

# Mechanically Jointed Rodless Cylinder with Brake, Hy-rodless Cylinder

## Series *ML1C*

ø25, ø32, ø40

### How to Order

Hy-rodless cylinder  
(With brake)

**ML1C** **25** **G** — **300** — — — **M5BW** —

• **Bore size (mm)**

<b>25</b>	25 mm
<b>32</b>	32 mm
<b>40</b>	40 mm

• **Standard stroke**

Bore size (mm)	Standard stroke (mm)*	Maximum manufacturable stroke (mm)
<b>25</b>	100, 200, 300, 400, 500, 600, 700, 800, 900, 1000	2000
<b>32</b>	100, 200, 300, 400, 500, 600, 700, 800, 900, 1000	2000
<b>40</b>	100, 200, 300, 400, 500, 600, 700, 800, 900, 1000	2000



\* When stroke is required, which is longer than the standard stroke, refer to the "Made to Order Specifications" for long stroke type (XB11).

• **Number of auto switches**

<b>Nil</b>	2 pcs.
<b>S</b>	1 pc.
<b>n</b>	"n" pcs.

• **Auto switch**

**Nil** Without auto switch (Built-in magnet)

\* For the applicable auto switch model, refer to the table below.  
\* Auto switches are shipped together, (but not assembled).

• **Suffix for stroke adjusting unit**

<b>Nil</b>	2 pcs.
<b>S</b>	1 pc.

• **Stroke adjusting unit**

<b>Nil</b>	Without adjusting unit
<b>H</b>	Shock absorber + Adjusting bolt

**Shock absorber for stroke adjusting unit**

ø25	ø32	ø40
RB1412	RB2015	RB2015

**Applicable Auto Switch**/Refer to page 9-15-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage		Auto switch model	Lead wire length (m)*			Pre-wire connector	Applicable load		
					DC	AC		0.5 (Nil)	3 (L)	5 (Z)				
Reed switch	—	Grommet	Yes	3-wire (NPN equivalent)	—	5 V	—	<b>E76A</b>	●	●	—	—	IC circuit	—
				2-wire	24 V	12 V	100 V	<b>E73A</b>	●	●	—	—	—	Relay, PLC
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	<b>M5N</b>	●	●	●	○	IC circuit	Relay, PLC
				3-wire (PNP)				<b>M5P</b>	●	●	●	○	IC circuit	
				2-wire				<b>M5B</b>	●	●	●	○	—	
				3-wire (NPN)				<b>M5NW</b>	●	●	●	○	IC circuit	
				3-wire (PNP)				<b>M5PW</b>	●	●	●	○	IC circuit	
				2-wire				<b>M5BW</b>	●	●	●	○	—	
				3-wire (NPN)				<b>M5NT</b>	—	●	●	○	IC circuit	
				3-wire (PNP)				<b>M5PT</b>	—	●	●	○	IC circuit	
Diagnostic indication (2-color indication)	Grommet	Yes	24 V	5 V, 12 V	—	—	—	—	—	—	—	—	—	
With timer														Grommet

\* Lead wire length symbols: 0.5 m.....Nil (Example) E76A  
3 m.....L (Example) E76AL  
5 m.....Z (Example) M5NTZ

\* Solid state switches marked with "○" are produced upon receipt of order.

- Since there are other applicable auto switches than listed, refer to page 9-14-11 for details.
- For details about auto switches with pre-wire connector, refer to page 9-15-66.

# Mechanically Jointed Rodless Cylinder with Brake

## Hy-rodless Cylinder Series ML1C



### Cylinder Specifications

Bore size (mm)		25	32	40
Guide type	Cam follower guide type			
Fluid	Air			
Action	Double acting			
Operating pressure range (MPa)	0.1 to 0.8			
Proof pressure (MPa)	1.2			
Ambient and fluid temperature	5 to 60°C (No freezing)			
Piston speed (mm/s)	100 to 1000			
Cushion	Air cushion on both ends (Standard)			
Lubrication	Non-lube			
Stroke length tolerance (mm)	+1.8 0			
Port size Rc	Front port, Side port, Bottom port	1/8		1/4



### Made to Order Specifications (For details, refer to page 9-16-1.)

Symbol	Specifications
-XB11	Long stroke
-X416	Holder mounting bracket I
-X417	Holder mounting bracket II

### Stroke Adjusting Unit Part No.

Bore size (mm)	25	32	40
Unit no.	ML1-A25H	ML1-A32H	ML1-A40H

### Side Support Part No.

Bore size (mm)	25	32	40
Type			
Side support A	MY-S25A	MY-S32A	MY-S40A
Side support B	MY-S25B	MY-S32B	MY-S40B

For details about dimensions, etc., refer to page 9-14-9.

### Auto Switch Mounting Bracket Part No.

Bore size (mm)	Mounting bracket part no.	Note	Auto switch part no.
25 32 40	BMY1-025	<ul style="list-style-type: none"> <li>Switch mounting screw M2.5 x 10<math>\phi</math></li> <li>Switch mounting nut</li> </ul>	D-E73A/ 76A/80A
	BMY2-025	<ul style="list-style-type: none"> <li>Switch mounting screw M2.5 x 12<math>\phi</math></li> <li>Switch mounting nut</li> </ul>	D-M5N/ M5P/M5B D-M5NW/ M5PW/ M5BW D-M5NTL/ M5PTL

### Brake Specifications

Lock operation	Spring locking (Exhaust lock)
Fluid	Air
Maximum operating pressure (MPa)	0.5
Brake releasing pressure (MPa)	0.25
Brake activating pressure (MPa)	0.18
Braking direction	Both directions

### Stroke Adjusting Unit Specifications

Applicable cylinder size (mm)	25	32	40
Stroke adjustment range	Any position on the entire stroke		
Stroke fine adjusting range (mm)	0 to -11.5	0 to -12	0 to -16
Shock absorber model	RB1412	RB2015	RB2015
Max. absorbing energy (J)	19.6	58.8	58.8
Stroke absorption (mm)	12	15	15
Max. collision speed (mm/s)	1000	1000	1000
Max. operating frequency (cycle/min)	45	25	25
Spring force (N)	When extended	6.86	8.34
	When retracted	15.98	20.50
Operating temperature range	5 to 60°C		

### Weight

Bore size (mm)	Basic weight	Additional weight per each 50mm of stroke	Side support weight (per set)		Stroke adjustment unit weight (per unit)
			Type A	Type B	
25	3.86	0.275	0.015	0.016	0.25
32	6.05	0.425	0.040	0.041	0.41
40	8.38	0.545	0.076	0.080	0.50

### Theoretical Output

Bore size (mm)	Piston area (mm <sup>2</sup> )	Operating pressure (MPa)						
		0.2	0.3	0.4	0.5	0.6	0.7	0.8
25	490	98	147	196	245	294	343	392
32	804	161	241	322	402	483	563	643
40	1256	251	377	502	628	754	879	1005

CL

CL1

MLGC

CNG

MNB

CNA

CNS

CLS

CLQ

MLGP

RLQ

MLU

ML1C

D-

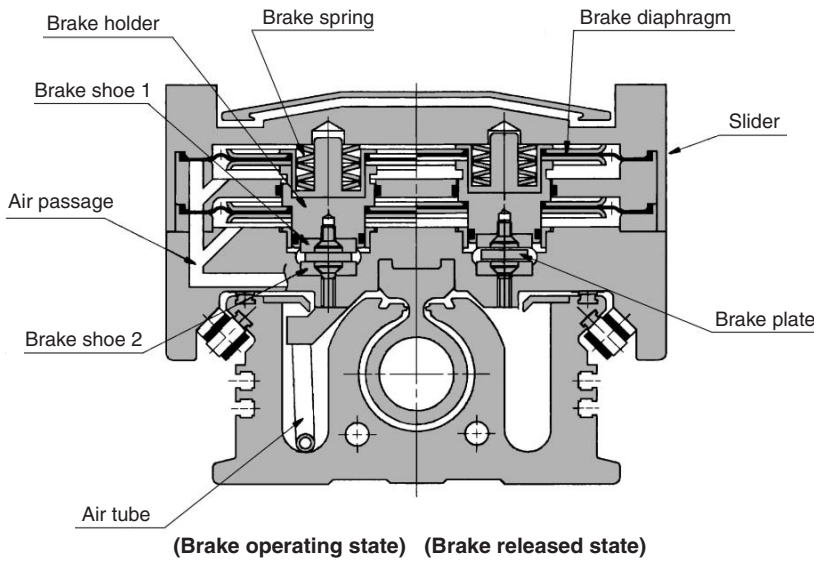
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Data

# Series ML1C

## Construction Principle of Brake



### [Anatomy of Brake Operation]

Brake force is generated by a brake spring acting on a brake shoe 1 attached to brake holder, brake rails and holds brake plate between brake shoe 1 and brake shoe 2 fixed to slider side so that slider will stop.

### [Brake releasing]

Air pressure supplied from the head cover side goes to the slide table through the air tube and acts on the brake diaphragm, reducing the spring.

## Brake Capacity

### Holding Force (Maximum static load)

Bore size (mm)	25	32	40
Holding force	320 N	500 N	800 N

1. The holding force is the lock's ability to hold a static load that does not involve vibrations or shocks, after it is locked without a load. Therefore, to use the cylinder near the upper limit of the constant holding force, be aware of the following:

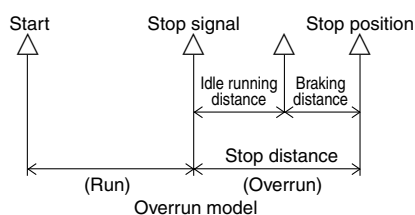
- Select the cylinder bore size so that the load is less than 80% of the holding force.
- If slipping occurs when the load is over holding force, the brake shoe will be damaged, and it is possible the holding force will become smaller or the cylinder life shortened.

### Allowable Kinetic Energy

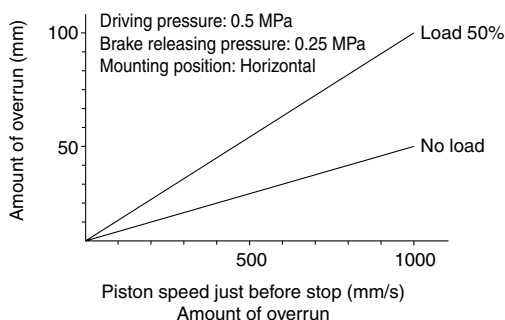
Bore size (mm)	25	32	40
Allowable kinetic energy (J)	0.43	0.68	1.21

## Overrun

### Overrun



When cylinder is stopped at intermediate strokes, "idle running distance" is from detection of stop signal to beginning of brake operation and "braking distance" is from beginning of brake operation to the stop of slider.



The graph above shows the relation between piston speed and overrun. (The length of overrun is changed, dependent on piston speed, load, piping conditions and control method. Be sure to adjust the stop signal position, etc. by trial operation with the actual machine.)

### Stop dispersion

When cylinder is stopped at intermediate stroke, there is dispersion of stop position. Dispersion of stop position is changed dependent on piston speed, load, piping condition and control method. Use values in the table below as reference.

### Stopping Accuracy

Piston speed (mm/s)	100	300	500	800	1000
Stopping accuracy (mm)	±0.5	±1.0	±2.0	±3.0	±4.0

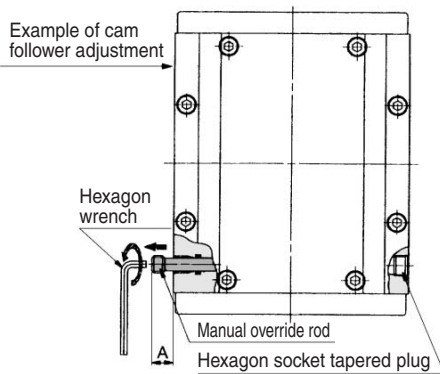
Conditions Driving pressure: 0.5 MPa

Brake releasing pressure: 0.25 MPa

Load: 25%

Solenoid valve for releasing brake is connected to cylinder directly. Dispersion of the control system is not included.

## Manual Operation



### Warning

In the case of manual operation, be sure to supply air for brake releasing. If not, this may result in damage to the brake, which will cause a cylinder malfunction.

#### [Brake releasing]

1. Supply the air for releasing the brake to the braking air port on the head cover. This should be 0.4 to 0.5 MPa.
2. Loosen the manual override (nickel plated) rod on the slide table, and draw the rod until it reaches to the end. The size of the hexagon wrench should be 3 mm (ML1C25, 32) or 4 mm (ML1C40).
3. Exhaust the air to release the brake.

### Manual Rod Drawing Dimensions

Model	A
ML1C25	23
ML1C32	27
ML1C40	32

#### [Brake operation]

1. Supply the air for releasing the brake to the braking air port on the head cover. This should be 0.4 to 0.5 MPa.
2. Push the manual rod and then screw it until it is housed inside a slider completely.
3. Exhaust the air to release the brake.

## Cushion Capacity

### Cushion selection

#### <Air cushion>

Air cushion is standard on Hy-rodless cylinder. The air cushion mechanism is incorporated to prevent excessive impact of the piston at the stroke end during high speed operation.

Air cushion is not applied for slow piston operation around the stroke end.

A range of the weights and speeds that an air cushion can absorb is within the limits shown in the graph, "Air Cushion Absorbing Capacity".

#### <Stroke adjustment unit with shock absorber>

Use this unit to decelerate the cylinder when weight and speed are beyond the air cushion limit lines or when the stroke adjustment causes limited or no cushion engagement.

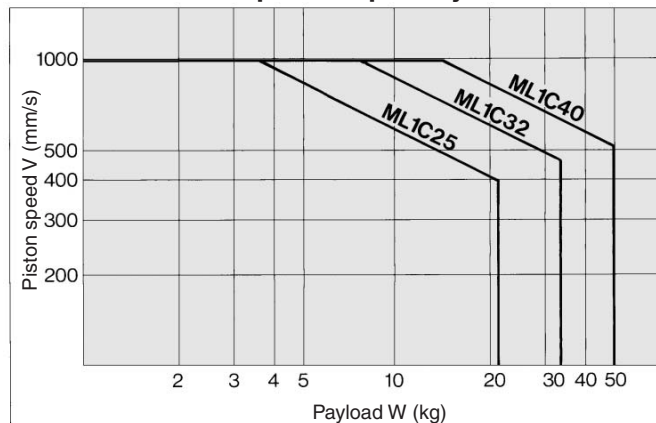
Note)

1. Adjust the shock absorber so that stroke will be fully utilized to near the limit of allowable energy, because absorption capacity becomes extremely small if the absorber's effective stroke is short due to a stroke adjustment.
2. When the shock absorber is used within the air cushion stroke range, almost open the air cushion needle (about 1 turn from the fully closed position).

### Air Cushion Stroke

Bore size (mm)	Cushion stroke
25	15
32	19
40	24

### Air Cushion Absorption Capability



### Stroke Adjusting Unit with Shock Absorber/ Calculation of Absorbed Energy

Type of impact	Horizontal collision	Vertical (Downward)	Vertical (Upward)
Kinetic energy $E_1$		$\frac{W}{2g} \cdot V^2$	
Thrust energy $E_2$	F·s	F·s + W·s	F·s - W·s
Absorbed energy E	$E_1 + E_2$		

Symbol

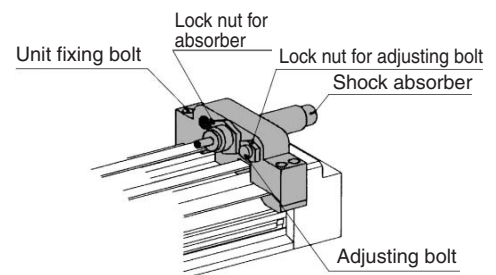
V: Impact speed (m/s) g: Gravitational acceleration (m/s<sup>2</sup>)

W: Impact object weight (kg) F: Cylinder thrust (N)

s: Stroke length of shock absorber (m)

Note) The speed of the impact object is measured at the moment of impact with the shock absorber.

### Adjusting Procedure



#### <Moving and fixing unit>

Remove the dust proof cover, loosen the four fixing bolts to move the unit body.

The unit body can be fixed by tightening four holding bolts evenly at an arbitrary position. However, there is a possibility that the adjustment mechanism will be tilted due to high impact energy. Since the holder mounting bracket for adjustment is available as an option for -X416, -X417, we recommend that you use it. Please refer to holder mounting bracket in Made to Order Specifications (2). If any other length is desired, please consult with SMC.

#### <Stroke adjustment of adjusting bolt>

After loosening the lock nut for adjusting bolt, adjust the stroke with hexagon wrench. Then, tighten lock nut.

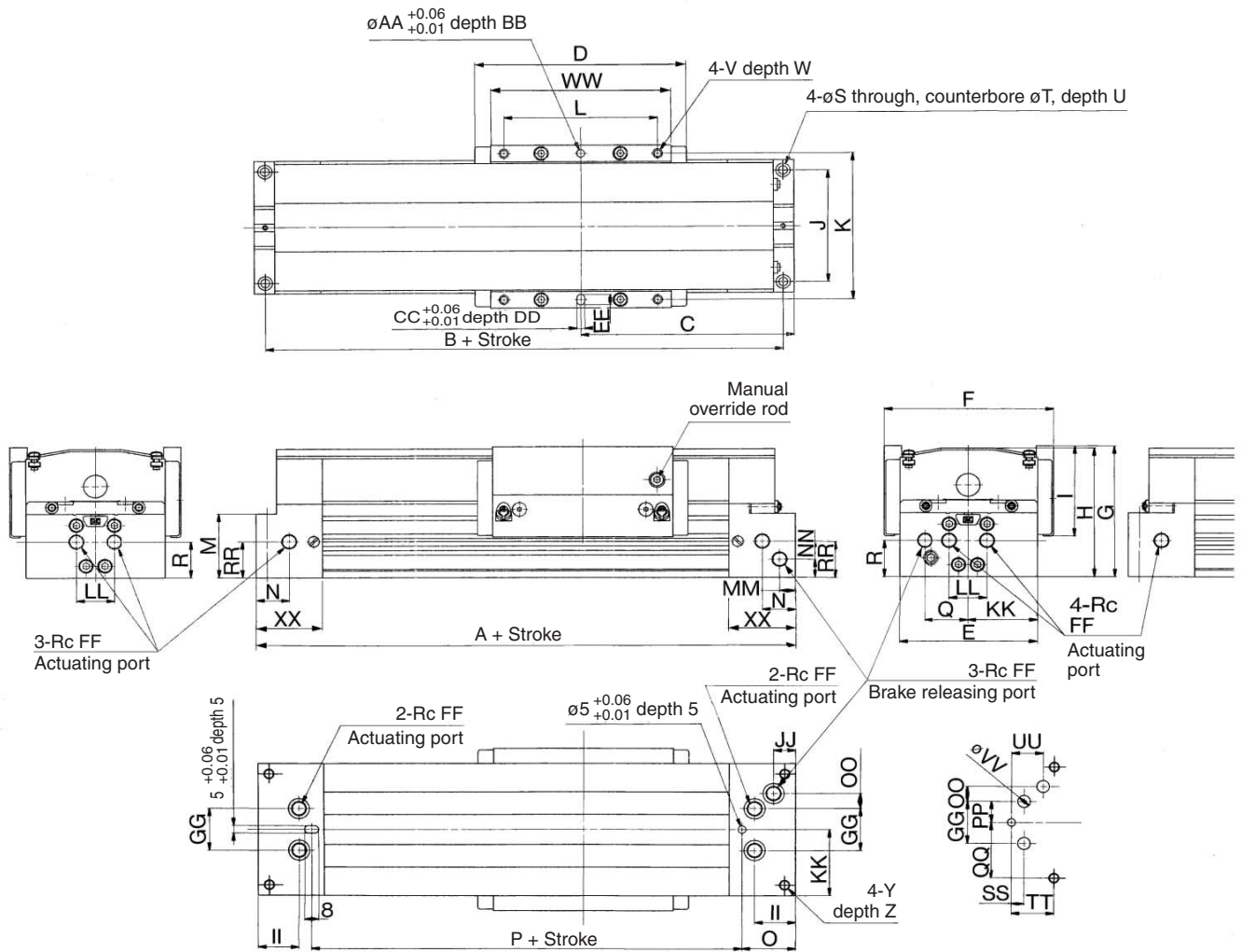
#### <Stroke adjusting of shock absorber>

After loosening the lock nut for the shock absorber, adjust the stroke by rotating shock absorber, then fix the shock absorber by tightening lock nut. Do not over tighten the lock nut.

# Series ML1C



## Basic Type



### Bottom Side Piping Port Size

(Mounting side should be processed according to the dimensions below.) (mm)

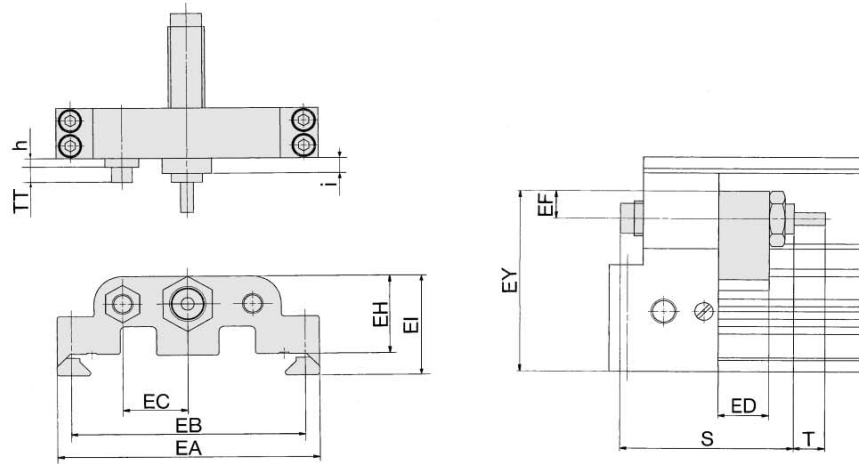
Model	OO	PP	QQ	RR	SS	TT	UU	VV	Applicable gasket
<b>ML1C25</b>	10	14	37	24	8	27	20	8	C11.2
<b>ML1C32</b>	16.5	18	46	30	12	32	22	8	C11.2
<b>ML1C40</b>	17	23.5	53	40	12.5	34	26	10	C14

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	Y	Z
<b>ML1C25</b>	274	260	137	140	88	108	87	85.5	60	74	97	100	42.5	26	34	206	28	24	5.6	9	5.5	M5 x 0.8	8.5	M6 x 1	9.5
<b>ML1C32</b>	322	306	161	160	108	131	101	99.5	64	92	118	120	53.5	28	40	242	36.5	30	6.8	11	6.6	M6 x 1	12	M8 x 1.25	16
<b>ML1C40</b>	372	354	186	190	124	158	118	116.5	73	106	144	140	64	30.5	43	286	40.5	35	8.6	14	8.5	M8 x 1.25	14	M10 x 1.5	15

Model	AA	BB	CC	DD	EE	FF	GG	II	JJ	KK	LL	MM	NN	WW	XX
<b>ML1C25</b>	5	5	5	5	7	1/8	28	26	14	44	20	16	12.5	120	42
<b>ML1C32</b>	6	5	6	5	8	1/8	36	28	18	54	36	18	12.5	140	48
<b>ML1C40</b>	6	5	6	5	8	1/4	47	30.5	17	62	30	22	16.5	170	51

# Mechanically Jointed Rodless Cylinder with Brake Hy-rodless Cylinder Series ML1C

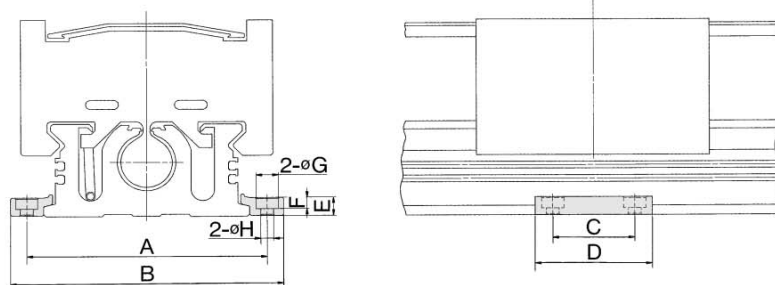
## Stroke Adjusting Unit



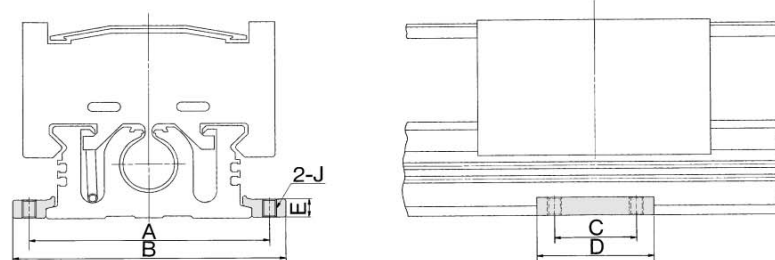
Part no.	Applicable bore (mm)	EA	EB	EC	ED	EF	EY	S	T	EH	EI	TT	h	i	Shock absorber model
ML1-A25H	ML1C25	101	90	25	20	11	72	67.3	12	31	39.5	Max. 16.5	4.5	3	RB1412
ML1-A32H	ML1C32	120	107	30	25	16	93	73.2	15	38	49	Max. 20	5.5	6	RB2015
ML1-A40H	ML1C40	147	129	30	31	16	105.5	73.2	15	40.5	54.5	Max. 25	5.5	6	

## Side Support

### Side support A



### Side support B



Part no.	Applicable bore (mm)	A	B	C	D	E	F	G	H	J
MY-S25 <sup>A</sup> <sub>B</sub>	ML1C25	103	117	35	50	8	5	9.5	5.5	M6 x 1
MY-S32 <sup>A</sup> <sub>B</sub>	ML1C32	128	146	45	64	11.7	6	11	6.6	M8 x 1.25
MY-S40 <sup>A</sup> <sub>B</sub>	ML1C40	148	170	55	80	14.8	5	14	9	M10 x 1.5

CL

CL1

MLGC

CNG

MNB

CNA

CNS

CLS

CLQ

MLGP

RLQ

MLU

ML1C

D-

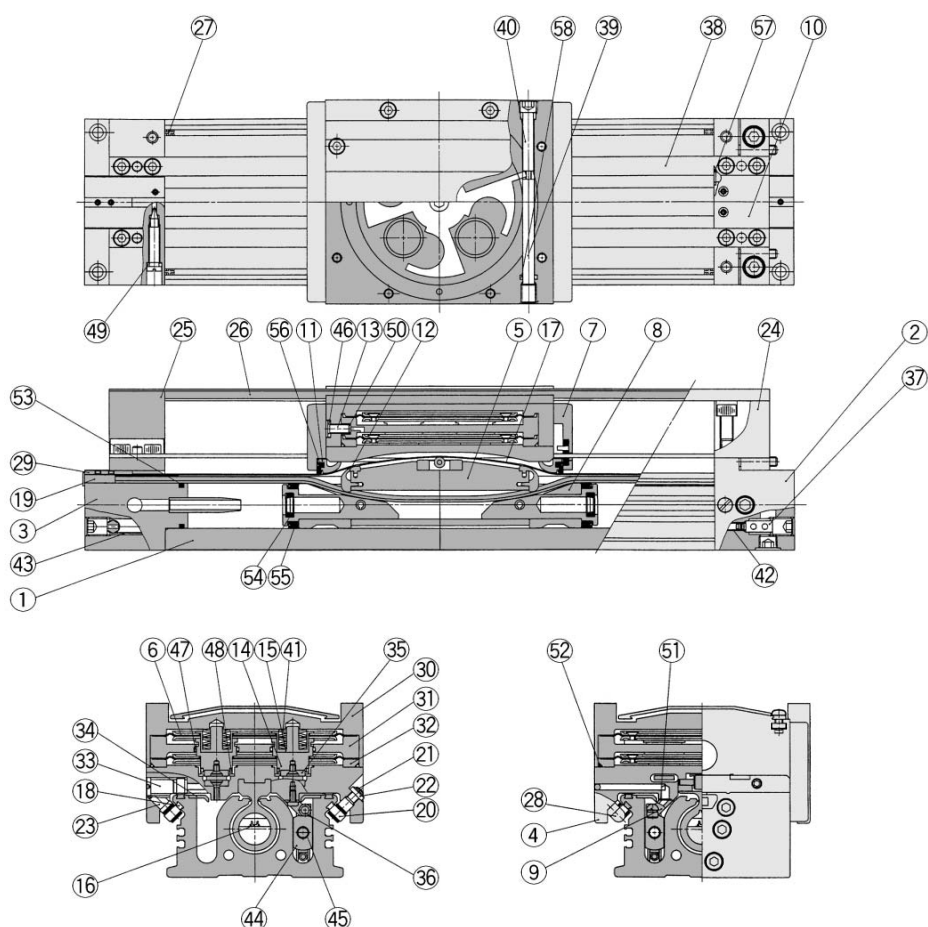
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Data

# Series ML1C

## Construction



### Component Parts

No.	Description	Material	Note
①	Cylinder tube	Aluminum alloy	Hard anodized
②	Head cover WR assembly	Aluminum alloy	Hard anodized
③	Head cover WL assembly	Aluminum alloy	Hard anodized
④	Slide table	Aluminum alloy	Hard anodized
⑤	Piston assembly	Aluminum alloy	Hard anodized
⑥	Brake diaphragm assembly	—	
⑦	End Cover	Chrome molybdenum steel	Nickel plated
⑧	Wear ring	Special resin	
⑨	Air joint assembly	—	
⑩	Plate tensile table	Rolled steel	Nickel plated
⑪	Backup plate	Special resin	
⑫	Belt separator	Special resin	
⑬	Port joint	Stainless steel	
⑭	Brake holder assembly	Carbon steel	Gas soft nitrided
⑮	Spring holder	Carbon steel	Gas soft nitrided
⑯	Seal belt	Special resin	
⑰	Dust seal band	Stainless steel	
⑱	Rail	Hard steel wire material	
⑲	Belt clamp	Special resin	
⑳	Cam follower	—	
㉑	Eccentric screw cap	Stainless steel	
㉒	Lock nut	Stainless steel	
㉓	Bushing	Stainless steel	
㉔	Dust proof cover mountable R	Aluminum alloy	Hard anodized
㉕	Dust proof cover mountable L	Aluminum alloy	Hard anodized
㉖	Dust cover	Aluminum alloy	Hard anodized
㉗	End spacer	Special resin	
㉘	Magnet assembly	Aluminum alloy	Anodized
㉙	Seal lock plate	Rolled steel	Nickel plated
㉚	Slider cover assembly	Aluminum alloy	Hard anodized
㉛	Diaphragm plate assembly	Aluminum alloy	Chromated
㉜	Diaphragm ring	Aluminum alloy	Chromated (ø25 only)

No.	Description	Material	Note
㉝	Cam follower cap	Aluminum alloy	Hard anodized
㉞	Tube cover	Aluminum alloy	Hard anodized
㉟	Brake shoe	Special friction material	
㊱	Joint ring	Stainless steel	
㊲	Air coupler 2	Stainless steel	
㊳	Brake plate	Stainless steel	Hard chrome plated
㊴	Manual rod 1	Carbon steel	
㊵	Manual rod 2	Carbon steel	
㊶	Brake spring		
㊷	Air tube	Stainless steel	
㊸	Cable	Stainless steel	
㊹	Tube guide assembly		
㊺	Guide rod	Stainless steel	

### Seal List

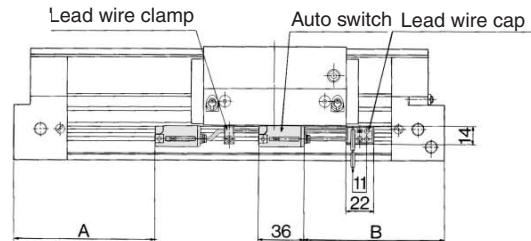
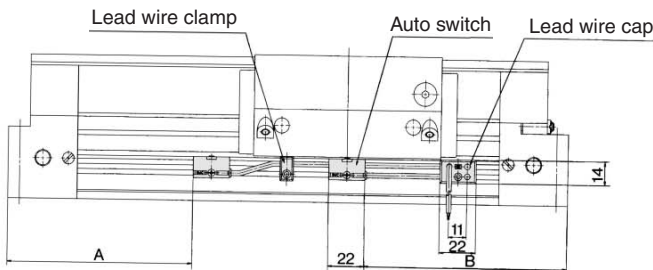
Part no.	Description	Material	ML1C25G	ML1C32G	ML1C40G
㊻	O-ring	NBR	C-7	C-7	C-7
㊼	O-ring	NBR	SO-015-22	SO-015-24	SO-020-31
㊽	O-ring	NBR	SO-015-16	SO-016-9	SO-015-20
㊾	Needle gasket	NBR	8.3 x 4.5 x 1.9	C-4	C-4
㊿	O-ring	NBR	SO-010-16	SO-010-16	SO-010-16
1	O-ring	NBR	SO-010-16	C-6	C-8
2	O-ring	NBR	C-100	AS568-048	C-150
3	Tube gasket	NBR	TMY-25	TMY-32	TMY-40
4	Cushion seal	NBR	RCS-8	RCS-10	RCS-12
5	Piston seal	NBR	GMY25	GMY32	GMY40
6	Scraper	NBR	M1L025-17A82076C	M1L032-17A82077C	M1L040-17A82078C
7	Bypass gasket	NBR	C-6	C-7	C-9
8	O-ring	NBR	P-6	P-6	P-8

# Mechanically Jointed Rodless Cylinder with Brake Hy-rodless Cylinder Series ML1C

## Proper Auto Switch Mounting Position (Detection at stroke end)

D-E7□A, D-E80A

D-M5□  
D-M5□W  
D-M5□TL



Note) Position auto switch's indicator sight toward the slide table side.

### Lead Wire Clamp/Lead Wire Cap (Option)

Series	Lead wire clamp	Lead wire cap
<b>ML1C</b>	LC-01	LP-01

Series	Mounting position	ø25	ø32	ø40
		<b>ML1C</b>	A	128.5
	B	123.5	147.5	172.5

### Lead Wire Clamp/Lead Wire Cap (Option)

Series	Lead wire clamp	Lead wire cap
<b>ML1C</b>	LC-01	LP-01

Series	Mounting position	(mm)		
		ø25	ø32	ø40
<b>ML1C</b>	A	124.8	148.8	173.8
	B	113.2	137.2	162.2

### Minimum Stroke for Auto Switch Mounting (mm)

No. of auto switches mounted	Applicable auto switch	
	D-E7□A, D-E80A	D-M5□, D-M5□W, D-M5□TL
1 pc.	10	5
2 pcs.	15	10

### Operating Range

Auto switch model	Bore size (mm)		
	25	32	40
<b>D-E7□A/E80A</b>	6	6	6
<b>D-M5□/M5□W/M5□TL</b>	4	4	4

\* Since this is a guideline including hysteresis, not meant to be guaranteed. (Assuming approximately ±30% dispersion.)  
There may be the case it will vary substantially depending on an ambient environment.

Besides the models listed in "How to Order", the following auto switches are applicable. For detailed specifications, refer to page 9-15-1.

Type	Model	Electrical entry	Features
Reed switch	D-E80A	Grommet	Without indicator light

CL

CL1

MLGC

CNG

MNB

CNA

CNS

CLS

CLQ

MLGP

RLQ

MLU

**ML1C**

D-

-X

20-

Data