SM-50520-A

INSTRUCTION MANUAL

FOR

3 – PORT, SOLENOID VALVE

NVP11 SERIES

Prior to using the Product, it is essential to read this INSTRUCTION MANUAL, especially the description of safety-use issue.

For quick reference whenever necessary, keep this INSTRUCTION MANUAL in a good manner.

CKD Corporation

Introduction

Thank you for choosing the CKD's solenoid valve NVP11.

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 an external-pilot, 3-port, selector solenoid valve specially designed for pneumatic or low vacuum systems of general industrial machines and instruments.

It is intended for switching a pneumatic circuit or absorbing and transfering goods using vacuum supplied through a low vacuum circuit.

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 properly handle 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

[CONTENTS]

1. Unpackaging

(1) Check that the model No. shown on the face plate of the product agrees 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 keep the product, install a seal plug to prevent the intrusion of foreign matter to the valve. Remove the seal plug when piping the valve.

2. Installation

2.1 Conditions for installation

2.1.1 Protection of the product

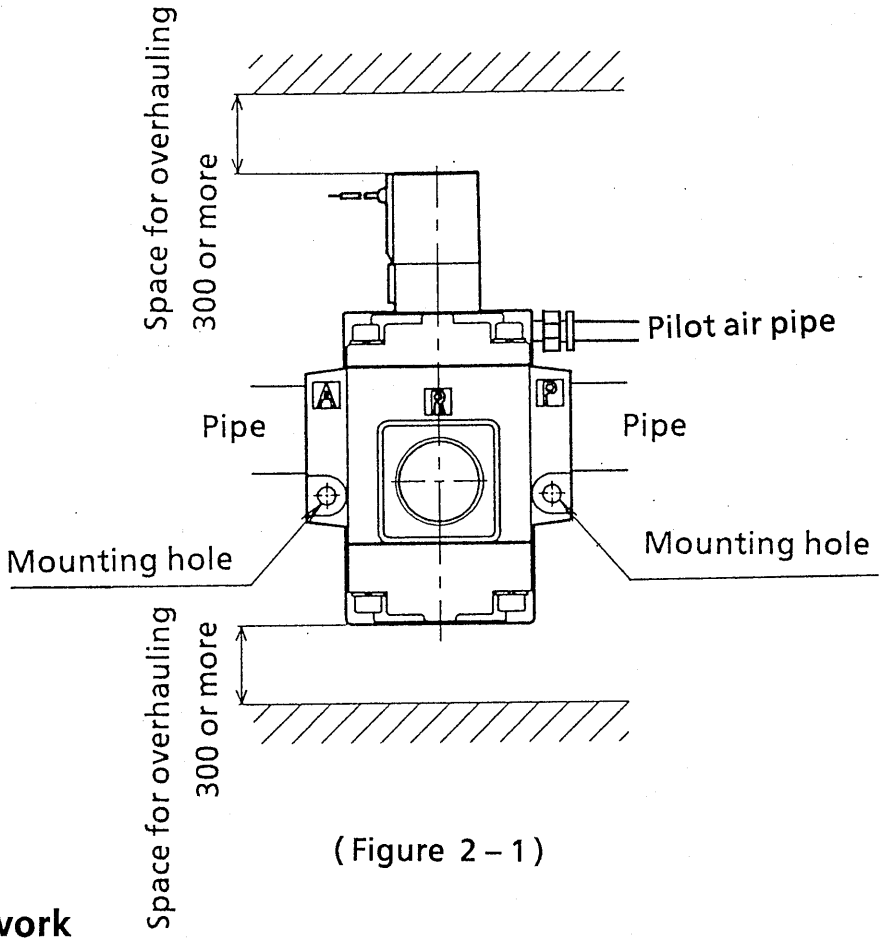
(1) Outdoor use
This valve cannot be used outdoor.
It shall be protected by enclosing with a cover or panel.
(2) Water drips and cutting oil
Protect the valve against water drips and cutting oil by enclosing the valve with a cover or panel.
(3) Use in a cold district
When using the valve in a cold district, an adequate provision is required to prevent the freezing of the valve.
(4) Corrosive atmosphere
Do not use the valve in the corrosive or explosive atmosphere.

2.1.2 Orientation

(1) The mounting posture of the valve is not specified.
(2) Fix the valve using the mounting hole on the valve except when using a metallic pipe.
(3) The valve cannot be used in a place where it will be submitted to the vibration larger than 5G.

2.1.3 Space for maintenance

- An adequate space shall be provided around the valve to assure the safety during the maintenace/troubleshooting work (see Figure 2-1).



(Figure 2 – 1)

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) Dust

If the valve is used in the atmosphere containing much dust, it will be likely to malfunction or cause a leakage. In this case, a silencer or filter shall be installed at the exhaust or air intake port to prevent the intrusion of dust.

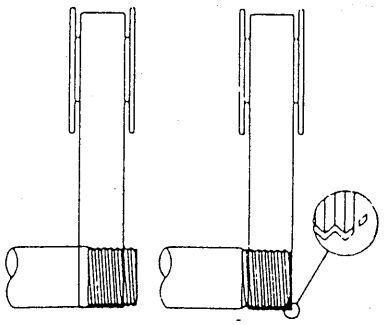
(4) Flowing direction of the fluid

The valve shall be piped in such a manner that the flowing direction of the fluid will match the direction of the arrow indicated on the JIS symbol of the product.

(5) Sealer

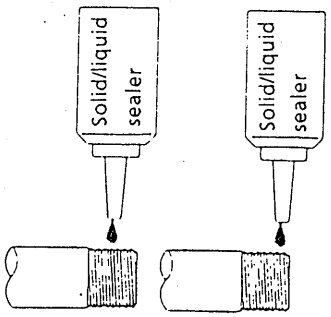
The sealer shall be used with great care to prevent it from entering the pipes or leaking out.
When taping a threaded portion, one point five or two threads at the end of the portion shall be exposed (see Figure 2-2).
When using liquid sealer, take care not to apply too much sealer. Similarly to the case of taping, one point five or two threads at the end of the threaded portion shall be exposed (see Figure 2-3).
Do not apply to the female screw of the apparatus.

● Seal tape



(Figure 2 – 2)

● Solid / liquid sealer



(Figure 2 – 3)

(6) 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	1/8	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]

(7) 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).

2.3 Wiring work

(1) Continuous power supply

When the solenoid valve is installed on a control panel or energized for an extended period, it will be heated to a temperature of 40 - 60°C. In this case, a provision is required to discharge heat, i.e. ventilation.

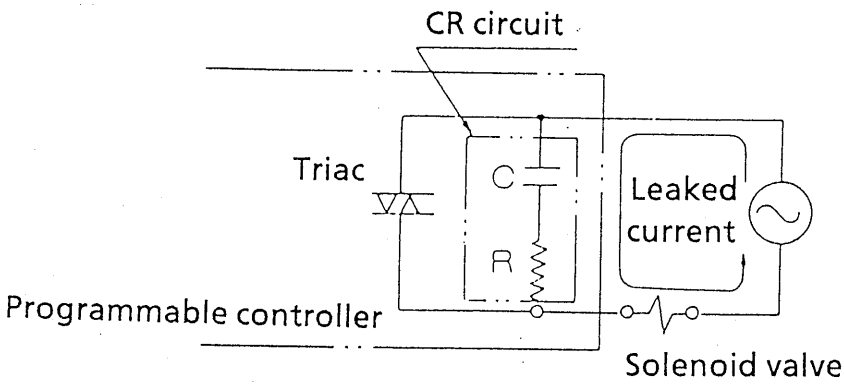
(2) Permissible limit of leaked current

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 (see Figure 2-4).

..... Leaked current: 1.8 (3) mA or less

The leaked current may lead to a malfunction.

The value within parentheses represents the leaked current measured with a surge killer provided.



(Figure 2 – 4)

(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 and/ or surge killer.

2.3.1 Electric connection of grommet coil lead

This subsection applies to the one with grommet coil (optional coil code "2C").

(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.

2.3.2 Electric connection of DIN terminal box

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

(1) For the cabtyre cord, use the one specified in Table 2-2.

Table 2-2

Specifications for cabtyre cord	Connection port size of valve	
	10A - 25A	32A - 50A
O.D. of cord	ϕ4.5 - ϕ7	ϕ6 - ϕ10
Nominal sectional area mm^2	0.75	0.75 - 1.5

(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.

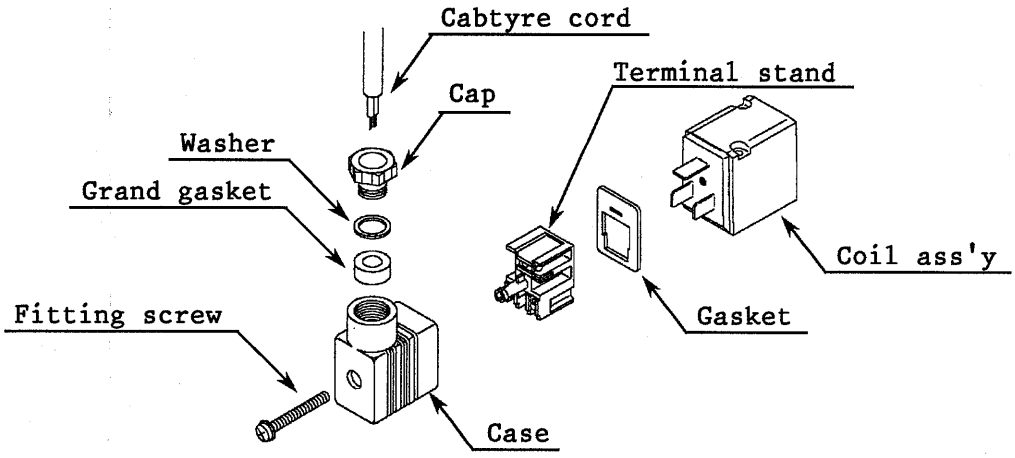
⚠ Caution	• Take care not to connect the terminal box in a wrong manner. The terminals with markings ① and ② on the terminal block are for conductors. The terminal with a marking GND on the terminal block is for grounding.

(5) Enclose the terminal block with the casing.

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

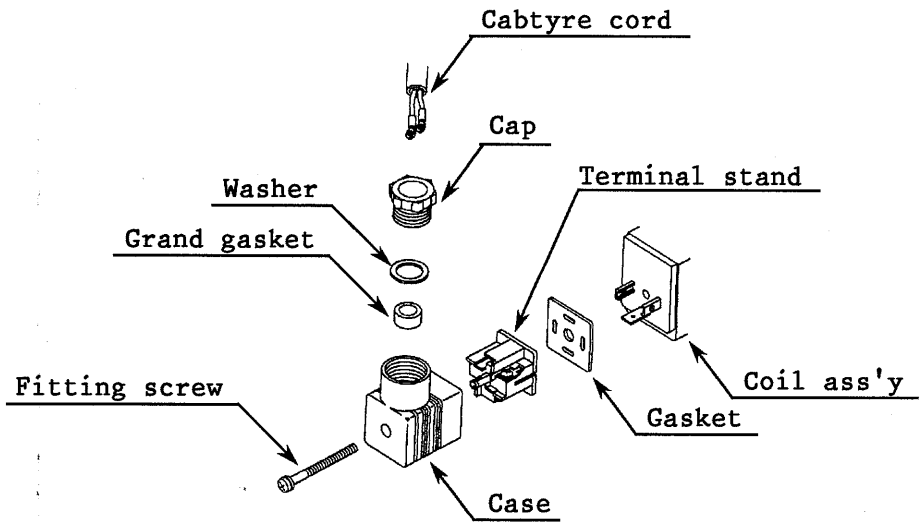
(7) Insert the DIN terminal box to the coil with the grounding terminal of the coil aligned with that on the terminal block.

- DIN terminal box (Pg 9)
- DIN terminal box with lamp (Pg 9)



(Figure 2-5.) Electric connection of DIN terminal box (10A to 25A)

- DIN terminal box (Pg 11)
- DIN terminal box with lamp (Pg 11)



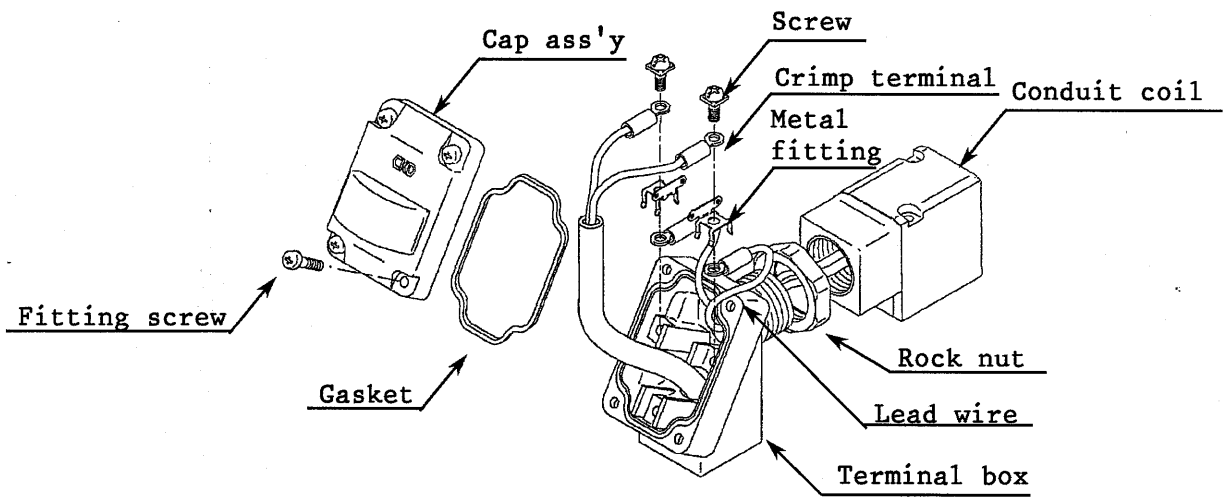
(Figure 2-6.) Electric connection of DIN terminal box (32A to 50A)

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 "3R").

(1) For the cabtyre cord, use the one with a nominal sectional area ranging from 0.75 to 1.5 mm^2.
(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.

- T-type terminal box (G1/2)
- T-type terminal box with lamp (G1/2)



(Figure 2 – 7) Electric connection of T-type terminal box

3. Pre-operation (post-installation) check

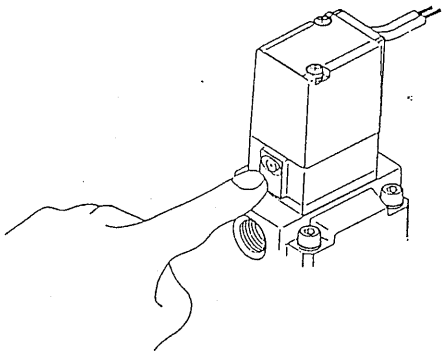
3.1 Appearance check

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

(1) Push the valve with finger to check 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

(1) Supply compressed pilot air to the pilot connector port (port X).
(2) Supply compressed fluid to the main line.
(3) Compress the fluid to check for leakage at pipe joints.
It is recommended to check for leakage by supplying a pneumatic pressure of 0.3 - 0.5 MPa with soapy water applied to the joints. Air bubbles will be generated at the leaking joints.
(4) Manual operation
① Supply compressed pilot air to portX.
② Compress the fluid.
③ Push the manual shaft until it bottoms.
The valve will be energized while the manual shaft is pushed.
The valve will return when the manual shaft is released.
(See Figure 3-1.)



The valve operates while the shaft is pushed.

(Figure 3 – 1)

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.

(3) If the time for which the valve is energized is too short, the valve may not follow the operation of the entire system.
Check that the operating frequency specified in section 10 is satisfied.

(4) If the valve has been out of use for seven days or longer, the first cycle after the restart of the valve may take approximately a second longer than usual.
In this case, a commissioning shall be performed before operating the valve.

4. Instructions for proper use

⚠ Caution	• When the solenoid valve is continuously operated, it will be heated to a temperature of 40 - 60°C. 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. • Install a silencer at the exhaust port of the main piping to the valve to reduce the noise to be given to the personnel working around the machine.

(1) Do not put any object on the valve.
(2) The voltage variation shall be within ± 10% of the rated voltage.
(3) The operating frequency specified below shall be satisfied.

Table 4-1. Operating frequency

Connection port size of valve	Operating frequency
10A · 15A	360 cycles/min or less
20A · 25A	180 cycles/min or less
32A - 50A	90 cycles/min or less

If the time for which the valve is energized is too short, the valve may not follow the operation of the entire system.

(4) If the valve has been out of use for seven days or longer, the first cycle after the restart of the valve may take approximately a second longer than usual.
In this case, a commissioning shall be performed before operating the valve.
(5) Periodically remove the drain accumulated in the air filter.
(6) If the filter element of the air filter turns black, it means that it has been contaminated with tar. Periodically clean the filter element.
(7) When supplying oil using a lubricator, periodically replenish oil to keep the oil level in the lubricator.
For lubrication, use type 1 turbine oil, ISO VG 32 (no additives).
(8) If any abnormal condition is found, see section 7 "Troubleshooting."

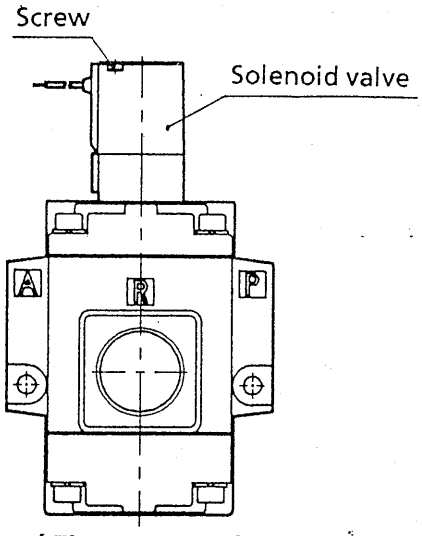
5. Disassembly and assembly

5.1 Replacement of pilot solenoid valve

5.1.1 Disassembly procedure

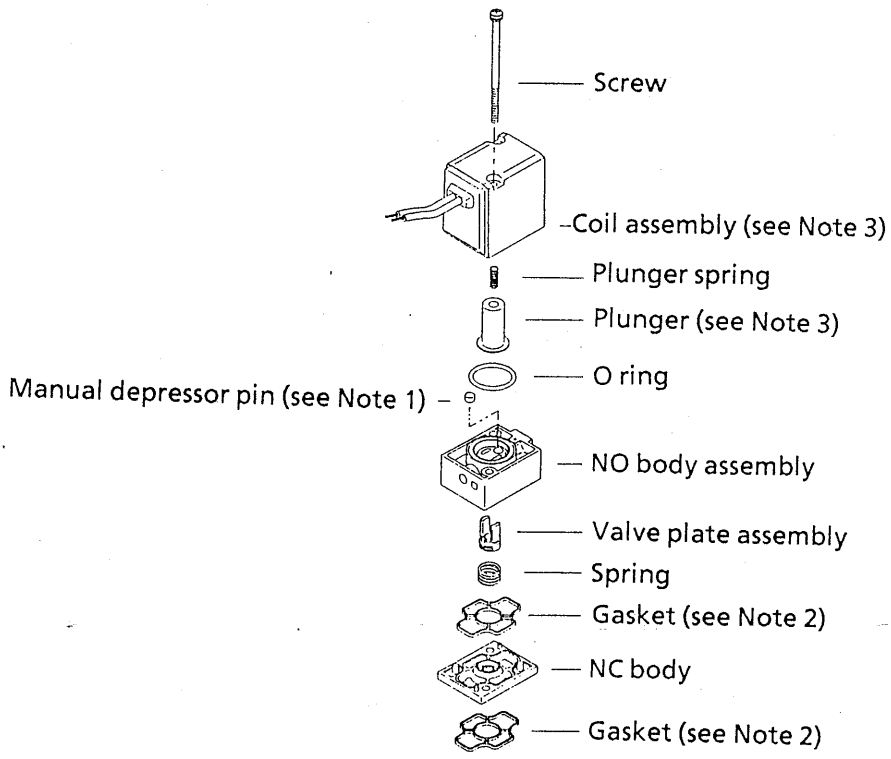
⚠ Caution	• Close the main valve. • Exhaust the fluid remaining in the valve. • Turn off the power.

(1) Remove wires from the solenoid valve.
(2) Loosen the screw.
(3) Raise the solenoid valve.



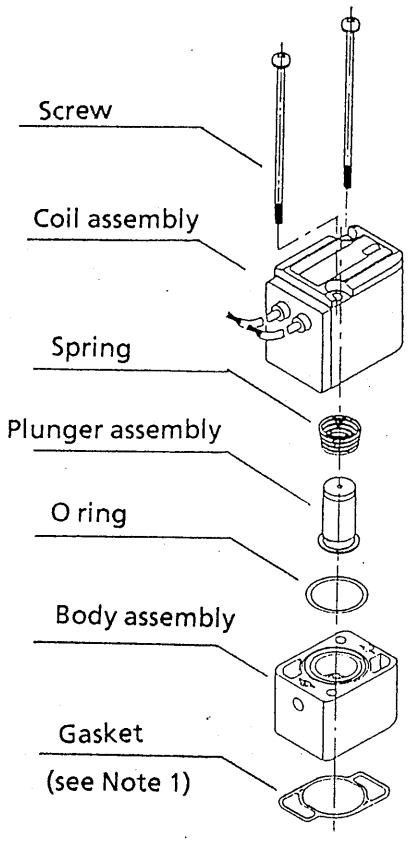
(Figure 5 – 1)

Note 1: When disassembling the solenoid valve, take case not to lose the manual depressor pin.
Note 2: When assembling the solenoid valve, take care not to install the gasket in the wrong direction.
Note 3: Different coil assemblies and plungers are used for AC voltage and for DC voltage. Replace the coil assembly and plunger as a unit.
Note 4: Turbine oil is applied to the plunger for lubrication.



(Figure 5 – 2) Developed view of the pilot solenoid valve (10A to25A)

Note 1: Take care not to install the gasket in the wrong direction.



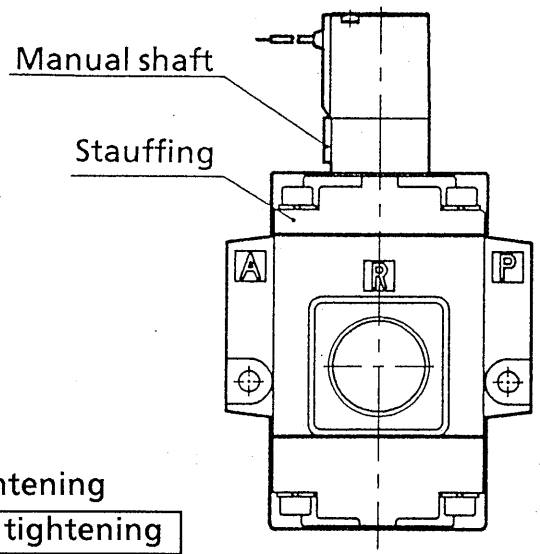
(Figure 5 – 3) Developed view of the pilot solenoid valve (32A to50A)

5.1.2 Assembly procedure

(1) Install the gasket to the body assembly with care not to install it in the wrong direction.

(2) Put the solenoid valve on the stauffing.
Take care not to orient the manual unit in a wrong way.

(3) Tighten the screw.



(Figure 5 – 4)

Table 5-1. Torques required for tightening

Size of screw	Torque required for tightening
M3	0.7 - 1.1 N · m
M4	1.1 - 1.8 N · m

(4) Connect electric wires to the valve.

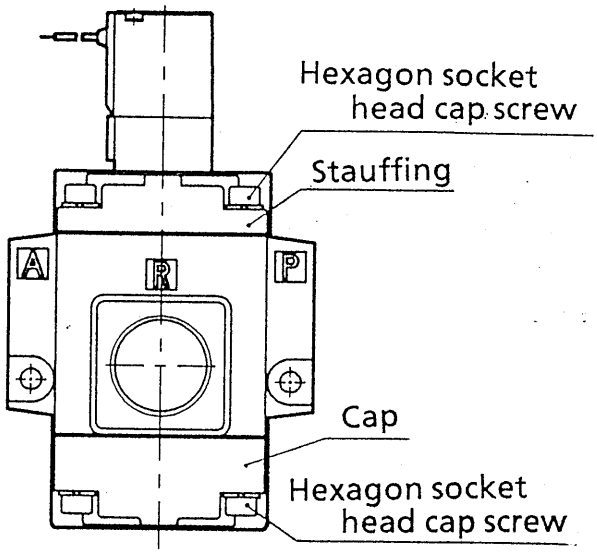
(5) Turn on the power and activate the fluid circuit.

5.2 Replacement of the valve stem

5.2.1 Disassembly procedure

⚠ Caution	• Close the main valve. • Exhaust the fluid remaining in the valve. • Turn off the power.

(1) Loosen the hexagon socket head cap screw on the stauffing.
(2) Raise the stauffing.
(3) Loosen the hexagon socket head cap screw on the cap. At this time, take care not to lose the spring located inside the cap.



(Figure 5 – 5)

5.2.2 Assembly procedure

(1) The assembly shall be performed with reference to section 8 "Internal construction drawings."
(2) Apply grease to the packing and O ring.
For grease, use silicone grease G-40H, Shinetsu Kagaku Kogyo.
(3) Apply grease to the surface on which the piston slides.
(4) Apply grease to the surfaces of the body and valve seat on which the packing slides.
(5) Insert the valve stem from the bottom of the body.
(6) Insert the valve seat from the bottom of the body.
(7) Install the gasket, piston, spring and cap and tighten the hexagon socket head cap screw.
At this time, the holes on the gasket shall be aligned with the body and cap respectively.
(8) Install the stauffing and tighten the hexagon socket head cap screw. Again, take care to correctly locate the holes on the gasket.
(9) Compress the fluid to check that the fluid is not leaking out.
(10) Turn on the power and activate the fluid circuit.

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) Solenoid valve
Replace the solenoid valve with a new one if an electric failure or another abnormal condition is observed with it.
As a guideline, replace it every 10 million cycles.

(2) Valve stem, valve seat and spring
Replace them with new ones if fluid leaks or the valve seat does not move or delays to move during the operation.
As a guideline, replace them every 10 million cycles.

(3) Packing, O ring and gasket
Replace them with new ones if fluid leaks or another abnormal condition is observed.
As a guideline, replace them every 10 million cycles.

7. Troubleshooting

- If the valve does not function as specified, check it according to Table 7-1.

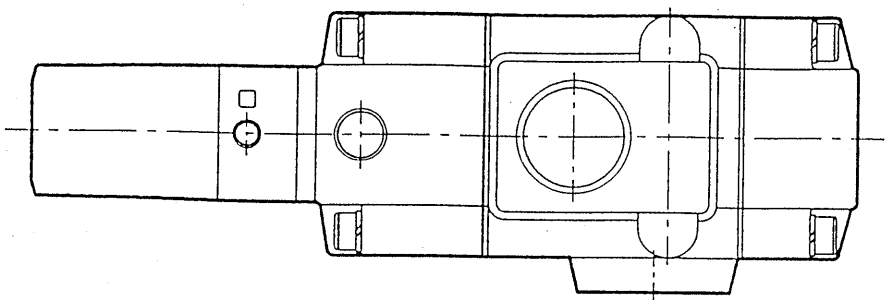
Table 7-1

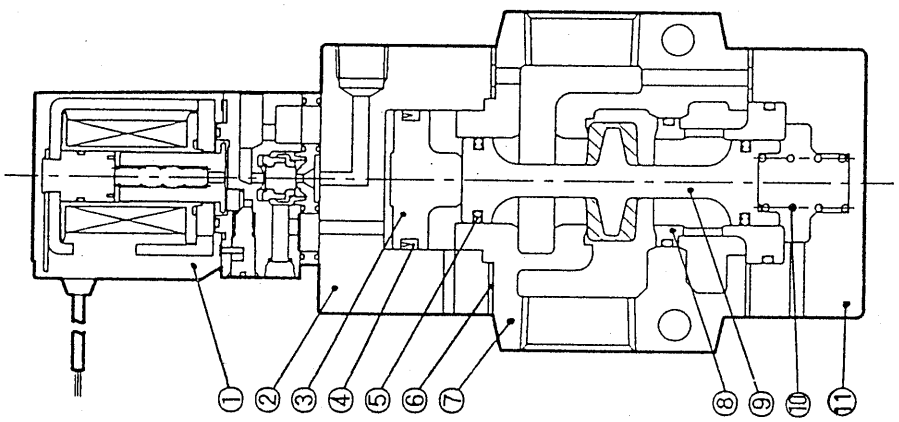
Symptom	Cause	Action
The valve does not move.	It is not energized.	Check the wiring and fuse and turn on the power supply.
	The voltage is lower than the rating.	Check the power supply and apply the rated voltage.
	The fluid pressure is too high.	Adjust the fluid pressure.
	The pilot air pressure is too low.	Adjust the pilot air pressure.
	The pilot solenoid valve does not move.	Replace the pilot solenoid valve with a new one.
	Foreign matter is entangled by the valve stem.	Overhaul the valve and clean the inside of it.
The valve does not return.	It is not de-energized.	Check for leaked current. Modify the circuit to turn off the power supply without fail.
	The pilot solenoid valve does not return.	Replace the pilot solenoid valve with a new one.
	Foreign matter is entangled by the valve stem.	Overhaul the valve and clean the inside of it.
	Packing is running short of grease.	Overhaul and reassemble the valve.
External leakage	The fluid pressure is too high.	Adjust the pressure.
	The packing is damaged or worn.	Overhaul the valve and replace the packing with a new one.
	O ring is damaged.	Overhaul the valve and replace the O ring with a new one.
Leakage from the valve seat	The valve seat on the body is damaged.	Replace the body with a new one.
	The sealing surface of the valve seat is damaged.	Replace the valve seat with a new one.
	The rubber or sealing surface of the valve stem is damaged or worn.	Replace the valve stem with a new one.
	Foreign matter is entangled by the valve stem.	Overhaul and clean the valve.

* If further information is required, consult us or the nearest agency.

8. Internal construction drawings

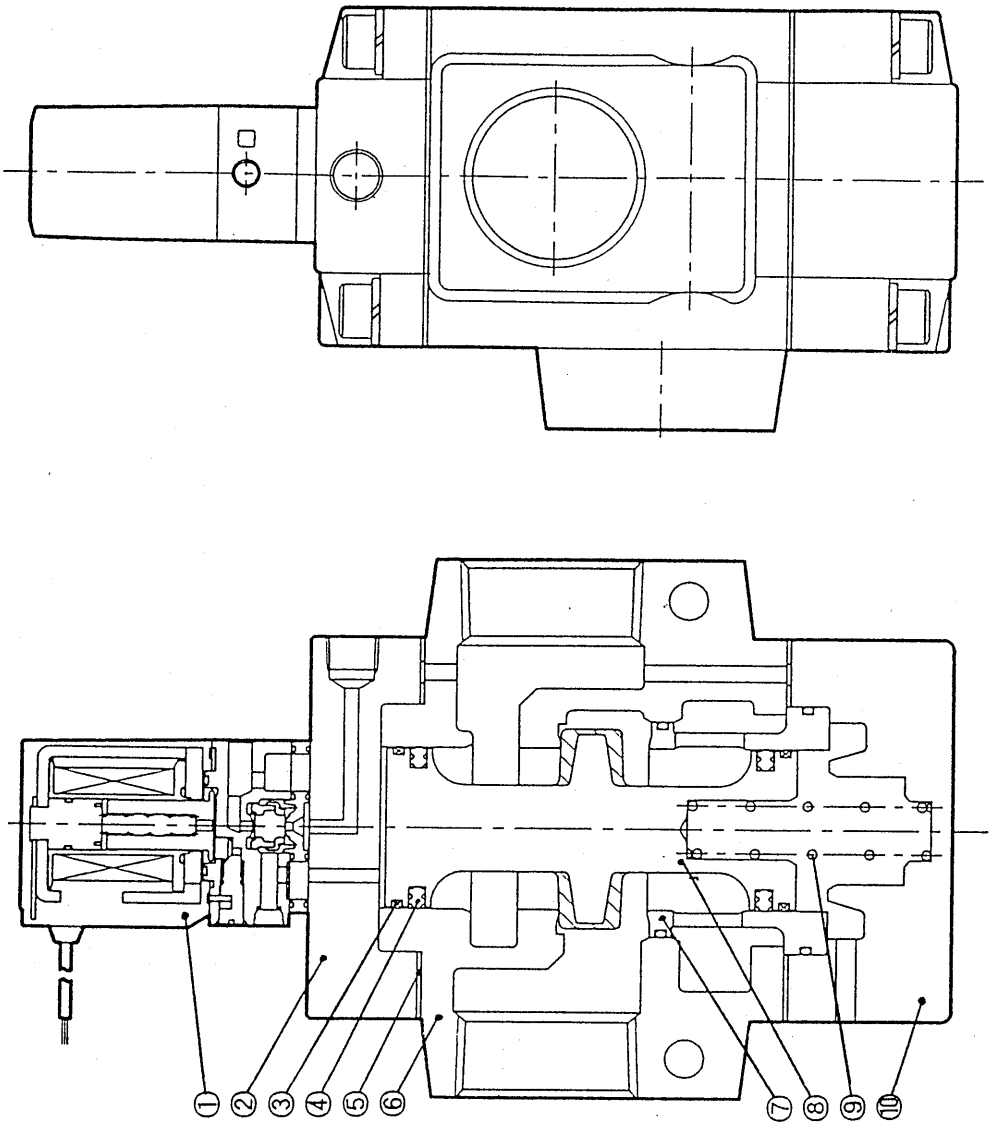
8.1 Connection port size : 10A to 15A





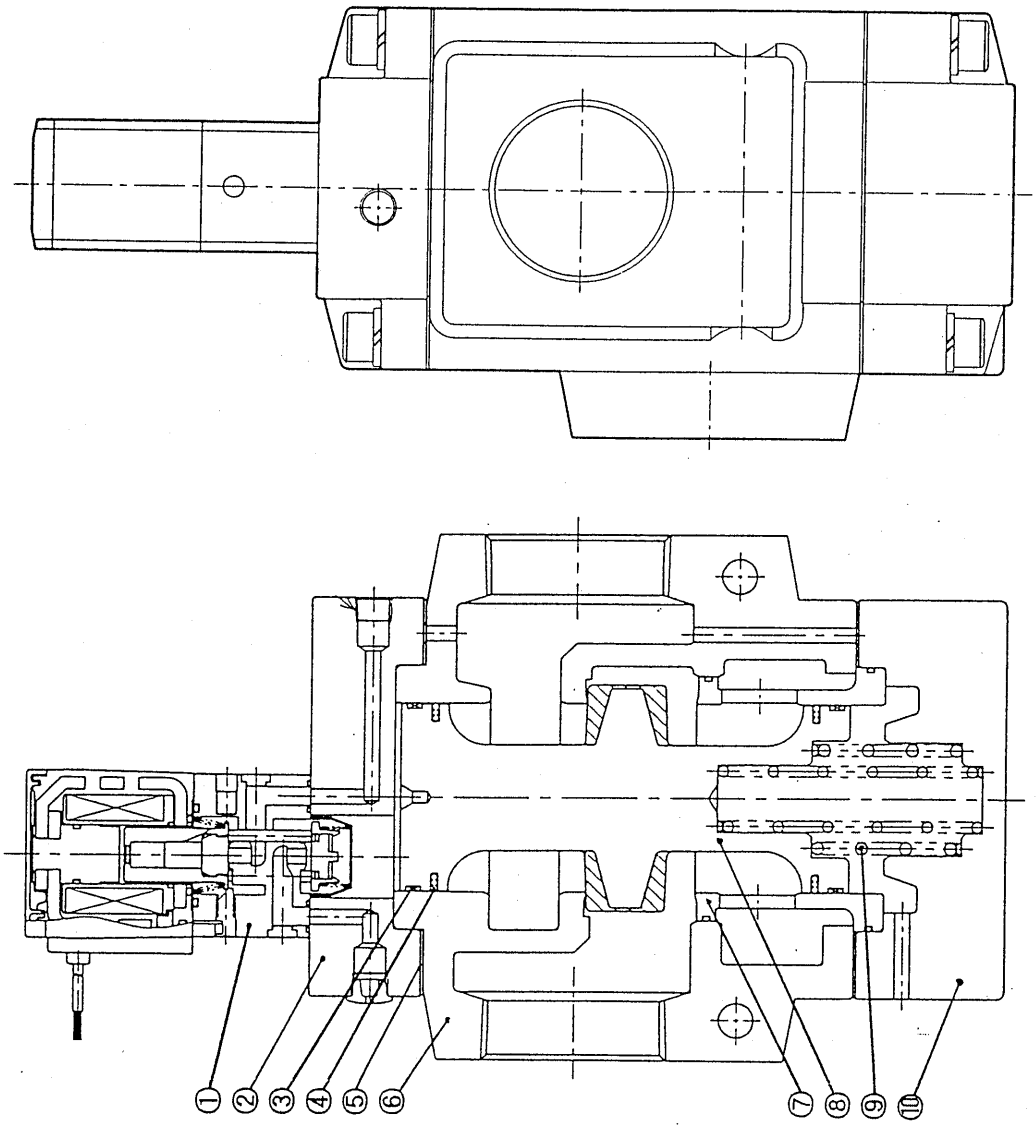
No.	Part name	Qty
1	Solenoid valve	1
2	Staffing	1
3	Piston	1
4	MY packing	1
5	Packing	2
6	Gasket	2
7	Body	1
8	Valve seat	1
9	Valve stem	1
10	Spring	1
11	Cap	1

8.2 Connection port size : 20A to 25A



No.	Part name	Qty
1	Solenoid valve	1
2	Staffing	1
3	Wear ring	2
4	Packing	2
5	Gasket	2
6	Body	1
7	Valve seat	1
8	Valve stem	1
9	Spring	1
10	Cap	1

8. 3 Connection port size : 32A to 50A



No.	Part name	Qty
1	Solenoid valve	1
2	Staffing	1
3	Wear ring	2
4	Packing	2
5	Gasket	2
6	Body	1
7	Valve seat	1
8	Valve stem	1
9	Spring	1
10	Cap	1

9. Operating mechanism

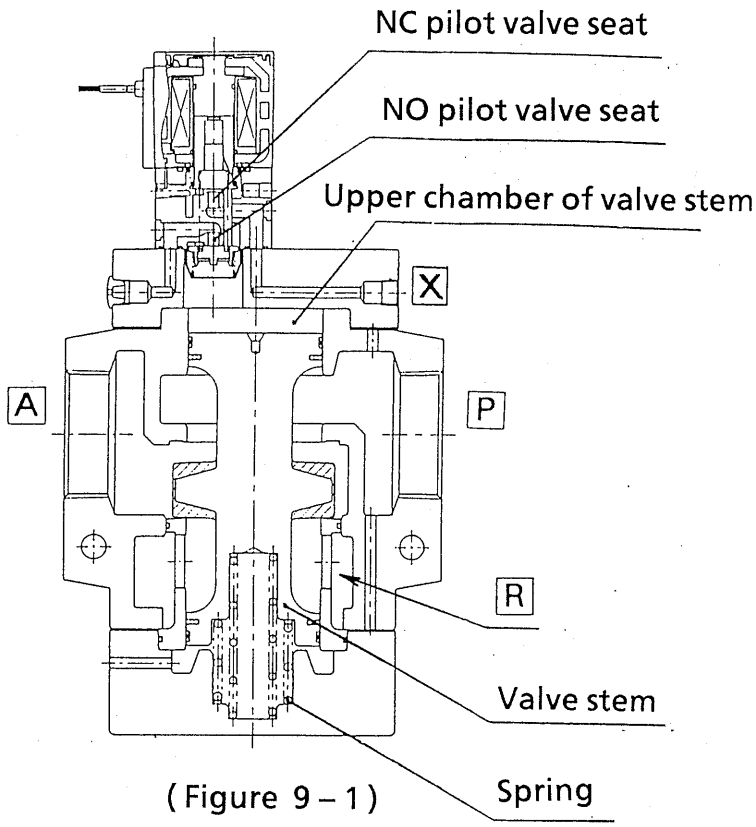
• Opening operation

(1) As the solenoid valve is energized, the NC pilot valve seat will open and the NO pilot valve seat will close.

(2) The pilot air, after sent to port X, will pass through the NC pilot valve seat and be supplied to the upper chamber of the valve stem.

(3) The valve stem will lower to close the valve seat and open the valve seat on the body.

(4) The fluid in the main line will connect ports P and A and close port R.



(Figure 9 – 1)

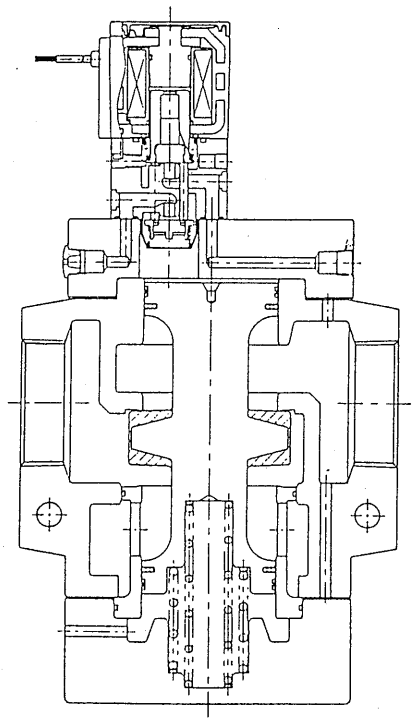
• Closing operation

(1) As the solenoid valve is de-energized, the NC pilot valve seat will close and the NO pilot valve seat will open.

(2) The pilot air in the upper chamber of the valve stem will pass through the NO pilot valve seat and be released to the atmosphere.

(3) The valve stem will rise by means of the spring force to close the valve seat on the body.

(4) The fluid in the main line will connect ports A and R and close port P.



(Figure 9 – 2)

10. Specifications for the product

10.1 Meaning of the model No.

NVP11 – 15A – 12GS – 1

① ② ③ ④ ⑤

① Body end connection port size	
Symbol	Content
10A	Rc 3/8
15A	Rc 1/2
20A	Rc 3/4
25A	Rc 1
32A	Rc 1 1/4
40A	Rc 1 1/2
50A	Rc 2

② Materials of body and seal		
Symbol	Body	Seal
1	Aluminum	NBR

③ Optional coil code	
Symbol	Content
2C	Grommet coil
2G	With DIN terminal box
2H	With DIN terminal box with lamp
3T	With T-type terminal box (G 1/2)
3R	With T-type terminal box with lamp (G 1/2)

④ Other optional equipment	
Symbol	Content
No symbol	No optional equipment
S	With surge killer

⑤ Rated voltage	
Symbol	Content
1	AC 100 V 50/60 Hz, AC110 V 60 Hz
2	AC 200 V 50/60 Hz, AC220 V 60 Hz
3	DC 24 V

10.2 Specifications for the product

I.D. of connector port	10A	15A	20A	25A	32A	40A	50A
Resisting pressure	1.2 MPa						
Operating fluid	Compressed air or low vacuum						
Fluid pressure	(Air) 0 - 0.8 MPa (Vacuum) 1Torr - 0.7 MPa						
Fluid temperature	5 - 60°C						
Ambient temperature	– 5 - 60°C				– 5 - 40°C		
Ambient humidity	95% or less						
Operating fluid	Compressed air						
Operating fluid pressure	0.35 - 0.7 MPa						
Operating fluid temperature	5 - 60°C						
Voltage variation	± 10% of the rated voltage						
Power consumption [W]	(AC) 2.0/1.7 (DC) 4				(AC) 7.5/6 (DC) 8		
Response time (in milliseconds)	30 or less		60 or less		120 or less		
Operating frequency (in clcyes/min)	360 or less		180 or less		90 or less		

- The response time is measured during the unlubricated operation with a supply pressure of 0.5 MPa. It varies depending on the pressure and the nature of the oil to be supplied.