



# Rotary Actuators Precautions 1

Be sure to read this before handling products.

## Design/Selection

### Warning

#### 1. Confirm the specifications.

Products represented in this catalog are designed only for use in compressed air systems (including vacuum).

Do not operate at pressures, temperatures, etc. beyond the range of specifications, as this can cause damage or malfunction. (Refer to the specifications.)

We do not guarantee against any damage if the product is used outside of the specification range.

#### 2. If the operation involves load fluctuations, ascending/descending movements, or changes in frictional resistance, make sure to provide safety measures.

Operating speed will increase, and bodily injury or damage to the machinery itself may occur.

#### 3. If there is a chance that the product will pose a hazard to humans, install a protective cover.

If the moving portion of the product will pose a hazard to humans or will damage machinery or equipment, provide a construction that prevents direct contact with those areas.

#### 4. Be certain that the secured portions will not loosen.

Be certain to adopt a reliable connecting method if the rotary actuator is used very frequently or if it is used in a location that is exposed to a large amount of vibration.

#### 5. There may be cases in which a speed-reduction circuit or a shock absorber is required.

If the driven object moves at high speeds or is heavy, it will be unfeasible for only the rotary actuator's cushion to absorb the shock. Therefore, provide a speed-reduction circuit to reduce the rotary actuator's speed before the thrust is applied to the cushion, or an external shock absorber to dampen the shock. If these countermeasures are taken, make sure to take the rigidity of the machinery and equipment into consideration.

#### 6. Consider the possibility of a reduction in the circuit air pressure caused by a power failure.

When an actuator is used as a clamping mechanism, there is a danger of a workpiece dropping if there is a decrease in clamping force due to a drop in circuit pressure caused by a power failure. Therefore, safety equipment should be installed to prevent damage to machinery/equipment and bodily injury.

#### 7. Consider the possibility of power source related malfunctions.

For machinery and equipment that rely on power sources such as compressed air, electricity, or hydraulic pressure, adopt a countermeasure to prevent the equipment from causing a hazard to humans or damage to the machinery and equipment in the event of a malfunction.

#### 8. If a speed controller is provided in the exhaust restrictor, implement a safety design taking the residual pressure into consideration.

If air pressure is applied to the air supply side without residual pressure in the exhaust side, the rotary actuator will operate at an abnormally high speed, which could pose a hazard to humans or damage the machinery and equipment.

#### 9. Consider the behavior of the rotary actuator in the event of an emergency stop.

Devise a safe system so that if a person engages the emergency stop, or if a safety device is tripped during a system malfunction, such as a power failure, the movement of the rotary actuator will not cause a hazard to humans or damage the equipment.

#### 10. Consider the action of the rotary actuator when restarting after an emergency stop.

Devise a safe design so that the restarting of the rotary actuator will not pose a hazard to humans or damage the equipment. Install manually controlled equipment for safety when the actuator has to be reset to the starting position.

#### 11. Do not use the product as a shock absorber.

If abnormal pressure or an air leakage occurs, the rotary actuator's speed reduction capability could become severely affected, which could pose a hazard to humans or damage the machinery and equipment.

#### 12. Select a speed within the product's allowable energy value.

If the product's kinetic energy of the load exceeds the allowable value, it could damage the product (damage to the shaft, gear, etc.), cause a hazard to humans, or damage the machinery and equipment.

#### 13. Provide a shock absorber if the kinetic energy that is applied to the product exceeds the allowable value.

If the product's kinetic energy exceeds the allowable value, it could damage the product (damage to the shaft, gear, etc.), cause a hazard to humans, or damage the machinery and equipment.

#### 14. Do not stop or hold the product at midpoint by keeping air pressure in the product. (Air balancers, etc.)

For a product lacking an external stopping mechanism, if the directional control valve is closed to keep the air pressure in the product in an attempt to stop the product at midpoint, it might not be possible to maintain that stopped position due to an air leakage. As a result, it could pose a hazard to humans or cause damage to machinery and equipment.

#### 15. Give consideration to the decline in strength caused by changes in the shaft shape.

Some shaft types, such as simple specials, may have shapes and dimensions that result in decreased strength when compared with standard models. Consider this carefully when using.

#### 16. Do not use two or more rotary actuators with the aim of synchronized movement.

One of the actuators may bear the entire load of the operation, making synchronized movement impossible, and possibly leading to the deformation of the equipment.

#### 17. Do not use in a location where adverse effects could result from the oozing of lubricant to the exterior.

The lubricant coating the interior of the product may leak to the outside of the product from the areas where the product connects to the rotary shaft, body cover, etc.

#### 18. Do not disassemble the product or make any modifications, including additional machining.

Doing so may cause human injury and/or an accident.

#### 19. Refer to the Auto Switches Precautions (pages 15 to 19) for using with an auto switch.



# Rotary Actuators Precautions 2

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## Design/Selection

### ⚠ Caution

#### 1. Do not use below the speed adjustment range specified for the product.

If the product is used below the specified speed adjustment range, it could cause the product to stick, slip, or the movement to stop.

#### 2. Do not apply an external torque to the product that exceeds the rated output.

If an external force that exceeds the product's rated output is applied to the product, it could damage the product.

#### 3. The holding torque of the rotating end of the double piston type

If the internal piston of a double piston product comes in contact with the angle adjustment screw or the cover and stops, the holding torque at the rotating end is one half of the actual output.

#### 4. If it is necessary to provide repeatability of the rotation angle, directly stop the load externally.

Even with a product that is equipped with an angle adjuster, there are times in which the initial rotation angle could change.

#### 5. Do not use under hydraulic pressure.

The product will be damaged if it is used by applying hydraulic pressure.

#### 6. There is a possibility of backlash being generated when stopping the double piston type in the middle with a valve of the closed center type.

#### 7. For the vane type product, if it is necessary to ensure a rotation angle, make sure to use a minimum pressure of 0.3 MPa.

#### 8. Do not use the made-to-order -XC30 at low speeds.

Although fluorine grease is used, it is not designed for low-speed applications.

For information on fluorine grease, refer to the Safety Data Sheet (SDS).

#### 9. Do not use in places where there are many temperature fluctuations. When using in lower temperature applications, use caution so that frost does not occur inside the cylinder or the piston rod.

Operation may be unstable.

#### 10. Adjust the speed control in the environment in which it will be used in.

Speed adjustments may deviate if the environment changes.

## Mounting

### ⚠ Warning

#### 1. Operation manual

Install the product and operate it only after reading the operation manual carefully and understanding its contents. Also, keep the manual in a location where it can be referred to as necessary.

## Mounting

### ⚠ Warning

#### 2. Ensure sufficient space for maintenance activities.

When installing the products, allow access for maintenance and inspection.

#### 3. Tighten threads with the proper tightening torque.

When installing the products, follow the listed torque specifications.

#### 4. Before adjusting the angle by supplying air pressure, take appropriate measures to prevent the equipment from rotating unnecessarily.

When an adjustment is performed under air pressure, the equipment could rotate and fall during the adjustment depending on the mounted placement of the equipment. As a result, it could pose a hazard to humans or damage the machinery and equipment.

#### 5. Do not loosen the angle adjustment screw beyond the allowable adjustment range.

The angle adjustment screw could fall out if it is loosened beyond its allowable adjustment range and cause a hazard to humans or damage to machinery and equipment.

#### 6. Do not place a magnetic object near the product.

The auto switch is a magnetic sensing type product. If a magnetic object is placed close to it, the rotary actuator could operate suddenly, which could pose a hazard to humans or damage the machinery and equipment.

#### 7. Do not perform additional machining to the product.

Additional machining to the product can result in insufficient strength and cause damage to the product. This can lead to possible human injury or damage to the surrounding equipment.

#### 8. Do not enlarge the fixed throttle by modifying the pipe connectors.

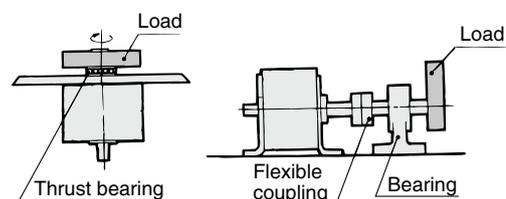
If the hole diameter is enlarged, the product's rotation speed will increase, causing the shock force to increase and damage the product. As a result, it could pose a hazard to humans or damage the machinery and equipment.

#### 9. If shaft couplings are used, use ones with angular freedom.

If shaft couplings that lack angular freedom are used, they could twist due to eccentricity, leading to equipment malfunction or product damage. As a result, it could pose a hazard to humans or damage the machinery and equipment.

#### 10. Do not apply to the shaft a load that exceeds the values given in the catalog.

If a load that exceeds the allowable value is applied to the product, it could lead to equipment malfunction, a hazard to humans, or damage to the machinery and equipment. Provided that a dynamic load is not generated, a load that is within the allowable radial/thrust load can be applied. However, applications in which the load is applied directly to the shaft should be avoided whenever possible. The methods such as those described below are recommended to prevent the load from being applied directly to the shaft in order to ensure a proper operating condition.





# Rotary Actuators Precautions 3

Be sure to read this before handling products.

## Mounting

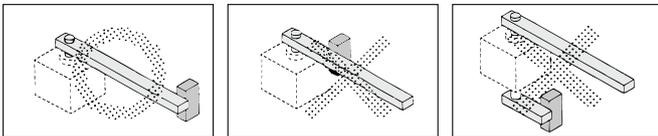
### Warning

#### 11. Place an external stopper in a position that is away from the rotating shaft.

If the stopper is placed near the rotating shaft, the torque that is generated by the product itself will cause the reaction force which is directed to the stopper to be redirected and applied to the rotating shaft. This will lead to the breakage of the rotating shaft and bearing. As a result, it could pose a hazard to humans or damage the machinery and equipment.

#### Precautions when Using External Stoppers

- Be sure to install external stoppers in the proper places. Installation in the wrong place can result in equipment breakage, which could damage other equipment or cause human injury.

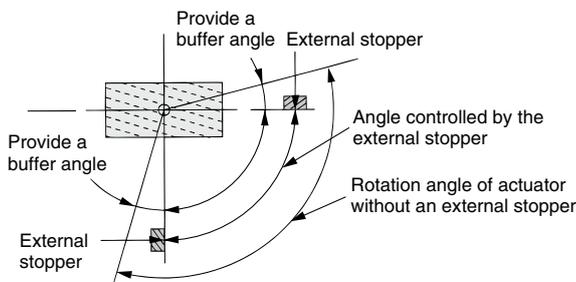


Install the stopper at a sufficient distance from the rotating shaft.

The external stopper becomes a fulcrum, resulting in the load's inertia force being applied to the shaft as a bending moment.

If an external stopper is installed on the shaft side which is opposite of the load, the inertia force generated by the load is applied directly to the shaft.

- Install external stoppers within the range of the rotating shaft angle. Installing an external stopper at the maximum rotation angle may result in the inability to fully absorb the kinetic energy generated, and damage to equipment may occur. When using external stoppers at rotation angles of 90°, 180°, or 270°, use products with rotation angles of 100°, 190°, or 280° respectively.



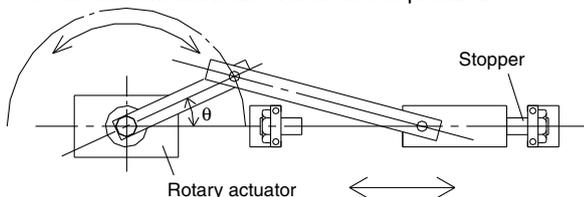
#### Backlash of the Single Rack Pinion Type CRA1 Series

There is a backlash of within 1° at the rotation end of the CRA1 series. It is necessary to decide the position of the external stopper when precise rotation is required.

#### Precautions when Converting Rotational Motion to Linear Motion

When using a link mechanism, etc., to convert rotational motion to linear motion and to determine the operation end using the stopper on the linear motion end (see below), a small value for  $\theta$  at the operation end may result in the torque of the rotary actuator. This may cause an excessive radial load to act on the output axle, and equipment breakage may occur.

Install a stopper on the rotational motion side, or increase the value of  $\theta$  at the operation end, to make sure the load generated does not exceed the allowable value for the product.



#### 12. Do not use springs, etc., to add force in the rotational movement direction.

When rotational force from an external spring, etc., acts and generates negative pressure on the product's interior, breakage of the internal seal or the acceleration of abrasion may occur.

### Caution

#### 1. Observe the specified torque to secure the block of the angle adjustment unit.

If it is secured with a torque that is lower than the specified torque, the block could become loosened during use, causing the angle to exceed the set angle.

#### 2. Do not use organic solvent to wipe the area of the name plate that shows the model.

It will erase what is indicated on the name plate.

#### 3. Do not hit the rotating shaft when securing the body or hit the body when securing the rotating shaft.

These actions could cause the shaft to bend or damage the bearing. When a load must be coupled to the rotating shaft, secure the rotating shaft.

#### 4. Do not place your foot directly on the shaft or on the equipment that is coupled to the shaft.

Placing one's weight directly onto the rotating shaft could cause the rotating shaft or the bearing to become damaged.

#### 5. If a product is equipped with an angle adjustment function, use it within the specified adjustment range.

If the product is used outside the specified adjustment range, it could lead to equipment malfunction or product damage. Refer to the product specifications for details on the adjustment range of the products.

#### 6. A product with an angle adjustment screw is temporarily secured at an arbitrary position near the rotation end. Before using the product, readjust it to the desired angle and tighten the screw firmly.

## Piping

### Caution

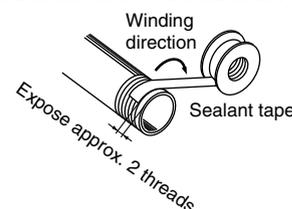
#### 1. Refer to the Fittings and Tubing Precautions (pages 52 to 56) for handling One-touch fittings.

#### 2. 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.

#### 3. Winding of sealant tape

When screwing piping or fittings into ports, ensure that chips from the pipe threads or sealing material do not enter the piping. Also, if sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.





# Rotary Actuators Precautions 4

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## Speed and Cushion Adjustment

### Warning

#### 1. To make a speed adjustment, gradually adjust starting from the low speed end.

If the speed adjustment is performed from the high speed end, it could damage the product. As a result, it could pose a hazard to humans or damage the machinery and equipment.

#### 2. The cushion valve is not adjusted at the time of shipment. Therefore, an adjustment must be made in accordance with the operating speed and the moment of inertia of the load.

The absorption of kinetic energy by the bumper is regulated by the adjustment of the valve. An improper adjustment could lead to damage of the equipment and the product. As a result, it could pose a hazard to humans or damage the machinery and equipment.

#### 3. Do not operate with the cushion valve in a fully closed condition.

This could tear the seal, which could pose a hazard to humans or damage the machinery and equipment.

#### 4. Do not apply an excessive force to loosen the cushion valve.

The valve itself is provided with a pull stop. However, the pull stop could be damaged if the valve is loosened through the application of excessive force. As a result, it could pose a hazard to humans or damage the machinery and equipment.

#### 5. For products with shock absorbers, when the shock absorber stops motion before reaching the stroke end using a stopper mechanism with the objective of shortening takt time, be sure the shock absorber is stopped in a position where it has adequately absorbed the kinetic energy.

Failure to do so may result in damage to equipment.

#### 6. Note that a product with an air cushion or a shock absorber is not designed to achieve shock-less, smooth stop operation and constant deceleration of a load. The product absorbs the kinetic energy of a load to prevent its damage.

## Lubrication

### Warning

#### 1. This product should be used without lubrication. If it is lubricated, it could lead to sticking or slipping.

## Air Supply

### Warning

#### 1. Type of fluids

Be sure to use compressed air for the fluid.

#### 2. When there is a large amount of drainage

Compressed air containing a large amount of drainage can cause the malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.

#### 3. Drain flushing

If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. This causes the malfunction of pneumatic equipment.

If the drain bowl is difficult to check and remove, the installation of a drain bowl with an auto drain option is recommended.

For compressed air quality, refer to the SMC Best Pneumatics No. 6 catalog.

#### 4. Use clean air.

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

### Caution

#### 1. When low dew point air is used as the fluid, degradation of the lubrication properties inside the equipment may occur, resulting in reduced reliability (or reduced service life) of the equipment. Consider using products compatible with low dew points such as those from the 25A- series.

#### 2. Install an air filter.

Install an air filter upstream near the valve. Select an air filter with a filtration size of 5  $\mu\text{m}$  or smaller.

#### 3. Take measures to ensure air quality, such as by installing an aftercooler, air dryer, or water separator.

Compressed air that contains a large amount of drainage can cause the malfunction of pneumatic equipment, such as rotary actuators. Therefore, take appropriate measures to ensure air quality, such as by providing an aftercooler, air dryer, or water separator.

#### 4. Ensure that the fluid and ambient temperatures are within the specified range.

If the fluid temperature is 5°C or less, the moisture in the circuit could freeze, causing damage to the seals or equipment malfunction. Therefore, take appropriate measures to prevent freezing.

For compressed air quality, refer to the SMC Best Pneumatics No. 6 catalog.



# Rotary Actuators Precautions 5

Be sure to read this before handling products.

## Operating Environment

### Warning

1. **Do not use in an atmosphere containing corrosive gases, chemicals, sea water, water, water steam, or where there is direct contact with any of these.**

Refer to the construction drawing for information on the materials of rotary actuators.

2. **Do not expose the product to direct sunlight for an extended period of time.**
3. **Do not use in a place subject to heavy vibration and/or shock.**
4. **Do not mount the product in locations where it is exposed to radiant heat.**
5. **Do not use in dusty locations or where water, oil, etc., splash on the equipment.**

## Maintenance

### Warning

1. **Perform maintenance and inspection according to the procedures indicated in the operation manual.**

If handled improperly, human injury and/or malfunction or damage of machinery and equipment may occur.

2. **Maintenance work**

If handled improperly, compressed air can be dangerous. Assembly, handling, repair, and element replacement of pneumatic systems should be performed by a knowledgeable and experienced person.

3. **Drain flushing**

Remove drainage from air filters regularly.

4. **Removal of equipment, and supply/exhaust of compressed air**

When components are removed, first confirm that measures are in place to prevent workpieces from dropping, run-away equipment, etc. Then, cut off the supply pressure and electric power, and exhaust all compressed air from the system using the residual pressure release function.

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

### Caution

1. **For lubrication, use the designated grease for each specific product.**

The use of a non-designated lubricant could damage the seals.



# Rotary Actuators Precautions 6

Be sure to read this before handling products.

## For Air-hydro Type

Please read this page along with the Rotary Actuators Precautions.

### Design

#### ⚠ Warning

1. **Do not use the product near flames, or in equipment or machinery that exceeds an ambient temperature of 60°C.**

There is a danger of fire because the air-hydro type uses a flammable hydraulic fluid.

Refer to the Safety Data Sheet (SDS) of the hydraulic fluid when supplying the fluid.

2. **Do not use the product in a clean room.**

#### ⚠ Caution

1. **Do not use in an environment, equipment, or machine that is not compatible with oil mist.**

The air-hydro type generates an oil mist during operation which may affect the environment.

2. **Be certain to install an exhaust cleaner on the directional control valve of the air-hydro type.**

A very small amount of hydraulic fluid is discharged from the exhaust port of a directional control valve, which may contaminate the surrounding area.

3. **Install the air-hydro type in a location where it can be serviced easily.**

Since the air-hydro type requires maintenance, such as the refilling of hydraulic fluid and bleeding of air, ensure sufficient space for these activities.

### Selection

#### ⚠ Caution

1. **Select an air-hydro type in combination with an air-hydro unit.**

Since good operation of an air-hydro type depends on its combination with an air-hydro unit, carefully select an appropriate air-hydro unit.

### Piping

#### ⚠ Warning

1. **For air-hydro type piping, use self-aligning fittings.**

Do not use One-touch fittings in the piping for an air-hydro type because oil leakage may occur.

2. **For air-hydro type piping, use hard nylon tubing or copper piping.**

As in the case of hydraulic circuits, surge pressures greater than the operating pressure may occur in air-hydro type piping, making it necessary to use safer piping materials.

### Lubrication

#### ⚠ Warning

1. **Completely discharge the compressed air in the system before filling the air-hydro unit with hydraulic oil.**

Before supplying hydraulic fluid to the air-hydro unit, first confirm that safety measures are implemented to prevent the dropping of objects, the release of clamped objects, etc. Then, shut off the air supply and the equipment's electric power, and exhaust the compressed air in the system.

If the air-hydro unit's supply port is opened with compressed air still remaining in the system, there is a danger of hydraulic fluid being blown out.

Refer to the Safety Data Sheet (SDS) of the hydraulic fluid when supplying the fluid.

2. **Use petroleum hydraulic fluid which can be used as turbine oil.**

If non-flammable hydraulic fluid is used, it may cause problems.

Suitable viscosity is in the range of approximately 40 to 100 mm<sup>2</sup>/s in operating temperature.

The suitable operating temperature for ISO VG32 is between 15 to 35°C. If a higher operating temperature range is required, select ISO VG46 (suitable for 25 to 45°C).

- \* Refer to the SMC website for the brand name of each manufacturer's class 1 (no additives) and class 2 (with additives) ISO VG32 turbine oil.

### Maintenance

#### ⚠ Caution

1. **Bleed air from the air-hydro type on a regular basis.**

Since air may accumulate inside the air-hydro type, bleed air from it, for example, before starting work. Bleed air from the bleeder valve provided on the air-hydro type or the piping.

2. **Confirm the oil level of the air-hydro system on a regular basis.**

Since a very small amount of hydraulic fluid is discharged from the air-hydro type and the air-hydro unit circuit, the fluid will gradually decrease. Therefore, check the fluid regularly and refill as necessary.

The oil level can be checked with the level gauge in the air-hydro converter.