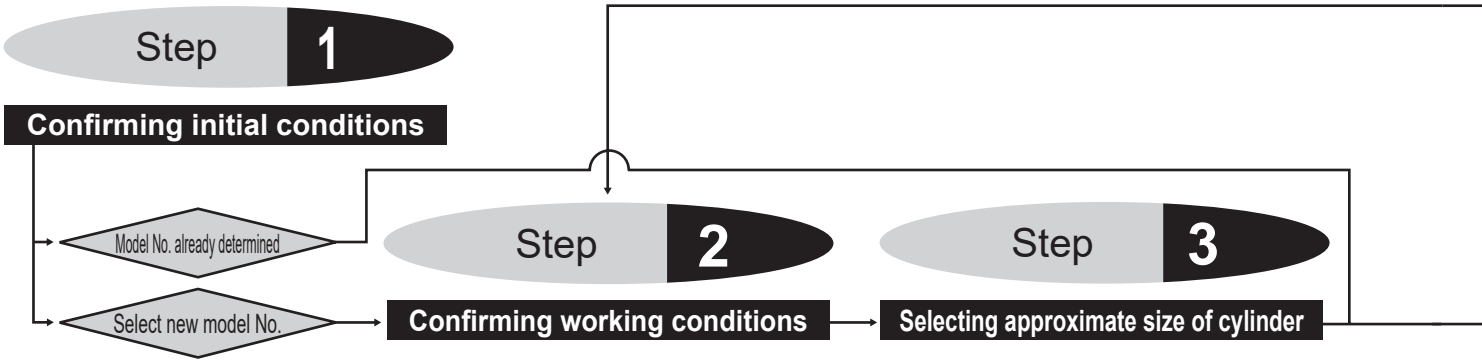
As the selection conditions are different from those of general air cylinders, confirm whether the model is adequate or not according to the selection guide.



Step 2 Confirming working conditions

1. Working pressure P (MPa)
2. Total applied load W (N)

[Total applied load]

When determining the total applied load, take into account the weight of the movable part weight of the cylinder body.

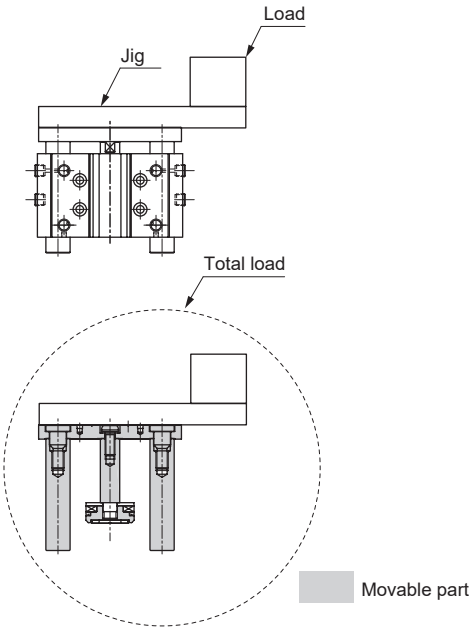
W = (Applied load) + (Jig load) +
(Self weight of movable part: Fa).

Calculate the self-weight of movable parts by using the value in movable part weight table on page 425.

Fa=Max10

Ma : Movable part weight (kg)

Fa : Self-weight of movable part (N)



3. Mounting orientation

[Actuation]

Horizontal, vertical-rise, vertical-decline

4. Stroke ST (mm)
5. Operation time t(s)
6. Stroke end speed V (m/s)

V = ST/t x (1 + 1.5 x α/100)

(Note) Load factor α will be calculated in 5-1 ②

Step 3 Selecting approximate size of cylinder

● Formula for calculating cylinder size (bore size)

$F = \pi/4 \times D^2 \times P$

$\therefore D = \sqrt{4F/\pi P}$

D: Cylinder bore size (mm)

P: Working pressure (MPa)

F: Cylinder theoretical thrust (N)

● When calculating from the theoretical thrust value in Table 1

Approximate required thrust ≥ Applied load x 2

("x 2" in "Applied load x 2" is for when the load factor is approx. 50% as a safety coefficient)

[Example] Working pressure 0.5(MPa)

Applied load 25(N)

Required thrust: 25(N)x2=50(N)

The bore size selected from Table 1 with theoretical thrust of 50 N and over at working pressure of 0.5 MPa will be ø12 or more.

D=ø12

[Cylinder theoretical thrust]

Table 1 Cylinder theoretical thrust table

Theoretical thrust table ø12, ø16 Unit: N

Actuation direction	Pressure MPa	Bore size mm	
		ø12	ø16
Push	0.15	17	22.6
	0.2	22.6	30.2
	0.3	33.9	45.2
	0.4	45.2	60.3
	0.5	56.6	75.4
	0.6	67.8	90.5
	0.7	79.1	106
	0.8	90.4	121
	0.9	101.8	136

* Refer to page 336 for theoretical thrust table.

Step 4

Calculating total applied load (W) and each moment

To the next page

Step 4 Calculating total applied load (W) and each moment

● Calculate the static load (W0) and the moment (M) based on the load cylinder mounting status.

W_0 = (Applied load) + (Jig load) (N)

$M_1 = F_1 \times \ell_1$ (N·m)

$M_2 = F_2 \times \ell_2$ (N·m)

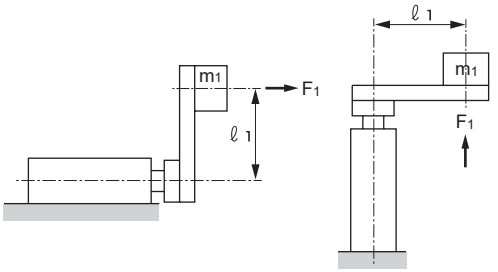
$M_3 = F_3 \times \ell_3$ (N·m)

For values of F_1, F_2 and F_3, use those shown in Fig. 2.

Fig. 2 Formula for calculating each moment
Calculate each moment from total applied load, inertia force coefficient and eccentric distance.

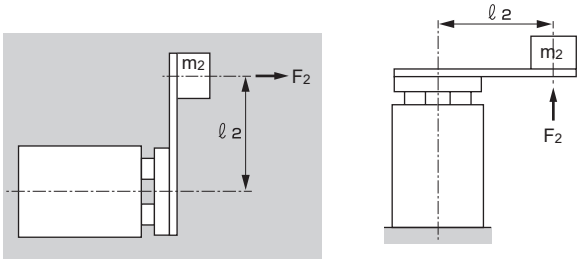
[Bending moment]

$M_1 = F_1 \times \ell_1 = 10 \times m_1 \times G \times \ell_1$



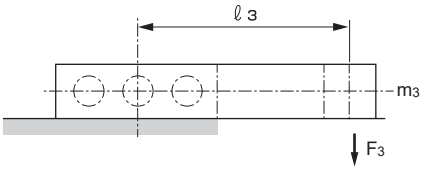
[Radial moment]

$M_2 = F_2 \times \ell_2 = 10 \times m_2 \times G \times \ell_2$



[Torsion moment]

$M_3 = F_3 \times \ell_3 = 10 \times m_3 \times {}_3\ell$

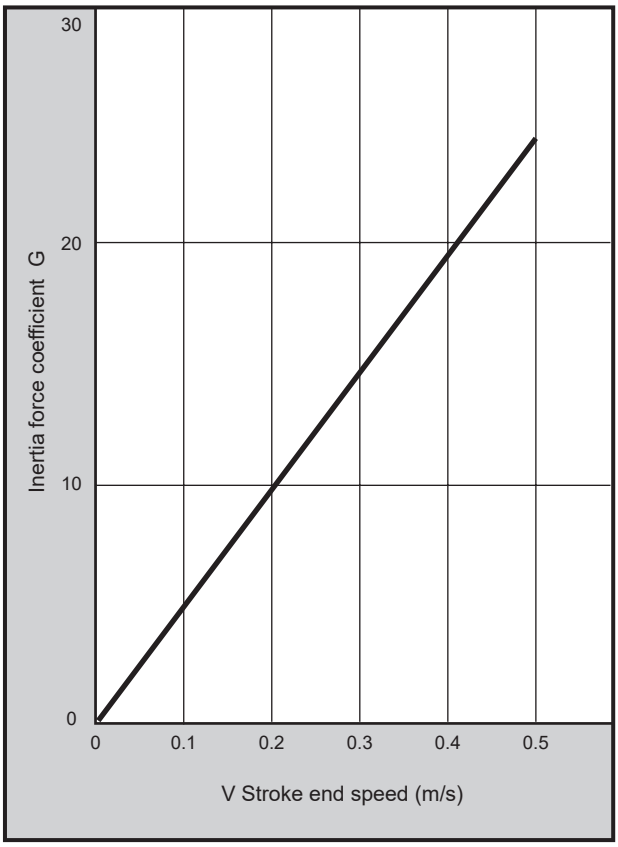


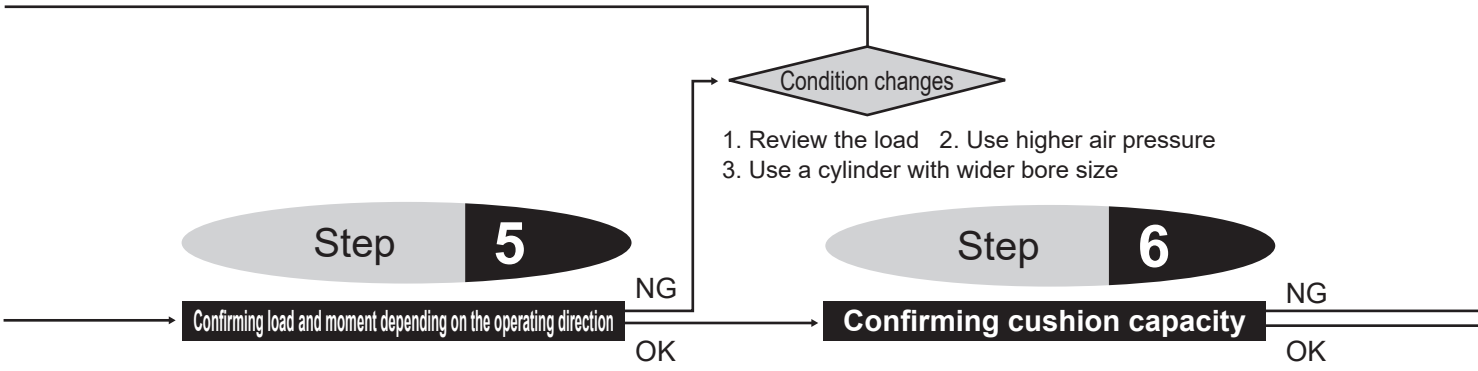
m_1:
m_2: } Load weight (kg)
m_3:

ℓ_1:
ℓ_2: } Eccentric distance (m)
ℓ_3:

G: Inertia force coefficient

Fig. 3 Trend of inertia force coefficient for guided cylinder





Step 5 Confirming load and moment depending on the operating direction

5-1 Confirming applied load

1 For horizontal operation

The value of static applied load must be the allowable load value or less.

Static applied load Wo Value obtained in Step 4
Allowable lateral load Wmax Select from Table 2 or the graph depending on stroke
(When using a custom stroke, select the longer standard stroke)

Wo ≤ Wmax

Table 2 Allowable lateral load Unit: N

Bore size (mm)	Model No.	Bearing	Stroke (mm)			
			10	20	25	30
ø12	STG-M	Metal bush bearing	29	24		20
	STG-B	Ball bearing	38	27		22
ø16	STG-M	Metal bush bearing	51	42		36
	STG-B	Ball bearing	49	35		29
ø20	STG-M	Metal bush bearing		67		58
	STG-B	Ball bearing		52		42
ø25	STG-M	Metal bush bearing		125		110
	STG-B	Ball bearing		81		66
ø32	STG-M	Metal bush bearing			223	
	STG-B	Ball bearing			171	

* Refer to page 420 for allowable lateral load.
Also refer to the graphs on pages 422 to 424 for eccentric load.

2 For vertical operation

The total applied load value must be the value obtained by applying the load factor to the theoretical thrust

● Calculation of load factor

Total applied load W Value obtained in Step 2
Theoretical thrust of cylinder F Refer to the theoretical thrust table on page 336 according to the pressure

α = W/F x 100 (%)

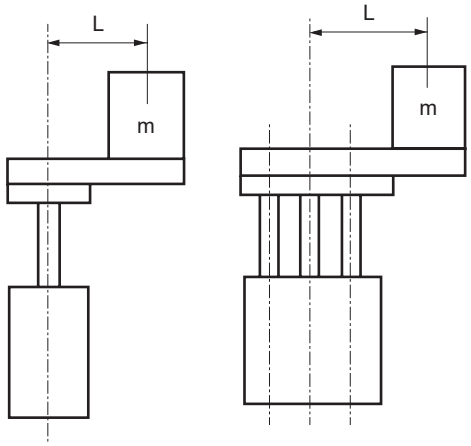
● Determine the load factor by taking into account the status of utilization such as stability margin and service life of the cylinder. For general use, the value within the range in Table 3 is desirable.

Table 3 Appropriate range of load factor (reference value)

Working pressure (MPa)	Load factor (%)
0.1 to 0.3	α ≤ 40
0.3 to 0.6	α ≤ 50
0.6 to 1.0	α ≤ 60

● Confirm the following when eccentric load is applied

The value must be the allowable load value or less from the graph of eccentric distance and load weight on pages 416 and 417



5-2 Confirming static moment

1 Divide the value of bending moment and radial moment by the value in Table 4 to obtain the moment ratio and check that the total value of the moment ratio is 1.0 or less.

● Calculation of moment ratio

Bending moment M_1 } Calculated value
Radial moment M_2 } in Step 4

$M_1/M_1max + M_2/M_2max \leq 1.0$

Condition changes

1. Install an external shock absorber
2. Decrease the operation speed
3. Use a cylinder with larger bore size

Selection complete

Table 4 Allowable value of moment (N·m)

Bore size (mm)	Allowable bending moment $M_{1\,max}$, $M_{2\,max}$ (N·m)	
	Bearing	
	STG-M Metal bush bearing	STG-B Ball bearing
ø12	11.2	7.0
ø16	19.2	11.2
ø20	35.3	19.2
ø25	51.9	35.3
ø32	171.5	51.9
ø40	171.5	51.9
ø50	294.0	171.5
ø63	294.0	171.5
ø80	509.6	294.0
ø100	793.8	509.6

Step 6 Confirming cushion capacity

Calculate the kinetic energy of the load that is actually to be used, and confirm whether it can be absorbed by the allowable absorbed energy of cylinder or not.

- To obtain the allowable absorbed energy of cylinder (E), use the value in the graphs below.
- Formula for calculating kinetic energy of load

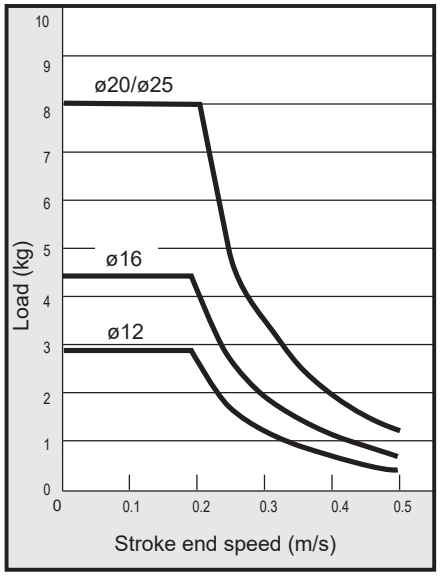
$$E = \frac{1}{2} x(W1+W2)xV^2$$

W1: Applied load (kg) W2: Movable part weight of cylinder (kg)
V: Stroke end speed (m/s)

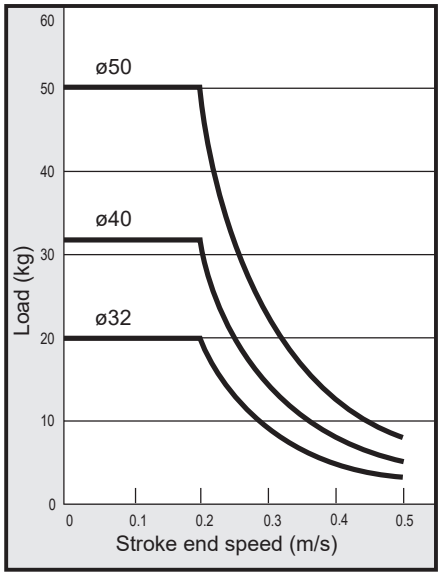
Allowable absorbed energy value

Use in the range below and to the left of the curve. For use in the upper right range, provide an external shock absorber.

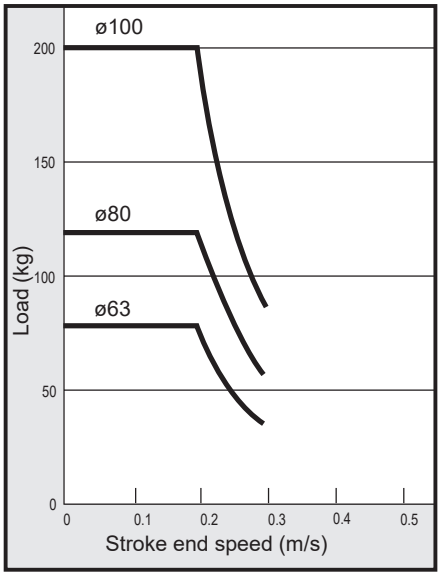
● STG-12 to 25



● STG-32 to 50



● STG-63 to 100



❷ The torsion moment must be the allowable torque value or less.

Torsion moment M3 Value obtained in Step 4
Allowable torque
M3max Select from Table 5 according to the stroke
(When using a custom stroke, select the longer standard stroke)

$M_3 \leq M_{3max}$

Table 5 Allowable torque (N·m)

Bore size (mm)	Model No.	Bearing	Stroke (mm)		
			10	20	25
ø12	STG-M	Metal bush bearing	0.30	0.25	
	STG-B	Ball bearing	0.39	0.28	
ø16	STG-M	Metal bush bearing	0.59	0.49	
	STG-B	Ball bearing	0.56	0.41	
ø20	STG-M	Metal bush bearing		0.90	
	STG-B	Ball bearing		0.70	
ø25	STG-M	Metal bush bearing		2.00	
	STG-B	Ball bearing		1.29	
ø32	STG-M	Metal bush bearing			4.35
	STG-B	Ball bearing			3.33
ø40	STG-M	Metal bush bearing			4.80
	STG-B	Ball bearing			3.68
ø50	STG-M	Metal bush bearing			9.56
	STG-B	Ball bearing			4.99
ø63	STG-M	Metal bush bearing			10.78
	STG-B	Ball bearing			5.63
ø80	STG-M	Metal bush bearing			15.01
	STG-B	Ball bearing			5.02
ø100	STG-M	Metal bush bearing			24.98
	STG-B	Ball bearing			8.04

* Refer to page 420 for allowable torque.

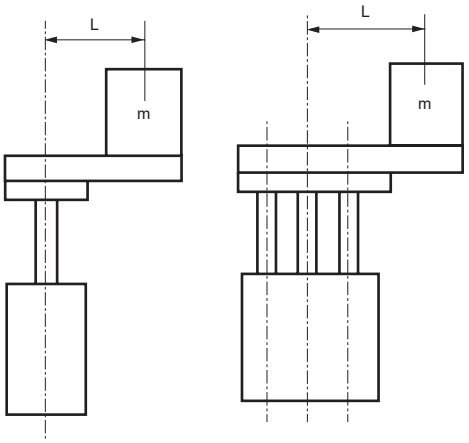
Selection guide

For vertical installation

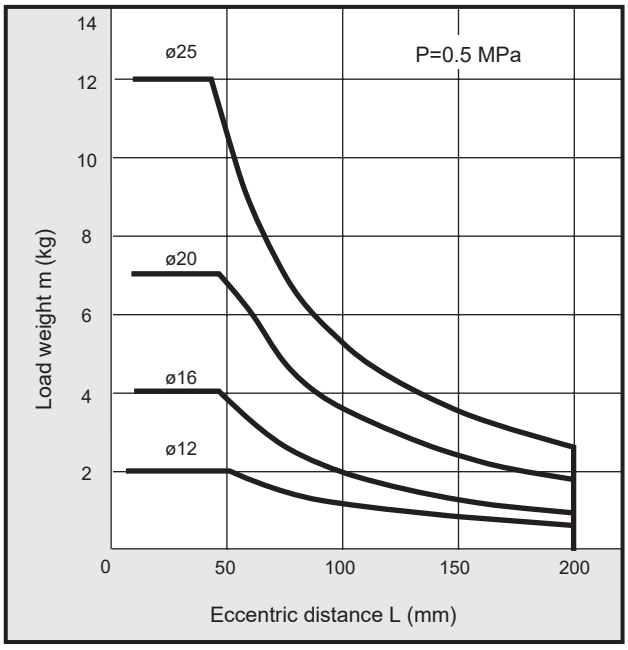
● As for the total load weight, select so that the ratio of the load to the theoretical thrust is within the values in the table below.

Bore size	Load factor for theoretical thrust
12, 16	40% or less
20, 25	50% or less
32 to 80	60% or less
100	60% or less

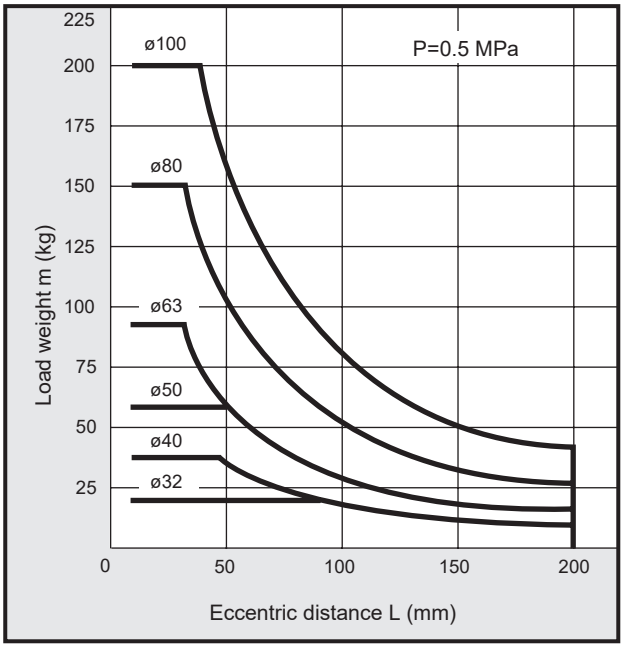
*1 : For copper and PTFE free (M: metal bush bearing only), design the cylinder with the allowable value in the table below x 0.7.



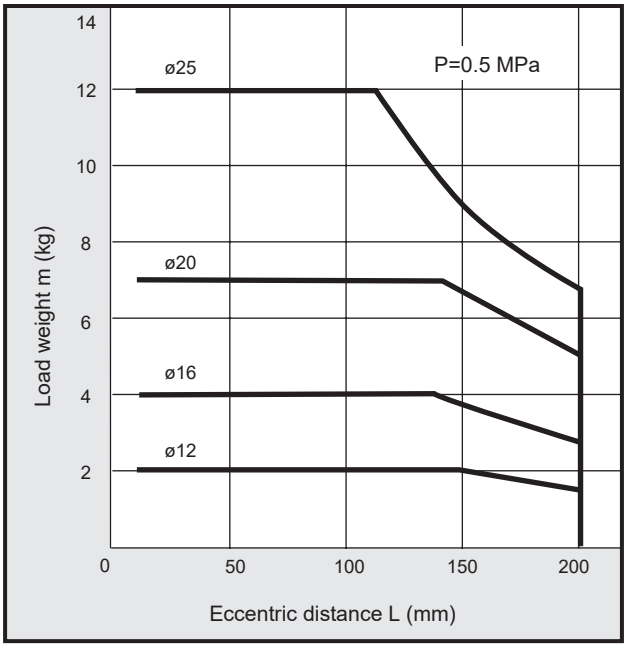
● STG-M-12 to 25
· 50 mm or less stroke



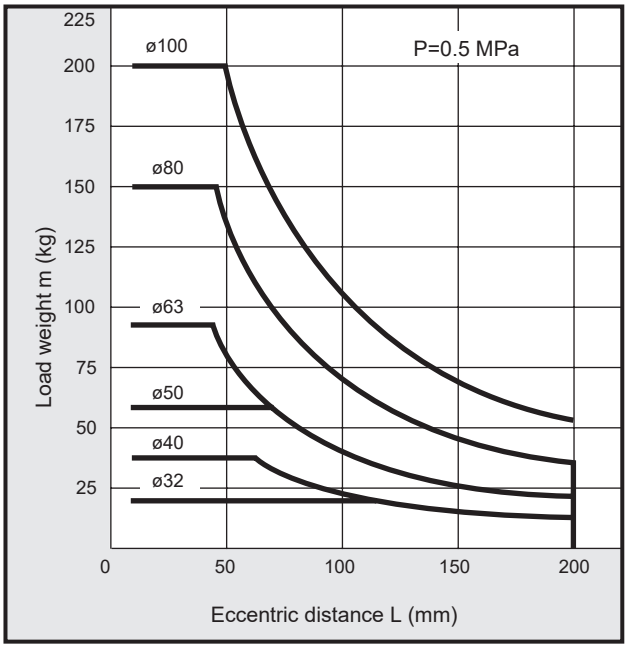
● STG-M-32 to 100
· 50 mm or less stroke



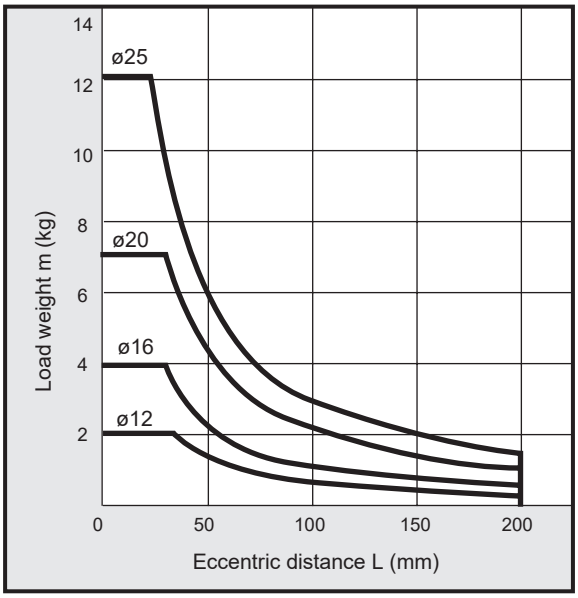
● STG-M-12 to 25
· Over 50 mm stroke



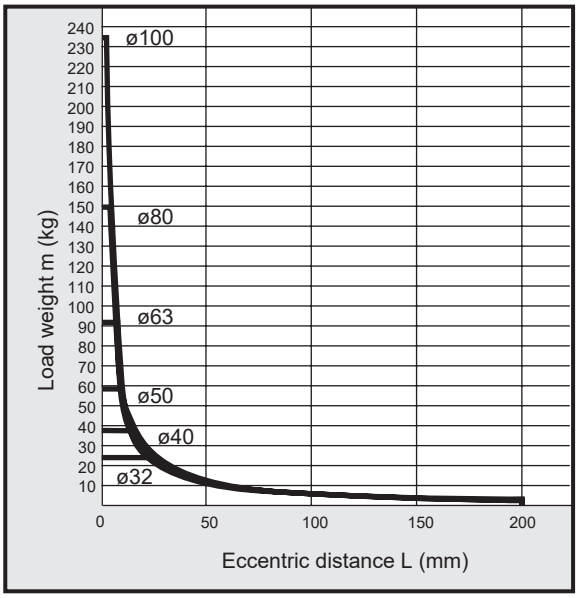
● STG-M-32 to 100
· Over 50 mm stroke



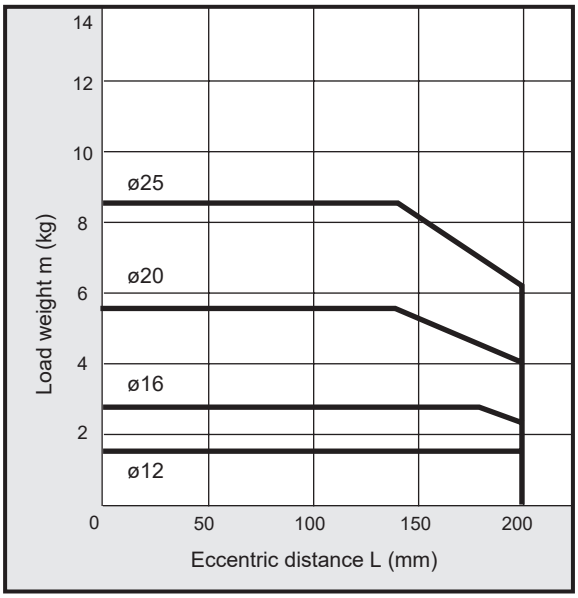
● STG-B-12 to 25
· 30 mm or less stroke



● STG-B-32 to 100
· 50 mm or less stroke

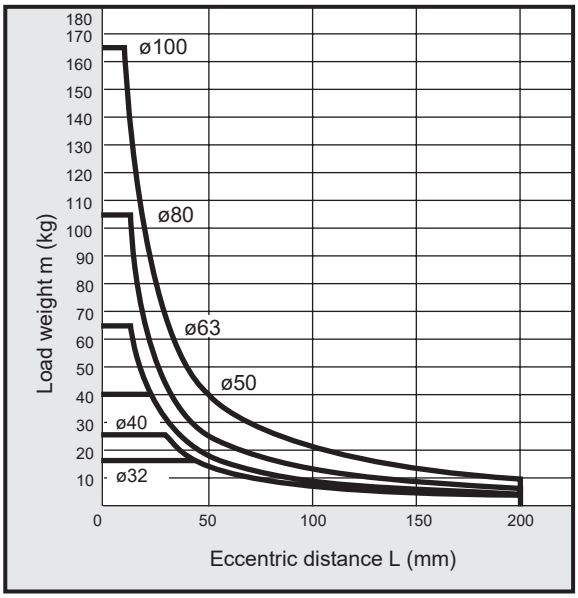


● STG-B-12 to 25
· Over 30 mm to 100 mm stroke

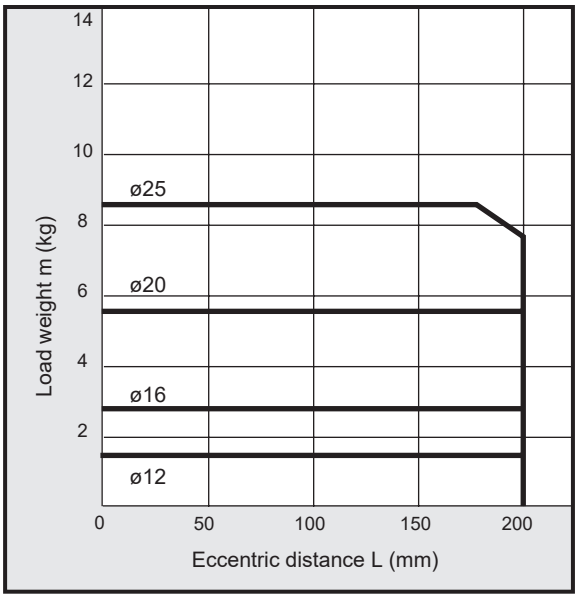


● STG-B-32 to 63
· Over 50 mm to 100 mm stroke

● STG-B-80, 100
· Over 50 mm to 200 mm stroke

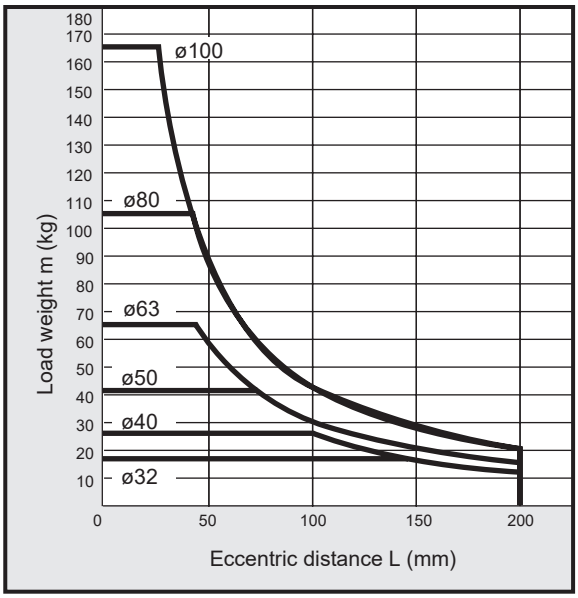


● STG-B-12 to 25
· Over 100 mm stroke



● STG-B-32 to 63
· Over 100 mm stroke

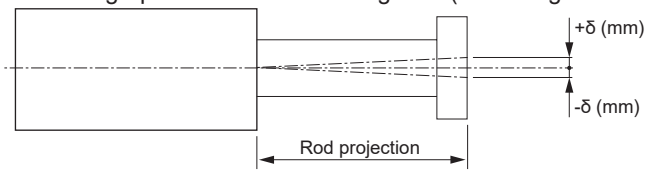
● STG-B-80, 100
· Over 200 mm stroke



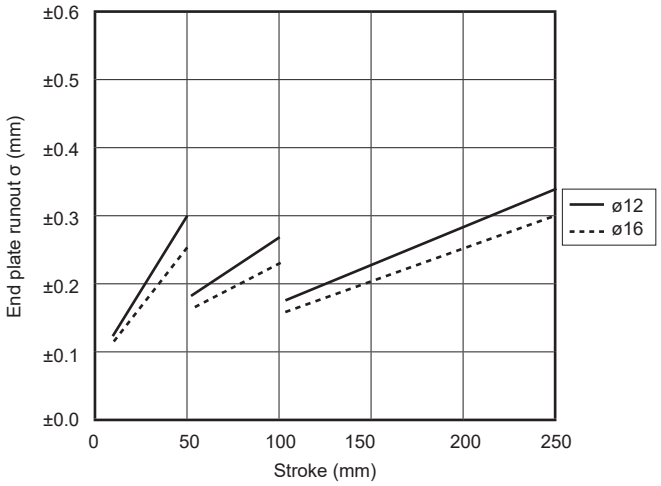
Selection guide

Deflection

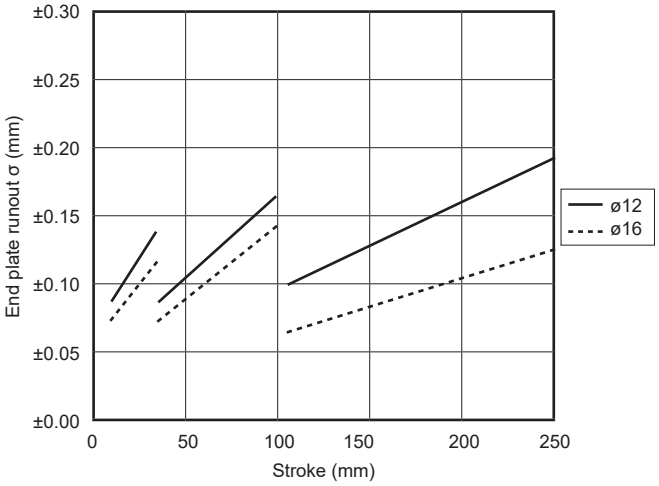
For the runout amount δ produced at the end of the end plate when no load is applied, the value in the graph below is used as a guide. (Excluding deflection of guide rod)



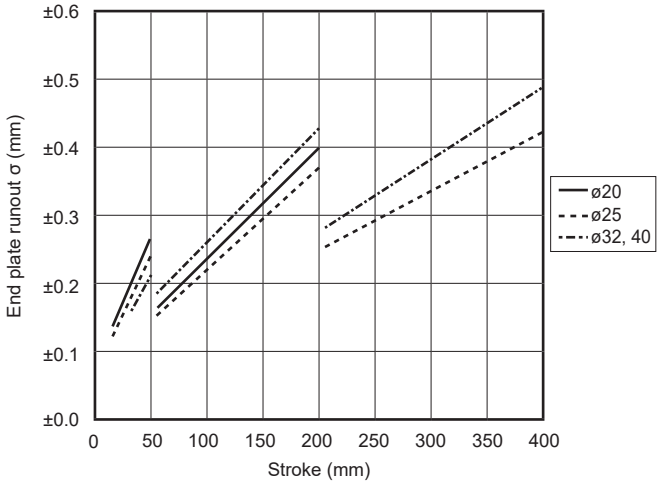
● ø12, ø16 Metal bush bearing
STG-M



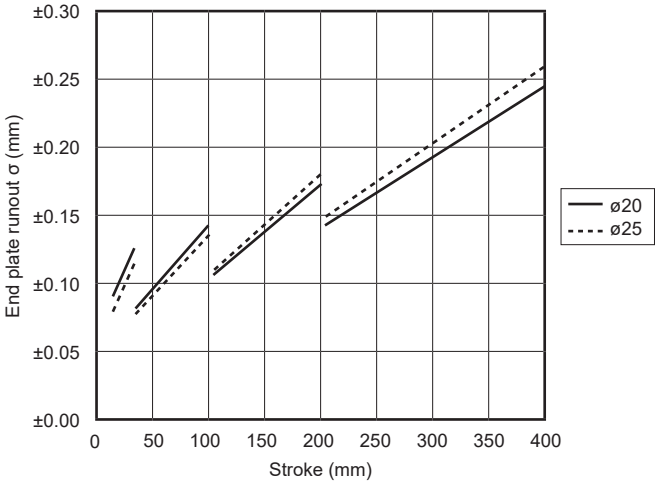
● ø12, ø16 ball bearing
STG-B



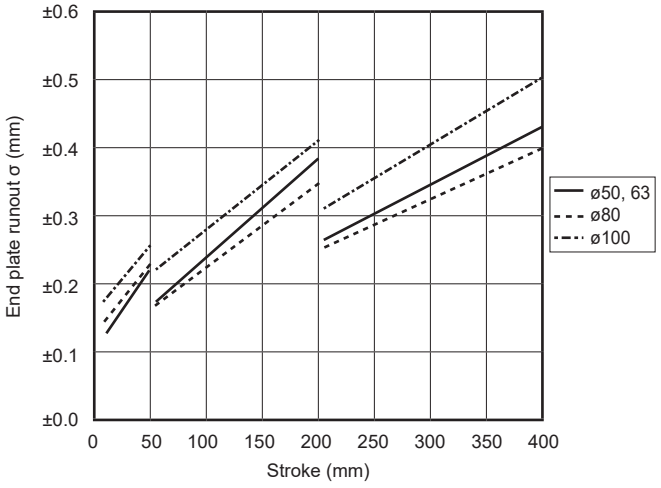
● ø20 to ø40 Metal bush bearing
STG-M



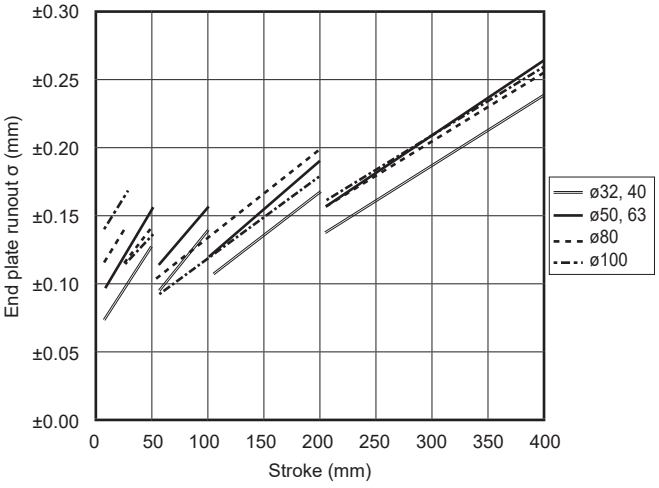
● ø20 to ø40 Ball bearing
STG-B



● ø50 to ø100 Metal bush bearing
STG-M

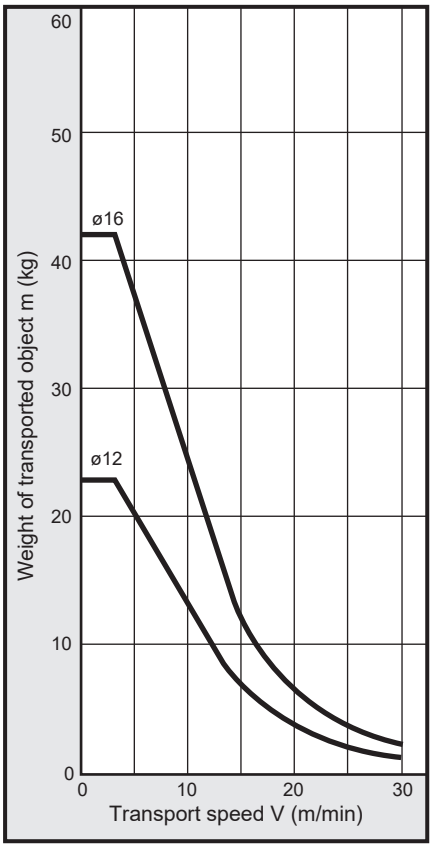


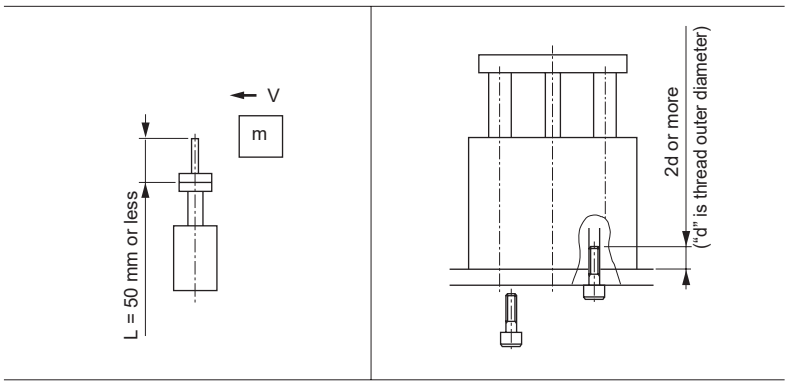
● ø50 to ø100 Ball bearing
STG-B



Specified range when using the product as a stopper

Impact load
STG-M-12, 16 (metal bush bearing)

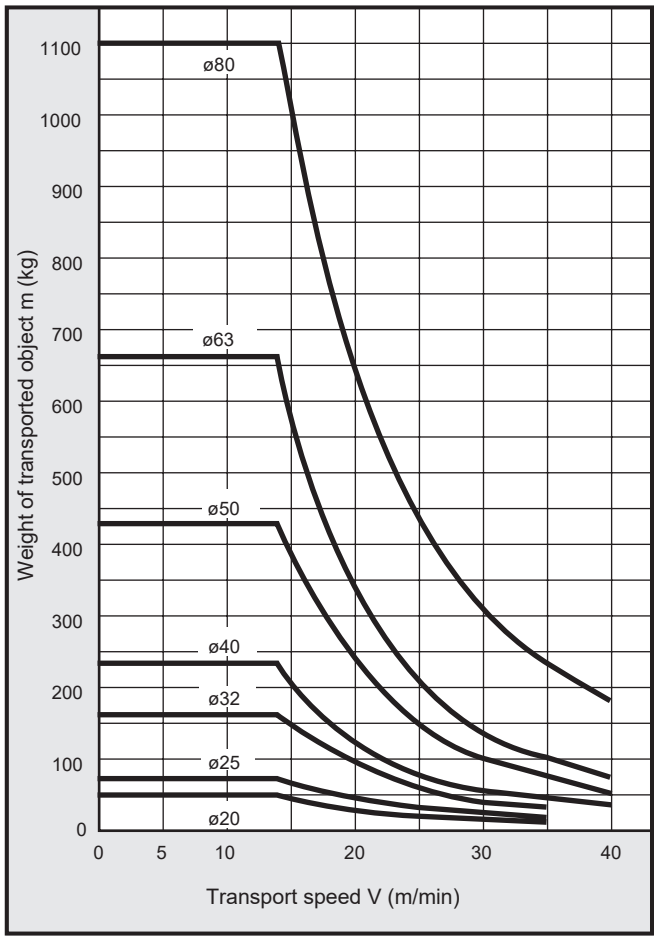




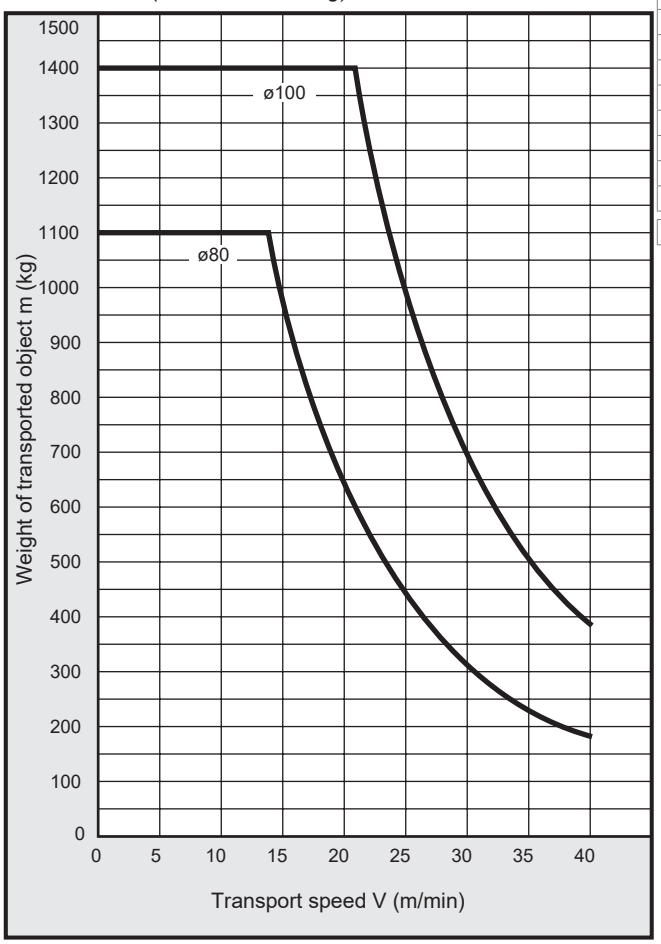
⚠ Safety precautions

*1 : When using the cylinder as a stopper, select a model with 50 mm stroke or less (STG-M). (30 mm or less stroke for ø12 to ø16)
*2 : Make sure that the total length of the stopper section L is 50 mm or less.
*3 : Make sure that the screw insertion depth of the bolt is 2d and over when fixing the cylinder body and consider countermeasures for preventing looseness (adhesive, spring washer, etc.).
(for ø80, make sure that the screw insertion depth is 1d. "d" is thread outer diameter)
*4 : STG-B (ball bearing) cannot be used as a stopper.

Impact load
STG-M-20 to 63 (metal bush bearing)

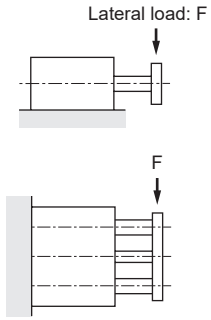


Impact load
STG-M-80/100 (metal bush bearing)



Selection guide

Allowable lateral load

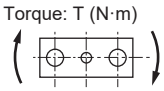


Unit: N

Bore size (mm)	Model No.	Bearing	Stroke (mm)				
			10	20	25	30	
ø12	STG-M	Metal bush bearing	29	24		20	
	STG-B	Ball bearing	38	27		22	
ø16	STG-M	Metal bush bearing	51	42		36	
	STG-B	Ball bearing	49	35		29	
ø20	STG-M	Metal bush bearing		67		58	
	STG-B	Ball bearing		52		42	
ø25	STG-M	Metal bush bearing		125		110	
	STG-B	Ball bearing		81		66	
ø32	STG-M	Metal bush bearing			223		
	STG-B	Ball bearing			171		
ø40	STG-M	Metal bush bearing			223		
	STG-B	Ball bearing			171		
ø50	STG-M	Metal bush bearing			348		
	STG-B	Ball bearing			181		
ø63	STG-M	Metal bush bearing			348		
	STG-B	Ball bearing			181		
ø80	STG-M	Metal bush bearing			385		
	STG-B	Ball bearing			129		
ø100	STG-M	Metal bush bearing			531		
	STG-B	Ball bearing			171		

*1: For copper and PTFE free (M: metal bush bearing only), design the cylinder with the allowable value in the table above x 0.7.

Allowable torque

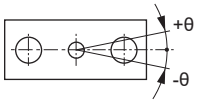


Unit: N·m

Bore size (mm)	Model No.	Bearing	Stroke (mm)				
			10	20	25	30	
ø12	STG-M	Metal bush bearing	0.30	0.25		0.21	
	STG-B	Ball bearing	0.39	0.28		0.23	
ø16	STG-M	Metal bush bearing	0.59	0.49		0.42	
	STG-B	Ball bearing	0.56	0.41		0.33	
ø20	STG-M	Metal bush bearing		0.90		0.78	
	STG-B	Ball bearing		0.70		0.57	
ø25	STG-M	Metal bush bearing		2.00		1.75	
	STG-B	Ball bearing		1.29		1.06	
ø32	STG-M	Metal bush bearing			4.35		
	STG-B	Ball bearing			3.33		
ø40	STG-M	Metal bush bearing			4.80		
	STG-B	Ball bearing			3.68		
ø50	STG-M	Metal bush bearing			9.56		
	STG-B	Ball bearing			4.99		
ø63	STG-M	Metal bush bearing			10.78		
	STG-B	Ball bearing			5.63		
ø80	STG-M	Metal bush bearing			15.01		
	STG-B	Ball bearing			5.02		
ø100	STG-M	Metal bush bearing			24.98		
	STG-B	Ball bearing			8.04		

Non-rotating accuracy

(reference value)



Unit: N

	Stroke (mm)											
	40	50	75	100	125	150	175	200	250	300	350	400
	18	16	20	17	15	13	12	10	9			
	34	29	21	16	12	11	9	8	6			
	32	28	36	31	27	24	21	19	16			
	50	43	31	25	20	17	15	13	10			
	51	46	60	51	45	40	36	33	28	24	21	19
	76	65	49	38	60	51	44	39	32	27	23	20
	98	88	112	97	85	76	69	63	53	46	41	37
	108	94	70	56	81	69	60	53	42	36	30	27
		180	179	156	138	124	112	103	88	77	68	61
		120	190	159	123	106	93	83	66	56	48	42
		180	179	156	138	124	112	103	88	77	68	61
		120	190	159	123	106	93	83	66	56	48	42
		286	292	257	230	208	190	174	150	132	118	106
		129	215	181	139	121	106	95	78	67	58	50
		286	292	257	230	208	190	174	150	132	118	106
		129	215	181	139	121	106	95	78	67	58	50
		326	345	309	280	256	235	218	190	169	151	137
		183	263	226	199	178	162	148	83	71	62	54
		460	475	429	392	360	333	310	272	243	219	199
		249	330	285	251	226	205	187	122	105	91	81

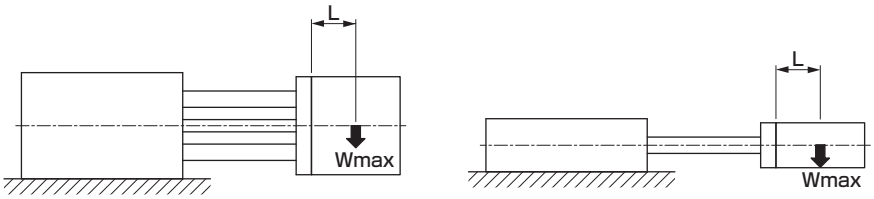
Unit: N·m

	Stroke (mm)											
	40	50	75	100	125	150	175	200	250	300	350	400
	0.18	0.16	0.21	0.18	0.15	0.13	0.12	0.11	0.09			
	0.35	0.30	0.21	0.17	0.13	0.11	0.09	0.08	0.07			
	0.36	0.32	0.42	0.35	0.31	0.27	0.24	0.22	0.18			
	0.58	0.50	0.36	0.28	0.23	0.19	0.17	0.15	0.12			
	0.69	0.62	0.80	0.69	0.61	0.54	0.49	0.44	0.37	0.32	0.29	0.26
	1.02	0.88	0.66	0.52	0.80	0.69	0.60	0.53	0.43	0.36	0.31	0.27
	1.56	1.41	1.80	1.55	1.37	1.22	1.10	1.00	0.85	0.74	0.66	0.59
	1.74	1.50	1.13	0.90	1.29	1.11	0.96	0.85	0.68	0.57	0.49	0.42
		3.50	3.48	3.04	2.69	2.42	2.19	2.01	1.72	1.50	1.33	1.20
		2.34	3.70	3.10	2.40	2.07	1.82	1.61	1.29	1.09	0.94	0.82
		3.86	3.84	3.35	2.97	2.66	2.42	2.21	1.89	1.65	1.47	1.32
		2.58	4.08	3.42	2.65	2.28	2.00	1.78	1.43	1.20	1.03	0.90
		7.86	8.02	7.07	6.32	5.71	5.21	4.79	4.13	3.63	3.23	2.92
		3.56	5.90	4.99	3.83	3.32	2.93	2.61	2.16	1.83	1.58	1.39
		8.86	9.04	7.97	7.12	6.44	5.88	5.41	4.66	4.09	3.65	3.29
		4.01	6.66	5.62	4.32	3.75	3.30	2.94	2.43	2.06	1.78	1.57
		12.70	13.46	12.05	10.92	9.98	9.18	8.51	7.42	6.58	5.90	5.36
		7.13	10.25	8.81	7.77	6.96	6.30	5.76	3.23	2.76	2.40	2.12
		21.60	22.32	20.17	18.40	16.92	15.66	14.57	12.79	11.40	10.28	9.37
		11.69	15.53	13.38	11.81	10.60	9.62	8.81	5.75	4.92	4.29	3.79

Item	Non-rotating accuracy θ (degrees)	
Bore size (mm)	Metal bush bearing	Ball bearing
ø12	±0.08	±0.06
ø16		
ø20	±0.07	±0.05
ø25		
ø32	±0.06	±0.04
ø40		
ø50	±0.05	±0.03
ø63		
ø80		
ø100		

(Default at PULL) Note: Excluding sag of guide rod

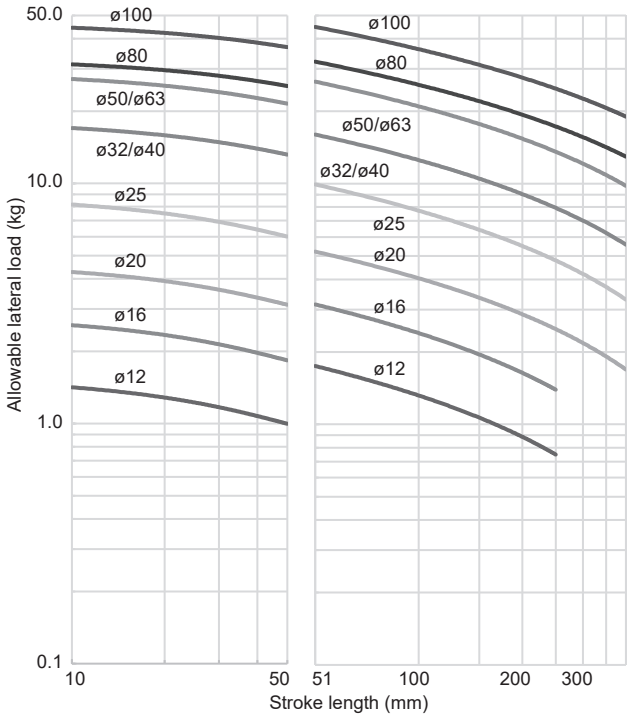
Allowable lateral load Metal bush bearing



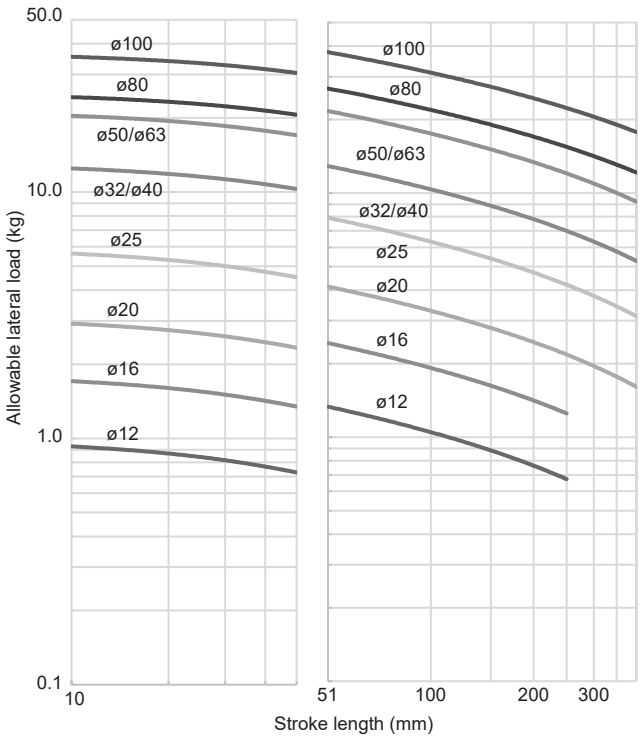
Wmax: Lateral load (kg)
L: Load center of gravity position (mm)

STG-M-12 to 100

● When L = 50 mm

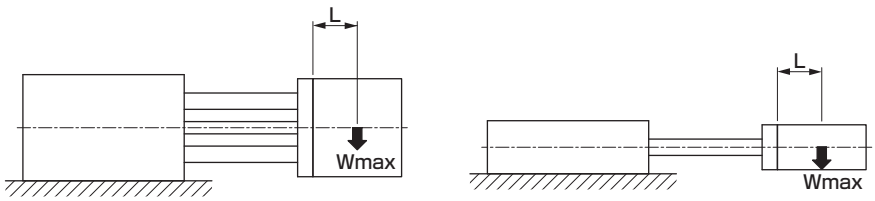


● When L = 100 mm



Note: For copper and PTFE free, design with 70% of the values in the graph above.

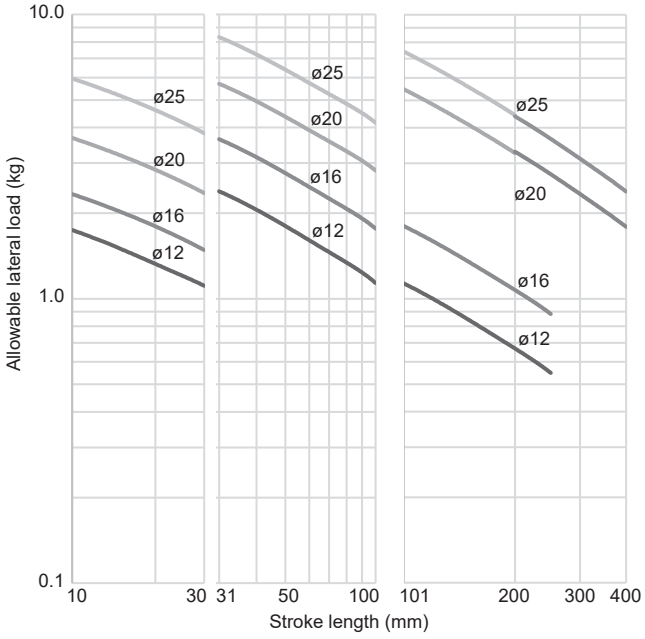
Allowable lateral load Ball bearing



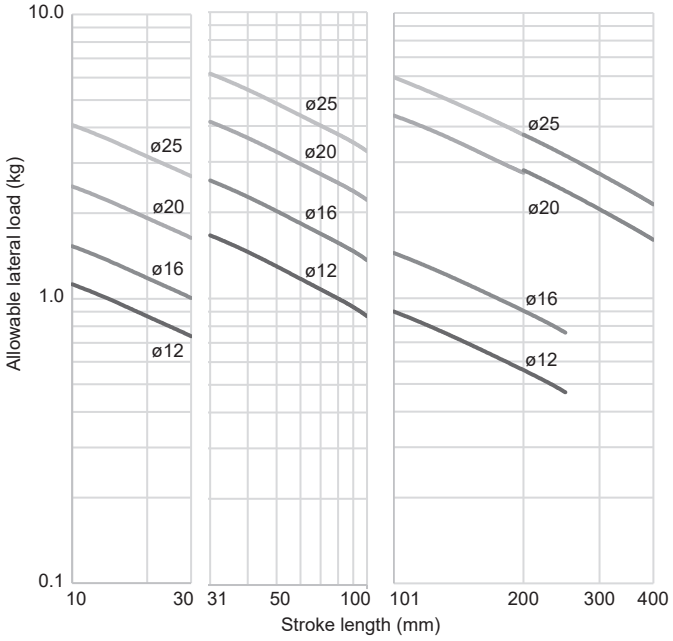
Wmax: Lateral load (kg)
L: Load center of gravity position (mm)

STG-B-12 to 25

● When L = 50 mm

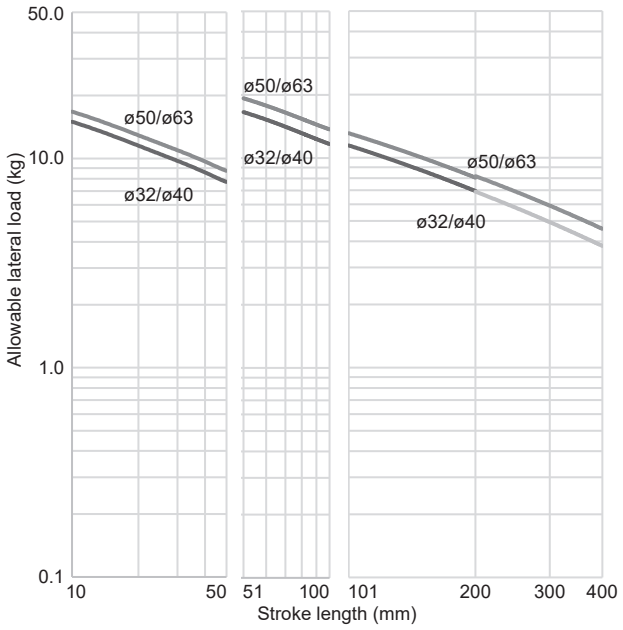


● When L = 100 mm

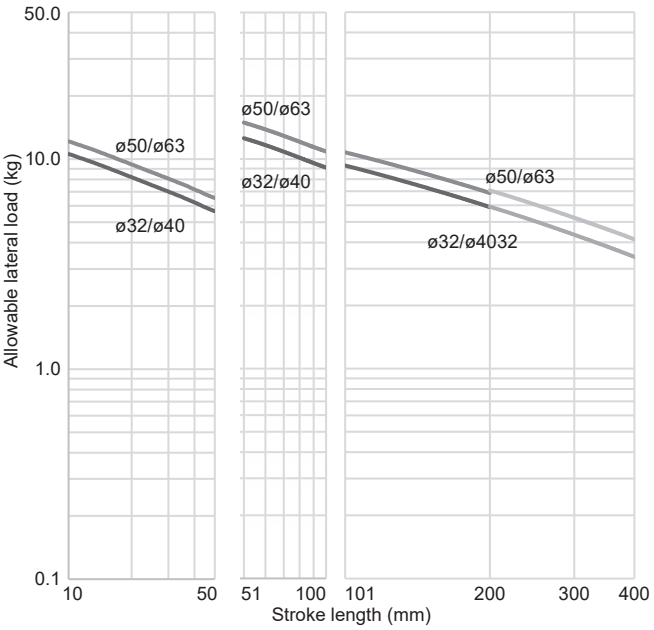


STG-B-32 to 63

● When L = 50 mm

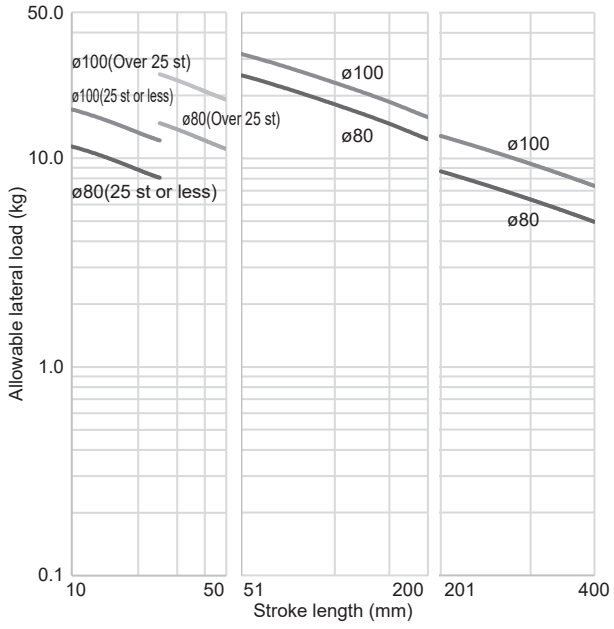


● When L = 100 mm

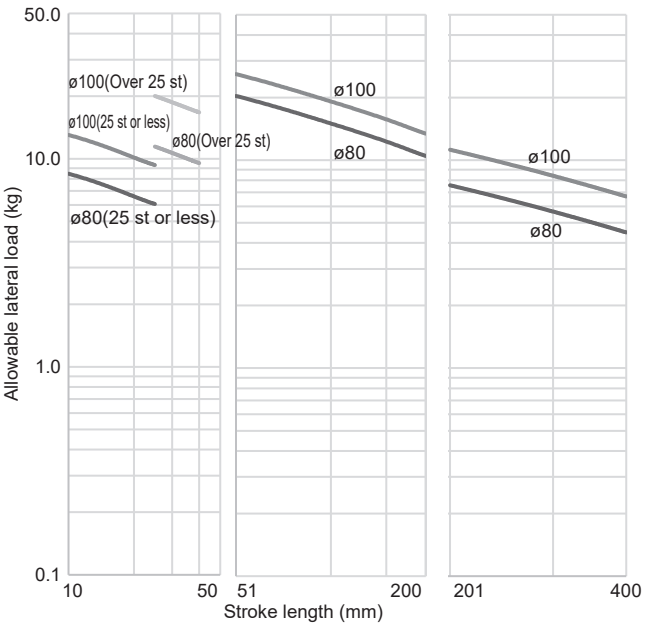


STG-B-80/100

● When L = 50 mm



● When L = 100 mm



Selection guide

■ Movable part weight table

● STG-M movable part weight table

Unit: kg

Bore size (mm)	Stroke (mm)															
	10	20	25	30	40	50	75	100	125	150	175	200	250	300	350	400
ø12	0.12	0.13		0.14	0.15	0.16	0.20	0.23	0.27	0.30	0.32	0.35	0.40			
ø16	0.16	0.18		0.19	0.21	0.22	0.29	0.33	0.41	0.45	0.49	0.53	0.62			
ø20		0.33		0.35	0.38	0.40	0.52	0.58	0.64	0.70	0.76	0.82	1.00	1.13	1.24	1.35
ø25		0.52		0.56	0.60	0.64	0.84	0.95	1.05	1.15	1.25	1.34	1.66	1.87	2.06	2.26
ø32			1.07			1.23	1.42	1.58	1.74	1.90	2.07	2.23	2.73	3.06	3.40	3.71
ø40			1.14			1.30	1.49	1.65	1.81	1.98	2.14	2.30	2.82	3.13	3.47	3.78
ø50			2.15			2.40	2.75	3.00	3.26	3.51	3.76	4.02	4.85	5.37	5.88	6.38
ø63			2.50			2.75	3.09	3.35	3.60	3.86	4.11	4.36	5.19	5.70	6.21	6.72
ø80			3.76			3.99	4.38	4.61	4.84	5.08	5.31	5.54	6.29	6.76	7.23	7.69
ø100			6.56			7.08	7.96	8.48	8.99	9.50	10.01	10.53	12.17	13.19	14.22	15.24

● STG-B movable part weight table

Unit: kg

Bore size (mm)	Stroke (mm)															
	10	20	25	30	40	50	75	100	125	150	175	200	250	300	350	400
ø12	0.11	0.11		0.12	0.13	0.14	0.16	0.17	0.20	0.22	0.23	0.25	0.29			
ø16	0.15	0.16		0.17	0.20	0.21	0.24	0.27	0.32	0.35	0.38	0.41	0.47			
ø20		0.31		0.33	0.37	0.39	0.44	0.48	0.56	0.60	0.65	0.70	0.80	0.90	1.00	1.09
ø25		0.49		0.52	0.58	0.61	0.69	0.76	0.88	0.95	1.02	1.10	1.28	1.44	1.58	1.72
ø32			0.82			0.94	1.11	1.23	1.40	1.53	1.65	1.77	2.07	2.30	2.54	2.78
ø40			0.89			1.01	1.18	1.30	1.48	1.60	1.72	1.83	2.14	2.38	2.61	2.84
ø50			1.77			1.95	2.24	2.45	2.71	1.89	3.08	3.27	3.76	4.13	4.50	4.87
ø63			2.11			2.30	2.59	2.77	3.05	3.25	3.43	3.61	4.11	4.48	4.84	5.21
ø80			3.54			3.81	4.12	4.31	4.50	4.69	4.88	5.07	5.58	5.97	6.35	6.73
ø100			6.21			6.91	7.69	8.10	8.51	8.93	9.34	9.75	10.83	11.65	12.48	13.30