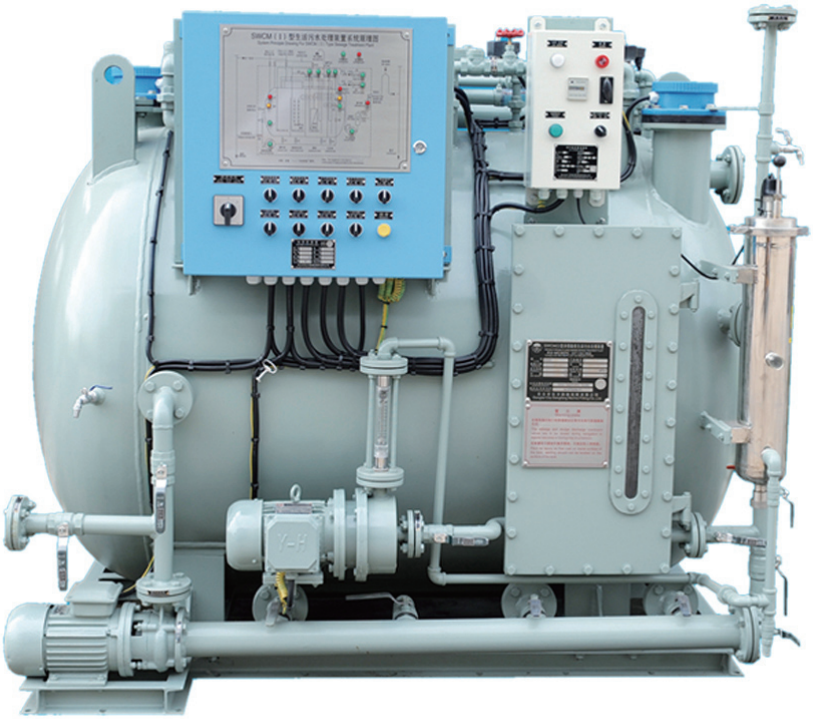
SWCM Type
Marine Sewage Treatment Plant

Instruction Book
(Manual)

Implement of IMO MEPC.227 (64) Resolution



Dongtai City Dongfang Marine Fitting Co., Ltd.

Marks:

1 The device can be used to treat toilet sewage washed by fresh water or sea water on ships.

2 The test pressure of the tank is 0.021MPa.

3 The effluent quality of the device is in compliance with the standards of IMO.MEPC.227 (64)

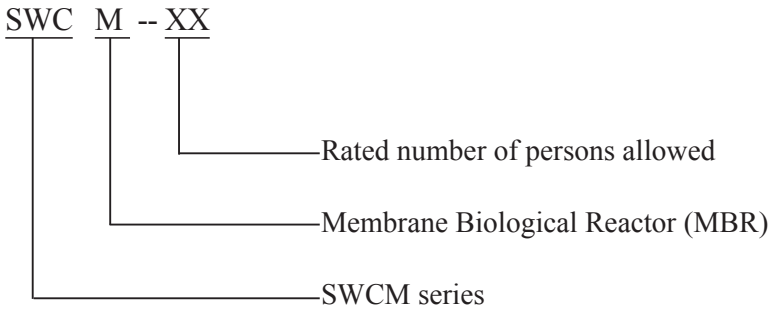
WARNING:

1 The plant cannot be installed in explosive atmosphere.

2 Paint tar epoxy as that coat on inside surface of the tank, welding should not be worked on the surface of the tank.

3 It needs clear space at front of device 600 mm and right side of device 300mm to allow for operation and maintenance of the device.

Type description



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1 Preface

This plant is applicable to treat the sewage, which means human body wastes and the wastes from the toilets on vessels and which is also called “black water”, to meet the effluent standards of IMO MEPC.227（64), and discharge the effluent to overboard.

Marine Sewage Treatment Plant belongs to the key devices for prevention of pollution form ships in seas and oceans according to the revised Annex IV of the International Convention of the Prevention of Pollution (MARPOL 73/78). This device is according to the MEPC.227(64) resolution enacted on 5 October 2012 . This plant is applicable to treat the sewage, which means human body wastes and the wastes from the toilets on vessels and which is also called “black water” .This device will be applicable to domestic sewage treatment devices installed on or after January 1, 2016 on the following ships:

（1）Vessels in all areas (except passenger vessels)

（2）Passenger ships outside the special area of MARPOL Annex IV

Summary all the rules and effluent standards as followings :

Index	IMO MEPC.159(55)	IMO MEPC.227(64)
TSS (mg/l)	35	≯35Qi/Qe
BOD5 (mg/l)	25	≯25Qi/Qe
COD (mg/l)	125	≯125Qi/Qe
coliform (per 100 ml)	100	100
PH	6~8.5	6~8.5
Residual chlorine (mg/l)	＜0.5	＜0.5

The SWCM type marine sewage treatment plant uses activated sludge, contact oxidizing and principle of biologic membrane to digest the organic pollutant, which can treat sewage effectively and reach at the IMO new effluent standard or other stricter requirements.

The device is patent product, provided with independent innovation intellectual property.

Warning

Mechanical Hazards

When the pump driven by the motor in the maintenance device must be turned off the power switch of the ship's supply equipment, and hang up the "OUT OF SERVICE"Eye-catching label, only the crew or workers in charge of the unit may perform maintenance on the moving parts.

Electrical Hazards

This device is supplied with high voltage power supply, such as accidental contact with human will cause danger, in any case do not open the door of the control box or motor junction box at will, in the need

of control box, motor maintenance, must supply the ship switch "off", when opening the electrical control box door, first turn off the main power switch in the control box. Anyone should be very careful to avoid the danger of electric shock.

Disease Hazards

Sewage is a common mode of transmission for parasite organisms such as bacteria, fungi, protozoa, viruses and worms; some of these may be pathogenic, meaning they have the capacity of causing serious communicable diseases. Most diseases associated with sewage result from hand to mouth transfer of the pathogenic organisms. Good personnel habits by those servicing or in any way coming in contact with the equipment are imperative.

After coming in contact with sewage on any contaminated equipment items, personnel should thoroughly clean themselves with a disinfectant soap solution. This precaution is an absolute requirement before eating, drinking, smoking or performing any hand to mouth functions. Skin abrasions, punctures, or any other wounds require immediate and proper medical attention.

2 Main technical performance

2.1 Table of main technical performance

Model		SWCM-															
		10	15	20	25	30	40	50	60	80	100	120	150	200	250	300	400
LOAD	Average load（L/d）	840	1120	1540	1890	2310	3080	3780	4480	6020	7700	9100	11200	14700	18200	23100	30800
	Peak load（L/h）	105	149	193	237	289	385	473	560	753	963	1138	1400	1838	2275	2888	3850
	Organic load (kgBOD5 /d）	0.42	0.595	0.77	0.945	1.155	1.54	1.89	2.24	3.01	3.85	4.55	5. 6	7.35	9.10	11.55	15.4
Rated number of persons（men）		10	15	20	25	30	40	50	60	80	100	120	150	200	250	300	400
Maximum of persons（men）		12	17	22	27	33	44	54	64	86	110	130	160	210	260	330	440
Electricity		AC 380V、50Hz、3φ/ AC 415V、50Hz、3φ/AC 440、60Hz、3φ															
Power （kW）		2.5	2.5	2.5	2.5	2.5	3.0	3.0	3.5	4.0	4.0	4.0	6.0	6.0	7.0	9.0	11
External dimension（mm） L ×W ×H		1510 × 1200 × 1300	1870 × 1200 × 1400	1745 × 1400 × 1525	1935 × 1400 × 1560	1985 × 1500 × 1650	2400 × 1600 × 1700	2410 × 1700 × 1850	2670 × 1700 × 1850	2780 × 1900 × 2050	2795 × 2000 × 2200	3000 × 2000 × 2200	3050 × 2200 × 2300	3600 × 2200 × 2350	3880 × 2400 × 2570	4750 × 2400 × 2570	5950 × 2400 × 2570
weight	Dry weight（kg）	900	1000	1000	1100	1200	1300	1450	1600	1850	2200	2300	2800	3000	3300	3700	4200
	Wet weight（kg）	1775	2283	2640	2740	3500	4400	5073	5270	6517	8268	9166	11340	13267	16538	20357	25417
Effluent standard		BOD5≯25m g/L 、COD≯125m g/L ,TSS≯35m g/L、coliform≯100/100ml 、PH6～8.5 、 CL2 ≯0.5m g/L															

2.2 Main components table

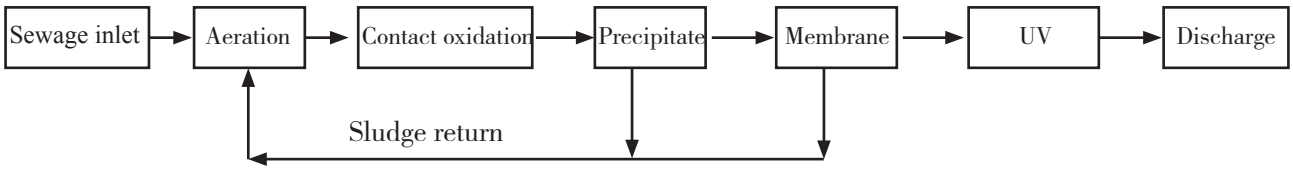
Items \ Type		SWCM -															
		10	15	20	25	30	40	50	60	80	100	120	150	200	250	300	400
Cutting and discharge pump	Type	0.5CWF-10B									1CWF-11B						
	Cap acity	5 m^3/h									10 m^3/h						
	Discharge pressure	0.1 MPa									0.11 MPa						
	Power	1.1 kW									1.5 kW						
	Manufactur er	Chekiang Mt.Tiant ai Water Pump Factory															
Air Pump	Type	CYBW-10					CYBW-15		CYBW-20	CYBW-25	CYBW-40				CYBW-60	CYBW-80	CYBW-120
	Cap acity	10 m^3/h					15 m^3/h		20m^3/h	25 m^3/h	40 m^3/h				60 m^3/h	80 m3/h	120 m^3/h
	Discharge pressure	0.06MPa					0.06MPa		0.06MPa	0.06MPa	0.06MPa				0.06MPa	0.06MPa	0.06MPa
	Power	0.37kW					0.55kW		0.75kW	1.1kW	1.5kW				2.2 kW	3.0kW	4.0kW
	Manufactur er	Chekiang Mt.Tiant ai Water Pump Factory															
Vacuum pump	Type	32-25-100										32-25-105					
	Cap acity	4.0 m^3/h										6.3 m^3/h					
	Discharge pressure	0.21 MPa										0.21 MPa					
	Power	0.55kW										0.75kW					
	Manufactur er	Guangdong Yangjiang Yuehua Pump Factory															
UV Sterilizer	Type	JX-0.5UV					JX-1UV			JX-2UV			JX-3UV		JX-4UV		
	Cap acity	0.5m3/h					1 m^3/h			2 m^3/h			3 m^3/h		4 m^3/h		
	Exposure Dose	≥30000uw.s/cm^2															
	Operating Pressure	0.6 MPa															
	Power	50W					100W			150W			200W				
	Manufactur er	Changzhou City Feihua Marine Equipments Co., Ltd.															
Membrane	Type	MBR-7						MBR-12					MBR-18				
	Quant ity	1Pc	2 Pc	2 Pc	2 Pc	3 Pc	4Pc	3 Pc	3 Pc	4 Pc	5Pc	6 Pc	6pc	7 Pc	8Pc	11 Pc	15 Pc
	M embrane Area	7m^2/Pc						12m2/Pc					18m^2/Pc				
	Flux	1 $m^3/Pc.Day$						1.6$m^3/Pc.Day$					2.5$m^3/Pc.Day$				
	Operating Pressure	-0.01～-0.03MPa															
	Manufactur er	Hangzhou Kaihong Membrane Technology Co., Ltd.															

3 System principle

3.1 Process principle; please refer to 321DF-1M-00XT

The device adopts activated sludge, contact oxidizing and principle of biologic membrane to digest the organic pollutant, which can treat sewage effectively and reach at the IMO new effluent standard or other stricter requirements.

The treatment procedures of the plants are shown as following:



In the 1st stage aeration tank, the activated sludge mainly consisting of aerobic bacteria form sticky flock is used to absorb and digest the organic substance to carbon dioxide and water under the condition of aeration, and produce new activated sludge in the meantime. The bacteria will die owing to the decreasing of organic pollution substance. The death bacteria are digested by the protozoa and the metazoan, which attached in the active sludge. The 95% of the sewage is easy-digested organic substance, they are oxidized entirely.

The soft biofilm stuffing is hung in the 2nd stage contact oxidizing compartment. The biofilm, which can digest organic substance, is floated in water. Most of the protozoa and the metazoan live in the fiber film. The organic substance is further digested by the protozoa on film. If restarting plant after stopped for some while, the restarting time is much quicker than that of conventional aeration starting time, because of the bacteria existing in the spore on the membrane. Meanwhile, the soft stuffing, similar as “cotton boll”, is able to expand as over nutrition and absorb superfluous activated sludge, or digest themselves as lack of nutrition, which is also called “endogenous respiration” . The “cotton boll” will be shrunk and wait for the future nutrition.

The sewage then enters the sedimentation tank, which is not aerated and the activated sludge will continuously precipitate. The sludge sediment is automatically and regularly "air lifted" back to the primary aeration tank for recycling treatment. A part of the activated sludge will float, and the floating sludge will be automatically blown away regularly and continue to settle. The supernatant after precipitation in the sedimentation tank flows into the membrane tank, creating a good operating condition for the membrane group.

The membrane cabinet is equipped with an immersed membrane group, which also participates in biochemical reaction through aeration, so it is also called membrane bioreactor (MBR). The membrane is hollow fiber ultrafiltration material, and the water permeated through the membrane is pumped by a vacuum pump, and then sterilized by ultraviolet light, which can meet the discharge standard and be discharged to the outboard or the ship's water tank. The device has designed an automatic lifting program for the lifting of concentrated sewage in the membrane cabinet. When the vacuum pump is working, the membrane cabi-net sludge lifting solenoid valve SV2 is opened every 30min to lift the membrane cabinet sludge to the first stage.

Note: only when the vacuum pump is working, the device can lift the sludge in membrane tank.

During the operation of the vacuum pump, the automatic operation is 9min, and the pumping is stopped for 1min. During the pumping stop, the dirt formed on the membrane filament will automatically fall off because of no adsorption force. At the same time, the aeration has been non-stop, which is conducive to the scrubbing of the membrane filament and prolonging the cleaning cycle of the membrane. Because the membrane cabinet is designed as a separate closed structure, it is not necessary to put forward the membrane group during cleaning, and can be cleaned "online" by adding cleaning chemicals to the membrane cabinet and aerating it at the same time, which can quickly remove the scale on the membrane filament like a washing machine. The water output can be restored to the original level after cleaning. If light immersion is not aerated, the effect is often poor. The sludge discharge cycle depends on the sewage quality and load, and it is generally appropriate to discharge excess sludge once every 6 to 9 months. Sludge discharge determination: under normal operation, the liquid containing suspended solids should be removed from the sampling port of the aerator with a 1000ml glass cylinder. After standing still for 30min, if the sediment interface exceeds 50%, the sludge should be discharged overboard or into the storage tank provided by the shipyard. For details, see "Sludge Discharge".

3.2 Air pump

The air pump is used to supply compressed air to the device. The air pump of the device is equipped with a main air pump and a lifting air pump, both of which have the same structure and different functions. The main air pump is mainly used to aerate the aerator and the contact oxidation tank. The lifting air pump is mainly used to lift the membrane tank and sediment tank sludge to the aerator, and also aerate the membrane tank.

3.3 Cutting and discharge pump

The cutting discharge pump is a centrifugal pump with knife, which is used for circulating cutting of sewage, so that the sewage after beating is easy to be decomposed; In case of emergency, sewage can also be discharged directly overboard. Or when cleaning the cabinet, you can empty the sludge and sewage in each cabinet, and only need to open the corresponding bottom valve of each cabinet at this time.

3.4 Vacuum pump

Vacuum pump is a centrifugal pump with stronger ability of suction, but it is better to keep some water in the pipes to avoid the problem for restarting. It can create a certain difference pressure and make the water permeate the membrane. If the membrane is blocked for pollution and not suction smoothly, the discharge capacity will come down, and cause the equipment to alarm at high level. Perform the “open 9min and stop 1min” procedure of Figure 1, it can prolong the service life of membrane.

3.5 Ultraviolet ray sterilizer

The disinfection principle of ultraviolet ray sterilization is to adopt appropriate length of UV wave to damage the molecular structure of the DNA or RNA of organism cell. It causes the deaths of growing cell and (or) regenerative cells and makes content of coliform in effluent meet the requirement of discharge standard.Its main element is lamp pipe to take care. Please see the “manual book” of “JX - UV type UV Disinfection Device”,if maintenance.

3.6 Electric control box

The electric box is provided with the function of electric operation, protection and procedure control for

the equipment.

There are three functions provided by the control procedure:

《Manual》 for trial running and breeding bacteria

《Automatic》 for 24h continuing running in normal operation.

《 High sea 》 the sewage, even if untreated, can be discharged overboard in high sea or unregulated sea area.

4 System description

4.1 Discharge pipe system

The suction inlet of the cutting discharge pump is connected with the aeration tank, settling tank and membrane tank at the same time, which are separated by ball valves. Under normal circumstances, the valve V1 and V7 of the aerator are usually open, and the sewage is continuously cycled and crushed in the aerator. In case of emergency, open the emergency discharge valve V6 and close the valve V7 to discharge the crushed sewage directly from the discharge pump outlet to the outboard or the international shore connection; If the valve V1, V7 is closed, and the valve V6, V8 is opened, the sewage treated by biochemical digestion and precipitation can be discharged; The normal discharge water is discharged from the membrane tank to the outboard by the vacuum pump.

Note: When installing a qualified discharge pipe, it shall be connected to the outboard by the qualified discharge water outlet. The gunwale shall be equipped with a wave check valve. If it is above the waterline, the discharge pipe shall be made into an anti-siphon pipe to prevent sewage from siphoning from the device to the outboard.

4.2 Ventilation system

There is an air-collecting dome on the top of the aeration tank. The dome can be used to collect the air escaped from water, in the other function; it can be used to restrain the swaying of the liquid in the tank. The vent pipe is connected from air-collecting domes outlet to the ventilation system of the ship. Anti- fire sparking net shall be installed on the pipe end (shipyards supply). Although the waste gas produced by aerobic bacteria does not contain odors and methane like a common storage tank, it should be kept far away from residential areas or windows of living house. The mode l of anti- fire sparking net can be selected according the dimension of vent inlet. (Please see the details in “marine pipe accessories” or consult our company) .

Note: The ventilation pipe should be kept through all the way.

4.3 Air pipes

The compressed air from the main air pump A1 enters into the aeration tank and contact oxidizing tank through V11. The compressed air from the lifting air pump A2 is divided into three ways, one way is to membrane tank for aeration, SV1 is normal open. The other 2ways are to membrane tank and settling tank for air lifting and return the sludge automatically in regular through the solenoid valves SV2, SV3 on the two pipes. The solenoid valve SV2 is opened for 2min every 30min, to return the sludge in settling tank.

When the level in membrane tank is down to low level L2, the solenoid valve SV1 is closed for

17min, the membrane tank does not aeration; meanwhile the lifting air pump is stopped for 15min, then the SV2 is opened for 2min, to return the sludge in membrane tank. If any one of SV1, SV2, and SV3 is opened, meanwhile the lifting air pump A2 should be opened. If the three valves are all closed, meanwhile the lifting air pump A2 should be closed.

In case that either air pump is fixing, open V9, and then close either V10 or V11, to maintain the air supply. It is dangerous that the plant is working without air supply.

4.4 Emergency overflow pipe

Water will overflow from the emergency outlet on the top of the settling tank when automatic control and high level warning are out of order and the troubles have not been resolved. The emergency outlet on the top of settling tank is connected to the bilge of the ship. The emergency overflow tank and pump out should be provided by shipyard.

4.5 Flushing water pipe

The flushing water pipe is provided by ship, the flush pressure should not exceed 0. 1MPa as for cleaning.

4.6 Connections

Flange of connections

Model	Sewage Inlet （DN）	Air vent (DN)	Effluent Outlet (DN)	Flushing water inlet (DN)	Overflow outlet (DN)	Emergency discharge (DN)
SWCM-10	150	100	32	40	65	40
SWCM-15	150	100	32	40	65	40
SWCM-20	150	100	32	40	65	40
SWCM-25	150	100	32	40	65	40
SWCM-30	150	100	32	40	65	40
SWCM-40	150	150	32	40	65	40
SWCM-50	150	150	32	40	65	40
SWCM-60	150	150	32	40	65	40
SWCM-80	150	150	32	40	65	40
SWCM-100	150	150	32	40	80	40
SWCM-120	150	200	32	40	80	40
SWCM-150	150	200	32	40	80	40
SWCM-200	150	250	32	40	80	40
SWCM-250	150	250	32	40	100	40
SWCM-300	150	250	32	40	100	40
SWCM-400	150	250×2	40	40	100	40

4.7 Standard shore connection

In order to connect the shore connection to match discharge pipe in ships, the discharge outlet and emergency discharge outlet should be equipped with standard shore connector complying with the requirements as followings:

Standard dimension of discharge connection flange

Items	Size
Outside Diameter	210mm
Inside Diameter	Acc. to the outside diameter of pipes.
Diameter of Bolt Ring	170mm
Channel of Flange	The 4 holes with 18mm diameter is distributing on the above- mentioned bolt ring, open the channel to the outside edge of flange. The width of channel slot is 18mm
Thickness of Flange	16mm
Bolt and nut number, diameter	Quantity:4 pieces; diameter:16 mm (with suitable length)
The flange should be designed as the one which can be connected with the pipe whose maximal inner diameter is less than 100mm. And it should be made of steel or other equivalent materials and its surface should be smooth. Together with a suitable gasket, its working pressure should reach 0.6MPa.	

For the ships whose molded depth is no more than 5m, the inside diameter of the discharge connector should be 38mm. For merchant fleets i.e. passenger ferries, the discharge connector can be equipped, which is approved by appropriate authority, such as quick-connect coupling.

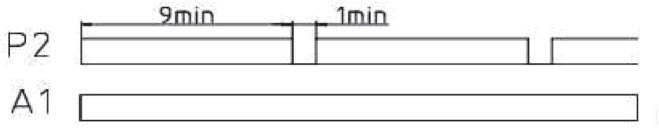


Figure 1, In normal water-level , Vacuum pump run 9min and stop 1min

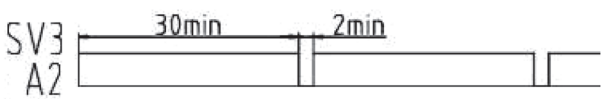


Figure2, the sludge lifting valve SV3 of settling tank close 30min, open 3min Settling

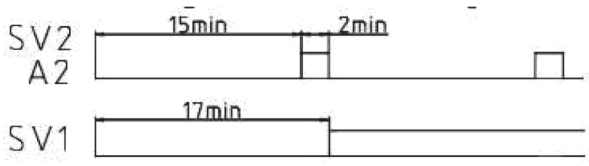


Figure 3, when the level is down to low position, lifting valve SV2 close 15min, open 2min

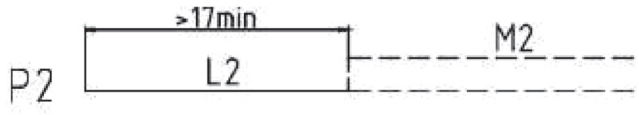


Figure 4, within the 17min as above-mentioned, if the level is up to M2 position, the procedure is continue

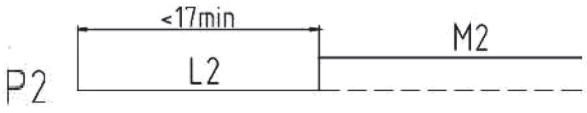


Figure 5, within the 17min as above-mentioned, if the level is up to high position, the procedure stop.

5 Electric control system principles

5.1 Refer to electric circuit diagram （321DF-3M-00YL）

When the cutting pump position switch (S2) is turned to "manual" position, contact or K1 will be on, and pump P1 will be continually running. The indicator lampH1 will light.

When the cutting pump position switch (S2) is turned to "stop" position, contact or K1 will be off and pump P1 will be stopped.

When the cutting pump position switch (S2) is turned to "auto"position:

(1) When procedure control switch S1 has not been turned to "high sea" position, If the level is lower than L1, P1 is run controlled by the PLC control as follows, run for 20min and stop for 20min. If the level is higher than L1, K1 is on and P1 continuous;

(2) When procedure control switch S1 is turned to "high sea" position, The plant will be run according the high sea discharge procedure; when the tank level reaches the M2 level switch position, K1 will be on and P1 will be in continuous operation. Even if the tank level is lower than the M2 position, the P1 pump can still activate if required, until the tank level reaches L2. When the level drops down to the L2 position, K1 will be off and the cutting pump will be stopped. When carrying out the high sea auto-discharge, the V6, V8 are opened, the V5, V7 are closed by manual and supernatant from sediment tank is discharged overboard by cutting pump without the membrane process.

Note: The procedure control switch S1 has three positions: auto, manual and high seadischarge . "Auto" means normal ope ration condition, "manual" means breeding bacteria operation. Note: The membrane tank should not be run in manual mode.

5.2 When the procedure control switch S1 is turned to "manual/breeding bacteria", or "high seas" position, the vacuum pump P2 should not be run in manual or auto mode.

When the control switch S1 is turned to “auto” position:

(1) When the position switch S3 is turned to the “manual” position, the contact or K2 will be on, P2 will be in continuous operation mode, the operational indicator lamp H2 will light and UV - lamp will not light . This function is only applicable to check the system function.

(2) When the position switch S3 is turned to the “auto. ” position and the tank level reaches the M2 position, then P2 will be in continuous run mode, the operation indicator lamp H2 will light and UV - lamp becomes operational. Even when the tank level is lower than the L2 position, the P2 pump can still activate if required, until the tank level reaches L2.

Note: The vacuum pump should not be allowed to operate without water.

When the tank level is above the L2 position, the vacuum pump (P2) will run in 10 minutes cycles, 9 minutes on and 1minute off, during this cycle the aeration does not stop. The one minute off portion of the cycle is a self cleaning step to facilitate the removal of the scale build up from the surface of membrane. The solenoid valve SV1 should be open during this process to ensure vacuum pump P2 will remain on.

5.3 When the position switch S4 for the main air pump is turned to “auto” position, for the purpose of “breeding bacteria”, and the level is higher than L1 position, the main air pump operation will be controlled by the PLC control in this way, open 20min, stop 20min (alternatively open 30min, stop 10min), When the level is up to the M1 position, the K3 contact or will be off and main air pump will be stopped. The tank level should be kept between L1 and M1 position. The liquid can be checked through the observation window as well.

When the position switch S4 for the main air pump is turned to “auto” position, K3 will be on and the main air pump A1 is run in 40 minutes cycles, 20 minutes on and 20 minutes off. An air supply is required continuously during the process of “breeding bacteria”

When the position switch S5 is turned to “auto” position, the procedure switch S1 is turned to “auto” position as well, the sludge return to the aeration tank by “air lifting” is automatic.

5.4 When the water level reaches L2→ M2→ H2, the corresponding contact or L2 and H2 areopened. When the water level begins to drop down to H2→M2→ L2, the corresponding contact points H2 and L2 are closed, then solenoid valve SV1 is closed, the air lifting pump A2,supplying the air for the membrane tank is stopped to allow the sludge to settle. The solenoid valve SV1 will close for17 min. After a 15 minute delay to allow for particulate settling, the valve SV2 is opened simultaneously engaging the lifting air pump (A2) for 2 min to remove sludge to the aeration tank. When the tank level is up to the H2 position, the procedure is terminated, and the valve SV1 is returned to its normally open position.

Note: During this time period, if the water level reaches the H2 position, the above procedure is terminated state, no longer lifting t he sludge in this time.

5.5 The lifting air pump A2 can be opened and stopped manually, by turning the position switch

S5 to the “manual” position. The lifting air pump A2 will be run manually only for testing the plant, unless SV1 should be opened manually at same time, otherwise, the air pump will be blocked.

When position switch S5 is turned “auto” position or the“high sea”, and procedure switch S1 is also turned to “auto” position, the PLC timer begins. The program is as follows. After a 30 minute delay the SV3 valve is opened simultaneously engaging the (A2) air lifting pump for 3 minutes. After the 3 minutes the Blowing Scum Valve (SV4) is opened for 1 minute and then closed.

If any one of SV1, SV2, SV3 or SV4 is opened, the lifting air pump A2 should be opened as well. If the four valves are all closed, the lifting air pump A2 should be closed as well.

5.6 “Procedure control” switch S1 has three positions, ensure every procedure is separated.

When carrying out the “high sea discharge” procedure, the membrane tank does not work, but the aeration tank and settling tank still work normally, the solenoid valve SV1 is opened.

Meanwhile, the solenoid valve SV3 is opened 2min every 30min, to return the sludge to the aeration tank. Although sewage water does not enter membrane tank, if there is residual water inside membrane tank aeration is required, preventing odors or gas build up. If there is no water inside tank, the solenoid valve SV1 should be closed manually. This time, it can be used to do membrane cleaning; however, care should be taken to ensure water does not spill out of the settling tank.

5.7 The four solenoid valves all can be controlled by “manual” or “auto”, normally they are all placed in “auto” position, when the solenoid valves have failed or need to be run in “manual” operation, they can be opened by switches separately.

5.8. UV-lamp can be controlled by “manual” or “auto”, normally it is placed in “auto” position, when it is needed to run in “manual” ope ration, the position switch S10 can be turned to “manual” position.

5.9 Please refer to the secondary electric wiring diagram of SWCM - STP:321DF-3M-00YL.

The level switches can be floated-ball type, or electrode type with normal open and normal close contact points, but only use the normally open contact point. The low level, middle level, high level of the aeration tank is denoted by L1, M1, H1 separately. The low level, middle level, high level of membrane tank is denoted by L2, M2, H2 separately. When the plant is placed in horizontal position, the fluid in aeration tank and membrane tank should be at same level, but actually the fluid level in membrane tank would be slightly low er than the level in aeration tank because of the suction of vacuum pump P2. When the vessel is pitching and rolling, the fluid level difference may be bigger, so the vacuum pump is operated by the level switches of membrane tank, and cutting pump is operated by the level switches of aeration tank. But when the high sea discharge procedure is operated, the fluid discharged is come from settling tank, so the cutting pump is operated by the level switches of membrane tank. Please ensure proper connection.

5.10 The process alarm includes the alarms occurring in the following conditions: high level of aeration tank, high level of membrane tank and motor overload protection of each pump RT1~RT4. When encounter a process alarm, first determine the cause, take appropriate measures to repair. You can press the button TA1, to mute the audible alarm (visual alarm will continue). The alarms and the ope ration / condition of each sub- item can be sent out to cabin or control room.

5.11 The electric control box is contains the PLC panel; please refer to the elements arrangement diagram of SWCM -STP: 321DF-3M-00YL. The control box also contains 16 indicator lamps 9 three position switches and 1 silence button.

6 Operation description

6.1 Preparation before starting

6.1. 1 Check the tightness of tank body, valves and pipe accessories, open the flush water valve V15 and feed water into plant until the water level is up toM1 position.

6.1.2 Check the power of electric box to see whether it complies with the design requirements; Check the rotation direction of all pumps, which should be adjusted as incorrect. Engage or turn on the power switch and all sub-switches (The equipment has been tested when leaving the factory, the pump direction is not correct, just adjust the total power phase sequence.)

6.1.3 Breeding bacteria

The new plant should have the “breeding bacteria” procedure carried our before operation.

(Incubation temperature of 20℃~25℃ is the best) below 5℃ need to be warmed.

Turn the procedure control switch S1 to “manual” position, it’s also called “breeding bacteria” mode. The change-over switch S2 of cutting pump P1, change-over switch S3 of Vacuum pump P2 are turned to “stop” position, the change-over switch S4 of main air pump A1, change-over switch S5 of lifting pump A2 are turned to the “stop”position. Close the valves V1, V2, V3, V4, V5, V6, V8 and V9 manually. Open (manually) valves V10, V11,V15,V16. At this point the plant is c ompletely controlled by personnel and should be monitored closely.

Before cultivating bacteria, firstly discharge the equipment clean water to the position of the membrane tank level "L2", then open the sewage inlet valve to let the sewage flow slowly, and close it when the liquid level in the device reaches M2. Then turn the cutting pump P1 transfer switch S2 to "automatic", P1 pump starts, the sewage is circulated and crushed in the aeration cabinet, the main air pump A1 transfer switch S4 is turned to "manual", the main air pump A1 pump runs continuously, and the sewage is "stuffy aeration" bacteria cultivation. One day later, turn the A1 transfer switch S4 of the main air pump to the "stop" position. 1 hour later, turn the A2 transfer switch S5 and the solenoid valve SV3 transfer switch S8 to the "manual", and stop the sludge in the reflux settling tank when the water in the return pipe is clear. According to the concentration of sewage, nutrients such as fertilizers can be added to the device appropriately. Close valve V1, V7, open valve V6, V8, turn the grinding pump P1 switch S2 to "manual", discharge a small amount of sewage overboard until the level reaches L2, close valve V6, V8, open valve V1, V7. As mentioned

above, the original sewage is re-entered, and so repeated operations are performed to culture the bacteria. Raw sewage bacteria cultivation needs to be based on the raw sewage organic content, salinity, freshness to determine the length of culture time, generally fresh water 30 days to 40 days, seawater 60 days to 80 days, if you can add "seed mud" bacteria can shorten the culture time.

1000ml sewage can be taken out from the sampling port of the aerator with 1000ml measuring cylinder to observe the culture state of activated sludge. After 20 to 30 minutes of static precipitation, if the sludge settling volume can reach 1/3 (30%), the shape of the sludge is normal, the cultivation process is completed, the shape of the sludge is wadding, and the water after precipitation is transparent.

Note:When culture bacteria the V5 valve cannot be opened.

6.2 Normal operations

6.2.1 Manually open V1,V5, V7,V10, V11,V12(need to be adjusted), V13,V15,V16, and close V2,V3,V4, V6, V8, V9, V14; turn the cutting pump P1 to “auto” position.

When the tank level is up to L1 position, the cutting pump P1 will continuously run and macerate the sewage automatically. When the level is low (down to L1 position) the cutting pump P1 will run a 40 minute cycle of open 20 min and closed 20 min

6.2.2 Turn the procedure control switch S1 to “auto” position.

6.2.3 Turn the main air pump A1 to “manual” position. A1 will run continuously. The air enters into the aeration and contact oxidizing tanks.

6.2.4 Turn the lifting air pump A2 to “auto” position, A2 is operated according the procedure, from Figure2, where the sludge lifting valve SV3 of settling tank is closed 30min, and open 3min to permit settling and returning the sludge to the aeration tank.

6.2.5 Turn the vacuum pump P2 to “auto” position, P2 will be operated by the level of the membrane tank, P 2 will start at mid level of the tank and stop at the low position.

6.2.6 Open V12, V13 and switch on UV power manually, close V14.

6.2.7 Open the inlet valve of raw sewage and let the sewage enter into the plant.

6.2.8 The vacuum pump P2 will be started up as the level reaches the M2 position and stopped automatically when the tank level is below the L2 position. Meanwhile the by-pass valve V12 of the vacuum pump should be adjusted so that the flow is controlled at the rated value in instruction manual. If the flow rate is too high it will cause high a trans-membrane pressure differential; if the flow rate is too s low it will cause a high level alarm.

Note: When the vacuum pump P2 is in operation, air should be supplied to membrane tank.

P2 should not be started up if the level is lower than L2 position.

6.2.9 When the tank level is up to the M2 position, the vacuum pump will start and operate a 10 minute cycle, on 9min and off 1min. The air pump is run continuously during the 1min stop time of vacuum pump to enable to a self-cleaning for the membrane threads. Please refer to Figure 1. Thus, the plant enters into normal operation status.

6.2.10 the auto-return of sludge

(1)The sludge in settling tank will be lifted and returned to aeration tank according the designed

procedure in figure 2: where the solenoid valve SV3 is opened for 3min every 30min.

(2)The sludge in membrane tank will be returned to aeration tank according the designed procedure until tank level is below the L2 position, and the P2 pump is stopped. The solenoid valve SV1 is closed for 17 min, stopping aeration to membrane tank and allowing the sludge to settle for 15 min. Then the SV2 is then opened for 2 minutes automatically, and the sludge in membrane tank is returned to aeration tank, and stopped 2min later. (see Figure 3).

(3)Normal condition: During the 15min settling, even if the level is up to the M2 position, the vacuum pump P2 should not be started, please refer to Figure 4.

(4)Abnormal condition: when the sewage load is over the normal design load, and the level is up to H2 position within 15min, then the vacuum pump P2 is started so as to terminate the condition, please see Figure 5.

When the level is up to high position, the system will send out an audible and visual alarm signal and the "stop to use" lamp sign in toilet will light, reminding the crews to not flush for a while. If the level is staying in high position for a long time, the operator should check the plant for problems.

6.3 Chemical cleaning

When vacuum pump is sending out a high level alarm caused by a slow or no effluent, this means the membrane should be cleaned. When cleaning the membrane, the toilets should not be used so as to not allow the sewage enter into the plant. Open V6, V3 and close V1, V5, V7 manually, and then start up the discharge pump P1 to empty the sewage in the membrane tank. Then open the flush water valve V15 to wash the membrane tank with tap water. Close V3 and keep the tank level up to middle position then close the flush water valve V15.

(1).Pour a measured amount of 0.5% NaClO into membrane tank from dosing inlet (See table below for instructions to make the solution as, Different type plants will need different dose for membrane tank of each plant vary in size).

(2).Soak for 2 hours. During this 2 hours open the main air pump A1 and allow the air to stir the membrane threads, (like a washing machine).

(3).After the time as elapsed empty the membrane tank and flush the tank again with tap water.

(4).Then with a solution of NaOH (See table below for instructions to make the solution as, Different type plants will need different dose for membrane tank of each plant vary in size)

(5).Soak for 2h, during this 2 hours again open the main air pump A1 and allow the air to stir the membrane threads.

(6). After the time as elapsed empty the membrane tank and flush the tank again with tap water, and the chemical cleaning work is finished the toilet can be used and the plant can be operated normally.

If chemical cleaning is performed in unregulated sea areas, it is permitted to carry out the "high seas discharge" procedure and use toilet at same time as the cleaning. The disposal and use of chemicals should be according to the membrane manufacturer' s requirement.

Please use chemicals according to instruction book.（Data for reference, not absolute value）

Items / Type	Volume of membrane tank (L)	60% NaClO (kg)	NaOH (kg)	Remark
SWCM-10	170	1.5	3.4	
SWCM-15	200	1.8	4.0	
SWCM-20	260	2.35	5.2	
SWCM-25	280	2.5	5.4	
SWCM-30	300	2.65	6.0	
SWCM-40	420	3.7	8.4	
SWCM-50	510	4.5	10.2	
SWCM-60	510	4.5	10.2	
SWCM-80	980	8.5	19.6	
SWCM-100	1150	10	23	
SWCM-120	1350	12	27	
SWCM-150	1350	12	27	
SWCM-200	1550	13.5	31	
SWCM-250	2230	19.5	44.6	
SWCM-300	3000	25	60	
SWCM-400	3850	34	77	

Warning:

1. Do not mix up bleaching powder near other substances such as grease, oil, lubricating oil, solvent, acid, alkali, soap, paint, home products, garbage, beverage, pine oil, dirty rags etc. If the powder is mixed up with these materials, it may cause fire that might be severe.

2. Prevent any hot or burning substance such as lit cigarette from falling into the vessel of the bleaching powder.

3. If the powder catches, pour the water into it and spray the surrounding area with water.

4. Do not touch eyes, skin, mucus membranes or clothes with bleaching powder otherwise it could cause severe chemical burns. If bleaching powder is s wal lowed, it may have deadly consequences.

5. Be careful to place the vessel containing bleaching powder. Don't drop it, roll it or spill it. Keep it vertical.

6. Use the bleaching powder only with clean dry rubber gloves or metal ware. Any contamination can cause a fire.

7. Use large quantity of water to deal with the spilling bleaching powder. If the left over bleaching powder in the vessel needs scouring, large quantity of water is needed to wash them into appropriate treatment system.

Antidote:

External: If exposed use large quantitative of clean water to rinse skin or eyes for 15 min.

If pain persists, consult a doctor. If you get the chemical in your eyes, consult an ophthalmologist immediately.

Internal: drink large quantities of water or milk, milk of magnesia, vegetable oil or egg and go to t he internal medical department for emergency.

8. Keep chemicals far from children.

9. Keep bleaching powder in cool and dry place and original vessel. Do not change the label and don't store the bleaching powder in other containers.

10. Do not reuse the empty container. Rinse the empty vessel thoroughly with water and place the cleaned vessel in safe place.

11. Post notices of "fire protection" around the place where the bleaching powder is stored and dispensation area. Provide fire prevention equipment such as fire extinguishers, foundry flasks etc.

When there is sewage in the device, the device will generate harmful gas es such as H2 S and methane etc. that could harm people around the area. T he air pump should be operated at all times to prevent build up or escape of harmful into working area.

6.4 High sea discharge

According to the international convention, it is permitted to discharge sewage without any treatment in high sea and unregulated sea.

There are two operation methods as follows:

(1) Close sewage inlet to the device and to discharge sewage overboard directly.meanwhile, the main air pump control switch should be turned to the "automatic" position to allow the air pump gap aeration, so that the strain is not starved to death, in order to prepare for the next time to be able to quickly start the device.

(2) Do not close the device sewage inlet valve, continue to let the sewage into, at this time, the program control switch S1 should be turned to the "high seas discharge" position, open the valve V6, V8, close V1, V2, V3, V4, V5, V7. Turn the grinding pump P1 transfer switch S2 to "automatic"; Vacuum pump transfer switch S3 turns to "stop", the membrane group and vacuum pump do not work; The main air pump transfer switch S4 turns to the "manual" position, the main air pump will continue to operate, and the air pump transfer switch S5 turns to "automatic"; The solenoid valve SV1~SV4 transfer switch S6~S9 turns to the "automatic" position, which can discharge the sewage after treatment and precipitation.

6.5 The sludge discharge

(1) Under normal operation, the liquid containing suspended solids should be removed from the sampling port of the aerator with a 1000ml measuring cylinder. After standing still for 30min, if the sediment interface exceeds 50%, the excess sludge of the aerator should be discharged overboard (12 nautical miles offshore) or into the storage tank provided by the shipyard. Check the sludge concentration once a week.

(2) To discharge the sludge in the aeration tank, close V7, open V6, V1, and start the cutting

pump manually. When the liquid level drops down to L1 position, stop the discharge pump.

(3) The sludge discharge cycle is generally about 6 to 9 months (for reference), and must be discharged in the high seas, so when the ship is sailing on the high seas, the sludge sediment exceeds 30%, you can discharge some of the sludge until the "aerator" L1 light is turned off to retain a certain amount of bacteria for the restart of the device.

(4) The MARPOL73/78 allows discharge the macerated and disinfected sewage outside 3 nautical miles from land and the raw sewage outside 12 nautical miles from land. When in a harbor, or where there is recycle vessel, the sludge can be discharged to shore connection.

6.6 "Zero Load"

"Zero load" means that no sewage has entered for a period of time (> 1 day). In order to keep the bacteria from dying, the main air pump A1 can be converted to switch S4 to "automatic", intermittent gas supply, reduce oxygen supply, so that the bacteria hibernate and internal consumption, in order to prepare for the next start soon into a stable state. "Zero load" should be operated when the water level is above L1 (the basic working principle is explained). For more than seven days, nutrients such as glucose should be added to the equipment to maintain bacterial stocks.

6.7 Stop

If you intend to stop the plant for a long time (>3 months), close the sewage inlet valve; discharge thoroughly all water in the device; open the flushing water valve V15 of the device, wash the tank with flushing water for two times, and discharge thoroughly through opening valve V1, V2, V3,V4, V6 by pump or empty the tanks through drain screw.

7 Installations

Warning: The membrane modules can't function in subzero water. And they also can't beplaced in environment of subzero temperature except stored separately when transiting or storing t he plant.

If the ship is laid in very cold space or something like this happens, it is necessary to take freeze- proofing measures as following for the membrane modules: Remove the membranes from the device.

7.1 Pipes

(1) Black water inlet pipe

The sewage from the W.C. shall be divided into two pipes, one is drained overboard directly, another is enters the plant, and they are separated by shut off valves DN150, the two valves should be closed.

(2) Air vent pipe

The air vent pipe should be led from vent of plant to the upper deck; the flue should be 3 meters higher than the deck. At the top a goose neck and sparking-proof net is needed (shipyard to supply). Although, the waste gas produced by aerobic bacteria does not contain odors and methane like a common storage tanks, it should still be kept far away from a residential areas or windows of

living areas.

Caution: The whole vent pipe should be as straight as possible to avoid vent blockage.

(3) Drain pipe

The drain connection is connected from outlet of the discharge pump to overboard directly. A check valve should be provided. If the drain connection is above the draft water line, an inverted drain anti-siphon should be provided to prevent the effluent self- flow from the device to overboard.

(4) Flushing water pipe

One pipe of the fire fighting system on board should be connected to the flushing water inlet of the device for cleaning the tank. A shut off valve should be installed by the shipyard in the pipe system. The flush water pressure for membrane flushing should not be higher than0.3MPa.

(5) Emergency discharge pipe

The emergency discharge pipe is connected to overboard from the outlet of cutting pump.

(6) Emergency overflow pipe

The overflow pipe of the plant should be connected to the sewage overflow barrier and directed to the bilge.

7.2 Installations

(1) The plant base is welded by channel steel 5#, 8# or10#, the connection between the ship base which is supplied by shipyard and the plant base should be welded or bolted. The weld length should be all around the ship base continuously with ship plate form. The bolt number has to meet the base drawing of each model of device.

(2) A barrier should be provided on the location of the plant, which is 80mm height and is used to collect the sewage in case constructed around of leakage from pump axle or overflow, collected sewage is directed to a bilge tank, where there is a submerged pump inside;

(3) Device should have electrical grounding connection after finishing connection of external wires of the electric control box;

(4) A running water tap and a washbasin for cleaning and a space for chlorine storage room should be provided. The space should be kept dry and far away from the place where explosion may occur.

7.3 Electricity

(1) An electric wire power supply of 3 phase, 380V, 50Hz should be connected into the electric control panel. The waterproof seal of wiring and connectors to the control box should be ensured. If the water pump rotates in the wrong direction, the two incoming wiring terminals should be exchanged with each other.

(2) A place for installation with a minimum of 600 mm free clearance in front of the control box to allow for maintenance should be provided.

8 Trouble shooting

No.	Trouble	Possible cause	Suggestion
1	H1 is warning, H2 not	The pipeline between contact oxidation tank and settling tank is blocked.	Clean the pipe
2	H1 and H2 are warning	Read the flow meter, if above rated flow capacity, may caused by peak load.	Stop using the toilet for a while
		Look at the flow meter, such as below the rated flow, the discharge pipe is not smooth.	check outlet pipes
		Read the flow meter, if below rated flow capacity, may caused by membrane pollution	Clean the membrane
3	Voice of air pump is abnormal	The outlet valve is not opened	Open the outlet valve
		Slide vane is damaged	Replace the slide vane or replace the air pump
		The lifting air pump is not opened synchronously for the problem of solenoid valve	Check the control circuit
4	Voice of vacuum pump is abnormal	Suction is not smooth	Check the pipe and adjust the V12 valve
		No water, membrane pollution, blockage	Clean the membrane
5	Solenoid valve SV3 has not opened for half an hour	The sludge in settling tank can not be lifted regularly	Check control lines and solenoid valves
6	SV2 does not lift and return the sludge	V9 is opened, does not stop aeration	CloseV9
		Meanwhile, Lifting air pump is not op en	Check the control circuit
7	lamp is not lighting	The UV control panel or lamp tube is damaged	Change the lamp tube or UV control panel
8	Wrong operation of device	The procedure switch position is not comply with the condition of valve switch	Read the 3 procedures carefully in manual book
9	Water quality is not qualified	Activated sludge is not enough or qualified	Breeding bacteria
		The membrane is out of order	Replace membrane

9 Maintenance

9.1 Cutting pump

9.1.1 Purpose:

The cutting pump installed in front of the plant, is used to macerate and recycle the sewage in the aeration tank, and also can be used to discharge the sludge in all tanks of main body. When carrying out the “high sea discharge” or “emergency discharge”, it also can be the discharge pump.

9.1.2 Structure

The pump is a open impeller type centrifugal pump, there are knife-edges on the blades of the impeller and at the inlet guide of the pump, to cut the solid waste in the sewage with the movement of the blades. At the back of the impeller, there are short vanes to balance the axial force generated by the pump.

9.2 Air pump

9.2.1 Structure

The air pump body and its motor are fixed on a common base, a coupling connects them. The rotor of the air pump has a supporting connection at both ends. The fan of the motor cools the device.

9.2.2 Operation and maintenance

(1) The air pump should be installed in a stable location in a clear well ventilated and roo m temperature environment.

(2) The sliding vane is made of self-lubricating material and no oil is required for the pump.

(3) The air pump inlet is ope n to air with a particulate filter in place.

(4) The air pump filter and the filter element should be kept clean, clean them once every two months.

(5) Clean and reassemble the air pump once every 6 months. Inject No.2 or No.3 calcium grease or bentonite grease into the rolling bearing after cleaning. If the rotor operates ineffectively, replace it or clear it. Replace the sliding vane if it is damaged. Pay attention to the following not es when replacing the sliding vane.

①Take care not to break the sliding vane. The edge of new sliding vane needs to be chamfered. The bevel edge of the sliding vane needs to be arranged outside the rotor groove and its direction need to be same as the circular of outside diameter of the rotor.

②Do not touch the machined surface and do not allow dirt or debris to enter into the air pump.

③ Clear inside surface of the air pump with a clean dry cloth.

④When the plant stored, the pump shall be kept from rust and moisture.

9.3 Electric control box

Warning: Make sure the external power supply s witches are off and that the current breakers in electric control box are also off when performing maintenance.

9.3.1 Removal

Replacement of control box components does not require removal of entire panel.

When checking the components and removing wires, pa y attention to the mark and code of wire for reassembly.

9.3.2 Reassembly

When it is necessary to replace damaged parts or reassemble components, refer to the electrical principle diagram. Ensure that the wiring is correct before turning the circuit breaker to ON.

9.4 Membrane module

(1) The storage of membrane

If the vessel should stay on a cold area for along time and the device is in a place where is lower than 0℃, please do the following anti-freezing measures: Mix ethylene glycol of 20~60% as antifreeze solution whose freezing point is -49℃. Pour it into membrane tank. The antifreeze solution has no damages for membrane and plastic. The higher the concentration is, the lower the freezing point becomes.

Warning: The membrane modules can't function in subzero water. And they also can't be placed in-environment of subzero temperature except being stored separately when transiting or storing the plant.

(2) Matters needed attention when using membrane

The products provided to our clients have been pretreated, and can be used directly after being installed in the MBR reactor.

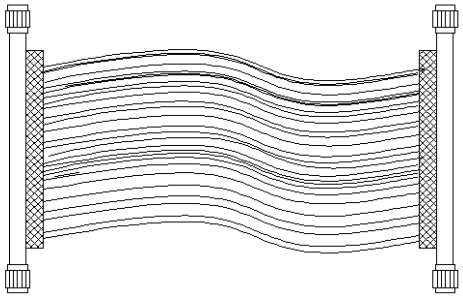
In order to save the service life of the film, proper operation and use can be of great benefit. Especially in the high seas and irregular sea areas, the sewage is still the nutrients of Marine life, the sea has a certain self-purification ability, can use the device's "high seas procedure" to discharge the sewage, so as to extend the service life of the membrane.

In normal operation, the sewage of the membrane tank comes from the settling tank, generally there will be no large solid particles, and the damage to the membrane is small. When the membrane tank is cleaned with washing water, the washing water should be fresh water as far as possible, and seawater cleaning will increase the burden on membrane penetration.

9.5 Membrane module details

9.5. 1 Membrane module (hereinafter called MBR - module) structure:

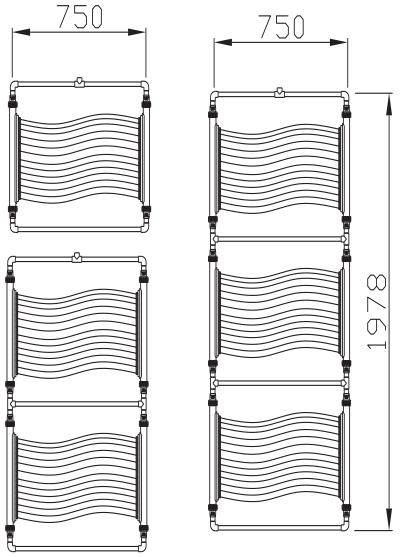
There is KH -MBR type piece in SWCM type STP. It's diagram of structure size as follows:



KH-MBR of MBR-pieces

9.5.2 KH -MBR type MBR - module connection manner

In normal use, KH -MBR type MBR -module can be combined one group with single piece, two pieces or three pieces as required, and fixed on membrane shelves in the biochemical treatment tank. This system is designed to use a single or a two piece connection for a group. Please see the attached diagram for the connections and dimensions. In the process of usage, membrane threads should be paralleled with the level of biochemical treatment tank.

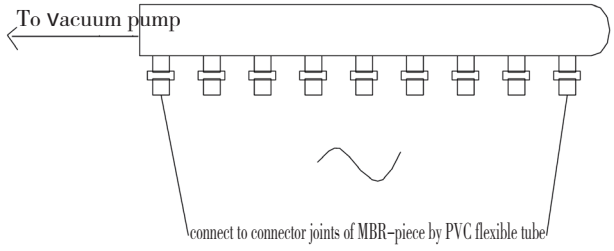


9.5.3 Water collection pipe of MBR -module

The all outlets of MBR groups are connected in parallel to an outflow pipe, which is called

"water collection pipe" . The number of joints on water collection pipe is decided by the number of MBR groups. Connect the water collection pipe to the vacuum pump; the effluent from MBR - module is discharged through the pump.

The seal connector joints of membrane module and water collection pipe are connected by PVC flexible tube.



9.5.4 Installation steps of MBR - module and related items

(1) Fix the bracket of MBR -module in membrane tank first, when replacing the membrane, to prevent vibration and shaking

(2) At same time, you may feed the raw sewage into the aeration tank, and breed the sludge

seed material in accordance with the activated sludge biochemical treatment method 6.1.3.

(3) Note: Only open the membrane tank inlet valve V5 when the sludge activity is good and the settlement ratio is more 10- 15%.

(4) Connect the loose joints between MBR -plates after the installation of MBR -plates according the assembly methods as above- mentioned. Please pay attention to place sealing gaskets and seal up the loose joints.

(5) After the MBR module groups are connected well and slid into the channels of membrane module bracket, connect the effluent outlet of MBR module groups to the connector joint of the water collection pipe.

(6) In order to prevent the MBR - module from floating at the time of aeration in biochemical treatment tank, a fixed rod is need after the MBR -modules are slotted into the channels.

(7) As a debugging for the MBR - module, inject water into the collection pipe through a prepared hole until the vacuum pump is full of water, then the pump can be started up.

(8) The membrane threads should be submerged in the water, to prevent the MBR- module losing from drying out.

(9) Please check the packing container of the modules before installation, to see whether the airproof bag is broken. If seal is broken or the protective solution is missing, the MBR - module will require re-treatment or consult the relevant technician.

9.5.5The pre-treatment for MBR - module before installation

The products provided to our clients have been pretreated, and can be used directly after installed in the MBR reactor.

If the clients have purchased the non pretreated MBR - modules or the module lost the protective saline solution during transport, the MBR - module should be pretreated before using. The pre-treatment method is to immerge membrane in the 95% of industrial alcohol for about 10 minutes, then rinse it with water. If the treated MBR - module will not be used immediately, it should be sealed in air tight packaging in order to maintain membrane thread moisture.

9.5.6 Membrane cleaning

The cleaning method is to remove the MBR -module from bracket, wash the membrane surface with clean water, in order to remove the activated sludge and scale attached on the membrane surface; immerge it in the 0.5 % NaClO solution for 1h, in order to kill the bacteria attached on the surface; rinse the membrane with clean water and then immerge it in 2-3% NaOH solution for 2 hours, in order to remove the organic matter and colloidal material attached on the surface. Then a final flush of the MBR -module with clean water. On this manner the membrane flux can be recovered. If the hardness of local water is high, an acid method can be combined to clean the membrane. The membrane should be submerged in prepared 1%-2% HCl for 2hours, and then flushed with clean water

After adding medicine and cleaning, be sure to rinse with water.

Caution: The operators should very be careful in the cleaning process, to prevent the membrane thread to be broken.

10 Scope of supply

10.1 The complete plant includes:

(1)Main body and base	1set
(2)Electric control box	1set
(3)Air pump	2set
(4)Cutting pump	1set
(5)Vacuum pump	1set
(6)UV Control box	1set
(7)Pipe system accessories of equipment	1set

10.2 Spare parts (refer to list of spare parts or negotiate 1set as part of purchasing)

11 Contact us

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Chapter 12 Appendix: Drawing