

SWCM (I) 型船用生活污水处理装置
SWCM (I) Type Marine Sewage Treatment Plant

用 户 手 册
Manual

执行IMO MEPC.227(64)决议
Implement of IMO MEPC.227(64)

东台市东方船舶装配有限公司
DONGTAI CITY DONGFANG MARINE FITTING CO., LTD.

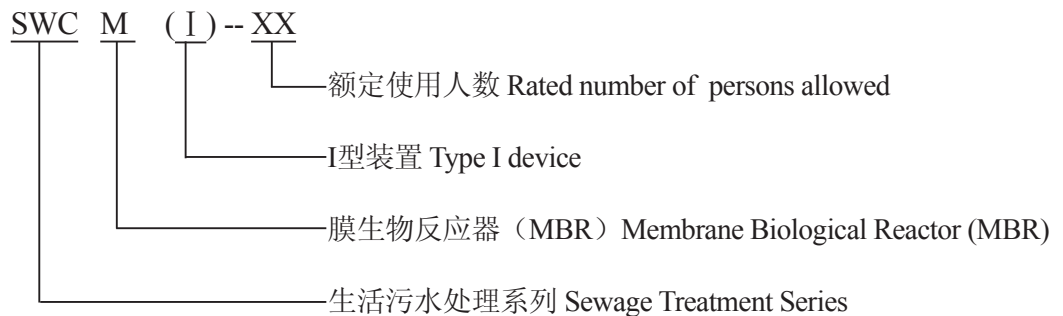


- A. 本装置可用于处理船舶使用淡水或海水冲洗的厕所污水。
The device can be used to treat toilet sewage washed by fresh water or sea water on ships.
- B. 本装置柜体的水压试验压力为0.021MPa。
The test pressure of the tank is 0.021MPa.
- C. 本装置排放水指标符合IMO.MEPC.227(64)排放标准。
The effluent quality of the device is in compliance with the standards of IMO.MEPC.227 (64) .

 **警告 WARNING**

- A. 本装置不可安装在爆炸性大气中，即非防爆型。
The plant cannot be installed in explosive atmosphere.
- B. 本装置柜内壁涂环氧沥青漆，不得在柜上再焊接。
Paint tar epoxy as that coat on inside surface of the tank, welding should not be worked on the surface of the tank.
- C. 本装置所需的操作和维修空间：建议所有操作和维修面为600mm。
It needs clear space at front of device 600 mm to allow for operation and maintenance of the device.
- D. 本装置在使用过程中不得使用任何杀毒剂。
Any disinfectants can't be used in the progress of device using.

型号说明 Type description





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Chapter 1 前言 Preface

船用生活污水处理装置属IMO国际防止船舶造成海洋污染公约《MARPOL 73/78》附则IV的关键设备。本系列装置遵守2012年10月5日颁布的MEPC.227(64)决议要求，用于处理船上来自厕所的粪便污水（又称黑水），处理过程中不添加任何稀释水、灰水、处理水和（或）海水。本系列装置不适用于特殊区域（指波罗的海）排放生活污水的客船，不考虑总氮和总磷性能指标的要求。本装置将适用于2016年1月1日或以后在下列船舶上安装的生活污水处理装置：

Marine domestic sewage treatment equipment is a key equipment of the IMO International Convention for the Prevention of Marine Pollution from Ships, MARPOL 73/78 Annex IV. This series of devices comply with the requirements of MEPC.227(64) of 5 October 2012 for the treatment of faecal sewage (also known as black water) from toilets on board ships without the addition of any diluted water, grey water, treated water and/or sea-water. This series of devices is not suitable for passenger ships discharging domestic sewage in special areas (referring to the Baltic Sea), and does not take into account the requirements of total nitrogen and total phosphorus performance indicators. This device will be applicable to domestic sewage treatment devices installed on or after January 1, 2016 on the following ships:

(1)所有区域的船舶（客船除外）

Vessels in all areas (except passenger vessels)

(2)MARPOL 附则IV特殊区域外的客船

Passenger ships outside the special area of MARPOL Annex IV

汇总各种规则和排放标准如下：

Summary all the rules and effluent standards as followings:

指标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
大肠菌群coliform (per 100ml)	100	100
PH	6~8.5	6~8.5
余氯Residual chlorine (mg/l)	<0.5	<0.5
氨氮Ammonia nitrogen(mg/l)	NR	NR

SWCM（I）型多级船用生活污水处理装置利用活性污泥、接触氧化和膜生物反应器（MBR）的原理消解有机污染物质。膜生物反应器能高效、彻底和干净地处理污水，使排放水满足IMO新标准和其他更严厉的要求。

本装置为专利产品，具有自主创新知识产权。

The SWCM(I) 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。

 **警告 WARNING**

机械危害!

在维修装置中由电动机驱动的泵时必须将船舶供应电源开关断开，并挂上“正在维修,不准合闸”的醒目标签，只有主管本装置的船员或工人才可对运转部件进行维修。

电气危害!

本装置供应有高压电源，如不小心接触人体会引起危险，在任何情况下不要随意打开控制箱的门或电动机接线盒，在需要对控制箱、电动机进行维修时，必须将供应电源的船舶开关“断开”，在打开电气控制箱门时首先拉开控制箱内电源总开关，任何人都应非常小心操作,以免引起触电的危害。

疾病危害!

生活污水通常都含有很多寄生虫机体，诸如：细菌、真菌、病菌、原生物、轮生虫等。它们多数是致病菌，意即可以引起严重的交叉感染，大多数与生活污水有关的疾病是由人的手到嘴来传播这些致病细菌，保持个人的良好卫生习惯，少接触占有污水的设备可以避免疾病的发生。

如果万一接触到污水或者被污水污染的设备时，个人应立即用消毒肥皂或洗洁精很好地清洗自己。在吃饭、喝饮料、吸烟或者任何从手到嘴的动作前特别应该清洗，如果皮肤划破应立即进行适当的医疗保护。

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.

Chapter2 技术参数 Technical Performance

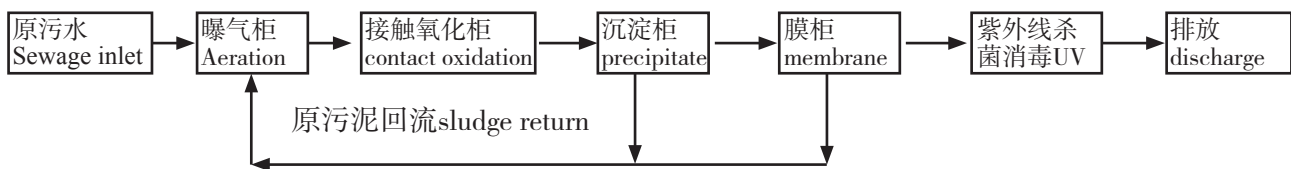
规格型号 Model		SWCM (I) -																			
		10	15	20	25	30	40	50	60	80	100	120	150	200	250	300	400	500	600		
处理负荷 LOAD	平均负荷 Average load (L/d)	770	1190	1540	1890	2310	3080	3780	4480	6020	7700	9100	11200	14700	18200	23100	30800	3850	4620		
	高峰负荷 Peak load (L/h)	97	149	193	237	289	385	473	560	753	963	1138	1400	1838	2275	2888	3850	4813	5775		
	有机负荷 Organic load (kgBOD ₅ /d)	0.385	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	19.25	23.1		
额定使用人数 Rated capacity (人)		10	15	20	25	30	40	50	60	80	100	120	150	200	250	300	400	500	600		
最大使用人数 Max capacity (人)		11	17	22	27	33	44	54	64	86	110	130	160	210	260	330	440	550	660		
电制 (可选) Electricity		AC 380V、50Hz、3φ/AC 415V、50Hz、3φ/AC 440、60Hz、3φ/AC 480V、60Hz、3φ																			
功率 Power (kW)		2.25	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	11	11		
外形尺寸 Outline dimension (mm) 长×宽×高		1300 × 1150 × 1250	1850 × 1200 × 1450	1680 × 1400 × 1570	1890 × 1400 × 1560	1980 × 1500 × 1650	2320 × 1700 × 1880	2320 × 1600 × 1700	2320 × 1700 × 1880	2650 × 1700 × 1860	2800× 1900× 2090	2800 × 2100 × 2300	3030 × 2100 × 2300	3090 × 2250 × 2390	3640 × 2250 × 2390	3890 × 2450 × 2580	4790 × 2450 × 2600	5980 × 2450 × 2600	6680 × 2450 × 2600	7680 × 2450 × 2600	
重量 Weight		干重 Dry weight (kg)		900		1000	1100	1200	1300	1450	1600	1850	2200	2300	2800	3000	3300	3700	4200	4700	5200
重量 Weight		湿重 Wet weight (kg)		1900		2283	2640	2740	3500	4400	5270	6517	8268	9166	11340	13267	16538	20357	25417	31543	35870
排放指标 Effluent standard		BOD ₅ ≥ 25 Qi/Qe mg/L, COD ≥ 125 Qi/Qe mg/L, TSS ≥ 35 Qi/Qe mg/L, coliform ≥ 100/100ml, PH6 ~ 8.5, CL ₂ < 0.5mg/L																			

Chapter 3 基本工作原理 System Principles

3.1 系统处理流程 System processe (请参照系统原理图)

本装置采用活性污泥、接触氧化和膜生物反应器 (MBR) 的处理原理来消解污水中的有机污染物质。MBR 能达到高效、彻底和干净地处理污水，使排放水满足IMO 新标准和其他更严厉的要求，其处理流程为：

The device adopts activated sludge, contact oxidizing and principle of biologic membrane to digest the organic pollutant, which can treat sewage effectively and meet the IMO new effluent standard or other stricter requirements. The treatment procedures of the plants are shown as following:



在**一级曝气柜**内以好氧菌为主的活性污泥菌团形成象棉絮状带有粘性的絮体吸附有机物质，在充氧的条件下消解有机物质变成无害的二氧化碳和水，同时活性污泥得到繁殖，在作为菌胶团营养的有机污染物质减少时细菌成饥饿状态以致死亡，死亡的细胞就成为附着在活性污泥中的原生物和后动物的食物所吞噬，粪便污水中95%以上是易消解的有机物质，完全被氧化。

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.

在**二级接触氧化柜**内悬挂有软性生物膜填料，具有吸附消解有机物功能的生物膜在水中自由飘动，大部分原生物寄居于纤维生物膜内，同样由于充氧的作用，有机物质进一步与生物膜接触氧化分解。如果停机一段时间再起动的的话，由于生物膜中尚有细菌的孢子存活，因此比常规曝气法起动时间要快得多。同时软性填料像棉桃一样，营养过剩时会涨开，吸附过剩的污泥；营养差时会慢慢消化自己，又称“内源呼吸”，“棉桃”萎缩，等待食物。

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.

污水随后进入沉淀柜，沉淀柜由于不曝气，活性污泥将不断地沉淀。污泥沉淀物被自动定期“气提”返送到一级曝气柜内进行循环处理。有一部分活性污泥会上浮，上浮污泥会被自动定期吹散，继续沉淀。沉淀柜内沉淀后的上清液流入膜柜，为膜组创造了良好的运行条件。

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.

膜柜内置有浸没式膜组，同时也通过曝气参与生化反应，所以又称膜生物反应器（MBR）。膜为中空纤维超滤材料，由真空泵抽吸渗过膜的清水，再经过紫外线消毒杀菌，就可达到排放标准，排放至舷外，或船上清水舱。装置设计了自动提升程序，用于膜柜内浓缩污水的沉淀物提升，在真空泵工作情况下，膜柜污泥提升电磁阀SV2每隔30min打开一次，提升膜柜污泥至第一级。

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 cabinet sludge lifting solenoid valve SV2 is opened every 30min to lift the membrane cabinet sludge to the first stage.

注：只有在真空泵工作的情况下，装置才可以膜柜污泥提升。

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

真空泵运行过程中，自动运行9min，停抽1min，在泵停抽期间，膜丝上结成的污垢因没有吸附力而自动掉下，同时曝气一直不停，这有利于膜丝的擦洗，延长了膜的清洗周期。由于膜柜设计成单独封闭结构，清洗时不需要提出膜组，可以采用“在线”清洗方式，只需向膜柜内添加清洗化学品，同时加以曝气，像洗衣机一样，可很快去除膜丝上的结垢。清洗后出水量可恢复到原来的水平。如光浸泡不曝气，效果往往不佳。污泥排放周期视污水水质和负荷而定，一般6~9个月左右排放一次多余污泥是适当的。污泥排放判定：在正常运行状态下，从曝气柜取样口用1000ml玻璃量筒取出含有悬浮物的液体，静止30min后，如沉淀物界面超过50%时，此时应将污泥排放至舷外或排入船厂提供的贮存柜。操作步骤详见“污泥排放”。

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 主要配套件 Main spare parts

(1) 气泵 Air pump

气泵用于向装置供送压缩空气，本装置气泵配有主气泵和提升气泵，两者结构一样，所起功能不同。主气泵主要是用来向曝气柜和接触氧化柜曝气。提升气泵主要是用来提升膜柜和沉淀柜污泥至曝气柜，同时也向膜柜曝气。

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.

(2) 粉碎排放泵 Cutting and discharge pump

粉碎排放泵为带刀离心泵，用于污水的循环粉碎，使打浆后的污水容易被分解；在应急情况下，也可直接将污水排放至舷外。或在清洗柜体时，可以排空各柜内污泥、污水，此时只需打开各柜相应的底阀。

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) 真空泵 Vacuum pump

真空泵具有较强的吸取能力，但正常运行时真空泵吸入管内最好不能脱水，以免下次启动困难。真空泵能在膜丝内外形成一定的压差，使水渗透过膜后排出。如果膜因污染堵塞，抽吸不畅，则排水量下降，最终造成装置高水位报警。

The vacuum pump has a strong suction ability, but it is best not to dehydrate the suction tube of the vacuum pump during normal operation, so as to avoid difficulty in the next startup. The vacuum pump can form a certain pressure difference inside and outside the membrane filament, so that water permeates the membrane and then comes out. If the membrane is blocked due to pollution and the suction is not smooth, the displacement

will decrease, and eventually cause the device to alarm the high water level.

(4) 紫外线杀菌灯 (UV) Ultraviolet ray sterilizer

紫外线杀菌灯的消毒原理是利用适当波长的紫外线破坏微生物机体细胞中的DNA(脱氧核糖核酸)或RNA(核糖核酸)的分子结构,造成生长性细胞死亡和(或)再生性细胞死亡,使大肠菌群符合排放标准。主要元件为紫外线灯管,如需维修时,请参阅《JX-UV型紫外线杀菌消毒器使用说明书》。

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 coli form 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:

(5) 电气控制箱 Electric control box

电气控制箱用以实现装置的自动控制、保护和程序控制的功能。

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

Chapter 4 安装要求 Installation

4.1 管路连接Pipe connection

(1) 污水入口管系Sewage inlet pipe:

从厕所来的污水分成两路，一路至舷外，另一路进入本装置，其间用截止阀隔开，两个阀应尽量相近。

The sewage from toilet is divided into two roads, one road is led to overboard, the other road is led into the device. They are separated by check valves. The two valves should be placed as near as possible.

(2) 排放水管系Discharging water pipe:

粉碎排放泵吸入口同时与曝气柜、沉淀柜、膜柜相连，其间分别用球阀相隔。一般情况下，曝气柜球阀V1，V7常开，污水在曝气柜内不断循环粉碎。应急时，打开应急排放阀V6，关闭阀V7，可将经粉碎后的污水直接从排放泵出口排至舷外或国际通岸接头；如关闭阀V1、V7，打开阀V6、V8，则可排放经生化消解、沉淀处理过的污水；正常排放水由真空泵从膜柜排放至舷外。

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.

注意：安装合格排放水管时由合格排放水口接至舷外，舷壁应加装防浪止回阀，如在水线以上，排放水管应做成防倒虹管，防止污水从装置虹吸至舷外。

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.

(3) 通气管系Ventilation Pipe:

在一级曝气柜顶部有一通气口，安装时用管道从装置通气口引出，通至上甲板高出甲板3米，并带有鹅颈弯管，管口加防火星网（船厂自配），经好氧分解的废气虽然不像一般贮存柜那样有恶臭和甲烷气体，但也应远离生活区或居室窗口。防火星网可根据装置通气口的大小选择相应的规格（具体请查询《船用管系附件》或征询本公司）。

There is an vent port on the top of the aeration tank. When installing, 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 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 model 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).

注意：通气管应保持其畅通，不得有“盛水弯”，防止“盛水弯”积水堵塞管路。

Note: Transport pockets should not exist in pipe lines to prevent transport pockets blocking up pipe lines, In addition vent pipe should be smooth, can't be added any addendum.

(4) 空气管系 Air pipe:

主气泵A1的压缩空气通过V11进入一级曝气柜和二级接触氧化柜曝气。提升气泵A2的压缩空气通过V10分成四路，一路接电磁阀SV1，向膜柜内曝气；另三路分别接电磁阀SV2, SV3, SV4，用于膜柜和沉淀柜内沉淀污泥的提升，吹浮渣。如某个气泵出现故障，需要维修时，可打开阀V9，然后关闭阀V10或V11,保持装置内部得到供气，防止装置长期缺氧出现危险。

The compressed air of the main air pump A1 enters the primary aeration tank and the secondary contact oxidation tank through V11 for aeration. The compressed air of the lifting air pump A2 is divided into four channels through V10, one of which is connected with the solenoid valve SV1 and aerated into the membrane cabinet. The other three are connected with solenoid valves SV2, SV3, SV4 respectively, which are used to lift the sediment sludge in the membrane cabinet and the sedimentation cabinet, and blow the scum. If an air pump fails and needs to be repaired, the valve V9 can be opened, and then the valve V10 or V11 can be closed to keep the gas supplied inside the device and prevent the device from long-term hypoxia.

(5) 溢流管系 Emergency overflow pipe:

当装置出现故障（自动控制或高位报警失控等），不能将污水正常排出时，可通过沉淀柜上部的应急溢流口溢流至污水舱。沉淀柜上部的应急溢流口应用船厂提供的溢流管连接至舱底。

When the device fails (automatic control or high alarm is out of control, etc.) and the sewage cannot be discharged normally, it can be overflowed to the sewage tank through the emergency overflow port on the upper part of the sedimentation cabinet. The emergency outlet on the top of settling tank is connected to the bilge of the ship by overflow pipe. The emergency overflow pipe should be provided by shipyard.

注意：溢流口应时刻保持畅通，不得外加任何附加物。

Note: Keep the overflow outlet unblocked. There couldn't be any accessories.

(6) 冲洗水管 Flushing water pipe:

船上消防水系统应引一路至本装置冲洗水入口处供清洗柜子时使用，船厂应装截止阀，冲洗水压力不得大于0.3Mpa（建议压力为0.1MPa），冲洗水尽量使用淡水。

One pipe of the firefighting system onboard should be connected to the flushing water inlet of the device for using when cleaning tank. The shipyard should install a check valve. The flushing water pressure can't be more than 0.3Mpa (usually is 0.1Mpa). Rinse water use fresh water as much as possible.

(7) 污泥排放管系 Emergency discharging pipe:

应急排放管直接从粉碎泵出口接至舷外和船上贮存柜。

The emergency drain line is connected directly from the cutting pump outlet to the outboard and onboard storage tank.

4.2 安装 Installations

(1) 本系列装置备有公共底座，用不同规格槽钢焊接而成，船厂自制的船舶基座与公共底座应相配，采用焊接或螺栓连接。若焊接，公共底座和船舶底座都应在四周连续满焊，保证足够强度；若螺栓连接，连接螺栓数量应符合各型号装置底座螺栓孔实际数量。

(1) This series of devices is equipped with a common base, welded with different specifications of channel steel, the ship base made by the shipyard and the common base should match, welded or bolted connection. If welded, the common base and the ship base should be continuously welded on all sides to ensure sufficient strength; If bolts are connected, the number of bolts must be consistent with the actual number of bolt holes in the base of each device.

(2) 装置安装处四周加围框，高约80毫米用以收集可能从泵轴处漏出的污水。围框内的污水应定期用泵抽到舱底污水收集柜。

(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. The sewage in the enclosed frame should be pumped to the bilge water collecting tank.

(3) 电气控制箱外部接线完毕以后，应将机架接地。

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

(4) 装置附近应设有清洗用自来水龙头和洗手盆，还应有空间存贮化学药品，此外应保持干燥和远离可能发生爆炸的地方。

(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.

4.3 电气 Electricity

(1) 应连接AC380V、3 ϕ 、50Hz或船东要求的电源，应保证接线填料函的密封，进线时应注意电源的相序。

(1) An electric wire power supply of 3 phase, 380V, 50Hz or required by the shipowner should be connected into the electric control panel. The waterproof seal of wiring and connectors to the control box should be ensured. Into the line should pay attention to the power supply phase sequence.

(2) 控制箱留有足够的维修空间，建议大约600毫米。

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

Chapter 5 操作说明 Operation Instructions

5.1 电控箱控制面板功能 The functions of electric control box control pane

(1) 程序控制开关S1 Procedure control switch S1

程序控制开关S1有三个位置：自动、手动和公海，这三种工况独立运行，限制了各线路之间不混淆。

The procedure control switch has three positions: auto, manual and high seas. The three working conditions work independently. So circuits can't affect each others.

① 正常运行时，程序控制开关S1转向“自动”位置，用于装置正常24h无人值守连续运行；

① When the device is in normal working, turn the procedure control switch S1 to “auto” position, then the device will work continuously for 24h without guard.

② 培菌时转向“手动”位置，用于测试和培菌程序；

② When cultivating bacteria, turn the switch to “manual” to cultivate bacteria and commissioning.

③ 公海排放时转向“公海”位置，用于在公海或非规则海区，或在条件允许情况下污水不经处理就排放至舷外。

③ When discharging to high seas, turn the switch to “high seas” position to discharge to high seas or irregular sea area. If condition permission, discharge the sewage overboard without treatment.

(2) 粉碎泵P1转换开关S2 The change-over switch S2 of cutting pump P1

粉碎泵P1转换开关S2有三个位置：自动、手动和停止。

The change-over switch S2 of cutting pump P1 has three positions: auto, manual and stop.

① 当粉碎泵开关S2转向“手动”位置时，粉碎泵P1连续运转；

① When S2 is turned to “manual” position, the cutting pump P1 will work continuously.

② 当将程序控制开关S1转向“公海”位置且粉碎泵开关S2转向“自动”位置时，粉碎泵P1受PLC控制，装置液位达到沉淀柜中位M2时，粉碎泵P1自动启动，液位降至低位L2时，粉碎泵P1停止，装置执行公海排放程序，排放经过沉淀柜沉淀的上清液。

② When the program control switch S1 is turned to the "high seas" position and the cutting pump switch S2 is turned to the "automatic" position, the cutting pump P1 is controlled by PLC. When the liquid level of the device reaches the middle of the settling cabinet M2, the cutting pump P1 will automatically start. When the liquid level drops to the low level L2, the cutting pump P1 will stop. The unit performs a high seas discharge procedure, discharging the supernatant that settles in the settling cabinet.

③ 当程序控制开关S1转向“自动”位置且粉碎泵开关S2转向“自动”位置时，粉碎泵P1开5分钟，停2小时，断续运行；

③ When the procedure control switch S1 is turned to “auto” position and the S2 is turned to “auto” position, the cutting pump will work for 5min and stop for 2hours, work fitfully.

④ 当粉碎泵开关S2转向“停止”位置时，粉碎泵停止运行。

④ When S2 is turned to “stop” position, the cutting pump will stop working.

(3) 真空泵P2转换开关S3 The change-over switch S3 of Vacuum pump P2

真空泵P2转换开关S3有三个位置：自动、手动和停止。

The change-over switch S3 of vacuum pump P2 has three positions: auto, manual and stop.

①当将程序控制开关S1转向“手动”或“公海”时，真空泵P2既不能自动也不能手动；

①When the procedure switch S1 is turned to “manual” or “high seas”, the vacuum pump P2 can't work automatically and manually.

②当将程序控制开关S1转向“自动”时，真空泵P2可以执行下列程序：

②When the procedure control switch S1 is turn to “auto”, The vacuum pump can implement the following procedure:

1) 当真空泵开关S3转向“手动”，紫外线开关S10转向“手动”时，真空泵P2连续运转，真空泵运转指示灯亮，此功能仅适用于试机；

1) When the vacuum pump switch S3 turns to "manual" and the ultraviolet switch S10 turns to "manual", the vacuum pump P2 runs continuously and the vacuum pump running indicator lights up. This function is only applicable to the test machine.

2) 当真空泵开关S3转向“自动”时，水位升至M2，真空泵自动启动运行，直至水位低于L2时才全部停止。SV1电磁阀和提升气泵进行配合曝气。

2) When the vacuum pump switch S3 turns to "automatic", the water level rises to M2, and the vacuum pump automatically starts to run until the water level is lower than L2. SV1 solenoid valve and lift air pump for aeration.

3) 当真空泵开关S3转向“停止”位置时，真空泵停止运行。

3)When the S3 is turned to “stop” position,the vacuum pump will stop working.

另外程序控制上限制：当紫外线消毒器出现故障时，真空泵不得启动。

Note:The Vacuum pump shall not be started when the UV light is in trouble

(4) 主气泵A1转换开关S4 The change-over switch S4 of main air pump A1

①当主气泵开关S4转向“手动”位置时，主气泵A1连续运行；

①When S4 is turned to “manual”, the main air pump A1 will work continuously.

②当主气泵开关S4转向“自动”位置时，主气泵A1受装置内部程序自动控制运行；高于曝气柜低位L1时，低于曝气柜中位M1时，气泵A1开20分钟停20分钟，断续运行。

②When the main air pump switch S4 turns to the "automatic" position, the main air pump A1 is automatically controlled by the internal program of the device. When it is higher than the low level L1 of the aerator and lower than the middle level M1 of the aerator, the air pump A1 starts for 20 minutes, stops for 20 minutes, and runs intermittently.

③当主气泵开关S4转向“停止”位置时，主气泵A1停止运行。

③When S4 is turned to “stop”, the main air pump A1 will stop working.

(5) 提升气泵A2转换开关S5 The change-over switch S5 of lifting air pump A2

①当提升气泵开关S5转向“手动”位置时，提升气泵连续运行；

① When S5 is turned to “manual”, the lifting air pump will work continuously.

②当提升气泵开关S5转向“自动”位置，提升气泵A2受装置内部程序自动控制运行；SV1~SV4任意阀开，提升气泵工作。

② When S5 is turned to “auto”, the lifting air pump A2 will work automatically controlled by device internal procedure. SV1~SV4 Open any valve, lift the air pump work.

③当提升气泵开关S5转向“停止”位置，提升气泵A2停止运行。

③ When S5 is turned to “stop”, the lifting air pump A2 will stop working.

注意：提升气泵A2转换开关S5转向“手动”时，提升气泵连续运转，仅用于短暂试机，除非同时手动开膜柜曝气电磁阀SV1，否则，气泵闷打！

Note: When the change-over switch S5 of lifting air pump A2 is turned to “manual”, the lifting air pump will work continuously. This is just appropriated for transitory testing machine. The air pump will idle run unless opening the membrane tank manually to aerate the solenoid valve SV1.

(6) 电磁阀转换开关S6、S7、S8、S9 The change-over switches S6, S7, S8 and S9 of solenoid valves

四个电磁阀SV1、SV2、SV3、SV4分别由电磁阀转换开关S6、S7、S8、S9控制，都具有自动、手动功能，正常状态都处于“自动”，SV1阀控制膜柜曝气，SV2阀控制膜柜提升污泥，SV3阀控制污泥沉淀柜提升污泥，SV4阀门控制沉淀柜吹浮渣。

The four solenoid valves SV1, SV2, SV3 and SV4 are separately controlled by change-over switches S6, S7, S8 and S9. They all have auto and manual function. Normally they are in “auto” status. SV1 valve controls membrane tank aeration, SV2 valve controls membrane tank lifting sludge, SV3 valve controls sludge settling tank lifting sludge, SV4 valve controls sediment tank blowing scum.

(7) 紫外线灯转换开关S10 The change-over switch S10 of UV light

紫外线灯UV转换开关可以手动、自动和停止，正常情况下都处于“自动”，当需要手动时，可将转换开关转向“手动”。

The change-over switch S10 of UV light has three positions. They are manual, auto and stop. If it needs manual, please turn the change-over switch to “manual” .

(8) 指示灯 Indicator light

① 控制电源和综合报警指示灯：装置接上电源和装置发生故障综合报警时，指示灯亮。

① Control power and comprehensive alarm indicator light: When the device is plugged in and the device is alarming for the fault, the indicator will be bright.

② 电磁阀指示灯：当SV1、SV2、SV3、SV4四个电磁阀正常工作时，电磁阀对应指示灯亮。

② Indicator light of solenoid valve: When the four solenoid valves SV1, SV2, SV3 and SV4 are all in normal working status, the indicator light of solenoid valve will be bright.

③ 泵和紫外线指示灯：当主气泵A1、提升气泵A2、粉碎泵P1、真空泵P2、紫外线灯正常工作时，指示灯亮。

③ The indicator lights of pumps and UV light: When the main air pump A1, lifting air pump A2, cutting pump P1, vacuum pump P2 and UV light are all in normal working status, the indicator light will be bright.

④ 液位控制指示灯: 当装置液位分别达到曝气柜的低液位L1、中液位M1、高液位H1, 膜柜的低液位L2、中液位M2、高液位H2时, 指示灯亮。

④ The indicator light of liquid level control: When the liquid level in device reaches the low level L1, middle level M1, high level H1 in aeration tank and the low level L2, middle level M2, high level H2 in membrane tank separately, the indicator light will be bright.

(9) 消声按钮TA1 Noise elimination button TA1:

按下消音按钮TA1, 综合报警声消失。

Press the noise elimination button TA1, the comprehensive alarm sound will disappear.

5.2 正常运行前的准备 The preparation before normal work

(1) 检查电气控制箱电源是否符合设计要求, 合上电源开关和各分开关, 检查泵转向是否正确, 如不对, 应进行调整。(出厂时设备已试验, 泵方向不对只需调整总电源相序。)

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

(2) 装置启动前, 打开冲洗水口外接冲洗水球阀向装置内灌清水至中水位M2, 检查柜体、阀门和管系附件是否有渗漏。

(2) Before starting the plant, open the flushing water ball valve at the place of flushing water outlet and feed water into plant until the water level is up to M2 position. Check whether the tank body, valves and piping have leakages.

5.3 “培菌”操作 Breeding bacteria

新装置必须在进行“培菌”后, 方可处理原污水。(培菌温度在20℃~25℃为最佳) 低于5℃需加温。

The new plant should have the “breeding bacteria” procedure before raw sewage treatment. (Incubation temperature of 20℃~25℃ is the best) below 5℃ need to be warmed.

将程序控制开关S1转向“手动”位置, 即培菌程序。粉碎泵P1转换开关S2、真空泵P2转换开关S3转向“停止”位置, 主气泵A1转换开关S4、提升泵A2转换开关S5转向“停止”位置, 手动关闭阀V2、V3、V4、V5、V6、V8、V9, 打开气源阀V10、V11、V15和V16。此时, 装置完全由人工控制, 需要仔细监视。

培菌前先将设备清水排放到膜柜液位“L2”位置, 然后打开污水入口阀, 让污水缓慢流入, 当装置内液位到达M2时关闭。然后将粉碎泵P1转换开关S2转向“自动”, P1泵启动, 将污水在曝气柜内循环粉碎, 将主气泵A1转换开关S4转向“手动”, 主气泵A1泵连续运行, 对污水进行“闷曝”培菌。一天后, 将主气泵A1转换开关S4转向“停止”位置, 1小时后将提升气泵A2转换开关S5、

电磁阀 SV3转换开关S8转向“手动”，回流沉淀柜 污泥至回流管水清后停止。根据污水浓度，可向装置内适当添加营养物质，如化肥等。关闭阀V1、V7、打开阀V6、V8，将粉碎泵P1转换开关S2转向“手动”，向舷外排放少量的污水，直至液位至L2 时停止，关闭阀V6、V8，打开阀V1、V7。如上所述，再次进入原污水，如此反复操作，对菌种进行培养。原污水培菌需要根据原污水有机物含量、含盐度、新鲜度来决定培菌时间长短，一般淡水30天~40天，海水60天~80天，如能加入“种泥”菌种可缩短培养时间。

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 completely 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.

可以用1000ml量筒从曝气柜取样口取出1000ml污水，观察活性污泥的培养状态如何。静止沉淀20~30分钟后，污泥沉降体积如能达到1/3即30%，污泥的形态正常了，培菌过程就完成了，污泥的形态为棉絮状，沉淀后的水为透明色。

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.

注意：培菌时V5阀门不能打开，不能让含有杂质的污水进入膜柜。

Note:When culture bacteria the V5 valve can not be opened.Sewage containing impurities must not be allowed to enter the membrane cabinet

5.4 正常运行 Normal operations

(1)将程序控制开关S1转向“自动”位置。

(1) Turn the procedure control switch S1 to "auto" position.

(2) 手动打开阀V1、V5、V7、V10、V11、V12(需调节)、V13、V15、V16, 关闭V2、V3、V4、V6、V8、V9、V14, 将粉碎泵P1转换开关S2转向“自动”位置, 粉碎泵断续循环粉碎污水, 开5min, 停2小时。

(2) 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 change-over switch S2 of cutting pump P1 to "auto" position. The cutting pump will smash sewage intermit-tently and circularly, start 5min and stop 2hours.

(3) 将程序控制开关S1转向“自动”位置。

(3) Turn the procedure control switch S1 to "auto" position.

(4)将紫外线UV开关、各电磁阀(SV1~SV4)转换开关(S6~S10)转向“自动”位置。

(4) Turn the UV switch and the transfer switch (S6 to S10) of each solenoid valve (SV1 to SV4) to the "automatic" position.

(5)将提升气泵A2转换开关S5转向“自动”位置, 提升气泵向膜柜供气并按各程序运行, 返送污泥。

(5) Turn the change-over switch S5 of lifting air pump A2 to "auto" position, A2 will be operated according the procedure.

(6)将真空泵P2转换开关S3转向“自动”位置, 真空泵按膜柜水位运行, 中位启动、低位停止。(运行过程中开9min, 停1min)

(6) Turn the change-over switch S3 of 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. (Run 9min, stop 1min)

(7)常开污水入口阀, 让污水缓慢流入装置。

(7) Open the inlet valve of raw sewage and let the sewage enter into the plant.

(8)手动调节真空泵的进口阀V12的开度, 按本说明书第2部分各型号装置标定的平均负荷(平均负荷除以24得出小时流量)控制排放流量, 如太高会引起跨膜压差太大; 太小会引起水位超高。

(8) Manually adjust the opening of the inlet valve V12 of the vacuum pump, and control the discharge flow according to the average load (average load divided by 24 hours of flow) calibrated for each type of device in Part 2 of this manual. If it is too high, the transmembrane pressure difference will be too large; Too small will cause the water level to rise too high.

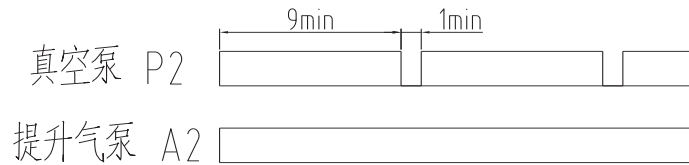
注意: 真空泵P2在运转时, 膜柜必须供气。水位低于L2时, 不能手动开启真空泵!

Note: When vacuum pump P2 is in operation, the membrane cabinet must supply gas. When the water level is lower than L2, do not manually start the vacuum pump!

膜不能在原污水内工作!!! Membrane can not work in the original sewage!!

(9)当装置液位达到M2时, 真空泵将自动启动运转, 同时执行“开9分钟, 停1分钟”程序。在真空泵停1分钟时提升气泵不停, 使得膜丝自动清洁, 参阅图1。

(9) When the liquid level of the device reaches M2, the vacuum pump will automatically start and run, and execute the program of "on for 9 minutes, stop for 1 minute". When the vacuum pump stops for 1 minute, the air pump is lifted to make the film wire clean automatically. (see Figure 1).



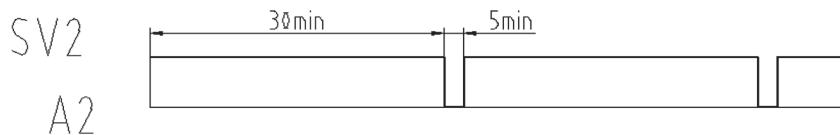
至此，装置进入正常运转状态。Thus, the plant enters into normal operation status

(10) 污泥的自动返送

(10) the auto-return of sludge

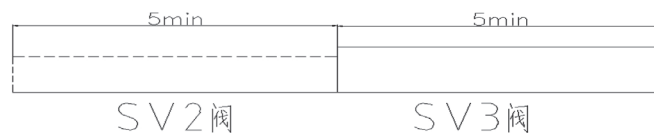
1) 膜柜内的污泥会按程序设计自动返送，每30min会自动打开SV2电磁阀5min，提升膜柜污泥返送至第一级，参阅图2。

1)The sludge in the membrane cabinet will be automatically returned according to the program design, and the SV2 solenoid valve will be automatically opened for 5 minutes every 30 minutes to lift the membrane cabinet sludge back to the first stage of the aeration cabinet. (see Figure 2).



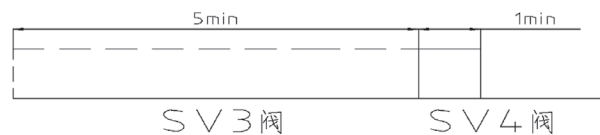
2) 沉淀柜内的污泥提升：SV2阀打开5分钟后，SV3电磁阀随即打开5min，提升沉淀柜污泥返送至第一级，参阅图3。

2) Sludge lifting in settling tank: After the valve SV2 is opened for 5min, solenoid valve SV3 is opened for 5min immediately, lift the sludge in settling tank and return it to the 1st stage. (see Figure 3).



3) 当沉淀柜污泥提升5分钟后，SV4电磁阀随即打开1分钟，用于吹沉淀柜内的浮渣，参阅图4。

3)After the sludge in settling tank is lifted for 5min, valve SV4 is opened for 1min immediately to blow down the scum on surface of water in settling tank, (see Figure 4).



4) 工作流程：每30min SV2阀工作5min；SV2阀工作5min后，SV3阀工作5min；SV3阀工作5min后，SV4阀工作1min，以此类推。

4)Work flow: SV2 valve works for 5min every 30min; SV2 valve work for 5 minutes, SV3 valve work for 5 minutes; SV3 valve works for 5 minutes, SV4 valve works for 1 minute, and so on.

5.5 综合报警 Comprehensive alarm

当装置内液位到达高位H1, H2时, 装置将发出高位报警, 并将报警信号远传至集控台, 提醒船员暂停冲洗厕所, 如长期高位, 操作人员应至现场检查。

When the liquid level in the device reaches high H1, H2, the device will send a high level alarm, and the alarm signal will be transmitted to the centralized control console to remind the crew to suspend flushing the toilet, such as long-term high, the operator should go to the scene for inspection.

5.6 公海排放 International Seas

在公海或非规则海区, 按国际公约规定, 可以排放未经处理的污水。

有二种操作方法:

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)关闭装置污水进口阀, 将污水直接排至舷外, 此时, 应将主气泵控制开关转向“自动”位置让气泵间隙曝气, 使菌种不至饿死, 以备下次能够快速启动装置。

(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)不关闭装置污水进口阀, 继续让污水进入, 此时, 应将程序控制开关S1转向“公海排放”位置, 打开阀V6、V8, 关闭V1、V2、V3、V4、V5、V7。将粉碎泵P1转换开关S2转向“自动”; 真空泵转换开关S3转向“停止”, 膜组和真空泵不工作; 主气泵转换开关S4转向“手动”位置, 主气泵将持续运转, 提升气泵转换开关S5转向“自动”; 电磁阀SV1~SV4转换开关S6~S9转向“自动”位置, 可以排放经过处理沉淀后的污水。

(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.

5.7 污泥排放 The sludge discharge

(1)在正常运行状态下, 从曝气柜取样口用1000ml量筒取出含有悬浮物的液体, 静止30min后, 如沉淀物界面超过50%时, 此时应将曝气柜多余污泥排放至舷外(离岸12海里)或排入船厂提供的贮存柜。检查污泥浓度需要每星期进行一次。

(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)排放污泥时，关闭阀V7，打开阀V6，V1，手动启动粉碎泵，将曝气柜和接触氧化柜内污泥排去，待液位降至L1时，手动停止排放泵。

(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)污泥排放周期一般为6~9个月左右（供参考），且一定要在公海内排放，所以当船舶航行于公海时，污泥沉淀物超过30%，可以将污泥排去一些，排至“曝气柜”L1灯熄灭，以保留一定量的菌种，用于装置的重启。

(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)《MARPOL73/78公约》允许在距陆地3海里外排放经消毒处理过的污水，在距陆地12海里外排放原污水。在码头上或有污水接收船时，可通过通岸接头排放污泥。

(4) The MARPOL73/78 allows to 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 has recycle vessel, the sludge can be discharged by shore connection.

5.8 零负荷 “Zero Load”

“零负荷”意味着一段时间内（>1天）无污水进入。为保持菌种不死亡，可将主气泵A1转换开关S4转向“自动”，间断供气，减少氧气供应量，使菌种休眠、内耗，以备下次启动时会很快进入稳定状态。“零负荷”应在水位至L1以上时进行操作（基本工作原理内有说明）。大于七天，需向设备内加入葡萄糖等营养保持细菌存货。

"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.

5.9 停机 Stop

如打算长期不使用装置（>3个月），应关闭原污水进口阀，将柜内污水排空，打开冲洗水进口阀，使用清水对柜体进行冲洗2次，通过打开V1、V3、V4、V6及泵将水排空，或直接打开V2阀将水排空。最后切断电源。

If you do not intend to use the device for a long time (> 3 months), you should close the original sewage inlet valve, drain the sewage in the cabinet, open the flushing water inlet valve, flush the cabinet with clean water twice, and empty the water by opening V1, V3, V4, V6 and the pump, or directly open the V2 valve to drain the water. Finally cut off the power.

Chapter 6 常见故障及排除 Trouble shooting

序号 No.	故障 Trouble	可能原因 Possible cause	排除方法 Suggestion
1	曝气柜H1高位报警 而膜柜H2不高位报警 H1 is warning, H2 not	装置内部接触氧化柜至沉淀柜管路堵塞 The pipeline between contact oxidation tank and settling tank is blocked.	清理此段管路 Clean the pipe
2	曝气柜H1高位报警 而膜柜H2也高位报警 H1 and H2 are warning	看流量计, 如在额定流量以上, 则可能 瞬时用厕高峰。Read the flow meter, if above rated flow capacity, may caused by peak load.	暂时停用厕所 Stop using the toilet for a while
		看流量计, 如在额定流量以下, 排放管 路不畅。 Look at the flow meter, such as below the rated flow, the discharge pipe is not smooth.	检查出口管路 check outlet pipes
		看流量计, 如在额定流量以下, 则可能 膜污染。Read the flow meter, if below rated flow capacity, may caused by membrane pollution	清洗膜 Clean the membrane
3	气泵声音异常 Voice of air pump is abnormal	出口阀未开。 The outlet valve is not opened	打开出口阀 Open the outlet valve
		气泵滑片磨损。 Slide vane is damaged	换滑片或换泵 Replace the slide vane or replace the air pump
		提升气泵因电磁阀未同步开。 The lifting air pump is not opened synchronously for the problem of solenoid valve	检查控制线路 Check the control circuit
4	真空泵声音异常Voice of vacuum pump is abnormal	吸入不畅。 Suction is not smooth	检查管路, 调节V12阀 Check the pipe and adjust the V12 valve
		无水, 膜污染, 堵死 No water, membrane pollution, blockage	清洗膜 Clean the membrane
5	电磁阀SV3半小时未开 Solenoid valve SV3 has not opened for half an hour	沉淀柜污泥不能定期提升。 The sludge in settling tank can not be lifted regularly	检查控制线路和电磁阀 Check control lines and solenoid valves
6	电磁阀SV2不提送污泥 SV2 does not lift and return the sludge	提升气泵不同步。 Lifting air pump is not synchronous	检查控制线路 Check the control circuit
7	紫外线灯不亮UV-lamp is not lighting	紫外线控制板或灯管损坏。 The UV control panel or lamp tube is damaged	换灯管或紫外线控制板 Change the lamp tube or UV control panel
8	装置运行不正确Wrong operation of device	程序开关位置与阀的开关情况不符合 The procedure switch position is not comply with the condition of valve switch	仔细阅读说明书Read the 3 procedures carefully in manual book
9	出水水质不佳 Water quality is not qualified	活性污泥不好 Activated sludge is not enough or qualified	培菌 Breeding bacteria
		膜寿命到了The membrane is out of order	换膜Replace membrane

Chapter 7 维护保养 Maintenance

7.1 粉碎泵 Cutting pump

(1) 用途 Purpose:

粉碎泵安装在装置前方，用于循环粉碎曝气柜内的污水，也可排放本体各腔污泥，此泵具有粉碎的功能，在公海排放和应急排放时作排放泵。

The cutting pump is installed in front of the device, which is used for circulating and cutting the sewage in the aeration tank, and can also discharge the sludge in each chamber of the body. The pump has the function of cutting, and is used as a discharge pump in the discharge of the open sea and emergency discharge.

(2) 运行和保养 Operation and maintenance:

① 如果发现泵有泄漏，应及时停机检查，关闭阀门，以免烧坏电机，必要时更换密封圈。泵正常运转时密封圈泄漏量应小于10ml/h。

① If the pump is found leaked, it is needed to stop and check, close valves in order to avoid causing electrical burn. Replace a new seal ring when necessary. When the pump is working normally, the leakage of sealing ring should be less than 10ml/h.

② 应定期（1个月）通过泵体上的加油杯注入钙钠基润滑脂至泵的轴封之间，以便润滑油封及轴衬。

② Calcium and sodium base grease should be injected periodically (1 month) between the shaft seal of the pump through the oil cup on the pump body to facilitate the lubricating oil seal and the bushing.

③ 泵长时间不用，应拆下清洗干净，并注意拆装时机械密封圈两密封面不得碰损。装回时应涂上适量润滑油，妥善保存。

③ When the long period of time without using, it is needed to remove it to clean. When removing, please don't damage the two sealing faces of mechanical seal ring. Please coat a right amount of lube oil when reassembling and keep it somewhere safe.

④ 泵不得空运转，以免烧坏密封圈。

④ The pump can't idle run in order to avoid burning out the seal ring.

7.2 气泵 Air pump

① 气泵应布置在清洁、通风和室温环境。

① The air pump should be installed in a stable location in a clear well ventilated and room temperature environment.

② 泵内禁止水或油等液体吸入。

② Water or oil and other liquids are prohibited in the pump.

③ 应经常保持空气吸入滤器及滤网的清洁，每二个月应清洗一次。

③ The air pump filter and the filter element should be kept clean, clean them once every two months.

④ 不要损伤或磨擦机械表面,不要让灰尘进入气泵。

- ④ Do not touch the machined surface and do not allow dirt or debris to enter into the air pump.
- ⑤ 气泵内表面应用干净的布清洁。
- ⑤ Clear inside surface of the air pump with a clean dry cloth.
- ⑥ 贮存仓库期间应采取防锈和防潮处理。
- ⑥ When the plant is stored, the pump shall be kept from rust and moisture.

7.3 电气控制箱 Electric control box

注意: 维护保养时, 要保证外部电源开关处于“断开”位置, 控制箱内电源断路器处于“断开”位置。

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

(1) 拆卸 Removal

在拆卸某几个电气元件时不必将整个电气元件板拆下来, 检查某个电气元件时应该先拆去接线, 注意电线上的标记和代号, 在必须拆下电气元件时才取下该电气元件。

Replacement of control box components does not require removal of entire panel. When checking the components and removing wires, pay attention to the mark and code of wire for reassembly.

(2) 再装配 Reassembly

当必须更换某个损坏的电气元件时, 应参照电气原理图及原来的接线编号连接电线, 只有当确认接线无误后才可以合闸通电试验。

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.

7.4 膜组 Membrane module

(1) 膜的存放 The storage of membrane

如果船舶长期停留寒冷地区, 装置所处温度在 0°C 以下时, 应对膜采取如下防冻措施: 配20~60% (体积百分比) 的乙二醇作为防冻剂, 其冰点为 -49°C , 灌进膜柜, 此防冻剂对膜和塑料没有损伤, 浓度愈大, 结冰点愈低。

If the vessel should stay on a cold area for a long time and the device is in a place where is lower than 0°C , please do the following anti-freezing measures: Mix ethylene glycol of 20~60% as antifreeze solution whose freezing point is -49°C . 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.

注意: 本装置膜柜内存有水, 不能在 0°C 以下运行、运输和存储, 若在 0°C 以下要有防冻措施。膜分开保存例外!

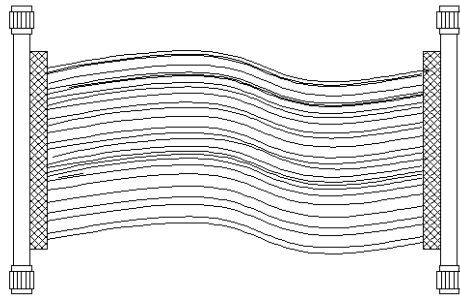
Warning: The membrane modules can't function in subzero water. And they also can't be placed in environment of subzero temperature except being stored separately when transiting or storing the plant.

(2) 膜组件的结构、安装 The structure and installation of membrane module

① 膜组件（以下称膜片）结构 Membrane module (hereinafter called MBR-module) structure:

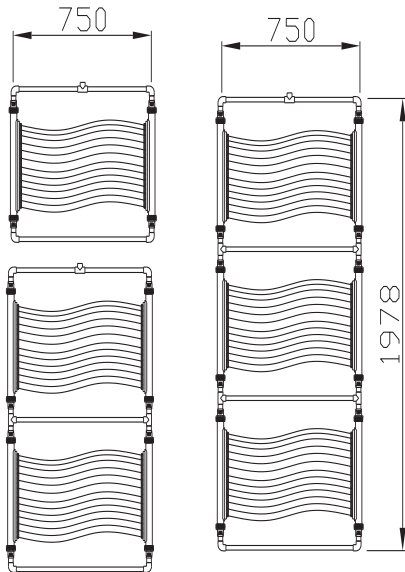
本系列装置采用KH-MBR-8、18型膜片，其结构示意图如下：

There is KH-MBR-8.18 type piece in SWCM type STP. It's diagram of structure size as follows:



膜片外形图 KH-MBR of MBR-pieces

② KH-MBR型膜片的连接方式 KH-MBR type MBR-module connection manner



在实际使用过程中，KH-MBR型膜片可以根据需要以单片、多片为一组，作为一个单元，固定在膜柜内的膜架上。在本系列装置中，采用了1片、或2片、或3片连接为一组，它们的连接方式和尺寸见附图。在使用过程中，膜丝与生化池内的液面呈平行状态。

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.

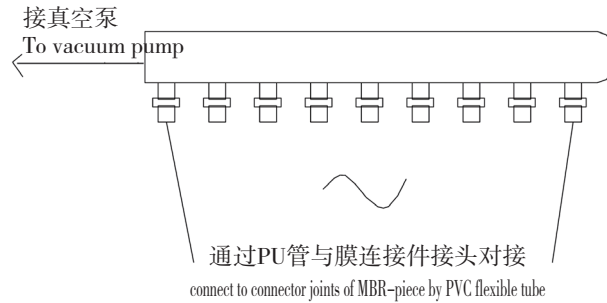
③ 膜片集水管 Water collection pipe of MBR-module

膜片安装在膜柜内固定的膜架上，所有膜片的出水口并联接到一根出水管上，称为集水管。集水管上根据膜组的数量，安装了相应的接口。集水管和真空泵连接，膜片出水通过真空泵抽吸出水。

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.

膜片连接件的气密接头和收集管的气密接头之间用PU软管连接。

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



④ 膜片的安装步骤和注意事项 Installation steps of MBR-module and related items

1) 在更换新膜片时，须在膜柜中固定好膜片机架，防止振动，摇晃。

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

2) 向曝气柜中注入待处理的污水，按照活性污泥生化处理方法，驯化和接种污泥。

2) At the 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.

3) 待污泥培养活性比较好，沉降比为20~30%时，才可以打进膜柜的阀V5，让污水进入。

3) Only open the membrane tank inlet valve V5 when the sludge activity is good and the settlement ratio is 20-30%.

4) 膜片的安装按照前述组装方式，接好各膜片之间的活接和连接件。在安装时，注意放置密封垫圈，并把活接旋紧。

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

5) 膜组连接好了后，顺着膜片机架的插槽，将膜组插入膜插槽内，最后将膜组出水口和集水管的接口连接上。

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) 为了防止膜片在生化处理池曝气时浮起来，将膜片安装进膜插槽后，再用固定杆固定住。

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

7) 膜片安装完成后必须确保所有膜丝浸没水中，防止膜片失水。

7) The membrane threads should be submerged in the water, to prevent the MBR-module from losing water.

8) 在安装膜片之前检查一下包装箱，看看密封袋是否破裂，如果膜片的保护液留失干了后，需要按下述方法重新处理，或请咨询有关技术人员。

8) 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.

(3)膜使用注意事项Matters needed attention when using membrane

① 本公司提供给客户的产品是已经经过亲水化处理的产品，装在MBR反应器内后可以直接使用。

① The products provided to our clients have been pretreated, and can be used directly after being installed in the MBR reactor.

② 为了节约膜的使用寿命，操作使用得当可有较大裨益。特别是在公海和非规则海区，污水还是海洋生物的营养物质，大海有一定的自净的能力，可使用本装置的“公海程序”对污水进行排放，这样可延长膜的使用寿命。

② 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.

③ 在正常运行时，膜柜的污水来自沉淀柜，一般不会有大的固体颗粒，对膜的损伤较小，在使用冲洗水对膜柜进行清洗时，**冲洗水尽量使用淡水，海水清洗会对膜渗透增加负担。**

③ 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.

(4)膜的清洗Membrane cleaning

本装置对膜通量的设计有足够的余量，预计膜的生命在5年左右，但当排放流量下降至70%并且调整真空泵进口调节阀开度后，流量计读数无明显变化时，则应对膜组进行化学清洗。

The device on the membrane flux design has sufficient margin is expected to the service life of the membrane in 5 years or so, but when discharge decreased to 70% and adjust vacuum pump inlet adjusting valve opening and flow meter readings without significant changes, with membrane chemical cleaning.

流量计读数Flow meter reading (数据供参考, 非绝对值Data for reference, not absolute value) :

型号Type	正常使用时流量计读数 Flow meter reading (LPM)	膜需清洗时流量计读数 When the membrane need to clean reading of the flow meter (LPM) ≤
SWCM (I) -10	0535	0.374
SWCM (I) -15	0.826	0.578
SWCM (I) -20	1.069	0.748
SWCM (I) -25	1.313	0.919
SWCM (I) -30	1.604	1.123
SWCM (I) -40	2.139	1.497
SWCM (I) -50	2.625	1.838
SWCM (I) -60	3.111	2.178
SWCM (I) -80	4.181	2.927
SWCM (I) -100	5.347	3.743
SWCM (I) -120	6.319	4.423
SWCM (I) -150	7.778	5.445
SWCM (I) -200	10.208	7.146
SWCM (I) -250	12.639	8.847
SWCM (I) -300	16.042	11.229
SWCM (I) -400	21.389	14.972
SWCM (I) -500	26.735	18.715
SWCM (I) -600	32.082	22.458

清洗方法是先用清水对膜片表面进行冲洗, 除去膜片表面附着的活性污泥; 再用0.5%NaClO溶液 浸泡2小时, 杀死附着在膜表面的细菌; 然后用2-3%左右的NaOH溶液将膜片浸泡2小时, 除去附着 在膜片表面的有机物和胶体物质, 再用清水对膜片进行冲洗, 膜片通量即可恢复。如果膜片使用的 当地水质硬度高的话, 也可以结合酸洗的方法对膜片进行浸泡清洗。配置1-2%的盐酸溶液, 浸泡 2 小时后, 取出, 用清水冲洗干净。加药清洗后, 一定要用清水冲干净。

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 2h, in order to kill the bacteria attached on the surface; rinse the membrane with clean water and thenimmerge it in 2-3% NaOH solution for 2 hours, in order to remove the organic matter and col- loidal 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 take it out, flush it with clean water. After adding medicine and cleaning, be sure to rinse with water.

注意: 此项工作要求操作人员在清洗过程中要十分小心, 以免弄断膜丝。

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

加药用量请阅读说明书Please use chemicals according to instruction book. (数据供参考, 非绝对值
Data for reference, not absolute value)

项目Items 型号Type	膜柜体积(L) Volume of membrane tank(L)	60% NaClO (kg)	NaOH (kg)	备注 Remark
SWCM (I) -10	150	1.35	3.0	
SWCM (I) -15	200	1.8	4.0	
SWCM (I) -20	260	2.35	5.2	
SWCM (I) -25	280	2.5	5.4	
SWCM (I) -30	300	2.65	6.0	
SWCM (I) -40	420	3.7	8.4	
SWCM (I) -50	510	4.5	10.2	
SWCM (I) -60	510	4.5	10.2	
SWCM (I) -80	980	8.5	19.6	
SWCM (I) -100	1150	10	23	
SWCM (I) -120	1350	12	27	
SWCM (I) -150	1350	12	27	
SWCM (I) -200	1550	13.5	31	
SWCM (I) -250	2230	19.5	44.6	
SWCM (I) -300	3000	25	60	
SWCM (I) -400	3850	34	77	
SWCM (I) -500	4900	43	98	
SWCM (I) -600	5800	51	116	

以上方法清洗完毕后, 如产水量还是严重不足时, 就必须更换膜片。

After several kinds of cleaning above mentioned, if the water discharging quantity isn't enough, please replace the membrane.

注意Note:

1、不要将下列物品与次氯酸钠中溶液混合以及接触: 润滑油脂、柴油、机油、溶剂、酸、碱、肥皂制品、油漆制品、厨房用化学品醋; 泔脚; 饮料; 松节油; 脏油加丝等。如与这类化学品混合或接触, 含氯消毒剂将会引起剧烈为燃烧。

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、防止任何热的或燃烧物质与次氯酸钠接触, 如点燃的香烟。

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

3、如果发生火灾, 必须用大量水浇灭和冷却周围环境。

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

4、不要让次氯酸钠接触人眼、皮肤或衣服，否则可能引起化学燃烧，吃入口中会发生很大的危险。

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

5、小心地安放容器，不要跌落、滚动或拖滑，保持朝上安放位置。

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

6、在添加次氯酸钠粉时必须保持手的干燥，清洁，戴橡皮手套用金属器皿，如果散落，可能引起火灾。

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

7、万一发生次氯酸钠粉散落，必须用大量水冲洗干净。

7. In case of sodium hypochlorite powder scattering, it must be washed with a lot of water.

解毒方法Detoxification method:

外部：用大量水冲洗皮肤或眼睛15分钟，如果皮肤灼烧，应立即医疗处理，如果眼睛灼烧应立即请外科医生处置。

内部：饮大量水或牛奶，然后吃镁盐泻药，蔬菜油或鸡蛋，对于眼睛立即请外科医生。

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 the internal medical department for emergency.

8、不要让儿童接触。

8. Keep chemicals far from children.

9、保持容器在冷却、干燥的地方，不要任意换容器

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、不要乱扔空桶，用空后立即用大量水冲净放在安全的处所。

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

11、在漂粉精贮存和分装的场所周围挂上“小心火灾”警告牌。设置如沙箱等防火等设备。

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.

12、只要有污水在装置内，就有可能产生有害气体，如 H₂S 和甲烷等危害人体。所以气泵要保持经常运转，以防有害气体产生并散发到周围工作场所。

12. When there is sewage in the device, the device will generate harmful gases such as H₂S and methane etc. that could harm people around the area. The air pump should be operated at all times to prevent build up or escape of harmful into working area.

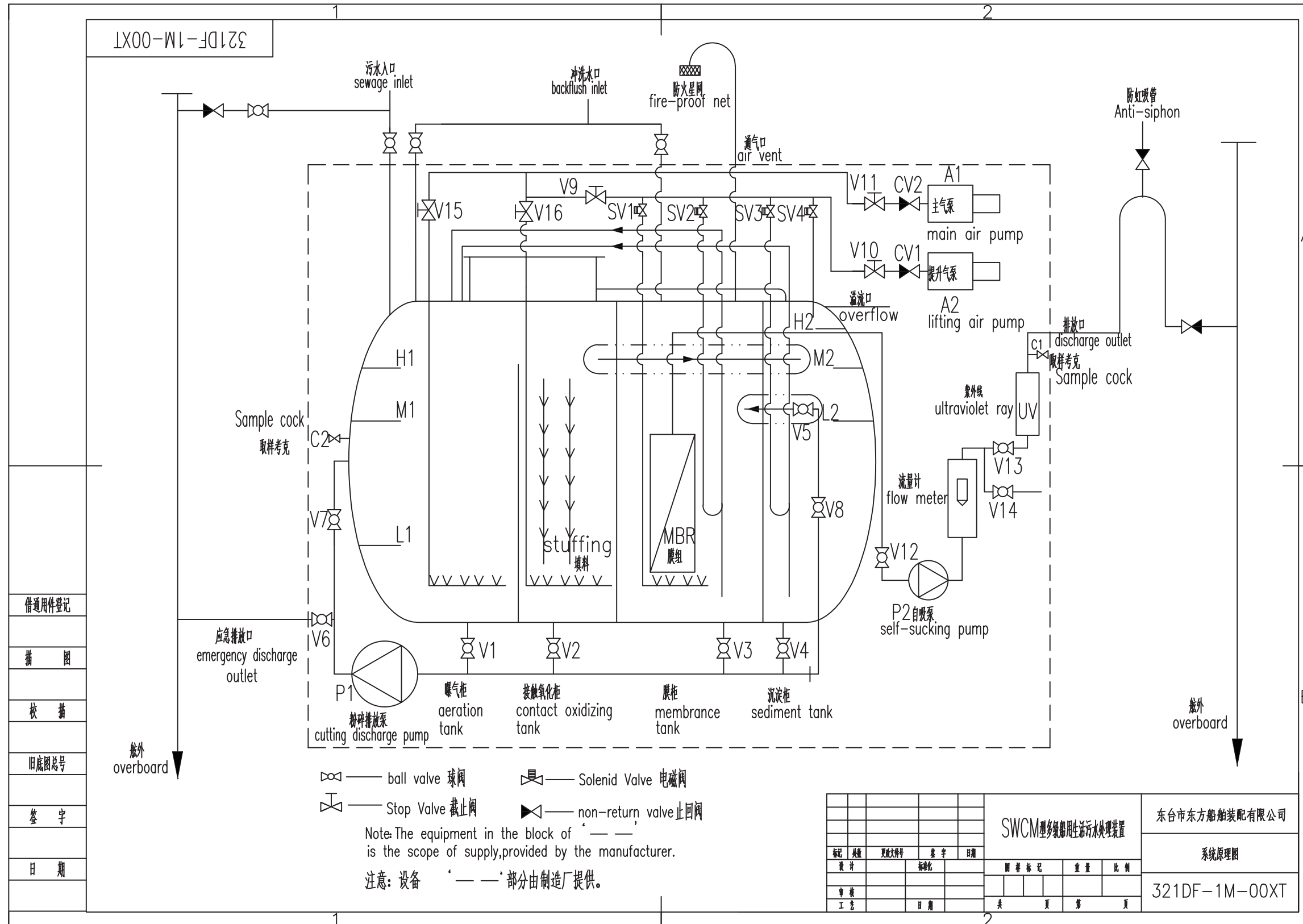
Chapter 8 备件清单 Spare Part List

序号 No.	图片	名称 Name	规格型号 Model	数量 Amount
1		粉碎泵机械密封 Cutting pump Mechanical seal	/	1套 1set
2		粉碎泵 O型密封圈 Cutting pump O ring	/	1套 1set

注：妥善保存用户手册，以便日后参阅

Note: Keep the user manual for future reference

Chapter 9 附录 Appendix: 图纸 Drawing



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