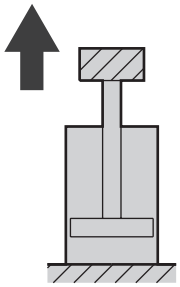
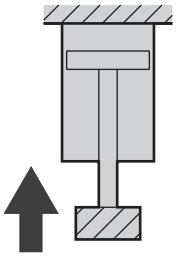
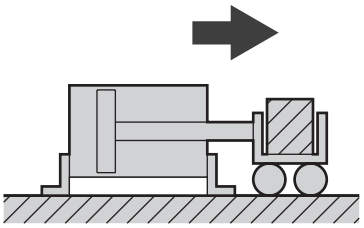
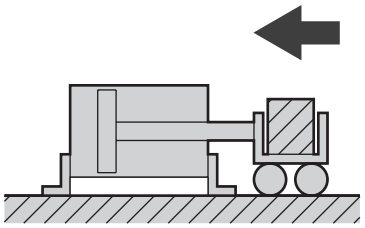
Cylinder and system selection guide

Some values may vary depending on conditions. Use the following values as guidelines.

STEP 1 Confirming working conditions

(1) Load weight M(kg)
(2) Stroke St(mm)
(3) Travel time T(s)
(4) Cylinder average speed V0(m/s)
V0=St/(Tx1000)
(5) Working pressure P(MPa)
(6) Mounting method/direction

A	B	C	D
Vertical upward push operation	Vertical downward pull operation	Horizontal pushing operation	Horizontal pull operation
			

Note : When lifting downward vertically, cylinder thrust is virtually unnecessary. Select the cylinder size with the lifting side requiring thrust.

STEP 2 Overview of cylinder size selection

(1) Set load factor (α) according to the piston speed.
High speed operation (1 to 2 m/s) α = 20%
Medium speed operation (1 m/s or less) α = 50%

(2) Calculate required cylinder thrust (F).

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

M : Load weight (kg)
α : Load factor (%)
μ : Coefficient of friction
Mounting method C/D horizontal rolling = 0.1
Mounting method A/B perpendicular and vertical = 1

(3) Find the cylinder bore size (D).

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

P : Working pressure (MPa)
F : Required cylinder thrust (N)

(4) Select a larger size than the value obtained in "(3)".

Size	Cylinder bore size (mm)
ø20	20
ø25	25
ø32	32
ø40	40
ø50	50
ø63	63

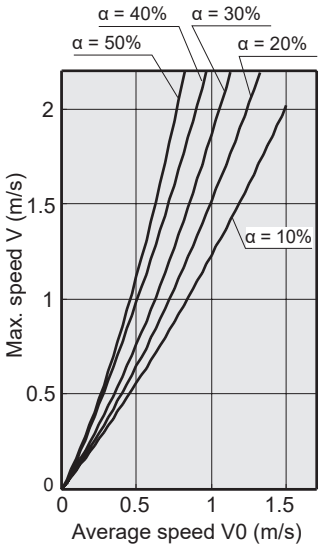
STEP 3 Calculation of max. speed

● Find maximum speed (Vmax) in [Graph 1] according to working conditions (average speed V0/mounting method/direction) of Step 1 and load factor α of Step 2. When maximum speed (Vmax) exceeds 2 m/s, go back to Step 1, and decrease average speed V0.

[Graph 1]

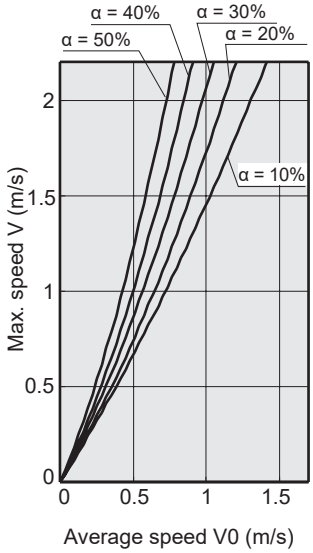
For mounting method/direction A

A: Vertical upward operation



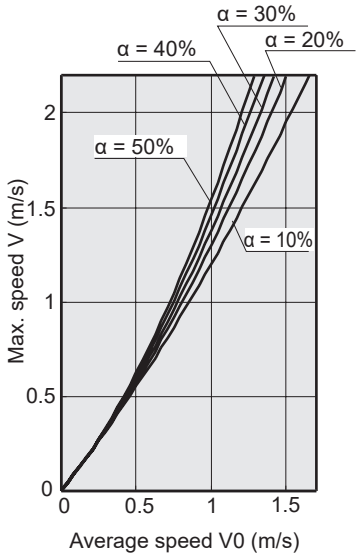
For mounting method/direction B

B: Vertical downward operation



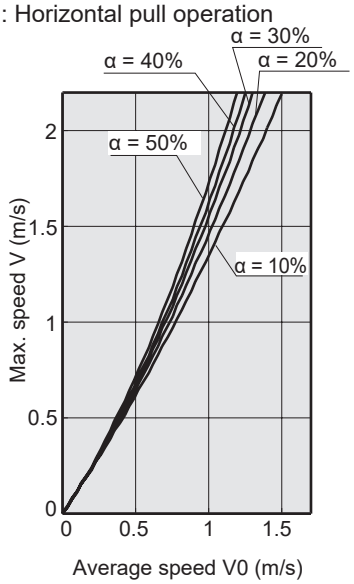
For mounting method/direction C

C: Horizontal pushing operation



For mounting method/direction D

D: Horizontal pull operation



Pipe length is approx. 2 m under working pressure P = 0.5 MPa.
When using under other conditions, use this for reference.

STEP 4 Confirming cushion capacity

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

Calculate kinetic energy (E1) according to load weight M of Step 1 and max. speed Vmax found at Step 3.

$$E1(J)=0.5x(Vmax)^2xM$$

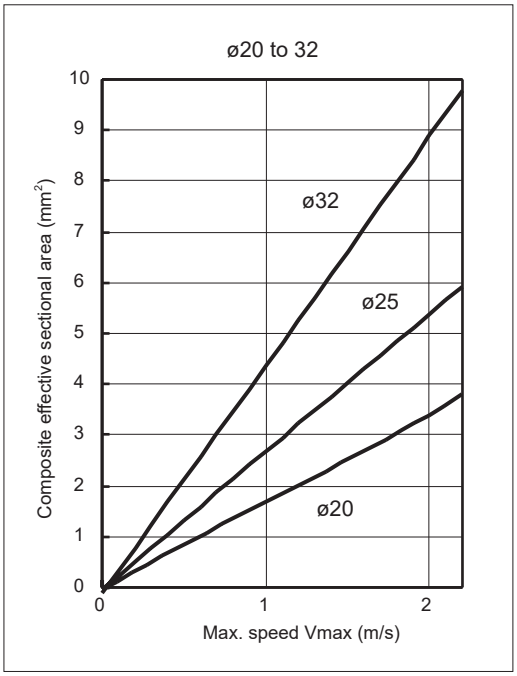
· E1 should not be greater than allowable absorbed energy E2 in Table 1.
When E1 > E2, decrease average speed V_0 or install an external buffer device (shock absorber).
[Table 1]

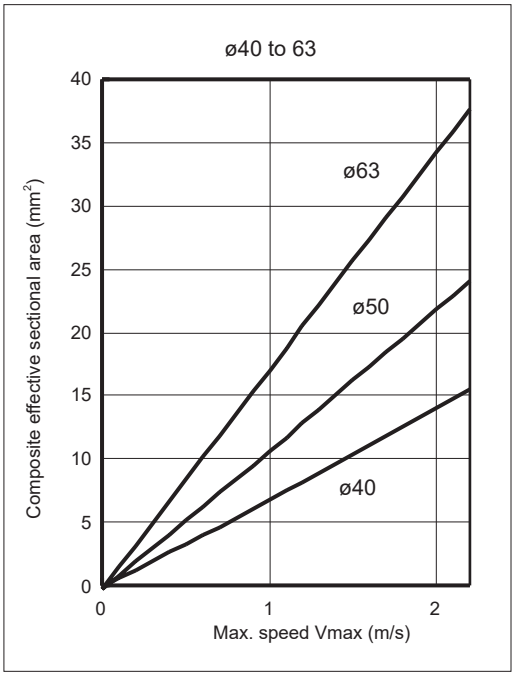
Bore size	Allowable absorbed energy E2 (J)
ø20	3
ø25	5
ø32	9
ø40	14
ø50	23
ø63	30

Note : During perpendicular-upward pull operation and perpendicular-downward push operation, energy can be absorbed, but a smooth stop is not possible. (Bounding, etc., is generated.)
When smooth stop is necessary, as reference, load factor should be 10% or less and max. speed should be 1 m/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 in Step 5.

[Table 2]

Code S in the table shows individual effective cross-sectional area (mm^2).

Composite effective sectional area	Solenoid valve								Speed controller		Silencer		Piping
	Direct mounting				Sub-plate								
	Single		Double		Single		Double						
(mm^2)	solenoid	S	solenoid	S	Solenoid	S	solenoid	S		S		S	(Pipe length 2 m)
1.2	4KA110-M5 4GA110R-M5	3	4KA120-M5 4GA120R-M5	3	4KB110-06 4GB110R-06	4	4KB120-06 4GB120R-06	4	SC3W-6-4	2.8	SLW-6A	10	ø4Xø2.5
2	4KA110-M5 4GA110R-M5	3	4KA120-M5 4GA120R-M5	3					SC3W-6-6	3.6	SLW-6A	10	ø6Xø4
2.3					4KB110-06 4GB110R-06	4	4KB120-06 4GB120R-06	4	SC3W-6-6	3.6	SLW-6A	10	ø6Xø4
3.1	4KA210-06 4GA210R-06	13	4KA220-06 4GA220R-06	12.5					SC3W-6-8	3.6	SLW-6A	10	ø8Xø5.7
3.2					4KB210-06 4GB210R-06	14	4KB220-06 4GB220R-06	14	SC3W-6-8	3.6	SLW-6A	10	ø8Xø5.7
3.6	4KA210-06 4GA210R-06	13	4KA220-06 4GA220R-06	12.5					SC1-6	8	SLW-6A	10	ø6Xø4
3.7					4KB210-06 4GB210R-06	14	4KB220-06 4GB220R-06	14	SC1-6	8	SLW-6A	10	ø6Xø4
5	4KA210-06 4GA210R-06	13	4KA220-06 4GA220R-06	12.5	4KB210-06 4GB210R-06	14	4KB220-06 4GB220R-06	14	SC1-6	8	SLW-6A	10	ø8Xø5.7
5.3					4KB210-08 4GB210R-08	14	4KB220-08 4GB220R-08	14	SC3W-8-8	7	SLW-8A	20	ø8Xø5.7
5.9					4KB210-08 4GB210R-08	14	4KB220-08 4GB220R-08	14	SC3W-8-10	7	SLW-8A	20	ø10Xø7.2
6.1	4F210-08	18	4F220-08	18					SC3W-8-10	7	SLW-8A	20	ø10Xø7.2
6.4	4KA310-08 4GA310R-08	25	4KA320-08 4GA320R-08	25	4KB310-08 4GB310R-08	28	4KB320-08 4GB320R-08	28	SC3W-8-10	7	SLW-8A	20	ø10Xø7.2
6.5	4KA210-06 4GA210R-06	13	4KA220-06 4GA220R-06	12.5					SC1-8	13	SLW-6A	10	ø10Xø7.2
6.9					4KB210-08 4GB210R-08	14	4KB220-08 4GB220R-08	14	SC1-8	13	SLW-8A	20	ø8Xø5.7
8.5					4F210-08	18	4F220-08	18	SC1-8	13	SLW-8A	20	ø10Xø7.2
9	4KA310-08 4GA310R-08	25	4KA320-08 4GA320R-08	25	4KB310-08 4GB310R-08	28	4KB320-08 4GB320R-08	28	SC1-8	13	SLW-8A	20	ø10Xø7.2
9.9	4F310-10	32	4F320-10	32					SC3W-10-10	15	SLW-8A	20	ø10Xø7.2
10	4KA410-10 4GA410-10	50	4KA420-10 4GA420-10	50	4KB410-10 4GB410-10	60	4KB420-10 4GB420-10	60	SC3W-10-10	15	SLW-8A	20	ø10Xø7.2
11	4KA410-10 4GA410-10	50	4KA420-10 4GA420-10	50	4KB410-10 4GB410-10	60	4KB420-10 4GB420-10	60	SC3W-10-12	15	SLW-8A	20	ø12Xø8.9
13					4F410-10	32	4F420-10	32	SC1-10	25	SLW-8A	20	ø12Xø8.9
15.8					4F510-10	47	4F520-10	47	SC1-10	25	SLW-10A	30	ø12Xø8.9
17					4F510-10	47	4F520-10	47	SC1-10	25	SLW-10A	30	ø15Xø11.5
19.6					4F510-10	47	4F520-10	47	SC1-15	36	SLW-10A	30	ø15Xø11.5
20					4F610-15	90	4F620-15	90	SC1-15	36	SLW-15A	40	ø12Xø8.9
24					4F610-15	90	4F620-15	90	SC1-15	36	SLW-15A	40	ø15Xø11.5
30					4F610-15	90	4F620-15	90	SC-20A	110	SLW-15A	40	ø15Xø11.5
41					4F610-15	90	4F620-15	90	SC-20A	110	SL-15A	92	ø15Xø11.5
45					4F610-15	90	4F620-15	90	SC-20A	110	SL-20A	160	ø15Xø11.5

[Circuit diagram]

1. Speed controller
2. Piping
3. Solenoid valve
4. Silencer