Doc. no.XL-OMJ0002-E

# Operation Manual

PRODUCT NAME

## High Vacuum L Type Valve

MODEL / Series / Product Number

XLAQ Series

XLDQ Series

SMC Corporation

# Contents

# 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.

# 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.

# 1. Precautions on handling 1

## ⚠ Common Specific Precautions 1 Be sure to read before handling.

Precautions on Design

### ⚠Warning

●All models

a) The body material is A6063、the bellows is SUS316L, and other metal seal material is SUS304. Standard seal material in the vacuum section is FKM that can be changed to the other materials (please refer “How to Order”). Use fluids those are compatible with using materials after confirming.
An external seal for vacuum uses vacuum grease (fluorine type grease: Y-VAC2).
Series XLDQ’s seal sliding part for vacuum uses vacuum grease (Y-VAC2). (Initial exhausting valve and sliding part)

b) Select materials for the actuation pressure piping, and heat resistance for fittings that are suitable for the applicable operating temperatures.

●Models with auto switch

a) The switch section should be kept at the temperature no greater than 60 $^{o}$C.

●Models with heater

a) When using a model with a heater (thermistor), a device should be installed to prevent over heating.

Selection

### ⚠Caution

●All models

a) When controlling valve responsiveness, take note of the size and length of piping, as well as the flow rate characteristics of the actuating solenoid valve.

b) Actuating press should be kept within the specified range.0.4 MPa to 0.5 MPa is recommended.

c) Use within the limits of the operating pressure range.

●High temperature types

a) In the case of gases which cause a large amount of deposits, heat the valve body to prevent deposits in the valve.

Mounting

### ⚠Caution

● All models

a) In high humidity environments, keep valves packed until the time of installation.

b) In case with switches, secure the lead wires so that they have sufficient slack, without any unreasonable force applied to them.

c) Perform piping so that excessive force is not applied to the flange sections. In case there is vibration of heavy objects or attachments, secure them so that torque is not applied directly to the flanges.

● High temperature types; (Temperature specifications/H0 H4 H5)

a) In models with heater (thermistor), take care not to damage the insulation component of the lead wires and the connector section.

b) The setting temperature for models with heater should be established without a draft or heat insulation. It will change depending on conditions such as heat retaining measures and the heating of other piping. Fine adjustment is not possible.

c) When installing heater accessories or mounting a heater ,check insulation resistance at the actual operating temperature . The installation of a short circuit breaker, etc. is recommended.

d) When a valve is to be heated, only the body section should be heated, excluding the bonnet section.

e) When a heater is in operation, the entire valve becomes hot. Be careful not to touch it with bare hands, as burns will result.

Piping

## ⚠Caution

a) Before mounting, clean the surface of the flange seal and the O-ring with ethanol, etc.

b) There is an indentation of 0.1 to 0.2mm in order to protect the flange seal surface, and it should be handled so that the seal surface is not damaged in any way.

Maintenance

## ⚠Warning

If the fluid or reaction product (deposit) may deteriorate safety, those who have domain knowledge and experience (specialist of the field) shall disassemble, clean and assemble the products.

## ⚠Caution

a) When removing deposits from a valve, take care not to damage any of its parts.

b) Replace the bonnet assembly when the end of its service life is approached.

c) If damage is suspected prior to the end of the service life, perform early maintenance.

d) SMC specified parts should be used for service. Refer to the Construction / Maintenance parts table.

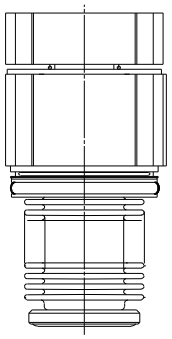
e) When removing valve or exterior seals, take care not to damage the sealing surfaces. When installing the valve seal, be sure that the O-ring is not twisted.

## 2. Precautions on handling 2

# Common Specific Precautions 2

Maintenance Parts

Be sure to read before handling



Bonnet assembly

## ⚠Caution

The bonnet assembly should also be replaced when changing the seal material. Due to the different materials used, changing only the seal may prove inadequate.

**Bonnet assembly/construction part number:1**

| Model | Temperature specifications | Indicator | Valve size | | | |
|---|---|---|---|---|---|---|
| | | | 16 | 25 | 40 | 50 |
| XLAQ | General use | without | XLAQ16-30-1 | XLAQ25-30-1 | XLAQ40-30-1 | XLAQ50-30-1 |
| | | with | XLAQ16A-30-1 | XLAQ25A-30-1 | XLAQ40A-30-1 | XLAQ50A-30-1 |
| | High temperature | without | XLAQ16-30-1H | XLAQ25-30-1H | XLAQ40-30-1H | XLAQ50-30-1H |
| | | with | XLAQ16A-30-1H | XLAQ25A-30-1H | XLAQ40A-30-1H | XLAQ50A-30-1H |
| XLDQ | General use | with (standard) | - | - | XLDQ40-30-1 | XLDQ50-30-1 |
| | High temperature | | - | - | XLDQ40-30-1H | XLDQ50-30-1H |

Note 1) List the optional seal material symbol after the model number, except for the standard seal material (FKM: compound No. 1349-80).

**Exterior seal, valve seal**

| Model | Description Constructions No. | Material | Valve size | | | |
|---|---|---|---|---|---|---|
| | | | 16 | 25 | 40 | 50 |
| XLAQ XLDQ | Exterior seal 3 | Standard | AS568-122V | AS568-129V | AS568-140V | AS568-231V |
| | | Specific | AS568-122 ** | AS568-129 ** | AS568-140 ** | AS568-231 ** |
| | Valve seal 2 | Standard | B2401-V15V | B2401-V24V | B2401-P42V | AS568-227V |
| | | Specific | B2401-V15 ** | B2401-V24 ** | B2401-P42 ** | AS568-227 ** |
| XLDQ | Valve S seal assembly 4 | Standard | - | - | XLD40-2-9-1A | XLD50-2-9-1A |
| | | Specific | - | - | XLD40-2-9-1A ** | XLD50-2-9-1A ** |

Note 2) List the optional seal material symbol after the model number, except for the standard seal material (FKM: compound no. 1349-80).

Note 3) Refer to the Construction of each series for the construction numbers.

Optional seal material

| Seal material | EPDM | Barrel Perfluoro® | Kalrez® | Chemraz® | | | VMQ | FKM for PLASMA | ULTIC ARMOR® | FKM |
|---|---|---|---|---|---|---|---|---|---|---|
| Combination No. | 2101-80 | 70W | 4079 | SS592 | SS630 | SSE38 | 1232-70 | 3310-75 | UA4640 | ※ |
| **Symbol** | **-XN1** | **-XP1** | **-XQ1** | **-XR1** | **-XR2** | **-XR3** | **-XS1** | **-XT1** | **-XU1** | **-XF1** |

Note 4) Due to the different materials used, changing only the seal may prove inadequate.

Barrel Perfluoro® is a registered trademark of the Matsumura Oil Co.,Ltd. .
Kalrez® is a registered trademark of the Dupont Dow Elastomers .
Chemraz® is a registered trademark of the Greene,Tweed & Co. .
ULTIC ARMOR® is a registered trademark of the NIPPON VALQUA INDUSTRIES,LTD.

※Same specifications as the standard FKM type

# 3. Specifications

XLAQ

| Model | | XLAQ-16 | XLAQ-25 | XLAQ-40 | XLAQ-50 |
|---|---|---|---|---|---|
| Flange (valve) size | | 16 | 25 | 40 | 50 |
| Actuating type | | Normally closed | | | |
| Fluid | | Vacuum of inert gas | | | |
| Operating temperature °C | | 5 to 60 (5 to 150 for high temperature type) | | | |
| Operating pressure Pa | | Atmospheric pressure to 1 x $10^{-6}$ | | | |
| Conductance l/s Note 1 | | 5 | 14 | 45 | 80 |
| Leakage Pa·m³/s | Internal | 1.3 x $10^{-10}$ for the standard material (FKM) at ambient temperatures , excluding gas permeation | | | |
| | External | 1.3 x $10^{-10}$ for the standard material (FKM) at ambient temperatures , excluding gas permeation | | | |
| Flange type | | KF (NW) | | | |
| Main material | | Body: aluminum alloy, Bellows: SUS316L, Main part: SUS304 and FKM (standard sealing material) Note2 | | | |
| Surface treatment for body | | Outside: hard anodized Inside: basis material | | | |
| Actuation pressure MPa | | 0.4～0.7 | | | |
| Air consumption cm³ Note 3 | for 0.5MPa | 19 | 46 | 200 | 360 |
| Port size | | M5 | | Rc 1/8 | |
| Weight kg | | 0.33 | 0.6 | 1.3 | 2.0 |
| Heater power W rush/ consumption Note 4 | (H4)100 °C | - | - | 200/40 | 200/60 |
| | (H5)120 °C | - | 200/30 | 400/70 | 400/80 |

Note 1 The conductance is “molecular flow” measured with an elbow pipe which has the same dimension with each flange.
Note 2 An external seal for vacuum uses vacuum grease (fluorine type grease: Y-VAC2).
Note 3 Air consumed by a reciprocating motion of a cylinder.
Note 4 A heater is provided as an option. Rush current of a heater runs for several tens of seconds, but it decreases after a while.

XLDQ

| Model | | XLDQ-40 | XLDQ-50 |
|---|---|---|---|
| Flange (valve) size | | 40 | 50 |
| Actuating type | | Normally closed | |
| Fluid | | Vacuum of inert gas | |
| Operating temperature °C | | 5 to 60 (5 to 150 for high temperature type) | |
| Operating pressure Pa | | Atmospheric pressure to 1 x $10^{-6}$ | |
| Conductance l/s Note 1 | Main pumping | 45 | 80 |
| | Initial pumping | 8 | 11 |
| Leakage Pa·m³/s | Internal | 1.3 x $10^{-10}$ for the standard material (FKM) at ambient temperatures , excluding gas permeation | |
| | External | 1.3 x $10^{-10}$ for the standard material (FKM) at ambient temperatures , excluding gas permeation | |
| Flange type | | KF (NW) | |
| Main material | | Body: aluminum alloy, Bellows: SUS316L, Main part: SUS304 and FKM (standard sealing material) Note 2 | |
| Surface treatment for body | | Outside: hard anodized Inside: basis material | |
| Actuation pressure MPa | | 0.4～0.7 | |
| Air consumption cm³ for 0.5MPa Note 3 | Main pumping | 200 | 360 |
| | Initial pumping | 12 | 15.5 |
| Port size | | Rc 1/8 | |
| Weight kg | | 1.5 | 2.2 |
| Heater power W rush/ consumption Note 4 | (H4)100 °C | 200/40 | 200/60 |
| | (H5)120 °C | 400/70 | 400/80 |

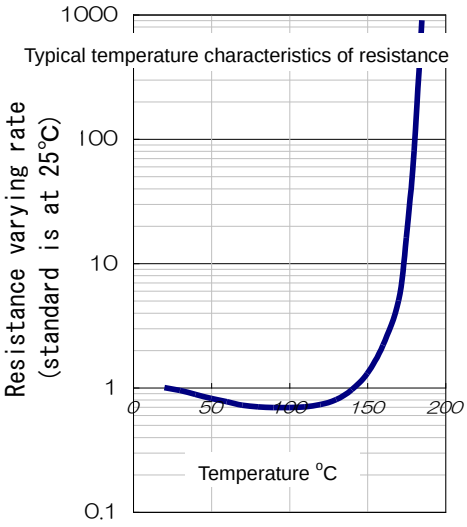
Note 1 The conductance is “molecular flow” measured with an elbow pipe which has the same dimension with each flange.
Note 2 An external seal for vacuum uses vacuum grease (fluorine type grease: Y-VAC2).
Series XLDQ’s seal sliding part for vacuum uses vacuum grease (Y-VAC2). (Initial exhausting valve and sliding part)
Note 3 Air consumed by a reciprocating motion of a cylinder.
Note 4 A heater is provided as an option. Rush current of a heater runs for several tens of seconds, but it decreases after a while.

Heater Specifications

Rated voltage: AC90V～AC125V

Temp. characteristics of resistance: Refer to the figure on the right.

Curie point (C.P.) 160 °C

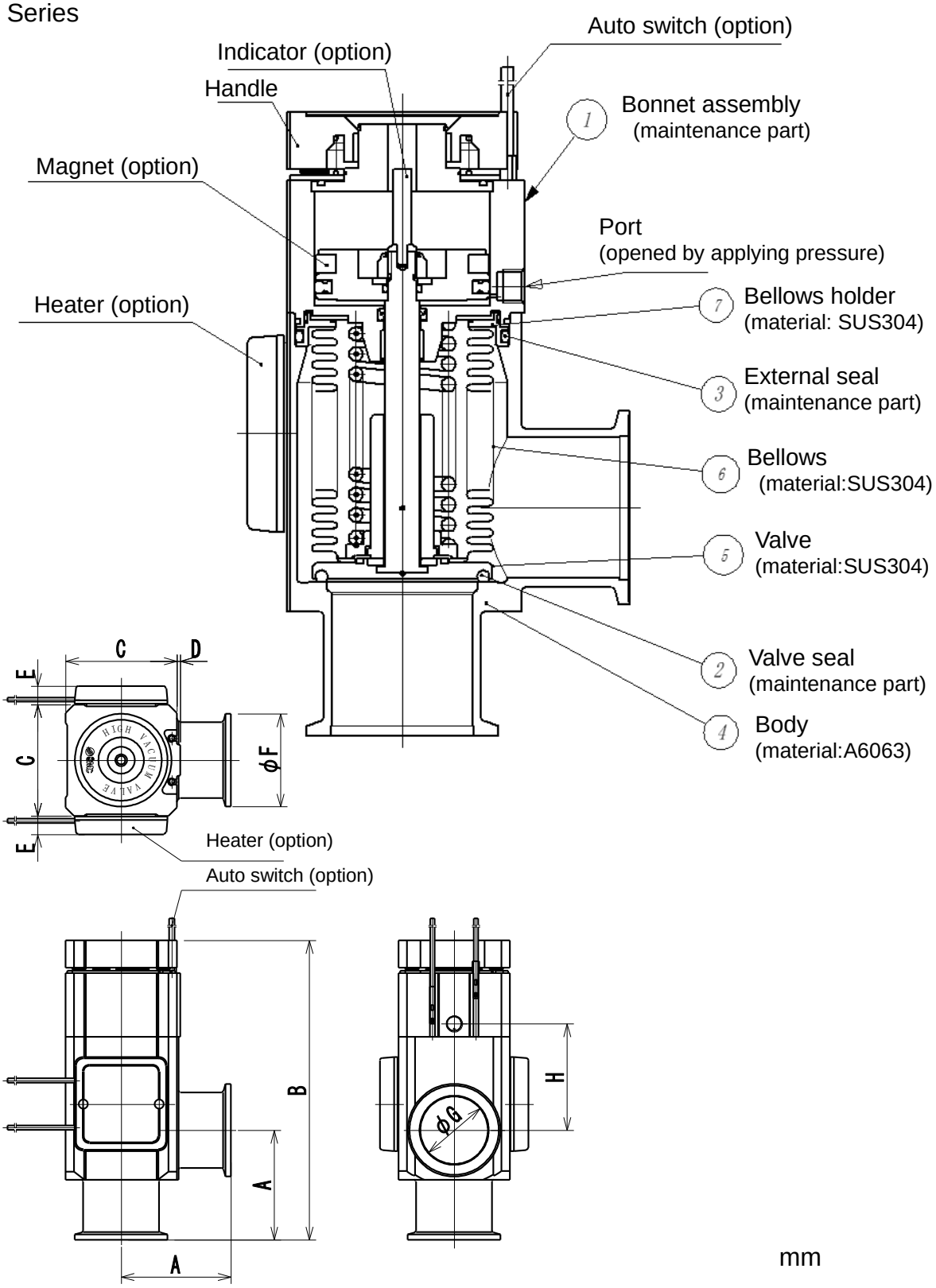



The used heater is PTC thermistor. It has characteristics such that the resistance decreases until temp. characteristics reaches approx. 100°C, and it increases with higher temp. However, the resistance decreases again with temperature approx. 200°C or more.

When a heater is heated externally and temperature reaches 200°C or more, it may have more current and be burned. If it is used in such environment, take a countermeasure such as using a temperature fuse with a heater to prevent overheating.

# 4. Construction/ Dimensions

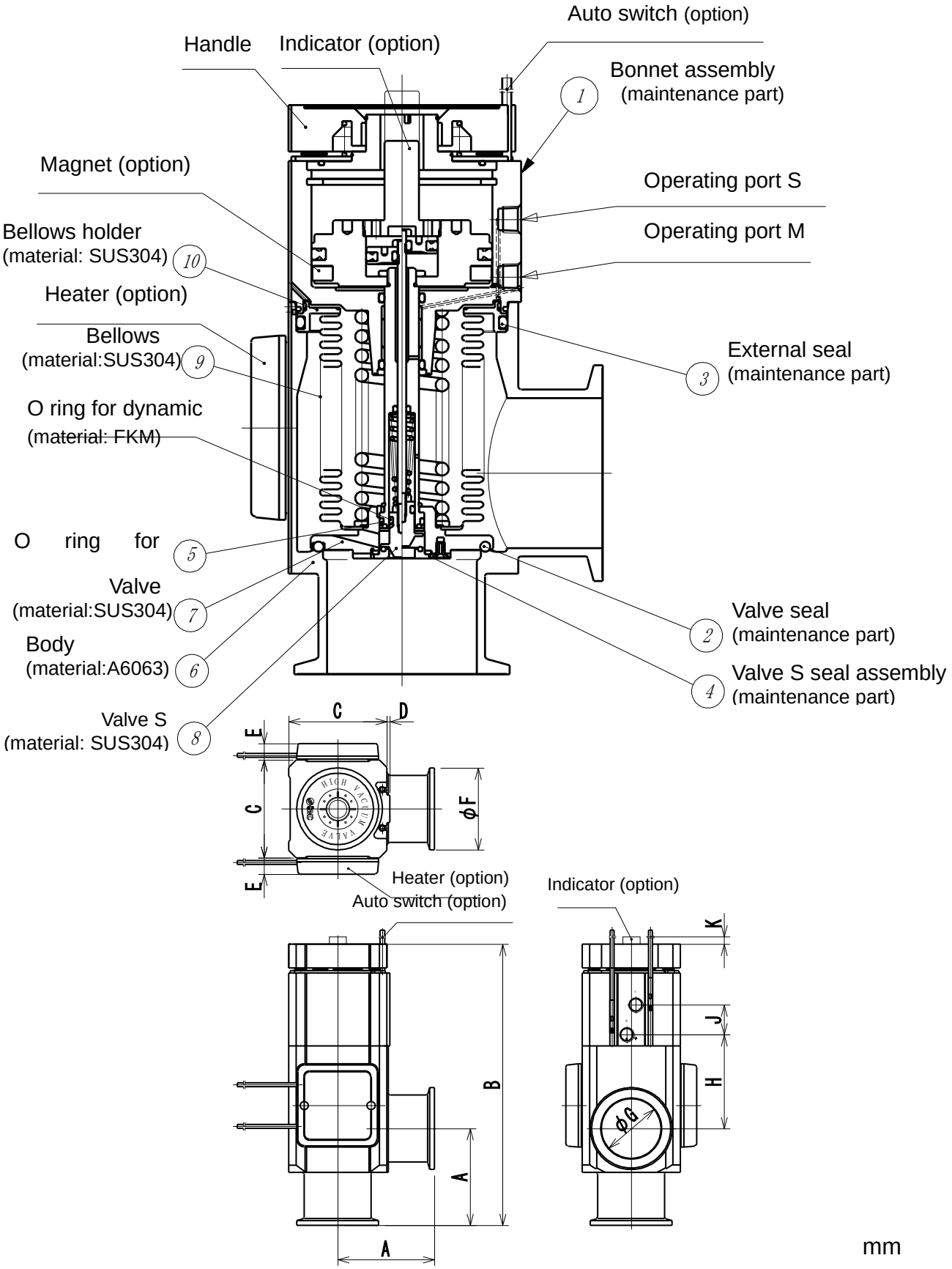
4-1 XLAQ Series




mm

| Model | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| XLAQ-16 | 40 | 120 | 38 | 1 | - | 30 | 17 | 40 |
| XLAQ-25 | 50 | 133 | 48 | 1 | 12 | 40 | 26 | 39 |
| XLAQ-40 | 65 | 178 | 66 | 2 | 11 | 55 | 41 | 63 |
| XLAQ-50 | 70 | 190 | 79 | 2 | 11 | 75 | 52 | 68 |

4-2 XLDQ Series




mm

| Model | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| XLDQ-40 | 65 | 189 | 66 | 2 | 11 | 55 | 41 | 63 | 20 | Max 5 |
| XLDQ-50 | 70 | 198 | 79 | 2 | 11 | 75 | 52 | 68 | 20 | Max 5 |

## 5. Guaranteed period and range

The guaranteed period covers the period which finishes the earliest among 2 million operating cycles [with our durability test conditions], 18 months after shipping from us, and 12 months after starting the use of the product at your place or your customer's place.
Note: The product durability is varied depending on the operating conditions (such as a use with large flow rate).

If the specification is not kept, or any non-conformance derived from mounting or replace of a device, an assembly, or an O-ring at your place occurs, the guarantee cannot be applied.

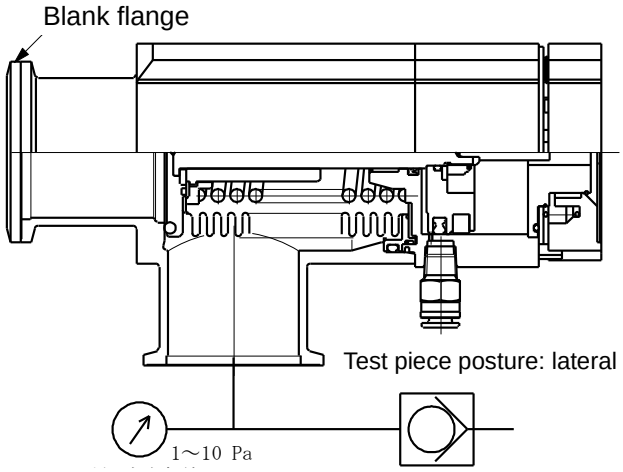
If any failure occurs due to our fault during the guaranteed period, we will guarantee the non-conformance by delivering a substitute in the worst case. However, responsibility of any damage which is led by the product failure is not taken by us.

Result of durability test (with the circuit shown on the right)

Internal/ external leakage and operation were checked by opening and closing a valve in internally evacuated condition at ordinary temperature (room temperature).

It was confirmed that this product satisfied the specification up to 2 million cycles.

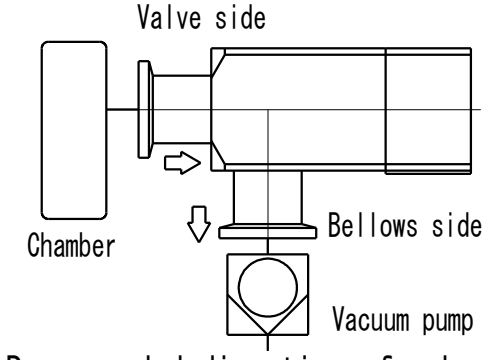
The test was performed with FKM, the standard sealing material.




Durability test conditions

<Reference>

The pumping direction is not limited, but if the pumping creates a flow stream, the durability of the product could be impaired.
Therefore, the pumping direction shown on the right figure (bellows side pumping) is recommended.
Also, the operating conditions should be checked beforehand because it affects the life.

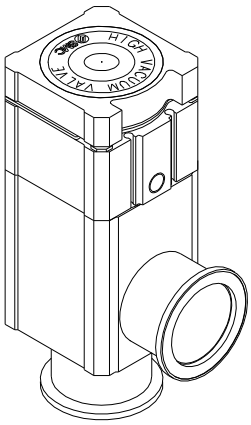



Recommended direction of exhaust

# 6. Bonnet assembly mounting/removing procedure

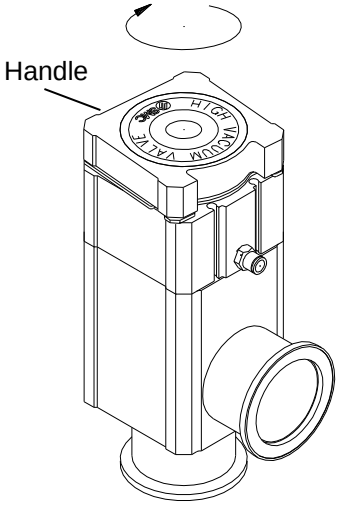
| | Bonnet assembly mounting/removing procedure | | | | |
|---|---|---|---|---|---|
| Dept. | 1 | Model | High Vacuum Angle Valve | | |

## Step 1 (Detaching)



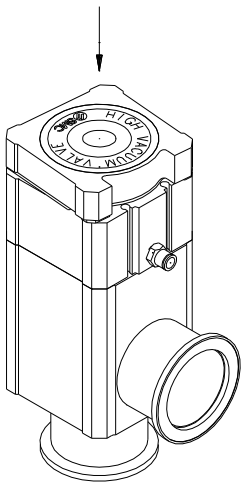
Supply 0.4Mpa of pressure to the port.

## Step 2



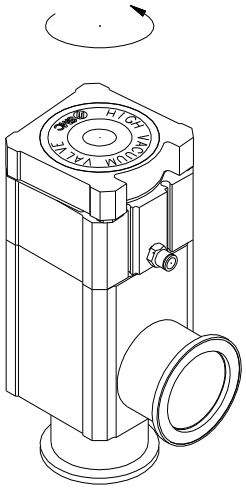

Turn the handle clockwise.

## Step 3



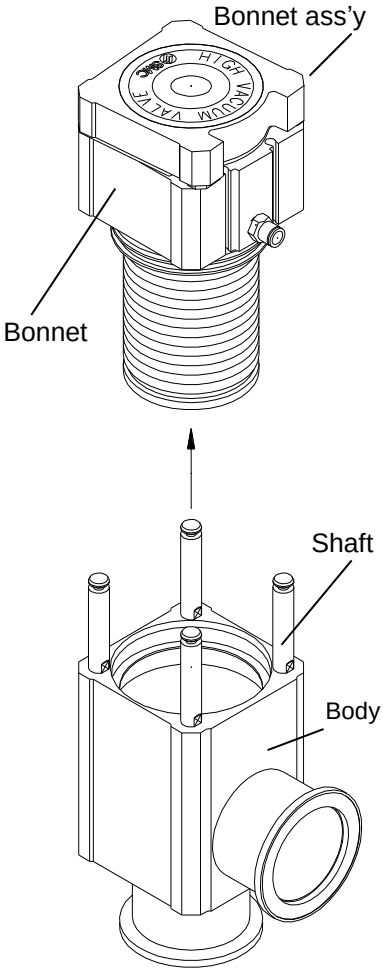
Press the handle with the condition of Procedure 2.

## Step 4



The bonnet assembly can be decoupled from the body when the handle is turned counterclockwise with the condition of Procedure 3.

## Step 5




Pull the bonnet assembly out from the body by holding the bonnet. Be careful not to hit the bellows to the shaft of the body.

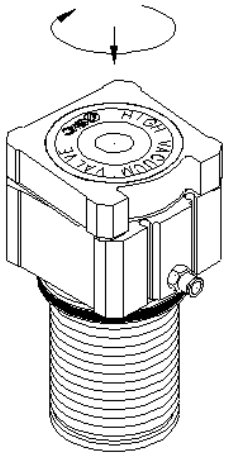
Pulling it out by holding the handle could cause the damage of the handle.

The handle is designed for holding the condition of Procedure 4, but if it is turned clockwise, it gets back to the condition of Procedure 1.

| | Valve seal / External seal replacement procedure | | | | |
|---|---|---|---|---|---|
| Dept. | 1 | Model | High Vacuum Angle Valve | | |

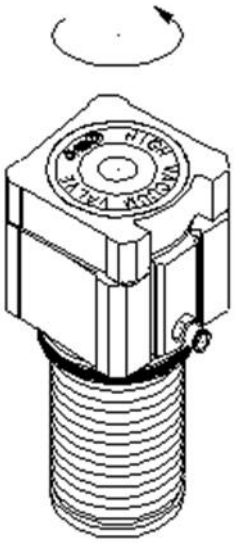
Step 1

If the bonnet assembly is held as it was removed from the body, start from Procedure 3.

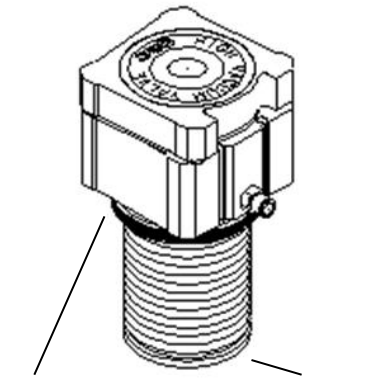


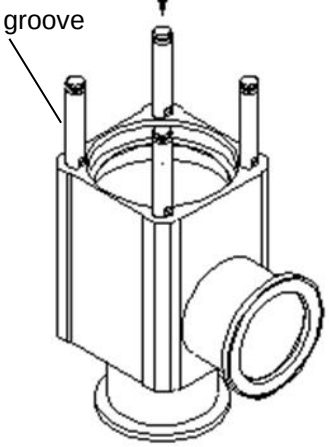
Press the bonnet assembly with the handle turning clockwise.

Step 4



Step 3

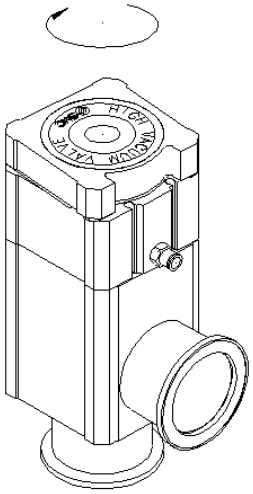



Apply pressure of 0.4MPa to the operating port.

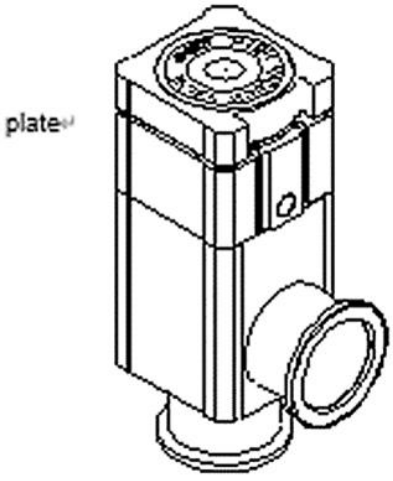
Press the bonnet assembly into the body with care not to hit the bellows to the shaft of the body. At this time, check the external seal and internal seal for particles.

Step 4



When the handle is turned clockwise with the bonnet assembly pressed, the mounting is completed.

Step 5




The handle returns to the initial position with a built-in spring.

Confirm that the plate is completely fitted into the groove.

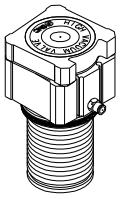
## 7. Bonnet assembly mounting/removing procedure

| | Valve seal / External seal replacement procedure | | | | |
|---|---|---|---|---|---|
| Dept. | 1 | Model | High Vacuum Angle Valve | | |

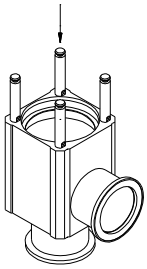
### Step 1

Refer to “Bonnet assembly mounting/removing procedure” for mounting/ removing the bonnet assembly.

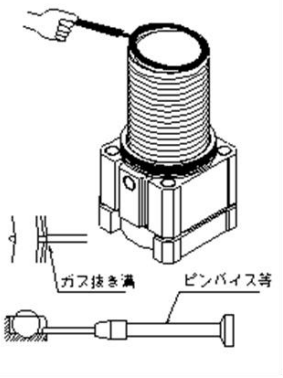
bonnet assembly



body

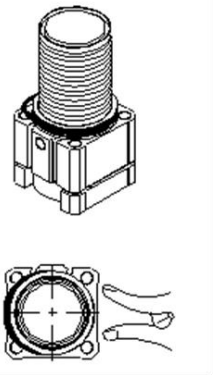


### Step 2



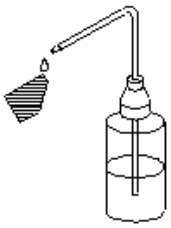

Remove the O-ring from the gas release groove with a pin whose
diam

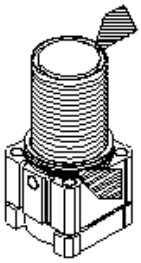
### Step 3



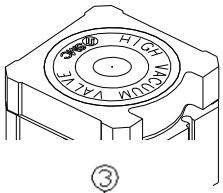
Remove the O-ring from the external O-ring groove.
Pushing the O-ring from one side enables easy removing of it.
The O-ring is applied vacuum grease. If the grease is applied to the bellows etc, wipe it out with ethanol.

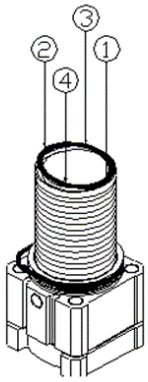
### Step 4



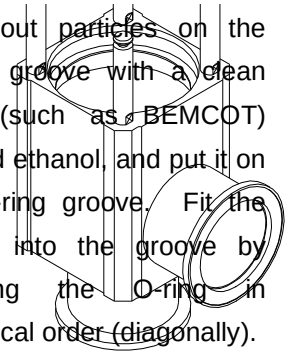


Wipe out particles in the O-ring groove with a clean cloth (such as BEMCOT) applied ethanol.

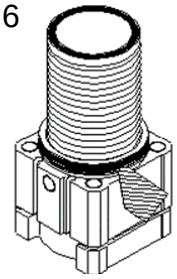





Wipe out particles on the O-ring groove with a clean cloth (such as BEMCOT) applied ethanol, and put it on the O-ring groove. Fit the O-ring into the groove by pressing the O-ring in numerical order (diagonally).



### Step 6



Wipe out particles on the external seal O-ring similarly, and fit it into O-ring.
Apply vacuum grease on the external seal O-ring. Applied amount:

XL*Q-16 : 0.2cm$^3$
XL*Q-25 :0.3cm$^3$
XL*Q-40 :0.4cm$^3$
XL*Q-50 :0.6cm$^3$

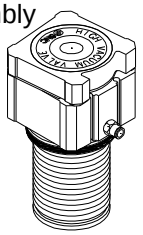
The grease is necessary for inserting and removing the bonnet assembly to reduce resistance. If it is assembled on the body without applying the grease, it is possible that removing cannot be done.

| | Valve S seal assembly replacement procedure | | | | |
|---|---|---|---|---|---|
| Dept. | 1 | Model | High Vacuum Angle Valve | | |

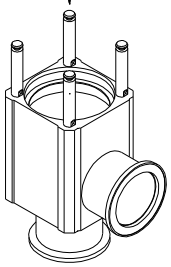
## Step 1

Refer to “Bonnet assembly mounting/removing procedure” for mounting/ removing the bonnet assembly.

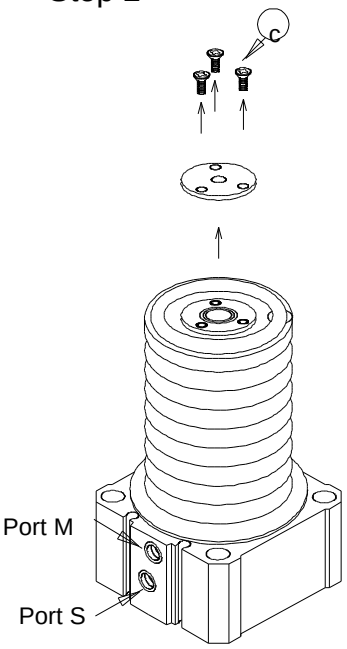
bonnet assembly



body

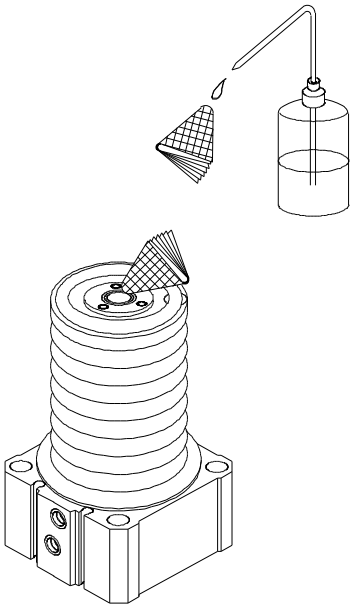


## Step 2



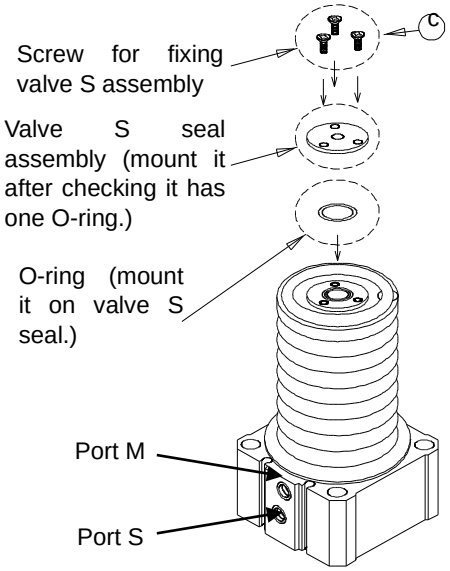

Apply pressure of 0.3MPa to the operating port S (for initial exhausting). Then, loosen screw c for fixing the valve S seal assembly to remove it.

## Step 3



Wipe out particles on the valve S seal assembly with a clean cloth (such as BENCOT) applied ethanol. (Ensure neither fiber nor dust on it at all.)

## Step 4




Mount the valve S seal assembly with an O-ring mounted under the condition in which pressure of 0.3MPa is applied to the operating port S (for initial exhausting). Next, tighten the screw c for fixing valve S seal assembly. First, for tightening, turn the all screws with your hand right before the O-rings are compressed. Then, apply some additional torque to all to complete the tightening.

| Revision history | | |
|---|---|---|
| E | Front cover, back cover, safety precautions Correction | 2024.08 |

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