



Operation Manual

PRODUCT NAME

Vacuum Pad with Ejector

MODEL / Series / Product Number

Series ZHP



SMC Corporation

Contents

1. Safety Instructions	2
2. Model Indication and How to Order	5
3. Names of parts of product	6
4. Mounting and Installation	7
5. Air Supply	9
6. Exhaust from Ejector	9
7. Piping	10
7.1 Piping connections to the PD Ports	10
7.2 Piping connections to the Supply (P) port	11
8. Construction	12
9. Dimensions	15
10. Repair	16
10.1 Maintenance and Repair Precautions	16
10.2 Pad replacement	17
10.3 Ejector assembly replacement	18
10.4 Silencer assembly replacement	19
10.5 Supply (P) port one-touch fitting replacement	19
10.6 Ejector Body Assembly, Blanking Plate Assembly, Check Valve Replacement	20
11. Specification	22
12. Circuit examples	24
13. Exhaust Characteristics and Flow Characteristics of Ejector	25
14. Troubleshooting	26
15. Non-conformance Examples	27

1. Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions are categorized into three groups, "Caution", "Warning" and "Danger" depending on the level of hazard and damage, and the degree of emergency. They are all important notes for safety and must be followed in addition to International Standards (ISO / IEC), Japan Industrial Standards (JIS)*¹⁾ and other safety regulations*²⁾.

- *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 10218-1: Manipulating industrial robots -- Safety.
JIS B 8370: General rules for pneumatic equipment.
JIS B 8361: General rules for hydraulic equipment.
JIS B 9960-1: Safety of machinery – Electrical equipment for machines. (Part 1: General requirements)
JIS B 8433: Manipulating industrial robots – Safety. etc.

- *2) Labor Safety and Sanitation Law. 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 adverse effects on people, property, or animals especially those requiring special safety requirements.
4. If used in an interlock circuit, consider using a mechanical function as a redundant safety measure. Perform periodical checks to confirm proper operation. Check the product regularly in order to confirm normal operation.

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 the product is being considered for use 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.*3) 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 SMC's responsibility, a replacement product or necessary parts will be provided. This limited warranty applies only to the SMC 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.



***3) 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 regulations 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. Instructions are provided as a drawing or sentence next to the symbol.
	Things you must do. Instructions are provided as a drawing or sentence next to the 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 or repair other than instructed in this manual. Otherwise, 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. Please check 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 cut off the compressed air supplied to this product during suctional transportation. Otherwise it can cause injury due to dropping of workpieces or damage to the system.
 Instruction	Ensure the load to be moved is within the designed capability of the system. Operation of the system outside of its designed specifications can cause personal injury or damage to the system or load.

 Caution	
 Instruction	Perform sufficient trial run. Otherwise, injury or damage to the system can result 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. Stop the fluid supply. Do not supply fluid if there is leakage. Safety cannot be assured in the case of an unexpected malfunction.
 Do not	Do not assemble any non-conforming parts. This may cause damage to the product.

2. Model Indication and How to Order

How to Order

Without ejector

ZHP 80 BM N B - 00

With ejector

ZHP 80 BM N B - 10 C6 S



Pad diameter

63	ø63
80	ø80

Pad form

BM	Bellows type with groove
UM	Flat type with groove

Pad material

N	NBR (Black)
S	Silicone rubber (White)
U	Urethane rubber (Brown)
F	FKM (Black) ^{*1)}

Mounting

Symbol	Type	Thread	Size
A	Metric size	Male thread	M8
B		Female thread	M10
C	Inch size	Male thread	5/16-18UNC
D		Female thread	3/8-16UNC
E	Metric size	Male thread	5/16-18UNC
F		Female thread	3/8-16UNC
G	Inch size	Male thread	5/16-18UNC
H		Female thread	3/8-16UNC

Exhaust release

S	Silencer exhaust
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Supply (P) port

Symbol	Type	Port size
C4	Metric	ø4 One-touch fitting
C6		ø6 One-touch fitting
N3	Inch	ø5/32" One-touch fitting
N7		ø1/4" One-touch fitting

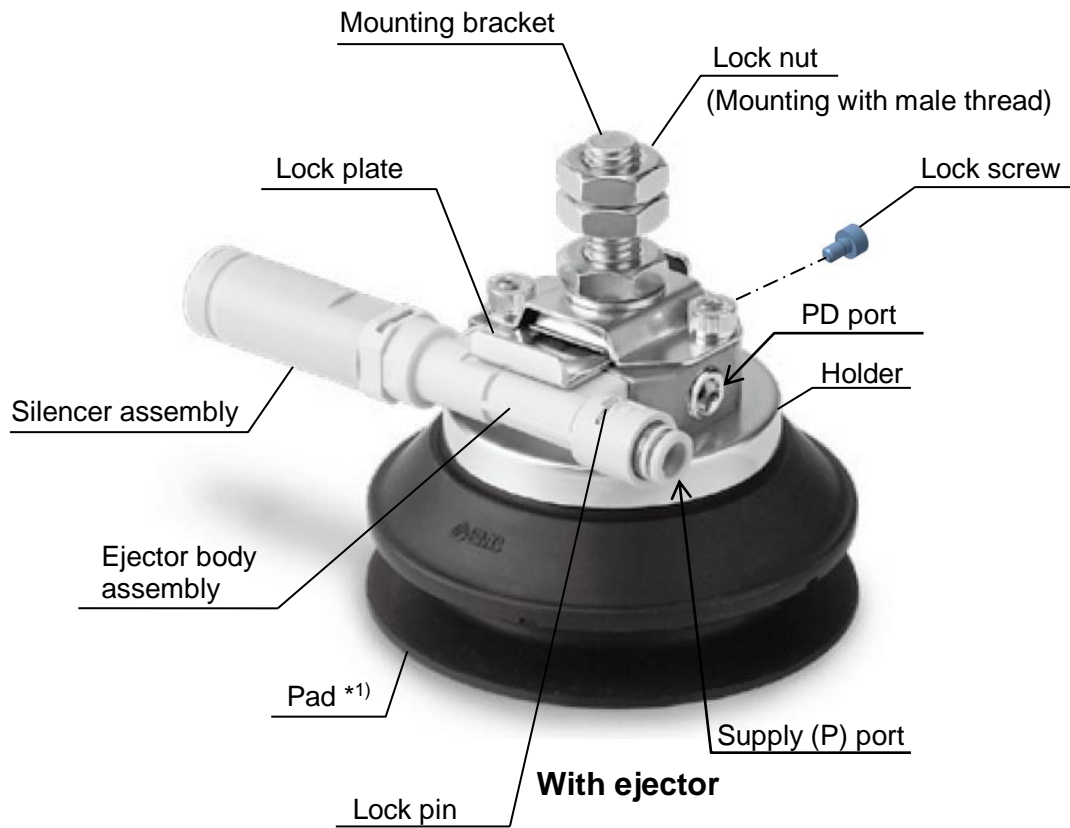
Ejector/
Nozzle nominal size [mm]

07	Nozzle: ø0.7
10	Nozzle: ø1.0
12	Nozzle: ø1.2
15	Nozzle: ø1.5

- *1) FKM and NBR have the same color. But, "F" mark is indicated on the inside of the pad when the plate is removed.

For pad and ejector selection, refer to SMC's website (<http://www.smcworld.com>) or Vacuum Equipment Model Selection in Best Pneumatics No. 4.

3. Names of Parts of Product



Without ejector

*1) The product uses standard pad (rubber) of Vacuum Pad / ZP3E series.
Refer to SMC's website for the details of the pad (<http://www.smcworld.com>).

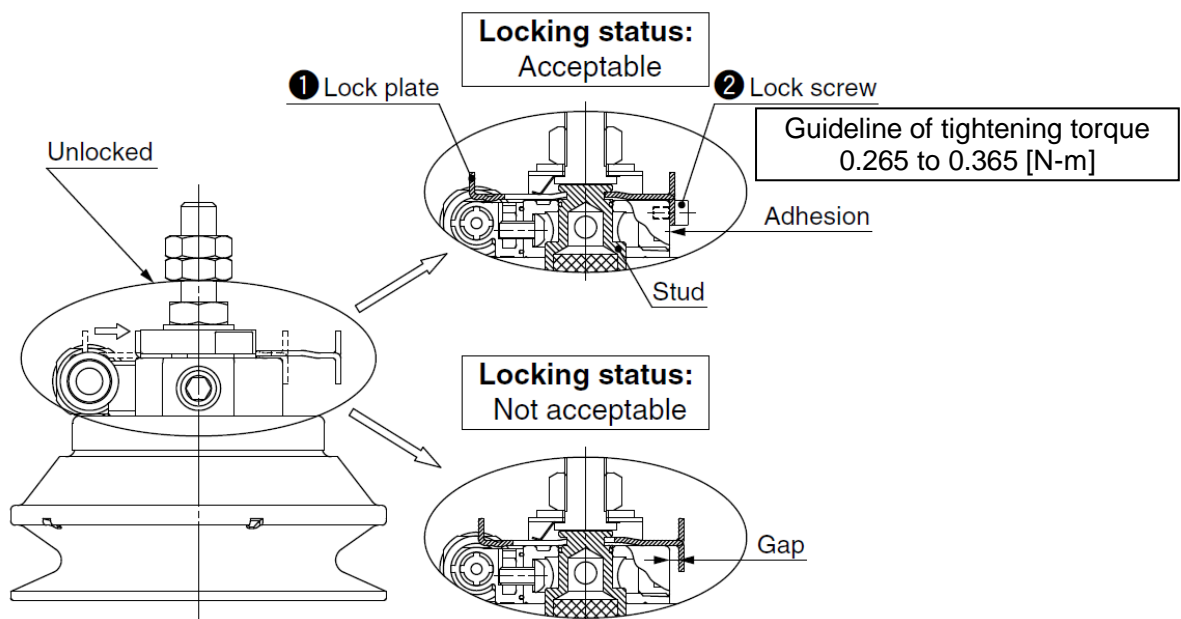
4. Mounting and Installation

- (1) After the pad replacement, ensure the lock plate (1) is locked (see below).

If the lock plate is not completely locked during operation, serious accidents such as falling of the pad or workpiece can occur due to the vibration or load.

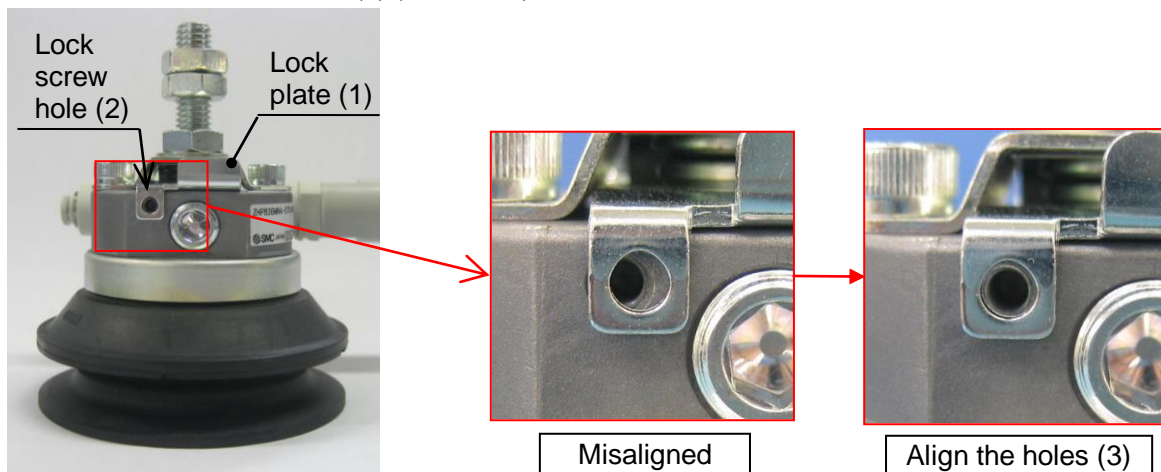
- (2) Make sure that the lock screw (2) of the lock plate (1) is properly tightened for safe operation.
(see below)

Serious accidents such as falling of pad or workpiece can occur, if the lock plate comes off during operation.

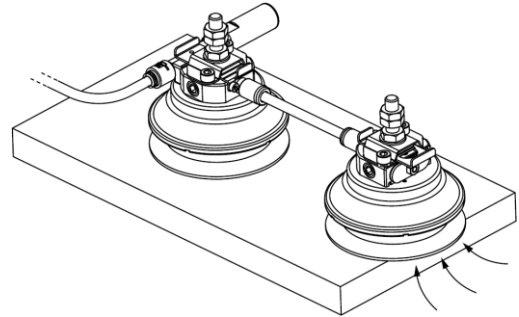


NOTE : If the lock plate (1) misaligns with the lock screw hole (2), the lock screw cannot be tightened.

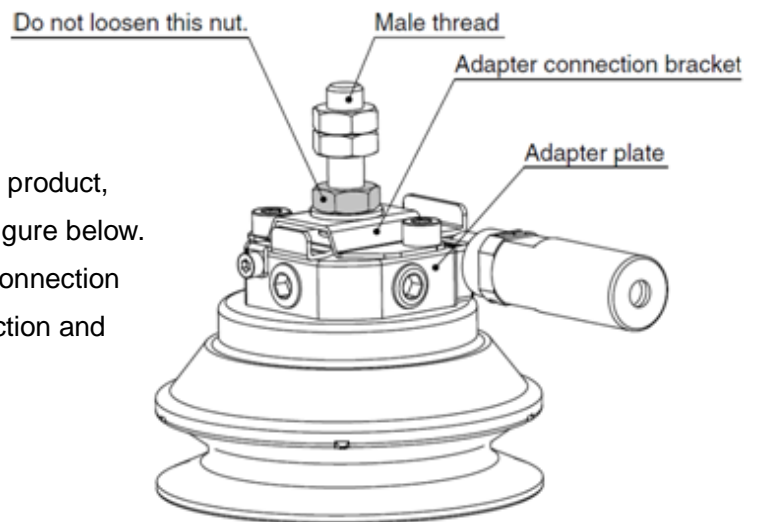
In this case, before tightening, adjust the lock plate so that the position of the lock screw hole and female thread is centered (3) (see below).



- (3) When connecting multiple pads to one ejector through the vacuum communication, other pads also cannot adsorb if incorrect adsorption occurs in one pad. Take safety measures so that the workpiece does not drop during transfer.



- (4) When using the male thread mounting type product, do not loosen the bottom nut shown in the figure below. (The bottom nut is intended to secure the connection between the bracket for the adapter connection and the male thread.)



- (5) Do not apply load to the silencer assembly, as it may cause damage.
- (6) Provide sufficient space for handling of the lock plate or maintenance of ejector.

5. Air supply

- (1) Air is the applicable fluid for this product.

Do not use fluid which includes chemicals, synthetic oils containing organic solvents, salt, or corrosive gases, etc.

- (2) If the air contains condensate or carbon powder, it may clog the ejector and cause deterioration of the performance or operation failure.

Install an air dryer or drain catch before the filter and perform draining regularly, to remove excess of the condensation from the air supply.

If the drainage is insufficient, an excessive condensation will build up in the secondary side. This can reduce vacuum pressure and cause suction failure.

Filter with an auto drain option is recommended as simple draining method.

- (3) Install an air drier, air filter and mist separator in the upper stream.

Refer to SMC's website for details, section "Handling Precautions for SMC Products" -> "Vacuum Equipment".

6. Exhaust from Ejector

- (1) Do not direct the through-hole silencer toward a person. Air from the ejector is exhausted directly to the atmosphere.

- (2) The silencer will gradually get clogged if it is operated in dusty environment. Reduction of performance can also be caused by contaminated air supply. Replace the silencer assembly when the exhaust noise raises.

- (3) Noise level during the adsorption of workpiece.

Nominal nozzle size [mm]	Noise level [dB(A)]
Ø 0.7	60
Ø 1.0	69
Ø 1.2	74
Ø 1.5	75

(Reference value based on measurement conditions of SMC)

- (4) Do not cover the through hole silencer.

7. Piping

7.1 Piping connections to the PD Ports

(1) PD port can be used in 3 ways:

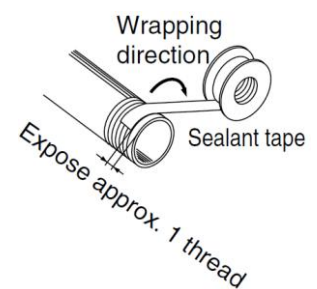
- 1) **Supply port of vacuum release air.**
- 2) **Connection port for the pressure sensor or pressure switch for vacuum for detecting the pressure in the pad.**
- 3) **Vacuum port when the ejector is not used.**

If PD ports are not used for any of the above actions, cover the ports with plugs supplied in the package.

(2) Perform air blow (flushing) sufficiently before piping to remove foreign matter.

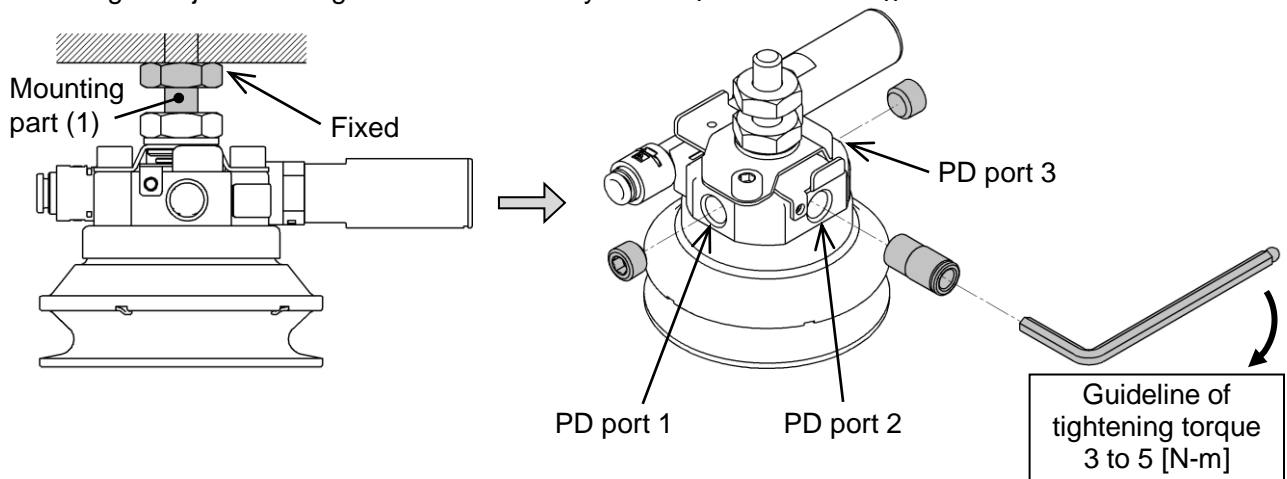
(3) When installing piping or a tube fitting into a port, prevent cutting chips and sealant material from getting inside the product.

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



(4) Hold the mounting part (1) during the connection of the PD ports to tubing or equipment.

Holding the ejector during the connection may lead to product breakage.



(5) Recommended One-touch fitting to be mounted at the PD port is the KQ2S06-01[S] or KQ2S07-34[S].

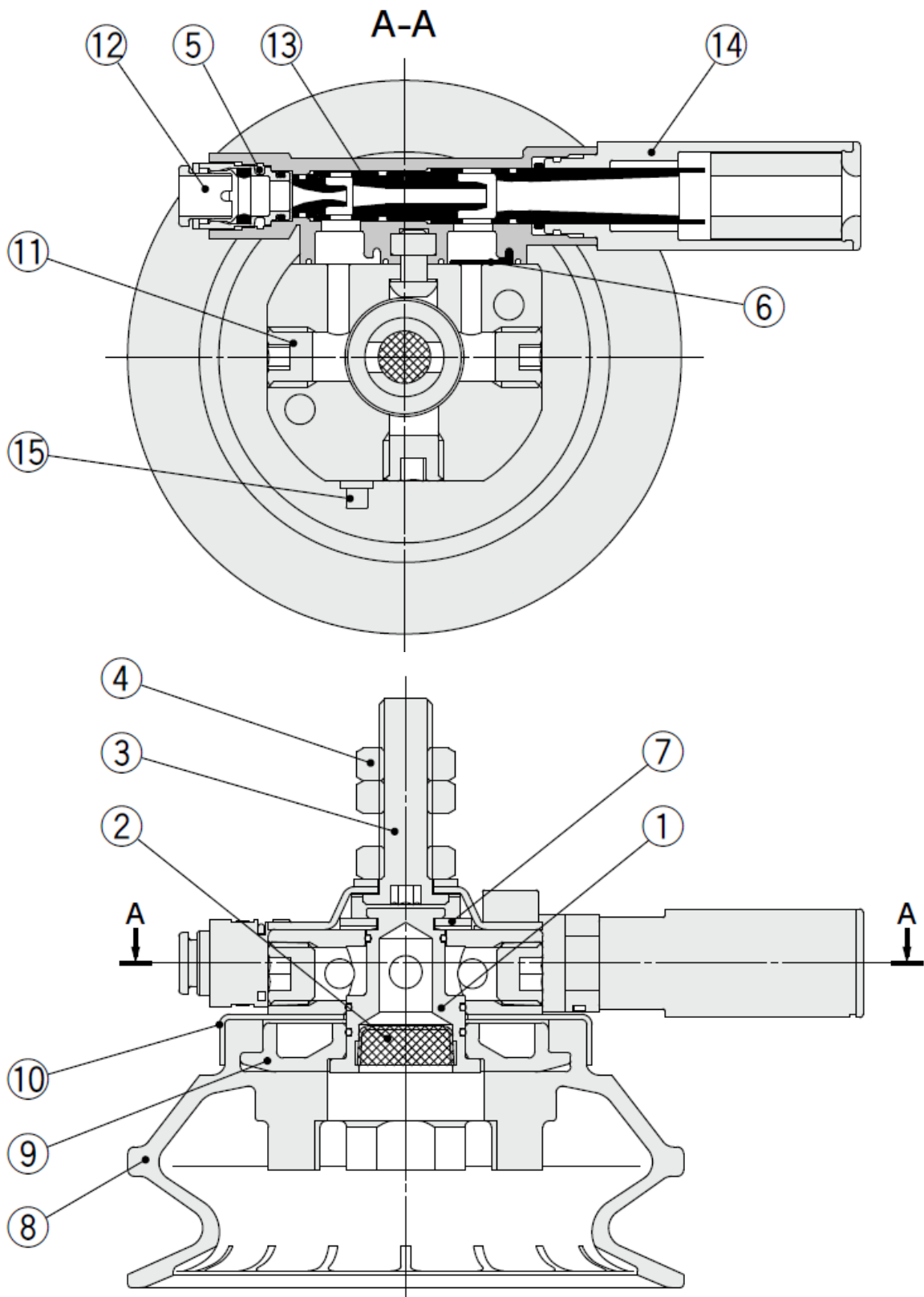
One-touch fitting may interfere with the top surface of the pad depending on the fitting dimensions. This may cause the One-touch fitting not to be mounted.

(6) When supplying the vacuum release air to the PD port, select an appropriate product suitable for the specifications so that the R port of the 2 port or 3 port valve to be used is blocked not to leak the vacuum in the closed state.

7.2 Connection to supply (P) 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) Prevent the connected tube from being rotated.
If the fittings are used in this way, the fitting is likely to break.
- (3) Do not lift the product by holding the piping after the tube is connected to the P port.
This may lead to damage of One-touch fitting.
- (4) Perform air blow (flushing) sufficiently before piping to remove foreign matter.
- (5) Applicable tube materials are nylon, soft nylon and polyurethane.
- (6) The tubing diameter should be the standard size. If the piping diameter is reduced, it may lead to insufficient flow of supply air, reduction of suction flow and delay in the transport cycle time.
- (7) This product has one-touch fittings, refer to Fittings & Tubing Precautions of Best Pneumatics No. 6.

8. Construction



Component Parts

No.	Description	Note
1	Stud	
2	Strainer	Mesh size: 100 mesh
3	Mounting bracket	
4	Lock nut	2 pcs. included for male thread mounting (Not included for female thread mounting)
7	Lock plate	

Replacement Parts

No.	Description	Part no.	Note
5	Lock pin	ZK2-CL1-A	5 pcs. in 1 set
6	Check valve	ZK2-CV-A	10 pcs. in 1 set
8	Pad	ZP3E-□□□□	Flat / Bellows type with groove
9	Plate	ZHP1-PL□-A	
10	Holder		
11	Plug *1)	TB00148	Included for metric size
		TB00055	Included for inch size
12	One-touch fitting	KJH□-C2	
13	Ejector assembly	ZK2-EJ□W-A	
14	Silencer assembly	ZHP1-SA1-A	
15	Lock screw	CA00284	Included

*1) 3 pieces are included in one product. (The part numbers are for 1 piece.)

⑧ Pad

ZP3E - **80** **BM** **N**

Pad material

N	NBR
S	Silicone rubber
U	Urethane rubber
F	FKM

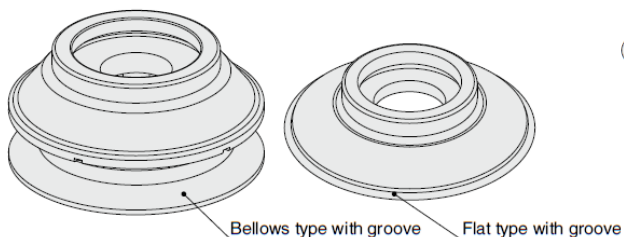
Pad form

BM	Bellows type with groove
UM	Flat type with groove

Pad diameter

63	ø63
80	ø80

* When changing the pad diameter, replace also the plate together.



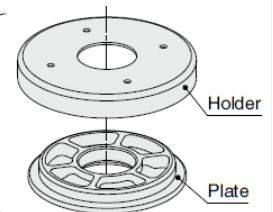
⑨⑩ Plate assembly*

ZHP1 - PL **1** - A

Size (Applicable pad dia./form)

1	ø63/ø80: Flat type, ø63: Bellows type
2	ø80: Bellows type

* Part number for a set of plate and holder



⑫ One-touch fitting (The order lot is 10 pieces.)

KJH **06** - C2

Applicable tubing O.D.

04	ø4
06	ø6
03	ø5/32"
07	ø1/4"

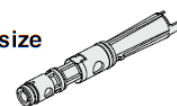


⑬ Ejector assembly

ZK2 - EJ **10** W - A

Nozzle nominal size

07	ø0.7
10	ø1.0
12	ø1.2
15	ø1.5



Replacement Parts

•Ejector body assembly

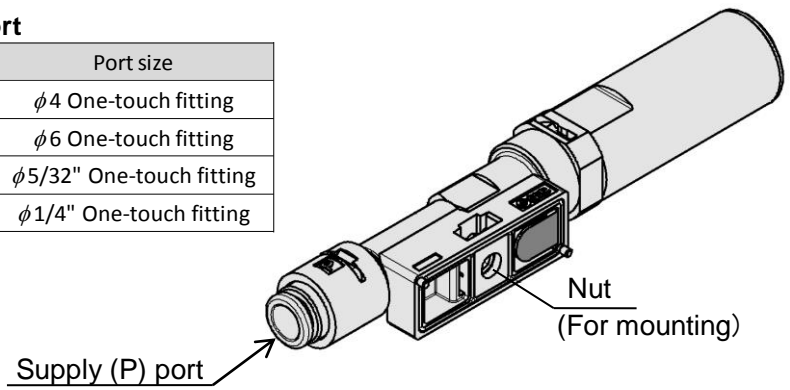
ZHP1 – EB1 **10** **C6** S – A

• Supply (P) port

Symbol	Type	Port size
C4	Metric	ϕ 4 One-touch fitting
C6		ϕ 6 One-touch fitting
N3	Inch	ϕ 5/32" One-touch fitting
N7		ϕ 1/4" One-touch fitting

• Nozzle nominal size

07	ϕ 0.7
10	ϕ 1.0
12	ϕ 1.2
15	ϕ 1.5

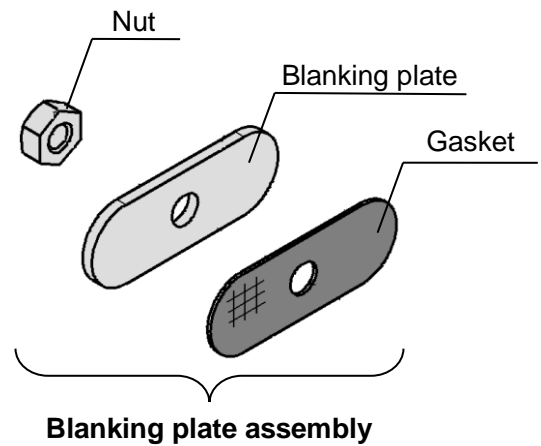


This assembly includes one-touch fitting, ejector assembly, silencer assembly and check valve.

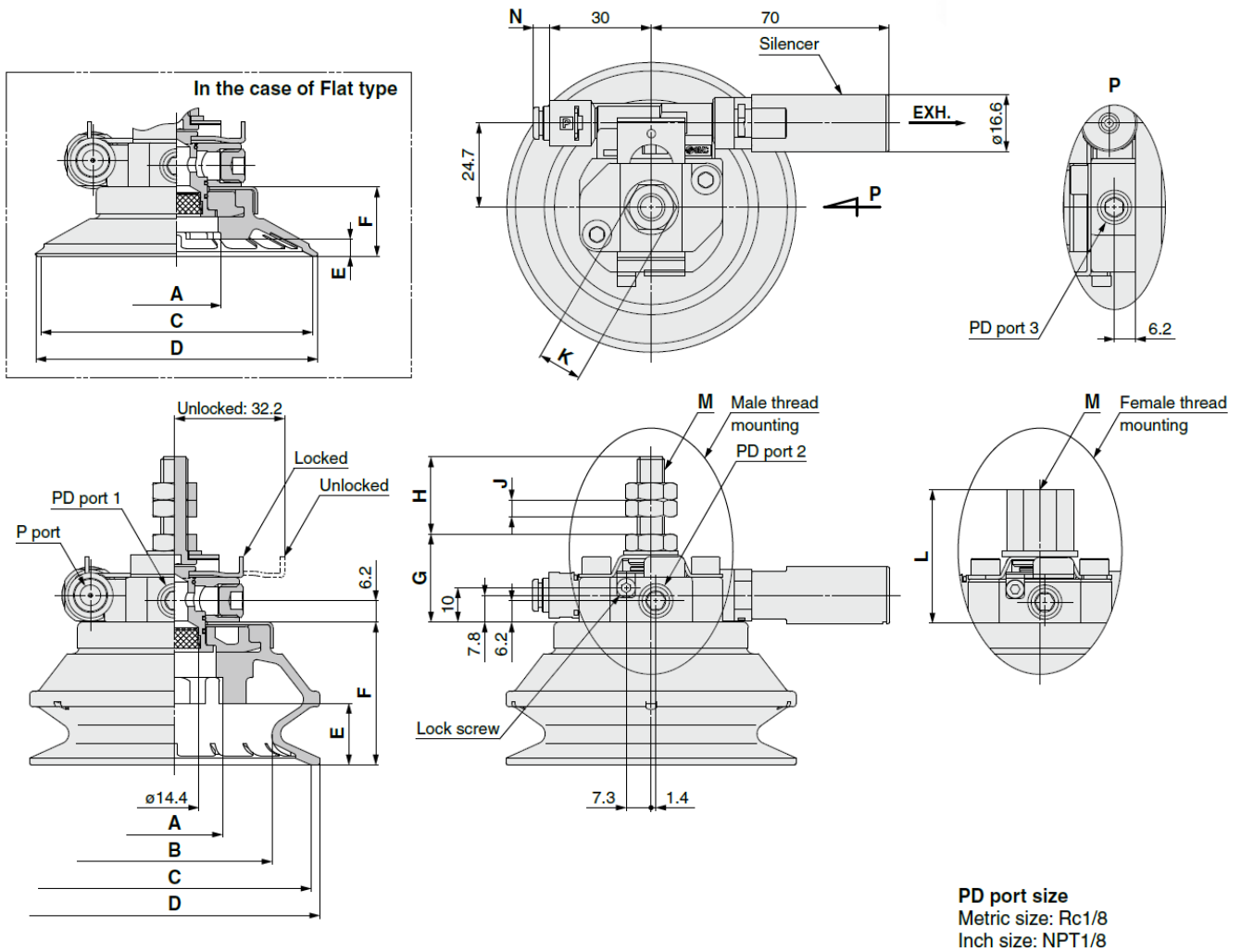
•Blanking plate assembly

ZHP1- BP1- A

This is the set number of the nut, blanking plate and gasket.



9. Dimensions



Dimensions [mm]

	A	B	C	D	E	F
ZHP63BM	$\phi 26$	$\phi 45.8$	$\phi 63$	$\phi 68$	12.5	33.8
ZHP80BM	$\phi 28$	$\phi 57$	$\phi 80$	$\phi 85$	18	41.8
ZHP63UM	$\phi 26$	—	$\phi 63$	$\phi 66$	5	20.3
ZHP80UM	$\phi 26$	—	$\phi 80$	$\phi 83$	5	20.3

Supply Port Dimensions [mm]

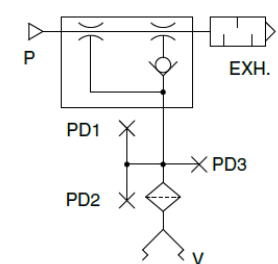
	N
C4	4.7
C6	4.7
N3	4.7
N7	7.3

Adapter Dimensions (by Mounting Style) [mm]

	G	H	J	K	L	M
ZHP□□□A-□□S	25.7	22.6	5	13	—	M8
ZHP□□□B-□□S	27.1	21.2	6	17	—	M10
ZHP□□□C-□□S	—	—	—	13	36.7	M8 depth 10
ZHP□□□D-□□S	—	—	—	17	39.1	M10 depth 10
ZHP□□□E-□□S	27.45	21.8	6.75	12.7	—	5/16-18UNC
ZHP□□□F-□□S	29.43	26.82	8.33	14.28	—	3/8-16UNC
ZHP□□□G-□□S	—	—	—	12.7	41.7	5/16-18UNC depth 11
ZHP□□□H-□□S	—	—	—	14.28	44.1	3/8-16UNC depth 11

For symbols G and H (inch-type female thread), the dimension K becomes the width across flats.

Circuit



10. Repair

10.1 Maintenance and Repair Precautions

(1) Perform regular maintenance to ensure safe and correct operation.

(2) The vacuum pad is a consumable. Regular replacement is necessary.

Replace the vacuum pad with a new one.

- The vacuum pad (rubber) may deteriorate.

- When the vacuum pad is used continuously, the following problems may occur.

1) Shrinkage of the pad dimensions and sticking of the rubber bellows due to the wearing of the suction surface.

2) Weakening of the rubber parts. (skirt of the suction surface, bending parts, etc.)

It may occur at an early stage depending on the operating conditions.

(vacuum pressure, suction time or frequency, etc.)

- Decide when to replace the pads, referring to the signs of deterioration, such as changes in the appearance due to wear, reduction in the vacuum pressure or delay in the transport cycle time.

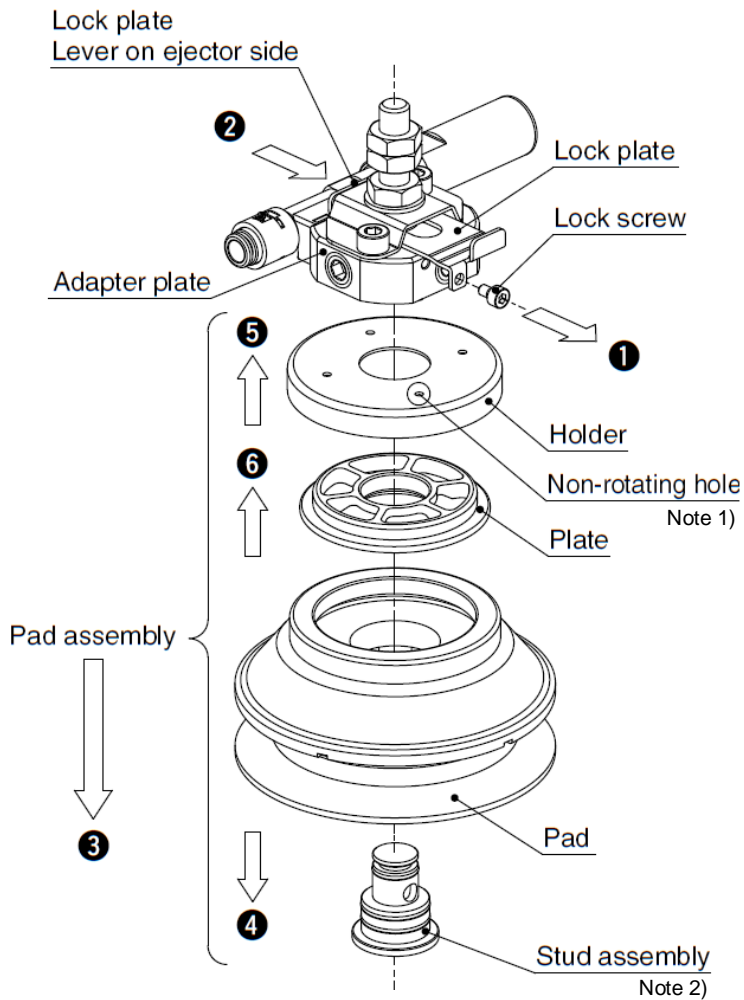
(3) Before maintenance, ensure the pressure supply is off and the pressure in the tubing is discharged.

(4) It is the responsibility of the customer to replace parts including specification changes.

(5) It is not possible to remove the strainer. Remove any particles from the strainer with air blow.

(6) It is the responsibility of the customer to perform daily inspection considering the operating conditions of the system.

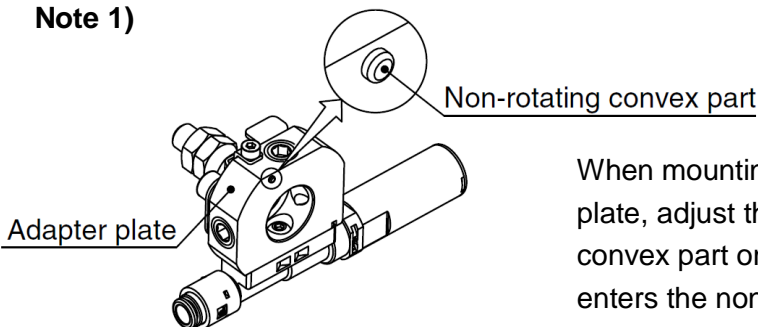
10.2 Pad Replacement



- (1) Remove the lock screw.
- (2) Push the lever (on the ejector side) of the lock plate to slide it to a position where it stops completely.
- (3) Pull out the pad assembly.
- (4) Pull out the stud assembly from the pad assembly.
- (5) Remove the holder.
- (6) Remove the plate from the pad.
- (7) Mount the pad in the reverse order of steps above.

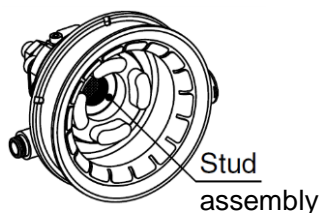
Cautions on pad mounting

Note 1)



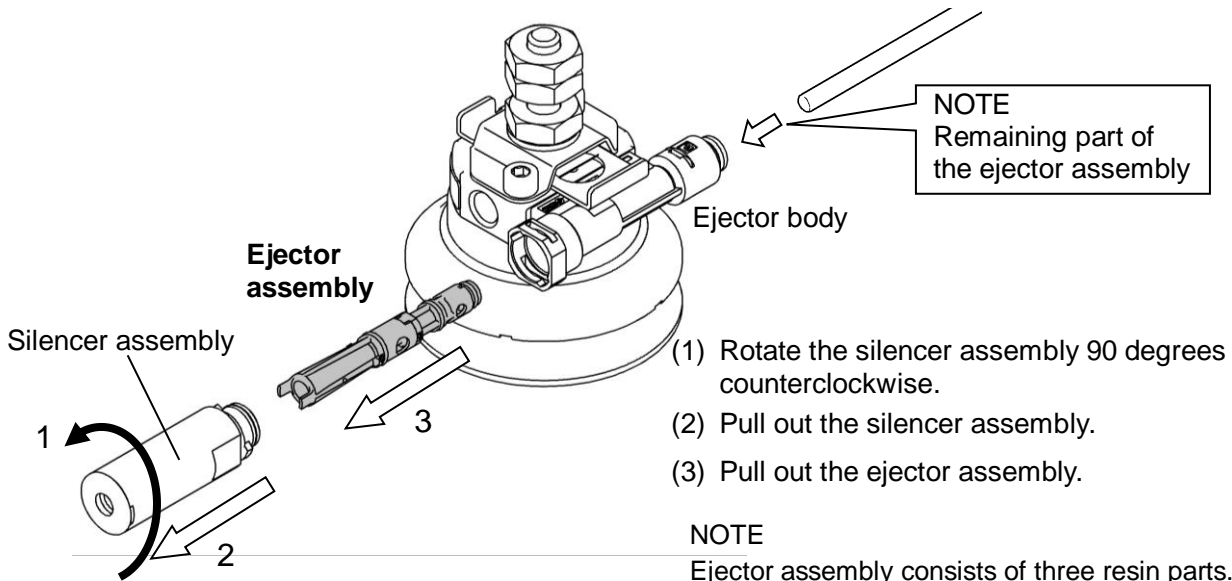
When mounting the pad assembly on the adapter plate, adjust the position so that the non-rotating convex part on the bottom of the adapter plate enters the non-rotating hole in the holder.

Note 2)



Push the stud assembly firmly upward when locking the lock plate. If the stud assembly is not pushed into the adapter plate completely, the lock plate slides insufficiently, causing pad drop or vacuum leak.

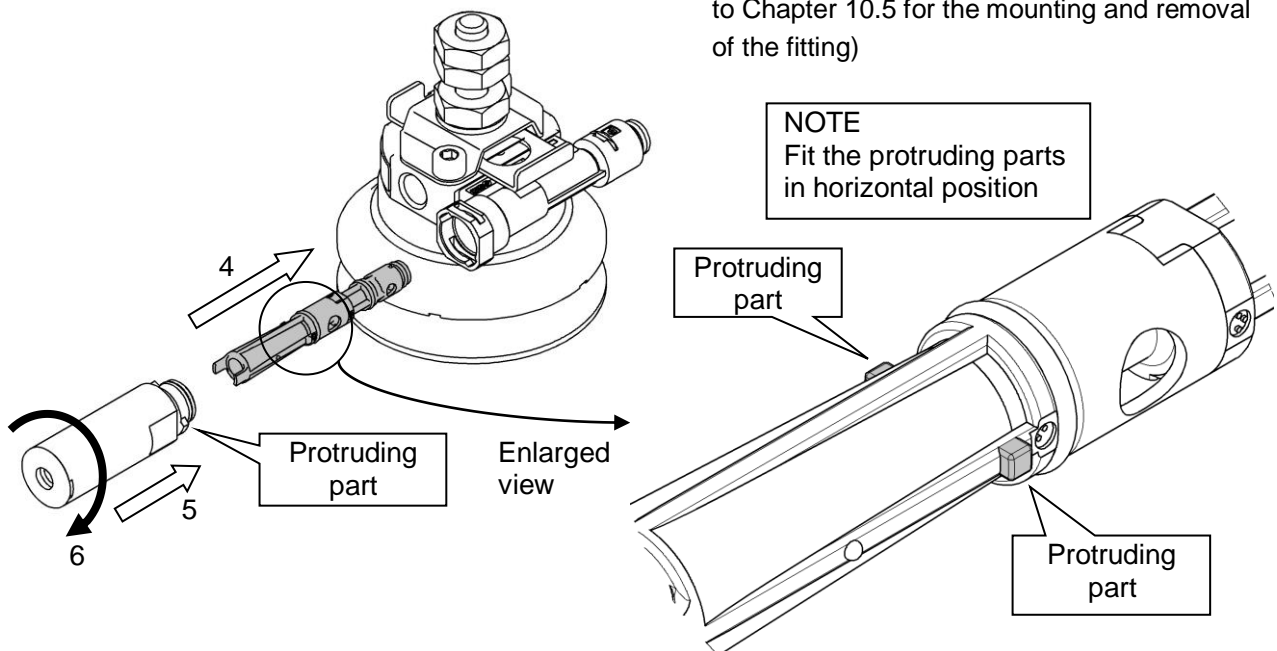
10.3 Ejector Assembly Replacement



NOTE

Ejector assembly consists of three resin parts. one of the parts may remain in the ejector body after the ejector assembly removal. In this case, use a tool ($\varnothing 3.5$ to $\varnothing 4.5$) to push it out from P port.

- Be careful not to damage the removed ejector assembly if it is going to be reused. Any damage may cause performance reduction.
- When the size of P port is $\varnothing 4$ or $\varnothing 5/32$ ", push out the ejector after removing the fitting. (Refer to Chapter 10.5 for the mounting and removal of the fitting)



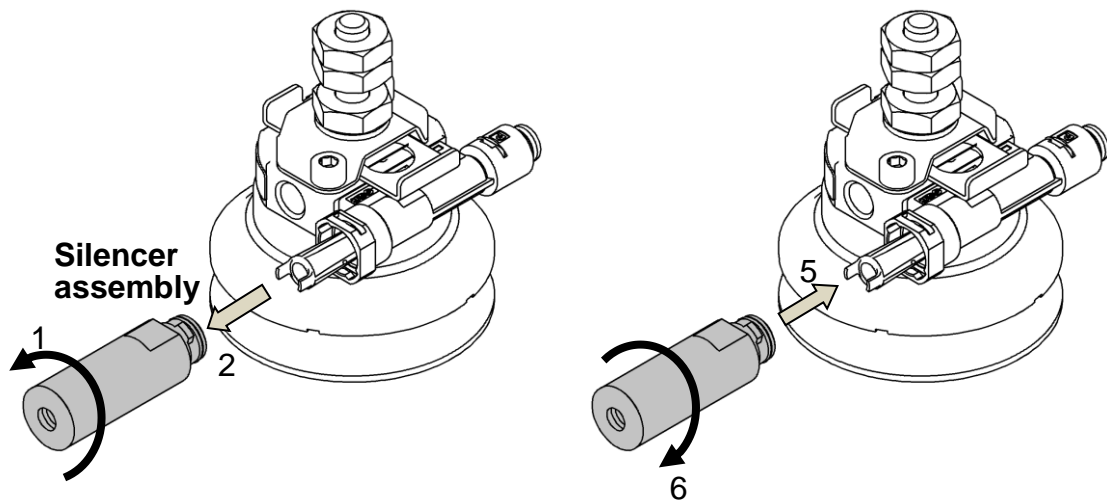
- (4) Insert a new ejector assembly into the ejector body.

NOTE

- 1) Make the protruding parts horizontal
- 2) As the ejector assembly uses three O-rings, resistance will be felt for three times.

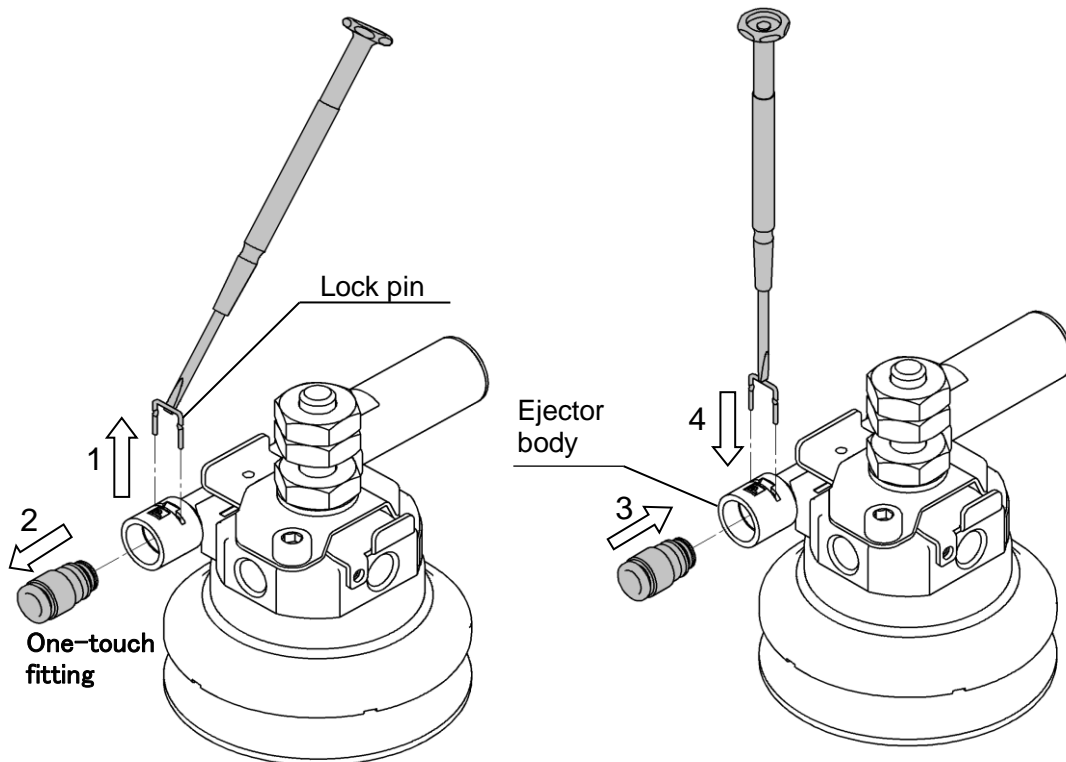
- (5) Insert the protruding parts of the silencer body so that they fit in the cutouts of the ejector body.
- (6) Rotate the silencer assembly clockwise approx. 90 degrees.

10.4 Silencer Assembly Replacement



Refer to (1), (2), (5), (6) of section 10.3 Ejector Assembly Replacement Procedure.

10.5 Supply (P) port One-touch Fitting Replacement



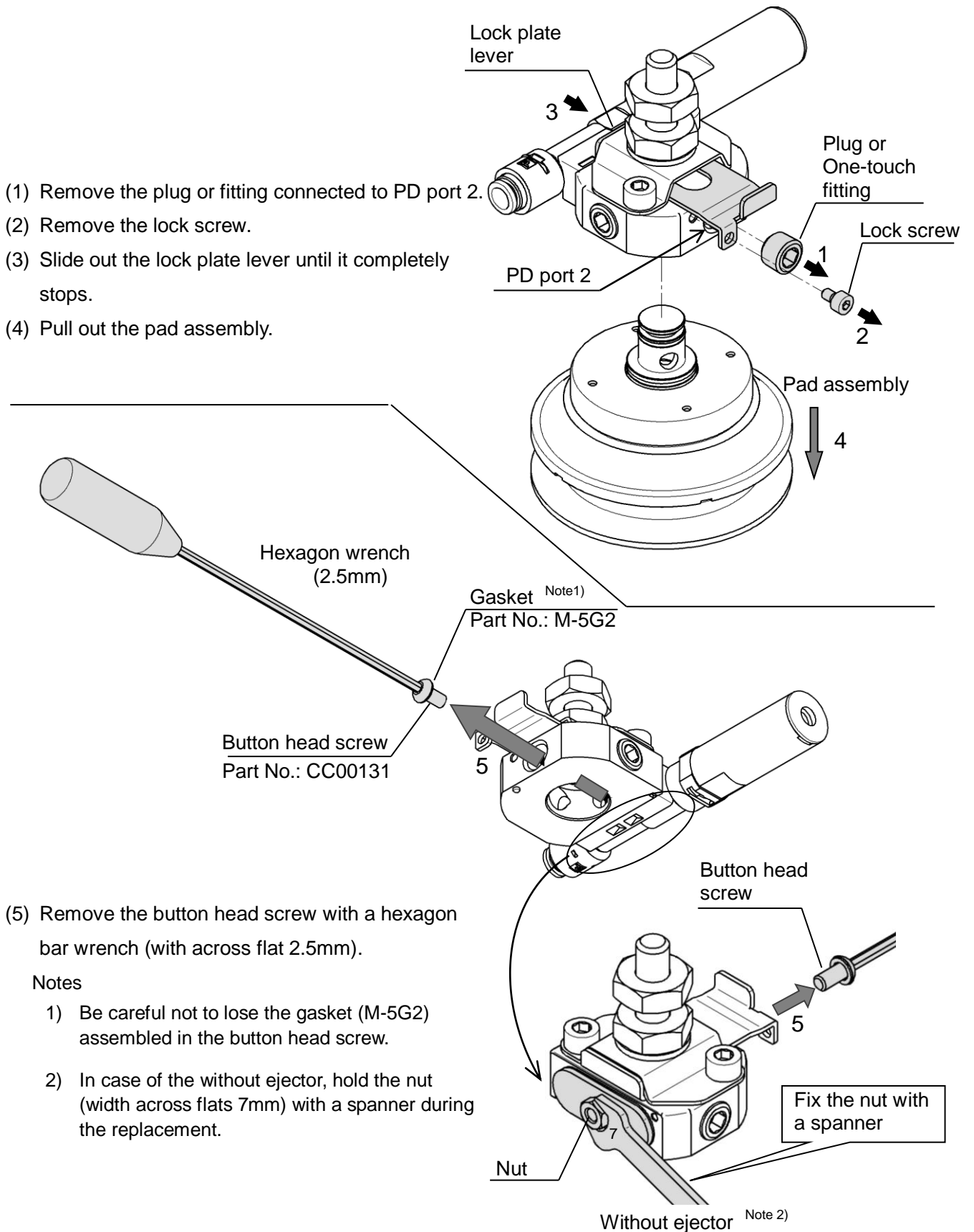
- (1) Remove the lock pin with a precision screwdriver.
- (2) Remove one-touch fitting.

- (3) Insert a new one-touch fitting.
- (4) Mount lock pin with a precision screwdriver.

Notes

- 1) Make sure the O-rings of the One-touch fittings are free from scratches and dust.
- 2) Hold the ejector body during the replacement.

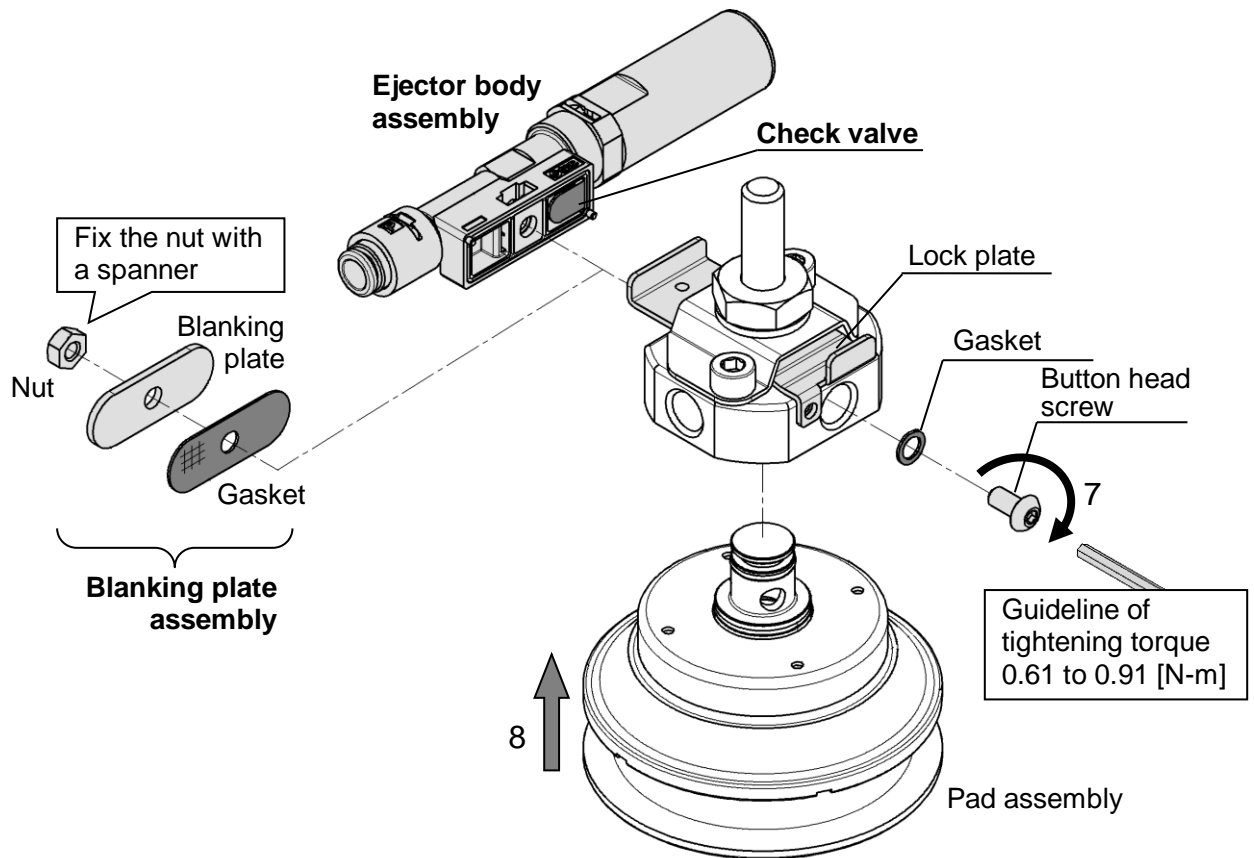
10.6 Ejector Body Assembly, Blanking Plate Assembly, Check Valve Replacement



(5) Remove the button head screw with a hexagon bar wrench (with across flat 2.5mm).

Notes

- 1) Be careful not to lose the gasket (M-5G2) assembled in the button head screw.
- 2) In case of the without ejector, hold the nut (width across flats 7mm) with a spanner during the replacement.



- (6) Replace the part with a new one.
- (7) Insert the button head screw to the gasket and tighten the button head screw.
- (8) For step after (7), refer to section **10.2 Pad Replacement**.

11. Specification

General specifications

Operating temperature range	0 to 50 °C (No freezing)
Fluid	Air
Operating pressure range	0.1 to 0.6 MPa

Ejector Specifications

	ZHP□□□-07□	ZHP□□□-10□	ZHP□□□-12□	ZHP□□□-15□
Nozzle nominal size [mm]	0.7	1.0	1.2	1.5
Max. suction flow rate [L/min(ANR)] *1)	30	51	62	77
Air consumption [L/min(ANR)] *1)	24	40	58	87
Vacuum pressure reached [kPa] *1)	-91			
Standard supply pressure [MPa]	0.35			

*1) Values are based on standard of SMC measurements. They depend on atmospheric pressure (weather, altitude, etc.) and measurement method.

*1) Standard supply pressure.

Response Time *2)

[ms]

	ZHP□BM□-07□	ZHP□BM□-10□	ZHP□BM□-12□	ZHP□BM□-15□
φ 63	295	143	120	86
φ 80	455	221	190	140

*2) Response time means a period of time that the vacuum pressure reaches -57 kPa after the externally installed valve has been turned ON when the bellows type pad is used and the supply pressure is 0.35 MPa.

Recommended Work Load

[N]

	ZHP63□	ZHP80□
Horizontal lifting	66	106
Vertical lifting	33	53

Use this product with the recommended work load or less. The transfer work over the recommended work load may cause the vacuum pressure to decrease by the air leak. The work load shown above is the value when the vacuum pressure reaches -85 kPa, and that is calculated by multiplying the theoretical value by a safety factor of "1/4" for the horizontal lifting or "1/8" for the vertical lifting. For details, refer to the Vacuum Equipment Model Selection in the Best Pneumatics No. 4. The vacuum pressure reached may vary depending on the workpiece (permeability, etc.). Calculate the actual work load in accordance with the vacuum pressure reached.

Rubber hardness

Material	NBR	Silicone rubber	Urethane rubber	FKM
Rubber hardness (±5°)	A55	A50	A50	A60

Weight

(1) Weight Difference by Mounting Style [g]

B	C	D	E	J	G	H
20	-5	14	7	25	1	11

(2) Weight Difference by Material [g]

Pad diameter / form	Silicone rubber	Urethane rubber	FKM
ZHP63BM	-2.9	0	20.3
ZHP80BM	-5.0	0	35.1
ZHP63UM	-1.5	0	10.6
ZHP80UM	-2.1	0	15.5

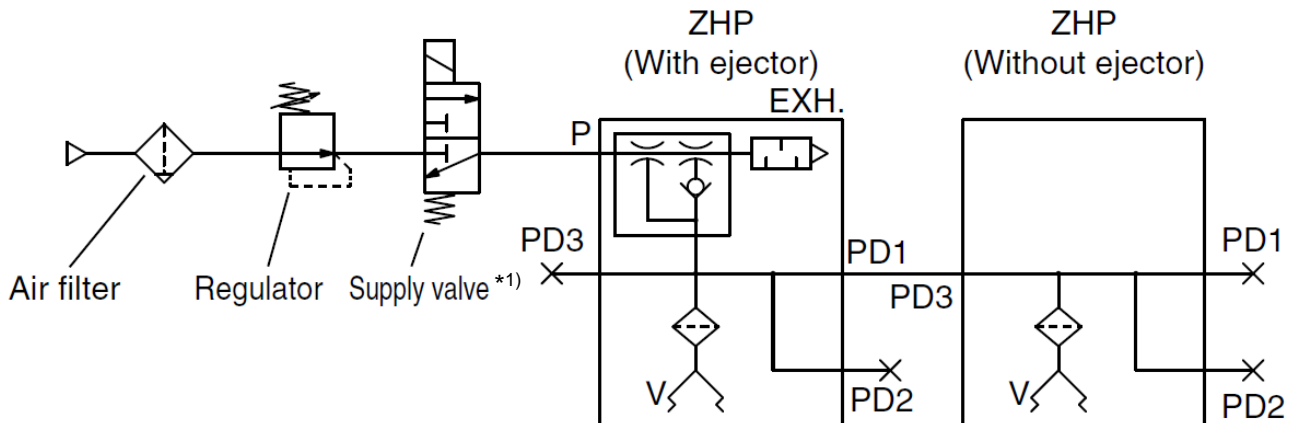
Material: **NBR**, Mounting: **A** [g]

ZHP63BMNA-□C6S	184
ZHP80BMNA-□C6S	224
ZHP63UMNA-□C6S	167
ZHP80UMNA-□C6S	175

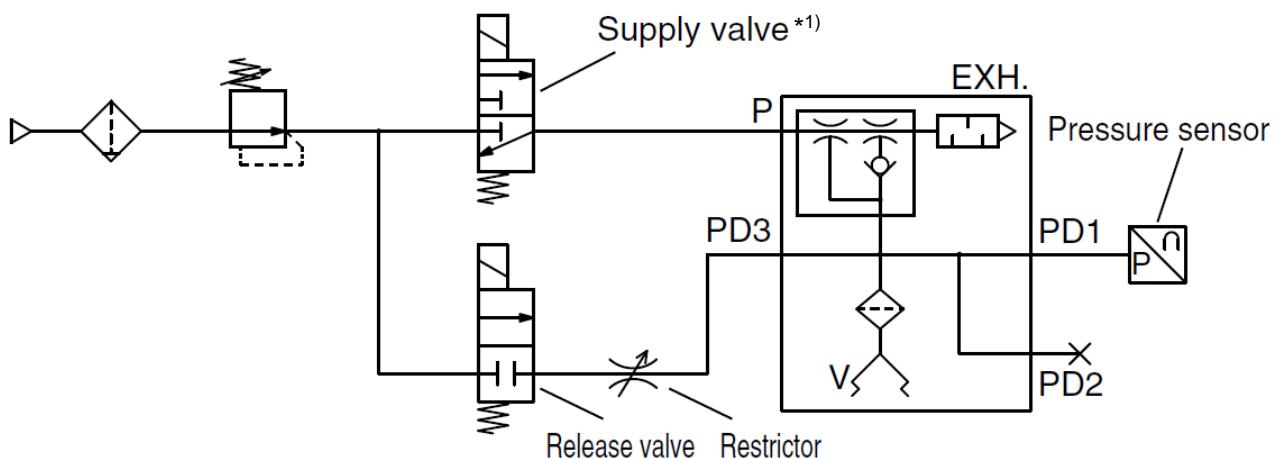
- For the ZHP□□□A-00 (without ejector), weight shown above -12 g.
- If the mounting symbol is different than "A", add the weight listed in Table (1) to the weight in the table above
- If the material is different than NBR, add the weight of Table (2) to the weight in the table above.
- This weight includes the accessory weight.

12. Circuit examples

Circuit without release valve (Usage example of vacuum connection)



Circuit with release valve (Usage example of pressure sensor)



*1) Select the supply valve which can supply sufficient flow rate compared with the ejector air consumption. If the flow rate of the supply valve is insufficient, it may lead to vacuum failure. The selected supply valve should at least have the C factor shown in the table on the right.

Minimum C Factor of a Supply Valve *2)

Nominal nozzle size [mm]	C [dm ³ / (s·bar)]
Ø 0.7	0.23
Ø 1.0	0.47
Ø 1.2	0.68
Ø 1.5	1.06

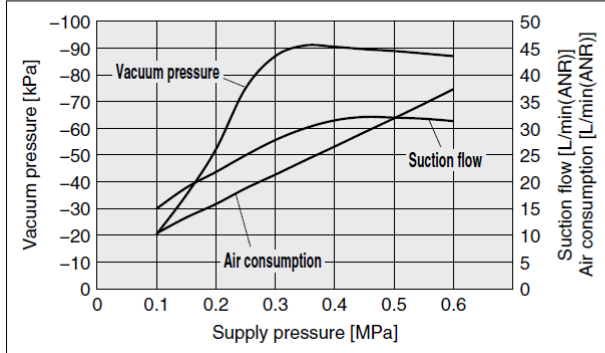
*2) Supply air guideline.

If a supply valve is used for multiple ejectors, prepare a supply valve which can supply the flow of C value (listed in the table above) x number of ejector.

13. Exhaust Characteristics and Flow Characteristics of Ejector (Representative Value)

Exhaust Characteristics

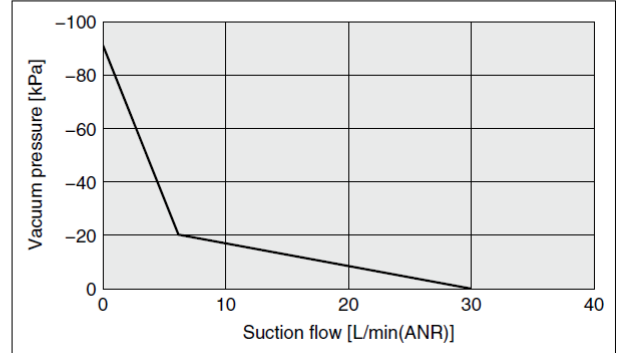
ZHP□-07□



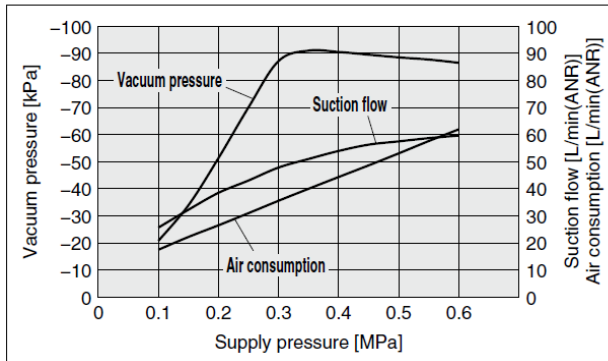
Flow-rate Characteristics

ZHP□-07□

(Supply pressure: 0.35 MPa)

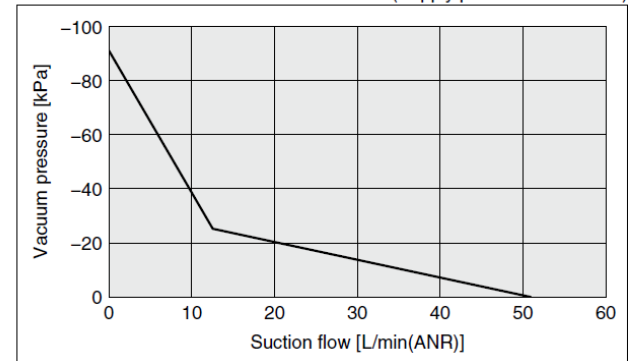


ZHP□-10□

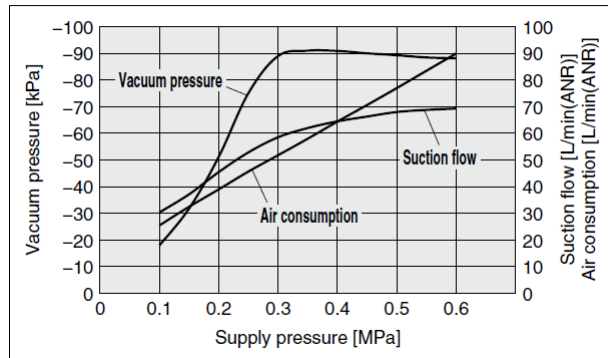


ZHP□-10□

(Supply pressure: 0.35 MPa)

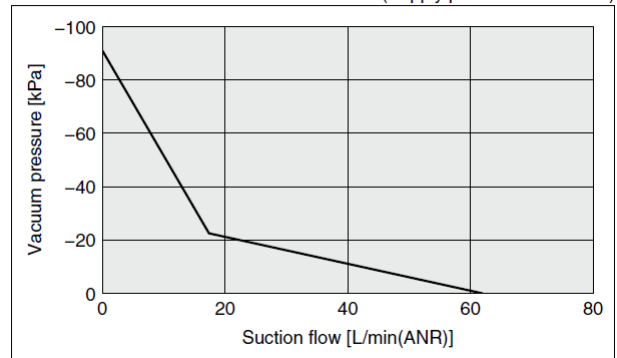


ZHP□-12□

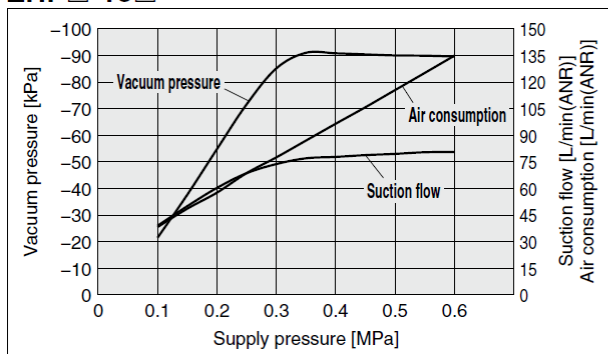


ZHP□-12□

(Supply pressure: 0.35 MPa)

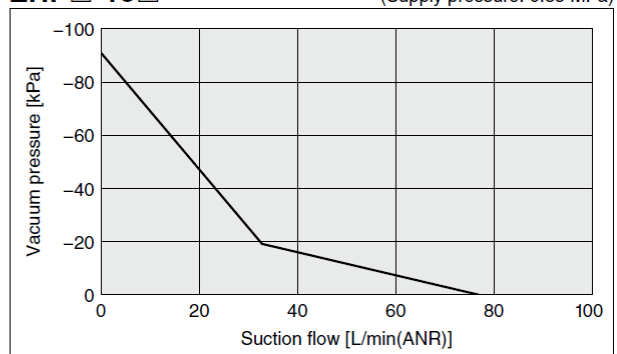


ZHP□-15□



ZHP□-15□

(Supply pressure: 0.35 MPa)



14. Troubleshooting

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.
	Inadequate supply pressure of vacuum ejector	Measure supply pressure in vacuum generation state. - Use standard supply pressure. - Reconsider compressed air circuit (line).
	Clogging of vacuum ejector (Infiltration of foreign matter during piping)	Remove foreign matter.
Late vacuum achieving time (Shortening of response time)	The internal volume of the pad is too large for the ejector capacity.	Change to an ejector with larger suction flow.
	The set vacuum pressure for the suction verification 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 the strainer	Remove foreign matter. Improve installation environment.
	Clogging of the silencer	Replace the silencer. Add a filter to supply (compressed) air circuit.
	Presence of foreign matter in the ejector.	Remove foreign matter. Replace the ejector Add a filter to supply (compressed) air circuit.
	Pad (rubber) deterioration, cracking, etc.	Replace pads. Check the compatibility of vacuum pad material and workpiece.
Workpiece is not released.	The increase of stickiness due to the wearing of the pad (rubber).	Replace pads. Check the compatibility of the pad material and workpiece.
	Vacuum pressure is too high.	Set the vacuum pressure to the minimum value necessary.

15. Non-conformance Examples

Phenomenon	Possible causes	Countermeasure
No problem occurs during the test, but adsorption becomes unstable after starting operation.	<ol style="list-style-type: none"> 1) Setting of the vacuum switch is not appropriate. 2) Supply pressure is unstable. 3) There is leakage between the workpiece and the vacuum pad. 	<ol style="list-style-type: none"> 1) Set the pressure to the appropriate value. 2) Revise the circuit of compressed air. 3) It is presumed that there was leakage during the test, but it was not serious enough to prevent adsorption. Revise the vacuum ejector and pad.
Generation of sticking of bellows of the bellows pad and/or recovery delays. (It may occur at an early stage.)	When the vacuum pad (bellows type) reaches the end of its life, weakening of bent parts, wearing, or sticking of rubber parts occurs.	<p>The operating conditions will determine the product life. Inspect it sufficiently and determine the replacement time.</p> <ul style="list-style-type: none"> - Replace pads. - Reconsider the diameter, form, and material of vacuum pads. - Reconsider the quantity of vacuum pads.
	Vacuum pressure is higher than necessary, so excessive force is applied to the pad (rubber part).	<p>Reduce the vacuum pressure.</p> <p>If inadequate lifting force causes a problem in transferring the workpieces due to the reduction of vacuum pressure, increase the number of pads.</p>
	<p>Load is applied to the bellows due to the following operations, leading to sticking of rubber parts or reduction of the pad recovery performance.</p> <ul style="list-style-type: none"> - Pushing exceeding pad displacement (operating range), external load. - Workpiece holding / Waiting. <p>Waiting 10 seconds or more while the workpiece is being held</p> <p>Note</p> <p>Even when under 10 seconds, pads sticking or a recovery delay issues may occur earlier depending on the operating environment and operating method. Longer workpiece holding times lead to longer recovery times and a shorter life.</p>	<p>Reduce the load applied to the pad.</p> <ul style="list-style-type: none"> - Review the equipment so that an external load exceeding the pad displacement (operating range) is not applied. - Avoid workpiece holding and waiting. <p>The operating conditions will determine the product life.</p> <p>Inspect it and determine the replacement time.</p>
Cracks are generated on the rubber (NBR).	<ul style="list-style-type: none"> - The product is operated in an ozone environment. - An ionizer is used. <p>Note</p> <p>This phenomenon occurs earlier if pushing or the high vacuum pressure is used.</p>	<p>Reconsider the operating environment.</p> <p>Revise the pad material.</p>

Revision history

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