CKD

SM－50766－A

INSTRUCTION MANUAL

WITH SPOOL POSITION DETECTOR
3-PORT, SOLENOID VALVE
SNP 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.

CKD Corporation

Safety precautions

When designing and manufacturing a device using CKD products, the manufacturer is obligated to manufacture a safe product by confirming safety of the system comprising the following items:

■ Device mechanism
■ Pneumatic or water control circuit
■ Electric control that controls the above

It is important to select, use, handle, and maintain the product appropriately to ensure that the CKD product is used safely.
Observe warnings and precautions to ensure device safety.
Check that device safety is ensured, and manufacture a safe device.

⚠WARNING

1. This product is designed and manufactured as a general industrial machine part. It must be handled by someone having sufficient knowledge and experience.

2. Use this product within its specifications.

Consult with CKD for details when using the product beyond the unique specification range, outdoors, or in the following conditions or environment: Additionally, the product must not be modified or machined.

① Use for special applications requiring safety including nuclear energy, railroad, aviation, ship, vehicle, medical equipment, equipment or applications coming into contact with beverage or food, amusement equipment, emergency shutoff circuits, press machine, brake circuits, or for safeguard.
② Use for applications where life or assets could be adversely affected, and special safety measures are required.

3. Observe corporate standards and regulations, etc., related to the safety of device design and control, etc.

ISO4414, JIS B 8370 (pneumatic system rules)
JFPS2008(principles for pneumatic cylinder selection and use)
Including High Pressure Gas Maintenance Law, Occupational Safety and Sanitation Laws, other safety rules, body standards and regulations, etc.

4. Do not handle, pipe, or remove devices before confirming safety.

① Inspect and service the machine and devices after confirming safety of the entire system related to this product.
② Note that there may be hot or charged sections even after operation is stopped.
③ When inspecting or servicing the device, turn off the energy source (air supply or water supply), and turn off power to the facility. Discharge any compressed air from the system, and pay enough attention to possible water leakage and leakage of electricity.
④ When starting or restarting a machine or device that incorporates pneumatic components, make sure that the system safety, such as pop-out prevention measures, is secured.

5. Observe warnings and cautions on the pages below to prevent accidents.

■ **The safety cautions are ranked as "DANGER", "WARNING" and "CAUTION" in this section.**

⚠ DANGER :When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries, or when there is a high degree of emergency to a warning.

⚠ WARNING :When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries.

⚠ CAUTION :When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.

Note that some items described as "CAUTION" may lead to serious results depending on the situation. In any case, important information that must be observed is explained.

Precautions with regard to guarantee

● **Guarantee period**

The guarantee period of our product shall be one (1) year after it is delivered to the place specified by the customer.

● **Guarantee coverage**

If any falure for which CKD CORPORATION is recognized to be responsible occurs within the above warranty period, a substitute or necessary replacement parts shall be provided free of charge, or the product shall be repaired free of chargeat the plant of CKD CORPORATION.

However, the guarantee excludes following cases:

① Defects resulting from operation under conditions beyond those stated in the catalogue or specifications.
② Failure resulting from malfunction of the equipment and/or machine manufactured by other companies.
③ Failure resulting from wrong use of the product.
④ Failure resulting from modification or repairing that CKD CORPORATION is not involved in.
⑤ Failure resulting from causes that could not be foreseen by the technology available at the time of delivery.
⑥ Failure resulting from disaster that CKD is not responsible of.

Guarantee stated here covers only the delivered products. Any other damage resulting from failure of the delivered products is not covered by this guarantee.

● **Confirmation of product compatibility**

Our customer shall be responsible of confirming compatibility of our product used in our customer's system, machinery or device.

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1. Unpacking

⚠ CAUTION	Do not remove the packing bag until just before piping work. Otherwise, foreign matter enters from the port and cause malfunction or bad operation.

(1) Check that the model No. shown on the face plate of the product agrees with that you ordered.
(2) Check that the product has no external damages.
(3) When storing the product, attach a sealing plug to prevent the intrusion of foreign matter to the valve. Remove the sealing plug when piping the valve.

2. Installation

⚠ WARNING	Contact CKD if the product is to be used beyond specifications, or in special applications.

2.1 Conditions for installation

⚠ WARNING	a) Do not splash fluids such as water or cutting oil directly. ・Fluids (such as water or cutting oil) splashed onto the coil part of the pilot solenoid valve causes the coil to burn. b) Coil generates heat. ・If the product will be installed in a control panel, of if the product will be energized for a long time, provide measures such as ventilation to release heat. The product temperature will be high. c) The product cannot be used in a corrosive or solvent atmosphere. d) Avoid using the product in a humid atmosphere, since change in temperature may cause bedewing. e) The product cannot be used in an explosive gas atmosphere. f) Prevent dust from entering the valve interior. ・If there are high levels of dust in the area , provide protection by installing a silencer or an elbow joint facing downward onto the exhaust port so that dust does not enter. g) Use the product away from radiant heat.

(1) When using the valve in a cold district, an proper provision is required to prevent freezing of the valve.
(2) This product cannot be used outdoors. Protect the product by a cover or by installing it in a panel.
(3) After the product is installed, avoid washing or painting the product using water or solvents. Otherwise, resin parts may break.
(4) Do not subject this product to vibration or inertia.

2.2 Installation

2.2.1 Installation

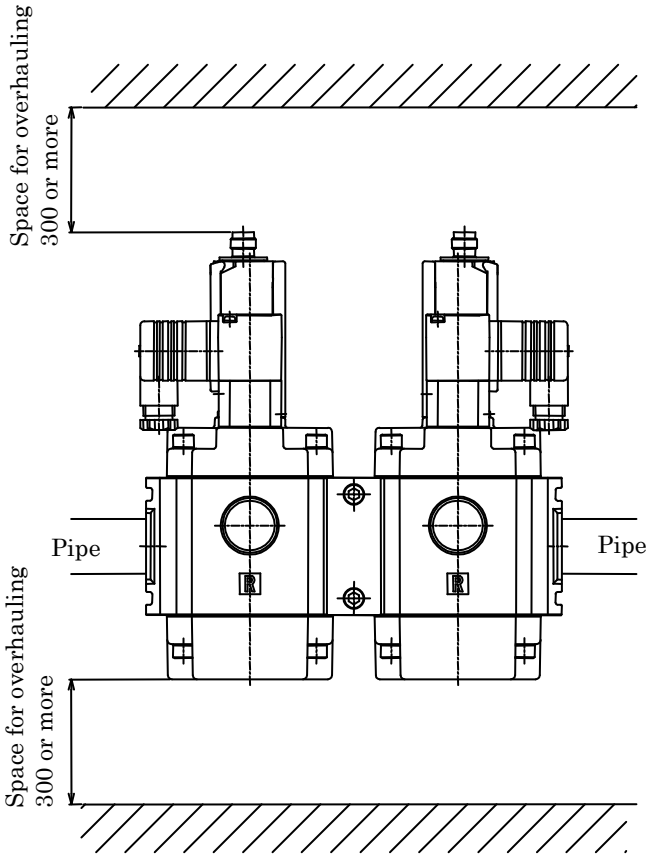
⚠ CAUTION	a) Always thoroughly read the Instruction Manual before installing this product. b) Always hold the body when handling or installing the product. c) After installing, check for leak from the pipe and make sure that the product is correctly installed.

(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.

2.2.2 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)

2.3 Piping method

⚠ CAUTION	a) Fix the product when tightening or reinstalling the piping. When piping to the body side, fix the body. b) Fix and support the pipes so that the weight and vibration of the pipes are not directly applied on the valves. c) Torque required to tightening pipes are shown in Table 2-1 for reference.

(1) Cleaning the pipes

・Before piping, flush the inside of the pipe with 0.3MPa air, and remove any foreign matter, metal powder, rust and sealing tape, etc.

(2) Removal of foreign matter

・Dust and foreign matter within the fluid causes the valve to malfunction and leak. Install a filter 5 μ m or finer at the primary side of the valve.

・The rusting of the inside of the pipes may lead to a malfunction and/or leakage.

(3) Prevention of dust being mixed

・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

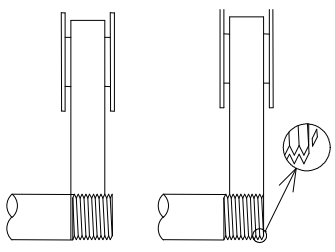
・The sealer shall be used with great care to prevent it from entering the pipes or leaking out.

・When taping a threaded portion, one 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 or two threads at the end of the threaded portion shall be exposed (see Figure 2-3).

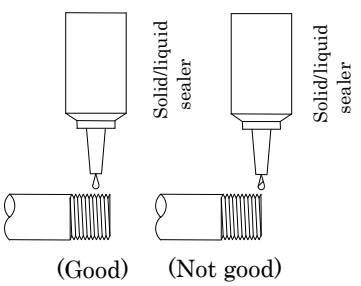
・Do not apply to the female screw of the apparatus.

●Seal type



(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 pipe
Rc 3/8	22 - 24 [N ・ m]
Rc 1/2	28 - 30 [N ・ m]
Rc 3/4	31 - 33 [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).

(8) Minimum differential pressure

・A differential pressure of 0. 2 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.

(9) Provision for drain

・ The compressed air contains high levels of drain (water, oxidized oil, tar, foreign matter) which can cause the reliability of the pneumatic components to drop remarkably. Improve the quality of the air (create clean air) by removing moisture with an after cooler or dryer, by removing the foreign matter with a filter, and by removing the tar with a tar removal filter, etc.

2.4 Wiring method

(1) Continuous power supply

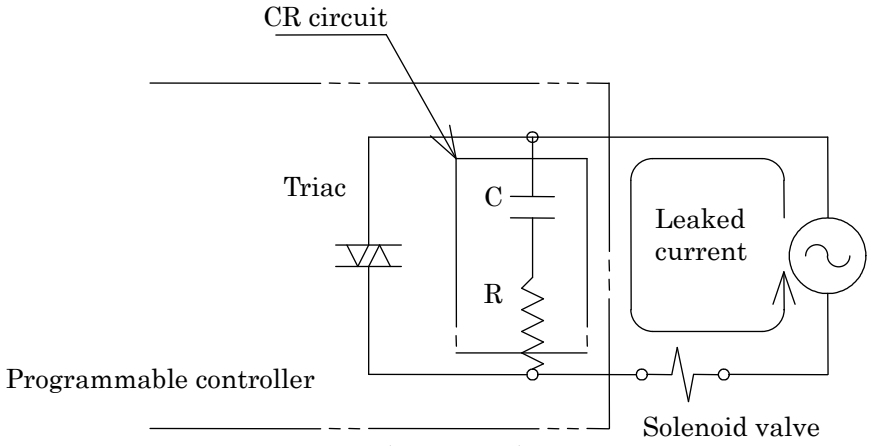
・When the solenoid valve is installed on a control panel or energized for an extended period, it will be heated to a temperature. In this case, a provision is required to discharge heat, i.e. ventilation.

(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.

2.4.1 Electric connection of DIN terminal box

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

⚠ 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.

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

Table 2-2

Specifications for cabtire cord	Connection port size of valve
	10A - 25A
O.D. of cord	φ4.5 – φ7
Nominal sectional area mm²	0.75

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

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

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

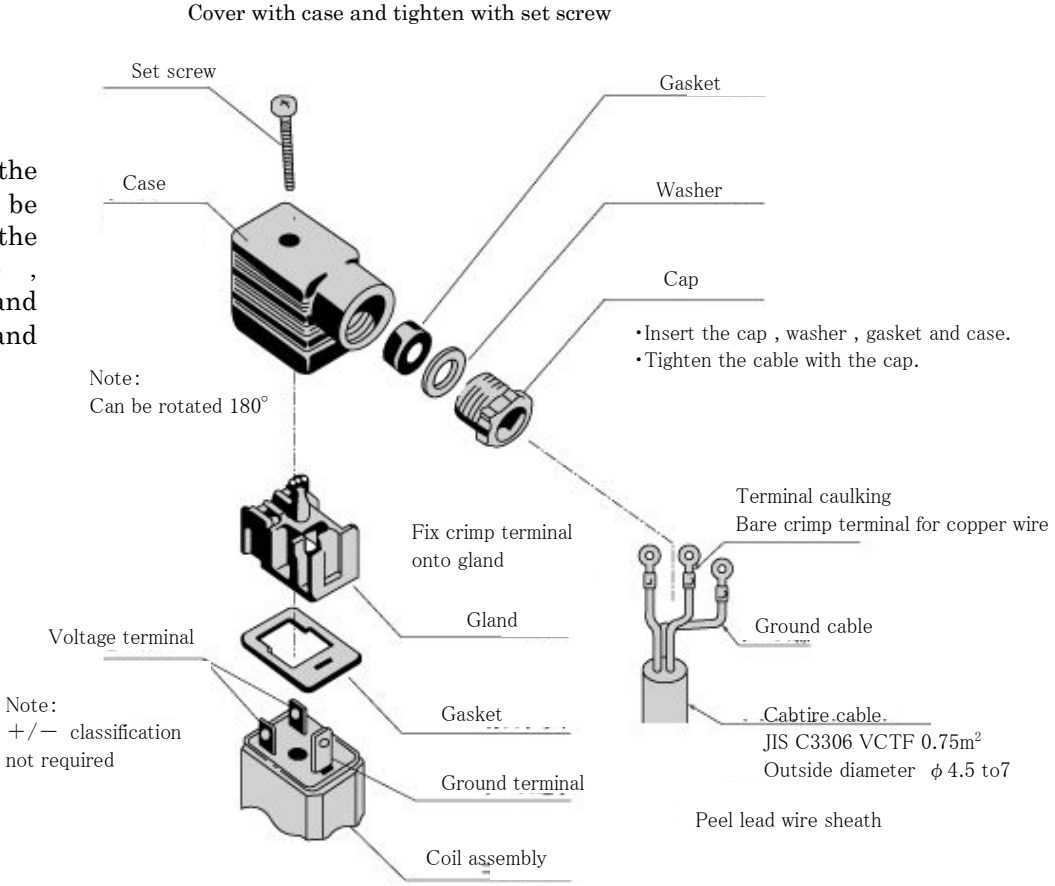
(5) Enclose the terminal block with the casing.

(6) Tighten the cap to fix the cabtire 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)

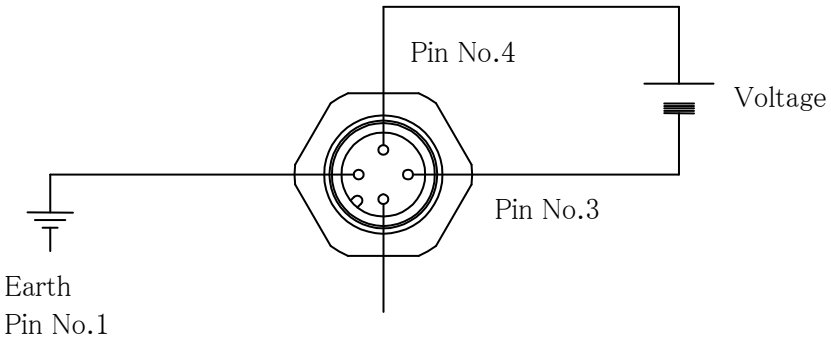
・the orientation of the cable lead out port can be changed by removing the gland from the case , rotating it by 180° , and then replacing the gland into the case.



(Figure 2-5.) Electric connection of DIN terminal box

●DIN terminal box (M12-4P Connector)

●DIN terminal box with lamp (M12-4P Connector)



(Figure 2-6.)

2.4.2 Electric connection of Limit switch

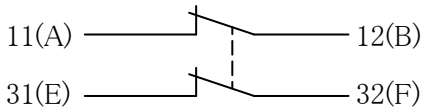
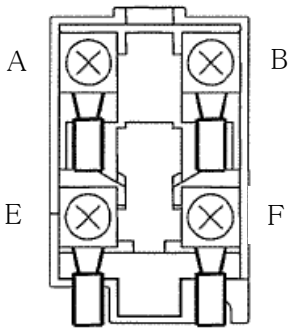
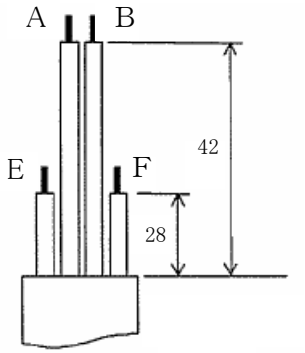
This subsection applies to the ones with Limit switch (optional limit switch code “L” or “M”.)

(1) When connect with insulation tubes and terminals, connect the terminals as shown in the following figure and wire without overriding to the case and the cover.

(2) Adequate conductor size is AWG 20 to 18 (0.5 to 0.75mm²).
Wire leads as shown in the following figure. Otherwise, the switch cover does not fit.

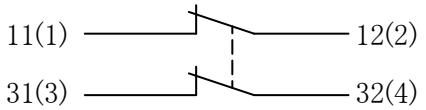
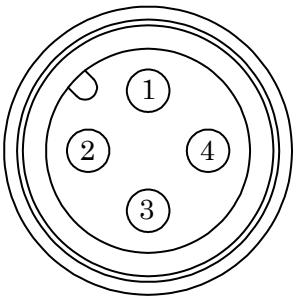
⚠ 注意	Do not push the ring connector and the likes into the opening between the parts in order to prevent the case from being broken and deformed. Use terminals having the thickness of 0.5mm or less to avoid the contact between the terminal and the switch case inside.

・When the Limit Switch option code is “L”

Contact configuration	Layout of terminals	Process of conductors
		

(Figure 2-7.)

・When the Limit Switch option code is “M”

Contact configuration	Connector No.
	

(Figure 2-8)

(3) If a connecter is to be attached to the conduit portion, use a connector that has thread length not more than 9 mm to prevent interference with the internal switch.
Recommended connector : ST-13.5 5301-5030 (LAPP)
Recommended sealing packing : JPK-16, GP-13.5 or GPM20

(4) Refer to table 2-3 for tightening torque of each portion.

Table 2-3 Mounting screw tightening torque

Clamping screw points	Mounting screw tightening
Terminal screw	0.6 to 0.8 [N ・ m]
Cover clamping screw	0.5 to 0.7 [N ・ m]
Connector	1.8 to 2.2 [N ・ m]

3. Pre-operation (post-installation) check

3.1 Appearance check

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

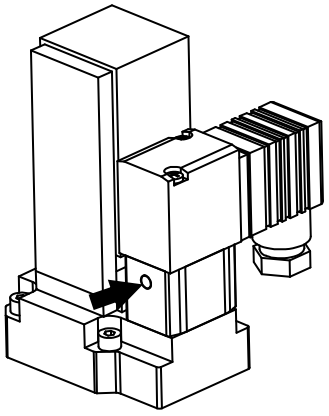
(1) Push the valve with finger to check that the valve has been fixed to the pipe or mounting hole.

(2) Check that the fasteners including hexagonal socket head cap screws and bolts have not been loosened.

3.2 Check for leakage

(1) 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.

(2) Manual operation
①Compress the fluid.
②Push 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 (With limit switch)

⚠WARNING	Turn off the power supply. Do not touch the wiring connection sections (bare live part) when energized. There is a risk of electric shock.

・Solenoid valve

(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.

・Limit Switch

(1) On the switching of general loads (250VAC, 3A), do not operate two circuits or more at the same time. Otherwise, insulation performance may be degraded.

(2) The limit switch is D4N-1B31(Option : L) and D4N-9B31(Option : M) made by OMRON Corporation. Please refer to the catalogue of D4N-1B31 and D4N-9B31 for the details.

4. Instructions for proper use

4.1 Precautions at use

⚠WARNING	a) Do not use this product for an emergency shut off valve. ・The valves listed in this catalog are not designed as valves to ensure safety such as emergency shut off valves. When using in this type of system, always take separate measures that will absolutely ensure safety. b) Take measures to prevent harm to operators or objects if this product fails. c) Liquid-filled state ・ When conveying a liquid in a circuit, operation may fail if liquid-filled state occurs. This is because pressure rises in the liquid filled state when temperature changes. d) Working fluids ・ Do not use this product for fluids other than the working fluids listed in the specifications. ・ Before starting use, confirm the compatibility of the product and applicable fluid with the catalog Applicable Fluid Check List. ・ Internal parts may wear when the valve operates. Caution is required because wear chips could enter the secondary side of the valve.

⚠CAUTION	b) When the solenoid valve is continuously operated, it will be heated to a temperature. Do not touch it by hand while it is energized. c) 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. d) 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 that weighs 1 kgf or more on the valve.

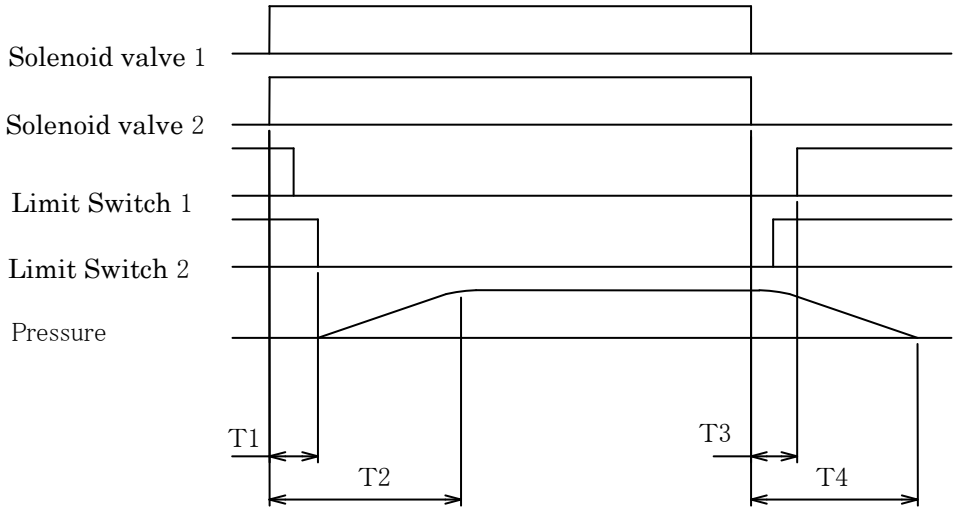
(2) The voltage variation shall be within ±10% of the rated voltage.

(3) The operating frequency specified below shall be satisfied.

Table 4-1.Operating frequency

Connection port size of valve	Operating frequency
10A・15A・20A	30 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.



T1･･･The moment the solenoid valve is turned ON until the moment Limit Switch 2 emits a “Valve Open” signal
T2･･･The moment the solenoid valve is turned ON until the moment pressure rises at the secondary side
T3･･･The moment the solenoid valve is turned OFF until the moment Limit Switch 1 emits a “Valve Closed” signal
T4･･･The moment the solenoid valve is turned off until the moment residual pressure on the secondary side is discharged

(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.

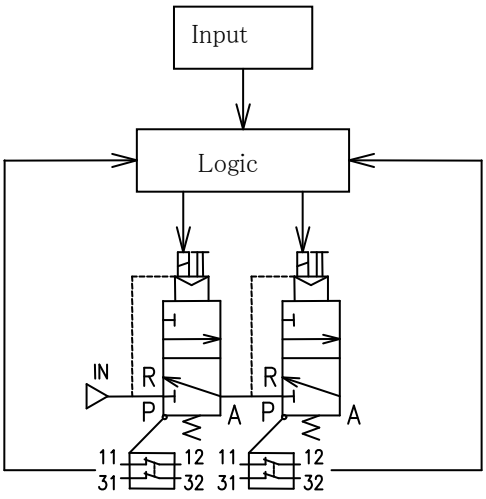
(6) If a connector is to be attached the the solenoid valve exhaust port (M5), use an elbow joint to prevent interference with the terminal box and valve.

(7) If the filter element of the air filter turns black, it means that it has been contaminated with tar. Periodically clean the filter element.

(8) 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).

(9) If any abnormal condition is found, see section “Troubleshooting.”

This valve integrates a Limit Switch to detect valve position. Detect valve position by a circuit such as one shown in figure 4−2.



4. 2 Procedures for disassembling and assembling solenoid actuator section

4.2.1 Disassembly procedure

⚠ CAUTION	a) Close the main valve. b) 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 valv e.

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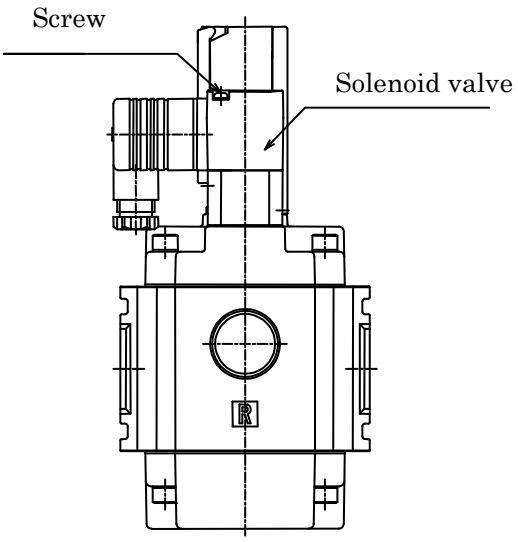
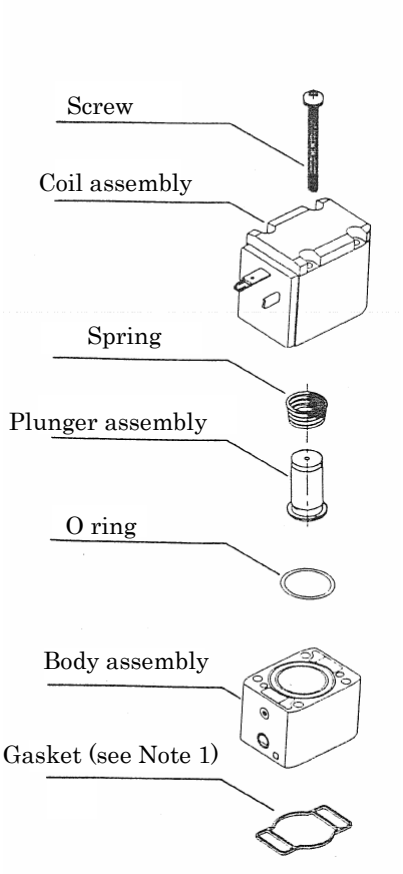


(Figure 4－1)

Note 1: When disassembling the solenoid valve, take case not to lose the manual depressor pin.



(Figure 4－2) Developed view of the pilot solenoid valve

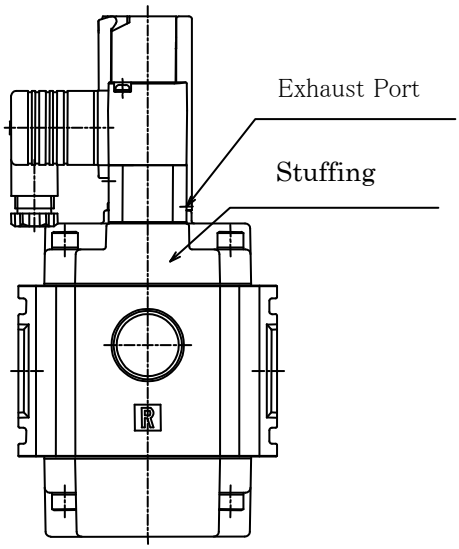
4.2.2 Assembly procedure

(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.

Table 4-2. Torques required for tightening

Size of screw	Torque required for tightening
M3	0.7 - 1.1N･m

(4) Connect electric wires to the valve.
(5) Turn on the power and activate the fluid.



（Figure 4－4）

5. Maintenance

5. 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.”

5. 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.

6. Troubleshooting

If the valve does not function as specified, check it according to Table 6-1.

Table 6-1

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 low.	Adjust the pressure.
	Too large a pressure drop during the operation.	The sectional area of the pipe at the fluid supply port is too small. Use a pipe of the size that fits the valve.
	The pilot solenoid valve does not move.	Replace the pilot solenoid valve with a new one.
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.
	The fluid pressure is too high.	Adjust the pressure.

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

7. Specifications for the product

7. 1 Meaning of the model No.

SNP − ※ − ※ − ※ ※ ※ ※ ※ − ※

3 port solenoid valve

No. of station

1R	Individual (Terminal box facing right)
1L	Individual (Terminal box facing left)
2	Two-station module

Port Size

10A	Rc3/8
15A	Rc1/2
20A	Rc3/4

Body／Sealing

0	Aluminum／Nitrile rubber

Coil housing

2G	DIN terminal box(Pg screw)
2HS	DIN terminal box with lamp and surge suppressor(Pg screw)
2J	DIN terminal box(M12-4P connector)
2KS	DIN terminal box with lamp and surge suppressor(M12-4P connector)

Limit Switch

L	Pg13.5 (D4N-1B31：OMRON's products)
M	M12-4P connector (D4N-9B31：OMRON's products)

Bracket

Blank	No options
B3	3000 series
B4	4000 series
B8	6000、8000 series

Silencer

Blank	No options
S1	sintered metal
S2	Resin

Rated Voltage

1	AC100V
2	AC200V
3	DC24V

7. 2Specifications for the product

Specifications

Descriptions		SNP		
Port size		Rc3/8	Rc1/2	Rc3/4
Actuation		Normally closed (NC type)		
Fluid pressure supply port		Port P		
Working Fluid		Compressed air		
Withstanding pressure	MPa	1.05		
Working pressure rang	MPa	0.2～0.7		
Fluid temperature	℃	5～60		
Ambient temperature	℃	-5～60		
Mass	kg	0.8 (1.7) ※1		1.8 (3.7) ※1
Valve seat leakage	cm^3/min	1 or less (under 0.2 to 0.7MPa compressed air)		
Valve structure		Internal pilot operated poppet valve structure		
Installation attitude		Free		

※1 Mass in ( ) is for the module type

Electrical Specifications			
Rated voltage	(※2)	AC100V(50/60Hz･AC110V(60Hz)、AC200V(50/60Hz)･220V(60Hz)、DC24V	
Apparent power (VA)	Holding	3.6 (50Hz)、2.8 (60Hz)	
	Starting	11 (50Hz)、9 (60Hz)	
Power consumption (W)	AC	1.9 (50Hz)、1.5 (60Hz)	
	DC	2.0	
Insulation class		Class B	
Protection structure (IEC standards 529)		DIN terminal box(Pg9)	IPX5
		DIN terminal box (M12-4P connector)	

※2:Allowable voltage range should be within ±10% of rated voltage.

Limit switch Specifications			
Manufacturer model number		D4N-1B31	D4N-9B31
Terminal		Pg13.5	M12-4P connector
Contact resistance		25mΩ max	
Minimum permissible load		1mA, 5VDC at resistive load	
Rated insulation voltage	V	300	
insulation resistance	MΩ	100	
Protection against electric shock		Class Ⅱ	
Pollution degree		3 (EN60947-5-1)	
Conditional short-circuit current	A	100	

※ Refer to the manufacturer catalog for details.

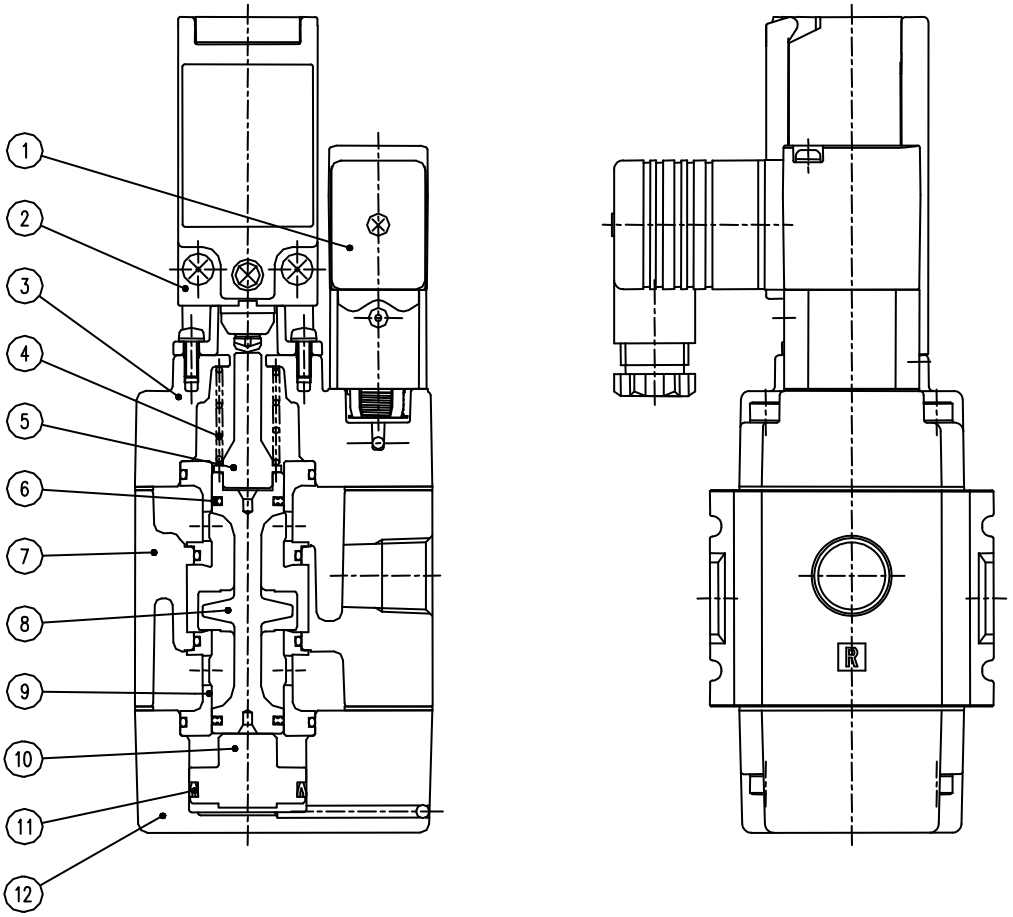
Effective sectional area

Series		P→A		A→R	
		C[dm^3/(s/bar)]	S(mm^2)	C[dm^3/(s/bar)]	S(mm^2)
Individual	SNP-10A	13	64	14	70
	SNP-15A	15	76	16	80
	SNP-20A	34	170	36	180
Two-station module	SNP-10A	10	50	14	70
	SNP-15A	12	59	16	80
	SNP-20A	26	130	36	180

8. Internal construction drawings

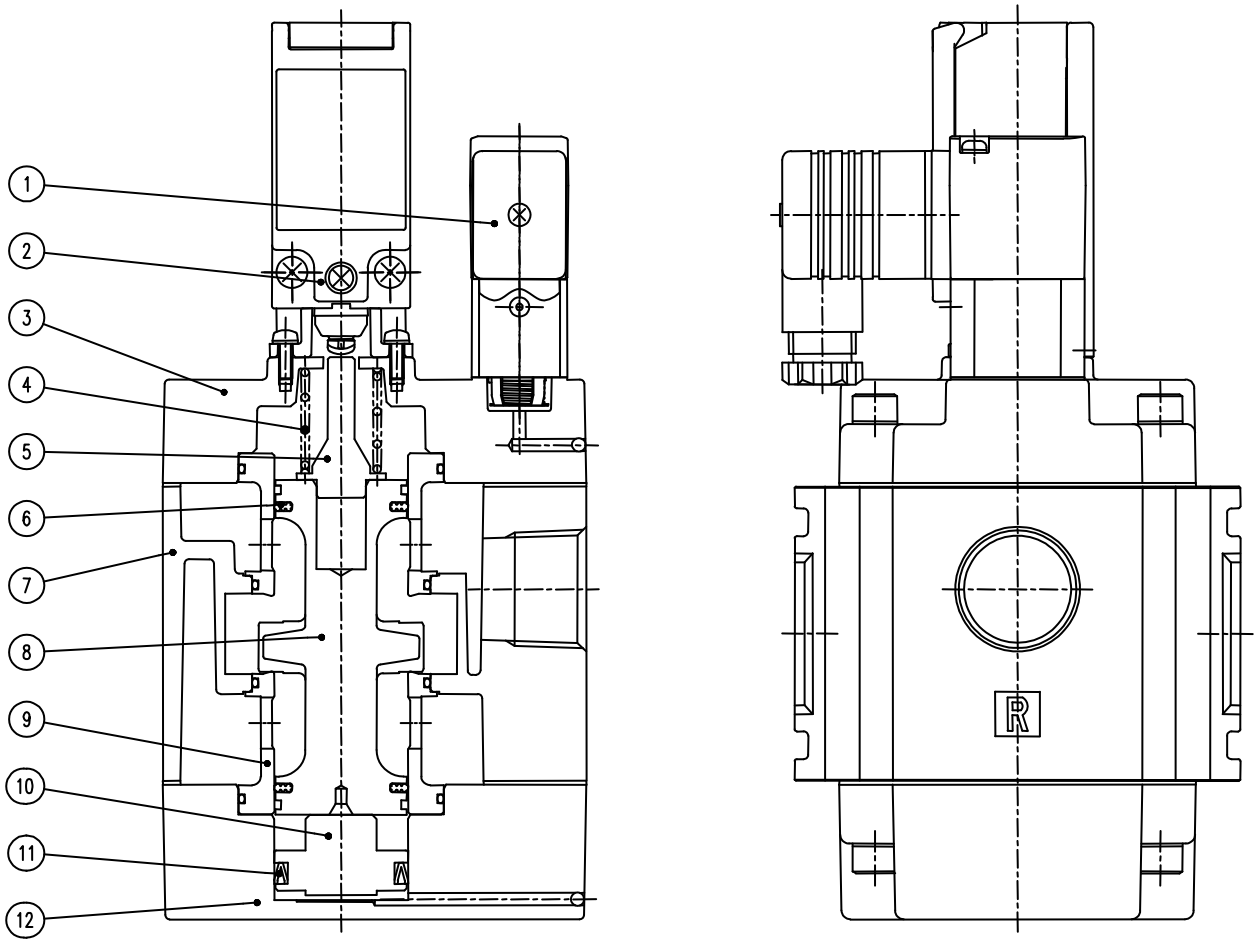
8. 1 Connection port size

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



8. 2 Connection port size： 20A to 25A

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



Module connection

● This product can modularize up to two stations.

Moreover, this product can easily unitize pneumatic equipments (C series).

Parts shown below are needed to form units.

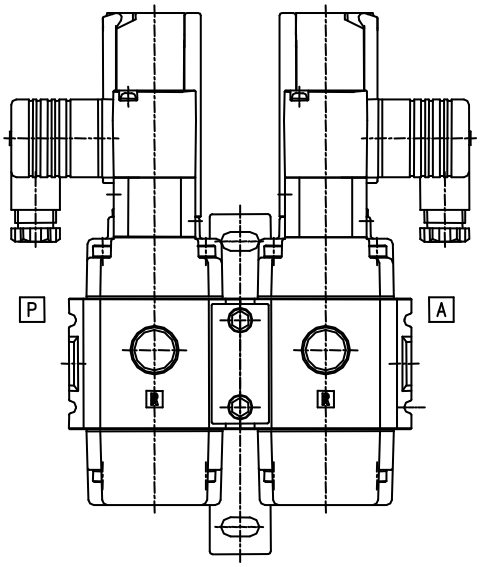
＜For 10A and 15A＞

Part name	Model number
Joiner set	C4000-J400-W
T type bracket set	B310-W(3000 Series)
	B410-W(4000 Series)

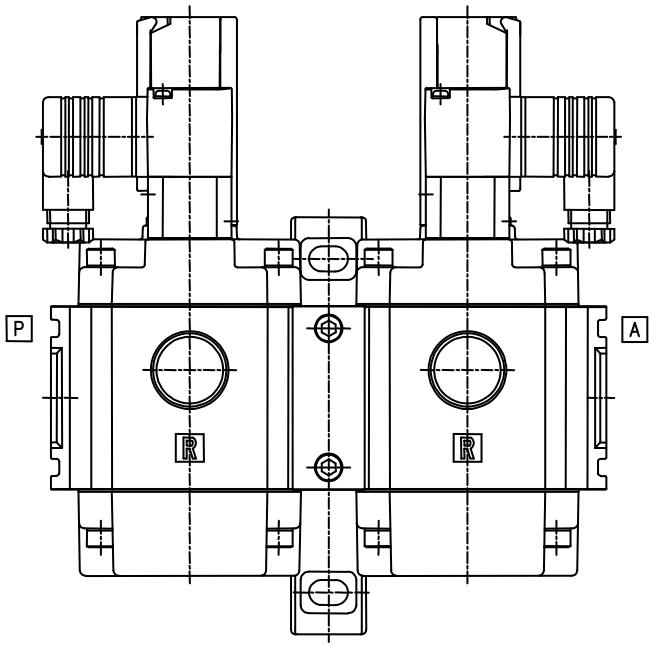
＜For 20A＞

Part name	Model number
Joiner set	C8000-J800-W
T type bracket set	B810-W(6000,8000 Series)

・Two-station module outline drawing



＜10A,15A＞



＜20A＞

●If the product is to be unitized with a filter or regulator, insert a distributor (D series) between the SNP and the filter or regulator (W series).

Port size	Distributor
10A,15A	D401-00－※-W
	D300-※-W
20A	D801-00-※-W