



# Safety Precautions

Be sure to read this section before use.

Refer to Intro Page 73 for general information of the cylinder, and to Intro Page 80 for general information of the cylinder switch.

## Product-specific cautions: Brake cylinder JSC3/JSC4 Series

### Design/selection

#### 1. Common

#### ⚠ WARNING

- **Design a structure that prevents person(s) from coming into contact with the driven workpiece as well as the moving parts of the cylinder with brakes.**  
Provide a protective cover so that no human body directly touches the unit. In case of possible contact, provide safety measures such as a sensor for emergency stop before making contact and a buzzer to warn of danger.
- **Use a balanced circuit that accommodates the protrusion of the piston rod.**  
If the cylinder is stopped part-way in the stroke with the brake, etc., and air pressure is applied to one side of the cylinder, the piston rod will pop out at high speeds when the brake is released. This could cause physical harm, such as pinched hands or feet, or mechanical damage. Use a balance circuit, such as the basic circuit, to prevent popping out. When using a low hydraulic brake cylinder, the brake section should always be operated by air pressure.
- **The holding force (max. static load) is the ability to hold static load that is not accompanied by vibration or shock, in a state where the brake is operating under no load.**  
Take care when constantly using near the upper limit of the holding force.
- **Do not apply loads with impact, strong vibration, or torque while brakes are activated.**  
If load is externally applied with impact, or if strong vibration or rotational force is externally applied, the holding force can be reduced, creating a dangerous situation.
- **Consider the stopping accuracy and overrun distance during the braking.**  
Because a mechanical lock is applied, the cylinder does not stop instantly when the stop signal is issued, but stops with a time-wise delay. The stroke at which the cylinder slides due to this delay is the overrun distance. The max. and min. width of the overrun distance is the stopping accuracy.
  - To achieve the required stop position, move the limit switch forward by the overrun distance.
  - The limit switch must have a detection length (dog length) of the overrun distance +  $\alpha$ .
  - The operating range of CKD cylinder switches is 7 to 16 mm, depending on the switch model. If overrun distance exceeds this, provide self-holding of the contact at the switch load.
- **In order to improve stopping accuracy, ensure that the brake stops the cylinder as soon as possible after receiving the stop signal.**  
Use a high response DC control electricity circuit or valve, and set the valve as close to the cylinder as possible.
- **The stopping accuracy is susceptible to fluctuations in piston speed.**  
If the piston speed changes due to load fluctuations or by some disturbance while the cylinder is moving, the stopping position may vary sharply. Make sure that the piston speed stays the same up to just before the stop position. Since the speed changes significantly in the cushioned range and in the acceleration range after starting operation, the variability of the stopping position will increase.  
The stopping accuracy with a piston speed of 300 mm/s with no load is  $\pm 1.0$  mm (reference value). This value differs based on the device used. For more information, refer to the page on stopping accuracy and overrun.

#### ■ Basic circuit

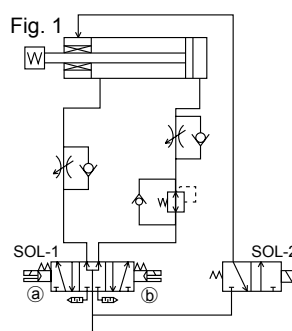
Always adopt the following circuit even for position locking and emergency stop applications. A 2-position valve cannot be used because it affects the brake section even when the cylinder thrust is stopped.

Maintain thrust and load balance with the following circuit.

Brakes may not be released when load is applied to brakes.

##### ● Horizontal load

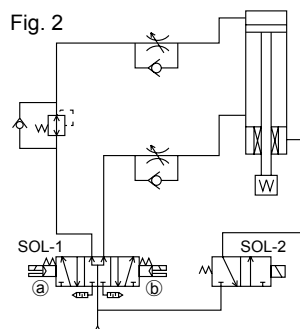
When piping is as shown in Fig. 1, equal pressure is applied to both ends of the piston when stopped to prevent the rod from popping out when the brakes are released. Install a regulator with check valve on the head side to maintain thrust balance.



a SOL-1 b		SOL-2	Operational status
OFF	OFF	OFF	Stop
ON	OFF	ON	Reverse
OFF	ON	ON	Forward

##### ● For downward vertical load

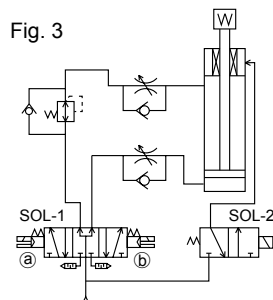
If load faces downward as shown in Fig. 2, the rod malfunctions in the load direction when brakes are released. Place a regulator with a check valve on the head side to reduce thrust in the load direction and balance the load.



a SOL-1 b		SOL-2	Operational status
OFF	OFF	OFF	Stop
ON	OFF	ON	Drop
OFF	ON	ON	Rise

##### ● For upward vertical load

If load faces upward as shown in Fig. 3, the rod malfunctions in the load direction when brakes are released. Place a regulator with a check valve on the rod side to reduce thrust in the load direction and balance the load.



a SOL-1 b		SOL-2	Operational status
OFF	OFF	OFF	Stop
ON	OFF	ON	Drop
OFF	ON	ON	Rise

- **Do not use multiple synchronized cylinders with brakes.** If the synchronization deviates, load is concentrated on the cylinder where the brake was applied first, risking shortened service life or damage.

- Do not apply torque to the rod when braking, as the holding force will decrease, creating hazardous conditions. Also, use this product in mechanisms in which the rod does not rotate.
- Do not apply to the cylinder any force that exceeds the brake holding force listed in the catalog.

### CAUTION

#### Stopping accuracy

- Stopping pitch and load factor

Stopping accuracy differs with stopping pitch and load factor. The load factor below is recommended for achieving stopping accuracy.

\*Stopping position reference value:  $\pm 1.0$  (300 mm/s, no load)

Stop pitch	Load factor	
	JSC3-*	JSC3-S*
50 mm or less	20% of thrust	15% of thrust
50 mm to 100 mm	40% of thrust	30% of thrust
100 mm or more	60% of thrust	45% of thrust

- Selection of valve for brake

The stopping accuracy and overrun distance will change according to the responsiveness of the brake valve. Refer to the JSC3-V electric specification for brake valve and select from the CKD pneumatic valve 4GB2 Series. Connect the valve directly to the brake port to improve stopping accuracy.

- When using a PLC (programmable controller)

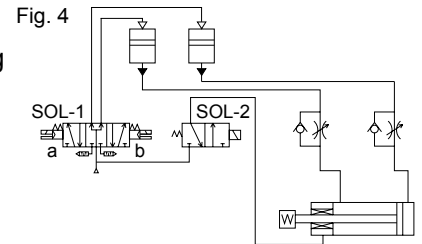
If a PLC (programmable controller) is used as the electrical control unit for the valve for brake, stopping accuracy drops due to scan time (computing time). When using a PLC, do not assemble the valve for brake into the PLC circuit.

- Do not make major changes in applied load when stopped with brakes, or the stopping position may change.

## 2. Low hydraulic JSC3-H/JSC4-H

### WARNING

- If the load fluctuates during the stroke, use the JSC3-H and a converter.



- Release brakes before cylinder operation. The brake may not be released when the cylinder is operating at high speed.
- If back pressure is applied to the locking mechanism, the lock may be released. Use the brake release valve as a single unit, or use an individual exhaust manifold.
- Use a 3-position P/A/B connection (pressurization on both sides) valve for the cylinder drive to prevent the piston from popping out when starting.
- To maintain balance of the thrust, including the load, the side with the larger thrust should have a regulator with a check valve.

### CAUTION

- This product is a pneumatic cylinder which enables the use of hydraulic fluid as its working fluid. Not compliant with JIS standards on activation and leak inspection for hydraulic cylinders.

## 3. Low pressure release JSC3-S

### CAUTION

- Note that brake holding force is also reduced due to release pressure reduction.

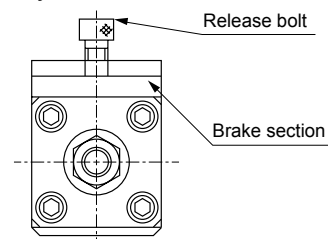
## Mounting, installation and adjustment

### 1. Common

### WARNING

- Release brakes before coupling the load to the end of the rod.  
If coupled while brakes are applied, torque or load exceeding holding force may be applied to the piston rod and damage the brake mechanism.
- If the brake is released while air is applied to only one side of the cylinder, the piston rod can pop out at high speed, creating a dangerous situation. When releasing the brake during adjustment or other maintenance, always observe the following:
  - Check that no one is in the movable range of the load and that no problems will arise if the load moves when brakes are released.
  - When releasing the brake, perform position locking or take other measures:
    - Place the load to the bottom end
    - Pressurize both sides
    - Place a strut to prevent the load from falling.
  - Confirm that air is not pressurized on only one side of the cylinder when releasing brakes.

#### How to manually release the brake



Note: How to release the brake

- The brakes are released by completely screwing the release bolt (attached with product) into the female threads (brake release port) on the top of the brakes. (For cylinders with a bore size of  $\phi 125$  and over, the brake can be released by turning the release bolt 2 to 3 times.) (Always remove the release bolt during normal use.)
- To manually release the brake, always use the release bolt attached with the product. The brakes could be damaged when other bolts are used. Follow the optimum screw-in volume shown below when using a regular bolt.

Bore size	Size		Appropriate screw-in volume
	JSC3	JSC3-V	
ø40/ø50	M10×8	M10×29	4 rotations or less
ø63	M12×9	M12×30	
ø80	M14×10	M14×31	
ø100	M16×12	M16×40	
ø125	M24×16 or higher		2 to 3 rotations
ø140	M24×20 or higher		
ø160	M24×20 or higher		
ø180	M24×24 or higher		

LCM
LCR
LCG
LCW
LCX
STM
STG
STS/STL
STR2
UCA2
ULK*
JSK/M2
JSG
JSC3/JSC4
USSD
UFCD
USC
UB
JSB3
LMB
LML
HCM
HCA
LBC
CAC4
UCAC2
CAC-N
UCAC-N
RCS2
RCC2
PCC
SHC
MCP
GLC
MFC
BBS
RRC
GRC
RV3*
NHS
HRL
LN
Hand
Chuk
MecHnd/Chuk
ShkAbs
FJ
FK
SpdContr
Ending

- Brakes are released manually or by pressurizing the brake release port. When mounting the load, the brake release operation may cause the load to fall; make sure to check that the brake is operational when the manual release operation is set to default or when there is no air in the brake release port.
  - Do not apply torque to the rod when braking, as the holding force will decrease, creating hazardous conditions. Also, use this product in mechanisms in which the rod does not rotate.
  - Do not apply to the cylinder any force that exceeds the brake holding force listed in the catalog.
  - If there is any play, such as looseness, in the brake signal dog, stopping accuracy is affected. Securely fix to eliminate play, etc.
  - If the piston speed is fast, the detection dog must be long enough to match relay response time. If the dog is short, the stop signal is not output and operation does not stop.
- ⚠ CAUTION**
- Adjust the air balance in the cylinder.  
With brakes released, place a load on the cylinder and balance the load by adjusting pneumatic pressure applied to the cylinder rod side and head side. Malfunctions such as piston popping out during brake release or abnormal brake release can be prevented by accurately balancing the load.

- Adjust the installation position of the detector parts, including the cylinder switch.  
When braking, consider the overrun distance vis-a-vis the desired stop position and adjust the installation positions for detector parts, including the cylinder switch.
- Load fluctuations during the reciprocating stroke of the cylinder can cause inconsistent piston speed, leading to greater variation in the stop position. Adjust the mounting of the load so as to prevent any load fluctuations during the reciprocating stroke of the cylinder, especially before the stop position.
- Since the speed changes significantly in the cushioned range and in the acceleration range after starting operation, the variability of the stopping position will increase. For this reason, the distance of the stop position increases when performing step operations with short stroke length, from the start point of the operation to the next position.
- Load to piston rod  
Operate the cylinder so that load applied to the piston rod is always applied in the axial direction more strictly than with a general-purpose air cylinder. Limit load movement using guides so play and torsion do not occur.
- Maintaining the rod sliding parts  
Protect the piston rod sliding surface from scratches and dents. Such scratches and dents can cause damage to packings, resulting in leakage and/or brake failure.

## Use/maintenance

### 1. Common

#### ⚠ WARNING

- The brake section can be removed from the cylinder body. Do not disassemble or inspect brakes, or a hazardous situation may occur when brakes are used again.
- The required grease is applied to brakes. Avoid applying extra grease and do not wipe grease off.
- The required grease is applied when brakes are replaced, so there is no need to apply grease to rods.
- Always use the product with the dust cover on, except for when performing manual release, in order to prevent failure or malfunction.

#### ⚠ CAUTION

- Air supply pipes that are too narrow or too long can reduce stopping accuracy.
- Frictional resistance increases and causes the piston speed to change when the cylinder has been stopped for a long time, such as when using first thing in the morning or afternoon. This may impair stopping accuracy. Conduct conditioning operations to obtain a stable stopping accuracy.

- If the manual release bolt is removed while the piston rod is pulled out, the bolt cannot be screwed in. When the manual release bolt has been removed, supply air from the brake release port and screw in the bolt.
- Certification of class 2 pressure vessel  
According to regulations of the Ministry of Health, Labour and Welfare, the following cylinders should be certified by the Japan Boilers Association.
  - (1) Cylinders with a rated pressure exceeding 0.2 MPa and cylinder capacity exceeding 0.04 m<sup>3</sup>.
  - (2) Cylinders with a rated pressure exceeding 0.2 MPa, tube bore size exceeding 200 mm and length exceeding 1000 mm.

$$V = \frac{D^2 \times S \times 3.14}{4 \times 10^9}$$

V: Cylinder capacity (m<sup>3</sup>)  
 D: Bore size (mm)  
 S: Body length (cylinder tube length) (mm)

- With cushion section check valve (C2)  
The larger the load, the greater the delay in the starting time of the cylinder will be. To shorten the starting time, use the cushion section check valve (C2).