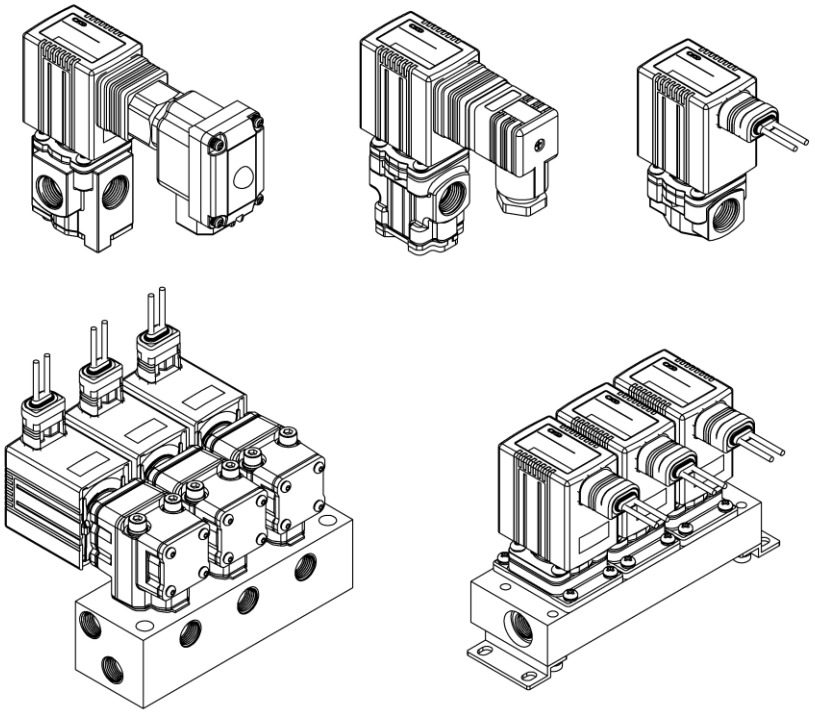
CKD

FFB Series/FFBM Series
FFG Series/FFGM Series
Multi-Fit Valve

INSTRUCTION MANUAL

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.



2022-06-30 SM-A57355-A

PREFACE

Thank you for purchasing CKD’s "FFB Series/FFBM Series/FFG Series/FFGM Series" multi-fit valve.

This Instruction Manual contains basic matters related to the operation of this product 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, which uses control valves such as solenoid valves, motor valves, and air operated valves, is intended for users who have basic knowledge about materials, fluids, piping, and electricity. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training with respect to control valves.

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 or water control circuit, and the electric system that controls such mechanism 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 edition of each standard)
- The High Pressure Gas Safety 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, handling that is not described in this Instruction Manual may lead to an accident. 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.

Some statements classified as "CAUTION" may still lead to serious results depending on the situation.
All statements that follow these labels are important and must be observed.

<Types of warning symbols>

	A general mark indicating a prohibited (not permitted) action.		A mark prohibiting people from touching objects or equipment.
	A mark prohibiting people from putting their fingers into openings.		A general mark warning people of dangers such as electric shock and burns.
	A mark warning people of dangers that occur when starting an automatic equipment.		A general mark indicating that a specific course of action must be taken.
	A mark indicating that an instruction manual must be read carefully.		A mark indicating that the earth terminal must be connected to the ground.

In addition, the following icons indicate general precautions.

- Contains useful information such as general precautions, supplementary information, and reference information.

Precautions on Product Use

WARNING

Do not modify the product or perform additional work on the product.

- Modification or additional work may not only pose a risk of fire or electric shock, but it may also cause the product to fail to satisfy the specifications described in this Instruction Manual.

Do not handle the product or install or remove pipes and devices until confirming safety.

- Inspect and service the machines and devices only after confirming that safety of the entire system related to the product is ensured. Also, turn off the energy source (air supply or water supply) and power to the relevant equipment. Release compressed air from the system and use extreme care to avoid water or electric leakage.
- There may be hot or live parts even after operation has stopped. When performing maintenance on equipment, wear heat-resistant and electric-resistant protective equipment such as gloves and be careful of hot or live parts.
- Before starting or restarting a machine or device that incorporates pneumatic components, make sure that a safety measure (such as a pop-out prevention mechanism) is in place and system safety is secured.

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 part for general industrial machinery and should be handled with care.

Use the product within the specifications.

- The product must not be used beyond its specifications.
- The product is intended for use as a device or part for general industrial machinery. It is not intended for use under the conditions or in environments listed below. Exception is made if the customer consults with CKD prior to use and understands the specifications of the product. However, even in that case, safety measures must be taken to avoid danger in case of a possible failure.
  - ◎ For use under the conditions or in environments other than those specified or outdoors.
  - ◎ In applications for nuclear power, railroad system, aviation, ship, vehicle, medical equipment, and equipment that directly touches beverage or food.
  - ◎ For special applications that require safety including amusement equipment, emergency shut-off circuit, press machine, brake circuit, and safety measures.
  - ◎ For applications where life or properties may be adversely affected and special safety measures are required.

CONTENTS

1. PRODUCT OVERVIEW

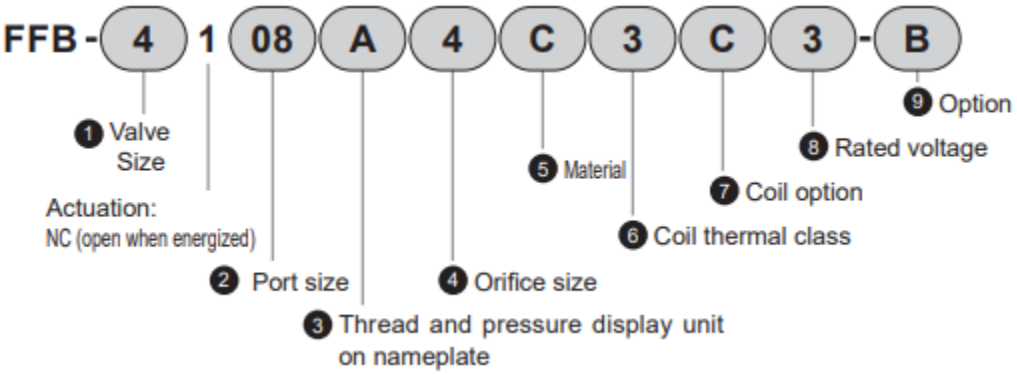
1.1. Series Variation

No. of Ports	Model		Configuration	Actuation
2-port		FFB-21	Discrete valve	NC (open when energized)
		FFB-31		
		FFB-41		
		FFB-51		
		FFB-32		NO (closed when energized)
		FFB-42		
		FFB-52		
		FFBM-21	Manifold	NC (open when energized) Common supply
		FFBM-31		
		FFBM-41		
		FFBM-51		
		FFBM-25		NC (open when energized) individual supply
		FFBM-35		
		FFBM-45		
		FFBM-55		
3-port		FFG-21	Discrete valve	Universal
		FFG-31		
		FFG-41		
		FFG-51		
		FFG-33		NC pressurization
		FFG-43		
		FFGM-31	Manifold	Universal Common supply Common exhaust
		FFGM-41		
		FFGM-51		

1.2. Model Number Indication

Only the model number indication for the representative model(s) is shown here. Refer to the catalog for the model number indication for the other models.

1.2.1. FFB-☐1 Series (NC type 2-port solenoid valve)



1 Valve size		Valve size 2	3	4	5
2	Width 24 mm	●			
3	Width 30 mm		●		
4	Width 35 mm			●	
5	Width 40 mm				●

2 Port size		Valve size 2	3	4	5
06	1/8	●	●		
08	1/4		●	●	●
10	3/8			●	●
15	1/2				●

3 Thread and pressure display unit on nameplate

	Thread	Pressure unit indicated
A	Rc thread	MPa
B	G thread	bar
C	NPT thread	psi
D	G thread	MPa *1
E	NPT thread	MPa *1

*1:"D" and "E" are selected mainly in Japan to indicate MPa as the pressure display unit even for G and NPT threads.

4 Orifice size		Valve size 2	3	4	5
S	ø1.5	●			
2	ø2	●	●		
3	ø3		●		
4	ø4			●	
5	ø5		●		●*1
7	ø7			●	●
X	ø10				●*2

*1:❽Not available when port size is "15".
*2:❽Not available for port size 08.

5 Material

	Body	Seal	Treatment	Remarks
A	Aluminum	NBR	-	Compressed air/dry air
C	Copper alloy	NBR	-	Compressed air/dry air/water/oil/low vacuum *1
D		FKM		Compressed air/dry air/water/oil/low vacuum *1
G		FKM	Vacuum inspection	Compressed air/dry air/medium vacuum *2
H	Stainless steel	NBR	-	Compressed air/dry air/water/oil/low vacuum *1
J		FKM		Compressed air/dry air/water/oil/low vacuum *1
M		FKM	Vacuum inspection	Compressed air/dry air/medium vacuum *2
N	Copper alloy	NBR	Oil-prohibited	Compressed air/dry air/water/oil/low vacuum *1
P		FKM		Compressed air/dry air/water/oil/low vacuum *1
Q		EPDM		Water
S	Stainless steel	NBR		Compressed air/dry air/water/oil/low vacuum *1
T		FKM		Compressed air/dry air/water/oil/low vacuum *1
U		EPDM		Water

*1:Low vacuum [1.33 × 10^2Pa (abs)] can be used, but valve seat leakage is 0.2cm^3/min (ANR) or less. (Valve seat leakage at positive pressure)
When used in a low vacuum, the lower limit of operating pressure is 1.33 x 102 Pa (abs), so the upper limit is 0.1 MPa lower.
*2:❽Not available when the orifice size is "X".

6 Coil thermal class

3	Class 130 (B)

❼ Coil option

			❶ Valve size				Voltage	
			2	3	4	5	DC	AC
A	Lead wire (300 mm)		●	●	●	●	●	●
B	With DIN terminal box (G1/2)		*1	●	●	●	●	●
C	DIN terminal box (Pg11)		●*2	●	●	●	●	●
D	DIN terminal box with lamp (Pg11)		●*2	●	●	●	*3	●
E	Conduit (G1/2)			●	●	●	●	●
F	Conduit (CTC19)			●	●	●	●	●
G	HP terminal box (G1/2)			●	●	●	●	●
H	HP terminal box with lamp (G1/2)			●	●	●	●	●
J	Lead wire (300 mm)	Surge With absorber	●	●	●	●	●*4	*5
K	DIN terminal box (Pg11)		●*2	●	●	●	●	
L	DIN terminal box with lamp (Pg11)		●*2	●	●	●	●	
M	Conduit (G1/2)			●	●	●	●	
P	Conduit (CTC19)			●	●	●	●	
Q	HP terminal box (G1/2)			●	●	●	●	
R	HP terminal box with lamp (G1/2)			●	●	●	●	

*1: ❶Coil option "B" cannot be selected when valve size is "2".
*2: ❶When the valve size is "2", the DIN terminal box thread size is Pg9.
*3: Use "L" DIN terminal box lamp with surge suppressor.
*4: The surge suppressor for the DC voltage coil option "J" is supplied with the product.
*5: All AC voltages are equipped with a full-wave rectifier circuit. For this reason, a surge suppressor is not available.

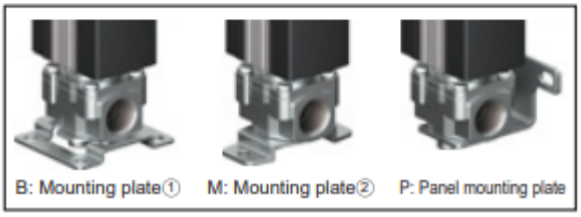
❽ Rated voltage

1	100 VAC 50/60Hz
2	200 VAC 50/60Hz
3	24 VDC
4	12 VDC
5	110 VAC 50/60Hz
6	220 VAC 50/60Hz

❾ Option *1

Blank	No	
B	Mounting plate①	*2
M	Mounting plate②	*3, *4
P	Panel mounting plate	

*1: Mounting plate and panel mounting plate are included with the product. Refer to the precautions on page 56 for tightening torque.
*2: Mounting plate① is compatible with our FAB or FWB Series.
*3: ❶Not available when valve size is "2".
*4: Mounting plate② is compatible with our product AB Series.



B: Mounting plate① M: Mounting plate② P: Panel mounting plate

Coil option code

A(DC) J		Grommet lead wire 300 mm Grommet lead wire 300 mm/ With surge suppressor
A(AC)		Grommet lead wire 300 mm
B C K		DIN terminal box DIN terminal box/with surge suppressor
D L		DIN terminal box/with lamp DIN terminal box/lamp/ With surge suppressor
G Q		HP terminal box HP terminal box/with surge suppressor
H R		HP terminal box/with lamp HP terminal box/lamp/ With surge suppressor
E F M P		Conduit (G1/2) Conduit (CTC19) Conduit (G1/2)/with surge suppressor Conduit (CTC19)/with surge suppressor

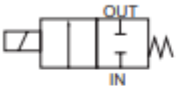
1.3. Specifications

Only the specifications of the representative model(s) are shown here. Refer to the catalog for the specifications of the other models.

1.3.1. FFB-□1 Series (NC type 2-port solenoid valve)

JIS symbol

● FFB-*1:NC(Open when energized)



Common specifications

Item	FFB
Working fluid	Compressed air/water/oil (50mm²/s or less)/medium vacuum (*2)/dry air
Max. working pressure MPa	1.4 (refer to working pressure in individual specifications.)
Proof pressure (water pressure) MPa	2.1(NC), 1.5(NO)
Fluid temperature °C	−10 to 60 (no freezing)
Ambient temperature °C	-10 to 60(DC), -10 to 55(AC)
Thermal class	Class 130 (B)
Atmosphere	Place free of corrosive gas and explosive gas
Valve structure	Direct acting poppet structure
Valve seat leakagecm³/min (ANR)	0.2 or less (air)
Valve seat leakage *1Pa·m³/sHe	1.33×10^{-6} or less
Mounting orientation	Unrestricted
Degree of protection	IP65

*1: Amount of leakage in medium vacuum. (FFB Series NC only)
*2: When using at medium vacuum, vacuum the OUT port side.

Individual specifications

Item / Model No.				Port size Rc, G, NPT	Orifice size (mm)	Working pressure (MPa) *1	Working pressure Pa (abs) *2, *3	Flow characteristics C[dm³/(s·bar)]	Flow characteristics b	Flow characteristics Cv	Weight (kg) *4
NC (open when energized)											
FFB-21	06	*	S	1/8	1.5	0 to 1.0	1.3×10^{-2} to 1×10^{6}	0.31	0.42	0.085	0.21
			2		2	0 to 0.6	1.3×10^{-2} to 0.6×10^{6}	0.53	0.34	0.13	
FFB-31	06 08	*	2	1/8 1/4	2	0 to 1.4	1.3×10^{-2} to 1.4×10^{6}	0.56	0.50	0.15	0.36
			3		3	0 to 0.6	1.3×10^{-2} to 0.6×10^{6}	1.2	0.45	0.31	
			5		5	0 to 0.2	1.3×10^{-2} to 0.2×10^{6}	2.9	0.43	0.63	
FFB-41	08 10	*	4	1/4 3/8	4	0 to 1.0	1.3×10^{-2} to 1×10^{6}	1.4	0.52	0.43	0.55
			7		7	0 to 0.15	1.3×10^{-2} to 0.15×10^{6}	4.2	0.43	1.15	
FFB-51	08 10 15	*	5	1/4 3/8 1/2	5	0 to 0.8	1.3×10^{-2} to 0.8×10^{6}	2.7	0.45	0.72	0.85
			7		7	0 to 0.3	1.3×10^{-2} to 0.3×10^{6}	4.7	0.38	1.2	
			X		10	0 to 0.1	1.3×10^{-2} to 0.1×10^{6}	6.9	0.41	2.0	

*1: Although it can be used with low vacuum [1.33×10^{2}Pa (abs)], valve seat leakage is 0.2cm³/min (ANR) or less. (Valve seat leakage at positive pressure)
When used in a low vacuum, the lower limit of operating pressure is 1.33×10^{2} Pa (abs), so the upper limit is 0.1 MPa lower.
*2: Working pressure at medium vacuum.
*3: When using at medium vacuum, vacuum the OUT port side.
*4: Weight of copper alloy body with DC lead wire.

2. INSTALLATION

WARNING

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

Prevent water and cutting oil from directly splashing onto the product.

- If water or cutting oil is directly splashed onto the solenoid valve, it may cause the coil to burn out.
- This product has a degree of protection equivalent to IP65. However, this does not guarantee protection of the coil because performance is greatly affected by weather resistance and aging. To prevent direct exposure to water and dust, protect the product by installing it under a cover or inside a paneled casing.
- If there is a possibility that the product may be exposed to spatter during welding, take appropriate protective measures.

Consider measures for dissipating heat generated from the coil.

- Appropriate ventilation or heat dissipation measures must be considered if the product is installed in a control board or needs to be energized for a long period.

CAUTION

Do not paint the product or clean it with water or solvent.

- The resin parts can become damaged and this may lead to a failure or malfunction.

Do not apply a heat insulating material to the coil part.

- If heat insulating material is applied to the coil, it may cause the coil to burn out.

2.1. Environment

WARNING

Do not use the product in the presence of corrosive gas or solvents.
- Do not use the product in an environment where corrosive gases such as sulfur dioxide gas or solvents are present.

Do not use the product in an explosive gas atmosphere.
- The product cannot be used in an explosive gas atmosphere. For use in an explosive gas atmosphere, select explosion-proof type solenoid valves or air operated valves.

CAUTION

Do not use the product in an environment where the valve is subject to vibrations or inertia.

Keep the product away from heat-generating equipment and use it in an environment where it is not exposed to radiant heat.

When using the product in cold climates, take appropriate measures against freezing.
- Freezing of the fluid such as water may cause damage to the product.

Install the product where it is not exposed to direct sunlight, ultraviolet rays, water, and rain.
- The product cannot be used outdoors.

- In sub-zero temperature environments, the sealing rubber and noise-reducing rubber may harden, resulting in reduced sealing performance and quietness.

2.2. Unpacking

CAUTION

Do not remove the piping port protector and do not take the product out of the plastic bag until immediately prior to performing piping work.

- If the piping port protector is removed or the product is taken out of the plastic bag before ready to begin piping work, foreign matters may enter from the piping ports and 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.

2.3. Mounting

CAUTION

Hold the body firmly when handling and mounting the product.

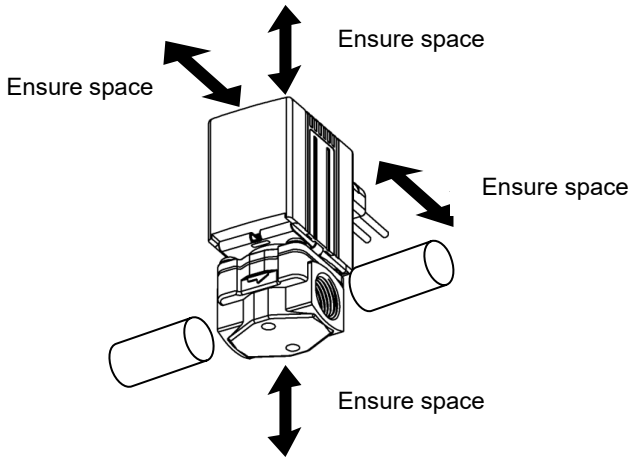
- Do not hold the coil or carry the product by holding the lead wires as it may cause a malfunction.

Do not subject the coil and lead wires to an excessive force when mounting the product.

- Secure sufficient space for working safely during maintenance and troubleshooting (refer to the figure below).
- For ease of maintenance, install a bypass circuit and use a union for piping.
- There is no restriction on the mounting orientation. However, if the coil is mounted facing down, foreign matters in the fluid will more easily stick to the electromagnetic iron core and cause an operation fault. Therefore, it is recommended to mount the product in an orientation other than downward.

1. Ensure sufficient space and secure the product

Hold the body at its width across flats with a spanner wrench, pipe wrench, monkey wrench, or the like, and secure the product by connecting it to piping or using the screw holes on the bottom of the body.



2.4. Piping

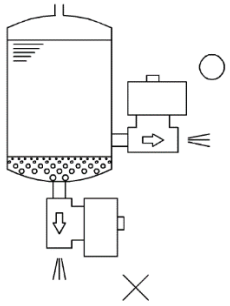
CAUTION

Be careful not to use the wrong supply port or connect to the wrong piping destination.

- Wrong supply port or piping destination may lead to a malfunction or accident.

To prevent the product from malfunctioning or being damaged, observe the following.

- When controlling fluids in a tank, connect the piping slightly above the bottom of the tank.
  If the product is installed at the bottom of the tank, accumulated foreign matter may cause an operation fault.



- Secure the product when retightening or reconnecting the piping.
- Secure and support the pipes to prevent the valve from being subjected to pipe loads and vibrations directly.
- When using the product with liquids, water hammer may occur depending on the piping conditions. Since the solenoid valve may be damaged due to sudden pressure fluctuation, take measures against the water hammer on the piping side.

Do not apply high pressure suddenly when supplying fluid for the first time after connecting the pipes.

- If the pipes are not secured properly, it may lead to accidents such as pipe disconnection or fluid leakage.

■ Pipe threading

When cutting the threads on the piping, observe the effective thread length of the body and chamfer the tip by about a 1/2 pitch.

■ Pipe cleaning

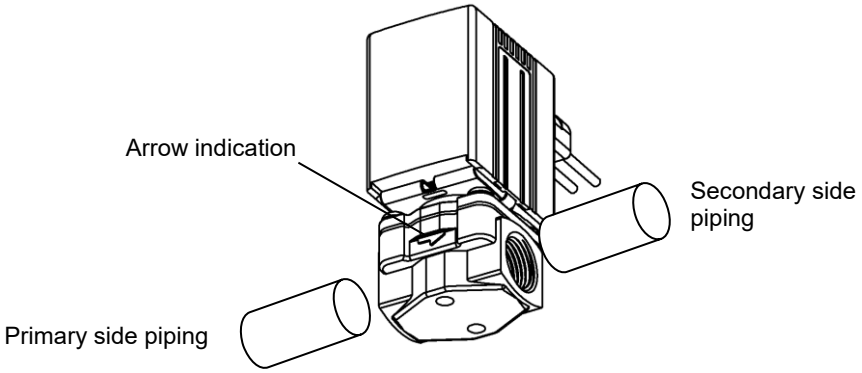
Before piping, perform flushing with air of more than 0.3 MPa to remove foreign matters such as dust, metal powder, rust, and seal tape.

■ Removal of foreign matters

Remove foreign matters such as dusts in the fluid to prevent causing an operation fault or leakage.
On the primary side of the valve, install a filter of 5 μm or less when the fluid is air, and install a strainer of 80 mesh or more when the fluid is water.

■ Direction of piping connection

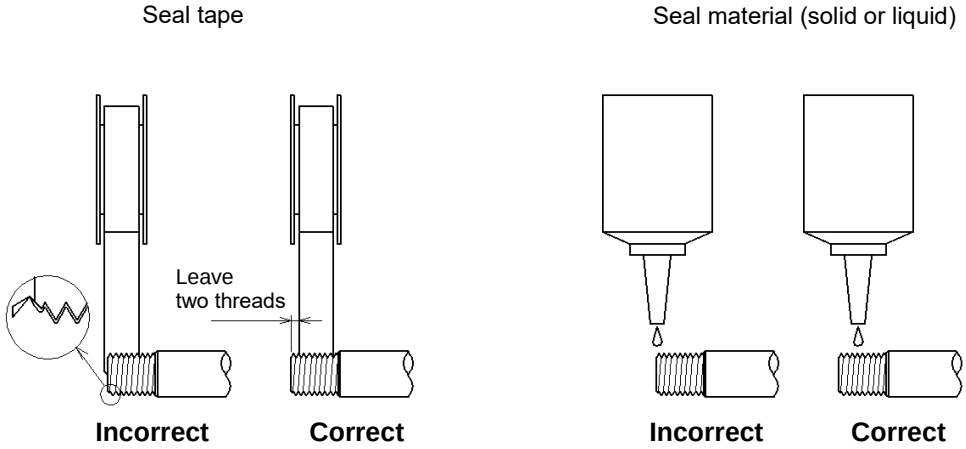
When piping, be careful of the connection destination and direction. For the description of supply ports, refer to "8.1 Internal Structure".
The FFB Series is marked with an arrow to indicate the direction of fluid flow. Install the primary side piping and secondary side piping according to the direction of flow.



■ Seal material

Apply a seal tape or seal material to the screw threads leaving one or two threads at the pipe end uncovered or uncoated.
If the pipe end is fully covered or coated, a shred of seal tape or residue of seal material may enter inside of the valve and cause a failure.

- When using a seal tape, wind it around the screw threads in the direction opposite from the screw threads and press it down with your fingers to attach it firmly.
- When using a liquid seal material, be careful not to apply it to resin parts.
  The resin parts can become damaged and this may lead to a failure or malfunction.
  Also, do not use the seal material excessively or apply it to the internal threads.



■ Tightening

When piping to the valve, secure the body with a wrench or a vise.
Refer to the following table for the tightening torque to be applied when piping.

<Recommended tightening torque for piping>

Port size	Recommended tightening torque (N·m)		
	Aluminum body	Brass body, stainless steel body	When using a push-in fitting for pneumatic piping
Rc1/8	7 to 9	18 to 20	3 to 5
Rc1/4	12 to 14	23 to 25	6 to 8
Rc3/8	22 to 24	31 to 33	13 to 15
Rc1/2	28 to 30	41 to 43	16 to 18

* The recommended tightening torque for NPT threads is the same as that for Rc threads of the same size.

If the product comes with the optional mounting plate, refer to the following table for the tightening torque to be applied when securing the mounting plate.

<Recommended tightening torque for mounting plate>

Screw/bolt size	Recommended tightening torque (N·m)
FFB-2/FFG-2: M4	1.3 to 1.6
FFB-3/FFG-3/FFB-4/FFG-4/FFB-5/FFG-5: M5	2.6 to 3.2

■ Lubrication

This valve can also be used without lubrication. Although a lubricator is not required, when lubricating, use Class 1 ISO VG32 turbine oil (additive-free).
If lubrication is stopped in the middle of operation, an operation fault may occur due to the loss of the initial lubricant. Make sure to continuously lubricate the oil so that it does not run out.

2.5. Precautions for Fabricating a Subplate

For customers fabricating their own subplates, refer to the precautions in this section.

2.5.1. FFBM Series (2-port solenoid valve, manifold)

CAUTION

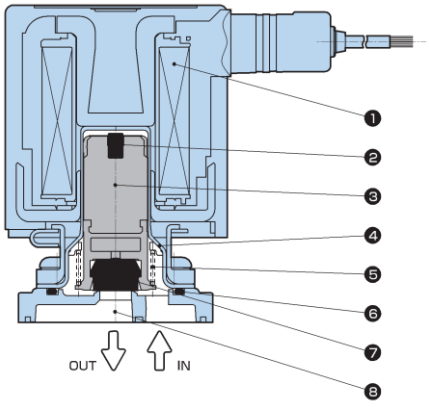
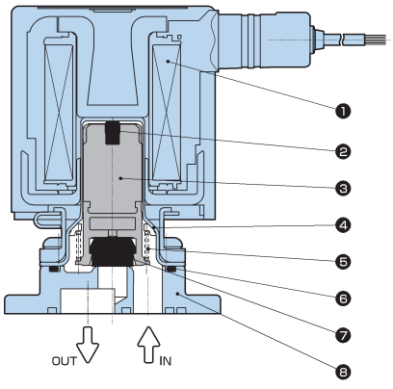
The mounting surface of the subplate shall be machined and finished to a roughness of Rz12.5 or less.

- Make sure to finish the mounting surface to the specified roughness so that it can be sealed with a gasket, O-ring, or the like.

If the body is aluminum, press-fit the included wave spring pin into place on the subplate. Refer to "■ Subplate mounting dimensions" on the next page for the press-fitting position. The press-fitting position depends on whether the manifold is a common supply type or an individual supply type.

■ Pressurizing direction and port position

For the common supply, set port C as the IN side.
For the individual supply, set port A as the IN side.

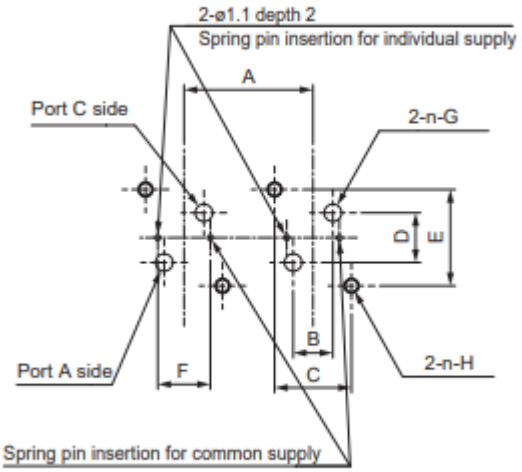
Type	Model		Section view	Port A	Port C
Aluminum body	Common supply	FFBM-☐1		OUT side	IN side
	Individual supply	FFBM-☐5		IN side	OUT side
Brass body, stainless steel body	Common supply	FFBM-☐1		OUT side	IN side
	Individual supply	FFBM-☐5		IN side	OUT side

■ Subplate mounting dimensions

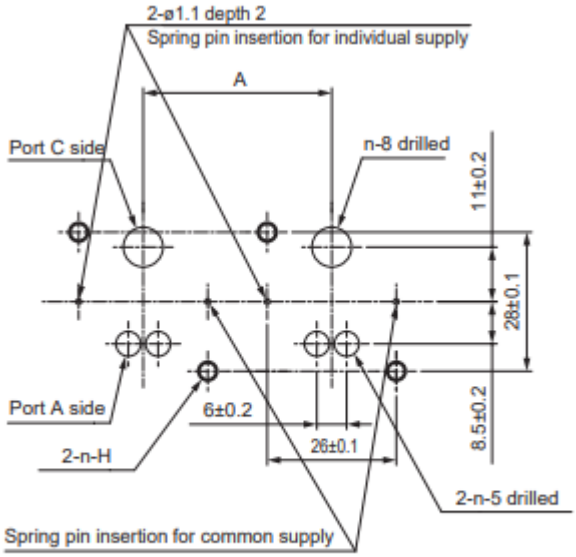
If the body is brass or stainless steel, the mounting pitch of the screws of the product (body) depends on whether the manifold is a common supply type or an individual supply type. Select the product model number according to the pressurizing direction.

<Aluminum body>

●FFBM-2, FFBM-3



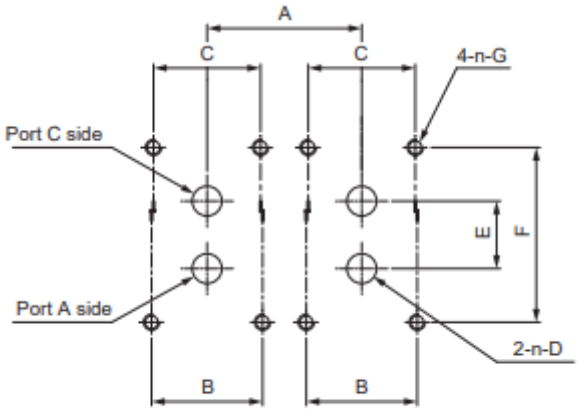
●FFBM-4, FFBM-5



Note: Machining diagram when using 2 actuators.

	A	B	C	D	E	F	G	H
FFBM-2	26 or more	8±0.15	15.5±0.1	10±0.15	19.4±0.1	10.6±0.1	ø3.5	M3 depth 6 or more
FFBM-3	32 or more	13±0.1	22.4±0.1	11.4±0.1	22.4±0.1	17±0.1	ø5.5	M3 depth 7 or more
FFBM-4	38 or more							M4 depth 7 or more
FFBM-5	46 or more							M4 depth 7 or more

<Brass body, stainless steel body>



Note: Machining diagram when using 2 actuators.

	A	B	C	D	E	F	G
FFBM-2	28 or more	19±0.1	18±0.1	ø3.5	10.6±0.1	30±0.1	M3 depth 6 or more
FFBM-3	36 or more	24±0.1	23±0.1	ø5.5	13.8±0.1	38±0.1	M4 depth 6 or more
FFBM-4	39 or more	28±0.1	27±0.1	ø7.5	17±0.1	44±0.1	M4 depth 6 or more
FFBM-5	45 or more	28±0.1	27±0.1	ø7.5	17±0.1	44±0.1	M4 depth 6 or more

■ Tightening

Refer to the following table for the tightening torque to be applied to the hexagon socket button head screw and pan head screw.

<Aluminum body: Recommended tightening torque for hexagon socket button head screw>

Screw/bolt size	Recommended tightening torque (N·m)
FFBM-2/FFBM-3: M3	0.59 to 0.71
FFBM-4/FFBM-5: M4	1.37 to 1.67

<Brass body, stainless steel body: Recommended tightening torque for pan head screw>

Screw/bolt size	Recommended tightening torque (N·m)
FFBM-2: M3	0.56 to 0.68
FFBM-3/FFBM-4/FFBM-5: M4	1.28 to 1.57

2.5.2. FFGM Series (3-port solenoid valve, manifold)

CAUTION

The mounting surface of the subplate shall be machined and finished to a roughness of Rz12.5 or less.

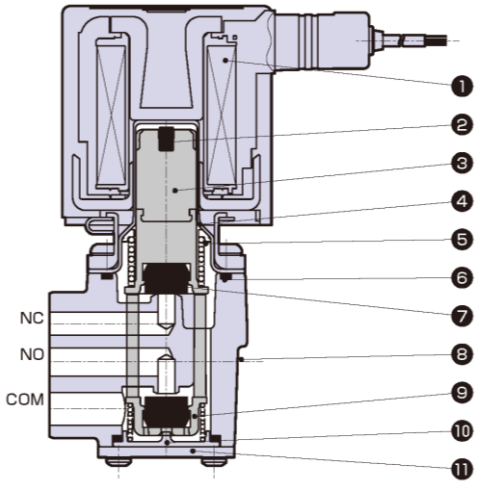
- Make sure to finish the mounting surface to the specified roughness so that it can be sealed with the mesh gasket.

Make sure there is no water, oil, and grease on the mesh gasket and the surface of the subplate.

Fasten the solenoid valve to the subplate by tightening the hexagon socket head bolts, which have spring washers and flat washers installed, twice, alternately from left to right.

Install the included mesh gasket between the actuator and the subplate, aligned with the port holes.

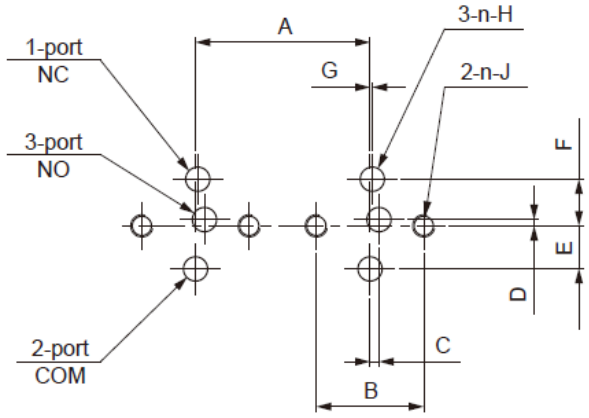
■ Pressurizing direction and port position

Type	Section view	Port 1	Port 2	Port 3
Universal type (Pressurized from any port)	FFGM-☐1 	NC	NO	COM

■ Subplate mounting dimensions

<Universal type (Pressurized from any port)>

●FFGM-☐1



Note: Machining drawing when using 2 actuators.

		A	B	C	D	E	F	G	H	J
FFGM-3	Aluminum body	36 or more	20±0.1	1.5±0.1	±0	9±0.2	7.5±0.2	0.5	ø4	M4 depth 6 or more
	Brass/SUS body	36 or more								
FFGM-4	Aluminum body	38 or more	24±0.1	2±0.1	1.4±0.1	9.6±0.2	10.4±0.2	0.5	ø5.4	M5 depth 6 or more
	Brass/SUS body	39 or more								
FFGM-5	Aluminum body	46 or more	24±0.1	2±0.1	1.4±0.1	9.6±0.2	10.4±0.2	0.5	ø5.4	M5 depth 6 or more
	Brass/SUS body	45 or more								

■ Tightening

Refer to the following table for the tightening torque to be applied to the hexagon socket head bolt.

<Recommended tightening torque for hexagon socket head bolt>

Screw/bolt size	Recommended tightening torque (N·m)
FFGM-3: M4	1.71 to 2.09
FFGM-4/FFGM-5: M5	3.45 to 4.21

2.6. Wiring

WARNING

Thoroughly read and understand this Instruction Manual before working on electrical wiring.

- The person handling this product must understand the structure and operating principles of solenoid valves and be well informed and capable of ensuring safety.

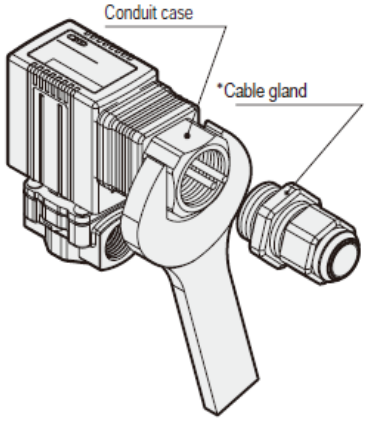
CAUTION

Check the rated voltage and whether AC or DC is used, and wire properly.

- To prevent the product from malfunctioning or being damaged, observe the items described in this section and wire properly.

When connecting the cable gland to the conduit, make sure to hold the conduit case with a spanner wrench or the like.

- Tighten the cable gland with a tightening torque of 0.45 N·m to 0.55 N·m.
- Holding the coil or body may cause damage to the conduit case.



* Parts indicated with an asterisk (*) (such as the cable gland) are not included with the product.

■ Protection of electrical equipment

Use a circuit breaker such as a fuse on the control circuit.

- The durability of the solenoid valve can be increased by using a switching circuit that does not cause contact chattering.

■ Wiring of lead wire type product

Use wires with a nominal cross-sectional area of approximately 0.5 mm^2 or more. In addition, do not subject the lead wires to an excessive force.
The conductor size of the lead wire of this product is 20 AWG (cord outer diameter is 2.6 mm). Use a crimp terminal suitable for the conductor size and make sure to insulate them.

- For this product (except for those that have an HP terminal box with lamp), even when the rated voltage is DC voltage, the solenoid valve has no (+)/(-) polarity.

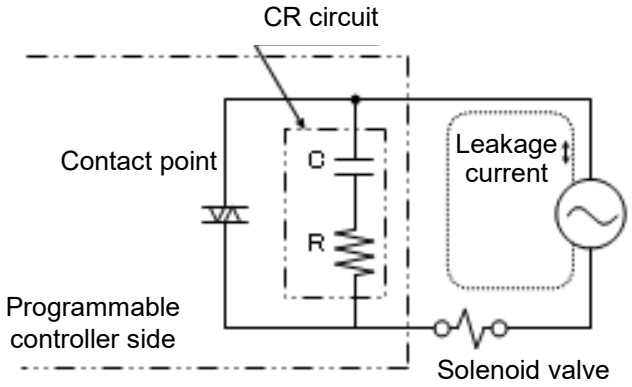
■ Prevention of malfunction of this product and control devices

To prevent this product and control devices from malfunctioning, observe the following.

- Surge voltages generated during the operation of solenoid valves can affect control devices and electrical circuits. In this case, use a solenoid valve that comes with a surge suppressor (coil option) or install a surge absorber in parallel with the solenoid valve.
- Make sure that the leakage currents from other control devices are less than or equal to the allowable value shown below.
  When using a control device such as a programmable controller that incorporates a CR circuit to absorb the surge voltage generated by the switching element, leakage currents from the control device may affect the solenoid valve and cause it to malfunction.

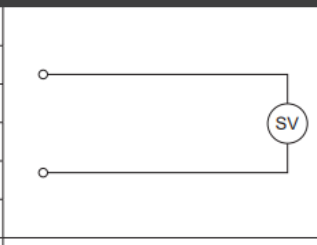
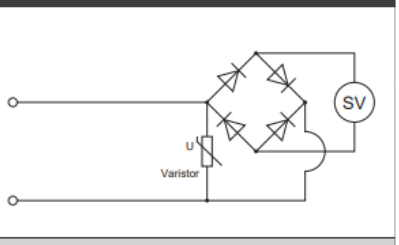
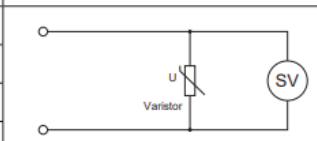
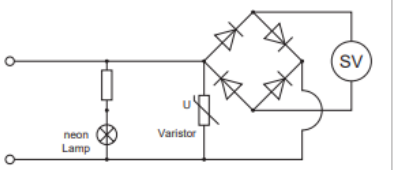
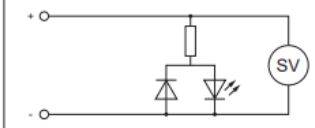
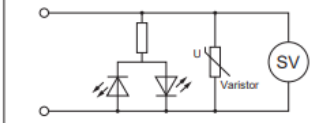
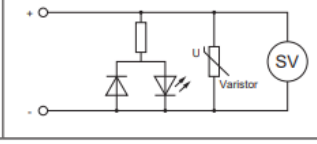
<Allowable leakage current>

Rated voltage	Leakage current
100 VAC	2 mA or less
110 VAC	2 mA or less
200 VAC	1 mA or less
220 VAC	1 mA or less
12 VDC	5 mA or less
24 VDC	5 mA or less



■ Electrical connection circuit diagram for each coil option

To identify the coil option code (A, B, C…) of the solenoid valve the customer purchased from the model number, see "1.2 Model Number Indication".

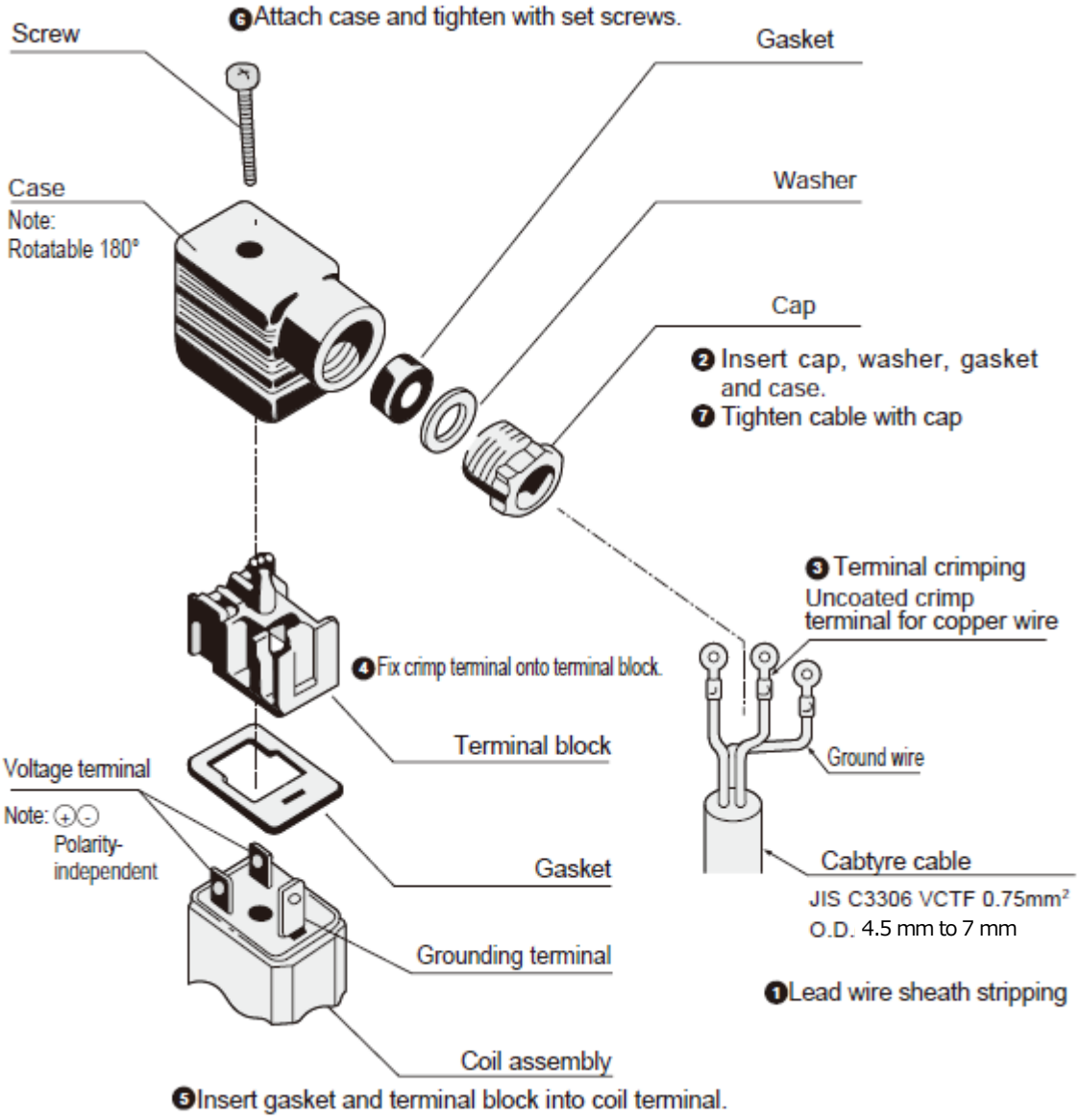
Coil option		Voltage			
		DC		AC	
A	Lead wire (300 mm)	●		●	
B	With DIN terminal box (G1/2)	●		●	
C	With DIN terminal box (Pg9, Pg11)	●		●	
E	Conduit (G1/2)	●		●	
F	Conduit (CTC19)	●		●	
G	With HP terminal box	●		●	
J	Lead wire (300 mm)/with surge suppressor	●*1	Product included	*2	
M	Conduit (G1/2)/with surge suppressor	●			
P	Conduit (CTC19)/with surge suppressor	●			
Q	HP terminal box/with surge suppressor	●			
K	DIN terminal box/with surge suppressor	●			
D	DIN terminal box with lamp (Pg11)	*3		●	
H	HP terminal box with lamp	●		●	
L	DIN terminal box with lamp/surge suppressor	●			
R	HP terminal box with lamp/surge suppressor	●			

Note 1: The surge suppressor for DC voltage type is included with the product.
Note 2: All AC voltage types are equipped with a full-wave rectifier circuit.
Due to the effect of the diodes, there are virtually no significant surges generated in the coil. For this reason, the surge suppressor is not available.
Note 3: For DC voltage types, coil option "D" is not available. Select instead coil option "L" (DIN terminal box with lamp/surge suppressor).

2.6.1. How to wire the DIN terminal box (Pg9)

For products which have a DIN terminal box, if the valve size is “2” and the coil option code is "C", "D", "K", or "L", refer to this section for wiring.
Use the cabtyre cord described in the following table.

Cord outer diameter	Nominal cross-sectional area
4.5 mm to 7 mm	0.75 mm^2



Wire with steps ❶ to ❼.

1. Strip the lead wire sheath.

Strip the sheath of the lead wires of the cabtyre cord.

- Use an appropriate tool to strip the lead wire sheath so as not to damage the copper wire.

2. Pull in the cabtyre cord.

Insert the cabtyre cord into the cap, washer, gasket, and case.

3. Attach the crimp terminal.

Insert the crimp terminals for copper wires into the lead wires of the cabtyre cord and crimp the terminals.
(Terminal screw size: M3)

- To attach the crimp terminals, use a tool specifically for this purpose.

4. Secure the crimp terminals and ground wire.

Insert the crimp terminals of the lead wires under the terminal screws on the terminal block and tighten the screws with a tightening torque of 0.45 N·m to 0.55 N·m.
Connect the ground wire to the grounding terminal on the terminal block.

5. Insert the gasket and the terminal block into the coil assembly.

6. Attach the case.

Put the case on the terminal block and secure the screw with a tightening torque of 0.45 N·m to 0.55 N·m.
To change the outlet direction of the cord, take the terminal block out of the case, turn it by 180°, and put it into the case.

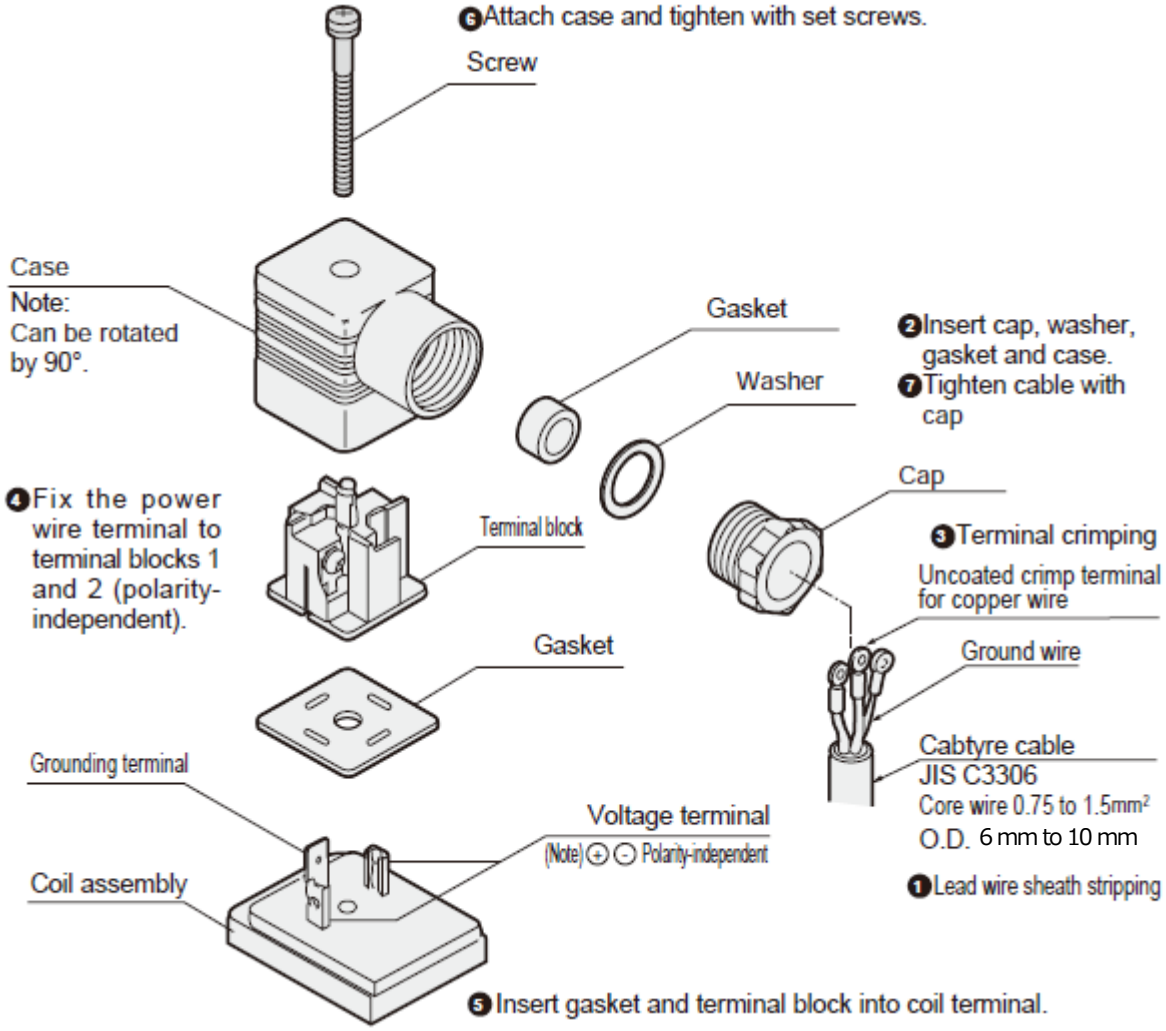
7. Secure the cabtyre cord.

Tighten the cap and secure the cabtyre cord.

2.6.2. How to wire the DIN terminal box (Pg11, G1/2)

For products which have a DIN terminal box, if the coil option code is "B", or if the valve size is other than "2" and the coil option code is "C", "D", "K", or "L", refer to this section for wiring.
Use the cabtyre cord described in the following table.

Cord outer diameter	Nominal cross-sectional area
6 mm to 10 mm	0.75 mm^2 to 1.5 mm^2



Wire with steps ❶ to ❼.

1. Strip the lead wire sheath.

Strip the sheath of the lead wires of the cabtyre cord.

- Use an appropriate tool to strip the lead wire sheath so as not to damage the copper wire.

2. Pull in the cabtyre cord.

Insert the cabtyre cord into the cap, washer, gasket, and case.

3. Attach the crimp terminal.

Insert the crimp terminals for copper wires into the lead wires of the cabtyre cord and crimp the terminals.
(Terminal screw size: M3)

- To attach the crimp terminals, use a tool specifically for this purpose.

4. Secure the crimp terminals and ground wire.

Insert the crimp terminals of the lead wires under the terminal screws on the terminal block and tighten the screws with a tightening torque of 0.45 N·m to 0.55 N·m.
Connect the ground wire to the grounding terminal on the terminal block.

5. Insert the gasket and the terminal block into the coil assembly.

6. Attach the case.

Put the case on the terminal block and secure the screw with a tightening torque of 0.45 N·m to 0.55 N·m.
To change the outlet direction of the cord, take the terminal block out of the case, turn it by 90°, and put it into the case.

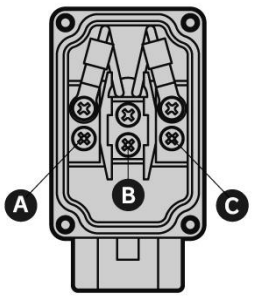
7. Secure the cabtyre cord.

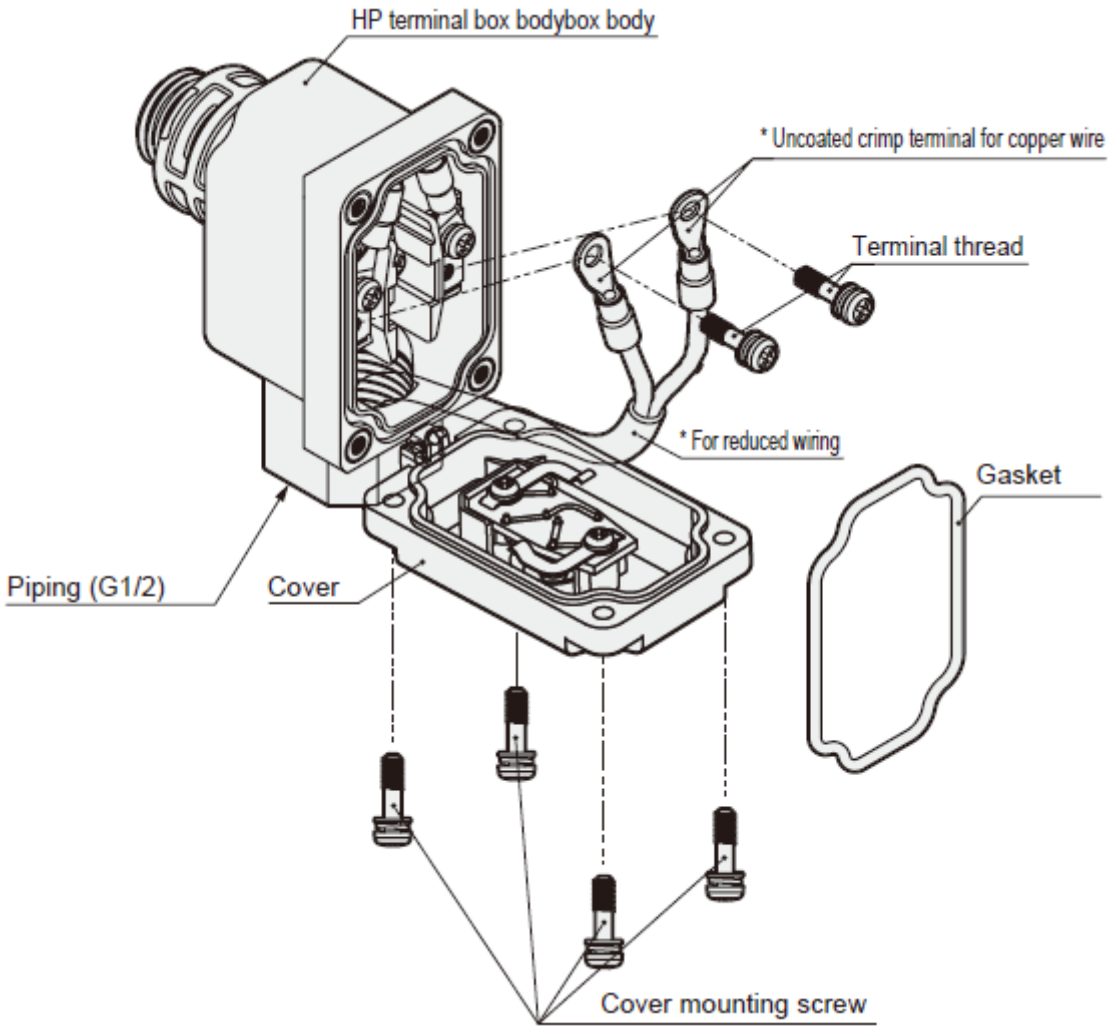
Tighten the cap and secure the cabtyre cord.

2.6.3. How to wire the HP-type terminal box

For products which have an HP-type terminal box, if the coil option code is "G", "H", "Q", or "R", refer to this section for wiring.

- Use a cabtyre cord with a nominal cross-sectional area of 0.5 mm^2.
- The product may or may not have (+)/(-) polarity depending on the coil option. Refer to the following table for wiring.

Type	Coil option code	Voltage	Polarity	Layout drawing (For 2 lead wires)
Without lamp	"G", "P"	DC/AC	There is no polarity. Wire the leads to terminals A and C.	
With lamp	"Q"	AC		
	"Q", "R"	DC	The lamp has polarity. Wire the (-) pole to terminal A and the (+) pole to terminal C.	



* Parts indicated with an asterisk (*) are not included with the product.

1. Strip the lead wire sheath.

Strip the sheath of the lead wires of the cabtyre cord.

- Use an appropriate tool to strip the lead wire sheath so as not to damage the copper wire.

2. Pull in the cabtyre cord.

Pass the cabtyre cord through the terminal box body.

3. Attach the crimp terminal.

Insert the crimp terminals for copper wires into the lead wires of the cabtyre cord and crimp the terminals.
(Terminal screw size: M3)

- To attach the crimp terminals, use a tool specifically for this purpose.

4. Secure the crimp terminals.

Insert the crimp terminals of the lead wires under the terminal screws on the terminal block and tighten the screws with a tightening torque of 0.45 N·m to 0.55 N·m.

5. Attach the cover.

Attach the cover to the terminal box and secure the screws with a tightening torque of 0.45 N·m to 0.55 N·m.

3. USAGE

WARNING

Do not use the product as a valve for ensuring safety such as an emergency shut-off valve.

- The product is not designed to be used as a valve for ensuring safety such as an emergency shut-off valve. If using the product for such a system, take appropriate measures in advance to secure safety.

Do not use fluids other than those specified in the Specifications.

- Check the compatibility with the working fluid by referring to the “Working fluid check list” in the catalog.
- Take appropriate measures specific to the fluid, such as installing a filter in the fluid circuit to remove contaminants.
  If the quality of the working fluid is poor, for example, if it contains fine particles, sludge, or foreign matters, it can lead to an operation fault or fluid leakage. In addition, abrasion of the internal parts of the solenoid valve may cause abrasion powder to enter the fluid.
- If the fluid is liquid, install a relief valve in the circuit to prevent blockage of the liquid. If the liquid is blocked, temperature changes may cause the pressure to rise and the solenoid valve to fail to operate.
- If the FFB-☐2 Series (NO type) is used by pumping a fluid such as highly viscous oil, the valve opening/closing operation may be delayed depending on the piping conditions.

Do not touch the coil and the actuator while the product is energized.

- There is a risk of burns.

Do not touch the electrical wiring connections (such as crimp terminals and terminal screws) while the product is energized.

- There is a risk of electric shock.

Take necessary measures in advance so that people and objects will not be adversely affected in the event of a failure of the product.

CAUTION

Use the fluid temperature, ambient temperature, working pressure, and fluid viscosity within the specified range.

- If the body is brass and water or warm water is used, an operation fault or internal leakage may occur due to dezincification and erosion/corrosion phenomenon. For use with water or warm water, stainless steel body is recommended.
- The viscosity of the fluid should be 50 mm^2/s or less.
- If the seal material is EPDM, using tap water for a long period may cause deterioration due to residual chlorine.

Be careful not to clog the strainer and filter.

3.1. Checks to Make Before Use (Checks Made After Mounting)

WARNING

Make sure to turn off the power and remove the fluid and the pressure in the piping before performing checks.

- Failure to do so may result in electric shock or injury.
  If it is necessary to perform checks while the product is energized and in an operating condition, be careful not to get an electric shock or injured by the fluid or residual pressure.

■ Appearance check

Check the following:

- Check that the valve is securely fixed to the piping by pressing it by hand.
- Check that the threaded parts such as bolts, nuts, and screws are not loose.
- Check that the piping and wiring are installed correctly.

■ Leakage check

Pressurize the fluid to check for leakage from the piping connection.

- It is recommended to check for leakage by supplying compressed air (0.3 MPa to 0.5 MPa) and applying soapy water to see if bubbles form.

■ Electricity check

Check the power supply voltage.

- Keep the voltage fluctuations within ±10% of the rated voltage range.
  Using the product beyond the voltage fluctuation range may cause an operation fault or damage to the coil.

Check the insulation resistance.

- Measure the insulation resistance between a non-live metal part mounted to the solenoid valve and a bare live part such as a lead wire. Check that the insulation resistance is 100 MΩ or more with 500 VDC megger.

■ Operation check

Apply the rated voltage and pressurize the working fluid to check if the solenoid valve performs opening and closing movement properly.

3.2. Safety Instructions

CAUTION

Do not stand or put a heavy object on the solenoid valve.
- It may cause injury, accident, or damage to the solenoid valve.

Do not hold the solenoid valve when carrying the product.
- It may cause the product to fall, cause an accident, or damage the solenoid valve.

Do not carry the solenoid valve by holding the lead wires and cables connected to the terminal box.
- It may cause disconnection or failure.

Completely remove any water in the circuit if the fluid is water and the product will not be used for one month or more.
- Residual water causes rust, and it can lead to an operation fault or fluid leakage. If water in the circuit cannot be completely removed, operate the solenoid valve several times a day to allow water to flow.

When storing the product, keep it packaged in the individual package box.
- Storing valves out of their individual package box can cause foreign matters to enter the valve.

- If the product has not been used for one month or more, the sealing rubber may stick to the body sealing part, resulting in a delay in the initial response time. Perform a trial run before starting operation.
- When an abnormality is found, refer to "5 TROUBLESHOOTING".
- Contact CKD before operating the product continuously for one month or more, or operating the product infrequently (such as once a month). It is a commonly accepted concept that solenoid valves are operated several times a day, and periodic inspections (at least once a month) are recommended by safety standards for equipment such as gas industrial furnaces. Even when using the product with continuous energization, it is recommended to perform periodic inspection at least once a month.
- If it is necessary to prevent the generation of rust, it is recommend to use products in which metal does not come in contact with liquids.

4. MAINTENANCE AND INSPECTION

WARNING

Make sure to turn off the power and remove the fluid and the pressure in the piping before performing maintenance.
• Failure to do so may result in electric shock or injury.

4.1. Maintenance Parts

Maintenance Parts	General rule for when to make replacements
Actuator assembly kit	Replace it when an abnormality such as leakage or operation fault is found while using the product. Replace all parts included in the set at the same time.

4.2. Periodic Inspection

In order to use the product under optimum conditions, perform periodic inspections every six months.
For the inspection details, refer to "3.1 Checks to Make Before Use (Checks Made After Mounting)" in this Instruction Manual.

4.3. Disassembling and Assembling

WARNING

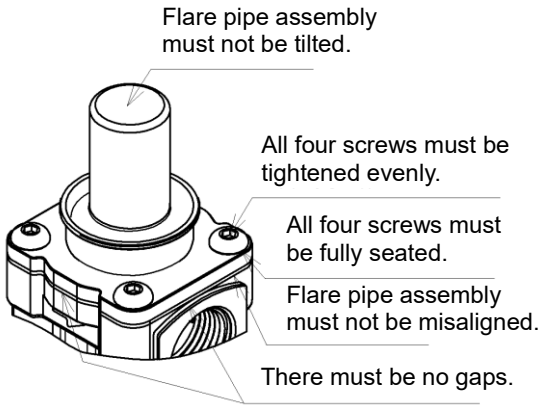
Turn off the power before disassembling and assembling.
- Working with the power turned on may cause an electric shock.

Close the main cock and discharge fluid in the valve before disassembling.
When disassembling the product, be careful of the springs as they may pop out.
- Failure to do so may result in injury. See "Exploded view" for the location of the springs.

CAUTION

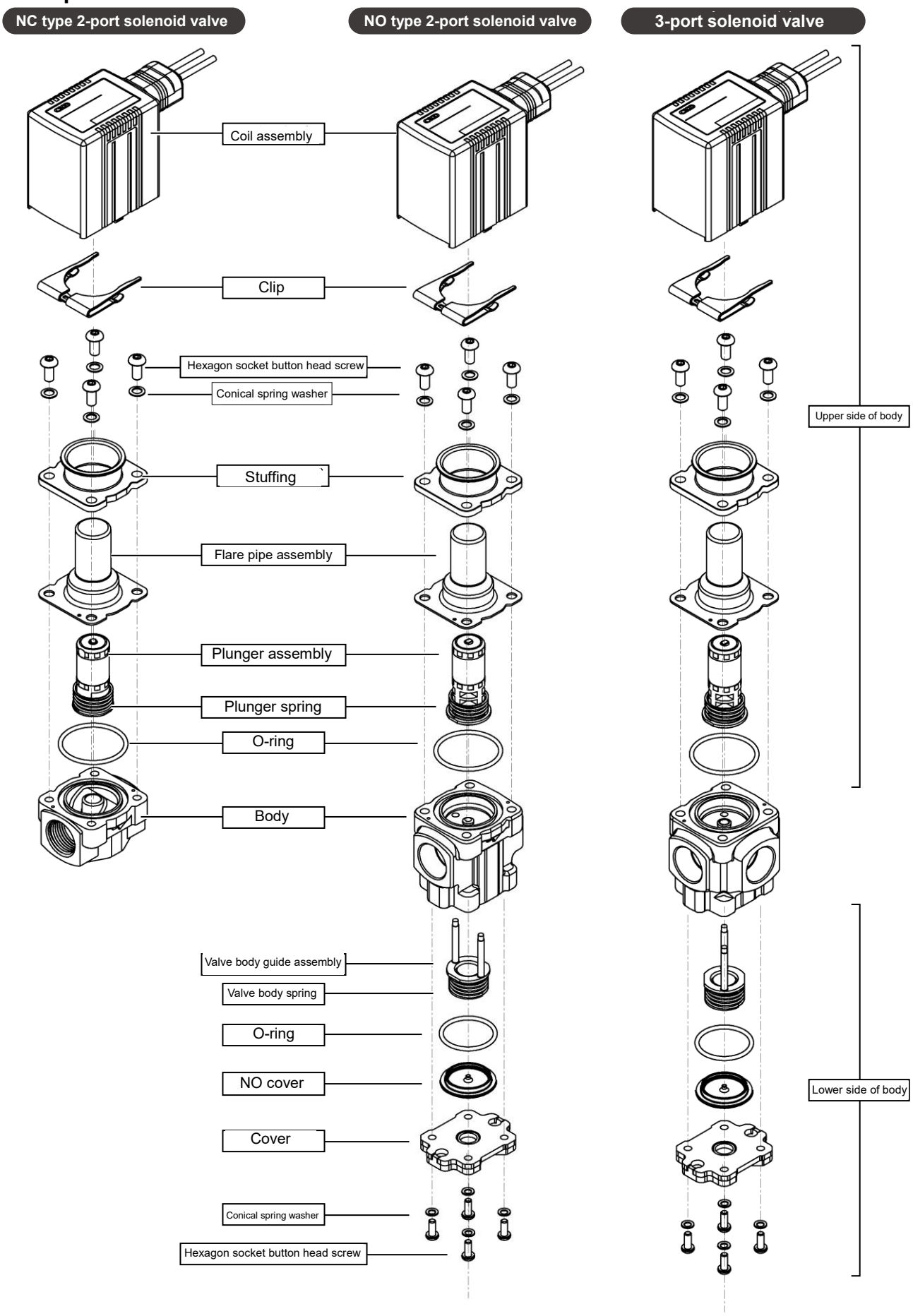
When replacing the plunger assembly, replace the flare pipe assembly at the same time.

When assembling, make sure that the flare pipe assembly is neither misaligned nor tilted and tighten the hexagon socket button head screws evenly and securely.
- Otherwise, it will cause damage to the flare pipe assembly and the hexagon socket button head screws.



- Faults caused by disassembly or replacement of the product or parts are not covered by the warranty.
- There is a specific orientation for assembling the body, flare pipe assembly, stuffing, and clip. Assemble them in the correct orientation.
- After assembling, perform a trial run to check that there is no abnormality such as leakage or operation fault.

<Exploded view>



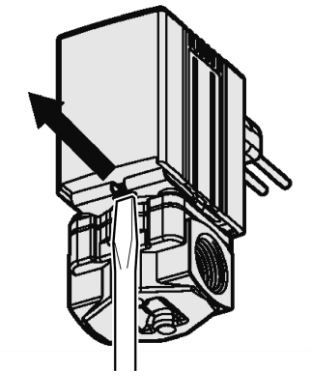
4.3.1. NC type 2-port solenoid valve

Disassemble and assemble the NC type 2-port solenoid valve (FFB-☐1, FFBM) according to this section.
See also "Exploded view" for illustrations.

■ Disassembling

1. Remove the clip.

Insert a flat blade screwdriver into the position shown in the figure below and move it in the direction of the arrow to remove the clip.
Depending on the orientation of the coil, rotate the coil assembly to a position where the flat blade screwdriver can be inserted.



2. Remove the coil assembly.

3. (For FFBM only) Remove the actuator kit from the subplate.

Remove the actuator kit from the subplate.
If the body is brass or stainless steel, remove the four cross recessed pan head screws; if the body is aluminum, remove the two hexagon socket button head screws.

4. Disassemble the upper side of the body.

While being careful not to drop or lose any parts, remove the four hexagon socket button head screws on the upper side of the body and disassemble the upper side of the body.

5. Clean each part.

Remove dirt and foreign matter from each part.

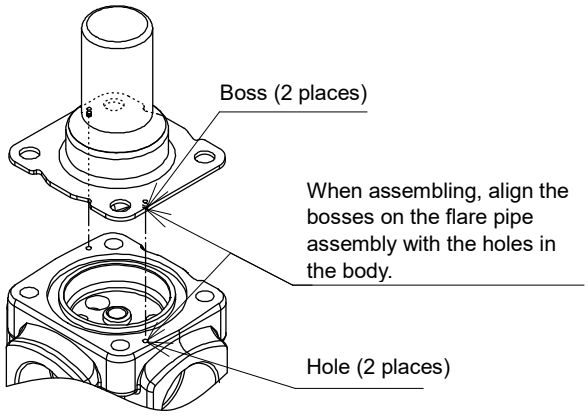
- When cleaning parts, use a neutral detergent or other cleaning solution that has minimal impact on the environment. Do not use organic solvents as they may cause swelling or deterioration of rubber parts and resin parts.
- Replace the rubber parts if they are noticeably dirty or deteriorated.

■ Assembling

1. Apply ethyl alcohol to the O-ring.

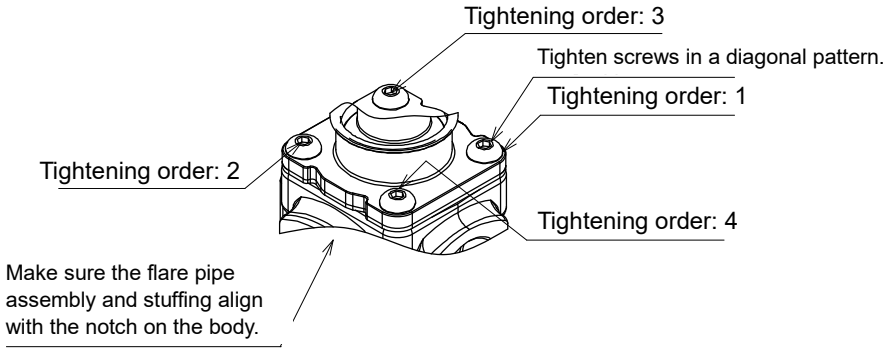
2. Assemble in the reverse order of disassembling.

To avoid forgetting to assemble parts, assemble the parts from the body to the stuffing in the reverse order of disassembling.
Install the O-ring securely in alignment with the groove on the body.
Align the bosses on the flare pipe assembly with the holes in the body.
Align the stuffing and flare pipe assembly with the notch on the body.



3. Tighten the four hexagon socket button head screws in part way.

While holding down the stuffing, put the four hexagon socket button head screws in place and temporarily tighten them little by little in a diagonal pattern.



4. Tighten the four hexagon socket button head screws in full.

Tighten the four hexagon socket button head screws little by little in a diagonal pattern with the tightening torque shown in the following table.

<Recommended tightening torque>

Screw/bolt size	Recommended tightening torque (N·m)
FFB-2/FFB-3: M3	0.59 to 0.71
FFB-4/FFB-5: M4	1.37 to 1.67

5. (For FFBM only) Mount the actuator kit to the subplate.

To avoid forgetting to assemble parts, mount the parts in the reverse order of disassembling.
Check that there are no foreign matters on the O-ring or gasket.
Install the O-ring or gasket securely in alignment with the groove on the actuator kit.
The mounting position of the actuator kit depends on whether the manifold is a common supply type or an individual supply type. Be careful of the orientation and mount the actuator kit to the subplate.
Tighten the mounting screws with the tightening torque shown in the following table.

<Aluminum body: Recommended tightening torque for hexagon socket button head screw>

Screw/bolt size	Recommended tightening torque (N·m)
FFB-2/FFB-3: M3	0.59 to 0.71
FFB-4/FFB-5: M4	1.37 to 1.67

<Brass body, stainless steel body: Recommended tightening torque for pan head screw>

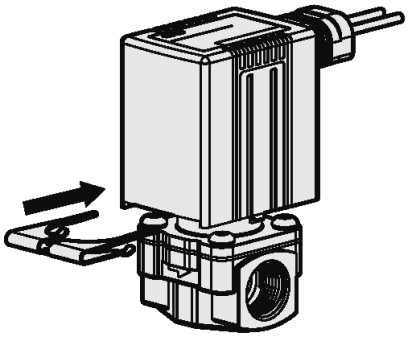
Screw/bolt size	Recommended tightening torque (N·m)
FFBM-2: M3	0.56 to 0.68
FFBM-3/FFBM-4/FFBM-5: M4	1.28 to 1.57

6. Mount the coil assembly.

For FFB-2, be careful of the orientation between the coil assembly and stuffing.

7. Insert the clip.

Be careful of the orientation of the clip and insert it from the direction of the arrow shown in the figure below.

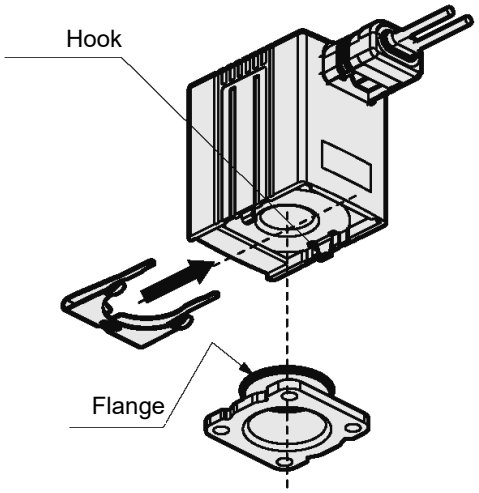


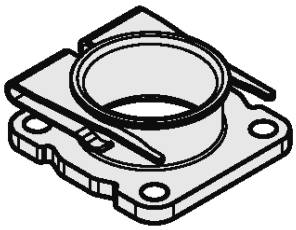
8. Check the coil assembly.

Check the following points to make sure that the coil assembly is assembled correctly.

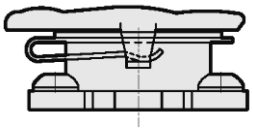
The upper part of the clip is in contact with the flange.

The bottom of the clip rests on the hook.





Clip is in contact with the flange.



Clip rests on the hook.

4.3.2. NO type 2-port solenoid valve/3-port solenoid valve

Disassemble and assemble the NO type 2-port solenoid valve (FFB-☐2)/3-port solenoid valve (FFG-☐1, FFG-☐3, FFGM) according to this section.
See also "Exploded view" for illustrations.

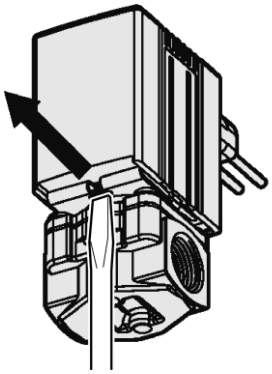
■ Disassembling

1. (For FFGM only) Remove the actuator kit from the subplate.

Remove the two hexagon socket head bolts and remove the actuator kit from the subplate.

2. Remove the clip.

Insert a flat blade screwdriver into the position shown in the figure below and move it in the direction of the arrow to remove the clip.
Depending on the orientation of the coil, rotate the coil assembly to a position where the flat blade screwdriver can be inserted.



3. Remove the coil assembly.

4. Disassemble the upper side of the body.

While being careful not to drop or lose any parts, remove the four hexagon socket button head screws on the upper side of the body and disassemble the upper side of the body.

5. Disassemble the lower side of the body.

While being careful not to drop or lose any parts, remove the hexagon socket button head screws on the lower side of the body and disassemble the lower side of the body.

6. Clean each part.

Remove dirt and foreign matter from each part.

- When cleaning parts, use a neutral detergent or other cleaning solution that has minimal impact on the environment. Do not use organic solvents as they may cause swelling or deterioration of rubber parts and resin parts.
- Replace the rubber parts if they are noticeably dirty or deteriorated.

■ Assembling

1. Apply ethyl alcohol to the O-ring.

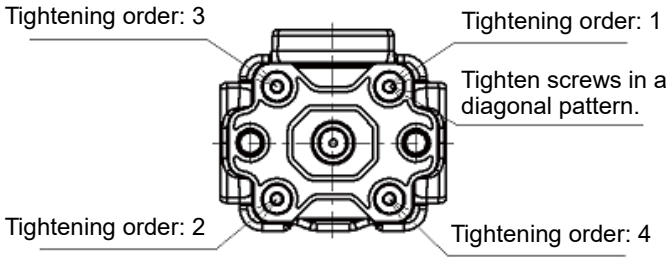
2. Assemble the lower side of the body in the reverse order of disassembling.

To avoid forgetting to assemble parts, assemble the parts from the body to the cover in the reverse order of disassembling.
Install the O-ring securely in alignment with the groove on the body.
Align the cover with the notch on the body.

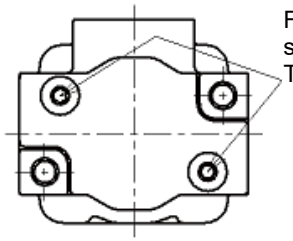
3. Tighten the hexagon socket button head screws on the lower side of the body in part way.

While holding down the cover, place the hexagon socket button head screws in place and temporarily tighten them little by little in a diagonal pattern.
At this point, check that the valve operates smoothly by pushing the valve stem on the valve body guide assembly from the upper surface of the body.

<Brass body, stainless steel body>



<Aluminum body>



For the aluminum body, two screws are used for mounting. Tighten screws evenly.

4. Tighten the hexagon socket button head screws on the lower side of the body in full.

Tighten the hexagon socket button head screws little by little in a diagonal pattern with the tightening torque shown in the table below.

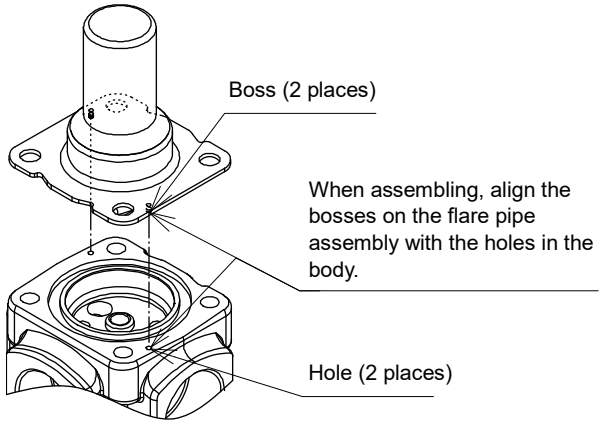
<Recommended tightening torque>

Screw/bolt size	Recommended tightening torque (N·m)
FFB-2/FFB-3/FFG-2/FFG-3: M3 (*)	0.59 to 0.71
FFB-4/FFB-5/FFG-4/FFG-5: M4	1.37 to 1.67

* For FFG-2/FFG-3, some models use M4 screws for mounting the cover. Tighten them with the tightening torque for M4.

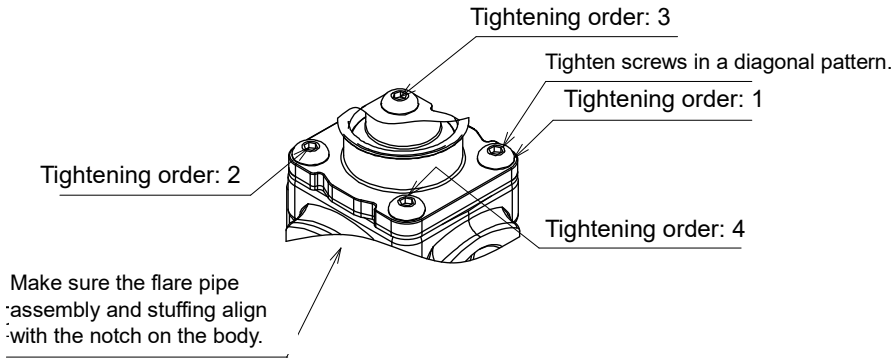
5. Assemble the upper side of the body in the reverse order of disassembling.

To avoid forgetting to assemble parts, assemble the parts from the body to the stuffing in the reverse order of disassembling.
Install the O-ring securely in alignment with the groove on the body.
Align the bosses on the flare pipe assembly with the holes in the body.
Align the stuffing and flare pipe assembly with the notch on the body.



6. Tighten the four hexagon socket button head screws on the upper side of the body in part way.

While holding down the stuffing, put the four hexagon socket button head screws in place and temporarily tighten them little by little in a diagonal pattern.



7. Tighten the four hexagon socket button head screws on the upper side of the body in full.

Tighten the four hexagon socket button head screws little by little in a diagonal pattern with the tightening torque shown in the following table.

<Recommended tightening torque>

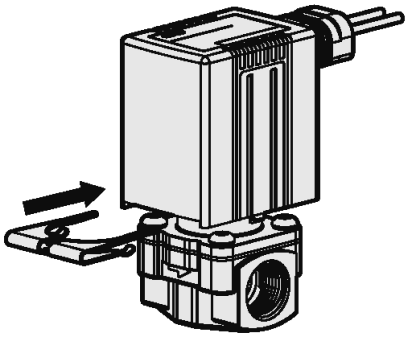
Screw/bolt size	Recommended tightening torque (N·m)
FFB-2/FFB-3/FFG-2/FFG-3: M3	0.59 to 0.71
FFB-4/FFB-5/FFG-4/FFG-5: M4	1.37 to 1.67

8. Mount the coil assembly.

For FFG-2, be careful of the orientation between the coil assembly and stuffing.

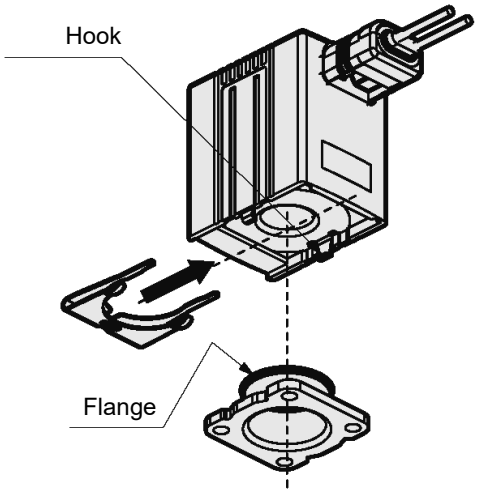
9. Insert the clip.

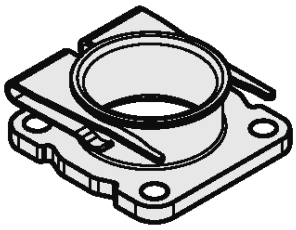
Be careful of the orientation of the clip and insert it from the direction of the arrow shown in the figure below.



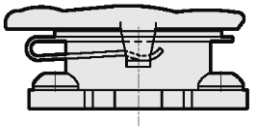
10. Check the coil assembly.

Check the following points to make sure that the coil assembly is assembled correctly.
The upper part of the clip is in contact with the flange.
The bottom of the clip rests on the hook.





Clip is in contact with the flange.



Clip rests on the hook.

11. (For FFGM only) Mount the actuator kit to the subplate.

To avoid forgetting to assemble parts, mount the parts in the reverse order of disassembling.
Check that there is no water, oil, and grease on the mesh gasket and the surface of the subplate.
Place the mesh gasket on the subplate, and align it with the port holes.
Mount the actuator kit to the subplate.
Install the spring washer and flat washer into the two hexagon socket head bolts.
Tighten them twice, alternately from left to right, with the tightening torque shown in the following table.

<Recommended tightening torque for hexagon socket head bolt>

Screw/bolt size	Recommended tightening torque (N·m)
FFGM-3: M4	1.71 to 2.09
FFGM-4/FFGM-5: M5	3.45 to 4.21

4.4. Precautions on Product Disposal

CAUTION

When disposing of the product, comply with local laws and regulations pertaining to disposal and cleaning of wastes and have an industrial waste disposal company dispose of the product.

5. TROUBLESHOOTING

5.1. Problems, Causes, and Solutions

If the product does not operate as intended, check the table below for a possible solution.

- If the problem is not resolved even after conducting inspections and taking corrective actions, contact your nearest CKD sales office or distributor.

■ NC type solenoid valve (FFB-☐1, FFG-☐1, FFG-☐3)

Problem	Cause	Solution
Fluid does not flow.	Valve is not energized.	Check the wiring, fuse, etc., and turn on the power.
	Applied voltage is lower than the voltage fluctuation range.	Check the power and input the rated voltage.
	Fluid pressure is too high.	Adjust it to be within the specified range.
	Foreign matter is clogging the valve.	Disassemble the valve and clean its inside.
	Foreign matter is clogging the filter or strainer.	Clean the filter and strainer.
Fluid does not stop.	Piping of pressurizing port is not correct.	Refer to this Instruction Manual and pipe correctly.
	Power is not turned off.	Check for leakage current and correct the circuit to make sure that the power turns off properly.
	Foreign matter is stuck between the sealing rubber and body sealing part.	Disassemble the valve and clean its inside.
	Foreign matter is stuck in the sliding part of plunger assembly.	Disassemble the valve and clean its inside.
There is external leakage.	There are abrasions and scratches on the O-ring.	Disassemble the valve to replace the packing and the O-ring.
	Hexagon socket button head screw is loose.	Tighten the hexagon socket button head screw.
There is internal leakage.	There are abrasions and scratches on the valve seat.	Replace the product.
	There are abrasions and scratches on the sealing surface of sealing rubber.	Replace the part.
	Foreign matter is stuck between the sealing rubber and body sealing part.	Disassemble the valve and clean its inside.

■ NO type solenoid valve (FFB-□2)

Problem	Cause	Solution
Fluid does not stop.	Valve is not energized.	Check the wiring, fuse, etc., and turn on the power.
	Applied voltage is lower than the voltage fluctuation range.	Check the power and input the rated voltage.
	Piping of pressurizing port is not correct.	Refer to this Instruction Manual and pipe correctly.
	Foreign matter is stuck between the sealing rubber and body sealing part.	Disassemble the valve and clean its inside.
Fluid does not flow.	Power is not turned off.	Check for leakage current and correct the circuit to make sure that the power turns off properly.
	Fluid pressure is too high.	Adjust it to be within the specified range.
	Foreign matter is clogging the valve.	Disassemble the valve and clean its inside.
	Foreign matter is clogging the filter or strainer.	Clean the filter and strainer.
	There are abrasions and scratches on the O-ring.	Disassemble the valve to replace the packing and the O-ring.
There is external leakage.	Hexagon socket button head screw is loose.	Tighten the hexagon socket button head screw.
	There are abrasions and scratches on the valve seat.	Replace the product.
There is internal leakage.	There are abrasions and scratches on the sealing surface of sealing rubber.	Replace the part.
	Foreign matter is stuck between the sealing rubber and body sealing part.	Disassemble the valve and clean its inside.

5.2. Frequently Asked Questions

Question	Answer
What is the color coding of the lead wires?	The colors of the lead wires mean the following: Red/Black: DC in general Blue: 0 VAC to less than 200 VAC Red: 200 V or more
How is the polarity of the product?	Only those that have an HP terminal box with lamp have polarity inside the terminal box.
What is oil-free treatment?	Parts with oil-free treatment are wetted (gas) parts, namely the flare pipe assembly, body, and plunger assembly. Except for rubber materials, they are cleaned prior to assembly. It is suitable when the product is used in a process that is incompatible with oil, or when oil should not be mixed in the fluid.
What sealing material can be used when using ozone gas as the working fluid?	Use FKM (fluoro rubber). However, depending on the concentration of ozone, problems may occur even with FKM (fluoro rubber).
Can the DIN terminal box be rotated?	For size 2, the case can be rotated 180 degrees. For size 3 to 5, the case can be rotated to 90 degrees, 180 degrees, and 270 degrees.
Can the HP terminal box be rotated?	It can be rotated. Remove the terminal screws on the coil side wiring, loosen the lock nut, and then rotate the HP terminal box. After rotating the HP terminal box, tighten the lock nut and rewire. Tightening torque for lock nut: 4.5 N·m to 5.5 N·m Tightening torque for terminal screw: 0.45 N·m to 0.55 N·m
Can the solenoid valve be used as an emergency shut-off valve?	The product is not designed to be used as a valve for ensuring safety such as an emergency shut-off valve. Use the product after taking appropriate measures that ensure safety on the device system side.
Can the FFB-☐2 (closed when energized) type of FFB Series direct acting 2-port valve be used as an emergency release valve?	The product is not designed to be used as a valve for ensuring safety such as an emergency shut-off valve or emergency release valve. Use the product after taking appropriate measures that ensure safety on the device system side.
I purchased a solenoid valve with a voltage of 24 VDC. If I want to change the voltage to 100 VAC, can I just replace the coil?	Replace the coil assembly. When changing from AC voltage to DC voltage, replacing the coil assembly is sufficient.
How should I wire the surge suppressor (varistor) provided with the solenoid valve?	The surge suppressor provided with the solenoid valve should be wired in parallel with the coil wiring.
How do I calculate the current value of the solenoid valve?	Use the following formula to calculate the current value. For AC current: Current value (A) = Apparent power (VA)/Voltage (V) For DC current: Current value (A) = Power consumption (W)/Voltage (V) Apparent power and power consumption are listed in the catalog.

Question	Answer
Is there a problem with using the product pressurized from the opposite direction?	Poppet-type solenoid valves have low pressure resistance against back pressure, which can cause problems such as valve opening. If back pressure is applied, use a ball valve or air operation valve.
What is the meaning of universal type actuation for FFG/FFGM Series direct acting 3-port solenoid valve?	There is no restriction on the direction of fluid flow, and pressure can be applied from the NC port, the NO port, or the COM port.
The coil surface of the solenoid valve has risen to such a temperature that it is too hot to touch. Are there any performance problems?	The coil surface temperature of the solenoid valve may exceed 90°C depending on the energization time. Although there is no particular problem with performance, continuous energization may induce an operation fault or lead to deterioration of resin or rubber parts depending on the operating conditions. Inspect the product periodically.

6. STANDARDS COMPLIANCE

Products that bear the CE marking conform to European standards.
This product is a component to be incorporated into the customer's equipment, and the CE marking affixed to the product itself indicates that CKD has declared conformity to the following directive(s) under our limited conditions. If the customer incorporates this product into a piece of equipment and ships it to or uses it within the European Economic Area as a final product, it is the responsibility of the customer to confirm compliance with the EU Directives.

6.1. EU Directives/European Standards

- EMC Directive: 2014/30/EU
  EN 61000-6-2:2005
- Low Voltage Directive: 2014/35/EU
  DIN VDE 0580:2011

6.2. Precautions for Use in Europe (EU Member States)

WARNING

For CE compliance, use the product under the following conditions.
- DC voltage type product should have measures against lightning surges implemented on the device system side.

CAUTION

If measures against noise are required, install a capacitor with a capacitance of 0.47 µF or more in parallel.
- AC voltage type product is equipped with a full-wave rectifier circuit and generates noise.

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 provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge. However, following failures are excluded from this warranty:

- 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.
- Failure caused by use of the product exceeding its durability (cycles, distance, time, etc.) or caused by consumable parts.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- 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.

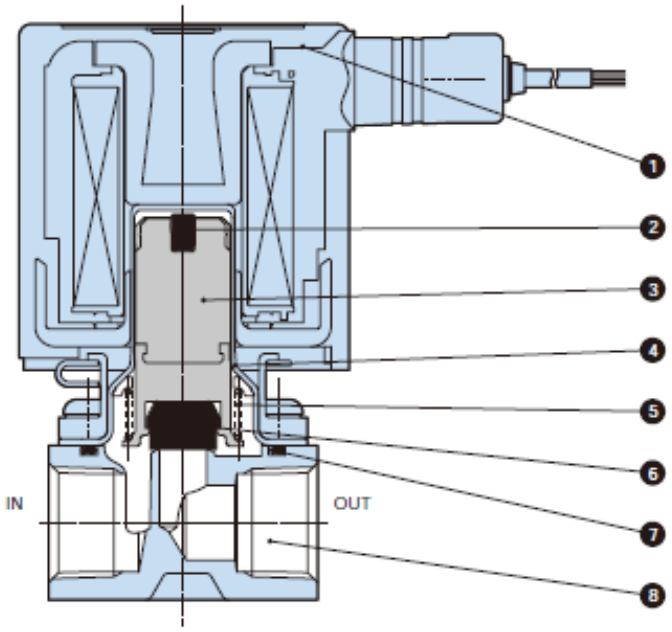
7.2. Warranty Period

The product specified herein is warranted for one (1) year from the date of delivery to the location specified by the customer.

8. REFERENCE INFORMATION

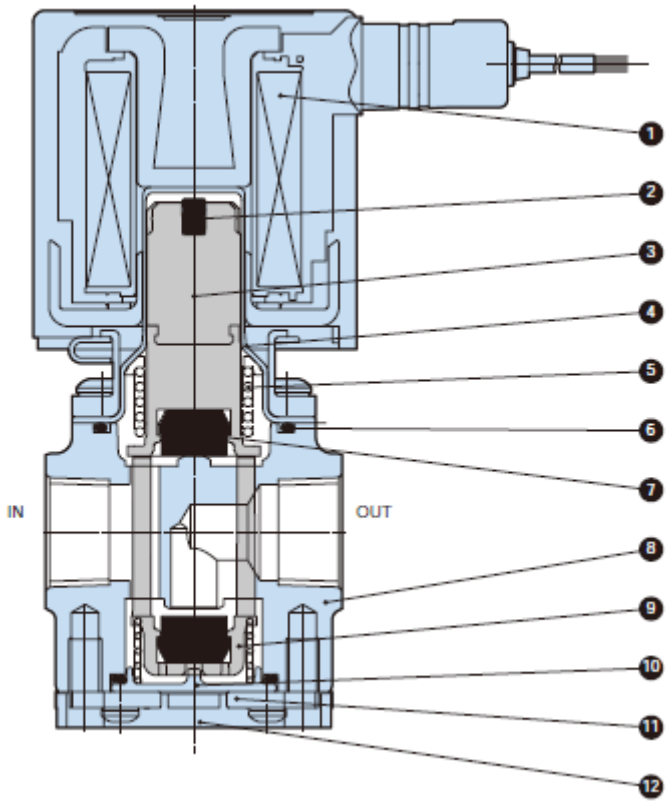
8.1. Internal Structure

8.1.1. FFB-□1 Series (NC type 2-port solenoid valve)



Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR(FKM,EPDM)	Hydrogenated nitrile rubber (fluoro rubber, ethylene propylene rubber)
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	Seal	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
7	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
8	Body	Copper alloy (ADC, SCS13)	Copper alloy (aluminum die-casting, stainless steel)

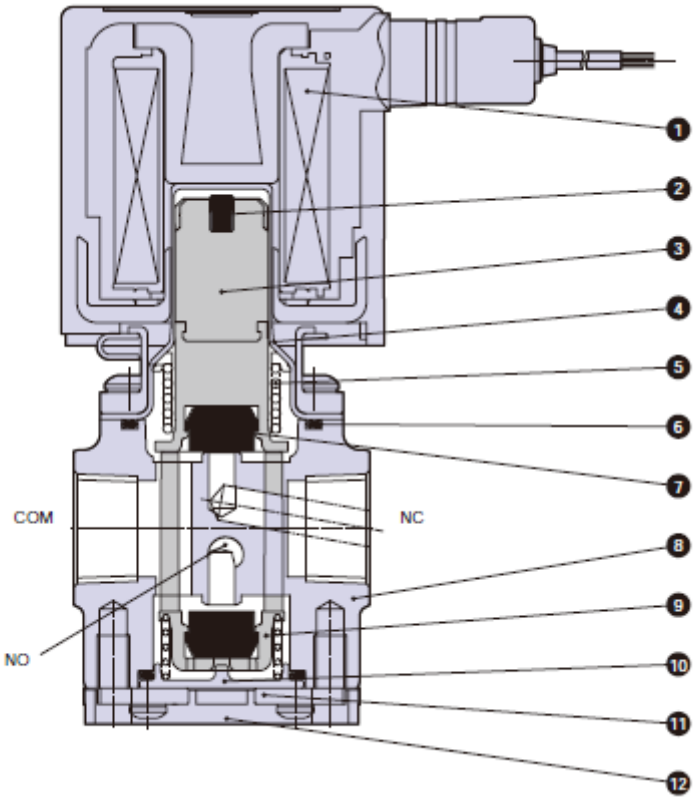
8.1.2. FFB-□2 Series (NO type 2-port solenoid valve)



Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR(FKM,EPDM)	Hydrogenated nitrile rubber (fluoro rubber, ethylene propylene rubber)
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
7	Seal	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
8	Body	Copper alloy (ADC, SCS13)	Copper alloy (aluminum die-casting, stainless steel)
9	Valving element guide	PPS	Polyphenylene sulfide
10	NO cover	PPS	Polyphenylene sulfide
11	Covers A, B *1	SUS304	Stainless steel
12	Cover A lid *2	POM	Polyacetal

*1: Copper alloy body, stainless steel cover A, aluminum cover B
*2: Only for copper alloy and stainless steel body

8.1.3. FFG Series (3-port solenoid valve)



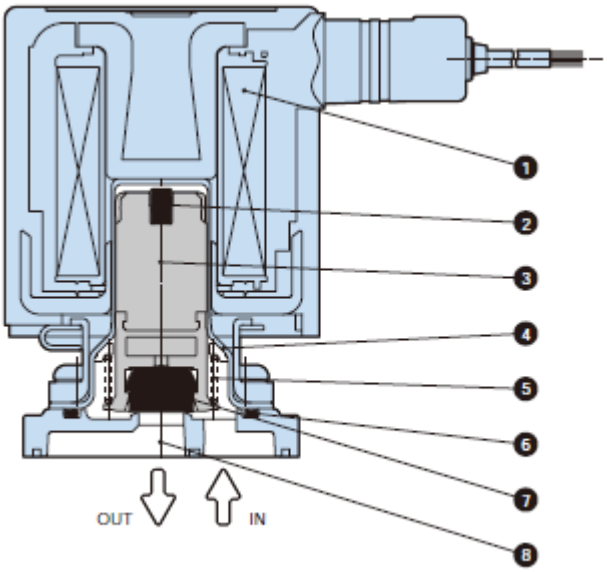
Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR(FKM,EPDM)	Hydrogenated nitrile rubber (fluoro rubber, ethylene propylene rubber)
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
7	Seal	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
8	Body	Copper alloy (ADC, SCS13)	Copper alloy (aluminum die-casting, stainless steel)
9	Valving element guide	PPS	Polyphenylene sulfide
10	NO cover	PPS	Polyphenylene sulfide
11	Covers A, B *1	SUS304	Stainless steel
12	Cover cover *2	POM	Polyacetal

*1: Copper alloy body, stainless steel cover A, aluminum cover B
*2: Only for copper alloy and stainless steel body

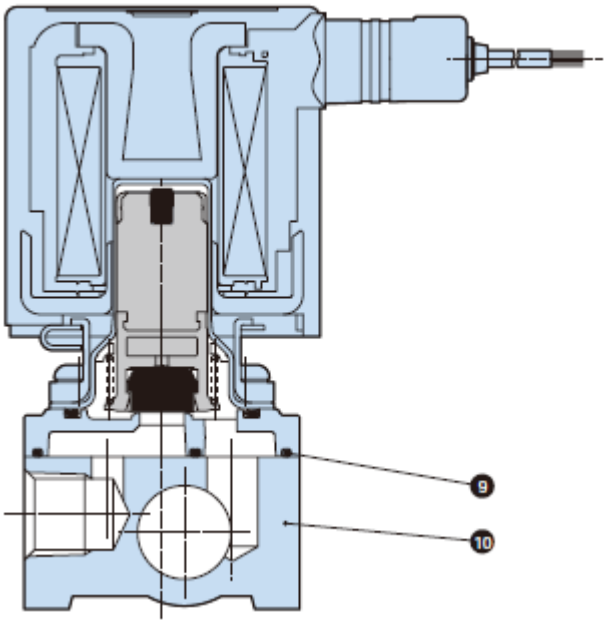
8.1.4. FFBM Series (2-port solenoid valve, manifold)

<Aluminum body>

●FFBM actuator



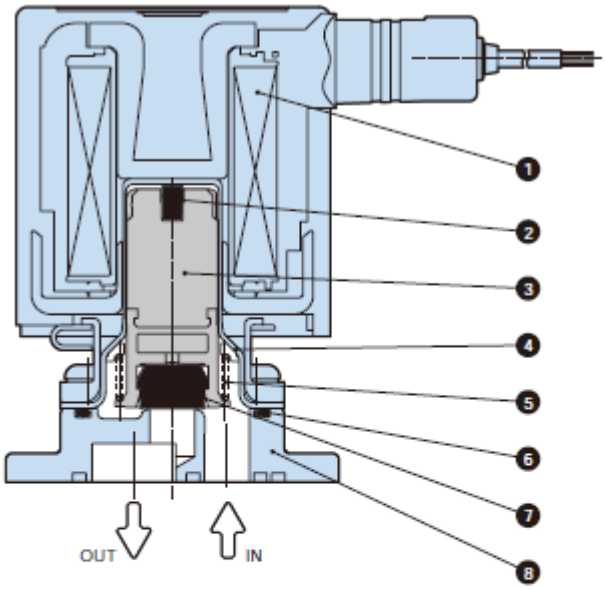
●FFBM manifold



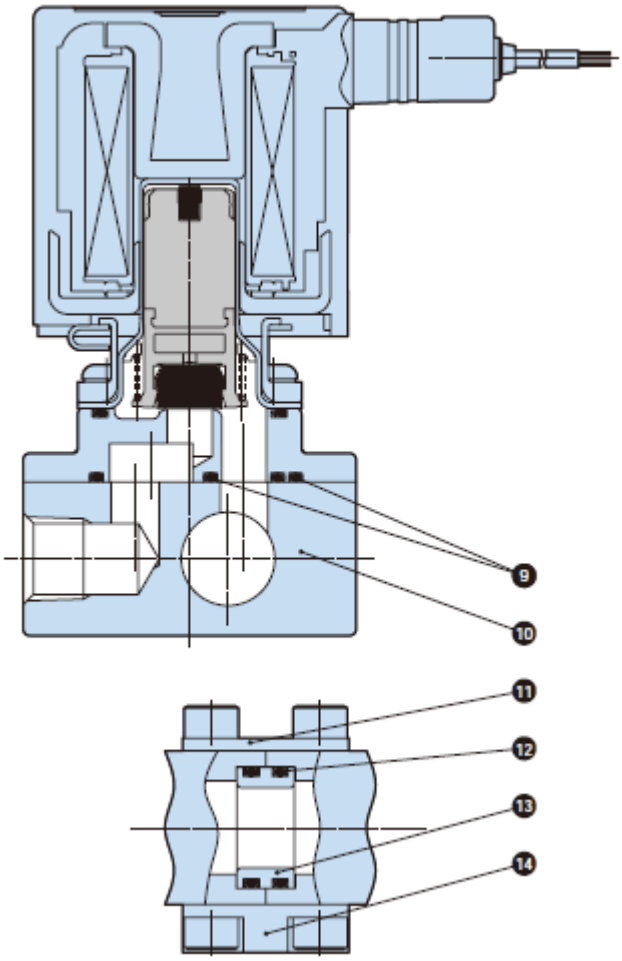
Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR	Hydrogenated nitrile rubber
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	O-ring	NBR	Nitrile rubber
7	Seal	NBR	Nitrile rubber
8	Body	ADC	Aluminum die-casting
9	Gasket	NBR	Nitrile rubber
10	Sub-plate	A6063	Aluminum

<Brass body, stainless steel body>

●FFBM actuator



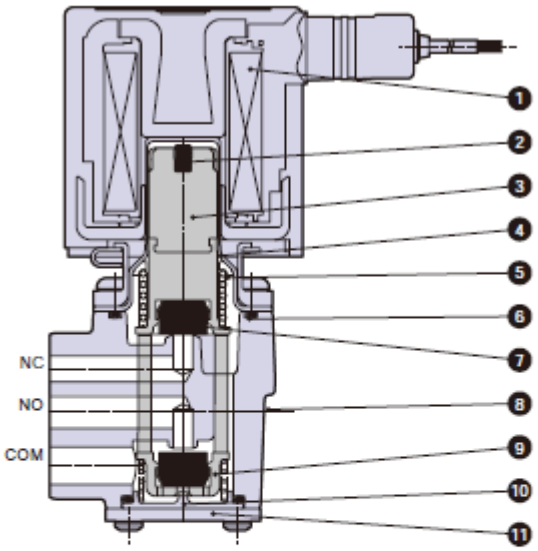
●FFBM manifold



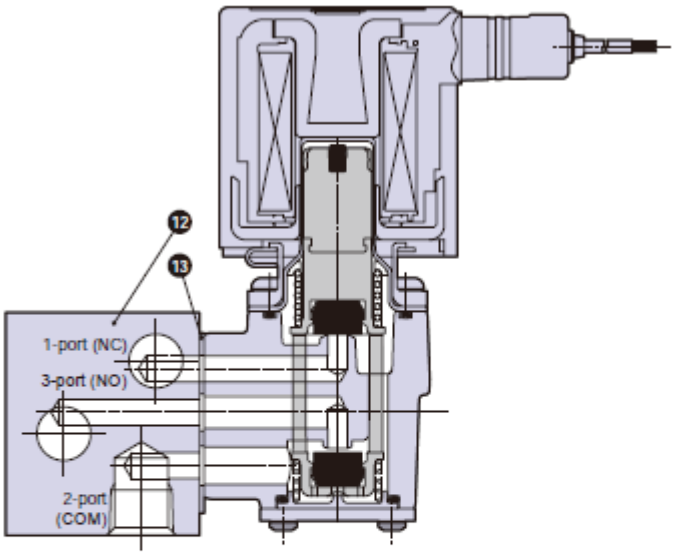
Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR(FKM,EPDM)	Hydrogenated nitrile rubber (fluoro rubber, ethylene propylene rubber)
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
7	Seal	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
8	Body	Copper alloy (SCS13)	Copper alloy (stainless steel)
9	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
10	Sub-plate	C3604(SUS304)	Copper alloy (stainless steel) * same material as body
11	Connecting plate	SPCC	Steel
12	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
13	Connector	C3604(SUS)	Copper alloy (stainless steel)
14	Connecting plate (bottom)	SS400	Steel

8.1.5. FFGM Series (3-port solenoid valve, manifold)

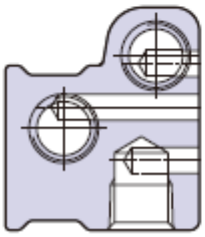
●FFGM actuator



●FFGM manifold



Body material: Copper alloy/SUS



Body material: Aluminum

Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR(FKM,EPDM)	Hydrogenated nitrile rubber (fluoro rubber, ethylene propylene rubber)
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
7	Seal	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
8	Body	Copper alloy (aluminum, SCS13)	Copper alloy (aluminum, stainless steel)
9	Valving element guide	PPS	Polyphenylene sulfide
10	NO cover	PPS	Polyphenylene sulfide
11	Cover M	SUS304	Stainless steel
12	Sub-plate	SUS304 (aluminum)	Stainless steel (aluminum) *1
13	Gasket	NBR (FKM)	Nitrile rubber (fluoro rubber)

*1: For copper alloy body, the sub-plate material is stainless steel.