

## INSTRUCTION MANUAL

### Delay solenoid valve for vacuum HVL12 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.

## Safety precautions

When designing and manufacturing a device using CKD products, the manufacturer is obligated to manufacture a safe product by confirming safety of the system comprising the following items:

- Device mechanism
- Pneumatic or water control circuit
- Electric control that controls the above

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 someone having sufficient knowledge and experience.**
2. **Use this product within its specifications.**  
 This product cannot be used beyond its specifications. Additionally, the product must not be modified or machined.  
 This product is intended for use in general industrial devices and parts. Use beyond such conditions is not considered. Consult with CKD for details when using the product beyond the unique specification range, outdoors, or in the following conditions or environments. In any case, measures for safety shall be provided when the valve malfunctions.
  - 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 shutoff 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.**  
 ISO4414, JIS B 8370 (pneumatic system rules)  
 JFPS2008 (principles for pneumatic cylinder selection and use)  
 Including High Pressure Gas Maintenance Law, Occupational Safety and Sanitation Laws, other safety rules, 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 the entire system 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. Release 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 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 a 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.

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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.

## **Precautions with regard to guarantee**

### ● **Guarantee period**

The guarantee period of our product shall be one (1) year after it is delivered to the place specified by the customer.

### ● **Guarantee coverage**

If any failure for which CKD CORPORATION is recognized to be responsible occurs within the above warranty period, a substitute or necessary replacement parts shall be provided free of charge, or the product shall be repaired free of charge at the plant of CKD CORPORATION.

However, the guarantee excludes following cases:

- ① Defects resulting from operation under conditions beyond those stated in the catalogue or specifications.
- ② Failure resulting from malfunction of the equipment and/or machine manufactured by other companies.
- ③ Failure resulting from wrong use of the product.
- ④ Failure resulting from modification or repairing that CKD CORPORATION is not involved in.
- ⑤ Failure resulting from causes that could not be foreseen by the technology available at the time of delivery.
- ⑥ Failure resulting from disaster that CKD is not responsible of.

Guarantee stated here covers only the delivered products. Any other damage resulting from failure of the delivered products is not covered by this guarantee.


### ● **Confirmation of product compatibility**

Our customer shall be responsible of confirming compatibility of our product used in our customer's system, machinery or device.

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## 1. Unpacking


 <b>CAUTION</b>	Do not remove the piping port protection until just before piping. Otherwise, foreign matter enters the valve and cause malfunction or bad operation.
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- 1) Check that the model No. shown on the Name Plate of the product is the same with what you ordered.
- 2) Check that the product has no external damages.
- 3) When storing the product, keep the product inside the packing box to prevent the intrusion of foreign matter to the valve. Take out the valve when piping.

## 2. Installation

 <b>WARNING</b>	Contact CKD if the product is to be used beyond specifications, or in special applications.
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### 2. 1 Conditions for installation

 <b>WARNING</b>	<ol style="list-style-type: none"> <li>a) The product cannot be used in an explosive gas atmosphere. In such atmosphere, use our explosion-proof valve or air operated valve.</li> <li>b) For AC voltage products, a beat sound may occur from the product, depending on usage conditions. If such sounds were to be avoided, select DC voltage products.</li> <li>c) Do not use the product under corrosive gas atmosphere, or atmosphere that degrades product material.</li> <li>d) Use the product away from heating elements and radiant heat.</li> <li>e) Use the product within the specified ambient temperature range.</li> <li>f) The product may break if the fluid freezes. Provide appropriate measures against freezing. If heat insulating material is to be covered around the solenoid valve, do not cover around the coil. Otherwise, the coil will burn.</li> <li>g) Install the product away from rain, water, direct sunlight or ultraviolet rays. The product cannot be used outdoors.</li> <li>h) Protective measures shall be taken against splashing of oil or welding spatter on the product.</li> </ol>
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 <b>CAUTION</b>	a) Install this product in a place free of vibration.
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## 2. 2 Installation method


### 2.2.1 Mounting

 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>a) Read this instruction manual thoroughly and understand the contents before installing the product.</li> <li>b) Always take hold of the Main Body (metal part) portion when handling and mounting the product. Do not apply force on the Coil Assembly portion.</li> <li>c) Make sure that there is no tension applied to the coil lead wire portion when installing.</li> <li>d) Always take hold of the Main Body (metal part) portion when carrying the product. Do not hang the product by its lead wire.</li> <li>e) After installation, confirm proper mounting by checking for leaks at the piping.</li> </ul>
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### 2.2.2 Maintenance space

- Provide enough space for safe maintenance and troubleshooting work.

## 2. 3 Piping

 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>a) When piping or re-piping, fix the product. Always fix the product by holding the Main Body . Fix the socket with a tool such as an adjustable spanner when tightening the A port.</li> <li>b) Fix and provide appropriate support to the piping, so that the weight and vibration of the piping will not directly be applied to the product.</li> <li>c) Tighten the piping with recommended torque shown in table 2-1.</li> <li>d) Before piping, flush the piping with compressed air 0.3MPa or more to remove foreign material such as dust, metal powder, rust and sealing material.</li> <li>e) Do not use excessive amount of sealing material (seal tape, gelatinous sealant). Otherwise, the sealing material will enter the product and cause malfunction.</li> <li>f) Foreign matter such as dust in the fluid hinders normal product operation. If dusts, foreign materials, etc. enter in the fluid, attach a filter of 60 <math>\mu</math> m or finer one on the air side of the solenoid valve.</li> </ul>
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#### 1) Cleaning the piping

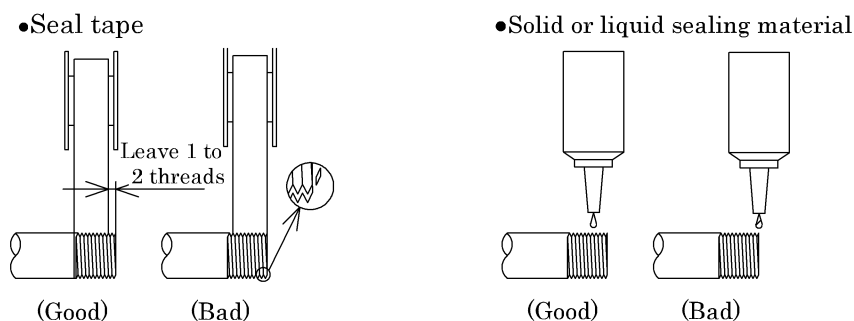
- Before piping, flush the piping with compressed air to remove foreign material such as dust, metal powder, rust and sealing material.

#### 2) Piping

- Always take hold of the Main Body (metal part) portion when mounting the product. Do not take hold the resin part.
- Fix the product by piping, or Mount Plate.
- After piping, check each connecting section for leakage. We recommend you to confirm leakage using a helium leak detector.

3) Sealing material

- When using sealing material, make sure the sealing material do not enter the piping. Also, make sure there is no external leakage. When taping seal tape to the pipe thread, leave 1.5 to 2 threads at the tip without taping. Also, when using liquid sealing material, leave 1.5 to 2 threads at the tip without sealing material. Do not apply too much sealing material on the thread. Do not apply sealing material to the internal thread (refer to Figure 2-3.) .



(Figure 2-1.) How to apply sealing material

4) Tightening

• Rc

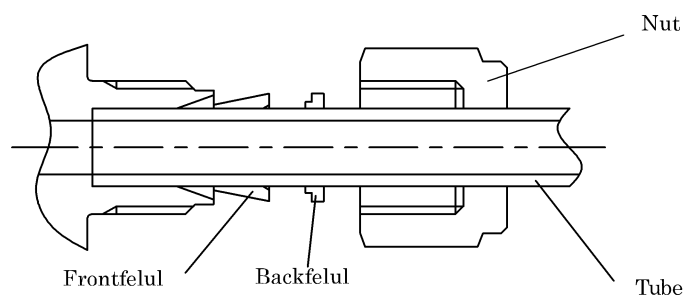
Refer to Table 2-1 for the recommended port tightening torque.

Table 2-1. Recommended port tightening torque

Port size	Tightening torque
Rc1/8	18 — 20 [N·m]


• Procedure for tightening Barbed joint

Before mounting process, check components. Insert tube and ferrule completely. Tighten the nut by hand, and finish tightening the nut 1/4 turn with the appropriate tool.



(Figure 2-2)

## 2. 4 Wiring

 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>a) Use within the allowed voltage range. Otherwise, malfunction and coil damage may occur.</li> <li>b) Use a breaker such as a fuse on the control circuit side to protect the electric equipment.</li> <li>c) As a reference, the wiring electric wires must have a nominal sectional area of 0.2mm<sup>2</sup> or more.</li> <li>d) Use of a switching circuit that does not cause contact chattering will lengthen the life of the solenoid valve.</li> <li>e) In the case of use of contactless relay circuit, be careful about leakage current. Select a switch whose capacity is 5% lower than the rated current.</li> <li>f) A solenoid valve for DC voltage has polarity.</li> </ul>
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### 1) Wiring of the lead wire type

This product uses lead wires described below.


If a terminal is to be crimped onto the lead wire, crimp and insulate the terminal properly.

Conductor size	Insulating covering outer diameter
AWG24	Φ1.6mm

A solenoid valve for DC voltage has polarity. Connected the red lead wire to the plus (+) side.

## 3. Pre-operation (post-installation) check

### 3. 1 Appearance check

 <b>WARNING</b>	<p>Stop the flow of the fluid (shut the supply) . Discharge the fluid inside the product. Shut off power supply.</p>
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- 1) Push the product by hand and confirm that the product is firmly fixed on the piping.
- 2) Confirm the piping is done properly.
- 3) Confirm that no screws and bolts are loose.
- 4) Confirm that the wiring is done properly.

### 3. 2 Leakage check

Confirm leakage at the connection part.

We recommend you to confirm leakage using a helium leak detector.

### 3. 3 Electrical check

 <b>WARNING</b>	<p>Cut off the electricity. Check while taking serious care to avoid electric shock.</p>
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#### 1) Check the supply voltage.

Voltage variation shall be within 10% of the rated voltage.

Use beyond the allowed variation range will cause malfunction or damage to the coil.


#### 2) Check insulation resistance


Check the insulation resistance between dead metal parts and un-insulated live parts (such as the tip of the lead wire) that are assembled to the product.

Confirm that insulation resistance is over 100MΩ at DC1000V megger.

## 4. Instructions for proper use

### 4. 1 Handling precautions

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>a) Do not use this product as an emergency shut-off valve. This product is not designed as a safety-securing valve, such as an emergency shut-off valve. For such systems, use this valve after providing another method of securing safety.</li> <li>b) Take measures to prevent harm to operators or objects if this product fails.</li> <li>c) Working fluids Internal parts may wear when the valve operates. Caution is required because wear chips could enter the secondary side of the valve.</li> <li>d) Foreign matter such as rust and dust in the fluid causes malfunction and leakage, which degrades product performance. Provide measures to remove foreign matter.</li> <li>e) Use within specified fluid temperature range.</li> <li>f) Use within specified ambient temperature range.</li> <li>g) Do not touch the coil sections when energized or immediately after energizing. Directly touching these products could cause burns.</li> <li>h) Do not touch the wiring connection sections (bare live part) when energized. There is a risk of electric shock.</li> <li>i) Use within the maximum working pressure range.</li> </ul>
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 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>a) Do not use the product as footings, or place heavy loads on the product.</li> <li>b) If the product has not been used for more than a month, carry out trial run before work.</li> <li>c) Beware of clogging of the strainer or filter.</li> <li>d) Apply voltage for 2 min or more. It is necessary for capacitor charge time 2 min or more.</li> </ul>
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- 1) Refer to “6. Troubleshooting” if any trouble occurs.

### 4. 2 Basic operating procedure

- 1) Apply rated voltage to the corresponding lead wire. The valve will immediately close.
- 2) Continue the application of the voltage to the lead wires for 2 min or longer and then stop it. The valve will remain closed for a time corresponding to the position to which the trimmer has been rotated, before opening. (The delay time is not proportional to the amount the trimmer is rotated. The delay time slightly varies according to the application period and ambient temperature.)



### 4. 3 Disassembly and assembly



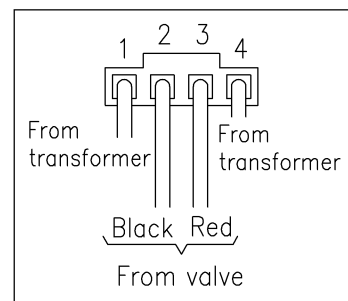
## CAUTION

- a) Stop the flow of the fluid (shut the supply).
- b) Discharge the fluid inside the product.
- c) Shut off power supply.

#### 4.3.1 Disassembly

##### <Remove valve from electrical part>

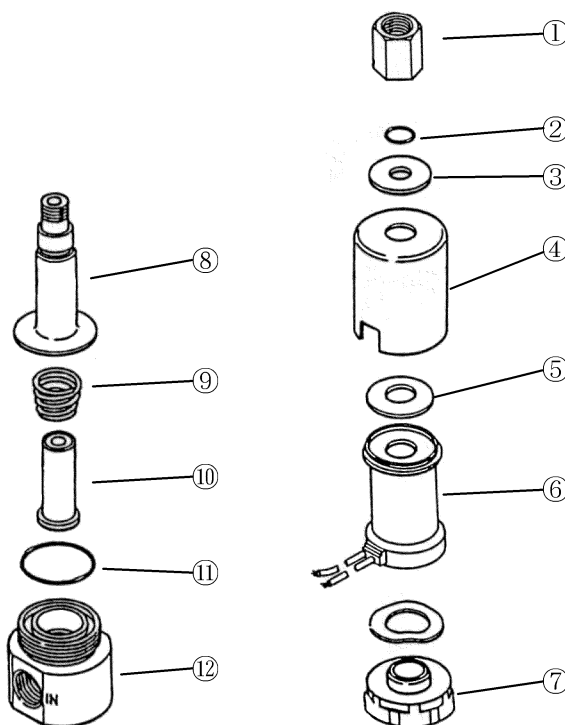
- 1) Be sure to turn off the power and pressure out before disassembling.
- 2) Open the cover located in the upside off electrical case, and pull the circuit board out from the inside.
- 3) Pull the connector out from the circuit board and pull the two lead wires out from the connector.
- 4) Remove the solenoid valve from the case of electrical part. (Before that unscrew two bolts located the below side.)



(Fig. 4-1)

##### <Remove valve from electrical part>

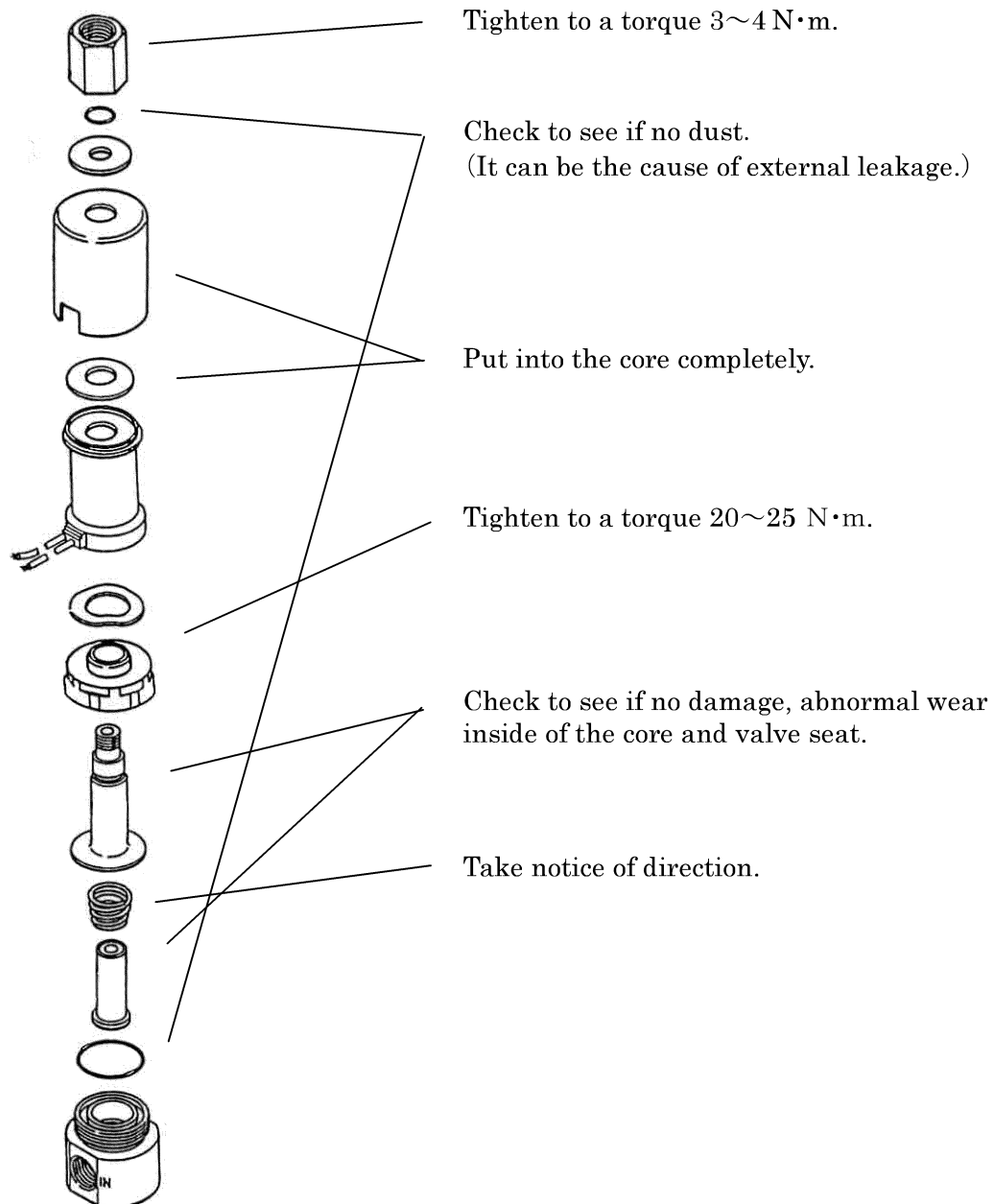
- 1) Disassembly of only coil.  
Take off socket ①.  
Take off ②, ③, ④, ⑤, ⑥ orderly.
- 2) Disassembly of inside of valve  
Unscrew core B ⑦.  
It is possible to take off the only inside parts of the valve.



(Fig. 4-2)

### 4.3.2 Assembly

Assemble the product with the opposite procedure to disassembling.  
To restore the original performance after the re-assembling, ensure that :



(Fig. 4-3)

## 5. Maintenance

### 5. 1 Maintenance and inspection



#### **CAUTION**

Shut off the power supply and release the fluid and pressure before performing maintenance.

- 1) Read this Instruction Manual thoroughly and understand the contents before performing maintenance and inspection.
- 2) Regularly inspect the product to ensure optimum performance. The product should be inspected every half year.
- 3) Always carry out trial run if the valve has not been used for more than a month.
- 4) Contents of inspection.
  - 1) Check to see if any dust, foreign material, etc. is not accumulated in the plunger, body, valve seat, etc. If such is found, disassemble and clean the unit.
  - 2) Check to see if valve seat, core assembly, valve seat in the actuator is not damaged or abnormally worn out. If such is found, replace it.

## 6. Troubleshooting

- 1) Perform inspection when power fails, or at emergencies such as malfunction.
- 2) If the product does not operate as intended, inspect the product following the table below.

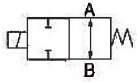
State of failure	Cause	Countermeasure
Valve does not shut	Valve is not energized.	Confirm wiring and fuse, then energize the valve.
	Voltage applied is the allowable voltage range.	Confirm the power supply, and apply rated voltage.
	Fluid pressure applied is beyond the value specified.	Adjust the pressure within the specified value.
	Foreign matter obstructs operation at the actuator portion.	Disassemble and clean the product interior.
Valve does not remain closed before opening.	Voltage applied is the allowable voltage range.	Confirm the power supply, and apply rated voltage.
	Is voltage applied for 2 min or more before valve opens.	Apply voltage for 2 min or more.
	Trimmer is not correctly set.	Correctly set trimmer.
External leakage	Foreign matter is caught in the O-ring.	Disassemble and clean the product interior
	O-ring is damaged or deformed.	Replace the product.
Internal leakage	Pressure applied is beyond the value specified.	Adjust the pressure within the specified value.
	The valve seat of the Body is worn or damaged.	Replace the product.
	The sealing side of the main valve Assembly is worn or damaged.	Replace the product.
	Foreign matter is caught in the valve seat.	Disassemble and clean the product interior.

- 3) Please consult CKD or your nearest agent for any unclear points.

## 7. Product specification and model number display

### 7.1 Product specification

JIS symbol



Item		HVL12
Working fluid		Air, nitrogen (Note 1)
Working pressure range	Pa(abs)	$1.3 \times 10^{-6}$ to $2.0 \times 10^5$
Max. working differential pressure	MPa	0.2
Valve seat leakage	$\text{Pa} \cdot \text{m}^3/\text{s}(\text{He})$	$1.3 \times 10^{-9}$ or less
External leakage	$\text{Pa} \cdot \text{m}^3/\text{s}(\text{He})$	$1.3 \times 10^{-9}$ or less
Proof pressure	MPa	0.5
Fluid temperature	°C	5 to 50
Ambient temperature	°C	0 to 50
Orifice	mm	1.2
Mounting attitude		Free
Weight	kg AC	0.5
	DC	0.2
Frequency		0.5 cycle/min. or less
Port size		Rc1/8, 1/4" double barbed joint, NW10.16 vacuum clamp joint
Cv		0.05
Max. set delay time		AC: 8sec, DC: 10sec (±35%)
Rated voltage		DC24V, AC100V, AC200V
Voltage fluctuation range		Rated voltage ±10%
Power consumption	W	4

Note 1: The durability may drop considerably depending on the degree of dryness.

Note 2: The weights listed are for port connection size Rc1/8.

Note 3: Do not handle by holding just the lead wire.

Note 4: Always use the M4 screws on the bottom of the case.

Note 5: Do not fix only at the port piping of the valve.

Use in a place which is not affected by vibration.

### 7.2 Model number display

**HVL 12 - 4S 6 - 5 - AC100V**

Model no.

**A** Port A connection  
Note1

**B** Port B connection  
Note1

**C** Voltage

#### **A** Port A connection Note1

6	Rc1/8
4S	1/4" double barbed joint
10K	NW10 vacuum clamp joint
16K	NW16 vacuum clamp joint

#### **B** Port B connection Note1

6	Rc1/8
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#### **C** Voltage

DC 24V	DC24V
AC100V	AC100V
AC200V	AC200V

#### **⚠ Note on model no. selection**

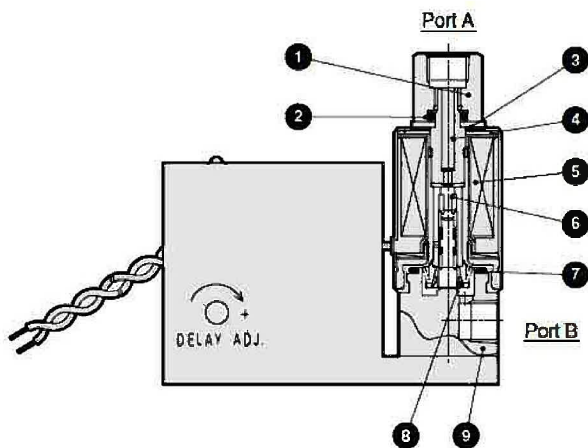
Note 1: If the symbols selected for port A and port B are the same, indicate only one.

Example: When both port A and port B are Rc1/8

HVL12-6-5-voltage (correct)

HVL12-66-5-voltage (wrong)

## 8. Internal construction



No.	Parts name	Material
1	Socket	SUS303
2	O ring	FKM
3	Washer	SUS304
4	Core assembly	SUS316L, SUS405
5	Coil assembly	PBT
6	Plunger assembly	SUS405, FKM, PTFE
7	O ring	FKM
8	Spring	SUS304
9	Body	SUS303