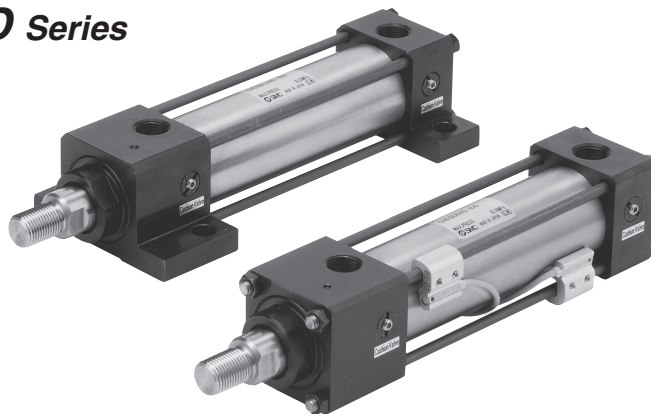


ISO Standard Hydraulic Cylinder

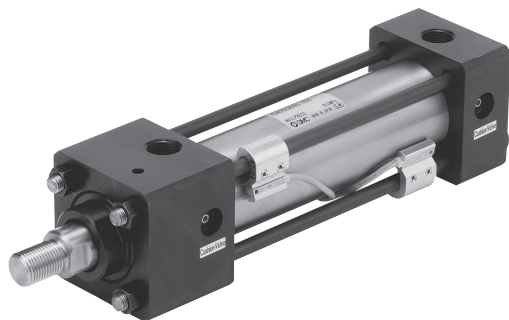
CHSD Series



Nominal pressure: **10 MPa**

Bore size [mm]: 40, 50, 63, 80, 100

CHSG Series



Nominal pressure: **16 MPa**

Bore size [mm]: 32, 40, 50, 63, 80, 100

CHSD/CHSG Series



EMC-CHSD-CHSG-01A-UK

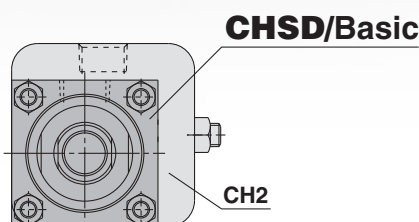
ISO Standard

Hydraulic Cylinder

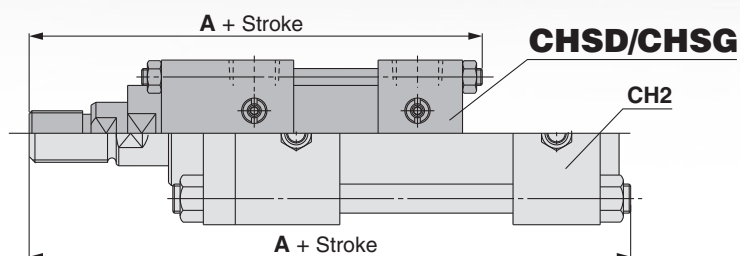
CHS Series

Nominal pressure 10 MPa/16 MPa

Reduced projection area: **76%** or less



Reduced overall length



- **Maximum weight: no more than 50 %* or 52 %* of CH2 series (CHSD) (CHSG)**

* Compared to CH2 series, the tie-rod type cylinder of same size.

- **Cylinder with built-in cover and mounting bracket allows easy disassembly and assembly.**

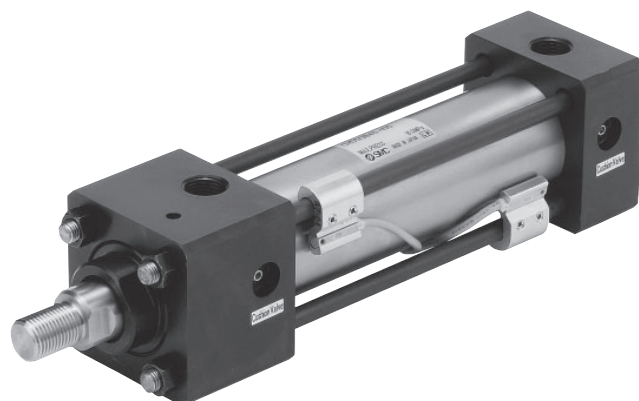
Tube size [mm]	Overall length (A size)		
	CHSD	CHSG	CH2
32	—	153	207
40	163	184	212
50	177	200	231
63	199	217	257
80	225	251	295
100	260	275	325



Conforming to ISO 10762 (JIS B 8367-5:2002)

CHSD Series/10 MPa

Ø 40, Ø 50, Ø 63, Ø 80, Ø 100



Conforming to ISO 6020-2 (JIS B 8367-2:2002)

CHSG Series/16 MPa

Ø 32, Ø 40, Ø 50, Ø 63, Ø 80, Ø 100

10 MPa

ISO Standard Hydraulic Cylinder

CHSD Series

Ø 40, Ø 50, Ø 63, Ø 80, Ø 100

How to Order

CHSD Series Model Example: CH D SD B 40 - 100 - M9BW

Magnet for auto switch:

—	Without
D	Built-in

Series type:

Symbol	Nominal pressure
D	10 MPa

Mounting type:

B	Basic
LA	Transaxial foot type
FY	Rod rectangular flange type
FZ	Head rectangular flange type
CB	Double clevis
TA	Rod trunnion

Bore size:

40	40 mm
50	50 mm
63	63 mm
80	80 mm
100	100 mm

Port thread type:

—	Rc
TN	NPT
TF	GF

Stroke: Refer to the standard stroke table on page 3.

Cylinder suffix:

Rod end nut	—	Without rod end nut
	A	With rod end nut
Presence of cushion	—	With cushion on both sides
	N	Without cushion
	R	With front bumper
	H	With rear bumper

Number of auto switches:

—	2 pcs.
S	1 pc.
n	"n" pcs.

Auto switch:

—	Without auto switch
---	---------------------

* Select an applicable auto switch model from the table below.

Port position:

Symbol	Position	Port and cushion valve location viewed from the side of piston rod end thread
—	Port on top, cushion valve on the right	
A	Port on top, cushion valve on the left	
B	Port on top, cushion valve down	
C	Port on the right, cushion valve down	
D	Port on the right, cushion valve on top	
E	Port on the right, cushion valve on the left	

Built-in Magnet Cylinder Model

If a built-in magnet cylinder without auto switch is required, there is no need to enter the symbol for the auto switch.
(Example) CHSDSB50-100

Applicable Auto Switches/Refer to website: www.smc.eu for further details on each auto switch.

Type	Special function	Electrical entry	Indicator/light	Wiring (output)	Load voltage		Auto switch model	Lead wire length (m)				Pre-wired connector	Applicable load	
					DC	AC		0.5 (—)	1 (M)	3 (L)	5 (Z)			
Solid state auto switch	Diagnostic indication (2-colour indicator)	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	M9N	●	●	●	○	○	IC circuit	Relay PLC
				3-wire (PNP)			M9P	●	●	●	○	○	—	
				2-wire	12 V	—	M9B	●	●	●	○	○	—	
				3-wire (NPN)			M9NW	●	●	●	○	○	IC circuit	
	Water resistant (2-colour indicator)	Grommet	Yes	3-wire (PNP)	24 V	5 V, 12 V	M9PW	●	●	●	○	○	IC circuit	
				2-wire			M9BW	●	●	●	○	○	—	
				3-wire (NPN)	24 V	5 V, 12 V	M9NA**	○	○	●	○	○	IC circuit	
				3-wire (PNP)			M9PA**	○	○	●	○	○	IC circuit	
	Diagnostic output (2-colour indicator)	Grommet	Yes	2-wire	12 V	—	M9BA**	○	○	●	○	○	—	
				4-wire (NPN)			F59F	●	—	●	○	○	IC circuit	
Reed auto switch	Diagnostic output (2-colour indicator)	Grommet	Yes	3-wire (NPN equiv.)	24 V	12 V	Z76	●	—	●	—	—	IC circuit	Relay PLC
				2-wire			Z73	●	—	●	—	—	—	
				2-wire	24 V	100 V or less	Z80	●	—	●	—	—	IC circuit	
				2-wire			A54*	●	—	●	●	—	—	
				2-wire	24 V	100 V, 200 V	A64*	●	—	●	—	—	—	
				2-wire			A59W*	●	—	●	—	—	—	

** Water resistant type auto switches can be mounted on the above models, but in such case SMC cannot guarantee water resistance. Consult with SMC regarding water resistant types with the above model numbers.

* Lead wire length symbols: 0.5 m — (Example) M9NW
1 m M (Example) M9NWM
3 m L (Example) M9NLW
5 m Z (Example) M9NZW

* Solid state auto switches marked with "○" are produced upon receipt of order.
* D-A5□/A6□/A59W can not be mounted to Ø 40, 50.

* Besides the models in the above table, there are some other auto switches that are applicable. For more information, refer to page 9.
* For details about auto switches with pre-wired connector, refer to website: www.smc.eu.

* D-M9□, M9□W, M9□A, Z7□, Z80 auto switches are shipped together, (not assembled). (Only auto switch mounting brackets are packed assembled.)

○ Piping port | Cushion valve

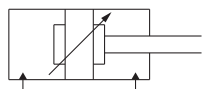
Note 1) Refer to table 1 for manufacturability.
Note 2) Diagrams illustrate the view from the rod on the left side of the cylinder dimensions.
Note 3) For mounting types FY, FZ, or TA, indicate port position with the symbol B.

Table 1 Manufacturability Check List by Mounting Type and Port Position

Mounting bracket Port position	B	LA	FY FZ	CB	TA
—	○	○	○	○	—
A	○	○	○	○	—
B	○	○	○	○	○
C	○	—	○	○	—
D	○	—	○	○	—
E	○	—	○	○	—

○: Standard product ○: Made to Order
—: Not available due to size limitation.

CHSD Series



Specifications

Bore size [mm]		40	50	63	80	100
Action		Double Acting: Single Rod				
Fluid		General mineral hydraulic fluid				
Nominal pressure		10 MPa				
Maximum allowable pressure		12 MPa				
Proof pressure		15 MPa				
Minimum operating pressure	With pressure at front side	0.25 MPa				
	With pressure at rear side	0.15 MPa				
Ambient and fluid temperature	Without magnet	-10 to 80 °C				
	Built-in magnet	-10 to 60 °C				
Piston speed		8 to 300 mm/s				
Cushion		Cushion seal				
Thread tolerance		JIS 6 g/6 H				
Stroke length tolerance		From 100st $^{+0.8}_0$, 101 to 250st $^{+1.0}_0$, 251 to 630st $^{+1.25}_0$, 631 to 1000st $^{+1.4}_0$				

Standard Stroke

Bore size [mm]	Standard stroke [mm]
40	25 to 800
50	25 to 800
63	25 to 800
80	25 to 800
100	25 to 1000

Theoretical Output



Unit: N

Bore size [mm]	Rod size [mm]	Operating direction	Piston area [mm ²]	Operating pressure [MPa]		
				3.5	7	10
40	22	OUT	1256	4396	8792	12560
		IN	876	3066	6132	8760
50	28	OUT	1963	6871	13741	19630
		IN	1347	4715	9429	13470
63	36	OUT	3117	10910	21819	31170
		IN	2099	7346	14693	20990
80	45	OUT	5026	17591	35182	50260
		IN	3436	12026	24052	34360
100	56	OUT	7853	27486	54971	78530
		IN	5390	18865	37730	53900

Theoretical output (N) = Pressure (MPa) x Piston area (mm²)

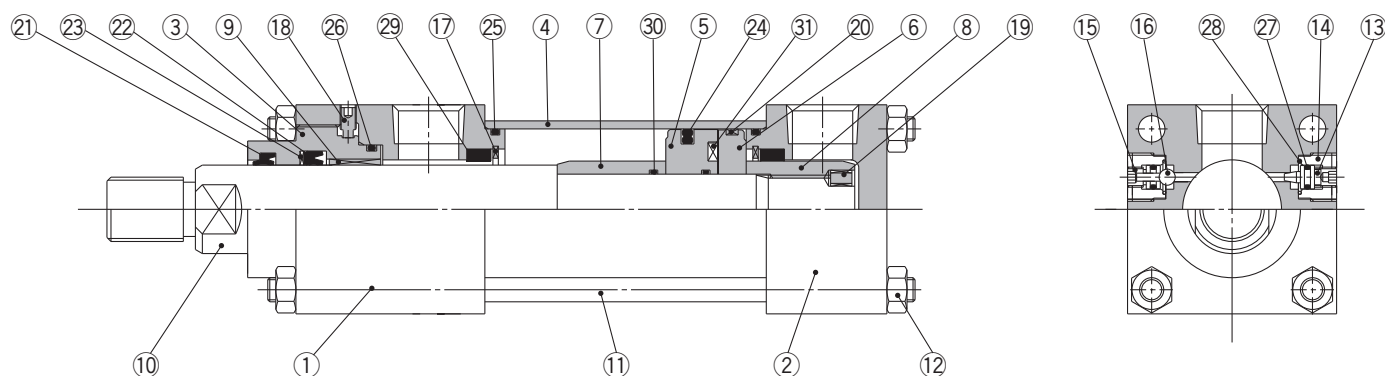
Weight

Unit: kg

Bore size [mm]			40	50	63	80	100
Basic weight (0 stroke)	Basic	B	2.10	3.20	5.10	8.90	14.5
	Transaxial foot	LA	2.40	3.60	5.50	9.70	16.0
	Rod flange	FY	2.60	3.80	5.90	10.1	16.0
	Head flange	FZ	2.50	3.80	6.00	10.0	16.4
	Double clevis	CB	2.30	3.50	6.10	9.90	16.2
	Rod trunnion	TA	2.10	3.40	5.40	9.40	15.5
Additional weight per 10 strokes			0.06	0.09	0.13	0.21	0.32

Construction

CH□SDB



Parts List

No.	Description	Material
1	Rod cover	Carbon steel
2	Head cover	Carbon steel
3	Seal holder	Carbon steel
4	Cylinder tube	Stainless steel
5	Piston	Stainless steel
6	Magnet plate	Stainless steel
7	Cushion ring	Carbon steel
8	Cushion ring nut	Carbon steel
9	Bushing	Copper alloy
10	Piston rod	Carbon steel
11	Tie-rod	Chromium molybdenum steel
12	Tie-rod nut	Carbon steel
13	Cushion valve	Alloy steel
14	Valve holder	Carbon steel
15	Air release valve	Alloy steel
16	Check ball	Bearing steel

No.	Description	Material
17	Retaining ring	Carbon tool steel
18	Set screw	Alloy steel
19	Pin	Stainless steel
20	Wear ring	Resin
21	Scraper	NBR
22	Rod seal	NBR
23	Back-up ring	Resin
24	Piston seal	NBR
25	Cylinder tube gasket	NBR
26	Holder gasket	NBR
27	Valve seal	NBR
28	Valve holder gasket	NBR
29	Cushion seal	—
30	Piston gasket	NBR
31	Magnet	—

Replacement Parts: Seal Kit

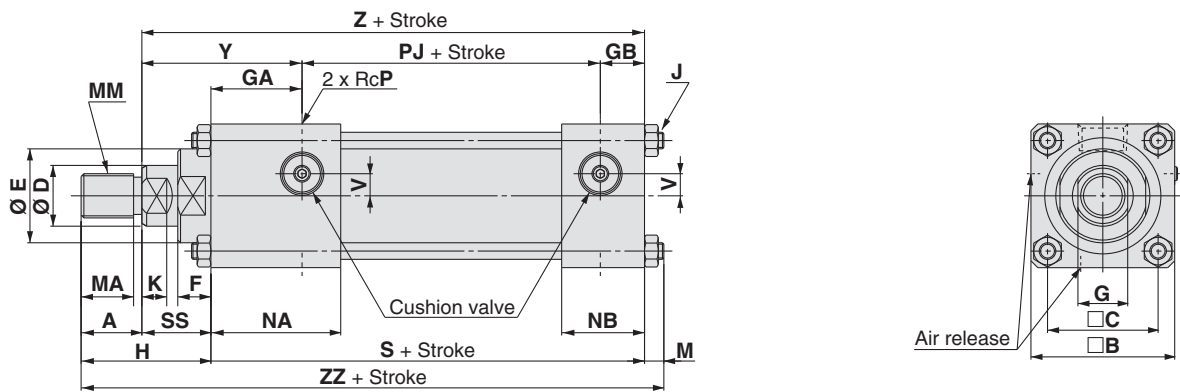
Bore size [mm]	Seal kit no.
40	CHSD40-PS
50	CHSD50-PS
63	CHSD63-PS
80	CHSD80-PS
100	CHSD100-PS

* Seal kit consists of items 21 to 25 and 29, and can be ordered by using the seal kit number for each bore size.

CHSD Series

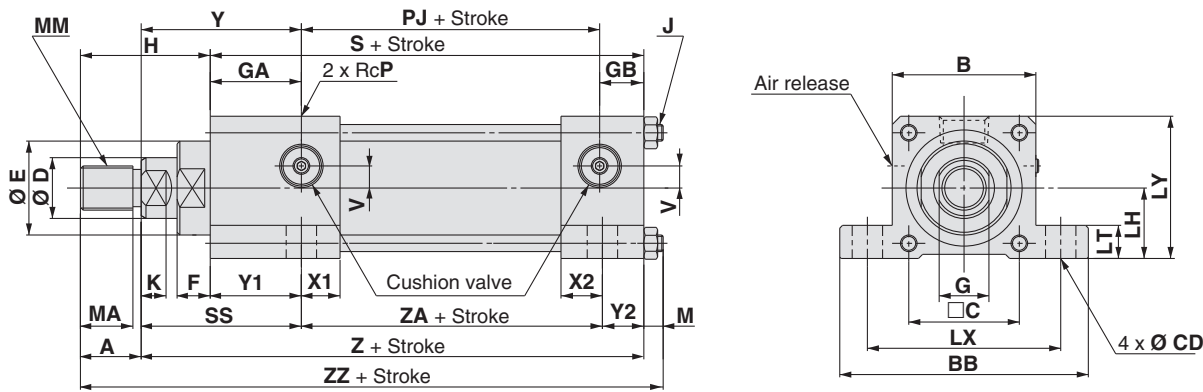
Dimensions

Basic: CHSDB



Bore size [mm]	Stroke range	A	B	C	D	E	F	G	GA	GB	H	J	K	M	MA	MM	NA	NB	P	PJ	S	SS	V	Y	Z	ZZ
40	25 to 800	22	52	40	22	34	12	19	33	16	47	M6 x 1	8	7.5	19	M16 x 1.5	46	29	3/8	58	107	25	6.5	58	132	161.5
50	25 to 800	28	65	50	28	42	15	24	34	16	59	M8 x 1	11	9	25	M20 x 1.5	46.5	28.5	3/8	58	108	31	8	65	139	176
63	25 to 800	36	77	58	36	50	19	30	31	18	74	M8 x 1	13	9	32	M27 x 2	46	33	1/2	66	115	38	12	69	153	198
80	25 to 800	45	96	75	45	60	13	41	42	17	80	M10 x 1.25	17	10.5	41	M33 x 2	57	32	1/2	74	133	35	15	77	168	223.5
100	25 to 1000	56	115	90	56	72	16	50	38	22	97	M14 x 1.5	19	14.5	52	M42 x 2	58	42	3/4	86	146	41	15	79	187	257.5

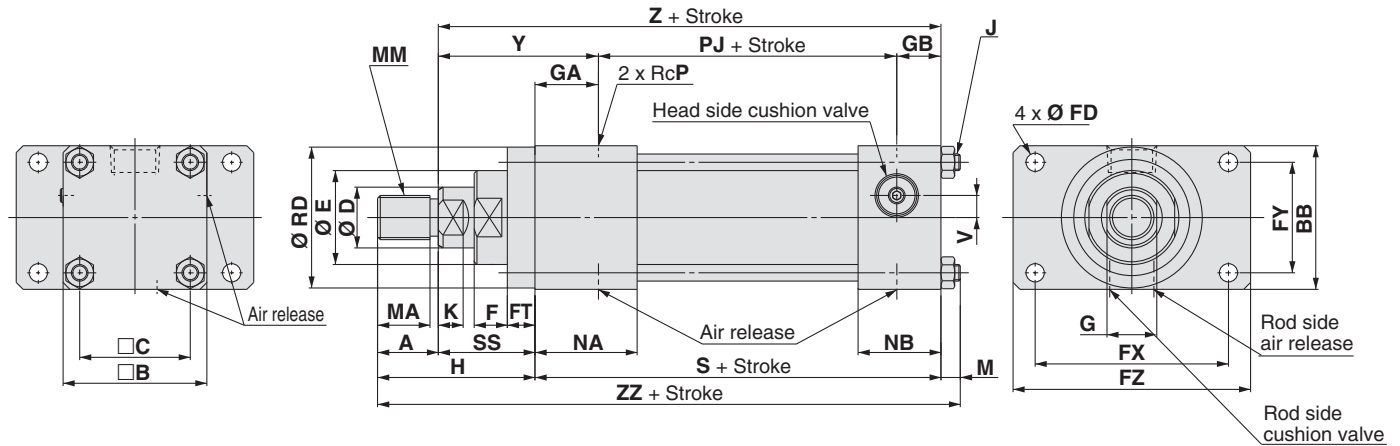
Transaxial foot: CHSDLA



Bore size [mm]	Stroke range	A	B	BB	C	CD	D	E	F	G	GA	GB	H	J	K	LH	LT	LX	LY	M	MA	MM	P	PJ	S	SS
40	25 to 800	22	52	90	40	11	22	34	12	19	33	16	47	M6 x 1	8	25.5	12	70	51.5	7.5	19	M16 x 1.5	3/8	58	107	58
50	25 to 800	28	65	103	50	11	28	42	15	24	34	16	59	M8 x 1	11	32	12	83	64.5	9	25	M20 x 1.5	3/8	58	108	65
63	25 to 800	36	77	115	58	11	36	50	19	30	31	18	74	M8 x 1	13	38	12	95	76.5	9	32	M27 x 2	1/2	66	115	68
80	25 to 800	45	96	147	75	14	45	60	13	41	42	17	80	M10 x 1.25	17	47.5	18	121	95.5	10.5	41	M33 x 2	1/2	74	133	77
100	25 to 1000	56	115	179	90	18	56	72	16	50	38	22	97	M14 x 1.5	19	57	25	145	114.5	14.5	52	M42 x 2	3/4	86	146	79

Bore size [mm]	V	X1	X2	Y	Y1	Y2	ZA	Z	ZZ
40	6.5	13	14	58	33	15	59	132	161.5
50	8	12.5	13.5	65	34	15	59	139	176
63	12	16	16	69	30	17	68	153	198
80	15	15	15	77	42	17	74	168	223.5
100	15	20	20	79	38	22	86	187	257.5

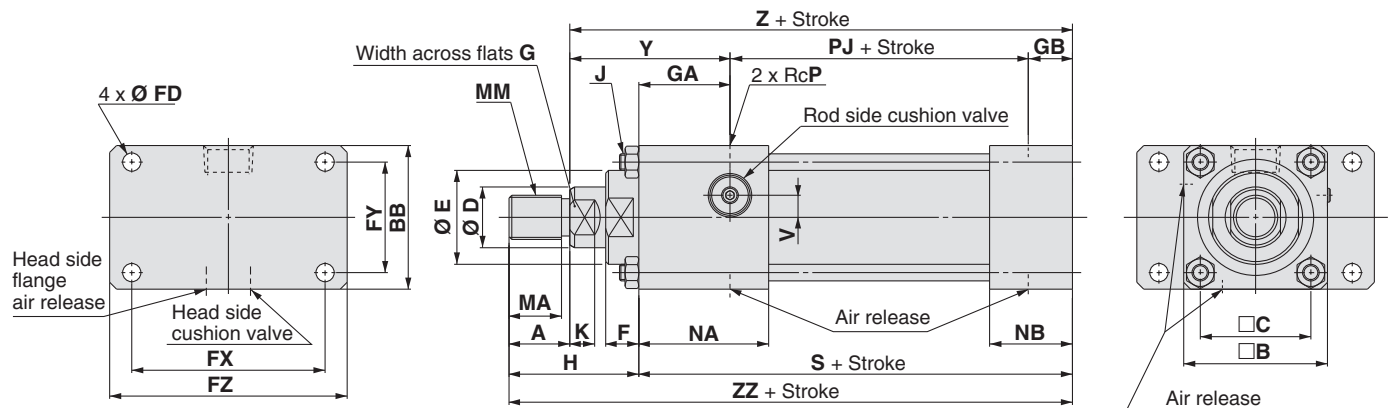
Rod flange: CHSDFY



Bore size [mm]	Stroke range	A	B	BB	C	D	E	F	FD	FT	FX	FY	FZ	G	GA	GB	H	J	K	M	MA	MM	NA	NB	P	PJ
40	25 to 800	22	52	52	40	22	34	12	6.6	10	70	40	86	19	23	16	57	M6 x 1	8	7.5	19	M16 x 1.5	36	29	3/8	58
50	25 to 800	28	65	65	50	28	42	15	9	10	86	50	105	24	24	16	69	M8 x 1	11	9	25	M20 x 1.5	36.5	28.5	3/8	58
63	25 to 800	36	77	77	58	36	50	19	9	10	98	56	118	30	21	18	84	M8 x 1	13	9	32	M27 x 2	36	33	1/2	66
80	25 to 800	45	96	96	75	45	60	13	11	16	119	70	143	41	26	17	96	M10 x 1.25	17	10.5	41	M33 x 2	41	32	1/2	74
100	25 to 1000	56	115	115	90	56	72	16	13.5	16	138	90	162	50	22	22	113	M14 x 1.5	19	14.5	52	M42 x 2	42	42	3/4	86

Bore size [mm]	RD	S	SS	V	Y	Z	ZZ
40	51	97	35	6.5	58	132	161.5
50	62	98	41	8	65	139	176
63	72	105	48	12	69	153	198
80	92	117	51	15	77	168	223.5
100	110	130	57	15	79	187	257.5

Head flange: CHSDFZ

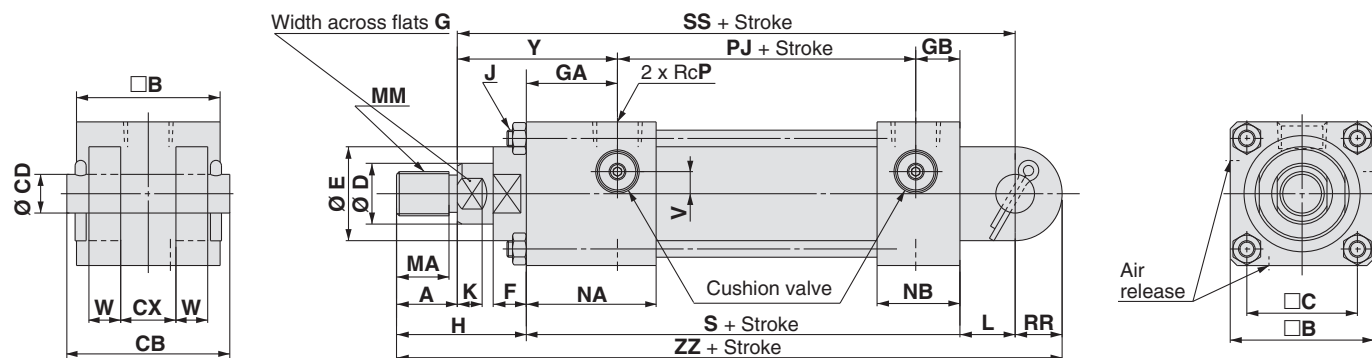


Bore size [mm]	Stroke range	A	B	BB	C	D	E	F	FD	FX	FY	FZ	G	GA	GB	H	J	K	MA	MM	NA	NB	P	PJ	S	V	Y	Z	ZZ
40	25 to 800	22	52	52	40	22	34	12	6.6	70	40	86	19	33	16	47	M6 x 1	8	19	M16 x 1.5	46	29	3/8	58	107	6.5	58	132	154
50	25 to 800	28	65	65	50	28	42	15	9	86	50	105	24	34	16	59	M8 x 1	11	25	M20 x 1.5	46.5	28.5	3/8	58	108	8	65	139	167
63	25 to 800	36	77	77	58	36	50	19	9	98	56	118	30	31	18	74	M8 x 1	13	32	M27 x 2	46	33	1/2	66	115	12	69	153	189
80	25 to 800	45	96	96	75	45	60	13	11	119	70	143	41	42	17	80	M10 x 1.25	17	41	M33 x 2	57	32	1/2	74	133	15	77	168	213
100	25 to 1000	56	115	115	90	56	72	16	13.5	138	90	162	50	38	22	97	M14 x 1.5	19	52	M42 x 2	58	42	3/4	86	148	15	79	187	243

CHSD Series

Dimensions

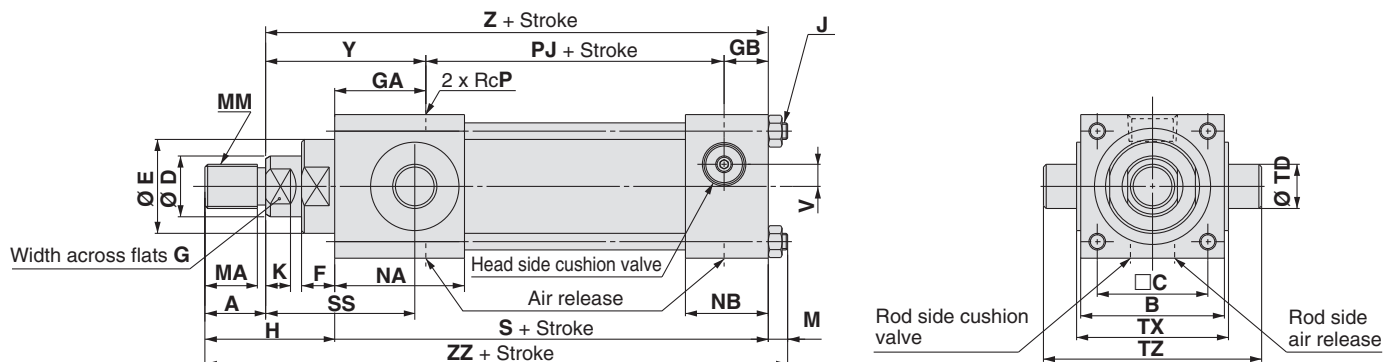
Double clevis: CHSDCB



Bore size [mm]	Stroke range	A	B	C	CB	CD	CX	D	E	F	G	GA	GB	H	J	K	L	MA	MM	NA	NB	P	PJ	RR	S
40	25 to 800	22	52	40	64	14	20	22	34	12	19	33	16	47	M6 x 1	8	19	19	M16 x 1.5	46	29	3/8	58	17	107
50	25 to 800	28	65	50	64	14	20	28	42	15	24	34	16	59	M8 x 1	11	19	25	M20 x 1.5	46.5	28.5	3/8	58	17	108
63	25 to 800	36	77	58	93	20	30	36	50	19	30	31	18	74	M8 x 1	13	32	32	M27 x 2	46	33	1/2	66	29	115
80	25 to 800	45	96	75	93	20	30	45	60	13	41	42	17	80	M10 x 1.25	17	32	41	M33 x 2	57	32	1/2	74	29	133
100	25 to 1000	56	115	90	113	28	40	56	72	16	50	38	22	97	M14 x 1.5	19	39	52	M42 x 2	58	42	3/4	86	34	146

Bore size [mm]	SS	V	W	Y	ZZ
40	151	6.5	11.5	58	190
50	158	8	11.5	65	203
63	185	12	17.5	69	250
80	200	15	17.5	77	274
100	226	15	21.5	79	316

Rod trunnion: CHSDTA

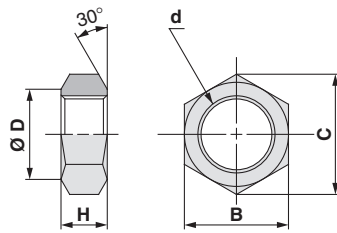


Bore size [mm]	Stroke range	A	B	C	D	E	F	G	GA	GB	H	J	K	M	MA	MM	NA	NB	P	PJ	S	SS	TD	TX	TZ	
40	25 to 800	22	52	40	22	34	12	19	33	16	47	M6 x 1	8	7.5	19	M16 x 1.5	46	29	3/8	58	107	54	16	-0.016 -0.043	55	79
50	25 to 800	28	65	50	28	42	15	24	34	16	59	M8 x 1	11	9	25	M20 x 1.5	46.5	28.5	3/8	58	108	61	20	-0.020 -0.053	68	100
63	25 to 800	36	77	58	36	50	19	30	31	18	74	M8 x 1	13	9	32	M27 x 2	46	33	1/2	66	115	67	25	-0.025 -0.064	80	120
80	25 to 800	45	96	75	45	60	13	41	42	17	80	M10 x 1.25	17	10.5	41	M33 x 2	57	32	1/2	74	133	73	32	-0.025 -0.064	100	150
100	25 to 1000	56	115	90	56	72	16	50	38	22	97	M14 x 1.5	19	14.5	52	M42 x 2	58	42	3/4	86	146	79	40	-0.025 -0.064	120	184

Bore size [mm]	V	Z	ZZ
40	6.5	132	161.5
50	8	139	176
63	12	153	198
80	15	168	223.5
100	15	187	257.5

Accessory (Option)

Rod end nut



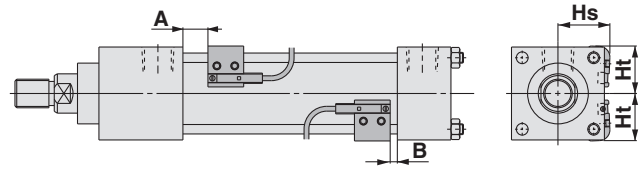
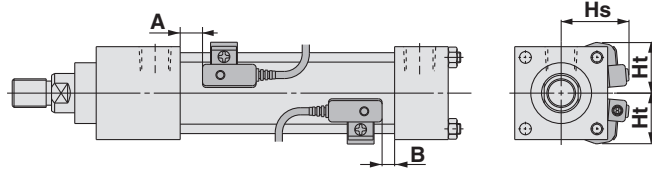
Material: Carbon steel

Part no.	Bore size [mm]	B	C	d	D	H
NTH-040	40	22	25.4	M16 x 1.6	21	10
NTH-050	50	27	31.2	M20 x 1.5	26	12
NTH-060S	63	41	47.3	M27 x 2	39	16
NTH-080S	80	50	57.7	M33 x 2	48	20
NTH-100S	100	65	75	M42 x 2	62	25

Auto Switch Proper Mounting Position (Detection at Stroke End) and Its Mounting Height

D-A5□/A6□
D-F5□(W)/J59(W)/F5BA

D-M9□/M9□V
D-M9□W/M9□WV
D-M9□A/M9□AV
D-Z7□/Z80



Auto Switch Proper Mounting Position

Bore size [mm]	D-M9□/M9□V D-M9□W/M9□WV D-M9□A/M9□AV		D-F5□/J59 D-F5□W/J59W D-F59F D-F5BA		D-F5NT		D-Z7□/Z80		D-A5□/A6□		D-A59W	
	A	B	A	B	A	B	A	B	A	B	A	B
40	11.5	8.5	8	5	13	10	5	2	—	—	—	—
50	13	8	9.5	4.5	14.5	9.5	6.5	1.5	—	—	—	—
63	14.5	9.5	11	6	16	11	8	3	4.5	0	8.5	3.5
80	18.5	13.5	15	10	20	15	12	7	8.5	3.5	12.5	7.5
100	18.5	15.5	15	12.5	20	17.5	12	9.5	8.5	6	12.5	10

Note 1) D-A5□/A6□/A59W cannot be mounted to Ø 40, Ø 50.

Note 2) Adjust the auto switch after confirming the operating conditions in the actual setting.

Auto Switch Mounting Height

Bore size [mm]	D-M9□/M9□W D-M9□A		D-M9□V/M9□WV D-M9□AV		D-F5□/J59 D-F5□W/J59W D-F59F/F5BA D-F5NT		D-A5□/A6□ D-A59W		D-Z7□/Z80	
	Ht	Hs	Ht	Hs	Ht	Hs	Ht	Hs	Ht	Hs
40	27	28.5	27	34	35.5	28.5	—	—	29	27
50	33	33.5	33	38.5	39.5	34.5	—	—	33	33
63	38.5	38	38.5	43.5	45	38.5	47.5	38.5	28	37
80	48	47	48	52	51	48	54	48	46.5	46
100	57.5	59	57.5	62.5	63.5	58	66.5	58	59	57

* D-A5□/A6□/A59W cannot be mounted to Ø 40, Ø 50.

Operating Range

Auto switch model	Bore size [mm]				
	40	50	63	80	100
D-M9□/M9□V D-M9□W/M9□WV D-M9□A/M9□AV	4.5	5	6	7.5	9
D-F5□/J59/F59F D-F5□W/J59W D-F5BA/F5NT	4	4.5	4.5	5.5	5.5
D-A5□/A6□	—	—	10.5	12	14.5
D-A59W	—	—	14	16	18
D-Z7□/Z80	8	9	10	12	14.5

* D-A5□/A6□/A59W cannot be mounted to Ø 40, Ø 50.

* Since this is a guideline including hysteresis, not meant to be guaranteed. (Assuming approximately ±30 % dispersion.)

There may be the case it will vary substantially depending on an ambient environment.

Minimum Auto Switch Mounting Stroke

Auto switch model	2 pcs. (Different surfaces and same surface), 1 pc.	"n" pcs.
D-M9□ D-M9□W D-M9□A	20	$20 + 40 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 1)
D-M9□V D-M9□WV D-M9□AV	20	$20 + 30 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 1)
D-F5□/J59/F5□W D-J59W/F5BA D-F59F/A5□/A6□	20	$20 + 55 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 1)
D-D-F5NT	25	$20 + 55 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 1)
D-A59W	30	$20 + 55 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 1)
D-Z7□/Z80	20	$20 + 40 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 1)

* D-A5□/A6□/A59W cannot be mounted to Ø 40, Ø 50.

Note 1) When "n" is an odd number, an even number that is one larger than this odd number is used for the calculation.

Besides the models listed in "How to Order," the following auto switches are applicable.
Refer to website: www.smc.eu for detailed auto switch specifications.

Auto switch type	Part no.	Electrical entry	Features
Solid state	D-M9NV, M9PV, M9BV	Grommet (perpendicular)	—
	D-M9NWV, M9PWV, M9BWV		Diagnostic indication (2-colour indicator)
	D-M9NAV, M9PAV, M9BAV		Water resistant (2-colour indicator)
	D-F59, F5P, J59	Grommet (in-line)	—
	D-F59W, F5PW, J59W		Diagnostic indication (2-colour indicator)
	D-F5BA		Water resistant (2-colour indicator)
	D-F5NT		With timer
Reed	D-A53, A56	Grommet (in-line)	—
	D-A67		Without indicator light

* Solid state auto switches are also available with pre-wired connector. Contact SMC for detailed auto switch specifications.

Auto Switch Mounting Brackets: Part Nos.

Auto switch models	Bore size [mm]				
	Ø 40	Ø 50	Ø 63	Ø 80	Ø 100
D-M9□/M9□V D-M9□W/M9□WV D-M9□A/M9□AV	BMB5-032	BA7-040	BA7-040	BA7-063	BS5-125
D-F5□/J59 D-F5□W/J59W D-F5BA/F59F/F5NT D-A5□/A6□/A59W	BT-03	BT-04	BT-04	BT-06	BT-12
D-Z7□/Z80	BMB4-032	BA4-040	BA4-040	BA4-063	BS4-125

Note 1) D-A5□/A6□/A59W cannot be mounted to Ø 40, Ø 50.

[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.)

BBA1 : For D-F5/J5/A5/A6 types

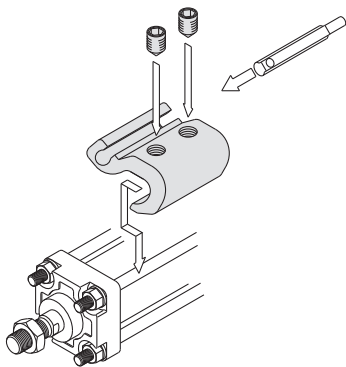
Note 2) Refer to the table below for details on BBA1.

Stainless mounting screw kit details

Part no.	Contents				Applicable auto switch mounting bracket part nos.	Applicable auto switches
	No.	Description	Size	Pcs.		
BBA1	1	Auto switch mounting screws	M4 x 0.7 x 8L	1	BT-□□	D-A5, A6 D-F5, J5
					BT-03, BT-04, BT-05 BT-06, BT-08, BT-12	
	2	Set screw	M4 x 0.7 x 6L	2	BA4-040, BA4-063, BA4-080 BMB4-032, BMB4-050	D-Z7, Z8 D-Y5, Y6, Y7
					BMB5-032 BA7-040, BA7-063, BA7-080	D-A9 D-M9
	3	Set screw	M4 x 0.7 x 8L	2	BT-16, BT-18A, BT-20	D-A5, A6 D-F5, J5
					BS4-125, BS4-160 BS4-180, BS4-200	D-Z7, Z8 D-Y5, Y6, Y7
					BS5-125, BS5-160 BS5-180, BS5-200	D-A9 D-M9

When D-F5BA auto switch is shipped mounted on a cylinder, the above stainless steel screws are used. Also when switches are shipped separately, BBA1 is included.

Note 3) When using D-M9□A(V), order stainless mounting screw kit BBA1 instead of the iron auto switch mounting brackets (BMB5-032, BA7-□□□, BS5-125) in the table above, and use the M4 x 6L stainless set screws included.

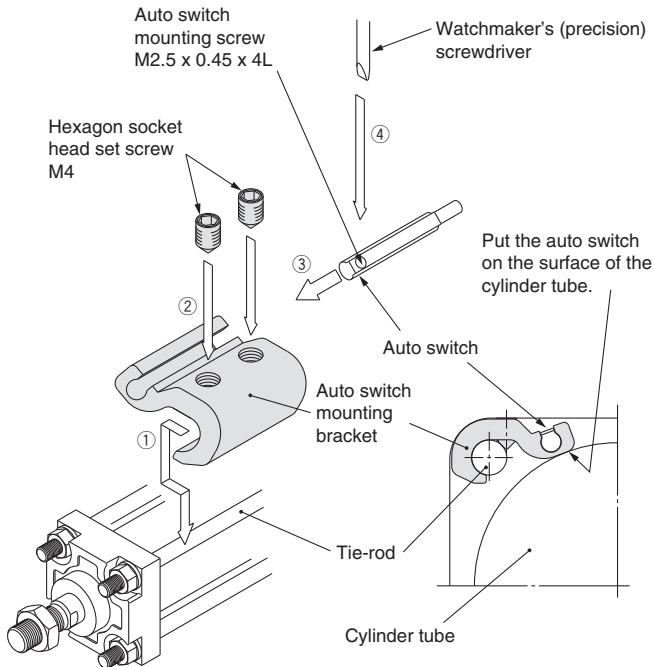


- Mounting example for D-M9□(V), M9□W(V), M9□A(V).

How to Mount and Move the Auto Switch

<Applicable auto switch>

Solid state D-M9N(V), D-M9P(V), D-M9B(V)
D-M9NW(V), D-M9PW(V), D-M9BW(V)
D-M9NA(V), D-M9PA(V), D-M9BA(V)

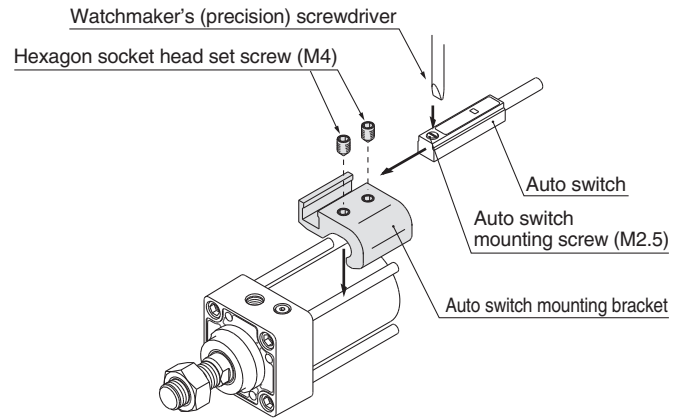


1. Fix it to the detecting position with a set screw by installing an auto switch mounting bracket in cylinder tie-rod and letting the bottom surface of an auto switch mounting bracket contact the cylinder tube firmly.
2. Fix it to the detecting position with a hexagon socket head set screw (M4).
(Use a hexagon wrench.)
3. Fit an auto switch into the auto switch mounting groove to set it roughly to the mounting position for an auto switch.
4. After confirming the detecting position, tighten up the mounting screw (M2.5) attached to an auto switch, and secure the auto switch.
5. When changing the detecting position, carry out in the state of 3.

Note 1) To protect auto switches, ensure that main body of an auto switch should be embedded into auto switch mounting groove with a depth of 15 mm or more.
Note 2) Set the tightening torque of a hexagon socket head set screw (M4) to be 1 to 1.2 N·m.
Note 3) When tightening an auto switch mounting screw (M2.5), use a watchmaker's screwdriver with a grip diameter of 5 to 6 mm. Also, set the tightening torque to be 0.05 to 0.15 N·m. As a guide, turn 90° from the position where it comes to feel tight.

<Applicable auto switch>

Reed D-Z73, D-Z76, D-Z80



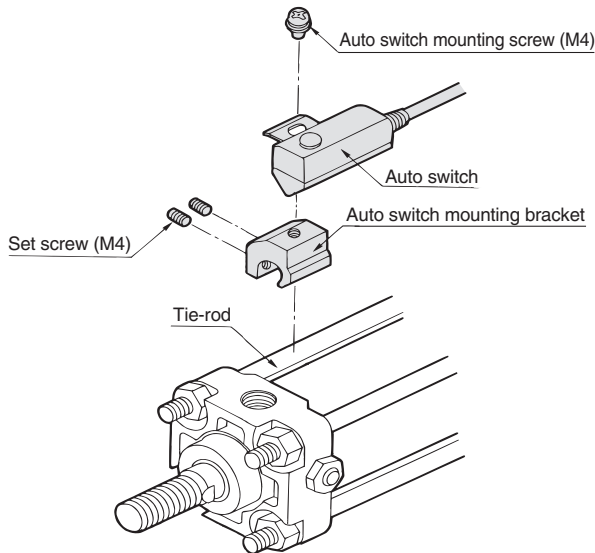
1. Fix it to the detecting position with a hexagon socket head set screw (M4) by installing an auto switch mounting bracket in cylinder tie-rod and letting the bottom surface of an auto switch mounting bracket contact the cylinder tube firmly. (Use a hexagon wrench)
2. Fit an auto switch into the auto switch mounting groove to set it roughly to the auto switch mounting position for an auto switch.
3. After confirming the detecting position, tighten up the mounting screw (M2.5) attached to an auto switch, and secure the switch.
4. When changing the detecting position, carry out in the state of 2.

Note 1) To protect auto switches, ensure that main body of an auto switch should be embedded into auto switch mounting groove with a depth of 15 mm or more.
Note 2) Set the tightening torque of a hexagon socket head set screw (M4) to be 1 to 1.2 N·m.
Note 3) When tightening an auto switch mounting screw (M2.5), use a watchmaker's screwdriver with a grip diameter of 5 to 6 mm. Also, set the tightening torque to be 0.05 to 0.15 N·m. As a guide, turn 90° from the position where it comes to feel tight.

How to Mount and Move the Auto Switch

<Applicable auto switch>

Solid state D-F59, D-F5P
D-J59, D-F5BA
D-F59W, D-F5PW, D-J59W
D-F59F, D-F5NT
Reed D-A53, D-A54, D-A56, D-A64, D-A67
D-A59W



1. Fix the auto switch on the auto switch mounting bracket with the auto switch mounting screw (M4) and install the set screw.
2. Fit the auto switch mounting bracket into the cylinder tie-rod and then fix the auto switch at the detecting position with the hexagonal wrench. (Be sure to put the auto switch on the surface of cylinder tube.)
3. When changing the detecting position, loosen the set screw to move the auto switch and then re-fix the auto switch on the cylinder tube. (Tightening torque of M4 screw should be 1 to 1.2 N·m.)

16 MPa

ISO Standard Hydraulic Cylinder

CHSG Series

Ø 32, Ø 40, Ø 50, Ø 63, Ø 80, Ø 100

How to Order

CH D SG B 40 - 100 - M9BW

Magnet for auto switch

—	Without
D	Built-in

Series type

Symbol	Nominal pressure
G	16 MPa

Mounting type

B	Basic
LA	Transaxial foot type
FY	Rod rectangular flange type
FZ	Head rectangular flange type
CA	Single clevis
CB	Double clevis
TA	Rod trunnion
TC	Centre trunnion

Bore size

32	32 mm
40	40 mm
50	50 mm
63	63 mm
80	80 mm
100	100 mm

Port thread type

—	Rc
TN	NPT
TF	GF

Stroke

Refer to the standard stroke table on the next page 14.

Cylinder suffix

Rod end nut	—	Without rod end nut
	A	With rod end nut
Presence of cushion	—	With cushion on both sides
	N	Without cushion
	R	With front bumper
	H	With rear bumper

Auto switch

—	Without auto switch
---	---------------------

* Select an applicable auto switch model from the table below.

Port position

Symbol	Position	Port and cushion valve location viewed from the side of piston rod end thread
—	Port on top, cushion valve on the right	
A	Port on top, cushion valve on the left	
B	Port on top, cushion valve down	
C	Port on the right, cushion valve down	
D	Port on the right, cushion valve on top	
E	Port on the right, cushion valve on the left	

Built-in Magnet Cylinder Model

If a built-in magnet cylinder without auto switch is required, there is no need to enter the symbol for the auto switch.
(Example) CHDSGB50-100

Note) When more than one symbol is to be specified, indicate them in alphabetical order.

Applicable Auto Switches/Refer to website: www.smc.eu for further details on each auto switch.

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage		Auto switch model	Lead wire length (m)				Pre-wired connector	Applicable load
					DC	AC		0.5	1	3	5		
Solid state auto switch	Diagnostic indication (2-colour indicator)	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	●	●	●	○	○	IC circuit
				3-wire (PNP)			M9N	—	—	—	—	—	
				2-wire	12 V	—	—	●	●	●	○	○	—
				3-wire (NPN)			M9P	—	—	—	—	—	
				3-wire (PNP)	24 V	5 V, 12 V	—	●	●	●	○	○	IC circuit
				2-wire			M9B	—	—	—	—	—	
	Water resistant (2-colour indicator)	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	●	●	●	○	○	IC circuit
				3-wire (PNP)			M9NW	—	—	—	—	—	
				2-wire	12 V	—	—	●	●	●	○	○	—
				3-wire (NPN)			M9PW	—	—	—	—	—	
				3-wire (PNP)	24 V	5 V, 12 V	—	●	●	●	○	○	IC circuit
				2-wire			M9BA**	—	—	—	—	—	
Reed auto switch	Diagnostic output (2-colour indicator)	Grommet	Yes	4-wire (NPN)	24 V	12 V	—	●	●	●	○	○	IC circuit
				3-wire (NPN equiv.)			M9NA**	—	—	—	—	—	
				2-wire	24 V	12 V	—	●	●	●	○	○	IC circuit
				2-wire			M9PA**	—	—	—	—	—	
				2-wire	24 V	12 V	—	●	●	●	○	○	IC circuit
				2-wire			M9BA**	—	—	—	—	—	

** Water resistant type auto switches can be mounted on the above models, but in such case SMC cannot guarantee water resistance. Consult with SMC regarding water resistant types with the above model numbers.

* Lead wire length symbols: 0.5 m — (Example) M9NW
1 m M (Example) M9NWM
3 m L (Example) M9NWL
5 m Z (Example) M9NWX

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

* Besides the models in the above table, there are some other auto switches that are applicable. For more information, refer to page 22.

* For details about auto switches with pre-wired connector, refer to website: www.smc.eu.

* D-M9□, M9□W, M9□A, Z7□, Z80 auto switches are shipped together, (not assembled). (Only auto switch mounting brackets are packed assembled.)

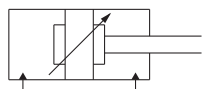
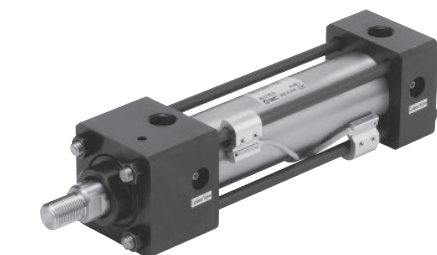
Note 1) Refer to table 1 for manufacturability.
Note 2) Diagrams illustrate the view from the rod on the left side of the cylinder dimensions.
Note 3) For mounting types FY, FZ, or TA, indicate port position with the symbol B.

Table 1 Manufacturability Check List by Mounting Type and Port Position

Mounting bracket	B	LA	FY FZ	CA CB	TA	TC
—	○	○	○	○	—	○
A	○	○	○	○	—	○
B	○	○	○	○	○	○
C	○	—	○	○	—	○
D	○	—	○	○	—	○
E	○	—	○	○	—	○

○: Standard product ○: Made to Order
—: Not available due to size limitation.

Specifications



Bore size [mm]		32	40	50	63	80	100
Action		Double Acting: Single Rod					
Fluid		General mineral hydraulic fluid					
Nominal pressure		16 MPa					
Maximum allowable pressure		20 MPa					
Proof pressure		24 MPa					
Minimum operating pressure	With pressure at rod side	0.25 MPa					
	With pressure at head side	0.15 MPa					
Ambient and fluid temperature	Without magnet	-10 to 80 °C					
	Built-in magnet	-10 to 60 °C					
Piston speed		8 to 300 mm/s					
Cushion		Cushion seal					
Thread tolerance		JIS 6 g/6 H					
Stroke length tolerance		From 100st $^{+0.8}_0$, 101 to 250st $^{+1.0}_0$, 251 to 630st $^{+1.25}_0$, 631 to 1000st $^{+1.4}_0$					

Standard Stroke

Bore size [mm]	Standard stroke [mm]
32	25 to 800
40	25 to 800
50	25 to 800
63	25 to 800
80	25 to 800
100	25 to 1000

Theoretical Output



Unit: N

Bore size [mm]	Rod size [mm]	Operating direction	Piston area [mm ²]	Operating pressure [MPa]			
				3.5	7	10	16
32	18	OUT	804	2814	5628	8040	12864
		IN	549	1922	3843	5490	8784
40	22	OUT	1256	4396	8792	12560	20096
		IN	876	3066	6132	8760	14016
50	28	OUT	1963	6871	13741	19630	31408
		IN	1347	4715	9429	13470	21552
63	36	OUT	3117	10910	21819	31170	49872
		IN	2099	7346	14693	20990	33584
80	45	OUT	5026	17591	35182	50260	80416
		IN	3436	12026	24052	34360	54976
100	56	OUT	7853	27486	54971	78530	125648
		IN	5390	18865	37730	53900	86240

Weight

Theoretical output (N) = Pressure (MPa) x Piston area (mm²)

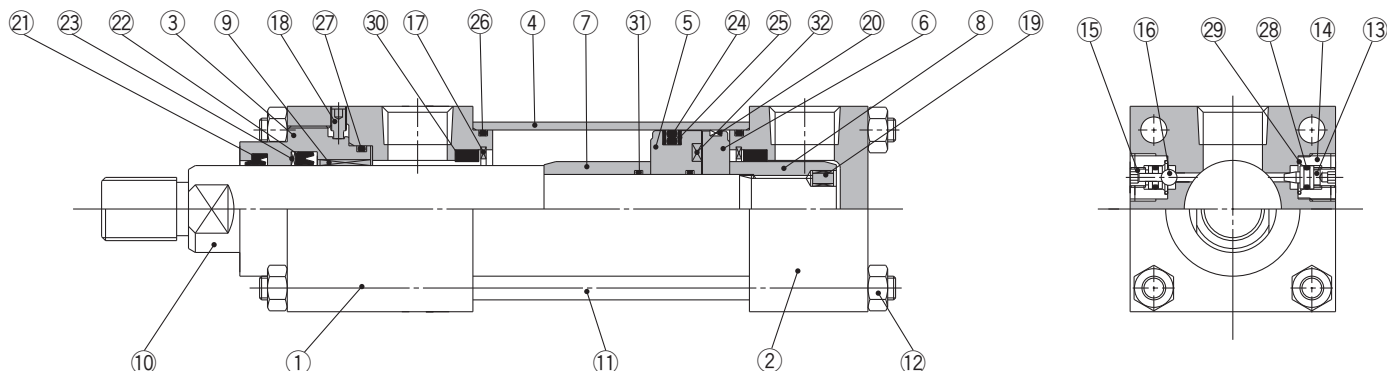
Unit: kg

Bore size [mm]			32	40	50	63	80	100
Basic weight (0 stroke)	Basic	B	1.60	3.20	4.70	7.80	14.7	20.8
	Transaxial foot	LA	1.80	4.00	5.70	8.65	17.0	23.3
	Rod flange	FY	1.90	4.10	6.00	9.10	16.7	22.9
	Head flange	FZ	1.70	3.90	5.60	8.20	16.4	24.8
	Single clevis	CA	1.60	3.40	5.60	8.20	16.4	24.8
	Double clevis	CB	1.60	3.40	5.60	8.20	16.4	24.8
	Rod trunnion	TA	1.70	3.40	5.20	8.40	15.9	22.5
	Centre trunnion	TC	1.90	3.90	5.80	9.40	18.2	25.4
Additional weight per 10 strokes			0.05	0.07	0.12	0.18	0.28	0.42

CHSG Series

Construction

CH□SGB



Parts List

No.	Description	Material
1	Rod cover	Carbon steel
2	Head cover	Carbon steel
3	Seal holder	Carbon steel
4	Cylinder tube	Stainless steel
5	Piston	Stainless steel
6	Magnet plate	Stainless steel
7	Cushion ring	Carbon steel
8	Cushion ring nut	Carbon steel
9	Bushing	Copper alloy
10	Piston rod	Carbon steel
11	Tie-rod	Chromium molybdenum steel
12	Tie-rod nut	Carbon steel
13	Cushion valve	Alloy steel
14	Valve holder	Carbon steel
15	Air release valve	Alloy steel
16	Check ball	Bearing steel

No.	Description	Material
17	Retaining ring	Carbon tool steel
18	Set screw	Alloy steel
19	Pin	Stainless steel
20	Wear ring	Resin
21	Scraper	NBR
22	Rod seal	NBR
23	Back-up ring	Resin
24	Piston seal	NBR
25	Back-up ring	Resin
26	Cylinder tube gasket	NBR
27	Holder gasket	NBR
28	Valve seal	NBR
29	Valve holder gasket	NBR
30	Cushion seal	—
31	Piston gasket	NBR
32	Magnet	—

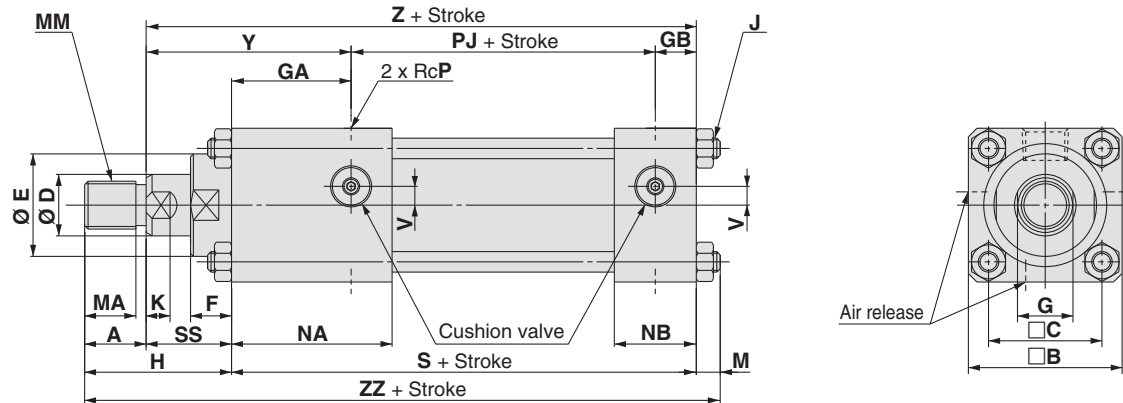
Replacement Parts: Seal Kit

Bore size [mm]	Seal kit no.
32	CHSG32-PS
40	CHSG40-PS
50	CHSG50-PS
63	CHSG63-PS
80	CHSG80-PS
100	CHSG100-PS

* Seal kit consists of items 21 to 26 and 30, and can be ordered by using the seal kit number for each bore size.

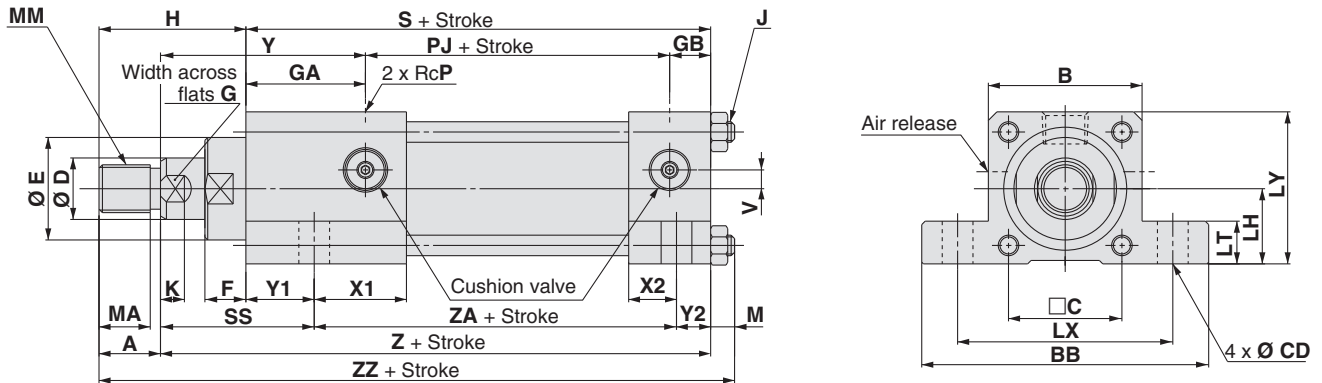
Dimensions

Basic: CHSGB



Bore size [mm]	Stroke range	A	B	C	D	E	F	G	GA	GB	H	J	K	M	MA	MM	NA	NB	P	PJ	S	SS	V	Y	Z	ZZ
32	25 to 800	18	45	33.2	18	30	12	14	35	12	43	M6 x 1	7	7.5	15	M14 x 1.5	46	23	1/4	56	103	25	5.5	60	128	153.5
40	25 to 800	22	63	41.7	22	34	12	19	37	18	47	M8 x 1	9	10	19	M16 x 1.5	51	32	3/8	73	128	25	6.5	62	153	185
50	25 to 800	28	75	52.3	28	42	9	24	42	18	53	M12 x 1.25	11	12	25	M20 x 1.5	57	33	1/2	74	134	25	7	67	159	199
63	25 to 800	36	90	64.3	36	50	13	30	39	17	68	M12 x 1.25	13	12	32	M27 x 2	55	33	1/2	80	136	32	12	71	168	216
80	25 to 800	45	115	82.7	45	60	9	41	46	20	76	M16 x 1.5	17	16	41	M33 x 2	66	40	3/4	93	159	31	15	77	190	251
100	25 to 1000	56	130	96.9	56	72	10	50	47	20	91	M16 x 1.5	19	16	52	M42 x 2	67	40	3/4	101	168	35	15	82	203	275

Transaxial foot: CHSGLA



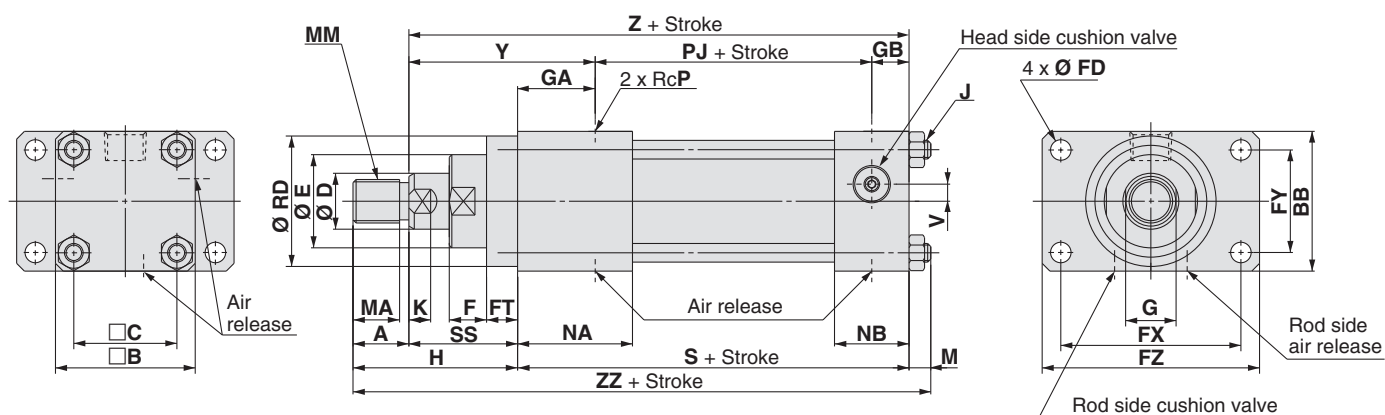
Bore size [mm]	Stroke range	A	B	BB	C	CD	D	E	F	G	GA	GB	H	J	K	LH	LT	LX	LY	M	MA	MM	P	PJ	S	SS
32	25 to 800	18	45	84	33.2	9	18	30	12	14	35	12	43	M6 x 1	7	22	12.5	63	44.5	7.5	15	M14 x 1.5	1/4	56	103	45
40	25 to 800	22	63	103	41.7	11	22	34	12	19	37	18	47	M8 x 1	9	31	12.5	83	62.5	10	19	M16 x 1.5	3/8	73	128	45
50	25 to 800	28	75	127	52.3	14	28	42	9	24	42	18	53	M12 x 1.25	11	37	19	102	74.5	12	25	M20 x 1.5	1/2	74	134	54
63	25 to 800	36	90	161	64.3	18	36	50	13	30	39	17	68	M12 x 1.25	13	44	26	124	89	12	32	M27 x 2	1/2	80	136	65
80	25 to 800	45	115	186	82.7	18	45	60	9	41	46	20	76	M16 x 1.5	17	57	26	149	114.5	16	41	M33 x 2	3/4	93	159	68
100	25 to 1000	56	130	216	96.9	26	56	72	10	50	47	20	91	M16 x 1.5	19	63	32	172	128	16	52	M42 x 2	3/4	101	168	79

Bore size [mm]	V	X1	X2	Y	Y1	Y2	ZA	Z	ZZ
32	5.5	26	13	60	20	10	73	128	153.5
40	6.5	31	22	62	20	10	98	153	185
50	7	28	20	67	29	13	92	159	199
63	12	22	16	71	33	17	86	168	216
80	15	29	23	77	37	17	105	190	251
100	15	23	18	82	44	22	102	203	275

CHSG Series

Dimensions

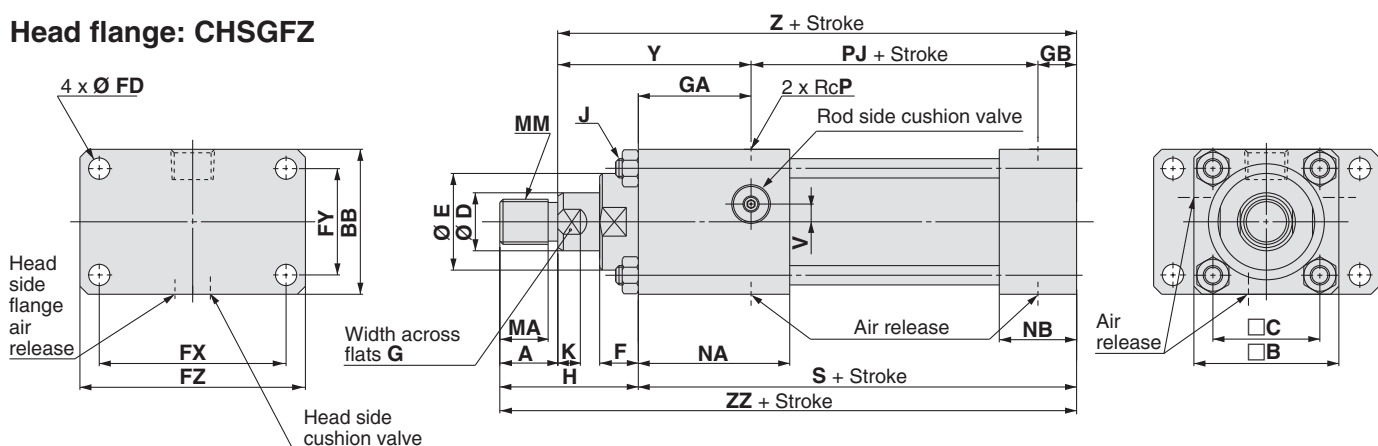
Rod flange: CHSGFY



Bore size [mm]	Stroke range	A	B	BB	C	D	E	F	FD	FT	FX	FY	FZ	G	GA	GB	H	J	K	M	MA	MM	NA	NB	P	PJ
32	25 to 800	18	45	45	33.2	18	30	12	6.6	10	58	33	70	14	25	12	53	M6 x 1	7	7.5	15	M14 x 1.5	36	23	1/4	56
40	25 to 800	22	63	63	41.7	22	34	12	11	10	87	41	110	19	27	18	57	M8 x 1	9	10	19	M16 x 1.5	41	32	3/8	73
50	25 to 800	28	75	75	52.3	28	42	9	14	16	105	52	130	24	26	18	69	M12 x 1.25	11	12	25	M20 x 1.5	41	33	1/2	74
63	25 to 800	36	90	90	64.3	36	50	13	14	16	117	65	145	30	23	17	84	M12 x 1.25	13	12	32	M27 x 2	39	33	1/2	80
80	25 to 800	45	115	115	82.7	45	60	9	18	20	149	83	180	41	26	20	96	M16 x 1.5	17	16	41	M33 x 2	46	40	3/4	93
100	25 to 1000	56	130	130	96.9	56	72	10	18	22	162	97	200	50	25	20	113	M16 x 1.5	19	16	52	M42 x 2	45	40	3/4	101

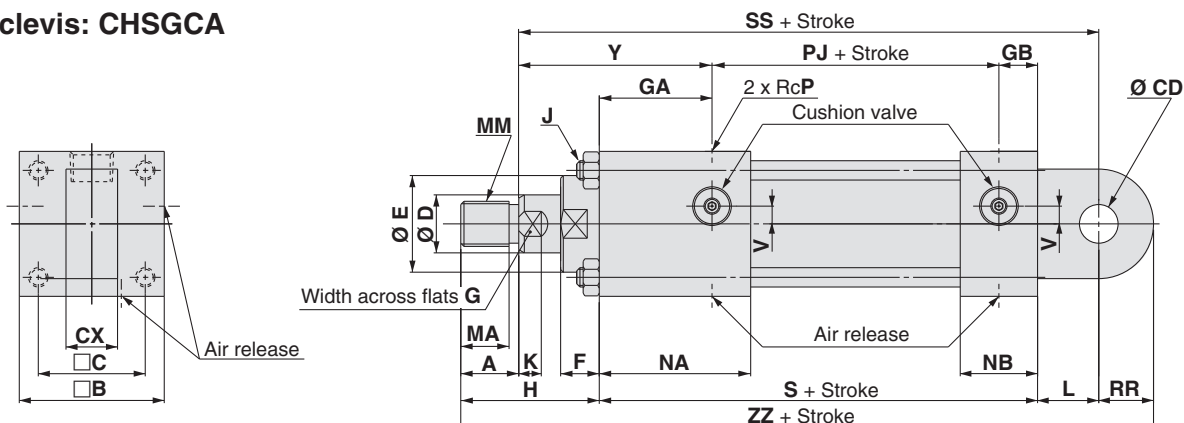
Bore size [mm]	RD	S	SS	V	Y	Z	ZZ
32	42 -0.025 -0.064	93	35	5.5	60	128	153.5
40	62 -0.030 -0.076	118	35	6.5	62	153	185
50	74	118	41	7	67	159	199
63	82	120	48	12	71	168	216
80	92 -0.036 -0.090	139	51	15	77	190	251
100	105	146	57	15	82	203	275

Head flange: CHSGFZ



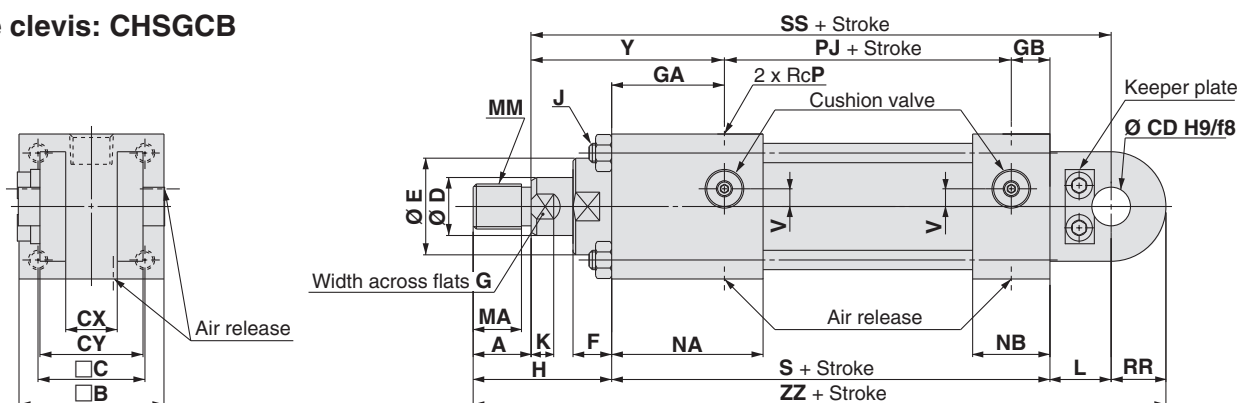
Bore size [mm]	Stroke range	A	B	BB	C	D	E	F	FD	FX	FY	FZ	G	GA	GB	H	J	K	MA	MM	NA	NB	P	PJ	S	V	Y	Z	ZZ
32	25 to 800	18	45	45	33.2	18	30	12	6.6	58	33	70	14	35	12	43	M6 x 1	7	15	M14 x 1.5	46	23	1/4	56	103	5.5	60	128	146
40	25 to 800	22	63	63	41.7	22	34	12	11	87	41	110	19	37	18	47	M8 x 1	9	19	M16 x 1.5	51	32	3/8	73	128	6.5	62	153	175
50	25 to 800	28	75	75	52.3	28	42	9	14	105	52	130	24	42	18	53	M12 x 1.25	11	25	M20 x 1.5	57	33	1/2	74	134	7	67	159	187
63	25 to 800	36	90	90	64.3	36	50	13	14	117	65	145	30	39	17	68	M12 x 1.25	13	32	M27 x 2	55	33	1/2	80	136	12	71	168	204
80	25 to 800	45	115	115	82.7	45	60	9	18	149	83	180	41	46	20	76	M16 x 1.5	17	41	M33 x 2	66	40	3/4	93	159	15	77	190	235
100	25 to 1000	56	130	130	96.9	56	72	10	18	162	97	200	50	47	20	91	M16 x 1.5	19	52	M42 x 2	67	40	3/4	101	168	15	82	203	259

Single clevis: CHSGCA



Bore size [mm]	Stroke range	A	B	C	CD	CX	D	E	F	G	GA	GB	H	J	K	L	MA	MM	NA	NB	P	PJ	RR	S	SS	V	Y	ZZ
32	25 to 800	18	45	33.2	12 ^{+0.043} ₀	16	18	30	12	14	35	12	43	M6 x 1	7	19	15	M14 x 1.5	46	23	1/4	56	17	103	147	5.5	60	182
40	25 to 800	22	63	41.7	14 ^{+0.052} ₀	20	22	34	12	19	37	18	47	M8 x 1	9	19	19	M16 x 1.5	51	32	3/8	73	17	128	172	6.5	62	211
50	25 to 800	28	75	52.3	20 ^{+0.062} ₀	30	28	42	9	24	42	18	53	M12 x 1.25	11	32	25	M20 x 1.5	57	33	1/2	74	29	134	191	7	67	248
63	25 to 800	36	90	64.3	20 ^{+0.062} ₀	30	36	50	13	30	39	17	68	M12 x 1.25	13	32	32	M27 x 2	55	33	1/2	80	29	136	200	12	71	265
80	25 to 800	45	115	82.7	28 ^{+0.062} ₀	40	45	60	9	41	46	20	76	M16 x 1.5	17	39	41	M33 x 2	66	40	3/4	93	34	159	229	15	77	308
100	25 to 1000	56	130	96.9	36 ^{+0.062} ₀	50	56	72	10	50	47	20	91	M16 x 1.5	19	54	52	M42 x 2	67	40	3/4	101	50	168	257	15	82	363

Double clevis: CHSGCB



Bore size [mm]	Stroke range	A	B	C	CD	CX	CY	D	E	F	G	GA	GB	H	J	K	L	MA	MM	NA	NB	P	PJ	RR
32	25 to 800	18	45	33.2	12	16	32	18	30	12	14	35	12	43	M6 x 1	7	19	15	M14 x 1.5	46	23	1/4	56	17
40	25 to 800	22	63	41.7	14	20	43	22	34	12	19	37	18	47	M8 x 1	9	19	19	M16 x 1.5	51	32	3/8	73	17
50	25 to 800	28	75	52.3	20	30	60	28	42	9	24	42	18	53	M12 x 1.25	11	32	25	M20 x 1.5	57	33	1/2	74	29
63	25 to 800	36	90	64.3	20	30	60	36	50	13	30	39	17	68	M12 x 1.25	13	32	32	M27 x 2	55	33	1/2	80	29
80	25 to 800	45	115	82.7	28	40	80	45	60	9	41	46	20	76	M16 x 1.5	17	39	41	M33 x 2	66	40	3/4	93	34
100	25 to 1000	56	130	96.9	36	50	100	56	72	10	50	47	20	91	M16 x 1.5	19	54	52	M42 x 2	67	40	3/4	101	50

Tolerances

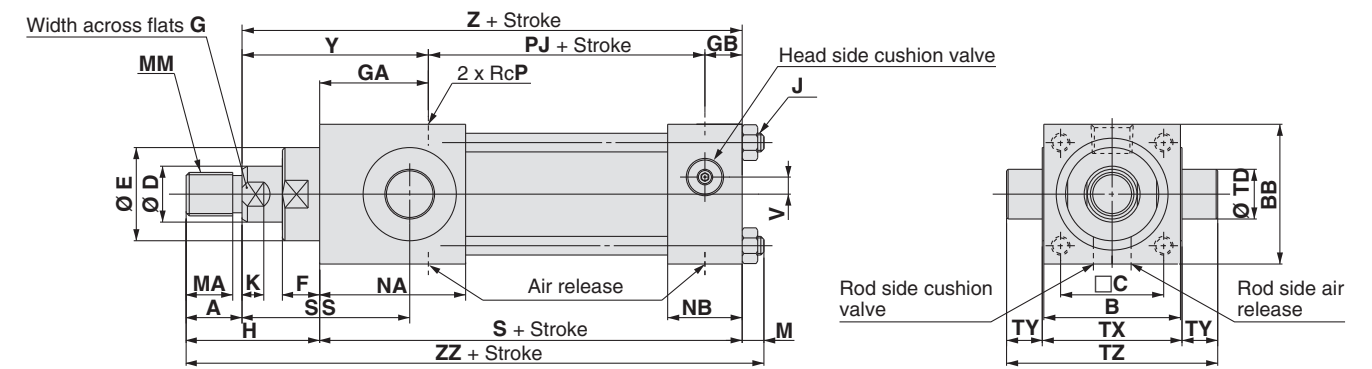
Bore size [mm]	S	SS	V	Y	ZZ
32	103	147	5.5	60	182
40	128	172	6.5	62	211
50	134	191	7	67	248
63	136	200	12	71	265
80	159	229	15	77	308
100	168	257	15	82	363

Bore size [mm]	CD	
	H9	f8
32	+0.043	-0.016
40	0	-0.043
50	+0.052	-0.020
63	0	-0.053
80	+0.062	-0.025
100	0	-0.064

CHSG Series

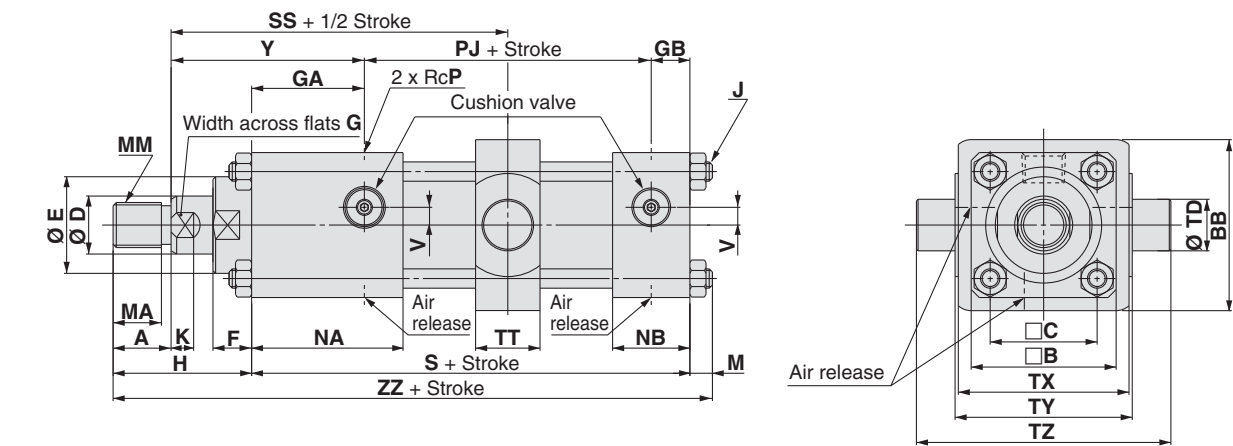
Dimensions

Rod trunnion: CHSGTA



Bore size [mm]	Stroke range	A	B	BB	C	D	E	F	G	GA	GB	H	J	K	M	MA	MM	NA	NB	P	PJ	TD	TX	TZ	S	SS	V	Y	Z	ZZ	
32	25 to 800	18	44	45	33.2	18	30	12	14	35	12	43	M6 x 1	7	7.5	15	M14 x 1.5	46	23	1/4	56	16	-0.016 -0.043	45	68	103	54	5.5	60	128	153.5
40	25 to 800	22	61	63	41.7	22	34	12	19	37	18	47	M8 x 1	9	10	19	M16 x 1.5	51	32	3/8	73	20	-0.020 -0.053	63	95	128	57	6.5	62	153	185
50	25 to 800	28	75	75	52.3	28	42	9	24	42	18	53	M12 x 1.25	11	12	25	M20 x 1.5	57	33	1/2	74	25	-0.020 -0.053	76	116	134	64	7	67	159	199
63	25 to 800	36	87	90	64.3	36	50	13	30	39	17	68	M12 x 1.25	13	12	32	M27 x 2	55	33	1/2	80	32	-0.025 -0.064	89	139	136	70	12	71	168	216
80	25 to 800	45	112	115	82.7	45	60	9	41	46	20	76	M16 x 1.5	17	16	41	M33 x 2	66	40	3/4	93	40	-0.025 -0.064	114	178	159	76	15	77	190	251
100	25 to 1000	56	125	130	96.9	56	72	10	50	47	20	91	M16 x 1.5	19	16	52	M42 x 2	67	40	3/4	101	50	-0.025 -0.064	127	207	168	71	15	82	203	275

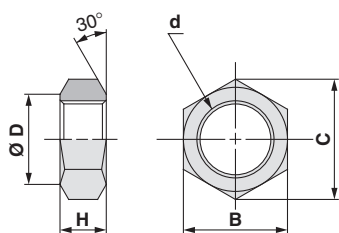
Centre trunnion: CHSGTC



Bore size [mm]	Stroke range	A	B	BB	C	D	E	F	G	GA	GB	H	J	K	M	MA	MM	NA	NB	P	PJ	S	SS	TD	TT	TX	TY	TZ	V	Y	ZZ	
32	25 to 800	18	45	57	33.2	18	30	12	14	35	12	43	M6 x 1	7	7.5	15	M14 x 1.5	46	23	1/4	56	103	88	16	0	20	53	55	79	5.5	60	153.5
40	25 to 800	22	63	65	41.7	22	34	12	19	37	18	47	M8 x 1	9	10	19	M16 x 1.5	51	32	3/8	73	128	98.5	20	-0.033	26	72	76	108	6.5	62	185
50	25 to 800	28	75	75	52.3	28	42	9	24	42	18	53	M12 x 1.25	11	12	25	M20 x 1.5	57	33	1/2	74	134	104	25	-0.004 -0.043	29	88	89	129	7	67	199
63	25 to 800	36	90	90	64.3	36	50	13	30	39	17	68	M12 x 1.25	13	12	32	M27 x 2	55	33	1/2	80	136	111	32	-0.009 -0.054	36	90	100	150	12	71	216
80	25 to 800	45	115	115	82.7	45	60	9	41	46	20	76	M16 x 1.5	17	16	41	M33 x 2	66	40	3/4	93	159	123.5	40	-0.009 -0.054	44	123	127	191	15	77	251
100	25 to 1000	56	130	130	96.9	56	72	10	50	47	20	91	M16 x 1.5	19	16	52	M42 x 2	67	40	3/4	101	168	132.5	50	-0.009 -0.054	54	130	140	220	15	82	275

Accessory (Option)

Rod end nut



Material: Carbon steel

Part no.		B	C	d	D	H
NTH-32S	32	22	25.4	M14 x 1.5	21	8
NTH-040	40	22	25.4	M16 x 1.6	21	10
NTH-050	50	27	31.2	M20 x 1.5	26	12
NTH-060S	63	41	47.3	M27 x 2	39	16
NTH-080S	80	50	57.7	M33 x 2	48	20
NTH-100S	100	65	75	M42 x 2	62	25

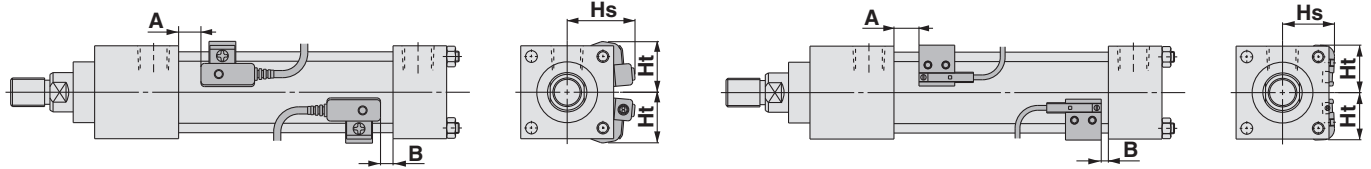
CHSG Series Auto Switch Mounting

Refer to pages 431 to 490 for detailed specifications.

Auto Switch Proper Mounting Position (Detection at Stroke End) and Its Mounting Height

D-A5□/A6□
D-F5□(W)/J59(W)/F5BA

D-M9□/M9□V
D-M9□W/M9□WV
D-M9□A/M9□AV
D-Z7□/Z80



Proper Auto Switch Mounting Position

Bore size [mm]	D-M9□/M9□V D-M9□W/M9□WV D-M9□A/M9□AV		D-F5□/J59 D-F5□W/J59W D-F59F D-F5BA		D-F5NT		D-Z7□/Z80		D-A5□/A6□		D-A59W	
	A	B	A	B	A	B	A	B	A	B	A	B
32	14	8	10.5	4.5	15.5	9.5	—	—	—	—	—	—
40	22.5	10.5	19	7	24	12	16	4	12.5	0.5	16.5	4.5
50	22.5	9.5	19	6	24	11	16	3	12.5	0	16.5	3.5
63	24.5	11.5	21	8	26	13	18	5	14.5	1.5	18.5	5.5
80	27.5	13.5	24	10	29	15	21	7	17.5	3.5	21.5	7.5
100	—	—	27.5	14.5	32.5	19.5	24.5	11.5	21	8	25	12

Note 1) D-M9□, M9□V, M9□W, M9□WV, M9□A, M9□AV cannot be mounted to Ø 100.

Note 2) D-A5□, A6□, A59W, Z7□, Z80 cannot be mounted to Ø 32.

Note 3) Adjust the auto switch after confirming the operating conditions in the actual setting.

Auto Switch Mounting Height

Bore size [mm]	D-M9□/M9□V D-M9□A		D-M9□W/M9□WV D-M9□AV		D-F5□/J59 D-F5□W/J59W D-F59F/F5BA D-F5NT		D-A5□/A6□ D-A59W		D-Z7□/Z80	
	Hs	Ht	Hs	Ht	Hs	Ht	Hs	Ht	Hs	Ht
32	25	23	31	23	32.5	25	—	—	—	—
40	29	28.5	34	28.5	36	30	38.5	30	29	28.5
50	37	36	41	36	41	37.5	43.5	37.5	37	36
63	43	42	47.5	42	46.5	43.5	49	43.5	42.5	42
80	54	54	55.5	54	57	56.5	59.5	56.5	54	54.5
100	—	—	—	—	66	64.5	69	64.5	62.5	61.5

Note 1) D-M9□, M9□V, M9□W, M9□WV, M9□A, M9□AV cannot be mounted to Ø 100.

Note 2) D-A5□, A6□, A59W, Z7□, Z80 cannot be mounted to Ø 32.

Operating Range

Auto switch model	Bore size [mm]					
	32	40	50	63	80	100
D-M9□/M9□V D-M9□W/M9□WV D-M9□A/M9□AV	4	4.5	5.5	7.5	8.5	—
D-F5□/J59/F59F D-F5□W/J59W D-F5BA/F5NT	4	4.5	5	4	5.5	6.5
D-A5□/A6□	—	9	10	11	14	17.5
D-A59W	—	12.5	13	14.5	17.5	22
D-Z7□/Z80	—	8.5	9.5	10.5	14.5	19.5

* D-M9□, M9□V, M9□W, M9□WV, M9□A, M9□AV cannot be mounted to Ø 100.

* D-A5□, A6□, A59W, Z7□, Z80 cannot be mounted to Ø 32.

* Since this is a guideline including hysteresis, not meant to be guaranteed.
(Assuming approximately ±30% dispersion.)

There may be the case it will vary substantially depending on an ambient environment.

Minimum Auto Switch Mounting Stroke

Auto switch model	Auto switch mounting number	Mounting bracket other than centre trunnion	Centre trunnion					
			32	40	50	63	80	100
D-M9□/M9□W	2 (Different surfaces and same surface), 1	20	85	95	100	105	115	—
	"n" pcs.	$20 + 40 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 3)	$85 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$95 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$100 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$105 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$115 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	—
D-M9□V/M9□WV	2 (Different surfaces and same surface), 1	20	65	75	80	85	95	—
	"n" pcs.	$20 + 30 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 3)	$65 + 30 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$75 + 30 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$80 + 30 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$85 + 30 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$95 + 30 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	—
D-M9□A	2 (Different surfaces and same surface), 1	25	100	115	120	125	135	—
	"n" pcs.	$25 + 40 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 3)	$100 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$115 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$120 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$125 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$135 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	—
D-M9□AV	2 (Different surfaces and same surface), 1	25	100	115	120	125	135	—
	"n" pcs.	$25 + 30 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 3)	$100 + 30 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$115 + 30 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$120 + 30 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$125 + 30 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$135 + 30 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	—
D-F5□/J59 D-F5□W/J59W D-F5BA/F59F	2 (Different surfaces and same surface), 1	20	110	125	130	135	140	150
	"n" pcs.	$20 + 55 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 3)	$110 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$125 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$130 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$135 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$140 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$150 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)
D-F5NT	2 (Different surfaces and same surface), 1	25	125	140	145	150	155	165
	"n" pcs.	$25 + 55 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 3)	$125 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$140 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$145 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$150 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$155 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$165 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)
D-A5□/A6□	2 (Different surfaces and same surface), 1	25	—	120	120	130	135	145
	"n" pcs.	$25 + 55 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 3)	—	$120 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$120 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$130 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$135 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$145 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)
D-A59W	2 (Different surfaces and same surface), 1	30	—	125	130	135	145	155
	"n" pcs.	$30 + 55 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 3)	—	$125 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$130 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$135 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$145 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$155 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)
D-Z7□/Z80	2 (Different surfaces and same surface), 1	25	—	95	100	105	115	125
	"n" pcs.	$25 + 40 \frac{(n-2)}{2}$ (n = 2, 4, 6, 8...) Note 3)	—	$95 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$100 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$105 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$115 + 40 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)	$125 + 55 \frac{(n-4)}{2}$ (n = 4, 8, 12, 16...) Note 4)

Note 1) D-M9□, M9□V, M9□W, M9□WV, M9□A, M9□AV cannot be mounted to Ø 100.

Note 2) D-A5□, A6□, A59W, Z7□, Z80 cannot be mounted to Ø 32.

Note 3) When "n" is an odd number, an even number that is one larger than this odd number is used for the calculation.

Note 4) When "n" is an odd number, a multiple of 4 that is larger than this odd number is used for the calculation.

Besides the models listed in "How to Order," the following auto switches are applicable.

Refer to website: www.smc.eu for detailed auto switch specifications.

Auto switch type	Part no.	Electrical entry	Features
Solid state	D-M9NV, M9PV, M9BV	Grommet (perpendicular)	—
	D-M9NWV, M9PWV, M9BWV		Diagnostic indication (2-colour indicator)
	D-M9NAV, M9PAV, M9BAV		Water resistant (2-colour indicator)
	D-F59, F5P, J59	Grommet (in-line)	—
	D-F59W, F5PW, J59W		Diagnostic indication (2-colour indicator)
	D-F5BA		Water resistant (2-colour indicator)
	D-F5NT		With timer
Reed	D-A53, A56	Grommet (in-line)	—
	D-A67		Without indicator light

* Solid state auto switches are also available with pre-wired connector. Contact SMC for detailed auto switch specifications.

Auto Switch Mounting Brackets: Part Nos.

Auto switch models	Bore size [mm]					
	Ø 32	Ø 40	Ø 50	Ø 63	Ø 80	Ø 100
D-M9□/M9□V D-M9□W/M9□WV D-M9□A/M9□AV	BMB5-032	BA7-040	BA7-080	BA7-080	BS5-160	—
D-F5□/J59 D-F5□W/J59W D-F5BA/F59F/F5NT D-A5□/A6□/A59W	BT-03	BT-04	BT-08	BT-08	BT-16	BT-16
D-Z7□/Z80	—	BMB4-050	BA4-080	BA4-080	BS4-160	BS4-160

Note 1) D-M9 cannot be mounted to Ø 100.

Note 2) D-A5□/A6□/A59W/Z7□/Z80 cannot be mounted to Ø 32.

[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.)

BBA1 : D-F5, J5, A5, A6

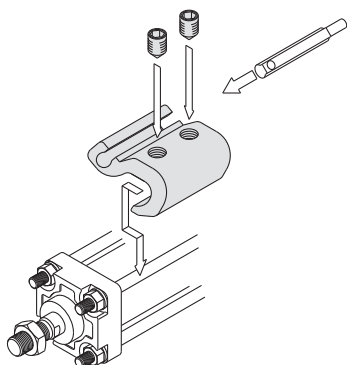
Note 3) Refer to the table below for details on BBA1.

Stainless mounting screw kit details

Part no.	Contents				Applicable auto switch mounting bracket part nos.	Applicable auto switches
	No.	Description	Size	Pcs.		
BBA1	1	Auto switch mounting screws	M4 x 0.7 x 8L	1	BT-□□	D-A5, A6 D-F5, J5
					BT-03, BT-04, BT-05 BT-06, BT-08, BT-12	
	2	Set screw	M4 x 0.7 x 6L	2	BA4-040, BA4-063, BA4-080 BMB4-032, BMB4-050	D-Z7, Z8 D-Y5, Y6, Y7
					BMB5-032 BA7-040, BA7-063, BA7-080	D-A9 D-M9
	3	Set screw	M4 x 0.7 x 8L	2	BT-16, BT-18A, BT-20	D-A5, A6 D-F5, J5
					BS4-125, BS4-160 BS4-180, BS4-200	D-Z7, Z8 D-Y5, Y6, Y7
					BS5-125, BS5-160 BS5-180, BS5-200	D-A9 D-M9

When D-F5BA auto switch is shipped mounted on a cylinder, the above stainless steel screws are used. Also when switches are shipped separately, BBA1 is included.

Note 4) When using D-M9□A(V), order stainless mounting screw kit BBA1 instead of the iron auto switch mounting brackets (BMB5-032, BA7-□□□, BS5-160) in the table above, and use the M4 x 6L stainless set screws included.

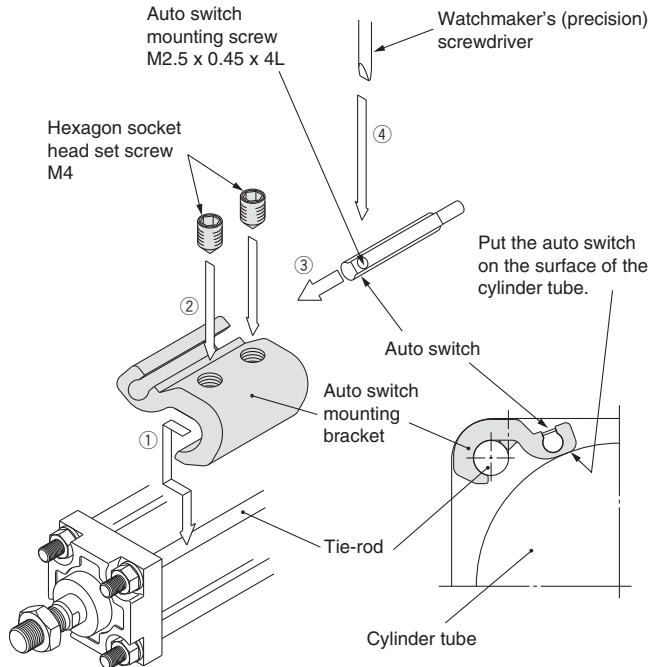


- Mounting example for D-M9□(V), M9□W(V), M9□A(V).

How to Mount and Move the Auto Switch

<Applicable auto switch>

Solid state D-M9N(V), D-M9P(V), D-M9B(V)
D-M9NW(V), D-M9PW(V), D-M9BW(V)
D-M9NA(V), D-M9PA(V), D-M9BA(V)



1. Fix it to the detecting position with a set screw by installing an auto switch mounting bracket in cylinder tie-rod and letting the bottom surface of an auto switch mounting bracket contact the cylinder tube firmly.
2. Fix it to the detecting position with a hexagon socket head set screw (M4).
(Use a hexagon wrench.)
3. Fit an auto switch into the auto switch mounting groove to set it roughly to the mounting position for an auto switch.
4. After confirming the detecting position, tighten up the mounting screw (M2.5) attached to an auto switch, and secure the auto switch.
5. When changing the detecting position, carry out in the state of 3.

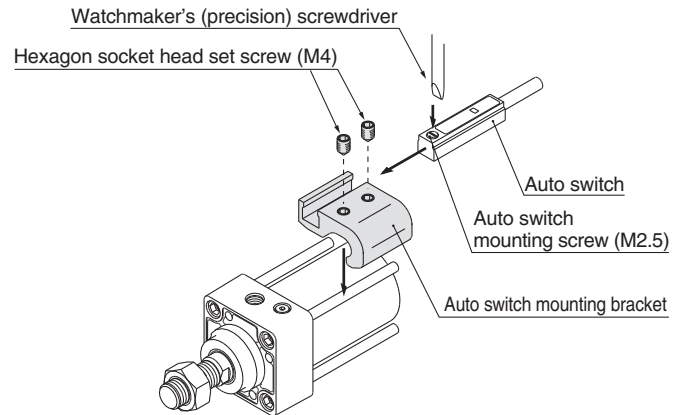
Note 1) To protect auto switches, ensure that main body of an auto switch should be embedded into auto switch mounting groove with a depth of 15 mm or more.

Note 2) Set the tightening torque of a hexagon socket head set screw (M4) to be 1 to 1.2 N·m.

Note 3) When tightening an auto switch mounting screw (M2.5), use a watchmaker's screwdriver with a grip diameter of 5 to 6 mm. Also, set the tightening torque to be 0.05 to 0.15 N·m. As a guide, turn 90° from the position where it comes to feel tight.

<Applicable auto switch>

Reed D-Z73, D-Z76, D-Z80



1. Fix it to the detecting position with a hexagon socket head set screw (M4) by installing an auto switch mounting bracket in cylinder tie-rod and letting the bottom surface of an auto switch mounting bracket contact the cylinder tube firmly. (Use a hexagon wrench)
2. Fit an auto switch into the auto switch mounting groove to set it roughly to the auto switch mounting position for an auto switch.
3. After confirming the detecting position, tighten up the mounting screw (M2.5) attached to an auto switch, and secure the switch.
4. When changing the detecting position, carry out in the state of 2.

Note 1) To protect auto switches, ensure that main body of an auto switch should be embedded into auto switch mounting groove with a depth of 15 mm or more.

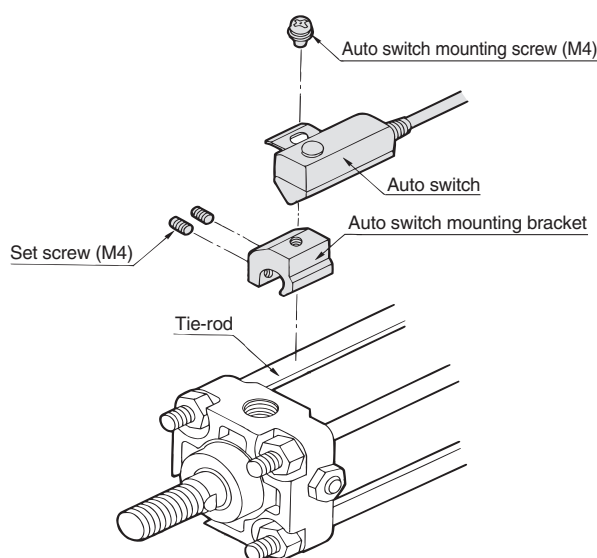
Note 2) Set the tightening torque of a hexagon socket head set screw (M4) to be 1 to 1.2 N·m.

Note 3) When tightening an auto switch mounting screw (M2.5), use a watchmaker's screwdriver with a grip diameter of 5 to 6 mm. Also, set the tightening torque to be 0.05 to 0.15 N·m. As a guide, turn 90° from the position where it comes to feel tight.

How to Mount and Move the Auto Switch

<Applicable auto switch>

Solid state D-F59, D-F5P
D-J59, D-F5BA
D-F59W, D-F5PW, D-J59W
D-F59F, D-F5NT
Reed D-A53, D-A54, D-A56, D-A64, D-A67
D-A59W



1. Fix the auto switch on the auto switch mounting bracket with the auto switch mounting screw (M4) and install the set screw.
2. Fit the auto switch mounting bracket into the cylinder tie-rod and then fix the auto switch at the detecting position with the hexagonal wrench. (Be sure to put the auto switch on the surface of cylinder tube.)
3. When changing the detecting position, loosen the set screw to move the auto switch and then re-fix the auto switch on the cylinder tube. (Tightening torque of M4 screw should be 1 to 1.2 N·m.)

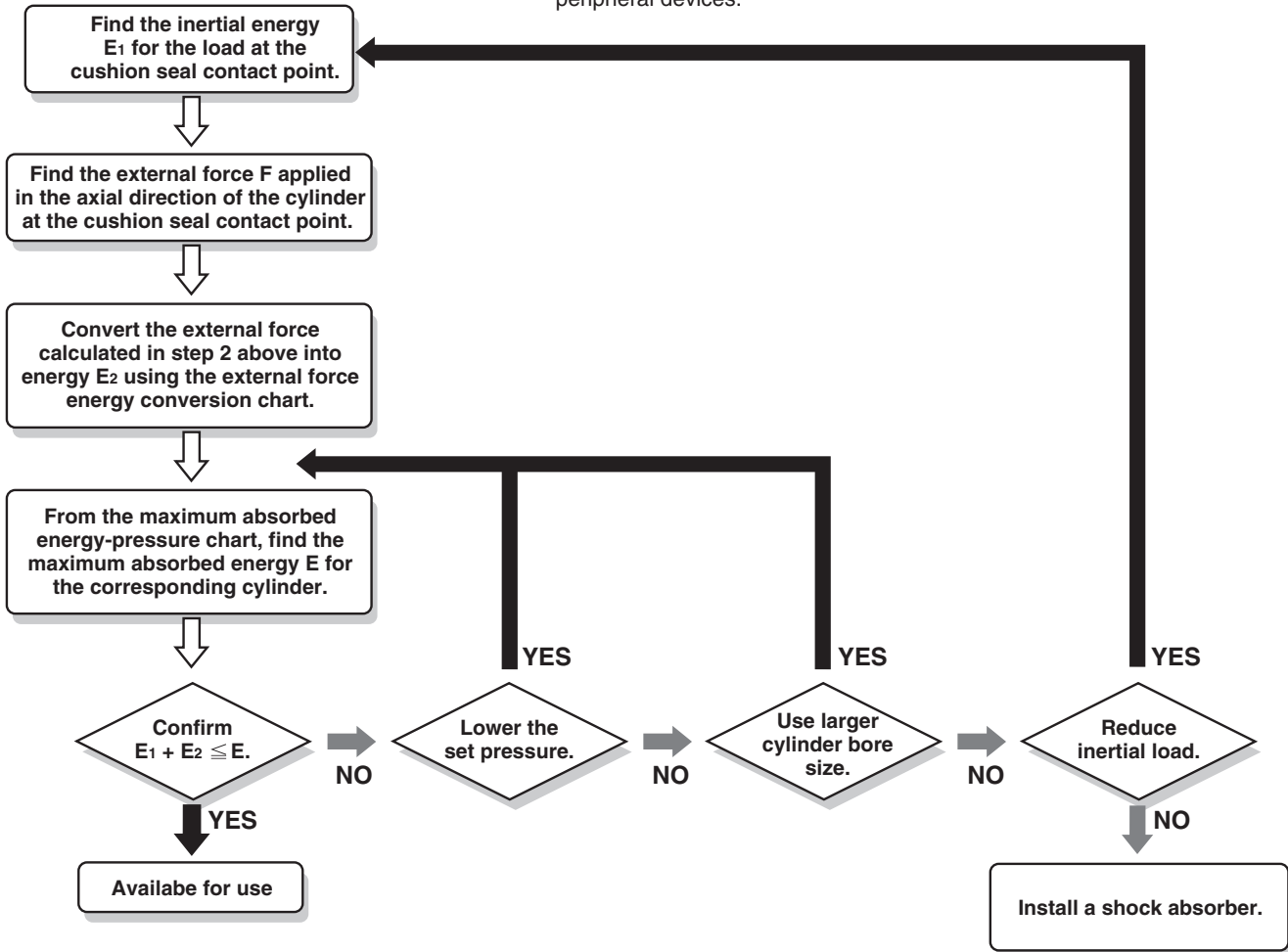
Model Selection 1

Cylinder Cushion Selection

Selection Procedures

⚠ 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.



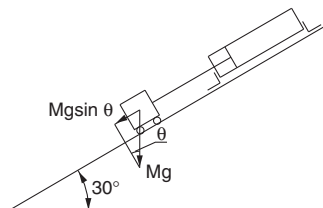
Calculation Example

<Design conditions>

Cylinder: CHSD50
 Set pressure: P1: 7 MPa
 Load weight: M: 400 kg
 Piston speed: V: 0.2 m/s
 (at the cushion seal contact point)
 Load transfer direction: Downward $\theta: 30^\circ$
 (External force applied to the cylinder is gravity only)
 Operating direction: Extended
 Gravitational acceleration: $g: 9.8 \text{ m/s}^2$

<Calculation>

1. Load inertial energy E_1 at the cushion seal contact point
 $E_1 = MV^2/2 = 400 \cdot 0.2^2/2 = 8\text{J}$
2. External force F applied in axial direction of the cylinder at the cushion seal contact point
 $F = Mgsin \theta = 400 \cdot 9.8 \cdot \sin 30^\circ = 1960\text{N}$



3. Convert the external force calculated in step 2 into energy E_2 .
 External force: Draw a vertical line from the value of 1960N, the point where this line intersects with the diagonal line 5.2J is energy caused by external force.
 $E_2 = 5.2\text{J}$

4. Find the maximum absorbed energy E for a cylinder.
 Maximum absorbed energy: Draw a vertical line from the set pressure 7MPa, the point where this line intersects with the line for $\varnothing 50$ (21J) is the maximum absorbed energy.
 $E = 21\text{J}$

5. Confirm that $E_1 + E_2 \leq E$.
 $E_1 + E_2 = 8 + 5.2 = 13.2\text{J}$
 $E = 21\text{J}$
 $E_1 + E_2 \leq E$
 Therefore, the cylinder cushion is available for use.

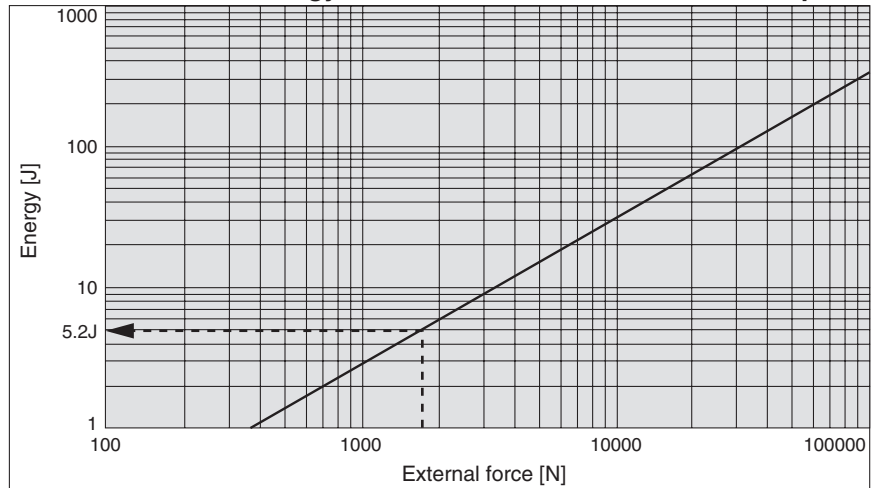
Model Selection 2

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

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

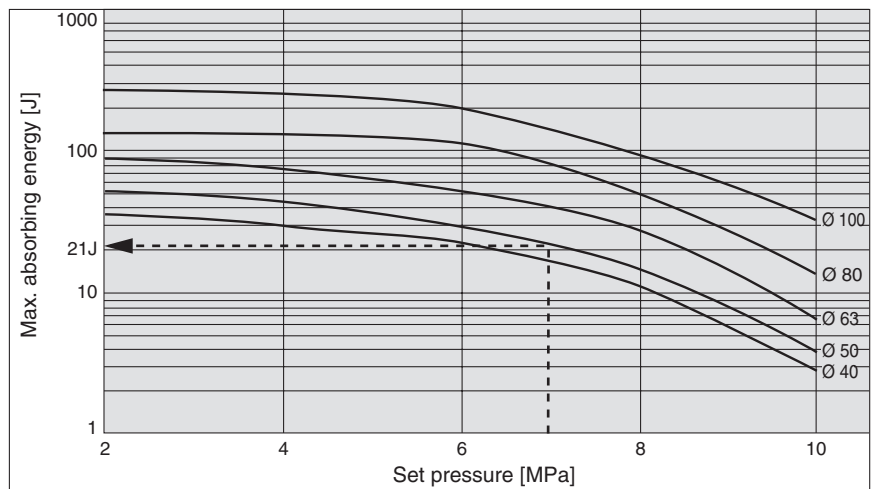
Be sure to keep the combined values of kinetic energy of the load operated by the cylinder and the energy generated by the external force within the values that are shown in the bottom chart.

External force and energy conversion at cushion seal contact point

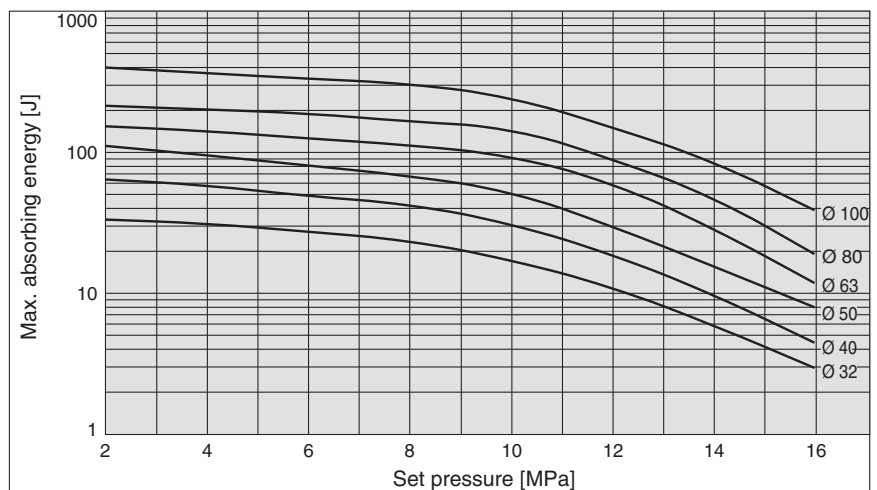


Maximum absorbed energy and pressure

Series CHSD



Series CHSG





Series CHS

Hydraulic Cylinder Precautions 1

Be sure to read before handling.

Design

⚠ Warning

1. There is a possibility of dangerous sudden action by 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 get caught in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be designed to prevent such dangers.

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

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

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

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

4. 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. Consider a possible drop in operating pressure due to a power outage.

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

6. Consider a possible loss of power source.

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. Consider emergency stops.

Design the system so that bodily 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.

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

Design machinery so that bodily 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 featured in this catalogue 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 catalogue 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: 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: 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	○
W/O hydraulic fluids	○
O/W hydraulic fluids	○
Water/Glycol hydraulic fluids	*
Phosphate hydraulic fluids	×

* Consult with SMC.

⚠ 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 stroke selection on pages 22 and 23 for maximum strokes.

2. Operate the piston with in 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.

Take load factors and piston speed on page 21 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.



Series CHS

Hydraulic Cylinder Precautions 2

Be sure to read before handling.

Selection

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 verify that the 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 after the instruction manual is thoroughly read and its contents are understood. Keep the instruction manual where it can be referred to as needed.

Piping

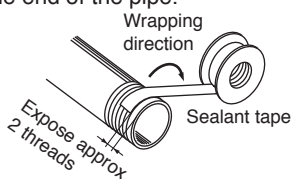
⚠ Caution

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, 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 pipe.



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

Cushion

⚠ Caution

1. Readjust using the cushion needle.

Cushion needles are adjusted at the time of shipment. When the cylinder is put into service, the cushion needles should be readjusted based on factors such as the size of the load and the operating speed. When the cushion needles are turned clockwise, restriction of the air flow becomes greater and thus the cushioning effect also increases.

2. Do not operate with the cushion needle in a fully closed condition.

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 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 10 μ m 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 regarding 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.



Series *CHS*

Hydraulic Cylinder Precautions 3

Be sure to read before handling.

Maintenance

Warning

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

If handled improperly, malfunction and damage of machinery or equipment may 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 that appropriate measures are in place to prevent cylinders from sudden movement.

Caution

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

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



Series CHS

Auto Switch Precautions 1

Be sure to read before handling.

Design and Selection

Warning

1. Check 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 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 40 mm.

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 operate properly. The maximum detectable piston speed is:

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

In case of a high piston speed, it is possible to extend the operating time of the load by using an auto switch (F5NT) with a built-in off delay timer (approximately 200 ms).

4. Keep wiring as short as possible.

<Reed switches>

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

- 1) For an auto switch without a contact protection circuit, use a contact protection box when the wire length is 5 m or longer.
- 2) Even when an auto switch has a built-in contact protection circuit, if the lead wire length is 30 m 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.

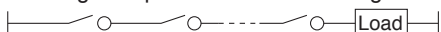
<Solid state switches>

- 3) Although wire length should not affect switch function, use a wire that is 100 m 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



- 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 (Model D-A6□, D-Z80).

<Solid state switches>

- 3) Generally, the internal voltage drop will be greater with a 2-wire solid state auto switch than with a reed switch. Take the same precautions as in 1).
Also note that a 12 VDC relay is not applicable.

6. Monitor leakage current.

<Solid state switches>

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

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

If the 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 a surge voltage, use a switch with a built-in contact protection circuit or use a contact protection box.

<Solid state switches>

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

8. Cautions for use in an interlock circuit

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

Also perform periodic maintenance inspections 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 CHS 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 (300 m/s² or more for reed switches and 1000 m/s² or more for solid state switches) while handling. Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

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

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

3. Mount switches using the proper tightening torque.

When a switch is tightened beyond the torque range, the mounting screws, mounting bracket or switch may be damaged. 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 centre of the operating range (the range in which a switch is ON). (The mounting position shown in a catalogue indicates the optimum position at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation will be unstable.

Wiring

⚠ Warning

1. Avoid repeatedly bending or stretching lead wires.

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

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

<2-wire type>

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

3. Confirm proper insulation of wiring.

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

4. Do not wire in conjunction 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.

Wiring

⚠ Warning

5. Do not allow short circuiting of loads.

<Reed switches>

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

<Solid state switches>

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>

*24 VDC 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 the maximum specified will damage a light emitting diode and make it inoperable.

Applicable models: D-A53, A54, D-Z73

2) Note however, in the case of 2-colour display type auto switch (A59W), if the wiring is reversed, the switch will be in a normally ON condition.

<Solid state switches>

1) Even 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. However, it is still necessary to avoid reversed connections since the switch will be damaged if a load short circuits in this condition.

*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]

* Lead wire colour changes

Lead wire colours 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

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 CHS

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 switch.)

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

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 the switch resulting in malfunction.

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

Consult with SMC if auto switches will be used in an environment 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 improper 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 (300 m/s² or more) is applied to a reed switch during operation, the contact point may malfunction and generate or cut off a signal momentarily (1 ms 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 switches>

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 amount of ferrous debris 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 switches to malfunction due to a loss of the magnetic force inside the cylinder.

Maintenance

Warning

1. Perform the following maintenance inspection and services 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 screws securely 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-colour indicator type switch lights up.

Confirm that the green LED is ON when stopped at the set position. If the red LED is ON when stopped at the set position, 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.

Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)¹⁾, and other safety regulations.

-  **Caution:** **Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
-  **Warning:** **Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
-  **Danger:** **Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

- 1) ISO 4414: Pneumatic fluid power – General rules relating to systems.
ISO 4413: Hydraulic fluid power – General rules relating to systems.
IEC 60204-1: Safety of machinery – Electrical equipment of machines.
(Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots - Safety.
etc.

Warning

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

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalogue information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

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

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalogue.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Caution

1. The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries. If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary. If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

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

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.²⁾ Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
 2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided. This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
 3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalogue for the particular products.
- 2) Vacuum pads are excluded from this 1 year warranty.
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered. Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

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

Caution

SMC products are not intended for use as instruments for legal metrology.

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country. Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

Safety Instructions

Be sure to read “Handling Precautions for SMC Products” (M-E03-3) before using.

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