CKD

SM-218289-A

INSTRUCTION MANUAL

SHOCKLESS VALVE

SKH-4

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

3rd

CKD Corporation

Safety precautions

When designing and manufacturing a device using CKD products, the manufacturer is obligated to manufacture a safe product by confirming safety of the system comprising the following items:

- Device mechanism
- Pneumatic control circuit
- Electric control that controls the above

It is important to select, use, handle, and maintain the product appropriately to ensure that the CKD product is used safely.
Observe warnings and precautions to ensure device safety.
Check that device safety is ensured, and manufacture a safe device.

⚠ WARNING

1. This product is designed and manufactured as a general industrial machine part. It must be handled by someone having sufficient knowledge and experience.

2. Use this product within its specifications.

This product cannot be used beyond its specifications. Additionally, the product must not be modified or machined.
This product is intended for use in general industrial devices and parts. Use beyond such conditions is not considered. Consult with CKD for details when using the product beyond the unique specification range, outdoors, or in the following conditions or environments.
In any case, measures for safety shall be provided when the vavle malfunctions.

① Use for special applications requiring safety including nuclear energy, railroad, aviation, ship, vehicle, medical equipment, equipment or applications coming into contact with beverage or food, amusement equipment, emergency shutoff circuits, press machine, brake circuits, or for safeguard.
② Use for applications where life or assets could be adversely affected, and special safety measures are required.

3. Observe corporate standards and regulations, etc., related to the safety of device design and control, etc.

ISO4414, JIS B 8370 (pneumatic system rules)
JFPS2008 (principles for pneumatic cylinder selection and use)
Including High Pressure Gas Maintenance Law, Occupational Safety and Sanitation Laws, other safety rules, standards and regulations, etc.

4. Do not handle, pipe, or remove devices before confirming safety.

① Inspect and service the machine and devices after confirming safety of the entire system related to this product.
② Note that there may be hot or charged sections even after operation is stopped.
③ When inspecting or servicing the device, turn off the energy source (air supply or water supply), and turn off power to the facility. Release any compressed air from the system, and pay enough attention to possible water leakage and leakage of electricity.
④ When starting or restarting a machine or device that incorporates pneumatic components, make sure that system safety, such as pop-out prevention measures, is secured.

5. Observe warnings and cautions on the pages below to prevent accidents.

■The safety cautions are ranked as "DANGER", "WARNING" and "CAUTION" in this section.

⚠ DANGER :When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries, or when there is a high degree of emergency to a warning.

⚠ WARNING :When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries.

⚠ CAUTION :When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.

Note that some items described as "CAUTION" may lead to serious results depending on the situation. In any case, important information that must be observed is explained.

⚠ WARNING

- ●Do not mount a deceleration command switch close to the cylinder end; the exhaust pressure of the cylinder will not be properly applied, resulting in an excessive impact and breakage of the cylinder or connected equipment.
- ●Do not set the pressure of the relief valves(R1 and R2)at too low a level before adjustments; otherwise, too much pressure will be relieved, resulting in an excessive impact and breakage of the cylinder or connected equipment.
- ●Do not perform an intermediate halt with the SKH-430 for an extended period of time; it will cause air leakage, so that upon resumption of operation, the piston may be thrust out, result out, resulting in an excessive impact and breakage of the cylinder or connected equipment.
- ●When the setting of a relief valve is complete, be sure to lock the valve knob. Failure to do so will cause the knob to loosen, changing the settings of the cylinder to increase the high speed and impact. This will result in breakage of the cylinder or connected equipment.
- ●To prevent a short circuit or an electric shock, do not remove the DIN terminal while the solenoid valve is energized.

Mandatory Installation of a Regulator

Since the Shockless Valve utilizes exhaust pressure in its cushion system, any fluctuation in the supply pressure affects the cushion characteristic. To avoid this adverse effect, be sure to install a regulator.

Precautions with regard to guarantee

● Guarantee period

The guarantee period of our product shall be one (1) year after it is delivered to the place specified by the customer.

● Guarantee coverage

If any failure for which CKD CORPORATION is recognized to be responsible occurs within the above warranty period, a substitute or necessary replacement parts shall be provided free of charge, or the product shall be repaired free of charge at the plant of CKD CORPORATION.

However, the guarantee excludes following cases:

① Defects resulting from operation under conditions beyond those stated in the catalogue or specifications.
② Failure resulting from malfunction of the equipment and/or machine manufactured by other companies.
③ Failure resulting from wrong use of the product.
④ Failure resulting from modification or repairing that CKD CORPORATION is not involved in.
⑤ Failure resulting from causes that could not be foreseen by the technology available at the time of delivery.
⑥ Failure resulting from disaster that CKD is not responsible of.

Guarantee stated here covers only the delivered products. Any other damage resulting from failure of the delivered products is not covered by this guarantee.

● Confirmation of product compatibility

Our customer shall be responsible of confirming compatibility of our product used in our customer's system, machinery or device.

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SKH-4
Shockless valve

Manual No. SM-218289-A

1. General Description of the SKH-4 Shockless Valve

The Shockless Valve is an air regulator for use with a cylinder. Provided with an outer cushion circuit for smooth cushioning at the cylinder ends, the Shockless Valve utilizes exhaust pressure in its cushion system.

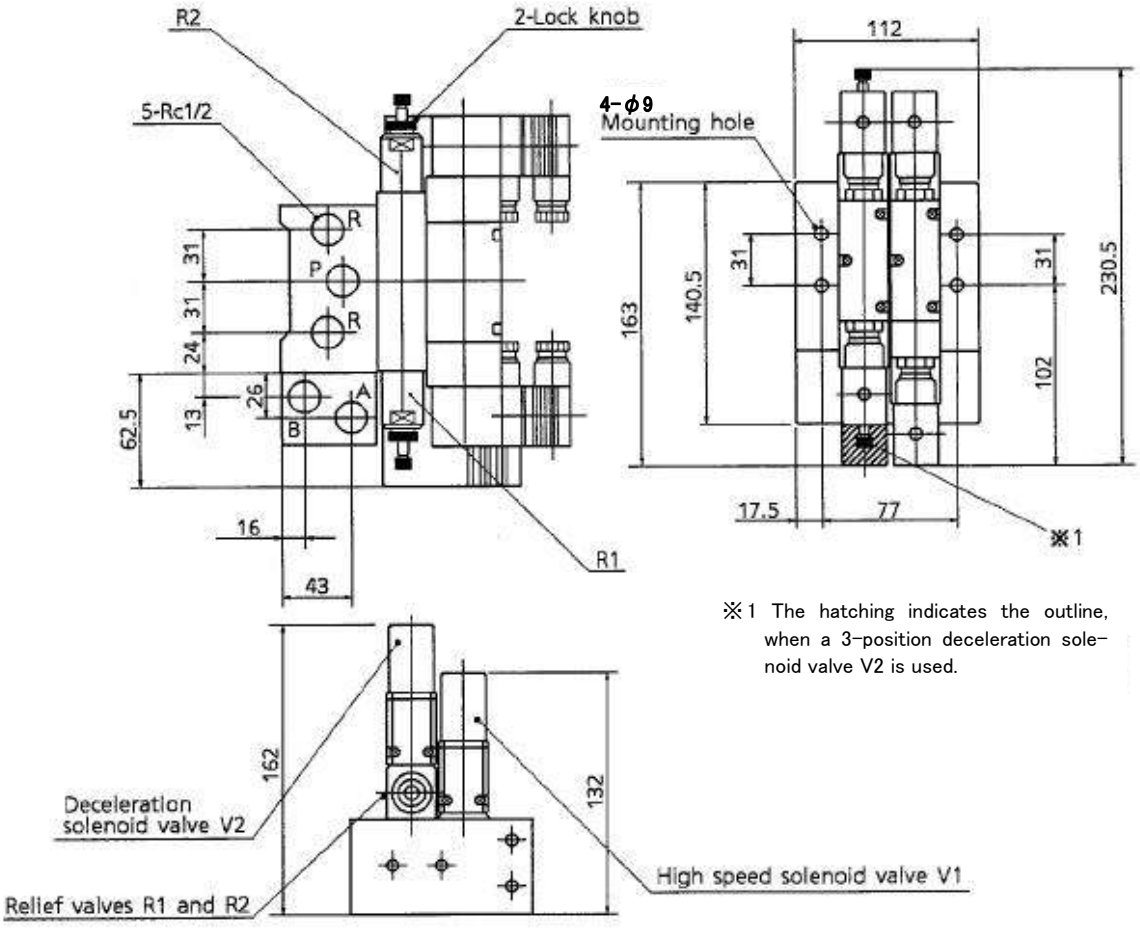
2. When Unpacking the Shockless Valve

Make sure that the model number indicated on identification plate of the received product is the same as that of your order.

3. Installation

3. 1 Mounting position

The Shockless Valve "SKH-4 type" may be mounted in any position. See the following drawings for the installation dimensions.



Drawings of SKH-4 type

3．2 Surrounding Conditions

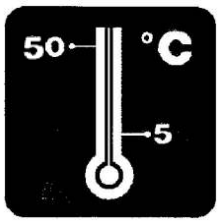
(1) Do not install the unit and other related components (filter, direction control valve, cylinder, etc.) where they can be affected by rain, water, or direct sunlight. Avoid outdoor installation.

(2) Do not use the unit where there is no direct protection against the falling or splashing of chips, oil, coolant liquid , oil mist, etc. If the unit has to be installed where these elements are present, make sure to protect the unit by means of a cover or similar devise.

(3) Do not use the unit where there is no direct protection against undesirable elements that may be adrift in the air such as chips, dust, dirt, and spatters. If the unit has to be installed where these elements do exist, make sure to protect the unit by means of a cover or similar devise.

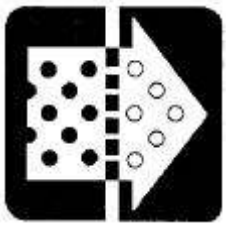
(4) Do not use the unit in an environment that is conducive to corrosion because it will cause damage and can cause the unit to malfunction.

(5) Use the unit within a temperature range of between 5℃ and 50℃. A temperature above 50℃ can cause damage and lead to a malfunction in the unit. A temperature below 5℃ can produce freezing of the moisture inside the pneumatic circuit, that can cause damage and lead to a malfunction in the unit. Take appropriate measures against the occurrence of such freezing.



3. 3 Fluid

(1) The unit requires the supply of clean and dry compressed air. Be sure to include a filter or other necessary devices in the pneumatic circuit. Note that the filtration rating and flow rate of the filter must be carefully determined, and also that the filter must be positioned close enough to the direction control valve. Be sure to discharge the drain liquid properly.
(Check the drain liquid level periodically and discharge the drain liquid before it reaches the filter element.)



(2) The unit can be used without lubrication. If the user decides to lubricate the unit, however, the user can do so with First Class Turbine Oil as per ISO VG32. The use of any other lubricant may cause a malfunction through damage to the packings. Once the unit is lubricated, watch out for a shortage of the lubricant. The operation becomes unstable when the lubrication becomes insufficient.

⚠ CAUTION

- If carbide (carbon, tar, or similar substances) in the compressor oil enters the pneumatic circuit, it will cause components to malfunction (filter, direction control valve, cylinder, etc.) Be sure to maintain and inspect the air compressor and other pneumatic components as instructed by the manufacturer.
- If unclean or humid compressed air is supplied, it will drastically decrease the life spans of components (filter, direction control valve, cylinder, etc.) and consumable parts (packings, gaskets, etc) and may lead to a malfunction.
- If the air compressor is installed in an atmosphere that includes corrosive elements, corrosion will take place inside the components supplied with this compressed air, and this ultimately will result in damage or a malfunction.

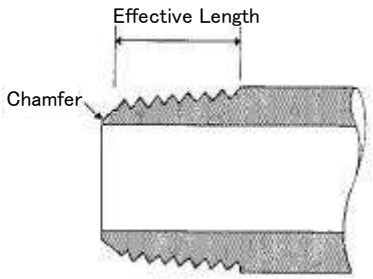
3. 4 Piping

(1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc.

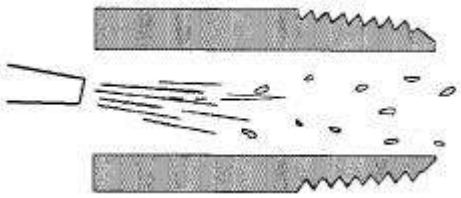
(2) See to it that the pipe connecting cylinder and solenoid valve has an effective sectional area which is needed for the cylinder to drive at the specified speed.

(3) Install filter preferably adjacent to the upper-stream to the solenoid valve for eliminating rust and foreign substances in the drain of the pipe.

(4) Be sure to adhere to the effective thread length of gas pipe and make a chamfer of approx. 1/2 pitch from the threaded end.

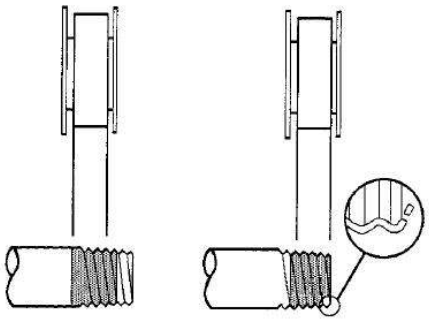


(5) Flush air into the pipe to blow out foreign substances and chips before piping.



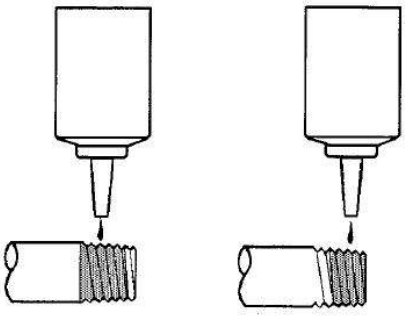
(6) Refrain from applying sealant or sealing tape approx. two pitches of thread off the tip of the pipe to avoid residual substances from falling into the piping system.

●Seal Tape



Right False

●Sealant(Paste or liquid)



Right False

3. 5 Wiring

●The applicable cabtyre cable is JIS C 3306 (VCTF of 0.75mm^2 and the diameter of ϕ4.5～ϕ7)

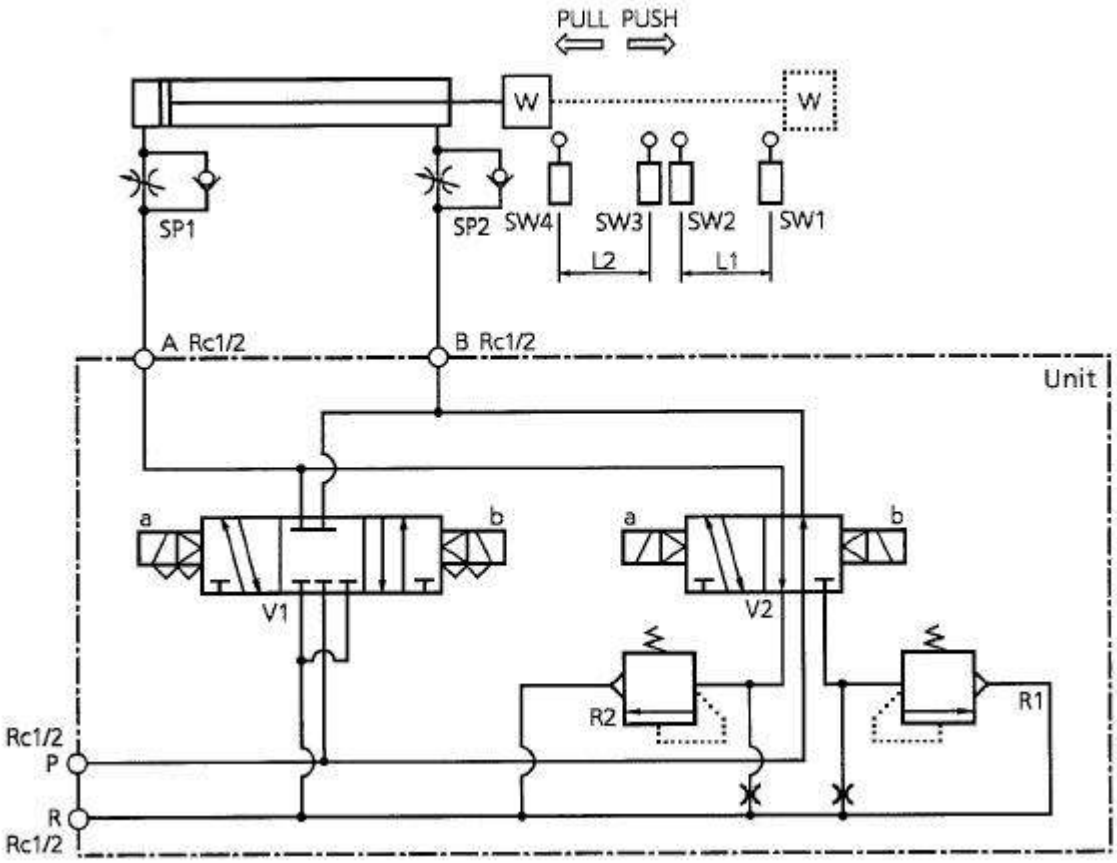
●The applicable crimp terminals are 1.25-3 and 1.25C3A manufactured by Japan Solderless Terminal Co.,Ltd. and their equivalents.

●The tightening torque range for the terminal stand screws is 0.5N·m±15%.

●Securely tighten the mounting machine screws of the main body of the solenoid valve.

3. 6 Piping diagram

Example of piping for the SKH-420.



4. Adjustments

4. 1 Notes on making adjustments

● The cushion characteristics of the air cylinder can be adjusted with the relief valves R1 or R2 of the variable speed unit, and the deceleration proximity switches SW2 and SW3 mounted on the air cylinder. The relief valves R1 or R2 adjust the exhaust pressure of the air cylinder to decelerate the cylinder speed. To increase the pressure and, consequently, the cushioning, turn the knob clockwise. (Adjust the knob of the relief valve located opposite the energizing side of the solenoid valve V2.) The mounting positions of the deceleration proximity switches SW2 and SW3 determine the cushion stroke of the air cylinder. See Table 1 below for reference when deciding mounting positions.

{Working conditions : horizontal operation of 80 mm-bore air cylinder with guide;maximum speed of 1,250 mm/sec.}

Table1

Load	The push stroke	The pull stroke
392N	300～400mm	250～350mm
784N	400～500mm	300～400mm
1177N	450～550mm	400～500mm
1569N	500～600mm	450～550mm

4. 2 How to set adjustments

4. 2. 1 Initial common settings for both push and pull sides

Follow the procedure below to perform initial settings:

Step1. Turn the knobs of the speed controllers SP1 and SP2 four to five rotations from their fully closed positions (so that each speed controller is set to 30-40% of its full capacity).

Step 2. Set the deceleration proximity switches SW2 and SW3 according to Table 1.

Step 3. Turn the adjusting knobs of the relief valves R1 and R2 four to five rotations from their fully closed positions.

Step 4. Select the load according to working conditions, such as the supplied pressure and the electrical signals, and operate the cylinder.

Step 5. During operation, check to see if bounce occurs before the stroke end (or the cylinder may slow down close to a standstill) or if any impact occurs at the stroke end.

Step 6. In case of bounce, gradually open the applicable speed controller to obtain approximately the desired speed while confirming bounce still occurs.
In the case of an impact at the stroke end, tighten the knob of the applicable relief valve until bounce occurs.

4. 2. 2 Push side setting

Step 7. Gradually open the relief valve R1 of the unit until the pistonrod smoothly stops without bouncing while repeatedly operating the cylinder. (At this step, there is no need to consider the cushioning on the pull side.) Even if the pistonrod cannot be made to stop smoothly by this setting, proceed to the next step anyway; to eliminate this problem, reposition the deceleration proximity switch SW2 at the end of the adjustment procedure.

Step 8. Adjust the speed controller SP2 attached to the piping port of the cylinder to obtain the desired Tact time. To increase the speed, slightly open the speed controller SP2 and then adjust the relief valve R1. Repeat this process until the desired speed is obtained.

4. 2. 3 Pull side setting

Step 9. Gradually open the relief valve R2 of the unit until the pistonrod smoothly stops without bouncing while repeatedly operating the cylinder. (there is no need to consider the cushioning on the push side.) Even if the pistonrod cannot be made to stop smoothly by this setting, proceed to the next step anyway;to eliminate this problem, reposition the deceleration proximity switch SW3 at the end of the adjustment procedure.

Step10. Adjust the speed controller SP1 attached to the piping port of the cylinder to obtain the desired Tact time. To increase the speed, slightly open the speed controller SP1 and then adjust the relief valve R2.Repeat this process until the desired speed is obtained.

4. 2. 4 Final adjustment

Step 11. For the final, fine adjustments, reposition the deceleration switches SW2 and SW3 to cause he piston to stop smoothly. Upon completion of the final adjustments, fix the lock knobs.

5. Description of Operation

5. 1 Operation on the push side

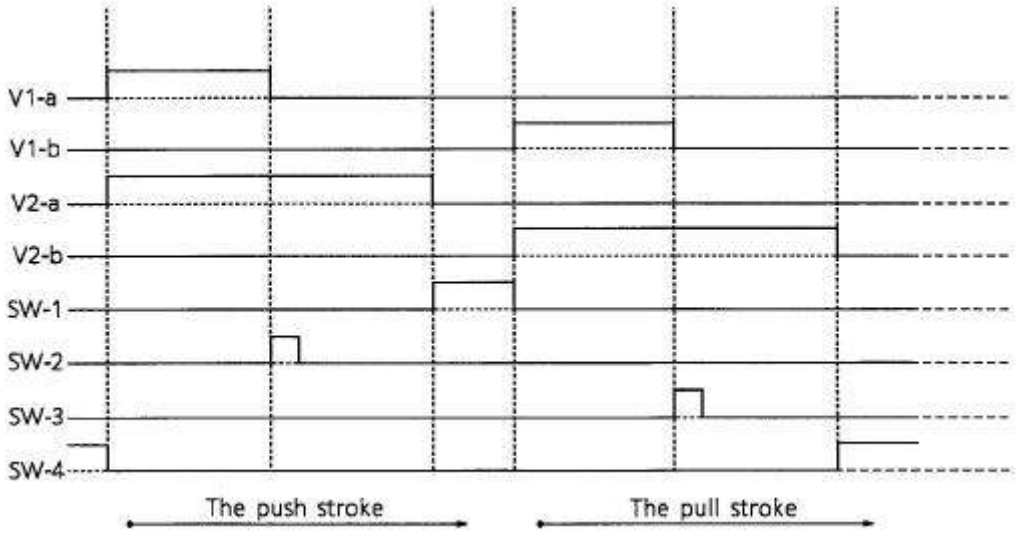
●When the "a" sides of the solenoid valves V1 and V2 are energized, the cylinder operates at a high speed. When the deceleration proximity switch SW2 is turned on, the solenoid valve V1 is no longer energized. Then, the exhaust pressure on the rod side builds up by the function of the relief valve R1 mounted on the exhaust side of the solenoid valve V2, thereby smoothly slowing down the rod to a half. The distance (L1) between the proximity switches SW1 and SW2 is the cushion stroke of the push stroke.

5. 2 Pull return stroke

●When the "b" sides of the solenoid valves V1 and V2 are energized, the cylinder operates at a high speed. When the deceleration proximity switch SW3 is turned on, the solenoid valve V1 is no longer energized. Then, the exhaust pressure on the rod side builds up by the function of the relief valve R2 mounted on the exhaust side of the solenoid valve V2, thereby smoothly slowing down the rod to a half. The distance (L2) between the proximity switches SW3 and SW4 is the cushion stroke of the pull stroke.

Note : The time until stop of the cylinder can be selected by adjusting the pressure of the relief valves. To stop the cylinder smoothly, adjust the cushion stroke and the relief valves. The piping diagram of Section 3.6 illustrates an example for piping the SKH-420; the SKH-430 and 450 require a different solenoid valve in the place of the place of the solenoid valve V2.

＜Time Chart＞



Design a circuit such that its control sequence is compatible with the timing

6. How to Change Parts

6. 1 Replacing the high speed solenoid valve V1

●Unscrew the three mounting screws (M4×45). Then the solenoid V1 can be removed from the subplate, and replace new V1 valve.

6. 2 Replacing the deceleration solenoid valve V2 and the relief valve R1 and R2

●First, unscrew the three mounting screws (M4×75). Second, remove from the subplate any of the deceleration solenoid valve V2 and the relief valves R1 and R2 as required, and replace new parts.

6. 3 Notes on changing parts

●When changing the high speed solenoid valve V1 and the deceleration solenoid valve V2, exercise care not to mount the replacement in reverse positions. As Drawings of SKH-4 Type by Page ”5”.

●Each gasket has one sealing surface; face each sealing surface in the proper direction during assembly.

●When a relief valve R1 or R2 is replaced, the cushioning changes. Perform the procedure described in Section 4.2 to make readjustments.

●When maintenance is performed on the air cylinder or either or of the speed controllers, repeat the adjustment procedure described in Chapter 4.

6. 4 Parts list

●For SKH-4 series valves with no anti-exhaust treatment code:

	High speed solenoid V1	Deceleration solenoid V2	Relief valves R1 and R2
SKH-420 type	4KB439-00-LS-(voltage)	4KB429-00-LS-(voltage)	SKH-4-SR
SKH-430 type	4KB439-00-LS-(voltage)	4KB439-00-LS-(voltage)	SKH-4-SR
SKH-450 type	4KB439-00-LS-(voltage)	4KB459-00-LS-(voltage)	SKH-4-SR

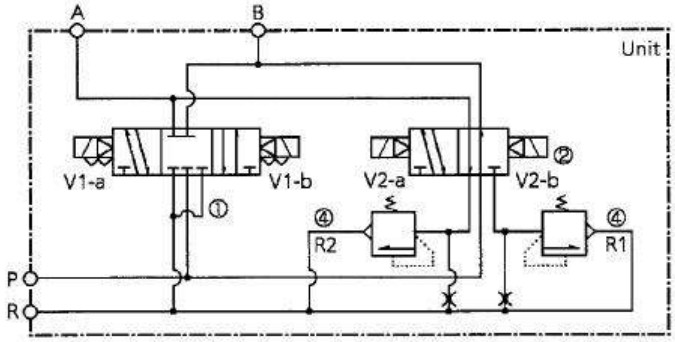
●For SKH-4 series valves with anti-copper-ionizing code P6:

	High speed solenoid V1	Deceleration solenoid V2	Relief valves R1 and R2
SKH-420 type	4KB439-00-LS-(voltage)-P6	4KB429-00-LS-(voltage)-P6	SKH-4-SR
SKH-430 type	4KB439-00-LS-(voltage)-P6	4KB439-00-LS-(voltage)-P6	SKH-4-SR
SKH-450 type	4KB439-00-LS-(voltage)-P6	4KB459-00-LS-(voltage)-P6	SKH-4-SR

7. Configuration of SKH-4 series valves

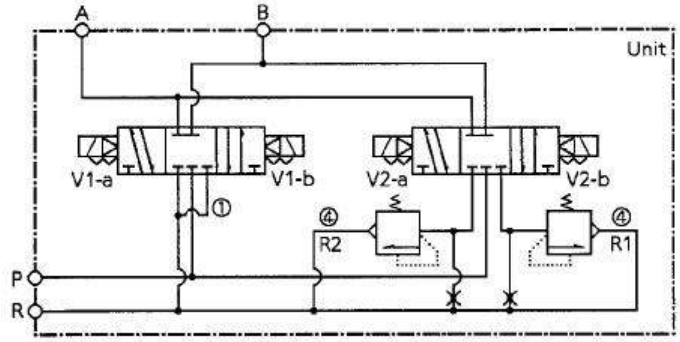
7. 1 SKH－420

To be used for standard ON/OFF operation. No intermediate stop is possible. In the event of a power failure, the piston continues to advance, stopping at the stroke end.



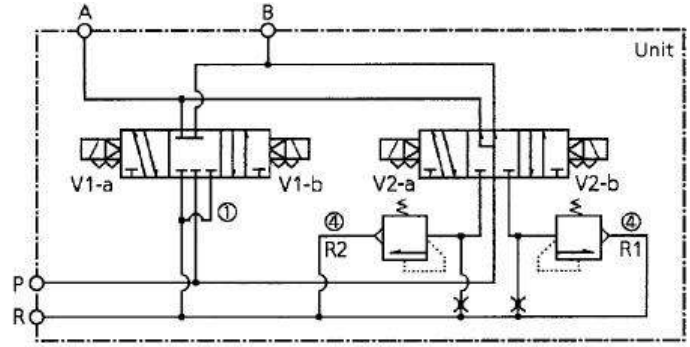
7. 2 SKH－430

Intermediate stops are possible. However, upon operation after a prolonged stop, the cylinder may be thrust out due to air leakage.



7. 3 SKH－450

Intermediate stops are possible. If a cylinder with a brake mechanism is to be controlled or a prolonged stop is required, both ends of the cylinder must be pressurized to maintain the rod in the intermediate position.



Caution:

Since both ends of the cylinder are pressurized during a stop, a reverse regulator may be installed to obtain a proper pressure balance.

8. Troubleshooting

Problem	Primary cause	Secondary cause	Action
Cylinder dose not operate.	Solenoid valve does not switch on.	No signal received.	Correct the electric control circuit.
		No air pressure applied.	Turn on the air source.
		Insufficient air pressure.	Adjust the pressure setting of the regulator.
		Coil breakage.	Change the coil.
		Contact failure in the terminal.	Rewire or exchange the new terminal.
		Foreign matter caught in the spool packing.	Overhaul the spool to remove any foreign matter.
	No exhaust side air obtained.	Speed controller is fully choked	Open the speed controller choke
Cylinder speed too slow.	High speed solenoid valve V1 does not switch on.	No signal received.	Correct the electric control circuit.
		Coil breakage.	Change the coil.
		Contact failure in the terminal.	Rewire or exchange the new terminal.
	Deceleration solenoid valve V2 does not switch on.	No signal received.	Correct the electric control circuit.
		Coil breakage.	Change the coil.
		Contact failure in the terminal.	Rewire or exchange the new terminal.
	Combined effective sectional area is too small.	Piping hose diameter is too small.	Use hose with larger diameter.
		Piping distance is too long.	Shorten the piping distance.
	Insufficient thrust.	Low air pressure.	Adjust the pressure setting of the regulator.
		Cylinder bore is too small	Use a cylinder with a larger bore.
		Excessive load.	Use a cylinder with a larger bore or adjust the pressure setting of the regulator.
Cylinder dose not decelerate.	High speed solenoid valve V1 dose not switch off.	No signal received.	Correct the electric control circuit.
		Foreign matter caught in the spool packing.	Overhaul the spool to remove any foreign matter.
	Deceleration solenoid valve V2 does not switch on.	No signal received.	Correct the electric control circuit.
		Foreign matter caught in the spool packing.	Overhaul the spool to remove any foreign matter.
		Deceleration switch positioned too close to the stroke end.	Reposition the deceleration switch.
	Exhaust pressure does not build up.	Relief valve set value is too low.	Change the relief valve set value.
		Speed controller choke is fully open.	Adjust the speed controller choke.
Cylinder bounds.	Exhaust pressure cannot be relieved.	Speed controller choke is too throttled.	Adjust the speed controller choke.
		Relief valve set value is too high.	Change the relief valve set value.

9. Specifications

Fluid specifications	Working fluid	Compressed air
	Working pressure (MPa)	0.3～0.7
	Ambient temperature (℃)	−5～50(No freezing)
	Fluid temperature (℃)	5～50
	Lubrication	Not required See Section 3.3(2)
	Manual override	Non-locking type
	Flow characteristics：C	8.9 $dm^3/(s \cdot bar)$
Electric specifications of coils	Rated voltage	AC100V、AC200V、DC24V
	Power consumption (W)	AC 50Hz 1.8、60Hz 1.5、DC 2.0
	Temperature rise (℃)	30
	Voltage fluctuation range	±10%
	Thermal class	B種
	Electric connection	Small terminal box
Others	Minimum stroke (mm)	800
	Minimum speed (mm/s)	500

10. Model No. Classification

SKH — a b c — d — e — f

ⓕ Anti-exhaust treatment type code

None	Standard model
P6	Anti-copper ionizing treatment model

ⓔ Voltage

1	AC100V 50/60Hz	Standard
2	AC200V 50/60Hz	
3	DC24V	

ⓓ Port size

15	Rc1/2

ⓒ Operator type

0	Solenoid valve

ⓑ Position / Operator type

2	2-position double
3	3-position all ports closed
5	3-position P/A/B connection

ⓐ Size

4	Using 4KB4