



# Operation Manual

PRODUCT NAME

***Vacuum Ejector  
Body Ported Type/Box Type (Built-in Silencer)***

MODEL / Series / Product Number

***ZH Series***

**SMC Corporation**

# Contents

Safety Instructions	<a href="#">2</a>
How to Order	<a href="#">4</a>
Operating Environment	<a href="#">6</a>
Mounting	<a href="#">6</a>
Piping	<a href="#">9</a>
Air Supply	<a href="#">10</a>
Model Selection	<a href="#">11</a>
Ejector Characteristics	<a href="#">11</a>
When Operating the Ejector	<a href="#">12</a>
Identification	<a href="#">12</a>
Construction	<a href="#">13</a>
Specifications	<a href="#">13</a>
Exhaust Characteristics / Flow Rate Characteristics (Representative Value)	<a href="#">14</a>
Circuit Examples	<a href="#">16</a>
Maintenance	<a href="#">18</a>
Trouble shooting (Vacuum Adsorption System)	<a href="#">18</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.

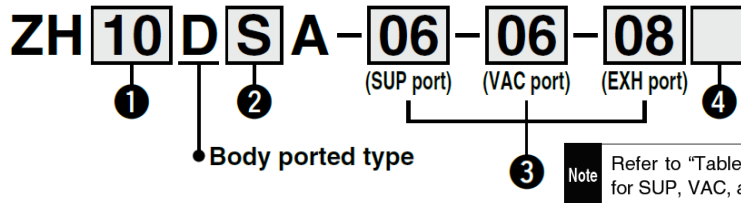
Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

# Body Ported Type Vacuum Ejector

## ZH Series

### How to Order

Body ported



Note Refer to "Table 1" for the combination available for SUP, VAC, and EXH port connection.

#### 1 Nozzle size

Nozzle size	Nozzle size
05	ø0.5 mm
07	ø0.7 mm
10	ø1.0 mm
13	ø1.3 mm
15	ø1.5 mm
18	ø1.8 mm
20	ø2.0 mm

#### 2 Vacuum pressure reached

Vacuum pressure reached	Note
S	-90 kPa ZH05 to 20
L	-48 kPa ZH05 to 13
	-66 kPa ZH15 to 20

#### 3 Port (SUP/VAC/EXH) size

##### One-touch fittings

Metric size	Inch size
06	ø6
08	ø8
10	ø10
12	ø12
07	ø1/4"
09	ø5/16"
11	ø3/8"
13	ø1/2"

##### Female threads

Metric size	Inch size
01	Rc1/8
02	Rc1/4
03	Rc3/8
04	Rc1/2
F01	G1/8
F02	G1/4
F03	G3/8
F04	G1/2
N01	NPT1/8
N02	NPT1/4
N03	NPT3/8
N04	NPT1/2

#### 4 Accessories (Standard bracket/Silencer)\*4

Symbol	Standard bracket	Silencer
Nil	●	×
N	×	×
S*3	●	●
NS*3	×	●

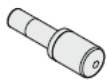
\*3 Options S and NS are not available for EXH port with a screw-in connection.

\*4 Each accessory is not assembled with the product but shipped together.

##### Standard bracket

Applicable model	ZH05 to 10D□A	ZH13/15D□A	ZH18/20D□A
Model	ZH2-BK1A-1-A	ZH2-BK1A-2-A	ZH2-BK1A-3-A

##### Silencer



- Silencer can only be selected for EXH port with One-touch fitting.
- The silencer part number depends on the size of the EXH port.

EXH port	Silencer part no.
06	AN10-C06
07	AN10-C07
08	AN15-C08
09	AN15-C08
10	AN20-C10
11	AN20-C11
12	AN30-C12

\* No silencer available for ZH18/20D□A in inch size for EXH port size '13'  
In that case, select the screw-in connection, and order silencer AN30-N03 and AN40-N04 separately  
For details about silencers, refer to the AN series in the Web Catalog.

Table 1 Body ported SUP/VAC/EXH port size

Model	Metric Size			Inch Size		
	SUP	VAC	EXH	SUP	VAC	EXH
ZH05D□A-	06 - 06 - 06	ø6	ø6	ø6	ø6	ø6
	06 - 01 - 06	ø6	Rc1/8	ø6	Rc1/8	ø6
	06 - F01 - 06	ø6	G1/8	ø6	G1/8	ø6
	01 - 01 - 01	Rc1/8	Rc1/8	Rc1/8	Rc1/8	Rc1/8
ZH07D□A-	F01 - F01 - F01	G1/8	G1/8	G1/8	G1/8	G1/8
	06 - 06 - 06	ø6	ø6	ø6	ø6	ø6
	06 - 01 - 06	ø6	Rc1/8	ø6	Rc1/8	ø6
	06 - F01 - 06	ø6	G1/8	ø6	G1/8	ø6
ZH10D□A-	01 - 01 - 01	Rc1/8	Rc1/8	Rc1/8	Rc1/8	Rc1/8
	F01 - F01 - F01	G1/8	G1/8	G1/8	G1/8	G1/8
	06 - 06 - 08	ø6	ø6	ø8	ø8	ø8
	06 - 01 - 08	ø6	Rc1/8	ø8	Rc1/8	ø8
ZH13D□A-	06 - F01 - 08	ø6	G1/8	ø8	G1/8	ø8
	01 - 01 - 01	Rc1/8	Rc1/8	Rc1/8	Rc1/8	Rc1/8
	F01 - F01 - F01	G1/8	G1/8	G1/8	G1/8	G1/8
	08 - 10 - 10	ø8	ø10	ø10	ø10	ø10
ZH15D□A-	08 - 02 - 10	ø8	Rc1/4	ø10	Rc1/4	ø10
	08 - F02 - 10	ø8	G1/4	ø10	G1/4	ø10
	01 - 02 - 02	Rc1/8	Rc1/4	Rc1/4	Rc1/4	Rc1/4
	F01 - F02 - F02	G1/8	G1/4	G1/4	G1/4	G1/4
ZH18D□A-	08 - 10 - 10	ø8	ø10	ø10	ø10	ø10
	08 - 03 - 10	ø8	Rc3/8	ø10	Rc3/8	ø10
	08 - F03 - 10	ø8	G3/8	ø10	G3/8	ø10
	02 - 03 - 03	Rc1/4	Rc3/8	Rc3/8	Rc3/8	Rc3/8
ZH20D□A-	F02 - F03 - F03	G1/4	G3/8	G3/8	G3/8	G3/8
	10 - 12 - 12	ø10	ø12	ø12	ø12	ø12
	10 - 03 - 12	ø10	Rc3/8	ø12	Rc3/8	ø12
	10 - F03 - 12	ø10	G3/8	ø12	G3/8	ø12
ZH20D□A-	03 - 03 - 03	Rc3/8	Rc3/8	Rc3/8	Rc3/8	Rc3/8
	F03 - F03 - F03	G3/8	G3/8	G3/8	G3/8	G3/8
	10 - 12 - 12	ø10	ø12	ø12	ø12	ø12
	10 - 04 - 12	ø10	Rc1/2	ø12	Rc1/2	ø12
ZH20D□A-	10 - F04 - 12	ø10	G1/2	ø12	G1/2	ø12
	03 - 04 - 04	Rc3/8	Rc1/2	Rc1/2	Rc1/2	Rc1/2
	F03 - F04 - F04	G3/8	G1/2	G1/2	G1/2	G1/2

\*1 Screw-in: Rc and G female threads

##### Inch Size

Model	Metric Size			Inch Size		
	SUP	VAC	EXH	SUP	VAC	EXH
ZH05D□A-	07 - 07 - 07	ø1/4"	ø1/4"	ø1/4"	ø1/4"	ø1/4"
	07 - N01 - 07	ø1/4"	NPT1/8	ø1/4"	NPT1/8	ø1/4"
	N01 - N01 - N01	NPT1/8	NPT1/8	NPT1/8	NPT1/8	NPT1/8
ZH07D□A-	07 - 07 - 07	ø1/4"	ø1/4"	ø1/4"	ø1/4"	ø1/4"
	07 - N01 - 07	ø1/4"	NPT1/8	ø1/4"	NPT1/8	ø1/4"
	N01 - N01 - N01	NPT1/8	NPT1/8	NPT1/8	NPT1/8	NPT1/8
ZH10D□A-	07 - 07 - 09	ø1/4"	ø1/4"	ø5/16"	ø5/16"	ø5/16"
	07 - N01 - 09	ø1/4"	NPT1/8	ø5/16"	NPT1/8	ø5/16"
	N01 - N01 - N01	NPT1/8	NPT1/8	NPT1/8	NPT1/8	NPT1/8
ZH13D□A-	09 - 11 - 11	ø5/16"	ø3/8"	ø3/8"	ø3/8"	ø3/8"
	09 - N02 - 11	ø5/16"	NPT1/4	ø3/8"	NPT1/4	ø3/8"
	N01 - N02 - N02	NPT1/8	NPT1/4	NPT1/4	NPT1/4	NPT1/4
ZH15D□A-	09 - 11 - 11	ø5/16"	ø3/8"	ø3/8"	ø3/8"	ø3/8"
	09 - N03 - 11	ø5/16"	NPT3/8	ø3/8"	NPT3/8	ø3/8"
	N02 - N03 - N03	NPT1/4	NPT3/8	NPT3/8	NPT3/8	NPT3/8
ZH18D□A-	11 - 13 - 13	ø3/8"	ø1/2"	ø1/2"	ø1/2"	ø1/2"
	11 - N03 - 13	ø3/8"	NPT3/8	ø1/2"	NPT3/8	ø1/2"
	N03 - N03 - N03	NPT3/8	NPT3/8	NPT3/8	NPT3/8	NPT3/8
ZH20D□A-	11 - 13 - 13	ø3/8"	ø1/2"	ø1/2"	ø1/2"	ø1/2"
	11 - N04 - 13	ø3/8"	NPT1/2	ø1/2"	NPT1/2	ø1/2"
	N03 - N04 - N04	NPT3/8	NPT1/2	NPT1/2	NPT1/2	NPT1/2

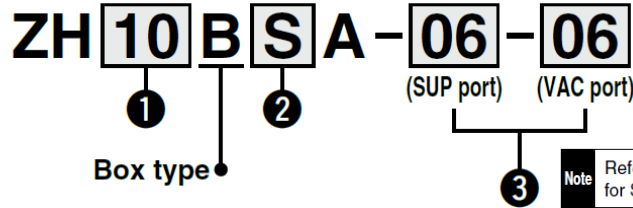
\*2 Screw-in: NPT female threads

# Box Type (Built-in Silencer) Vacuum Ejector

## ZH Series

### How to Order

#### Box type



**Note** Refer to "Table 2" for the combination available for SUP and VAC port connection.

#### 1 Nozzle size

Nozzle size	Nozzle size
05	ø0.5 mm
07	ø0.7 mm
10	ø1.0 mm
13	ø1.3 mm
15	ø1.5 mm
18	ø1.8 mm
20	ø2.0 mm

#### 2 Vacuum pressure reached

S	-89 kPa
L	-48 kPa

#### 3 Port (SUP/VAC) size

One-touch fittings		One-touch fittings	
Metric size		Inch size	
06	ø6	07	ø1/4"
08	ø8	09	ø5/16"
10	ø10	11	ø3/8"
12	ø12	13	ø1/2"

#### Female threads

Metric size		Inch size	
01	Rc1/8	N01	NPT1/8
02	Rc1/4	N02	NPT1/4
03	Rc3/8	N03	NPT3/8
04	Rc1/2	N04	NPT1/2
F01	G1/8		
F02	G1/4		
F03	G3/8		
F04	G1/2		

Table 2 **Box type (Built-in silencer) SUP/VAC port size**

Metric size \*5

Model	SUP	VAC	SUP	VAC
ZH05B□A-	06	- 06	ø6	ø6
	06	- 01	ø6	Rc1/8
	06	- F01	ø6	G1/8
	01	- 01	Rc1/8	Rc1/8
	F01	- F01	G1/8	G1/8
ZH07B□A-	06	- 06	ø6	ø6
	06	- 01	ø6	Rc1/8
	06	- F01	ø6	G1/8
	01	- 01	Rc1/8	Rc1/8
	F01	- F01	G1/8	G1/8
ZH10B□A-	06	- 06	ø6	ø6
	06	- 01	ø6	Rc1/8
	06	- F01	ø6	G1/8
	01	- 01	Rc1/8	Rc1/8
	F01	- F01	G1/8	G1/8
ZH13B□A-	08	- 10	ø8	ø10
	08	- 02	ø8	Rc1/4
	08	- F02	ø8	G1/4
	01	- 02	Rc1/8	Rc1/4
	F01	- F02	G1/8	G1/4
ZH15B□A-	08	- 10	ø8	ø10
	08	- 03	ø8	Rc3/8
	08	- F03	ø8	G3/8
	02	- 03	Rc1/4	Rc3/8
	F02	- F03	G1/4	G3/8
ZH18B□A-	10	- 12	ø10	ø12
	10	- 03	ø10	Rc3/8
	10	- F03	ø10	G3/8
	03	- 03	Rc3/8	Rc3/8
	F03	- F03	G3/8	G3/8
ZH20B□A-	10	- 12	ø10	ø12
	10	- 04	ø10	Rc1/2
	10	- F04	ø10	G1/2
	03	- 04	Rc3/8	Rc1/2
	F03	- F04	G3/8	G1/2

\*5 Screw-in: Rc and G female threads

Inch size \*6

Model	SUP	VAC	SUP	VAC
ZH05B□A-	07	- 07	ø1/4"	ø1/4"
	07	- N01	ø1/4"	NPT1/8
	N01	- N01	NPT1/8	NPT1/8
ZH07B□A-	07	- 07	ø1/4"	ø1/4"
	07	- N01	ø1/4"	NPT1/8
	N01	- N01	NPT1/8	NPT1/8
ZH10B□A-	07	- 07	ø1/4"	ø1/4"
	07	- N01	ø1/4"	NPT1/8
	N01	- N01	NPT1/8	NPT1/8
ZH13B□A-	09	- 11	ø5/16"	ø3/8"
	09	- N02	ø5/16"	NPT1/4
	N01	- N02	NPT1/8	NPT1/4
ZH15B□A-	09	- 11	ø5/16"	ø3/8"
	09	- N03	ø5/16"	NPT3/8
	N02	- N03	NPT1/4	NPT3/8
ZH18B□A-	11	- 13	ø3/8"	ø1/2"
	11	- N03	ø3/8"	NPT3/8
	N03	- N03	NPT3/8	NPT3/8
ZH20B□A-	11	- 13	ø3/8"	ø1/2"
	11	- N04	ø3/8"	NPT1/2
	N03	- N04	NPT3/8	NPT1/2

\*6 Screw-in: NPT female threads

## Operating Environment

### Warning

1. Do not use in an atmosphere containing corrosive gases, chemicals, sea water, water, water steam, or where there is direct contact with any of these.
2. Do not use in a place subject to heavy vibration and/or shock.
3. 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.
4. The product should not be exposed to prolonged sunlight. Use a protective cover.
5. Remove any sources of excessive heat.
6. In locations where there is contact with spatter from water, oil, solder, etc., take suitable protective measures.
7. 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. Load to the ejector body

As the body material is resin, do not apply any load to the port after mounting. Prevent operations which generate moment, as they may cause performance reduction or damage to the body.

#### 2. Standard bracket

It is possible to mount and remove the standard bracket, which is included with this product (an option without a bracket can also be selected). Do not excessively pull on or bend the bracket as it may break. The appropriate tightening torques for the standard bracket, body mounting hole (Fig. 1), and cover mounting hole (Fig. 2) are shown below.

For M3: 0.315 ±0.03 N·m For M4: 0.76 ±0.08 N·m

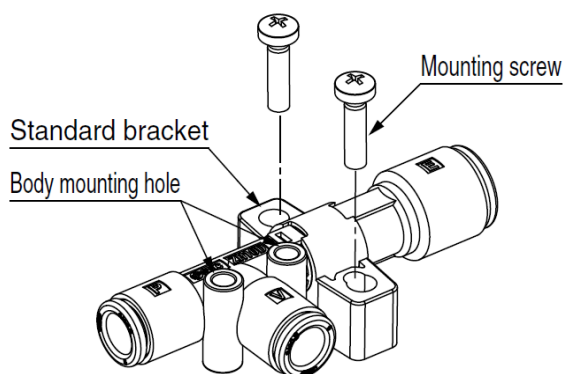


Fig. 1

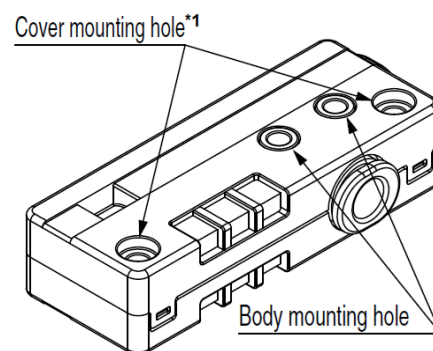


Fig. 2

\*1: For ZH15 to 20B, there is only one mounting hole



- Mounting of the standard bracket (ZH05 to 15D□A) and adjustment of the vacuum (V) port
  - (1) Align the recess of the standard bracket and the protrusion of the adapter. Push the bracket from the top onto the adapter (Fig. 3).
  - (2) Adjust the adapter to rotate the vacuum (V) port (Fig. 4).

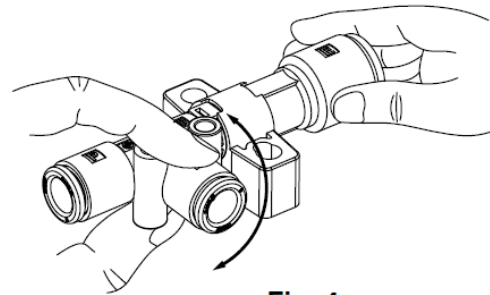
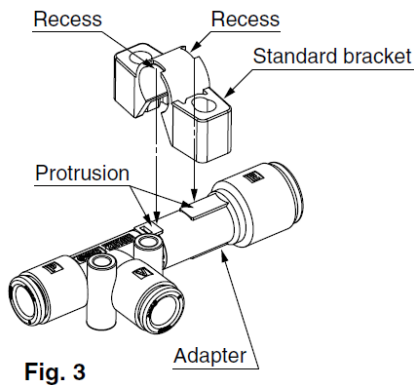


Fig. 4

- (3) When mounting the product with the standard bracket, tighten the screw while holding both sides of the bracket. If the fit of the bracket is loose, the ejector may move after tightening the screws. (Fig. 5)

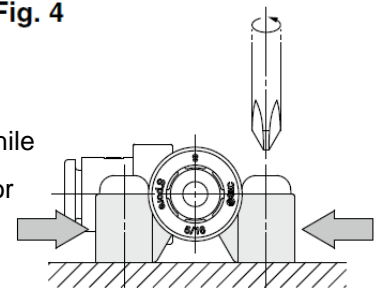


Fig. 5

- Mounting of the standard bracket (ZH18/20D□A) and adjustment of the vacuum (V) port
  - (1) The standard bracket for the ZH18/20D□A can be mounted by using either mounting hole 1 or 2 (Fig. 6).
  - (2) When mounting the product through mounting hole 1, mount the bracket to the installation surface first (Fig. 6).
  - (3) To mount the product to the bracket, push it down with the adapter's narrow rib and E mark facing upward and the wider rib to the side (Fig. 7). Hold the adapter when rotating the vacuum (V) port for adjustment.
  - (4) To remove the body from the bracket, unclip the fingers (2 pcs.) on one side and pull the ejector upward while rotating the adapter. If the ejector is pulled upward without first unclipping the fingers, it may damage the bracket (Fig. 8, 9). If an increased holding force is required, please contact your SMC sales representative.

## Bracket for ZH18/20D□A

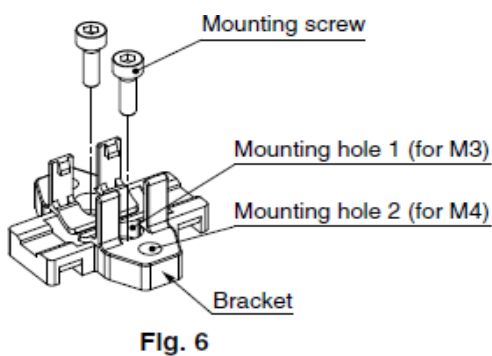


Fig. 6

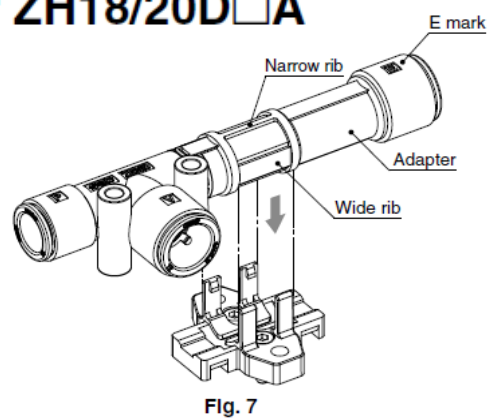
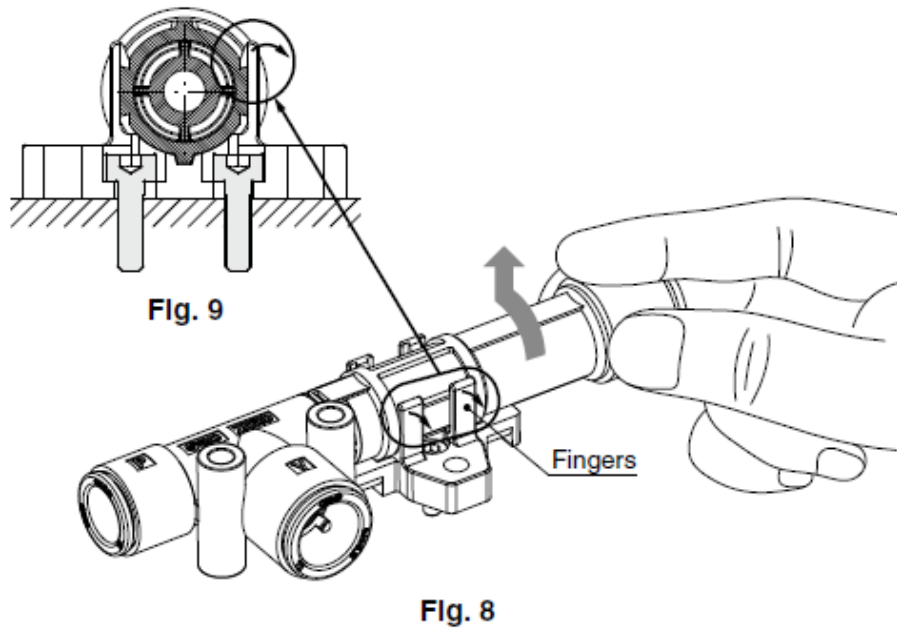


Fig. 7





**⚠ Caution**

**3. Precautions for mounting with the body mounting holes**

If the models listed below are to be mounted on a plane surface through the body mounting holes, the outside diameter of the screw-in stud will interfere with the mounting surface.

Therefore, use a spacer with a thickness of 1 or more (Fig. 10).

Applicable model	t
ZH15D□A-09-N03-11 ZH15D□A-N02-N03-N03	2
ZH18D□A-11-N03-13 ZH18D□A-N03-N03-N03	1
ZH20D□A-10-04-12	
ZH20D□A-03-04-04	
ZH20D□A-10-F04-12	
ZH20D□A-03-F04-F04	
ZH20D□A-11-N04-13	
ZH20D□A-N03-N04-N04	

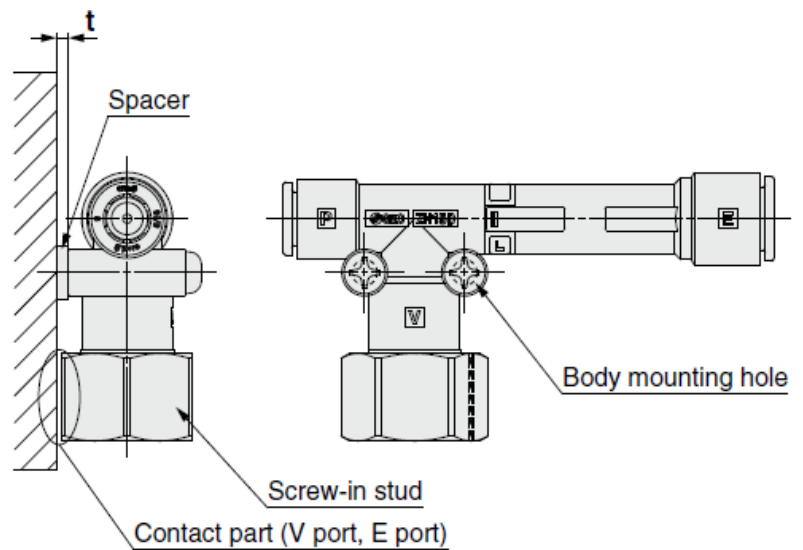
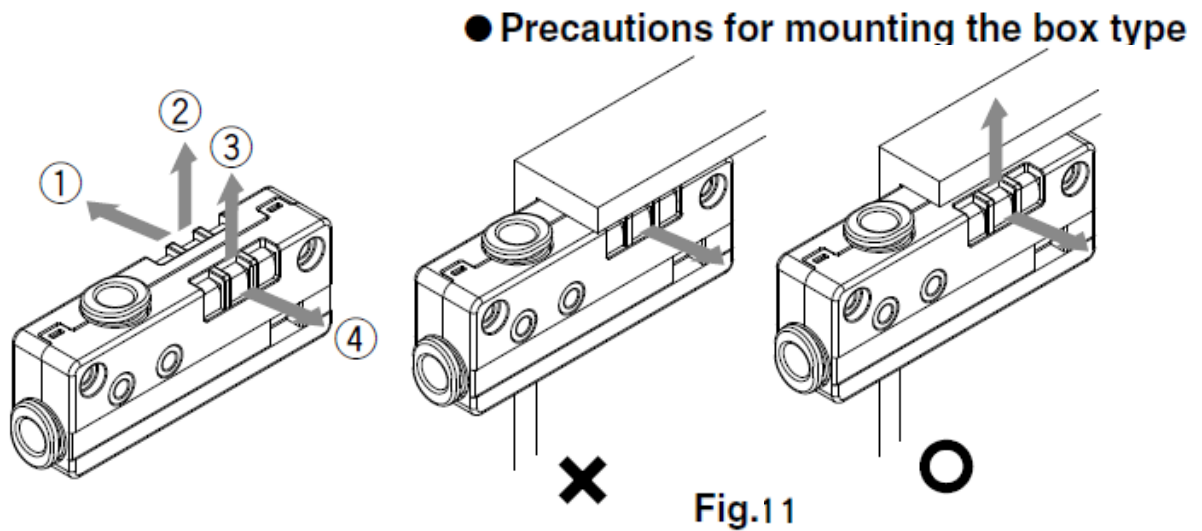


Fig.10

#### 4. Exhaust port

When mounting the box type product, be sure to allow release from at least 2 of the 4 exhaust directions shown in Fig. 11. If 3 or more directions are covered, the vacuum performance of the ejector will be reduced due to exhaust air back pressure.



## Piping

### ⚠ Caution

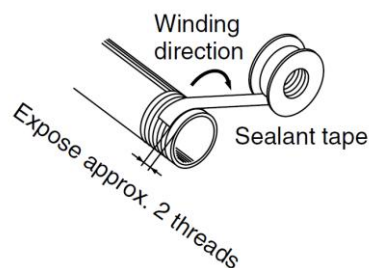
1. Refer to the Fittings and Tubing Precautions for handling One-touch fittings.

#### 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 is used, 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. Use piping with large conductance on the exhaust side of the ejector.**

If the exhaust piping is restrictive, there will be a decline in the ejector's performance.

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

**8. 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.

**9. Exhaust port piping**

If there is any piping or a silencer connected to the exhaust port, keep the back pressure at 5 kPa or less. Increased back pressure may lead to the reduction of suction flow and delays in the transport cycle time. If a silencer is connected, the specified vacuum performance is reduced by 10% or less.

**10. One-touch fittings**

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

**11. 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**

The recommendation for cleanliness of the compressed air supplied to the product is as specified in "System No. C [Dry air]" of the "Model Selection Guide of Air Preparation Equipment" on the SMC website. This describes the impurity content in the compressed air based on the grade of compressed air quality 2.4.3, 2.5.3 and 2.6.3 of ISO 8573-1:2001 (JIS B 8392-1:2003). 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 Supply Valve C Factor

Model	C [dm <sup>3</sup> /(s·bar)]
ZH05□□A	0.12
ZH07□□A	0.23
ZH10□□A	0.47
ZH13□□A	0.80
ZH15□□A	1.06
ZH18□□A	1.53
ZH20□□A	1.88

#### (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).

## When Operating the Ejector

### ⚠ Caution

#### 1. Exhaust air

If solid substances are sucked in through the vacuum (V) port, they will be discharged from the exhaust port at a high speed if the exhaust (EXH) port is opened. Therefore, do not look into the exhaust port or direct the exhaust port toward a person when the ejector is operating.

#### 2. Exhaust noise

Models with a large nozzle diameter generate a large exhaust noise if the exhaust (EXH) port is opened. Install piping or a silencer to the exhaust port to reduce the exhaust noise.

## Identification

### ⚠ Caution

(1) The appearance of the screw-in connection differs depending on the thread type. (Fig. 12)

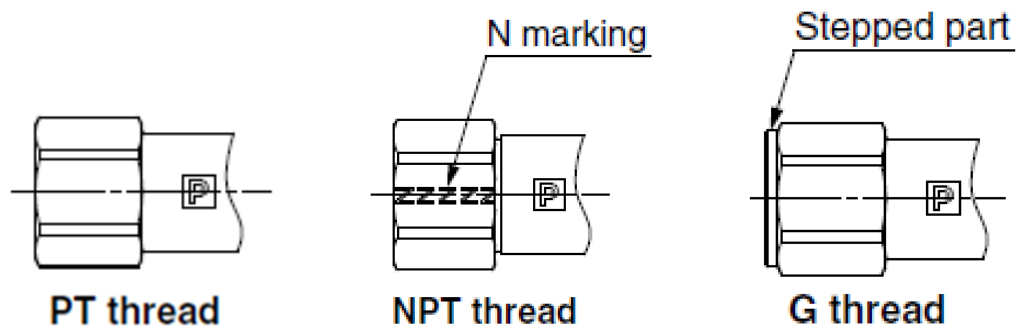
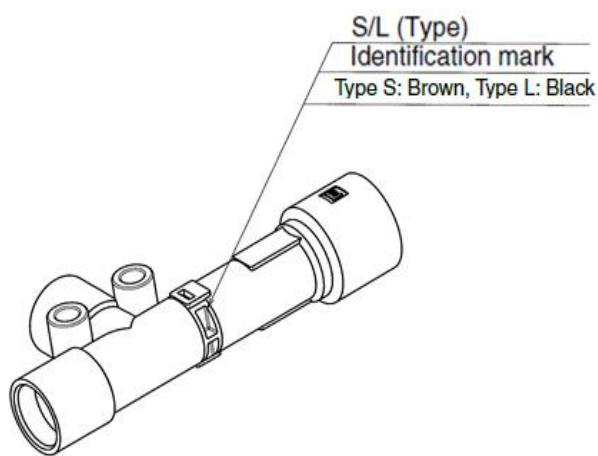
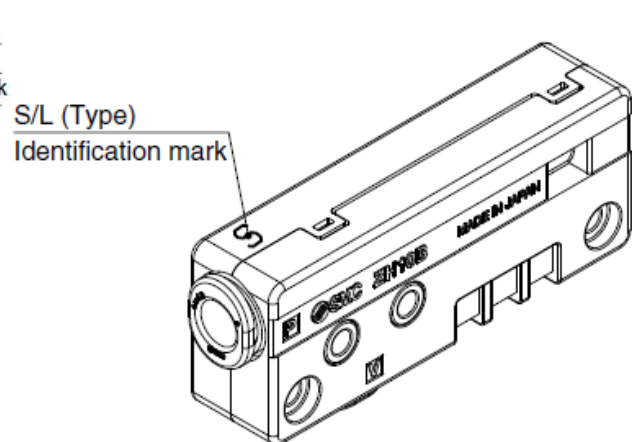


Fig. 12

(2) A different identification mark symbol is used according to the vacuum pressure reached (type S or type L). (Fig. 13, 14)



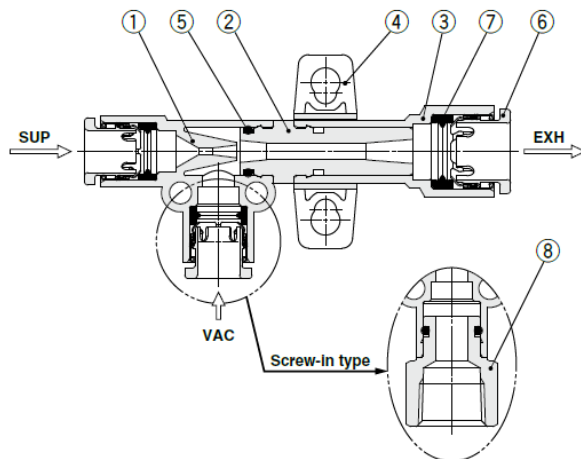
Body ported type  
Fig.13



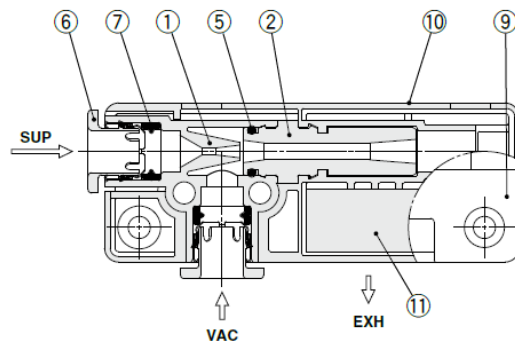
Box type  
Fig.14

# Construction

### Body ported type



### Box type



### Component Parts

No.	Description	Material	Note
1	Body	PBT	
2	Diffuser	PPS	Type S: Brown, Type L: Black
3	Adapter	PBT	
4	Standard bracket*1	PBT	Detachable (Accessory)
5	O-ring	NBR	Grease applied
6	Cassette	—	

\*1 Refer to page 4 for the order number.

No.	Description	Material	Note
7	Seal	NBR	Grease applied
8	Screw-in stud	Brass	Electroless nickel plating
9	Cover A	PBT	
10	Cover B	PBT	With identification mark for type S or type L (Refer to page 12 for details.)
11	Sound absorbing material	Resin	

# Specifications

## Specifications

Operating temperature range	-5 to 50°C*1
Fluid	Air
Applicable tubing material	FEP, PFA, Nylon, Soft nylon, Polyurethane
Operating pressure range	0.1 to 0.6 MPa*2

\*1 No freezing

\*2 This is the supply pressure to the supply (P) port. The vacuum (V) and exhaust (E) ports should not be sealed simultaneously.

## Ejector Specifications\*1

Model	Nozzle nominal size [mm]	Vacuum pressure reached*2 [kPa]		Maximum suction flow rate [L/min (ANR)]		Air consumption [L/min (ANR)]	Weight*3 [g]
		Type S	Type L	Type S	Type L		
ZH05D□A	0.5	-90	-48	6	13	13	5.0
ZH07D□A	0.7			12	28	27	5.2
ZH10D□A	1.0			26	52	52	6.1
ZH13D□A	1.3			40	78	84	12.4
ZH15D□A	1.5			58	78	113	13.4
ZH18D□A	1.8			76	128	162	22.2
ZH20D□A	2.0	90	155	196	23.3		
ZH05B□A	0.5	-89	-48	6	13	13	12.3
ZH07B□A	0.7			12	28	27	12.4
ZH10B□A	1.0			26	52	52	13.6
ZH13B□A	1.3			40	78	84	26.9
ZH15B□A	1.5			58	78	117	28.7
ZH18B□A	1.8			76	128	165	46.4
ZH20B□A	2.0	90	155	201	46.2		

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

\*2 Supply pressure: 0.45 MPa

\*3 Weight for the One-touch fitting type (Excludes the standard bracket)

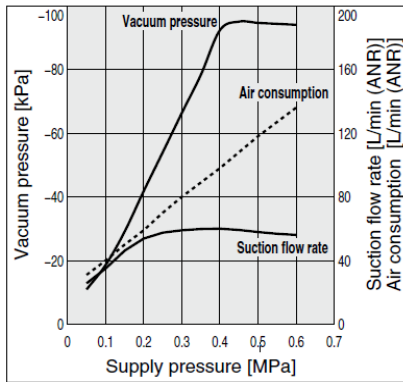




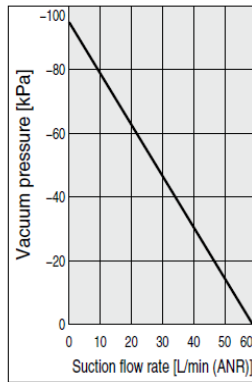
## Exhaust Characteristics / Flow Rate Characteristics (Representative Value)

### ZH15□SA

Exhaust Characteristics

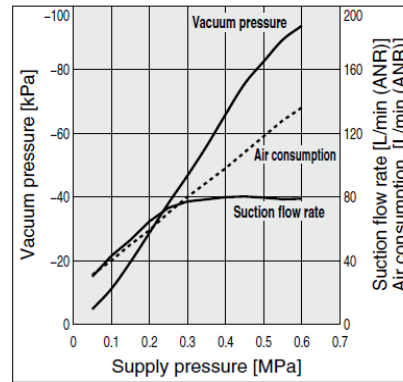


Flow Rate Characteristics

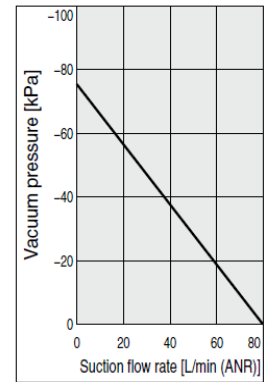


### ZH15□LA

Exhaust Characteristics

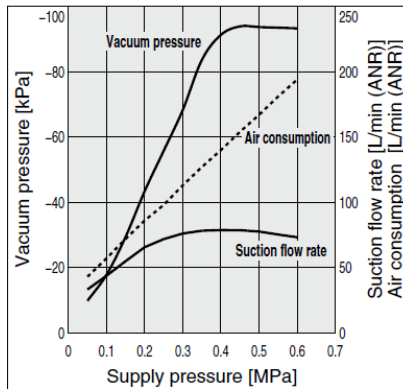


Flow Rate Characteristics

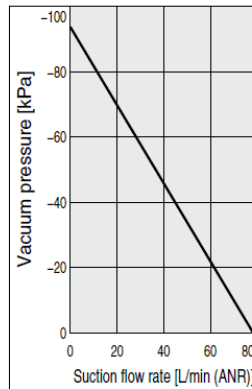


### ZH18□SA

Exhaust Characteristics

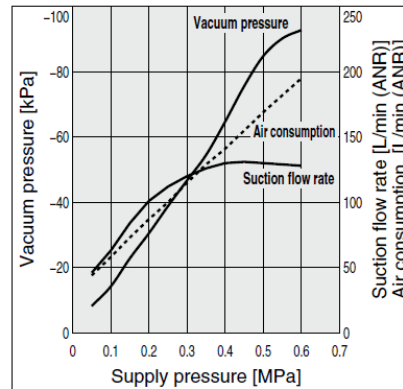


Flow Rate Characteristics

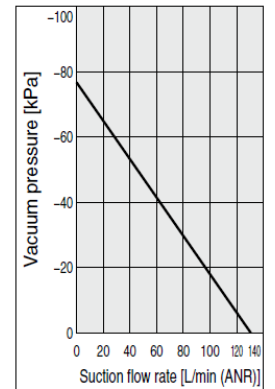


### ZH18□LA

Exhaust Characteristics

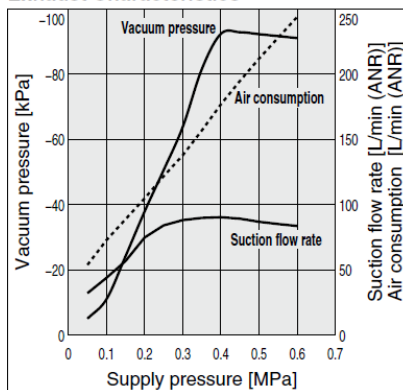


Flow Rate Characteristics

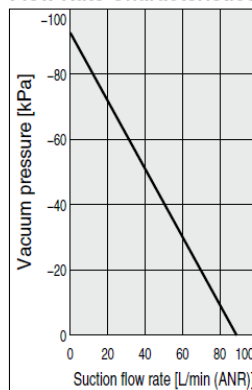


### ZH20□SA

Exhaust Characteristics

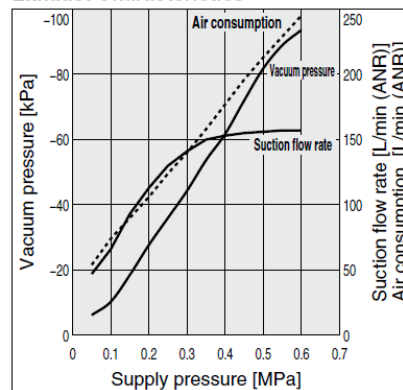


Flow Rate Characteristics

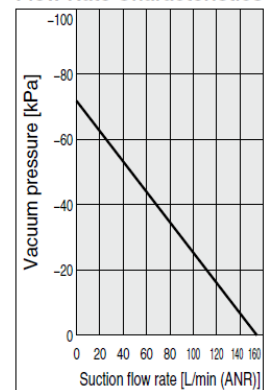


### ZH20□LA

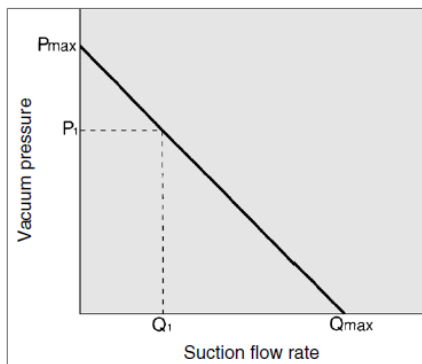
Exhaust Characteristics



Flow Rate Characteristics



## How to Read Flow Rate Characteristics Graph



Flow rate characteristics are expressed in ejector vacuum pressure and suction flow. If suction flow changes, the vacuum pressure will also be changed. Normally this relationship is expressed in ejector standard operating pressure use. In the graph,  $P_{max}$  is maximum vacuum pressure and  $Q_{max}$  is maximum suction flow. The values are specified according to catalog use. Changes in vacuum pressure are expressed in the below order.

1. When the ejector suction port is covered and made airtight, the suction flow becomes zero and vacuum pressure is at the maximum value ( $P_{max}$ ).
2. When the suction port is opened gradually, air can flow through, (air leakage), suction flow increases, but vacuum pressure decreases. (condition  $P_1$  and  $Q_1$ )

3. When the suction port is opened further and fully opened, suction flow moves to the maximum value ( $Q_{max}$ ), but vacuum pressure is near zero (atmospheric pressure).

As described above, the vacuum pressure changes when the suction flow changes. In other words, when there is no leakage from the vacuum port, the vacuum pressure can reach its maximum, but as the amount of leakage increases, the vacuum pressure decreases. When the amount of leakage and the maximum suction flow become equal, the vacuum pressure becomes almost zero.

In the case when a ventilative or leaky workpiece should be adsorbed, take note that vacuum pressure will not rise.

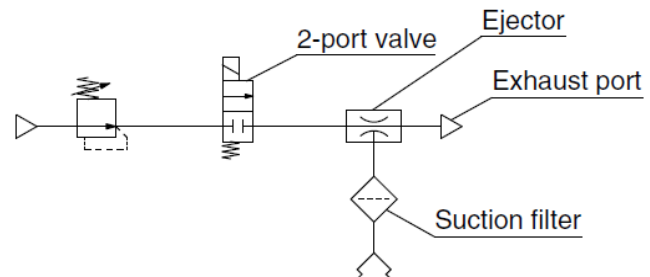
## Circuit Examples

### ⚠ Caution

Select the related air preparation equipment with appropriate size in reference to the circuit example below.

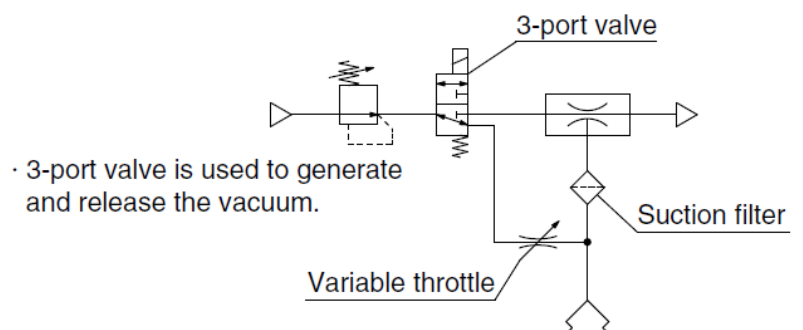
#### 【Ex.1】 Supply valve (2-port valve) + Suction filter

2-port valve is used to generate and stop the vacuum. Vacuum is released to the atmosphere. A suction filter is installed to protect the ejector.



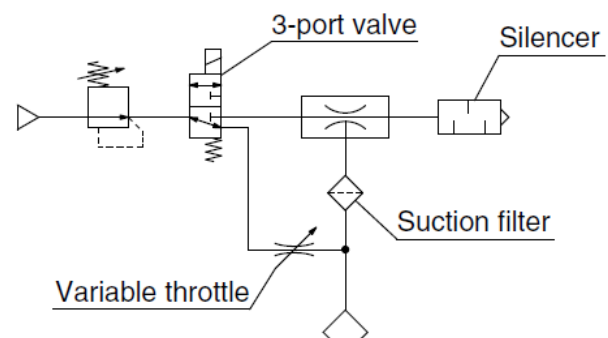
#### 【Ex.2】 Supply valve (3-port valve) + Variable throttle + Suction filter

3-port valve is used to generate and stop the vacuum (vacuum release is performed simultaneously). Variable throttle is installed for break flow adjustment. A suction filter is protecting the ejector.



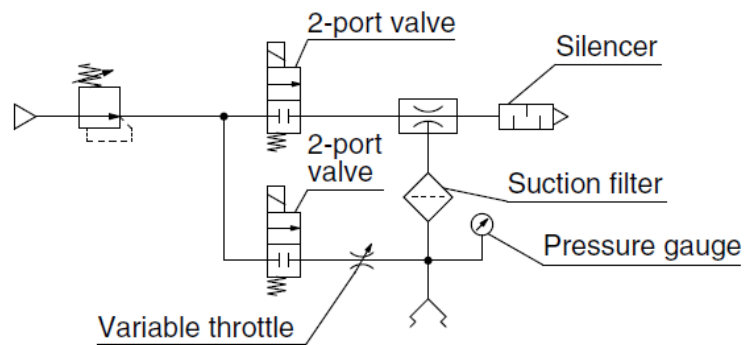
#### 【Ex.3】 Supply valve (3-port valve) + Variable throttle + Suction filter + Silencer

Power failure is prevented by changing the valve piping of Ex. 2 and applying vacuum generation N.O. specification. Variable throttle and suction filters are installed. A silencer is mounted to the exhaust port (to reduce exhaust noise).



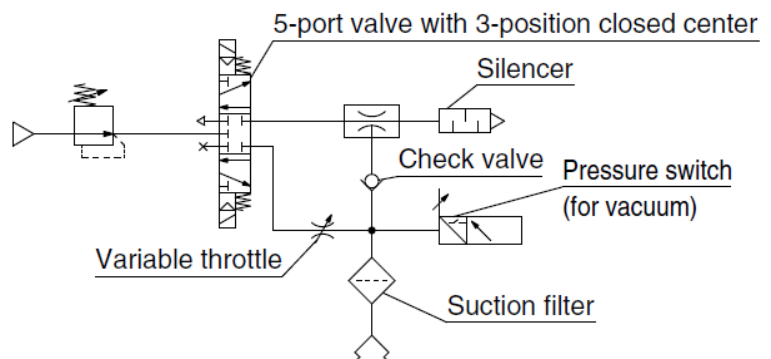
#### [Ex.4] Supply valve (2-port valve) + Release valve (2-port valve) + Variable throttle + Silencer + Suction filter+ Pressure gauge

Vacuum generation and vacuum release are controlled by a supply valve and release valve. A pressure gauge is installed to visually check the vacuum pressure during adsorption. The suction filter should be mounted to the location where the collected dust should not flow back due to the release of air. (When using the 3-port valve, seal the R-port of the release valve.)



#### [Ex.5] Supply/Release valve (5-port valve with 3-position closed center)+ Variable throttle

5-port valve with 3-position closed center is used to control the vacuum generation and release. A check valve is installed to the vacuum port to prevent vacuum pressure from being reduced when the supply valve is OFF\*. A pressure switch is installed in the vacuum circuit to detect pressure. A suction filter should be mounted to the position where the duct collected by release air can be flushed by released air.



\* The vacuum may leak depending on the check valve used. If a breathable workpiece is used, vacuum pressure is reduced rapidly. Sufficient verification is required before use.

## 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.

#### 4. Perform maintenance of silencers periodically.

The performance of the ejector will deteriorate due to clogged silencers. If the silencer is clogged, replace it with a new silencer or else the exhaust speed and system function will decrease,

If you are using an accessory silencer in ZH direct piping type, replace it with a new silencer. (See P.4 for model) If you are using a ZH box type, replace it with a new ejector.

\* In the case of ZH box type, silencer (sound absorbing material) cannot be replaced, so do not disassemble it.

## 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 sound absorbing material	Replace sound absorbing materials. Add a filter to supply (compressed) air circuit. Install an additional suction filter.
	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 the vacuum pad (rubber).	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