

Please read the following general handling instructions and precautions carefully before ordering rotary actuators.

Safety Precautions

References: JIS B9702: Safety of machinery, principles of risk assessment
JIS B9370: Pneumatic fluid power, general rules relating to systems

Warning Following information is based on a risk assessment for Konan pneumatic rotary actuators (hereafter referred to as actuator). Each section provides information essential for safe operation of the actuators and prevention of risk and damage that may affect operators. Please read carefully.

① Selection of actuator

1.1 Shock and mechanical safety

Rotary actuator is an actuator to rotate loads by means of pneumatic pressure. It is often used for high-speed operation systems and equipment with heavy loads. In order to enable safe operation of a system incorporating the actuator, it is essential to select appropriate type and size of actuator for the load and motion energy as well as take into consideration the load connection method.

In particular, if motion energy of the load is high (large mass and high-speed operation), appropriate type and size of actuator must be selected.

For example, rotating loads with large inertial force such as dampers may cause damage to internal components of the actuator and connection components that may affect operators and surrounding mechanical systems.

1.2 Output torque characteristics of actuator

Output torque of an actuator is provided by multiplying the internal piston output (supply pressure & piston area) and length of piping. The characteristics of output torque differ depending on the mechanism that converts the linear action of internal piston into rotating action.

In concrete, in the pneumatic double-acting type and rack-and-pinion mechanism type actuators the output torque increases constantly within the whole rotation range, while in the scotch-yoke type the torque is minimum at the center of rotation angle and increases as the rotation angle comes closer to both ends.

Selection of an actuator should be made with a torque suitable for operating the load.

1.3 Load factor and redundant safety

Output torque of an actuator is provided by multiplying the internal piston output (supply pressure & piston area) and length of piping. In order to get sufficient speed (dynamic output), select the actuator size so that the load factor to the output torque indicated in the catalogue becomes no more than 70%.

In case the actuator plays a significant part of the system functionality or that it is used with conditions in which routine maintenance is difficult, the system should be designed to lower the actuator load factor.

For example, selecting a larger size actuator will reinforce impact resistance.

1.4 Mechanical back-up

For securing safe operation of an actuator even in case of entire error of functions involving pneumatic pressure, select a spring offset actuator (hereafter single-acting type actuator) or take other measures to maintain the operation by means of different energy sources.

1.5 Entire safety consideration

Select the actuator model and size in a comprehensive planning and design process of a pneumatic control system, taking into consideration the direct performance requirement as well as the safety in various conditions, including installation, adjustment, full-scale operation, failure, and disposal.

② Design of load interface to actuator

2.1 Connection with loads

Install the actuator so that thrust load and transverse load are not applied to the spindle.

Apply an independent stopper to the rotational axis on the load side in order to prevent axial movement. (Do not use the spindle of the actuator as a stopper.)

Ensure that the load has sufficient insertion length into the spindle, or the mating surface pressure increases to enlarge clearance, which may cause failure in the load positioning.

may become high, which may cause deterioration of packings or malfunction of the actuator.

2) In a place where temperature is close to 0°C, remove moisture in the compressed air with an air dryer. If the dehumidification is not performed, significant amount of moisture may freeze inside the actuator to cause malfunction.

Warning ④ Safety measures

4.1 Operation space

Secure sufficient operation space for safe installation and maintenance of an actuator. This should be considered sufficiently, since in many cases a pneumatic control system is installed after completion of a main system. Ensuring safety is the first and foremost priority.

4.2 Mechanical safety

1) Intrinsic safety

Make sure to avoid significant damage to operators by contact with movable, heated or energized components (squashing, dragging, blow, cutting, burn, electric shock, etc.).

2) Safety measures

Put protection cover to the spindle and other movable components during the system operation to prevent operators from approaching. Take utmost care not to insert arms, hands, or fingers into the system.

3) Safety system

If setting of a protection cover or other safety measures cannot be taken due to the functional problem of the system, add equipment that prevents or stops operation of the actuator when people come closer.

4.3 Constraint during operation

Before connecting an actuator and a load, firmly fix the both in order to avoid unintended movement due to gravity or operational work.

4.4 Weight

See Section 1.1 of the Users Instructions.

4.5 Residual energy

See Section 4.3 of the Safety Precautions.

4.6 Other

1) Care should be taken for risks related to actuator system operation such as: sudden blowout of compressed air; unintended operation of the actuator due to residual pressure after exhaustion of air inside the system; and abrupt rotation of actuator just after restarting air supply.

2) Pressurize the exhaust side cylinder chamber before activation of the actuator. If the operation is started with the chamber filled in atmospheric pressure, the load will be abruptly rotated.

Warning ⑤ Use of actuator

5.1 Modification

Do not modify an actuator. Unexpected risk may arise.

5.2 Load connection

Install the actuator so that thrust load and transverse load are not applied to the spindle.

Apply an independent stopper to the rotational axis on the load side in order to prevent axial movement. (Do not use the spindle of the actuator as a stopper.)

Ensure that the load has sufficient insertion length into the spindle, or the mating surface pressure increases to enlarge clearance, which may cause failure in the load positioning.

5.3 Working pressure

Do not use the actuator with the pressure over the maximum working pressure, which may cause damage to the components or malfunction.

In order to ensure smooth operation and stable output torque, do not use the actuator with the pressure less than the minimum working pressure.

5.4 Dust prevention of single-acting type

When a single-acting type actuator is used outdoors or at such a place where it is exposed to water splash or much powder dust, prevent the breathing port of spring cover from entry of water or dust.

Care must be taken not to close up the breathing port at installation.

③ Actuator installation

Actuators have precise operational functions and are used for applications with versatile conditions and environment. It is therefore sometimes difficult to assume all concerned risks or risk factors when designing an actuator. In such cases the actuator function and performance may be deteriorated in a period shorter than the maintenance period set by the manufacturer.

In order to avoid the risks, install the actuator as instructed below.

3.1 Maximum rotation speed

Do not use the actuator with the speed over the maximum rotation speed indicated in the catalogue. Depending on the shape of loads the actuator may be collapsed by inertial force.

3.2 Installation site

Install an actuator in a place where setting and maintenance is easy.

3.3 Operating procedure

Conduct actuator operations test for any abnormality before connection with loads. Then connect loads and check for thrust load and transverse load to the spindle, air leakage from the connection ports, and other abnormalities before installation into the system. If no abnormalities are found, then check the entire system operation.

3.4 Prevention of abrupt rotation of actuator

If an actuator is not in the position under control of a directional control valve at air supply after installation or during maintenance, it may rapidly shift to the control position. In order to avoid this risk, install a slow-start valve at the IN port of the directional control valve.

3.5 Indication

If an actuator nameplate cannot be seen due to installation environment, place an alternative indication near the actuator.

3.6 Residual pressure

An actuator should be installed taking into consideration the risks for sudden blowout of compressed air and unintended operation due to air pressure remaining in the actuator even after exhaustion of air.

3.7 Training

A sufficiently trained person should be responsible for installation and maintenance of an actuator. (Konan provides training for operation and maintenance of pneumatic components. Feel free to contact our sales personnel for details.)

④ Maintenance of actuator

Maintenance should be performed in accordance with the following steps. Feel free to contact our sales personnel for separate maintenance manual.

4.1 Daily inspection

1) Exhaust drain from the air filter.

2) During operation of the system, observe the actuator visually and acoustically from a safe place for loosening of screws and other external abnormalities as well as abnormal noise.

Inspection should also be performed while the system is not in operation without exhausting pressure for: loosening of screws; external air leakage; and air leakage from exhaust port of the directional control valve and piping joint.

4.2 Periodical inspection

Following periodical inspection should be conducted by-annually or annually.

1) Precise inspection should be performed after electric/pneumatic shut-down and the status recorded. Repair should be performed if necessary.

5.5 Disassembly of single-acting type spring ass'y

Never attempt to disassemble a spring ass'y of single-acting type actuator. If disassembled forcibly, internal parts may jump out. If any disassembly is necessary, contact our sales personnel.

5.6 Shock absorption using external shock absorber

Generally, shock-absorbing mechanism is not incorporated in the actuator. With the load with high motion energy (large mass and high operation speed), internal components of actuator may be damaged. In such case, it is necessary to slow down the operation speed or mount external rubber cushions or other shock absorbers.

External shock absorbers should have appropriate absorption characteristics as well as suitable connection surface and connection stand with sufficient strength and rigidity.

5.7 External operation

In the event it is necessary to rotate the actuator with spanners and other tools for system adjustment, do not apply static load over the maximum output torque to the spindle.

5.8 Appearance

This product is a die-cast product, and due to the deterioration of the die-cast mold over time, there may be cases where wrinkles may appear on the surface during molding, but this does not cause any problems in use.

Caution ⑥ Actuator adjustment

6.1 Adjustment of rotation angle

Adjustment of rotation angle is made by an adjustment screw after loosening the locknut. Make sure to tighten the locknut after adjustment to secure the adjustment screw. Avoid stopper or piston force to be applied to the screw during adjustment.

6.2 Adjustment of rotation speed

As an actuator needs adjustment of rotation speed, install a speed control valve to restrict the exhausting air from the actuator port (meter-out control).

1) Do not reverse flow direction of a speed controller.

2) Konan standard SC6 series speed controller has an adjustment screw. When it is turned clockwise, the speed decreases to become zero (valve closed). When the screw is then turned counterclockwise, the actuator speed increases corresponding to the number of screw revolution.

3) For safety, fully close the speed controller before air supply, then pressurize and gradually increase the actuator speed using a directional control valve.

4) After adjustment, firmly fasten the locknut of adjustment screw.

Caution ⑦ Intermediate stop of actuator

Because of the small volume of movable parts, an actuator cannot be stopped intermediately by controlling with a 3-position closed-center type directional control valve. If necessary, an actuator with optional positioner should be selected. Consult our sales personnel for detailed specifications of the actuator with positioner.

Caution ⑧ Spray lubrication using a lubricator

An actuator can be used without lubrication.6.3 Selection of oilless solenoid valve

8.1 Overhaul of oilless actuator

1) Before overhaul of an actuator contact our sales personnel for grease used after the overhaul. Use specified grease after overhaul of an oilless actuator.

2) A greased oilless actuator can be lubricated but the grease will be exhausted. Although durability is enhanced after the lubrication, continual lubrication will be required.

8.2 Lubrication

1) Use JIS K 2213 (ISO VG32) type turbine oil for lubrication using a lubricator.

2) Spray volume of a lubricator is determined by the number of oil drops (typically 0.03 cm³ per drop or 1.5 to 2.5 drops per 1 m² of air).

8.3 Centralized lubrication

In principle 1 lubricator should be used for 1 actuator.

2) Overhaul should be performed in the 2nd annual inspection and components exchanged as specified or if necessary. The overhaul should also be performed when the actuator operational cycle reaches 100,000 cycles even before two years from the date of last inspection.

4.3 Residual energy

Maintenance requiring actual operation of a system should be performed after pneumatic/electric shut-down and exhaustion of all residual electrical charge and compressed air from the system. Make sure the movable components do not move during the maintenance, and mechanically fix them if necessary for safety. Care should also be taken for components that may drop out during the maintenance operation and components with sharp edges to ensure safety.

4.4 Removing actuator

Before removing or disassembling the actuator, make sure to disconnect the power supply (electricity and compressed air) and release residual pressure in the equipment and piping thoroughly.

For single-acting type actuator make sure that the spindle is positioned with the spring elongated.

For the actuator with manual operating mechanism also make

Users Instructions

Caution ① Transport of actuator

1.1 Weight

Heavy-weight actuators should be transported with the aid of conveyer equipment. Actuator weight can be confirmed by referring to Konan Rotary Actuator Catalogue and product drawings. Qualified personnel should be responsible for the operation of forklift truck, crane, or slinging according to the regulations and company safety code.

Care should also be taken for transport of light-weight actuators not to cause actuator component deformation and other damage.

1.2 Dropping

During lifting or horizontal transportation of an actuator, handle the actuator carefully not to drop or damage.

1.3 Dust prevention

Plastic plug is attached to the actuator connection ports to prevent dusts and rusts from entering the actuator. Do not remove the plug until immediately before piping. If the plug is lost, take a protection measure with alternative cover.

1.4 Dust prevention for single-acting type

When a single-acting type actuator is used outdoors or at such a place where it is exposed to water splash or much powder dust, prevent the breathing port of spring cover from entry of water or dust.

Care must be taken not to close up the breathing port at installation.

Caution ② Storage

2.1 Storage during transport

If an actuator is to be installed where it is exposed to wind and rain or other adverse environment, transport the actuator to the specified site just before installation. If the actuator is to be stored at the installation site by necessity, keep it packed and protect with a sheet cover. In such case make sure to shorten the storage period as much as possible.

2.2 Storage

An actuator should be stored as follows to prevent contamination and material deterioration.

1) Avoid high temperature and humidity as well as places with dusts and moisture.

2) If an actuator is to be stored for more than 1 year, keep it packed or provide equivalent protection.

3) Long-term storage may result in sticking of packings due to shortage of lubrication. In such cases, conduct pre-

Lubricating multiple actuators may result in uneven oil supply to each actuator, particularly if there are differences in the operation frequency, pipe length, size, and installation height of the actuators. By grouping the actuators with similar conditions, centralized lubrication can be achieved.

Reference ⑨ Actuator system control

9.1 Sequence control

Follow the below steps for sequence control of an actuator.

1) Detect the position.

2) Interlock the control of other actuators in the system.

3) If operation is stopped in the middle of sequence, make sure to restart the operation from the stopped position safely. If impossible, manually control the actuator to return to the starting position.

4) Set a sequence starting position at which movable components do not move after air exhaustion.

9.2 Power failure and pneumatic pressure failure

1) In case of power failure or emergency stop of an actuator operation, ensure the actuator at operation stops or shifts to a safe position. Care should be taken not to damage personnel or equipment after recovery of the power failure or the system operation. Indicate procedure to recover power failure.

2) In order to complete a cycle operation even in case of pneumatic pressure failure, reserve sufficient amount of pneumatic pressure in an air tank.

3) In case of the system shut-down due to emergency stop or power failure, avoid damage to personnel or equipment when restarting the actuator operation after power recovery or system reset.

Warning ⑩ Clamp system

If dropout of a workpiece due to pneumatic pressure drop in an actuator-driven clamp system is anticipated, use a single-acting type actuator.

Warning ⑪ Lifting system

Do not use an actuator for elevators transporting people.

Warning ⑫ Residual pressure exhaustion

Follow the below for exhaustion of residual pressure inside a pneumatic control system at installation or maintenance.

1) Use a manual control valve for exhaustion of residual pressure.

2) Place manometers, pressure switches, and other residual pressure indicators at each section with residual pressure.

3) In a sequence control system, make sure to centrally control all related residual pressure exhaustion. If this is impossible, indicate the place and switching condition of the air exhaustion equipment with a tag.

4) If allowing separate maintenance of each cylinder chamber, install a 3-port manual valve or other residual pressure exhaustion valve at the inlet or outlet of the directional control valve.

5) In a system circuit using a check valve, pilot type check valve and closed-center directional control valve, exhaust residual pressure separately or indicate warnings for residual pressure, as air may be contained even the system is not in operation.

6) Indicate the residual pressure exhaustion valve in the system circuit drawing.

Reference ⑬ Circuit and piping

13.1 Pressure drop

In a pneumatic control system with long pipes at the and/or entrance of the system, sufficient pressure may not be supplied due to pressure drop. Piping thus should be designed properly, or supplementary air tank should be installed to secure supply pressure if the actuator is operated intermittently.

13.2 Air filtration

Air supplied to an actuator should be filtered by a filter with

sure that the spindle is positioned with the spring elongated. When removing a spring unit of single-acting type, loosen the adjustment screw completely before removal, avoiding stopper or piston force to be applied to the screw.

4.5 Communication

If multiple persons are involved in the maintenance operation, keep all the personnel informed about the conditions including power-off, completion of residual pressure exhaustion, power-on, and resumption of air supply.

⑤ Actuator installation

1. Actuator installation site

Use of an actuator at the following sites requires compliances with special functional specifications and regulations. Consult our sales personnel in the planning process for anything unclear.

1) Operating conditions not within the specified range
2) Significant risk for users, properties, or environment is anticipated

Ex: Use for nuclear power plants, vehicles, medical components, components related to the Occupational Health and Safety Law and/or the High Pressure Gas Safety Law, etc.

conditioning operation of the actuator before regular use.

4) After a long period of storage, permanent deformation, change of size, or deterioration of packings would be a concern. After such storage period, conduct an actuator operation test. If any abnormalities are found, perform an overhaul or exchange deformed/deteriorated components as appropriate and connection portions fastened tightly. After start of operation, inspect the connections in a periodical manner to check any loose parts or deformation and re-fasten screws.

Warning ③ Surrounding environment

3.1 Vibration/shock

1) If an actuator is to be used in a place where it is exposed to excessive shock or vibration, confirm acceleration rate and other conditions before consulting our sales personnel.

2) If the actuator is used in a place where vibration is a concern, ensure the actuator is firmly fixed at the setting and connection portions fastened tightly. Particularly, if the actuator is to be used frequently, take into consideration the fatigue resistance.

3) After start of operation, inspect the connection portions in a periodical manner to check any loose parts or deformation and re-fasten screws. Loose parts may cause unintended motion of the actuator, significantly affecting operators and surrounding systems.

3.2 Handling during installation

Rough handling of an actuator may diminish regular performance of the actuator. For example, riding on, hammering or dropping the actuator may cause damage and deformation of the actuator components. Slight deformation of the actuator body diameter will result in malfunction. Also, bending or deformation of spindle will damage packings, causing air leakage.

3.3 Surrounding environment

Environment surrounding an actuator should be considered carefully. Avoid places where the actuator is exposed to rain and wind, direct sunlight, salt, corrosive gas, chemical fluids, organic solvents, steam, etc. Corrosion resistance measure can be taken depending on the environment. Feel free to contact our sales personnel for details.

3.4 Working temperature

Use an actuator with specified range of ambient/working temperature and supply pressure.

1) Temperature of compressed air around an air compressor

nominal filtration rating of no more than 40 μm to remove solid contaminants. Exhaust liquid drain or oil through the filter or drain separator after sufficient cooling of the air. Exposure to contaminated, high temperature compressed air may deteriorate packings or other components, making the product life significantly shorter.

13.3 Piping

1) Do not remove the plastic plug and keep the actuator packed until just before piping in order to prevent dusts and rusts from entering the actuator during storage or installation. Use galvanized pipe for steel tube piping and remove dusts after screwing.

2) Before connection, clean the pipes by air flushing or washing to remove internal dusts, moisture, and oil.

3) If a seal tape is used for screwing, wrap the tape around twice or three times in a direction opposite to the screwing direction, leaving 1.5 to 2 threads from the screw edge.