



Safety Precautions

Be sure to read this section before use.

When designing and manufacturing a device using CKD products, the manufacturer is obligated to check that device safety mechanism, pneumatic control circuit, or water control circuit and the system operated by electrical control that controls the devices is secured.

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 an operator having sufficient knowledge and experience.
 - 2** Use this product in accordance with specifications.
This product must be used within its stated specifications. In addition, never modify or additionally machine this product. This product is intended for use in general industrial machinery equipment or parts. It is not intended for use outdoors (except for products with outdoor specifications) or for use under the following conditions or environments.
(Note that this product can be used when CKD is consulted prior to its usage and the customer consents to CKD product specifications. The customer should provide safety measures to avoid danger in the event of problems.)
 - ①** Use for applications requiring safety, including nuclear energy, railways, aircraft, marine vessels, vehicles, medical devices, devices or applications in contact with beverages or foodstuffs, amusement devices, emergency cutoff circuits, press machines, brake circuits, or safety devices or applications.
 - ②** Use for applications where life or assets could be significantly affected, and special safety measures are required.
 - 3** Observe organization standards and regulations, etc., related to the safety of device design and control, etc. ISO4414, JIS B 8370 (Pneumatics fluid power - General rules and safety requirements for systems and their components) JFPS2008 (Principles for pneumatic cylinder selection and use)
Including the High Pressure Gas Safety Act, Industrial Safety and Health Act, other safety rules, organization 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 all systems 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 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 in the following pages to prevent accidents.
- The precautions 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, and when there is a high degree of emergency to a warning.

 **WARNING:** If handled incorrectly, a dangerous situation may occur, resulting in death or serious injury.

 **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.
Every item provides important information and must be observed.

Warranty

- 1** **Warranty period**
The product specified herein is warranted for one (1) year from the date of delivery to the location specified by the customer.
- 2** **Warranty coverage**
If the product specified herein fails for reasons attributable to CKD within the warranty period specified above, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge. However, following failures are excluded from this warranty:
 - 1) Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or the Instruction Manual.
 - 2) Failure caused by use of the product exceeding its durability (cycles, distance, time, etc.) or caused by consumable parts.
 - 3) Failure not caused by the product.
 - 4) Failure caused by use not intended for the product.
 - 5) Failure caused by modifications/alterations or repairs not carried out by CKD.
 - 6) Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
 - 7) Failure caused by acts of nature and disasters beyond control of CKD.The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.
Note: For details on the durability and consumable parts, contact your nearest CKD sales office.
- 3** **Compatibility check**
The customer is responsible for confirming the compatibility of CKD products with the customer's systems, machines and equipment.



Safety precautions

Fluid Control Components: Warnings and Cautions

Be sure to read this section before use.

Read safety precautions in “General Purpose Valves (Catalog No. CB-03-1SA)” and “Air Unit CXU Series (Catalog No. CC-901A)” as well.

Product-specific cautions: Pilot operated 2-port solenoid valve for compressed air EXA Series

Design/selection

1. Checking the specifications

⚠ WARNING

- Use the product in the range of conditions specified for the product.
Use with pressure or temperature outside the specifications range may result in damage or operation faults.
(Refer to specifications)
To use fluids other than compressed air, contact CKD.

■ Working fluids

Active gases cannot be used, so contact CKD when these applications are required.

- If the product is used under conditions where the pressure differential between the primary side and secondary side while the valve is open is below 0.01 MPa, the diaphragm may vibrate, resulting in a short service life. When using under conditions where there is a chance that the differential pressure or flow rate can become very small as described below, contact CKD for details.
 - When the primary or secondary side of solenoid valve has a needle valve
 - When multiple solenoid valves connected in parallel piping are opened simultaneously
(The drop in solenoid valve source pressure causes the pressure difference between the primary side and the secondary side to diminish.)

2. Safety design

⚠ WARNING

- Take measures to prevent physical harm or property damage in the event of failure of this product.

- Protection characteristic (IPX5) of DIN terminal box connection IPX5 is a rating of ingress protection based on IEC60529 [IEC529:1989-11] standards. Avoid use in conditions where water or cutting oil directly contacts the valve.

Explanation of IPX5 protection characteristic codes and test method

- Degree of protection

Note: IP-X5 is based on the following testing method.

- IEC (International Electrotechnical Commission) standards

(IEC60529 [IEC529:1989-11])

IP -

Protection characteristic codes (International Protection)

1st characteristic No.
(degree of protection for foreign solid matter)

2nd characteristic No. (degree of protection for water entry)

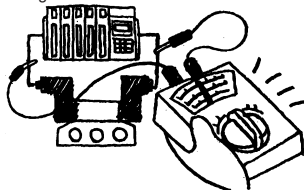
Grade	Degree of protection	Overview of test method (fresh water is used)
5	Protection against water jets No harmful effects occur even when water is sprayed with nozzles from all directions.	The sample (exterior) is exposed to water jetting of 1 m ² per minute for a total of 3 minutes or more from all directions with the testing equipment in the figure below. Water discharge nozzle bore size: 6.3 mm

⚠ CAUTION

- Check for leakage current to avoid malfunction caused by leakage current from other fluid control components.

- When using a programmable controller, leakage current may affect the solenoid valve and cause malfunction.
Note that the values that are affected by leakage current depend on the solenoid valve.

Programmable controller



For 100 VAC	2.0 mA or less
For 12 VDC	1.5 mA or less
For 24 VDC	1.8 mA or less

- Observe the following precautions when using nylon or urethane tubes as the piping material.
 - Use flame-resistant tubes where they could come in contact with spatter.
 - When using the standard push-in fitting on the spiral tube, fix the base of the tube with a hose clamp. Rotation may occur, causing a reduction in holding force.

3. Working environment

- Use clean air.

- Do not use the compressed air if it contains chemicals, synthetic oils containing organic solvents, salt, or corrosive gas, as it can cause damage and/or operation failure.
- The ozone content in the compressed air should be 0.1 ppm or below. A higher ozone content may cause malfunction and leakage.

4. Durability

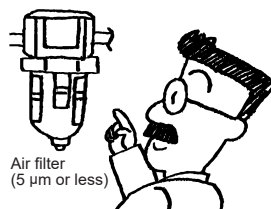
⚠ WARNING

- Using the solenoid valve with continuous energizing can cause a deterioration of performance. Contact CKD when using the solenoid valve under such conditions.

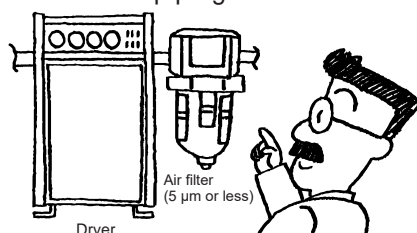
5. Pneumatic source

⚠ CAUTION

- Install a pneumatic filter just before the pneumatic component in the circuit.



- Do not supply anything other than compressed air.
- Use clean compressed air that does not contain corrosive gases.
- Use dry compressed air that does not cause moisture inside the piping.



- Moisture will occur if the temperature drops in the pneumatic piping or pneumatic components.
- Operation failure could occur if moisture enters the air flow path of pneumatic components and temporarily blocks passage.
- Moisture could cause rust, making the pneumatic components fail.
- Use compressed air that does not contain oil oxides, tar, carbon, etc., from the air compressor.
 - If oil oxides, tar, or carbon enter the pneumatic components and solidify, resistance at the sliding section will increase, leading to operation failure.
- Use compressed air that does not contain solid foreign matter.
 - Any solid foreign matter in the compressed air can enter the pneumatic components and cause wear, locking or internal leakage in the sliding parts.

6. Surge suppressor

⚠ CAUTION

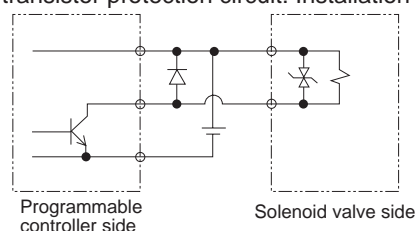
- The surge suppressor attached to the solenoid valve is intended to protect the output contacts for the solenoid valve drive. There is no significant protection for the other peripheral devices, and devices could be damaged or could malfunction due to a surge. As well, surges generated by other devices may be absorbed and cause damage such as burning. Note the following points.

- The surge suppressor functions to limit solenoid valve surge voltage, which can reach several hundred volts, to a low voltage level that the output contact can withstand. Depending on the output circuit used, this may be insufficient and could result in damage or malfunction. Check whether the surge suppressor can be used within the surge voltage limit of the solenoid valve in use, the output device's withstand pressure and circuit structure, and by the degree of return delay time. When necessary, provide other surge countermeasures. CKD's solenoid valve with surge suppressor can counter inverse voltage surge which occurs when the valve is turned OFF to the level shown in the table below.

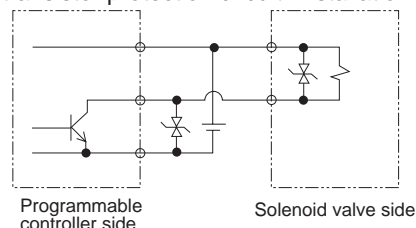
Specification voltage	Inverse voltage when OFF
12 VDC	Approx. 27 V
24 VDC	Approx. 47 V

- If the output unit is an NPN type, a surge voltage equaling the voltage shown in the table above plus the power supply voltage may be applied to the output transistor.

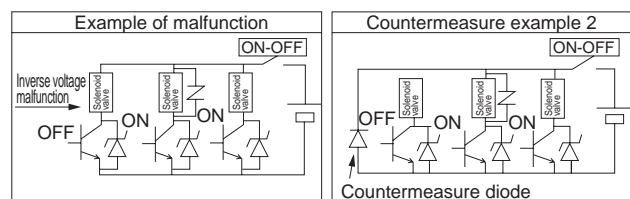
[Output transistor protection circuit: Installation example 1]



[Output transistor protection circuit: Installation example 2]



- If another device or solenoid valve is connected in parallel to the solenoid valve, the inverse voltage surge generated when the valve is OFF would apply to those devices. Even in the case of a solenoid valve with 24 VDC surge suppressor, a surge voltage may reach negative tens of volts for some models. This inverse voltage may cause damage or malfunction to other components connected in parallel. Avoid parallel connection of devices susceptible to inverse polarity voltages, e.g. LED indicator lamps. When driving several solenoid valves in parallel, the surge from other solenoid valves may enter the surge suppressor of one solenoid valve, and it may burn depending on the current value. When driving several solenoid valves with surge suppressors in parallel, surge current could concentrate at the surge suppressor with the lowest limit voltage and cause similar burning. Due to the variations in surge suppressor limit voltage that exist even among solenoid valves of the same model No., in the worst case the surge suppressor may burn out. Avoid driving multiple solenoid valves in parallel.



- The surge suppressor incorporated in the solenoid valve will often be short-circuited if it is damaged by overvoltage or overcurrent from other solenoid valves. Where there is a failed surge suppressor, if a large current flows when the output is ON, in the worst case scenario, the output circuit or solenoid valve could be damaged or ignited. Do not continue energizing in a state of failure. Additionally, to prevent large currents from continuing to flow, connect an overcurrent protection circuit to the power supply and drive circuit, or use a power supply with overcurrent protection.

7. 100 VAC specifications

⚠ CAUTION

- The 100 VAC specification has a built-in full-wave rectifier circuit.

Depending on the type of SSR used to turn ON/OFF the solenoid valve, recovery failure of the valve may result.

Use caution when selecting SSRs. (Consulting the manufacturer of the relay or PLC is recommended.)

Mounting, installation and adjustment

1. Installation

⚠ WARNING

- When mounting a valve, do not use a mounting method that relies on support from the piping.
 - Mount and fix the valve body.
- After mounting, do not clean or paint with water or solvent.
 - Otherwise some resin parts may be damaged.
- Do not remove the solenoid valve package until you are ready to connect to the piping.
 - Removing the package before starting piping work may cause foreign matter to enter inside the solenoid valve from the piping port, resulting in failure or malfunction.
- Make sure that there is no torsion, tension or moment load applied to the fitting or the tube.
- Check that the tubing is not worn or damaged.
 - Tubing could collapse, rupture, or become dislocated.

2. Pre-operation confirmation

⚠ CAUTION

- When supplying compressed air after connecting pipes, do not suddenly apply high pressure.
 - The pipe connection could dislocate, causing the pipe to fly off, risking accidents.
- Before supplying compressed air after connecting pipes, check that there are no air leaks at any pipe connections.
 - Use the product after checking for air leaks by applying leak detection liquid on the piping connections.

3. Piping

- Connect the piping so that connections are not dislocated by equipment movement, vibration, tension, etc.
 - Cut the push-in fitting tube at right angles with a dedicated tool.
 - Confirm that the tube has been inserted properly, and make sure that there is no tension during use. The tube could be dislocated or damaged if there is any tension.

- Make sure that there is no torsion, tension or moment load applied to the fitting or the tube.
- Use the designated tube.
 - Particularly in the case of super-flexible urethane tubes, attach insert sleeves for use.
- Securely insert the tube completely to the end, and make sure that the tube cannot be pulled out.
- Cut the tube with a dedicated cutter and always at a right angle.

4. Lead wire connection

⚠ CAUTION

- Connect the lead wire appropriately.

The following lead wire should be used:

Electrical connection code	Content	Conductor size	Conductor sectional area	Outer diameter of insulator	Outer diameter of covering
Blank	Grommet lead wire	AWG#24	0.22 or equiv.	1.42	-

5. DIN terminal box

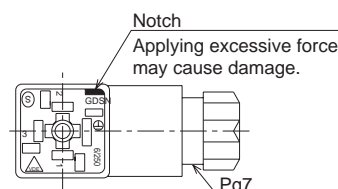
⚠ WARNING

- As there is a risk of electric shock when assembling or disassembling the terminal box, perform the assembly and/or disassembly after turning OFF the power supply.

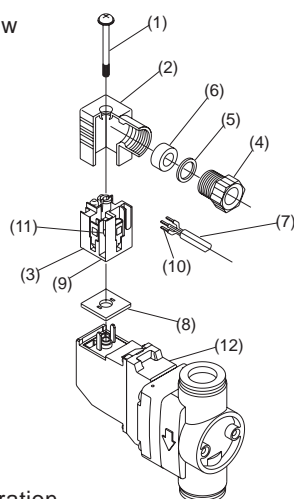
⚠ CAUTION

- Disassembly
 - Loosen screw (1) and pull cover (2) in the direction of screw (1) to remove the connector from coil assembly (12).
 - Pull out screw (1) from cover (2).
 - Notch (9) (next to the GDSN mark) can be found at the bottom of terminal block (3). Insert a compact flathead screwdriver in the gap between housing (2) and terminal block (3) and pry to remove terminal block (3) from cover (2) (Refer to Fig.1). Remove the terminal block without applying excessive force. There is a risk of damage.
 - Remove cable gland (4) and take out washer (5) and rubber packing (6).

Fig. 1



Exploded view



■ Wiring

● Wiring preparation

- The dimensions for cable (7) are as the VCTF2(3) core (bore size: $\phi 3.5$ to 7) defined in JIS C3306.
- The length of the lead wire stripping of the cable is 10 mm.
- Both stranded wires and solid wires can be used for wiring.
- When using a stranded wire, avoid connecting a pre-soldered wire.
- When using a crimp sleeve (10) at the end of the twisted wire, select H0.5/6 (0.3 to 0.5 mm²) or H0.75/6 (0.75 mm²) made by Weidmüller Japan, or an equivalent product. Crimp sleeves are not included.

● Wiring

- Pass cable (7) through cable gland (4), washer (5), and rubber packing (6) in this order, and insert it into cover (2).
- Connect to terminals 1 and 2. There is no polarity.
- The recommended tightening torque is 0.2 to 0.25 N·m.

■ Assembly

- Set the wired terminal block (3) on cover (2). (Push in until it clicks.)

* The terminal block can be set in any of the four different directions (Fig.2).

- Insert the rubber packing (6) and washer (5) in this order into the cable through hole in cover (2), and securely tighten cable gland (4).

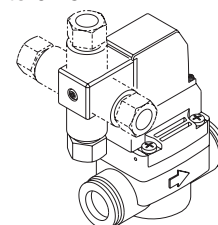
Remarks: The recommended tightening torque for the cable gland is 1.0 to 1.5 N·m.

Pull the cable to check that it does not become loose.

- Place gasket (8) between the bottom part of terminal block (3) and the plug of coil assembly (12), insert the connector, insert screw (1) from over cover (2) and tighten it.

Remarks: The recommended tightening torque for screws is 0.2 to 0.25 N·m.

Fig. 2



Use/maintenance

1. Common

⚠ CAUTION

- Continuous energizing for long periods may accelerate degradation of the solenoid valve. Furthermore, use caution under the following working conditions, as with continuous energization:

- When the energized time exceeds non-energized time in intermittent operation
- When one energizing session exceeds 30 minutes in intermittent operation

Consider heat dissipation when installing the product. Contact CKD when energizing this device continuously.

■ Sudden leakage

With the pilot operated 2-port valve, if the pressure is suddenly applied when the compressor starts while the valve is closed, the valve may open for an instant causing fluid to leak. Caution is required during use.

■ Disassembly

Do not disassemble this valve. Once disassembled, the valve may not retain its valve performance.

- The coil and AC rectification stack generate heat while the valve is energized and immediately after energization. Do not touch these parts with your hands or other body parts.

■ Pressure differential

Under the following conditions, make sure to set the pressure so that the pressure differential while the valve is open does not drop below 0.01 MPa. If a pressure differential (between the primary side and secondary side) of at least 0.01 MPa cannot be secured while the valve is open, the diaphragm may vibrate, resulting in a short service life.

- When a needle valve is mounted on the secondary side
- When multiple solenoid valves connected in parallel piping (module and manifold connection) are opened simultaneously (The drop in source pressure causes the pressure differential between the primary side and the secondary side to diminish.)
- If sufficient pressure differential between the primary side and the secondary side cannot be ensured while the valve is open, or if the pressure differential is unknown, contact CKD for details.

- Note that the secondary side pressure is retained when the primary side pressure drops below the secondary side pressure while the solenoid valve is open. (While the solenoid valve is closed, fluid flows from the secondary side to the primary side.)

- When installing the valve, make sure that no tension is applied to the coil lead wire.

- When carrying the product, hold the body. (Do not dangle the product from the lead wire when carrying it.)

- When the regulator and solenoid valve are directly coupled, the parts could mutually vibrate, causing resonance and chattering.

- If the piping cross-sectional area on the fluid inlet is reduced, the operation may become unstable due to differential pressure failure during valve operation. For the fluid supply side, use piping of a piping size that matches the port size of the valve.

- Depending on the conditions of your usage, the operation of the solenoid valve may become unstable after being left unattended for an extended period of time. Always perform a test run before using the product for actual operations.

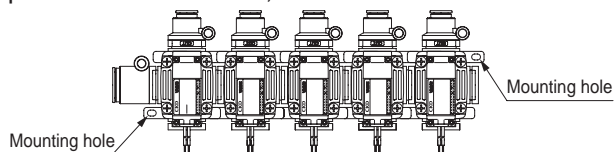
- Avoid using the product for applications that involve continuous fitting rotation or oscillations. Fittings may become damaged.

2. Oil-prohibited specifications

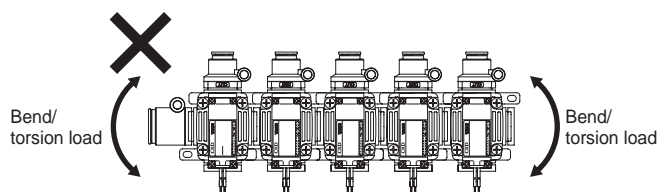
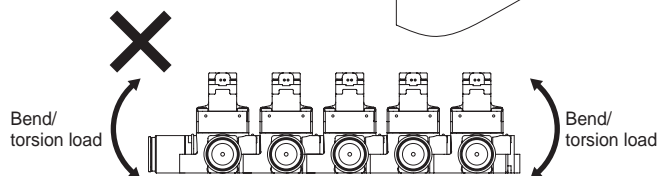
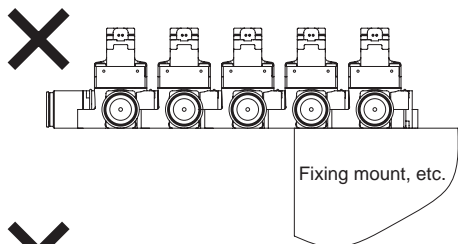
- The oil-prohibited specifications for this product indicate cleaning and assembly under the following conditions:
 - Cleaning target: Major flow path components that come into contact with the fluid (excluding components that deteriorate in performance when cleaned)
 - Cleaning solution: Industrial alcohol or fluorine cleaning agent
 - Assembly system: Using assembly and testing systems for standard products.

3. Manifold

- If you are considering an increase or decrease in the number of stations or changing the compatible tube size for this product, contact CKD for details.
- To install this product, use the mounting holes as shown in the figure below to install the product on a smooth, even surface.



- Do not install or carry this product by one side as shown in the figure below. Do not hold or carry this product in such a way that a torsional or bending force is applied to the manifold body. External leakage may occur when fluid pressure is increased, or the product may fail or break.



- Do not drop this product or use it as footing. The product may fail or break.

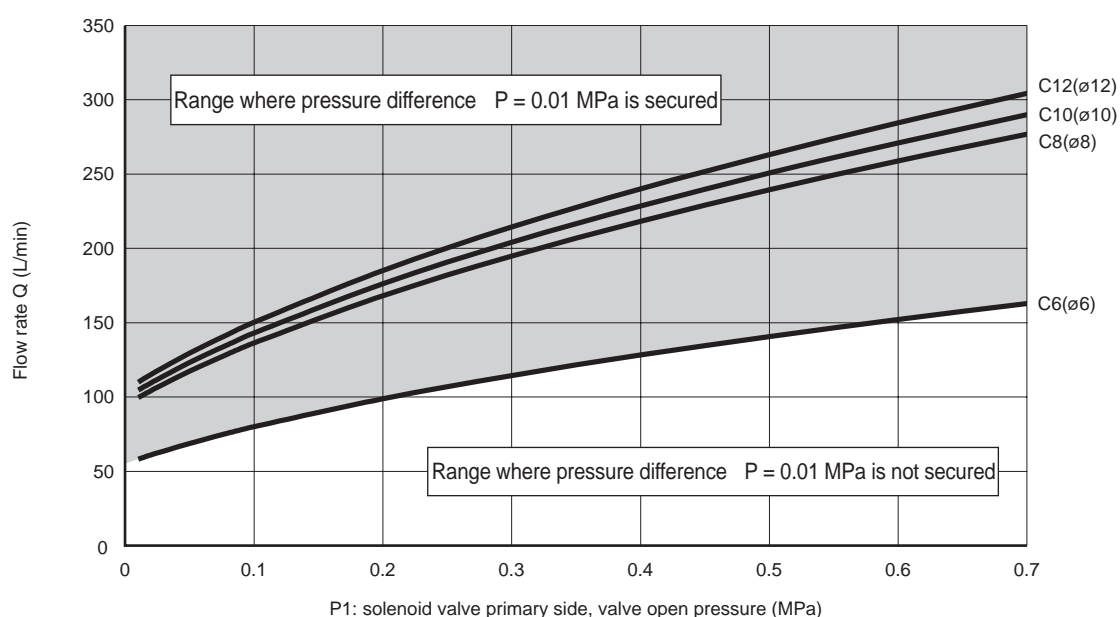
Use/maintenance

4. Internal exhaust specifications: Ensuring the min. working pressure differential

Target model No.: ^{EXA}_{GEXA} - [Port size] - 0 [Coil option] [Mounting plate option] - [Voltage code]

This pilot operated solenoid valve opens and closes based on differential pressure before and after the solenoid valve. Hence, a pressure difference ($\Delta P = P_1 - P_2$) of at least 0.01 MPa must be ensured for accurate operation of the valve. If pressure differential ΔP cannot be secured, the diaphragm may vibrate upon use, resulting in a short service life.

Pressure difference ΔP is determined by the flow rate Q that flows through the solenoid valve. The larger the flow rate Q is, the greater the pressure difference ΔP will become. The guideline values for the “flow rate required” for ensuring a pressure difference ΔP of at least 0.01 MPa while the valve is open are as shown in the figure below.



- (1) When selecting a product, check the above figure to make sure that the necessary pressure difference ΔP is secured with the required flow rate.
- (2) Note that, particularly in the following cases, the required pressure differential ΔP and flow rate may not be secured:
 - When flow rate is reduced before/after the solenoid valve by using a needle valve, nozzle, or long piping
 - When air supply on the primary side of the solenoid valve is low (insufficient regulator capacity, a throttling section, long piping, etc.)
 - When air consumption of a component sharing the air supply source (regulator, etc.) on the primary side of the solenoid valve increases constantly or temporarily
 - When the flow rate changes/decreases due to the fluctuation of the source pressure of the air supply on the primary side of the solenoid valve
 - When multiple solenoid valves are opened simultaneously
- (3) When operating a manifold with multiple valves opened simultaneously, be sure to select components so that the following flow rate will be ensured.
 Operation flow rate/solenoid valve \times No. of valves opened simultaneously = Required operation flow rate < supply flow rate.
 (Example) If $P_1 = 0.3$ MPa when 1 solenoid valve is open, the flow rate that can be ensured when the pressure difference $\Delta P = 0.01$ MPa is approximately 110 L/min (operation flow rate). When 3 manifolds are opened simultaneously, $110 \text{ L/min} \times 3 \text{ manifold stations} = 330 \text{ L/min}$ (operation flow rate) < the supply flow rate.
- (4) If the flow rate required for operation cannot be ensured, or if the flow rate cannot be checked, contact CKD.