CKD

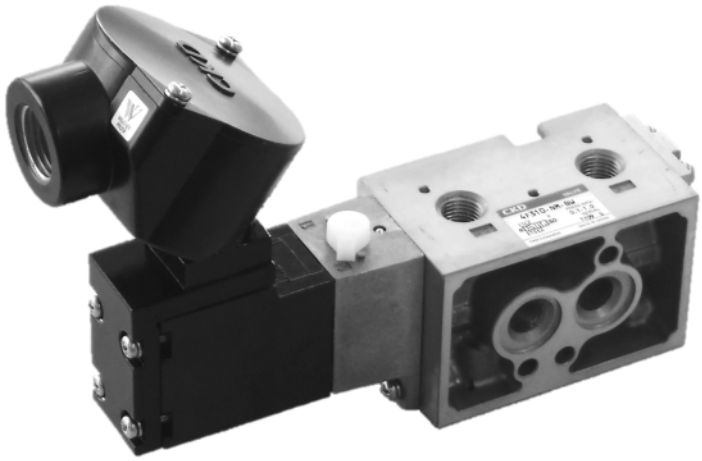
5-PORT PNEUMATIC SOLENOID VALVE

4F1･3-NM SERIES (NAMUR Standards/Outdoor Type)

Single Valve

INSTRUCTION MANUAL

SM-P00123-A/3



- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

PREFACE

Thank you for purchasing CKD's **5-port pneumatic solenoid valve**.
This Instruction Manual contains basic matters such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- The product is intended for users who have basic knowledge about materials, fluids, piping and electricity necessary to use control valves (solenoid valves, motor operated valves, air operated valves, etc.). CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them. Depending on the application or usage, the product may not be able to exercise its full performance or an accident may occur due to fluid, piping, or other conditions. It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device, the pneumatic pressure control circuit or hydraulic control circuit, and the electric system that controls them is ensured.

To ensure the safety of device design and control, observe organization standards, relevant laws and regulations, which include the following:

ISO 4414, JIS B 8370, JFPS 2008 (the latest editions)
Act, the Industrial Safety and Health Act, other safety rules, organization standards, relevant laws and regulations

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, customer's improper handling may lead to an accident. To avoid this:

Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: “DANGER”, “WARNING”, and “CAUTION”.

⚠ **DANGER**	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
⚠ **WARNING**	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
⚠ **CAUTION**	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as “CAUTION” may still lead to serious results depending on the situation.
All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.

	Indicates general precautions and tips on using the product.

Precautions on Product Use

⚠ WARNING

The product must be handled by a qualified person who has extensive knowledge and experience.

This product is designed and manufactured as a device or a part for general industrial machinery.

Use the product within the specifications.

The product must not be used beyond its specifications. Also, the product must not be modified and additional work on the product must not be performed.

This product is intended for use as a device or a part of general industrial equipment. Use of this product under the following conditions or environment is is not covered under the warranty.

(If you consult with us before use and understand the specifications for our product, the warranty is applied.

However, also in this case, take safety measures to avoid hazards in case of failure.)

- Use for nuclear power, railway, aircraft, ships, vehicles, medical devices, and devices or purposes in direct contact with drinks or foods.
- Use for entertainment equipment, emergency shut-off circuits, press machines, brake circuits and safety devices that are needed to ensure the safety.
- Use for purposes that may significantly affect people and properties and are needed to ensure the safety.

Never handle this product or remove any piping or device before confirming the safety.

- Before inspecting or maintaining the machine or equipment, ensure the safety of all systems associated with this product. Also, turn off the energy source (air supply or water supply) and power to the relevant facility. Release compressed air from the system and use extreme care to avoid water or electric leakage.
- Some parts may be hot or charged even while the operation is stopped. Take care when handling the product and removing any piping or device.
- Before starting or restarting any machine or equipment using pneumatic devices, confirm that the safety of the system is ensured by protrusion preventing means, etc.

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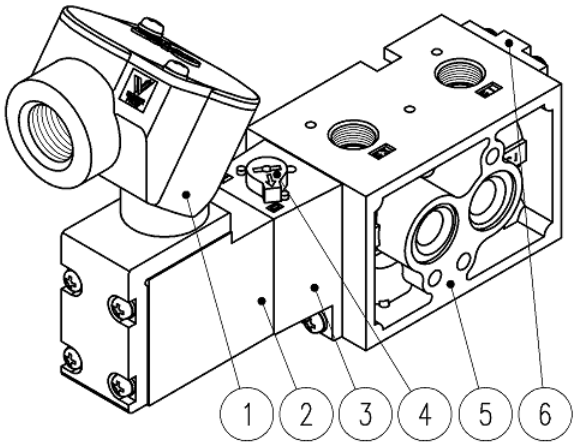
1. PRODUCT OVERVIEW

1.1 Part Name



Part No.	Part name	Description
1	Round terminal box	Terminal box for wiring
2	Coil assembly	Electric signals are converted into electromagnetic energy to switch the pilot passage.
3	Pilot valve body assembly	Pilot air passage for switching the main passage
4	Manual override	Device to be manually operated to switch the pilot passage
5	Body assembly	Assembly for switching the main passage
6	Cap	Cap for sealing the pressure to be returned to the return side after receiving the air source pressure

1.2 Model Number Indication

1.2.1 Model number structure

4F3 1 0-NM- M2 B W - 100 VAC

Ⓐ Model No.
Ⓑ Solenoid position
Ⓒ Port size
Ⓓ Manual override
Ⓔ Electrical connections
Ⓕ Outdoors
Ⓖ Other options
Ⓗ Voltage

Symbol	Description	Ⓐ Model No. 4F1	4F3
Ⓑ Solenoid position			
1	2-position single	●	●
2	2-position double	●	●
Ⓒ Port size			
NM	NAMUR standards (port size Rc1/4) (Note 1)	●	●
Ⓓ Manual override Note 1			
Blank	Locking type (plastic)	●	●
M2	Non-locking type (metallic)	●	●
M3	Locking type (plastic) with manual lever	●	●
R	Change of position of manual override	●	●
Ⓔ Electrical connections			
B1	Round terminal box (G3/4)	●	●
B	Round terminal box (G1/2)	●	●
BL	Round terminal box (G1/2) with lamp (Note 2)	●	●
G	Round terminal box (G1/ 2) With gland (A-15a)	●	●
GL	Round terminal box (G1/2) with lamp (Note 3) With gland (A-15a)	●	●
Ⓕ Outdoors			
W	Outdoor specification (general)	●	●
WC	Outdoor specification (low-temperature environment) (Note 4)		●
Ⓖ Other options			
Blank	No option	●	●
S	Surge suppressor attached	●	●
G	3-year warranty after delivery	●	●
Ⓗ Voltage			
100 VAC	100 VAC 50/60 Hz	●	●
200 VAC	100 VAC 50/60 Hz	●	●
110 VAC	110 VAC 50/60 Hz	●	●
220 VAC	220 VAC 50/60 Hz	●	●
12 VDC	12 VDC (Note 3)	●	●
24 VDC	24 VDC	●	●
***Other made-to-order products**			
48 VDC	48 VDC	●	●
100 VDC	100 VDC	●	●
110 VDC	110 VDC	●	●

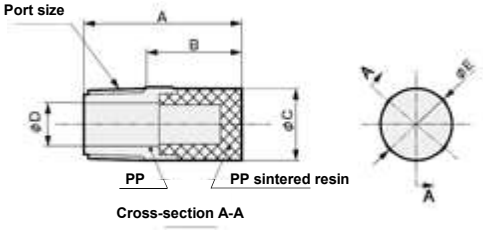
Notes for selecting model number

Note 1: The only piping port is Rc1/4. The threads of the C1/C2 port on the NAMUR face have not been machined.
Note 2: When using the unit in a complete outdoor exposure environment (where direct sunlight strikes permanently), select the non-locking manual override M2 (metal).
Further, as a metal locking manual override is available made to order, contact CKD for details.
Note 3: 12VDC is not available for BL with lamp and GL.
Note 4: WC is only 4F3.
Note 5: The valves cannot be supplied with manifold.

1.2.2 Related devices

■ Silencer

<SLW-☐S>



Screw size	Tightening torque (N·m)
R1/8	0.1 to 0.15
R1/4	0.15 to 0.25

Type	Model No.	Port size	Effective sectional area mm²	A	B	C	D	E	Sound deadening effect dB
Compact type	SLW-6S	R1/8	12	22	13.3	10.5	6	10.5	25 or more
	SLW-8S	R1/4	30	28	19	14.8	9	15.4	28 or more

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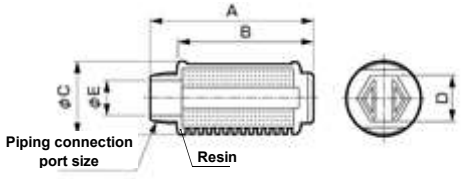


Screw size	Tightening torque (N·m)
R1/8	1.0
R1/4	2.5
R3/8	3.0
R1/2	3.0
R3/4	3.0

Type	Model No.	Port size	Effective sectional area mm²	A	B	C	D	E	Sound deadening effect dB
Standard type	SLW-6A	R1/8	10	34	28	16.5	10	7	30 or more
	SLW-6N	NPT1/8							
	SLW-6G	G1/2							
	SLW-8A	R1/4	20	44.5	36	20	13	8.5	
	SLW-8N	NPT1/4							
	SLW-8G	G1/4							
	SLW-10A	R3/8	30	58.5	48.5	25.5	17	12	
	SLW-10N	NPT3/8							
	SLW-10G	G3/8							
	SLW-15A	R1/2	75	71.4	58.4	28	19	15	
	SLW-15N	NPT1/2							
	SLW-15G	G1/2							
	SLW-20S	R3/4	90	75.4	58.4	28	19	18	
Type with high sound deadening effect	SLW-8A-H	R1/4	15	44.5	36	20	13	8.5	40 or more
	SLW-10A-H	R3/8	30	58.5	48.5	25.5	17	12	
	SLW-15A-H	R1/2	50	71.4	58.4	28	19	15	
High flow rate type	SLW-8L	R1/4	30	57.4	48.5	25.5	17	8.5	30 or more
	SLW-10L	R3/8	60	68.2	58.4	28	19	12	

1.2.3 Kit parts

■ Coil assembly

4F310-B W-COIL-100VAC

Ⓐ Electrical connections

Ⓑ Voltage

Symbol	Description
Ⓐ Electrical connections	
B1	Round terminal box (G3/ 4)
B	Round terminal box (G1/ 2)
BL	Round terminal box (G1/ 2) with lamp (Note 2)
G	Round terminal box (G1/ 2) With gland (A-15a)
GL	Round terminal box (G1/2) with lamp (Note 3) With gland (A-15a)
Ⓑ Voltage	
100 VAC	100 VAC 50/60 Hz
200 VAC	100 VAC 50/60 Hz
110 VAC	110 VAC 50/60 Hz
220 VAC	220 VAC 50/60 Hz
12 VDC	12 VDC (Note 3)
24 VDC	24 VDC
***Other made-to-order products**	
48 VDC	48 VDC
100 VDC	100 VDC
110 VDC	110 VDC

Notes for selecting model number

Note 1: The kit parts are not designed for WC (low-temperature type).
Note 2: 4F3 products (standard) are used in coil assembly of 4F1-NM. For model number, select 4F3.
Note 3: 12VDC is not available for BL with lamp and GL.

1.3 Specifications

1.3.1 Common specifications

Item	Description
Model number	4F1, 3
Valve type and operating method	Pilot type soft spool valve
Gas used	Compressed air
Max. working pressure MPa	1.0
Min. working pressure MPa	0.1
Pressure resistance MPa	1.5
Ambient temperature (Note 1) °C	W General type: -10 to 60 WC Low-temperature type (selectable only for 4F3): -20 to 60 (no condensation)
Fluid temperature °C	5 to 60 (WC: -20 to 60 no condensation)
Manual override	Locking type (standard), non-locking type, locking type with manual lever
Lubrication (Note 2)	Unnecessary
Protection class	IP65 (Note 3)
Vibration resistance m/s^2	50 m/s^2 or less
Impact resistance m/s^2	300 m/s^2 or less
Atmosphere	Not for use in corrosive gas atmosphere
Response times	50 ms or less (Note 4)

Note 1: The ambient temperature refers to the temperature in the storage or installation area and differs from the fluid temperature during operation.
Note 2: If lubrication is required, use Class 1 ISO VG 32 turbine oil. When you intend to lubricate in a low-temperature environment, consult us.
Note 3: Do not open the piping ports to the atmosphere. Prevent ingress of dirt and water.
Note 4: This table shows the response time values obtained when the valve is on at a working pressure of 0.5 MPa without lubrication. The response time varies depending on the pressure and the lubrication oil quality.

1.3.2 Electrical specifications

Model No.	4F1,3								
Rated voltage	100 VAC (50/60 Hz)	200 VAC (50/60 Hz)	110 VAC (50/60 Hz)	220 VAC (50/60 Hz)	12 VDC	24VDC	48 VDC	100 VDC	110 VDC
Starting current A	0.17/0.14	0.09/0.07	0.15/0.13	0.08/0.06	—	—	—	—	—
Holding current A	0.10/0.08	0.05/0.04	0.09/0.07	0.05/0.04	0.50	0.25	0.13	0.06	0.055
Power consumption W	5.0/4.0	5.0/4.0	5.0/4.0	5.0/4.0	6.0	6.0	6.0	6.0	5.5
Voltage fluctuation range	±10%								
Thermal class	B (mold coil)								
Surge suppressor	Option								
Indicator	Lamp (option)								

1.3.3 Flow characteristics

Model number	Solenoid position		Port size	Sonic conductance C [$dm^3/(s \cdot bar)$]
4F1	2-position	Single	Rc/4 (S,E1,E2)	1.6
		Double		
4F3	2-position	Single		3.1
		Double		

Note: Formula for converting sonic conductance C to effective cross-sectional area S is S ≈ 5.0 x C.

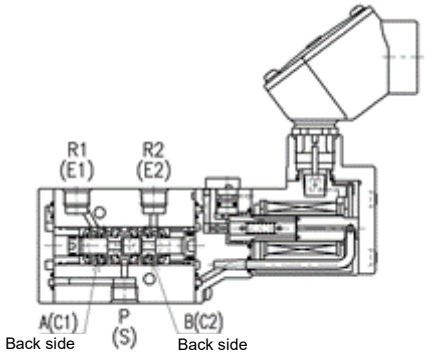
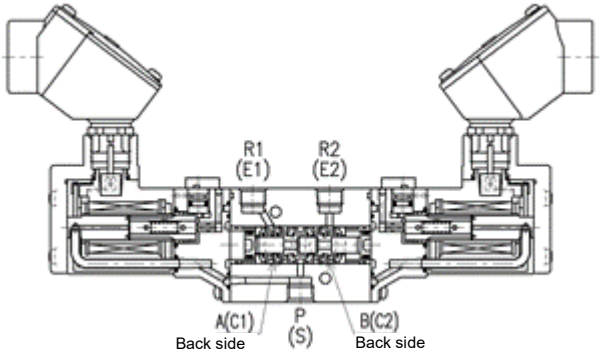
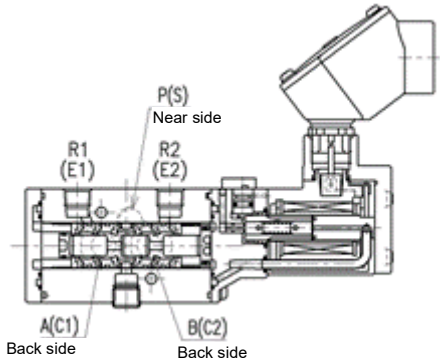
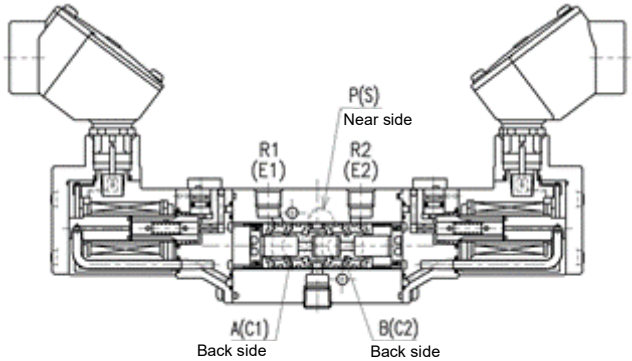
1.3.4 Weight

Model number	Solenoid position		Weight (kg)
4F1	2-position	Single	0.80
		Double	1.36
4F3	2-position	Single	0.94
		Double	1.50

1.4 Internal Structure

1.4.1 Description of operation

■ Valve operation

Model No.	Diagram of operation	Description of operation
4F110 2-position Single		De-energized (shown in the diagram) P(S) -> A(C1) B(C2) -> R2(E2) Energized P(S) -> B(C2) A(C1) -> R1(E1)
4F120 2-position Double		SOL a Energized (shown in the diagram) P(S) -> A(C1) B(C2) -> R2(E2) SOL b Energized P(S) -> B(C2) A(C1) -> R1(E1)
4F310 2-position Single		De-energized (shown in the diagram) P(S) -> A(C1) B(C2) -> R2(E2) Energized P(S) -> B(C2) A(C1) -> R1(E1)
4F320 2-position Double		SOL a Energized (shown in the diagram) P(S) -> A(C1) B(C2) -> R2(E2) SOL b Energized P(S) -> B(C2) A(C1) -> R1(E1)

Note 1: SOL = solenoid

2. INSTALLATION

2.1 Environment

⚠WARNING

Do not use the product in an application where cutting oil can splash onto the valve directly.

- In an environment where cutting oil can splash onto the valve, protect it by installing it under a cover or inside a paneled casing.
- If cutting oil splashes onto the cylinder rod, the oil may enter into the secondary side piping of the solenoid valve through the cylinder, causing a malfunction. Consult CKD before using the product in such an environment.

Observe the following precautions since coils produce heat.

- Appropriate ventilation or heat dissipation measures must be considered if the product is installed in a control board or if the solenoid coil needs to be energized for a long period.
- Be careful when touching the valve since the coil temperature may rise depending on the surrounding temperature and energization time.

Do not use the product in the presence of corrosive gas or solvents.

Do not use the product in the presence of corrosive gas, such as sulfur dioxide, or solvents.

Do not use in a high humidity environment.

Condensation may occur due to a change in the temperature.

Do not use the product in an explosive gas environment.

For use in an explosive gas environment, select an explosion-proof solenoid valve.

⚠CAUTION

Take measures to prevent foreign matters from entering the exhaust port and the breathing hole in a dusty environment.

Foreign matters may enter the exhaust port of a solenoid valve when the valve is operated to supply or exhaust air or if the exhaust port or the breathing hole is facing up. Install a silencer, the exhaust port and the breathing hole face down.

Do not use the product where it is subject to vibrations or shocks.

Do not subject the product to vibrations exceeding 50 m/s2 or shocks exceeding 300 m/s2.

Use extreme care to avoid deterioration of packings and gaskets when using the product in a place with high ozone concentration (for example, near a beach or in an area with frequent thunderstorms).

Packing and gaskets may deteriorate sooner than usual.

Take measures against lightning surges on the device side.

The product has no resistance to lightning surges.
Use AC voltage models in an installation category II environment.

Use the product outdoors in a general environment.

If the product is used under a special environment, it may have malfunctions such as rusting in a short period of time. Contact CKD when using in special environments.

2.2 Unpacking

⚠CAUTION

Do not remove the solenoid valves from their packaging bag until just before piping.
If bags are opened before the valves are ready to be piped, foreign matters may enter inside the solenoid valves from the piping ports and may cause a failure or malfunction.

- Check that the model number ordered and the model number indicated on the product are the same.
- Check the exterior of the product for any damage.
- When any cautionary documents are provided with the product, read them, as well as this Instruction Manual, before use.
- Secure sufficient space around the solenoid valve for installation, removal, wiring, and piping.

2.3 Mounting

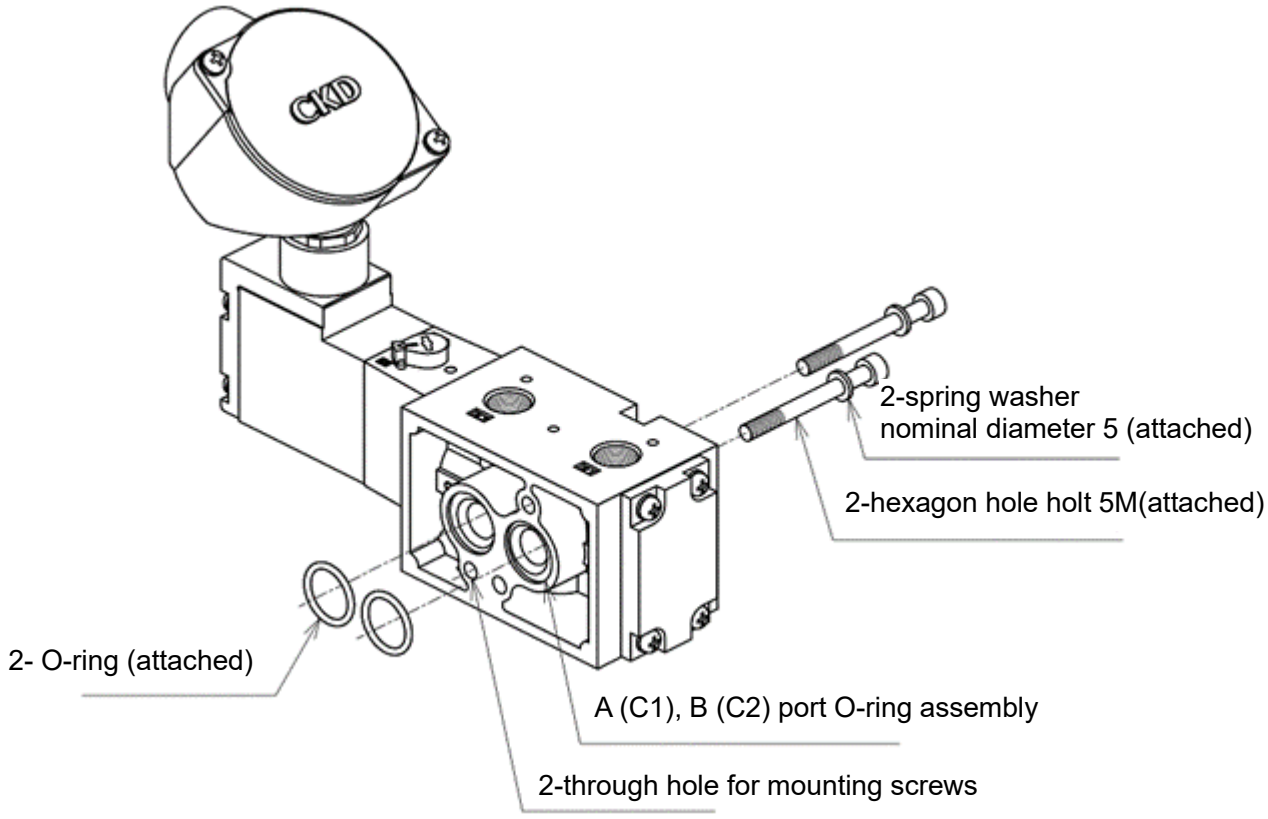
⚠CAUTION

Do not use a method of mounting that relies on support from the piping when mounting the solenoid valve.
Mount and secure the solenoid valve body.

Tighten the screws with the appropriate tightening torque.
- If assembly or tightening is not properly done, it may result in air leakage, product falling off, damage to the threads, or deformation of DIN rails.

■ Mounting

4F1 and 3 can be mounted using the through holes.
Install O-rings on the A (C1) and B (C2) ports during assembly.



2.4 Piping

⚠CAUTION

Tighten the pipes/tubes with the appropriate tightening torque.
Observe the appropriate tightening torque to prevent air leakage and damage to the threads. To prevent damage to the screw threads, first use your hands to lightly tighten the pipe/tube and then use a tool to tighten the pipe/tube further.

Make sure that the pipes/tubes will not be disconnected at the joints by mechanical movements, vibrations or tension.

- If the exhaust piping of the pneumatic pressure circuit is disconnected, the actuator speed cannot be controlled.
- For the chuck holding mechanism, the chuck holding force is lost when the piping is disconnected.

When supplying compressed air for the first time after piping is complete, make sure that there is no air leakage at the joints.

Do not apply high pressure suddenly when supplying compressed air for the first time after connecting the pipes/tubes.
Sudden introduction of highly-pressurized air may cause the tubes to become disconnected and jump around and an accident may occur.

Do not decrease the inside diameter of the piping from any of the solenoid valve exhaust ports to a diameter less than the piping port size.
Smooth exhaust flow is important for normal operation of the actuator. With a manifold, a restriction to the exhaust flow may prevent normal operation of other solenoid valves.

Remove foreign matter.
Rust and other foreign matters in the piping may cause a malfunction or valve seat leakage.
Insert a filter (which removes particles exceeding 5 μm) immediately upstream of the solenoid valve.

Do not restrict the flow of air through the supply piping.
A delay in operation may occur due to a drop in the supply pressure when multiple valves are operated.

2.4.1 Recommended tightening torque

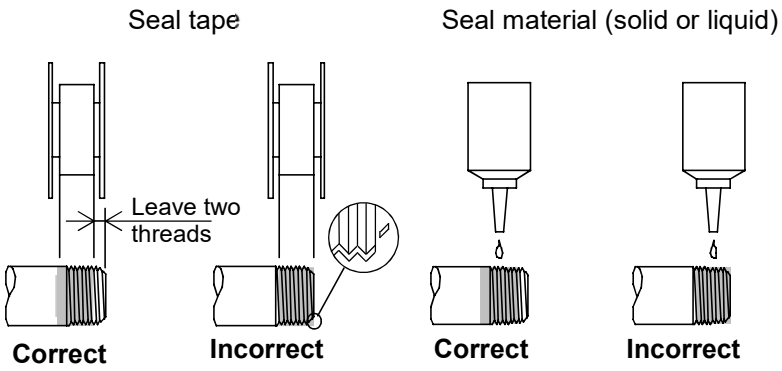
The following table shows the tightening torque for each connection thread.

Connection thread	Tightening torque (N·m)
Rc1/4	6 to 8

2.4.2 Seal material

Apply a sealing tape or sealing agent leaving two threads or more from the end of the threaded portion. If the pipe end is fully covered or coated, a shred of seal tape or residue of seal material may enter inside of the solenoid valve and cause a failure.

When using a sealing tape, wind the tape in the opposite direction to the threading direction, and press the tape with your finger to bring it into close contact with the threads.
When using a liquid sealing agent, take care that the agent does not adhere to the plastic parts. The agent will damage the plastic parts, thereby causing trouble or malfunction. Do not apply any sealing agent to the internally threaded portion.



2.4.3 Flushing

Before piping, flush the pipes/tubes, solenoid valves, and connected devices to remove foreign matters.

2.4.4 Blow circuit

Do not open the cylinder port to the atmosphere during use. Doing so may cause malfunction due to drop in the supply pressure.
In addition, the grease in the sliding parts may flow, and therefore the minimum operating pressure may increase, and the service life of the sealing parts may be shortened.

2.4.5 Exhaust port

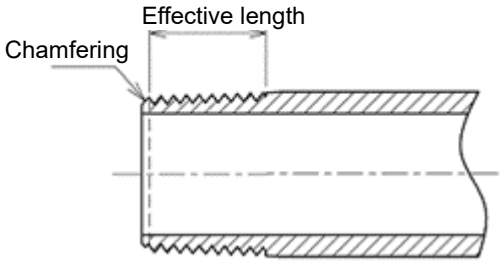
Blocking the exhaust air may cause a delay in cylinder response. Adjust the speed between the cylinder and the solenoid valve. Do not block the breathing hole or the exhaust port. Doing so may cause malfunction because the pilot pressure is not released. Take measures to prevent ingress of dirt, dust, and rainwater into the breathing hole or the exhaust port.

2.4.6 Piping connection

Do not open the connection ports to the atmosphere. Take measures to prevent ingress of dirt, dust, and rainwater into the body.
To prevent leakage during piping, wind a seal tape or apply a sealing agent before connecting the piping.

■ Length of gas pipe screws

When using gas pipes, observe the effective length of thread. Chamfer the end (about 1/2 pitch) of the threaded portion.



■ Appropriate tube

For solenoid valves provided with push-in fitting, use tubes specified by CKD.
- Soft nylon tubes (F-1500 Series)
- Urethane tubes (U-9500 Series)

■ Spatter

In an environment exposed to spatter, use flame-retardant tubes or steel pipes.

■ Hydraulic hose

When piping is for use in both hydraulic and pneumatic systems, use a hydraulic hose.
When the standard push-in fitting is used with a spiral tube, secure the base or end of the tube with a hose clamp. Otherwise, the tube will rotate and lose its clamping ability.
In an atmosphere where the temperature is high, use fastening fittings, not push-in fittings. Do not use quick joints.

■ Commercially available tubes

When using commercially available tubes, check the outside diameter accuracy, wall thickness, and hardness of such tubes. The hardness of a urethane tube should be 93° or more (as measured by a rubber hardness meter).
Using a tube with insufficient diameter accuracy and hardness will cause the chucking force to drop, which makes the tube come off easily or difficult to insert.

■ Minimum allowable bending radius of tubes

Observe the minimum allowable bending radius of tubes. Neglecting the minimum allowable bending radius may cause disconnection or leakage.

Outside diameter (mm)	Minimum allowable bending radius (mm)	
	Soft nylon (F-1500 Series)	Urethane (U-9500 Series)
ø6	8	20
ø8	15	30
ø10	20	40
ø12	26	50
ø15	43	—
ø16	46	—

■ Tube cutting

To cut a tube, use a tube cutter to cut the tube perpendicularly to the length of the tube. Inserting an obliquely cut end of a tube may cause air leakage.

■ Tube connections

From the end of the fitting, secure a straight section as long as the outside diameter of the tube and do not bend the tube abruptly at the fitting connection point. The tension applied sideways through the tube should not exceed 40 N.

■ Blanking plug to use

For solenoid valves provided with push-in fitting, use blanking plugs specified by CKD:

- Blanking plug (GWP☐-B Series)

2.5 Wiring

⚠WARNING

Turn off the power before wiring.
An electric shock may occur.

Do not touch live parts with bare hands.
An electric shock may occur.

Thoroughly read and understand this Instruction Manual before working on electrical wiring.
The product must be handled by a person who understands the structure and operation principle of solenoid valve and has knowledge to secure the safety.

⚠CAUTION

Check the power supply voltage and the type of current (AC or DC) before supplying power.

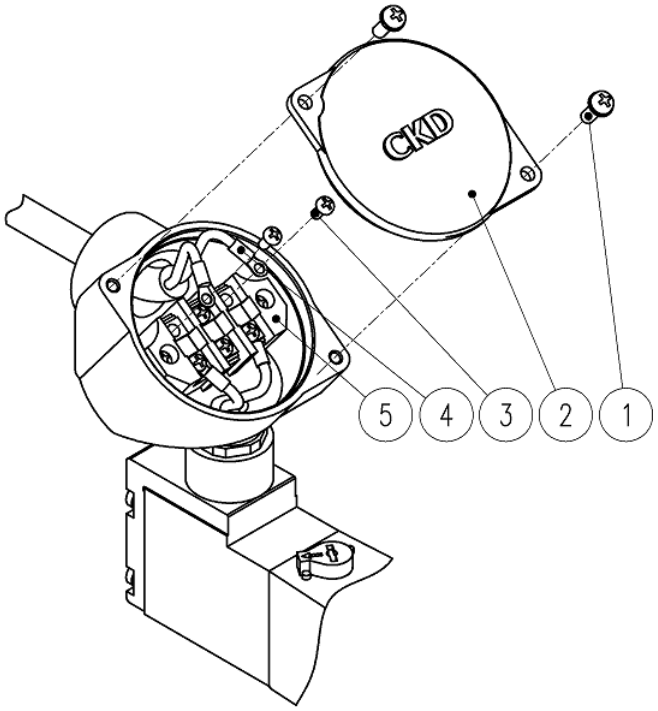
Do not apply stress to the lead wires.
Undue stress may cause such problems as disconnection of the lead wires or the contact terminals.

Make sure that the voltage drop on the solenoid does not exceed 10% of the rated voltage.
Voltage drop occurs when energizing solenoids at the same time or depending on the cable length.

Take measures to prevent ingress of rainwater from the lead wire outlet of the round terminal box.

2.5.1 Wiring connection

- The externally threaded portion of the round terminal box body is bonded in the solenoid valve coil block with an adhesive. Do not remove the round terminal box body or change the direction of the wiring port. Doing so may cause ingress of rainwater from the external threaded portion of the round terminal box.
- Protect the electric wire piping with cable glands, etc. to protect the wires from water.

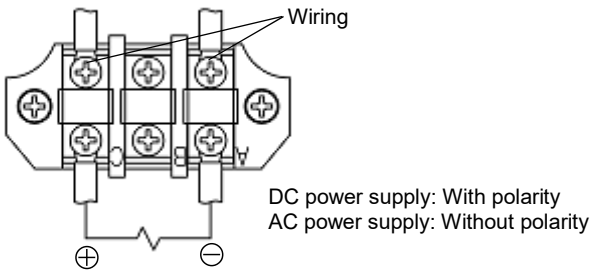


■ Disassembly

- Loosen the cap screws (1), and remove the cap (2).

■ Wiring

- Remove the terminal screw (3), and connect the wiring wire (4) to the terminal block (5).
  * Attach a crimp terminal to the wiring wire, and trim the wire ends.
    Use a coated crimp terminal with an external dimension of 7 mm or less.
  * Two lead wires from the coil are connected to the terminal block.
    The terminal boxes without lamp (B1, B and G) do not have polarity. Connect the lead wires to the terminals A and C of the terminal box.
    When using the terminal box with lamp (BL or GL), pay attention to the wiring positions because the DC voltage has polarity.
    Connect the negative electrode to the terminal block terminal A and the positive electrode to the terminal C.
    If the polarity is reversed, the solenoid valve will operate. However, the lamp will not light up.
  * The recommended tightening torque for the terminal block screws is 0.5 N.m.



■ Assembling

- Fit the cap (2) using the mounting screws (1).
  * The cap is directional. When fitting it, pay attention to the direction referring to the above figure.
  * The recommended tightening torque for the cap screws is 0.5 N.m.

3. USAGE

⚠WARNING

Consult CKD about the specifications before using the product outside the designated specifications or for special applications.

3.1 Safety Instructions

3.1.1 Air quality

⚠WARNING

Do not supply anything other than compressed air.
Use clean compressed air that does not contain corrosive gases.

⚠CAUTION

Improve the quality of air.
Compressed air usually contains a large amount of drainage, oxidized oil, tar, foreign matters, and rust from the piping, which may cause malfunction such as an operation fault and short service life. In addition, the exhaust causes pollution.

Use Class 1 ISO VG 32 turbine oil when lubricating.
Although the product is designed for oil-free operations, if lubricated even once, it will require periodic lubrication from then on. Make sure to keep it lubricated.
When you intend to lubricate in a low-temperature environment, consult us.

Do not use either spindle oil or machine oil.
They induce expansion of the rubber parts, which will cause operation faults.

■ Super-dry air

The super-dry air (humidity class of 0 to 3 as specified in JIS B 8392-1) may cause the lubricant to scatter, resulting in short service life.

■ Lubrication

Generally, the 4F Series does not require any lubrication. If lubrication is required, use Class 1 ISO VG 32 turbine oil.
If there is too much lubrication on the product or if the pressure is significantly low, the response time may be delayed. The response time indicated in the catalog shows the data obtained when the product is not lubricated and the pressure is 0.5 MPa.
When you intend to lubricate in a low-temperature environment, consult us.

■ Drainage

- If the temperature inside the pneumatic piping or pneumatic component drops, drainage may occur.
- If drainage enters and momentarily blocks the air passage inside the pneumatic component, it may cause an operation fault.
- If drainage generates rust, it may cause a failure in the pneumatic component.
- If drainage flushes the lubricant, it may cause a lubrication failure.

■ Contamination

- Use compressed air that does not contain oxidized oil, tar, carbon, or other contaminants from the air compressor.
  If oxidized oil, tar, or carbon enters into and adheres to pneumatic components, the resistance of the sliding section may increase and result in operation faults.
  If the supplied lubricant mixes in with oxidized oil, tar, or carbon, the sliding section of the pneumatic components will wear out.
- Use compressed air that does not contain solid foreign matters.
  If solid foreign matters in compressed air enter into the pneumatic components, the sliding section will wear out and contaminants will adhere to the inside.

■ Improvement of air quality

Take measures (such as dehumidifying with an aftercooler or a dryer, removing foreign matters with an appropriate filter, or installing a tar removing filter) in order to improve the quality of air.

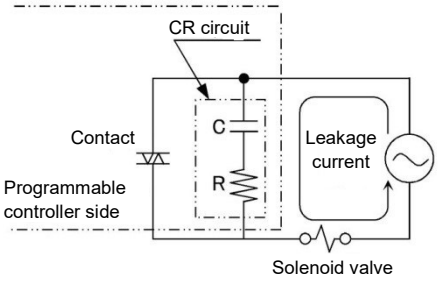
3.1.2 Electric circuit

⚠ CAUTION

Check for leakage currents from external control devices to prevent a malfunction.

When a programmable controller or a similar control device is used, a leakage current may prevent the valve from operating correctly even if the solenoid valve is de-energized.

When controlling solenoid valves using a programmable controller or a similar control device, make sure that the leakage current from the programmable controller output is as specified in the table below.



Voltage	Allowable leakage current value
100, 110 V AC	1.5 mA or less
200, 220 V AC	3.0 mA or less
12 V DC	1.5 mA or less
24 V DC	1.8 mA or less

- When energizing a double-solenoid type instantaneously, the energizing time must be 0.1 second or longer. It is recommended to energize while the cylinder is operating when the back pressure of another solenoid valve is conceivable.
- When energizing continuously, the surface temperature of the manifold increases. This is not abnormal, but appropriate ventilation or heat dissipation measures must be considered.

3.2 Manual Operation

⚠WARNING

After operating the manual override (including the residual pressure exhaust mechanism), return the cylinder to the original position (initial position) before re-starting operation.

Make sure that nobody is near the cylinder to be activated before performing manual operation (including residual pressure exhaust).

Release the lock before performing normal operation for non-locking/locking combination manual override.

- Performing normal operation while the manual override is locked causes malfunction.

- The 4F Series is a pilot operated solenoid valve. If air is not supplied to the port P (S), the pilot passage cannot be switched even by operating the manual override.

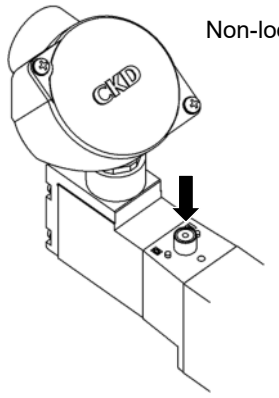
3.2.1 Non-locking/locking combination manual override

■ How to operate the manual override

<Non-locking operation>

1 Press the lever down in the direction of the arrow until it stops.
Manual operation can be performed while the lever is pressed down.

2 Release the lever to finish manual operation.
The lever returns to the original position when released.

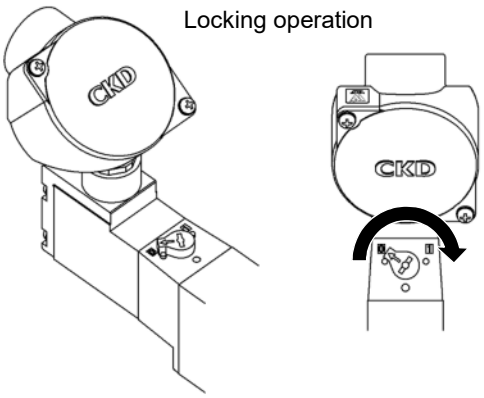


Non-locking operation

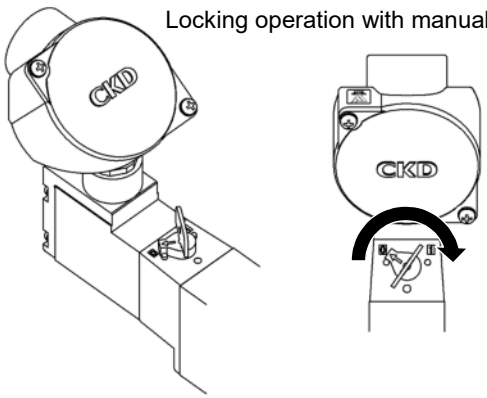
<Locking operation/locking operation with manual lever>

1 Turn the lever from “0” to “1” in the direction of the arrow.
The pilot passage can be switched while the lever is in “1.”

2 Return the lever to the original position to finish manual operation.
When the lever is returned to the original position, the pilot passage will be switched.



Locking operation



Locking operation with manual lever

4. MAINTENANCE AND INSPECTION

4.1 Periodic Inspection

⚠WARNING

Turn off the power, stop the supply of compressed air, and make sure that there is no residual pressure before maintenance.
Observe the condition to ensure safety.

⚠CAUTION

Plan and perform daily and periodic inspections so that maintenance can be managed properly.
If maintenance is not properly managed, the product's functions may deteriorate significantly and this may lead to faults (such as short service life, damage, and malfunction) or accidents.

In order to use the product under optimum conditions, perform a periodic inspection once or twice a year.

■ Pressure of supplied compressed air

- Is the set pressure supplied?
- Does the pressure gauge indicate the set pressure during operation of the device?

■ Pneumatic filter

- Is drainage correctly discharged?
- Are the bowl and element clean enough to use?

■ Leakage of compressed air from piping connections

- Are all connections, especially at movable sections, correctly connected?

■ Operation of solenoid valves

- Is there any delay in operation?
- Are the valves exhausting properly?

■ Operation of pneumatic actuator

- Are operations smooth?
- Is the actuator reaching the end stop properly?
- Are loads connected properly?

■ Lubricator

- Is the oil rate correctly adjusted?

■ Lubricant

- Is the specified lubricant supplied?

■ Screws

- Are there any loose screws?

4.2 Disassembling and Assembling

⚠WARNING

Thoroughly read and understand this Instruction Manual before working on disassembly or assembly of the manifold.

- The product must be handled by a person who understands the structure and operation principle of solenoid valve and has knowledge to secure the safety.
- A level of 2nd grade (or higher) Certified Skilled Professional of Pneumatic Apparatus Assembling is required.

Turn off the power and release the pressure before adding or removing a manifold valve.

Do not disassemble or reassemble the inside of the solenoid valve.

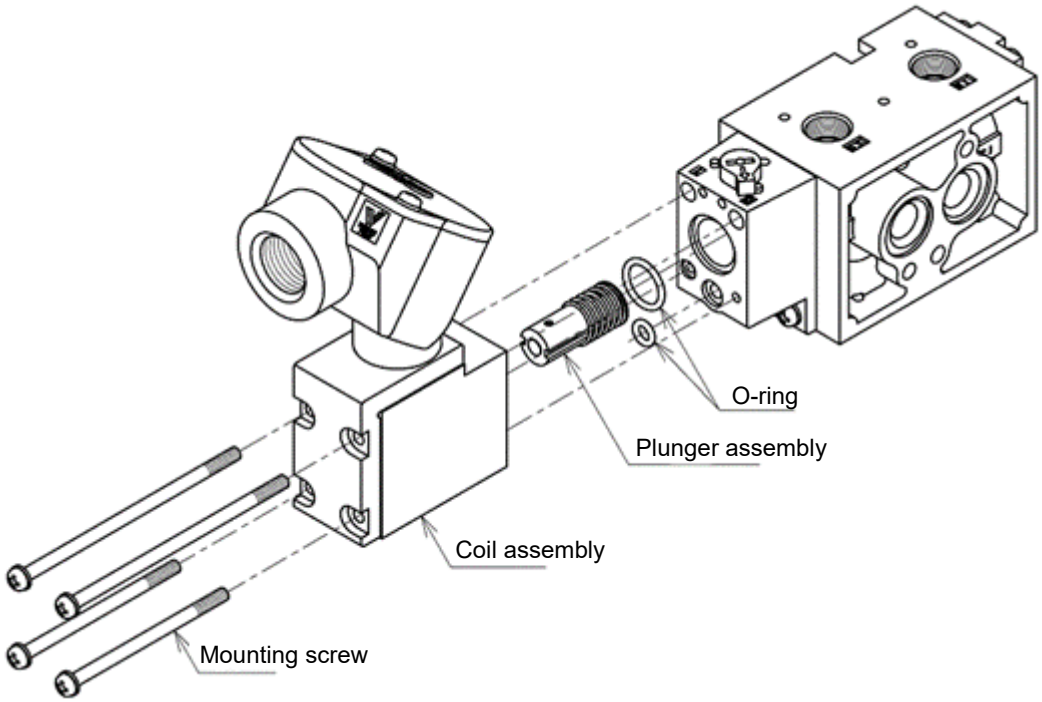
- Disassembling and reassembling the inside of the solenoid valve will impair the sealing performance.
- Disassembling and reassembling the solenoid valve will void the warranty.

4.2.1 How to replace a coil assembly

1 Remove four mounting screws securing the coil assembly and remove the old coil assembly. Loosening other screws may cause operation faults.

2 Make sure that the O-ring and plunger assembly are mounted on the pilot valve body assembly.

3 Attach the replacement coil assembly and tighten the mounting screws.
Improper tightening torque may cause air leakage or operation faults.
The recommended tightening torque is 1.9 N.m.



5. TROUBLESHOOTING

5.1 Problems, Causes, and Solutions

If this product does not operate as specified, inspect it according to the following table.

Problem	Cause	Solution
Does not operate at all	There is no electric signal.	Turn on the power.
	Electric signals are faulty.	Repair the control circuit.
	Voltage or current fluctuation is excessive.	Check the power capacity (voltage fluctuation range: ± 10%).
	Wiring is not correct.	Correct the wiring.
	All pilot air exhaust ports are closed.	Inspect and correct the piping.
Does not operate properly	Leakage current is excessive.	Correct the control circuit and/or add a bleed circuit.
	Chattering occurs.	Check the switching system and check for loose wiring.
	Voltage is not as specified on nameplate.	Correct the voltage to meet the specification.
	Coil is damaged or short-circuited.	Replace the coil.
	Pressure source is disconnected.	Turn on the pressure source.
	Pressure is insufficient.	Readjust the pressure reducing valve or install a valve for increasing pressure.
	Flow rate is insufficient.	Inspect and correct the piping or install a surge tank.
	Pressure is supplied through exhaust port.	Inspect and correct the piping.
	Piping is incorrect or omitted.	Inspect and correct the piping.
	Speed control throttle valve is completely closed.	Readjust the needle.
	A (C1) or B (C2) is left open to atmosphere.	Use a pipe fitting with diameter equal to or smaller than the diameter of port P fitting.
	Valve is frozen.	Take measures against freezing (such as keeping the product warm and draining water).
	Return of plunger is delayed by excessive oil or existence of tar.	Check the quality of the lubricant (Class 1 ISO VG 32 turbine oil). Readjust the lubricator drip rate. Install a tar removing filter.
	Exhaust ports are clogged with dust.	Install a cover or silencer. Clean the exhaust ports periodically.
Requires high pressure to operate	Packing is swelling.	Check the quality of the lubricant (Class 1 ISO VG 32 turbine oil). Use the solenoid valves away from where cutting oil is used. Keep organic chemicals away.
	A (C1) or B (C2) is open to atmosphere.	Inspect and correct the piping.
	Foreign matters are stuck in packing.	Remove foreign matters.

If you have any other questions or concerns, contact your nearest CKD sales office or distributor.

6. REFERENCE INFORMATION

6.1 Port Identification

Piping ports are identified and labeled, such as S and C1.

Port	ISO standard	JIS standard	Indication on 4F
Air supply port	1	P	S
Output port	4	A	C1
Output port	2	B	C2
Exhaust port	5	R1	E1
Exhaust port	3	R2	E2

There is no restriction on the mounting orientation of the solenoid valves.
Check the port symbols and make sure to pipe correctly so that reverse operation of the cylinder does not occur.

7. WARRANTY PROVISIONS

7.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly repair the faulty product at one of CKD's facilities free of charge.
However, following failures are excluded from this warranty:

(1) Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
(2) Failure caused by use of the product after the durability limit (number of times, distance, time, etc.) is reached or by expendables
(3) Failure not caused by the product.
(4) Failure caused by use not intended for the product.
(5) Failure caused by modifications/alterations or repairs not carried out by CKD.
(6) Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
(7) Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.
When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

7.2 Warranty Period

The product is warranted for one year from the date of delivery to the location specified by the customer.
The option G is warranted for three years from the date of delivery or one year after the start of use, whichever is shorter.