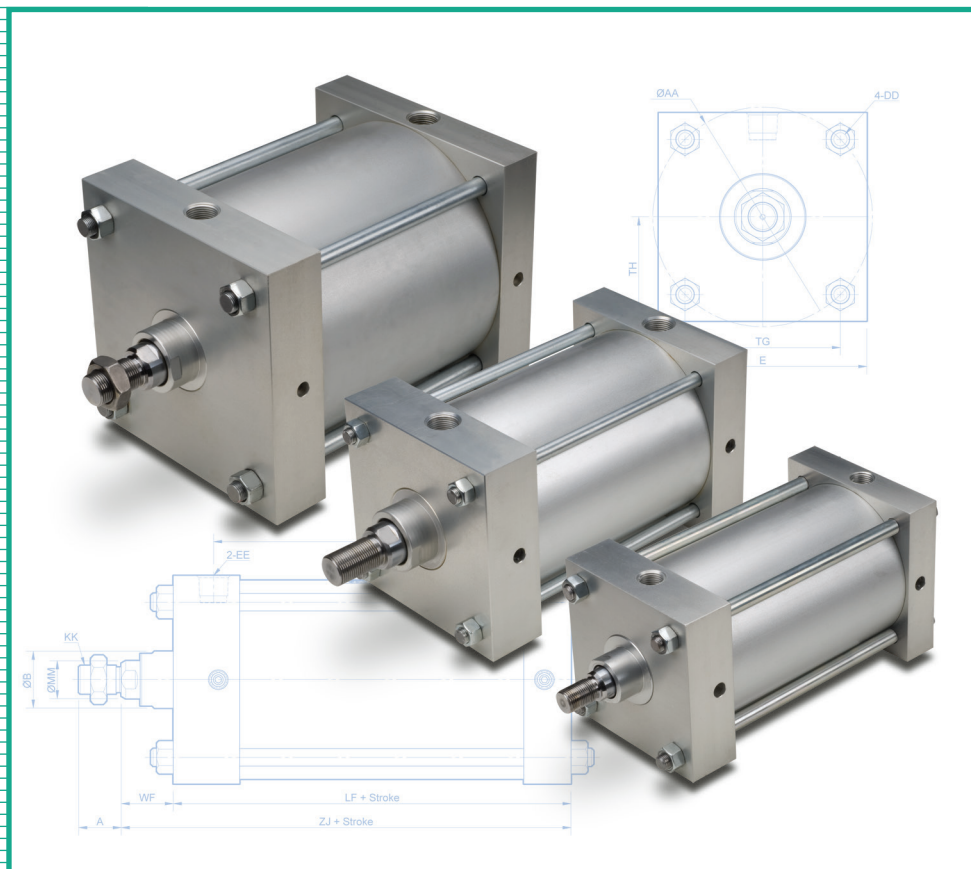




Series *NCA1*

Air Cylinder NFPA Interchangeable Large Bore Size



Features

- Medium duty 5", 6" and 8" bores
- 11 different NFPA mounting options
- Standard with adjustable air cushion
- Auto switch capable

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How to Order

NC **D** A1 **B** **500** - **04** **00** - **XB5**

Built in magnet

Nil	None
D	Auto switch capable (magnetic option)

Bore size

500	5"
600	6"
800	8"

Option

Nil	No option
XB5	Oversized rod
XB6	High temperature
XB7	Low temperature
XC3	Rotated ports *
XC6	Stainless steel piston rod
XC35	With coil scraper

Mounting style

B	MX0	Basic style
BA	MX1	Tie rod extended - both ends
BB	MX2	Tie rod extended - head end
BC	MX3	Tie rod extended - rod cover end
F*	MF1	Rod side rectangular flange
G*	MF2	Head side rectangular flange
L	MS1	Foot style
S	MS2	Side lug style
R	MS4	Side tapped style
X	MP1	Double head clevis style
D	MP2	Double detachable head side clevis style

Standard stroke

Inches

Stroke

Hundredths of an inch

Air Cushion

Nil	Both ends
N	None
H	Head end
R	Rod end

* Refer to page 11 for order details.

Notes:

- Low temperature option does not include air cushions. When using this option, specify "N" in part number for air cushion.
- Auto switch capable not available with options XB6 & XB7
- High temperature option for bore 6" and 8" does not include air cushions. When using this option, specify "N" in part number for air cushion.
- External cushioning recommended for cylinder without standard air cushioning. (Refer to kinetic energy absorption warning)
- Limit of two X-options per standard model. XB6 and XB7 can not be combined.

* Not available on 8" bore

Auto switches

Type	Special function	Indicator light	Wiring (output)	Load voltage		Auto switch model	Lead wire length (m)				Pre-wired Connector	Applicable load		
				DC	AC		0.5 (Nil)	1 (M)	3 (L)	5 (Z)				
Solid state switch	-	-	3 wire (NPN)	24 V	5 V	M9N	●	●	●	○	○	IC circuit	Relay, PLC	
			3 wire (PNP)	-	12 V	M9P	●	●	●	○	○			
			2 Wire	-	12 V	M9B	●	●	●	○	○			
			3 wire (NPN)	5 V	-	M9NW	●	●	●	○	○			
	Diagnostic indication (2-color indication)	Yes	-	3 wire (PNP)	12 V	-	M9PW	●	●	●	○	○		IC circuit
				2 Wire	24 V	12 V	M9BW	●	●	●	○	○		-
				3 wire (NPN)	5 V	-	M9NA	○	○	●	○	○		IC circuit
				3 wire (PNP)	12 V	-	M9PA	○	○	●	○	○		IC circuit
Water Resistant (2-color indication)	-	-	2 Wire	12 V	-	M9BA	○	○	●	○	○	-		
			3 wire (NPN)	5 V	-	M9NA	○	○	●	○	○	IC circuit		
Reed switch	-	-	3 Wire (NPN equivalent)	-	5 V	A96	●	-	●	-	-	IC circuit	-	
			Yes	2 Wire	24 V	5 V	100 V	A93	●	-	●	-	-	Relay, PLC
			No	2 Wire	24 V	5 V	100 V or less	A90	●	-	●	-	-	IC circuit

* With pre-wired connector is available for solid state autoswitches. For details, refer to Best Pneumatics No. 2

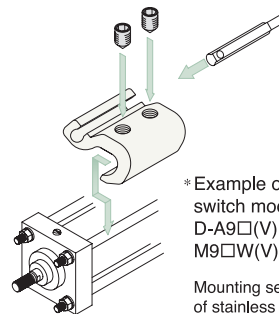
Operating Range

Auto switch model	Bore size		
	Ø5	Ø6	Ø8
D-A9□/A9□V	12	12.5	11.5
D-M9□/M9□V	6	6.5	6.5
D-M9□W/M9□WV			
D-M9□AL/M9□AVL			

* Since this is a guideline including hysteresis, it is not meant to be guaranteed. (Assuming approximately ±30% dispersion.) In some cases it may vary substantially depending on the ambient environment.

Switch Mounting Bracket Part No.

Auto switch model	Bore size (in)		
	Ø5	Ø6	Ø8
D-A9□/A9□V	BS5-125	BS5-125	BS5-160
D-M9□/M9□V			
D-M9□W/M9□WV			
D-M9□AL/M9□AVL			



* Example of mounting switch models: D-A9□(V), M9□(V), M9□W(V), M9□A(V)L
Mounting set screws made of stainless steel

Series NCA1 Cylinder

Large Bore

Specifications

Type	Double acting, single rod
Fluid	Air
Lubrication	Non-lube
Minimum operating pressure	8 psi (0.06 Mpa)
Maximum operating pressure	250 psi (1.75 Mpa)
Ambient and Fluid Temperature	40 - 140°F (5 - 60°C)
Piston speed	2 ~ 20 in/sec (50 ~ 500mm/sec)
Cushion	Standard, both ends
Maximum stroke	36 in
Industry specification	ANSI/(NFPA) T3.6.7 R3

Kinetic Energy Absorbed

Bore size	Effective Cushion Length (in)	Absorbable Kinetic Energy (ft-lb)
Ø5"	0.85	23.49
Ø6"	1.06	38.48
Ø8"	1.03	65.25

Warning

A deceleration circuit or shock absorber may be required. When a driven object is operated at high speed or the load is heavy, a cylinder's cushion will not be sufficient to absorb the shock. Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the shock. In this case, the rigidity of the machinery should also be examined.

Weight / Aluminum Tube

Bore Size (inch)		500 (5")	600 (6")	800 (8")
Basic weight	B/R - basic type (MX0/MS4)	13.41	21.38	36.57
	BA/BB - Tie rod extended - either end (MX1/MX2)	13.65	21.63	37.25
	BC - Tie rod extended - both ends (MX3)	13.89	21.86	37.75
	F/G - Flange Mounting (MF1/MF2)	19.63	31.57	N/A
	L - Foot mounting (MS1)	16.66	25.55	41.64
	S - Side lug (MS2)	15.41	23.76	40.21
	X - Clevis mounting (MP1)	18.05	30.65	52.74
	D - Double detachable head side clevis	18.73	29.58	54.73
	Additional weight for magnet (NCDA1)	0.04	0.05	0.06
	Additional weight for oversize rod (XB5)	0.91	1.54	1.57
Additional weight per 2" stroke	Standard piston rod	1.22	1.61	2.30
	Oversize piston rod (XB5)	1.61	2.13	2.81

Calculation example: NCDA1B500-0600-XB5 (Basic mount, auto switch capable, Ø5" bore, 6" stroke, oversized rod)

basic weight	13.41 lb + 0.91 lb	=	14.32 lb
add auto switch magnet	0.036 lb	=	0.04 lb
additional weight based on stroke	1.61 lb (6"/2")	=	4.84 lb
			19.20 lb

Cylinder Bores and Forces: Push Stroke (Extend)



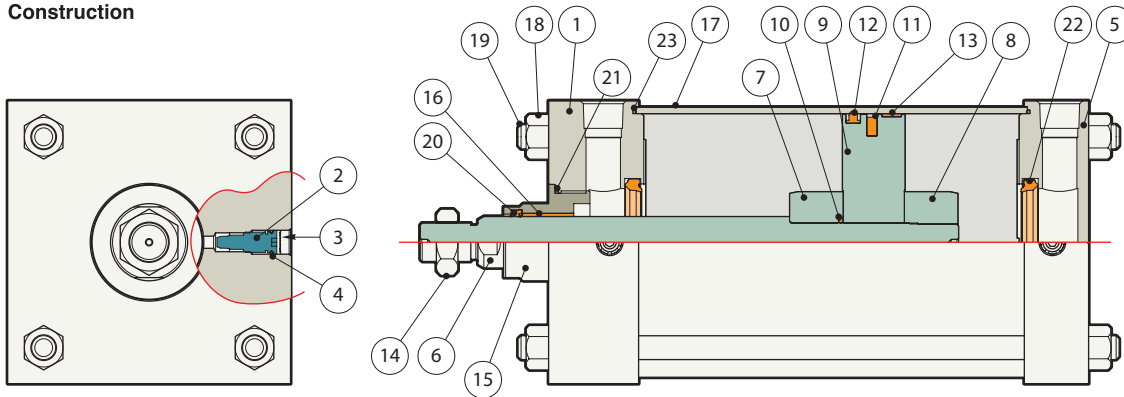
Operating Pressure (psi)		50	60	80	100	200	250
Bore Size	Piston Area	Force output (lbs)					
5"	19.63	982	1178	1571	1963	3927	4909
6"	28.27	1414	1696	2262	2827	5655	7069
8"	50.27	2513	3016	4021	5027	10053	12566

Cylinder Bores and Forces: Pull Stroke (Retract)



Operating Pressure (psi)		50	60	80	100	200	250
Bore Size	Piston Area	Force output (lbs)					
5"	18.85	942	1131	1508	1885	3770	4712
5" XB5	18.15	908	1089	1452	1815	3630	4538
6"	26.79	1339	1607	2143	2679	5358	6697
6" XB5	25.87	1293	1552	2070	2587	5174	6467
8"	48.78	2439	2927	3902	4878	9756	12195
8" XB5	47.86	2393	2872	3829	4786	9572	11965

Construction



How to Order Seal Kits

NCA **500** - PS -

Bore	Special options
500	Nil Standard
600	XB5 Oversized rod
800	XB6 High temperature
	XB7 Low temperature
	XB5B6 Oversized W/ high temperature
	XB5B7 Oversized W/ low temperature

Seal kits include the following parts:

1 - Rod seal	2 - Cushion valve seal
1 - Piston seal	2 - Grease pack
1 - Gland seal	1 - Loctite 243
2 - Cylinder tube gasket	

* Cushion seal is not included for XB6, XB5B6, XB7, and XB5B7 over ø5" bore

How to Order Cylinder Tube - Double Acting, Single Rod

NCA **500** - 04 - **0400**

Bore	Stroke
500	(In inches and hundredths)
600	
800	

How to Order Gland Kits

NCA **500** - RG -

Bore	Special options	Gland kits Include:
500	Nil Standard	1 - Gland
600	XB5 Oversized rod	1 - Bushing
800	XC35 Coil scraper	* Scraper with XC35
	XB5C35 Oversized W/ Coil scraper	

How to Order Piston Rod Assembly - Double Acting, Single Rod

Magnet	Bore	Stroke	Special options
NC	D	A	500 - 26A - 0400 - <input type="text"/>
Nil - Non-Magnet	500	(In inches and hundredths)	Nil Standard
D - With Magnet	600		XB5 Oversized rod
	800		XB6 High temperature
			XB7 Low temperature
			XB5B6 Oversized W/ high temperature
			XB5B7 Oversized W/ low temperature
			XC3 Stainless steel piston rod

Component parts

Component	Material	Qty.	Note
1	Rod cover	Aluminum alloy	1 Anodized
2	Cushion valve	Rolled steel	2 Electroless nickel plating
3	Snap ring	Spring steel	2 Phosphate coated
4	Cushion valve seal	NBR	2
5	Head cover	Aluminum alloy	1 Anodized
6	Piston rod	Carbon steel	1
7	Cushion A	Aluminum alloy	1 Anodized
8	Cushion B	Aluminum alloy	1 Anodized
9	Piston	Aluminum alloy	1
10	Piston gasket	NBR	1
11	Magnet	-	(1)
12	Piston seal	NBR	1
13	Wear ring	Resin	1
14	Jam nut	Rolled steel	1 Nickel plating
15	Gland	Aluminum alloy	1 Anodized
16	Bushing	Composite	1
17	Cylinder tube	Aluminum alloy	1 Hard anodized
18	Tie rod nut	Rolled steel	8 Nickel plated
19	Tie rod	Carbon steel	4 Zinc chromated
20	Rod seal	NBR	1
21	Gland seal	NBR	1
22	Cushion seal	Urethane	2
23	Cylinder tube gasket	NBR	2

How to Order Tie Rods - Double Acting, Single Rod

Mounting	Bore	Stroke
NCA B	500 - 11 - 0400	<input type="text"/>
B	L	500 (In inches and hundredths)
BA	S	600
BB	R	800
BC	X	
F	D	
G		

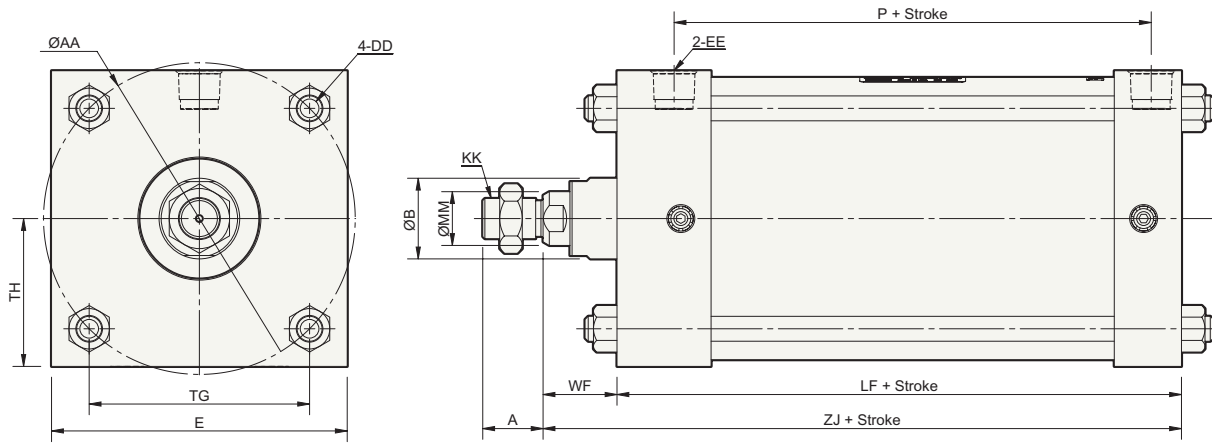
Note: Tie rod length varies by mounting style.
Quantity one set (4 pcs) of tie rods by mounting

Series NCA1 Cylinder

Large Bore

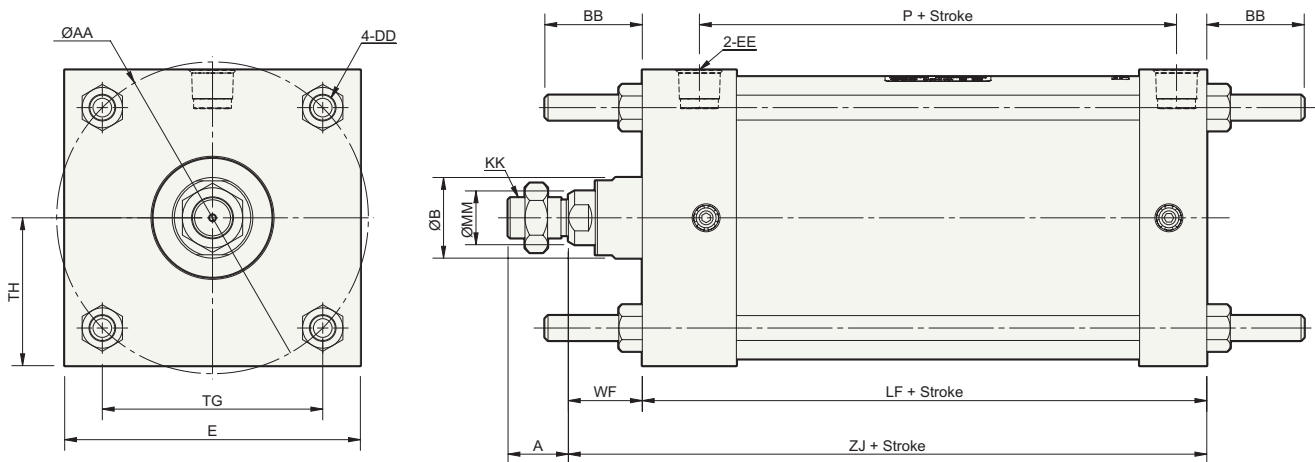
Dimension Drawings

MX0 - Basic style (B)



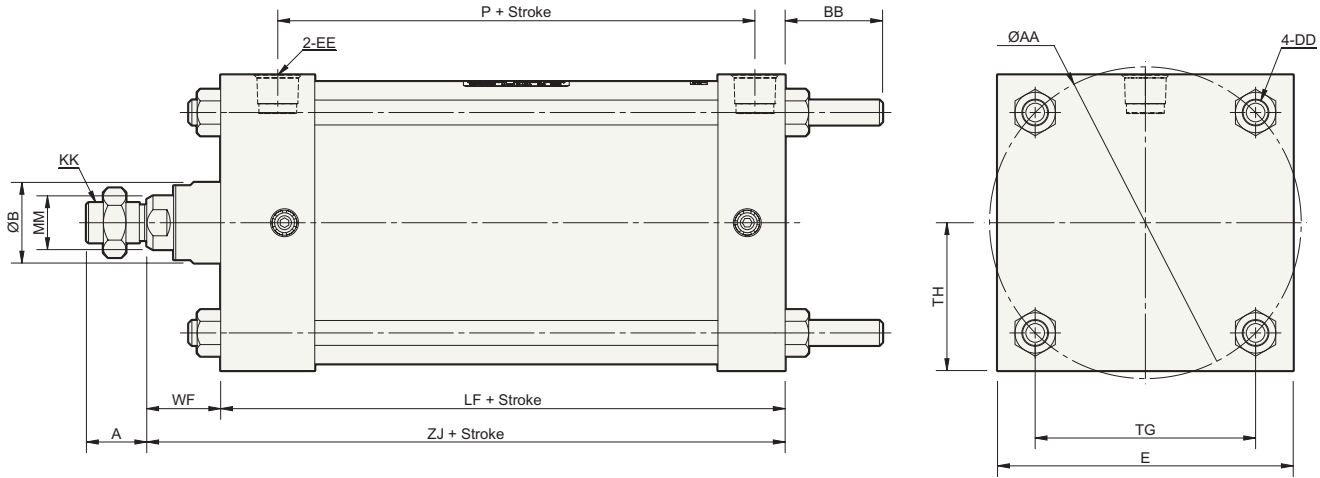
Bore Size (in)	ØMM	KK	A	AA	ØB	DD	E	EE	LF+	P+	TG	TH	WF	ZJ+
500 (5")	1.000	3/4-16	1.13	5.80	1.500	1/2-20	5.50	1/2 NPT	4.50	2.88	4.10	2.75	1.38	5.88
600 (6")	1.375	1-14	1.63	6.90	2.000	1/2-20	6.50	3/4 NPT	5.00	3.13	4.88	3.25	1.63	6.63
800 (8")	1.375	1-14	1.63	9.10	2.000	5/8-18	8.50	3/4 NPT	5.13	3.25	6.44	4.25	1.63	6.75

MX1 - Tie rod extended - both ends (BA)



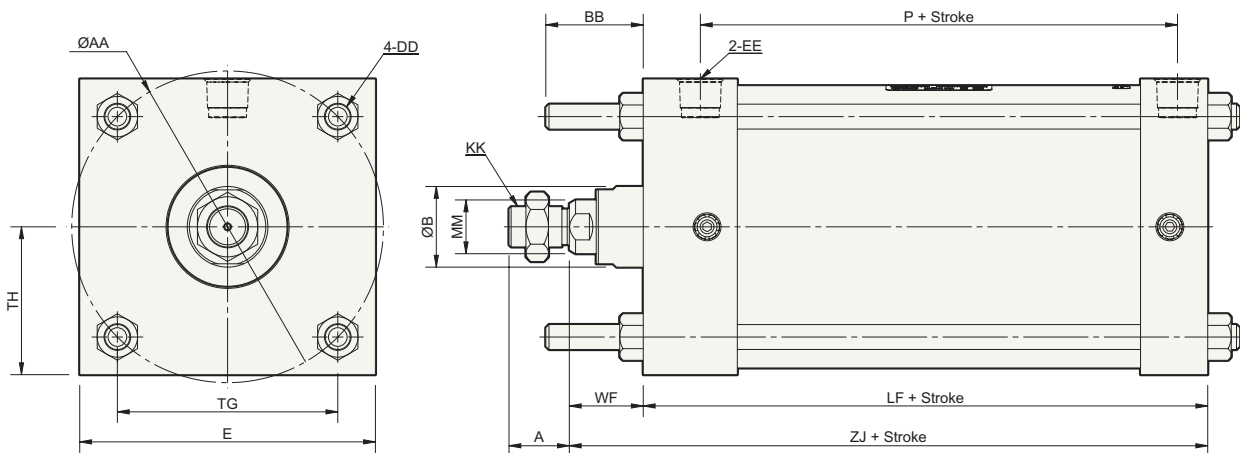
Bore Size (in)	ØMM	KK	A	AA	ØB	BB	DD	E	EE	LF+	P+	TG	TH	WF	ZJ+
500 (5")	1.000	3/4-16	1.13	5.80	1.500	1.81	1/2-20	5.50	1/2 NPT	4.50	2.88	4.10	2.75	1.38	5.88
600 (6")	1.375	1-14	1.63	6.90	2.000	1.81	1/2-20	6.50	3/4 NPT	5.00	3.13	4.88	3.25	1.63	6.63
800 (8")	1.375	1-14	1.63	9.10	2.000	2.31	5/8-18	8.50	3/4 NPT	5.13	3.25	6.44	4.25	1.63	6.75

MX2 - Tie rod extended - head end (BB)



Bore Size (in)	ØMM	KK	A	AA	ØB	BB	DD	EE	E	LF+	P+	TG	TH	WF	ZJ+
500 (5")	1.000	3/4-16	1.13	5.80	1.500	1.81	1/2-20	1/2 NPT	5.50	4.50	2.88	4.10	2.75	1.38	5.88
600 (6")	1.375	1-14	1.63	6.90	2.000	1.81	1/2-20	3/4 NPT	6.50	5.00	3.13	4.88	3.25	1.63	6.63
800 (8")	1.375	1-14	1.63	9.10	2.000	2.31	5/8-18	3/4 NPT	8.50	5.13	3.25	6.44	4.25	1.63	6.75

MX3 - Tie rod extended - rod cover end (BC)



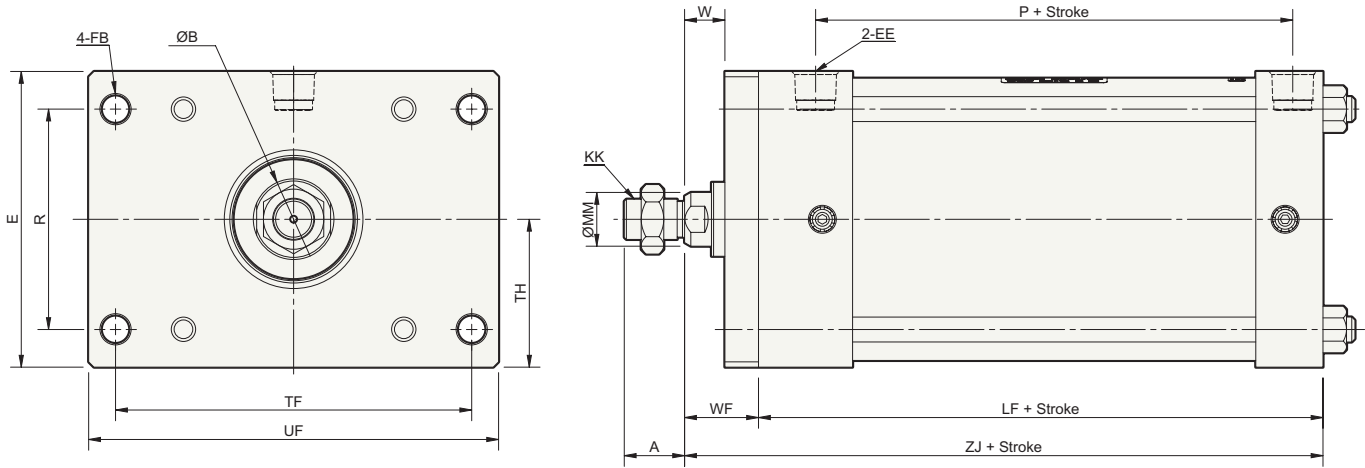
Bore Size (in)	ØMM	KK	A	AA	ØB	BB	DD	EE	E	LF+	P+	TG	TH	WF	ZJ+
500 (5")	1.000	3/4-16	1.13	5.80	1.500	1.81	1/2-20	1/2 NPT	5.50	4.50	2.88	4.10	2.75	1.38	5.88
600 (6")	1.375	1-14	1.63	6.90	2.000	1.81	1/2-20	3/4 NPT	6.50	5.00	3.13	4.88	3.25	1.63	6.63
800 (8")	1.375	1-14	1.63	9.10	2.000	2.31	5/8-18	3/4 NPT	8.50	5.13	3.25	6.44	4.25	1.63	6.75

Series NCA1 Cylinder

Large Bore

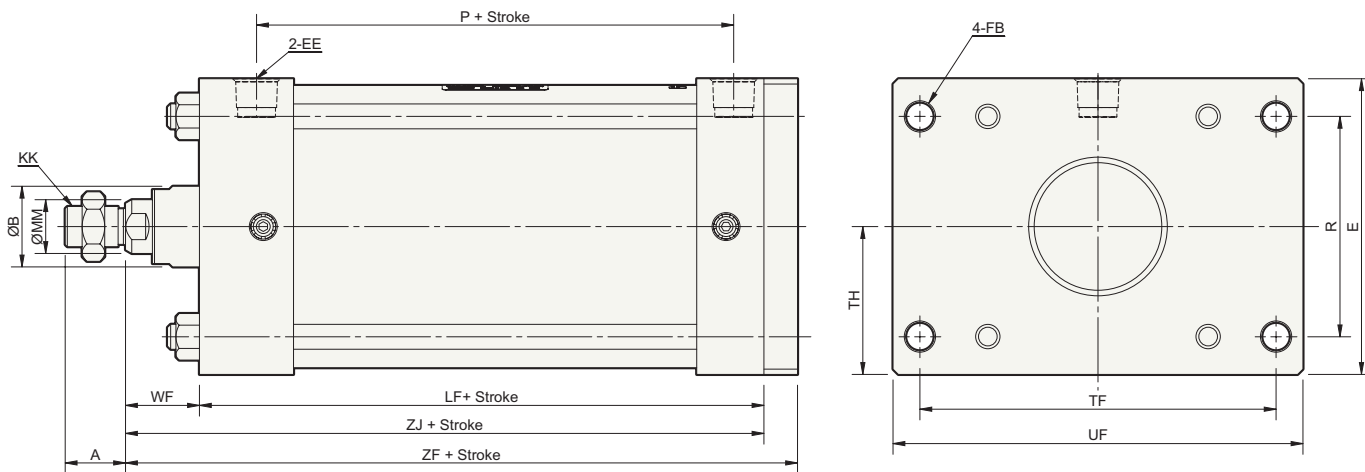
Dimension Drawings

MF1 - Rod side rectangular flange (F)



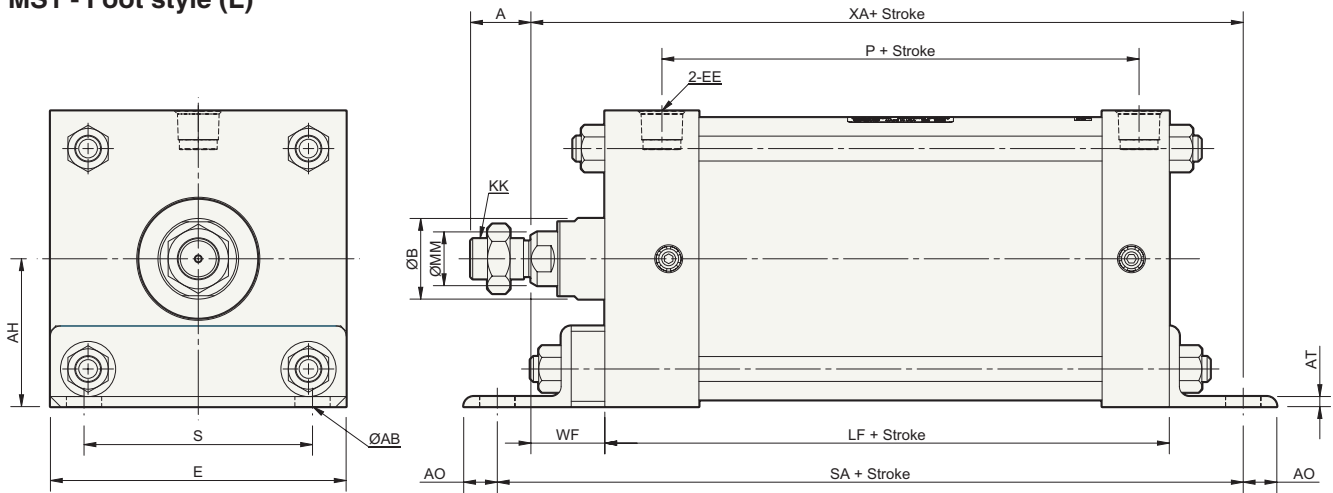
Bore Size (in)	ØMM	KK	A	ØB	E	EE	ØFB	LF+	P+	R	TF	TH	UF	W	WF	ZJ+
500 (5")	1.000	3/4-16	1.13	1.500	5.50	1/2 NPT	.50	4.50	2.88	4.10	6.63	2.75	7.63	.75	1.38	5.88
600 (6")	1.375	1-14	1.63	2.000	6.50	3/4 NPT	.50	5.00	3.13	4.88	7.63	3.25	8.63	.88	1.63	6.63

MF2 - Head side rectangular flange (G)



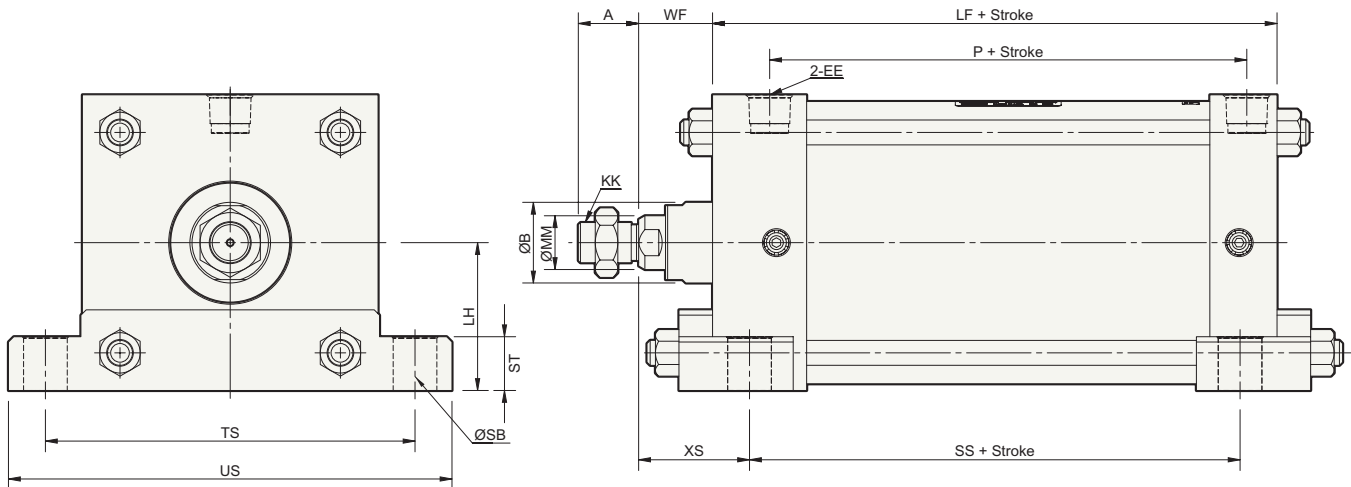
Bore Size (in)	ØMM	KK	A	ØB	E	EE	ØFB	LF+	P+	R	TF	TH	UF	WF	ZF+	ZJ+
500 (5")	1.000	3/4-16	1.13	1.500	5.50	1/2 NPT	.50	4.50	2.88	4.10	6.63	2.75	7.63	1.38	6.50	5.88
600 (6")	1.375	1-14	1.63	2.000	6.50	3/4 NPT	.50	5.00	3.13	4.88	7.63	3.25	8.63	1.63	7.38	6.63

MS1 - Foot style (L)



Bore Size (in)	ØMM	KK	A	ØAB	AH	AO	AT	ØB	E	EE	LF+	P+	S	SA+	WF	XA+
500 (5")	1.000	3/4-16	1.13	.63	2.75	.63	.19	1.500	5.50	1/2 NPT	4.50	2.88	4.25	7.88	1.38	7.25
600 (6")	1.375	1-14	1.63	.75	3.25	.63	.19	2.000	6.50	3/4 NPT	5.00	3.13	5.25	8.50	1.63	8.00
800 (8")	1.375	1-14	1.63	.75	4.25	.69	.25	2.000	8.50	3/4 NPT	5.13	3.25	7.13	8.75	1.63	8.56

MS2 - Side lug style (S)



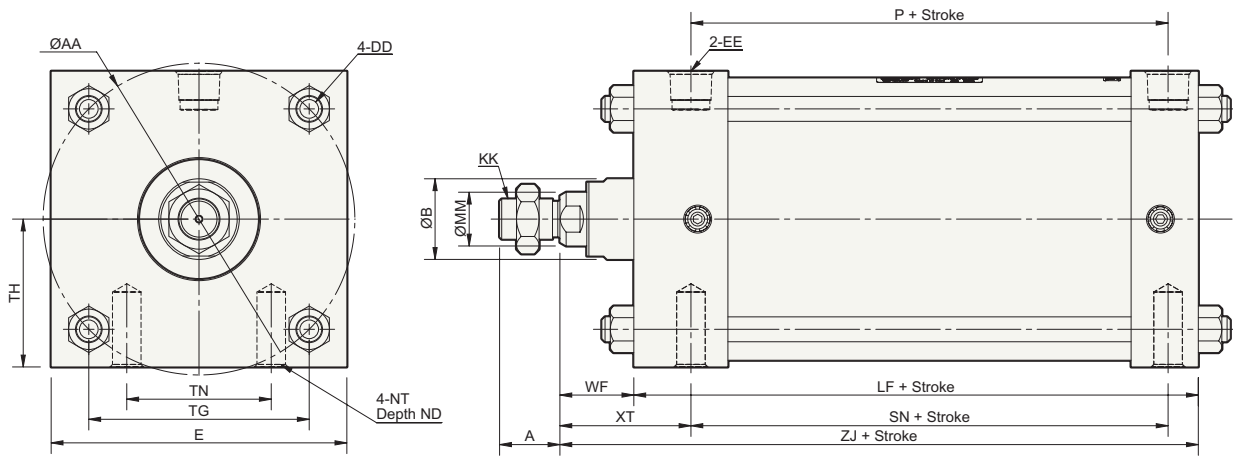
Bore Size (in)	ØMM	KK	TS	A	ØB	US	ST	EE	LF+	XS	SS+	P+	LH	WF	ØSB
500 (5")	1.000	3/4-16	6.88	1.13	1.500	8.25	1.00	1/2 NPT	4.50	2.06	3.13	2.88	2.75	1.38	0.75
600 (6")	1.375	1-14	7.88	1.63	2.000	9.25	1.00	3/4 NPT	5.00	2.31	3.63	3.13	3.25	1.63	0.75
800 (8")	1.375	1-14	9.88	1.63	2.000	11.25	1.00	3/4 NPT	5.13	2.31	3.75	3.25	4.25	1.63	0.75

Series NCA1 Cylinder

Large Bore

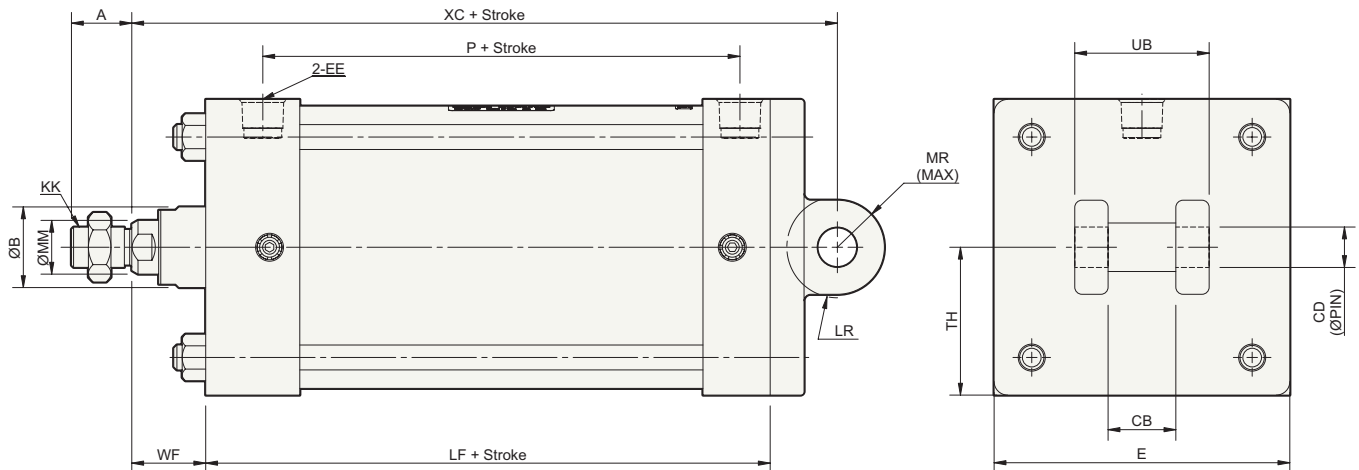
Dimension Drawings

MS4 - Side tapped style (R)



Bore Size (in)	ØMM	KK	A	AA	ØB	DD	E	EE	LF+	ND	NT	P+	SN+	TG	TH	TN	WF	XT	ZJ+
500 (5")	1.000	3/4-16	1.13	5.80	1.500	1/2-20	5.50	1/2NPT	4.50	.75	5/8-11	2.88	2.88	4.10	2.75	2.68	1.38	2.44	5.88
600 (6")	1.375	1-14	1.63	6.90	2.000	1/2-20	6.50	3/4NPT	5.00	.88	3/4-10	3.13	3.13	4.88	3.25	3.25	1.63	2.81	6.63
800 (8")	1.375	1-14	1.63	9.10	2.000	5/8-18	8.50	3/4NPT	5.13	1.13	3/4-10	3.25	3.25	6.44	4.25	4.50	1.63	2.81	6.75

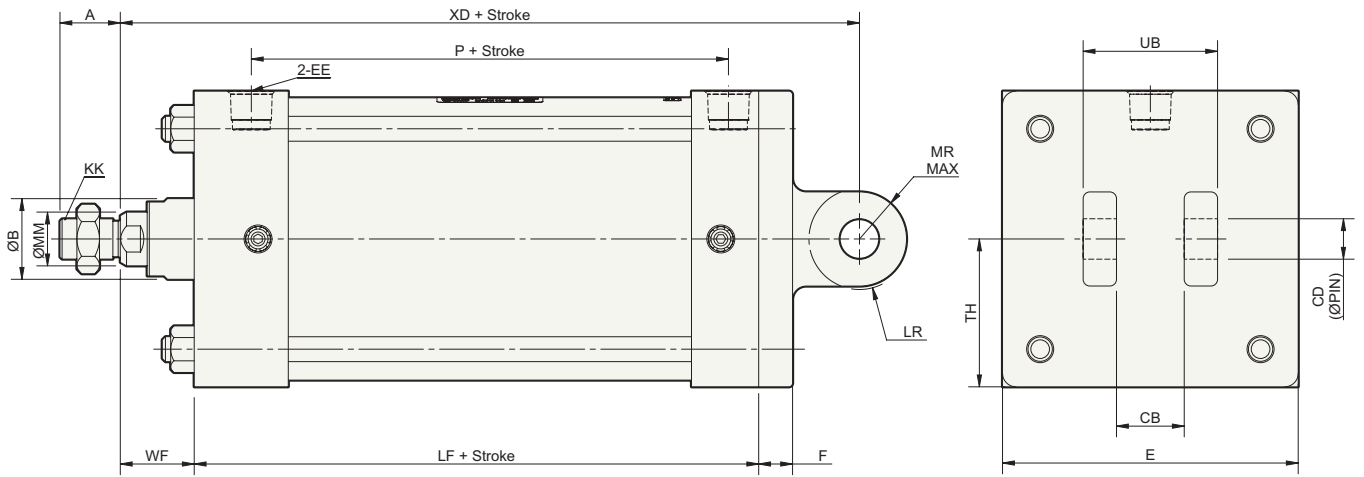
MP1 - Double head clevis style (X)



Bore Size (in)	ØMM	KK	A	ØB	CB	CD	E	EE	LF+	LR	MR	P+	TH	UB	WF	XC+
500 (5")	1.000	3/4-16	1.13	1.500	1.280	.750	5.50	1/2 NPT	4.50	.94	.95	2.88	2.75	2.500	1.38	7.13
600 (6")	1.375	1-14	1.63	2.000	1.530	1.000	6.50	3/4 NPT	5.00	1.31	1.32	3.13	3.25	3.000	1.63	8.13
800 (8")	1.375	1-14	1.63	2.000	1.530	1.000	8.50	3/4 NPT	5.13	1.31	1.32	3.25	4.25	3.000	1.63	8.25

Note: Pivot and cotter pins are included.

MP2 - Double detachable head side clevis style (D)

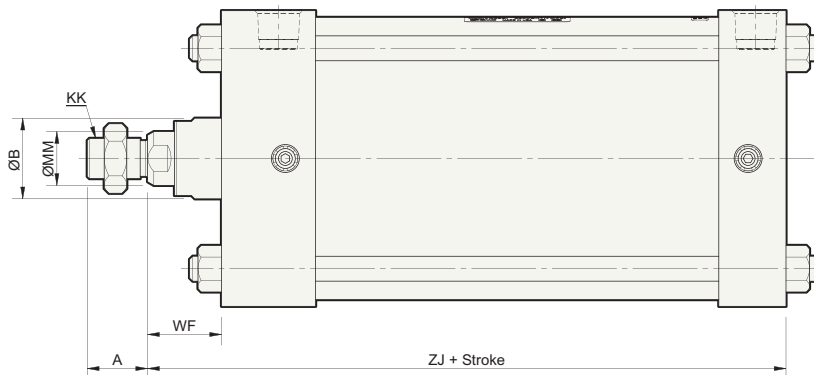


Bore Size (in)	ØMM	KK	A	ØB	CB	CD	E	EE	F	LF+	LR	MR	P+	TH	UB	WF	XD+
500 (5")	1.000	3/4-16	1.13	1.500	1.280	.750	5.50	1/2 NPT	.63	4.50	.94	.95	2.88	2.75	2.500	1.38	7.75
600 (6")	1.375	1-14	1.63	2.000	1.530	1.000	6.50	3/4 NPT	.75	5.00	1.31	1.32	3.13	3.25	3.000	1.63	8.88
800 (8")	1.375	1-14	1.63	2.000	1.530	1.000	8.50	3/4 NPT	.75	5.13	1.31	1.32	3.25	4.25	3.000	1.63	9.00

Note: Pivot and cotter pins are included.

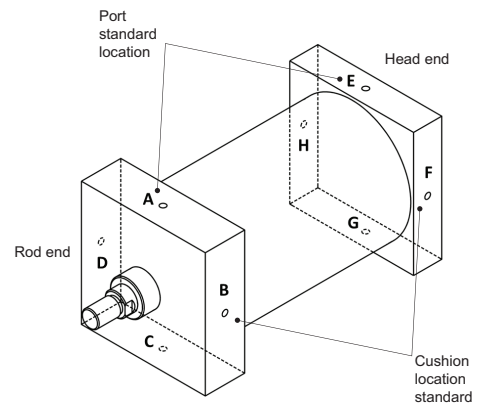
Dimension changes for Options

Oversized rod (XB5 Option)



Bore Size (in)	ØMM	KK	A	ØB	WF	ZJ+
500 (5")	1.375	1-14	1.63	2.00	1.63	6.13
600 (6")	1.75	1 1/4-12	2.00	2.375	1.88	6.88
800 (8")	1.75	1 1/4-12	2.00	2.375	1.88	7.00

Rotated Ports (XC3 Option)



How to Order: -XC3 Port Cushion

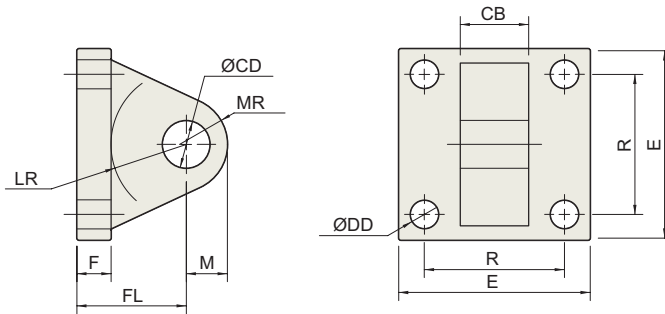
- Standard Part Number Location. AB (A=port, B=cushion)
- Available on standard, XB5, XB6, XB7, XC6, and XC35
- Ports and cushions in same location on rod and head ends
- Standard available configurations: XC3BC, XC3CD, XC3DA, XC3AC, XC3DB, XC3AD, XC3BA, XC3CB, XC3DC
- Ports and cushions NOT aligned between Rod and Head ends available via RFS

Example: NCA1B500-0400-XC3BC (B = port, C = cushion)

Series NCA1 Cylinder

Large Bore

Eye Bracket

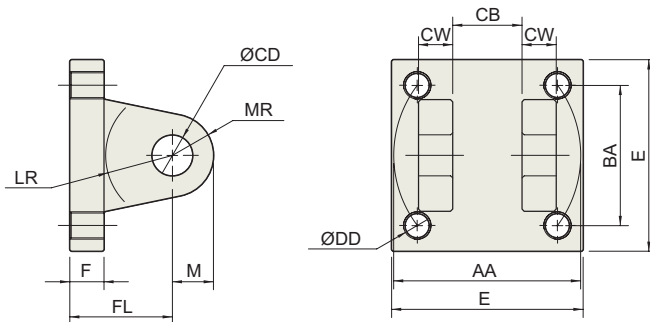


Dimensions

Part No.	CB	CD	DD	E	F	FL	LR	M	MR	R	Weight (lbs)
NCA1-P325	1 1/4	3/4	17/32	3 1/2	5/8	1 7/8	1 1/4	3/4	7/8	2.56	3.11
NCA1-P800	1 1/2	1	21/32	4 1/2	3/4	2 1/4	1 1/2	1	1 1/4	3.25	5.80
NCA1-P1000	2	1 3/8	21/32	5	7/8	3	2 1/8	1 3/8	1 5/8	3.81	10.42

Note: Pivot pin is not included

Clevis Bracket

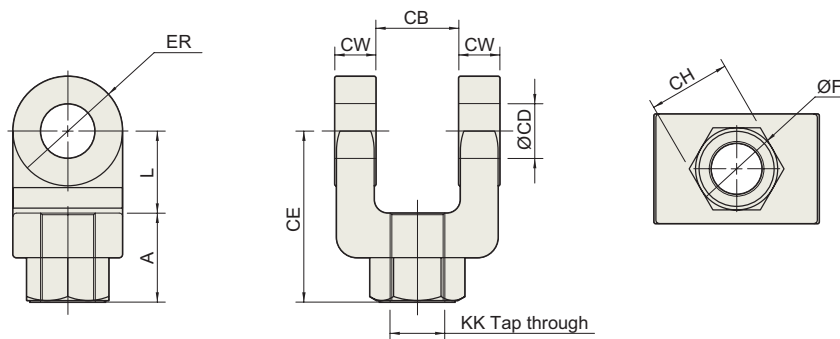


Dimensions

Part No.	AA	BA	CB	CD	CW	DD	E	F	FL	LR	M	MR	Weight (lbs)
NCA1-CB325	3.6	2 9/16	1.265	3/4	5/8	1/2-20	3 1/2	5/8	1 7/8	1 1/16	3/4	1 1/16	2.79
NCA1-CB800	4.6	3 1/4	1.515	1	3/4	5/8-18	4 1/2	3/4	2 1/4	1 1/4	1	1 1/8	5.45
NCA1-CB1000	5.4	3 13/16	2.032	1 3/8	1	5/8-18	5	7/8	3	1 7/8	1 3/8	1 3/4	9.89

Note: Pivot pin is not included.

Rod Clevis

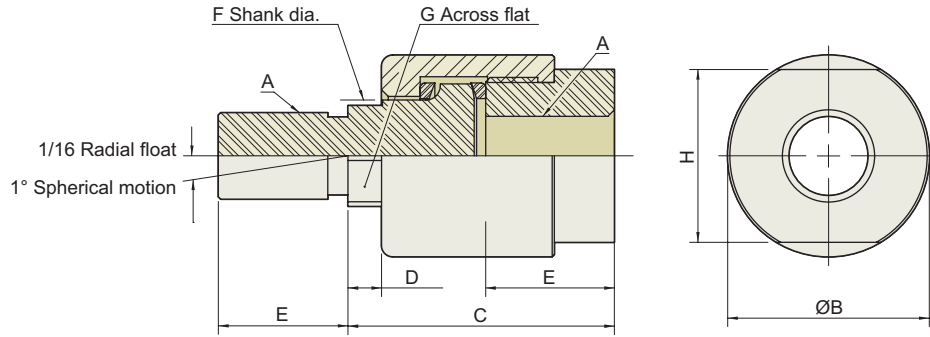


Dimensions

Part No.	CB	CD	CE	CH	CW	F	L	A	KK	ER	Weight (lbs)
NY-325	1.265	0.75	2 3/8	1 3/8	5/8	1 1/4	1 1/4	1 1/8	3/4-16	3/4	1.50
NY-800	1.515	1	3 1/8	1 1/2	3/4	1 1/2	1 1/2	1 5/8	1-14	1	3.78
NY-1000	3.032	1 3/8	4 1/8	2	1	2	2 1/8	2	1 1/4-12	1 3/8	9.32

Note: Jam nut, pivot, and cotter pins are included.

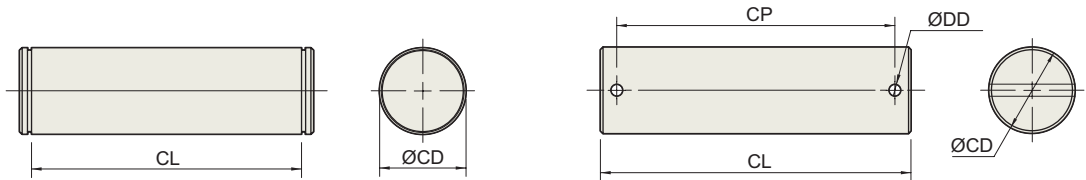
Alignment Coupler



Dimensions

Part No.	A	B	C	D	E	F	G	H
NCA1-AC325	3/4-16	1 3/4	2 5/16	5/16	1 1/8	31/32	7/8	1 1/2
NCA1-AC800	1-14	2 1/2	2 15/16	1/2	1 5/8	1 3/8	1 1/4	2 1/4
NCA1-AC1000	1 1/4-12	2 1/2	2 15/16	1/2	1 5/8	1 3/8	1 1/4	2 1/4

Pivot Pins



Dimensions

Part No.	CD	CL
NCA1-325	3/4	2 5/8
NCA1-800	1	3 1/8
NCA1-1000	1 3/8	4 1/8

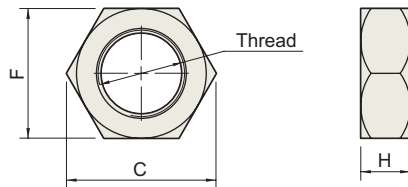
Note: Retainer rings are included.

Dimensions

Part No.	CD	DD	CL	CP
NCDP-325	3/4	.140	3.10	2.72
NCDP-800	1	.140	3.60	3.22
NCDP-1000	1 3/8	.173	4.66	4.25

Note: Cotter pins are included.

Rod Jam Nut

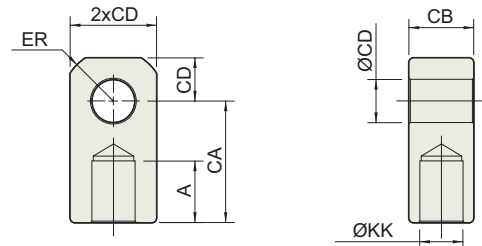


Dimensions

Part No.	C	F	H	Thread
JM-10	1.299	1 1/8	27/64	3/4-16UNF
JM-800	1.732	1 1/2	35/64	1-14UNF
JM-1000	2.165	1 7/8	23/32	1 1/4-12UNF

Dimensions per ASME B18.2.2 1987 (1999)

Rod Eye



Dimensions

Part No.	A	CA	CB	CD	ER	KK	Weight (lbs)
NI-325	1 1/8	2 1/16	1 1/4	3/4	7/8	3/4-16	0.39
NI-800	1 5/8	2 13/16	1 1/2	1	1 3/16	1-14	1.04
NI-1000	2	3 7/16	2	1 3/8	1 9/16	1 1/4-12	2.37

Note: Jam nut is included.



Series NCA1 Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of "**Caution**", "**Warning**" or "**Danger**". To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

⚠ Caution : Operator error could result in injury or equipment damage.

⚠ Warning : Operator error could result in serious injury or loss of life.

⚠ Danger : In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power – Recommendations for the application of equipment to transmission and control systems

Note 2) JIS B 8370: General Rules for Pneumatic Equipment

⚠ Warning

1. The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.

2. Only trained personnel should operate pneumatically operated machinery and equipment.

Compressed air can be dangerous if handled incorrectly. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back pressure.)

4. Contact SMC if the product is to be used in any of the following conditions:

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

Series NCA1 Actuator Precautions 1

Be sure to read before handling.

Design

Warning

- 1. There is a possibility of danger of sudden action by air cylinders if sliding parts of machinery are twisted, due to external forces, etc.**

In such cases, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be adjusted to operate smoothly and designed to avoid such dangers.

- 2. A protective cover is recommended to minimize the risk of personal injury.**

If a stationary object and moving parts of a cylinder are in close proximity, personal injury may occur. Design the structure to avoid contact with the human body.

- 3. Securely tighten all stationary parts and connected parts so that they will not become loose.**

Especially when a cylinder operates with high frequency or is installed where there is a lot of vibration, ensure that all parts remain secure.

- 4. A deceleration circuit or shock may be required.**

When a driven object is operated at high speed or the load is heavy, a cylinder's cushion will not be sufficient to absorb the impact. Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the impact. In this case, the rigidity of the machinery should also be examined.

- 5. Consider a possible drop in circuit pressure due to a power outage, etc.**

When a cylinder is used in a clamping mechanism, there is a danger of work pieces dropping if there is a decrease in clamping force due to a drop in circuit pressure caused by a power outage, etc. Therefore, safety equipment should be installed to prevent damage to machinery and/or human injury. Suspension mechanisms and lifting devices also require consideration for drop prevention.

- 6. Consider a possible loss of power source.**

Measures should be taken to protect against bodily injury and equipment damage in the event that there is a loss of power to equipment controlled by pneumatics, electricity or hydraulics, etc.

- 7. Design circuit that will prevent the driven object from shooting out.**

The driven object will shoot out at a high speed if one side of the cylinder is pressurized after the air inside the cylinder is exhausted; for example, when the cylinder is driven with exhaust center directional control valves or when it is started after the residual pressure inside the circuit is exhausted.

Such an event can possibly lead to bodily injury, by, for example catching in human limbs, or damage to the machinery. Therefore, select equipment and design circuits to prevent shoot-outs.

- 8. Consider emergency stops.**

Design so that human injury and/or damage to machinery and equipment will not be caused when machinery is stopped by a safety device under abnormal conditions, a power outage or a manual emergency stop.

- 9. Consider the action when operation is restarted after an emergency stop or abnormal stop.**

Design the machinery so that human injury or equipment damage will not occur upon restart of operation. When the cylinder has to be reset at the starting position, install safe manual control equipment.

Selection

Warning

- 1. Check the specifications.**

The products featured in this catalog are designed for use in industrial compressed air systems. If the products are used in conditions where pressure and/or temperature are outside range of specification, damage and/or malfunction may occur. Do not use in these conditions. (Refer to specifications.)

Consult SMC if you use a fluid other than compressed air.

- 2. Intermediate stops**

When intermediate stopping of a cylinder piston is performed with a 3 position closed center type directional control valve, it is difficult to achieve stopping positions as accurate and precise as with hydraulic pressure due to the compressibility of air.

Furthermore, since valves and cylinders, etc., are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time. Contact SMC in case it is necessary to hold a stopped position for an extended period.

Caution

- 1. Operate within the limits of the maximum usable stroke.**

The piston rod will be damaged if operated beyond the maximum stroke. Refer to the cylinder model selection procedure for the maximum useable stroke.

- 2. Operate the piston within a range such that collision damage will not occur at the stroke end.**

The operation range should prevent damage from occurring when a piston, having inertial force, stop by striking the cover at the stroke end. Refer to the cylinder model selection procedure for the maximum usable stroke.

- 3. Use a speed controller to adjust the cylinder drive speed, gradually increasing from a low speed to the desired speed setting.**

- 4. Provide intermediate supports for long stroke cylinders.**

An intermediate support should be provided in order to prevent damage to a cylinder having a long stroke, due to problems such as sagging of the rod deflection of the cylinder tube, vibration and external load.

Actuator Precautions 2

Be sure to read before handling.

Mounting

⚠ Caution

1. **Be certain to match the rod shaft center with the load and direction of movement when connecting.**

When not properly matched, problem may arise with the rod and tube, and damage may be caused due to friction on areas such as the inner tube surface, bushings, rod surface, and seals.

2. **When an external guide is used, connect the rod end and the load in such a way that there is no interference at any point within the stroke.**

3. **Do not scratch or gouge the sliding parts of the cylinder tube or piston rod by striking or grasping them with other objects.**

Cylinder bores are manufactured to precise tolerances, so that even a slight deformation may cause faulty operation.

Moreover scratches or gouges, etc., in the piston rod may lead to damaged seals and cause air leakage.

4. **Prevent the seizure of rotating parts.**

Prevent the seizure of rotating parts (pins, etc.) by applying grease.

5. **Do not use until you can verify that equipment can operate properly.**

After mounting, repairs, or modification, etc., connect the air supply and electric power, and then confirm proper mounting by means of appropriate function and leak tests.

6. **Instruction manual**

The product should be mounted and operated after the instruction manual is thoroughly read and its contents are understood.

Keep the instruction manual where it can be referred to as needed.

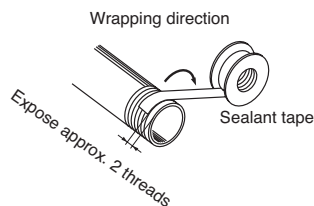
1. **Preparation before piping**

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

2. **Wrapping of pipe tape**

When screwing together pipes and fittings, etc., be certain that chips from the pipe threads and sealing material do not get inside the piping.

Also, when sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



Cushion

⚠ Caution

1. **Readjust using the cushion needle.**

Cushions are adjusted at the time of shipment, however, the cushion needle on the cover should be readjusted when the product is put into service, based upon factors such as the size of the load and the operating speed. When the cushion needle is turned clockwise, the restriction becomes smaller and the cushion's effectiveness is increased. Tighten the lock nut securely after adjustment is performed.

2. **Do not use the cushion needle fully closed.**

This will cause damage to the seals.

⚠ Warning

1. **Use clean air.**

Do not use compressed air which includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction.

⚠ Caution

1. **Install air filters.**

Install air filters at the upstream side of valves. The filtration degree should be 5 μ m or finer.

2. **Install an after cooler, air dryer or water separator, etc.**

Air that includes excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an after cooler, air dryer or water separator, etc.

3. **Use the product within the specified range of fluid and ambient temperature.**

Take measures to prevent freezing, since moisture in circuits can be frozen under 5°C, and this may cause damage to seals and lead to malfunction.

Refer to SMC's "Air Cleaning Equipment" catalog for further details on compressed air quality.

Maintenance

⚠ Warning

1. **Removal of equipment, and supply/exhaust of compressed air.**

Before any machinery or equipment is removed, first ensure that the appropriate measures are in place to prevent the fall or erratic movement of driven objects and equipment, then cut off the electric power and reduce the pressure in the system to zero. Only then should you proceed with the removal of any machinery and equipment.

When machinery is restarted, proceed with caution after confirming measures to prevent cylinder lurching.

⚠ Caution

1. **Drain flushing**

Remove drainage from air filters regularly. (Refer to specifications.)

Auto Switch Precautions 1

Be sure to read before handling.

Design & Selection

⚠ Warning

1. Confirm the specifications.

Read the specifications carefully and use this product appropriately. The product may be damaged or malfunction if it is used outside the range of specifications for current load, voltage, temperature or impact.

2. Take precautions when multiple cylinders are used close together.

When multiple auto switch cylinders are used in close proximity, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40mm.

3. Pay attention to the length of time that a switch is ON at an intermediate stroke position.

When an auto switch is placed at an intermediate position of the stroke and a load is driven at the time the piston passes, the auto switch will operate, but if the speed is too great the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

$$V \text{ (mm/s)} = \frac{\text{Auto switch operating range (mm)} \times 1000}{\text{Time load applied (ms)}}$$

4. Keep wiring as short as possible.

<Reed switches>

As the length of the wiring to a load gets longer, the rush current at switching ON becomes greater, and this may shorten the product's life. (The switch will stay ON all the time.)

Use a contact protection box when the wire length is 5m or longer.

<Solid state switches>

Although wire length should not affect switch function, use a wire 100m or shorter.

5. Pay attention to the internal voltage drop of the switch.

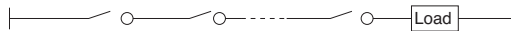
<Reed switches>

1) Switches with an indicator light (Except D-Z76)

- If auto switches are connected in series as shown below, take note that there will be a large voltage drop because of internal resistance in the light emitting diodes. (Refer to internal voltage drop in the auto switch specifications.)

[The voltage drop will be "n" times larger when "n" auto switches are connected.]

Even though an auto switch operates normally, the load may not operate.



⚠ Warning

- In the same way, when operating under a specified voltage, although an auto switch may operate normally, the load may not operate. Therefore, the formula below should be satisfied after confirming the minimum operating voltage of the load.

$$\text{Supply voltage} - \text{Internal voltage drop of switch} > \text{Minimum operating voltage of load}$$

2) If the internal resistance of a light emitting diode causes a problem, select a switch without an indicator light (Model D-Z80).

<Solid state switches>

3) Generally, the internal voltage drop will be greater with a 2 wire solid state auto switch than with a reed switch. Take the same precautions as in 1).

Also, note that a 12VDC relay is not applicable.

6. Pay attention to leakage current.

<Solid state switches>

With a 2 wire solid state auto switch, current (leakage current) flows to the load to operate the internal circuit even when in the OFF state.

$$\text{Operating current of load (OFF condition)} > \text{Leakage current}$$

If the criteria given in the above formula are not met, it will not reset correctly (stays ON). Use a 3 wire switch if this specification will not be satisfied.

Moreover, leakage current flow to the load will be "n" times larger when "n" auto switches are connected in parallel.

7. Do not use a load that generates surge voltage.

<Reed switches>

If driving a load such as a relay that generates a surge voltage, use a contact protection box.

<Solid state switches>

Although a zener diode for surge protection is connected at the output side of a solid state auto switch, damage may still occur if the surge is applied repeatedly. When a load, such as a relay or solenoid which generates surge is directly driven, use a type of switch with a built-in surge absorbing element.

8. Cautions for use in an interlock circuit

When an auto switch is used for an interlock signal requiring high reliability, devise a double interlock system to avoid trouble by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch.

Also perform periodic maintenance and confirm proper operation.

9. Ensure sufficient clearance for maintenance activities.

When designing an application, be sure to allow sufficient clearance for maintenance and inspections.

Auto Switch Precautions 2

Be sure to read before handling.

Mounting & Adjustment

⚠ Warning

1. Do not drop or bump.

Do not drop, bump or apply excessive impacts (300m/s² or more for reed switches and 1000m/s² or more for solid state switches) while handling. Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

2. Do not carry a cylinder by the auto switch lead wires.

Never carry a cylinder by its lead wires. This may not only cause broken lead wires, but it may cause internal elements of the switch to be damaged by the stress.

3. Mount switches using the proper tightening torque.

If a switch is tightened beyond the range of tightening torque, the mounting screws or switch may be damaged.

On the other hand, tightening below the range of tightening torque may allow the switch to slip out of position. (Refer to switch mounting instructions for each series for switch mounting, moving, and tightening torque, etc.)

4. Mount a switch at the center of the operating range.

Adjust the mounting position of an auto switch so that the piston stops at the center of the operating range (the range in which a switch is ON). (The mounting position shown in the catalog indicates the optimum position at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation will be unstable.

Wiring

⚠ Warning

1. Avoid repeatedly bending or stretching lead wires.

Broken lead wires will result from repeatedly applying bending stress or stretching force to the lead wires.

2. Be sure to connect the load before power is applied.

<2 wire type>

If the power is turned ON when an auto switch is not connected to a load, the switch will be instantly damaged because of excess current.

3. Confirm proper insulation of wiring.

Be certain that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Damage may occur due to excess current flow into a switch.

4. Do not wire with power lines or high voltage lines.

Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits containing auto switches may malfunction due to noise from these other lines.

Wiring

⚠ Warning

5. Do not allow short circuit of loads.

<Reed switches>

If the power is turned ON with a load in a short circuited condition, the switch will be instantly damaged because of excess current flow into the switch.

<Solid state switches>

All models of PNP output type switches do not have built-in short circuit protection circuits.

Note that if a load is short circuited, the switch will be instantly damaged as in the case of reed switches.

- *Take special care to avoid reverse wiring with the brown (red) power supply line and the black (white) output line on 3 wire type switches.

6. Avoid incorrect wiring.

<Reed switches>

A 24VDC switch with indicator light has polarity. The brown (red) lead wire is (+), and the blue (black) lead wire is (-).

- 1) If connections are reversed, a switch will operate, however, the light emitting diode will not light up.

Also note that a current greater than that specified will damage a light emitting diode and it will no longer operate.

Applicable models: D-Z73

<Solid state switches>

- 1) If connections are reversed on a 2 wire type switch, the switch will not be damaged if protected by a protection circuit, but the switch will always stay in an ON state. However, it is still necessary to avoid reversed connections, since the switch could be damaged by a load short circuit in this condition.
- *2) If connections are reversed (power supply line + and power supply line -) on a 3 wire type switch, the switch will be protected by a protection circuit. However, if the power supply line (+) is connected to the blue (black) wire and the power supply line (-) is connected to the black (white) wire, the switch will be damaged.

* Lead wire color changes

Lead wire colors of SMC switches and related products have been changed in order to meet NECA (Nippon Electric Control Equipment Industries Association) Standard 0402 for production beginning September, 1996 and thereafter. Please refer to the tables provided.

Special care should be taken regarding wire polarity during the time that the old colors still coexist with the new colors.

2 wire

	Old	New
Output (+)	Red	Brown
Output (-)	Black	Blue

3 wire

	Old	New
Power supply	Red	Brown
GND	Black	Blue
Output	White	Black

Solid state with diagnostic output

	Old	New
Power supply	Red	Brown
GND	Black	Blue
Output	White	Black
Diagnostic output	Yellow	Orange

Solid state with latch type diagnostic output

	Old	New
Power supply	Red	Brown
GND	Black	Blue
Output	White	Black
Latch type diagnostic output	Yellow	Orange

Auto Switch Precautions 3

Be sure to read before handling.

Operating Environment

Warning

1. Never use in an atmosphere of explosive gases.

The structure of auto switches is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

2. Do not use in an area where a magnetic field is generated.

Auto switches will malfunction or magnets inside cylinders will become demagnetized. (Consult SMC regarding the availability of a magnetic field resistant auto switch.)

3. Do not use in an environment where the auto switch will be continually exposed to water.

Although switches satisfy IEC standard IP67 construction (JIS C 0920: watertight structure), do not use switches in applications where continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.

4. Do not use in an environment with oil or chemicals.

Consult SMC if auto switches will be used in an environment with coolant, cleaning solvent, various oils or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.

5. Do not use in an environment with temperature cycles.

Consult SMC if switches are used where there are temperature cycles other than normal temperature changes, as there may be adverse effects inside the switches.

6. Do not use in an environment where there is excessive impact shock.

<Reed switches>

When excessive impact (300m/s² or more) is applied to a reed switch during operation, the contact point will malfunction and generate or cut off a signal momentarily (1ms or less). Consult SMC regarding the need to use a solid state switch depending upon the environment.

7. Do not use in an area where surges are generated.

<Solid state switches>

When there are units (solenoid type lifter, high frequency induction furnace, motor, etc.) which generate a large amount of surge in the area around cylinders with solid state auto switches, this may cause deterioration or damage to the switch. Avoid sources of surge generation and disorganized lines.

8. Avoid accumulation of iron waste or close contact with magnetic substances.

When a large amount of iron waste such as machining chips or spatter is accumulated, or a magnetic substance (something attracted by a magnet) is brought into close proximity with an auto switch cylinder, it may cause the auto switch to malfunction due to a loss of the magnetic force inside the cylinder.

Maintenance

Warning

1. Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.

1) Secure and tighten switch mounting screws.

If screws become loose or the mounting position is dislocated, retighten them after readjusting the mounting position.

2) Confirm that there is no damage to lead wires.

To prevent faulty insulation, replace switches or repair lead wires, etc., if damage is discovered.

3) Confirm the lighting of the green light on the 2 color indicator type switch.

Confirm that the green LED is on when stopped at the established position. If the red LED is on, the mounting position is not appropriate. Readjust the mounting position until the green LED lights up.

Other

Warning

1. Consult SMC concerning water resistance, elasticity of lead wires, and usage at welding sites, etc.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.
Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.^{Note)}
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided. This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

Note) Vacuum pads are excluded from this 1 year warranty.

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered. Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of an SMC product to another country, assure that all local rules governing that export are known and followed.



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