PESCO INDUSTRIES-USA

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MBR Integrated Sewage Treatment Equipment

Installation, Operation, and Maintenance Guide

Environmental Protection Equipment

1 Warning messages and their meanings used in this manual

The warning information used in this manual is very important. Please understand its meaning correctly and pay enough attention to it.

indicates that if the device is used incorrectly by ignoring this instruction, it is expected that there may be death or injury

Dangerous. Serious injury. Dangerous. Serious injury.

It indicates that if the device is used incorrectly by ignoring this instruction, personal injury and

Warning: Property damage. Warning: Property damage.

Indicates that if the device is used incorrectly by ignoring this instruction, device damage may occur.

Note that this may cause other adverse consequences. Note that this may cause other adverse consequences.

2 MBR Integrated Sewage Treatment Equipment

2.1 Product Features

（1） The effluent water quality is good and stable.

（2） Modular structure for easy combination and quick installation.

（3） The device is integrated, occupies a small area and is easy to transport.

（4） It has low operating cost, wide adaptability and mobility.

（5） Smart remote control via APP (optional).

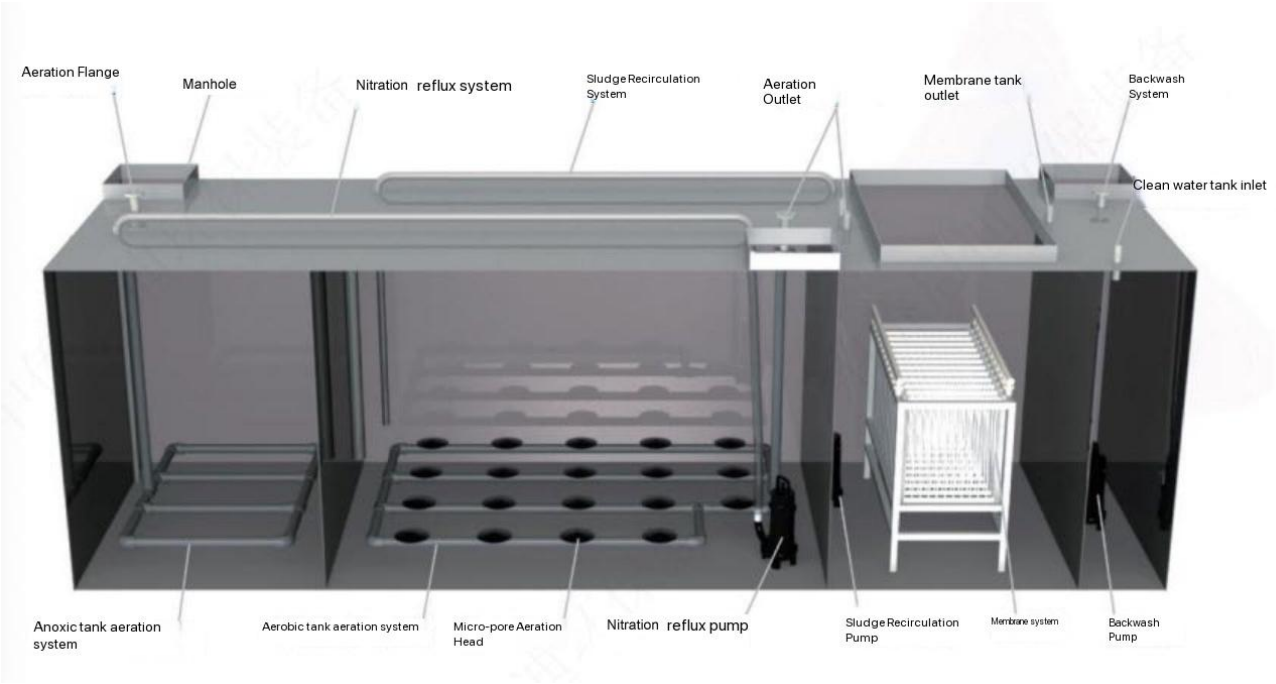
2.2 product composition

The MBR integrated wastewater treatment system features modular design, consisting of a control unit (equipment room) and equipment units (chassis). The configuration can be customized to meet purification requirements and site-specific conditions, combining basic modules into tailored systems. Typical configurations include: AO+MBR membrane tank+clear water tank, A2O+MBR membrane tank+clear water tank, AO+slant tube sedimentation+MBR membrane tank+clear water tank, among others.

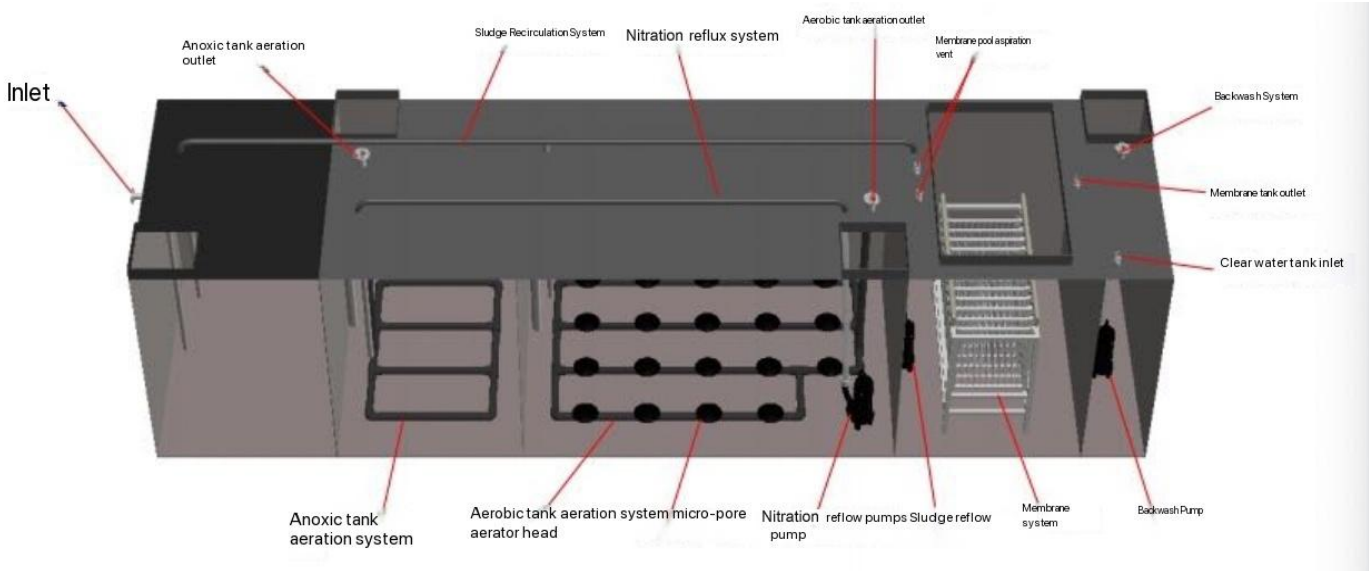
2.3 Process Combination and Schematic Diagram

(1) The AO+MBR membrane tank + clear water tank process, its wastewater purification system consists of anaerobic tank, aerobic tank, membrane tank and clear water tank.

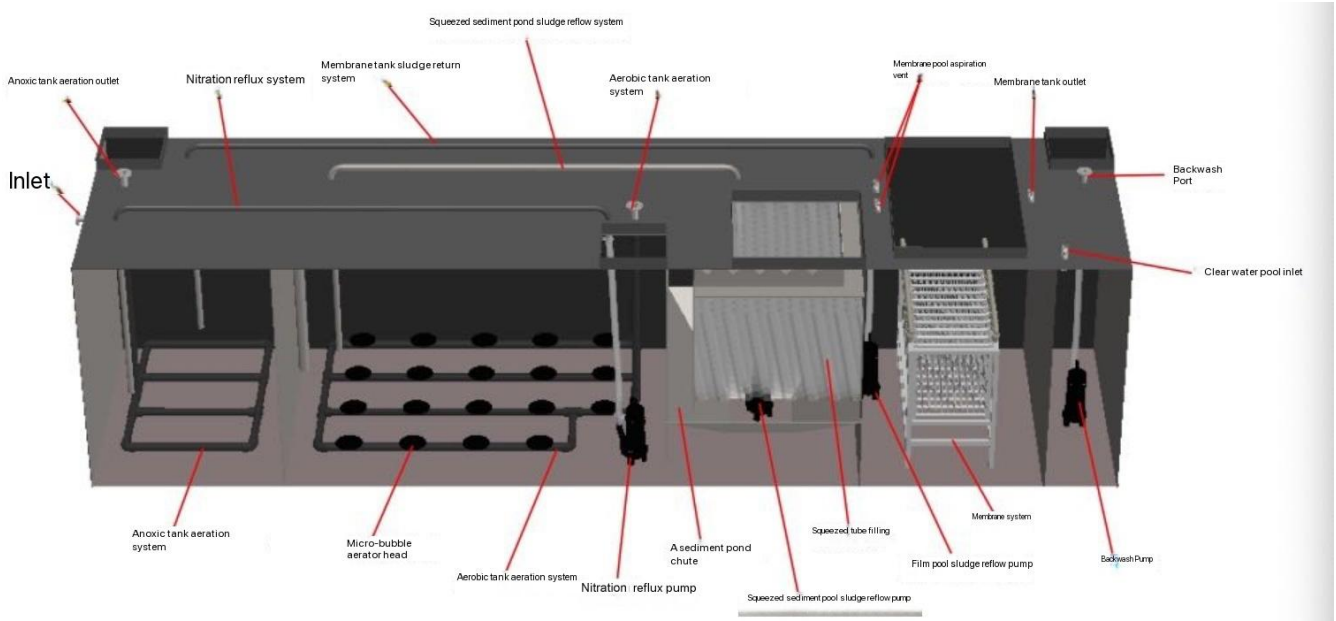
The diagram is as follows:



（2） The A2O+MBR membrane tank + clear water tank process features a wastewater purification system comprising an anaerobic tank, an anoxic tank, an aerobic tank, a membrane tank, and a clear water tank. The schematic diagram is shown below:



（3） The AO+ inclined tube sedimentation + MBR membrane tank + clear water tank process, its wastewater purification system consists of anoxic tank, aerobic tank, inclined tube sedimentation tank, membrane tank, and clear water tank. The schematic diagram is as follows.



Water quality parameters for product inlet and outlet

The main water quality indicators for the inflow and outflow are shown in Table 2-1 and 2-2.

Table 2-1 Inlet Water Quality Boundary Table

order number	metric	standard boundary index
1	Chemical Oxygen Demand (CODcr) (mg/L)	350
2	5-day biochemical oxygen demand (BOD5) (mg/L)	150
3	Suspended Solids (SS) (mg/L)	200
4	ammonia nitrogen （mg/L）	35
5	TN(mg/L)	45
6	TP(mg/L)	4
7	Fecal coliforms (per liter)	–
8	pH	6~9
9	Mineral oil (mg/L)	3
10	Plant oil (mg/L)	50
11	water temperature ℃	10

Note: The above are standard boundary indicators for influent water quality. If exceeded, consider adding pretreatment or reducing the operating flow rate of the integrated wastewater treatment system. Consult the technical staff for specific guidance.

Table 2-2 Water Quality of Outflow

order number	metric	MBR membrane integration
1	Chemical Oxygen Demand (CODcr) (mg/L)	50
2	5-day biochemical oxygen demand (BOD5) (mg/L)	10
3	Suspended Solids (SS) (mg/L)	10

4	ammonia nitrogen （mg/L）	5(8)
5	TN(mg/L)	-
6	TP(mg/L)	0.5

Note: Values outside parentheses represent control indicators for water temperature>12℃, while values within parentheses indicate control indicators for water temperature ≤12℃.

In the following special influent conditions, users must perform pretreatment or post-treatment prior to sewage entering the MBR integrated wastewater treatment system:

（1） The influent water contains high levels of iron and manganese, necessitating an additional flocculation and sedimentation tank.

（2） The water content of vegetable oil should be <50mg/L and mineral oil <3mg/L; otherwise, a pre-oil separator or oil separator tank must be installed.

（3） If the influent contains a large amount of hair or large pieces of suspended matter, a 5mm or smaller screen should be installed before the wastewater enters the equipment.

（4） When the influent is uneven and discontinuous, a regulating tank should be built in front of the integrated sewage treatment equipment. The hydraulic retention time of the regulating tank should be determined according to the actual situation, and the regulating tank should be equipped with overflow.

（5） If the product contains heavy metals or other special contaminants, we provide customized solutions.

3 Product Inspection and Random Data

Shandong Fangting Zhichuang Environmental Protection Equipment Co., Ltd. supplies products to customers after passing inspection, which comply with national technical standards and specifications as well as the company's internal standards. Upon delivery, the recipient must inspect the goods to confirm their compliance with the specified requirements.

（1） file list

The product is accompanied by the following materials:

① Packing list

② Product Quality Certificate

③ Product Factory Inspection Report

④ Product Installation, Operation, and Maintenance Manual

⑤ Random manuals for each electromechanical equipment

（2） examine goods

① Verify that all product models and quantities are correct.

② Total intangible change and damage.

③ The weld is intact and free from cracks.

④No damage to the pipeline, etc.

⑤No missing connecting or fixing bolts, etc.

⑥All labels are intact without any missing parts.

⑦ Check if the cables connecting the agitator and reflux pump are intact and undamaged.

⑧ The aeration disc in the aerobic

tank is securely fixed and

undamaged. Note: The following

matters should be noted during the

inspection of the membrane module.

①The membrane unit is intact with no deformation or damage, and all components are present.

②The connecting bolts should be free from loosening or missing, and the welding joints should be intact without cracks.

③ The membrane module is in good condition with no damage.

Upon receiving the goods, if any defects such as missing items or damage are found, please notify our after-sales service team within 2 business days to resolve the issue.

4 Storage and Transportation Requirements

4.1 Product storage and transportation are not enabled

As the product contains membrane modules, plastic fittings, and electromechanical equipment, appropriate storage measures must be implemented. The following requirements are specified for key precautions.

4.1.1 The product does not support short-term storage

If the product is not put into use within a short period (within 15 days) after arrival, the following storage requirements must be met:

（1） The product must be placed flat and stable, without tilting or upside down, and maintain good ventilation with humidity <60%.

（2） Membrane unit (membrane assembly): Sunlight protection, waterproof, UV protection, keep away from fire sources, storage temperature 5~35℃.

（3） Other electromechanical equipment: lightproof, fireproof, rainproof, moisture-proof, frostproof, and chemical corrosion-resistant.

4.1.2 long-stem storage

In principle, after the product is delivered to the site, it is not recommended to store the product

on-site for an extended period without immediate use. The membrane tank should be filled with water within 15 days. In case of special circumstances, the product must be stored under the following conditions:

（1） Store products in a cool, indoor location, ensuring they are stable and not tilted or inverted. Protect them from sunlight and UV radiation, and keep them dry and away from fire sources. Maintain a temperature of 5−35°C and humidity below 60%. Special attention should be given to protecting membrane modules: remove them, seal them in plastic bags, and store them in sturdy cardboard or wooden boxes. Avoid direct sunlight, UV exposure, high temperatures, and open flames. Keep them dry and protected from freezing. The recommended storage temperature is 5–35°C.

（2） Avoid physical and chemical damage to the product.

（3） Open the cabinet door periodically (approximately every 2 weeks) to inspect the storage condition of all equipment and perform ventilation to prevent moisture damage to electromechanical devices and electrical control cabinets.

（4） Effectively seal equipment openings, observation ports, doors, and windows to prevent animals from entering the equipment and damaging membrane components, cables, and instrument panels.

（5） Given the product's unique nature, anti-theft measures must be implemented on-site, including immediate locking of equipment rooms and regular staff patrols.

（6） The product shall be stored for no more than 6 months from the date of manufacture. In exceptional circumstances requiring storage beyond 6 months, please consult our company for technical support.

4.1.3 transport

Due to the large size and weight of the product, specialized tools are required for loading, unloading, and transportation. When using a crane, lifting should be performed steadily and slowly to prevent collisions, and personal safety must be prioritized.

danger nsure that the load of loading/unloading and transfer vehicles does not exceed their rated capacity to prevent personal injury and property damage.

4.2 Product storage and transportation enabled

If the product needs to be discontinued due to special circumstances after a period of normal use, the storage of the membrane unit must comply with the following requirements, while other equipment should be stored according to their respective product instructions.

4.2.1 Enabled for saving the membrane component

Short-term storage: The deactivation period should not exceed 1 month. The membrane pool mixture does not need to be drained, and the membrane module can remain in place. The membrane module can be purged by running the membrane pool fan for 1−2 hours daily to reduce membrane fouling.

Long-term storage: If the inactivity period exceeds 1 month, save the data as follows.

（1） Sealed storage

Remove the membrane module from the membrane assembly unit, rinse its surface thoroughly to remove sludge and debris, then soak it in the appropriate chemical solution to eliminate chemical contaminants. Subsequently, treat it with a protective solution (1-2% NaHSO3 or 100ppm NaClO solution). Each module should be sealed in a plastic bag and stored uniformly in wooden crates or other suitable packaging for long-term preservation, under the same conditions as unused modules. Inspect every two weeks for mold growth. If detected, perform chemical cleaning (soak in a 3000-5000 ppm NaClO solution for 8-12 hours), rinse the module with clean water to remove residual chemicals, and then replace the protective solution.

（2） in situ preservation

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● In-situ preservation is only suitable when the water temperature in the membrane pool ranges between 5-35°C and the water level must submerge the collector pipe of the membrane module. During preservation, freezing and high temperatures are strictly prohibited.

Remove the membrane module from the membrane module unit, rinse its surface thoroughly to remove sludge and debris, then reinstall it. Subsequently, immerse the entire module in a specific chemical solution to eliminate chemical contaminants. Replace the solution in the membrane tank with clean water (preferably tap water, or reclaimed water or qualified secondary sedimentation tank effluent is acceptable), and add sodium hypochlorite to achieve a free chlorine concentration of 100 ppm. After cleaning, reinstall the module back into the tank and store it undisturbed. During storage, replenish sodium hypochlorite monthly (maintaining 100ppm concentration) and replace the solution every 3-4 months. Prior to reuse, perform an online high-concentration sodium hypochlorite cleaning (1000-3000 ppm) based on the module's actual storage duration and condition.

4.2.2 Other devices

Pools, equipment, and pipelines: Focus on anti-corrosion (for steel products, pump impellers, etc.) and anti-freezing measures. During storage in low-temperature seasons (approaching or below 0°C), the pool and container solutions must be drained, and all equipment and pipelines must be emptied, cleaned, and dried to prevent damage caused by freezing and corrosion.

5 Product installation

5.1 Installation conditions

5.1.1 placement foundation

（1） Reinforced concrete foundation shall be laid with a surface load capacity exceeding 40 kN/m².

（2） The allowable horizontal deviation for equipment cabinet installation is ±3mm.

（3） The site is clean and tidy, with no debris.

（4） The base area is sufficient to accommodate all products with a certain surplus for easy operation and maintenance.

（5） If the equipment is buried underground or installed in low-lying areas such as riverbanks or lakeshores, appropriate waterproofing measures must be implemented.

5.1.2 supporting facilities

Road: The road should be smooth and solid, with width and length sufficient for normal operation of product transport vehicles, preferably featuring a concrete-paved surface.

Power supply: 380V,3-phase, 50Hz.

Grounding type for low-voltage distribution lines: TN-S.

Regulation tank: A reinforced concrete structure, optionally equipped with a submersible mixer. Its effective volume should be 1/4 to 1/2 of the designed daily water discharge. The inlet must be fitted with a screen, with spacing selected based on the influent's debris content. Ensure the tank is free of debris, fully hardened, and ready for water intake.

For oil separators and grit chambers: Determine their necessity based on actual water quality conditions. For inlet pipes: Ensure the pipe length and diameter match the product's inlet specifications.

Product water outlet pipe: The pipe length and diameter must match the product's water outlet. Overflow pipe: The pipe length and diameter must match the product's overflow port. Drainage pipe: The pipe length and diameter must match the product's drainage port. Backwash pipe: The pipe length and diameter must match the product's drainage port (if the product has a built-in backwash device, this step is unnecessary).

5.1.3 Tools and equipment

(1) Wrenches: 10mm (M6),13mm (M8),16mm (M10),18mm (M12),24mm (M16),27mm (M18),30mm (M20). The bolt sizes in parentheses are for reference only; actual product specifications

should be confirmed. Alternatively, a suitable adjustable wrench may be used.

(2) Lifting equipment: Use cranes with adequate load capacity. For large-volume containers, multiple cranes may be required to operate simultaneously.

(3) The tools for external pipeline connection should be selected according to the material and processing requirements of the pipeline.

(4) Pump mounting equipment: Stainless steel chains and corrosion-resistant ropes are both acceptable.

5.1.4 fittings of a machine

Prepare all required components including connecting bolts, flange gaskets, pipes, fittings, power cables, and lifting pumps. Pre-assemble those that can be pre-installed.

5.1.5 personnel

Prior to installation, specialized training shall be conducted for on-site construction personnel, covering detailed explanations of installation procedures, precautions, and safety protocols, along with technical briefings. The project shall include: 1) A general supervisor responsible for personnel allocation and workflow coordination; 2) 1-2 electricians with qualified certifications for high-voltage equipment operation; 3) 4-5 installation personnel for pipe connections and cabinet positioning; and 4) 1-3 crane operators, depending on the specific product model.

5.1.6 Device inspection and reset

■ Inspection of equipment inside the box.

（1） Verify that all product models and quantities are accurate.

（2） The box body is intact without deformation or damage, and the welds are intact without cracking.

（3） All connectors and fastening bolts are intact without any missing parts.

（4） The membrane unit showed no visible deformation, damage, or missing components.

（5） Before filling the tank with water, release the securing wire (for transportation) of the reflux pump to check if its chain guide is properly secured.

（6） Check if the float's power cord is securely fastened and if the height positioning is correct (the high level must not exceed the overflow port, and the low level must not fall below the main collection pipe). The float level gauge should move freely without any scraping or obstruction.

（7） The wire, rope or tape used to fix the reflux pump, low-speed push-flow mixer and its power line should be removed and restored to their normal installation positions.

（8） Ensure the product's built-in grille is intact and free of debris. If the placement is off-center, adjust it to align directly below the water inlet.

（9） Membrane units are typically pre-assembled with membrane modules and equipped with rain/sun protection before shipment. On-site, these protective covers may be removed or

retained based on operational needs. If water production debugging is not required at this stage, the covers should be kept.

（10） During transportation, due to factors such as vibration, the fastening bolts of equipment and pipeline connection components may loosen or detach. A thorough inspection is required, followed by re-tightening or replacement of the corresponding bolts. Pay attention to checking for any abnormalities in the connecting components of the membrane module (valves, flanges, right-angle elbows, etc.).

（11） Whether all instruments and equipment are properly secured;

（12） Check the electrical control box to verify that the wiring matches the schematic diagram. Inspect the cabinet for loose or detached wiring and electrical components, and re-tighten or reinstall any found. (Note: For long-distance transportation, it is recommended to re-tighten all terminals before power supply.)

（13） Inspect the fan: verify belt installation correctness, lubricant level (fill to oil window center when idle), belt rotation freedom, pressure gauge functionality, and fastening integrity of anchor bolts.

（14） Check if all pipeline valves are properly opened/closed, functioning normally, and all screws are securely tightened; verify the correct electrical wiring of solenoid valves.

Note: If the membrane unit is not equipped with membrane modules, on-site installation is required. For assistance, please contact our after-sales service team for expert technical support.

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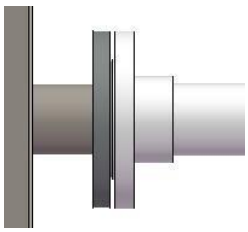
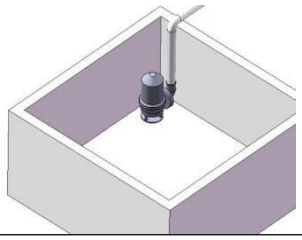
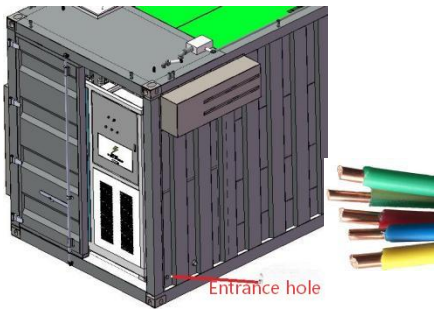
- If entry into the pool for construction is required, it involves confined space operations, and corresponding protective measures must be implemented. The air quality within the pool must be tested to ensure safety before entering. Additionally, at least two personnel must work collaboratively, with one person outside the pool providing necessary protective measures.

5.2 Installation steps

Step 1: Box positioning		1. During hoisting operations, ensure the safety of personnel and products. 2. During lifting and lowering operations, ensure smooth and slow movements to avoid tilting. 3. mark the position area of the box on the base in advance; 4. The enclosure must be placed stably. If the base leveling does not meet the requirements, additional blocks should be added to the base to ensure levelness. 5. If a device consists of two boxes spaced 100mm apart, use two 100×100mm square tubes to position the second box.

Step 2: Pipeline Connection	 	The product is pre-equipped with corresponding pipe ports (e.g., inlet, outlet, and spray-marked ports on the tank), allowing external pipelines to be pre-assembled and then connected to the product's ports. Before connecting, inspect and clean the reserved opening to ensure it is clean, and ensure the specifications match the reserved opening. After the pipeline connection, ensure the joint is sealed and secure. If the whole set of equipment consists of two boxes, the mixing liquid reflux pipeline and connecting pipeline should be checked whether they are connected well.
Step 3: Installation of the booster pump	 	1. Connect to the water supply pipeline. 2. Position the booster pump at an optimal spot in the regulating tank (typically, ensure the pump base is at least 300mm above the tank floor). To prevent cable tension or overextension, secure the power cord to the corrosion-resistant anchor rope with a tie strap. 3. The fixed level float ball is designed to maintain the water level in the regulating tank, ensuring that the lifting pump remains below the liquid surface even when the tank's water level is low. 4. Connect the power cord of the booster pump and level float to the reserved power supply in the electrical control cabinet. The interface and power cord (including specific length and model) shall be provided on-site.
Step 5: Cable Connection for Mixer		If the complete system consists of two enclosures, the cables must be connected on-site. The cable for the mixer and the float ball in the backwash tank are pre-marked with corresponding pairing symbols before leaving the factory. Simply connect them according to the cable markings and the terminal numbers in the junction box.
Step 6: Connect the main power cord		Before connecting to the main power supply, ensure the main power switch of the electrical control cabinet is turned off and all control buttons are in the stop position. The main power supply must provide sufficient voltage and power to meet the product's requirements. Additionally, a switch should be installed near the product to easily disconnect the main power supply during maintenance or repair. The main power cable enters the electrical control cabinet through the inlet hole and cable tray, connecting the phase line, ground line, and neutral line to supply power. Start the fan and check its rotation direction. If incorrect, simply swap the positions of any two phase lines. Note: ① Check if the main power supply is properly grounded (using yellow, green, red, blue, or yellow-green dual-color wires); ② Verify if the main power supply voltage meets specifications (requires a three-phase five-wire system with 380V for any two phases and 220V for the neutral phase).

Precautions for underground equipment installation:

（1） After the equipment installation is completed, backfill the soil to the designed ground level. During backfilling, the following points should be noted:

（2） The equipment manhole cover plate must be raised approximately 50mm above the floor level.

（3） The backfilling earth should not block the air inlet.

（4） The backfilled earth must be free of lumps and sharp objects.

（5） During backfilling, the process should be conducted slowly, and the machinery must be

positioned at least 2 meters away from the equipment.

5.3 technical safety measures

The installation and disassembly of the product involve hoisting operations, high-altitude work, and electrical work, which are the key and difficult points of construction. During construction, the corresponding operating procedures must be strictly followed.

5.4.1 Lifting operation

（1） On-site construction workers must wear safety helmets, and personnel engaged in special operations must hold valid special operation certificates.

（2） Prior to hoisting operations, all equipment including lifting machinery, steel cables, chains, and hooks must undergo thorough inspection to ensure safety and reliability. Operators are strictly prohibited from working with faulty equipment.

（3） When hoisting operations are performed, clear division of labor must be ensured, and personnel must remain at their posts while following instructions.

（4） Prior to hoisting operations, a thorough safety inspection must be conducted on the moving parts of lifting machinery, safety devices, as well as lifting and rigging equipment. The safety devices of hoisting equipment must be sensitive and reliable. A test lift must be performed before hoisting to confirm that everything is in order before proceeding.

（5） No person shall accompany the lifting of heavy objects or lifting machinery. In special circumstances where it is necessary to follow the lifting, reliable safety measures must be implemented and approved by the on-site commander.

（6） No standing, passing or working is permitted under the suspended load.

5.4.2 High-altitude Work

（1） Construction work on the pool is classified as high-altitude operation. Personnel with hypertension, anemia, heart disease, epilepsy, or other conditions unsuitable for high-altitude work are prohibited from participating in the construction.

（2） Before construction work begins, all safety protective equipment must be thoroughly inspected. Under any circumstances with potential hazards, no forced or reckless operations shall be permitted.

（3） When installing, safety belts must be used as required, and their application should follow the principle of 'high hanging, low use' to ensure the secure and reliable attachment point.

（4） Do not throw the transfer tool during installation to prevent it from falling into the pool or injuring workers.

（5） If the pool is filled with solution, the construction site must be equipped with safety gear such as lifebuoys to prevent potential worker drownings.

5.4.3 Electrical Work

（1） Construction personnel must possess the corresponding construction qualifications, hold

valid work permits, and correctly wear protective equipment.

（2） Live-line work is prohibited, and warning signs must be installed at the corresponding live parts.

（3） Electrical work is prohibited during thunderstorms.

danger

● During hoisting, high-altitude, and electrical work operations, all personnel must follow unified commands and strictly adhere to relevant safety

6 Product debugging

6.1 Debugging preparation

（1） Power supply: The power supply meets the requirements, is a formal power source, and has been properly connected to the electrical control cabinet.

（2） Clean water: Ensure water quality and quantity, with tap water being the preferred option, followed by reclaimed water or underground drinking water.

（3） Staff: 3-4 people, including 1 electrician.

（4） Tools: A set of open-end wrenches (preferably adjustable), along with electrical tools.

6.2 Power check

Ensure all electrical and mechanical equipment connections are securely and correctly made, with main circuit and critical electrical component cables re-tightened as required.
Where grounding is required, it must be implemented.

After ensuring all transfer switches on the electrical control cabinet are in the off position, verify the power supply meets product specifications by measuring the main switch voltage with a multimeter to confirm 380V line voltage and 220V phase voltage. Once verified, close the main power switch. Then test the voltage of subsequent circuit breakers; if normal, sequentially close the equipment circuit breakers.

To verify the correct power phase sequence, briefly activate a device (e.g., a three-phase load like a blower) for about 3 seconds. Check if the motor rotates forward. If it rotates backward, adjust the wiring sequence until the device runs forward.

6.3 single machine debugging

During single-machine debugging, the product tank should remain dry or without mixed liquid, with only intermittent testing of the equipment. The idle time should not be prolonged to avoid equipment damage. Typically, the intermittent operation (switching the control to manual mode) should last approximately 3 seconds. Throughout the debugging process, refer to the accompanying product manual to prevent operational errors.

6.3.1 elevator pump

Manually rotate the drum to ensure smooth impeller operation. Check the lift pump outlet pipeline

for blockage-free condition.

Manually operate the equipment to verify the correct rotation direction of the pump impeller and check for any abnormal noises during rotation. After confirming everything is in order, reinstall the lifting pump at its original position in the regulating tank.

6.3.2 blowing machine

（1） Check and tighten all fastening bolts.

（2） Check if the intake filter is installed correctly.

（3） Check the tension of the drive belt.

（4） Check the hand strap or pulley for smooth operation.

（5） Check the oil level and verify it against the manual to ensure the oil quantity and grade are correct.

（6） Ensure the valve on the air duct is fully open.

（7） The safety valve ensures that the exhaust pressure does not exceed the design limit. The factory-set pressure is 1.1 times the rated exhaust pressure.

Do not adjust the safety valve arbitrarily, as it may cause equipment damage. Unauthorized personnel are strictly prohibited from making any adjustments.

（8） Rotate the fan and check if the motor's rotation direction matches the arrow on the motor belt cover, and listen for any unusual noises.

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- Handle the belt or pulley carefully and slowly to avoid hand injuries or harm to others.

6.3.3 water pump

（1） Check and tighten all fastening bolts.

（2） Ensure the valves before and after the pump are in the correct open or closed state.

（3） Rotate the impeller with a stick or screwdriver to ensure smooth rotation.

（4） Operate the movable water pump to check its rotation direction and detect any abnormal noises.

6.3.4 phosphorus removal dosing pump

（1） Check and tighten all fastening bolts.

（2） Ensure the valves before and after the pump are in the correct open/closed state. (3) Check whether the pulse dosing pump is operating.

6.3.5 reflux pump

（1） Ensure the pump's rear valve is in the correct open/closed position. Remove all securing wires from the pump, and prevent the pump body from being tilted, horizontally placed, or inverted. The cables should be securely fastened, and the chain must remain taut.

（2） Use a suitable stick or screwdriver to rotate the impeller, ensuring smooth operation.

（3） Activate the reflux pump and check for proper rotation direction and abnormal noises.

6.3.6 low speed push flow agitator

（1） Check whether the agitator is placed flat, without tilting or suspension, and tighten all fixing bolts.

（2） Gently operate the low-speed push-flow mixer to check the rotation direction and detect any abnormal noises.

6.3.7 backwash pump

（1） Check and tighten all fastening bolts.

（2） Ensure the valves before and after the pump are in the correct open or closed state.

（3） Use a suitable rod or screwdriver to rotate the impeller, ensuring smooth operation.

（4） Activate the backwash pump and check if the rotation direction is correct and if there are any abnormal noises.

6.3.8 Ultraviolet disinfection device

（1） Check for integrity, absence of missing or damaged parts, and correct installation.

（2） Ensure all fasteners are securely and reliably connected, with reliable cable wiring, routing methods, and waterproofing measures.

（3） The spot sterilizer can be normally activated.

6.3.9 appearance

（1） Check the appearance is intact.

（2） Check and tighten all fastening bolts.

（3） Check if the connection wiring or components are securely fastened.

6.4 Qingshui joint debugging

（1） Before filling the pool with clean water, the following matters should be noted.

① All tanks are clean and free of debris, with no other equipment or personnel present inside.

② All the drain valves of the tanks are in the closed state.

③ The valve connecting the pool is in the fully open state.

④All underwater equipment is properly installed, with power cables properly tensioned, and equipment securing chains or ropes in good condition and properly tensioned.

⑤ All external connecting pipes are properly connected.

⑥ All valves on the pipeline are in proper open/closed positions (see Table 5: Layout Table for details).

（2） Add appropriate amounts of clean water to each tank, ensuring no overflow occurs. If the regulating tank contains water, the water supply can be directly initiated by activating the lift pump. When the water level reaches 5-10cm above the aeration discs in the aerobic tank and the aeration troughs in the membrane module, suspend water intake. Confirm that the aeration valves for both the membrane tank and aerobic tank are open by at least two-thirds.

Then manually operate the blower to check for uniform aeration and inspect the air pipes for leaks (the blower typically stops after a brief run, and any leakage usually produces audible sounds). After verifying no aeration issues, resume water intake. At this point, set the lift pump to automatic mode, ensuring the water level covers the PVC manifold of the module.

（3） The blower, low speed push flow mixer and reflux pump conversion switch are all placed in automatic position.

（4） Monitor the aeration conditions of the aerobic tank and membrane module, and adjust the aeration volume to an appropriate state by regulating the corresponding valves. Refer to Table 6 for the aeration volume of each product model's tank body, and observe whether the exhaust fan operates in conjunction with the blower.

（5） The operation status of the low-speed push-flow mixer and the water agitation were observed.

（6） The operation of the reflux pump is observed, and there is no obvious abnormal noise.

（7） After the membrane module aerator stabilizes, trial production water will be conducted. The membrane module is a dry membrane, and the initial water production generally requires soaking for 4-8 hours. If time is tight, the soaking duration can be appropriately shortened. The water production pipeline is filled with air, so the intake cap of the water production pump must first be unscrewed, followed by adding an appropriate amount of water. Use a suitable rod or screwdriver to rotate the impeller a few times to form a liquid film on the mechanical seal friction surfaces. Then, switch the water production pump to automatic mode. If no water flows from the outlet pipe after several minutes of operation, stop the pump and re-add water. This process may need to be repeated until normal water production is achieved. After water production, check for leaks in the water pipes (leakage before the pump indicates air suction, preventing water production; leakage after the pump indicates water leakage). Adjust the water production flow rate accordingly.

Check the flowmeter and pressure transmitter for normal operation within the specified range.

（8） Monitor the water production cycle. The default cycle is 8 minutes, with 7 minutes of water production followed by 1 minute of stoppage (aeration continues). If an anomaly occurs, stop the water production pump, identify the issue, and resolve it.

（9） Manually adjust the float positions in each tank to verify proper operation of all equipment (refer to Table 5 for electrical control parameters in automatic mode).

（10） Fill the phosphorus removal tank with an appropriate amount of water, open the dosing valve, start the dosing pump, and set the flow rate to the desired level.

（11） Initiate the backwash procedure by adding an appropriate amount of clean water to the backwash tank. Manually shut off the production water pump, then after approximately 2 minutes, turn off the blower. Next, close the manual water production valve, open the chemical feed valve, and activate the backwash pump. Set the flow rate and monitor the

pressure and flow rate to ensure stability. After approximately 5 minutes of normal operation, shut off the chemical feed pump. Finally, close the chemical feed valve and open the water production valve.

（12） After confirming that all process parameters and equipment are normal, the system enters fully automatic operation mode. Monitor all tank bodies and dosing boxes.

Verify the appropriateness of the liquid level control and make adjustments if abnormalities are detected to meet operational requirements. See Table 5 for electrical control parameters.

Note: As the liquid level float in the lift pump is field-connected, special attention must be paid to ensure correct liquid level control.

（13） The water system shall operate automatically for 1-2 hours. During this period, monitor and test the operational status of all equipment, including motor current and voltage, pump flow rate, pipeline pressure, etc., and record the corresponding instrument readings to form a debugging log. If any abnormalities are detected, corrections or corresponding adjustments shall be made.

（14） After the water test run is completed, first shut down the production water pump, then switch all other equipment to the stop position.

（15） Drain the pool of water, or retain the water as needed.

Note: During the trial run of the clean water system, if any abnormalities occur—such as pipeline leaks, gas leaks, or mechanical/electrical equipment malfunctions (including equipment, circuits, or programs)—immediately halt the equipment and perform repairs while the power is disconnected to prevent personal injury or property damage.

Table 5 Process Operation Sequence Table

Manual valve name	normal operation		Online cleaning		outage maintenance	
	open	Guan	open	Guan	open	Guan
blower outlet valve	√			√		√
intake valve of membrane chamber	√			√		√
aerator inlet valve	√			√		√
water outlet valve	√			√		√
backwash valve			√			√
phosphorus removal valve	√			√		√
pool interconnectin	√		√			√

g valve						

Note: The state marked with "√" indicates the valve body condition at that time.

Table 6 Electronic Control (Automatic Mode) Parameters

order number	device name	process conditions	remarks
1	elevator pump	(1) When the regulating tank level light is on and the membrane tank high level light is off, the lift pump starts. move； (2) The lift pump stops when the regulating tank level light turns off or the membrane tank high-level light turns on. stop；	Adjustment of the regulating tank level It depends on the actual needs of the site.
2	blowing machine	（1） The system operates normally for 24 hours under PLC control. （2） When the membrane cell is at low liquid level or the pressure transmitter reading reaches-35kPa and remains at this level for 10 minutes, the blower operates in a cycle of 30 minutes on and 60 minutes off. （3） When the water pump remains continuously stopped for 24 hours, the blower operates according to The system operates in a 60-minute on and 24-hour off cycle.	
3	water pump	（1） Normal operation runs for 7 minutes and stops for 1 minute. （2） The water production pump is only activated when the blower is running, which is synchronized with the blower. （3） The pump is started when the low liquid level light of the membrane tank is on. （4） The pump stops when the low liquid level light in the membrane tank is off. （5） When the pressure transmitter reading reaches-35KPa and remains at this level for 4 minutes, the pump will shut down with an alarm, requiring manual reset (either by cleaning the diaphragm or troubleshooting other causes). The pump can only be restarted after the malfunction has been resolved.	
4	dosing pump	（1） Linked to the production water pump, the production water pump starts, the dosing pump starts, and the production water pump stops. 2 minutes, the drug delivery pump stops; （2） The dosing tank reached low liquid level, causing pump shutdown. Manual liquid replenishment was required before the pump could be restarted.	
5	reflux pump	（1） The pump stops when the low liquid level light in the membrane tank is off. （2） The low liquid level indicator light in the membrane tank is on, and the pump is activated. （3） The return pump is only activated when the blower is running, which is synchronized with the blower.	

6	low speed push flow agitator	（1） The pump chamber low liquid level light turns off, and the mixer stops. （2） The pump chamber low liquid level light is on, and the mixer is started. （3） The mixer is only activated when the blower is running, which is synchronized with the blower.	
7	Ultraviolet disinfection device	Linked to the production water pump, the UV disinfection unit activates upon startup of the production water pump and stops when the pump ceases operation. If the operation exceeds 2 minutes, the UV disinfection device will automatically shut down.	

6.5 sludge culture

6.5.1 dry mud culture method

The activated sludge is sourced from a nearby large-scale domestic sewage treatment plant, consisting of fresh sludge (with a moisture content of 70-80%) after dewatering. The sewage is first pumped into the tank using a lift pump, ensuring the liquid level fully submerges the aeration disc in the aerobic tank (avoiding low levels to prevent fan operation issues, particularly for rotary fans). At this point, manually activate the blower to maintain adequate aeration in the aerobic tank.

The recommended sludge dosage is typically 2-5% of the effective volume of the product tank. Sludge may contain chemical agents (used for conditioning) at certain concentrations. If the agent content is excessively high or the toxicity is significant, the sludge should not be used as inoculum for microbial cultivation. To determine if sludge is suitable for inoculation, crush a small amount of sludge and place it in a small container (such as a beaker or plastic bucket) with water and aeration. After a period of time, if the sludge turns yellow, it is ready for inoculation.

⑴ After sludge addition, the low-speed push-flow mixer and blower are set to automatic mode. If the liquid level in the tank is too low, the lift pump can be manually activated to add water until the level meets the operational requirements for the low-speed push-flow mixer and blower, after which the lift pump should be turned off.

⑵ Continue aeration for 2-4 hours, observing the sludge color to check for brownish-yellow discoloration. During this period, allow controlled wastewater inflow while preventing overflow.

⑶ When the sludge concentration exceeds 1500ppm, set the low-speed push-flow mixer, blower, and lift pump to automatic mode. After confirming normal aeration in the membrane module, activate the production water pump. During initial water production, adjust the water production valve to set the flow rate at 1/3 to 1/2 of the design flow rate. If the sludge concentration surpasses 3000ppm, increase the water production flow rate to the design flow rate (Table 10: Design Water Production Flow Rate Values for the Product).

⑷ During the trial production of water, the sludge concentration, SV30, COD, BOD5, ammonia nitrogen, total phosphorus, total nitrogen and other indexes of the mixed liquid were tested

to determine whether the water quality was qualified and to adjust the process parameters in time.

⑤ If the influent COD is too low, nutrients such as flour and glucose should be added.

6.5.2 concentrated sludge cultivation

The activated sludge should be cultivated using mixed sludge from adjacent municipal sewage treatment plants, aerobic tanks, or secondary sedimentation tanks. For activated sludge cultivation in urban wastewater and industrial wastewater treatment systems with complete nutrients and low toxicity, the sludge mixture can be directly added to the wastewater to be treated for aeration. Continuous wastewater feeding can commence once the sludge turns brownish-yellow, with the inflow rate gradually increasing.

To accelerate the cultivation process, unfermented fecal water or other nutrients may be added during the cultivation. The microbial cultivation is completed when the activated sludge concentration reaches the required process value.

6.5.3 Natural Cultivation Method

Natural microbial cultivation, also known as direct microbial cultivation, is a process that utilizes the small number of microorganisms originally present in wastewater for gradual proliferation. This method can be considered for urban sewage and certain industrial wastewater with relatively complete nutrient composition and low toxicity, such as wastewater from food factories and meat processing plants, although the cultivation time is relatively longer. Natural microbial cultivation can be further divided into two types: batch cultivation and continuous cultivation.

（1） Intermittent sludge cultivation. Fill the aeration tank with wastewater and perform silent aeration (aeration without wastewater inflow). After several days, stop aeration and allow 1 hour of sedimentation. Then drain about 1/5 of the upper wastewater layer and inject an equal volume of fresh wastewater. Repeat the cycle of silent aeration, sedimentation, and water inflow, with each cycle featuring increased inflow volume and shortened aeration duration. During spring and autumn seasons, sludge can be preliminarily cultivated within 2-3 weeks. When the mixed liquor sludge concentration in the aeration tank reaches approximately 1 g/L, continuous water inflow and aeration can commence. During the initial cultivation phase, lower sludge concentration results in minimal sediment accumulation in the settling tank, requiring reduced return flow. As sludge volume increases, return flow should be proportionally increased. Once the sludge concentration meets process requirements, normal operation can begin with controls implemented according to process specifications.

（2） Continuous sludge cultivation. First, fill the aeration tank with wastewater, then stop the inflow and maintain aeration for half a day to a day before resuming continuous inflow. Gradually increase the inflow volume during continuous aeration, similar to the intermittent method. After a period of continuous operation, activated sludge will form and gradually accumulate. When the sludge volume in the aeration tank reaches the required concentration for the process, control should

be adjusted according to the process specifications. Since the natural sludge cultivation method directly uses wastewater to grow activated sludge, the cultivation process also involves microorganisms gradually adapting to the wastewater properties and achieving acclimation.

6.6 normal operation

Once the sludge reaches a sufficient concentration (≥3000ppm) and all effluent parameters meet basic standards, the product can enter normal operation. The following items must be reconfirmed:

（1） All pipeline valves are properly operated, and the liquid level control float signals are functioning normally.

（2） The booster pump can supply water normally.

（3） The basket grid is installed correctly and free from blockage.

（4） The hypoxia tank low-speed push-flow mixer operates normally, with the mixed liquid being uniform and showing no significant sedimentation.

（5） The aeration in aerobic tank and membrane tank is uniform, the size is normal, and there is no obvious dead corner.

（6） The reflux pump operates normally with normal flow rate (when the equipment is reversed, the reflux flow is reduced and the equipment current is increased).

（7） The enclosure exhaust fan operates normally.

(8) The UV sterilizer operates normally;

(9) If the phosphorus removal dosing pump is not in use, the dosing tank need not be filled with chemicals; simply set the transfer switch to the stop position.

(10) Ensure all control switches for the booster pump, blower, mixer, reflux pump, and phosphorus removal dosing pump are set to automatic mode and functioning properly. Then activate the production water pump by switching its control switch to automatic mode, thereby initiating the equipment's automatic operation.

7 product operation and maintenance

7.1 membrane organizer

7.1.1 Run Notes

（1） Transmembrane pressure differential (TMP) (TMP= pump shutdown stable pressure-pump running stable pressure): 0~35 kPa. When approaching or reaching 35 kPa, it is recommended to perform recovery cleaning or offline cleaning.

（2） Filter/Stop interval: The filter cycle is 8 minutes, with 7 minutes of filtering and 1 minute of stopping (these are recommended but not mandatory).

（3） Filter membrane flux: Operating above the design flow rate is not recommended.

Excessive flux will accelerate membrane fouling and shorten the actual service life of the membrane module.

（4） Aeration intensity: For domestic and municipal wastewater, the recommended range is 60-110 $Nm^3/(m^2 \cdot h)$, with 70-80 $Nm^3/(m^2 \cdot h)$ being the standard selection. This parameter measures the aeration volume per unit cross-sectional area of the membrane module. Insufficient aeration may cause membrane fouling, while excessive aeration could reduce the module's service life. Aeration intensity is directly correlated with MLSS (Maximum Loadable Sludge Volume), meaning higher MLSS values require greater aeration intensity.

（5） The membrane module can only start water production when the sludge concentration in the membrane tank reaches above 1500ppm, and the flow rate should be set at 1/3 to 1/2 of the design flow rate. Only after the effluent quality meets the basic standards when the sludge concentration exceeds 3000ppm can the water production flow rate be adjusted to the design flow rate.

（6） Activated sludge: The recommended sludge concentration in the membrane tank is 5000~10000 mg/L. If it exceeds 10000 mg/L, the aeration intensity of the membrane unit must be increased and the water production flow rate reduced. If it exceeds 15000 mg/L, water production is not recommended, and sludge discharge is required to reduce the sludge concentration in the membrane tank to a reasonable range before water production can be restored.

（7） Water temperature: The recommended operating water temperature for membrane tanks is 10－35°C. Temperatures above 35°C may adversely affect membrane performance and lifespan, while temperatures below 10°C result in a significant decrease in membrane flux.

（8） Pre-treatment requirements: It is recommended to install a screen at the influent inlet of the regulating tank with a mesh size of 3~5mm to remove large debris and protect the lift pump. Additionally, the basket screen provided with the product must be correctly installed to safeguard the membrane module from damage by large debris.

Set up an aeration grit chamber according to the actual water quality to prevent hard particles from entering the membrane tank and damaging the membrane modules. If the influent contains high oil content, an oil removal device must be added to avoid membrane fouling caused by oil. If the influent has high levels of iron, manganese, or other heavy metals, it is recommended to add a flocculation and sedimentation tank. For cases involving heavy metals or other special pollutants, please consult our company.

（9） pH: The recommended pH range for the membrane pool mixture is 6 to 9.

（10） Sludge loading: The BOD-SS ratio ranges from 0.05 to 0.15 (kg·BOD)/kg·MLSS per day, depending on factors such as raw water composition.

7.1.2 Special Notes for Running

(1) Verify the power supply parameters: 380V,3-phase, 50Hz.

（1） The aeration system, the effluent system, the pretreatment system and the control system are confirmed to be normal.

（2） Confirm that the water quality and quantity of the inlet and outlet are normal.

（3） Confirm that the activated sludge concentration in the membrane tank meets the required standards. The method of adding activated sludge can be employed to rapidly increase the activated sludge concentration in the membrane tank. However, the added activated sludge must be filtered through a screen with a pore size of ≤ 1.0mm to prevent any objects that may damage the membrane product from entering the membrane tank.

（4） Severe membrane clogging may occur due to oil contamination, and water ingress must be prevented. Total vegetable oil content should be controlled below 50 mg/L, and mineral oil content below 3 mg/L.

（5） When aeration is stopped or the aeration volume cannot meet the requirement, the membrane unit is strictly prohibited from producing water.

（6） If the product requires operation during low-temperature seasons, additional thermal insulation measures shall be implemented to ensure normal operation of pipelines and equipment, as well as compliance with water quality standards. If the system is deactivated, the aqueous solution within the tank, pipelines, containers, and equipment must be drained, and the membrane modules shall be disassembled for separate storage. For details, refer to Section 4.2.1 of this manual.

（7） The membrane module system must undergo regular online chemical cleaning and offline cleaning. For specific methods, refer to this guide. For any other matters not specified herein, please consult our company.

（8） For industrial wastewater treatment, please consult our company separately.

7.1.3 membrane cleaning

Chemical cleaning of membranes includes online chemical cleaning and offline chemical cleaning, which must be performed by trained professionals. Membrane modules operate at specified flow rates and require periodic chemical cleaning. When the transmembrane pressure difference reaches 35 kPa, it is mandatory to...

Restorative cleaning must be performed. If the membrane flux cannot be effectively restored through restorative cleaning, offline chemical cleaning should be considered.

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- If the transmembrane pressure differential approaches or reaches 35 kPa, online restorative chemical cleaning should be performed. If the operation time exceeds 1 month, online restorative chemical cleaning is recommended even if the

Online Chemical Process (CIP)

To ensure optimal water production performance of the membrane, regular online chemical cleaning should be performed. If the transmembrane pressure differential reaches or exceeds

If cleaning is performed at 35 kPa, the restoration effect will be significantly compromised.

The recommended online chemical cleaning method is: perform online sodium hypochlorite cleaning every 7-30 days, and acid cleaning at least once every six months.

（1） Types and frequency of drug cleaning

The commonly used solutions are sodium hypochlorite, citric acid, and oxalic acid.

Sodium hypochlorite cleaning cycle: once every 7-30 days, using a sodium hypochlorite solution with a concentration of 1000-3000 ppm.

Acid washing cycle: once every six months or based on the specific contamination condition of the membrane fibers, using a 1-2% (by mass) solution of citric acid or oxalic acid.

（2） dose

The recommended dosage is 2–4 L per square meter of membrane area, plus the required amount for filling the drug delivery tubing. For specific product cleaning procedures, refer to Table 11.

（3） Online chemical cleaning steps

① Ensure the cleaning tank is clean before online cleaning. If no suitable stirring tool is available, add the cleaning solution first, then fill with an appropriate amount of water, and stir to achieve uniform mixing. For products with built-in backwash systems, follow these steps: First, open the water supply valve, then slightly close the outlet valve (after the production pump) to allow some of the produced water to enter the tank. After adding the required water volume, open the outlet valve and close the supply valve. In regions with low water temperatures, consider heating the cleaning solution to improve cleaning effectiveness. The recommended solution temperature ranges from 25°C to 35°C. If the product lacks a backwash system at the factory, install a cleaning device on-site according to the information in Table 11.

Note: The outlet pipe valve need not be fully closed. Keep it open to allow water injection, preventing pressure buildup that could damage equipment.

② Stop filtration and aeration: First, shut down the production water pump and close the production water valve. After 1-2 minutes, turn off the aeration and ensure the membrane module aeration is fully deactivated. Then, open the valve for the chemical supply pipeline.

③Add medication: Start the infusion pump, set the infusion rate, and inject the required dosage within 0.5 hours, then close the medication supply valve.

④After dosing, the membrane unit should be left undisturbed for 1-1.5 hours, followed by 0.5-1 hour of empty aeration (aeration without water production). Then, open the manual water production valve to resume automatic operation.

Offline chemical cleaning

For membrane offline cleaning services, please contact the After-sales Service Department of Shandong Fangting Zhichuang Environmental Protection Equipment Co., Ltd. We will provide comprehensive technical support.

7.1.4 membrane module maintenance

Regularly monitor the aeration status of the membrane module. If uneven aeration, reduced aeration, or complete aeration failure is detected, immediately shut off the water production and aeration in the aerobic tank. Redirect all blower airflow to the membrane module for intensive aeration (approximately 1 hour) to eliminate uneven aeration. If the issue persists, disassemble the membrane module for inspection to check for sludge accumulation or clogging. If present, perform offline cleaning to remove sludge and debris before restoring normal water production.

7.1.5 maintenance overhaul

For details, refer to the attached "Membrane Unit Leakage Elimination Operating Procedures".

7.2 elevator pump

（1） Conduct monthly inspections of the cable lines to check for insulation damage or corrosion.

（2） Inspect the pump body and connecting bolts monthly to ensure there is no loosening or detachment.

（3） Inspect and clean the impeller monthly to prevent blockage by debris.

（4） Avoid idling.

（5） Before each startup, rotate the impeller to ensure smooth operation.

（6） The annual overhaul is usually carried out once a year.

（7） Refer to the random product documentation for the above specific operations and other relevant requirements.

Note: If a significant decrease in water inflow is observed, immediately shut off the booster pump power and remove the pump for inspection.

7.3 Grid

（1） Based on the water quality of incoming water, the basket screen should be cleaned regularly. The principle is that under normal inflow conditions, the water inside the basket screen should not overflow due to blockage by debris.

（2） When cleaning the screen, turn off the lift pump, remove the screen, and use a stiff brush to thoroughly clear debris. Rinse it with clean water, then restore the automatic mode.

（3） If the grille is damaged, it should be repaired or replaced immediately to prevent debris from entering the membrane tank, which could lead to fouling of the membrane module or clogging of the water pump.

7.4 Blower

（1） Regularly inspect and clean the oil filter and air filter sponge. Check the flexibility of the safety valve. If it is not flexible, clean and adjust the safety valve to ensure reliable operation.

（2） Perform weekly inspections to verify: (1) correct belt installation, (2) proper lubricant level (fill to the oil window center when idle), (3) belt rotation freedom, (4) pressure gauge functionality, and (5) secure fastening of anchor bolts and other connections.

（3） While checking the oil level, inspect the belt for damage and replace it promptly if any is found.

（4） If the fan produces abnormal noises or shows a significant drop in airflow, it should be shut down for maintenance.

（5） The fan is overhauled every year.

（6） Refer to the random product documentation for the above specific operations and other relevant requirements.

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- All operations including lubricant inspection, replenishment, replacement, oil filter cleaning, air filter sponge cleaning, and belt inspection/replacement must be performed with the machine shut

7.5 Pump

（1） Regularly check the fastening bolts to ensure they are properly tightened.

（2） Before each startup, rotate the impeller to ensure smooth operation.

（3） Avoid running with an oversubscribed quota.

（4） Avoid idling.

（5） The motor current must not exceed its rated current when measured monthly.

（6） The annual overhaul is usually carried out once a year.

（7） For other relevant requirements, refer to the random product documentation.

7.6 Phosphorus Removal Dosing Pump

（1） Regularly check the fastening bolts to ensure they are properly tightened.

(2) Whether the liquid level in the medicine cabinet meets the startup requirements before each startup.

(3) The motor current must not exceed its rated current during monthly measurements.

(4) A major overhaul is generally performed once a year.

(5) Other relevant requirements refer to the random product documentation.

7.7 Recirculation Pump

（1） Conduct monthly inspections of the cable lines to check for insulation damage or corrosion.

（2） Inspect the pump body and connecting bolts monthly to ensure there is no loosening or detachment.

（3） Inspect and clean the impeller monthly to prevent blockage by debris.

（4） Avoid idling.

（5） Before each startup, rotate the impeller to ensure smooth operation.

（6） The annual overhaul is usually carried out once a year.

（7） Refer to the random product documentation for the above specific operations and other relevant requirements.

7.8 Low-speed Push-flow Mixer

（1） Inspect the motor insulation and fastening bolts at least once a year. If the insulation deteriorates, the machine must be shut down for maintenance.

（2） Cable lines should be inspected at least once a year, and any damaged cables must be replaced.

（3） For other relevant requirements, refer to the random product documentation.

7.9 Backwash Pump

（1） Regularly check the fastening bolts to ensure they are properly tightened.

（2） Before each startup, rotate the impeller to ensure smooth operation.

（3） Avoid running with an oversubscribed quota.

（4） Avoid idling.

（5） The motor current must not exceed its rated current when measured monthly.

（6） The annual overhaul is usually carried out once a year.

（7） For other relevant requirements, refer to the random product documentation.

7.10 UV Disinfector

（1） The work indicator light is on, indicating normal operation.

（2） To ensure continuous sterilization efficacy, the lamp tube should be replaced after 5000 hours of use.

（3） The quartz sleeve should be cleaned after continuous use for more than 1 year, and replaced after more than 3 years of use.

7.11 Tank and Pipelines

When the tank has no area for stirring or aeration, sludge will be deposited after long-term operation. Generally, the sludge at the bottom of the tank should be cleaned at least once a year to avoid excessive sludge affecting the normal operation.

When products are suspended during cold seasons (temperature ≤0℃) or fail to maintain proper thermal insulation, proper winter storage procedures must be implemented.

（1） All solutions in the pools and containers must be drained.

（2） The solution in each tube must also be drained.

（3） The aqueous solution in each device must be thoroughly removed. If special requirements apply, it shall be stored in accordance with the product instructions.

（4） The membrane component must be stored separately (see Section 4.2.1(1) of this manual for

details).

pay attention to uring cold seasons, proper insulation or storage with the system shut down ould be implemented to prevent product damage caused by freezing.

7.12 Monitoring of the Mixed Solution

7.12.1 pH and Temperature of the Mixed Solution

The pH and temperature of the mixed sludge are routine monitoring parameters during operation. In actual operation, the pH of the mixed sludge typically remains within the range of 6.5 to 8.0, without significant fluctuations. During routine operation, attention should be paid to the pH of the influent. If the pH is below 6.0 or above 9.0, appropriate measures should be taken promptly.

The temperature of the mixed solution is mainly affected by the water temperature of the system and the local temperature. The temperature data of the mixed solution should be monitored and recorded once a day, as the basis for the analysis of the membrane flux and the change of the negative pressure during the daily operation.

7.12.2 Hardness, Alkalinity

When the influent has high alkalinity and hardness with alkaline pH, scaling is likely to occur. The influent quality of the membrane tank should be adjusted accordingly by reducing the pH of the mixed liquor or decreasing its hardness to prevent scaling substances from accumulating on the membrane, which could cause severe membrane fouling.

7.12.3 MLSS/MLVSS

The mixed liquor's MLSS (Maximum Liquid Solids) level, a routine monitoring parameter for water treatment plants, is typically maintained between 5,000 and 8,000 mg/L. During operation, this value can be dynamically adjusted based on influent water quality, flow rate, and seasonal variations.

The mixed liquor MLVSS in the membrane pool should be tested weekly or monthly. The MLVSS/MLSS ratio varies depending on influent water quality, membrane pretreatment process, and the type and dosage of chemicals added. In MBR processes, the SRT (specific reaction time) for biochemical reactions is longer, resulting in a lower MLSS/MLVSS ratio compared to other processes, typically ranging from 40% to 70%.

7.12.4 SV30 and SVI, filter paper filtration properties

In daily operation, the mixed liquor SV30 can be used as the basis for the selection of sludge discharge and the adjustment of sludge concentration in the system.

SVI (Sludge Volume Index) is a parameter used to evaluate the settling performance of activated sludge, calculated as SVI = SV30/MLSS. The filtration performance of the membrane tank's mixed liquor filter paper should be included in

routine monitoring, with specific operational procedures detailed in Appendix 3.

The filtration rate of the mixed liquor must be maintained at 25 mL/50 mL for more than 5 minutes (this value is a warning threshold, and each wastewater treatment plant may determine the specific warning value based on daily

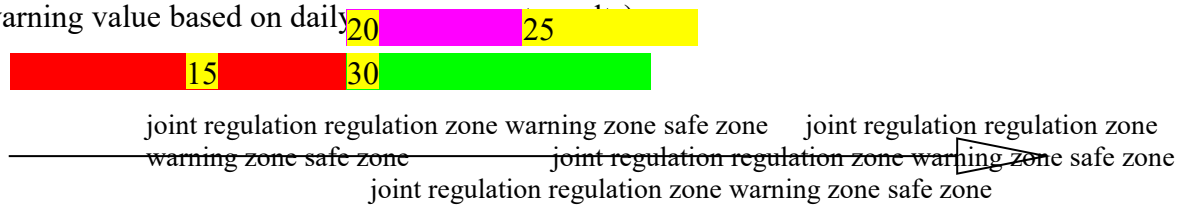


Figure 5 Early warning value of mixed liquid filter paper filtration

Control measures: In actual operation, the specific causes of filtration deterioration must be analyzed based on the project's operational conditions and the mixed liquid's status, followed by targeted improvement measures. See the table below for details.

Table 12 Analysis of Causes and Countermeasures for Deterioration of Mixed Liquid Filtration Performance

order number	1	2	3
apparent condition of the mixed solution	MLSS is too high or too low (SV30>95% or <15%)	The supernatant is turbid in appearance, containing suspended flocs of sludge and residues.	The supernatant is opaque and frothy, containing insoluble colloidal substances.
Cause analysis	. Uneven distribution of sludge in the tank . Failure to discharge sludge in a timely manner or unreasonable reflux ratio . excessive sludge age	1. excessive aeration 2. The inflow contains toxic substances or excessive addition of certain chemical agents (e.g., PAM), leading to sludge poisoning and disintegration. 3. The concentration of sodium hypochlorite used for film washing is too high, and the dosage is excessive. 4. The concentration of refractory organic matter in influent water is excessively high.	1. The overall activity of the sludge deteriorates. 2. The incoming water contains large molecular non-degradable substances in dissolved and colloidal states. 3. containing oil or surfactant substances in the water 4. The temperature of the membrane pool mixture is too low.
pis aller	. Stabilize sludge, adjust reflux ratio . Controlling the sludge age and sludge concentration within a reasonable range . Control the proper ratio of nutrients in water inflow	. Moderately reduce aeration in the biochemical tank and stop aeration when no effluent is produced. . Stop the entry of toxic substances and add PAC regulation by substances such as . Perform online chemical cleaning with appropriate intensity, especially in winter. . Sludge displacement or nutrient addition	1. Sludge displacement or nutrient addition 2. Replace the supernatant or add powdered activated carbon 3. Avoid excessive oil or surfactant substances entering the membrane system. 4. Reducing the intensity of online chemical cleaning 5. Administer appropriate regulatory agents

7.12.5 Viscosity

The monitoring interval for mixed sludge viscosity can be adjusted based on operational conditions. Viscosity primarily fluctuates with temperature and sludge concentration, typically remaining below 10 mPa·s under normal circumstances. Lower temperatures and higher sludge concentrations result in increased viscosity. Higher sludge viscosity leads to greater membrane resistance, which may manifest as elevated negative pressure during membrane operation and reduced water production.

7.12.6 Total Organic Carbon (TOC) in the supernatant

The TOC (Total Organic Carbon) of the mixed liquid supernatant serves as an optional monitoring parameter for the mixed liquid. Its measurement can be performed based on system operation conditions. The TOC value in the mixed liquid supernatant typically ranges from 10 to 15 mg/L, with a maximum of 30 mg/L. This value primarily reflects the amount of soluble small-molecule organic compounds in the supernatant. A lower TOC value indicates a slower rate or reduced probability of membrane fouling.

7.12.7 Sludge Discharge Volume

The volume of residual sludge discharge should be adjusted according to the effluent quality requirements, and the sludge concentration in the membrane tank should not exceed 10,000 mg/L. Otherwise, it may easily cause the membrane to clog and solidify, leading to a significant decrease in water production and affecting normal operation. During daily operation, the discharge volume of excess sludge can be adjusted based on the production of biological sludge, the constant volume of chemical sludge, and the actual influent and effluent water quality.

7.13 Restart after stopping

Restart the system after a 1-3 day shutdown. The activated sludge should be reactivated after 1 day of fan operation before the system returns to automatic control. For long-term shutdown (exceeding 3 days), refer to the sludge culture process in this manual.

8 debugging

8.1 membrane organizer

8.1.1 abnormal membrane water production turbidity

（1） There is leakage in the water pipe.

（2） There is leakage in the collector manifold.

（3） The right-angle elbow is improperly installed or damaged, and the O-ring seal is damaged, missing, or misaligned.

（4） The membrane component is damaged.

Specific solutions are

provided in Appendix 3.

8.1.2 Uneven aeration of membrane bioreactor

（1） The foundation of the membrane tank is not flat.

（2） Abnormalities in the membrane bioreactor aeration system, such as uneven or damaged aeration tank installation, aeration pipe damage, or aeration hole blockage.

（3） The membrane component has the condition of mud accumulation and compaction.

8.1.3 Variable water flow rate with air entrainment in effluent

1. Leakage is detected in the pipeline above the liquid level of the water production system. Apply gas pressure while controlling the pressure (generally not exceeding 20 kPa, gradually increasing the pressure, ensuring no bubble formation at the film point). The primary inspection focuses on potential leaks at all connections in the water production pipeline above the liquid level. A hand soap solution can be applied to each connection; the presence of bubbles indicates a gas leak.

2. Elevated transmembrane pressure differential. As membrane pressure limits vary across different types, this issue typically occurs when exceeding 30 kPa, particularly under low water temperatures where higher dissolved oxygen levels exacerbate vacuum extraction. The primary cause is membrane fouling, necessitating either online or offline cleaning. Reducing the transmembrane pressure differential will alleviate or eliminate the vacuum extraction phenomenon.

8.2 Insufficient airflow

If the wastewater agitation in the membrane module is significantly reduced, first check the air supply system for issues like air leaks, pipe blockages, or fan system malfunctions. Once confirmed, proceed to inspect the aeration system of the membrane module.

8.3 A sudden increase in transmembrane pressure gradient and a decrease in water production

If the preset water production flow rate remains unchanged and a sudden significant increase in transmembrane pressure differential is observed, accompanied by a marked decrease in water output, the following steps should be taken for troubleshooting:

（1） Check if the pressure gauge and other instruments are functioning properly.

（2） Check the aeration condition of the membrane module, and confirm that the aeration intensity and uniformity are normal.

（3） Check relevant records for power outages or fan malfunctions.

（4） Perform air aeration for 1-2 hours (i.e., stop water production and maintain normal aeration or 1.5 times the original aeration rate), or conduct water backwashing for 0.5

hours (with flow rate 1-1.5 times the original water production rate), or combine air aeration with water backwashing. If normal operation cannot be restored, consider the following methods.

（5） Perform a restorative cleaning.

（6） Check for severe mud accumulation in the membrane module. If present, flush the module with clean water, then perform either online chemical cleaning or offline chemical soaking to resume water production.

8.4 foaming phenomenon

Wastewater contains a significant amount of detergents, and sludge can generate considerable foam during aeration. After membrane cleaning, the short-term foam phenomenon caused by sodium hypochlorite (which typically resolves spontaneously within $2-3$ days) is a normal occurrence and requires no treatment. If excessive foam overflow occurs, the following measures may be implemented:

（1） Water spray defoaming.

（2） Use alcohol-based defoamers.

8.5 Common Equipment Issues and Solutions

8.5.1 Adjust the float position

The float level indicator light remains unchanged, typically due to the following reasons:

1. The float signal is not connected; the normally open contact of the float is activated, meaning the float contacts are engaged when the float rises.

(Note: The float comes with a 3-core cable. Unused single-core cables should be properly insulated.)

2. The float ball wire is incorrectly connected to another device's circuit;

3. There is a circuit break in the transmission to the level signal light.

8.5.2 alarm buzzer of electrical control cabinet

There are generally two causes for the buzzer alarm in the electrical control cabinet:

1. Thermal relay alarm:

To clear a thermal relay alarm, simply reset the device (press the blue button), but first identify and resolve the underlying cause.

2. Pressure alarm:

(1) Severe membrane fouling occurs, with pressure reaching the alarm threshold, requiring membrane washing;

(2) The pressure signal line is incorrectly connected to the PLC. Reconnecting the signal line will resolve the alarm (when modifying the wiring, ensure no shared conductors with other circuits).

(3) The pressure transmitter outputs abnormal current signals or the analog module processes

abnormal signals. A milliamperemeter should be used for measurement.

8.5.3 The water flow meter display panel shows incorrect values

(1) Flowmeter parameter configuration error: Reset parameters according to the operation manual.

(2) Loose power cord connection: Re-tighten the flowmeter's power cord.

(3) The slow response of the flowmeter's internal electrical components causes the panel display to remain unchanged. To troubleshoot, first power off the flowmeter several times and check the panel display. If the display remains abnormal, the flowmeter requires maintenance (typically involving a return to the manufacturer).

(4) The ground wire of the flowmeter head does not require wiring (as some field ground wires may not meet the requirements).

8.5.4 The pump is not working properly.

1. Backwash pump

（1） The cleaning pump's prolonged inactivity caused bearing bending and jamming, requiring monthly manual rotation to prevent bending.

（2） If the pump body is rusted or jammed, restart the pump for 3-5 seconds after normal operation.

（3） The power cord is not properly connected, preventing the pump from starting. Check the power cord wiring and tighten each connection individually.

2. Dosing pump

（1） The medication tank is low on liquid, and the pump cannot operate automatically. Check the liquid level in the medication tank, replenish the liquid, and observe whether the pump can operate automatically.

（2） Air is present at the pump suction inlet, resulting in interrupted drug flow and inability to maintain continuous liquid delivery. The pump outlet exhaust valve must be opened to purge all internal gas from the tubing system.

（3） The pump outlet flow rate is too low, and the diaphragm movement frequency inside the pump head is insufficient. After prolonged operation, the pump inlet becomes blocked, resulting in the pump's inability to supply liquid. It is necessary to increase the pump outlet flow rate to ensure that a high-flow rate of medicinal solution passes through the pump, flushing the internal pipeline, and then adjust the pump outlet flow rate to the corresponding value.

（4） The power cord is not properly connected, preventing the pump from starting. Check the power cord wiring and tighten each connection individually.

（5） The motor is burnt out and needs to be replaced.

3. Sludge Recirculation Pump

If the pump outlet shows no flow or very low flow, the possible causes include:

（1） If the water pump runs in reverse, adjust the wiring sequence and check if the pump's outlet flow increases.

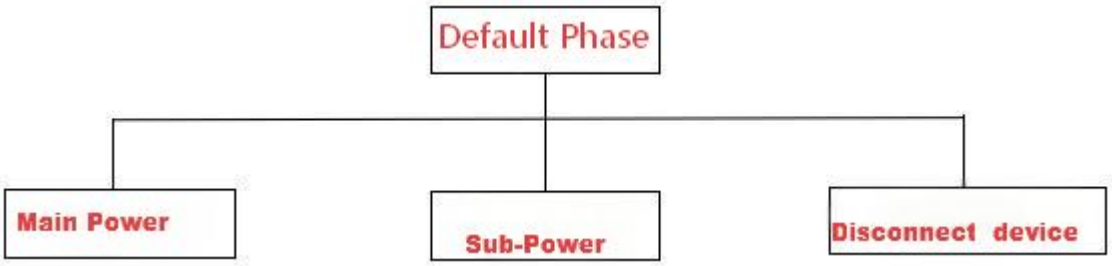
（2） The pump outlet hose has detached. The pump must be removed from the membrane tank, and the pipeline should be reinstalled and secured.

(3) If the pump suction inlet is clogged, remove the pump from the membrane tank and clear debris from the suction inlet.

8.5.5 equipment

1. When the pump transfer switch in the electrical control cabinet is set to manual, the equipment remains inactive but emits audible noise. The thermal relay will trip after 1-2 minutes.

The main reason for this phenomenon is phase loss, which can be mainly divided into: main power supply phase loss, branch power supply phase loss, line break from branch power supply to



terminal, break from control cabinet terminal to equipment branch terminal, and break from branch terminal to equipment.

2. When the manual switch of the electrical control cabinet is set, the operation signal light remains off, the contactor fails to engage, and the equipment stops running.

This kind of problem mainly detects whether the control circuit has power access, whether the control circuit line is correct, whether the control circuit is broken, whether the transfer switch is normal, whether the contactor and thermal relay are normal.

If the control circuit checks out but the equipment still won't start, manually energize the contactor to test its operation. This issue may indicate a burned-out contactor.

3. Set the pump transfer switch on the electrical control cabinet to manual mode, then open the circuit breaker.

The circuit breaker tripped primarily due to excessive current. Inspect whether the breaker is genuine and if there are any abnormalities. If the breaker is functioning normally, disconnect the equipment at the electrical control cabinet terminals and check for internal short circuits in the cabinet. Perform equipment testing (verify if the motor's three-phase resistance is balanced and if the insulation resistance between phase lines and ground meets requirements).

4. After the switch is closed and the equipment runs for a while, the thermal relay will trip after a period of time.

The thermal relay is configured for overheat protection, with tripping indicating line overheating. If the thermal relay trips within 1-3 minutes, verify the setting value. If the setting is correct but the thermal relay still trips, check the motor's rotation direction and potential jamming.

5. When the equipment transfer switch is set to automatic, the equipment operation signal light remains off, and the equipment does not operate, but manual operation functions normally.

Causes: 1. Electrical control conditions are not met; 2. The contact of the transfer switch is not in contact; 3. The PLC has no program; 4. Abnormal wiring in the control circuit.

When the switch is set to automatic mode, the PLC displays a corresponding indicator light for signal input. When the electrical control conditions are met, the corresponding signal light indicates signal output.

Appendix: Membrane Device Leakage Elimination Procedure

I. Determination of the Leaky Membrane Unit

①Activate manual water production mode. When the liquid level drops to the point where the membrane unit's water production flange emerges above the water surface, turn off the water production pump.

After 2 to 5 minutes, turn off the aeration.

② Prepare the air source (oil-free compressed air) and the pressure testing device (Beijing Bishuiyuan Membrane Technology Co., Ltd. can manufacture or provide relevant documentation).

③Remove the water production pipeline of one of the units, and connect it with the water production flange using a flange blind plate with a gas pipe.

④ Activate the gas supply and maintain a constant pressure (not exceeding 0.01MPa). Inspect the membrane unit; the location with visible bubble emission indicates the leak point. Record the corresponding position.

⑤Complete the pressure test and leak detection for the remaining membrane units according to the above steps.

Note: Minor membrane fiber breakage or membrane layer damage may occur due to normal wear during membrane operation or improper handling during offline cleaning. During gas pressure testing, these damaged points may also release bubbles. Small, minor bubbles will not cause leakage or adversely affect membrane operation. The following is a relevant schematic diagram:

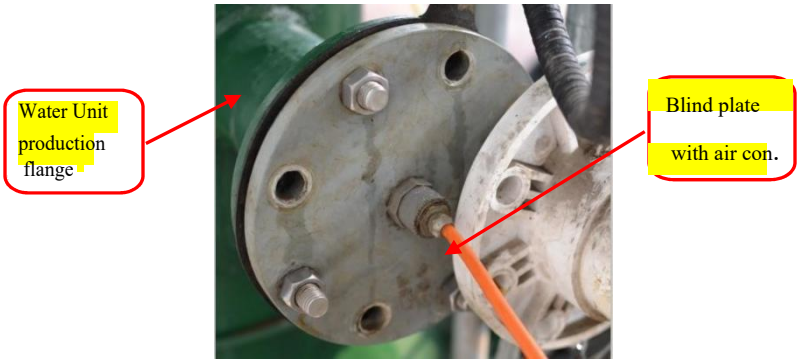


Figure 1 The blind flange of the air duct is connected to the water production flange of the assembly.

II. Leak Solution

Table 1 Common Abnormalities and Solutions of Membrane Filters Table 1 Common Abnormalities and Solutions of Membrane Filters

order number	fault point	judgment basis	countermeasures	Notes (Tools)
1	ABS collection nozzle rupture	Bubble in the suppression	Replace or repair	ABS collection nozzle, sealing ring, ABS rubber
2	ABS manifold seal ring misalignment	Bubble formation during compression	Replace the sealing ring	Seal ring, glycerin (hand sanitizer)
3	There is a leak in the PVC main water supply pipeline.	Bubble formation during compression	weld repair or replacement	PVC welding rods, welding guns
4	General case of broken thread	Bubble formation during compression	Capable of knotting	
5	Root break near the sealing adhesive	Bubble formation during compression	plugging	forceps, plastic stopper
6	The membrane has cracks.	Bubble formation during compression	Repair or replace the membrane assembly.	ABS adhesive, RF-I and RF-II membrane modules
7	Delamination at the connection between the water collection square pipe and the membrane box	Bubble formation during compression	Repair or replace the membrane module.	RF-I and RF-II membrane modules with excellent adhesion properties
8	Damage to the water supply pipeline		renewal	Corresponding pipes and fittings
9	leakage at the flange connection of water production		Replace the rubber gasket	rubber gasket for flange

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