

# ■ Notes on Safety in Use ■

Before using the product, be sure to read the "Notes on Safety" carefully for correct use. This catalog gives an explanation about the degrees of hazard and damage by classifying them by the details into three levels "Danger," "Warning" and "Caution" in order to prevent any hazard to users or other individuals or loss of assets.

The JIS and ISO also establish standards for safety and prevention of failures/accidents in relation to pneumatic systems used in machinery and equipment. Read them together with the notes given in this catalog.




In addition to these notes, thoroughly understand the specification of the product, take the possibility of failure into account and have personnel with expertise engage in design, assembly, handling, etc.

JIS (Japanese Industrial Standards)

JIS B 8370 (General Rule for Pneumatic Systems)

ISO (International Organization for Standardization)

ISO 4414 : Pneumatic fluid power—Recommendations for the application of equipment to transmission and control systems

 <b>DANGER</b>	 <b>WARNING</b>	 <b>CAUTION</b>
Failure to follow the instructions marked with this wording may cause imminent danger leading to death or serious injury.	Failure to follow the instructions marked with this wording may lead to death or serious injury.	Failure to follow the instructions marked with this wording may lead to minor or medium level of injury or property damage.

# Notes on Safety of Actuators

## ■ Notes on design

Also read the "Notes on Design" and "Notes on Safety" provided for each series.

### ⚠ WARNING

#### Installation in High-Reliability Equipment

Applications shown below may involve situations unexpected by designed specification of actuators and separate agreements are required for ensuring safety.

1. Nuclear energy, medical care equipment, railway, vehicle, aerospace, marine, vessel, gas appliance, waterworks, food equipment, amusement/health equipment and military/defense
2. Brake circuit, emergency cutoff circuit, safety device and other applications that particularly require safety
3. Applications other than above that may cause major hazards to humans and/or property

#### Safety Cover

It is dangerous to bring the hand, finger, face, etc. close to moving parts such as the stopper and the table. Provide a safety cover if there is any possibility of injury during operation of the equipment or the actuator.

#### Power Source Failure and Supply Pressure Abnormality

If any power source such as electricity and air pressure fails or the supply pressure abnormally increases or decreases due to trouble, etc., the thrust of actuator may also vary, causing abnormal operation. Take measures for preventing injury or damage to human body or equipment even if such situations occur.

#### Emergency Stop and Abnormal Stop

Take measures for preventing injury or damage to human body or equipment due to actuator movement even when the equipment is brought to emergency stop or abnormal stop or restarted after a stop.

#### Prevention of Projection

In the cylinder of an actuator, supplying air to one side of the piston when the air on both sides of the piston has been discharged may cause rapid movement of the actuator. This may cause damage to human body or equipment. Be sure to design a circuit that prevents projection.

#### Provision of Maintenance Space

Ensure that space is provided for adjustment, maintenance/inspection and replacement of actuators, switches, joints, jigs, etc.

#### Fluid to use

Fluids other than air, including gases and liquids, cannot be used.

#### Operating Pressure Range

Use at a pressure higher than the maximum operating pressure causes wear and damage to various parts, leading to breakdown or malfunction.

Use at a pressure lower than the minimum operating pressure may cause problems such as inability to achieve smooth operation.

Ensure that the pressure is within the specified operating pressure range.

#### Operating Speed Range

Use at a speed above the operating speed range may cause large impact to be applied to the actuator body or stopper due to inertial force, leading to damage.

Use at a speed below the operating speed range may cause a stick-slip (jerking) phenomenon, hindering smooth operation.

Be sure to use valves and pipes with appropriate effective cross-sectional areas and provide speed controllers, etc. for operation within the specified speed range.

#### Intermediate Stop

Air cylinders and valves permit slight air leakage from the packing (compliant with JIS B 8377).

Accordingly, intermediate stop in the middle of a stroke may cause inability to maintain the stop position for a long time.

With the compressibility of air, high-accuracy intermediate stop is not possible, unlike hydraulic or electric actuators.

#### Impact Absorption

If the inertial force is large, provide a separate shock absorber.

For some series, models with rubber stopper or shock absorber are optionally available. If these are not sufficient, provide a separate shock absorber.

#### Allowable Mass and Allowable Moment

For operation of an actuator with any load mounted, make sure that the following three values are within the allowable ranges.

Use with any of these exceeding the range may lead to lower accuracy of the bearing, actuator malfunction or damage.

1. Total Mass of Load
2. Gravitational Moment applied to Load
3. Inertial Force at Stop

## ■ Notes on Operating Environment

### ⚠ WARNING

#### Outdoor Use

Places subject to direct or indirect wind and rain, direct sunlight or external temperature, etc. are out of the specification in terms of weatherability. Do not use the product in such places.

#### Use in Corrosive Environment

Do not use the product in the following environments.

- Places subject to acidic or alkaline liquids, organic solvents, chemicals or splashes of them or atmosphere of gases of them.
- Corrosive gas atmosphere.
- Under water or water vapor atmosphere.
- Places subject to ultraviolet rays or radiation.
- Places where ozone is generated.
- Environments other than the above that may cause deterioration of metal, rubber, resin or grease.

In the following environments, attachment to the sliding part of the actuator may damage the rolling element or packing, leading to malfunction or air leakage. Provide a cover to prevent attachment.

- Places subject to water, hot water, salt water, etc.
- Places subject to dust, soil, sand, resin, metal chips, magnetized metal powder such as iron sand, spatter, etc.
- Places subject to oils that may deteriorate metal, rubber, resin, grease, etc. such as machine oil, spindle oil and machining oil

#### Use in Magnetic Field

In places with magnetic field, actuators with switches may experience problems such as switch malfunction and cannot be used.

#### Operating Temperature Range

Use at a temperature exceeding the operating temperature range may accelerate deterioration of various parts including hardening of packing, leading to malfunction.

Even if the ambient temperature is within the specified range, heat may be conducted through jigs or objects to be driven. During high-speed operation, sliding surfaces may be locally heated to cause similar problems and adiabatic expansion may cause solidification or freezing of drain water or moisture or condensation on the surface. Provide measures to prevent freezing.

#### Vibration

Avoid use in environments subject to vibration. If it is unavoidable, ensure that the vibration is not conducted.

## ■ Notes on Handling

### ⚠ WARNING

#### Mounting Locks

Provide bolts for securing the actuator or mounting jigs, etc. with locking measures and ensure that the mounting base has a structure that prevents deformation or damage due to inertial force by the thrust or at stop. For securing the actuator or jigs, etc., use all of the through or threaded holes for securing provided in the mounting surface. Use only some of them may cause actuator failure or damage or injury to equipment or human body.

#### Actuator Operation Check

After mounting the actuator on the equipment, do not start the equipment right away but make sure that it is correctly mounted and confirm safety. When adjustment of the stopper is required, use caution not to get injured by having the hand or finger caught in it.

#### Notes on Magnetic Products

Bringing any magnetic recording medium close to an actuator equipped with a magnet for switch detection or integrating a connecting magnet (PRD, PRZ and PRM Series) may cause the data to be erased. Do not bring it close to any device that may malfunction due to magnetism.

#### Shock Absorbing Mechanism

Removing the shock absorber or cushion rubber provided as standard devices or using the product with the air cushion not sufficiently functioning may cause failure or damage to human body or equipment.

### ⚠ CAUTION

#### Speed Adjustment

Adjust the speed controller by gradually increasing the speed from the low-speed condition with the needle valve closed to achieve the specified speed.

#### Flaws

Flaws, nicks, etc. in and around the groove where the bearing balls roll or sliding surfaces of the rod, etc. may lead to damage to packing, bearing, etc., causing failure. Flaws, nicks, etc. on the outer circumference of the tube or body may cause deformation of the sliding surfaces of the internal piston, leading to failure.

## ■ Notes on Pneumatic Circuit

### ⚠ WARNING

#### Quality of Compressed Air

Compressed air containing dirt, moisture, salt, drain water including deteriorated compressor oil or oil carbon particles, etc. or corrosive gas may damage the packing and other parts, causing malfunction or damage. Use clean compressed air.

#### Drain Water Removal

Compressed air containing a large amount of drain water may cause malfunction of pneumatic devices and environmental pollution as well. Provide an aftercooler, air dryer, air filter (with filtration rating of up to 50  $\mu\text{m}$ ), etc.

For an air purification system to drive the actuator, see JPAS005 "Guidelines for Usage and Selection of Pneumatic Cylinders" and refer to a recommended system.

#### Lubrication of Compressed Air

Actuators can be used without oiling. (Except EHGB)  
When oiling is required as a system, use additive-free turbine oil type 1 ISO VG32 or ISO VG46.  
Do not use machine oil or spindle oil, which may cause damage to packing and malfunction.  
Interrupting oiling may cause the initial lubricating grease to run out to accelerate damage to packing and other parts, causing malfunction. Be sure to oil continuously.

#### Actuators not permitting Oiling

PRD, PRZ, PRM, clean type PPTN, PPTNF and JKXN use special grease. Do not lubricate the compressed air.

#### Cleaning of Piping

Before piping, blow compressed air in the pipes or clean the pipes as required to remove any foreign matter such as dust, scales, chips generated by piping, seal tape and machining oil.

#### Sealing of Joints

When winding seal tape around pipe or joint threads, leave one or two threads at the end uncovered to wind the tape one to two turns and press with the finger for adherence to the threads.

When using liquid sealing agent, leave one or two threads at the end uncovered and apply the agent. Do not apply on the female threads of the ports of the product.

Any piece of seal tape or sealing agent entering the product may cause malfunction or failure.

#### Piping

Inadequate piping may cause malfunction.  
For joints with the thread size M5 or smaller, mount a gasket on the seating surface before use.

## ■ Notes on Maintenance and Inspection

### ⚠ WARNING

#### Actuator Removal

When removing an actuator for reasons such as equipment remodeling and maintenance, confirm safety in advance by making sure that falling of workpieces, jigs, etc. or rapid operation of equipment or devices do not cause damage to human body or equipment.

Then, shut off the air supply and power supply, discharge any residual pressure and remove the actuator.

Do not step on, hang from, use as a scaffold or put any object on the actuator.

#### Actuator Disassembly and Remodeling

Do not replace the packing of any actuator with no repair parts specified or perform disassembly, additional work or remodeling other than replacement of the packing, which may cause accidents and/or failure.

#### Check for Loosening of Bolts

Loosening of the bolts and nuts that secure the actuator body or mounted load may cause accidents or failure.

#### Check for Abnormal Noise

If impact noise or vibration has increased abnormally during operation, the actuator body or parts used in it may require replacement.

Check the following for any abnormal noise.

1. Bearing
2. Packing
3. Shock Absorber
4. Rubber Stopper

### ⚠ CAUTION

#### Replacement of Packing

Only actuators with repair parts specified allow replacement of packing.

Use the packing included in our packing set.

Use of other packing may cause failure.

For replacement, follow the procedure below.

1. Make sure that no compressed air is supplied to the actuator and there is no residual pressure before disassembling.
2. Wipe off deteriorated grease and drain water thoroughly.
3. When removing the packing, ensure that the housing is not scratched.
4. Apply grease on the entire packing and the housing and mount it while using caution not to scratch or twist it. Make sure that the packing is correctly oriented.
5. Apply grease on the outer circumference of the piston, rod and inside the cylinder tube.
6. Contact us for the grease to be applied.
7. Ensure that the packing is not scratched during reassembly. Also ensure that no foreign matter is attached or enters inside.
8. Secure firmly and mount the cover and other parts using bolts, retaining rings, etc. Mount the retaining ring with the side that does not have a shear droop on the circumference facing toward you.
9. After reassembly, operate the product manually or at a low speed by reducing the supply pressure to make sure that operation is smooth.

#### Maintenance of Compressed Air Purification System

Operating the actuator without maintaining the compressed air purification system including the compressor, aftercooler, air dryer and air filter or draining the filter may cause shorter service life or failure. In particular, drain water is easily generated in high-temperature and high-humidity environment. Frequent draining is necessary. Use of a model with an automatic drain is recommended.

#### Actuator Storage

In order to prevent actuator performance degradation due to rust development or deterioration of rubber or grease, note the following.

1. Do not open the package more than necessary. It may lead to dirt attachment, rust development or scratches on the product.
2. Do not store the actuator outdoors, in a corrosive environment or place subject to a large amount of dust.
3. Storing in a humid place may cause rust development.
4. Deterioration of rubber or grease is accelerated in high-temperature or low-temperature environment.

#### Actuator Disposal

When discarding the actuator, dispose of it as industrial waste.