



Operation Manual

Product Name

Hand Lever Valve

Model / Series / Product Number

VHL

SMC Corporation

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Hand Lever Valve / VHL Series

Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “**Caution**,” “**Warning**” or “**Danger**.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)^{*1)}, and other safety regulations.

*1) ISO 4414: Pneumatic fluid power - General rules and safety requirements for systems and their components
ISO 4413: Hydraulic fluid power - General rules and safety requirements for systems and their components
IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots
etc.



Danger

Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.



Warning

Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.



Caution

Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.



Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Our products cannot be used beyond their specifications. Our products are not developed, designed, and manufactured to be used under the following conditions or environments.

Use under such conditions or environments is not covered.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, fuel equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogs and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.



Hand Lever Valve / VHL Series Safety Instructions

Caution

We develop, design, and manufacture our products to be used for automatic control equipment, and provide them for peaceful use in manufacturing industries.

Use in non-manufacturing industries is not covered.

Products we manufacture and sell cannot be used for the purpose of transactions or certification specified in the Measurement Act.

The new Measurement Act prohibits use of any unit other than SI units in Japan.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.

Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.*2)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***2) Vacuum pads are excluded from this 1 year warranty.**

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.

2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

2. Specific Product Precautions

Design/ Selection

Warning

(1) Confirm the specifications.

This product is designed to be used only in a compressed air system (including vacuum).

Do not operate at pressures, temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to the specifications.)

We do not guarantee against any damage if the product is used outside of the specifications range.

(2) Do not disassemble the product or make any modifications, including additional machining.

Doing so may cause human injury and/or an accident.

Note that the handle of the spring return type and detent type is detachable.

The handle of the shift prevention lock type is not detachable. Therefore, do not disassemble it.

(3) Actuator drive

When an actuator, such as a cylinder, is to be driven using a valve, take appropriate measures to prevent potential danger caused by actuator operation.

(4) Intermediate stops

For 3-position closed center type, it is difficult to make a piston stop at the required position accurately due to the compressibility of air. Furthermore, since valves and cylinders are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time.

When it is necessary to hold a stopping position, select an equipment to prevent displacement and design the circuit.

(5) Holding pressure (including vacuum).

Since the valve is subject to air leakage, it cannot be used for applications such as holding pressure (including vacuum) in a pressure vessel.

(6) Not suitable for use as an emergency shut-off valve, etc.

The valves listed in this instruction manual are not designed for safety applications such as an emergency shutoff valve. If the valves are used for the mentioned applications, additional safety measures should be adopted.

Design/ Selection

Warning

(7) Release of residual pressure

For maintenance purposes install a system for releasing residual pressure. Especially in the case of 3-position closed center valve type, ensure that the residual pressure between the valve and the cylinder is released.

(8) 3-position type

When using the 3-position type for the first time, actuators may travel in an unexpected direction depending on the switching position of the valve. Implement measures to prevent any danger from occurring when operating the actuator.

Check that the actuator moves in the intended direction by operation of the product (handle).

(9) Sonic conductance (C) and critical pressure ratio (b) values for products are representative values.

(10) Operation

The valve must be switched to each position instantly and securely. Stopping the handle between the extreme positions may cause malfunction.

This product is a directional control valve and not intended to be used for flow rate control. If this product is used to control the drive speed of an actuator or for any other unintended purpose without fully shifting the handle, the product may be damaged.

(11) Switch the valve by hand.

If a hammer or other tools are used, or it is operated mechanically through the use of a cylinder or the like, the product could be damaged.

(12) Move the handle in the correct direction (longitudinal direction of the product).

Attempting to shift the handle in an unintended direction may damage the product.

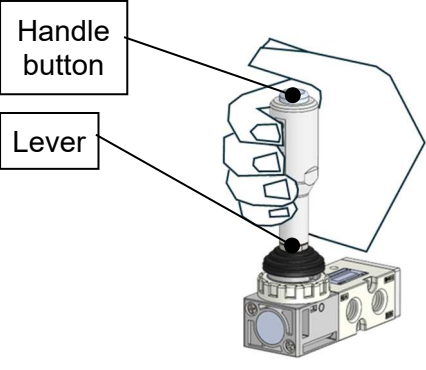
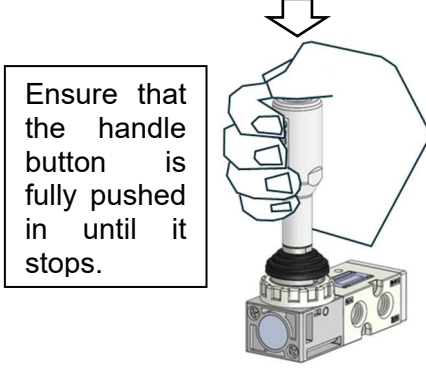
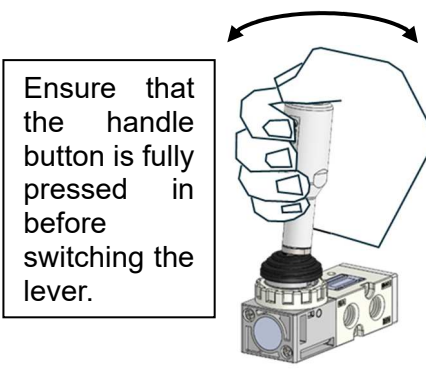
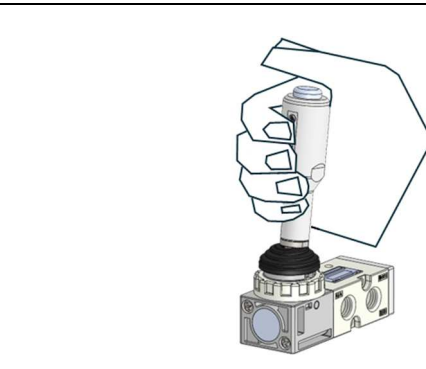
(13) Ensure that the product is unlocked before moving the handle.

The shift prevention lock type has a shift lock. Attempting to move the handle with the lock engaged may damage the product.

Design/ Selection

Warning

- (13) **Ensure that the handle button is fully pressed in before switching the lever.**
 The shift prevention lock type has a shift lock. Attempting to move the handle while the lock engaged may damage the product. Please operate the handle according to the procedure described below.

Procedure	Figure
(1) Initial	
(2) Press the handle button	
(3) Move the lever	
(4) Release the handle button	

Design/ Selection

Warning

- (14) **If the product is not operated for a prolonged period, it may take some time for the valve to recover due to sticking of the seal.**
 Take due care when keeping the product in one energisation state for an extended period of time.

- (15) **Avoid applying vibration or impact to the product.**
 Vibration and impact may cause the product to malfunction.

Design/ Selection

Caution

- (1) **Operation in a low temperature condition**
 Take appropriate measures to avoid freezing of drainage, moisture etc. in low temperature.
- (2) **Do not supply air pressure from other ports than port 1(P).**
 Air leakage may occur when the pressure is supplied from other ports.
- (3) **Mounting orientation**
 Mounting orientation is unrestricted. The product can be directly mounted or fixed by means of set nut. A set nut comes with all of the models of this series.
- (4) **Grease is applied to the inner parts of the valve. Grease may enter into the downstream side of the valve.**
- (5) **Repetitive use of this product may cause the thread of the handle to come loose. In this case, first tighten the threaded portion of the handle by hand, and then tighten further using the width across flats of a tool.**
 Tighten with a torque of 2 to 3 Nm as reference.
(Approximately 1/4 turns after tightening by hand)

Mounting

Warning

(1) Operation Manual

Install the product and operate it only after reading the Operation Manual carefully and understanding its contents. Also, keep the Manual where it can be referred to as necessary.

(2) Ensure sufficient space for maintenance activities.

When installing the product, allow access for maintenance.

(3) Tighten threads with the proper tightening torque.

When installing the product, follow the torque specifications given by the fitting manufacturer used.

(4) Use R external threads with Rc internal threads and NPT external threads with NPT internal threads and G external threads with G internal threads.

(5) If air leakage increases or equipment does not operated properly, stop operation.

Check mounting conditions when air and power supplies are connected. Initial function and leakage tests should be performed after installation.

An unexpected movement may cause injury or break the product.

(6) Painting and coating

Warnings or specifications printed or affixed to the product should not be erased, removed or covered up.

Do not paint resin parts, as this may have an adverse effect due to the solvent in the paint.

(7) Do not drop the product or apply impact to it during transport or installation. This could damage the product.

(8) Use a panel with the specified applicable thickness only.

For the panel cutout dimensions and applicable panel thicknesses, refer to the product catalog or SMC website

(URL <http://www.smcworld.com>).

Piping

Caution

(1) Refer to the Fittings and Tubing Precautions for handling one-touch fittings.

(2) Preparation before piping

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

When screwing together pipes and fittings, etc., be certain that chips from the pipe threads and sealing material do not get inside the pipe.

(3) When using a closed center type, sufficiently check the piping between the product and cylinder for air leakage.

(4) When piping to the product, refer to the symbols and labels on the product to ensure correct piping to the supply and other ports.

(5) Follow the procedures of the manufacturer when fittings other than SMC are used.

Confirm that no problem will occur in the operating conditions.

Lubrication

Warning

(1) The product has been lubricated for life by the manufacturer, and does not require lubrication in service.

(2) Use turbine oil Class 1, ISO VG32 (with no additives), if lubricated. Use turbine oil Class 1, ISO VG32 (with no additives), if lubricated. Besides, if the lubrication is suspended halfway, the original lubricant will be lost and may result in a malfunction. Be sure to keep lubricating continuously.

For details about lubricant manufacturers' brands, refer to the SMC website.

Air Supply

Warning

(1) Type of fluids

Use compressed air as the fluid used.

Air Supply

Warning

- (2) **When there is a large amount of drainage**
Compressed air containing a large amount of drainage can cause the malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.
- (3) **Drain flushing**
If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. This causes the malfunction of pneumatic equipment.
If the drain bowl is difficult to check and remove, the installation of a drain bowl with an auto drain option is recommended.
For compressed air quality, refer to SMC catalog "Compressed Air Purification System".
- (4) **Use clean air**
Do not use compressed air that contains chemicals, synthetic oils that include organic solvents, salt, corrosive gases, etc., as it can cause damage or malfunction.

Air Supply

Caution

- (1) **If ultra-dry air is used as the fluid, the lubrication characteristics inside the product will degrade, possibly affecting the reliability (service life) of the product.**
- (2) **Install air filters.**
Install air filters close to the valves on the upstream side. A filtration degree of 5 micrometers or less should be selected.
- (3) **Ensure that the fluid and ambient temperatures are within the specified range.**
If the fluid temperature is 5°C or less, the moisture in the circuit could freeze, causing damage to the seals or leading to equipment malfunction. Therefore, take appropriate measures to prevent freezing.
For compressed air quality, refer to SMC catalog "Compressed Air Purification System".
- (4) **If excessive carbon powder is seen, install a mist separator on the upstream side of the valve.**
If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valve and cause malfunction.

Operating environment

Warning

- (1) **Do not use in an atmosphere containing corrosive gases, chemicals, sea water, water, water steam, or where there is direct contact with any of these.**
- (2) **Do not use this product in an environment where flammable or volatile gases are present; there is a risk of fire or explosion.**
- (3) **Do not operate in a location subject to vibration or impact.**
- (4) **Do not expose the product to direct sunlight for an extended period of time.**
- (5) **Do not mount the product in locations where it is exposed to radiant heat.**
- (6) **Employ suitable protective measures in a location where there is contact with oil or welding spatter, etc.**
- (7) **When the valve is exposed to a large amount of dust, install a silencer into the port "5(EA)" and "3(EB)".**
When dust enters the valve from the port "5(EA)" or "3(EB)", it may cause air leakage.
- (8) **To prevent malfunction of this product due to water, oil, or dust entering the product through the lever opening, install the supplied dust boot before using the product.**
Note that the dust boot is intended to prevent entry of large foreign matter and is not intended to provide a protective enclosure.

For how to install the dust boot, refer to "3. Installation of accessories"

Maintenance



Warning

- (1) **Perform maintenance and inspection according to the procedures indicated in the operation manual.**

If handled improperly, malfunction or damage of machinery and equipment may occur.

- (2) **Maintenance work**

If handled improperly, compressed air can be dangerous.

Assembly, handling, repair and element replacement of pneumatic systems should be performed by a knowledgeable and experienced person.

- (3) **Removal of equipment, and supply/exhaust of compressed air**

Before components are removed, first confirm that measures are in place to prevent workpieces from dropping, run-away equipment, etc. Then, cut the supply pressure and electric power, and exhaust all compressed air from the system using the residual pressure release function.

In the closed center type, compressed air remains between the valve and the cylinder. Therefore, exhaust the pressure in the same manner.

When machinery is restarted, proceed with caution after confirming that appropriate measures are in place to prevent sudden movement.

- (4) **If the air leakage increases or the product does not function properly, stop operating it. Periodically conduct maintenance of the valve to check for air leakage and operation conditions.**

Maintenance



Caution

- (1) **Drain flushing**

Remove drainage from air filters regularly.

- (2) **Lubrication**

Once lubrication has been started, it must be continued. Apply class 1 turbine oil (ISO VG32) as a lubricant. Use of other lubricants may cause malfunction.

One-touch Fittings

Caution

When fittings are used, they may interfere with one another depending on their types and sizes. Therefore, the dimensions of the fittings to be used should first be confirmed in their respective catalogs. Fittings whose compliance with the VHL series is already confirmed are stated below. If the fitting within the applicable range is selected, there will not be any interference.

Applicable Fittings : Series KQ2H, KQ2S

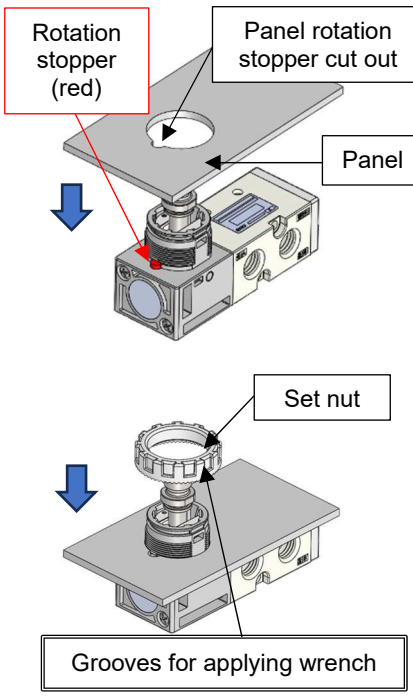
Series	Model	Piping port	Port size	Applicable tubing O.D.						
				φ3.2	φ4	φ6	φ8	φ10	φ12	φ16
VHL200	VHL21□□-□02	4(A),2(B)	1/4							
		1(P),5(EA),3(EB)	P:1/4 EA,EB:1/8							

3. Installation of accessories

Install the supplied accessories following the instructions below.
The accessories should be installed in accordance with the product being used.

A) For spring return or detent type

A) 3-1 Set nut installation (panel mounted)



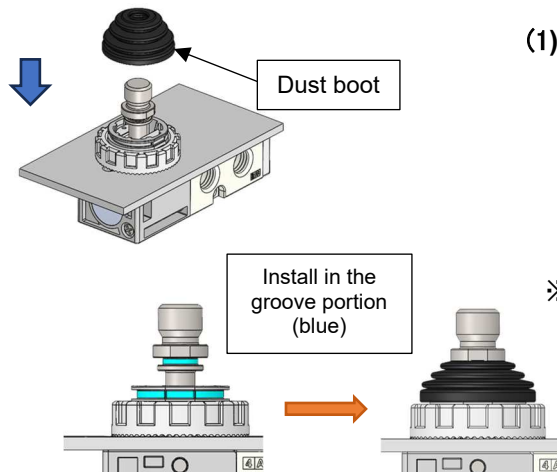
(1) Mount the product to the panel.
Mount the product to the panel, aligning the rotation stopper on the product with the panel rotation stopper cut-out.

(2) Tighten the set nut to fix the product to the panel.
Tighten the set nut by hand, additionally tighten it by using a tool, and then check that the product is securely installed.

* When retightening
Please use a hook wrench on the grooves of the set nut.
After hand tightening, follow the values in the table below for retightening.

Model	Tool size	Amount of retightening	Reference torque
VHL200 Series	34/38	2 to 5 notch	2.0±0.2 N · m

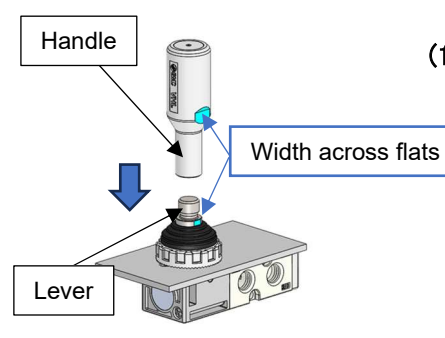
A) 3-2 Dust boot installation



(1) Install the dust boot before use.
 Install the dust boot so that it is hooked at the step of the lever and the head cover, shown in blue.
 After installation, shift the lever to ensure that the dust boot is securely in the groove.
 If the dust boot flips up during lever shift, re-install it so that it is caught in the groove.

※The dust boot is intended to prevent entry of large foreign matter and is not intended to provide a protective enclosure.
 Take appropriate protective measures according to the operating environment.

A) 3-3 Handle installation



(1) Install the handle.
 Install the handle on the lever.
 Tighten the handle by hand, additionally tighten it by using a tool, and then check that the product is securely installed.

* When tightening by hand only, the handle may come loose during operation.
 When retightening the handle after hand tightening, tighten the handle by using the width across flats shown in blue to a tightening torque indicated in the table below.

Model	Tool size (Width across flats)	Amount of retightening	Reference torque
VHL200 Series	Handle : 22mm Lever : 14mm	Approximately 1/4 turns after tightening by hand	2.0 to 3.0 Nm

B) For Shift prevention lock

B) 3-1 Remove the set nut

(1) Remove the dust boot from the groove and move it to the position shown.
If the dust boot remains installed in the groove, subsequent actions will be difficult. Allow the top and bottom edges of the dust boot to be removed from the groove respectively.

(2) Remove the set nut.
Remove the dust boot by deforming it with your fingers and passing the dust boot inside the set nut. Be careful not to damage the dust boot by using tools or forcibly stretching it.

B) 3-2 Set nut installation (panel mounted)

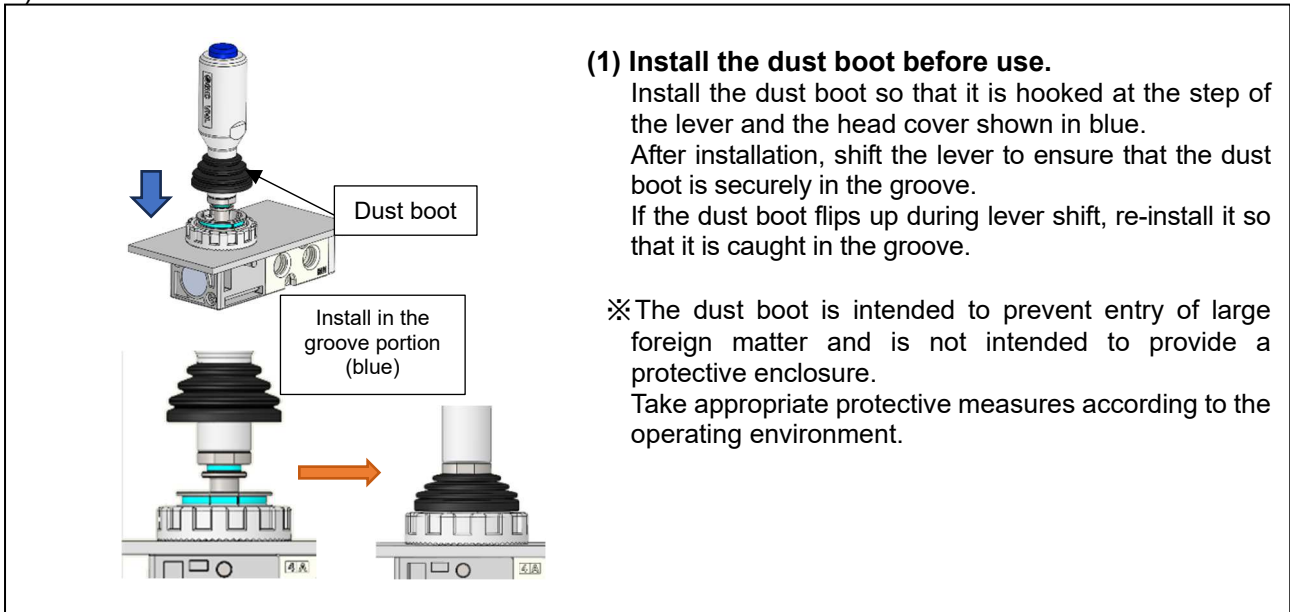
(1) Mount the product to the panel.
Mount the product to the panel, aligning the rotation stopper on the product with the panel rotation stopper cut-out. Install the dust boot by deforming it with your fingers and passing the dust boot through the panel cut diameter.

(2) Tighten the set nut to fix the product to the panel.
Install the dust boot by deforming it with your fingers and passing the dust boot inside the set nut. Tighten the set nut by hand, additionally tighten it by using a tool, and then check that the product is securely installed.

* When retightening
Please use a hook wrench on the grooves of the set nut. After hand tightening, follow the values in the table below for retightening.

Model	Tool size	Amount of retightening	Reference torque
VHL200 Series	34/38	2 to 5 notch	2.0±0.2 N · m

B) 3-3 Dust boot installation



4. Application

This product is a valve for signal transmission used for a pneumatic control circuit of machining equipment or general industrial machinery, etc.

5. Specifications

Model	VHL21*S*	VHL21*(D,W)*
Operation type	Spring return type	Detent type
Fluid	Air	
Operating pressure	-0.1 to 1.0MPa	
Operating temperature	-10 to 60 °C (No freezing)	
Port size	1(P),4(A),2(B) : 1/4, 5(EA),3(EB) : 1/8	
Option	With Shift prevention lock	

6. TROUBLE SHOOTING

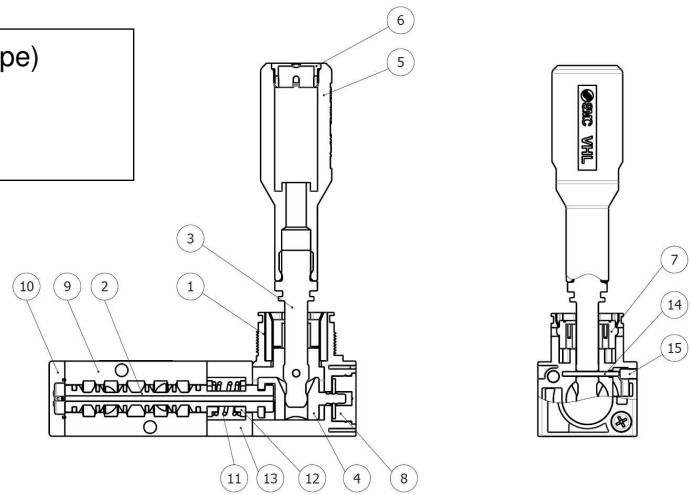
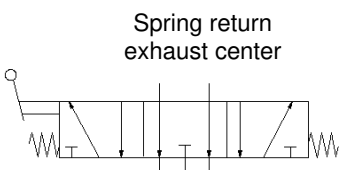
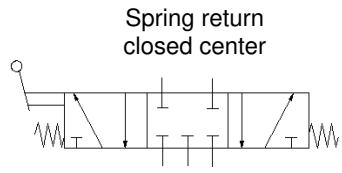
Should any trouble be found during operation, trace the source of the trouble in the following order and take corrective action.

Trouble phenomenon		Cause expected	Remedy
Leakage	Internal leakage	Intrusion of foreign matter	<ul style="list-style-type: none"> In case of ingress of foreign matter, remove foreign matter by air blow of piping and then replace valve.
		Poor seal on actuator (cylinders, etc.) side	<ul style="list-style-type: none"> Repair or replace actuators.
Malfunction	The valve cannot be switched.	Breakage due to application of excessive operating force Breakage due to application of excessive moment load	<ul style="list-style-type: none"> Any of the functional parts inside the product may be broken. Replace the part with a new one.
	Spring return is disabled.	Sticking due to prolonged operation in a single position.	<ul style="list-style-type: none"> Avoid using this product by keeping it in a single operation state for an extended period of time.
	The detent does not function.	Wear of detent part.	<ul style="list-style-type: none"> Replace product.
	The valve is unintentionally switched.	Use of the product in an environment with vibrations and/or impact.	<ul style="list-style-type: none"> Review the installation environment. If vibration or impact is applied to the product in its operating environment, the use of shift prevention lock type is recommended.
	The handle button does not return.	The lock plate was broken due to an external force, and the button was caught.	<ul style="list-style-type: none"> Replace product.
Other	Handle cannot be installed. Set nut cannot be installed.	Thread deformation	<ul style="list-style-type: none"> Replace product. Install the nut to the torque indicated in the Operation Manual.

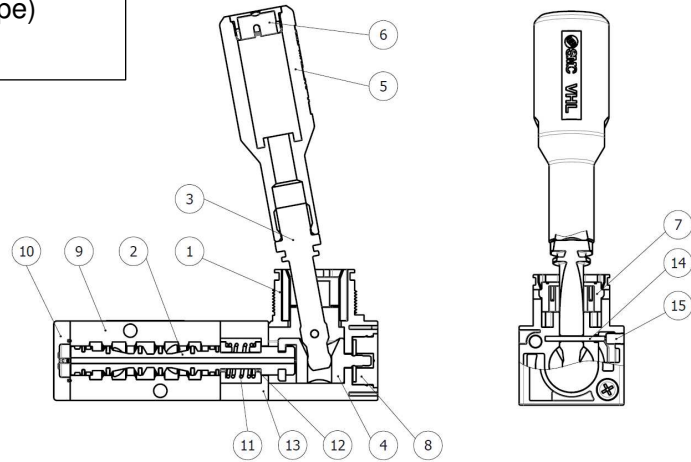
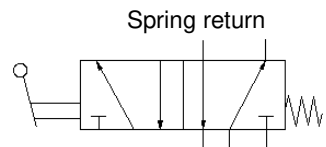
If the problem persists after the above countermeasures have been implemented, the valve may be experiencing a failure. In this case, stop using the valve immediately.

7. Construction

VHL21*S-*02 (Spring return type)
 - 3-position closed center
 - 3-position exhaust center



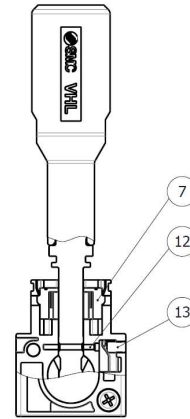
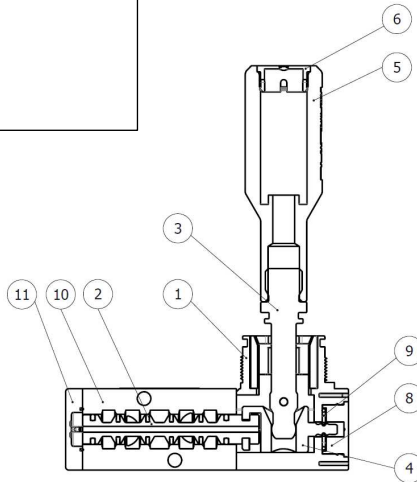
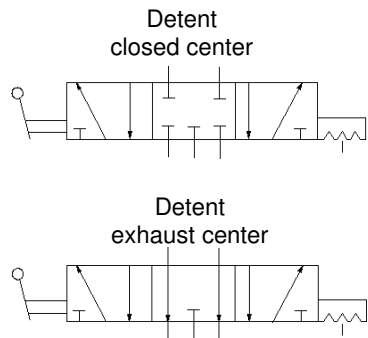
VHL212S-*02 (Spring return type)
 - 2-position



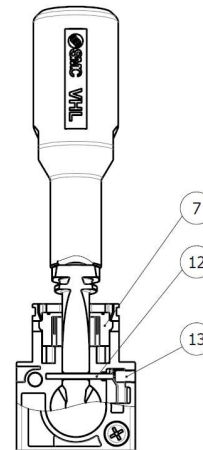
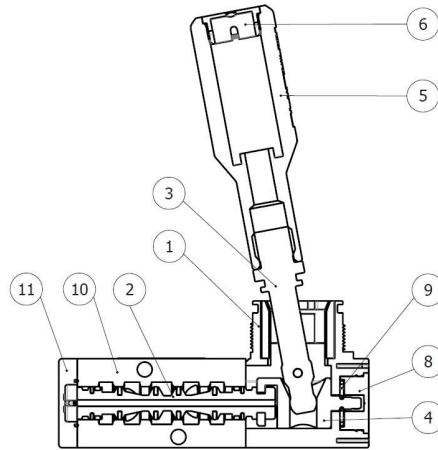
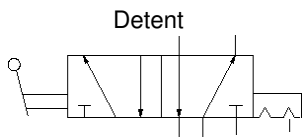
No.	Description	Material	Note
1	Head Cover	PBT	Gray
2	Spool valve	Aluminum alloy, HNBR,POM	
3	Lever	Stainless steel	
4	Joint	Carbon steel	
5	Handle	POM	Gray
6	Handle button	Aluminum alloy	Anodized (Blue)
7	Lock plate	Stainless steel	
8	Handle spring	Stainless steel	
9	Guide plate	PBT	White
10	End cover	Aluminum alloy	
11	Clip ring	Stainless steel	
12	Body	Aluminum die-casted	White
13	End cover	PA	White
14	Pin	Stainless steel	
15	Pin	Stainless steel	
16	Pin	Carbon steel	

Note) The Set nut is made of POM and the Dust boot is made of CR.

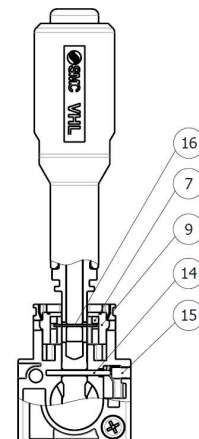
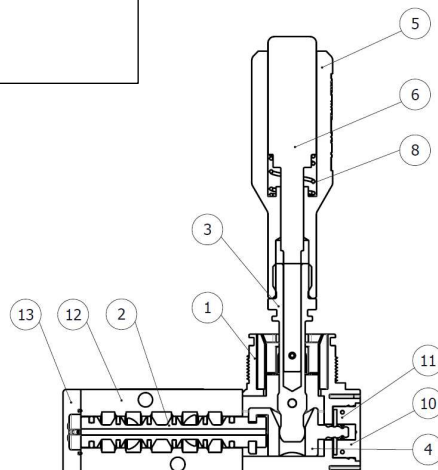
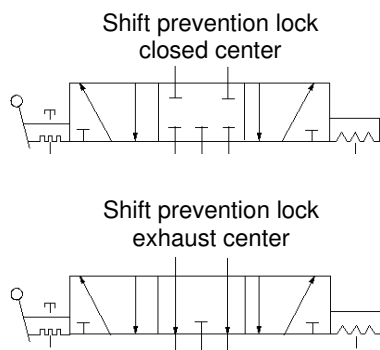
VHL21*D-*02 (Detent type)
 - 3-position closed center
 - 3-position exhaust center



VHL212D-*02 (Detent type)
 - 2-position

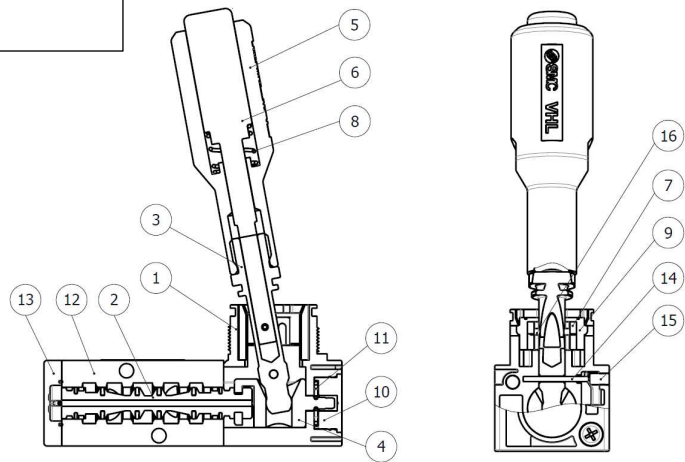


VHL21*W-*02 (Shift prevention lock type)
 - 3-position closed center
 - 3-position exhaust center



VHL212W-*02 (Shift prevention lock type)
- 2-position

Shift prevention lock



No.	Description	Material	Note
1	Head Cover	PBT	Gray
2	Spool valve	Aluminum alloy, HNBR,POM	
3	Lever	Stainless steel	
4	Joint	Carbon steel	
5	Handle	POM	Gray
6	Handle button	Aluminum alloy	Anodized (Blue)
7	Lock plate	Stainless steel	
8	Handle spring	Stainless steel	
9	Guide plate	PBT	White
10	End cover	Aluminum alloy	
11	Clip ring	Stainless steel	
12	Body	Aluminum die-casted	White
13	End cover	PA	White
14	Pin	Stainless steel	
15	Pin	Stainless steel	
16	Pin	Carbon steel	

Note) The Set nut is made of POM and the Dust boot is made of CR.

Revision history	
1 : Format update	2025.10
2 : Add procedures to (13)	2026.4

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
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