Toray UF

Instruction Manual

Module Parts for Pressurized Type

'TORAY'

Innovation by Chemistry

06-G-MB2-UFModuleParts-250926

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Content

I. Introduction

These Module Parts are for a pressurized hollow fiber UF (Ultra Filtration) membrane module “HFUG series” and “HFU series”. This instruction manual describes the safe handling and specifications of the module parts. Be sure to read this instruction manual to handle the parts properly. Please refer to the “HFUG series” or “HFU series” instruction manuals for handling of the hollow fiber membrane module.

II. For Your Safety

- Please be sure to read and follow the instructions below before using membrane modules and parts. This manual should be retained for future reference.

- Follow the safety precautions as they are intended to protect operators and equipment from various risks such as physical harm and/or property damage. The following table shows a level of potential risk for each indicated symbol.

DANGER	This symbol indicates an imminent hazardous situation which will result in serious injury or death when the instruction is not observed.
WARNING	This symbol indicates a potentially hazardous situation which will result in serious injury or death when the instruction is not observed.
CAUTION	This symbol indicates a potentially hazardous situation which might result in injury or property damage when the instruction is not observed.

- The following table explains the information to be noted.

Prohibited	“Prohibited” This symbol indicates a prohibited action or procedure.
Instruction	“Instruction” This symbol indicates an important action or procedure which has to be taken without fail.

1. Safety Instruction for Unpacking, Installation/ Attachment, Detachment, and Stograge.

DANGER


Instruction

Be sure to wear safety gear such as rubber gloves and safety glasses for unpacking. The membrane is packaged in sodium hypochlorite solution (Max. 200 mg/L as Cl_2). If the solution happens to splash onto the skin, wash the affected part with running water. If the solution happens to get in the eyes or mouth, wash the affected part with sufficient amounts of clean running water for more than 15 minutes and see the doctor immediately.

WARNING


Instruction

Be sure to wear safety gear such as a helmet to protect your head and safety shoes to avoid injury due to falling of related parts or equipment, such as module, etc.


Instruction

Use equipment such as chain blocks, a crane, or a forklift truck when you handle the module. The HFUG-2020AN module is too heavy to handle by hand.

CAUTION


Prohibited

The preservative solution should be drained out before using the modules. After that, fill tap water or equivalent quality water into the modules to prevent the hollow fiber membrane from drying out. Do not allow the modules to dry even for a few hours.


Prohibited

The membrane modules should not be frozen.


Prohibited

Be careful not to damage or dent the modules during handling.


Instruction

Be sure to wear protective appropriate gloves to avoid injury of hands by the packaging box of the modules.


Instruction

Housing type joints and screw are applied to connect the membrane modules to the piping. Follow the instruction of the connection provided by the supplier at the connection point. Wrong connections may damage the modules.


Instruction

When connecting and unconnecting the modules to the piping, be sure to secure a sufficient working space, and take care not to catch and hurt fingers.


Prohibited

Keep the connection surface free of any dirt or oils.


Instruction

Be sure to install the modules vertically for effective air scrubbing.

2. Safety Instruction for Filtration Operation

DANGER


Instruction

Flush all the piping out with clean water and make sure no debris is remaining in the piping prior to connecting the modules.


Instruction

Confirm that the preservative solution in the modules is completely drained out before starting the filtration operation. The preservative solution is harmful to humans.


Instruction

Flush the modules at low pressure, filling from the bottom, and vent to remove any air from the modules. Air left in the modules may cause water hammer and may result in damage to the membrane.


Instruction

Prior to use, make certain modules are flushed. Filtrate water should be drained unless it meets the required quality.

WARNING


Instruction

Protect modules from direct sunlight and ultraviolet light. Ultraviolet light can degrade module housing and membranes.


Instruction

Constantly monitor filtrate water quality such as turbidity and/or the number of particles during filtration, and stop the operation if abnormal water quality is detected.


Prohibited

Do not exceed the maximum applicable pressure of 300 kPa (43.5 psi). Higher pressures can damage the modules. Do not exceed the maximum temperature of 40 deg C (104 deg F). The higher temperature damages the modules.


Prohibited

Do not freeze the membrane modules.


Instruction

The operating conditions, including the filtration flux and the periodical physical cleaning, must be properly set-up otherwise the trans-membrane pressure may rise too quickly. The operation range is described in the latter section of this manual.


Instruction

Make sure air tubes or connected pipes are properly fixed. Otherwise, the tubes or connected pipes may be blown away or behave violently during air-scrubbing.


Instruction

Do not overfeed air to the modules. Excessive scrubbing air damages the membranes and/or shortens the membrane life.
The air flow rate should be within the range below for each module type.

HFUG-2020AN: 4.8 – 9.0 Nm^3/h (2.8 – 5.3 scfm)

The maximum required air pressure during the air-scrubbing for inside of the module will be 40 kPa (6 psi).


Instruction

At the integrity tests, such as Pressure Decay Test (PDT) or Diffusive Air Flow (DAF) Test, keep the air pressure below 130 kPa (18.9 psi). Keep the source air pressure lower than 200 kPa (29 psi), to prevent excess air inflow. All the air used for air scrubbing and integrity testing must be dry oil-free air.

III. Specifications of Module Parts

1. Packaging Box

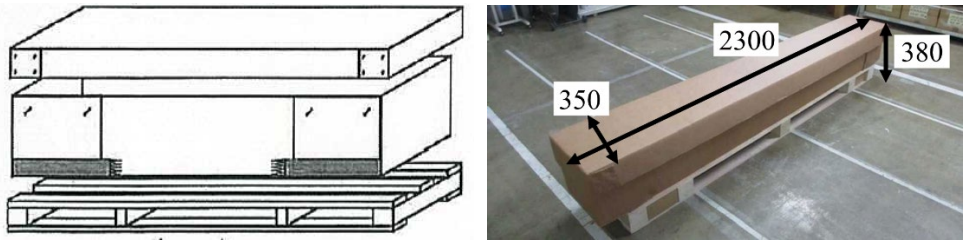

Figure 1: Single-Module Packaging for 2020AN Type

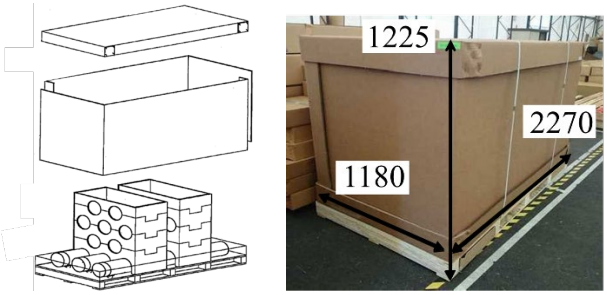

Figure 2: Multiple-Module Packaging for 2020AN Type
(maximum 10 modules per box)

Table 1: Specifications of Packaging Boxes *1), *2)

Module Type (Packaging Type)	2020AN (Single Module)	2020AN (Multiple Modules)
Maximum Number of Modules	1	10
Materials	(Box) Cardboard (Pallet) Wood	
Height (mm)	380	1,225
Width (mm)	350	1,190
Length (mm)	2,300	2,270
Weight (kg) *3)	75	630

*1): Note that the specifications are subject to change without notice.

*2): These dimensions include pallets.

*3): The weight includes modules.

Table 2: Specifications of Packaging Boxes *1), *2)

Module Type (Packaging Type)	2315AN (Single Module)	2315AN (Multiple Modules)
Maximum Number of Modules	1	16
Materials	(Box) Cardboard (Pallet) Wood	
Height (mm)	380	1,270
Width (mm)	340	1,075
Length (mm)	2,480	2,390
Weight (kg) *3)	46	733

*1): Note that the specifications are subject to change without notice.

*2): These dimensions include pallets.

*3): The weight includes modules.

See sections of IV and X for working with packaging boxes.

2. Housing Type Joint

Figure 3: Housing Type Joint 80A

Figure 4: Housing Type Joint 65A

Table 3: Specifications of Housing Type Joints for 2020AN Type *1) *2)

Size	80A (For top and bottom nozzles)		65A (For side nozzles)	
Materials	(Housing) Polyamide + Glass fiber (Gasket) Ethylene propylene rubber (Bolt/Nut) Stainless (304/316/316L)			
Type	A	B	A	B
Height (mm)	126	128	109.5	108
Width (mm)	45	47	50	46
Length (mm)	177	160	156	148
Weight (kg)	0.6	0.5	0.3	0.3
Bolt/Nut Size (mm)	19	14	13	14

*1): Note that the specifications are subject to change without notice.

See sections of V and VI for working with housing type joints.

3. Repair Pin

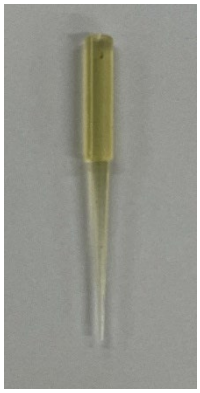

Figure 5: Repair Pin

Table 4: Specifications of Repair Pins *1)

Applicable Modules	HFU series	HFUG series
Materials	PVC and/or equivalent	
Length (mm)	26	25
Diameter of top (mm)	2.2	2.2
Diameter of bottom (mm)	0.6	0.3

*1): Note that the specifications are subject to change without notice.

See sections of IX for working with repair pins.

4. Module Cap

(1): Module Cap for 2020AN, 1020AN and 2320AN

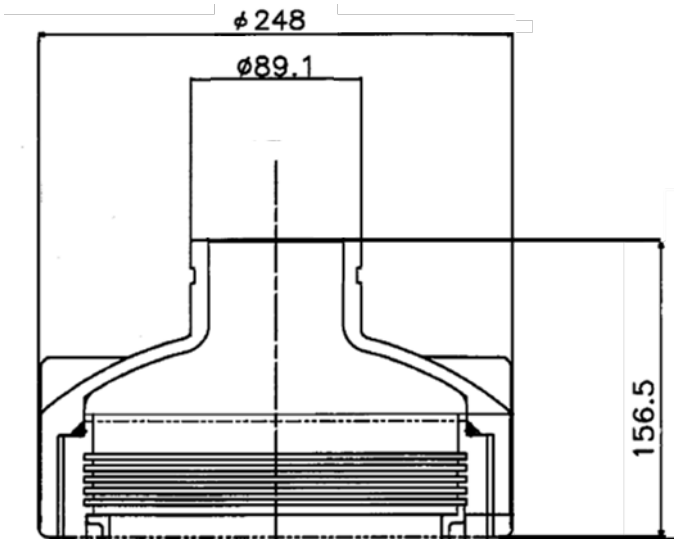

Figure 6: Module Cap for 2020AN, 1020AN and 2320AN Type

Table 5: Specification of Module Caps for 2020AN Type *1)

Materials	PVC and/or equivalent
Hight (mm)	156.5
Diameter (mm)	248
Weight (kg)	1.6

*1): Note that the specifications are subject to change without notice.

(2): Module Cap for 2315AN

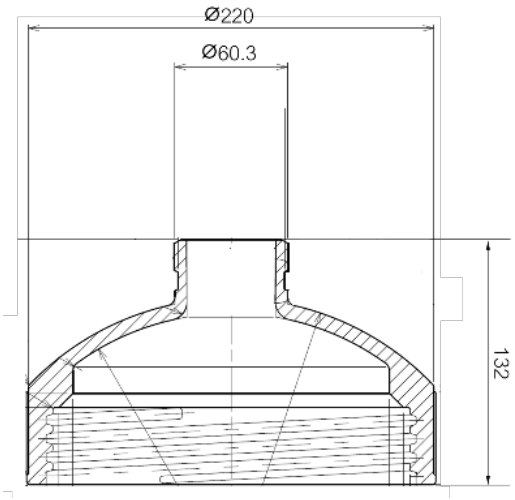

Figure 7: Housing Cap

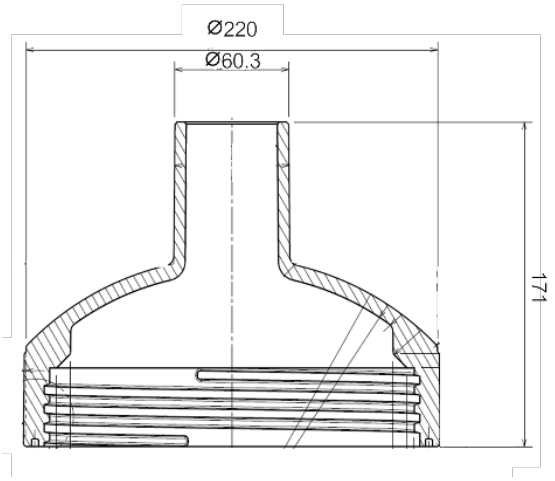

Figure 8: Straight Cap

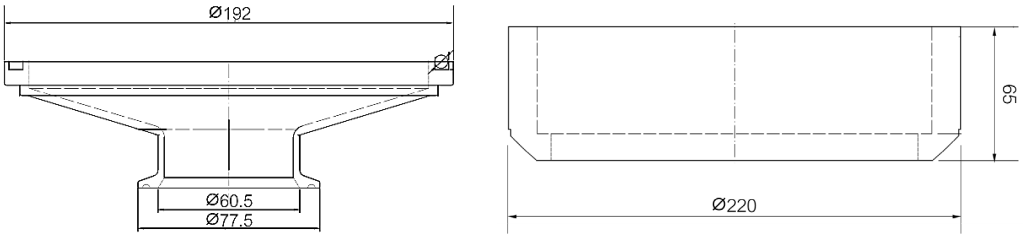

Figure 9: Sanitary Cap (Left: Nut, Right: Cap)

Table 6: Specification of Module Caps for 2315AN Type *1)

Cap Type	Housing cap	Straight cap	Sanitary cap
Materials	PVC and/or equivalent		(Cap) PVC and/or equivalent (Nut) Stainless (304L)
Hight (mm)	132	171	96
Diameter (mm)	220	220	192
Weight (kg)	1.2	1.2	1.8

*1): Note that the specifications are subject to change without notice.

See sections of VII and VIII for working with module caps.

5. Dummy Module

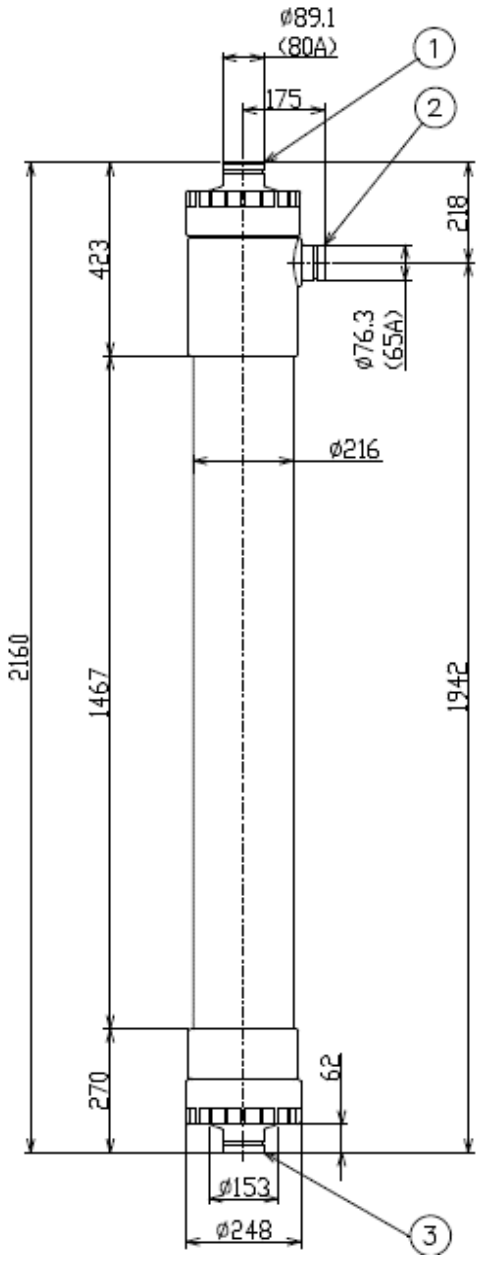

Figure 10: Module Type 2020AN

(1): Filtrate Outlet / Backwash Water Inlet

(2): Air Outlet / Backwash Water Outlet

(3): Feed Water Inlet / Air Inlet / Drain Outlet

Connections for 2020AN Type

	Pipe Fitting Outer Diameter mm (in)	Connectors
(1)	89.1 (3 1/2”)	Housing type joint 80A
(2)	76.3 (3”)	Housing type joint 65A
(3)	89.1 (3 1/2”)	Housing type joint 80A

Table 7: Specifications of Dummy Modules for 2020AN Type *1)

Module Type	2020AN
Materials	PVC and/or equivalent
Hight (mm)	2,160
Diameter (mm)	216
Weight (kg)	20.5

*1): Note that the specifications are subject to change without notice.

Depending on customer demands, HFUG Series provides several connection options. TYPE B or C can be used depending on how the top or bottom is connected. Please contact Toray for more information.

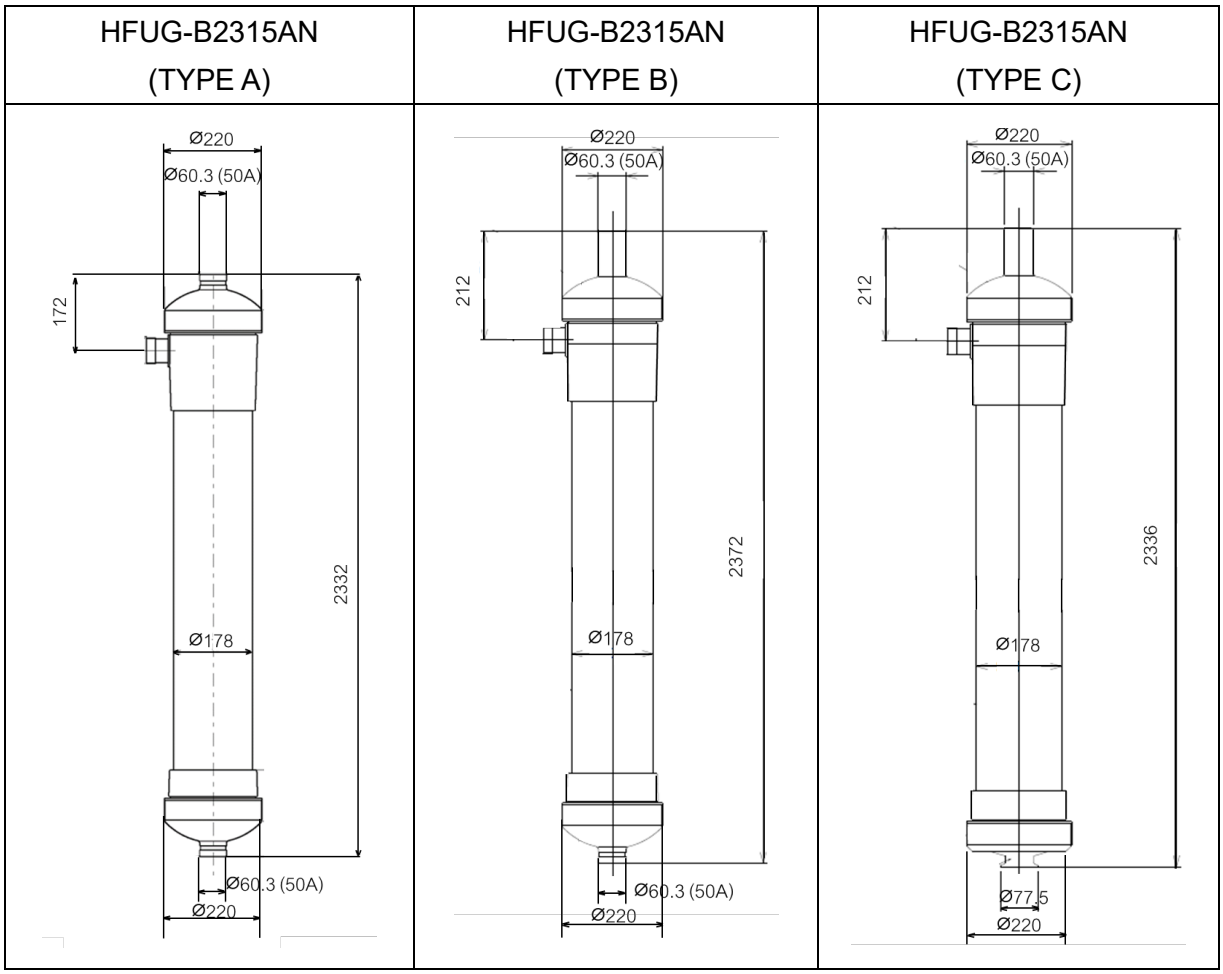

Figure 11: Referential drawings for HFUG-B2315AN (TYPE A, B and C)

Table 8: Specifications of Dummy Modules for 2315AN Type *1)

Module Type		2315AN Type A	2315AN Type B	2315AN Type C
Top Cap Type		Housing cap	Straight cap	Straight cap
Bottom Cap Type		Housing cap	Housing cap	Sanitary cap
Materials		PVC and/or equivalent		PVC and/or equivalent (Sanitary cap nut: Stainless)
Hight (mm)		2,332	2,372	2,336
Diameter (mm)		178		
Weight (kg)		13.6	13.6	14.2
Pipe Fitting Outer Diameter (mm (in))	Top	60.3 (2.4”)	60.3 (2.4”)	60.3 (2.4”)
	Side	57.9 (2.3”)	57.9 (2.3”)	57.9 (2.3”)
	Bottom	60.3 (2.4”)	60.3 (2”)	77.5 (3.1”)
Connectors	Top	Housing type joint 2 inches (U.S.)	Pipe fitting expansion joints*2) 50A	Pipe fitting expansion joints*2) 50A
	Side	Original*3) + AS568-325 (O-ring)	Original*3) + AS568-325 (O-ring)	Original*3) + AS568-325 (O-ring)
	Bottom	Housing type joint 2 inches (U.S.)	Housing type joint 2 inches (U.S.)	Sanitary joint 2.5S

*1): Note that the specifications are subject to change without notice.

*2): Use parts written in the sections of 8. (1) for the connection.

*3): Use parts written in the sections of 8. (2), (3), and (4) for the connection.

See sections of V and VI for working with dummy modules.

6. O-ring

Figure 12: O-ring

Table 9. Specification of O-rings *1)

Module Type	2020AN
Type	G-200 (JIS B2401)
Materials	Ethylene propylene rubber
Thickness (mm)	5.7
Inner Diameter (mm)	199.3
Outer Diameter (mm)	210.7

*1): Note that the specifications are subject to change without notice.

Table 10. Specification of O-rings*1)

Module/Cap Type	2315AN		
	Housing Cap Straight Cap	Sanitary Cap	Side
Type	G-170 (JIS B2401)	G-175 (JIS B2401)	AS568-325 (AN6227-28)
Materials	Ethylene propylene rubber		
Thickness (mm)	5.7	5.7	5.3
Inner Diameter (mm)	169.3	174.3	37.5
Outer Diameter (mm)	180.7	185.7	48.1

*1): Note that the specifications are subject to change without notice.

See sections of VII and VIII for working with O-rings.

7. Plugging Plate and Plugging Cap

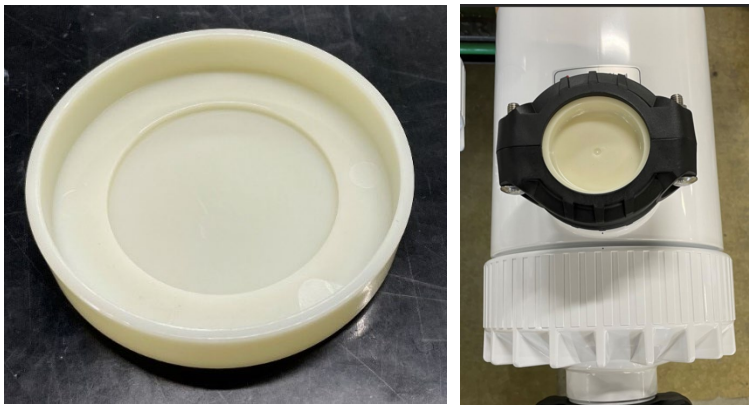

Figure 13: Plugging Plate
(Bottom side of this picture is the module side)

Figure 14: Plugging Cap
(Bottom side of this picture is the module side)

Table 11: Specifications of Plugging Plates for 2020AN Type *[1)]

Nozzle	Top and bottom nozzles	Side nozzles
Materials	PVC and/or equivalent	
Height (mm)	18	18
Diameter (mm)	89.1	76.3

*1): Note that the specifications are subject to change without notice.

Table 12: Specifications of Plugging Caps for 2315AN Type *1)

Size	Top and bottom nozzles	Side nozzles
Materials	PP and/or equivalent	
Height (mm)	25	25
Diameter (mm)	53	37

*1): Note that the specifications are subject to change without notice.

See sections of V and VI for working with plugging plate and plugging cap.

8. Connection Parts

(1): Sight Glass Joint

Figure 15: Sight Glass Joint

Table 13: Specifications of Sight Glass Joint *1)

Materials	PVC and/or equivalent
Pipe Length (mm)	133
Diameter (mm)	92

*1): Note that the specifications are subject to change without notice.

(2): Union Cap Nut

Figure 16: Union Cap Nut

Table 14: Specifications of Union Cap Nut *1)

Materials	PVC and/or equivalent
Height (mm)	33
Diameter (mm)	70

*1): Note that the specifications are subject to change without notice.

(3): Union Socket

Figure 17: Union Socket

Table 15: Specifications of Union Socket *1)

Materials	PVC and/or equivalent
Length (mm)	120
Diameter (mm)	53

*1): Note that the specifications are subject to change without notice.

(4): Joint

Figure 18: Joint

Table 16: Specifications of Joint *1)

Materials	PVC and/or equivalent
Pipe Length (mm)	106
Diameter (mm)	78

*1): Note that the specifications are subject to change without notice.

See sections of V and VI for working with connection parts.

IV. Taking Modules out of Packaging Box

The standard method to take modules out of the packaging box is described below.

1. Taking Module out of Single-Module Packaging

(1) Move the packaging box containing the single module to the work area.

WARNING	● Use equipment such as chain blocks, a crane, or a forklift truck when you handle the packaging box. The box with module is too heavy to handle by hand.

(2) Remove the stretch wrap and PP strapping band covering the box and open it.

CAUTION	● Be careful not to cut your hands with scissors, PP strapping band or the box.

(3) Take the module out of the box.

WARNING	● When taking out the module, be careful not to drop or fall the module as this could cause injury to your foot or head. Also, be careful not to get your fingers caught in the module or the box. ● Use equipment such as chain blocks, a crane, or a forklift truck when you handle the module. The module is too heavy to handle by hand.

(4) Take the module out of its bag.

DANGER	● Note that the preservative solution is sodium hypochlorite (Max. 200 mg/L as Cl_2). If this solution splashes onto your skin, wash the affected part with running water. If the solution gets in your eyes or mouth, wash the affected part with enough amounts of running water for over 15 minutes and see the doctor immediately.

2. Taking Modules out of Multiple-Module Packaging

(1) Move the packaging box containing modules to the work area.

WARNING	● Use equipment such as chain blocks, a crane, or a forklift truck when you handle the packaging box. The box with module is too heavy to handle by hand.

(2) Remove the stretch wrap and PP strapping band covering the box and open the lid and 2 side panels.

CAUTION	● Be careful not to cut your hands with scissors or the box.

(3) Remove the upper partition.

(4) Lift the top module and take it out of the packaging box.

WARNING	● When taking out the membrane module, be careful not to drop or fall the module as this could cause injury to your foot or head. Also, be careful not to get your fingers caught in the module or the box. ● Use equipment such as chain blocks, a crane, or a forklift truck when you handle the module. The module is too heavy to handle by hand.

(5) After taking out modules of the first tier, remove the partition and take out modules of the next tier.

(6) Take the modules out of each bag.

DANGER	● Note that the preservative solution is sodium hypochlorite (Max. 200 mg/L as Cl_2). If this solution splashes onto your skin, wash the affected part with running water. If the solution gets in your eyes or mouth, wash the affected part with enough amounts of running water for over 15 minutes and see the doctor immediately.

V. Installation of Modules

Refer to the instruction manual of HFUG series or HFU series for installation of the modules or dummy modules.

WARNING

- When pumping water to the dummy module, make sure it is installed in the same way as the membrane module. Incorrect installation may result in water leakage or damage to the dummy module.
- When pumping water to the modules, pump water gradually and remove air fully to prevent damage to the modules by water hammer.
- When pumping water to the module with plugging plates or plugging cap, they may be blow out or broken.

The following is the standard procedure of connecting the piping to each connection point of the module with housing type joints.

1. Install the gasket over the pipe end. Make sure the gasket lip does not overhang the pipe end.

2. Join pipe end and connection point of the module. Make sure that the housing type joint can be connected without any misalignment or excessive gaps in the piping.

3. slide gasket into position, centered between the groove on each end.

4. Install the housings over the gasket.

5. Install bolts and thread a nut finger-tight onto each bolt.

6. Tighten the nuts evenly by alternating sides until there are no gaps between housings.

CAUTION

- Take care not to catch and hurt fingers.
- If only one nut on one side is tightened too strongly, the module or pipe may be damaged.

VI. Removing Module

The following is the standard procedure of removing the installed membrane module or dummy module.

1. Confirm that the liquid in the pipes and module is water. If it is not water, replace it with water.

2. Make sure that the operation is stopped, and the module is connected to pipes and fixed with a support belt.

3. Open the drain valve to drain water in the pipes and module.

4. Detach housing type joints between the module and pipes.

CAUTION	● When tightening or loosening the housing type joints, be sure to secure a sufficient working space, and take care not to catch and hurt fingers.

5. Remove the support belt and module from the rack.

WARNING	● Do not drop the module. ● Take care not to catch and hurt fingers. ● Use equipment such as chain blocks, a crane, or a forklift truck when you handle the module. The module is too heavy to handle by hand.

6. Attach plugging plates or plugging caps to filtrate outlet, backwash water outlet, and feed water inlet.

CAUTION	● Do not drop the module. ● Take care not to catch and hurt fingers.

Refer to the instruction manual of HFUG series or HFU series for storage of the removed modules.

CAUTION	● The modules should not be frozen.

VII. Removing Module Cap

The following is the standard procedure of removing the module cap.

1. Move the module to the work area and put on a pedestal or sleeper.

WARNING	● Use equipment such as chain blocks, a crane, or a forklift truck when you handle the membrane module. The water filled modules are heavy to handle by hand.

2. Move the module to the work area and put on a pedestal or sleeper.

3. If the module cap needs to be replaced with another one, make a new mark in an easily recognizable position (end of threads recommended) on both the module and the cap. A mark color other than black is recommended. If black, it is recommended that the mark be different from the mark already made. This mark will be a guide for fastening the new cap.

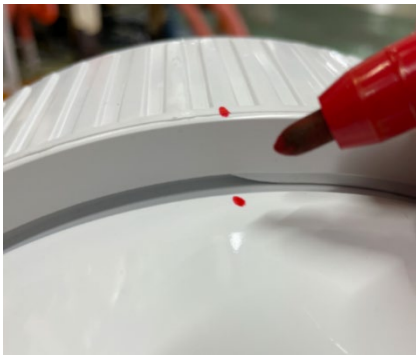

Figure 19: Making a mark

4. Wrap one belt wrench around the top or bottom cap of the UF module and wrap the other belt wrench around the middle part of the UF module housing.

5. Turn the belt wrench on the top cap counterclockwise to remove the cap. Use the other belt wrench to hold the module housing.

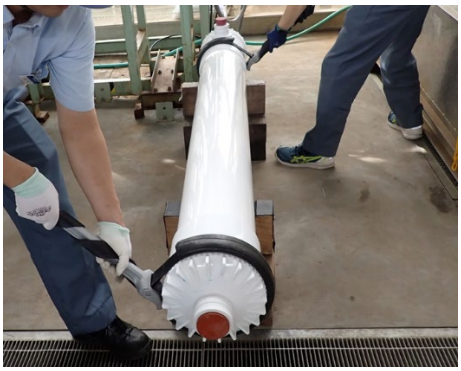

Figure 20: Removing the bottom cap

WARNING	● When applying force to turn the cap, the reaction from opening the cap may cause high-speed rotation and consequent injury. Be careful not to apply 100% force to avoid it.

VIII. Attaching Module Cap

The following is the standard procedure of attaching the module cap.

1. Move the module to the work area and put on a pedestal or sleeper.

WARNING

- Use equipment such as chain blocks, a crane, or a forklift truck when you handle the membrane module. The water filled modules are heavy to handle by hand.

2. Wet the O-ring with water.

3. Attach the O-ring to the module.

Figure 21: Position of O-ring

4. When installing a different cap from the one originally attached, mark the replacement cap at the same location as the mark made in Section VII.3.

Figure 22: Marking the replacement cap

5. Attach the cap and turn it clockwise by hand.

6. Wrap one belt wrench around the cap of the UF module and wrap the other belt wrench around the middle part of the UF module housing.

7. Turn the belt wrench on the top cap clockwise to attach the cap. Use the other belt wrench to hold the module housing. Tighten the cap securely to the mark or over the mark to prevent leakage.

Figure 23: Cap Mark

WARNING	● When applying force to turn the cap, the reaction from opening the cap may cause high-speed rotation and consequent injury. Be careful not to apply 100% force to avoid it.

CAUTION	● Weak force to tighten the cap will cause leakage.

IX. Integrity Test and Fiber Repair

1. Pressure Decay Test

Pressure Decay Test (PDT) is recommended for testing the integrity of Toray UF modules. The PDT is conducted by applying pressurized air to the module and monitoring the rate of pressure loss.

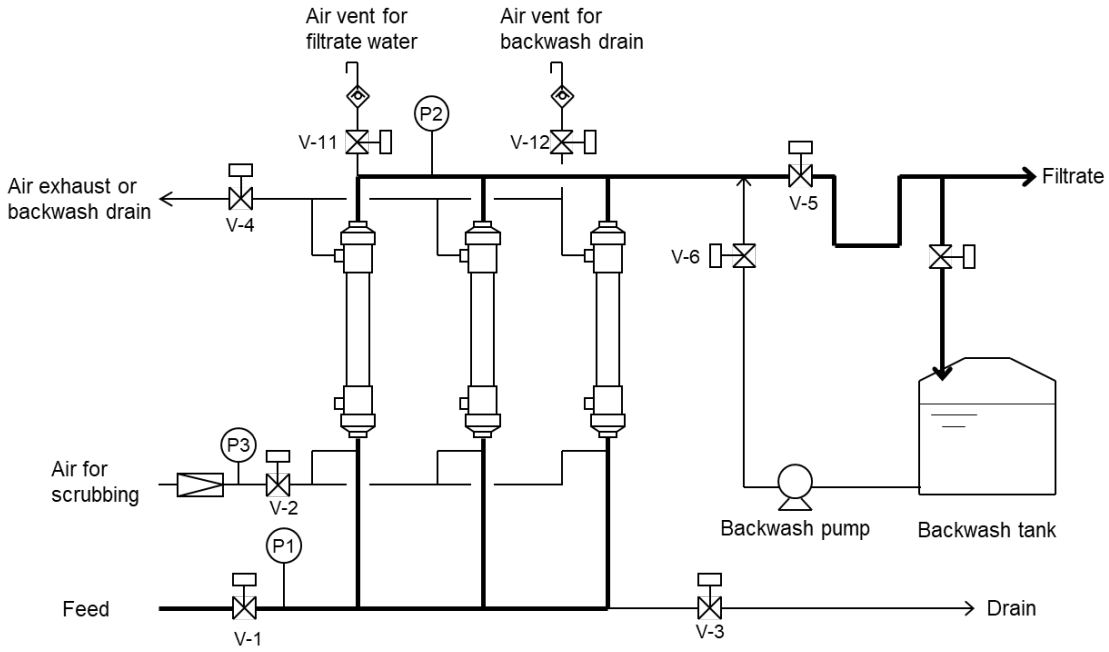

Figure 24: PDT Flow Diagram

(1) Stop an operation. Stop pumps and close all valves.

(2) Open the backwash drain valve (V-4), filtrate valve (V-5), air vent valve for filtrate (V-11), and air vent valve for backwash drain (V-12).

(3) Open the feed valve (V-1) to refill water in modules.

CAUTION	● Do not exceed the maximum feed pressure of the module. Refer to the instruction manual of HFUG series or HFU series for the maximum feed pressure.

(4) Ensure that no air comes out from the air vent valve for filtrate (V-11) and air vent valve for backwash drain (V-12) and close the air vent valves (V-11 and V-12).

(5) Close the feed valve (V-1) and backwash drain valve (V-4).

(6) Set the air pressure 130 kPa by air regulator. Open the air scrubbing valve (V-2) slowly and supply air to the feed side. Check that the pressure value shows 130 kPa again.

CAUTION	● Keep the source air pressure lower than 200 kPa (29 psi) to prevent excess air inflow. ● All the air used for air scrubbing and integrity testing must be dry oil-free air.

(7) Wait until the feed water in the module is filtrated by air pressure.

(8) After most of the feed water is filtrated, open the drain valve (V-3) to drain the water remaining in the module.

(9) Close the drain valve (V-3) and filtrate valve (V-5) and open the air vent valve for filtrate (V-11).

(10) Close the air scrubbing valve (V-2) and wait 5 minutes for the pressure to stabilize.

(11) Skip this step if the pressure doesn't change. If the pressure changes after 5 minutes, open the air scrubbing valve (V-2) and adjust the pressure to 130 kPa again if necessary. After that, close the air scrubbing valve (V-2).

(12) Measure the rate of the pressure loss for 3 to 5 minutes*1). The rate of the pressure loss can be calculated by dividing the amount of the pressure drop by the test time. If the rate of the pressure loss is under 1 kPa/min*2), the module rack is considered to have integrity. If not, proceed to the step "2. Specify the Leaking Modules".

(13) When any abnormality is not found from the test, open the drain valve (V-3) and air vent valve for backwash drain to relieve the pressure on the feed side.

(14) Close the drain valve (V-3) and open the backwash drain valve (V-4) and filtrate valve (V-5). Set the air pressure again for normal operation.

(15) Open the feed valve (V-1) and begin the normal operation.

CAUTION	● Begin filtration as soon as the test is completed, as drying will degrade the module performance.

*1): The measuring time can be adjusted depending on the site conditions, but the data should be collected to calculate the pressure changes per minute.

*2): The value is just a standard and depends on the number of membrane modules, pipe configuration, temperature, and other factors. Please contact Toray Industries, Inc. for details.

2. Specifying the Leaking Modules

(1) Check the air pressure and open the air scrubbing valve (V-2) to adjust the pressure again if the pressure is too low.

(2) Place an electronic stethoscope (Figure 25) on the upper filtrate pipe of the moules to check the bubble noise. If the air pressure is too strong or too weak to specify the leaking module, adjust the air pressure.
If the clear pipe is installed at the filtrate side, significant amount of air bubbles will be observed in the pipe of the leaking module[*3)].

Figure 25: Electronic Stethoscope

(3) Mark the leaking modules. After completing marking, open the drain valve (V-3), backwash drain valve (V-4), and air vent valve for backwash drain (V-12) to relieve the pressure from the feed side.

(4) Close the drain valve (V-3).

(5) Open the feed valve (V-1) and fill the module with water to prevent the membrane from drying.

(6) Check that water was drained from the backwash drain valve and close the feed valve (V-1), backwash drain valve (V-4), and air vent valve for backwash drain (V-12).

*3): Note that small air passages are normal due to air diffusion through the membrane. Sharp differences in air bubbling between two neighboring modules may expose a leaking module. A slight buzzing or vibrating noise may also be an indication of a leaking module.

3. Specifying the Leaking Fiber

(1) Open the drain valve (V-3), backwash drain valve (V-4), filtrate valve (V-5), and air vent valve for backwash drain (V-12) to drain water in the module.

(2) Close the filtrate valve (V-5).

(3) Disconnect the pipe on the filtrate side of the marked module and open the upper module cap with a belt wrench (Figure 26 and 27).

Figure 26: Opening Module Cap

Figure 27: Belt Wrench

WARNING	● Module cap can be difficult to open. When tightening or loosening the membrane module cap, make sure to have a stable footing and sufficient working space, and be careful not to catch and hurt fingers.

(4) Attach a cylindrical frame to the module (Figure 28) or put tape around the perimeter.

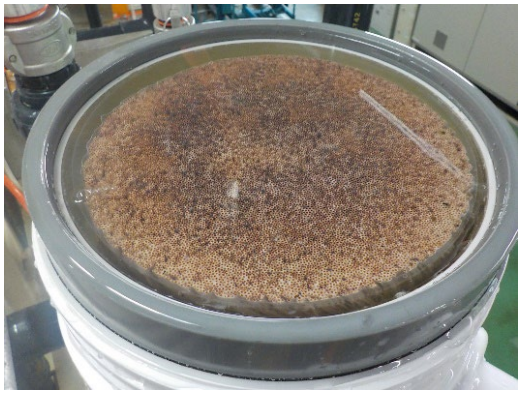

Figure 28: Cylindrical Frame

(5) Fill the top of the module with clean water so that all fibers are completely submerged.

(6) Close the drain valve (V-3), backwash drain valve (V-4), and air vent valve for backwash drain (V-12).

(7) Set the air pressure at 50 kPa or less by regulator.

(8) Open the air scrubbing valve (V-2) to supply oil-free air and check the air pressure is 50 kPa or less.

CAUTION	● Excessive pressure can cause damage to the module. Keep the source air pressure lower than 200 kPa (29 psi)

(9) Wait 1 minute and observe the top of the module. Broken fibers produce continuous large bubbles [*4)].

(10) If broken fibers are detected, mark them with marker pins.

CAUTION	● Be careful not to prick fingers with the marker pins.

(11) After marking all broken fibers, close the air scrubbing valve (V-2) and open the drain valve (V-3), backwash drain valve (V-4), and air vent valve for backwash drain (V-12) to relieve the air pressure.

*4): Note that small bubbles are normal due to air diffusion through membrane pores.

4. Repair of Leaking Hollow Fiber

(1) Remove the water on the top of the module.

(2) Hold the top of the repair pin, apply PVC adhesive (Weld-on 717 manufactured by IPS) to the tip and replace the marker pin with the repair pin. Push the repair pin by hand (If necessary, hit the repair pin by hammer.), cut off the head of the repair pin that is protruding from the membrane surface by nippers[*5)].

WARNING

- Be careful not to stick fingers with the repair pins or maker pins.
- Be careful not to cut your fingers with nippers.
- Be careful not to hit hands or fingers with a hammer.

CAUTION

- Hitting a module too hard with a hammer can damage the module.

(3) Wait 15 minutes for the adhesive to cure.

(4) Remove the O-ring, wet it with water, and reattach it.

CAUTION

- Make sure that the O-ring is installed correctly, otherwise it will cause water leakage.

(5) Install and turn the cap by hand.

(6) Tighten the cap firmly to the position marked with a belt wrench.

(7) Connect the filtrate pipes to the module.

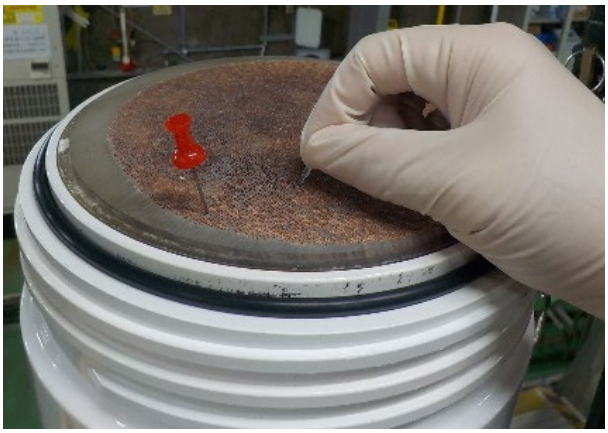

Figure 29: Insertion of Repair Pin

WARNING	● When tightening or loosening the membrane module cap, make sure to have a stable footing and sufficient working space, and be careful not to catch and hurt fingers.

CAUTION	● Begin filtration as soon as the repair is completed, as drying will degrade the module performance.

*5): The repair pin(s) can be substituted by Nylon fish line(s) (D 0.52 mm x L 50 mm). In that case, follow the step (2)' below instead of the step (2) above.

(2)' Hold the fish line a few millimeters from the edge, put epoxy adhesive (epoxy resin: Cemedine High-super 5 A, curing agent: Cemedine High-super 5 B) on the edge, and insert a few millimeters of the fish line edge with adhesive into the membrane fiber. Cut off the fish line protruding from the membrane surface.

CAUTION	● Do not use adhesives other than those listed above.

X. Put Module in Packaging Box

The following is the standard procedure to put a module in a packaging box.

1. Refer to the instruction manual of HFUG series or HFU series to be sure that the appropriate preservative solution is used in the module.

2. Move the packaging box for single module to the work area.

WARNING	● Use equipment such as chain blocks, a crane, or a forklift truck when you handle the packaging box.

3. Open the packaging box.

CAUTION	● Be careful not to catch and hurt fingers by packaging box.

4. Put the module in the packaging box.

WARNING	● Do not drop the module. ● Take care not to catch and hurt fingers. ● Use equipment such as chain blocks, a crane, or a forklift truck when you handle the module. The module is too heavy to handle by hand.

5. Fasten the packaging box with PP strapping band.

CAUTION	● Be careful not to cut your hands with scissors, PP strapping band or the box.

Toray specializes in the development and manufacture of innovative membrane technologies. We offer an integrated approach using our RO, NF, UF, MBR, and antiscalant products to solve water and process treatment challenges. Contact us today to find out how Toray can help maximize water recovery, achieve high water quality for water reuse, lower energy requirements, and minimize life cycle costs. **TORAY, experts in RO, NF, UF and MBR.**

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