

# Low Friction Cylinders

## Metal Seal Type

**ø30, ø40  
newly added**

**Compact  
Low Friction Cylinder  
Series MQQ**

Series	Bore size (mm)	Operating pressure range (MPa)	Actuation speed (mm/s)
<b>MQQT</b> Standard type	10	0.005 to 0.5	0.3 to 300
	16		
	20		
<b>MQQL</b> Lateral load resisting type (Built-in ball bushing)	25	0.005 to 0.7	0.5 to 500
	30		
	40		

**Lateral Load Resisting  
Low Friction Cylinder  
Series MQM**

Series	Bore size (mm)	Operating pressure range (MPa)	Actuation speed (mm/s)
<b>MQML</b> Standard type	6 (Standard only)	ø6: 0.02 to 0.7 ø10 to ø25: 0.005 to 0.7	0.5 to 1000
	10		
	16		
<b>MQML□□H</b> High speed/frequency	20	0.01 to 0.7	5 to 3000
	25		

**NEW**

**Low Friction Cylinder  
(Single Acting)  
Series MQP**

Series	Bore size (mm)	Operating pressure range (MPa)	Thrust control standard (N)
<b>MQP</b>	ø4	0.001 to 0.7 (Except for moving parts weight)	0.01 to 8
	ø6		0.03 to 19
	ø10		0.08 to 50
	ø16		0.20 to 140
	ø20		0.30 to 200

# Low Friction Cylinder Series MQP



Fully covers a pressure force

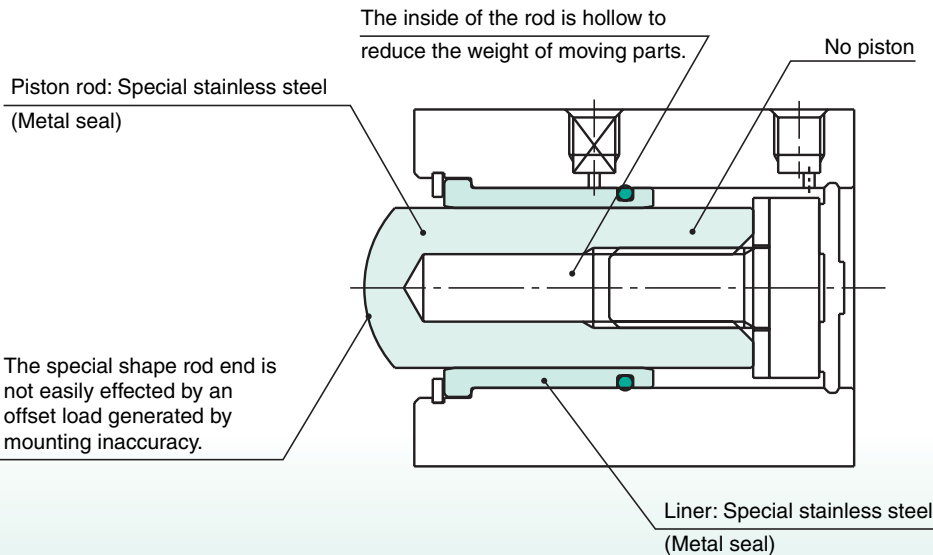
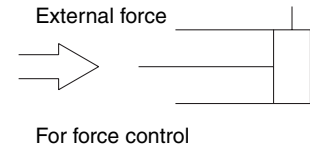
## No lurching

Even extremely small degree lurching such as 0.01 mm does not occur. In addition, special air supply to a bearing for fluid is unnecessary.

## No piston

Sliding resistance is drastically decreased because the piston and the rod share the same shaft.

## Special single acting/Piston retraction by external force



## Reduced thrust dispersion

Dispersion of piston diameter: 3 μm or less  
Readjusting thrust is not necessary when the cylinder is replaced.  
Dispersion of thrust does not occur even more than one cylinder is connected to the same circuit, either. (Depends on the operation environment.)

## Low friction and soft-touching

Possible to control the output in increments of 0.01 N. (Depends on the piston area of a cylinder x pressure accuracy)  
In addition, sliding resistance does not change after periods of non-operation.

## High-precision linear control

Delicate and precise linear movement control is possible.

### Series MQP

Low friction cylinder suitable for low friction, force control.

Bore size [mm] (Pressure receiving diameter)	Stroke [mm]	Operating pressure range [MPa]	Weight of moving parts [g]	Thrust control standard [N]
ø 4	10	0.001 to 0.7 (Excluding the weight of moving parts)	4	0.01 to 8
ø 6			8	0.03 to 19
ø10			24	0.08 to 50
ø16			62	0.20 to 140
ø20			103	0.30 to 200

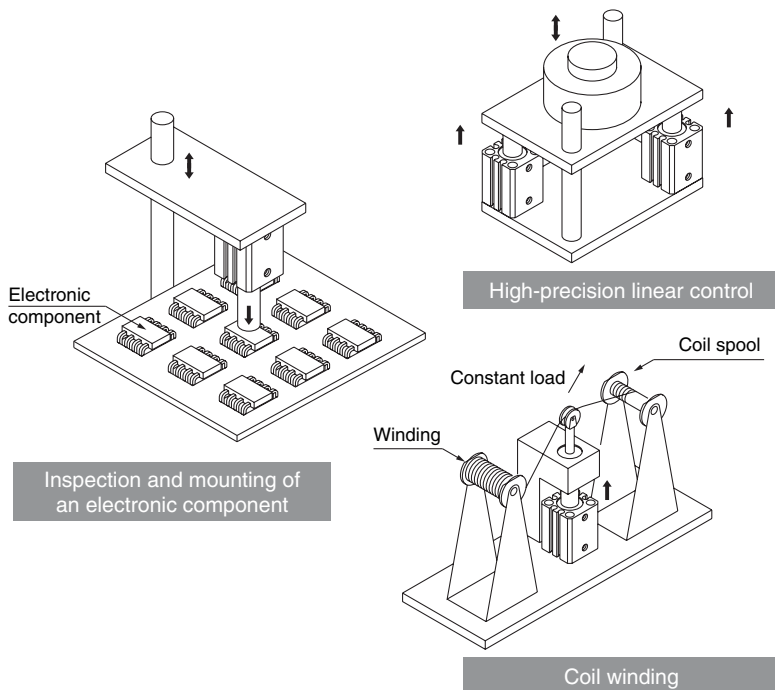
# (Metal Seal Type/Single Acting)

/ø4, ø6, ø10, ø16, ø20

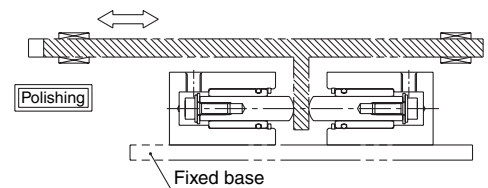
control range of 0.01 N to 200 N

## Application Examples: For force control responding to a slight pressure fluctuation

### Application examples for a single acting model



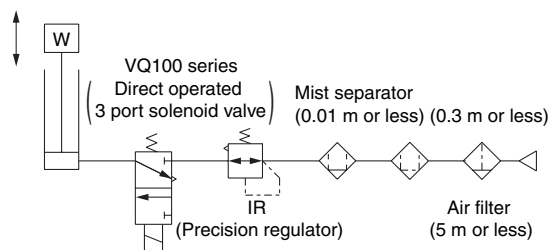
### Application example for a double acting model



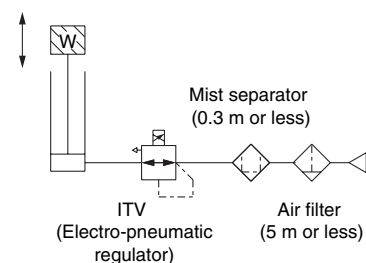
Using 2 MQP cylinders can improve the thrusting accuracy of an MQQ and/or MQM double acting metal cylinder. Additionally, equal strength of both extension and retracting thrust can be obtained.

## Recommended Circuit Examples

### Example 1) Normal operation



### Example 2) Soft-touch operation



- 1) When using a solenoid valve, SMC recommends you use the VQ100 series in which the lubricant in the main valve will not flow out.
- 2) Do not use a speed controller in the circuit. If it is used, accurate thrust control may not be possible because the internal pressure of a cylinder will drop. Be sure to employ pressure control for control operations.

### Made to Order

- Vacuum retraction cylinder
- Single acting, spring return type (Built-in springs)
- No exterior leakage (For clean rooms)
- Tubing with a maximum of ø40 (I.D.) is available.

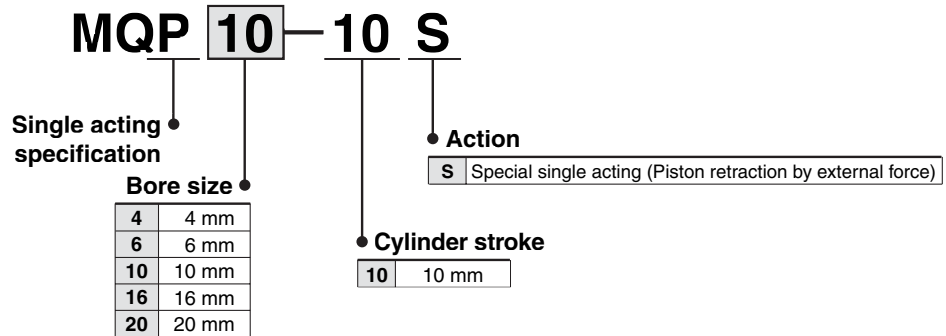
Metal Seal

# Low Friction Cylinder (Single Acting)

## Series MQP

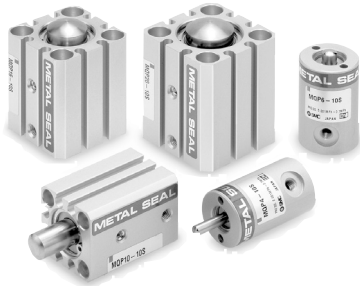
ø4, ø6, ø10, ø16 ø20

### How to Order



\* The MQP series is not auto switch capable.

### Specifications



Bore size (mm)	4	6	10	16	20
<b>Seal construction</b>	Metal seal				
<b>Action</b>	Special single acting (Piston retraction by external force)				
<b>Proof pressure</b>	1.05 MPa				
<b>Maximum operating pressure</b>	0.7 MPa				
<b>Minimum operating pressure</b> <small>Note 1)</small>	0.001 MPa				
<b>Ambient and fluid temperature</b>	-5 to +80C				
<b>Lubrication</b> <small>Note 2)</small>	Not required (Non-lube)				
<b>Stroke length tolerance</b>	+1.0 0				
<b>Total allowable leakage</b>	Supply pressure 0.1 MPa	100 cm <sup>3</sup> /min or less			
	Supply pressure 0.3 MPa	500 cm <sup>3</sup> /min or less			
	Supply pressure 0.5 MPa	1000 cm <sup>3</sup> /min or less			

Note 1) Excluding the weight of moving parts

Note 2) Refer to precautions on page 22 regarding lubrication.

### Moving Parts and Total Weight

Bore size (mm)	Moving parts weight	Total weight
4	4	43
6	8	55
10	24	96
16	62	161
20	103	239

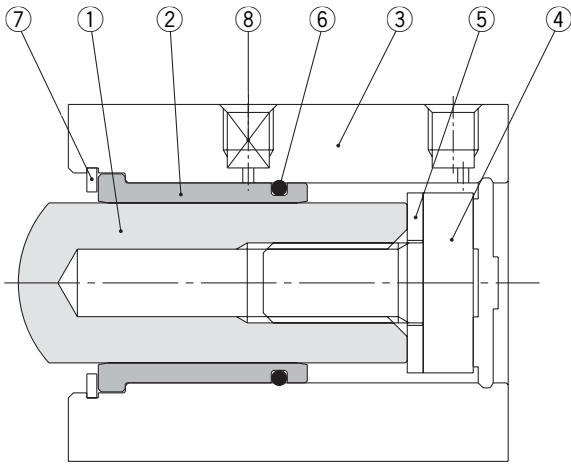
Unit: g

### Theoretical Output

Bore size (mm)	Piston area (mm <sup>2</sup> )	Operating pressure (MPa)						
		0.1	0.2	0.3	0.4	0.5	0.6	0.7
4	12.6	1.3	2.6	3.9	5.2	6.5	7.8	9.1
6	28.3	2.8	5.6	8.4	11.2	14.0	16.8	19.6
10	78.5	7.9	15.7	23.6	31.4	39.3	47.1	55.0
16	196.1	19.6	39.2	58.9	78.4	98.1	117.7	137.3
20	314.2	31.4	62.8	94.3	125.7	157.1	188.5	219.9

Unit: N

## Construction

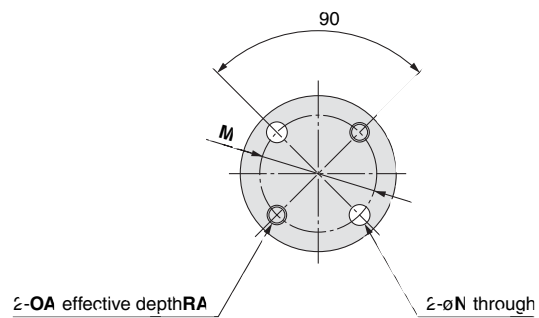
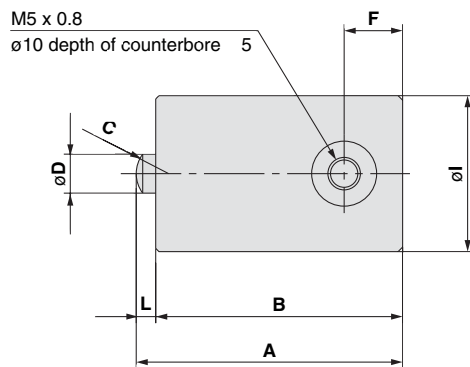


### Component Parts

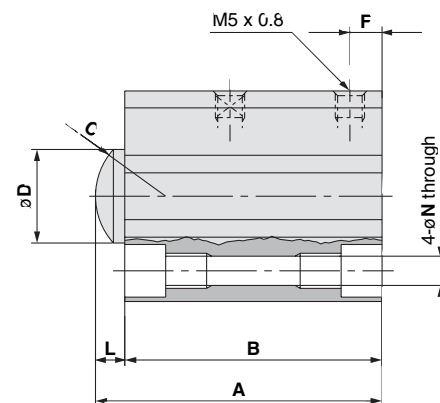
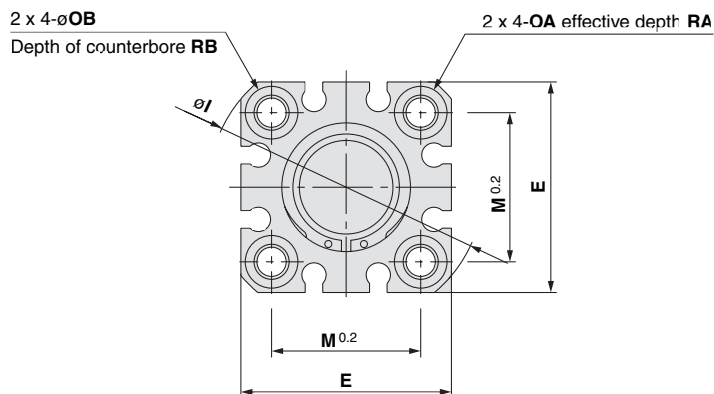
No.	Description	Material	Note
1	<b>Piston rod</b>	Special stainless steel	
2	<b>Liner</b>	Special stainless steel	
3	<b>Cylinder tube</b>	Aluminum alloy	Harc anodized
4	<b>Bolt</b>	Carbon tool steel	
5	<b>Bumper</b>	Fluororesin	
6	<b>O-ring</b>	NBR	
7	<b>Retaining ring</b>	Carbon tool steel	Nicel plated
8	<b>Plug</b>	Carbon tool steel	Nicel plated

## Dimensions

**ø4, ø6**



**ø10, ø16, ø20**



(mm)

Bore size (mm)	A	B	C	D <sup>Note)</sup>	E	F	I	L	M	N	OA	OB	RA	RB
4	41	38	SR3	4	—	9	22	3	16	3.2	M3 x 0.5	—	6	—
6	41	38	SR5	6	—	9	24	3	18	3.2	M3 x 0.5	—	6	—
10	46.5	41.5	SR8	10	29	5.5	38	5	20	3.5	M4 x 0.7	6.5	7	4
16	49	44	SR12	16	36	5.5	47	5	25.5	5.4	M6 x 1.0	9	10	7
20	52.5	47.5	SR15	20(19)	40	5.5	52	5	28	5.4	M6 x 1.0	9	10	7

Note) Figures in ( ) are the diameter in the rod end part.



# Series MQP

## Specific Product Precautions

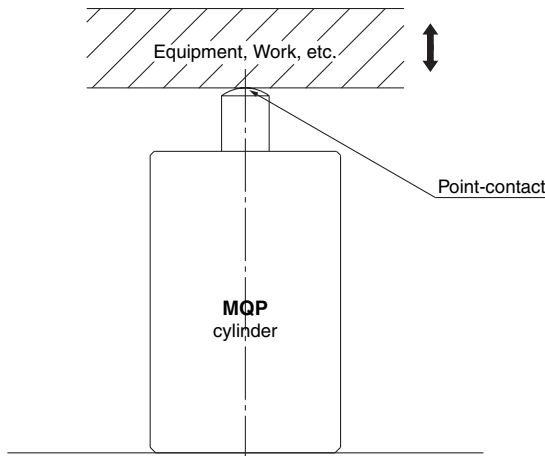
Be sure to read this before handling.

Refer to back page 1 through to 3 for Safety Instructions and Actuators Precautions.

### Operation

#### ⚠ Caution

1. When mounting, thoroughly flush out the connector piping and be sure that dirt and chips, etc., do not get inside the cylinder.
2. Install an air filter with a nominal filtration degree of 5 μm or less on the air supply. Furthermore, when controlling for low speed or controlled output, use clean air (atmospheric pressure dew point temperature of -10°C or less). Installation of a mist separator (nominal filtration degree 0.3 μm or less) is also recommended.
3. Use a metal seal type when using solenoid valves for cylinder actuation. If a rubber seal type is used, there may be an increase in operating resistance due to grease sprayed from the main valve.
4. This cylinder cannot be used at the end of its stroke. Use it with an intermediate stroke of 10 mm.
5. The rod end should not come in direct contact with an equipment or workpiece. Also, make sure that the opposite side of the rod end is flat to make point-contact with the spherical surface of the rod end.



The material of the cylinder rod is heat-treated stainless steel (HRC60). The roughness of the spherical contact of the attaching part (Equipment, Work, etc) should be Rz6.3 and the material should be HB100 or greater (Aluminum material: 2000 line or 7000 line or equivalent) When higher precision or longer service life is required, we recommend using a heat-treated material + flat polished machined material (Rz0.8)

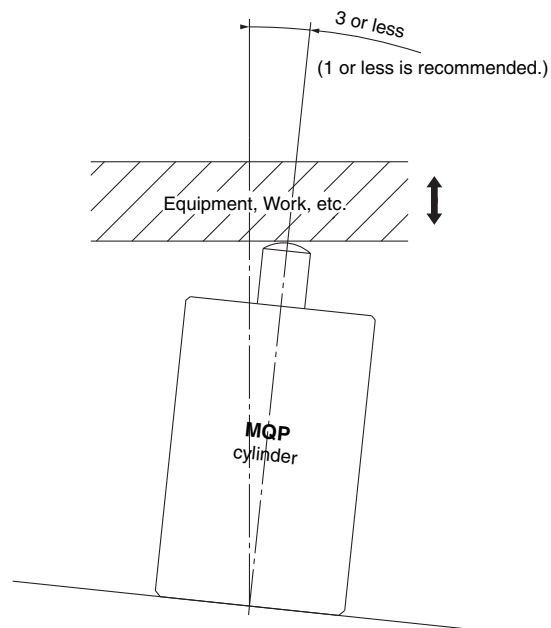
Also, although applying grease on the spherical contact parts will make the operation more smooth and reduce the abrasion, use caution to prevent any grease from being applied to the cylinder's sliding surface.

### Operation

6. When connecting, be sure to align the rod axis with the load and the direction of movement.

The allowable angle of the cylinder's mounting surface in an equipment should be 3 or less.

(1 or less is recommended.) When not properly aligned, a lateral load will likely be applied to the rod and the spherical surface will likely skid. This will result in a reduction or dispersion of thrust and likely a malfunction.



### Disassembly

#### ⚠ Caution

1. The component parts of the metal seal cylinder are manufactured to precision tolerances, and therefore cannot be disassembled.

### Lubrication

#### ⚠ Caution

1. Lubrication of non-lube type cylinder

Do not apply lubrication when controlling for low speed or controlled output. If lubrication is applied, there may be changes in operating resistance due to factors such as the viscosity and surface tension of the oil. Also, use a metal seal type when using solenoid valves for cylinder actuation. If a rubber seal type is used, there may be an increase in operating resistance due to grease sprayed from the main valve.


Lubrication is also unnecessary for high speed actuation, but in the event that lubrication is applied, use turbine oil class 1 (with no additives) ISO VG32. (Do not use spindle oil or machine oil.)







# Series *MQQ/MQM/MQP* Safety Instructions

The following safety instructions are intended to prevent a hazardous situation and/or equipment damage. The instructions indicate the level of potential hazard by labels of "Caution", "Warning" or "Danger". To ensure safety, please observe all safety practices, including ISO 4414 <sup>Note 1)</sup> and JIS B 8370 <sup>Note 2)</sup>.

 **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 possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power – General rules relating to systems

Note 2) JIS B 8370: General Rules for Pneumatic Equipment

## Warning

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

Since the products specified here are used in various operating conditions, their compatibility with a specific pneumatic system must be based on specifications, post analysis and/or tests to meet a specific requirement. The expected performance and safety assurance is the responsibility of the person who determines the compatibility of the system. This person should continuously review the suitability of all specified items by referring to the latest information in the catalog and by taking into consideration the possibility of equipment failure when configuring the system.

### **2. Only trained personnel should operate pneumatic machinery and equipment.**

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

### **3. Do not service machinery/equipment or attempt to remove components until the safety of the worker is confirmed.**

1. Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of the driven objects have been confirmed.
2. When equipment is to be removed, confirm that all safety precautions have been followed. Turn off the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before restarting any machinery/equipment exercise caution to prevent quick extension of a cylinder piston rod, etc.

### **4. Contact SMC if the product will be used in any of the following conditions:**

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, clutch and brake circuits in press applications, or safety equipment.
3. An application which has the possibility of having a negative affect on people, property, requiring special safety analysis.



# Actuators Precautions 1

Be sure to read this before handling.

## Caution on Design

### Warning

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

In such cases, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be adjusted to operate smoothly and designed to avoid such dangers.

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

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

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

Especially when a cylinder 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 may be required.

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

In this case, the rigidity of the machinery should also be examined.

#### 5. Consider a possible drop in circuit pressure due to a power outage, etc.

When a cylinder is used in a clamping mechanism, there is a danger of workpieces dropping if there is a decrease in clamping force due to a drop in circuit pressure caused by a power outage, etc. Therefore, safety equipment should be installed to prevent damage to machinery and human injury. Suspension mechanisms and lifting devices also require consideration for drop prevention.

#### 6. Consider a possible loss of power source.

Measures should be taken to protect against bodily injury and equipment damage in the event that there is a loss of power to equipment controlled by pneumatics, electricity, or hydraulics.

#### 7. Design circuitry to prevent sudden lurching of driven objects.

When a cylinder is driven by an exhaust center type directional control valve or when starting up after residual pressure is exhausted from the circuit, etc., the piston and its driven object will lurch at high speed if pressure is applied to one side of the cylinder because of the absence of air pressure inside the cylinder. Therefore, equipment should be selected and circuits designed to prevent sudden lurching, because there is a danger of human injury and/or damage to equipment when this occurs.

#### 8. Consider emergency stops.

Design so that human injury and/or damage to machinery and equipment will not be caused when machinery is stopped by a safety device under abnormal conditions, a power outage or a manual emergency stop.

#### 9. Consider the action when operation is restarted after an emergency stop or abnormal stop.

Design the machinery so that human 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.

## Selection

### Warning

#### 1. Confirm the specifications.

The products featured in this catalog are designed for use in industrial compressed air systems. If the products are used in conditions where pressure and/or temperature are outside the range of specifications, damage and/or malfunctions may occur. Do not use in these conditions. (Refer to the specifications.)

Please consult with SMC if you use a fluid other than compressed air.

#### 2. Intermediate stops

When intermediate stopping of the cylinder piston is performed by a 3 position closed center type directional control valve, it is not possible to maintain the stop position for an extended time due to the construction of the metal seal cylinder.

### Caution

#### 1. Operate the piston within a range such that collision damage will not occur at the stroke end.

#### 2. When controlling cylinder output, do not create a restricting circuit by using a speed controller, etc. Pressure inside the cylinder will drop and control will become impossible. Be sure to control actuation through pressure control.

## Mounting

### Caution

#### 1. Be certain to match the rod shaft center with the direction of the load and movement when connecting.

When not properly matched, problems may arise with the rod and tube, and damage may be caused due to friction on areas such as the inner tube surface, bushings, rod surface and seals.

#### 2. When an external guide is used, connect the 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 gouge the sliding parts of the cylinder tube or tube rod, etc., by striking or grasping them with other objects.

Cylinder bores are manufactured to precise tolerances, so that even a slight deformation may cause malfunction. Also, scratches or gouges, etc., in the tube rod may lead to damaged seals and cause air leakage.

#### 4. Prevent the seizure of rotating parts.

Prevent the seizure of rotating parts (pins, etc.) by applying grease.





# Actuators Precautions 2

Be sure to read this before handling.

## Mounting

### ⚠ Caution

#### 5. Do not use until you verify that the equipment can operate properly.

After mounting, repairs, or modification, etc., connect the air supply and electric power, and then confirm proper mounting by means of appropriate function and leak tests.

#### 6. Instruction manual

Install the products and operate them only after reading the instruction manual carefully and understanding its contents. Also keep the manual where it can be referred to as necessary.

## Piping

### ⚠ Caution

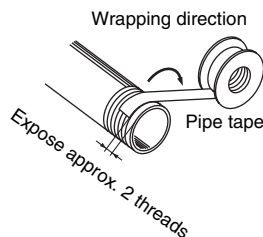
#### 1. Preparation before piping

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

#### 2. Wrapping of pipe tape

When screwing in pipes and fittings, etc., be certain that chips from the pipe threads and sealing material will not ingress inside the piping.

Also, when pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



## Lubrication

### ⚠ Caution

#### 1. Lubrication of non-lube type cylinder

Do not apply lubrication when controlling for low speed or controlled output. If lubrication is applied, there may be changes in operating resistance due to factors such as the viscosity and surface tension of the oil. Also, use a metal seal type when using solenoid valves for cylinder actuation. If a rubber seal type is used, there may be an increase in operating resistance due to grease sprayed from the main valve.

Lubrication is also unnecessary for high speed actuation, but in the event that lubrication is applied, use turbine oil class 1 (with no additives) ISO VG32. (Do not use spindle oil or machine oil.)

## Air Supply

### ⚠ 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.

## Air Supply

### ⚠ Caution

#### 1. Install air filters.

Install air filters near valves on their upstream side. The nominal filtration degree should be 5 μm or less. Furthermore, when controlling for low speed or controlled output, use clean air (atmospheric pressure dew point temperature of  $-10^{\circ}\text{C}$  or less). Installation of mist separator AM series (nominal filtration degree 0.3 μm or less) or AM + AMD series (nominal filtration degree 0.01 μm or less) is also recommended.

#### 2. Install an aftercooler, air dryer, or water separator.

Air that includes excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an air dryer, aftercooler or water separator, etc.

#### 3. Use the product within the specified range of fluid and ambient temperature.

Take measures to prevent freezing when below  $5^{\circ}\text{C}$ , since moisture in circuits can freeze and cause damage to seals and lead to malfunctions.

For compressed air quality, refer to "Best Pneumatics 2004 Vol.14" catalog.

## Operating Environment

### ⚠ Warning

#### 1. Do not use in atmospheres or locations where corrosion hazards exist.

#### 2. In dusty locations or where water or oil, etc., splash on the equipment, take suitable measures to protect the rod.

## Maintenance

### ⚠ Warning

#### 1. Perform maintenance procedures as shown in the instruction manual.

If it is handled improperly, malfunction or damage of machinery or equipment may occur.

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

Before any machinery or equipment is removed, first ensure that the appropriate measures are in place to prevent the fall or erratic movement of driven objects and equipment, then cut off the electric power and reduce the pressure in the system to zero. Only then should you proceed with the removal of any machinery and equipment.

When machinery is restarted, proceed with caution after confirming that appropriate measures are in place to prevent cylinders from sudden movement.

### ⚠ Caution

#### 1. Drain flushing

Remove drainage from air filters regularly. (Refer to the specifications.)