CKD

New products

Pneumatic vacuum control valve
IAVB Series

VACUUM CONTROL SYSTEM IAVB SERIES

CKD Corporation

CC-1323A

Best solution to pneumatic control

While inheriting superior assurance of CKD's high vacuum valves, a pressure control function was added to conduct a wide variety of processes.
This is a new proposal for vacuum control of all types of industries and applications.

Pneumatic vacuum control valve

IAVB Series

High vacuum valve + pressure control

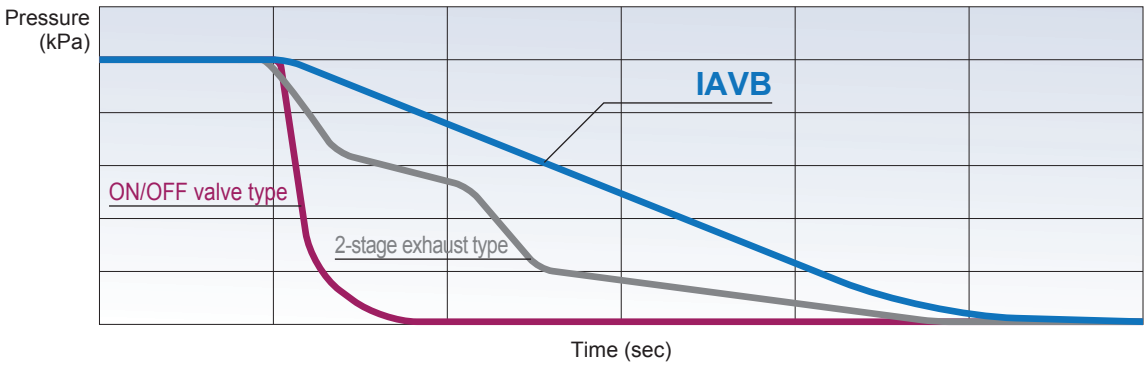
Based on our highly reliable vacuum valves, a pressure control function was added.
For pressure adjustments under a vacuum, no regulator nor variable leak valve are required.

Fully-closed operation achieved

By adopting a poppet-valve mechanism, a fully-closed operation, which is troublesome for butterfly valves, is achieved in the O-ring seal structure delivering stable performance associated with CKD's vacuum valves.

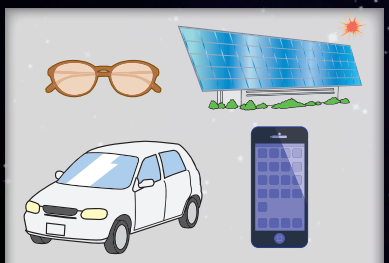
Slow exhaust control is implemented.

Compared with general ON/OFF type vacuum valves and two-stage exhaust vacuum valves, gentle exhaust is achieved at a constant rate.
A wide dynamic range supports any type of pump to be used.



For all types of industries and applications - application examples -

Film formation



- Anti-reflection of glasses, camera lenses, etc.
- Silicon thin films for solar panels, etc.
- Reflection films of automobile head lamps, etc.
- Transparent electromotive films for touch panels, etc.

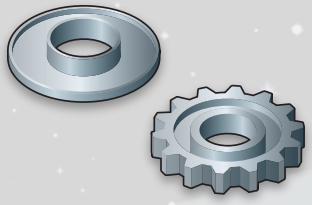
Deaeration/defoaming

- Quality control of chocolates, mayonnaise, etc.
- Quality improvement of adhesives, ink, etc.
- Filling process of tooth paste, shampoo, etc.

Drying

- Freeze-drying of instant foods
- Drying process of precision machinery components
- Drying process of printed circuit boards and lithium-ion batteries

Industrial furnace

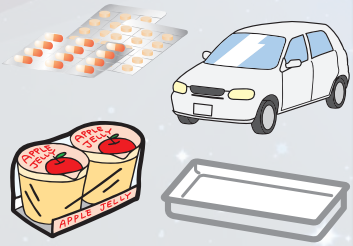


- Heat treatment of ceramics, electronic components, and powdery substances
- Coating on gears and parts for greater durability

Molding

- Protection, waterproofing, fixation, and insulation of electric/electronic components

Shape forming



- Blister packages
- Bumpers for automobiles
- Food packages, food trays, etc.

High durability/long service life

Adopted high durability valves with a special structure employing CKD's proprietary bellows.

Bore sizes for 4 models

Bore sizes supporting a lineup of NW16, NW25, NW40 and NW50

Total cleanliness control system

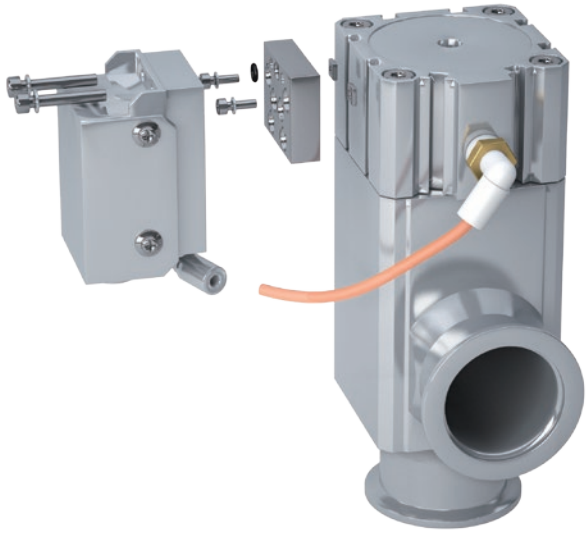
The products are manufactured under a seamless quality control system from machining to assembly, inspection and packaging.

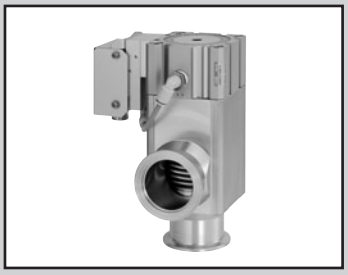
RoHS compliant

Substances harmful to the environment (such as lead, hexavalent chromium, etc.) have been eliminated.

Easy maintenance

Valves and electrical components can be maintained independently.



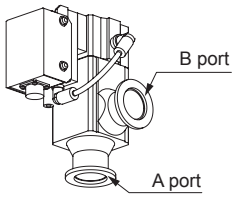


Pneumatic vacuum control system

IAVB Series

RoHS

Specifications

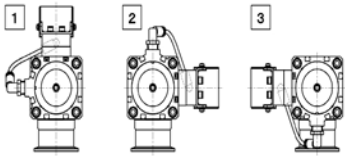
Description	IAVB217	IAVB317	IAVB417	IAVB517
Working fluid	Vacuum and inert gas			
Working pressure Pa (abs)	1.3×10^{-6} to 1×10^{5}			
Maximum working differential pressure MPa	0.1			
Valve seat leakage Pa·m³/s(He)	1.3×10^{-10} or less			
External leakage Pa·m³/s(He)	1.3×10^{-11} or less			
Withstanding pressure MPa	0.3 MPa			
Fluid temperature °C	5 to 60			
Ambient temperature °C	5 to 45			
Orifice size mm	ø17	ø24	ø43	ø48
Conductance *1 ℓ/s	5	13	43	74
Connection	NW16	NW25	NW40	NW50
Weight kg	0.6	0.8	1.6	2.4
Pilot air pressure MPa	0.45 to 0.55 MPa			
Mounting orientation	Flexible			
Connecting direction *2	Connect A port on the chamber side, B port on the vacuum pump side. 			

*1: Conductance values are obtained by theoretical calculation in the molecular flow range, not by measurement.
*2: Reverse connection is not allowed because it will lead to unstable vacuum pressure control, while full-open/full-close operation can be made.
Note: A coating of vacuum grease is applied to the O-ring of the outside seal part.

How to order

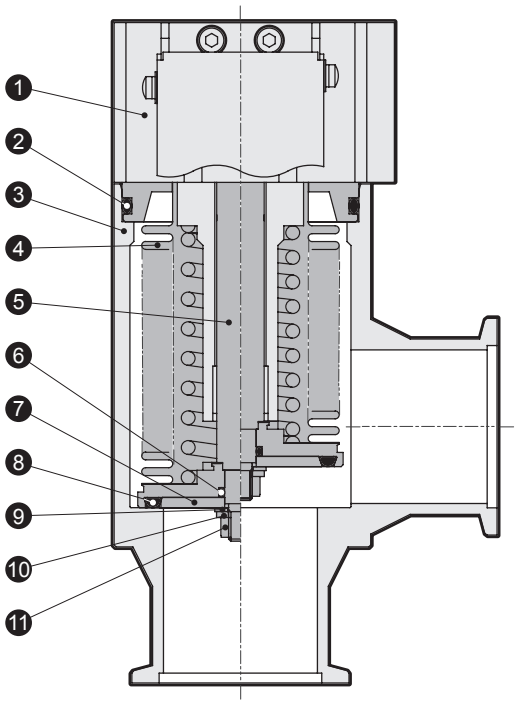
IAVB 2 1 7 - 16 K - 3

- IAVB: Model No.
- 2: Ⓐ Orifice size
- 1: Actuation NC type
- 7: Aluminum single-acting valve
- 16 K: Ⓑ Connection
- 3: Ⓒ Operating port position

Code	Descriptions
ⒶOrifice size	
2	Orifice size ø17
3	Orifice size ø24
4	Orifice size ø39
5	Orifice size ø48
ⒷConnection	
16 K	NW16
25 K	NW25
40 K	NW40
50 K	NW50
ⒸOperating port position	
3	
1	
2	Operation port positions are indicated with 3 (standard), 1, 2 in reference to the flange direction viewed from the valve top surface.

Internal structure and parts list

● IAVB217 • IAVB317 • IAVB417 • IAVB517

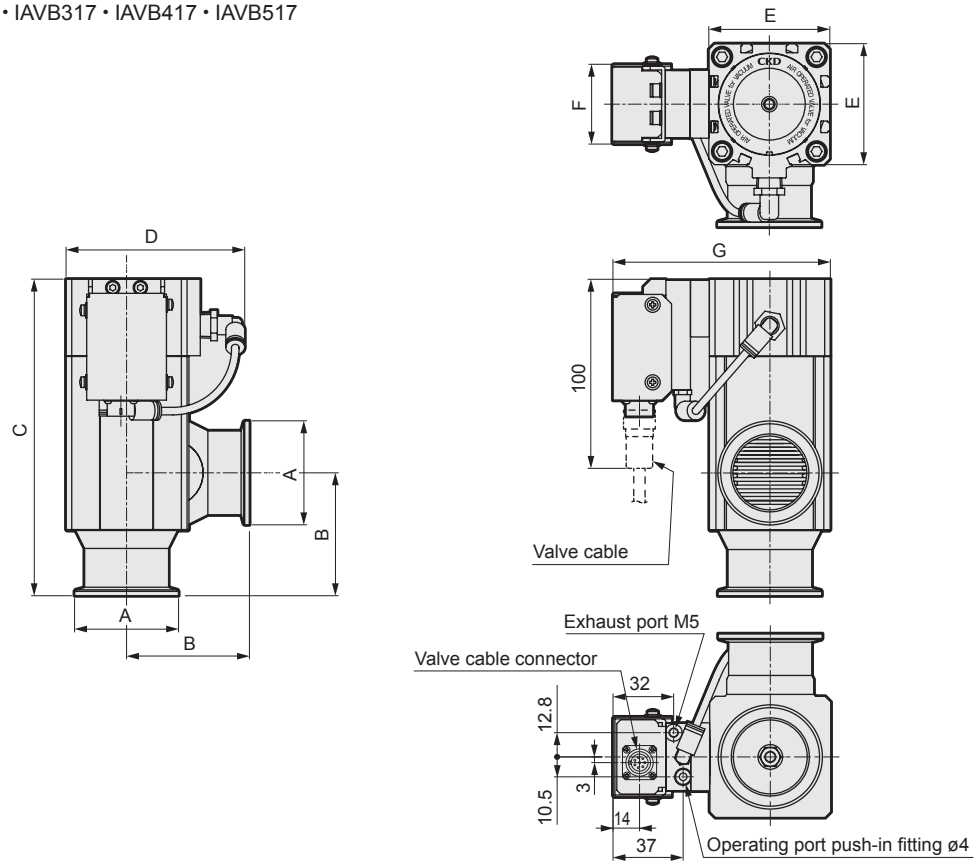


No.	Parts name	Material
1	Cylinder (in the magnet)	
2	O-ring	FKM *
3	Body	A6063
4	Bellows	SUS316L
5	Rod	SUS316L
6	O-ring	FKM
7	Valve disk B	SUS316L
8	O-ring	FKM
9	Plain washer	SUS304
10	Spring washer	SUS304
11	Hexagon nut	SUS304

*For other O-ring materials, please contact CKD.

Dimensions

● IAVB217 • IAVB317 • IAVB417 • IAVB517



Model No.	A	B	C	D	E	F	G
16K	ø30 (NW16)	40	114	57	40	43	91
25K	ø40 (NW25)	50	127	71	45	43	96
40K	ø55 (NW40)	65	168	95	64	43	115
50K	ø75 (NW50)	70	186	108	77	43	128

Controller for IAVB

RoHS

General specifications

Description		IAVB-CONT			
		IAVB217	IAVB317	IAVB417	IAVB517
Power supply voltage		24 VDC ± 10% (stabilized power supply with ripple factor 1% or less)			
Current consumption		0.5 A or less (fuse capacity 1 A)			
Ambient temperature	°C	10 to 40			
External input	Input points	2 points			
	Input method	Non-voltage contact input (photo-coupler isolation)			
	Input capacitance	24 VDC 10 mA or less			
External output	Output points	2 points			
	Output method	NPN open collector output (photo-coupler isolation)			
	Load capacitance	30 VDC 15 mA or less			
	Internal voltage drop	1.2 VDC or less			
Analog voltage input	Number of points	2 points			
	Method	0-10 VDC 0-5 VDC (with input load of 20 kΩ for either case)			
Analog voltage output	Number of points	1 point			
	Output	0-10 VDC (with connection load of 10 kΩ)			
Repeatability		In a range of ± 1% F.S.			
Operation method		Operated by serial communication or by contact input and analog voltage (selective)			
Communication method		RS-485			
Number of pressure controls		1 ch			

Use a power supply capable enough for the fuse capacity (current).

How to order

How to order discrete controllers

IAVB-CONT

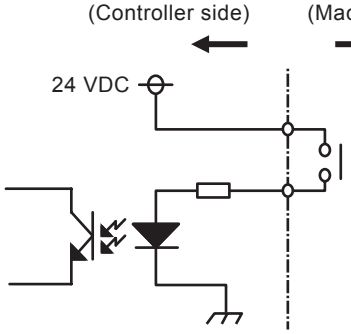
How to order discrete valve cables

IAVB-VCBL-03

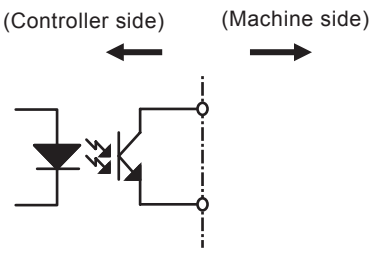
Cable length 3 m

Interface circuit

Non-voltage contact input:
photo-coupler input
With the contact closed, a current of about 5 mA flows.

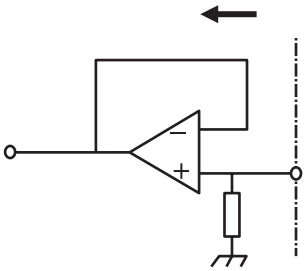


NPN open collector output:
photo-coupler output
Load capacitance 30 VDC, 15 mA or less
Internal voltage drop 1.2 VDC or less



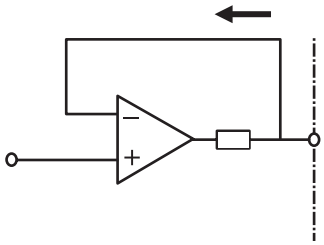
Analog voltage input: follower input
Input load 20 kΩ

(Controller side) (Machine side)



Analog voltage output: follower output
Analog voltage output: follower output

(Controller side) (Machine side)



Pin assignment of connector for controller

1. MAIN (D-SUB 25 pin male)

Pin number	Signal name	Input/output	Remarks
1	Earth terminal	Earth	i.e grounding
2	(NC)	—	(Do not connect.)
3	Power supply 24 VDC	Power input (+)	Power source (+)
4	(NC)	—	(Do not connect.)
5	(NC)	—	(Do not connect.)
6	(Inspection port used by CKD)	—	(Do not connect.)
7	PRESS monitor output (0-10 V)	Analog output	0-10 V corresponds to 0-100% on the sensor.
8	PRESS command value input (0-5 V)	Analog input	0-5 V corresponds to 0-100% on the sensor.
9	Valve status output	NPN output	Photo-coupler collector output 2
10	Alarm status output	NPN output	Photo-coupler collector output 1
11	Valve operation input COM	Contact input (-) COM	Contact input (-) COM
12	Valve operation contact 2 input	Contact input (+)	Photo-coupler cathode 2
13	AGND	Analog GND	Analog line 0 V
14	(NC)	—	(Do not connect.)
15	(NC)	—	(Do not connect.)
16	Power supply GND	Power input (-)	Power source (-)
17	(NC)	—	(Do not connect.)
18	AGND	Analog GND	Analog line 0 V
19	(NC)	—	(Do not connect.)
20	AGND	Analog GND	Analog line 0 V
21	AGND	Analog GND	Analog line 0 V
22	(Reserved)	(NPN output)	(Photo-coupler collector output 3)
23	Status COM	Photo-coupler emitter COM	Photo-coupler emitter COM
24	Valve operation contact 1 input	Contact input (+)	Photo-coupler cathode 1
25	(Inspection port used by CKD)	—	(Do not connect.)

2. PRESS (D-SUB 9 pin female)

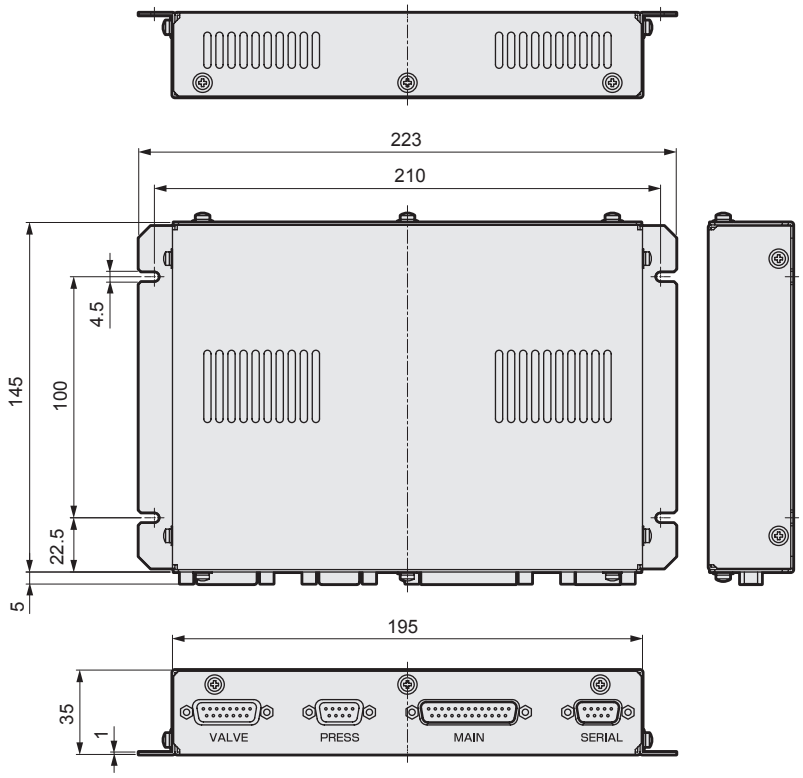
Pin number	Signal name	Input/output	Remarks
1	(Inspection port used by CKD)	—	(Do not connect.)
2	(Inspection port used by CKD)	—	(Do not connect.)
3	PRESS input (0-10 V)	Analog input	Chamber pressure sensor
4	PRESS GND	Analog GND	Sensor signal GND
5-9	(NC)	—	(Do not connect.)

3. SERIAL (D-SUB 9 pin male)

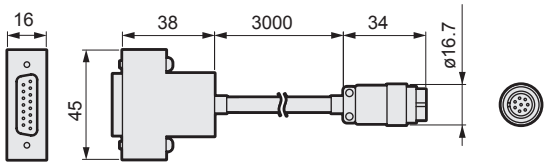
Pin number	Signal name	Input/output	Remarks
1	NC	—	(Do not connect.)
2	NC	—	(Do not connect.)
3	TXD (+) / RXD (+)	Sent/received (+)	Controller (+) ⇔ Host (+)
4	TXD (-) / RXD (-)	Sent/received (-)	Controller (-) ⇔ Host (-)
5	SG	Signal ground	Serial power supply 0 V
6-9	(NC)	—	(Do not connect.)

Dimensions

● IAVB-CONT



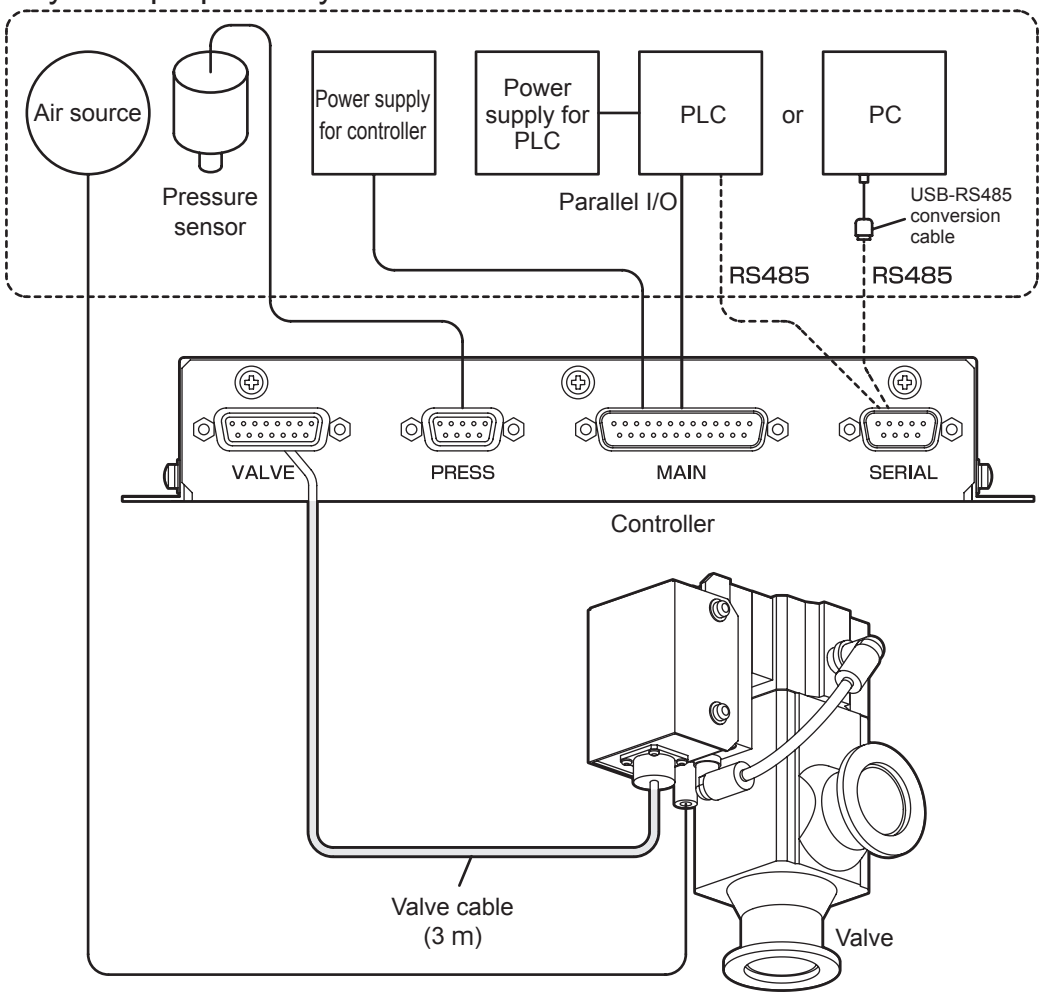
● IAVB-VCBL-03



Valve cable

System configuration

System prepared by customers



●As for a pressure sensor, a capacitance manometer (output 0-10 V) is recommended.
(For other pressure sensors, please consult CKD.)
●When using a PC, a USB-RS-485 conversion cable is required.

Product components

Name	Quantity
Valve	1
Controller	1
Valve cable	1

This product is to be communicated and controlled through the PLC prepared by customers. The confirmation as to the compatibility of the product to the system, equipment, devices, etc., that is to be used is the sole responsibility of the customer.
The purchase of a controller will include a free support software.
This free software is provided to support users to start up the product smoothly and quickly but does not guarantee for the proper operation which is dependent on the customer's individual computer environment.

Safety precautions

Always read this section before use.

When designing and manufacturing devices using the CKD products, the manufacturer has an obligation to check that the safety of the device mechanism, pneumatic/water control circuits, and the system operation controlled by such electric devices mentioned above is secured.
It is important to appropriately select, use, handle and maintain the product to ensure that the CKD product is used safely.
Always observe the warnings and cautions to ensure the safety of the device.
Check the device for safety and manufacture a safe device.

⚠ WARNING

1 This product is designed and manufactured as a device and parts for general industrial machines. This product must be handled by a well versed and skilled operator.

2 Use the product within the range of specifications.

This product cannot be used outside the product's characteristic specifications. Never modify or additionally machine this product. This product is intended for use in the device and part for general industrial machines. It is not intended for outdoor use, or under the following conditions or environments. (By way of exception, however, a customer can use this product outside the specifications only when he/she consults CKD in advance and consents to CKD product specifications. The customer must provide safety measures to avoid risks in the event of problems.)

❶ Use for special applications requiring a high level of safety, such as nuclear energy, railway, aircraft, ship, vehicle, medical devices, devices or applications coming into contact with beverages or foodstuffs, amusement machines, emergency shutdown circuits, press machines, brake circuits and safeguards.
❷ Use for applications where human life or assets could be greatly affected, and special safety measures are required.

3 Always observe organization standards and regulations, etc., related to the safety of device design and control, etc.

ISO 4414, JIS B 8370 (pneumatic system rules)
JFPS 2008 (pneumatic cylinder selection and usage policy)
High Pressure Gas Safety Act, Industrial Safety and Health Act, and other safety rules, organization standards and regulations.

4 Never handle this product nor dismount the piping/devices before confirming safety.

❶ Before performing inspection/maintenance of the machine and devices, confirm safety of the entire system related to this product.
❷ Note that there may be hot sections or charged sections even when operation is stopped.
❸ When inspecting/maintaining the device, cut off the energy source (air supply or water supply), and cut off the power to the relevant facility. Discharge any compressed air from the system, and pay special attention to water leaks and electricity leaks.
❹ When starting or restarting a machine or device that incorporates pneumatic devices, make sure that the system safety, such as the popping-out prevention measures, is secured.

5 Always observe the following warnings and cautions to prevent accidents.

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

⚠ **DANGER**	When a dangerous situation may occur if mishandling, leading to fatal accidents or serious injuries, and a restricted situation with a high degree of emergency.
⚠ **WARNING**	When a dangerous situation may occur if mishandling, leading to fatal or serious injuries.
⚠ **CAUTION**	When a dangerous situation may occur if mishandling, leading to minor injuries or physical damage.

Note that some items described as "CAUTION" may lead to serious results depending on the situation.
In any case, always follow the instructions explaining important information.

Remarks on ordering

1 Warranty period

CKD products come with a one-year warranty valid from the delivery date at the place designated by the customer.

2 Warranty scope

Within the warranty period above, when a defect which CKD is explicitly to blame for occurs, a replacement of the product or required alternative parts shall be offered or the defect product shall be repaired at the CKD factory at no charge.
CKD shall not be liable, however, for the following cases.

① When using under conditions or environment beyond the scope of specifications provided in CKD catalogs or instruction manuals
② Damage resulting from an event irrelevant to this product
③ When using the product for other than intended use
④ Damage resulting from product modifications or repairs not approved by CKD
⑤ Damage resulting from a reason unpredictable within the scope of the technology in practical use at the time of product delivery
⑥ Damage resulting from a disaster or a failure not attributable to CKD

Warranty mentioned here, however, shall only apply to a delivery product itself and damage arising from a fault of the delivery product is excluded.

3 Confirming compatibility

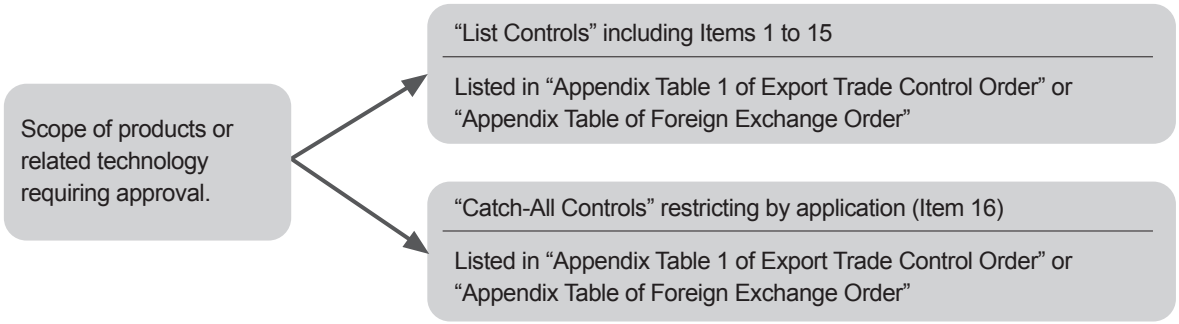
Compatibility of CKD products with the user's system, machines and equipment must be ensured under the responsibility of customers themselves.

Information on Export

Security Trade Control

The products listed in this catalog and the related technology may require approval before export or provision.
To contribute to world peace and global safety, such cases may arise when approval under the Foreign Exchange and Foreign Trade Act is required depending on the country to where the product or related technology is being exported or provided.
The scope of products and related technology requiring approval is listed in “Appendix Table 1 of Export Trade Control Order” or “Appendix Table of Foreign Exchange Order.”
“Appendix Table 1 of Export Trade Control Order” and “Appendix Table of Foreign Exchange Order” consist of the following two types of information:

- “List Controls” including Items 1 to 15 for each section
- “Catch-All Controls”, which do not specify specifications based on each item, but restrict based on application (Item 16)



Application for Approval is received by the Security Export Licensing Division, Ministry of Economy, Trade and Industry or each local bureau of Economy, Trade, and Industry depending on a combination of the product or related technology and the export or provision destination.

Products and related technology listed in this catalog

Products and related technology listed in this catalog are subject to the Catch-All Controls of the Foreign Exchange and Foreign Trade Act.
When exporting or providing the products or related technology listed in this catalog, pay sufficient attention to ensure that they are not used for arms or weapons.

Contact

Contact your local CKD Sales Office for more information on the Security Export Control of the products and related technology listed in this catalog.

Safety Precautions

Always read this section before use.

Design & Selection

1. Confirming specifications

DANGER

■ Do not use this product in a place where ignitable, flammable, or explosive substances exist. Failure to observe this may cause ignition or an explosion.

■ This product is not waterproof. Keep away the product from water/oil drops. Failure to observe this may cause a fire or a failure.

■ As for a power supply, make sure to use a DCstabilized power supply (24 VDC ± 10%). Direct connection to an AC power supply may cause a fire, a burst, a corruption, etc.

WARNING

■ Incorrect selection and handling of devices will cause a problem not only in this product but also in the user's system. Check the specifications of this product and compatibility with the user's system before use.

■ Preparing for the device stop under abnormal conditions, such as an emergency stop or a power failure, a safe circuit or the device design should be implemented to prevent a device damage, a personal injury, etc.

■ This product should be installed indoors and in a place of low humidity.
Installing this product in an area exposed to rain or high humidity (85% humidity or over, with condensation) may cause a current leakage or a fire accident. Also avoid oil drops and oil mist.

■ Use/store this product at the designated operating/storage temperatures under no condensation.
Failure to observe this may result in an abnormal stop or a loss of life. Ventilate in a place where heat accumulates.

■ Avoid installing this product in an area exposed to direct sunlight, dust, a corrosive/explosive/flammable gas, or flammable substances, or close to a heating element. This product is not chemical-proofed.
Failure to observe this may cause a malfunction, an explosion, or ignition.

■ Avoid use/storage of this product in an area exposed to a strong electromagnetic wave, ultraviolet radiation, or other radiation.
Failure to observe this may cause a malfunction or a failure.

Caution

■ When wiring, in order to prevent an induced noise from being applied to this product, do not install in a place where a large current or a strong magnetic field is produced or where the piping/wiring is constructed to share with a large motor power line of other devices (using a multicore cable). In addition, an inverter power supply and a wiring section (identical wiring/piping not allowed) used for robots, etc. should be eliminated. A frame ground must be established on the same power supply, and a filter inserted in the output part.

■ When using a common power supply in the output part of this product and the induced load generating a surge of the solenoid valve/relay, a surge current will flow into the output part to cause a corruption so that the output line to become an induced load and the output power supply of this product must be installed separately. If it is not possible to implement another power supply, a surge absorber element must be connected directly in parallel with all induced load.

■ Do not disassemble the product.

■ Cables are not designed to be able to withstand repeated bendings.

■ Cables should be fixed so as not to move easily. When fixing a cable, it should not be bent to an acute angle.

2. Working fluid

Caution

■ This product is designed to control vacuum or inert gas. Passing other fluids (active gas, liquids, solids, etc.) may disrupt the product function or the performance drastically. Always ensure compatibility between the materials of the gas-contacting area and the working fluid before use.

If the working fluid can possibly solidify, make sure that there will be no problems in use before starting.

■ Avoid using fluids which may form crystals to accumulate in the piping.

Installation and adjustment

1. Installation

⚠DANGER

■At the time of installation, make sure the product is securely held and fixed. Toppling, dropping, or abnormal initiation of the product may cause injury.

⚠WARNING

■ Incorrect installation and piping will cause a problem not only in this product but also in the user's system and furthermore it may cause death or serious injury. Users are responsible for ensuring that the operator has read the instruction manual and fully understood the system. After installation, conduct an appropriate function test to confirm the correct installation.

■ This product contains precision components. Therefore an extra precaution should be taken to avoid toppling over, vibration, and impact during transport.
Failure to observe this may cause a corruption of the components.

■ When temporarily laying down the product, place it on a level surface.

■ Never ride on nor stack anything on the product package.

■ During transport, an ambient temperature within the range of -20 to 60ºC and an ambient humidity of 35 to 85% must be maintained without condensation and freezing taking place.
Failure to observe this may cause a failure of the components.

■ This product must be installed on a nonflammable substance. Installing directly on or close to a flammable substance may cause a fire.

■ For wiring installation, refer to this catalog and check carefully to prevent miswiring and loosening of connectors. Please check the insulation of the wiring.
Contact with other circuits, a ground fault, or an insulation failure may cause excessive current to flow in resulting in breakage. It may also cause malfunctions and fire.

■ Before powering on the product, always check the machine and its surroundings for safety.
Powering on the product carelessly may cause electric shocks and injury.

■ Always use the supplied cable to connect the valve and the controller, and install it so as not to be strained or damaged. Modifying the supplied cables (in length or material) is prohibited because it will lead to an operation failure, a fault, or a malfunction.

■ During operation or right after operation stop, do not touch the product with the hands or body parts.
Failure to observe this may result in burns.

■ Do not ride/climb on the product and never stack anything on it.
Failure to observe this may cause a falling accident, the product to topple, or a product breakage/damage and result in a malfunction or other problems.

■ At power shutdown (including the event of a failure), take proper action to protect the operators and the equipment.
It can cause unpredictable results.

2. Ensuring space

⚠Caution

■ Ensure sufficient space for installation, removal, piping and wiring work.

■ Ensure sufficient space for maintenance and inspection.

3. Piping

⚠Caution

■ The inside of the bellows directly connects to the atmosphere. Make sure there are no blockages in the connection holes (2 holes just below the control port) connecting the inside of the bellows to the atmosphere.

■ If foreign particles or burrs generated during piping are left, the valve seat or the O-ring seal part can be damaged and cause a leak. Always remove any dirt or burrs before installing the valve.

■ When piping, make sure that a pipe tension, a compressive/bending force, etc. are not applied to the valve body.

■ Before installation, the seal surface of the vacuum flange and the O-ring of the center ring must be cleaned with ethanol, etc.

■ A protective sealing covers the vacuum flange surface, creating a 0.1 to 0.2mm concave layer, but be careful not to scratch the seal surface.

■ Durability may decrease depending on the exhaust flow. Therefore, it is recommended to use the bellows side as the exhaust side.
Check the situation carefully, as durability will vary depending on working conditions.

■ When completing the piping work, always carry out a leak inspection and confirm that there are no leaks.

■ During transport and installation, do not hold the product by the cable part.
Failure to observe this may cause injury or a broken wire.

■ Avoid piping in an area where a strong vibration/shock exists.
A strong vibration/shock may cause a malfunction. Under continuous vibrating conditions, durability may be decreased. Piping should be installed so as to prevent excessive vibration and shock.

■ Do not forcedly operate the movable parts by an external force.
Failure to observe this may produce a regenerative current to cause malfunctions or breakage.

■ When an autorun function is used, the valve must be kept under atmospheric pressure. If not, the origin point may be misidentified.

■ Keep away this product from strong magnetic sources, such as a rare-earth magnet. Failure to observe this may disrupt the proper accuracy of this product.

■ This product is subject to a precision cleaning process and then assembled in a clean room. The clean pack in the package box must be opened in a clean environment just before installation.

■ Piping should be installed so as to avoid an excessive force on the flange part. If a heavy object or a mounted component vibrates, fix it to eliminate a torque directly applied to the flange.

4. Air piping

⚠ Caution

■ Before the start of piping, refer to the instruction manual and pipe the connection ports correctly.
- Failure to observe this may cause malfunctions.

■ When connecting pipes, wrap a sealing tape clockwise starting from a position of 2 or more threads inside from the end of the pipe threads.
- If the sealing tape lies off the edge of the pipe threads, it could be cut off when screwed in and enter inside to cause a failure.

■ Pipes must be connected with appropriate tightening torque.
- This is required to prevent leakage of air and damage to screws.
- Firstly tighten the screw by hand to prevent damage to the screw threads, then use a tool.

[Reference value] 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

Usage & Maintenance

1. Preparation before use

⚠ DANGER

■ Only expert engineers are allowed to perform wiring and inspection work.

■ Piping work must be completed prior to wiring.
Failure to observe this may cause electric shock.

■ Do not perform any work with wet hands.
Failure to observe this may cause electric shock.

■ Before starting wiring/inspection work, make sure that 5 or more minutes have elapsed from power OFF and check the voltage using a tester.
Failure to observe this may cause electric shock.

■ Make sure that the power supply is disconnected before wiring or installing connectors.
Failure to observe this may cause malfunctions, failure, or electric shock.

⚠ WARNING

■ While a storage environment should comply with the installation environment, it is not recommended to store this product for 1 month or longer. Especially, a measure to prevent condensation from forming is required.

2. Maintenance/inspection

⚠ WARNING

■ According to the instruction manual, perform maintenance/inspection work regularly.

■ Before starting maintenance/inspection work, read the instruction manual carefully to understand the details.

■ Make sure to drain the fluids before maintenance.

⚠ Caution

■ Conduct a periodic inspection for the items described below to ensure optimal performance of the valve.
(1) Leaks outside of the valve
(2) Leaks from the valve seat (internal leaks)
(3) Smooth valve operation
(4) Loosen pipes and valve screws
(5) O-ring wear or corrosion

■ Be careful not to damage any parts when removing the deposits.

■ If damage is anticipated before reaching the maximum usage in durability, perform maintenance and inspections as soon as possible.

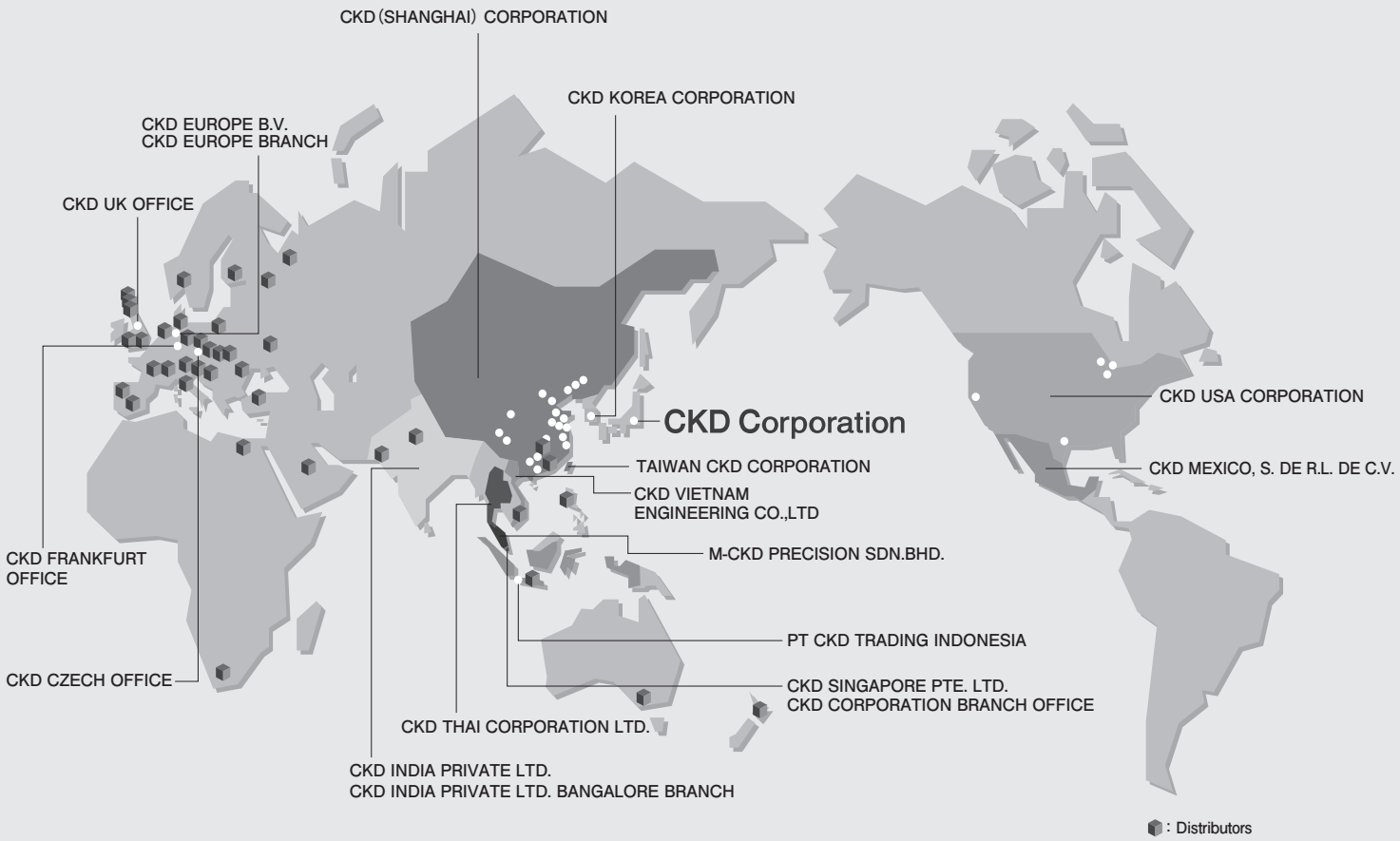
■ In the event of a failure (abnormal heat generation, smoke, odors, sounds, vibrations, etc.), shut down the power supply immediately. Failure to observe this may cause breakage of the product or fire from a continuous flow of current.

■ When performing maintenance/inspections or repairs, make sure that the power supply is turned off. Call attention to the staff around to avoid accidentally turning on the power or operating the machine.

■ When discarding the product, comply with the regulations of waste disposal and cleaning, and process by, for example, contracting designated waste disposal companies.

■ This product has a valve closing (normally closed) structure with a passive spring. Before powering on the machine, check that the amount of leakage is less than the allowable level.

■ If foreign matter is caught at power ON, the valve closing state may be misidentified. Before powering ON the machine, check that the amount of leakage is less than the allowable level.



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