

Instruction Manual

Explosion-Proof Valve for Dust Collectors PDVE4 series

Be sure to read this instruction manual before using the product.

Particularly, read the safety instructions carefully.

Keep this instruction manual in a safe place so that it can be taken out and read whenever necessary.



Introduction

Thank you for choosing CKD's dust collector valve "PDVE4 Series."

Before using the product, be sure to fully understand this instruction manual and use the product correctly.

1. Intended Use and Application

This dust collector valve is a pilot-operated 2-port solenoid valve that can be used in Class 1 and 2 hazardous areas.

The type of explosion-proof structure is a pressure-resistant explosion-proof structure with explosion class 2 and ignition temperature class 4, and its symbol is d2G4.

Since this solenoid valve has an explosion-proof structure, it has obtained a certificate of conformity from the Technology Institution of Industrial Safety. The approval No. is indicated on the cap of the terminal box.

For Class 1 and Class 2 hazardous areas, refer to page 11.

2. General Precautions

- (1) This instruction manual describes the basics regarding product handling, including unpacking, installation, use, maintenance, and disposal.
- (2) The installation section of this instruction manual is intended for mechanical and electrical engineers.

Read this carefully before design and installation to ensure the safety of machinery and equipment and the proper handling of this product.

3. Safety Precautions

- (1) Warning messages are provided to prevent personal injury and property damage such as fire. Be sure to follow them.
- (2) Warning signs are classified as "Danger," "Warning," and "Caution" according to risk assessment. Since this product is a component used in machinery and equipment, all information is described with "Caution."

Example of display

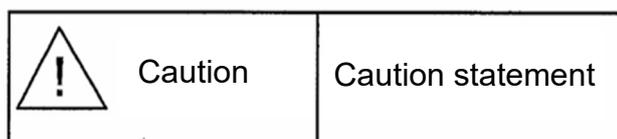


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1. Unpacking

- (1) Check that the model number of the product you ordered is the same as the model number on the product nameplate.
- (2) Check whether the rated voltage and rated frequency match.
- (3) When storing the valve, store it in the individual box to prevent foreign matter from entering the valve.
When piping, remove it from the box.

2. Installation

2.1 Installation Conditions

2.1.1 Product Protection

- (1) Outdoor Specifications
Can be used outdoors.
- (2) Water Droplets
The product is not affected even if water droplets fall directly on it.
- (3) Cold Region
If using the product in a cold region, take appropriate measures to prevent freezing.
- (4) Corrosive Environment
Do not use the product in a corrosive gas atmosphere.
If the gas processed by the dust collector contains a corrosive gas, prevent it from entering the valve.

2.1.2 Installation Position

- (1) The installation position is free.
- (2) It cannot be used in locations with vibrations of 4.3G or more; avoid installation in such locations.

2.1.3 Maintenance Space

Ensure sufficient space for safe maintenance and troubleshooting.

2.2 Piping

(1) Cleaning of Piping Materials

Before piping work, make sure that there is no foreign matter, chips, or burrs on the piping material.

Blow air at a pressure of 0.3 MPa or higher to remove foreign matter, chips, and burrs from inside the pipes.

(2) Air Filter

Use air that has passed through an air filter of 5 μm or less.

Rust inside the piping may cause malfunctions or leaks.

(3) Fluid Flow Direction

Install the piping so that the IN side of the fluid flow direction aligns with the IN port marked on the product.

(4) Sealant

When using a sealing material, do not allow it to enter the pipe and ensure there is no external leakage.

When wrapping sealing tape around a threaded part, leave 2 to 3 threads from the tip. (See Figure 2-1)

Also when using liquid sealant, apply it without excess, leaving 2 to 3 threads from the tip. (See Figure 2-2)

● Sealing tape

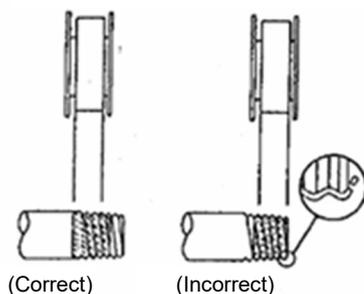


Figure 2-1

● Solid/liquid sealant

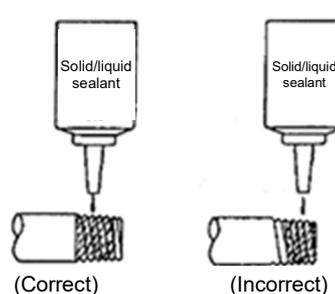


Figure 2-2

(5) Tightening Torque

Refer to the table below for tightening torque during piping.

Recommended piping tightening torque

Nominal pipe diameter	Piping tightening torque (recommended value)
Rc 1/8	7–9 [N·m]
Rc 1/4	12–14 [N·m]
Rc 3/8	22–24 [N·m]
Rc 1/2	28–30 [N·m]
Rc 3/4	31–33 [N·m]
Rc 1	36–38 [N·m]
Rc 1¼	40–42 [N·m]
Rc 1½	48–50 [N·m]
Rc 2	54–56 [N·m]

- (6) **Lubrication / Non-lubrication**
This valve can be used without lubrication. No lubricator is necessary.
- (7) **Minimum Operating Differential Pressure**
This valve requires a differential pressure of at least 0.1 MPa for operation.
If the cross-sectional area of the fluid supply port is restricted, the operation may become unstable due to insufficient differential pressure during valve operation.
The fluid supply pipe size must match the valve's connection port size.
- (8) **Air Supply**
Ensure that the air supply to the header tank is approximately 2 to 3 times the amount of air used by the dust collector.

2.3 Wiring Work

- (1) **Continuous Energization**
If energized for a long period, the coil surface of the solenoid valve will become hot.
Do not touch it directly as this may cause burns.
- (2) **Leakage Current Limit**
When operating a solenoid valve using a programmable controller, check that the leakage current of the output of the programmable controller is within the specifications in the table below.

Rated voltage	Leakage voltage
AC 100 V	6 mA or less
AC 200 V	3 mA or less
DC 24 V	1 mA or less
DC 12 V	2 mA or less

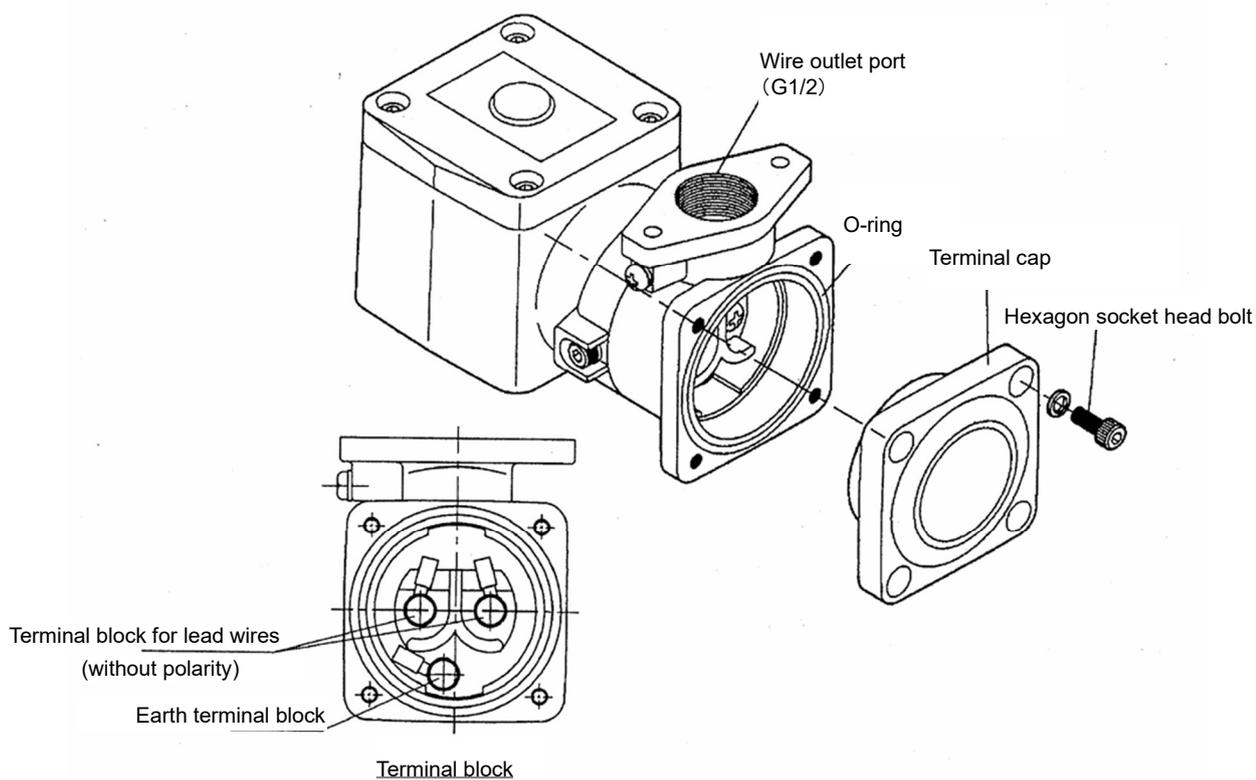
- (3) **Solenoid Valve Polarity**
This solenoid valve has no polarity of (+) or (-) even when the rated voltage is DC voltage.

2.3.1 Terminal Box Wiring Method

- (1) Use the following cabtyre cord.
Cord outer diameter: $\phi 7.5$ to $\phi 11.4$
Nominal cross-sectional area: 0.75 mm^2
- (2) Loosen the hexagon socket head bolts and remove the terminal cap.
- (3) Pass the cabtyre cord from the wire outlet port (G1/2), insert the copper wire crimp terminal into the lead wire of the cabtyre cord, and crimp the terminal.
(The crimp terminals for copper wires are provided.)
The tightening screw size of the terminal block in the terminal box is M4.
- (4) Secure the crimp terminal to the terminal block.

	<h2>Caution</h2> <ul style="list-style-type: none"> ● Do not mistakenly connect the wires to the terminal block. ● The terminal block is unmarked. — Wire connection ● Terminal block earth symbol: E — For earth terminal
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- (5) Cover the terminal block with the terminal cap and secure it using hexagon socket head bolts.



3. Check before Use (Post-Installation Check)

3.1 Appearance Check

	Caution <ul style="list-style-type: none">● Stop the liquid flow.● Discharge the fluid inside the valve (inside the header tank).● Turn off the power.
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- (1) Press the valve by hand to make sure it is securely attached to the pipe.
- (2) Check that the threaded parts such as bolts are not loose.

3.2 Leak Check

Pressurize the liquid and check for leakage at the connections.

To check for leaks, apply air pressure of 0.3 to 0.5 MPa, apply soapy water, and check for bubbles.

3.3 Electrical Check

	Caution <ul style="list-style-type: none">● Turn off the power.
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- (1) Insulation Resistance Check
Measure the insulation resistance between the metal part such as the threaded portion of the valve and the energized part of the lead wire.

100 MΩ or more with a DC 1000 V megger
- (2) Check the power supply voltage.
Voltage fluctuations should be within the range of -10% to 5% of the rated voltage.

4. Proper Use



Caution

- If energized for a long period, the coil surface of the solenoid valve will become hot. Do not touch it directly as this may cause burns.
- If the power cable catches on the worker's feet, it may cause an accident.
- If the exhaust noise of the pilot air may cause noise problems, attach a silencer to the exhaust port.

- (1) Do not place any object weighing over 1 kgf on the valve.
- (2) Voltage fluctuations should be within the range of -10% to 5% of the rated voltage.
- (3) Determine the power supply time based on the dust collection efficiency of the dust collector.
- (4) If the product has not been used for more than 7 days, perform a test run before starting work.
- (5) Periodically drain any condensate accumulated from the air filter.
- (6) If the air filter element is blackened and dirty, tar has accumulated on it. Replace the filter element regularly.
- (7) If you notice any abnormalities, refer to Section 8 "Troubleshooting."
- (8) For precautions regarding explosion-proof structure, refer to Section 5 "Explosion-Proof Structure."

5. Explosion-Proof Structure

5.1 Regarding Explosion-Proof Structure

For this explosion-proof structure, we have adopted a highly reliable pressure-resistant explosion-proof structure in accordance with the Guidelines for Explosion-Proof Electrical Equipment in Factories.

This pressure-resistant explosion-proof structure is designed to contain any explosion within the explosion-proof device itself and prevent ignition of external explosive gases in the unlikely event that, during normal operation of the solenoid or terminal connections, a short circuit generates sparks or a high temperature ignites explosive gases that have entered from outside.

The bolts required to maintain pressure resistance and explosion-proofing have a locking structure with counterbores incorporating spring washers. Loosening these bolts will result in the loss of pressure-resistant explosion-proof performance.

Particular care must be taken to ensure that these bolts are not handled by anyone other than the responsible person.

A pressure-resistant explosion-proof structure requires careful consideration of the cable entry method. This product employs a pressure-resistant stud-type entry method, ensuring the terminal box itself possesses sufficient explosion-proof performance to safely house the connection terminals.

At the same time, a conduit screw connection method is employed to connect external conductors (lead wires) to the terminal box.

The symbol "d2G4" indicating the explosion-proof structure of the terminal cap of the terminal box is clearly marked.

This symbol indicates the range of explosive gases permitted in the air for this pressure-resistant explosion-proof structure and denotes suitability for general factory use. It cannot be used in coal mines or on ships.

5.2 Classification of Explosive Gases

The table below classifies explosive gases by explosion class and ignition temperature.

The lower in the table, the greater the energy released in an explosion, and the further to the right, the lower the ignition point, making the atmosphere more severe.

Explosion class \ Ignition temperature	Classification by ignition temperature				
	450°C or below	450°C-300°C	350°C-200°C	200°C-135°C	135°C-100°C
	G1	G2	G3	G4	G5
1	Acetone Ammonia Carbon monoxide Ethane Acetic acid Ethyl acetate Toluene Propane Benzene Methanol Methane	Ethanol Isoamyl acetate Butanol Butane Acetic anhydride	Gasoline Hexane	Acetaldehyde Ethyl ether	
2	Coal gas	Ethylene Ethylene oxide	Isoprene		
3	Water gas Hydrogen	Acetylene			Carbon disulfide

This product can be used within the range of ignition temperature class G4 and explosion class 2.

The body, cover, coil cap, and terminal cap of this product are made of aluminum.

Do not use it in an atmosphere containing corrosive gases that may corrode aluminum.

5.3 Hazardous Zone Classification

A hazardous zone is defined as a place where an explosive atmosphere may be generated by a sufficient amount of explosive gas mixing with air. Depending on the duration and frequency of the presence of such a hazardous atmosphere, it is classified into Zone 0, Zone 1, or Zone 2, which determines the type of explosion-proof structure required.

- Zone 0

- A location where a hazardous atmosphere is continuously present, or may be present continuously, and where the concentration of explosive gas is at or above the lower explosive limit either continuously or for a long period of time.

Example A: The space above the liquid level in a container or tank of a flammable liquid

Example B: Inside flammable gas containers, tanks, etc.

Example C: Near the surface of a flammable liquid in an open container

- Zone 1

- A location where explosive gas may accumulate to a hazardous concentration during normal operation, such as during product withdrawal, lid opening and closing, or safety valve operation.
- A place where explosive gases may accumulate to dangerous concentrations due to repairs, maintenance, or leaks.

Example A: Near the opening of a tank truck, drum, etc. filled with flammable liquid

Example B: Near an opening where a relief valve occasionally operates to release explosive gas

Example C: Near the gas vents of tanks

- Zone 2

- A location where flammable gases or flammable liquids are normally handled but where they are kept in sealed containers or equipment, and there is a risk of leakage to hazardous concentrations only in the event of accidental damage or incorrect operation, even when handled in accordance with the Technical Guidelines of the Ministry of Labor's National Institute of Industrial Safety and the Recommended Practices for Explosion-protected Electrical Installations.
- A location where explosive gases are prevented from accumulating by a reliable mechanical ventilation system, but where, if the ventilation system fails, explosive gases may accumulate and reach dangerous concentrations.
- A location where explosive gases may rarely enter and reach dangerous concentrations near a Zone 1 location or in an adjacent room.

Example A: A location where explosive gas storage containers may be damaged by corrosion or deterioration, causing leakage.

Example B: A location where operator error may result in the release of explosive gas or abnormal reactions that may cause high temperatures and pressures, destroying the equipment and causing explosive gas leaks.

Example C: A location where explosive gas may stagnate due to a breakdown in the forced ventilation system, creating a dangerous atmosphere.

This product can be used in Zones 1 and 2 hazardous areas.

6. Disassembly and Assembly

6.1 Disassembly Procedure



Caution

- Stop the liquid flow.
- Discharge the liquid inside the valve (header tank).
- Turn off the power.

- (1) Before disassembly, be sure to turn off the power and release the fluid and pressure.
- (2) When disassembling the actuator (solenoid valve), the locking section of the coil case, which has a pressure-resistant explosion-proof structure, must be loosened. However, loosening the bolts used in the locking section will result in the loss of pressure-resistant explosion-proof performance.
Therefore, if it becomes necessary to disassemble the actuator (solenoid valve), please contact our sales representative.
- (3) Clean each part with a neutral detergent or ethyl alcohol (or pure water).
Do not use organic solvents as they may cause swelling and deterioration of rubber and plastic parts.

6.1.1 PDVE4-20A, 25A, 40A, and 40A-Rc

- (1) When removing diaphragm ④, remove the four hexagon upset bolts ②, and then diaphragm ④ and cover ③ will come off.

6.1.2 PDVE4-50A

- (1) When removing the pilot diaphragm assembly ④
When removing the hexagon upset bolts ②, the explosion-proof solenoid valve ①, pilot spring ③, and pilot diaphragm assembly ④ will come off.
- (2) When removing the main diaphragm assembly ⑨
When you remove the six hexagon bolts ⑤ and spring washers ⑥, the stuffing ⑦, the main spring ⑧, and the main diaphragm assembly ⑨ will come off.

(See 6.3 Exploded View.)

6.2 Assembly Procedure

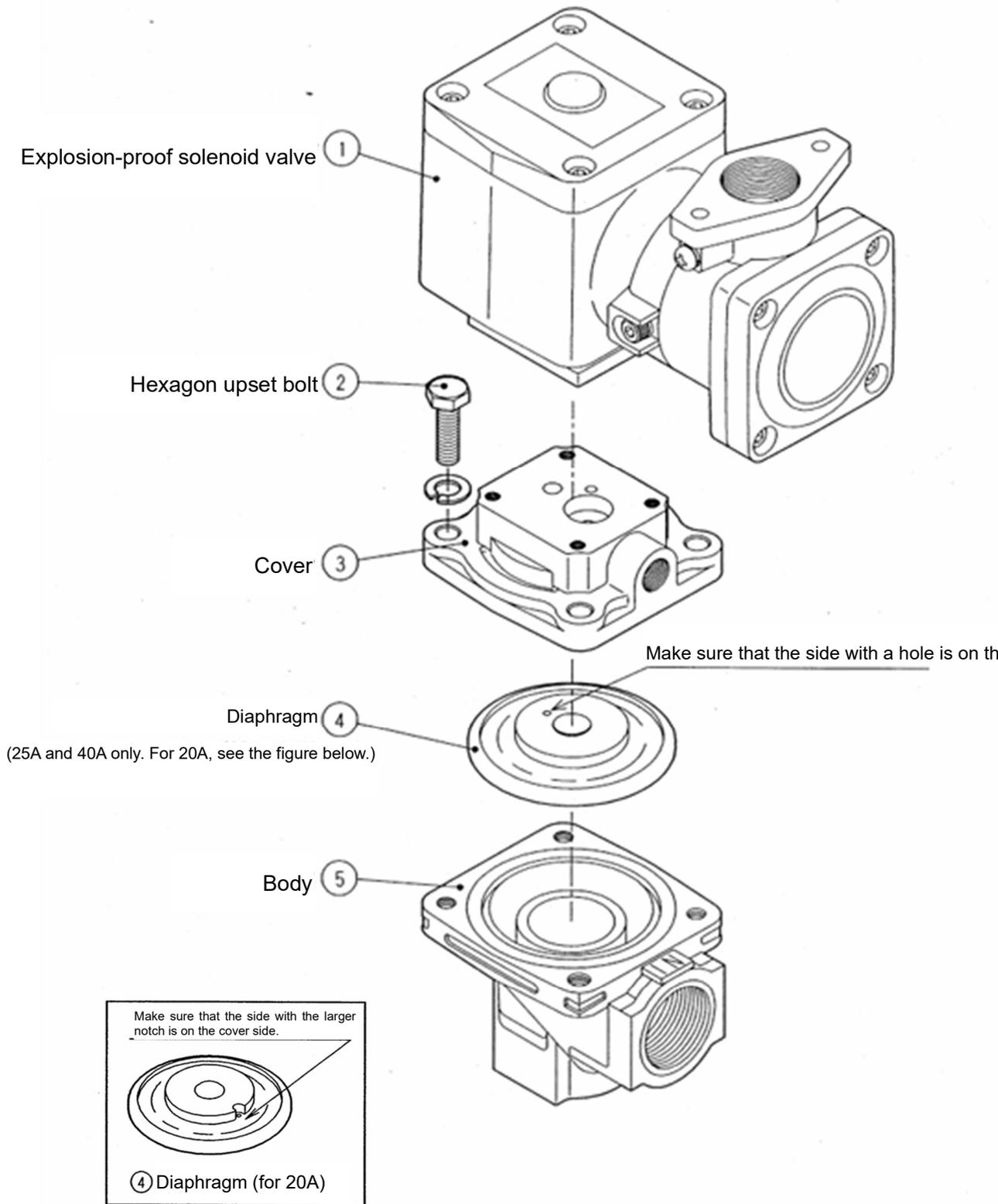
- (1) When reassembling, assemble in the reverse order of disassembly, taking care not to omit any parts.
- (2) Tighten the hexagon bolts evenly to the tightening torque shown below.
- (3) When assembling the diaphragm, make sure that the side with the larger notch is on the cover side.

	Screw size	Tightening torque
20A	M6	4.9–6.4 [N·m]
25A	M8	12.2–18.3 [N·m]
Assembly of 40A/50A main diaphragm	M10	24.5–36.8 [N·m]
Assembly of 50A pilot diaphragm.	M5	2.5–3.1 [N·m]

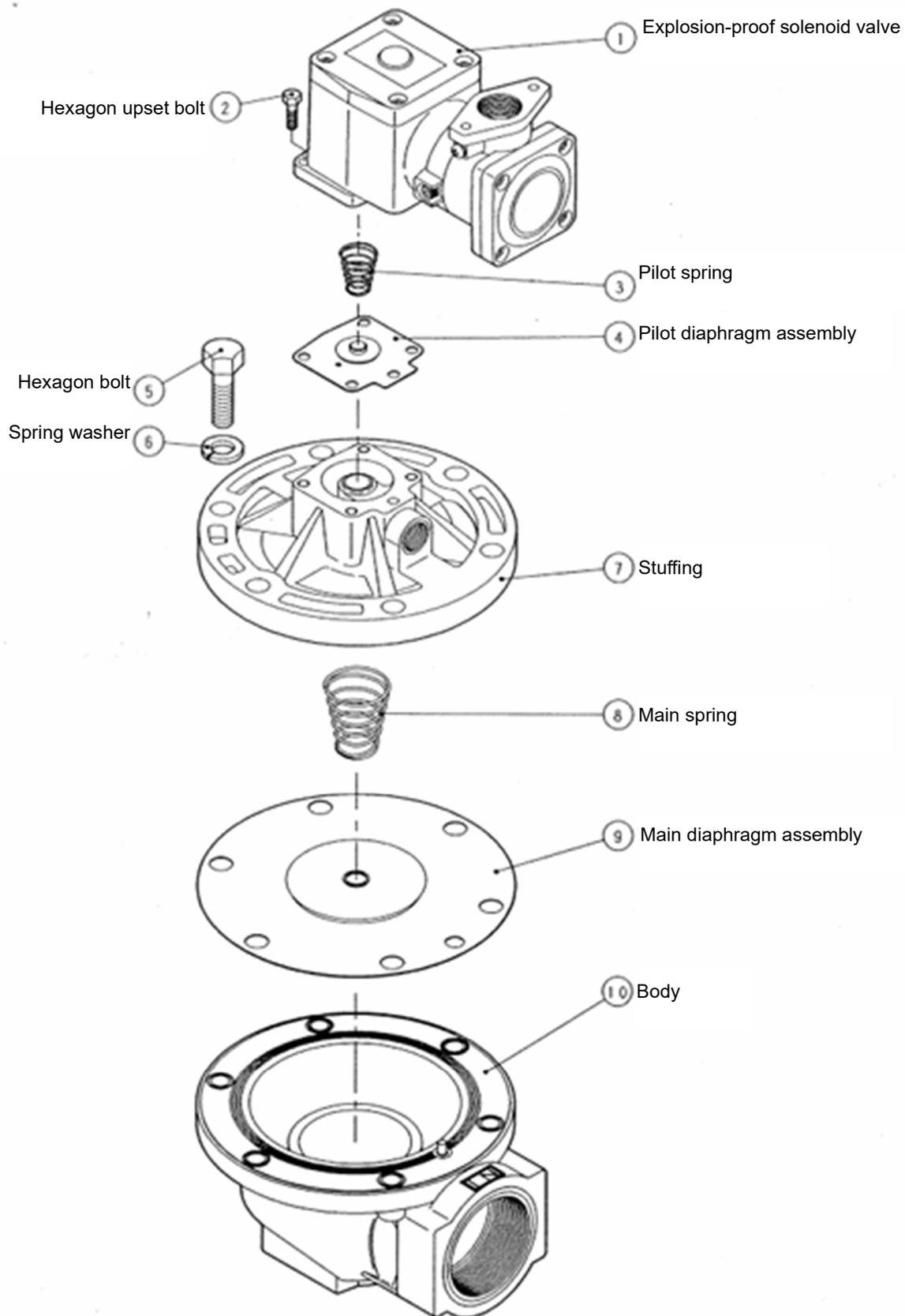
(See 6.3 Exploded View.)

6.3 Exploded View

6.3.1 PDVE4-20A, 25A, 40A, and 40A-Rc



6.3.2 PDVE4-50A



7. Maintenance

7.1 Maintenance and Inspection

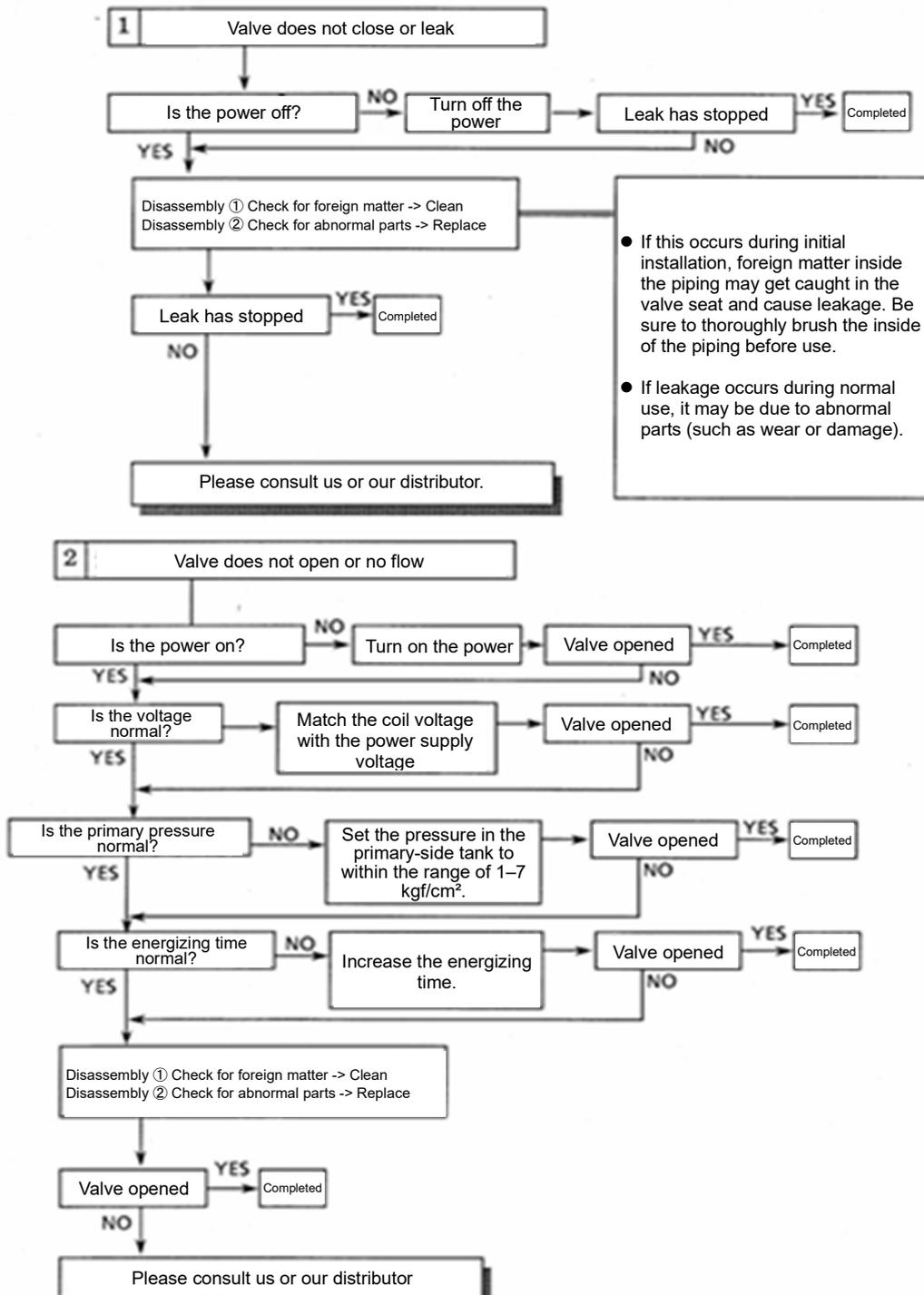
- (1) To ensure optimal operation of the product, perform a periodic inspection about once every six months.
- (2) Refer to Section 3 “Check before Use (Post-Installation Check)” for inspection details.

7.2 Maintenance Parts

- (1) Diaphragm
Replace the diaphragm if any abnormalities such as leakage, delayed operation, or failure to open are noticed during use.
As a guideline, the PDVE4-20A, 25A, 40A, and 40A-Rc should be replaced after 1 million operations, and the PDVE4-50A should be replaced after 500,000 operations.
- (2) Actuator Assembly
Replace the actuator assembly when an electrical failure or abnormality is detected.
As a guideline, it should be replaced after 5 million operations.
When disassembling the actuator (solenoid valve), the lock on the coil case, which has a pressure-resistant and explosion-proof structure, must be loosened.
Therefore, if it becomes necessary to disassemble the actuator (solenoid valve) for maintenance or inspection, please contact our sales representative.

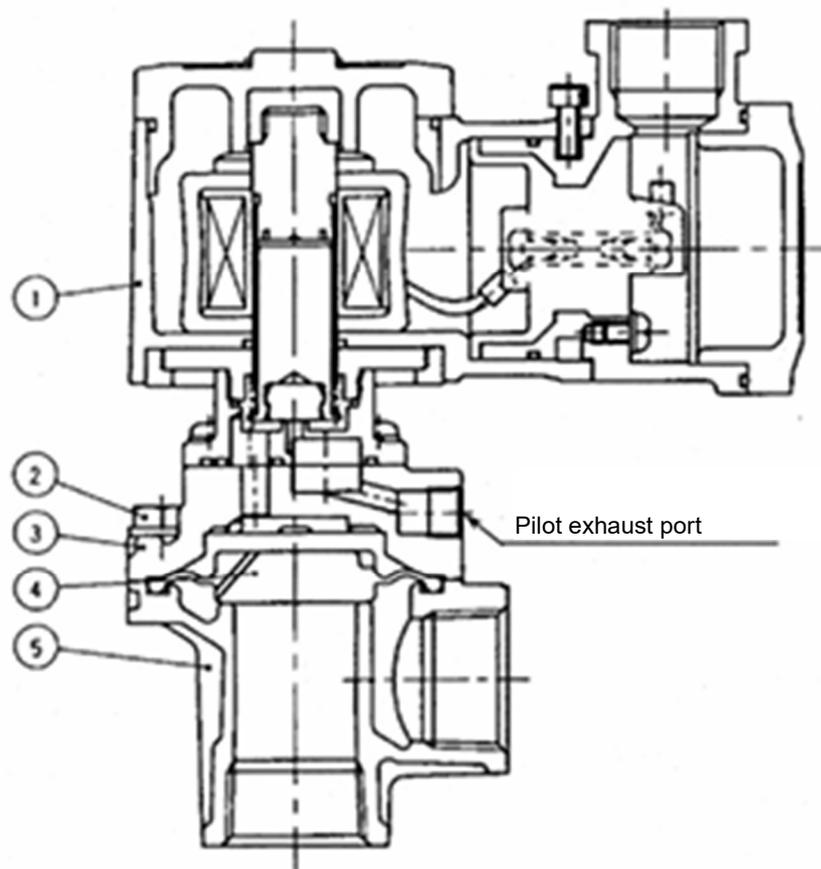
8. Troubleshooting

If the valve does not operate as intended, inspect it according to the flowchart below.



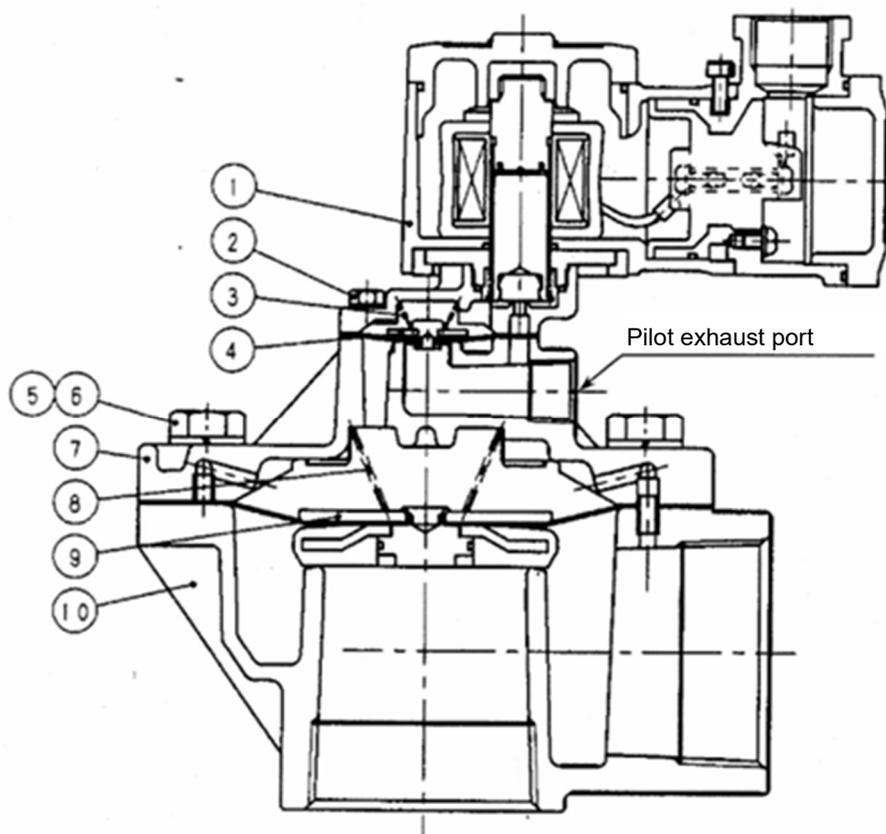
9. Internal Structure Diagram

9.1 PDVE4-20A, 25A, 40A, and 40A-Rc



No.	Part Name	Quantity
1	Explosion-proof solenoid valve	1
2	Hexagon upset bolt	4
3	Cover	1
4	Diaphragm	1
5	Body	1

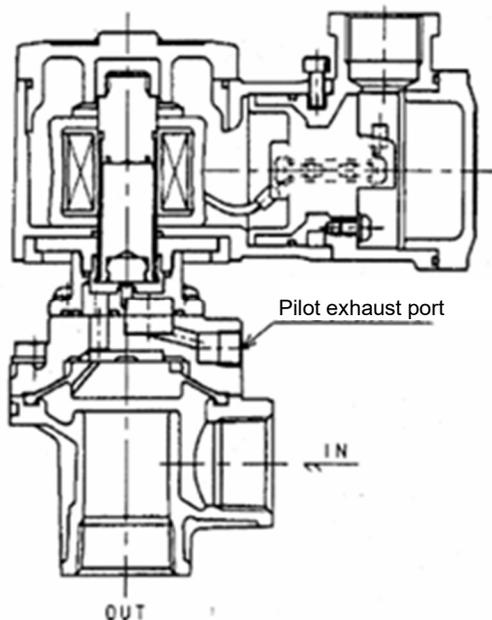
9.2 PDVE4-50A



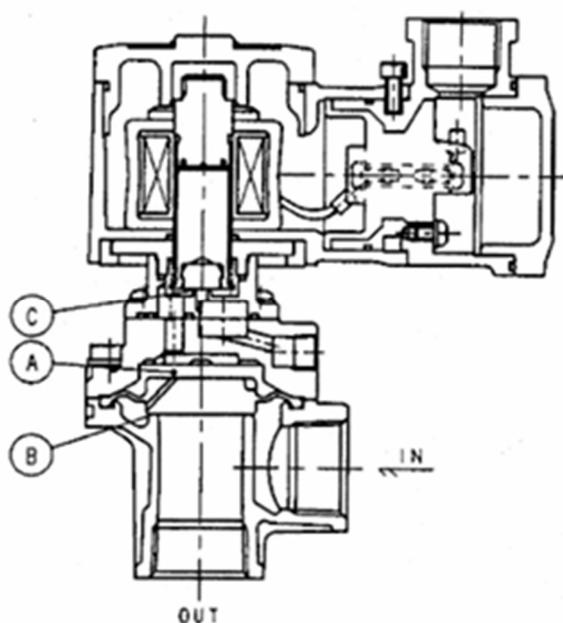
No.	Part Name	Quantity
1	Explosion-proof solenoid valve	1
2	Hexagon upset bolt	4
3	Pilot spring	1
4	Pilot diaphragm assembly	1
5	Hexagon bolt	6
6	Spring washer	6
7	Stuffing	1
8	Main spring	1
9	Main diaphragm assembly	1
10	Body	1

10. Operation description

10.1 PDVE4-20A, 25A, 40A, and 40A-Rc

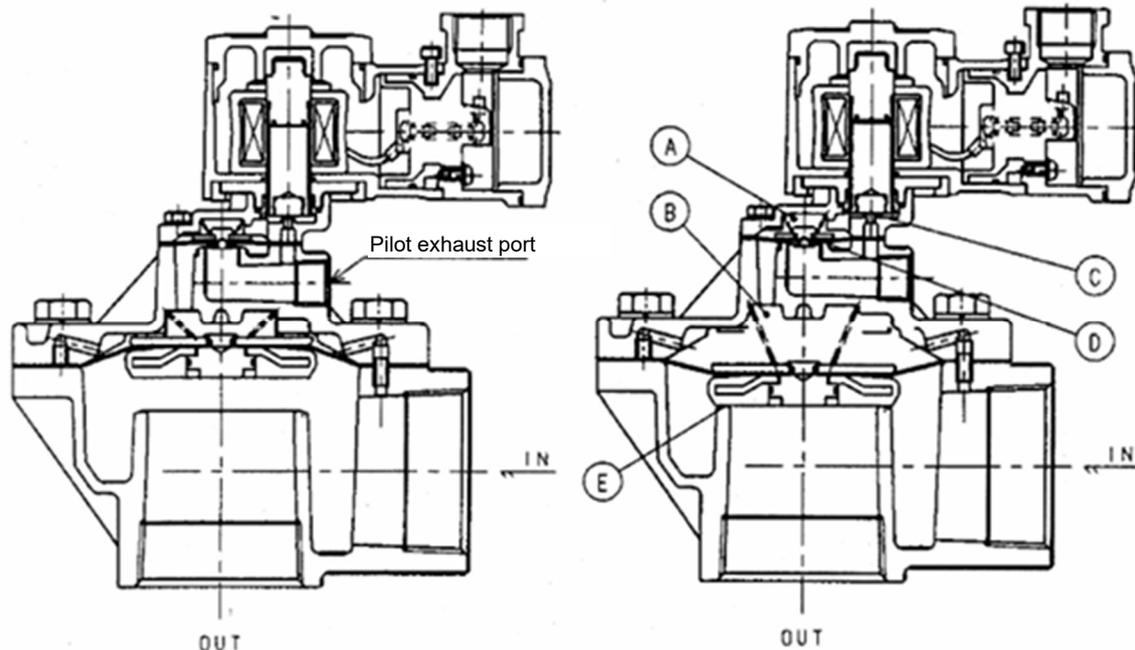


When the coil assembly is energized, the plunger assembly rises and the fluid in the pilot chamber (A) flows through the pilot exhaust port into the atmosphere. The pressure in the pilot chamber (A) becomes lower than the pressure on the IN side, and due to this differential pressure, the diaphragm lifts, allowing the fluid to flow from IN to OUT.



When power to the coil assembly is cut off, the plunger assembly descends under the force of the plunger spring, closing the valve seat and replenishing fluid into the pilot chamber (A). When the pressure becomes the same as the IN side, the diaphragm drops, closing the valve seat (B) and stopping the flow of fluid.

10.2 PDVE4-50A



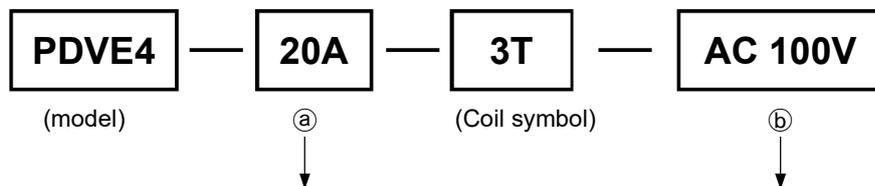
When the coil assembly is energized, the plunger assembly rises, and the fluid in the pilot diaphragm chamber ① flows through the pilot exhaust port to the atmosphere. At this moment, the pressure inside the pilot diaphragm chamber ① becomes lower than the pressure inside the main diaphragm chamber ②. This pressure difference causes the pilot diaphragm assembly to float up, causing the fluid inside the main diaphragm chamber ② to flow through the pilot exhaust port to the atmosphere. Next, the pressure inside the main diaphragm chamber ② becomes lower than that on the IN side. This pressure difference lifts the main diaphragm assembly, and the fluid flows from IN to OUT.

When the coil assembly is de-energized, the plunger assembly descends under the force of the plunger spring, closing the valve seat ④. Fluid is supplied to the pilot diaphragm chamber ①, causing the pilot diaphragm assembly to descend and close the pilot valve seat ③. Next, fluid is supplied to the main pilot chamber ②, causing the main diaphragm assembly to descend, which closes the main valve seat ⑤ and stops the fluid.

11. Product Specifications

11.1 Model Designation

Model designation method



Ⓐ Connection port size	
20A	Rc 3/4
25A	Rc 1
40A	IN Rc1½
	OUT Outer diameter φ48 Length 52
40A-Rc	Rc1½
50A	Rc 2

Ⓑ Voltage
AC 100V
AC 200V

Note 1: AC100V can be used at AC100V 50/60Hz and AC110V 60Hz. AC200V can be used at AC200V 50/60Hz and AC220V 60Hz.

Note 2: For other voltages, please contact us.

11.2 Product Specifications

Model number	PDVE4-20A-3T	PDVE4-25A-3T	PDVE4-40A-3T	PDVE4-40A-Rc-3T	PDVE4-50A-3T
Valve structure	Explosion-proof pilot-operated 2-port valve (open when energized)				
Fluid	Air (must not contain corrosive gases)				
Withstand pressure MPa {Kgf/cm ² }	2{20}			1.5{15}	
Operating pressure range MPa {Kgf/cm ² }	0.1 to 0.7 {1 to 7}				
Fluid temperature °C	-10 to 60 (without freezing)				
Ambient temperature °C	-10 to 50 (Class B coil)				
Atmosphere	Outdoors; explosive gases (explosion classes 1–2, ignition temperatures G1–G4)				
Orifice (Cv value) mm	23(11)	28(18)	37(45)		53(62)
Connection port size	Rc 3/4	Rc1	IN Rc1½ OUT Outside diameter φ48 Length 52	Rc½	Rc2
Mounting orientation	Free				
Pilot exhaust port	Rc1/8			Rc3/8	
Voltage Specifications	Rated voltage	AC100V, AC200V			
	Allowable voltage fluctuation	-10 to +5%			
	Apparent power VA	Continuous operation: 18/15 (50/60 Hz) Startup: 29/24 (50/60 Hz)			
	Power consumption W	8/7 (50/60Hz)			
	Insulation class	Class B			