



# Operation Manual

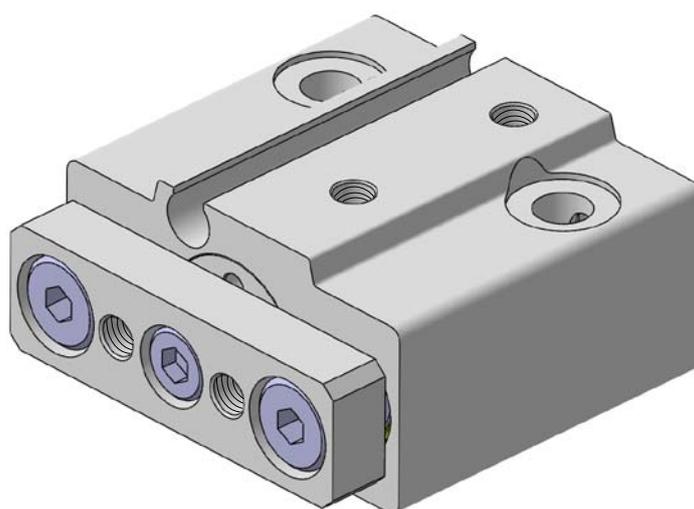
PRODUCT NAME

Miniature Guide Rod Cylinder

MODEL/ Series

Series MGJ

$\phi 6$ ,  $\phi 10$



**SMC Corporation**

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# Series MGJ

## Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution," "Warning" or "Danger." They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC), Japan Industrial Standards (JIS)\*1) and other safety regulations\*2).

\*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems  
ISO 4413: Hydraulic fluid power -- General rules relating to systems  
IEC 60204-1: Safety of machinery -- Electrical equipment of machines (Part 1: General requirements)  
ISO 10218-1992: Manipulating industrial robots -- Safety  
JIS B 8370: General rules for pneumatic equipment.  
JIS B 8361: General rules for hydraulic equipment.  
JIS B 9960-1: Safety of machinery – Electrical equipment for machines. (Part 1: General requirements)  
JIS B 8433-1993: Manipulating industrial robots - Safety. etc.

\*2) Labor Safety and Sanitation Law, etc.



### Caution

Operator error could result in injury or equipment damage.



### Warning

Operator error could result in serious injury or loss of life.



### Danger

In extreme conditions, there is a possibility of serious injury or loss of life.

## Warning

### 1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

### 2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

### 3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

### 4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1) Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2) Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3) An application which could have negative effects on people, property, or animals requiring special safety analysis.

## 2. Product Specifications

### 2-1. Specifications

Tube I.D. (mm)	6	10
Action	Double acting	
Operating fluid	Air	
Proof pressure	1.05MPa	
Max. operating pressure	0.7MPa	
Min. operating pressure	0.15MPa	
Ambient and fluid temperature	-10 to 60 deg.C (No freezing)	
Cushion	Rubber bumper at both ends	
Lubrication	Not required.	
Piston speed	50 to 500mm/sec.	
Stroke length tolerance	$\begin{matrix} +1.0 \\ 0 \end{matrix}$	
Port size	M3X0.5	
Guide O.D.	Φ5	Φ6

### Warning

#### 1) Understand the features of the product before using it.

MGJ mini-guide rod cylinder is designed to minimize the dimensions of every part including the overall length in order to miniaturize the entire application equipment and to save space. If this cylinder is used in the same way as a conventional cylinder, not only will it be unable to maintain the performance for a long time, but also it may cause breakage depending on the operating conditions.

#### 2) Confirm the specifications.

The product is designed only for use in industrial compressed air systems. Do not operate at pressures or temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to the specifications.)

Contact SMC in advance for non-industrial uses, or if using with a fluid other than compressed air.

## 3. Installation and Handling

### 3-1. Air supply

The compressed air supplied to the cylinder should be filtered by SMC AF series air filter and regulated to the specified set pressure by SMC AR series regulator.

### Warning

#### 1) Use clean air.

Do not use compressed air which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc., as this can cause damage or malfunction.

## **Caution**

### **2) Install an air filter.**

Install an air filter close to the upstream side of the valve. A filtration degree of 5mm or less should be selected.

### **3) Install an aftercooler, air dryer or drain catch before the filter and take appropriate measures.**

Do not use compressed air containing a lot of condensate, which can cause the operating failure of the product and other pneumatic equipment. Install an aftercooler, air dryer or drain catch before the filter and take appropriate measures.

### **4) Use the product within the specified fluid and ambient temperature range.**

When operating at temperatures below 5°C, water in the circuit may freeze and cause breakage of seals or malfunction. Corrective measures should be taken to prevent freezing.

Operable temperature range is -10 to 60 deg.C (No freezing).

Use the product within this range. If the cylinder is used outside of the operable temperature range, the seal can be worn out due to hardening of the seal and lubrication failure of the grease, causing air leakage.

For the details of compressed air mentioned above, refer to SMC catalog "Compressed Air Purification System".

### **5) Lubrication of non-lubricating cylinder**

The product has been lubricated during manufacturing, so it does not require lubrication in service.

For further lubrication, use a lubricant oil equivalent to Polyalphaolefin.

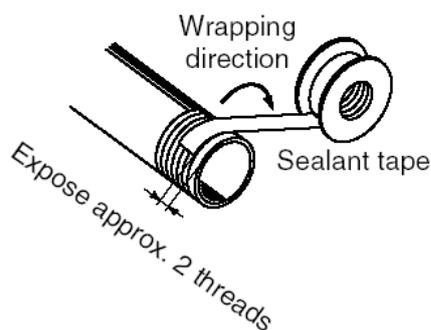
Once lubricant is used in the system, lubrication must be continued because the original lubricant applied during manufacturing will be washed away.

### **6) Before piping**

Before piping, perform air blow (flushing) or cleaning to remove any cutting chips, cutting oil, dust, etc. from the piping.

### **7) Sealant tape**

When installing piping or a fitting into a port, prevent cutting chips and sealant material from getting inside the piping. If a sealant tape is used, leave 1.5 to 2 threads exposed at the end.



### 3-2. Operating environment

#### **Warning**

**1) Do not use in environments where there is a danger of corrosion.**

Refer to the construction drawings regarding cylinder materials.

**2) Install a cover over the rod if it is used in an area that is dusty, or in an environment in which water or oil splashes on the cylinder.**

**3) When using auto switches, do not operate in an environment with strong magnetic fields.**

### 3-3. Speed control

When the piston speed is adjusted, install SMC AS series speed controller near the air supply port to adjust to the specified speed. There are two methods of speed adjustment, one is to restrict air supplied to the product, and the other is to restrict air exhausted from the product. Normally, the latter method should be adopted.

#### **Caution**

**1) Piston speed should be controlled gradually from low speed to the specified speed with a speed controller.**

### 3-4. Direction control

To switch the operating direction of the cylinder, mount an applicable solenoid valve selected from SMC's range of solenoid valves.

#### **Caution**

**1) Design a circuit to prevent sudden action of a driven object.**

When the product is actuated by an exhaust center type directional control valve or when one side of the piston is pressurized with air exhaust, such as when the product is started after the exhaust of the residual pressure from the circuit, driven objects may act suddenly at high speed. In such cases, injury may occur, such as hands or feet getting caught in the machinery, or damage to the machinery itself may occur. Design the machinery using equipment to prevent sudden action.

### 3-5. Design

#### **Warning**

**1) There is a possibility of dangerous sudden action by cylinders if sliding parts of machinery are twisted due to external forces, etc.**

In such cases, injury may occur, such as hands or feet getting caught in the machinery, or damage to the machinery itself may occur. Design the machinery to avoid such dangers.

**2) A protective cover is recommended to minimize the risk of personal injury.**

If a driven object and moving parts of the product are in close proximity, personal injury may occur. Design the system to avoid contact with the human body.

**3) Securely tighten all stationary parts and connected parts so that they will not become loose.**

When the product operates with high frequency or is installed where there is a lot of vibration, ensure that all parts remain secure.

**4) A deceleration circuit or shock absorber etc., may be required.**

When a driven object is operated at high speed or the load is heavy, the cylinder's cushion will not be sufficient to absorb the shock. Install a deceleration circuit before the cushion is hit to reduce the speed before cushioning, or install an external shock absorber to relieve the shock.

In this case, please verify the rigidity of the equipment carefully.

**5) Consider the possibility of a reduction in the circuit air pressure that could be caused by a power failure.**

When a cylinder is used in a clamping mechanism, the work piece may come off due to a decrease in clamping force because of a decrease in the circuit pressure caused by a power failure, etc. Therefore, safety equipment should be installed to prevent damage to machinery and injury. Suspension equipment and lifting devices also require measures to prevent dropping.

**6) Consider a possible loss of power source.**

Measures should be taken to prevent injury and equipment damage in the event that there is a loss of power to equipment controlled by air pressure, electricity or hydraulics, etc.

**7) Consider emergency stop.**

Design the system to prevent injury and damage to machinery and equipment when it is stopped by a safety device for a power outage or manual emergency stop.

**8) Consider the action when operation is restarted after an emergency stop or abnormal stop.**

Design the machinery so that injury or equipment damage will not occur upon restart of operation.

When the cylinder has to be reset at the starting position, install manual safety equipment.

**9) Design the system so that it will not apply an external force over the maximum force to the product.**

The product can break, causing a risk of injury or damage to equipment.

**10) The cylinder generates a large force. Install on a sufficiently rigid mounting base, taking this force into consideration.**

There is a risk of injury or damage to equipment.

**11) Do not synchronize cylinders coupled to the same load.**

Air is a compressible fluid, and it is difficult to control its velocity since it is affected by fluctuations in the supply pressure, load, temperature and lubrication conditions, deviation in the performance

of individual cylinders, and the change of components over time. Therefore, it is possible to synchronize multiple cylinders for a short period of time by adjusting them with a speed controller. However, the synchronization could fail easily due to changes in various conditions. When the synchronization fails, the difference in position will apply an excessive force to the piston rod. The force will be a lateral load, which can cause uneven wear of the seals, abrasion of the bushing, and galling between the cylinder tube and piston. For this reason, avoid designing the system in such a way that the movement is synchronized by the cylinders. If the synchronized use is unavoidable, provide a guide with high rigidity and high precision to prevent the failure of synchronization against the difference in force of the cylinders.

## **12) Intermediate stop**

It is difficult for this product to make a piston stop at the required intermediate position accurately and precisely by a 3 position closed center type directional control valve, due to the compressibility of air. Furthermore, since valves and cylinders are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for extended periods of time. Contact SMC if it is necessary to hold the stopped position for extended periods of time.

### **Caution**

#### **13) Operate the product within a range such that the piston will not collide and be damaged at the stroke end.**

If the piston with inertia force is expected to stop by colliding with the cover at the stroke end, use it within a range that will not cause damage. Refer to the cylinder model selection table for the range that will not cause damage.

## **3-6. Mounting, Installation and Others**

### **Caution**

#### **1) Make sure to connect the piston rod and the load so that their axial centers and movement directions match.**

If they do not match, stress could be applied to the rod and the cylinder body, causing the inner surface of the cylinder body, the bushing, the rod surface, and the seals to wear and become damaged.

#### **2) When an external guide is used, connect the piston rod end and the load in such a way that there is no interference at any point within the stroke.**

#### **3) Do not scratch or dent the sliding parts of the cylinder body or guide rod or piston rod, by striking or gripping them with other objects.**

Cylinder body bores are manufactured to precise tolerances, so that even a slight deformation may cause faulty operation.

Scratches or dents, etc. in the piston rod may lead to damaged seals and cause air leakage.

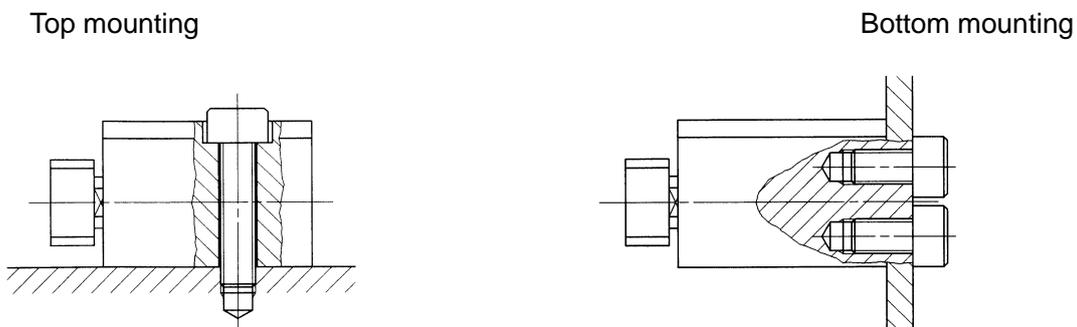
Moreover, scratches or dents may lead to damaged bearing and cause deterioration of non-rotating accuracy and operation failure.

**4) Do not use the product until you have verified that the equipment can operate properly.**

After installation, repair or modification, apply compressed air and power supplies to the equipment and perform appropriate functional and leakage inspections to make sure the equipment is mounted properly.

**5) When mounting the mini-guide rod cylinder, tighten the screws to the appropriate tightening torque.**

Model	Bolt	Appropriate tightening torque (Nm)	
		Top mounting	Bottom mounting
MGJ6	M3X0.5	1.2	0.3
MGJ10	M4X0.7	2.7	0.7



**Figure 3-1**

**6) Keep the flatness of the mounting surface 0.02mm or less.**

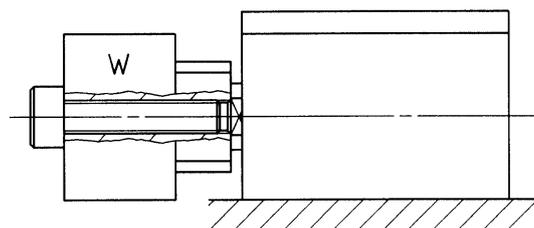
When mounting the mini-guide rod cylinder to the application or when mounting a workpiece to the plate, it will cause operation failure if the flatness of the mounting surface is more than 0.02mm.

**7) Retract the piston rod when mounting a load.**

If a load is mounted to the plate while the piston rod is extended, the guide will be twisted which may lead to malfunction.

**8) Tighten the screw to the appropriate tightening torque when mounting a load.**

Model	Bolt	Appropriate tightening torque (Nm)
MGJ6	M2.5X0.45	0.5
MGJ10	M3X0.5	1.0



**Figure 3-2**

**9) Do not use this cylinder as a stopper.**

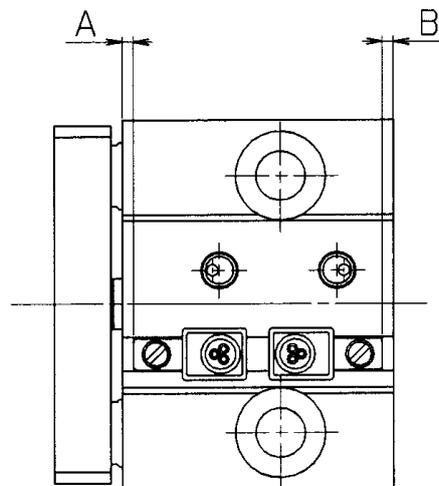
**3-7. Auto switches**

Refer to the catalog for the type of applicable auto switches and specifications. Also, for the handling of the auto switch, refer to the Operation Manual of the auto switch.

**3-7-1. Proper mounting position for stroke end detection**

Unit: mm

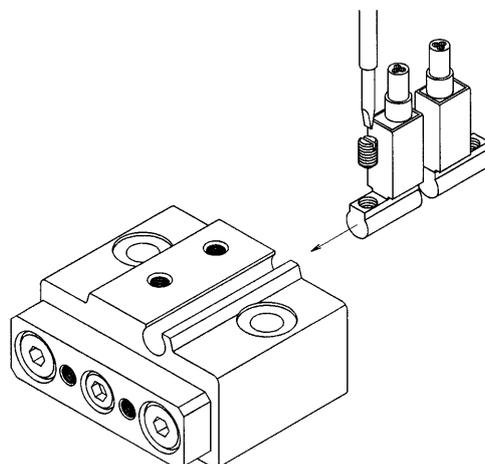
Bore size	A	B	Operating range
$\phi 6$	1.6	0.9	3
$\phi 10$	1.3	1.7	4



**Figure 3-3**

**3-7-2. Mounting of auto switch**

To mount the auto switch, insert it into the mounting groove of the cylinder from the direction shown in Figure 3-4, set in the appropriate piston, and tighten using the mounting screws provided. For the tightening of the mounting screws, use a watchmaker's screwdriver with a handle diameter of about 5 to 6 mm. The tightening torque should be between 0.10 and 0.20Nm.



**Figure 3-4**

### 3-7-3. Minimum mountable stroke for a cylinder with auto switch(es)

The auto switches applicable to this cylinder may turn on in the entire stroke or two switches may turn on at the same time if the stroke is 5 or less. Be sure to secure the actual operating distance 4mm or more in order to avoid such errors.

## 4. Model Selection

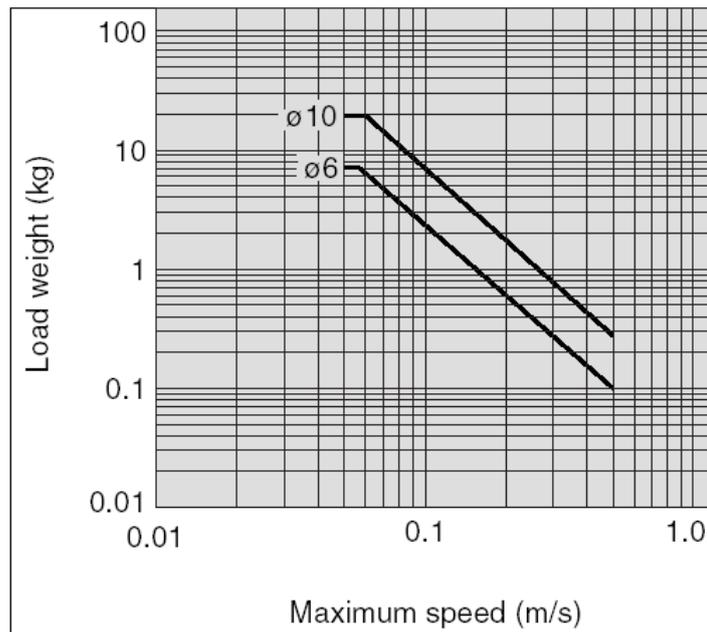
### 4-1. Allowable kinetic energy



#### Caution

The cylinder will be damaged if kinetic energy exceeds the allowable kinetic energy. Select a cylinder so that kinetic energy does not exceed the allowable kinetic energy.

Tube I.D. (mm)	6	10
Piston speed (m/s)	0.05 to 0.5	
Allowable kinetic energy (J)	0.012	0.035



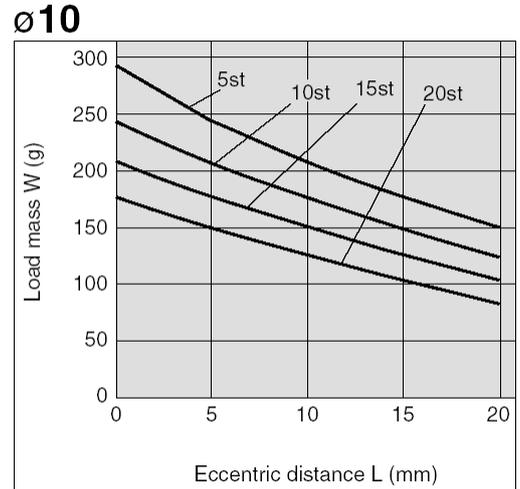
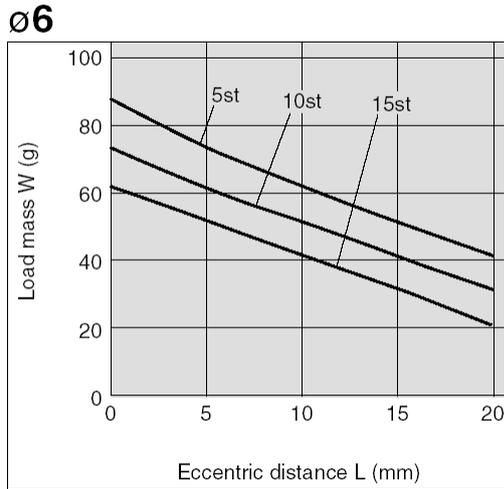
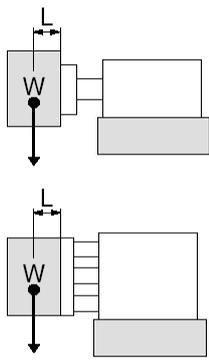
**Figure 4-1**

### 4-2. Allowable lateral load of the plate

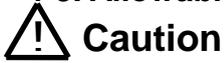


#### Caution

If this cylinder has an eccentric distance (L) from the plate (the rod end), the load weight (W) should be not more than the values shown in the graph below. If this cylinder is operated outside of the limited range, it may reduce the life time or damage the machine.

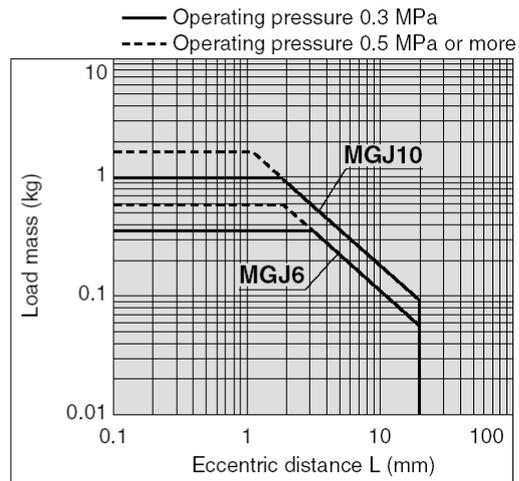
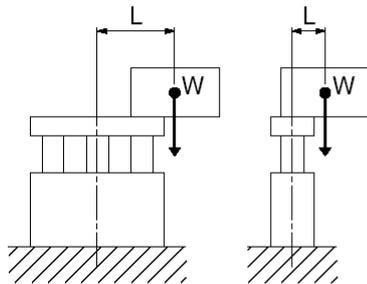


### 4-3. Allowable eccentric load

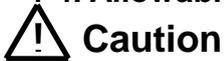


#### Caution

Make sure that the load mass (W) is within the range in the graph below when there is an eccentric distance (L) from the center of the cylinder. Using cylinders are beyond the limit may shorten the product service life or cause damage.

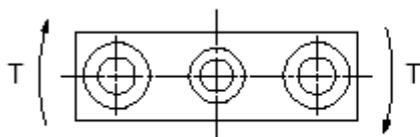


### 4-4. Allowable rotating torque of the plate



#### Caution

The rotating torque (T) applied to the plate (the rod end) should be not more than the values shown in the table below. If this cylinder is operated outside of the limited range, it may reduce the life time or damage the machine.



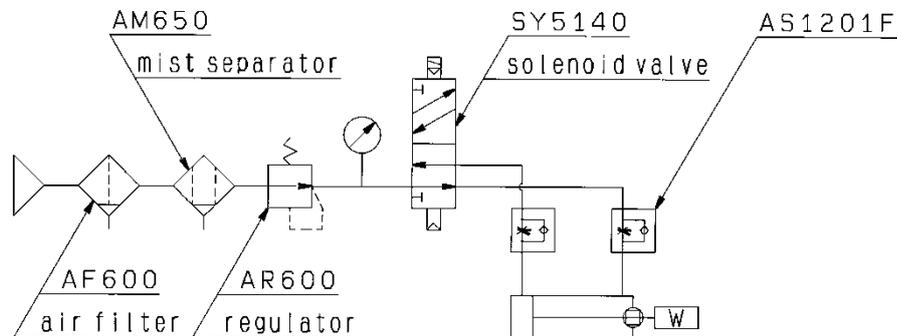
Unit: cN·m

Bore size (mm)	Stroke (mm)			
	5	10	15	20
<b>6</b>	0.92	0.73	0.61	—
<b>10</b>	4.75	3.96	3.36	2.87

**Figure 4-3**

## 5. Pneumatic Circuit

The basic circuit (meter-out) for operating the product with air filter, regulator, solenoid valve and speed controller is shown in the following figure.



**Figure 5-1**

## 6. Maintenance

### 6-1. Daily check

- 1) Smoothness of the operation
- 2) Changes in piston speed and cycle time
- 3) Proper stroking

### 6-2. Regular maintenance

- 1) Looseness of the cylinder mounting bolts and the workpiece
- 2) Smoothness of the operation
- 3) Changes in piston speed and cycle time
- 4) External leakage
- 5) Proper stroking
- 6) Scratches on piston rod
- 7) Whether drainage in the air filter is regularly discharged or not.

Check at least the items shown above, and if any abnormalities are found, take appropriate action.

Contact your SMC Sales representative for any inquiries.

### **Warning**

#### **1) Maintenance should be performed according to the procedure above.**

Improper handling can cause damage and malfunction of equipment and machinery.

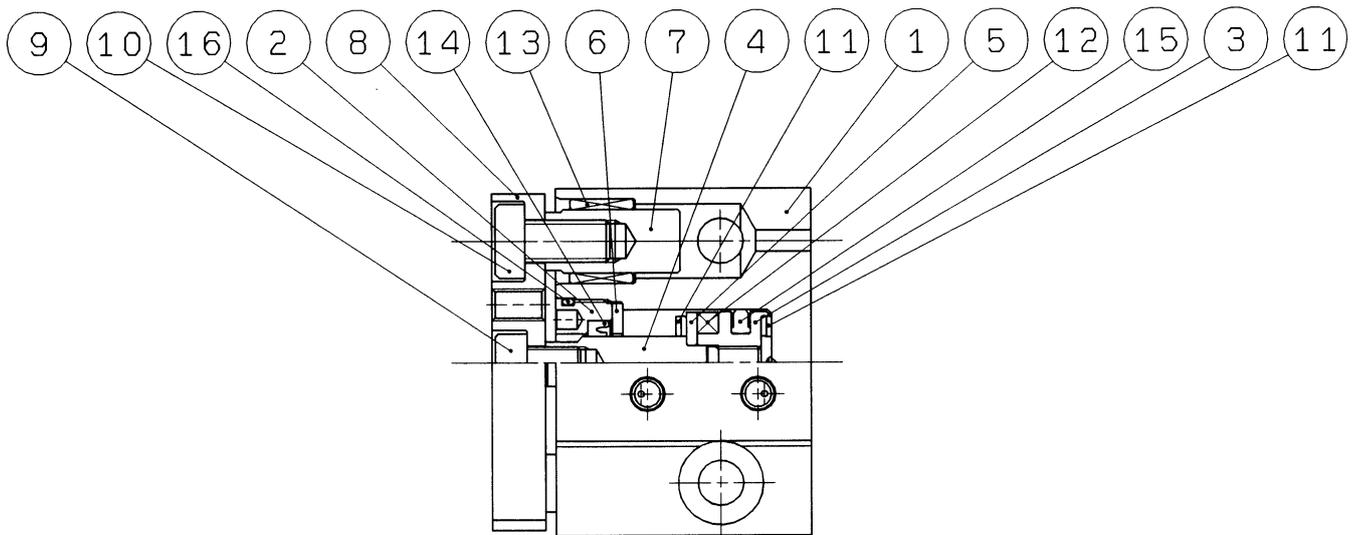
#### **2) Removal of equipment, and supply/exhaust of compressed air**

When equipment is serviced, first confirm that measures are in place to prevent dropping of driven objects and or equipment running out of control, etc. Then cut the supply pressure and the power of facilities, and exhaust all compressed air from the system. Before restarting the equipment, confirm that measures are taken to prevent sudden action.

## 7. Troubleshooting

Trouble	Trouble	Cause	Countermeasures	Referential section
Operation is not smooth. Force has decreased. Does not operate.	Air leakage (External leakage)	<ol style="list-style-type: none"> <li>Frictional wear of the rod seal due to scratches on the piston rod surface</li> <li>Frictional wear of the rod seal due to insufficient grease on the piston rod</li> <li>Frictional wear of the rod seal due to usage outside of the operating temperature range</li> </ol>	<ol style="list-style-type: none"> <li>Ask SMC for replacement of the rod seal.</li> <li>Ask SMC for replacement of the rod seal and add grease.</li> <li>Operate within the operating temperature range after the rod seal is replaced by SMC.</li> </ol>	
	Air leakage (Internal leakage)	<ol style="list-style-type: none"> <li>Frictional wear of the piston seal due to loss of grease because of liquid such as drainage entering inside and washing the grease away.</li> </ol>	<ol style="list-style-type: none"> <li>After the piston seal is replaced by SMC, install air preparation equipment such as a filter to the piping.</li> </ol>	3-1.
	Insufficient air pressure	<ol style="list-style-type: none"> <li>Source pressure has lowered.</li> <li>Inadequate setting of the regulator</li> <li>Clogging of the piping</li> </ol>	<ol style="list-style-type: none"> <li>Supply adequate pressure.</li> <li>Set the regulator again.</li> <li>Flush the piping.</li> </ol>	3-1.
	Excessive load	<ol style="list-style-type: none"> <li>Lateral load over the allowable value was applied.</li> <li>Rotating torque over the allowable value was applied.</li> </ol>	<ol style="list-style-type: none"> <li>Operate it within the allowable range.</li> <li>Operate it within the allowable range.</li> </ol>	4-2. 4-3.
	Operation at a low speed	<ol style="list-style-type: none"> <li>Operation at a speed lower than the specified operating piston speed.</li> </ol>	<ol style="list-style-type: none"> <li>Operate it within the specification range.</li> </ol>	3-3.
	Inadequate pneumatic circuit	<ol style="list-style-type: none"> <li>Inappropriate system composition</li> </ol>	Use piping tubing, fitting, directional control valve, speed controller etc. of adequate size.	3-1. 3-5.
The parts are damaged.	Bumper or piston rod or guide rod or rod cover or body is damaged.	<ol style="list-style-type: none"> <li>Operation at a high speed due to inappropriate adjustment of the speed controller</li> <li>Kinetic energy over the allowable value was applied.</li> <li>Lateral load over the allowable value was applied.</li> <li>Rotating torque over the allowable value was applied.</li> <li>Excessive external force was applied.</li> </ol>	<ol style="list-style-type: none"> <li>Adjust the speed by the speed controller and keep within the specified range.</li> <li>Keep within the specified allowable kinetic energy range.</li> <li>Keep within the specified allowable lateral load range.</li> <li>Keep within the specified allowable rotating torque range.</li> <li>It may cause damage and deformation of the cylinder if the mechanism interferes or eccentric load or over load is applied to it. Remove such causes.</li> </ol>	3-3. 4-1. 4-2. 4-3.

## 8. Basic Construction



16	O-ring	NBR	
15	Piston seal	NBR	
14	Rod seal	NBR	
13	Bushing	Oil-impregnated sintered bearing	
12.	Magnet	Magnet	
11	Bumper	Resin	
10	Hexagon thin socket head bolt	Structural steel	
9	Hexagon socket head cap screw	Structural steel	For $\Phi 10$
	Torx head cap screw	Structural steel	For $\Phi 6$
8	Plate	Aluminum alloy	
7	Guide rod	Structural steel	
6	Seal retainer	Stainless steel	For $\Phi 10$
		Aluminum alloy	For $\Phi 6$
5	Magnet retainer	Stainless steel	For $\Phi 10$
		Aluminum alloy	For $\Phi 6$
4	Piston rod	Stainless steel	
3	Piston	Aluminum alloy	
2	Rod cover	Aluminum alloy	
1	Body	Aluminum alloy	
No.	Description	Material	Remarks

Revision history
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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.

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