



# Operation Manual

PRODUCT NAME

***In-line Type Vacuum Ejector***

Model / Series / Product Number

***ZU Series***

**SMC Corporation**

# Contents

Safety Instructions	<a href="#">2</a>
How to Order	<a href="#">4</a>
Operating Environment	<a href="#">4</a>
Mounting	<a href="#">5</a>
Piping	<a href="#">5</a>
Air Supply	<a href="#">6</a>
Model Selection	<a href="#">6</a>
Ejector Characteristics	<a href="#">7</a>
Identification	<a href="#">8</a>
Construction	<a href="#">8</a>
Specifications	<a href="#">9</a>
Exhaust Characteristics / Flow Rate Characteristics (Representative Value)	<a href="#">10</a>
Maintenance	<a href="#">11</a>
Trouble shooting (Vacuum Adsorption System)	<a href="#">11</a>



# 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

**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.

## In-line Type Vacuum Ejector

## ZU□A Series

## How to Order

**ZU 05 S A □**

**Nozzle diameter**

03	0.3 mm
04	0.4 mm
05	0.5 mm
07	0.7 mm

**Port size**

Symbol	Port size	ZU03/04	ZU05/07
Nil	ø4 One-touch fitting	●	—
	ø6 One-touch fitting	—	●
01	Rc1/8 female thread	—	●
N	ø5/32"	●	—

**Symbol**

**Ultimate vacuum pressure**

Symbol	Ultimate vacuum pressure	ZU03/04	ZU05/07
S	-85 kPa (ZU03)/-87 kPa (ZU04)	●	—
	-90 kPa	—	●
L	-40 kPa	●	—
	-48 kPa	—	●

## Operating Environment

**Warning**

- 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.
- Do not use in a place subject to heavy vibration and/or shock.
- Do not use in an environment where flammable gas or explosive gas exists. Usage may cause a fire or explosion. The products do not have an explosion-proof construction.
- The product should not be exposed to prolonged sunlight. Use a protective cover.
- Remove any sources of excessive heat.
- In locations where there is contact with spatter from water, oil, solder, etc., take suitable protective measures.
- Keep the ambient temperature of the product between 5 and 50°C. At the same time, avoid rapid temperature changes even within the specified temperature range.

## Mounting

### Caution

1. When this product is mounted in between piping, the piping on both the P port and V port side should be adequately supported to avoid causing unnecessary loading and stressing of the product which may lead to performance issues or damage to the body of the product.
2. When mounting the product, please do not block the exhaust port at the center of the body during installation as this may cause performance issues.

## Piping

### Caution

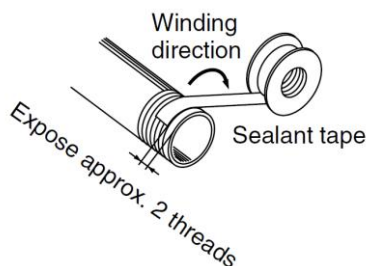
1. Refer to the Fittings and Tubing Precautions for handling One-touch fittings.

#### 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.

#### 3. 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 use, leave 1.5 to 2 thread ridges exposed at the end of the threads.



#### 4. Use piping with adequate conductance.

Select equipment and piping for the vacuum side which has adequate conductance so that the ejector's maximum suction flow rate can be accommodated by the piping.

Also, make sure that there are no unnecessary restrictions, leaks, etc., along the course of the piping.

Furthermore, the air supply should be designed while taking into consideration the ejector's maximum air consumption and the air consumption of other pneumatic circuits.

#### 5. Avoid disorganized piping.

Piping which is direct and of the shortest possible length should be used for both the vacuum and supply sides.

Disorganized piping should be avoided. Unnecessary length increases the piping volume, and thus increases

the response time.

**6. Be certain that there are no crushed areas in the piping due to damage or bending.**

**7. Piping diameter**

The piping diameter for each port should be the standard size for One-touch fittings. If the piping diameter is reduced, it may lead to the insufficient flow of supply air, the reduction of suction flow, and a reduction in the vacuum pressure.

**8. One-touch fittings**

Refer to the "Fittings and Tubing Precautions" on the SMC website for handling One-touch fittings.

**9. Piping to the female thread type**

When mounting a fitting to the screw-in stud (female thread), hold the width across flats with an appropriate size wrench. If the load is applied to the resin body directly, it may damage the body.

## Air Supply

### Caution

**(1) Quality of supply air**

Use clean compressed air as fluid. (Air quality class 2: 4: 3, 2: 5: 3 or 2: 6: 3 as specified in ISO 8573-1: 2010). If impurities enter the product, vacuum performance might be reduced due to the deterioration of the air passage or clogging of the exhaust system.

**(2) Drain flushing**

If drain in the air filter or mist separator is not removed, the drain flows from the outlet, causing the pneumatic equipment to malfunction. If drain flushing is deemed difficult, it is recommended to use a product with an auto drain option. For details about compressed air quality, refer to the SMC Best Pneumatics No. 6 catalog.

## Model Selection

### Caution

**(1) Supply valve**

Select a supply valve which can supply a sufficient flow rate that takes the ejector air consumption into account. If the flow rate of the supply valve is insufficient, it may lead to vacuum failure. The selected supply valve should have a C factor of at least the value shown in the table below.

### Minimum C Factor of a Supply Valve

Model	C [dm <sup>3</sup> /(s·bar)]
<b>ZU03</b>	0.04
<b>ZU04</b>	0.08
<b>ZU05</b>	0.12
<b>ZU07</b>	0.23

**(2) Mounting of air equipment**

If particles are sucked through the vacuum (V) port during workpiece adsorption, the vacuum performance might be reduced due to the adhesion of particles in the air passage of the product or clogging of the exhaust passage (silencer). The installation of an air suction filter (ZFA, ZFB, or ZFC series) in the middle of the piping on the vacuum side is recommended to prevent performance reduction. If air containing moisture is sucked, vacuum performance might also be reduced for the same reason. In this case, install a drain separator for vacuum (AMJ series).

**(3) The maximum vacuum pressure of the vacuum ejector is affected by the atmospheric pressure of the operating environment.**

As atmospheric pressure changes based on altitude, climate, etc., the actual maximum vacuum pressure may not reach the value listed in the specifications.

## Ejector Characteristics

### **Caution**

**1. Intermittent noise during vacuum generation**

When the ejector standard supply pressure is close to the pressure that generates peak vacuum pressure, the vacuum pressure may become unstable due to fluid vibration. If there is any operation failure or the intermittent noise needs to be reduced, increase or decrease the supply pressure. Avoid the supply pressure range where the vacuum pressure becomes unstable.

**2. Temperature reduction and vapor condensation during vacuum generation**

When the ejector generates vacuum, compressed air expands adiabatically after passing through the nozzle. This reduces the temperature around the nozzle, so condensation might be generated on the product surface (the condensation dew point may vary depending on the temperature and relative humidity of the operating environment).

## Identification

### Caution

- The nozzle diameter and type (S or L) can be identified by the Model number printed on the side of the product.  
(Fig. 1)

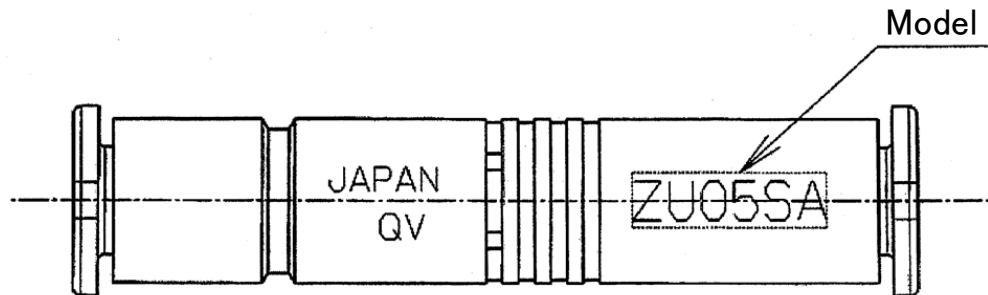
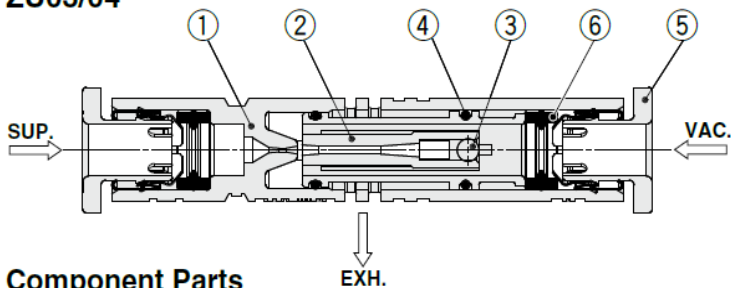


Fig.1

## Construction

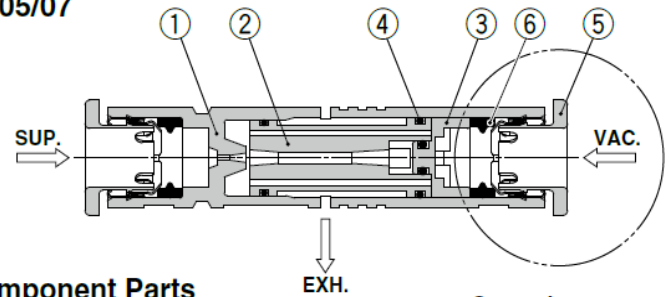
### ZU03/04



#### Component Parts

No.	Description	Material	Note
1	Body	Resin	
2	Diffuser	Resin	
3	Steel ball	Stainless steel	
4	O-ring	NBR	Grease applied
5	Cassette	—	
6	Seal	NBR	Grease applied

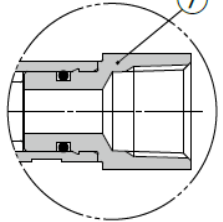
### ZU05/07



#### Component Parts

No.	Description	Material	Note
1	Body	Resin	
2	Diffuser	Resin	
3	Cap	Resin	
4	O-ring	NBR	Grease applied
5	Cassette	—	
6	Seal	NBR	Grease applied
7	Screw-in stud	Brass	Electroless nickel plating

Screw-in type ⑦



## Specifications

### Specifications

Operating temperature range		-5 to 50°C (No freezing)	
Fluid		Air	
Applicable tubing material		FEP, PFA, Nylon, Soft nylon, Polyurethane	
Operating pressure range		0.1 to 0.6 MPa	
Standard supply pressure	ZU03/04	0.35 MPa	
	ZU05/07	0.45 MPa	

### Ejector Specifications<sup>\*1</sup>

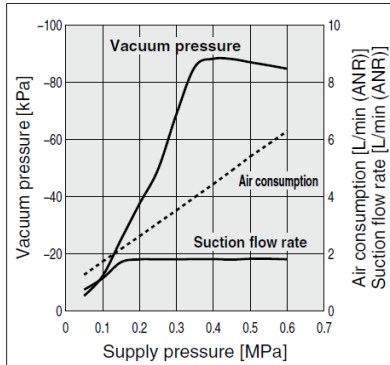
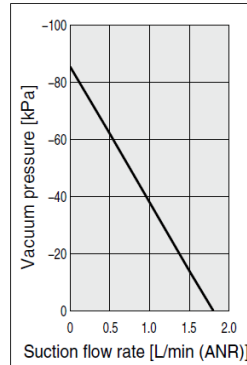
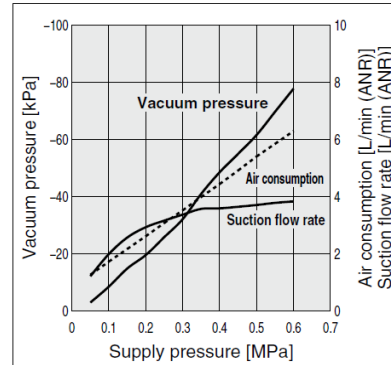
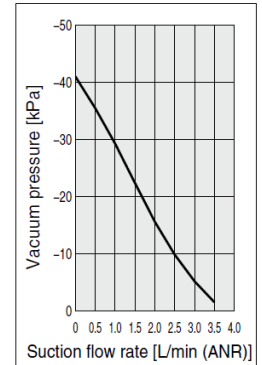
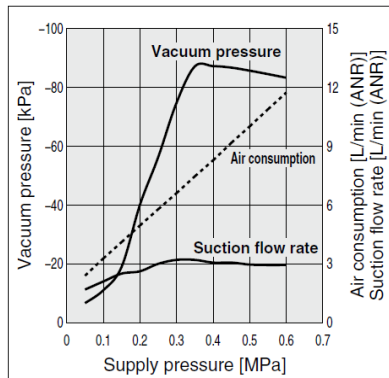
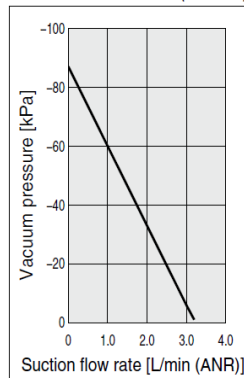
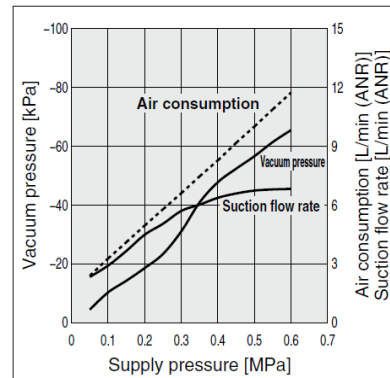
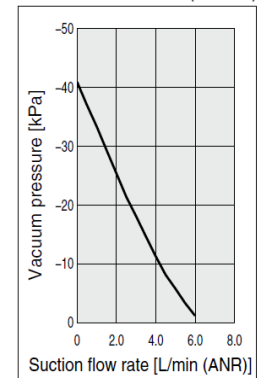
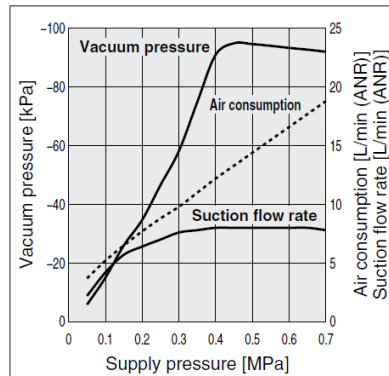
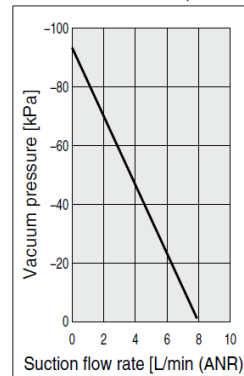
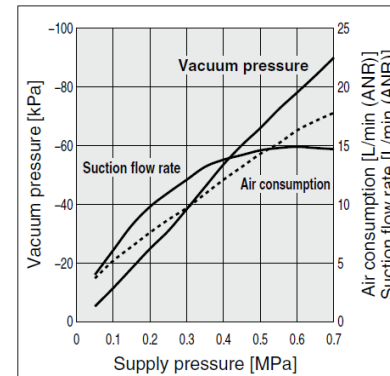
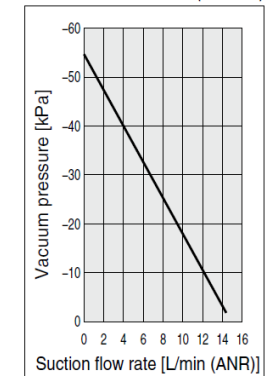
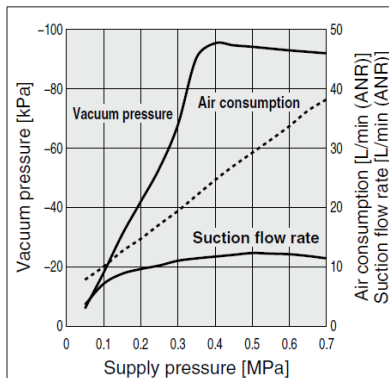
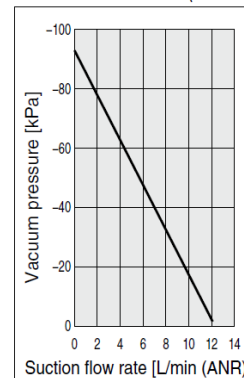
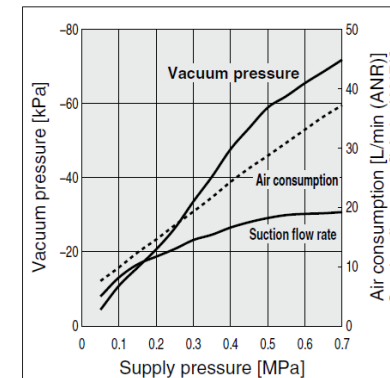
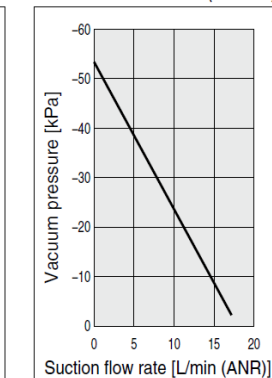
Model	Nozzle diameter [mm]	Ultimate vacuum pressure <sup>*2</sup> [kPa]		Maximum suction flow rate <sup>*2</sup> [L/min (ANR)]		Air consumption <sup>*2</sup> [L/min (ANR)]	Weight [g]	
		Type S	Type L	Type S	Type L		One-touch connection	Screw-in connection
<b>ZU03□A</b>	0.3	-85	-40	1.8	3.4	4.2	2.4	—
<b>ZU04□A</b>	0.4	-87		3.2	5.8	7.7		
<b>ZU05□A</b>	0.5	-90	-48	7	13	14	3.9	18.6
<b>ZU07□A</b>	0.7			11	16	28	4.3	19.1

\*1 The values indicating characteristics are representative values, and may vary depending on the atmospheric pressure (weather, altitude, etc.) and measurement method.

\*2 Standard supply pressure

**Exhaust Characteristics/Flow Rate Characteristics (Representative Value)**

(Flow rate characteristics: Standard supply pressure)

**ZU03SA****Exhaust Characteristics****Flow Rate Characteristics (0.35 MPa)****ZU03LA****Exhaust Characteristics****Flow Rate Characteristics (0.35 MPa)****ZU04SA****Exhaust Characteristics****Flow Rate Characteristics (0.35 MPa)****ZU04LA****Exhaust Characteristics****Flow Rate Characteristics (0.35 MPa)****ZU05SA****Exhaust Characteristics****Flow Rate Characteristics (0.45 MPa)****ZU05LA****Exhaust Characteristics****Flow Rate Characteristics (0.45 MPa)****ZU07SA****Exhaust Characteristics****Flow Rate Characteristics (0.45 MPa)****ZU07LA****Exhaust Characteristics****Flow Rate Characteristics (0.45 MPa)**

## 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 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 after remounting or replacement, first confirm that measures are in place to prevent the lurching of actuators, etc. Then, confirm that the equipment is operating normally.

## Troubleshooting (Vacuum Adsorption System)

Condition & Description of improvement	Contributing factor	Countermeasure
Initial adsorption problem (During trial operation)	Adsorption area is small. (Lifting force is lower than the workpiece mass.)	Recheck the relationship between workpiece mass and lifting force. • Use a vacuum pad with a large adsorption area. • Increase the quantity of vacuum pads.
	Vacuum pressure is low. (Leakage from adsorption surface) (Air permeable workpiece)	Eliminate (reduce) leakage from adsorption surface. • Reconsider the shape of a vacuum pad. Check the relationship between suction flow rate and arrival pressure of vacuum ejector. • Use a vacuum ejector with a high suction flow rate. • Increase adsorption area.
	Vacuum pressure is low. (Leakage from vacuum piping)	Repair leakage point.
	Internal volume of vacuum circuit is large.	Check the relationship between internal volume of the vacuum circuit and suction flow rate of the vacuum ejector. • Reduce internal volume of the vacuum circuit. • Use a vacuum ejector with a high suction flow rate.
	Pressure drop of vacuum piping is large.	Reconsider vacuum piping. • Use a shorter or larger tube (with appropriate diameter).
	Inadequate supply pressure of vacuum ejector	Measure supply pressure in vacuum generation state. • Use standard supply pressure. • Reconsider compressed air circuit (line).
	Clogging of nozzle or diffuser (Infiltration of foreign matter during piping)	Remove foreign matter.
	Supply valve (switching valve) is not being activated.	Measure supply voltage at the solenoid valve with a tester. • Reconsider electric circuits, wiring and connectors. • Use in the rated voltage range.
	Workpiece deforms during adsorption.	Since a workpiece is thin, it deforms and leakage occurs. • Use a pad for adsorption of thin objects.

Condition & Description of improvement	Contributing factor	Countermeasure
Late vacuum achieving time (Shortening of response time)	Internal volume of vacuum circuit is large.	Check the relationship between internal volume of the vacuum circuit and suction flow rate of the vacuum ejector. • Reduce internal volume of the vacuum circuit. • Use a vacuum ejector with a high suction flow rate.
	Pressure drop of vacuum piping is large.	Reconsider vacuum piping. • Use a shorter or larger tube (with appropriate diameter).
	Using the product as close to the highest vacuum power in the specifications.	Set vacuum pressure to minimum necessary value by optimizing the pad diameter etc. As the vacuum power of an ejector (venturi) rises, the vacuum flow actually lowers. When an ejector is used at its highest possible vacuum value, the vacuum flow will lower. Due to this, the amount of time needed to achieve adsorption is lengthened. One should consider an increase in the diameter of the ejector nozzle or an increase the size of the vacuum pad utilized in order to lower the required vacuum pressure, maximum the vacuum flow, and speed up the adsorption process.
	Setting of vacuum pressure switch is too high.	Set to suitable setting pressure.
Fluctuation in vacuum pressure	Fluctuation in supply pressure	Reconsider compressed air circuit (line). (Addition of a tank etc.)
	Vacuum pressure may fluctuate under certain conditions due to ejector characteristics.	Lower or raise supply pressure a little at a time, and use in a supply pressure range where vacuum pressure does not fluctuate.
Occurrence of abnormal noise (intermittent noise) from exhaust of vacuum ejector	Intermittent noise may occur under certain conditions due to ejector characteristics.	Lower or raise supply pressure a little at a time, and use in a supply pressure range where the intermittent noise does not occur.
Adsorption problem over time (Adsorption is normal during trial operation.)	Clogging of suction filter	Replace filters. Improve installation environment.
	Clogging of nozzle or diffuser	Remove foreign matter. Add a filter to supply (compressed) air circuit. Install an additional suction filter.
	Vacuum pad (rubber) deterioration, cracking, etc.	Replace vacuum pads. Check the compatibility of vacuum pad material and workpiece.
Workpiece is not released.	Inadequate release flow rate	Open release flow adjustment needle.
	Vacuum pressure is high. Excessive force (adhesiveness of the rubber + vacuum pressure) is applied to the pad (rubber part).	Reduce the vacuum pressure. If inadequate lifting force causes a problem in transferring the workpieces, increase the number of pads.
	Effects due to static electricity	Use a conductive pad.
	Adhesiveness of the rubber increases due to the operating environment or wearing of the pad. • Adhesiveness of the rubber material is high. • Adhesiveness increases due to wearing of	Replace pads. Reconsider the pad material and check the compatibility of pad material and workpiece. Reconsider the pad form. (Changes to rib, groove, blast options)
		Reconsider the pad diameter and quantity of pads.

Revision history

## SMC Corporation

4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021 JAPAN

Tel: + 81 3 5207 8249 Fax: +81 3 5298 5362

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

---

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

© 2021 SMC Corporation All Rights Reserved