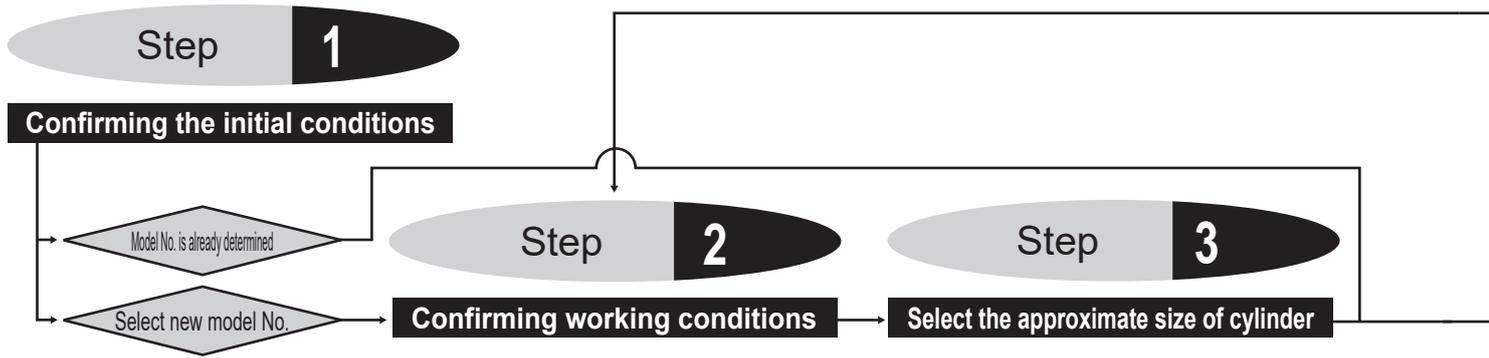


As the selection conditions are different from those of general air cylinders, confirm whether the model is adequate or not according to selection guide.



Step 2 Confirming working conditions

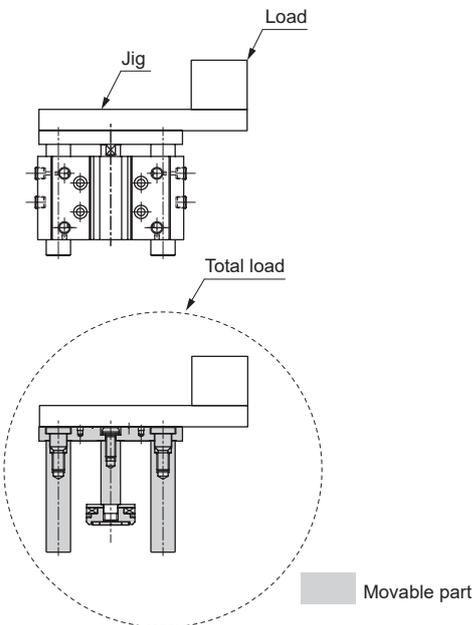
1. Working pressure P (MPa)
2. Total applied load W (N)

[Total applied load]

When determining the total applied load, take into account the weight of the movable part weight of the cylinder body.
 $W = (\text{Applied load}) + (\text{Jig load}) + (\text{weight of movable part: } Fa)$.
 Calculate the weight of the movable part by using the value in movable part weight table on page 230.

$$Fa = Ma \times 10$$

Ma: Movable part weight (kg)
 Fa: Weight of movable part (N)



3. Mounting orientation

[Actuation]

Horizontal, vertical-rise, vertical-decline

4. Stroke length L (mm)
5. Operation time t (s)
6. Operation speed V (mm/s)

Formula of the cylinder's average operation speed Va

$$Va = L / t \text{ (mm/s)}$$

Step 3 Select the approximate size of cylinder

- Formula for calculating cylinder size (bore size)

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

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

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 \geq Applied load \times 2
 (" \times 2" in "Applied load \times 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 is 25 (N) \times 2 = 50 (N)

When selecting the tube bore size with theoretical thrust of 50 N and over at working pressure of 0.5 MPa from Table 1, it will be ϕ 12 and over.

$$D = \phi 12$$

[Cylinder theoretical thrust]

Table 1. Cylinder theoretical thrust table

Theoretical thrust table ϕ 12, ϕ 16 Unit: N

Actuation direction	Pressure MPa	Bore size mm	
		ϕ 12	ϕ 16
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 216 for theoretical thrust table.

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder Switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R. (module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

Step 4

Calculate the total applied load (W) and each moment

To the next page

Step 4 Calculate the total applied load (W) and each moment

- Calculate the static load (W₀) and the moment (m) of the load, which is dependent on how the cylinder is mounted.

$$W_0 = (\text{Applied load}) + (\text{Jig load}) \text{ (N)}$$

$$M_1 = F_1 \times \ell_1 \text{ (N}\cdot\text{m)}$$

$$M_2 = F_2 \times \ell_2 \text{ (N}\cdot\text{m)}$$

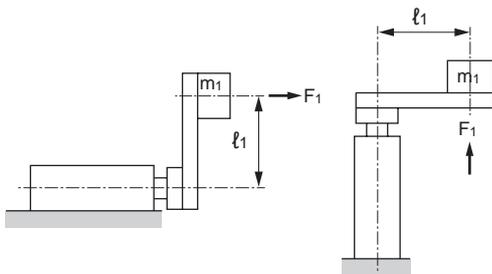
$$M_3 = F_3 \times \ell_3 \text{ (N}\cdot\text{m)}$$

For values of F₁, F₂ and F₃, 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.

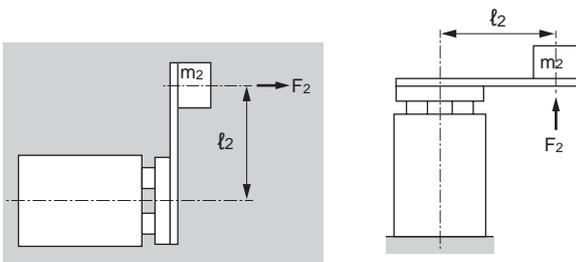
[Bending moment]

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



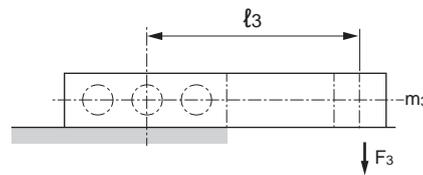
[Radial moment]

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



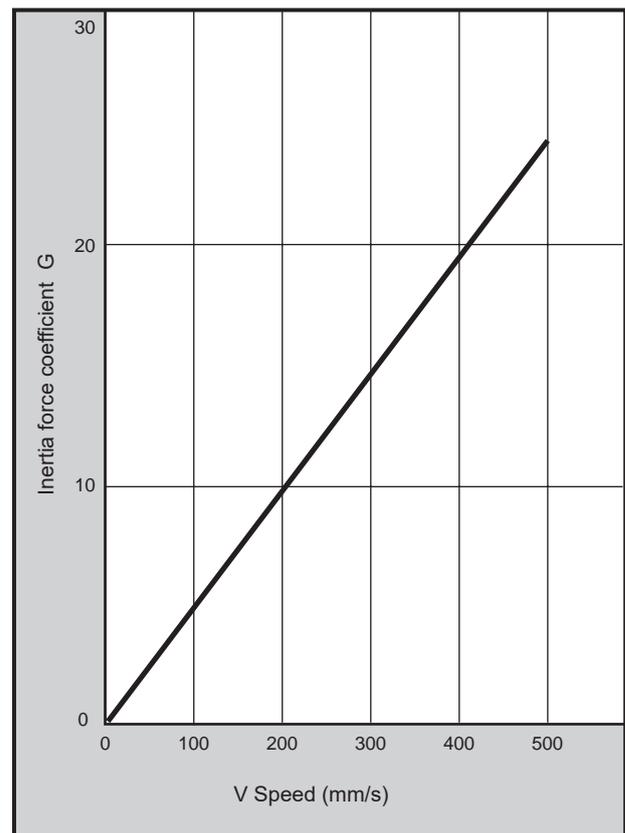
[Torsion moment]

$$M_3 = F_3 \times \ell_3 = 10 \times m_3 \times \ell_3$$

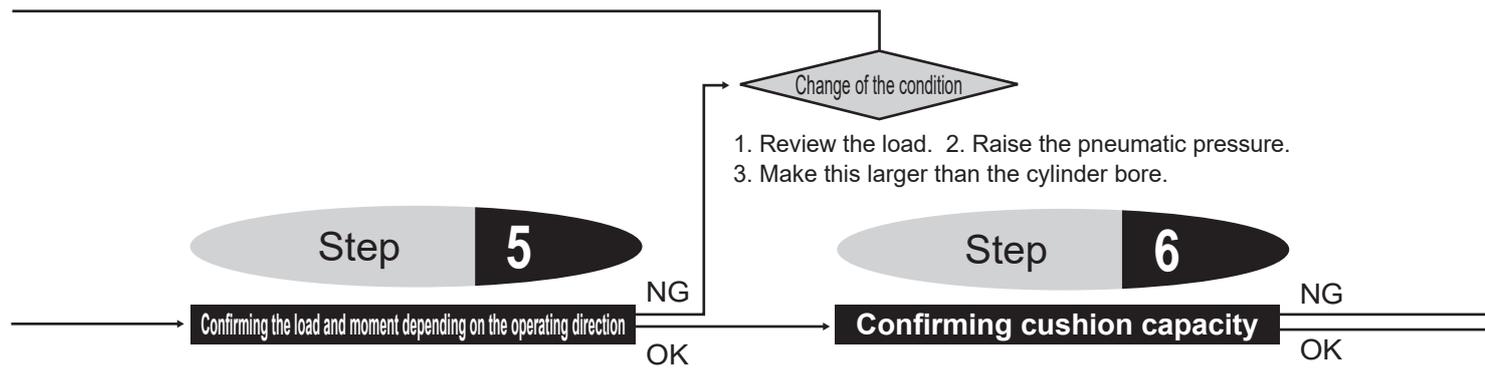


- m₁: }
- m₂: } Load weight (kg)
- m₃: }
- ℓ₁: }
- ℓ₂: } Eccentric distance (m)
- ℓ₃: }
- G: Inertia force coefficient (Fig. 3)

Fig. 3. Trend of inertia force coefficient for guided cylinder



SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder switch
MN3E
MN4E
4GA/B
M4GA/B
MN4GA/B
F.R (module unit)
Clean F.R
Precision R
Press gauge
Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending



Step 5 Confirming the load and moment depending on the operating direction

5-1 Confirming applied load

1 For horizontal operation

The value of applied static load must be the allowable load or less.
 Applied static load W_0 Value obtained in Step 4
 Allowable lateral load W_{max} Select from Table 2 or graph according to the stroke length (when using custom stroke length, select the longer standard stroke length)
 $W_0 \leq W_{max}$

Table 2. Allowable lateral load Unit: N

Bore size (mm)	Stroke length (mm)			
	10	20	25	30
$\phi 12$	38	27		22
$\phi 16$	49	35		29
$\phi 20$		52		42
$\phi 25$		81		66
$\phi 32$			171	

* Refer to page 230 for allowable lateral load. When using an eccentric load, refer to the graph on page 232.

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 Select from the theoretical thrust table on page 216 depending on the pressure

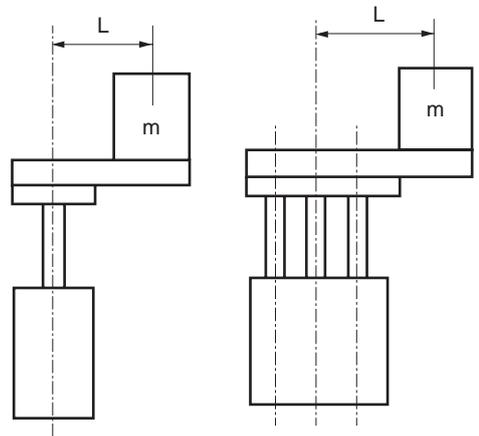
$$\alpha = W/F \times 100 (\%)$$

● 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	$\alpha \leq 40$
0.3 to 0.6	$\alpha \leq 50$
0.6 to 1.0	$\alpha \leq 60$

● 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 228 and 229



5-2 Confirming the 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 } Value obtained
 Radial moment M_2 } in Step 4

$$M_1 / M_{1max} + M_2 / M_{2max} \leq 1.0$$

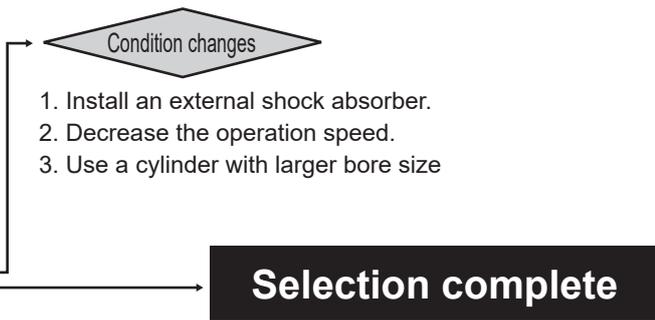


Table 4. Allowable moment (N·m)

Bore size (mm)	Allowable bending moment M1, M2 (N·m)
ø12	7.0
ø16	11.2
ø20	19.2
ø25	35.3
ø32	51.9
ø40	51.9
ø50	171.5
ø63	171.5

- 2 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 length, select the longer standard stroke length)

$$M_3 \leq M_{3max}$$

Table 5. Allowable torque (N·m)

Bore size (mm)	Stroke length (mm)		
	10	20	25
ø12	0.39	0.28	
ø16	0.56	0.41	
ø20		0.70	
ø25		1.29	
ø32			3.33
ø40			3.68
ø50			4.99
ø63			5.63

* Refer to page 230 for allowable torque.

Step 6 CONFIRMING CUSHION FACULTY

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 the kinetic energy of load

$$E = \frac{1}{2} \times (W1 + W2) \times V^2$$

W1: Applied load (kg)

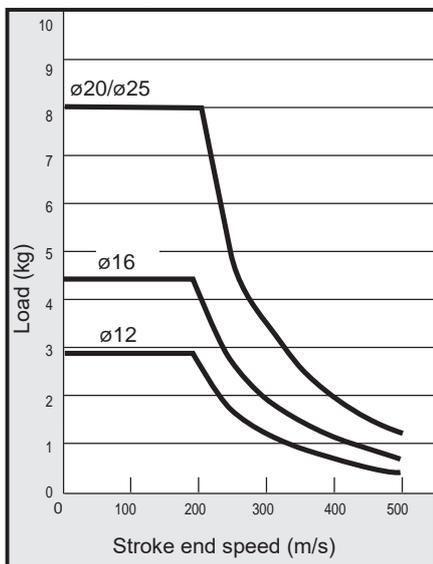
W2: Movable part weight of cylinder (kg)

V: Cylinder speed (m/s)

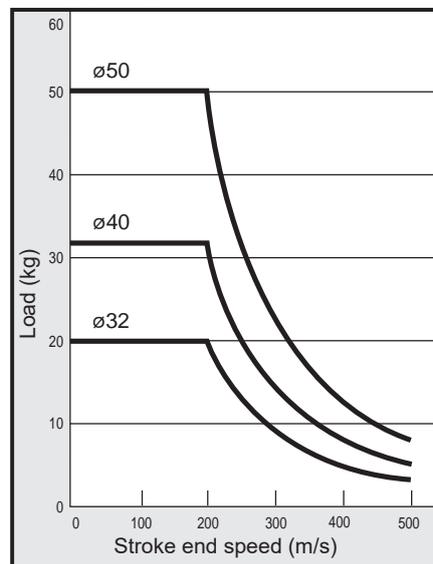
Allowable absorbed energy value

Use the product in the range of the lower-left side of the curve. For use in the upper right range, provide an external shock absorber.

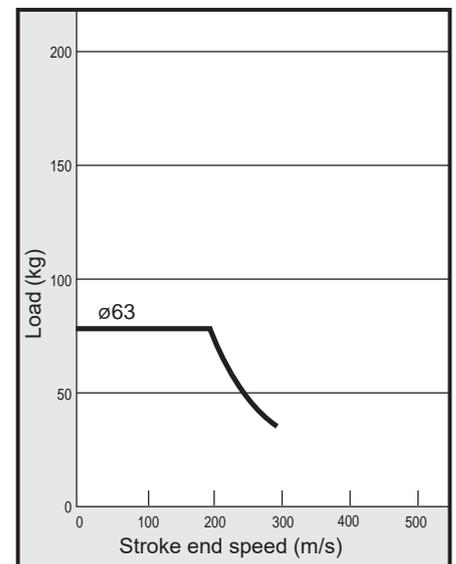
- STG-12 to 25



- STG-32 to 50



- STG-63



- SCPD3
- SCM
- SSD2
- MDC2
- SMG
- LCM
- LCR
- LCG
- LCX
- STM
- STG**
- STR2
- MRL2
- GRC
- Cylinder Switch
- MN3E MN4E
- 4GA/B
- M4GA/B
- MN4GA/B
- F.R. (module unit)
- Clean F.R
- Precision R
- Press gauge Diff. press gauge
- Electro-pneumatic R
- Speed controller
- Auxiliary valve
- Fitting/ tube
- Clean air unit
- Pressure sensor
- Flow rate sensor
- Valve for air blow
- Ending

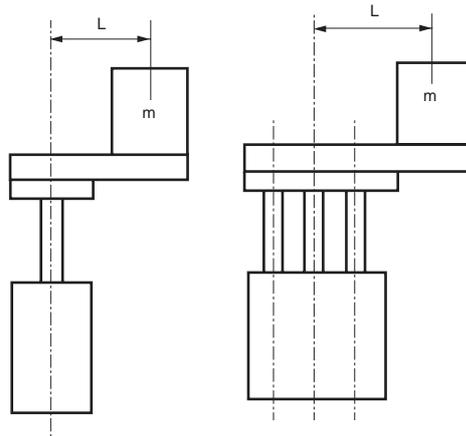
Selection guide

- SCPD3
- SCM
- SSD2
- MDC2
- SMG
- LCM
- LCR
- LCG
- LCX
- STM
- STG**
- STR2
- MRL2
- GRC
- Cylinder switch
- MN3E
MN4E
- 4GA/B
- M4GA/B
- MN4GA/B
- F.R (module unit)
- Clean F.R
- Precision R
- Press gauge
Diff. press gauge
- Electro-pneumatic R
- Speed controller
- Auxiliary valve
- Fitting/tube
- Clean air unit
- Pressure sensor
- Flow rate sensor
- Valve for air blow
- Ending

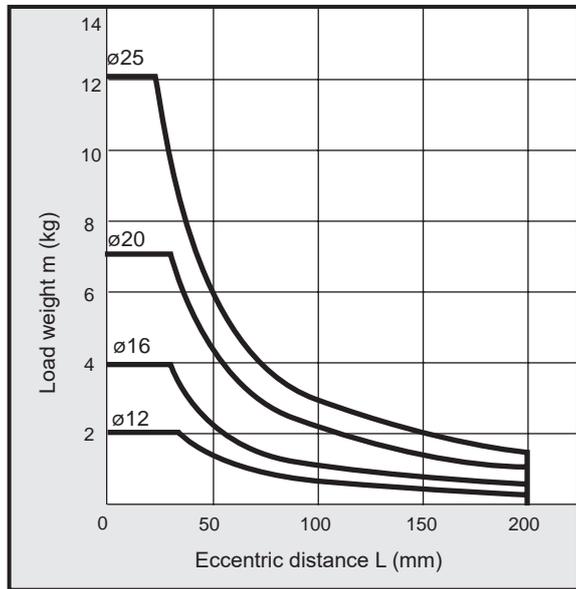
In case of vertical installation

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

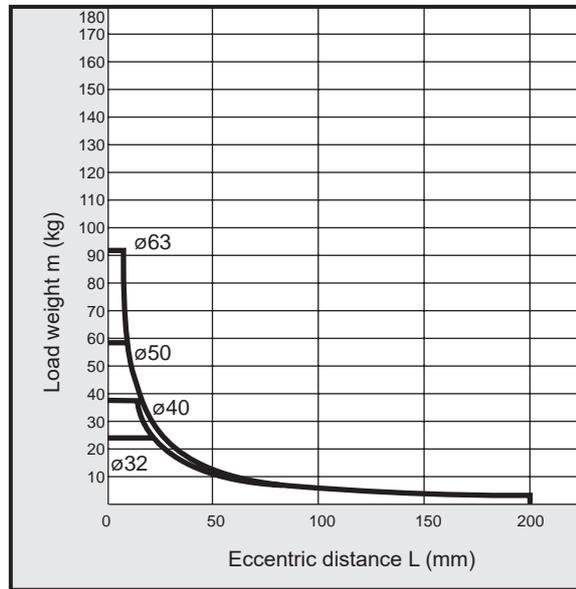
Bore size	Load factor for the theoretical thrust
12, 16	40% or less
20, 25	50% or less
32 to 80	60% or less
100	60% or less



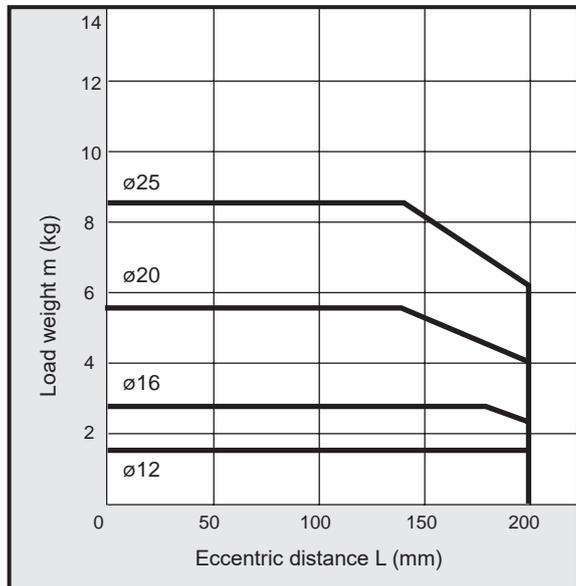
● STG-B-12 to 25
• Stroke length of 30 mm or less



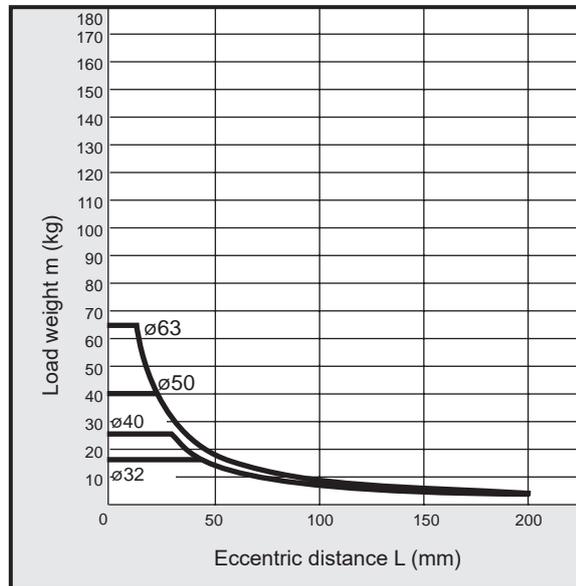
● STG-B-32 to 63
• Stroke length of 50 mm or less



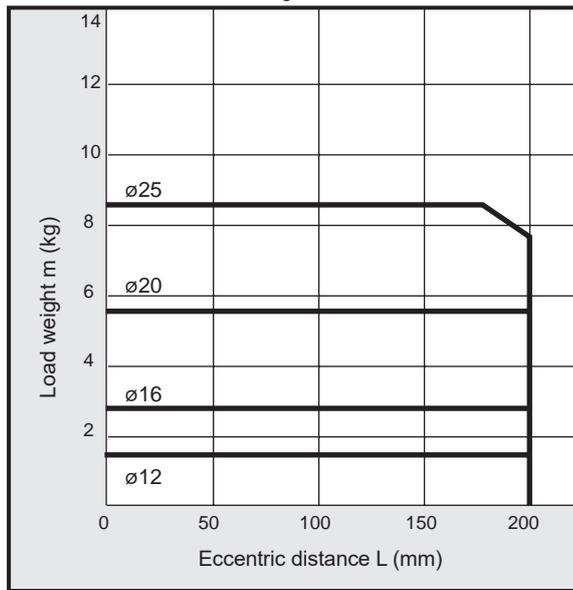
● STG-B-12 to 25
• Over 30 mm to 100 mm stroke length



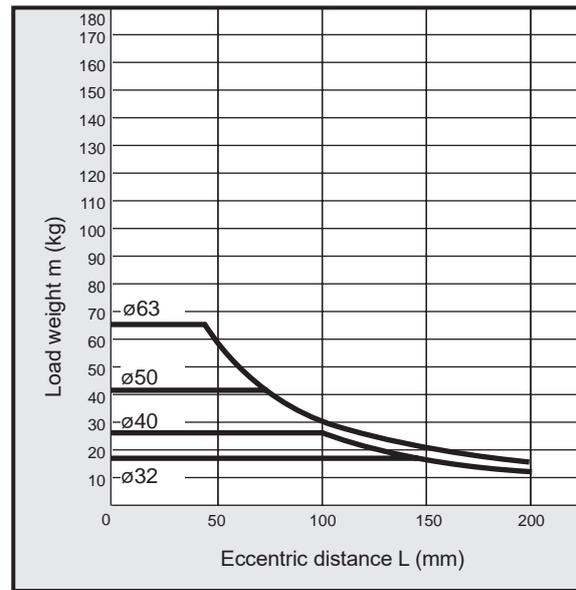
● STG-B-32 to 63
• Over 50 mm to 100 mm stroke length • Over 50 mm to 200 mm stroke length



● STG-B-12 to 25
• Over 100 mm stroke length

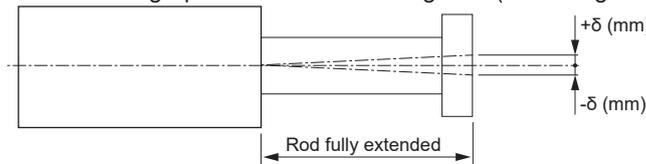


● STG-B-32 to 63
• Over 100 mm stroke length • Over 200 mm stroke length

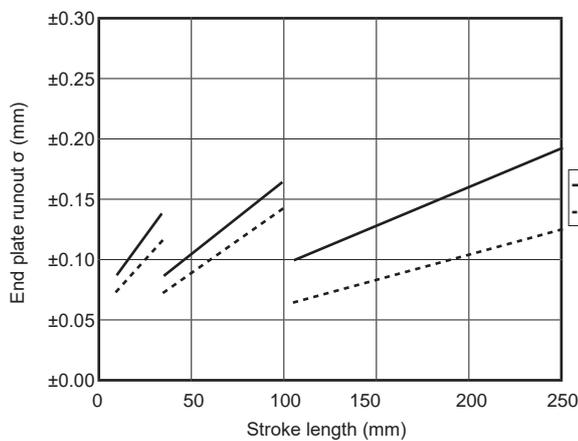


Deflection

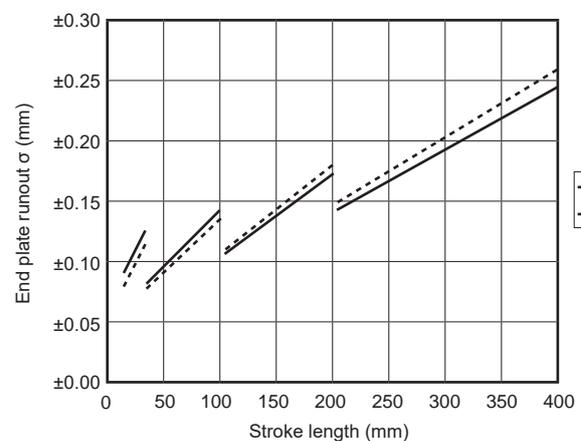
For the runout amount δ that is produced at the end of the end plate when no load is applied, the value in the graph below is used as a guide. (Excluding deflection of guide rod)



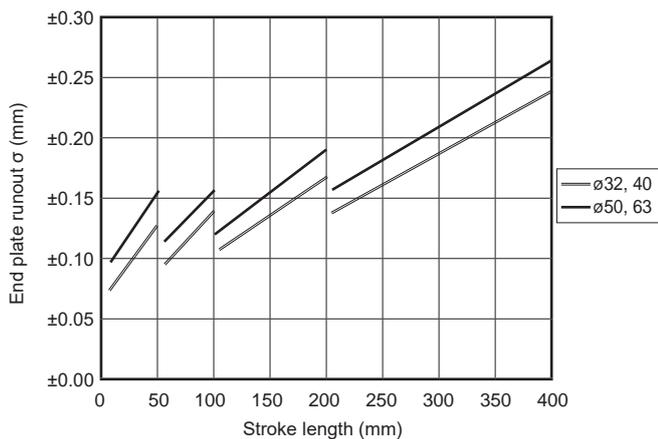
● ø12, ø16



● ø20 to ø40



● ø50 to ø63

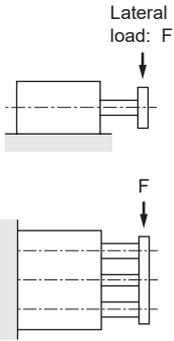


SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder Switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R. (module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

Selection guide

Unit: N

Allowable lateral load

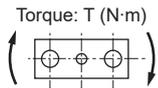


Bore size (mm)	Stroke length (mm)							
	10	20	25	30	40	50	75	
ø12	38	27		22	34	29	21	
ø16	49	35		29	50	43	31	
ø20		52		42	76	65	49	
ø25		81		66	108	94	70	
ø32			171			120	190	
ø40			171			120	190	
ø50			181			129	215	
ø63			181			129	215	

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

Unit: N·m

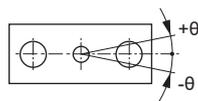
Allowable torque



Bore size (mm)	Stroke length (mm)							
	10	20	25	30	40	50	75	
ø12	0.39	0.28		0.23	0.35	0.30	0.21	
ø16	0.56	0.41		0.33	0.58	0.50	0.36	
ø20		0.70		0.57	1.02	0.88	0.66	
ø25		1.29		1.06	1.74	1.50	1.13	
ø32			3.33			2.34	3.70	
ø40			3.68			2.58	4.08	
ø50			4.99			3.56	5.90	
ø63			5.63			4.01	6.66	

Non-rotating accuracy

(reference value)



Unit: kg

Movable part weight table

Bore size (mm)	Stroke length (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

Unit: N

Stroke length (mm)									
	100	125	150	175	200	250	300	350	400
	16	12	11	9	8	6			
	25	20	17	15	13	10			
	38	60	51	44	39	32	27	23	20
	56	81	69	60	53	42	36	30	27
	159	123	106	93	83	66	56	48	42
	159	123	106	93	83	66	56	48	42
	181	139	121	106	95	78	67	58	50
	181	139	121	106	95	78	67	58	50

Unit: N·m

Stroke length (mm)									
	100	125	150	175	200	250	300	350	400
	0.17	0.13	0.11	0.09	0.08	0.07			
	0.28	0.23	0.19	0.17	0.15	0.12			
	0.52	0.80	0.69	0.60	0.53	0.43	0.36	0.31	0.27
	0.90	1.29	1.11	0.96	0.85	0.68	0.57	0.49	0.42
	3.10	2.40	2.07	1.82	1.61	1.29	1.09	0.94	0.82
	3.42	2.65	2.28	2.00	1.78	1.43	1.20	1.03	0.90
	4.99	3.83	3.32	2.93	2.61	2.16	1.83	1.58	1.39
	5.62	4.32	3.75	3.30	2.94	2.43	2.06	1.78	1.57

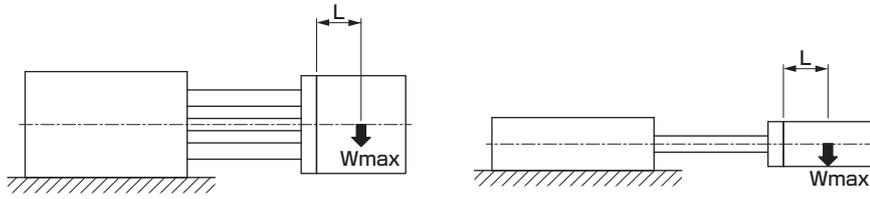
Descriptions	Non-rotating accuracy θ (degree)
Bore size (mm)	
$\phi 12$	± 0.06
$\phi 16$	
$\phi 20$	
$\phi 25$	± 0.05
$\phi 32$	
$\phi 40$	± 0.04
$\phi 50$	
$\phi 63$	
	± 0.03

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

- SCPD3
- SCM
- SSD2
- MDC2
- SMG
- LCM
- LCR
- LCG
- LCX
- STM
- STG**
- STR2
- MRL2
- GRC
- Cylinder Switch
- MN3E
MN4E
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- M4GA/B
- MN4GA/B
- F.R. (module unit)
- Clean F.R
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- Press gauge
Diff. press gauge
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- Auxiliary valve
- Fitting/tube
- Clean air unit
- Pressure sensor
- Flow rate sensor
- Valve for air blow
- Ending

- SCPD3
- SCM
- SSD2
- MDC2
- SMG
- LCM
- LCR
- LCG
- LCX
- STM
- STG**
- STR2
- MRL2
- GRC
- Cylinder switch
- MN3E
MN4E
- 4GA/B
- M4GA/B
- MN4GA/B
- F.R (module unit)
- Clean F.R
- Precision R
- Press gauge
Diff. press gauge
- Electro-pneumatic R
- Speed controller
- Auxiliary valve
- Fitting/
tube
- Clean air unit
- Pressure sensor
- Flow rate sensor
- Valve for air blow
- Ending

Allowable lateral load

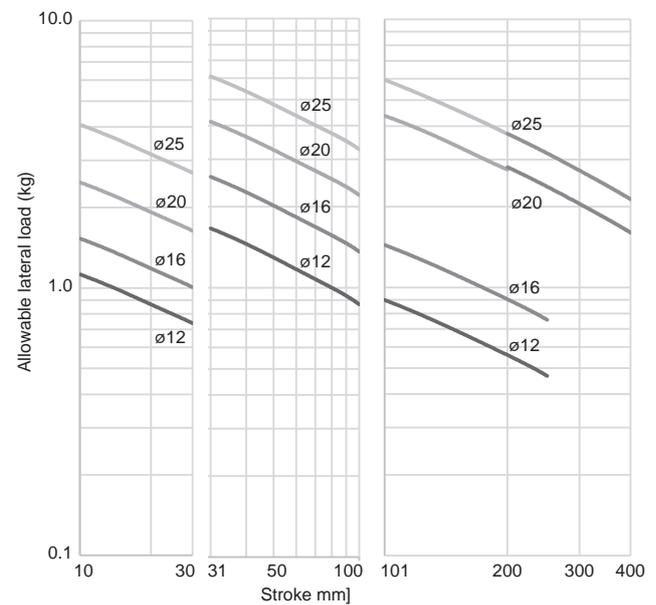
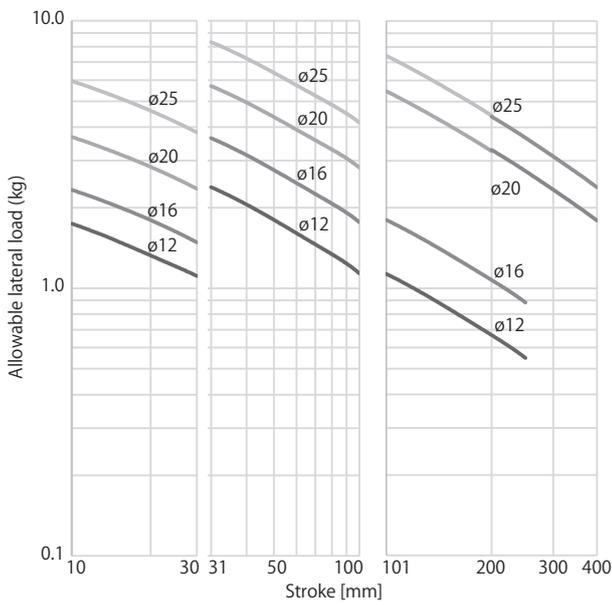


Wmax: Lateral load (kg)
L: Position of center of gravity of load (mm)

STG-B-12 to 25

● For L=50mm

● For L=100mm



STG-B-32 to 63

● For L=50mm

● For L=100mm

