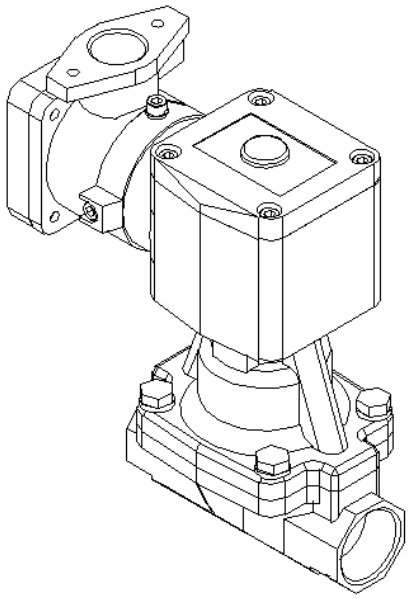
CKD

SM－2285－A

INSTRUCTION MANUAL

Explosionproof MULTILEX VALVE

AP11E4･AP11E2 Series
AP12E4･AP12E2 Series
AP21E4･AP21E2 Series
AP22E4･AP22E2 Series



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

Ver.3

CKD Corporation

Safety precautions

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

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

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

⚠ WARNING

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

2. **Use this product within its specifications.**

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

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

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

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

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

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

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

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

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

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

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

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

Precautions with regard to guarantee

- **Guarantee period**

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

- **Guarantee coverage**

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

However, the guarantee excludes following cases:

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

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

- **Confirmation of product compatibility**

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

【 Contents 】

1. Glossary

(1) Acts, related regulations, and related standards

・In Japan, basis related to explosionproofed electrical equipments are as follows:

*Japanese Industrial Standards (JIS)

*Industrial Safety and Health Law and its related regulations

*Electricity Business Act and its related regulations.

Acts, laws, and regulations stated above are required to comply with the “Recommended Practices for Explosion-Protected Electrical Installations in General Industries”.

(2) Recommended Practices for Explosion-Protected Electrical Installations in General Industries

・Publisher: National Institute of Occupational Safety and Health, Japan

Document name: Recommended Practices for Explosion-Protected Electrical Installations in General Industries (Explosion-protecting of gas and steam, 2006). Recently, “Recommended Practices for Explosion-Protected Electrical Installations in General Industries” (Technical guide consistent with international standards 2008), which is consistent with international standard (IEC 60079), is published.

・The explosionproof solenoid valve explained in this instruction manual does not conform with the IEC standard. It conforms with “Recommended Practices for Explosion-Protected Electrical Installations in General Industries” (Explosion-Protecting of gas and steam, 2006).

(3) Hazardous area

・A location in which fire or explosion hazards may exist that calls for special safety provisions to the structure, installation and specification of electrical equipments.

・Hazardous locations are classified into Zone0, Zone1, and Zone2. This explosionproof solenoid valve is classified in Zone2, since it has an “explosionproof structure of the solenoid in solenoid valves”.

・Zone2 is a location where (at normal conditions) there is little possibility of the atmosphere becoming explosive, and the duration of the explosive atmosphere is short, even if the explosive atmosphere is formed.

・Previously, hazardous locations were classified into Location0, Location1, and Location2. The classification was reviewed, and now they are called Zone0, Zone1, and Zone2.

(4) Explosion class and ignition temperature

・Degree of hazard for explosive gases is classified by its ignition temperature and explosion class. Explosionproofed electrical equipments are obligated to display its type of explosionproof construction, explosion class, and ignition temperature in this order. This display shows the type of gas, classified by explosion class and ignition temperature, the electrical equipment is intended to handle and manage.

・Our explosionproof solenoid valve displays either d2G2 or d2G4. Symbols indicate the following :

*d: Explosionproof construction

*2: Explosion class

*G2 and G4: Ignition temperature

The classification above restricts manageable explosive gases.

・Within our explosionproof solenoid valves, the following models are classified into d2G4:

AP11E4, AP12E4, AP21E4, and AP22E4

The following model is classified into d2G2:

AP11E2, AP12E2, AP21E2, and AP22E2

2. Unpacking

⚠ **CAUTION**	Do not remove the port covering 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.

3. Installation

⚠ **WARNING**	This explosionproof solenoid valve is certified as having an explosionproof construction in the "Recommended Practices for Explosion-Protected Electrical Installations in General Industries". If this product is used as an explosionproof electrical equipment, the product cannot be used beyond specifications, since its use is regulated by law.

3. 1 Conditions for installation

⚠ **WARNING**	a) Confirm the explosion class and ignition temperature of the explosive gas. Make sure the explosionproof class of the solenoid valve conforms with the explosion class and ignition temperature of the gas. ・Some gases such as hydrogen and acetylene cannot be conveyed even with explosionproof construction valves. b) Confirm that the fluid pressure, fluid temperature, and ambient temperature are within specifications. ・Observe specifications, since fluid pressure affects operation of the solenoid valve, and since temperature affects the risk of explosion. c) The coil generates heat. ・Do not use this product in a sealed container. Provide ventilation measures. d) The product cannot be used in a corrosive or solvent environment. e) Avoid humid environments, since condensation may occur with change in temperature. f) This explosionproof construction is intended for factory use. Do not use this valve for coal mines or marine vessels.

(1) Provide appropriate measures to prevent the product from freezing at cold places.
(2) This product can be used outdoors.
Ingress Protection code rating defined in JIS C0920 is IP65.
(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: AP12E4, AP12E2, AP22E4, and AP22E2), the plunger within will vibrate and may result in beat sounds or malfunction.

3．2 Installation method

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

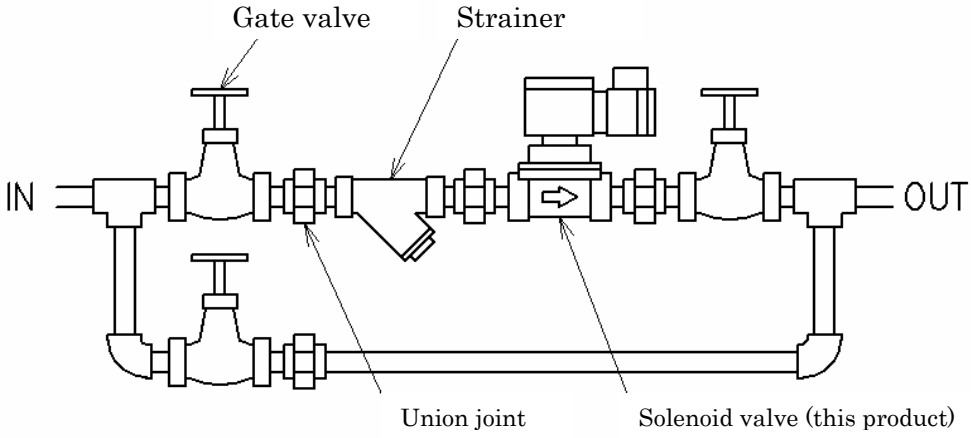
(1) Mounting posture is unrestricted under operation pressure differential range.
Since this product uses fluid pressure to operate, pressure beyond specified range destabilizes operation.
Moreover, avoid positioning the coil side down, since foreign matter in the fluid accumulates around the plunger and result in beat sounds and malfunction.

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

3．3 Piping

⚠ **CAUTION**	a) When piping or re-piping, fix the product. 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. c) When piping is finished and fluid is to be flown, supply pressure gradually. ・If the piping is improper, the piping may disconnect or the fluid may leak.

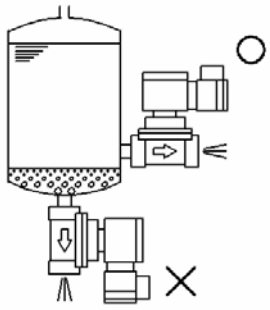
(1) Installing a bypass circuit
・To ease maintenance work, install a bypass circuit in the piping (Refer to Figure 1.).



(Figure 1.) Bypass circuit

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

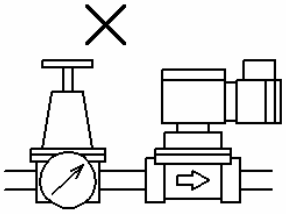
・When installing the product to control drain from a tank, do not install the product at the bottom of the tank. Otherwise, foreign matter accumulated at the bottom of the tank enters the product and cause malfunction. Install the product a little above the tank bottom (Refer to Figure 2.).



(Figure 2.) Drain circuit from the tank

(3) Connecting the product directly with a regulator

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



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

(4) Sectional area of the piping

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

Even if fluid pressure at the fluid supply side is within specifications when the valve is closed, fluid pressure at that side drops drastically when the valve opens if the sectional area of the piping at that side is restricted. As a result, restricting the sectional area of the piping at the fluid supply side will reduce pressure differential, destabilizing the solenoid valve operation. Refer to “4.1 Handling precautions” for details.

(5) Cleaning the piping

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

(6) Removal of foreign matter

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

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

(7) When the fluid is steam

・When the fluid is steam, a drain trap must be installed. Steam generated in a boiler contains a large amount of drain that needs to be removed.

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

・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.

(8) Piping

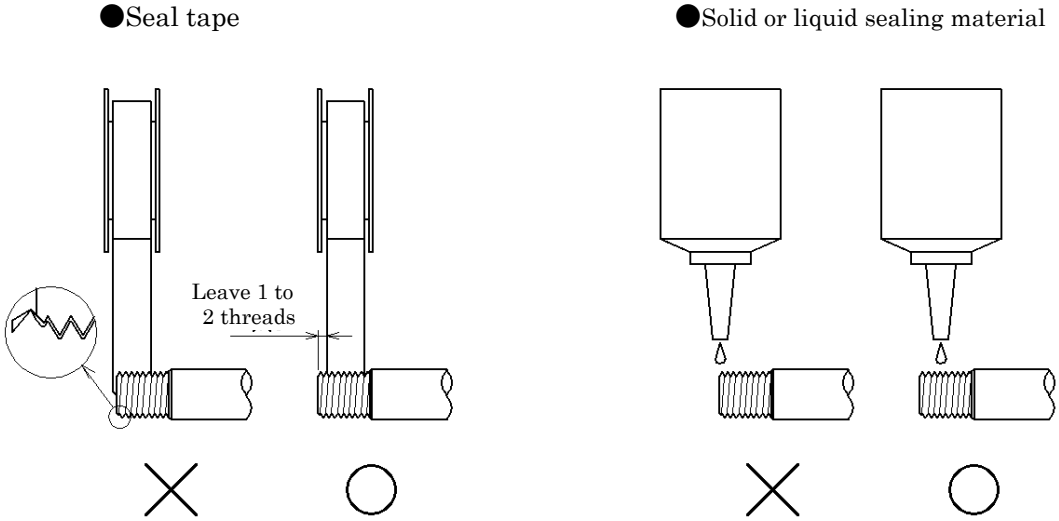
・Make sure that the piping port is correct.

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

(9) Sealing material

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

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



(Figure 4.)How to apply sealing material

(10) Tightening

・Refer to Table 1. for the recommended port tightening torque.

Table 1. Recommended port tightening torque

Port size	Recommended tightening torque
Rc1/8	18 to 20 N・m
Rc1/4	23 to 25 N・m
Rc3/8	31 to 33 N・m
Rc1/2	41 to 43 N・m
Rc3/4	62 to 65 N・m
Rc1	83 to 86 N・m
Rc1・1/4	97 to 100 N・m
Rc1・1/2	104 to 108 N・m
Rc2	132 to 136 N・m

(11) 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 (additive-free) or equivalent. Once lubricated, do not stop periodical lubrication.

(12) Insulation cover of the piping

・When placing an insulation cover to the piping conveying fluids such as steam or hot water, structure the insulation cover so that it can be easily detached at the time of maintenance.

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

3．4 Wiring

⚠ CAUTION

a) Those who wire explosionproof solenoid valves shall have read the “4000 Explosion-Protecting Electric Wires” in the “Recommended Practices for Explosion-Protected Electrical Installations in General Industries (Explosion-Protecting of gas and steam, 2006)” thoroughly, and have enough knowledge and skill to perform work.

b) Read this instruction manual thoroughly and understand the contents before wiring the product.

- You need to understand the structure and the operation principle of the solenoid valve. You additionally need knowledge to secure safety.
- If the bolt on the Terminal Box is loosened, explosionproof performance is lost. Sufficient skill is required when handling these bolts.

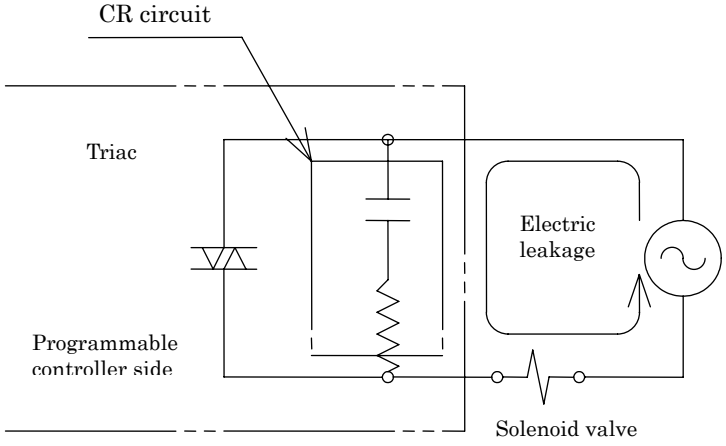
⚠ CAUTION

a) Confirm the voltage and the alternating or direct current type.

b) To prevent unintended operation caused by electric leakage of other control components, confirm electric leakage.

- When using a control circuit such as a programmable controller, the solenoid valve may operate without intention because of the electric leakage from the control components.
- When using this product, keep the electric leakage from other components below the value shown in the table below.

Rated voltage	Electric leakage
AC100V	6 mA or less
AC200V	3 mA or less
DC12V	2 mA or less
DC24V	1 mA or less
AC100V coil with built-in diode	2 mA or less
AC200V coil with built-in diode	1 mA or less



(1) Maintenance of the electric equipment

- To maintain the electric equipment, install a breaker such as a fuse (1A) in the control circuit side.

(2) Polarity for DC voltages

- There is no polarity for DC coils.

(3) Wiring the conduit (G1/2) type

⚠WARNING	When wiring to the terminal box, do not damage the matching portion of the Terminal Case and the Terminal Cap. Otherwise, explosionproof performance will degrade and explosion hazards may occur in explosive atmosphere. ・Repairing is impossible and replacement is needed, once the Terminal Case and the Terminal Cap is damaged.

This item is for conduit types (Refer to figure 5.).

① Use cabtire cable with outer diameter φ7.5-φ11, and with nominal sectional area 0.5mm^2 or more.

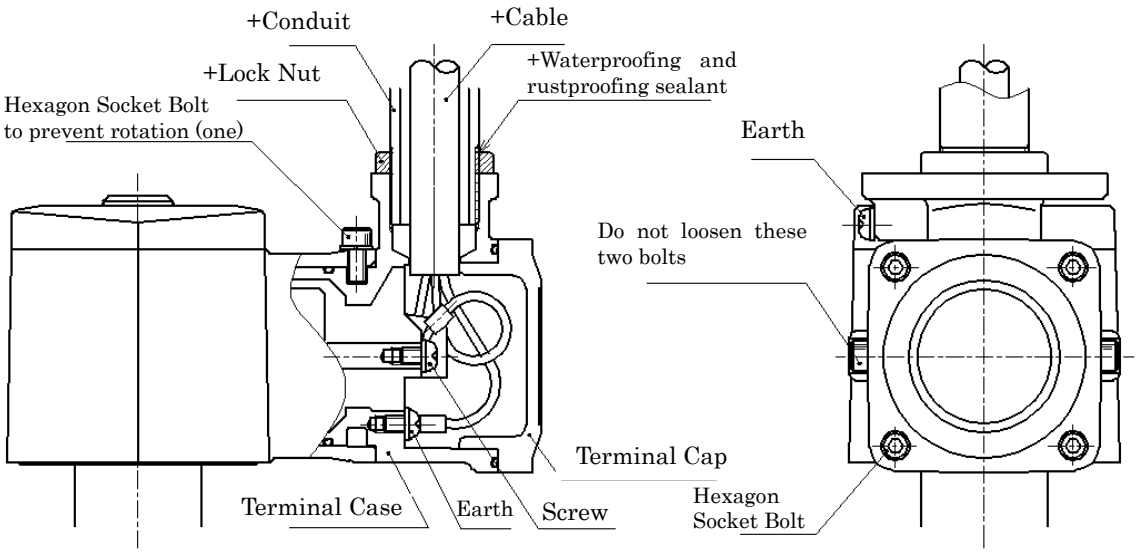
② Pass the cabtire cable through the external conductor entrance of the Terminal Case.

③ Insert the crimp terminal onto the lead wire of the cabtire cable, and crimp the terminal.

④ Fix the crimp terminal of the lead wire on to the screw.
Connect the earth conductor to the earth terminal on the Terminal Case.

⑤ Place the Terminal Cap. Then, fix the Terminal Cap with the Hexagon Socket Bolt.
When placing the Terminal Cap onto the Terminal Case, be careful not to damage the matching portion.
Tighten the four Hexagon Socket Bolts equally with tightening torque 0.6-0.8N・m.

⑥ Apply waterproofing and rustproofing sealant to the Lock Nut and the screw portion of the conduit. Then, fix the Lock Nut to the external conductor entrance of the Terminal Case.



Parts marked with "+" are not included in the product.

(Figure 5.) Example of wiring the conduit type

(4) Wiring the pressureproof packing type (G1/2)

⚠WARNING	When wiring to the terminal box, do not damage the matching portion of the Terminal Case and the Terminal Cap. Otherwise, explosionproof performance will degrade and explosion hazards may occur in explosive atmosphere. ・Repairing is impossible and replacement is needed, once the Terminal Case and the Terminal Cap is damaged.

This item is for the pressureproof packing type (Refer to figure 6.).

① The outer diameter of the cabtire cable to be used is different, according to the option symbol on the model number.
When the option symbol is "L"・・・Cabtire cable outer diameterφ7.5-φ8.4
When the option symbol is "M"・・・Cabtire cable outer diameterφ8.5-φ9.4
Nominal sectional area of the cabtire cable shall be 0.5mm^2 or more.

② After loosening the Connector Cap, lightly loosen the Cable Connector Fixing Bolt in order to let the cabtire cable pass through easily.

③ Pass the cabtire cable through the Connector Cap, Connector, Cable Connector, Spacer, Packing, Spacer, and Terminal Case.

④ Insert a crimp terminal on the lead wire of the cabtire cable, and crimp the terminal.

⑤ Fix the crimp terminal of the lead wire on to the screw.
Connect the earth conductor to the earth terminal on the Terminal Case.

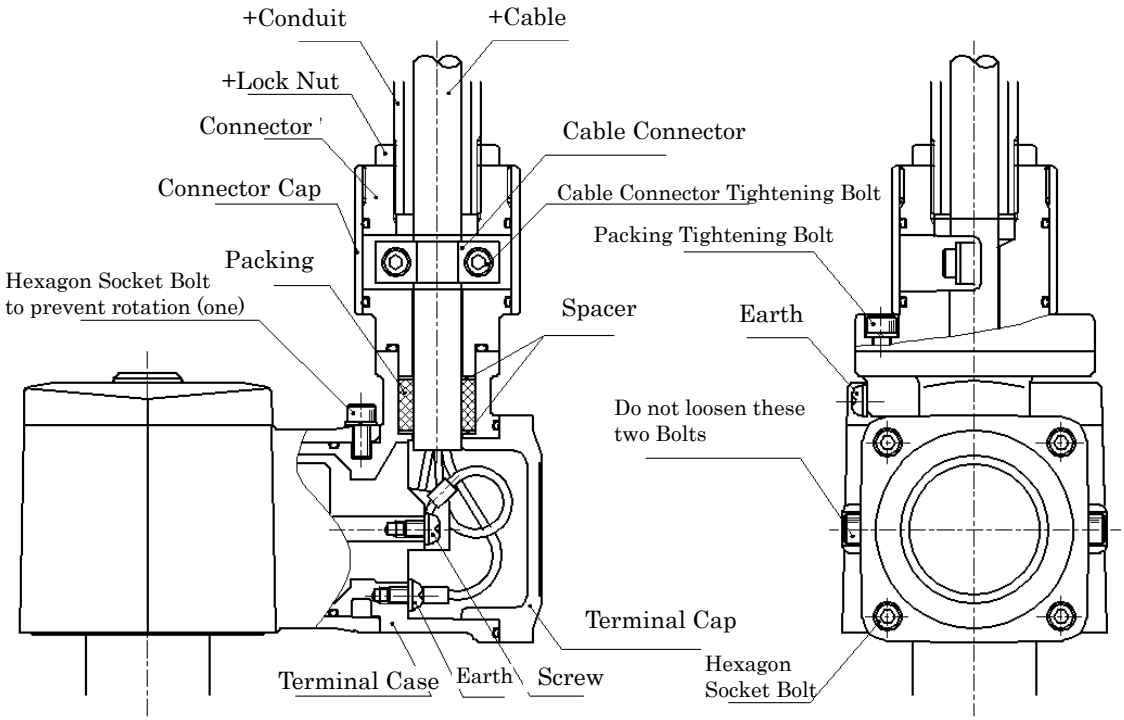
⑥ Adjust the cabtire cable where the Packing can be retained. Then, tighten the Packing Tightening Bolt.

⑦ Tighten the Cable Connector Tightening Bolt in order to fix the cabtire cable with the Cable Connector.

⑧ Tighten the Connector Cap.

⑨ Place the Terminal Cap in position, and tighten it by Hexagon Socket Bolts.
Be careful not to damage the matching part when inserting the Terminal Cap to the Terminal Case.
Tighten the four Hexagon Socket Bolts equally with tightening torque 0.6-0.8N・m.

⑩ Fix the conduit and lock nut to the Connector.



Parts marked with "+" are not included in the product.

(Figure 6.) Example of wiring the pressureproof packing type

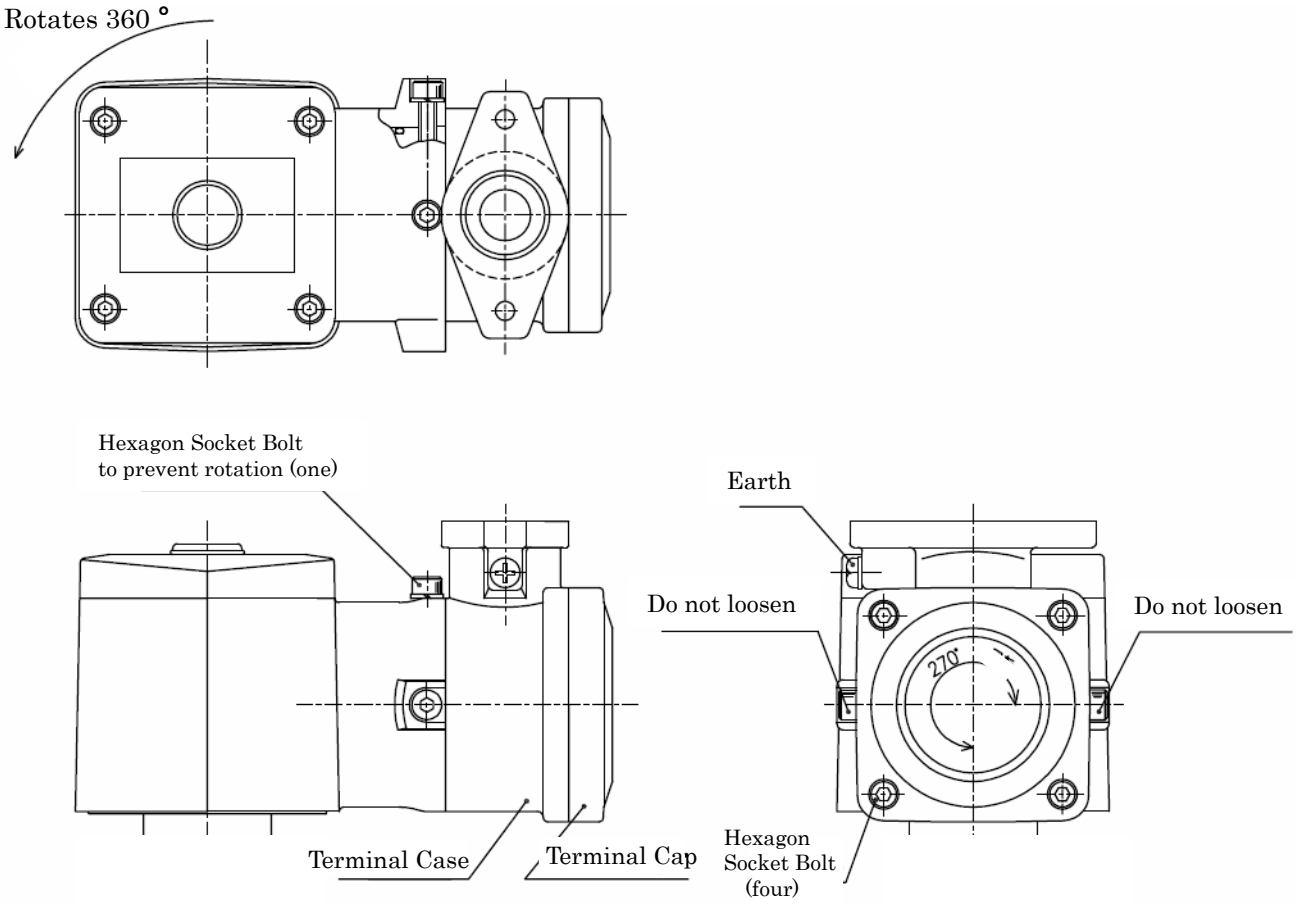
(5) Adjusting the direction of the wire outlet of the Terminal Box

The Terminal Box rotates 270°. It can be rotated when the “Hexagon Socket Bolt to prevent rotation (one)” is loosened (Refer to figure 7.).

① After wiring is completed, and after the wire outlet direction is set, fix the Terminal Box by the Hexagon Socket Bolt to prevent rotation with tightening torque 0.6-0.8N･m.

If the “Hexagon Socket Bolt to prevent rotation” is loose, the Bolt may fall off while use. Additionally, the rotation portion may break or internal wiring may disconnect resulting from rotation of the Terminal Box.

② Do not loosen the Bolts other than the four Terminal Cap fixing Bolts, which are needed for wiring, and other than the one “Hexagon Socket Bolt to prevent rotation”. Otherwise, explosionproof performance cannot be guaranteed.



(Figure 7.) Wire outlet direction of the Terminal Box

4. Pre-operation (post-installation) check

4. 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.

4. 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.

4. 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% to +5% 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.

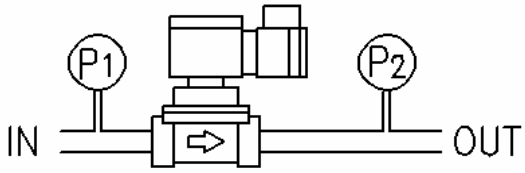
4. 4 Operation check

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

5. Instructions for proper use

5. 1 Handling precautions

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

⚠ CAUTION	a) Do not touch the coil sections or actuator sections when energized or immediately after energizing. Depending on the product, directly touching these products could cause burns. b) Do not touch the wiring connection sections (bare live part) when energized. There is a risk of electric shock. c) Always use within the maximum working pressure and maximum working pressure differential range. ・In particular, be sure to maintain the pressure differential across the IN and OUT ports at or over 0.05MPa when the valve is open. Otherwise, the valve will malfunction. *Pressure differential across the IN and OUT ports=P1-P2 

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

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

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

(4) If water hammer is a problem in your intended usage, please consider our air operated "SAB1W type" valve.

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

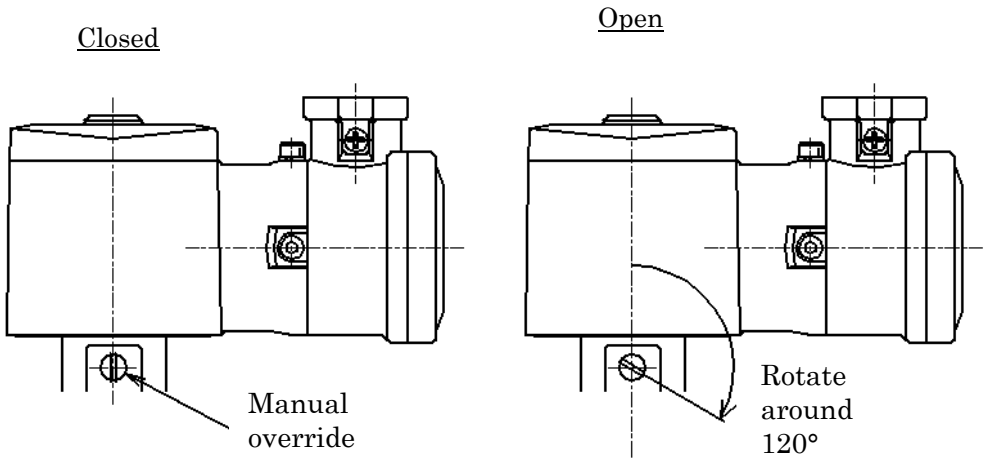
(6) If the fluid is dry air or inert gas, number of duration cycles decrease significantly due to abrasion.

(7) Fluid viscosity shall be 50 mm^2/s or less. Otherwise, the product will malfunction.
(8) Refer to "7. Troubleshooting" if any trouble occurs.

5．2 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 (Model：AP11E4・AP21E4 rubber sealing type only)
① When the manual override is rotated clockwise about 120°with a slotted screwdriver, the plunger lifts and the valve opens (refer to figure 8.).
② Return the manual override to its initial position after it is operated.



(Figure 8.) Operation method of the manual override

6. Maintenance

6. 1 Maintenance and inspection

⚠CAUTION	When performing maintenance and inspection of the explosionproof solenoid valve, read the "5000 Maintenance of Explosion-Protected Electric Installations" of the "Recommended Practices for Explosion-Protected Electrical Installations in General Industries (Explosion-Protection of gas and steam, 2006)" thoroughly, and observe its requirements. ・Save documents and records of maintenance and inspection. ・Perform education and training to workers. ・Maintain continuously.

⚠CAUTION	a) Read this Instruction manual thoroughly and understand the contents well before performing maintenance and inspection. b) Shut off the power supply and release the fluid pressure before performing maintenance. c) To guarantee the explosionproof performance, do not disassemble and repair the product.

(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 "4. Pre-operation check" for contents of inspection.

(3) When not using the product for one or more month 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.

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

6. 2 Repairing the explosionproof solenoid valve

(1) Do not disassemble the explosionproof solenoid valves that are used at hazardous areas, even if the valve needs repairing.

・This product is an approved explosionproof equipment regulated by acts, laws and regulations. Therefore, in association with the disclaimer at "Precautions with Regard to Guarantee", we do not allow our customer to disassemble and repair this product.

We shall not be held responsible for any accidents resulting from disassembly and repairing by our customer.

・Please consult our sales staff if there is a need to disassemble or repair the explosionproof solenoid valve. In order to maintain the explosionproof performance, we will keep the explosionproof solenoid valve, and repair it in our factory.

7. Troubleshooting

⚠ CAUTION	Do not disassemble the Coil Case portion, which is an explosionproof construction. Otherwise, explosionproof performance cannot be guaranteed.

(1) If the solenoid valve does not operate as intended, check according to tables 2. and 3.

Table 2. Cause of malfunction and countermeasures for normally closed 2-port valves (Model: AP11E4, AP11E2, AP21E4, AP21E2)

State of failure	Cause	Countermeasure
Fluid does not flow	Valve is not energized.	Confirm wiring and fuse, then energize the valve.
	Voltage applied is lower than the allowable voltage range.	Confirm the power supply, and apply rated voltage.
	Applied fluid pressure is too high.	Set pressure within allowable range.
	Foreign matter caught in.	Blow air from ports, or replace the product.
Fluid does not stop flowing	Wrong port is connected to the high pressure side.	Pipe correctly.
	Electricity is not shut off.	Check for leak of electricity. Modify the circuit to shut off electricity completely.
	Foreign matter caught in.	Blow air from ports, or replace the product.
Valve leaks externally	Abrasion or flaw of packing and O ring.	Replace the product.
	Core Assembly or Bolt is loose.	Replace the product.
Valve leaks internally	Abrasion or flaw at valve seat of Body or Stuffing.	Replace the product.
	Abrasion or flaw of the sealing side of the Plunger Assembly.	Replace the product.
	Foreign matter caught in the Valve Seat.	Replace the product.

Table 3. Cause of malfunction and countermeasures for normally open 2-port valves (Model: AP12E4, AP12E2, AP22E4, AP22E2)

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.
	Wrong port is connected to the high pressure side.	Pipe correctly.
	Foreign matter caught in.	Blow air from ports, or replace the product.
Fluid does not flow	Fluid is not pressurized.	Adjust to normal pressure.
	Electricity is not shut off.	Check for leak of electricity. Modify the circuit to shut off electricity completely.
	Applied fluid pressure is too high.	Set pressure within allowable range.
	Foreign matter caught in.	Blow air from ports, or replace the product.
Valve leaks externally	Abrasion or flaw of packing and O ring.	Replace the product.
	Core Assembly or Bolt is loose.	Replace the product.
Valve leaks internally	Abrasion or flaw at valve seat of Body or Stuffing.	Replace the product.
	Abrasion or flaw of the sealing side of the Plunger Assembly.	Replace the product.
	Foreign matter caught in the Valve Seat.	Replace the product.

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

8. Appropriate disposal

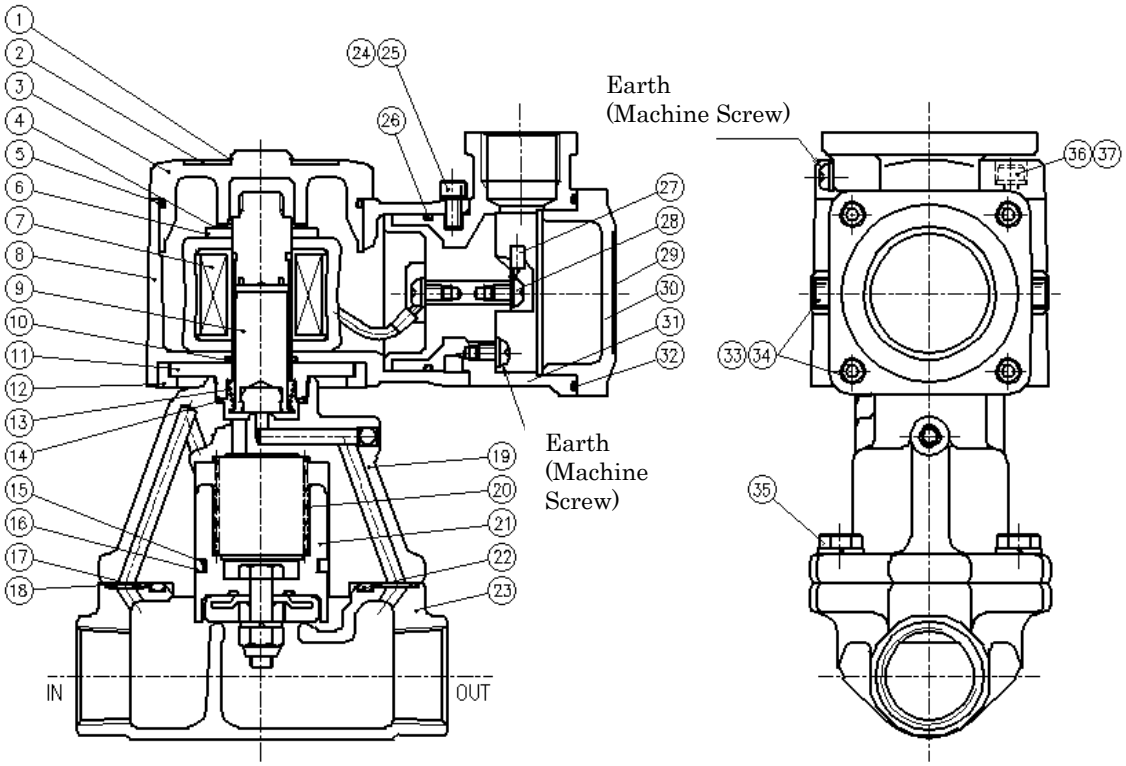
(1) When disposing this product, dispose this product as industrial waste.

9. Internal construction

9. 1 Internal construction of the normally closed 2-port valve

(1) AP11E4-15A･20A･25A

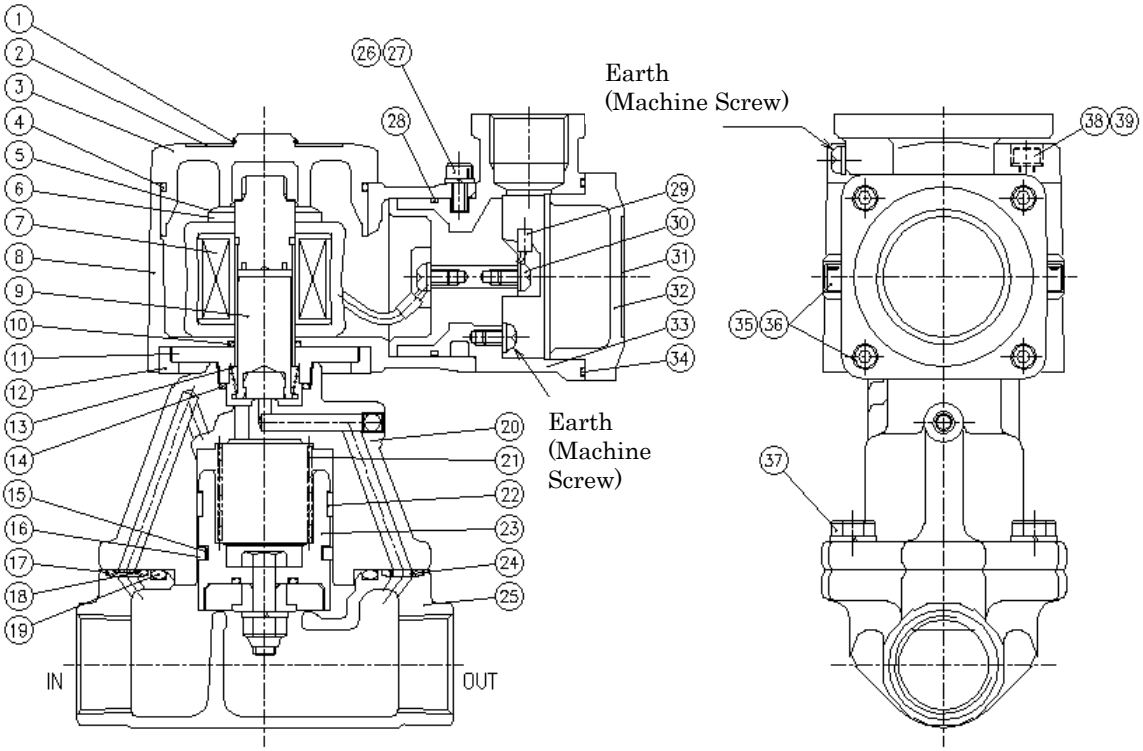
Model：AP11E4



No.	Part name	Quantity	No.	Part name	Quantity
1	Snap Ring	1	20	Valve Spring	1
2	Name Plate	1	21	Main Valve Assembly	1
3	Coil Cap	1	22	O ring	1
4	Waving Washer	1	23	Body	1
5	O ring	1	24	Hexagon Socket Bolt	1
6	Spacer	1	25	Washer	1
7	Coil Assembly	1	26	O ring	1
8	Coil Case	1	27	Crimp Style Terminal	3
9	Plunger Assembly	1	28	Cross Recessed Screw with Washer	6
10	O ring	1	29	Certified Label	1
11	Core Assembly	1	30	Terminal Cap	1
12	Holder	1	31	Terminal Case	1
13	Plunger Spring	1	32	O ring	1
14	O ring	1	33	Hexagon Socket Bolt	6
15	Tension Ring	1	34	Washer	6
16	Piston Ring	1	35	Hexagon Head Bolt with Washer	4
17	Orifice Plate	1	36	Hexagon Socket Bolt	4
18	O ring	2	37	Washer	4
19	Stuffing	1			

(2) AP11E2-15A･20A･25A (For steam)

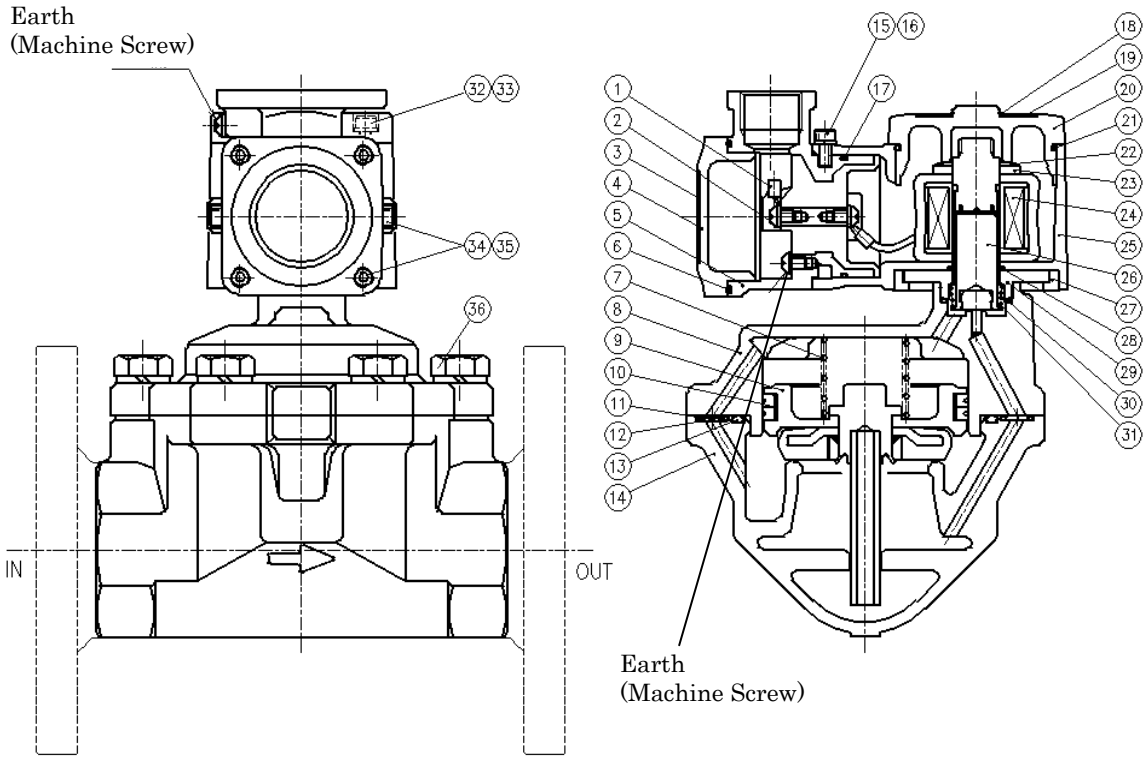
Model: AP11E2



No.	Part name	Quantity	No.	Part name	Quantity
1	Snap Ring	1	21	Valve Spring	1
2	Name Plate	1	22	Rider Ring	1
3	Coil Cap	1	23	Main Valve Assembly	1
4	O ring	1	24	Gasket Guide	1
5	Waving Washer	1	25	Body	1
6	Spacer	1	26	Hexagon Socket Bolt	1
7	Coil Assembly	1	27	Washer	1
8	Coil Case	1	28	O ring	1
9	Plunger Assembly	1	29	Crimp Style Terminal	3
10	O ring	1	30	Cross Recessed Screw with Washer	6
11	Core Assembly	1	31	Certified Label	1
12	Holder	1	32	Terminal Cap	1
13	Plunger Spring	1	33	Terminal Case	1
14	O ring	1	34	O ring	1
15	Tension Ring	1	35	Hexagon Socket Bolt	6
16	Piston Ring	1	36	Washer	6
17	Gasket	2	37	Hexagon Head Bolt with Washer	4
18	Orifice Plate	1	38	Hexagon Socket Bolt	4
19	O ring	1	39	Washer	4
20	Stuffing	1			

(3) AP21E4-32A･40A･50A･32F･40F･50F

Model: AP21E4

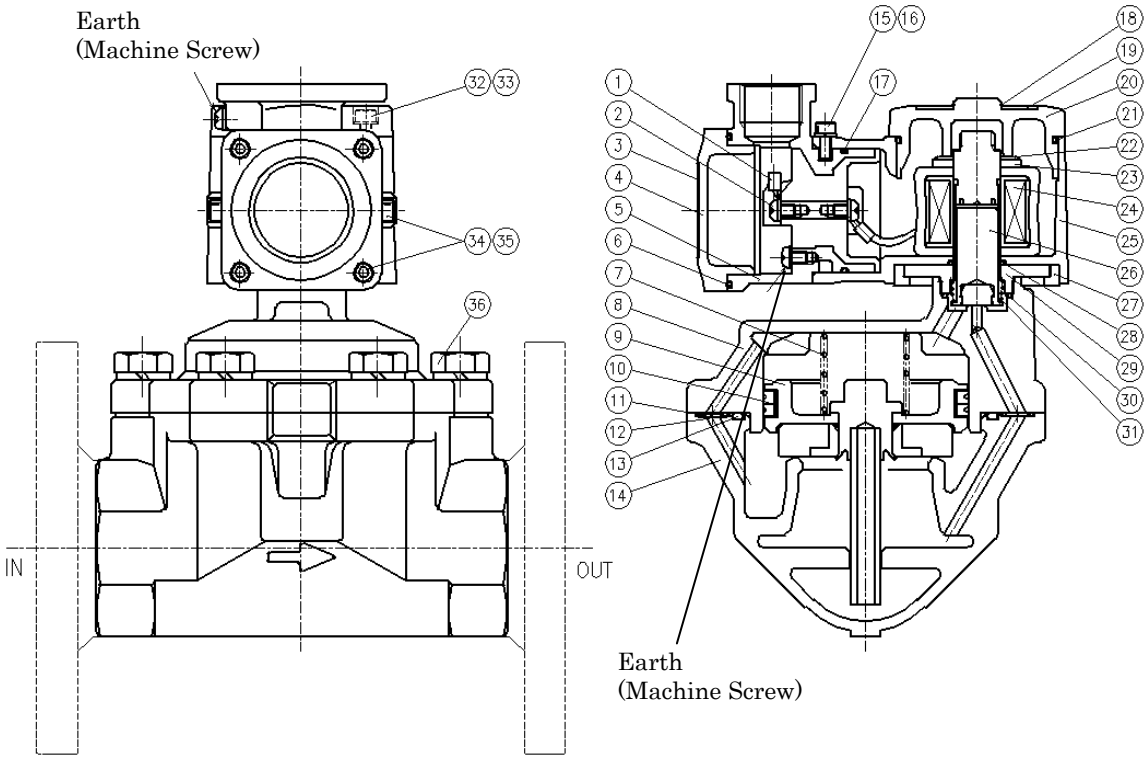


Note: Shape for flange connection options (32F･40F･50F) are shown above in the broken line.

No.	Part name	Quantity	No.	Part name	Quantity
1	Crimp Style Terminal	3	19	Name Plate	1
2	Cross Recessed Screw with Washer	6	20	Coil Cap	1
3	Certified Label	1	21	O ring	1
4	Terminal Cap	1	22	Waving Washer	1
5	Terminal Case	1	23	Spacer	1
6	O ring	1	24	Coil Assembly	1
7	Valve Spring	1	25	Coil Case	1
8	Stuffing	1	26	Plunger Assembly	1
9	Main Valve Assembly	1	27	Holder	1
10	Seal Ring Kit	1	28	O ring	1
11	O ring	2	29	Core Assembly	1
12	Orifice Plate	1	30	O ring	1
13	O ring	1	31	Plunger Spring	1
14	Body	1	32	Hexagon Socket Bolt	4
15	Hexagon Socket Bolt	1	33	Washer	4
16	Washer	1	34	Hexagon Socket Bolt	6
17	O ring	1	35	Washer	6
18	Snap Ring	1	36	Hexagon Head Bolt with Washer	6

(4) AP21E2-32A･40A･50A･32F･40F･50F (For steam)

Model: AP21E2



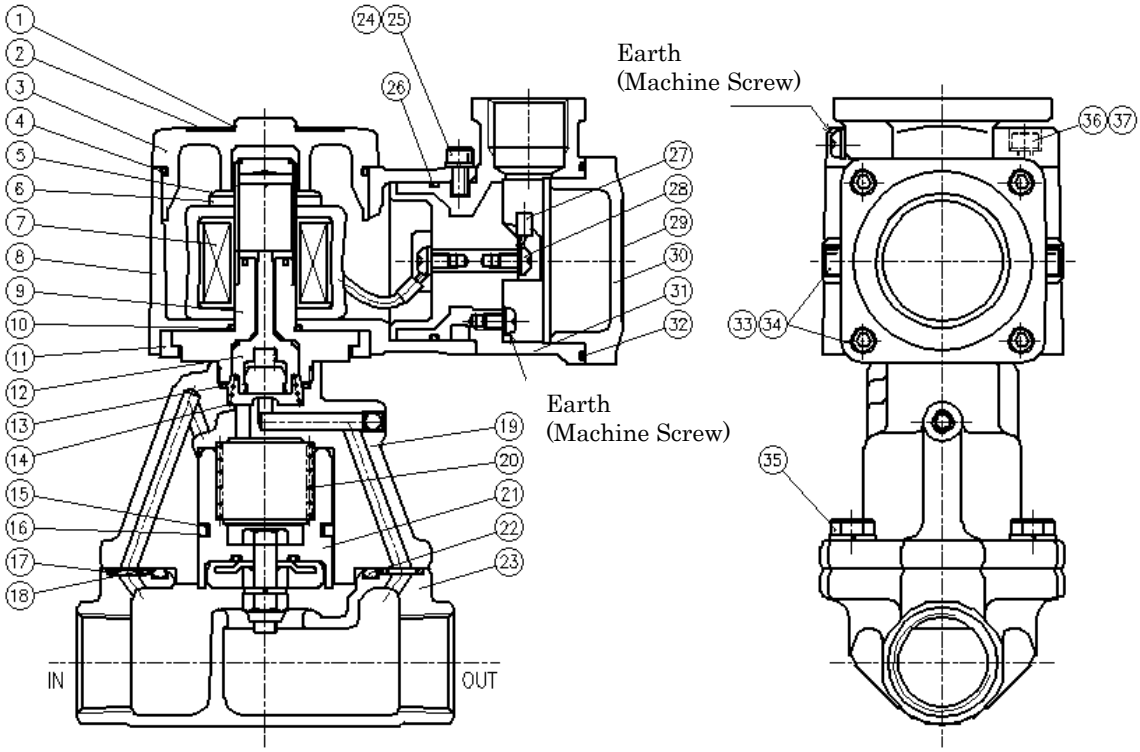
Note: Shape for flange connection options (32F･40F･50F) are shown above in the broken line.

No.	Part name	Quantity	No.	Part name	Quantity
1	Crimp Style Terminal	3	19	Name Plate	1
2	Cross Recessed Screw with Washer	6	20	Coil Cap	1
3	Certified Label	1	21	O ring	1
4	Terminal Cap	1	22	Waving Washer	1
5	Terminal Case	1	23	Spacer	1
6	O ring	1	24	Coil Assembly	1
7	Valve Spring	1	25	Coil Case	1
8	Stuffing	1	26	Plunger Assembly	1
9	Main Valve Assembly	1	27	Holder	1
10	Seal Ring Set	1	28	O ring	1
11	O ring	2	29	Core Assembly	1
12	Orifice Plate	1	30	O ring	1
13	O ring	1	31	Plunger Spring	1
14	Body	1	32	Hexagon Socket Bolt	4
15	Hexagon Socket Bolt	1	33	Washer	4
16	Washer	1	34	Hexagon Socket Bolt	6
17	O ring	1	35	Washer	6
18	Snap Ring	1	36	Hexagon Head Bolt with Washer	6

9．2 Internal construction of the normally open 2-port valve

(1) AP12E4-15A･20A･25A

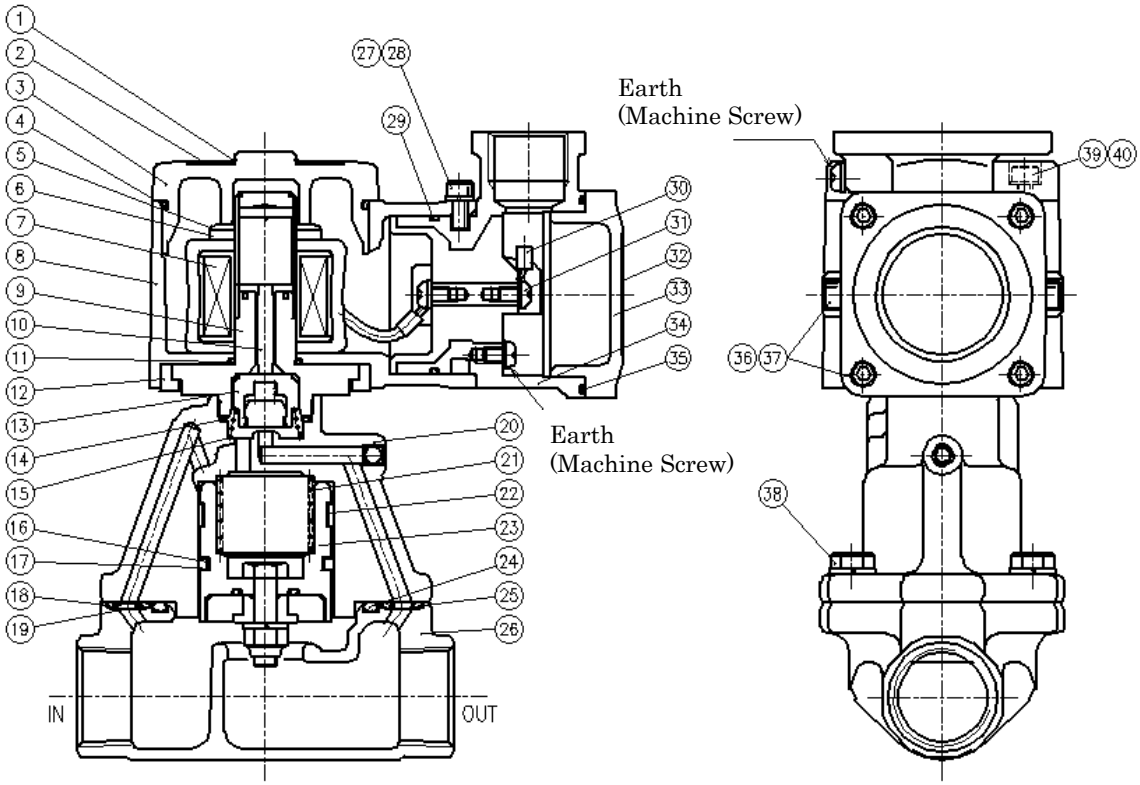
Model: AP12E4



No.	Part name	Quantity	No.	Part name	Quantity
1	Snap Ring	1	20	Valve Spring	1
2	Name Plate	1	21	Main Valve Assembly	1
3	Coil Cap	1	22	O ring	1
4	O ring	1	23	Body	1
5	Waving Washer	1	24	Hexagon Socket Bolt	1
6	Spacer	1	25	Washer	1
7	Coil Assembly	1	26	O ring	1
8	Coil Case	1	27	Crimp Style Terminal	3
9	Core Assembly	1	28	Cross Recessed Screw with Washer	6
10	O ring	1	29	Certified Label	1
11	Holder	1	30	Terminal Cap	1
12	Valve Guide Assembly	1	31	Terminal Case	1
13	O ring	1	32	O ring	1
14	Spring	1	33	Hexagon Socket Bolt	6
15	Tension Ring	1	34	Washer	6
16	Piston Ring	1	35	Hexagon Head Bolt with Washer	4
17	O ring	2	36	Hexagon Socket Bolt	4
18	Orifice Plate	1	37	Washer	4
19	Stuffing	1			

(2) AP12E2-15A･20A･25A (For steam)

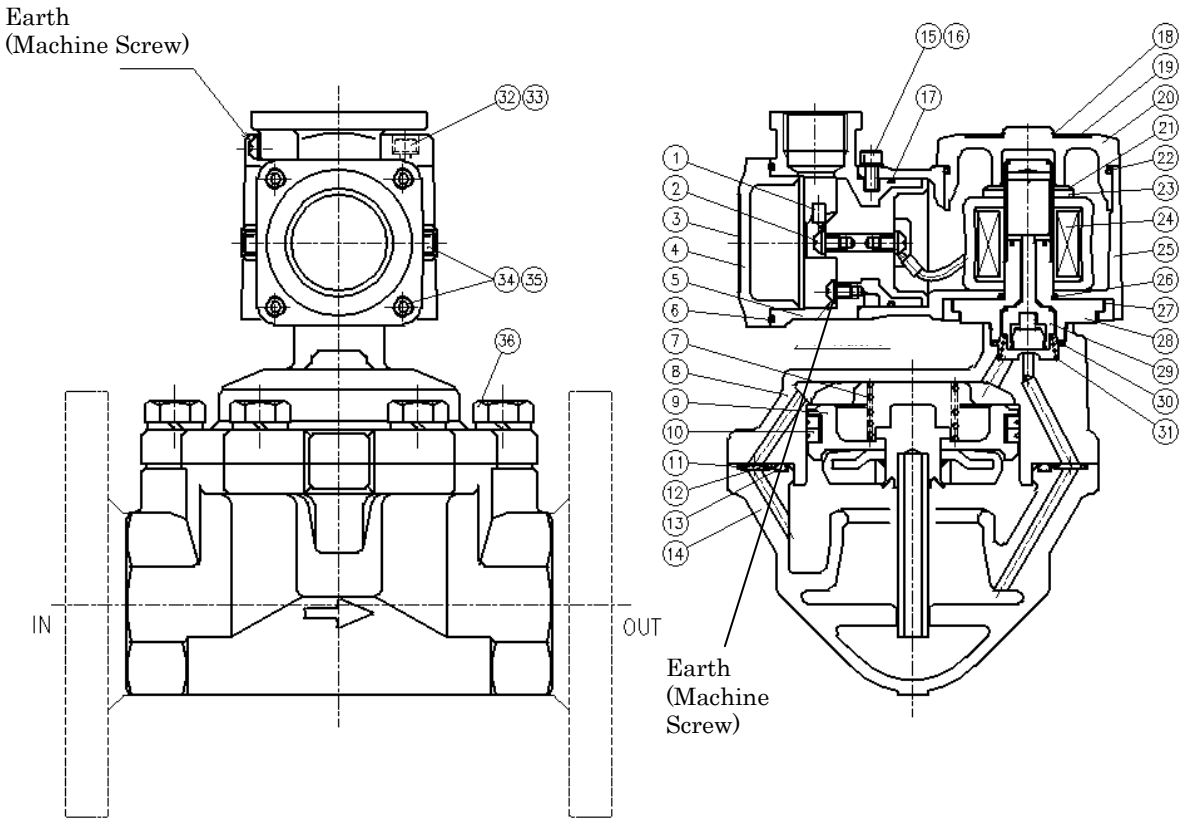
Model: AP12E2



No.	Part name	Quantity	No.	Part name	Quantity
1	Snap Ring	1	21	Valve Spring	1
2	Name Plate	1	22	Rider Ring	1
3	Coil Cap	1	23	Main Valve Assembly	1
4	O ring	1	24	O ring	1
5	Waving Washer	1	25	Gasket Guide	1
6	Spacer	1	26	Body	1
7	Coil Assembly	1	27	Hexagon Socket Bolt	1
8	Coil Case	1	28	Washer	1
9	Core Assembly	1	29	O ring	1
10	Push Rod	1	30	Crimp Style Terminal	3
11	O ring	1	31	Cross Recessed Screw with Washer	6
12	Holder	1	32	Certified Label	1
13	NO Valve Assembly	1	33	Terminal Cap	1
14	O ring	1	34	Terminal Case	1
15	Spring	1	35	O ring	1
16	Tension Ring	1	36	Hexagon Socket Bolt	6
17	Piston Ring	1	37	Washer	6
18	Gasket	2	38	Hexagon Head Bolt with Washer	4
19	Orifice Plate	1	39	Hexagon Socket Bolt	4
20	Stuffing	1	40	Washer	4

(3) AP22E4-32A･40A･50A･32F･40F･50F

Model: AP22E4

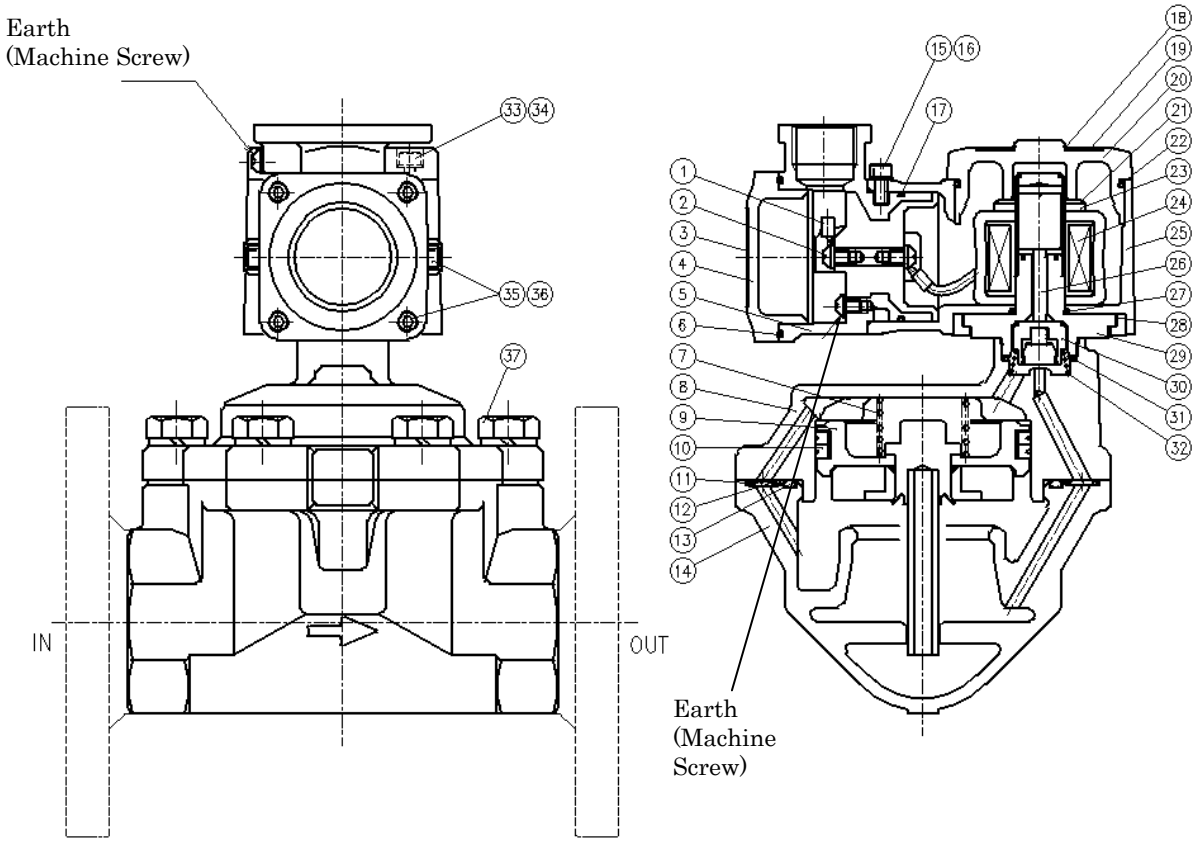


Note: Shape for flange connection options (32F･40F･50F) are shown above in the broken line.

No.	Part name	Quantity	No.	Part name	Quantity
1	Crimp Style Terminal	3	19	Name Plate	1
2	Cross Recessed Screw with Washer	6	20	Coil Cap	1
3	Certified Label	1	21	Waving Washer	1
4	Terminal Cap	1	22	O ring	1
5	Terminal Case	1	23	Spacer	1
6	O ring	1	24	Coil Assembly	1
7	Valve Spring	1	25	Coil Case	1
8	Stuffing	1	26	O ring	1
9	Main Valve Assembly	1	27	Holder	1
10	Seal Ring Set	1	28	Core Assembly	1
11	O ring	2	29	Valve Guide Assembly	1
12	Orifice Plate	1	30	O ring	1
13	O ring	1	31	Spring	1
14	Body	1	32	Hexagon Socket Bolt	4
15	Hexagon Socket Bolt	1	33	Washer	4
16	Washer	1	34	Hexagon Socket Bolt	6
17	O ring	1	35	Washer	6
18	Snap Ring	1	36	Hexagon Head Bolt with Washer	6

(4) AP22E2-32A･40A･50A･32F･40F･50F (For steam)

Model: AP22E2



Note: Shape for flange connection options (32F･40F･50F) are shown above in the broken line.

No.	Part name	Quantity	No.	Part name	Quantity
1	Crimp Style Terminal	3	20	Coil Cap	1
2	Cross Recessed Screw with Washer	6	21	Waving Washer	1
3	Certified Label	1	22	O ring	1
4	Terminal Cap	1	23	Spacer	1
5	Terminal Case	1	24	Coil Assembly	1
6	O ring	1	25	Coil Case	1
7	Valve Spring	1	26	Push Rod	1
8	Stuffing	1	27	O ring	1
9	Main Valve Assembly	1	28	Holder	1
10	Seal Ring Set	1	29	Core Assembly	1
11	O ring	2	30	NO Valve Assembly	1
12	Orifice Plate	1	31	O ring	1
13	O ring	1	32	Spring	1
14	Body	1	33	Hexagon Socket Bolt	4
15	Hexagon Socket Bolt	1	34	Washer	4
16	Washer	1	35	Hexagon Socket Bolt	6
17	O ring	1	36	Washer	6
18	Snap Ring	1	37	Hexagon Head Bolt with Washer	6
19	Name Plate	1			

10. Reference material

10. 1 Classification of explosive gases

(1) Table 4. classifies explosive gases in terms of explosion class and ignition temperature. Explosion energy becomes bigger as the table progresses below. Ignition temperature becomes lower as the table progresses to the right.

(2) Table 4. Is for reference; be sure to confirm the latest "Recommended Practices for Explosion-Protected Electrical Installations in General Industries" before actual use.

Table 4. Classification of explosive gases → Prone to ignite

Bigger explosion energy ↓

Classification by explosion class		Classification by ignition temperature				
		450℃ or more	300 to 450℃	200 to 300℃	135 to 200℃	100 to 135℃
		G1	G2	G3	G4	G5
	1	methyl acrylate acrylonitrile acetonitrile acetone ammonia carbon monoxide ethane +isopropyl chloride o-xylene m-xylene p-xylene chlorobenzene acetic acid +ethyl acetate +methyl acetate hydrogen cyanide ethyl bromide 1,1-dichloroethene 1,2-dichloroethene styrene 1,2,4-trimethylbenzene toluene propylene benzene benzotrifluoride methane	ethyl acrylate acetylacetone isooctane isobutanol isopentane ethanol epichlorohydrin +vinyl chloride +isopentyl acetate +vinyl acetate +butyl acetate +propyl acetate +pentyl acetate cyclohexanone diisopropyl ether dimethyl ether 1,2-dichloroethane thiophene tetrahydrofuran 1-butanol butane furane 2-propanol propane acetic acid anhydride methyl methacrylate methanol	+butyl chloride octane cyclohexane decane butylaldehyde 1-hexanol hexane heptane 1-pentanol pentane 2-methylhexane gasoline	acetaldehyde ethyl ether	
	2	methanol coal gas	ethylene ethylene oxide 1,3-butadiene propylene oxide	isoprene +hydrogen sulfide		
	3	hydrogen water gas	acethylene		dibutyl ether	carbon disulfide

Note 1: Do not use explosive gases marked with (+) in table 4. They are corrosive as well as explosive.

Note 2: Main material used for the explosionproof construction portion for this explosionproof solenoid valve is ADC12. NBR or FKM rubber is used for the Gasket. Do not use this valve in an atmosphere that corrodes material used for the valve.

10. 2 Classification of hazardous areas

(1) Hazardous area is an area that is likely to form hazardous atmosphere by mixture of air and explosive gases with enough volume to explode or burn. As shown in table 5., hazardous area is classified by the period and frequency the hazardous atmosphere is present.

(2) This explosionproof solenoid valve is classified in zone2.

Table 5. Classification of hazardous areas

Classification	Atmosphere	Example
Zone0	In normal operation, area in which an explosive gas-air mixture is continuously present, present for long periods, or frequently present.	1) Near the liquid level of ignitable liquids in an open container.
Zone1	In normal operation, area in which an explosive gas-air mixture is likely to occur for short periods.	1) Near an opening where explosive gas emits during normal operation to take out products, or during opening and closing of lids 2) Near an opening where explosive gas emits for short periods during inspection and maintenance. 3) Within doors or areas without ventilation where explosive gas may accumulate.
Zone2	In normal operation, area in which an explosive gas-air mixture is not likely to occur, and if it occurs it will only exist for a very short time.	1) Areas where explosive gas may leak due to reasons such as degradation of gaskets. 2) Areas where explosive gas may be emitted due to reasons such as device malfunction and abnormal reaction. 3) Areas where explosive atmosphere may form due to accumulation of explosive gas caused by ventilation malfunction. 4) Around zone1 or within doors adjacent to zone2 where explosive atmosphere intrudes in rare cases.