SEPAREL®

Hollow Fiber Membrane Module

For Controlled Degassing and Aeration of Various Liquids

Cleaning Guide

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

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

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

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Cleaning Guide

■About this Document

This instruction manual explains how to clean SEPAREL® degassing modules with precautions to be followed for your safety.

Before using the SEPAREL® series, be sure to read this Cleaning Guide to ensure safe and proper use.

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

Please note that this guide does not describe all information about risks related to cleaning method.

Although the content of this Cleaning Guide 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 guide.

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.

	Caution
⚠	This guide does not mention user safety or the safe handling of chemicals. The handling person must assume sole responsibility for using SEPAREL. Installers and operators in charge of handling must take the following steps to ensure safe usage and to protect the environment. ● Complete education of hazardous substance ● Understand any chemical risks ● Complete safety education and wear proper protective equipment ● Understand Material Safety Data Sheet (MSDS) ● Research safety of chemicals and materials before handing

■ Regarding Reproduction and Photocopying of this Document

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1. Intent of Document

There are many different types of contaminants that may adhere to the hollow fiber. The cleaning process, which covers chemical cleaning agents, concentrations, time and flow rates, will be specific to each system.

This guide was developed to ensure proper cleaning processes for your application.

To apply a warranty period, the stipulations in ″2. Warranty ″, P. 4 must be met.

2. Warranty

This guide is applied to SEPAREL® degassing modules that come in contact ONLY WITH WATER.

If any cleaning process other than the process detailed in this guide is conducted, the warranty, as expressly detailed in the Instruction Manual, will not be applied.

In the case where a cleaning process other than the process detailed in this guide was conducted, but based on consultation with DIC, any warranty will be determined through consultations between DIC and the customer.

In order for a decision to be made, the customer must provide compatibility test results which detail how the module reacts when in contact with any liquid. DIC will inform the customer about compatibility testing procedures.

※ Please be sure to follow all the handling instructions written in this guide.
If you do not follow these instructions, the warranty can not be applied.

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3. Cleaning Parameters

There are four parameters that affect the cleaning process:
○ Time (duration and frequency)
○ Temperature mechanical shearing on membrane surface by flowing liquids
○ Chemical type and chemical strength (caustic, acid, alcohol, etc.)

Changing any one of these parameters can affect the others. Therefore, it is important to develop a specific cleaning process for your application. The guide will lead you through the cleaning process. We recommend starting with cleaning chemicals that are generally used in your industry.

※To apply a warranty period, the stipulations in ″2. Warranty ″, P. 4 must be met.

The initial performance of the contactor should be monitored to establish its baseline performance. This baseline performance can be compared to the performance of the contactor after cleaning. Other considerations for establishing the best protocol for your applications are:
○ Experimentation with time (frequency and duration), temperature, chemical concentration, and cleaning liquid flow rate will determine the best method for cleaning the degassing module.
○ Refer to the specification sheet for maximum temperature and pressure ratings. Take into account the rise in temperature that occurs during a physical or chemical reaction such as mixing water with caustic soda or sulfuric acid, mixing of acids and bases, or from pumping.
○ An aggressive cleaning process may clean the degassing module in a shorter time period, but can also reduce the degassing module’ s service life.

Generally, the cleaning frequency can be determined by monitoring a performance decrease.

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4. Chemical Compatibility / Sanitization / Detergents

Table 1 explains tolerance time to the chemicals used for cleaning and sterilizing the degassing module.

Table 1. Tolerance Time

Chemical	Concentration	Endurance Time by Dipping Hollow Fiber, 25 Degrees Celsius
Chlorine	10 ppm	1000 hour
	100 ppm	500 hour
	300 ppm	60 hour
	500 ppm	50 hour
Hydrogen Peroxide	**3.5 wt%**	**200 hour**
Hydrochloric Acid	3.5 wt%	〃
Nitric Acid	3 wt%	900 hour
Formaldehyde	3.5wt %	10000 hour
Soda	**3.5 wt%**	〃
Citric Acid	3 wt%	〃

We calculated the the dipping time by determining when the tensile strength of the hollow fiber has decreased by 30% when compared to its initial value.
Please do not use chemicals in higher concentrations than specified in the data above.
Tolerance time becomes shorter under high temperature conditions.

Cautions Associated with Selecting Cleaning Chemicals

The cleaning process established by DIC is limited to only using oxygenated water and soda as indicated in the next page. If you use other chemicals, please be sure to contact us with your washing method.

Avoid contact with surfactants/solvents or oxidants (e.g. ozone, chlorine) to the hydrophobic membrane in order to prevent wet-out or oxidation.

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5. Cleaning Protocol for Biological Soil Removal

When the performance of the degassing module for water has decreased, it is possible to recover performance ability through cleaning. If a contaminant is only stuck in the hollow thread surface of degassing module, the performance can be recovered by simply cleaning the liquid side of the hollow fiber surface.

If the performance is not recovered by two cleaning processes, please replace the module.

When you degas RO water, the cause of the performance deterioration is biotic contamination, also known as bacteria breeding. Below you will find steps which explain the cleaning method for degassing modules in water applications which have been negatively impacted by bacteria breeding.

Table 2. Cleaning Process for Biotic Contamination

Process	Step	Operating	Caution
Bacterial Removal	1	Hydrogen Peroxide adjusted to 1-3.5 wt% is filled in the module.	Fill the liquid so that an air bubble isn't left inside the degassing module (We recommended that you flow liquid inside the degassing module.)
	2	After leaving the Hydrogen Peroxide for over 1 hour, remove it by rinsing. (Until acceptable cleaning solution pH is achieved)	Be careful as there is no cumulative wetted time with the hydrogen peroxide beyond 200 hours. Oxidation degrades the hollow fiber and causes leaking.
Cleaning	3	The NaOH-aq (pH 10-12) is filled in the module.	
	4	After leaving the NaOH-aq for over 1 hour, remove it.	Fill the liquid so that an air bubble isn't left inside the degassing module (We recommended that you flow liquid inside the degassing module.)
Rinsing	5	Rinse degassing module and remove NaOH perfectly. (Until acceptable cleaning solution pH is achieved)	

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5. Cleaning Protocol for Biological Soil Removal

【Reference Example】

The degassing module's performance will decrease due to brightly-colored bacteria if the module was left without being drained of water for a long period of time. To combat this, DIC has implemented the following cleaning process.

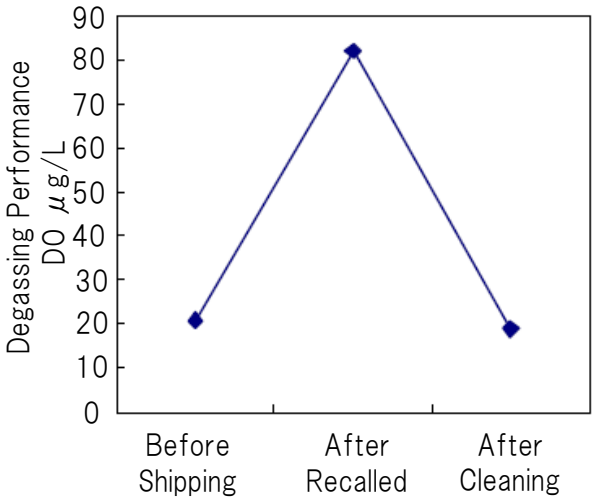
Cleaning Conditions

a) The liquid side of the module is filled with Hydrogen Peroxide (1wt%) and kept an hour at R.T.

b) The liquid side of the module is filled with NaOH-aq (pH 12) and kept for 65 hours at R.T.

Degassing Performance of EF-040P

DO : Dissolved Oxygen



Performance Conditions:

Module Model	: SEPAREL EF-040P
Flow Rate	: 2000 L/min
Temperature	: 25℃
Vacuum Degree	: 2.7 kPa
$DO_{initial}$	: 8 mg/L
DO meter	: Orbisphere MOCA-3600

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6. Drying the Degassing Module of Water

We do not recommend any drying method via vacuuming processes.
Our vacuuming test shows that liquid cannot be removed even if the vacuuming process is conducted for a few hours.

Therefore, the degassing module must be dried in accordance with Table 3.

Caution

It is necessary to flow drying gas into the gas port depending on module model. Table 4, P 10 explains the location for each degassing module model.

After the drying process detailed in Table 3, please replace the connection and conduct the drying process.

Table 3. Water Removal Process

Step	Operation
1	Remove the piping.
2	Lower SEPAREL with its body facing the ground and turn liquid-OUT port to the floor. (Almost all water can be removed in this step.)
3	Flow gas to the liquid part until water droplet doesn't come out from. - During this process, vacuum poor should be open. - Feeding gas should be dry and filtered by gas filter of smaller than 0.2 micron meter. - For recommend time to feed gas, please refer to the table 4 in page 10.
4	Shut Liquid-IN/OUT Port.

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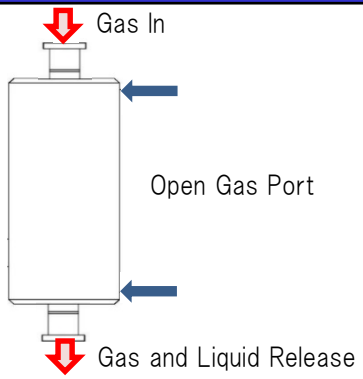
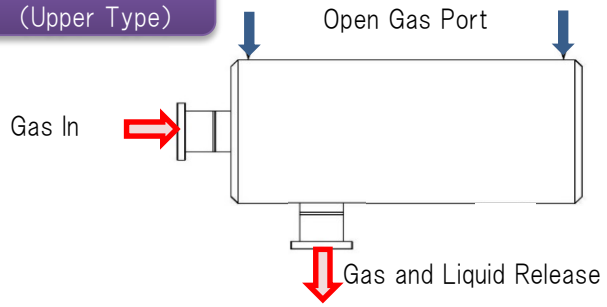
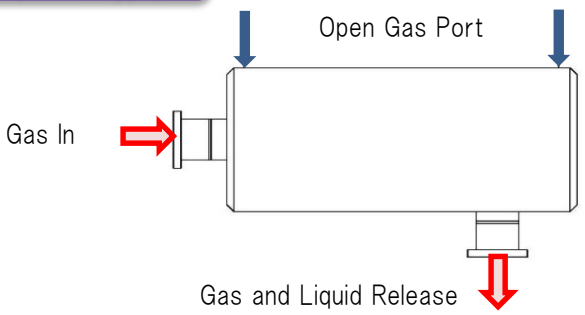
6. Drying Degassing Module for Water

Table 4. Drying Method of Each Part Number Gas Temperature: R.T.

Model	Flow Rate	Drying Operation		Drying Flow Diagram (Liquid Port Side) ※When drying gas port, please replace a connection.
		Liquid Port	Gas Port	
PF-001D PF-004D	80 L/min	1 h ≦	-	PF-Series 
PF-015 PF-030	60 L/min	1 h ≦	-	
EF-002A	80 L/min	20 h ≦	0.5 h	EF-Series (Upper Type) 
EF-040P	80 L/min	48 h ≦	1 h	
EF-MICRO EF-G2 EF-G3 EF-G5	30 L/min	20 h ≦	-	EF-Series (Under Type) 
EF-010 EF-020	80 L/min	40 h ≦	1 h	
EF-120	80 L/min	48 h ≦	2 h	

※The above is one case which DIC conducted. The proper conditions are different depending on the use environment of each customer. Contact us if you have any questions.

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