

## Mechanical Vacuum Switch

- *Vacuum switch with a tubing connection.*
- *Compact body, light weight 1oz. (29g).*
- *Easy to install, normally open and normally closed.*
- *Easy to adjust.*

# Vacuum Accessories Series

## Mechanical Vacuum Switch

### Model Designation of Mechanical Vacuum Switch

**VUSM10** - **1/4**

Mechanical Vacuum Switch

① Pressure port (Negative pressure)

#### ① Pressure port (Negative pressure)

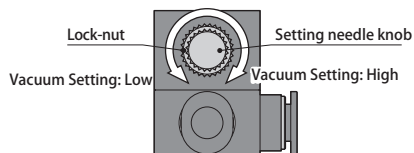
| Code      | 5/32  | 1/4               | 4    | 6    |
|-----------|-------|-------------------|------|------|
| Tube dia. | ø3.97 | 1/4" O.D. (ø6.35) | ø4mm | ø6mm |

### Specification of Box Union Switch Type VB and Mechanical Vacuum Switch Type VUSM

|                          |   |
|--------------------------|---|
| Pressure detection       | Diaphragm to Micro switch   |
| Fluid medium             | Air   |
| Operating temp. range    | 32~140°F (0~60°C) (No freezing)   |
| Micro switch rating      | 3A 250V   |
| Pressure setting range   | -5.9inHg ~ -19.5inHg (-20 ~ -66kPa)   |
| Accuracy                 | ±1.5 inHg (±5kPa)   |
| Differential response    | 6.5 inHg (22kPa)  |
| Factory default pressure | -15.7 inHg (-53kPa)   |
| Lead wire                | Length: About 11.8" (300mm) White: Common, Red: Normally closed, Black: Normally open |

### How to adjust the vacuum level

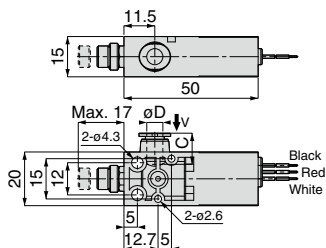
As the knob is turned clockwise, the vacuum setting is higher, as turned counter-clockwise the setting is lower. Make sure to tighten the lock-nut to secure the setting.



# VUSM Mechanical Vacuum Switch



RoHS compliant



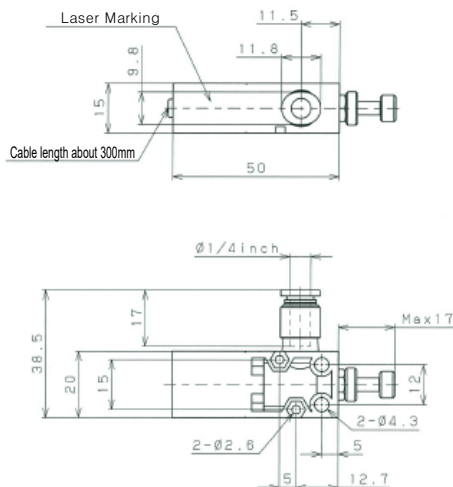
Unit : mm

| Model code  | Tube O.D. øD | C    | Weight (g) | CAD file name |
|-------------|--------------|------|------------|---------------|
| VUSM10-5/32 | 5/32"        | 11   | 29         | N/A           |
| VUSM10-1/4  | 1/4"         | 17   | 36         | N/A           |
| VUSM10-4    | 4            | 11   | 29         | VUSM10-4      |
| VUSM10-6    | 6            | 11.6 | 29         | VUSM10-6      |

※ Lead wire White: Common  
 Red: Normally closed  
 Black: Normally open

## VUSM10-1/4

Unit : mm



## Detailed Safety Instructions

Before using PISCO products, be sure to read "Safety Instructions" and "Safety Instruction Manual" and "Common Safety Instructions for Tubes".



## Common Safety Instructions for Mechanical Vacuum Switch

### Warning

1. Do not use mechanical vacuum switch in the environment of inflammable or explosive gas / fluid. Since the products are not explosive-proof structure, use in such environment may cause a fire or an explosion.
2. Keep a mechanical vacuum switch away from water, oil drops or dusts which may cause malfunction. The product is not drip-proof nor dust-proof structure.
3. Applying 0.5 MPa instantaneously to a mechanical vacuum switch does not affect on its performance, but do not apply more than 0.2 MPa as blow-off air pressure constantly. It may cause damage to the switch.
4. Use a vacuum switch within the described pressure setting range in the specifications. There is a risk of misactuation by a hysteresis when the products are operated with the pressure beyond the range.
5. Make sure to turn off the power supply before wiring mechanical vacuum switch. Pay special attention to lead wire colors to prevent a incorrect wiring.
6. Avoid excessive pulling, twisting, bending force on the wire, which may cause an open circuit.



# SAFETY Instructions

This safety instructions aim to prevent personal injury and damage to properties by requiring proper use of PISCO products.

Be certain to follow ISO 4414 and JIS B 8370

ISO 4414 : Pneumatic fluid power...Recommendations for the application of equipment to transmission and control systems.

JIS B 8370 : General rules and safety requirements for systems and their components.

This safety instructions is classified into "Danger", "Warning" and "Caution" depending on the degree of danger or damages caused by improper use of PISCO products.



**Danger**

Hazardous conditions. It can cause death or serious personal injury.



**Warning**

Hazardous conditions depending on usages. Improper use of PISCO products can cause death or serious personal injury.



**Caution**

Hazardous conditions depending on usages. Improper use of PISCO products can cause personal injury or damages to properties.



## Warning

### 1. Selection of pneumatic products

- ① A user who is a pneumatic system designer or has sufficient experience and technical expertise should select PISCO products.
- ② Due to wide variety of operating conditions and applications for PISCO products, carry out the analysis and evaluation on PISCO products. The pneumatic system designer is solely responsible for assuring that the user's requirements are met and that the application presents no health or safety hazards. All designers are required to fully understand the specifications of PISCO products and constitute all systems based on the latest catalog or information, considering any malfunctions.

### 2. Handle the pneumatic equipment with enough knowledge and experience

- ① Improper use of compressed air is dangerous. Assembly, operation and maintenance of machines using pneumatic equipment should be conducted by a person with enough knowledge and experience.

### 3. Do not operate machine / equipment or remove pneumatic equipment until safety is confirmed.

- ① Make sure that preventive measures against falling work-pieces or sudden movements of machine are completed before inspection or maintenance of these machine.
- ② Make sure the above preventive measures are completed. A compressed air supply and the power supply to the machine must be off, and also the compressed air in the systems must be exhausted.
- ③ Restart the machines with care after ensuring to take all preventive measures against sudden movements.

## Disclaimer

1. PISCO does not take any responsibility for any incidental or indirect loss, such as production line stop, interruption of business, loss of benefits, personal injury, etc., caused by any failure on use or application of PISCO products.
2. PISCO does not take any responsibility for any loss caused by natural disasters, fires not related to PISCO products, acts by third parties, and intentional or accidental damages of PISCO products due to incorrect usage.
3. PISCO does not take any responsibility for any loss caused by improper usage of PISCO products such as exceeding the specification limit or not following the usage the published instructions and catalog allow.
4. PISCO does not take any responsibility for any loss caused by remodeling of PISCO products, or by combinational use with non-PISCO products and other software systems.
5. The damages caused by the defect of Pisco products shall be covered but limited to the full amount of the PISCO products paid by the customer.



# SAFETY INSTRUCTION MANUAL

PISCO products are designed and manufactured for use in general industrial machines. Be sure to read and follow the instructions below.

## ⚠ Danger

1. Do not use PISCO products for the following applications.
  - ① Equipment used for maintaining / handling human life and body.
  - ② Equipment used for moving / transporting human.
  - ③ Equipment specifically used for safety purposes.

## ⚠ Warning

1. Do not use PISCO products under the following conditions.
  - ① Beyond the specifications or conditions stated in the catalog, or the instructions.
  - ② Under the direct sunlight or outdoors.
  - ③ Excessive vibrations and impacts.
  - ④ Exposure / adhere to corrosive gas, inflammable gas, chemicals, seawater, water and vapor. \*  
\* Some products can be used under the condition above(④), refer to the details of specification and condition of each product.
2. Do not disassemble or modify PISCO products, which affect the performance, function, and basic structure of the product.
3. Turn off the power supply, stop the air supply to PISCO products, and make sure there is no residual air pressure in the pipes before maintenance and inspection.
4. Do not touch the release-ring of push-in fitting when there is a working pressure. The lock may be released by the physical contact, and tube may fly out or slip out.
5. Frequent switchover of compressed air may generate heat, and there is a risk of causing burn injury.
6. Avoid any load on PISCO products, such as a tensile strength, twisting and bending. Otherwise, there is a risk of causing damage to the products.
7. As for applications where threads or tubes swing / rotate, use Rotary Joints, High Rotary Joints or Multi-Circuit Rotary Block only. The other PISCO products can be damaged in these applications.
8. Use only Die Temperature Control Fitting Series, Tube Fitting Stainless SUS316 Series, Tube Fitting Stainless SUS316 Compression Fitting Series or Tube Fitting Brass Series under the condition of over 60°C (140° F) water or thermal oil. Other PISCO products can be damaged by heat and hydrolysis under the condition above.
9. As for the condition required to dissipate static electricity or provide an antistatic performance, use EG series fitting and antistatic products only, and do not use other PISCO products. There is a risk that static electricity can cause system defects or failures.
10. Use only Fittings with a characteristic of spatter-proof such as Anti-spatter or Brass series in a place where flame and weld spatter is produced. There is a risk of causing fire by sparks.
11. Turn off the power supply to PISCO products, and make sure there is no residual air pressure in the pipes and equipment before maintenance. Follow the instructions below in order to ensure safety.
  - ① Make sure the safety of all systems related to PISCO products before maintenance.
  - ② Restart of operation after maintenance shall be proceeded with care after ensuring safety of the system by preventive measures against unexpected movements of machines and devices where pneumatic equipment is used.
  - ③ Keep enough space for maintenance when designing a circuit.
12. Take safety measures such as providing a protection cover if there is a risk of causing damages or fires on machine / facilities by a fluid leakage.

## ⚠ Caution

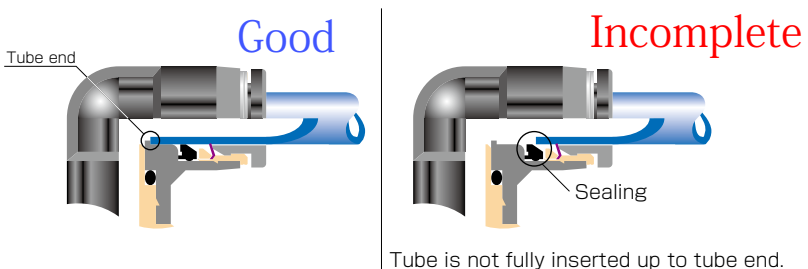
1. Remove dusts or drain before piping. They may get into the peripheral machine / facilities and cause malfunction.
2. When inserting an ultra-soft tube into push-in fitting, make sure to place an Insert Ring into the tube edge. There is a risk of causing the escape of tube and a fluid leakage without using an Insert Ring.
3. The product incorporating NBR as seal rubber material has a risk of malfunction caused by ozone crack. Ozone exists in high concentrations in static elimination air, clean-room, and near the high-voltage motors, etc. As a countermeasure, material change from NBR to HNBR or FKM is necessary. Consult with PISCO for more information.
4. Special option "Oil-free" products may cause a very small amount of a fluid leakage. When a fluid medium is liquid or the products are required to be used in harsh environments, contact us for further information.
5. In case of using non-PISCO brand tubes, make sure the tolerance of the outer tube diameter is within the limits of Table 1.

● Table 1. Tube O.D. Tolerance

| mm size | Nylon tube | Polyurethane tube | inch size | Nylon tube | Polyurethane tube |
|---------|------------|-------------------|-----------|------------|-------------------|
| ø1.8mm  | —          | ± 0.05mm          | ø1/8      | ± 0.1mm    | ± 0.15mm          |
| ø3mm    | —          | ± 0.15mm          | ø5/32     | ± 0.1mm    | ± 0.15mm          |
| ø4mm    | ± 0.1mm    | ± 0.15mm          | ø3/16     | ± 0.1mm    | ± 0.15mm          |
| ø6mm    | ± 0.1mm    | ± 0.15mm          | ø1/4      | ± 0.1mm    | ± 0.15mm          |
| ø8mm    | ± 0.1mm    | ± 0.15mm          | ø5/16     | ± 0.1mm    | ± 0.15mm          |
| ø10mm   | ± 0.1mm    | ± 0.15mm          | ø3/8      | ± 0.1mm    | ± 0.15mm          |
| ø12mm   | ± 0.1mm    | ± 0.15mm          | ø1/2      | ± 0.1mm    | ± 0.15mm          |
| ø16mm   | ± 0.1mm    | ± 0.15mm          | ø5/8      | ± 0.1mm    | ± 0.15mm          |

## 6. Instructions for Tube Insertion

- ① Make sure that the cut end surface of the tube is at right angle without a scratch on the surface and deformations.
- ② When inserting a tube, the tube needs to be inserted fully into the push-in fitting until the tubing edge touches the tube end of the fitting as shown in the figure below. Otherwise, there is a risk of leakage.



- ③ After inserting the tube, make sure it is inserted properly and not to be disconnected by pulling it moderately.
- ※ When inserting tubes, Lock-claws may be hardly visible in the hole, observed from the front face of the release-ring. But it does not mean the tube will surely escape. Major causes of the tube escape are the followings;
- ① Shear drop of the lock-claws edge
  - ② The problem of tube diameter (usually small)
- Therefore, follow the above instructions from ① to ③, even lock-claws is hardly visible.



7. Instructions for Tube Disconnection

- ① Make sure there is no air pressure inside of the tube, before disconnecting it.
- ② Push the release-ring of the push-in fitting evenly and deeply enough to pull out the tube toward oneself. By insufficient pushing of the release-ring, the tube may not be pulled out or damaged by scratch, and tube shavings may remain inside of the fitting, which may cause the leakage later.

8. Instructions for Installing a fitting

- ① When installing a fitting, use proper tools to tighten a hexagonal-column or an inner hexagonal socket. When inserting a hex key into the inner hexagonal socket of the fitting, be careful so that the tool does not touch lock-claws. The deformation of lock-claws may result in a poor performance of systems or an escape of the tube.
- ② Refer to Table 2 which shows the recommended tightening torque. Do not exceed these limits to tighten a thread. Excessive tightening may break the thread part or deform the gasket and cause a fluid leakage. Tightening thread with tightening torque lower than these limits may cause a loosened thread or a fluid leakage.
- ③ Adjust the tube direction while tightening thread within these limits, since some PISCO products are not rotatable after the installation.

● Table 2: Recommended tightening torque / Sealock color / Gasket materials

| Thread type                | Thread size | Tightening torque | Sealock color | Gasket materials |
|----------------------------|-------------|-------------------|---------------|------------------|
| Metric thread              | M3 × 0.5    | 0.7N·m            | —             | SUS304<br>NBR    |
|                            | M5 × 0.8    | 1.0 ~ 1.5N·m      |               |                  |
|                            | M6 × 1      | 2 ~ 2.7N·m        |               |                  |
|                            | M3 × 0.5    | 0.5 ~ 0.6N·m      |               | POM              |
|                            | M5 × 0.8    | 1 ~ 1.5N·m        |               |                  |
|                            | M6 × 0.75   | 0.8 ~ 1N·m        |               |                  |
| Taper pipe thread          | M8 × 0.75   | 1 ~ 2N·m          | White         | —                |
|                            | R1/8        | 7 ~ 9N·m          |               |                  |
|                            | R1/4        | 12 ~ 14N·m        |               |                  |
|                            | R3/8        | 22 ~ 24N·m        |               |                  |
| Unified thread             | R1/2        | 28 ~ 30N·m        | —             | SUS304, NBR      |
|                            | No.10-32UNF | 1.0 ~ 1.5N·m      |               |                  |
| National pipe thread taper | 1/16-27NPT  | 7 ~ 9N·m          | White         | —                |
|                            | 1/8-27NPT   | 7 ~ 9N·m          |               |                  |
|                            | 1/4-18NPT   | 12 ~ 14N·m        |               |                  |
|                            | 3/8-18NPT   | 22 ~ 24N·m        |               |                  |
|                            | 1/2-14NPT   | 28 ~ 30N·m        |               |                  |

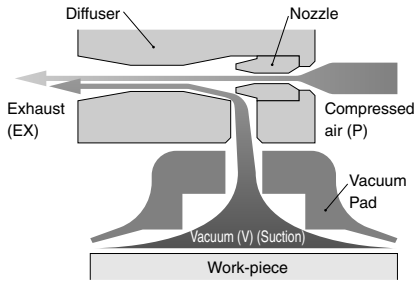
※ These values may differ for some products. Refer to each specification as well.

9. Instructions for removing a fitting

- ① When removing a fitting, use proper tools to loosen a hexagonal-column or an inner hex bolt.
- ② Remove the sealant stuck on the mating equipment. The remained sealant may get into the peripheral equipment and cause malfunctions.

10. Arrange piping avoiding any load on fittings and tubes such as twist, tensile, moment load, shaking and physical impact. These may cause damages to fittings, tube deformations, bursting and the escape of tubes.

# Mechanism of Vacuum Generator



- An ejector (Vacuum generator) can generate the vacuum suction force by applying a compressed air to it. Its mechanism is explained in the left figure.
- Compressed air is squeezed and released to diffuser with high speed. The vacuum force is generated by a drop of pressure level due to a high-speed jet flow, and enables to convey a work-piece.
- An ejector consists of a nozzle and a diffuser in order to obtain a high degree of vacuum level by a high-speed jet flow. Final vacuum, exhaust airflow (suction flow) and air consumption are determined by the shapes and dimensions of these components.

