Specification

Bore size(mm)		6	10	16	20
Guide rail width mm		5	7	9	12
Acting type		Double acting			
Fluid		Air(to be filtered by 40 μ m filter element)			
Operating pressure	Φ6	0.15~0.7MPa(22~100psi)(1.5~7.0bar)			
	Others	0.06~0.7MPa(9~100psi)(0.6~7.0bar)			
Proof pressure		1.05MPa(150psi)(10.5bar)			
Temperature ℃		-20~70			
Speed range mm/s		50~500			
Allowable kinetic energy J		0.008	0.025	0.05	0.1
Stroke tolerance		$^{+1.0}_{0}$			
Cushion type		Bumper			
Sensor switches ①		DS1-H□N、DS1-H□P			
Port size		M5 × 0.8			

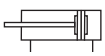
① Sensor switch should be ordered additionally, please refer to P457~480 for detail of sensor switch.

Stroke

Bore size (mm)	Standard stroke (mm)	Max. stroke
6	5 10 15 20 25 30	30
10	5 10 15 20 25 30 40 50	50
16, 20	5 10 15 20 25 30 40 50 60	60

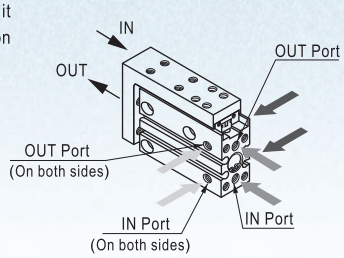
Note) Consult us for non-standard stroke.

Symbol



Product feature

1. Miniature linear roller ball bearing integrated wise cylinder.
2. With the excellent straightness and non-rotation precision, it is more suitable for precision assembly.
3. Mounting is possible from 4 directions.
4. Piping is possible from 3 directions.



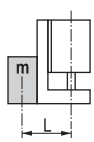
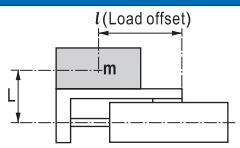
Ordering code

HLH 20 × 30 S

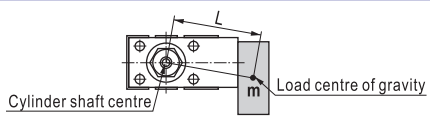
- **Model**: HLH: Compact slide cylinder(Double acting type)
- **Bore size**: 6, 10, 16, 20
- **Magnet**: S: With magnet
- **Stroke**: Refer to stroke table for details

Model Selection Method

1. Select the bore size according to the thrust and practicality. Refer to the table on page 327.
2. Determine the selection conditions in order, starting from the upper row in the table below, and choose one of the selection graphs to be used.

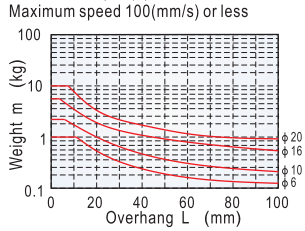
	Vertical			Horizontal								
Mounting position												
Maximum speed(mm/s)	⩽100	⩽300	⩽500	⩽100			⩽300			⩽500		
Load offset l(mm)	–	–	–	50	100	200	50	100	200	50	100	200
Selection graph	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

L: Overhang
(the distance from the cylinder shaft centre to the load centre of gravity)

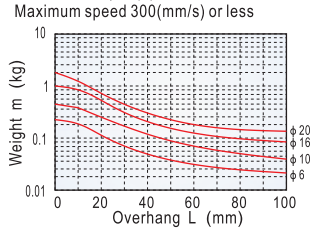


2.1) The relation between loading and overhang(Selection graphs)

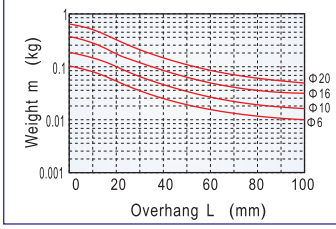
Selection Graphs(1)
Maximum speed 100(mm/s) or less



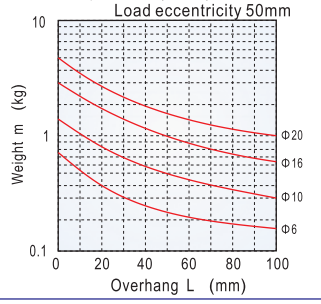
Selection Graphs(2)
Maximum speed 300(mm/s) or less



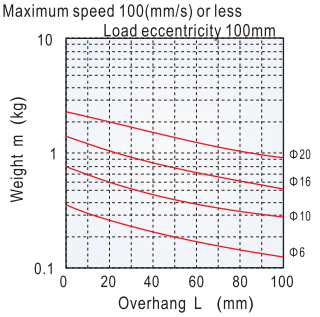
Selection Graphs(3)
Maximum speed 500(mm/s) or less



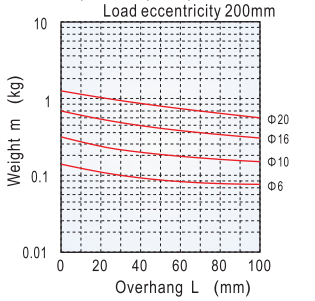
Selection Graphs(4)
Maximum speed 100(mm/s) or less
Load eccentricity 50mm



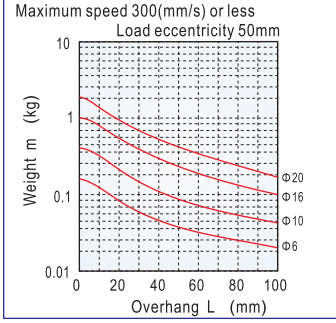
Selection Graphs(5)
Maximum speed 100(mm/s) or less
Load eccentricity 100mm



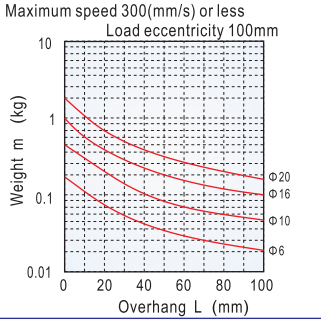
Selection Graphs(6)
Maximum speed 100(mm/s) or less
Load eccentricity 200mm



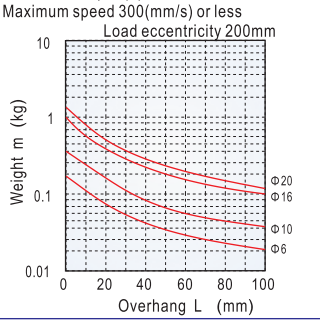
Selection Graphs(7)
Maximum speed 300(mm/s) or less
Load eccentricity 50mm



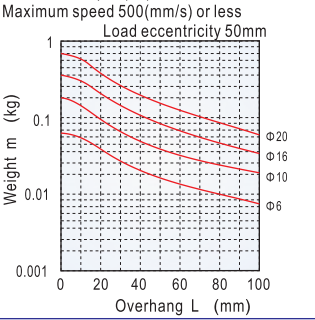
Selection Graphs(8)
Maximum speed 300(mm/s) or less
Load eccentricity 100mm



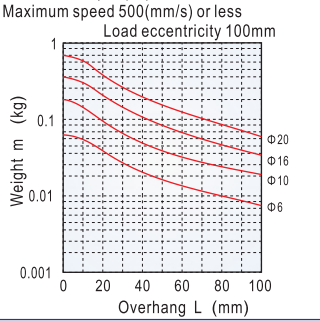
Selection Graphs(9)
Maximum speed 300(mm/s) or less
Load eccentricity 200mm



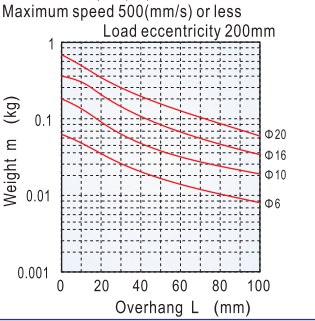
Selection Graphs(10)
Maximum speed 500(mm/s) or less
Load eccentricity 50mm



Selection Graphs(11)
Maximum speed 500(mm/s) or less
Load eccentricity 100mm



Selection Graphs(12)
Maximum speed 500(mm/s) or less
Load eccentricity 200mm



2.2) Selection Examples

Example ①: Mounting: Vertical
Maximum speed: 500mm/s
Overhang: 40mm
Load weight: 0.1Kg

Refer to Graph based on vertical mounting and a speed of 500mm/s. In Graph , find the intersection of a 40mm overhang and load weight of 0.1Kg, which results in a selection of ø20.

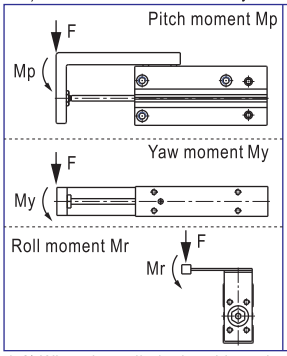
Example ②: Mounting: Horizontal
Maximum speed: 500mm/s
Load eccentricity: 50mm
Overhang: 30mm
Load weight: 0.1Kg

Refer to Graph based on horizontal mounting, a speed of 500mm/s and load eccentricity of 50mm.In Graph , find the intersection of a 30mm overhang and load weight of 0.1Kg, which results in a selection of ø16.

Installation and application

1. The actual loading and moment of cylinder must be less than it's allowable loading and moment:

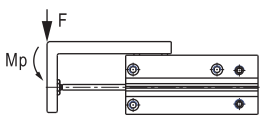
1.1) The allowable moment of cylinder

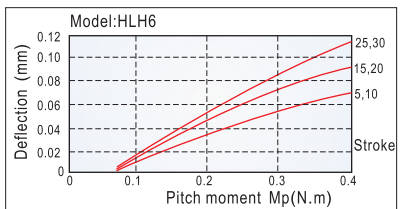


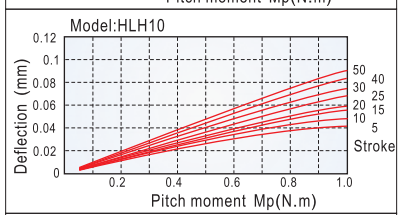
Model	Allowable torque (Nm)		
	Pitch moment Mp	Yaw moment My	Roll moment Mr
HLH6	0.25	0.25	0.41
HLH10	0.95	0.95	1.49
HLH16	3.28	3.28	3.45
HLH20	6.29	6.29	6.61

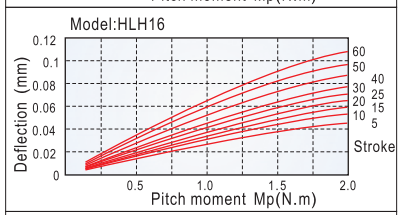
1.2) When the cylinder is subjected to different type of moment, there will be different degree of shift in performance, please refer to the following table for details.

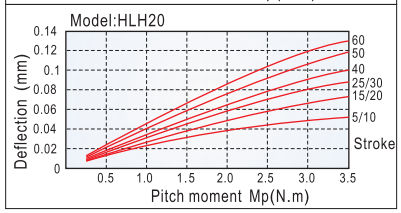
Table deflection due to pitch moment
Table deflection (arrow) when a load acts upon the section marked with the arrow at the full stroke of the compact slide.

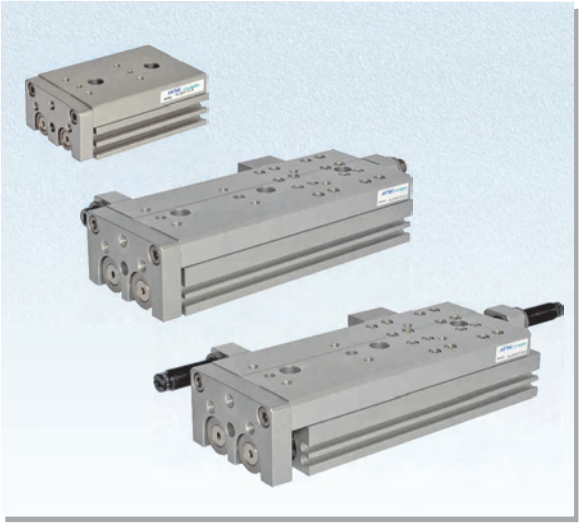












Specification

Bore size(mm)	6	8	12	16	20	25
Guide rail width (mm)	10	10	7	9	9	12
Number of guide rail	Single guide rail		Double guide rail			
Acting type	Double acting					
Fluid	Air(to be filtered by 40 μ m filter element)					
Operating pressure	0.15~0.7MPa(22~100psi)(1.5~7.0bar)					
Proof pressure	1.05MPa(150psi)(10.5bar)					
Temperature ℃	-20~70					
Speed range mm/s	50~500					
Stroke tolerance	$0\sim100^{+1.0}_{0}$ $>100^{+1.5}_{0}$					
Cushion type	Bumper(Both ends), Shock absorber					
Sensor switches ①	DS1-H□N、DS1-H□P					
Port size	M5×0.8				1/8"	

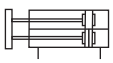
① Sensor switch should be ordered additionally, please refer to P457~480 for detail of sensor switch.

Stroke

Bore size (mm)	Standard stroke (mm)	Max. stroke (mm)
6	10 20 30 40 50	50
8	10 20 30 40 50 75	75
12	10 20 30 40 50 75 100	100
16	10 20 30 40 50 75 100 125	125
20	10 20 30 40 50 75 100 125 150	150
25	10 20 30 40 50 75 100 125 150	150

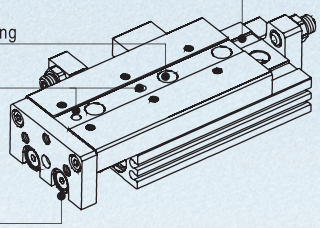
Note) Consult us for non-standard stroke.

Symbol

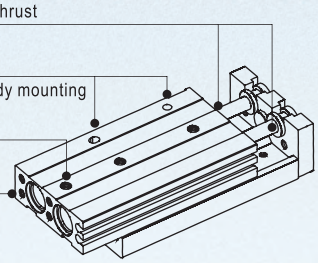


Product feature

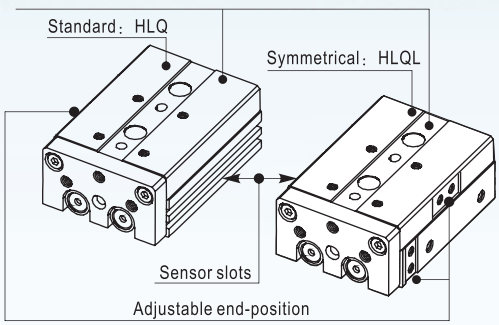
1. Recirculating linear ball bearing, it achieves high precision, high rigidity, with antirust and dustproof function
2. Through hole for body mounting
3. Pin holes for positioning
   Improved repeatability of work mounting



4. Floating joint design
   Piston rod needn't endure additional torque
5. Dual rod-doubles the output thrust
6. Pin holes for positioning
   Improved repeatability of body mounting
7. Body mounting holes provide 3 mounting positions



8. Two models (HLQ/HLQL) are available for choosing due to different designs of sensor slots and flexible cushioning elements.



HLQ

Ordering code

HLQ 20 × 30 S AS □

Model
- HLQ: Compact slide cylinder (Double acting type) (Recirculating linear ball bearing)
- HLQL: Symmetrical Compact slide cylinder (Double acting type) (Recirculating linear ball bearing)

Bore size
6, 8, 12, 16, 20, 25

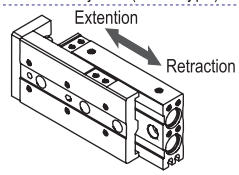
Stroke
Refer to stroke table for details

Magnet
S: With magnet

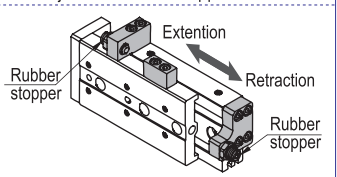
Thread type ①
- Blank: PT
- G: G
- T: NPT

Adjuster option ②

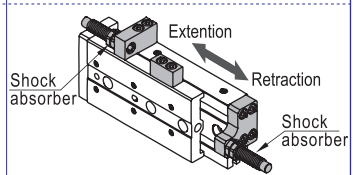
Blank: Without adjuster(Basic type)



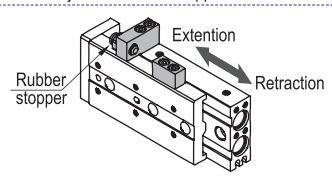
A: Adjustable rubber stopper(Both ends)



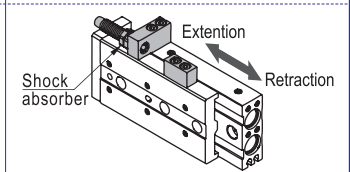
B: Shock absorber(Both ends)



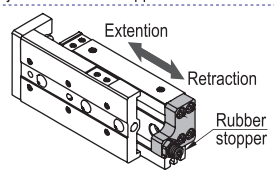
AS: Adjustable rubber stopper(Extention)



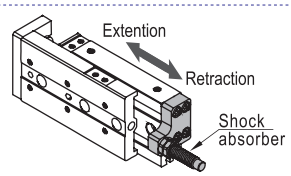
BS: Shock absorber(Extention)



AF: Adjustable rubber stopper(Retraction)



BF: Shock absorber(Retraction)



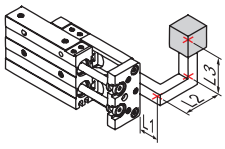
① When the thread is standard, the code is blank.
② B type, BS type, BF type are unavailable for bore size of Φ6.

Model Selection Method

Please select compact cylinder's type according to following procedure, and cross reference with data sheets.

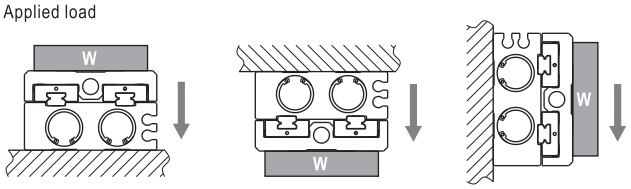
1) Operating conditions(According to mounting position and work form)

1. Model used(Bore size, Stroke)
2. Type of cushion(Bumper, Shock absrober)
3. Mounting position of work(Top, front)
4. Mounting direction(Axial, Vertical)
5. Average speed Va(mm/s)
6. Applied load W(N) **Fig. 1**
7. Overhang L1, L2, L3(mm)



Explain: L1 is the distance of load's center beyond the end plank's plane. If load's center is not beyond the end plank's plane, L1 is negative.

Fig. 1: Applied load



2) Kinetic energy check

Steps

1. Calculate kinetic energy of load E(J)

$$E=\frac{1}{2}\times\frac{W}{g}\times\left(\frac{1.4\times Va}{1000}\right)^2$$

2. Calculate allowable kinetic energy Ea(J)

$$Ea = K \times E_{max}$$

K:Mounting work coefficient **(Fig 2)**

E_{max}:Maximum allowable kinetic energy **(Table 1)**

3. Check that kinetic energy of load doesn't exceed allowable kinetic energy:

$$E \leqslant Ea$$

3) Load check

Steps

1. Calculate allowable applied load Wa (N)

$$Wa = K \times \beta \times W_{max}$$

K:Mounting work coefficient **(Fig 2)**

W_{max}:Maximum allowable applied load **(Table 1)**

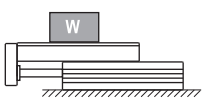
β :Applied load coefficient **(Fig 3)**

2. Check that load(W) doesn't exceed allowable applied load(Wa):

$$W \leqslant Wa$$

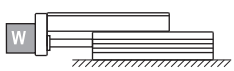
Fig 2: Mounting work coefficient (K)

Top



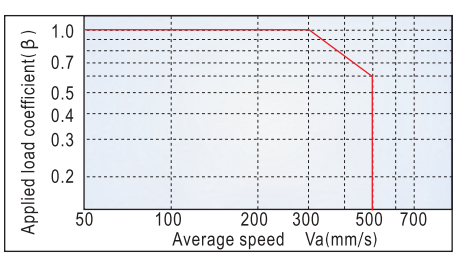
Mounting work coefficient K=1

Front



Mounting work coefficient K=0.6

Fig 3: Applied load coefficient (β)

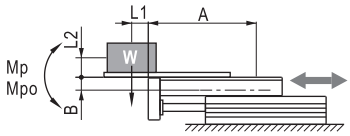


4) Moment check

Steps

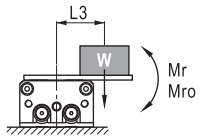
Horizontal

1. Calculate actual moment: Mp、Mpo、My、Myo、Mr、Mro (Nm)



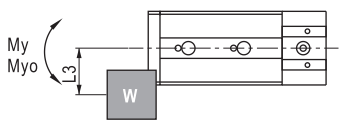
Dynamic moment:
$Mp=W\times(L1+A)/1000$

Static moment:
$Mpo=\frac{W\times(L1+A)}{1000}+\frac{W\times a\times(L2+B)}{1000\times g}$



Dynamic moment:
$Mr=W\times L3/1000$

Static moment:
$Mro=(W\times a\times L3)/1000g$



Dynamic moment:
$My=0$

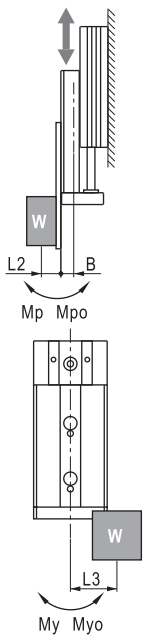
Static moment:
$Myo=(W\times a\times L3)/1000g$

2. Check

Dynamic moment:	$\frac{Mp}{Mp_{max}}+\frac{My}{My_{max}}+\frac{Mr}{Mr_{max}}\leqslant 1$
Static moment:	$\frac{Mpo}{Mpo_{max}}+\frac{Myo}{Myo_{max}}+\frac{Mro}{Mro_{max}}\leqslant 1$

Vertical

1. Calculate actual moment: Mp、Mpo、My、Myo(Nm)



Dynamic moment:
$Mp=W\times(L2+B)/1000$

Static moment:
$Mpo=\frac{W\times(L2+B)}{1000}+\frac{W\times a\times(L2+B)}{1000\times g}$

Dynamic moment:
$My=W\times L3/1000$

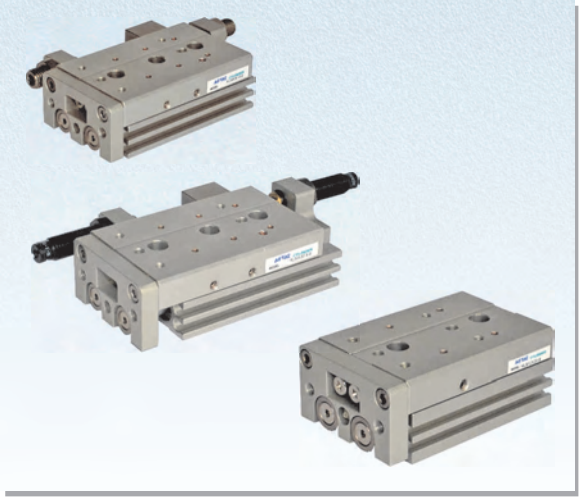
Static moment:
$Myo=\frac{W\times a\times L3}{1000g}+\frac{W\times L3}{1000}$

2. Check

Dynamic moment:	$\frac{Mp}{Mp_{max}}+\frac{My}{My_{max}}\leqslant 1$
Static moment:	$\frac{Mpo}{Mpo_{max}}+\frac{Myo}{Myo_{max}}\leqslant 1$

Explain:
L1, L2, L3: The distance of load center to mount plane(Determined by actuality).
A, B: Correction value for center position distance of moment(Refer to table 2).
Mp_{max}, My_{max}, Mr_{max}, Mpo_{max}, Myo_{max}, Mro_{max}: Maximum allowable moment(Refer to table 2).
g: Acceleration of gravity($g=9.81m/s^2$).
a: Acceleration of inertia
(Bumper: $a=1600\times(Va/1000)^2$, Shock absorber: $a=400\times(Va/1000)^2$)
W: Load weight(Determined by actuality).

HLQ



Specification

Bore size(mm)	6	8	12	16	20	25
Acting type	Double acting					
Fluid	Air(to be filtered by 40 μ m filter element)					
Operating pressure	0.15~0.7MPa(22~100psi)(1.5~7.0bar)					
Proof pressure	1.05MPa(150psi)(10.5bar)					
Temperature ℃	-20~70					
Speed range mm/s	50~500					
Stroke tolerance	$0\sim100^{+1.0}_{0}$ $>100^{+1.5}_{0}$					
Cushion type	Bumper(Both ends), Shock absorber					
Sensor switches ①	DS1-H□N、DS1-H□P					
Port size	M5×0.8				1/8"	

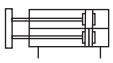
① Sensor switch should be ordered additionally, please refer to P457~480 for detail of sensor switch.

Stroke

Bore size (mm)	Standard stroke (mm)	Max. stroke (mm)
6	10 20 30 40 50	50
8	10 20 30 40 50 75	75
12	10 20 30 40 50 75 100	100
16	10 20 30 40 50 75 100 125	125
20	10 20 30 40 50 75 100 125 150	150
25	10 20 30 40 50 75 100 125 150	150

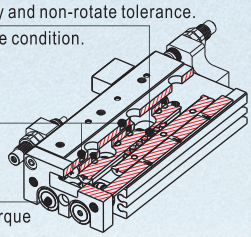
Note) Consult us for non-standard stroke.

Symbol

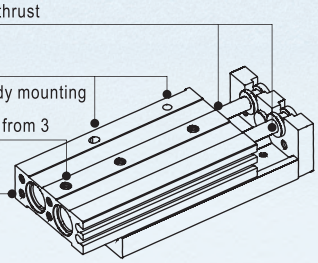


Product feature

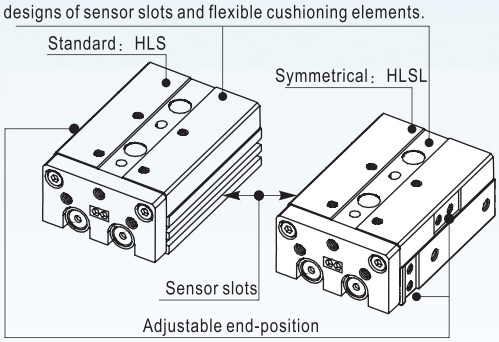
1. Roller bearing incorporating the cylinder, it achieves high precision, high rigidity, high load, excellent linearity and non-rotate tolerance. So it can be used in precision assemblage condition.



2. Pin holes for positioning improved repeatability of work mounting
3. Floating jointer design
Piston rod needn't endure additional torque
4. Dual rod, doubles the output thrust



5. Pin holes for positioning
Improved repeatability of body mounting
6. Body mounting tap Mounting from 3 direction available
7. Two models (HLQ/HLQL) are available for choosing due to different designs of sensor slots and flexible cushioning elements.



Ordering code

HLS 20×30 S AS □

Model
HLS: Compact slide cylinder (Double acting type)(Roller bearing)
HLSL: Symmetrical Compact slide cylinder (Double acting type)(Roller bearing)

Bore size
6, 8, 12, 16, 20, 25

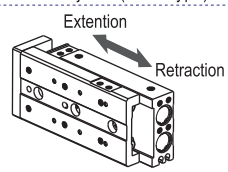
Stroke
Refer to stroke table for details

Magnet
S: With magnet

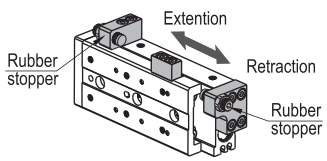
Thread type ①
Blank: PT
G: G
T: NPT

Adjuster option ②

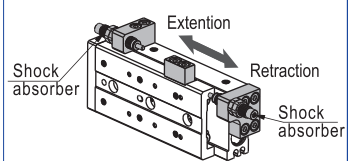
Blank: Without adjuster(Basic type)



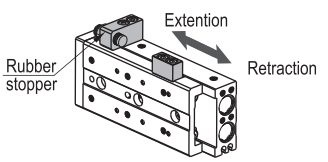
A: Adjustable rubber stopper(Both ends)



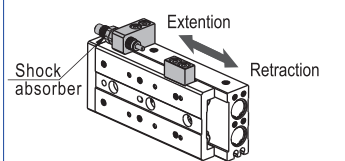
B: Shock absorber(Both ends)



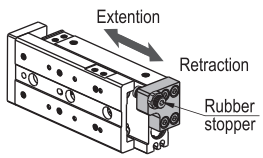
AS: Adjustable rubber stopper(Extention)



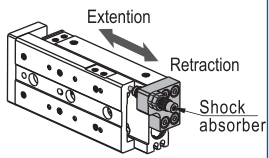
BS: Shock absorber(Extention)



AF: Adjustable rubber stopper(Retraction)



BF: Shock absorber(Retraction)



① When the thread is standard, the code is blank.
② B type, BS type, BF type are unavailable for bore size of Φ6.

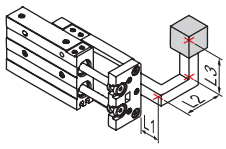
HLS

Model Selection Method

Please select compact cylinder's type according to following procedure, and cross reference with data sheets.

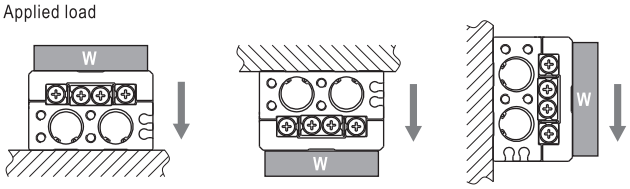
1) Operating conditions(According to mounting position and work form)

1. Model used(Bore size, Stroke)
2. Type of cushion(Bumper, Shock absrober)
3. Mounting position of work(Top, front)
4. Mounting direction(Axial, Vertical)
5. Average speed Va(mm/s)
6. Applied load W(N) **Fig. 1**
7. Overhang L1, L2, L3(mm)



Explain: L1 is the distance of load's center beyond the end plank's plane. If load's center is not beyond the end plank's plane, L1 is negative.

Fig. 1: Applied load



2) Kinetic energy check

Steps

1. Calculate kinetic energy of load E(J)

$$E=\frac{1}{2}\times\frac{W}{g}\times\left(\frac{1.4\times Va}{1000}\right)^2$$

2. Calculate allowable kinetic energy Ea(J)

$$Ea = K \times E_{max}$$

K:Mounting work coefficient **(Fig 2)**

E_{max}:Maximum allowable kinetic energy **(Table 1)**

3. Check that kinetic energy of load doesn't exceed allowable kinetic energy:

$$E \leqslant Ea$$

3) Load check

Steps

1. Calculate allowable applied load Wa (N)

$$Wa = K \times \beta \times W_{max}$$

K:Mounting work coefficient **(Fig 2)**

W_{max}:Maximum allowable applied load **(Table 1)**

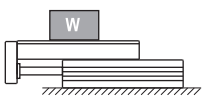
β :Applied load coefficient **(Fig 3)**

2. Check that load(W) doesn't exceed allowable applied load(Wa):

$$W \leqslant Wa$$

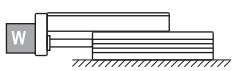
Fig 2: Mounting work coefficient (K)

Top



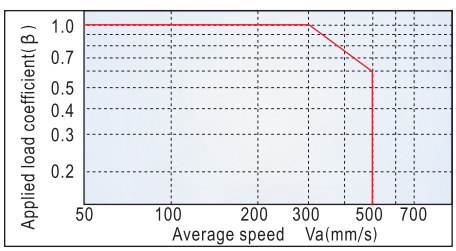
Mounting work coefficient K=1

Front



Mounting work coefficient K=0.6

Fig 3: Applied load coefficient (β)

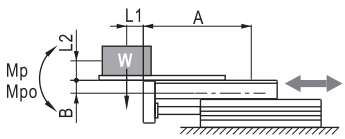


4) Moment check

Steps

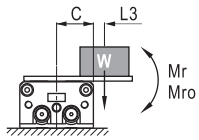
Horizontal

1. Calculate actual moment: Mp、Mpo、My、Myo、Mr、Mro (Nm)



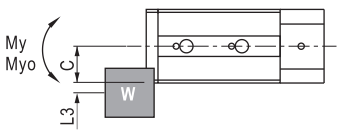
Dynamic moment:
$Mp=W\times(L1+A)/1000$

Static moment:
$Mpo=\frac{W\times(L1+A)}{1000}+\frac{W\times a\times(L2+B)}{1000\times g}$



Dynamic moment:
$Mr=W\times(C+L3)/1000$

Static moment:
$Mro=(W\times a\times(C+L3))/1000g$



Dynamic moment:
$My=0$

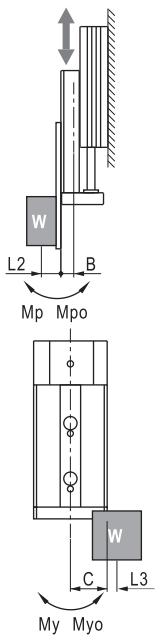
Static moment:
$Myo=(W\times a\times(C+L3))/1000g$

2. Check

Dynamic moment:	$\frac{Mp}{Mp_{max}}+\frac{My}{My_{max}}+\frac{Mr}{Mr_{max}}\leqslant 1$
Static moment:	$\frac{Mpo}{Mpo_{max}}+\frac{Myo}{Myo_{max}}+\frac{Mro}{Mro_{max}}\leqslant 1$

Vertical

1. Calculate actual moment: Mp、Mpo、My、Myo(Nm)



Dynamic moment:
$Mp=W\times(L2+B)/1000$

Static moment:
$Mpo=\frac{W\times(L2+B)}{1000}+\frac{W\times a\times(L2+B)}{1000\times g}$

Dynamic moment:
$My=W\times(C+L3)/1000$

Static moment:
$Myo=\frac{W\times a\times(C+L3)}{1000g}+\frac{W\times(C+L3)}{1000}$

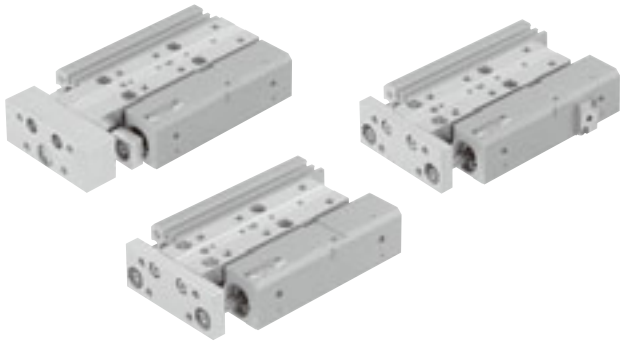
2. Check

Dynamic moment:	$\frac{Mp}{Mp_{max}}+\frac{My}{My_{max}}\leqslant 1$
Static moment:	$\frac{Mpo}{Mpo_{max}}+\frac{Myo}{Myo_{max}}\leqslant 1$

Explain:
L1, L2, L3: The distance of load center to mount plane(Determined by actuality).
A, B, C: Correction value for center position distance of moment(Refer to table 2).
Mp_{max}, My_{max}, Mr_{max}, Mpo_{max}, Myo_{max}, Mro_{max}: Maximum allowable moment(Refer to table 2).
g: Acceleration of gravity($g=9.81m/s^2$).
a: Acceleration of inertia
(Bumper: $a=1600\times(Va/1000)^2$, Shock absorber: $a=400\times(Va/1000)^2$)
W: Load weight(Determined by actuality).

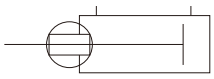
HLS

Z SLIDERS

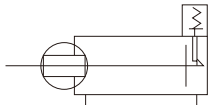


Symbols

●Standard



●With end keep



Bore Size and Stroke

mm

Bore size	Standard strokes	Maximum available stroke
6	10, 20, 30, 40, (50, 60, 70)	70
10	10, 20, 30, 40, 50, (60, 70, 80, 90, 100)	100
16	10, 20, 30, 40, 50, (60, 70), 80, (90, 100)	120
20	10, 20, 30, 40, 50, (60, 70), 80, (90, 100)	150
25	10, 20, 30, 40, 50, (60, 70), 80, (90, 100)	150

Note: Figures in parentheses ( ) are for made to order products.
For specification and delivery, consult us.

Specifications

●Standard

Item \ Model		ZS6	ZS10	ZS16	ZS20	ZS25
Bore size mm [in.]		6 [0.236]	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]
Stroke tolerance mm [in.]		$^{+1}_{0}$ [$^{+0.039}_{0}$]				
Operation type		Double Acting Type				
Media		Air				
Operating pressure range MPa [psi.]		0.15～0.7 [22～102]				
Proof pressure MPa [psi.]		1.05 [152]				
Operating temperature range °C [°F]		0～60 [32～140]				
Operating speed range mm/s [in./sec.]		50～500 [2.0～19.7]				
Cushion	Standard	Rubber bumper				
	Options	Shock absorber				
Lubrication	Cylinder portion	Not required (If lubrication is required, use Turbine Oil Class 1 [ISO VG32] or equivalent.)				
	Guide portion	Not required (If lubrication is required, use lithium soap-based grease.)				
Repeatability[Note 1] mm [in.]		±0.05 [±0.002]				
Traveling parallelism[Note 2] mm [in.]		0.1 [0.004] (Up to standard maximum stroke ϕ6: 40mm, ϕ10: 50mm, ϕ16, 20, 25: 80mm) 0.2 [0.008] (Exceeds the standard maximum stroke, up to the maximum available stroke)				
Parallelism of table top surface[Note 2] mm [in.]						
Perpendicularity of plate surface[Note 2] mm [in.]						
Stroke adjusting range[Note 3] mm [in.]	Rubber stopper retracted side	–5～0 [–0.197～0]				
	Rubber stopper extended side	–12～0 [–0.472～0]	–11～0 [–0.433～0]	–14～0 [–0.551～0]	–13～0 [–0.512～0]	–17～0 [–0.669～0]
	Shock absorber retracted side	—	–5～0 [–0.197～0]	–11～0 [–0.433～0]	–10～0 [–0.394～0]	–7～0 [–0.276～0]
	Shock absorber extended side	—	–11～0 [–0.433～0]	–19～0 [–0.748～0]	–18～0 [–0.709～0]	–17～0 [–0.669～0]
Maximum allowable load mass kg [lb.]		6.7 [14.8]	16.6 [36.6]	22.9 [50.5]	41.7 [91.9]	63.4 [139.8]
Port size		M5×0.8			Rc1/8	

Notes: 1. For shock absorber with stroke adjusting bracket type. (Not available for ϕ6 [0.236in.])
2. The datum is the cylinder body mounting surface parallel to the table, and measured when no load and air pressure are applied.
3. For unit with stroke adjusting bracket. (Shock absorber type is not available for ϕ6 [0.236in.])

● Z slider with buffer

Item \ Model	ZSG6	ZSG10	ZSG16	ZSG20	ZSG25
Bore size mm [in.]	6 [0.236]	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]
Operating speed range mm/s [in./sec.]	50～500 [2.0～19.7] (At horizontal: 50～300 [2.0～11.8])				
Buffer stroke mm [in.]	10 [0.394] MAX.				

Remarks: 1. For specifications not specified with-buffer Z sliders, use the standard specifications.
2. If using Z slider with-buffer specification, see the Handling Instructions and Precautions on p.943.
3. For Z slider with-buffer type stroke and spring force, etc., see the table on p.943.
Note that the spring force is set to the lowest level at shipping.

● Z slider with end keep

Item \ Model	ZSK16	ZSK20	ZSK25
Bore size mm [in.]	16 [0.630]	20 [0.787]	25 [0.984]
Operating pressure range MPa [psi.]	0.2～0.7 [29～107]		
Maximum holding force at end keep N [lbf.]	96 [21.6]	151 [33.9]	235 [52.8]
Backlash at end keep mm [in.]	1 [0.039] MAX.		

Remarks: 1. For specifications not specified with-end-keep Z sliders, use the standard specifications.
2. If using Z slider with-end-keep specification, see the Handling Instructions and Precautions on p.942.
3. The operating life at maximum holding force is 0.5million cycles.

Shock Absorber Specifications

Item \ Model	KSHA5×5-D	KSHA6×8-F	KSHA7×8-G	KSHA7×8-K
Applicable cylinder	ZS10	ZS16	ZS20	ZS25
Maximum absorption Note J [ft·lbf]	1.0 [0.74]	2.9 [2.14]	3.9 [2.88]	5.9 [4.35]
Absorbing stroke mm [in.]	5 [0.197]	8 [0.315]		
Maximum impact speed m/s [ft./sec.]	1.0 [3.28]			
Maximum operating frequency cycle/min	60	30		
Spring return force N [lbf.]	3.9 [0.88]	6.5 [1.46]		
Angle variation	1° or less	3° or less		
Operating temperature range °C [°F]	0～60 [32～140]			
Mass g [oz.]	7 [0.25]	20 [0.71]	28 [0.99]	

Note: Do not exceed the Z Slider maximum speed, even when it is within the shock absorber's absorption range.
Remarks: 1. Do not loosen the small screw on the rear end of the shock absorber. The oil inside will leak out, which will fail the function of the shock absorber.
2. The life of shock absorber may vary from the Z Slider, depending on its operating conditions.
3. For details about the shock absorber, see the General Catalog of Air Treatment, Auxiliary, and Vacuum.

Order Codes

ZS [ ][ ] - [ ][ ] - [ ][ ][ ]

Z Slider double acting type

Bore size × Stroke

Operation
Blank : Standard cylinder
G : Cylinder with buffer
K : Cylinder with end keep Note 1
BB : Symmetrical cylinder

Stroke adjusting mechanism
Blank : No stroke adjustment
RS : With rubber stopper
SS : With shock absorber Note 2

Stroke adjusting position Note 3
2 : Both ends (with 2 units) Note 4
F : Extended end (with 1 unit)
R : Retracted end (with 1 unit) Note 4

Lead wire length
A : 1000mm [39in.]
B : 3000mm [118in.]

Number of sensor switches
1 : With 1 sensor switch
2 : With 2 sensor switches
3 : With 3 sensor switches
⋮

Sensor switch

Blank	: No sensor switch		
ZE101	: Reed switch type without indicator lamp	Horizontal lead wire	DC5～28V, AC85～115V
ZE102	: Reed switch type with indicator lamp	Horizontal lead wire	DC10～28V, AC85～115V
ZE201	: Reed switch type without indicator lamp	Vertical lead wire Note5	DC5～28V, AC85～115V
ZE202	: Reed switch type with indicator lamp	Vertical lead wire Note5	DC10～28V, AC85～115V
ZE135	: 2-lead wire Solid state type with indicator lamp	Horizontal lead wire	DC10～28V
ZE155	: 3-lead wire Solid state type with indicator lamp	Horizontal lead wire	DC4.5～28V
ZE235	: 2-lead wire Solid state type with indicator lamp	Vertical lead wire Note5	DC10～28V
ZE255	: 3-lead wire Solid state type with indicator lamp	Vertical lead wire Note5	DC4.5～28V

●For details of sensor switches, see p.1544.

Notes: 1. The end keep mechanism is available in ϕ16～25 head side only.
2. Not mountable on the ϕ6 size.
3. Not available with both-end and extended side 10mm stroke cylinders.
4. For cylinders with end keep, stroke adjustment cannot be performed on the retracted side.
5. The lead wire of sensor switches is a vertical type.

Order codes for options only

●Stroke adjusting bracket set Note 4

S [ ] - **ZS** [ ]

Stroke adjusting position
2 : Both ends (with 2 units) Note 2
F : Extended end (with 1 unit)
R : Retracted end (with 1 unit) Note 2

Stroke adjusting bracket set Note 1

Cylinder basic model

Bore size
6 : For ϕ6 [0.236in.]
10 : For ϕ10 [0.394in.]
16 : For ϕ16 [0.630in.]
20 : For ϕ20 [0.787in.]
25 : For ϕ25 [0.984in.]

Notes: 1. Extended side stroke adjustment cannot be performed on the 10mm stroke.
2. For cylinders with end keep, stroke adjustment cannot be performed on the retracted side.
3. For the contents of a set , see the table to the right.
4. The sets do not include a shock absorber or rubber stopper.

Set contents

pc.

Item \ Model	S2	SF	SR
Bracket A	1	1	—
Bracket A mounting bolt	2	2	—
Bracket B	1	—	1
Bracket B mounting bolt	2	—	2
Stopper A	1	1	—
Stopper A mounting bolt	1	1	—
Stopper B	1	1	1
Stopper B mounting bolt	—	—	2

●Shock absorber single unit

Bore size	Shock absorber model
ϕ 6 [0.236in.]	—
ϕ10 [0.394in.]	**KSHA5×5-D**
ϕ16 [0.630in.]	**KSHA6×8-F**
ϕ20 [0.787in.]	**KSHA7×8-G**
ϕ25 [0.984in.]	**KSHA7×8-K**

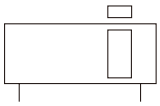
Remarks: 1. For details of the shock absorbers, see "Shock Absorbers KSHA Series" in the General Catalog of Air Treatment, Auxiliary, Vacuum.
2: The set consists of the shock absorber body and mounting nuts.

●Rubber stopper single unit

Bore size	Rubber stopper model
ϕ 6 [0.236in.]	**CRK570**
ϕ10 [0.394in.]	**CRK571**
ϕ16 [0.630in.]	**CRK572**
ϕ20 [0.787in.]	**CRK573**
ϕ25 [0.984in.]	**CRK574**

Remark: The set consists of the rubber stopper body and mounting nuts.

Symbol



Specifications

Item \ Bore size mm [in.]		10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]	40 [1.575]
Operation type		Double acting type					
Media		Air					
Operating pressure range MPa [psi.]		0.25～0.7 [36～102]	0.2～0.7 [29～102]				
Proof pressure MPa [psi.]		1.05 [152]					
Operating temperature range °C [°F]		0～60 [32～140]					
Operating speed range mm/s [in./sec.]		150～1000 [5.9～39.4] (2000 [78.7]) Note2	100～1000 [3.9～39.4] (2000 [78.7]) Note2				
Cushion		Shock absorber (Standard equipment for both ends)					
Lubrication	Cylinder portion	Not required (If lubrication is required, use Turbine Oil Class.1 [ISO VG32] or equivalent, or fluorine-contained lithium soap-based grease.)					
	Guide portion	Required (Lithium soap-based grease)					
Repeatability mm [in.]		±0.05 [±0.002]					
Parallelism Note1 mm [in.]		0.3 [0.012]					
Stroke adjusting range mm [in.]		Adjustable over the entire stroke (Specified stroke +10mm [0.394])					
Maximum load capacity N [lbf.]		130 [29.2]		300 [67.4]		600 [135]	
Port size		M5×0.8		Rc1/8		Rc1/4	

Notes: 1. This is the parallelism between the upper surface of the table and the bottom surface of the body. It is not the same as the traveling parallelism.
2. Figures in parentheses ( ) are for when MRS series with shock absorbers are set for 2000mm/s [78.7in./sec.] impact speed.
Remark: For the relation between the mass and piston speed, see the shock absorber absorption capacity graph on p.1196.

Magnet Retaining Force

N [lbf.]

Bore size mm [in.]	10 [0.394]	16 [0.630]	20 [0.787]	25 [0.984]	32 [1.260]	40 [1.575]
Magnet retaining force	58.8 [13.2]	156.9 [35.3]	294.2 [66.1]	451.1 [101.4]	715.9 [160.9]	1147.4 [257.9]

Specifications of Shock Absorber

Item \ Model	KSHJ10×10-01	KSHJ10×10-02	KSHJ14×12-01	KSHJ14×12-02	KSHJ20×16-01	KSHJ20×16-02
Applicable cylinder	MRS10, MRS16		MRS20, MRS25		MRS32, MRS40	
Maximum absorption J [ft·lbf]	3 [2.2]		10 [7.4]		30 [22.1]	
Absorbing stroke mm [in.]	10 [0.394]		12 [0.472]		16 [0.630]	
Maximum impact speed mm/s [in./sec.]	1000 [39.4]	2000 [78.7]	1000 [39.4]	2000 [78.7]	1000 [39.4]	2000 [78.7]
Maximum operating frequency cycle/min	60		40		30	
Maximum absorption per minute J/min [ft·lbf/min.]	120 [88.5]		240 [177]		450 [332]	
Spring return force Note N [lbf.]	8.0 [1.80]		9.2 [2.07]		22.0 [4.95]	
Angle variation	1° or less				3° or less	
Operating temperature range °C [°F]	0～60 [32～140]					

Note: Values at retracted position.
Caution: The life of the shock absorber may vary from the Magnet Type Rodless Cylinder, depending on its operating conditions.

Cylinder Thrust

N [lbf.]

Bore size mm [in.]	Pressure area mm² [in²]	Air pressure MPa [psi.]					
		0.2 [29]	0.3 [44]	0.4 [58]	0.5 [73]	0.6 [87]	0.7 [102]
10 [0.394]	78.5 [0.122]	—	24 [5.4]	31 [7.0]	39 [8.8]	47 [10.6]	55 [12.4]
16 [0.630]	201 [0.312]	40 [9.0]	60 [13.5]	80 [18.0]	101 [22.7]	121 [27.2]	141 [31.7]
20 [0.787]	314 [0.487]	63 [14.2]	94 [21.1]	126 [28.3]	157 [35.3]	188 [42.3]	220 [49.5]
25 [0.984]	490 [0.760]	98 [22.0]	147 [33.0]	196 [44.1]	245 [55.1]	294 [66.1]	343 [77.1]
32 [1.260]	804 [1.246]	161 [36.2]	241 [54.2]	322 [72.4]	402 [90.4]	482 [108.4]	563 [126.6]
40 [1.575]	1256 [1.947]	251 [56.4]	377 [84.7]	502 [112.8]	628 [141.2]	754 [169.5]	879 [197.6]

Remark: The above cylinder thrust is the theoretical value. Allow plenty of margin in actual applications.

Bore Size and Stroke

mm

Bore size	Standard strokes	Available strokes
10	150, 200, 250, 300, 350, 400, 500, 600	50～1000
16	150, 200, 250, 300, 350, 400, 500, 600	50～1500
20	200, 250, 300, 350, 400, 500, 600, 700, 800	50～2000
25	200, 250, 300, 350, 400, 500, 600, 700, 800	50～2000
32	300, 400, 500, 600, 700, 800, 900, 1000	50～2000
40	300, 400, 500, 600, 700, 800, 900, 1000	50～2000

Remark: Non-standard strokes are available at each 50mm stroke. For delivery, consult us.

Mass

kg [lb.]

Bore size mm [in.]	Zero stroke mass	Additional mass for each 50mm [1.969in.] stroke	Additional mass of 1 sensor switch Note	
			ZE□□□A	**ZE□□□B**
10 [0.394]	0.82 [1.80]	0.11 [0.24]	0.015 [0.033]	0.035 [0.077]
16 [0.630]	0.99 [2.18]	0.12 [0.26]		
20 [0.787]	2.56 [5.64]	0.22 [0.49]		
25 [0.984]	2.94 [6.48]	0.23 [0.51]		
32 [1.260]	6.22 [13.72]	0.34 [0.75]		
40 [1.575]	7.47 [16.47]	0.35 [0.77]		

Note: Sensor switch types A and B show the lead wire lengths.
A : 1000mm [39in.] B : 3000mm [118in.]

Air Flow Rate and Air Consumption

While the rodless cylinder's air flow rate and air consumption can be found through the following calculations, the quick reference table below provides the answers more conveniently.

Air flow rate: $Q_1 = \frac{\pi D^2}{4} \times L \times \frac{60}{t} \times \frac{P+0.101}{0.101} \times 10^{-6}$

Air consumption: $Q_2 = \frac{\pi D^2}{4} \times L \times 2 \times n \times \frac{P+0.101}{0.101} \times 10^{-6}$

Q_1	: Required air flow rate for cylinder	ℓ/min(ANR)
Q_2	: Air consumption of cylinder	ℓ/min(ANR)
D	: Cylinder tube inner diameter	mm
L	: Cylinder stroke	mm
t	: Time required for cylinder to travel 1 stroke	s
n	: Number of cylinder reciprocations per minute	times/min
P	: Pressure	MPa

Air flow rate: $Q_1' = \frac{\pi D'^2}{4} \times L' \times \frac{60}{t} \times \frac{P'+14.7}{14.7} \times \frac{1}{1728}$

Air consumption: $Q_2' = \frac{\pi D'^2}{4} \times L' \times 2 \times n \times \frac{P'+14.7}{14.7} \times \frac{1}{1728}$

Q_1'	: Required air flow rate for cylinder	ft.³/min.(ANR)※
Q_2'	: Air consumption of cylinder	ft.³/min.(ANR)※
D′	: Cylinder tube inner diameter	in.
L′	: Cylinder stroke	in.
t	: Time required for cylinder to travel 1 stroke	sec.
n	: Number of cylinder reciprocations per minute	times/min
P′	: Pressure	psi.

※Refer to p.54 for an explanation of ANR.

cm³ [in.³]/Reciprocation (ANR)

Bore size mm [in.]	Air pressure MPa [psi.]					
	0.2 [29]	0.3 [44]	0.4 [58]	0.5 [73]	0.6 [87]	0.7 [102]
10 [0.394]	0.468 [0.0286]	0.623 [0.0380]	0.779 [0.0475]	0.934 [0.0570]	1.090 [0.0665]	1.245 [0.0760]
16 [0.630]	1.198 [0.0731]	1.596 [0.0974]	1.993 [0.1216]	2.391 [0.1459]	2.789 [0.1702]	3.187 [0.1945]
20 [0.787]	1.872 [0.1142]	2.493 [0.1521]	3.115 [0.1901]	3.737 [0.2280]	4.359 [0.2660]	4.980 [0.3039]
25 [0.984]	2.924 [0.1784]	3.896 [0.2377]	4.867 [0.2970]	5.838 [0.3563]	6.810 [0.4156]	7.781 [0.4748]
32 [1.260]	4.791 [0.2924]	6.383 [0.3895]	7.975 [0.4867]	9.566 [0.5838]	11.158 [0.6809]	12.75 [0.7781]
40 [1.575]	7.486 [0.4568]	9.973 [0.6086]	12.46 [0.7604]	14.95 [0.9123]	17.43 [1.0636]	19.92 [1.2156]

The figures in the table show the air flow rate and air consumption when a rodless cylinder makes 1 reciprocation with stroke of 1mm [0.0394in.]. The air flow rate and consumption actually required are found by the following calculations.

● Finding the air flow rate (for selecting F.R.L., valves, etc.)
Example: When operating a rodless cylinder with bore size of 40mm [1.575in.] at speed of 300mm/s [11.8in./sec.] and under air pressure of 0.5Mpa [73psi.]

$14.95 \times \frac{1}{2} \times 300 \times 10^{-3} = 2.24$ ℓ/s [0.0791ft.³/sec.] (ANR)

(At this time, the air flow rate per minute is $14.95 \times \frac{1}{2} \times 300 \times 60 \times 10^{-3} = 134.55$ ℓ/min [4.750ft.³/min.] (ANR).)

● Finding the air consumption
Example 1. When operating a rodless cylinder with bore size of 40mm [1.575in.] and stroke of 100mm [3.94in.], and under air pressure of 0.5MPa [73psi.], for 1 reciprocation
$14.95 \times 100 \times 10^{-3} = 1.495$ ℓ [0.0528ft.³]/Reciprocation (ANR)
Example 2. When operating a rodless cylinder with bore size of 40mm [1.575in.] and stroke of 100mm [3.94in.], and under air pressure of 0.5MPa [73psi.], for 10 reciprocations per minute
$14.95 \times 100 \times 10 \times 10^{-3} = 14.95$ ℓ/min [0.528ft.³/min.] (ANR)

Note: To find the actual air consumption required when using rodless cylinders, add the air consumption of the piping to the air consumption obtained from the above calculation.

Order Codes for Magnet Type Rodless Cylinders

MRS [ ] **16×200** - [ ] - [ ] [ ] [ ]

Magnet type rodless cylinder MRS series

Bore size
×
Stroke

Heli-sert and locating dowel pin hole on the table
Blank : No heli-sert and dowel pin hole
P : With heli-sert and dowel pin hole

Shock absorber (Standard equipment)
KL : Impact speed 100～1000mm/s [3.9～39.4in./sec.]
KM : Impact speed 100～2000mm/s [3.9～78.7in./sec.]

Sensor switch
Blank : No sensor switch

ZE135 :	2-lead wire Solid state type	with indicator lamp	DC10～28V
ZE155 :	3-lead wire Solid state type	with indicator lamp	DC4.5～28V
ZE101 :	2-lead wire Reed switch type	without indicator lamp	DC5～28V, AC85～115V
ZE102 :	2-lead wire Reed switch type	with indicator lamp	DC10～28V, AC85～115V

Lead wire length
A : 1000mm [39in.]
B : 3000mm [118in.]

Number of sensor switches
1 : With 1 sensor switch
2 : With 2 sensor switches
3 : With 3 sensor switches
⋮

Additional Parts

● Shock absorber

KSHJ [ ] - [ ]

Linear orifice type shock absorber

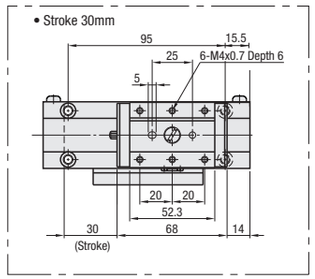
Mounting thread size × Stroke
10×10 —— For MRS10, 16
14×12 —— For MRS20, 25
20×16 —— For MRS32, 40

Impact speed range
01 : 100～1000mm/s [3.9～39.4in./sec.]——For **MRS**□×□ **-KL**
02 : 100～2000mm/s [3.9～78.7in./sec.]——For **MRS**□×□ **-KM**

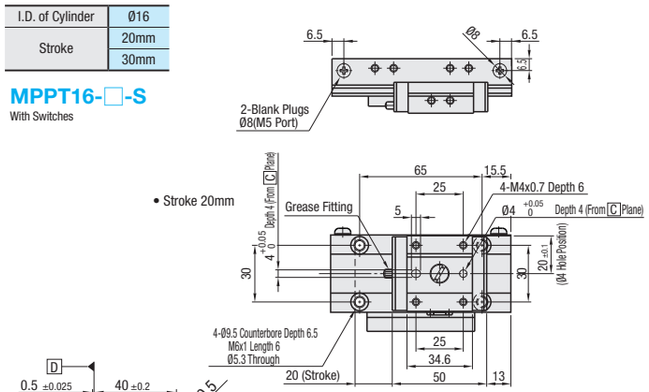
I.D. of Cylinder	Ø16
Stroke	20mm
	30mm

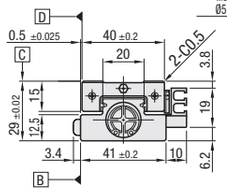
MPPT16-□-S
With Switches

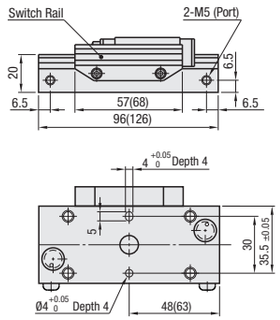
• Stroke 30mm



• Stroke 20mm





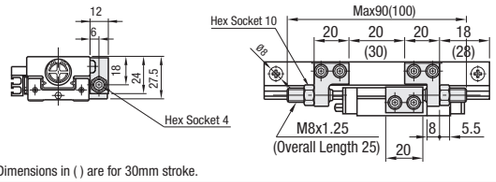


1. B D - Installation Datum Plane
2. Dimensions in ( ) are for 30mm stroke.
3. 2 switches are included with Switch Type.

MPPT16-□-N
Main Body Only

The dimensions are the same as Switch Type.

MPPT16-□-□
With Metal Stopper and Switches
With Rubber Stopper and Switches



Dimensions in ( ) are for 30mm stroke.

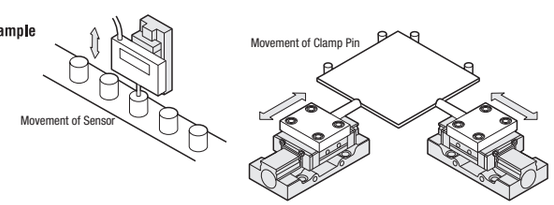
Dimension lines for tapped holes and etc. for switches and stoppers are omitted above. For details of the dimensions, please refer to CAD data.

Part Number	Stroke	Specification Selection	Stroke Adjustable Amount	Max. Load Mass	Main Body Mass	Unit Price (per Each Spec.) 1 ~ 3 pc(s). N, J, S, RS, TS	MS, RMS, TMS	MT, RMT, TMT
MPPT16	20	N (Main Body Only) J (Main Body with Switch Rail)	-	2.0kg	445g		-	-
	30				610g		-	-
	20	S (Contacting Switch) MS (Non-contact Switch) MT (3 Wire Non-contact Switch)			490g			
	30				660g			
	20	RS (Metal Stopper, Contacting Switch) RMS (Metal Stopper, Non-contact Switch) RMT (Metal Stopper, 3 Wire Non-contact Switch)	10mm for Both Sides	1.0kg	590g			
	30				760g			
	20	TS (Rubber Stopper, Contacting Switch) TMS (Rubber Stopper, Non-contact Switch) TMT (Rubber Stopper, 3 Wire Non-contact Switch)		2.0kg	590g			
	30				760g			

For orders larger than indicated quantity, please request a quotation.

Ordering Example: Part Number - Stroke - Spec. Code
MPPT16 - 30 - RMS

Example

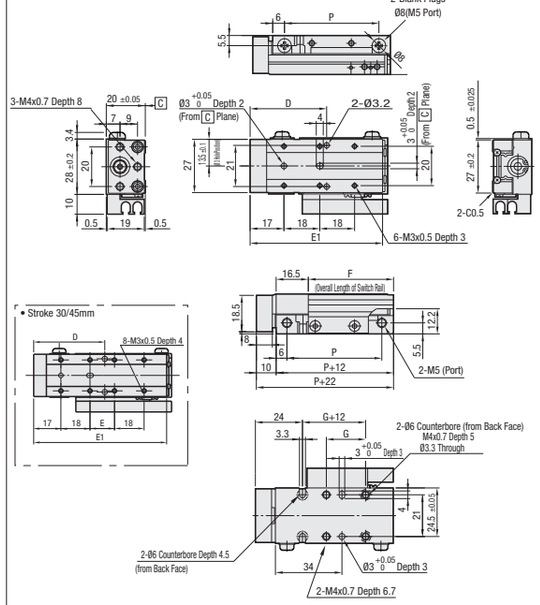


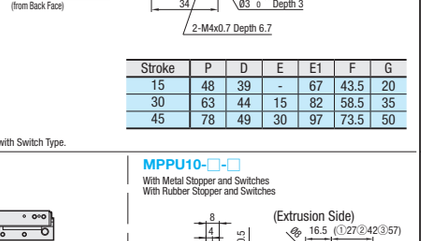
About Specifications and Switches P.621

I.D. of Cylinder	Ø10
Stroke	15mm
	30mm
	45mm

MPPU10-□-S
With Switches

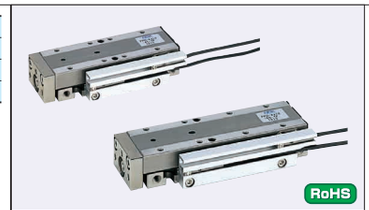
• Stroke 15mm





Stroke	P	D	E	E1	F	G
15	48	39	-	67	43.5	20
30	63	44	15	82	58.5	35
45	78	49	30	97	73.5	50

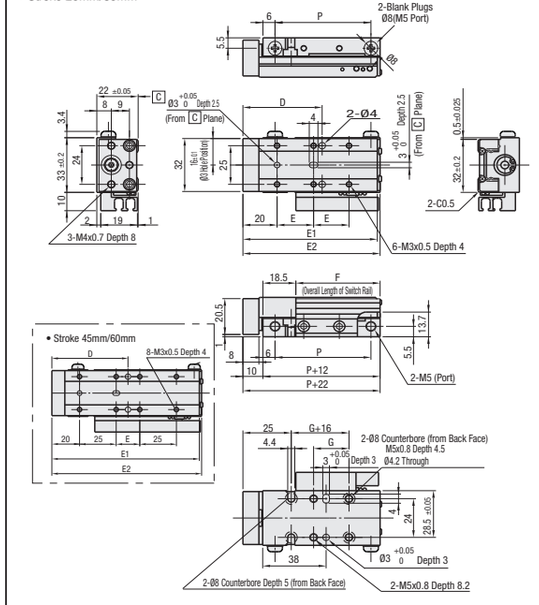
2 switches are included with Switch Type.

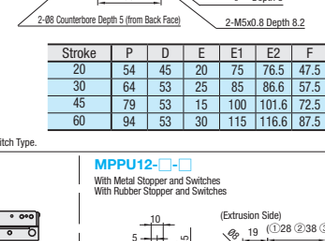


I.D. of Cylinder	Ø12
Stroke	20mm
	30mm
	45mm
	60mm

MPPU12-□-S
With Switches

• Stroke 20mm/30mm

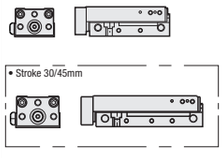




Stroke	P	D	E	E1	E2	F	G
20	54	45	20	75	76.5	47.5	20
30	64	53	25	85	86.6	57.5	30
45	79	53	15	100	101.6	72.5	45
60	94	53	30	115	116.6	87.5	60

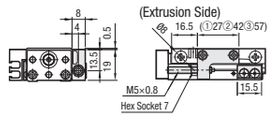
2 switches are included with Switch Type.

MPPU10-□-N
Main Body Only
• Stroke 15mm



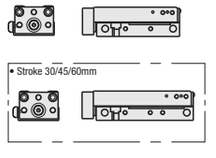
The dimensions are the same as Switch Type.

MPPU10-□-□
With Metal Stopper and Switches
With Rubber Stopper and Switches



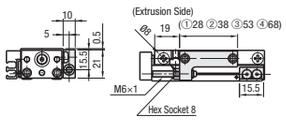
Dimensions in ( ) are①15mm,②30mm,③45mm stroke

MPPU12-□-N
Main Body Only
• Stroke 20mm



The dimensions are the same as Switch Type.

MPPU12-□-□
With Metal Stopper and Switches
With Rubber Stopper and Switches



Dimensions in ( ) are①20mm,②30mm,③45mm ,④60 mm stroke

Dimension lines for tapped holes and etc. for switches and stoppers are omitted above. For details of the dimensions, please refer to CAD data.

■MPPU10-□-□

Part Number	Stroke	Specification Selection	Stroke Adjustable Amount	Max. Load Mass	Main Body Mass	Unit Price (per Each Spec.) 1 ~ 3 pc(s). N, J, S, SS, SN	MS, SMS, SMN	MT, SMT, SMR
MPPU10	15	N (Main Body Only) J (Main Body with Switch Rail)	-	0.8kg	230g		-	-
	30				270g		-	-
	45				320g		-	-
	15	S (Contacting Switch) MS (Non-contact Switch) MT (3 Wire Non-contact Switch)			275g			
	30				320g			
	45				375g			
	15	SS (Metal Stopper, Contacting Switch) SMS (Metal Stopper, Non-contact Switch) SMT (Metal Stopper, 3 Wire Non-contact Switch)	Push Side 15mm	0.3kg	310g			
	30				365g			
	45				430g			
	15	SN (Rubber Stopper, Contacting Switch) SMN (Rubber Stopper, Non-contact Switch) SMR (Rubber Stopper, 3 Wire Non-contact Switch)		0.8kg	310g			
	30				365g			
	45				430g			

Ordering Example: Part Number - Stroke - Spec. Code
MPPU12 - 60 - MS

About Specifications and Switches P.621

■MPPU12-□-□

Part Number	Stroke	Specification Selection	Stroke Adjustable Amount	Max. Load Mass	Main Body Mass	Unit Price (per Each Spec.) 1 ~ 3 pc(s). N, J, S, SS, SN	MS, SMS, SMN	MT, SMT, SMR
MPPU12	20	N (Main Body Only) J (Main Body with Switch Rail)	-	1.2kg	320g		-	-
	30				370g		-	-
	45				425g		-	-
	60				495g		-	-
	20	S (Contacting Switch) MS (Non-contact Switch) MT (3 Wire Non-contact Switch)			367g			
	30				420g			
	45				480g			
	60				555g			
	20	SS (Metal Stopper, Contacting Switch) SMS (Metal Stopper, Non-contact Switch) SMT (Metal Stopper, 3 Wire Non-contact Switch)	Push Side 15mm	0.5kg	412g			
	30				475g			
	45				550g			
	60				640g			
	20	SN (Rubber Stopper, Contacting Switch) SMN (Rubber Stopper, Non-contact Switch) SMR (Rubber Stopper, 3 Wire Non-contact Switch)		1.2kg	412g			
	30				475g			
	45				550g			
	60				640g			

For orders larger than indicated quantity, please request a quotation.