CKD

SM-50570-A

# Instruction Manual

## PDVE4 Series

- Prior to using the Product, it is absolutely necessary to read this INSTRUCTION MANUAL, especially the safety precaution.
- For quick reference whenever necessary, keep this INSTRUCTION MANUAL in a good manner.

CKD Corporation

# Introduction

Thank you for choosing the CKD's Pulse Jet Valve PD3 or PDV3.

To avoid the abuse of the valves, thoroughly read this instruction manual before using them.

## 1.Purpose of the valves

This dust collector valve is pilot operated 2-port solenoid valve used under such hazadous places as classified as class 1 and class 2 locations.

This kind of explosion proof construction is considered as a pressure tight explosion proof construction of greade 2 explosion and degree 4 ignition. The symbol for this type is d2g4.

This valve has a certificate from Technical Institution of Industrial Safety, Japan for its pressure tight explosion proof construction.

The approval No. is marked on the cap of terminal box.

Note: Refer to page 10 for class 1 and class 2 locations.

## 2.Scope of application

Dust collector

## 3.General precaution

(1) This instruction manual describes the basic matters regarding the handling of the product, unpackaging, installation, use, maintenance, and withdrawal.

(2) The instructions for installation given by this manual assume that they will be read by specialist engineers, i.e.mechanics and electricians.

Thoroughly read this manual before starting the design and installation in order to assure the safety of the machine or instrument, and to properly handle the product.

## 4.Safety precautions

(1) To avoid personal injury,fire,and damages to the facilities,the warning labels attached to the product shall be strictly observed.

(2) Each warning label has a keyword,"Danger","Warning"or"Caution"depending on the rating of possible risk.As these valves are used as components of a machine or instrument,all the warning labels are shown with the keywords "warning"and"caution".

## Example:

| | |
|---|---|
|  Caution | A sentence that describes possible hazard |

# Table of Contents

# 1. Unpackaging

(1) Check that the model No. shown on the nameplate of the product matches with that you ordered.

(2) Check that the rated voltage and frequency meet your specification.

(3) Check that the product has no external damages.

(4) When storing the product, attach a seal plug to prevent foreign matter from entering the valve. Remove the seal plug when piping the valve.

# 2. Installation

## 2.1 Installation conditions

| | |
|---|---|
| ⚠ Caution | This valve shall not be used as an emergency shut-off valve.<br>This valve is not designed as a safety valve, such as emergency shut-off valve.<br>Always take appropriate measures to ensure the safety of the customer's system. |

### 2.1.1 Protection of the product

(1) Outdoor use

This valve can be used outdoors.

(2) Water Drips

This valve can be used even when it comes in touch with water drips.

(3) Use in a cold district

When using the valve in a cold district, an adequate provision is required to prevent the freezing of the valve.

(4) Corrosive environment

Do not use in the corrosive gas atmosphere.

If the treatment gas of the dust collector contains corrosive gas, care should be taken that the corrosive gas will not flow into valves.

### 2.1.2 Mounting Style

(1) The mounting position of the valve is not specified.

(2) The valve cannot be used in a place where it will be exposed to the vibration larger than 4.3G.

### 2.1.3 Space for maintenance

An adequate space shall be provided around the valve to assure the safety during the maintenace/troubleshooting work.

## 2.2 Piping work

(1) Cleaning the pipes

Before piping the valve, check that the pipes are free from foreign matter, cutting chips and burrs. If the pipes need to clean, remove the foreign matter, cutting chips and/or burrs inside the pipes using compressed air with a pressure of 0.3 MPa or more.

(2) Air filter

Install an air filter with a 5 micrometer or finer mesh before the valve. The rusting of the inside of the pipes may lead to a malfunction and/or leakage.

(3) Flow direction

Match the flow direction of the fluid with "IN" and "OUT" of the solenoid valve.

(4) Sealer

The sealer shall be used with great care to prevent it from entering the pipes or leaking out. When taping a threaded portion, two or three threads at the end of the portion shall be exposed (see Figure 2.2). When using Gel sealer, take care not to apply too much sealer. Similarly to the case of taping, two or three threads at the end of the threaded portion shall be exposed. Do not apply the sealer to the female screw of the valve.

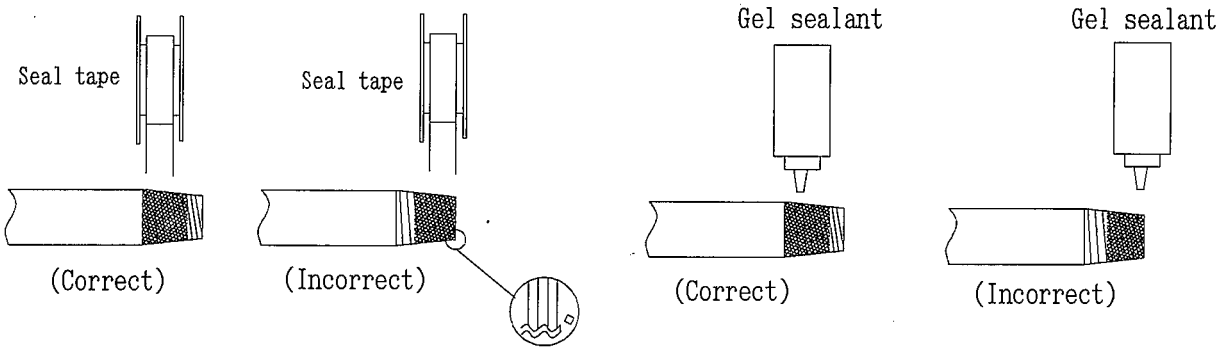



*Fig.2.2*

(5) Torques required for tightening pipes

The torques required for tightening pipes are shown in table 2.2 for reference.

Table 2.2 Recommended valves of the torques for tightening pipes.

| Nominal size of pipe | | Torque for tightening (recommended) |
|---|---|---|
| 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 | $1\ ^1/_4$ | 40 - 42[N · m] |
| Rc | $1\ ^1/_2$ | 48 - 50[N · m] |
| Rc | 2 | 54 - 56[N · m] |

(6) Lubricated or unlubricated operation

This valve requires no lubrication. Never lubricate the valve.

(7) Minimum differential pressure

A differential pressure of 0. 1 MPa or more is required for the valve to operate. If the sectional area of the pipe at the fluid supply port is too small, the valve operation may become instable due to the insufficient differential pressure. For the fluid supply port, use a pipe of the size that fits the inside diameter of the connector port of the valve.

(8) Volume of Air Supply

Make sure that the air volume of the header tank is 2-3 times the air used in the dust collector.

## 2.3Wiring work

| | |
|---|---|
| ⚠ **Caution** | Incorrect wiring of the power supply lines may cause a short-circuit trouble. Always carry out the wiring properly. If the valve is repeatedly energized and de-energized for an extended period of time, the coil surface of the solenoid valve becomes hot, causing burn hazard. Do not touch the valve surface directly during operation. |

(1) Continuous power supply

Long continuous electric current will raise surface temperature of coils of solenoid valves. Be careful not to touch directly for rear of a burn.

(2) Permissible limit of leakage current

When operating the solenoid valve using a programmable controller or equivalent, ensure that the leakage current from the output line of the programmable controller will not exceed the following level.

| Rated voltage | AC100-110V | AC200-220V | DC12V | DC24V |
|---|---|---|---|---|
| Permissible limit of leakage current | 6mA | 3mA | 2mA | 1mA |

CKD's step controller OMC-2 series meets the above specifications.

(3) Polarity of the solenoid valve

Solenoid valve does not have positive and negative terminals although it is designed for use with a direct current.

(4) The voltage variation shall be within –10～5% of the rated voltage.

## 2.3.1 Electric connection of terminal box

(1) For the cabtyre cord, used Nominal Sectional area 0.75 $mm^2$ and outer diameter 7.5-11.4mm.

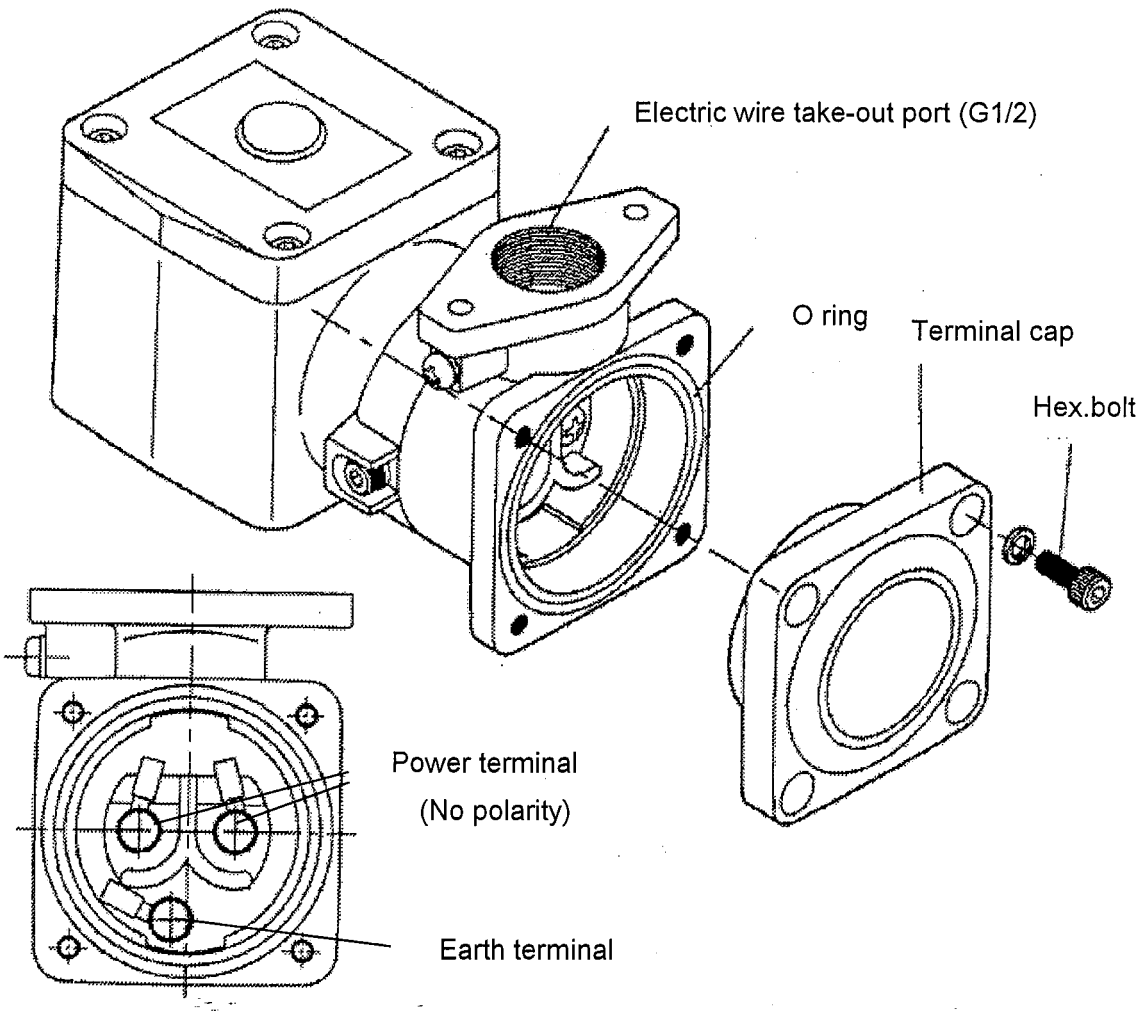
(2) Remove four hex.bolts and the terminal cap.

(3) Pass the cabtyre cord to the terminal box from the electric wire take-out port.Pass a crimped terminal specially designed for copper leads (attached) through the lead of the cabtyre cord and crimp the terminal.

(4) Tighten the free terminal screw to fix the crimped terminal.

| | |
|---|---|
| ⚠ Caution | Connect the earth line to the protective earth terminal marked"E".<br>Other two terminals are power terminal for solenoid. |

(5) Install the O ring and terminal cap and fix with four hex.bolts.



# 3. Pre-operation (post-installation) check

## 3.1 Appearance check

| | |
|---|---|
|  Caution | Shut off the fluid flow.<br>Exhaust the fluid remaining in the valve.<br>Turn off the power. |

(1) Check that the piping is secured firmly.

(2) Check that the screw parts securing the valve are not loose.

## 3.2 Check for leakage

Compress the fluid to check for leakage at pipe joints. It is recommended to check for leakage by supplying compressed air having a pressure of 0.3 - 0.5MPa with soapy water applied to the joints. Air bubbles will be found If a joint is faulty.

## 3.3 Electrical check

| | |
|---|---|
|  Caution | Turn off the power. |

(1) Check the dielectric resistance.

Measure the dielectric resistance using a 1,000 VDC megaohmmeter between a metallic part such as screw fixing the valve and the active part of the lead. The measured dielectric resistance shall be 100 Mohms or more.

(2) Check the supply voltage.

The voltage variation shall be within –10～5% of the rated voltage.

# 4. Instructions for proper use

| | |
|---|---|
| ⚠ Caution | When the solenoid valve is continuously operated, it will be heated. Do not touch it by hand while it is energized.If there is a possibility that the operator may trip on a power cable, it may lead to an accident. Protect the power cable using a pressure tight explosion proof conduit or equivalent. Install a silencer at the exhaust port of the the valve to reduce the noise to be given to the personnel working around the machine. |

(1) Do not put any object that weighs 9.8N or more on the valve.

(2) The voltage variation shall be within –10-5% of the rated voltage.

(3) The time for applying power shall be determined according to the required specification of the dust collector.

(4) If not used for 7 days or more, perform a test run before starting operation.

(5) Periodically empty the drain in the air filter.

(6) Filter element of the air filter might be stained with tar adhesion so that the filter element should be exchanged at regular intervals.

(7) If any abnormal condition is found, see section 7 "Troubleshooting".

(8)For safety use,check the cautions on use for explosion proof construction, see section 5 "Types of explosion proof construction".

# 5.Types of explosion proof construction

## 5.1 Pressure tight explosion proof

This valve type has been designed, incorporating pressure tight explosion proof construction, according to the factory electrical facility explosion proof guid.

When an explosion occurs as a result of sparks from a short circuit or due to temperature increase as a result of a fire, this valve is designed to prevent ignition of any surrounding explosive gas.

Hexagon socket head cap screws are used where necessary to maintain pressure tight explosion proof characteristic. Loosening these cap screws will lose the pressure tight explosion proof characteristic. Unauthorised personal shuld not loosen these cap screws as incorrect tightening will effect the explosion proof characteristic of the valve.

This valve type incorporates pressure tight stand type drawing method which is important in pressure and explosion proof construction. The connection terminal is installed inside the terminal box which has explosion proof characteristics. A condut screw connection is used for external lead wire to terminal box.

The symbol d2g4 denotes explosion proof construction and is marked on the cap of the terminal box. This shows the level of explosive gases allowable in the air, and factory use.

It is not suitable for use in collieries or on vessels.

## 5.2 Classification of explosive gases

The table classifies the grade of explosion and degree of ignition of explosive gas.

| Ignition degree / Explosion class | Classification by ignition temperature | | | | |
|---|---|---|---|---|---|
| | 450 or less | 450～350°C | 350～200°C | 200～135°C | 135～100°C |
| | G1 | G2 | G3 | G4 | G5 |
| 1 | Acetone<br>Ammonia<br>Carbon monoxide<br>Etane<br>Triene<br>Propane<br>Benzene<br>Methanol<br>Methane | Ethanol<br>Butan<br>Acetic anhyride | Hexane<br>Gasoline | Acetaldehyde Ethyl ether | |
| 2 | Coal gas | Ethylene<br>Ethylene oxide | Isopulene | | |
| 3 | Hydrogen<br>Water gas | Acetylene | | | Carbon disulfide |

This valve can be used in the range of Ignition degree 4 and Explosion class 2.
Do not use the valve under the corrosine gas which may corrode aluminum, because Body, Cover, Coil cap and Terminal cap are made of aluminum.

## 5.3 Classification of hazardous places

A hazardous place exists when sufficient explosive gas is present and mixed with air to from a potentially explosive atomosphere. These are further classified into Class 0, Class 1 and Class 2 locations.
The type of explosion proof construction required is determined by the period and frequency of the hazard.

●Class 0 location

A location where hazardous atomosphere exists or could exist and where the level of explosive gas remains above the safe working limit continually or for a long period of time.

Ex A. Vessel of combustible fluid and/or space above the fluid surface inside a closed vesseel.
Ex B. Inside a vesel of inflammable gas.
Ex C. The space in a vessel without a cover above the combustible fluid.

●Class 1 location

A location where explosive gas could accumulate and reach a hazardous level during normal operation such as opening/closing of a lid or during safety valve operations.
A location where explosive gas ofen accumulates and could reach a hazardous level during repair work or through leakage.

Ex A. Opening section of fuel tank of truck when filling with combustible fluid.
Ex B. Opening section of relief valve when operating to exhaust explosive gases.
Ex C. Opening section of filler of gas tank

●Class 2 location

A location where explosive gas or ignitable liquid could leak to be a dangerous level, due to breakage of sealed vessel and facility by anaaccident only when handled by mistake, against by the labour minstry industrial safety laboratory engineering guide and electrical facility explosion proof guide.
A location where a reliable mechanical ventilator is installed to prevent accumulation of explosive gas. In the case of faulty operation of ventilator, explosive gas could reach a dangerous level.
Around class 1 location or neibouring indoors where explosive gas could enter to reach a dangerous level.

Ex A. A location where explosive gas could escape from a vessel due to corrosion or deterioration.
Ex B. A location where explosive gas could escape due to operator mistake or due to excessive temperture or pressure.
Ex C. A location where explosive gas could remain and reach dangerous level due to ventilator malfunction.

These valves can be used in class 1 & 2 locations.

# 6. Disassembly and assembly

| | |
|---|---|
| ⚠ Caution | Turn off the power. Shut-off the fluid flow. Exhaust the fluid from the valve (in header tank) and confirm that the pressure is 0 MPa. Hexagon socket head cap screws are used where necessary to maintain pressure tight explosion proof characteristic. Loosening these cap screws will lose the pressure tight explosion proof characteristic. |

## 6.1 Disassembly procedure

(1) Always turn off the power, and exhaust the fluid and pressure before disassembling the valve.

(2)Do not disassemble the coil assembly bacause of lose the pressure tight explosion proof characteristic. When the coil assembly must be disassembled,contact our company's office.

(3)Clean each part with neutral detergent, ethyl alcohol (demineralized water). Note, that the coil ssembly cannot be cleaned, because the recharge section must be protected. Clean it such as by wiping off the foreign matters inside. Don't use any organic solvent either, because the rubber and resin products could be swollen/deteriorated by it.

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

To remove the diaphragm ④, remove four hex. bolts ②.

(See 6.3 Disassembly )

### 6.1.2 PDVE4-50A

(1)To remove the pilot diaphragm assembly ④,remove four hex.bolts ②.

(2)To remove the main diaphragm assembly ⑨,remobe six hex.bolts ⑤.

(See 6.3 Disassembly )

## 6.2 Assembly procedure

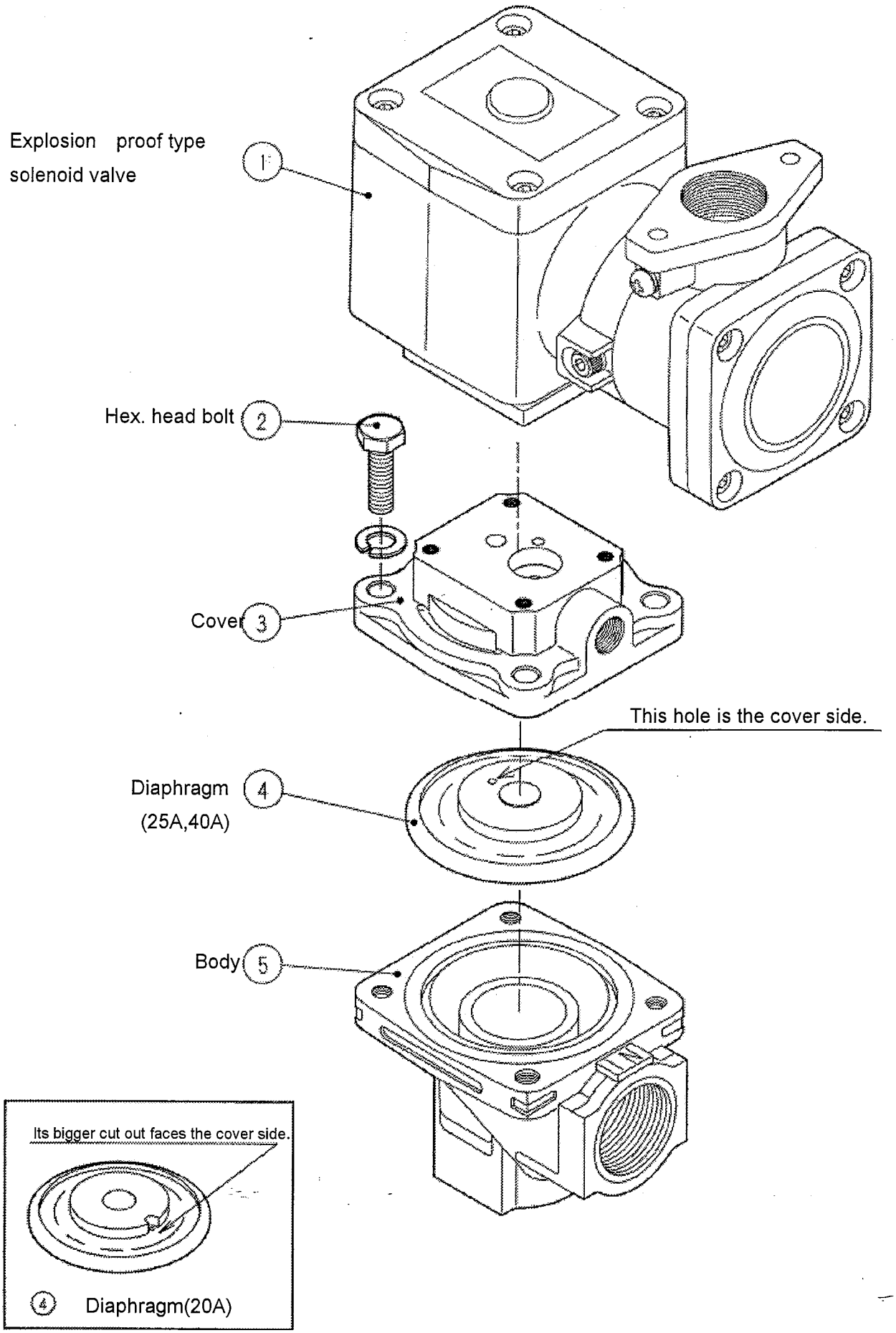
(1) When re-assembling, be sure to assemble the parts in the reverse order of the procedure for disassembly.

(2) Tighten the hex. bolts to the torque shown below.

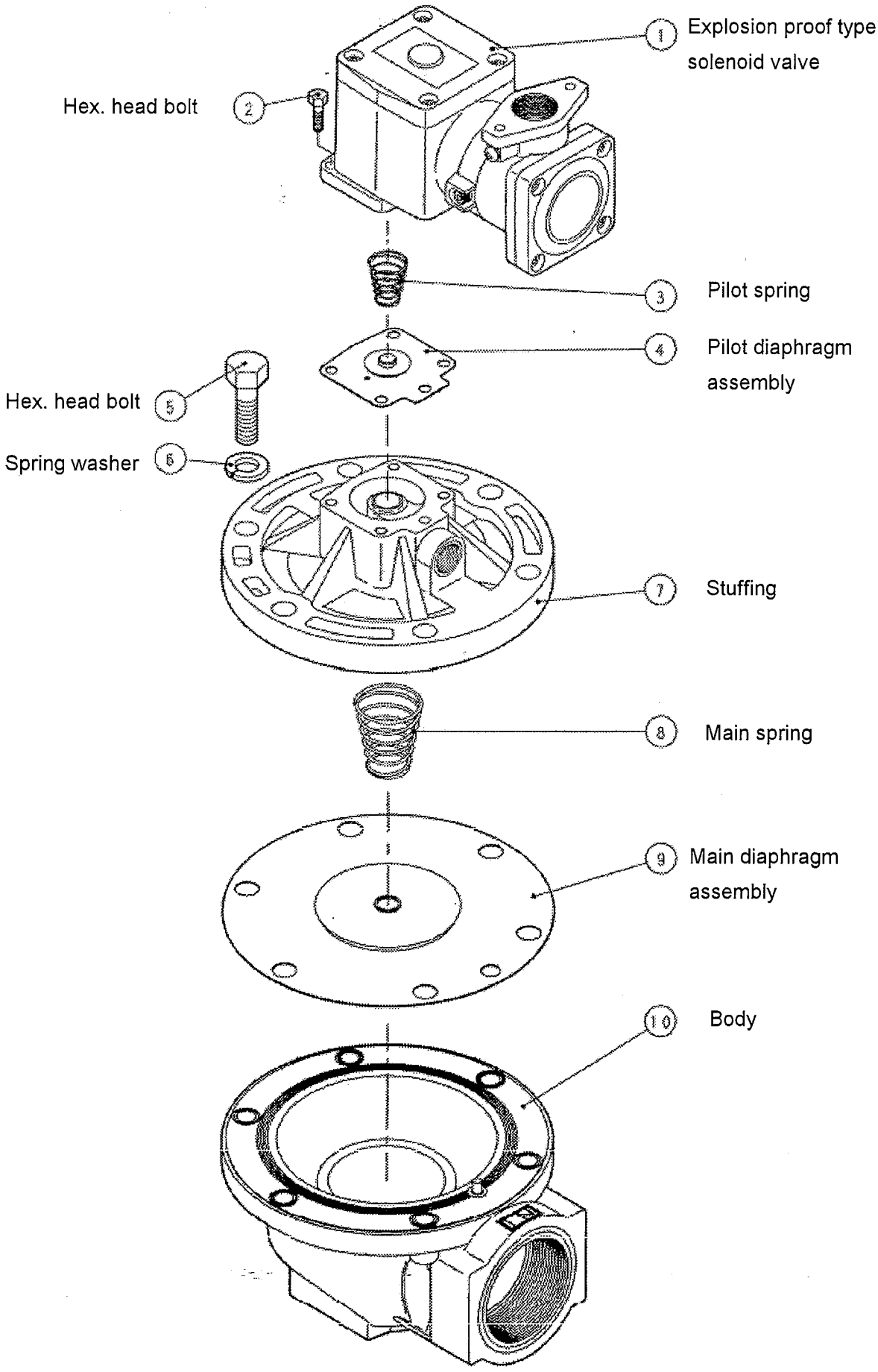
| | Screw size | Tightening torque |
|---|---|---|
| 20A | M6 | 4.9~6.4 [N · m] |
| 25A | M8 | 12.2~18.3 [N · m] |
| 40A,50A(Main diaphragm) | M10 | 24.5~36.8 [N · m] |
| 50A(Pilot diaphragm) | M5 | 2.5~3.1 [N · m] |

# 6.3 Disassembly

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



### 6.3.2 PDVE4-50A



# 7. Maintenance

## 7.1 Maintenance and inspection

(1) To use the product at its optional operating level, inspect it twice a year unless otherwise specified.

(2) For details of inspection, see section 3 "Pre-operation check".

## 7.2 Service parts

(1) Diaphragm assembly

**PDVE4-20A,25A,40A,40-Rc**

If any leak,operation delay or inability to open is detected in operation,replace the diaphragm. For an earmark, 1 million of operations indicates the time for replacement.

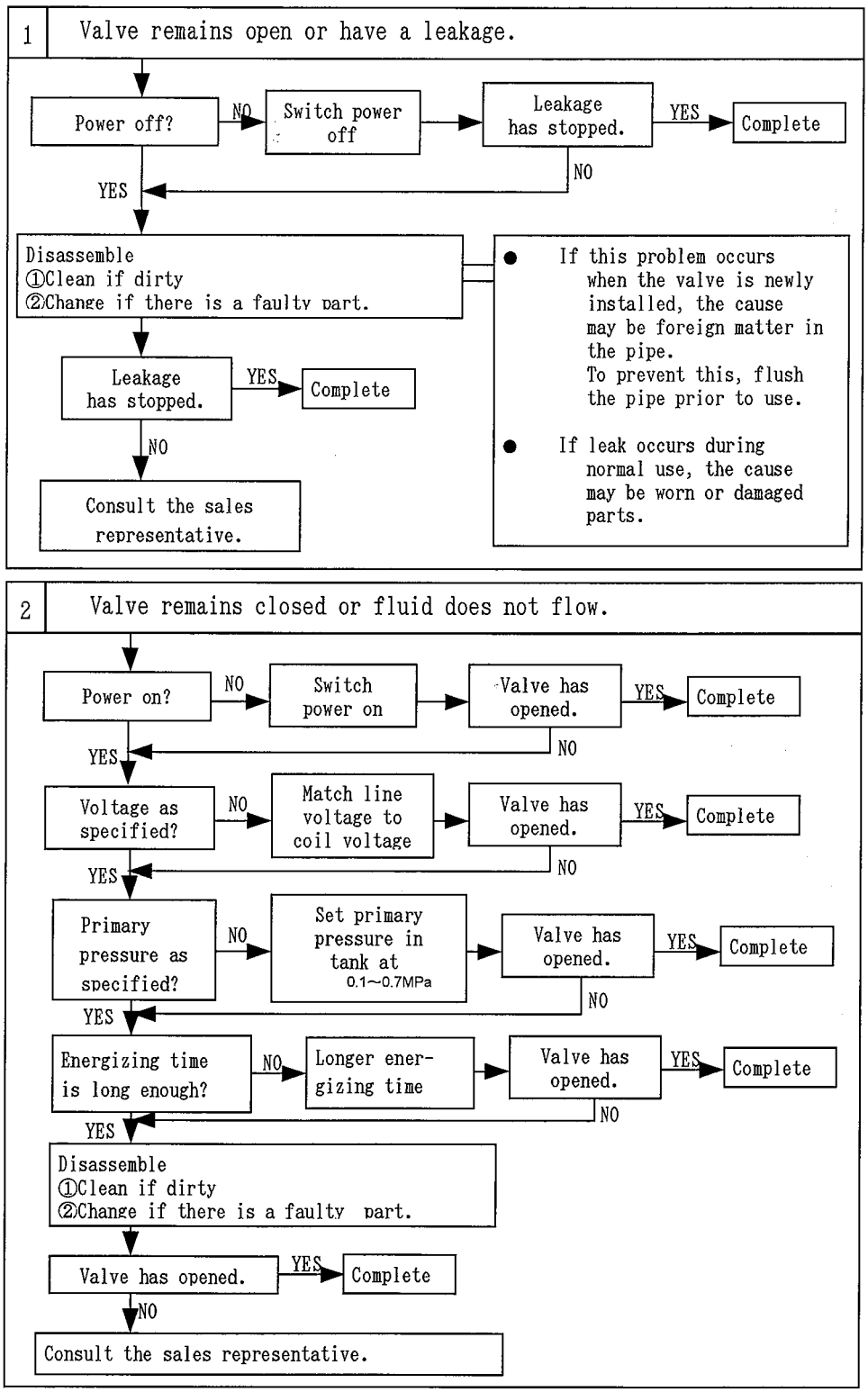
**PDVE4-50A**

If any leak,operation delay or inability to open is detected in operation,replace the diaphragm assembly. For an earmark, 500 thousant of operations indicates the time for replacement.

(2) Actuatoar assembly

If any electrical failure or fault is detected,replace the actuator. For an earmark, 5 million of operations indicates the time for replacement.

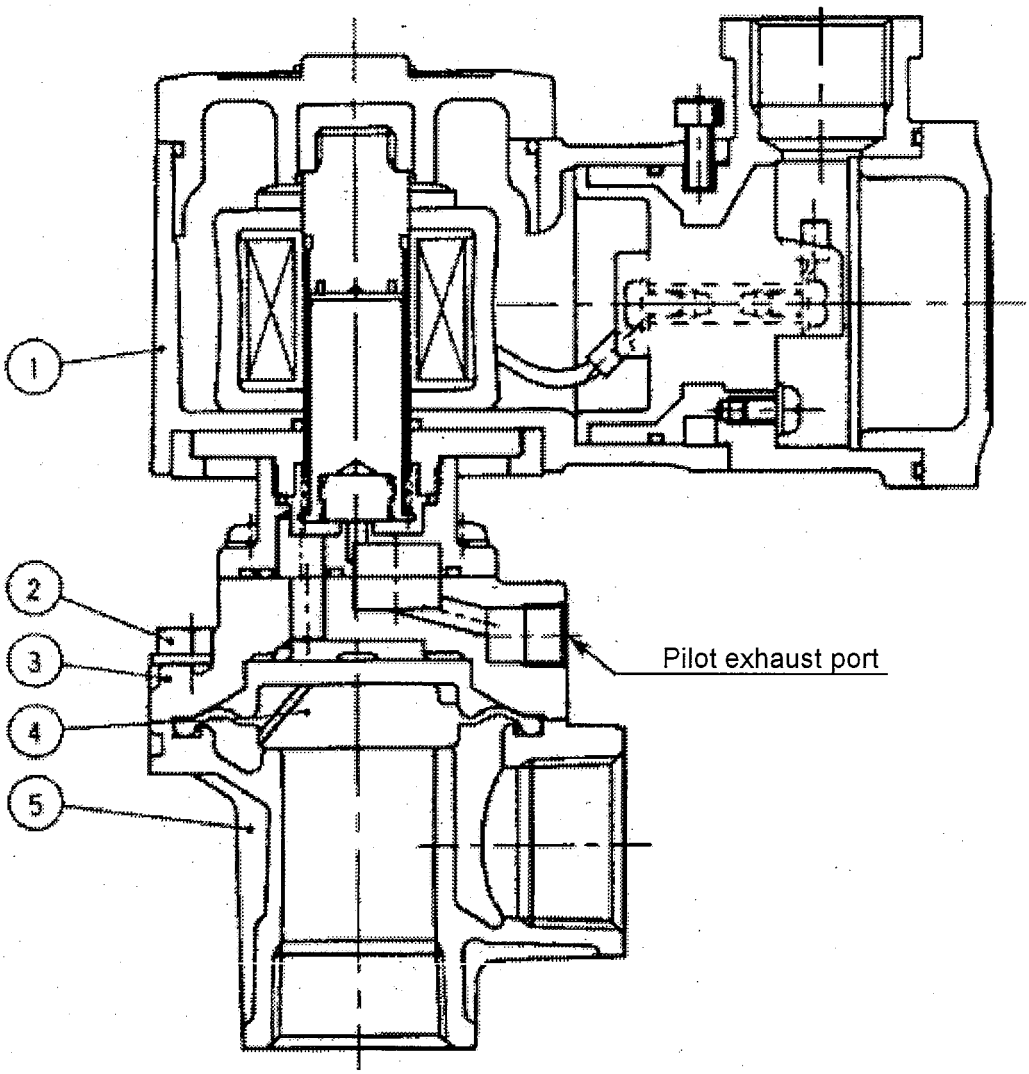
# 8. Troubleshooting




If further information is required, consult CKD or your the nearest sales representative.

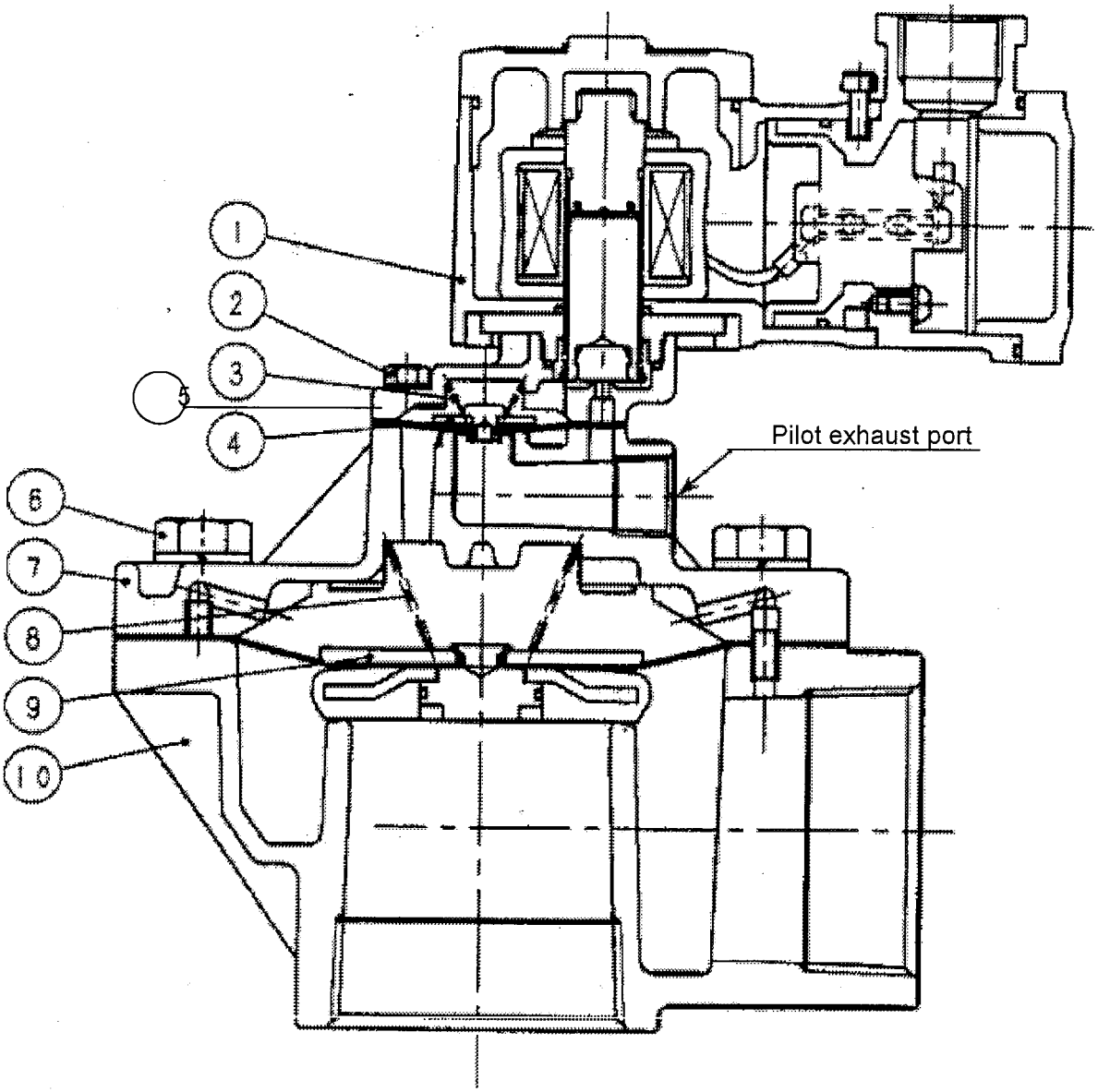
# 9. Internal construction drowings

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




| No. | Part name | Qty |
|---|---|---|
| 1 | Explosion proof type solenoid valve | 1 |
| 2 | Hex.head bolt | 4 |
| 3 | Cover | 1 |
| 4 | Diaphragm | 1 |
| 5 | Body | 1 |

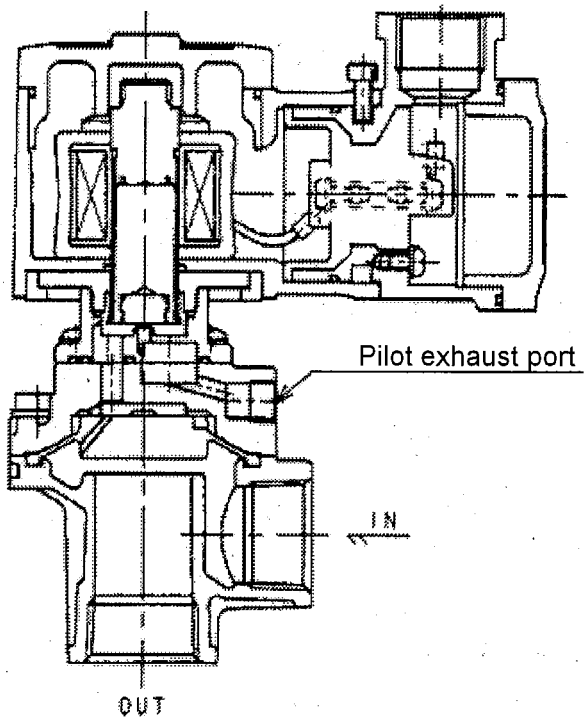
## 9.2 PDVE4-50A




| No | Part name | Qty | No. | Part name | Qty |
|---|---|---|---|---|---|
| 1 | Explosion proof type solenoid valve | 1 | 6 | Hex.head bolt | 6 |
| 2 | Hex.head bolt | 4 | 7 | Stuffing | 1 |
| 3 | Plot spring | 1 | 8 | Main spring | 1 |
| 4 | Polot diaphragm assembry | 1 | 9 | Main diaphragm assembry | 1 |
| 5 | Cover | 1 | 10 | Body | 1 |

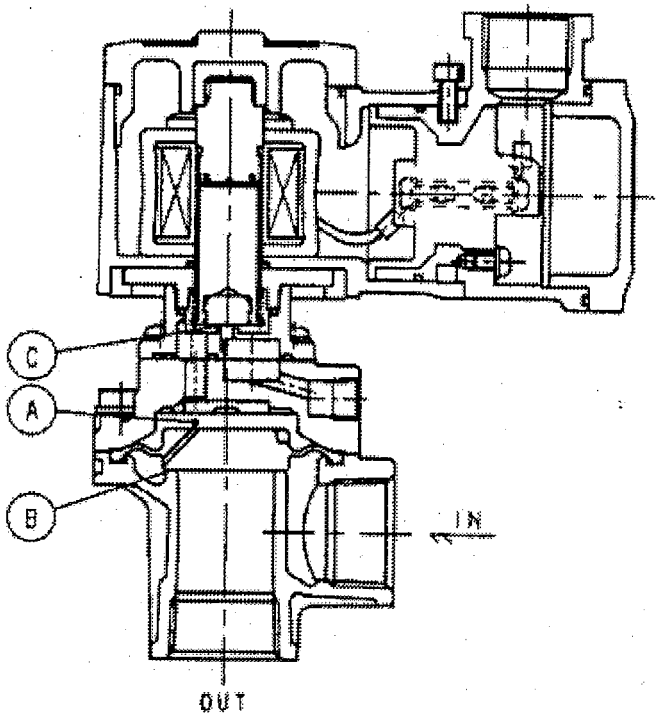
# 10. Operating mechanism

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




【Open】

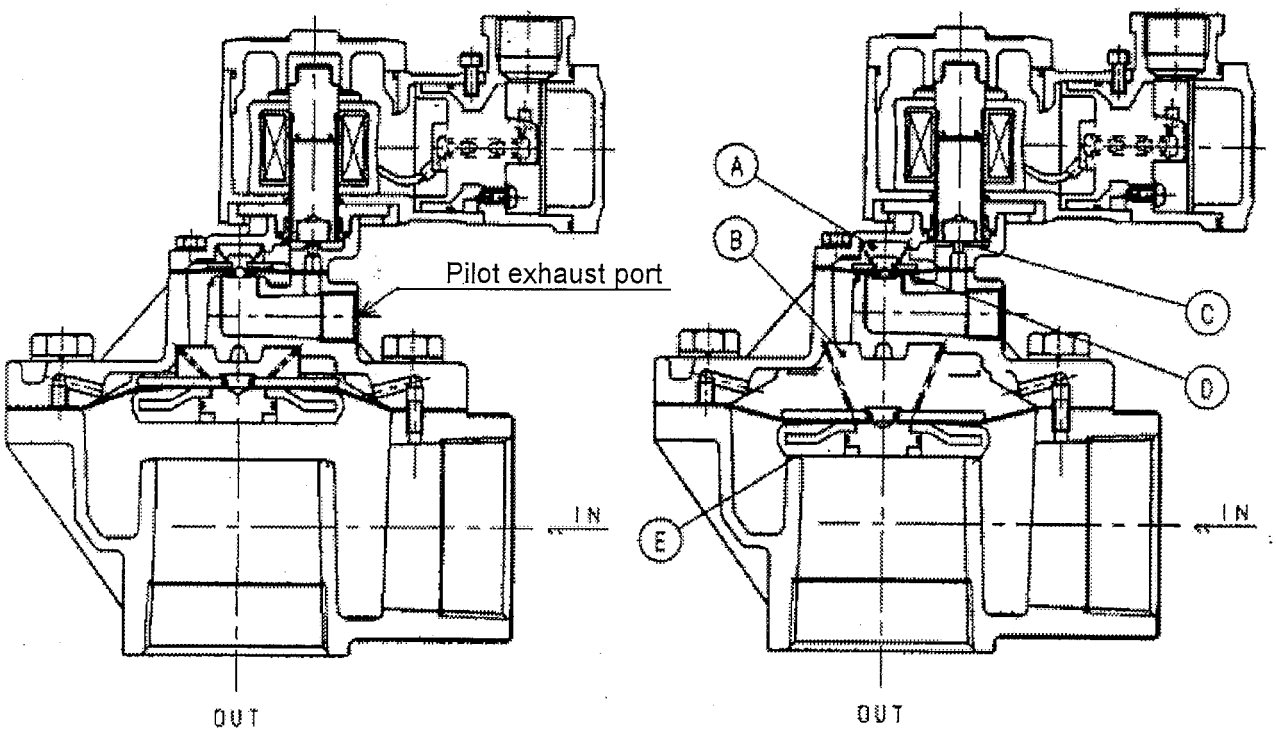
When the solenoid is energized,the air in the diaphragm chamber A flows outside after passing through pilot exhaust port. At this time,the pressure in the diaphragm chamber A becomes lower than the pressure at IN side. This pressure difference lifts the diaphragm and lets the air flow from IN to OUT.




【Close】

When the solenoid is de-energized, the plunger lowers down due to the force of spring and closes the valve seat C. The air is supplied to the diaphragm chamber A to make the pressures between IN side and the diaphragm chamber A uniform. Therefore the diaphgram assembly lowers down and close valve seat B to stop air flow.

# 10.2 PDVE4-50A




【Open】

【Close】

When the solenoid is energized,the air in the diaphragm chamber A flows outside after passing through the valve oriffice C. At this time,the pressure in the diaphragm chamber A becomes lower than the pressure of the diaphragm chamber B. This pressure difference makes the pilot diaphragm push up and lets the air flow from diaphragm chamber B to outside. Then main diaphragm is pushed up by the air from IN and it flow to OUT.

When the solenoid is de-energized, the plunger lowers down due to the force of spring and closes the valve seat C. The air of diaphragm chamber B is supplied to the diaphragm chamber A. Therefore the pilot diaphgram closes due to the pressure of diaphgram chamber A and the force of spring. Then the pressure at IN side is supplied to the diaphragm chamber C to make the main diaphragm pushed down and stops the air flow from IN to OUT.

# 11. Specifications for the product

| Model No. | PDVE4-20A-3T | PDVE4-25A-3T | PDVE4-40A-3T | PDVE4-40A-Rc-3T | PDVE4-50A-3T |
|---|---|---|---|---|---|
| Valve construction | Explosion proof type, Pilot-type poppet | | | | |
| Fluid | Air(not corresive gas) | | | | |
| Pressure proof MPa | 2.0 | | | | 1.5 |
| Working pressure MPa | 0.1～0.7 | | | | |
| Fluid temp ℃ | -10～60(not to freeze) | | | | |
| Ambient temp ℃ | -10～50 | | | | |
| Atmosphere | Outdoor,Explosive gases:Explosion class 1～2 ,Ignition degree G1～G4 | | | | |
| Orifice (Cv value) mm | 23(11) | 28(18) | 37(45) | | 53(62) |
| Connection Port size | Rc3/4 | Rc1 | IN:Rc11/2<br>OUT:$\phi$48×52 | Rc11/2 | Rc2 |
| Mounting style | Free | | | | |
| Pilot exhaust port | Rc1/8 | | | | Rc3/8 |
| Rated voltage | AC100V AC200V | | | | |
| Voltage variation | -10～+5% | | | | |
| Apparent power VA | Holding power 18/15(50/60Hz) Starting power 29/24 (50/60Hz) | | | | |
| Consumption power | AC8/7(50/60Hz) | | | | |
| Coil Insulation | B | | | | |

**Note**

1. AC100V coil is operable with AC100v 50/60Hz orAC110V 60Hz.
   AC200V coil is operable with AC200v 50/60Hz orAC220V 60Hz.
2. Please comsult us for other voltage.

# CKD Corporation

2-7-2
Meieki Minami, Nakamura-ku, Nagoya 450-0003 Japan
PHONE (0568) 77-1111 FAX (0568) 75-3715

- **U.S.A**

**MILLER FLUID POWER CORPORATION**
800 N.York Road Bensenville.IL 60106 U.S.A
PHONE (847) 437-9727 FAX (847) 437-9728

**CKD CINCINNATI OFFICE**
1420 Jamike Drive Erlanger, KY 41018
PHONE (606) 283-2776 FAX (606) 283-2785

- **Canada**

**MILLER FLUID POWER CANADA LTD.**
1214 Kamato Road Mississauga. Ontario L4W1Y1 Canada
PHONE (905) 625-2780 FAX (905) 625-8724

- **Europe**

**CKD EUROPE**
P.O.Box 1428, 1211 Geneva 26, Switzerland
PHONE (022) 342-2922 FAX (022) 342-2947

- **Singapore**

**CKD SINGAPORE PTE LTD.**
No. 705 Sims Drive #03-01 Shun Li Industrial Complex, Singapore 387384
PHONE 744-2623 FAX 744-2486

- **Malaysia**

**M-CKD PRECISION SDN. BHD.**
Lot No.6, Jalan Modal 23/2, Seksyen 23, Kaw.Miel, Fasa 8, 40300 Shan Alam, Selangor Darul Ehsan, Malaysia
PHONE (03) 541-1468 (6 lines) FAX(03) 541-1533

- **Thailand**

**CKD SALES THAI CORPORATION LTD.**
Suwan Tower 14/1 Soi Saladaeng 1, Sathan NUA., Bangrak, Bangkok 10500
PHONE (02) 267-6304 FAX (02) 267-6305

- **Taiwan**

**TAIWAN CKD CORPORATION**
Office :8F, No.46 Sec 1st, Nan-King E Road Taipei, 10407 Taiwan
PHONE (02) 551-3235 FAX (02) 522-3033
Factory : No.362, Sec 1st, Kwanfu-Road, Shinchu, 30054, Taiwan
PHONE (03) 578-3162 · 578-0572 FAX (03) 578-0571

- **China**

**WUXI CKD PNEUMATIC INDUSTRY CO., LTD.**
Qingyang South No.3, Road, Wuxi, Jiangsu, China
PHONE (0510) 575-9598, 573-2914 FAX (0510) 575-9598
POSTCODE : 214023