

SEPAREL®

Hollow Fiber Membrane Module

INSTRUCTION MANUAL (For IJ)

EF 'External Flow' Small Size Series

- EF-MICRO
- EF-G2 Series
- EF-G3 Series
- EF-G5 Series



Before using the SEPAREL® EF small size series, be sure to read this instruction manual to ensure safe and proper use.

DIC will not have any liability to a customer or end user in connection with any costs and damages arising directly or indirectly from any defective modules.

We are not responsible for any usage, installation, or any other handling done by the customer. The module must be used, installed, and handled responsibly by the customer.

INSTRUCTION MANUAL

■ About this Instruction Manual

This instruction manual explains how to handle SEPAREL® EF small size degassing modules, such as the EF-MICRO, EF-G2, EF-G3, and EF-G5 series, with precautions to be followed for your safety.

Before using the SEPAREL® EF small size series, be sure to read this instruction manual to ensure safe and proper use.

Depending on use conditions, proper methods for usage and storage may differ even though there are descriptions about usage methods, storage methods, and risks associated with the product module within this manual.

Please note that this manual does not describe all information about risks related to usage and storage of the product.

Although the content of this instruction manual is based on reliable testing and measurement results, no guarantees are provided for its accuracy.

DIC does not have any responsibility for anything described or not described in this manual.

The details of this instruction manual may be modified for improved reliability of the SEPAREL® EF series or to account for changes in its design.

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■ Warranty, Warranty Period

【Warranty】

At the time of delivery, DIC warrants that the Separel module will be free from defects in material and workmanship and meet the specifications supplied to the customer by DIC.

【Warranty Period】

The following Warranty Period is applied only if customer use of the Separel module is in accordance with the instructions contained in this manual, the specification sheet, any applicable Cleaning Guides and the Warranty Statement.

(1) Water

Maximum 12 months from the date of delivery of the module

- This warranty period is applied only if customer refers to P.11, 3-3 (1).
- The above warranty will be voided in the event that water of unspecified quality is used.

(2) Liquids other than water

- Water-Based Liquid : Maximum 12 months from the date of delivery of the module*1
- Non-Water-Based Liquid : Maximum 6 months from the date of delivery of the module*1

***1 The warranty periods shown above are strictly to demonstrate the maximum warranty period available for the modules. Any actual warranty period will be based upon the results of compatibility tests of the module with all liquids which may come in contact with the module. The compatibility testing procedures will be informed to the customer by DIC. It is the customer's responsibility to conduct the compatibility tests and provide the results thereof to DIC. In accordance with the results of the compatibility test, any warranty period will be determined through consultations between DIC and the customer. DIC and the customer will agree in writing to the warranty period, as well as, terms of use for the module ("Warranty Statement").**

If a liquid other than water (2) is used, only several SEPAREL products are applicable—please refer to Table 1 below.

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【Warranty Remedy】

During the applicable warranty period as specified in the Warranty Statement, any defective module will be replaced free of charge by DIC in cases where a defect is found under normal use in accordance with this instruction manual and under use and storage conditions specified in the specification sheet and Warranty Statement.

This is the sole remedy available to the customer under this warranty. **DIC will not have any liability to a customer or end user in connection with any costs and damages arising directly or indirectly from any defective modules.**

We are not responsible for any usage, installation, or any other handling done by the customer. The module must be used, installed, and handled responsibly by the customer. **The above warranty will be voided in the event that a liquid which has not been specified for use between the customer and DIC, as specified in the Warranty Statement, is used in the module or by any other use, installation or handling that is not in accordance with the instructions contained in this manual, the specification sheet and Warranty Statement.**

This module is consumable. DIC recommends that customers replace the module within the warranty period.

■ Regarding Reproduction and Photocopying of this Manual

- ◆ Reproduction of this manual in whole or in part is strictly prohibited.
- ◆ The content of this manual are subject to change without notice.
- ◆ SEPAREL® is a registered trademark of the DIC Corporation.

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1. BASIC PRECAUTIONS

- 1-1. Maintain use, handling, and storage conditions described in specifications.
- 1-2. SEPAREL is consumable. We recommend replacement within the warranty period.
- 1-3. We are not responsible for any usage, installation, or other handling done by the customer. Make sure that the product is used, installed, and handled responsibly.
- 1-4. Do not feed the following liquids into SEPAREL—oxidizing agents (highly concentrated chlorine water, ozone water, etc.), strong acids, strong bases, organic solvents, alcohol, oils, or any other liquid which is not compatible with the liquid and materials that SEPAREL modules are composed of.
- 1-5. Do not remove the end-cap of SEPAREL modules..

In cases where liquid that has not been deemed compatible by DIC is used, no warranty will apply to the product.

2. UPON RECEIPT

- 2-1. Check the label and shape of the module to confirm that the type and series number are the same as that of which you ordered.
- 2-2. Check whether no damage was sustained during transportation. If you find any damage, notify your sales representative immediately.
- 2-3. Do not physically shock or shake the SEPAREL module during unloading or storage.

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3. INSTALLATION

3-1. Place of Installation:

Install SEPAREL in accordance with conditions specified in the specification sheet,

- No exposure to direct sunlight
- No physical shock or shaking
- No contact with dust, moisture, corrosive gas, or liquid
- Easy access for maintenance, inspection, repair, and replacement

3-2. Method of Installation:

- Set the vacuum port downward to smoothly purge liquid derived from vapor.
- If you fix SEPAREL with a U-band, make sure not to loosen the fitting. Do not apply too much pressure when fixing SEPAREL with a U-band as too much pressure may damage the module. Putting a cushion between SEPAREL and U-band may prevent damage to the module.

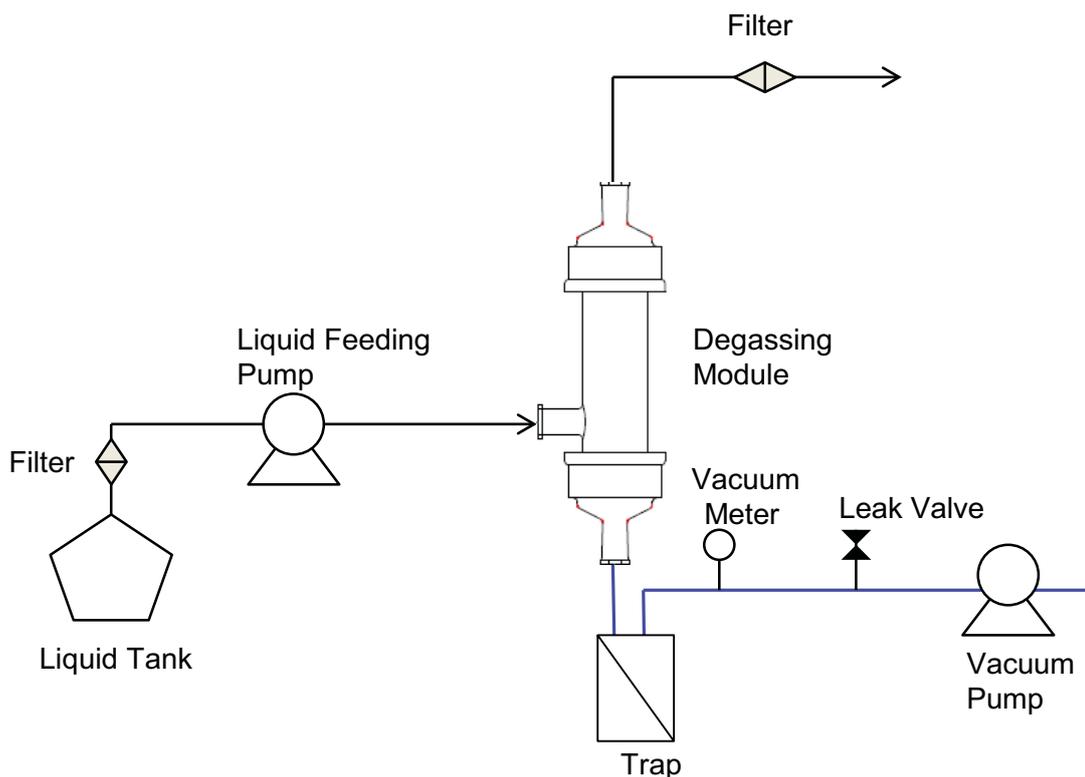
3-3. Connection of the SEPAREL Module:

- Clean pipe/tube before connecting to prevent/remove dust, rust, oil, etc.
- Do not apply too much pressure to the connection.
- Do not shake or shock the SEPAREL module. Shaking or shocking SEPAREL may damage the module even if it is a light impact.
- Because the housing of the SEPAREL module is composed of PP, polypropylene, excess pressure to the connector may cause damage to the connecting port. Excess pressure to connecting port may shave thread and cause resin particles to appear in the liquid side.
- Do not touch hollow fibers.
- When you add a connector, adjust the insertion depth and not the screw part to touch hollow fibers. If the screw part touches the hollow fibers, the hollow fibers may become damaged.
- Depending on the type of connector, recommended conditions of connector insertion may differ. For detailed conditions, including torque value, contact us.
- The liquid feeding pump is recommended to be placed in front of the SEPAREL module.
- When you uninstall the SEPAREL module, be careful to not damage it.

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3. INSTALLATION

< Example of Installation >



**The above example is for your reference.
Depending on use conditions, the above example may not be suitable.**

※Optimal flow direction differs by use conditions and the above flow direction is not always the correct direction. For suitable flow direction, contact us.

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3. INSTALLATION

1) Liquid In:

- Install security devices, such as a pressure reducing valve and/or safety valve, to make sure that pressure will not be beyond the maximum operating pressure.
- If you use a solenoid valve, select one which does not cause sudden opening/shutting.
- If you use two modules in parallel, properly measure the liquid flow into both modules and ensure that liquid flow is equal.
- If impurities and large particles remain in liquid, install a filter in front of the SEPAREL module.
- Use RO water or higher quality water for the water supply.
 - ▼ In the event water of a water quality lower than RO water is used:
 - ① Please ensure the remaining chloride concentration is, $\leq 1\text{mg/L}$.
 - ✳ You can use water with over 1mg/L, but any warranty period will be determined through consultations between DIC and the customer.
 - ② To stop performance degradation by fouling in the film surface and clogging by particle debris, please refer to the following table and use a pre-filter. Specifically, since soluble compounds included in well water, a branch and tap water are easy to penetrate filtration and adhere to the surface of the filtration membrane, please use water in combination with the recommendations in following table. If you have any questions, please contact DIC Corporation.

Liquid in phase	1.0 micron filter
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2) Liquid Out:

- There is a possibility that particles are generated by the SEPAREL module. To prevent a problem with such particle occurrence, install a filtration filter behind the module. The most suitable filtration size depends on your use conditions. For more details, please contact DIC.
- Note that back pressure to the SEPAREL module should be avoided.

3) Vacuuming:

- Installed vacuum lines must always be facing downwards. If it is pointed upwards, liquid generated from vapor may block the vacuum line.
- Install a trap to detect leaked liquid and to prevent the vacuum pump from damage due to vapor and leaked liquid. A trap is also effective in preventing leaked liquid from feeding into other modules using the same vacuum line.

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4. START UP

- 4-1. Open a valve on the outlet side first. Next, open a valve on the inlet side gradually to make the liquid flow rate and pressure lower than the designated value for actual use until liquid is filled. Do not flow liquid at a very high flow rate nor at a very high pressure. Even if it is instantaneous, very high flow rates or pressure may damage hollow fibers and cause leakage. For efficient removal of remaining air in the liquid area of SEPAREL modules, filling the liquid with a vacuum is recommended. During the vacuuming process, check the airtightness of the vacuum line and not the air that is leaked from pipe, connector, and SEPAREL module.
- 4-2. Observe liquid quality, temperature, and pressure specified in the specification sheet.
- 4-3. Do not flow oxidizing agents, such as highly concentrated chlorine water and ozone water, strong acids, strong bases, organic solvents, oil, or any other liquid which has not been confirmed as compatible by DIC. The warranty will not apply if liquid, which has not been confirmed as compatible by DIC, is used.
- 4-4. Do not change the flow rate dramatically in order to ensure that the hollow fibers are not damaged by drastic pressure fluctuations.
- 4-5. If vacuum pressure is very strong, and conditions are close to a perfect vacuum situation, stop the vacuum pump when liquid flow has stopped. Strong vacuuming for an extended period of time without liquid flow may freeze and damage hollow fibers via vaporization heat and liquid may leak from the damaged hollow fibers.
- 4-6. Check the items below periodically. If obvious deterioration is found, replace with a new degassing module .

Item	Points to be Checked
Liquid Inlet Pressure	Do not exceed maximum pressure specified in the specification sheet.
Liquid Temperature	·Do not exceed the maximum temperature specified in the specification sheet. ·Do not fall below the minimum temperature specified in the specification sheet.
Pressure Drop	Significant increase from initial value may be caused by clogging of hollow fiber or liquid flow path. In this case, replacement or cleaning is necessary.
Drain/Trap in Vacuum Line	Continuous leaking of liquid to the vacuum means the product is reaching the end of its lifetime and replacement with a new degassing module is necessary.

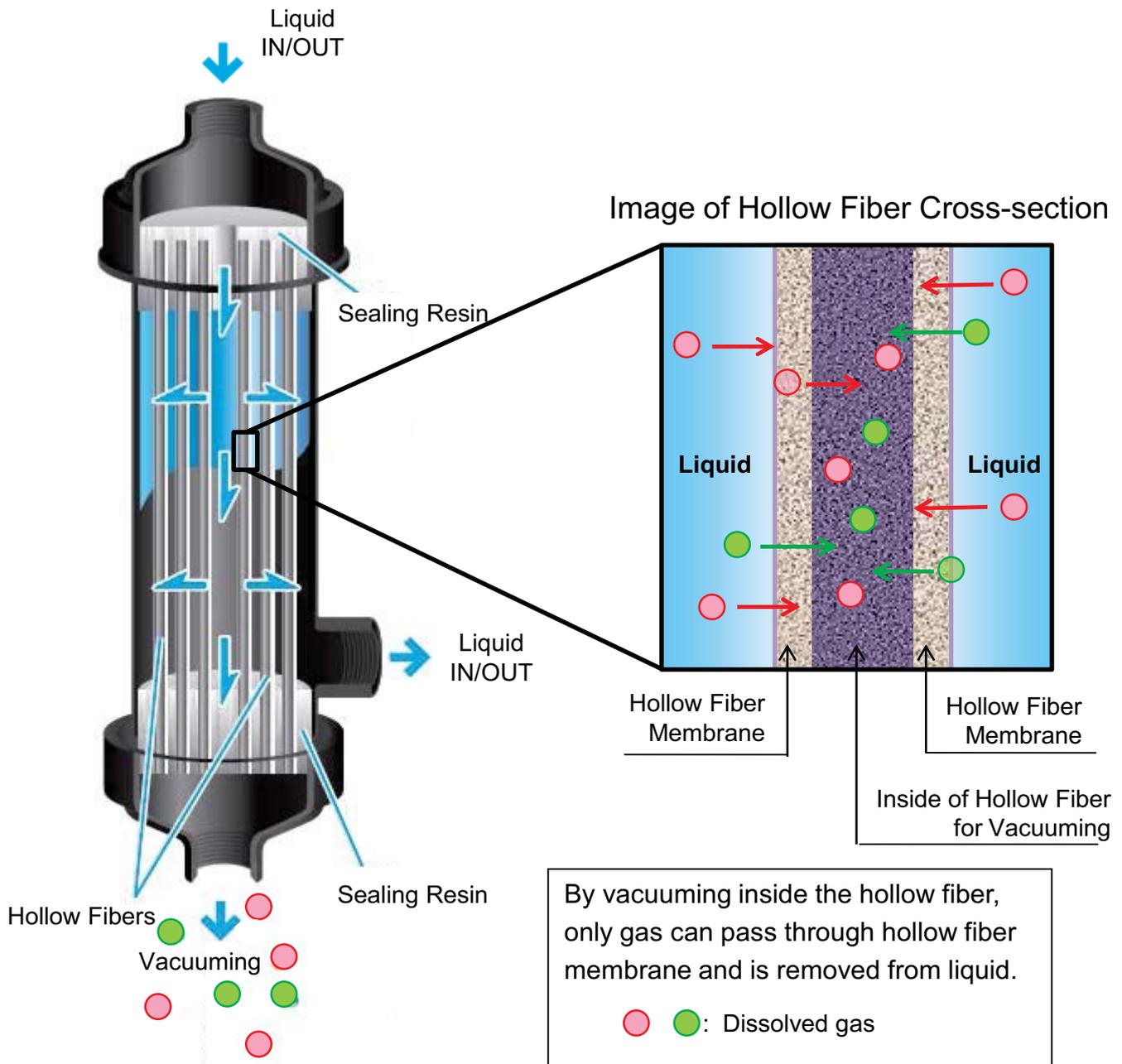
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5. SHUTOFF AND STORAGE

- 5-1. Open the leak valve in the vacuum line. After vacuum is released, stop the vacuum pump.
- 5-2. Close the valve on the ink inlet side and then close the valve on the liquid outlet side.
- 5-3. Handling during Shutoff Period:
 - 1) Store under the conditions specified by the specification sheet.
 - 2) If the shutoff period is extensive, remove the SEPA REL modules and store after cleaning and drying completely. If it is difficult to uninstall the SEPA REL module, fill it with liquid that is compatible with SEPA REL and close all liquid and vacuum ports completely. Even liquid that is compatible with degassing module materials can lead to bacteria generation if it is left in the module during shutoff periods. The generation of bacteria may have a negative impact on product quality.

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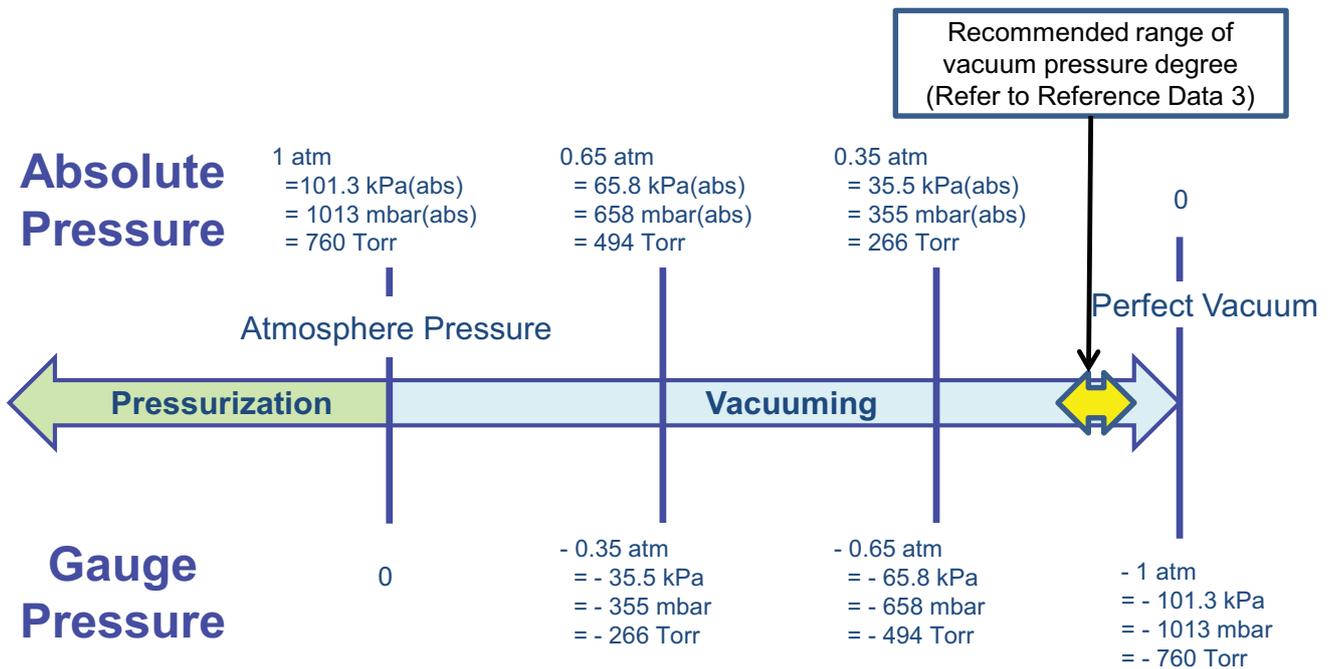
REFERENCE DATA 1: Basic Principles of Degassing



INSTRUCTION MANUAL

REFERENCE DATA 2: Vacuum Pressure Degree

- Note that the vacuum pressure degree in our data sheet is mainly indicated by absolute pressure, not by gauge pressure.



< Absolute Pressure >

For vacuuming conditions, every value should be 0 or plus. It cannot be minus.

< Gauge Pressure >

For vacuuming conditions, every value should be 0 or minus. It cannot be plus.

(Reference : Absolute pressure - Gauge pressure = 1atm)

※ The value for maximum pressure resistance is indicated by gauge pressure.

INSTRUCTION MANUAL

REFERENCE DATA 3: Setting Value of Vacuum Pressure Degree

As the vacuum pressure degree approaches a perfect vacuum, degassing performance is improved. However, if the vacuum pressure degree is too strong yet close to perfect pressure, liquid may evaporate and penetrate through the membrane. As a result, the composition of liquids may change. Therefore, DIC recommends following the exact vacuum pressure degree.

1. For Water or Aqueous Liquid

Recommended Degree of Vacuum : 5kPa(abs) ~ 10kPa(abs)
= 50mbar(abs) ~ 100mbar(abs)

※The above pressure is the recommended value when using the module at 15-30°C. When using the module at temperatures lower than 15°C or higher than 30°C, please contact DIC for more details.

※The above vacuuming pressure is not suitable for every application. Depending on applications, composition, and target degassing performance, the most suitable vacuuming value may be different from the above value.

<Reference : Saturated Water Vapor Pressure>

Temperature (°C)	kPa(abs)	Torr	mbar
15	1.7	12.8	17
20	2.3	17.3	23
25	3.2	24	32
30	4.2	31.5	42

2. For Non-Aqueous Liquid.

Recommended Vacuuming Degree: We recommend setting weaker degrees (higher in value) than the recommended saturated vapor pressure of the liquid.

Ex : In cases where saturated vapor pressure is 8kPa(abs), we recommend a weaker vacuum degree than 10kPa(abs).

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REFERENCE DATA 4: Range of Liquid Flow Rate

Make sure that the liquid feeding pressure at the inlet port is lower than the maximum pressure value described in the specification sheet.

If the feeding pressure exceeds the maximum value, even momentarily, the hollow fiber may be damaged and ink may leak into the vacuum line.

※ The warranty will not apply in cases where liquid feeding pressure exceeds the maximum pressure value specified in the specification sheet.

Product	Maximum Pressure Resistance
EF-MICRO	0.2 MPa (= 2 bar)
EF-G2 Series	0.2 MPa (= 2 bar)
EF-G3 Series	0.2 MPa (= 2 bar)
EF-G5 Series	0.2 MPa (= 2 bar)

Even if liquid feeding pressure is lower than the specified maximum pressure, an increased flow rate will cause lesser degassing performance. On the other hand, if the flow rate is too low, degassing cannot be efficient. Therefore, DIC supplies recommended flow ranges in the table below.

※ The recommended flow range below was calculated when using water. In the case of high viscosity liquid, a suitable flow range will be more narrow.

Product	Flow area
EF-MICRO	0.5 ~ 10 ml/min
EF-G2 series	1 ~ 60 ml/min
EF-G3 series	5 ~ 300 ml/min
EF-G5 series	10 ~ 1500 ml/min

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REFERENCE DATA 5: Inner Volume

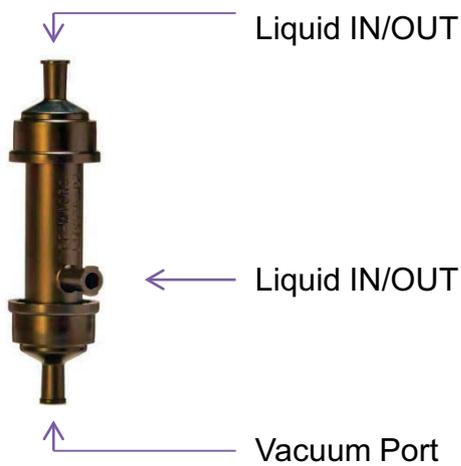
Product	Inner Volume at Liquid Part
EF-MICRO	Approx. 4 ml
EF-G2 Series	Approx. 11 ml
EF-G3 Series	Approx. 40 ml
EF-G5 Series	Approx. 85 ml

**The above values are for reference and are not guaranteed values.
Actual volume may differ by connection type.**

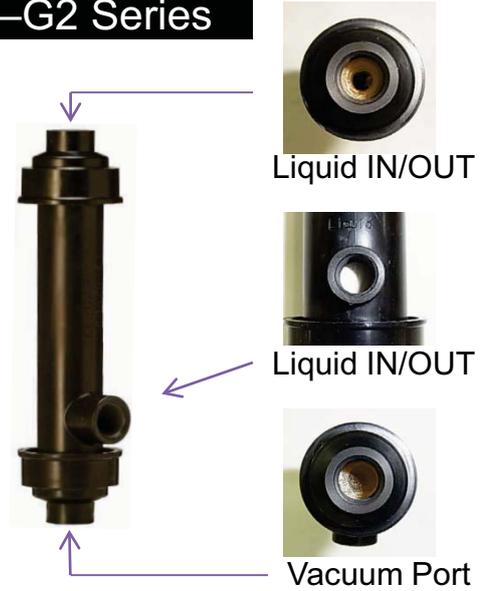
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REFERENCE DATA 6: Image of Connecting Port

EF-MICRO



EF-G2 Series



EF-G3 Series



EF-G5 Series

