



**Series CUJ**

# Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of "Caution", "Warning" or "Danger". To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

**⚠ 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 — Recommendations for the application of equipment to transmission and control 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 for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.

**2. Only trained personnel should operate pneumatically operated machinery and equipment.**

Compressed air can be dangerous if handled incorrectly. 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 safety is confirmed.**

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back pressure.)

**4. Contact SMC if the product is to 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, press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.



# Series CUJ Actuator Precautions 1

Be sure to read before handling.

## Design

### ⚠ Warning

#### 1. There is a danger of sudden action by air cylinders if sliding parts of machinery are twisted, etc., and changes in forces occur.

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 designed to avoid such dangers.

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

If a driven object and moving parts of a cylinder pose a danger of human injury, 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 work pieces 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. Suspended 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 human injury and equipment damage in the event that there is a loss of power to equipment controlled by pneumatics, electricity or hydraulics, etc.

#### 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, such as a power outage or a manual emergency stop.

## Design

### ⚠ Warning

#### 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 safe manual control equipment.

## Selection

### ⚠ Warning

#### 1. Confirm the specifications.

The products included in this catalog are designed according to use in industrial compressed air systems. If the products are used in conditions where pressure and/or temperature are out of specification, damage and/or malfunction may be caused. Do not use in these conditions. (Refer to specifications.)

Consult SMC if you use a fluid other than compressed air.

#### 2. Intermediate stops

When intermediate stopping of a cylinder piston is performed with a 3 position closed center type directional control valve, it is difficult to achieve stopping positions as accurate and precise as with hydraulic pressure 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 an extended period of time. Contact SMC in case it is necessary to hold a stopped position for an extended period.

### ⚠ Caution

#### 1. Operate within the limits of the maximum usable stroke.

The piston rod will be damaged when operated with a stroke exceeding the maximum stroke range. Refer to the air cylinder selection procedures regarding the maximum usable stroke.

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

Operate within a range such that damage will not occur when the piston having inertial force stops by striking the cover at the stroke end. Refer to the cylinder selection procedures for the range within which damage will not occur.

#### 3. Use a speed controller to adjust the cylinder drive speed, gradually increasing from a low speed to the desired speed setting.

#### 4. Provide an intermediate support for a cylinder with a long stroke.

If the cylinder has a long stroke, provide an intermediate support to prevent the rod from sagging and the tube from bending, as well as to prevent damage to the rod due to vibrations or external loads.



# Series CUJ

## Actuator Precautions 2

Be sure to read before handling.

### Mounting

#### ⚠ Caution

##### 1. Be sure to connect so that the rod axis is aligned with the load and movement direction.

If they are not aligned, stress could be applied to the rod and the tube, causing the inner surface of the tube, the bushing, the rod surface, and the seals to wear and to become damaged.

##### 2. Do not scratch or gouge the sliding parts of the cylinder tube or piston rod 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 in the piston rod may lead to damaged seals and cause air leakage.

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

Following mounting, repair or conversions, verify correct mounting by suitable function and leakage tests after compressed air and power are connected.

##### 4. Instruction manual

The product should be mounted and operated after thoroughly reading the manual and understanding its contents.

Keep the instruction manual where it can be referred to as needed.

### Piping

#### ⚠ Caution

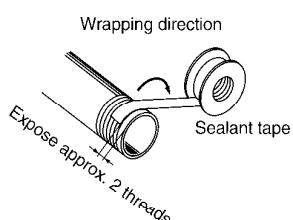
##### 1. Preparation before piping

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 sealant tape

When screwing together pipes and fittings, etc., be certain that chips from the pipe threads and sealing material do not get inside the piping.

Also, when sealant 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

The cylinder is lubricated at the factory and can be used without any further lubrication.

However, in the event that it will be lubricated, use class 1 turbine oil (with no additives) ISO VG32.

Stopping lubrication later may lead to malfunction due to the loss of the original lubricant. Therefore, lubrication must be continued once it has been started.

### Air Supply

#### ⚠ Warning

##### 1. Use clean air.

Do not use compressed air that includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction.

#### ⚠ Caution

##### 1. Install air filters.

Install air filters at the upstream side of valves. The filtration degree should be 5µm or finer.

##### 2. Install an air dryer, after-cooler or water separator, etc.

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

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

At temperatures of 5°C or lower, take measures to prevent freezing, since moisture in circuits may be frozen and this can cause damage to seals and lead to malfunction.

Refer to SMC's "Air Cleaning Equipment" catalog for further details on compressed air quality.



# Series CUJ

## Actuator Precautions 3

Be sure to read before handling.

### 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. In dusty locations or where water or oil splash on the equipment, install a protective cover over the rod.
3. When using auto switches, do not operate in an environment with strong magnetic fields.

### Maintenance

#### ⚠ Warning

1. Perform maintenance according to the procedure indicated in the instruction manual.  
If handled improperly, malfunction and damage of machinery or equipment may occur.
2. Removal of equipment, and supply/exhaust of compressed air  
When machinery is removed, first check measures to prevent dropping of driven objects and run-away of equipment, etc. Then cut off the supply pressure and electric power, and exhaust all compressed air from the system.  
When machinery is restarted, proceed with caution after confirming measures to prevent cylinder lurching.

#### ⚠ Caution

##### 1. Drain flushing

Drain air filters regularly.



# Series CUJ

## Auto Switch Precautions 1

Be sure to read before handling.

### Design and Selection

#### ⚠ Warning

##### 1. Confirm the specifications.

Read the specifications carefully and use this product appropriately. The product may be damaged or malfunction if it is used outside the range of specifications for load current, voltage, temperature or impact.

##### 2. Take precautions when multiple cylinders are used close together.

When multiple auto switch cylinders are used in close proximity, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40mm. (When the allowable separation is indicated for each cylinder series, use the specified value.)

##### 3. Monitor the length of time that a switch is ON at an intermediate stroke position.

When an auto switch is placed at an intermediate position of the stroke and a load is driven at the time the piston passes, the auto switch will operate, but if the speed is too great the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

$$V(\text{mm/s}) = \frac{\text{Auto switch operating range (mm)}}{\text{Load operating time (ms)}} \times 1000$$

##### 4. Keep wiring as short as possible.

<Solid state switch>

Although wire length should not affect switch function, use a wire 100m or shorter.

##### 5. Be careful of the internal voltage drop of the switch.

<Solid state switch>

Generally, the internal voltage drop will be greater with a 2 wire solid state auto switch than with a reed switch.

- Note that there will be a large voltage drop if auto switches are connected in series as shown below. (Refer to internal voltage drop in the auto switch specifications.)

[The voltage drop will be "n" times larger when "n" auto switches are connected.]

Even though auto switches operate normally, the load may not operate.



### Mounting and Adjustment

#### ⚠ Warning

##### 1. Do not drop or bump.

Do not drop, bump or apply excessive impacts (1000m/s<sup>2</sup> or more for solid state switches) while handling. Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

##### 2. Do not carry a cylinder by the auto switch lead wires.

Never carry a cylinder by its lead wires. This may not only cause broken lead wires, but it may cause internal elements of the switch to be damaged by the stress.

##### 3. Mount switches using the proper tightening torque.

When a switch is tightened beyond the range of tightening torque, the mounting screws or switch may be damaged.

On the other hand, tightening below the range of tightening torque may allow the switch to slip out of position. (Refer to page 10 regarding switch mounting, movement and tightening torque, etc.)

#### ⚠ Warning

- Similarly, when operating below a specified voltage, it is possible that the load may be ineffective even though the auto switch function is normal. Therefore, the formula below should be satisfied after confirming the minimum operating voltage of the load.

$$\text{Supply - Internal voltage drop of switch} > \text{Minimum operating voltage of load}$$

Also, note that a 12VDC relay is not applicable.

##### 6. Be careful of leakage current.

<Solid state switch>

With a 2 wire solid state auto switch, current (leakage current) flows to the load to operate the internal circuit even when in the OFF state.

$$\text{Operating current of load (OFF condition)} > \text{Leakage current}$$

If the above requirement is not satisfied, it will not reset correctly (stays ON). Use a 3 wire switch if this specification cannot be satisfied.

Moreover, leakage current flow to the load will be "n" times larger when "n" auto switches are connected in parallel.

##### 7. Do not use a load that generates surge voltage.

<Solid state switch>

Although a zener diode for surge protection is connected at the output side of a solid state auto switch, damage may still occur if the surge is applied repeatedly. When a load, such as a relay or solenoid, which generates surge is directly driven, use a type of switch having a built-in surge absorbing element.

##### 8. Cautions for use in an interlock circuit

When an auto switch is used for an interlock signal requiring high reliability, devise a double interlock system to avoid trouble by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch. Also, perform periodic maintenance and confirm proper operation.

##### 9. Ensure sufficient clearance for maintenance activities.

When designing an application, be sure to allow sufficient clearance for maintenance and inspections.



# Series CUJ

## Auto Switch Precautions 3

Be sure to read before handling.

### Operating Environment

#### ⚠ Warning

##### 1. Never use in an atmosphere of explosive gases.

The construction of auto switches is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

##### 2. Do not use in an area where a magnetic field is generated.

Auto switches will malfunction or magnets inside cylinders will become demagnetized.

##### 3. Do not use in an environment where the auto switch will be continually exposed to water.

Although switches, except for a few models, conform to IEC standard IP67 construction (JIS C 0920: watertight construction), they should not be used in applications where they are continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.

##### 4. Do not use in an environment with oil or chemicals.

Consult SMC if auto switches will be used in an environment with coolant, cleaning solvent, various oils or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.

### Maintenance

#### ⚠ Warning

##### 1. Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.

###### 1) Keep switch mounting screws securely tightened.

If screws should become loose or switches should slip from their original mounting position, retighten the screws after readjusting the mounting position.

###### 2) Confirm that there is no damage to lead wires.

To prevent faulty insulation, replace switches or repair lead wires if damage is discovered.

### Other

#### ⚠ Warning

##### 1. Consult SMC concerning water resistance, flexibility of lead wires, and usage at welding sites, etc.



# Series CUJ Specific Product Precautions 1

Be sure to read before handling.

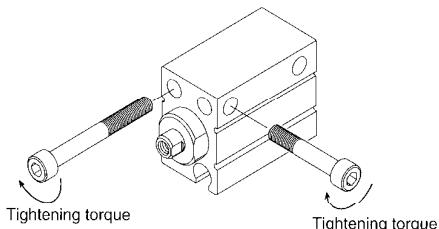
Refer to pages 15 through 21 for safety instructions, actuator precautions and auto switch precautions.

## Mounting

### ⚠ Caution

When mounting a mini free-mount cylinder, tighten the bolts with the proper tightening torque.

	Bolt	Proper tightening torque N m
CUJB4	M2.5 x 0.45	0.54
C(D)UJB6		
C(D)UJB8	M3 x 0.5	1.06
C(D)UJB10		

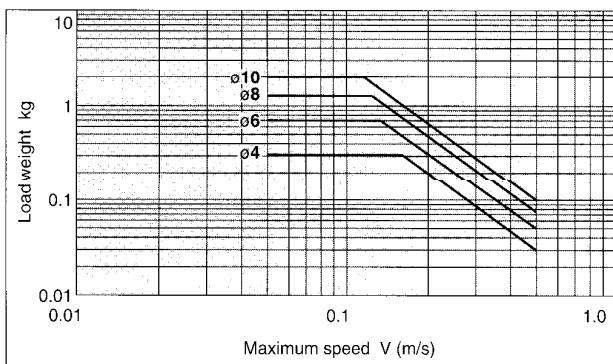


## Allowable Kinetic Energy

### ⚠ Caution

When driving an inertial load, operate a cylinder with kinetic energy within the allowable value. The range in the chart below that is delineated by bold solid lines indicates the relation between load weights and maximum driving speeds.

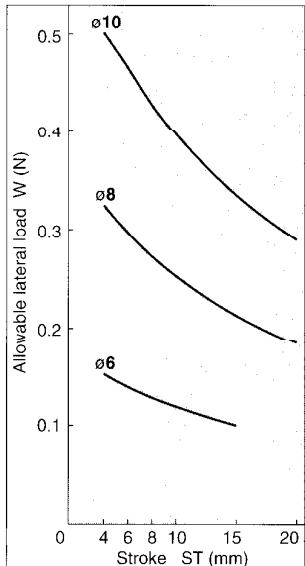
Bore size (mm)	4	6	8	10
Operating piston speed (m/s)		0.05 to 0.5		
Allowable kinetic energy (J)	$3.8 \times 10^{-3}$	$6.25 \times 10^{-3}$	$9.35 \times 10^{-3}$	$12.5 \times 10^{-3}$



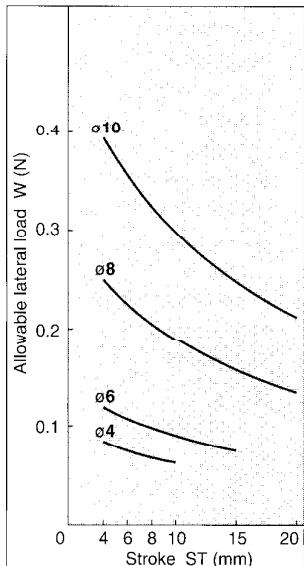
## Selection

Strictly observe the limiting range of lateral load on a piston rod. (See the graphs below.) If this product is used beyond the limits, it may shorten the machine life or cause damage.

### With auto switch



### Without auto switch





## Series CUJ

# Specific Product Precautions 2

Be sure to read before handling.

Refer to pages 15 through 21 for safety instructions, actuator precautions and auto switch precautions.

### Mounting of Speed Controllers and Fittings

#### ⚠ Caution

Since the cylinder port size of M3 x 0.5 is used, use the cylinder series models listed below when connecting speed controllers and fittings directly to cylinders.

1. After manually tightening speed controllers and fittings, tighten approximately a quarter turn more using a tightening tool. In cases where there are gaskets in two places such as universal elbows, universal tees, etc., double the additional tightening to a half turn. If screws are tightened excessively, air leakage may result due to broken threads or a deformed gasket. If screws are tightened insufficiently, looseness and accompanying air leakage are likely to occur.

#### <Speed controllers>

##### With auto switch

Bore size (mm)	6, 8, 10
Port size	M3 x 0.5
Stroke (mm)	4 or more
AS12□1F-M3-23	●
AS12□1F-M3-04	●
AS13□1F-M3-23	●
AS13□1F-M3-04	●

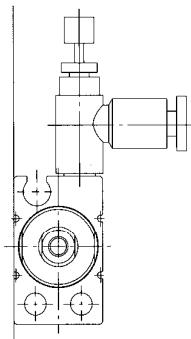
Note) Only applicable to the mounting position shown in Figure 1 below.

##### Without auto switch

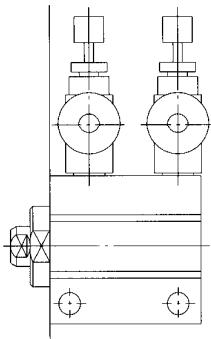
Bore size (mm)	4, 6, 8, 10	
Port size	M3 x 0.5	
Stroke (mm)	6	8 or more
AS12□1F-M3-23	●	●
AS12□1F-M3-04	—	●
AS13□1F-M3-23	●	●
AS13□1F-M3-04	—	●

Note) Only applicable to the mounting position shown in Figure 1 below.

Figure 1



a) Side mount



b) Front mount

#### <One-touch fittings and hose nipples>

##### With auto switch

Bore size (mm)	6, 8, 10	
Port size	M3 x 0.5	
Stroke (mm)	4	6 or more
One-touch fitting	KJS23-M3	●
Hose nipple	M-3AU	●
	M-3ALU	●

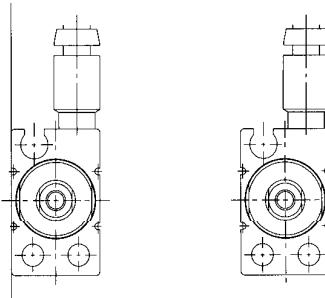
##### Without auto switch

Bore size (mm)	4	6, 8, 10		
Port size	M3 x 0.5			
Stroke (mm)	4	6 or more	4	6 or more
One-touch fitting	KJS23-M3	●	●	●
	KJS04-M3	—	○	—
	KJH23-M3	—	○	—
	KJH04-M3	—	○	—
	KJL23-M3	—	○	—
	KJL04-M3	—	○	—
	KJW23-M3	—	○	—
	KJW04-M3	—	○	—
Hose nipple	M-3AU	●	●	●
	M-3ALU	●	●	●

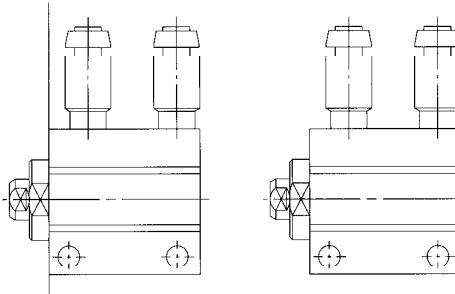
●: Applicable to mounting positions 1, 2, 3 and 4.

○: Applicable to mounting positions 1, 2 and 3.

△: Applicable to mounting positions 1 and 3.



Mounting position 1   Mounting position 2



Mounting position 3   Mounting position 4

Notes) 1. The above figures show the mounting positions with series KJS One-touch fittings installed.

2. Refer to sections starting on pages 2-1-1 and 2-1-47 of "Best Pneumatics No. 4" for the details of One-touch fittings and hose nipples.