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CKD

SM-50541-A

INSTRUCTION MANUAL

PILOT OPERATED SOLENOID VALVE FOR AIR

FAD 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.

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Introduction

Thank yor for choosing the CKD's Pilot operated solenoid valve for air "FAD" series.

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

1. Purpose and use of the valves

This valve is a 2-port pilot operated solenoid valve for use in common industrial machinery or equipment.

The purpose of this solenoid valve is to remove the cuttings of the machine tools and the others.

2. General precautions

(1) This instruction manual describes the basic matters regarding the handling of the product from the unpackaging, installation, use, maintenance through 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 the design and installation in order to assure the safety of the machine or instrument and proper handling of the product.

3. Safety precautions

(1) To avoid injury, fire and damages to the facilities, the warnings shown on the product shall be strictly observed.

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

Example:

! Caution	A warning

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1. Unpackaging

(1) Check that the model No. shown on the face plate of the product agrees with your order.
(2) Check that the rated voltage and frequency meet your specification.
(3) When stored, the valve should be stored in the box, so that no foreign matters may come in. Take it out of the box when piping work begins.

2. Installation

2.1 Conditions for installation

2.1.1 Protection of the product

(1) Outdoor use
Solenoid valve (Type FAD) cannot be used outdoors. The valves should be protected by installing them in a cover or panel.

(2) Water Drips
If the Solenoid valve (Type FAD) is used, protect it such as by installing it in a cover or panel, so that it does not come directly in contact with water.

(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 or in the explosive gas atmosphere.

2.1.2 Orientation

(1) The mounting position of the valve is not specified.
(2) The valve cannot be used in a location which is subjected to 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 maintenace/troubleshooting work.

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2.2 Piping work

(1) Cleaning the pipes

Before piping, check that the pipes are free from foreign matter, cutting chips and burrs.

If necessary, remove the foreign matter, cutting chips and/or burrs inside the pipes using compressed air at a pressure of 0.3 MPa or more.

(2) Air filter

Install an air filter with 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) Flowing direction of the fluid

When piping make the direction of the fluid same as the arrow paiting on the product.

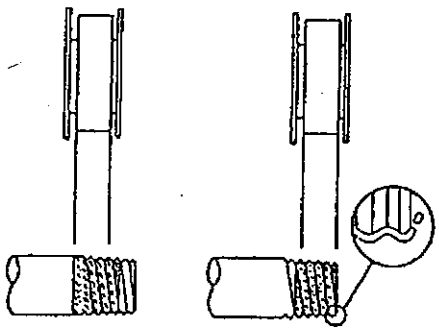
(4) Sealer

The sealer shall be used carefully 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 1-1).

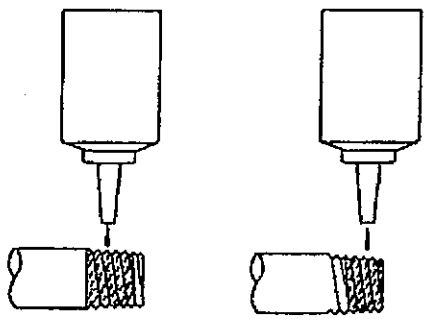
When using liquid sealer, take care not to apply too much sealer. Similarly to the case of taping, two or three threads at the end of the threaded portion shall be exposed (see Figure 1-2).

● Seal tape



(Figure 1 – 1)

● Solid / liquid sealer



(Figure 1 – 2)

(5) Torques required for tightening pipes

The torques required for tightening pipes are shown in Table 2-1 for reference.

Table 2-1. Recommended values of the torques for tightening pipes

Nominal size of pipe		Torque for tightening (recommended)
Rc	1/4	12~14 [N · m]
Rc	3/8	22~24 [N · m]
Rc	1/2	28~30 [N · m]

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(6) Lubricated or unlubricated operation
This valve does not require lubrication. Therefore, no lubricator is needed.
If the valve is to be lubricated, use type 1 turbine oil, ISO VG 32 (no additives).

(7) Minimum operating 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.

2.3 Wiring work

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

Leaked current: Voltage / Model	AC100V	AC200V	DC24V	DC12V
FAD – 8A 10A	3mA less	1.5mA less	1mA less	1mA less
FAD – L10A 15A	6mA less	3mA less		

(3) Polarity of the solenoid valve
The valve does not have positive and negative terminals although it is designed for use with a direct current. It will not have polarity even if it is used with a lamp.

2.3.1 Electric connection of grommet coil lead

This section is applied to products with the grommet coil ; option code "2C" and "2CS", or products with conduit ; option code "2CG" and "2CH".

(1) The lead shall be connected using a crimped terminal or sleeve specially designed for copper leads.

(2) If there is a possibility of leaked electricity at the electric connection, it shall be adequately insulated.

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2.3.2 Electric connection of DIN terminal box

2.3.2.1 FAD-$^{8A}_{10A}$

This subsection applies to the valves with small terminal box (optional coil code "2G" or "2HS").

(1) For the cabtyre cord, used
O.D. of cord : $\phi 4.5 \sim \phi 7$
Nominal sectional area : $0.75mm^2$

(2) Pass a cap, washer, gasket and casing through the cabtyre cord.

(3) Pass a crimped terminal specially designed for copper leads through the lead of the cabtyre cord and crimp the terminal.

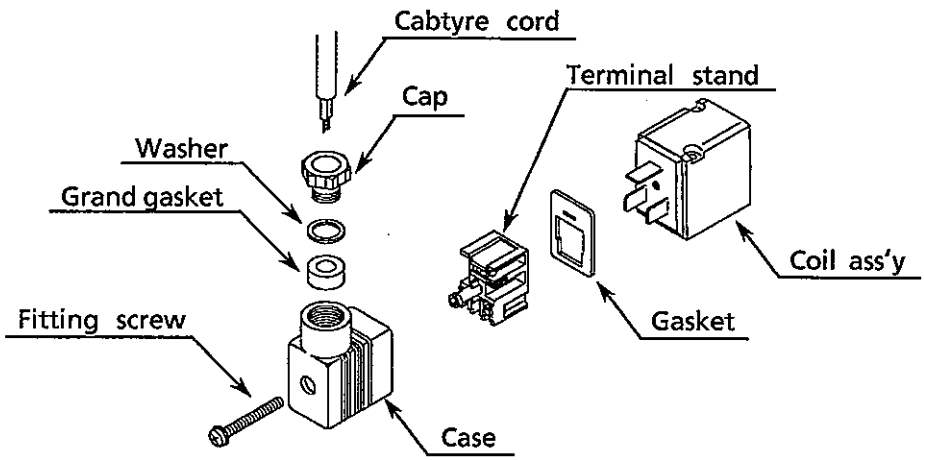
(4) Fix the crimped terminal on the terminal block.

⚠ Caution	• Take care not to connect the terminal box in a wrong manner. The terminals with markings ① and ② on the terminal block are for conductors. The terminal with a marking GND on the terminal block is for grounding.

(5) Enclose the terminal block with the casing.

(6) Tighten the cap to fix the cabtyre cord so that it will not come off.

(7) Insert the small terminal box to the coil with the grounding terminal of the coil aligned with that on the terminal block.



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2.3.2 Electric connection of DIN terminal box

2.3.2.2 FAD-$^{L10A}_{15A}$

This subsection applies to the valves with DIN terminal box (optional coil code "2G" or "2HS").

(1) For the cabtyre cord, used
O.D. of cord : $\phi 6 \sim \phi 10$
Nominal sectional area : 0.75mm²

(2) Pass a cap, washer, gasket and casing through the cabtyre cord.

(3) Pass a crimped terminal specially designed for copper leads through the lead of the cabtyre cord and crimp the terminal.

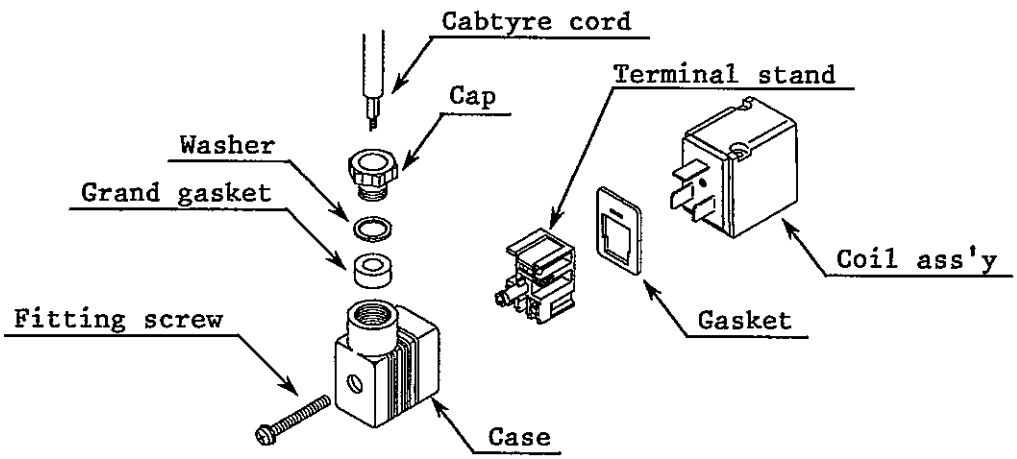
(4) Fix the crimped terminal on the terminal block.

⚠ Caution	• Take care not to connect the terminal box in a wrong manner. The terminals with markings ① and ② on the terminal block are for conductors. The terminal with a marking GND on the terminal block is for grounding.

(5) Enclose the terminal block with the casing.

(6) Tighten the cap to fix the cabtyre cord so that it will not come off.

(7) Insert the DIN terminal box to the coil with the grounding terminal of the coil aligned with that on the terminal block.



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2.3.3 Electric connection of T-type terminal box

This subsection applies to the ones with T-type terminal box (optional coil code "3T" or "3RS").

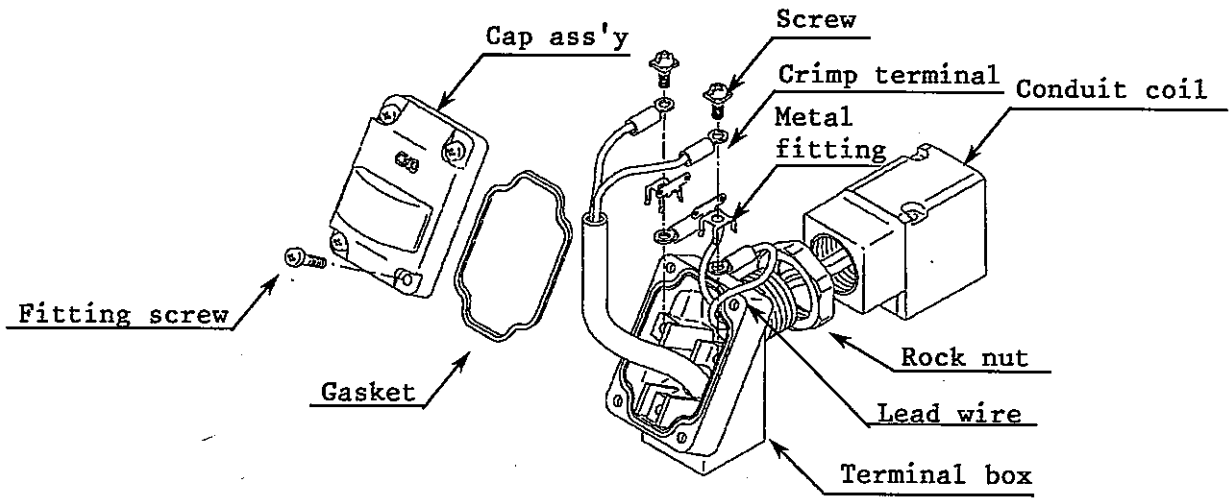
(1) For the cabtyre cord, used Nominal Sectional area 0.75 mm².

(2) Pass the cabtyre cord to the terminal box.

(3) Pass a crimped terminal specially designed for copper leads through the lead of the cabtyre cord and crimp the terminal.

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

(5) Install the gasket and cap assembly and fix with screws.



Electric connection of T-type terminal box

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3. Pre-operation (post-installation) check

3.1 Appearance check

⚠ Caution	• Shut off the fluid flow. • Exhaust the fluid remaining in the valve. • Turn off the power.

(1) Check by hand that the valve has been fixed to the pipe or mounting hole.
(2) Check that the fasteners including hexagonal socket head cap screws and bolts have not been loosened.

3.2 Check for leakage

Use compressed air to check for leakage at pipe joints.
It is recommended to check for leakage by supplying air pressure of 0.3 - 0.5 MPa with soapy water applied to the joints, and check if air bubbles will be generated.

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% of the rated voltage.

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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 conduit or equivalent.

(1) Do not put any object on the valve.
(2) The voltage variation shall be within ± 10% of the rated voltage.
(3) If not used for 7 days or more, perform a test run before starting operation.
(4) Periodically empty the drain in the air filter.
(5) Filter element of the air filter might be stained with tar adhesion so that the filter element should be exchanged at regular intervals.
(6) If any abnormal condition is found, see section 7 "Troubleshooting."

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5. Disassembly and Assembly

5.1 Procedure for Disassembly

⚠ Caution	Stop the flow of fluid. Exhaust the fluid inside the valve Turn off the power.

(1) Before disassembly, be sure to turn off the power, and exhaust fluid/pressure. (If disassembled with power on, the coil assembly ② will burnout.)

(2) To remove the diaphragm ⑦, remove four hexagon head bolts ⑨.

(3) Taking out the plunger assembly ④ :
Loosen the machine screws and washer assembly ①, and the coil assembly ②, spring ③, plunger assembly ④ and O-ring ⑤ will come off.

(4) Clean each part with neutral detergent, ethyl alcohol (pure).
Note, that the coil assembly ② 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/deterior (See 5.3 Disassembly Dia gram.)
(See 5.3 Disassembly Diagram.)

5.2 Procedure for Assembly

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

(2) Tighten the hexagon head bolts ⑨ and machine screws and washer assembly ① to the torque shown below.

(3) When assembling, make the direction of the diaphragm ⑦ and the groove of the body ⑧ same.

Model	Screw	Screw size	Tightening torque
FAD- 8A 10A	machine screw and washer assembly	M3	0.7~1.1 [N·m]
	hexagon head bolt	M5	1.8~2.8 [N·m]
FAD- L10A 15A	machine screw and washer assembly	M4	1.1~1.8 [N·m]
	hexagon head bolt	M6	4.9~6.4 [N·m]

(See 5.3 Disassembly Dia gram.)

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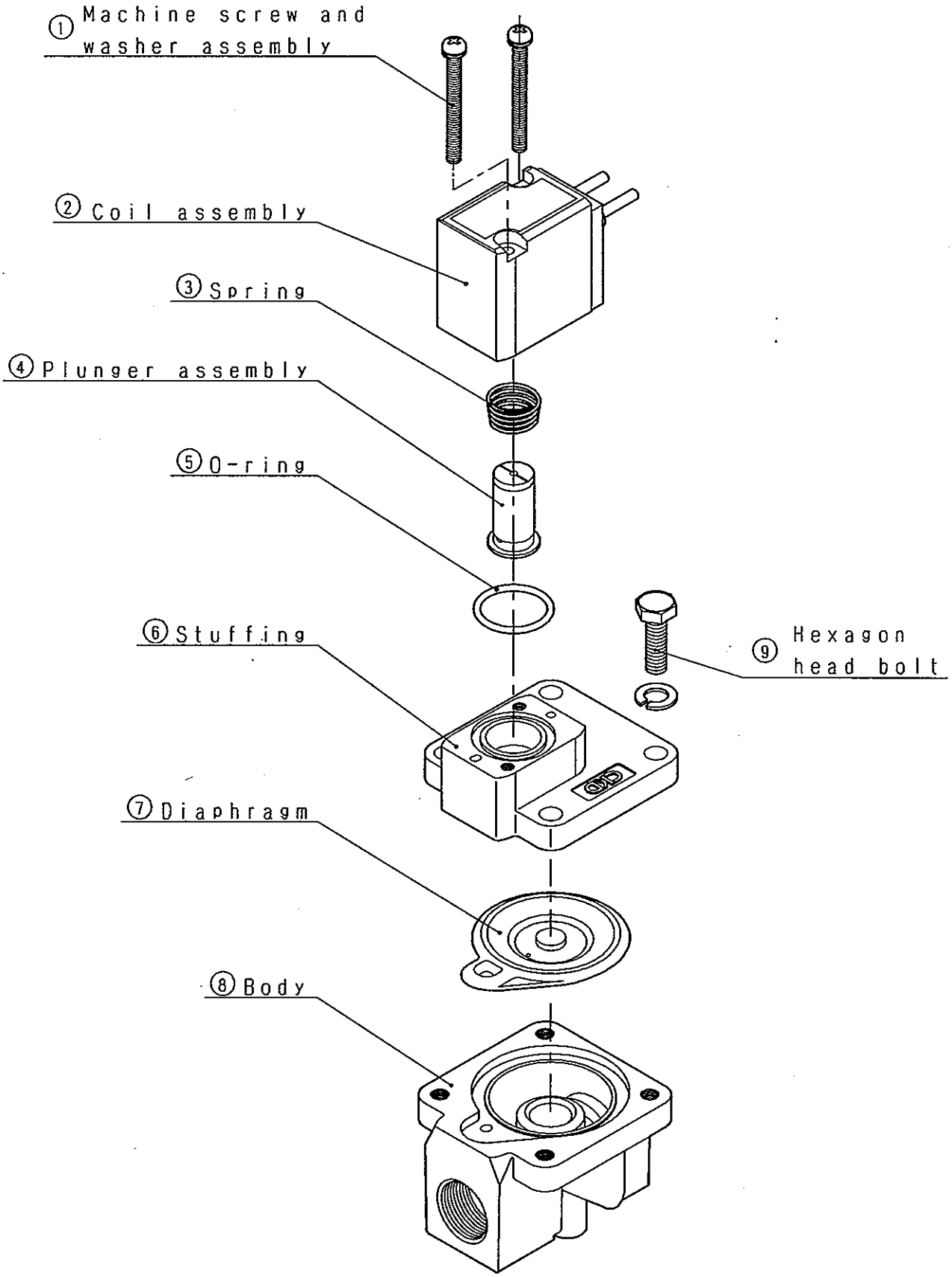

Pirot operated solenoid valve for air (FAD Series)

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6. Maintenance

6.1 Maintenance and inspection

(1) To keep the product in the good condition, inspect it twice a year unless otherwise specified.

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

6.2 Service parts

(1) Diaphragm

If any leak, operation delay or inability to open is detected in operation, replace the diaphragm.

For an earmark, 5 million of operations indicates the time for replacement.

(2) Actuator Assembly

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

Maintenance parts may be procured in a form of actuator assembly consisting of stuffing ⑥, machine screws and washer assembly ①, coil assembly ②, plunger assembly ④, O-ring ⑤ and spring ③ (See P.12).

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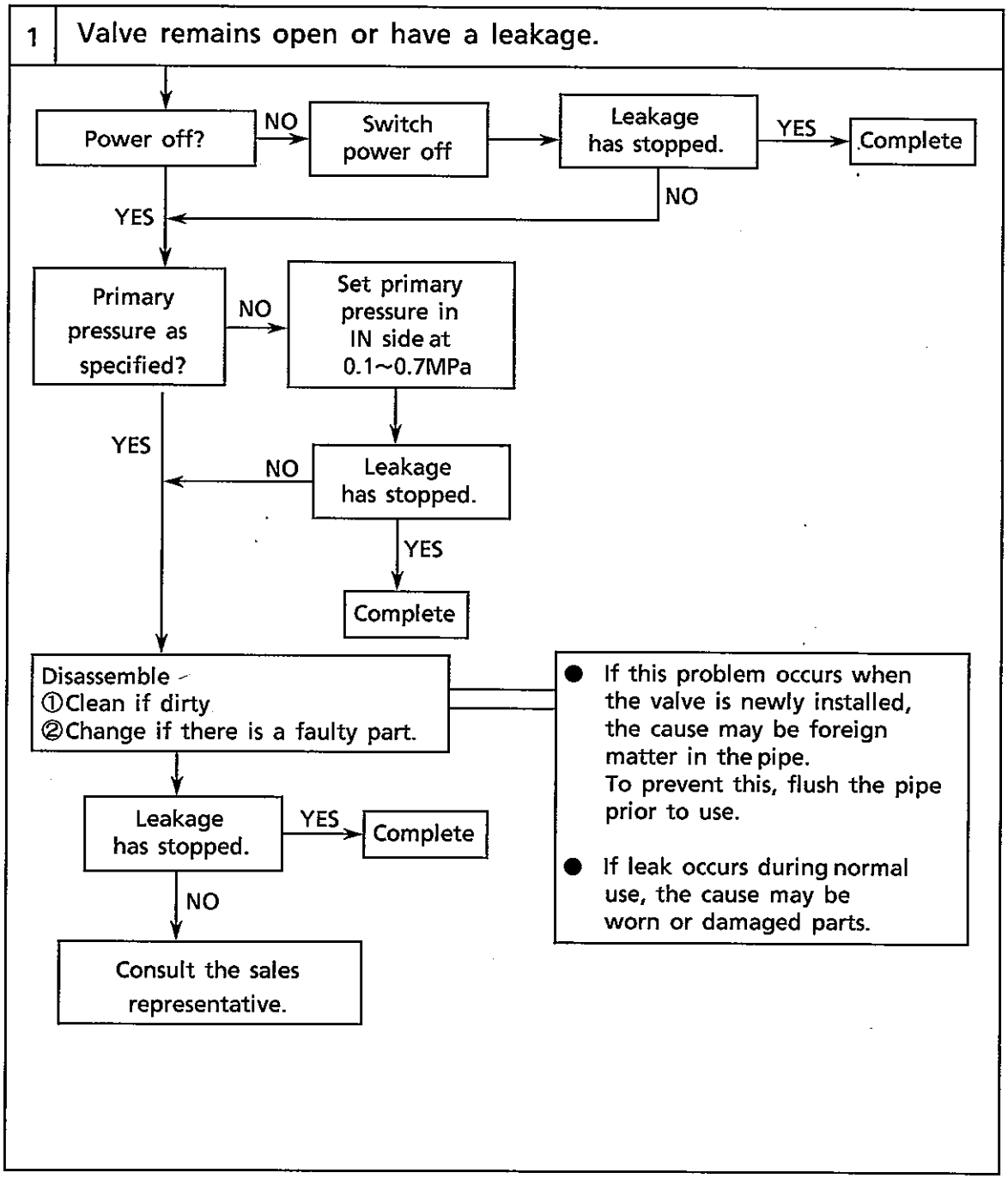
7. Troubleshooting

When a valve doesn't work properly, inspect the valve according to the following flow chart.



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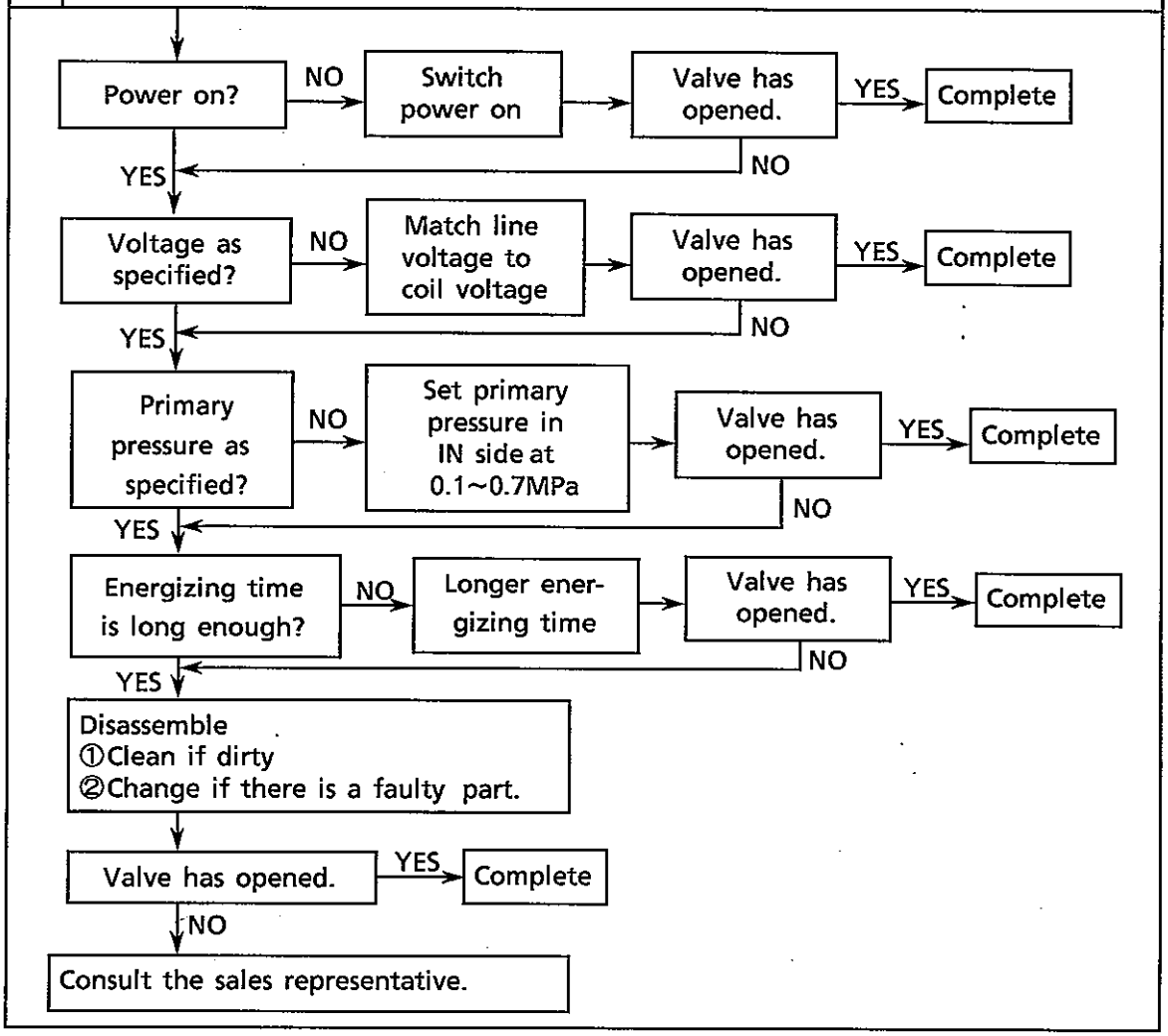
2 Valve remains closed or fluid does not flow.



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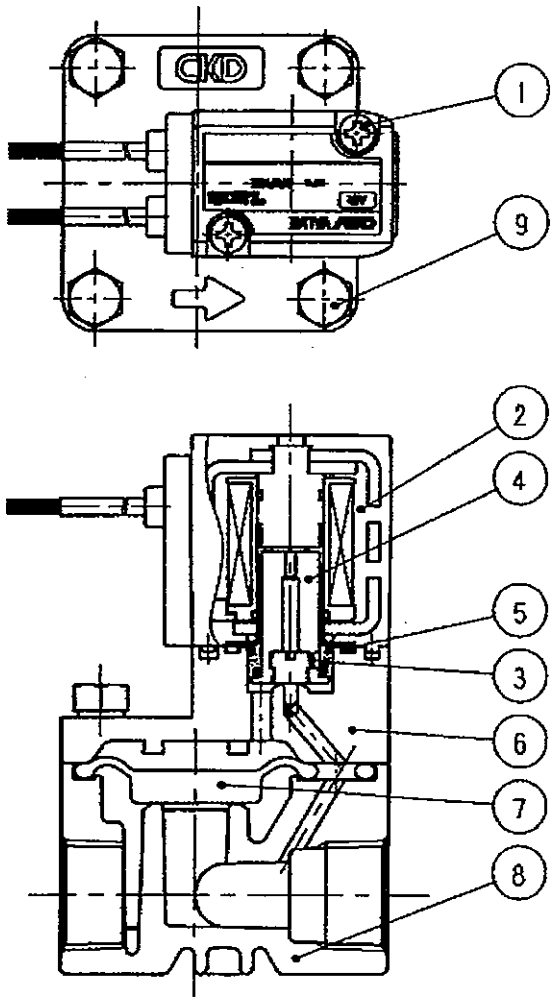
8. Internal construction drawings



No.	Part name	Qty
1	Machine screw and washer assembly	2
2	Coil assembly	1
3	Spring	1
4	Plunger assembly	1
5	O-ring	1
6	Stuffing	1
7	Diaphragm	1
8	Body	1
9	Hexagon head bolt	4

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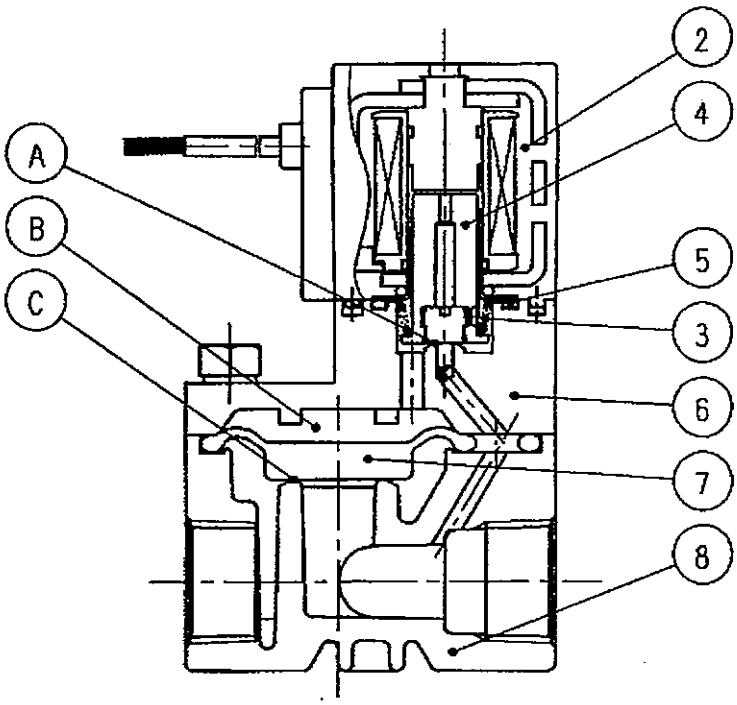
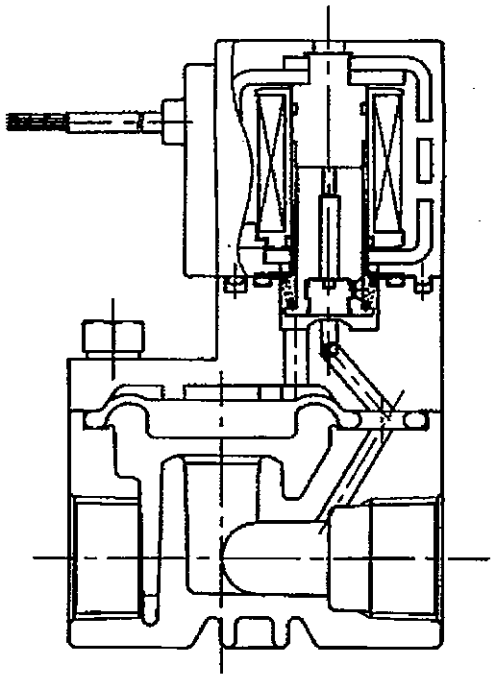
9. Operating mechanism



[OPEN]

When the coil assembly ② is energized, the air in the diaphragm chamber Ⓑ flows outside after passing through the valve.
At this time,the pressure in the diaphragm chamber Ⓑ becomes lower than the pressure at IN side.
This pressure difference lifts the diaphragm ⑦ and lets the air flow from IN to OUT.



[CLOSE]

When the coil assembly ② is de-energized, the plunger ④ lowers down due to the force of spring ③ and closes the valve seat Ⓐ.
The air is supplied to the diaphragm chamber Ⓑ to make the pressures between IN side and the diaphragm chamber Ⓑ uniform.
Therefore the diaphgram ⑦ lowers down and close valve seat Ⓒ to stop air flow.

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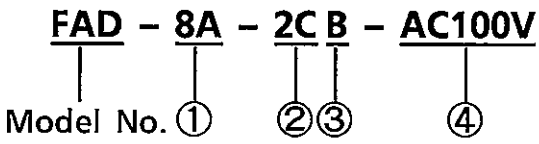
10. Specifications for the product

10.1 Meaning of the model No.



① Body end connection port size	
Symbol	Content
8A	Rc 1/4
10A	Rc 3/8
L10A	Rc 3/8
15A	Rc 1/2

③ Othres	
Symbol	Content
Nil	None
B	Mounting plate

② Optional coil code			
Symbol	Content	FAD-8A 10A	FAD-L10A 15A
2C	Grommet lead wire	○	○
2CS	Grommet lead wire with surge absorber	○	○
2G	With small terminal box	○ Pg9	○ Pg11 Note 3
2HS	With small terminal box with lamp and surge absorber	○ Pg9	○ Pg11 Note 3
2CG	Conduit (CTC19)	—	○
2CH	Conduit (G1/2)	—	○
3T	T-type terminal box (G1/2)	—	○
3RS	T-type terminal box (G1/2) with lamp and surge absorber	—	○

④ Rated Voltage	
AC 100 V	AC 200 V
DC 24 V	DC 12 V

Note
1. AC 100 V coil is operable with AC 100 V 50/60 Hz or AC 110 V 60 Hz
   AC 200 V coil is operable with AC 200 V 50/60 Hz or AC220 V 60 Hz.
2. Please consult us for other voltage.
3. L10A and 15A for FAD have DIN terminal box.

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10.2 Specifications for the product

Item		FAD-8A	FAD-10A	FAD-L10A	FAD-15A
Valve construction		Pilot operated 2 - port valve Normally closed type			
Fluid		Air (not corrosive gas)			
Pressure proof		1.4MPa {14Kgf/cm^2}			
Min. operating differential pressure		0.1MPa{1Kgf/cm^2}			
Max. operating differential pressure		0.7MPa{7Kgf/cm^2}			
Max. working pressure		0.7MPa{7Kgf/cm^2}			
Fluid temp.		– 10~60°C (not to frozen)			
Ambient temp.		– 10~60°C			
Atmosphere		Free from corrosive and explosive gas The place kept from water			
Leakage		Below 10cm^3/min			
Orifice		10mm		15mm	
Effective sectional Area of Valve		45mm^2	50mm^2	88mm^2	98mm^2
Connection port size		Rc1/4	Rc3/8	Rc3/8	Rc1/2
Mass		0.27kg		0.44kg	
Mounting style		Free			
Electric specifications	Rated voltage	AC100V 50/60Hz , AC200V 50/60Hz , DC24V , DC12V			
	Apparent power	AC : 5.3/3.7VA (50/60Hz)		AC : 7.5/5.5VA (50/60Hz)	
	Consumption power	AC : 2.7/2W (50/60Hz) , DC : 4W		AC : 4/3.4W (50/60Hz) , DC : 6.5W	
	Coil Insulation	Class B			