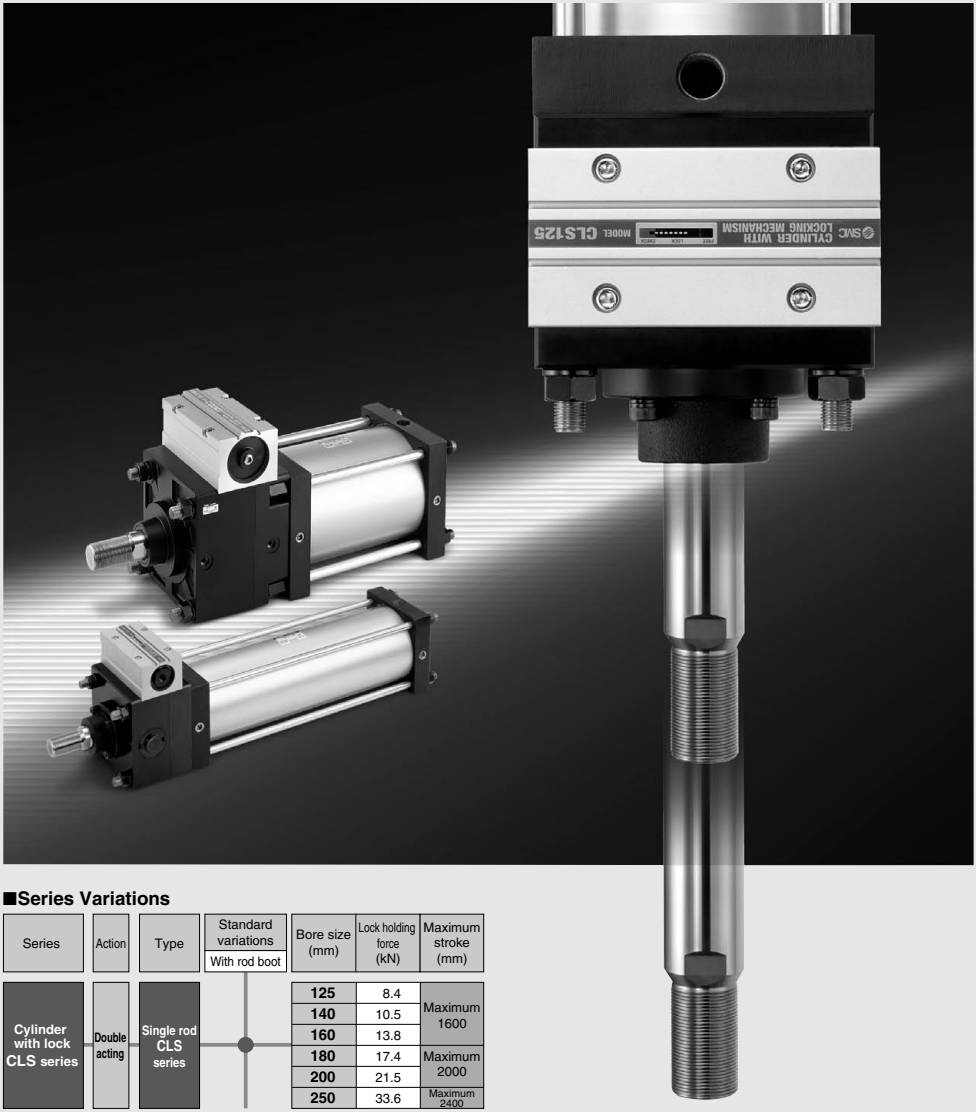
# Cylinder with Lock

## *CLS* Series

### ø125, ø140, ø160, ø180, ø200, ø250

**A locking cylinder ideal for intermediate stops, emergency stops and drop prevention.**




■**Series Variations**

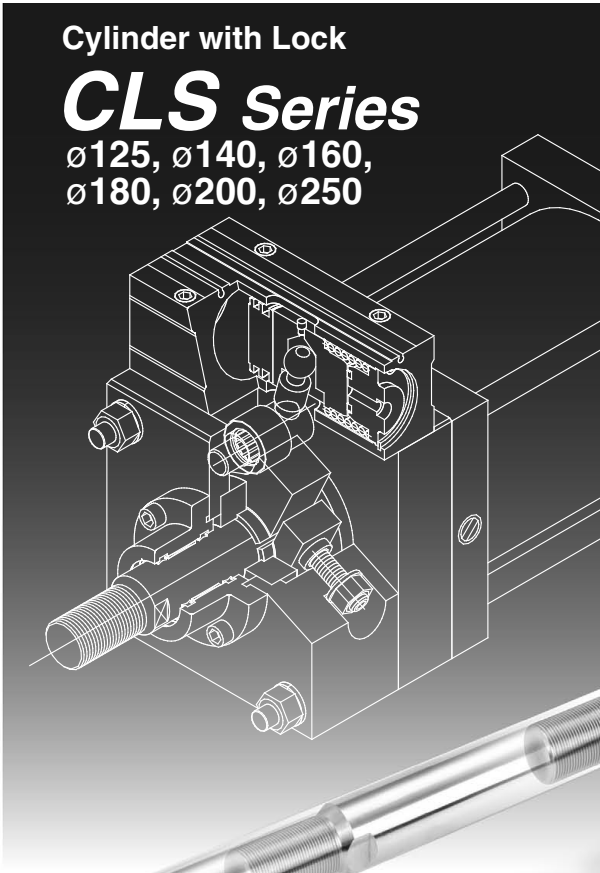
| Series | Action | Type | Standard variations | Bore size (mm) | Lock holding force (kN) | Maximum stroke (mm) |
|---|---|---|---|---|---|---|
| | | | With rod boot | | | |
| Cylinder with lock CLS series | Double acting | Single rod CLS series | | 125 | 8.4 | Maximum 1600 |
| | | | | 140 | 10.5 | |
| | | | | 160 | 13.8 | |
| | | | | 180 | 17.4 | Maximum 2000 |
| | | | | 200 | 21.5 | |
| | | | | 250 | 33.6 | Maximum 2400 |

# A locking cylinder ideal emergency stops and

Cylinder with Lock

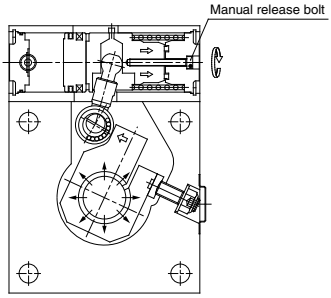
## CLS Series

ø125, ø140, ø160,
ø180, ø200, ø250



## Manual unlocking function

Even if the air supply is cut off or discharged, the lock can be released by screwing in the manual release bolt (hexagon socket head cap screw).




## Design minimizes influences of unlocking air quality

A design largely unaffected by factors such as moisture and drainage in compressed air has been realized by separating the lock mechanism and the brake cylinder.

## Can be locked in both directions

An equal holding force can be obtained on either reciprocating stroke of the cylinder.

## Short body lock unit

Overall length has been reduced by using an independent brake cylinder (–15% compared to previous series). Weight reduction has also been realized through parts simplification (max. –40% compared to previous series).

## Steady holding force

Outstanding durability and steady holding force are maintained by using a brake shoe with superior wear resistance.

# for intermediate stops, drop prevention.

## Lock unit switch

By providing a switch on the brake cylinder, the operating state of the lock unit (brake piston) can be detected using the switch signal.


## Small auto switches are mountable.

Small auto switches can also be mounted on the cylinder unit.



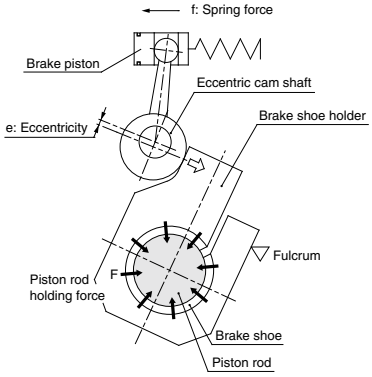
Solid state auto switch
**D-M9, D-M9□W,**
**D-M9□AL**
Reed auto switch
**D-A9**
Magnetic field resistant auto switch
**D-P3DWA**

## Fail safe construction

Since the mechanism locks when air pressure is exhausted, safe operation is possible even when there is a failure in the air supply or power supply, etc.

## Construction principle

Uses an energizing mechanism based on the wedge effect of the eccentric cam shaft and the lever principle of the shoe holder.




## Maintenance simplified

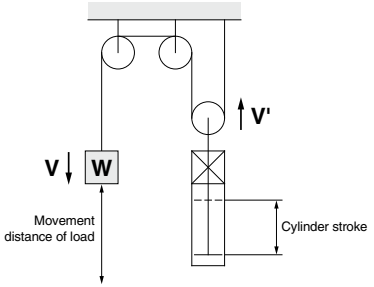
The lock monitor makes it possible to confirm the operating state of the lock unit (brake piston) and the state of wear for each part, providing a guide for maintenance.

# Model Selection

## Caution on Model Selection

### ⚠ Caution

1. In order that the originally selected maximum speed is not exceeded, be certain to use a speed controller and adjust if so that movement through the total movement distance of the load takes place in no less than the applicable movement time.
   The movement time is the time that is necessary for the load to travel the total movement distance from the start without any intermediate stops.
2. In cases where the cylinder stroke and the movement distance of the load are different (double speed mechanism, etc.), use the movement distance of the load for selection purposes.
   Example)




3. Shown below is an example of a model selection procedure for an intermediate stop application (including an emergency stop in operation). Only when locking in a drop prevention application, when no kinetic energy is applied, the maximum load mass should be determined by using graphs 5 through 7 on page 981 (taking into consideration the upper limit of the load mass at a maximum speed of 100 mm/s).

## Selection Example

- Load mass: **m** = 320 kg
- Movement distance: **st** = 400 mm
- Movement time: **t** = 2 s
- Load condition: Vertical downward = Load in direction of rod extension
- Operating pressure: **P** = 0.4 MPa

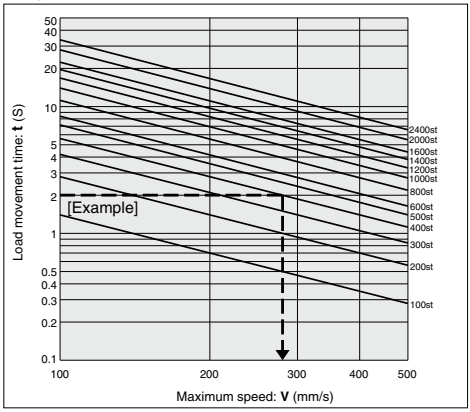
Step 1: From graph 1 find the maximum movement speed of the load
∴ Maximum speed **V**: approx. 280 mm/s

Step 2: Select Graph 6 based upon the load condition and operating pressure, and then from the intersection of the maximum speed **V** = 280 mm/s found in Step 1, and the load mass **m** = 320 kg
∴ ø140→ select a CLS140 or larger bore size.

## Step 1 Find the maximum load speed: V.

Find the maximum load speed: **V** (mm/s) from the load movement time: **t** (s) and the movement distance: **st** (mm).

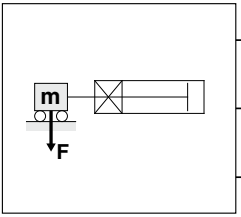
**Graph 1**

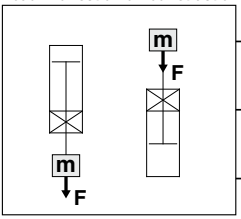



## Step 2 Find the cylinder bore size.

Select a graph based upon the load condition and operating pressure, and then find the point of intersection for the maximum speed found in Step 1 and the load mass. Select the bore size on the line above the point of intersection.

| Load condition | Operating pressure | |
|---|---|---|
| **Direction of load at right angle to rod** (∗ Being held by a guide) | from 0.3 MPa | Graph 2 |
| | from 0.4 MPa | Graph 3 |
| | from 0.5 MPa | Graph 4 |
| **Load in direction of rod extension**<br>**Load in direction of rod retraction** | from 0.3 MPa | Graph 5 |
| | from 0.4 MPa | Graph 6 |
| | from 0.5 MPa | Graph 7 |

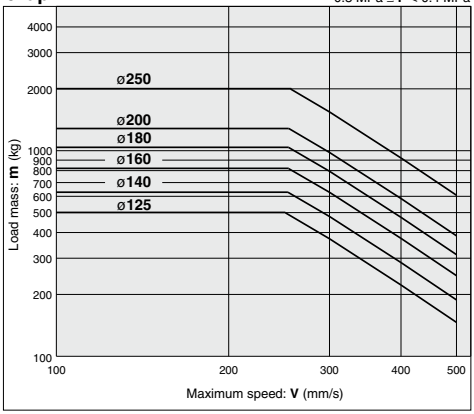


## Selection Graph

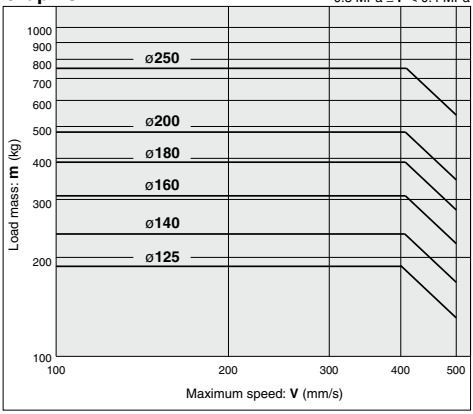
### Graph 2

0.3 MPa ≤ **P** < 0.4 MPa



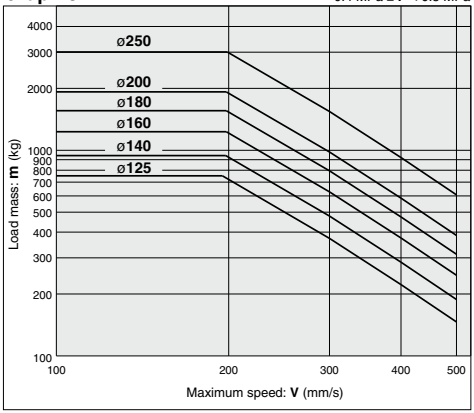

### Graph 5

0.3 MPa ≤ **P** < 0.4 MPa



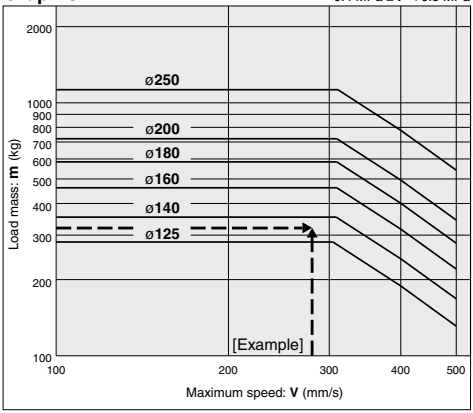

### Graph 3

0.4 MPa ≤ **P** < 0.5 MPa



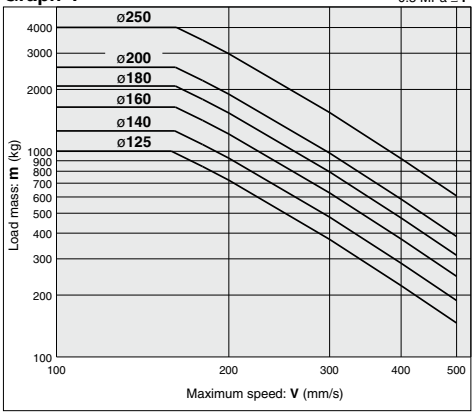

### Graph 6

0.4 MPa ≤ **P** < 0.5 MPa



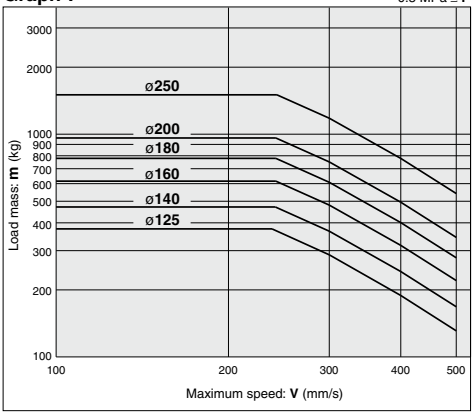

### Graph 4

0.5 MPa ≤ **P**




### Graph 7

0.5 MPa ≤ **P**



# Cylinder with Lock
# Double Acting, Single Rod
# CLS Series
## ø125, ø140, ø160, ø180, ø200, ø250

### How to Order

**CLS** L □ 125 □ – 100 □ ——— D M9B – □ – V

**With Auto Switch** **CDLS** L 125 □ – 100 □ – M9BW □ – D M9B – □

**With auto switch** (Built-in magnet)

**Mounting type**

| | | | |
|---|---|---|---|
| B | Basic type | C | Single clevis type |
| L | Foot type | D | Double clevis type |
| F | Rod flange type | T | Center trunnion type |
| G | Head flange type | | |

**Tube material**

| Symbol | Bore size | Without magnet | Built-in magnet |
|---|---|---|---|
| | | Tubing material | Tubing material |
| Nil | 125, 140 | Aluminum tube (1000 st or less) | Aluminum tube |
| | | Steel tube (1001 st or more) | |
| | 160 | Aluminum tube (1200 st or less) | |
| | | Steel tube (1201 st or more) | |
| | 180, 200 | Steel tube *2 | |
| | 250 | Steel tube | |
| F *1 | 125 to 160 | Steel tube | |

*1 Auto switches are not available with steel tube.
*2 For items corresponding to the Class 2 Pressure Vessel Act, the material is aluminum.

**Port thread type**

| | |
|---|---|
| Nil | Rc |
| TN | NPT |
| TF | G |

**Cylinder stroke (mm)**
Refer to the maximum stroke table on page 983.

**Bore size**

| Symbol | Without auto switch | With auto switch |
|---|---|---|
| 125 | 125 mm | 125 mm |
| 140 | 140 mm | 140 mm |
| 160 | 160 mm | 160 mm |
| 180 | 180 mm | 180 mm |
| 200 | 200 mm | 200 mm |
| 250 | 250 mm | — |

**Cylinder unit auto switch**

| | |
|---|---|
| Nil | Without auto switch |

* Select applicable auto switches from the table below.

**Number of auto switches**

| | |
|---|---|
| Nil | 2 pcs. |
| S | 1 pc. |
| n | "n" pcs. |

**Cylinder**

| | | |
|---|---|---|
| Rod boot | Nil | Without rod boot |
| | J | Nylon tarpaulin |
| | K | Heat resistant tarpaulin |
| Cushion | Nil | With double-side cushion |
| | N | Without cushion |
| | R | With rod cushion |
| | H | With head cushion |

* Indicate in alphabetical order when 2 or more symbols are applicable.

**Lock unit auto switch**

| | |
|---|---|
| Nil | Without auto switch |

* Refer to the table below for applicable auto switch models.

**Lock unit built-in magnet**

| | |
|---|---|
| Nil | Without magnet (Without auto switch) |
| D | Built-in magnet |

**Made to Order**
Refer to page 983 for details.

**Class 2 Pressure Vessel**
(Subject to or not subject to)

| | |
|---|---|
| Nil | Applicable |
| V | Not applicable |

* This indicates whether or not the cylinder stroke is applicable to the Class 2 Pressure Vessel Act and whether or not the product is made in Japan.
* "-V" is not put on a product with a stroke not applicable to the Class 2 Pressure Vessel Act. For details, refer to page 984.

### Cylinder Unit/Applicable Auto Switches
/Refer to pages 1119 to 1245 for detailed auto switch specifications.

| Type | Special function | Electrical entry | Indicator light | Wiring (output) | Load voltage DC | Load voltage AC | Auto switch model: Tie-rod mounting | Auto switch model: Band mounting | Lead wire length (m): 0.5 (Nil) | 1 (M) | 3 (L) | 5 (Z) | Pre-wired connector | Applicable load: | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Solid state auto switch | — | Grommet | Yes | 3-wire (NPN) | 24 V | 5 V, 12 V | M9N | — | ● | ● | ● | ○ | ○ | IC circuit | Relay, PLC |
| | | | | 3-wire (PNP) | | | M9P | — | ● | ● | ● | ○ | ○ | | |
| | | | | 2-wire | | 12 V | M9B | — | ● | ● | ● | ○ | ○ | — | |
| | | Terminal conduit | | 3-wire (NPN) | 24 V | 12 V | — | G39 | — | — | — | — | — | IC circuit | |
| | | | | 2-wire | | | — | K39 | — | — | — | — | — | | |
| | With diagnostic output (2-color indicator) | Grommet | | 3-wire (NPN) | | 5 V, 12 V | M9NW | — | ● | ● | ● | ○ | ○ | | |
| | | | | 3-wire (PNP) | | | M9PW | — | ● | ● | ● | ○ | ○ | | |
| | | | | 2-wire | | 12 V | M9BW | — | ● | ● | ● | ○ | ○ | | |
| | Water resistant (2-color indicator) | | | 3-wire (NPN) | | 5 V, 12 V | M9NA*1 | — | ○ | ○ | ● | ○ | ○ | — | |
| | | | | 3-wire (PNP) | | | M9PA*1 | — | ○ | ○ | ● | ○ | ○ | | |
| | | | | 2-wire | | 12 V | M9BA*1 | — | ○ | ○ | ● | ○ | ○ | | |
| | With diagnostic output (2-color indicator) | | | 4-wire (NPN) | | 5 V, 12 V | F59F | — | ● | — | ● | ○ | ○ | IC circuit | |
| | Magnetic field resistant (2-color indicator) | | | 2-wire (Non-polar) | | — | P3DWA | — | ● | — | ● | ● | ○ | — | |
| Reed auto switch | — | — | Yes | 3-wire (NPN equiv.) | — | 5 V | — | A96 | — | ● | — | ● | — | — | IC circuit | — |
| | | | Yes | 2-wire | 24 V | 12 V | 100 V | A93 | — | ● | ● | ● | ● | — | — | Relay, PLC |
| | | | No | | | 5 V, 12 V | 100 V or less | A90 | — | ● | — | ● | — | — | IC circuit | |
| | | | Yes | | | | 100 V, 200 V | A54 | — | ● | — | ● | ● | — | | |
| | | Terminal conduit | | | | 12 V | — | A33 | — | — | — | — | — | — | PLC | |
| | | DIN terminal | | | | | — | A34 | — | — | — | — | — | | Relay, PLC |
| | | | | | | | 100 V, 200 V | A44 | — | — | — | — | — | | |
| | Diagnostic indication (2-color indicator) | Grommet | | | | — | — | A59W | — | ● | — | ● | — | — | | |

*1 Water resistant type auto switches can be mounted on the above models, but in such case SMC cannot guarantee water resistance. Consult with SMC regarding water resistant types with the above model numbers.

* Lead wire length symbol: 0.5 m ..... Nil (Example) M9NW
1 m ..... M (Example) M9NWM
3 m ..... L (Example) M9NWL
5 m ..... Z (Example) M9NWZ

* Solid state auto switches marked with "○" are produced upon receipt of order.
* There are applicable auto switches other than listed above. For details, refer to page 998.
* For details about auto switches with pre-wired connector, refer to pages 1192 and 1193.
* D-A9□/M9□/M9□W/M9□A/P3DWA□ auto switches are shipped together (not assembled). (Only auto switch brackets are assembled at the time of shipment.)

### Lock Unit/Applicable Auto Switches

| Auto switch type | Special function | Indicator light | Wiring (output) | Load voltage DC | Load voltage AC | Auto switch model | Lead wire length (m): 0.5 (Nil) | 1 (M) | 3 (L) | 5 (Z) | Applicable load: | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Solid state | Grommet | Yes | 3-wire (NPN) | 24 V 5 V, 12 V | — | M9N | ● | ● | ● | ○ | IC circuit | Relay, PLC |
| | | | 3-wire (PNP) | | | M9P | ● | ● | ● | ○ | | |
| | | | 2-wire | 12 V | | M9B | ● | ● | ● | ○ | — | |
| Reed | | No | | 5 V, 12 V | 100 V or less | A90 | ● | — | ● | — | IC circuit | Relay, PLC |
| | | Yes | | 12 V | 100 V | A93 | ● | ● | ● | — | — | |

*D-A9□/M9□ auto switches are shipped together (not assembled).

Made to Order

**Made to Order**
Click here for details

| Symbol | Specifications |
|---|---|
| -XA□ | Change of rod end type |
| -XC3 | Special port location |
| -XC14 | Change of trunnion bracket mounting position (125, 140, 160 only) |
| -XC35 | With coil scraper (125, 140, 160 only)* |

* ø180 to ø250 come with a coil scraper as standard.

## Stopping Accuracy

Unit: mm

| Lock type | Piston speed (mm/s) | | |
|---|---|---|---|
| | 100 | 300 | 500 |
| Spring lock | ±0.5 | ±1.0 | ±2.0 |

Conditions:
Horizontal, Supply pressure P = 0.5 MPa
Load mass ..... Upper limit of allowed value
Solenoid valve for locking ... Mounted directly to unlocking port
Maximum value from range of 100 measured stopping positions

## Class 2 Pressure Vessel

A Class 2 Pressure Vessel will be required for strokes exceeding those shown below.

| Bore size (mm) | Cylinder stroke (mm) |
|---|---|
| **180** | 1569 |
| **200** | 998 |
| **250** | 813 |

Refer to pages 995 to 998 for cylinders with auto switches.

- Minimum auto switch mounting stroke
- Proper auto switch mounting position (detection at stroke end) and mounting height
- Operating range
- Switch mounting bracket: Part no.

## Rod Boot Material

| Symbol | Material | Max. ambient temperature |
|---|---|---|
| **J** | Nylon tarpaulin | 20°C |
| **K** | Heat resistant tarpaulin | 110°C* |

* Maximum ambient temperature for the rod boot itself.

## Cylinder Specifications

| Bore size (mm) | 125 | 140 | 160 | 180 | 200 | 250 |
|---|---|---|---|---|---|---|
| **Type** | Not required (Non-lube) | | | | | |
| **Fluid** | Air | | | | | |
| **Proof pressure** | 1.57 MPa, 1.2 MPa* | | | | | |
| **Max. operating pressure** | 0.97 MPa, 0.7 MPa* | | | | | |
| **Min. operating pressure** | 0.08 MPa | | | | | |
| **Piston speed** | 50 to 500 mm/s** | | | | | |
| **Cushion** | Yes | | | | | |
| **Ambient and fluid temperature** | Without auto switch: 0°C to 70°C<br>With auto swiatch: 0°C to 60°C (with no freezing) | | | | | |
| **Stroke length tolerance** | to 250: $^{+1.0}_{0}$, 251 to 1000: $^{+1.4}_{0}$, 1001 to 1500: $^{+1.8}_{0}$, 1501 to 2000: $^{+2.2}_{0}$, 2001 to 2400: $^{+2.6}_{0}$ | | | | | |
| **Mounting** | Basic type, Foot type, Rod flange type, Head flange type, Single clevis type, Double clevis type, Center trunnion type | | | | | |

* For ø180 and ø200 with auto switches.
** There are load limitations depending on the piston speed when locked, the mounting method, and the operating pressure.

## Lock Specifications

| Bore size (mm) | 125 | 140 | 160 | 180 | 200 | 250 |
|---|---|---|---|---|---|---|
| **Locking action** | Spring locking (exhaust locking) | | | | | |
| **Unlocking pressure** | 0.25 MPa or more | | | | | |
| **Locking pressure** | 0.20 MPa or less | | | | | |
| **Max. operating pressure** | 1.0 MPa | | | | | |
| **Locking direction** | Both directions | | | | | |
| **Holding force (max. static load) kN*** | 8.4 | 10.5 | 13.8 | 17.4 | 21.5 | 33.6 |

* The holding force (max. static load) shows the maximum capability and does not show the normal holding capability. So, select an appropriate cylinder while referring to page 980.

## Cylinder Stroke

Unit: mm

| Tube material | Aluminum alloy | Carbon steel tube | |
|---|---|---|---|
| Bore size (mm) | Basic type, Head flange type, Single clevis type, Double clevis type, Center trunnion type, Foot type, Rod flange type | Basic type, Head flange type, Single clevis type, Double clevis type, Center trunnion type | Foot type Rod flange type |
| **125, 140** | 1000 or less | 1000 or less | 1600 or less |
| **160** | 1200 or less | 1200 or less | 1600 or less |
| **180** | — | 1200 or less | 2000 or less |
| **200** | — | 1200 or less Note) | 2000 or less |
| **250** | — | 1200 or less | 2400 or less |

Note) The tubing material of items with a bore size of 180 and 200 corresponding to the Class 2 Pressure Vessel Act is aluminum tubing.

## Cylinder Stroke/Auto Switch Mounting on Cylinder Unit (Built-in Magnet)

Refer to the minimum auto switch mounting stroke (page 996) for those with an auto switch.

Unit: mm

| Bore size (mm) | Basic type, Head flange type, Single clevis type, Double clevis type, Center trunnion type | Foot type Rod flange type |
|---|---|---|
| **125, 140** | 1000 or less | 1400 or less |
| **160** | 1200 or less | 1400 or less |
| **180** | 1200 or less | 1500 or less |
| **200** | 998 or less | 998 or less |
| Note | For ø200, 998 to 1200 strokes are available as made to order. | For ø200, 998 to 1500 strokes are available as made to order. |

## Mounting Bracket Part No.

| Bore size (mm) | 125 | 140 | 160 | 180 | 200 | 250 |
|---|---|---|---|---|---|---|
| Foot type Note 1) | CS1-L12 | CS1-L14 | CS1-L16 | CS1-L18 | CS1-L20 | CS1-L25 |
| Rod flange type Note 2) | CS1-FL12 | CS1-FL14 | CS1-FL16 | CS1-FL18 | CS1-FL20 | CS1-FL25 |
| Head flange type | CS1-F12 | CS1-F14 | CS1-F16 | CS1-F18 | CS1-F20 | CS1-F25 |
| Single clevis type | CS1-C12 | CS1-C14 | CS1-C16 | CS1-C18 | CS1-C20 | CS1-C25 |
| Double clevis Note 3) | CS1-D12 | CS1-D14 | CS1-D16 | CS1-D18 | CS1-D20 | CS1-D25 |

Note 1) When ordering foot brackets, 2 pcs. should be ordered for each cylinder.
Note 2) ø125 to ø250 front flange types use CS1 series long stroke flanges.
Note 3) A clevis pin and cotter pins (2 pcs.) are packed with the double clevis type.

## Accessories

| Mounting brackets | | Basic type | Foot type | Rod flange type | Head flange type | Single clevis type | Double clevis type | Center trunnion type |
|---|---|---|---|---|---|---|---|---|
| Standard equipment | Clevis pin | — | — | — | — | — | ● | — |
| Individual parts | Rod end nut | ● | ● | ● | ● | ● | ● | ● |
| | Single knuckle joint | ● | ● | ● | ● | ● | ● | ● |
| | Double knuckle joint (with pin) | ● | ● | ● | ● | ● | ● | ● |
| Options | With rod boot | ● | ● | ● | ● | ● | ● | ● |

∗ Refer to the accessory models and dimensions on page 993.
∗∗ Refer to page 994 when the rod end nut, and the single and double knuckle joints are used together.

## Weight

/Numbers inside ( ) are for steel tube Unit: kg

| Bore size (mm) | | 125 | 140 | 160 | 180 | 200 | 250 |
|---|---|---|---|---|---|---|---|
| Lock unit weight | | 9.40 | 11.37 | 16.93 | 26.20 | 36.4 | 61.70 |
| Basic weight | Basic type | 23.49 (24.96) | 28.30 (30.11) | 40.87 (43.08) | 57.30 (63.91) | 75.46 (82.01) | — (138.94) |
| | Foot type | 25.12 (26.59) | 30.82 (32.63) | 43.67 (45.88) | 61.50 (68.11) | 80.34 (86.89) | — (148.44) |
| | Flange type | 26.17 (27.64) | 33.30 (35.11) | 47.26 (49.47) | 67.13 (73.74) | 87.37 (93.92) | — (160.78) |
| | Single clevis type | 26.56 (28.03) | 32.59 (34.40) | 46.36 (48.57) | 65.69 (72.30) | 85.36 (91.91) | — (157.33) |
| | Double clevis type (includes clevis pin & cotter pin) | 27.02 (28.49) | 33.34 (35.15) | 47.21 (49.42) | 67.37 (73.98) | 87.39 (93.94) | — (160.52) |
| | Center trunnion type | 27.62 (29.09) | 34.03 (35.84) | 48.27 (50.48) | 68.46 (75.07) | 89.45 (96.00) | — (166.78) |
| Additional weight per 100 mm of stroke | | 1.77 (2.66) | 1.96 (3.01) | 2.39 (3.58) | 2.85 (4.95) | 3.42 (5.75) | — (9.08) |
| Accessories | Single knuckle | 0.91 | 1.16 | 1.56 | 3.07 | 2.90 | 5.38 |
| | Double knuckle (with pin) | 1.37 | 1.81 | 2.48 | 4.74 | 4.59 | 9.22 |
| | Rod end nut | 0.16 | 0.16 | 0.23 | 0.33 | 0.56 | 1.01 |

Calculation (Ex.) **CLSL140-100**
Basic weight ..... 30.82 (foot type, ø140)
Additional weight ..... 1.96/100 mm stroke
Cylinder stroke ..... 100 mm stroke
30.82 + 1.96 x 100/100 = 32.78 kg

## Regulations/Class 2 Pressure Vessel Act

The air cylinder uses the compressed air, but may become applicable to the regulations depending on the cylinder size.
So, please fully understand the regulations before using the cylinder.

**Regulations regarding Class 2 Pressure Vessel**

**1.** As specified in Articles 42 and 44 of the Industrial Safety and Health Act, the individual examination shall be conducted in conformity with the Class 2 Pressure Vessel Act. If the pressure vessel structure does not satisfy the Class 2 Pressure Vessel Act, it shall not be transferred, leased or installed.

**2. About Class 2 Pressure Vessel**

The Class 2 Pressure Vessel is a vessel (except for Class 1 Pressure Vessel) that contains the gas with a gauge pressure of 0.2 MPa or more and satisfies the conditions shown below.

① Vessel with an inside capacity of 0.04 $m^3$ or more

② Vessel with a shell inside diameter of 200 mm or more and a length of 1000 mm or more (extracted from Article 1-7 of the Industrial Safety and Health Act.)

The following shows SMC products that are applicable to the Class 2 Pressure Vessel Act.

**Products applicable to the Class 2 Pressure Vessel Act**

If the stroke exceeds the level shown below, the cylinder is applicable to the Class 2 Pressure Vessel Act.

| Bore size (mm) | Cylinder stroke (mm) |
|---|---|
| 180 | 1569 |
| 200 | 998 |
| 250 | 813 |
| 300 | 564 |

**3 Periodical Self Inspection**

As specified in Article 45 of the Industrial Safety and Health Act, it is obligated to conduct the periodical self inspection of the product applicable to the Class 2 Pressure Vessel Act and keep the inspection records when using it. (Related laws: Articles 88 and 89 of the Ordinance on Safety of Boilers and Pressure Vessels)
After the use of the product applicable to the Class 2 Pressure Vessel Act has been started, the self inspection of the following points is conducted once a year and the inspection results are recorded.

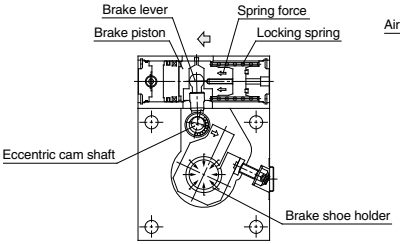
1 Check the main body for damage.
2 Check the lid tightening bolt for wear.
3 Check the pipe and valve for damage.

**4 Products not applicable to the Class 2 Pressure Vessel Act**

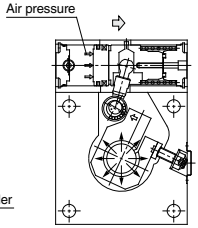
According to Articles 13 and 14 of the Industrial Safety and Health Act, when it is obvious that the product is not used in Japan, it is not necessary to examine the product in conformity with the Class 2 Pressure Vessel Act. Additionally, when it is obvious that the product is not used in Japan, the product is exempted from the machine applicable to Articles 42 and 44 of the Industrial Safety and Health Act.
Please order the air cylinder with "-V" put at the end of the part number.
(The symbol "-V" is not put on a product with a stroke not applicable to the Class 2 Pressure Vessel Act.)
The cylinders manufactured in SMC overseas factories are not examined in conformity with the Class 2 Pressure Vessel Act. When using the cylinder in Japan, be sure to use the cylinder made in Japan that has been examined in conformity with the Class 2 Pressure Vessel Act.

**5** A safety valve is installed on the upstream side of the piping so that any pressure exceeding the maximum operating pressure of the cylinder applicable to the Class 2 Pressure Vessel Act is not applied.

## Construction Principle




**Locked condition (when air is exhausted.)**

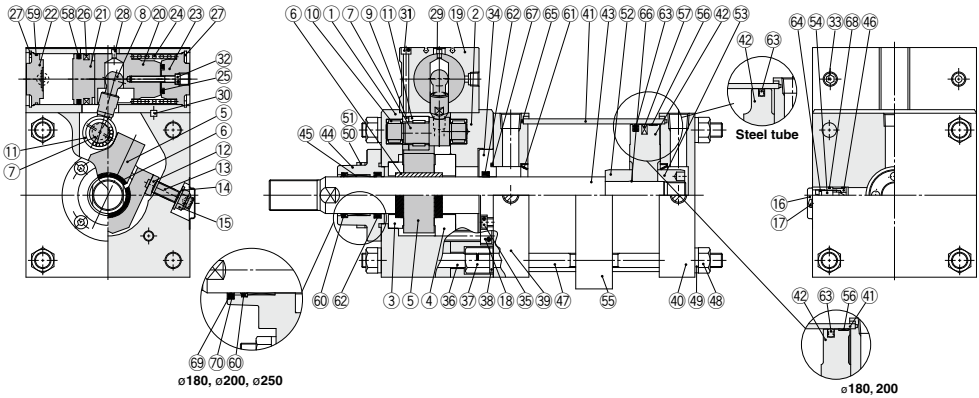



**Unlocked condition (when air is supplied.)**

**Spring locking (exhaust locking)**

The brake piston actuated by the force of the spring turns the eccentric cam shaft via the brake lever. This turning force distorts the brake shoe holder due to the wedge effect of the cam, acting on the brake shoe and locking the piston rod by tightening on it with a large force.
Unlocking occurs when air pressure is supplied to the unlocking port, causing the brake piston to counteract the force of the spring and push the brake lever back. This removes the force which is distorting the shoe holder and unlocks the piston rod.

## Construction




### Component Parts

| No. | Description | Material | Note |
|---|---|---|---|
| 1 | **Cover A** | Aluminum alloy | Black hard anodized (ø125, ø140, ø160) |
| | | | Hard anodized & coated (ø180, ø200, ø250) |
| 2 | **Cover B** | Aluminum alloy | Black hard anodized (ø125, ø140, ø160) |
| | | | Hard anodized & coated (ø180, ø200, ø250) |
| 3 | **Thrust washer A** | Carbon steel | Electroless nickel plated (ø125, ø140, ø160) |
| | | | Special treatment (ø180, ø200, ø250) |
| 4 | **Thrust washer B** | Carbon steel | Electroless nickel plated (ø125, ø140, ø160) |
| 5 | **Brake shoe holder A** | Chromium molybdenum steel | Special treatment |
| 6 | **Brake shoe** | Special friction material | |
| 7 | **Eccentric cam shaft** | Special steel | |
| 8 | **Brake lever** | Chromium molybdenum steel | Zinc chromated |
| 9 | **Washer** | Carbon steel | Zinc chromated |
| 10 | **Needle bearing** | — | |
| 11 | **Needle bearing** | — | |
| 12 | **Stopper** | Special steel | Electroless nickel plated |
| 13 | **Adjustment screw** | Chromium molybdenum steel | Zinc chromated |
| 14 | **Conical spring washer** | Spring steel | |
| 15 | **U nut** | Carbon steel | |
| 16 | **Cover** | Steel plate | Black zinc chromated |
| 17 | **Cover holding screw** | Carbon steel | |
| | | | |
| 18 | **Cover holding bolt** | Chromium molybdenum steel | |
| 19 | **Brake tube** | Aluminum alloy | Clear hard anodized |
| 20 | **Brake piston A** | Carbon steel | Nitriding |
| 21 | **Brake piston B** | Aluminum alloy | Chromated |
| 22 | **Bottom plate** | Aluminum alloy | Black anodized |
| 23 | **Spring collar** | Aluminum alloy | Black anodized |
| 24 | **Brake spring** | Steel wire | Zinc chromated |
| 25 | **Bumper B** | Polyurethane rubber | |
| 26 | **Magnet** | — | (Built-in magnet for lock unit) |
| 27 | **Retaining ring** | Carbon tool steel | Phosphate coated |
| 28 | **Marker** | Resin | White |
| 29 | **Trim plate** | Resin | |
| 30 | **Key** | Carbon steel | |
| 31 | **Brake tube holding bolt** | Chromium molybdenum steel | |
| 32 | **Manual release bolt** | Chromium molybdenum steel | |
| 33 | **Plug with breathing hole** | — | |
| 34 | **Retaining plate B** | Aluminum alloy | |
| 35 | **Retaining plate holding bolt** | Chromium molybdenum steel | |
| 36 | **Unit holding tie-rod** | Carbon steel | Chromated |
| 37 | **Wing nut** | Carbon steel | |
| 38 | **Conical spring washer** | Spring steel | |
| 39 | **Rod cover** | Rolled steel plate | Black coated |
| 40 | **Head cover** | Rolled steel plate | Black coated |
| 41 | **Cylinder tube** | Aluminum alloy | Hard anodized (ø125 to ø200) |
| | | Carbon steel pipe | Hard chrome plated (ø125 to ø250) |

### Component Parts

| No. | Description | Material | Note |
|---|---|---|---|
| 42 | **Piston** | Aluminum alloy casting | In case of aluminum tube |
| | | Cast iron | In case of steel tube |
| 43 | **Piston rod** | Carbon steel | Hard chrome plated |
| 44 | **Retaining plate** | Cast iron | Black coated (ø125, ø140, ø160) |
| 45 | **Bushing** | Bearing alloy | |
| 46 | **Valve guide** | Brass | |
| 47 | **Tie-rod** | Carbon steel | Chromated |
| 48 | **Tie-rod nut** | Rolled steel plate | |
| 49 | **Spring washer** | Steel wire | |
| 50 | **Retaining plate bolt** | Chromium molybdenum steel | |
| 51 | **Spring washer** | Steel wire | |
| 52 | **Cushion ring A** | Rolled steel | Zinc chromated |
| 53 | **Cushion ring B** | Rolled steel | Zinc chromated |
| 54 | **Cushion valve** | Rolled steel | Electroless nickel plated |
| 55 | **Tie-rod reinforcement ring** | Rolled steel | Black coated (long stroke) |
| 56 | **Wear ring** | Resin | In case of aluminum tube |
| 57 | **Magnet** | — | For built-in magnet type |
| 58 | **Piston seal** | NBR | |
| 59 | **Tube gasket** | NBR | |
| 60 | **Wiper ring** | NBR | |
| 61 | **Cushion seal** | NBR | |
| 62 | **Rod seal** | NBR | |
| 63 | **Piston seal** | NBR | |
| 64 | **Valve seal** | NBR | |
| 65 | **Tube gasket** | NBR | |
| 66 | **Piston gasket** | NBR | |
| 67 | **Retaining plate gasket** | NBR | |
| 68 | **Guide gasket** | NBR | |
| 69 | **Coil scraper** | Phosphor bronze | (ø180, ø200, ø250) |
| 70 | **Coil scraper holder** | Aluminum alloy | Black anodized (ø180, ø200, ø250) |

### Replacement Parts: Seal Kit

| Bore size (mm) | Order No. | Contents |
|---|---|---|
| **125** | CLS125-PS | A set of above Nos. 60, 62, 63, 64, 65 & 67 |
| **140** | CLS140-PS | |
| **160** | CLS160-PS | |
| **180** | CLS180-PS | |
| **200** | CLS200-PS | |
| **250** | CLS250-PS | |

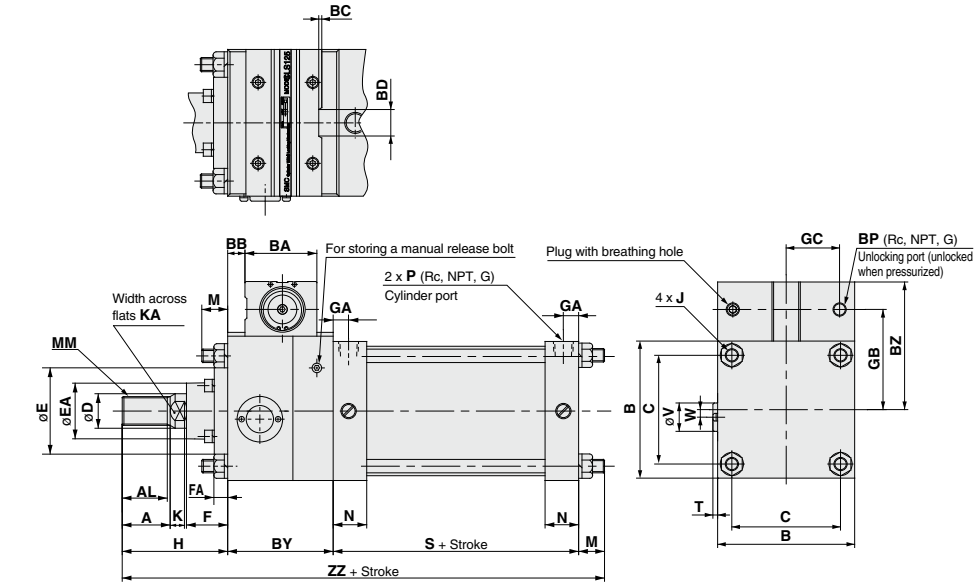
∗ Since the lock section for CLS series is normally replaced as a unit, replacement seal kits are for the cylinder section only.

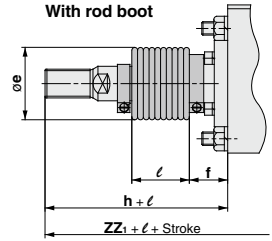
∗∗ Seal kits are sets consisting of items 60, 62, 63, 64, 65 and 67, which can be ordered using the order number for each cylinder bore size.

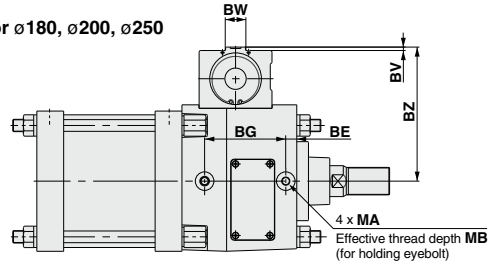
∗ Seal kit includes a grease pack (ø125 to ø160: 40 g, ø180, ø200: 50 g, ø250: 60 g).
Order with the following part number when only the grease pack is needed.
**Grease pack part no.: GR-S-010** (10 g), **GR-S-020** (20 g)

## Dimensions

### Basic type/(B)




(mm)

| Bore size (mm) | Stroke range (mm) | A | AL | B | BA | BB | BC | BD | BE | BG | BY | BZ | BV | BW | BP | C | D | E | EA | F | FA | GA | GB | GC | H | J | K | KA | M | MM | MA | MB | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | Up to 1000 | 50 | 47 | 145 | 75 | 18 | — | — | — | — | 110 | 136 | — | — | 1/4 | 115 | 36 | 90 | 59 | 43 | 14 | 16 | 107 | 58 | 110 | M14 x 1.5 | 15 | 31 | 27 | M30 x 1.5 | — | — | 35 |
| **140** | Up to 1000 | 50 | 47 | 161 | 78 | 18 | 3 | 30 | — | — | 110 | 146 | — | — | 1/4 | 128 | 36 | 90 | 59 | 43 | 14 | 16 | 114 | 64 | 110 | M14 x 1.5 | 15 | 31 | 27 | M30 x 1.5 | — | — | 35 |
| **160** | Up to 1200 | 56 | 53 | 182 | 95 | 23 | 5 | 46 | — | — | 132 | 169 | — | — | 1/4 | 144 | 40 | 90 | 59 | 43 | 14 | 18.5 | 130 | 74 | 120 | M16 x 1.5 | 17 | 36 | 30.5 | M36 x 1.5 | — | — | 39 |
| **180** | Up to 1200 | 63 | 60 | 204 | 106 | 36 | — | — | 16 | 118 | 167 | 195 | 5 | 30 | 3/8 | 162 | 45 | 115 | 70 | 48 | 17 | 18.5 | 149 | 86 | 135 | M18 x 1.5 | 20 | 41 | 35 | M40 x 1.5 | M12 x 1.75 | 25 | 39 |
| **200** | Up to 1200 | 63 | 60 | 226 | 124 | 40.5 | — | — | 21 | 131 | 187 | 216 | 5.5 | 34 | 3/8 | 182 | 50 | 115 | 74 | 48 | 17 | 18.5 | 165 | 97 | 135 | M20 x 1.5 | 20 | 46 | 35 | M45 x 1.5 | M16 x 2 | 31 | 39 |
| **250** | Up to 1200 | 71 | 67 | 277 | 152 | 58 | — | — | 35 | 155 | 237 | 261.5 | 6 | 42 | 1/2 | 225 | 60 | 140 | 86 | 60 | 20 | 23 | 200 | 117 | 160 | M24 x 1.5 | 25 | 56 | 41.5 | M56 x 2 | M20 x 2.5 | 41 | 49 |

(mm)

| Bore size (mm) | P | S | T | V | W | ZZ |
|---|---|---|---|---|---|---|
| **125** | 1/2 | 98 | 5 | 30 | — | 345 |
| **140** | 1/2 | 98 | 5 | 30 | 8 | 345 |
| **160** | 3/4 | 106 | 5 | 30 | 9 | 388.5 |
| **180** | 3/4 | 111 | — | — | — | 448 |
| **200** | 3/4 | 111 | — | — | — | 468 |
| **250** | 1 | 141 | — | — | — | 579.5 |

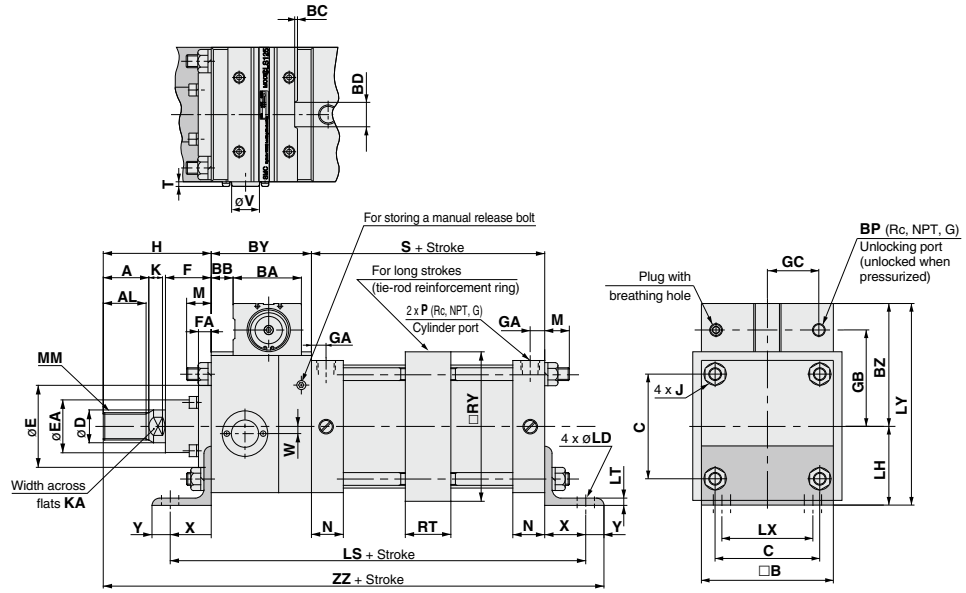
**With Rod Boot** (mm)

| Bore size (mm) | Stroke range (mm) | e | f | h | ℓ | ZZ1 |
|---|---|---|---|---|---|---|
| **125** | 30 to 1000 | 75 | 40 | 133 | 0.2 stroke | 368 |
| **140** | 30 to 1000 | 75 | 40 | 133 | 0.2 stroke | 368 |
| **160** | 30 to 1200 | 75 | 40 | 141 | 0.2 stroke | 409.5 |
| **180** | 30 to 1200 | 85 | 45 | 153 | 0.2 stroke | 466 |
| **200** | 30 to 1200 | 90 | 45 | 153 | 0.2 stroke | 486 |
| **250** | 30 to 1200 | 105 | 55 | 176 | 0.17 stroke | 595.5 |

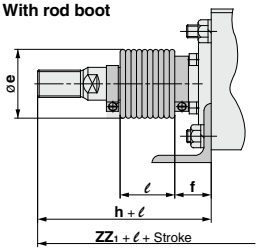
**With Auto Switch** (mm)

| Bore size (mm) | Stroke range (mm) | S | Without rod boot ZZ | With rod boot ZZ1 |
|---|---|---|---|---|
| **125** | Up to 1000 | 98 | 345 | 368 |
| **140** | Up to 1000 | 98 | 345 | 368 |
| **160** | Up to 1200 | 106 | 388.5 | 409.5 |
| **180** | Up to 1200 | 115 | 452 | 470 |
| **200** | Up to 998 | 120 | 477 | 495 |

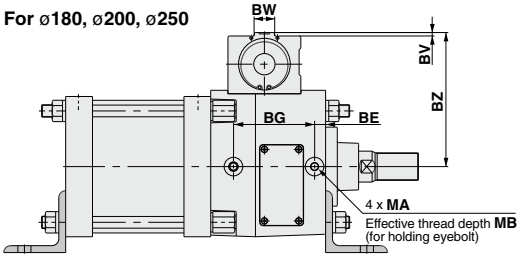
## Axial foot type/(L)




### With rod boot




### For ø180, ø200, ø250




(mm)

| Bore size (mm) | Stroke range (mm) | Long stroke range (mm) | A | AL | B | BA | BB | BC | BD | BE | BG | BY | BZ | BV | BW | BP | C | D | E | EA | F | FA | GA | GB | GC | H | J | K | KA | LD | LH | LS | LT | LX | LY | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | Up to 1400 | 1401 to 1600 | 50 | 47 | 145 | 75 | 18 | — | — | — | — | 110 | 136 | — | — | 1/4 | 115 | 36 | 90 | 59 | 43 | 14 | 16 | 107 | 58 | 110 | M14 x 1.5 | 15 | 31 | 19 | 85 | 298 | 8 | 100 | 221 | 27 |
| **140** | Up to 1400 | 1401 to 1600 | 50 | 47 | 161 | 78 | 18 | 3 | 30 | — | — | 110 | 146 | — | — | 1/4 | 128 | 36 | 90 | 59 | 43 | 14 | 16 | 114 | 64 | 110 | M14 x 1.5 | 15 | 31 | 19 | 100 | 298 | 9 | 112 | 246 | 27 |
| **160** | Up to 1400 | 1401 to 1600 | 56 | 53 | 182 | 95 | 23 | 5 | 46 | — | — | 132 | 169 | — | — | 1/4 | 144 | 40 | 90 | 59 | 43 | 14 | 18.5 | 130 | 74 | 120 | M16 x 1.5 | 17 | 36 | 19 | 106 | 338 | 9 | 118 | 275 | 30.5 |
| **180** | Up to 1800 | 1801 to 2000 | 63 | 60 | 204 | 106 | 36 | — | — | 16 | 118 | 167 | 195 | 5 | 30 | 3/8 | 162 | 45 | 115 | 70 | 48 | 17 | 18.5 | 149 | 86 | 135 | M18 x 1.5 | 20 | 41 | 24 | 125 | 398 | 10 | 132 | 320 | 35 |
| **200** | Up to 1800 | 1801 to 2000 | 63 | 60 | 226 | 124 | 40.5 | — | — | 21 | 131 | 187 | 216 | 5.5 | 34 | 3/8 | 182 | 50 | 115 | 74 | 48 | 17 | 18.5 | 165 | 97 | 135 | M20 x 1.5 | 20 | 46 | 24 | 132 | 418 | 10 | 150 | 348 | 35 |
| **250** | Up to 2000 | 2001 to 2400 | 71 | 67 | 277 | 152 | 58 | — | — | 35 | 155 | 237 | 261.5 | 6 | 42 | 1/2 | 225 | 60 | 140 | 86 | 60 | 20 | 23 | 200 | 117 | 160 | M24 x 1.5 | 25 | 56 | 29 | 160 | 538 | 12 | 180 | 421.5 | 41.5 |

(mm)

| Bore size (mm) | MM | MA | MB | N | P | RT | RY | S | T | V | W | X | Y | ZZ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | M30 x 1.5 | — | — | 35 | 1/2 | 36 | 164 | 98 | 5 | 30 | — | 45 | 20 | 383 |
| **140** | M30 x 1.5 | — | — | 35 | 1/2 | 36 | 184 | 98 | 5 | 30 | 8 | 45 | 30 | 393 |
| **160** | M36 x 1.5 | — | — | 39 | 3/4 | 45 | 204 | 106 | 5 | 30 | 9 | 50 | 25 | 433 |
| **180** | M40 x 1.5 | M12 x 1.75 | 25 | 39 | 3/4 | 45 | 228 | 111 | — | — | — | 60 | 30 | 503 |
| **200** | M45 x 1.5 | M16 x 2 | 31 | 39 | 3/4 | 45 | 257 | 111 | — | — | — | 60 | 30 | 523 |
| **250** | M56 x 2 | M20 x 2.5 | 41 | 49 | 1 | 55 | 325 | 141 | — | — | — | 80 | 40 | 658 |

### With Rod Boot

(mm)

| Bore size (mm) | Stroke range (mm) | e | f | h | ℓ | ZZ1 |
|---|---|---|---|---|---|---|
| **125** | 30 to 1400 | 75 | 40 | 133 | 0.2 stroke | 406 |
| **140** | 30 to 1400 | 75 | 40 | 133 | 0.2 stroke | 416 |
| **160** | 30 to 1400 | 75 | 40 | 141 | 0.2 stroke | 454 |
| **180** | 30 to 1800 | 85 | 45 | 153 | 0.2 stroke | 521 |
| **200** | 30 to 1800 | 90 | 45 | 153 | 0.2 stroke | 541 |
| **250** | 30 to 2000 | 105 | 55 | 176 | 0.17 stroke | 674 |

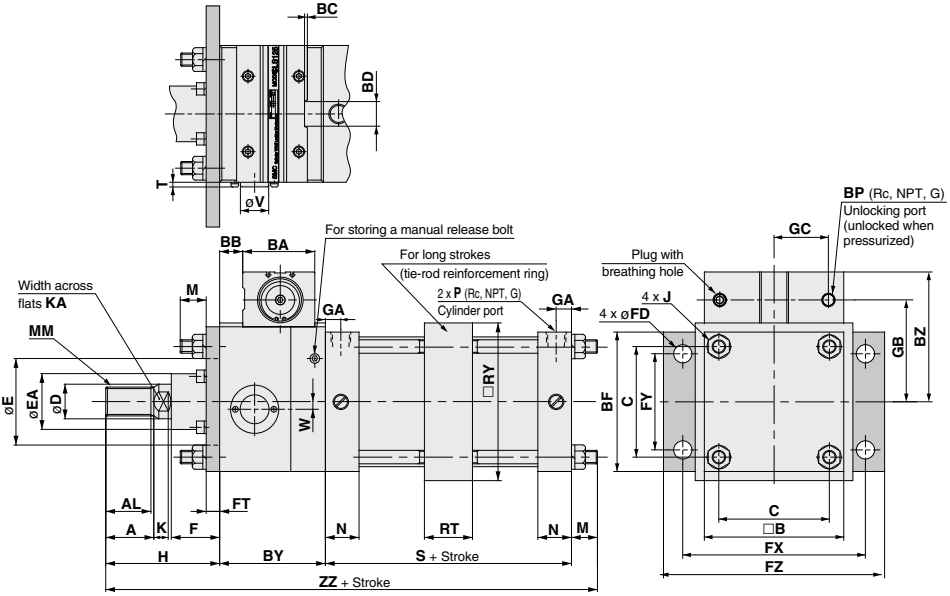
### With Auto Switch

(mm)

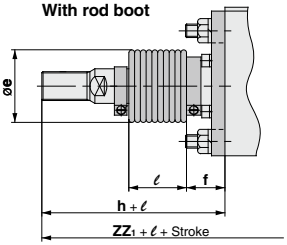
| Bore size (mm) | Stroke range (mm) | S | LS | Without rod boot ZZ | With rod boot ZZ1 |
|---|---|---|---|---|---|
| **125** | Up to 1400 | 98 | 298 | 383 | 406 |
| **140** | Up to 1400 | 98 | 298 | 393 | 416 |
| **160** | Up to 1400 | 106 | 338 | 433 | 454 |
| **180** | Up to 1500 | 115 | 402 | 507 | 525 |
| **200** | Up to 998 | 120 | 427 | 532 | 550 |

## Dimensions

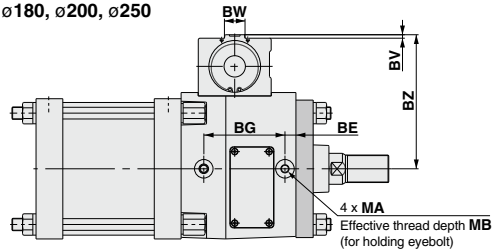
### Rod flange type/(F)




**With rod boot**




**For ø180, ø200, ø250**




(mm)

| Bore size (mm) | Stroke range (mm) | Long stroke range (mm) | A | AL | B | BA | BB | BC | BD | BE | BG | BF | BY | BZ | BV | BW | BP | C | D | E | EA | F | FD | FT | FX | FY | FZ | GA | GB | GC | H | J | K | KA | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | Up to 1400 | 1401 to 1600 | 50 | 47 | 145 | 75 | 18 | — | — | — | — | 145 | 110 | 136 | — | — | 1/4 | 115 | 36 | 90 | 59 | 43 | 19 | 14 | 190 | 100 | 230 | 16 | 107 | 58 | 110 | M14 x 1.5 | 15 | 31 | 19 |
| **140** | Up to 1400 | 1401 to 1600 | 50 | 47 | 161 | 78 | 18 | 3 | 30 | — | — | 160 | 110 | 146 | — | — | 1/4 | 128 | 36 | 90 | 59 | 43 | 19 | 20 | 212 | 112 | 255 | 16 | 114 | 64 | 110 | M14 x 1.5 | 15 | 31 | 19 |
| **160** | Up to 1400 | 1401 to 1600 | 56 | 53 | 182 | 95 | 23 | 5 | 46 | — | — | 180 | 132 | 169 | — | — | 1/4 | 144 | 40 | 90 | 59 | 43 | 19 | 20 | 236 | 118 | 275 | 18.5 | 130 | 74 | 120 | M16 x 1.5 | 17 | 36 | 22 |
| **180** | Up to 1800 | 1801 to 2000 | 63 | 60 | 204 | 106 | 36 | — | — | 16 | 118 | 200 | 167 | 195 | 5 | 30 | 3/8 | 162 | 45 | 115 | 70 | 48 | 24 | 25 | 265 | 132 | 320 | 18.5 | 149 | 86 | 135 | M18 x 1.5 | 20 | 41 | 26 |
| **200** | Up to 1800 | 1801 to 2000 | 63 | 60 | 226 | 124 | 40.5 | — | — | 21 | 131 | 225 | 187 | 216 | 5.5 | 34 | 3/8 | 182 | 50 | 115 | 74 | 48 | 24 | 25 | 280 | 150 | 335 | 18.5 | 165 | 97 | 135 | M20 x 1.5 | 20 | 46 | 26 |
| **250** | Up to 2000 | 2001 to 2400 | 71 | 67 | 277 | 152 | 58 | — | — | 35 | 155 | 275 | 237 | 261.5 | 6 | 42 | 1/2 | 225 | 60 | 140 | 86 | 60 | 29 | 30 | 355 | 180 | 420 | 23 | 200 | 117 | 160 | M24 x 1.5 | 25 | 56 | 30 |

(mm)

| Bore size (mm) | MM | MA | MB | N | P | RT | RY | S | T | V | W | ZZ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | M30 x 1.5 | — | — | 35 | 1/2 | 36 | 164 | 98 | 5 | 30 | — | 337 |
| **140** | M30 x 1.5 | — | — | 35 | 1/2 | 36 | 184 | 98 | 5 | 30 | 8 | 337 |
| **160** | M36 x 1.5 | — | — | 39 | 3/4 | 45 | 204 | 106 | 5 | 30 | 9 | 380 |
| **180** | M40 x 1.5 | M12 x 1.75 | 25 | 39 | 3/4 | 45 | 228 | 111 | — | — | — | 439 |
| **200** | M45 x 1.5 | M16 x 2 | 31 | 39 | 3/4 | 45 | 257 | 111 | — | — | — | 459 |
| **250** | M56 x 2 | M20 x 2.5 | 41 | 49 | 1 | 55 | 325 | 141 | — | — | — | 568 |

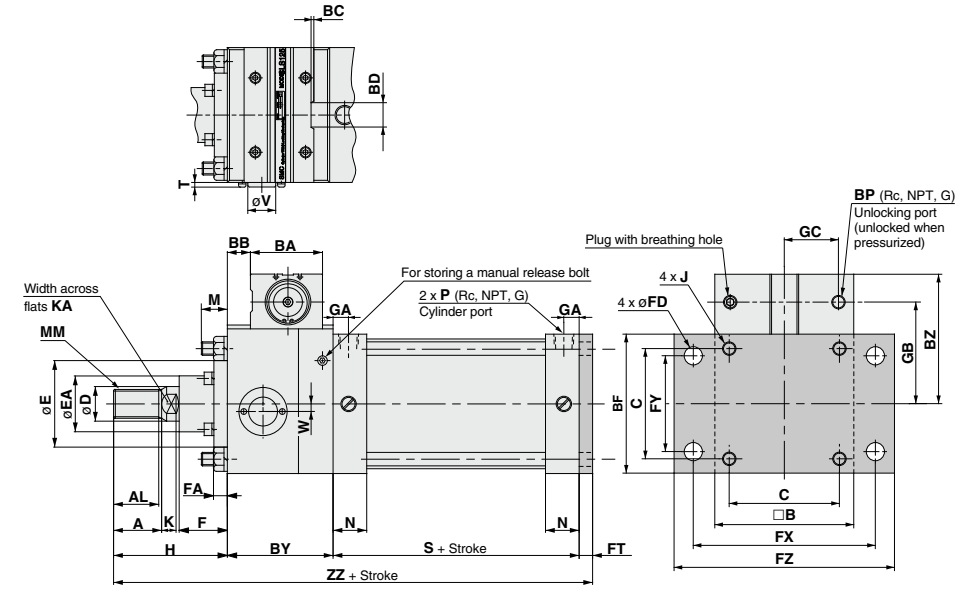
**With Rod Boot** (mm)

| Bore size (mm) | Stroke range (mm) | e | f | h | ℓ | ZZ1 |
|---|---|---|---|---|---|---|
| **125** | 30 to 1400 | 75 | 40 | 133 | 0.2 stroke | 360 |
| **140** | 30 to 1400 | 75 | 40 | 133 | 0.2 stroke | 360 |
| **160** | 30 to 1400 | 75 | 40 | 141 | 0.2 stroke | 401 |
| **180** | 30 to 1800 | 85 | 45 | 153 | 0.2 stroke | 457 |
| **200** | 30 to 1800 | 90 | 45 | 153 | 0.2 stroke | 477 |
| **250** | 30 to 2000 | 105 | 55 | 176 | 0.17 stroke | 584 |

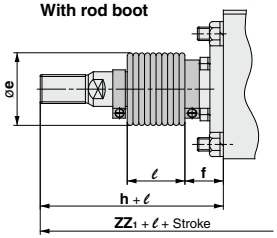
**With Auto Switch** (mm)

| Bore size (mm) | Stroke range (mm) | S | Without rod boot ZZ | With rod boot ZZ1 |
|---|---|---|---|---|
| **125** | Up to 1400 | 98 | 337 | 360 |
| **140** | Up to 1400 | 98 | 337 | 360 |
| **160** | Up to 1400 | 106 | 380 | 401 |
| **180** | Up to 1500 | 115 | 443 | 461 |
| **200** | Up to 998 | 120 | 468 | 486 |

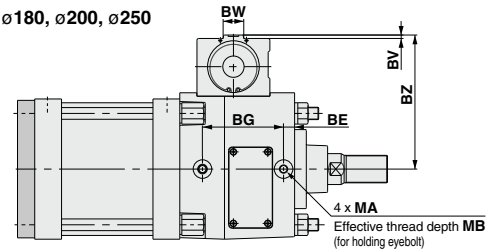
## Head flange type/(G)




**With rod boot**




**For ø180, ø200, ø250**




(mm)

| Bore size (mm) | Stroke range (mm) | A | AL | B | BA | BB | BC | BD | BE | BG | BF | BY | BZ | BV | BW | BP | C | D | E | EA | F | FA | FD | FT | FX | FY | FZ | GA | GB | GC | H | J | K | KA | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | Up to 1000 | 50 | 47 | 145 | 75 | 18 | — | — | — | | 145 | 110 | 136 | — | — | 1/4 | 115 | 36 | 90 | 59 | 43 | 14 | 19 | 14 | 190 | 100 | 230 | 16 | 107 | 58 | 110 | M14 x 1.5 | 15 | 31 | 19 |
| **140** | Up to 1000 | 50 | 47 | 161 | 78 | 18 | 3 | 30 | — | | 160 | 110 | 146 | — | — | 1/4 | 128 | 36 | 90 | 59 | 43 | 14 | 19 | 20 | 212 | 112 | 255 | 16 | 114 | 64 | 110 | M14 x 1.5 | 15 | 31 | 19 |
| **160** | Up to 1200 | 56 | 53 | 182 | 95 | 23 | 5 | 46 | — | | 180 | 132 | 169 | — | — | 1/4 | 144 | 40 | 90 | 59 | 43 | 14 | 19 | 20 | 236 | 118 | 275 | 18.5 | 130 | 74 | 120 | M16 x 1.5 | 17 | 36 | 22 |
| **180** | Up to 1200 | 63 | 60 | 204 | 106 | 36 | — | — | 16 | 118 | 200 | 167 | 195 | 5 | 30 | 3/8 | 162 | 45 | 115 | 70 | 48 | 17 | 24 | 25 | 265 | 132 | 320 | 18.5 | 149 | 86 | 135 | M18 x 1.5 | 20 | 41 | 26 |
| **200** | Up to 1200 | 63 | 60 | 226 | 124 | 40.5 | — | — | 21 | 131 | 225 | 187 | 216 | 5.5 | 34 | 3/8 | 182 | 50 | 115 | 74 | 48 | 17 | 24 | 25 | 280 | 150 | 335 | 18.5 | 165 | 97 | 135 | M20 x 1.5 | 20 | 46 | 26 |
| **250** | Up to 1200 | 71 | 67 | 277 | 152 | 58 | — | — | 35 | 155 | 275 | 237 | 261.5 | 6 | 42 | 1/2 | 225 | 60 | 140 | 86 | 60 | 20 | 29 | 30 | 355 | 180 | 420 | 23 | 200 | 117 | 160 | M24 x 1.5 | 25 | 56 | 30 |

(mm)

| Bore size (mm) | MM | MA | MB | N | P | S | T | V | W | ZZ |
|---|---|---|---|---|---|---|---|---|---|---|
| **125** | M30 x 1.5 | — | — | 35 | 1/2 | 98 | 5 | 30 | — | 332 |
| **140** | M30 x 1.5 | — | — | 35 | 1/2 | 98 | 5 | 30 | 8 | 338 |
| **160** | M36 x 1.5 | — | — | 39 | 3/4 | 106 | 5 | 30 | 9 | 378 |
| **180** | M40 x 1.5 | M12 x 1.75 | 25 | 39 | 3/4 | 111 | — | — | — | 438 |
| **200** | M45 x 1.5 | M16 x 2 | 31 | 39 | 3/4 | 111 | — | — | — | 458 |
| **250** | M56 x 2 | M20 x 2.5 | 41 | 49 | 1 | 141 | — | — | — | 568 |

**With Rod Boot** (mm)

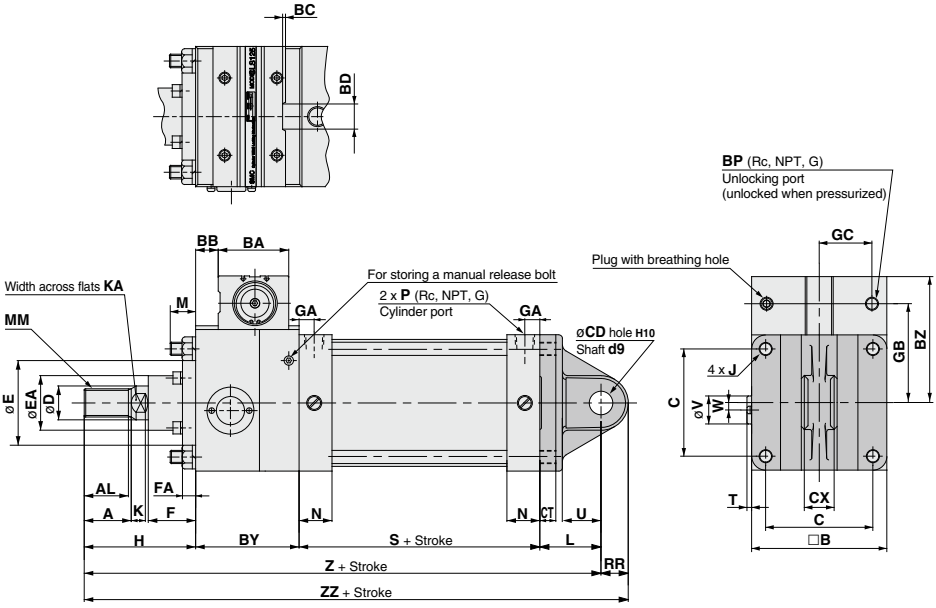
| Bore size (mm) | Stroke range (mm) | e | f | h | ℓ | ZZ1 |
|---|---|---|---|---|---|---|
| **125** | 30 to 1000 | 75 | 40 | 133 | 0.2 stroke | 355 |
| **140** | 30 to 1000 | 75 | 40 | 133 | 0.2 stroke | 361 |
| **160** | 30 to 1200 | 75 | 40 | 141 | 0.2 stroke | 399 |
| **180** | 30 to 1200 | 85 | 45 | 153 | 0.2 stroke | 456 |
| **200** | 30 to 1200 | 90 | 45 | 153 | 0.2 stroke | 476 |
| **250** | 30 to 1200 | 105 | 55 | 176 | 0.17 stroke | 584 |

**With Auto Switch** (mm)

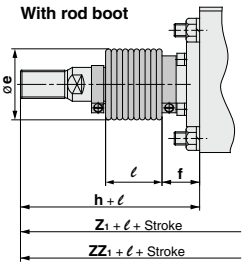
| Bore size (mm) | Stroke range (mm) | S | Without rod boot ZZ | With rod boot ZZ1 |
|---|---|---|---|---|
| **125** | Up to 1000 | 98 | 332 | 355 |
| **140** | Up to 1000 | 98 | 338 | 361 |
| **160** | Up to 1200 | 106 | 378 | 399 |
| **180** | Up to 1200 | 115 | 442 | 460 |
| **200** | Up to 998 | 120 | 467 | 485 |

## Dimensions

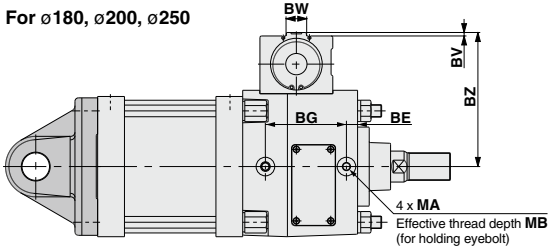
### Single clevis type/(C)




**With rod boot**




**For ø180, ø200, ø250**




(mm)

| Bore size (mm) | Stroke range (mm) | A | AL | B | BA | BB | BC | BD | BE | BG | BY | BZ | BV | BW | BP | C | CD H10 | CT | CX | D | E | EA | F | FA | GA | GB | GC | H | J | K | KA | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | Up to 1000 | 50 | 47 | 145 | 75 | 18 | — | — | — | | 110 | 136 | — | — | 1/4 | 115 | $25^{+0.084}_{0}$ | 17 | $32^{-0.1}_{-0.3}$ | 36 | 90 | 59 | 43 | 14 | 16 | 107 | 58 | 110 | M14 x 1.5 | 15 | 31 | 65 | 19 |
| **140** | Up to 1000 | 50 | 47 | 161 | 78 | 18 | 3 | 30 | — | | 110 | 146 | — | — | 1/4 | 128 | $28^{+0.084}_{0}$ | 17 | $36^{-0.1}_{-0.3}$ | 36 | 90 | 59 | 43 | 14 | 16 | 114 | 64 | 110 | M14 x 1.5 | 15 | 31 | 75 | 19 |
| **160** | Up to 1200 | 56 | 53 | 182 | 95 | 23 | 5 | 46 | — | | 132 | 169 | — | — | 1/4 | 144 | $32^{+0.100}_{0}$ | 20 | $40^{-0.1}_{-0.3}$ | 40 | 90 | 59 | 43 | 14 | 18.5 | 130 | 74 | 120 | M16 x 1.5 | 17 | 36 | 80 | 22 |
| **180** | Up to 1200 | 63 | 60 | 204 | 106 | 36 | — | — | 16 | 118 | 167 | 195 | 5 | 30 | 3/8 | 162 | $40^{+0.100}_{0}$ | 23 | $50^{-0.1}_{-0.3}$ | 45 | 115 | 70 | 48 | 17 | 18.5 | 149 | 86 | 135 | M18 x 1.5 | 20 | 41 | 90 | 26 |
| **200** | Up to 1200 | 63 | 60 | 226 | 124 | 40.5 | — | — | 21 | 131 | 187 | 216 | 5.5 | 34 | 3/8 | 182 | $40^{+0.100}_{0}$ | 25 | $50^{-0.1}_{-0.3}$ | 50 | 115 | 74 | 48 | 17 | 18.5 | 165 | 97 | 135 | M20 x 1.5 | 20 | 46 | 90 | 26 |
| **250** | Up to 1200 | 71 | 67 | 277 | 152 | 58 | — | — | 35 | 155 | 237 | 261.5 | 6 | 42 | 1/2 | 225 | $50^{+0.100}_{0}$ | 30 | $63^{-0.1}_{-0.3}$ | 60 | 140 | 86 | 60 | 20 | 23 | 200 | 117 | 160 | M24 x 1.5 | 25 | 56 | 110 | 30 |

(mm)

| Bore size (mm) | MM | MA | MB | N | P | RR | S | T | U | V | W | Z | ZZ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | M30 x 1.5 | — | — | 35 | 1/2 | 29 | 98 | 5 | 35 | 30 | — | 383 | 412 |
| **140** | M30 x 1.5 | — | — | 35 | 1/2 | 32 | 98 | 5 | 40 | 30 | 8 | 393 | 425 |
| **160** | M36 x 1.5 | — | — | 39 | 3/4 | 36 | 106 | 5 | 45 | 30 | 9 | 438 | 474 |
| **180** | M40 x 1.5 | M12 x 1.75 | 25 | 39 | 3/4 | 44 | 111 | — | 50 | — | — | 503 | 547 |
| **200** | M45 x 1.5 | M16 x 2 | 31 | 39 | 3/4 | 44 | 111 | — | 50 | — | — | 523 | 567 |
| **250** | M56 x 2 | M20 x 2.5 | 41 | 49 | 1 | 55 | 141 | — | 65 | — | — | 648 | 703 |

**With Rod Boot**

(mm)

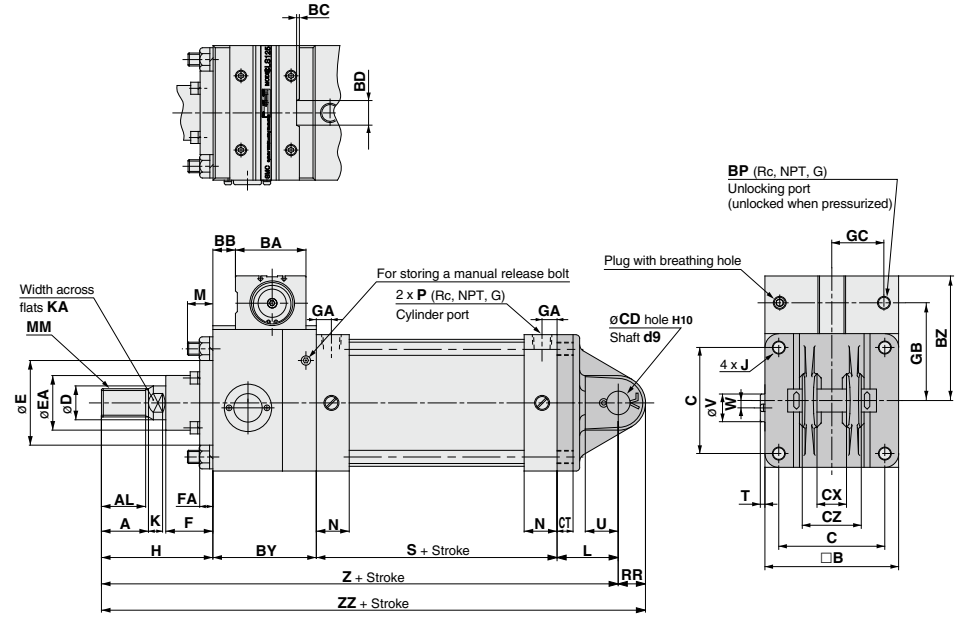
| Bore size (mm) | Stroke range (mm) | e | f | h | ℓ | $Z_1$ | $ZZ_1$ |
|---|---|---|---|---|---|---|---|
| **125** | 30 to 1000 | 75 | 40 | 133 | 0.2 stroke | 406 | 435 |
| **140** | 30 to 1000 | 75 | 40 | 133 | 0.2 stroke | 416 | 448 |
| **160** | 30 to 1200 | 75 | 40 | 141 | 0.2 stroke | 459 | 495 |
| **180** | 30 to 1200 | 85 | 45 | 153 | 0.2 stroke | 521 | 565 |
| **200** | 30 to 1200 | 90 | 45 | 153 | 0.2 stroke | 541 | 585 |
| **250** | 30 to 1200 | 105 | 55 | 176 | 0.17 stroke | 664 | 719 |

**With Auto Switch**

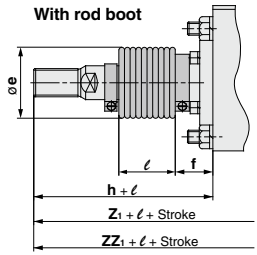
(mm)

| Bore size (mm) | Stroke range (mm) | S | Without rod boot | | With rod boot | |
|---|---|---|---|---|---|---|
| | | | Z | ZZ | $Z_1$ | $ZZ_1$ |
| **125** | Up to 1000 | 98 | 383 | 412 | 406 | 435 |
| **140** | Up to 1000 | 98 | 393 | 425 | 416 | 448 |
| **160** | Up to 1200 | 106 | 438 | 474 | 459 | 495 |
| **180** | Up to 1200 | 115 | 507 | 551 | 525 | 569 |
| **200** | Up to 998 | 120 | 532 | 576 | 550 | 594 |

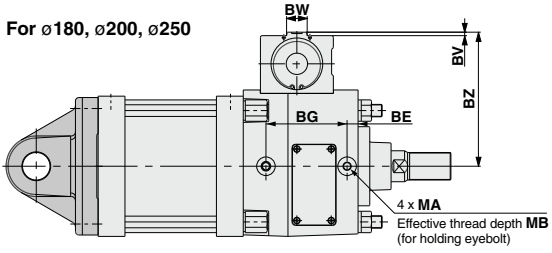
## Double clevis type/(D)




**With rod boot**




**For ø180, ø200, ø250**




(mm)

| Bore size (mm) | Stroke range (mm) | A | AL | B | BA | BB | BC | BD | BE | BG | BY | BZ | BV | BW | BP | C | $CD_{H10}$ | CT | CX | CZ | D | E | EA | F | FA | GA | GB | GC | H | J | K | KA | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | Up to 1000 | 50 | 47 | 145 | 75 | 18 | — | — | — | | 110 | 136 | — | — | 1/4 | 115 | $25^{+0.084}_{0}$ | 17 | $32^{+0.3}_{+0.1}$ | $64^{0}_{-0.2}$ | 36 | 90 | 59 | 43 | 14 | 16 | 107 | 58 | 110 | M14 x 1.5 | 15 | 31 | 65 |
| **140** | Up to 1000 | 50 | 47 | 161 | 78 | 18 | 3 | 30 | — | | 110 | 146 | — | — | 1/4 | 128 | $28^{+0.084}_{0}$ | 17 | $36^{+0.3}_{+0.1}$ | $72^{0}_{-0.2}$ | 36 | 90 | 59 | 43 | 14 | 16 | 114 | 64 | 110 | M14 x 1.5 | 15 | 31 | 75 |
| **160** | Up to 1200 | 56 | 53 | 182 | 95 | 23 | 5 | 46 | — | | 132 | 169 | — | — | 1/4 | 144 | $32^{+0.100}_{0}$ | 20 | $40^{+0.3}_{+0.1}$ | $80^{0}_{-0.2}$ | 40 | 90 | 59 | 43 | 14 | 18.5 | 130 | 74 | 120 | M16 x 1.5 | 17 | 36 | 80 |
| **180** | Up to 1200 | 63 | 60 | 204 | 106 | 36 | — | — | 16 | 118 | 167 | 195 | 5 | 30 | 3/8 | 162 | $40^{+0.100}_{0}$ | 23 | $50^{+0.3}_{+0.1}$ | $100^{-0.1}_{-0.3}$ | 45 | 115 | 70 | 48 | 17 | 18.5 | 149 | 86 | 135 | M18 x 1.5 | 20 | 41 | 90 |
| **200** | Up to 1200 | 63 | 60 | 226 | 124 | 40.5 | — | — | 21 | 131 | 187 | 216 | 5.5 | 34 | 3/8 | 182 | $40^{+0.100}_{0}$ | 25 | $50^{+0.3}_{+0.1}$ | $100^{-0.1}_{-0.3}$ | 50 | 115 | 74 | 48 | 17 | 18.5 | 165 | 97 | 135 | M20 x 1.5 | 20 | 46 | 90 |
| **250** | Up to 1200 | 71 | 67 | 277 | 152 | 58 | — | — | 35 | 155 | 237 | 261.5 | 6 | 42 | 1/2 | 225 | $50^{+0.100}_{0}$ | 30 | $63^{+0.3}_{+0.1}$ | $126^{-0.1}_{-0.3}$ | 60 | 140 | 86 | 60 | 20 | 23 | 200 | 117 | 160 | M24 x 1.5 | 25 | 56 | 110 |

(mm)

| Bore size (mm) | M | MA | MB | MM | N | P | RR | S | T | U | V | W | Z | ZZ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | 19 | — | — | M30 x 1.5 | 35 | 1/2 | 29 | 98 | 5 | 35 | 30 | — | 383 | 412 |
| **140** | 19 | — | — | M30 x 1.5 | 35 | 1/2 | 32 | 98 | 5 | 40 | 30 | 8 | 393 | 425 |
| **160** | 22 | — | — | M36 x 1.5 | 39 | 3/4 | 36 | 106 | 5 | 45 | 30 | 9 | 438 | 474 |
| **180** | 26 | M12 x 1.75 | 25 | M40 x 1.5 | 39 | 3/4 | 44 | 111 | — | 50 | — | — | 503 | 547 |
| **200** | 26 | M16 x 2 | 31 | M45 x 1.5 | 39 | 3/4 | 44 | 111 | — | 50 | — | — | 523 | 567 |
| **250** | 30 | M20 x 2.5 | 41 | M56 x 2 | 49 | 1 | 55 | 141 | — | 65 | — | — | 648 | 703 |

∗ Clevis pins and cotter pins are included.

**With Rod Boot** (mm)

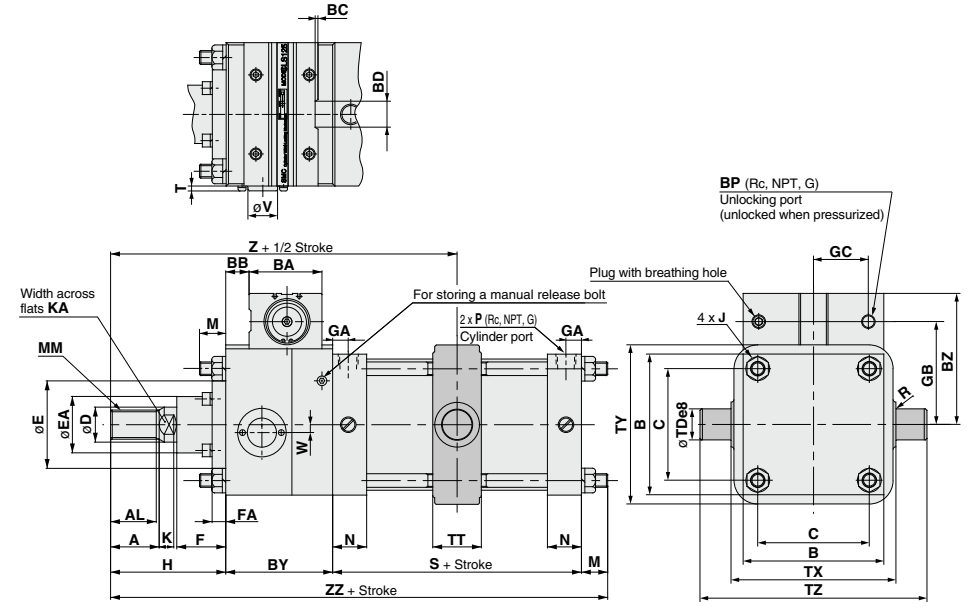
| Bore size (mm) | Stroke range (mm) | e | f | h | ℓ | $Z_1$ | $ZZ_1$ |
|---|---|---|---|---|---|---|---|
| **125** | 30 to 1000 | 75 | 40 | 133 | 0.2 stroke | 406 | 435 |
| **140** | 30 to 1000 | 75 | 40 | 133 | 0.2 stroke | 416 | 448 |
| **160** | 30 to 1200 | 75 | 40 | 141 | 0.2 stroke | 459 | 495 |
| **180** | 30 to 1200 | 85 | 45 | 153 | 0.2 stroke | 521 | 565 |
| **200** | 30 to 1200 | 90 | 45 | 153 | 0.2 stroke | 541 | 585 |
| **250** | 30 to 1200 | 105 | 55 | 176 | 0.17 stroke | 664 | 719 |

**With Auto Switch** (mm)

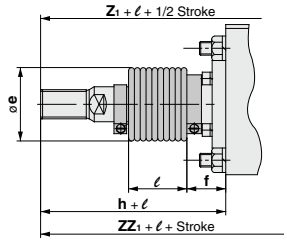
| Bore size (mm) | Stroke range (mm) | S | Without rod boot | | With rod boot | |
|---|---|---|---|---|---|---|
| | | | Z | ZZ | $Z_1$ | $ZZ_1$ |
| **125** | Up to 1000 | 98 | 383 | 412 | 406 | 435 |
| **140** | Up to 1000 | 98 | 393 | 425 | 416 | 448 |
| **160** | Up to 1200 | 106 | 438 | 474 | 459 | 495 |
| **180** | Up to 1200 | 115 | 507 | 551 | 525 | 569 |
| **200** | Up to 998 | 120 | 532 | 576 | 550 | 594 |

## Dimensions

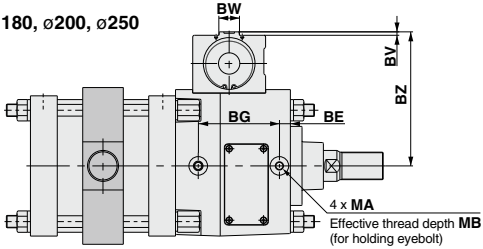
### Center trunnion type/(T)




### With rod boot




### For ø180, ø200, ø250




(mm)

| Bore size (mm) | Stroke range (mm) | A | AL | B | BA | BB | BC | BD | BE | BG | BY | BZ | BV | BW | BP | C | D | E | EA | F | FA | GA | GB | GC | H | J | K | KA | M | MM | MA | MB | N | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | 25 to 1000 | 50 | 47 | 145 | 75 | 18 | — | — | — | | 110 | 136 | — | — | 1/4 | 115 | 36 | 90 | 59 | 43 | 14 | 16 | 107 | 58 | 110 | M14 x 1.5 | 15 | 31 | 19 | M30 x 1.5 | — | — | 35 | 1/2 |
| **140** | 30 to 1000 | 50 | 47 | 161 | 78 | 18 | 3 | 30 | — | | 110 | 146 | — | — | 1/4 | 128 | 36 | 90 | 59 | 43 | 14 | 16 | 114 | 64 | 110 | M14 x 1.5 | 15 | 31 | 19 | M30 x 1.5 | — | — | 35 | 1/2 |
| **160** | 35 to 1200 | 56 | 53 | 182 | 95 | 23 | 5 | 46 | — | | 132 | 169 | — | — | 1/4 | 144 | 40 | 90 | 59 | 43 | 14 | 18.5 | 130 | 74 | 120 | M16 x 1.5 | 17 | 36 | 22 | M36 x 1.5 | — | — | 39 | 3/4 |
| **180** | 30 to 1200 | 63 | 60 | 204 | 106 | 36 | — | — | 16 | 118 | 167 | 195 | 5 | 30 | 3/8 | 162 | 45 | 115 | 70 | 48 | 17 | 18.5 | 149 | 86 | 135 | M18 x 1.5 | 20 | 41 | 26 | M40 x 1.5 | M12 x 1.75 | 25 | 39 | 3/4 |
| **200** | 30 to 1200 | 63 | 60 | 226 | 124 | 40.5 | — | — | 21 | 131 | 187 | 216 | 5.5 | 34 | 3/8 | 182 | 50 | 115 | 74 | 48 | 17 | 18.5 | 165 | 97 | 135 | M20 x 1.5 | 20 | 46 | 26 | M45 x 1.5 | M16 x 2 | 31 | 39 | 3/4 |
| **250** | 30 to 1200 | 71 | 67 | 277 | 152 | 58 | — | — | 35 | 155 | 237 | 261.5 | 6 | 42 | 1/2 | 225 | 60 | 140 | 86 | 60 | 20 | 23 | 200 | 117 | 160 | M24 x 1.5 | 25 | 56 | 30 | M56 x 2 | M20 x 2.5 | 41 | 49 | 1 |

(mm)

| Bore size (mm) | R | S | T | TDe8 | TT | TX | TY | TZ | V | W | Z | ZZ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **125** | 1 | 98 | 5 | $32^{-0.050}_{-0.089}$ | 50 | 170 | 164 | 234 | 30 | — | 269 | 337 |
| **140** | 1.5 | 98 | 5 | $36^{-0.050}_{-0.089}$ | 55 | 190 | 184 | 262 | 30 | 8 | 269 | 337 |
| **160** | 1.5 | 106 | 5 | $40^{-0.050}_{-0.089}$ | 60 | 212 | 204 | 292 | 30 | 9 | 305 | 380 |
| **180** | 2 | 111 | — | $45^{-0.050}_{-0.089}$ | 59 | 236 | 228 | 326 | — | — | 357.5 | 439 |
| **200** | 2 | 111 | — | $45^{-0.050}_{-0.089}$ | 59 | 265 | 257 | 355 | — | — | 377.5 | 459 |
| **250** | 3 | 141 | — | $56^{-0.060}_{-0.106}$ | 69 | 335 | 325 | 447 | — | — | 467.5 | 568 |

**With Rod Boot** (mm)

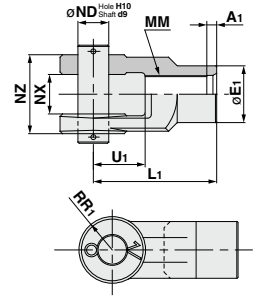
| Bore size (mm) | Stroke range (mm) | e | f | h | ℓ | Z1 | ZZ1 |
|---|---|---|---|---|---|---|---|
| **125** | 30 to 1000 | 75 | 40 | 133 | 0.2 stroke | 292 | 360 |
| **140** | 30 to 1000 | 75 | 40 | 133 | 0.2 stroke | 292 | 360 |
| **160** | 30 to 1200 | 75 | 40 | 141 | 0.2 stroke | 326 | 401 |
| **180** | 30 to 1200 | 85 | 45 | 153 | 0.2 stroke | 375.5 | 457 |
| **200** | 30 to 1200 | 90 | 45 | 153 | 0.2 stroke | 395.5 | 477 |
| **250** | 30 to 1200 | 105 | 55 | 176 | 0.17 stroke | 483.5 | 584 |

**With Auto Switch** (mm)

| Bore size (mm) | Stroke range (mm) | S | Without rod boot | | With rod boot | |
|---|---|---|---|---|---|---|
| | | | Z | ZZ | Z1 | ZZ1 |
| **125** | Up to 1000 | 98 | 269 | 337 | 292 | 360 |
| **140** | Up to 1000 | 98 | 269 | 337 | 292 | 360 |
| **160** | Up to 1200 | 106 | 305 | 380 | 326 | 401 |
| **180** | Up to 1200 | 115 | 359.5 | 443 | 377.5 | 461 |
| **200** | Up to 998 | 120 | 382 | 468 | 400 | 486 |

# Accessory Dimensions 1

## Y Type Double Knuckle Joint

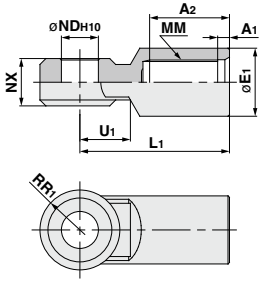



Material: Cast iron (mm)

| Model | Applicable bore size (mm) | A1 | E1 | L1 | MM | NDH10 | NX | NZ | RR1 | U1 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Y-12** | **125** | 8 | 46 | 100 | M30 x 1.5 | $25^{+0.084}_{0}$ | $32^{+0.3}_{+0.1}$ | $64^{-0.1}_{-0.3}$ | 27 | 42 |
| **Y-14** | **140** | 8 | 48 | 105 | M30 x 1.5 | $28^{+0.084}_{0}$ | $36^{+0.3}_{+0.1}$ | $72^{-0.1}_{-0.3}$ | 30 | 47 |
| **Y-16** | **160** | 8 | 55 | 110 | M36 x 1.5 | $32^{+0.1}_{0}$ | $40^{+0.3}_{+0.1}$ | $80^{-0.1}_{-0.3}$ | 34 | 46 |
| **Y-18** | **180** | 8 | 70 | 125 | M40 x 1.5 | $40^{+0.1}_{0}$ | $50^{+0.3}_{+0.1}$ | $100^{-0.1}_{-0.3}$ | 42.5 | 54 |
| **Y-20** | **200** | 8 | 70 | 125 | M45 x 1.5 | $40^{+0.1}_{0}$ | $50^{+0.3}_{+0.1}$ | $100^{-0.1}_{-0.3}$ | 42.5 | 54 |
| **Y-25** | **250** | 9 | 86 | 160 | M56 x 2 | $50^{+0.1}_{0}$ | $63^{+0.3}_{+0.1}$ | $126^{-0.1}_{-0.3}$ | 53 | 81 |

∗ Knuckle pins and cotter pins are included.

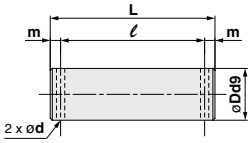
## I Type Single Knuckle Joint




Material: Cast iron (mm)

| Model | Applicable bore size (mm) | A1 | A2 | E1 | L1 | MM | NDH10 | NX | RR1 | U1 |
|---|---|---|---|---|---|---|---|---|---|---|
| **I-12** | **125** | 8 | 54 | 46 | 100 | M30 x 1.5 | $25^{+0.084}_{0}$ | $32^{-0.1}_{-0.3}$ | 27 | 33 |
| **I-14** | **140** | 8 | 54 | 48 | 105 | M30 x 1.5 | $28^{+0.084}_{0}$ | $36^{-0.1}_{-0.3}$ | 30 | 39 |
| **I-16** | **160** | 8 | 60 | 55 | 110 | M36 x 1.5 | $32^{+0.1}_{0}$ | $40^{-0.1}_{-0.3}$ | 34 | 39 |
| **I-18** | **180** | 8 | 67 | 70 | 125 | M40 x 1.5 | $40^{+0.1}_{0}$ | $50^{-0.1}_{-0.3}$ | 42.5 | 44 |
| **I-20** | **200** | 8 | 67 | 70 | 125 | M45 x 1.5 | $40^{+0.1}_{0}$ | $50^{-0.1}_{-0.3}$ | 42.5 | 44 |
| **I-25** | **250** | 9 | 75.5 | 86 | 160 | M56 x 2 | $50^{+0.1}_{0}$ | $63^{-0.1}_{-0.3}$ | 53 | 66 |

## Clevis Pin/Knuckle Pin

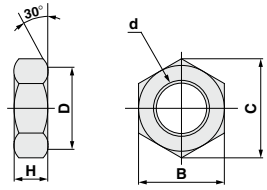



Material: Carbon steel (mm)

| Model | Applicable bore size (mm) | d (drill through) | Dd9 | L | ℓ | m | Cotter pin |
|---|---|---|---|---|---|---|---|
| **IY-12** | **125** | 4 | $25^{-0.065}_{-0.117}$ | 79.5 | 69.5 | 5 | ø4 x 40 L |
| **IY-14** | **140** | 4 | $28^{-0.065}_{-0.117}$ | 86.5 | 76.5 | 5 | ø4 x 40 L |
| **IY-16** | **160** | 4 | $32^{-0.080}_{-0.142}$ | 94.5 | 84.5 | 5 | ø4 x 40 L |
| **IY-18** | **180, 200** | 4 | $40^{-0.080}_{-0.142}$ | 115 | 105 | 5 | ø4 x 55 L |
| **IY-25** | **250** | 5 | $50^{-0.080}_{-0.142}$ | 144 | 132 | 6 | ø5 x 65 L |

∗ Cotter pins (2 pcs.) are included.

## Rod End Nut

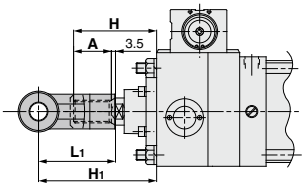



Material: Rolled steel (mm)

| Model | Applicable bore size (mm) | d | H | B | C | D |
|---|---|---|---|---|---|---|
| **NT-12** | **125, 140** | M30 x 1.5 | 18 | 46 | 53.1 | 44 |
| **NT-16** | **160** | M36 x 1.5 | 21 | 55 | 63.5 | 53 |
| **NT-18** | **180** | M40 x 1.5 | 23 | 60 | 69.3 | 57 |
| **NT-20** | **200** | M45 x 1.5 | 27 | 70 | 80.8 | 67 |
| **NT-25** | **250** | M56 x 2 | 34 | 85 | 98.1 | 82 |

# Accessory Dimensions 2

## Single/Double Knuckle Joint Mounting




(mm)

| Bore size (mm) \ Symbol | H | A | $L_1$ | $H_1$ | Applicable knuckle joint part nos. | |
|---|---|---|---|---|---|---|
| | | | | | I type single knuckle | Y type double knuckle |
| **125** | 110 | 50 | 100 | 156.5 | I-12 | Y-12 |
| **140** | 110 | 50 | 105 | 161.5 | I-14 | Y-14 |
| **160** | 120 | 56 | 110 | 170.5 | I-16 | Y-16 |
| **180** | 135 | 63 | 125 | 193.5 | I-18 | Y-18 |
| **200** | 135 | 63 | 125 | 193.5 | I-20 | Y-20 |
| **250** | 160 | 71 | 160 | 245.5 | I-25 | Y-25 |

**A, H dimensions when single/ double knuckle joint and rod end nut are mounted together.**

| Bore size (mm) | A | H |
|---|---|---|
| **125** | 65 | 125 |
| **140** | 65 | 125 |
| **160** | 76 | 140 |
| **180** | 83 | 155 |
| **200** | 88 | 160 |
| **250** | 106 | 195 |

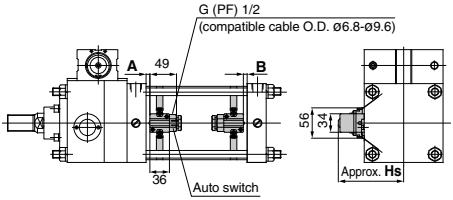
* Single knuckle joint and double knuckle joint should be used separately. (Fasten by screwing completely into the rod end threads.)
* When using a single/double knuckle joint together with a rod end nut, the A and H dimensions should be extended. (For extension of A and H dimensions, refer to the table above and specify with "Simple Specials -XA0" (page 1254).)

# Auto Switch Mounting 1

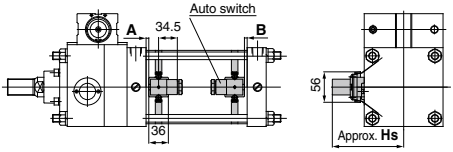
## Auto Switch Proper Mounting Position (Detection at Stroke End) and Its Mounting Height

**<Band mounting type>**

**D-A3□**
**D-G39/K39**

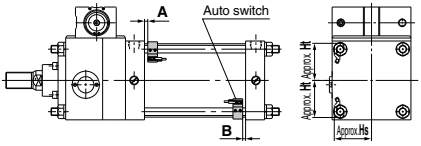



**D-A44**

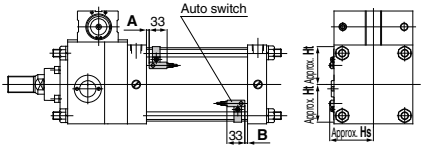



**<Tie-rod mounting type>**

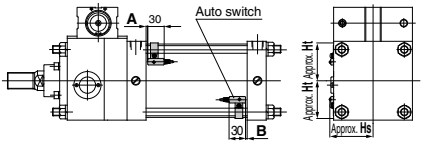
**D-Z7□/Z80/A9□/A9□V**
**D-Y59□/Y69□/Y7P/Y7PV/M9□/M9□V**
**D-Y7□W/Y7□WV/M9□W/M9□WV**
**D-Y7BA/M9□A/M9□AV**



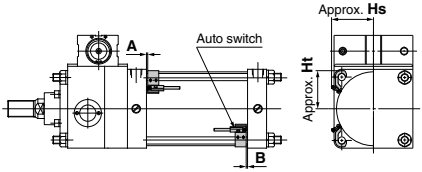

**D-A5□/A6□**
**D-A59W**




**D-F5□/J59/D-F5NT**
**D-F5□W/J59W**
**D-F5BA/F59F**




**D-P3DWA**




### Auto Switch Proper Mounting Position

(mm)

| Auto switch model / Bore size (mm) | D-M9□ D-M9□V D-M9□W D-M9□WV D-M9□A D-M9□AV | | D-A9□ D-A9□V | | D-Z7□/Z80 D-Y5□/Y6□ D-Y7P/Y7PV D-Y7□W D-Y7□WV D-Y7BA | | D-A5□ D-A6□ D-A3□ D-A44 D-G39 D-K39 | | D-A59W | | D-F5□W D-J59W D-F5BA D-F5□ D-J59 D-F59F | | D-F5NT | | D-P3DWA | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B | A | B | A | B | A | B | A | B |
| 125 | 8 | 8 | 4 | 4 | 1.5 | 1.5 | 0 | 0 | 2 | 2 | 4.5 | 4.5 | 9.5 | 9.5 | 3.5 | 3.5 |
| 140 | 8 | 8 | 4 | 4 | 1.5 | 1.5 | 0 | 0 | 2 | 2 | 4.5 | 4.5 | 9.5 | 9.5 | 3.5 | 3.5 |
| 160 | 8 | 8 | 4 | 4 | 1.5 | 1.5 | 0 | 0 | 2 | 2 | 4.5 | 4.5 | 9.5 | 9.5 | 3.5 | 3.5 |
| 180 | 13.5 | 12.5 | 9.5 | 7.5 | 7 | 5 | 3.5 | 1.5 | 7.5 | 5.5 | 10 | 8 | 15 | 13 | 9 | 7 |
| 200 | 16 | 14 | 12 | 10 | 9.5 | 7.5 | 6 | 4 | 10 | 8 | 12.5 | 10.5 | 17.5 | 15.5 | 11.5 | 9.5 |

∗ Figures in the table above are used as a reference when mounting the auto switches for stroke end detection. In the case of actually setting the auto switches, adjust them after confirming their operation.

### Auto Switch Mounting Height

(mm)

| Auto switch model / Bore size (mm) | D-M9□ D-M9□W D-M9□A D-A9□ D-A9□V | | D-M9□V D-M9□WV D-M9□AV | | D-Z7□/Z80 D-Y5□/Y6□ D-Y7P D-Y7PV D-Y7□W D-Y7□WV D-Y7BA | | D-A3□ D-G39 D-K39 | D-A44 | D-A5□ D-A6□ D-A59W | | D-F5□ D-J59 D-F5□W D-J59W D-F5BA D-F59F D-F5NT | | D-P3DWA | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hs | Ht | Hs | Ht | Hs | Ht | Hs | Hs | Hs | Ht | Hs | Ht | Hs | Ht |
| 125 | 69 | 69.5 | 71.5 | 69.5 | 69 | 69.5 | 116 | 126 | 75.5 | 69.5 | 74.5 | 70 | 76 | 69.5 |
| 140 | 76 | 76 | 77.5 | 76 | 76 | 76 | 124 | 134 | 81 | 76.5 | 80 | 76.5 | 82 | 76 |
| 160 | 85 | 85 | 86 | 85 | 85 | 85 | 134.5 | 144.5 | 89 | 87.5 | 88 | 87.5 | 91 | 85 |
| 180 | 95 | 95 | 95.5 | 95 | 95 | 95 | 144 | 154 | 97 | 97.5 | 96 | 97.5 | 100 | 95 |
| 200 | 106 | 106 | 106 | 106 | 106 | 106 | 154 | 164 | 107 | 108 | 107.5 | 108 | 111 | 106 |

# Auto Switch Mounting 2

## Minimum Stroke for Auto Switch Mounting

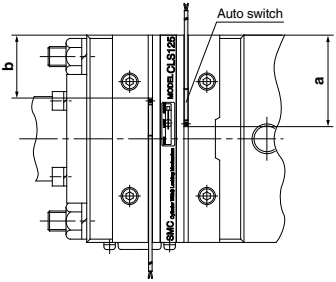
n: No. of auto switches (mm)

| Auto switch model | No. of auto switches mounted | | Mounting brackets other than center trunnion | Center trunnion type | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | ø125 | ø140 | ø160 | ø180 | ø200 |
| D-M9□<br>D-M9□W | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 15 | 105 | 110 | 115 | | |
| | "n" pcs. | | $15 + 40\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $105 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $110 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $115 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | | |
| D-M9□V<br>D-M9□WV | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 10 | 80 | 85 | 90 | | |
| | "n" pcs. | | $10 + 30\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $80 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $85 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $90 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | | |
| D-M9□A | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 20 | 115 | 120 | | | |
| | "n" pcs. | | $20 + 40\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $115 + 40\frac{(n-2)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $120 + 40\frac{(n-2)}{2}$ (n = 4, 8, 12, 16…) Note 2) | | | |
| D-M9□AV | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 15 | 90 | 95 | | | |
| | "n" pcs. | | $15 + 30\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $90 + 30\frac{(n-2)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $95 + 30\frac{(n-2)}{2}$ (n = 4, 8, 12, 16…) Note 2) | | | |
| D-A9□ | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 15 | 100 | 105 | 110 | | |
| | "n" pcs. | | $15 + 40\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $100 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $105 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $110 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | | |
| D-A9□V | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 10 | 75 | 80 | 85 | | |
| | "n" pcs. | | $10 + 30\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $75 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $80 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $85 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | | |
| D-A5□/A6□<br>D-A59W<br>D-F5□/J59<br>D-F5□W<br>D-J59W<br>D-F5BA<br>D-F59F | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 25 | 125 | 135 | | 150 | |
| | "n" pcs. (Same surface) | | $25 + 55\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $125 + 55\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $135 + 55\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | | $150 + 55\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | |
| D-F5NT | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 35 | 145 | 155 | | 170 | |
| | "n" pcs. (Same surface) | | $35 + 55\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $145 + 55\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $155 + 55\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | | $170 + 55\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | |
| D-A3□<br>D-G39<br>D-K39 | 2 pcs. | Different surfaces | 35 | 110 | | | | 150 |
| | | Same surface | 100 | | | | | |
| | "n" pcs. | Different surfaces | 35 + 30 (n–2) (n = 2, 3, 4, 5…) | 110 + 30 (n–2) (n = 2, 4, 6, 8…) Note 1) | | | | 150 + 30 (n–2) (n = 2, 4, 6, 8…) Note 1) |
| | | Same surface | 100 + 100 (n–2) (n = 2, 3, 4, 5…) | 110 + 100 (n–2) (n = 2, 4, 6, 8…) Note 1) | | | | 150 + 100 (n–2) (n = 2, 4, 6, 8…) Note 1) |
| | 1 pc. | | 15 | 110 | | | | 150 |
| D-A44 | 2 pcs. | Different surfaces | 35 | 110 | | | | 150 |
| | | Same surface | 55 | | | | | |
| | "n" pcs. | Different surfaces | 35 + 30 (n–2) (n = 2, 3, 4, 5…) | 110 + 30 (n–2) (n = 2, 4, 6, 8…) Note 1) | | | | 150 + 30 (n–2) (n = 2, 4, 6, 8…) Note 1) |
| | | Same surface | 55 + 55 (n–2) (n = 2, 3, 4, 5…) | 110 + 50 (n–2) (n = 2, 4, 6, 8…) Note 1) | | | | 150 + 50 (n–2) (n = 2, 4, 6, 8…) Note 1) |
| | 1 pc. | | 15 | 110 | | | | 150 |
| D-Z7□<br>D-Z80<br>D-Y59□<br>D-Y7P<br>D-Y7□W | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 15 | 105 | 110 | 115 | | |
| | "n" pcs. | | $15 + 40\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $105 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $110 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $115 + 40\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | | |
| D-Y69□<br>D-Y7PV<br>D-Y7□WV | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 10 | 90 | 95 | 100 | | |
| | "n" pcs. | | $10 + 30\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $90 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $95 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $100 + 30\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | | |
| D-Y7BA | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 20 | 115 | 120 | 125 | 130 | |
| | "n" pcs. | | $20 + 45\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $115 + 45\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $120 + 45\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $125 + 45\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $130 + 45\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | |
| D-P3DWA | 2 pcs. (Different surfaces, Same surface), 1 pc. | | 20 | 110 | 115 | 120 | | |
| | "n" pcs. | | $20 + 50\frac{(n-2)}{2}$ (n = 2, 4, 6, 8…) Note 1) | $110 + 50\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $115 + 50\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | $120 + 50\frac{(n-4)}{2}$ (n = 4, 8, 12, 16…) Note 2) | | |

Note 1) When "n" is an odd number, an even number that is one larger than this odd number is used for the calculation. Note 2) When "n" is an odd number, a multiple of 4 that is larger than this odd number is used for the calculation.

## Proper Mounting Positions for Lock Unit Auto Switches

The operating status (at the unlocked end) of the lock unit (brake piston) can be detected by a signal from the auto switch, which is mounted on the brake cylinder of the CLS series.




(mm)

| Auto switch model / Bore size | D-A90 D-A93 | | D-M9N D-M9P D-M9B | |
|---|---|---|---|---|
| | a | b | a | b |
| 125 | 62 | 42 | 58 | 46 |
| 140 | 70.5 | 50.5 | 66.5 | 54.5 |
| 160 | 70.5 | 50.5 | 66.5 | 54.5 |
| 180 | 80.5 | 60.5 | 76.5 | 64.5 |
| 200 | 86 | 66 | 82 | 70 |
| 250 | 102 | 82 | 98 | 86 |

∗ Be sure to confirm operation after mounting.

## Operating Range

(mm)

| Auto switch model | Bore size | | | | |
|---|---|---|---|---|---|
| | 125 | 140 | 160 | 180 | 200 |
| D-M9□/M9□V<br>D-M9□W/M9□WV<br>D-M9□A/M9□AV | 7 | 6.5 | 6.5 | 7 | 7 |
| D-A9□/A9□V | 12 | 12.5 | 11.5 | 12 | 12.5 |
| D-Z7□/Z80 | 14 | 14.5 | 13 | 14 | 14.5 |
| D-A3□/A44<br>D-A5□/A6□ | 10 | 10 | 10 | 10 | 10 |
| D-A59W | 17 | 17 | 17 | 17 | 17 |
| D-Y59□/Y69□<br>D-Y7P/Y7PV<br>D-Y7□W/Y7□WV<br>D-Y7BA | 12 | 13 | 7 | 7.5 | 8 |
| D-F5□/J59/F59F<br>D-F5□W/J59W<br>D-F5BA/F5NT | 5 | 5 | 5.5 | 6 | 6 |
| D-G39/K39 | 11 | 11 | 10 | 10 | 10 |
| D-P3DWA | 6 | 6.5 | 6.5 | 6.5 | 7 |

∗ Since this is a guideline including hysteresis, not meant to be guaranteed (assuming approximately ±30% dispersion).
There may be the case to change substantially depending on an ambient environment.

## Auto Switch Mounting Bracket Part No.

| Auto switch model | Bore size (mm) | | | | |
|---|---|---|---|---|---|
| | ø125 | ø140 | ø160 | ø180 | ø200 |
| D-M9□/M9□V<br>D-M9□W/M9□WV<br>D-M9□A/M9□AV<br>D-A9□/A9□V | BS5-125 | BS5-125 | BS5-160 | BS5-180 | BS5-200 |
| D-A5□/A6□<br>D-A59W<br>D-F5□/J59<br>D-F5□W/J59W<br>D-F5BA<br>D-F59F/F5NT | BT-12 | BT-12 | BT-16 | BT-18A | BT-20 |
| D-A3□/A44<br>D-G39/K39 | BS1-125 | BS1-140 | BS1-160 | BS1-180 | BS1-200 |
| D-Z7□/Z80<br>D-Y5□/Y6□<br>D-Y7P/Y7PV<br>D-Y7□W/Y7□WV<br>D-Y7BA | BS4-125 | BS4-125 | BS4-160 | BS4-180 | BS4-200 |
| D-P3DWA | BS7-125S | BS7-125S | BS7-160S | BS7-180S | BS7-200S |

**[Mounting screw set made of stainless steel]**

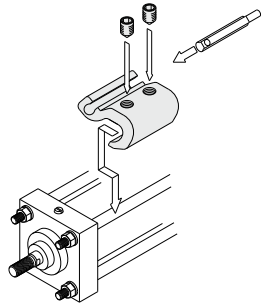
The following set of mounting screws made of stainless steel (including nuts) is available. Use it in accordance with the operating environment. (Please order the auto switch mounting bracket separately, since it is not included.)

BBA1: For D-A5/A6/F5/J5 types

D-F5BA auto switch is set on the cylinder with the stainless steel screws above when shipped. When an auto switch is shipped independently, BBA1 is attached.

Note 1) Refer to page 1233 for the details of BBA1.

Note 2) When using D-M9□A(V)/Y7BA, do not use the steel set screws which is included with the auto switch mounting brackets above (BS5-□□□, BS4-□□□). Order a stainless steel screw set (BBA1) separately, and select and use the M4 x 8L stainless steel set screws included in the BBA1.



• The above figure shows the mounting example of D-A9□(V)/M9□(V)/M9□W(V)/M9□A(V).

# Auto Switch Mounting 3

Besides the models listed in How to Order, the following auto switches are applicable.
Refer to page 1119 to 1245 for the detailed specifications.

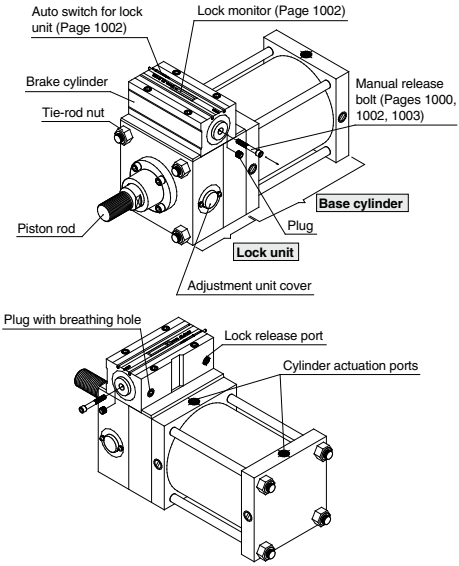
| Auto switch type | Model | Electrical entry (Fetching direction) | Features |
|---|---|---|---|
| **Reed** | D-A90V | Grommet (Perpendicular) | Without indicator light |
| | D-A93V, A96V | | — |
| | D-Z73, Z76 | Grommet (In-line) | |
| | D-A53, A56 | | |
| | D-A64, A67 | | Without indicator light |
| | D-Z80 | | |
| **Solid state** | D-M9NV, M9PV, M9BV | Grommet (Perpendicular) | — |
| | D-Y69A, Y69B, Y7PV | | |
| | D-M9NWV, M9PWV, M9BWV | | 2-color indicator |
| | D-Y7NWV, Y7PWV, Y7BWV | | |
| | D-M9NAV, M9PAV, M9BAV | | Water resistant (2-color indicator) |
| | D-F59, F5P, J59 | Grommet (In-line) | — |
| | D-Y59A, Y59B, Y7P | | |
| | D-F59W, F5PW, J59W | | 2-color indicator |
| | D-Y7NW, Y7PW, Y7BW | | |
| | D-F5BA, Y7BA | | Water resistant (2-color indicator) |
| | D-F5NT | | With timer |

∗ For solid state auto switches, auto switches with a pre-wired connector are also available. Refer to pages 1192 and 1193.
∗ Normally closed (NC = b contact) solid state auto switches (D-M9□E(V)/Y7G/Y7H) are also available. Refer to pages 1592-1 and 1139 for details.

# *CLS Series*
# Specific Product Precautions 1

**Be sure to read this before handling the products.**
**Refer to back page 50 for Safety Instructions and pages 3 to 12 for Actuator and Auto Switch Precautions.**

## Parts Description




## Design of Equipment and Machinery

### ⚠ Warning

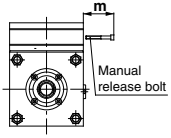
**1. Construct so that the human body will not come into direct contact with driven objects or the moving parts of the cylinder with brake.**

Devise a safe structure by attaching protective covers that prevent direct contact with the human body, or in cases where there is a danger of contact, provide sensors or other devices to perform an emergency stop, etc., before contact occurs.

**2. Use a balance circuit, taking cylinder lurching into consideration.**

In cases such as an intermediate stop, where a lock is operated at a desired position within the stroke and air pressure is applied from only one side of the cylinder, the piston will lurch at high speed when the lock is released. In such situations, there is a danger of causing human injury by having hands or feet, etc., caught, and also a danger of causing damage to the equipment. In order to prevent this lurching, a balance circuit such as the recommended air pressure circuits (page 1001) should be used.

**3. When designing equipment and machinery, give consideration to clearance and mounting orientation so that manual release of the lock (using the manual release bolt) will be possible.**




∗ **Minimum Clearance for Manual Release** (mm)

| Bore size (mm) | Clearance: **m** |
|---|---|
| **125** | 50 |
| **140**<br>**160** | 60 |
| **180** | 70 |
| **200** | 80 |
| **250** | 90 |

## Selection

### ⚠ Warning

**1. When in a locked condition, do not apply a load accompanied by an impact shock, strong vibration or turning force, etc.**

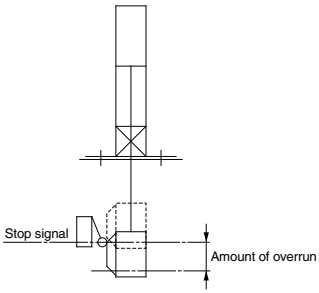
Use caution, because an external action such as an impacting load, strong vibration or turning force, may damage the locking mechanism or reduce its life.

**2. Consider stopping accuracy and the amount of overrun when an intermediate stop is performed.**

Due to the nature of a mechanical lock, there is a momentary lag with respect to the stop signal, and a time delay occurs before stopping. The cylinder stroke resulting from this delay is the overrun amount. The difference between the maximum and minimum overrun amounts is the stopping accuracy.

- **Place a limit switch before the desired stopping position, at a distance equal to the overrun amount.**
- **The limit switch must have a detection length (dog length) of the overrun amount + α.**
- **SMC's auto switches have operating ranges from 8 to 14 mm (depending on the switch model).**
  **When the overrun amount exceeds this range, self-holding of the contact should be performed at the switch load side.**

∗ Refer to page 983 regarding stopping accuracy.




**3. In order to further improve stopping accuracy, the time from the stop signal to the operation of the lock should be shortened as much as possible.**

To accomplish this, use a device such as a highly responsive electric control circuit or solenoid valve driven by direct current, and place the solenoid valve as close as possible to the cylinder.

**4. Note that stopping accuracy will be influenced by changes in piston speed.**

When piston speed changes during the course of the cylinder stroke due to variations in the load or disturbances, etc., the dispersion of stopping positions will increase. Therefore, consideration should be given to establishing a standard speed for the piston just before it reaches the stopping position.
Moreover, the dispersion of stopping positions will increase during the cushioned portion of the stroke and during the accelerating portion of the stroke after the start of operation, due to the large changes in piston speed.

# *CLS Series*
# Specific Product Precautions 2

**Be sure to read this before handling the products.**
**Refer to back page 50 for Safety Instructions and pages 3 to 12 for Actuator and Auto Switch Precautions.**

## Selection

### ⚠ Warning

**5. Holding force (maximum static load) means the maximum capability of holding a static load that is not accompanied by vibration or impact under the condition that no load is applied. Therefore, it does not refer to a load that cannot be held constantly.**

Determine the optimum bore size which meets your application based on the model selection procedure. The procedures for Model Selection, assuming the intermediate stop application (including the emergency stop in operation), are shown on pages 980 and 981. Only when locking the cylinder in a condition where a kinetic energy is not applied, such as in a drop prevention application, the maximum load mass when using the lock should not exceed the upper limit of the load mass, according to the operating pressure, when the maximum speed is V = 100 mm/s in Graph 5 through 7 on page 981.

## Mounting

### ⚠ Warning

**1. Be certain to connect the piston rod end to the load with the lock released.**

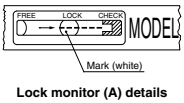
If connected when in the locked condition, turning force or a load greater than the holding force may operate on the piston rod and cause damage to the lock mechanism. The CLS series is equipped with an emergency unlocking mechanism, however, the load should be connected to the piston rod end with the lock in the released condition. This can be accomplished manually or by simply connecting an air line to the unlocking port and supplying air pressure of 0.25 MPa or more.

**2. The unit is shipped from the factory with the lock in the released condition. Since the lock will not operate in this condition, be sure to put it in the locked condition before operation, following the procedure given below.**

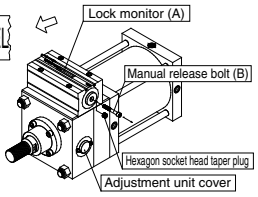
(1) Remove the manual release bolt (B) using a hexagon wrench. (The manual release bolt can be removed easier by applying air pressure to the lock release port.)

(2) Confirm that the white mark on the lock monitor (A) is in the LOCK position.

(3) Plug the bolt insertion hole with the included hexagon socket head taper plug.




**Lock monitor (A) details**




**Manual Release Bolt** Unit: mm

| Bore size (mm) | Size |
|---|---|
| **125** | M6 x 1.0 x 35 L |
| **140** | M6 x 1.0 x 40 L |
| **160** | M8 x 1.25 x 40 L |
| **180** | M10 x 1.5 x 50 L |
| **200** | M10 x 1.5 x 55 L |
| **250** | M12 x 1.75 x 70 L |

∗ Use a hexagon socket head cap screw if the included manual release bolt is not available.

**Hexagon Socket Head Taper Plug Size**

| Bore size (mm) | Hexagon socket head taper plug |
|---|---|
| **125**<br>**140** | Rc 1/4 |
| **160** | Rc 3/8 |
| **180**<br>**200** | Rc 1/2 |
| **250** | Rc 3/4 |

## Mounting

### ⚠ Warning

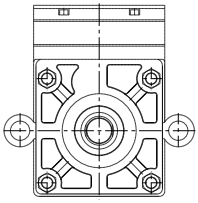
**3. Remove the manual release bolt and attach it to the cylinder cover storage part. (The bolt is necessary at times of maintenance.)**

**4. Mount the cylinder after confirming that the lock is working correctly by applying or releasing air pressure to or from the lock release port. Apply air pressure (more than 0.25 MPa) to unlock the cylinder or release the air pressure (0 MPa) to lock the cylinder.**

**5. The adjustment screw inside the adjustment unit cover is set before shipment. Since any discrepancy in this adjustment can cause cylinder or lock malfunction, etc., never touch the screw.**

**6. When raising the unit, do not insert your hands or fingers.**

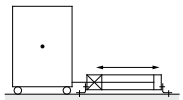
As this is a heavyweight product, be sure to use caution.
Screw holes for installing eyebolts are provided for ø180, ø200 and ø250. (Eyebolts are not included in the unit.)



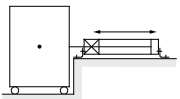
### ⚠ Caution

**1. Do not apply an offset load to the piston rod.**

Particular care should be taken to match the load's center of gravity with the center of the cylinder shaft. When there is a large discrepancy, the piston rod may be subjected to uneven wear or damage due to the inertial moment during locking stops.



X Load center of gravity and cylinder shaft center are not matched.



○ Load center of gravity and cylinder shaft center are matched.

∗ An offset load can be operated if there is an effective guide to absorb all of the generated moment.

# *CLS Series*
# Specific Product Precautions 3

**Be sure to read this before handling the products.**
**Refer to back page 50 for Safety Instructions and pages 3 to 12 for Actuator and Auto Switch Precautions.**

## Mounting

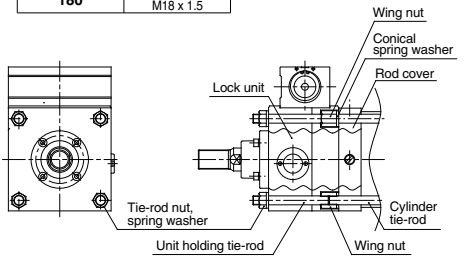
### ⚠Caution

**2. Cautions when using the base unit and when changing bracket positions, etc.**

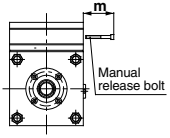
The lock unit and cylinder rod cover are assembled as shown in the drawing below. For this reason, it cannot be installed as in the case of common air cylinders, by using the basic type and screwing the cylinder tie-rods directly to machinery.
Furthermore, when brackets are replaced, the unit holding tie-rods may become loose and they should be retightened.

| Bore size (mm) | Tie-rod nut |
|---|---|
| **125**<br>**140** | JIS B1181 Class 2<br>M14 x 1.5 |
| **160** | JIS B1181 Class 2<br>M16 x 1.5 |
| **180** | JIS B1181 Class 2<br>M18 x 1.5 |

| Bore size (mm) | Tie-rod nut |
|---|---|
| **200** | JIS B1181 Class 2<br>M20 x 1.5 |
| **250** | JIS B1181 Class 2<br>M24 x 1.5 |




**3. When installing the cylinder to machinery, etc., secure enough clearance and consider the mounting direction for manual lock release (releasing with the manual release bolt).**




∗ **Minimum Clearance for Manual Release** (mm)

| Bore size (mm) | Clearance: **m** |
|---|---|
| **125** | 50 |
| **140**<br>**160** | 60 |
| **180** | 70 |
| **200** | 80 |
| **250** | 90 |

## Adjustment

### ⚠Caution

**1. Adjust the cylinder's air balance. Balance the load by adjusting the air pressure in the front and rear sides of the cylinder with the load connected to the cylinder and the lock in a released condition. Lurching of the cylinder when unlocked can be prevented by carefully adjusting this air balance.**

**2. Adjust the mounting positions of the detectors on auto switches, etc. When intermediate stops are to be performed, adjust the mounting positions of detectors on auto switches, etc., taking into consideration the overrun amount with respect to the desired stopping positions.**

**3. Do not open the cushion valve excessively.**

If the cushion valve is rotated excessively in the opening direction (counterclockwise), it could be damaged. Be aware that the valve could slip out, or the threads becomes too short.

## Pneumatic Circuits

### ⚠Warning

**1. Be certain to use a pneumatic circuit which will apply balancing pressure to both sides of the piston when in a locked stop.**

In order to prevent cylinder lurching when restarting or manually unlocking after a locked stop, a circuit should be used to apply balancing pressure to both sides of the piston, thereby canceling the force generated by the load in the direction of piston movement.

**2. The effective area of the lock release solenoid valve should be at 25% of the effective area of the cylinder driving solenoid valve, and it should be installed as close to the cylinder as possible so that it is closer than the cylinder driving solenoid valve.**

If the effective area of the lock release solenoid valve is excessively large, the brake piston will operate at a high speed, which may result in damage to the internal parts. However, if the effective area of the lock release solenoid valve is excessively small, or if the distance from the cylinder is too great, the time required to exhaust the air for releasing the lock will be longer, which may cause a delay in the locking operation.
The delay in the locking operation may result in problems such as increase of overrunning when performing intermediate stop or emergency stop during operation, or if maintaining position from the operation stop state such as drop prevention, workpieces may be dropped depending on the timing of the load action to the operation delay of the lock.

**3. Avoid backflow of the exhaust pressure when there is a possibility of interference of exhaust air, for example for a common exhaust type valve manifold.**

The lock may not operate properly when the exhaust air pressure backflows due to interference of the exhaust air when exhausting air for lock release. It is recommended to use an individual exhaust type manifold or individual valves.

**4. Allow at least 0.5 seconds from a locked stop (intermediate stop of the cylinder) until release of the lock.**

When the locked stop time is too short, the piston rod (and load) may lurch at a speed greater than the control speed of the speed controller.

**5. When restarting, control the switching signal for the unlocking solenoid valve so that it acts before or at the same time as the cylinder drive solenoid valve.**

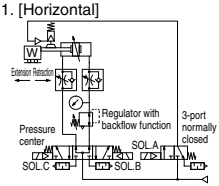
If the signal is delayed, the piston rod (and load) may lurch at a speed greater than the control speed of the speed controller.

**6. Carefully check for dew condensation due to repeated air supply and exhaust of the locking solenoid valve.**

The operating stroke of the lock part is very small. So, if the piping is long and the air supply and exhaust are repeated, the dew condensation caused by the adiabatic expansion accumulates in the lock part. This may corrode internal parts, causing air leak or lock release fault.

**7. Basic circuits**

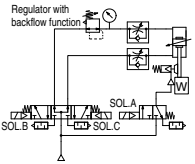
1. [Horizontal]



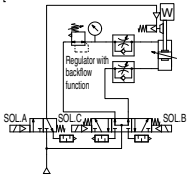

| SOL.A | SOL.B | SOL.C | Action | |
|---|---|---|---|---|
| ON | ON | OFF | Extension | |
| OFF | OFF | OFF | Locked stop | 0.5 s or more |
| ON | OFF | OFF | Unlocked | 0 to 0.5 s |
| ON | ON | OFF | Extension | |
| ON | OFF | ON | Retraction | |
| OFF | OFF | OFF | Locked stop | 0.5 s or more |
| ON | OFF | OFF | Unlocked | 0 to 0.5 s |
| ON | OFF | ON | Retraction | |

2. [Vertical]

[Load in the direction of rod extension]




[Load in the direction of rod retraction]




∗ The symbol for the cylinder with lock in the basic circuit uses SMC original symbol.

# *CLS Series*
# Specific Product Precautions 4

**Be sure to read this before handling the products.**
**Refer to back page 50 for Safety Instructions and pages 3 to 12 for Actuator and Auto Switch Precautions.**

## Lock Monitor

## ⚠Caution

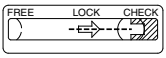
**The CLS series is equipped with a lock monitor on the lock unit. Use the lock monitor as a criterion to confirm the operating condition of the lock unit (brake piston) and the state of wear (life) of the brake shoe.**


**Unlocked** **Locked by operation of brake**

∗ Please note that the position of the mark when locked varies somewhat from unit to unit.

### Brake shoe life

The position of the lock condition mark on the lock monitor gradually moves to the right side with wear of the shoe, etc. When the mark is half way or more into the CHECK zone, this indicates that the brake shoe is near the end of its life. (The brake will not immediately become ineffective in this condition.)




## Auto Switch for Lock Unit

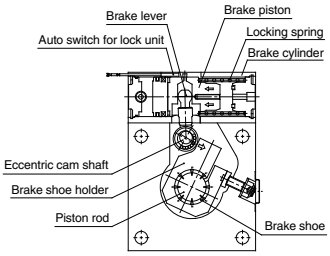
## ⚠Caution

**1. By installing a switch on the brake cylinder of the CLS series, the operating condition (unlocked side) of the lock unit (brake piston) can be detected as a switch signal.**

∗ The condition of the lock monitor and the detection signal from the lock unit auto switch do not directly confirm the locking condition at the piston rod, but confirm this indirectly from the position of the brake piston.

### Lock unit mechanism

The spring force applied to the brake piston is transmitted and magnified through the lever, eccentric cam shaft and brake shoe holder, finally tightening on the piston rod via the brake shoe and locking the piston rod by means of their mutual frictional force.




**Locked condition**
**(when air is exhausted.)**

## Manual Unlocking

## ⚠Warning

**1. Never perform the manual unlocking operation (with the manual release bolt, etc.) until safety has been confirmed.**

1) If air pressure is applied to only one side of the cylinder when unlocking is performed, the moving parts of the cylinder may lurch at high speed causing a serious hazard.
2) When unlocking is performed, be sure to confirm that personnel are not within the movement range of the load, and also that no problems will be caused if the load is actuated.

**2. When unlocking in the case of loads which move up and down, take measures to assure that the load will not drop.**

1) Perform work with the load at its lowest position.
2) Prevent dropping of the load by using a support or brace, etc.
3) Verify that balanced pressure is applied to both sides of the piston.

## ⚠Caution

**1. The CLS series manual release mechanism is an emergency unlocking mechanism only.**

During an emergency when the air supply is cut off, it is used to alleviate a problem by forcibly pulling the brake piston back to release the lock.

**2. In the case of large bore cylinders, even when the lock is released, operational resistance as shown in the table below is generated in a non-load state.**

| Bore size (mm) | 125 | 140 | 160 | 180 | 200 | 250 |
|---|---|---|---|---|---|---|
| Operational resistance (N) | 962 | 1206 | 1576 | 1995 | 2463 | 3848 |

**3. Care must be taken, because if the manual release bolt is screwed in only part way and air is supplied to the unlocking port, or it is changed from a supply to an exhaust state, the head of the manual release bolt may be ejected from the end of the brake cylinder or be pulled in creating a serious hazard.**

**Unlocking procedure using the manual release bolt**

**1. Remove the hexagon socket head taper plug which is on the same side as the brake cylinder adjustment unit cover.**

**2. Insert the manual release bolt (see table below) into the threads and screw it in clock-wise.**

**3. The lock is released by screwing in the manual release bolt until the white mark of the lock monitor on the top of the brake cylinder moves to the FREE position.**

Unit: mm

| Bore size (mm) | 125 | 140 | 160 | 180 | 200 | 250 |
|---|---|---|---|---|---|---|
| Manual release bolt | M6 x 1.0 x 35 L | M6 x 1.0 x 40 L | M8 x 1.25 x 40 L | M10 x 1.5 x 50 L | M10 x 1.5 x 55 L | M12 x 1.75 x 70 L |
| Screw depth | 30 | 32 | 35 | 40.5 | 45 | 55 |

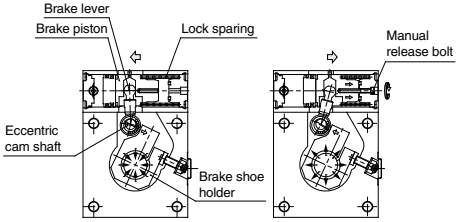
∗ In case the manual release bolt is not available, use an appropriate hexagon socket head bolt (full thread) as shown above.

# Specific Product Precautions 5

**Be sure to read this before handling the products.**
**Refer to back page 50 for Safety Instructions and pages 3 to 12 for Actuator and Auto Switch Precautions.**

## Manual Unlocking

### ⚠ Caution




[Principle]

When the manual release bolt is screwed clockwise, the brake piston is pulled back and the spring is compressed. This causes the lever to be returned, releasing the lock.

## Operating Environment

### ⚠ Caution

**1. In locations where the cylinder body will be directly exposed to cutting oil or coolant, etc., a cover or other protection should be provided for the cylinder body and rod.**

## Maintenance

### ⚠ Caution

**1. The operating condition of the lock unit (brake piston) can be confirmed externally by means of the lock monitor.**

1) When the lock monitor mark has moved half way or more into the CHECK zone
If used in this condition, the holding force will gradually decrease. If an operational problem is found in the course of checking the lock's operating condition, early replacement of the cylinder body or lock unit is necessary. Contact SMC regarding replacement of the lock unit.

2) When the lock monitor mark moves into the CHECK zone prematurely
Since there is a possibility of damage to the lock unit, consult with SMC after reviewing the method of operation.

**2. This cylinder is a non-lube type. Do not lubricate the cylinder or apply grease to the piston rod, as there is a danger of drastically reducing brake performance.**

**3. When replacing seals in the base cylinder, it is recommended that the lock unit be separated from the base cylinder so that replacement work can be done on the cylinder alone. Refer to separate instructions for seal replacement.**

**4. Never disassemble the lock unit.**

- A heavy duty spring is contained in part of the unit, which presents a serious hazard if disassembly is performed incorrectly.
- In addition, the lock unit is adjusted before shipment. If readjustment is not performed correctly after reassembly, a serious danger will be created, as performance will not meet specifications.