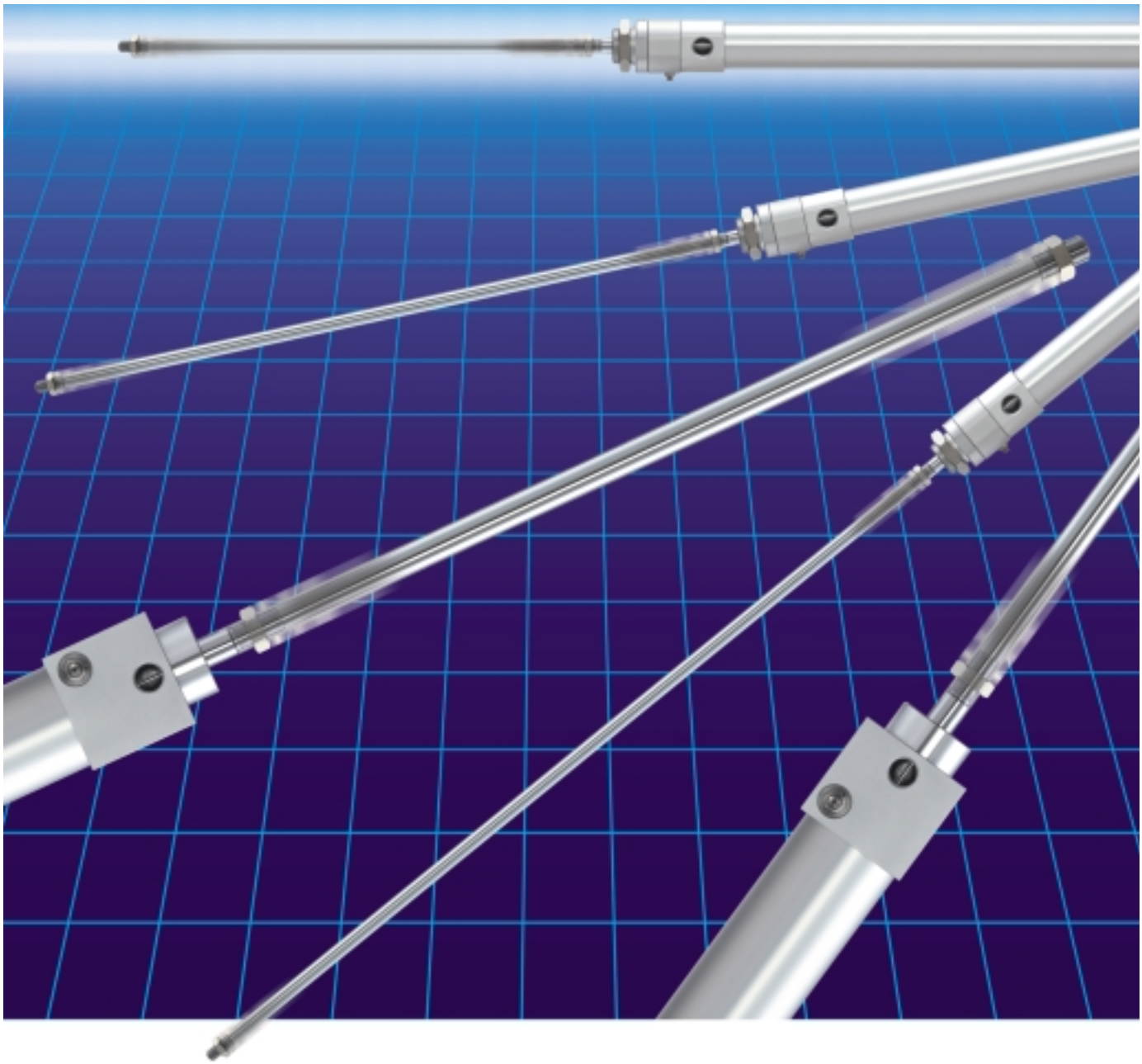
CAT.ES20-105 B

SMC

High Power Cylinder

Series RHC

ø20, ø25, ø32, ø40, ø50, ø63, ø80, ø100



Bore sizes ø50, ø63, ø80 and ø100 added to Series RHC and newly released!
Suitable for high speed use or heavy loads at low speed.

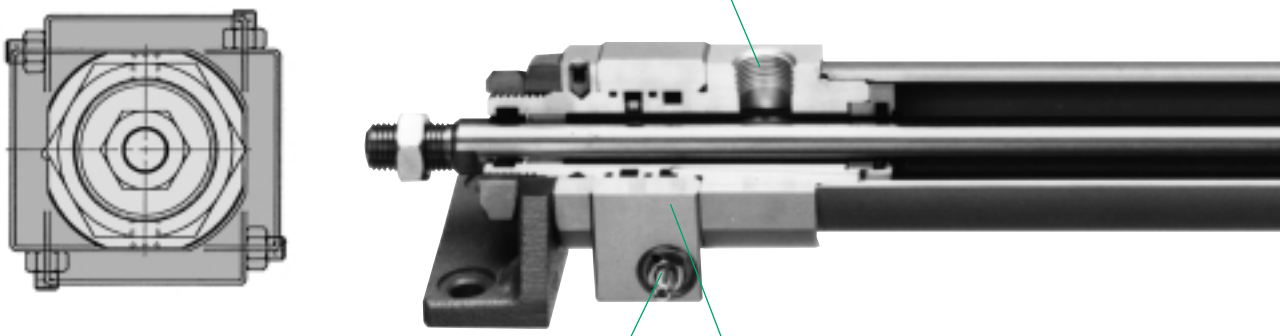
High Power Cylinder

Smooth cushioning from high speed (3000mm/s)/ligh

Energy absorbing capacity 10 to 20 times that of genera

Supply/Exhaust port

Port orifices have been enlarged to accommodate high speed movement.



Relief valve body

The relief valve body rotates 360° allowing relief adjustment from any direction.

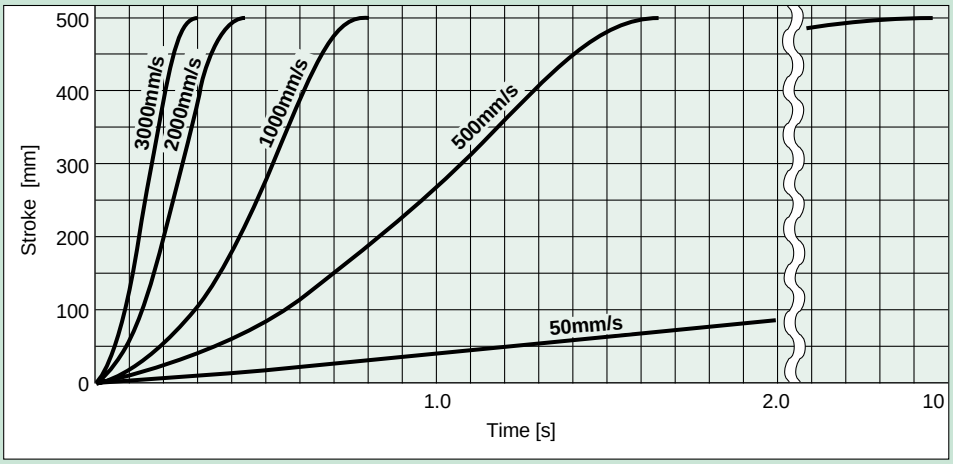
Relief valve adjustment screw

Mounting and Cushion Adjustment

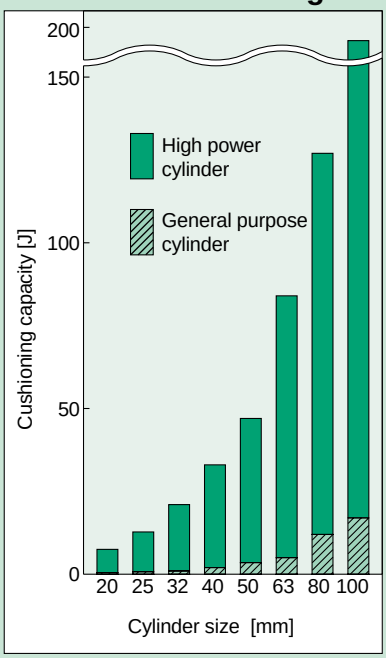
Piping and mounting labor is the same as general purpose cylinders. Cushion adjustment (relief adjustment) labor is the same as general purpose cylinder adjustment (cushion needle adjustment).

Cushioning quality

(RHCF40-500, load weight 5kg, supply pressure 0.5MPa, horizontal drive)



Amount of cushioning



: Series RHC

t load to medium low speed/heavy load
al purpose cylinders

New
ø50, ø63, ø80, ø100

Cushion ring

The cushion ring has been lengthened for greater energy (speed/weight) absorption.

Cushion seal

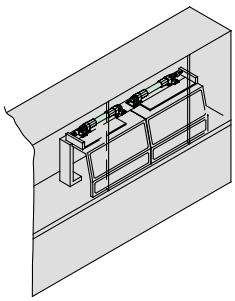
The use of heavy duty seals provides improved durability at high speeds and increased buffer capacity.

Relief valve

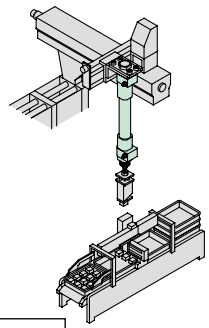
The use of a relief valve as the cushion valve (pressure control) provides a better cushioning effect as compared with needle adjustment on a general purpose cylinder (flow control).

Applications

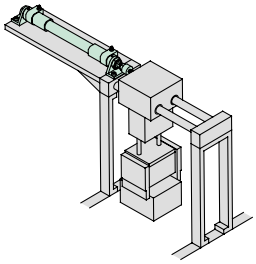
Opening and closing doors
(2000mm/s, several 10kg)



High speed Z-axis
(to 3000mm/s, several kg)

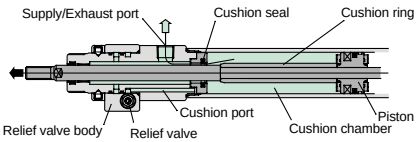


Transfer equipment
40kg, 1000mm/s (with ø32)



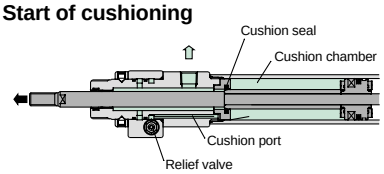
Operating Principles

1. Before cushioning starts



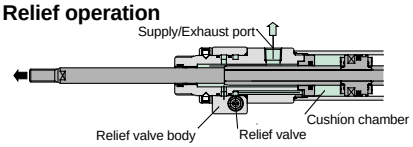
Air passes through the space between the cushion seal and piston rod to the supply/exhaust port.

2. Start of cushioning



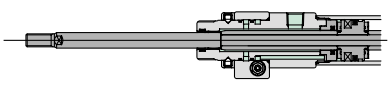
The cushion chamber is closed by the cushion seal. Air flows to the cushion port provided in the rod cover.

3. Relief operation



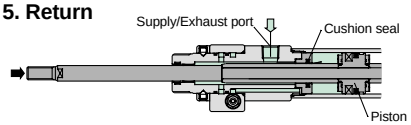
Air passes through the relief valve provided in the relief valve body, and through the inside of the rod cover to the supply/exhaust port.

4. Completion of cushioning



Shifting to the reverse stroke, the air that passed through the cushion seal, which works as a check valve, starts to push the piston.

5. Return



The cushion ring pulls out of the cushion seal beginning the stroke opposite to 1, and the operations in 1 to 4 above are performed on the head cover side.

High Power Cylinder

Series RHC

ø20, ø25, ø32, ø40, ø50, ø63, ø80, ø100

How to Order

High Power Cylinder **RHC** **B** **20** — **[ ]** — **C73** **[ ]**

High power cylinder

Mounting brackets

B	Basic type
L	Axial foot type
F	Front flange type
G	Rear flange type

Bore size

20	20mm
25	25mm
32	32mm
40	40mm
50	50mm
63	63mm
80	80mm
100	100mm

Cylinder stroke

∗ Refer to the 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 pages 10 through 14 for detailed auto switch specifications.

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 loads	
Reed switch	—	Grommet	Yes	3 wire (NPN equiv.)	—	5V —	**C76**	●	●	—	—	IC circuit	—
				2 wire	24V	—	**B53**	●	●	●	—	—	PLC
						12V 100V, 200V	**B54**	●	●	●	—	—	Relay, PLC
			No			200V or less	**B64**	●	●	—	—		
			Yes			12V 100V	**C73**	●	●	●	—		
			No			5V, 12V 100V or less	**C80**	●	●	—	—	IC circuit	
		Connector	Yes			12V —	**C73C**	●	●	●	●	—	
			No			5V, 12V 24V or less	**C80C**	●	●	●	●	IC circuit	
	Diagnostic indication (2 color indicator)	Grommet	Yes			— —	**B59W**	●	●	—	—	—	
Solid state switch	—	Grommet	Yes	3 wire (NPN)	24V	5V, 12V —	**H7A1**	●	●	○	—	IC circuit	Relay, PLC
				3 wire (PNP)			**H7A2**	●	●	○	—		
				2 wire		12V	**H7B**	●	●	○	—	—	
		Connector					**H7C**	●	●	●	●		
	Diagnostic indication (2 color indicator)	Grommet		3 wire (NPN)		5V, 12V	**H7NW**	●	●	○	—	IC circuit	
				3 wire (PNP)			**H7PW**	●	●	○	—		
				2 wire		12V	**H7BW**	●	●	○	—	—	
	Water resistant (2 color indicator)						**H7BA**	—	●	○	—		
	With timer			3 wire (NPN)		5V, 12V	**G5NT**	—	●	○	—	IC circuit	
	With diagnostic output (2 color indicator)			4 wire (NPN)			**H7NF**	●	●	○	—		
	Latch type with diagnostic output (2 color indicator)					—	**H7LF**	●	●	○	—	—	

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

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

Mounting bracket part nos.

Refer to Page 2 for part numbers of air cylinder mounting brackets other than the basic type.

Specifications

Fluid	Air
Proof pressure	1.5 MPa
Maximum operating pressure	1.0 MPa
Minimum operating pressure	0.05 MPa
Ambient and fluid temperature	–10 to 60°C (with no freezing)
Piston speed	50 to 3000 mm/s
Cushion	Air cushion
Lubrication	None (non-lube)
Thread tolerance	JIS class 2
Stroke length tolerance	to 1000 st +1.4
Mounting brackets	Basic type, Axial foot type, Front (Rear) flange type

Stroke Table

Unit: mm

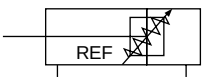
Bore size (mm)	Standard Note 1) stroke	Maximum Note 2) stroke
20	to 700	1500
25	to 700	1500
32	to 1000	1500
40	to 1000	1500
50	to 1200	1500
63	to 1200	1500
80	to 1400	1500
100	to 1500	1500

Energy Absorption/Cushion Stroke

Bore size (mm)	Max. energy absorption [J (kgfcm)]	Effective cushion stroke (mm)
20	7 (70)	80
25	12 (120)	80
32	21 (210)	80
40	33 (330)	80
50	47 (470)	80
63	84 (840)	80
80	127 (1270)	80
100	196 (1960)	80

Note 1) When the standard stroke is exceeded, it is outside the guaranteed range.
Note 2) Contact SMC if a stroke greater than the maximum stroke is desired.

Symbol



Mounting Bracket Part Numbers

Bore size (mm)	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**
Axial foot type*	RHC-L020	RHC-L025	RHC-L032	RHC-L040	RHC-L050	RHC-L063	RHC-L080	RHC-L100
Flange*	RHC-F020	RHC-F025	RHC-F032	RHC-F040	RHC-F050	RHC-F063	RHC-F080	RHC-F100

Auto Switch Mounting Bracket Part Numbers (Band and screw included)

Applicable auto switches		Bore size (mm)							
		20	**25**	**32**	**40**	**50**	**63**	**80**	**100**
Reed	**D-C73, D-C76, D-C80** **D-C73C, D-C80C**	BMA2-020	BMA2-025	BMA2-032	BMA2-040	BMA2-050	BMA2-063	—	—
Solid state	**D-H7A1, D-H7A2, D-H7B, D-H7C** **D-H7NW, D-H7PW, D-H7BW** **D-H7LF, D-H7NF, D-H7BAL**								
Reed	**D-B53, D-B54, D-B64, D-B59W**	BA-01	BA-02	BA-32	BA-04	BA-05	BA-06	BA-08	BA-10
Solid state	**D-G5NTL**								
Reed	**D-A33, D-A34, D-A4**	—		—	BD1-04M	BD1-05M	BD1-06M	BD1-08M	BD1-10M
Solid state	**D-G39, D-K39**								

Theoretical Output Table

Unit: N

Bore size (mm)	Rod size (mm)	Operating direction	Piston area (mm²)	Operating pressure MPa								
				0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
20	10	OUT	314	63	94	126	157	188	220	251	283	314
		IN	236	47	71	94	118	142	165	189	212	236
25	12	OUT	491	98	147	196	246	295	344	393	442	491
		IN	378	76	113	151	189	227	265	302	340	378
32	12	OUT	804	161	241	322	402	482	563	643	724	804
		IN	691	138	207	276	346	415	484	553	622	691
40	16	OUT	1260	252	378	504	630	756	882	1010	1130	1260
		IN	1060	212	318	424	530	636	742	848	954	1060
50	20	OUT	1963	393	589	785	982	1178	1374	1570	1767	1964
		IN	1473	295	442	589	736	884	1031	1178	1325	1473
63	20	OUT	3117	623	935	1247	1559	1870	2182	2494	2806	3117
		IN	2626	525	788	1051	1313	1576	1839	2101	2364	2626
80	25	OUT	5027	1005	1508	291	2513	3016	3519	4021	4524	5027
		IN	4320	864	1296	1728	2160	2592	3024	3456	3888	4320
100	30	OUT	7854	1570	2356	3142	3927	4712	5498	6283	7069	7854
		IN	6892	1378	2068	2757	3446	4135	4824	5514	6203	6892

1N: Approx. 0.102kgf 1MPa: Approx. 10.2kgf/cm²
Note) Theoretical output (N) = Pressure (MPa) x Piston area (mm²)

Weight Table (Based on a 500mm stroke for each bore size.)

(kg)

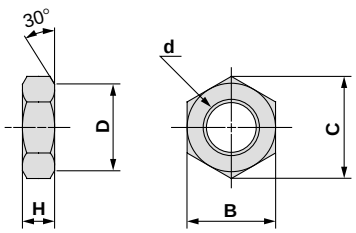
Bore size (mm)		**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**
Basic weight	Basic type	1.20	1.62	2.04	3.20	4.90	6.08	8.93	13.60
	Axial foot type	1.44	1.88	2.44	3.72	5.95	7.32	11.04	16.67
	Flange type	1.29	1.79	2.23	3.47	5.68	6.97	10.67	15.92
Additional weight per 50mm of stroke		0.06	0.08	0.09	0.15	0.22	0.25	0.35	0.51

Calculation method Example: RHCL32-600
- Basic weight …… 2.44 [foot type ø32]
- Additional weight .... 0.09/50mm stroke
- Cylinder stroke …… 600mm stroke

2.44 + 0.09 x 100/50 = 2.62kg

Accessories

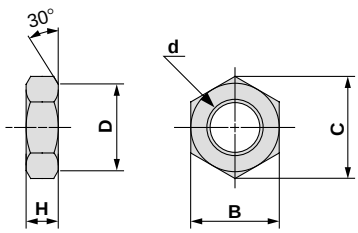
Mounting nut



(mm) Material: Carbon steel

Part No.	Applicable bore size	B	C	D	d	H
SOR-20	**20**	26	30	26	M22 x 1.5	8
SOR-25	**25**	32	36.9	32	M24 x 1.5	8
SOR-32	**32**	38	43.9	38	M30 x 1.5	9
SOR-40	**40**	41	47.3	41	M33 x 2.0	11

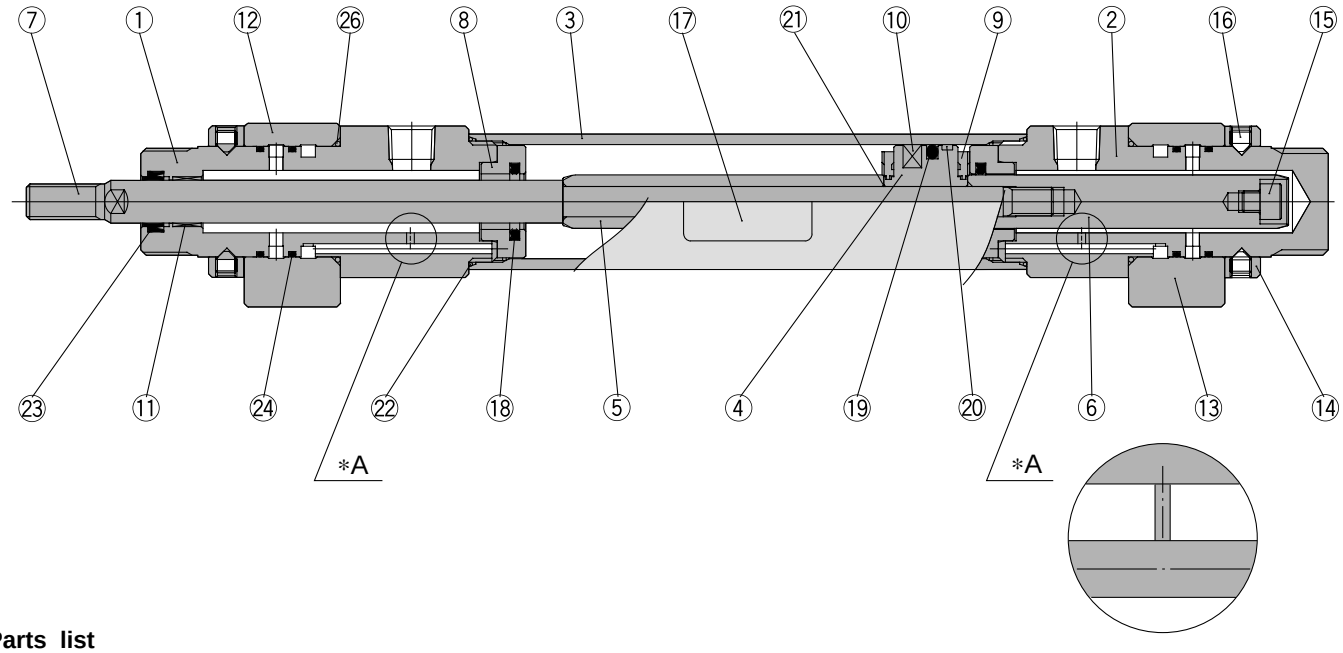
Rod end nut



(mm) Material: Carbon steel

Part No.	Applicable bore size	B	C	D	d	H
NT-02	**20**	13	15	12.5	M8 x 1.25	5
NT-03	**25/32**	17	19.6	16.5	M10 x 1.25	6
NT-04	**40**	22	25.4	21.0	M14 x 1.5	8
NT-05	**50**	27	31	26	M18 x 1.5	11
NT-05	**63**	27	31	26	M18 x 1.5	11
NT-08	**80**	32	37	31	M22 x 1.5	13
NT-10	**100**	41	47.3	39	M26 x 1.5	16

Construction (ø20 to ø40)



Section A enlarged view

Parts list

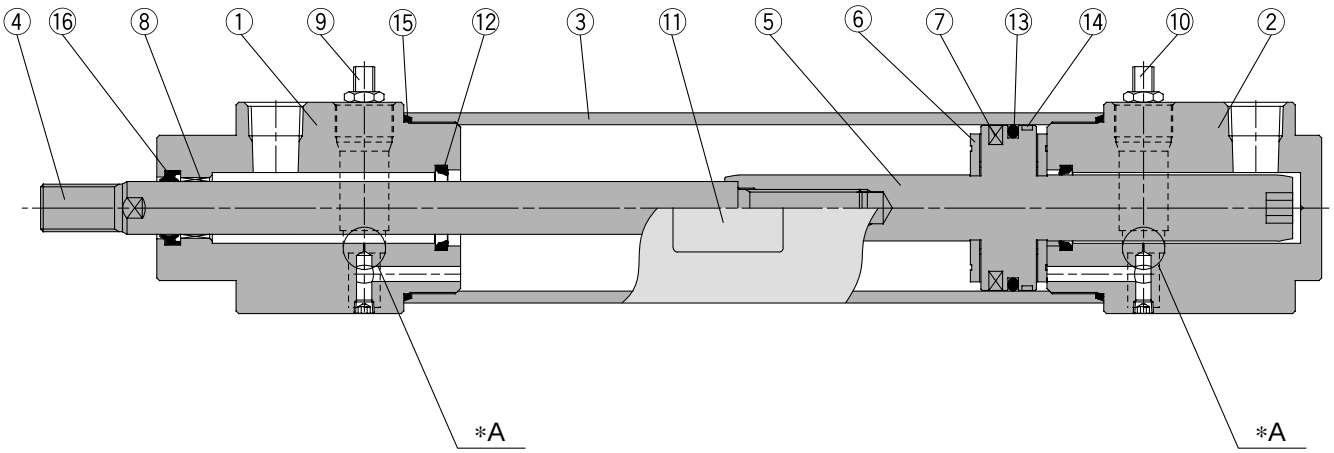
No.	Description	Material	Note
1	**Rod cover**	Aluminum alloy	Clear anodized
2	**Head cover**	Aluminum alloy	Clear anodized
3	**Cylinder tube**	Aluminum alloy	Hard anodized
4	**Piston**	Aluminum alloy	Chromated
5	**Cushion ring A**	Carbon steel	Hard chrome plated
6	**Cushion ring B**	Carbon steel	Hard chrome plated
7	**Piston rod**	Carbon steel	Hard chrome plated
8	**Cushion spacer**	Stainless steel	
9	**Bumper**	Urethane	
10	**Magnet**	—	
11	**Bushing**	Oil containing sintered metal	
12	**Relief valve assembly (rod side)**	—	
13	**Relief valve assembly (head side)**	—	
14	**Relief valve body retainer**	Aluminum alloy	Clear anodized
15	**Hexagon socket head cap screw**	Chromium molybdenum steel	ø20: M5 x 0.8 x 6 ø25, ø32: M6 x 1 x 6 ø40: M8 x 1.25 x 8 Nickel plated
16	**Hexagon socket head set screw**	Chromium molybdenum steel	ø20, ø25: M5 x 0.8 x 6 ø32, ø40: M6 x 1 x 8 Nickel plated
17	**Label**	—	
18	**Cushion seal**	Special resin	
19	**Piston seal**	NBR	
20	**Wear ring**	Resin	
21	**Piston gasket**	NBR	
22	**Cylinder tube gasket**	NBR	
23	**Rod seal**	NBR	
24	**O-ring**	NBR	
25	**O-ring**	NBR	

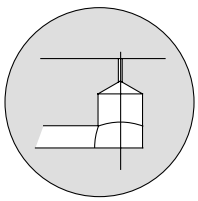
Replacement parts: Seal kits

Bore size (mm)	Seal kit no.	Contents
20	RHC20-PS	Set of nos. 19 to 25 above
25	RHC25-PS	
32	RHC32-PS	
40	RHC40-PS	

∗ Seal kits are sets consisting of items 19 through 25, which can be ordered using the seal kit number for each bore size.

Construction (ø50 to ø100)





Section A enlarged view

Parts list

No.	Description	Material	Note
1	**Rod cover**	Aluminum alloy	Clear anodized
2	**Head cover**	Aluminum alloy	Clear anodized
3	**Cylinder tube**	Aluminum alloy	Hard anodized
4	**Piston rod**	Carbon steel	Hard chrome plated
5	**Piston**	Aluminum alloy	Hard anodized
6	**Bumper**	Urethane	
7	**Plastic magnet**	—	
8	**Bushing**	—	
9	**Relief valve assembly L**	—	
10	**Relief valve assembly R**	—	
11	**Label**	—	
12	**Cushion seal**	Urethane	
13	**Piston seal**	NBR	
14	**Wear ring**	Resin	
15	**Cylinder tube gasket**	NBR	
16	**Rod seal**	NBR	

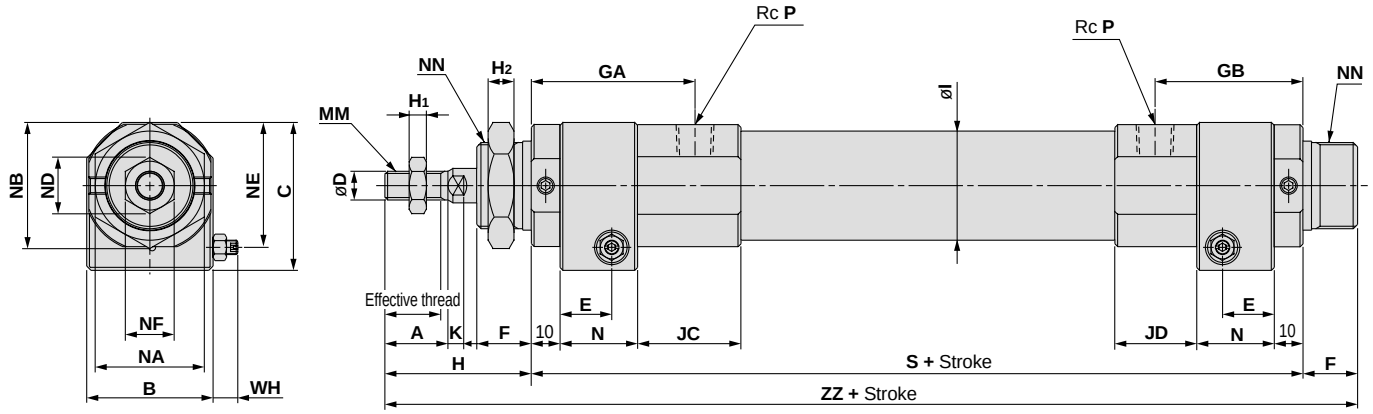
Replacement parts: Seal kits

Bore size (mm)	Seal kit no.	Contents
50	RHC50-PS	Set of nos. 12 to 16 above
63	RHC63-PS	
80	RHC80-PS	
100	RHC100-PS	

∗ Seal kits are sets consisting of items 12 through 16, which can be ordered using the seal kit number for each bore size.

Dimensions/Basic Type

ø20 to ø40

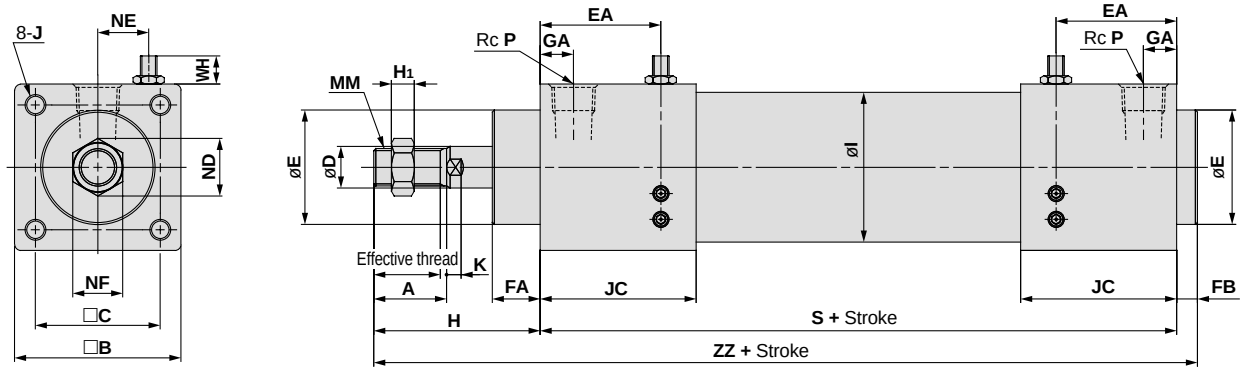


(mm)

Bore size (mm)	Stroke range (mm)	Effective thread length	A	B	C	D	E	F	GA	GB	H	H1	H2	I
20	200 to 700	15.5	18	32	40.5	10	14.5	16	53.5	47.5	44	5	8	26
25	200 to 700	19.5	22	36	45.5	12	18	16	56.5	49.5	48	6	8	31
32	200 to 1000	19.5	22	44	51.5	12	18	19	55	51.5	51	6	9	38
40	200 to 1000	21	24	53	61.5	16	20.5	21	56	51.5	54.5	8	11	47

Bore size (mm)	JC	JD	K	MM	N	NE	NA	NB	NF	ND	NN	P	S	WH	ZZ
20	43	30.5	5	M8 x 1.25	22	33.5	26	30	13	15.0	M22 x 1.5	1/4	192	5.8 to 8.8	252
25	39	25.5	5.5	M10 x 1.25	27	37	32	36.9	17	19.6	M24 x 1.5	1/4	193		257
32	36	28.5	5.5	M10 x 1.25	27	43.5	38	43.9	17	19.6	M30 x 1.5	3/8	195		265
40	32	23	7.5	M14 x 1.5	30	52.5	41	47.3	22	25.4	M33 x 2.0	3/8	201.5	6.8 to 11.3	277

ø50 to ø100



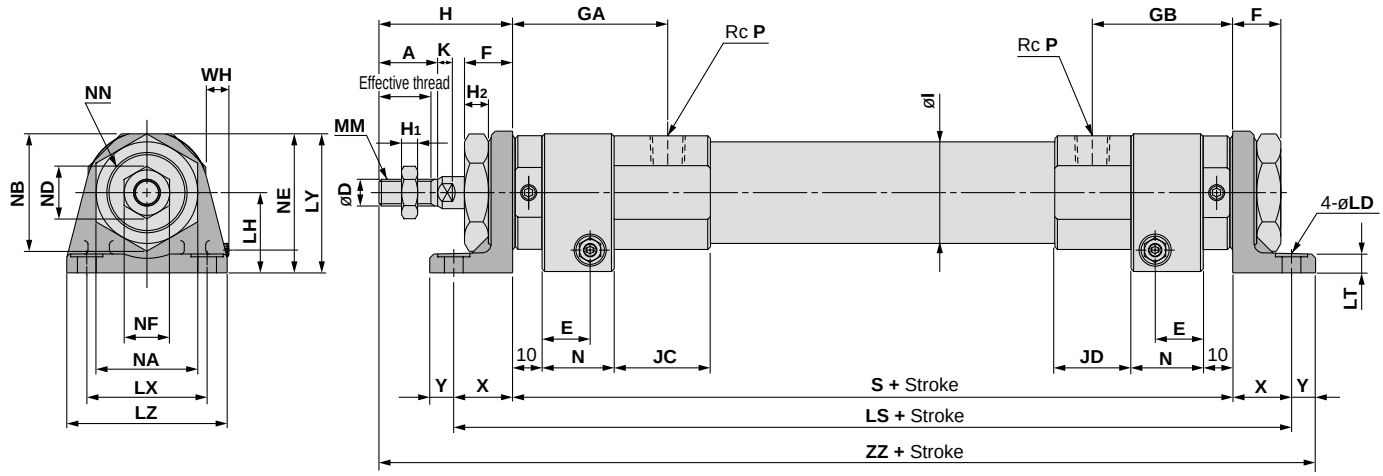
(mm)

Bore size (mm)	Stroke range (mm)	Effective thread length	A	B	C	D	E	EA	FA	FB	GA	H
50	250 to 1000	32	35	70	53	20	$50^{0}_{-0.042}$	62	23	10	16	80
63	250 to 1000	32	35	80	60	20	$55^{0}_{-0.074}$	58	23	10	16	80
80	250 to 1000	37	40	95	75	25	$65^{0}_{-0.074}$	61	23	10	20	90
100	250 to 1000	37	40	116	90	30	$80^{0}_{-0.074}$	63	25	10	20	95

Bore size (mm)	H1	I	J	JC	K	MM	ND	NE	NF	P	S	WH	ZZ
50	11	58	M10 x 1.5 thread depth 20	75	7	M18 x 1.5	27.7	25	24	1/2	215	6.8 to 11.3	305
63	11	72	M10 x 1.5 thread depth 20	75	7	M18 x 1.5	27.7	24.5	24	1/2	215		305
80	13	89	M12 x 1.75 thread depth 25	78	10	M22 x 1.5	37	30.5	32	3/4	228	8.5 to 13.5	328
100	16	110	M12 x 1.75 thread depth 25	80	10	M26 x 1.5	47.3	34	41	3/4	236		341

Dimensions/Axial Foot Type

ø20 to ø40

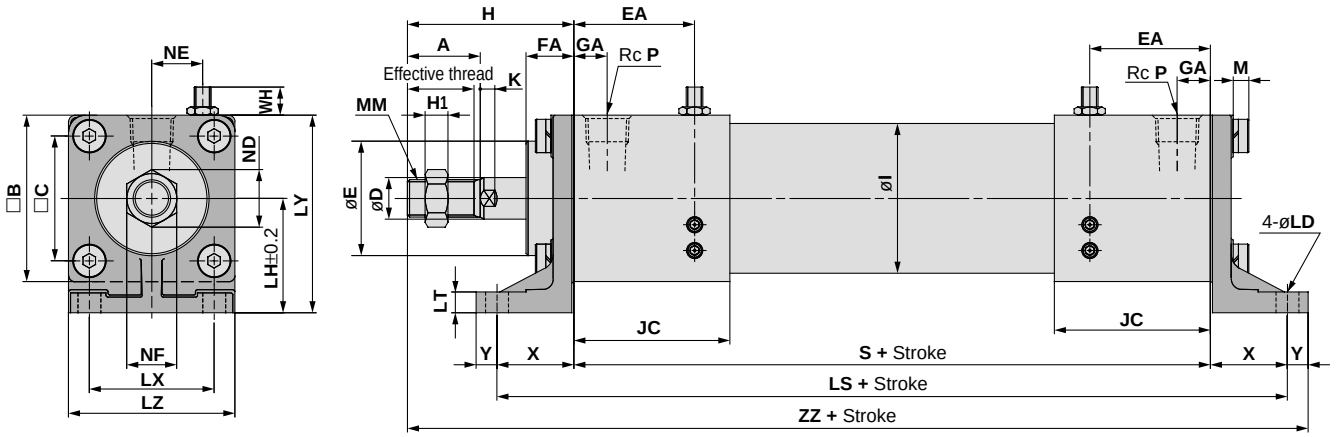


(mm)

Bore size (mm)	Stroke range (mm)	Effective thread length	A	D	E	F	GA	GB	H	I	JC	JD	K	LD	LH	H1	H2
20	200 to 700	15.5	18	10	14.5	16	53.5	47.5	44	26	43	30.5	5	7	25	5	8
25	200 to 700	19.5	22	12	18	16	56.5	49.5	48	31	39	25.5	5.5	7	28	6	8
32	200 to 1000	19.5	22	12	18	19	55	51.5	51	38	36	28.5	5.5	7	30	6	9
40	200 to 1000	21	24	16	20.5	21	56	51.5	54.5	47	32	23	7.5	9	35	8	11

Bore size (mm)	LS	LT	LX	LY	LZ	MM	N	NA	NB	NE	NF	ND	NN	P	S	WH	X	Y	ZZ
20	232	5.5	40	41	55	M8 x 1.25	22	26	30	33.5	13	15.0	M22 x 1.5	1/4	192	5.8 to 8.8	20	9	265
25	233	5.5	40	46.5	55	M10 x 1.25	27	32	36.9	37	17	19.6	M24 x 1.5	1/4	193		20	9	270
32	241	6	45	53	60	M10 x 1.25	27	38	43.9	43.5	17	19.6	M30 x 1.5	3/8	195		23	9	278
40	251.5	6	55	62	75	M14 x 1.5	30	41	47.3	52.5	22	25.4	M33 x 2.0	3/8	201.5	6.8 to 11.3	25	11	292

ø50 to ø100



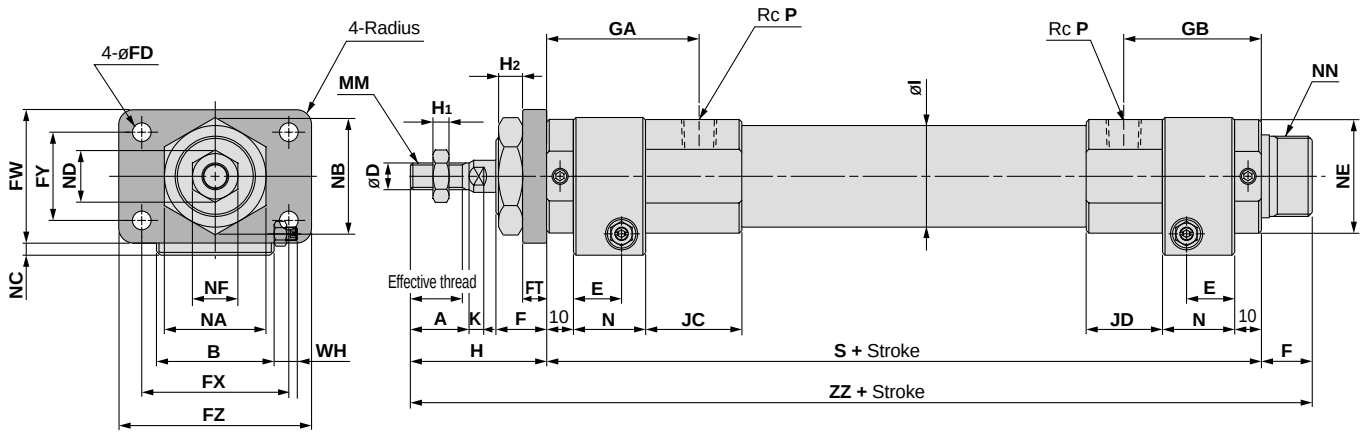
(mm)

Bore size (mm)	Stroke range (mm)	Effective thread length	A	B	C	D	E	EA	FA	GA	H	H1	I	JC	K	LD
50	250 to 1000	32	35	70	53	20	$50-^{0}_{0.042}$	62	23	16	80	11	58	75	7	11
63	250 to 1000	32	35	80	60	20	$55-^{0}_{0.074}$	58	23	16	80	11	72	75	7	11
80	250 to 1000	37	40	95	75	25	$65-^{0}_{0.074}$	61	23	20	90	13	89	78	10	13
100	250 to 1000	37	40	116	90	30	$80-^{0}_{0.074}$	63	25	20	95	16	110	80	10	13

Bore size (mm)	LH	LS	LT	LY	LX	LZ	M	MM	ND	NE	NF	P	S	WH	X	Y	ZZ
50	52	275	10	88.5	53	73	7.5	M18 x 1.5	27.7	25	24	1/2	215	6.8 to 11.3	30	10	335
63	55	289	10	95	60	80	7.5	M18 x 1.5	27.7	24.5	24	1/2	215		37	10	342
80	65	308	12	115	75	100	10	M22 x 1.5	37	30.5	32	3/4	228	8.5 to 13.5	40	13	371
100	80	330	14	139	90	118	10	M26 x 1.5	47.3	34	41	3/4	236		47	13	391

Dimensions/Front Flange Type

ø20 to ø40

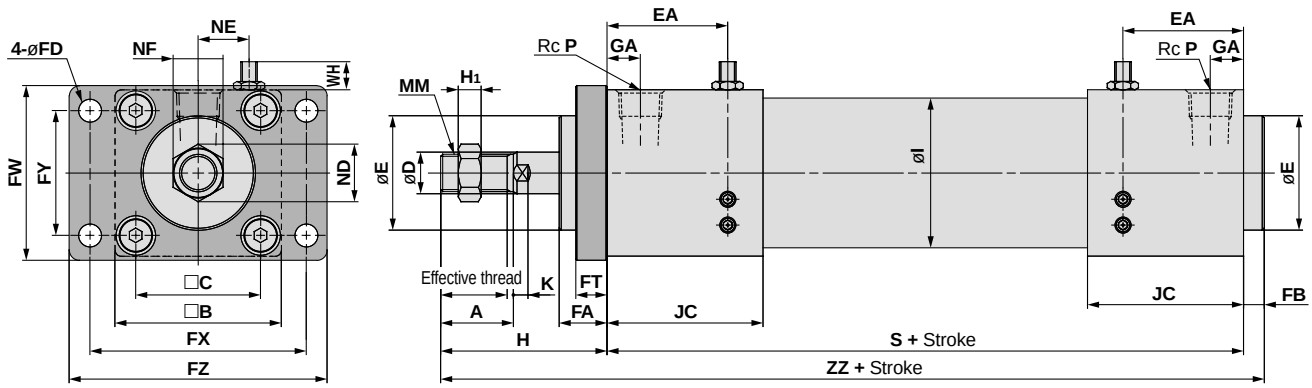


(mm)

Bore size (mm)	Stroke range (mm)	Effective thread length	A	B	D	E	F	FD	FT	FX	FY	FW	FZ	GA	GB	H1	H2
20	200 to 700	15.5	18	32	10	14.5	16	7	6	51	21	38	68	53.5	47.5	5	8
25	200 to 700	19.5	22	36	12	18	16	7	9	53	27	44	70	56.5	49.5	6	8
32	200 to 1000	19.5	22	44	12	18	19	7	9	55	33	50	72	55	51.5	6	9
40	200 to 1000	21	24	53	16	20.5	21	9	9	66	36	60	84	56	51.5	8	11

Bore size (mm)	H	I	JC	JD	K	MM	N	NA	NB	NC	NE	NF	ND	NN	P	S	WH	ZZ
20	44	26	43	30.5	5	M8 x 1.25	22	26	30	5.5	33.5	13	15.0	M22 x 1.5	1/4	192	5.8 to 8.8	252
25	48	31	39	25.5	5.5	M10 x 1.25	27	32	36.9	5.5	37	17	19.6	M24 x 1.5	1/4	193		257
32	51	38	36	28.5	5.5	M10 x 1.25	27	38	43.9	4.5	43.5	17	19.6	M30 x 1.5	3/8	195		265
40	54.5	47	32	23	7.5	M14 x 1.5	30	41	47.3	4.5	52.5	22	25.4	M33 x 2.0	3/8	201.5	6.8 to 11.3	277

ø50 to ø100



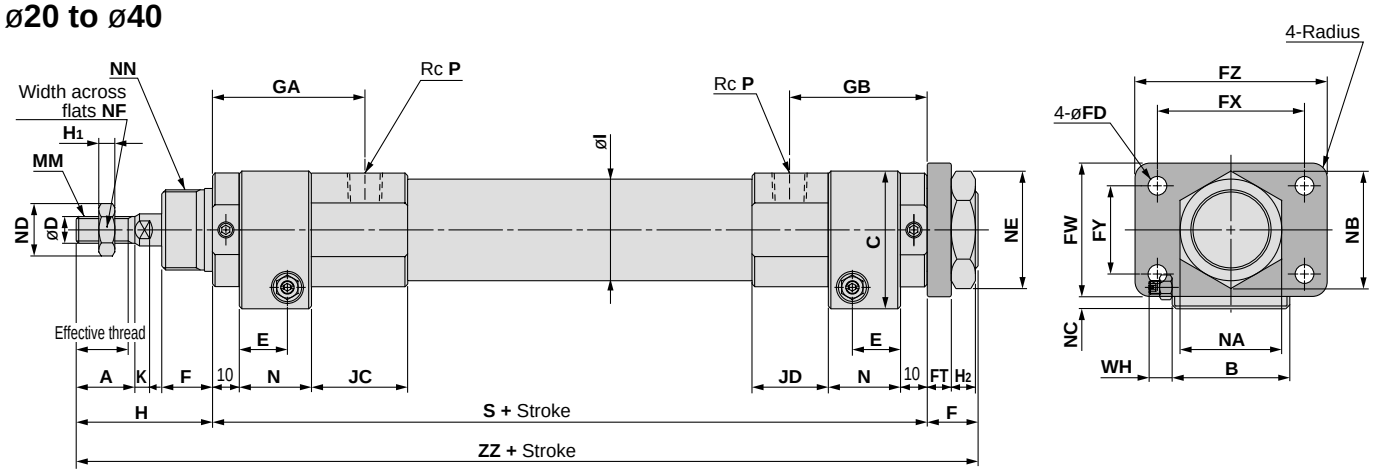
(mm)

Bore size (mm)	Stroke range (mm)	Effective thread length	A	B	C	D	E	EA	FA	FB	FD	FT	FW	FX
50	250 to 1000	32	35	70	53	20	$50^{0}_{-0.042}$	62	23	10	11	15	78	96
63	250 to 1000	32	35	80	60	20	$55^{0}_{-0.074}$	58	23	10	11	15	84	104
80	250 to 1000	37	40	95	75	25	$65^{0}_{-0.074}$	61	23	10	13	18	106	130
100	250 to 1000	37	40	116	90	30	$80^{0}_{-0.074}$	63	25	10	13	20	120	145

Bore size (mm)	FY	FZ	GA	H	H1	I	JC	K	MM	ND	NE	NF	P	S	WH	ZZ
50	53	116	16	80	11	58	75	7	M18 x 1.5	27.7	25	24	1/2	215	6.8 to 11.3	305
63	60	124	16	80	11	72	75	7	M18 x 1.5	27.7	24.5	24	1/2	215		305
80	75	155	20	90	13	89	78	10	M22 x 1.5	37	30.5	32	3/4	228	8.5 to 13.5	328
100	90	172	20	95	16	110	80	10	M26 x 1.5	47.3	34	41	3/4	236		341

Dimensions/Rear Flange Type

ø20 to ø40

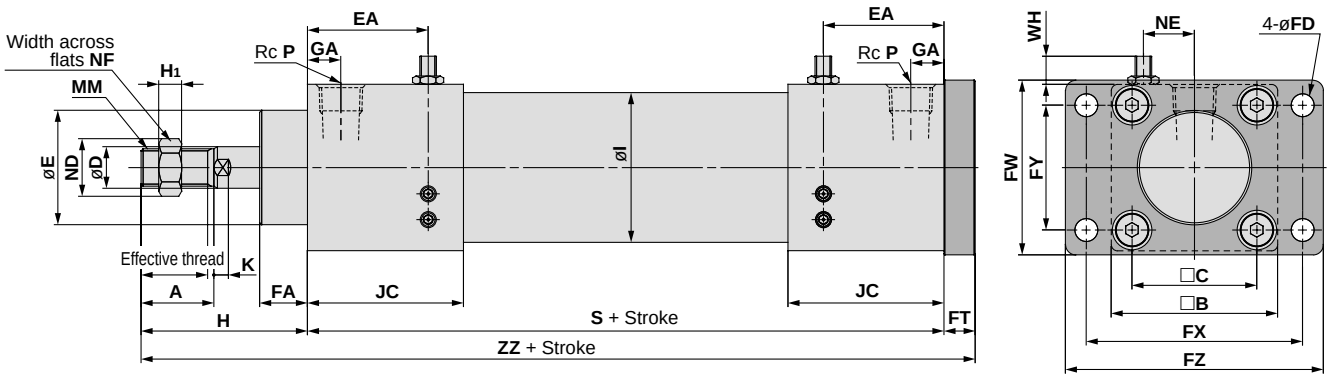


(mm)

Bore size (mm)	Stroke range (mm)	Effective thread length	A	B	C	D	E	F	FD	FT	FX	FY	FW	FZ	GA	GB	H_1
20	200 to 700	15.5	18	32	40.5	10	14.5	16	7	6	51	21	38	68	53.5	47.5	5
25	200 to 700	19.5	22	36	45.5	12	18	16	7	9	53	27	44	70	56.5	49.5	6
32	200 to 1000	19.5	22	44	51.5	12	18	19	7	9	55	33	50	72	55	51.5	6
40	200 to 1000	21	24	53	61.5	16	20.5	21	9	9	66	36	60	84	56	51.5	8

Bore size (mm)	H	I	JC	JD	K	MM	N	NA	NB	NC	NE	NF	ND	NN	P	S	WH	ZZ
20	44	26	43	30.5	5	M8 x 1.25	22	26	30	5.5	33.5	13	15.0	M22 x 1.5	1/4	192		252
25	48	31	39	25.5	5.5	M10 x 1.25	27	32	36.9	5.5	37	17	19.6	M24 x 1.5	1/4	193	5.8 to 8.8	257
32	51	38	36	28.5	5.5	M10 x 1.25	27	38	43.9	4.5	43.5	17	19.6	M30 x 1.5	3/8	195		265
40	54.5	47	32	23	7.5	M14 x 1.5	30	41	47.3	4.5	52.5	22	25.4	M33 x 2.0	3/8	201.5	6.8 to 11.3	277

ø50 to ø100



(mm)

Bore size (mm)	Stroke range (mm)	Effective thread length	A	B	C	D	E	EA	FA	FD	FT	FW	FX	FY
50	250 to 1000	32	35	70	53	20	$50^{0}_{-0.042}$	62	23	11	15	78	96	53
63	250 to 1000	32	35	80	60	20	$55^{0}_{-0.074}$	58	23	11	15	84	104	60
80	250 to 1000	37	40	95	75	25	$65^{0}_{-0.074}$	61	23	13	18	106	130	75
100	250 to 1000	37	40	116	90	30	$80^{0}_{-0.074}$	63	25	13	20	120	145	90

Bore size (mm)	FZ	GA	H	H_1	I	JC	K	MM	ND	NE	NF	P	S	WH	ZZ
50	116	16	80	11	58	75	7	M18 x 1.5	27.7	25	24	1/2	215	6.8 to 11.3	310
63	124	16	80	11	72	75	7	M18 x 1.5	27.7	24.5	24	1/2	215		310
80	155	20	90	13	89	78	10	M22 x 1.5	37	30.5	32	3/4	228	8.5 to 13.5	336
100	172	20	95	16	110	80	10	M26 x 1.5	47.3	34	41	3/4	236		351

Series RHC
Auto Switch Specifications

∗ Refer to CAT.E274-A “Auto Switch Guide” for detailed specifications of auto switch units.

Applicable Auto Switches

Auto switch type	Auto switch model	Electrical entry
Reed switch	**D-C7, C8**	Grommet
	D-C73C, C80C	Connector
	D-B5, B6	Grommet
	D-B59W	Grommet (2 color indicator)
Solid state switch	**D-H7A, H7B**	Grommet
	D-H7C	Connector
	D-H7□W	Grommet (2color indicator)
	D-H7BAL	Grommet (water resistant/2 color indicator)
	D-G5NT	Grommet (with timer)
	D-H7NF	Grommet (with diagnostic output /2 color indicator)
	D-H7LF	Grommet (latch type with diagnostic output/2 color indicator)

Auto Switch Mounting Bracket Part Numbers (Band and screw included)

Applicable auto switches		Bore size (mm)							
		20	**25**	**32**	**40**	**50**	**63**	**80**	**100**
Reed	**D-C73, D-C76, D-C80** **D-C73C, D-C80C**	BMA2-020	BMA2-025	BMA2-032	BMA2-040	BMA2-050	BMA2-063	—	—
Solid state	**D-H7A1, D-H7A2, D-H7B, D-H7C** **D-H7NW, D-H7PW, D-H7BW** **D-H7LF, D-H7NF, D-H7BAL**								
Reed	**D-B53, D-B54, D-B64, D-B59W**	BA-01	BA-02	BA-32	BA-04	BA-05	BA-06	BA-08	BA-10
Solid state	**D-G5NTL**								
Reed	**D-A33, D-A34, D-A4**	—		—	BD1-04M	BD1-05M	BD1-06M	BD1-08M	BD1-10M
Solid state	**D-G39, D-K39**								

⚠Specific Product Precautions

Be sure to read before handling. Refer to Pages 17 through 22 for safety instructions and common precautions.

Series RHC
Auto Switch Specifications

Contact Protection Boxes/CD-P11, CD-P12

<Applicable auto switches >

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

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

1. The operating load is an induction load.

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

3. The load voltage is 100VAC.

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

The life of the contacts may otherwise be reduced. (They may stay on continuously.) Even in the case of types which have internal contact protection circuits (D-B54, D-B64, D-B59W), when the length of wiring to the load is very long (30m or more) and a PLC having a large rush current is used, a contact protection box may be necessary. This should be confirmed.

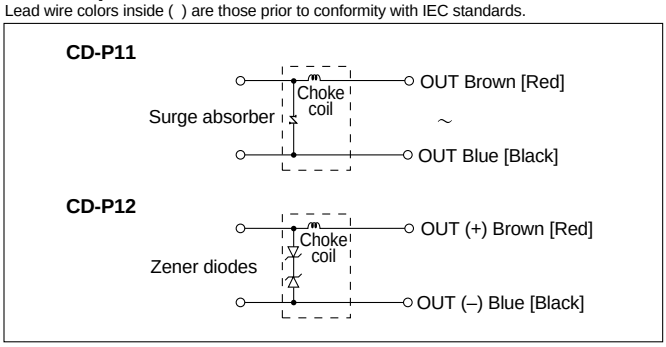
Contact protection box specifications

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

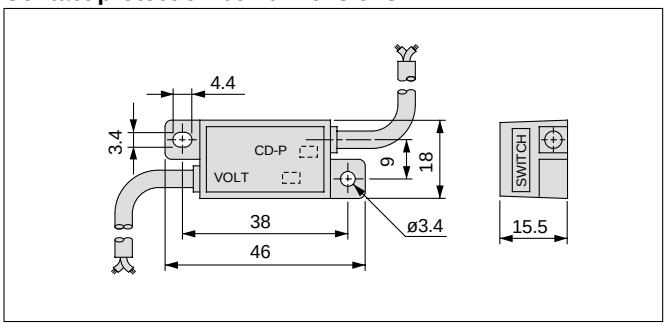
∗ Lead wire length —— Switch connection side 0.5m
Load connection side 0.5m

Contact protection box internal circuits

Lead wire colors inside ( ) are those prior to conformity with IEC standards.



Contact protection box dimensions



Contact Protection Box Connection

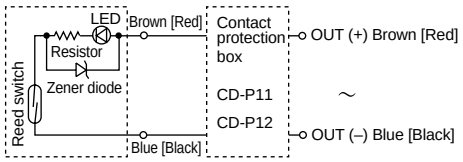
To connect a switch unit to a contact protection box, connect the lead wires from the side of the contact protection box marked SWITCH to the lead wires coming out of the switch unit. Further, the switch unit should be kept as close as possible to the contact protection box, with a lead wire length of no more than 1 meter.

Auto Switch Internal Circuits

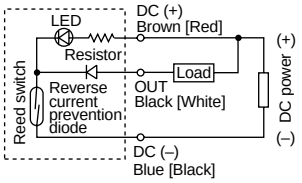
Lead wire colors inside ( ) are those prior to conformity with IEC standards.

Reed Switches

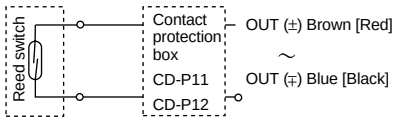
D-C73



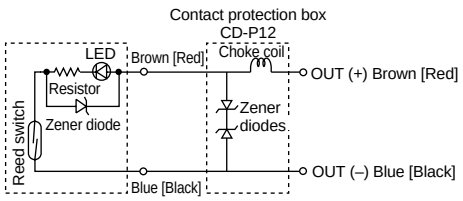
D-C76



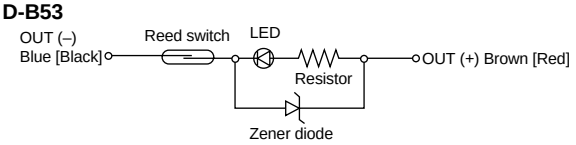
D-C80



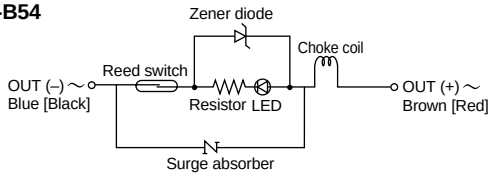
D-C73C



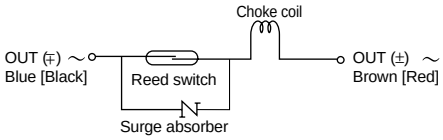
D-B53



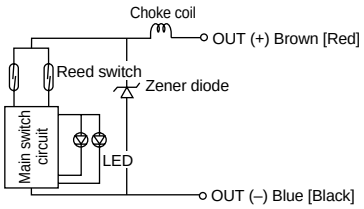
D-B54



D-B64



D-B59W



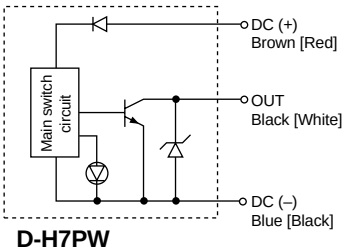
Auto Switch Specifications

Auto Switch Internal Circuits

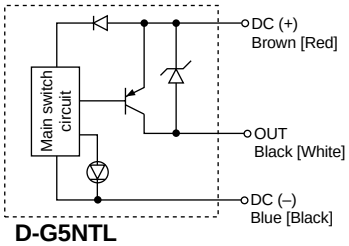
Lead wire colors inside ( ) are those prior to conformity with IEC standards.

Solid State Switches

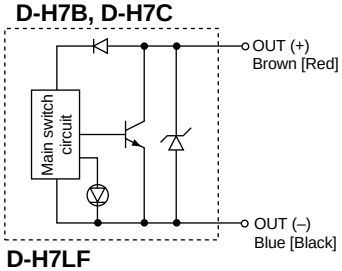
D-H7A1



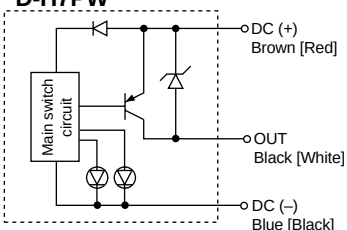
D-H7A2



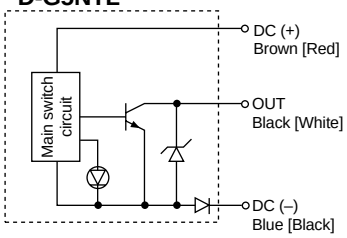
D-H7B, D-H7C



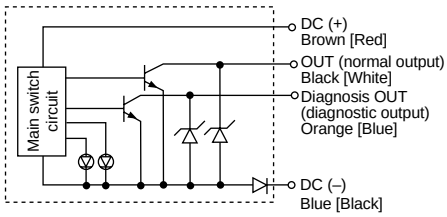
D-H7PW



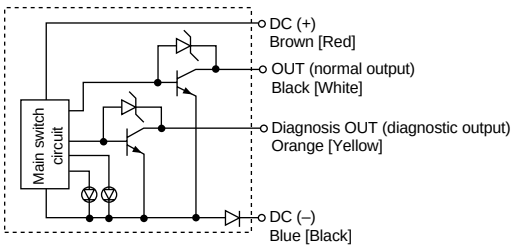
D-G5NTL



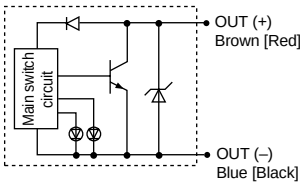
D-H7LF



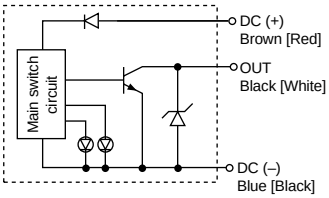
D-H7NF



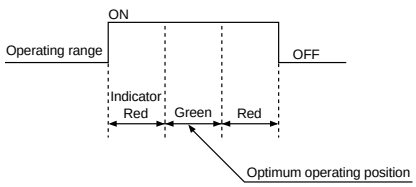
D-H7BAL, D-H7BW



D-H7NW



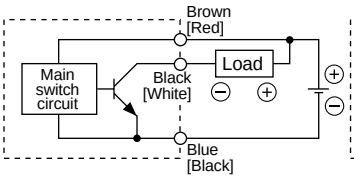
Indicator light/Display method



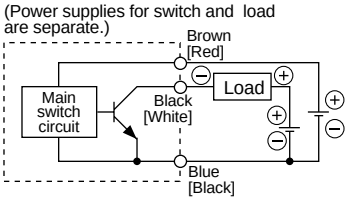
Series RHC
Auto Switch Connections and Examples

Basic Wiring

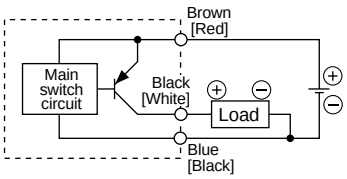
Solid state 3 wire, NPN



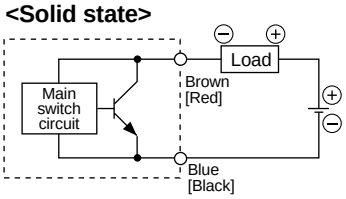
(Power supplies for switch and load are separate.)

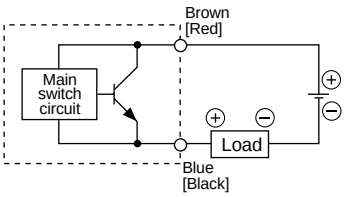


Solid state 3 wire, PNP

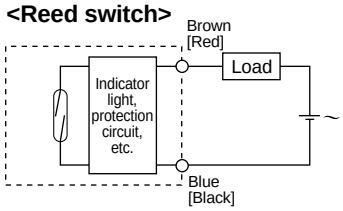


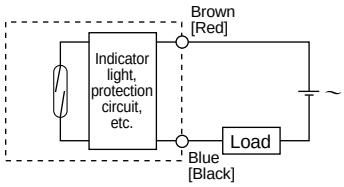
2 wire <Solid state>





2 wire <Reed switch>

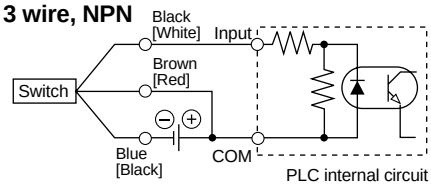




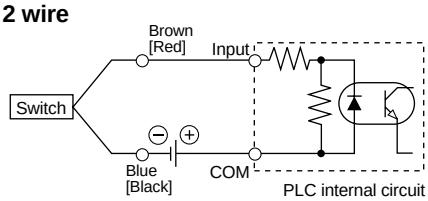
Examples of Connection to PLC

Sink input specifications

3 wire, NPN

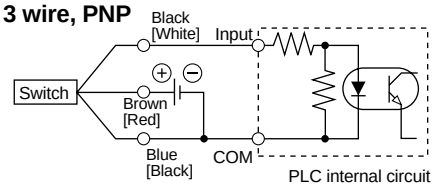


2 wire

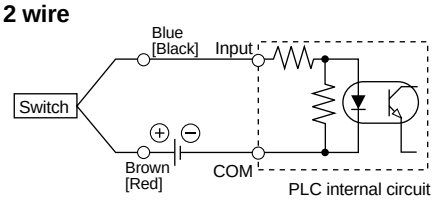


Source input specifications

3 wire, PNP



2 wire

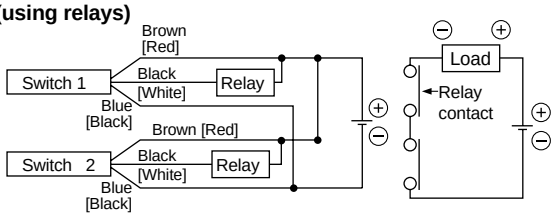


Connect according to the applicable PLC input specifications, as the connection method will vary depending on the PLC input specifications.

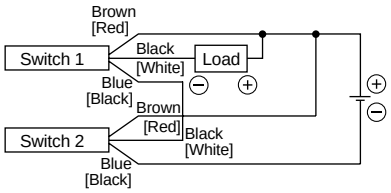
Connection Examples for AND (Series) and OR (Parallel)

3 wire

AND connection for NPN output (using relays)

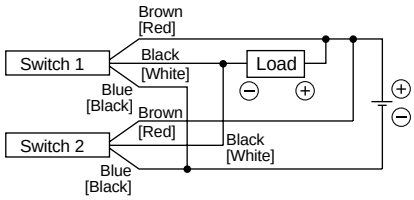


AND connection for NPN output (performed with switches only)

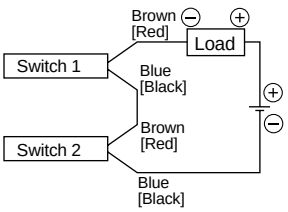


The indicator lights will light up when both switches are turned ON.

OR connection for NPN output



2 wire with 2 switch AND connection



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

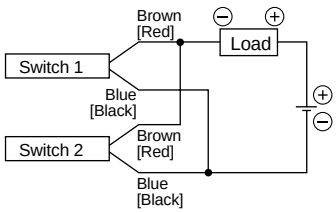
Load voltage at ON = $\frac{\text{Power supply voltage}}{} - \frac{\text{Residual voltage}}{}$ x 2 pcs.

= 24V – 4V x 2 pcs.

= 16V

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

2 wire with 2 switch OR connection



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

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

= 1mA x 2 pcs. x 3kΩ

= 6V

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

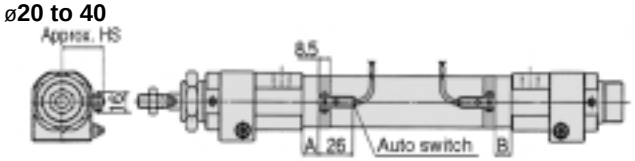
<Reed switch>
Because there is no current leakage, the load voltage will not increase when turned OFF. However, depending on the number of switches in the ON state, the indicator lights may sometimes get dark or not light up, because of dispersion and reduction of the current flowing to the switches.

Series ***RHC***
Auto Switch Specifications

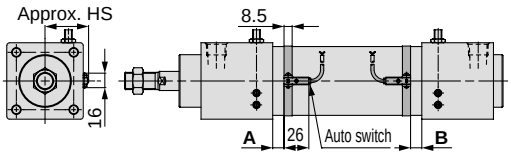
Auto Switches/Proper Mounting Position and Mounting Height for Stroke End Detection

D-C7/C8 type

ø20 to 40



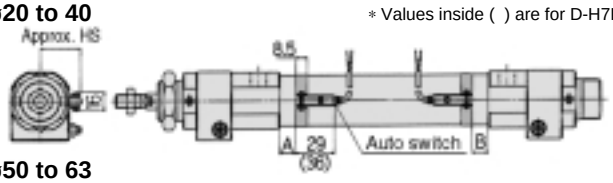
ø50 to 63



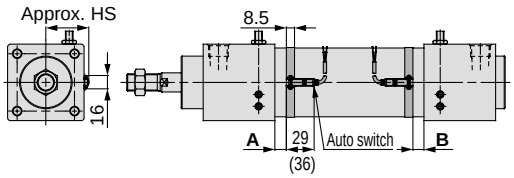
D-H7□/H7□W/H7□F/H7BAL type

ø20 to 40

∗ Values inside ( ) are for D-H7LF.

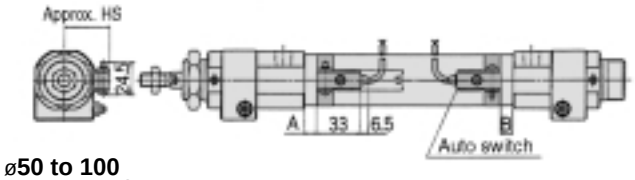


ø50 to 63

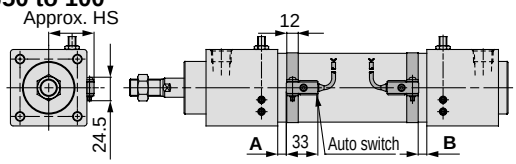


D-B5/B6/B59W type

ø20 to 40

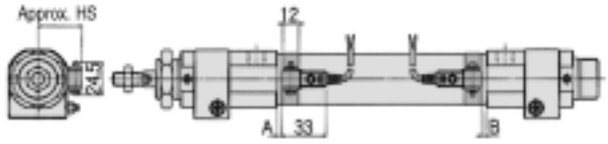


ø50 to 100

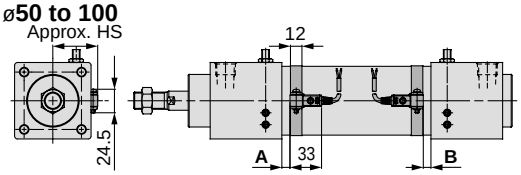


D-G5NTL type

ø20 to 40

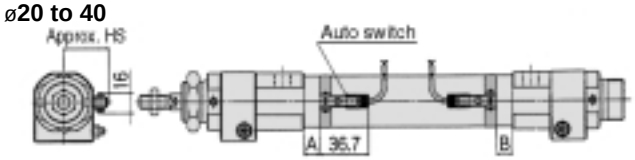


ø50 to 100

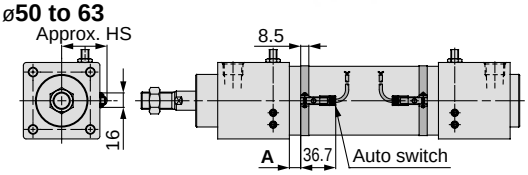


D-C73C/C80C type

ø20 to 40

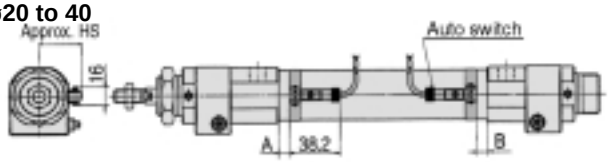


ø50 to 63

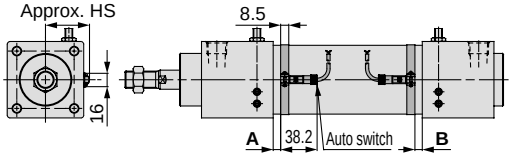


D-H7C type

ø20 to 40



ø50 to 63



Proper auto switch mounting position

(mm)

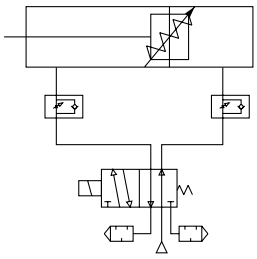
Bore size (mm)	D-C7 D-C8 D-C73C D-C80C		D-B5 D-B6		D-H7□ D-H7C		D-G5NTL		D-H7□W D-H7□F D-H7BAL		D-B59W	
	A	B	A	B	A	B	A	B	A	B	A	B
20	15	20.5	9	14.5	14	19.5	10.5	16	12.5	18	12	17.5
25	15	20.5	9	14.5	14	19.5	10.5	16	12.5	18	12	17.5
32	15	22.5	9	16.5	14	21.5	10.5	18	12.5	20	12	19.5
40	20	27.5	14	21.5	19	26.5	15.5	23	17.5	25	17	24.5
50	18	28	12	22	17	27	13.5	23.5	15.5	25.5	15	28.5
63	18	28	12	22	17	27	13.5	23.5	15.5	25.5	15	28.5
80	—	—	13.5	27.5	—	—	15	29	—	—	16.5	30.5
100	—	—	15.5	29.5	—	—	17	31	—	—	18.5	32.5

Auto switch mounting height

(mm)

Bore size (mm)	D-C7,D-C8 D-H7□ D-H7C D-H7□W D-H7□F D-H7BAL	D-B5/B6 D-B59W D-G5NTL	D-C73C D-C80C
	HS	HS	HS
20	24.5	27.5	27
25	27	30	29.5
32	30.5	33.5	33
40	35	38	37.5
50	40.5	43.5	43
63	47.5	50.5	50.5
80	—	59	—
100	—	69.5	—

Series RHC
High Power Cylinder
System Selection

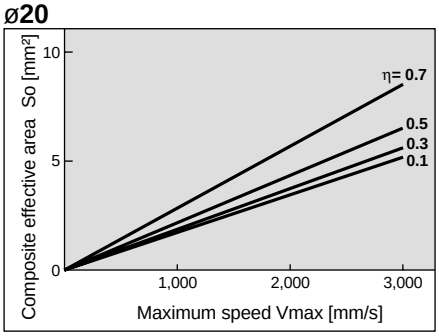


1.Solenoid valve (A to G group)
2. Speed control valve (1-A to 2-B)
3. Piping 3m
4. Silencer
(Supply pressure 0.5MPa)

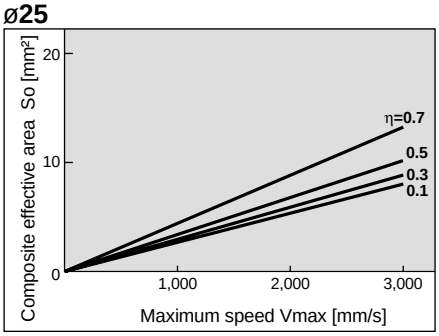
Find the effective area So from the graphs by assigning values for η and Vmax.

Select solenoid valves, speed control valves and tubing sizes, etc., using the system selection table.

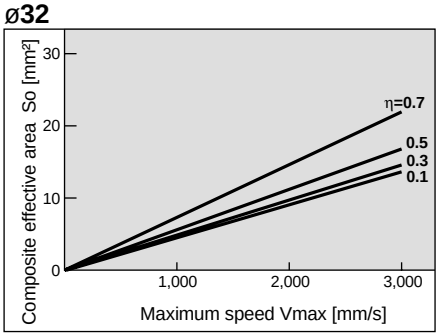
ø20



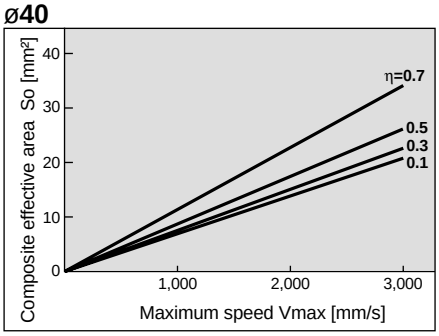
ø25



ø32



ø40



η: Cylinder load factor
Vmax: Maximum speed (Refer to Page 24)

System Selection Table

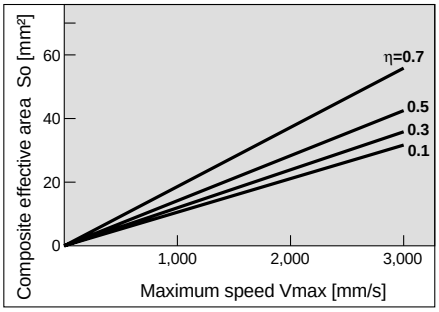
Cylinder bore size mm	Maximum cylinder speed mm/s	Composite effective area mm²	Solenoid valves ( ) indicates effective area mm² ▭ indicates metal seal type					Speed controller		Piping tube O.D. mm Steel tube piping size
			A group	B group	C group	D group	E group			
			3.6 to 6.3	9.0 to 14.4	16.2 to 21.6	36 to 45	64.8 to 67			
			VQ1000 (3.6)	VQ2000 (14.4)	—	VQ4000 (36.0)	—	1 With One-touch fitting	1-A Elbow type	
			VQ1000 (5.4)	—	VQ2000 (16.2)	VQ4000 (39.6)	—		1-B Unversal type	
			SY3000 (5.4)	SY5000 (12.6)	SY7000 (21.6)	—	—		1-C In-line type	
			SX3000 (5.4)	SX5000 (12.6)	SX7000 (21.6)	—	—			
			SYJ5000 (4.5)	SYJ7000 (12.6)	—	—	—			
			VQZ1000 (3.6)	VQZ2000 (12.6)	VQZ3000 (16.2)	—	—			
			VQZ1000 (6.3)	VQZ2000 (12.6)	VQZ3000 (21.6)	—	—			
			—	—	VFR2000 (16.2)	VFR3000 (41.4)	VFR4000 (67.0)	2 Standard type	2-A Metal elbow type	
			—	VFS1000 (9.0)	VFS2000 (18.0)	VFS3000 (36.0)	VFS4000 (64.5)		2-B In-line type	
			—	—	—	—	—			
20	500	1.5	■					1-A	AS22□1F (3.5)	ø6 1/8,1/4
								1-B	AS23□1F (3.5)	
								1-C	AS2051F (4.5)	
								2-A	AS22□0 (2.9)	
								2-B	AS2000 (3.8)	
	1000	3		■				1-C	AS3001F (6.5)	ø6 1/4, 3/8
								2-B	AS3000, AS3500 (12.3)	
	1500	4.5		■				1-C	AS4001F (16)	ø10 1/4, 3/8
								2-B	AS3000, AS3500 (12.3)	
	2000	6			■			1-C	AS4001F (16)	ø10 1/4,3/8
								2-B	AS3000, AS3500 (12.3)	
	2500	7.5			■			1-C	AS4001F (16)	ø10 1/4, 3/8
								2-B	AS3000, AS3500 (12.3)	
	3000	9			■			1-C	AS4001F (16)	ø10 1/4, 3/8
								2-B	AS3000, AS3500 (12.3)	
25	500	2.5	■					1-C	AS2051F (4.5)	ø6 1/4,3/8
								2-B	AS3000, AS3500 (12.3)	
	1000	5		■				1-C	AS3001F (10)	ø8 1/4, 3/8
								2-B	AS3000, AS3500 (12.3)	
	1500	7.5			■			1-C	AS4001F (16)	ø10 1/4, 3/8
								2-B	AS3000, AS3500 (12.3)	
	2000	10				■		1-C	AS4001F (16)	ø10 1/4
								2-B	AS4000 (25.5)	
	2500	12.5				■		2-B	AS4000 (25.5)	1/4
	3000	15					■	2-B	AS4000 (25.5)	1/4
32	500	4		■				1-A	AS32□1F (10)	ø6 ø10 1/4, 3/8
								1-B	AS33□1F (10)	
								1-C	AS4001F (16)	
								2-A	AS32□0 (13)	
								2-B	AS3000, AS3500 (12.3)	
	1000	8			■			1-C	AS4001F (16)	ø10 1/4, 3/8
								2-A	AS32□0 (13)	
								2-B	AS3000, AS3500 (12.3)	
	1500	12				■		2-B	AS4000 (25.5)	1/4,3/8
	2000	16				■		2-B	AS5000 (74)	3/8
	2500	20				■		2-B	AS5000 (74)	3/8
	3000	24					■	2-B	AS5000 (74)	3/8
40	500	6			■			1-A	AS32□1F (10)	ø8 ø10 1/4, 3/8
								1-B	AS33□1F (10)	
								1-C	AS4001F (16)	
								2-A	AS32□0 (13)	
								2-B	AS3000, AS3500 (12.3)	
	1000	12				■		2-B	AS4000 (25.5)	3/8ø12
	1500	18				■		2-B	AS5000 (74)	3/8ø12
	2000	24					■	2-B	AS5000 (74)	3/8ø12
	2500	30					■	2-B	AS5000 (74)	3/8ø12
	3000	36					■	2-B	AS420 (74)	3/8ø12

Note) Since the cushion capacity may be exceeded in high speed, high load operation, confirm the maximum energy absorption on page 2.

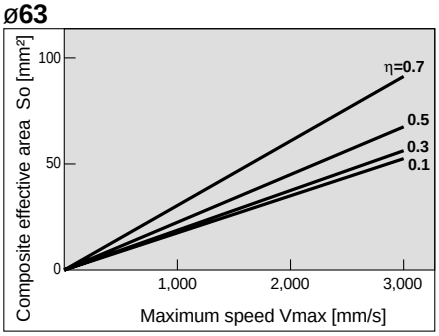
Find the effective area So from the graphs by assigning values for η and Vmax.

Select solenoid valves, speed control valves and tubing sizes, etc., using the system selection table.

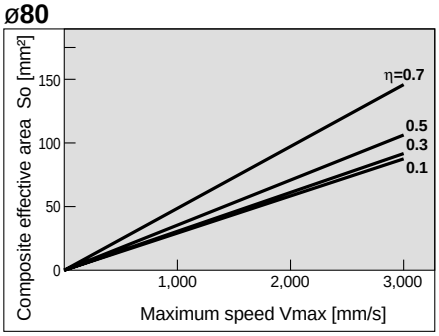
ø50



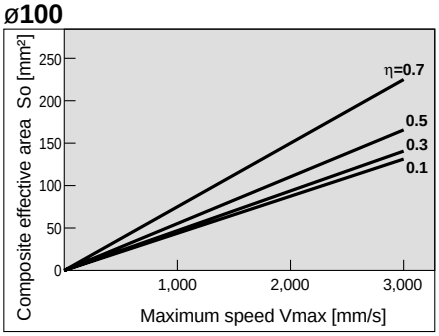
ø63



ø80



ø100



η : Cylinder load factor
Vmax : Maximum speed (Refer to page 24)

System Selection Table

Cylinder bore size mm	Maximum cylinder speed mm/s	Composite effective area mm²	Solenoid valve ( ) indicates effective area mm² ▭ indicates metal seal type. C group	D group	E group	F group	G group	Speed controller		Piping tube O.D. mm Steel tube piping size
			16.2 to 21.6	36 to 45	64.8 to 67	102.6 to 120	180 to 300			
			—	VQ4000 (36.0)	—	—	—	1 With One-touch fitting	1-A Elbow type	
			VQ2000 (16.2)	VQ4000 (39.6)	—	—	—		1-B Universal type	
			SY7000 (21.6)	—	—	—	—		1-C In-line type	
			SX7000 (21.6)	—	—	—	—			
			—	—	—	—	—			
			VQZ3000 (16.2)	—	—	—	—		2-A Metal elbow type	
			VQZ3000 (21.6)	—	—	—	—			
			VFR2000 (16.2)	VFR3000 (41.4)	VFR4000 (67.0)	VFR5000 (102.6)	VFR6000 (191)	2 Standard type		
			VFS2000 (18.0)	VFS3000 (36.0)	VFS4000 (64.5)	VFS5000 (12.6)	VFS6000 (180)		2-B In-line type	
			—	—	—	VP□50 (120)	VP□70 (300)			
50	500	9.5	■					1-A	AS42□1F (24)	ø8, ø10 1/4
			■					2-B	AS43□1F (24)	
			■					1-C	AS4001F (16)	
			■					2-A	AS4200 (26)	
			■					2-B	AS420 (102)	
	1000	19			■			1-A	AS42□1F (26)	ø12, ø16 1/4, 3/8
					■			2-B	AS43□1F (24)	
				■				2-A	AS4200 (26)	
				■				2-B	AS420 (102)	
	1500	28.5		■				2-B	AS420 (102)	3/8, ø16
	2000	38			■			2-B	AS420 (102)	3/8, ø16
	2500	47				■		2-B	AS420 (102)	3/8, ø16
	3000	56.5					■	2-B	AS420 (102)	1/2, ø16
63	500	15			■			1-A	AS42□1F (24)	ø10, ø12, ø16 1/4, 3/8
					■			2-B	AS43□1F (24)	
				■				1-C	AS4001F (16)	
				■				2-A	AS4200 (26)	
			■					2-B	AS420 (102)	
	1000	30		■				2-B	AS420 (102)	3/8, ø16
	1500	45			■			2-B	AS420 (102)	1/2, ø16
	2000	60				■		2-B	AS420 (102)	1/2, ø16
	2500	75					■	2-B	AS600 (258)	3/4, ø16
	3000	89.5					■	2-B	AS500 (123)	3/4, ø16
80	500	24.5				■		2-A	AS4200 (26)	ø16 3/8, 1/2
				■				2-B	AS420 (102)	
	1000	48.5				■		2-B	AS500 (123)	3/8, ø16
	1500	72.5					■	2-B	AS600 (258)	1/2, ø16
	2000	96.5					■	2-B	AS600 (258)	3/4
	2500	120.5					■	2-B	AS600 (258)	3/4
	3000	106					■	2-B	AS600 (258)	3/4
100	500	38			■			2-B	AS420 (102)	3/8
	1000	75.5					■	2-B	AS600 (258)	1/2, ø16
	1500	113					■	2-B	AS600 (258)	3/4
	2000	110.5					■	2-B	AS600 (258)	3/4
	2500	138					■	2-B	AS800 (586)	3/4
	3000	88.5					■	2-B	AS500 (123)	3/4

Note) Since the cushion capacity may be exceeded in high speed, high load operation, confirm the maximum energy absorption on page 2.

Series RHC
Safety Instructions

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

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

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

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

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

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

⚠ Warning

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

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

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

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

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

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

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

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

Series RHC
Actuator Precautions 1

Be sure to read before handling.

Precautions on Design

⚠ Warning

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

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

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

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

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

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

4. 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, etc.

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

When a cylinder is driven by an exhaust center type directional control valve or when starting up after residual pressure is exhausted from the circuit, etc., the piston and its driven object will lurch at high speed if pressure is applied to one side of the cylinder because of the absence of air pressure inside the cylinder. 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.

6. Consider emergency stops.

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

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

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

Selection

⚠ Warning

1. Check the specifications.

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

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

⚠ Caution

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

The piston rod will be damaged if operated with a stroke exceeding the maximum stroke. Refer to air cylinder model selection procedures for the maximum useable stroke.

Mounting

⚠ Caution

1. Be sure to connect so that the rod shaft center and load are aligned in the direction of movement.

If they are not aligned, the rod and tube will be twisted, and damage will be caused by abrasion of the tube's inner surface, bushings, rod surface and seals, etc.

2. When an external guide is used, connect the end rod 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 and piston rod by striking or grasping them with other objects.

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

Furthermore, scratches or gouges in the sliding areas of the piston rod will lead to seal damage and cause air leakage.

4. Prevent seizure of rotating parts.

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

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

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

6. Instruction manual

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

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

Series RHC
Actuator Precautions 2
Be sure to read before handling.

Piping

⚠ Caution

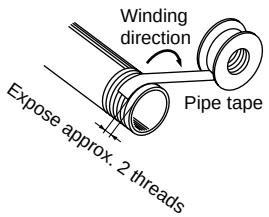
1. Preparation before piping

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

2. Wrapping of pipe tape

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

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



Lubrication

⚠ Caution

1. Lubrication of non-lube type cylinder

The cylinder has been lubricated for life at the factory and can be used without any further lubrication.

However, in the event that it will be lubricated, use class 1 turbine oil (without additives) ISO VG32.

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

Air Supply

⚠ Warning

1. Use clean air.

If compressed air includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., it can cause damage or malfunction.

⚠ Caution

1. Install air filters.

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

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

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

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

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

Operating Environment

⚠ Warning

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

Refer to the construction drawings regarding cylinder materials.

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

In situations with heavy dust, use a heavy duty scraper type. When there is liquid splash or spray, use a water resistant cylinder.

Maintenance

⚠ Warning

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

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

2. Removal of equipment and supply/exhaust of compressed air

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

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

⚠ Caution

1. Drain flushing

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

Series RHC
Auto Switch Precautions 1

Be sure to read before handling.

Design & Selection

⚠ Warning

1. Confirm the specifications.

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

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

When multiple auto switch cylinders are used in close proximity, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40mm. (When the allowable separation is indicated for each cylinder series, use the specified value.)

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

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

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

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

4. Keep wiring as short as possible.

<Reed switch>

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

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

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

<Solid state switch>

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

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

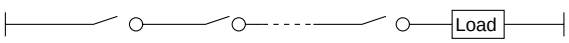
<Reed switch>

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

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

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

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



⚠ Warning

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

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

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

<Solid state switch>

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

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

6. Pay attention to leakage current.

<Solid state switch>

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

Operating current of load (OFF condition) > Leakage current

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

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

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

<Reed switch>

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

<Solid state switch>

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

8. Cautions for use in an interlock circuit

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

9. Ensure sufficient clearance for maintenance activities.

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

Series RHC
Auto Switch Precautions 2

Be sure to read before handling.

Mounting & Adjustment

⚠ Warning

1. Do not drop or bump.

Do not drop, bump or apply excessive impacts (300m/s² or more for reed switches and 1000m/s² or more for solid state switches) while handling.

Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

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

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

3. Mount switches using the proper tightening torque.

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 allow the switch to slip out of position. (Refer to switch mounting for each series regarding switch mounting, moving, and tightening torque, etc.)

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

Adjust the mounting position of an auto switch so that the piston stops at the center of the operating range (the range in which a switch is ON). (The mounting positions shown on page 14 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 repeatedly applying bending stress or stretching force to the lead wires.

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

<2 wire type>

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

3. Confirm proper insulation of wiring.

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

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

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

Wiring

⚠ Warning

5. Do not allow short circuit of loads.

<Reed switch>

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

<Solid state switch>

Model D-G5NB and all models of PNP output type switches do not have built-in short circuit prevention circuits. If loads are short circuited, the switches will be instantly damaged.

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

6. Avoid incorrect wiring.

<Reed switch>

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

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

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

Applicable models: D-C73, C73C, B53, B54

2) However, in the case of a 2 color indicator type auto switch (D-B59W), note that the switch will be in a normally ON condition if connections are reversed.

<Solid state switch>

1) If connections are reversed on a 2 wire type switch, the switch will not be damaged if protected by a protection circuit, but the switch will be in a normally ON state. However, it is still necessary to avoid reversed connections, since the switch could be damaged by a load short circuit in this condition.

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

∗ Lead wire color changes

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

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

2 wire

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

3 wire

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

Solid state with diagnostic output

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

Solid state with latch type diagnostic output

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

Series RHC
Auto Switch Precautions 3
Be sure to read before handling.

Operating Environment

⚠ Warning

1. Never use in an atmosphere of explosive gases.

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

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

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

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

Although switches, except some models (D-A3□, A44□, G-39□, K39□), satisfy IEC standard IP67 construction (JIS C 0920: water tight structure), do not use switches in applications where continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.

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

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

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

Consult SMC if switches are used where there are temperature cycles other than normal temperature changes, as they may be adversely affected.

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

<Reed switch>

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

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

<Solid state switch>

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

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

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

Maintenance

⚠ Warning

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

1) Secure and tighten switch mounting screws.

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

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

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

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

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

Other

⚠ Warning

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

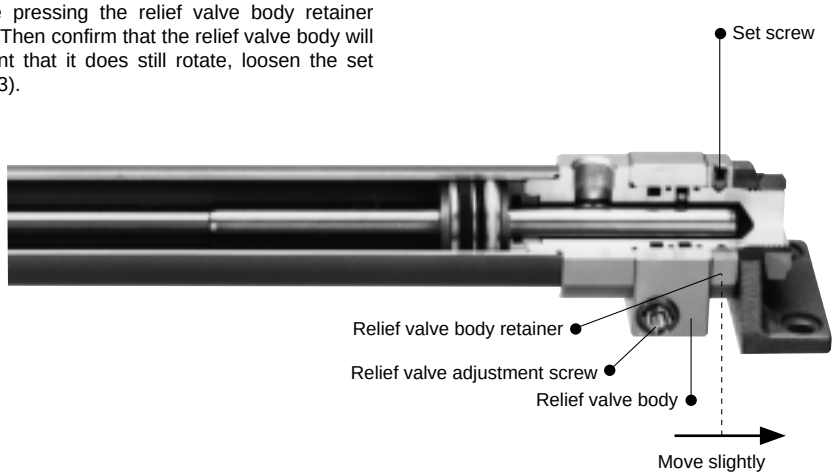
Rotation of the Relief Valve Body (ø20, 25, 32, 40)

⚠Caution

The relief valve adjustment screw can be set in the desired direction by rotating the relief valve body according to the following procedure.

Procedure

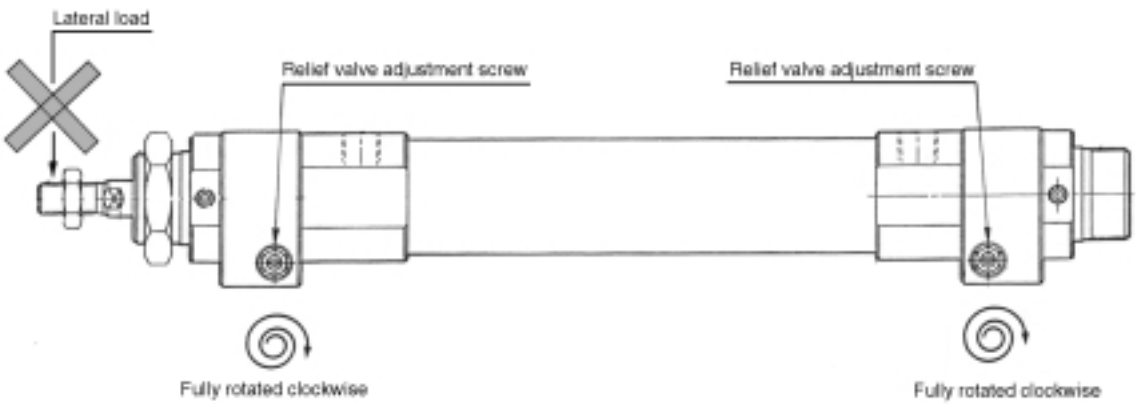
1. After confirming that there is no residual pressure inside the cylinder, loosen the mounting brackets (foot, flange, etc.).
2. Loosen the set screw attached to the relief valve body retainer, and rotate the relief valve body.
3. Secure the set screw while pressing the relief valve body retainer against the relief valve body. Then confirm that the relief valve body will no longer rotate. In the event that it does still rotate, loosen the set screw again and repeat step 3).



Handling

⚠Caution

1. Confirm that the relief valve body does not rotate when the cylinder is mounted. If there is play in the axial direction of the relief valve body, the cushion may become ineffective. When attaching brackets (foot, flange), do so after loosening the relief valve body set screw. Retighten the relief valve body set screw after the brackets have been attached. (ø20, 25, 32, 40)
2. The cylinder stroke end cushion adjustment screw is adjusted starting from the position where it is rotated fully clockwise (fully closed as when shipped from the factory). Furthermore, it should never be rotated more than six turns (more than 10 turns for ø63, 80 and 100) from the position where it is rotated fully counter-clockwise (fully opened). This can damage the spring inside the relief valve.
3. The cylinder ports are designed so that a maximum speed of 3000mm/s can be obtained. However, it may not be possible to attain the desired speed in the case of short cylinder strokes. It may also be impossible to attain the desired speed due to restriction by component equipment (valves, speed control valves, piping, fittings, etc.). Make every effort to ensure sufficient effective area in the component equipment.
4. Avoid applications in which lateral loads are applied to the cylinder piston rod. Especially in the case of long strokes, implement measures such as providing a guide for the load.



Series RHC
Model Selection

High Power Cylinder Model Selection Examples

Selection example 1

Operating conditions

Horizontal drive	Figure 1-1
Load weight	M = 100kg
Stroke	St = 500mm
Stroke duration	To = 0.5s

Maximum speed estimation

Average stroke speed	Vm = St/To = 1000mm/s
Maximum speed	Vmax = 1.5Vm = 1500mm/s

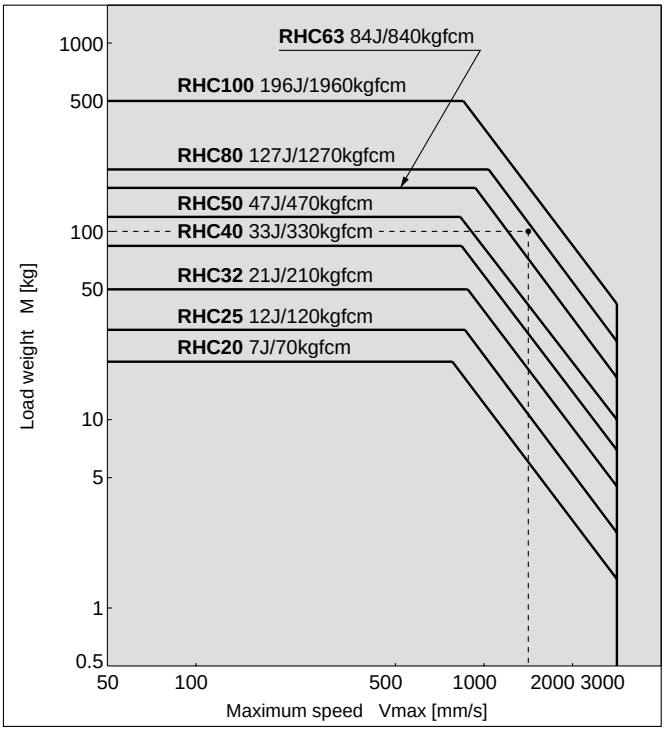
Model selection from graph

Load weight	M = 100kg
Maximum speed	Vmax = 1500mm/s

○ in Figure 1-1

RHC80

Figure 1-1 Horizontal drive **Supply pressure 0.5MPa**



Selection example 2

Operating conditions

Vertical drive	Figure 1-2
Load weight	M = 5kg
Stroke	St = 800mm
Stroke duration	To = 0.5s

Maximum speed estimation

Average stroke speed	Vm = St/To = 1600mm/s
Maximum speed	Vmax = 1.5Vm = 2400mm/s

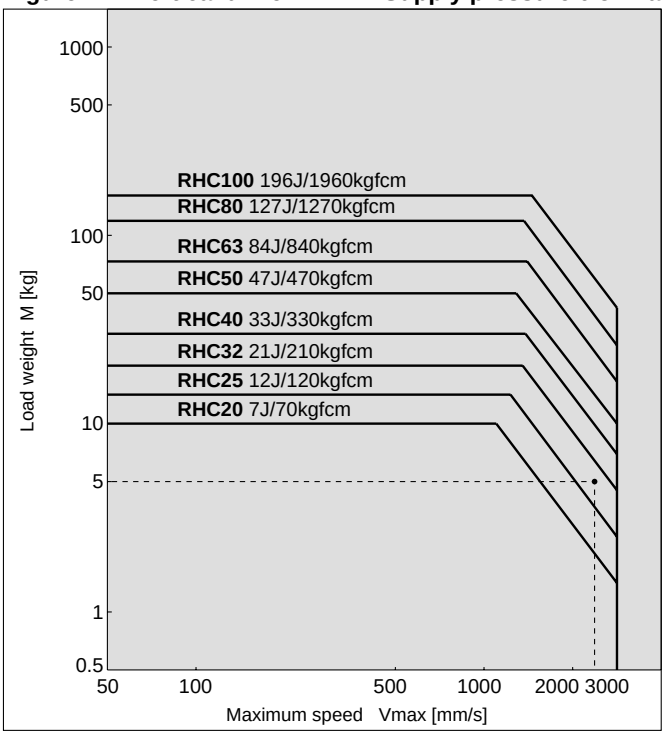
Model selection from graph

Load weight	M = 5kg
Maximum speed	Vmax = 2400mm/s

● in Figure 1-2

RHC32

Figure 1-2 Vertical drive **Supply pressure 0.5MPa**



Maximum energy absorption

Bore size (mm)	20	25	32	40	50	63	80	100
Maximum energy absorption [J (kgfcm)]	7 (70)	12 (120)	21 (210)	33 (330)	47 (470)	84 (840)	127 (1270)	196 (1960)

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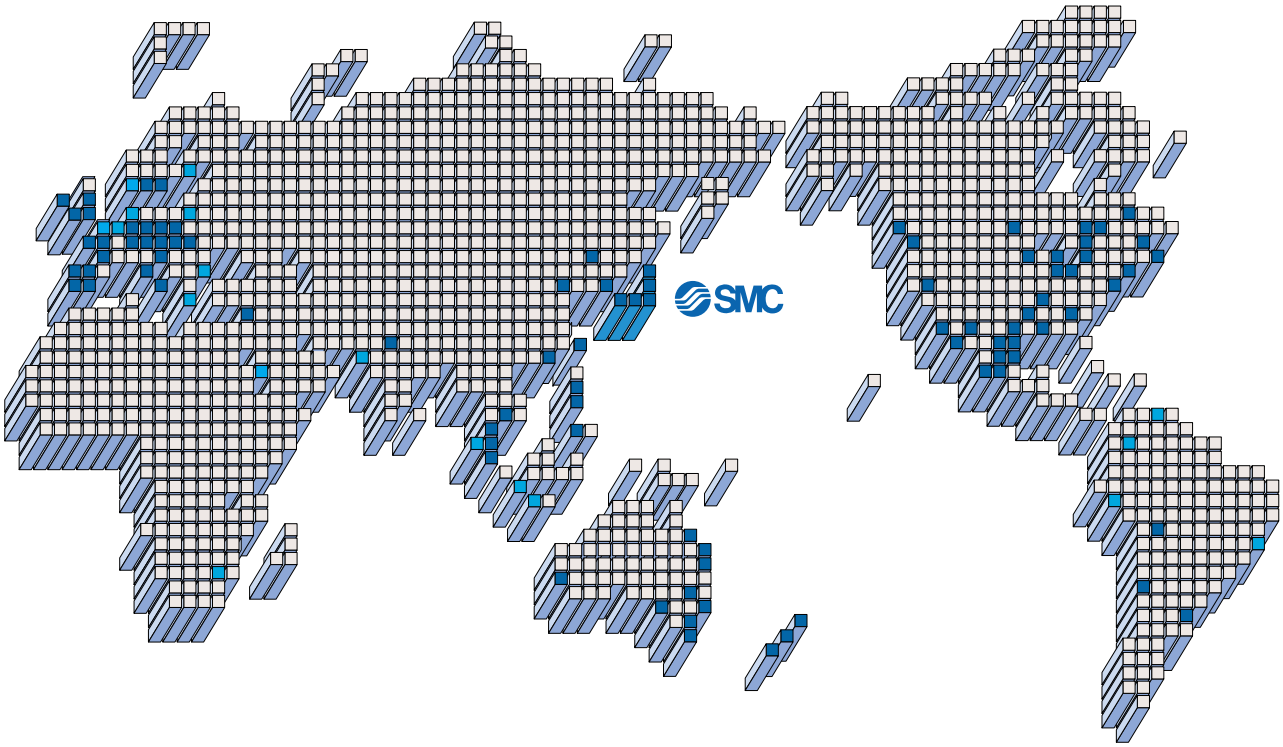

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