



Operation Manual

PRODUCT NAME

Multistage Ejector

MODEL / Series / Product Number

ZL112·212 Series

SMC Corporation

Contents

Safety Instructions	2
Model Indication and How to Order	10
Mounting and Installation	12
Air Supply	12
Supply Pressure	13
Piping	13
Solenoid Valve	15
Construction	15
Maintenance and Inspection	17
Exhaust from Ejector	19
Specifications	19
Circuit Diagram	22
Weight	23
Exhaust Characteristics and Flow Characteristics of Ejector	24
Flow Characteristics Curves	25
Vacuum Pressure Switch Assembly	26
Troubleshooting	27



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 10218-1992: 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.

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.

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.









■ Explanation of Symbols





Symbol	Definition
	Things you must not do. Actual instructions are provided as a drawing or sentence close to this symbol.
	Things you must do. Actual instructions are provided as a drawing or sentence close to this symbol.

■ Operator

1. This Operation Manual is intended for those who have knowledge of machinery using pneumatic equipment, and have sufficient knowledge of assembly, operation and maintenance of such equipment. Only those persons are allowed to perform assembly, operation and maintenance.
2. Read and understand this Operation Manual carefully before assembling, operating or providing maintenance to the product.

■ Safety Instructions

 Warning	
 Disassembly prohibited	Do not disassemble, modify (including the replacement of board) or repair other than instructed in this manual. An injury or failure can result.
 Do not	Do not operate the product outside of the specifications. Do not use for flammable or harmful fluids. Fire, malfunction, or damage to the product can result. Verify the specifications before use.
 Do not	Do not use in an atmosphere containing flammable or explosive gases. Fire or an explosion can result. The product is not designed to be explosion proof.
 Do not	Do not use the product in a place where static electricity is a problem. Otherwise failure or malfunction of the system can result.
 Do not	Do not cut off the power and compressed air supplied to this product while it is operating. Otherwise it can cause injury due to dropping of workpieces or damage to the system.
 Instruction	If using the product in an interlocking circuit: - Provide a double interlocking system, for example a mechanical system. - Check the product for proper operation. Otherwise malfunction can result, causing an accident.
 Instruction	The following instructions must be followed during maintenance : Turn off the power supply Stop the air supply, exhaust the residual pressure in piping and verify that the air is released before performing maintenance work. An injury can result.

 Caution	
 Do not touch	Do not touch the terminals and connectors while the power is on. Otherwise electric shock, malfunction or damage to the switch can occur.
 Instruction	Perform sufficient trial run. Otherwise, injury or damage to the system can occur due to suction failure depending on the conditions of the suction of the workpiece or the pressure switch settings. Perform sufficient verification before using this product.
 Instruction	After maintenance is complete, perform appropriate functional inspections and leak test. Stop operation if the equipment does not function properly or there is leakage of fluid. If there is leakage from parts other than the piping, the product might be broken. Cut off power supply and stop supplying fluid. Do not supply fluid if there is leakage. Safety cannot be assured in the case of unexpected malfunction.

■ Handling Precautions

Follow the instructions given below for selecting and handling of the vacuum unit.

- The instructions on selection (installation, wiring, environment, adjustment, operation, maintenance, etc.) described below must also be followed.

*Product specifications

- For the compressed air quality, refer to JIS B 8392-1 2.4.3 to 2.6.3.
Insufficient air quality can cause operating failure.
If compressed air containing condensate is used, install an air dryer or drain catch before the filter and perform drainage regularly.
If draining is not performed regularly and condensate enters the secondary side, it can cause operating failure of pneumatic equipment.
When it is difficult to control drainage, the use of a filter with an auto drain is recommended.
- The applicable fluids are air, non-corrosive gas and inert gas.
Do not use a fluid containing chemicals, synthetic oils including organic solvent, salt and corrosive gases.
Otherwise, damage to the vacuum unit and malfunction can occur.
Check the details of the specifications before use.
- Use the specified operating pressure.
Otherwise it can cause damage to the vacuum unit or inability to hold work piece correctly.
- Reserve suitable space for maintenance.
Allow sufficient space around the product for maintenance when designing the system.
- Use the specified voltage.
Otherwise failure or malfunction can occur.
- Do not exceed the specified maximum allowable load.
Otherwise it can cause damage or shorten the life of the product.
- Design the product to prevent reverse current when the circuit is opened or the product is forced to operate for operational check.
Reverse current can cause malfunction or damage the product.

● Handling

*Mounting

- Tighten to the specified tightening torque.
If the tightening torque is exceeded, the mounting screws, brackets and the product can be damaged. Insufficient torque can cause displacement of the product from its proper position and loosening of the mounting screws.
- Ensure that the FG terminal is connected to ground when using a commercially available switch-mode power supply.
- Do not drop, hit or apply excessive shock to the product.
Otherwise damage to the internal parts of the product, solenoid valve and internal parts of the pressure switch can occur, causing malfunction.
- Do not pull the lead wire forcefully, or lift the product by pulling the lead wire. (Tensile strength 35N or less)
Hold the body when handling to avoid damaging the product.
The solenoid valve and the pressure switch will be damaged, leading to failure and malfunction.
- Eliminate any dust left in the piping by using a blast of air before connecting the piping to the product.
If dust is left in the piping, failure and malfunction can result.
- Do not insert metal wires or other foreign objects into the pressure port of the pressure sensor.
The pressure sensor will be damaged, leading to failure and malfunction.
- If the fluid may contain foreign matter, install and connect a filter or mist separator to the inlet.
Failure and malfunction can result.

*Wiring (Including connecting/disconnecting of the connectors)

- Do not pull hard on the lead wire, or lift the product by holding the lead wires (Tensile strength 35 N or less).
In particular, never lift the product by the lead wire of the solenoid valve or the pressure switch when fittings and piping are built in.
Otherwise damage to the solenoid valve or the internal parts of the pressure switch can result, causing malfunction or causing the connector to come off.
- Avoid repeatedly bending, stretching or applying a heavy object or force to the lead wire.
Repetitive bending stress or tensile stress to the lead wire can cause the sheath of the wire to peel off.
If the lead wire can move, fix it near the body of the product.
The recommended bend radius of the lead wire is 6 times the outside diameter of the sheath, or 33 times the outside diameter of the insulation material, whichever is larger.
Replace the damaged lead wire with a new one.
 - Wire correctly.
Incorrect wiring can cause malfunction or breakage of the solenoid valve or the pressure switch/sensor.
 - Do not perform wiring while the power is on.
Otherwise damage to the solenoid valve or the internal parts of the pressure switch/sensor can result, causing malfunction.
 - Do not route wires and cables together with power or high voltage cables.
Route the wires (piping) of the solenoid valve or the pressure switch separately from power or high voltage cables in order to avoid noise or surge entering the signal line from the power or high voltage line.
 - Confirm proper insulation of wiring.
Poor insulation (interference with other circuits, poor insulation between terminals etc.) can apply excessive voltage or current to the solenoid valve or the pressure sensor, causing damage.
 - Design the system to prevent reverse current when the product is forced to operate for operational check.
Depending on the circuit used, insulation may not be maintained when operation is forced, allowing reverse current to flow, which can cause malfunction and damage to the solenoid valve or the pressure switch.
 - Keep wiring as short as possible to prevent interference from electromagnetic noise and surge voltage.
Do not use a cable longer than 10 m.
Wire the DC (-) line (solenoid valve: black, pressure switch: blue) as close as possible to the power supply.

***Operating environment**

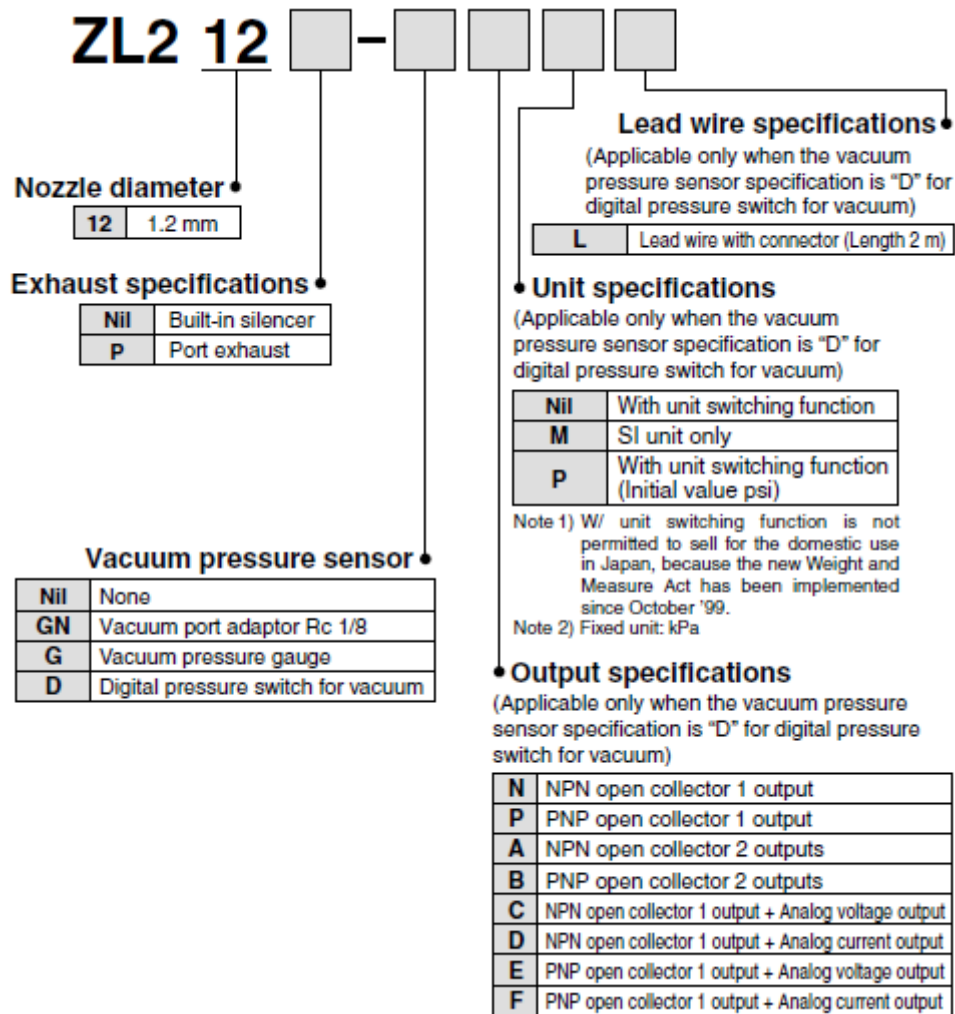
- Do not use in an environment where corrosive gases, chemicals, sea water, water or steam are present.
These can cause failure or malfunction.
- Do not use the product in a place where the product could be splashed by oil or chemicals.
If the product is to be used in an environment containing oils or chemicals such as coolant or cleaning solvent, even for a short time, it may be adversely affected (damage, malfunction, or hardening of the lead wires).
- Do not use the product in an area where surge is generated.
When there are machines or equipment that generate large surge near the pressure switch (magnetic type lifter, high frequency inductive furnace, motor, etc.), this can result in deterioration and damage of the internal elements. Take measures against the surge sources, and prevent the lines from coming into close contact.
- Do not use a load which generates surge voltage.
When a surge-generating load such as a relay or solenoid is directly driven, use the product with a surge absorbing element built-in.
- The product is CE marked, but not immune to lightning strikes. Take measures against lightning strikes in the system.
The product is CE marked, but settings may change if excessive noise is applied.
- Mount the product in a location that is not affected by vibration or impact.
Failure and malfunction can occur.
- Do not let foreign matter, such as wire debris, get inside the product.
In order to avoid failure and malfunction, do not let foreign matter, such as wire debris, get inside the product.
- Do not use this product in places where there are cyclic temperature changes.
Heat cycles other than ordinary changes in temperature can adversely affect the inside of the product.
- Do not use where the product is exposed to direct sunlight.
Shade the sunlight in locations where the product is exposed to direct sunlight.
Failure and malfunction can result.
- Keep within the specified operating fluid and ambient temperature range.
The operating fluid and ambient temperature range is 5 to 50°C. Operation under low temperature may lead to damage or operation failure due to frozen moisture in the fluid or air.
Protection against freezing is necessary. Mounting of an air dryer is recommended for elimination of drainage and water.
Avoid abrupt temperature changes even within the specified temperature range.
- Do not use in a location where the product is exposed to radiant heat from surrounding heat sources.
This can cause operating failure.

***Adjustment/Operation**

- Connect a load before turning the power supply on.
If the power supply is turned on with no load, over current may flow, causing the pressure switch to break instantly.
- Do not short circuit the load.
An error is displayed when the load of the pressure switch is short circuited, but over current may flow, causing damage to the pressure switch.
- Do not press the setting buttons with a sharp pointed object.
This may damage the setting buttons.
- If using the product to detect very small pressures, warm up the product for 10 to 15 minutes first.
There will be a drift on the display of approx. 1% for 10 minutes after the power supply is turned on.
- Perform settings suitable for the operating conditions.
Incorrect setting can cause operation failure.
For details of each setting, refer to the Operation Manual of the pressure switch.
- Do not touch the LED during operation.
The display can vary due to static electricity.

***Maintenance**

- Turn off the power supply, stop the supplied air, exhaust the residual compressed air in the piping and verify the release of air before performing maintenance.
There is a risk of unexpected malfunction of components.
- Perform regular maintenance and inspections.
There is a risk of unexpected malfunction of components due to the malfunction of equipment and machinery.
- Perform drainage regularly.
If condensate enters the secondary side, it can cause operating failure of pneumatic equipment.
- Do not use solvents such as benzene, thinner etc. to clean the product.
They could damage the surface of the product and erase the indication on the product.
Use a soft cloth to remove stains. For heavy stains, use a cloth soaked with diluted neutral detergent, then wipe again with a dry cloth.



Mounting and Installation

Note the following points when mounting and installing the product.

■ Common Precautions for Mounting and Installation

1. If the product is operated in a dusty environment or if there is dust on the surface of the work pieces, it can cause clogging of the silencing material as well as the suction filter. Secure space necessary for the maintenance checks and replacement of the silencer when the ejector performance decreases.
2. Keep the ambient temperature of the product between 5 and 50°C. In environments such as inside a panel where heat radiation efficiency is poor, the ambient temperature will rise due to the heat generation of the coil of the solenoid valve, causing malfunction.
3. When handling the product, do not hold the lead wires or cables of the solenoid valve or pressure switch for vacuum. Otherwise, this may cause damage to cable connections and damage to the product.
4. If air leakage increases or the equipment does not operate properly, stop operation. After installation and maintenance, apply air and power supplies to the equipment and perform appropriate functional and leakage inspections to make sure the equipment is mounted properly.
5. Do not obstruct the exhaust port of the ejector. Do not cover the exhaust port. Otherwise, vacuum is not generated. Do not block the exhaust port to release the work piece. This can damage the vacuum ejector.

Air Supply

■ Use clean air.

- (1) Using compressed air which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc. can cause damage or malfunction. Do not use compressed air containing toxic impurities.
- (2) If the compressed air contains excessive moisture or carbon powder, it can stick to the vacuum parts (the nozzle diffuser), inside of the solenoid valve or the pressure switch and cause a decrease in performance or operation failure. An air dryer, mist separator, and filter should be installed upstream from filters.
If condensation in the drain bowl and air filter is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. This causes malfunction of pneumatic equipment. If the drain bowl is difficult to check and remove, installation of a drain bowl with an auto drain option is recommended.
- (3) For the compressed air quality, refer to 2.4.3, 2.5.3 and 2.6.3 of ISO8573-1:2001 (JIS B8392-1:2003). It is recommended that an air filter and a mist separator are connected to the upstream side of the ejector and the pump system. (Refer to Air Preparation Equipment Selection Guide in Best Pneumatics 5 for detail.)

Supply Pressure

- Use the product within the specified supply pressure range.

Operation over the specified supply pressure range can cause damage to the product.

Piping

- Piping for Air Pressure Supply and Vacuum Pressure Supply

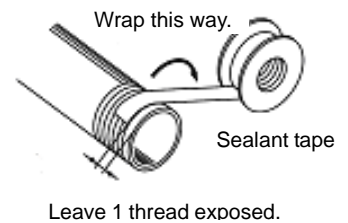
(1) Before piping

Before piping, perform air blow (flushing) or cleaning to remove any cutting chips, cutting oil, dust, etc. from the piping.

(2) Sealant tape

When installing piping or a tube fitting into a port, prevent cutting chips and sealant material from getting inside the product.

If a sealant tape is used, leave 1 thread exposed at the end of threads.



- ### (3) When connecting tubing, consider factors such as changes in the tubing length due to pressure, and allow a sufficient margin.

Otherwise, it can damage the fitting and cause the tube to come off. Refer to Fittings & Tubing Precautions from 1 to 4 shown in Best Pneumatics 6 on SMC's website (URL <http://www.smcworld.com>) for the recommended piping conditions.

(4) Connection of fittings

Use the correct tightening torque as shown below.)

Connection thread	Correct tightening torque (Nm)
Rc1/8	7 to 9
Rc1/2	28 to 30
Rc3/4	28 to 30
Rc1	36 to 38

■ Piping to the Vacuum (V) Port

- (1) Allow a sufficient margin of tube length when piping, in order to prevent twisting, tensile, moment loads, vibration or impact being applied to the tubes and fittings.

This can cause damage to the tube fittings and crushing, bursting or disconnection of tubing.

- (2) Piping to the product is assumed to be static piping.

If the tube moves, it may become worn, elongated or torn due to tensile forces, or disconnected from the fitting. Ensure the tube is in a static condition at all times before using.

- (3) Prevent the connected tube from being rotated.

If the fittings are used in this way, the fitting may fail.

- (4) Do not lift the product by holding the piping after the tube is connected to the vacuum (V) port.

■ One-touch Fittings Precautions

1. Insertion of tube

- 1) Cut the tube perpendicularly, being careful not to damage the external surface. Use SMC's tube cutter TK-1, 2 or 3 for cutting. Do not cut the tube with pliers, nippers, scissors, etc. If the tube is cut by any tools other than a tube cutter, the cut surface of the tube will be slanted or flat, making it impossible to be connected securely, or causing the tube to come off or air leakage after the tube is connected. Also, allow a sufficient margin of tube length.
- 2) Hold the tube and push it in slowly, inserting it securely all the way into the fitting.
- 3) After inserting the tubing, pull on it gently to confirm that it will not come out. If it is not installed securely all the way into the fitting, problems such as leakage or disconnection of the tube can occur.

2. Removal of the tube

- 1) KQ2 series is used for the vacuum (V) port. For this series, the tube can be removed by pushing one part of the release button.
- 2) Hold down the release button while pulling out the tube. If the release button is not held down fully, there will be more bite so it will be more difficult to pull out the tube.
- 3) If the removed tubing is to be used again, cut off the section of the tubing which has been gripped. Using the gripped portion of the tube as it is can cause problems such as air leakage or difficulty in removing the tube.

■ Precautions for Use of Other Manufacturers' Tubes

If tubes of brands other than SMC are used, confirm that the materials and tolerance of the tubing outside diameter will satisfy the following specifications.

- | | |
|----------------------|-----------------------------|
| 1) Nylon tube | within +/-0.1mm |
| 2) Soft nylon tube | within +/-0.1mm |
| 3) Polyurethane tube | within +/-0.15mm and -0.2mm |

Do not use tubing which does not meet these outside diameter tolerances. Connection to the fitting may fail, causing disconnection of the tube and air leakage.

Solenoid Valve

■ Do NOT energize the solenoid valve for a long time.

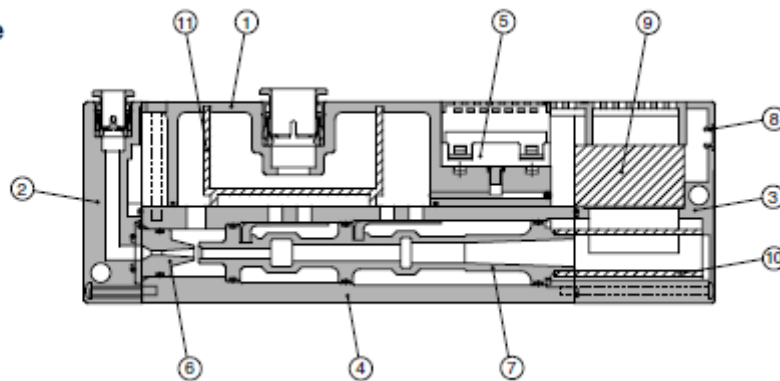
If the solenoid valve is continuously energized for an extended period of time, heat generated by the coil may result in reduced performance or have adverse effects on peripheral equipment.

The solenoid valve should not be energized continuously for longer than 10 minutes, and the energizing time in one day should be shorter than the non-energizing time. (The duty ratio should be 50% at maximum.) When the valve is mounted onto a control panel, take measures against high temperatures in order to keep the valve temperature within the specified range. When energizing adjacent units at the same time continuously, the temperature increase will increase further.

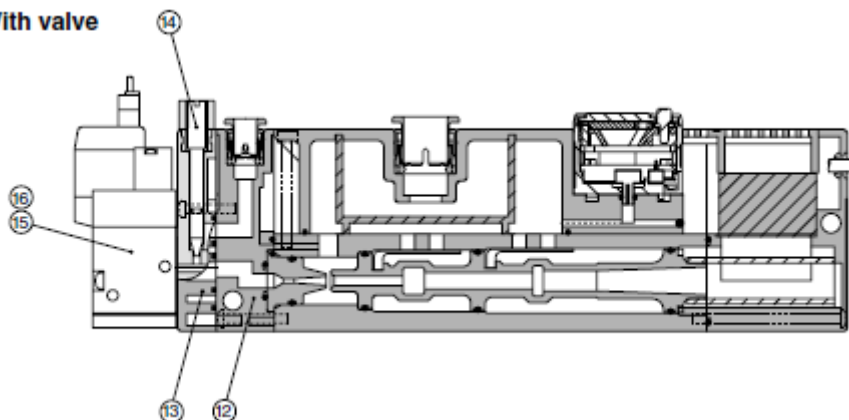
Construction

■ Construction of ZL112 Series

Without valve



With valve



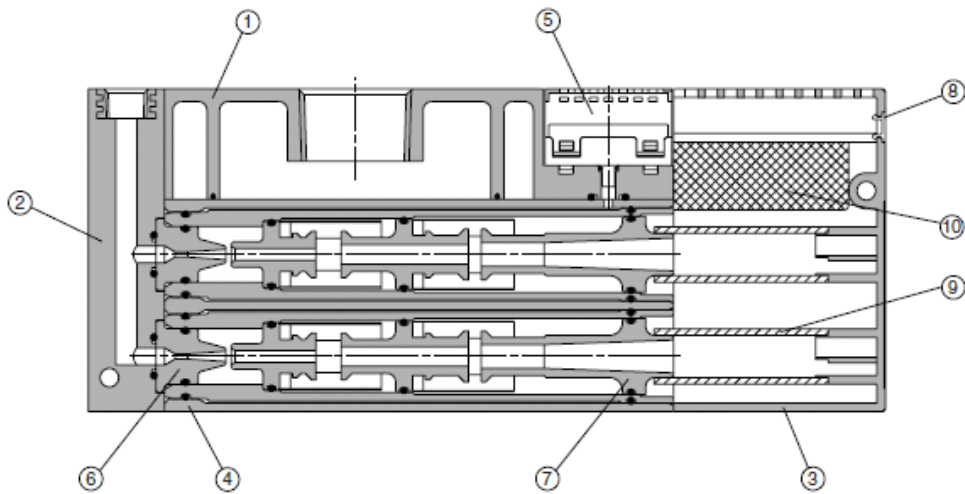
Comonent Parts

No.	Description	Part no.	Note
1	Suction cover		
2	Front cover		Without valve
3	End cover		
4	Body		
5	Vacuum sensor unit		
6	Nozzle		
7	Diffuser		
8	Detent plug		Other than vacuum switch
	Lead wire cover		Vacuum switch specifications
12	Front cover B		With valve
13	Valve plate		With valve
14	Needle		With valve
15	Supply valve (N.C.)	SYJ514-□□□	With valve
16	Release valve (N.C.)	SYJ514-□□□	With valve

Replacement Parts

No.	Description	Material	Part no.
9	Sound absorbing material B	PVF	ZL112-SP01 (Set no. for 9, 10 & 11)
10	Sound absorbing material A	PVF	
11	Suction filter	PE	

■ Construction of ZL212 Series



Component Parts

No.	Description	Note
1	Suction cover	
2	Front cover A	
3	End plate	
4	Body	
5	Vacuum sensor unit	
6	Nozzle	
7	Diffuser	
8	Detent plug	Other than vacuum switch
	Lead wire cover	Vacuum switch specifications

Replacement Parts

No.	Description	Material	Part no.
9	Sound absorbing material A	PVF	ZL212-SP01
10	Sound absorbing material	PVF	(Set no. for 9 & 10)

Maintenance and Inspection

- Implement the maintenance and inspections shown below in order to use the ejector safely and in an appropriate way for a long period of time.
 - 1) Maintenance should be performed according to the procedure indicated in the Operation Manual. Improper maintenance can cause damage and malfunction of equipment and machinery.
 - 2) Maintenance work
Compressed air can be dangerous when handled incorrectly. Therefore, in addition to observing the product specifications, replacement of elements and other maintenance activities should be performed by personnel with sufficient knowledge and experience pertaining to pneumatic equipment.
 - 3) Draining
Remove condensate from air filters and mist separators regularly. If the collected drainage is drained to the downstream side, it can stick inside of the product, causing operation failure and failure to reach the desired vacuum pressure.
 - 4) Replace the filter element built into the ejector and the silencer regularly.
(Refer to the replacement procedure below.)
It is recommended to replace the filter element and the silencer when the pressure drop reaches 5kPa as a guideline, although the replacement cycle varies depending on the operating conditions, operating environment and supply air quality.
However, if there is a vacuum pressure drop and/or delay in the vacuum (adsorption) response time which causes problem with the settings during operation, stop the operation of the product and replace the element regardless of the above mentioned replacement guideline.
 - 5) Operation in an environment where there is a lot of dust in the air
The processing capacity of the filter element built in to the product may be insufficient. It is recommended to use SMC's air suction filter (ZFA, ZFB, ZFC series) in order to avoid problems.
 - 6) Check before and after the maintenance work
When the product is to be removed, turn off the power supply, and be sure to cut off the supply pressure and exhaust the compressed air. Confirm that the air is released to atmosphere.
When mounting the product after the maintenance work, supply product with compressed air and power, checking for any leakages and that the product functions properly
 - 7) Do not disassemble or modify the product, other than the replacement parts specified in this manual.

■ Spare Part List

ZL112 Series

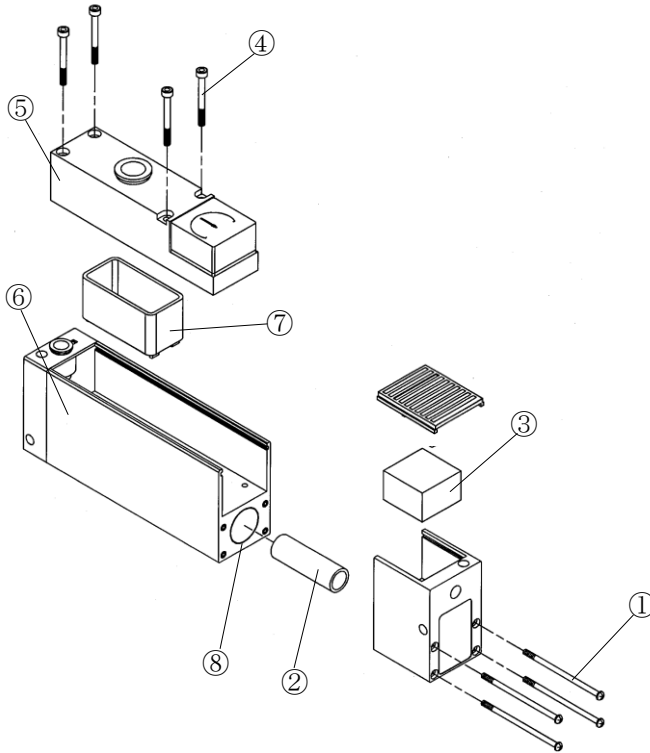
No.	Description	Product number	Remarks
9	Silencer set	ZL112-SP01	Sound Absorbing Material A
10			Sound Absorbing Material B
11			Suction filter

ZL212 Series

No.	Description	Product number	Remarks
9	Silencer set	ZL212-SP01	Sound Absorbing Material A
10			Sound Absorbing Material B

■ Spare parts replacement procedure

ZL112-G



Replacement procedure of ZL112-SP01 (Silencer set)

Disassembly

1. Remove the four round head combination screws (M2.5 x 41) (1).
2. Remove the sound absorbing material A (2) and sound absorbing material B (3). Be careful not to lose the O-ring (8).
3. Remove the four hexagon socket head cap screws (M3 x 30) (4).
4. Remove the suction cover assembly (5) from the body (6), and remove the suction filter (7).

Reassembly

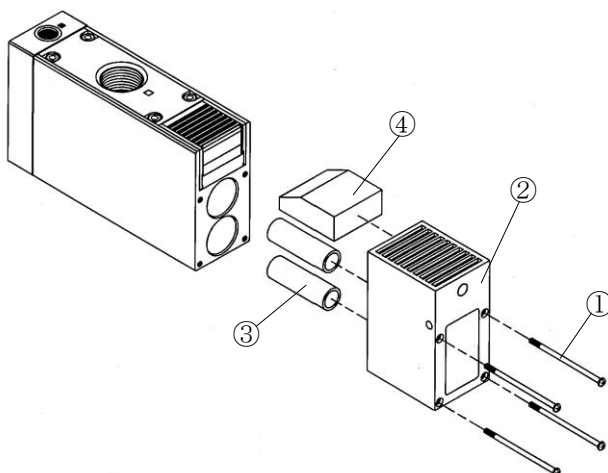
Reassemble by following the disassembly procedure in reverse.

Confirm that the O-ring and gasket are mounted correctly into the specified groove.

Tightening torque

- (1) Round head combination screw (M2.5 x 41): 0.3 to 0.36 Nm
- (4) Hexagon socket head cap screw (M3 x 30): 0.6 to 0.66 Nm

ZL212



Replacement procedure of ZL212-SP01 (Silencer set)

Disassembly and Reassembly

1. Remove the four round head combination screws (M2.5 x 53) (1).
2. Remove the two sound absorbing materials A (3) and sound absorbing material B (4) which are integrated into the end plate (2), and integrate the spare part (ZL212-SP01).
3. Reassemble the four round head combination screws (M2.5 x 53) (1).

Tightening torque

- (1) Round head combination screw (M2.5 x 53): 0.6 to 0.66 Nm

Exhaust from Ejector

- Avoid back pressure being applied to the exhaust air of the ejector.

The exhaust resistance should be as small as possible to obtain the full ejector performance.

There should be no shield around the exhaust port for the silencer exhaust specification. For the port exhaust specification, the back pressure increase should be 0.005MPa (5kPa) at maximum, as exhaust resistance is generated with some piping bore sizes and piping lengths.

For the silencer exhaust specification, the silencer will gradually get clogged if dust in the operating environment is sucked in or if the supply air is not clean enough. If the silencer is clogged, back pressure is applied to the ejector exhaust which results in a reduction in the vacuum pressure and the adsorption flow rate.

It is recommended to replace the silencer with a new one when the vacuum pressure of the ejector decreases or a delay in response time is generated.

Specifications

■ General Specifications

Operating temperature range	5 to 50°C (No condensation)
Operating fluid	Air, inert gas

■ Ejector Specifications

Model	ZL112
Nozzle diameter	1.2 mm
Maximum suction flow rate	100 ℓ/min (ANR)
Air consumption	63 ℓ/min (ANR)
Maximum vacuum pressure	-84 kPa
Maximum operating pressure	0.7 MPa
Supply pressure range	0.2 to 0.5 MPa
Standard supply pressure	0.4 MPa
Operating temperature range	5 to 50°C

Model	ZL212
Nozzle diameter	ø1.2 mm x 2
Maximum suction flow rate	200 ℓ/min (ANR)
Air consumption	126 ℓ/min (ANR)
Maximum vacuum pressure	-84 kPa
Maximum operating pressure	0.7 MPa
Supply pressure range	0.2 to 0.5 MPa
Standard supply pressure	0.4 MPa
Operating temperature range	5 to 50°C

■ Specifications for Supply Valve and Release Valve

Part no.	SYJ514-□□□□	
Type of valve actuation	N.C.	
Fluid	Air	
Operating pressure range	Internal pilot type	0.15 to 0.7 Mpa
Ambient and fluid temperature	-10°C to 50°C (No freezing)	
Response time (For 0.5 MPa) ⁽¹⁾	25 ms or less	
Maximum operating frequency	5 Hz	
Manual override	Non-locking push type/Locking slotted type	
Pilot exhaust type	Pilot valve individual exhaust, Main valve/Pilot valve common exhaust	
Lubrication	Not required	
Mounting position	Unrestricted	
Impact/Vibration resistance ⁽²⁾	150/30 m/s ²	
Enclosure	Dust proof	

Note 1) Based on JIS B 8374-1981 dynamic performance test. (coil temperature 20°C, at rated voltage, without surge voltage suppressor)

Note 2) Impact resistance: No malfunction when tested with a drop tester in the axial direction and at a right angle to the main valve and armature, one time each in both energized and deenergized states. (initial value)

Vibration resistance: No malfunction when tested with one sweep of 45 to 2000 Hz in the axial direction and at a right angle to the main valve and armature, one time each in both energized and deenergized states. (initial value)

Note 3) Refer to "Best Pneumatics No. 1" for details on valves.

■ Option Specifications

Vacuum Pressure Gauge Specifications

Part no.	GZ30S
Fluid	Air
Pressure range	-100 to 100 kPa
Scale range (Angular)	230°
Accuracy	±3% F.S. (Full span)
Class	Class 3
Operating temperature range	0 to 50°C
Material	Housing: Polycarbonate/ABS resin

Digital Pressure Switch for Vacuum

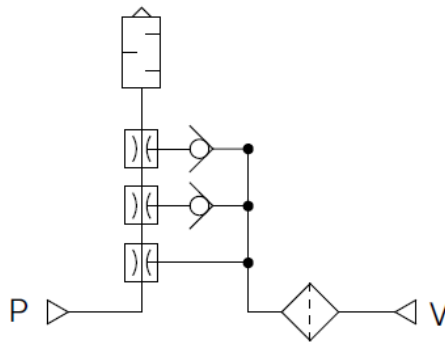
Rated pressure range		0.0 to -101.0 kPa	
Set pressure range		10.0 to -105.0 kPa	
Withstand pressure		500 kPa	
Minimum unit setting		0.1 kPa	
Applicable fluid		Air, Non-corrosive gas, Non-flammable gas	
Power supply voltage		12 to 24 VDC $\pm 10\%$ (with power supply polarity protection)	
Current consumption		40 mA (at no load)	
Switch output		NPN or PNP open collector 1 output NPN or PNP open collector 2 outputs (selectable)	
Maximum load current		80 mA	
Maximum applied voltage		28 V (at NPN output)	
Residual voltage		1 V or less (with load current of 80 mA)	
Response time		2.5 ms or less (with anti-chattering function: 20, 100, 500, 1000, 2000 ms)	
Short circuit protection		Yes	
Repeatability		$\pm 0.2\%$ F.S. ± 1 digit	
Hysteresis	Hysteresis mode	Variable (0 to variable)	
	Window comparator mode		
Analog output	Voltage output <small>Note 1)</small>	Output voltage (Rated pressure range)	1 to 5 V $\pm 2.5\%$ F.S.
		Linearity	$\pm 1\%$ F.S. or less
		Output impedance	Approx. 1 k Ω
	Current output <small>Note 2)</small>	Output current (Rated pressure range)	4 to 20 mA $\pm 2.5\%$ F.S.
		Linearity	$\pm 1\%$ F.S. or less
		Load impedance	Maximum load impedance: Power supply voltage 12 V: 300 Ω , Power supply voltage 24 V: 600 Ω Minimum load impedance: 50 Ω
Display		4-digit, 7-segment, 2-color LCD (Red/Green) Sampling cycle: 5 times/sec.	
Display accuracy		$\pm 2\%$ F.S. ± 1 digit (Ambient temperature of 25°C)	
Indicator light		Lights up when switch output is turned ON. (OUT1: Green, OUT2: Red)	
Environment resistance	Enclosure		IP40
	Operating temperature range		Operating: 0 to 50°C, Stored: -10 to 60°C (No freezing or condensation)
	Operating humidity range		Operating/Stored: 35 to 85% RH (No condensation)
	Withstand voltage		1000 VAC for 1 minute between live parts and case
	Insulation resistance		50 M Ω or more between live parts and case (at 500 VDC Mega)
	Vibration resistance		10 to 150 Hz at whichever is smaller of 1.5 mm amplitude or 20 m/s ² acceleration, in X, Y, Z directions, for 2 hours each
	Impact resistance		100 m/s ² , in X, Y, Z directions, for 2 hours each
Temperature characteristics		$\pm 2\%$ F.S. (Based on 25°C)	
Lead wire		Oilproof heavy-duty vinyl cable, 3 cores $\phi 3.5$, 2 m 4 cores Conductor area: 0.15 mm ² (AWG26) Insulator O.D.: 1.0 mm	
Standards		CE Marking, UL/CSA, RoHS compliance	

Note 1) When analog voltage output is selected, analog current output cannot be used together.

Note 2) When analog current output is selected, analog voltage output cannot be used together.

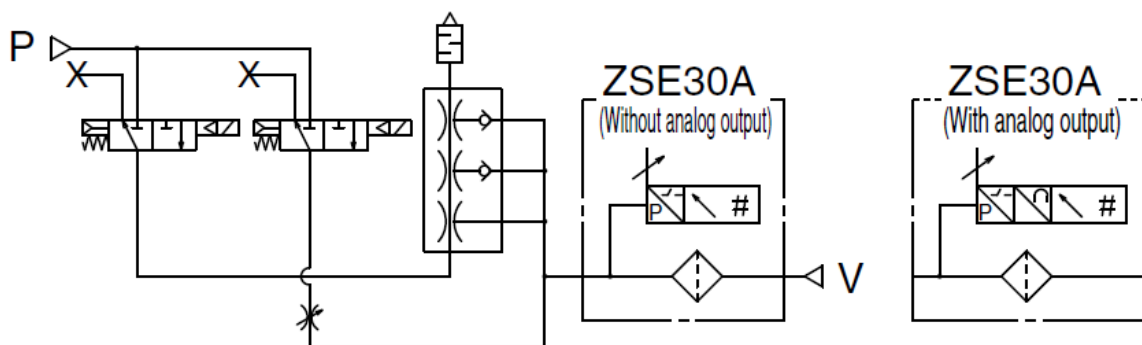
Circuit Diagram

■ ZL112



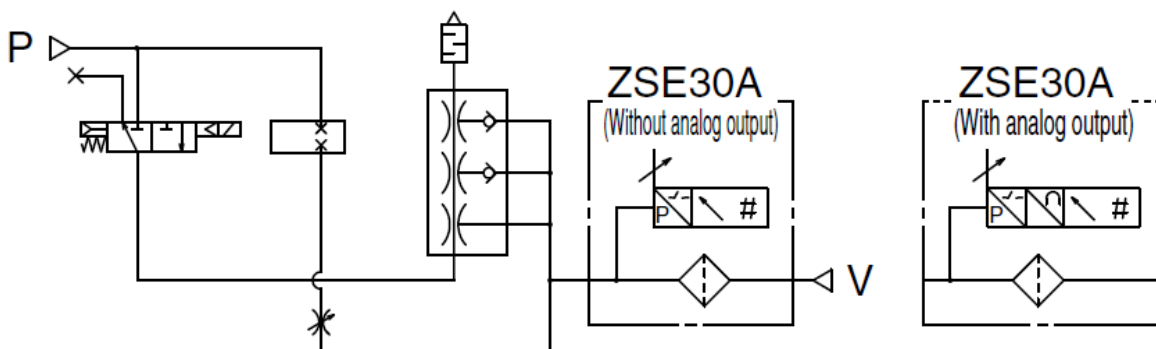
■ ZL112-K1****-D****

A

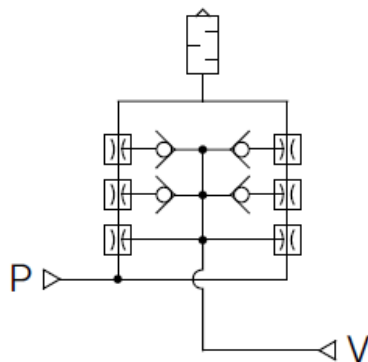


■ ZL112-K2****-D****

A



■ ZL212



Weight

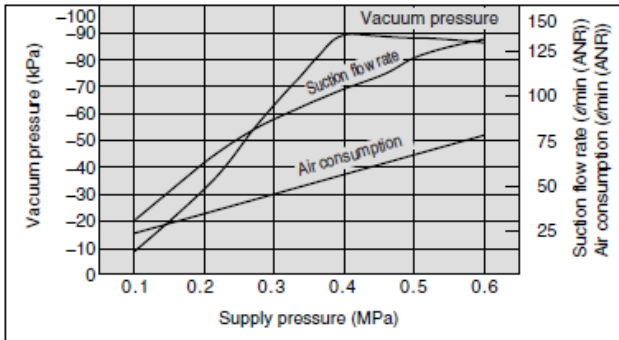
ZL112 (Basic)	450 g
Port exhaust	+110 g
Digital pressure switch for vacuum (Excluding lead wire)	+43 g
Digital pressure switch for vacuum (Including 3 cores lead wire)	+81 g
Digital pressure switch for vacuum (Including 4 cores lead wire)	+85 g
Valve (per 1 pc.)	+45 g

ZL212	700 g
Port exhaust	+300 g
Digital pressure switch for vacuum (Excluding lead wire)	+43 g
Digital pressure switch for vacuum (Including 3 cores lead wire)	+81 g
Digital pressure switch for vacuum (Including 4 cores lead wire)	+85 g
Valve (per 1 pc.)	+45 g

Exhaust Characteristics and Flow Characteristics of Ejector

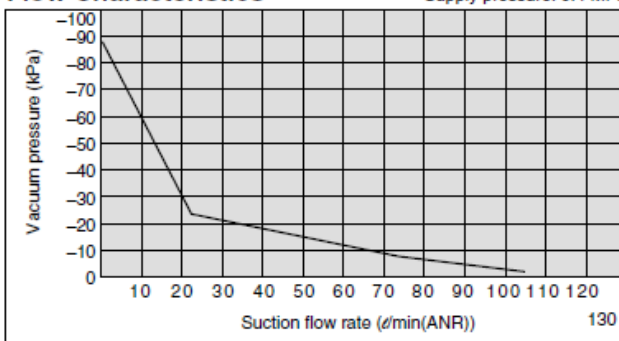
ZL112

Exhaust Characteristics



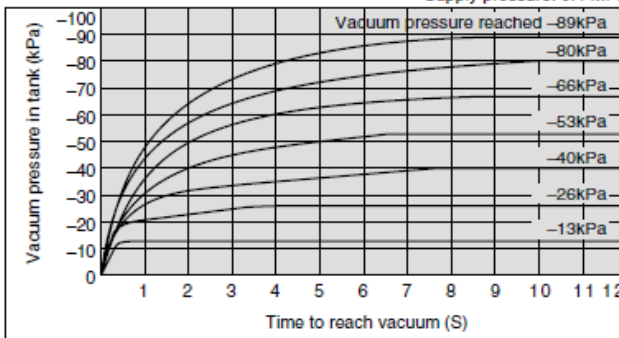
Flow Characteristics

Supply pressure: 0.4 MPa



Time to Reach Vacuum

Tank capacity: 1ℓ
Supply pressure: 0.4 MPa

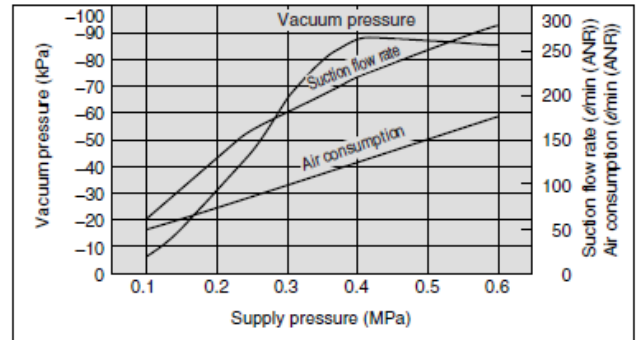


<How to Read the Graph>

The graphics indicate the time required to reach a vacuum pressure determined by adsorption conditions for workpieces, etc., starting from atmospheric pressure in a 1ℓ sealed tank. Approximately 8.8 seconds are necessary to attain a vacuum pressure of -89 kPa.

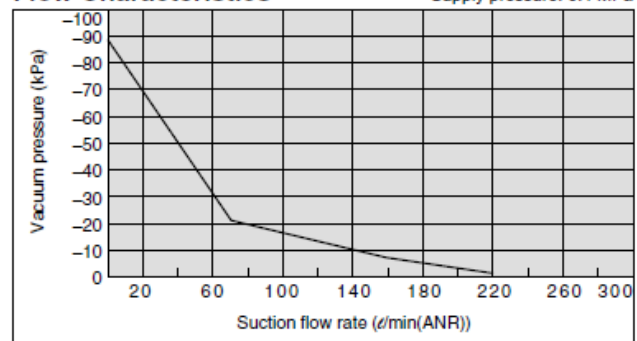
ZL212

Exhaust Characteristics



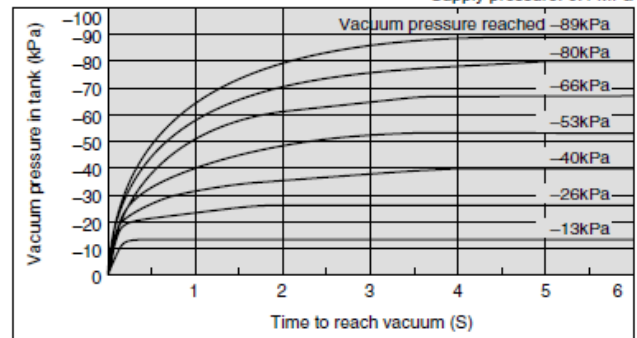
Flow Characteristics

Supply pressure: 0.4 MPa



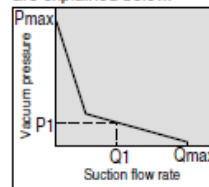
Time to Reach Vacuum

Tank capacity: 1ℓ
Supply pressure: 0.4 MPa



<How to Read the Graph>

The flow characteristics indicate the relationship between the vacuum pressure and the suction flow rate of the ejector, and show that when the suction flow rate changes the vacuum pressure also changes. In general, this indicates the relationship at the ejector's standard operating pressure. In the graph, Pmax indicates the maximum vacuum pressure, and Qmax indicates the maximum suction flow rate. These are the values that are published as specifications in catalogs, etc. Changes in vacuum pressure are explained below.



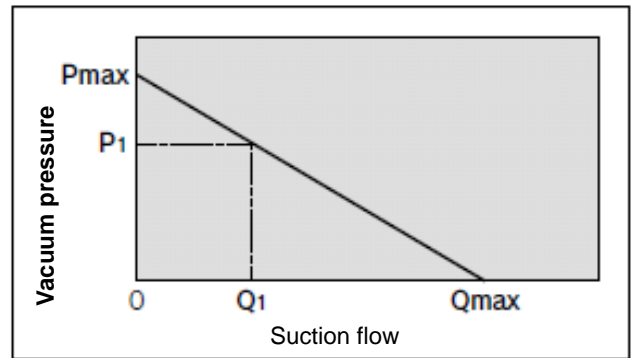
1. If the ejector's suction port is closed and sealed tight, the suction flow rate becomes "0" and the vacuum pressure increases to the maximum (Pmax).
2. If the suction port is opened and air is allowed to flow (the air leaks), the suction flow rate increases and the vacuum pressure decreases. (the condition of P1 and Q1)
3. If the suction port is opened completely, the suction flow rate increases to the maximum (Qmax), while the vacuum pressure then drops almost to "0" (atmospheric pressure). When adsorbing work pieces which are permeable or subject to leakage, etc., caution is required as the vacuum pressure will not be very high.

Flow Characteristics Curve

■ How to Read the Flow Characteristics Curves of Ejector/Vacuum Pump System

- The flow characteristics curve shows the relationship between the vacuum pressure and the suction flow of the ejector/vacuum pump system. It shows that the vacuum pressure changes when the suction flow changes. Generally, the curve shows the relationship at the standard supply pressure of the ejector.

In the graph on the right, P_{max} means the maximum vacuum pressure and Q_{max} means the maximum suction flow.



The value shown in this graph is what is shown in this operation manual and the catalogs as the specifications.

The change of vacuum pressure is explained in sequence as follows.

- 1) When the vacuum port (V) is closed, the suction flow will be "0" and the vacuum pressure will reach its maximum (P_{max}).
- 2) When the vacuum port (V) is opened gradually, air will flow. (If there is bleeding air, the suction flow will increase, but the vacuum pressure will decrease.): [State of $P_1 - Q_1$]
- 3) If the vacuum port (V) is opened fully, the suction flow will reach its maximum (Q_{max}), but the vacuum pressure will become almost "0" (atmospheric pressure).

As described above, the vacuum pressure changes when the suction flow changes.

Converting this to the adsorption state of the workpiece, the vacuum pressure reaches its maximum when the pad and the piping on the vacuum port (V) have no leakage. Vacuum pressure decreases when there is a lot of leakage when adsorbing a workpiece. When the amount of leakage and the maximum suction flow are equal, the vacuum pressure becomes almost "0", and it fails to adsorb the workpiece.

Vacuum pressure will not increase if the product is used for adsorption of permeable workpieces or in an adsorption state with leakage. In such a case, sufficient verification and prior tests are required.

Vacuum Pressure Switch Assembly

■ Handling Precautions

- 1) Do not drop, hit or apply excessive shock (100m/s^2) to the product. The inner parts can be damaged leading to malfunction even if the sensor body is not damaged.
- 2) The tensile strength of the lead wire with connector is 35N. Exceeding this value can cause breakage. Be sure to hold the body when handling.
- 3) Avoid repeatedly bending or stretching the lead wire with connector. The lead wire may break if it is wired so that such force acts on it. If the lead wire can move, fix it near the body of the product. The recommended bending radius is 40mm or more. Contact SMC for more details if required.

■ Connection

- 1) Incorrect wiring can damage the switch and cause malfunction. Connections should be done while the power supply is turned off.
- 2) Do not attempt to insert or pull out the connector from the pressure switch while the power is on. This may cause switch output malfunction.
- 3) Malfunctions stemming from noise may occur if the wire is installed in the same route as that of power or high-voltage cable. Wire the pressure switch independently.
- 4) Be sure to connect the ground terminal F.G. to ground when using a commercially available switch-mode power supply.

■ Operating Environment

The use of resin piping can cause static electricity to be generated, depending on the fluid. Therefore, when connecting the vacuum pressure switch assembly, take appropriate measures against static electricity at the customer's equipment side, and separate the grounding for the product from the grounding for any equipment which generates a strong electromagnetic noise or high frequency.

Otherwise, static electricity can break the vacuum pressure switch assembly.

Refer to SMC website (URL <http://www.smcworld.com>) for details of the 2-color display high precision digital pressure switch, ZSE30A Series, other than those shown above.

Troubleshooting

■ Problems when using ejector troubleshooting

Trouble	Cause	Countermeasures
Initial adsorption failure (It fails to adsorb during the trial run.)	The adsorption area is too small; the adsorption force is not strong enough compared with the weight of the workpiece and the force applied during transfer.	Increase the lifting force. → Increase the pad diameter → Increase the number of pads.
	Vacuum pressure is too small, due to leakage at the adsorption part or generation of a space between the pad and the workpiece due to deformation of the workpiece.	Reduce the vacuum leakage (by increasing the vacuum pressure). → Change the pad configuration. Increase the adsorption area. → Change the pad material (e.g. to a material that fits the uneven surface). → If the workpiece is thin, change to a suitable pad.
	Vacuum pressure is too small, due to leakage of vacuum pressure due to permeability of the workpiece.	Check the vacuum pressure and the suction flow. → Change to an ejector with larger suction flow.
	Vacuum pressure is too small due to leakage from the vacuum piping.	→ Repair vacuum piping.
	Suction flow is too small. (Ejector performance is not high enough.)	→ Change to an ejector with larger suction flow.
	Suction flow is too small because the piping diameter is too small and the length is too long, causing restriction of the sucking flow of the ejector.	→ Increase the piping diameter and length on the vacuum side.
	Vacuum pressure and/ or suction flow are too small, making the supply pressure to the ejector insufficient.	→ Measure the supply pressure when the vacuum is generated, and increase the supply pressure to the standard supply pressure. Improve the line if the flow is insufficient. Especially when more than one product is operated at the same time in a manifold, the supply air can be insufficient, causing decrease of the supply pressure.
	Vacuum pressure and/or suction flow are too small, due to clogging of the nozzle and the diffuser.	→ Remove foreign matter and substances sticking to it. (Needs to be repaired.) Perform flushing and mount an air filter on the supply side to prevent it happening again.
Malfunction of supply valve	Measure the supply voltage to the solenoid valve. → Revise the electrical circuit, wiring and connectors. → Use within the rated voltage range.	

Trouble	Cause	Countermeasures
Adsorption response is not quick enough.	Internal capacity of the circuit on the vacuum side is too large for the ejector performance.	→ Reduce the internal capacity of the vacuum circuit. → Change to an ejector with larger suction flow.
	The set vacuum pressure for the suction verification is too high, making the time before it reaches the set value longer.	Optimize the lifting force and change the setting to have the suction verification with the vacuum pressure as low as possible.
Fluctuation of vacuum pressure	Supply pressure fluctuates.	Install a tank in the compressed air line on the supply side, and reduce the air consumption of other equipment.
	The generated vacuum pressure fluctuates, making the exhaust noise intermittent at a certain supply pressure range.	This is a phenomenon peculiar to ejectors which is caused when the supply pressure is a little lower than the standard supply pressure. → Increase or decrease the supply pressure a little.
Vacuum failure over time (absorbs properly initially.)	Vacuum pressure is reduced, due to clogging of the suction filter (due to dust in the environment on the vacuum side, foreign matter on the surface of workpiece, adsorption of humidity, etc.)	→ Replace the filter element with a new one. → Increase the number of suction filters (such as ZFA, ZFB and ZFC)
	Vacuum pressure is reduced, because of the clogging of the silencer (due to foreign matter such as drainage and carbon particles in the supply air).	Clean the supply air. → Control the drainage. → Mount an air filter and a mist separator. → Replace the silencer with a new one.
	Vacuum pressure and/or suction flow is reduced due to clogging of the nozzle and the diffuser.	→ Remove foreign matter and substances sticking to it. (Needs to be repaired.) Mount an air filter on the supply side to prevent it happening again.
	Vacuum pressure and/or suction flow is reduced due to clogging of the nozzle and the diffuser.	→ Remove foreign matter and substances sticking to it. (Needs to be repaired.) Mount an air filter on the supply side to prevent it happening again.

Trouble	Cause	Countermeasures
Vacuum failure over time (absorbs properly initially.)	Adsorbing part has some problem, such as deterioration of the vacuum pad, or leakage due to frictional wear.	→ Replace the vacuum pad with a new one. → Revise the adsorption conditions (such as compatibility of the vacuum pressure with the pad/workpiece)
	The filter case gasket has come off when the filter element was replaced.	Vacuum pressure leaks if the gasket has come off or out of the groove when maintenance of the filter was performed. → Check if it is mounted properly.
	Defective operation caused by energization of solenoid valve for an extended period of time. (Energized for 10 minutes or more or operated with the duty ratio of 50% or more.)	→ Shorten the energization time of the solenoid valve. → Provide forced ventilation in the operating environment in order to prevent temperature increase around the solenoid valve.
Workpiece is not released smoothly.	Vacuum break flow is not large enough.	→ Open the vacuum break flow adjusting needle. → For the specification with individual port for release pressure supply port and air supply port, increase the release pressure at the releaser pressure supply port.
	The vacuum pad surface is worn out, making it sticky.	→ Replace the vacuum pad with a new one. → Revise the material and configuration of the vacuum pad. → Use a special pad which has a blasted adsorption surface. (Made-to-order)
	Vacuum pressure is too high.	→ Decrease the supply pressure to lower the vacuum pressure. → Decrease the pressure in the piping on the vacuum side with a vacuum regulator.
	Workpiece sticks to the pad due to static electricity.	→ Use a conductive pad.
	Vacuum break signal timing is inappropriate .	If the pad is lifted before the workpiece is completely released from the pad, the workpiece is lifted together with the pad due to the viscosity of the pad. → Revise the timing of the vacuum break and the lifting of the pad.

If the countermeasures shown are not effective, there may be a problem with the product. In that case, stop using the product immediately **without disassembling or repairing it.**

If any of the examples below are applicable, there may be a problem with the product.

1) It was used with a voltage other than the rated voltage. 2) Lubricant was contained in the supply air. 3) Liquid such as water was directly splashed onto the product body. 4) A strong impact was applied to the product. 5) Drainage and dust got mixed into the supply air. 6) Other actions corresponding to the precautions mentioned in this operation manual.

When removing the product from the application, be sure to confirm that safety measures are taken, and shut down the compressed air supply and the power supply before removing the product.

Revision history

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