



Please read the following safety precautions carefully before ordering hydraulic cylinders.

## Safety Precautions

**Warning** Following information is based on a risk assessment for Konan hydraulic cylinders (hereafter referred to as "Cylinder"). Each section provides information essential for safe operation of cylinder systems and prevention of risk and damage that may affect operators. Please read carefully.

### ① Selection of cylinders

#### 1.1 Shock and mechanical safety

A cylinder is an actuator to drive loads by means of hydraulic 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 cylinder, it is essential to select appropriate type and size of cylinders 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), sufficient strength and rigidity of mounting structure is necessary. Installation of separate shock absorber may also be required.

Use of a cylinder with excessive mass of loads may cause damage to piston and connection components that may affect operators and surrounding mechanical systems.

#### 1.2 Entire safety consideration

Select the cylinder model and size in a comprehensive planning and design process of a hydraulic 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 Cylinder installation

Cylinders 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 a cylinder. In such cases the cylinder 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 cylinder as instructed below.

#### 2.1 Installation site

Install a cylinder in a place where setting and maintenance is easy.

#### 2.2 Operating procedure

After installation, conduct a cylinder operation test for any abnormality, including lateral or uneven load on the piston rod and oil leakage from the piston rod or connection components. If no abnormalities are found, then check the entire system operation.

#### 2.3 Bursting out of a cylinder

If a piston of a cylinder is not in the position under control of a directional control valve at oil supply after installation or during maintenance, it may rapidly shift to the control position.

#### 2.4 Indication

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

#### 2.5 Residual pressure

A cylinder should be installed taking into consideration the risks for sudden blowout of oil and unintended operation due to hydraulic pressure remaining in the cylinder even after exhaustion of oil.

#### 2.6 Training

A sufficiently trained person should be responsible for installation and maintenance of a cylinder.

### ③ Maintenance of cylinders

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

maintenance manual.

#### 3.1 Daily inspection

During operation of the system, observe the cylinder visually and acoustically from a safe place for loosening of screws and other external abnormalities as well as abnormal noise. Confirm residual oil film on the surface of piston rod, taking care of the inspector's safety. Inspection should also be performed while the system is not in operation without exhausting inlet pressure for: loosening of screws; flaws on the piston rod surface; and oil leakage from piston packings, exhaust port of the directional control valve, and piping joint.

#### 3.2 Periodical inspection

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

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

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 cylinder operational distance reaches 1000 km, even before two years from the date of last inspection.

#### 3.3 Residual energy

Maintenance requiring actual operation of a system should be performed after hydraulic pressure / electric shut-down and exhaustion of all residual electrical charge and hydraulic pressure 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.

#### 3.4 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 oil supply.

### ④ Cylinder installation site

Use of a cylinder 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

Eg: Use for nuclear power plants, vehicles, medical components, components related to the Occupational Health and Safety, etc.

If the load on the piston rod and the driving component of the cylinder may possibly harm the operator during the cylinder operation, mount a protection cover so that the operator cannot directly touch the driving components.

### Reference ⑥ Cylinder system control

#### 6.1 Sequence control

Follow the below steps for sequence control of a hydraulic cylinder.

- 1) Detect the piston position.
- 2) Interlock the control of other cylinders 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 cylinder piston to return to the starting position.
- 4) Set a sequence starting position at which movable components do not move after pressure exhaustion.

#### 6.2 Power failure and hydraulic pressure failure

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

### Warning ⑦ Residual pressure exhaustion

Follow the below for exhaustion of residual pressure inside a hydraulic 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 oil exhaustion equipment with a tag.
- 4) If allowing separate maintenance of each cylinder, 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 (non-return valve), a pilot check valve, and/or a closed center check valve, exhaust residual pressure separately or indicate warnings for residual pressure, as oil may be contained even the system is not in operation.
- 6) Indicate the residual pressure exhaustion valve in the system circuit drawing.

### Reference ⑧ Circuit and piping

#### 8.1 Piping

- 1) Do not remove the plastic plug and keep the cylinder packed just before piping in order to prevent dusts and rusts from entering the cylinder during storage or installation.
- 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.
- 4) For piping works using tapered male thread joints or steel tubes, use sealing materials such as seal tape and fasten to adhere tightly to the threads. Do not use wrenches and spanners that are excessively large for the joint or those with long extended handle. Do not step on the wrench/spanner to fasten the pipe.

### Warning ⑨ Disposal

- 1) Do not incinerate a cylinder for disposal. It may explode or emit poisonous gas.
- 2) Check the material of each component of a cylinder with catalogue or operation manual for segregation disposal. Konan cylinders do not include materials indisposible as general industrial waste.

## Users Instructions

### Caution ① Transport of cylinders

#### 1.1 Weight

Heavy-weight cylinders should be transported with the aid of a conveyer equipment. 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 cylinders not to cause cylinder tube deformation and other component damage.

#### 1.2 Dropping

During lifting or horizontal transportation of a cylinder, handle the cylinder carefully not to drop or damage.

#### 1.3 Dust prevention

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

### Caution ② Storage

#### 2.1 Storage during transport

If a cylinder is to be installed where it is exposed to wind and rain or other adverse environment, transport the cylinder to the specified site just before installation. If the cylinder 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

A cylinder 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 a cylinder 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 or other components due to shortage of lubrication. In such cases, conduct pre-conditioning operation of the cylinder before regular use.
- 4) After a long period of storage, permanent deformation, change of size, or deterioration of packings and other components would be a concern. After such storage period, conduct a cylinder operation test. If any abnormalities are found, perform an overhaul or exchange deformed/deteriorated components as appropriate.

### Warning ③ Surrounding environment

#### 3.1 Vibration/shock

- 1) If a cylinder 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 cylinder is used in a place where vibration is a concern, ensure the cylinder is firmly fixed at the setting and connection portions fastened tightly. Particularly, if the cylinder 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 cylinder, significantly affecting operators and surrounding systems.

#### 3.2 Handling during installation

Rough handling of a cylinder may diminish regular performance of the cylinder. For example, riding on, hammering, or dropping the cylinder may cause damage and deformation of the cylinder tube and piston rod. Slight deformation of the cylinder tube diameter will result in malfunction. Also, flaw or deformation of movable components of piston rod will damage packings, causing oil leakage.

#### 3.3 Surrounding environment

Environment surrounding a cylinder should be considered carefully. Avoid places where the cylinder 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 a cylinder with specified range of ambient/working temperature and supply pressure.

### Warning ④ Safety measures

#### 4.1 Operation space

Secure sufficient operation space for safe installation and maintenance of a cylinder. This should be considered sufficiently, since in many cases a hydraulic 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 (squashing, dragging, blow, cutting, burn, electric shock, etc.) by contact with movable, heated, or energized components.
- 2) Safety measures  
Put protection cover to the piston rod 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 cylinder when people come closer.

#### 4.3 Constraint during operation

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

#### 4.4 Other

Care should be taken for risks related to cylinder system operation such as: sudden blowout of oil; unintended actuation of the cylinder due to residual pressure after exhaustion of oil inside the system; and bursting out of the cylinder just after restarting oil supply.

### Warning ⑤ Use of cylinder

#### 5.1 Modification

Do not modify a cylinder. Unexpected risk may arise.

#### 5.2 Lateral load and bending pressure on a piston rod

If a cylinder is operated with lateral load and bending pressure on the piston rod, the piston rod and cylinder tube may be damaged, which may result in deformation, abnormal wearing, and friction fluctuation as well as irregular or abnormal functioning of the cylinder, affecting operators or the mechanical system. In order to avoid this, follow the steps below.

- 1) Remove the lateral load by establishing a guide for the load.
- 2) After alignment to match the piston rod shaft center and the load operating shaft, fix the cylinder and connect the piston rod and the load.
- 3) If the piston rod shaft center and the load operating shaft do not match or the load oscillates, select a method to use fittings such as pin and ball joint to avoid external bending pressure on the piston rod.

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