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: Brake cylinder JSK2/JSM2 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 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 recommended pneumatic pressure 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 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 + α.
- 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.

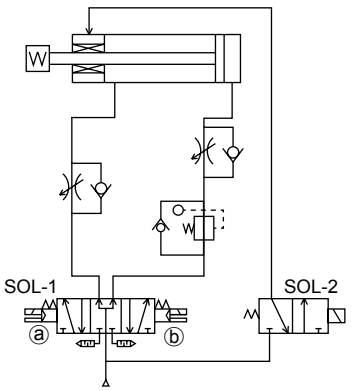
■ The stopping accuracy is susceptible to fluctuations in piston speed.
If the piston speed changes due to load fluctuations or by some disturbance while the cylinder is moving, the stopping position may vary sharply. Make sure that the piston speed stays the same up to just before the stop position. As well, 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 piston speed of 300 mm/s with no load is ±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.

■ Do not use multiple synchronized cylinders with brakes. If the synchronization deviates, an excess moment load or load concentration is applied to the cylinder where the brake was applied first, risking brake release defects, shortened service life, or damage.

■ 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

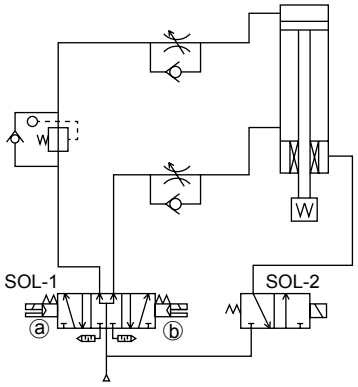


ⓐ SOL-1 ⓑ		SOL-2	Operational status
OFF	OFF	OFF	Stop
ON	OFF	ON	Reverse
OFF	ON	ON	Forward

● 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

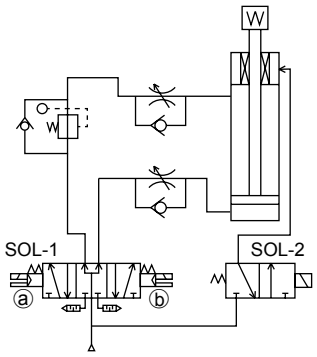


ⓐ SOL-1 ⓑ		SOL-2	Operational status
OFF	OFF	OFF	Stop
ON	OFF	ON	Drop
OFF	ON	ON	Rise

● 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

⚠ WARNING

■ Drain

If the piping capacity is larger than the brake release cylinder capacity, the compressed air in the cylinder will not be completely exhausted when switching with the solenoid valve. This compressed air will condense, form water drops, and cause drainage.
Drainage will cause lubricant to flow and cause lubrication faults, temporarily block the passage, corrode the inside of the brakes, cause faulty brake operation, obstruct the stopping accuracy, and/or prevent application or release of the brakes, etc.

Calculate the working compressed air's atmospheric dew point from the scale factor A of the piping capacity with respect to the cylinder capacity. Install a dryer and adjust the air quality so that the value is kept below the following values and drainage is not generated. This can also be done by adjusting the bore size and length of the tube from the release port to the solenoid valve to match the working compressed air's atmospheric dew point so that the following conditions are satisfied.

Magnification A<1 : Atmospheric dew point -20°C or below
1 ≤ Magnification A<2 : Atmospheric dew point -25°C or below
Magnification A ≥ 2 : Atmospheric dew point -30°C or below

Calculation of scale factor A of the piping capacity with respect to the cylinder capacity

$$A=\frac{V_t+V_1}{V_0(10P+1)}$$

V_t : Piping volume (mm^3)
V_0: Brake release cylinder volume (mm^3)
V_1: Brake release cylinder blank volume (mm^3)
P : Working pressure (MPa)

	$V_0(mm^3)$	$V_1(mm^3)$
JSK2-20 JSM2-20	754	754
JSK2-25 JSK2-32 JSM2-30	1963	1865
JSK2-40 JSM2-40	4021	3860

Example)JSK2-20, Piping to the brake release port, Tube I.D.: ø4 / length: 1.5 m Operating pressure: 0.5 MPa

Piping volume V_t = Cross-sectional area x length = 4 x 4 x π / 4 x 1500
≈ 18,850 mm^3

$$A=\frac{18850+754}{754\times(10\times0.5+1)}=4.3$$

Adjust the air quality so that the atmospheric dew point is -30°C or below.

● If adjustment is difficult, consider using a cylinder with valve (JSK2-V, JSM2-V).

■ 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 solenoid valve as a single unit, or use an individual exhaust manifold.

■ Use a 3-position P/A/B connection (pressurization on both sides) solenoid 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

■ Notes for 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
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 JSK2-V and JSM2-V brake valve electric specifications. 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.

■ For a TA mounting, the brake section with cover and the clevis bracket cannot be selected together since they may interfere with each other.

■ Although the contact service life of the reed switch varies depending on usage conditions, it will generally last several million cycles. The contact service life is reached sooner if the device is used continuously or operated at a high frequency. In this case, use a proximity switch with no contact.

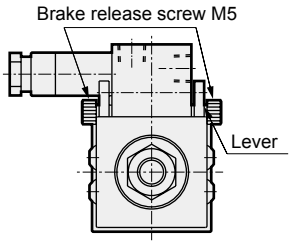
Mounting, installation and adjustment

⚠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.

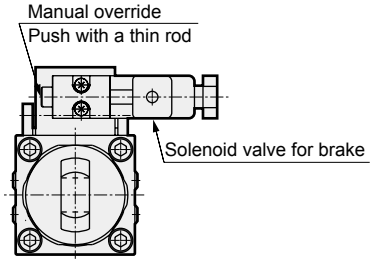
■ If the brake is released while air is applied to only one side of the cylinder, the piston rod can pop out at high speed, creating a dangerous situation. When releasing the brake during adjustment or other maintenance, always observe the following:
● Check that no one is in the movable range of the 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
● When there is no pneumatic source/power supply



As shown in the above figure, the brakes are released by turning the lever screws on both sides two or three turns past the point where they offer resistance.
Note ① The brake may go out if screwed in too far.
② Always remove the screw during normal operation.

● When manually operating the solenoid valve for the brake (with pneumatic source)



As shown in the above figure, the brakes are released when the manual override on the solenoid valve is pushed with a bar. Note that a non-locking method is incorporated, so the brakes will be applied when the manual device is released.

■ 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.

■ With the JSM2 Series, the brakes can be manually released by screwing a hexagon socket head cap bolt into the brake release female thread on the side or top of the brakes. However, the brakes may be damaged if the bolt is screwed in too far; use the bolts attached with the product, or if using commercially available bolts, use the appropriate screw insertion depth for the release bolt shown in the table below.

Bore size	No. of bolt rotations
ø20	8 to 9 rotations
ø25	11 to 12 rotations
ø30	
ø32	
ø40	14 to 15 rotations

ø20 to ø40 : Bolts M5 x 15 or over

■ 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 length to the next point.

■ 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.

■ The terminal box is shipped facing inward (ø20: downward) when shipped to prevent damage. Set it to the orientation to be used when wiring the terminal box.

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.

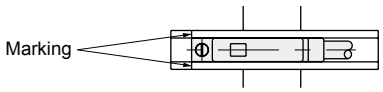
■ Frictional resistance increases and causes the piston speed to change when the cylinder has been stopped for a long time, such as when using first thing in the morning or afternoon. This may impair stopping accuracy. Conduct conditioning operations to obtain a stable stopping accuracy.

2. Common (With T type switch)

⚠CAUTION

■ When moving the switch position to the stroke length direction

- The 1-color display switch can be fine-tuned by ±3 mm from the default. If the adjusting range exceeds ±3 mm, or when fine-tuning the 2-color display switch, move the band position.
- Loosen the switch fixing screw, shift the switch along the rail, then tighten at the specified position.
  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 T*C, T1, T2J, T2Y, T3Y, or T8, tighten the screw with a tightening torque of 0.5 to 0.7 N·m.
- The switch bracket rail has a marking 4 mm from the rail end. Use as a guide to the mounting position when replacing the switch.
  Switch rail markings are set to the default switch max. sensitivity position.
  The max. sensitivity position will change when the switch is changed or when the band is moved. Adjust the position accordingly in this case.



■ When moving the switch position to the circumferential direction

- Loosen the band fixing screw, shift the switch rail in the circumferential direction, then tighten at the specified position. Tightening torque is 0.6 to 0.8N·m.

■ Shifting the band position

- Loosen the band fixing screw, shift the switch rail and band along the cylinder tube, and tighten at the specified position. Tightening torque is 0.6 to 0.8N·m.