

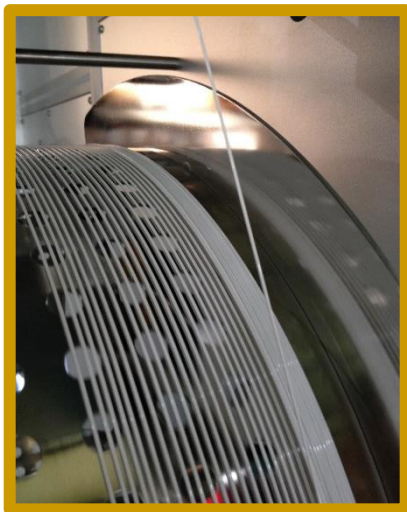
# Hollow fiber membrane manufacturing systems

## About MEMS

**MEMS** is one of the masterpieces of PHILOS, who is the leading company with 20+ years' experience in membrane manufacturing and system design. It is renowned for its capabilities in providing total solutions for various kinds of membrane applications.

**MEMS** focuses on adopting to customer's mind of work. We have developed our systems which are user friendly and convenient to use. With years of knowledge and experience behind us we are able to offer you the most advanced design and technology in membrane evaluation and manufacturing system. No matter the size, scale, usage or application, all of our customers will benefit from our experts' advice.

## MEMS proposal to customers



Carrying many years of experience in R&D, manufacturing and engineering of membranes, we are clearly aware about the reality of what goes inside the lab. We closely understand the challenges of doing an experiment and are well acquainted with the problems of you, researchers in the lab better than anyone else.

Moreover, while working together with researchers, we have observed each one of them closely and have tried to understand the mindset of researchers. We know that convenience in handling device is what matters the most while doing research. We say this because we know very well that many researchers are relying on some sloppy self-made devices in spite of having expensive and perfectly well conditioned equipment just because it is not convenient to operate. Those systems occupy much space in lab, are needed a severe cleaning process and do not fit your purposes to make prototype.

Therefore, after years of experience, observation and realization, we at MEMS made it our mission to provide the most user friendly and convenient equipment to those who want to research and develop membranes. MEMS was born to overcome even the slightest of challenges that faced by researchers but are often shadowed. So at MEMS we have developed "A device that recognizes the researcher's mind" by adopting to user mind of researchers through our years of experience. That is our proposal to you, researchers.

## Special feature of MEMS Hollow fiber membrane manufacturing systems

Recognizing the user's mind of research, we at MEMS offer the most precise, user-friendly, time and space efficient hollow fiber membrane manufacturing system. MEMS hollow fiber membrane manufacturing equipment allows researchers to not only prepare a lot of membrane samples in a short time with confidence in reproducibility and accuracy but can also permits to carry out experiments in various conditions.

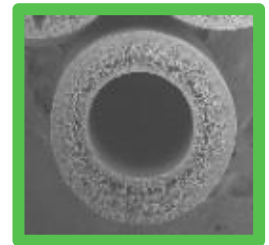
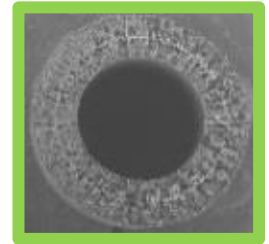
MEMS makes the experiment easy as it solves one of the most concerned issue of researchers; Cleaning. Especially considering the challenges of cleaning the dope tank, we have designed MEMS hollow fiber spinning system is such a way that researchers no more have to worry about cleaning. We have adopted the use of disposable plastic bottles in the dope tank which can be changed every time a user wishes to work with new ingredient. This simple yet important and innovative design can save user much time and energy by making the whole experimenting experience more likeable.

Moreover, with MEMS users can now put them self at ease and not worry much about that little extra space they might need in their lab to adjust a new equipment. MEMS's compact designs make it more adjustable to fit even in the smallest of space as it has been constantly working with experts and design engineers to make the system more compact, skilled & precise.

Researchers will certainly benefit with reliable and accurate results from MEMS hollow fiber manufacturing machine as it is equipped with various sizes of spinnerets, gear pumps, inverter control, and other control systems with the highest precision allowing researchers a great precision control for the overall process from start to finish; spinning to winding. Perhaps this might even help the researcher collect more data.

In addition to obtain good and reproducible result, our experts suggest a separate water bath to be installed in the device which will completely remove solvents and additives from the membrane. As without this process, it is never possible to create a membrane with good performance and no reproducibility can be obtained.

MEMS will help you to get more reliable and diverse data.



## The process of hollow fiber membrane manufacturing

MEMS supplies all sorts of facilities associated with the membrane manufacturing from the materials used to the technical facilities, it provides an overall solution to membrane manufacturing. Even the facilities to manufacture modules, and to evaluate them are available at MEMS. Including very simple experimental devices to production facilities, MEMS has it all.

**Dope formulation ⇒ Hollow fiber membrane spinning ⇒ Rinsing & drying ⇒ Module potting ⇒ Module cutting ⇒ QC/Performance evaluation**

For more inquiries on business of PHILOS, please refer to [www.membranefilter.co.kr](http://www.membranefilter.co.kr) .

## MEMS Hollow fiber membrane spinning systems

Item	System	Specification
HSL	Lab HFM Spinning System	Dope tank(1L) and supply by compressed air Non-temperature control system, Customer can connect water bath for the temperature control Free roll-guide, Winding speed is 5-10 m/min 840L x 350W x 410
HSR	Regular HFM Spinning System	Dope tank(2L) and supply by gear pump/inverter control Inner coagulant is supplied by compressed air Temperature control for coagulation bath (RT~70°C) Free roll-guide Detachable wheel, Winding speed is max. 20 m/min 900L x 700W x 1,800H
HSH	High Functional HFM Spinning System	Dope and inner coagulant tank; 2L Dope temperature control: RT ~ 70±5°C Motor driven roll-guide Temperature control for coagulation bath (RT~70°C) Detachable wheel, Winding speed is max. 20 m/min 2 Membrane wheel flushing bath for solvent removal 900L x 700W x 1,800H
HSD	HFM Spinning System for Double-layer Membrane	Double-layered membrane spinning 2 Dope tanks and inner coagulant tank; 2L Dope temperature control: RT ~ 70±5°C Motor driven roll-guide Temperature control for coagulation bath (RT~70°C) Detachable wheel, Winding speed is max. 20 m/min 2 Membrane wheel flushing bath for solvent removal 1,600L X 800W X 2300H
HSP	HFM Spinning System for the Production	8 Hole scale spinning system All the systems are temperature controlled Gear pumps are used for dope and inner coagulant supply Godet roll Traverse guide for winding system

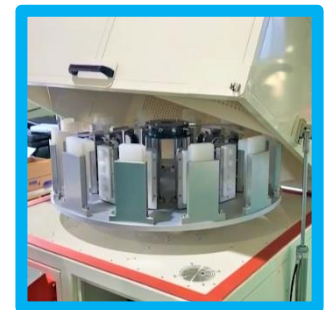


## Module potting systems

Manufactured hollow fiber membrane is inserted into the module housing and then is put into the centrifugal potting system, after the placement of the housing modules inside the system an adhesive glue is then injected into the module housing and is allowed to rotate.

An additional glue diffuser is hence strongly recommended as it helps precise mixing of PU or Epoxy adhesive whilst removing air bubbles from it, and injecting the adhesive into the module housing at precise temperatures. All these steps are all very critical and needed to module manufacturing process.

Item	System	Specification
<b>MPL</b>	<b>Lab Module Potting System</b>	1~3inch x 300mL, 600L x 600W x 1,000H Speed control 0~400 rpm Hot air circulation, RT~ 50°C
<b>MPP</b>	<b>Pilot Module Potting System</b>	2~4inch x 1,000mL, 1,500L x 1,500W x 1,200H Speed control 0~400 rpm Hot air circulation, RT~ 50°C
<b>MPC</b>	<b>Commercial Module Potting System</b>	6~10inch x 2,000mL, 3,000L x 3,200W x 3,200H Speed control 0~300 rpm Hot air circulation, RT~ 50°C
<b>MPW</b>	<b>Water Purifier Module Potting System</b>	Order-made system, 32mmD x 100mmL 24~48 ea potting/cycle 1,200L x 1,200W x 1,400H Hot air circulation, RT~ 50°C



## Module cutting systems

The cutting system is essential for membrane development as it is the final and most important step of the process. Glued modules are cut at both ends and the final product is ready.

Item	System	Specification
<b>MCL</b>	<b>Lab Module Cutting System</b>	1~3inch x Max.40inch 1,000L x 300W x 500H Guillotine, screw moving
<b>MCC</b>	<b>Commercial Module Cutting System</b>	4~10inch x Max.40inch 2,500L x 1,000W x 2,600H Guillotine, hydraulic power moving AC Servo system, LM guide
<b>MCW</b>	<b>Water purifier Module Cutting System</b>	2~3inch x 160mmL, 1,000L x 1,000W x 2,000H Automatic cutting



# New area of hollow fiber membranes

Coating systems for Gas, RO, FO, PRO and other composite membranes

Item	System	Specification
HCS	Hollow fiber membrane solution coating system	Winding & unwinding and tension control Dip coating and drying system 1~10 m/min by inverter control and traverse winding Temperature control RT ~ 120°C by air blower 1,800L x 1,000W x 2,000H
HCP	Hollow fiber membrane TFC coating system by polymerization	Three Chemical treatment process (Amine-Acyl Chloride-post chemical treat) 0.4~2 m/min by inverter control and traverse winding Godet roll, insulating, N2 gas purge, Temp. control : 10,500L x 4,000W x 2,000H
HCM	Hollow fiber membrane coating system as a module	Two chemical treatment of membrane module as it is. Max. 10L/min flow of chemicals Modules are set in the oven, temperature controlled : 1,800 L x 840W x 1,720H



# Appendix



# MEMS Hollow fiber membrane spinning systems

	HSL	HSR	HSH	HSD	HSP
	Lab HFM spinning system	Regular HFM spinning system	High functional HFM spinning system	HFM spinning system for double layer membrane	HFM spinning system for the production
<b>Dope formulation</b>	none	none	none	none	- Capacity : 100L - Temp. control : RT ~ 60±5°C
<b>Dope filtration</b>	none	none	none	none	- Candle type, 2set - Mesh size : 5um - driving force : compressed air
<b>Dope storage tank</b>	- capacity : 1L - Temperature control : RT	- capacity : 2L - Temperature control : RT	- capacity : 2L - Temperature control : RT ~ 70±5°C	- capacity : 2L - Temperature control : RT ~ 70±5°C	- capacity : 100L x 2set - Temperature control : RT ~ 60±5°C
<b>Dope supply unit</b>	- compressed air	- Gear pump	- Gear pump	- Gear pump	- Gear pump
<b>Inner coagulant formulation</b>	none	none	none	none	- Capacity : 100L - Temp. control : RT
<b>Inner coagulant filtration</b>	none	none	none	none	- Candle type, 1set - Mesh size : 5um - driving force : compressed air
<b>Inner coagulant storage tank</b>	- capacity : 1L - Temperature control : RT	- capacity : 2L - Temperature control : RT	- capacity : 2L - Temperature control : RT ~ 70±5°C	- capacity : 2L - Temperature control : RT ~ 70±5°C	- capacity : 100L x 1set - Temperature control : RT ~ 60±5°C
<b>Inner coagulant supply unit</b>	- compressed air	- compressed air	- Gear pump	- Gear pump	- Gear pump
<b>Outer solution storage tank</b>	none	none	none	- capacity : 2L - Temperature control : RT ~ 70±5°C	none
<b>Outer solution supply unit</b>	none	none	none	- Gear pump	none
<b>Nozzle and plate</b>	- single layer type - mounting quantity : 1set - No temp. control function. - Air gap : 100mm	- single layer type - mounting quantity : 1set - No temp. control function. - Air gap : 150mm	- single layer type - mounting quantity : 1set - No temp. control function. - Air gap : 200mm	- Double layer type - mounting quantity : 1set - Temp. control by water bath (RT ~ 80°C) - Air gap : 200mm	- single layer type - mounting quantity : 8set - Temp. control : RT ~ 80°C - Air gap : 200mm
<b>coagulation bath</b>	- 1st guide roll : free roll - volume : 32L - No temp. control function. (Customer can connect circulating water bath)	- 1st guide roll : free roll - volume : 150L - Temp. control : RT ~ 70±2°C	- 1st guide roll : motor drive - volume : 150L - Temp. control : RT ~ 70±2°C	- 1st guide roll : motor drive - volume : 210L - Temp. control : RT ~ 70±2°C	- 1st guide roll : motor drive - 1st guide roll up and down (motor drive) - volume : 520L - Temp. control : RT ~ 70±2°C
<b>Washing bath</b>	none	none	none	none	- Godet roller type - Total pass length : 100m - volume : 510L (circulation pump) - Temp. control : RT ~ 60±2°C - No of bath system : 1 set
<b>Drying system</b>	none	none	none	none	
<b>Take-up winder</b>	- wheel size : 140mm D x 34mm W - mounting quantity : 1set - winding speed : ~ 10m/min (max)	- wheel size : 220mm D x 34mm W - mounting quantity : 1set - detachable type - winding speed : ~ 20m/min (max)	- wheel size : 220mm D x 34mm W - mounting quantity : 1set - detachable type - winding speed : ~ 20m/min (max)	- wheel size : 220mm D x 34mm W - mounting quantity : 1set - detachable type - winding speed : ~ 20m/min (max)	- 2 shaft auto turret system - winding speed : ~ 70m/min (max) - tension control : variable by dancer roll - bobbin : 250mmD x 200mmW
<b>Flushing bath</b>	none	none	- Flushing of 2 bobbins simultaneously - Aeration system by blower - Temp. control : RT ~ 50±3°C - Included inside the spinning system.	- Flushing of 4 bobbins simultaneously - Aeration system by blower - Temp. control : RT ~ 50±3°C - Separate cleaning system	- Fixed to the membrane cassette - Temp. control : RT - No of bath system : 5 set
<b>System power and control</b>	- 220V single phase (3kw) - Dial adjustment control	- 380~400V, 3phase (12Kw) - touch screen control (7")	- 380~400V, 3phase (15Kw) - touch screen control (7")	- 380~400V, 3phase (17Kw) - touch screen control (10")	- 380~400V, 3phase (50Kw) - touch screen control
<b>System dimension (mm)</b>	840L x 350W x 410H	900L x 700W x 1,800H	900L x 700W x 1,800H	1,600L X 800W X 2300H	

# Module potting systems

	<b>MPL</b>	<b>MPP</b>	<b>MPC</b>	<b>MPW</b>
	<b>Lab module potting system</b>	<b>Pilot module potting system</b>	<b>Commercial module potting system</b>	<b>Water purifier module potting system</b>
<b>Module dimension (OD)</b>	1~3 inch	2~4 inch	6~10 inch	32mmD (53mmD)
<b>Module dimension (Length)</b>	300 mmL	1,000 mmL	2,000 mmL	100mmL (112mmL)
<b>Capacity</b>	1 ea/cycle	1 ea/cycle	1 ea/cycle	48 ea/cycle (24ea/cycle)
<b>Module type</b>	I type	I type	I type	U type
<b>System dimension (mm)</b>	600L x 600W x 1,000H	1,500L x 1,500W x 1,200H	3,000L x 3,200W x 3,200H	1,200L x 1,200W x 1,400H
<b>Potting adhesion</b>	PU or Epoxy	PU or Epoxy	PU or Epoxy	PU or Epoxy
<b>Motor power</b>	1Hp	2Hp	10Hp	2Hp
<b>rotating speed</b>	0~400 RPM	0~400 RPM	0~300 RPM	0~400 RPM
<b>Speed control</b>	Dial adjustment	Digital setting and indicating	Digital setting and indicating	Digital setting and indicating
<b>Running time setting</b>	Digital setting and indicating	Digital setting and indicating	Digital setting and indicating	Digital setting and indicating
<b>Temp. control</b>	- Hot air circulation type - range : RT ~ 50°C	- Hot air circulation type - range : RT ~ 50°C	- Hot air circulation type - range : RT ~ 50°C	- Hot air circulation type - range : RT ~ 50°C
<b>Safety</b>	- door locking system - safety mode setting	- door locking system - safety mode setting	- door locking system - safety mode setting	- door locking system - safety mode setting
<b>Electrical power</b>	- 220V single phase, 2kw	- 380V 3phase, 10kw	- 380V 3phase, 15kw	- 380V 3phase, 15kw



## Module cutting systems

	MCL	MCC	MCW
	Lab module cutting system	Commercial module cutting system	Water purifier module cutting system
<b>Module dimension (OD)</b>	1 ~ 3 inch	4 ~ 10 inch	2 ~ 3 inch
<b>Module dimension (Length)</b>	Max 40 inch	Max 40 inch	Max 160mm L
<b>Potting material</b>	polyurethane	polyurethane	polyurethane
<b>System dimension (mm)</b>	1,000L x 300W x 500H	2,500L x 1,000W x 2,600H	1,000L x 1,000W x 2,000H
<b>cutting type</b>	- guillotine type (knife slicing type) - loading, unloading, cutting : manual	- guillotine type (knife slicing type) - loading and unloading : manual	- guillotine type (knife slicing type) - Auto loading -> jig -> cutting -> unloading
<b>capacity</b>	1ea/cycle	1ea/cycle	1ea/cycle
<b>module moving</b>	none	- moving unit : LM guide & ball screw - module holder : clamp type - driving system : AC servo system	Automatic cutting
<b>Cutting part</b>	screw, manual	- hydraulic power unit - knife material : SKD11	- hydraulic power unit - knife material : SKD11
<b>Control system</b>	none	- PLC control - touch screen : 5.7inch	- PLC control - touch screen : 5.7inch
<b>Electrical power</b>	none	380V, 3phase, 5kw	

# New area of Hollow fiber membranes / coating systems

	HCS	HCP	HCM
	Hollow fiber membrane solution coating system	Hollow fiber membrane TFC coating system by polymerization	Hollow fiber membrane coating system as a module
Coating process	unwinder -> dipping coating -> dry oven -> winder	unwinder -> 1st chemical -> 2nd chemical -> air drying -> washing -> 3rd chemical -> dry oven -> winder	module setting -> 1st chemical -> air blowing -> 2nd chemical -> dry oven
Unwinder unit	<ul style="list-style-type: none"> <li>- Detached unwinding bobbin</li> <li>- Dancer roll control</li> <li>- Speed control : 1 ~ 10 m/min by inverter control</li> </ul>	<ul style="list-style-type: none"> <li>- Detached unwinding bobbin</li> <li>- Dancer roll control</li> <li>- Speed control : 0.4 ~ 2 m/min by inverter control</li> <li>- Explosion Proof Grade: Ex d II B T4</li> </ul>	
Coating solution unit	<ul style="list-style-type: none"> <li>- Material : stainless steel 304 or PP</li> <li>- Coating bath : minimum 300 mL</li> </ul>	<p><b>1st chemical treatment</b></p> <ul style="list-style-type: none"> <li>- coating and chemical tank</li> <li>- godet roll type</li> <li>- fiber immersed in the bath : 10m</li> <li>- chemical supplying pump and tank</li> <li>- chemical tank temp. control : 4~60°C (by water bath)</li> </ul> <p><b>2nd chemical treatment</b></p> <ul style="list-style-type: none"> <li>- The length of fiber path on chemical bath ; more than 2 m</li> <li>- tank dimension (mm) : 2,500L x 100W x 350H</li> <li>- chemical supplying pump and tank</li> <li>- chemical tank temp. control : 4~60°C (by water bath)</li> </ul> <p><b>3rd chemical treatment</b></p> <ul style="list-style-type: none"> <li>- dipping type chemical treatment</li> <li>- bath dimension(mm) : 250L x 100W x 150H (2 set)</li> </ul>	<p><b>1st and 2nd chemical treatment</b></p> <ul style="list-style-type: none"> <li>- chemical pump : 10L/min, PP</li> <li>- chemical tank : 10"D x 420mmH, PP, 70L</li> <li>- Dimension (mm) : 900L x 840W x 1,720H</li> </ul>
Drying chamber	<ul style="list-style-type: none"> <li>- Inner chamber material : stainless steel 304</li> <li>- Outer insulating coverage material : powder coating on steel</li> <li>- Insulation material : glass wool</li> <li>- Temperature control of coating chamber : ~ 120°C</li> <li>- Chamber dimension (mm) : 250L x 200W x 1,800H</li> <li>- Heating type air blower is effective for the coating process.</li> </ul>	<ul style="list-style-type: none"> <li>- godet roll type</li> <li>- Inner chamber material : stainless steel 316</li> <li>- Temperature; ~ 70 ± 5°C</li> <li>- Heating type air blower is effective for the coating process.</li> <li>- Insulating material : Glass wool</li> <li>- N2 gas supply</li> </ul>	<p><b>Chemical treatment oven</b></p> <ul style="list-style-type: none"> <li>- Inner chamber material : stainless steel 304</li> <li>- Outer insulating coverage material : powder coating on steel</li> <li>- Insulation material : glass wool</li> <li>- Temperature control : ~ 120°C</li> <li>- oven dimension (mm) : 600L x 800W x 1,720H</li> <li>- Heating type air blower is effective for the coating process.</li> </ul>
Washing		<ul style="list-style-type: none"> <li>- godet roll type</li> <li>- tank dimension (mm) : 850L x 400W x 500H</li> <li>- fiber immersed in the bath : 10m</li> <li>- chemical supplying pump and tank</li> <li>- chemical tank temp. control : RT ~ 50°C</li> <li>- water circulation pump</li> </ul>	
Winder	<ul style="list-style-type: none"> <li>- Detachable unwinding bobbin</li> <li>- Speed control : 1~10 m/min</li> <li>- Weight type (dancer roll) tension control is connected to take-up speed control</li> <li>- Traverse winding device</li> </ul>	<ul style="list-style-type: none"> <li>- Detached unwinding bobbin</li> <li>- Dancer roll control</li> <li>- Speed control : 0.4 ~ 2 m/min by inverter control</li> <li>- Explosion Proof Grade: Ex d II B T4</li> </ul>	
System	<ul style="list-style-type: none"> <li>- Frame : aluminum profile</li> <li>- Dimension (mm) : 1,800L x 1,000W x 2,000H</li> </ul>	<ul style="list-style-type: none"> <li>- Frame : aluminum profile</li> <li>- Dimension (mm) : 10,500L x 4,000W x 2,000H</li> </ul>	<ul style="list-style-type: none"> <li>- Piping and fitting : PTFE</li> <li>- Dimension(mm) : 1,800 L x 840W x 1,720H</li> </ul>
Electrical power	380V, 3phase, 20kW	380V, 3phase, 50kW	220V, single phase, 5kW