

SINAP[®]

Operation and maintenance manual



Shanghai SINAP Membrane Tech Co., Ltd

Catalogue

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Preface

Thank you for choose SINAP membrane.

This installation manual introduces the construction, packaging, transportation, storage, installation, pilot running and attentions of SINAP membrane module.

Before installation and operation please read this manual carefully. And please keep this manual for take reference when needed.

If have question please contact our technical staff. Tell: +86-21-66032658; E-mail: sinap@sh-sinap.com

1. Operation condition

Following conditions should be met to ensure the normal operation of membrane modules.
(Show in Table 1)

Table 1 Operation condition

Temperature (°C)	5~40
pH	6~9
MLSS (mg/L)	3000~15000
Max operate pressure (kPa)	-25
Normal operate pressure (kPa)	0~-25
Influent SS (mg/L)	≤ 9000
Aeration volume (L/min)	Single deck: 10~12
	Double deck: 7~8

Notice!

- 1) Drastic changes (temperature, pH, operate pressure and sludge character) should be avoided even changes still in operation conditions.
- 2) $TMP = P_2 - P_1$ (P_2 : Vacuum gauge reading when the membrane pump is running; P_1 : Vacuum gauge reading when the membrane pump is stopping)

2. Influent requirement

MBR use microbial to degrade organic, it's similar to CAS. But MBR still have different requirement for raw water following two points need to be noticed:

- (1) If raw water contains any organic may damage the membrane and whether these organic can be degraded;
- (2) A pilot test and a comprehensive analysis of raw water is necessary.

Standard MBR influent requirement. (Table 2)

Table 2 MBR Influent requirement

EVENT	Temperature (°C)	COD (mg/L)	BOD (mg/L)	SS (mg/L)	Oil (mg/L)		NH-N (mg/L)
					Animal and vege oils	Mineral oil	
Requirement	5-40	<500	<300	<150	<30	<3	<50

Pertinence pretreatments are needed before raw water flow into MBR process if not met the data above. Requirement as follows:

1) Solid particles

Raw water needs to pretreat by screen which less than 3 mm first. Untreated large particles will cause membrane damage. SINAP will not assume such responsibility.

2) pH

pH of influent should in range 6~9

3) Hardness

When membrane module operates in water with high hardness softening process is needed before MBR process. Because calcium, Magnesium and other precipitate will attach on membrane and diffuser form into scaling during long term operation. Scaling has seriously effect on the membrane and whole system.

4) Temperature

Water temperature should not higher than 40°C. Higher temperature will short the membrane life and affect the biological process. In some high temperature resistant microorganism cases, limit is 45°C.

5) Oil and organic solvent

Flat sheet membrane cannot treat water contains oil and organic solvent. Oil will attach on the membrane surface case the block and organic solvent will corrode the filter functional layer. Oli limited is less than 30mg/L; mineral oil content is less than 3mg/L. (Specific need to be determined by test)

6) Organic solvents

Normally organic membrane cannot treat wastewater containing organic solvents; a certain concentration of organic solvents will erode the membrane filtration layer. Organic solvents should be avoided. (Special cases need to fully tested and verified)

7) Chemical pollutant

Influent cannot contain polymer flocculants, epoxy resin coating and the dissolution of ion exchange resin. These chemicals will form pollutant on membrane surface lower the flux.

3. MBR operating

3.1 Sludge acclimatization

After the clean water trial operation, put inoculated sludge into membrane tank and acclimate the sludge before formal operation.

Inoculated sludge needs to pass 1~3mm screen to prevent impurities come into membrane tank and make damage.

Do not use PAM.

During sludge acclimatization, open aeration and stop permeate.

3.2 Formal operation

Begin formal operation after sludge acclimatization. Aeration needs continue. MBR usually use intermittent permeate at constant flow. Permeate operation pattern is recommended as 8 min operating and 2 min rest.

Table 3 Normal operation

System	Action	Time (mins)
1.Aeration	Operate	Continue
2. Permeate	Operate	8
	Rest	2

For new membrane system, flux need to adjust step by step. (Show in figure 1)

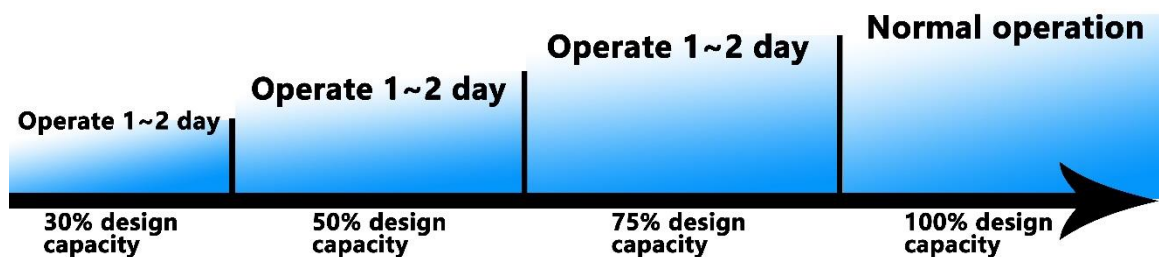


Figure 1 Flux adjust

3.3 Low load operation

In the dry season (low capacity period), it is recommended to lower the instantaneous flux or reducing the operation time.

3.4 MBR long time stopping

If stop operate MBR system for long time, the system shall be run maintained mode. Stop permeate, keep intermittent aeration. (Show in table 4)

Table 4 long time stopping mode

System	Action	Time (mins)
1.Aeration	Operate	5
	Stop	55
2. Permeate	Stop	/

4. MBR operate Announcements

Warning!

(1) Suction pump shall be stopped immediately if aeration blower stopped by any malfunction. Continue operation without aeration will cause sludge accumulation on the membrane surface rapidly made suction pressure rise sharply and even cause the system collapse.

Warning!

(2) Set minimum protection level to prevent membrane getting dry and damage (minimum protection level is the level above nozzle on membrane panel), When water lower then protection level, suction pump needs to stop automatically.

Notice!

(3) Normally suction pressure rises slowly and steadily during operation. Doing cleaning process when TMP reach 25kPa (Chapter 5).

Notice!

(4) Recommend operating in constant flow mode. If choose other operate mode please contact SINAP.

(5) Record operation data for better maintenance.

5. Membrane Cleaning

Normally TMP rises slowly and steadily during operation. Membrane needs to do cleaning when TMP reach or over -25kPa. If operate 6 month without cleaning even the TMP still lower -25 kPa it's still needs to do a cleaning.

5.1 Clean in place

Membrane elements usually doing chemical clean in place. Cleaning cycle depends on the membrane pollute situation.

5.1.1 Quantity of Cleaning Chemical

Table 5 Quantity of Cleaning Chemical

Membrane Type	Quantity (L/PC)
SINAP80	3.0
SINAP100	3.5
SINAP150	5.0

5.1.2 Cleaning agent formula and conditions

Pollutants	Cleaning agent	Concentration	Temperature°C	pH	Duration
Organic pollutant	NaOCl	5000ppm	40~50	10	2~4h
Organic pollutant (containing oil)	First:NaOH Second:NaOCl	0.0001N 5000ppm	40~50	10	2~4h
Inorganic pollutant (calcium, magnesium) And minerals	Citric acid or hydrochloric acid	1%	40~50	3.0	1~2h
Iron compound	Oxalic acid	1%	40~50	3.0	1~2h

5.1.3 Chemical cleaning method

Notice!

If dosing funnel set outdoor, a cover is needed to prevent other material follow with cleaning chemical into pipe;

Warning!

Standard setting of dosing funnel is 1 meter above water level (less than10kPa), in some special situation cannot over 1.5 meter (less than15kPa). High pressure will damage the membrane.

Method one: Gravity dosing, chemical dosing tank set above MBR tank (Show in figure 2-1)

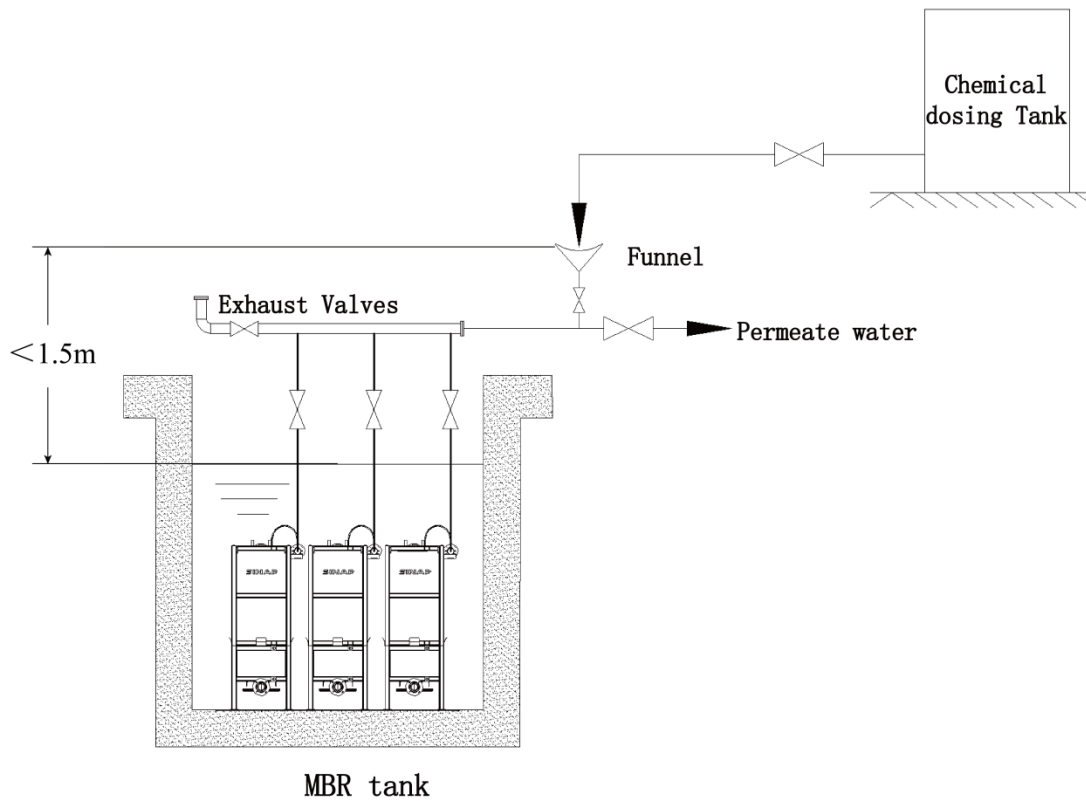


Figure 2-1 Gravity dosing

Method two: Pump lift, chemical dosing tank set below MBR tank. (Show in figure 2-2)

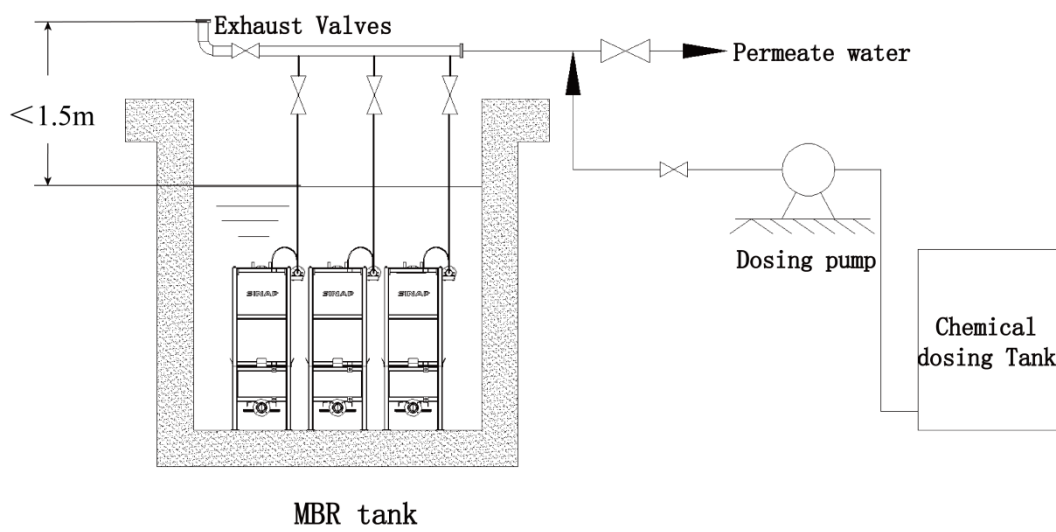


Figure 2-2 Pump lift

Method three: Online dilution. Use metering pump and dilution pump inject chemical and water into pipeline mixer (Show in figure 2-3) If you use this method for chemical cleaning, please consult our company for details.

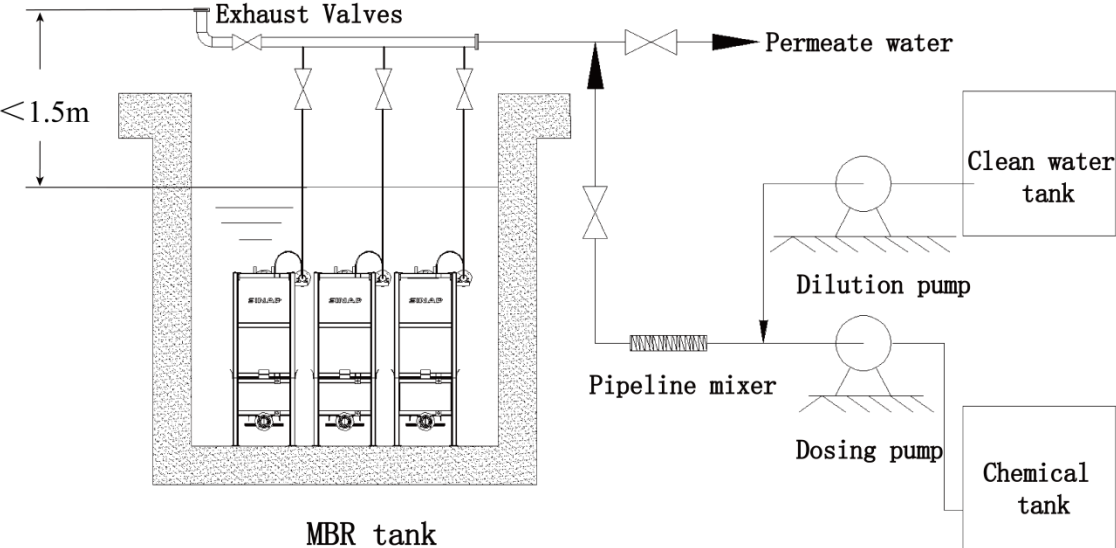


Figure 2-3 Online dilution

5.1.4 Chemical cleaning process

Chemical cleaning needs to be protected according to chemical operation requirements; Chemical cleaning process is shown in figure 3.

1) Turn off the blower, pump and valve ④ in turn. Then open valve ③, valve ①, valve ② in turn, inject cleaning chemical into membrane elements from chemical dosing tank;

2) After the membrane elements are filled with the cleaning chemical, close the valve ②, Soaked in alkaline for about 2-5h (soaked in acid for about 1h);

3) After soaking, close the valve ①③ then open the blower valve ④, pump in turn. Discharges the residual chemical which remains in membrane elements into adjust tank or membrane cleaning tank.

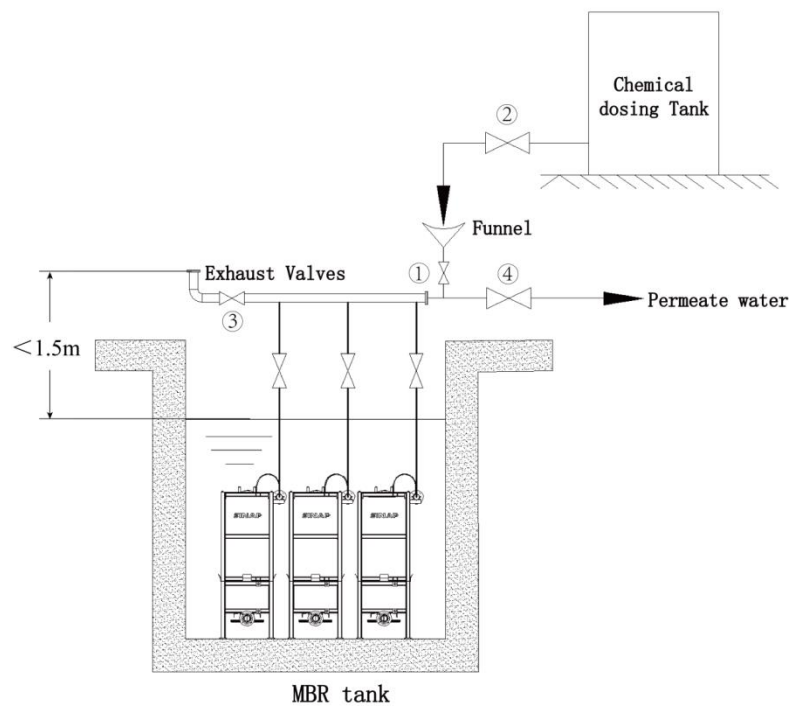


Figure 3 Chemical cleaning process

5.1.5 Chemical cleaning Announcements

- a) Make sure all membrane modules are fully immersed before dosing.
- b) Stop aeration during chemical cleaning otherwise it will cause damage to the membrane.
- c) It is recommended to set a large dosing port and control the valve to fill slowly.
- d) It is recommended to add an exhaust valve on the dosing pipe to avoid spillage of the cleaning chemical caused by air in the dosing pipe during the gravity inflow.
- e) The higher the temperature of the cleaning chemical, the better the cleaning effect.

Generally, around 35°C is the best, but should not over 40°C.

f) Please operate and store in strict accordance with the announcements and methods in the cleaning chemical manual.

5.2 Off-line cleaning

When chemical clean in place cannot restore the membrane performance, it needs to do off-line cleaning.

5.2.1 Lift membrane module and pull out membrane elements

1) For system with guide rail, first remove permeate pipe connection and anti-floating rod on guide rail; Use lifting equipment to lift the membrane case out and place it on a firm, flat surface(Show in figure 4);

2) For system without guide rail, empty MBR tank first, remove permeate pipe connection and connecting bolt between membrane case and aeration case; Use lifting equipment to lift the membrane case out and place it on a firm, flat surface.



Figure 4 Lifting Membrane case

3) Flush the activated sludge and other pollutant attached on the membrane case with clean water.

4) Remove the hoses (manifold side can be remain connected), remove the stainless steel cover plate at the top of the membrane case, and remove the rubber inserter; Remove the membrane elements piece by piece with a professional hook tool (take care not to damage the membrane surface) as shown in figure 5.

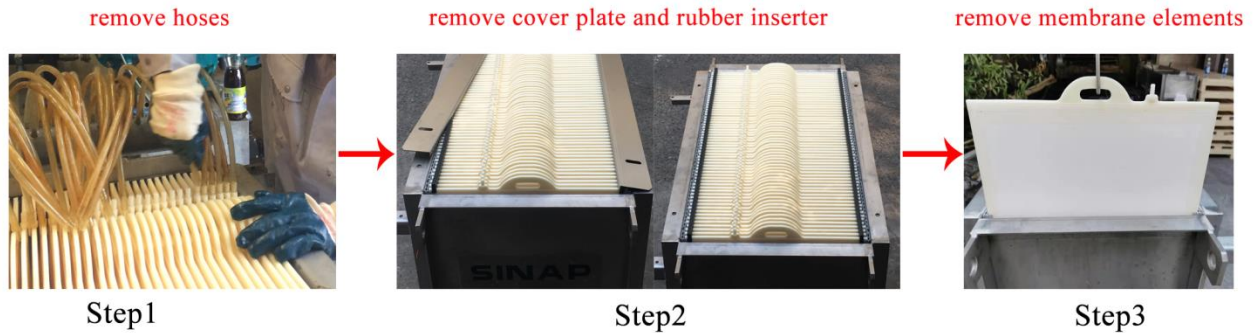


Figure 5 Remove membrane elements

5.2.2 Off-line physical cleaning

Put removed membrane elements into a shallow flat container, flush the membrane surface with a low pressure water gun first then wipe the membrane surface with sponge or other soft object. Rinse with clean water at the end.

5.2.3 Off-line chemical cleaning

Notice!

Cleaning chemical agents are usually corrosive. Please protect strictly in accordance with chemical operation specifications

After 5.2.2 physical cleaning, the membrane element shall be placed in a special container with prepared cleaning chemicals (Alkali: 0.2% ~ 0.5% sodium hypochlorite solutions, acid: 0.5% ~ 1% oxalic acid solution). Soak for more than 5 hours, take out the membrane element and rinse with clean water then put it back into modules.

6. Cleaning of diffusers

During the operation of membrane modules, the holes of diffusers will be blocked with dry mud by the effect of dry air which will reduce the aeration amount and cause part of membrane elements lack of scouring lead to the membrane pollution then effect to the capacity. So the aerator pipe needs to be cleaned. The cleaning method is as follows:

6.1 Stop permeate

Let the blower continue work. Close permeate valve, stop pump. (Show in figure 6)

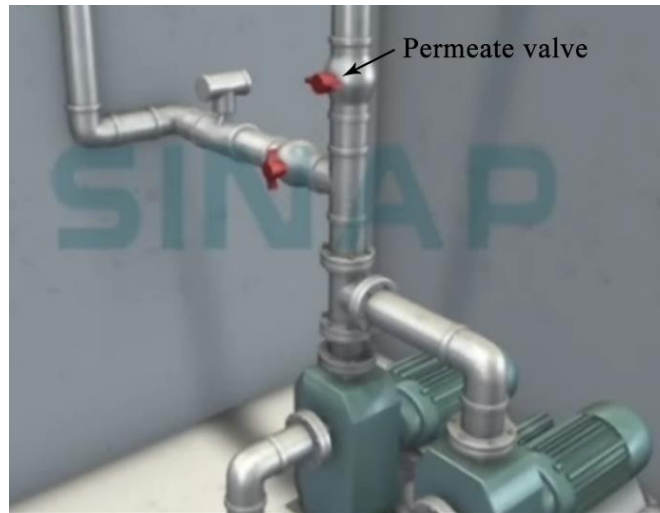


Figure 6 Close permeate valve, stop pump

6.2 Open the diffuser cleaning valve

Open the diffuser cleaning valve. Gas and water form into turbulence, flushes dirt around the diffuser out of the diffuser cleaning pipe. The mixed mud-water is discharged into the membrane tank. (Show in figure 7)

Generally, the cleaning process is about 5 minutes. If the cleaning effect is not obvious, the cleaning time should be extended.



Figure 7 Cleaning diffuser and its holes

6.3 Restart after cleaning

After cleaning, close the diffuser cleaning valve, make sure the aeration of MBR tank back on operate, restart pump and open permeate valve, back to normal operation. (Show in figure 8)



Figure 8 Back normal operation

7. Replacement of membrane elements

Lift out the membrane case according to 5.2.1.

For small module or where lifting are not available it can replace in place. In this case the water level needs to drop lower than membrane modules. Please replace the new membrane elements in the following step:

- 5) Remove hoses on the membrane elements (manifold side can be remain connected);
- 6) Unscrew the bolts on the cover plate and remove the cover plates and rubber inserter;
- 7) Pull out membrane elements; (If it cannot be removed by hand, please use professional hook tool);
- 8) Insert the new membrane element into membrane case carefully and slowly, do not push hard;
- 9) After confirming the replacement of membrane elements, install rubber inserter and cover plate then tighten the bolts.
- 10) After replace membrane elements reconnect the membrane elements and manifold by hoses. Pay attention to the following points during replacing:

Warning!

- a) Its strictly prohibited to step on the nozzle of membrane elements;

Notice!

- b) It's strictly prohibited to step on the manifold;

Warning!

- c) It must use the special silicone hose designated by our company;

Notice!

- d) The silicone hose need be pulled along the outlet direction, not incline or horizontal;

Notice!

- e) When the membrane element is installed into the membrane case, it is strictly prohibited to disengage or fall in halfway. It must be inserted vertically;

Notice!

- f) Please start to operate the membrane module after all the membrane elements have been replaced. It is strictly prohibited to start the operation with some leak of membrane elements;

Notice!

- g) Do not let sharp objects touch or collide membrane surface during replacing;
- h) After installation, it is necessary to check if the hose has been inserted into the root of the nozzle to ensure the tightness of the connection;

Danger!

- i) Please use safety protection when installing membrane elements to avoid danger.

8. Replacement of Accessories

During operation, some accessories (show in figure 9) have aging problems, and need to be replaced regularly.

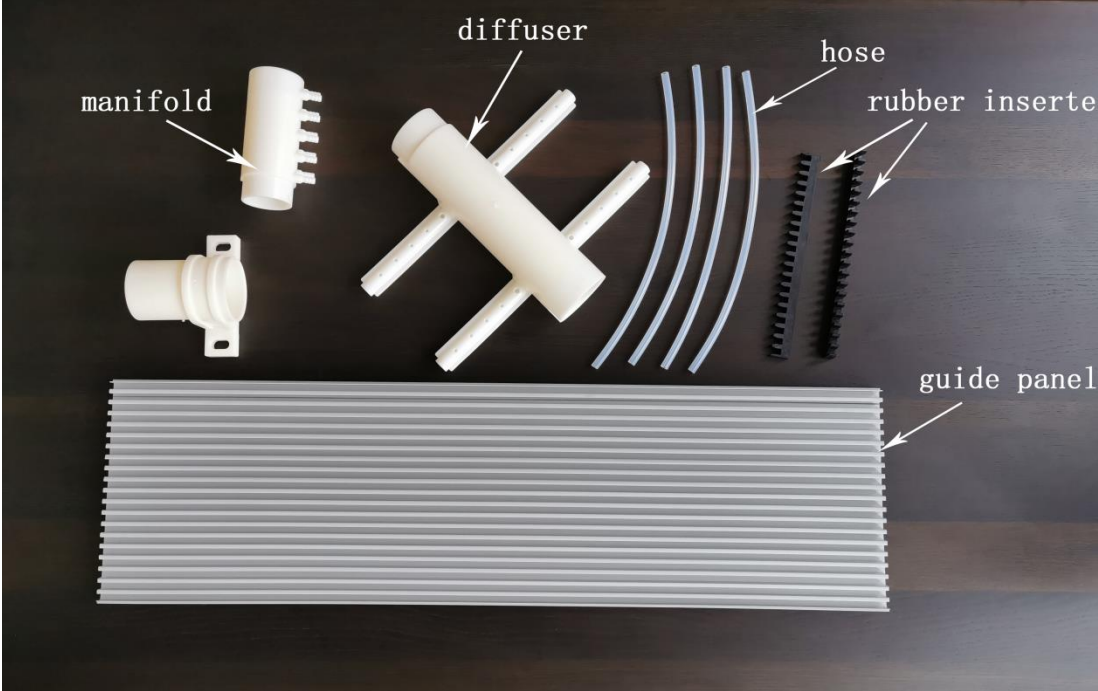


Figure 9 Accessories



Figure 10 Membrane elements

Table 6 is period of accessories replacement:

Table 6 period of accessories replacement

Accessory	Period
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Rubber inserter	3 years
Hose	1-3 years
Membrane elements	Over 5 years (due to operate situation)

* SINAP provides a three-year warranty for membrane elements. During the warranty period,, products will be replaced unconditionally and free of charge by any product quality problems (except for damage caused by user not following the manuals);

* Please use the special accessories designated by our company for replacement.

Usually the membrane module frame (304 stainless steel) SINAP offered did not need for replace. But for the special water (such as waste water contains high concentration of chloride ion or some salt), case of the limit corrosion resistance of stainless steel and in order to the long-term stable operation, it is recommended to do periodic inspection, replace the frame if necessary or the use special materials to make membrane module frame.

9. Maintenance of membrane elements

Warning! After the membrane element is used, it must be kept wet. Dry again will cause the membrane lose its original performance.

Warning! The membrane element shall not be stored below 0°C.

10. Some failure of membrane module, reasons and solutions

Failure	Possible reasons	Solutions
No permeate water	production pump turning in the wrong direction	Check and adjust the steering
	No water in the pump when it is started	injecting water into pump then start
	Serious air leaking in the inlet pipe of the production pump	Inspect and repair piping
a lot of bubbles in the permeate water	air leakage points in the suction line	Check for leaks and repair
	membrane is polluted and blocked, and the suction pressure is too high	Clean or replace membrane elements
permeate water is cloudy	One or more membrane elements are damaged	Check the failure membrane elements and replace
	Hose loose	Check and reconnect
	Local cracks in the production pipe	Check for leaks and repair
	Connection loose	Check and reconnect
TMP rises fast (normally less than 0.02MPa)	Flux sets high	Low the flux
	membrane is polluted	Clean membrane elements
	Aeration system failure	Repair and adjust the aeration system
	Activated sludge character abnormalities	Detection and restore to the normal range
Aeration is not uniform	Blower failure	Inspection blower
	Diffuser blocked	Clean diffusers
	Installation defects	Adjust the diffuser case to the horizontal state
	Diffuser damaged	Replace diffuser
	The aeration passage is blocked	Clean the aeration passage

Capacity reduced TMP rises rapidly	membrane is blocked	Clean membrane elements
	Aeration system failure case poor flushing of the membrane surface	Adjust the aeration system
	Sludge filtration performance deteriorates due to activated sludge character abnormalities	Improve sludge properties, adjust sludge discharge, prevent the inflow of abnormal components (oil content, etc.), adjust BOD load, adjust raw water (add nitrogen, phosphorus, etc.)

Note: For other unknown faults, please consult our technical personnel.