CKD

INSTRUCTION MANUAL

SOLENOID VALVE FOR HIGH VACUUM

HVB $\frac{6}{7}$ 12 SERIES

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

FOR SAFETY USE

The Product is to be used by those who has a basic knowledge about material, fluid, piping electricity regarding Control Valves (solenoid valves, motor valves, air oerated valves and so on.)

Never use this Product by those who have no knowledge or are not well trained about Control Valves.

Should be any trouble or accident caused by a wrong selection and/or wrong use of the Product even by a person of basic knowledge about Control Valves, we are not responsible therefore.

Since any customer of the Product have a variety of its application, we are not in a position to get all the information on how and where the Product is used. There may be the cases where that the Product may not meet customers' requiremnent or may cause any trouble or accident, by fluid, piping or other condition that are not within the specifications of the Product.
Under such a circumstance, select with fheir responsibility the most suitable application and use of the Product according to the customer's requirements.

The Product incorporates a various safety arrangement, however miss-handling of the product may lead to any trouble or accident on customers side. **To avoid any possible trouble, read this INSTRUCTION MANUAL carefully and understand it fully.**

Pay your attention to the items described in this Text, as well as the items indicated below.

⚠ CAUTIONS

- **When energized, heat is generated at coil portion of solenoid valves and motor valves particularly "Class H" coil where may have a high temperature.**

- **There my have electric shock when wire connecting portion of solenoid valves or motor valves are touched. In case of disassembly or inspection, turn off power supply beforehand. Don't touch live portion by wet hands.**

Thank you very much for purchasing CKD's solenoid valve model HVB series for use in a high vacuum atmosphere.
The model HVB is a solenoid valve developed for use with high vacuum based on years of experiences so that it can be used in various fields by as many as possible customers.
We are sure that CKD's strict quality control system will draw your complete satisfaction.
In order to use the CKD products more effectively, please read through this instruction manual thoroughly.
Please refer to the latest specification sheet and drawing of this product for the allowable specifications, the internal construction and the parts list.

CONTENTS

1. Safety precautions

When designing and manufacturing a device using CKD products, the manufacture is obligated to check that device safety mechanical 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 devise.

⚠ 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 in handling.

2. Use this product in accordance of specifications.

Contact CKD when using the product outside the unique specifications range, when using it outdoors, and when using it under the conditions or environment below. Do not attempt to modify or additionally machine the product.

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

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

ISO 4414, JIS B 8370(pneumatic system rules), High Pressure Gas Maintenance Laws Occupational Safety and Sanitation Laws, and other safety regulations, corporate standards, and regulations.

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

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

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

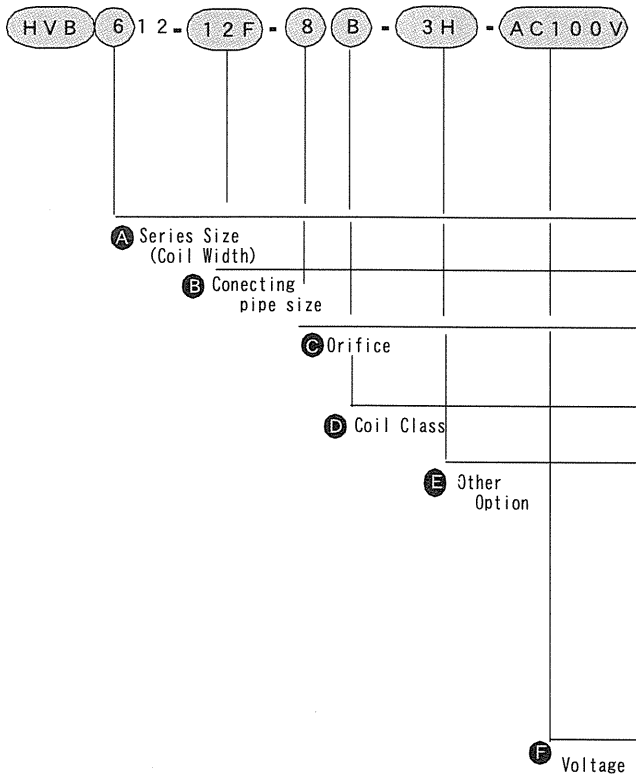
■The safety cautions are ranked as "DANGER", "WARNING" and "CAUTION" in this section.

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

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

2. How to order

Model number viewpoint



Symbol		Contents	Model of Series HVB612	Model of Series HVB712	
A	6		●		
	7			●	
B	12F	Flange φ48	●		
	15F	Flange φ52		●	
C	8	φ8	●		
	12	φ12	●	●	
	15	φ15		●	
D	B	Class B	●	●	
	H	Class H	●	●	※1
E	Blank	No	●	●	
	3H	Square sharp terminal box with a lamp(G1/2)	●	●	※2
	3K	Square sharp terminal box(G1/2)	●	●	※2
	F	Companion flange (including O-ring and mountingbolt)	●	●	
	3HF	Square sharp terminal box with a lamp(G1/2)+Companion flange (including O-ring and mountingbolt)	●	●	※2
	3KF	Square sharp terminal box(G1/2)+Companion flange (including O-ring and mountingbolt)	●	●	※2
F	AC100V	AC100V 50／60Hz	●	●	
	AC200V	AC200V 50／60Hz	●	●	
	DC24V	DC24V	●	●	

NOTES ON THE MODEL SELECTION

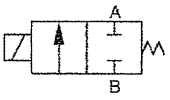
※1 : D Symbol H can't produce Orifice 12 of HVB612

※2 : E Symbol 3H, 3K, 3HF, 3KF can't be produced for the AC voltage of D Symbol H

※3 : Please consult about joint (Barbed joint, JXR joint)other than the above-mentioned table separately.

Please select it from among the combination of ●symbol in the above-mentioned.

3.Specification of Product

Model / From		HVB612 −8B	HVB612 −8H	HVB612 −12B	HVB712 −12B	HVB712 −12H	HVB712 −15B	HVB712 −15H
Working fluid		Air・Vacuum・Inert gases(※1)						
Range use of presure(※2)	Pa(abs)	1.3×10^{-6} ～2.0×10^{5}	1.3×10^{-6} ～3.0×10^{5}	1.3×10^{-6} ～1.0×10^{5}	1.3×10^{-6} ～1.5×10^{5}	1.3×10^{-6} ～3.0×10^{5}	1.3×10^{-6} ～1.0×10^{5}	1.0×10^{-6} ～1.0×10^{5}
Maximum working pressure	MPa	0.2	0.3	0.1	0.15	0.3	0.1	0.1
Orifice	mm	8		12	12		15	
Cv flow factor	Straight direction	1.8		2.7	3.2		4.3	
	Direction of L	2.1		3.2	3.6		4.7	
Exhaust back pressure(※3)	MPa	0.1		0.02	0.1		0.02	0.1
Valve seat leakage rate	$Pa\cdot m^3/sHe$	below 1.0×10^{-9} (at the normal temp.)						
External leakage rate	$Pa\cdot m^3/sHe$	below 1.0×10^{-9} (at the normal temp.)						
Pressure Limit	MPa	0.5						
Fluid temp.	℃	5～55						
Ambient Temp.	℃	0～55(Don't freeze)						
Frequency	Cycle/min	10 or less						
Mounting Posture		Free						
Connecting pipe size		Flange ϕ48			Flange ϕ52			
Mass	kg	1.15			2.0			
JIS Symbol								
Electric Specifications								
Rating Voltage		DC24V,AC100V(50/60Hz),AC200V(50/60Hz)						
Permission voltage change		Rating Voltage ±10%						
Electric power	W	14.3	28	14.3	19	AC:32.5 / DC:40	19	AC:32.5 / DC:40
Heat-resistant class		Class B	Class H	Class B	Class B	Class H	Class B	Class H
Temp Rise(at rating voltage)	K	75	125	75	75	125	75	125

Special Note

※1 : The endurance frequency might become remarkably short depending on a dry level.

※2 : The vacuum level witin the range of the use pressure is not the one that it is guaranteed that there are neither vacuum arrival time nor a vacuum level change.

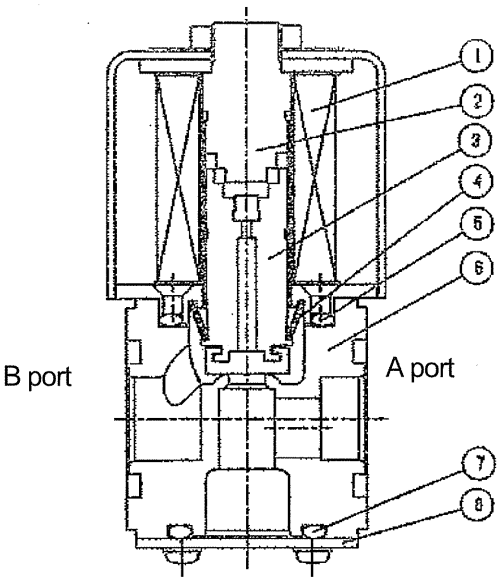
※3 : Pressure that can be pressurized from A port as B port the atomosphere.
(However, a reverse-vacuum of HVB612-12F-12B, HVB712-15F-15B is not acceptable.)

※4 : FKM is used for seal material, and consider the generation of the emitted gas, please.

※5 : High vacuum grease is used for O-RING in the wet part.

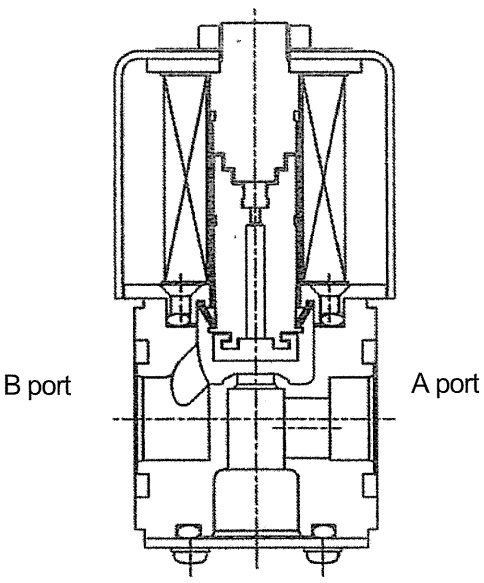
4. Operation Explanation

Open Operation



PLUNGER ASS'Y ③ absorbs CORE ASS'Y ② when energizing to the Coil ① ,and the Valve Sheet opens.
The fluid flows to A port ⇔ B port..

Close Operation



PLUNGER ASS'Y ③ from CORE ASS'Y ② according to the power in SPRING ④, returns to former position when energizing to the Coil ① is stopped and the Valve Sheet shuts.

MAIN PART MATERIAL

No	PARTS	MATERIAL
①	COIL ASS'Y	
②	CORE ASS'Y	SUS
③	PLUNGER ASS'Y	SUS,FKM,PFA
④	SPRING	SUS
⑤	O-RING	FKM
⑥	BODY	SCS13
⑦	O-RING	FKM
⑧	BOTTOM CAP	SUS

5. WARNING／CAUTION

5-1.Design & Selection

⚠ WARNING

① **Do not use this product for an emergency shut off valve.**
This product is not designed as valves to ensure safety such as emergency shut off valves. When using in this type of system, always take separate measures that will accurately ensure safety.Wrong part selection may cause major functional problems.

② **Do not use this product for an explosive environment.**
This product is not designed as valves to explosion proof solenoid valve. Be cautious.

③ **Working fluids**
These high vacuum components control gases and vacuum. If other fluid(liquid and solid) is used, malfunctioning may result. Before using, Confirm the compatibility of the component material and fluid, atmosphere. If the fluid is solidified, the leakage may occur due to the valve seat leak, operation failure or damage of the plunger sealing etc.. Confirm if the fluid is solidified.

④ **Fluid quality**
Provide a filter in supply as foreign particles such as burrs from plumbing may cause malfunction such as valve seal leakage.

⑤ **Fluid temperature**
Use this product within the fluid temperature range specified, or it may cause mulfunction or leakage of this product.

⑥ **Working environment**
- Store the products in a safe environment away from explosive gas, flammable gas corrosive gases, water, and high humidity.
- Use this product within temperature and humidity range specified, or it may cause mulfunction or leakage of this product.

⑦ **When this product is used, in case of causing the serious danger to human life or to property, design your equipment, machine or system etc. with performance plus safety measures which minimize the danger even when the equipment, machine or system etc. has a failure.**

⚠ CAUTION

① **Secure maintenance space**
Secure the space required for maintenance and inspection.

5-2.Installation

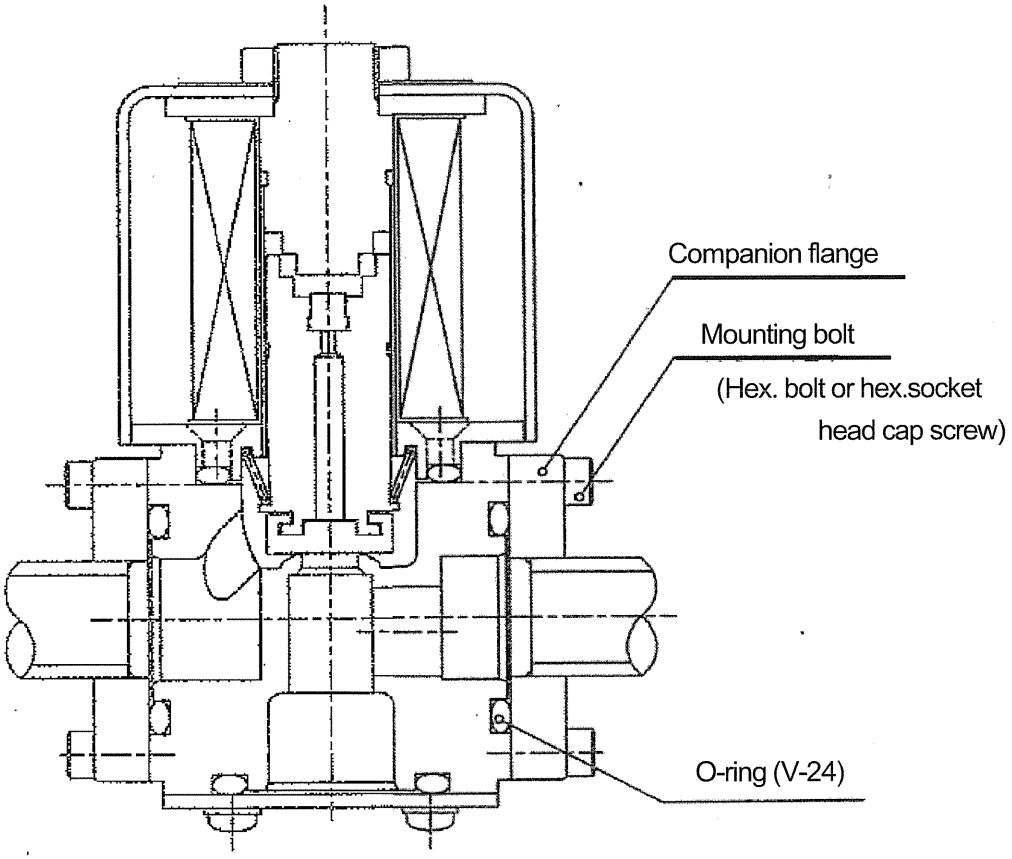
⚠ WARNING

① **Installation**
Read “Caution in Usage” in the Instruction Manual. Install this product only after completely understanding these contents.
Verify correct installation by a thorough functional inspection after installation.

⚠ CAUTION

① Piping

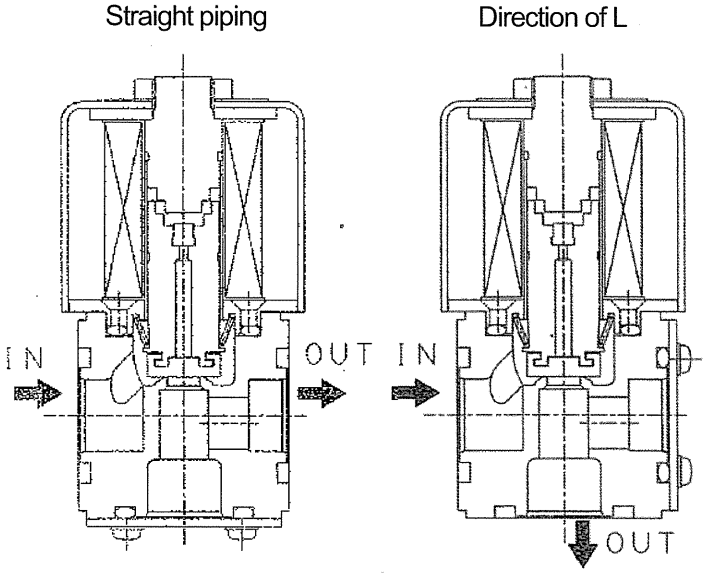
- Use V24(JIS B 2401)O-ring for which fitted in between flamge. Use care that no foreign material attaches to O-ring.



- Dust and burr left inside the pipe may damage the valve seat or plunger sealing and cause leakage.
- Follow flow direction when connecting components.
- Tighten the joints after making sure that no dust or burr are left behind on the sealing section.
- After tightening the joint, check for leakage.
  We recommend you to confirm leakage using a helium leak detector.

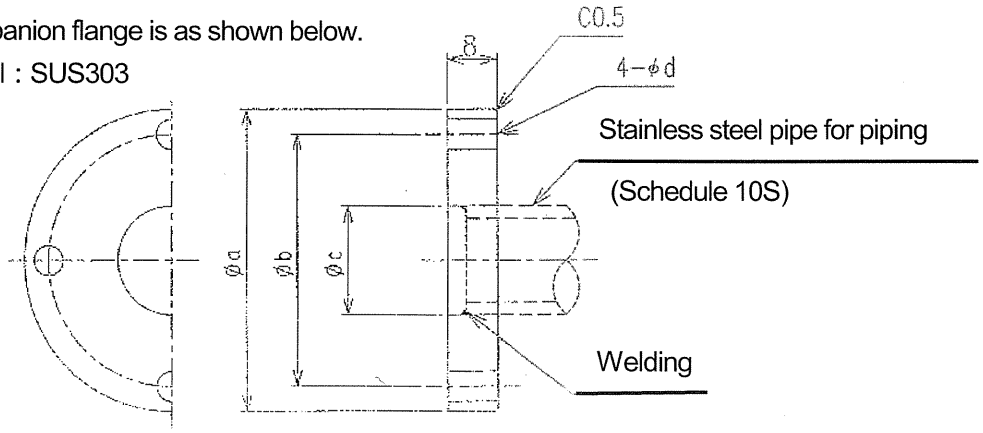
② Installation

- During installation, all wetted surface areas must be kept free of any contaminants.
- Pay attention to the connecting direction. Check for pressure rating and select the direction. If mounting direction is incorrect, it may cause mulfunction or leakage of this product.
- The exhaust port can be used in two ways depending upon place of blind mounted.(However, at the time of shipp-ing , the valve is designed to have a straight piping as shown in the right side figure below.



- A flange used here is different from the one stipulated in JIS in size.
  - If 12F is shown on the model number, the connecting pipe size is 48mm in outer diameter.(The thickness of flange is 6mm with a screw passes through.)
  - If 15F is shown on the model number, the connecting pipe size is 52mm in outer diameter.(The thickness of flange is 6mm with a screw passes through.)

A companion flange is as shown below.
Material : SUS303



	a	b	c	d	Mount-ing bolt	O-ring used
HVB612−12F	48	40±0.2	17.3 $^{+0.5}_{0}$	4.8	M4-14	JIS B 2401 V-24
HVB712−15F	52	42.4±0.2	21.7 $^{+0.5}_{0}$	5.8	M5-14	JIS B 2401 V-24

- If dusts, foreign materials, etc. enter in the fluid, attach a filter of 60 μm or finer one on the air side of the solenoid valve.

③ Wiring

- Check power voltage.
  The voltage shall be within ±10% of the rating. Use outside of the allowable voltage range can lead to malfunction or coil damage.
- Use a breaker such as a fuse on the control circuit side to protect the electric equipment.
- Adopt a switching circuit that does not cause chattering at the contact point.
- When using a contactless relay circuit or a programmable controller, etc.,leakage current could cause the solenoid valve to malfunction. Use a contactless relay circuit or a programmable controller that has leakage current, please note leakage current.
- The electric wire for wiring must use official sectional area 0.5mm^2 or more as a standard.
- Moreover ,impossible power must not join the lead wire.

④ Surge suppressor

This product includes the surge suppressor as a custom specification. Please pay attention to the following details.

- **Purpose and limitations of surge suppressor for solenoid valves.**
  The built-in surge suppressor aims to protect the output area of the driving force of this product. Protection of the other peripheral equipment cannot be expected, and they may be affected by surge and cause of damage, malfunctioning, etc. To the contrary, it may absorb surge that other apparatus generates, and cause damages such as damage by fire. Please use caution.
- **Performance and side effects of surge suppressor**
  Surge suppressor limits the surge voltage (reaches up to hundreds of volts) to the low voltage level that the output area can bear. Depending on the circuit output of use, it may be insufficient and cause destruction or malfunctioning. Moreover, it has side effects which results in delay.
- **Do not parallelly connect with the other apparatus.**
  If other apparatus or solenoid valve is connected parallel with this product, when the product is OFF, the reverse voltage surge will be generated against those parallel connections. This reverse polarity of voltage may cause destruction or malfunctioning of the apparatus of parallel connection. Please avoid the parallel connection with other apparatus. Also, please avoid parallel drive of two or more solenoid valves.
- **Turn the power supply off after the drive output is turned off.**
  Do not disconnect the power supply until the drive output is turned OFF. If power supply turns off, emergency stops, blows a fuse, accidental disconnection, or etc. occurs while the drive output is ON, it may cause damage, destruction or malfunctioning of other solenoid valves and apparatus connected to the power supply.

- **Protect the circuit from heavy current when the surge suppressor has a defect.**
  From damage caused by excess voltage/over-current, in many cases, the surge suppressor built-in this product causes short circuits. Heavy current may flow with Output ON from the damage, and in the worst case, the output circuit and the product may cause damage or a fire. Please do not continue energizing with a failure state. (Please install an over-current protection circuit in a power supply or a drive circuit, or use a power supply with over-current protection to prevent current flow.)

5-3. During use

⚠ CAUTION

① Use this product in accordance of specifications. Confirm the latest specification sheet and drawing of this product about the allowable specifications.

② The solenoid valve coil heats up when energized and may reach high temperature. Handle with Caution! Direct contact with coil may result in burns.

③ Touching the pin connector of the solenoid valve may result in electric shock.
Don't touch live portion by wet hands.

5-4. Maintenance

⚠ CAUTION

① Maintain the product according to the Instruction Manual.

② Disconnect the electric power and turn OFF the gases before doing any maintenance work. Don't touch live portion by wet hands.

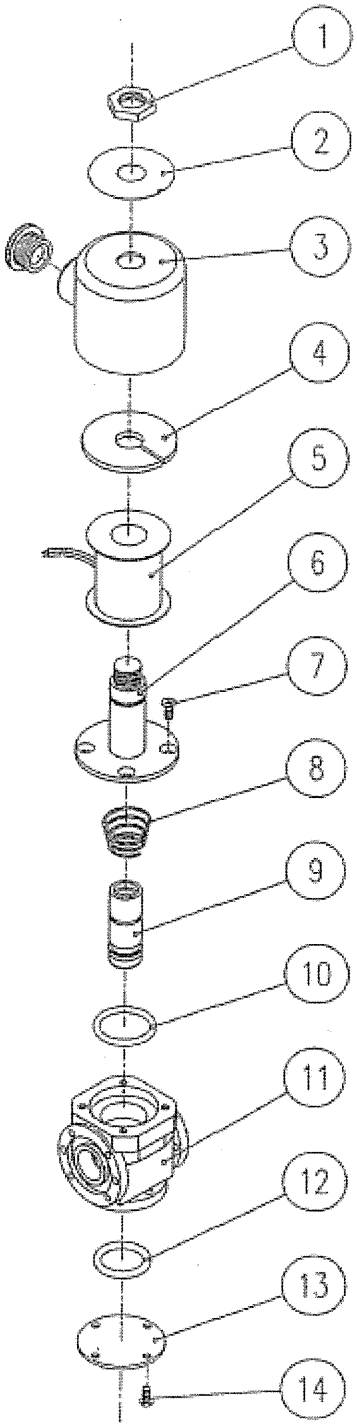
③ Before replacing a valve, please purge thoroughly with inactive gases so that any peripheral equipment and personnel will not be affected with residual gases in the valve or the tubing.

④ Before installing a valve, please remove dusts, burr and flash thoroughly and provide piping.

⑤ After maintenance, perform leakage test.

⑥ Resolution and assembly method

<<After it resollves, and it asembles it again of the product, I will assume a product guaranteeoff the subject.>>



<Resolution method>

1. Be sure to turn power off and then purqe fuild pressure before disassembly.
2. For removal of coil⑤, plate②, bonnet③ and bonnet pice④ can be taken out when nut① is loosened.
3. For removal of plunger assembly. loosen four cross-recessed coutershunk flat head screw⑦ to separate core assembly⑥, spring⑧, and plunger assembly⑨.
4. For removal of bottom cap⑬, unscrew one cross recessed head machin screw⑭. The bottom cap⑬ with one O-ring in it can be removed.

<Assembly method>

1. Reassemble the valve in the reverse order of disassembly.
2. Use care, while reassembling, that no dust, foreign material stick to plunger assembly ⑨ (including vaveseat), spring⑧, core assembly⑥, O-ring⑩⑫, body⑪,bottom cap⑬.
3. Each screw has been tightened to a torque in the range of the list shown below.

Model	Cross-recessed coutershunk flat head screw⑦ Cross–recessed head machin screw⑭	Nut①
HVB612	1.5~2.0N·m	8 ~ 10N·m
HVB712	1.5~2.0N·m	

⑦ Inspection

When the product is resolved and it assemble it again,

(1) Please confirm the presence of the outside and an internal leakage by the Leakdetector etc.

(2) Please confirm an electric signal is put,and the valve does the opening and shutting operation normally.

⑧ Maintenance and Inspection

Please make periodical inspection (function inspection, leakage inspection, etc.) for 1-2 times per year to use this product at the best condition.

⑨ Troubleshooting

If a failure should occur, following are assumed for causes.
Please contact with your distributor.

	Symptoms		Cause	Countermeasure
1.	Internal leakage		・Jam with foreign materials or adhesion of them.	・Please contact with your distributor.
			・Mark, deform on the valve seat.	・Please contact with your distributor.
			・Mounting direction of the valve is incorrect.	・Check the allowable pressure, and change the direction.
2.	External leakage		・Mark on the O-RING.	・Please contact with your distributor.
			・Foregin material adhesion to O-ring.	・Please contact with your distributor.
			・The core assembly damaged.	・Please contact with your distributor.
			・Mark on flange sealing surface	・Please contact with your distributor.
3.	Malfunc -tioning	Valve does not open.	・Power is not ON.	・Check the wires, a fuse etc., and Turn the power on.
			・The voltage is not normal.	・Check the coil voltage and power voltage the same.
			・Foreign material is bit or adhere in either to plunger or core assembly.	・Please contact with your distributor.
			・Plunger or core assembly is abnormally worn out.	・Please contact with your distributor.
			・The pressure difference of the valve is beyond the allowable pressure difference range or mounting direction of the valve is incorrect.	・Check the allowable pressure,mounting direction of the valve etc., and change the direction or the fluid pressure.
			・Coil failure	・Please contact with your distributor.
		Valve does not close.	・Power is not OFF.	・Check power source.
			・Foreign material is bit or adhere in either to plunger or core assembly.	・Please contact with your distributor.
		Instable valve operation	・Foreign material is bit or adhere in either to plunger or core assembly.	・Please contact with your distributor.
			・Plunger or core assembly is abnormally worn out.	・Please contact with your distributor.
		Burned coil	・Abnormal voltage	・Check voltage

◎Any other troubles not included in the above table shall be contacted to your distributor.