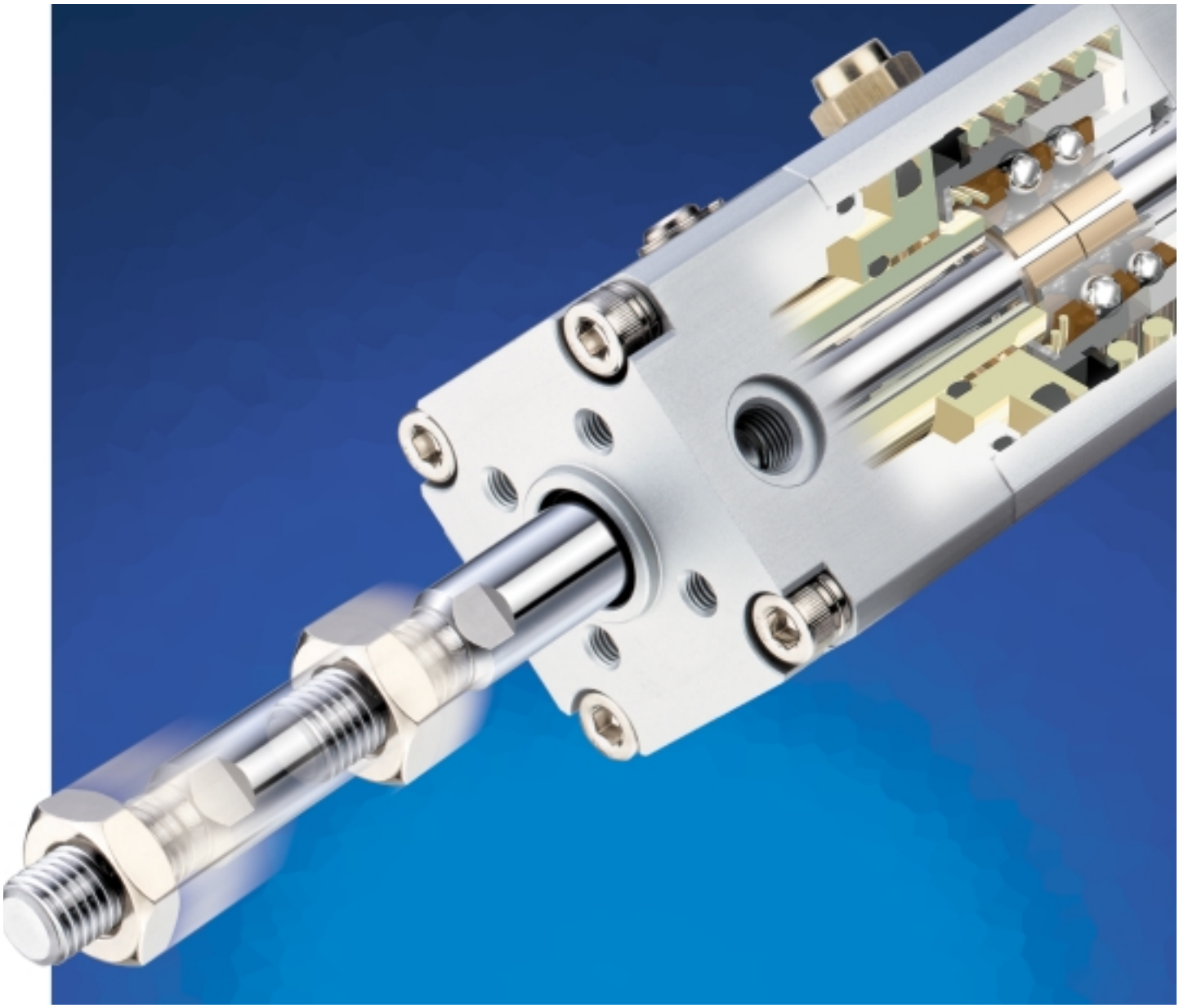
CAT.E281-A

SMC

Cylinder with Lock

Series CNG

ø20, ø25, ø32, ø40

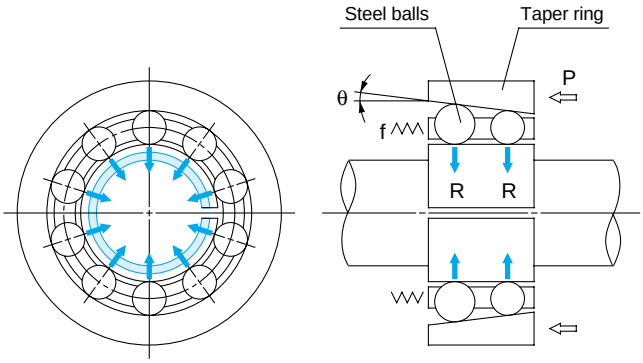


A locking cylinder ideal for intermediate stops, emergency stops and drop prevention.

A locking cylinder idea
emergency stops ar

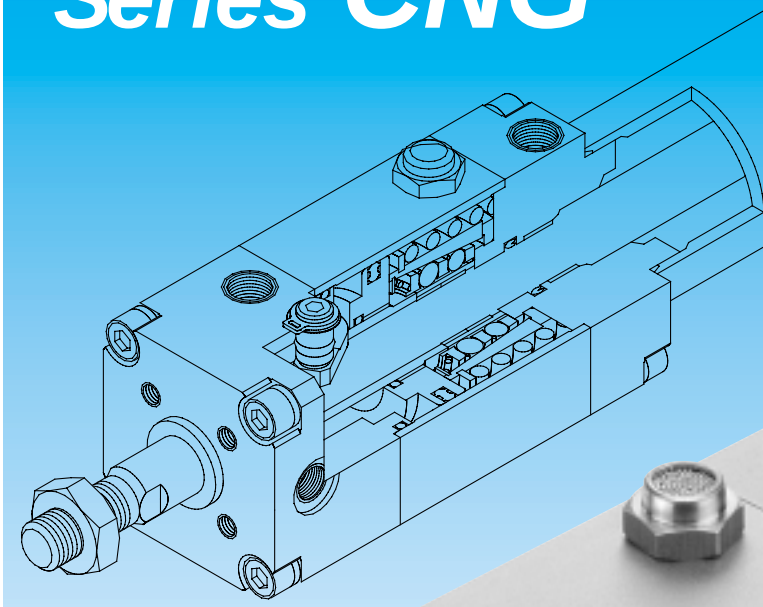
Simple construction

A force magnifying mechanism is employed based on the wedge effect of a taper ring and steel balls.



Cylinder with Lock

Series CNG

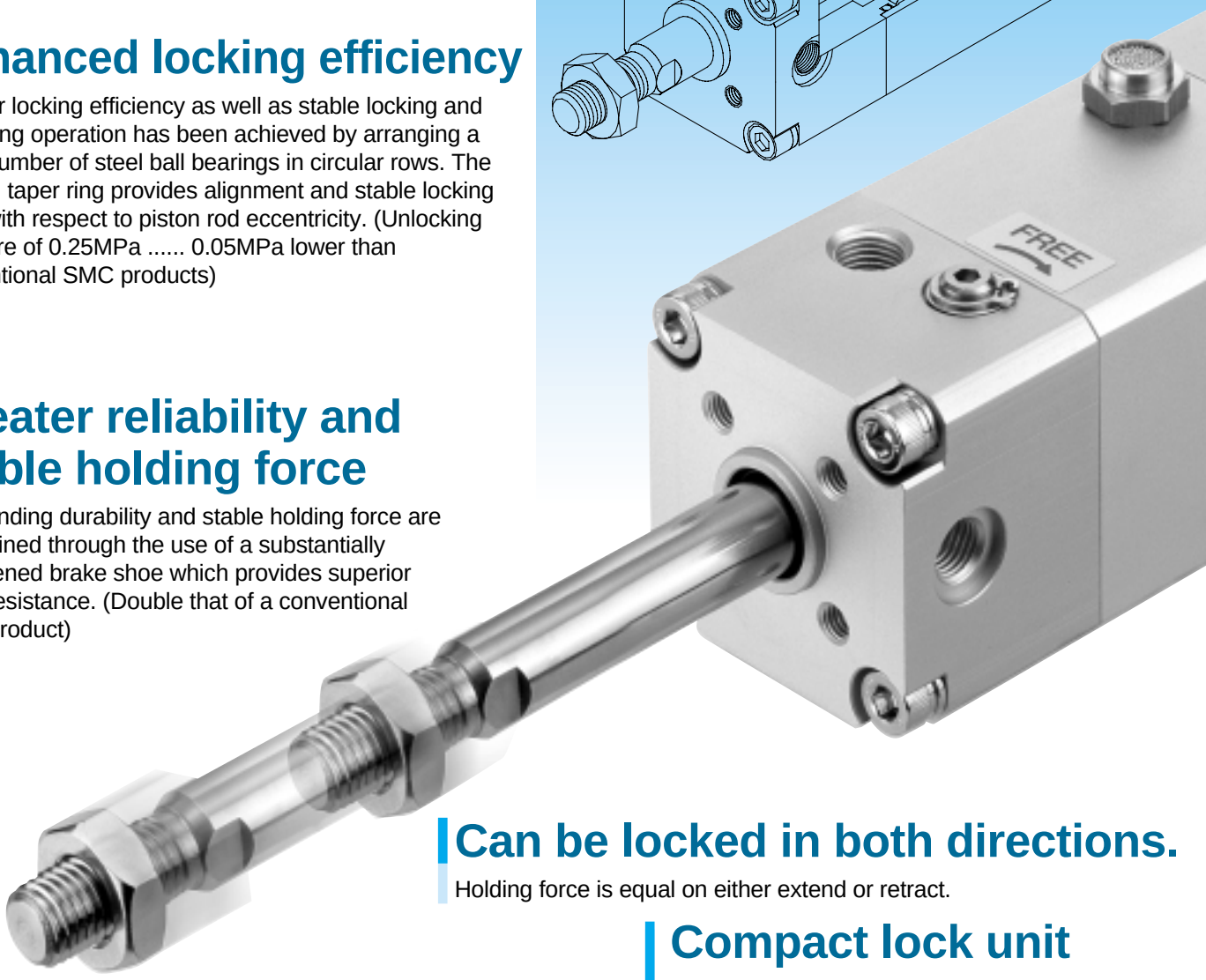


Enhanced locking efficiency

Greater locking efficiency as well as stable locking and unlocking operation has been achieved by arranging a large number of steel ball bearings in circular rows. The floating taper ring provides alignment and stable locking force with respect to piston rod eccentricity. (Unlocking pressure of 0.25MPa ..... 0.05MPa lower than conventional SMC products)

Greater reliability and stable holding force

Outstanding durability and stable holding force are maintained through the use of a substantially lengthened brake shoe which provides superior wear resistance. (Double that of a conventional SMC product)



Can be locked in both directions.

Holding force is equal on either extend or retract.

Compact lock unit saves space

The lock unit is extremely compact, without a large overhang.

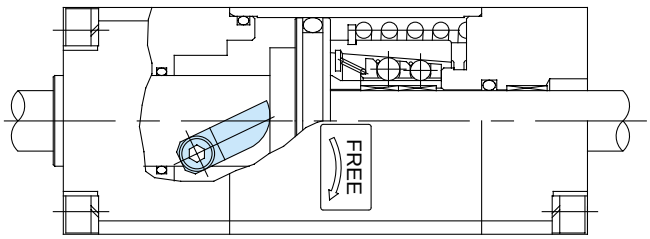
l for intermediate stops, d drop prevention.

Maximum piston speed: 1000mm/s

Within the allowable kinetic energy range, speeds between 50 to 1000mm/s can be achieved.

Simple manual override

In the event that the air supply is cut off or unavailable, unlocking can be performed with a commercially available tool. The fail safe mechanism locks again when the manual override is released.



Enclosed construction minimizes influences of poor air quality

Separation of the lock mechanism and the unlocking piston chamber produces a structure which is resistant to moisture and drainage in compressed air.

Series variations

Series	Action	Cushion type		Standard variations		Bore size (mm)	Standard stroke (mm)
		Rubber bumper	Air cushion	Built-in auto switch magnets	With rod boot		
Cylinder with lock Series CNG	Double acting Single rod	●	●	●	●	20 25 32 40	Maximum to 800

Applicable auto switch models

Auto switch model		Electrical entry
Reed switches	D-C7, C8	Grommet
	D-C73C, C80C	Connector
	D-B5, B6	Grommet
	D-B59W	Grommet (2 color indication)
Solid state switches	D-H7□	Grommet
	D-H7□W	Grommet (2 color indication)
	D-H7LF	Grommet (2 color indication,latch type with diagnostic output)
	D-H7NF	Grommet (2 color indication, with diagnostic output)
	D-H7BA	Grommet (2 color indication, water resistant)
	D-H7C	Connector
	D-G5NT	Grommet (with timer)

Cylinder with Lock

Double Acting: Single Rod

Series CNG

ø20, ø25, ø32, ø40

How to Order

Standard Type CNG L N 32 — 100 ☐ — D

With Auto Switch CDNG L N 32 — 100 ☐ — D — B53 ☐

With auto switch (with magnet)

Mounting brackets

B	Basic type
L	Axial foot type
F	Front flange type
G	Rear flange type
U	Front trunnion type
T	Rear trunnion type
D	Clevis type

∗ Brackets are packed together (not attached) when shipped.

Cushion type

N	Non-lube/rubber bumper
A	Non-lube/air cushion

Bore size

20	20mm
25	25mm
32	32mm
40	40mm

Cylinder strokes (mm)
Refer to standard stroke table on page 2.

Rod boot

Rod boot	Nil	None
	J	Nylon tarpaulin
	K	Heat resistant tarpaulin

∗ When equipped with rod boot, foot and front flange type brackets are attached before shipment.

Locking direction

D	Both directions

Auto Switch Type

Nil	Without auto switch

∗ Select applicable auto switch models from the table below.

Number of auto switches

Nil	2 pcs.
S	1 pc.
n	"n" pcs.

Applicable Auto Switches/Refer to page 16 for detailed auto switch specifications.

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage DC	Load voltage DC	Load voltage AC	Auto switch model	Lead wire length (m)∗ 0.5 (Nil)	3 (L)	5 (Z)	None (N)	Applicable loads	
Reed switches	—	Grommet	Yes	3 wire (NPN equiv.)	—	5V	—	C76	●	●	–	–	IC circuit	—
				2 wire	24V	12V	—	B53	●	●	●	–	—	PLC
							100V, 200V	B54	●	●	●	–	—	Relay, PLC
			No				200V or less	B64	●	●	–	–		
			Yes			12V	100V	C73	●	●	●	–		
			No			5V, 12V	100V or less	C80	●	●	–	–	IC circuit	
		Connector	Yes			12V	—	C73C	●	●	●	●	—	
			No			5V, 12V	24V or less	C80C	●	●	●	●	IC circuit	
	Diagnostic indication (2 color indicator)	Grommet	Yes			—	—	B59W	●	●	–	–	—	
Solid state switches	—	Grommet	Yes	3 wire (NPN)	24V	5V, 12V	—	H7A1	●	●	○	–	IC circuit	Relay, PLC
				3 wire (PNP)				H7A2	●	●	○	–		
				2 wire		12V		H7B	●	●	○	–	—	
		Connector						H7C	●	●	●	●		
	Diagnostic indication (2 color indicator)	Grommet		3 wire (NPN)		5V, 12V		H7NW	●	●	○	–	IC circuit	
				3 wire (PNP)				H7PW	●	●	○	–		
	Water resistant (2 color indicator)			2 wire		12V		H7BW	●	●	○	–	—	
								H7BA	–	●	○	–		
	With timer			3 wire (NPN)		5V, 12V		G5NT	–	●	○	–	IC circuit	
	With diagnostic output (2 color indicator)			4 wire (NPN)				H7NF	●	●	○	–		
	Latch type with diagnostic output (2 color indicator)					—		H7LF	●	●	○	–	—	

∗ Lead wire length symbols 0.5m ..... Nil (Example) C73C 5m …..... Z (Example) C73CZ
3m …..... L C73CL None …... N C73CN

∗ Solid state auto switches marked with a "○" are produced upon receipt of order.

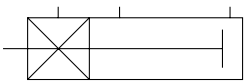
Internal magnet cylinder part numbers

In the case of internal magnets with no auto switches, the auto switch type symbol is "Nil".
(Example) CDNGLN40-100-D

Mounting brackets part numbers

Refer to page 3 for the part numbers of mounting brackets for other than the basic air cylinder.

Symbol



Models

Series	Type	Action	Bore size (mm)	Locking action
CNG	Non-lube type	Double acting	20, 25, 32, 40	Spring locking

Cylinder Specifications

Type	Non-lube type
Fluid	Air
Proof pressure	1.5MPa
Maximum operating pressure	1.0MPa
Minimum operating pressure	0.08MPa
Piston speed	50 to 1000mm/s*
Ambient and fluid temperature	Without auto switch: –10°C to 70°C With auto switch: –10°C to 60°C (with no freezing)
Cushion	Rubber bumper, Air cushion
Stroke length tolerance (mm)	to 800st: $^{+1.4}_{0}$
Thread tolerance	JIS class 2
Mounting brackets	Basic type, Axial foot type, Front flange type, Rear flange type, Front trunnion type, Rear trunnion type, Clevis type (used for 90° change of port position)

* There is a limit to the load weight depending on the piston speed when locked, mounting position and operating pressure.

Lock Specifications

Bore size (mm)	20	25	32	40
Locking action	Spring locking (exhaust locking)			
Unlocking pressure	0.20MPa or more	0.25MPa or more		
Locking pressure	0.15MPa or less	0.20MPa or less		
Operating pressure range	0.2 to 1.0MPa	0.25 to 1.0MPa		
Locking direction	Both directions			

Minimum Stroke for Auto Switch Mounting

Model	Number of auto switches mounted	
	2 pcs.	1 pc.
D-C7, C8 D-B5, B6 D-H7 D-G5N	15mm	10mm
D-B59W	20mm	15mm
D-H7LF	20mm	10mm

Standard Strokes

Bore size (mm)	Standard stroke (mm) Note 1)	Long stroke (mm) Note 2)	Maximum available stroke (mm)
20	25, 50, 75, 100, 125, 150, 200	201 to 350	1500
25	25, 50, 75, 100, 125, 150, 200, 250, 300	301 to 400	
32		301 to 450	
40		301 to 800	

Note 1) Intermediate strokes other than the above are produced upon receipt of order. Spacers are not used for intermediate strokes. (Refer to pages 5 through 12 for dimensions.)
Note 2) Long strokes are applicable to the axial foot type and front flange type.
In case of other mounting brackets or when long stroke limits are exceeded, the maximum useable stroke is determined by the stroke selection table (information edition).

Rod Boot Material

Symbol	Rod boot material	Max. operating temp.
J	Nylon tarpaulin	70°C
K	Heat resistant tarpaulin	110°C *

* The maximum ambient temperature for the rod boot itself.

Stopping Accuracy

Unit: mm

Locking action	Piston speed (mm/s)			
	100	300	500	1000
Spring locking	±0.3	±0.6	±1.0	±2.0

Conditions/Horizontal, supply pressures P = 0.5MPa
Load weight ……Upper limit of allowed values
Solenoid valve for locking Mounted directly to unlocking port
Maximum value taken from the range of 100 measured stopping positions

Holding Force for Spring Locking (Maximum Static Load)

Bore size(mm)	**20**	**25**	**32**	**40**
Holding force N	215	335	550	860

Mounting Bracket Part Numbers

Mounting bracket	Bore size (mm)			
	20	25	32	40
Axial foot *	CNG-L020	CNG-L025	CNG-L032	CNG-L040
Flange	CNG-F020	CNG-F025	CNG-F032	CNG-F040
Trunnion pin	CG-T020	CG-T025	CG-T032	CG-T040
Clevis **	CG-D020	CG-D025	CG-D032	CG-D040
Front trunnion bracket	CNG-020-24	CNG-025-24	CNG-032-24	CNG-040-24
Rear trunnion bracket	CG-020-24A	CG-025-24A	CG-032-24A	CG-040-24A

* Order 2 pcs. of foot brackets for each cylinder.
** The clevis type is packaged with clevis pin, snap ring and mounting bolts.
*** Mounting bolts are included with the foot and flange types.

Auto Switch Mounting Bracket Part Nos.

Auto switch model	Bore size (mm)			
	20	25	32	40
D-C7, C8	BMA2-020	BMA2-025	BMA2-032	BMA2-040
D-H7				
D-B5, B6	BA-01	BA-02	BA-32	BA-04
D-G5NT				

Stainless Steel Mounting Screw Kits
The following stainless steel mounting screw kits are available for use depending on the operating environment. (Switch mounting bands are not included and should be ordered separately.)
BBA3: for D-B5/B6/G5
BBA4: for D-C7/C8/H7
When type D-H7BAL switches are shipped mounted on a cylinder, the above stainless steel screws are used. Also, when switches are shipped separately BBA4 is included.

Accessories

Mounting bracket		Basic type	Axial foot type	Front flange type	Rear flange type	Front trunnion type	Rear trunnion type	Clevis type
Standard equipment	Rod end nut	●	●	●	●	●	●	●
	Clevis pin	–	–	–	–	–	–	●
Options	Single knuckle joint	●	●	●	●	●	●	●
	Double knuckle joint (with pin) *	●	●	●	●	●	●	●
	Trunnion bracket	–	–	–	–	●	●	●
	Rod boot	●	●	●	●	●	●	●

* The pin and snap ring are packaged together with the double knuckle joint when shipped.

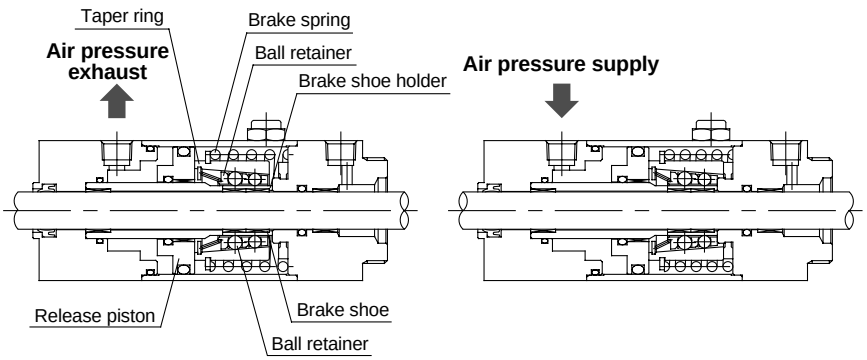
Weight Table

(kg)

Bore size (mm)		20	25	32	40
Basic weight	Basic type	0.52	0.83	0.91	1.24
	Axial foot type	0.63	0.96	1.07	1.46
	Flange type	0.64	1.01	1.08	1.47
	Trunnion type	0.53	0.85	0.94	1.29
	Clevis type	0.57	0.91	1.06	1.47
Front trunnion bracket		0.11	0.13	0.20	0.27
Rear trunnion bracket		0.08	0.09	0.17	0.25
Single knuckle joint		0.05	0.09	0.09	0.10
Double knuckle joint (with pin)		0.05	0.09	0.09	0.13
Additional weight per 50mm of stroke		0.05	0.07	0.09	0.15
Additional weight for air cushion		0.01	0.01	0.02	0.02
Additional weight for long stroke		0.01	0.01	0.02	0.03

Calculation method (Example) CNGLA20-100-D (foot type, ø20, 100st)
Basic weight …… 0.63kg (foot type, ø20)
Additional weight ……. 0.05kg/50st
Air cylinder stroke ……..... 100st
Air cushion additional weight …..... 0.01kg
0.63 + 0.05 x 100/50 + 0.01 = 0.74kg

Construction Principle



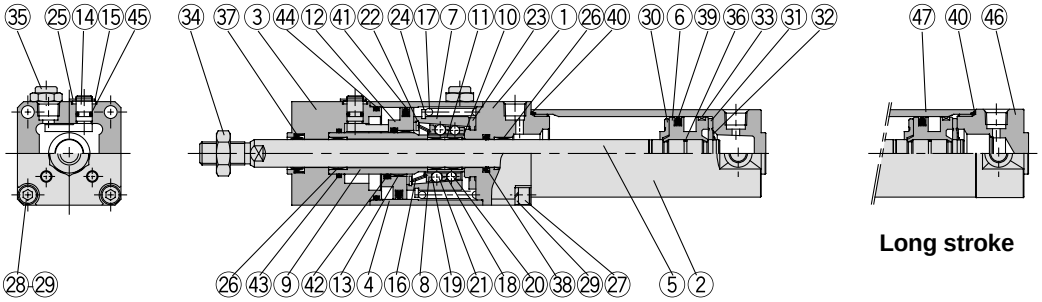
Locked condition

Unlocked condition

Spring Locking (Exhaust Locking)
The spring force which acts upon the taper ring is magnified by a wedge effect, and is conveyed to all of the numerous steel balls which are arranged in two circles. These act on the brake shoe holder and brake, which locks the piston rod by tightening against it with a large force.
Unlocking is accomplished when air pressure is supplied to the unlocking port. The release piston and taper ring oppose the spring force, moving to the right side, and the ball retainer strikes the cover section. The braking force is released as the steel balls are removed from the taper ring by the ball retainer.

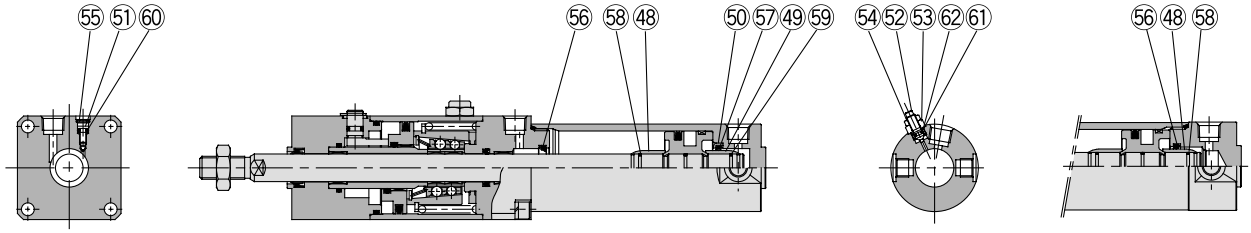
Construction

With rubber bumper/CNGBN



Long stroke

With air cushion/CNGBA



Long stroke

Parts list

No.	Description		Material	Note
1	Rod cover		Aluminum alloy	White hard anodized
2	Tube cover		Aluminum alloy	White hard anodized
3	Cover		Aluminum alloy	White hard anodized
4	Intermediate cover		Aluminum alloy	White hard anodized
5	Piston rod		Carbon steel *	Hard chrome plated
6	Piston		Aluminum alloy	Chromated
7	Taper ring		Carbon steel	Heat treated
8	Ball retainer		Special resin	
9	Piston guide		Carbon steel	Zinc chromated
10	Brake shoe holder		Special steel	Heat treated
11	Brake shoe		Special friction material	
12	Release piston		Carbon steel	Zinc chromated
13	Release piston bushing	ø20	Sintered oil containing alloy	
		ø25,ø32,ø40	Steel + Special resin	
14	Unlocking cam		Chromium molybdenum steel	Electroless nickel plated
15	Washer		Rolled steel	Electroless nickel plated
16	Retainer pre-load spring		Steel wire	Zinc chromated
17	Brake spring		Steel wire	Zinc chromated
18	Clip A		Stainless steel	ø25, ø32 only
19	Clip B		Stainless steel	ø25, ø32 only
20	Steel ball A		Carbon steel	
21	Steel ball B		Carbon steel	
22	Tooth ring		Stainless steel	
23	Damper		Urethane	
24	C type snap ring for taper ring		Carbon steel	
25	C type snap ring for unlocking cam shaft		Carbon steel	
26	Bushing		Sintered oil containing alloy	ø40 is lead bronze casting
27	Hexagon socket head screw		Chromium molybdenum steel	Nickel plated
28	Hexagon socket head screw		Chromium molybdenum steel	Nickel plated
29	Spring washer for hexagon socket head screw		Steel wire	Nickel plated
30	Damper A		Urethane	
31	Damper B		Urethane	ø40 is the same as damper A
32	Snap ring		Stainless steel	
33	Wear ring		Resin	
34	Rod end nut		Rolled steel	Nickel plated
35	BC element		Bronze	
36	Piston gasket		NBR	

Note) In the case of cylinders equipped with auto switches, magnets are installed in the piston.
* The material for ø20 and ø25 cylinders equipped with auto switches is stainless steel.

Parts list

No.	Description	Material	Note
37	Rod seal A	NBR	
38	Rod seal B	NBR	
39	Piston seal	NBR	
40	Cylinder tube gasket	NBR	
41	Release piston seal	NBR	
42	Rod seal C	NBR	
43	Piston guide gasket	NBR	
44	Intermediate cover gasket	NBR	
45	Unlocking cam gasket	NBR	
46	Head cover	Aluminum alloy	White hard anodized
47	Cylinder tube	Aluminum alloy	Hard anodized
48	Cushion ring A	Brass	
49	Cushion ring B	Brass	Same as cushion ring A except for ø20, 25 standard strokes
50	Seal retainer	Rolled steel	Zinc chromated long strokes not available
51	Cushion valve A	Chromium molybdenum steel	Electroless nickel plated
52	Cushion valve B	Rolled steel	Electroless nickel plated
53	Valve retainer	Rolled steel	Electroless nickel plated
54	Lock nut	Rolled steel	Nickel plated
55	Snap ring	Stainless steel	
56	Cushion seal A	Urethane	
57	Cushion seal B	Urethane	Same as cushion seal A except for ø20, 25 standard strokes
58	Cushion ring gasket A	NBR	
59	Cushion ring gasket B	NBR	Same as cushion ring gasket A except for ø20, 25 standard strokes
60	Valve seal A	NBR	
61	Valve seal B	NBR	
62	Valve retainer gasket	NBR	

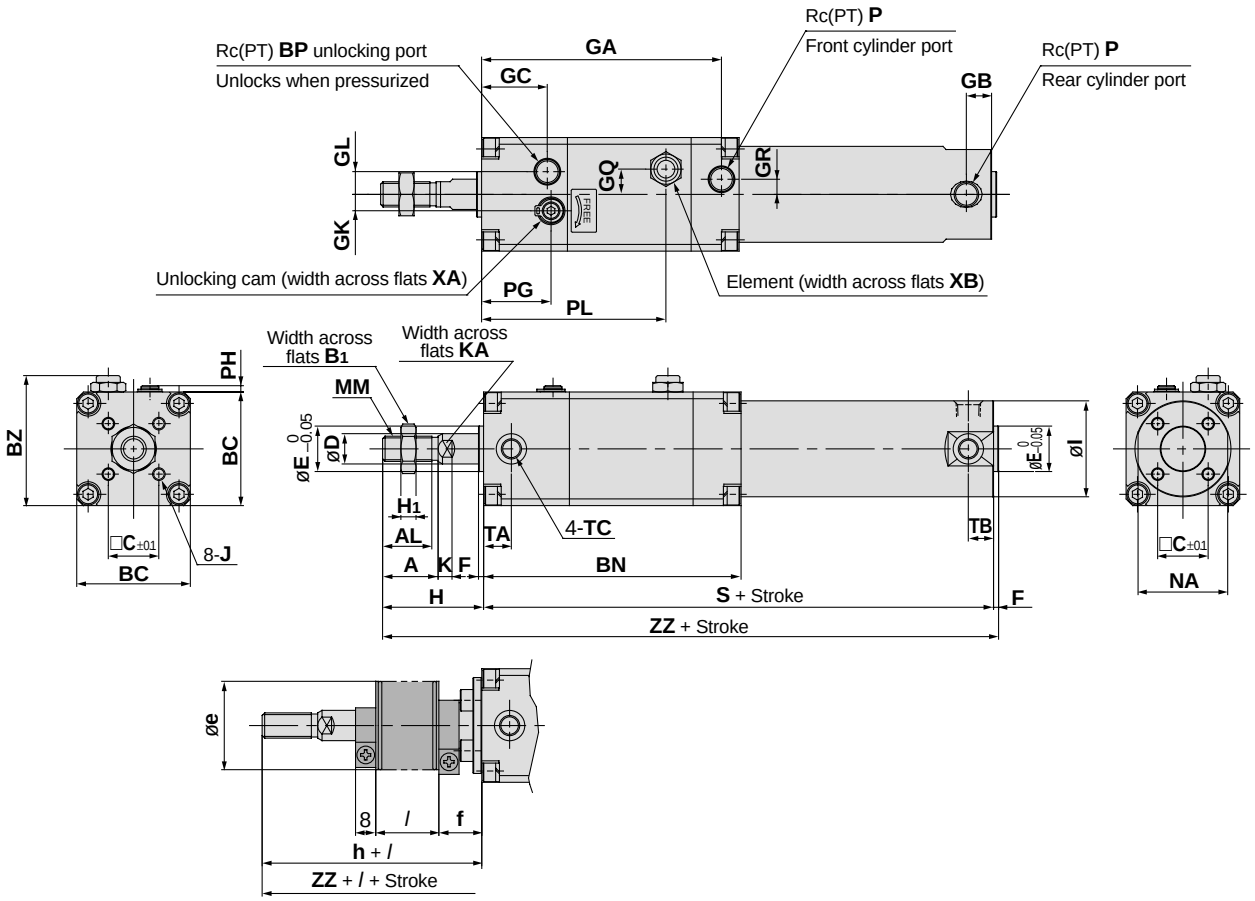
Replacement parts: Seal kits

Bore size (mm)	Seal kit No.	Contents
20	CG1N20-PS	A set of above Nos. 37, 39, 40
25	CG1N25-PS	
32	CG1N32-PS	
40	CG1N40-PS	

* Since the lock section for Series CNG is normally replaced as a unit, replacement seal kits are for the cylinder section only. Order using the seal kit number for each bore size.

Dimensions

Basic type (B): With rubber bumper/CNGBN



With rod boot

(mm)

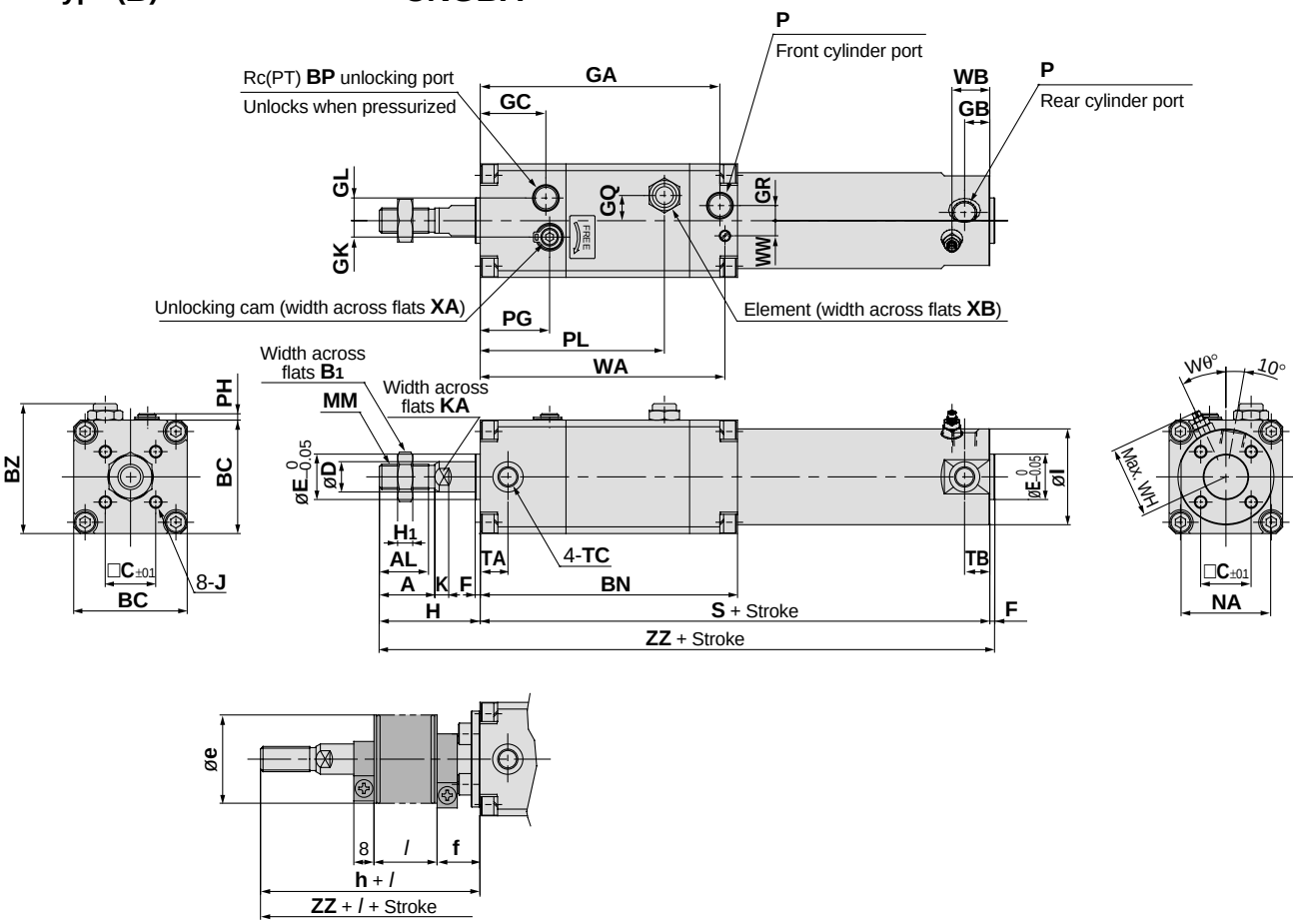
Bore size (mm)	Stroke range without rod boot		Stroke range with rod boot		A	AL	B1	BC	BN	BP	BZ	□C	D	E	F	GA	GB	GC	GK	GL	GR	GQ	H1	I
	Standard	Long stroke	Standard	Long stroke																				
20	to 200	201 to 350	20 to 200	201 to 350	18	15.5	13	38	93	1/8	44.5	14	8	12	2	85	10 (12)	18	5.5	6	4	8	5	26
25	to 300	301 to 400	20 to 300	301 to 400	22	19.5	17	45	103	1/8	51.5	16.5	10	14	2	96	10 (12)	25	6.5	9	7	10	6	31
32	to 300	301 to 450	20 to 300	301 to 450	22	19.5	17	45	104	1/8	51.5	20	12	18	2	97	10 (12)	25	6.5	9	7	10	6	38
40	to 300	301 to 800	20 to 300	301 to 800	30	27	19	52	112	1/8	58.5	26	16	25	2	104	10 (13)	26	7	11	7	12	8	47

(mm)

Bore size (mm)	J	K	KA	MM	NA	P	PG	PH	PL	S	TA	TB	TC	XA	XB	Without rod boot		With rod boot				
																H	ZZ	e	f	h	l	ZZ
20	M4 x 0.7 depth 7	5	6	M8 x 1.25	24	1/8	21.5	2	65	141 (149)	11	11	M5 x 0.8	3	12	35	178 (186)	30	16	55	0.25 x Stroke	198 (206)
25	M5 x 0.8 depth 7.5	5.5	8	M10 x 1.25	29	1/8	26.5	2.5	73	151 (159)	11	11	M6 x 0.75	3	12	40	193 (201)	30	17	62		215 (223)
32	M5 x 0.8 depth 8	5.5	10	M10 x 1.25	35.5	1/8	26.5	2.5	73	154 (162)	11	10 (11)	M8 x 1.0	3	12	40	196 (204)	35	17	62		218 (226)
40	M6 x 1 depth 12	6	14	M14 x 1.5	44	1/8	28	2.5	81	169 (178)	12	10 (12)	M10 x 1.25	4	12	50	221 (230)	35	17	70		241 (250)

Note) Dimensions inside ( ) are for long strokes.

Basic type (B): With air cushion/CNGBA



With rod boot

(mm)

Bore size (mm)	Stroke range without rod boot		Stroke range with rod boot		A	AL	B1	BC	BN	BP	BZ	□C	D	E	F	GA	GB	GC	GK	GL	GR	GQ	H1	I
	Standard	Long stroke	Standard	Long stroke																				
20	to 200	201 to 350	20 to 200	201 to 350	18	15.5	13	38	93	1/8	44.5	14	8	12	2	87	10 (12)	18	5.5	6	4	8	5	26
25	to 300	301 to 400	20 to 300	301 to 400	22	19.5	17	45	103	1/8	51.5	16.5	10	14	2	97	10 (12)	25	6.5	9	7	10	6	31
32	to 300	301 to 450	20 to 300	301 to 450	22	19.5	17	45	104	1/8	51.5	20	12	18	2	97	10 (12)	25	6.5	9	7	10	6	38
40	to 300	301 to 800	20 to 300	301 to 800	30	27	19	52	112	1/8	58.5	26	16	25	2	104	10 (13)	26	7	11	7	12	8	47

(mm)

Bore size (mm)	J	K	KA	MM	NA	P	PG	PH	PL	S	TA	TB	TC	WA	WB	WH	WW	Wθ	XA	XB
20	M4 x 0.7 depth 7	5	6	M8 x 1.25	24	M5 x 0.8	21.5	2	65	141 (149)	11	11	M5 x 0.8	88	15 (16)	23	5.5	30°	3	12
25	M5 x 0.8 depth 7.5	5.5	8	M10 x 1.25	29	M5 x 0.8	26.5	2.5	73	151 (159)	11	11	M6 x 0.75	98	15 (16)	25	6	30°	3	12
32	M5 x 0.8 depth 8	5.5	10	M10 x 1.25	35.5	Rc(PT) 1/8	26.5	2.5	73	154 (162)	11	10 (11)	M8 x 1.0	99	15 (16)	28.5	6	25°	3	12
40	M6 x 1 depth 12	6	14	M14 x 1.5	44	Rc(PT) 1/8	28	2.5	81	169 (178)	12	10 (12)	M10 x 1.25	107	15 (16)	33	8	20°	4	12

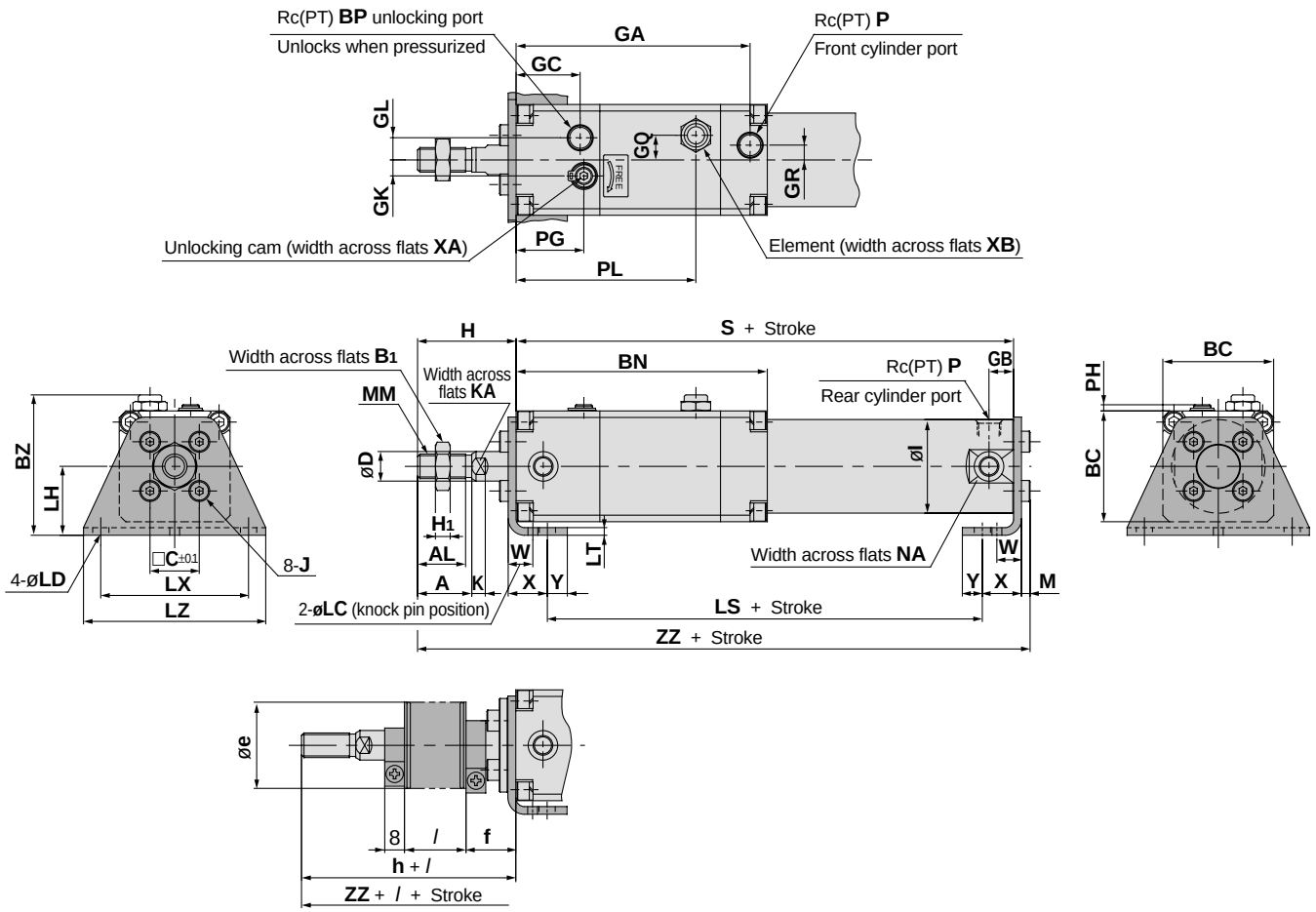
(mm)

Bore size (mm)	Without rod boot		With rod boot				
	H	ZZ	e	f	h	l	ZZ
20	35	178 (186)	30	16	55	0.25 Stroke x	198 (206)
25	40	193 (201)	30	17	62		215 (223)
32	40	196 (204)	35	17	62		218 (226)
40	50	221 (230)	35	17	70		241 (250)

Note) Dimensions inside ( ) are for long strokes.
Dimensions with mounting bracket are the same as dimensions with rubber bumper.

Dimensions

Axial foot type (L): With rubber bumper/CNGLN



With rod boot

(mm)

Bore size (mm)	Stroke range without rod boot		Stroke range with rod boot		A	AL	B1	BC	BN	BP	BZ	□C	D	GA	GB	GC	GK	GL	GR	GQ	H1	I	J
	Standard	Long stroke	Standard	Long stroke																			
20	to 200	201 to 350	20 to 200	201 to 350	18	15.5	13	38	93	1/8	50.5	14	8	85	10 (12)	18	5.5	6	4	8	5	26	M4 x 0.7
25	to 300	301 to 400	20 to 300	301 to 400	22	19.5	17	45	103	1/8	57	16.5	10	96	10 (12)	25	6.5	9	7	10	6	31	M5 x 0.8
32	to 300	301 to 450	20 to 300	301 to 450	22	19.5	17	45	104	1/8	57	20	12	97	10 (12)	25	6.5	9	7	10	6	38	M5 x 0.8
40	to 300	301 to 800	20 to 300	301 to 800	30	27	19	52	112	1/8	65.5	26	16	104	10 (13)	26	7	11	7	12	8	47	M6 x 1

(mm)

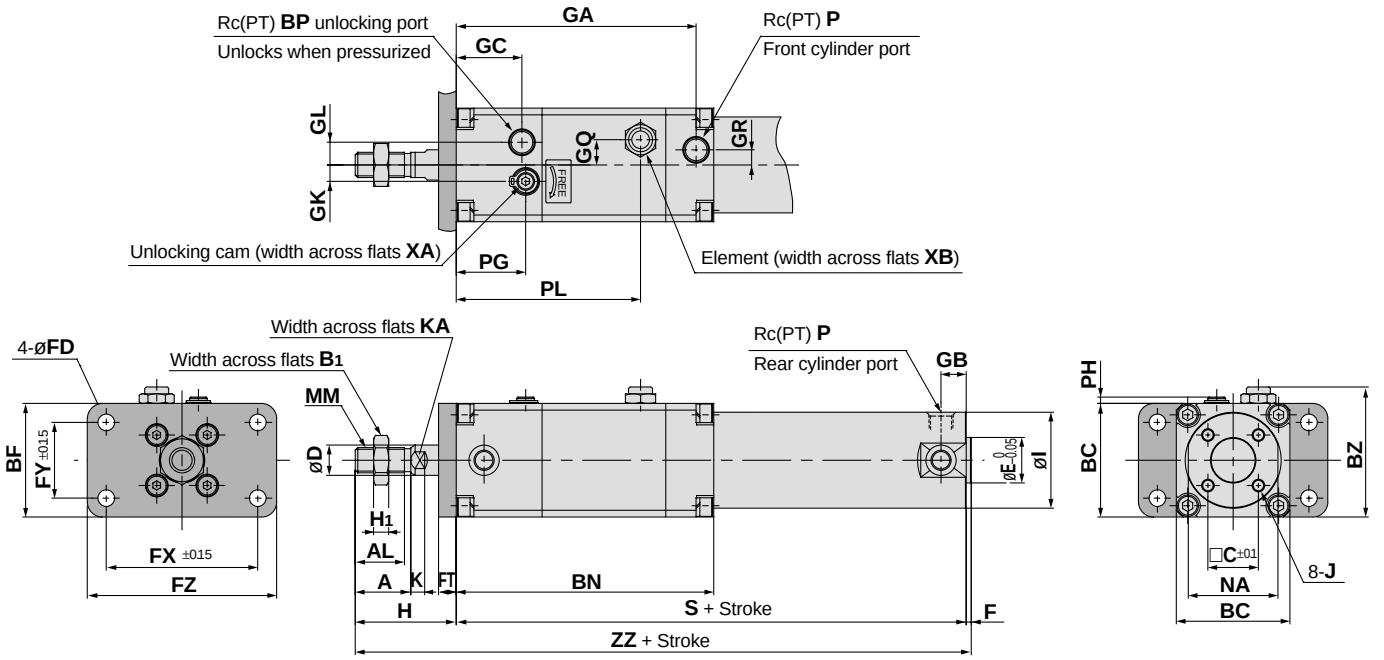
Bore size (mm)	K	KA	M	MM	NA	P	PG	PH	PL	S	LC	LD	LH	LS	LT	LX	LZ	X	Y	W	XA	XB
20	5	6	3	M8 x 1.25	24	1/8	21.5	2	65	141 (149)	4	6	25	117 (125)	3	50	62	15	7	10	3	12
25	5.5	8	3.5	M10 x 1.25	29	1/8	26.5	2.5	73	151 (159)	4	6	28	127 (135)	3	57	70	15	7	10	3	12
32	5.5	10	3.5	M10 x 1.25	35.5	1/8	26.5	2.5	73	154 (162)	4	6.6	28	128 (136)	3	60	74	16	8	10	3	12
40	6	14	4	M14 x 1.5	44	1/8	28	2.5	81	169 (178)	4	6.6	33	142 (151)	3	68	84	16.5	8.5	10	4	12

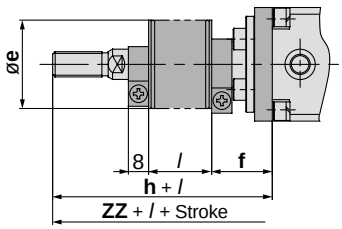
(mm)

Bore size (mm)	Without rod boot		With rod boot				
	H	ZZ	e	f	h	l	ZZ
20	35	182 (190)	30	19	55	0.25 Stroke x	202 (210)
25	40	197.5 (205.5)	30	20	62		219.5 (227.5)
32	40	200.5 (208.5)	35	20	62		222.5 (230.5)
40	50	226 (235)	35	20	70		246 (255)

Note) Dimensions inside ( ) are for long strokes.

Front flange type (F): With rubber bumper/CNGFN





With rod boot

(mm)

Bore size (mm)	Stroke range without rod boot		Stroke range with rod boot		A	AL	B1	BC	BF	BN	BP	BZ	□C	D	E	F	GA	GB	GC	GK	GL	GR	GQ	H1
	Standard	Long stroke	Standard	Long stroke																				
20	to 200	201 to 350	20 to 200	201 to 350	18	15.5	13	38	38	93	1/8	44.5	14	8	12	2	85	10 (12)	18	5.5	6	4	8	5
25	to 300	301 to 400	20 to 300	301 to 400	22	19.5	17	45	45	103	1/8	51.5	16.5	10	14	2	96	10 (12)	25	6.5	9	7	10	6
32	to 300	301 to 450	20 to 300	301 to 450	22	19.5	17	45	45	104	1/8	51.5	20	12	18	2	97	10 (12)	25	6.5	9	7	10	6
40	to 300	301 to 800	20 to 300	301 to 800	30	27	19	52	52	112	1/8	58.5	26	16	25	2	104	10 (13)	26	7	11	7	12	8

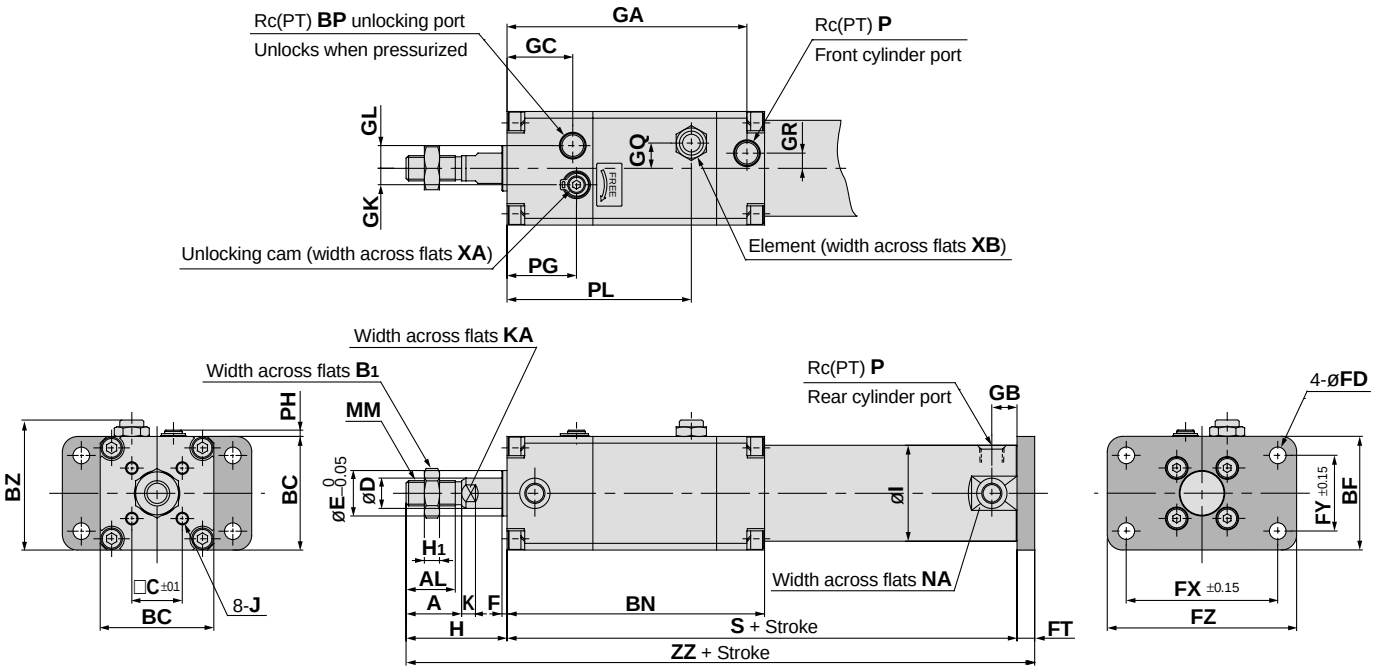
(mm)

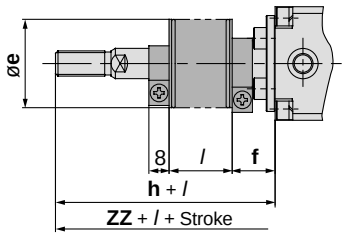
Bore size (mm)	I	J	K	KA	MM	NA	P	PG	PH	PL	S	FD	FT	FX	FY	FZ	XA	XB	Without rod boot		With rod boot				
																			H	ZZ	e	f	h	l	ZZ
20	26	M4 x 0.7	5	6	M8 x 1.25	24	1/8	21.5	2	65	141 (149)	5.5	6	52	25	65	3	12	35	178 (186)	30	22	55	0.25 x Stroke	198 (206)
25	31	M5 x 0.8	5.5	8	M10 x 1.25	29	1/8	26.5	2.5	73	151 (159)	5.5	7	60	30	75	3	12	40	193 (201)	30	24	62		215 (223)
32	38	M5 x 0.8	5.5	10	M10 x 1.25	35.5	1/8	26.5	2.5	73	154 (162)	6.6	7	60	30	75	3	12	40	196 (204)	35	24	62		218 (226)
40	47	M6 x 1	6	14	M14 x 1.5	44	1/8	28	2.5	81	169 (178)	6.6	8	66	36	82	4	12	50	221 (230)	35	25	70		241 (250)

Note) Dimensions inside ( ) are for long strokes.

Dimensions

Rear flange type (G): With rubber bumper/CNGGN





With rod boot

(mm)

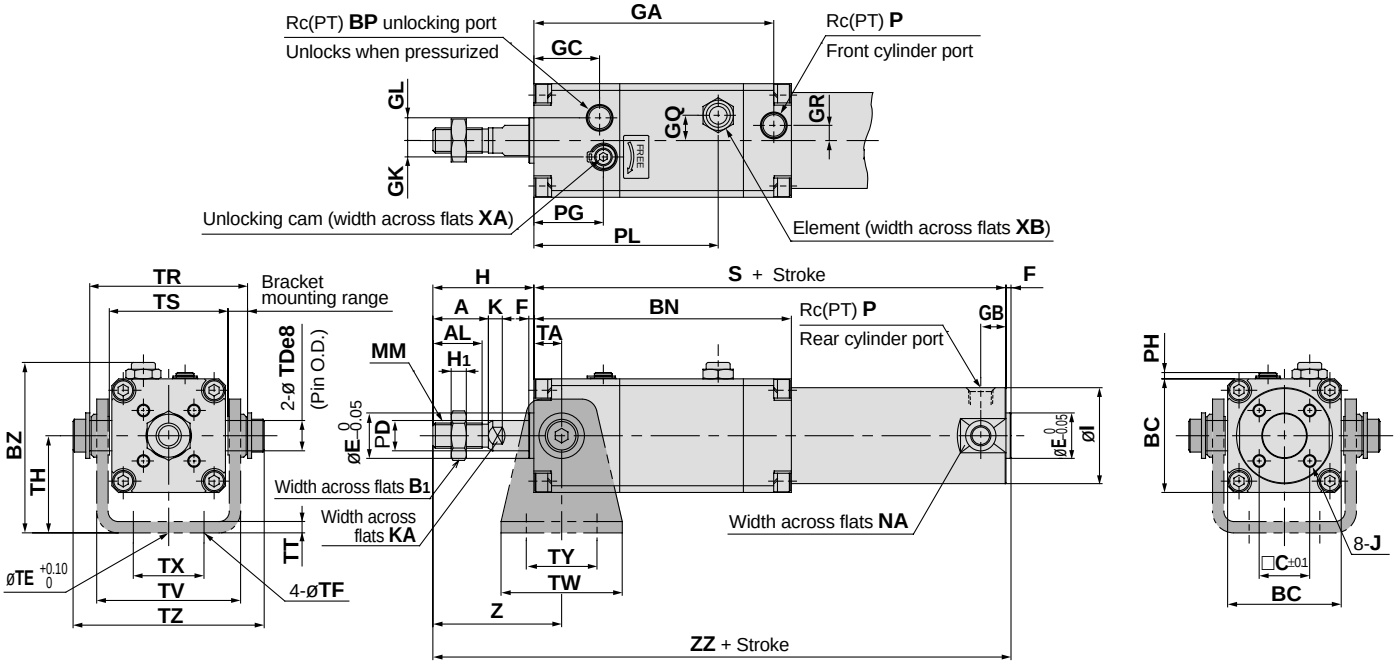
Bore size (mm)	Stroke range without rod boot		Stroke range with rod boot		A	AL	B1	BC	BF	BN	BP	BZ	□C	D	E	F	GA	GB	GC	GK	GL	GR	GQ	H1	I
	Standard	Long stroke	Standard	Long stroke																					
20	to 200	—	20 to 200	—	18	15.5	13	38	38	93	1/8	44.5	14	8	12	2	85	10	18	5.5	6	4	8	5	26
25	to 300	—	20 to 300	—	22	19.5	17	45	45	103	1/8	51.5	16.5	10	14	2	96	10	25	6.5	9	7	10	6	31
32	to 300	—	20 to 300	—	22	19.5	17	45	45	104	1/8	51.5	20	12	18	2	97	10	25	6.5	9	7	10	6	38
40	to 300	301 to 500	20 to 300	301 to 500	30	27	19	52	52	112	1/8	58.5	26	16	25	2	104	10 (13)	26	7	11	7	12	8	47

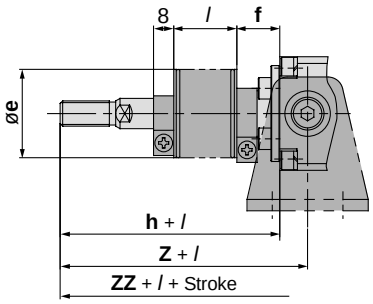
(mm)

Bore size (mm)	J	K	KA	MM	NA	P	PG	PH	PL	S	FD	FT	FX	FY	FZ	XA	XB	Without rod boot		With rod boot				
																		H	ZZ	e	f	h	l	ZZ
20	M4 x 0.7	5	6	M8 x 1.25	24	1/8	21.5	2	65	141	5.5	6	52	25	65	3	12	35	182	30	16	55	0.25 x Stroke	202
25	M5 x 0.8	5.5	8	M10 x 1.25	29	1/8	26.5	2.5	73	151	5.5	7	60	30	75	3	12	40	198	30	17	62		220
32	M5 x 0.8	5.5	10	M10 x 1.25	35.5	1/8	26.5	2.5	73	154	6.6	7	60	30	75	3	12	40	201	35	17	62		223
40	M6 x 1	6	14	M14 x 1.5	44	1/8	28	2.5	81	169 (178)	6.6	8	66	36	82	4	12	50	227 (236)	35	17	70		247 (256)

Note) Dimensions inside ( ) are for long strokes.

Front trunnion type (U): With rubber bumper/CNGUN





With rod boot

(mm)

Bore size (mm)	Stroke range without rod boot		Stroke range with rod boot		A	AL	B1	BC	BN	BP	BZ	□C	D	E	F	GA	GB	GC	GK	GL	GR	GQ	H1	I
	Standard	Long stroke	Standard	Long stroke																				
20	to 200	—	20 to 200	—	18	15.5	13	38	93	1/8	56.5	14	8	12	2	85	10	18	5.5	6	4	8	5	26
25	to 300	—	20 to 300	—	22	19.5	17	45	103	1/8	66	16.5	10	14	2	96	10	25	6.5	9	7	10	6	31
32	to 300	—	20 to 300	—	22	19.5	17	45	104	1/8	67.5	20	12	18	2	97	10	25	6.5	9	7	10	6	38
40	to 300	301 to 500	20 to 300	301 to 500	30	27	19	52	112	1/8	75	26	16	25	2	104	10 (13)	26	7	11	7	12	8	47

(mm)

Bore size (mm)	J	K	KA	MM	NA	P	PG	PH	PL	S	TA	TDe8	TE	TF	TH	TR	TS	TT	TV	TW	TX	TY	TZ	XA	XB
20	M4 x 0.7	5	6	M8 x 1.25	24	1/8	21.5	2	65	141	11	$8^{-0.025}_{-0.047}$	10	5.5	31	51	40	3.2	47.8	42	26	28	59.6	3	12
25	M5 x 0.8	5.5	8	M10 x 1.25	29	1/8	26.5	2.5	73	151	11	$10^{-0.025}_{-0.047}$	10	5.5	37	58	47	3.2	54.8	42	28	28	68	3	12
32	M5 x 0.8	5.5	10	M10 x 1.25	35.5	1/8	26.5	2.5	73	154	11	$12^{-0.032}_{-0.059}$	10	6.6	38.5	62.5	47	4.5	57.4	48	28	28	75.7	3	12
40	M6 x 1	6	14	M14 x 1.5	44	1/8	28	2.5	81	169 (178)	12	$14^{-0.032}_{-0.059}$	10	6.6	42.5	72.5	54	4.5	65.4	56	36	30	85.7	4	12

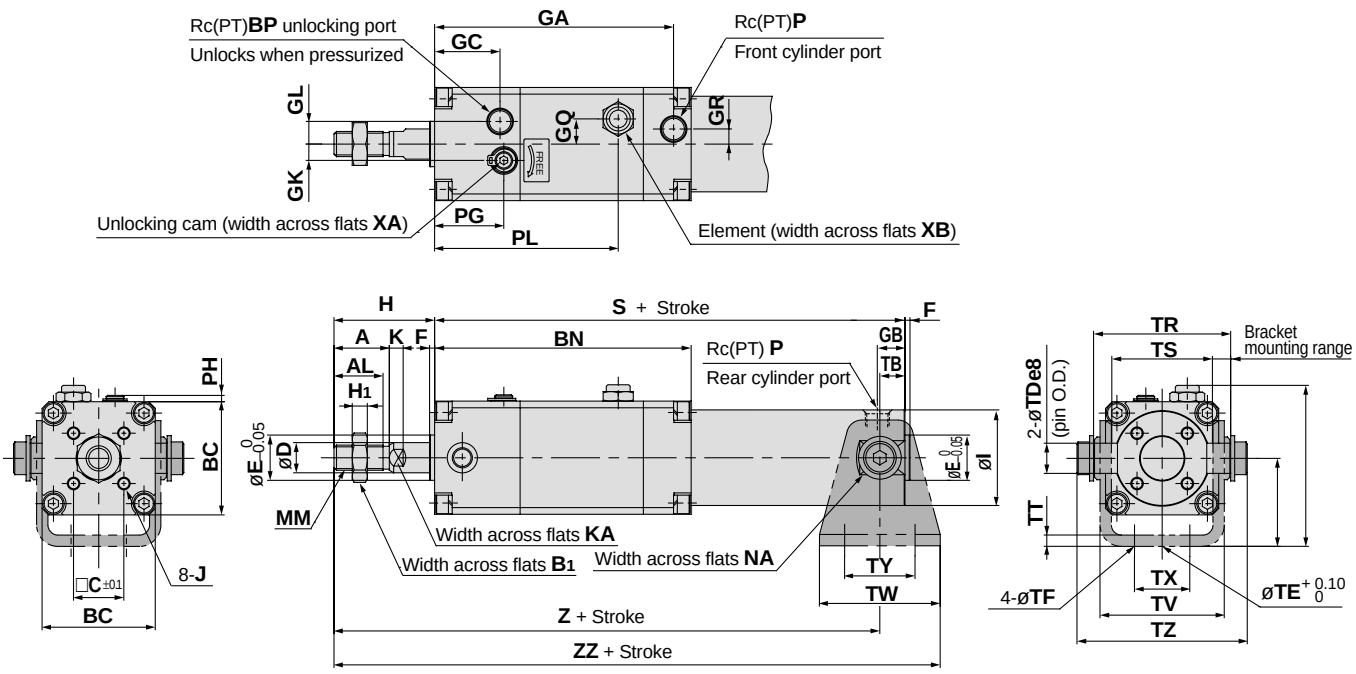
(mm)

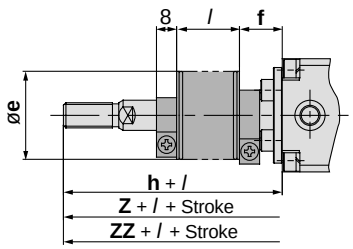
Bore size (mm)	Without rod boot			With rod boot					
	H	Z	ZZ	e	f	h	l	Z	ZZ
20	35	46	178	30	16	55	0.25	66	198
25	40	51	193	30	17	62	Stroke x	73	215
32	40	51	196	35	17	62		73	218
40	50	62	221 (230)	35	17	70		82	241 (250)

Note) Dimensions inside ( ) are for long strokes.
Refer to page 13 regarding the trunnion bracket.

Dimensions

Rear trunnion type (T): With rubber bumper/CNGTN





With rod boot

(mm)

Bore size (mm)	Stroke range without rod boot		Stroke range with rod boot		A	AL	B1	BC	BN	BP	BZ	□C	D	E	F	GA	GB	GC	GK	GL	GR	GQ	H1	I
	Standard	Long stroke	Standard	Long stroke																				
20	to 200	—	20 to 200	—	18	15.5	13	38	93	1/8	50.5	14	8	12	2	85	10	18	5.5	6	4	8	5	26
25	to 300	—	20 to 300	—	22	19.5	17	45	103	1/8	59	16.5	10	14	2	96	10	25	6.5	9	7	10	6	31
32	to 300	—	20 to 300	—	22	19.5	17	45	104	1/8	64	20	12	18	2	97	10	25	6.5	9	7	10	6	38
40	to 300	301 to 500	20 to 300	301 to 500	30	27	19	52	112	1/8	72.5	26	16	25	2	104	10 (13)	26	7	11	7	12	8	47

(mm)

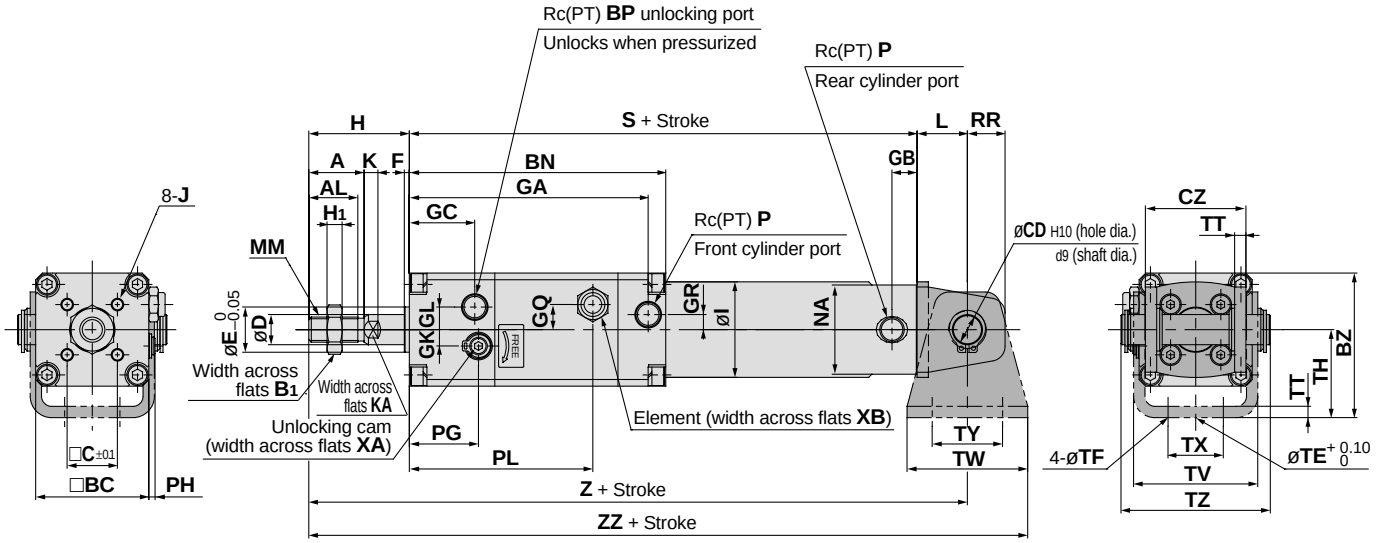
Bore size (mm)	J	K	KA	MM	NA	P	PG	PH	PL	S	TB	TDe8	TE	TF	TH	TR	TS	TT	TV	TW	TX	TY	TZ	XA	XB
20	M4 x 0.7	5	6	M8 x 1.25	24	1/8	21.5	2	65	141	11	$8^{-0.025}_{-0.047}$	10	5.5	25	39	28	3.2	35.8	42	16	28	47.6	3	12
25	M5 x 0.8	5.5	8	M10 x 1.25	29	1/8	26.5	2.5	73	151	11	$10^{-0.025}_{-0.047}$	10	5.5	30	43	33	3.2	39.8	42	20	28	53	3	12
32	M5 x 0.8	5.5	10	M10 x 1.25	35.5	1/8	26.5	2.5	73	154	10	$12^{-0.032}_{-0.059}$	10	6.6	35	54.5	40	4.5	49.4	48	22	28	67.7	3	12
40	M6 x 1	6	14	M14 x 1.5	44	1/8	28	2.5	81	169 (178)	10 (12)	$14^{-0.032}_{-0.059}$	10	6.6	40	65.5	49	4.5	58.4	56	30	30	78.7	4	12

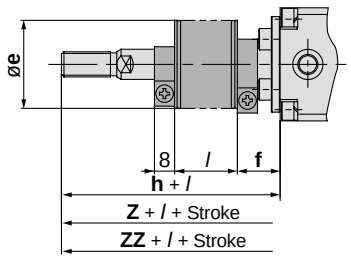
(mm)

Bore size (mm)	Without rod boot			With rod boot					
	H	Z	ZZ	e	f	h	l	Z	ZZ
20	35	165	186	30	16	55	0.25 Stroke x	185	206
25	40	180	201	30	17	62		202	223
32	40	184	208	35	17	62		206	230
40	50	209 (216)	237 (244)	35	17	70		229 (236)	257 (264)

Note) Dimensions inside ( ) are for long strokes.
Refer to page 13 regarding the trunnion bracket.

Clevis type (D): With rubber bumper/CNGDN





With rod boot

(mm)

Bore size (mm)	Stroke range without rod boot		Stroke range with rod boot		A	AL	B1	BC	BN	BP	BZ	□C	D	E	F	GA	GB	GC	GK	GL	GR	GQ	H1	I
	Standard	Long stroke	Standard	Long stroke																				
20	to 200	—	20 to 200	—	18	15.5	13	38	93	1/8	44	14	8	12	2	85	10	18	5.5	6	4	8	5	26
25	to 300	—	20 to 300	—	22	19.5	17	45	103	1/8	52.5	16.5	10	14	2	96	10	25	6.5	9	7	10	6	31
32	to 300	—	20 to 300	—	22	19.5	17	45	104	1/8	57.5	20	12	18	2	97	10	25	6.5	9	7	10	6	38
40	to 300	301 to 500	20 to 300	301 to 500	30	27	19	52	112	1/8	66	26	16	25	2	104	10 (13)	26	7	11	7	12	8	47

(mm)

Bore size (mm)	J	K	KA	MM	NA	P	PG	PH	PL	S	CD	CZ	L	RR	TE	TF	TH	TT	TV	TW	TX	TY	TZ	XA	XB
20	M4 x 0.7	5	6	M8 x 1.25	24	1/8	21.5	2	65	141	8	29	14	11	10	5.5	25	3.2	35.8	42	16	28	43.4	3	12
25	M5 x 0.8	5.5	8	M10 x 1.25	29	1/8	26.5	2.5	73	151	10	33	16	13	10	5.5	30	3.2	39.8	42	20	28	48	3	12
32	M5 x 0.8	5.5	10	M10 x 1.25	35.5	1/8	26.5	2.5	73	154	12	40	20	15	10	6.6	35	4.5	49.4	48	22	28	59.4	3	12
40	M6 x 1	6	14	M14 x 1.5	44	1/8	28	2.5	81	169 (178)	14	49	22	18	10	6.6	40	4.5	58.4	56	30	30	71.4	4	12

(mm)

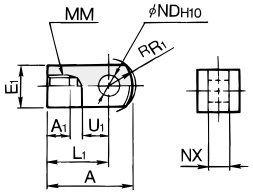
Bore size (mm)	Without rod boot			With rod boot					
	H	Z	ZZ	e	f	h	l	Z	ZZ
20	35	190	211	30	16	55	0.25 Stroke x	210	231
25	40	207	228	30	17	62		229	250
32	40	214	238	35	17	62		236	260
40	50	241 (250)	269 (278)	35	17	70		261 (270)	289 (298)

Note) Dimensions inside ( ) are for long strokes.
The clevis pin and snap ring are included.
Refer to page 13 regarding the trunnion bracket.

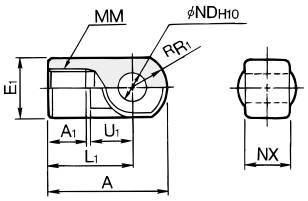
Series CNG
Accessory Dimensions

Single Knuckle Joint

I-G02, G03
Material: Rolled steel



I-G04
Material: Cast iron



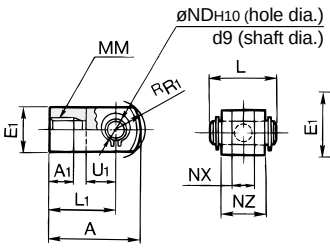
(mm)

Part No.	Applicable bore size (mm)	A	A_1	E_1	L_1	MM	$^{R}R_1$	U_1	ND_{H10}	NX
I-G02	20	34	8.5	□16	25	M8 x 1.25	10.3	11.5	$8^{+0.058}_{0}$	$8^{-0.2}_{-0.4}$
I-G03	25, 32	41	10.5	□20	30	M10 x 1.25	12.8	14	$10^{+0.058}_{0}$	$10^{-0.2}_{-0.4}$
I-G04	40	42	14	ø22	30	M14 x 1.5	12	14	$10^{+0.058}_{0}$	$18^{-0.3}_{-0.5}$

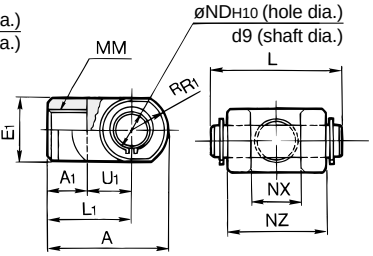
Double Knuckle Joint

∗ The knuckle pin and snap ring are included.

Y-G02, G03
Material: Rolled steel



Y-G04
Material: Cast iron

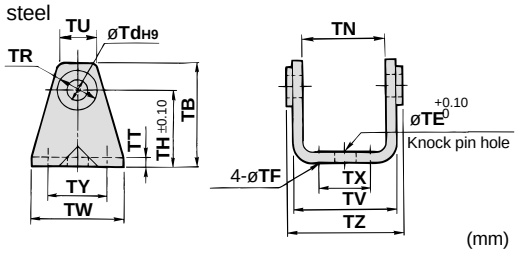


(mm)

Part No.	Applicable bore size (mm)	A	A_1	E_1	L_1	MM	$^{R}R_1$	U_1	ND	NX	NZ	L	Applicable pin part no.
Y-G02	20	34	8.5	□16	25	M8 x 1.25	10.3	11.5	8	$8^{+0.4}_{+0.2}$	16	21	IY-G02
Y-G03	25, 32	41	10.5	□20	30	M10 x 1.25	12.8	14	10	$10^{+0.4}_{+0.2}$	20	25.6	IY-G03
Y-G04	40	42	16	ø22	30	M14 x 1.5	12	14	10	$18^{+0.5}_{+0.3}$	36	41.6	IY-G04

Front Trunnion Bracket

ø20 to ø40
Material: Rolled steel



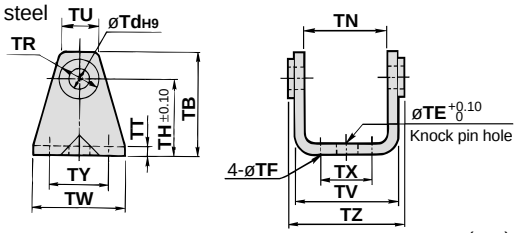
(mm)

Part No.	Applicable bore size (mm)	TB	Td_{H9}	TE	TF	TH	TN
CNG-020-24	20	42	$8^{+0.036}_{0}$	10	5.5	31	$41^{+0.4}_{+0.1}$
CNG-025-24	25	48	$10^{+0.036}_{0}$	10	5.5	37	$48^{+0.4}_{+0.1}$
CNG-032-24	32	53	$12^{+0.043}_{0}$	10	6.6	38.5	$48^{+0.5}_{+0.1}$
CNG-040-24	40	60	$14^{+0.043}_{0}$	10	6.6	42.5	$56^{+0.5}_{+0.1}$

Part No.	Applicable bore size (mm)	TR	TT	TU	TV	TW	TX	TY	TZ
CNG-020-24	20	13	3.2	21.2	47.8	42	26	28	50
CNG-025-24	25	15	3.2	21.3	54.8	42	28	28	57
CNG-032-24	32	17	4.5	25.6	57.4	48	28	28	61.4
CNG-040-24	40	21	4.5	26.3	65.4	56	36	30	71.4

Rear Trunnion Bracket

ø20 to ø40
Material: Rolled steel



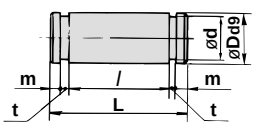
(mm)

Part No.	Applicable bore size (mm)	TB	Td_{H9}	TE	TF	TH	TN
CG-020-24A	20	36	$8^{+0.036}_{0}$	10	5.5	25	(29.3)
CG-025-24A	25	43	$10^{+0.036}_{0}$	10	5.5	30	(33.1)
CG-032-24A	32	50	$12^{+0.043}_{0}$	10	6.6	35	(40.4)
CG-040-24A	40	58	$14^{+0.043}_{0}$	10	6.6	40	(49.2)

Part No.	Applicable bore size (mm)	TR	TT	TU	TV	TW	TX	TY	TZ
CG-020-24A	20	13	3.2	18.1	35.8	42	16	28	38.3
CG-025-24A	25	15	3.2	20.7	39.8	42	20	28	42.1
CG-032-24A	32	17	4.5	23.6	49.4	48	22	28	53.8
CG-040-24A	40	21	4.5	27.3	58.4	56	30	30	64.6

Knuckle Pin

Material: Carbon steel

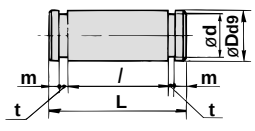


(mm)

Part No.	Applicable bore size (mm)	Dd_9	L	d	l	m	t	Snap ring
IY-G02	20	$8^{-0.040}_{-0.076}$	21	7.6	16.2	1.5	0.9	C type 8 for shaft
IY-G03	25, 32	$10^{-0.040}_{-0.076}$	25.6	9.6	20.2	1.55	1.15	C type 10 for shaft
IY-G04	40	$10^{-0.040}_{-0.076}$	41.6	9.6	36.2	1.55	1.15	C type 10 for shaft

Clevis Pin

Material: Carbon steel

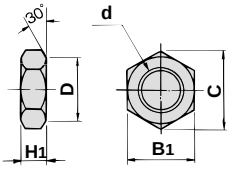


(mm)

Part No.	Applicable bore size (mm)	Dd_9	L	d	l	m	t	Snap ring
CD-G02	20	$8^{-0.040}_{-0.076}$	43.4	7.6	38.6	1.5	0.9	C type 8 for shaft
CD-G25	25	$10^{-0.040}_{-0.076}$	48	9.6	42.6	1.55	1.15	C type 10 for shaft
CD-G03	32	$12^{-0.050}_{-0.093}$	59.4	11.5	54	1.55	1.15	C type 12 for shaft
CD-G04	40	$14^{-0.050}_{-0.093}$	71.4	13.4	65	2.05	1.15	C type 14 for shaft

Rod End Nut

Material: Rolled steel



(mm)

Part No.	Applicable bore size (mm)	B_1	C	D	d	H_1
NT-02	20	13	(15)	12.5	M8 x 1.25	5
NT-03	25, 32	17	(19.6)	16.5	M10 x 1.25	6
NT-G04	40	19	(21.9)	18	M14 x 1.5	8

Series CNG
Auto Switch Specifications

Applicable Auto Switch Models

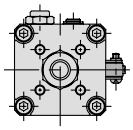
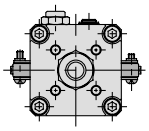
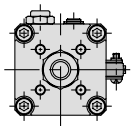
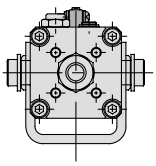
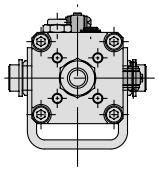
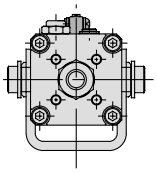
Auto switch model		Electrical entry
Reed switches	**D-C7, C8**	Grommet
	D-C73C, C80C	Connector
	D-B5, B6	Grommet
	D-B59W	Grommet (2 color indication)
Solid state switches	**D-H7□**	Grommet
	D-H7□W	Grommet (2 color indication)
	D-H7LF	Grommet (2 color indication, latch type with diagnostic output)
	D-H7NF	Grommet (2 color indication, with diagnostic output)
	D-H7BA	Grommet (2 color indication, water resistant)
	D-H7C	Connector
	D-G5NT	Grommet (with timer)

⚠ Specific Product Precautions

Be sure to read before handling.
When using auto switches, refer to pages 25 through 27 regarding safety instructions and common precautions.

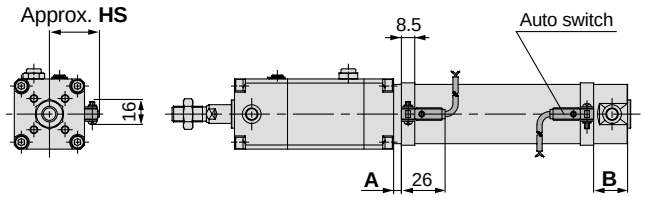
Auto Switch Mounting Brackets by Stroke/Mounting Surfaces

st: Stoke (mm)

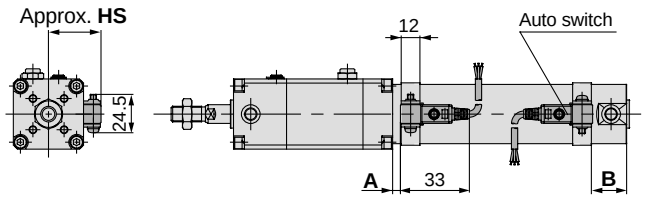
Mounting bracket	Basic type, Foot type, Flange type, Clevis type			Trunnion type		
Number of auto switches	1 pc. (rod cover side)	2 pcs. (mounted on different sides)	2 pcs. (mounted on same side)	1 pc.	2 pcs. (mounted on different sides)	2 pcs. (mounted on same side)
Switch mounting surface / Switch model	Port surface 	Port surface 	Port surface 			
D-C7, C8	10st or more	15 to 49st	50st or more	10st or more	15 to 49st	50st or more
D-H7□, H7□W D-H7BA, H7NF	10st or more	15 to 59st	60st or more	10st or more	15 to 59st	60st or more
D-C73C, C80C, H7C	10st or more	15 to 64st	65st or more	10st or more	15 to 64st	65st or more
D-H7LF	10st or more	20 to 64st	65st or more	10st or more	20 to 64st	65st or more
D-B5, B6, G5NT	10st or more	15 to 74st	75st or more	10st or more	15 to 74st	75st or more
D-B59W	15st or more	20 to 74st	75st or more	15st or more	20 to 74st	75st or more

Auto Switches/Proper Mounting Position and Mounting Height for Stroke End Detection

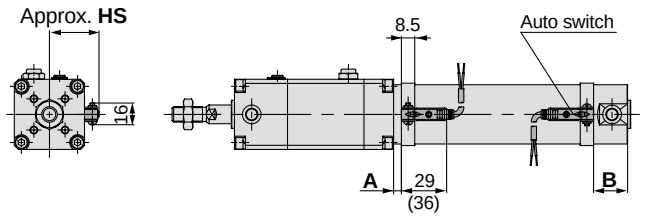
D-C7, D-C8



D-G5NT

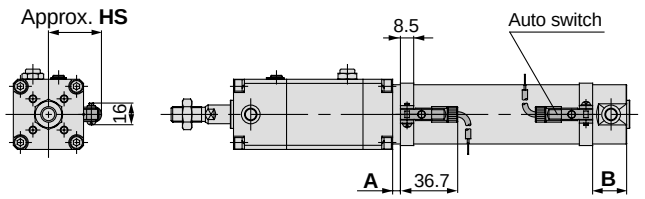


D-H7, D-H7□W
D-H7□F, D-H7BA

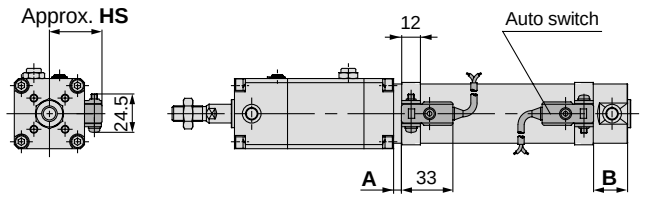


∗ Numbers inside ( ) are for type D-H7LF.

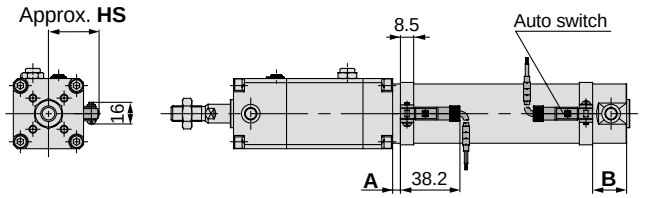
D-C73C, D-C80C



D-B5, D-B6, D-B59W



D-H7C



Auto switch mounting position (mm)

Auto switch model / Bore size (mm)	D-C7, C8 D-C73C D-C80C		D-B5, B6		D-B59W		D-H7□ D-H7C D-H7□W D-H7BA		D-H7□F		D-G5NT	
	A	B	A	B	A	B	A	B	A	B	A	B
20	8.5	20.5 (28.5)	2.5	14.5 (22.5)	5.5	17.5 (25.5)	7.5	19.5 (27.5)	6	18 (26)	4	16 (24)
25	8.5	20.5 (28.5)	2.5	14.5 (22.5)	5.5	17.5 (25.5)	7.5	19.5 (27.5)	6	18 (26)	4	16 (24)
32	9.5	21.5 (29.5)	3.5	15.5 (23.5)	6.5	18.5 (26.5)	8.5	20.5 (28.5)	7	19 (27)	5	17 (25)
40	14.5	23.5 (33)	8.5	17.5 (27)	11	20.5 (30)	13.5	22.5 (32)	12	21 (30.5)	10	19 (28.5)

Auto switch mounting height (mm)

D-C7, C8 D-H7□ D-H7□W D-H7□F D-H7BA	D-C73C D-C80C	D-B5, B6 D-B59W	D-G5NT D-H7C
HS	HS	HS	
24.5	27	27.5	
27	29.5	30	
30.5	33	33.5	
35	37.5	38	

Dimensions inside ( ) are for long strokes.

Series CNG
Auto Switch Specifications

Contact Protection Boxes/CD-P11, CD-P12

<Applicable switch models>

D-C7/C8, D-C73C/C80C, D-B53

The above auto switches do not have internal contact protection circuits.

1. The operating load is an induction load.

2. The length of wiring to the load is 5m or more.

3. The load voltage is 100VAC.

A contact protection box should be used in any of the above situations.

Otherwise, the life of the contacts may be reduced. (They may stay on continuously.)

Further, even in the case of a type having an internal contact protection circuit (D-B54, D-B64, D-B59W), if the length of the wiring to the load is extremely long (30m or more) and a PLC having a large rush current is used, confirm whether a contact protection box may be necessary.

Contact protection box specifications

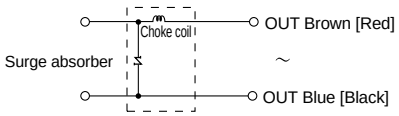
Part No.	CD-P11		CD-P12
Load voltage	100VAC	200VAC	24VDC
Maximum load current	25mA	12.5mA	50mA

∗ Lead wire length …… Switch connection side 0.5m
Load connection side 0.5m

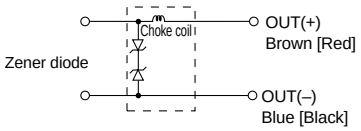
Contact protection box internal circuits

Lead wire colors inside [ ] are those prior to conformity with IEC standards.

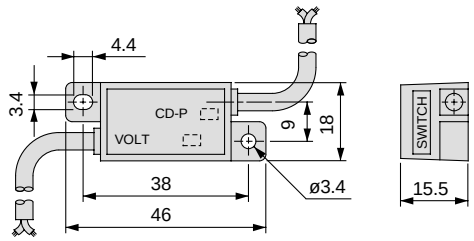
CD-P11



CD-P12



Contact protection box/Dimensions



Contact protection box/Connection

To connect a switch unit to a contact protection box, connect the lead wire from the side of the contact protection box marked SWITCH to the lead wire coming out of the switch unit.

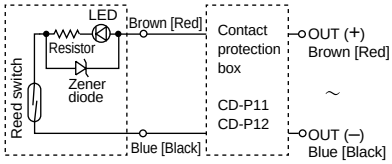
Moreover, the switch unit should be kept as close as possible to the contact protection box, with a lead wire length of no more than 1m.

Auto Switch Internal Circuits

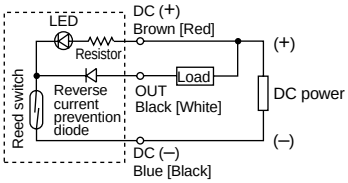
Lead wire colors inside [ ] are those prior to conformity with IEC standards.

Reed switches

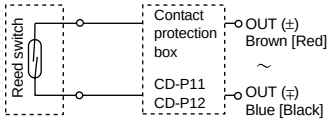
D-C73



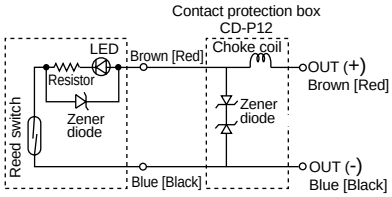
D-C76



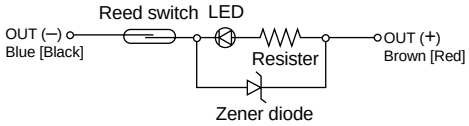
D-C80



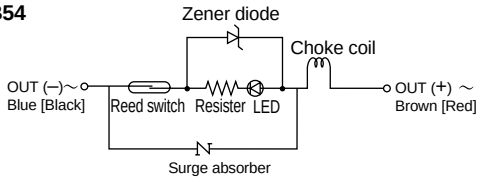
D-C73C



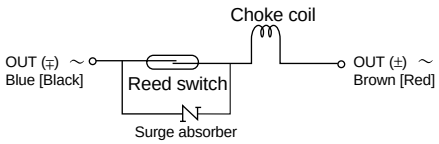
D-B53



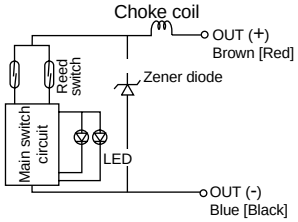
D-B54



D-B64



D-B59W



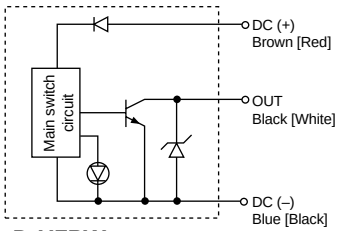
Series CNG
Auto Switch Specifications

Auto Switch Internal Circuits

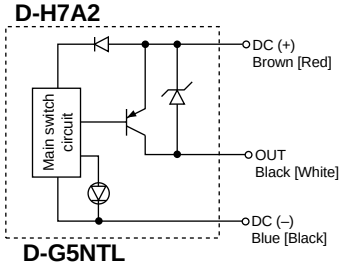
Lead wire colors inside [ ] are those prior to conformity with IEC standards.

Solid state switches

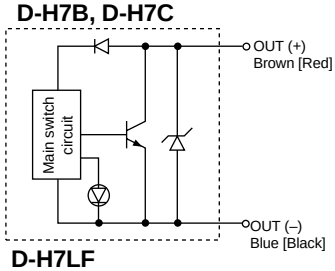
D-H7A1



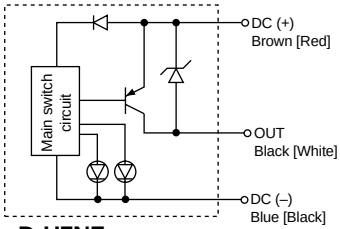
D-H7A2



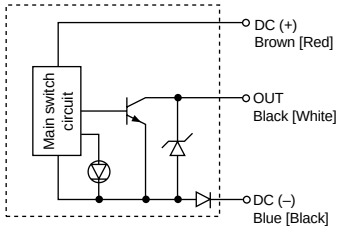
D-H7B, D-H7C



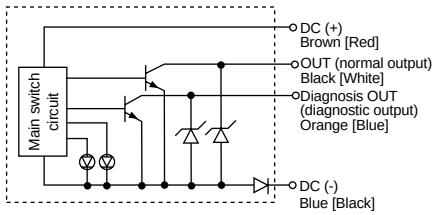
D-H7PW



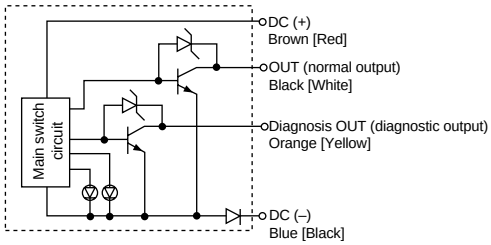
D-G5NTL



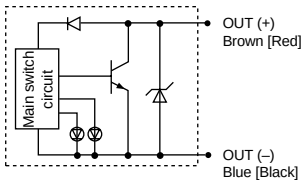
D-H7LF



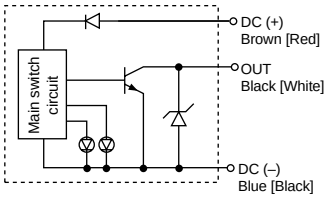
D-H7NF



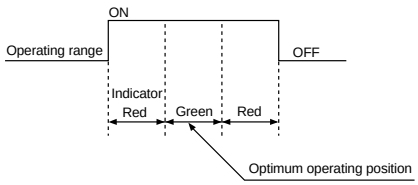
D-H7BAL, D-H7BW



D-H7NW



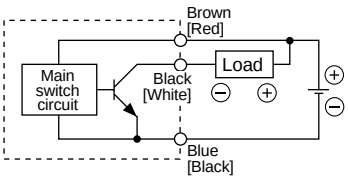
Indicator light/Display method



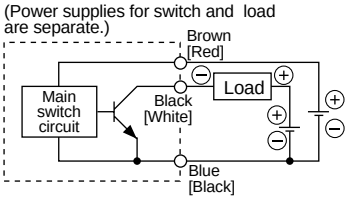
Series CNG
Auto Switch Connections and Examples

Basic Wiring

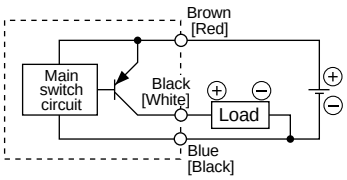
Solid state 3 wire, NPN



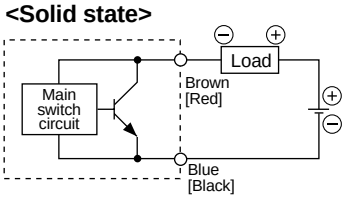
(Power supplies for switch and load are separate.)

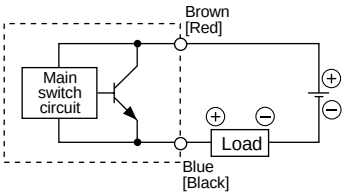


Solid state 3 wire, PNP

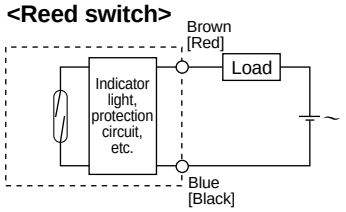


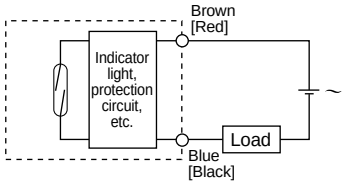
2 wire <Solid state>





2 wire <Reed switch>

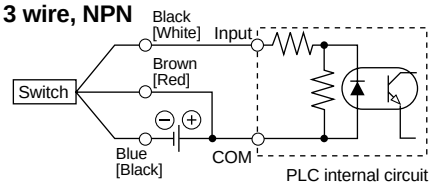




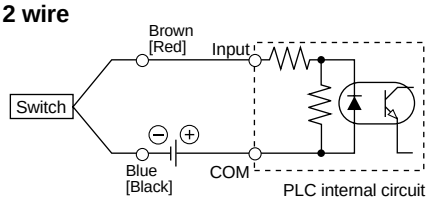
Examples of Connection to PLC

Sink input specifications

3 wire, NPN

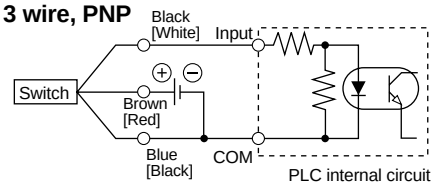


2 wire

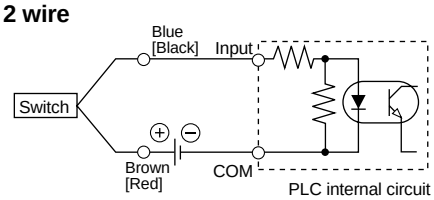


Source input specifications

3 wire, PNP



2 wire

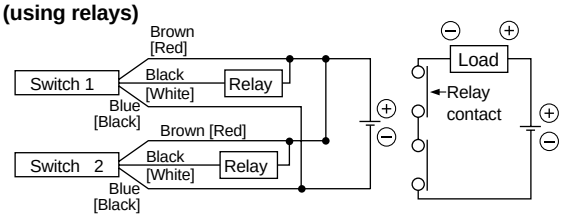


Connect according to the applicable PLC input specifications, as the connection method will vary depending on the PLC input specifications.

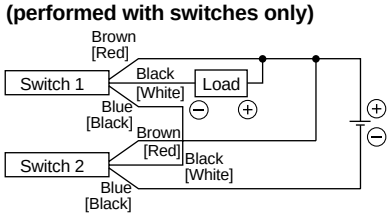
Connection Examples for AND (Series) and OR (Parallel)

3 wire

AND connection for NPN output (using relays)

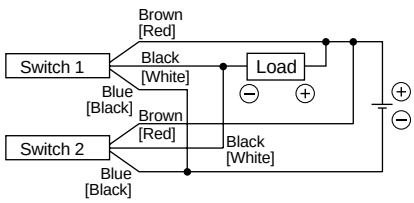


AND connection for NPN output (performed with switches only)

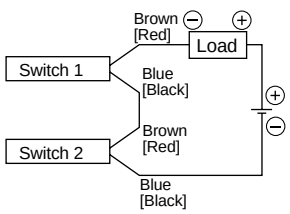


The indicator lights will light up when both switches are turned ON.

OR connection for NPN output



2 wire with 2 switch AND connection



When two switches are connected in series, a load may malfunction because the load voltage will decline when in the ON state.
The indicator lights will light up if both of the switches are in the ON state.

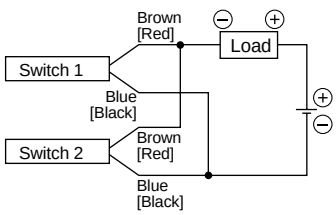
Load voltage at ON = $\frac{\text{Power supply voltage}}{} - \frac{\text{Residual voltage}}{} \times 2$ pcs.

= 24V – 4V x 2 pcs.

= 16V

Example: Power supply is 24VDC
Voltage decline in switch is 4V

2 wire with 2 switch OR connection



<Solid state>
When two switches are connected in parallel, malfunction may occur because the load voltage will increase when in the OFF state.

Load voltage at OFF = $\frac{\text{Leakage current}}{} \times 2$ pcs. $\times \frac{\text{Load impedance}}{}$

= 1mA x 2 pcs. x 3kΩ

= 6V

Example: Load impedance is 3kΩ
Leakage current from switch is 1mA

<Reed switch>
Because there is no current leakage, the load voltage will not increase when turned OFF, but due to the number of switches in the ON state, the indicator lights will sometimes get dark or not light up, because of dispersion and reduction of the current flowing to the switches.

Series CNG
Model Selection

Precautions on Model Selection

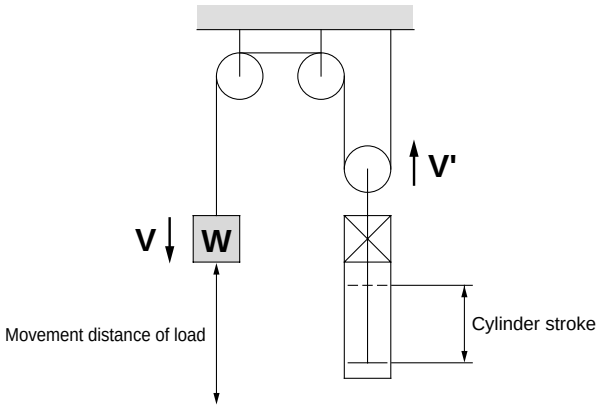
⚠Caution

1. In order that the originally selected maximum speed is not exceeded, be certain to use a speed controller to adjust the total movement distance of the load so that movement takes place in no less than the applicable movement time.

   The movement time is the time that is necessary for the load to travel the total movement distance from the start without any intermediate stops.

2. In cases where the cylinder stroke and the movement distance of the load are different (double speed mechanism, etc.), use the movement distance of the load for selection purposes.

Example)



Selection Example

- **Load weight:** m = 12kg
- **Movement distance:** st = 200mm
- **Movement time:** t = 0.8s
- **Load condition:** Vertical downward = Load in direction of rod extension
- **Operating pressure:** P = 0.4MPa

Step 1: From graph 1 find the maximum movement speed of the load

∴ Maximum speed V: approx. 350mm/s

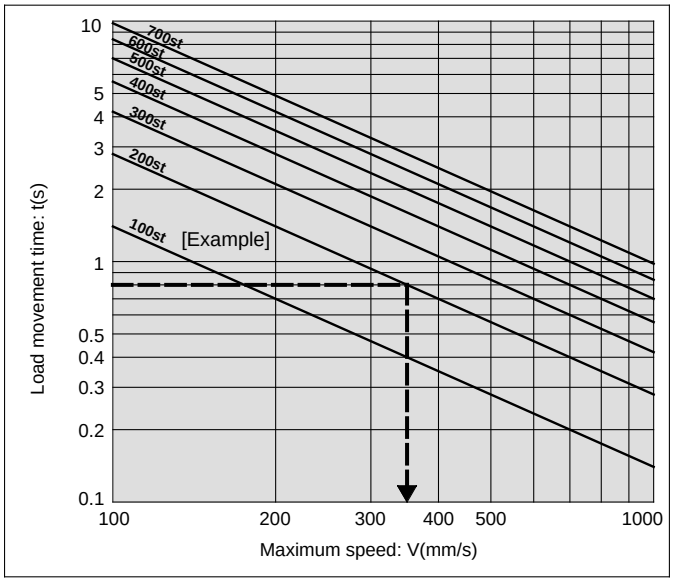
Step 2: Select Graph 6 based upon the load condition and operating pressure, and then from the intersection of the maximum speed V = 350mm/s found in Step 1, and the load weight m = 12kg

∴ ø32→ select a CNG32 or larger bore size.

Step 1 Find the maximum load speed: V.

Find the maximum load speed: V(mm/s) from the load movement time: t(s) and the movement distance: st(mm).

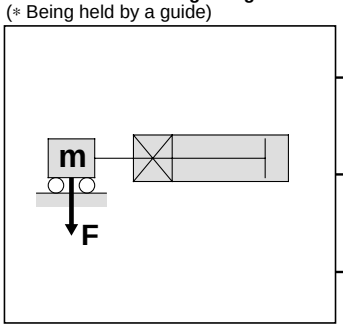
Graph 1

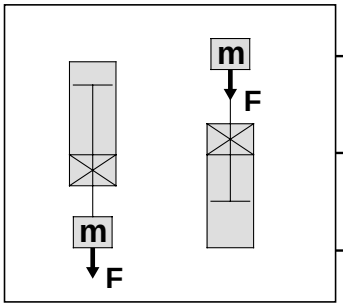


Step 2 Find the cylinder bore size.

Select a graph based upon the load condition and operating pressure, and then find the point of intersection for the maximum speed found in Step 1 and the load weight. Select the bore size on the line above the point of intersection.

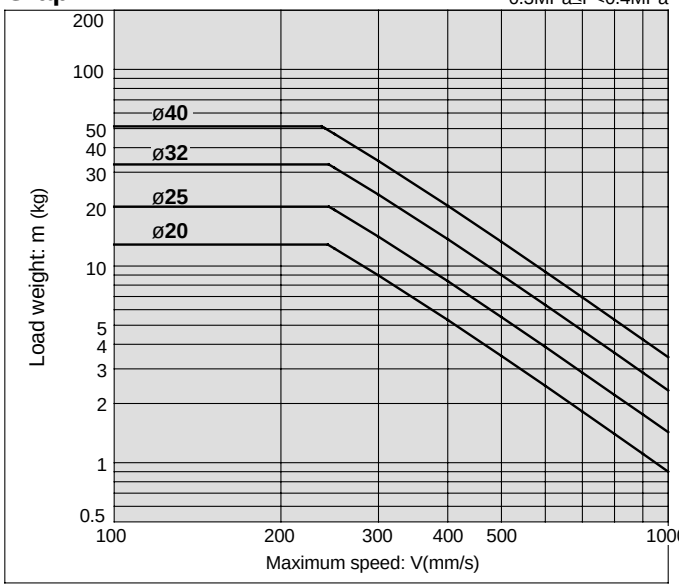
Load condition	Operating pressure	
Direction of load at right angle to rod (∗ Being held by a guide)	**0.3MPa ≤**	**Graph 2**
	0.4MPa ≤	**Graph 3**
	0.5MPa ≤	**Graph 4**
Load in direction of rod extension **Load in direction of rod retraction**	**0.3MPa ≤**	**Graph 5**
	0.4MPa ≤	**Graph 6**
	0.5MPa ≤	**Graph 7**



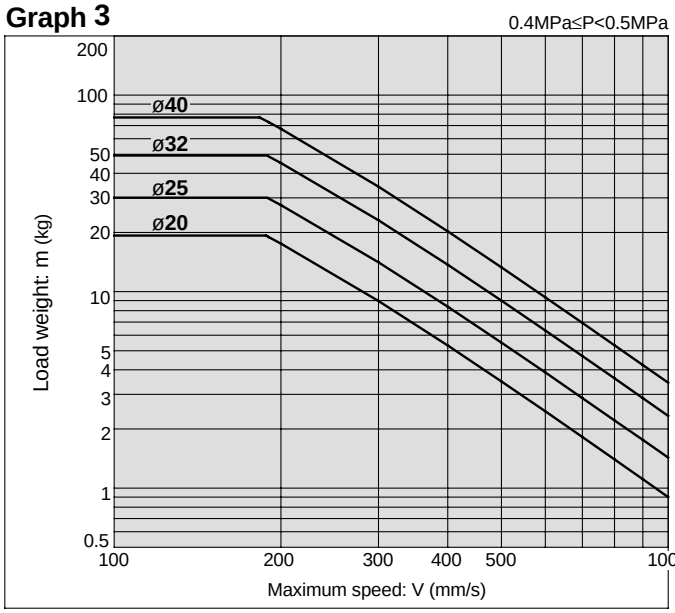


Selection Graphs

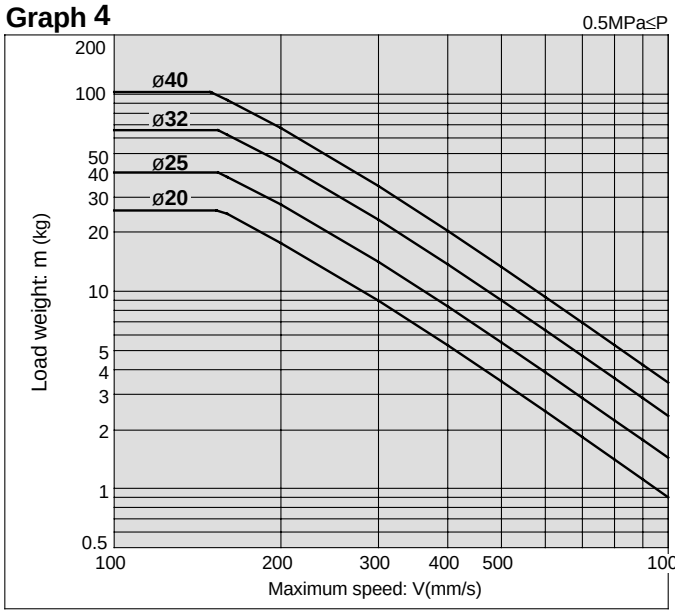
Graph 2



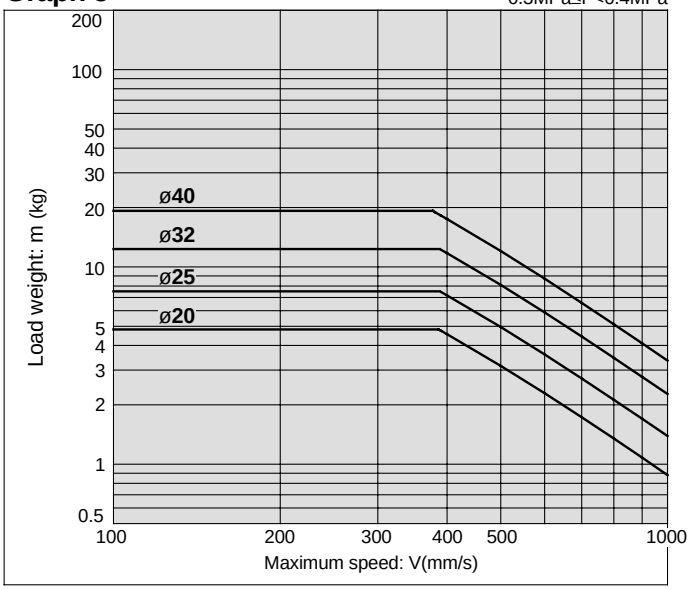
Graph 3



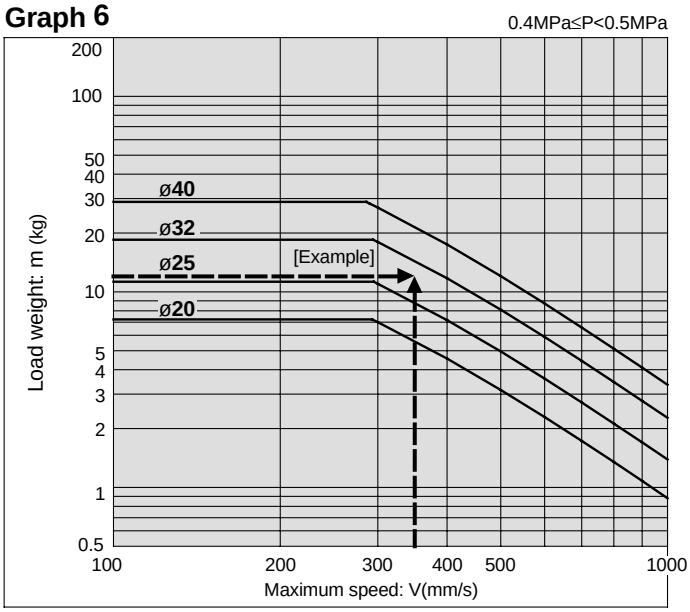
Graph 4



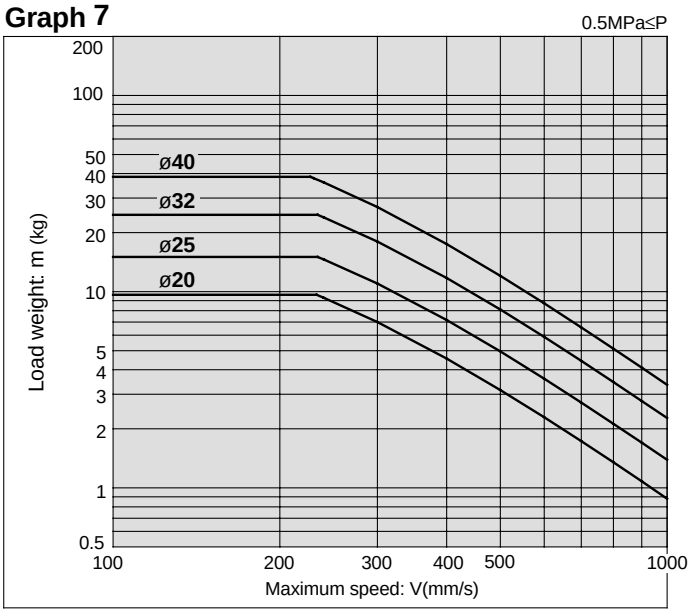
Graph 5



Graph 6



Graph 7



Series CNG

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: Pneumatic system axiom.

⚠ 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 an operator is unfamiliar with it. 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 CNG
Actuator Precautions 1
Be sure to read before handling.

Precautions on Design

⚠Warning

1. There is a possibility of dangerous 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 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.

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

4. A deceleration circuit or shock absorber, etc., 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.

5. 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.

6. 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 manual safety equipment.

Selection

⚠Warning

1. Check the specifications.

The products advertised in this catalog are designed according to use in industrial compressed air systems. If the products are used in conditions where pressure, temperature, etc., are out of specification, damage and/or malfunction may be caused. Do not use in these conditions.

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

⚠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 air 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.

Operate within a range such that damage will not occur when the piston having inertial force stops by striking the cover at the stroke end. Refer to the cylinder model selection procedure for the range within which damage will not occur.

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

4. Provide an intermediate support for cylinders having a long stroke length.

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

Mounting

⚠Caution

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

When not properly matched, problems may arise with the rod and tubing, 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, etc., 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 dents, 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 verify that the equipment can operate properly.

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

6. Instruction manual

The product should be mounted and operated after thoroughly reading the manual and understanding its contents.

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

Series CNG
Actuator Precautions 2

Be sure to read before handling.

Piping

⚠Caution

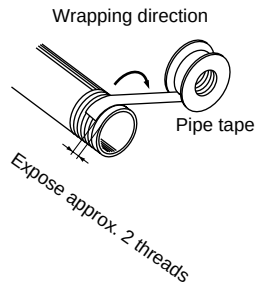
1. Preparation before piping

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 pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the pipe.



Cushions

⚠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 operate with the cushion needle in a fully closed condition.

This will cause damage to the seals.

Lubrication

⚠Caution

1. Lubrication of non-lube type cylinder

The cylinder is lubricated at the factory and can be used without any further lubrication.

However, in the event that it will be lubricated, use turbine oil class 1 (with no additives) ISO VG32.

Stopping lubrication later may lead to malfunction due to the loss of the original lubricant. Therefore, lubrication must be continued once it has been started.

Air Supply

⚠Warning

1. Use clean air.

If compressed air includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., 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 5μm or less.

2. Install an air dryer, after cooler or Drain Catch, etc.

Air that includes much condensate causes malfunction of valves and other pneumatic equipment. To prevent this, install an air dryer, after cooler or Drain Catch, etc.

3. Use the product within the range of specifications for fluid temperature and ambient temperature.

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

Refer to the "Compressed Air Cleaning Systems" catalog for details on compressed air quality.

Operating Environment

⚠Warning

1. Do not use in environments where there is a danger of corrosion.

Refer to the construction drawings regarding cylinder materials.

2. In dirty areas, such as dusty locations or where water, oil, etc. splash on the equipment, take suitable measures to protect the rod.

Maintenance

⚠Warning

1. Maintenance should be done according to the procedure indicated in the instruction manual.

If handled improperly, malfunction and damage of machinery or equipment may occur.

2. Removal of machinery and supply and exhaust of compressed air.

When machinery is removed, first check measures to prevent dropping of driven objects and run-away of equipment, etc. Then cut off the supply pressure and electric power, and exhaust all compressed air from the system.

When machinery is restarted, proceed carefully after confirming measures to prevent lurching of actuators.

⚠Caution

1. Drain flushing

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

Series CNG
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 of load current, 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:

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

In cases of high piston speed, the use of an auto switch (G5NT) with a built-in OFF delay timer (approx. 200ms) makes it possible to extend the load operating time.

4. Wiring should be kept as short as possible.

<Reed switch>

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.)

1) For an auto switch without a contact protection circuit, use a contact protection box when the wire length is 5m or longer.

2) Even if an auto switch has a built-in contact protection circuit, when the wiring is more than 30m long, it is not able to adequately absorb the rush current and its life may be reduced. It is again necessary to connect a contact protection box in order to extend its life. Please contact SMC in this case.

<Solid state switch>

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

5. Take precautions for the internal voltage drop of the switch.

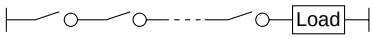
<Reed switch>

1) Switches with an indicator light (Except D-C76)

- 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.



- 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.

  Supply voltage − Internal voltage drop of switch > 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-C80).

<Solid state switch>

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 switch>

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.

Operating current of load (OFF condition) > 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 switch>

If driving a load such as a relay that generates a surge voltage, use a switch with a built-in contact protection circuit or use a contact protection box.

<Solid state switch>

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.

Series CNG
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 fastening torque.

When a switch is tightened beyond the range of fastening torque, the mounting screws, mounting bracket or switch may be damaged. On the other hand, tightening below the range of fastening torque may allow the switch to slip out of position.

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 a 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 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 including auto switches may malfunction due to noise from these other lines.

5. Do not allow short circuit of loads.

<Reed switch>

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 switch>

All models of PNP output type switches do not have built-in short circuit prevention circuits. If loads are short circuited, the switches will be instantly damaged.

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

6. Avoid incorrect wiring.

<Reed switch>

∗ A 24VDC switch with indicator light has polarity. The brown lead wire is (+) and the blue 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-C73, C73C
D-B53, B54

2) Note however, that in the case of 2 color indicator type auto switches (D-B59W), if the wiring is reversed, the switch will be in a normally ON condition.

<Solid state switch>

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 wire and the power supply line (–) is connected to the black 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

Series CNG
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, except for a few models, satisfy IEC standard IP67 construction (JIS C 0920: watertight construction), 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 air temperature changes, as they may be adversely affected.

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

<Reed switch>

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 switch>

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 switches. Avoid sources of surge generation and disorganized lines.

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

When a large amount of ferrous powder 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 a 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.

Series CNG
Specific Product Precautions 1

Be sure to read before handling.
Refer to pages 22 through 27 for safety instructions, actuator precautions and auto switch precautions.

Design of Equipment & Machinery

⚠Warning

1. Construct so that the human body will not come into direct contact with driven objects or the moving parts of locking cylinders.

Devise a safe structure by attaching protective covers that prevent direct contact with the human body, or in cases where there is a danger of contact, provide sensors or other devices to perform an emergency stop, etc. before contact occurs.

2. Use a balance circuit, taking cylinder lurching into consideration.

In cases such as an intermediate stop, where a lock is operated at a desired position within the stroke and air pressure is applied from only one side of the cylinder, the piston will lurch at high speed when the lock is released. In such situations, there is a danger of causing human injury by having hands or feet, etc. caught, and also a danger of causing damage to the equipment. In order to prevent this lurching, use a balance circuit such as the recommended air pressure circuits (p. 29).

Selection

⚠Warning

1. When in a locked condition, do not apply a load accompanied by an impact shock, strong vibration or turning force, etc.

Use caution, because an external action such as an impacting load, strong vibration or turning force, may damage the locking mechanism or reduce its life.

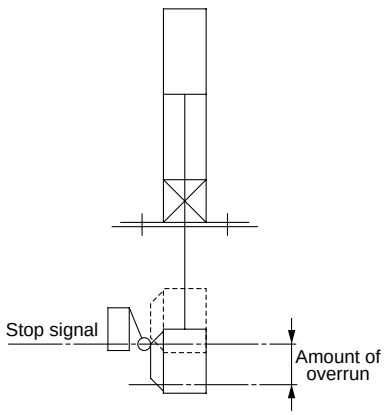
2. Consider stopping accuracy and the amount of overrun when an intermediate stop is performed.

Due to the nature of a mechanical lock, there is a momentary lag with respect to the stop signal, and a time delay occurs before stopping. The cylinder stroke resulting from this delay is the overrun amount. The difference between the maximum and minimum overrun amounts is the stopping accuracy.

- Place a limit switch before the desired stopping position, at a distance equal to the overrun amount.
- The limit switch must have a detection length (dog length) of the overrun amount + α**.**
- SMC's auto switches have operating ranges from 8 to 14mm (depending on the switch model).

  When the overrun amount exceeds this range, self-holding of the contact should be performed at the switch load side.

∗ Refer to page 2 regarding stopping accuracy.



Selection

⚠Warning

3. In order to further improve stopping accuracy, the time from the stop signal to the operation of the lock should be shortened as much as possible.

To accomplish this, use a device such as a highly responsive electric control circuit or solenoid valve driven by direct current, and place the solenoid valve as close as possible to the cylinder.

4. Note that stopping accuracy will be influenced by changes in piston speed.

When piston speed changes during the course of the cylinder stroke due to variations in the load or disturbances, etc., the dispersion of stopping positions will increase. Therefore, consideration should be given to establishing a standard speed for the piston just before it reaches the stopping position.

Moreover, the dispersion of stopping positions will increase during the cushioned portion of the stroke and during the accelerating portion of the stroke after the start of operation, due to the large changes in piston speed.

Mounting

⚠Warning

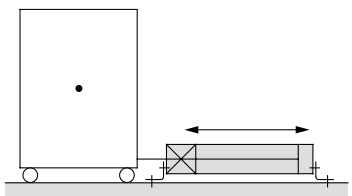
1. Be certain to connect the rod end to the load with the lock released.

- If connected when in the locked condition, a load greater than the turning force or holding force may operate on the piston rod and cause damage to the lock mechanism. The CNG series is equipped with an emergency unlocking mechanism, however, when connecting the rod end to the load this should be done with the lock released by simply connecting an air line to the unlocking port and supplying air pressure of 0.25MPa or more.

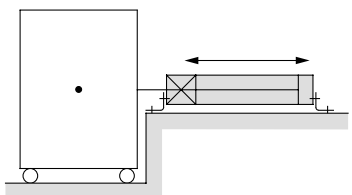
⚠Caution

1. Do not apply an offset load to the piston rod.

Particular care should be taken to match the load's center of gravity with the center of the cylinder shaft. When there is a large discrepancy, the piston rod may be subjected to uneven wear or damage due to the inertial moment during locking stops.



X Load center of gravity and cylinder shaft center are not matched.



○ Load center of gravity and cylinder shaft center are matched.

Note) Can be used if all of the generated moment is absorbed by an effective guide.

Series CNG
Specific Product Precautions 2

Be sure to read before handling.
Refer to pages 22 through 27 for safety instructions, actuator precautions and auto switch precautions.

Adjustment

⚠Caution

1. Adjust the cylinder's air balance.

Balance the load by adjusting the air pressure in the front and rear sides of the cylinder with the load connected to the cylinder and the lock released. Lurching of the cylinder when unlocked can be prevented by carefully adjusting this air balance.

2. Adjust the mounting positions of the detectors on auto switches, etc.

When intermediate stops are to be performed, adjust the mounting positions of detectors on auto switches, etc., taking into consideration the overrun amount with respect to the desired stopping positions.

Air Pressure Circuits

⚠Warning

1. Be certain to use an air pressure circuit which will apply balancing pressure to both sides of the piston when in a locked stop.

In order to prevent cylinder lurching after a locked stop, when restarting or when manually unlocking, a circuit should be used which will apply balancing pressure to both sides of the piston, thereby canceling the force generated by the load in the direction of piston movement.

2. Use a solenoid valve for unlocking which has a large effective area, as a rule 50% or more of the effective area of the cylinder drive solenoid valve.

The larger the effective area is, the shorter the locking time will be (the overrun amount will be shorter), and stopping accuracy will be improved.

3. Place the solenoid valve for unlocking close to the cylinder, and no farther than the cylinder drive solenoid valve.

The less distance there is from the cylinder (the shorter the piping), the shorter the overrun amount will be, and stopping accuracy will be improved.

Air Pressure Circuits

⚠Warning

4. Allow at least 0.5 seconds from a locked stop (intermediate stop of the cylinder) until release of the lock.

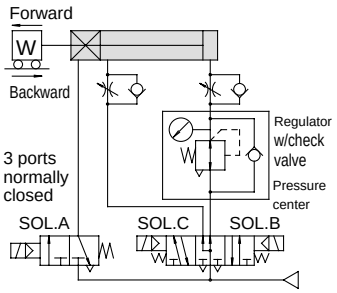
When the locked stop time is too short, the piston rod (and load) may lurch at a speed greater than the control speed of the speed controller.

5. When restarting, control the switching signal for the unlocking solenoid valve so that it acts before or at the same time as the cylinder drive solenoid valve.

If the signal is delayed, the piston rod (and load) may lurch at a speed greater than the control speed of the speed controller.

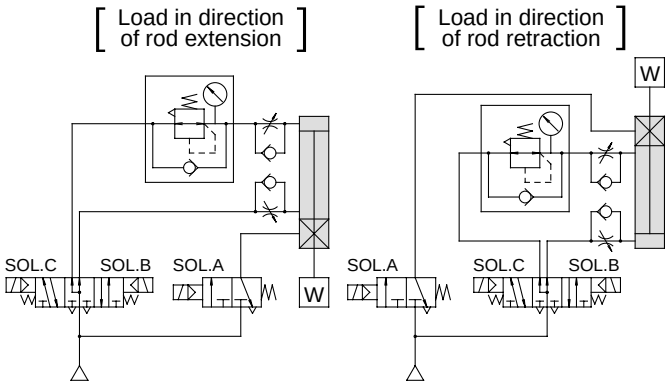
6. Basic circuits.

1. [Horizontal]



SOL.A	SOL.B	SOL.C	Action	
ON	ON	OFF	Forward	
OFF	OFF	OFF	Locked stop	0.5s or more
ON	OFF	OFF	Unlocked	0 to 0.5s
ON	ON	OFF	Forward	
ON	OFF	ON	Backward	
OFF	OFF	OFF	Locked stop	0.5s or more
ON	OFF	OFF	Unlocked	0 to 0.5s
ON	OFF	ON	Backward	

2. [Vertical]



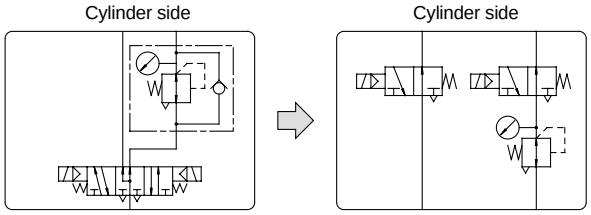
Series CNG
Specific Product Precautions 3

Be sure to read before handling.
Refer to pages 22 through 27 for safety instructions, actuator precautions and auto switch precautions.

Air Pressure Circuits

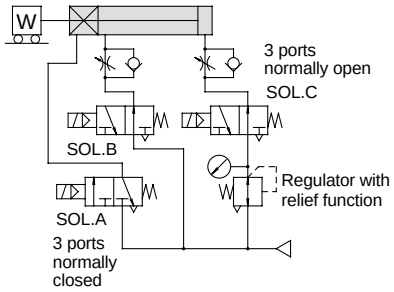
⚠Caution

1. A 3 position pressure center solenoid valve and regulator with check valve can be replaced with two 3 port normally open valves and a regulator with relief function.



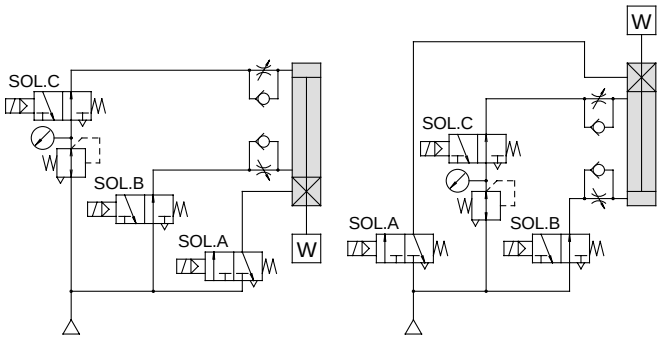
[Example]

1. [Horizontal]



2. [Vertical]

[Load in direction of rod extension] [Load in direction of rod retraction]



Manual Unlocking

⚠Warning

1. Never operate the unlocking cam until safety has been confirmed. (Do not turn to the FREE side.)

a) When unlocking is performed with air pressure applied to only one side of the cylinder, the moving parts of the cylinder will lurch at high speed causing a serious hazard.

b) When unlocking is performed, be sure to confirm that personnel are not within the load movement range and that no other problems will occur if the load moves.

2. Before operating the unlocking cam, exhaust any residual pressure which is in the system.

Manual Unlocking

⚠Warning

3. Take measures to prevent the load from dropping when unlocking is performed.

a) Perform work with the load in its lowest position.

b) Use supports, etc. to prevent the load from dropping.

⚠Caution

1. The unlocking cam is an emergency unlocking mechanism only.

During an emergency when the air supply is stopped or cut off, this is used to alleviate a problem by forcibly pushing back the release piston and brake spring to release the lock.

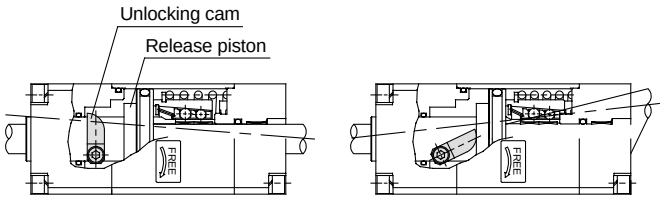
2. When installing the cylinder into equipment or performing adjustments, etc., be sure to apply air pressure of 0.25MPa or more to the unlocking port, and do not perform work using the unlocking cam.

3. When releasing the lock with the unlocking cam, it must be noted that the internal resistance of the cylinder will be high, unlike normal unlocking with air pressure.

Bore size (mm)	Cylinder internal resistance N	Cam operating torque (standard) N·m	Max. cam operating torque N·m	Applicable hex. wrench size
20	24.6	1.0	2.3	Size 3
25	38.2	2.5	4.7	Size 3
32	62.7	3.0	4.7	Size 3
40	98	4.0	8.2	Size 4

4. Be sure to operate the unlocking cam on the FREE side (clockwise direction), and do not turn with a torque greater than the maximum cam operating torque. There is a danger of damaging the unlocking cam if it is turned excessively.

5. For safety reasons, the unlocking cam is constructed so that it cannot be fixed in the unlocked condition.



Locked condition Unlocked condition

[Principle]
If the unlocking cam is turned in a clockwise direction with a hexagon wrench, the release piston is pushed back and the lock is released. Further, if the unlocking cam is not held it will return to its original position and the unit will lock again. Therefore, the unlocking cam must be held in position for as long as unlocking is required.

Series CNG
Specific Product Precautions 4

Be sure to read before handling.
Refer to pages 22 through 27 for safety instructions, actuator precautions and auto switch precautions.

Maintenance

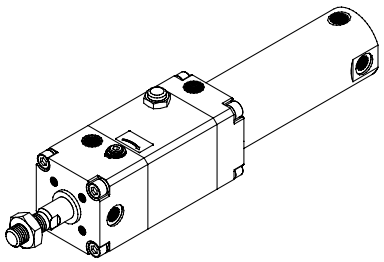
⚠ Caution

1. Series CNG lock units are replaceable.
(However, please note that lock units cannot be replaced in the case of long stroke specifications.)
To order replacement lock units for the CNG series, use the order numbers given in the table below.

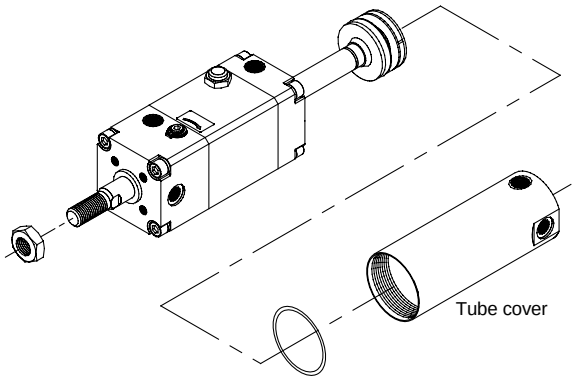
Bore size (mm)	Lock unit order number	
	Rubber bumper type	Air cushion type
20	CNGN20D-UA	CNGA20D-UA
25	CNGN25D-UA	CNGA25D-UA
32	CNGN32D-UA	CNGA32D-UA
40	CNGN40D-UA	CNGA40D-UA

2. Replacement of lock units.
1) Remove the lock unit by securing the square section of the rod cover or the wrench flats of the tube cover in an apparatus such as a vice, and then loosening the other end with a spanner or adjustable angle wrench, etc.
See the table below for the dimensions of the square section and the wrench flats.

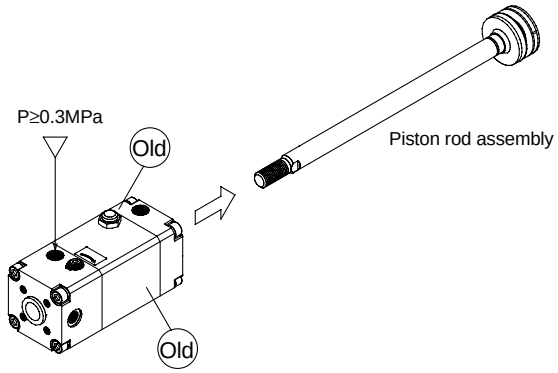
Bore size (mm)	Rod cover square section (mm)	Tube cover wrench flats (mm)
20	38	24
25	45	29
32	45	35.5
40	52	44



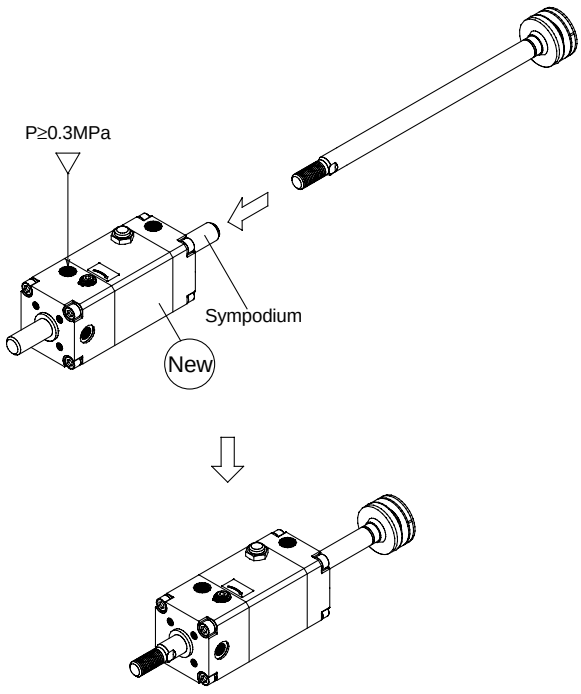
2) Remove the tube cover.



3) Apply compressed air of 0.3MPa or more to the unlocking port, and pull out the piston rod assembly.



4) Similarly apply compressed air of 0.3MPa or more to the unlocking port of the new lock unit, and replace the sympodium with the previous piston rod assembly.



5) Reassemble by reversing the procedure in steps 1) and 2).
When retightening the sections, turn approximately 2° past their position prior to disassembly.

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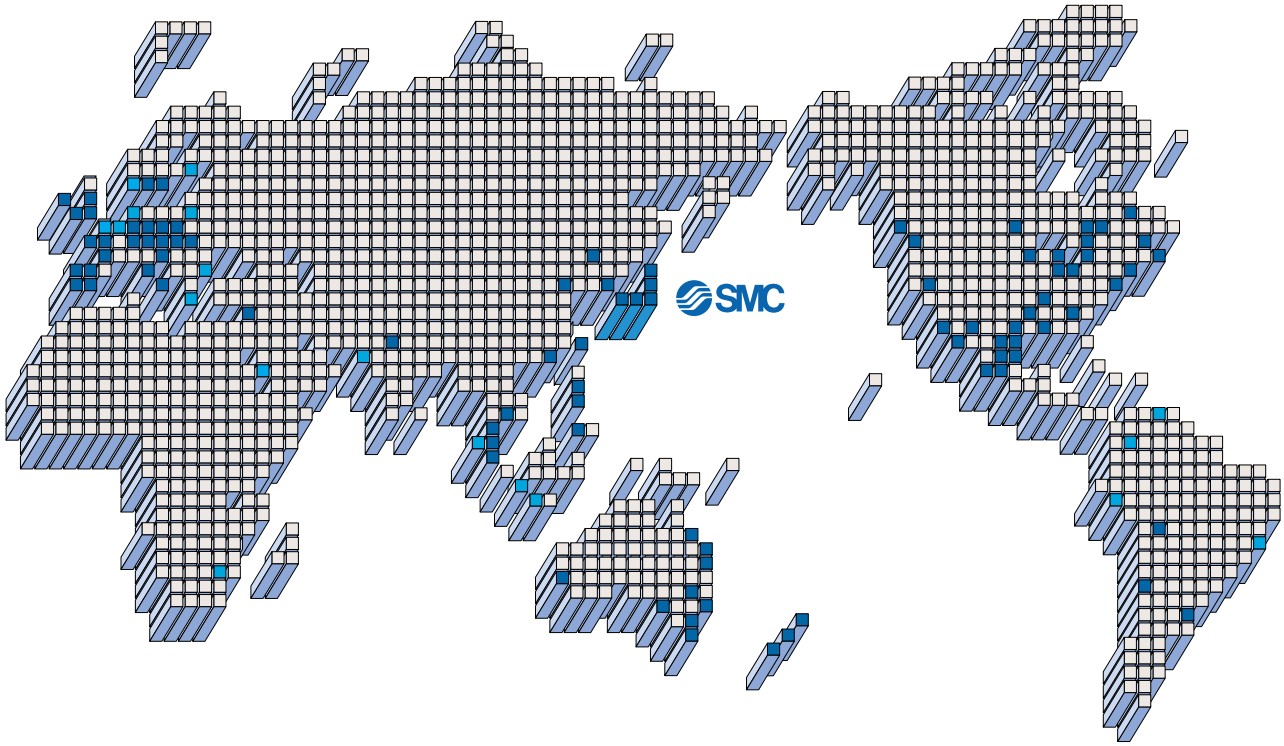

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