

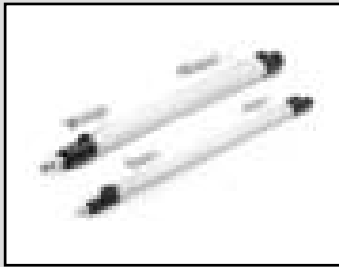
CKD

- **HCM**

High energy absorption cylinder

Working speed: 50~2000 mm/sec.



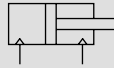


High energy absorption cylinder, double acting/single rod type

HCM Series

- Bore size: 20, 25, 32, 40, 50, 63 mm

JIS symbol



Specifications

Descriptions		HCM					
		20 dia.	25 dia.	32 dia.	40 dia.	50 dia.	63 dia.
Bore size	mm	20 dia.	25 dia.	32 dia.	40 dia.	50 dia.	63 dia.
Actuation		Double acting					
Working fluid		Compressed air					
Max. working pressure	MPa	1.0					
Min. working pressure	MPa	0.15					
Withstanding pressure	MPa	1.6					
Ambient temperature	°C	-10 to 60 (to be unfrozen)					
Port size		Rc ¹ / ₈	Rc ¹ / ₈	Rc ¹ / ₄	Rc ¹ / ₄	Rc ³ / ₈	Rc ³ / ₈
Stroke length tolerance	mm	+2.0 0			+2.0 0		
Working piston speed	mm/s	50 to 2000 (use this within the range of allowable energy absorption.)					
Cushion		Air cushion					
Lubrication		Not required (when lubrication, use turbine oil Class 1 ISOVG32.)					
Allowable energy absorption J Note 1	Air cushion	3	5	9	14	23	30
Effective cushion length	mm	56.5	56.5	56.5	55.5	58.5	58.5

Note 1: When kinetic energy exceeds this value, consider installing an external shock absorber.
Please refer to "Cylinder & sistem selection pages" to calculate energy end select actuator.

Stroke length

Stroke length (Note 1)							
Bore size	mm	20 dia.	25 dia.	32 dia.	40 dia.	50 dia.	63 dia.
Stroke range	mm	200 to 700			200 to 1000		

Note 1: Consult with CKD about stroke length other than above.

Cylinder mass

(Unit: kg)

Bore size (mm)		20 dia.	25 dia.	32 dia.	40 dia.	50 dia.	63 dia.
Product mass when 0 mm stroke	Basic type 00	0.33	0.47	0.62	0.98	1.58	2.27
	Axial foot type LB	0.44	0.6	0.78	1.2	2.06	2.99
	Flange type FA/FB	0.36	0.51	0.68	1.06	1.92	2.77
Switch mass (per switch)		0.018					
Additional mass per stroke length without switch	100mm	0.012	0.016	0.017	0.027	0.040	0.044
Additional mass per stroke length with switch rail	100mm	0.014	0.018	0.019	0.029	0.042	0.046

[Calculation e.g.]

Product mass of HCM-LB-40B-500-T2H-D

When stroke length 0mm, product mass is 1.2kg.

Additional mass at stroke length 500mm is $0.029 \times \frac{500}{100} = 0.145\text{kg}$.

Mass of two switch is $0.018 \times 2 = 0.036\text{kg}$

Product mass is $1.2 + 0.145 + 0.036 = 1.381\text{kg}$

Switch specifications

- One color/bi-color indicator

Descriptions	Proximity 2 wire		Proximity 3 wire		Reed 2 wire			
	T2H/T2V/T2JH/T2JV	T2YH/T2YV	T3H/T3V	T3YH/T3YV	T0H/T0V		T5H/T5V	
Applications	Programmable controller		Programmable controller, relay		Programmable controller, relay		Programmable controller, relay IC circuit (without indicator light), serial connection	
Power voltage	-		DC10 to 28V		-			
Load voltage	DC10 to 30V		DC30V or less		DC12/24V	AC110V	DC5/12/24V	AC110V
Load current	5 to 20mA (Note 1)		100mA or less	50mA or less	5 to 50mA	7 to 20mA	50mA or less	20mA or less
Light	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)		-	

Note 1: Max. load current : 20mA above is the value at 25 °C. When ambient temperature around a switch is higher than 25 °C, the value is lower than 20mA. (5 to 10mA at 60 °C).

- With preventive maintenance output

Descriptions	Proximity 3 wire		Proximity 4 wire		Proximity 3 wire		Proximity 4 wire	
	T2YFH/V		T3YFH/V		T2YMH/V		T3YMH/V	
Applications	Programmable controller		Programmable controller, relay		Programmable controller		Programmable controller, relay	
Light	Installation position adjustment	Red/green LED (ON lighting)						
	Preventive maintenance output	-			Yellow LED (ON lighting)			
Output	Current voltage	-	DC10 to 28V		-	DC10 to 28V		
	Load voltage	DC10 to 30V	DC30V or less		DC10 to 30V	DC30V or less		
	Load current	DC5 to 20mA	DC50mA or less		DC5 to 20mA	DC50mA or less		
Preventive maintenance output	Load voltage	DC30V or less						
	Load current	DC20mA or less	DC50mA or less		DC5 to 20mA or less		DC50mA or less	

- Strong magnetic field

Descriptions	Proximity switch	
	T2YD	
Applications	Programmable controller	
Light	Red/green LED (ON lighting)	
Load voltage	DC24V±10%	
Load current	5 to 20mA	
Internal voltage drop	6V or less	
Leakage current	1.0mA or less	

How to order

Without switch

HCM — LB — 40 — B — 500 — I

With switch

HCM — LB — 40 — B — 500 — T2H* — D — Q — I

A Mounting style

B Bore size

C Cushion

D Stroke length

E Switch model No.

F Switch quantity

G Option

H Accessory

Symbol	Descriptions
A Mounting style	
00	Basic type
LB	Axial foot type
FA	Rod side flange type
FB	Head side flange type

B Bore size (mm)	
20	20 dia.
25	25 dia.
32	32 dia.
40	40 dia.
50	50 dia.
63	63 dia.

C Cushion	
B	Both sides cushion
R	Rod side cushion
H	Head side cushion
N	No cushion

D Stroke length (mm)						
Bore size (mm)	20	25	32	40	50	63
200	200	●	●	●	●	●
250	250	●	●	●	●	●
300	300	●	●	●	●	●
350	350	●	●	●	●	●
400	400	●	●	●	●	●
450	450	●	●	●	●	●
500	500	●	●	●	●	●
550	550	●	●	●	●	●
600	600	●	●	●	●	●
650	650	●	●	●	●	●
700	700	●	●	●	●	●
750	750	-	-	-	●	●
800	800	-	-	-	●	●
850	850	-	-	-	●	●
900	900	-	-	-	●	●
950	950	-	-	-	●	●
1000	1000	-	-	-	●	●

E Switch model No.				
Lead wire Straight type	Lead wire Radial type	Contact	Indicator	Lead wire
T0H*	T0V*	Reed	1 color indicator	2 wire
T5H*	T5V*			
T2H*	T2V*			
T3H*	T3V*	Proximity	1 color indicator	2 wire 3 wire
T2YH*	T2YV*			
T3YH*	T3YV*			
T2YFH*	T2YFV*		With preventive maintenance output	4 wire 3 wire 4 wire
T3YFH*	T3YFV*			
T2YMH*	T2YMV*			
T3YMH*	T3YMV*	Strong magnetic field proof switch	Off delay type	2 wire
T2YD*	-			
T2YDT*	-			
T2JH*	T2JV*			2 wire

* Lead wire length	
Blank	1m (standard)
3	3m (option)
5	5m (option)

F Switch quantity	
R	One on rod side
H	One on head side
D	Two
T	Three
4	4
5	5

G Option	
Q	Switch rail attached at shipment
M	Piston rod material (stainless steel)

H Accessory	
I	Rod eye
Y	Rod clevis

<Example of model number>

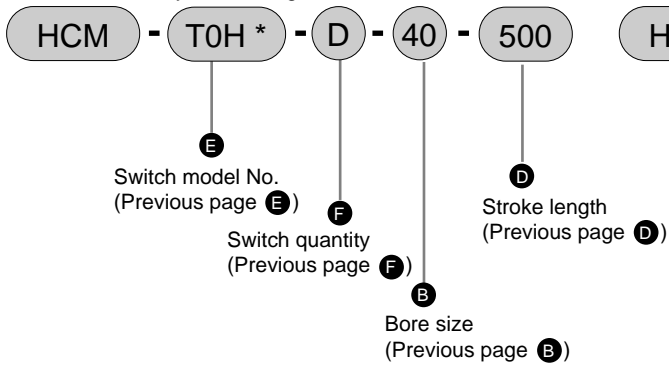
HCM-LB-40B-500-T2H-D-QI

Model: High energy absorption cylinder, double acting

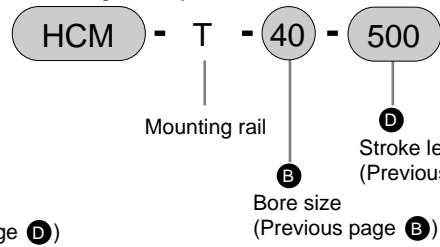
- A Mounting style : Axial foot type
- B Bore size : 40 mm
- C Cushion : Both sides cushion
- D Stroke length : 500 mm
- E Switch model No.: Proximity T2H switch, lead wire 1m
- F Switch quantity : Two
- G Option : Switch rail attached at shipment
- H Accessory : Rod eye

How to order switch

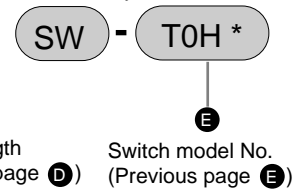
• Switch main body + mounting rail set



• Mounting rail only



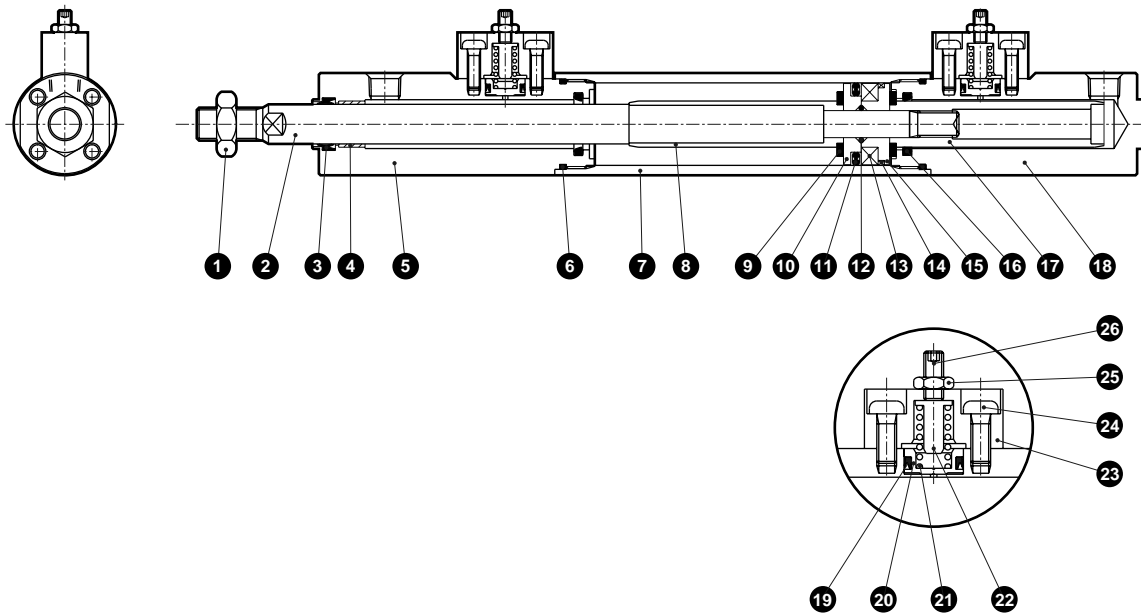
• Switch only



Mounting bracket model No.

Bore size / Mounting style	Foot (LB)	Flange (FA/FB)
20 dia.	HCM-LB-20	HCM-FA-20
25 dia.	HCM-LB-25	HCM-FA-25
32 dia.	HCM-LB-32	HCM-FA-32
40 dia.	HCM-LB-40	HCM-FA-40
50 dia.	HCM-LB-50	HCM-FA-50
63 dia.	HCM-LB-63	HCM-FA-63

Internal structure and parts list



No.	Parts name	Material	Remarks	No.	Parts name	Material	Remarks
1	Rod nut	Steel	Nickeling	14	Wear ring	Resin	
2	Piston rod	20, 25 dia.: Stainless steel 32 to 63 dia.: Steel	Industrial chrome plated	15	Piston (H)	Aluminum alloy	Chromate treatment
3	Rod packing seal	Special nitrile rubber		16	Cushion packing seal	20 to 32 dia.: Urethane rubber 40 to 63 dia.: Urethane rubber/steel	
4	Bush	Oil impregnated bearing alloy		17	Cushion ring (H)	Aluminum alloy	Chromate treatment
5	Rod cover	Aluminum alloy	Black alumite	18	Head cover	Aluminum alloy	Black alumite
6	Cylinder gasket	Nitrile rubber		19	Relief valve packing seal	Nitrile rubber	
7	Cylinder tube	Aluminum alloy	Hard alumite	20	Relief valve	Copper alloy	
8	Cushion ring (R)	Aluminum alloy	Chromate treatment	21	Spring	Steel	Electrodeposition coating
9	Cushion rubber	Urethane rubber		22	Collar for spring	Steel	Chromate treatment
10	Piston (R)	Aluminum alloy	Chromate treatment	23	Relief valve holder	Aluminum alloy	Black alumite
11	Piston packing seal	Special nitrile rubber		24	Cross headed pan	Steel	Blackening
12	Piston gasket	Nitrile rubber	25 to 63 dia.	25	Hexagon nut	Steel	Blackening
13	Magnet	Plastic		26	Hexagon socket head set screw	Steel	Blackening

Repair parts list

Bore size (mm)	Kit number	Repair parts number
20 dia.	HCM-20K	
25 dia.	HCM-25K	
32 dia.	HCM-32K	3 6 9 11 14
40 dia.	HCM-40K	16 19
50 dia.	HCM-50K	
63 dia.	HCM-63K	

Note: When placing an order, indicate kit number.

Mounting bracket material/treatment

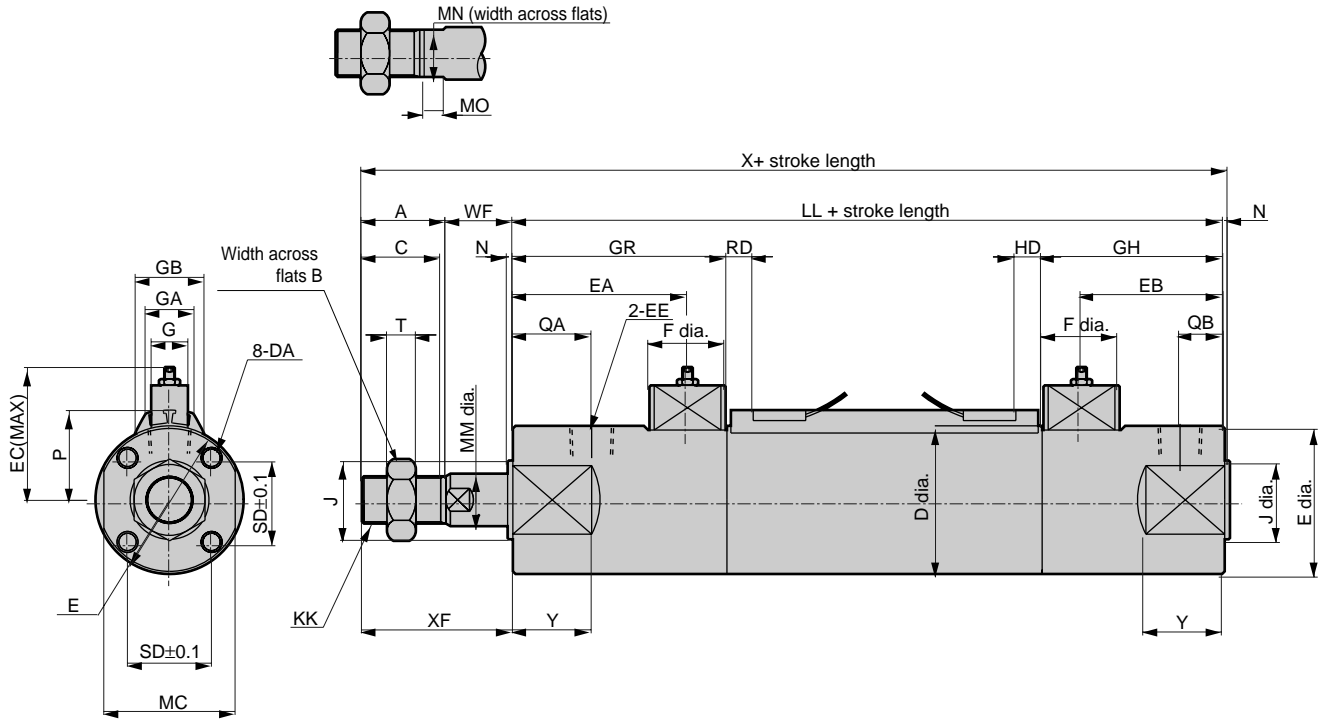
Mounting style	Material	Treatment
LB	Steel	Zinc chromate
FA/FB	20 to 40 mm bore	Aluminum alloy
	50, 63 mm bore	Steel

Dimensions

•Basic type (00)



(File name: Page 1432 or Ending 149)



Symbol	A	B	C	D	DA	E	EA	EB	EC	EE	F	G	J	KK	LL	MC	MM	MN	MO	
Bore size																				
20 dia.	18	13	16	26	M4 depth 8	28	52	43	32.7	Rc ¹ / ₈	29	14	13	M8	164	24	10	8	5	
25 dia.	20	17	18	31	M5 depth 9	31	56.5	47.5	34.5	Rc ¹ / ₈	29	14	15	M10	173	27	12	10	6	
32 dia.	20	17	18	37	M5 depth 9	37	56.5	47.5	37.8	Rc ¹ / ₄	29	14	18	M10	173	32	12	10	6	
40 dia.	26	22	24	46	M6 depth 10	46	62	51	47.3	Rc ¹ / ₄	29	14	25	M14X1.5	186	41	16	14	7	
50 dia.	32	27	30	56.4	M8 depth 12	56.4	66.5	54.5	52.6	Rc ³ / ₈	29	14	30	M18X1.5	196	50	20	17	8	
63 dia.	32	27	30	69.4	M10 depth 15	69.4	66.5	54.5	59.3	Rc ³ / ₈	29	14	32	M18X1.5	196	60	20	17	8	
Symbol																				
Bore size																				
	N	QA	QB	SD	T	WF	X	XF	Y	GR	GH	GA	GB	P	T0/T5		T2/T3		T2Y/T3Y	
															RD	HD	RD	HD	RD	HD
20 dia.	2	18	10	14	5	15.5	199.5	33.5	20	67	58	18	23	19.5	9.5	9	10	10	9.5	9
25 dia.	2	20	10	16.5	6	17	212	37	20	71.5	62.5	18	24.4	22	10	8	11	9	10	8
32 dia.	2	20	12	20	6	17	212	37	28	71.5	62.5	18	25	25	10	8	11	9	10	8
40 dia.	2	26	14	26	8	20.5	234.5	46.5	28	77	66	18	25.7	29.5	12	10.5	13	11	12	10.5
50 dia.	2	30	17	32	11	25.5	255.5	57.5	30	81.5	69.5	18	26.2	34.7	13	11.5	14	12	13	11.5
63 dia.	2	30	17	38	11	25.5	255.5	57.5	30	81.5	69.5	18	26.5	41.2	13	11.5	14	12	13	11.5

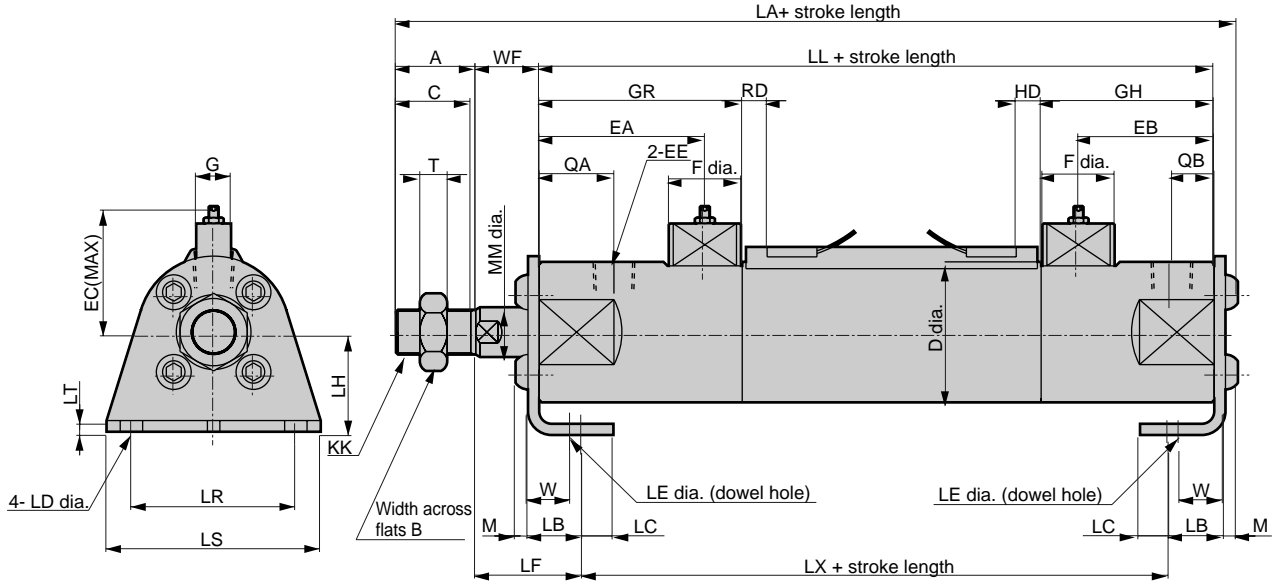
Note 1: Only for 20 dia., tube outer diameter D and cover outer diameter E are different.

Dimensions

- Axial foot type (LB)



(File name: Page 1432 or Ending 149)



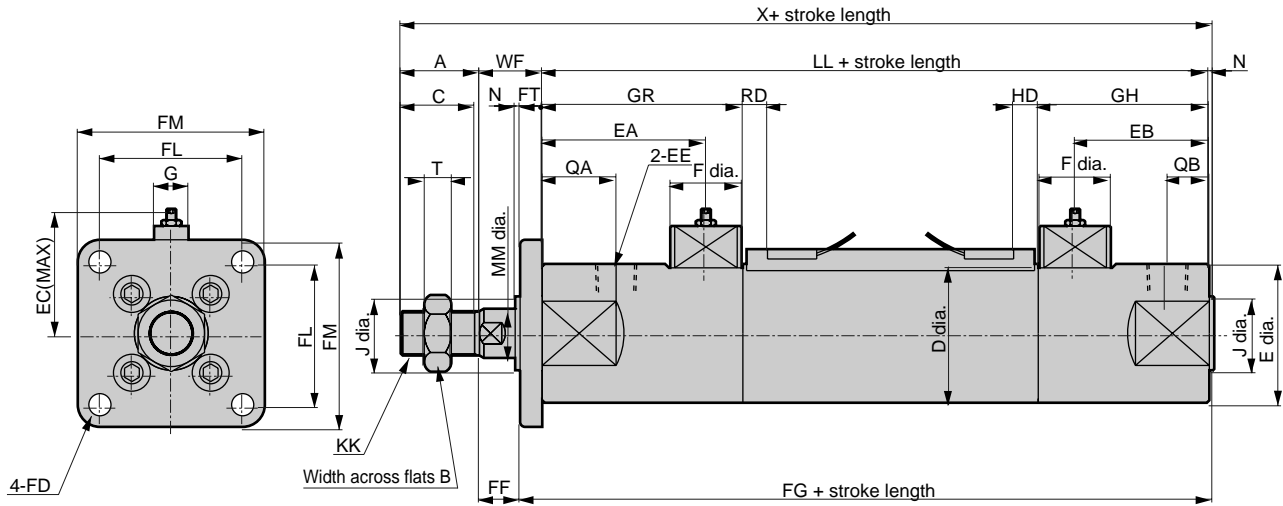
Symbol	A	B	C	D	EA	EB	EC	EE	F	G	KK	LA	LB	LC	LD	LE	LF	LH		
Bore size																				
20 dia.	18	13	16	26	52	43	32.7	Rc ^{1/8}	29	14	M8	203.3	15.1	7.1	5.7	4	27	20		
25 dia.	20	17	18	31	56.5	47.5	34.5	Rc ^{1/8}	29	14	M10	216.6	15.1	7.1	5.7	4	28.9	22		
32 dia.	20	17	18	37	56.5	47.5	37.8	Rc ^{1/4}	29	14	M10	216.6	16.1	8.1	6.8	4	29.9	25		
40 dia.	26	22	24	46	62	51	47.3	Rc ^{1/4}	29	14	M14X1.5	239.7	16.6	9.1	6.8	4	33.9	30		
50 dia.	32	27	30	56.4	66.5	54.5	52.6	Rc ^{3/8}	29	14	M18X1.5	263	22	11	9	5	43	40		
63 dia.	32	27	30	69.4	66.5	54.5	59.3	Rc ^{3/8}	29	14	M18X1.5	263	22	13	11	5	43	45		
Symbol	LL	LR	LS	LT	LX	M	MM	QA	QB	T	W	WF	GR	GH	T0/T5		T2/T3		T2Y/T3Y	
Bore size															RD	HD	RD	HD	RD	HD
20 dia.	164	32	44	3.2	140.2	2.6	10	18	10	5	10	15.5	67	58	9.5	9	10	10	9.5	9
25 dia.	173	36	49	3.2	149.2	3.4	12	20	10	6	10	17	71.5	62.5	10	8	11	9	10	8
32 dia.	173	44	58	3.2	147.2	3.4	12	20	12	6	10	17	71.5	62.5	10	8	11	9	10	8
40 dia.	186	54	71	3.2	159.2	4	16	26	14	8	10	20.5	77	66	12	10.5	13	11	12	10.5
50 dia.	196	66	86	4.5	161	5	20	30	17	11	17.5	25.5	81.5	69.5	13	11.5	14	12	13	11.5
63 dia.	196	82	106	4.5	161	5	20	30	17	11	17.5	25.5	81.5	69.5	13	11.5	14	12	13	11.5

Dimensions

- Rod side flange type (FA)



(File name: Page 1432 or Ending 149)



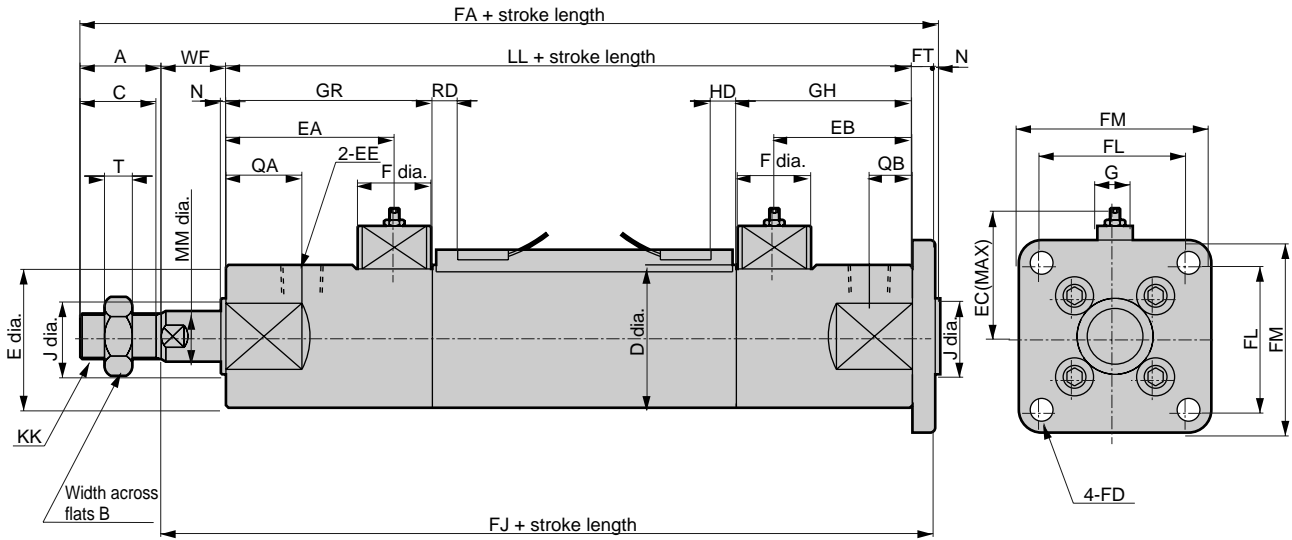
Symbol	A	B	C	D	E	EA	EB	EC	EE	F	FD	FF	FG	FL	FM	FT	G	J	KK
Bore size																			
20 dia.	18	13	16	26	28	52	43	32.7	Rc ¹ / ₈	29	5.5	9.5	172	28	40	6	14	13	M8
25 dia.	20	17	18	31	31	56.5	47.5	34.5	Rc ¹ / ₈	29	5.5	10	182	32	44	7	14	15	M10
32 dia.	20	17	18	37	37	56.5	47.5	37.8	Rc ¹ / ₄	29	6.6	10	182	38	53	7	14	18	M10
40 dia.	26	22	24	46	46	62	51	47.3	Rc ¹ / ₄	29	6.6	12.5	196	46	61	8	14	25	M14X1.5
50 dia.	32	27	30	56.4	56.4	66.5	54.5	52.6	Rc ³ / ₈	29	9	16.5	207	58	76	9	14	30	M18X1.5
63 dia.	32	27	30	69.4	69.4	66.5	54.5	59.3	Rc ³ / ₈	29	11	16.5	207	70	92	9	14	32	M18X1.5
Symbol	LL	MM	N	QA	QB	T	WF	X	GR	GH	T0/T5		T2/T3		T2Y/T3Y				
Bore size											RD	HD	RD	HD	RD	HD			
20 dia.	164	10	2	18	10	5	15.5	199.5	67	58	9.5	9	10	10	9.5	9			
25 dia.	173	12	2	20	10	6	17	212	71.5	62.5	10	8	11	9	10	8			
32 dia.	173	12	2	20	12	6	17	212	71.5	62.5	10	8	11	9	10	8			
40 dia.	186	16	2	26	14	8	20.5	234.5	77	66	12	10.5	13	11	12	10.5			
50 dia.	196	20	2	30	17	11	25.5	255.5	81.5	69.5	13	11.5	14	12	13	11.5			
63 dia.	196	20	2	30	17	11	25.5	255.5	81.5	69.5	13	11.5	14	12	13	11.5			

Dimensions

- Head side flange type (FB)



(File name: Page 1432 or Ending 149)




Symbol	A	B	C	D	E	EA	EB	EC	EE	F	FA	FD	FJ	FL	FM	FT	G	J	KK
Bore size																			
20 dia.	18	13	16	26	28	52	43	32.7	Rc ^{1/8}	29	205.5	5.5	185.5	28	40	6	14	13	M8
25 dia.	20	17	18	31	31	56.5	47.5	34.5	Rc ^{1/8}	29	219	5.5	197	32	44	7	14	15	M10
32 dia.	20	17	18	37	37	56.5	47.5	37.8	Rc ^{1/4}	29	219	6.6	197	38	53	7	14	18	M10
40 dia.	26	22	24	46	46	62	51	47.3	Rc ^{1/4}	29	242.5	6.6	214.5	46	61	8	14	25	M14X1.5
50 dia.	32	27	30	56.4	56.4	66.5	54.5	52.6	Rc ^{3/8}	29	264.5	9	230.5	58	76	9	14	30	M18X1.5
63 dia.	32	27	30	69.4	69.4	66.5	54.5	59.3	Rc ^{3/8}	29	264.5	11	230.5	70	92	9	14	32	M18X1.5
Symbol	LL	MM	N	QA	QB	T	WF	GR	GH	T0/T5		T2/T3		T2Y/T3Y					
Bore size										RD	HD	RD	HD	RD	HD				
20 dia.	164	10	2	18	10	5	15.5	67	58	9.5	9	10	10	9.5	9				
25 dia.	173	12	2	20	10	6	17	71.5	62.5	10	8	11	9	10	8				
32 dia.	173	12	2	20	12	6	17	71.5	62.5	10	8	11	9	10	8				
40 dia.	186	16	2	26	14	8	20.5	77	66	12	10.5	13	11	12	10.5				
50 dia.	196	20	2	30	17	11	25.5	81.5	69.5	13	11.5	14	12	13	11.5				
63 dia.	196	20	2	30	17	11	25.5	81.5	69.5	13	11.5	14	12	13	11.5				

Note 1: Only for 20 dia., tube outer diameter D and cover outer diameter E are different.

Accessory dimensions

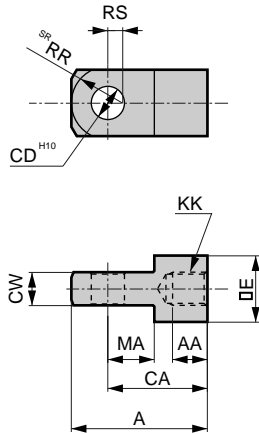
Rod eye

 (File name: Page 1432 or Ending 149)

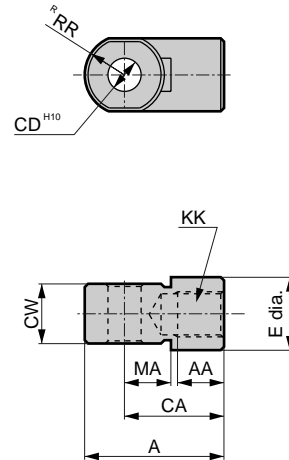
• HCM-I- 20 to 25 mm bore

• HCM-I- 40 to 63 mm bore

Material: Steel



Material: Cast iron



Model No.	Applicable bore size (mm)	A	AA	CA	CD	CW	E	KK	MA	RR	RS
HCM-I-20	20	34	8.5	25	8 ^{+0.058} ₀	8 ^{-0.2} _{-0.4}	16	M8	11.5	13.4	3.1
HCM-I-25	25/32	41	10.5	30	10 ^{+0.058} ₀	10 ^{-0.2} _{-0.4}	20	M10 X 1.25	14	17.1	4.5
HCM-I-40	40	42	14	30	10 ^{+0.058} ₀	18 ^{-0.3} _{-0.5}	22	M14 X 1.5	14	12	-
HCM-I-50	50/63	56	18	40	14 ^{+0.070} ₀	22 ^{-0.3} _{-0.5}	28	M18 X 1.5	20	16	-

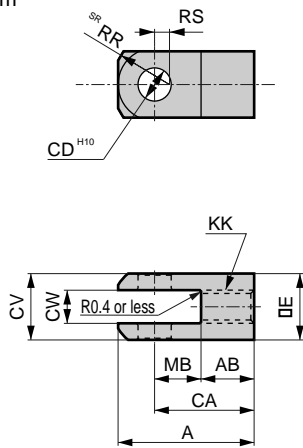
Rod clevis

 (File name: Page 1432 or Ending 149)

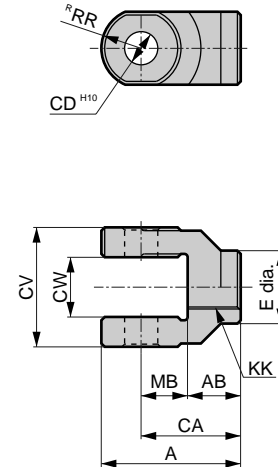
• HCM-Y- 20 to 25mm

• HCM-Y- 40 to 63mm

Material: Steel



Material: Cast iron

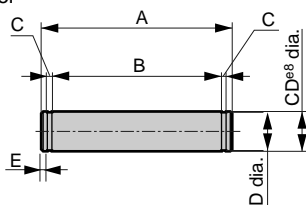


Model No.	Applicable bore size (mm)	A	AB	CA	CD	CV	CW	E	KK	MB	RR	RS	Applicable pin model No.
HCM-Y-20	20	34	13.5	25	8 ^{+0.058} ₀	16	8 ^{+0.2} _{+0.4}	16	M8	11.5	13.4	3.1	HCM-P-20
HCM-Y-25	25/32	41	16	30	10 ^{+0.058} ₀	20	10 ^{+0.2} _{+0.4}	20	M10 X 1.25	14	17.1	4.5	HCM-P-25
HCM-Y-40	40	42	16	30	10 ^{+0.058} ₀	36	18 ^{+0.3} _{+0.5}	22	M14 X 1.5	14	12	-	HCM-P-40
HCM-Y-50	50/63	56	20	40	14 ^{+0.070} ₀	44	22 ^{+0.3} _{+0.5}	28	M18 X 1.5	20	16	-	HCM-P-50

Note: A pin and a snap ring are attached to rod clevis.

For knuckle pin

Material: Steel



Model No.	Applicable bore size (mm)	A	B	C	CD	D	E	Applicable snap rings
HCM-P-20	20	21	16.2	0.9	8 ^{-0.025} _{-0.047}	7.6	1.5	Shaft C 8
HCM-P-25	25/32	25.6	20.2	1.15	10 ^{-0.025} _{-0.047}	9.6	1.6	Shaft C 10
HCM-P-40	40	41.6	36.2	1.15	10 ^{-0.025} _{-0.047}	9.6	1.6	Shaft C 10
HCM-P-50	50/63	50.6	44.2	1.15	14 ^{-0.032} _{-0.059}	13.4	2.1	Shaft C 14

Note: A pin and a snap ring are attached to rod clevis.

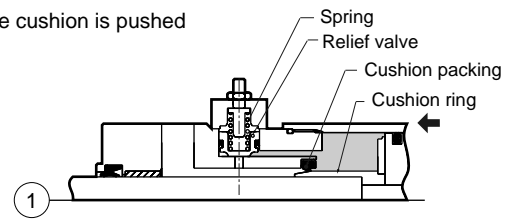
Principle of cushion operation

1. When the piston moves and pushes the cushion ring into the cushion packing, a sealed air space forms in the shaded section. When the piston moves further, air in the shaded section is compressed and kinetic energy in the direction of movement is absorbed.

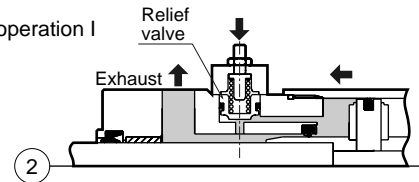
2. At the same time, the relief valve is opened by compressed air. Compressed air is instantaneously exhausted and the relief valve closes.

3. After the relief valve closes, remaining compressed air is exhausted from the slit orifice. The piston moves and contacts the cover. The energy absorption stroke is completed at this time.

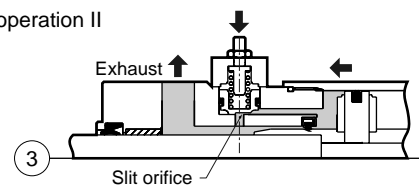
• Before the cushion is pushed



• Cushion operation I

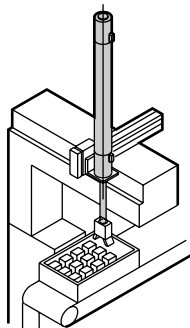


• Cushion operation II

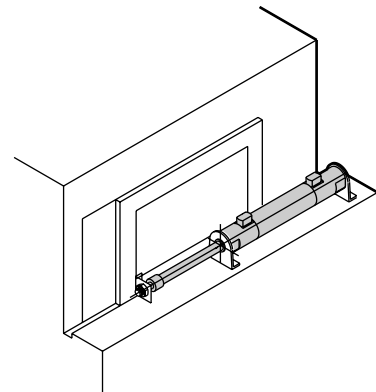


Application

• Resin molding machine ejection robot



• Opening/closing of machine door

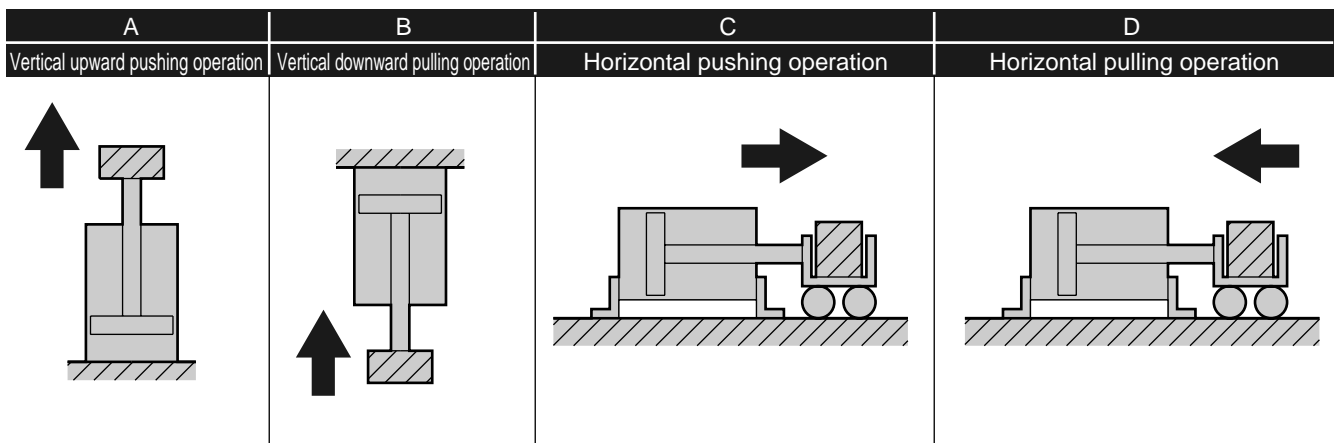


Cylinder and system selection guide

Some values may vary depending on conditions. Use following values as reference.

■ Step 1: Confirming working conditions

- (1) Load mass M (kg)
- (2) Stroke length St (mm)
- (3) Moving time T (s)
- (4) Cylinder average speed V0 (m/s)
 $V0 = St / (T \times 1000)$
- (5) Working pressure P (MPa)
- (6) Installation method/direction



Note: When lifting downward vertically, cylinder thrust is almost not required. Select the cylinder size according to lifting upward that requires thrust.

■ Step 2: Roughly selecting cylinder size

- (1) Please set load factor (α) according to piston speed.
 When high speed operation (1 to 2m/s), $\alpha \leq 20\%$
 When medium speed operation (1m/s or less), $\alpha \leq 50\%$

- (2) Calculate required cylinder thrust (F).

$$F(N) = \frac{980 \times M \times \mu}{\alpha}$$

- M : Load mass (kg)
- α : FLoad factor (%)
- μ : Coefficient of friction
 Installation method C/D horizontal rolling = 0.1
 Installation method A/B vertical upside down = 1

- (3) Please find cylinder bore size (D).

$$D \text{ (mm)} = \sqrt{\frac{F}{0.25 \times P \times \pi}}$$

- P: Working pressure (MPa)
- F: Cylinder thrust (N)

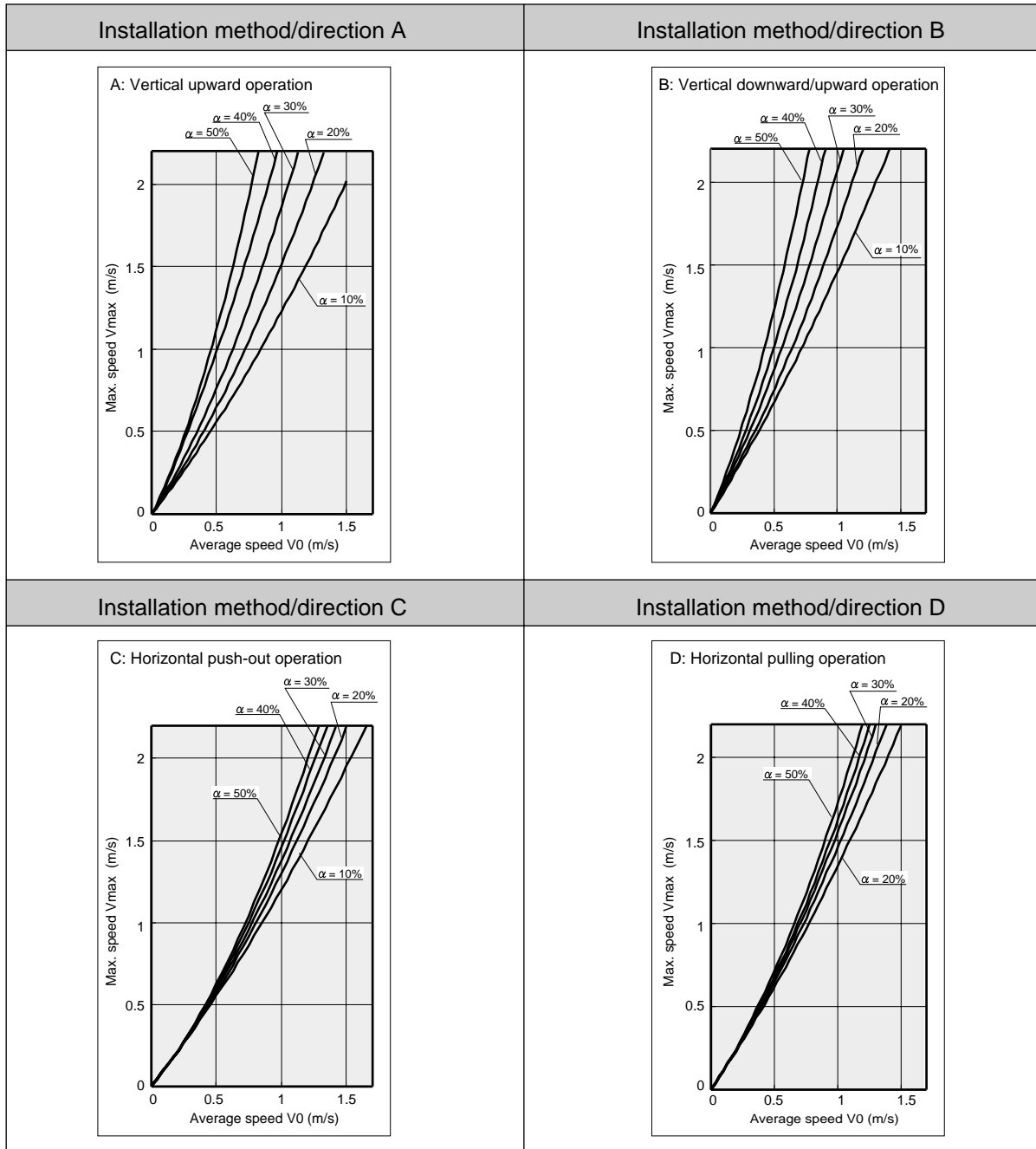
- (4) Select the size larger than the value found at (3).

Size	Cylinder bore size (mm)
20 dia.	20
25 dia.	25
32 dia.	32
40 dia.	40
50 dia.	50
63 dia.	63

■ Step 3: Calculation of max. speed

- Find max. speed (V_{max}) in graph -1 according to working conditions (average speed V_0 /installation method/direction) of <Step 1> and load factor α of <Step 2>. When max. speed (V_{max}) exceeds 2m/s, go back to <step 1>, and decrease average speed V_0 .

[Graph -1]



Pipe length is approximate 2m under working pressure $P=0.5$ Mpa.
For other conditions, this is just reference.

■ Step 4: Confirming cushion faculty

- Check if the kinetic energy generated by movement of load is absorbed by the cylinder cushion.

Calculate kinetic energy (E1) according to load mass M of <step 1> and max. speed Vmax found at <step 3> .

$$E1(J)=0.5 \times (V_{max})^2 \times M$$

- E₁ should not be greater than allowable absorbing energy E2 on Table 1.

When E₁>E₂, decrease average speed V₀ or install an external buffer device (shock absorber).

[Table 1]

Bore size	Allowable absorbing energy -E2 (J)
20 dia.	3
25 dia.	5
32 dia.	9
40 dia.	14
50 dia.	23
63 dia.	30

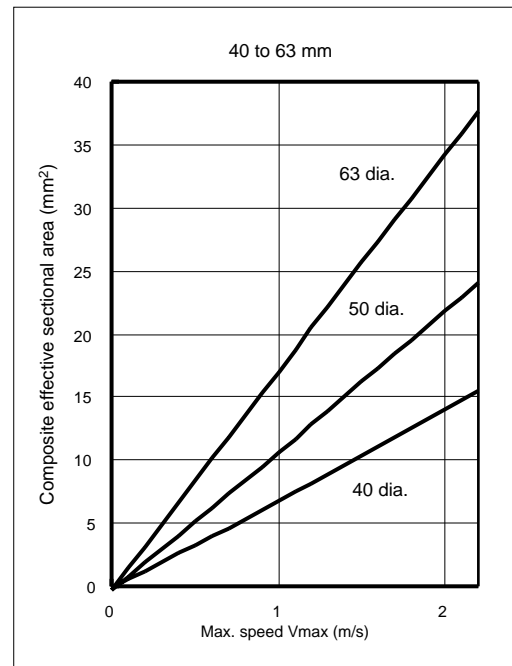
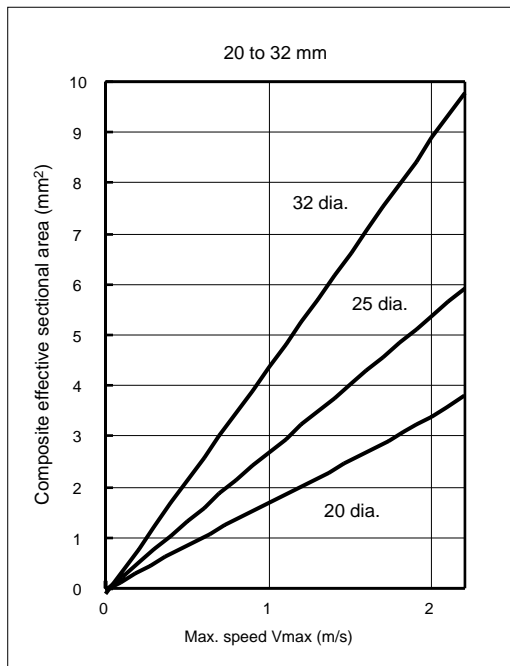
Note: When vertical-upward retract operation and vertical-downward extract operation, energy can be absorbed but can not be stopped smoothly. (Bound etc. may occur)

When smooth stop is necessary, as reference, load factor should be 10% or less and max. speed should be 1m/s or less.

■ Step 5: Calculation of required composite effective sectional area

Find required effective sectional area S according to max. speed Vmax found at <Step 3> and cylinder bore size found at <Step 2>.

[Graph 2]



Step 6: System circuit selection

- Using [Table 2], select the system circuit according to the required composite effective sectional area found at <Step 5>.

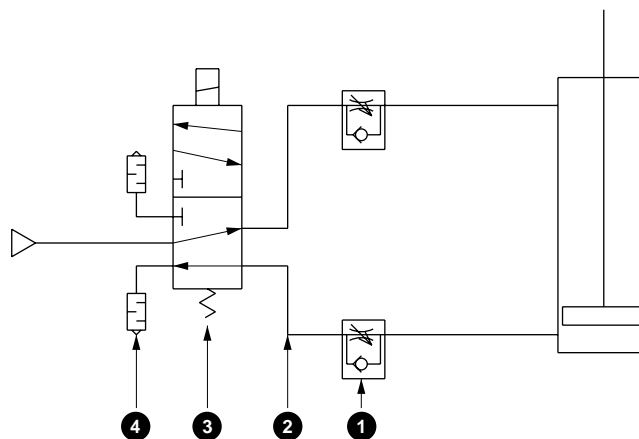
[Table 2]

Symbol S in the table shows individual effective sectional area (mm²).

Composite effective sectional area (mm ²)	Solenoid valve								Flow control valve		Silencer		Pipe (Pipe length 2m)
	Direct mounting				Sub base type								
	Single solenoid		Double solenoid		Single solenoid		Double solenoids		S	S			
		S		S		S		S					
1.2	4KA110-M5	3	4KA120-M5	3	4KB110-06	4	4KB120-06	4	SC3W-6-4	2.8	SLW-6A	10	4 dia. X 2.5 dia.
2	4KA110-M5	3	4KA120-M5	3					SC3W-6-6	3.6	SLW-6A	10	6 dia. X 4 dia.
2.3					4KB110-06	4	4KB120-06	4	SC3W-6-6	3.6	SLW-6A	10	6 dia. X 4 dia.
3.1	4KA210-06	13	4KA220-06	12.5					SC3W-6-8	3.6	SLW-6A	10	8 dia. X 5.7 dia.
3.2					4KB210-06	14	4KB220-06	14	SC3W-6-8	3.6	SLW-6A	10	8 dia. X 5.7 dia.
3.6	4KA210-06	13	4KA220-06	12.5					SC1-6	8	SLW-6A	10	6 dia. X 4 dia.
3.7					4KB210-06	14	4KB220-06	14	SC1-6	8	SLW-6A	10	6 dia. X 4 dia.
5	4KA210-06	13	4KA220-06	12.5	4KB210-06	14	4KB220-06	14	SC1-6	8	SLW-6A	10	8 dia. X 5.7 dia.
5.3					4KB210-08	14	4KB220-08	14	SC3W-8-8	7	SLW-8A	20	8 dia. X 5.7 dia.
5.9					4KB210-08	14	4KB220-08	14	SC3W-8-10	7	SLW-8A	20	10 dia. X 7.2 dia.
6.1	4F210-08	18	4F220-08	18					SC3W-8-10	7	SLW-8A	20	10 dia. X 7.2 dia.
6.4	4KA310-08	25	4KA320-08	25	4KB310-08	28	4KB320-08	28	SC3W-8-10	7	SLW-8A	20	10 dia. X 7.2 dia.
6.5	4KA210-06	13	4KA220-06	12.5					SC1-8	13	SLW-6A	10	10 dia. X 7.2 dia.
6.9					4KB210-08	14	4KB220-08	14	SC1-8	13	SLW-8A	20	8 dia. X 5.7 dia.
8.5					4F210-08	18	4F220-08	18	SC1-8	13	SLW-8A	20	10 dia. X 7.2 dia.
9	4KA310-08	25	4KA320-08	25	4KB310-08	28	4KB320-08	28	SC1-8	13	SLW-8A	20	10 dia. X 7.2 dia.
9.9	4F310-10	32	4F320-10	32					SC3W-10-10	15	SLW-8A	20	10 dia. X 7.2 dia.
10	4KA410-10	50	4KA420-10	50	4KB410-10	60	4KB420-10	60	SC3W-10-10	15	SLW-8A	20	10 dia. X 7.2 dia.
11	4KA410-10	50	4KA420-10	50	4KB410-10	60	4KB420-10	60	SC3W-10-12	15	SLW-8A	20	12 dia. X 8.9 dia.
13					4F410-10	32	4F420-10	32	SC1-10	25	SLW-8A	20	12 dia. X 8.9 dia.
15.8					4F510-10	47	4F520-10	47	SC1-10	25	SLW-10A	30	12 dia. X 8.9 dia.
17					4F510-10	47	4F520-10	47	SC1-10	25	SLW-10A	30	15 dia. X 11.5 dia.
19.6					4F510-10	47	4F520-10	47	SC1-15	36	SLW-10A	30	15 dia. X 11.5 dia.
20					4F610-15	90	4F620-15	90	SC1-15	36	SLW-15A	40	12 dia. X 8.9 dia.
24					4F610-15	90	4F620-15	90	SC1-15	36	SLW-15A	40	15 dia. X 11.5 dia.
30					4F610-15	90	4F620-15	90	SC-20A	110	SLW-15A	40	15 dia. X 11.5 dia.
41					4F610-15	90	4F620-15	90	SC-20A	110	SL-15A	92	15 dia. X 11.5 dia.
45					4F610-15	90	4F620-15	90	SC-20A	110	SL-20A	160	15 dia. X 11.5 dia.

[Circuit diagram]

- Flow control valve
- Pipe
- Solenoid valve
- Silencer



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