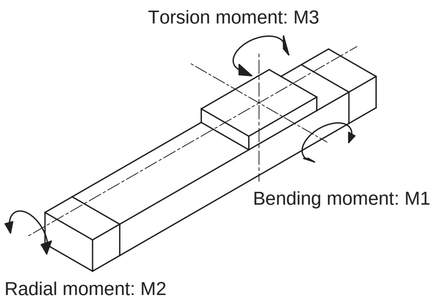
Rodless cylinder with brake (SRT3) selection guide

[STEP1]

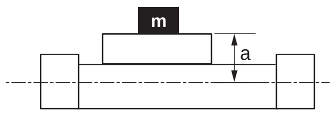
Moment actuates according to the cylinder mounting direction and the position of center of gravity of load.

● Types of moment caused by load



[Table 1] Value of a

Bore size	a(m)
ø12	0.023
ø16	0.025
ø20	0.028
ø25	0.036
ø32	0.039
ø40	0.045
ø50	0.054
ø63	0.060



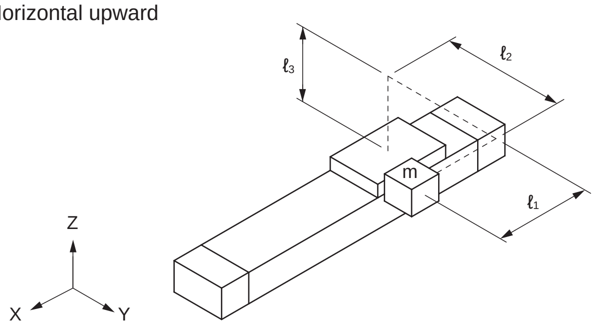
1 Obtain the static moment.

Unit: N·m

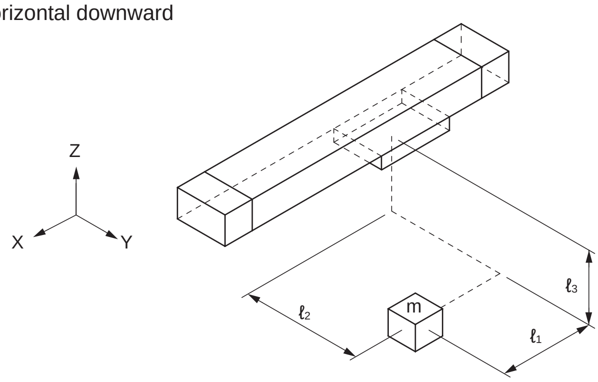
Mounting orientation	Horizontal upward	Horizontal downward	Horizontal lateral	Vertical
Vertical load W	mx9.8			-
Static moment M1	Wxℓ_1	Wxℓ_1	-	Wx(ℓ_3+a)
Static moment M2	Wxℓ_2	Wxℓ_2	Wx(ℓ_3+a)	-
Static moment M3	-	-	Wxℓ_1	Wxℓ_2

m : Load weight [kg]
ℓ_1 : Length along the stroke direction from the center of table to the center of gravity of load [m]
ℓ_2 : Length in the width direction from the center of table to the center of gravity of load [m]
ℓ_3 : Length in the vertical direction from the center of table to the center of gravity of load [m]

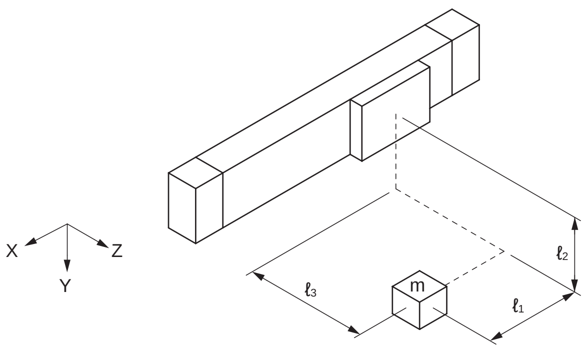
Horizontal upward



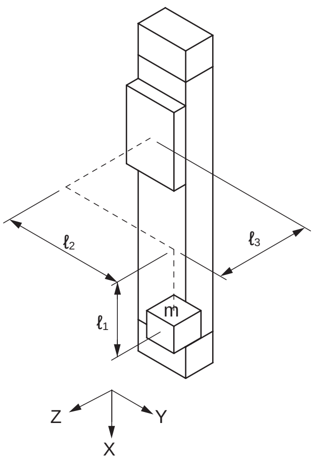
Horizontal downward



Horizontal lateral



Vertical



2 Obtain the dynamic moment caused by the load inertia at the stroke end.

Unit: N·m

	Mounting orientation	Horizontal upward	Horizontal downward	Vertical	Horizontal lateral
Dynamic moment	M1i	$Wx(\ell_3 + a)xG$			
	M2i	M2i dynamic moment is not generated.			
	M3i	$Wx\ell_2xG$			

Dynamic moment can be calculated with the formulas above regardless of the mounting direction.

Obtain an approximate G coefficient from Table 2.

[Table 2]

$$\text{Va (Average speed)} = \frac{\text{Moving distance}}{\text{Movement time}} \text{ (m/s)}$$

Va (Average speed) (m/s)	Vm (stroke end speed) (m/s)	G Coefficient
0.3	to 0.65	9
0.6	to 1.00	15
0.9	to 1.30	23
1.2	to 2.00	40

G Coefficient = ☐

3 Select an approximate bore size.

Select an approximate bore size.

$M1 + M1_i$	= ☐	(N·m)	→(ø)
M2	= ☐	(N·m)	→(ø)
$M3 + M3_i$	= ☐	(N·m)	→(ø)
W	= ☐	(N)	→(ø)
$E' = \frac{1}{2} xmxVm^2$	= ☐	(J)	→(ø)

Select a temporary max. bore size.

ø ☐

[Table 3] Allowable value

Item / Bore size (mm)	Wmax (N)	M1max (N·m)	M2max (N·m)	M3max (N·m)
ø12	30	1.5	0.6	0.6
ø16	140	5	1	1
ø20	200	10	1.5	3
ø25	360	17	5	10
ø32	620	36	10	21
ø40	970	77	23	26
ø50	1470	154	32	42
ø63	2320	275	52	76

[Table 4] Allowable absorbed energy value (E_0)

Bore size (mm)	Integrated air cushion (J)
ø12	0.03
ø16	0.22
ø20	0.59
ø25	1.40
ø32	2.57
ø40	4.27
ø50	9.13
ø63	17.4

Note) SRT3 with shock absorber attached is not available.
Install an external shock absorber if the kinetic energy of load: E' is larger than the allowable absorbed energy: E_0.

4 Obtain the resultant moment at the stroke end (M_T).
(Confirm that the bore size selected in **3** satisfies the formula below.)

$$M_T = \frac{M1+M1_i}{M1max} + \frac{M2}{M2max} + \frac{M3+M3i}{M3max} + \frac{W}{Wmax} < 1$$

M	: Resultant moment (must be smaller than 1)
Wmax	: Max. allowable value of W (from Table 3)
M1max	: Max. allowable value of M1 (from Table 3)
M2max	: Max. allowable value of M2 (from Table 3)
M3max	: Max. allowable value of M3 (from Table 3)

· If M_T is much more than 1, change the selection condition.
· If M_T is slightly more than 1, improving the accuracy in STEP 2 may make the value 1 or less. Perform STEP 2 to see the result.

[STEP2]

Next, obtain a more accurate load factor, effective thrust, stroke end speed and resultant moment.

● Calculate the load factor.

$$\alpha = \frac{F_0}{F} \times 100\ [\%]$$

α : Load factor
F_0 : Force (N) required to move the workpiece
F : Effective thrust of the cylinder (N) (Fig. 1 to 3)

For horizontal operation	For vertical operation
$F_0=F_W+F_1+F_2+F_3+F_L$	$F_0=W+F_1+F_2+F_3+F_L$

F_W: Wx0.2(N)
F_1: M_1 x C1 Note(N)
F_2 : M2 x C2 Note (N)
F_3: M_3 x C3 Note(N)
F_L : Other kinds of resistance (e.g., guide resistance) (N)W : Load (N)

Note: Coefficient to correct the increase of friction caused when moment is applied

[Table 5] Moment friction coefficients 1/m

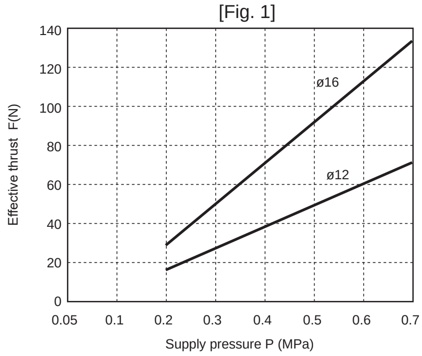
Bore size (mm)	C1	C2	C3
ø12 or equiv.	8	27	8
ø16 or equiv.	7	24	7
ø20 or equiv.	6	21	6
ø25 or equiv.	5	16	5
ø32 or equiv.	4	13	4
ø40 or equiv.	4	11	4
ø50 or equiv.	4	9	4
ø63 or equiv.	3	8	3

[Table 6] Load factor guidelines

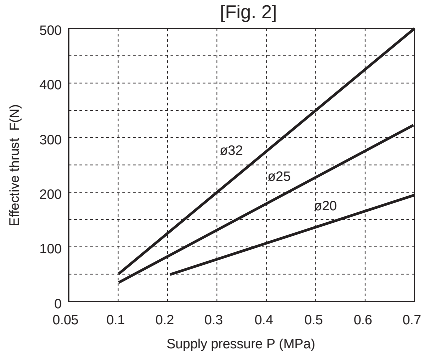
Working pressure (MPa)	Load factor (%)
0.2 to 0.3	α ≤ 40
0.3 to 0.6	α ≤ 50
0.6 to 0.7	α ≤ 60

● Graph for obtaining effective thrust

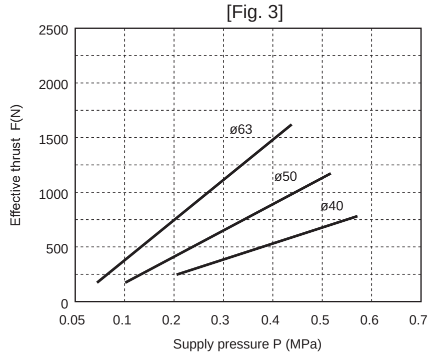
[Fig. 1]



[Fig. 2]



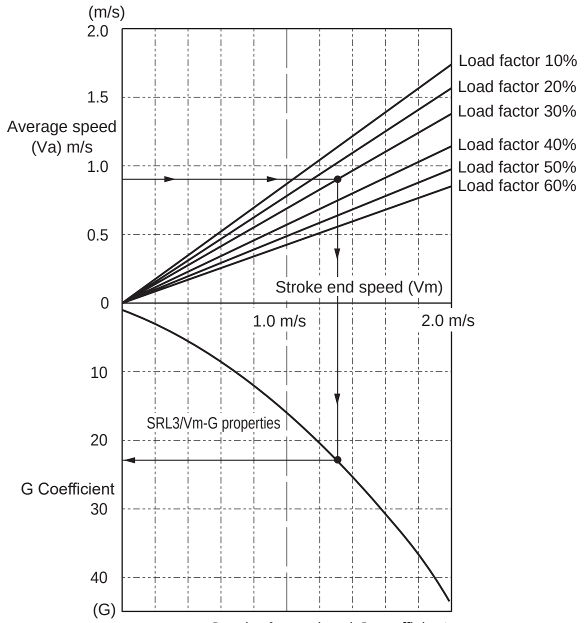
[Fig. 3]



[STEP3]

In [Fig. 3], obtain the stroke end speed (Vm) and G coefficient from the average speed (Va) and load factor obtained in STEP 2.

● Graph of speed and G coefficient [Fig. 3]



Graph of speed and G coefficient

G Coefficient = ☐

● The arrow (→) in the figure is the formula for obtaining

- Stroke end speed :1.3 m/s
- G Coefficient :22.5

at

- Average speed :0.9 m/s
- Load factor : 30%

[STEP4]

● Calculate the resultant moment (M_T) using the G coefficient obtained in STEP 3.

$M1 + M1_i$ = ☐ (N·m)

$M2$ = ☐ (N·m)

$M3 + M3_i$ = ☐ (N·m)

W = ☐ (N)

$$M_T = \frac{M1 + M1_i}{M1max} + \frac{M2}{M2max} + \frac{M3 + M3i}{M3max} + \frac{W}{Wmax}$$

$M_T \leq 1$

↓

Bore size is decided. (* Refer to [Table 3] in STEP 1)

↓

Confirm cushion capacity

Unit: N·m

Mounting orientation		Horizontal upward	Horizontal downward	Vertical	Horizontal lateral
Dynamic moment	M1i	$Wx(\ell_3 + a)xG$			
	M2i	M2i dynamic moment is not generated.			
	M3i	$Wx\ell_2xG$			

Although the formulas are the same as those in STEP 1, use the G coefficient obtained in STEP 3 for calculation.

[STEP5]

● Confirming cushion capacity

$$E = \frac{1}{2} \times m \times Vm^2$$

E : Kinetic energy at stroke end (J)
m : Load weight (kg)
Vm : Speed of the piston entering the cushion (m/s)

[Table 7] Allowable absorbed energy value (E_0)

Bore size (mm)	Integrated air cushion (J)
ø12	0.03
ø16	0.22
ø20	0.59
ø25	1.40
ø32	2.57
ø40	4.27
ø50	9.13
ø63	17.4

Note: SRT3 with shock absorber attached is not available.
Install an external shock absorber if the kinetic energy at stroke end: E is larger than the allowable absorbed energy: E_0.

[STEP6]

● The bore size determined from the cushion performance is øA. (Bore size determined in STEP 5)

● The bore size determined from the load conditions is øB. (Bore size determined in STEP 4)