49218A	1/2 – 20	.500	.500	1.375	1.000	.250	.750	.375
49219	49219A	3/4 – 16	.750	.750	1.750	1.500	.375	1.000	.500

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

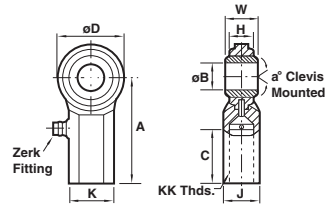
NFPA Rod Eye



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

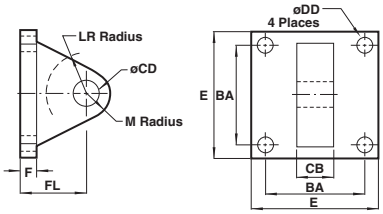
Rod Eye	Rod Eye Assy.	KK	A	CB	CD	CE	ER
49015	49015A	7/16 – 20	.750	.750	.500	1.500	.563
49014	49014A	1/2 – 20	.750	.750	.500	1.500	.563
49091	49091A	5/8 – 18	.750	1.250	.750	2.063	.500
49013	49013A	3/4 – 16	1.125	1.250	.750	2.063	.938
49092	49092A	7/8 – 14	1.125	1.250	.750	2.063	.750
49011	49011A	1 – 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	1 – 14
a°	Misalignment Angle	12	14	14
A	± .015	2.125	2.875	4.125
B	+ .0025 / -.0005	.500	.750	1.000
C	+ .062/ -.031	1.063	1.563	2.125
D	± .010	1.313	1.750	2.750
H	Reference	.453	.593	1.000
J	± .010	.750	1.000	1.500
K	± .010	.875	1.125	1.625
W	+ .000 / -.005	.625	.875	1.375

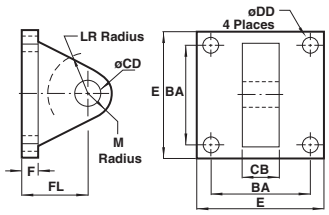
NFPA Eye Bracket



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

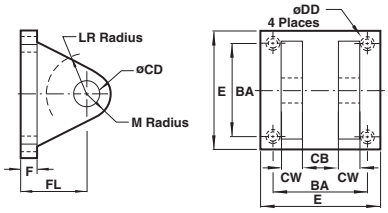


Note: Norgren Eye Bracket Assembly is supplied with Standard Pin.

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

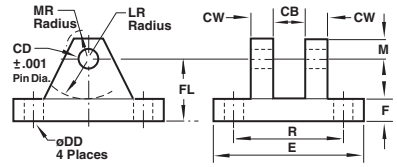


Note: NFPA Clevis Bracket Assembly is supplied with Standard Pin.

NFPA Clevis Bracket	49250	49251	49252
Clevis Bracket Assembly	49250A	49251A	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.

Norgren Clevis Bracket

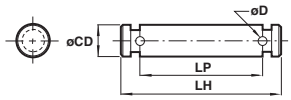


Note: Norgren Clevis Bracket Assembly is supplied with Standard Pin.

Norgren Clevis Bracket	49022	49023	49024	49027	49025	49026
Clevis Bracket Assembly	49022A	49023A	49024A	49027A	49025A	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.

NFPA Pin

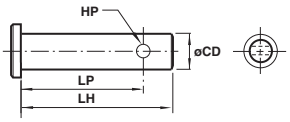


Note: ø.500, .750, 1.000 are Retainer type design ø1.375 and larger are Cotter Pin design.

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	5.812	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.

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

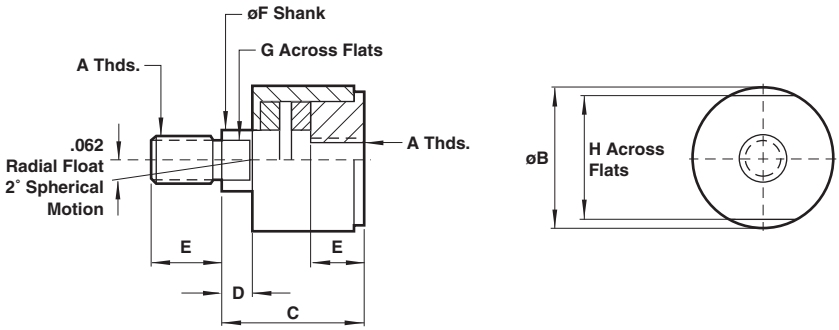
All dimensions ± .015 unless otherwise noted.

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.



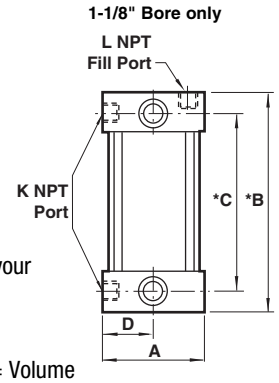
Rod Alignment Coupler Dimensions

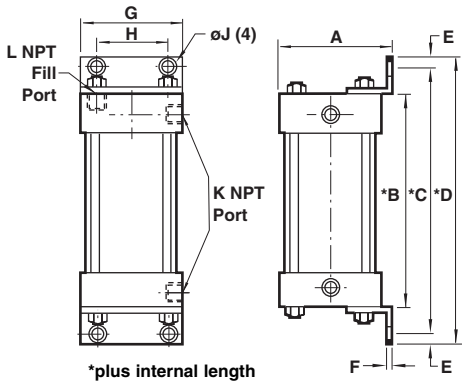
	CC-1-07	CC-1-08	CC-1-10	CC-1-12	CC-1-14	CC-1-16	CC-1-20	CC-1-24	CC-1-28
A	7/16 – 20	1/2 – 20	5/8 – 18	3/4 – 16	7/8 – 14	1 – 14	11/4 – 12	11/2 – 12	13/4 – 12
B	1.250 (31.75)	1.250 (31.75)	1.250 (31.75)	1.750 (44.45)	1.750 (44.45)	2.500 (63.50)	2.500 (63.50)	3.250 (82.50)	3.250 (82.50)
C	2.000 (50.80)	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)
D	.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)
E	.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)
F	.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)
G	.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)
H	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)
Max Pull (lbs.)	10,000	14,000	19,000	34,000	39,000	64,000	78,000	134,000	134,000

NFPA Aluminum & Steel 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

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

(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	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)	.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)	4.25	(107.95)	7.125	(180.98)
øJ			.437	(11.10)	.562	(14.27)	.690	(17.53)	.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 — Bore Area	1-1/8" .995 sq."	2" 3.14 sq."	3-1/4" 8.30 sq."	5" 19.64 sq."	8" 50.26 sq."
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

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) 40	(3)	60	(4)	80	(6)	100	(7)	150	(10)	200	(14)	Volume Cu Ft (cm3) Displacement Per Inch	
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) 40	(3)	60	(4)	80	(6)	100	(7)	150	(10)	200	(14)	Volume Cu Ft (cm3) Displacement Per Inch	
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)

Piston Rod Diameter Selection

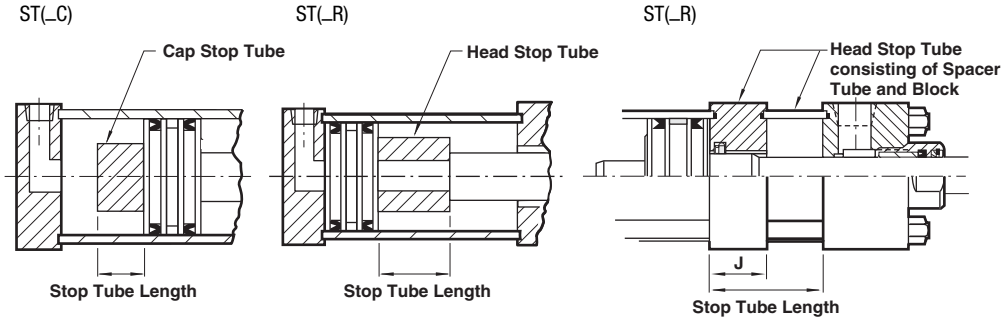
Applications requiring long extend (push) strokes may require oversize piston rod diameters to prevent buckling.

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).
5. 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 value of L (calculated from the Adequate Rod Diameter Chart) 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".
6. Recommended Mounting Styles for Maximum Stroke and Thrust Load:
   - Multiply cylinder stroke by appropriate stroke factor to obtain effective length L.
   - If cylinder has extra rod extension, add this extension to the stroke length before obtaining effective length.

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)

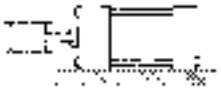
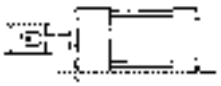
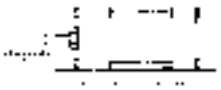
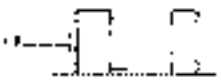
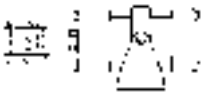
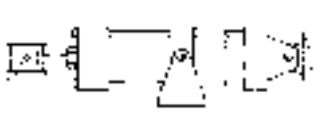
Rod Selection Chart

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

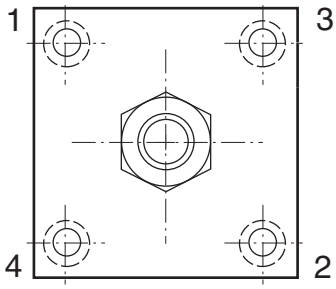
Cylinder Mounting Diagram Chart

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 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.



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	–	–	–	–	–

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.

Series A & EA Cylinder Weights lbs (kg)

Bore Inch (mm)	Rod Inch (mm)	Mounting Code 01, 05, 16	03	04	06	7R, 8R, 09, 60	11	12	15	20, 21, 22, 32	10, 42, 52	Add Per Inch of Stroke
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)
2" (50.80)	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)
	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)
2-1/2" (63.50)	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)
	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)
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 01, 05, 16	03	04	06	07, 08, 09	11	12	15	20, 21, 22, 32	10, 42, 52	Add Per Inch of Stroke
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)
2" (50.80)	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)
	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)
2-1/2" (63.50)	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)
	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)
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 (39.81)	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 Extend	Series J Retract	Low Friction Seals (LF) Extend	Low Friction Seals (LF) 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 Value added Solutions

Position Feedback

- Continuous indication of piston position.
- Completely integrated.
- Can be manufactured to accept multiple brands of feedback devices.

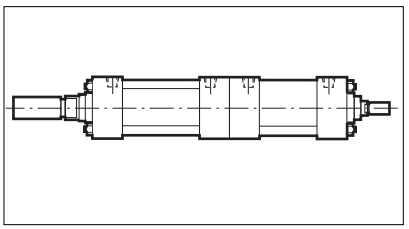
Unit-Air Assembly

- Valve mounted cylinder
- Integrated design
- Improved efficiency and performance

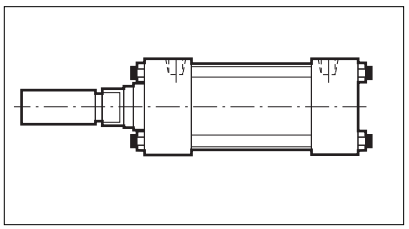
Position-Air

- Fixed multiple positions.
- Space saving design.
- Incorporates many of the extensive features available in the NFPA design.

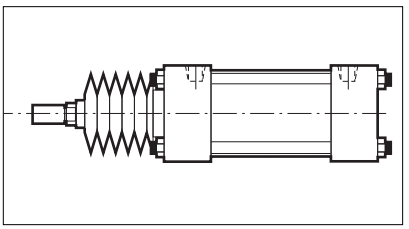
Multi-Position Back-to-Back



Oversize Piston Rod



Protective Rod Boot



Other Custom Cylinders:

Norgren designs and manufactures literally hundreds of specialty cylinders. We welcome the opportunity to provide you with a customized cylinder that meets the specific requirements of your application. For more information on how to order custom cylinders consult factory.

NEN Series NFPA Aluminum Cylinders

1-1/2" to 4" bore sizes

Competitively priced
Magnetic piston standard
Adjustable cushion standard
Sleeve nut construction standard
Stocked strokes

Technical data

Medium:
Filtered compressed air

Operating temperature:
-25°F to 140°F (-5°C to 60°C)
With Viton Seals: -23°F to 300°F (-5°C to 150°C)

Operating Pressure:
Minimum 7 psi (.5 bar)
Maximum 140 psi (9.7 bar)

Bore Sizes: 1-1/2", 2", 2-1/2", 3-1/4", 4"

Rod Diameter: 5/8" diameter piston rod in 1-1/2", 2", 2-1/2" bore

1" diameter piston rod in 3-1/4" and 4" bore

Lubrication: None required
Norgren Air Cylinders are rated for "no lube added" service.

Materials

Head and End Caps:
Die cast aluminum painted for corrosion protection.

Tube: Aluminum alloy, hard coat anodized

Piston: machined high-strength aluminum casting.

Rod Bearing: clean metal teflon composite

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

Tie Rods: Nickel plated high-tensile strength steel.

1 Piston Rod: Hard chrome plated carbon steel, ground and polished.
2 Head Bearing Housing and cap: Die cast aluminum
3 Tie-Rods: Nickel plated steel
4 Piston: Machined aluminum .
5 Captive Cushion Needle Adjustment: Provides safe and precise cushion adjustment.
6 Wear Ring: Teflon® material provides supreme wear and excellent bearing support.
7 Cylinder Tube: Hard anodized aluminum alloy, with corrosion and score resistant surface finish.
8 Piston Rod Wiper/Seal: Abrasion resistant nitrile.
9 Piston Seal: Single Nitrile bi-directional piston seal.
10 Cushion Seal: Nitrile cushion seal is captured within a precision machined groove allowing for linear and radial float eliminating misalignment.
11 Rod Bearing: A composite of Teflon and polyphenylene sulfide and bronze molded to a steel backing provides low friction and excellent linear features.

NEN "Add-a-mount" flexibility

NEN cylinders allow you to add NFPA mounts shown below when you order the cylinder from the factory, or add the mounts later.


NFPA MF1


NFPA MF2


NFPA MP1


NFPA MP2

NEN Series NFPA Aluminum Cylinders

All Dimensions in Inches (mm)

Cylinder Order Information

NEN 1 C x 4 E – MP1 – V
(1) (2) (3) (4) (5) (6) (7)

Series
NEN

Piston Rod Threads	
Small Male (Solid) (std)	1
Intermediate Thread Male (Solid)	2
Female	3

Bore	Single rod
1-1/2"	C
2.0"	D
2-1/2"	E
3-1/4"	F
4.0"	G

Stroke (whole inches)	
All bores	48" max.*

* Conatact factory for strokes longer than 48".

Fraction of Stroke length	
0	Blank
0.125"	C
0.250	E
0.375	G
0.500	J
0.625	M
0.750	P
0.875	S

Additional Options	
Viton® Seals	V
Rod Extension	RX
Non-standard piston rod thread	T
Piston Rod thread extension	TX
Stainless steel piston rod	S
Stainless steel tie rods	SS

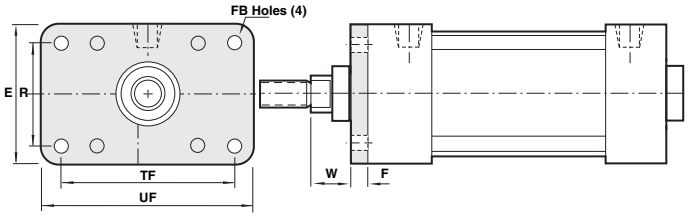
Mounting Options**	
MS4 (standard)	blank
Head Rectangular Flange	MF1
Cap Rectangular Flange	MF2
Detachable Cap Clevis	MP2
Cap Fixed Clevis	MP1
Tie Rod Extended both ends	MX1
Tie Rod Extended Cap	MX2
Tie Rod Extended Head	MX3
Side Lug Mount	MS2

** For factory installed mounts specify mounting option in position 6. If no mount required leave position 6 blank. Mounting kits can be ordered separately
Contact factory for mounting kits, or visit www.norgren.com

Stock Stroke Cylinders

1-1/2" Bore			2.0" Bore			2-1/2" Bore			3-1/4" Bore			4.0" Bore		
Model Number	Cylinder Bore	Stroke	Model Number	Cylinder Bore	Stroke	Model Number	Cylinder Bore	Stroke	Model Number	Cylinder Bore	Stroke	Model Number	Cylinder Bore	Stroke
NEN1C x 1	1-1/2	1.00	NEN1D x 1	2	1.00	NEN1E x 1	2-1/2	1.00	NEN1F x 1	3-1/4	1.00	NEN1G x 1	4	1.00
NEN1C x 2	1-1/2	2.00	NEN1D x 2	2	2.00	NEN1E x 2	2 1/2	2.00	NEN1F x 2	3-1/4	2.00	NEN1G x 2	4	2.00
NEN1C x 3	1-1/2	3.00	NEN1D x 3	2	3.00	NEN1E x 3	2 1/2	3.00	NEN1F x 3	3-1/4	3.00	NEN1G x 3	4	3.00
NEN1C x 4	1-1/2	4.00	NEN1D x 4	2	4.00	NEN1E x 4	2 1/2	4.00	NEN1F x 4	3-1/4	4.00	NEN1G x 4	4	4.00
NEN1C x 5	1-1/2	5.00	NEN1D x 5	2	5.00	NEN1E x 5	2 1/2	5.00	NEN1F x 5	3-1/4	5.00	NEN1G x 5	4	5.00
NEN1C x 6	1-1/2	6.00	NEN1D x 6	2	6.00	NEN1E x 6	2 1/2	6.00	NEN1F x 6	3-1/4	6.00	NEN1G x 6	4	6.00
NEN1C x 8	1-1/2	8.00	NEN1D x 8	2	8.00	NEN1E x 8	2 1/2	8.00	NEN1F x 8	3-1/4	8.00	NEN1G x 8	4	8.00
NEN1C x 10	1-1/2	10.00	NEN1D x 10	2	10.00	NEN1E x 10	2 1/2	10.00	NEN1F x 10	3-1/4	10.00	NEN1G x 10	4	10.00
NEN1C x 12	1-1/2	12.00	NEN1D x 12	2	12.00	NEN1E x 12	2 1/2	12.00	NEN1F x 12	3-1/4	12.00	NEN1G x 12	4	12.00
NEN1C x 14	1-1/2	14.00	NEN1D x 14	2	14.00	NEN1E x 14	2 1/2	14.00	NEN1F x 14	3-1/4	14.00	NEN1G x 14	4	14.00
NEN1C x 16	1-1/2	16.00	NEN1D x 16	2	16.00	NEN1E x 16	2 1/2	16.00	NEN1F x 16	3-1/4	16.00	NEN1G x 16	4	16.00
NEN1C x 18	1-1/2	18.00	NEN1D x 18	2	18.00	NEN1E x 18	2 1/2	18.00	NEN1F x 18	3-1/4	18.00	NEN1G x 18	4	18.00
NEN1C x 20	1-1/2	20.00	NEN1D x 20	2	20.00	NEN1E x 20	2 1/2	20.00	NEN1F x 20	3-1/4	20.00	NEN1G x 20	4	20.00
N/A	-	24.00	NEN1D x 24	2	24.00	NEN1E x 24	2 1/2	24.00	NEN1F x 24	3-1/4	24.00	NEN1G x 24	4	24.00

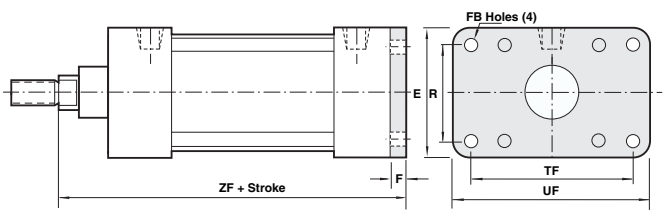
NFPA (MF1) 03 Head Rectangular Flange Mount



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"
E	2.000	2.500	3.000	3.750	4.500
F	.375	.375	.375	.625	.625
FB	.313	.375	.375	.438	.438
R	1.428	1.838	2.192	2.758	3.323
TF	2.750	3.375	3.875	4.688	5.438
UF	3.375	4.125	4.625	5.500	6.250
W	.625	.625	.625	.750	.750

All dimensions ± .015 unless otherwise noted.

NFPA (MF2) 04 Cap Rectangular Flange Mount

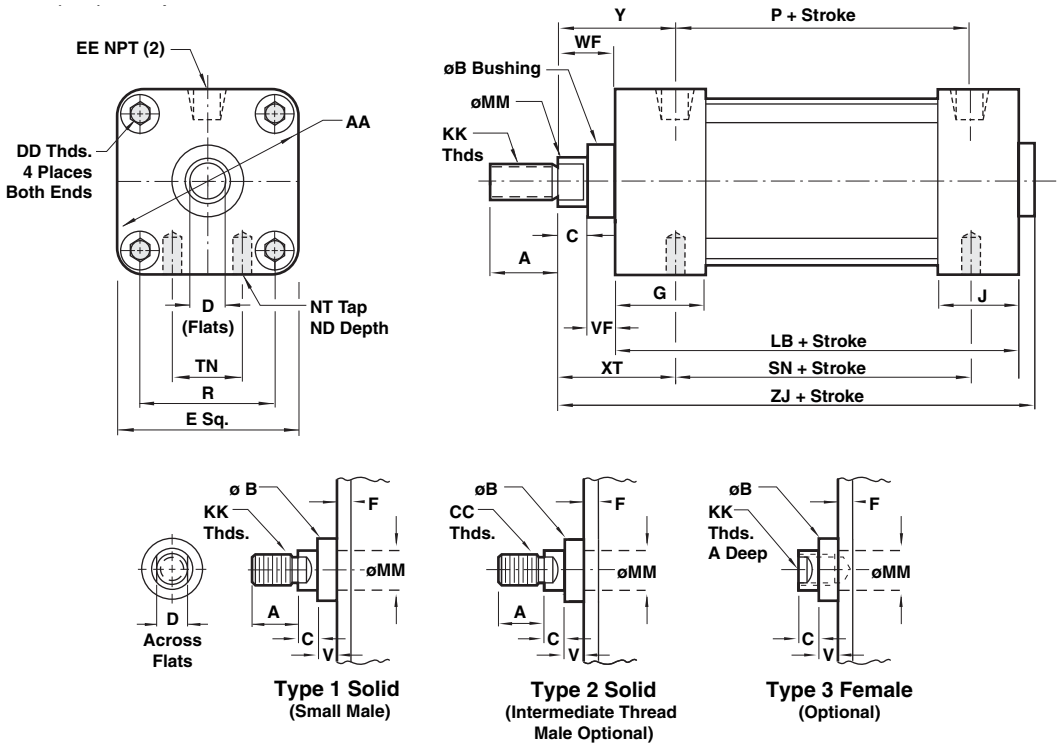


Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"
E	2.000	2.500	3.000	3.750	4.500
F	.375	.375	.375	.625	.625
FB	.313	.375	.375	.438	.438
R	1.428	1.838	2.192	2.758	3.323
TF	2.750	3.375	3.875	4.687	5.438
UF	3.375	4.125	4.625	5.500	6.250
ZF	5.000	5.000	5.125	6.250	6.250

All dimensions ± .015 unless otherwise noted.

NEN Series NFPA Aluminum Cylinders

NFPA (MS4) Side tap mount standard

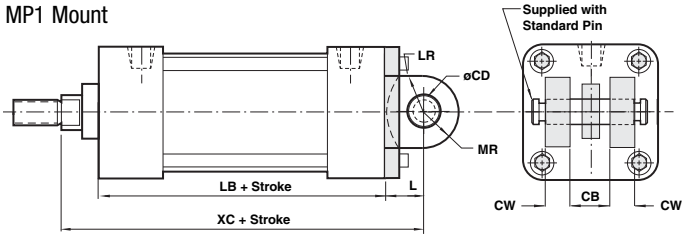


Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"
ø Rod	5/8"	5/8"	5/8"	1"	1"
A	0.750	0.750 (19.05)	0.750 (19.05)	1.125 (28.58)	1.125 (28.58)
AA	2.020	2.600 (66.04)	3.100 (78.74)	3.900 (99.06)	4.700 (119.38)
B	1.124	1.124 (28.55)	1.124 (28.55)	1.500 (38.07)	1.499 (38.07)
BA	1.125 (28.58)	1.125 (28.58)	1.125 (28.58)	1.250 (28.58)	1.250 (28.58)
C	0.375 (9.53)	0.375 (9.53)	0.375 (9.53)	0.500 (12.70)	0.500 (12.70)
CC	1/2-20	1/2-20	1/2-20	7/8-14	7/8-14
D	0.562 (14.27)	0.562 (14.27)	0.562 (14.27)	0.875 (22.23)	0.875 (22.23)
DD	1/4-28	5/16-24	5/16-24	3/8-24	3/8-24
E	2.000 (50.80)	2.500 (63.50)	3.000 (76.20)	3.750 (95.25)	4.500 (114.30)
EE	3/8	3/8	3/8	1/2	1/2
G	1.260 (32.00)	1.260 (32.00)	1.300 (33.02)	1.570 (39.88)	1.570 (39.88)
J	1.010 (25.65)	1.060 (26.92)	1.060 (26.92)	1.180 (29.97)	1.180 (29.97)
KK	7/16-20	7/16-20	7/16-20	3/4-16	3/4-16
LB	3.625 (92.08)	3.625 (92.08)	3.750 (95.25)	4.250 (107.95)	4.250 (107.95)
MM	0.625 (15.88)	0.625 (15.88)	0.625 (15.88)	1.000 (25.40)	1.000 (25.40)
NT	1/4-20	5/16-18	3/8-16	1/2-13	1/2-13
ND	0.281 (7.14)	0.438 (11.13)	0.593 (15.06)	0.625 (15.88)	0.625 (15.88)
P	2.360 (59.94)	2.400 (60.96)	2.480 (62.99)	2.720 (69.09)	2.720 (69.09)
R	1.430 (36.32)	1.840 (46.74)	2.190 (55.63)	2.760 (70.10)	3.320 (84.33)
SN	2.250 (57.15)	2.250 (57.15)	2.375 (60.33)	2.625 (66.68)	2.625 (66.68)
TN	0.625 (15.88)	0.875 (22.23)	1.250 (31.75)	1.500 (38.10)	2.063 (52.40)
VF	0.625 (15.88)	0.625 (15.88)	0.625 (15.88)	0.875 (22.23)	0.875 (22.23)
WF	1.000 (25.40)	1.000 (25.40)	1.000 (25.40)	1.375 (34.93)	1.375 (34.93)
XT	1.938 (49.23)	1.938 (49.23)	1.938 (49.23)	2.438 (61.93)	2.438 (61.93)
Y	1.710 (43.43)	1.710 (43.43)	1.750 (44.45)	2.340 (59.44)	2.340 (59.44)
ZJ	4.750 (120.65)	4.750 (120.65)	4.870 (123.95)	5.820 (147.83)	5.820 (147.83)

NEN Series NFPA Aluminum Cylinders

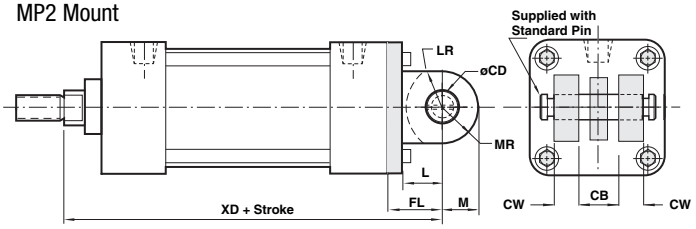
All Dimensions in Inches (mm)

MP1 Mount



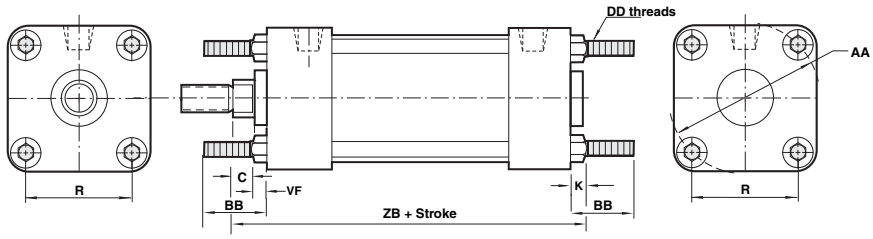
Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"
CB	0.750	0.750	0.750	1.250	1.250
CD	0.500	0.500	0.500	0.750	0.750
CW	0.500	0.500	0.500	0.625	0.625
L	0.750	0.750	0.750	1.250	1.250
LB	3.625	3.625	3.750	4.250	4.250
LR	0.625	0.625	0.625	0.875	0.875
MR	0.625	0.625	0.625	0.875	0.875
XC	5.375	5.375	5.500	6.875	6.875

MP2 Mount



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"
CB	0.750	0.750	0.750	1.250	1.250
CD	0.500	0.500	0.500	0.750	0.750
CW	0.500	0.500	0.500	0.625	0.625
FL	1.125	1.125	1.125	1.875	1.875
L	0.750	0.750	0.750	1.250	1.250
LR	0.750	0.750	0.750	1.250	1.250
M	0.500	0.500	0.500	0.875	0.750
MR	0.625	0.625	0.625	0.875	0.875
XD	5.750	5.750	5.875	7.500	7.500

NFPA (MX1) (4) Extended Tie Rods Both Ends Mount
NFPA (MX2) Cap Tie Rods Extended Mount
NFPA (MX3) Head Tie Rods Extended Mount



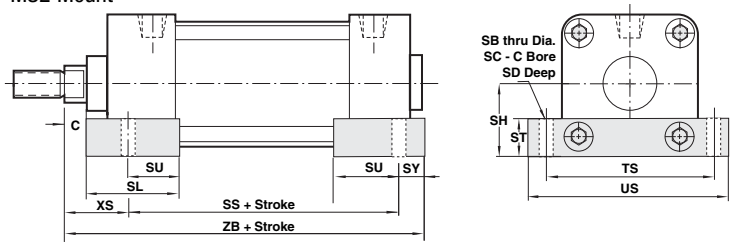
Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"
AA	2.020	2.600	3.100	3.900	4.700
BB	1.000	1.125	1.125	1.375	1.375
C	0.375	0.375	0.375	0.500	0.500
DD	1/4 – 28	5/16 – 24	5/16 – 24	3/8 – 24	3/8 – 24
K	0.250	0.313	0.313	0.375	0.375
R	1.428	1.838	2.192	2.758	3.323
VF	0.625	0.625	0.625	0.875	0.875
ZB	4.875	4.938	5.063	6.000	6.000

All dimensions ± .015 unless otherwise noted.

NEN Series NFPA Aluminum Cylinders

All Dimensions in Inches (mm)

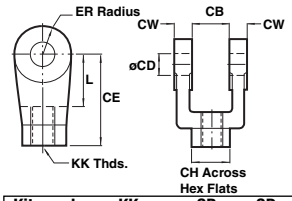
MS2 Mount



Bore	1-1/2"	2"	2-1/2"	3-1/4"	4"
SB	0.438	0.438	0.438	0.563	0.563
SC	0.690	0.690	0.690	0.800	0.800
SD	0.030	0.030	0.030	0.030	0.030
SH	1.000	1.250	1.500	1.875	2.250
SL	1.875	1.875	1.875	2.500	2.500
SY	0.940	0.940	0.940	1.250	1.250
SS	2.875	2.875	3.000	3.250	3.250
ST	0.620	0.620	0.750	1.000	1.000
SU	0.940	0.940	0.940	1.250	1.250
TS	2.750	3.250	3.750	4.750	5.500
US	3.500	4.000	4.500	5.750	6.500
XS	1.375	1.375	1.375	1.875	1.875
ZB	5.190	5.190	5.310	6.380	6.380

NEN Cylinder Accessories and Kits

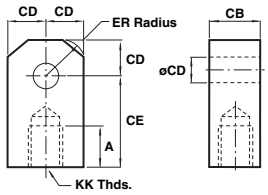
RC (rod clevis)



Kit number	KK	CB	CD.	CE	CH	CW	ER	L
NENC-RC	7/16-20	0.750	0.500	1.500	1.000	0.500	0.500	0.750
NENF-RC	3/4-16	1.250	0.750	2.375	1.250	0.625	0.750	1.250

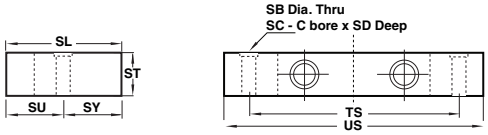
RC and RE rod accessories come complete with pivot pin and retaining clips.

RE (rod eye)



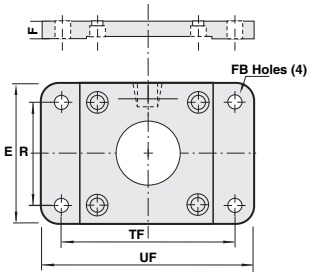
Kit number	KK	A	CB	CD	CE	ER
NENC-RE	7/16-20	0.750	0.750	0.500	1.500	0.563
NENF-RE	3/4-16	1.125	1.250	0.750	2.063	0.875

MS2 Mounting Kit



Kit number	SB	SC	SD	SY	ST	SU	TS	US
MK-NENC-MS2	0.41	0.69	0.03	0.94	0.62	0.94	2.75	3.50
MK-NEND-MS2	0.41	0.69	0.03	0.94	0.62	0.94	3.25	4.00
MK-NENE-MS2	0.41	0.69	0.03	0.94	0.75	0.94	3.75	4.50
MK-NENF-MS2	0.52	0.80	0.03	1.25	1.00	1.25	4.75	5.75
MK-NENG-MS2	0.52	0.80	0.03	1.25	1.00	1.25	5.50	6.50

NFPA MF1 / MF2 Mounting Kit - MK-NEN-MF1

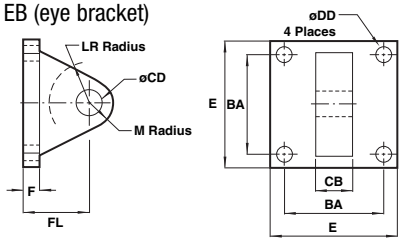


Kit number	UF	TF	FB	E	R	F
MK-NENC-MF1	3-3/8	2-3/4	5/16	2.00	1.43	3/8
MK-NEND-MF1	4-1/8	3-3/8	3/8	2-1/2	1.84	3/8
MK-NENE-MF1	4-5/8	3-7/8	3/8	3.00	2.19	3/8
MK-NENF-MF1	5-1/2	4-11/16	7/16	3-3/4	2.76	5/8
MK-NENG-MF1	6-1/4	5-7/16	7/16	4-1/2	3.32	5/8

NEN Series NFPA Aluminum Cylinders

All Dimensions in Inches (mm)

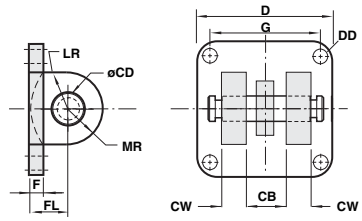
EB (eye bracket)



NFPA Eye Bracket	NENC-EB	NENF-EB
BA	1.625	2.563
CB	0.750	1.250
CD	0.500	0.750
DD	0.406	0.531
E	2.500	3.500
F	0.375	0.625
FL	1.125	1.875
LR	0.750	1.250
M	0.500	0.750

All dimensions ± .015 unless otherwise noted.

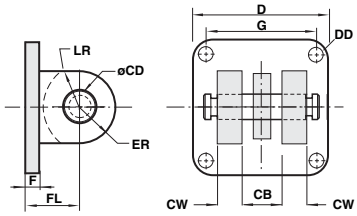
MP1 Mount kit - MK-NEN-MP1



Kit number	CD	FL	F	B	CW	D	MR	G	LR	DD
MK-NENC-MP1	0.502	0.75	0.38	0.76	0.50	2.00	0.62	1.43	0.62	0.28
MK-NEND-MP1	0.502	0.75	0.38	0.76	0.50	2.50	0.62	1.84	0.62	0.34
MK-NENE-MP1	0.502	0.75	0.38	0.76	0.50	3.00	0.62	2.19	0.62	0.34
MK-NENF-MP1	0.752	1.25	0.63	1.26	0.62	3.75	0.87	2.77	0.87	0.41
MK-NENG-MP1	0.752	1.25	0.63	1.26	0.62	4.50	0.87	3.32	0.87	0.41

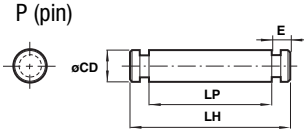
MP1 and MP2 kits come complete with mounting hardware, pivot pin and retaining clips.

MP2 Mount kit - MK - NEN - MP2



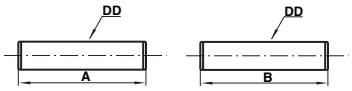
Kit number	CD	FL	F	B	CW	D	ER	G	DD
MK-NENC-MP2	0.502	1.13	0.38	0.76	0.50	2.00	0.62	1.43	0.28
MK-NEND-MP2	0.502	1.13	0.38	0.76	0.50	2.50	0.62	1.84	0.34
MK-NENE-MP2	0.502	1.13	0.38	0.76	0.50	3.00	0.62	2.19	0.34
MK-NENF-MP2	0.752	1.88	0.63	1.26	0.62	3.75	0.87	2.77	0.41
MK-NENG-MP2	0.752	1.88	0.63	1.26	0.62	4.50	0.87	3.32	0.41

P (pin)



NFPA Pin	NEN-5	NEN-7
CD	0.500	0.750
E	0.109	0.125
LH	2.094	2.875
LP	1.875	2.625

MX1, MX2, MX3 Mount kit



MX1 Mount Kit-MK-NEN-MX1 Tie Rod extended Both Ends			
Kit number	**DD**	**A**	**B**
MK-NENC-MX1	1/4-28	1.375	1.375
MK-NEND-MX1	5/16-24	1.500	1.500
MK-NENE-MX1	5/16-24	1.500	1.500
MK-NENF-MX1	3/8-24	1.812	1.937
MK-NENG-MX1	3/8-24	1.812	1.937
MX2 Mount Kit-MK-NEN-MX2 Tie Rod Extended Cap End			
Kit number	**DD**	**A**	**B**
MK-NENC-MX2	1/4-28	N/A	1.375
MK-NEND-MX2	5/16-24	N/A	1.500
MK-NENE-MX2	5/16-24	N/A	1.500
MK-NENF-MX2	3/8-24	N/A	1.937
MK-NENG-MX2	3/8-24	N/A	1.937
MX3 Mount Kit-MK-NEN-MX3 Tie Rod Extended Head End			
Kit number	**DD**	**A**	**B**
MK-NENC-MX3	1/4-28	1.375	N/A
MK-NEND-MX3	5/16-24	1.500	N/A
MK-NENE-MX3	5/16-24	1.500	N/A
MK-NENF-MX3	3/8-24	1.812	N/A
MK-NENG-MX3	3/8-24	1.812	N/A

NFPA Aluminum & Steel Cylinders

NFPA Rodlock LE option Passive

LD option Passive with manual release

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).

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

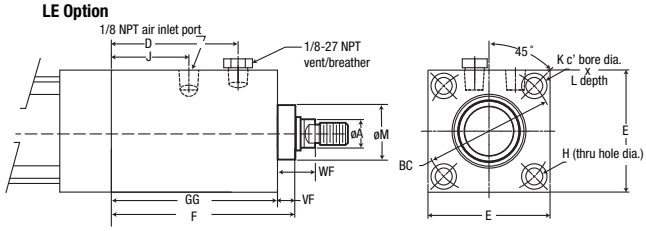
* Oversize rod diameters available upon request.

* Air assist manual override rod lock available upon request.

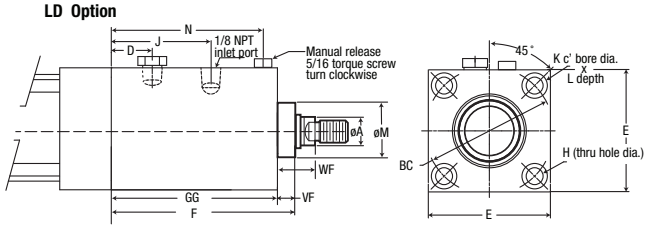
***CAUTION: Rated holding force corresponds to static load conditions. If the rated value is exceeded, slipping may occur.**

(Dimensions in inches)

LE Option



LD Option



LE Option

Bore Dia.	øA	øBC	E	D	GG	F	VF	J	øH	K	L	øM -.001 -.003	WF
1.50	0.625	2.022	2.00	1.95	2.937	2.77	0.375	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	1.02	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	1.02	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	1.56	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	1.56	0.406	0.719	1.28	1.500	1.375
5.00	1.000	5.798	5.50	2.99	4.443	4.69	0.500	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	1.68	0.531	0.844	1.50	2.000	1.625

LD Option

Bore Dia.	øA	øBC	E	D	GG	F	VF	J	øH	K	L	M -.001 -.003	N	WF
1.5	0.625	2.022	2.00	1.01	2.625	3.00	0.375	1.91	0.281	0.438	0.909	1.125	2.405	1.00
2.0	0.625	2.602	2.50	1.00	2.875	3.25	0.375	1.980	0.344	0.516	1.03	1.125	2.535	1.00
2.5	0.625	3.097	3.00	1.04	2.875	3.38	0.500	2.12	0.344	0.516	1.03	1.125	2.529	1.00
3.25	1.000	3.903	3.75	1.37	4.500	5.00	0.500	2.99	0.406	0.719	1.28	1.500	3.869	1.375
4.0	1.000	4.695	4.50	1.69	4.875	5.37	0.500	3.15	0.406	0.719	1.28	1.500	4.25	1.375
5.0	1.000	5.798	5.50	1.50	5.375	5.87	0.500	3.38	0.531	0.844	1.50	1.500	4.655	1.375
6.0	1.375	6.901	6.50	1.87	6.375	7.13	0.750	3.67	0.531	0.844	1.50	2.000	5.21	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**

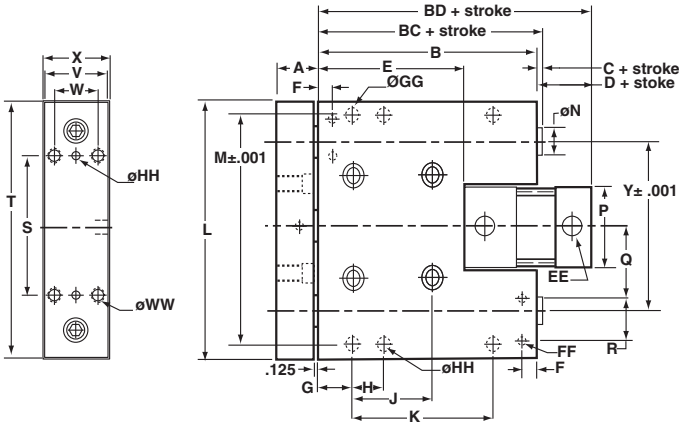
This chart features the energy absorption capacity of the impact dampening piston seals with Non-Adjustable cushions.

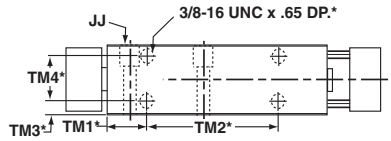
	1-1/2" Bore				2.0" Bore			
	Load (LBS.) Short Body		Load (LBS.) Long Body		Load (LBS.) Short Body		Load (LBS.) Long Body	
Velocity In./Sec	Standard Guide Shaft	Oversize Guide Shaft	Standard Guide Shaft	Oversize Guide Shaft	Standard Guide Shaft	Oversize Guide Shaft	Standard Guide Shaft	Oversize Guide 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 basd on a 6.0" stroke cylinder.)

NFPA Aluminum & Steel Cylinders

Dimensional data





*Dimensions apply to TM option only

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	2.375	3.125	3.125
JJ	.41thru .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
S	2.375	2.375	3.125	3.125
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	

Maximum Stroke

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

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

Options

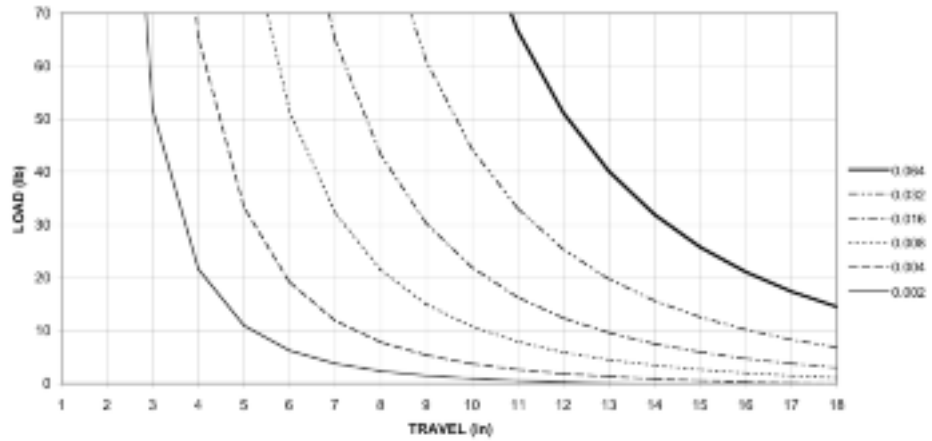
AE = stroke adjustment (collar & bumper) - extend stroke
AR = stroke adjustment (collar & bumper) - retract stroke
CR = corrosion resistance (includes linear slide and cylinder)
GL = guide rod lubrication (includes oiler cups installed)
GM = guide rod lubrication modification for oiler cups
L() = non-standard 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.

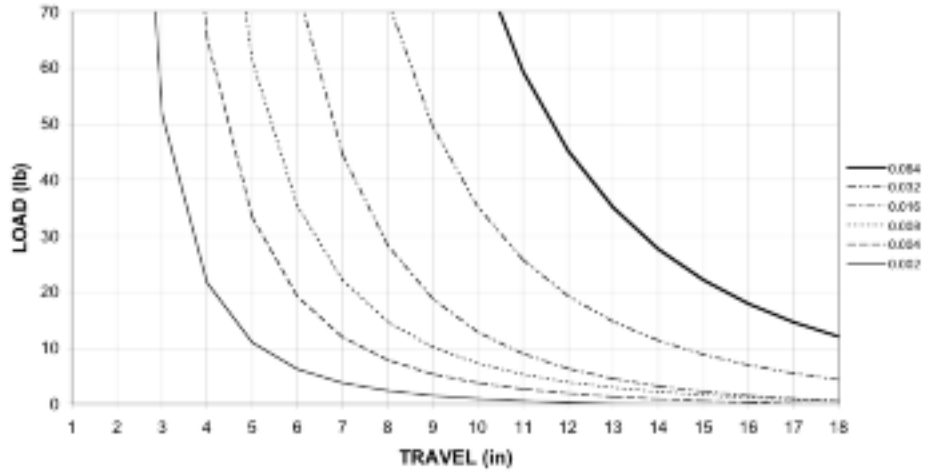
NFPA Aluminum & Steel Cylinders

Load and Deflection Graphs

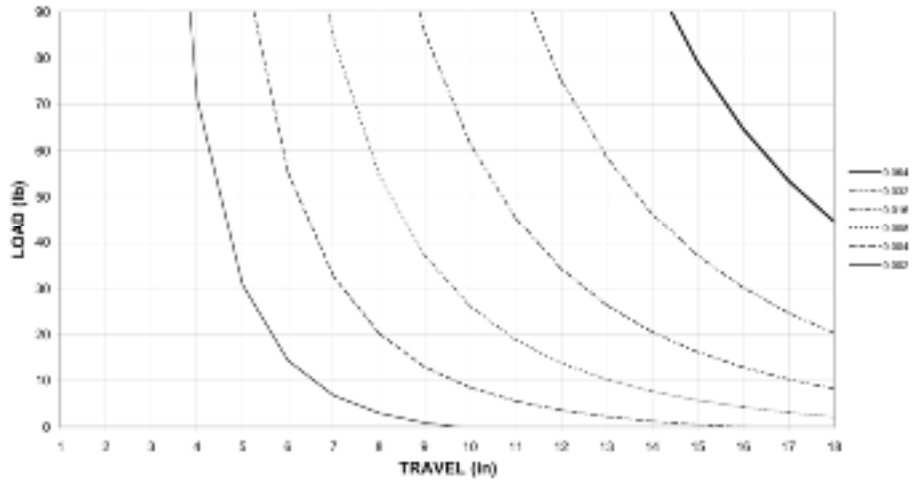
1-1/2" bore, 3/4 inch guide rod, short body, composite bearing



1-1/2" bore, 3/4 inch guide rod, short body, roller bearing

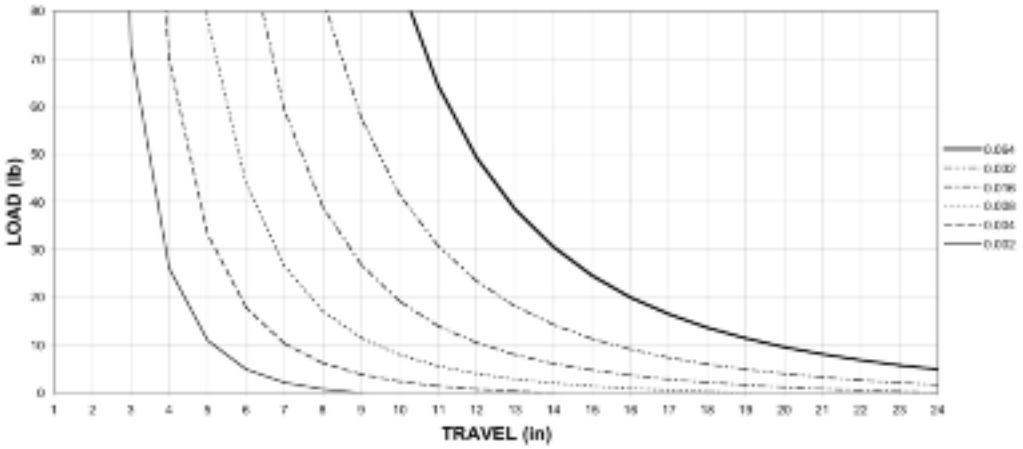


1-1/2" bore, 1 inch guide rod, short body, composite bearing

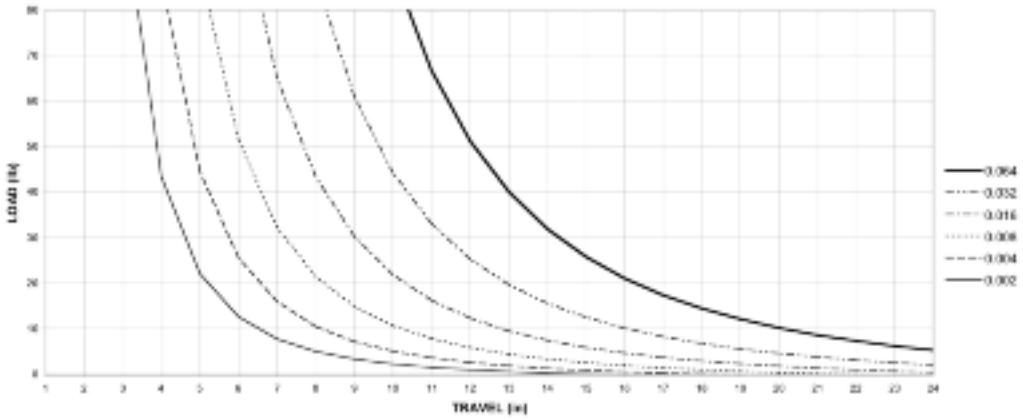


Load and Deflection Graphs

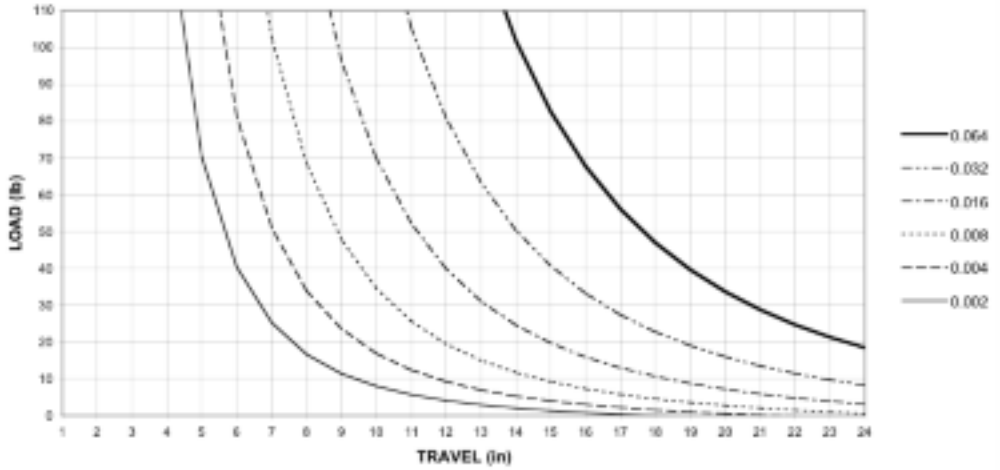
1-1/2" bore, 3/4 inch guide rod, long body, roller bearing



1-1/2" bore, 3/4 inch guide rod, long body, composite bearing



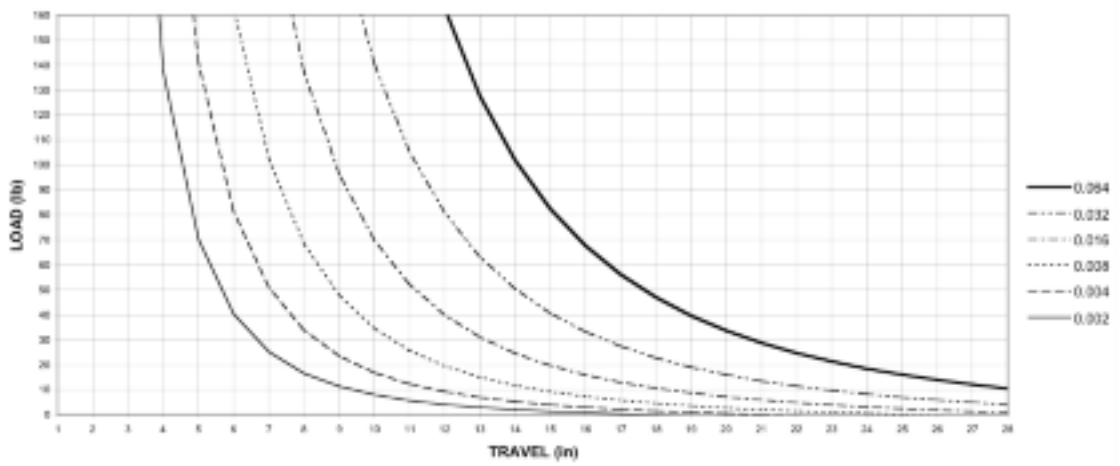
1-1/2" bore, 1 inch guide rod, long body, composite bearing



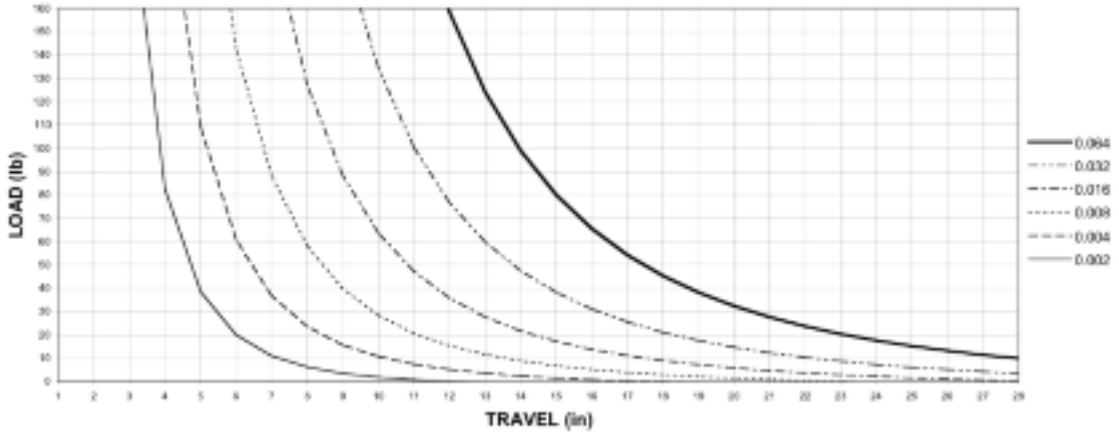
NFPA Aluminum & Steel Cylinders

Load and Deflection Graphs

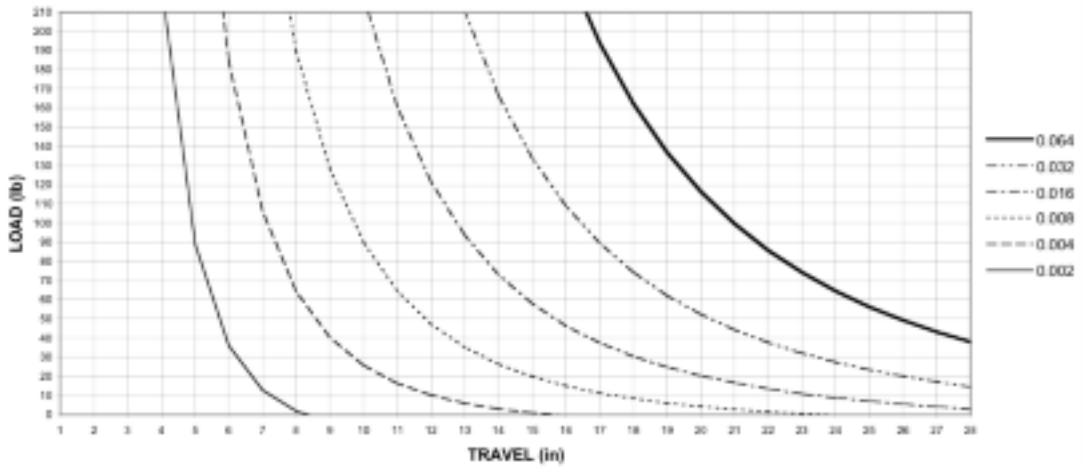
2.0" bore, 1 inch guide rod, long body, composite bearing



2.0" bore, 1 inch guide rod, long body, roller bearing

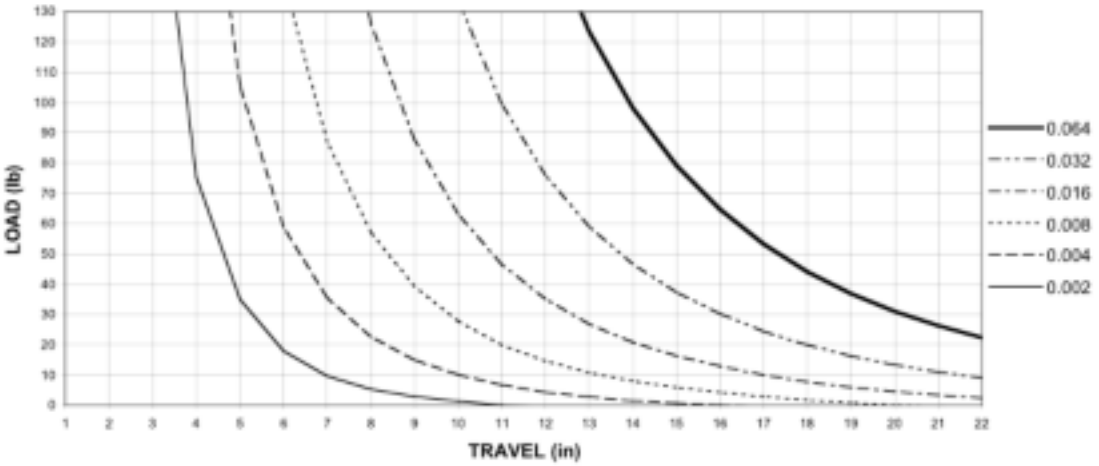


2.0" bore, 1-3/8 inch guide rod, long body, composite bearing

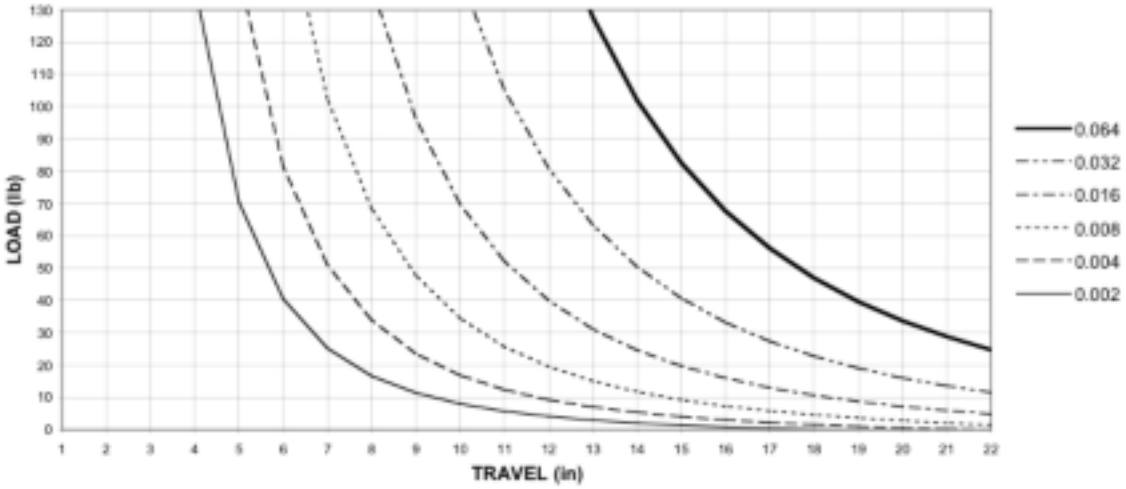


Load and Deflection Graphs

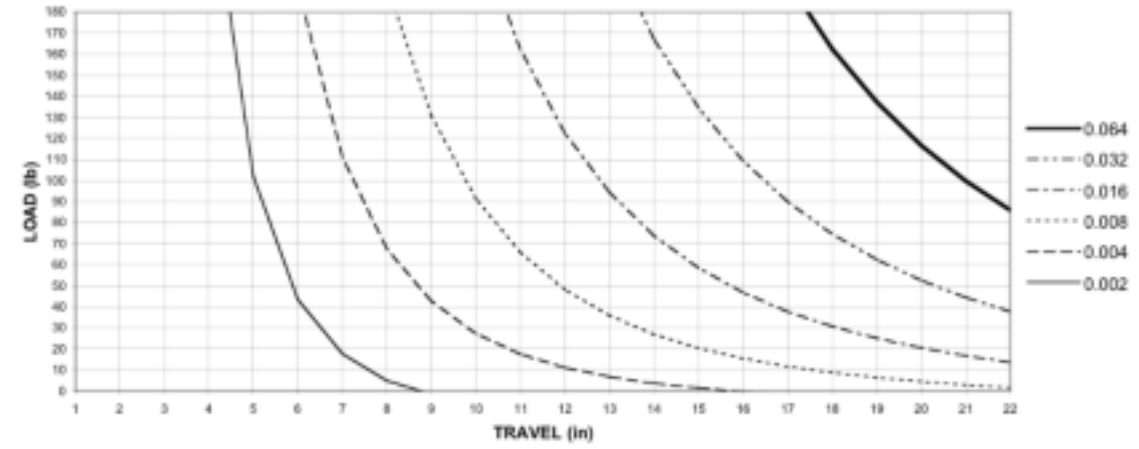
2.0" bore, 1 inch guide rod, short body, roller bearing



2.0" bore, 1 inch guide rod, short body, composite bearing



2.0" bore, 1-3/8 inch guide rod, short body, composite bearing



NORGREN
ENGINEERING ADVANTAGE

Roundline Plus
Stainless Steel Body Actuators

5/16" to 3" bore

Single and Double acting actuators

Full range of bore sizes

All essential models

Optional Ecology seal

Technical data

Medium:

Filtered, lubricated or non-lubricated, compressed air

Maximum Operating Pressure:

250 psig (17.2 bar)

Temperature Range*:

Standard Nitrile Seals:
-20° to 200°F (-29° to 93°C)
Viton/High temp Seals:
-20° to 400°F (-29° to 205°C)

*With dew point of supply air less than air temperature below 35°F (2°C)

Lubrication:

All Roundline Plus cylinders are pre-lubricated during assembly with a Teflon® based grease for non-lube service and long life.

Materials

Cylinder Body:
304 Stainless Steel

Head and Cap:
Aluminum Alloy

Piston Rod:
Stainless steel in double rod cylinders, and 5/16", 7/16", and 9/16" bores. Chrome plated steel in all other bore sizes

Rod Bearing: Oil Impregnated Sintered Bronze

Piston: Aluminum Alloy or stainless steel

Rod & Piston Seals: Nitrile

Pivot Bracket, Rod Clevis, Foot Bracket, Mounting Nut: Bright Zinc Plated Carbon Steel

Options selector

RP 075 x 2.50 - DAN - PS

Series

Roundline Plus	RP
Roundline Plus with Ecology seals*	*ERP

Bore Size

5/16"	031
7/16"	043
9/16"	056
3/4" (E)	075
7/8"	087
1-1/16" (E)	106
1-1/4" (E)	125
1-1/2" (E)	150
1-3/4"	175
2" (E)	200
2-1/2" (E)	250
3" (E)	300

E - Available with Ecology Seals

Stroke

Increments of 1/16" up to a maximum. See table

Mounting Options

Single Acting Nose	SAN
Single Acting Pivot	SAP
Single Acting Front Block	SBF
Single Acting Rear Block	SBR
Single Acting Front Trunnion	STF
Single Acting Rear Trunnion	STR
Single Acting Non-Rotating Nose	NRN
Single Acting Non-Rotating Pivot	NRP
Reverse Acting Nose	RAN
Reverse Acting Pivot	RAP
Reverse Acting Front Block (available in 3/4", 1-1/16" & 1-1/2" only)	RAF
Reverse Acting Rear Block	RAR
Double Acting Nose	DAN
Double Acting Pivot	DAP
Double Acting Double End Mount	DAD
Double Acting Front Block	DAF
Double Acting Rear Block	DAR
Double Acting Front Trunnion	DFT
Double Acting Rear Trunnion	DRT
Double Acting Double Rod End	DRD

Mounting Options

Adjustable Cushion Head End	CH†††
Adjustable Cushion Cap End	CC†††
Adjustable Cushion Both Ends	CB†††
Bumpers	UB
Alternate Port Location	PL(__)
Side Ported End Cap (DAN, SAN, and DAFmodels only, note length adder)	PC
Magnetic Piston	PS
Switch Rail and location	M1,M2, M3,M4
Non-Adjustable cushion head end	NH*
Non-Adjustable cushion cap end	NC*
Non-Adjustable cushions both ends	NB*
No Flats (no plain rod stick out)	NF**
No Rod Thread	PR
No Pin	NP
Pivot Bushing (no pin)	PO
Non-Standard Male Thread	TM(__)
Non-Standard Female Thread	FT(__)
Thread extension over standard (specify additional length)	TX†(__)
Rod extension over standard (specify additional length)	RX†(__)
Stainless Steel piston rod (standard on certain models)	SS
Viton/High Temperature Seals	HT
Rod Wiper (not available with HT)	RW

* ERP, ecology cylinders come complete with non-adjustable cushions both ends (NH, NC, NB, options not required in model number of ERP cylinder). ERP on DAP, DAF, DAD, and DAN models only (add PC option length adder to DAN models)

** Available only on 1-1/16" bore - RAN and RAP, mounts.

† Male thread extension only. Consult factory for negative thread or rod extensions.

††† Available on 075, 106, 150, 200, 250 & 300 Bores.

Maximum Stroke Lengths††

Bore	Single & Reverse Acting	Double Acting
5/16"	4	12
7/16"-9/16"	12	36
3/4"-1-3/4"	12	36
2"	4	36
2-1/2"-3"	-	36

†† Consult factory for longer stroke lengths.

Roundline Plus Stainless Steel Body Actuators

1. Oil impregnated sintered bronze Rod Bearing provides exceptional rod support, and optimal cycle life
2. Chrome plated carbon steel Piston Rod for strength, smooth operation, and long life (stainless steel Piston Rod on 5/16, 7/16, 9/16 and all Double Rod cylinders)
3. Lip-Type nitrile Rod Seal, pressure energized and wear compensating
4. Head and Cap are solid aluminum alloy for strength and durability
5. Solid aluminum Piston is strong yet lightweight for low inertia
6. Lip-type nitrile Piston Seals are wear compensating for long life
7. 304 stainless steel Cylinder Body with polished I.D. ensures smooth performance and outstanding life cycle

*Note: Single acting cylinders (not shown) use springs manufactured from music wire to provide millions of trouble free cycles.

Ecology Roundline Plus - ERP Model

The ERP model is the cost effective answer to load deceleration and faster through cushion performance.

1. IMPACT DAMPENING ECOLOGY PISTON SEALS
   - » Increased load capabilities and cycle rates
   - » Vibration and noise reduction
2. PRE-ENGINEERED NON-ADJUSTABLE CUSHION
   - » Tamper resistant
   - » Increased performance

Roundline Ecology Piston Seal Option (ERP)

The Ecology (Impact Dampening) Piston Seal option is available on select inch bore size Roundline cylinders in DAP, DAD, and DAN configurations. This option includes non-adjustable air cushions on both the extend and retract stroke of the cylinder. By including the Ecology Piston Seal option, cylinders can be specified based on weights of load being carried and speed of load. This is shown in the table below.

Energy Absorption Capacity of the Impact Dampening Piston Seal

This chart represents the energy absorption capacity of the Impact Dampening piston seals with standard Non-Adjustable air cushions. The values given are usable pounds stoppable at stated piston speeds.

	Cylinder Bore					
In/Sec	3/4	1-1/16	1-1/4	1-1/2	2	2-1/2
6	36.6	62.3	74.5	115.5	258.9	421.1
12	5.6	15.6	18.6	28.9	64.7	105.3
18	2.5	6.9	8.3	12.8	28.8	46.8
24	1.4	3.9	4.7	7.2	16.2	26.3
30	0.9	2.5	3.0	4.6	10.4	16.8
36	0.6	1.7	2.1	3.2	7.2	11.7
42	0.5	1.3	1.5	2.4	5.3	8.6
48	0.3	1.0	1.2	1.8	4.0	6.6
54	0.3	0.8	0.9	1.4	3.2	5.2
60	0.2	0.6	0.7	1.2	2.6	4.2

Effect of Impact Dampening Seals on Total Stroke of Cylinders						
	Cylinder Bore					
PSI	3/4	1-1/16	1-1/4	1-1/2	2	2-1/2
0	.11	.12	.12	.14	.15	.17
20	.08	.09	.09	.10	.10	.12
40	.05	.06	.06	.07	.07	.08
60	.03	.04	.04	.04	.04	.05
80	.01	.02	.02	.02	.02	.02
100	0	0	0	0	0	0

The figure above represents total stroke loss (both ends) for the pressure indicated for new cylinders. The impact dampening seals will take some compression set during operation of the cylinder and the stroke loss will decrease. To determine stroke loss for either head or cap divide the value shown by 2.

NORGREN ENGINEERING ADVANTAGE

Roundline Plus Stainless Steel Body Actuators

Dimensions in inches

Force Factor Data

Bore	Code	Force Factor (Area)	
		Extend	Retract
5/16"	(031)	0.077	0.064
7/16"	(043)	0.15	0.12
9/16"	(056)	0.25	0.22
3/4"	(075)	0.44	0.39
7/8"	(087)	0.6	0.55
1-1/16"	(106)	0.89	0.81
1-1/4"	(125)	1.23	1.08
1-1/2"	(150)	1.77	1.62
1-3/4"	(175)	2.41	2.21
2"	(200)	3.14	2.84
2-1/2"	(250)	4.91	4.61
3"	(300)	7.07	6.63

Force Output Formula

Cylinder Output Force = Force Factor (area) x Air Line Pressure (psi)

Ex: 1-1/16 bore cylinder operating at 80 psi:

Force exerted on the extend: 0.89 x 80 = 71.2 lbs.

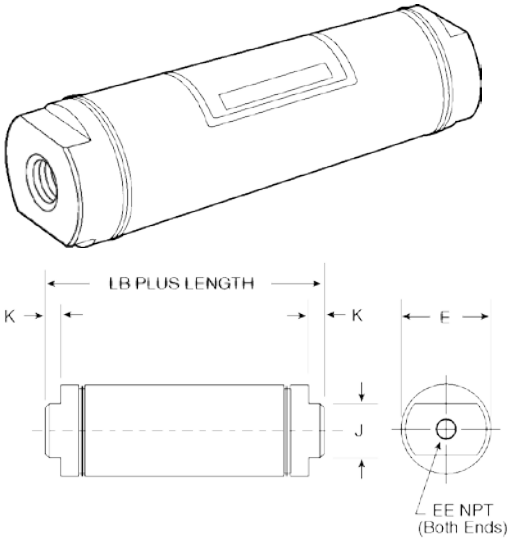
Force exerted on the retract: 0.81 x 80 = 55.2 lbs.

Approximate Spring Forces (lbs.)

Bore	Code	Relaxed (lbs)	Compressed (lbs)
5/16"	(031)	0.5	1
7/16"	(043)	1	2
9/16"	(056)	2	4
3/4"	(075)	3	6
7/8"	(087)	3	6
1-1/16"	(106)	3	6
1-1/4"	(125)	7.5	15
1-1/2"	(150)	7	14
1-3/4"	(175)	11	24
2"	(200)	15	30

Air Reservoir

Air Reservoirs are made of the same high-quality stainless steel as the Series RP Cylinders.



Dimensions — All Dimensions in Inches

Bore	E	EE	J	K	LB	Standard Internal Lengths
3/4"	0.813	1/8"	0.625	0.187	1.938	1" increments thru 4"
1-1/16"	1.125	1/8"	0.875	0.187	2.375	1" increments thru 8"
1-1/2"	1.562	1/8"	0.875	0.250	2.250	1" increments thru 16"
2"	2.080	1/4"	1.250	0.312	2.875	1" increments thru 16"
2-1/2"	2.610	1/4"	1.750	0.312	2.875	1" increments thru 24"

How to Order

Example:
1-1/16" bore air reservoir with a 3" internal length would be ordered as follows: AR-1-1/16 x 3

Roundline Plus Stainless Steel Body Actuators

CH,CC,CB - Adjustable Cushions

Available only on DAN, DAP, and DAD models.

Available on bore sizes: 3/4", 1-1/16", 1-1/2", 2", 2-1/2", 3"

Position #4 standard

UB - Bumpers

- Standard on 5/16", 7/18", 1-1/4", and 1-3/4" bore sizes.
- The UB option will increase the overall length on all other bore sizes (see chart for length changes).
- Single acting models will have one bumper on the piston side opposite the spring.
- Bumpers are not included or available on ERP Ecology Seal models.
- When the HT high temperature option is ordered on these bore sizes, the bumpers are omitted and may change the overall length of the cylinder (except 5/16" bore, bumpers are not omitted).
- See "HT" Option below for further explanation of HT and UB in combination.

Bore	Increase in cylinder length due to the UB option			
	Single Acting	Reverse Acting	Double Acting	Double Rod End
5/16"	Std	Std	Std	Std
7/16"	0.062	0.125	0.188	0.25
9/16"	0.062	0.062	0.125	0.125
3/4"	0.125	0.125	0	0
7/8"	Std	Std	Std	Std
1-1/16"	0.125	0.125	0.125	0.5*
1-1/4"	Std	Std	Std	Std
1-1/2"	0.125	0.125	0.125	0.125
1-3/4"	Std	Std	Std	Std
2"	0.125	0.125	0.250	0.250
2-1/2"	0.125	0.125	0.250	0.250
3"	0.125	0.125	0.250	0.250

* When the UB and PS options are in combination on an 1-1/16" bore, double rod end, only the bumper length should be added. All other models and bore sizes should add the UB length and the PS length together.

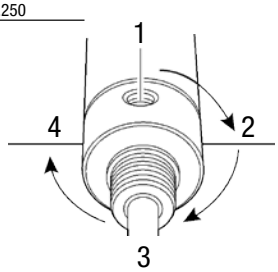
HT - High Temperature Seals (Viton)

- For service up to 400°F
- Not available with RW rod wiper option.
- When ordered with the UB bumper option, bumpers will also be rated to 400°F.
- For cylinders where bumpers are standard, opting for HT will omit the bumpers and may decrease the overall length of the cylinder (except 5/16" bore). See chart below for length changes.
- For cylinders where bumpers are standard, if high temp bumpers are required, reference both HT and UB in the model number. This will provide high temp seals and bumpers and not change the overall length of the cylinder (except 5/16" bore).
- On the 5/16" bore, bumpers are always standard, and never omitted. Additionally, high temperature bumpers are not available on this bore size. As a result, with the HT option, the 5/16" bore cylinder is rated to 200°F.

Bore	Decrease in Overall length due to HT option (in.)			
	Single Acting	Reverse Acting	Double Acting	Double Rod End
5/16"	0.000	0.000	0.000	0.000
7/8"	0.090	0.125	0.220	0.250
1-1/4"	0.125	0.125	0.190	0.250
1-3/4"	0.125	0.125	0.250	0.250

PL(__) - Alternate Port Location

Designate location on head and cap respectively. For example: L(12) = Head port location 1, and Cap port location 2.



PC - Side ported end cap (DAN and SAN models only)

Port will be on the side of the end cap and in line with the head end port. Overall length of the cylinder will increase.

Change in overall length due to the PC option.

Bore	Length Increase
5/16"	0.2
7/16"	0.19
9/16"	0.03
3/4"	0.44
7/8"	0.28
1-1/16"	0.25
1-1/4"	0.31
1-1/2"	0.19
1-3/4"	0.56
2"	0.38
2-1/2"	0.38
3"	0.44

PS - Magnetic Piston

A magnet on the piston may increase the length of the cylinder. See chart below for length adders.

Bore	Increase in cylinder length with the PS option		
	Single & Reverse Acting	Double Acting	Double Rod End
5/16"	0.150	0.150	N/A
7/16"	0.200	0.250	0.250
9/16"	0.125	0	0
3/4"	0.125	0	0
7/8"	0.125	0.125	0.125
1-1/16"	0.125	0	0.125**
1-1/4"	0.125	0	0
1-1/2"	0.125	0	0
1-3/4"	0.125	0	0
2"	0.125	0	0
2-1/2"	-	0	0
3"	-	0	0

* When the UB and PS options are in combination on an 1-1/16" bore, double rod end, only the bumper length should be added. All other models and bore sizes should add the UB length and the PS length together.

** Ecology piston seal adds .375" to the overall length when combined with PS option on the 1-1/16" bore DRD model only.

Rail shown at position M2

M1,M2,M3,M4 - Switch rail mounted and position

Switch rail will be mounted in position #1 for M1 option, Position #2 for M2 option, etc. Must also reference the PS option in the cylinder model number to receive a magnet on the piston.

A band style swtich bracket can be ordered as a separate item instead of the switch rail. See switch section for band style bracket information.

Switches ordered as separate items.

FT(__) - Female thread

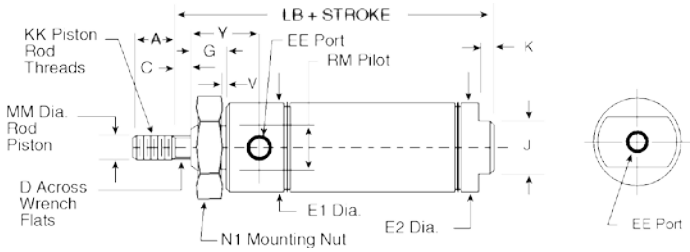
Specify thread type in parentheses. Female rod thread available on 1-3/4", 2", 2-1/2", 3" bores.

NORGREN ENGINEERING ADVANTAGE

Roundline Plus Stainless Steel Body Actuators

Dimensions in inches

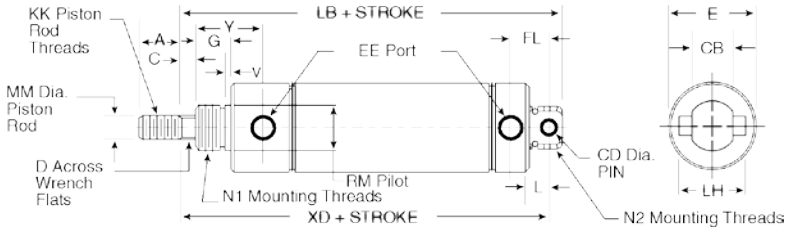
Double Acting (DAN) — Nose Mount



Bore	A	C	D	EE	E1	E2	G	J	K	KK	LB	MM	N1	RM	Y	V
5/16"	0.38	N/A	N/A	10-32	0.61	0.36	0.31	0.36	N/A	5-40	1.64	0.125	3/8-24	.371/.373	0.47	0.03
7/16"	0.50	N/A	N/A	10-32	0.74	0.50	0.38	0.38	0.19	10-32	2.12	0.187	7/16-20	.434/.437	0.72	0.05
9/16"	0.50	N/A	N/A	10-32	0.62	0.62	0.38	0.50	0.19	10-32	2.28	0.187	7/16-20	.434/.437	0.75	0.06
3/4"	0.50	N/A	N/A	1/8 NPT	0.86	0.81	0.50	0.62	0.19	1/4-28	2.97	0.250	5/8-18	.621/.624	0.97	0.09
7/8"	0.50	N/A	N/A	1/8 NPT	0.94	0.94	0.50	0.62	0.19	1/4-28	2.94	0.250	5/8-18	.621/.624	0.97	0.09
1-1/16"	0.50	N/A †	N/A	1/8 NPT	1.12	1.12	0.50	0.88	0.19	5/16-24	3.12	0.312	5/8-18	.621/.624	1.06	0.09
1-1/4"	0.75	0.25	0.38	1/8 NPT	1.34	1.34	0.63	0.88	0.25	7/16-20	4.00	0.437	3/4-16	.746/.749	1.37	0.09
1-1/2"	0.75	0.25	0.38	1/8 NPT	1.56	1.56	0.63	0.88	0.25	7/16-20	3.69	0.437	3/4-16	.746/.749	1.25	0.09
1-3/4"	0.88	0.31	0.44	1/4 NPT	1.84	1.84	0.75	1.25	0.25	1/2-20	4.69	0.500	1-14	1.029/1.032	1.63	0.09
2"	0.88	0.38	0.50	1/4 NPT	2.08	2.08	0.81	1.25	0.31	1/2-20	4.69	0.625	1-1/4-12	1.372/1.375	1.46	0.12
2-1/2"	0.88	0.38	0.50	1/4 NPT	2.59	2.59	0.81	1.75	0.31	1/2-20	4.69	0.625	1-3/8-12	1.497/1.500	1.46	0.12
3"	1.25	0.38	0.63	3/8 NPT	3.12	3.12	1.00	2.00	0.31	5/8-18	5.25	0.750	1-1/2-12	1.622/1.625	1.71	0.19

† 1-1/16 bore with SS or PS option, C = 0.12 and D = 0.25. To remove the flats and plain rod stick out, specify NF in the model number.

Double Acting (DAP) — Pivot Mount



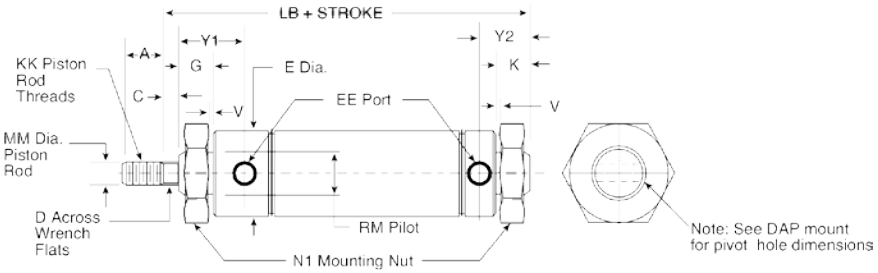
Bore	A	C	CB	CD	D	E	EE	FL	G	KK	L	LB	LH	MM	N1	N2	RM	V	XD	Y
5/16"*	0.38	N/A	0.25	0.125	N/A	0.61	10-32	0.34	0.31	5-40	0.19	2.19	0.39	0.125	3/8-24	3/8-24	.371/.373	0.03	2.03	0.47
7/16"	0.50	N/A	0.31	0.156	N/A	0.74	10-32	0.44	0.38	10-32	0.25	2.81	0.50	0.187	7/16-20	7/16-20	.434/.437	0.05	2.56	0.72
9/16"*	0.50	N/A	0.31	0.156	N/A	0.62	10-32	0.38	0.38	10-32	0.25	2.75	0.50	0.187	7/16-20	7/16-20	.434/.437	0.06	2.56	0.75
3/4"	0.50	N/A	0.38	0.250	N/A	0.86	1/8 NPT	0.62	0.50	1/4-28	0.34	4.03	0.75	0.250	5/8-18	5/8-18	.621/.624	0.09	3.75	0.97
7/8"	0.50	N/A	0.38	0.250	N/A	0.94	1/8 NPT	0.62	0.50	1/4-28	0.34	3.84	0.75	0.250	5/8-18	5/8-18	.621/.624	0.09	3.56	0.97
1-1/16"	0.50	0.12	0.38	0.250	0.25	1.12	1/8 NPT	0.62	0.50	5/16-24	0.34	4.12	0.75	0.312	5/8-18	5/8-18	.621/.624	0.09	3.84	1.07
1-1/4"	0.75	0.25	0.50	0.250	0.38	1.34	1/8 NPT	0.78	0.63	7/16-20	0.41	5.12	0.88	0.437	3/4-16	3/4-16	.746/.749	0.09	4.72	1.37
1-1/2"	0.75	0.25	0.62	0.375	0.38	1.56	1/8 NPT	0.81	0.63	7/16-20	0.50	4.75	1.00	0.437	3/4-16	3/4-16	.746/.749	0.09	4.38	1.25
1-3/4"	0.88	0.31	0.62	0.376	0.44	1.84	1/4 NPT	1.12	0.75	1/2-20	0.50	6.25	1.00	0.500	1-14	1-14	1.029/1.032	0.09	5.75	1.63
2"*	0.88	0.38	0.75	0.375	0.50	2.08	1/4 NPT	1.03	0.81	1/2-20	0.56	6.06	1.63	0.625	1-1/4-12	1-1/4-12	1.372/1.375	0.12	5.62	1.54
2-1/2"*	0.88	0.38	0.75	0.375	0.50	2.59	1/4 NPT	1.03	0.81	1/2-20	0.56	6.06	1.63	0.625	1-3/8-12	1-3/8-12	1.497/1.500	0.12	5.62	1.47
3"*	1.25	0.38	0.88	0.500	0.63	3.12	3/8 NPT	1.34	1.00	5/8-18	0.81	7.12	1.90	0.750	1-1/2-12	1-1/2-12	1.622/1.625	0.19	6.50	1.71

* Pivot bushing included

Roundline Plus Stainless Steel Body Actuators

Dimensions in inches

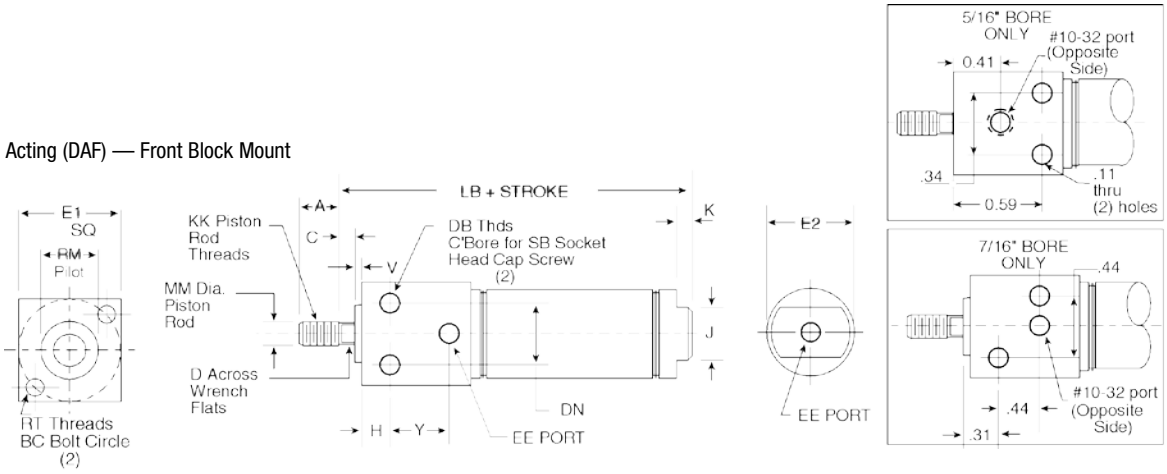
Double Acting (DAD) — Double End Mount



Bore	A	C	D	E	EE	G	K	KK	LB	MM	N1	RM	V	Y1	Y2
5/16"*	0.38	N/A	N/A	0.61	10-32	0.31	0.35	5-40	2.19	0.125	3/8-24	.371/.373	0.03	0.47	0.50
7/16"	0.50	N/A	N/A	0.74	10-32	0.38	0.50	10-32	2.81	0.187	7/16-20	.434/.437	0.05	0.73	0.69
9/16"*	0.50	N/A	N/A	0.62	10-32	0.38	0.44	10-32	2.75	0.187	7/16-20	.434/.437	0.06	0.75	0.57
3/4"	0.50	N/A	N/A	0.86	1/8 NPT	0.50	0.62	1/4-28	4.03	0.250	5/8-18	.621/.624	0.09	0.97	0.90
7/8"	0.50	N/A	N/A	0.94	1/8 NPT	0.50	0.62	1/4-28	3.84	0.250	5/8-18	.621/.624	0.09	0.97	0.90
1-1/16"	0.50	0.12	0.25	1.12	1/8 NPT	0.50	0.62	5/16-24	4.12	0.312	5/8-18	.621/.624	0.09	1.07	0.90
1-1/4"	0.75	0.25	0.38	1.34	1/8 NPT	0.63	0.81	7/16-20	5.12	0.437	3/4-16	.746/.749	0.09	1.37	1.18
1-1/2"	0.75	0.25	0.38	1.56	1/8 NPT	0.63	0.88	7/16-20	4.75	0.437	3/4-16	.746/.749	0.09	1.25	1.18
1-3/4"	0.88	0.31	0.44	1.84	1/4 NPT	0.75	1.00	1/2-20	6.25	0.500	1-14	1.029/1.032	0.09	1.63	1.62
2"*	0.88	0.38	0.50	2.08	1/4 NPT	0.81	1.00	1/2-20	6.06	0.625	1-1/4-12	1.372/1.375	0.12	1.46	1.47
2-1/2"*	0.88	0.38	0.50	2.59	1/4 NPT	0.81	1.00	1/2-20	6.06	0.625	1-3/8-12	1.497/1.500	0.12	1.46	1.47
3"*	1.25	0.38	0.63	3.12	3/8 NPT	1.00	1.43	5/8-18	7.12	0.750	1-1/2-12	1.622/1.625	0.19	1.71	1.96

* Pivot bushing included

Double Acting (DAF) — Front Block Mount



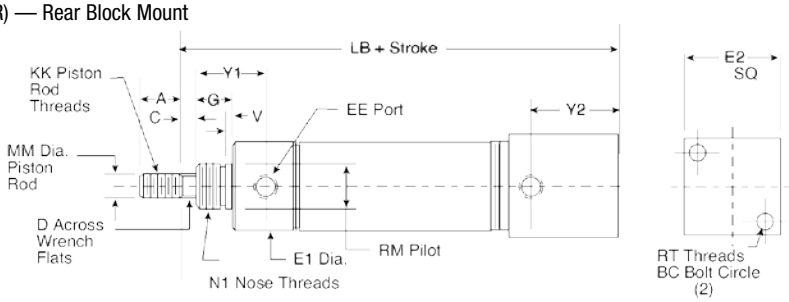
Bore	A	BC	C	D	DB	DN	EE	E1	E2	H	J	K	KK	LB	MM	RM	RT	SB	V	Y
5/16"	0.38	N/A	N/A	N/A	N/A	N/A	10-32	0.50	0.36	N/A	N/A	N/A	5-40	1.72	0.125	N/A	N/A	N/A	N/A	N/A
7/16"	0.50	0.75	N/A	N/A	8-32	N/A	10-32	0.75	0.50	N/A	0.38	0.19	10-32	2.12	0.187	0.437	8-32	N/A	0.06	N/A
3/4"	0.75	1.00	0.25	0.22	1/4-20	0.62	1/8 NPT	1.00	0.81	0.38	0.62	0.19	1/4-28	3.22	0.250	0.625	10-32	#10	0.09	0.50
1-1/16"	0.75	1.25	0.38	0.25	1/4-20	0.81	1/8 NPT	1.25	1.12	0.62	0.88	0.19	5/16-24	3.75	0.312	0.75	10-32	#10	0.09	0.54
1-1/2"	1.25	1.75	0.25	0.38	5-16-18	1.12	1/4 NPT	1.75	1.56	0.88	0.88	0.25	7/16-20	4.19	0.437	1.00	1/4-20	1/4	0.13	0.65

NORGREN ENGINEERING ADVANTAGE

Roundline Plus Stainless Steel Body Actuators

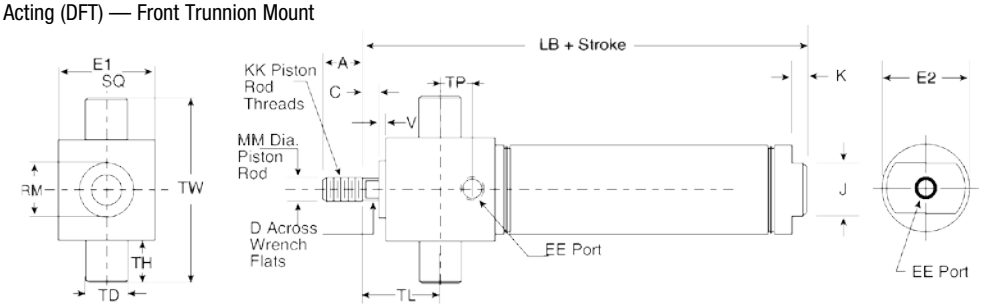
Dimensions in inches

Double Acting (DAR) — Rear Block Mount



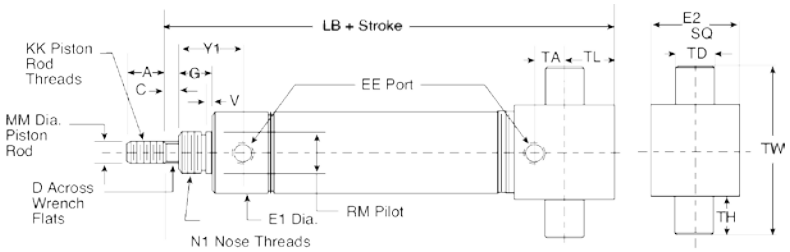
Bore	A	C	D	E1	E2	EE	G	KK	LB	MM	N1	RM	RT	BC	V	Y1	Y2
7/16"	0.50	N/A	N/A	0.75	0.75	10-32	0.38	10-32	2.44	0.187	7/16-20	.433/.437	8-32	0.75	0.05	0.72	0.34
3/4"	0.75	0.25	0.22	0.86	1.00	1/8 NPT	0.50	1/4-28	3.78	0.250	5/8-18	.621/.624	10-32	1.00	0.09	0.97	0.44
1-1/16"	0.75	0.38	0.25	1.12	1.25	1/8 NPT	0.50	5/16-24	4.00	0.312	5/8-18	.621/.624	10-32	1.25	0.09	1.06	1.25
1-1/2"	1.25	0.25	0.38	1.56	1.75	1/4 NPT	0.63	7/16-20	4.38	0.437	3/4-16	.746/.749	1/4-20	1.75	0.09	1.25	0.62

Double Acting (DFT) — Front Trunnion Mount



Bore	A	C	D	E1	E2	EE	J	K	KK	LB	MM	RM	TD	TH	TL	TP	TW	V
7/16"	0.50	N/A	N/A	0.75	0.50	10-32	0.38	0.19	10-32	2.12	0.187	0.44	0.374	0.25	0.31	0.41	1.25	0.06
3/4"	0.75	0.25	0.22	1.00	0.81	1/8 NPT	0.62	0.19	1/4-28	3.22	0.250	0.62	0.500	0.38	0.69	0.53	1.75	0.09
1-1/16"	0.75	0.38	0.25	1.25	1.12	1/8 NPT	0.88	0.19	5/16-24	3.75	0.312	0.75	0.500	0.38	1.09	0.53	2.00	0.09
1-1/2"	1.25	0.25	0.38	1.75	1.56	1/4 NPT	0.88	0.25	7/16-20	4.19	0.437	1.00	0.500	0.38	1.19	0.59	2.50	0.12

Double Acting (DRT) — Rear Trunnion Mount

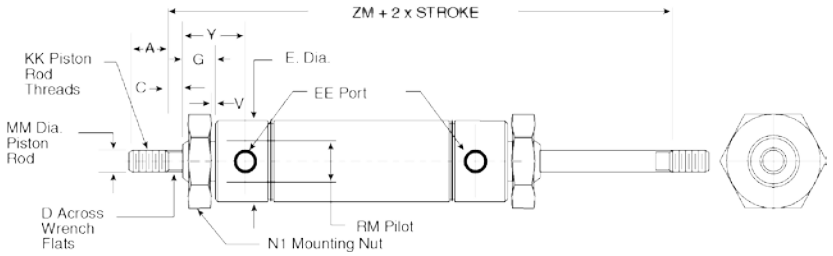


Bore	A	C	D	E1	E2	EE	G	KK	LB	MM	N1	RM	TA	TD	TH	TL	TW	V	Y1
7/16"	0.50	N/A	N/A	0.75	0.75	10-32	0.38	10-32	2.44	0.187	7/16-20	.433/.437	0.09	0.374	0.25	0.25	1.25	0.05	0.72
3/4"	0.75	0.25	0.22	0.86	1.00	1/8 NPT	0.50	1/4-28	3.78	0.250	5/8-18	.621/.624	0.06	0.500	0.38	0.38	1.75	0.09	0.97
1-1/16"	0.75	0.38	0.25	1.12	1.25	1/8 NPT	0.50	5/16-24	4.00	0.312	5/8-18	.621/.624	0.06	0.500	0.38	0.38	2.00	0.07	1.06
1-1/2"	1.25	0.25	0.38	1.56	1.75	1/4 NPT	0.63	7/16-20	4.38	0.437	3/4-16	.746/.749	0.12	0.500	0.38	0.50	2.50	0.09	1.25

Roundline Plus Stainless Steel Body Actuators

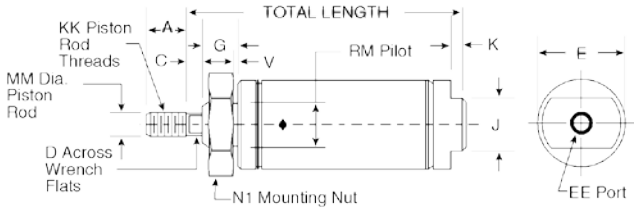
Dimensions in inches

Double Acting Double Rod End (DRD) — Double End Mount



Bore	A	C	D	E	EE	G	KK	MM	N1	RM	V	Y	ZM
7/16"	0.50	N/A	N/A	0.74	10-32	0.38	10-32	0.187	7/16-20	.434/.437	0.05	0.72	2.81
9/16"	0.50	N/A	N/A	0.62	10-32	0.38	10-32	0.187	7/16-20	.434/.437	0.06	0.75	2.94
3/4"	0.50	N/A	N/A	0.86	1/8 NPT	0.50	1/4-28	0.250	5/8-18	.621/.624	0.09	0.97	4.00
7/8"	0.50	N/A	N/A	0.94	1/8 NPT	0.50	1/4-28	0.250	5/8-18	.621/.624	0.09	0.97	3.91
1-1/16"	0.50	0.12	0.25	1.12	1/8 NPT	0.50	5/16-24	0.312	5/8-18	.621/.624	0.09	1.06	4.00
1-1/4"	0.75	0.25	0.38	1.34	1/8 NPT	0.63	7/16-20	0.437	3/4-16	.746/.749	0.09	1.37	5.56
1-1/2"	0.75	0.25	0.38	1.56	1/8 NPT	0.63	7/16-20	0.437	3/4-16	.746/.749	0.09	1.25	5.12
1-3/4"	0.88	0.31	0.44	1.84	1/4 NPT	0.75	1/2-20	0.500	1-14	1.029/1.032	0.09	1.94	6.56
2"	0.88	0.38	0.50	2.08	1/4 NPT	0.81	1/2-20	0.625	1-1/4-12	1.372/1.375	0.12	1.46	6.56
2-1/2"	0.88	0.38	0.50	2.59	1/4 NPT	0.81	1/2-20	0.625	1-3/8-12	1.497/1.500	0.12	1.46	6.56
3"	1.25	0.38	0.63	3.12	3/8 NPT	1.00	5/8-18	0.750	1-1/2-12	1.622/1.625	0.19	1.71	7.31

Single Acting Spring Return (SAN) — Nose Mount



Bore	A	C	D	E	EE	G	J	K	KK	MM	N1	RM	V	Total Length
5/16"	0.38	N/A	N/A	0.36	10-32	0.25	N/A	N/A	5-40	0.125	1/4-28	.309/.312	0.03	1.12 + (0.75 per 1/2" of stroke)
7/16"	0.50	N/A	N/A	0.50	10-32	0.31	0.38	0.19	10-32	0.187	3/8-24	.369/.373	0.05	1.31 + (0.94 per 1/2" of stroke)
9/16"	0.50	N/A	N/A	0.62	10-32	0.38	0.50	0.19	10-32	0.187	7/16-20	.434/.437	0.06	1.53 + (1.62 per 1" of stroke)
3/4"	0.50	N/A	N/A	0.81	1/8 NPT	0.44	0.62	0.19	1/4-28	0.250	1/2-20	.494/.498	0.08	1.50 + (1.69 per 1" of stroke)
7/8"	0.50	N/A	N/A	0.94	1/8 NPT	0.50	0.62	0.19	1/4-28	0.250	5/8-18	.621/.624	0.09	1.84 + (1.56 per 1" of stroke)
1-1/16"	0.50	N/A†	N/A	1.12	1/8 NPT	0.50	0.88	0.19	5/16-24	0.312	5/8-18	.621/.624	0.07	1.94 + (1.56 per 1" of stroke)
1-1/4"	0.75	0.25	0.38	1.34	1/8 NPT	0.63	0.88	0.25	7/16-20	0.437	3/4-16	.746/.749	0.09	2.66 + (1.81 per 1" of stroke)
1-1/2"	0.75	0.25	0.38	1.56	1/8 NPT	0.63	0.88	0.25	7/16-20	0.437	3/4-16	.746/.749	0.09	2.44 + (1.69 per 1" of stroke)
1-3/4"	0.88	0.31	0.44	1.84	1/4 NPT	0.75	1.25	0.25	1/2-20	0.500	1-14	1.029/1.032	0.09	2.97 + (2.00 per 1" of stroke
2"	0.88	0.38	0.50	2.08	1/4 NPT	0.81	1.25	0.31	1/2-20	0.625	1-1/4-12	1.372/1.375	0.12	Consult Factory

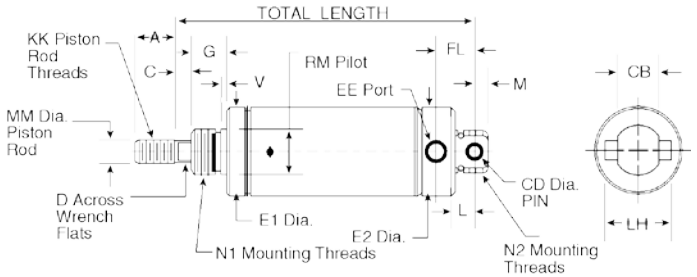
† 1-1/16 bore with SS or PS option, C = 0.12 and D = 0.25. To remove the flats and plain rod stick out, specify NF in the model number.

NORGREN ENGINEERING ADVANTAGE

Roundline Plus Stainless Steel Body Actuators

Dimensions in inches

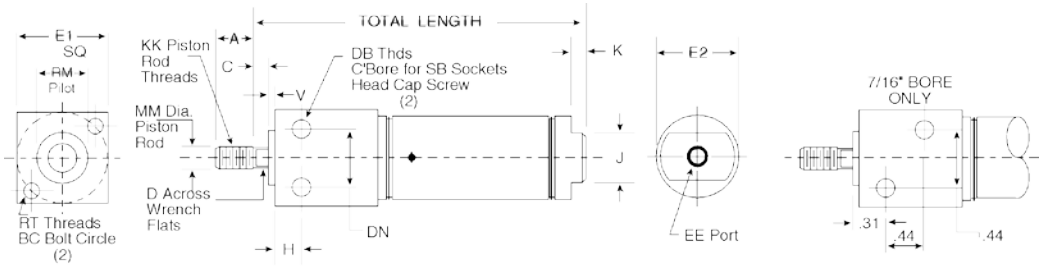
Single Acting Spring Return (SAP) — Pivot Mount



Bore	A	CB	C	CD	D	E1	E2	EE	FL	G	KK	L	LH	M	MM	N1	N2	V	RM	Total Length
5/16"*	0.38	0.25	N/A	0.125	N/A	0.36	0.36	10-32	0.34	0.25	5-40	0.19	N/A	0.16	0.125	1/4-28	3/8-24	0.03	.245/.249	1.52 + (.75 per 1/2" of stroke)
7/16"	0.50	0.31	N/A	0.156	N/A	0.50	0.74	10-32	0.44	0.31	10-32	0.25	0.50	0.25	0.187	3/8-24	7/16-20	0.05	.369/.373	1.75 + (.94 per 1/2" of stroke)
9/16"*	0.50	0.31	N/A	0.156	N/A	0.62	0.62	10-32	0.38	0.38	10-32	0.25	N/A	0.19	0.187	7/16-20	7/16-20	0.06	.434/.437	1.81 + (1.62 per 1" of stroke)
3/4"	0.50	0.38	N/A	0.250	N/A	0.81	0.86	1/8 NPT	0.62	0.44	1/4-28	0.34	0.75	0.28	0.250	1/2-20	5/8-18	0.08	.494/.498	2.28 + (1.69 per 1" of stroke)
7/8"	0.50	0.38	N/A	0.250	N/A	0.94	0.94	1/8 NPT	0.62	0.50	1/4-28	0.34	0.75	0.28	0.250	5/8-18	5/8-18	0.09	.621/.624	2.47 + (1.56 per 1" of stroke)
1-1/16"	0.50	0.38	0.12	0.250	0.25	1.12	1.12	1/8 NPT	0.62	0.50	5/16-24	0.34	0.75	0.28	0.312	5/8-18	5/8-18	0.07	.621/.624	2.66 + (1.56 per 1" of stroke)
1-1/4"	0.75	0.50	0.25	0.250	0.38	1.34	1.34	1/8 NPT	0.78	0.63	7/16-20	0.41	N/A	0.40	0.437	3/4-16	3/4-16	0.09	.746/.749	3.38 + (1.81 per 1" of stroke)
1-1/2"	0.75	0.62	0.25	0.375	0.38	1.56	1.56	1/8 NPT	0.81	0.63	7/16-20	0.50	N/A	0.38	0.437	3/4-16	3/4-16	0.09	.746/.749	3.12 + (1.69 per 1" of stroke)
1-3/4"	0.88	0.62	0.31	0.375	0.44	1.84	1.84	1/4 NPT	1.12	1.06	1/2-20	0.50	N/A	0.50	0.500	1-14	1-14	0.09	1.029/1.032	4.03 + (2.00 [per 1" of stroke)
2"*	0.88	0.75	0.38	0.375	0.50	2.08	2.08	1/4 NPT	1.03	0.81	1/2-20	0.56	N/A	0.44	0.625	1-1/4-12	1-1/4-12	0.12	1.372/1.375	Consult Factory

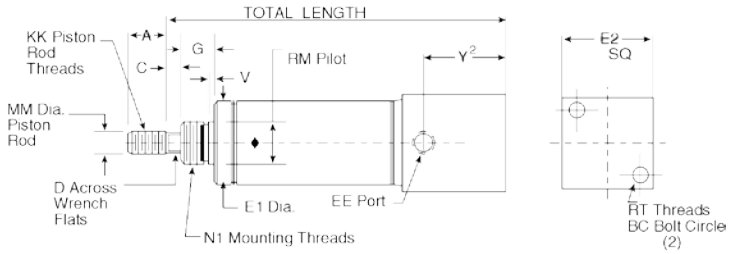
* Pivot bushing included

Single Acting Spring Return (SBF) — Front Block Mount



Bore	A	BC	C	D	DB	DN	E1	E2	EE	H	J	K	KK	MM	RM	RT	SB	V	Total Length
7/16"	0.50	0.75	N/A	N/A	8-32	N/A	0.75	0.50	10-32	N/A	0.38	0.19	10-32	0.187	0.44	8-32	N/A	0.06	1.94 + (.94 per 1/2" of stroke)
3/4"	0.75	1.00	0.25	0.22	1/4-20	0.62	1.00	0.81	1/8 NPT	0.38	0.62	0.19	1/4-28	0.250	0.63	10-32	#10	0.09	2.66 + (1.69 per 1" of stroke)
1-1/16"	0.75	1.25	0.38	0.25	1/4-20	0.81	1.25	1.12	1/8 NPT	0.62	0.88	0.19	5/16-24	0.312	0.75	10-32	#10	0.09	3.38 + (1.81 per 1" of stroke)
1-1/2"	1.25	1.75	0.25	0.38	5/16-18	1.12	1.75	1.56	1/4 NPT	0.88	0.88	0.25	7/16-20	0.437	1.00	1/4-20	1/4	0.13	3.69 + (2.00 per 1" of stroke)

Single Acting Spring Return (SBR) — Rear Block Mount

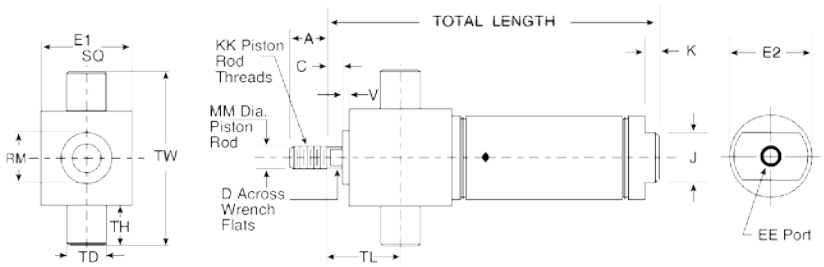


Bore	A	BC	C	D	E1	E2	EE	G	KK	MM	N1	RM	RT	V	Y2	Total Length
7/16"	0.50	0.75	N/A	N/A	0.50	0.75	10-32	0.31	10-32	0.187	3/8-24	.369/.373	8-32	0.05	0.34	1.62 + (0.94 per 1/2" of stroke)
3/4"	0.75	1.00	0.25	0.22	0.81	1.00	1/8 NPT	0.44	1/4-28	0.250	1/2-20	.494/.498	10-32	0.08	0.44	2.31 + (1.69 per 1" of stroke)
1-1/16"	0.75	1.25	0.25	0.25	1.12	1.25	1/8 NPT	0.50	5/16-24	0.312	5/8-18	.621/.624	10-32	0.07	0.44	2.81 + (1.81 per 1" of stroke)
1-1/2"	1.25	1.75	0.25	0.38	1.56	1.75	1/8 NPT	0.63	7/16-20	0.437	3/4-16	.746/.749	1/4-20	0.09	0.62	3.06 + (2.00 per 1" of stroke)

Roundline Plus Stainless Steel Body Actuators

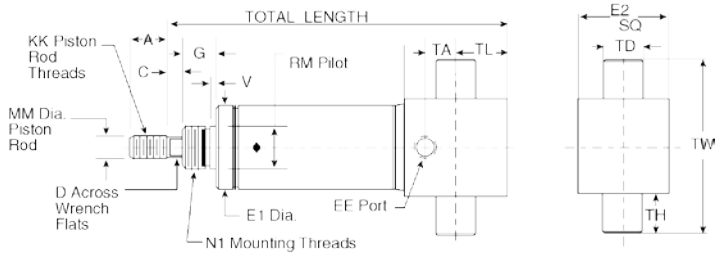
Dimensions in inches

Single Acting Spring Return (STF) — Front Trunnion Mount



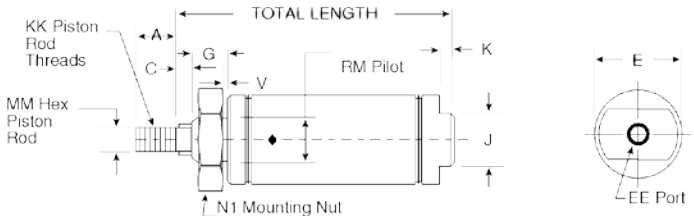
Bore	A	C	D	E1	E2	EE	J	K	KK	MM	RM	TD	TH	TL	TW	V	Total Length
7/16"	0.50	N/A	N/A	0.75	0.50	10-32	0.38	0.19	10-32	0.187	0.44	0.37	0.25	0.31	1.25	0.05	1.94 + (0.94 per 1/2" of stroke)
3/4"	0.75	0.25	0.22	1.00	0.81	1/8 NPT	0.62	0.19	1/4-28	0.250	0.62	0.50	0.38	0.69	1.75	0.09	2.66 + (1.69 per 1" of stroke)
1-1/16"	0.75	0.25	0.25	1.25	1.12	1/8 NPT	0.88	0.19	5/16-24	0.312	0.75	0.50	0.38	0.97	2.00	0.09	3.38 + (1.81 per 1" of stroke)
1-1/2"	1.25	0.25	0.38	1.75	1.56	1/4 NPT	0.88	0.25	7/16-20	0.437	1.00	0.50	0.38	1.19	2.50	0.12	3.69 + (2.00 per 1" of stroke)

Single Acting Spring Return (STR) — Rear Trunion Mount



Bore	A	C	D	E1	E2	EE	G	KK	MM	N1	RM	TA	TD	TH	TL	TW	V	Total Length
7/16"	0.50	N/A	N/A	0.50	0.75	10-32	0.31	10-32	0.187	3/8-24	.370/.375	0.09	0.37	0.25	0.25	1.25	0.05	1.62 + (0.94 per 1/2" of stroke)
3/4"	0.75	0.25	0.22	0.81	1.00	1/8 NPT	0.69	1/4-28	0.250	1/2-20	.494/.498	0.06	0.50	0.38	0.38	1.75	0.08	2.31 + (1.69 per 1" of stroke)
1-1/16"	0.75	0.25	0.38	1.12	1.25	1/8 NPT	0.75	5/16-24	0.312	5/8-18	.621/.624	0.06	0.50	0.38	0.38	2.00	0.07	2.81 + (1.81 per 1" of stroke)
1-1/2"	1.25	0.25	0.38	1.56	1.75	1/4 NPT	0.88	7/16-20	0.437	3/4-16	.746/.749	0.12	0.50	0.38	0.50	2.50	0.06	3.06+ (2.00 per 1" of stroke)

Single Acting Non-Rotating (NRN) — Nose Mount



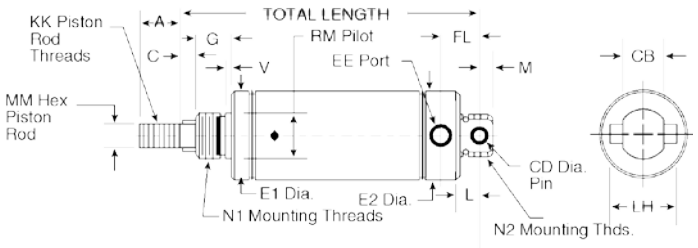
Bore	A	C	E	EE	G	J	K	KK	MM (hex)	N1	RM	V	Total Length
7/16"	0.50	0.25	0.50	10-32	0.31	0.38	0.19	10-32	0.187	3/8-24	.369/.373	0.05	1.56 + (.94 per 1/2" of stroke)
9/16"	0.50	0.25	0.62	10-32	0.38	0.50	0.19	10-32	0.187	7/16-20	.434/.437	0.06	1.78 + (1.62 per 1" of stroke
3/4"	0.50	0.25	0.81	1/8 NPT	0.44	0.62	0.19	1/4-28	0.250	1/2-20	.494/.498	0.08	1.75 + (1.69 per 1" of stroke)
7/8"	0.50	0.25	0.94	1/8 NPT	0.50	0.62	0.19	1/4-28	0.250	5/8-18	.621/.624	0.09	2.09 + (1.56 per 1" of stroke)
1-1/16"	0.50	0.25	1.12	1/8 NPT	0.50	0.88	0.19	5/16-24	0.375	5/8-18	.621/.624	0.07	2.19 + (1.56 per 1" of stroke)
1-1/4"	0.88	0.25	1.34	1/8 NPT	0.63	0.88	0.25	7/16-20	0.437	3/4-16	.746/.749	0.09	2.66 + (1.81 per 1" of stroke)
1-1/2"	0.88	0.25	1.56	1/8 NPT	0.63	0.88	0.25	7/16-20	0.437	3/4-16	.746/.749	0.09	2.44 + (1.69 per 1" of stroke)
1-3/4"	0.88	0.38	1.84	1/4 NPT	0.74	1.25	0.25	1/2-20	0.500	1-14	1.029/1.032	0.09	3.03 + (2.00 per 1" of stroke)

NORGREN ENGINEERING ADVANTAGE

Roundline Plus Stainless Steel Body Actuators

Dimensions in inches

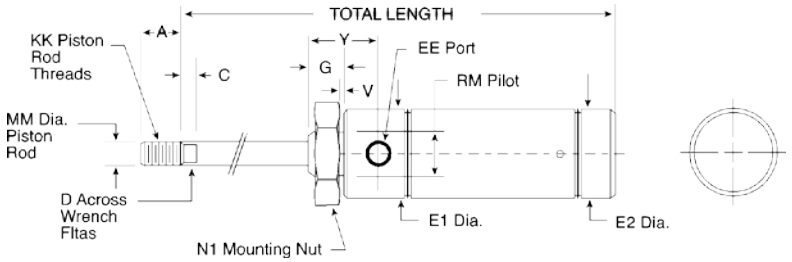
Single Acting Non-Rotating (NRP) — Pivot Mount



Bore	A	C	CB	CD	E1	E2	EE	FL	G	KK	L	LH	M	MM (hex)	N1	N2	RM	V	Total Length
7/16"	0.50	0.25	0.31	0.156	0.50	0.74	10-32	0.44	0.31	10-32	0.25	0.50	0.25	0.187	3/8-24	7/16-20	.369/.373	0.05	2.00 + (.94 per 1/2" of stroke)
9/16"*	0.50	0.25	0.31	0.156	0.62	0.62	10-32	0.38	0.38	10-32	0.25	N/A	0.19	0.187	7/16-20	7/16-20	.434/.437	0.06	2.06 + (1.62 per 1" of stroke)
3/4"	0.50	0.25	0.38	0.250	0.81	0.86	1/8 NPT	0.62	0.44	1/4-28	0.34	0.75	0.28	0.250	1/2-20	5/8-18	.494/.498	0.08	2.53 + (1.69 per 1" of stroke)
7/8"	0.50	0.25	0.38	0.250	0.94	0.94	1/8 NPT	0.62	0.50	1/4-28	0.34	0.75	0.28	0.250	5/8-18	5/8-18	.621/.624	0.09	2.72 + (1.56 per 1" of stroke)
1-1/16"	0.50	0.25	0.38	0.250	1.12	1.12	1/8 NPT	0.62	0.50	5/16-24	0.34	0.75	0.28	0.375	5/8-18	5/8-18	.621/.624	0.07	2.78 + (1.56 per 1" of stroke)
1-1/4"	0.88	0.25	0.50	0.250	1.34	1.34	1/8 NPT	0.78	0.63	7/16-20	0.41	0.88	0.40	0.437	3/4-16	3/4-16	.746/.749	0.09	3.38 + (1.81 per 1" of stroke)
1-1/2"	0.88	0.38	0.62	0.375	1.56	1.56	1/8 NPT	0.81	0.63	7/16-20	0.50	1.00	0.37	0.437	3/4-16	3/4-16	.746/.749	0.09	3.25 + (1.69 per 1" of stroke)
1-3/4"	0.88	0.38	0.62	0.375	1.84	1.84	1/4 NPT	1.12	0.74	1/2-20	0.50	N/A	0.50	0.500	1-14	1-14	1.029/1.032	0.09	4.09 + (2.00 per 1" of stroke)

* Pivot bushing included

Reverse Acting Spring Extend (RAN) — Nose Mount

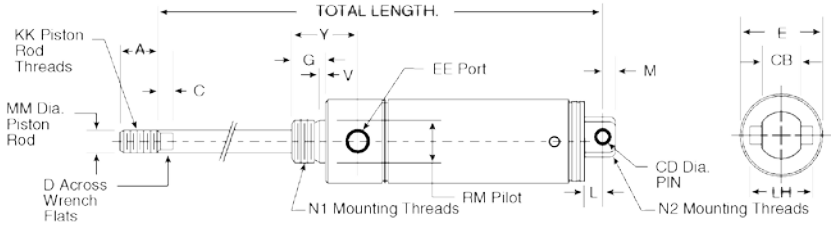


Bore	A	C	D	E1	E2	EE	G	KK	MM	N1	RM	V	Y	Total Length
5/16"	0.38	N/A	N/A	0.61	0.36	10-32	0.31	5-40	0.125	3/8-24	.371/.373	0.03	0.47	1.49 + (1.25 per 1/2" of stroke)
7/16"	0.50	N/A	N/A	0.74	0.50	10-32	0.38	10-32	0.187	7/16-20	.434/.437	0.05	0.72	1.94 + (1.44 per 1/2" of stroke)
9/16"	0.50	N/A	N/A	0.62	0.62	10-32	0.38	10-32	0.187	7/16-20	.434/.437	0.06	0.75	2.00 + (2.62 per 1" of stroke)
3/4"	0.50	N/A	N/A	0.86	0.81	1/8 NPT	0.50	1/4-28	0.250	5/8-18	.621/.624	0.09	0.97	2.31 + (2.69 per 1" of stroke)
7/8"	0.50	N/A	N/A	0.94	0.94	1/8 NPT	0.50	1/4-28	0.250	5/8-18	.621/.624	0.09	0.97	2.31 + (2.56 per 1" of stroke)
1-1/16"	0.50	0.12	0.25	1.12	1.12	1/8 NPT	0.50	5/16-24	0.312	5/8-18	.621/.624	0.09	1.06	2.62 + (2.81 per 1" of stroke)
1-1/4"	0.75	0.25	0.38	1.34	1.34	1/8 NPT	0.63	7/16-20	0.437	3/4-16	.746/.749	0.09	1.37	3.47 + (2.81 per 1" of stroke)
1-1/2"	1.25	0.25	0.38	1.56	1.56	1/8 NPT	0.63	7/16-20	0.437	3/4-16	.746/.749	0.09	1.25	3.19 + (3.00 per 1" of stroke)
1-3/4"	0.88	0.31	0.44	1.84	1.84	1/4 NPT	0.75	1/2-20	0.500	1-14	1.029/1.032	0.09	1.62	4.03 + (3.00 per 1" of stroke)
2"	0.88	0.38	0.50	2.08	2.08	1/4 NPT	0.81	1/2-20	0.625	1-1/4-12	1.372/1.375	0.12	1.46	Consult Factory

Roundline Plus Stainless Steel Body Actuators

Dimensions in inches

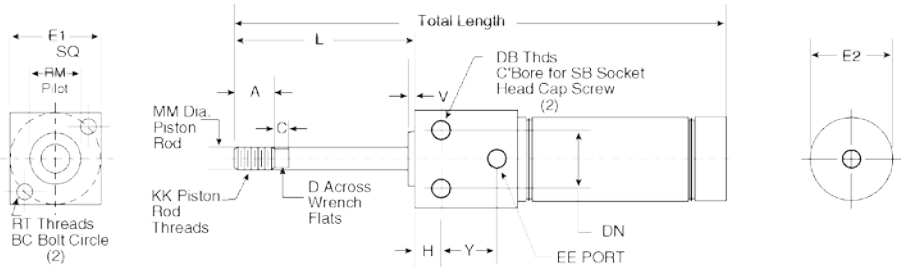
Reverse Acting Spring Extend (RAP) — Pivot Mount



Bore	A	C	CB	CD	D	EE	E	G	KK	L	LH	MM	M	N1	N2	RM	V	Y	Total Length
5/16"*	0.38	N/A	0.25	0.125	N/A	10-32	0.61	0.31	5-40	0.19	N/A	0.125	0.16	3/8-24	3/8-24	.371/.373	0.03	0.47	1.88 + (1.25 per 1/2" of stroke)
7/16"	0.50	N/A	0.31	0.156	N/A	10-32	0.74	0.38	10-32	0.25	0.50	0.187	0.25	7/16-20	7/16-20	.434/.437	0.05	0.72	2.38 + (1.44 per 1/2" of stroke)
9/16"*	0.50	N/A	0.31	0.156	N/A	10-32	0.62	0.38	10-32	0.25	0.50	0.187	0.19	7/16-20	7/16-20	.434/.437	0.06	0.75	2.28 + (2.62 per 1" of stroke)
3/4"	0.50	N/A	0.38	0.250	N/A	1/8 NPT	0.86	0.50	1/4-28	0.34	0.75	0.250	0.28	5/8-18	—	.621/.624	0.09	0.97	2.44 + (2.69 per 1" of stroke)
7/8"	0.50	N/A	0.38	0.250	N/A	1/8 NPT	0.94	0.50	1/4-28	0.34	0.75	0.250	0.28	5/8-18	—	.621/.624	0.09	0.97	2.62 + (2.56 per 1" of stroke)
1-1/16"	0.50	0.12	0.38	0.250	0.25	1/8 NPT	1.12	0.50	5/16-24	0.34	0.75	0.312	0.28	5/8-18	—	.621/.624	0.09	1.06	2.78 + (2.81 per 1" of stroke)
1-1/4"	0.75	0.25	0.50	0.250	0.38	1/8 NPT	1.34	0.63	7/16-20	0.44	0.88	0.437	0.38	3/4-16	3/4-16	.746/.749	0.09	1.37	3.78 + (2.81 per 1" of stroke)
1-1/2"	1.25	0.25	0.62	0.375	0.38	1/8 NPT	1.56	0.63	7/16-20	0.50	1.00	0.437	0.38	3/4-16	3/4-16	.746/.749	0.09	1.25	3.88 + (3.00 per 1" of stroke)
2"*	0.88	0.38	0.75	0.375	0.50	1/4 NPT	2.08	0.81	1/2-20	0.56	1.63	0.625	0.44	1-1/4-12	1-1/4-12	1.372/1.375	0.12	1.46	Consult Factory

* Pivot bushing included

Reverse Acting Spring (RAF) — Front Block Mount



Bore	A	C	D	DB	DN	SB	E1	E2	EE	H	KK	L	MM	RM	RT	BC	V	Y	Total Length
3/4"	0.75	0.25	0.22	1/4-20	0.63	10-32	1.00	0.81	1/8 NPT	0.38	1/4-28	1.09	0.250	0.62	10-32	1.00	0.09	0.5	2.56 + (2.69 per 1" of stroke)
1-1/16"	0.75	0.25	0.38	1/4-20	0.81	10-32	1.25	1.12	1/8 NPT	0.62	5/16-24	1.22	0.312	0.75	10.32	1.25	0.07	0.54	3.12 + (2.81 per 1" of stroke)
1-1/2"	1.25	0.25	0.38	5/16-18	1.12	0.25	1.75	1.56	1/4 NPT	0.88	7/16-20	1.63	0.437	1.00	1/4-20	1.75	0.12	0.65	3.69 + (3.00 per 1" of stroke)

NORGREN
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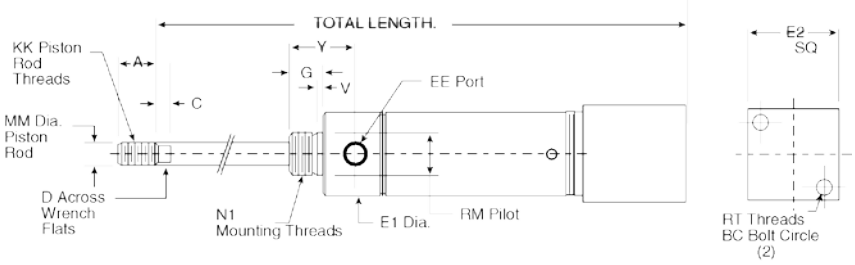
Roundline Plus Stainless Steel Body Actuators

Dimensions in inches

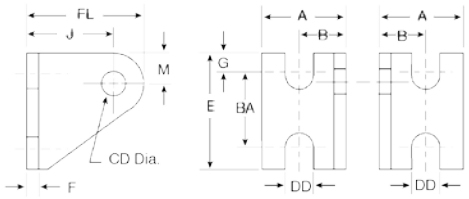
Reverse Acting Spring (RAR) — Rear Block Mount



Bore	A	C	D	E1	E2	EE	G	KK	MM	N1	RM	RT	BC	V	Y	Total Length
3/4"	0.75	0.25	0.22	0.86	1.00	1/8 NPT	0.50	1/4-28	0.250	5/8-18	.621/.624	10-32	1.00	0.09	0.97	3.22 + (2.69 per 1" of stroke)
1-1/16"	0.75	0.25	0.25	1.12	1.25	1/8 NPT	0.50	5/16-24	0.312	5/8-18	.621/.624	10-32	1.25	0.09	1.06	3.53 + (2.81 per 1" of stroke)
1-1/2"	1.25	0.25	0.38	1.56	1.75	1/4 NPT	0.62	7/16-20	0.437	3/4-16	.746/.749	1/4-20	1.75	0.09	1.25	3.88 + (3.00 per 1" of stroke)

- All accessories are clear zinc plated carbon steel

Pivot Bracket (without pin)

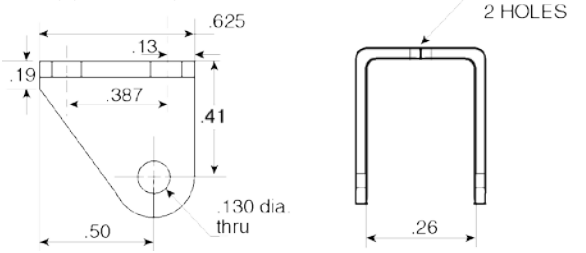


Bore	Part Number	A	B	BA	CD	DD	E	F	FL	G	J	M
7/16", 9/16"	PB-1	0.50	0.28	0.50	0.16	0.19	0.75	0.06	0.77	0.12	0.56	0.20
3/4", 7/8", 1-1/16", 1-1/4"	PB-2	0.81	0.44	0.75	0.25	0.27	1.12	0.12	1.19	0.19	0.88	0.31
1-1/2"	PB-3	1.00	0.62	1.00	0.38	0.27	1.50	0.12	1.75	0.25	1.38	0.38
1-3/4",2", 2-1/2"	PB-4	1.13	0.68	1.00	0.38	0.26	1.50	0.25	1.75	0.25	1.38	0.38
3"	PB-5	1.44	0.88	1.25	0.50	0.27	1.75	0.25	2.25	0.25	1.75	0.50

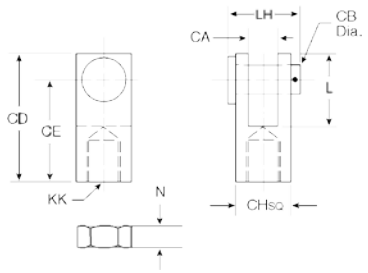
Pivot Bracket (with pin)

Bore	Part Number
5/16	PB-0
7/16", 9/16"	PB-1K
3/4", 7/8", 1-1/16", 1-1/4"	PB-2K
1-1/2"	PB-3K
1-3/4",2", 2-1/2"	PB-4K
3"	PB-5K

PB-0 (5/16" bore only) (includes pin)



Rod Clevis
(Includes Pin & Jam Nut)

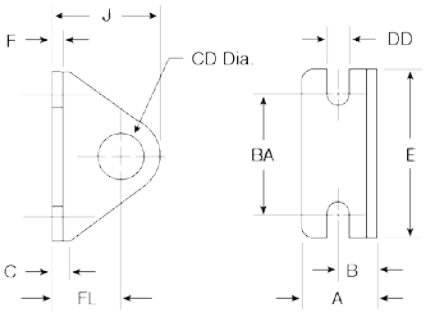


Bore	Part Number	CA	CB dia.	CD	CE	CH	KK	L	LH	N
5/16"	RC-0	0.13	0.13	0.56	0.44	0.31	5-40	0.38	0.5	0.16
7/16", 9/16"	RC-1	0.19	0.19	0.94	0.75	0.38	10-32	0.56	0.66	0.12
3/4", 7/8"	RC-2	0.25	0.25	1.19	0.94	0.50	1/4-28	0.68	0.85	0.16
1-1/16"	RC-3	0.25	0.25	1.19	0.94	0.50	5/16-24	0.69	0.85	0.19
1-1/4", 1-1/2"	RC-4	0.38	0.38	1.69	1.31	0.75	7/16-20	0.94	1.12	0.25
1-3/4, 2", 2-1/2"	RC-5	0.38	0.38	1.69	1.31	0.75	1/2-20	0.94	1.12	0.31
3"	RC-6	0.50	0.50	2.75	2.25	1	5/8-18	1.5	1.41	0.38

Roundline Plus Stainless Steel Body Actuators

Dimensions in inches

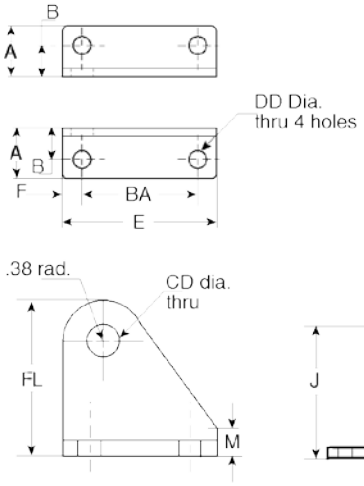
Foot Bracket



Bore	Part Number	A	B	BA	C	CD	DD	E	F	FL	J
5/16"(S)	FB-0S	0.38	0.25	0.75	0.13	0.25	0.13	1.00	0.06	0.44	0.75
5/16"(D)	FB-0D	0.38	0.25	0.75	0.13	0.38	0.13	1.00	0.06	0.44	0.75
7/16"(S)	FB-1	0.62	0.31	1.00	0.12	0.38	0.19	1.38	0.07	0.56	0.88
7/16"(D), 9/16"(S/D)	FB-2	0.69	0.38	1.00	0.12	0.44	0.19	1.38	0.09	0.56	0.83
3/4"(S)	FB-3	0.75	0.44	1.25	0.19	0.50	0.19	1.62	0.10	0.69	1.09
3/4"(D), 7/8"(S/D), 1-1/16"(S/D)	FB-4	1.00	0.56	1.50	0.25	0.62	0.27	1.88	0.12	0.81	1.38
1-1/4"(S/D), 1-1/2"(S/D)	FB-5	1.50	0.75	1.88	0.62	0.75	0.28	2.50	0.12	1.00	1.75
1-3/4"(S/D)	FB-5A	1.50	0.88	2.25	0.75	1.03	0.34	3.00	0.19	1.25	2.13
2"(S/D)	FB-6	1.62	1.00	2.25	0.62	1.38	0.34	3.12	0.25	1.50	2.50
2-1/2"(D)	FB-7	1.62	1.00	2.88	0.75	1.50	0.34	3.75	0.25	1.75	3.00
3"(D)	FB-8	1.62	1.00	3.50	0.89	1.63	0.34	4.38	0.26	1.89	3.14

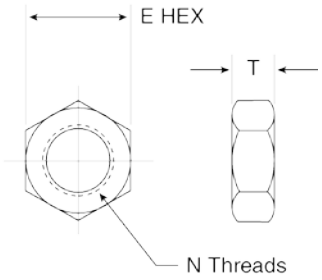
S = Single Acting Models D = Double Acting Models S/D = Single and Double Acting Models

Trunnion Bracket



Bore	Part number	A	B	BA	CD	DD	E	F	FL	G	J	M
7/16"	PB-4	1.13	0.69	1.00	0.38	0.27	1.50	0.25	1.75	0.25	1.38	0.38
3/4", 1-1/16", 1-1/2"	TB-1	1.13	0.69	1.00	0.50	0.27	1.50	0.25	1.75	0.25	1.38	0.38

Mounting Nut



Single Acting Spring Return Models

Bore	Part Number	N	E	T
5/16"	MN-0	1/4-28	0.44	0.16
7/16"	MN-1	3/8-24	0.56	0.22
9/16"	MN-2	7/16-20	0.69	0.25
3/4"	MN-3	1/2-20	0.75	0.31
7/8", 1-1/16"	MN-4	5/8-18	0.94	0.38
1-1/4", 1-1/2"	MN-5	3/4-16	1.12	0.42
1-3/4"	MN-5A	1-14	1.50	0.55
2"	MN-6	1-1/4-12	1.88	0.50

Single Acting Spring Extend & Double Acting Models

Bore	Part Number	N	E	T
5/16"	MN-1	3/8-24	0.56	0.22
7/16", 9/16"	MN-2	7/16-20	0.69	0.25
3/4", 7/8", 1-1/16"	MN-4	5/8-18	0.94	0.38
1-1/4", 1-1/2"	MN-5	3/4-16	1.12	0.42
1-3/4"	MN-5A	1-14	1.50	0.55
2"	MN-6	1-1/4-12	1.88	0.50
2-1/2"	MN-7	1-3/8-12	1.88	0.50
3"	MN-8	1-1/2-12	2.25	0.50

NORGREN
ENGINEERING ADVANTAGE

RPHD Series Magnetic Roundline Plus Stainless Steel Body Cylinders

Double acting

9/16" - 2-1/2" bores

Technical Data

Medium:
Filtered, lubricated or non-lubricated, compressed air

Maximum Operating Pressure:
250 psig (17.2 bar)

Temperature Range*:
Standard nitrile seals:
-20°F to 200°F (-29°C to 93°C)
Viton / High temp seals:
-20°F to 400°F (-29°C to 205°C)
* With dew point of supply air less than air temperature below 36°F (2°C).

Lubrication:
All RPHD cylinders are pre-lubricated during assembly with a Teflon® based grease for non-lube service and long life.

Materials:
Cylinder Body:
304 Stainless Steel
Head and Cap:
Aluminum alloy
Piston Rods:
300 series, chrome plated stainless steel
Rod Bearings:
Oil impregnated sintered bronze
Piston:
Aluminum Alloy or stainless steel
Rod & Piston Seals: Nitrile
Pivot bracket, rod clevis, foot bracket, mounting nut:
Bright zinc plated carbon steel

Options selector

RPHD 106 x 3.250 - DAN - M2

Series	Substitute
RPHD Series Magnetic	RPHD

Bore	Substitute
9/16"	056
3/4"	075
1-1/16"	106
1-1/4"	125
1-1/2"	150
1-3/4"	175
2"	200
2-1/2"	250

Stroke
Increments of 1/16" up to 36"

Options	Substitute
Viton / High Temp seals	HT*
Switch rail and position	M1, M2, M3, M4
Side Ported end cap (DAN mount only)	PC
Alternate port location	PL(__)
Plain rod end	PR**
Rod extension over std. (specify additional length)	RX(_)
Thread extension over std. (specify additional length)	TX(_)
Bumpers both ends	UB*

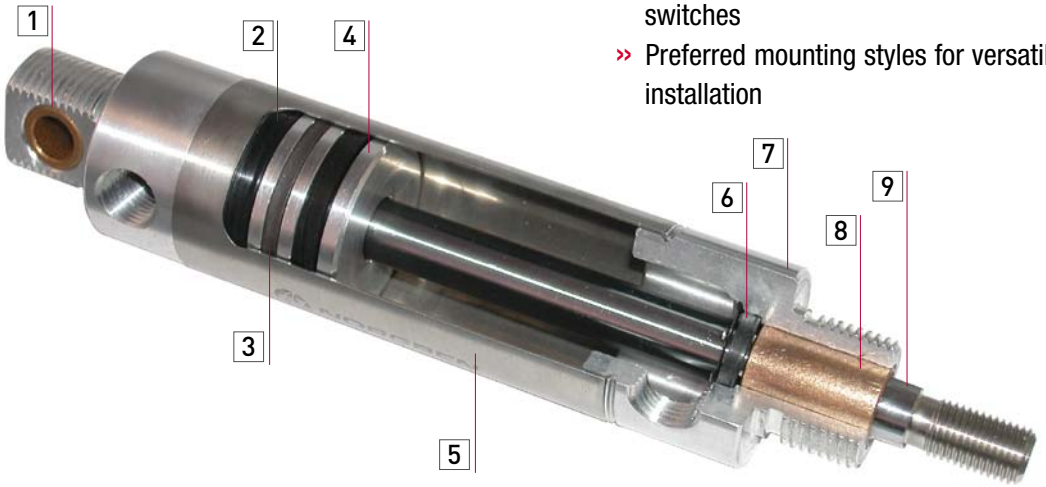
*Viton seals and Bumpers are available in combination; however, the temperature rating of the cylinder is limited to the maximum temperature rating of the bumpers.
Note: The magnetic field could be compromised with temperatures in excess of 200°F.
** PR Rod end will not have threads, but will maintian the standard "A" dimension.

Mounting Options (All models are double acting)	Substitute
Nose	DAN
Double End (with pivot bushing)	DAD
Double Rod End	DRD

RPHD Series Magnetic Roundline Plus Stainless Steel Body Cylinders

The RPHD Series cylinders provide:

- Roundline Plus cylinder features and construction
- More robust mounting threads
- Larger rod diameters
- Longer rod bearing for long life
- A magnet for position sensing with external reed switches
- Preferred mounting styles for versatility and ease of installation



1 **Pivot Bushing** (DAD model): Sintered bronze pivot bushing

2 **Piston Seals:** Lip-Type nitrile piston seals are wear compensating for long life.

3 **Magnetic Band:** On piston for position sensing with external switches.

4 **Piston:** Solid aluminum piston is strong, yet lightweight for low inertia. Stainless steel in double rod models.

5 **Cylinder Tube:** 304 Stainless steel cylinder body ensures smooth performance and outstanding life cycle.

6 **Rod Seal:** Lip-Type nitrile, pressure energized and wear compensating.

7 **Head and Cap:** Solid aluminum alloy for strength and durability.

8 **Bearing:** Oil impregnated, sinterend bonze provides exceptional rod support, and optimal cycle life.

9 **Piston Rod:** Chrome plated 300 series stainless steel for smooth operation and corrosion resistance.

Options

Switch Rail Mounting Position

Switch rail can be mounted in 4 positions
M1 = position 1
M2 = position 2
M3 = position 3
M4 = position 4

Switches ordered separately

Option PC - Side Ported End Cap
Cap end port will be on the side of the end cap and in line with the head end port. Overall length of the cylinder will increase with this option. See dimensional tables for overall length information.

Option PL(__)
Alternate Port Location
Designate location on head and cap respectively. For Example: L(12) = Head port location #1, and cap port location #2.

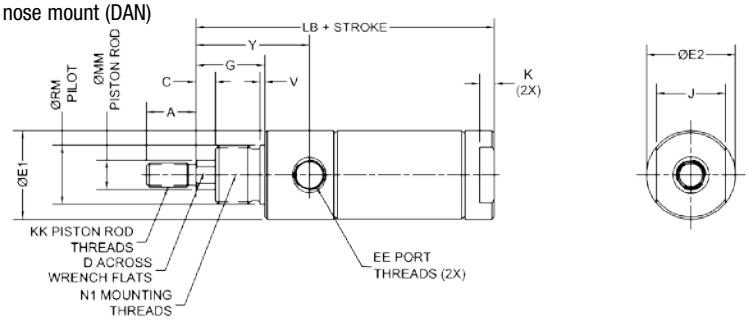
Option UB -
Bumpers both ends
NOTE: Bumpers will increase the overall length of the cylinder. See chart for length adders.

Bore	UB option length adder
9/16"	0.125"
3/4"	0.250"
1-1/16"	0.250"
1-1/4"	0.250"
1-1/2"	0.250"
1-3/4"	0.250"
2"	0.250"
2-1/2"	0.250"

NORGREN
ENGINEERING ADVANTAGE

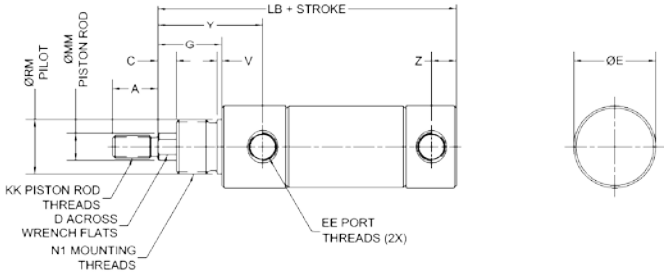
RPHD Series Magnetic Roundline Plus Stainless Steel Body Cylinders

RPHD Double acting nose mount (DAN)



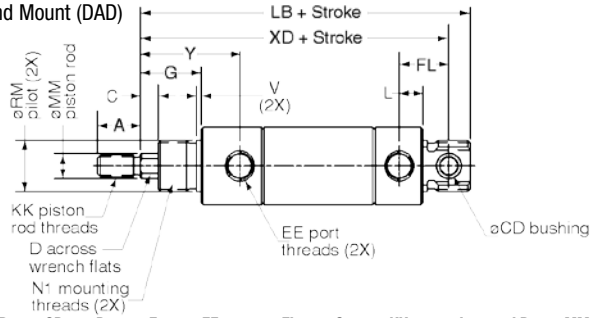
Bore	Code	A	C	D	EE	E1	E2	G	J	K	KK	LB	MM	N1	RM	V	Y
9/16"	(056)	0.50	N/A	N/A	#10-32	0.61	0.61	0.38	0.50	0.19	#10-32	2.53	0.187	7/16-20	.434/.437	0.06	0.75
3/4"	(075)	0.59	0.25	0.25	1/8 NPT	1.13	0.81	0.75	0.63	0.19	1/4-28	3.53	0.312	5/8-18	.621/.624	0.06	1.28
1-1/16"	(106)	0.63	0.25	0.31	1/8 NPT	1.13	1.13	0.88	0.88	0.19	5/16-24	3.78	0.375	3/4-16	.746/.749	0.06	1.44
1-1/4"	(125)	0.75	0.25	0.38	1/8 NPT	1.34	1.34	1.00	0.88	0.25	3/8-24	3.91	0.437	7/8-14	.871/.874	0.08	1.56
1-1/2"	(150)	0.88	0.25	0.44	1/4 NPT	1.56	1.56	1.06	0.88	0.25	7/16-20	4.13	0.500	1-14	.996/.999	0.09	1.66
1-3/4"	(175)	1.00	0.31	0.50	1/4 NPT	1.84	1.84	1.25	1.25	0.25	1/2-20	4.63	0.562	1-1/8-12	1.121/1.124	0.09	1.91
2"	(200)	1.00	0.31	0.50	1/4 NPT	2.08	2.08	1.31	1.25	0.31	1/2-20	5.09	0.625	1-1/4-12	1.246/1.249	0.11	2.03
2-1/2"	(250)	1.25	0.38	0.63	3/8 NPT	2.63	2.63	1.44	1.75	0.31	5/8-18	5.41	0.750	1-3/8-12	1.371/1.374	0.13	2.22

RPHD DAN w/PC side ported end cap option



Bore	Code	A	C	D	E	EE	G	KK	LB	MM	N1	RM	V	Y	Z
9/16"	(056)	0.50	N/A	N/A	0.61	#10-32	0.38	#10-32	2.56	0.187	7/16-20	.434/.437	0.06	0.75	0.13
3/4"	(075)	0.59	0.25	0.25	1.13	1/8 NPT	0.75	1/4-28	3.97	0.312	5/8-18	.621/.624	0.06	1.28	0.28
1-1/16"	(106)	0.63	0.25	0.31	1.13	1/8 NPT	0.88	5/16-24	4.09	0.375	3/4-16	.746/.749	0.06	1.44	0.34
1-1/4"	(125)	0.75	0.25	0.38	1.34	1/8 NPT	1.00	3/8-24	4.16	0.437	7/8-14	.871/.874	0.08	1.56	0.34
1-1/2"	(150)	0.88	0.25	0.44	1.56	1/4 NPT	1.06	7/16-20	4.50	0.500	1-14	.996/.999	0.09	1.66	0.41
1-3/4"	(175)	1.00	0.31	0.50	1.84	1/4 NPT	1.25	1/2-20	4.94	0.562	1-1/8-12	1.121/1.124	0.09	1.91	0.41
2"	(200)	1.00	0.31	0.50	2.08	1/4 NPT	1.31	1/2-20	5.47	0.625	1-1/4-12	1.246/1.249	0.11	2.03	0.44
2-1/2"	(250)	1.25	0.38	0.63	2.63	3/8 NPT	1.44	5/8-18	6.09	0.750	1-3/8-12	1.371/1.374	0.13	2.22	0.63

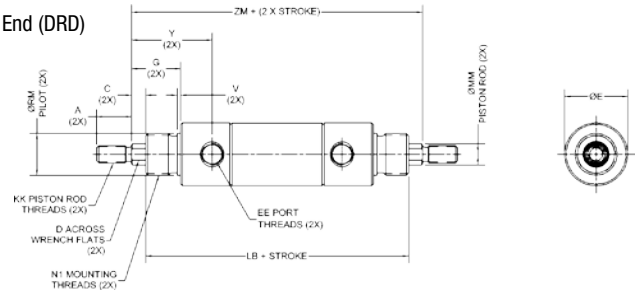
RPHD Double Acting, Double End Mount (DAD)



Bore	Code	A	C	CB	CD	D	E	EE	FL	G	KK	L	LB	MM	N1	RM	V	XD	Y
9/16"	(056)	0.50	N/A	0.31	0.16	N/A	0.61	#10-32	0.38	0.38	#10-32	0.25	3.00	0.187	7/16-20	.434/.437	0.06	2.81	0.75
3/4"	(075)	0.59	0.25	0.44	0.22	0.25	1.13	1/8 NPT	0.63	0.75	1/4-28	0.34	4.59	0.312	5/8-18	.621/.624	0.06	4.31	1.28
1-1/16"	(106)	0.63	0.25	0.50	0.25	0.31	1.13	1/8 NPT	0.72	0.88	5/16-24	0.38	4.78	0.375	3/4-16	.746/.749	0.06	4.47	1.44
1-1/4"	(125)	0.75	0.25	0.63	0.31	0.38	1.34	1/8 NPT	0.81	1.00	3/8-24	0.47	5.00	0.437	7/8-14	.871/.874	0.08	4.63	1.56
1-1/2"	(150)	0.88	0.25	0.69	0.38	0.44	1.56	1/4 NPT	0.97	1.06	7/16-20	0.56	5.53	0.500	1-14	.996/.999	0.09	5.06	1.66
1-3/4"	(175)	1.00	0.31	0.75	0.38	0.50	1.84	1/4 NPT	0.97	1.25	1/2-20	0.56	5.97	0.562	1-1/8-12	1.121/1.124	0.09	5.50	1.91
2"	(200)	1.00	0.31	0.86	0.44	0.50	2.08	1/4 NPT	1.09	1.31	1/2-20	0.66	6.63	0.625	1-1/4-12	1.246/1.249	0.11	6.13	2.03
2-1/2"	(250)	1.25	0.38	1.00	0.50	0.63	2.63	3/8 NPT	1.31	1.44	5/8-18	0.69	7.41	0.750	1-3/8-12	1.371/1.374	0.13	6.78	2.22

RPHD Series Magnetic Roundline Plus Stainless Steel Body Cylinders

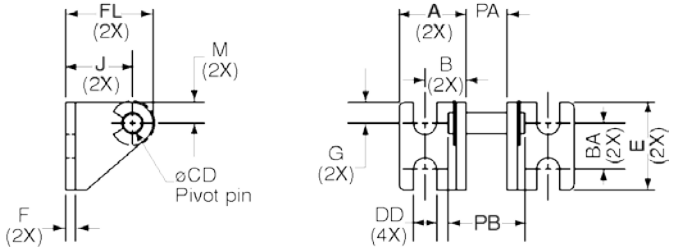
RPHD Double Acting, Double Rod End (DRD)



Bore	Code	A	C	D	E	EE	G	KK	LB	MM	N1	RM	V	Y	ZM
9/16"	(056)	0.50	N/A	N/A	0.61	#10-32	0.38	#10-32	3.19	0.187	7/16-20	.434/.437	0.06	0.75	3.19
3/4"	(075)	0.59	0.25	0.25	1.13	1/8 NPT	0.75	1/4-28	4.41	0.312	5/8-18	.621/.624	0.06	1.28	4.91
1-1/16"	(106)	0.63	0.25	0.31	1.13	1/8 NPT	0.88	5/16-24	4.69	0.375	3/4-16	.746/.749	0.06	1.44	5.19
1-1/4"	(125)	0.75	0.25	0.38	1.34	1/8 NPT	1.00	3/8-24	4.88	0.437	7/8-14	.871/.874	0.08	1.56	5.38
1-1/2"	(150)	0.88	0.25	0.44	1.56	1/4 NPT	1.06	7/16-20	5.25	0.500	1-14	.996/.999	0.09	1.66	5.75
1-3/4"	(175)	1.00	0.31	0.50	1.84	1/4 NPT	1.25	1/2-20	5.81	0.562	1-1/8-12	1.121/1.124	0.09	1.91	6.44
2"	(200)	1.00	0.31	0.50	2.08	1/4 NPT	1.31	1/2-20	6.50	0.625	1-1/4-12	1.246/1.249	0.11	2.03	7.13
2-1/2"	(250)	1.25	0.38	0.63	2.63	3/8 NPT	1.44	5/8-18	7.00	0.750	1-3/8-12	1.371/1.374	0.13	2.22	7.75

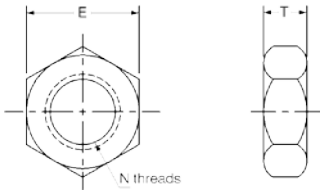
RPHD Mounting Accessories

RPHD Pivot Bracket



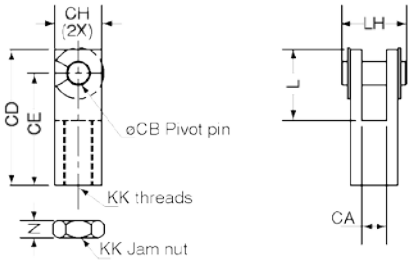
Bore	Code	Part Number	A	B	BA	CD	DD	E	F	FL	G	J	M	PA	PB
9/16"	(056)	PB-1K	0.50	0.28	0.50	0.16	0.20	0.75	0.06	0.77	0.13	0.56	0.20	0.34	0.63
3/4"	(075)	PB-52	0.81	0.50	0.56	0.22	0.28	1.06	0.12	1.03	0.25	0.81	0.22	0.44	0.88
1-1/16"	(106)	PB-53	0.81	0.50	0.56	0.25	0.28	1.06	0.12	1.06	0.25	0.81	0.25	0.50	0.94
1-1/4"	(125)	PB-54	0.88	0.56	0.81	0.31	0.28	1.31	0.16	1.31	0.25	1.00	0.31	0.63	1.19
1-1/2"	(150)	PB-55	1.00	0.63	1.00	0.38	0.28	1.50	0.19	1.50	0.25	1.13	0.38	0.69	1.44
1-3/4"	(175)	PB-56	1.13	0.69	1.00	0.38	0.34	1.63	0.19	1.63	0.31	1.25	0.38	0.75	1.44
2"	(200)	PB-57	1.19	0.75	1.19	0.44	0.34	1.81	0.25	1.81	0.31	1.38	0.44	0.88	1.69
2-1/2"	(250)	PB-58	1.38	0.88	1.38	0.50	0.41	2.13	0.25	2.13	0.38	1.63	0.50	1.00	2.22

RPHD Mounting Nut



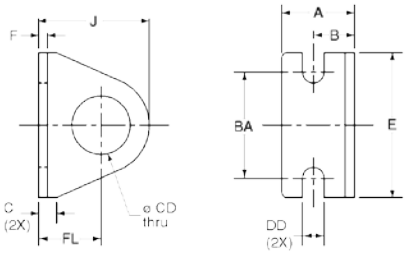
Bore	Code	Part Number	E	N	T
9/16"	(056)	MN-2	0.69	7/16-20	0.25
3/4"	(075)	MN-4	0.94	5/8-18	0.38
1-1/16"	(106)	MN-5	1.13	3/4-16	0.42
1-1/4"	(125)	MN-54	1.31	7/8-14	0.51
1-1/2"	(150)	MN-5A	1.50	1-14	0.55
1-3/4"	(175)	MN-56	1.69	1-1/8-12	0.64
2"	(200)	MN-6	1.88	1-1/4-12	0.50
2-1/2"	(250)	MN-7	2.25	1-3/8-12	0.50

RPHD Rod Clevis



Bore	Code	Part Number	CA	CB	CD	CE	CH	KK	L	LH	N
9/16"	(056)	RC-1	0.19	0.19	0.94	0.75	0.38	#10-32	0.56	0.66	0.13
3/4"	(075)	RC-52	0.22	0.22	1.44	1.19	0.44	1/4-28	0.75	0.63	0.16
1-1/16"	(106)	RC-53	0.25	0.25	1.44	1.19	0.50	5/16-24	0.75	0.69	0.20
1-1/4"	(125)	RC-54	0.31	0.31	1.69	1.38	0.63	3/8-24	0.94	0.88	0.23
1-1/2"	(150)	RC-55	0.38	0.38	2.00	1.63	0.75	7/16-20	1.13	1.03	0.26
1-3/4"	(175)	RC-56	0.38	0.38	2.13	1.75	0.75	1/2-20	1.13	1.03	0.32
2"	(200)	RC-57	0.44	0.44	2.31	1.88	0.88	1/2-20	1.31	1.14	0.32
2-1/2"	(250)	RC-6	0.50	0.50	2.75	2.25	1.00	5/8-18	1.50	1.41	0.39

RPHD Foot Bracket



Bore	Code	Part Number	A	B	BA	C	CD	DD	E	F	FL	J
9/16"	(056)	FB-2	0.69	0.38	1.00	0.13	0.44	0.20	1.38	0.09	0.56	0.83
3/4"	(075)	FB-4	1.00	0.56	1.50	0.25	0.63	0.28	1.88	0.12	0.81	1.38
1-1/16"	(106)	FB-53	0.94	0.53	1.38	0.23	0.75	0.28	1.88	0.12	0.81	1.44
1-1/4"	(125)	FB-54	1.16	0.66	1.56	0.31	0.88	0.28	2.13	0.16	1.00	1.75
1-1/2"	(150)	FB-55	1.31	0.75	1.81	0.37	1.00	0.28	2.38	0.19	1.13	2.00
1-3/4"	(175)	FB-56	1.44	0.81	2.13	0.37	1.13	0.34	2.75	0.19	1.25	2.19
2"	(200)	FB-57	1.59	0.91	2.38	0.43	1.25	0.34	3.00	0.22	1.38	2.44
2-1/2"	(250)	FB-58	1.88	1.06	3.00	0.50	1.38	0.41	3.75	0.25	1.63	2.81

NORGREN
ENGINEERING ADVANTAGE

RPD Series Delrin® End Cap

Roundline Plus Stainless Steel Body Actuators

9/16" to 2" bore

Double acting pneumatic actuators

Delrin Acetal Resin end cap cylinders for washdown, and corrosive environment application

Technical data

Medium:
Filtered, lubricated or non-lubricated, compressed air

Maximum Operating Pressure:
125 psig (8.6 bar)

Temperature Range:
Standard Nitrile Seals:
32° to 160°F (0°C to 72°C)

Lubrication:
All RPD cylinders are pre-lubricated during assembly with a Teflon® based grease for non-lube service and long life.

Materials
Cylinder Body:
304 Series stainless steel
Head and Cap:
Delrin Acetal Resin
Piston Rod:
300 Series chrome plated stainless steel
Piston: Anodized aluminum alloy or stainless steel
Rod & Piston Seals: Nitrile
Mounting Accessories: 300 Series stainless steel

Delrin® is a registered trademark of E.I. Du Pont de Nemours and Company for its brand of acetal resin.

Options selector

RPD 106 x 3.250 - DAN - PS

Series

RPD Series Delrin end cap	RPD
RPD Series Delrin with Ecology Seals*	*ERPD

* Ecology version not available on 9/16" bore RPD cylinder

Bore Size

9/16"	056
3/4"	075
1-1/16"	106
1-1/2"	150
2"	200

Stroke

Increments of 1/16" up to 36"

Additional Options

Alternate female thread (Specify thread type)	FT (_)
Viton seals	HT**
Switch rail and position	M1, M2, M3, M4
Side ported end cap (DAN mount only)	PC
Alternate port location	PL(_)
Plain rod end	PR
Magnetic piston	PS
Rod extension over std. (specify additional length)	RX(_)
Rod wiper	RW†
Alternate male thread (Specify thread type)	TM (_)
Thread extension over std. (specify additional length)	TX(_)
Bumper both ends	UB

Mounting Options (all models are double acting)

Nose	DAN
Double End (with pivot hole)	DAD
Double Rod End	DRD

** Viton seals are for chemical compatibility applications, and are not available in Ecology 1-1/16" bore

† Rod wiper not available on 9/16" bores

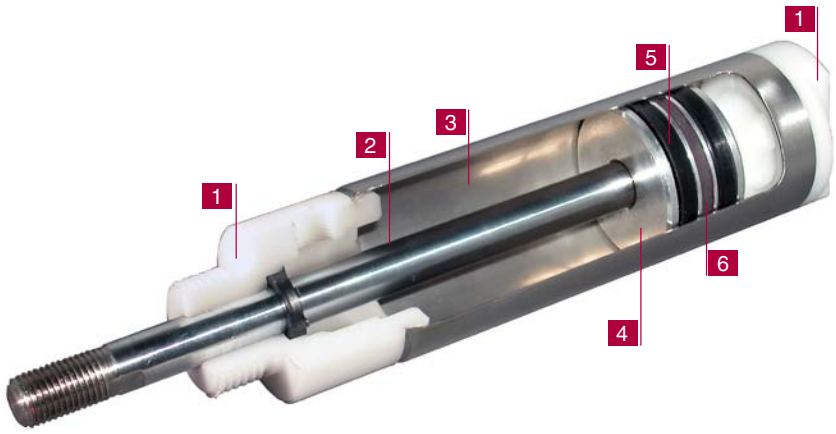
RPD Series Delrin® End Cap

RPD Series Delrin® End Cap
Roundline Plus Stainless Steel Body Actuators

The Norgren RPD Series Cylinder utilizes a stainless steel body, a stainless steel rod, and Delrin® (acetal resin) end caps for corrosion resistance. This cylinder is designed to endure a variety of environmental conditions. The RPD Series construction provides resistance to moisture, various solvents, and many other neutral chemicals. The Norgren RPD Series is ideal in corrosive environment applications.

Additionally, the Norgren RPD Series Cylinder is the only Delrin® end cap cylinder in the industry to offer the patented impact dampening Ecology Seal Technology. The Ecology Seal option, used in conjuction with a fixed cushion, eliminates the bacteria-collecting cushion screw orifice found in competing adjustable cushion model cylinders.

1. Head and Cap: Delrin® (acetal resin)
2. Piston Rod: Chrome plated stainless steel
3. Tube: Stainless steel
4. Piston: Anodized aluminum (stainless steel on 9/16" bore DRD model)
5. Piston Seals: Nitrile (Viton® optional)
6. Optional magnet on piston for position sensing

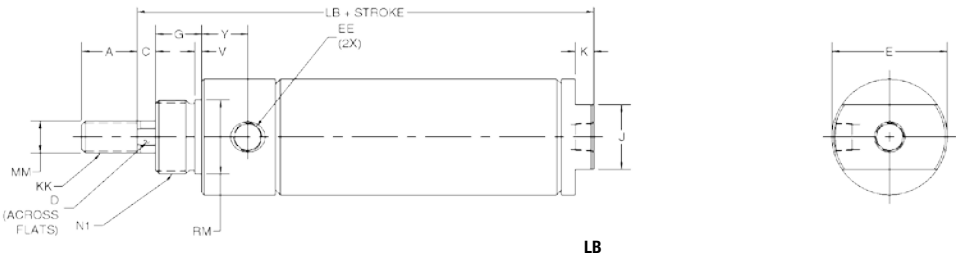


Delrin® is a registered trademark of E.I. Du Pont de Nemours and Company for its brand of acetal resin.
For detailed technical specifications on the properties of Delrin®, please contact DuPont (www.dupont.com).

NORGREN
ENGINEERING ADVANTAGE

RPD Series Delrin® End Cap

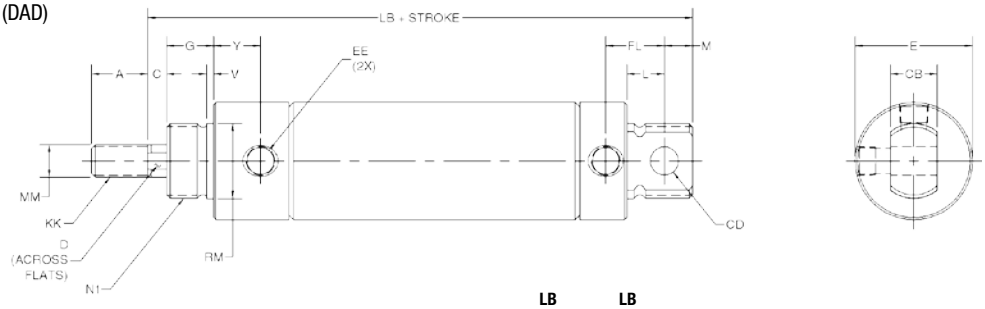
Double Acting Nose Mount (DAN)



Bore		A	C	D	E	EE	G	J	K	KK	LB	LB Ecology or PC	LB Bumpers	MM	N1	RM	V	Y
9/16"	(056)	0.50	--	--	0.61	#10-32	0.38	0.50	0.19	#10-32	2.28	--	2.41	0.19	7/16-20	.434/.437	0.06	0.38
3/4"	(075)	0.50	--	--	0.81	1/8 NPT	0.50	0.63	0.19	1/4-28	2.97	3.41	2.97	0.25	5/8-18	.621/.624	0.09	0.47
1-1/16"	(106)	0.50	0.13	0.25	1.13	1/8 NPT	0.50	0.88	0.19	5/16-24	3.25	3.50	3.38	0.31	5/8-18	.621/.624	0.09	0.56
1-1/2"	(150)	0.75	0.25	0.38	1.56	1/8 NPT	0.63	0.88	0.25	7/16-20	3.69	3.88	3.82	0.44	1-14	.996/.999	0.09	0.63
2"	(200)	0.88	0.38	0.50	2.08	1/4 NPT	0.81	1.25	0.31	1/2-20	4.69	5.06	4.94	0.63	1-1/4-12	1.371/1.374	0.13	0.73

PS (Magnetic Piston) length adder: 1-1/16" & 1-1/2" bores = 0.125". 9/16", 3/4", and 2" bores = 0.25".
When PS (magnetic piston) and Ecology options are ordered in combination, use "LB Ecology" length only - do not add extra length for the magnet.

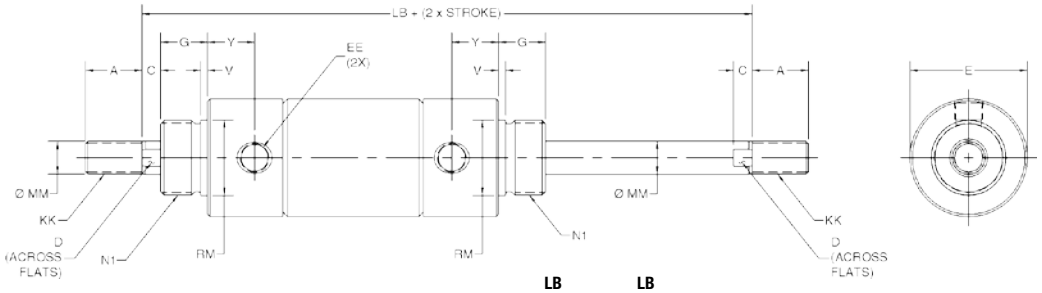
Double Acting Pivot Mount (DAD)



Bore		A	C	CB	CD	D	E	EE	FL	G	KK	L	LB	LB Ecology	LB Bumpers	M	MM	N1	RM	V	Y
9/16"	(056)	0.50	--	0.31	0.16	--	0.61	#10-32	0.38	0.38	#10-32	0.25	2.56	–	2.69	0.19	0.19	7/16-20	.434/.437	0.06	0.38
3/4"	(075)	0.50	--	0.38	0.25	--	0.81	1/8 NPT	0.63	0.50	1/4-28	0.34	3.75	3.75	3.75	0.28	0.25	5/8-18	.621/.624	0.09	0.47
1-1/16"	(106)	0.50	0.13	0.38	0.25	0.25	1.13	1/8 NPT	0.63	0.50	5/16-24	0.34	3.84	3.84	3.97	0.28	0.31	5/8-18	.621/.624	0.09	0.56
1-1/2"	(150)	0.75	0.25	0.63	0.38	0.38	1.56	1/8 NPT	0.78	0.63	7/16-20	0.50	4.38	4.38	4.50	0.38	0.44	1-14	.996/.999	0.09	0.63
2"	(200)	0.88	0.38	0.74	0.38	0.50	2.08	1/4 NPT	1.03	0.81	1/2-20	0.56	5.63	5.63	5.88	0.44	0.63	1-1/4-12	1.371/1.374	0.13	0.73

PS (Magnetic Piston) length adder: 1-1/16" & 1-1/2" bores = 0.125". 9/16", 3/4", and 2" bores = 0.25".
When PS (magnetic piston) and Ecology options are ordered in combination, use "LB Ecology" length only - do not add extra length for the magnet.

Double Acting Double Rod End Mount (DRD)



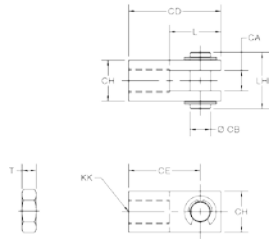
Bore		A	C	D	E	EE	G	KK	LB	LB Ecology	LB Bumpers	MM	N1	RM	V	Y
9/16"	(056)	0.50	--	--	0.61	#10-32	0.38	#10-32	2.94	–	3.06	0.19	7/16-20	.434/.437	0.06	0.38
3/4"	(075)	0.50	--	--	0.86	1/8 NPT	0.50	1/4-28	4.00	4.00	4.00	0.25	5/8-18	.621/.624	0.09	0.47
1-1/16"	(106)	0.50	0.13	0.25	1.13	1/8 NPT	0.50	5/16-24	4.00	4.00	4.50	0.31	5/8-18	.621/.624	0.09	0.56
1-1/2"	(150)	0.75	0.25	0.38	1.56	1/8 NPT	0.63	7/16-20	5.13	5.13	5.25	0.44	1-14	.996/.999	0.09	0.63
2"	(200)	0.88	0.38	0.50	2.08	1/4 NPT	0.81	1/2-20	6.56	6.56	6.81	0.63	1-1/4-12	1.371/1.374	0.13	0.73

PS (Magnetic Piston) length adder = 0.25" for all bore sizes.
When PS (magnetic piston) and Ecology options are ordered in combination, use "LB Ecology" length only - do not add extra length for the magnet.

RPD Series Delrin® End Cap

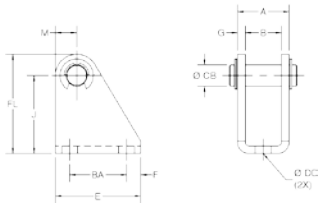
Dimensions in inches

Stainless steel Rod Clevis (includes nut and pin)



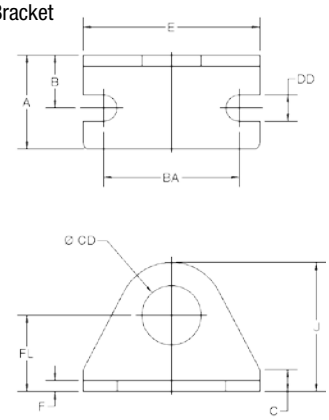
Bore		P/N	CA	CB	CD	CE	CH	L	LH	KK	T
9/16"	(056)	DRC-056	0.19	0.19	0.94	0.75	0.38	0.56	0.56	#10-32	0.13
3/4"	(075)	DRC-075	0.25	0.25	1.19	0.94	0.50	0.69	0.69	1/4-28	0.16
1-1/16"	(106)	DRC-106	0.25	0.25	1.19	0.94	0.50	0.69	0.69	5/16-24	0.19
1-1/2"	(150)	DRC-150	0.38	0.38	1.69	1.31	0.75	0.94	1.03	7/16-20	0.25
2"	(200)	DRC-200	0.38	0.38	1.69	1.31	0.75	0.94	1.03	1/2-20	0.31

Stainless steel Pivot Bracket (includes pin)



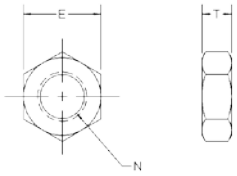
Bore		P/N	A	B	BA	CB	DD	E	F	FL	G	J	M
9/16"	(056)	DPB-056	0.44	0.31	0.50	0.16	0.20	0.75	0.13	0.76	0.06	0.56	0.20
3/4"	(075)	DPB-075	0.63	0.38	0.75	0.25	0.22	1.13	0.19	1.19	0.12	0.88	0.31
1-1/16"	(106)	DPB-075	0.63	0.38	0.75	0.25	0.22	1.13	0.19	1.19	0.12	0.88	0.31
1-1/2"	(150)	DPB-150	0.91	0.63	1.00	0.38	0.28	1.50	0.25	1.75	0.13	1.38	0.38
2"	(200)	DPB-200	1.25	0.75	1.00	0.38	0.28	1.50	0.25	1.75	0.25	1.38	0.38

Stainless steel Foot Bracket



Bore		P/N	A	B	BA	C	CD	DD	E	F	FL	J
9/16"	056	RPDFB-056	0.69	0.38	0.97	0.13	0.44	0.19	1.38	0.09	0.56	0.84
3/4"	075	RPDFB-075	1.00	0.56	1.44	0.23	0.63	0.27	1.88	0.12	0.81	1.38
1-1/16"	106	RPDFB-075	1.00	0.56	1.44	0.23	0.63	0.27	1.88	0.12	0.81	1.38
1-1/2"	150	RPDFB-150	1.50	0.75	1.88	0.72	1.00	0.28	2.50	0.12	1.00	1.75
2"	200	RPDFB-200	1.63	1.00	2.25	0.61	1.38	0.34	3.13	0.25	1.50	2.50

Stainless steel Mounting Nut



Bore		P/N	E	N	T	Maximum torque (in-lbs.)
9/16"	(056)	52025-SS	0.69	7/16-20	0.25	4
3/4"	(075)	52027-SS	0.94	5/8-18	0.38	12
1-1/16"	(106)	52027-SS	0.94	5/8-18	0.38	12
1-1/2"	(150)	52030-SS	1.50	1-14	0.55	30
2"	(200)	52085-SS	1.88	1-1/4-12	0.50	45

NORGREN ENGINEERING ADVANTAGE

RT Series Roundline Plus Thrusters

9/16" to 3" bore

Composite and Roller Bearings

PS magnetic piston option

Optional ecology seal

Optional shock absorbers

Choice of high load composite or precision low friction bearings

Comes with stroke adjusting collars

Technical data

Medium:

Filtered, lubricated or non-lubricated, compressed air

Operating Pressure

250 psig (17.2 Bar) Max.

Temperature Range:

Standard Nitrile seals:

-20°F to 200°F (-29°C to 93°C)

*With dew point of supply air less than air temperature below 35°F (2°C)

Lubrication:

All Roundline Thruster cylinders are prelubricated at the time of assembly with a Teflon®-Based grease, for non-lube service and long life.

Thruster Materials:

Guide shafts with **composite bearings**:

9/16" to 2.0" bore: Chrome plated 303 SS.

2-1/2" to 3.0": Chrome plated carbon steel.

Guide shafts with **roller bearings**:

All bore sizes case hardened carbon steel shafts.

Body: Anodized aluminum housing and tooling plate. Choice of composite or roller bearing shaft guides.

Cylinder Materials:

304 Stainless Steel body

Aluminum alloy head,cap and piston

Oil impregnated sintered bronze rod bearing

Chrome Plated stainless steel piston rod.

Nitrile piston and rod seals

Options selector

RT 075 C x 4.50 CC

Series

Roundline Thruster	RT
Roundline Cylinder with *Ecology Seals	ERT*

Bore Size

9/16"		056
3/4"	E	075
1-1/16"	E	106
1-1/2"	E	150
2"	E	200
2-1/2"	E	250
3"	E	300

E*- Ecology seals available, Note: Ecology seals not available in 9/16" bore.

Bearing Type

Composite	C
Roller	R

Maximum Stroke Lengths **

056	6.0" Maximum Stroke
075	12.0" Maximum Stroke
106	12.0" Maximum Stroke
150	12.0" Maximum Stroke
200	12.0" Maximum Stroke
250	12.0" Maximum Stroke
300	12.0" Maximum Stroke

* ERT, Ecology Thruster come complete with non-adjustable cushions both ends (NH, NC, NB, options not required in model number of ERT Thruster). Note cushions and ecology seals not available in 9/16" bore.

**Consult factory for longer stroke lengths.

Options

Stroke Adjustment (Collar & Bumper) Extend	AE
Stroke Adjustment (Collar & Bumper) Both Ends	AJ
Stroke Adjustment (Collar & Bumper) Retract	AR
Adjustable Cushion Both Ends	CB
Adjustable Cushion Cap End (Retract)	CC
Adjustable Cushion Head End (Extend)	CH
Dowel Pin*	DP
Switch Rail	M1
Mounting Plate (Composite only)**	MP
No Mounting Plate (Roller only)**	NM
Non-Adjustable cushions both ends†	NB
Non-Adjustable cushion cap end (Retract)†	NC
Non-Adjustable cushion head end (Extend)†	NH
Side Ported	PC
Magnetic Piston	PS
Shock Absorber Extend ††	SG (‡)
Shock Absorber Retract ††	SH (‡)
Shock Absorber Both ††	SJ (‡)
Tapped Mounting Holes (Composite only)**	TH
Stainless Steel Tooling Plate	TP
Internal Bumpers	UB

*Contact factory for dowel pin option.

** Mounting plate and tapped holes, standard with roller bearing thruster

† ERT Ecology Thrusters come complete with non-adjustable cushions both ends. (NH,NC,NB option not required in model number or ERT Thruster). Note cushions and ecology seals not available in 9/16" bore.

†† Contact application engineering for applications requiring shock absorbers. Shocks available in three different duty rating: Note, shock absorbers not available in 2 1/2" or 3" bore

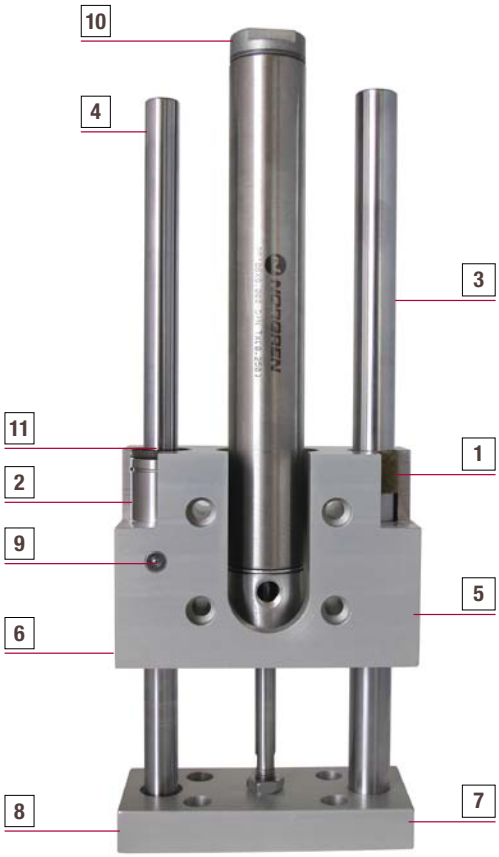
‡ L=Light, M=Medium, H=Heavy

RT Series Roundline Plus Thrusters

Features

- PS Magnetic piston option for position sensing with either Reed or Hall Effect switches.
- Optional ecology seal with non-adjustable cushion for the optimum in smooth, noise dampening deceleration of load at end of stroke.
- Shock absorbers optional to decelerate heavier loads or high speed applications
- Choice of high load composite or precision low friction bearings.
- A set of stroke adjusting collars come standard on the extend stroke of the roller bearing thruster.

Roller bearings Composite bearings



This product is for demonstration purposes only.

1. Two bearings options:
   High load carrying composite bearings...
2. ...or high precision low friction recirculating ball bearings (roller bearings)
3. Composite bearing:
   9/16" to 2.0" bore has stainless steel guide shafts
   2-1/2" and 3.0" bore has chrome plated carbon steel guide shafts
4. Roller bearing: Case hardened steel guide shafts
5. Composite bearings, precision machined clear hard anodized aluminum body and tooling plate
6. Roller bearing, precision machined black anodized aluminum body
7. Composite bearings, clear hard anodized aluminum tooling plate
8. Roller bearings, black oxide steel tooling plate
9. Easily accessible oiler port on roller bearing model
10. RP Series Actuator with stainless steel tube aluminum end caps and chrome plated stainless steel piston rod.
11. Guide shaft wiper included on roller bearing model

Force Factor Data

		Force Factor (Area)	
Bore	Code	Extend	Retract
9/16"	056	0.25	0.2
3/4"	075	0.44	0.36
1-1/16"	106	0.89	0.69
1-1/2"	150	1.77	1.46
2.0"	200	3.14	2.70
2-1/2"	250	4.91	4.47
3.0"	300	7.07	6.47

Force Output Formula
Cylinder Output Force=
Force Factor(area) x Air Line Pressure
Example: 1 1/16" Bore operating at 80psi
Extend Force = .89 x 80 = 71.2lbs
Retract Force = .69 x 80= 55.2 lbs

Replacement Cylinder for (RT) Roundline Thruster

Bore	Model Number
9/16"	RP056X***-DAN-TX(0.063) - options*
3/4"	RP075X***-DAN-SS-TX(0.125) - options*
1-1/16"	RP106X***-DAN-SS-TX(0.250) - options* -NF
1-1/2"	RP150X***-DAN-SS-TX(0.250) - options*
2"	RP200X***-DAN-SS-TX(0.250) - options*
2-1/2"	RP250X***-DAN-SS-TX(0.250) - options*
3"	RP300X***-DAN-SS-TX(0.250) - options*

*** = Stroke in inches
* The following options, if in the model number of the thruster, must be added to the model number of the replacement cylinder part number above.:
PS, M1, CH, CC, CB, NB, NC, NH, PC, UB
Note: If CC, CH or CB, must also add the following option:
CC ------- N(03) CH ------- N(30) CB ------- N(33)

Replacement Cylinder for (ERT) Ecology Roundline Thruster

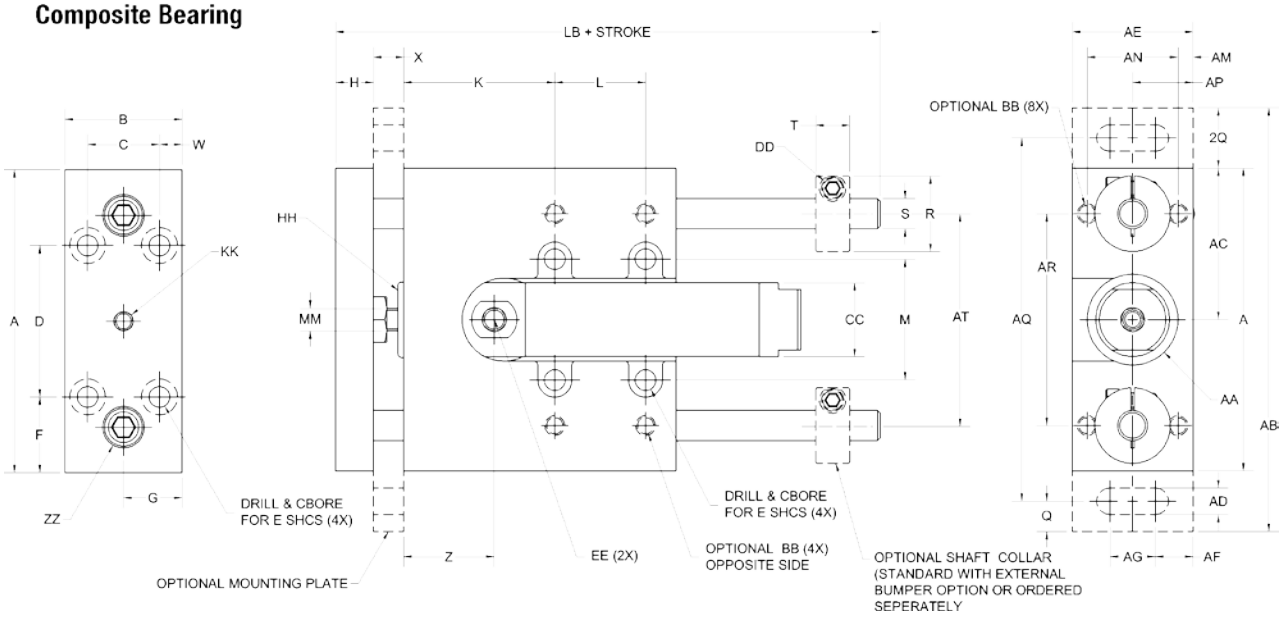
Bore	Model Number
9/16"	N/A
3/4"	ERP075X***-DAN-SS-TX(0.125) - options*
1-1/16"	ERP106X***-DAN-SS-TX(0.250) - options* -NF
1-1/2"	ERP150X***-DAN-SS-TX(0.250) - options*
2"	ERP200X***-DAN-SS-TX(0.250) - options*
2-1/2"	ERP250X***-DAN-SS-TX(0.250) - options*
3"	ERP300X***-DAN-SS-TX(0.250) - options*

NORGREN ENGINEERING ADVANTAGE

RT Series Roundline Plus Thrusters

All Dimensions in Inches

Composite Bearing



Bore	A	B	BB	C	CC	D	DD	E	EE	F	G	H	HH	K	KK	L	LB	M	MM	Q
9/16"	2.50	0.90	#8-32	0.60	0.62	1.25	#6-32	#8	#10-32	0.63	0.45	0.38	7/16-20	1.25	10-32	0.75	3.50	1.00	0.19	0.25
3/4"	3.00	1.15	#10-32	0.75	0.81	1.50	#8-32	#10	1/8 NPT	0.75	0.58	0.50	5/8-18	0.78	1/4-28	0.94	4.25	1.25	0.25	0.38
1-1/16"	4.25	1.75	1/4-20	1.00	1.12	2.00	#10-32	1/4"	1/8 NPT	1.12	0.88	0.62	5/8-18	0.81	5/16-24	1.38	5.00	1.88	0.31	0.50
1-1/2"	5.50	2.25	5/16-18	1.50	1.56	3.00	1/4-28	5/16"	1/8 NPT	1.25	1.12	0.75	3/4-16	1.12	7/16-20	1.75	6.38	2.38	0.44	0.50
2"	6.00	2.75	5/16-18	2.00	2.08	3.00	1/4-28	5/16"	1/4 NPT	1.50	1.38	1.00	1-1/4-12	1.00	1/2-20	2.00	7.12	2.70	0.62	0.50
2-1/2"	7.50	3.25	3/8-16	2.25	2.62	3.75	1/4-28	3/8"	1/4 NPT	1.88	1.63	1.25	1-3/8-12	1.75	1/2-20	2.50	9.75	3.50	0.62	1.00
3"	9.00	4.00	1/2-13	2.75	3.12	4.50	1/4-28	1/2"	3/8 NPT	2.25	2.00	1.50	1-1/2-12	2.00	5/8-18	3.00	11.50	4.20	0.75	1.00

Bore	R	S	T	W	X	Z	AA	AB	AC	AD	AE	AF	AG	AM	AN	AP	AQ	AR	AT	ZZ
9/16"	0.88	0.38	0.34	0.15	0.25	0.86	0.75	3.50	1.25	0.22	1.00	0.31	0.38	0.12	0.75	0.50	3.00	1.75	1.75	#10-32
3/4"	1.12	0.50	0.41	0.20	0.38	0.85	1.00	4.50	1.50	0.25	1.25	0.38	0.50	0.16	0.94	0.62	3.75	2.12	2.12	1/4-20
1-1/16"	1.31	0.62	0.44	0.38	0.38	1.00	1.50	6.25	2.12	0.38	2.00	0.50	1.00	0.31	1.38	1.00	5.25	3.12	3.12	5/16-18
1-1/2"	1.50	0.75	0.50	0.38	0.50	1.38	2.00	7.50	2.75	0.44	2.50	0.59	1.31	0.38	1.75	1.25	6.50	4.00	4.00	3/8-16
2"	1.62	0.88	0.50	0.38	0.75	1.60	2.25	8.00	3.00	0.44	3.00	0.75	1.50	0.50	2.00	1.50	7.00	4.25	4.25	3/8-16
2-1/2"	1.87	1.13	0.50	0.50	0.75	1.45	3.00	11.50	3.75	0.69	3.50	0.84	1.81	0.50	2.50	1.75	9.50	5.37	5.37	1/2-13
3"	2.25	1.38	0.56	0.63	1.00	1.62	3.50	13.00	4.50	0.81	4.50	1.15	2.19	0.75	3.00	2.25	11.00	6.50	6.50	3/4-16

Approximate Thruster Weights

Bore	Composite Bearing	Roller Bearing	Composite Bearing Per Inch Adder	Roller Bearing Per Inch Adder	Mounting Plate Adder
9/16"	.70 lbs	.83 lbs	.08 lbs	.05 lbs	.06 lbs
3/4"	1.33 lbs	1.59 lbs	.15 lbs	.10 lbs	.14 lbs
1-1/16"	3.18 lbs	4.03 lbs	30 lbs	.16 lbs	.32 lbs
1-1/2"	6.55 lbs	8.54 lbs	.35 lbs	.25 lbs	.60 lbs
2"	9.81 lbs	18.07 lbs	.50 lbs	.40 lbs	1.15 lbs
2-1/2"	19.34 lbs	35.82 lbs	.75 lbs	.62 lbs	2.0 lbs
3"	35.19 lbs	68.71 lbs	1.9 lbs	.96 lbs	3.9 lbs

Guide Shaft Extension With Bumper

Bore Size	Length Adder
9/16"	0.50"
3/4"	0.50"
1-1/16"	0.63"
1-1/2"	0.75"
2"	0.88"
2-1/2"	1.38"
3"	1.50"

Retraction Stroke Reduction with Bumper

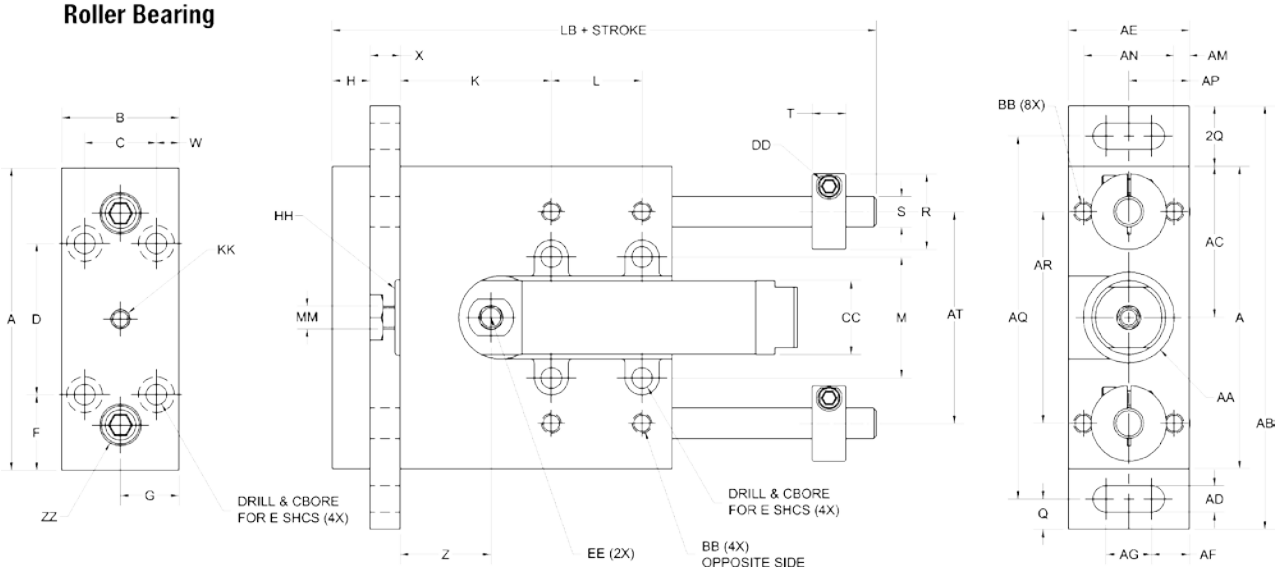
Bore Size	Standard	w/Mounting Plate Option
9/16"	0.34"	0.59"
3/4"	0.28"	0.66"
1-1/16"	0.31"	0.69"
1-1/2"	0.25"	0.75"
2"	0"	0.75"
2-1/2"	0.25"	1.00"
3"	0.31"	1.31"

Guide shafts are extended so the extend stroke is not affected with the addition of bumpers and collars, however the retract stroke is shortened. See above chart.

RT Series Roundline Plus Thrusters

All Dimensions in Inches (mm)

Roller Bearing



Bore	A	B	BB	C	CC	D	DD	E	EE	F	G	H	HH	K	KK	L	LB	M	MM	Q
9/16"	2.50	1.00	#8-32	0.60	0.62	1.25	4-40	#8	#10-32	0.62	0.50	0.31	7/16-20	1.25	10-32	0.75	3.50	1.00	0.19	0.25
3/4"	3.00	1.25	#10-32	0.75	0.81	1.50	6-32	#10	1/8 NPT	0.75	0.62	0.38	5/8-18	0.78	1/4-28	0.94	4.12	1.25	0.25	0.38
1-1/16"	4.25	2.00	1/4-20	1.00	1.12	2.00	8-32	1/4	1/8 NPT	1.12	1.00	0.50	5/8-18	0.81	5/16-24	1.38	4.75	1.88	0.31	0.50
1-1/2"	5.50	2.50	5/16-18	1.50	1.56	3.00	10-32	5/16	1/8 NPT	1.25	1.25	0.75	3/4-16	1.12	7/16-20	1.75	6.38	2.38	0.44	0.50
2"	7.00	3.00	3/8-16	2.00	2.08	4.00	1/4-28	3/8	1/4 NPT	1.50	1.50	1.00	1 1/4-12	0.94	1/2-20	2.12	7.00	3.25	0.62	0.63
2-1/2"	8.50	4.00	3/8-16	3.00	2.62	4.75	1/4-28	3/8	1/4 NPT	1.76	2.00	1.25	1 3/8-12	1.69	1/2-20	2.63	9.50	4.10	0.62	1.00
3"	11.00	4.00	1/2-13	3.00	3.12	6.00	1/4-28	1/2	3/8 NPT	2.50	2.00	1.50	1 1/2-12	1.50	5/8-18	4.00	11.50	5.25	0.75	1.00

Bore	R	S	T	W	X	Z	AA	AB	AC	AD	AE	AF	AG	AM	AN	AP	AQ	AR	AT	ZZ
9/16"	0.62	0.25	0.28	0.20	0.25	0.86	0.75	3.50	1.25	0.22	1.00	0.31	0.38	0.12	0.75	0.50	3.00	1.75	1.75	N/A
3/4"	0.88	0.38	0.34	0.25	0.38	0.85	0.94	4.50	1.50	0.25	1.25	0.38	0.50	0.16	0.94	0.62	3.75	2.12	2.12	10-32
1-1/16"	1.12	0.50	0.41	0.50	0.38	1.00	1.62	6.25	2.12	0.38	2.00	0.50	1.00	0.31	1.38	1.00	5.25	3.12	3.12	1-4-20
1-1/2"	1.31	0.62	0.44	0.50	0.50	1.50	2.12	7.50	2.75	0.44	2.50	0.59	1.31	0.38	1.75	1.25	6.50	4.00	4.00	3/8-16
2"	1.50	0.75	0.50	0.50	0.75	1.60	3.00	9.50	3.50	0.56	4.00	1.22	1.56	0.94	2.12	2.00	8.25	5.00	5.00	3/8-16
2-1/2"	1.75	1.00	0.50	0.50	0.75	1.48	3.50	12.50	4.25	0.63	4.50	1.25	2.00	0.94	2.63	2.25	10.50	6.25	6.25	1/2-13
3"	2.06	1.25	0.50	0.50	1.00	1.88	4.63	15.00	5.50	0.81	6.00	1.41	3.19	1.00	4.00	3.00	13.00	8.00	8.00	3/4-16