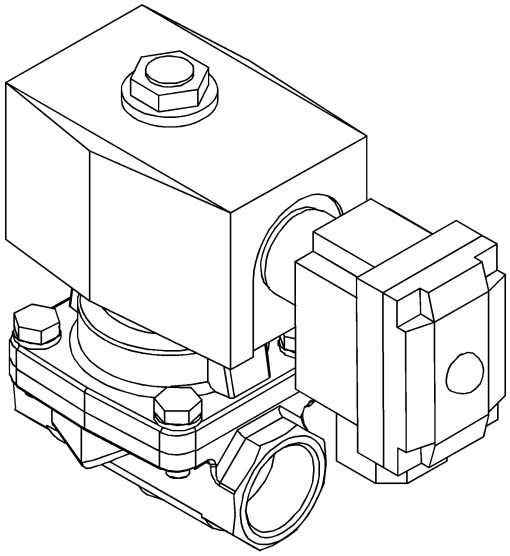
CKD

SM－50763－A

INSTRUCTION MANUAL

Pilot Operated Solenoid Valve for Steam SPK11-15 to 25 Series



- 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.

Ver.2

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 or water 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.

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.

【Contents】

1. Unpacking

⚠ CAUTION	Do not take off the port protection until just before piping. Otherwise, foreign matter enters the valve and cause malfunction or bad operation.

(1) Check that the model No. shown on the name plate of the product is the same with what you ordered.
(2) Check that the product has no external damages.
(3) When storing the product, keep the product inside the packing box to prevent the intrusion of foreign matter to the valve. Take out the valve when piping.

2. Installation

⚠ WARNING	Contact CKD if the product is to be used beyond specifications, or in special applications.

2. 1 Conditions for installation

⚠ WARNING	a) Do not splash liquid such as water or lubricating oil. Otherwise, liquid splashed on the coil causes the coil to burn. Protective measure shall be taken such as covering, or valve installation inside a panel. Protective measure shall be taken against welding spatter. b) The coil generates heat. ・ If the product is to be installed inside a control panel, or if energizing time is long, provide ventilation measures. Temperature around the product will be high. c) The product can not be used in a corrosive or solvent environment. d) Avoid humid environments, since condensation may occur with change in temperature. e) The product cannot be used in an explosive gas atmosphere. In such atmosphere, use our explosion-proof valve. f) Use the product away from radiant heat.

(1) Provide appropriate measures to prevent the product from freezing at cold places.
(2) The product cannot be used outdoors. Protective measure shall be taken such as covering, or valve installation inside a panel.
(3) Do not wash the product with water or solvents. Do not paint the product. Resin material used in the product may break down.
(4) Do not use the product under vibration or inertia.

2. 2 Installation method

⚠ CAUTION	a) Read this instruction manual thoroughly and understand the contents before installing the product. b) Always take hold of the body portion when handling and mounting the product. c) Confirm leakage from the piping after installation.

(1) Mounting posture is restricted. Be sure to follow the mounting posture described in Table 1.

Table 1. Mounting posture of the product

Series	Mounting posture
SPK11	Coil position shall be upwards, or within 90 degrees from the upward position. However, if the working pressure differential is below 0.05MPa, coil position shall be upwards only.

・If the working pressure differential is below 0.05MPa, internal sealing becomes unstable. Please contact us if you were to use the product in such conditions.

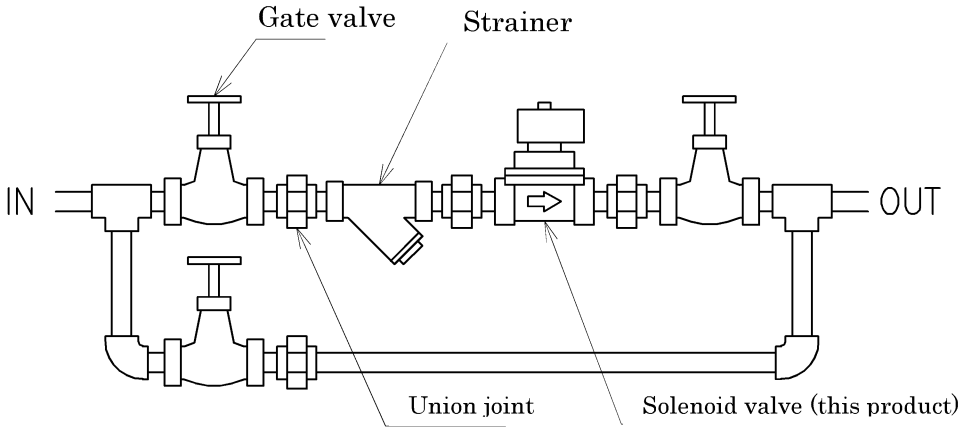
(2) Provide enough space for safe maintenance and troubleshooting work.

2. 3 Piping

⚠ CAUTION	(1) When piping or re-piping, fix the product. (2) Fix and provide appropriate support to the piping, so that the weight and vibration of the piping will not directly be applied to the product. (3) When piping is finished and fluid is to be flown, supply pressure gradually. ・If the piping is improper, the piping may disconnect or the fluid may leak.

(1) Installing a bypass circuit

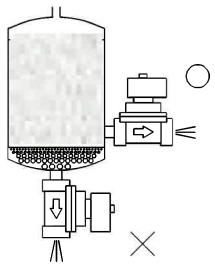
・To ease maintenance work, install a bypass circuit in the piping. (Refer to Figure 1.)



(Figure 1.) Bypass circuit

(2) When installing the product on a exhaust circuit of a tank

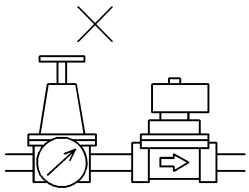
・When installing the product to control steam exhaust from a tank, do not install the product at the bottom of the tank. Otherwise, foreign matter accumulated at the bottom of the tank enters the product and cause malfunction. Install the product a little above the tank bottom. (Refer to Figure 2.)



(Figure 2.) Exhaust circuit from the tank

(3) Connecting the product directly with a regulator

・If a regulator and a solenoid valve are directly connected, they may enter into resonance with each other and cause malfunction. (Refer to Figure 3.)



(Figure 3.) Connecting the product directly to a regulator

(4) Sectional area of the piping

・Select piping bore so that the sectional area of the piping at the fluid supply side does not restrict flow. Select piping that matches with the port size of the solenoid valve.

・Even if fluid pressure at the fluid supply side is within specifications when the valve is closed, fluid pressure at that side drops drastically when the valve opens if the sectional area of the piping at that side is restricted. As a result, restricting the sectional area of the piping at the fluid supply side will reduce pressure differential, destabilizing the solenoid valve operation.

(5) Cleaning the piping

・Before piping, flush the piping with compressed air 0.3MPa or more to remove foreign material such as dust, metal powder, rust and sealing material.

(6) Removal of foreign matter

・Foreign matter such as dust in the fluid causes malfunction and leakage.

To remove foreign matter, attach an appropriate apparatus to the primary side of the product. Attach a strainer 80 mesh or finer.

・A device to soften supply water, and a filter for steam must be installed. Supply water to the boiler contains calcium salts and magnesium salts, which react with oxygen and carbon dioxide. The reaction makes scale and sludge that needs to be removed.

(7) Removal of drain

・A drain trap must be installed. Steam generated in a boiler contains a large amount of drain that needs to be removed.

Incline the steam circuit piping: slope of 1 in 250 going down, and 1 in 80 going up. Install the drain trap where drain is likely to pool.

(8) Piping

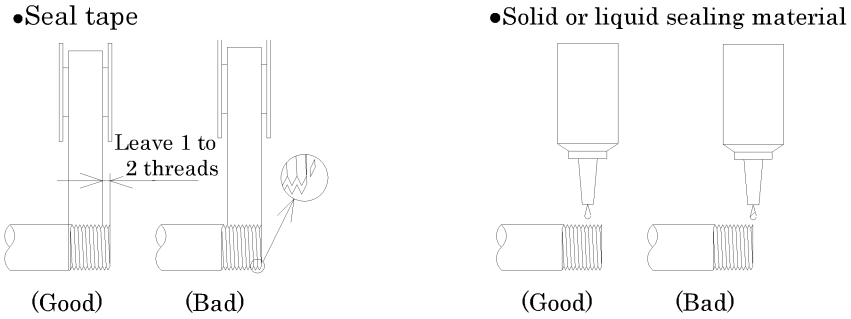
・Make sure that the piping port is correct.

Match the fluid flow direction with the arrow shown on the product body.

(9) Sealing material

・When using sealing material, make sure the sealing material do not enter the piping. Also, make sure there is no external leakage. When taping seal tape to the pipe thread, leave 1 to 2 threads at the tip without taping.

Also, when using liquid sealing material, leave 1 to 2 threads at the tip without sealing material. Do not apply too much sealing material on the thread. Do not apply sealing material to the internal thread (refer to Figure 4.).



(Figure 4.) How to apply sealing material

(10) Tightening

・Refer to Table 2. for the recommended port tightening torque.

Table 2. Recommended port tightening torque

Port size	Recommended torque
Rc1/2	41 to 43 N・m
Rc3/4	62 to 65 N・m
Rc1	83 to 86 N・m

(11) Insulation cover of the piping

・When placing an insulation cover to the piping, structure the insulation cover so that it can be easily detached at the time of maintenance.

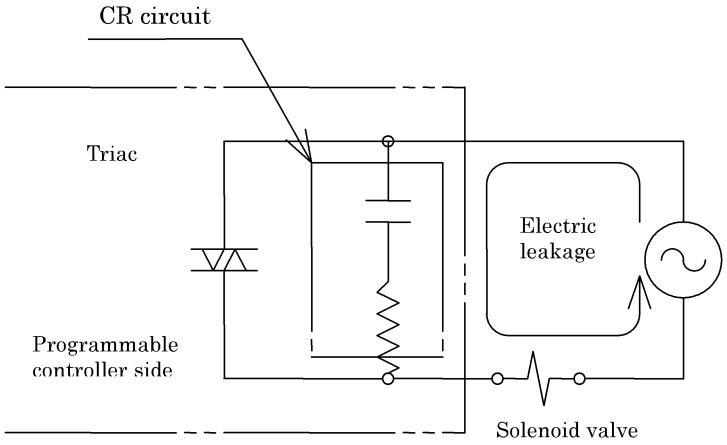
・Do not insulate the coil portion of the solenoid valve.

2. 4 Wiring

⚠ CAUTION	Read this instruction manual thoroughly and understand the contents before wiring the product. ・ You need to understand the structure and the operation principle of the solenoid valve. You additionally need knowledge to secure safety.

⚠ CAUTION	a) Confirm the voltage. b) To prevent unintended operation caused by electric leakage of other control components, confirm electric leakage. ・ When using a control circuit such as a programmable controller, the solenoid valve may operate without intention because of the electric leakage from the control components. ・When using this product, keep the electric leakage from other components below the value shown in the table below.

Rated voltage	Electric leakage
AC100V	6mA or less
AC110V	5.7mA or less
AC200V	3mA or less



(1) Maintenance of the electric equipment

・To maintain the electric equipment, install a breaker such as a fuse in the control circuit side.

(2) Wiring of the lead wire type

・For wiring, use wire with nominal cross-sectional area 0.5mm^2 or larger. Additionally, take care not to apply too much force on the lead wire.

(3) Wiring of the HP terminal box type

This section is for products with HP terminal box attached (refer to Figure 5.) .

①Use wire with nominal cross-sectional area 0.5mm^2 or more.

②Pass the wire through the main body of the terminal box.

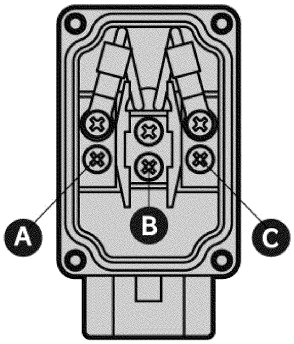
③Put the crimp terminal for copper wires on the wire and crimp the terminal.

④Fix the crimp terminal with the Terminal screw with tightening torque 0.5N・m.

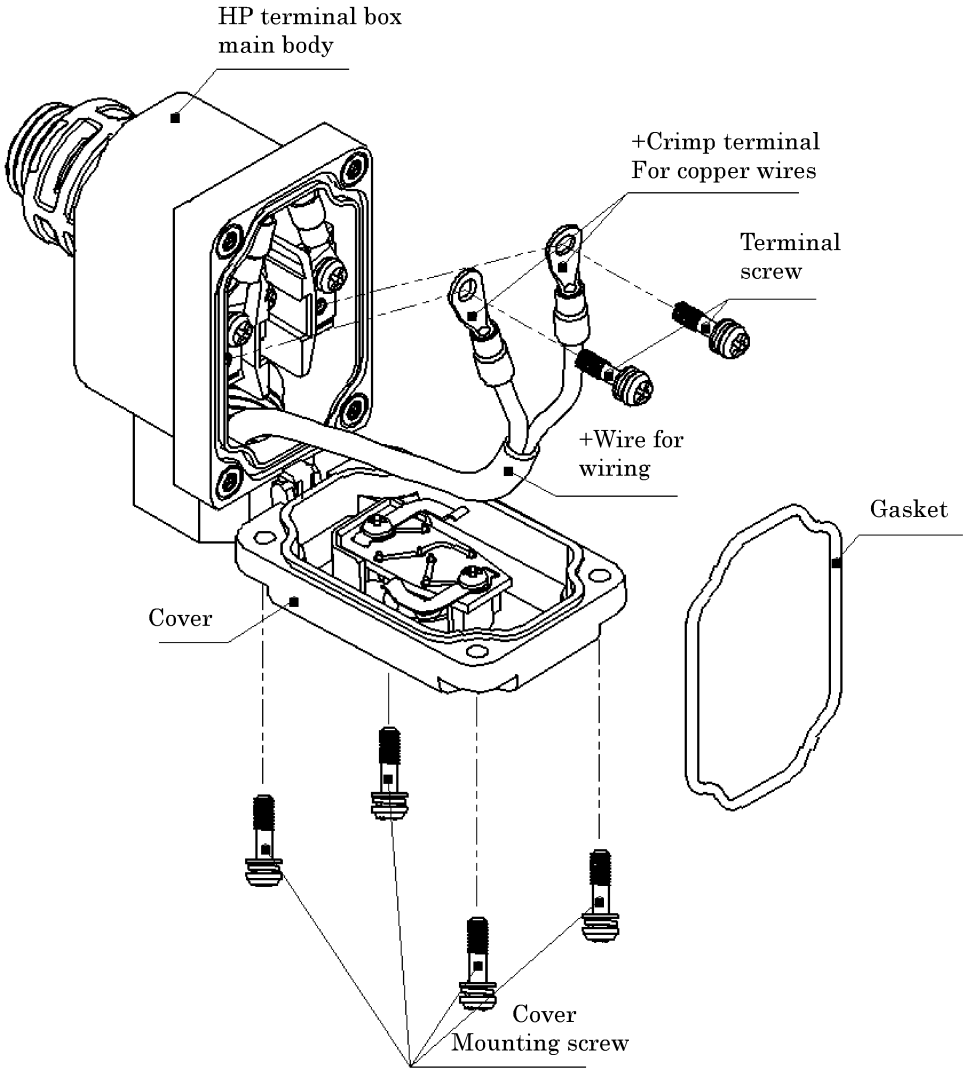
Table 3. How to connect the wire to the terminal of the HP terminal box

HP terminal box type	Connection of the wire to the terminal
HP terminal box without lamp	Connect the wire to terminal A and C. There is no polarity.
HP terminal box with lamp for AC voltage	

<Connecting diagram>



⑤After wiring is complete, make sure the Gasket is attached properly. Then, close the Cover, and tighten the Cover Mounting screw with tightening torque 0.5Nm.



Parts marked with “+” are not included in the product.

（Figure 5.）Wiring of the HP terminal box

3. Pre-operation (post-installation) check

3. 1 Appearance check

⚠ WARNING	Stop the flow of the fluid（shut the supply）. Discharge the fluid inside the product.

(1) Push the product by hand and confirm that the product is firmly fixed on the piping.
(2) Confirm that threaded parts such as bolts, nuts and screws are not loose.

3. 2 Leakage check

(1) Confirm leakage at the connection part by applying pressure to the fluid.
We recommend leakage check by the following method:
- Supply compressed air (0.3-0.5MPa)
- Apply soap water to the portion to check for leakage
- Bubbles will appear if there is any leakage.

3. 3 Electrical check

⚠ WARNING	Cut off the electricity. Check while taking serious care to avoid electric shock.

(1) Check the supply voltage.
Voltage variation shall be within 10% of the rated voltage.
Use beyond the allowed variation range will cause malfunction or damage to the coil.
(2) Check insulation resistance
Check the insulation resistance between dead metal parts and uninsulated live parts (such as the tip of the lead wire) that are assembled to the product.
Confirm that insulation resistance is over 100MΩ at DC500V megger.

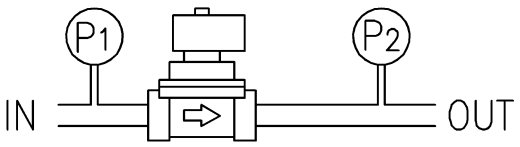
3. 4 Operation check

(1) Apply rated voltage to the valve and rated pressure to the working fluid. Confirm normal operation of the product.

4. Instructions for proper use

4. 1 Handling precautions

⚠ WARNING	a) Do not use this product as an emergency shut-off valve. ・ This product is not designed as a safety-securing valve, such as an emergency shut-off valve. For such systems, use this valve after providing another method of securing safety. b) Take measures to prevent harm to operators or objects if this product fails. c) Liquid-filled state ・ Operation may fail if liquid-filled state occurs. This is because pressure rises in the liquid-filled state when temperature rises. Provide an escape valve in the system so that a liquid-filled state circuit is not created. d) Working fluids ・ Do not use this product for fluids other than the working fluids listed in the catalog specifications. ・ Before use, confirm the compatibility of the product and applicable fluid with the Applicable Fluid Check List. ・ Depending on the model, internal parts may wear when the valve operates. Caution is required because wear chips could enter the secondary side of the valve.

⚠ CAUTION	a) Do not touch the coil sections or actuator sections when energized or immediately after energizing. Depending on the product, directly touching these products could cause burns. b) Do not touch the wiring connection sections (bare live part) when energized. There is a risk of electric shock. c) Always use within the maximum working pressure and maximum working pressure differential range. ・Use beyond the specified pressure will result in malfunction. 

(1) When carrying the solenoid valve, hold the main body.
Do not carry the valve by the lead wire, or by the cable attached to the terminal box.

(2) Do not use the product as footings, or place heavy loads on the product.

(3) When pressure is suddenly applied to a closed valve, the valve may open instantaneously and leak internally. A remedy for this is to install a partition valve at the primary side of the solenoid valve, and operate the partition valve so that pressure rises gradually.

(4) Do not apply back pressure. Otherwise, the valve may malfunction.

(5) If the product has not been used for more than a month, carry out trial run before work.

(6) If any abnormalities occur, refer to “6. Troubleshooting”.

4. 2 Disassembling work precautions

⚠ CAUTION	Shut off the power supply and release the fluid and pressure before performing disassembly work.

(1) Refer to “8. Internal construction” when performing disassembly work.

(2) Precautions when disassembling the Core Assembly

・When disassembling the Core Assembly from the Stuffing, make use of the opposing flat sides on the Core Assembly. Do not apply external force on the Pipe portion of the Core Assembly. Deformation of the Pipe will result in leakage and malfunction.

(3) Precautions when taking out the Main Valve Assembly

・To disassemble the assembled Plunger Assembly, Kick Spring, and Main Valve Assembly, hold the Main Valve Assembly on your left hand and turn the Kick Spring clockwise.
To disassemble smoothly, lift the first turn of the Kick Spring onto the crest of the groove. Then, push the tip of the Kick Spring clockwise.
Be careful not to deform the Kick Spring permanently.

・To detach the Seal Ring from the Main Valve Assembly, stretch out the opening on the Seal Ring.
Detach the Inner Ring with a sharp-edged tool such as a piece of wire.
Be careful not to deform the Seal Ring and the Inner Ring.

(4) When washing the parts, use a low public nuisance washing agent such as a neutral detergent.

4. 3 Assembling work precautions

(1) Follow the procedure opposite to disassembly when re-assembling. Make sure all parts are assembled.

(2) Assembling the Plunger Assembly, Kick Spring, and Main Valve Assembly

・To assemble the Kick Spring to the Plunger Assembly, insert the tip of the Kick Spring to the groove on the Plunger Assembly, and turn counterclockwise.

・Assemble the Kick Spring to the Main Valve Assembly in the same way.
Be careful not to deform the Kick Spring permanently.

(3) Precautions when assembling the Seal Ring to the Main Valve Assembly

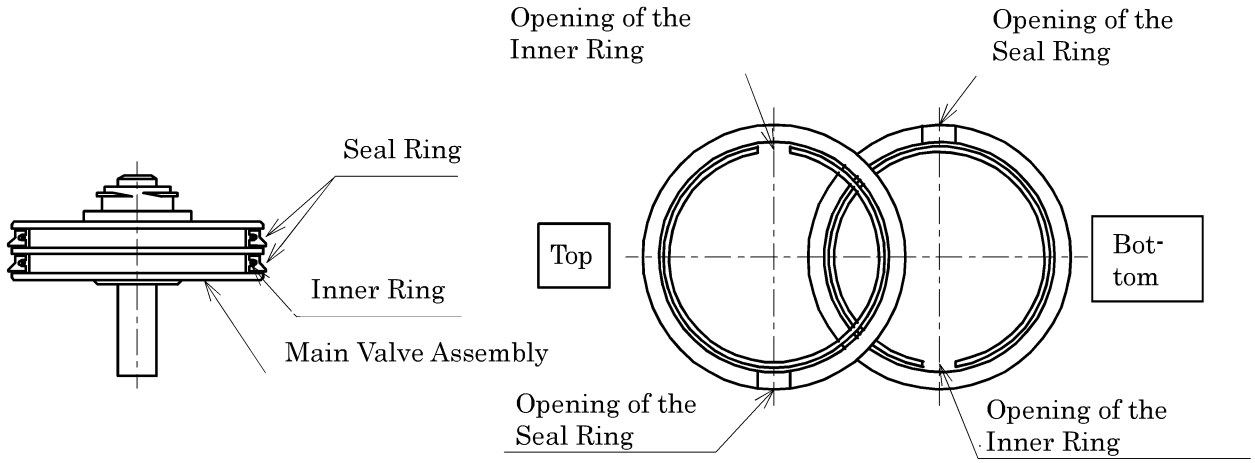
・Be careful not to deform the Seal Ring and the Inner Ring permanently.

・Assemble so that the opening of the Seal Rings are evenly split apart from the opening of the Inner Ring (Refer to figure 6.).

・ Attaching the Seal Ring

・After setting the two Inner Rings in the piston groove of the Main Valve Assembly, set the two Seal Rings, one above the other.

Set the Seal Rings so that the opening of the Seal Ring and the opening of the Inner Ring are 180°positioned apart. Next, direct the opening of the Seal Ring above so that the opening of the Seal Ring above and the opening of the Seal Ring below are 180° positioned apart. Make sure that the Inner Ring fits firmly into the groove of the Seal Ring (Refer to figure 6.).



(Figure 6.) How to attach the Seal Ring

(3) Precautions when attaching the Stuffing to the Body

・Stuffing mounting direction with respect to the Body is unrestricted.

・When tightening the Hexagon Head Bolt, tighten diagonally and gradually, and tighten several times to squash the Body Gasket evenly.

(4) Tightening torque

・Tighten the threaded parts with torque shown in table 4.

Table 4. Tightening torque of threaded parts

Part Name	Port size 15・20	Port size 25
Hexagon Head Bolt	7 to 8 N・m	15 to 19 N・m
Core Assembly	50 to 80 N・m	50 to 80 N・m
Nut	8 to 16 N・m	8 to 16 N・m

5. Maintenance

5. 1 Maintenance and inspection

⚠ CAUTION	a) Read this Instruction manual thoroughly and understand the contents well before performing maintenance and inspection. b) Shut off the power supply and release the fluid pressure before performing maintenance.

(1) Regularly inspect the product to ensure optimum performance. Although inspection frequency differs based on the working state, the product should be inspected every half year.

(2) Refer to "3. Pre-operation check" for contents of inspection.

(3) When not using the product for one or more months, completely remove any drain left in the product. Drain residue will cause rust and may lead to operation failure or leaks.

(4) Please contact CKD if there are any unclear points concerning consumable parts.

(5) Beware the clogging of the strainer and filter.

5. 2 Parts for maintenance

(1) Gasket

Replace when the valve leaks while use, or at disassembly and reassembly.

(2) Plunger Assembly, Core Assembly, Spring, Kick Spring

Replace when the valve shows abnormality such as leak, malfunction, or beat sounds.

(3) Main Valve Assembly and Seal Ring Set

Replace when the valve shows abnormality such as leak or malfunction.

Additionally, replace when the sealing side of the Main Valve Assembly have any sign of flaw or abrasion.

6. Troubleshooting

(1) If the solenoid valve does not operate as intended, check according to tables 5.

Table 5. Cause of malfunction and countermeasures

State of failure	Cause	Countermeasure
Fluid does not flow	Valve is not energized.	Confirm wiring and fuse, then energize the valve.
	Voltage applied is lower than the allowable voltage range.	Confirm the power supply, and apply rated voltage.
	Applied fluid pressure is too high.	Set pressure within allowable range.
	Foreign matter caught in the valve.	Disassemble and remove foreign matter.
Fluid does not stop flowing	Wrong port is connected to the high pressure side.	Pipe correctly.
	Electricity is not shut off.	Check for leak of electricity. Modify the circuit to shut off electricity completely.
	Foreign matter caught in the valve.	Disassemble and remove foreign matter.
Fluid leaks externally	Abrasion or flaw of Gasket.	Replace parts.
	Loose screws or bolts.	Tighten screws and bolts.
Fluid leaks internally	The valve seat of the Body or Main Valve Assembly is worn or damaged.	Replace the product.
	Abrasion or flaw of the sealing side of the rubber parts.	Replace parts.
	Foreign matter caught in the valve seat.	Disassemble and remove foreign matter.

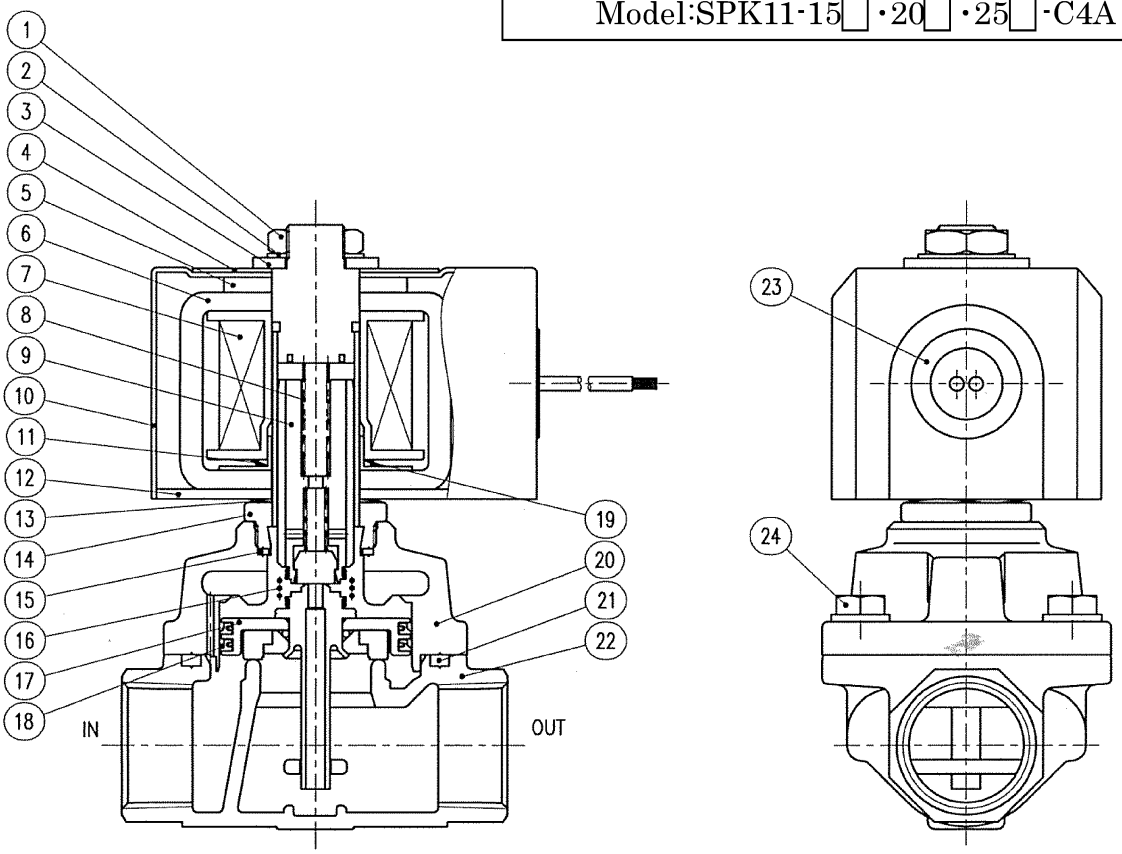
(2) Please contact CKD or your nearest agent for any unclear points.

7. Appropriate disposal

(1) When disposing this product, dispose this product as industrial waste.

8. Internal construction

Model:SPK11-15□・20□・25□-C4A



No.	Part name	Remark 1.	Remark 2.
1	Nut		
2	Spacer A		
3	Plain Washer		
4	Name Plate		
5	Bonnet Spacer		
6	Core C		
7	Coil Assembly		
8	Spring		Consumable part
9	Plunger Assembly		Consumable part
10	Bonnet Case		
11	Auxiliary Ring Core		
12	Bonnet Base		
13	Waving Washer		
14	Core Assembly		Consumable part
15	Gasket		Consumable part
16	Kick Spring		Consumable part
17	Main Valve Assembly		Consumable part
18	Seal Ring Set	2 Seal Rings and 2 Inner Rings	Consumable part
19	Waving Washer		
20	Stuffing		
21	Gasket		Consumable part
22	Body		
23	Bushing	Only for options 4A	
24	Hexagon Head Bolt with Washer		

Note: Consumable parts kit is available for replacement.