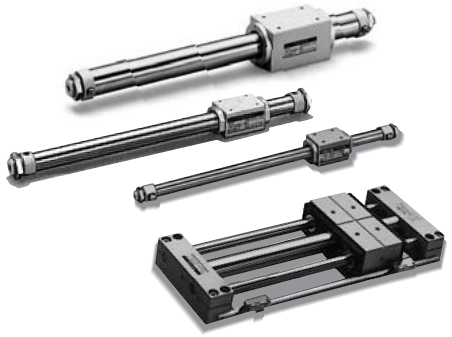
Space-saving non-lubrication type magnetic rod-less cylinders

- Large holding force
- Requiring about half the installation space of conventional cylinder
- Separable type convenient for maintenance
- Installation in any of vertical and horizontal directions
- Guided cylinders come in two types of guide structure, general purpose and high-accuracy types.
- No lubrication (Cylinders with stroke of 1,000 mm or more must be lubricated.)



Cylinder Specifications

Model		Standard type	With guide	
Type		Standard type	Standard type	Switch Set
Cylinder bore (mm)		ϕ10·ϕ16·ϕ20·ϕ25·ϕ32·ϕ40		
Working fluid		Air		
Lubrication		Unnecessary (Cylinders with strokes of 1000 mm or more must be lubricated.)		
Working pressure range	H	0.15 to 0.7 MPa	0.2 to 0.7 MPa	
	M	0.15 to 0.45 MPa	0.2 to 0.45 MPa	
Proof test pressure		1.03 MPa		
Working speed range		100 to 500 mm/s		
Working temperature range (Ambient/fluid temperature)		−10 to +70℃ (No freezing)		
Structure of cushioning		ϕ10 to ϕ25 :With shock absorbing pad ϕ32·ϕ40 :With cushions on both ends	—	
Tolerance for thread		JIS 6H/6g		
Installing direction		Free		
Guide type		—	●General purpose type (slide bearing) ●High-accuracy type (linear bearing)	
Accessory		—	●With shock absorber	

- Cylinders with bores of 10, 16 and 20 mm come only in H type.
- In the case of a Switch Set Cylinder, when the sensor is installed at the intermediate position, the cylinder max. speed must be less than 300 mm/s for reasons of the response speed of the load relay.
  (Note) Cylinders with stroke of 1000 mm or more must be lubricated.

Specifications for Cylinders with Shock Absorber

Item \ Bore	ϕ10·ϕ16	ϕ20·ϕ25	ϕ32·ϕ40
Model number	A2M12N010	A2M16N012	A2M20N016SD
Stroke (mm)	10	12	16
Max. absorbed energy J	2.94	7.85	25.5
Max. equivalent weight	30 kg	50 kg	200 kg
Max. energy capacity per min J/min	98.1	235	343

- With absorbed energy adjusting mechanism

Stroke Range

Unit: mm

Bore \ Stroke	Possible stroke range
ϕ10	50 to 500
ϕ16	50 to 1000
ϕ20	50 to 1500
ϕ25·ϕ32·ϕ40	50 to 1800

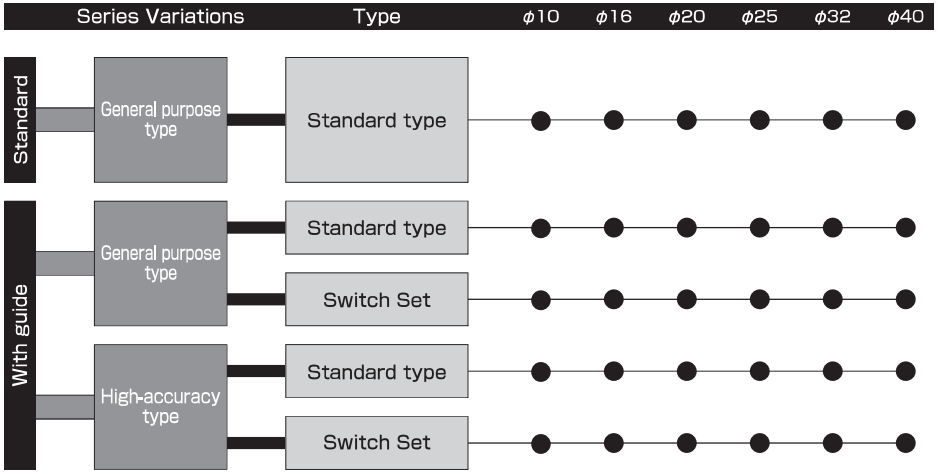
Magnetic holding force

Unit: N

Cylinder bore (mm)	ϕ10	ϕ16	ϕ20	ϕ25	ϕ32	ϕ40
H type	53.9	147	265	431	637	1030
M type	—	—	—	245	373	608

Product Lineup

Unit: mm



Weight Table

Unit: kg

Bore (mm)	Standard type		With guide										
	Basic weight	Additional weight per mm of stroke	Basic weight			Additional weight per mm of stroke			Additional weight				
	Standard type		Standard type	With sensor		Standard type	With sensor		Shock absorber	G/H type sensor		SR type sensor	
				G/H type	SR type		G/H type	SR type		Cord lentgh 1.5 m	Cord lentgh 5 m	Cord lentgh 1.5 m	Cord lentgh 5 m
ϕ10	0.11	0.00027	1.35	1.40	1.37	0.0015	0.0019	0.0016	0.04	0.028	0.087	0.105	0.263
ϕ16	0.25	0.00042	1.91	1.96	1.93	0.0022	0.0026	0.0023	0.04	0.028	0.087	0.105	0.263
ϕ20	0.50	0.00080	3.17	3.23	3.19	0.0040	0.0044	0.0041	0.10	0.028	0.087	0.105	0.263
ϕ25	1.30	0.0010	6.15	6.22	6.17	0.0059	0.0063	0.0060	0.10	0.028	0.087	0.105	0.263
ϕ32	2.10	0.0017	7.34	7.41	7.36	0.0066	0.0070	0.0067	0.19	0.028	0.087	0.105	0.263
ϕ40	3.40	0.0021	12.40	12.49	12.43	0.0098	0.0102	0.0099	0.19	0.028	0.087	0.105	0.263

Note) ●The weight of guided cylinder with sensor shown in the above table does not include the weight of the sensor.

Calculation formula: Cylinder weight (kg)=basic weight+(cylinder stroke (mm)×additional weight per mm of stroke)+(sensor additional weight×sensor quantity)+(shock absorber additional weight+shock absorber quantity)

Calculation example: RL2, guided, bore ϕ32, cylinder stroke 500 mm, 2 pcs of GS101 (cord length 1.5 m), 2 shock absorbers
7.41+(0.0070×500)+(0.028×2)+(0.19×2)=11.346kg

● How to order

● Standard

Standard type RL2 SD 25 H – 300

❶ Model
❷ Mounting style
❸ Cylinder bore
❹ Magnetic holding force
❺ Stroke

Cylinder bore (mm)
ϕ10, ϕ16, ϕ20, ϕ25, ϕ32, ϕ40

Cylinder stroke (mm)

H Strong type
M General purpose type

● With guide

[Standard type]	Standard type	RL2	MG	32	H	300				
	With shock absorber	RL2	MG	32	H	300	–		A	2
[Switch Set]	Standard type	RL2	MG	32	H	300	–	B	2	
	With shock absorber	RL2	MG	32	H	300	–	B	2	A	2

❶ Model
❷ Guide type
❸ Cylinder bore
❹ Magnetic holding force
❺ Stroke
❻ Sensor symbol
❼ Sensor quantity
❽ Shock absorber symbol
❾ Shock absorber quantity

MG General purpose type
HG High-accuracy type

Cylinder bore (mm)
ϕ10, ϕ16, ϕ20, ϕ25, ϕ32, ϕ40

H Strong type
M General purpose type

Cylinder stroke (mm)

Sensor symbol
Note) Select applicable sensors out of the Sensor List.

Sensor quantity (1 or 2)

Blank None
A With shock absorber

Shock absorber quantity (1 or 2)

❗Note on ordering Switch Set
● Sensors are not mounted on cylinders at delivery.

● How to order when not requiring sensor

RL2 MG32H–300– 00

00 : SR type sensor
99 : G∗/H∗ type sensor

(However, a sensor mounting rail is provided.)

Note) The mounting rail and magnet assembly designed for SR type sensor and those designed for GR, GS, HR and HS type sensors are available.

Stroke Range

Bore \ Stroke	Possible stroke range
ϕ10	50 to 500
ϕ16	50 to 1000
ϕ20	50 to 1500
ϕ25·ϕ32·ϕ40	50 to 2000

★Delivery state

● The product will be delivered without shock absorber mounted.

★Semi-standard range

● SR type sensors with improved waterproofness (with 5m long cord) can be fabricated.

Sensor List

Semi-standard

Type	Sensor symbol	Load voltage range	Load current range	Max. sensoring capacity	Protective circuit	Indicating lamp	Wiring method	Cord length	Applicable load
Reed sensor	B GR101	DC: 5 to 50V AC: 5 to 120V	DC: 3 to 40 mA AC: 3 to 20 mA	DC: 1.5 W AC: 2 VA	None	LED (Lights in red when sensing)	0.3 mm², 2-core, outer dia. ϕ3.4 mm, rear wiring	1.5 m	Small relay, programmable controller
	C GR105							5 m	
	J HR101						0.3 mm², 2-core, outer dia. ϕ3.4 mm, upper wiring	1.5 m	
	K HR105							5 m	
	S SR405	AC: 80 to 220 V	300 mA	30 VA	Provided	Neon lamp (Lights when not sensing)	0.5 mm², 2-core, ourter dia. ϕ6 mm, rear wiring	5 m	Small relay, programmable controller
Solid state sensor	M GS211	DC: 10 to 30 V	6 to 70 mA	–	Provided	LED (2-LED type in red/green)	0.3 mm², 2-core, outer dia. ϕ3.4 mm, rear wiring	1.5 m	Small relay, programmable controller
	N GS215							5 m	
	W HS211						0.3 mm², 2-core, outer dia. ϕ3.4 mm, upper wiring	1.5 m	
	Y HS215							5 m	

Notes) ● For the sensors without a protective circuit, be sure to provide a protective circuit (SK-100) with the load when using any induction load (relay, etc.).
● For handling of sensors, be sure to see the sensor specifications at the end of this catalog.
● We recommend AND Unit (AU series) for multiple sensors connected in series. For details, refer to AND Unit at the end of this catalog.

● G∗/H∗ type sensor

● Rear wiring

● Upper wiring

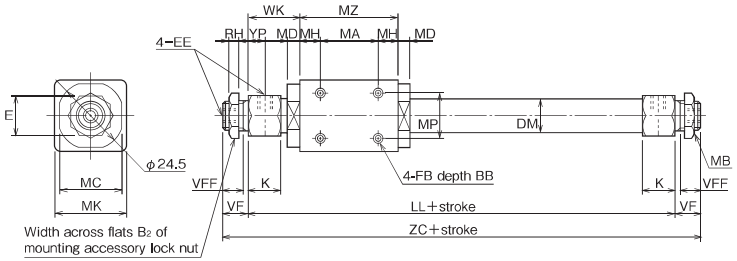
● SR type sensor

CAD/DATA RL2/TRL2 is available.

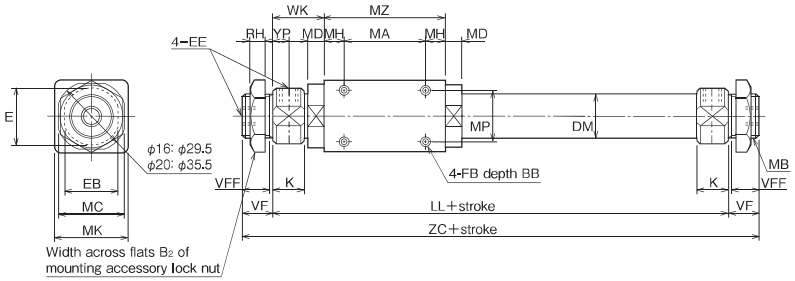
Standard type

RL2 SD− Bore − Magnetic holding force − Stroke

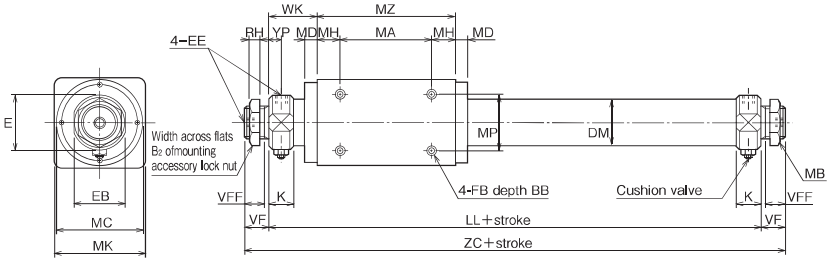
● Bore ϕ10



● Bore ϕ16 and ϕ20



● Bore ϕ25, ϕ32, and ϕ40



● 25-mm bore cylinders are not provided with a cushion valve.

Dimensional Table

Symbol / Bore	B_2	BB	DM	E	EB	EE	FB	K	LL	MA
ϕ10	14	4.5	ϕ12	14	—	M5×0.8	M3×0.5	11	70	20
ϕ16	22	6	ϕ18	ϕ21	19	M5×0.8	M4×0.7	11	84	26
ϕ20	30	6	ϕ23	ϕ28	26	Rc1/8	M4×0.7	15	110	40
ϕ25	30	10	ϕ28	ϕ33	31	Rc1/8	M5×0.8	16	143	52
ϕ32	32	10	ϕ36	ϕ40	38	Rc1/8	M6×1	16	165	66
ϕ40	41	10	ϕ44	ϕ48	46	Rc1/4	M6×1	20	174	70

Symbol / Bore	MB	MC	MD	MH	MK	MP	MZ	RH	VF	VFF	WK	YP	ZC
ϕ10	M10×1	22	4	7.5	□25	16	35	3	9	8	17.5	5.5	88
ϕ16	M16×1.5	27	7	9	□30	20	44	6	12	9.5	20	5.5	108
ϕ20	M22×1.5	33	8	10	□36	26	60	7	15	10.5	25	8	140
ϕ25	M22×1.5	ϕ57	8	12	□58	36	76	7	15	12	33.5	8	173
ϕ32	M24×2	ϕ61	8	17	□62	40	100	8	16	13	32.5	8	197
ϕ40	M30×2	ϕ77	10	15	□78	50	100	9	16	12	37	10	206

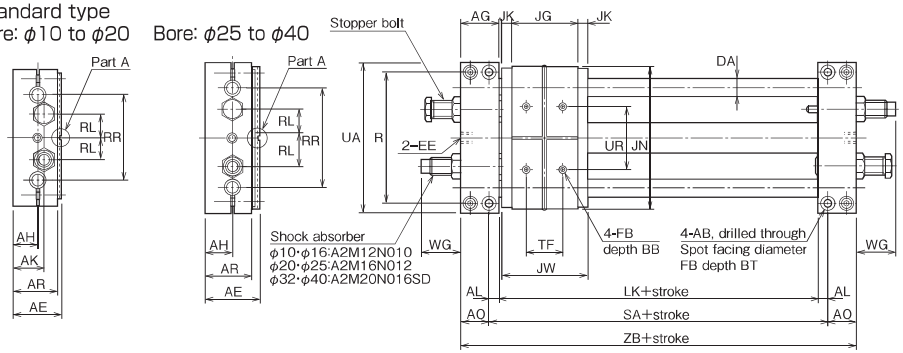
Note) Dimension VFF is the effective length of threaded portion.

CAD/DATA RL2/TRL2 is available.

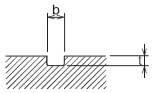
With guide

RL2 | Guide structure | Bore | Magnetic holding force | – | Stroke | Shock absorber symbol | Number of shock absorbers

Standard type
Bore: ϕ10 to ϕ20 Bore: ϕ25 to ϕ40



Details of part A (dimensions of key groove)



Dimensional Table

Bore \ Symbol	b	t
ϕ10·ϕ16·ϕ20	$3^{-0.004}_{-0.029}$	$1.8^{+0.1}_{0}$
ϕ25·ϕ32·ϕ40	$4^{0}_{-0.03}$	$2.5^{+0.1}_{0}$

Procedures for adjusting the stroke of cylinder with shock absorber

Bore ϕ10 to ϕ25
- Adjust the stroke with the stopper bolt. Take care that the slider does not get into direct contact with the shock absorber end face.

Bore ϕ32 and ϕ40
- Adjust the stroke by screwing the shock absorber. (The stroke can be adjusted on the shock absorber end face.)

- Above shown is the outline drawing of a cylinder with a shock absorber.
- The basic style 32 and 40mm bore cylinders with a shock absorber are not provided with a stopper bolt.

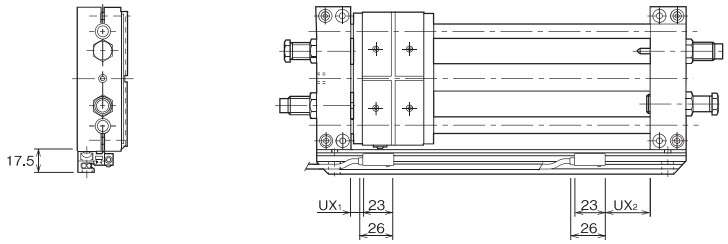
Dimensional Table

Bore \ Symbol	AB	AE	AG	AH	AK	AL	AO	AR	BB	BT	DA	EE	FB
ϕ10	ϕ4.5	34	28	18	21	7	21	32	8	4.5	ϕ10	M5×0.8	M4×0.7
ϕ16	ϕ5.5	39	30	20.5	24.5	7.5	22.5	36	10	5.5	ϕ12	M5×0.8	M5×0.8
ϕ20	ϕ6.6	45	35	23	29	9	26	42	10	6.6	ϕ16	Rc1/8	M5×0.8
ϕ25	ϕ9	58	44	29.5	—	11	33	54	12	8.7	ϕ20	Rc1/8	M6×1
ϕ32	ϕ9	63	44	32	—	11	33	54	16	8.7	ϕ20	Rc1/8	M8×1.25
ϕ40	ϕ9	78	44	39.5	—	11	33	66	16	8.7	ϕ25	Rc1/4	M8×1.25

Bore \ Symbol	FG	JG	JK	JN	JW	LK	R	RL	RR	SA	TF	UA	UR	WG	ZB
ϕ10	ϕ9	50	10	90	70	70	86	16	61	84	22	100	33	44.5	126
ϕ16	ϕ10	54	10	106	74	74	101	18.5	72	89	25	116	40	42.5	134
ϕ20	ϕ12.5	67	11	124	89	89	117	22	84	107	35	134	46	56	159
ϕ25	ϕ17	76	12	156	100	100	145	28	104	122	40	166	62	47	188
ϕ32	ϕ17	79.5	12	170	103.5	103.5	159	34	118	125.5	45	180	73	46	191.5
ϕ40	ϕ17	113.5	12	199	137.5	137.5	188	40	142	159.5	70	209	90	46	225.5

Switch Set

RL2 | Guide structure | Bore | Magnetic holding force | Stroke | – | Sensor symbol | Sensor quantity | Shock absorber symbol | Shock absorber quantity



- Above shown is the outline drawing of a cylinder with a shock absorber and Switch Set (G∗/H∗ type).
- The basic style 32 and 40mm bore cylinders with a shock absorber are not provided with a stopper bolt.

Dimensional Table

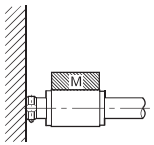
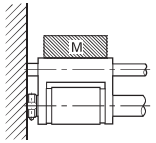
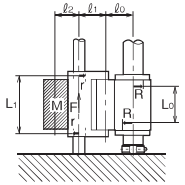
Bore	UX_1			UX_2		
	Reed sensor		Solid state sensor	Reed sensor		Solid state sensor
	GR/HR type	SR type	GS/HS type	GR/HR type	SR type	GS/HS type
ϕ10	11.5	9	9	35.5	21	38
ϕ16	12.5	12	10	38.5	24	41
ϕ20	19.5	18.5	17	46.5	30.5	49
ϕ25	22.5	24	20	54.5	36	57
ϕ32	25.5	25	23	55	37	57.5
ϕ40	40.5	42	38	74	54	76.5

Note) ●Dimension UX indicates the optimum sensor mounting position for detection of stroke end.

Operating Range and Hysteresis

Bore	Reed sensor		Solid state sensor	
	GR/HR type		GS/HS type	
	Operating range	Hysteresis	Operating range	Hysteresis
ϕ10	5 to 7	2 or less	8 to 12	1 or less
ϕ16				
ϕ20				
ϕ25				
ϕ32				
ϕ40				

Selection Materials

	Standard type		
	Direct connection of load	Connection with external load	
Mounting form			
Points of selection	● The thrust force is approx. 50% of the theoretical cylinder force. ● The speed is within the range shown in Chart C. ● The load rate is less than 60%.	● The thrust force is approx. 70% of the theoretical cylinder force. ● The speed is within the range shown in Chart C. ● The load rate is less than 60%.	● The thrust force varies depending on the resisting force (R) acting on the cylinder bearing part. ● The resisting force (R) is less than max.R shown in Table ❶. ● The load rate is less than 60%. ● The speed is within the range shown in Chart C.
Calculating method	Thrust force F(N)=A×P×0.5 A: piston pressure receiving area (mm^2) $A=\frac{\pi}{4}D^2$ P: operating pressure (MPa) D: cylinder bore (mm)	Thrust force F(N)=A×P×0.7 A: piston pressure receiving area (mm^2) $A=\frac{\pi}{4}D^2$ P: operating pressure (MPa) D: cylinder bore (mm)	1. The cylinder bearing part resisting force (R) is: $R=f\times\ell_0\times1/L_0$ ● The load force (f) in the case of horizontal movement is: $f=M\times\mu\times g$ ● The load force (f) in the case of vertical movement is: $f=M\times g+2\times\mu\times(\ell_1+\ell_2)\times M\times g\times1/L_1$ 2. The thrust force (F) is the intersection of the calculated resisting force (R) with the operating pressure (MPa) in Chart A.
Example	Determine the thrust force when a standard type 32mm bore cylinder is used at an operating pressure of 0.5 MPa.	Determine the thrust force when a standard type 32mm bore cylinder is used at an operating pressure of 0.5 MPa.	Determine the thrust force which can be taken to the outside when a weight of 20 kg is moved vertically by driving at an operating pressure of 0.4 MPa by RL2SD40H1000 using two linear bearings for the guide. And, determine the cylinder load rate. (where, μ=0.05, ℓ_0=45, ℓ_1=40, ℓ_2=70 and L1=230. L0=77 according to Table ❶.)
Solution	Thrust force F(N)=A×P×0.5 =804×0.5×0.5≒200N	Thrust force F(N)=A×P×0.7 =804×0.5×0.7≒280N	1. Determine the cylinder bearing part resisting force (R). The load force (f) is: $f=M\times g+2\times\mu\times(\ell_1+\ell_2)\times M\times g\times1/L_1$ $=20\times9.8+2\times0.05\times(40+70)\times20\times9.8\times1/230\fallingdotseq201N$ The resisting force (R) is: $R=f\times\ell_0\times1/L_0=201\times45\times1/77$ 117N Ascertain whether the resisting force (R) is less than max.R shown in Table 1 under the above conditions. 2. The thrust force (F) which can be taken to the outside when the operating pressure is 0.4 MPa is the intersection of the resisting force of 117 N with the operating pressure of 0.4 MPa in Chart A-6. F=343N 3. Determine the load rate (β), and ascertain whether the rate is less than 60%. $\beta=f/F\times100=201/343\times100=59\%$

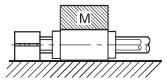
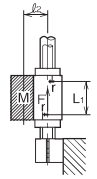
	With guide	
	Horizontal conveying	Vertical conveying
Mounting form		
Points of selection	● The load is within the range shown in Chart B. ● The speed is within the range shown in Chart C.	● The thrust force is approx. 70% of the theoretical cylinder force. ● The guide bearing part resisting force (r) is less than the max.r shown in Table ❶. ● The load rate is less than 60%. ● The speed is within the range shown in Chart C.
Calculating method	—	Thrust force F(N)=A×P×0.7 A: piston pressure receiving area (mm^2) $A=\frac{\pi}{4}D^2$ P: operating pressure (MPa) D: cylinder bore (mm) ● The load force (f) in the case of vertical movement is: $f=M\times g+2\times\mu\times\ell_2\times M\times g\times1/L_1$ 2. The guide bearing part resisting force (r) is: $r=\ell_2\times Mg\times1/L_1\times1/2$
Example	Determine the maximum weight (kg) which can be conveyed horizontally by RL2MG32M1000. And, determine the maximum conveying speed (mm/s) in the above case.	Determine the thrust force generated when a weight of 10 kg is connected directly with RL2MG32H1000 and moved vertically at an operating pressure of 0.4 MPa. And, determine the cylinder load rate. (where, ℓ_2=50. μ=0.1 and L_1=57.5 according to Table ❶.)
Solution	The weight which can be conveyed is 7.5 kg according to Chart B. The max. moving speed is 500 mm/s according to Chart C.	1. Determine the thrust force (F). F=A×P×0.7 =804×0.4×0.7≒225N 2. Determine the guide bearing part resisting force (r). $r=\ell_2\times M\times g\times1/L_1\times1/2$ $=50\times10\times9.8\times1/57.5\times1/2\fallingdotseq42.6N$ Then, ascertain whether the resisting force (r) is less than max.r shown in Table ❶. 3. Determine the load rate (β), and ascertain whether it is less than 60%. The load force (f) is: $f=M\times g+2\times\mu\times\ell_2\times M\times g\times1/L_1$ $=10\times9.8+2\times0.1\times50\times10\times9.8\times1/57.5\fallingdotseq115N$ $\beta=f/F\times100$ $=115/225\times100\fallingdotseq51\%$

Table ❶

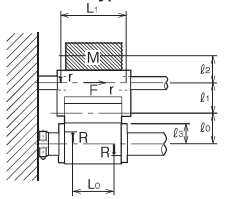
● Standard type Unit: mm

Bore	L_0	ℓ_3	max.R
ϕ10	24	12.5	11.8
ϕ16	34	15	39.2
ϕ20	49	18	58.8
ϕ25	59	29	108
ϕ32	82	31	167
ϕ40	77	39	245

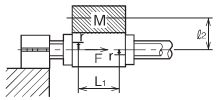
● With guide Unit: mm

Bore	L_1	ℓ_4	μ	max.r
ϕ10	45.5	16	0.1	44.1
ϕ16	42.5	18.5	0.1	68.6
ϕ20	52	22	0.1	118
ϕ25	57.5	28.5	0.1	177
ϕ32	57.5	31	0.1	177
ϕ40	91.5	38.5	0.1	216

● Standard type



● With guide



M :weight (kg)
F :thrust force (N)
ℓ_0 :distance from cylinder axis to cylinder transfer point (mm)
ℓ_1 :distance from guide axis to cylinder transfer point (mm)
ℓ_2 :distance from guide axis to center of gravity of weight (mm)
ℓ_3 :distance from cylinder axis to load fitting surface (mm)
ℓ_4 :distance from slider axis to load fitting surface (mm)
μ :guide friction coefficient
L_0 :distance between cylinder bearings (mm)
L_1 :distance between guide bearings (mm)
R :cylinder bearing part resisting force (N)
r :guide bearing part resisting force (N)
β :load rate
f :load force

Theoretical cylinder force: calculated force acting on piston
Weight :weight to be conveyed
Thrust force :force which can be actually taken to the outside of cylinder
Load force :force by load which the cylinder must actually convey
Load rate :ratio of load force to thrust force