

# MSDG

Compact Cylinder with Compact Linear Guide

ø6, ø8, ø12, ø16

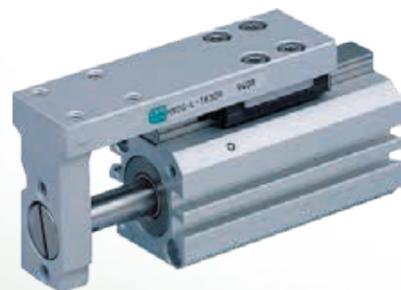
With Linear Guide



## C O N T E N T S

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Achieves high precision and high rigidity in a space-saving design

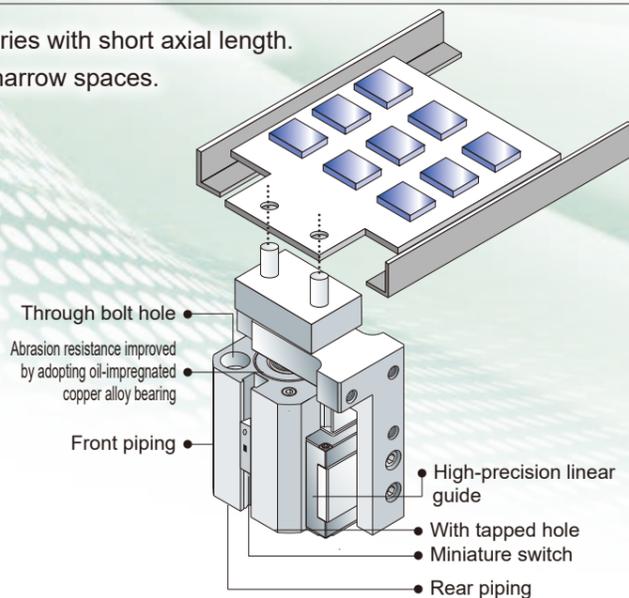
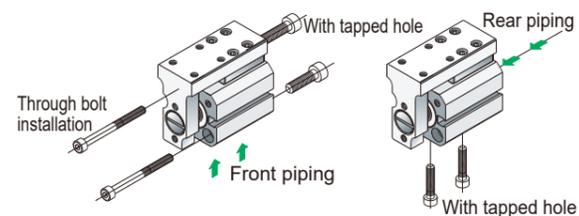


## ■ Axial direction space-saving type with linear guide

High-precision linear guide mounted on the MSD series with short axial length. Can meet high-precision and high-rigidity needs in narrow spaces.

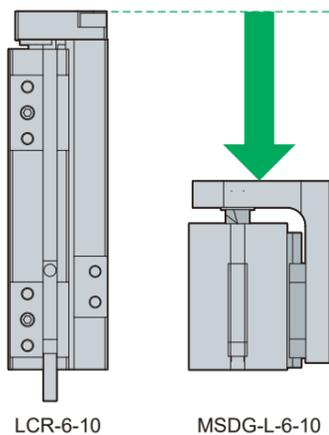
## ■ Direct 3-surface mounting

Adoption of a square body allows direct mounting from each direction. Mounting from the main body rod side and head side is possible with through bolts and tap mounting. Furthermore, adoption of rear piping has made mounting on the side of the main body possible.



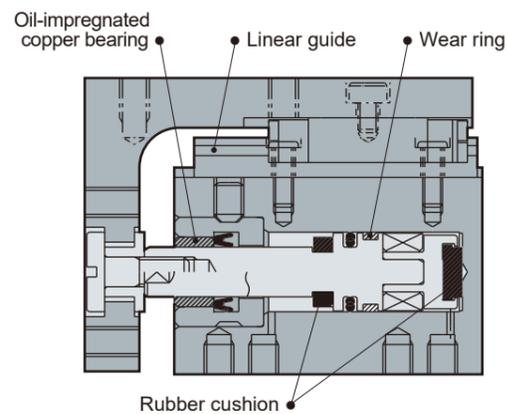
## ■ Axial direction space saving

Axial length made compact. Mounting space can be reduced.



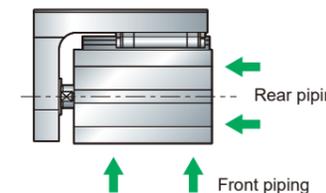
## ■ Long life design (Approx. 4 times longer than conventional products)

Oil-impregnated copper-based bearing adopted for the rod bearing part, improving wear resistance.



## ■ Piping direction selectable

Piping can be selected from two directions: front piping or rear piping.

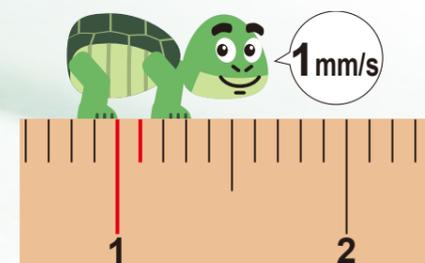


## ■ Equipped with ultra-compact F series with switch

Achieved switch inclusion in compact sizes of ø6 and ø8.

## ■ Achieves smooth ultra-low speed operation of 1 mm/s (MSDG-LF)

**Ultra-low speed drive up to 1 mm/s possible**  
No stick-slip and stable operation even at fine speeds make it ideal for conveying and positioning delicate products.

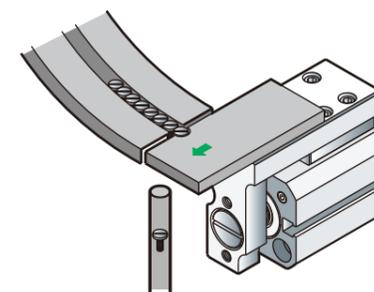


**Our company's original sliding mechanism**

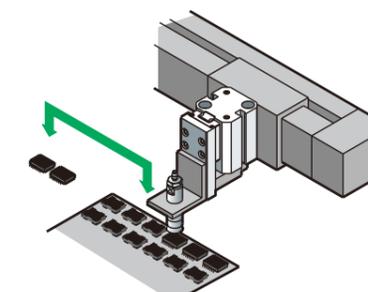
- Special treatment of the tube inner surface.
- Special treatment of the packing surface and optimization of hardness.
- Optimal grease selection.

## ■ Usage Examples

Compact parts feeding



Workpiece conveyance



## ■ MSDG Series Product System

| Variation  | Model No. | Bore Size (mm)   | Standard Stroke (mm) |    |    |    |    |    |
|--|-----------|------------------|----------------------|----|----|----|----|----|
|  |           |                  | 5                    | 10 | 15 | 20 | 25 | 30 |
| Double acting, Guided type                         | MSDG-L    | ø6, ø8, ø12, ø16 | ●                    | ●  | ●  | ●  | ●  | ●  |
| Double acting, Guided type<br>Ultra low speed type | MSDG-LF   | ø12, ø16         | ●                    | ●  | ●  | ●  | ●  | ●  |

●: Standard, ◎: Option, ◻: Not manufacturable

| Variation  | Model No.  | Bore Size (mm)      | Standard Stroke (mm) |    |    |    |    |    | Min. Stroke (mm) | Max. Stroke (mm) | Option           | Switch | Page |
|--|--|---------------------|----------------------|----|----|----|----|----|------------------|------------------|------------------|--------|------|
|  |  |                     | 5                    | 10 | 15 | 20 | 25 | 30 |                  |                  | Rear piping type |        |      |
| Double acting, Guided type                         | MSDG-L<br>  | ø6 / ø8<br>ø12, ø16 | ●                    | ●  | ●  | ●  | ●  | ●  | 5                | 30               | ◎                | ◎      | 320  |
| Double acting, Guided type<br>Ultra Low Speed Type | MSDG-LF<br> | ø12, ø16            | ●                    | ●  | ●  | ●  | ●  | ●  | 5                | 30               | ◎                | ◎      | 328  |

With Linear Guide

With Linear Guide

LCM

LCM

LCR

LCR

LCG

LCG

LCW

LCW

LCX

LCX

MSDG

MSDG

Cylinder Switch

Cylinder Switch

Ending

Ending

## Combination Availability Table for Variations and Option Items

● Guided type MSDG Series

⊙ Mark: Option

○ Mark: Custom Products

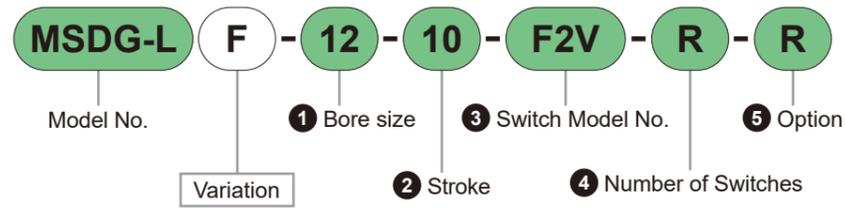
△ Mark: Manufacturable depending on conditions

× Mark: Not manufacturable

| Category | Code             | Variation                       |                      | Option           |                 |
|----------|------------------|---------------------------------|----------------------|------------------|-----------------|
|          |                  | Double Acting / Single Rod Type | Ultra Low Speed Type | Rear piping type | Cylinder Switch |
| LCM      | Blank            | None                            | F                    | R                |                 |
| LCR      | F                |                                 |                      |                  | ⊙               |
| LCG      | R                |                                 |                      |                  | ⊙               |
| LCW      | Separately Shown |                                 |                      |                  | ⊙               |

MEMO

### [Model No. Notation Example]



Model No.: Compact cylinder with small guide

● Variation: Ultra Low Speed Type

① Bore Size :  $\phi 12$  mm

② Stroke : 10 mm

③ Switch model No. : Solid State F2V, Lead wire 1 m

④ Number of Switches : With 1 pc. on rod side

⑤ Options : Rear piping

Cylinder Switch

Ending

With Linear Guide

LCM

LCR

LCG

LCW

LCX

MSDG

Cylinder Switch

Ending



Compact Cylinder with Compact Linear Guide  
Double acting, Linear guide equipped type with switch

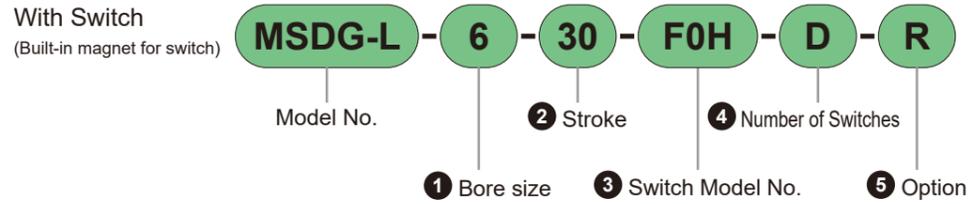
# MSDG-L Series

● Bore size: ø6, ø8, ø12, ø16

Circuit Diagram  
Symbol



## Model No. Notation Method



### ① Bore Size (mm)

| Code | Content |
|------|---------|
| 6    | ø6      |
| 8    | ø8      |
| 12   | ø12     |
| 16   | ø16     |

### ② Stroke (mm)

| Code | Content |
|------|---------|
| 5    | 5       |
| 10   | 10      |
| 15   | 15      |
| 20   | 20      |
| 25   | 25      |
| 30   | 30      |

\*For details on stroke, please refer to P. 323.

### ③ Switch Model No.

For switch details, please refer to P. 753.  
Switches are included to the product and shipped.

| Contact      | Indicator LED Special Function | Wiring (Output) | Load Voltage (V) |            | Load Current (mA) |            | Lead wire *1 |         | Image |
|--------------|--------------------------------|-----------------|------------------|------------|-------------------|------------|--------------|---------|-------|
|              |                                |                 | AC               | DC         | AC                | DC         | Straight     | L-shape |       |
| Solid State  | 1-Color                        | 2-wire          | -                | 10 to 30   | -                 | 5 to 20    | -            | F2S□    |       |
|              |                                | 3-wire (NPN)    | -                | 30 or less | -                 | 50 or less | -            | F3S□    |       |
|              |                                | 2-wire          | -                | 10 to 30   | -                 | 5 to 20 *2 | F2H□         | F2V□    |       |
|              |                                | 3-wire (NPN)    | -                | 30 or less | -                 | 50 or less | F3H□         | F3V□    |       |
|              |                                | 3-wire (PNP)    | -                | 30 or less | -                 | 50 or less | F3PH□        | F3PV□   |       |
|              |                                | 2-Color         | 2-wire           | -          | 24±10%            | -          | 5 to 20      | F2YH□   | F2YV□ |
| 3-wire (NPN) | -                              |                 | 30 or less       | -          | 50 or less        | F3YH□      | F3YV□        |         |       |
| Reed         | 1-Color                        | 2-wire          | -                | 24 ± 10%   | -                 | 5 to 20    | FOH          | F0 V    |       |

\*1: For "□" in the switch model No., enter the code selected from the "Lead wire length" table.

\*2: The maximum load current value above, 20 mA, is at 25°C. If the switch operating ambient temperature is higher than 25°C, it will be lower than 20 mA. (At 60°C, it will be 5 to 10 mA.)

\*3: For models with switches, use non-magnetic (stainless steel, etc.) mounting bolts for ø6 and ø8.

\*4: When using a solid state switch with ø12 or ø16, use non-magnetic through bolts (made of stainless steel, etc.).

\*5: Switches other than the model No.s listed above are also available. (Custom product) For details, See P. 753.

\*6: Depending on the cylinder mounting and stroke relationship, it may not be possible to mount the switch. For mountability, please refer to P. 322.

### \* Lead wire length

| Code  | Content        |
|-------|----------------|
| Blank | 1 m (Standard) |
| 3     | 3 m (Option)   |

Example) Lead wire length  
1 m F2S  
3 m F2S [3]

### ④ Number of Switches

| Code | Content                |
|------|------------------------|
| R    | With 1 pc on rod side  |
| H    | With 1 pc on head side |
| D    | With 2 pcs             |

### ⑤ Option

| Code  | Content           | Image |
|-------|-------------------|-------|
| Blank | Front piping type |       |
| R     | Rear piping type  |       |

\*1: In the case of the rear piping type, mounting on the side of the main body is possible.

### Rechargeable Battery Compatible Specification

(Catalog No. CC-1226AA)

- Design compatible with rechargeable battery manufacturing process

**MSDG-L - - - - - P4□**

\*Please contact us for details.

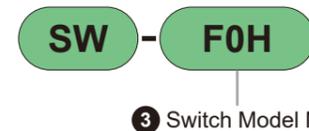
### High Durability Components HP Series

(Catalog No. CC-1421AA)

- Long-life actuator that contributes to productivity improvement with stable operation

**MSDG-L - - - - - HP□**

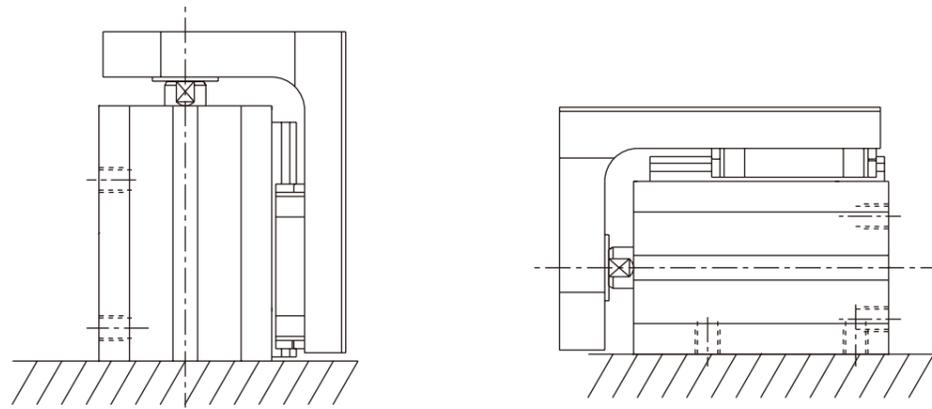
### Switch Single Unit Model No. Notation Method



Switch usability selection table

Depending on the cylinder mounting and stroke relationship, it may not be possible to mount the switch. Select the switch after confirming the table below. In addition, for side mounting, it cannot be used in the following combinations.

- Combination of attaching F2YH/V, F3YH/V, F3PH/V to switch mounting position H with a stroke of 5 mm
- Combination of attaching F2YH, F3YH, F3PH to switch mounting position H with a stroke of 10 mm  
(For minimum stroke with switch, refer to P. 323.)



At head side mounting

At side mounting

● At head side mounting

| Tube Inner Diameter (mm) | Stroke (mm) | Solid state switch       |   |                          |   |                          |   |                          |   |                          |   | Reed switch              |   |                          |   |   |
|--------------------------|-------------|--------------------------|---|--------------------------|---|--------------------------|---|--------------------------|---|--------------------------|---|--------------------------|---|--------------------------|---|---|
|                          |             | F2S/F3S                  |   | F2H/F3H                  |   | F2 V/F3 V                |   | F2YH/F3YH/F3PH           |   | F2YV/F3YV/F3PV           |   | F0H                      |   | F0 V                     |   |   |
|                          |             | Switch mounting position |   | Switch mounting position |   | Switch mounting position |   | Switch mounting position |   | Switch mounting position |   | Switch mounting position |   | Switch mounting position |   |   |
|                          |             | R                        | H | R                        | H | R                        | H | R                        | H | R                        | H | R                        | H | R                        | H |   |
| ø6                       | 5           | ○                        | ○ | ×                        | ○ | ○                        | ○ | ×                        | × | ○                        | ○ | ×                        | ○ | ○                        | ○ | ○ |
|                          | 10          | ○                        | ○ | ×                        | ○ | ○                        | ○ | ×                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○ |
|                          | 15 to       | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○ |
| ø8                       | 5           | ○                        | ○ | ×                        | ○ | ○                        | ○ | ×                        | × | ○                        | ○ | ×                        | ○ | ○                        | ○ | ○ |
|                          | 10          | ○                        | ○ | ×                        | ○ | ○                        | ○ | ×                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○ |
|                          | 15 to       | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○ |
| ø12                      | 5           | ○                        | ○ | ×                        | ○ | ○                        | ○ | ×                        | ○ | ○                        | ○ | ×                        | ○ | ○                        | ○ | ○ |
|                          | 10          | ○                        | ○ | ×                        | ○ | ○                        | ○ | ×                        | × | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○ |
|                          | 15 to       | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○ |
| ø16                      | 5           | ○                        | ○ | ×                        | ○ | ○                        | ○ | ×                        | ○ | ○                        | ○ | ×                        | ○ | ○                        | ○ | ○ |
|                          | 10          | ○                        | ○ | ×                        | ○ | ○                        | ○ | ×                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○ |
|                          | 15 to       | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○                        | ○ | ○ |

Note) R: With 1 rod side switch H: With 1 head side switch

Specifications

| Item                          | MSDG-L (With switch)                                      |       |                     |       |
|-------------------------------|---|-------|---------------------|-------|
|                               | ø6  | ø8    | ø12                 | ø16   |
| Bore Size mm                  | ø6  | ø8    | ø12                 | ø16   |
| Actuation method              | Double Acting Type  |       |                     |       |
| Operating Fluid               | Compressed Air  |       |                     |       |
| Max. working pressure MPa     | 1.0   |       |                     |       |
| Min. Operating Pressure MPa   | 0.2   | 0.15  | 0.1                 |       |
| Proof Pressure MPa            | 1.6   |       |                     |       |
| Ambient Temperature °C        | 5 to 60   |       |                     |       |
| Port Size                     | Front piping type M3                                      |       | Rear piping type M5 |       |
|                               | M3  |       | M3                  |       |
| Stroke tolerance mm           | +2.0<br>0   |       |                     |       |
| Operating Piston Speed mm/s   | 50 to 500   |       |                     |       |
| Cushion                       | With Rubber Cushion                                       |       |                     |       |
| Lubrication                   | Not Required (When lubricating, use Turbine Oil ISO VG32) |       |                     |       |
| Allowable absorption energy J | 0.004   | 0.014 | 0.044               | 0.110 |

Stroke

| Bore Size (mm) | Standard Stroke (mm)  | Minimum stroke with 2 switches (mm) |                    | Minimum stroke with 1 switch (mm) |                    |
|----------------|-----------------------|-------------------------------------|--------------------|-----------------------------------|--------------------|
|                |                       | Reed switch                         | Solid state switch | Reed switch                       | Solid state switch |
| ø6             | 5, 10, 15, 20, 25, 30 | 10                                  | 5                  | 5                                 | 5                  |
| ø8             | 5, 10, 15, 20, 25, 30 | 10                                  | 5                  | 5                                 | 5                  |
| ø12            | 5, 10, 15, 20, 25, 30 | 10                                  | 5                  | 5                                 | 5                  |
| ø16            | 5, 10, 15, 20, 25, 30 | 10                                  | 5                  | 5                                 | 5                  |

Note) Strokes other than standard are not available.

Cylinder Weight Table

(Unit: g)

| Stroke (mm)    | 5   | 10  | 15  | 20  | 25  | 30  | Weight per Switch  |
|----------------|-----|-----|-----|-----|-----|-----|--|
| Bore Size (mm) |     |     |     |     |     |     |  |
| ø6             | 43  | 48  | 52  | 57  | 61  | 66  | Refer to the mass described in the switch specifications on P. 753 |
| ø8             | 50  | 56  | 63  | 69  | 76  | 82  |  |
| ø12            | 76  | 88  | 100 | 112 | 124 | 136 |  |
| ø16            | 129 | 146 | 163 | 180 | 197 | 214 |  |

Theoretical Thrust Table

(Unit: N)

| Bore Size (mm) | Operating Direction | Operating Pressure MPa |      |      |      |      |                        |                        |                        |                        |                        |                        |
|----------------|---------------------|------------------------|------|------|------|------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
|                |                     | 0.1                    | 0.15 | 0.2  | 0.3  | 0.4  | 0.5                    | 0.6                    | 0.7                    | 0.8                    | 0.9                    | 1.0                    |
| ø6             | Push                | -                      | -    | 5.65 | 8.48 | 11.3 | 14.1                   | 17.0                   | 19.8                   | 22.6                   | 25.4                   | 28.3                   |
|                | Pull                | -                      | -    | 3.14 | 4.71 | 6.28 | 7.85                   | 9.42                   | 11.0                   | 12.6                   | 14.1                   | 15.7                   |
| ø8             | Push                | -                      | 7.54 | 10.1 | 15.1 | 20.1 | 25.1                   | 30.2                   | 35.2                   | 40.2                   | 45.2                   | 50.3                   |
|                | Pull                | -                      | 4.59 | 6.13 | 9.19 | 12.3 | 15.3                   | 18.4                   | 21.4                   | 24.5                   | 27.6                   | 30.6                   |
| ø12            | Push                | 11.3                   | 17.0 | 22.6 | 33.9 | 45.2 | 56.5                   | 67.9                   | 79.2                   | 90.5                   | 1.02x10 <sup>2</sup>   | 1.13 x 10 <sup>2</sup> |
|                | Pull                | 8.48                   | 12.7 | 17.0 | 25.4 | 33.9 | 42.4                   | 50.9                   | 59.4                   | 67.9                   | 76.3                   | 84.8                   |
| ø16            | Push                | 20.1                   | 30.2 | 40.2 | 60.3 | 80.4 | 1.01 x 10 <sup>2</sup> | 1.21 x 10 <sup>2</sup> | 1.41 x 10 <sup>2</sup> | 1.61 x 10 <sup>2</sup> | 1.81 x 10 <sup>2</sup> | 2.01 x 10 <sup>2</sup> |
|                | Pull                | 15.1                   | 22.6 | 30.2 | 45.2 | 60.3 | 75.4                   | 90.5                   | 1.06 x 10 <sup>2</sup> | 1.21 x 10 <sup>2</sup> | 1.36 x 10 <sup>2</sup> | 1.51 x 10 <sup>2</sup> |

With Linear Guide

LCM

LCR

LCG

LCW

LCX

MSDG

With Linear Guide

LCM

LCR

LCG

LCW

LCX

MSDG

Cylinder Switch

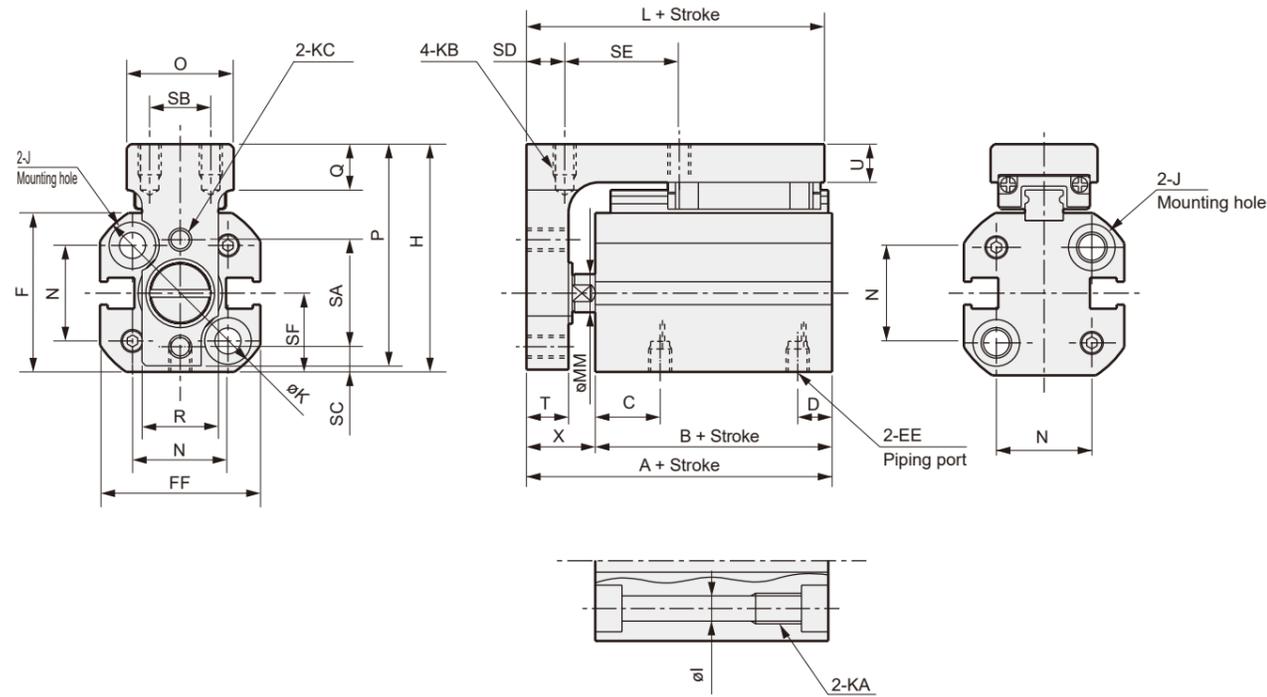
Ending

Cylinder Switch

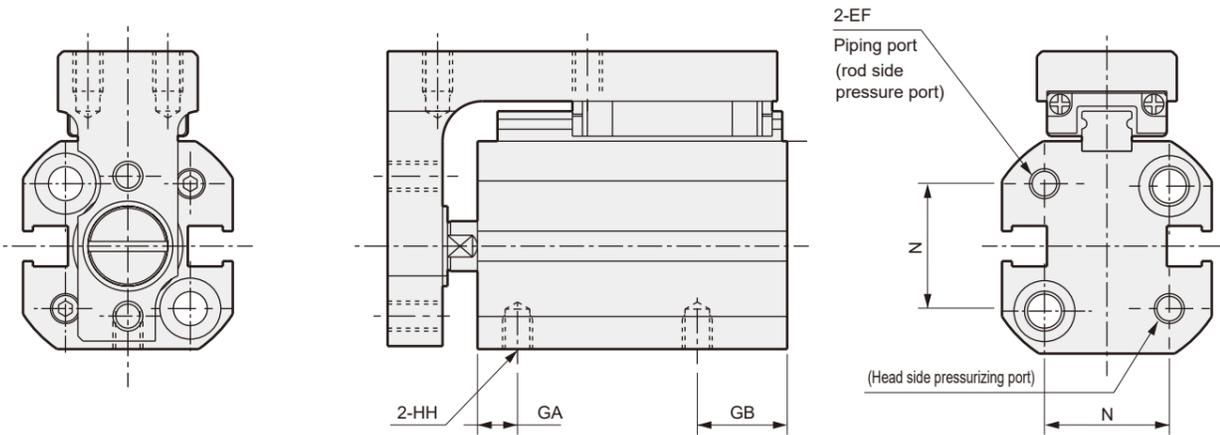
Ending

External dimensions diagram (Bore size:  $\phi 6$  to  $\phi 12$ )

● MSDG-L-6 / 8 / 12



● MSDG-L-6 / 8 / 12-□-R (Rear piping)



| Bore Size (mm) | Common dimension |      |      |   |    |      |    |      |     |                                  |      |            |              |              |      |    |      |    |
|----------------|------------------|------|------|---|----|------|----|------|-----|----------------------------------|------|------------|--------------|--------------|------|----|------|----|
|                | A                | B    | C    | D | EE | F    | FF | H    | I   | J                                | K    | KA         | KB           | KC           | L    | MM | N    | O  |
| $\phi 6$       | 33.5             | 24.5 | 7.5  | 4 | M3 | 18.8 | 19 | 27.8 | 3.2 | Counterbore $\phi 6.1$ Depth 3.5 | 22.5 | M4 Depth 6 | M3 Depth 4   | M3 (Through) | 32   | 4  | 11   | 14 |
| $\phi 8$       | 35               | 26   | 9    | 4 | M3 | 20.8 | 21 | 29.8 | 3.2 | Counterbore $\phi 6.1$ Depth 3.5 | 25   | M4 Depth 6 | M3 Depth 4   | M3 (Through) | 33.5 | 5  | 12.5 | 14 |
| $\phi 12$      | 38               | 27   | 11.5 | 5 | M5 | 24.8 | 25 | 36.3 | 3.2 | Counterbore $\phi 6.1$ Depth 3.5 | 31   | M4 Depth 6 | M3 Depth 4.5 | M3 (Through) | 36.5 | 6  | 15.5 | 19 |

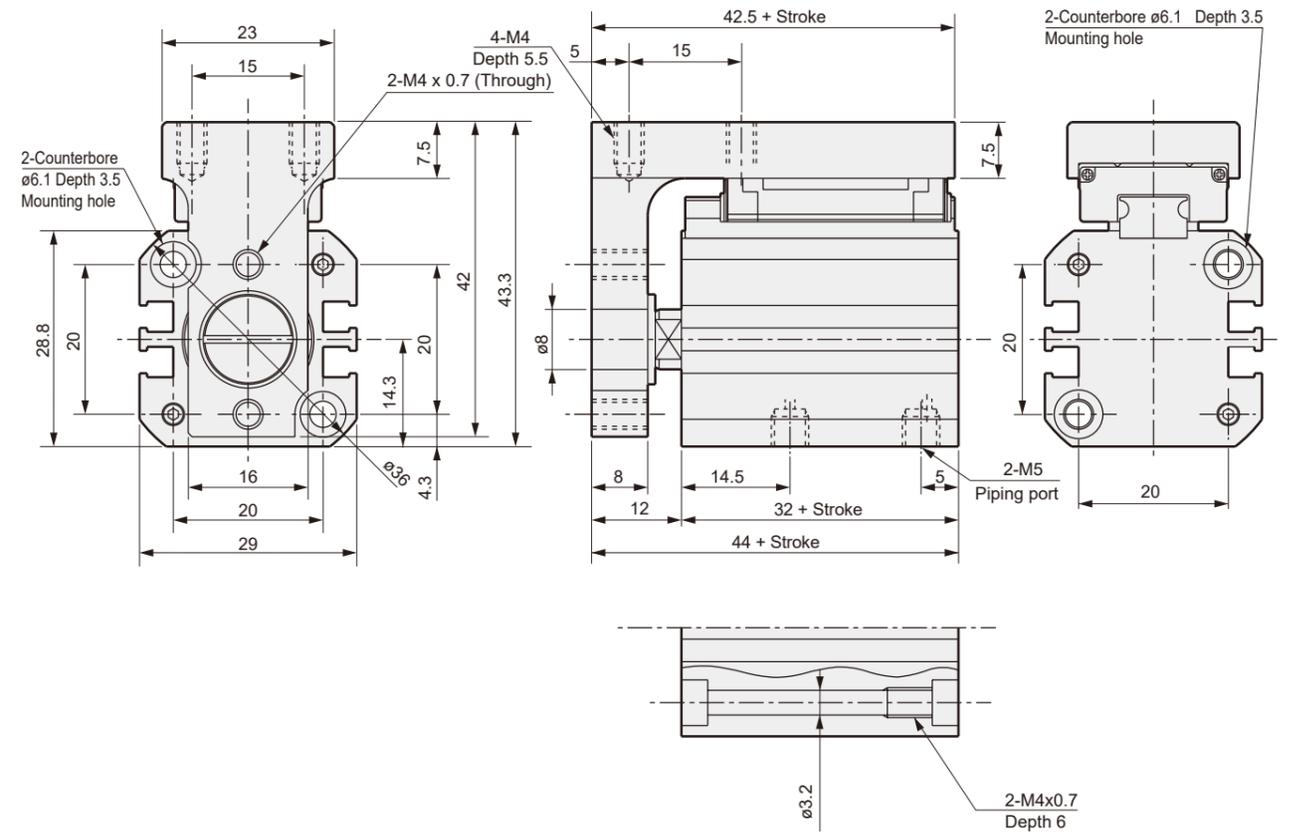
| Bore Size (mm) | Common dimension |     |     |      |    |     |    |    |      |     |     |    | Rear piping dimension |     |      |            |
|----------------|------------------|-----|-----|------|----|-----|----|----|------|-----|-----|----|-----------------------|-----|------|------------|
|                | P                | Q   | R   | SA   | SB | SC  | SD | SE | SF   | T   | U   | X  | EF                    | GA  | GB   | HH         |
| $\phi 6$       | 27               | 6   | 9.5 | 12   | 8  | 3.3 | 5  | 15 | 9.3  | 5.5 | 5   | 9  | M3                    | 3   | 8.5  | M3 Depth 3 |
| $\phi 8$       | 29               | 6   | 10  | 14   | 8  | 3.3 | 5  | 15 | 10.3 | 5.5 | 5   | 9  | M3                    | 4.5 | 8.5  | M3 Depth 3 |
| $\phi 12$      | 35               | 6.5 | 13  | 15.5 | 12 | 4.5 | 5  | 15 | 12.3 | 7   | 6.5 | 11 | M3                    | 4   | 10.5 | M3 Depth 3 |

Note) For dimensions with each switch, refer to P. 332, 333.

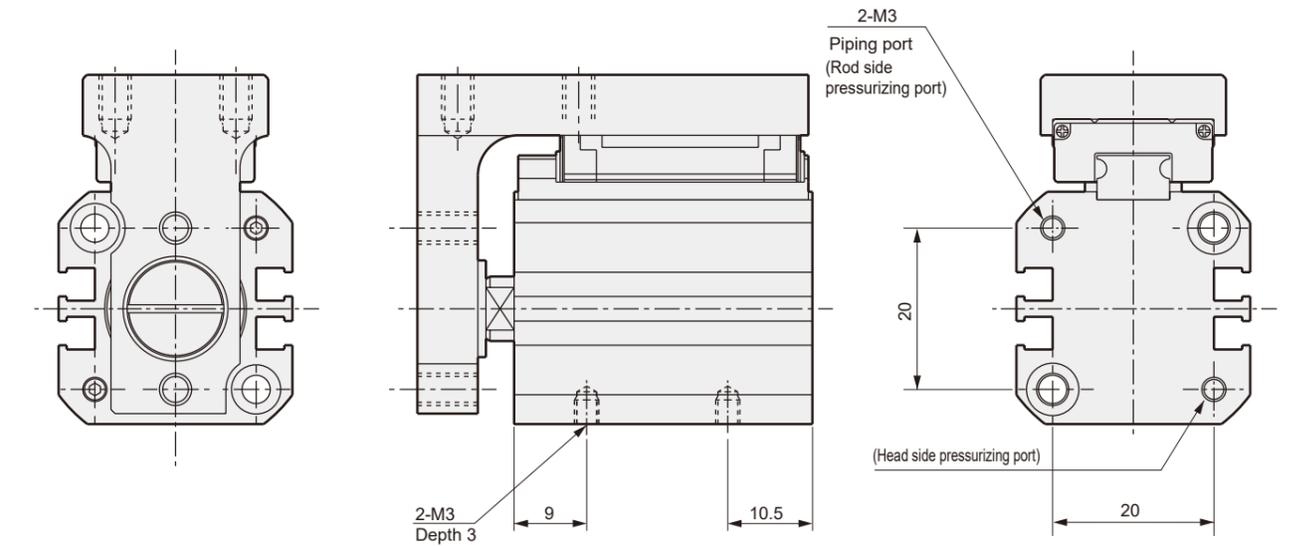
Outline Dimension Drawing

Outline dimension drawing (Bore size:  $\phi 6$ )

● MSDG-L-16



● MSDG-L-16-□-R (Rear piping)



Note) For dimensions with each switch, refer to P. 332, 333.

With Linear Guide

LCM

LCR

LCG

LCW

LCX

MSDG

With Linear Guide

LCM

LCR

LCG

LCW

LCX

MSDG

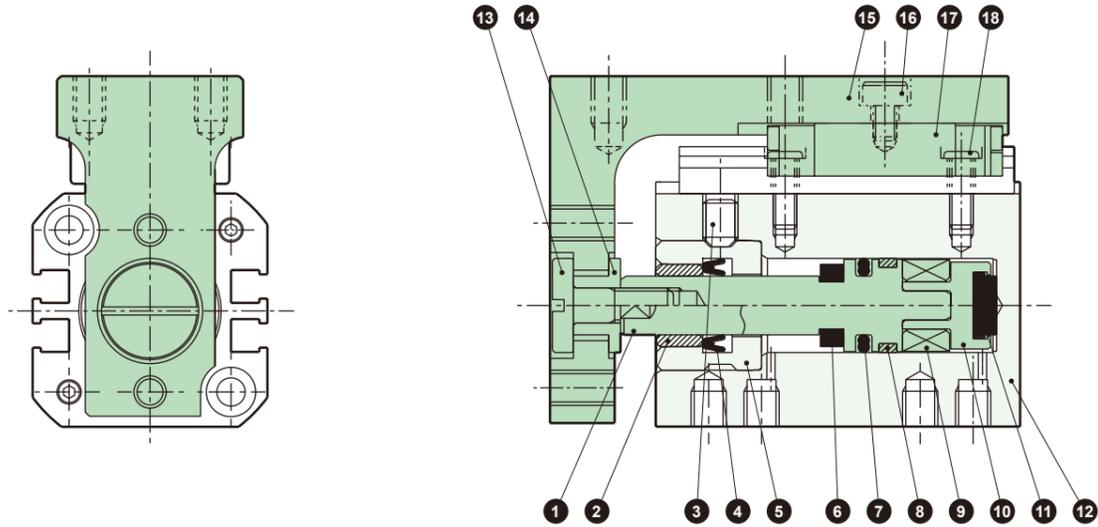
Cylinder Switch

Ending

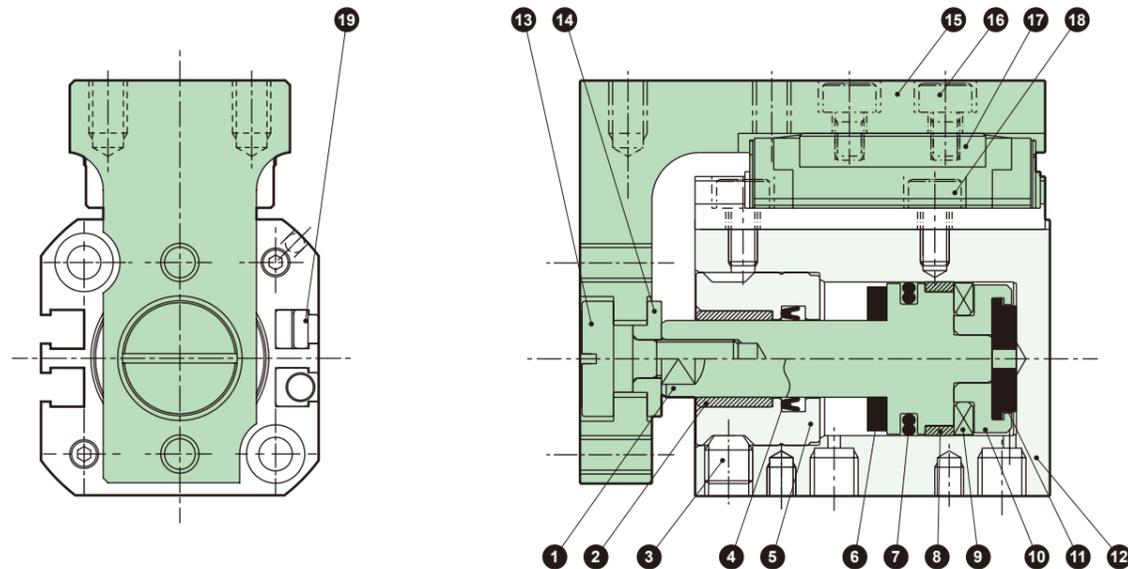
Cylinder Switch

Ending

● MSDG-L-6 / 8 / 12



● MSDG-L-16



**Do not disassemble**

| Part No. | Part Name                     | Material                      | Remarks | Part No.    | Part Name                     | Material        | Remarks        |
|----------|-------------------------------|-------------------------------|---------|-------------|-------------------------------|-----------------|----------------|
| 1        | Piston                        | Stainless Steel               |         | 11          | Cushion rubber H              | Urethane Rubber |                |
| 2        | Bushing                       | Oil-impregnated Bearing Alloy |         | 12          | Cylinder Body                 | Aluminum Alloy  | Hard Anodized  |
| 3        | Hexagon socket head set screw | Stainless Steel               |         | 13          | Floating bolt                 | Steel           | Nickel Plating |
| 4        | Rod Packing                   | Nitrile Rubber                |         | 14          | Floating bush                 | Stainless Steel |                |
| 5        | Rod Metal                     | Stainless Steel               |         | 15          | Table                         | Aluminum Alloy  | Alumite        |
| 6        | Cushion rubber R              | Urethane Rubber               |         | 16          | Hexagon Socket Head Cap Screw | Stainless Steel |                |
| 7        | Piston Packing                | Nitrile Rubber                |         | 17          | High-precision guide          | Stainless Steel |                |
| 8        | Wear Ring                     | Polyacetal Resin              |         | 18          | Bolt                          | Stainless Steel |                |
| 9        | Magnet                        | Plastic                       |         | With Switch |                               |                 |                |
| 10       | Adapter                       | Aluminum alloy                |         | 19          | Switch                        |                 |                |

MEMO

With Linear Guide

LCM

LCR

LCG

LCW

LCX

MSDG

With Linear Guide

LCM

LCR

LCG

LCW

LCX

MSDG

Cylinder Switch

Ending

Cylinder Switch

Ending



Compact Cylinder with Compact Linear Guide  
Double acting, Linear guide equipped type with switch Ultra low speed type

# MSDG-LF Series

● Bore size:  $\phi 12$ ,  $\phi 16$

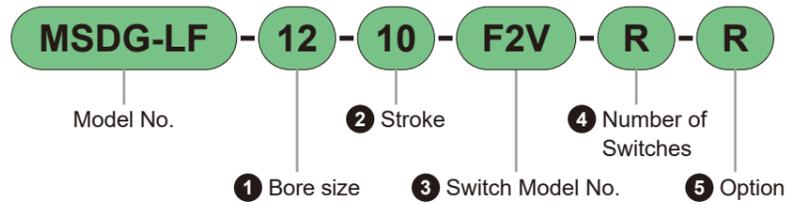
Circuit Diagram  
Symbol



## MSDG-LF Series Model No. Notation Method

### Model No. Notation Method

With Switch  
(Built-in magnet for switch)



#### 1 Bore Size (mm)

| Code | Content   |
|------|-----------|
| 12   | $\phi 12$ |
| 16   | $\phi 16$ |

#### 2 Stroke (mm)

| Code | Content |
|------|---------|
| 5    | 5       |
| 10   | 10      |
| 15   | 15      |
| 20   | 20      |
| 25   | 25      |
| 30   | 30      |

\*For details on stroke, please refer to P. 330.

#### 4 Number of Switches

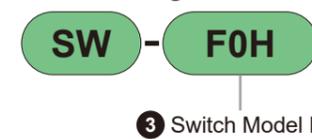
| Code | Content                |
|------|------------------------|
| R    | With 1 pc on rod side  |
| H    | With 1 pc on head side |
| D    | With 2 pcs             |

#### 5 Option

| Code  | Content               |
|-------|-----------------------|
| Blank | Front piping type<br> |
| R     | Rear piping type<br>  |

\*1: In the case of the rear piping type, mounting on the side of the main body is possible.

### Switch Single Unit Model No. Notation Method



#### 3 Switch Model No.

For switch details, please refer to P. 753.  
Switches are included to the product and shipped.

| Contact      | Indicator LED Special Function | Wiring (Output) | Load Voltage (V) |            | Load Current (mA) |            | Lead wire *1 |         | Image |
|--------------|--------------------------------|-----------------|------------------|------------|-------------------|------------|--------------|---------|-------|
|              |                                |                 | AC               | DC         | AC                | DC         | Straight     | L-shape |       |
| Solid State  | 1-Color                        | 2-wire          | -                | 10 to 30   | -                 | 5 to 20    | -            | F2S□    |       |
|              |                                | 3-wire (NPN)    | -                | 30 or less | -                 | 50 or less | -            | F3S□    |       |
|              |                                | 2-wire          | -                | 10 to 30   | -                 | 5 to 20 *2 | F2H□         | F2V□    |       |
|              |                                | 3-wire (NPN)    | -                | 30 or less | -                 | 50 or less | F3H□         | F3V□    |       |
|              |                                | 3-wire (PNP)    | -                | 30 or less | -                 | 50 or less | F3PH□        | F3PV□   |       |
|              |                                | 2-Color         | 2-wire           | -          | 24±10%            | -          | 5 to 20      | F2YH□   | F2YV□ |
| 3-wire (NPN) | -                              |                 | 30 or less       | -          | 50 or less        | F3YH□      | F3YV□        |         |       |
| Reed         | 1-Color                        | 2-wire          | -                | 24 ± 10%   | -                 | 5 to 20    | FOH          | F0 V    |       |

\*1: For "\*" in the switch model No., enter the code selected from the "Lead wire length" table.

\*2: The maximum load current value above, 20 mA, is at 25°C. If the switch operating ambient temperature is higher than 25°C, it will be lower than 20 mA. (At 60°C, it will be 5 to 10 mA.)

\*3: When with solid state switch, use non-magnetic mounting bolts (made of stainless steel, etc.) only for through bolts.

\*4: Switches other than the model No.s listed above are also available. (Custom Product) For details, see P. 753.

\*5: Depending on the cylinder mounting and stroke relationship, it may not be possible to mount the switch. For mountability, please refer to P. 322.

#### \* Lead wire length

| Code  | Content        |
|-------|----------------|
| Blank | 1 m (Standard) |
| 3     | 3 m (Option)   |

Example) Lead wire length  
1 m F2S  
3 m F2S [3]

With Linear Guide

LCM

LCR

LCG

LCW

LCX

MSDG

With Linear Guide

LCM

LCR

LCG

LCW

LCX

MSDG

Cylinder Switch

Ending

Cylinder Switch

Ending

# MSDG-LF Series

## Specifications

| Item                      |                   | MSDG-LF                    |       |
|---------------------------|-------------------|----------------------------|-------|
| Bore Size                 | mm                | ø12                        | ø16   |
| Actuation method          |                   | Double acting, Guided type |       |
| Operating Fluid           |                   | Compressed Air             |       |
| Max. working pressure     | MPa               | 1.0                        |       |
| Min. Operating Pressure   | MPa               | 0.1                        |       |
| Proof Pressure            | MPa               | 1.6                        |       |
| Ambient Temperature       | °C                | 5 to 60                    |       |
| Port Size                 | Front piping type | M5                         |       |
|                           | Rear piping type  | M3                         |       |
| Stroke tolerance          | mm                | +2.0<br>0                  |       |
| Operating Piston Speed    | mm/s              | 1 to 200                   |       |
| Cushion                   |                   | With Rubber Cushion        |       |
| Lubrication               |                   | Not Available              |       |
| Allowable Absorbed Energy | J                 | 0.044                      | 0.110 |

MEMO

## Stroke

| Bore Size (mm) | Standard Stroke (mm)  | Minimum stroke with 2 switches (mm) |                    | Minimum stroke with 1 switch (mm) |                    |
|----------------|-----------------------|-------------------------------------|--------------------|-----------------------------------|--------------------|
|                |                       | Reed switch                         | Solid state switch | Reed switch                       | Solid state switch |
| ø12            | 5, 10, 15, 20, 25, 30 | 10                                  | 5                  | 5                                 | 5                  |
| ø16            | 5, 10, 15, 20, 25, 30 | 10                                  | 5                  | 5                                 | 5                  |

Note) Strokes other than standard are not available.

## Theoretical Thrust Table

(Unit: N)

| Bore Size (mm) | Operating Direction | Operating Pressure MPa |      |      |      |      |                        |                        |                        |                        |                        |                        |
|----------------|---------------------|------------------------|------|------|------|------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
|                |                     | 0.1                    | 0.15 | 0.2  | 0.3  | 0.4  | 0.5                    | 0.6                    | 0.7                    | 0.8                    | 0.9                    | 1.0                    |
| ø12            | Push                | 11.3                   | 17.0 | 22.6 | 33.9 | 45.2 | 56.5                   | 67.9                   | 79.2                   | 90.5                   | 1.02x10 <sup>2</sup>   | 1.13 x 10 <sup>2</sup> |
|                | Pull                | 8.48                   | 12.7 | 17.0 | 25.4 | 33.9 | 42.4                   | 50.9                   | 59.4                   | 67.9                   | 76.3                   | 84.8                   |
| ø16            | Push                | 20.1                   | 30.2 | 40.2 | 60.3 | 80.4 | 1.01 x 10 <sup>2</sup> | 1.21 x 10 <sup>2</sup> | 1.41 x 10 <sup>2</sup> | 1.61 x 10 <sup>2</sup> | 1.81 x 10 <sup>2</sup> | 2.01 x 10 <sup>2</sup> |
|                | Pull                | 15.1                   | 22.6 | 30.2 | 45.2 | 60.3 | 75.4                   | 90.5                   | 1.06 x 10 <sup>2</sup> | 1.21 x 10 <sup>2</sup> | 1.36 x 10 <sup>2</sup> | 1.51 x 10 <sup>2</sup> |

## Outline Dimension Drawing

Same as double acting, guided type MSDG-L series. Please refer to P. 324, 325.

With Linear Guide

LCM

LCR

LCG

LCW

LCX

MSDG

Cylinder Switch

Ending

With Linear Guide

LCM

LCR

LCG

LCW

LCX

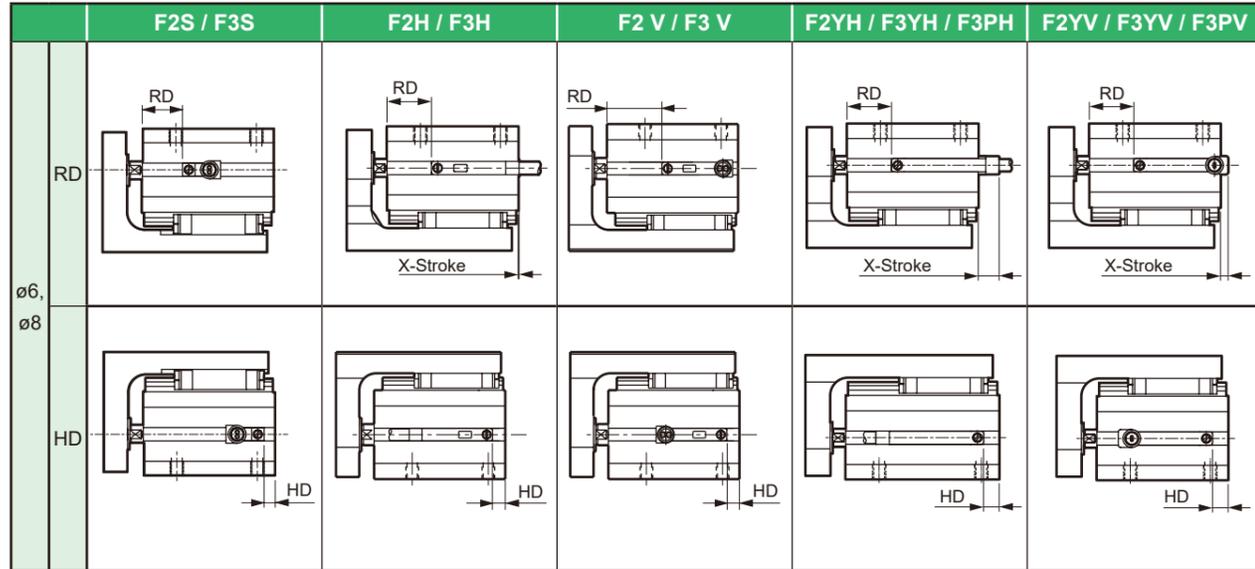
MSDG

Cylinder Switch

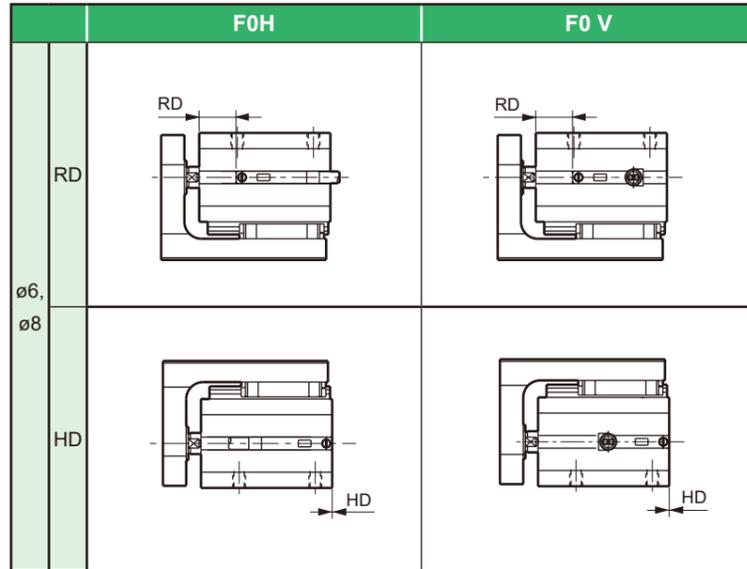
Ending

MSDG-L series (ø6 / ø8) Switch external dimensions diagram

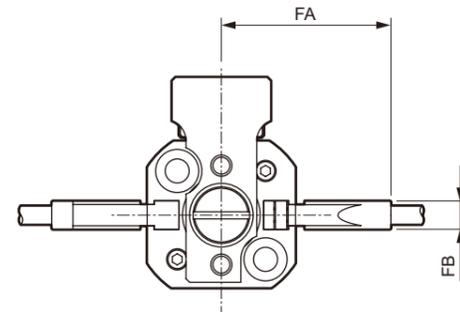
● F2S, F3S, F2H/V, F3H/V, F2YH/V, F3YH/V, F3PH/V



● FOH/V



● Protrusion dimension when mounting cylinder switch F2S, F3S



(Unit: mm)

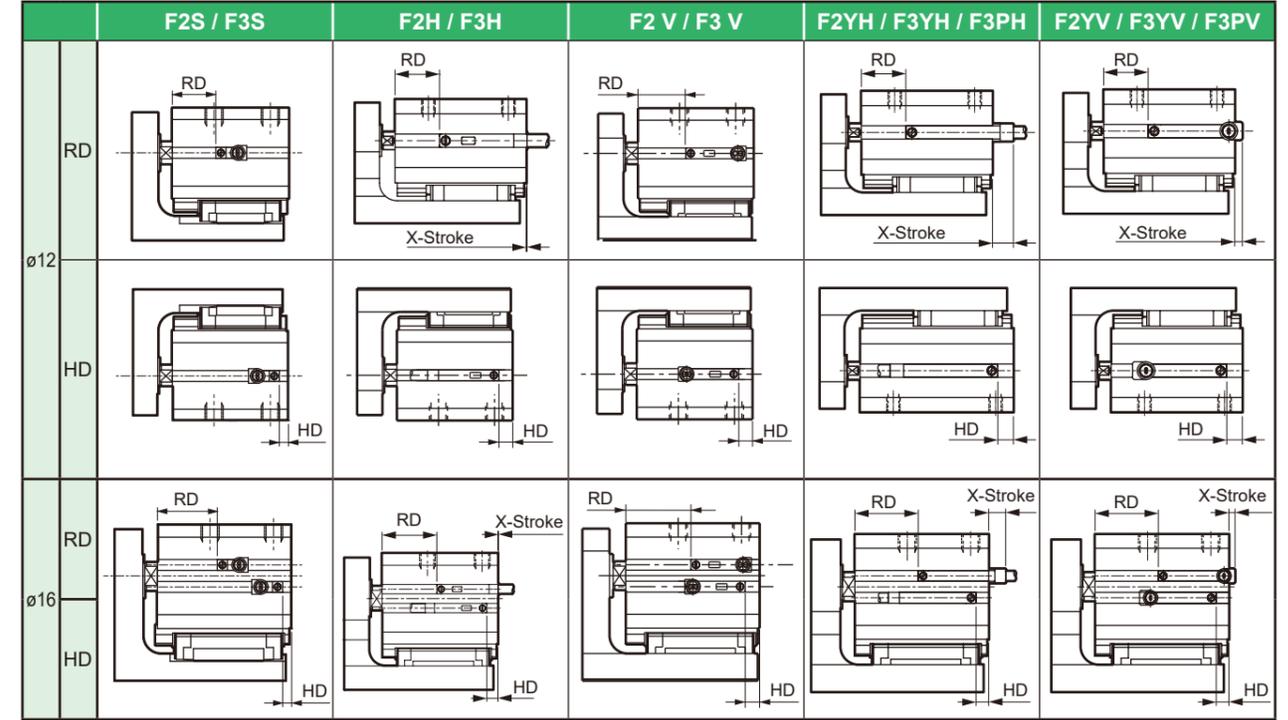
| Code | F2S/F3S |     |         |         | F2H/F3H |     |        | F2 V/F3 V |     | F2YH/F3YH/F3PH |     |        |      |     | F2YV/F3YV/F3PV |     |    | F0H |    | F0 V |  |
|------|---------|-----|---------|---------|---------|-----|--------|-----------|-----|----------------|-----|--------|------|-----|----------------|-----|----|-----|----|------|--|
|      | RD      | HD  | FA (*2) | FB (*2) | RD      | HD  | X (*1) | RD        | HD  | RD             | HD  | X (*1) | RD   | HD  | X (*1)         | RD  | HD | RD  | HD |      |  |
| ø6   | 9       | 2.5 | 20.6    | 4       | 10      | 3.5 | 5.2    | 10        | 3.5 | 10             | 3.5 | 9.7    | 10   | 3.5 | 6.7            | 6.0 | 0  | 6.0 | 0  |      |  |
| ø8   | 11.5    | 1.5 | 21.6    | 4       | 12.5    | 2.5 | 6.2    | 12.5      | 2.5 | 12.5           | 2.5 | 10.7   | 12.5 | 2.5 | 7.7            | 8.5 | 0  | 8.5 | 0  |      |  |

\*1: X dimension is the switch protrusion dimension from the main body end face. If X-stroke is negative, there is no switch protrusion from the main body end face.  
 \*2: For FA and FB dimensions, please refer to "Protrusion dimension when mounting cylinder switch F2S, F3S".  
 \*3: For switch mountability, refer to the model No. notation method for each variation.

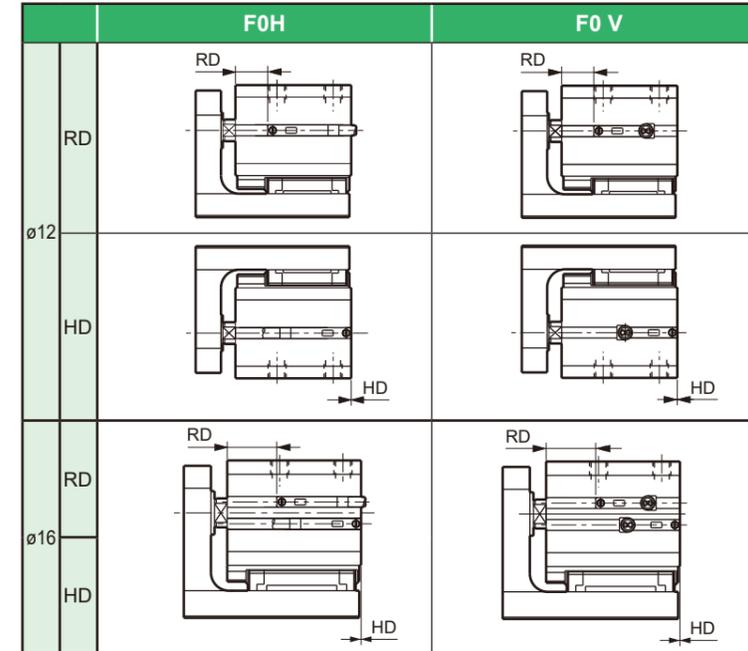
External Dimensions Diagram with Switch

MSDG-L series (ø12 / ø16) Switch external dimensions diagram

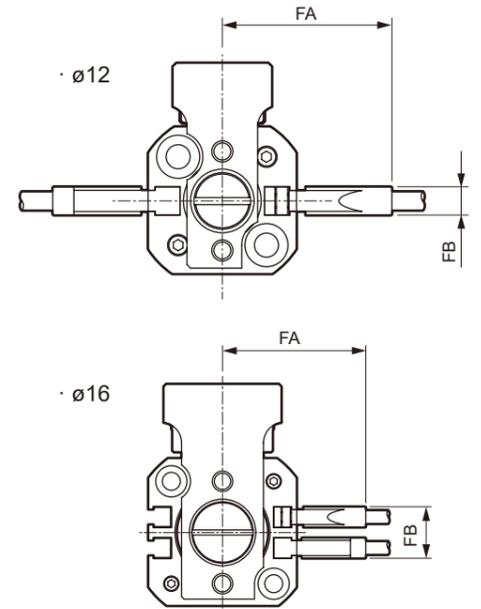
● F2S, F3S, F2H/V, F3H/V, F2YH/V, F3YH/V, F3PH/V



● FOH/V



● Protrusion dimension when mounting cylinder switch F2S, F3S



(Unit: mm)

| Code | F2S/F3S |     |         |         | F2H/F3H |     |        | F2 V/F3 V |     | F2YH/F3YH/F3PH |     |        |      |     | F2YV/F3YV/F3PV |      |    | F0H  |    | F0 V |  |
|------|---------|-----|---------|---------|---------|-----|--------|-----------|-----|----------------|-----|--------|------|-----|----------------|------|----|------|----|------|--|
|      | RD      | HD  | FA (*2) | FB (*2) | RD      | HD  | X (*1) | RD        | HD  | RD             | HD  | X (*1) | RD   | HD  | X (*1)         | RD   | HD | RD   | HD |      |  |
| ø12  | 12      | 2.5 | 23.6    | 4       | 13      | 3.5 | 5.7    | 13        | 3.5 | 13             | 3.5 | 10.2   | 13   | 3.5 | 7.2            | 9.0  | 0  | 9.0  | 0  |      |  |
| ø16  | 16.5    | 2.5 | 25.6    | 10      | 17.5    | 3.5 | 5.2    | 17.5      | 3.5 | 17.5           | 3.5 | 9.7    | 17.5 | 3.5 | 6.7            | 14.0 | 0  | 14.0 | 0  |      |  |

\*1: X dimension is the switch protrusion dimension from the main body end face. If X-stroke is negative, there is no switch protrusion from the main body end face.  
 \*2: For FA and FB dimensions, please refer to "Protrusion dimension when mounting cylinder switch F2S, F3S".  
 \*3: For switch mountability, refer to the model No. notation method for each variation.

With Linear Guide

LCM

LCR

LCG

LCW

LCX

MSDG

With Linear Guide

LCM

LCR

LCG

LCW

LCX

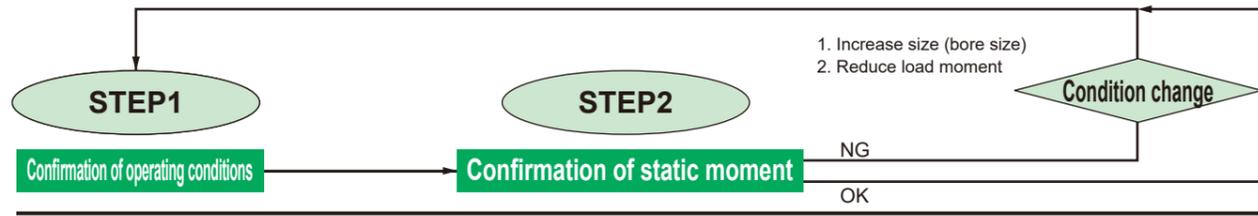
MSDG

Cylinder Switch

Ending

Cylinder Switch

Ending



**STEP1**  
Confirmation of operating conditions

- |   |   |
|---|---|
| 1. Bore Size : D (mm)   | 6. Load moment : M1, M2, M3 direction (N·m)                     |
| 2. Stroke : St (mm)   | 7. Load Weight : m1, m2, m3 (kg)                                |
| 3. Operating Pressure : P (MPa)   | 8. Overhang amount : L1, L2, L3 (m)                             |
| 4. Travel time : t (s)  | 9. Length from the center of the guide to the table end : L (m) |
| 5. Cylinder movement direction : Vertical direction, Horizontal direction | 10. Length from the table end to the load : A (m)               |

**STEP2**  
Confirmation of static moment

The allowable moment value differs depending on the load mounting direction (M1, M2, M3 direction). Calculate the value of the acting moment with reference to the diagram below.

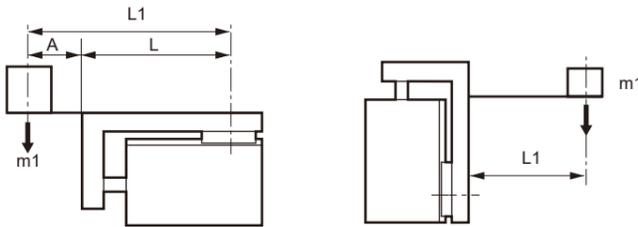
- When the load mounting direction is only one direction:  
Confirm that the calculated value is less than or equal to the allowable moment value (Table 1).
- When the load mounting direction is two or more directions (in the case of combined moment):  
Divide the calculated value in each direction by the allowable moment value (Table 1), obtain the moment ratio, and confirm that the total value is 1.0 or less.

$$\frac{M1}{M1 \text{ max}} + \frac{M2}{M2 \text{ max}} + \frac{M3}{M3 \text{ max}} \leq 1.0$$

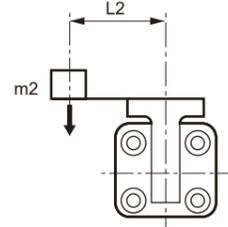
Table 1 Allowable moment during operation (Unit: N·m)

| Bore Size (mm) | M1   | M2   | M3   |
|----------------|------|------|------|
| ø6             | 0.16 | 0.24 | 0.16 |
| ø8             | 0.16 | 0.24 | 0.16 |
| ø12            | 0.27 | 0.55 | 0.27 |
| ø16            | 0.57 | 1.16 | 0.57 |

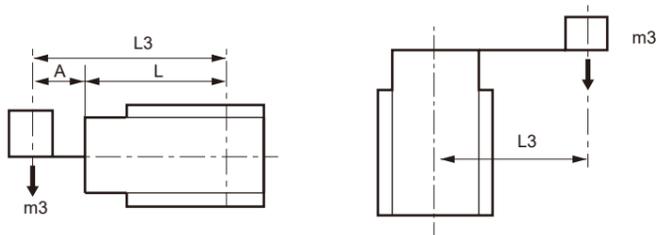
- Bending moment: M1  
 $M1 \text{ (N·m)} = 10 \times m1 \text{ (kg)} \times L1 \text{ (m)}$



- Lateral bending moment: M2  
 $M2 \text{ (N·m)} = 10 \times m2 \text{ (kg)} \times L2 \text{ (m)}$

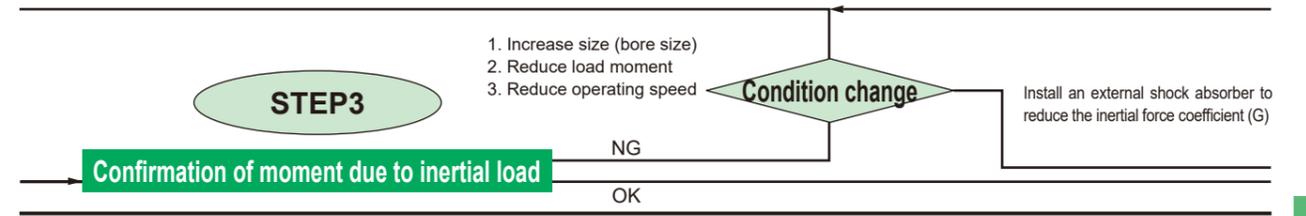


- Torsional moment: M3  
 $M3 \text{ (N·m)} = 10 \times m3 \text{ (kg)} \times L3 \text{ (m)}$



Value of L (Unit: m)

| Bore Size (mm) | Stroke |       |       |       |       |       |
|----------------|--------|-------|-------|-------|-------|-------|
|                | 5      | 10    | 15    | 20    | 25    | 30    |
| ø6             | 0.027  | 0.032 | 0.037 | 0.042 | 0.047 | 0.052 |
| ø8             | 0.028  | 0.033 | 0.038 | 0.043 | 0.048 | 0.053 |
| ø12            | 0.031  | 0.036 | 0.041 | 0.046 | 0.051 | 0.056 |
| ø16            | 0.033  | 0.038 | 0.043 | 0.048 | 0.053 | 0.058 |



**STEP3**  
Confirmation of moment due to inertial load

Depending on the load mounting direction (M1, M2, M3 direction), moment due to inertial load may act. Calculate the value of the moment due to inertial load with reference to the diagram below.

Moment due to inertial load (M1'/M3') is load weight (m1, m2, m3), overhang amount (L1, L2, L3, L1', L3') Determined by the inertial force coefficient (G).

The inertial force coefficient (G) is determined from the relationship between the inertial force coefficient and the stroke end speed (Figure 1).

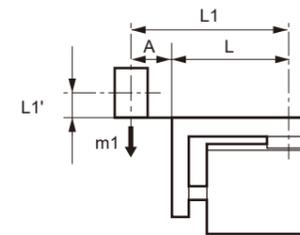
Confirm that the calculated value is less than or equal to the allowable moment value (Table 2).

Table 2 Allowable moment when inertial load is acting (Unit: N·m)

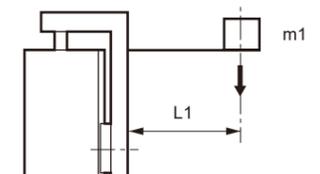
| Bore Size (mm) | M1'  | M2' | M3'  |
|----------------|------|-----|------|
| ø6             | 0.33 | -   | 0.33 |
| ø8             | 0.33 | -   | 0.33 |
| ø12            | 0.49 | -   | 0.49 |
| ø16            | 1.11 | -   | 1.11 |

\* Inertial load does not act in the M2 direction.

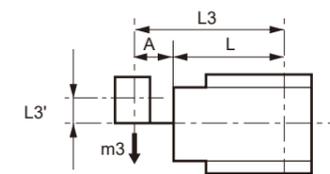
- Bending moment: M1  
 $M1' = 10 \times m1 \times (L1 + G \times L1')$



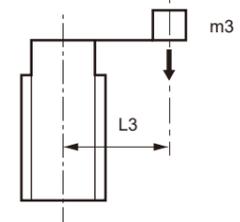
$$M1' = 10 \times m1 \times L1 \times (1 + G)$$



- Torsional moment: M3'  
 $M3' = 10 \times m3 \times (L3 + G \times L3')$



$$M3' = 10 \times m3 \times L3 \times (1 + G)$$



$$M3' = 10 \times m2 \times G \times L2$$

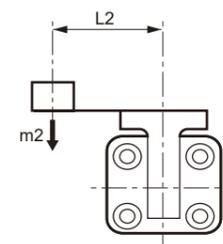
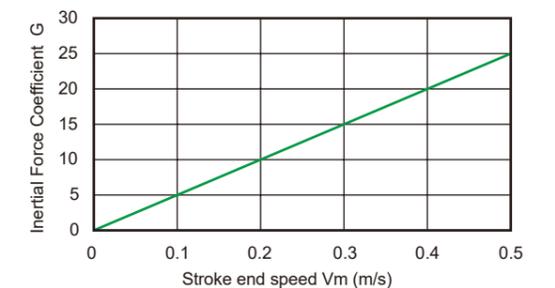
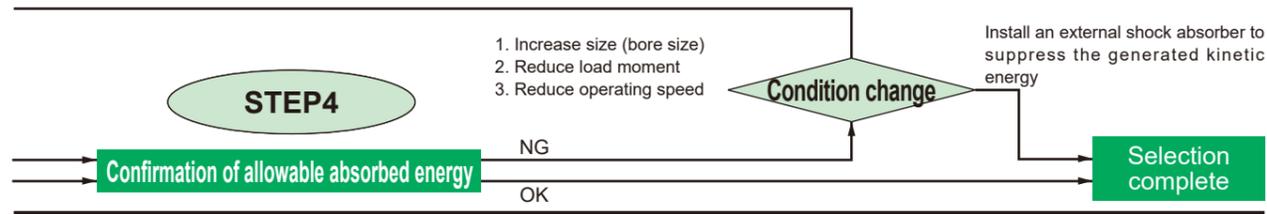


Figure 1 Relationship between inertial force coefficient and stroke end speed



Note) Stroke end speed Vm is calculated from STEP4.



**STEP4**  
Confirmation of allowable absorbed energy

First, determine the kinetic energy of the cylinder.

$$E = \frac{1}{2} \times m \times Vm^2$$

$$Vm = \frac{1 \times 10^{-3}}{t} \times (1 + 1.5 \times \frac{\alpha}{100})$$

$$\alpha = \frac{Fn}{F} \times 100$$

$$F = FO \times \frac{\mu}{100}$$

- E : Kinetic Energy (J)
- m : Load weight (kg)
- Vm : Stroke end speed (m/s)
- St : Stroke (mm)
- t : Travel time (s)
- $\alpha$  : Load factor (%)
- Fn : Required thrust to move the workpiece (N)
- F : Actual thrust (N)
- FO : Theoretical thrust (Refer to Table 4) (N)
- $\mu$  : Thrust efficiency (%)

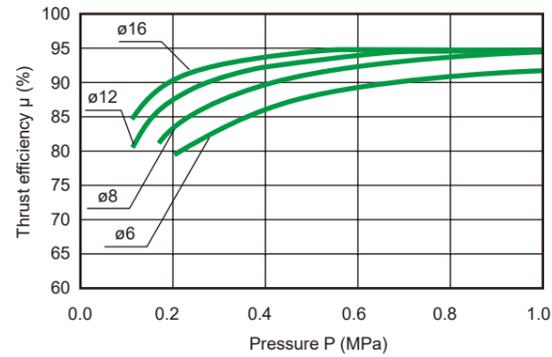
Table 3 Required thrust (Fn)

| Cylinder movement direction | Horizontal direction          | Vertical Direction            |
|-----------------------------|-------------------------------|-------------------------------|
| Thrust                      | $Fn = 0.2 \times 10 \times m$ | $Fn = 1.2 \times 10 \times m$ |

Table 4 Theoretical thrust table (FO)

| Tube Bore | Operating Direction | Operating pressure MPa |      |     |     |     |     |     |     |     |     |     |
|-----------|---------------------|------------------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|           |                     | 0.1                    | 0.15 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| ø6        | Push                |                        |      | 6   | 8   | 11  | 14  | 17  | 20  | 23  | 25  | 28  |
|           | Pull                |                        |      | 3   | 5   | 6   | 8   | 9   | 11  | 13  | 14  | 16  |
| ø8        | Push                | 8                      | 10   | 15  | 20  | 25  | 30  | 35  | 40  | 45  | 50  |     |
|           | Pull                | 5                      | 6    | 9   | 12  | 15  | 18  | 21  | 24  | 28  | 31  |     |
| ø12       | Push                | 11                     | 17   | 23  | 34  | 45  | 57  | 68  | 79  | 90  | 102 | 113 |
|           | Pull                | 8                      | 13   | 17  | 25  | 34  | 42  | 51  | 59  | 68  | 76  | 85  |
| ø16       | Push                | 20                     | 30   | 40  | 60  | 80  | 100 | 121 | 141 | 161 | 181 | 201 |
|           | Pull                | 15                     | 23   | 30  | 45  | 60  | 75  | 90  | 106 | 121 | 136 | 151 |

Figure 2 Relationship between thrust efficiency and pressure



Confirm that the kinetic energy (E) is less than or equal to the allowable absorption energy (E0).

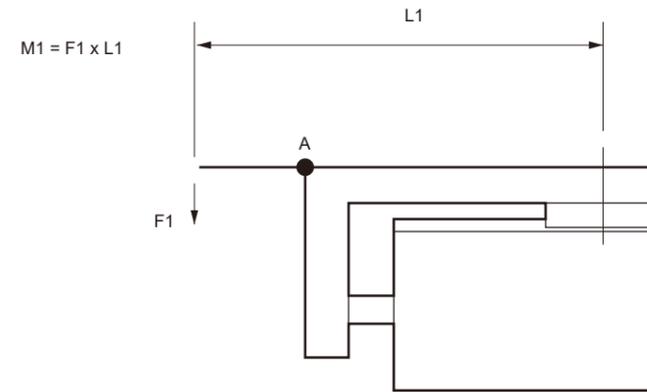
$E \leq E0$

Table 5 Allowable absorption energy (E0)

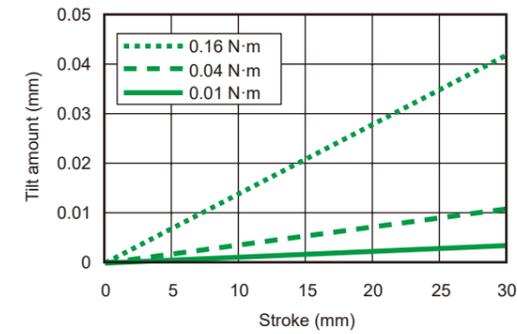
| Bore Size (mm) | Allowable Absorption Energy E0 (J) |
|----------------|------------------------------------|
| ø6             | 0.004                              |
| ø8             | 0.014                              |
| ø12            | 0.044                              |
| ø16            | 0.110                              |

Table tilt amount (Reference value)

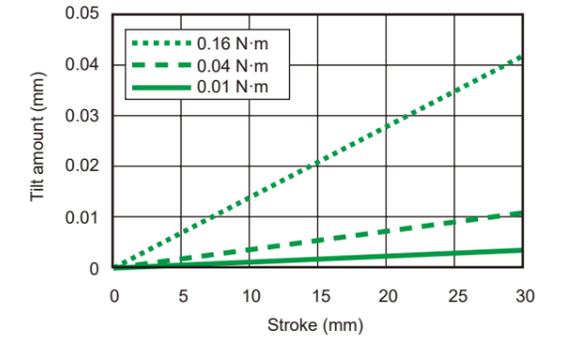
● Tilt amount at point A when M1 moment is acting



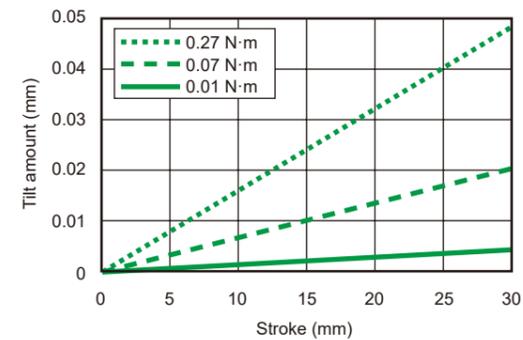
● MSDG-L-6



● MSDG-L-8



● MSDG-L-12



● MSDG-L-16

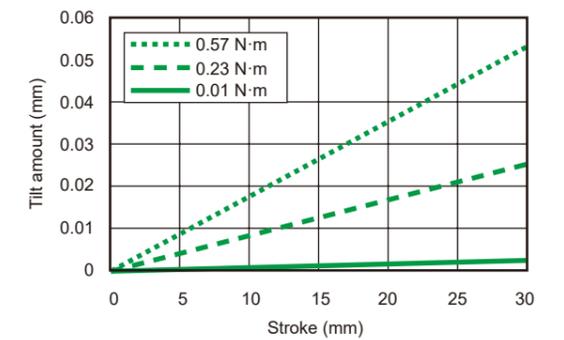
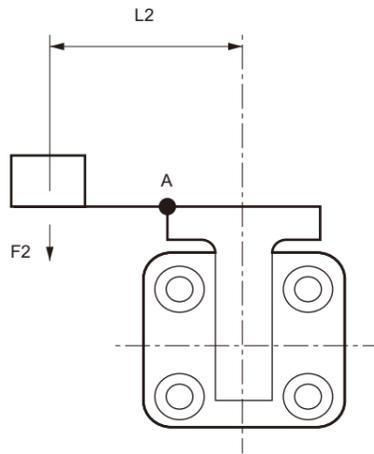


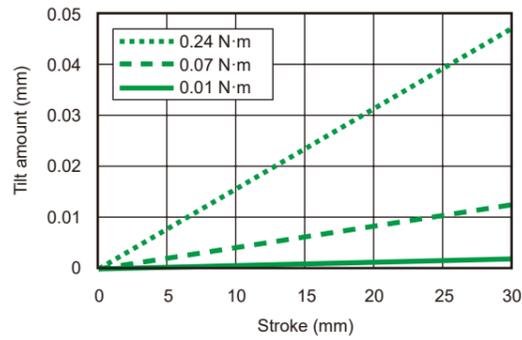
Table tilt amount (Reference value)

● Tilt amount at point A when M2 moment is acting

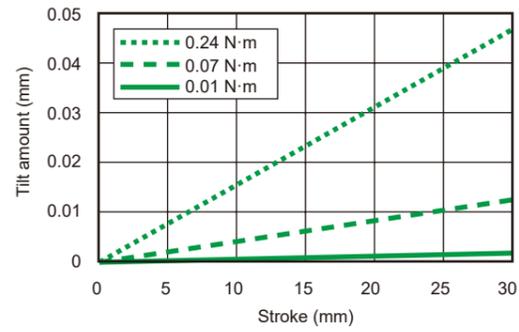
$M2 = F2 \times L2$



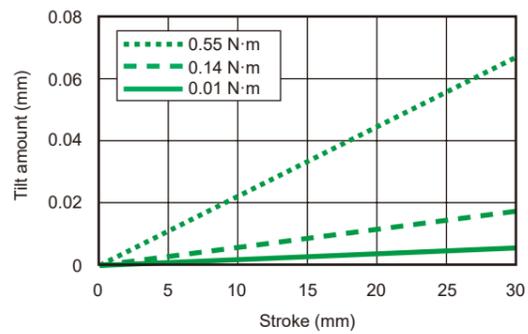
● MSDG-L-6



● MSDG-L-8



● MSDG-L-12



● MSDG-L-16

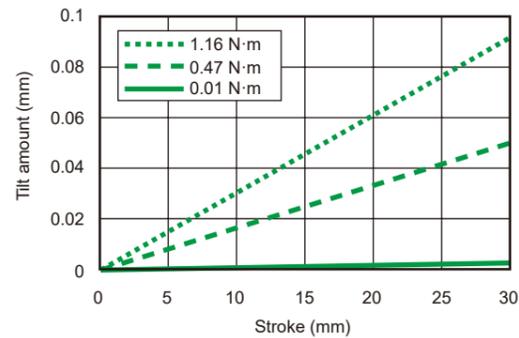
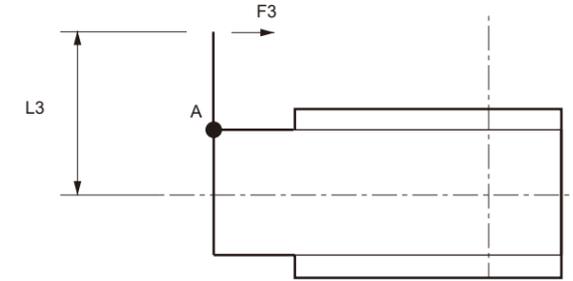


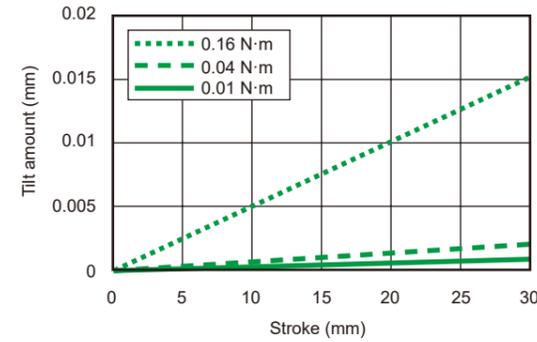
Table tilt amount (Reference value)

● Tilt amount at point A when M3 moment is acting

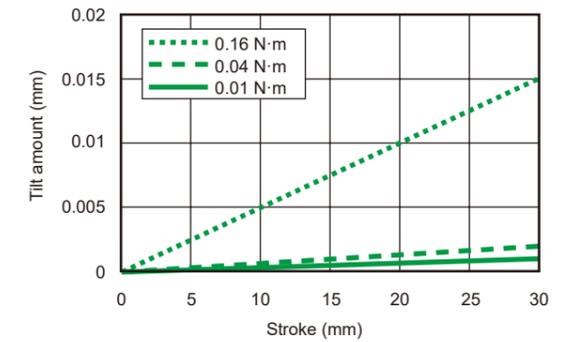
$M3 = F3 \times L3$



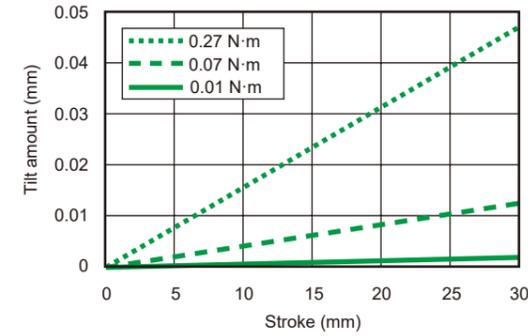
● MSDG-L-6



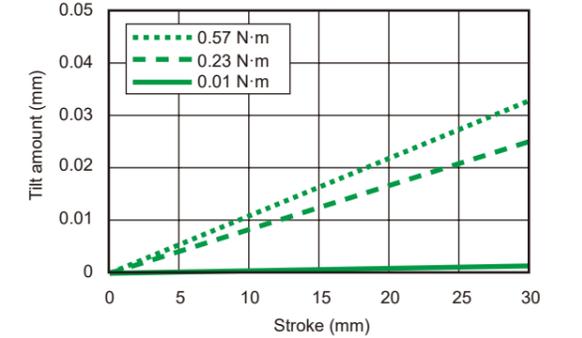
● MSDG-L-8



● MSDG-L-12



● MSDG-L-16





# To Use This Product Safely

Be sure to read this before use.

For general cylinder information, see Intro P. 41, and for cylinder switches, see P. 808.

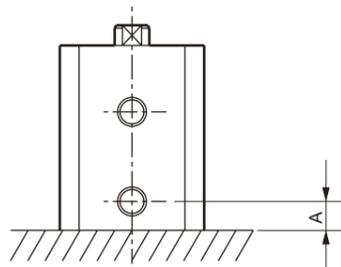
## Individual Precautions: Compact cylinder with small linear guide MSDG Series

### During Design / Selection

#### 1. Common

##### Caution

- When selecting a cylinder, follow the "Model Selection Guide" on P. 334 to 336.
- Please consult us if using the cylinder as a stopper.
- When selecting a cylinder switch, refer to the "Switch Usability Selection Table" on P. 322.
- During piping
  - Precautions for piping speed controllers and fittings. There are restrictions on usable piping fittings, so please refer to the table below when using.



#### Fitting Usability Table

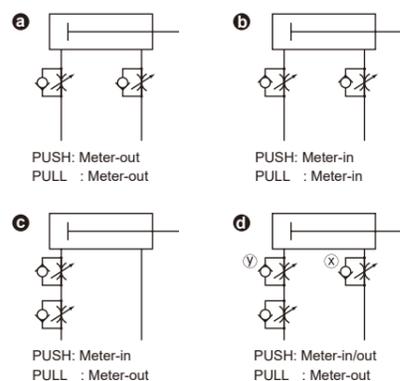
| Code<br>Bore Size (mm) | Port Size | Port position<br>Dimension A | Usable speed<br>controllers / fittings   | Fitting outer<br>diameter |
|------------------------|-----------|------------------------------|--|---------------------------|
| ø6<br>ø8               | M3        | 4                            | SC3W-M3-3<br>SC3W-M3-4<br>SC3U-M3-3<br>SC3U-M3-4<br>GWS3-M3-S<br>GWS4-M4-S<br>FTS4-M3                                      | ø8 or less                |
| ø12<br>ø16             | M5        | 5                            | SC3W-M5-3<br>SC3W-M5-4<br>SC3W-M5-6<br>SC3U-M5-3<br>SC3U-M5-4<br>SC3U-M5-6<br>GWS4-M5-S<br>GWS6-M5-S<br>FTS4-M5<br>FTS6-M5 | ø10 or less               |

#### Ultra low speed type MSDG-LF

##### Caution

- Use without lubrication. Lubrication may change characteristics.

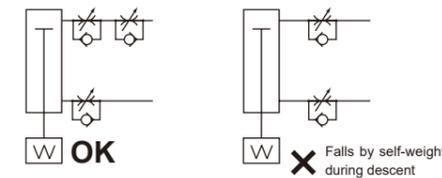
- Generally, the higher the air pressure and the lower the load factor, the more stable the speed. Use with a load factor of 50% or less.
- Speed control with a meter-out circuit provides stability. When driving a single-rod cylinder at creep speed in the PUSH direction, if the load resistance is small, a flying-out phenomenon may occur at the start of operation. As countermeasures, use circuits **b**, **c**, **d**. In addition, circuit **d** is the most stable.



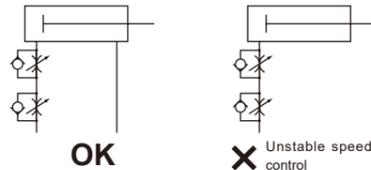
- d** Speed adjustment method for PUSH operation of the circuit:
- Speed setting with x-speed controller
  - Throttle with y-speed controller until lunging stops.
  - Reconfirmation of speed

(\*1) Comparing **b**, **c**, **d**, the **d** circuit is the most stable in operation.

(\*2) For vertical mounting, it will fall by its own weight in a meter-in circuit, so combine it with a meter-out circuit.



(\*3) For series connection of speed controllers, use the circuit shown in the figure below.



(Guideline for lurching occurrence)  
Lurching occurs in the following cases:

- Thrust > Resistance
  - \* Resistance: Thrust due to residual pressure on exhaust side (For creep speed type, + intake pressure = residual pressure)
  - For horizontal use: Frictional force due to load
  - For vertical use: Dead weight of the load
- Do not apply lateral load to the cylinder. Operation becomes unstable when lateral load is applied.
- Avoid use in places with vibration. Operation becomes unstable due to the influence of vibration.

### During Use

#### 1. Common

##### Caution

- Install the switch while adhering to the tightening torque. If tightened beyond the tightening torque range, mounting screws, mounting brackets, switches, etc. may be damaged. Also, if tightened below the tightening torque range, the switch mounting position may shift. Tightening torque: 2.0 (N·m)
- During installation
  - Please do not make dents, scratches, etc. on the main body (tube) mounting surface and table surface that would impair flatness. The flatness of the mating side to be included to the table should be 0.05 mm or less.

#### Ultra low speed type MSDG-LF

##### Caution

- Install the speed controller near the cylinder. If installed far from the cylinder, the speed will become unstable. Use SC-M3/M5-F, SC3W, or SCD-M3/M5-F series speed controllers.
- Adjust alignment etc. so that no lateral load is applied to the cylinder. Also, adjust and install so that there is no twisting with respect to the sliding guide. Operation will become unstable if there are fluctuations in load or resistance. Guides with a large difference between static friction and dynamic friction will result in unstable operation.

For precautions regarding mounting, installation, adjustment, use, and maintenance, please see "Precautions for Use" in this catalog and the CKD Components Product website (<https://www.ckd.co.jp/kiki/en/>) → "Model No." → "Instruction Manual"