CAT.ES110-11 A

SMC

Hydraulic Cylinder
7MPa Nominal Pressure
Series CHN

ø20, ø25, ø32, ø40

Our Series CHN stainless steel tube hydraulic cylinder comes in four small bore sizes and can handle nominal pressures of up to 7MPa.

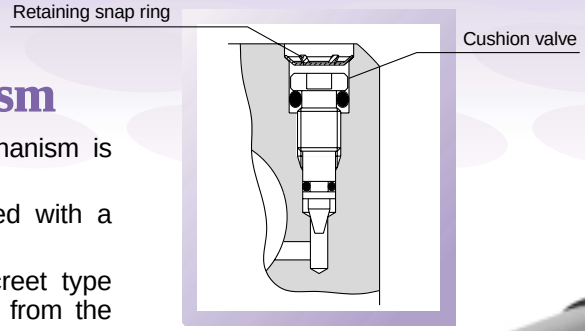
Our stainless steel tube hydraulic cylinder comes in 4 small bore sizes that can accommodate up to 7MPa of nominal pressure.

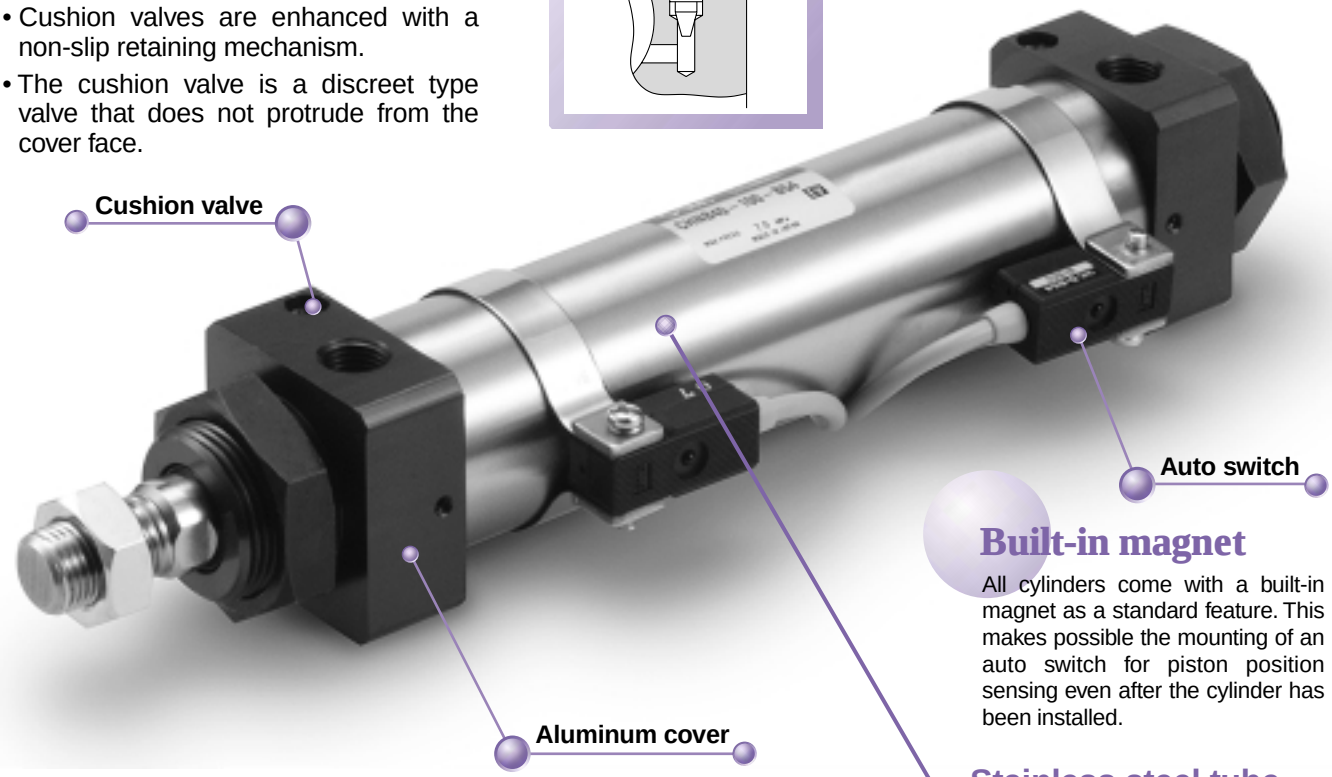
Series CHN

ø20, ø25, ø32, ø40

Equipped with cushion mechanism

- A cushion seal system mechanism is now a standard feature.
- Cushion valves are enhanced with a non-slip retaining mechanism.
- The cushion valve is a discreet type valve that does not protrude from the cover face.



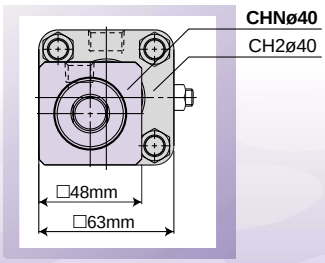


Built-in magnet

All cylinders come with a built-in magnet as a standard feature. This makes possible the mounting of an auto switch for piston position sensing even after the cylinder has been installed.

Reduced cross sectional area

When compared to the same size tie-rod cylinder, the cross sectional area of our Series CHN cylinder projects less than 45%, thereby attaining a better space savings.



Light weight

Using aluminum alloy for both the rod cover and head cover reduces overall weight.

Model	Weight (kg)
CHNB20-100	0.51
CHNB25-100	0.63
CHNB32-100	0.89
CHNB40-100	1.51

Basic type with a 100 mm stroke

Series Variations

Series	Nominal pressure	Bore size (mm)	Mounting bracket	Auto Switch
CHN	7.0MPa	20 25 32 40	Basic type Axial foot type Front flange type Rear flange type Single clevis type	Band mounting type Reed type Solid state type

7MPa

Hydraulic Cylinder
Series CHN
ø20, ø25, ø32, ø40

How to Order

CHN [L] [25] — [100] — [C73] [ ]

Mounting bracket

B	Basic type
L	Axial foot type
F	Front flange type
G	Rear flange type
C	Single clevis type

Bore size

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

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

Auto switch type

Nil	Without auto switch

∗ Select applicable auto switches from the table below.

Number of auto switches

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

Applicable auto switches: Refer to "Best Pneumatics 2" for detailed auto switch specifications. Refer to pages 15 and 16 for auto switch circuits.

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage DC	Load voltage AC	Auto switch model	Lead wire length (m)∗ 0.5 (Nil)	3 (L)	5 (Z)	None (N)	Applicable load	
Reed switch	—	Grommet	Yes	3-wire (NPN equiv.)	5V	—	**C76**	●	●	—	—	IC circuit	—
				2-wire	12V	—	**B53**	●	●	●	—	—	PLC
						200V or less	**B54**	●	●	●	—	—	Relay PLC
			No				**B64**	●	●	—	—		
			Yes			100V	**C73**	●	●	●	—		
			No		5V, 12V	100V or less	**C80**	●	●	—	—	IC circuit	
		Connector	Yes		24V 12V	—	**C73C**	●	●	●	●	—	
			No		5V, 12V	24V	**C80C**	●	●	●	●	IC circuit	
		Terminal conduit	Yes		12V	—	**A33**	—	—	—	●	—	PLC
		DIN terminal			12V	100V, 200V	**A34**	—	—	—	●	—	Relay PLC
							A44	—	—	—	●	—	
	Diagnostic indication (2-color display)	Grommet			—	—	**B59W**	●	●	—	—	—	
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24V 5V, 12V	—	**H7A1**	●	●	○	—	IC circuit	Relay PLC
				3-wire (PNP)			**H7A2**	●	●	○	—		
				2-wire	12V		**H7B**	●	●	○	—	—	
		Connector					**H7C**	●	●	●	●		
		Terminal conduit		3-wire (NPN)	5V, 12V		**G39**	—	—	—	●	IC circuit	
				2-wire	12V		**K39**	—	—	—	●	—	
	Diagnostic indication (2-color display)	Grommet		3-wire (NPN)	5V, 12V		**H7NW**	●	●	○	—	IC circuit	
				3-wire (PNP)			**H7PW**	●	●	○	—		
				2-wire	12V		**H7BW**	●	●	○	—	—	
	Water resistant (2-color display)						**H7BA**	—	●	○	—		
	With timer			3-wire (NPN)	5V, 12V		**G5NT**	—	●	○	—	IC circuit	
	With diagnostic output (2-color display)			4-wire (NPN)			**H7NF**	●	●	○	—		
	Latch type with diagnostic output (2-color display)				—		**H7LF**	●	●	○	—	—	

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

Notes) • Solid state switches marked "○" are produced upon receipt of order.
• You do not need to specify "N" (i.e., without lead wire) for D-A3□, D-A44, D-G39, and D-K39. This is the only standard specification automatically available for these models.

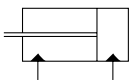
Specifications

Action	Double acting/Single rod
Fluid	Hydraulic fluid
Nominal pressure	7MPa
Proof pressure	10.5MPa
Maximum allowable pressure	9MPa
Minimum operating pressure	0.3MPa
Ambient and fluid temperature	Without auto switch: –10° to 80°C
	With auto switch: –10° to 60°C
Piston speed	8 to 300mm/s
Cushion	Cushion seal
Rod end thread	Male thread
Thread tolerance	JIS class 2
Stroke length tolerance	to 250mm $^{+1.0}_{0}$ 251 to 800mm $^{+1.4}_{0}$
Mounting types	Basic type, Axial foot type Rear flange type, Front flange type Single clevis type

Note) Refer to page 26 for definitions of terms related to pressure.

Accessories

JIS symbol



Mounting types		Basic	Axial foot	Rear flange	Front flange	Single clevis
Standard	**Mounting nut**	● (2 pcs.)	● (2 pcs.)	● (1 pc.)	● (1 pc.)	—
	Rod end nut	●	●	●	●	●
Option	**Clevis pin**	—	—	—	—	—
	Single knuckle joint	●	●	●	●	●
	Double knuckle joint (with pin)	●	●	●	●	●
	Knuckle bracket	●	●	●	●	●

Standard Strokes

Refer to page 3 for minimum strokes for auto switch mounting.

Bore size (mm)	Standard strokes (mm)	Long stroke
20	25 to 300	800
25	25 to 400	
32	25 to 500	
40		

∗ Standard strokes above have a minimal delivery time. Consult with SMC for the manufacture of strokes other than the above.

Hydraulic Fluid Compatibility

Hydraulic fluid	Compatibility
Standard mineral hydraulic fluid	Compatible
W/O hydraulic fluids	Compatible
O/W hydraulic fluids	Compatible
Water/Glycol hydraulic fluids	∗
Phosphate hydraulic fluids	Not compatible

∗ Consult with SMC.

Mounting Brackets: Part Nos.

Bore size (mm)	20	25	32	40
Axial foot∗	CHN-L020	CHN-L025	CHN-L032	CHN-L040
Flange	CHN-F020	CHN-F025	CHN-F032	CHN-F040

∗ When ordering the axial foot type, order 2 pieces for each cylinder.

Auto Switch Mounting Brackets: Part Nos. (incl. band & screws)

Bore size (mm)	Auto switch models		
	D-C7, D-C8 D-H7	D-B5, D-B6 D-G5, D-K5	D-A3, D-A4
20	BMA2-020	BA-01	BD1-01M
25	BHN3-025	BHN2-025	BD1-02M
32	BHN3-032	BGS1-032	BHN1-032
40	BHN3-040	BH2-040	BDS-04M

[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: D-B5, D-B6, D-G5, and D-K5
BBA4: D-C7, D-C8, D-H7

∗ When 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.

Minimum Strokes for Auto Switch Mounting

(mm)

Auto switch models	No. of auto switches				
	2 pcs.		"n" pcs.		1 pc.
	Different sides	Same side	Different sides	Same side	
D-C7 **D-C8**	15	50	$15 + 45\left(\frac{n-2}{2}\right)$ (n = 2, 4, 6 ···)	50 + 45 (n – 2) (n = 2, 3, 4, 5 ···)	10
D-H7□ **D-H7□W** **D-H7BAL** **D-H7NF**	15	60		60 + 45 (n – 2) (n = 2, 3, 4, 5 ···)	10
D-C73C **D-C80C** **D-H7C**	15	65	$15 + 50\left(\frac{n-2}{2}\right)$ (n = 2, 4, 6 ···)	65 + 50 (n – 2) (n = 2, 3, 4, 5 ···)	10
D-H7LF	20	65	$20 + 50\left(\frac{n-2}{2}\right)$ (n = 2, 4, 6 ···)		10
D-B5 **D-B6**	15	75	$15 + 50\left(\frac{n-2}{2}\right)$ (n = 2, 4, 6 ···)	75 + 55 (n – 2) (n = 2, 3, 4, 5 ···)	10
D-B59W	20	75	$20 + 50\left(\frac{n-2}{2}\right)$ (n = 2, 4, 6 ···)		15
D-A3 **D-G39** **D-K39** **D-A44**	35	100	35 + 30 (n – 2) (n = 2, 3, 4, 5 ···)	100 + 100 (n – 2) (n = 2, 3, 4, 5 ···)	10

n: Number of auto switches

Theoretical Output

Unit (N)

Bore size (mm)	Rod size (mm)	Operating direction	Piston area (mm^2)	Operating pressure (MPa)			
				1	**3**	**5**	**7**
20	10	OUT	314	314	942	1570	2198
		IN	235	235	705	1175	1645
25	12	OUT	490	490	1470	2450	3430
		IN	377	377	1131	1885	2639
32	16	OUT	804	804	2412	4020	5628
		IN	603	603	1809	3015	4221
40	18	OUT	1256	1256	3768	6280	8792
		IN	1002	1002	3006	5010	7014

Theoretical output (N) = Pressure (MPa) x Piston area (mm^2)

Weights

(kg)

Bore size (mm)		**20**	**25**	**32**	**40**
Basic weight	**Basic type**	0.27	0.37	0.53	1.05
	Axial foot type	0.51	0.63	0.91	1.59
	Flange type	0.36	0.54	0.72	1.26
	Clevis type	0.25	0.45	0.67	1.00
Additional weight per 50mm		0.12	0.13	0.18	0.23

- Calculation method
  (Example) CHNL20–100
  (Foot type, ø20, 100mm stroke)
- Basic weight ····· 0.51kg
- Additional weight ····· 0.12/50mm
- Cylinder stroke ····· 100mm
  0.51 + 0.12/50 x 100 = 0.75kg

⚠ Specific Product Precautions

Be sure to read before handling. Refer to pages 25 through 31 for safety instructions, hydraulic cylinder precautions and auto switch precautions.

⚠Caution

When operating a cylinder for the first time, make sure to release the air at low pressure. When the air release is complete, operate the cylinder at reduced pressure, gradually increasing it to the normal operating pressure. However, the piston speed at this time should be adjusted to the minimum speed.

Mounting

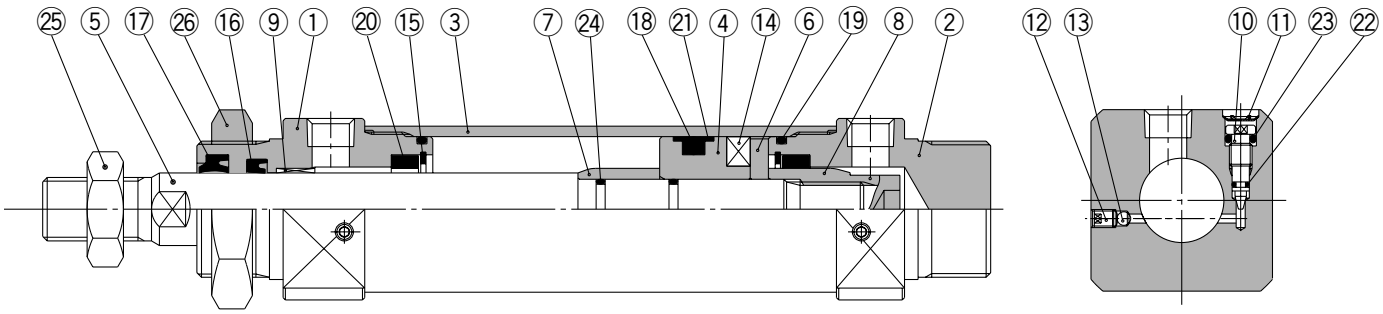
⚠Caution

1. When mounting with bracket mounting nuts, tighten them using the tightening torques in the table below as a guide.

Bore size (mm)	Mounting nut thread	Mounting nut width across flats (mm)	Tightening torque (N·m)
20	M22 x 1.5	26	45
25	M24 x 1.5	32	60
32	M30 x 1.5	38	85
40	M33 x 1.5	41	110

2. When mounted with one side attached and one side unattached (basic type and flange type) and operating at high speed, bending moment acts on the cylinder due to oscillation at the stroke end, which may cause cylinder damage. In this case, install brackets to suppress the oscillation of the cylinder body, or reduce the piston speed enough so that the cylinder body does not oscillate at the stroke end.

Construction



Parts list

No.	Description	Material	Note
1	**Rod cover**	Aluminum alloy	Black anodized
2	**Head cover**	Aluminum alloy	Black anodized
3	**Cylinder tube**	Stainless steel	
4	**Piston**	Stainless steel	
5	**Piston rod**	ø20, 25: Stainless steel ø32, 40: Carbon steel	Hard chromium electro plating
6	**Magnet plate**	Stainless steel	
7	**Cushion ring A**	Carbon steel	
8	**Cushion ring B**	Carbon steel	
9	**Bushing**	Lead bronze	
10	**Cushion valve**	Carbon steel	
11	**Snap ring**	Spring steel	
12	**Air release valve**	Alloy steel	
13	**Check ball**	Bearing steel	

No.	Description	Material	Note
14	**Magnet**	—	
15	**Snap ring**	Spring steel	
16	**Rod seal**	NBR	
17	**Scraper**	NBR	
18	**Piston seal**	NBR	
19	**Tube gasket**	NBR	
20	**Cushion seal**	—	
21	**Back-up ring**	Resin	
22	**Cushion valve seal A**	NBR	
23	**Cushion valve seal B**	NBR	
24	**Piston gasket**	NBR	
25	**Rod end nut**	Carbon steel	
26	**Mounting nut**	Carbon steel	

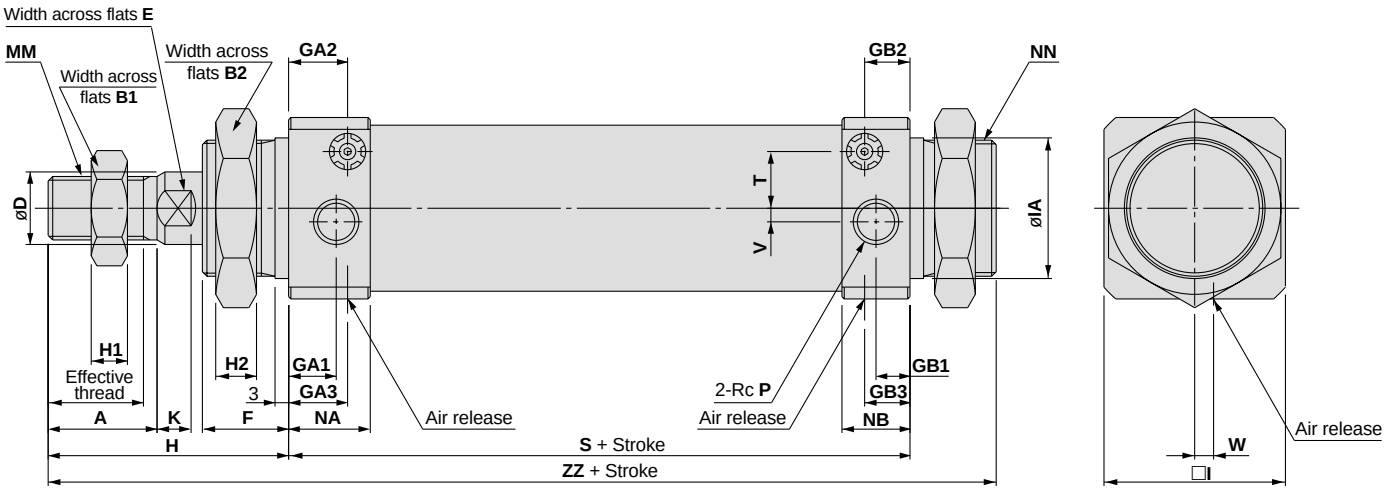
Replacement parts: Seal kits

Bore size (mm)	Seal kit no.	Kit components
20	**CHN20-PS**	Nos.16 to 20, and 22 from the chart
25	**CHN25-PS**	
32	**CHN32-PS**	
40	**CHN40-PS**	

∗ Seal kits consist of items 16 to 20, and 22, and can be ordered by using the seal kit number for each bore size.

Dimensions

Basic type: CHNB



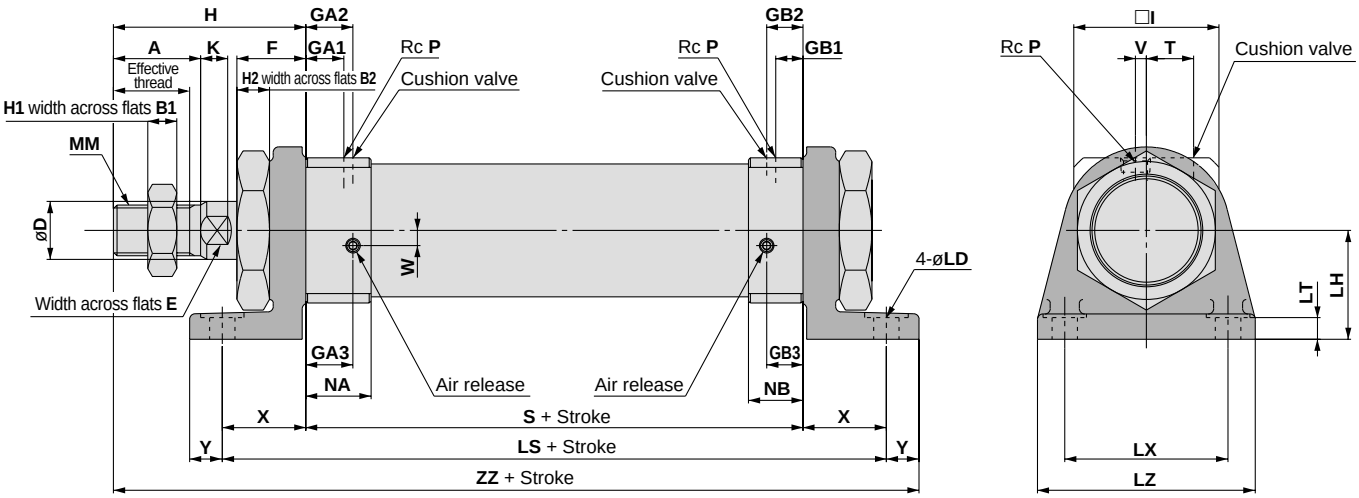
(mm)

Bore size (mm)	Stroke range (mm)	Effective thread length (mm)	A	B1	B2	D	E	F	GA1	GA2	GA3	GB1	GB2	GB3	H	H1	H2	I
20	25 to 300	15.5	18	13	26	10	8	16	10	12	12	8	10	10	41	5	8	31
25	25 to 400	19.5	22	17	32	12	10	16	10	12	12	8	10	10	46	6	8	34
32	25 to 500	21	24	22	38	16	14	19	11	13	13	8	10	10	53	8	9	40
40	25 to 500	21	24	24	41	18	16	21	12	17	17	11	16	16	54	10	11	48

(mm)

Bore size (mm)	IA	K	MM	NA	NB	NN	P	S	T	V	W	ZZ
20	23f8 $^{-0.020}_{-0.053}$	5	M8 x 1.25	17	15	M22 x 1.5	1/8	81	9.5	4.5	6.5	138
25	25f8 $^{-0.020}_{-0.053}$	5.5	M10 x 1.25	17	15	M24 x 1.5	1/8	81	11	3.5	5.5	143
32	31f8 $^{-0.025}_{-0.064}$	7.5	M14 x 1.5	18	15	M30 x 1.5	1/8	87	13	3	4	159
40	34f8 $^{-0.025}_{-0.064}$	7.5	M16 x 1.5	22	21	M33 x 2	1/4	108	16	5	0	183

Axial foot type: CHNL



(mm)

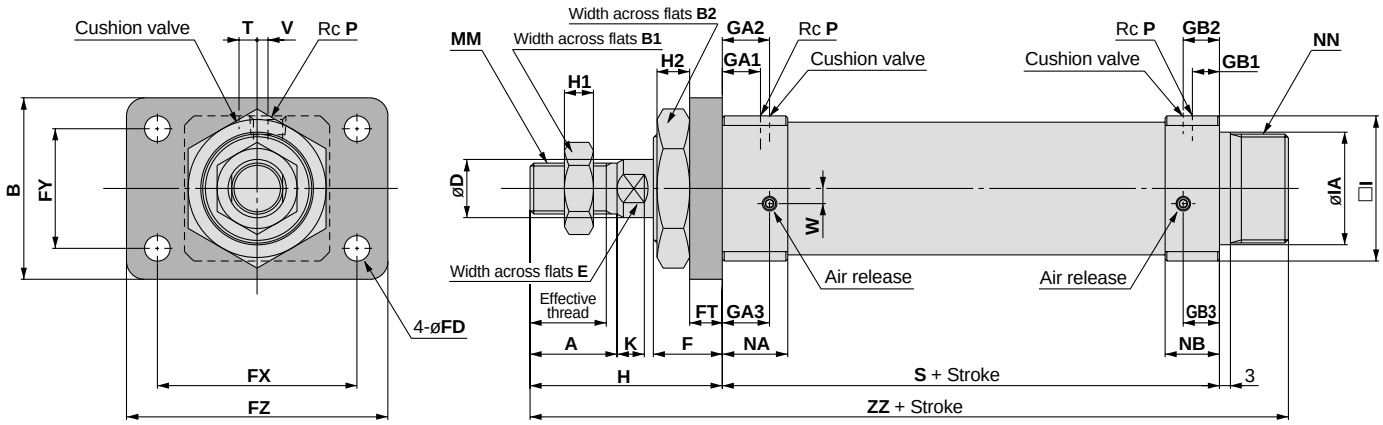
Bore size (mm)	Stroke range (mm)	Effective thread length (mm)	A	B1	B2	D	E	F	GA1	GA2	GA3	GB1	GB2	GB3	H	H1	H2	I	K
20	25 to 300	15.5	18	13	26	10	8	16	10	12	12	8	10	10	41	5	8	31	5
25	25 to 400	19.5	22	17	32	12	10	16	10	12	12	8	10	10	46	6	8	34	5.5
32	25 to 500	21	24	22	38	16	14	19	11	13	13	8	10	10	53	8	9	40	7.5
40	25 to 500	21	24	24	41	18	16	21	12	17	17	11	16	16	54	10	11	48	7.5

(mm)

Bore size (mm)	LD	LH	LS	LT	LX	LZ	MM	NA	NB	P	S	T	V	W	X	Y	ZZ
20	7	25	121	5.5	40	55	M8 x 1.25	17	15	1/8	81	9.5	4.5	6.5	20	9	151
25	7	28	121	5.5	40	55	M10 x 1.25	17	15	1/8	81	11	3.5	5.5	20	9	156
32	7	30	133	6	45	60	M14 x 1.5	18	15	1/8	87	13	3	4	23	9	172
40	9	35	158	6	55	75	M16 x 1.5	22	21	1/4	108	16	5	0	25	11	198

Dimensions

Front flange type: CHNF



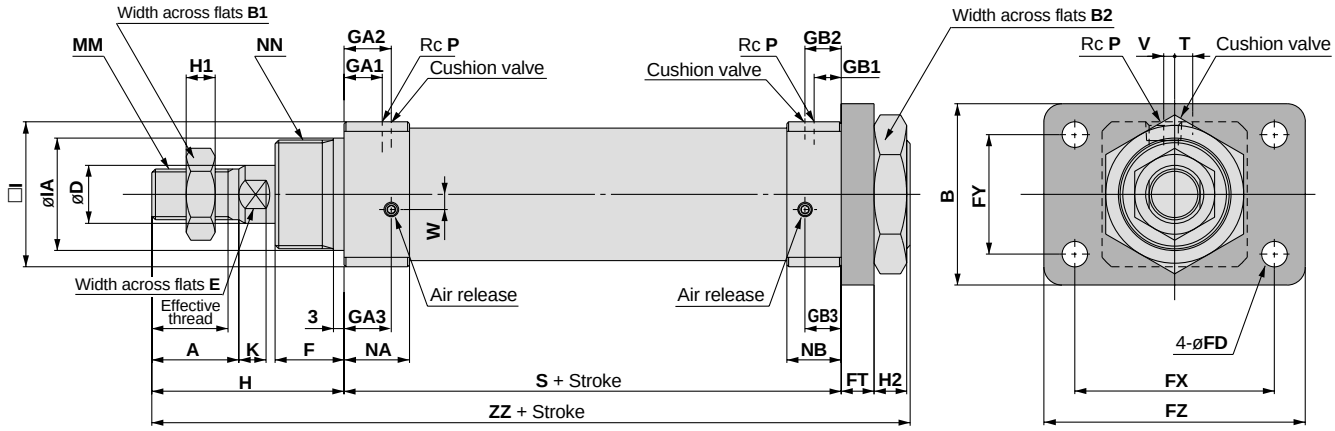
(mm)

Bore size (mm)	Stroke range (mm)	Effective thread length (mm)	A	B	B1	B2	D	E	F	FD	FT	FX	FY	FZ	GA1	GA2	GA3	GB1	GB2
20	25 to 300	15.5	18	38	13	26	10	8	16	7	6	51	21	68	10	12	12	8	10
25	25 to 400	19.5	22	44	17	32	12	10	16	7	9	53	27	70	10	12	12	8	10
32	25 to 500	21	24	50	22	38	16	14	19	7	9	55	33	72	11	13	13	8	10
40	25 to 500	21	24	60	24	41	18	16	21	9	9	66	36	84	12	17	17	11	16

(mm)

Bore size (mm)	GB3	H	H1	H2	I	IA	K	MM	NA	NB	NN	P	S	T	V	W	ZZ
20	10	41	5	8	31	23f8 $^{-0.020}_{-0.053}$	5	M8 x 1.25	17	15	M22 x 1.5	1/8	81	9.5	4.5	6.5	138
25	10	46	6	8	34	25f8 $^{-0.020}_{-0.053}$	5.5	M10 x 1.25	17	15	M24 x 1.5	1/8	81	11	3.5	5.5	143
32	10	53	8	9	40	31f8 $^{-0.025}_{-0.064}$	7.5	M14 x 1.5	18	15	M30 x 1.5	1/8	87	13	3	4	159
40	16	54	10	11	48	34f8 $^{-0.025}_{-0.064}$	7.5	M16 x 1.5	22	21	M33 x 2	1/4	108	16	5	0	183

Rear flange type: CHNG



(mm)

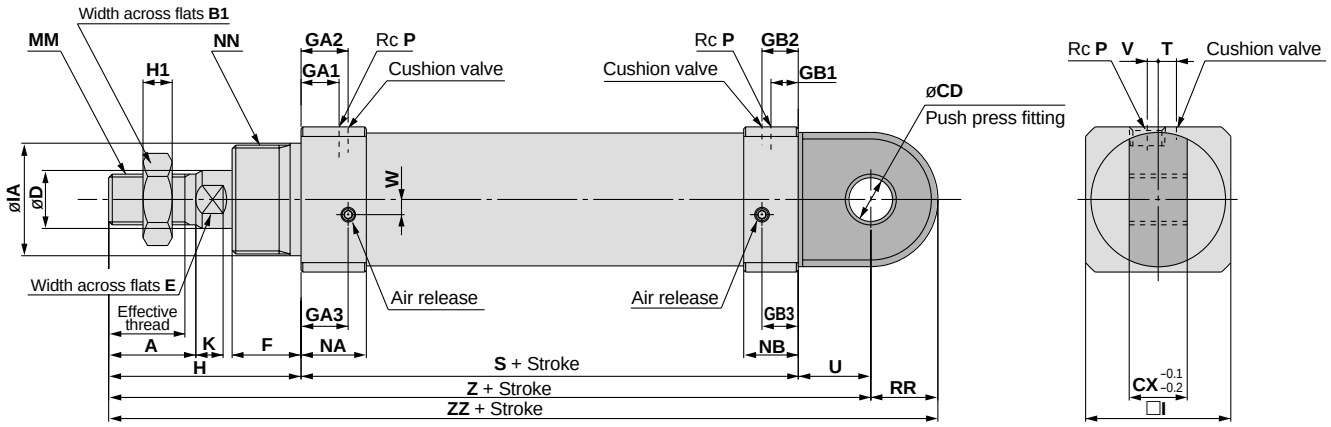
Bore size (mm)	Stroke range (mm)	Effective thread length (mm)	A	B	B1	B2	D	E	F	FD	FT	FX	FY	FZ	GA1	GA2	GA3	GB1	GB2
20	25 to 300	15.5	18	38	13	26	10	8	16	7	6	51	21	68	10	12	12	8	10
25	25 to 400	19.5	22	44	17	32	12	10	16	7	9	53	27	70	10	12	12	8	10
32	25 to 500	21	24	50	22	38	16	14	19	7	9	55	33	72	11	13	13	8	10
40	25 to 500	21	24	60	24	41	18	16	21	9	9	66	36	84	12	17	17	11	16

(mm)

Bore size (mm)	GB3	H	H1	H2	I	IA	K	MM	NA	NB	NN	P	S	T	V	W	ZZ
20	10	41	5	8	31	23f8 $^{-0.020}_{-0.053}$	5	M8 x 1.25	17	15	M22 x 1.5	1/8	81	9.5	4.5	6.5	138
25	10	46	6	8	34	25f8 $^{-0.020}_{-0.053}$	5.5	M10 x 1.25	17	15	M24 x 1.5	1/8	81	11	3.5	5.5	143
32	10	53	8	9	40	31f8 $^{-0.025}_{-0.064}$	7.5	M14 x 1.5	18	15	M30 x 1.5	1/8	87	13	3	4	159
40	16	54	10	11	48	34f8 $^{-0.025}_{-0.064}$	7.5	M16 x 1.5	22	21	M33 x 2	1/4	108	16	5	0	183

Dimensions

Single clevis type: CHNC



(mm)

Bore size (mm)	Stroke range (mm)	Effective thread length (mm)	A	B1	CD	CX	D	E	F	GA1	GA2	GA3	GB1	GB2	GB3	H	H1	I
20	25 to 300	15.5	18	13	10 $^{+0.109}_{0}$	16	10	8	16	10	12	12	8	10	10	41	5	31
25	25 to 400	19.5	22	17	10 $^{+0.109}_{0}$	16	12	10	16	10	12	12	8	10	10	46	6	34
32	25 to 500	21	24	22	12 $^{+0.109}_{0}$	16	16	14	19	11	13	13	8	10	10	53	8	40
40	25 to 500	21	24	24	16 $^{+0.034}_{-0.015}$	24	18	16	21	12	17	17	11	16	16	54	10	48

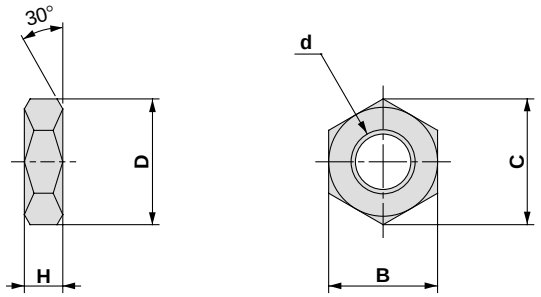
(mm)

Bore size (mm)	IA	K	MM	NA	NB	NN	P	RR	S	T	U	V	W	Z	ZZ
20	23f8 $^{-0.020}_{-0.053}$	5	M8 x 1.25	17	15	M22 x 1.5	1/8	13.5	81	9.5	14	4.5	6.5	136	150
25	25f8 $^{-0.020}_{-0.053}$	5.5	M10 x 1.25	17	15	M24 x 1.5	1/8	14.5	81	11	15	3.5	5.5	142	157
32	31f8 $^{-0.025}_{-0.064}$	7.5	M14 x 1.5	18	15	M30 x 1.5	1/8	18.5	87	13	20	3	4	160	179
40	34f8 $^{-0.025}_{-0.064}$	7.5	M16 x 1.5	22	21	M33 x 2	1/4	22.5	108	16	20	5	0	182	205

Accessories (Standard)

Rod end nut

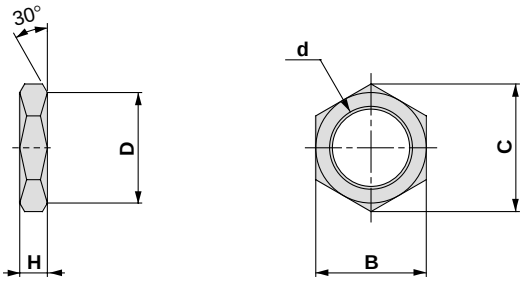
Material: Carbon steel



Part no.	Applicable bore size (mm)	d	H	B	C	D
NT-02	20	M8 x 1.25	5	13	15.0	12.5
NT-03	25	M10 x 1.25	6	17	19.6	16.5
NT-04	32	M14 x 1.5	8	22	25.4	21.0
AC-NI-50	40	M16 x 1.5	10	24	27.7	23

Mounting nut

Material: Carbon steel

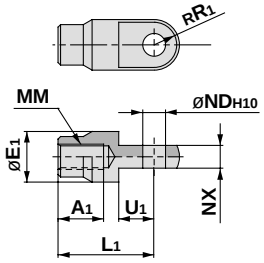


Part no.	Applicable bore size (mm)	d	H	B	C	D
SO-02	20	M22 x 1.5	8	26	30	26
SO-03	25	M24 x 1.5	8	32	36.9	32
SO-04	32	M30 x 1.5	9	38	43.9	38
SO-05	40	M33 x 2.0	11	41	47.3	41

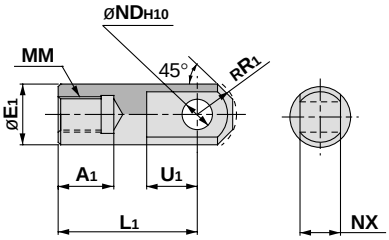
Accessory Brackets (Optional)

I-shaped single knuckle joint

ø20: I-02
ø25: I-03
Material: Rolled steel plate



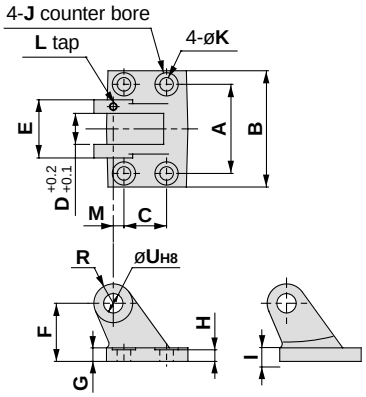
ø32: I-04
ø40: IHN-04
Material: Rolled steel plate



Part no.	Applicable bore size (mm)	A_1	E_1	L_1	MM	R_1	U_1	ND_{H10}	NX
I-02	20	16	20	36	M8 x 1.25	10	14	$9^{+0.058}_{0}$	$9^{-0.1}_{-0.2}$
I-03	25	18	20	38	M10 x 1.25	10	14	$9^{+0.058}_{0}$	$9^{-0.1}_{-0.2}$
I-04	32	22	24	55	M14 x 1.5	15.5	20	$12^{+0.070}_{0}$	$16^{-0.1}_{-0.3}$
IHN-04	40	22	24	55	M16 x 1.5	15.5	20	$15^{+0.070}_{0}$	$16^{-0.1}_{-0.3}$

Bracket for clevis type

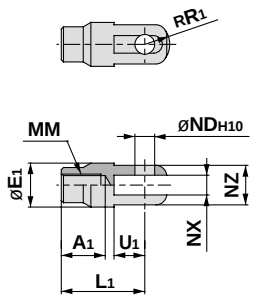
Material: Cast iron



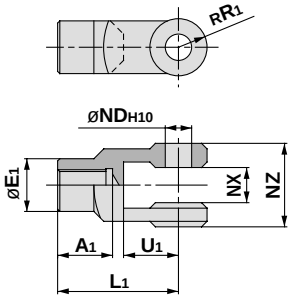
Part no.	Applicable bore size (mm)	A	B	C	D	U_{H8}	E	F	G	H	I	J	K	L	M	R
AD-FI-20	20	46	60	22	16	$10^{+0.027}_{0}$	30	28	6.5	5.5	10	12	7	M4	5.5	10
AD-FI-25	25	46	60	22	16	$10^{+0.027}_{0}$	30	30	6.5	5.5	10	12	7	M4	5.5	10
AD-FI-32	32	56	80	30	16	$12^{+0.027}_{0}$	36	40	10	9	13	12	7	M5	7	12
AD-CHN-40	40	64	88	30	24	$16^{+0.027}_{0}$	44	43	10	9	13	16	9	M5	10	12

Y-shaped double knuckle joint

ø20: Y-02
ø25: Y-03
Material: Rolled steel plate



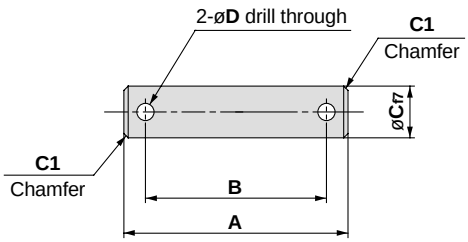
ø32: Y-04C
ø40: YHN-04
Material: Cast iron



Part no.	Applicable bore size (mm)	A_1	E_1	L_1	MM	R_1	U_1	ND_{H10}	NX	NZ
Y-02	20	16	20	36	M8 x 1.25	12	14	$9^{+0.058}_{0}$	$9^{+0.2}_{+0.1}$	18
Y-03	25	18	20	38	M10 x 1.25	12	14	$9^{+0.058}_{0}$	$9^{+0.2}_{+0.1}$	18
Y-04C	32	22	24	55	M14 x 1.5	13	25	$12^{+0.070}_{0}$	$16^{+0.3}_{+0.1}$	38
YHN-04	40	22	24	55	M16 x 1.5	13	25	$15^{+0.070}_{0}$	$16^{+0.3}_{+0.1}$	38

Bracket pin

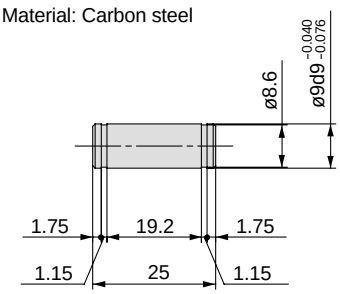
Material: Carbon steel



Part no.	Bore size (mm)	A	B	C_{f7}	D	Cotter pin
AD-EI-20	20	45.5	35.5	$10^{-0.016}_{-0.034}$	3.2	ø3.2 x 16*l*
AD-EI-25	25	45.5	35.5	$10^{-0.016}_{-0.034}$	3.2	
AD-EI-32	32	52	42	$12^{-0.016}_{-0.034}$	4	ø4 x 20*l*
AD-CHN-40	40	60	50	$16^{-0.016}_{-0.034}$	4	

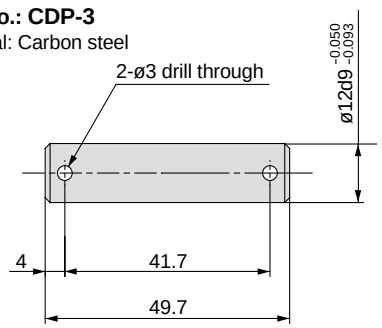
Knuckle pin

ø20, ø25
Part no.: CDP-1
Material: Carbon steel



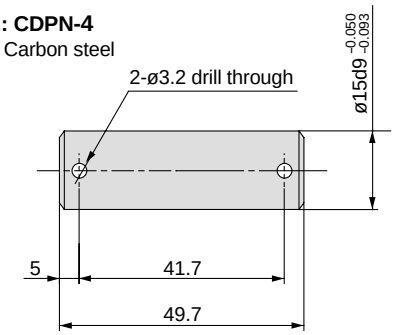
Snap ring: C type 9 for shaft

ø32
Part no.: CDP-3
Material: Carbon steel



Cotter pin: ø3 x 18*l*

ø40
Part no.: CDPN-4
Material: Carbon steel



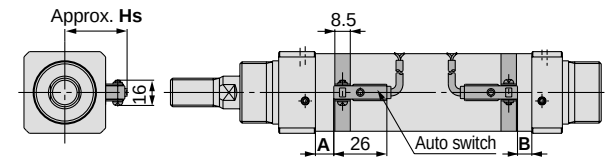
Cotter pin: ø3.2 x 20*l*

Series CHN
Auto Switch Specifications

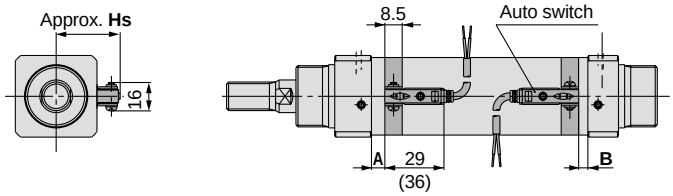
Refer to "Best Pneumatics 2" for detailed auto switch specifications.

Auto Switches: Proper Mounting Positions and Mounting Heights for Stroke End Detection

D-C7, D-C8

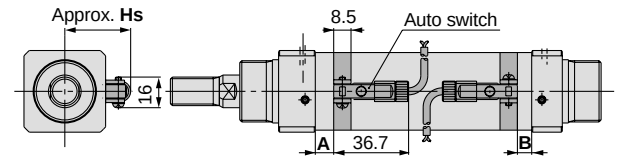


D-H7□, D-H7□W, D-H7□F, D-H7BAL

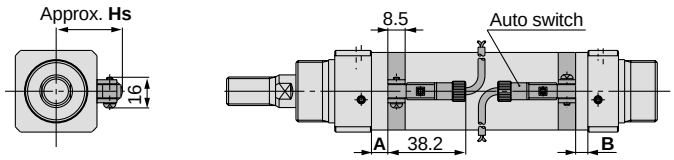


∗ Dimensions inside ( ) are for D-H7LF.

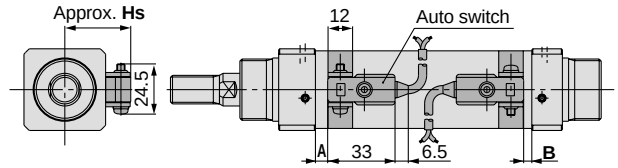
D-C73C, D-C80C



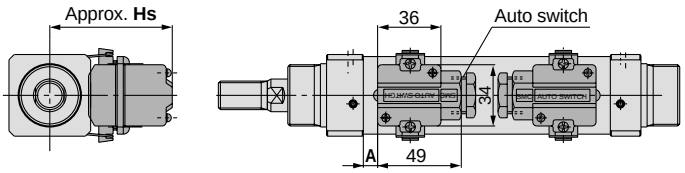
D-H7C



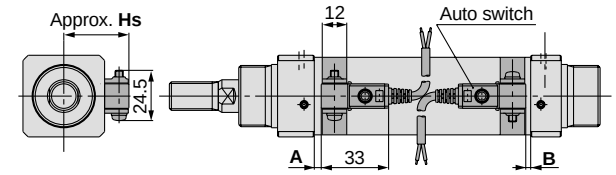
D-B5, D-B6, D-B59W



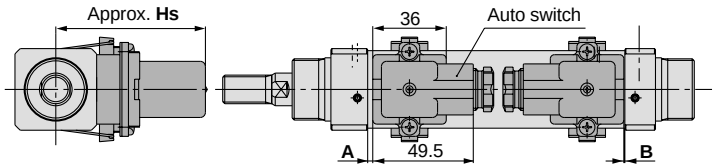
D-A3, D-G3, D-K3



D-G5, D-K5, D-G5□W, D-G5BA, D-K9W, D-G59F, D-G5NT



D-A44



Proper auto switch mounting positions

(mm)

Bore size (mm)	D-C7□ D-C80 D-C73C D-C80C		D-B5□ D-B64		D-H7□ D-H7C D-H7□W D-H7BAL		D-G5NTL		D-H7□F		D-B59W		D-G39 D-K39 D-A3□ D-A44	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
20	19	11	12.5	4.5	17.5	9.5	14	6	16	8	15.5	7.5	12	4
25	20.5	10.5	14	4	19	9	15.5	5.5	17.5	7.5	17	7	13.5	3.5
32	23.5	12.5	17	6	22	11	18.5	7.5	20.5	9.5	20	9	16.5	5.5
40	28.5	18.5	22	12	27	17	23.5	13.5	25.5	15.5	25	15	21.5	11.5

Auto switch mounting heights

(mm)

Bore size (mm)	D-C7 D-C8 D-H7 D-H7□W D-H7□F D-H7BAL	D-B5 D-B6 D-B59W D-G5NTL	D-C73C D-C80C D-H7C	D-G39 D-K39 D-A33 D-A34	D-A44
	HS	HS	HS	HS	HS
20	25	28	27.5	62	72
25	27	30	29.5	64	74
32	30.5	33.5	32.5	66	76
40	34.5	37.5	37.0	70.5	80.5

Hydraulic Cylinder
Auto Switch Specifications

⚠ Specific Product Precautions

Be sure to confirm auto switch precautions on pages 29 through 31 before handling auto switches.

Auto Switch Common Specifications

Type	Reed switch	Solid state switch
Leakage current	None	3-wire: 100μA or less 2-wire: 1mA or less
Operating time	1.2ms	1ms or less*2)
Impact resistance	300m/s²	1000m/s²
Insulation resistance	50MΩ or more at 500VDC (between lead wire and case)	
Withstand voltage	1500VAC for 1min.*1) (between lead wire and case)	1000VAC for 1min. (between lead wire and case)
Ambient temperature	–10° to 60°C	

∗ 1) Electrical entry: Connector types (C73C and C80C) are 1000VAC for 1 minute (between lead wire and case).

∗ 2) Except solid state switch with timer (G5NTL).

Lead Wire Length

Lead wire length indication (Example)

D–B54 L

Lead wire length

Nil	0.5m
L	3m
Z	5m
N∗	None

∗ Applicable only to connector type switch D-□□C.

Note 1) Lead wire length: Z (5m) applicable auto switches
Reed: D-B53, D-B54, D-C73(C), D-C80C
Solid state: All types are produced upon receipt of order (standard).

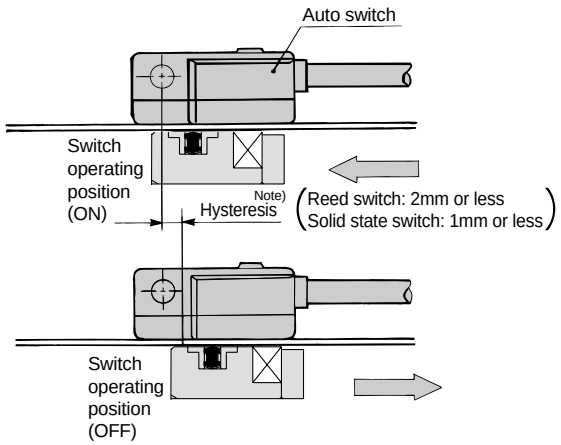
Note 2) The standard lead wire length is 3m for solid state switches with timer and water resistant 2-color display solid state switches (0.5m is not available).

Part nos. for lead wire with connector
(applicable only to connector type)

Part no.	Lead wire length
D-LC05	0.5m
D-LC30	3m
D-LC50	5m

Auto Switch Hysteresis

Hysteresis is the distance between the position at which piston movement operates an auto switch and the position at which movement in the opposite direction turns the switch OFF. This hysteresis is included in part (one side) of the operating range.



Note) The amount of hysteresis varies with the operating environment and is not guaranteed. Consult with SMC regarding applications in which hysteresis becomes a problem.

Contact Protection Boxes: CD-P11, CD-P12

1

<Applicable switch models>

D-C7, D-C8, D-C73C, D-C80C

The above auto switches do not have built-in 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 or 200VAC.

A contact protection box should be used in any of the above conditions. Otherwise, the life of the contacts may be reduced. (They may stay on continuously.)

2

Furthermore, even in the case of a type having an internal contact protection circuit (D-A34, D-A44, 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, consult with SMC as a contact protection box may be necessary.**

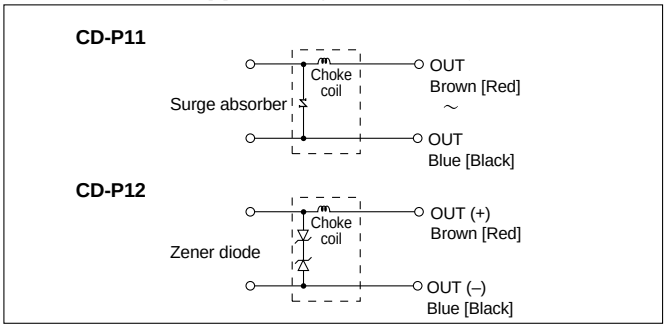
Contact protection box specifications

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

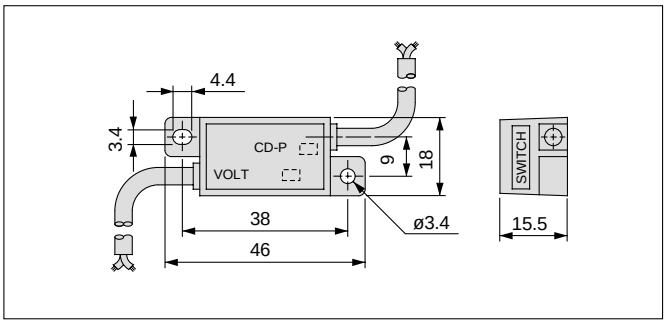
∗ Lead wire length —— Switch connection side: 0.5m
Load connection side: 0.5m

Internal circuits

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



Dimensions



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.

The length of the lead wires between the switch unit and contact protection box should be no more than 1m, and they should be placed as close together as possible.

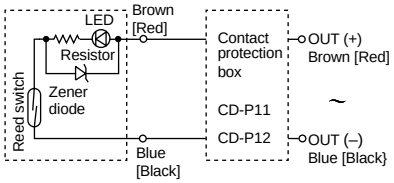
Hydraulic Cylinder
Auto Switch Specifications

Auto Switch Internal Circuits

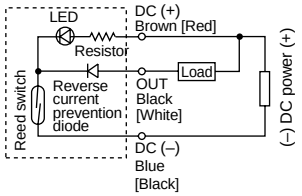
Lead wire colors inside [ ] are those prior to conformity with IEC standards.

Reed switches

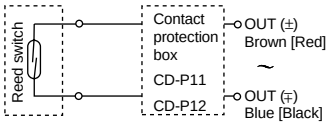
D-C73



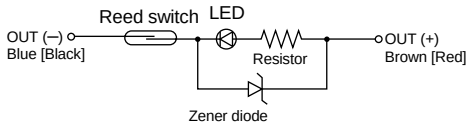
D-C76



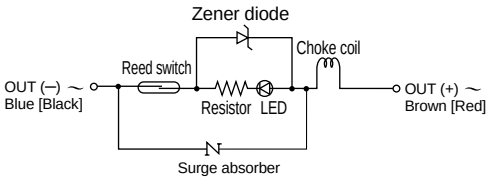
D-C80, D-C80C



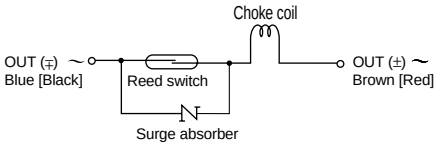
D-B53



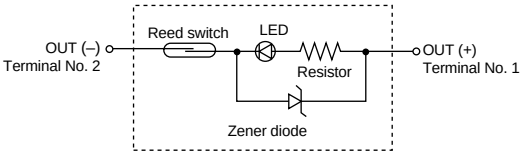
D-B54



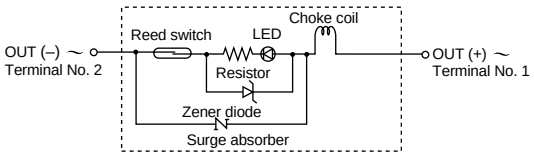
D-B64



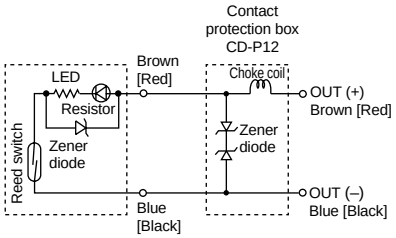
D-A33



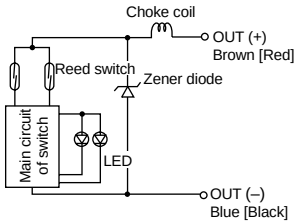
D-A34, D-A44



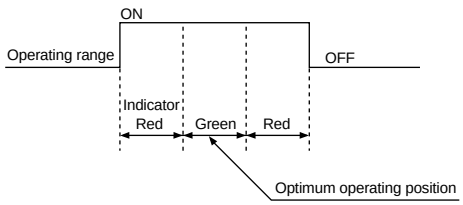
D-C73C



D-B59W



Indicator light: Display method

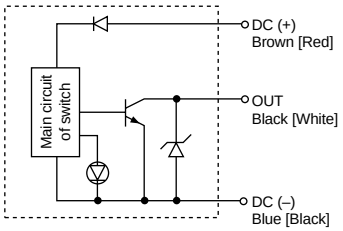


SMC

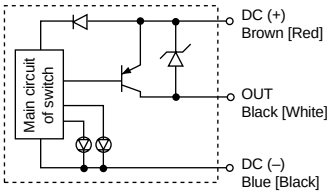
Lead wire colors inside [ ] are those prior to conformity with IEC standards.

Solid state switches

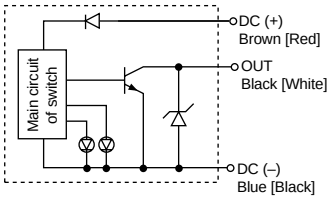
D-H7A1



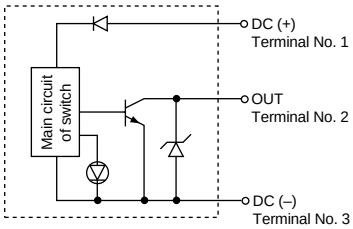
D-H7PW



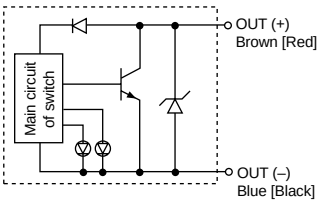
D-H7NW



D-G39, D-G39C



D-H7BAL, D-H7BW



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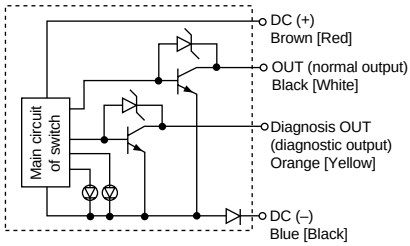
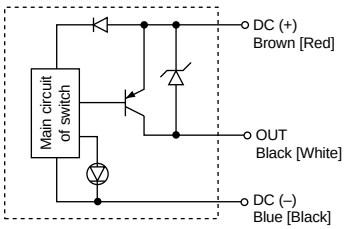


D-H7A2



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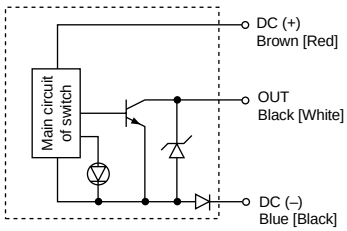
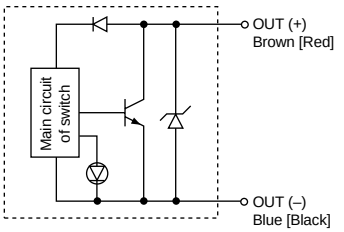
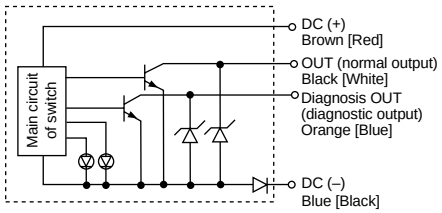


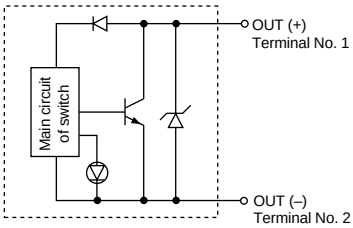
D-H7B, D-H7C



D-H7LF



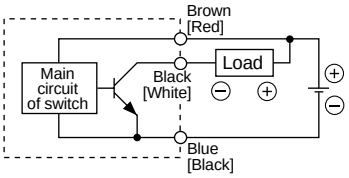
D-K39, D-K39C



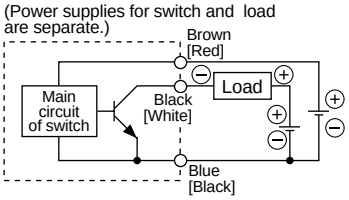
Hydraulic Cylinder
Auto Switch Connections and Examples

Basic Wiring

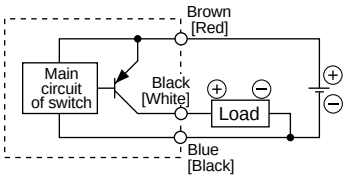
Solid state 3-wire, NPN



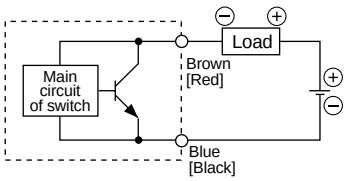
(Power supplies for switch and load are separate.)

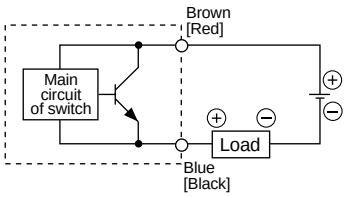


Solid state 3-wire, PNP

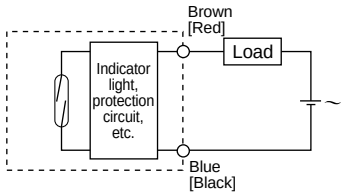


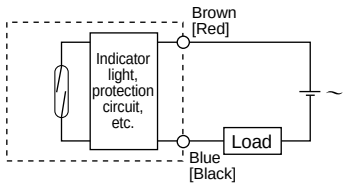
Solid state 2-wire





Reed switch 2-wire

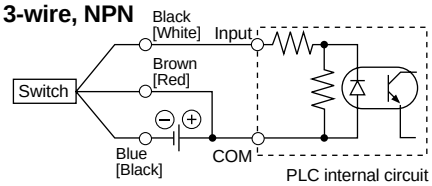




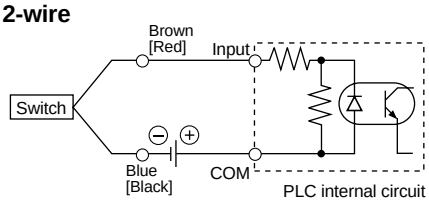
Examples of Connection to PLC

Sink input specifications

3-wire, NPN

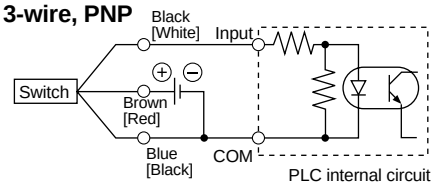


2-wire

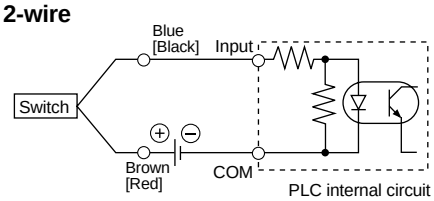


Source input specifications

3-wire, PNP



2-wire

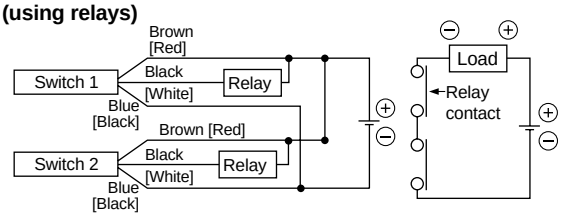


The connection method will vary depending on the PLC input specifications. Connect accordingly.

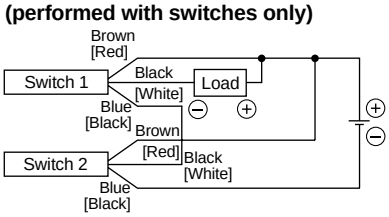
Connection Examples for AND (Series) and OR (Parallel)

3-wire

AND connection for NPN output (using relays)

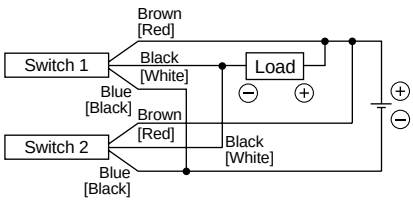


AND connection for NPN output (performed with switches only)

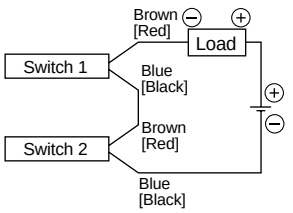


The indicator lights will light up when both switches are turned ON.

OR connection for NPN output



2-wire with 2-switch AND connection



When 2 switches are connected in series, the load may malfunction because the load voltage will decline when in the ON state.
The indicator lights will light up when both of the switches are in the ON state.

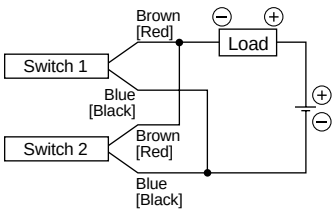
Load voltage at ON = $\frac{\text{Power supply voltage}}{} - \frac{\text{Residual voltage}}{} \times 2$ pcs.

= 24V – 4V x 2 pcs.

= 16V

Example: Power supply is 24VDC.
Internal voltage drop in switch is 4V.

2-wire with 2-switch OR connection



<Solid state>
When 2 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. $\times \frac{\text{Load}}{\text{impedance}}$

= 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. However, depending on the number of switches in the ON state, the indicator lights may sometimes grow dim or not light up because of the dispersion and reduction of current flowing to the switches.

Technical Data 1

Bore Size Selection

Relationship among generated force, bore size and pressure

A cylinder's generated force will be lower than the theoretical output due to the following factors.

(1) Sliding resistance on the cylinder bearings, seals, etc.
(2) Pressure loss in hydraulic equipment and piping
(3) Frictional resistance in moving parts of machinery

It is necessary to select bore sizes considering these factors.
When a cylinder is nearly at rest, the relation of generated force, bore size and pressure can be expressed with the following formulas.

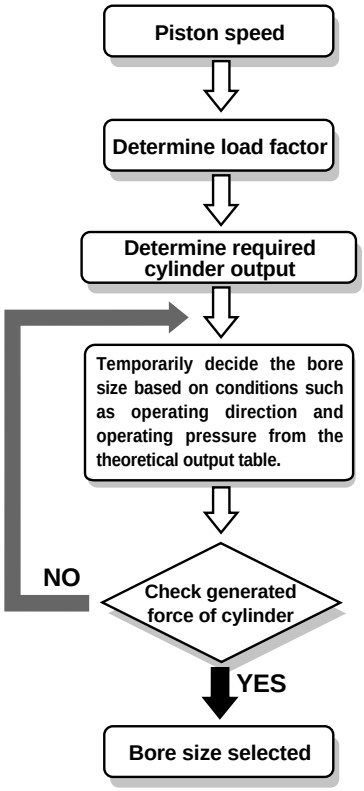
$Fp_1 = \mu_1 \times Ff_1$ ····· Formula (1)
$Fp_2 = \mu_2 \times Ff_2$ ····· Formula (2)
$Ff_1 = \frac{\pi}{4} D^2 \times P$ ····· Formula (3)
$Ff_2 = \frac{\pi}{4} (D^2 - d^2) \times P$ ··· Formula (4)

Fp_1: Generated extension force of cylinder (N)
Fp_2: Generated retraction force of cylinder (N)
Ff_1: Theoretical extension output (N)
Ff_2: Theoretical retraction output (N)
P: Operating pressure (MPa)
D: Bore size (mm)
d: Piston rod diameter (mm)
μ_1: Cylinder extension load pressure coefficient 0.9
μ_2: Cylinder retraction load pressure coefficient 0.9

Example

To find the cylinder bore size that is required to operate:

- On a load weight of 1000N.
- With operating pressure of 5MPa, and
- The operating piston speed when the cylinder is extended at 150mm/s.



150mm/s (initial condition)

30% (from the table above)

Load weight: 1000N, Load factor: 30%
Required cylinder output: F = 1000/0.3 = 3333(N)

According to the theoretical output table, the bore size that satisfies the required cylinder output F with operating pressure 5MPa when the operating direction is OUT is ø32.

Formula (1) $Fp_1 = \mu_1 \times Ff_1 = 0.9 \times 4020$
$= 3618(N) > F(3333N)$

Selection standards

The ratio of the load to the theoretical output is the load factor. It is imperative to understand the relationship between this load factor and the piston speed in order to make the proper bore size selection. Use the table below as a guide for understanding the correlation between load factor and piston speed.

Piston speed (mm/s)	Maximum load factor
8 to 100	70%
101 to 200	30%
201 to 300	10%

Series CHN Theoretical Output

Unit: N

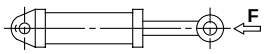
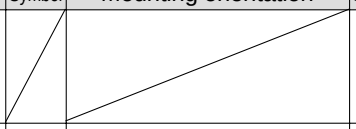
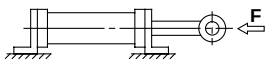
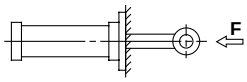
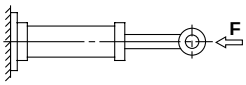
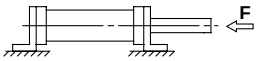
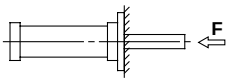
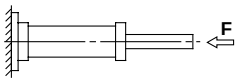
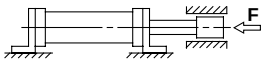
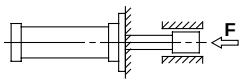
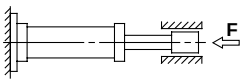
Bore size (mm)	Rod size (mm)	Operating direction	Piston area (mm^2)	Operating pressure (MPa)			
				1	3	5	7
20	10	OUT	314	314	942	1570	2198
		IN	235	235	705	1175	1645
25	12	OUT	490	490	1470	2450	3430
		IN	377	377	1131	1885	2639
32	16	OUT	804	804	2412	4020	5628
		IN	603	603	1809	3015	4221
40	18	OUT	1256	1256	3768	6280	8792
		IN	1002	1002	3006	5010	7014

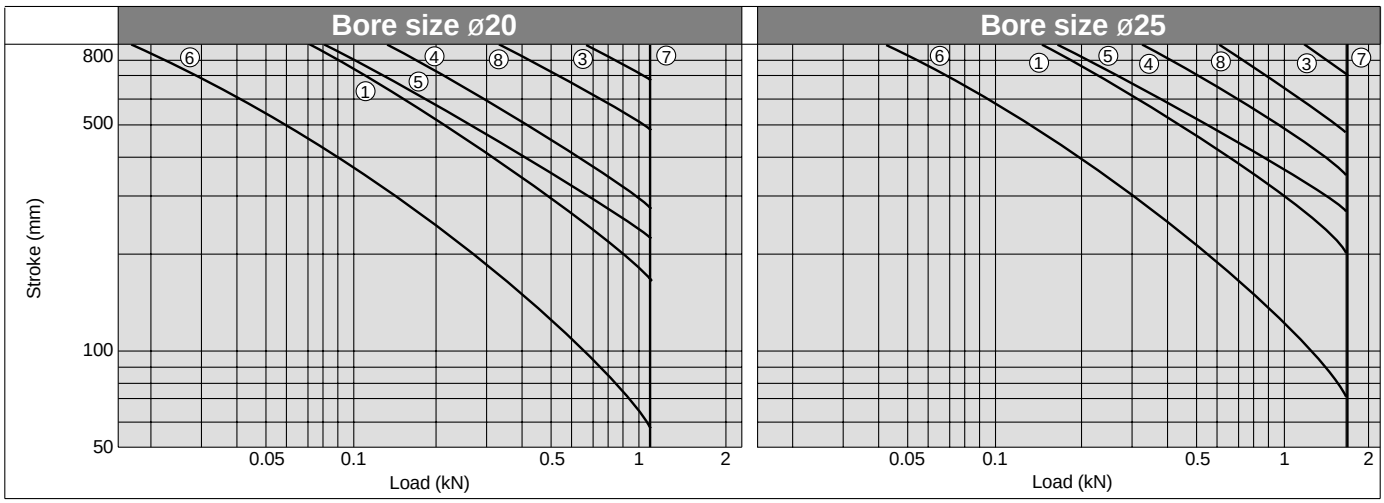
Technical Data 2

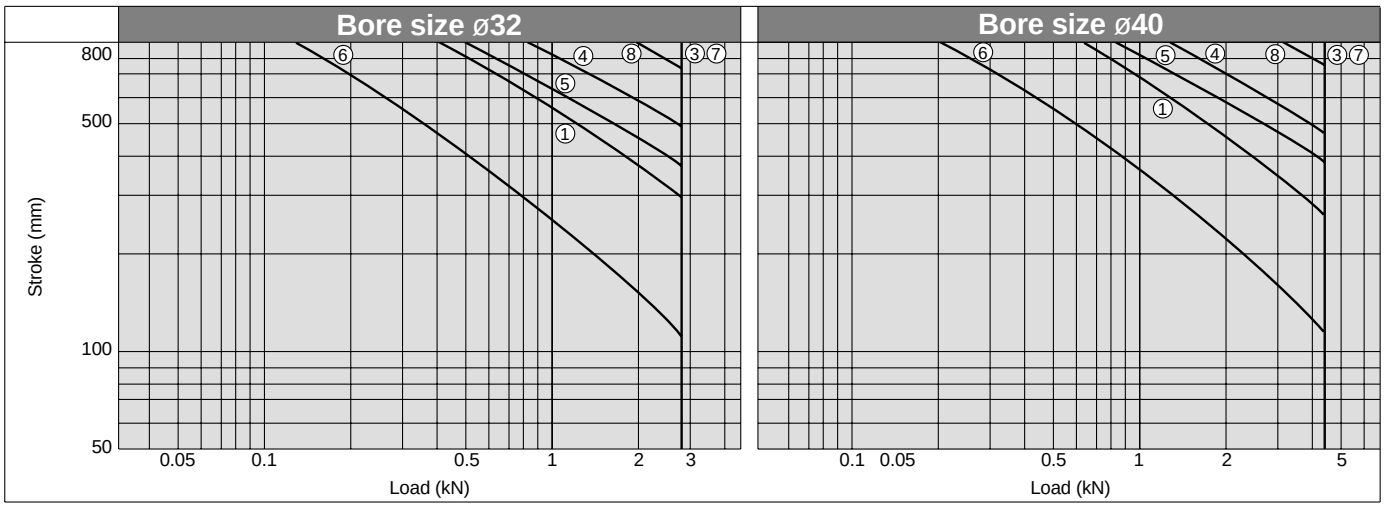
Stroke Selection (Maximum Usable Stroke Based on Buckling Strength)

Refer to stroke range limit charts regarding rod buckling due to load weight.
The values in these tables indicate the maximum stroke that can be used in a situation when air is being supplied while the cylinder is stopped in an intermediate position by a) an external force acting on the piston rod and/or b) by an external stopper.
Since the maximum usable stroke varies depending on the diameter of the piston rod and operating conditions, verify the applicability using the stroke range limit charts.

Series CHN Stroke range limit charts: Bore size ø20, ø25, ø32, ø40

Symbol	Mounting orientation	Symbol	Mounting orientation	Symbol	Mounting orientation	Symbol	Mounting orientation
①				③		③	
④		⑤		⑤		⑥	
⑦		⑦		⑧			





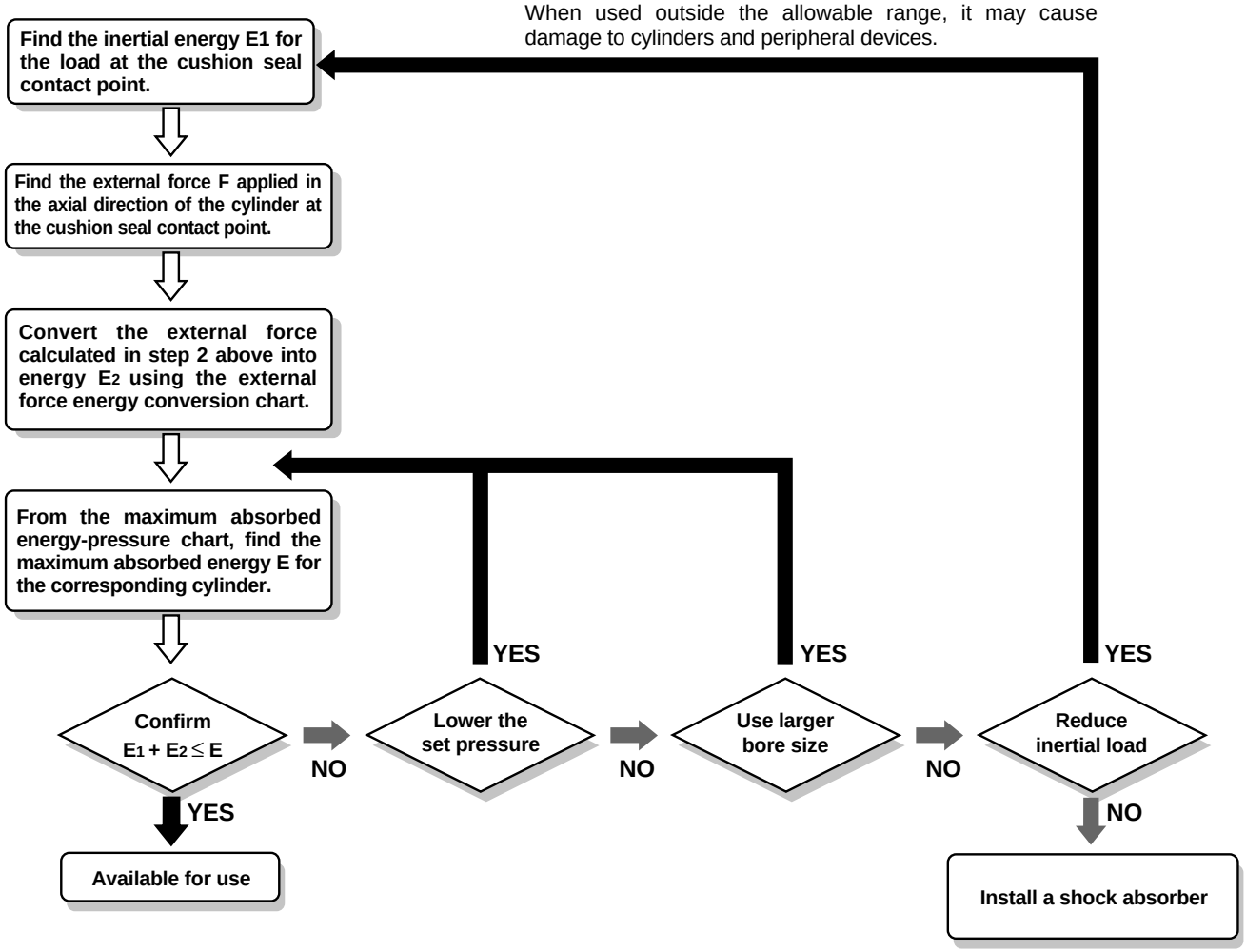
Technical Data 3-1

Cylinder Cushion Selection

Procedure

⚠Caution

Use a cylinder cushion within the maximum absorbed energy range.
When used outside the allowable range, it may cause damage to cylinders and peripheral devices.

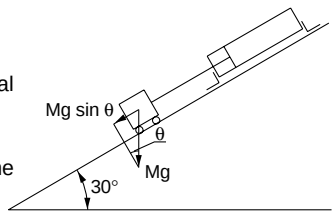


Calculation Example

<Design conditions>
Cylinder: CHN25
Set pressure P_1: 5MPa
Load weight M: 50kg
Piston speed V: 0.3m/s (at the cushion seal contact point)
Load transfer direction: Downward θ: 30°
(External force applied to the cylinder is gravity only).
Operating direction: Out
Gravitational acceleration g: 9.8m/s²

<Calculation>

1. Load inertial energy E_1 at the cushion seal contact point
   $E_1 = MV^2/2 = 50 \times 0.3^2/2 = 2.25J$
2. External force F applied in axial direction of the cylinder at the cushion seal contact point
   $F = Mg \sin \theta = 50 \times 9.8 \times \sin 30° = 245N$



3. Convert the external force calculated in step 2 into energy E_2.
   In the "External force and energy conversion chart" on page 22, draw a vertical line from the value of F (= 245N). The point where this line intersects with the diagonal line (0.27J) is the energy caused by external force.
   $E_2 = 0.27J$
4. Find the maximum absorbed energy E for a cylinder.
   In the "Maximum absorbed energy and pressure chart" on page 22, draw a vertical line from the set pressure 5MPa. The point where this line intersects with the line for ø25 (3.7J) is the maximum absorbed energy.
   $E = 3.7J$
5. Confirm that $E_1 + E_2 \leq E$
   $E_1 + E_2 = 2.25 + 0.27 = 2.52J$
   Since $E = 3.7J$, $E_1 + E_2 \leq E$
   Therefore, the cylinder cushion is available for use.

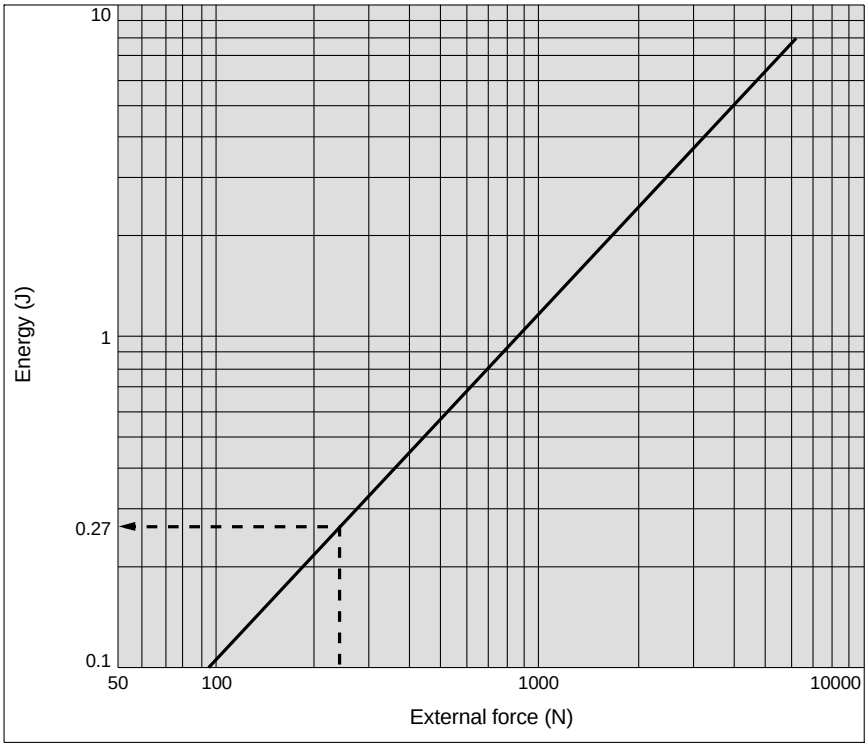
Technical Data 3-2

Maximum Absorbed Energy Chart & External Force and Energy Conversion Chart at Cushion Seal Contact Point

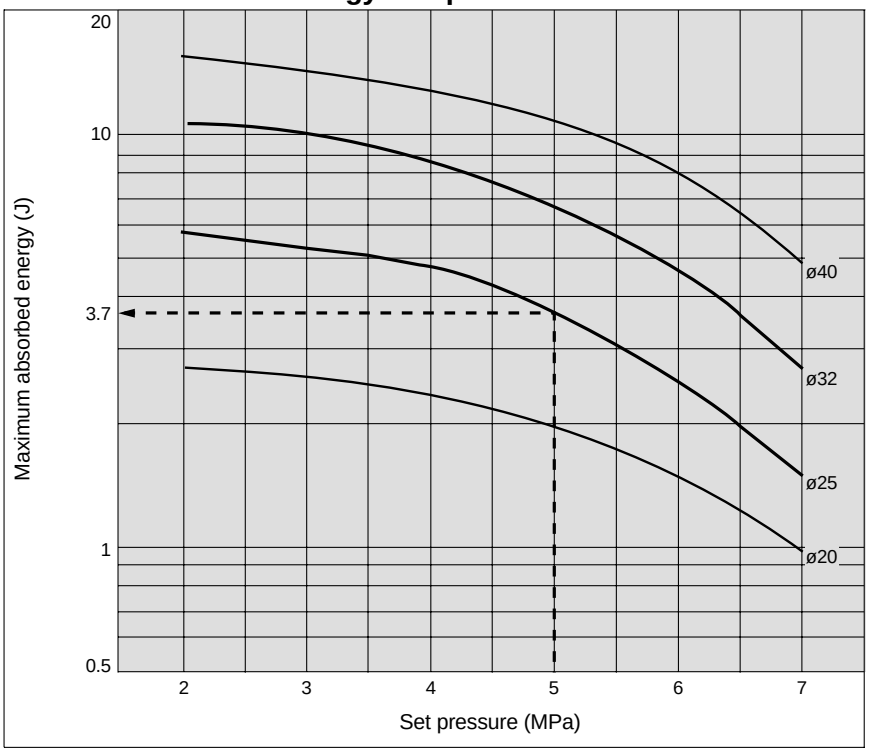
Maximum absorbed energy pressure and chart in terms of cushion performance characteristics

Be sure to keep the combined values of kinetic energy of the load operated by the cylinder and the energy generated by the external force within the values that are shown in the bottom chart.

External force and energy conversion chart at cushion seal contact point



Maximum absorbed energy and pressure chart



Technical Data 4

Piston Speed, Required Fluid Volume, and Piping Size Selection

This information is intended to help you find the required fluid volume and piping size to operate a cylinder at a specified speed.

Relationship between piston speed and fluid volume

$$Q_1 = \frac{\pi}{4} D^2 \cdot \upsilon \cdot \frac{6}{1000} \quad \text{..... Formula (1)}$$

$$Q_2 = \frac{\pi}{4} (D^2 - d^2) \cdot \upsilon \cdot \frac{6}{1000} \quad \text{..... Formula (2)}$$

Q_1 : Required fluid volume for extension (l/min)
Q_2 : Required fluid volume for retraction (l/min)
D : Bore size (cm)
d : Piston rod diameter (cm)
υ : Piston speed (mm/s)

Effective inside diameter of piping

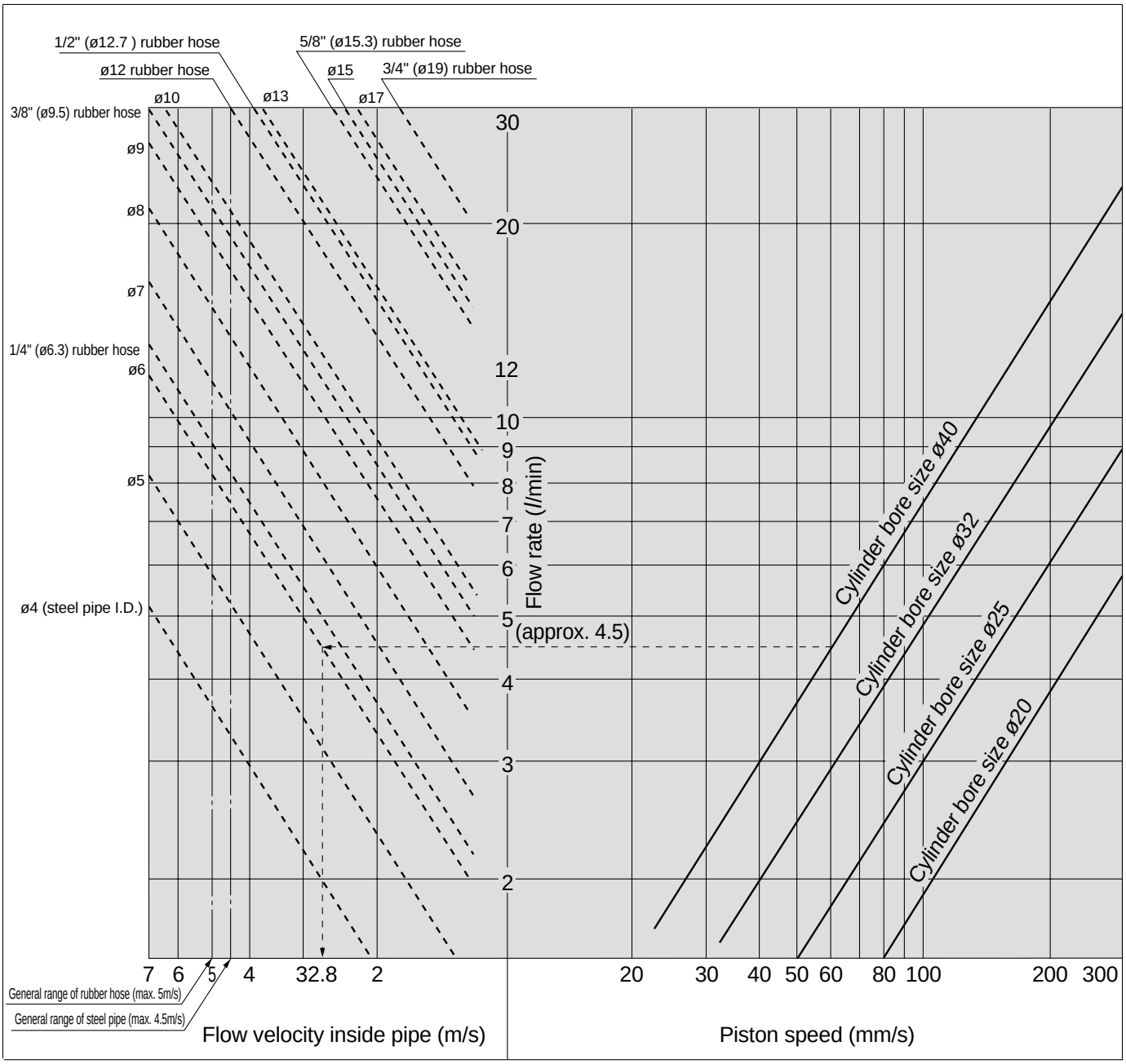
$$V = \frac{Q}{\frac{\pi}{4} din^2 \times 10^{-3}} \cdot \frac{1}{60} \quad \text{..... Formula (3)}$$

V : Fluid flow velocity (m/s)
Q : Fluid volume (l/min)
din: Effective inside diameter of piping (mm)

In general, it is necessary to select a piping diameter that will not allow the fluid flow velocity to exceed the values shown in the chart below.
If the fluid flow velocity exceeds this value, turbulent flow and overheating may occur in conjunction with pressure loss.

Fluid flow velocity

Rubber hose	5m/s
Steel piping	4.5m/s



How to read the chart:
Example) The required flow rate to operate a ø40 cylinder at a speed of 60mm/s is approximately 4.5l/min.
When a ø6 (I.D.) steel pipe is used for piping, the flow velocity in the piping will be approximately 2.7m/s.

Series CHN

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 4413 Note 1), JIS B 8361 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 4413: Hydraulic fluid power — General rules for the application of equipment to transmission and control systems

Note 2) JIS B 8361: General Rules for Hydraulic Equipment

⚠ Warning

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

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

2. Only trained personnel should operate hydraulic machinery and equipment.

Oil hydraulics can be dangerous if an operator is unfamiliar with it. Assembly, handling, or repair of hydraulic 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 oil supply pressure and electric power for this equipment and confirm that there is no pressure in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc., and proceed with caution.

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, and therefore requires special safety analysis.

Series CHN
Hydraulic Cylinder Precautions 1

Be sure to read before handling.

Design

⚠Warning

1. There is a danger of sudden erratic action by air cylinders if sliding parts of machinery are twisted, causing changes in forces to occur.

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

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

If driven objects and moving parts of a cylinder pose a likely threat of personal injury, design the structure to avoid direct human contact with that area.

3. Securely tighten all of the cylinder's stationary parts and connected parts so that they will not become loose.

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

4. Cases when a deceleration circuit or shock absorber may be required

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

5. Take into account a possible drop in circuit pressure due to a power outage.

When the cylinder is used as a clamping mechanism, there is a danger of work pieces dropping out of it if there is a decrease in clamping force due to a drop in circuit pressure caused by a power outage. Therefore, safety equipment should be installed to prevent damage to machinery and human injury. Also apply drop prevention measures to suspension mechanisms and lifting devices.

6. Take into account a possible loss of power supply.

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

7. Design circuitry to prevent sudden lurching of driven objects.

When hydraulic pressure in a cylinder is zero, the driven object will lurch at high speed if pressure is applied to one side of the piston. Therefore, equipment should be selected and circuits designed to prevent sudden lurching because there is a danger of human injury and/or damage to equipment when this occurs.

8. Take into account emergency stops.

Design the system so that human injury and/or damage to machinery and equipment will not occur when machinery is stopped by a manual emergency stop or a safety device triggered by abnormal conditions such as a power outage.

Design

⚠Warning

9. Consider the action of the system when operation is restarted after an emergency stop or abnormal stop.

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

Selection

⚠Warning

1. Confirm the specifications.

The products featured in this catalog are designed strictly for use in industrial oil hydraulic system applications. If the products are used in conditions that are outside the range of pressure and temperature specifications, damage and/or malfunction may occur. Do not use in these conditions. (Refer to specifications.)

Consult with SMC if a fluid other than hydraulic fluid is to be used.

2. Intermediate stops

Since hydraulic cylinders are not guaranteed for zero oil leakage, it may not be possible to hold a stopped position for an extended period of time.

3. Take surge pressure into consideration.

Use cylinders which can withstand the surge pressures (maximum allowable pressure) generated in hydraulic systems. (Refer to specifications.)

Inside cylinders, pressure may be generated that is higher than the set pressure for the relief valve, e.g., internal pressure due to load inertia or surge pressure when switching valves.

Consider these factors and determine the operating pressure so that the pressure generated inside cylinders will be within the maximum allowable pressure.

Pressure terminology used in this catalog is defined as follows:

Nominal pressure: Pressure assigned to a cylinder for convenient identification. It is not necessarily the same as the operating pressure which guarantees performance under specified conditions.

Maximum allowable pressure: The maximum allowable value for the pressure that is generated inside cylinders (such as surge pressure).

Proof pressure: Test pressure that the cylinder must be able to withstand without lowering system performance when returning to the nominal pressure.

Minimum operating pressure: Minimum pressure at which a horizontally installed cylinder operates with no-load.

4. Take into account compatibility with hydraulic fluids.

Hydraulic fluid	Compatibility
Standard mineral hydraulic fluid	Compatible
W/O hydraulic fluids	Compatible
O/W hydraulic fluids	Compatible
Water/Glycol hydraulic fluids	∗
Phosphate hydraulic fluids	Not compatible

∗ Consult with SMC.

Series CHN
Hydraulic Cylinder Precautions 2

Be sure to read before handling.

Selection

⚠Caution

1. Operate within the limits of the maximum stroke.

The piston rod will be damaged if operated beyond the maximum stroke. Refer to the stroke selection on page 20 for maximum strokes.

2. Operate the piston within a range that will prevent impact damage from occuring at the stroke end.

Ensure a safety margin so that damage will not occur when the piston, having inertial force, stops by striking the cover at the stroke end.

Take load factors and piston speed on page 19 into consideration and determine the operability by referring to the chart under "Selection Standards".

3. Use a flow control valve to adjust the hydraulic cylinder drive speed, gradually increasing from a low speed to the desired speed setting.

4. Provide intermediate supports for long stroke cylinders.

Provide intermediate supports for cylinders with long strokes to prevent piston rod damage due to sagging of the piston rod, deflection of the tube, vibration, and external loads.

Mounting

⚠Caution

1. Make sure to align the axis center of the piston with the load and direction of movement when connecting.

When not properly aligned, twisting of the piston rod and tubing may occur, and damage may be caused due to wear on areas such as the inner tube surface, bushings, piston rod surface and seals.

Allow for decentering of the axis either by aligning the axis center or using a floating joint.

2. When an external guide is used, connect the piston 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 by striking or grasping it with other objects.

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

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

Following mounting, repairs, or conversions, verify correct mounting by conducting suitable function and leakage tests after piping and power connections have been made.

5. Instruction manual

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

Keep the instruction manual readily available for easy reference as needed.

Piping

⚠Caution

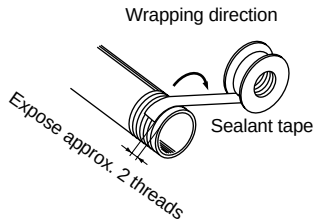
1. Preparation before piping

Before piping is connected, it should be thoroughly flushed out with air or water to remove chips, cutting oil and other debris.

2. Wrapping of sealant tape

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

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



3. Set up so that air cannot accumulate inside piping.

Cushion

⚠Caution

1. Readjust using the cushion needle.

Cushions are adjusted at the time of shipment. However, the cushion needle on the cover should be readjusted when the product is put into service, based on 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.

2. Do not operate with the cushion needle fully closed.

This will contribute to the generation of surge pressure, and the cylinder or equipment can be damaged.

Air Release

⚠Caution

1. Operate after opening the air release valve and completely releasing any internal air.

Residual air can cause a malfunction.

2. When adjusting the air release, do not loosen the plug too much.

Use caution, since loosening the plug too much may cause it to fly out or fluid to blow out, posing a danger of human injury.

Hydraulic Cylinder Precautions 3

Be sure to read before handling.

Hydraulic Fluid

⚠Warning

1. Use clean fluid.

Do not use deteriorated fluid or fluid containing foreign matter, moisture or corrosive additives, as this can cause the malfunction and damage or corrosion of parts.

⚠Caution

1. Install hydraulic fluid filters.

Provide your hydraulic system with hydraulic fluid filters with a filtration degree of 10mm or finer.

Refer to SMC's hydraulic filter specifications.

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

Take measures to prevent freezing, since moisture in hydraulic fluid will freeze at 0°C or below, and this may cause damage to seals and lead to a malfunction.

3. Use hydraulic fluid with a viscosity grade equivalent to ISO VG32 or VG46.

Operating Environment

⚠Warning

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

Refer to the construction drawings for cylinder materials.

2. Install a protective cover if the product is to be used in a dusty environment or where it will be exposed to chips and spatter.

Maintenance

⚠Warning

1. Perform maintenance according to the procedures indicated in the instruction manual.

Improper handling and maintenance may cause malfunctioning and damage of machinery or equipment to occur.

2. Removal of equipment

When machinery is removed, first ensure that there are measures in place to prevent the fall or sudden, erratic movement of driven objects and equipment. Then cut off the air supply and electric power, and reduce the pressure in the system to zero.

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

⚠Caution

1. Perform periodic maintenance on filters installed in a hydraulic system in order to keep the fluid clean.

If the fluid used in hydraulic cylinders contains foreign matter, parts such as the piston seals and rod seals will be damaged.

Series CHN
Auto Switch Precautions 1

Be sure to read before handling.

Design and Selection

⚠Warning

1. Confirm the specifications.

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

2. Take precautions when cylinders are used close together.

When two or more cylinders with auto switches are lined up in close proximity to each other, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40mm.

3. Monitor 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 move properly. The maximum detectable piston speed is:

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

In case of a high piston speed, it is possible to extend the operating time of the load by using an auto switch (G5NT) with a built-in off delay timer (approximately 200ms).

4. Keep wiring as short as possible.

<Reed switches>

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

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 when an auto switch has a built-in contact protection circuit, if the lead wire length is 30m or more, the rush current cannot be adequately absorbed and the life of the switch may be shortened. Contact SMC, as it is also necessary in this case to connect a contact protection box to extend the switch life.

<Solid state switches>

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

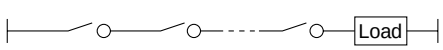
5. Monitor the internal voltage drop of the switch.

<Reed switches>

1) Switches with an indicator light
   - 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 move.



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

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

2) If the internal resistance of a light emitting diode causes a problem, select a switch without an indicator light (D-C80□ or D-B64).

<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. Be careful of 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 condition given in the above formula is not met, it will not reset correctly (stays ON). Use a 3-wire switch if this specification cannot be satisfied.

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

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

<Reed switches>

If driving a load such as a relay that generates surge voltage, use a switch with a built-in contact protection circuit or 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 CHN
Auto Switch Precautions 2

Be sure to read before handling.

Mounting and 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 external body of the switch (switch case) 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 table by its lead wires, as this may not only cause broken lead wires, but it may cause internal elements of the switch to be damaged by the stress.

3. Mount switches using the proper tightening torque.

When a switch is tightened beyond the range of tightening torque, the mounting screws, mounting bracket, or switch may be damaged. On the other hand, tightening below the range of tightening torque may cause the switch to slip out of position. (Refer to pages 12 through 17 for detailed auto switch specifications.)

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 positions shown in the catalog indicate the optimum positions at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation may be unstable.

Wiring

⚠Warning

1. Avoid repeatedly bending or stretching lead wires.

Broken lead wires will result from installation or applications that repeatedly apply 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 (such as contact with other circuits, ground fault, or improper insulation between terminals). Damage may occur due to excess current flow into a switch.

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

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

Wiring

⚠Warning

5. Do not allow short circuit of loads.

<Reed switches>

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

<Solid state switch>

D-J51 and all models of PNP output type switches do not have built-in short circuit protection circuits. As in the case of reed switches, if loads are short circuited, the switches will be instantly damaged.

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

6. Avoid incorrect wiring.

<Reed switches>

* A 24VDC switch with indicator light has polarity. The brown [red] lead wire or terminal No.1 is (+), and the blue [black] lead wire or terminal No. 2 is (–).

1) If connections are reversed, the switch will still operate, but the light emitting diode will not light up.

   Also note that a current greater than specified will damage a light emitting diode and make it inoperable.

   Applicable models: D-A33, D-A34, D-A44, D-C73□, D-B53, D-B54

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

<Solid state switches>

1) Event if connections are reversed on a 2-wire type switch, the switch will not be damaged because it is protected by a protection circuit, but it will remain in a normally ON state. But reverse wiring in a load short circuit condition should be avoided to protect the switch from being damaged.

*2) Even if (+) and (–) power supply line connections are reversed on a 3-wire type switch, the switch will be protected by a protection circuit. However, if the (+) power supply line is connected to the blue [black] wire and the (–) power supply line is connected to the black [white] wire, the switch will be damaged.

* Lead wire color changes

Lead wire colors of SMC switches have been changed in order to meet NECA 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
Power supply GND	Black	Blue
Output	White	Black

Solid state with diagnostic output

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

Solid state with latch type diagnostic output

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

Series CHN
Auto Switch Precautions 3

Be sure to read before handling.

Operating Environment

⚠Warning

1. Never use in an atmosphere of explosive gases.

The construction 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 with SMC regarding the availability of a magnetic field resistant auto switches.)

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

With the exception of some models (D-A3□, D-A44, D-G39□, D-K39□), switches satisfy IEC standard IP67 construction (JIS C 0920: watertight construction). Nevertheless, they should not be used in applications where they are continually exposed to water splash or spray. This may cause deterioration of the insulation or swelling of the potting resin inside switches and may cause a malfunction.

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

Consult with SMC if auto switches will be used in an environment laden with coolants, cleaning solvents, various oils, or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by a deterioration of the insulation, a 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 with SMC if switches are to be used where there are temperature cycles other than normal temperature changes, as they may be adversely affected internally.

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

<Reed switches>

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

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

<Solid state switch>

When there are units (such as solenoid type lifters, high frequency induction furnaces, motors) that generate a large amount of surge in the area around cylinders with solid state auto switches, their proximity or presence may cause deterioration or damage to the internal circuit elements of the switches. Avoid sources of surge generation and crossed lines.

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

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

Maintenance

⚠Warning

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

1) Securely 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 if damage is discovered.

3) Confirm that the green light on the 2-color display type switch lights up.

Confirm that the green LED is on when stopped at the set 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 with SMC concerning water resistance, elasticity of lead wires and usage at welding sites.

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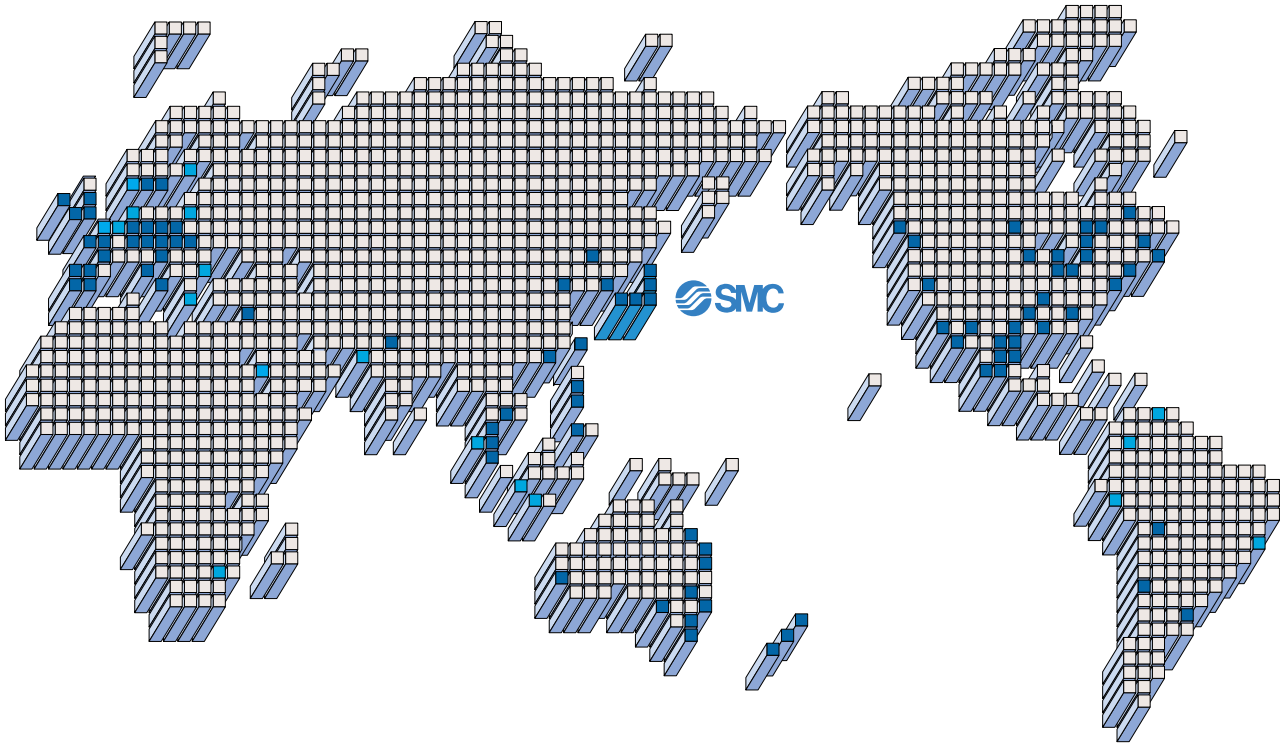

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