



# Operation Manual

PRODUCT NAME

Electro-pneumatics Hybrid Regulator

MODEL / Series / Product Number

VY1 Series

**SMC Corporation**

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# 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 relating to systems.

ISO 4413: Hydraulic fluid power -- General rules relating to systems.

IEC 60204-1: Safety of machinery -- Electrical equipment of machines .(Part 1: General requirements)

ISO 10218: Manipulating industrial robots -Safety.

etc.



## Caution

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



## Warning

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



## Danger

**Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious 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. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.



# Safety Instructions

## Caution

### **1. The product is provided for use in manufacturing industries.**

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

## **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 regulation 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.**

## Caution

**SMC products are not intended for use as instruments for legal metrology.**

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.

Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.



## Precautions 1

Be sure to read this before handling.

### Design/Selection

#### ⚠ Warning

##### 1. Confirm the specifications.

Products represented in this manual are designed only for use in compressed air systems.

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

Please contact SMC when using a fluid other than compressed air.

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

##### 2. Please consult with SMC if the intended application calls for absolutely zero leakage, due to special atmospheric requirements, or if the use of a fluid other than air is required.

##### 3. The grease used on internal sliding parts and seals may come in contact with outlet side components. Please consult with SMC if this is not desirable. Please consult with SMC if this is not desirable. Please contact SMC if the Safety Data Sheet (SDS) of the grease is required.

##### 4. Do not disassemble the product or make any modifications, including additional machining.

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

#### ⚠ Caution

##### 1. Select a model that is suitable for the desired air cleanliness by referring to the SMC Best Pneumatics catalog.

### Mounting

#### ⚠ Warning

##### 1. Operation Manual (this copy)

Install the products and operate them 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 products, allow access for maintenance and inspection.

##### 3. Tighten threads with the proper tightening torque.

When installing the products, follow the listed torque specifications.

#### ⚠ Caution

##### 1. Confirm the symbols "1" and "2" before the valve is connected. The port marked "1(P)" is the air inlet and the port marked "2(A)" is the outlet. Reversed connections can cause a malfunction.

##### 2. Ensure sufficient top, bottom, and front clearance for maintenance and operation of each component. Refer to the Dimensions section of the catalog for necessary clearance.

### Piping

#### ⚠ Caution

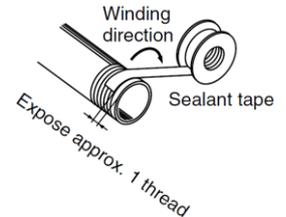
##### 1. Preparation before piping

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.

##### 2. Winding of sealant tape

When screwing piping or fittings into ports, ensure that chips from the pipe threads or sealing material do not enter the piping.

Also, if sealant tape is used, leave 1 thread ridge exposed at the end of the threads.



##### 3. Tightening the fittings and their torque

When screwing fittings into the regulators, make sure to tighten them to the proper torque values given below.

###### ● Connection thread: M5

First, tighten by hand, then use a wrench appropriate for the hexagon flats of the body to tighten an additional 1/6 to 1/4 turn. A reference value for the tightening torque is 1 to 1.5 N·m.

● For the fitting with sealant R or NPT, first, tighten it by hand, then use a wrench appropriate for the hexagon flats of the body to tighten it a further two or three turns. For a tightening torque guide, refer to the table below.

Connection thread size (R, NPT)	Proper tightening torque (N·m)
1/8	3 to 5
1/4	8 to 12
3/8	15 to 20
1/2	20 to 25
3/4	28 to 30
1	36 to 38
1 1/4	40 to 42
1 1/2	48 to 50
2	48 to 50

### Air Supply

#### ⚠ Warning

##### 1. Type of fluids

Please consult with SMC when using the product in applications other than compressed air.

##### 2. Take measures to ensure air quality, such as by installing an aftercooler, air dryer, or water separator.

Compressed air that contains a large amount of drainage can cause the malfunction of pneumatic equipment, such as filters, regulators, and lubricators. Therefore, take appropriate measures to ensure air quality, such as by providing an aftercooler, air dryer, or water separator.

##### 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 the Air Preparation Equipment Selection Guide (Best Pneumatics).



## Precautions 2

Be sure to read this before handling.

**Air Supply** **Warning****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.

When synthetic oil is used for the compressor oil, depending on the type of synthetic oil used or on the conditions of use, there may be adverse effects on the resin of the pneumatic equipment or on the seals if the oil is flowed out to the outlet side. The mounting of a main line filter is recommended in such cases.

 **Caution****1. Ensure that the fluid and ambient temperatures are within the specified range.**

When using at low temperatures, drain or moisture could solidify or freeze, causing damage to the seals or equipment malfunction. If the fluid temperature is less than 5°C, the moisture in the circuit could freeze, causing damage to the seals or equipment malfunction. Therefore, take appropriate measures to prevent freezing.

For compressed air quality, refer to the Air Preparation Equipment Selection Guide (Best Pneumatics).

**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.**

Refer to the construction diagram in the catalog for details of the materials used in the product.

**2. Do not expose the product to direct sunlight for an extended period of time.****3. Do not use in a place subject to heavy vibration and/or shock.****4. Do not mount the product in locations where it is exposed to radiant heat.****Maintenance** **Warning****1. Maintenance should be performed according to the procedure indicated in the Operation Manual (this copy).**

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. Drain flushing**

Remove drainage from air filters regularly.

**4. 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 off the supply pressure and electric power, and exhaust all compressed air from the system using the residual pressure release function.

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

**Design/Selection** **Warning****1. Attach a safety device if damage or malfunction of equipment and devices on the outlet side may result from the output pressure exceeding the set pressure.****2. It may take some time to release the residual pressure in the outlet side after releasing the inlet pressure. The value of the residual pressure can be checked using the outlet pressure gauge.****3. Please contact SMC if air will not be consumed in the system for long periods of time or if the outlet side will be used with a sealed circuit and a balanced circuit, since this may cause the set pressure of the outlet side to fluctuate.****4. Please contact SMC when a circuit requires the use of a regulator having relief sensitivity with high precision and setting accuracy.****Adjustment** **Warning****1. Set the regulator while confirming the displayed values of the inlet and outlet pressure gauges.****Lubrication** **Caution**

1. The regulator has been lubricated for life by the factory and does not require any further lubrication.

2. If a lubricant is used in the system, use class 1 turbine oil (no additives), ISO VG32. For details about lubricant manufacturers' brands, refer to the SMC website. Additionally, please contact SMC for details about class 2 turbine oil (with additives) ISO VG32.

Once lubricant is utilized within the system, since the original lubricant applied within the product during manufacturing will be washed away, please continue to supply lubrication to the system. Without continued lubrication, malfunctions could occur.

If turbine oil is used, refer to the Safety Data Sheet (SDS) of the oil.



# VY1 Series Specific Product Precautions 1

Be sure to read this before handling.

## Pressure Gauge

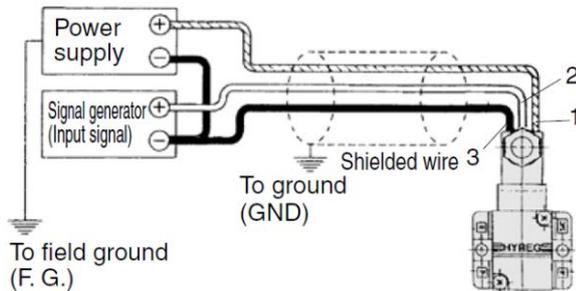
### ⚠ Caution

For products with pressure gauge, use caution about the durability of a pressure gauge, since it may be affected by the sudden pressure changes during operation.

## Wires to be Used

### ⚠ Caution

Use 3 core shielded wires measuring 0.5 (mm<sup>2</sup>) for the power supply and signal lines according to the respective number of conductors. When connecting the shielded braided wire, connect it to the ground of the signal generator. As a rule, the electro-pneumatic hybrid regulator should be installed in a location that is free of noise or is shielded. If it must be installed in an environment with poor noise conditions, eliminate the power supply noise by using a line filter, Z-wrap, or a spark killer on the 100 V power supply or signal source line. The length of the power supply and signal lines must be kept as short as possible.



Terminal no.	Details of wire connection
1	Power supply (+)
2	Command signal (+)
3	GND (-) COMMON

## How to Use DIN Terminal

### ⚠ Caution

#### ● Wiring procedures

- Loosen the retaining screw and pull the connector from the solenoid valve terminal block.
- Remove the retaining screw, insert a flat head screwdriver into the groove below the terminal block and pry it up to separate the terminal block from the housing.
- Loosen the terminal screws (slot head screws) on the terminal block. Then, in accordance with the wiring procedure, insert the cord of the lead wires into the terminals and tighten the terminal screws to secure in place.
- Tighten the ground nut to secure the cord.

#### ● Outlet changing procedure

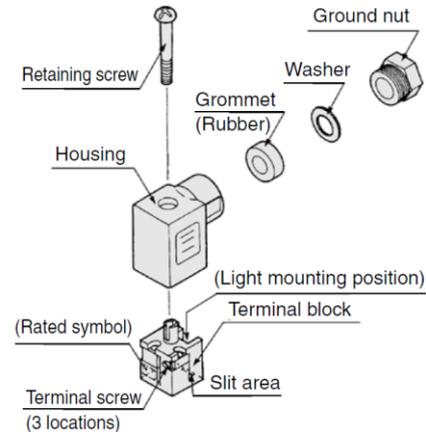
After the terminal block has been separated from its housing, reassemble the housing in the desired direction (in four 90° increments) to change the direction of the cord outlet.

#### ● Precautions

Kindly insert the connector straight in without tilting it, and pull it out straight.

#### ● Applicable wire

Cord external diameter: φ4 to φ6.5 c.f. 0.5 mm<sup>2</sup> 3 core wire (JIS C 3306 equivalent)



## Input Signal

### ⚠ Caution

#### ● Input signal when out of operation

There is dispersion in operation start voltage (current) for the input signal.

If the command signal when out of operation exceeds the lower limit of the operation start voltage (current), the solenoid valve inside the pilot valve starts to activate and may be in the operation state. The service life of this product varies depending on the operating time of the solenoid valve inside the pilot valve. Be sure to cut off the command signal when the pressure control on the outlet side is not required, such as when the line is temporarily halted, etc.

#### Command signal voltage (current) for starting the operation of a pilot valve VY1D00 (direct operated)

(There is dispersion in the following range)

Symbol (1)	Input signal	Operation start range
Nil, 5	1 to 5 VDC	0.93 to 1.07 VDC
1, 6	0 to 10 VDC	0.01 to 0.1 VDC
2, 7	4 to 20 mA DC	3.7 to 4.3 mA DC
3, 8	0 to 20 mA DC	0.02 to 0.2 mA DC

Note 1) Enter symbols above □ in VY1D00-□\*\*. □ indicates power supply and a command signal.

Note 2) Other body sizes add the dispersion on the above data when the main valve activates.

## Bleed

### ⚠ Caution

Since the pilot solenoid valve enters the normally operating status and the air is discharged continuously from the pilot EXH port (port 3 (R) for VY1D00, VY1A0□ and VY1B0□) in the pressure setting status, the bleed sound is produced. However, this is not an abnormal phenomenon.

## Operating Fluid

### ⚠ Caution

- If drainage or debris is present in the supply pressure line, the sliding resistance of the main valve or piston, etc. increases, resulting in a malfunction. Therefore, in addition to the air filter (SMC's AF series), make sure to use a mist separator (SMC's AM, AFM series). Concerning the quality of the operating air, refer to SMC's air preparation equipment selection guide.
- Make sure to perform a maintenance periodically on air filter and mist separator (by discharging the drain and cleaning a filter element or replacing with new one).



# VY1 Series Specific Product Precautions 2

Be sure to read this before handling.

## Option

Description		Part no.									
		VY1D00	VY1A0 <sup>0</sup> <sub>1</sub>	VY1B0 <sup>0</sup> <sub>1</sub>	VY110 <sup>0</sup> <sub>1</sub>	VY120 <sup>0</sup> <sub>1</sub>	VY130 <sup>0</sup> <sub>1</sub>	VY140 <sup>0</sup> <sub>1</sub>	VY150 <sup>0</sup> <sub>1</sub>	VY170 <sup>0</sup> <sub>1</sub>	VY190 <sup>0</sup> <sub>1</sub>
Bracket (With bolt, washer)	<b>B</b>	—	VEXA-18-2A	—	VEX1-18-1A	—	VEX3-32A	—	VEX5-32A	VEX7-32A	VEX9-32A
	<b>F</b>	—	VEXA-18-3A	—	VEX1-18-2A	—	—	—	—	—	—
Pressure gauge	<b>G</b>	—	—	G27-10-R1-X207	G27-10-01	G36-10-01	—	—	—	G46-10-01	—
Pilot EXH port silencer	<b>N</b>	AN120-M5	—	—	AN120-M5	AN101-01	AN120-M5	—	—	AN210-02	—

## Sub-plate and Base Gasket Part No.

Valve size	D	B																
Sub-plate	<b>VEXD-5</b> (Port size: M5)	<p><b>VEXB-2-2</b> □ □ P</p> <p>Port size</p> <table border="1"> <thead> <tr> <th>Symbol</th> <th>Port size</th> </tr> </thead> <tbody> <tr> <td><b>A</b></td> <td>M5</td> </tr> <tr> <td><b>B</b></td> <td>1/8</td> </tr> </tbody> </table> <p>Thread type</p> <table border="1"> <thead> <tr> <th>Symbol</th> <th>Thread type</th> </tr> </thead> <tbody> <tr> <td><b>Nil</b></td> <td>Rc</td> </tr> <tr> <td><b>F</b></td> <td>G (1)</td> </tr> <tr> <td><b>N</b></td> <td>NPT</td> </tr> <tr> <td><b>T</b></td> <td>NPTF</td> </tr> </tbody> </table>	Symbol	Port size	<b>A</b>	M5	<b>B</b>	1/8	Symbol	Thread type	<b>Nil</b>	Rc	<b>F</b>	G (1)	<b>N</b>	NPT	<b>T</b>	NPTF
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Base gasket	<b>VYD-7</b>	<b>VEXB-4-1</b>																

Valve size	2	4																																		
Sub-plate	<p><b>VEX1-9-1</b> □ □ P</p> <p>Port size</p> <table border="1"> <thead> <tr> <th>Symbol</th> <th>Port size</th> </tr> </thead> <tbody> <tr> <td><b>A</b></td> <td>1/8</td> </tr> <tr> <td><b>B</b></td> <td>1/4</td> </tr> </tbody> </table> <p>Thread type</p> <table border="1"> <thead> <tr> <th>Symbol</th> <th>Thread type</th> </tr> </thead> <tbody> <tr> <td><b>Nil</b></td> <td>Rc</td> </tr> <tr> <td><b>F</b></td> <td>G (1)</td> </tr> <tr> <td><b>N</b></td> <td>NPT</td> </tr> <tr> <td><b>T</b></td> <td>NPTF</td> </tr> </tbody> </table>	Symbol	Port size	<b>A</b>	1/8	<b>B</b>	1/4	Symbol	Thread type	<b>Nil</b>	Rc	<b>F</b>	G (1)	<b>N</b>	NPT	<b>T</b>	NPTF	<p><b>VEX4-2A-</b> □ □ P</p> <p>Port size</p> <table border="1"> <thead> <tr> <th>Symbol</th> <th>Port size</th> </tr> </thead> <tbody> <tr> <td><b>A</b></td> <td>1/4</td> </tr> <tr> <td><b>B</b></td> <td>3/8</td> </tr> <tr> <td><b>C</b></td> <td>1/2</td> </tr> </tbody> </table> <p>Thread type</p> <table border="1"> <thead> <tr> <th>Symbol</th> <th>Thread type</th> </tr> </thead> <tbody> <tr> <td><b>Nil</b></td> <td>Rc</td> </tr> <tr> <td><b>F</b></td> <td>G (1)</td> </tr> <tr> <td><b>N</b></td> <td>NPT</td> </tr> <tr> <td><b>T</b></td> <td>NPTF</td> </tr> </tbody> </table>	Symbol	Port size	<b>A</b>	1/4	<b>B</b>	3/8	<b>C</b>	1/2	Symbol	Thread type	<b>Nil</b>	Rc	<b>F</b>	G (1)	<b>N</b>	NPT	<b>T</b>	NPTF
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Base gasket	<b>VEX1-11-2</b>	<b>VEX4-4</b>																																		

Note 1) Not conforming to ISO1179-1.

Applicable valve	VY1B0 <sup>0</sup> <sub>1</sub>	VY120 <sup>0</sup> <sub>1</sub>	VY140 <sup>0</sup> <sub>1</sub>
<b>Blanking plate assembly</b> (2)	VEXB-6	VEX1-17	VEX4-5

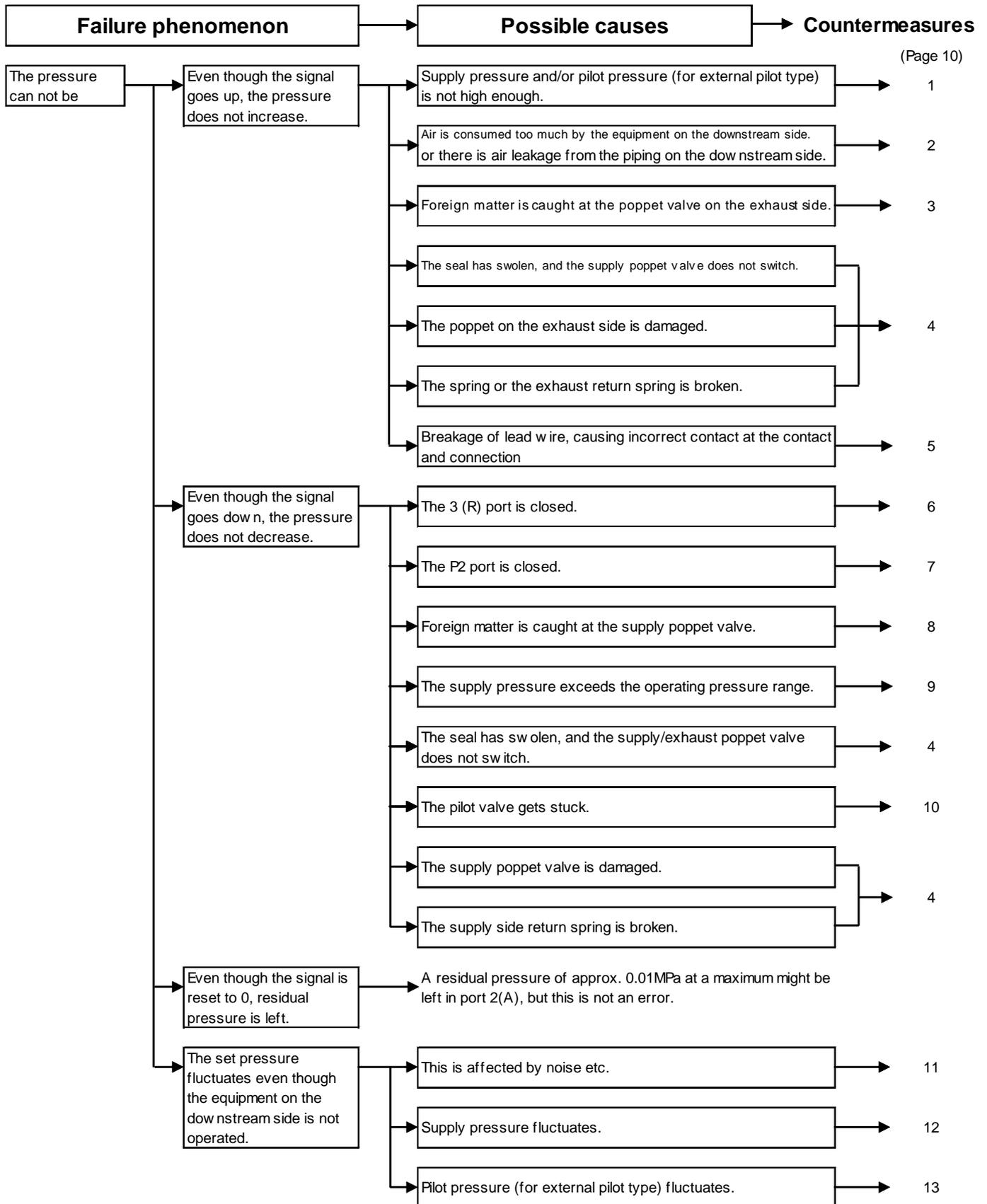
Note 2) Gasket and mounting bolts are equipped.

- DIN connector part no.:VK300-82-1

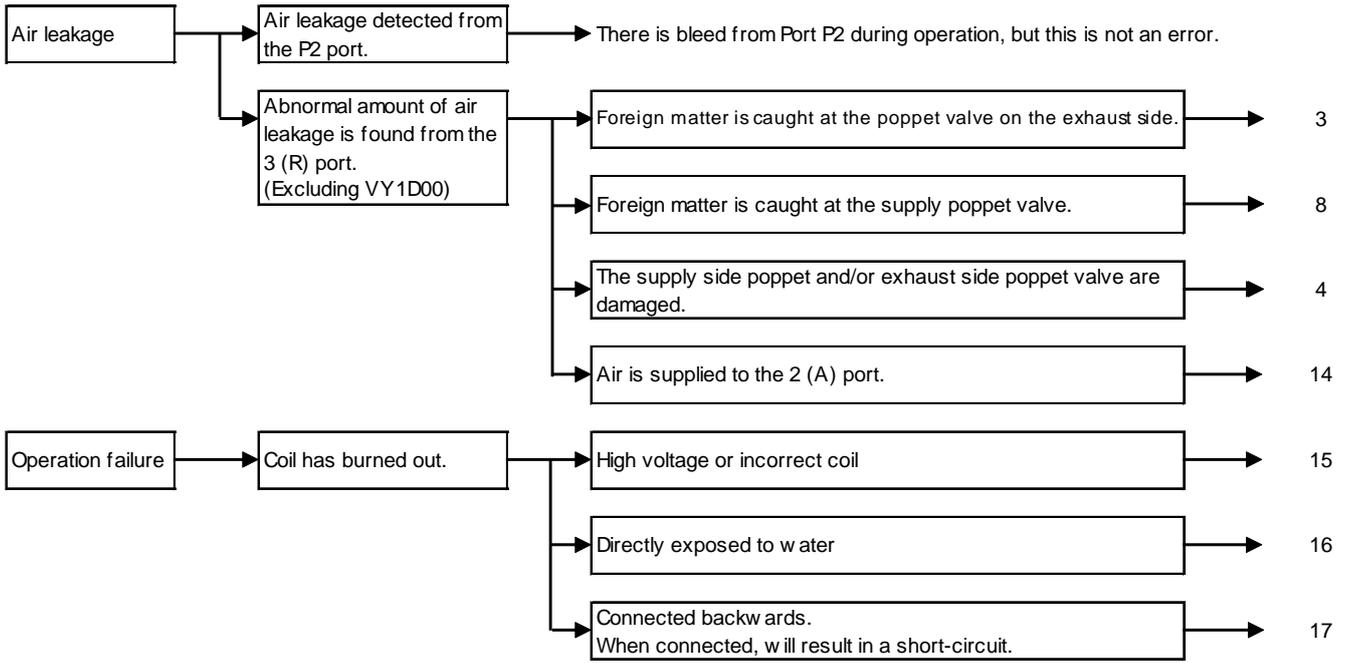
# Troubleshooting

First, confirm the total operation time.

If it exceeds the guide of 4000 to 5000Hrs (in super-dry air, 300Hrs), the pilot valve may have reached its life expectancy, therefore, please replace it.



(Page 10)



## Countermeasures

No.	Countermeasures
1	Ensure proper supply pressure and pilot pressure
2	Stop the equipment which is using the air. Locate the source of any air leaks and repair them.
3	Reset the signal to 0, pressurize port 2 (A) and exhaust air from port 3 (R). (It is possible to blow the poppet valve.)
4	Replace the electro-pneumatic hybrid regulator.
5	Check the connection. Please check that each wire and cable is not broken.
6	Open the 3 (R) port.
7	Open the P2 port.
8	Input signal, and supply air to port 2 (A). (It is possible to blow the poppet valve.)
9	Replace the pilot valve, and adjust the supply pressure so that it will be in the operating pressure range.
10	Replace the pilot valve assembly.
11	Refer to the cautions (operating cable), and take countermeasures.
12	Install a tank on the supply side to stabilize the supply pressure.
13	Install a tank on the pilot pressure supply side to stabilize the pilot pressure.
14	Check the air flow direction, and if it is incorrect, mount the regulator in the correct fluid flow direction.
15	Check the voltage, and replace the pilot valve assembly.
16	Protect the valve especially the coil to prevent it from being exposed to water.
17	Replace the pilot valve assembly. Check the polarity, and properly connect the wiring.

If the countermeasures above are not effective, there may be a problem with the electro-pneumatic hybrid regulator. Stop using the electro-pneumatic hybrid regulator immediately.

If any of the examples below are applicable, there may be an internal problem with the electro-pneumatic hybrid regulator. Stop using the electro-pneumatic hybrid regulator immediately.

- 1) The voltage used was not the rated voltage.
- 2) The oil supplied was not the specified type.
- 3) Lubrication was stopped during operation. Or, lubrication was interrupted temporarily
- 4) The product was directly exposed to water
- 5) Severe impact was applied.
- 6) Foreign matter such as condensate or dust has entered the product
- 7) Other than the cases mentioned above, any usage which falls into the precautions given in this Operation Manual.

If the product has failed, then please return the electro-pneumatic hybrid regulator as it is.

Revision history	
<input checked="" type="checkbox"/> Renewal	WQ

1st printing : -

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

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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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