



登録No. VFS2000-OMH0002

OPERATION MANUAL

PILOT OPERATED 4-WAY SOLENOID VALVES
SERIES VFS2000

SUB-PLATE TYPE

CORD No. _____

SMC CORPORATION

SYM	PL	CHANGE	DATE	BY

TABLE OF CONTENTS

	<u>Page</u>
1. SPECIFICATIONS	
1)Standard Specifications	1
2)Model Specifications	2
2. MODEL IDENTIFICATION	
1)VALVE MODEL IDENTIFICATION	3
2)MANIFOLD MODEL IDENTIFICATION	4
3. INDICATOR LIGHT & SURGE SUPPRESSOR	4
4. REPLACEMENT AND REMOVAL	5
5. CONNECTION OF LEAD WIRES	5
6. INSTALLATION	6
7. PIPING	7
8. ENVIRONMENTAL CONDITIONS	8
9. LUBRICANTS	8
10. MAINTENANCE	8
11. TROUBLE AND REMEDY	
1)LOCATION THE SOURCE OF TROUBLE	9
2)TROUBLESHOOTING	10
3)REMEDY	10

1 . SPECIFICATIONS

1)Standard Specifications

MEDIA	Air, inert gases			
Max. operating pressure kgf/cm {kpa}	9.9{990}			
Min. operating pressure kgf/cm {kpa}	2 posi:1.0 {100} , 3 posi:1.5 {150}			
Proof pressure kgf/cm {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	VFS21**	Rc(Pt)1/8 Rc(Pt)1/4	12.6 (0.7) 15 (0.83)	1200	15 max	0.14
2-position double solenoid	VFS22**	Rc(Pt)1/8 Rc(Pt)1/4	12.6 (0.7) 15 (0.83)	1200	13 max	0.22
3-position closed center	VFS23**	Rc(Pt)1/8 Rc(Pt)1/4	11.7 (0.65) 12.1 (0.67)	600	20 max	0.23
3-position exhaust center	VFS24**	Rc(Pt)1/8 Rc(Pt)1/4	11.7 (0.65) 12.1 (0.67)	600	20 max	0.23
3-position pressure center	VFS25**	Rc(Pt)1/8 Rc(Pt)1/4	11.7 (0.65) 12.1 (0.67)	600	20 max	0.23
3-position perfect	VFS26**	Rc(Pt)1/8 Rc(Pt)1/4	7.2 (0.4) 7.2 (0.4)	600	25 max	0.4
2-position single reverse pressurized	VFS27**	Rc(Pt)1/8 Rc(Pt)1/4	12.6 (0.7) 15 (0.83)	1200	15 max	0.14
2-position double reverse pressurized	VFS28**	Rc(Pt)1/8 Rc(Pt)1/4	12.6 (0.7) 15 (0.83)	1200	13 max	0.22

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

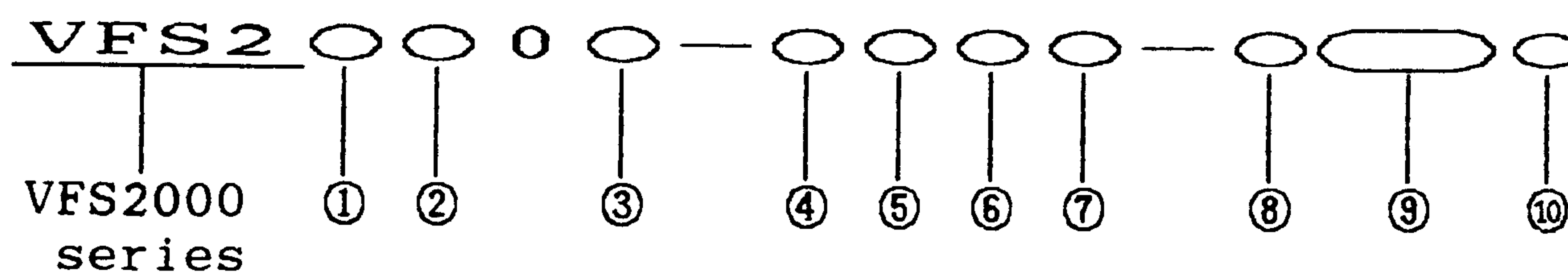
2) Conforming to JIS B8375-1981. (5kgf/cm)

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-plate 0.2kgf (Rc1/8,1/4) and a non plug-in sub-plate 0.1kgf (Rc1/8,1/4) 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 Method of pilot signal

None	Internal pilot
*R	External pilot

*Semi-standard

④ 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

⑨ Port size

None	W/O Sub-plate		
Type	Port size	Plug-in type	Non plug-in type
01	Rc(PT)1/8	Standard	Standard
02	Rc(PT)1/4	W/Terminal	(Big flow type)
P01	Rc(PT)1/8	Compact type	
P02	Rc(PT)1/4	W/Lead wire ass'y	
S01	Rc(PT)1/8		
S02	Rc(PT)1/4		Compact type

⑩ Pipe threads

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

*Semi-standard

⑤ Electrical entry

F	Plug-in
G	Grommet
E	Grommet terminal
T	Conduit terminal
D	Din type terminal

⑥ Option

None	Not provided
Z	W/Indicator light & surge suppressor
*S	W/Surge suppressor

*Grommet type only.

⑦ Type of pilot valve manual operation

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

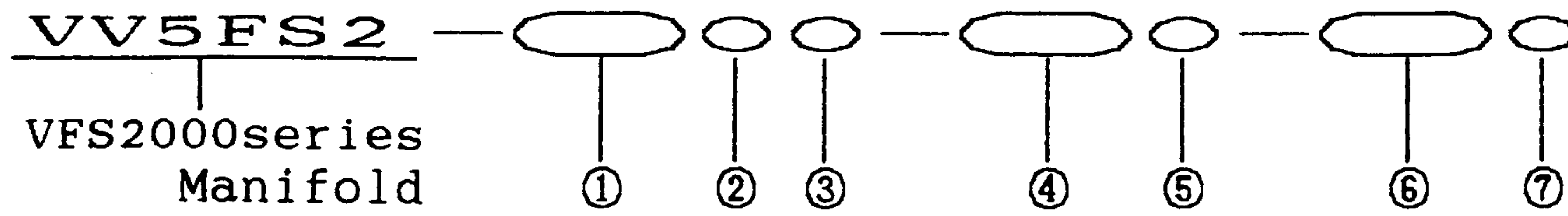
*Semi-standard

⑧ Piping specifications

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

*Semi-standard

2) MANIFOLD MODEL IDENTIFICATION



① Manifold spec electrical entry

01	Plug-in Installation of leads wire
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	01,01T,10
D	D side	01C,01F
U	U side	

③ Junction cover spec.

Mark	Junction cover	Manifold
None	Stacking junction cover	01,01T
1	Integral junction cover	01T,01C,01F

④ Number of stations

02	Two
⋮	⋮
15	Fifteen

⑤ Manifold spec.

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

*Semi-standard

⑥ Port size

Mark	P,EA,EB	A,B
01	Rc(PT)1/4	Rc(PT)1/8
02		Rc(PT)1/4
M		Mixing

⑦ Pipe threads

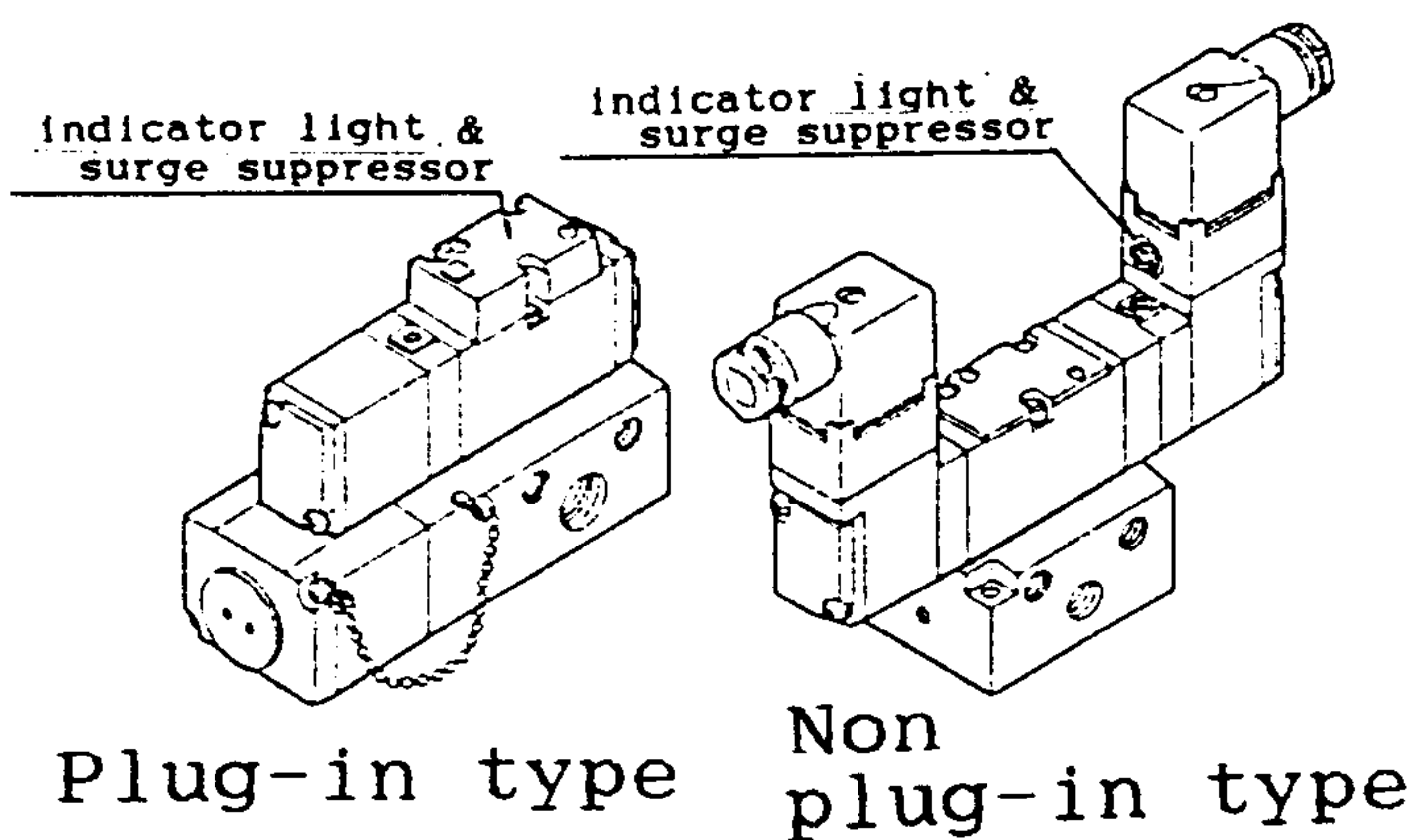
Mark	Pipe threads
None	Rc(PT)
*N	NPT
*T	NPTF
*F	G(PF)

*Semi-standard

3 . INDICATOR LIGHT & SURGE SUPPRESSOR

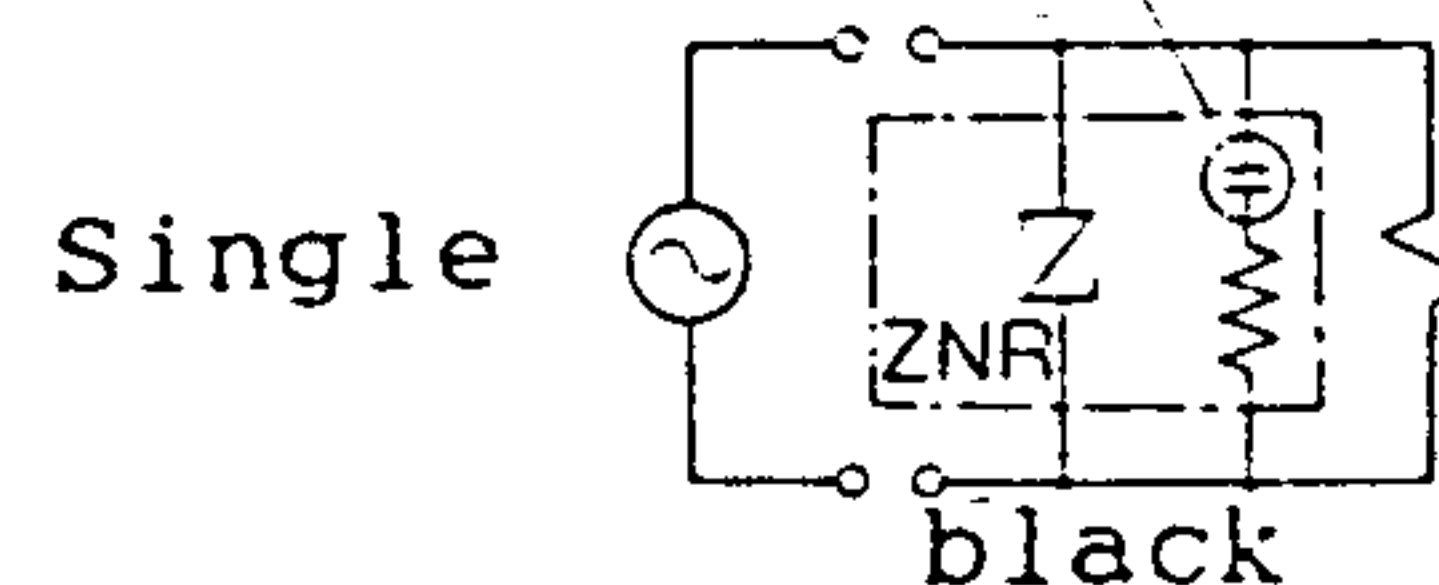
For surge suppressor, the surge suppressor absorbing element ZNR installed on AC service.

Directional diode is stalled on 24 DC or less.

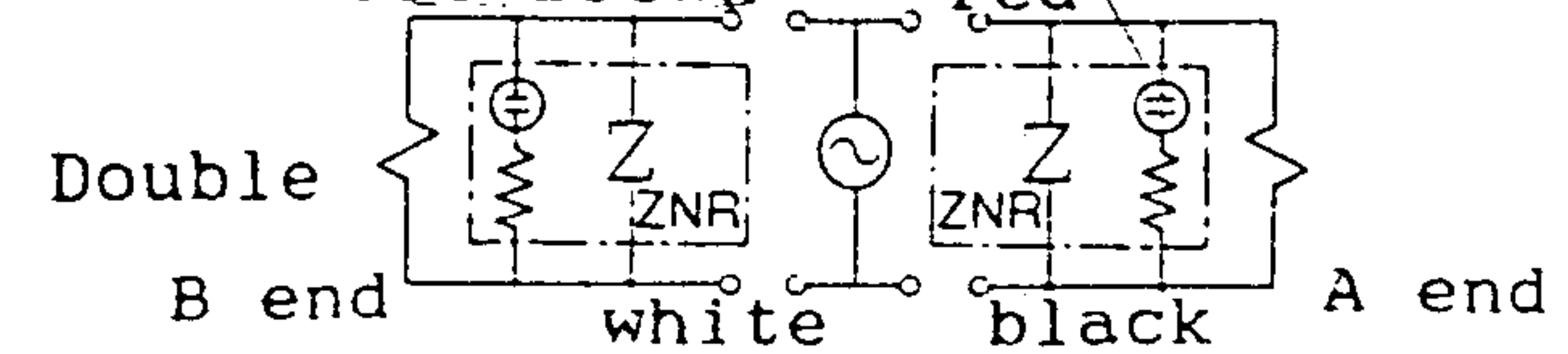


AC, DC 100V

lead wire red indicator light ass'y

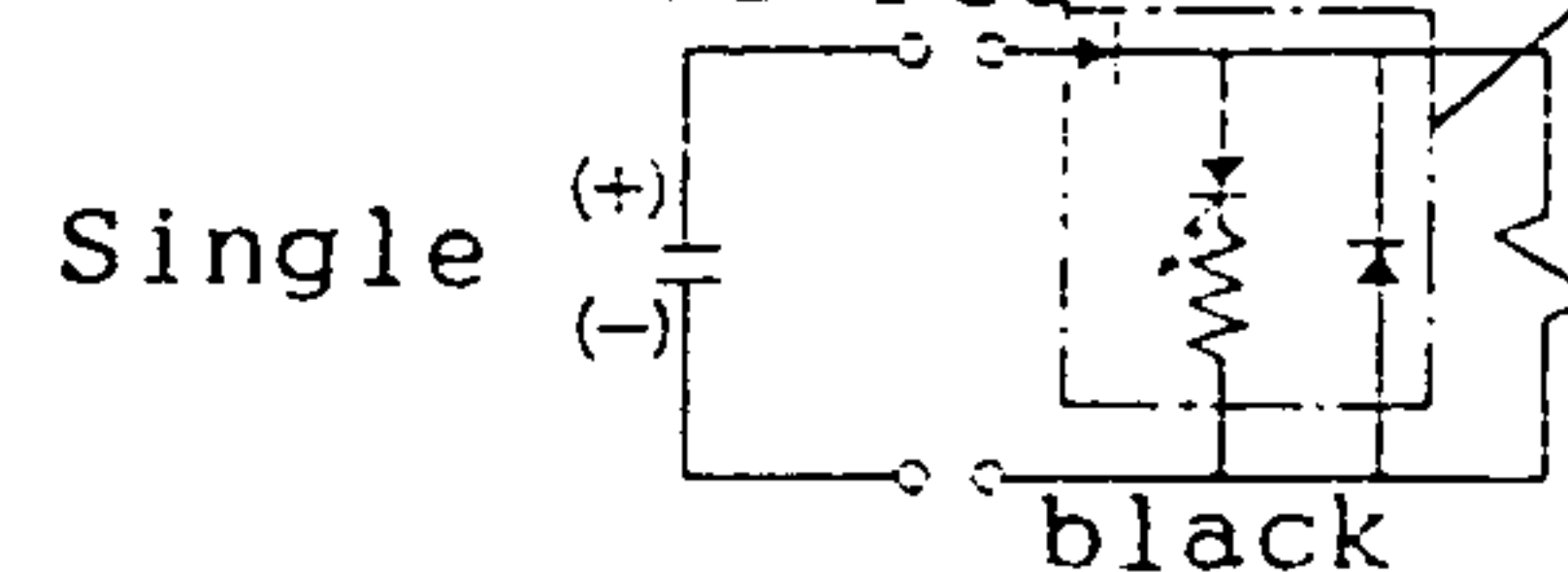


lead wire brown

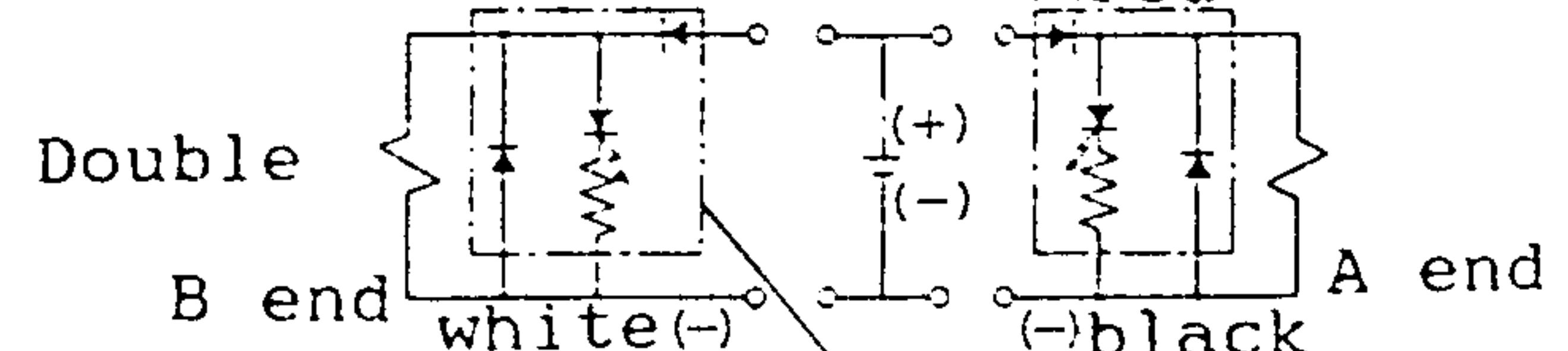


24V DC or less

lead wire red indicator light ass'y



lead wire brown(+)



indicator light ass'y

4 . REPLACEMENT AND REMOVAL

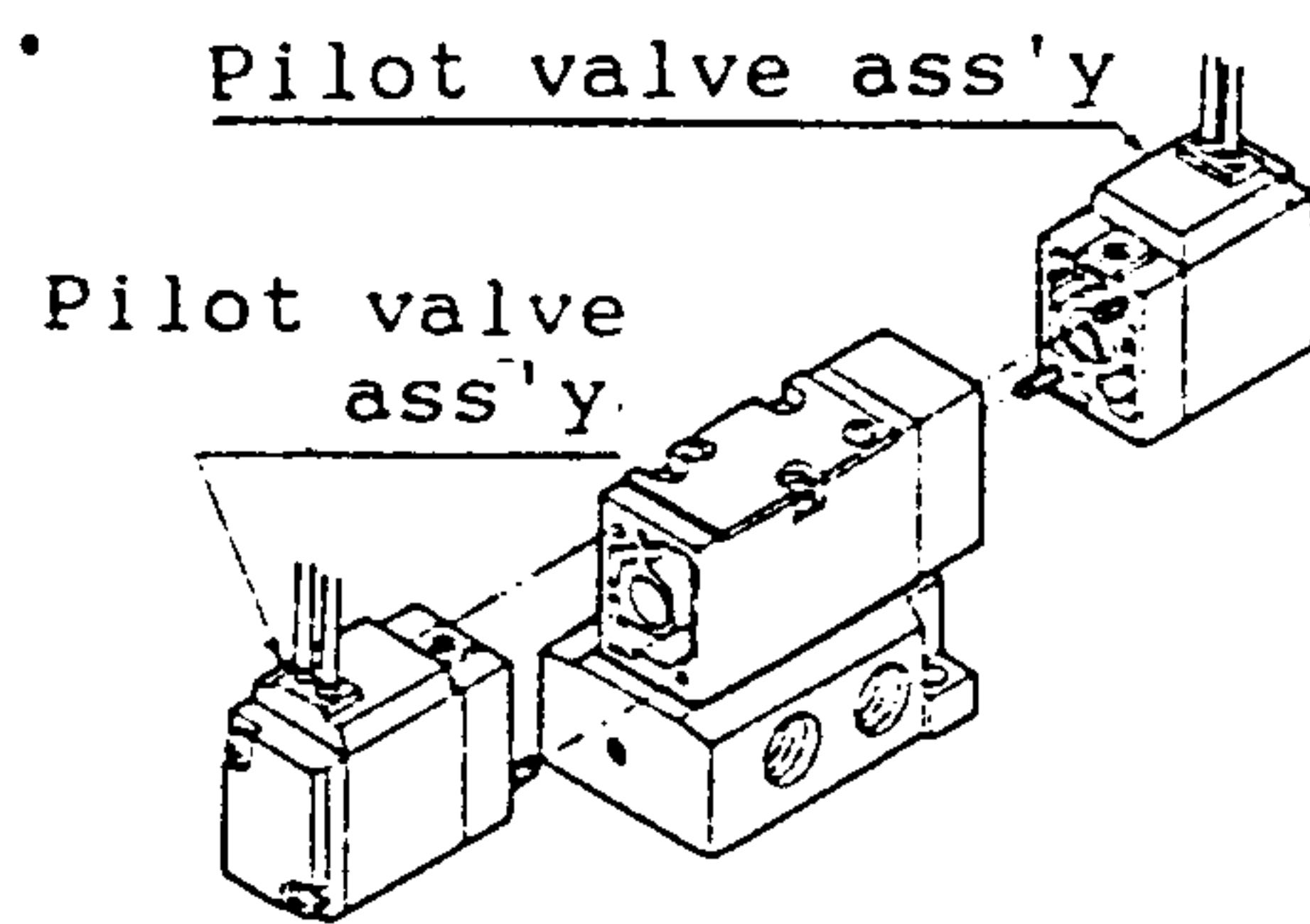
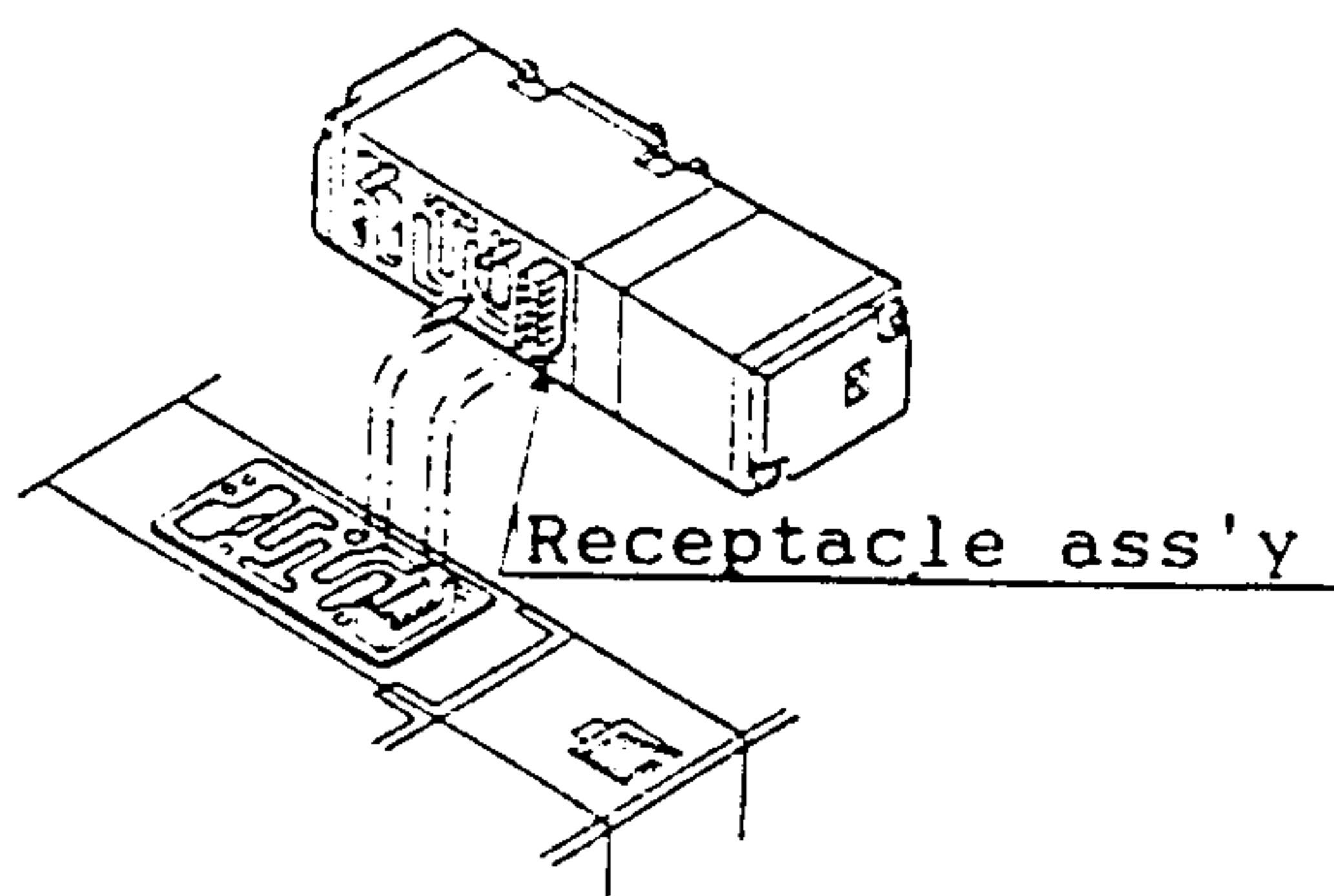
Remove the bolts (M3x32 3psc.), and extract straight the solenoid valve body from the sub-plate.

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).

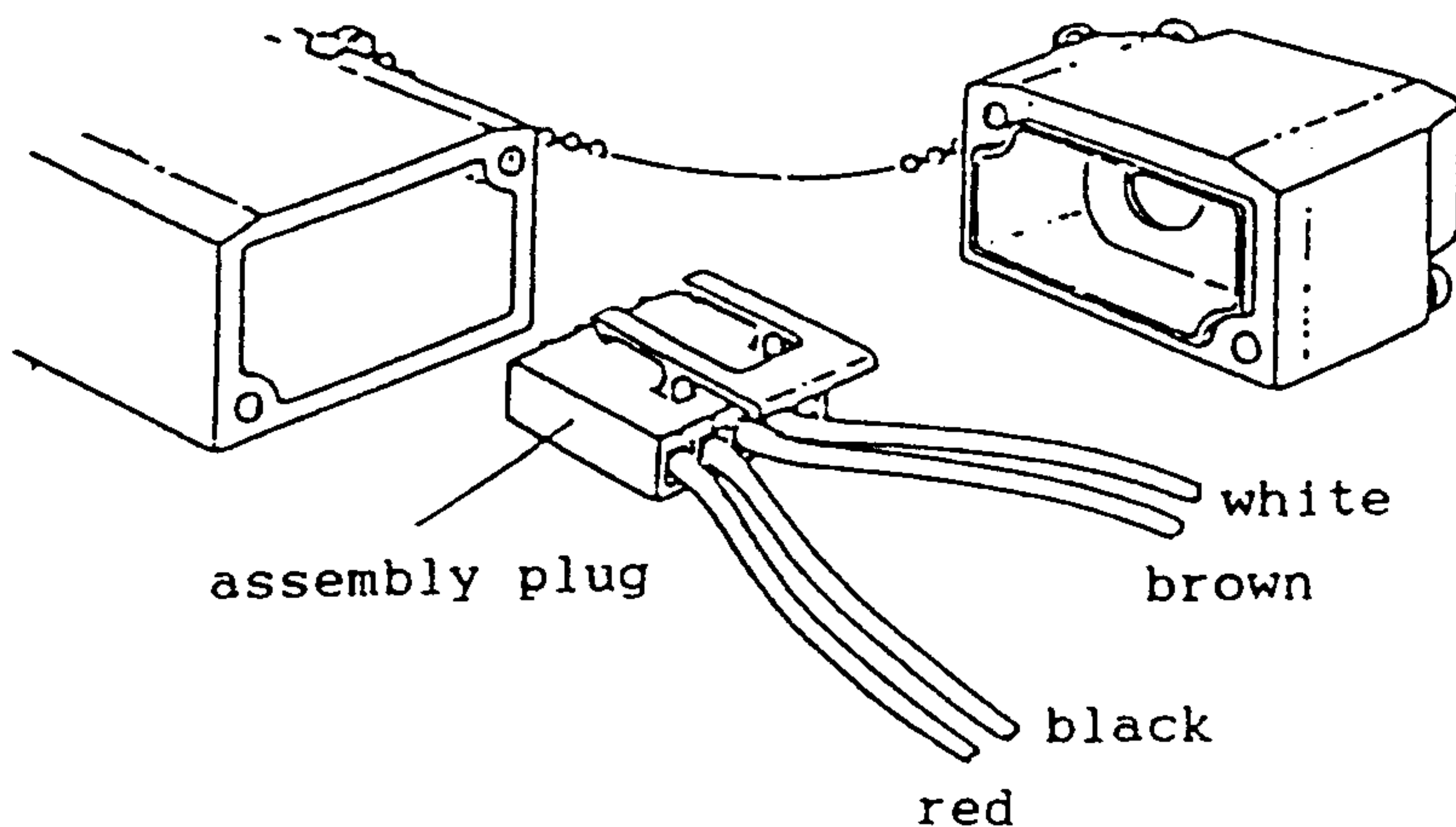
Replacement of pilot valve

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



5 . CONNECTION OF LEAD WIRES

1) Single Plug-in sub-plate mounted



Leads assembly plug is built in sub-plate.

For single solenoid: AXT624-52A-S-1

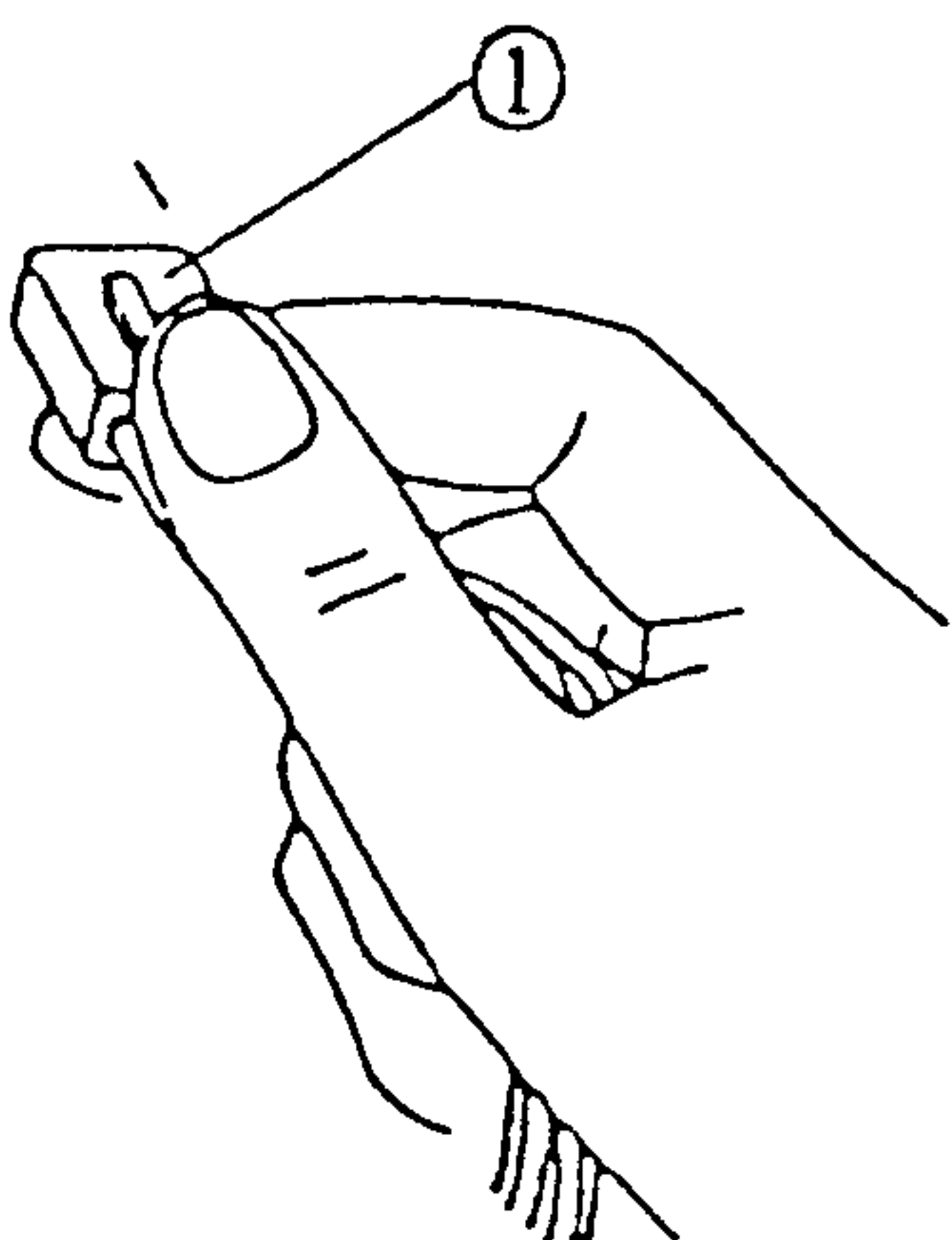
For double solenoid: AXT624-52A-D-1

For leads assembly plug, leads connect to valves as shown below, connect them to the power source end.

Power source	Valve type	Solenoid A	Solenoid B
AC	Single Solenoid	Red:Black	—————
	Double Solenoid	Red:Black	Brown:White
DC	Single Solenoid	Red(+):Black(-)	—————
	Double Solenoid	Red(+):Black(-)	Brown(+):White(-)

*DC service (+)(-) connections are with lamp surge voltage protection.

Installation and removal of wire assembly

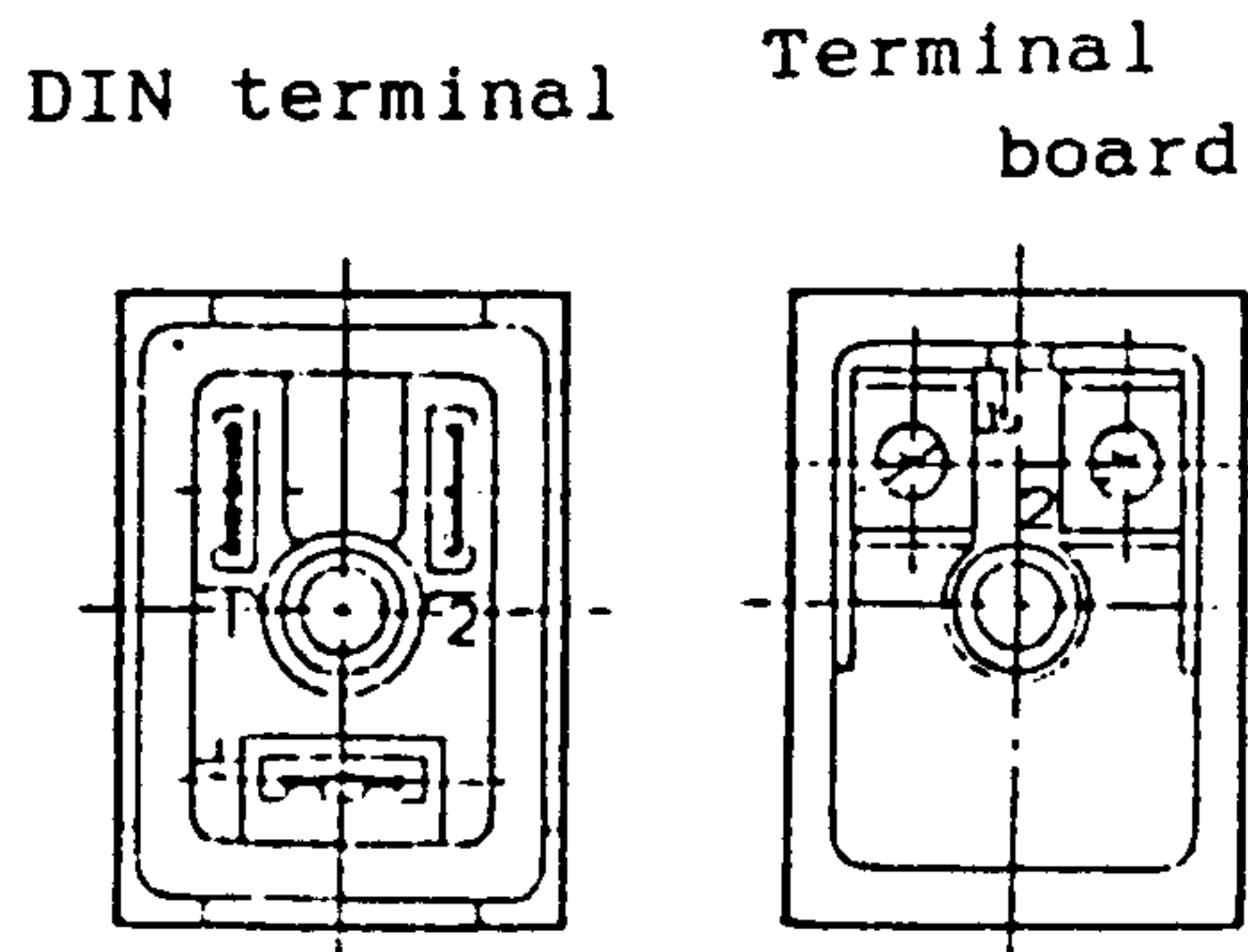


To install wire assembly into sub-plate, depress wire assembly lock ① and push firmly into plug housing.

For removal of wire assembly push wire assembly into housing. Depress wire harness lock and firmly pull out.

2) Single Non Plug-in sub-plate

Connect leads wire from solenoid housing to the power source end.



The units with DIN terminal and terminal board (with voltage suppressor) are so internally wired as shown below; connect them to the power source end.

Terminal No.	1	2
Terminal board	+	-
DIN terminal	+	-

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

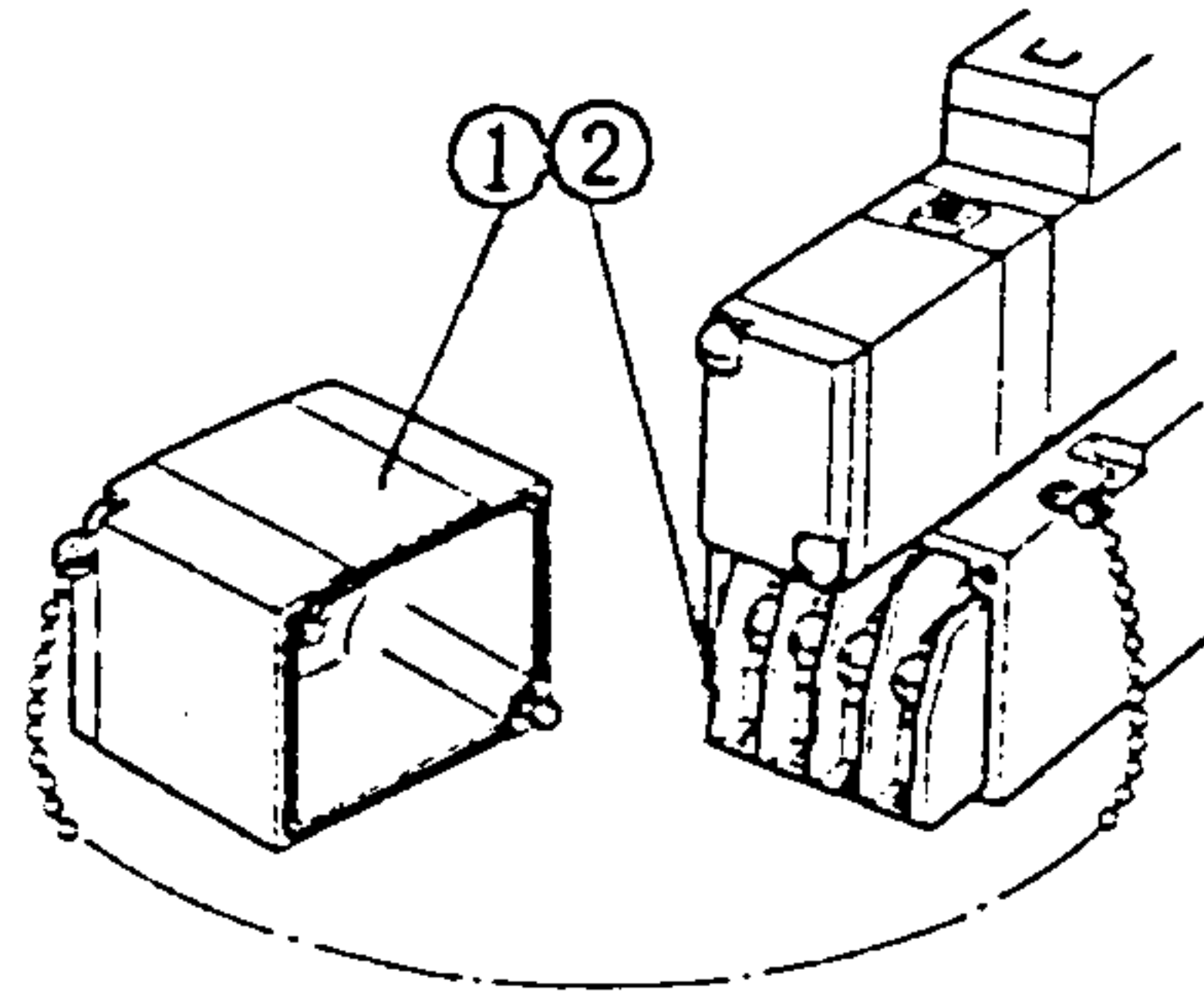
Fastening torque of connector

Clamping screws: 6kgf-cm

Terminal screws: 9kgf-cm

3) Plug-in Type (with terminals)

First remove junction cover ① of the sub-plate, and then pull out of the terminal board ② (Part No. NVF2000-27A) 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	
	A		B	
Marking on terminal board	+	-	+	-

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

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.)

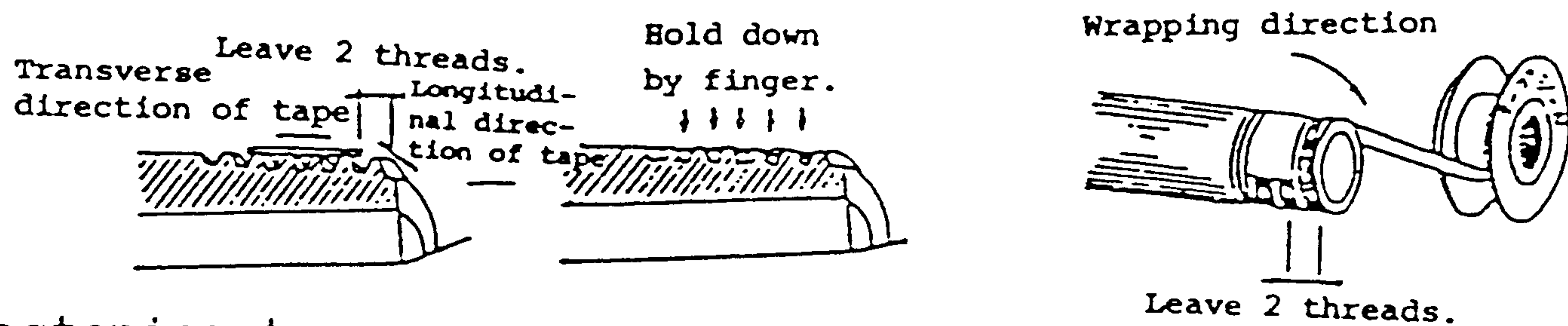
7. PIPING

- 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.

TROUBLES AND REMEDY

- 1) Location the source of trouble

Step1 What is the phenomenon of trouble?

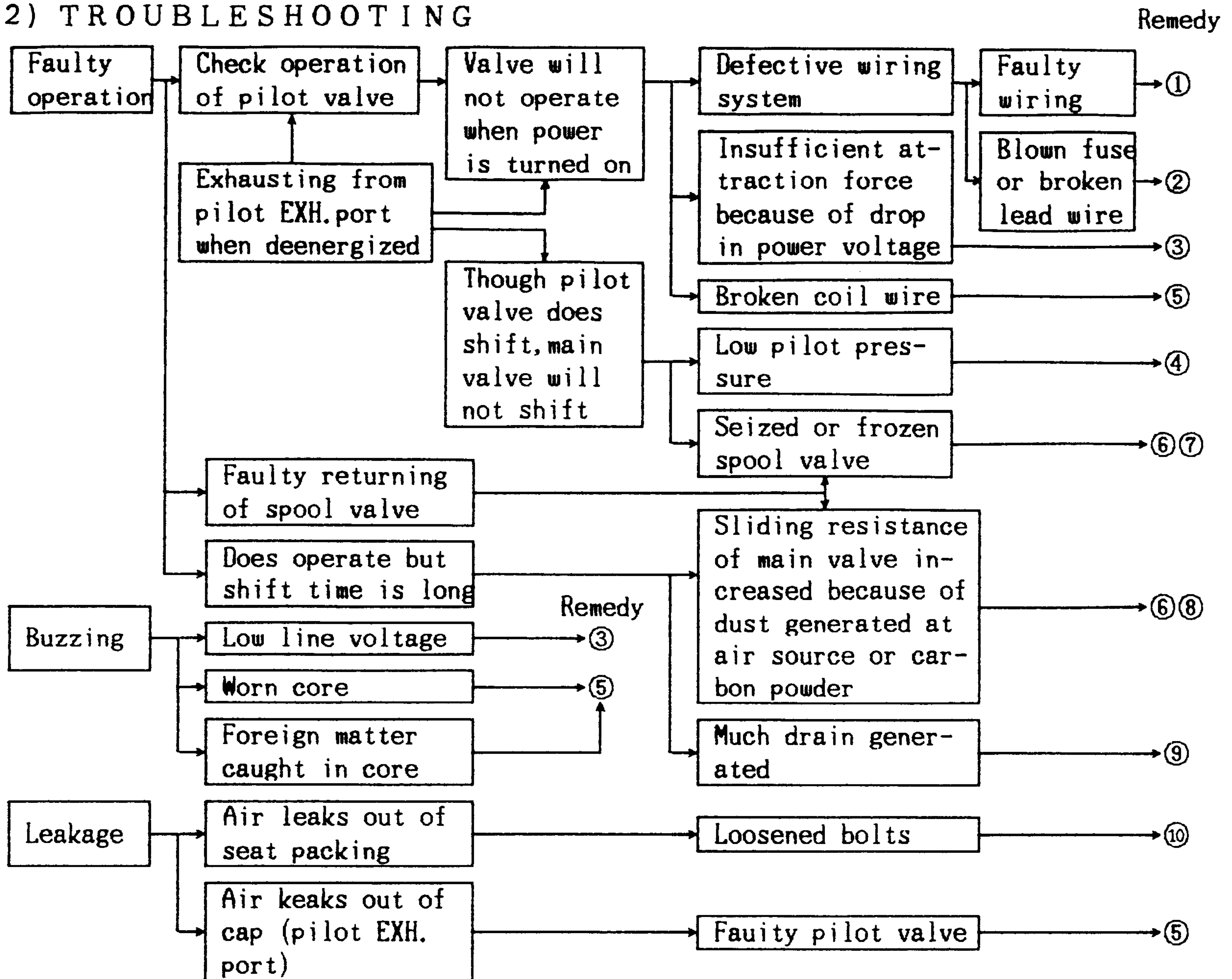
- (1) Faulty operation?
- (2) Buzzing?
- (3) Poor seal?

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.