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2 Port Solenoid Valve  
VQ20/30 Series  
OPERATION MANUAL

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SMC Corporation



VQ20·30 Series

# Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard by labeling "Caution", "Warning", and "Danger". To ensure safety, be sure to observe ISO4414, JIS B8370 and other safety practices.



**Caution** : Operator error could result in injury or equipment damage.



**Warning** : Operator error could result in serious injury or loss of life.



**Danger**: In extreme conditions, there is a possibility of serious injury or loss of life.

※1)ISO 4414 :Pneumatic fluid power Recommendations for the application of equipment to transmission and control systems

※2)JIS B 8370:Pneumatic system axiom.

## Warning

1. **The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decide its specifications.**  
Since the product specified here are used in various operating conditions, their compatibility with the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.
2. **Only trained personnel should operate pneumatically operated machinery and equipment.**  
Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.
3. **Do not service machinery/equipment or attempt to remove components until safety is confirmed.**
  - 1) Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked out control positions.
  - 2) When equipment is to be removed, confirm the safety process as mentioned above. Cut the pressure supply for the equipment and exhaust all residual compressed air in the system.
  - 3) Before machinery/equipment is re-started, take measures to prevent quick extensions of the cylinder piston rod etc.
4. **Contact SMC if the product is to be used in any of the following conditions.**
  - 1) Conditions and environments beyond the given specifications or if product is used outdoors.
  - 2) Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications or safety equipment.
  - 3) An application which has the possibility of having negative effects on people, property, or animals requiring special safety analysis.



## VQ20 30 Series

# 2 Port Solenoid Valve / Precautions ①

Be sure to read before handling.

### Installation

#### ⚠ Warning

##### ① Operation of actuator

When an actuator, e.g. cylinder, is to be operated using a valve, take appropriate measures to prevent potential injuries to personnel caused by the actuator movement.

##### ② Holding pressure (including vacuum)

Since the valve may have slight internal air leakage, it may not be suitable for holding pressure (including vacuum) in a tank or other vessel for an extended period of time.

##### ③ Not suitable for use as an emergency shutoff valve

The valve represented in this catalog is not intended for use as an emergency shutoff valve. If the valve is used in this type of system, other positive shutoff components should be used in conjunction.

##### ④ Long periods of continuous energization

Contact SMC when the valve is to be continuously energized for a long periods.

##### ⑤ Liquid rings

When using in liquid, install a releasing valve in the system to prevent the liquid ring.

##### ⑥ Valves are not explosion proof.

##### ⑦ Maintenance space

Installation should consider ensure enough space is provided for maintenance (removal of valve, etc.)

### Selection

#### ⚠ Warning

##### ① Confirm specifications.

Use within the specification range indicated in this catalog taking application, operating fluids and operating environment into consideration.

##### ② Operating fluids

###### ① Corrosive gases

Since corrosive gases may cause stress corrosion, cracking or other accidents, it is not applicable for valves in this catalog.

② Use a Non-lube valve when impurities such as oil should not be in the fluid passage.

##### ③ Operating fluid temperatures

Use valves within the specified range of operating fluids temperature. Operating fluid temperature range varies depending on seal materials, coil insulation, power voltage, etc.

##### ④ Quality of operating fluids

If using contaminated fluids, install an appropriate filter (strainer) in front of valve to prevent valve seat or armature from wearing highly or sticking of external object to armature or actuating part. It may cause malfunction or damage of the seal. Generally requires about 80 to 100 mesh application.

##### ⑤ Quality of operating air

###### ① Use clean air.

If the compressed air supply includes chemicals, synthetic materials (including organic solvents), salinity, corrosive gas, etc., it can lead to damage or malfunction.

###### ② Install an air filter.

Install an air filter at the up stream side to the valve. Filtration degree should be 5 $\mu$ m or less.

###### ③ Install an air dryer, after cooler, etc.

Air that includes excessive condensate may cause malfunction of valve and other pneumatics equipment. To prevent this, install an air dryer, after cooler, etc.

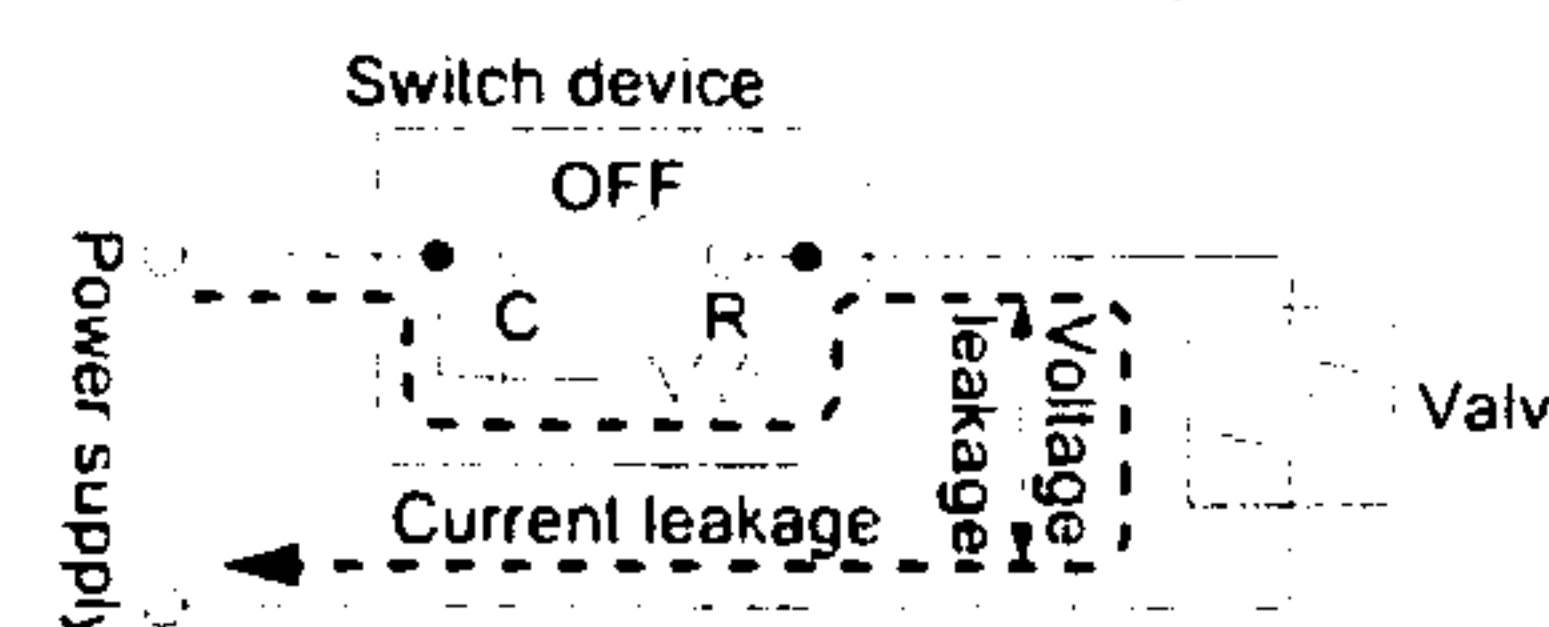
###### ④ If excessive carbon powder is seen, install a mist separator on the upstream side of the valve.

Refer to "Air Cleaning Equipment" catalog for compressed air quality.

#### ⚠ Caution

##### ① Leakage voltage

Be particularly aware that if a resistor is used in parallel with a switching element, or if a C-R element (surge voltage protector) is used for protecting the switching element, a leakage current will flow via the respective resistor or C-R element, thus increasing the leakage voltage.



AC coil: 10% or less rated voltage

DC coil: 2% or less rated voltage

##### ② Use in low temperature environments

###### ① Valve use is possible to temperature extremes of -10°C.

Take appropriate measures to avoid freezing of drainage, moisture etc.



## VQ20 30 Series

# 2 Port Solenoid Valve / Precautions ②

Be sure to read before handling.

### Installation

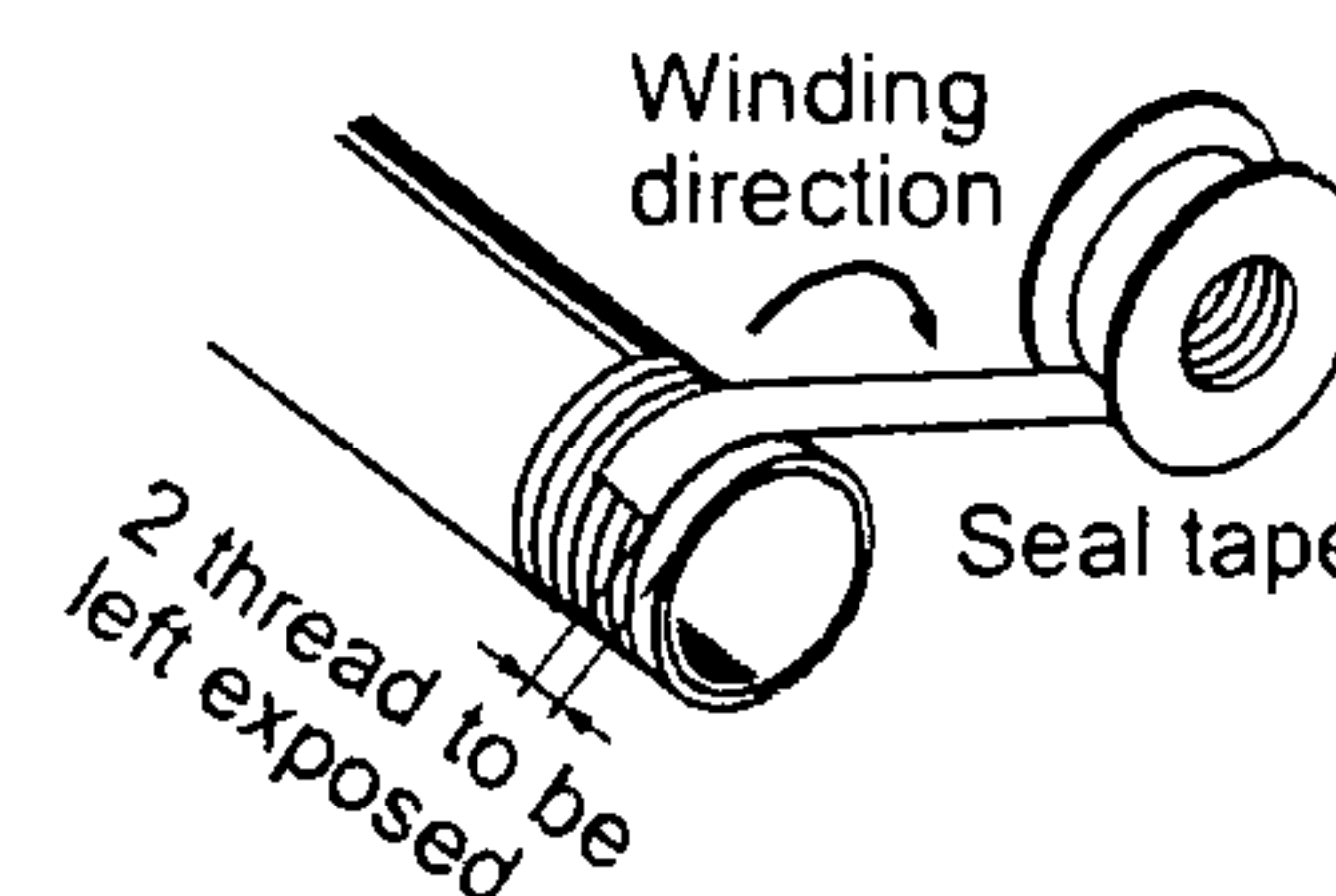
#### ⚠ Warning

- ① **If air leakage is increasing or equipment is not properly operating, cease use of the valve and inspect.**  
Check mounting conditions after air and power supplies are connected. Initial function and leakage tests should be performed after installation.
- ② **Do not apply external force to the coil portion.**  
Apply spanner to the external connection part when tightening.
- ③ **Do not supply the coil assembly part with the lagging material to prevent burning.**  
Tape heater for anti-freezing is applicable to use only for piping or body.
- ④ **Other than fittings made of stainless steel or copper should be tightened with a bracket.**
- ⑤ **Do not use in a place subjected to vibrations. If impossible, arm from the body should be as short as possible to prevent resonance.**
- ⑥ **Install only after reading and understanding the safety instructions.**  
Keep the catalog on life so that it can be referred to when necessary.
- ⑦ **Coating**  
Warnings or specifications indicated on the product should not be erased, removed, or covered up.

### Piping

#### ⚠ Caution

- ① **Before piping**  
Make sure to clean up chips, cutting oil, dust, etc., before piping.
- ② **Sealant tape**  
When installing piping or fitting into a port, ensure that sealant material does not enter the port internally. When using sealant tape, leave 1.5 to 2 threads exposed on the end of pipe/fitting.



- ③ **Pay special attention to contamination by foreign objects and air tight for vacuum or non-leak specifications.**
- ④ **Do not earth the piping. It may cause the corrosion of system due to electrolytic corrosion.**
- ⑤ **Tightening torque**  
When installing fittings, etc., follow the given torque levels below.

#### Tightening torque

Thread	Appropriate tightening torque (Nm)
Rc3/8	22 to 24

- ⑥ **Piping to product**  
When installing a piping to a product, refer to operation manual to avoid mistakes.

### Wiring

#### ⚠ Caution

- ① **Use electrical wires for piping with more than 0.5 to 1.25mm<sup>2</sup>.**  
Do not apply excessive force to wires.
- ② **Electrical circuit should be adopted without generating chattering at set points.**
- ③ **When electrical circuit is not acceptable for surge voltage generated by solenoid, install a surge absorber in parallel to the solenoid or use a optional type with surge killer.**
- ④ **Operating voltage must be within ±10% of rated voltage. If high response of DC voltage is required, ±5% of rated voltage is recommended.**



## VQ20 30 Series

# 2 Port Solenoid Valve / Precautions ③

Be sure to read before handling.

### Operating Environment

#### ⚠ Warning

- ① Do not use in atmospheres where the valve is in direct contact with corrosive gases, chemicals, salt water, water or steam.
- ② Do not use in explosive atmospheres.
- ③ Do not use in a place subject to heavy vibrations and/or shocks.
- ④ Do not use in a place subject to emissive heat.
- ⑤ If using in an atmosphere where there is possible contact with water drop-lets, oil, weld spatter, etc., take suitable protectional measures.

### Maintenance

#### ⚠ Warning

- ① Maintenance procedures are shown in operation manual.

If handling is wrong, it causes malfunction and damage of machine or equipment.

#### ② Machine maintenance

When machine is to be serviced, first check for removal of workpieces and run-away of equipment etc. Then cut the supply pressure and power, and exhaust all compressed air from the system.

#### ③ Low frequency operation

Valve should be switched at least once every 30 days to avoid malfunction.

#### ④ Manual override

When manual override is engaged, connected equipment starts to operate. Be sure of safety.

#### ⚠ Caution

##### ① Filter, Strainer

- ① Be careful not to cause the clogging of filter or strainer.
- ② Exchange the filter element after use for one year or when pressure drop exceeds 0.1MPa.
- ③ Clean the strainer when pressure drop exceeds 0.1MPa.
- ④ Remove condensate from air filter regularly.

##### ② Lubrication

If a lubricant is introduced, continue to lubricate.

### How to Calculate Flow Rate (At an temperature 20°C)

Subsonic flow:  $P_1+0.1013 < 1.89(P_2+0.1013)$

$$Q = 226S \sqrt{\Delta P(P_2+0.1013)}$$

Sonic flow:  $P_1+0.1013 \geq 1.89(P_2+0.1013)$

$$Q = 113S(P_1+0.1013)$$

Q: Flow rate [ $\mu$ /min(ANR)]

S: Effective area (mm<sup>2</sup>)

$\Delta P$ : Pressure differential ( $P_1-P_2$ ) [MPa]

P1: Upstream pressure [MPa]

P2: Downstream pressure [MPa]

\* When the air temperature is different, multiply the flow rate calculated with the above formula by the following coefficient for compensation.

Air temperature (°C)	-20	-10	0	10	30	40	50	60
Coeff. for compensation	1.08	1.06	1.04	1.02	0.98	0.97	0.95	0.94

## ⚠ Precautions

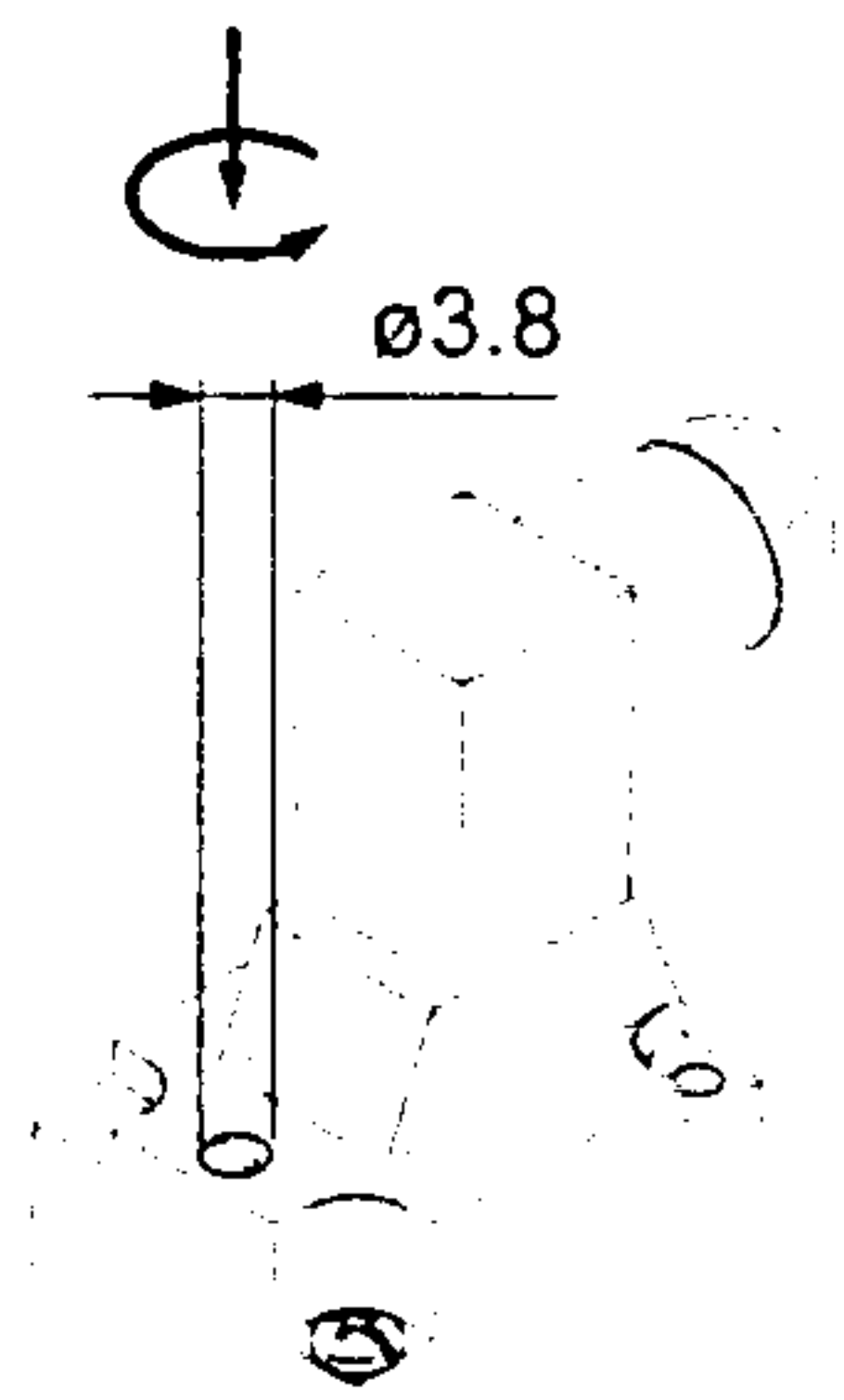
Be sure to read before handling.

### ⚠ Warning

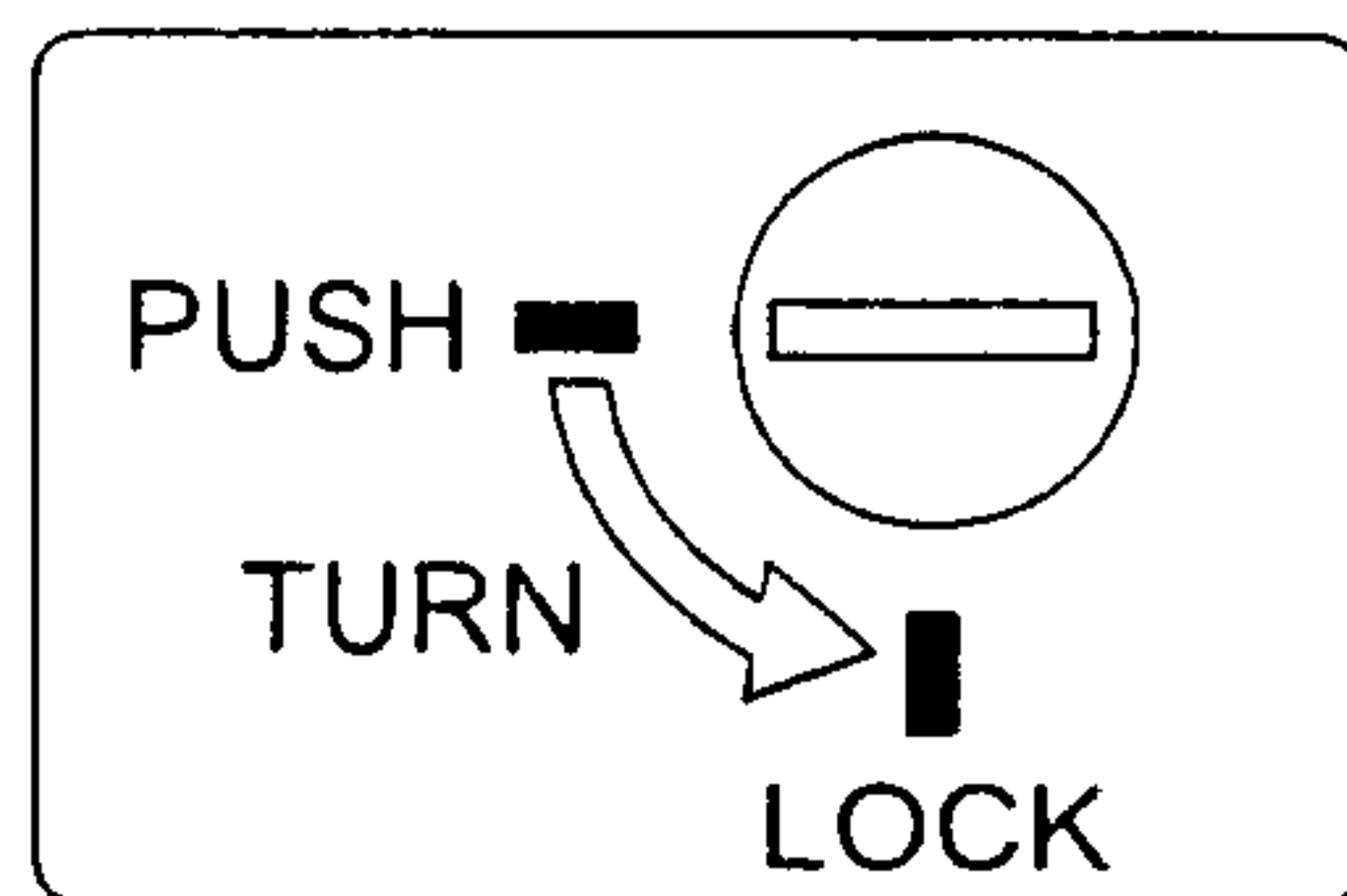
#### Manual Override

Regardless of electric signals to the solenoid valve, the manual override is used for switching the main valve. (DIN connector only.)

#### Locking slotted style

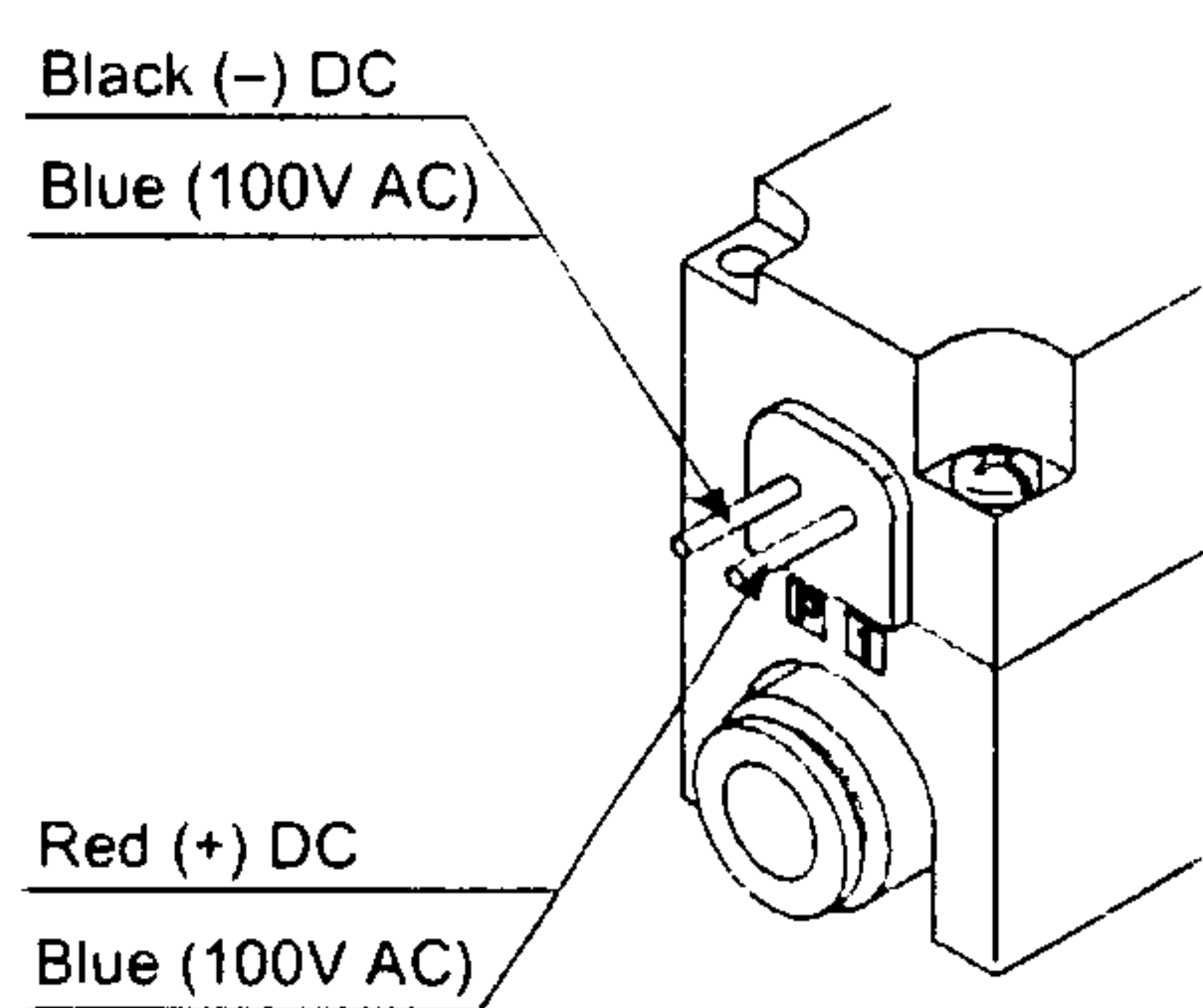


Push the manual override button with a small screw driver until it stops. Turn it in the counter-clockwise direction at 90°, and it is locked. Turn it right to release.

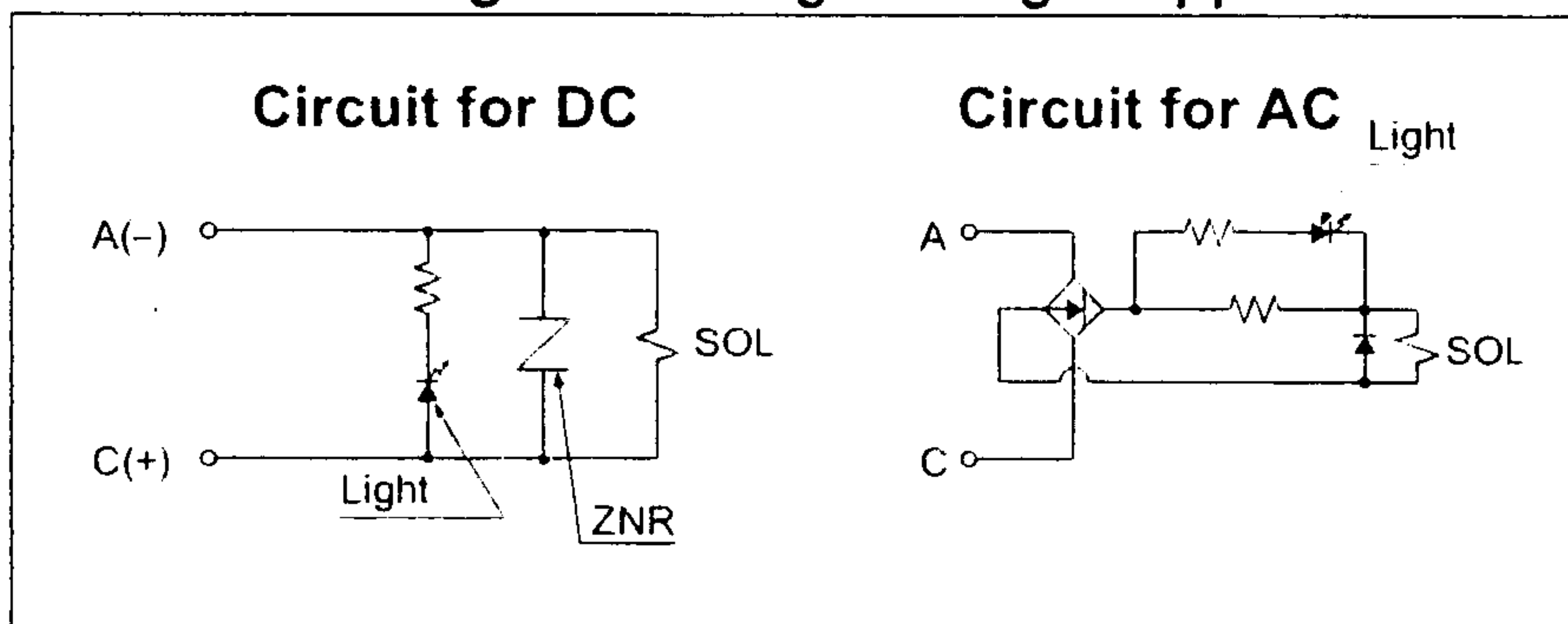


### ⚠ Caution

#### Connection and Electrical Circuit



#### With indicator light and surge voltage suppressor



### ⚠ Caution

#### How to Wire The DIN Connector

##### ISO#: Based on DIN 43650C (Pin gap 8mm) Connection

- ① Loosen the tightening screw and pull the connector off of the solenoid valve.
- ② After removing the tightening screw, divide the terminal block and housing by prying open the slot area of the lower part of the terminal block open with a screw driver.
- ③ Loosen the terminal screws of the block and insert stripped lead wires in accordance with the wiring diagram. Secure each wire by retightening the terminal screw.
- ④ Tighten the ground nut to secure the cable wire.

#### Change of electrical entry

Wire entry can be changed by mounting the housing in either direction (four directions at every 90°) after dividing the terminal block and the housing.

\* For the indicator lighted style, be careful not to damage the light with the lead wire of the cable.

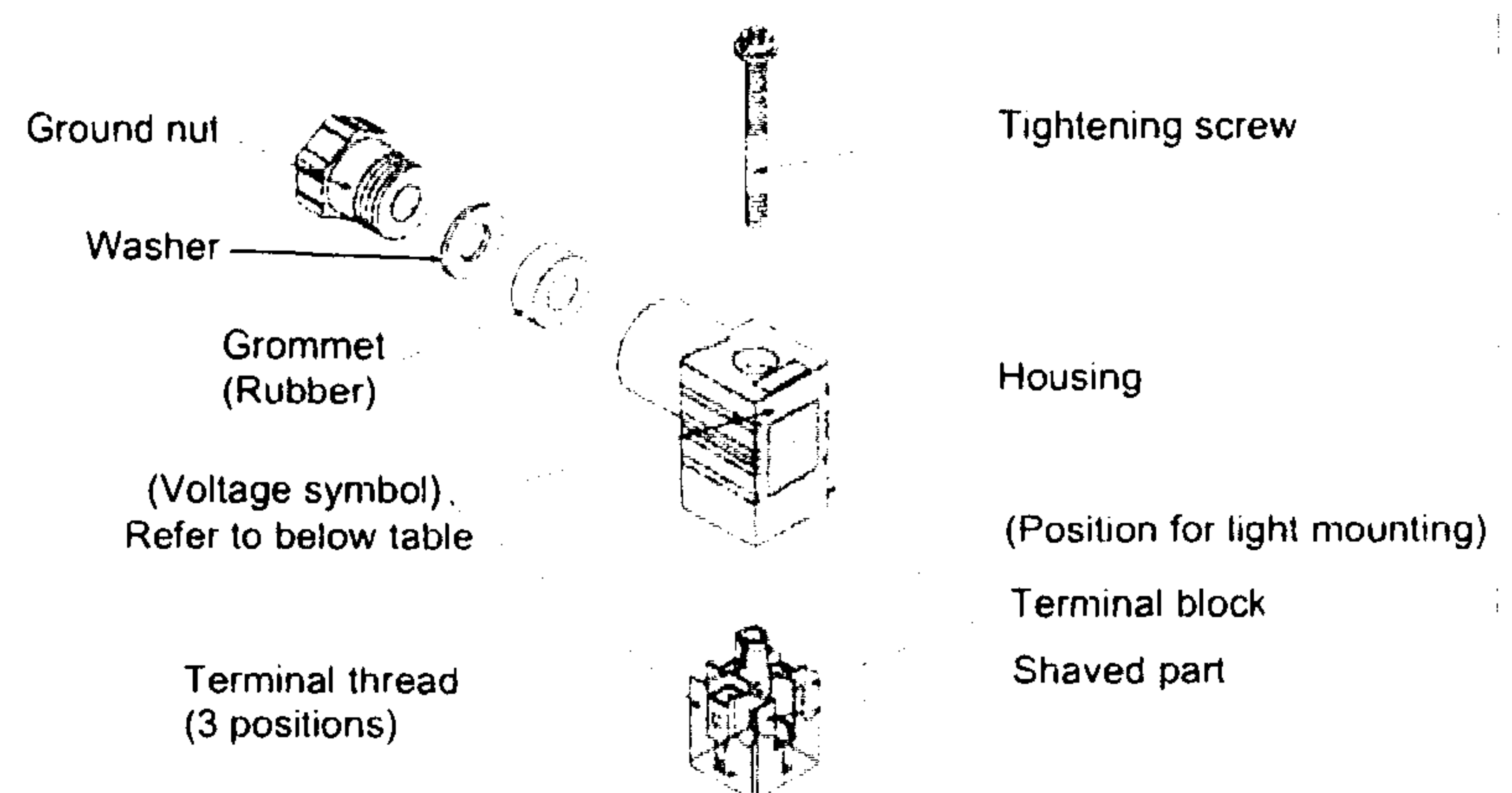
#### Precaution

Insert/remove the connector vertically, not at an angle.

#### Applicable cable

Cord O.D.:  $\phi 3.5$  to  $\phi 7$

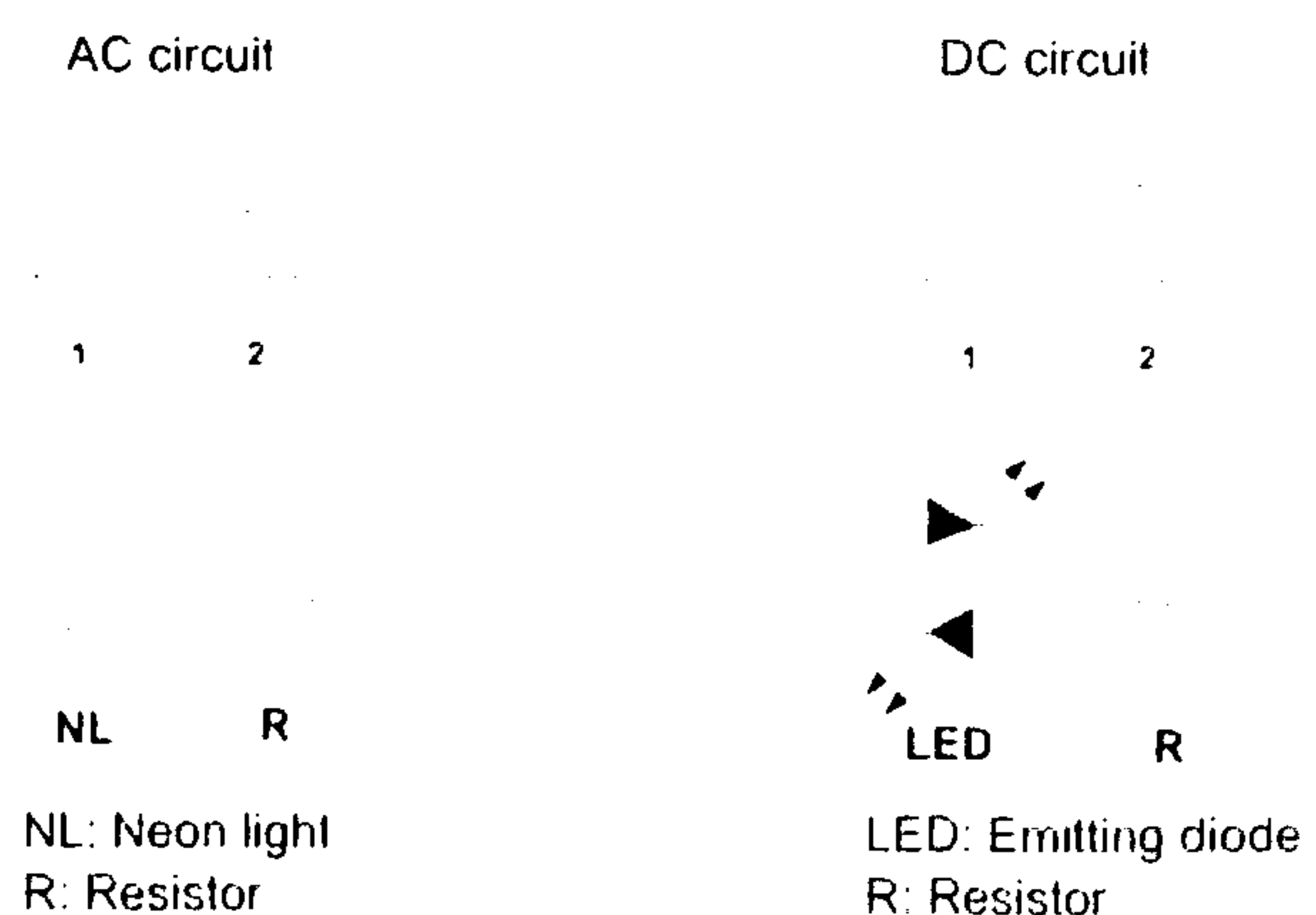
(Reference) 0.5mm<sup>2</sup> 2-core and 3-core wires equivalent to JIS C 3306.



#### DIN connector part number (Based on DIN)

Without light		SY100-82-4
With light		
Rated voltage	Voltage symbol	Part No.
24V DC	24V	SY100-82-3-05
12V DC	12V	SY100-82-3-06
100V AC	100V	SY100-82-2-01

#### DIN connector circuit with light



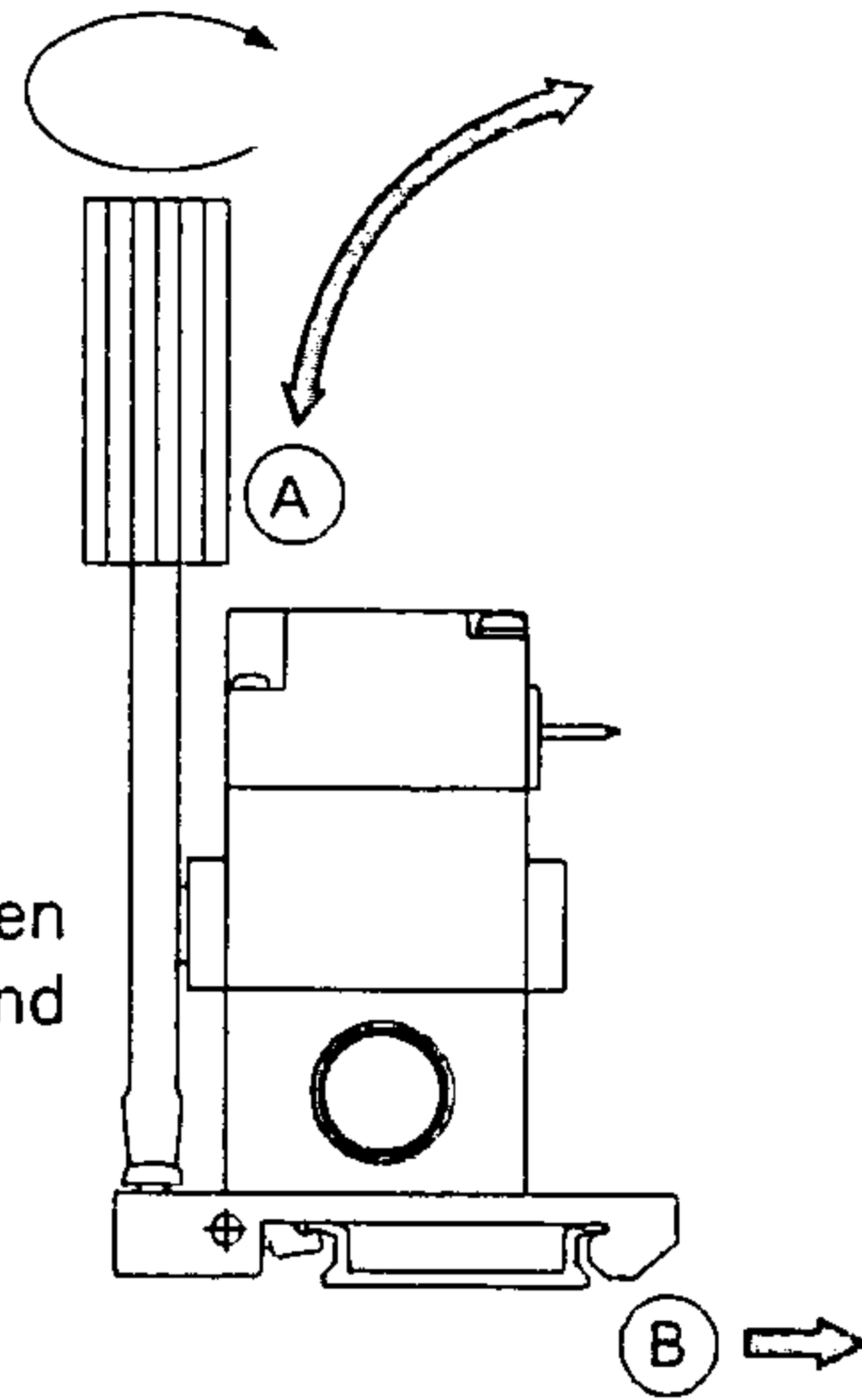
## Manifold

### ⚠ Caution

#### How to Mount/Remove from DIN Rail

##### To remove manifold from DIN rail:

- 1) Loosen the clamp screw on the "A" side of both ends of the manifold.
- 2) Lift the "A" side of the manifold off the DIN rail and slide it in the direction of the "B" side.



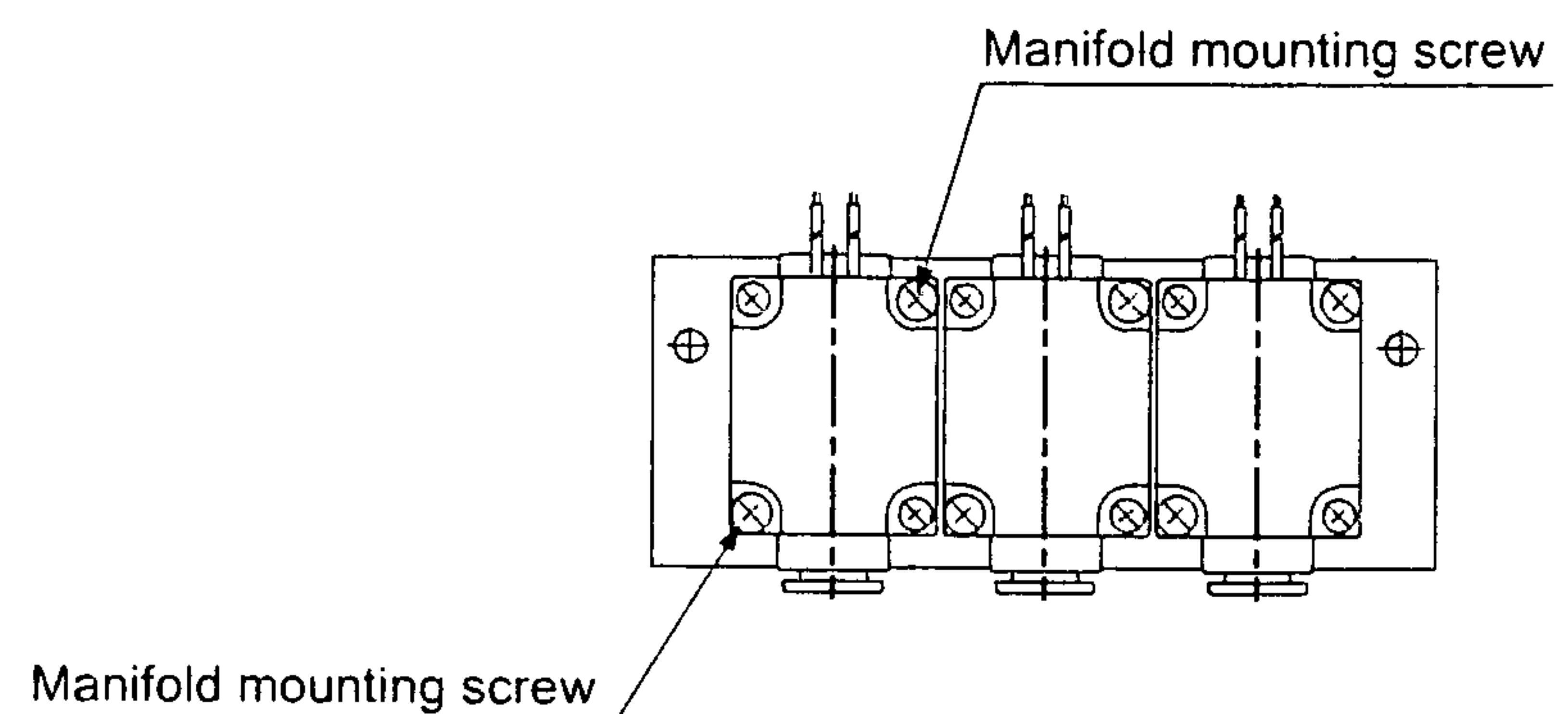
##### Mounting manifold to DIN rail:

- 1) Hook the mounting hook on the "B" side of the manifold base to the DIN rail.
- 2) Push side "A" onto the DIN rail and tighten the clamp screw on the "A" side of the end plate. (Tightening torque: 0.3 to 0.4Nm)

### ⚠ Caution

#### Valve Mounting

After confirming the gasket is correctly placed under the valve, tighten the mounting screws with the appropriate torque (0.2 to 0.23Nm).



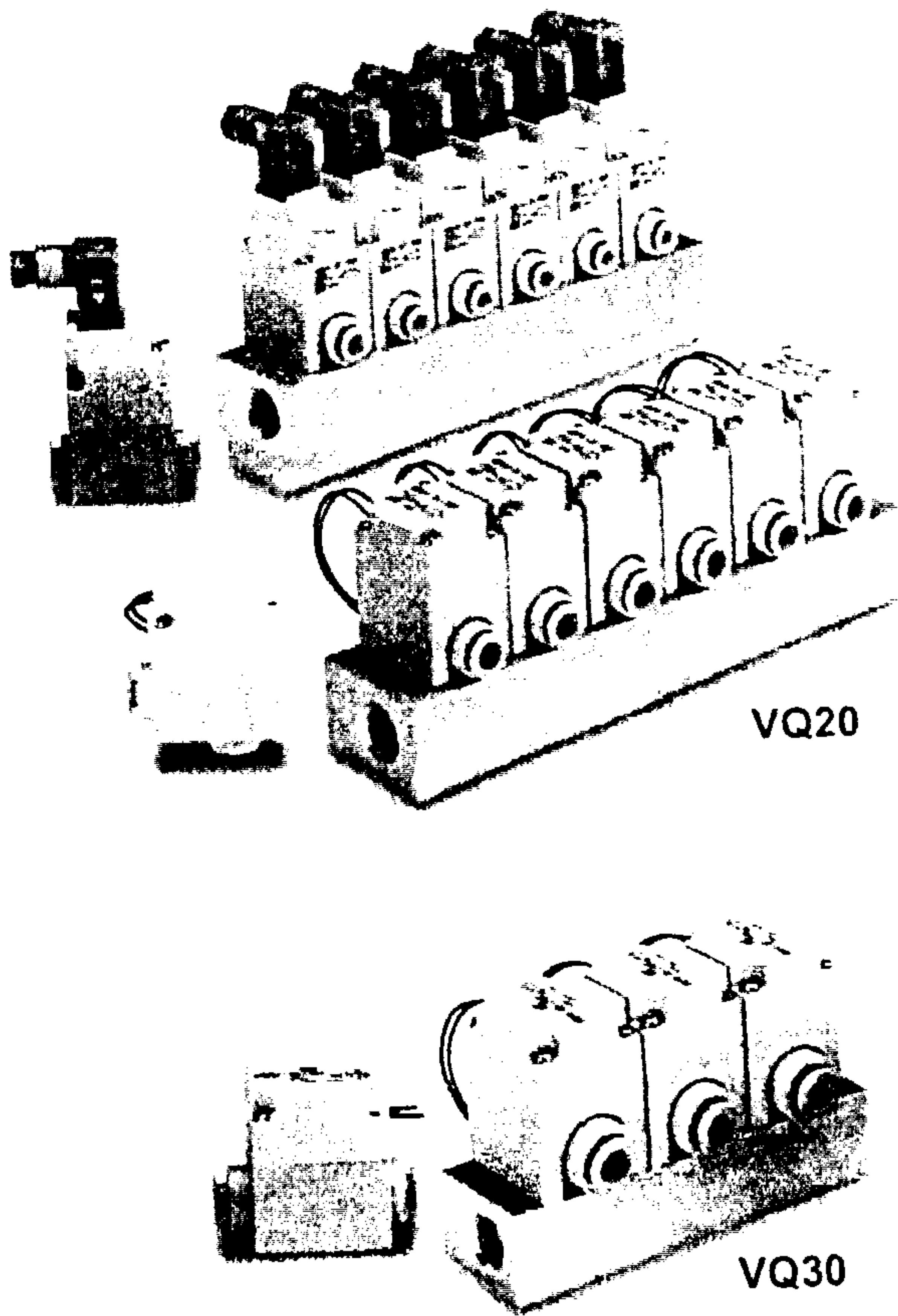
### ⚠ Caution

#### Maximum Number of Valves for Simultaneous Operation

Series	P port one side supply	P port both side supply
VQ20	4	8
VQ30	2	4

If the max. number of valves simultaneously operated exceeds the numbers above, the effective flow rates will be reduced.

# For Dry Air, Pilot Operated 2 Port Solenoid Valve **Series VQ20/30**



## Standard Specifications

		VQ20	VQ30	
Valve	Series	VQ20	VQ30	
	Valve structure	2 port poppet pilot operated		
	Fluid	Air, Inert gas		
	Ambient and fluid temperature	-10 to 50°C *1		
	Lubrication	Not required		
	Manual override	Locking style(Slotted) *2		
	Shock resistance/Vibration resistance	150 / 30m/s <sup>2</sup> *3		
	Enclosure	Dust proof *4		
	Mounting position	Free		
	Weight	46g	80g	
Solenoid	Coil rated voltage	12VDC,24VDC,100VAC,110VAC,200VAC		
	Allowable voltage	+/- 10% of rated voltage		
	Coil insulation	Class B or equivalent		
	Power consumption	DC(w/Power saving circuit)	Inrush:2.9W, Holding:0.6W	
		DC(w/o Power saving circuit)	2.9W	
		AC	2VA	
Electrical entry	Grommet, DIN terminal			

\*1) Use dry air to prevent condensation when operating at low temperatures.

\*2) Manual override is available only for DIN terminal style.

\*3) Shock resistance: No malfunction resulted from the impact test using a drop impact tester.

The test was performed on the axis and right angle directions of the main valve and armature, for both energized and de-energized states. (Valve in the initial stage.)

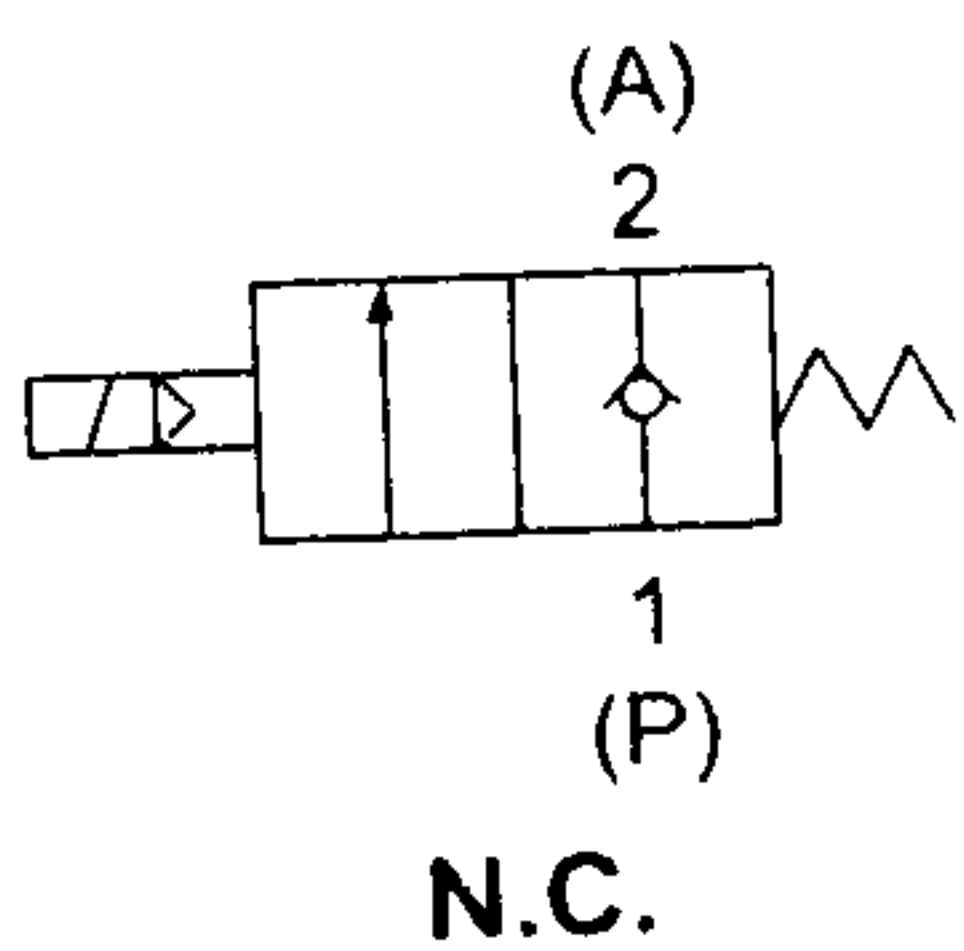
Vibration resistance: No malfunction occurred in a one-sweep test between 8.3 and 2000Hz.

Test was performed at both energized and de-energized states to the axis

and right angle direction of the main valve and armature. (Valve in the initial stage.)

\*4) DIN connector style: Applicable to dust and jet proof (IP65).

## Symbol

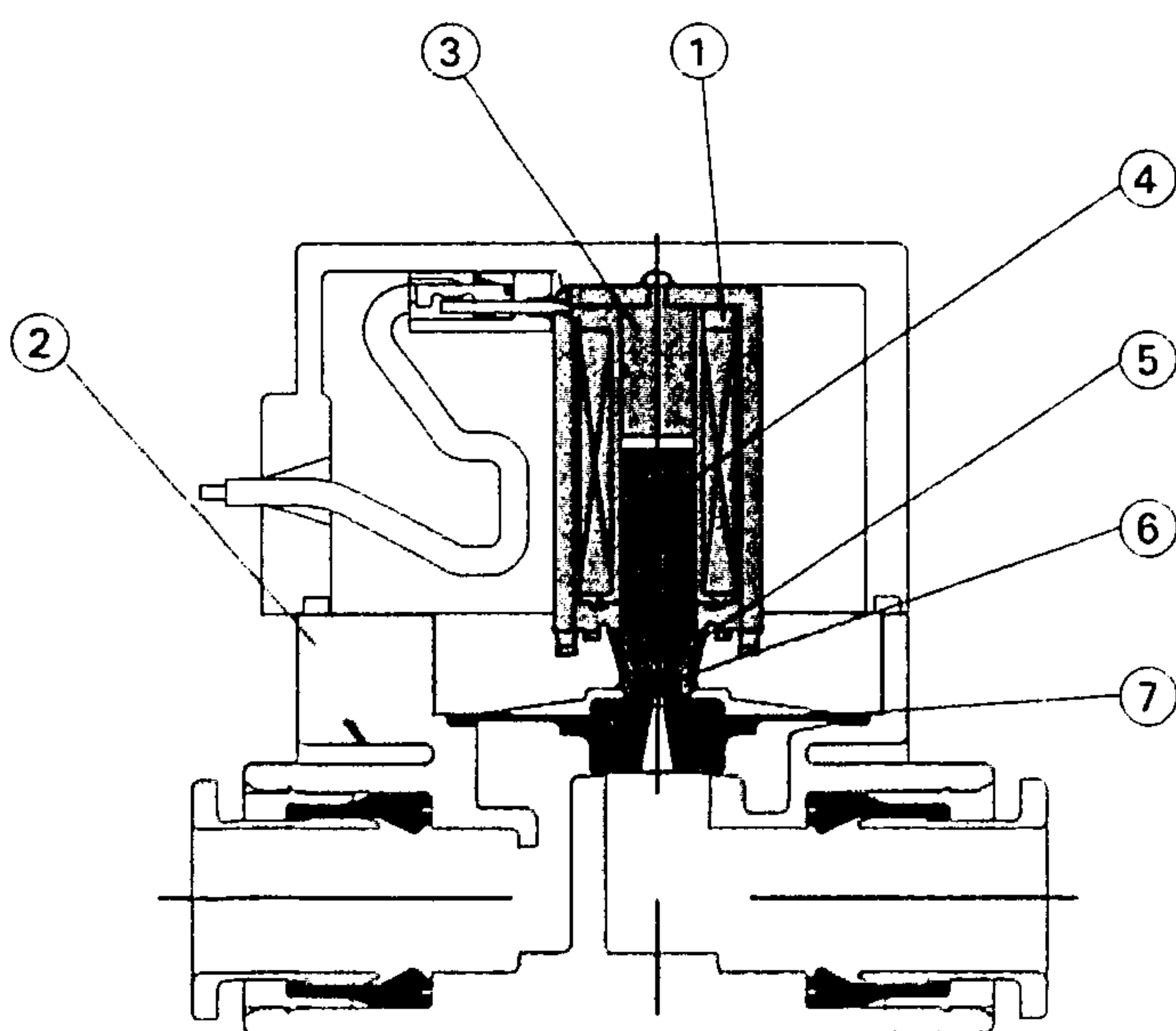


## Characteristics specifications

Series		VQ20		VQ30		
Flow characteristics		C6	C8	C10	C12	
	C[dm <sup>3</sup> /(s·bar)]	1.4	1.5	2.8	3.0	
	b	0.23	0.42	0.42	0.37	
	Cv	0.33	0.39	0.80	0.81	
Min. operating pressure		0.01MPa				
Max. operating pressure		0.6MPa		0.5MPa		
Response time *1	Circuit	With Power saving circuit	High speed response type	With Power saving circuit	High speed response type	
		ON	10ms or less	7ms or less	25ms or less	20ms or less
		OFF	15ms or less	5ms or less	15ms or less	5ms or less

\*1) According to JISB8375 (Supply pressure: 0.5MPa, DC type)

## Construction



## Component Parts

No.	Description	Material
①	Solenoid coil	—
②	Body	Resin
③	Fixed armature	Stainless Steel
④	Armature	Stainless Steel
⑤	Return spring	Stainless Steel
⑥	Poppet	NBR
⑦	Diaphragm assembly	NBR, Resin



## Trouble Shooting

If any problem found during operation, dispose the problem following the chart below.

Operation failure	Case	Countermeasure
Fluid does not stop	Power in on	Turn off the power and check the circuit
	Vibration and impact is large	Correct the wiring
	Foreign material entered / trapped	Eliminate foreign material. Install filter
	Connect direction is opposite	IN port shall be high pressure side
	Leakage voltage in high	Rated voltage AC is 10%, DC is 20 %
	Power source is OFF	Turn on the power and check the circuit
	Voltage is low	Adjust voltage (Rated voltage $\pm 10\%$ )
	Pressure is high	Adjust pressure, select appropriate type
	Fluid temp. , and ambient temp. is high	Select appropriate type
	Coil (lead wire) disconnected (mishandling)	Replace the coil assembly
Coil burnt	Voltage is high / low	Adjust voltage (dated voltage $\pm 10\%$ )
	Foreign material entered, trapped	Eliminate foreign material, install filter
	Large impact, large vibration	Solution against vibration, change install location
	Exposed to air	Protect the product from air