MRL2 Series selection guide

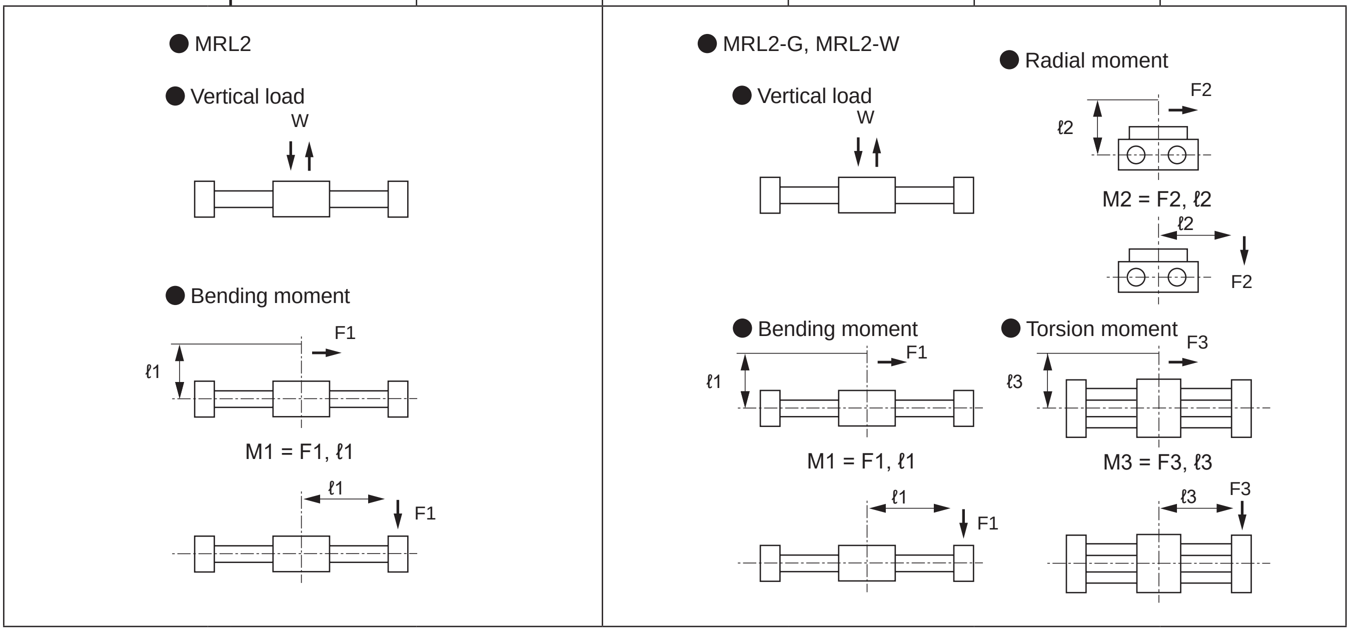
STEP-1 Determination of allowable load

(1) Calculate all load (W) and moment (M1, M2, M3) per load.
(2) Divide each load by the max. value shown in the table below to find load/moment ratio, and confirm that the total is 1.0 or less.

$$\frac{W}{Wmax} + \frac{M1}{M1max} + \frac{M2}{M2max} + \frac{M3}{M3max} \leq 1.0$$

Max. allowable load weight

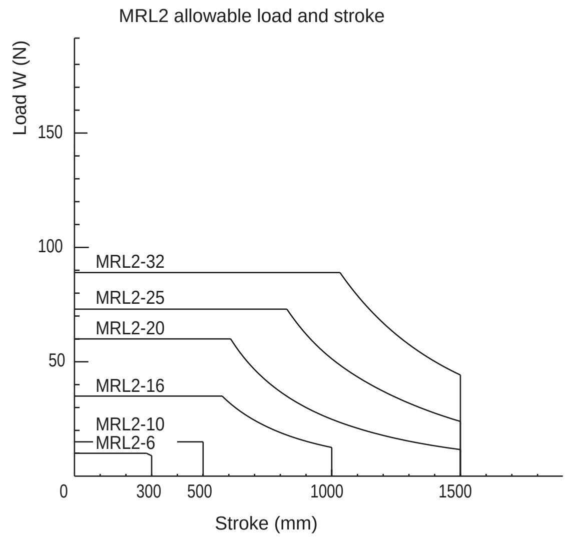
Descriptions / Bore size (mm)	MRL2		MRL2-G/MRL2-W			
	Vertical load W (N)	Bending moment M1 (N·m)	Vertical load W (N)	Bending moment M1 (N·m)	Radial moment M2 (N·m)	Torsion moment M3 (N·m)
ø6	10	0.1	20	0.2	0.1	0.2
ø10	15	0.3	30	0.6	0.2	0.6
ø16	35	1.2	70	2.4	0.5	2.4
ø20	60	2.5	120	5.0	1.0	5.0
ø25	73	3.3	146	6.6	3.7	6.6
ø32	89	4.5	178	9.0	5.3	9.0

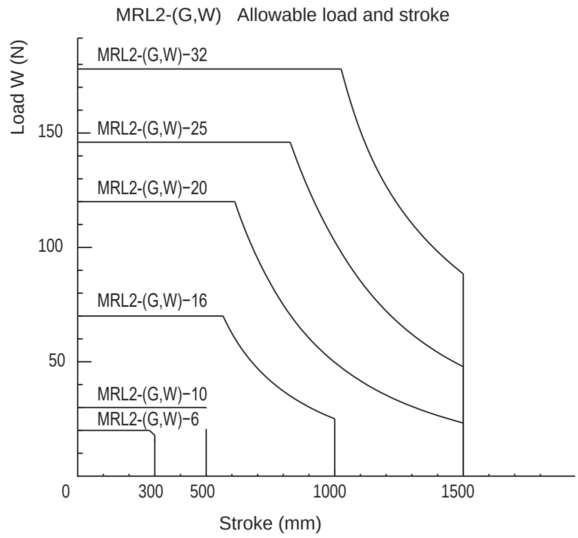


Note: Give sufficient consideration to inertia when the load moves or stops.

The value of the allowable vertical load W will vary depending on the stroke. Select so that the value falls within the graph of Fig 1.

Fig. 1 stroke and allowable vertical load relationship



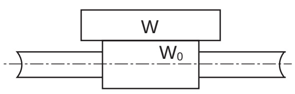
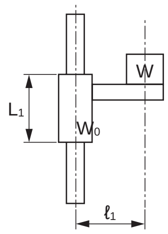
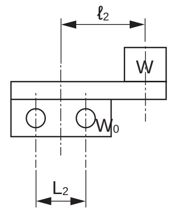
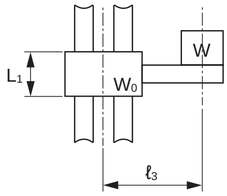


SCP*3
CMK2
CMA2
SCM
SCG
SCA2
SCS2
CKV2
CAV2/COVP/N2
SSD2
SSG
SSD
CAT
MDC2
MVC
SMG
MSD/MSDG
FC*
STK
SRL3
SRG3
SRM3
SRT3
MRL2
MRG2
SM-25
ShkAbs
FJ
FK
Spd Contr
Ending

STEP-2 Calculation of load factor

1. Depending on the size and direction of the load as well as the mounting orientation, calculate the required thrust with Tables 2 and 3 below as guidelines.

Table 2

	Vertical load	Bending moment	Radial moment	Torsion moment
Size and direction of load				
Mounting orientation	Horizontal	Vertical	Horizontal	Vertical
Required thrust	$F_N=0.2\ (W+W_0)$	$F_N=\dfrac{0.2\ W\ell_1}{L_1}+W+W_0$	$F_N=0.2\left(\dfrac{W\ell_2}{L_2}+W+W_0\right)$	$F_N=\dfrac{0.2\ W\ell_3}{L_1}+W+W_0$

As the slider rotates with the single, radial moment and torsion moment cannot be applied.

F_N : Required thrust (N)
W : Load (N)
W_0 : Slider self-weight (N)
ℓ_n (n = 1, 2, 3): Overhang (mm)
L_1 : Slider bearing pitch (mm)
L_2 : Pitch of guide (mm)

Table 3

Model No.	W_0	L_1	L_2
MRL2-6	0.4	27	-
10	0.6	27	-
16	1.2	39	-
20	2.4	58	-
25	3.8	70	-
32	5.2	78	-
MRL2-$\frac{G}{W}$-6	0.9	27	26
10	1.7	27	34
16	3.0	39	38
20	5.9	58	46
25	8.5	70	50
32	11.9	78	60

2. Calculate the load factor from the required thrust calculated in 1 and ■ Table 4, Fig. 2. (Make sure that the load factor is less than or equal to approximately 50%.)

$$\text{Load factor } \alpha = \frac{F_N}{\frac{a}{100}\cdot A} \times 100$$

$$B = \frac{a}{100}\cdot A$$

F_N: Required thrust (N)
A : Theoretical thrust (N)
a: Thrust efficiency (%)
B: Effective thrust (N)

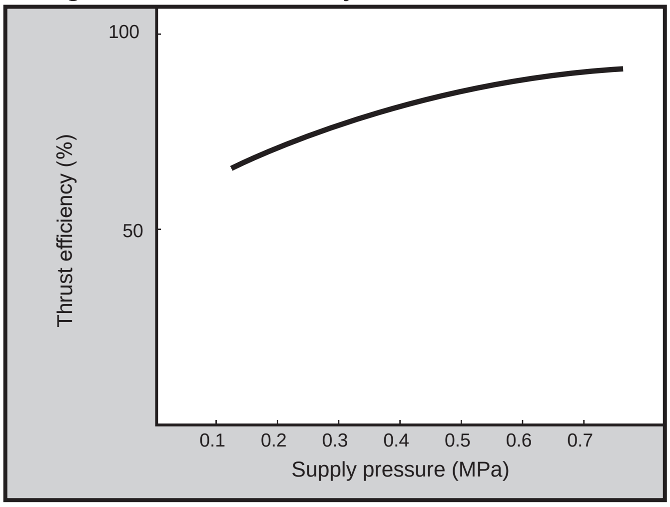
Table 4 Theoretical thrust table

N

Indicator code						
Model No.	Working pressure MPa					
	0.2	0.3	0.4	0.5	0.6	0.7
MRL2,MRL2-G-6	-	8	11	14	17	20
10	-	24	31	39	47	55
16	40	60	80	101	121	141
20	63	94	126	157	188	220
25	98	147	196	245	295	344
32	161	241	322	402	483	563
MRL2-W-6	-	17	23	28	34	40
10	-	47	63	79	94	110
16	80	121	161	201	241	281
20	126	188	251	314	377	440
25	196	295	393	491	590	687
32	322	483	643	804	966	1130

* Note that the difference between effective thrust and theoretical thrust will be greater with a lower pressure due to the thrust efficiency being lower.

Fig. 2 Thrust efficiency



STEP-3 Formula for kinetic energy calculation

Calculate the kinetic energy from the load weight (m) and speed (V) and make sure that this is less than or equal to the allowed value listed in ■ Table 5.
When exceeding the allowable absorbed energy value, increase the cylinder size so that the value falls under the allowable absorbed energy or consider the use of an external shock absorber.
This speed is the velocity just before cushion entry and not the average speed, if it is unknown, calculate the cushion entry velocity by using formula (1).

$$E=\frac{1}{2}mV^2$$

$$Va=\frac{L}{t}$$

$$V=Va \times \left(1+1.5\frac{\alpha}{100}\right) \qquad (1)$$

E : Kinetic energy (J)
m : Weight (kg)
V : Cushion entry velocity (m/s)
Va: Average speed (m/s)
L : Stroke (m)
t : Travel time (s)
α : Load factor (%)

Table 5 Allowable absorbed energy value

Bore size	Allowable absorbed energy (J)	
	MRL2	MRL2-G/W
ø6	0.006	0.12
ø10	0.028	0.12
ø16	0.100	0.25
ø20	0.265	0.58
ø25	0.283	0.74
ø32	0.523	0.74

Shock absorber specifications

Bore size	Max. absorbed energy (J)	Stroke (mm)
ø6	0.24	4
ø10	0.24	4
ø16	0.80	5.5
ø20	2.11	7.5
ø25	3.88	9.5
ø32	3.88	9.5

SCP*3
CMK2
CMA2
SCM
SCG
SCA2
SCS2
CKV2
CAV2/ COVP/N2
SSD2
SSG
SSD
CAT
MDC2
MVC
SMG
MSD/ MSDG
FC*
STK
SRL3
SRG3
SRM3
SRT3
MRL2
MRG2
SM-25
ShkAbs
FJ
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STEP-4 Confirmation of inertia load

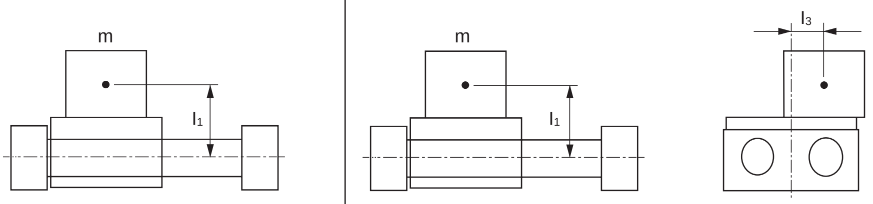
Confirm that the weight (m), overhang (l_n (n = 1, 3)), and cushion entry velocity (V) multiplied together and then divided by the value of A shown in the table below is less than or equal to 1.
When this value exceeds 1, increase the cylinder size so that this value becomes 1 or less or review the usage conditions.

Bore size	A	
	MRL2	MRL2-G/W
ø6	5.6	11.2
ø10	17	34
ø16	68	136
ø20	142	284
ø25	187	374
ø32	255	510

m : Weight (kg)
l_n (n=1,3) : Overhang (mm)
V : Cushion entry velocity (m/s)

● MRL2

● MRL2-G,MRL2-W



$$\frac{m \cdot l_1 \cdot V}{A} \leq 1$$

$$\frac{m \cdot (l_1 + l_3) \cdot V}{A} \leq 1$$