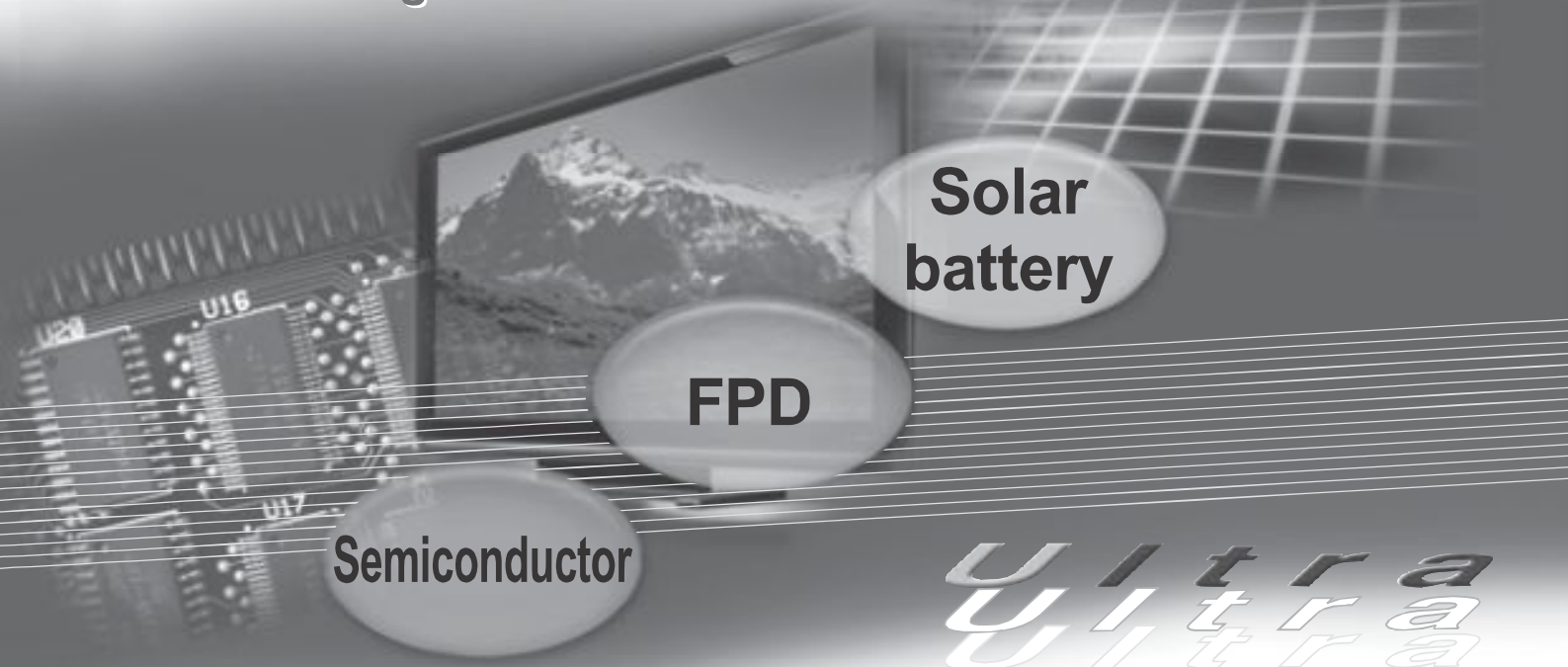


Long service life, high durability.

Unprecedented drive life achieved through a special structure that employs CKD's original formed bellows.

Highly reliable and easy-to-use high vacuum control valve part 7 series.

Double acting and manual models added to the series!

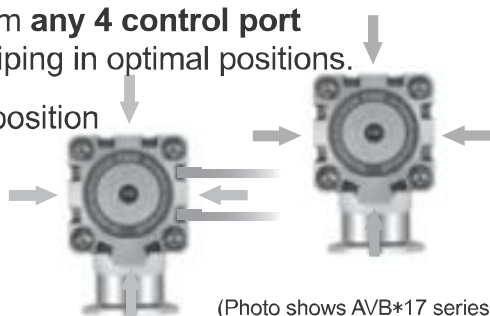


Increased positioning and piping flexibility

■ Option to choose from **any 4 control port positions** enables piping in optimal positions.

■ Miniature operating position detection **switches** can be installed in **all 4 positions**.

(Port size NW16 is 3-sided)



(Photo shows AVB*17 series)

■ Ultra-fine concept

CKD's unique UF concept implements complete cleanliness in all critical areas for product development from design, evaluation, manufacturing methods, to manufacturing for total cleanliness control of products.

Installation compatibility

Installation method is ISO21358 compliant.

Visually check operation

Indicator provided as standard.



(Photo shows MVB*17 series)

Weight reduced with aluminum body

Significant weight reduction achieved compared to conventional stainless steel body.

A wide variety of flange sizes

Model no.	Actuation	Connection							Indicator
		NW16	NW25	NW40	NW50	NW63	NW80	NW100	Standard equipment
AVB * 17	NC	●	●	●	●	●	●	●	●
AVB * 47	Two stage type	●	●	●	●	●	●	●	●
AVB * 37	Double acting	●	●	●	●	●	●	●	●
MVB * 17	Manual	●	●	●	●	●	●	●	●

Installation possible
in any 4 directions

Operation port

**Light
weight**
with
aluminum body

Check operation
with just one look

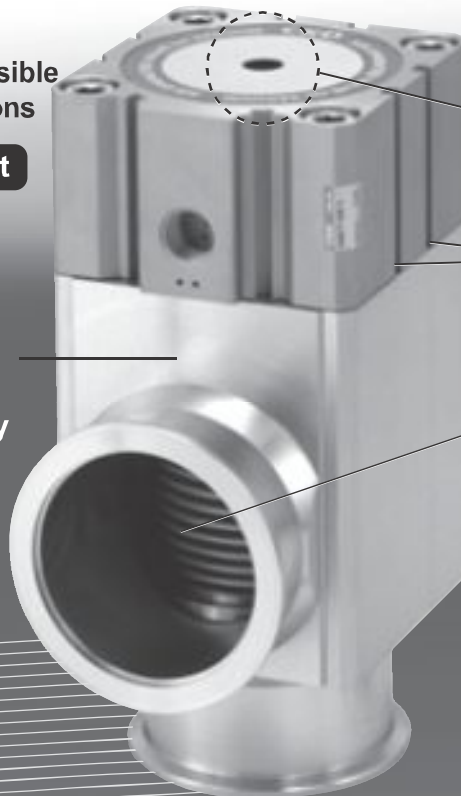
Indicator

Switches can be
installed on all 4 sides

Switch

Reed/proximity switch (can be installed later)

Uniquely formed bellows



AVB*17 series



AVB*47 series



AVB*37 series



MVB*17 series

*Fine
Fine
Fine*

Air operated valve
for high vacuum

New

Manual valve
for high vacuum

AVB 7 Series

MVB 7 Series

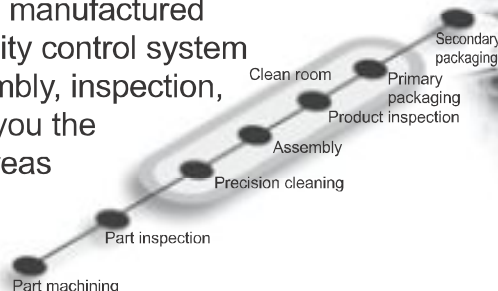
RoHS

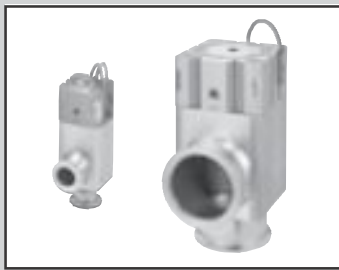
RoHS compliant

Substances harmful to the environment, including
lead and hexavalent chrome, have been eliminated.

Total cleanness control system

This product has been manufactured
using a seamless quality control system
from machining, assembly, inspection,
to packaging. Giving you the
highest quality in all areas
including cleanness.






NC type air-operated valve for high vacuum

AVB*17 Series

● Formed bellows aluminum body type



Specifications

Descriptions	AVB217	AVB317	AVB417	AVB517	AVB617	AVB717
Working fluid	Vacuum and inert gas					
Working pressure range Pa (abs)	1.3×10^{-6} to 1×10^5					
Maximum working differential pressure MPa	0.1					
Valve seat leakage $\text{Pa} \cdot \text{m}^3/\text{s}$ (He)	1.3×10^{-10} or less					
External leakage $\text{Pa} \cdot \text{m}^3/\text{s}$ (He)	1.3×10^{-11} or less					
Withstanding pressure MPa	0.3					
Fluid temperature $^{\circ}\text{C}$	5 to 60 (5 to 150) Note 1					
Ambient temperature $^{\circ}\text{C}$	0 to 60 (no freezing)					
Orifice mm	ø17	ø24	ø39	ø48	ø68	ø80
Conductance Note 2 ℓ/s	5	13	43	74	166	242
Connection	NW16	NW25	NW40	NW50	NW63	NW80
Operating pressure MPa	0.4 to 0.6					
Weight kg	0.4	0.5	1.2	2.0	3.5	6.5
JIS symbol						

Note 1: Inside the parentheses "()" indicate high temperature specification types.

Note 2: The conductance is the theoretical calculation value at the molecular flow range, and is not the actual measurement value.

Switch specifications

Descriptions	Proximity switch		Reed switch		
	T2H/T2V	T3H/T3V	TOH/TOV	T5H/T5V	ETOH/ETOV
Applications	Programmable controller	Relay, programmable controller	Relay, programmable controller	Programmable controller, relay, IC circuit (w/o lamp), Serial connection	Relay, programmable controller
Power voltage	-	10 to 28 VDC	-	-	-
Load voltage/current	10 to 30VDC, 5 to 20 mA Note 4	30VDC or less, 100 mA or less	12/24VDC 5 to 50 mA 100VAC 7 to 20 mA	12/24VDC 50 mA or less 100VAC 20 mA or less	12/24VDC 5 to 50 mA 110VAC 7 to 20 mA
Power consumption	-	10 mA or less at 24VDC (ON)	-	-	-
Internal voltage drop	4 V or less	0.5 V or less	3 V or less	0 V	3 V or less
Light	LED (ON lighting)			-	LED (ON lighting)
Leakage current	1 mA or less	10 μA or less	0 mA	0 mA	0 mA
Lead wire length Note 3	Standard 1 m (oil-resistant vinyl cabtire cord 2-conductor 0.2 mm ²)	Standard 1 m (oil-resistant vinyl cabtire cord 3-conductor 0.2 mm ²)	Standard 1 m (oil resistant vinyl round code 2-conductor 0.2 mm ²)		Standard 1 m (heat-resistant fluorine insulation cabtire cord 2-conductor 0.5 mm ²)
Maximum impact	980 m/s ²		294 m/s ²		
Insulation resistance	20 M Ω and over when measured with a 500VDC megger				100 M Ω and over when measured with a 500VDC megger
Withstand voltage	No abnormal condition when 1000VAC applied for 1 min				
Ambient temperature range	-10 to +60 $^{\circ}\text{C}$				-10 to +150 $^{\circ}\text{C}$
Protective structure	IEC Standard IP67, JIS CO920 (water-tight type), oil-resistant				

Note 3: 3 m and 5 m lead wire lengths are also available.

Note 4: Above-mentioned load current's maximum value 20 mA is for 25 $^{\circ}\text{C}$.

The current will be lower than 20 mA if ambient temperature around the switch is higher than 25 $^{\circ}\text{C}$. (5-10mA at 60 $^{\circ}\text{C}$)

Note 5: For other safety precautions regarding switch usage, refer to pages 105 to 109.

How to order

AVB 4 17 - 40K - 4 - D T5H 3 - H

Model no.

A Series

Actuation
NC

B Connection

C Fluid temperature

D Operation port
position

E Switch installation
position
Note 1

F Switch model No.
Note 2

Note on model no. selection

Note 1: Only Series 2 (ø17 orifice) has 3-sided switch installation. Switch installation is possible on all surfaces excluding the control port side.

Not available for the models below

AVB217-16K-1-A F G H

AVB217-16K-2-B F G H

AVB217-16K-3-C F G H

AVB217-16K-4-D F G H

Note 2: C If fluid temperature is "HOM", select either ETOH or ETOV.

Note 3: F "3" and "5" are not available for switch model no. "ETOH", "ETOV".

Note 4: F "R" and "D" are not available for switch model no. "ETOH", "ETOV".

<Example of model number>

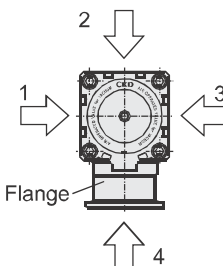
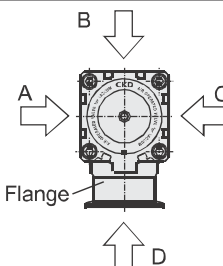
AVB417-40K-4-DT5H3-H

Model: AVB417 Air-operated valve for high vacuum (NC type)

- A Series : Orifice ø39
- B Connection : NW40
- C Fluid temperature : 5 to 60°C (magnet integrated)
- D Operation port position : 4
- E Switch installation position : D
- F Switch model No. : T5H (Axial lead wire)
- G Lead wire length : 3 m
- H Switch quantity : Detect when valve is open

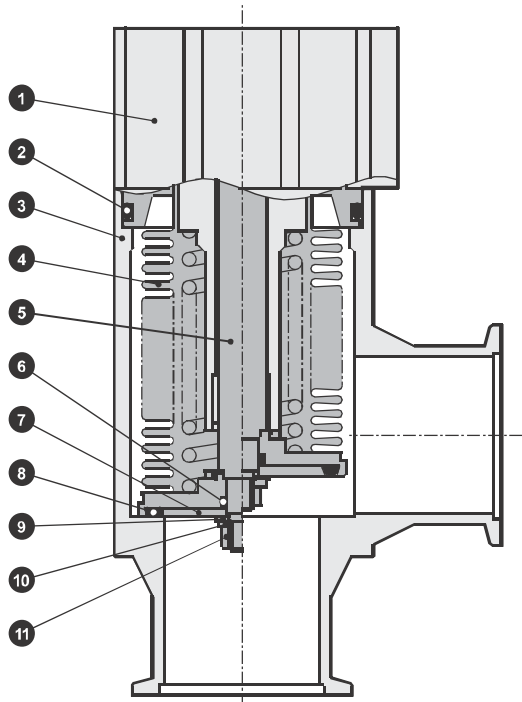
G Switch lead
wire length
Note 3

H Switch
quantity
Note 4

Symbol	Descriptions			
A Series				
2	Orifice ø17			
3	Orifice ø24			
4	Orifice ø39			
5	Orifice ø48			
6	Orifice ø68			
7	Orifice ø80 (Cannot be selected with high temperature spec)			
B Connection				
16K	NW16	Available for AVB217 only		
25K	NW25	Available for AVB317 only		
40K	NW40	Available for AVB417 only		
50K	NW50	Available for AVB517 only		
63K	NW63	Available for AVB617 only		
80K	NW80	Available for AVB717 only		
C Fluid temperature				
Blank	5 to 60°C (magnet integrated)			
HO	5 to 150°C (without magnet)			
HOM	5 to 150°C (magnet integrated)			
D Operation port position				
4				
1				
2				
3				
Operation port positions are displayed (4, 1, 2, 3) as viewed from the valve's top surface.				
E Switch installation position				
Blank	Without switch			
D				
A				
B				
C				
Switch installation positions are displayed (D, A, B, C) as viewed from the valve's top surface.				
F Switch model No.				
Blank	Without switch			
T0H	Axial lead wire	Reed	2 wire	
T5H				
T0V	Radial lead wire			
T5V	Radial lead wire	Proximity	3 wire	
T2H	Axial lead wire		2 wire	
T3H	Radial lead wire		3 wire	
T2V	Radial lead wire	Reed	2 wire	
T3V	Radial lead wire			
ETOH	Axial lead wire			
ETOV	Radial lead wire			
G Switch lead wire length				
Blank	1 m (standard)			
3	3 m			
5	5 m			
H Switch quantity				
H	Detect when valve is open			
R	Detect when valve is closed			
D	Detect when valve is open/closed			

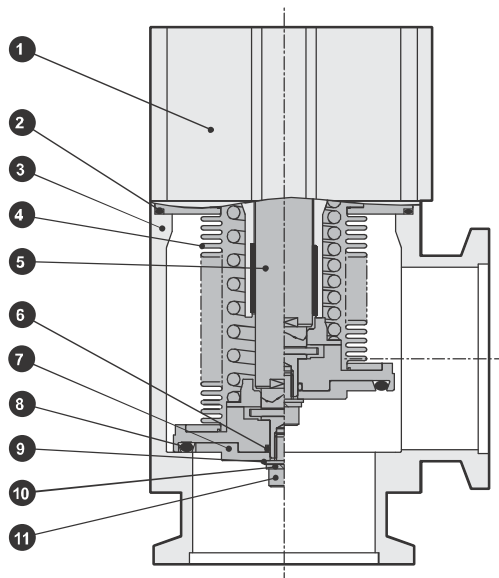
Internal structure and parts list (NC type)

● AVB217/AVB317/AVB417/AVB517/AVB617



No.	Part name	Material
1	Cylinder (magnet integrated)	
2	O ring	FKM
3	Body	A6063
4	Bellows	SUS316L
5	Rod	SUS316L
6	O ring	FKM
7	Valve disk B	SUS316L
8	O ring	FKM
9	Plain washer	SUS304
10	Spring washer	SUS304
11	Hexagon nut	SUS304

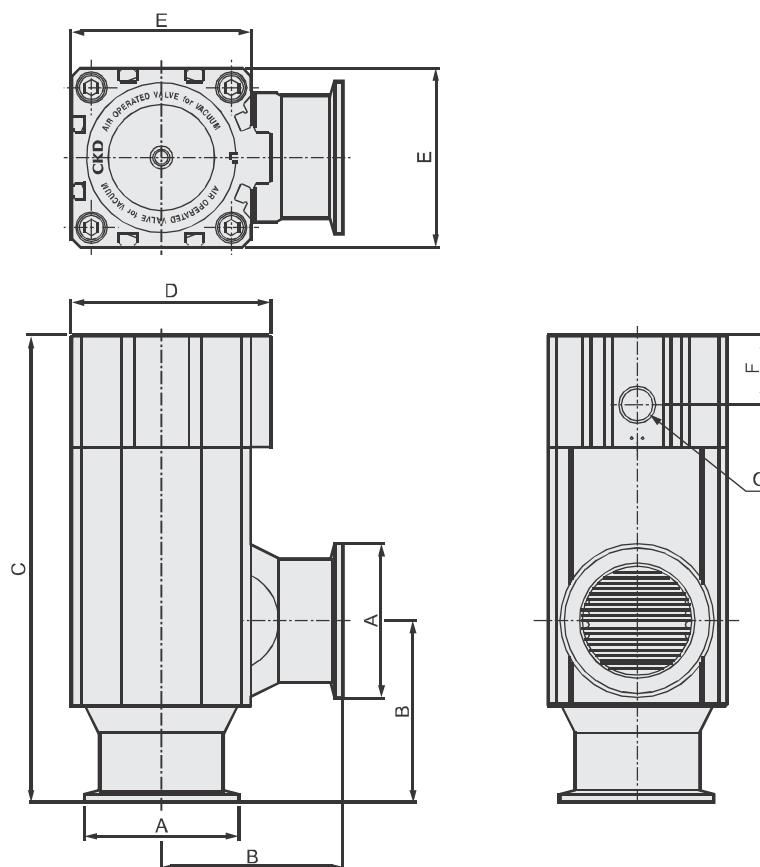
● AVB717



No.	Part name	Material
1	Cylinder (magnet integrated)	
2	O ring	FKM
3	Body	A6063
4	Bellows	ASL350
5	Rod	SUS304
6	O ring	FKM
7	Valve disk B	SUS316L
8	O ring	FKM
9	Plain washer	SUS304
10	Spring washer	SUS304
11	Hexagon socket bolt	SUS304

Dimensions (NC type)

● AVB217/AVB317/AVB417/AVB517/AVB617/AVB717



Model no.	A	B	C	D	E	F	G
AVB217	ø30 (NW16)	40	114	40	40	20	M5
AVB317	ø40 (NW25)	50	127	49.5	45	23	Rc1/8
AVB417	ø55 (NW40)	65	168	71	64	24.5	Rc1/4
AVB517	ø75 (NW50)	70	186	84	77	31	Rc1/4
AVB617	ø87 (NW63)	88	214	104	98	37	Rc1/4
AVB717	ø114 (NW80)	90	235	123.5	117	52.5	Rc1/4



High vacuum components

Safety precautions

Always read this section before starting use.
Refer to Intro 9 for the general cautions.

Design and selection

1. Confirming specifications

WARNING

- Incorrect selection and handling of devices may cause problems with this product and problems in the user's system. Confirm that the regulator specifications and the user's system are compatible before use.
- Confirm the compatibility of materials used for wetted area and the fluid used.
- Use the product within the fluid temperature and working pressure range in specifications.

2. Working media

CAUTION

- This product is designed to control vacuum or inert gas. Using other fluids (active gas, liquids, solids, etc.) may disrupt the product's operation or performance could drop. Confirm the compatibility of materials used for wetted area and the fluid used. If the working fluid could solidify, check that no problems in use exist before starting.
- Avoid using fluids causing crystals to accumulate in piping.

3. Selection

CAUTION

- When controlling the valve's responsiveness, check port size and length, as well as flow rate characteristics of the operation solenoid valve for control.
- The inside of the cylinder and the bellows are directly connected to the atmosphere. Make sure there is no blockages in the connection holes (2 holes just below the control port) connecting the bellows to the atmosphere.
- Use air piping and fittings suitable for working temperature.

Installation and adjustment

1. Installation

WARNING

- Incorrect installation and piping will cause product problems, may cause problems in the user's system, and may cause death or serious injury. The user is responsible for ensuring that the operator has read the instruction manual and fully understands the system.
After installation, conduct an appropriate function test to confirm that the product is correctly installed.

● High temperature specification

- Handle with care as the valve body will become hot due to the fluid temperature. Make sure that the valve body's temperature has cooled sufficiently before removing the valve.

CAUTION

- This product is assembled in a clean room after precision cleaning.
Open the clean pack in the package box in a clean environment immediately before installation.
- Pipe the valve so that excessive force is not applied to the flange. Fix heavy objects or mounted parts that vibrate so that the torque is not directly applied to the flange.

- Durability could drop if this product is used where there is continuous vibration. Pipe the product so that excessive vibration and impact are not applied.

● High temperature specification

- When thermally insulating the valve, only insulate the body. If the cylinder is insulated, proper operation may not be maintainable. Therefore, please use caution.

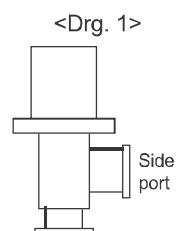
2. Direction when connecting piping (for some models)

CAUTION

- The vacuum valve is basically designed so all ports can be used as connection ports to the vacuum pump. However, with some models (below), the port for connection to the vacuum pump is limited to one direction.

<Table 1> Models with limited vacuum pump connection port

Model	Vacuum pump connection port
AVP712-50K	Bottom port (Refer to fig.1)
AVB812-80K	Bottom port (Refer to fig.1)
AVP812-80K	Bottom port (Refer to fig.1)
HVB612-12F-12B	A port
HVB712-15F-15B	A port



If connecting the models in the above table to a port that it is not designated to; problems such as defective sealing or malfunction may occur.

High vacuum components

Individual precautions

3. Ensuring space

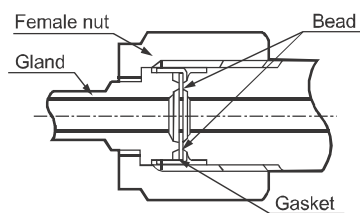
CAUTION

- Ensure sufficient space for installation, removal, piping, and wiring work.
- Ensure sufficient space for maintenance and inspection.

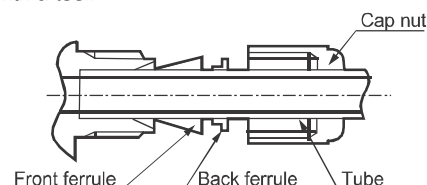
4. Piping

CAUTION

- If dirt or burrs get on pipes or in the areas during piping, the valve seat or O-ring may be damaged; and cause leaks from the valve seat. Carefully remove any dirt or burrs before installing the valve.
 - Pipe the product so that the pipe tension, compression, and bending, etc., are not applied to the valve body.
 - Handle with care so that the vacuum flange seal surface is not damaged. AVB**7, MBV*17, EVB flange surfaces have a 0.1-0.2 mm step (concave shape) for seal surface protection.
 - Durability may decrease depending on the exhaust flow. Therefore, we recommend that you use the bellows side as the exhaust side (except for models with limited vacuum pump connection port). Please perform sufficient checks, as durability will vary depending on working conditions.
 - When work is completed, always carry out a leak inspection and confirm that there are no leaks.
 - Check that no dirt, scratches, or burrs get on the seal before tightening the fitting in the following procedures:
- (1) Tightening the fitting
- When the gasket material of JXR fitting is nickel or SUS316, screw in the nut manually until the gasket contacts the bead section, and then tighten another 1/8 turn using a tool. (Contact CKD if other materials are to be used.)



- Double barbed fitting
Check that the front ferrule, back ferrule, and nut are properly attached, and then insert the tube until it contacts the back of the product. After tightening the nut manually, tighten another 1/4 turn with a tool.



- (2) After tightening the fitting, always carry out a leak inspection and confirm that there are no leaks.

5. Solenoid valve

CAUTION

- High-temperature warning during energizing solenoid valve's coil
 - Coil section of solenoid valves (HVB/HVL) will generate heat when energized. Models using the H Class specification coil (some HVB models) become especially hot when energized. Beware of direct contact, it may cause burns.
- Precautions for wiring solenoid valve
 - (1) As a reference, use a lead wire with nominal cross-section area of 0.5 mm² or larger. Check that no excessive force is applied to leads.
 - (2) Use with in allowable voltage range. Use exceeding the allowable voltage range may cause malfunctions or coil damage.
 - (3) Provide an appropriate circuit breaker (such as a fuse) on the control circuit side to protect electrical equipment.
 - (4) Using a switching circuit that does not generate contact chattering improves solenoid valve durability.
 - (5) If the electric circuit is not susceptible to the solenoid surge, provide measures such as inserting a surge absorber parallel to the solenoid.

6. Air piping

CAUTION

- Refer to the instruction manual and pipe connection ports correctly.
 - Failure to observe this could lead to operation faults.
- When connecting pipes, wrap sealing tape in the clockwise from threads starting 2 pitches inside from the end of piping threads.
 - If sealing tape protrudes from pipe threads, it could be cut when screwed in. This could cause the tape to enter and lead to faults.



- Tighten pipes with the appropriate torque.
 - Pipes must be connected with the appropriate torque to prevent air leakages and screw damage.
 - First tighten the screw by hand to prevent damage to screw threads, then use a tool.



[Reference value] Please refer to the instruction manual.

Connection screw	Tightening torque (N·m)
M5	1 to 1.5
Rc1/8	3 to 5
Rc1/4	6 to 8
Rc3/8	13 to 15

During use and maintenance

1. Using this product

WARNING

- Always use this product within the specified range.

CAUTION

- Do not step on valves, etc., or place heavy objects on them.
- Do not over tighten the manual valve. Over tightening can cause damage to the valve.
- High temperature specification
- Screw hole on the surface of the body side is not for securing. Please do not use.
- When using the AVB*47 adjusting nut, make sure the valve body has cooled sufficiently before adjusting.

2. Maintenance/inspection

WARNING

- Always carry out the work as specified in the instruction manual.
- Read instructions and precautions included with the product before use or maintenance.
- Make sure to remove the operating air and fluid before maintenance.

CAUTION

- Conduct the periodic inspections below to ensure optimal performance of the valve.
 - (1) Confirm that there are no leaks outside of the valve.
 - (2) Confirm that there are no leaks from the valve seat (internal leaks).
 - (3) Confirm that valve operation is smooth.
 - (4) Confirm that no pipes or valve screws are loose.
 - (5) Confirm that the O-ring is not worn or corroded.
- Be careful not to damage any parts when removing deposits.
- If damage is anticipated before designated durability, perform maintenance and inspections as soon as possible.
- Please use CKD's specified parts for maintenance parts. Refer to the structural drawing/repair parts/maintenance parts list.
- Please contact CKD or the nearest distributor regarding maintenance parts.

3. Solenoid valve

CAUTION

- Precaution regarding solenoid valve electric wiring connection electric shock
 - If electric wiring connection parts (bare live parts) of the solenoid valve (HVB/HVL) are touched, electric shock can occur.
Always disconnect the power supply before starting disassembly inspection.
Do not touch the live parts with wet hands.



Safety precautions

Proximity switch/T2H/T2V/T3H/T3V

Please make sure to read the safety precautions in "Pneumatic cylinder I" (No. CB-029SA) before use.

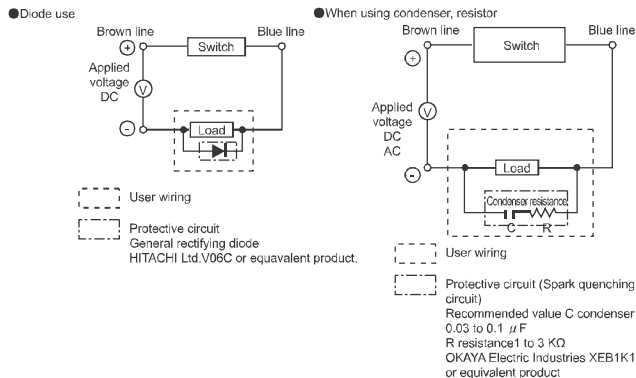
Design and selection

WARNING

- Application, load current, voltage, temperature, impact, environment, etc., exceeding the specifications will result in damage or operation faults. Use the device as instructed in specifications.
- Do not use this product in flammable atmosphere. Switch doesn't have explosion proof structure. Never use in any atmosphere with explosive gas as it can lead to explosions.

CAUTION

- Check when using for an interlock circuit.
When using the cylinder switch for an interlock signal, requiring high reliability, provide mechanical protection or use a double interlock, installing a switch (sensor) other than the cylinder switch as protection against faults. Execute inspection regularly to check that the normal operation is done.
- Check the contact capacity.
Do not use a load that exceeds the switch's maximum contact capacity. It can cause failure. The switch may not light if the load is less than the rated current value.
- Check the contact capacity.
 - Provide a protection circuit when connecting an inductive load (relay, solenoid valve), as surge voltage is generated when the switch is turned OFF.

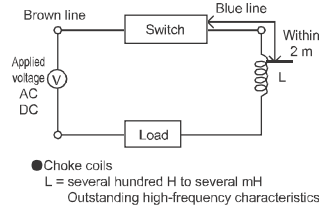


- Provide a protection circuit when connecting a capacitive load (capacitor), because rush current will occur when the switch is turned ON.
- When the wiring length increases, wiring capacity is reached and rush current is generated. This can damage switch or reduce lifetime. Provide a contact protection circuit if the wiring length exceeds values in Table 1.

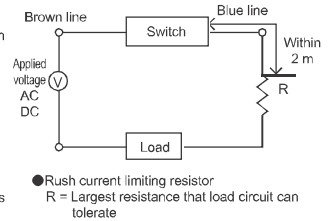
Switch	Voltage	Wire length
T	DC	50m
T	AC	10m

Table 1

● Using choke coils



● Using resistors



Refer to supplement page 29 of the Pneumatic Cylinders catalog (CB-029SA) for contact protecting circuit specifications.

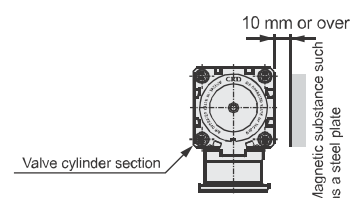
- Avoid using in an environment exposed to water.
 - Operation faults could occur due to insulation faults.
- Avoid use in environments containing oil or chemicals.
 - The switch could be adversely affected (insulation fault, malfunction caused by swelling of filled resin, hardening of lead sheath, etc.) if used in an environment containing oil, coolant, cleaning fluid, or chemicals. Contact with CKD about such an environment.
- Do not use in a high-impact environment.
When using the reed switch, an impact of 294 m/s² or more applied during use could output a signal for an instant (1 ms or less), or could turn it OFF. It may be necessary to use a proximity switch depending on the working environment. Contact with CKD.
- Do not use where surge is generated.
If there is a device (magnetic lifter, high-frequency induction furnace, motor, etc.) that generates a large surge near the valve with a proximity switch, circuit elements in the switch could deteriorate or be damaged. Take measures against the surge-generating source.
- Check the accumulation of iron chips and contact of magnetic material.

If a large amount of iron chips, such as cutting chips or welding spatter accumulate or if magnetic objects (material attracted to magnets) are present around the valve with switch, the magnetic force in the valve is lost, and the switch's operations may be inhibited.

- Note the proximity of valves. When using more than two valves with switches adjacently in parallel, observe the indicated allowable spacing.
- Switches could malfunction because of bidirectional magnetic interference.

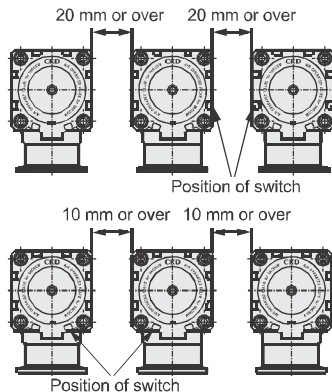
CAUTION

- Sources of magnetism such as steel plates near the switch could cause the valve to malfunction. Keep at least 10 mm away from the valve.
(Same for all bore sizes)

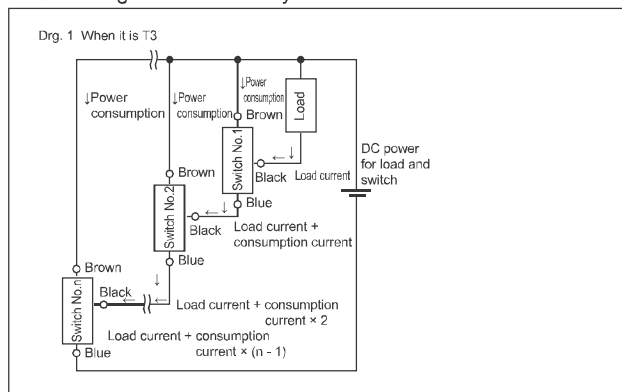


High vacuum components

- If valves are adjacent, the switch could malfunction. Check that following distance is maintained between valve surfaces.
(Same for all bore sizes)



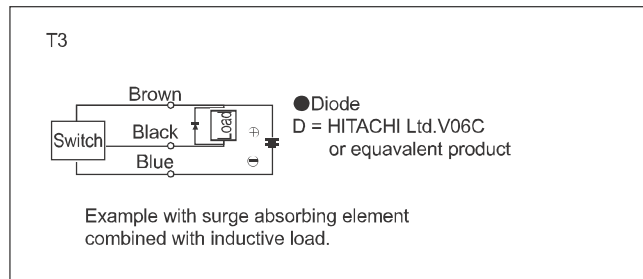
- Check the magnetic environment.
 - When installing valves with switches adjacently in parallel or if magnetic material moves near valves with switches, mutual interference may occur and affect detection accuracy.
- Check internal voltage drops caused by serial connections.
 - When connecting several 2-wire type switches in serial, the switch voltage drop is the total voltage drop of all connected switches. The voltage applied to the load is the voltage obtained by subtracting the voltage drop at switches from the power voltage. Check load specifications and determine the number of switches to be connected.
 - When connecting several 3-wire serial proximity switches, the switch's voltage drop is the total voltage drop of all connected switches, as with the 2-wire switch. The current that flows to the switch is the total of the connected switch's current consumption and load current, as shown below. Check load specifications and determine the number of switches to be connected so that the maximum switch load current is not exceeded.
 - The light turns ON only when all switches are ON.



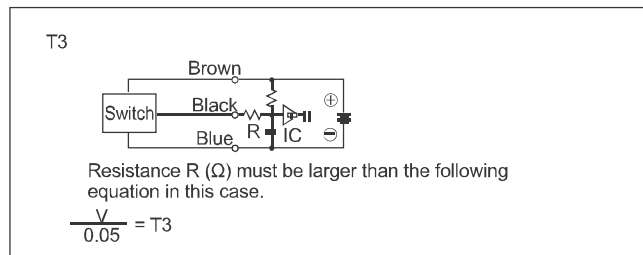
- Please use caution to ensure that no current leaks from parallel connections.
 - When connecting several 2-wire switches in parallel, note that leakage current increases in proportion to the number of connected units. Check load specifications and determine the number of switches to be connected. Note that switch light could dim or may not turn ON.
 - With the 2-wire proximity switch, when 1 switch is changing from ON to OFF status, voltage at both ends of the switch connected in parallel drops to the internal voltage drop value at switch ON and is less than the load voltage range and other switches will not turn ON. Check input specifications of the programmable controller, which is the connection load, before starting use.
 - The 3-wire proximity switch has an extremely small leakage current (10 μ A or less), so there is no problem to use under normal conditions.

Output circuit protection

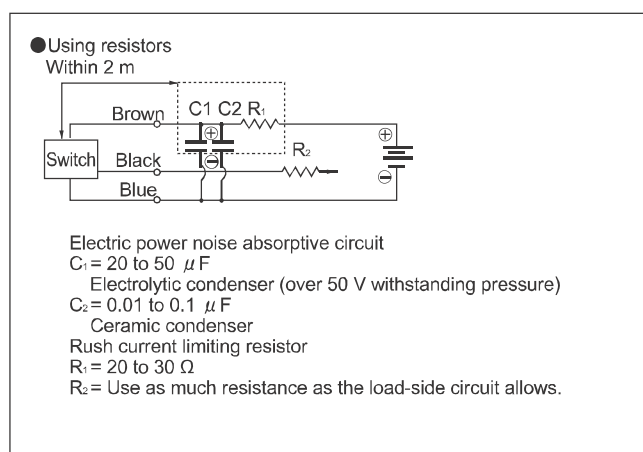
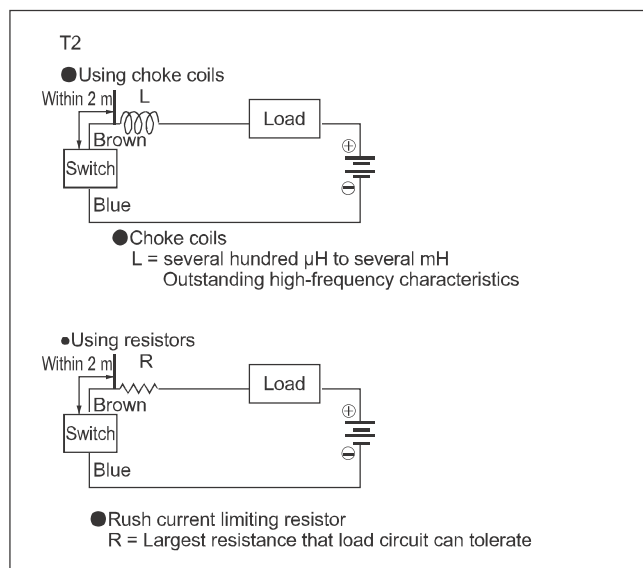
- When an inductive load (relay, solenoid valve) is connected, a surge voltage is generated when the switch is turned OFF. Provide the following protective circuit.



- When a capacious load (capacitor) is connected, rush current is generated when the switch is turned ON. Provide the following protective circuit.



- Provide the following protective circuit if the lead wire length exceeds 10 m.



Reed switch ETOH/ETOV

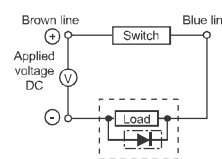
Please make sure to read the safety precautions in "Pneumatic cylinder I" (No. CB-029SA) before use.

Design and selection

⚠ WARNING

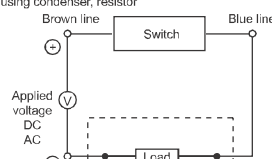
- Application, load current, voltage, temperature, impact, environment, etc., exceeding the specifications will result in damage or operation faults. Use the device as instructed in specifications.
- Do not use this product in flammable atmosphere. Switch is not explosion proof structure. Never use in any atmosphere with explosive gas as it can lead to explosions.
- LED is used for the lamp. Visibility will slowly decline if used continuously under high temperature. Even if the LED turns off, the switch output will operate properly as it has a separate circuit structure system.

⚠ CAUTION

- Check the contact protection circuit.
Do not use a load that exceeds the switch's maximum contact capacity. It can cause failure. The switch may not light if the load is less than the rated current value.
- Check the contact protection circuit.
 - Provide the contact protection circuit when connecting an inductive load (relay, solenoid valve), as surge voltage is generated when the switch is turned OFF.
- Diode use
 

Applied voltage DC

User wiring

Protective circuit
General rectifying diode
HITACHI Ltd.V06C or equivalent product.
- When using condenser, resistor
 

Applied voltage DC AC

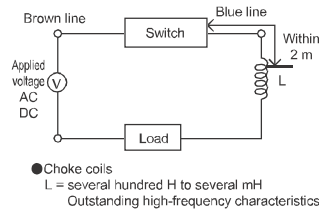
User wiring

Protective circuit (Spark quenching circuit)
Recommended value C condenser 0.03 to 0.1 μ F
R resistance 1 to 3 K Ω
OKAYA Electric Industries XEB1K1 or equivalent product.
- Provide the contact protection circuit when connecting a capacious load (condenser), because rush current will be generated when the switch is turned ON.
- When the wiring length increases, wiring capacity is reached and rush current is generated. This can damage switch or reduce lifetime. Provide a contact protection circuit if the wiring length exceeds values in Table 1.

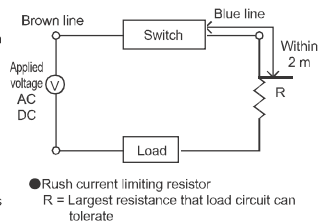
Switch	Voltage	Wire length
ET0	DC	50m
ET0	AC	10m

Table 1

● Using choke coils



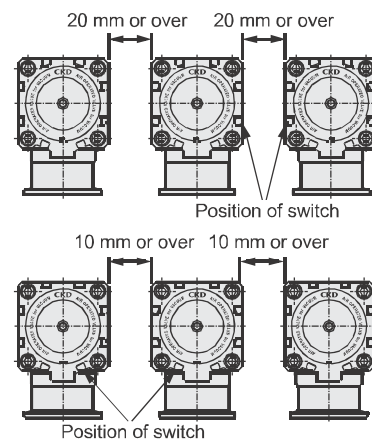
● Using resistors



Refer to supplement page 29 of the Pneumatic Cylinders catalog (CB-029S) for contact protecting circuit specifications.

■ Check the magnetic environment.

- When installing valves with switches adjacently in parallel or if magnetic material moves near valves with switches, mutual interference may occur and affect detection accuracy.
- When adjoining switches other than ET0 types, usage in the below distances can cause malfunction. Accordingly, confirm its operation before use. (Same for all bore sizes)



■ Check internal voltage drops caused by serial connections.

- When connecting several 2-wire type switches in serial, the switch voltage drop is the total voltage drop of all connected switches. The voltage applied to the load is the voltage obtained by subtracting the voltage drop at switches from the power voltage. Check load specifications and determine the number of switches to be connected.

■ Please use caution against leaking current from parallel connections.

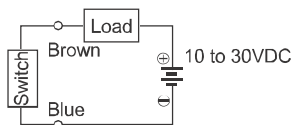
- When connecting several 2-wire switches in parallel, note that leakage current increases in proportion to the number of connected units. Check load specifications and determine the number of switches to be connected. Note that switch light could dim or may not turn ON.

Installation and adjustment

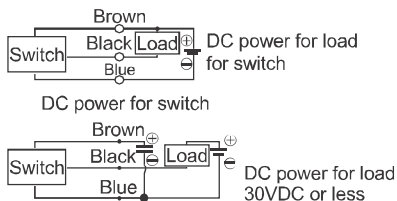
⚠ CAUTION

- Do not drop or bump the product
Do not drop, bump, or apply excessive impact (294 m/s² or more for reed switches, 980 m/s² or more for proximity switches). Even if the switch case does not break, switch components could break or malfunction.
- Do not carry the valve by the switch's lead wire.
Do not carry the valve by the switch's lead wire because the wire could disconnect, and stress on the switch could damage switch components.
- Do not wire with a power cable or high voltage cable.
Avoid wiring in parallel with or in the same conduit as a power cable or high voltage cable. Wire separately. Control circuit (including switch) can malfunction due to noise.
- Do not short-circuit the load.
If turned ON while the load is short-circuited, an overcurrent will flow, and the switch will be damaged instantly.
- Use caution with regards to lead wire connections.
Turn OFF power to the device in the electric circuit to be connected before starting wiring. Conducting work with power ON could result in accidents from electric shock or unpredictable operation.
 - Reed switch
Connect the switch's lead wire in parallel to the load instead of directly to power. For TO, use caution regarding "1", "2" below.
 - (1) When used for DC, connect so that the brown wire is on the plus (+) side and the blue wire on the negative (-) side.
The switch will function when connected in reverse, but the light will not turn ON.
 - (2) When connected to an AC relay or programmable controller input, conducting half wave rectification with that circuit may prevent the switch light from turning ON. The light will light up when the switch lead's polarity is reversed.
 - Proximity switch
Connect the lead wires in the following diagram correctly according to color codes. Incorrect wiring could result in damage.

● T2

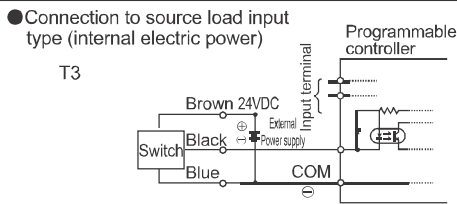
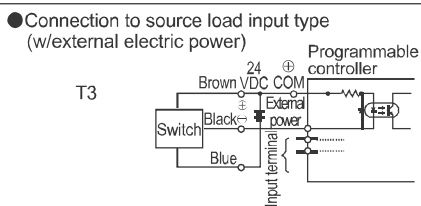
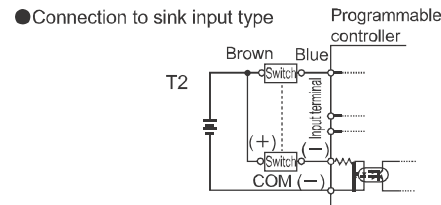
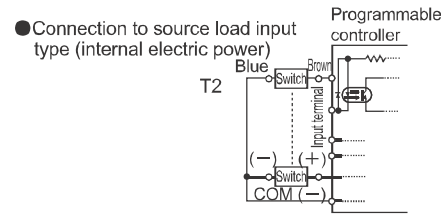
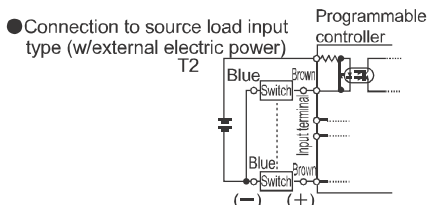


● T3



Connection to programmable controller(PLC)

- Connection differs with the type of programmable controller used. Connect based on input specifications.



- Set the switch to the center of the operation range.
Adjust the switch installation position so that the piston stops at the center of the operating range (range while power is ON). Operation may become unstable if set at the end of the operating range (near the ON, OFF borderline).
- Observe tightening torque when installing the switch.
If the tightening torque range is exceeded, the set screw, bracket, switch, etc., could be damaged.
If installed with a tightening torque less than that designated, the switch installation position could deviate. Loosen the tightening screw (set screw), and move the switch along the switch groove. Tighten at the required position.
Tighten the switch fixing screw using a flat-tipped screwdriver 5 to 6 mm in grip diameter, 2.4 mm or less in end width, and 0.3 mm or less in thickness (precision screwdriver, or one for clocks) with a tightening torque of 0.1 to 0.2 N·m. Tighten ETOH and ETOV with a tightening torque of 0.5 to 0.7 N·m.
- Protection for lead wire
Lead wire's minimum curve radius shall be 9 mm or over (while secured). Use care when wiring so that there is no repeated bending stress or tension.
- Relay
Use the following or equivalent relays.
 - OMRON MY type
 - Electric HH5 type
 - Tokyo Electric Company MPM type
 - MATSUSHITA ELECTRIC WORKS LTD. .. HC type

During use and maintenance

⚠ WARNING

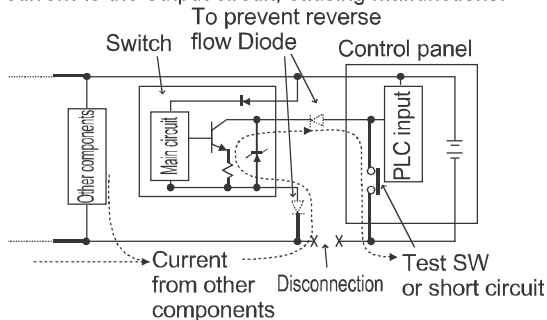
- Please do not use/apply over current.

If overcurrent flows to the cylinder switch because of a load short-circuit, etc., the switch will be damaged and could ignite. Install overcurrent protection circuits such as fuses in output wires and power supply wires as needed.

⚠ CAUTION

- Use caution regarding reverse electrical current caused by disconnection and wiring resistance.

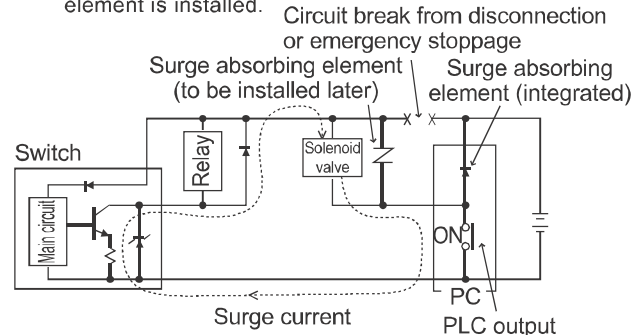
- When other components (including switches) are connected to the same power supply as the switch, short circuiting the output wire and power supply wire side or disconnecting the power supply wire side to check the control panel's input unit operation can send reverse current to the output circuit; causing malfunctions.



- To prevent malfunction from reverse currents, take countermeasures such as the following.
- (1) Avoid centralizing current at the power cable, especially a negative power cable, and use as thick a wire as possible.
 - (2) Limit components connected to the same power source as the switch.
 - (3) Prevent reverse current by inserting diode in a series on the switch output wire.
 - (4) Insert a diode serially with the switch power cable negative side to prevent reversal of current.

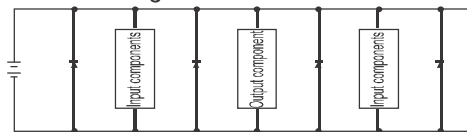
- Pay attention to leading of surge current

- When switch power is shared with an inductive load that generates a surge, such as a solenoid valve or relay, and the circuit is cut off while the inductive load is functioning, the surge current could enter the output circuit and cause damage depending on where the surge absorption element is installed.



- To prevent malfunction from surge current leading, take countermeasures such as those listed below.

- (1) Separate the power supply for the output system comprising the inductive load such as the solenoid valve and relay, and the input system such as the switch.
- (2) If you cannot separate the power source, install a direct surge absorption element for all inductive loads. Note that the surge absorption element connected to the PLC, etc., protects only that device.
- (3) Connect surge suppressors to the points as following to reduce damages when lines are disconnected.

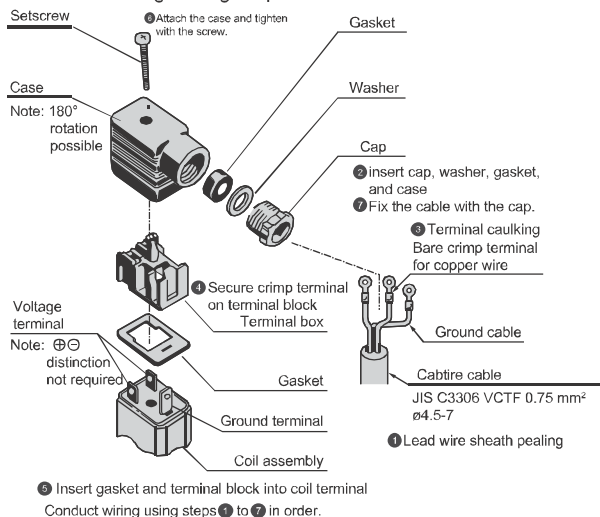


When devices are connected to a connector, the output circuit could be damaged by the above if the connector is disconnected while power is ON. Turn power OFF before connecting or disconnecting the connector.

How to wire the terminal box

- DIN terminal box (Pg9), DIN terminal box w/lamp (Pg9)

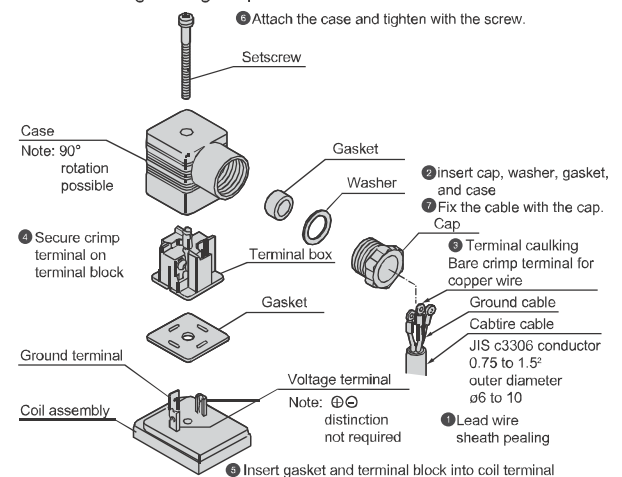
- (1) Use the following cabtire cable.
 - Cable outer diameter: $\phi 4.5$ to $\phi 7$ • Nominal section area: 0.75 mm^2
- (2) Insert the crimp terminal for copper wires into the cabtire cable's lead wire, and crimp the terminal with the designated tool. M3 terminal screws are used with the terminal box.
- (3) Tighten screws with the following tightening torque.
 - Screw tightening torque... 0.5 Nm
 - Terminal screw tightening torque... 0.5 Nm



- * The orientation of the cable lead out port is changed by taking out the terminal box from the case, rotating it by 180° , then replacing the terminal box into the case.

- DIN terminal box (Pg11), DIN terminal box w/lamp (Pg11)

- (1) Use the following cabtire cable.
 - Cable outer diameter: $\phi 6$ to $\phi 10$ • Nominal section area: 0.5 to 1.5 mm^2
- (2) Insert the crimp terminal for copper wires into the cabtire cable's lead wire, and crimp the terminal with the designated tool. M3 terminal screws are used with the terminal box.
- (3) Tighten screws with the following tightening torque.
 - Screw tightening torque... 0.5 Nm
 - Terminal screw tightening torque... 0.5 Nm



- * The orientation of the cable lead out port is changed by taking out the terminal box from the case, rotating it by 90° , then replacing the terminal box into the case.