# Mechanically Jointed Hy-rodless Cylinder with Brake

## *ML1C* Series

## ø25, ø32, ø40

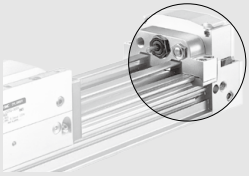
**Brake mechanism has been compactly integrated into the slide table which enables intermediate stops of the rodless cylinder.**

### Large holding brake force

Force from 4 brake springs hold slide tightly.

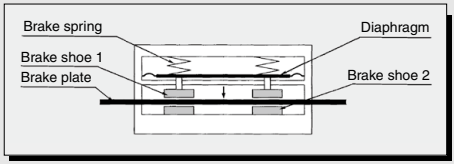
- Holding force ø25 — 320 N
  ø32 — 500 N
  ø40 — 800 N

### Stroke adjustment unit combines a shock absorber and stopper bolt.



### Brake construction is designed not to allow loads on guide.

Spring force works directly on the brake-shoe and the brake plate is caught between brake shoes from top and bottom so that the slide table can stop without compromising guide performance. The brake shoe yields long service life due to special friction resistant material.



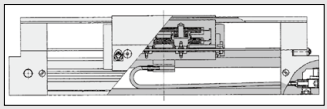

### Stop is possible at the arbitrary position.

### Locking in both directions is possible.

Locking in either side of cylinder stroke is possible, too.

### External air piping for brake release not required.

Brake releasing air flows from head cover to slide table through air tube in cylinder body. There is no restriction on piping requirements because piping to the outside of the slide table is not necessary.



### Cam follower guide type

Cam follower is adopted for the guide section.
Trafficability is excellent in moment resistance.

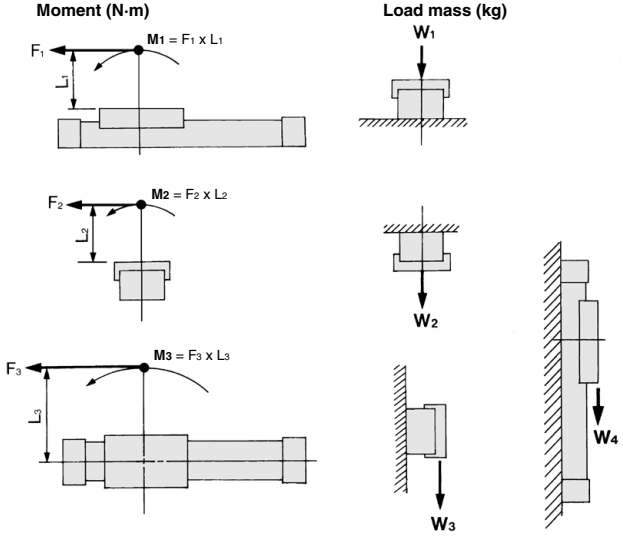
## Maximum Allowable Moment/Maximum Load Mass

| Model | Allowable moment (N·m) | | | Maximum load mass (kg) | | | |
|---|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | W1 | W2 | W3 | W4 |
| ML1C25 | 14.7 | 4.90 | 4.90 | 20 | 12 | 3 | 10 |
| ML1C32 | 29.4 | 9.80 | 9.80 | 32 | 19 | 5 | 16 |
| ML1C40 | 58.8 | 19.6 | 19.6 | 50 | 30 | 8 | 25 |

## Caution on Design

### Allowable moment and Load Mass Maximum

Allowable moment and Maximum load mass varies depending on mounting orientation, piston speed, etc. Therefore use the cylinder within the range shown in the graph corresponding to operating conditions.




### (How to calculate the load ratio)

**A.** Consider (1) max. load mass, (2) static moment, (3) dynamic moment (when stopper collides) when calculating the max. allowable moment and load mass.

∗ Evaluate (1) and (2) as **υa** (average speed), and (3) as **υ** (collision speed **υ** = 1.4 **υa**). Calculate (1) (**Wmax**) from the graph of max. payload (**W1**, **W2**, **W3**) and calculate (2) and (3) (**Mmax**) from the maximum allowable moment graph (**M1**, **M2**, **M3**).

$$\text{Sum of the load factors } \Sigma\alpha = \frac{\text{Load mass [m]}}{\text{Maximum load mass [m·max]}} + \frac{\text{Static moment [M]}^{\text{(Note 1)}}}{\text{Static allowable moment [Mmax]}} + \frac{\text{Dynamic moment [ME]}^{\text{(Note 2)}}}{\text{Dynamic allowable moment [MEmax]}} \leq 1$$

Note 1) Moment generated by load, etc. when the cylinder stops.
Note 2) Moment generated by load equivalent to impact at stroke end (when stopper collides).
Note 3) Depending on the shape of the workpiece, multiple moments may occur. When this happens, the sum of the load factors ($\Sigma\alpha$) is the total of all such moments.

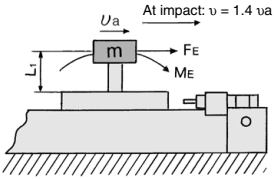
**B.** Reference formula [Dynamic moment at impact]
Refer to following calculation for dynamic moment considering the impact when stopper collides.

**W** : Mass (kg)
**F** : Load (N)
**FE** : Load equivalent to impact (when stopper collides) (N)
**υa** : Average speed (mm/s)
**M** : Static moment (N·m)
**υ** : Collision speed (mm/s)
**L1** : Distance to the center of load gravity (m)
**ME** : Dynamic moment (N·m)
**g** : Gravitational acceleration (9.8 m/s²)

**υ** = 1.4 **υa** (mm/s) $F_E = \frac{1.4}{100}\,\upsilon a \cdot g \cdot W$

$\therefore M_E = \frac{1}{3}^{\text{(Note 4)}} \cdot F_E \cdot L_1 = 0.05\,\upsilon a g W L_1$ (N·m)

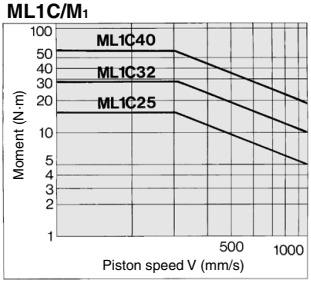
Note 4) Average load coefficient (This coefficient is meant to average the maximum load moment at the time of impact with stopper in the light of calculating the service life.)



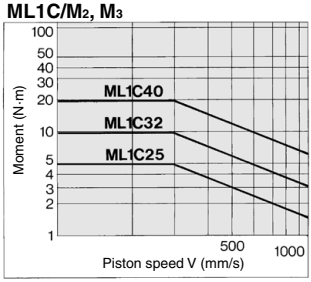

## Maximum Allowable Moment

Select the moment within the limits shown in the graphs below. Note that the maximum payload value in some cases may exceed maximum allowable payload despite being within the limit shown in the graph; therefore, payload on the operating conditions should be checked.

**ML1C/M1**



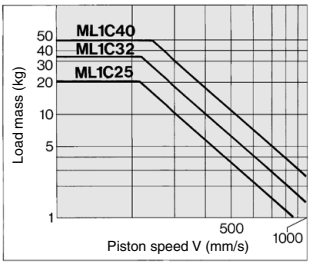

**ML1C/M2, M3**



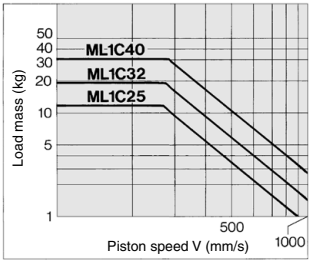
## Maximum Load Mass

Select the maximum load mass to be applied within the limits shown in the graph. Note that the maximum allowable moment may in some cases exceed Maximum allowable moment despite being within the limit shown in the graph: therefore, allowable moment on operating conditions should be checked.

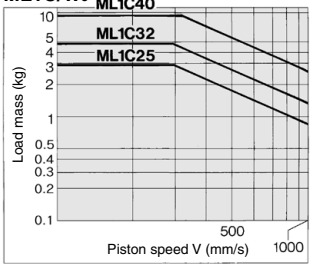
**ML1C/W$_1$**



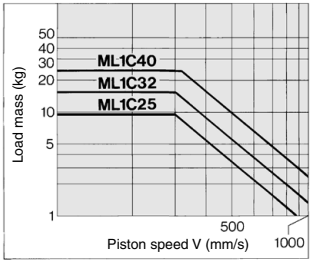

**ML1C/W$_2$**




**ML1C/W$_3$**



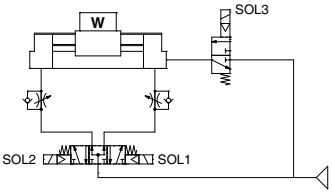

**ML1C/W$_4$**



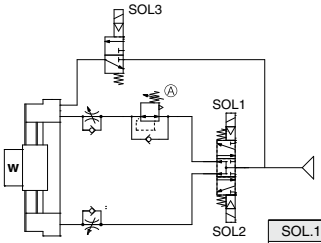

## Caution on Pneumatic Circuit Design

**Operating pneumatic circuit**

**Horizontal, Lateral mounting**




**Vertical mounting**




| SOL.1 | SOL.2 | SOL.3 | Actuation |
|---|---|---|---|
| OFF | OFF | OFF | Stop |
| ON | OFF | ON | To left |
| OFF | ON | ON | To right |

∗ Be sure to use the circuit above. Please consult with SMC in case of using other circuits.

## Solenoid Valve for Driving and Braking

**<Solenoid valve for driving>**

Use pressure center type valve.
Control the operation with a meter-out system.

**<Solenoid valve for braking>**

- Use the solenoid valve for braking which has the effective area equivalent to the one of solenoid valve for driving. If the effective area is smaller, it may encounter an unexpected sudden slide table movement.
- Install a solenoid valve for braking as close to the cylinder as possible. If there is a long distance between the cylinder and valve, it may cause fluctuations in the stop accuracy or unexpected sudden slide table movements.

**<Recommended solenoid valve example>**

| | Horizontal, lateral mounting | Vertical |
|---|---|---|
| Solenoid valve for driving | VFS2500 | |
| Solenoid valve for braking | VP300 or VFS2100 | |

∗ Determine the size of the solenoid valve according to the operating cylinder speed.

## Air Balance

On both above mentioned circuit, the air balance is made by pressurizing to both sides of cylinder on the condition of the intermediate stop.
In the case of the vertical orientation, reduce the pressure of the upside by regulator (check valve) (A) to keep the balance is not made, it may cause unexpected sudden slide table movements after the intermediate stop operation, once the reverse operation occurs, resulting in compromised accuracy of the cylinder.

## Supply Pressure

- Set the supply pressure at 0.25 to 0.5 MPa. If setting at less than 0.25 MPa, malfunction of the release brake may occur.
- If line pressure is used directly as supply pressure, any fluctuation in pressure will appear in the form of changes in cylinder characteristics. Therefore, make sure to use a pressure regulator to convert line pressure into supply pressure for the actuating valve and the brake valve. In order to actuate multiple cylinders at once, use a pressure regulator that can handle a large air flow volume and also consider installing a surge tank.

# Mechanically Jointed Hy-rodless Cylinder with Brake

# *ML1C* Series

**ø25, ø32, ø40**

## How to Order

**Hy-rodless cylinder (With brake)**

**ML1C** | **25** | **G** – | **300** | **H** – | **E73A** | | – | |

**Made to Order**
Refer to page 953 for details.

**Bore size (mm)**

| | |
|---|---|
| **25** | 25 mm |
| **32** | 32 mm |
| **40** | 40 mm |

**Number of auto switches**

| | |
|---|---|
| **Nil** | 2 pcs. |
| **S** | 1 pc. |
| **n** | "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 (not assembled).

**Cylinder stroke**

| Bore size (mm) | Standard stroke (mm)∗ | Maximum manufacturable stroke (mm) |
|---|---|---|
| **25** | 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000 | 2000 |
| **32** | 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000 | 2000 |
| **40** | 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).

**Stroke adjustment unit symbol**
Refer to page 953 for stroke adjustment unit.

### Applicable Auto Switches/Refer to pages 1341 to 1435 for further information on auto switches.

| Type | Special function | Electrical entry | Indicator light | Wiring (Output) | Load voltage DC | Load voltage DC | Load voltage AC | Auto switch model | Lead wire length (m)∗ 0.5 (Nil) | 3 (L) | 5 (Z) | Pre-wired connector | Applicable load | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reed auto switch | — | Grommet | Yes | 3-wire (NPN equivalent) | — | 5 V | — | **E76A** | ● | ● | — | — | IC circuit | — |
| | | | | 2-wire | 24 V | 12 V | 100 V | **E73A** | ● | ● | — | — | — | Relay, PLC |
| | | | No | | | 5 V,12 V | 100 V or less | **E80A** | ● | ● | — | — | IC circuit | |

∗ Lead wire length symbols: 0.5 m·····Nil (Example) E73A
3 m·····L (Example) E73AL

∗ Auto switches are shipped together (not assembled). (For details about auto switch mounting, etc., refer to page 960.)

## 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 | | |
| **Lubrication** | | Not required (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

**Made to Order Specifications**

Click here for details

| Symbol | Specifications |
|---|---|
| **-XB11** | Long stroke type |

## 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 Adjustment Unit Specifications

| Applicable cylinder size (mm) | | 25 | 32 | 40 |
|---|---|---|---|---|
| **Unit symbol** | | **H** | **H** | **H** |
| **Configuration Shock absorber model** | | RB1412 + with adjustment bolt | RB2015 + with adjustment bolt | RB2015 + with adjustment bolt |
| **Stroke adjustment range by intermediate fixing spacer (mm)** | **Without spacer** | 0 to –11.5 | 0 to –12 | 0 to –16 |
| | **With short spacer** | –11.5 to –23 | –12 to –24 | –16 to –32 |
| | **With long spacer** | –23 to –34.5 | –24 to –36 | –32 to –48 |

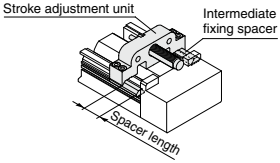
∗ Stroke adjustment range is applicable for one side when mounted on a cylinder.
∗ The shock absorber service life is different from that of the ML1C cylinder depending on the operating conditions. Refer to the Specific Product Precautions for the replacement period.

## Stroke Adjustment Unit Symbol

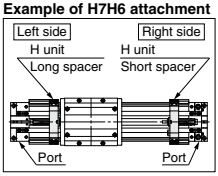
| | | | Right side stroke adjustment unit | | | |
|---|---|---|---|---|---|---|
| | | | Without unit | H: With high load shock absorber + Adjustment bolt | | |
| | | | | | With short spacer | With long spacer |
| **Left side stroke adjustment unit** | **Without unit** | | **Nil** | **SH** | **SH6** | **SH7** |
| | **H: With high load shock absorber + Adjustment bolt** | | **HS** | **H** | **HH6** | **HH7** |
| | | **With short spacer** | **H6S** | **H6H** | **H6** | **H6H7** |
| | | **With long spacer** | **H7S** | **H7H** | **H7H6** | **H7** |

∗ Spacers are used to fix the stroke adjustment unit at an intermediate stroke position.

**Stroke adjustment unit mounting diagram**




**Example of H7H6 attachment**




## Stroke Adjustment Unit Shock Absorber Model

| ø25 | ø32 | ø40 |
|---|---|---|
| RB1412 | RB2015 | RB2015 |

## Shock Absorber Specifications

| Applicable cylinder size (mm) | | 25 | 32 | 40 |
|---|---|---|---|---|
| **Shock absorber model** | | **RB1412** | **RB2015** | **RB2015** |
| **Max. energy absorption (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)** | **Extended** | 6.85 | 8.34 | 8.34 |
| | **Retracted** | 15.98 | 20.50 | 20.50 |
| **Operating temperature range (°C)** | | 5 to 60 | | |

∗ Stroke adjustment range is applicable for one side when mounted on a cylinder.
∗ The shock absorber service life is different from that of the ML1C cylinder depending on the operating conditions. Refer to the Specific Product Precautions for the replacement period.

## Theoretical Output

(N)

| Bore size (mm) | Piston area ($mm^2$) | 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 |

## Weight

(kg)

| Bore size (mm) | Basic weight | Additional weight per each 50 mm 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 |

## Option

### Stroke Adjustment Unit Model

**ML1 − A 25 H − 6N**

**Stroke adjustment unit**

**Cylinder bore size**

| | |
|---|---|
| **25** | 25 mm |
| **32** | 32 mm |
| **40** | 40 mm |

**Unit part no.**

| Symbol | Stroke adjustment unit | Mounting position |
|---|---|---|
| **H** | H unit | For both sides |

Note) For details about adjustment range, refer to page 953.

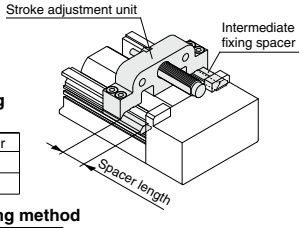
**Intermediate fixing spacer**

| | |
|---|---|
| **Nil** | Without spacer |
| **6□** | Short spacer |
| **7□** | Long spacer |

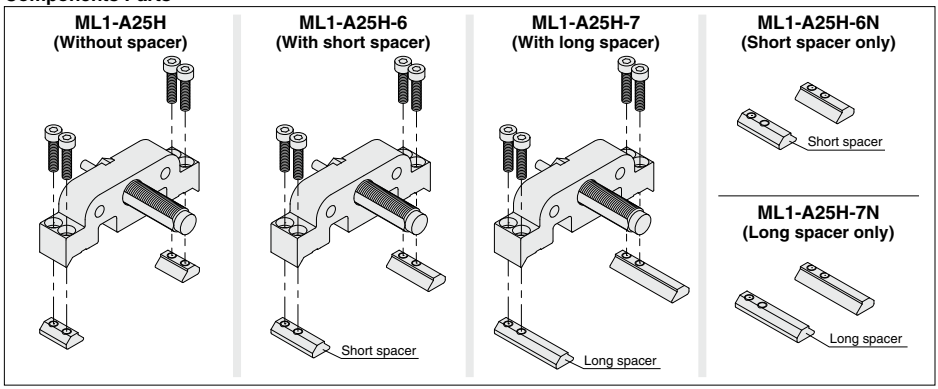
**Spacer shipping method**

| | |
|---|---|
| **Nil** | Assembled as a unit |
| **N** | Spacer only |

∗ Spacers are used to fix the stroke adjustment unit at an intermediate stroke position.
∗ Spacers are shipped in 2 piece sets.




### Components Parts

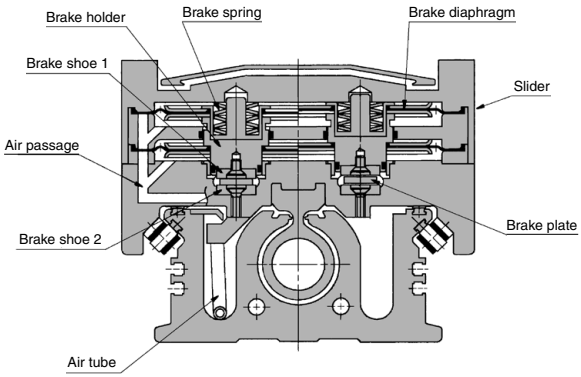



### Side Support Part No.

| Type \ Bore size (mm) | 25 | 32 | 40 |
|---|---|---|---|
| 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 958.

## Construction Principle of Brake




**(Brake operating state) (Brake released state)**

**[Anatomy of Brake Operation]**

Spring force generated by the brake spring works on a brake shoe 1 fixed to the brake holder, bend brake plate fixed on head cover on both sides, 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 | 320N | 500N | 800N |

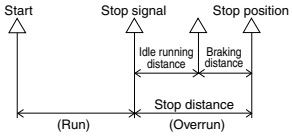
**1.** The holding force is the lock's ability to hold a static load that does not involve vibrations or shocks, after it is locked without a load. Therefore, to use the cylinder near the upper limit of the constant holding force, be aware of the following:
- Select the cylinder bore size so that the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

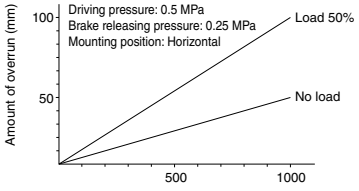
## Overrun

### Overrun




**Overrun model**

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.




**Amount of overrun**

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

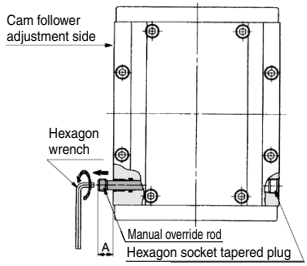
When cylinder is stopped at intermediate stroke, there is dispersion of stop position. Dispersion of stop position is changed dependent on piston speed, load, piping condition and control method. Use values in the table below as reference.

### 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 by using a hexagon wrench, 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 mass 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>**

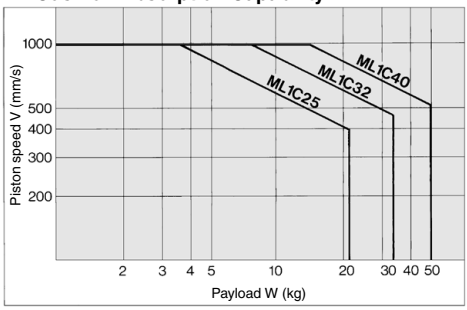
Use this unit to decelerate the cylinder when mass and speed are beyond the air cushion limit lines or when the stroke adjustment causes limited or no cushion engagement.
Note)

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).

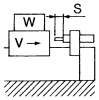
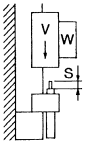
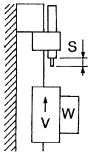
### Air Cushion Stroke (mm)

| Bore size (mm) | Cushion stroke |
|---|---|
| **ø25** | 15 |
| **ø32** | 19 |
| **ø40** | 24 |

### Air Cushion Absorption Capability




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

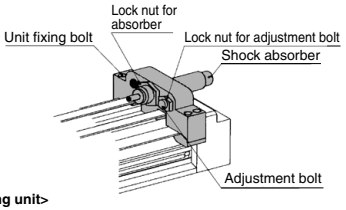
| Type of impact | Horizontal collision | Vertical (Downward) | Vertical (Upward) |
|---|---|---|---|
| |  |  |  |
| Kinetic energy $E_1$ | $\frac{W}{2}\cdot V^2$ | | |
| Thrust energy $E_2$ | F·s | F·s + W·s·g | F·s – W·s·g |
| Absorbed energy E | $E_1 + E_2$ | | |

**Symbol**

**V**: Impact speed (m/s) **g**: Gravitational acceleration (m/s²)
**W**: Impact object mass (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.

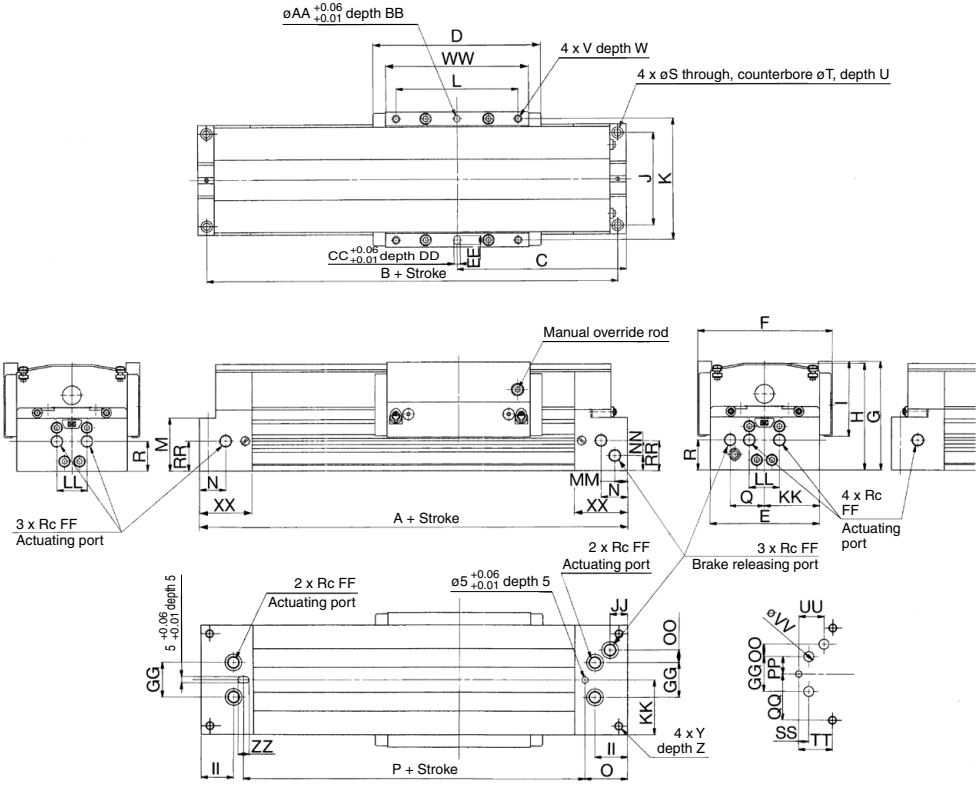
**<Stroke adjusting of adjustment bolt>**

After loosening the lock nut for adjustment 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.

## Basic Type




### Bottom Side Piping Port Size

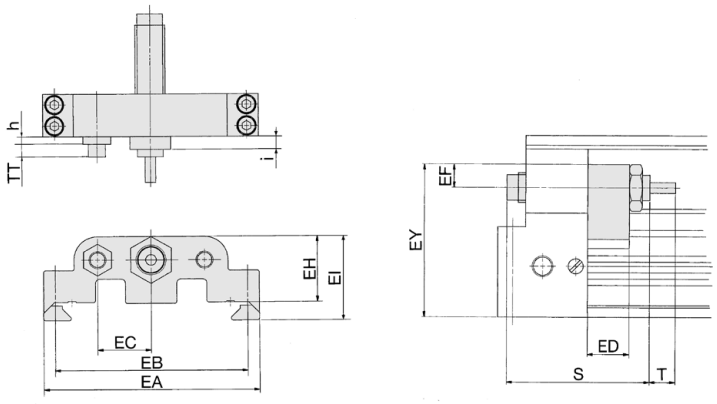
(Mounting side should be processed according to the dimensions below.) (mm)

| Model | OO | PP | QQ | RR | SS | TT | UU | VV | Applicable gasket |
|---|---|---|---|---|---|---|---|---|---|
| **ML1C25** | 10 | 14 | 37 | 24 | 8 | 27 | 20 | 8 | C11.2 |
| **ML1C32** | 16.5 | 18 | 46 | 30 | 12 | 32 | 22 | 8 | C11.2 |
| **ML1C40** | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ML1C25** | 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 |
| **ML1C32** | 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 |
| **ML1C40** | 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 | ZZ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ML1C25** | 5 | 5 | 5 | 5 | 7 | 1/8 | 28 | 26 | 14 | 44 | 20 | 16 | 12.5 | 120 | 42 | 8 |
| **ML1C32** | 6 | 5 | 6 | 5 | 8 | 1/8 | 36 | 28 | 18 | 54 | 36 | 18 | 12.5 | 140 | 48 | 8 |
| **ML1C40** | 6 | 5 | 6 | 5 | 8 | 1/4 | 47 | 30.5 | 17 | 62 | 30 | 22 | 16.5 | 170 | 51 | 10 |

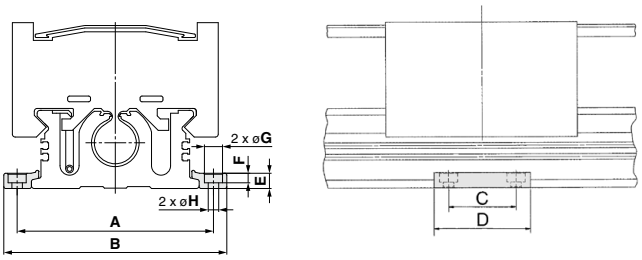
## Stroke Adjustment Unit



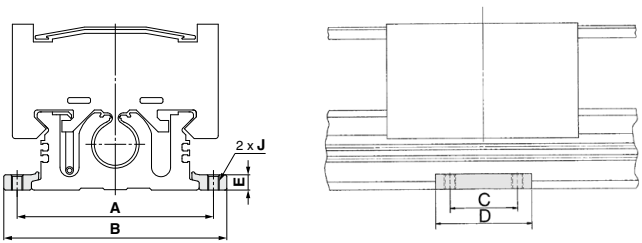

| Part no. | Applicable bore | EA | EB | EC | ED | EF | EY | S | T | EH | EI | TT | h | i | Shock absorber model |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ML1-A25H** | **ML1C25** | 101 | 90 | 25 | 20 | 11 | 72 | 67.3 | 12 | 31 | 39.5 | Max. 16.5 | 4.5 | 3 | RB1412 |
| **ML1-A32H** | **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



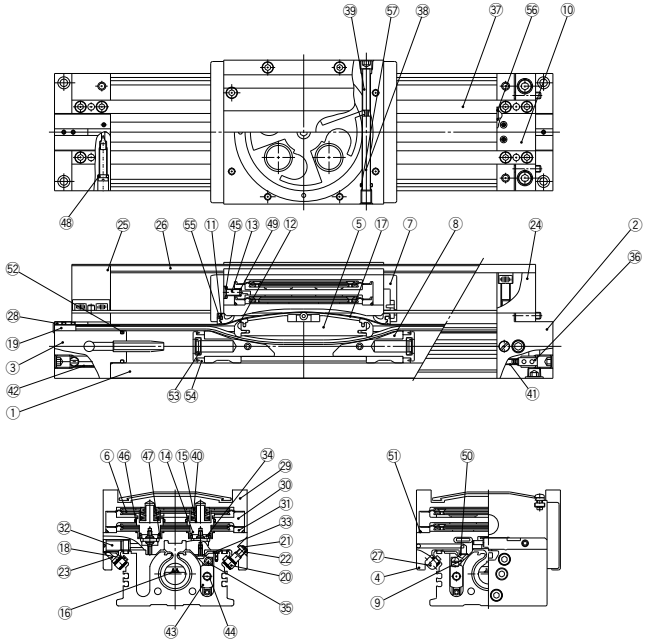

### Side support B




(mm)

| Part no. | Applicable bore | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|---|
| **MY-S25$^{A}_{B}$** | **ML1C25** | 103 | 117 | 35 | 50 | 8 | 5 | 9.5 | 5.5 | M6 x 1 |
| **MY-S32$^{A}_{B}$** | **ML1C32** | 128 | 146 | 45 | 64 | 11.7 | 6 | 11 | 6.6 | M8 x 1.25 |
| **MY-S40$^{A}_{B}$** | **ML1C40** | 148 | 170 | 55 | 80 | 14.8 | 5 | 14 | 9 | M10 x 1.5 |

## 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 | **Stopper** | Carbon steel | Nickel plated |
| 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 | **Magnet assembly** | Aluminum alloy | Anodized |
| 28 | **Seal lock plate** | Rolled steel | Nickel plated |
| 29 | **Slider cover assembly** | Aluminum alloy | Hard anodized |
| 30 | **Diaphragm plate assembly** | Aluminum alloy | Chromated |
| 31 | **Diaphragm ring** | Aluminum alloy | Chromated (ø25 only) |

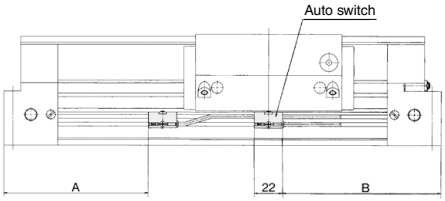
### Component Parts

| No. | Description | Material | Note |
|---|---|---|---|
| 32 | **Cam follower cap** | Aluminum alloy | Hard anodized |
| 33 | **Tube cover** | Aluminum alloy | Hard anodized |
| 34 | **Brake shoe** | Special friction material | |
| 35 | **Joint ring** | Stainless steel | |
| 36 | **Air coupler 2** | Stainless steel | |
| 37 | **Brake plate** | Stainless steel | Hard chrome plated |
| 38 | **Manual rod 1** | Carbon steel | Nickel plated |
| 39 | **Manual rod 2** | Carbon steel | Chromated |
| 40 | **Brake spring** | | |
| 41 | **Air tube** | Special resin | |
| 42 | **Cable** | Stainless steel | |
| 43 | **Tube guide assembly** | | |
| 44 | **Guide tube** | Stainless steel | |
| 45 | **Tension rod** | Rolled steel | Nickel plated |
| 46 | **Spacer** | Stainless steel | |
| 47 | **O-ring** | NBR | |
| 48 | **O-ring** | NBR | |
| 49 | **O-ring** | NBR | |
| 50 | **Needle gasket** | NBR | |
| 51 | **O-ring** | NBR | |
| 52 | **O-ring** | NBR | |
| 53 | **O-ring** | NBR | |
| 54 | **Tube gasket** | NBR | |
| 55 | **Cushion seal** | NBR | |
| 56 | **Piston seal** | NBR | |
| 57 | **Scraper** | NBR | |
| 58 | **Bypass gasket** | NBR | |
| 59 | **O-ring** | NBR | |

# Auto Switch Mounting

## Auto Switch Proper Mounting Position (Detection at Stroke End)

### D-E7□A, D-E80A




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

| Series | Mounting position | ø25 | ø32 | ø40 |
|---|---|---|---|---|
| ML1C | A | 128.5 | 152.5 | 177.5 |
| | B | 123.5 | 147.5 | 172.5 |

### Minimum Stroke for Auto Switch Mounting

(mm)

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

### Operating Range

| Auto switch model | Bore size (mm) | | |
|---|---|---|---|
| | 25 | 32 | 40 |
| D-E7□A, E80A | 6 | 6 | 6 |

∗ 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.

## Auto Switch Mounting Bracket: Part No.

| Bore size (mm) | Auto switch mounting bracket part no. | Note | Auto switch model |
|---|---|---|---|
| 25<br>32<br>40 | BMY1-025 | ●Switch mounting screw M2.5 x 10 L<br>●Switch mounting nut | D-E7□A-80A |

# *ML1C Series*
# Specific Product Precautions

**Be sure to read this before handling the products. Refer to page 9 for safety instructions and pages 10 to 19 for actuator and auto switch precautions.**

## Adjustment

### ⚠ Caution

**1. Even though hy-rodless cylinders can be loaded within the maximum allowable moment and payload, precise alignment is required if connected to a payload which has an external support structure.**
As the stroke becomes longer, variations in the center axis become larger. Consider using a connection method (floating mechanism) that is able to absorb deflection.

**2. Due to the factory pre-adjusted guide and brake plate, readjustment is not required under normal operating conditions.**
Therefore, do not unnecessarily alter the guide adjustment setting.

**3. Do not operate the cylinder in an environment in which the cylinder will be exposed to cutting chips, dust (paper debris, lint, etc.), spatter or cutting fluid (gas oil, water (warm water), etc.), which could lead to operational problems.**

**4. It is recommended that grease be applied periodically to the sliding portion of the bearing and to the dust seal band to increase their service life.**

**5. Take precautions under operating conditions in which negative pressure is generated inside the cylinder by external forces or inertial forces. Air leakage may occur due to separation of the seal belt. Do not generate negative pressure in the cylinder by forcibly moving it with an external force during the trial operation or dropping it with self-weight under the non-pressure state, etc.**
When the negative pressure is generated, slowly move the cylinder by hand and move the stroke back and forth. After doing so, if air leakage still occurs, consult with SMC.

**6. Since the hy-rodless cylinders have a unique seal structure, a slight speed change may occur.**
For applications that require constant speed, select an applicable equipment for the level of demand.

**7. The hy-rodless cylinder does not guarantee traveling parallelism. When accuracy in traveling parallelism and a middle position of stroke is required, consult with SMC.**

**8. When the cylinder is used extremely infrequently, operation may be interrupted in order for anchoring and a change lubrication to be performed or service life may be reduced.**

**9. Mount a cylinder after confirming the cylinder tube is not twisted.**
If flatness of the mounting surface is not sufficient, the cylinder tube may be twisted, which may cause air leakage due to separation of the seal belt, damage to a dust seal band, or malfunctions.

## Handling Precautions

### ⚠ Caution

**1. Do not scratch or dent the outside surface of the cylinder tube.**
This may result in damaged bearings or scrapers, which can cause cylinder malfunction.

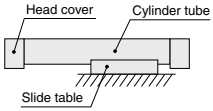
## Handling Precautions

### ⚠ Caution

**2. Do not apply a load to the dustproof cover.**
It may cause malfunction.

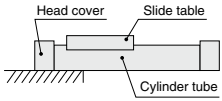
**3. Since the slide table is supported by precision bearings, do not subject it to strong impact or excessive moment when mounting workpieces.**

**4. Do not mount a slide table on the fixed equipment surface.**
It may cause damage or malfunctions since an excessive load is applied to the bearing.



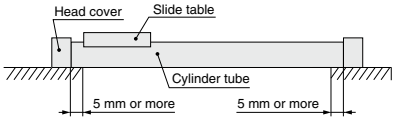

**Mounting with a slide table (slider)**

**5. Consult with SMC when mounting in a cantilevered way.**
Since the cylinder body deflects, it may cause malfunctions. Consult with SMC when using it this way.




**Mounting in a cantilevered way**

**6. Fixed parts of the cylinder on both ends must have at least 5 mm of contact between where the bottom of the cylinder tube and the equipment surface.**




**7. Consider uncalculated loads such as piping, cableveyor, etc., when selecting a load moment.**
Calculation does not include the external acting force of piping, cableveyor, etc. Select load factors taking into account the external acting force of piping, cableveyor, etc.

## Service Life and Replacement Period of Shock Absorber

### ⚠ Caution

**1. Allowable operating cycle under the specifications set in this catalog is shown below.**
1.2 million cycles RB08□□
2 million cycles RB10□□ to RB2725
Note) Specified service life (suitable replacement period) is the value at room temperature (20 to 25°C). The period may vary depending on the temperature and other conditions. In some cases the absorber may need to be replaced before the allowable operating cycle above.