

**OPERATION MANUAL**

PILOT OPERATED 4-WAY SOLENOID VALVES  
SERIES VFS5000

SUB-PLATE TYPE

Blank lines for sub-plate type information.

**SMC CORPORATION**

登録No. VFS5000-OMH0003

SYM.	PL.	CHANGE	DATE	BY

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# 1 . SPECIFICATIONS

## 1)Standard Specifications

MEDIA	Air, inert gases			
Max.operating pressure kgf/cm <sup>2</sup> {kpa}	9.9{990}			
Min.operating pressure kgf/cm <sup>2</sup> {kpa}	1.0{100}			
Proof pressure kgf/cm <sup>2</sup> {kpa}	15{1500}			
Ambient and operating fluid temperature ,°C	(Note 1) -10 ~ +60			
Lubrication	(Note 2) Unnecessary			
Protection	Dust-proof			
Pilot valve manual operation	Non-lock push type(Flush type)			
Rated voltage of coil	100VAC, 200VAC, 50/60Hz 24VDC			
Allowable voltage fluctuation, %	-15 ~ +10 (at rated voltage)			
Classification of coil insulation	class B or equivalent (130 °C)			
Apparent power, VA (Power consumption, W)	AC	Inrush	50Hz	5.6
			60Hz	5.0
		Holding	50Hz	3.4(2.1)
			60Hz	2.3(1.5)
	DC	1.8		

Note 1. In low temperature applications, use dry air.

2. When supplying oil, use turbine oil Class 1  
(ISO VG32 or equivalent).

2) Model Specifications

Valve Functions	Model	Port size	Eff. Area, mm (Cv Factor)	1) Max. Operating Frequency, CPM.	2) Response Time ms.	3) Weight, kgf
2-position single solenoid	VFS51**	Rc(Pt)3/8	78.7 (4.4)	600	45 max	0.88
		Rc(Pt)1/2	97.2 (5.4)			
		Rc(Pt)3/4	102.6 (5.7)			
2-position double solenoid	VFS52**	Rc(Pt)3/8	78.7 (4.4)	600	25max	1.06
		Rc(Pt)1/2	97.2 (5.4)			
		Rc(Pt)3/4	102.6 (5.7)			
3-position closed center	VFS53**	Rc(Pt)3/8	67.1 (3.7)	300	55max	1.16
		Rc(Pt)1/2	82.8 (4.6)			
		Rc(Pt)3/4	86.4 (4.8)			
3-position exhaust center	VFS54**	Rc(Pt)3/8	70.0 (3.9)	300	55 max	1.14
		Rc(Pt)1/2	86.4 (4.8)			
		Rc(Pt)3/4	90.0 (5.0)			
3-position pressure center	VFS55**	Rc(Pt)3/8	70.0 (3.9)	300	55 max	1.14
		Rc(Pt)1/2	86.4 (4.8)			
		Rc(Pt)3/4	88.2 (4.9)			
3-position perfect	VFS56**	Rc(Pt)3/8	39.4 (2.2)	180	60 max	1.99
		Rc(Pt)1/2	48.6 (2.7)			
		Rc(Pt)3/4	50.4 (2.8)			
2-position single reverse pressurized	VFS57**	Rc(Pt)3/8	78.7 (4.4)	600	45 max	0.88
		Rc(Pt)1/2	97.2 (5.4)			
		Rc(Pt)3/4	102.6 (5.7)			
2-position double reverse pressurized	VFS58**	Rc(Pt)3/8	78.7 (4.4)	600	25 max	1.06
		Rc(Pt)1/2	97.2 (5.4)			
		Rc(Pt)3/4	102.6 (5.7)			

Note 1) Conforming to JIS B8375-1981 (once a month)

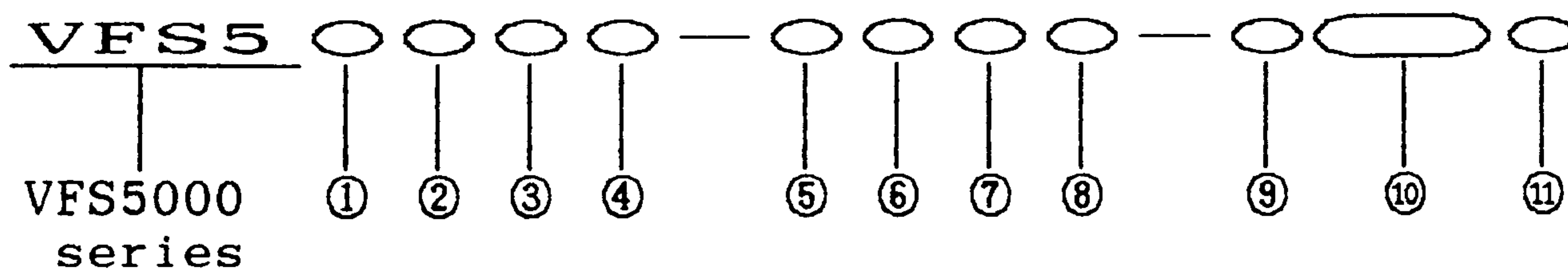
2) Conforming to JIS B8375-1981.

SUP.press.:5kgf/cm, Solenoid:w/o Surge suppressor.

3) Figures in the list are those without a sub-plate. for models with a plug-in sub-plate0.75kgf(Rc3/8,1/2), 0.97kgf(Rc3/4)and a nonplug-in sub-plate0.56kgf(Rc3/8,1/2), 0.83kgf(Rc3/4) respectively.

## 2 . MODEL IDENTIFICATION

### 1) VALVE MODEL IDENTIFICATION



#### ① Valve functions

1	2-position single
2	2-position double
3	3-position closed center
4	3-position exhaust center
5	3-position pressure center
6	3-position Perfect
7	2-position single reverse pressurized
8	2-position double reverse pressurized

#### ② Body type

0	Plug-in sub-plate
1	Non plug-in sub-plate

#### ③ Body option

0	Standard
1	With direct manual

#### ④ Method of pilot signal

None	Internal pilot
*R	External pilot

\*Semi-standard

#### ⑤ Power source

1	100	VAC, 50/60 Hz
2	200	VAC, 50/60 Hz
*3	110-120	VAC, 50/60 Hz
*4	220	VAC, 50/60 Hz
5	24	VDC
*6	12	VDC
*7	240	VAC, 50/60 Hz
*9	others	

\*Semi-standard

#### ⑥ Electrical entry

F	Conduit terminal
E	Grommet terminal
D	Din type terminal

#### ⑦ Option

None	Not provided
Z	W/Indicator light surge suppressor
*P	W/DIN type connector guard
*ZP	W/Indicator light surge suppressor W/DIN Type connector guard

\*DIN type only.

#### ⑧ Type of pilot valve manual operation

None	Push safety type(flush)
*A	Push type (extended)
*B	Lock tool-requiring type
*C	Lock lever type

\*Semi-standard

#### ⑨ Piping specifications

None	Side piping, W/O Sub-plate
*B	Rear piping

\*Semi-standard

#### ⑩ Port size

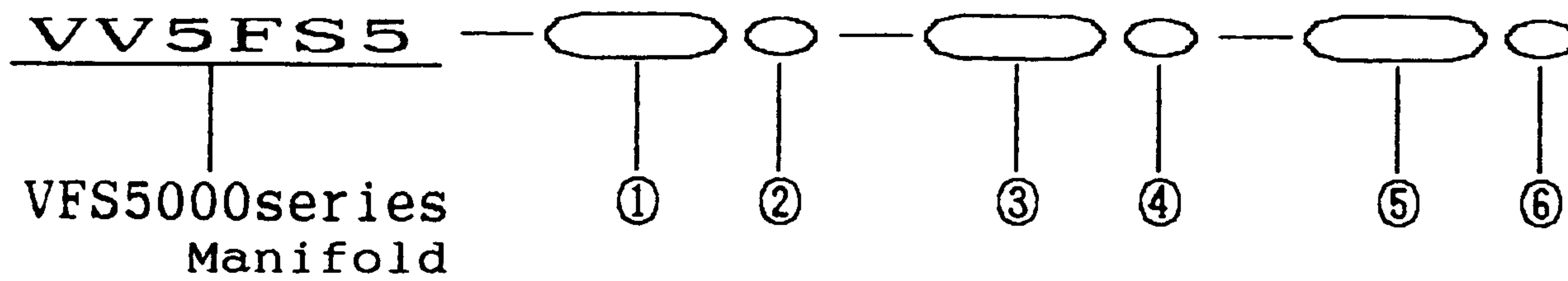
None	W/O Sub-plate
03	Rc(PT)3/8
04	Rc(PT)1/2
06	Rc(PT)3/4

#### ⑪ Pipe threads

None	Rc(PT)
*N	NPT
*T	NPTF
*F	G(PF)

\*Semi-standard

## 2) MANIFOLD MODEL IDENTIFICATION



### ① Manifold spec electrical entry

01T	Plug-in terminal
01C	Plug-in malth connector
01F	Plug-in flat cable connector
10	Non plug-in type

### ② Connector of installed

Mark	Connector	Manifold
None	Not provided	01T,10
D	D side	01C,01F
U	U side	

### ③ Number of stations

02	Two
⋮	⋮
10	Ten

### ④ Manifold spec.

Mark	Port spec.		Piping spec.
	P	EA,EB	
1	common		Side
*2			Rear

\*Semi-standard

### ⑤ Port size

Mark	P,EA,EB	A,B
04	Rc(PT)3/4	Rc(PT)1/2
06		Rc(PT)3/4
M		Mixing

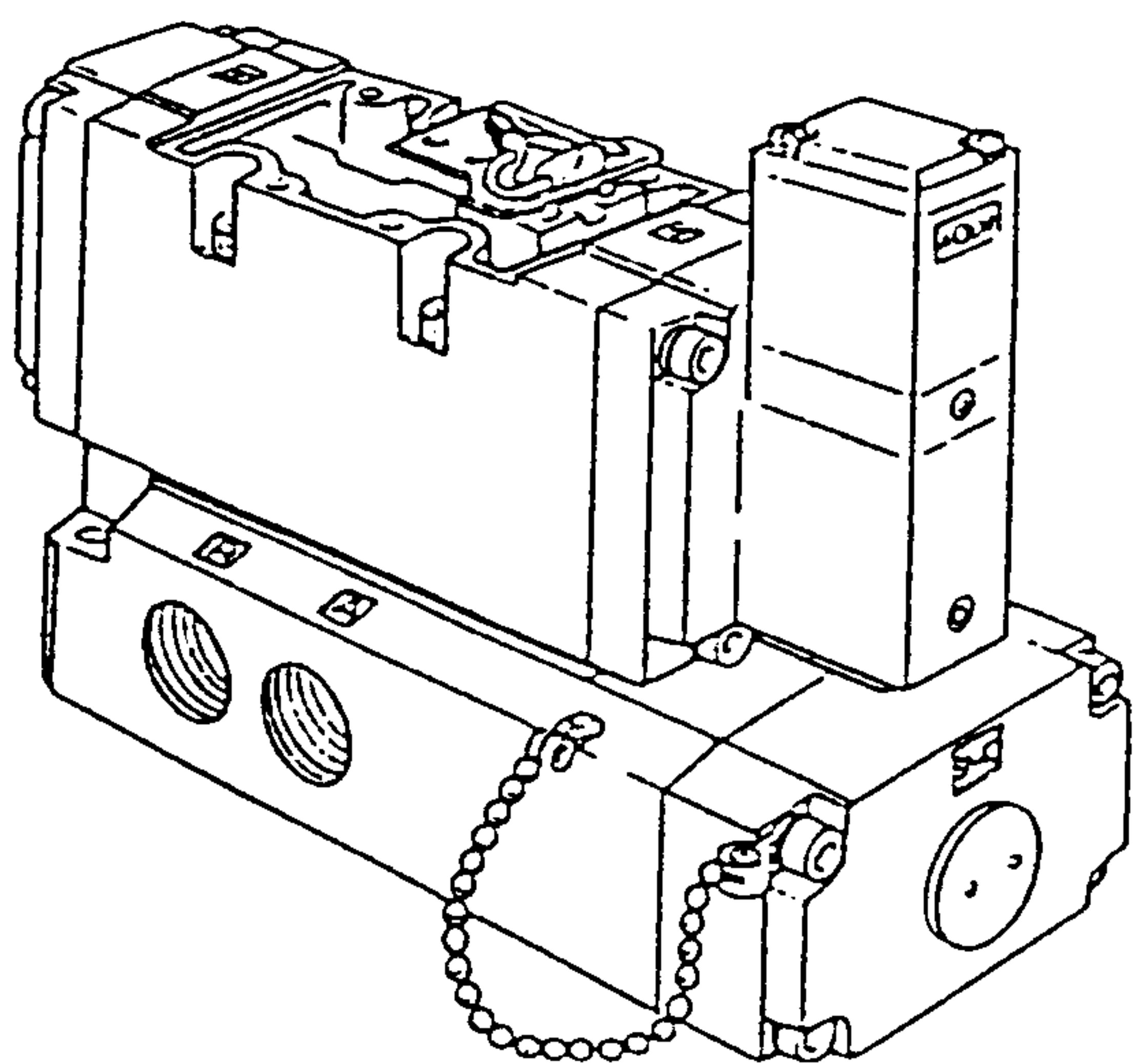
Note: In case of bottom port it is available to use only Rc(PT)1/2.

### ⑥ Pipe threads

None	Rc(PT)
*N	NPT
*T	NPTF
*F	G(PF)

\*Semi-standard

## 3 . INDICATOR LIGHT & SURGE SUPPRESSOR

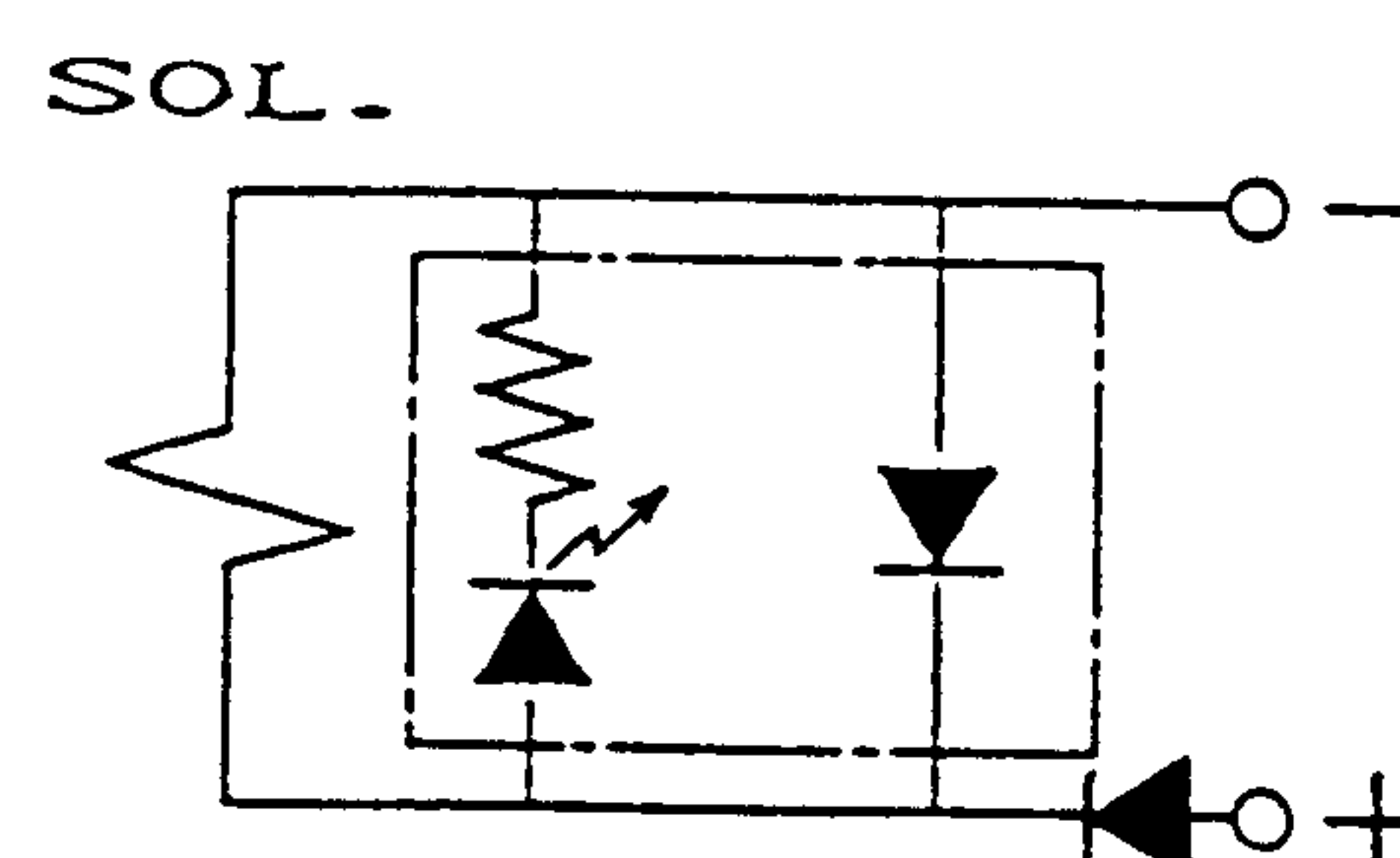
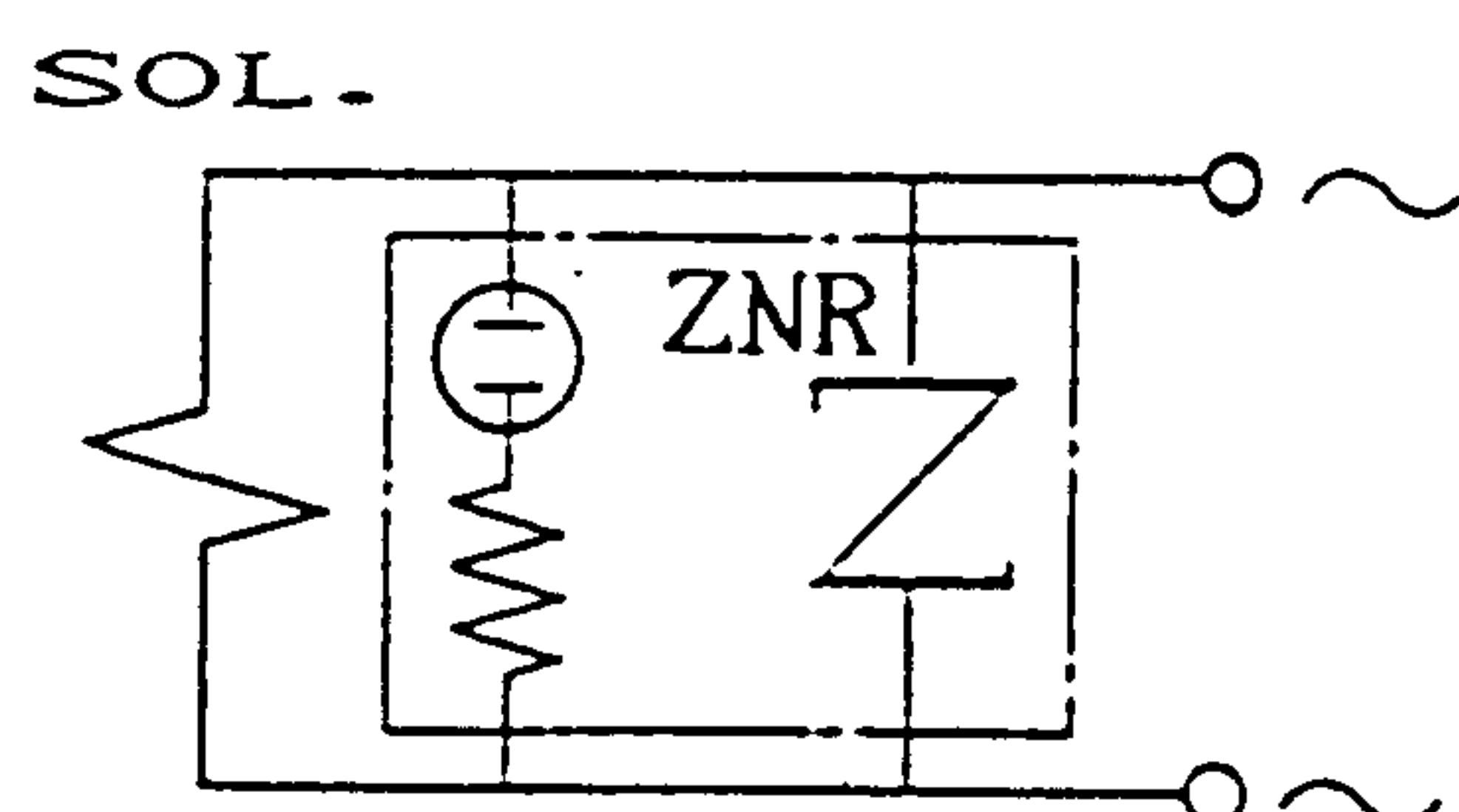


The indicator light & surge suppressor can easily be mounted by the circuit board assembly (Part No. AXT627-7<sup>A</sup>/<sub>B</sub>-\*) to the pin terminal of the terminal board inside body.

The circuit is as follows:

100 VAC, VDC

24 VDC and below



#### 4 . REPLACEMENT AND REMOVAL

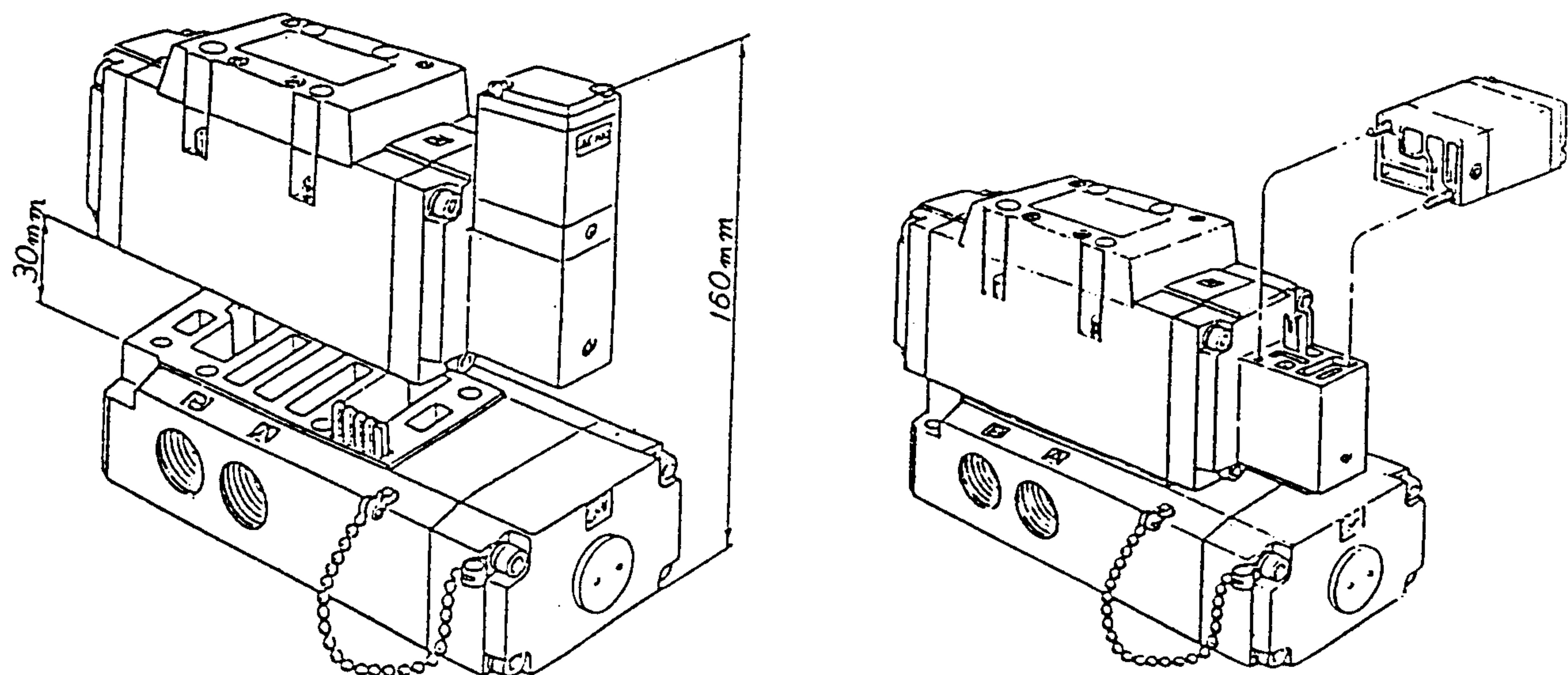
Remove the bolts (M5x50 4psc.),and extract straight the solenoid valve body from the sub-plate.

Extract straight to avoid problems.

When mounting the solenoid valve body to the base,be sure to insert the pin assembly(male pin side) straight to the receptacle assembly(female pin side).

Replacement of pilot valve

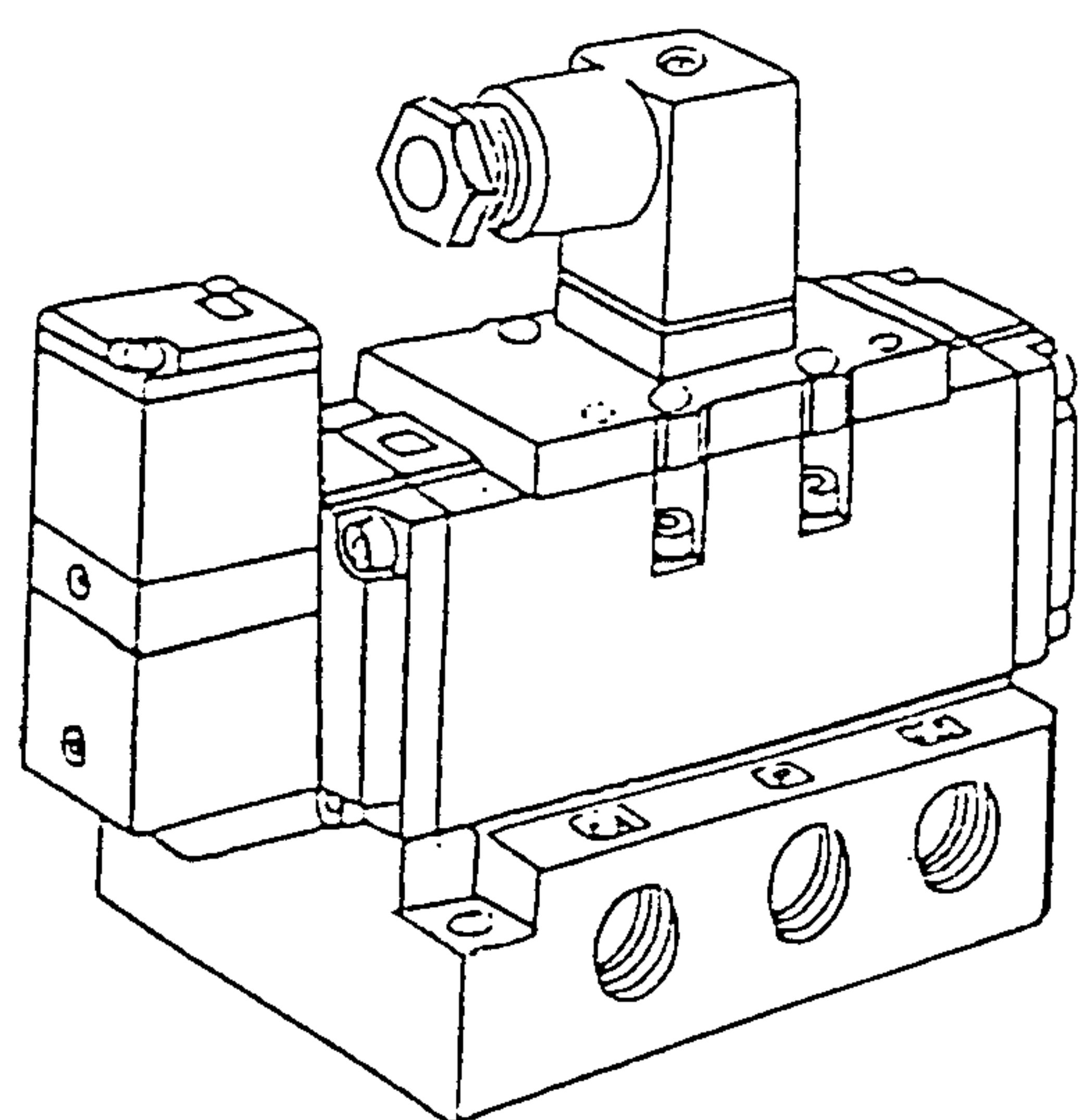
For either plug-in type or standard type pilot valve, replacement can be performed in the same procedure as that of the solenoid valve body.



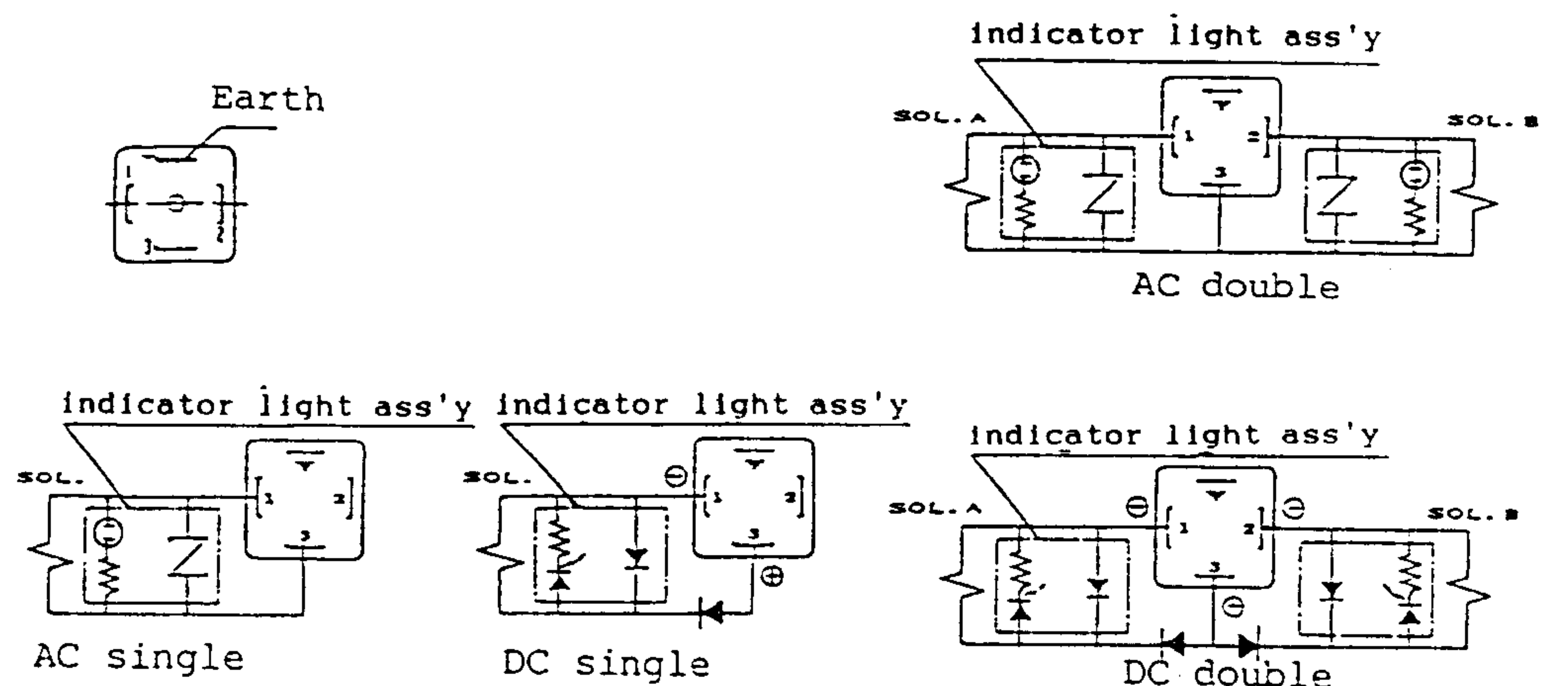
#### 5 . CONNECTION OF LEAD WIRES

##### 1)DIN Terminal Board Type

The male pin terminals of the DIN terminal board are internally connected to the solenoid as shown below; connect the lead wires to the respective terminals of the connector.



DIN terminal(electrical connection)



Applicable insulated cable  
 Cables of 6.8 to 11.5mm in diameter  
 Applicable solderless terminals  
 Three types shown below

1.25Y-3L, 1.25-3.5S, 1.25-4M

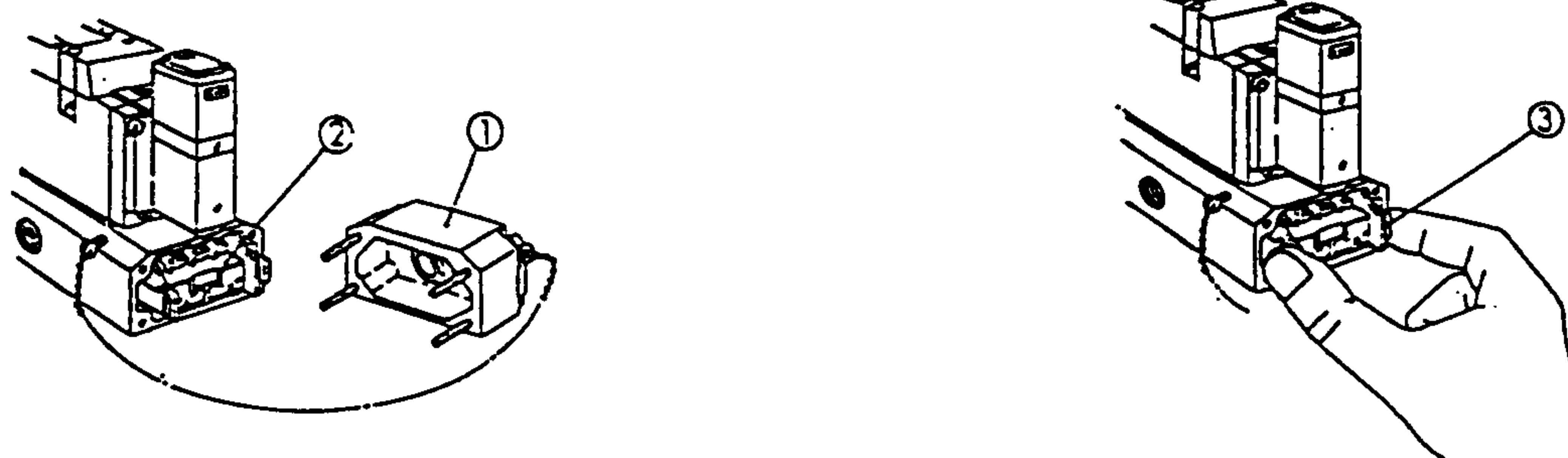
Fastening torque of connector

Clamping screws: 6kgf-cm

Terminal screws: 9kgf-cm

2) Plug-in Type (with terminals)

First remove junction cover ① of the sub-plate, and then pull out, by pinching levers ③ of the terminal board ② (Part No. AXT627-22A) with a thumb and a forefinger.



On the terminal board are put the following markings; connect them to the power supply side.

	Solenoid A Side	Solenoid B Side
Marking on terminal board	A	B
	com	
	-	+
	+	-

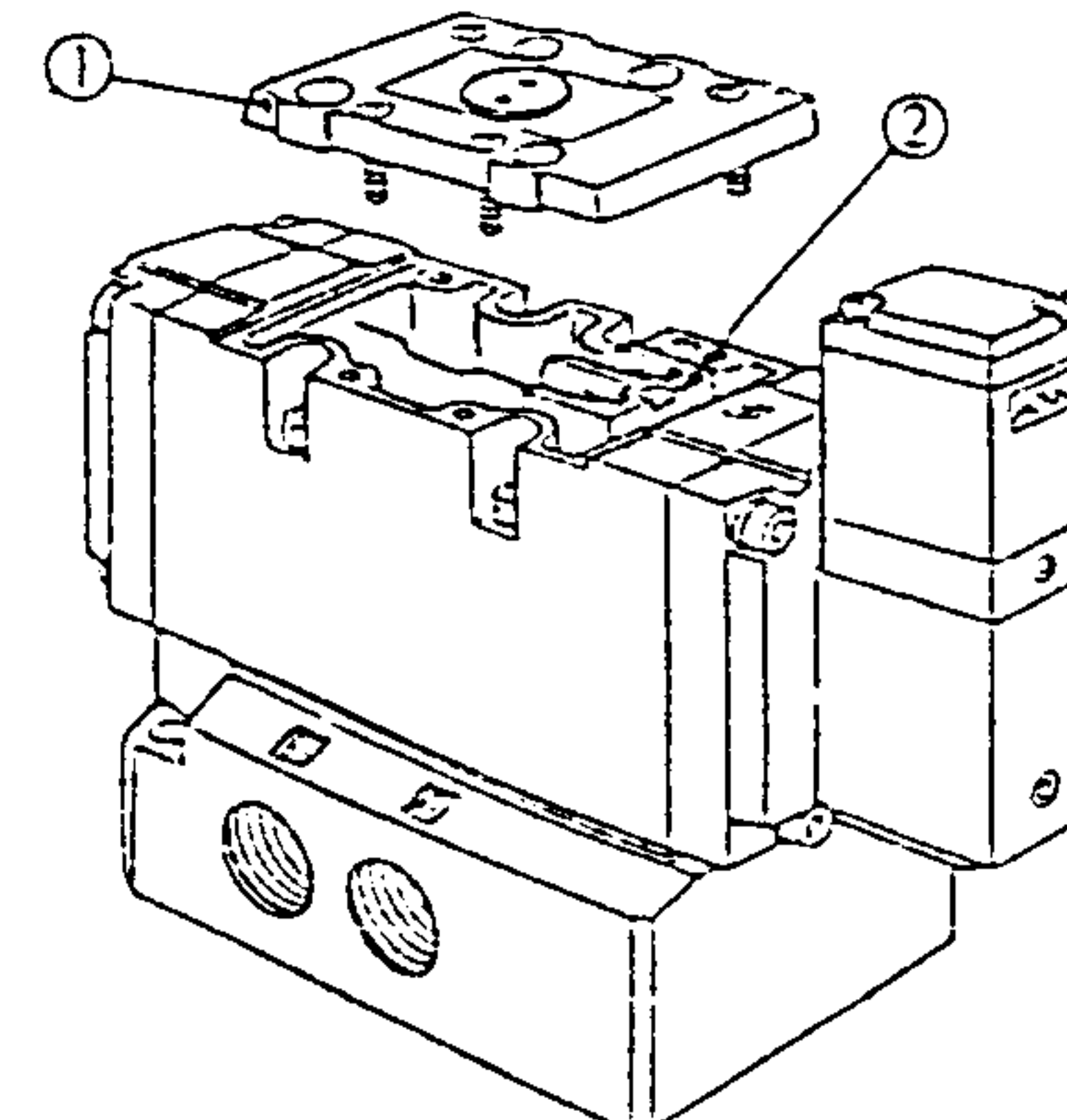
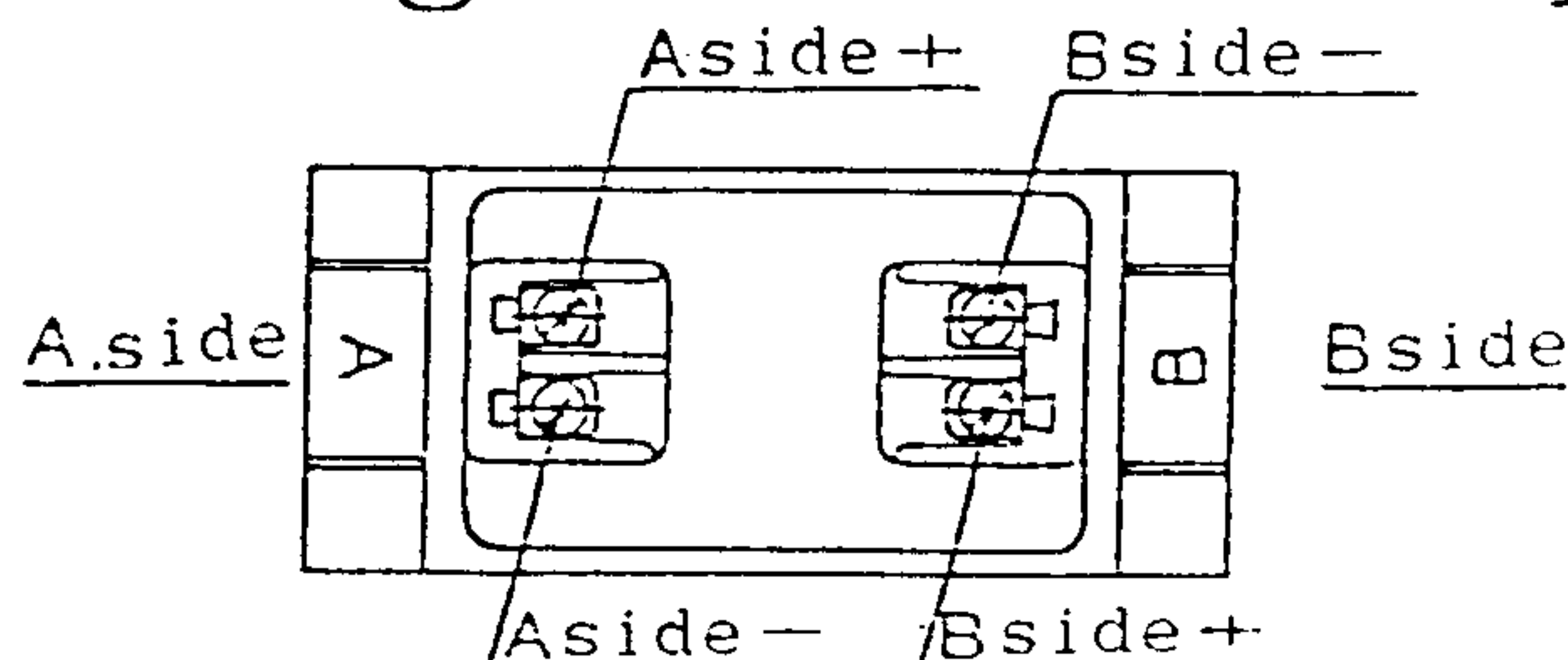
(+) and (-) indicates the polarities of the DC solenoids with lamp and surge protection circuit.

When the "com" terminal is used, it becomes "+com".

This can easily be attained by inserting special probe C (Part No. AXT627-34) com between (+) terminals from rear.

3) Standing Type (with terminals)

Remove cover ①, and then connect the lead wires to terminal board ② inside the body.



6. INSTALLATION

1) The unit can be installed in almost any position. For double-solenoid and 3-position models, however, be careful so that the spool valve is parallel to the ground.

In applications where vibration is unavoidable, install the



unit so that the spool valve is perpendicular to the direction of vibration.

(Do not use this unit in a place where vibration of more than 5G is expected.)

## 7. PIPING

- 1) Use a pipe of inside diameter equal to or larger than the nominal diameter.
- 2) Before piping, thoroughly flush both primary (supply pressure side) and secondary (final controlling element side) pipes to completely clear away dust, scale, and other foreign matters generated during piping job.
- 3) For the manifold to which the 3-position closed center valve is mounted, check the pipings between the valve and the cylinder and also fittings for possible leakage using a soapy water. If any leakage is present, take corrective action to stop the leakage.

Also check the packings of the cylinder rod and piston for leakage. The presence of any leakage will cause the cylinder not to stop at the neutral position when the valve is turned off but to move.

When wrapping the threads with a teflon sealing tape, leave one to two threads exposed at the tip of the thread and press the tape onto the thread by a finger nail to tightly adhere. When using a liquid sealing agent, also leave one to two threads and be careful not apply too much agent on the threads.

In no case should the female threads be applied with the agent.



### Fastening torque

Thread	Proper fastening torque, kgf-cm(N-m)	
M5	15- 20	(1.5-2)
Rc(PT)1/8	70- 90	( 7- 9)
Rc(PT)1/4	120-140	(12-14)
Rc(PT)3/8	220-240	(22-24)
Rc(PT)1/2	280-300	(28-30)

Pay utmost attention to design and performance of piping to facilitate removal and installation of the unit in the event trouble.

## 8 . ENVIRONMENTAL CONDITIONS

- 1) When the unit is used in dusty location, protect the rod of the cylinder to prevent dust from entering the secondary side through the rod.

On the EXH.port, provision should be made to prevent dust from entering the unit either by installing a silencer to the EXH.port or installing an elbow with its open end pointing downward.

- 2) In applications where installation of the unit in a place exposed to corrosive gas, chemical solution or its vapor, seawater, etc. or where high temperatures more than 60°C is expected is unavoidable, consult with the manufacturer.

## 9 . LUBRICANTS

- 1) The unit does not require lubrication. If however, lubrication is required for any reason such as the use of a lubrication-requiring cylinder, install a lubricator (oiler) in the primary side piping to supply atomized oil. Use turbine oil Class 1 (ISO VG32) as a lubricant. Never use spindle oil or machine oil. In low temperature applications, use low temperature lubricant.

Example : Idemitsu Kosan, lubricant for low temperatures,  
Daphne Super Hydro 32WR -20 to +60°C

Turbine oil is higher in viscosity at low temperatures below 0°C, causing valve trouble.

## 10 . MAINTENANCE

- 1) This solenoid valve does not require any particular maintenance. If, however, any trouble should occur during operation, refer to the troubleshooting list.

- 2) The carbon powder generated from an air pressure source (mainly a compressor) and oil contaminants will adhere to the spool, increasing the sliding resistance of the spool and eventually resulting in faulty operation of the valve.

In the worst case, the spool may completely seize, pay particular attention to the quality of air.

In applications where the air with poor quality is used, if the unit is left with the SUP. pressure applied to the unit for a long period of time, the carbon powder contained in the

air or oil contaminant will build up between the spool and sleeve, causing the spool to seize. In such a case, check the type of compressor lubricant, and use compressor oil with better quality which forms less oxidized substances.

Installation of a mist-separator with finer filtration (AM-series) after a normal filter (AF series) will prevent fine particles from entering the inside of the valve.

Commercially available compressor lubricants are :

Nippon Oil : Farecaol A-80

Idemitsu Kosan : Daphne CSS55, CS49

- 3) When the spool and the sleeve seize because of the foreign matter generated at an air pressure source, remove the adapter plate and end cap (in which the return spring is housed), extract the spool and sleeve from the valve body, and then clean them in a solution such as trichloroethylene or tetrachloride.

In so doing, do not immerse the "O"ring attached to the sleeve in cleaning solution.

- 4) When assembling the disassembled parts, be sure to replace all the parts in place. Tighten all the bolts evenly so that the gaskets do not slip.

## 1 1 . TROUBLES AND REMEDY

- 1) Location the source of trouble

Step1 What is the phenomenon of trouble?

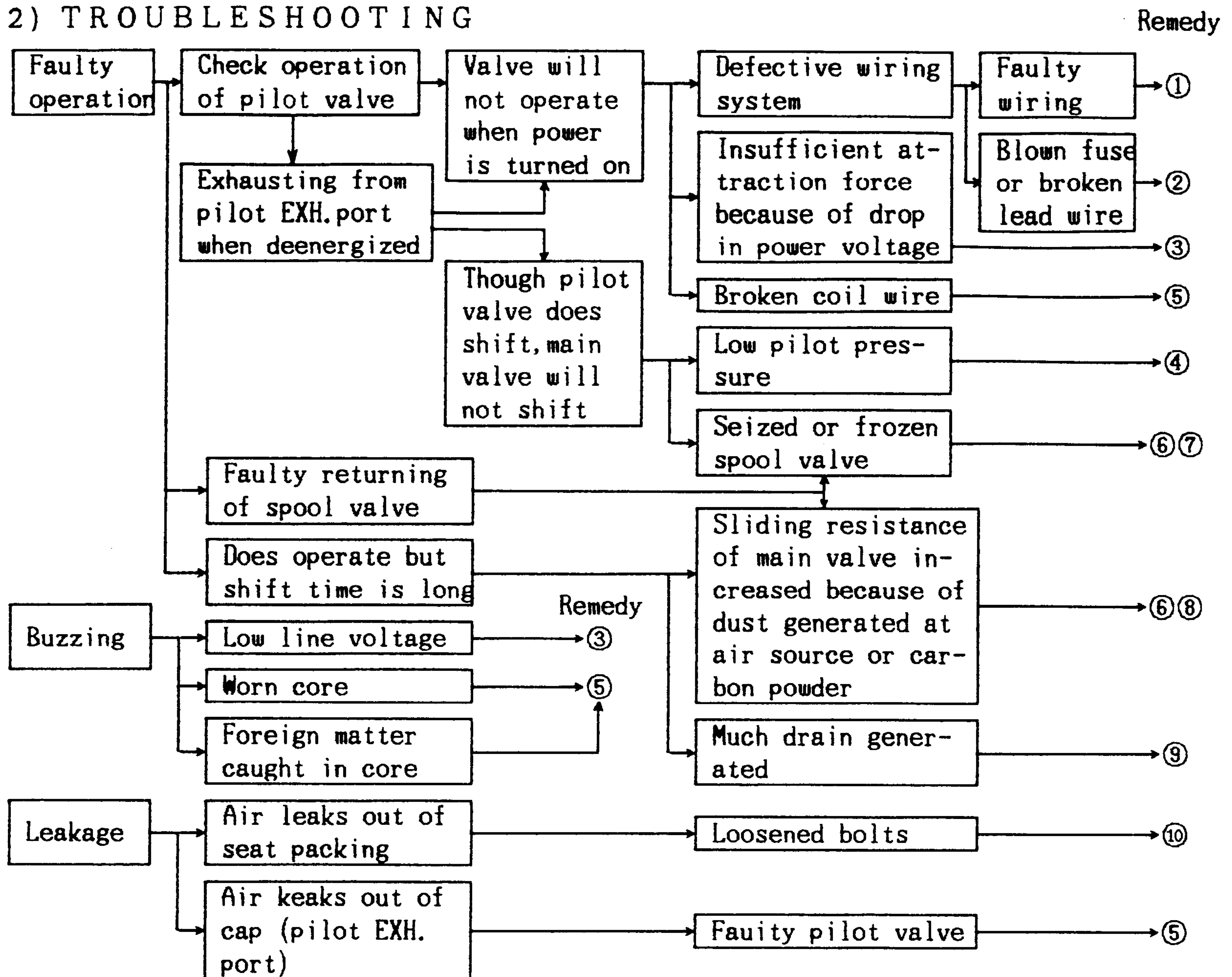
- (1) Faulty operation?
- (2) Buzzing?
- (3) Poor seal?

Step2 Check the possible sources of trouble in the order of their higher probability judging the actual phenomenon.

Step3 Once the real source of trouble is located, take a corrective action based on the chart in 2) TROUBLE-SHOOTING.

For replacement of the valve assembly, refer to 4. REPLACEMENT AND REMOVAL

## 2) TROUBLESHOOTING



## 3) REMEDY

No.	Remedy
①	Re-wire correctly.
②	Replace parts and correct wiring.
③	Regulate power voltage.
④	Regulate pressure so as to fall in operating pressure range.
⑤	Replace pilot valve ass'y.
⑥	Disassemble main valve spool and sleeve valve and eliminate dust.
⑦	Take countermeasure against freezing.
⑧	Take countermeasure against contamination of air source.
⑨	Take countermeasure against removing drain.
⑩	Fasten mounting bolts.

To users :

If the above remedies do not work , please send the unit back to the supplier for repair or replacement.