Operation Manual

PRODUCT NAME

Return Filter

MODEL / Series / Product Number

FH100 Series
FH100 X0 Series

SMC Corporation

Contents

Return Filter

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) General requirements) 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 resultin 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.

Return Filter
Safety Instructions

⚠Caution

The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.
Read and accept them before using the product.

『Limited warranty and Disclaimer』

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first. *2)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***2)Vacuum pads are excluded from this 1 year warranty.**
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

『Compliance Requirements』

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited. 2. The export 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.

2. Check the law for pressure vessels or operating fluids specified in each country in advance and determine whether or not the product can be used.

3. This product does not correspond to regulations or standards for pressure vessel of any country or region.

⚠ Caution

SMC products are not intended for use as instruments for legal metrology.
For products that SMC manufactures or sells are not measurement instruments that are qualified by pattern approval tests relating to the measurement laws of each country. Therefore, SMC products cannot be used for business or certification ordained by the measurement laws of each country.

Return Filter/Safety Instructions

Be sure to read this before handling the products.

These safety instructions are intended to prevent hazardous situations and/or equipment damage. Make sure to follow every instruction since they are for safety.

⚠ **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.

Incorrect handling can result in unexpected accidents. Equipment compatibility should be determined by a knowledgeable and experienced designer of the system.

Range of Operating Conditions

⚠ Warning

1. Operating pressure
   Do not use the product beyond the operating pressure range.
   Do not use in locations where peak pressure exceeds the operating pressure range due to water hammer, surge pressure, etc.
2. Operating temperature
   Do not use the product beyond the operating temperature range.
   Do not use at temperatures at or above the boiling point of the fluid.
3. Fluid
   -Do not use fluids other those indicated in the drawings and catalog.
   - Do not use the product for toxic, corrosive or flammable fluids.。
   -Do not use fluids which cause corrosion or swelling of the material used for each part of the filter.
   -Never use the product with gases.
   -Do not use any fluid which will cause the seal, O-ring or element to swell or deteriorate. The fluid may deteriorate these causing leakage.
4. Operating environment
   -Do not use in operating conditions or environments where changes in color or deterioration of material due to corrosion occur.
   -Do not use this product in a place where shock or vibrations occur.
   -Do not use the hydraulic filter outdoors.

⚠ Caution

5. Rated flow rate
   -Do not use flow rates beyond the rated flow rate indicated in the drawings and catalog.

Replacement of O-ring

⚠ Caution

Check the O-ring of each part when replacing the element. If it is swollen or damaged, replace it with a new O-ring.

Be sure to follow the instructions shown below, considering prevention of damage to the element, maintaining performance and efficiency of the maintenance check.

Design and Installation

⚠ Caution

【Design】

1. Design the system with operating conditions, including operating pressure, operating temperature, operating fluid, and operating environment appropriate for safe operation.
2. Install the mist separator and micro-mist separator in a place where pulsation seldom occurs.
3. Prevent back pressure and backflow from occurring.

   The element may be damaged by back pressure and backflow.
4. Prevent the propagation of an excess moment load and vibration from the piping side.
5. If a relief function of the hydraulic filter which controls the pressure is not used in the hydraulic circuit, design a circuit safe for the customer's system.
6. Provide sufficient space for maintenance.

[Mounting]

1. Mount the product vertically so that the cover faces upwards.

   If the product is mounted horizontally, foreign matters will accumulate on the element and the product will be damaged by the load.

【Piping】

1. Connect it with IN and OUT ports in proper location.
   It does not work with the connection reversed.
2. Connect the valves or fittings suited to the operating conditions by checking the size of each connection port.
   During connection work, make sure that powder from the piping screws or seal material does not get into the interior of the piping.
   Prior to operating, flush the piping line and check for abnormalities, such as fluid leakage.
3. Firmly fix the piping to the mounting frame using a saddle, etc., to avoid vibration or force caused by the weight.
4. During element replacement, it is necessary to release fluid from the vessel.
   Be sure to connect the pipe so that fluid releasing work can be absolutely performed.
5. Make sure that air releasing work can be absolutely performed.
   If the pump is in a high position, idling sometimes occurs during re-start.
   Take measures such as releasing the air in a high position, etc.

[Low temperature operation**]**

The hydraulic fluid used becomes high viscosity when the temperature is low during the winter, etc., and the differential pressure indicator or the switch may activate. If this occurs, wait until the oil temperature rises by a warm-up operation, and confirm if the differential pressure indicator and switch can be reset, then start the operation. (20 ^{o}C or more is the guide.) In the case of the differential pressure indication switch, design the system in combination with the temperature sensor, so that the output signal is not accepted until the oil temperature reaches the set value or more.

Return Filter/Safety Instructions

Be sure to read this before handling the products.

These safety instructions are intended to prevent hazardous situations and/or equipment damage. Make sure to follow every instruction since they are for safety.

Replacement of element

Caution

1.Timing of element replacement

Replace the element when differential pressure reaches 0.13MPa (red part appears in the view port of the differential pressure indicator or when the differential pressure indicator switch is actuated).

If the element is not replaced, the element can be damaged.

2.Cleaning each component

- When replacing the element, make sure to wear protective gloves, protective glasses, etc.

Trapped substances may cause injury.

Fluid, which is stuck to your fingers may make your hand slip and drop the element, etc.

For proper sealing during the replacement of the element, clean off any paint etc which is stuck to the threads of the O-ring seat surface and the cover connecting part.

3.Temperature

Using this product at a high temperature (40 to 80 ^{o}C) may cause burns.

Be sure to confirm that the temperature of the filter surface and operating part is reduced to 40 degrees or less to prevent burns.

4.Drainage discharge

Be sure to exhaust the drainage that has accumulated in the filter when performing maintenance.

1. How to Order

FH100 - 06 - 0 0 0 – P 005 ___

Table1-7 Made to Order

Symbol	Made to Order
Nil	None (Standard)
X0	Non-standard filtration equipped

Note) The non-standard filtration is for micromesh elements only.

Table1-5 Element

Symbol	Element
P	Paper
M	Micromesh

Table1-4 Hydraulic fluid

Symbol	Hydraulic fluid
0	Petroleum
1	Water-glycol, Emulsion
2	Phosphoric ester

Table1-3 Relief valve

Symbol	Relief valve
0	With relief valve
1	None

Table1-6 Nominal filtration

Symbol	Nominal filtration
005	5μm
010	10μm
020	20μm

Note) The paper elements for water-glycol or emulsion is 10 μm only.

Table1-2 Differential pressure indication

Symbol	Differential pressure indication
0	None
4	Differential pressure indicator
5	Differential pressure indication switch

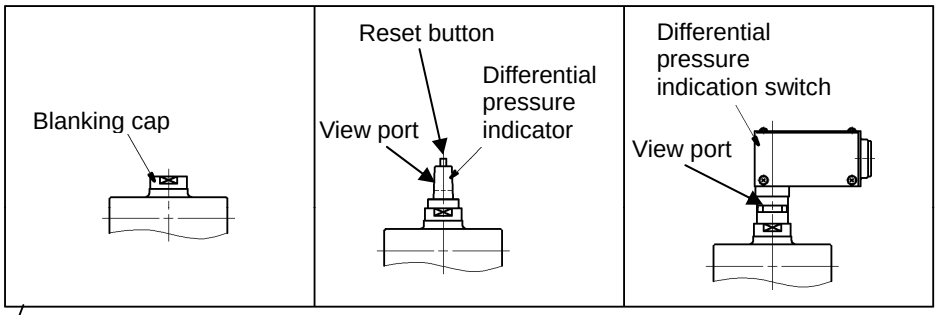
Symbol		Nominal filtration
standard	074	74μm
	105	105μm
Non-standard	003	3μm
	005	5μm
	010	10μm
	020	20μm
	040	40μm
	149	149μm
	270	270μm

Table1-1 Port size (Rc)

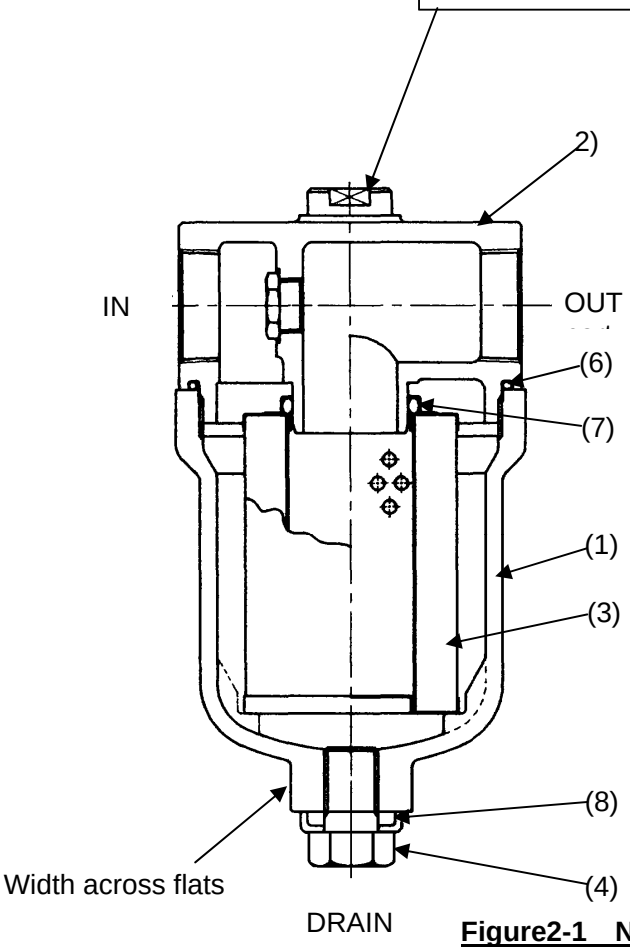
Symbol	Port size Threaded connection
06	3/4
08	1
10	$1\ ^1/_4$
12	$1\ ^1/_2$
16	2
20	$2\ ^1/_2$
24	3

2. Construction and names of individual parts

Figure 2-2 (5) Differential pressure indicator



【Differential pressure indicator】
1. When the differential pressure increases to 0.13Mpa (guideline for replacement) due to clogging, a red ring floats and becomes visible in the view port.
2. Once it is visible, it stays floating even when the pump is stopped unless it is reset.



【Differential pressure indication switch】
1. When the differential pressure increases to 0.13Mpa (guideline for replacement) due to clogging, a red ring floats and becomes visible in the view port. At the same time, the micro switch in the switch box is actuated.
2. Automatically recovers when the pump stops.

Figure2-1 Name of individual parts and dimensions

Table2-1 Parts

No.	Description	Part No.	Material	quantity
(1)	Case	-	See 3. Specifications	1
(2)	Cover	-	See 3. Specifications	1
(3)	Element	Refer to 6. Maintenance parts (1) Replacement Element	See 3. Specifications	1
(4)	Hexagon bolt	-	Carbon steel	1
(5)	Differential pressure indicator	Refer to 6. Maintenance parts (2) Replacement Differential pressure indicator	Aluminum alloy Nylon	1
(6)	O-ring	Refer to 6. Maintenance parts (3) Replacement O-ring and seal bracket.	See 3. Specifications	1
(7)	O-ring	Refer to 6. Maintenance parts (3) Replacement O-ring and seal bracket.	See 3. Specifications	1
(8)	Seal washer	Refer to 6. Maintenance parts (3) Replacement O-ring and seal bracket.	See 3. Specifications	1

3. Specifications

Table3-1 Specifications

Item		Specifications						
Fluid		Hydraulic fluid: Oils below are applicable. (Note1) (Petroleum,Water-glycol, Emulsion,Phosphoric ester)						
Applicable model		FH100-06	FH100-08	FH100-10	FH100-12	FH100-16	FH100-20	FH100-24
IN・OUT Port size (Rc)		3/4^{B}	1^{B}	1 1/4^{B}	1 1/2^{B}	2^{B}	2 1/2^{B}	3^{B}
Drain port size		M16×2						
Rated flow rate (L/min)	Paper	50	80	120	160	260	450	600
	Micromesh	60	100	150	200	300	550	700
Operating pressure		1.0MPa						
Operating temperature		80^{o}C						
Nominal filtration		1. How to Order Table1-6 reference						
Element size		ø 64×L96		ø 74×L117		ø 88×L158	ø 119×L208	
Number of element		1						
Element replacement differential pressure		0.13MPa						
Relief valve open pressure		0.15MPa (relief valve type)						
Differential pressure resistance		0.6MPa						
Weight (kg)		2.5		4.3		6.8	17.5	
Material	Case	Aluminum casting						
	Cover	Cast iron						
	O-ring	Petroleum, water-glycol fluid or emulsion hydraulic fluid: NBR Phosphate ester hydraulic oil: FKM						
	Element	Paper: Paper, Epoxy resin, Carbon steel Micromesh: Stainless steel, rolled steel, Epoxy resin						
	Seal washer	Petroleum, water-glycol fluid or emulsion hydraulic fluid: SUS304,NBR Phosphate ester hydraulic oil: SUS304,FKM						
Surface Treatment		Cover: Phosphate conversion coating, baking finish (Metallic blue) Case: Trivalent chromate, baking finish (Metallic blue)						
Micro switch for differential pressure switch		Refer to 6. Maintenance parts (4) Micro switch for Differential pressure indication switch.						

Note1. Do not use the product for toxic, corrosive or flammable fluids. Do not use the product with fluid which is harmful for the filter.

4. Installation and Piping

1) **Installation**

-When installing, allow sufficient space for maintenance. (Refer to 6. Maintenance parts (5) Maintenance space)

2) **Piping**

-Check each port size for selecting valves and fittings suitable for operating conditions.
Please check Safety Instruction before use.

3) When the differential pressure indication switch is mounted, refer to Steps (1) to (8) below for wiring. (See Figure 4-1,Figure 4-2)

Refer to 6. Maintenance parts (4) Micro switch for Differential pressure indication switch for specifications of the micro switch inside.

(1) Loosen the 4 screws that tighten the cover and remove it.

Loosen the screw for holding the box position.

(2) Remove the cover.

(3) Remove the rubber plug.

(4) Hold the cord using the cable clamp as in Figure 4-2 and solder the cord to the terminal of the micro switch.

(5) After wiring, secure the cover by tightening the screws.

(6) Keep the length of the connected cord so that it does not interfere with the replacement of the element.

(7) Adjust the switch box position by pushing from the top. Hold the position of the switch box by tightening the screw.

(8) The output signal is reset when the operation of the differential pressure indication switch is stopped, and the inlet and outlet pressures of the filter become equal.
Design an electric circuit with a holding mechanism is necessary.

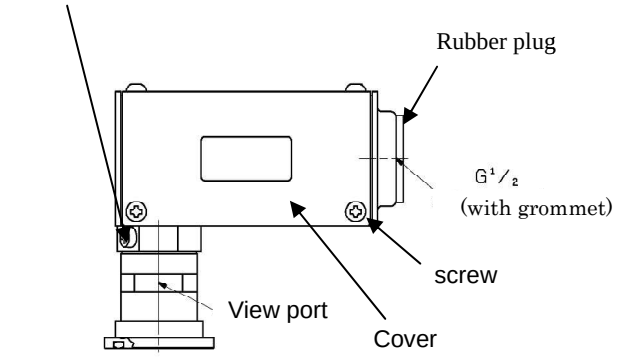


Figure 4-1 Differential pressure indication switch

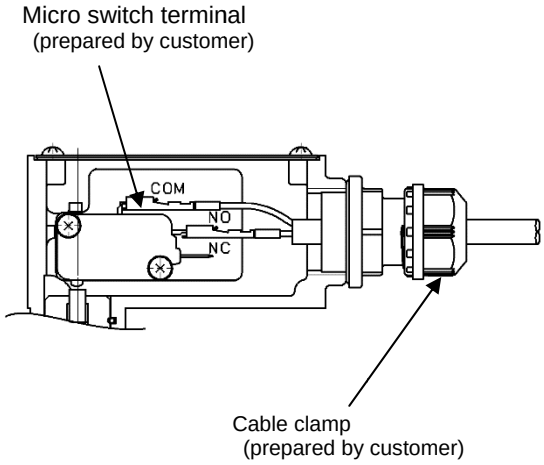


Figure 4-2 Differential pressure indication switch wiring

5. Maintenance

Replace the element when differential pressure reaches 0.13MPa (red part appears in the view port of the differential pressure indicator or when the differential pressure indicator switch is actuated). Replacement of element should be performed according to the procedure below.

1) Removal of the bowl

1. Stop operation.
2. Confirm that the pressure of the system in which the filter is installed is zero.
3. Close the valve in order of IN, then, OUT.
4. Hold the width across flats at the bottom of the bowl with a wrench and remove the hexagon socket head bolt (width across flats 24) of the drain port. Discharge all the fluid in the bowl from the drain port. (Fluid in the bowl may not be completely discharged if air does not enter the bowl. In this case, loosen the differential pressure indicator to discharge the fluid)

(5) Hold the cover. Loosen the bowl and remove it. (Fluid in the bowl may not be completely discharged if air does not enter the bowl. In this case, loosen the differential pressure indicator to discharge the fluid)

⚠ **Warning** Confirm that the internal pressure of the filter is zero before removing the bowl.

⚠ **Caution** When using the product at a high temperature, be sure to check that the surface temperature of the filter container is not more than 40 ^{o}C before starting operation in order to prevent burns.

2) Removal of the element

1. Pull down the element out of the cover, and replace it with a new element. (Refer to 6. Maintenance parts (1) Replacement Element) Clean the sealing surface for sealing properly.

3) **Mounting of element**

1. Mount the element by the reversed procedure for the Removal of the element in 2).

4) Mounting of the bowl

1. Check the O-ring of each part. If it is swollen or damaged, replace it with a new O-ring. (Refer to 6. Maintenance parts (3) Replacement O-ring and seal bracket.
2. Mount the element by the reversed procedure for the Removal of the bowl. Hold the cover and screw in the bowl to the cover. (**Tightening torque: 70N・m)**
3. Mount the seal bracket to the hexagon socket head bolt (width across flats 24) of the drain port. Fix the width across flats (36) at the bottom of the bowl with a wrench and tighten it to the bowl. **(Tightening torque: 20N・m)**

5) Restart the operation

1. After the replacement of the element, check the parts are assembled correctly before restarting operation. In case of fluid leakage, stop the operation immediately. Check the sealing condition and take corrective actions.

6. Maintenance parts

[1]Replacement Element

Table6-1 3) Element number

Port size Symbol	Element type		Element Size (mm)
	Paper	Micromesh	
06,08	EP420-□□	EM810-□□	ø64×L95
10,12	EP020-□□	EM910-□□	ø 74×L117
16	EP520-□□	EM020-□□	ø 88×L158
20,24	EP620-□□	EM120-□□	ø 119×L208

Note) Refer to the Figure 2-1 for the assembly position.

How to Order - Element

● Paper element

EP420－□□

Table 6-3 Hydraulic operating fluid type

Symbol	Hydraulic fluid type
[N]	Petroleum
W	Water-glycol,Emulsion
V	Phosphoric ester

Table 6-2 Nominal filtration

Symbol	Nominal filtration (Note)
005	5μm
010	10μm
020	20μm

Note) The paper elements for water-glycol or emulsion is 10 μm only.

● Micro mesh element

EM810－□□

Hydraulic fluid type (See Table 6-3)

Table 6-4 Nominal filtration

Symbol	Nominal filtration
003	3μm
005	5μm
010	10μm
020	20μm
040	40μm
074	74μm
105	105μm
149	149μm
270	270μm

Note) Refer to the Table 6-7 for the product number of the O-ring for the element.

[2] Replacement Differential pressure indicator

Table 6-5 5. Replacement Differential pressure indicator

Name	Hydraulic fluid type		
	Petroleum	Water-glycol, Emulsion	Phosphoric ester
Differential pressure indication	CB-50H		CB-50H-V
Differential pressure indication switch	CB-51H		CB-51H-V
Blanking cap	AG-12H	AG-12H-W	AG-12H-V

Note 1) Refer to the Figure 2-1 for the assembly position.

Note2) Tightening torque for cover: 15N・m

(3) Replacement O-ring and seal bracket

Table 6-7　Replacement O-ring and seal bracket

Hydraulic fluid type	Port size	O-ring for the cover and bowl (6)	Element O-ring (7)	Seal bracket for drain port (8)
Petroleum Water-glycol, Emulsion **(O-ring material: NBR)**	06,08	KA00466 (G90)	KA00800 (P35)	NB00006
	10,12		KA00082 (P44)	
	16	KA00788 (G130)	KA00806 (P50)	
	20,24	KA00756 (AS568-259,Hs70)	KA00809 (P85)	
Phosphoric ester **(O-ring material: FKM)**	06,08	KA00704 (G90)	KA00721 (4D-P35)	NB00074
	10,12		KA00107 (4D-P44)	
	16	KA00690 (G130)	KA00636 (4D-P50)	
	20,24	KA00676 (AS568-259,Hs70)	KA00725 (4D-P85)	

Note) Refer to the Figure 2-1 for the assembly position.　Value in ( ) indicates nominal value.

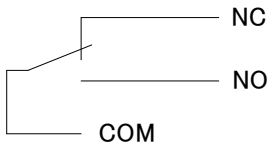
[4] Microswitch for Differential Pressure Indication Switch

(1) Contact specifications

Table 6-8 Contact specifications

Item		Specifications
Inrush current	Normally closed	Max. 15A
	Normally open	-
Minimum applicable load		DC5V 160mA

(4) Electric circuit



(N. C. and N. O. common)

Precautions
1. Connect desired wiring to the micro switch indication symbols 1 (COM.) , 2 (N. C.) ,and 3 (N. O.) . 2. When a protection mechanism is required, take appropriate considerations on the electric circuit since the micro switch is a type of non-reset.

(2) Rating

Table 6-9 Rating

Rated voltage	Resistance load
250 VAC	5A

(5) Terminal type

Soldering terminal

(3) Other performance

Table 6-10 Other specifications

Item		Specifications
Insulation resistance		100 MΩ or more (Measured by 500 VDC, insulation resistance tester.)
Contact resistance		30mΩ or less
Withstand voltage	Between terminals with the same pole	AC1000V 50/60Hz 1min
	Between charged metal part and ground	AC1500V 50/60Hz 1min
	Between each terminal and non-charged metal part	AC1500V 50/60Hz 1min

[5] Maintenance space

Table 6-11 Maintenance space

Port size	Dimension to draw the element	Drain flushing dimension
06,08	290mm from the lower end of the bowl	100mm from the lower end of the bowl
10,12	380mm from the lower end of the bowl	
16	430mm from the lower end of the bowl	
20,24	540mm from the lower end of the bowl	

Revision history
Revision A: Full scale revision

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