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

Pneumatic components

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: Tie rod with brake JSG Series

Design/selection

⚠ 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 one can directly touch 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.

■ **The holding force 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 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 + α.
● The operating range of CKD cylinder switches is 7 to 16mm (differs depending on the switch model). If overrun distance exceeds this, provide self-holding of the contact at the switch load.

■ **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.**

■ **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 300mm/s with no load is ±1.0mm (reference value). This value differs based on the device used. For more information, refer to the page on stopping accuracy and overrun.

⚠ WARNING

■ **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.
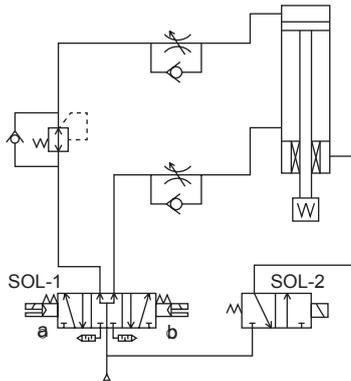
Fig. 1
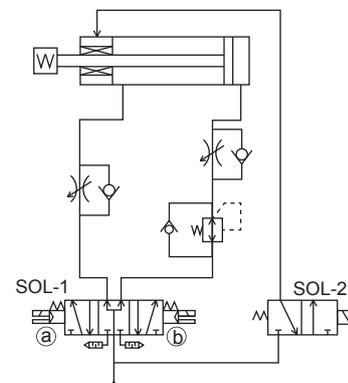
ⓐ SOL-1 ⓑ		SOL-2	Operational status
OFF	OFF	OFF	Stop
ON	OFF	ON	Reverse
OFF	ON	ON	Forward

CKD

Design/selection

● 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.
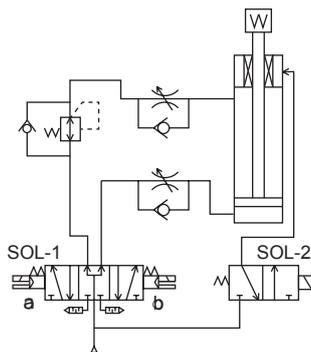
Fig. 2

ⓐ SOL-1 ⓑ		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.

Fig. 3

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

⚠ CAUTION

■ Mount a speed controller on the cylinder.
Mount the speed controller on the cylinder.
Use within the working piston speed range of each series.

■ 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 accuracy reference value: ±1.0 (300 mm/s, no load)

Stop pitch	Load factor
	JSG
50 mm or less	20% of thrust
50 mm to 100 mm	40% of thrust
100 mm or more	60% 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 JSG-V electrical specification for brake valve and select from the CKD pneumatic valve 4KB2 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.

⚠ CAUTION

■ As a cushion mechanism integrated in the cylinder, the rubber cushion and the air cushion are available. The purpose of the air cushion is to absorb the piston's kinetic energy by using air compressibility, avoiding collisions of piston and cover at the stroke end. Thus, the cushion is not used to decelerate the piston speed (deceleration action) near the stroke end. The following table shows the kinetic energy that can be absorbed by the cushion. If the kinetic energy exceeds these values, or if bouncing caused by the air compressibility is to be avoided, consider using another shock absorber.

Bore size (mm)	Rubber cushion	Air cushion	
	Allowable absorbed energy J	Effective air cushion length (mm)	Allowable absorbed energy J
ø40	0.9	8.6	3.7
ø50	1.6	13.4	8.0
ø63	1.6	13.4	14.4
ø80	3.3	15.4	25.4
ø100	5.8	15.4	45.6

Kinetic energy (J) =

$$\frac{1}{2} \times \text{Weight (kg)} \times \{\text{Speed (m/s)}\}^2$$

(Note) Calculating kinetic energy

Average cylinder speed is obtained with $Va = \frac{L}{T}$.

  Va : Average speed   (m/s)
  L : Cylinder stroke   (m)
  T : Operating time   (s)

With respect to this, the cylinder speed just before rushing into the cushion can be obtained with the following simple formula.

  $Vm = \frac{L}{T} \times (1 + 1.5 \times \frac{\omega}{100})$

  Vm : Speed just before rush-into the cushion (m/s)
 ω   : Cylinder load factor   (%)

Use this Vm value as speed to calculate kinetic energy.

Mounting, installation and adjustment

⚠ 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 pressured on only one side of the cylinder when releasing brakes.

■ How to manually release the brake
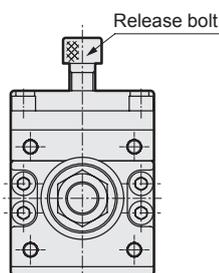
Release bolt

Note: How to release the brake
● The brakes are released by screwing the release bolt into the female threads (brake release port) on the top of the brakes. (Always remove the release bolt during normal use.)

Release bolt size

Bore size	Bolt screw diameter	Bolt length		Appropriate screw-in volume
		JSG	JSG-V	
ø40	M12×1.75	16 or more	40 or more	3 rotations or less
ø50	M12×1.75	16 or more	40 or more	4 rotations or less
ø63	M14×2	16 or more	40 or more	4 rotations or less
ø80	M16×2	20 or more	40 or more	4.5 rotations or less
ø100	M18×2.5	20 or more	50 or more	5 rotations or less

■ 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.

CKD

Mounting, installation and adjustment

⚠ WARNING

■ With the JSG Series, the brakes can be manually released by screwing a hexagon socket head cap bolt into the brake release female thread on the top of the brakes. However, the brakes may be damaged if the bolt is screwed in too far; use the appropriate screw insertion depth for the release bolt shown in the table below.

Bore size	Suitable screw-in volume
ø40	3 rotations or less
ø50	4 rotations or less
ø63	4 rotations or less
ø80	4.5 rotations or less
ø100	5 rotations or less

■ 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 accuracy described in the specifications may not be obtained when a step just after start of the operation has a short stroke to the next point.

■ Load to piston rod
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.

■ Fixing the switch
For screw fixing when using T2, T3, T0, or T5, use a flathead screwdriver (clockwork screwdriver, precision screwdriver, etc.) with a grip diameter of 5 to 6 mm, a 2.4 mm or smaller tip, and a thickness of 0.3 mm or less to tighten the screws with a tightening torque of 0.1 to 0.2 N·m.
When using T2J, T2Y, or T3Y, tighten the screw with a tightening torque of 0.5 to 0.7 N·m.

JSG/JSG-V Series

Use/maintenance

⚠ 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.

CKD