

INSTRUCTION MANUAL

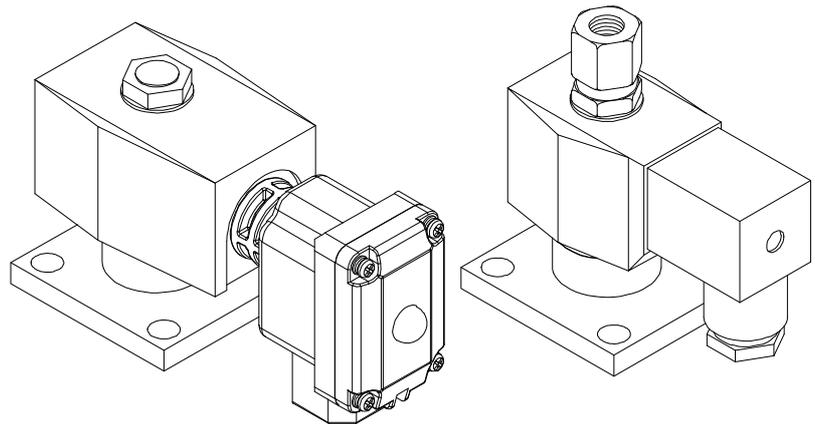
MULTILEX VALVE

GAB3 Series

GAB4 Series

GAG3 Series

GAG4 Series



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

Safety precautions

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

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

It is important to select, use, handle, and maintain the product appropriately to ensure that the CKD product is used safely.

Observe warnings and precautions to ensure device safety.

Check that device safety is ensured, and manufacture a safe device.

WARNING

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

2. Use this product within its specifications.

This product cannot be used beyond its specifications. Additionally, the product must not be modified or machined.

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

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

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

ISO4414, JIS B 8370 (pneumatic system rules)

JFPS2008 (principles for pneumatic cylinder selection and use)

Including High Pressure Gas Maintenance Law, Occupational Safety and Sanitation Laws, other safety rules, standards and regulations, etc.

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

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

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

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

**DANGER**

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

**WARNING**

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

**CAUTION**

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

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

Precautions with regard to guarantee

- **Guarantee period**

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

- **Guarantee coverage**

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

However, the guarantee excludes following cases:

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

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

- **Confirmation of product compatibility**

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

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1. Unpacking



CAUTION

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

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

2. Installation



WARNING

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

2. 1 Conditions for installation



WARNING

- a) Do not splash liquid such as water or lubrication oil. Otherwise, liquid splashed on the coil causes the coil to burn. The protection grade of IP61 to IP65 is equivalent depending on the coil option. However, we do not guarantee protection against continuous pouring of water. Protective measure shall be taken such as covering, or valve installation inside a panel. Protective measure shall be taken against welding spatter.
- b) The coil generates heat.
 - If the product is to be installed inside a control panel, or if energizing time is long, provide ventilation measures. Temperature around the product will be high.
- c) The product can not be used in a corrosive or solvent environment.
- d) Avoid humid environments, since condensation may occur with change in temperature.
- e) The product cannot be used in an explosive gas atmosphere. In such atmosphere, use our explosion-proof valve.
- f) Use the product away from radiant heat.

- (1) Provide appropriate measures to prevent the product from freezing at cold places.
- (2) The product cannot be used outdoors. Protective measure shall be taken such as covering, or valve installation inside a panel.
- (3) Do not wash the product with water or solvents. Do not paint the product. Resin material used in the product may break down.
- (4) Do not use the product under vibration or inertia. For normally open valves (model: GAB42), the plunger within will vibrate and may result in beat sounds or malfunction.

2. 2 Installation method

 CAUTION	<p>a) Read this instruction manual thoroughly and understand the contents before installing the product.</p> <p>b) Always take hold of the body portion when handling and mounting the product.</p> <p>c) Confirm leakage from the piping after installation.</p>
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(1) Mounting posture is unrestricted.

However, avoid positioning the coil side down, since foreign matter in the fluid accumulates around the plunger and result in beat sounds and malfunction.

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

2. 3 Piping method

 CAUTION	<p>a) When piping or re-piping, fix the product.</p> <p>b) Fix and provide appropriate support to the piping, so that the weight and vibration of the piping will not directly be applied to the product.</p> <p>c) When piping is finished and fluid is to be flown, supply pressure gradually.</p> <p>•If the piping is improper, the piping may disconnect or the fluid may leak.</p>
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(1) Cleaning the piping

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

(2) Removal of foreign matter

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

To remove foreign matter, attach an appropriate apparatus to the primary side of the product. When the fluid is air, attach a filter 5 μ m or finer. When the fluid is water, attach a strainer 80 mesh or finer.

(3) When the fluid is steam

- When the fluid is steam, a drain trap must be installed. Steam made in a boiler contains a large amount of drain that needs to be removed.
- When the fluid is steam, a device to soften supply water, and a filter for steam must be installed. Supply water to the boiler contains calcium salts and magnesium salts, which react with oxygen and carbon dioxide. The reaction makes scale and sludge that needs to be removed.

(4) Piping

- Make sure that the piping port is correct.

If the supply port is not clear, refer to the product model number and the JIS symbol in the catalogue.

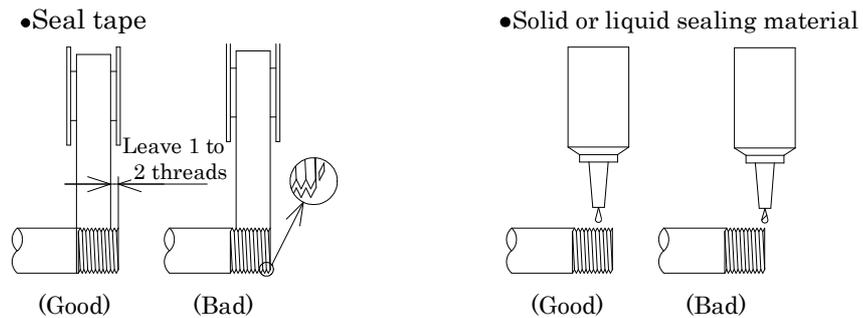
The Sub Plate has C port and A port indications. The supply port differs according to the model.

- For a 3-port valve, fix the socket with a tool such as an adjustable spanner when tightening the NO port.

(5) Sealing material

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

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



(Figure 1.) How to apply sealing material

(6) Tightening

- Refer to table 1. for the recommended port tightening torque.

Table 1. Recommended port tightening torque

Port size	Recommended torque
1/8 inch	18-20[N·m]
1/4 inch	23-25[N·m]
3/8 inch	31-33[N·m]

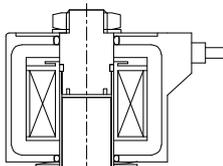
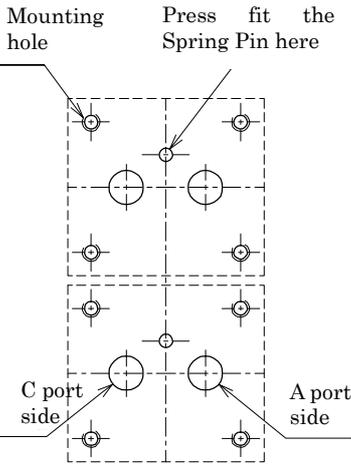
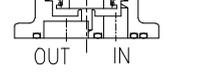
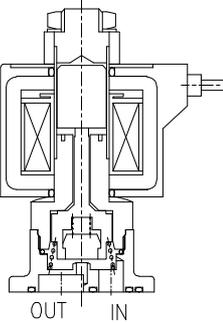
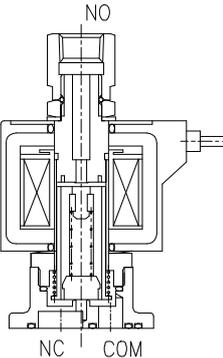
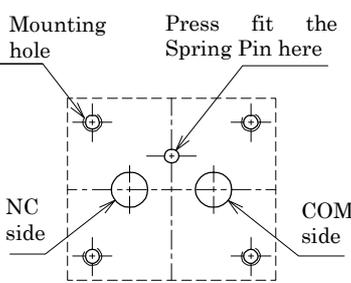
(7) Lubricated or non-lubricated operation

- This product does not require lubrication. Therefore, no lubricator is needed. If the product is to be lubricated, use turbine oil Class 1, ISO VG32 (#90) or equivalent. Once lubricated, do not stop periodical lubrication. Otherwise, disappearance of initial lubrication will result in operation malfunction.
- Do not lubricate ethylene propylene rubber seal, as it is not oil-resistant.

(8) Precautions when mounting the actuator to a part manufactured by our customer

- Press fit the Spring Pin attached to the actuator into an appropriate position on the part.
- Refer to table 2 for pressure supply ports for each actuator model number.
- Tighten the pan head screws with torque shown below.
Recommended tightening torque···7.8-15.7N·m
- Make sure that the mounting side of the part has appropriate surface roughness, since the mounting side is sealed by an O ring.
Recommended surface roughness···Rz12.5

Table 2. Pressure supply direction and pressure supply port position for each model number

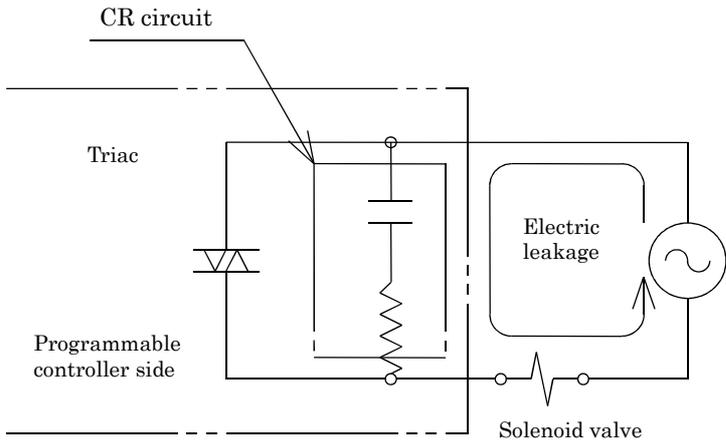
Classification		Model	Actuator	A port	C port	Mounting shape
2-port valve	Normally closed, centralized supply	GAB312 GAB412		OUT	IN	
	Normally closed, individual supply	GAB352 GAB452		IN	OUT	
	Normally open, centralized supply	GAB422		OUT	IN	
3-port valve	Universal (Can be pressurized from any port)	GAG31□ GAG41□		COM	NC	
		GAG35□ GAG45□		NC	COM	
	NC pressurization	GAG33□ GAG43□		COM	NC	
	NO pressurization	GAG34□ GAG44□		—	—	

2.4 Wiring

 <p>CAUTION</p>	<p>Read this instruction manual thoroughly and understand the contents before wiring the product.</p> <ul style="list-style-type: none"> You need to understand the structure and the operation principle of the solenoid valve. You additionally need knowledge to secure safety.
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 <p>CAUTION</p>	<p>a) Confirm the voltage and the alternating or direct current type.</p> <p>b) To prevent unintended operation caused by electric leakage of other control components, confirm electric leakage.</p> <ul style="list-style-type: none"> When using a control circuit such as a programmable controller, the solenoid valve may operate without intention because of the electric leakage from the control components. When using this product, keep the electric leakage from other components below the value shown in the table below.
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Rated voltage	Electric leakage
AC100V	6mA or less
AC110V	5.7mA or less
AC200V	3mA or less
AC220V	2.8mA or less
DC12V	2mA or less
DC24V	1mA or less
AC100V (with built-in diode)	2mA or less
AC200V (with built-in diode)	1mA or less



The diagram illustrates a CR circuit for a solenoid valve. It shows a Triac connected to a Programmable controller side. A Solenoid valve is connected to the output of the Triac. A section of the circuit is labeled 'Electric leakage' and includes a circular symbol with a wavy line, representing an AC source or measurement point. The diagram is divided into sections by dashed lines, with labels for 'CR circuit', 'Triac', 'Programmable controller side', and 'Solenoid valve'.

(1) Maintenance of the electric equipment

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

(2) Wiring of the lead wire type

Lead wire size

Coil option codes "Blank (00)", "3A", "5A": Conductor size; AWG20, coated outer diameter; ϕ approx. 2.6

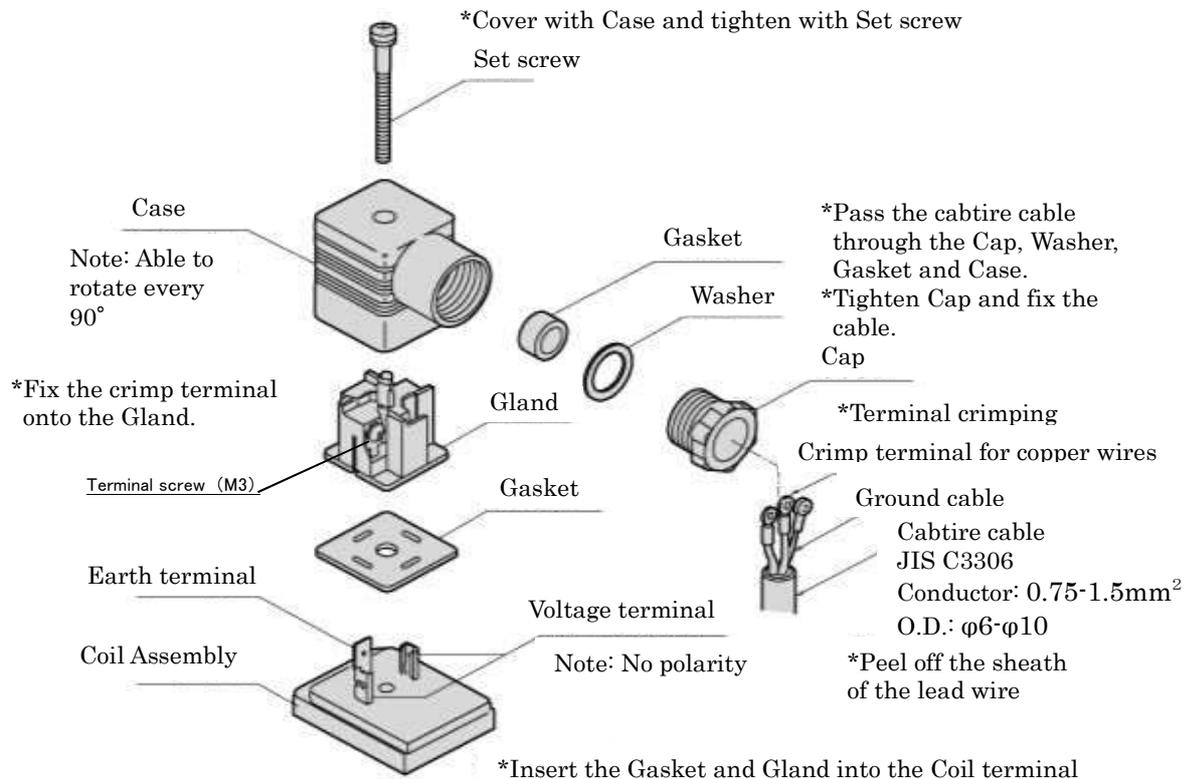
Coil option code "4A": Conductor size; nominal cross-sectional area 0.75mm², coated outer diameter; ϕ approx. 2.3

- Take care not to apply too much force on the lead wire.
- There is no polarity for DC coils.
- For wiring, use wire with nominal cross-sectional area 0.5mm^2 or larger. Additionally.

(3) Wiring of the DIN terminal box type

This section is for products with DIN terminal box attached (refer to figure 2.) .

- ① Use the following cabtire cable. Cable outer diameter: $\phi 6\text{-}\phi 10$; Nominal cross-sectional area: $0.75\text{-}1.5\text{mm}^2$
- ② Pass the cabtire cable through the Cap, Washer, Gasket and Case.
- ③ Put the crimp terminal for copper wires on the lead wire of the cabtire cable and crimp the terminal.
- ④ Fix the crimp terminal of the lead wire on to the screw of the gland.
Connect the ground cable to the earth terminal on the gland.
- ⑤ Place the Case on the Gland, then fix the Case with a Set screw.
The case can be rotated every 90° .
- ⑥ Insert the Gasket and Washer before fixing the Cap onto the Case.



(Figure 2.) Wiring of the DIN terminal box

(4) Wiring of the HP terminal box type

This section is for products with HP terminal box attached (refer to figure 3.) .

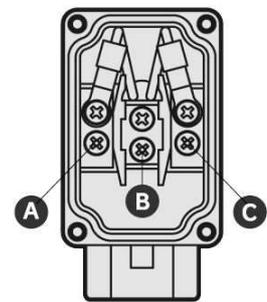
- ① Use wire with nominal cross-sectional area 0.5mm² or more.
- ② Pass the wire through the main body of the terminal box.
- ③ Put the crimp terminal for copper wires on the wire and crimp the terminal.
- ④ Fix the crimp terminal with the Terminal screw with tightening torque 0.5N·m.

There is polarity only for “HP terminal box with lamp at DC voltage”. Wire according to table 3 when the coil option is “HP terminal box with lamp at DC voltage”..

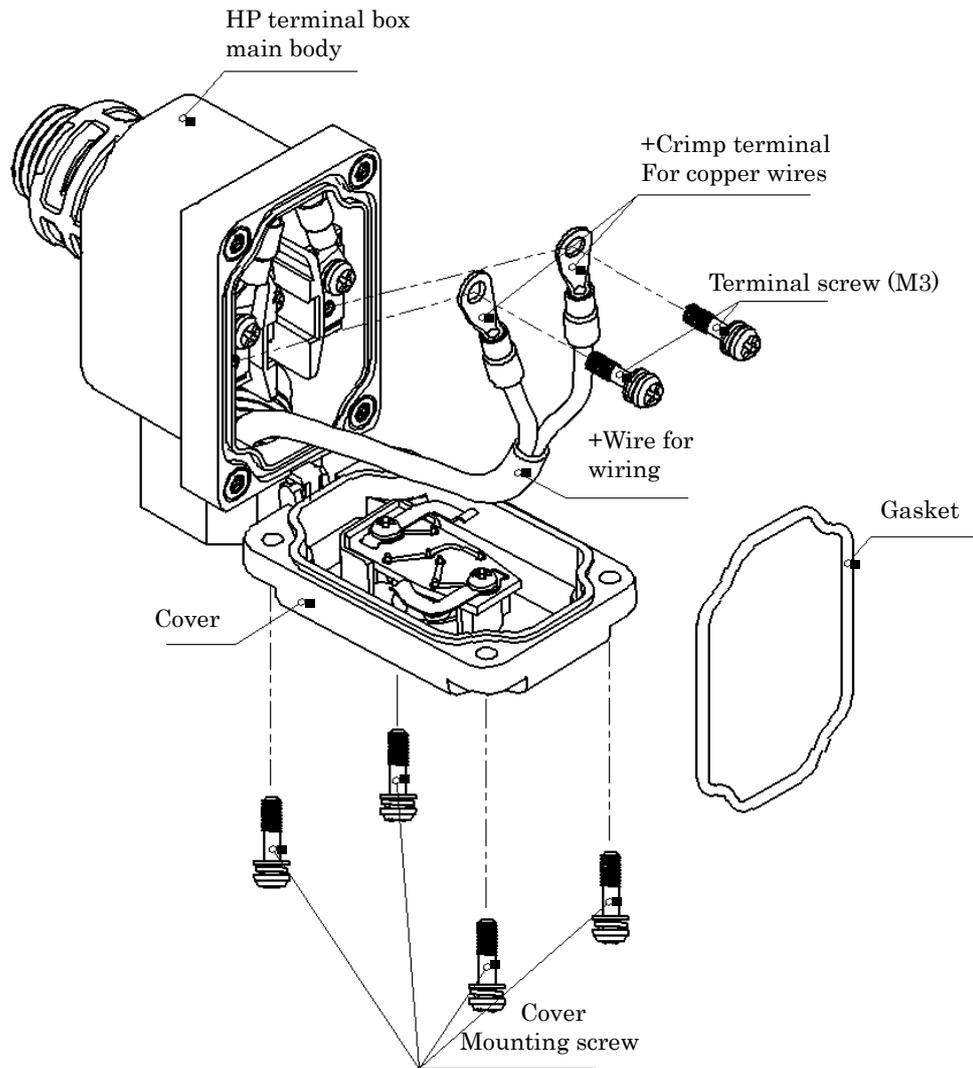
Table 3. How to connect the wire to the terminal of the HP terminal box

HP terminal box type	Connection of the wire to the terminal
HP terminal box without lamp	Connect the wire to terminal A and C.
HP terminal box with lamp for AC voltage	There is no polarity.
HP terminal box with lamp for DC voltage	Connect the negative (-) wire to terminal A, and positive (+) wire to terminal C, since there is polarity for the lamp.

<Connecting diagram>
When there are two conductors



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



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

(Figure 3.) Wiring of the HP terminal box

3. Pre-operation (post-installation) check

3.1 Appearance check

**WARNING**

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

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

3.2 Leakage check

- (1) Confirm leakage at the connection part by applying pressure to the fluid.

We recommend leakage check by the following method:

- Supply compressed air (0.3-0.5MPa)
- Apply soap water to the portion to check for leakage
- Bubbles will appear if there is any leakage.

3.3 Electrical check

**WARNING**

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

- (1) Check the supply voltage.

Voltage variation shall be within 10% of the rated voltage.

Use beyond the allowed variation range will cause malfunction or damage to the coil.

- (2) Check insulation resistance

Check the insulation resistance between dead metal parts and uninsulated live parts (such as the tip of the lead wire) that are assembled to the product.

Confirm that insulation resistance is over 100MΩ at DC500V megger.

3.4 Operation check

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

4. Instructions for proper use

4.1 Handling precautions

 WARNING	<ul style="list-style-type: none"> a) Do not use this product as an emergency shut-off valve. <ul style="list-style-type: none"> • This product is not designed as a safety-securing valve, such as an emergency shut-off valve. For such systems, use this valve after providing another method of securing safety. b) Take measures to prevent harm to operators or objects if this product fails. c) Liquid-filled state <ul style="list-style-type: none"> • When conveying a liquid in a circuit, operation may fail if liquid-filled state occurs. This is because pressure rises in the liquid-filled state when temperature rises. Provide an escape valve in the system so that a liquid-filled state circuit is not created. d) Working fluids <ul style="list-style-type: none"> • Do not use this product for fluids other than the working fluids listed in the catalog specifications. • Before use, confirm the compatibility of the product and applicable fluid with the Applicable Fluid Check List. • Depending on the model, internal parts may wear when the valve operates. Caution is required because wear chips could enter the secondary side of the valve.
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 CAUTION	<ul style="list-style-type: none"> a) Do not touch the coil sections or actuator sections when energized or immediately after energizing. Depending on the product, directly touching these products could cause burns. b) Do not touch the wiring connection sections (bare live part) when energized. There is a risk of electric shock. c) Always use within the maximum working pressure and maximum working pressure differential range.
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(1) When carrying the solenoid valve, hold the main body.

Do not carry the valve by the lead wire, or by the cable attached to the terminal box.

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

(3) If the product has not been used for more than a month, the seal rubber and metal at the valve seat may stick and operation time may be delayed. Carry out trial run in such cases.

(4) When the 3-port solenoid valve is to be energized continuously pressurized from the NO port, select a normally open type (model: GAG34, GAG44)

Additionally, if the valve is to be energized continuously for the universal type (model: GAG31, GAG35, GAG41 or GAG45) or normally closed type (GAG33, GAG43), select options with fluoro rubber sealing.

(5) If the fluid is dry air or inert gas, number of duration cycles decrease significantly due to abrasion. Select valves for dry air in such cases.

(6) This product cannot be used for vacuum holding. Please contact CKD if the product is to be used for vacuum holding.

(7) Fluid viscosity shall be 50 mm²/s or less. Otherwise, the product will malfunction.

(8) Refer to “6. Troubleshooting” if any trouble occur.

4.2 Manual override (For option with manual override)

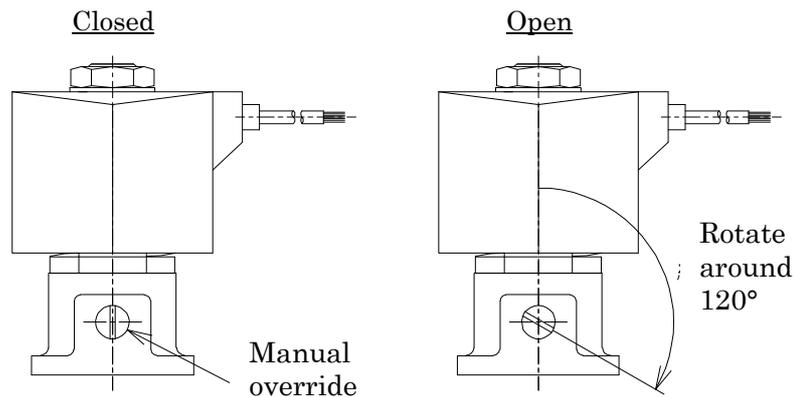
**CAUTION**

Confirm that the manual override is reset to its initial position after it is operated.

1) Manual operation of normally closed 2-port valves and 3-port valves

Model: GAB31, GAB35, GAB41, GAB45, GAG31, GAG33, GAG34, GAG35,
GAG41, GAG43, GAG44, GAG45

- (1) When the manual override is rotated clockwise about 120° with a slotted screwdriver, the plunger lifts and the valve opens (refer to figure 4.)
- (2) Return the manual override to its initial position after it is operated.



(Figure 4.) Operation method of the manual override

2) Manual operation of normally open 2-port valves

Model: GAB42

- (1) The Manual Rod is threaded. Pinch the Manual rod and rotate it clockwise. The Manual rod will stop to rotate after it sinks 5-6mm, and the valve will close (refer to figure 5.) .
- (2) After operation, return the Manual Rod to its initial position by rotating it counterclockwise as far as possible.

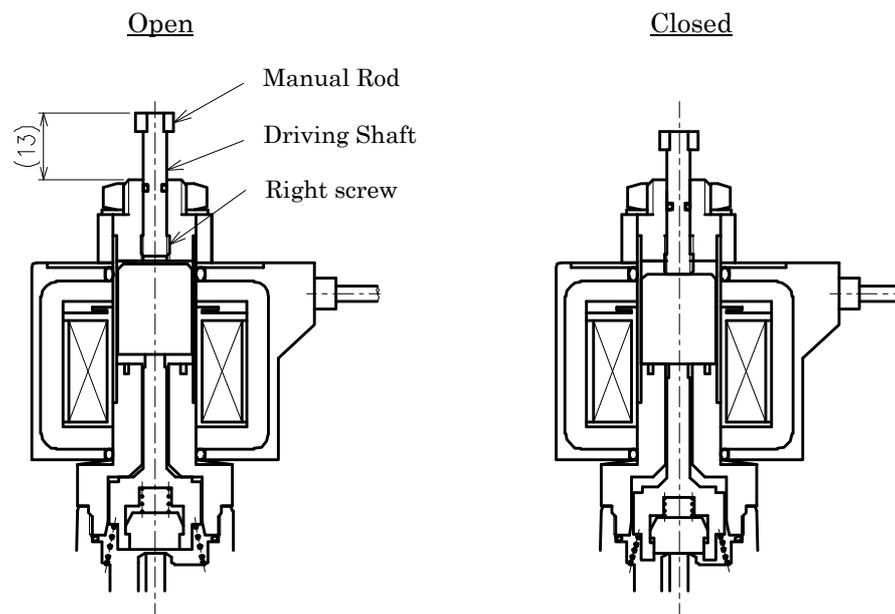


Figure 5. Operation method of the manual override

5. Maintenance

5.1 Maintenance and inspection

 CAUTION	<ul style="list-style-type: none"> a) Read this Instruction manual thoroughly and understand the contents well before performing maintenance and inspection. b) Shut off the power supply and release the fluid pressure before performing maintenance.
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- (1) Regularly inspect the product to ensure optimum performance. Although inspection frequency differs based on the working state, the product should be inspected every half year.
- (2) Refer to “3. Pre-operation check” for contents of inspection.
- (3) When washing the product, use a washing agent with low environmental impact. Note that the rubber parts must be replaced as they could expand.
- (4) When not using the product for one or more months after passing water or hot water, completely remove any water or hot water left in the product. Water or hot water residue will cause rust and may lead to operation failure or leaks.
- (5) Please contact CKD if there are any unclear points concerning consumable parts.
- (6) Beware the clogging of the strainer and filter.
- (7) When the product is disassembled and reassembled, tighten the threaded parts with torque shown in Table 4.

Table 4. Recommended tightening torque of parts

Model	Core Assembly	Nut	Socket	Pan head screw
GAB3·GAB4	30-45N·m	8-16N·m	—	1-1.4N·m
GAG3·GAG4	30-45N·m	8-16N·m	8-16N·m	1-1.4N·m

5.2 Parts for maintenance

- (1) O ring

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

- (2) Plunger Assembly, Spring, Core Assembly

Replace when abnormalities occur such as leak, operation malfunction, or beat sound.

6. Troubleshooting

(1) If the solenoid valve does not operate as intended, check according to tables 5. and 6.

Table 5. Cause of malfunction and countermeasures for normally closed valves (Model: GAB31, GAB35, GAB41, GAB45, GAG31, GAG33, GAG35, GAG41, GAG43, GAG45)

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

Table 6. Cause of malfunction and countermeasures for normally open valves (Model: GAB42, GAG34, GAG44)

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

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

7. Appropriate disposal

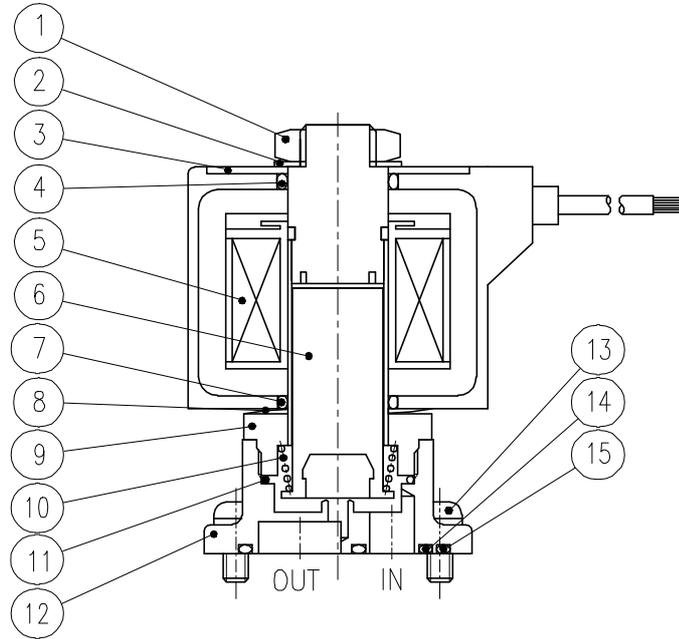
(1) When disposing this product, dispose this product as industrial waste.

(2) This valve series includes coil types that uses lead wires insulated by PVC covering. Do not burn this product at disposal, since deleterious chlorine gas emits when PVC is burned.

8. Internal construction

8.1 Internal construction of the normally closed 2-port valve

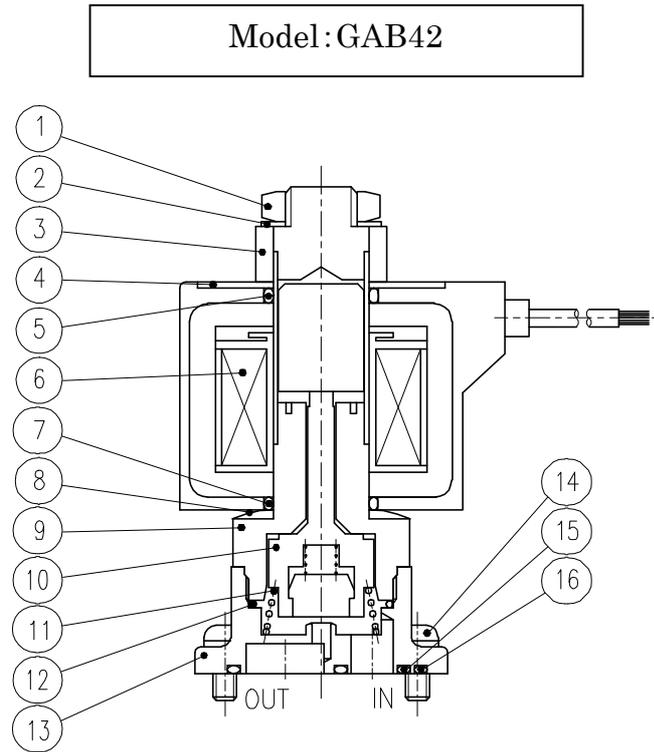
Model: GAB31, GAB35, GAB41, GAB45



No.	Part name	Remarks
①	Nut	
②	Spacer A	
③	Name Plate	
④	O ring	
⑤	Coil Assembly	
⑥	Plunger Assembly	Consumable part
⑦	O ring	
⑧	Waving Washer	
⑨	Core Assembly	Consumable part
⑩	Spring	Consumable part
⑪	O ring	Consumable part
⑫	Body	
⑬	Combination slotted and cross recessed pan head machine screw with captive spring lock washer	
⑭	O ring	Consumable part
⑮	O ring	Consumable part

Note: Consumable parts kit is available for replacement.

8. 2 Internal construction of the normally open 2-port valve

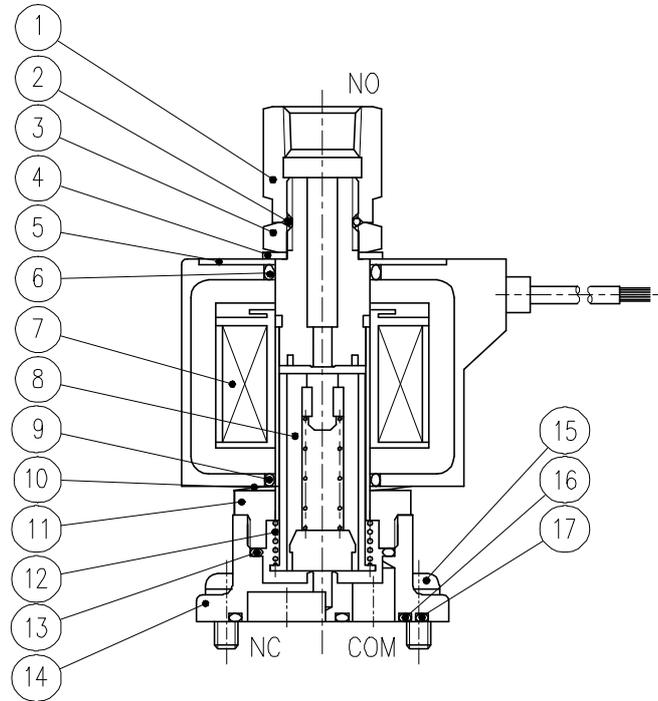


No.	Part name	Remarks
①	Nut	
②	Spacer A	
③	Spacer	
④	Name Plate	
⑤	O ring	
⑥	Coil Assembly	Consumable part
⑦	O ring	
⑧	Waving Washer	
⑨	Core Assembly	Consumable part
⑩	Valve Guide Assembly	Consumable part
⑪	Spring	Consumable part
⑫	O ring	Consumable part
⑬	Body	
⑭	Combination slotted and cross recessed pan head machine screw with captive spring lock washer	
⑮	O ring	Consumable part
⑯	O ring	Consumable part

Note: Consumable parts kit is available for replacement.

8. 3 Internal construction of the 3-port valve

Model: GAG31, GAG33, GAG34, GAG35,
GAG41, GAG43, GAG44, GAG45



No.	Part name	Remarks
①	Socket	
②	O ring	Consumable part
③	Nut	
④	Spacer A	
⑤	Name Plate	
⑥	O ring	
⑦	Coil Assembly	Consumable part
⑧	Plunger Assembly	Consumable part
⑨	O ring	
⑩	Waving Washer	
⑪	Core Assembly	Consumable part
⑫	Spring	Consumable part
⑬	O ring	Consumable part
⑭	Body	
⑮	Combination slotted and cross recessed pan head machine screw with captive spring lock washer	
⑯	O ring	Consumable part
⑰	O ring	Consumable part

Note: Consumable parts kit is available for replacement.