BWMS Operation and Maintenance Manual

Cyeco™ Ballast Water Treatment System

压载水处理系统

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Foreword

The CYeco ™ BWMS ballast water treatment system is a ship ballast water treatment system designed and manufactured based on the International Convention for the Control and Management of Ships' Ballast Water and Sediments promulgated by the International Maritime Organization (IMO) in 2004. To prevent, minimize and eliminate risks to the environment, human health, property and resources from the transfer of harmful aquatic organisms and pathogens.

Seagoing ships complying with the provisions of Convention B-3 shall be equipped with ballast water treatment systems to ensure that the discharged ballast water meets the D-2 discharge standard. The system is applicable to the ballast water treatment of all ocean-going ships.

The purpose of this manual is to provide users and operators with a concise and detailed description of the technical and operational aspects of the CYECO ™ BWMS Ballast Water Treatment System, as well as important information on routine maintenance.

See also CYECO ™ BWMS Site Disclosure Service Manual for the installation and start-up of the system.

System commissioning and initialization, see also CYECO ™ BWMS Commissioning Delivery Manual.

Users should read this manual carefully and receive training on relevant safety knowledge. Personnel without sufficient training in electrical, mechanical and safety aspects, lack of sufficient understanding of the technical principles and operation of system equipment, and lack of necessary professional knowledge shall not carry out the operation and maintenance of relevant systems and equipment.

If you have any questions about the information and procedures described in this manual, please consult Shanghai Electric Chuanyan Environmental Protection Technology Co., Ltd. in a timely manner, and we will provide you with a satisfactory answer.

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Definition

(1) Ballast water management system (BWMS): means any system that treats ballast water to meet or exceed the ballast water performance standards specified in Regulation D-2. Including ballast water treatment equipment, all associated control equipment, monitoring equipment and sampling facilities.

(2) Ballast water management plan: means the document describing the ballast water management process and procedures on board each ship as described in Article B-1 of the Convention.

(3) Ballast water treatment equipment: equipment that uses mechanical, physical, chemical or biological treatment methods alone or in combination to remove, harmlessly dispose of, or avoid the ingestion or discharge of harmful aquatic organisms and pathogens in ballast water and sediments. During the voyage, the ballast water treatment equipment can work when the ballast water is injected or discharged, or at the same time.

(4) Ballast Water Management Convention means the International Convention for the Control and Management of Ships' Ballast Water and Sediments.

(5) Active substance: means a substance or organism, including a virus or fungus, that has a general or specific potent or adverse effect on harmful aquatic organisms and pathogens.

(6) Control equipment: equipment installed to operate and control the ballast water treatment equipment.

(7) Testing equipment: equipment installed to evaluate the operational effectiveness of ballast water treatment equipment.

Part I: Operation Manual

1 Cyeco™BWMS System Description

1.1 Standards and specifications

- IMO International Convention for the Control and Management of Ships' Ballast Water and Sediments (2004)
- MPEC.300 (72) Resolution Ballast Water Management System Approval Rules (G8)

1.2 Cyeco™BWMS Process Description

1.2.1 Cyeco™BWMS Process

Cyeco ™ B WMS Ballast Water Treatment System is an online secondary treatment system that combines 100% pure physical process, mechanical filtration and ultraviolet (UV) disinfection technology to effectively treat and manage the ballast and discharge of ship ballast water. Filters greatly reduce the sediment load in ballast water and remove large organisms. Ultraviolet disinfection equipment kills plankton, viruses and other microorganisms.

The Cyeco ™ B WMS Ballast Water Treatment Unit uses a high pressure backwash self-cleaning filter to pre-treat the ballast water, followed by a medium pressure UV disinfection system to sterilize the seawater. The device system (filter and UV sterilization device) is connected in series to the ballast water pipeline system, so that the incoming and outgoing seawater can be effectively treated online.

Cyeco ™ BWMS processes ballast water during ballast and discharge. The process will not cause interruption of system operation or affect the operation time of ballast and discharge. The control system controls the automatic operation of relevant valves according to the PLC program.

1.2.2 Cyeco™BWMS System Features

- Safe and reliable, without adding any chemicals
- No toxic byproducts
- Compact design

- Simple operation and automatic operation
- Convenient maintenance and low cost
- No corrosion problem
- Reduce sediment in ballast tank

The Cyeco ™ BWMS Ballast Water Treatment System provides GPS signal access to effectively record vessel position and time/date of operation data, which is stored on the memory card of the control system. The Cyeco ™ B WMS Ballast Water Treatment System continuously monitors the operation of the Ballast Water Management System; Operation and fault data are stored in the system memory card, valid for two years; The recorded data can be downloaded and viewed through the data interface.

1.2.3 Cyeco™BWMS Technical Specifications

- System composition: self-cleaning filter, ultraviolet sterilization device, pipeline system and control system
- Power supply: 3-phase AC 380/440V, 50/60 HZ
- Design pressure: 0.8 Mpa
- Salinity: Unlimited
- Temperature: Unlimited
- Retention time: 24 hours

1.2.4 Cyeco™BWMS Emission Standard

Cyeco ™ BWMS Ballast Water Management System series products, using pure physical process of filtration and ultraviolet disinfection, effectively treat the ship's ballast water and meet the D-2 discharge standard required by IMO Convention.

1.3 Cyeco™BWMS Process Flow Description

Cyeco™BWMS is controlled by PLC, and the touch screen man-machine interface is used for operation display and operation.

1.3.1 PFD

See the attachment for the process flow of Cyeco™BWMS pipes and valves: Cyeco/TD04-4003-D003; Cyeco™ BWMS PFD Drawing。

1.3.2 Operation of self-cleaning filter

The self-cleaning filter uses a filter screen to intercept sediments and large aquatic organisms in seawater and play a filtering role. The system uses differential pressure detection instrument to automatically detect the filter resistance of the filter screen. When the filter resistance increases due to the accumulation of filter intercepts on the surface of the filter screen, the system will automatically clean the filter screen under the control of PLC according to the differential pressure detection signal. The interceptor on the filter surface of the filter screen is cleaned through the decontamination suction nozzle on the inner side of the filter screen.

The decontamination suction nozzle is driven by a motor through a central shaft, performs axial and circumferential composite motion along the surface of the filter screen to generate spiral scanning, and forms a cleaning surface under the action of negative pressure dirt suction to complete the cleaning of the filter screen.

1.3.3 Operation of UV Disinfection Reactor

Medium pressure ultraviolet disinfection equipment uses ultraviolet light to kill plankton, viruses and other microorganisms for biological inactivation. The ultraviolet light is generated by a medium-pressure ultraviolet lamp arranged in a reaction cavity of the ultraviolet disinfection device. The medium-voltage ultraviolet lamp is sealed and fixed in the quartz sleeve, controlled by PLC and powered by electronic ballast. The irradiation intensity of ultraviolet rays is automatically detected by the UV intensity detection probe and the detection signal is transmitted to the system PLC. The temperature of the cavity of the ultraviolet disinfection device is detected and monitored by a temperature sensor fixed on the cavity.

1.3.3.1 Preheating and cooling of UV lamp tube

In order to ensure stable ultraviolet intensity output, the ultraviolet lamp tube shall be preheated for a certain period of time (about 3 minutes) from lighting to stable operation, so as to ensure stable irradiation dose and play a predetermined role in sterilization. Therefore, whether it is ballast operation or discharge operation, the UV system needs a certain period of preheating process after the lamp is powered on.

In order to reduce the influence of the residual heat of the lamp tube on the service life, the medium-voltage ultraviolet lamp tube should be cooled for a certain period of time after being shut down and powered off;

Preheating and cooling are carried out automatically under the control of PLC program, which is realized by the internal circulation of the return pipeline inside the system. The heat of the medium-voltage ultraviolet lamp is taken out and dispersed in the seawater through the internal circulation.

The backflow internal circulation is cooperatively switched by the opening of the backflow valve and the closing of the flow regulating valve, so that the seawater medium flows back to the inlet of the ballast pump.

	Lack of delayed cooling may lead to serious damage to the UV tube.

1.3.3.2 Cleaning of UV lamp

During the operation of the UV unit, when the penetration of ultraviolet rays is affected due to the adhesion of viscous substances in the seawater medium or scaling on the outer wall of the quartz sleeve, the system PLC will automatically clean the quartz sleeve outside the UV lamp tube under the control of the automatic detection signal of ultraviolet light intensity.

Cleaning of quartz casing: driven by the motor, the cleaning shaft drives the cleaning ring to reciprocate to clean the quartz casing.

1.3.4 Ballast flow

The ballast operation is controlled by the PLC program, and the running flow is automatically detected by the electromagnetic flowmeter in the system pipeline. During ballasting, the seawater flows through the self-cleaning filter to remove large particles and microorganisms, and then enters the ultraviolet cavity for sterilization. Filter

pretreatment is also effective in preventing the accumulation of sediment in the ballast tank. The automatic backwash sewage of the filter is automatically discharged back to the ballast water intake point. Under the control of the system PLC, the ballast process automatically completes the preheating and ballast operation.

1.3.4.1 Ballast preheating

After the ballast program is started, the system automatically executes the ballast preheating program first, and then automatically executes the ballast operation.

Ballast preheating process: the ballast pump pumps seawater from the subsea valve box, filters it through the self-cleaning filter, disinfects it through the ultraviolet unit, and then returns it to the suction inlet of the ballast pump through the return valve. The excess heat of the UV lamp tube is taken out in the backflow process and dispersed into the seawater medium to achieve the purpose of preheating the medium-pressure ultraviolet lamp tube.

In order to ensure the operation safety, the electromagnetic flowmeter is used to detect and monitor the medium flow in the backflow process to prevent the backflow failure from affecting the safety of the lamp tube.

See the attachment for the operation process of Cyeco™BWMS ballast preheating: Cyeco/TD04-4003-D003; Cyeco™ BWMS PFD Drawing-Ballast Preheating。

1.3.4.2 Ballast

After preheating, the system will automatically open the flow control valve according to the PLC program for flow control and regulation, and close the return valve at the same time, and the program will automatically switch to ballast operation.

Ballast process: the seawater from the outboard is pumped by the ship's ballast pump from the subsea valve chest, measured and detected by the electromagnetic flowmeter, and enters the Cyeco ™ BWMS system. The PLC automatically opens the inlet valve of the filter according to the program. After being filtered by the filter, the seawater enters the UV unit for disinfection treatment. The flow is controlled by the flow control valve at the UV outlet. The treated seawater is sent to the ballast tank of the ship until the ballast operation is completed.

In the process of ballast operation, the system detects the running flow and UV dose in real time, and controls the flow and UV dose in real time according to the set parameters.

The seawater treated by BWMS is sent to the ballast tank.

Filter wash fluid during ballasting is automatically discharged overboard.

See the attachment for the ballast operation process of Cyeco™BWMS:

Cyeco/TD04-4003-D003; Cyeco™ BWMS PFD Drawing-Ballast。

1.3.5 Discharge process

Because the seawater entering the ballast tank has been filtered in the ballast stage, the filter is bypassed when discharging, and the seawater is only disinfected by ultraviolet equipment to sterilize the ballast water again. Effectively kill the residual aquatic organisms and pathogens in the discharged seawater, and ensure that the quality of the discharged water fully meets the D-2 requirements, so as to ensure that there is no transfer of foreign organisms and pathogens.

1.3.5.1 Drain preheating

If the ballast operation is the same, the discharge operation also includes two stages of preheating and discharge. When the drain sequence is activated, the system automatically performs the warm-up sequence first and then the drain sequence.

Discharge preheating process: the ship ballast pump sucks seawater from the ballast tank, sends it to the ultraviolet cavity for disinfection, and then returns to the ballast pump inlet through the return valve. The excess heat of the UV lamp tube is taken out in the backflow process and dispersed into the seawater medium to achieve the purpose of preheating the medium-pressure ultraviolet lamp tube.

In order to ensure the operation safety, the electromagnetic flowmeter is used to detect and monitor the medium flow in the backflow process to prevent the backflow failure from affecting the safety of the lamp tube.

Cyeco™BWMS discharge preheating operation process is detailed in the attachment:

Cyeco/TD04-4003-D003; Cyeco™ BWMS PFD Drawing-Discharge Preheating。

1.3.5.2 Discharge

After preheating, the system will automatically open the flow control valve according to the PLC program for flow control and regulation, and close the return valve at the same time, and the program will automatically switch to the discharge operation.

Discharge process: The seawater from the ballast tank is pumped by the ship's ballast

pump, measured and detected by the electromagnetic flowmeter, and enters the Cyeco ™ BWMS system. The PLC automatically opens the UV inlet valve according to the program, enters the UV unit for disinfection treatment, regulates the flow through the flow regulating valve at the UV outlet, and discharges the treated ballast water out of the shipboard until the discharge is completed.

In the process of discharge operation, the system detects the operating flow and UV dose in real time, and controls the flow and UV dose in real time according to the set parameters. The seawater treated by BWMS is discharged overboard.

The Cyeco ™ BWMS emission operation process is detailed in the attachment: Cyeco/TD04-4003-D003; Cyeco™ BWMS PFD Drawing-Discharge。

1.3.6 Sweep process

The cleaning process is a special discharge process. Due to the large amount of sediment at the bottom of the ballast tank, it is also necessary to be pretreated by a filter when discharging, which is applicable to the tank sweeping process. When sweeping the cabin, the seawater flows through the self-cleaning filter to remove large particles and microorganisms, and then enters the ultraviolet cavity for sterilization. Pretreatment of the filter can effectively treat the sediment in the ballast tank. Filter automatic backwash sewage is automatically discharged back to the bilge. Under the control of system PLC, the cleaning process automatically completes the preheating and cleaning operation.

1.3.6.1 Sweep preheating

After the cabin sweeping program is started, the system first automatically executes the cabin sweeping preheating program, and then automatically executes the cabin sweeping operation.

Sweeping and preheating process: seawater is pumped from the bottom of the ballast tank by the sweeping pump, filtered by the self-cleaning filter, then disinfected by the ultraviolet unit, and then returned to the suction port of the sweeping pump through the return valve. The excess heat of the UV lamp tube is taken out in the backflow process and dispersed into the seawater medium to achieve the purpose of preheating the medium-pressure ultraviolet lamp tube.

In order to ensure the operation safety, the electromagnetic flowmeter is used to detect and monitor the medium flow in the backflow process to prevent the backflow failure

from affecting the safety of the lamp tube.

See the attachment for the operation process of Cyeco™BWMS cabin sweeping and preheating:

Cyeco/TD04-4003-D003; Cyeco™ BWMS PFD Drawing-Strip Preheating。

1.3.6.2 Sweep the cabin

After preheating, the system will automatically open the flow control valve according to the PLC program to control and regulate the flow, and close the return valve at the same time, and the program will automatically switch to the operation of sweeping.

Sweeping process: the seawater from the ballast tank is pumped by the ship's sweeping pump from the bottom of the ballast tank, measured and detected by the electromagnetic flowmeter, and enters the Cyeco ™ BWMS system. The PLC automatically opens the inlet valve of the filter according to the program. After being filtered by the filter, the seawater enters the UV unit for disinfection treatment. The flow is controlled by the flow control valve at the UV outlet. The treated seawater is discharged out of the shipboard until the cleaning operation is completed.

In the process of sweeping operation, the system detects the running flow and UV dose in real time, and controls the flow and UV dose in real time according to the set parameters. The seawater treated by BWMS is discharged overboard.

Filter cleaning fluid during sweeping is automatically discharged to the bilge.

See the attachment for the ballast operation process of Cyeco™BWMS:

Cyeco/TD04-4003-D003; Cyeco™ BWMS PFD Drawing-Strip。

1.3.7 System shutdown

After the operation of ballast, discharge and tank sweeping, manually click the "shutdown" button on the touch screen to start the shutdown procedure and realize the shutdown operation.

After the shutdown program is started, the system PLC will first open the return valve, then close the flow control valve, switch the system pipeline to the return state, and cut off the system water outlet. After the flow control valve is completely closed, the system PLC will automatically shut down the power supply of the electronic ballast to the UV lamp. Maintain a certain backflow state, and stop the ballast pump and (/or) stripping pump after the lamp tube is cooled enough, and then the system is shut down.

Cyeco ™ BWMS automatically reverts to the initial standby state after a shutdown.

1.3.8 Bypass

In case of emergency, the bypass mode can be opened, and the ballast water will not flow through the ballast water management system.

Warning: Any bypass action will be recorded by the system and stored for 24 months.

The Cyeco ™ BWMS bypass operation process is detailed in the attachment: Cyeco/TD04-4003-D003; Cyeco™ BWMS PFD Drawing-Bypass。

1.3.9 Emergency stop

When an emergency occurs and the BWMS needs to be stopped immediately, press the emergency stop button. The following will occur:

- All components of the BWMS will stop immediately.
- When the button is pressed, all valves will be closed. This will prevent accidental discharge/ballasting.
- If necessary, the operator should shut down the ballast pump.
- An audible and visual alarm will be activated and an emergency stop action will be recorded.

To disengage the emergency stop, turn the knob clockwise. The system will then enter the start-up procedure described in chapter 3.9.5. When the start-up procedure is complete, the system will enter the standby state. The system will not restart from where it left off and should be restarted from the beginning. The action is logged.

1.4 Cyeco™BWMS system composition

The Cyeco ™ BWMS Ballast Water Treatment Unit consists of:

- Self-cleaning filter unit
- UV disinfection unit
- Piping system
- Detection instrument
- Control System
- Sampling device

1.4.1 Self-cleaning filter unit

1.4.1.1 Effect of Filter Pretreatment

Purpose of filter pretreatment:

- Intercepting organisms and sediments larger than 50 microns in water
- Reduce sediment in ballast tank
- The transmittance of the ultraviolet lamp is improved, so that the sterilization efficiency of the UV device is improved.

The self-cleaning filter is installed at the outlet of the ballast pump, with continuous filtration and automatic backwashing. The backwashing does not affect the filtration operation. It is a mature and convenient automatic filtration system.

Pretreatment with a filter fineness of 50 microns is effective enough for medium pressure UV sterilization technology.

1.4.1.2 Filtration principle

For ballast water treatment, Cyeco ™ BWMS filters raw water using a two-stage series of coarse and fine filters.

- Filtration by coarse filter screen: the raw seawater enters the filter from the water inlet and passes through the coarse filter screen to preliminarily intercept the large-scale granular mechanical impurities, so as to avoid the mechanical blockage of the post-stage decontamination suction nozzle;

- Fine filter screen filtration: the filtration precision is 50 microns, the impurities and organisms larger than the filtration precision are intercepted by the filter screen, and the filtered seawater flows out from the water outlet, so that the treated water is filtered.

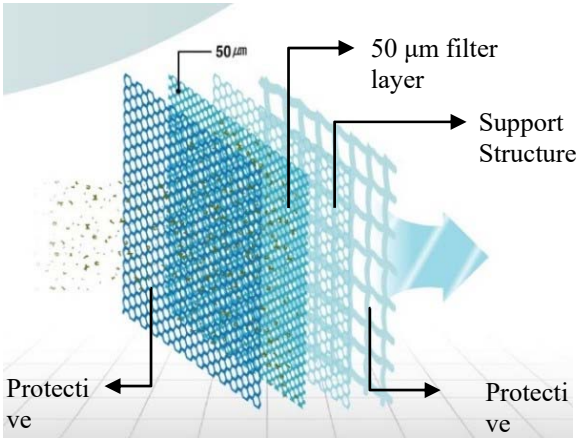


Figure1: Filter structure

1.4.1.3 Composition of self-cleaning filter

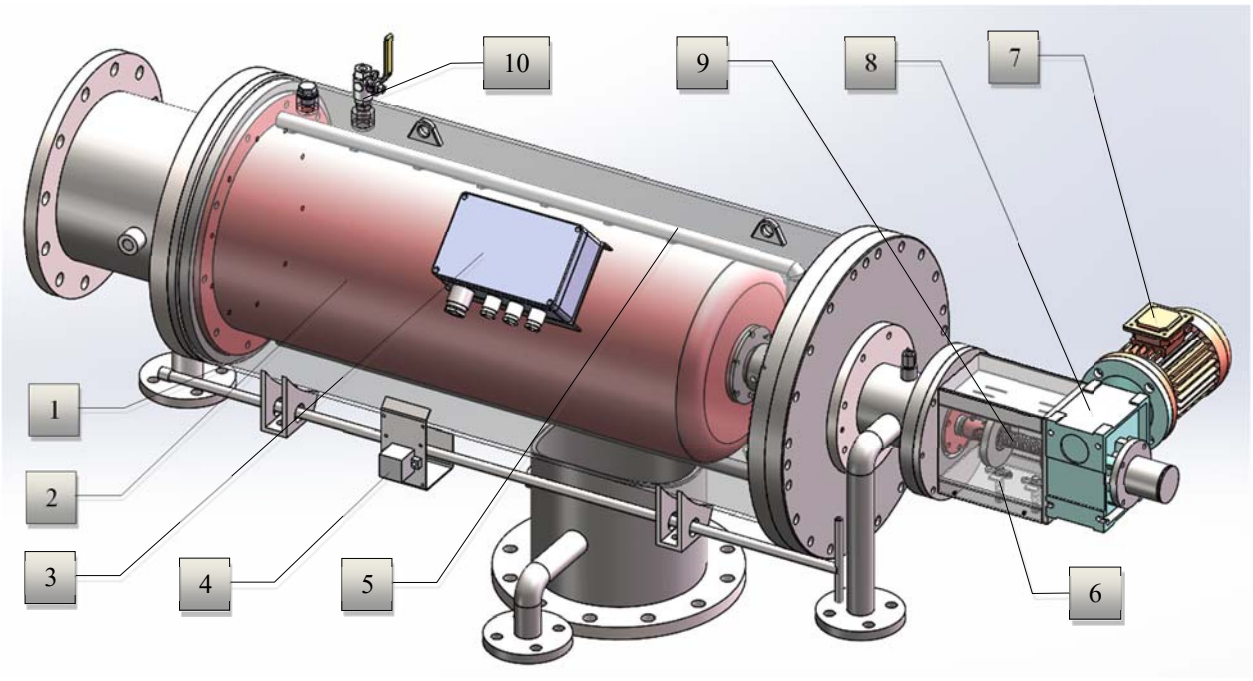


Figure2: 3D model of high pressure backwash filter

The self-cleaning filter is mainly composed of the following components:

1) Cylinder
2) Filter element
3) Junction box
4) Differential pressure measuring instrument

5) Backwash blowdown mechanism
6) Travel switch
7) Clean the motor
8) Reducer
9) Drive shaft
10) Exhaust Valve
11) High pressure pump (external)

1.4.1.4 Features of self-cleaning filter

- Large filtering area, reliable operation and simple structure
- Two-way stainless steel 50 μm precision folding filter filter, stable and reliable filtered water
- Small structure size and small occupied space
- Low system pipeline medium back pressure operation, 0.1-0.2MPa ballast pump lift can operate
- Automatic filtration resistance differential pressure detection, automatic cleaning
- Uninterrupted continuous filtration, backwash cleaning filter screen does not affect the operation of filtration

1.4.2 UV disinfection unit

1.4.2.1 Function of UV disinfection unit

The ultraviolet disinfection unit is used to kill plankton, viruses and other microorganisms in the treated medium for biological inactivation.

1.4.2.2 Ultraviolet disinfection principle

The ultraviolet disinfection unit uses UV light to effectively kill plankton, pathogens and microorganisms in the water body. The effective spectral range of UV light is between 200 and 280 nm, which is easily absorbed by organisms and has a strong bactericidal effect. After absorbing a certain amount of ultraviolet light, organisms cause damage to their DNA structure sequence, thus killing the surviving cells and inhibiting their reproduction. Because the UV disinfection process does not require the addition of any chemicals, there is no chemical residue, so the UV disinfection technology will not adversely affect the

environment.

Ultraviolet sterilization and disinfection of water is a very mature and reliable technology. Ultraviolet (UV) is an electromagnetic wave with a wavelength between visible light (400 nm) and X-rays (100 nm). According to the order of wavelength from high to low, ultraviolet radiation can be divided into four bands: UV-a, UV-B, UV-C and vacuum ultraviolet (UV-V).

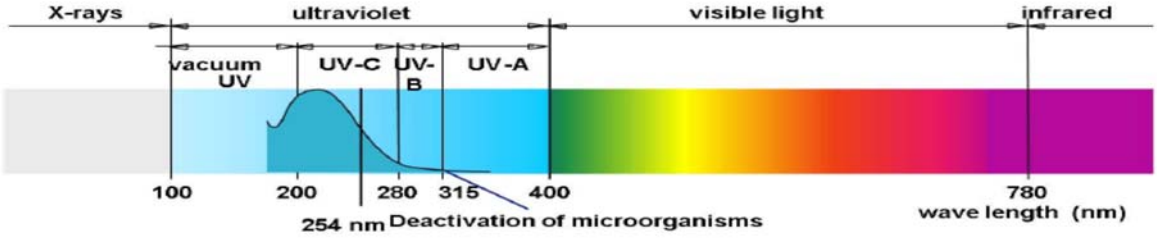


Figure3Electromagnetic spectrum

- UV-A (400-315 nm), also known as black light, has the longest wavelength and the lowest energy, accounting for the largest share of ultraviolet light in nature:
- UV-B (315-280 nm): Can cause sunburn, but poor penetration in liquids;
- UV-C (280-200 nm): All absorbed by the atmosphere and usually only produced by artificial light sources. Has strong bactericidal effect;
- UV-V (200-100 nm): compounds can be photolyzed, but by-products are easily produced. For example, at a wavelength of 185 nm, ozone is produced.

When microorganisms are exposed to ultraviolet radiation, DNA and RNA, the genetic material of cells, absorb enough ultraviolet energy, and the original structure will break bonds and form new bonds in the molecule. Because the structure of DNA material is destroyed, DNA can not replicate, which inhibits the reproduction of microorganisms.

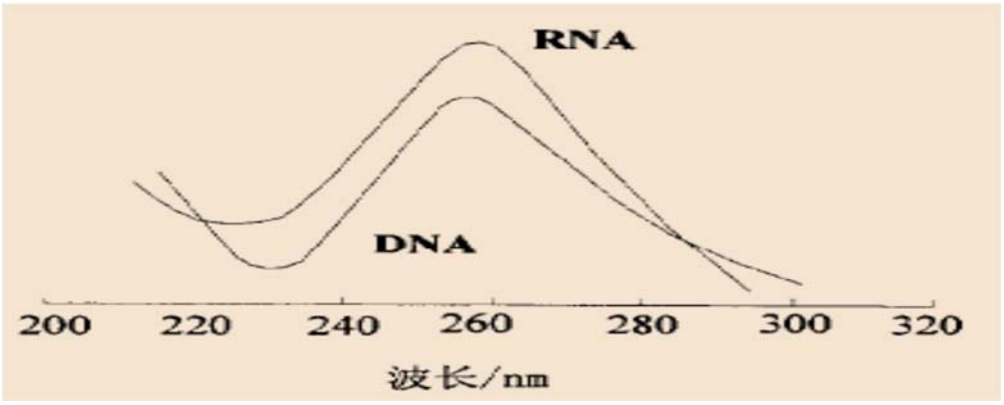


Figure 4Ultraviolet absorption spectra of DNA and RNA

The figure above is the ultraviolet absorption spectrum of DNA and RNA. The absorption spectrum ranges from 240 nm to 280 nm, and has the maximum absorption of ultraviolet light with a wavelength of about 265 nm.

Both DNA and RNA are sensitive to UV-C. The most common effect of UV-C is the formation of a cyclobutane ring between adjacent thymocytes on the same DNA/RNA strand. This isomer, called thymocyte dimer, disrupts the helical structure of the DNA/RNA molecule, preventing the attachment of photorepair enzymes, thereby inhibiting microbial reproduction.

Figure5Structural changes that occur when DNA absorbs ultraviolet light

1.4.2.3 Advantages of medium pressure UV disinfection

Cyeco ™ BWMS disinfects ballast water using a medium-pressure UV lamp with high intensity and broad spectrum characteristics. In the working condition of the ballast water treatment system, compared with the low-pressure lamp, the medium-pressure ultraviolet lamp has obvious advantages:

- The medium-pressure ultraviolet lamp has higher power density and radiation intensity, and has the characteristics of more compact device design and small equipment occupation area aiming at the working conditions of large flow and small space. Under the condition of limited installation space, it has obvious advantages.
- Medium pressure ultraviolet lamp has wide spectrum characteristics, which has stronger sterilization effect in dealing with complex water quality conditions such as ballast water.
- Cyeco ™ BWMS UV disinfection unit with cross-flow lamp arrangement, compact design, small footprint and low pressure loss. Its unique advantage is that it can effectively treat water with low light transmittance or very large amount of water.
- The installation of the UV unit requires only inlet and outlet connections. All monitor components are integrally mount with that reaction chamber. All individual power/control modules may be remotely mounted or mounted near the reaction chamber.

1.4.2.4 Composition of Cyeco™BWMS Ultraviolet Disinfection Device

Medium pressure UV sterilizer for Cyeco ™ BWMS, major components include:

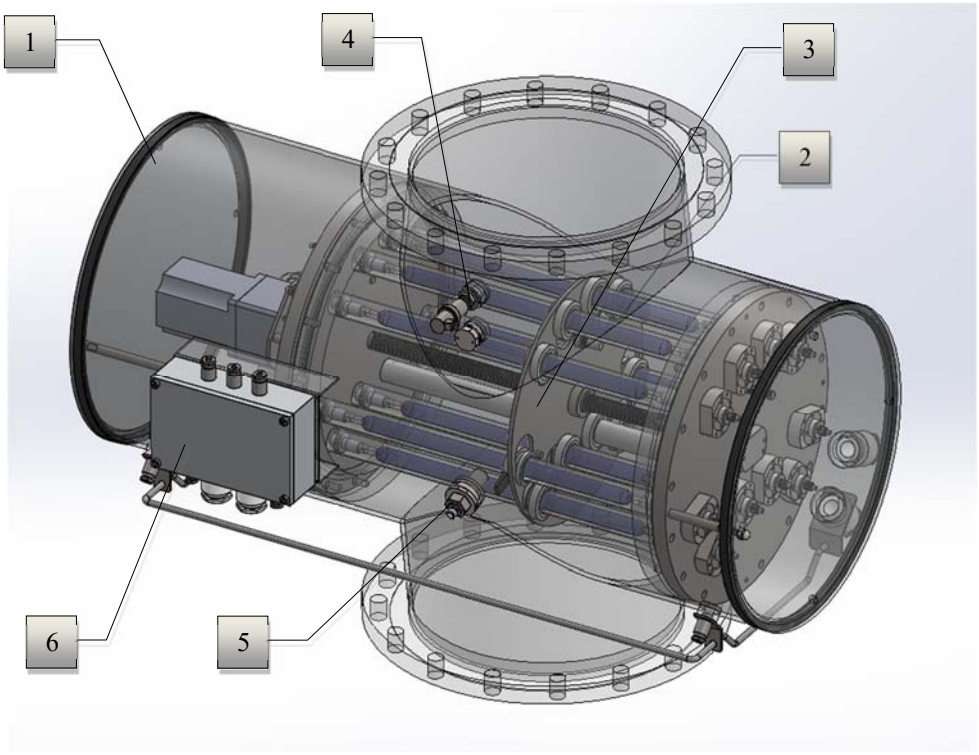


Figure6: 3D model of medium pressure UV sterilization device

1) UV reaction chamber

2) Medium-voltage ultraviolet lamp tube with quartz sleeve

3) Automatic clean device for ultraviolet lamp tub

4) Temperature sensor in ultraviolet cavity

5) UV intensity sensor

6) Junction box

7) Electronic ballast (electronic ballast is installed in the power cabinet)

UV reaction chamber

- The main component of the ultraviolet sterilization device is the reaction chamber, which is made of 316L stainless steel, durable, leakage-free and with flange interface.
- Design pressure: 8 bar;
- Operating water temperature: < 45 ℃
- Material of reaction chamber: SS316L

Lamp tube/quartz sleeve

The ultraviolet lamp tube is arranged in the high-purity quartz sleeve. The transparent high-purity quartz sleeve protects the ultraviolet lamp tube and is connected with the cavity. The water flow passes through a stainless steel reaction cavity containing a plurality of ultraviolet lamps to be treated.

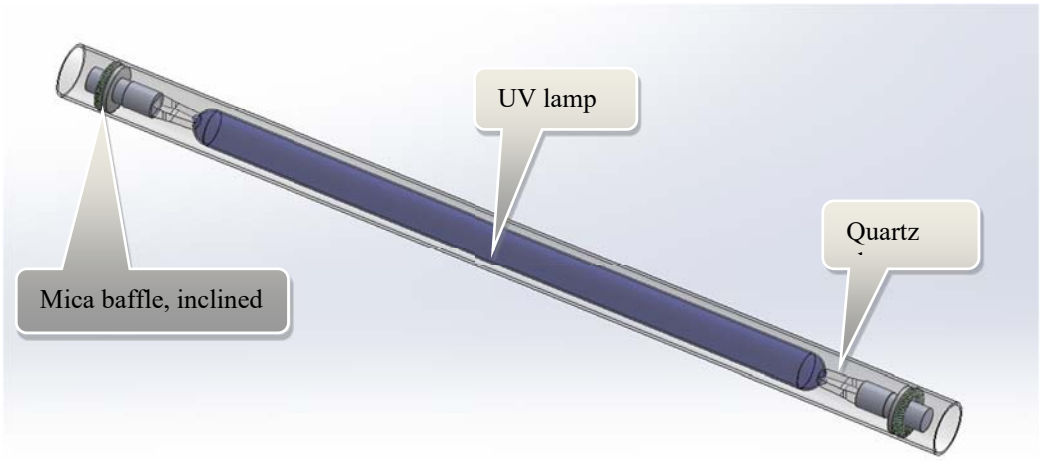


Figure 73D model of pressure ultraviolet lamp

Automatic clean device for lamp tub

The lamp tube automatic cleaning device is used for cleaning the substance adhered on the surface of the quartz sleeve and keeping the ultraviolet transmittance of the quartz sleeve. The lamp tube automatic cleaning device mainly comprises a cleaning motor, a cleaning bracket, a transmission shaft and a cleaning ring. When the UV probe continuously detects low ultraviolet light intensity, the system PLC will automatically start the lamp cleaning program to clean the lamp. When the cleaning system works, the cleaning shaft is driven to rotate by the positive/negative rotation of the driving motor, and the cleaning support is driven to horizontally reciprocate in the reaction cavity, so that the lamp tube cleaning exchange is driven to scrub the surface of the quartz sleeve, and adhesions on the surface of the quartz sleeve are removed, so that ultraviolet light can be normally transmitted. The cleaning ring is made of fluororubber material with corrosion resistance and ultraviolet aging resistance. The cleaning mechanism runs stably and reliably, and the cleaning effect is good.

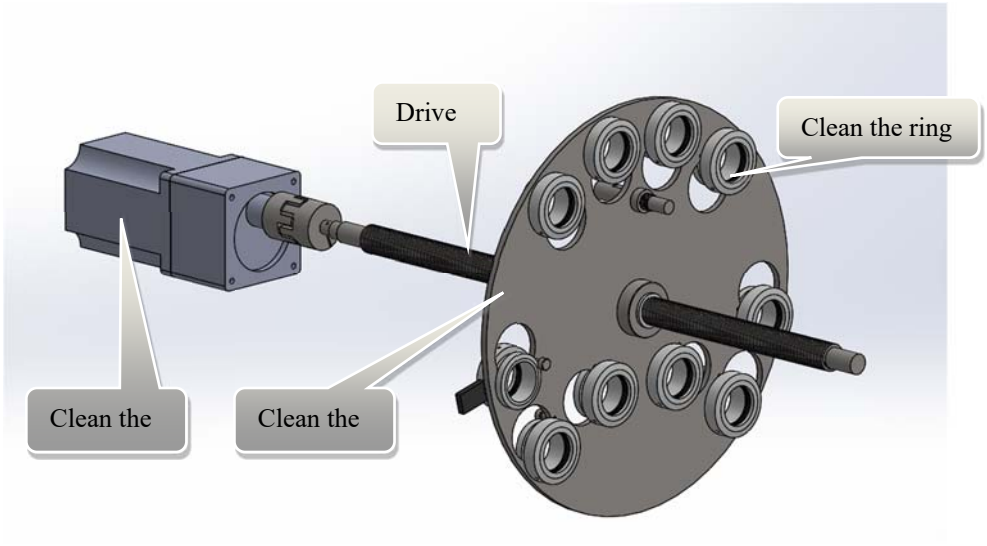


Figure 8: 3D model of automatic lamp cleaning device

The normal work of the ultraviolet sterilization device is not affected during cleaning. Remote manual or automatic cleaning can be realized through the operation interface and remote control, and the cleaning cycle can be controlled.

Ultraviolet intensity detection system

The ultraviolet radiation intensity is detected online by the ultraviolet intensity detector, and the ultraviolet lamp is controlled in real time by the system PLC according to the set UV dose parameters. The ultraviolet light intensity detector is arranged in the cavity to continuously detect the irradiation intensity of UV light on a fixed point in the reaction cavity in real time, and ultraviolet dose data is calculated and displayed through a PLC program. Real-time detection of ultraviolet light intensity.

Temperature detection and alarm system

When the UV lamp tube is powered on, the surface of the lamp tube will produce a high temperature of 600-900 ℃, which will produce a large amount of heat. The excess heat needs to be taken away by the flowing seawater medium. The normal operation of the lamp tube can be maintained only by controlling the surface temperature of the tube below 45 ℃.

- A temperature probe (PT-100) is arranged in the ultraviolet cavity;
- If the detected temperature is higher than the set value, an alarm is triggered and the operation of the ultraviolet sterilization system is automatically stopped.

1.4.3 Piping system requirements

- Cyeco ™ BWMS equipment units are designed and manufactured for a design pressure

of 0.8 MPa unless otherwise specified. The interface flange shall be configured as per 1.0 MPa grade;

- The pipeline is configured according to the pressure rating of 1.0 MPa;
- The piping system shall be connected with standard flange interface. According to customer conditions, applicable flange standards include: GB/T 2506-2010 and GB/T 9119-2000;
- The system pipeline is set according to the normal ballast water system pipeline, and the relevant valves are set according to the P & ID;
- An exhaust valve is arranged at the high point of the pipeline to reduce the gas resistance;
- A blow-down valve is arranged at the low point to facilitate maintenance;
- The pipeline setting is simple, the space layout is reasonable, and the maintenance is convenient.

1.4.4 Detection instrument

In addition to the instruments on the self-cleaning filter and the UV disinfection unit itself, the Cyeco ™ BWMS system uses an electromagnetic flowmeter for system flow detection and monitoring;

Through the detection signal of the electromagnetic flowmeter and the PLC control of the system, Cyeco ™ BWMS adjusts and controls the system flow by the flow control valve in the system pipeline according to the set flow parameters to keep the system temperature running.

1.4.5 Control System

1.4.5.1 Cyeco ™ BWMS Control System Components

Cyeco ™ BWMS adopts PLC (programmable logic control box) control and touch screen operation to connect the local electromechanical equipment, detection instruments, valves and power system of the system, complete the operation control of the system, and can be remotely controlled.

The Cyeco ™ BWMS control system consists of:

- PLC cabinet

- Power cabinet
- Remote box (optional)
- Instrument

1.4.5.2 PLC cabinet

The PLC cabinet is the control center of the Cyeco ™ BWMS and controls the system's startup, ballast, discharge, shutdown, fault alarm, operation log, and data storage functions.

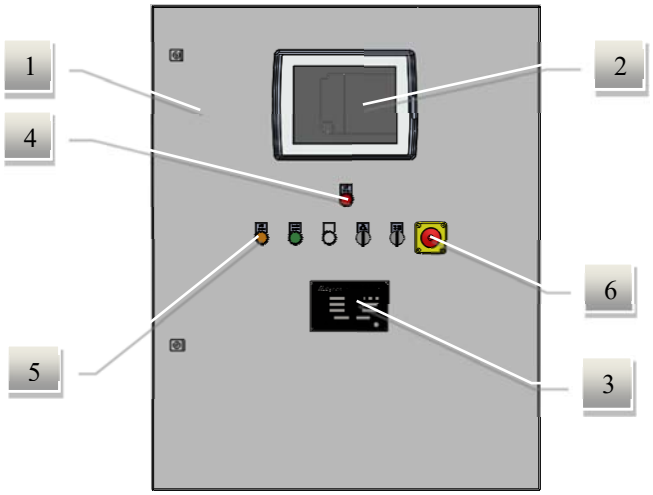


Figure 9: PLC control cabinet 3D model

1) Box	2) Touch screen
3) System nameplate	4) Power supply indication
5) Operation and fault indication	6) Emergency stop button

The automatic control instrument monitors the flow, pressure difference, temperature and ultraviolet radiation intensity on line, and transmits signals to the PLC system for control and alarm. The system control, status and parameter display and related operations are completed through the touch screen man-machine interface, including:

- Acquisition of instrument detection data
- Control of system valves
- Regulation of system flow
- Operation of ballast/discharge and other systems
- Parameter and fault display
- Data record and query of historical data

- Data processing
- Data communication
- Remote operation
- Transmission of GPS signal data

Relevant parameters of PLC cabinet are as follows:

- Input: AC3Ø440V60Hz/AC3Ø380V50Hz;
- Protection class: IP54
- Environmental requirements: atmospheric pressure: 0.1MPa; Temperature: 0-55 ℃; Maximum relative humidity: 90%; No corrosive gas.

1.4.5.3 Power cabinet

The power cabinet is the power control center of the ultraviolet lamp tube and is set independently with the PLC control cabinet. The electronic ballast is installed in the power cabinet. The independent ultraviolet lamp tube loop is powered by an independent electronic ballast to form an independent power distribution system of the independent lamp tube control loop. Comprises a power distribution system, a detection and monitoring system and a control system. The detection and monitoring system transmits the signal to the PLC, and then the PLC outputs the control signal to control the electronic ballast to adjust the output and transmit the current to each ultraviolet lamp circuit.

Relevant parameters of the power cabinet are as follows:

- Input: AC 3Ø440V50Hz/AC3Ø440V60Hz
- Protection class: IP54
- Environmental requirements: atmospheric pressure: 0.1MPa; Temperature: 0-55 ℃; Maximum relative humidity: 90%; No corrosive gas.

1.4.5.4 Remote box

It is convenient for remote operation to carry out ballast, discharge and shutdown operation. There is indication of remote system operation. Audible and visual alarm for remote box system failure.

1.4.5.5 Data storage

Data records are retained for 24 months. The recorded data can be downloaded via the

data interface.

1.5 Sampling device

The Cyeco ™ BWMS sampling device has been designed and fabricated in accordance with IMO RESOLUTION MEPC. 173 (58), GUIDELINES FOR BALLAST WASTER SAMPLING (G2).

- Diameter of sampling device: Diso = Dm (Qiso/Qm) 1/2
- It is installed on the straight pipe section at the outlet end of the ballast water discharge pipeline.

See the attachment for the structure of the sampling device:
Cyeco/TD04-4003-D004; Cyeco™BWMS Sample Device.

1.6 Cyeco™BWMS System Limitations

1.6.1 Cyeco ™ BWMS Main Operating Parameters

- Design pressure: 0.8 MPa
- Salinity: Unlimited
- Temperature: Unlimited

1.6.2 Applicable electrical conditions

- Power supply: AC-3P 380V (± 10%) 50Hz/AC-3P 440V (± 10%) 60Hz
- Protection class: IP54

1.6.3 Applicable installation conditions

- Cyeco ™ BWMS is for indoor installation only, and must be approved by the supplier in special cases.
- The Cyeco ™ BWMS generic version is suitable for use in safe areas.
- Cyeco ™ BWMS Power Cabinets and PLC Cabinets are suitable for safe area installation unless otherwise specified.
- Cyeco ™ BWMS explosion-proof equipment has an explosion-proof rating of ExIIdBT4. It is suitable for installation and use in hazardous areas other than Zone 0. Explosion-proof equipment must be used and installed in accordance with the

operating conditions defined by the corresponding unit certificate.

1.6.4 Applicable storage conditions

- Atmospheric pressure: 0.1MPa
- Ambient temperature: 0-70 ℃
- Maximum relative humidity: 90%
- Indoor environment without corrosive gas

1.7 Cyeco™BWMS system fault alarm, data logging and storage

1.7.1 Cyeco™BWMS Fault Classification

Cyeco ™ BWMS faults are defined in two categories, where:

- Level 1: warning;

No.	Warning Item	Warning item
1	Bypass valve open	The bypass valve is open
2	UV Unit temperature high	High temperature of UV unit
3	UV Dose low	UV metering is low
4	Pressure high	High pressure
5	Diff pressure high	High differential pressure

- Level 2: alarm;

No.	Alarm Item	Alarm item
1	Valves Overload	Valve is overloaded
2	Valve Malfunction	Valve failure
3	Pump & motor malfunction	Pump and motor failure
4	Flow higher than certified. Reduce flow!	High flow alarm
5	Flow Low	Low flow alarm
6	UV Unit temperature too high	UV chamber temperature too high
7	Power supply cabinet temperature too high	Power cabinet temperature is too high for too long
8	UV Lamp Fail	UV lamp failure
9	UV Dose too low	UV metering is low
10	Pressure too high	Pressure is too high
11	Diff pressure too high	The differential pressure is too high
12	Temperature in Power Cabinet too high	Temperature of power cabinet is too high
13	UV lamp fault	UV lamp tube not fully open

Note: warning will only give a warning and will not affect the operation of the equipment; The alarm will give an alarm and affect the operation of the equipment, causing the equipment to shut down.

1.7.2 Cyeco™BWMS fault alarm list

See attachment: Cyeco/TD04-4003-D005; BWMS fault alarm list.

1.7.3 System bypass alarm

Bypass operation of the system is possible through the panel transfer switch. In case of first-level fault of the system, enter the bypass state according to the program

conditions. During bypass operation, the system will simultaneously output local and remote audible and visual alarms.

1.7.4 Data logging and storage

See Chapter 3.9.15 for detailed data recording and storage.

2 General operating instructions

For a convenient, safe and efficient use and operation of the Cyeco ™ BWMS Ballast Water Management System, the user should carefully read each chapter of this manual and pay special attention to the relevant safety regulations to ensure the safety of the operator.

2.1 Important safety signs and instructions

The following safety signs and instructions are essential to the operation of this system

	Wear safety goggles to prevent UV rays from damaging the eyes; Do not look directly at the power supply with the UV lamp on.
	Do not expose the skin to UV rays; When touching the surface of the UV lamp tube, please wear clean gloves without talcum powder and lubricating oil to avoid contaminating the surface of the lamp tube.
	After the UV lamp is turned off, the lamp tube is still hot for a certain period of time; Wait at least 15 minutes for the lamp to cool completely before touching it.
	Any maintenance work must be carried out with the power supply turned off.
	When the UV lamp tube does not reach the standard working temperature, sufficient disinfection effect cannot be achieved.
	UV tubes contain mercury. Waste lamp tubes shall be treated as chemical waste. Discarded lamps shall not be discarded as unsorted municipal waste. 

Note the following information:

- Keep the working environment clean and well-lit.

- When the system is in an abnormal state, the power supply of the equipment shall be turned off.
- Use only Genuine Cyeco Components.
- Perform proper maintenance on a regular basis. Refer to Chapter 12, "Equipment Care and Maintenance" for maintenance guidelines.

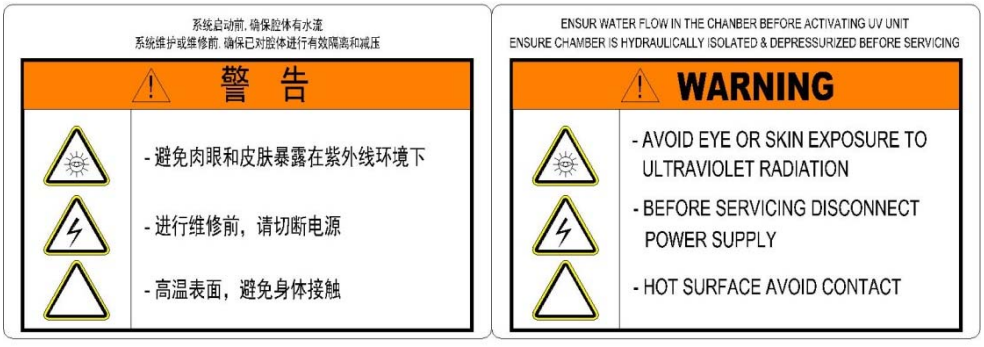
2.2 System security measures

Safety measures for the Cyeco ™ BWMS Ballast Water Treatment Unit:

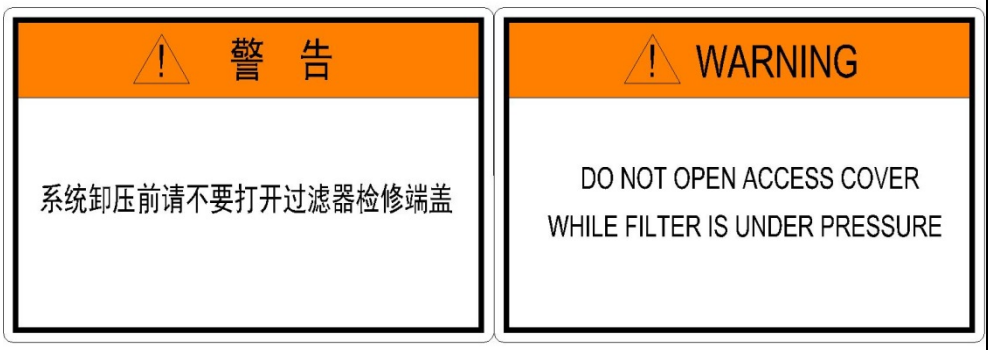
- Filter screen pressure loss detection;
- Sealing and protection measures for UV rays;
- Overheat protection of system power supply equipment;
- Overheat protection of UV chamber;
- UV intensity monitoring and control during disinfection;
- System flow monitoring and low flow protection;
- UV lamp tube fault monitoring;
- Electronic ballast fault detection;
- Phase loss protection of three-phase motor;

Safety signs on the Cyeco ™ B WMS Ballast Water Treatment Unit:

UV reactor cavity surface label



Self-cleaning filter cavity surface label



Labels outside the ballast (power) cabinet/PLC control cabinet

2.3 Broken lamp tube and quartz sleeve

Warning!	The UV tube contains a small amount of mercury. If the lamp tube is damaged, it is necessary to sprinkle sulfur powder to deal with the residual mercury. Carefully remove residual mercury and follow local regulations to recycle chemical waste to storage. Avoid contact with eyes and skin, prevent inhalation of mercury vapor, and ensure ventilation. If necessary, the damaged lamp tube can be sent to a professional company for disposal.	
Warning!	If the quartz casing is damaged, the water inlet and outlet valves on the pipeline shall be cut off immediately, and the system power supply shall be turned off. The damaged parts can be replaced only after the safety is confirmed. The system can be restarted only after the replacement is completed and the system is rechecked and confirmed to be safe.	

2.4 Prohibition clause

- It is prohibited to start up the system in any unfinished piping system.
- Under any conditions, the UV lamp must be installed in the reaction chamber in a sealed manner to prevent UV ray damage.
- During operation, it is forbidden to disassemble any part to prevent personal injury, especially to prevent the leakage of UV rays.
- Consult Cyeco before using clear ductwork.
- Mechanical changes and modifications of any type to the equipment, such as drilling or welding, are prohibited and may result in damage to the system equipment.
- Ultraviolet lamps must be installed according to strict installation procedures. Under no circumstances should the UV lamp be in direct contact with the liquid.

	To avoid damage to the UV tube, do not touch the tube with bare hands.
	Keep in mind that the UV tube that has just been turned off is hot.
	There is also a small amount of mercury in the UV tube. See relevant chapters for the treatment method of damaged lamp tubes.

Notice!	The UV lamp needs a certain time to warm up (1-5 minutes) to reach full power, so the UV system needs a certain time to warm up before starting to reach maximum intensity. Avoid adjusting or using the system during the warm-up phase.
	Frequent starting and stopping of the lamp will affect the service life of the lamp, and the output intensity of UV will also be reduced.
	Contamination on the quartz sleeve can affect the UV output intensity.

3 System operation

3.1 Initial system startup condition

- Only the Cyeco ™ BWMS system that has completed the installation and commissioning of the system will perform the start-up operation.
- The initial start-up must be carried out under the guidance and supervision of relevant technical personnel.
- Personnel who are not trained and do not have the basic knowledge of system operation shall not operate the system.

3.2 Operation of control cabinet

In this section, the following type labels such as "Local/Remote" are used as the operation labels of the touch screen.

3.3 Power supply indication

Power indication: the main power is switched on, and the white power indicator is on.

3.4 Local remote selector switch

Cyeco ™ BWMS is divided into local and remote system control functions according to the different needs of users, that is, the system operation control can be completed by the local human-machine interface or by the remote human-machine interface.

- When the "local/remote" touch screen engineer 1 interface selection button is in the "local" position, all control functions can only be realized by the local human-machine interface.
- When the "Local/Remote" touch screen engineer 1 interface selection button is in the "Remote" position, all control functions can only be performed by the remote HMI.

3.5 Check, Normal, Bypass Select Switch

Cyeco ™ BWMS is divided into three working modes: check, normal and bypass according to different requirements of users.

- When the touch screen engineer 1 interface selection button is in the "Check" position, it allows the inspection of components and the functional testing of valves, motors, UV, etc.
- When the touch screen engineer 1 interface selection button is in the "normal" position, the system can operate normally and automatically when the startup conditions are met.
- When the touch screen engineer 1 interface selection button is in the "bypass" position, the bypass valve is opened, the filter inlet valve and the UV inlet valve are closed, and the water flow cannot pass through the filter and the UV device.

3.6 Emergency stop button

The emergency stop button on the panel of the control cabinet is used for immediate shutdown in any emergency. The user only needs to press the emergency stop button, and the system will automatically stop immediately.

3.7 Operation indication

UV operation indication: the indicator light is on during normal ballasting and unloading.

3.8 Preheat indication

UV warm-up indicator: the red indicator is on during the warm-up phase of the normal ballast and unloading system.

3.9 Human Machine Interface (HMI) Operating Manual

The system operation in this manual takes the Siemens TP1200 touch screen as an example. For the operation instructions of touch screens of other brands and models, see the attachment: "Brand" Touch Screen Operation Manual.

3.9.1 Introduction and description of control system interface

The button functions of each display unit involved in the operation interface of the control system are described in the following table (Table 1 and Table 2).

Table1 Symbols and functions of page switching buttons

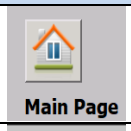
Symbol	Description	Function	Remark
	The main page navigation switches	Page navigation switch	
	Run Mode Page Navigation Toggle	Page navigation switch	
	Parameter setting page navigation switch	Page navigation switch	
	System Status Page Navigation Toggle	Page navigation switch	
	Alarm page navigation switch	Page navigation switch	
	Valve inspection page navigation switch	Page navigation switch	
	Engineer Page Navigation Toggle	Page navigation switch	

Table2 Function operation button symbol and function

Symbol	Description	Function	Remark
Ballast	Ballast mode operation	On/off	
Deballast	Discharge mode operation	On/off	
Stop	Shutdown mode operation	On/off	
LOCAL	Local mode	System state switching	
REMOTE	Remote mode	System state switching	
BYPASS	Bypass mode	System state switching	
NORMAL	Normal mode	System state switching	
MAINT	Check mode	System state switching	
DP mode	Differential pressure control mode	On/off	
Intensity mode	UV Intensity Control Mode	On/off	
Time mode	Time control mode	On/off	
Manual mode	Manual control mode	On/off	
Silence	Alarm silencing	On/off	
Reset	Alarm reset	On/off	
Open	The valve is open	On/off	
Close	Valve is closed	On/off	

Table3 Parameter display and function description

Parameter	Description	Unit
Cavity temperature	Indicates the temperature inside the UV chamber	℃
UV dose	Indicating UV irradiation dose	mJ/cm^2
Warm-up time of UV lamp	Display the warm-up time of UV lamp	s
UV lamp cooling time	Displays the UV lamp cooling times	s
Remaining interval of filter self-cleaning	Display the remaining time of filter self-cleaning interval	m
Remaining interval of lamp cleaning	Display the remaining interval time of lamp cleaning	m

3.9.2 Touch screen operation

- Close the main circuit breaker in the power cabinet, and close the electronic ballast circuit breaker and other circuit breakers;
- Switch on the main circuit breaker of the control cabinet, and switch on the high-pressure pump, filter cleaning motor, UV cleaning motor and each valve circuit breaker;
- Switch on the electromagnetic flowmeter power supply, DC24V power supply, PLC power supply and touch screen power supply in the control cabinet, and the touch screen startup initial interface will be opened.

3.9.3 Clock and date settings

After the touch screen is powered on, enter the Windows CE operating system, pop up a dialog box, and click the control panel button.

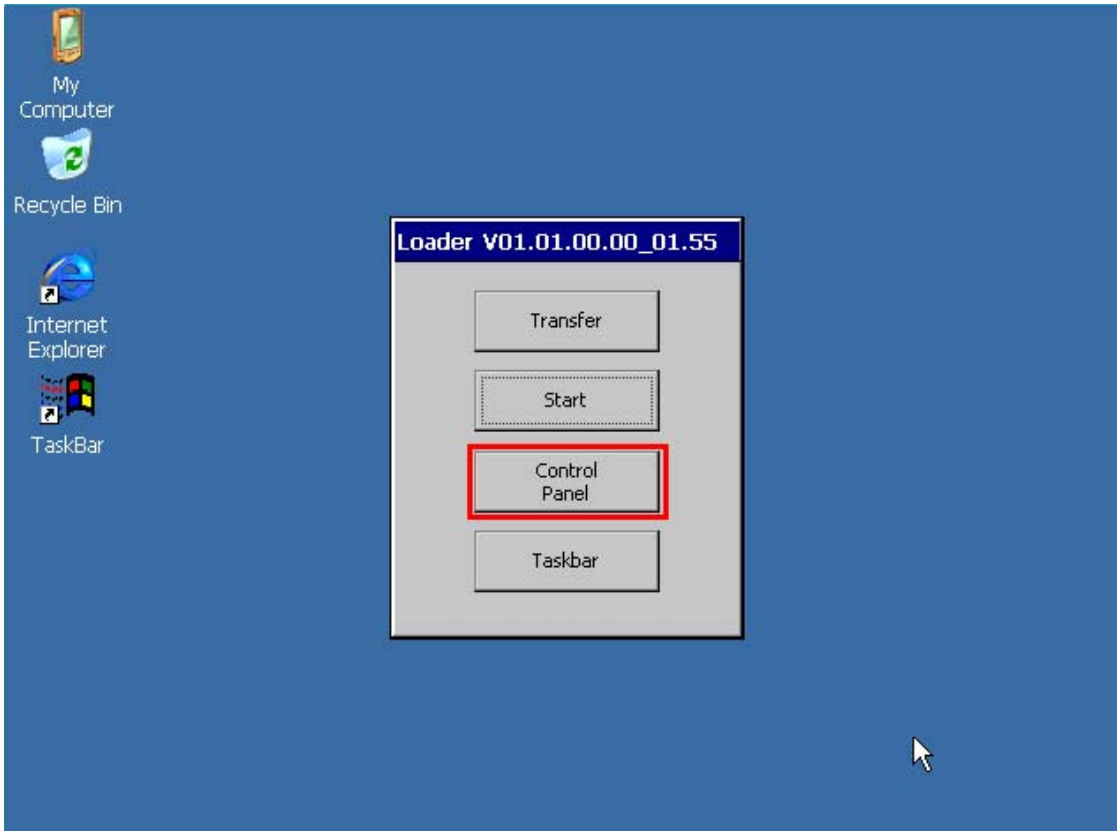


Figure10: Windows Settings Interface

Click the control panel button, find the Date/Time icon, and double-click to open it.

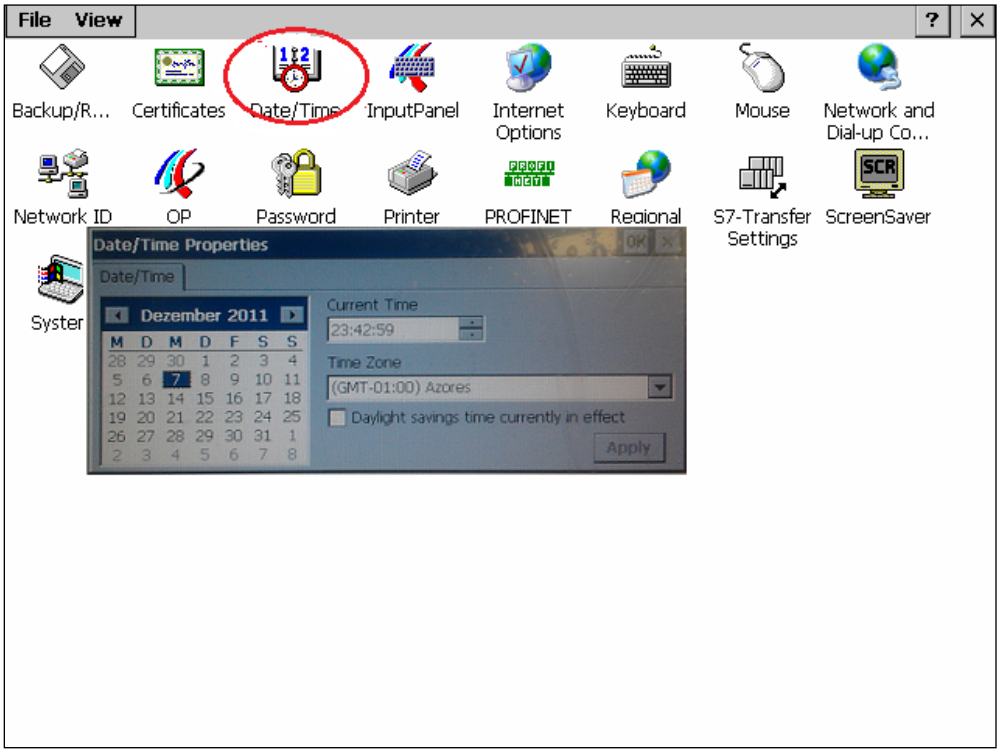


Figure 11: Clock and date setting interface

3.9.4 Communication settings

Go to the control panel and find the Tranfer icon.

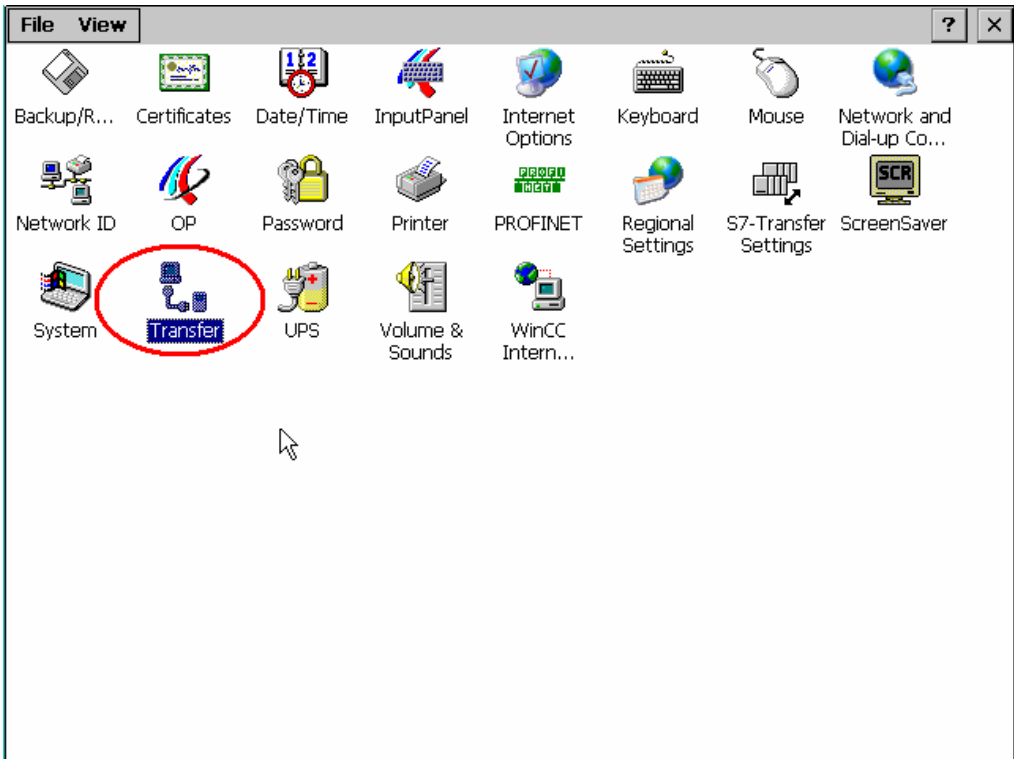


Figure12: Windows Settings Interface

Double-click the transfer object icon to enter the transfer parameter setting. First, check the Enable Channel option of Channel 2:. For the convenience of downloading, check the Remote Control option at the same time, select the download method as ETHERNET, and then click the "Advanced" button.

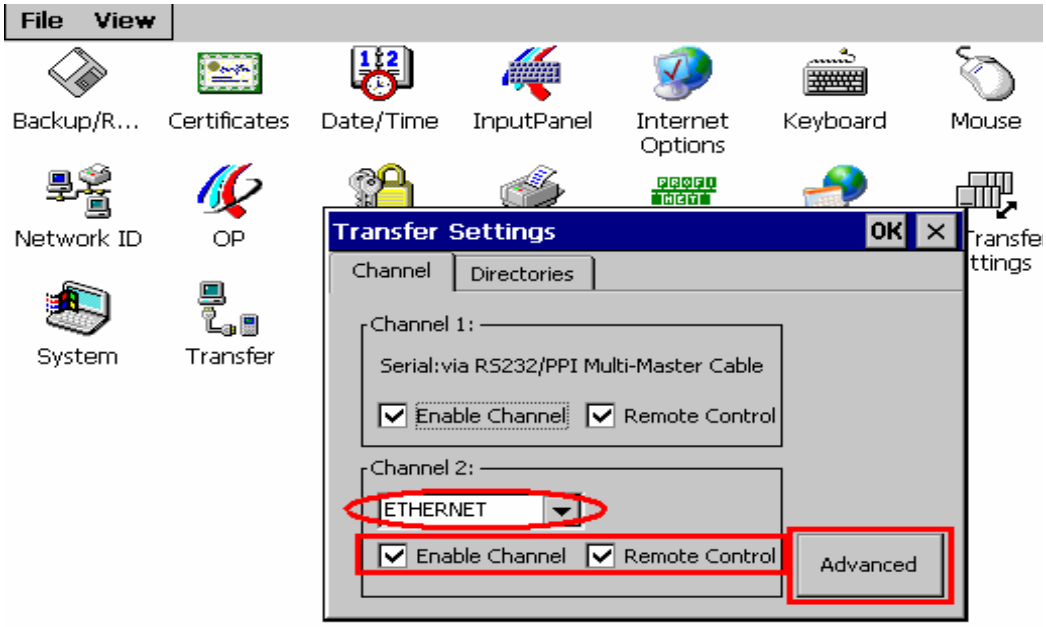


Figure13: Communication settings

Double-click the Ethernet connection icon to enter the Ethernet property setting dialog box. Enter the IP Address setting dialog box, click to select the Specify an IP address entry, then IP Address and Subnet Mask input are enabled, so as to input the IP address of this panel, for example, we use 192.168.0.110. Use 255.255.255.0 for the subnet mask. Others need not be specified.

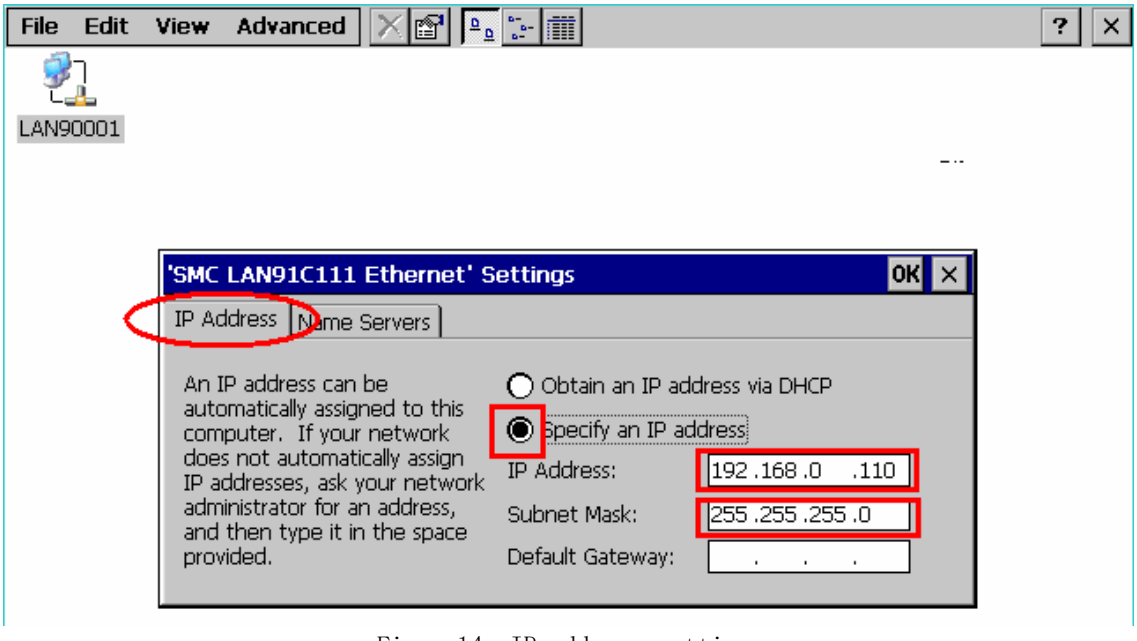


Figure14: IP address settings

The following are the relevant settings of the download computer. Enter the control panel of the download computer, find the Network Connections icon, double-click to enter the Ethernet card list, and double-click the Ethernet card icon connected to the Siemens panel.

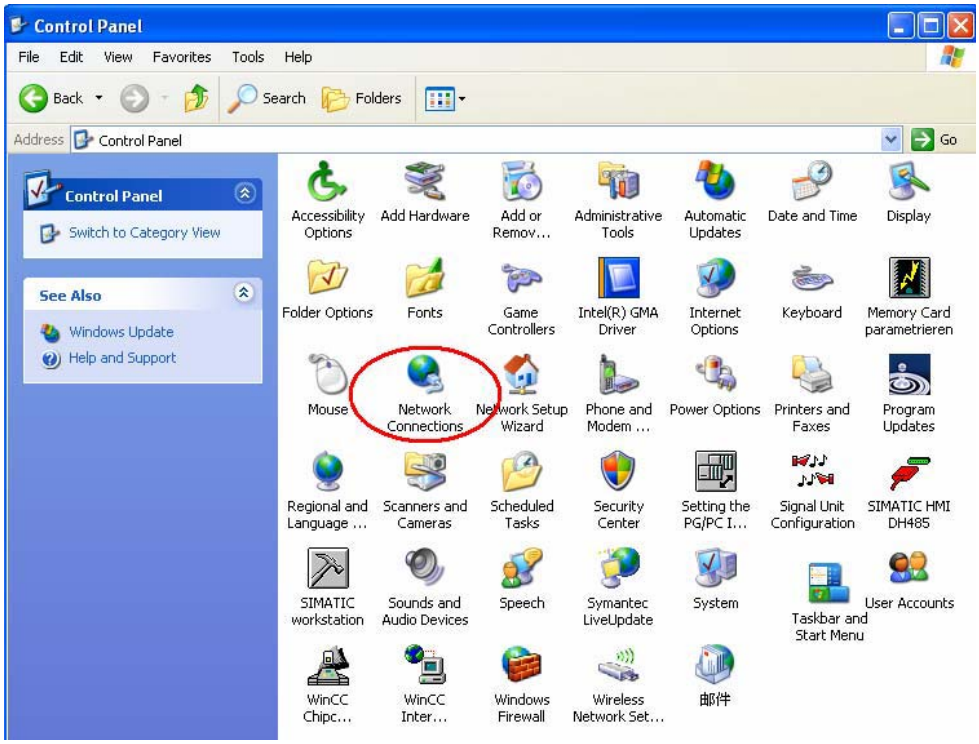


Figure15: Windows Dashboard

Local Area Connection pops up ··· For the properties dialog, click "properties".

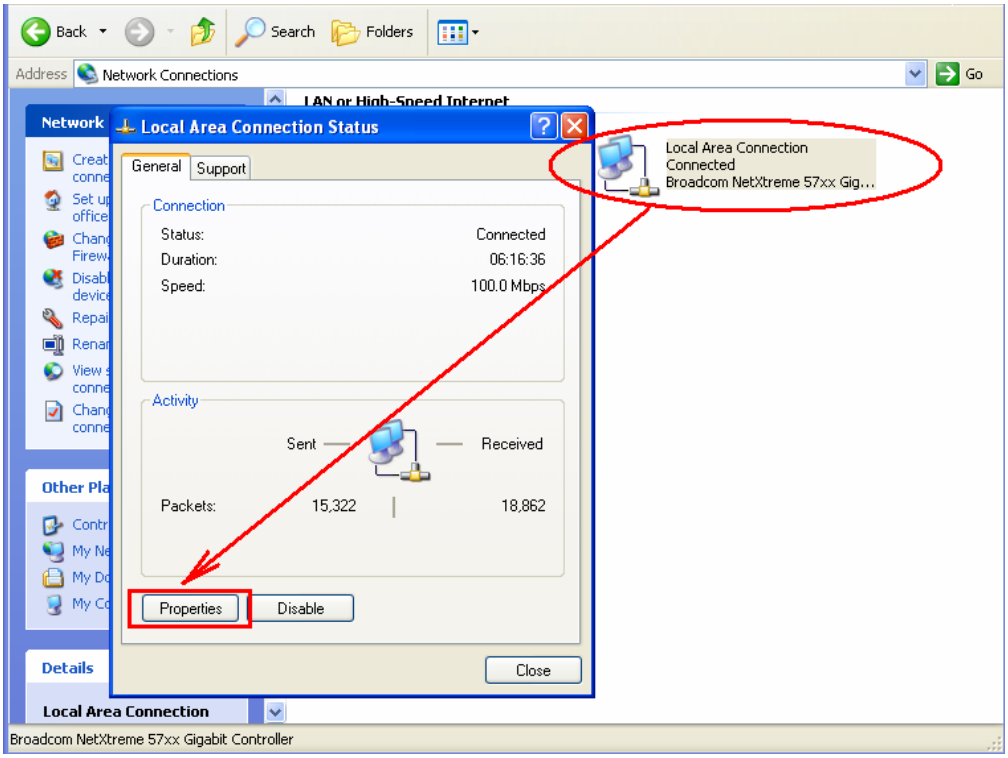


Figure16: Local Area Connection

Select "Internet Protocol (TCP/IP)" in the list and double-click it. Specify the IP address and subnet mask in the Internet Protocol (TCP/IP) Properties dialog box that pops up. The IP address must be in the same network segment as the IP address of the panel. In this example, it is 192.168.0.222 and the subnet mask is set to 255.255.255.0.

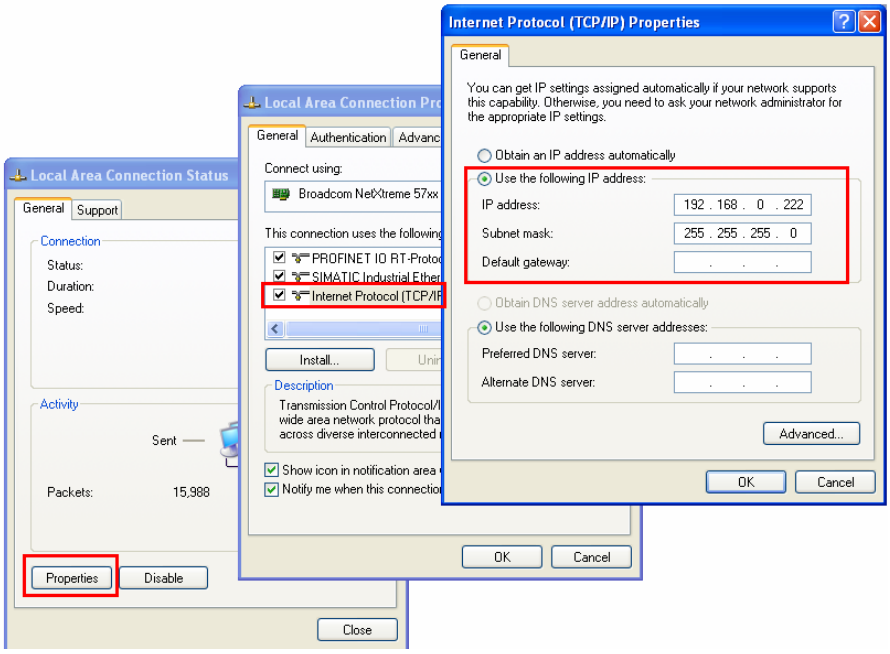


Figure17: IP address settings

3.9.5 System password

After the touch screen is powered on, the initial interface of touch screen startup will be opened. Click the Input Password button.

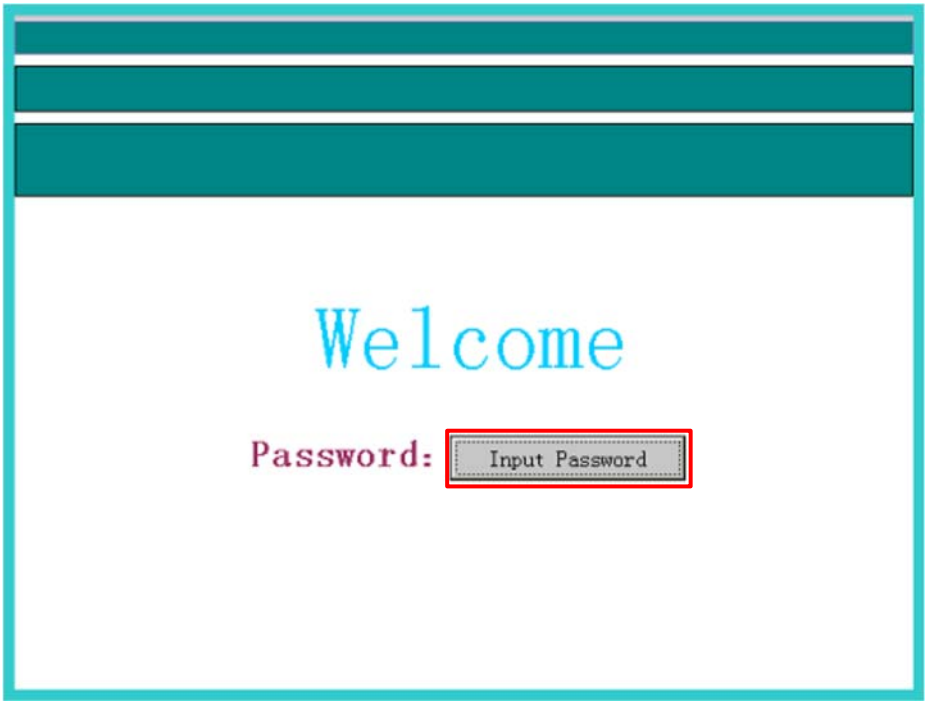


Figure18: Initial interface

After clicking the Input Password button, a login window will pop up on the screen. Login name: admin, login password: 123456.

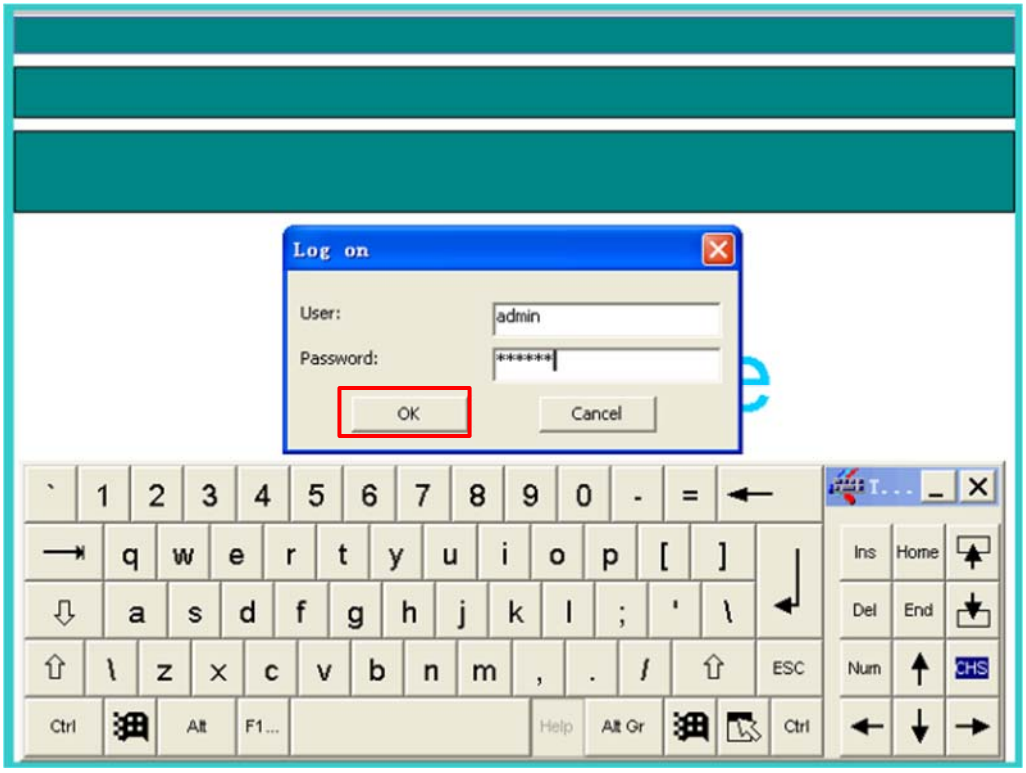


Figure19: Login interface

After selecting the user and inputting the corresponding password, press "OK" to select the language in the screen and enter the system main page.

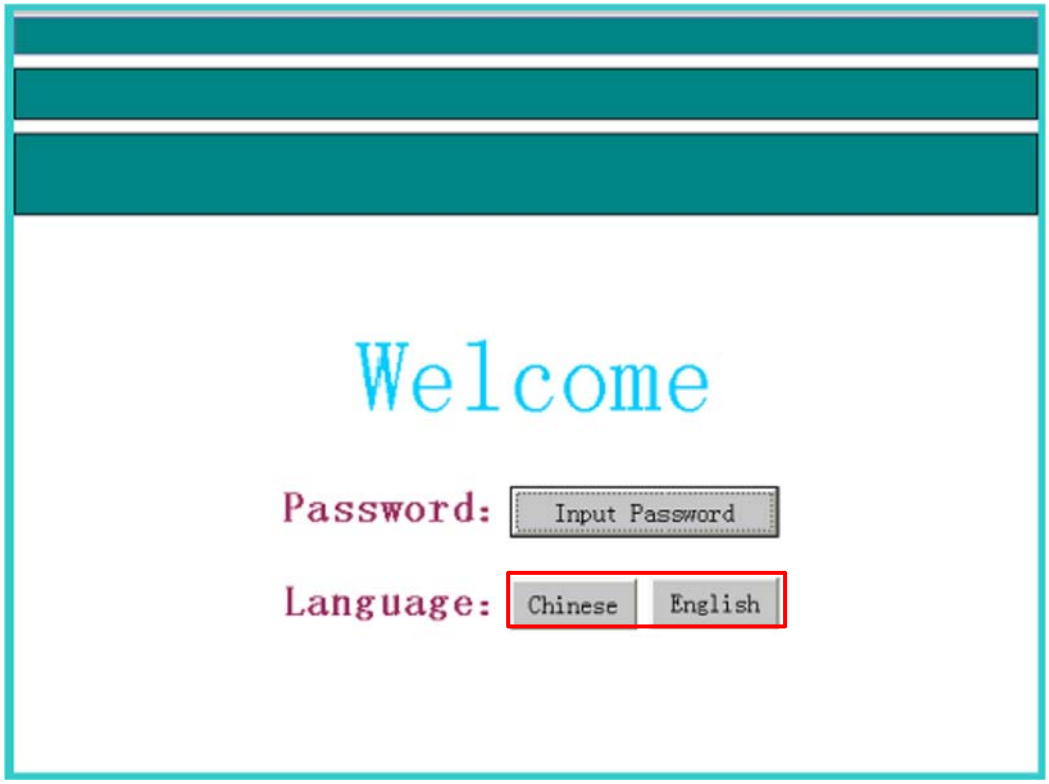


Figure20: Language selection page

3.9.6 How to start

Before starting the system, select Normal as the system operation mode. At this time, after the system is powered on, it will automatically complete the self-test and initialization, and enter the operation preparation interface.

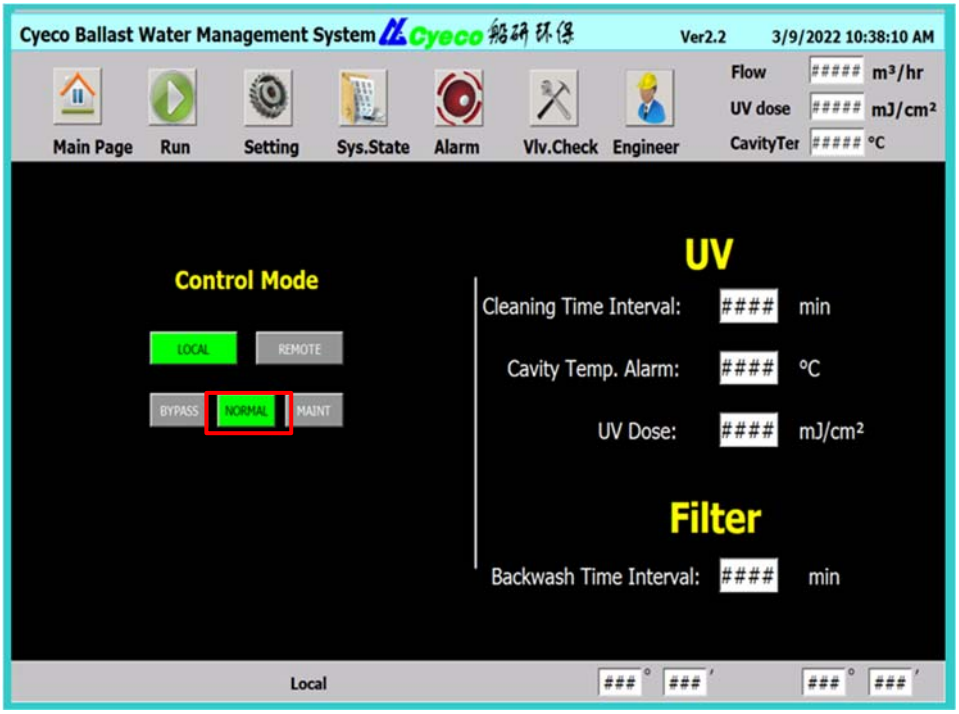


Figure21: Work Mode Selection Page

The operation preparation interface is shown below, and the "Ballast" and "Unload" buttons are active.

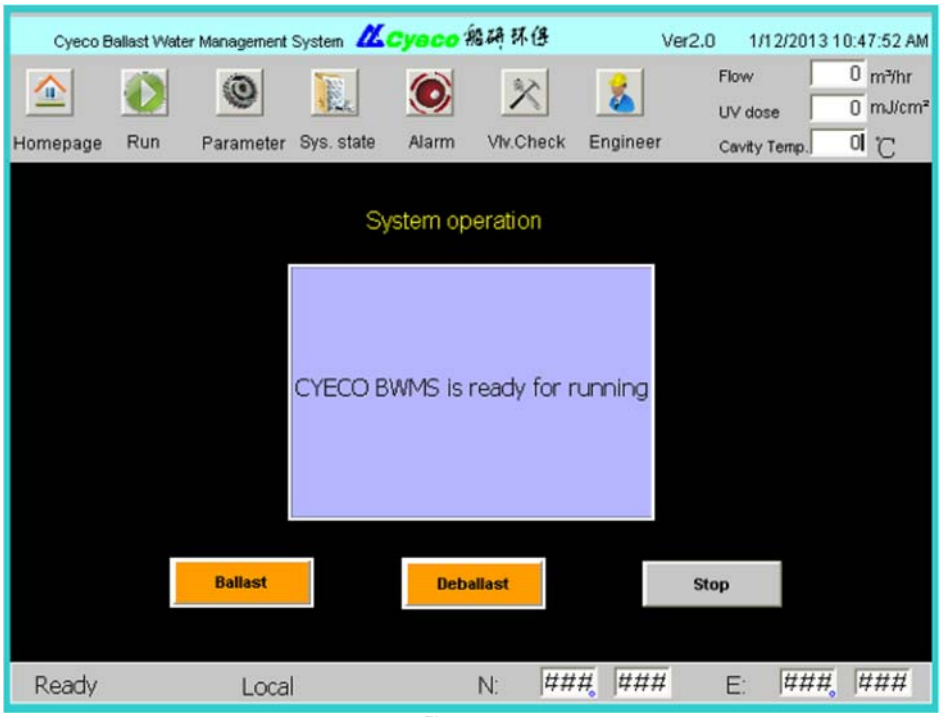


Figure22: Cyeco™BWMS Preparation Page

The main page is shown in the following figure:

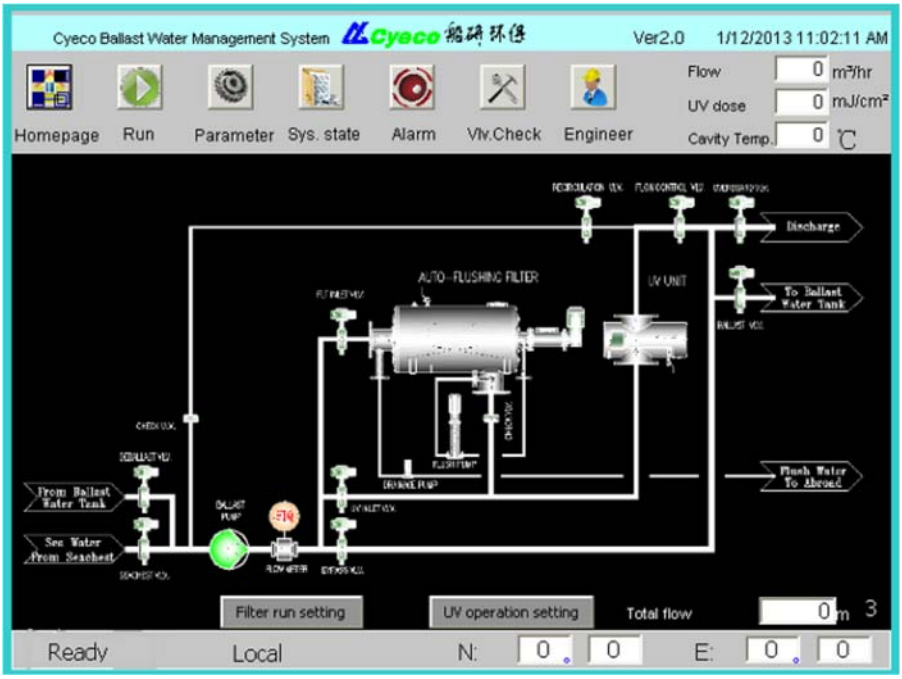


Figure23: Cyeco™BWMS Main Page

Before ballast operation, please confirm that the "sea valve" and "ballast valve" are opened, and before unloading operation, confirm that the "discharge valve" and "sea discharge valve" are opened. Take the ballast operation as an example. Click the "Ballast" button on the "Operation Interface" of the touch screen. At this time, the operation interface will prompt "The working valve is opening, please wait a moment". The system will automatically switch the valve according to the control requirements.

Figure24: System valve operation waiting interface

When the working valve is opened in place, the operation interface will prompt "start ballast pump".

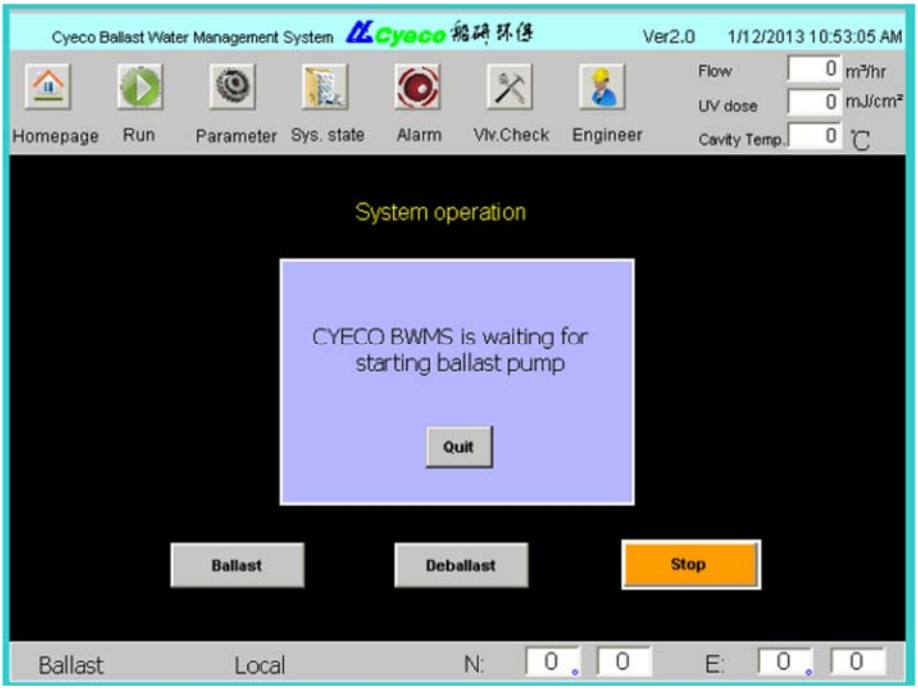


Figure25: Waiting for ballast pump startup interface

When the flow reaches the set value of the system, the operation interface will prompt "Please confirm to turn on the UV lamp". After confirming to turn on the UV lamp, the system begins to enter the preheating state. The preheating indicator on the control cabinet panel is on, and the operation interface and the main page are as shown in the figure below:

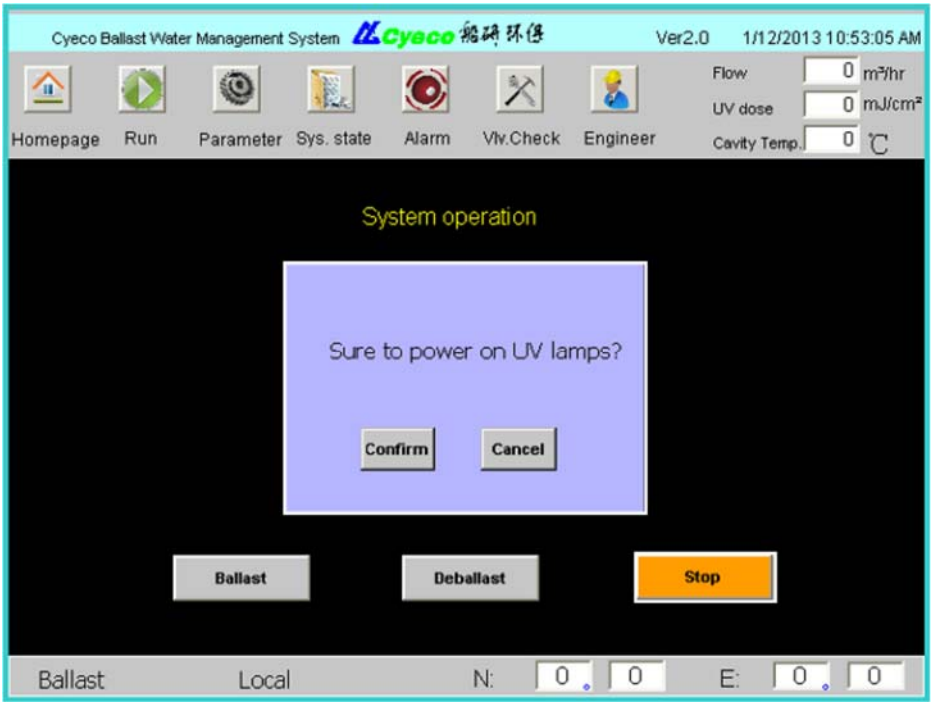


Figure26: UV lamp lamp confirmation interface

Figure 27: Warm up the page

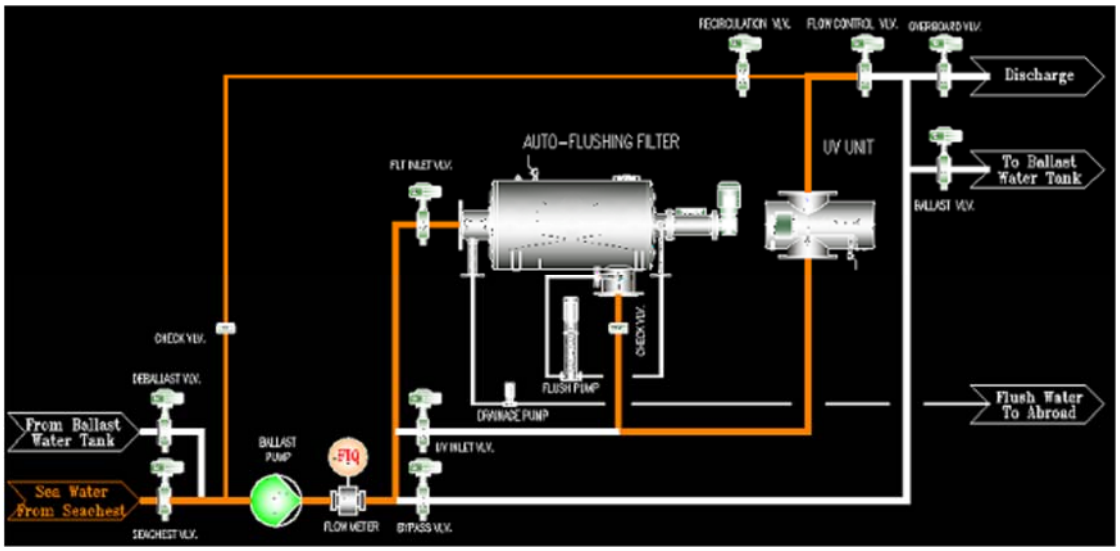


Figure 28: Ballast Mode Return Flow Chart

The preheating time is 3-6min. After the preheating is finished, the operation interface will prompt "system ballast in progress", the system will carry out the normal ballast process, and the operation indicator on the control cabinet panel will be on. The operation interface and the main page are shown in the following figure:

Figure29: Work Aspects of Ballast Procedures

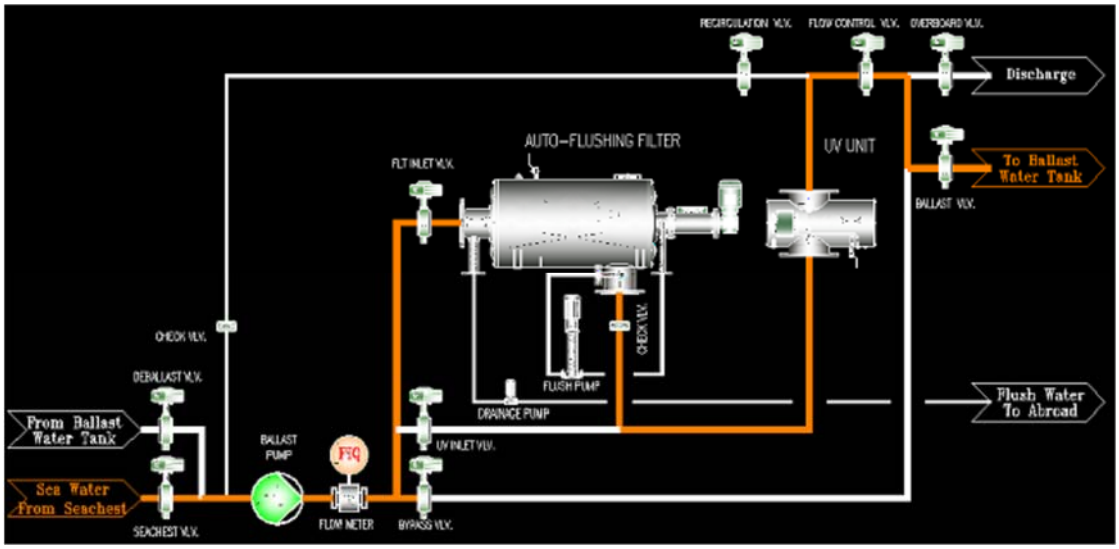


Figure30: Flow chart of ballast operation procedure

3.9.7 How to shut down

When shutdown is required, take ballast shutdown as an example, the "STOP" button in the figure is valid. Press the "STOP" button, the system will automatically stop running and cool the light for 3-6min. The cooling indicator on the control cabinet panel flashes alternately. The running interface and the main page are shown in the following figure:

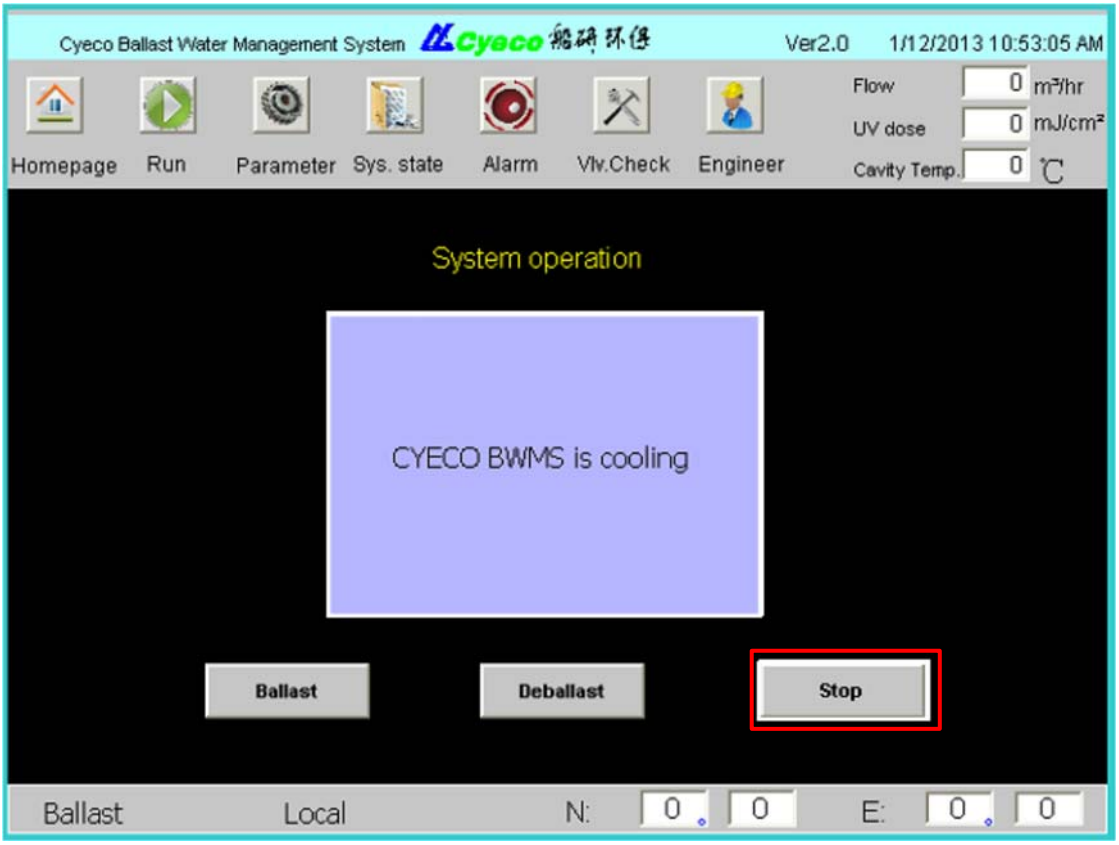


Figure31: System Cooling Page

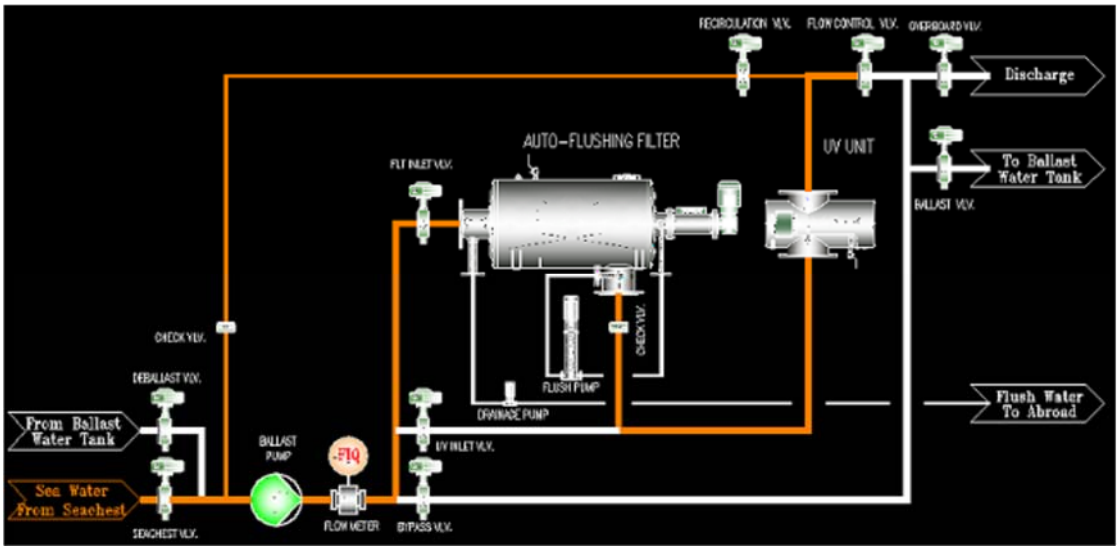


Figure32: Diagram of system cooling operation reflux procedure

After cooling, stop the ballast pump and reset the peripheral valves. The system automatically switches the internal valves. The operation interface is shown in the following figure:

Figure33: Valve is waiting to be closed during shutdown

In order to prevent the impact of frequent startup on the service life of the equipment, after the working valve is switched in place, the system is allowed to wait for 20 minutes to restart, as shown in the figure below:

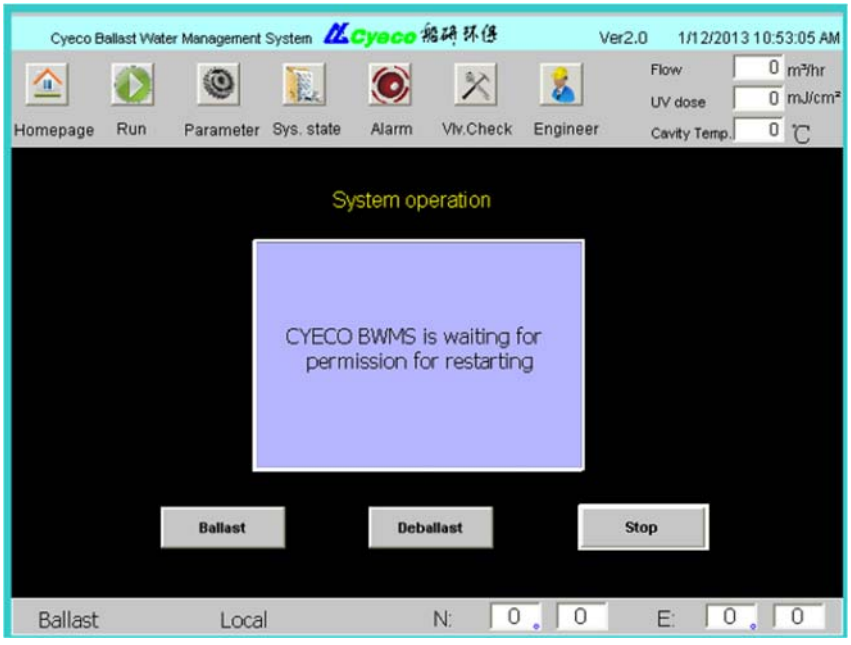


Figure34: The system is waiting to restart

After the waiting time is over, the operation interface is restored as shown in Figure 22, and the "Ballast" and "Unload" operations can be performed again.

3.9.8 Functions and operation methods of the main page

- On the main page, you can see the status of each cell.
- Display the instantaneous flow, the total flow for this run, the UV dose, and the cavity temperature.
- The valve is green when it is open, gray when it is closed, and red when there is water flow in the pipeline and red when there is no water flow.
- Click the "Filter operation setting" button to enter the "Filter operation setting" interface, and set some parameters in the filter operation; Click the "UV operation setting" button to enter the "UV operation setting" interface and set some parameters in the UV lamp operation.

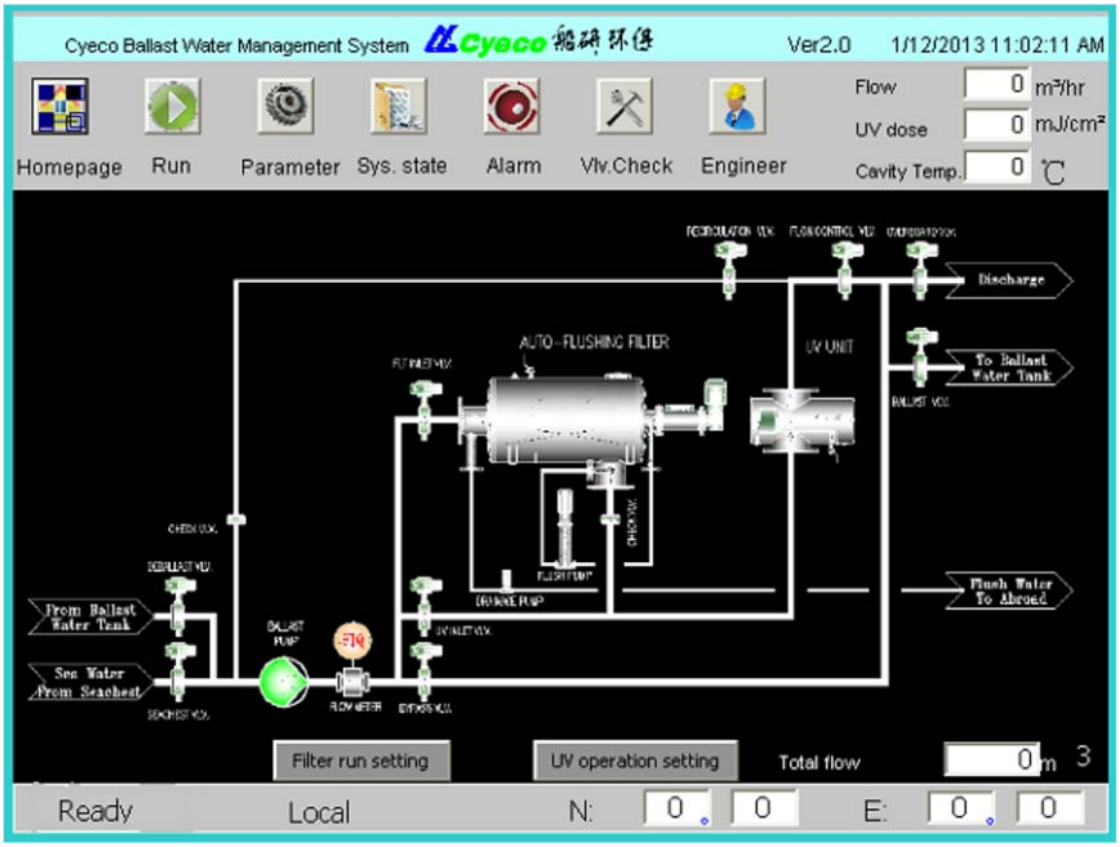


Figure35 Main page

3.9.9 Functions and operation methods of the filter page

- Press the Time mode "button and the filter will run in time mode.
- If necessary, if the "Manual mode" "button is pressed, the system will complete a cycle of filter backwashing and return to the original operation mode after the cycle.
- One cycle is that when the user manually presses the control button, the backwashing drive motor only rotates forward or backward once, and after one cleaning is completed, the system will automatically return to the original set operation mode;
- The time mode is to automatically repeat the periodic backwashing according to the time interval set by the user. The default time interval is 10 minutes.

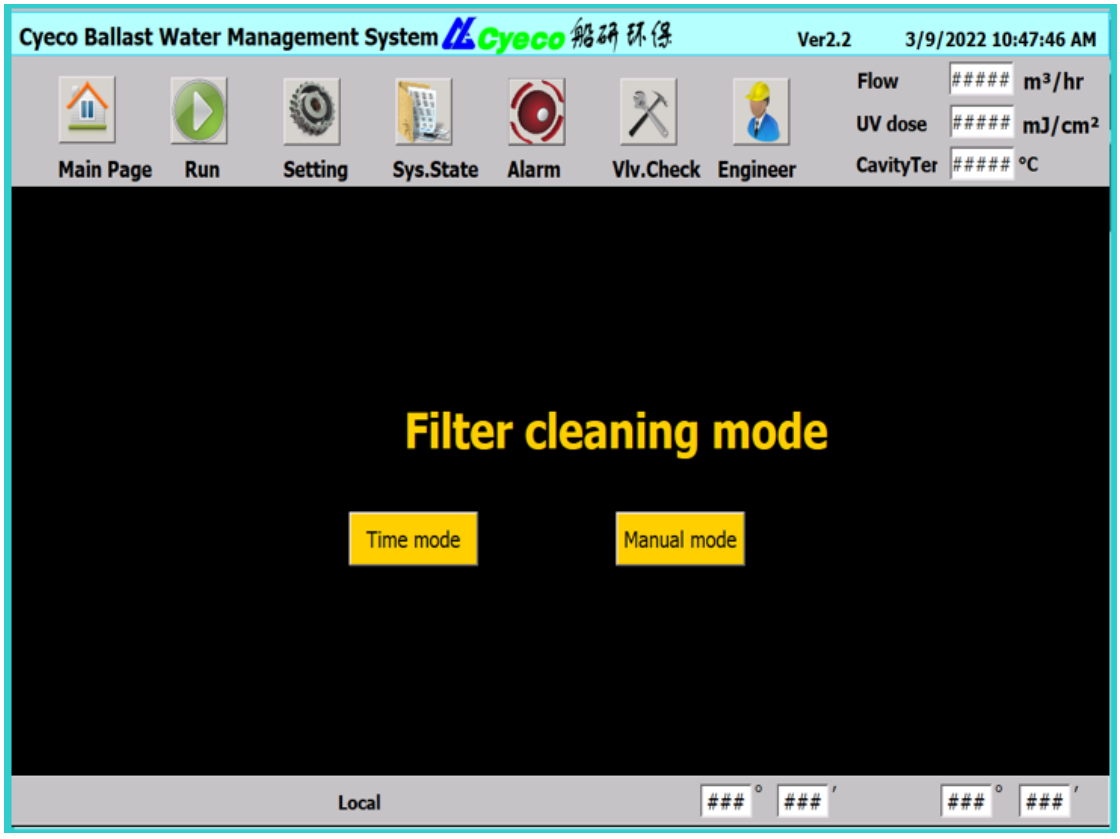


Figure36 Filter interface

3.9.10 Function and operation method of UV page

- Press the Dose mode "button and the system will operate in UV intensity mode.
- Press the "Time mode" "button, and the system will operate according to the timing mode.
- If necessary, if the "Manual mode" button is pressed, the system will complete a cycle of lamp cleaning and return to the previous operation mode after the cleaning is completed.
- One cycle is that when the user manually presses the control button, the automatic cleaning device drives the motor to rotate forward and backward only once, and after one cleaning, the system will automatically return to the original set operation mode.
- Intensity mode means that when the actually measured UV irradiation dose value is less than the UV irradiation dose value set by the user, the system will automatically clean the UV lamp tube. The default UV cleaning irradiation dose is 230 mJ/cm2;
- Time mode is to automatically carry out periodic cleaning according to the time interval set by the user. The default time interval is 20 minutes.

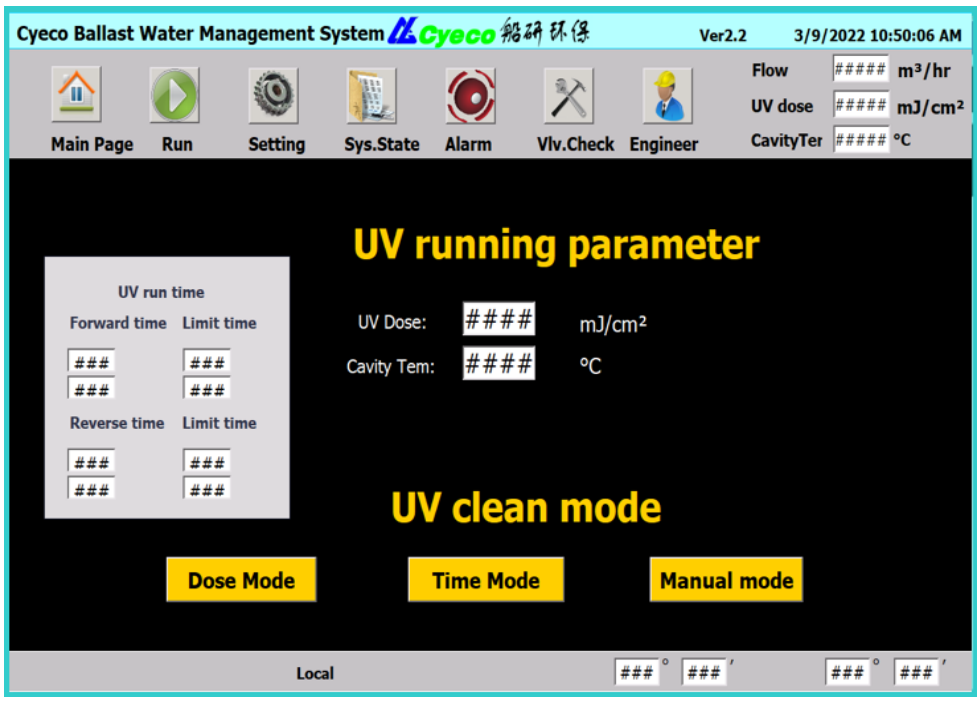


Figure37 UV picture

3.9.11 Function and operation method of system status page

- The system status page mainly indicates the operation status of filter unit and UV unit, including the operation mode indication of filter and UV unit, the positive and negative rotation indication of filter freshening motor and UV cleaning motor, and the status indication of UV lamp tube.
- The System Status page also indicates the Backwash Countdown, UV Lamp Warm-up Countdown, and UV Lamp Cooldown Countdown.
- When the indicator light corresponding to each item is green, it indicates that the equipment is in the state of the item. For example, if the indicator light in front of "EB1" in "UV lamps state" is green, it indicates that the "EB1" lamp has been turned on.

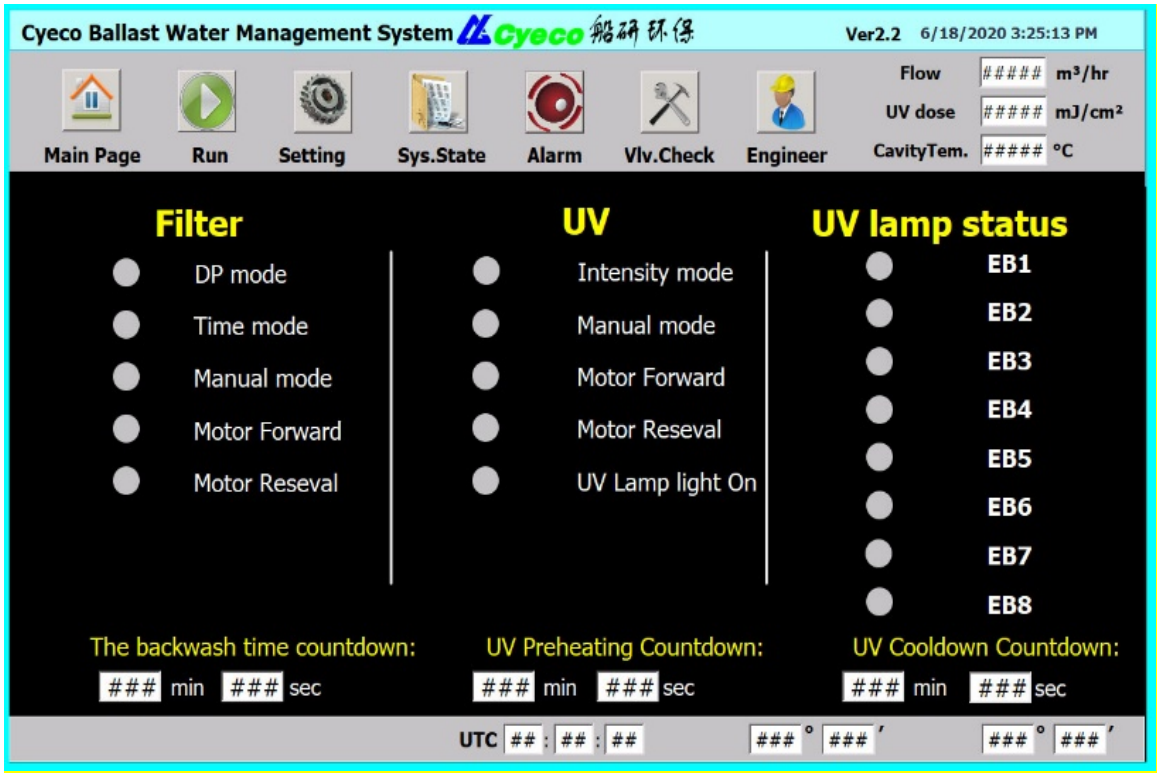


Figure38: System operation status

The system status page filter unit is detailed as follows:

- DP mode: Automatically control backwashing according to differential pressure
- Time mode: Automatically control the backwashing according to the accumulated running time

- Manual mode: Manually forced backwashing
- Motor forward: Backwash motor forward rotation
- Motor reversal: Reverse rotation of backwash motor
- The backwash countdown: Filter backwash completion remaining time countdown

The system status page UV units are detailed as follows:

- Intensity mode: Automatic control of backwash according to UV dosage intensity
- Time mode: Automatically control the backwashing according to the accumulated running time
- Manual mode: Manually forced backwashing
- Motor forward: Backwash motor forward rotation
- Motor reveral: Reverse rotation of backwash motor
- UV lamps on: The UV lamp is powered on
- UV lamps preheat countdown: UV lamp preheating is started by 3-minute countdown.
- UV lamps cool countdown: UV lamp cooling is counted down by 3 minutes from the start

The system status page UV lamp status unit is detailed as follows:

- EB1: 1 # lamp tube
- EB2: 2 # lamp tube
- EB3: 3 # lamp tube
- EB4: 4 # lamp tube
- EB5: 5 # lamp tube
- EB6: 6 # lamp tube
- EB7: 7 # lamp tube
- EB8: 8 # lamp tube

And so on.

3.9.12 Function and operation method of alarm page

- When the "Clear" fault occurs during the operation of the system, the system will give an alarm. Press the "Silence" button to stop the buzzer alarm.
- After the buzzer stops alarming and the fault is eliminated, press the "Reset" button on the alarm page to reset the system.
- If the system is reset without proper troubleshooting for system errors, the system will continue to display non-overridable alarm messages and the system will not function properly. Therefore, proper troubleshooting must be performed when the system fails.
- If "C" appears in the "Status" item in the alarm column, the surface fault is not removed successfully. If the alarm is removed successfully, "CD" is displayed.

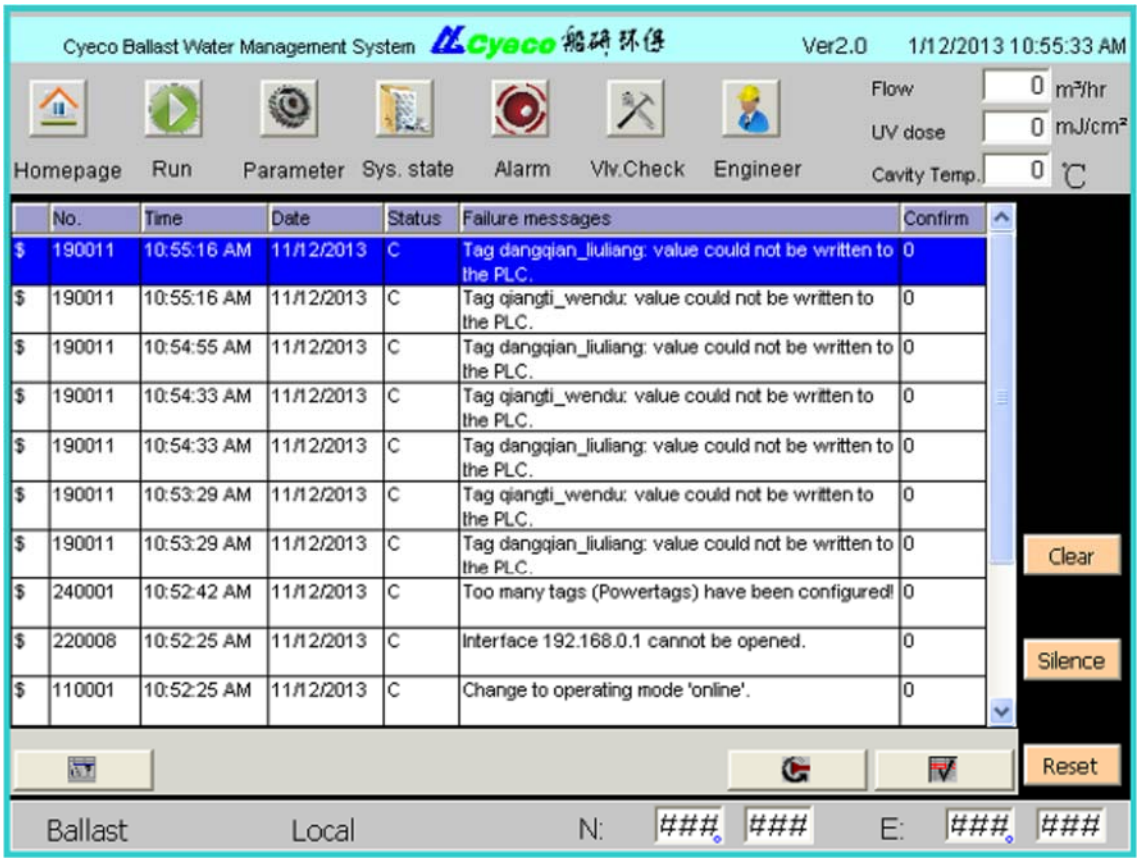


Figure39: Alarm Status Page

3.9.13 Function and operation method of valve inspection page

- If a single valve is to be opened or closed, the equipment shall be switched to the "inspection mode" (which can be switched in the "parameter setting" interface or in the selector switch of the control cabinet).
- If the "Inspection Mode" is selected, the user presses the "Open" button of the corresponding valve, and the valve will be opened.
- If the valve is open, it will indicate "on" in the "Status", if the valve is closed, it will indicate "off" in the "Status", and if the valve is not in place, it shall indicate "?" 。

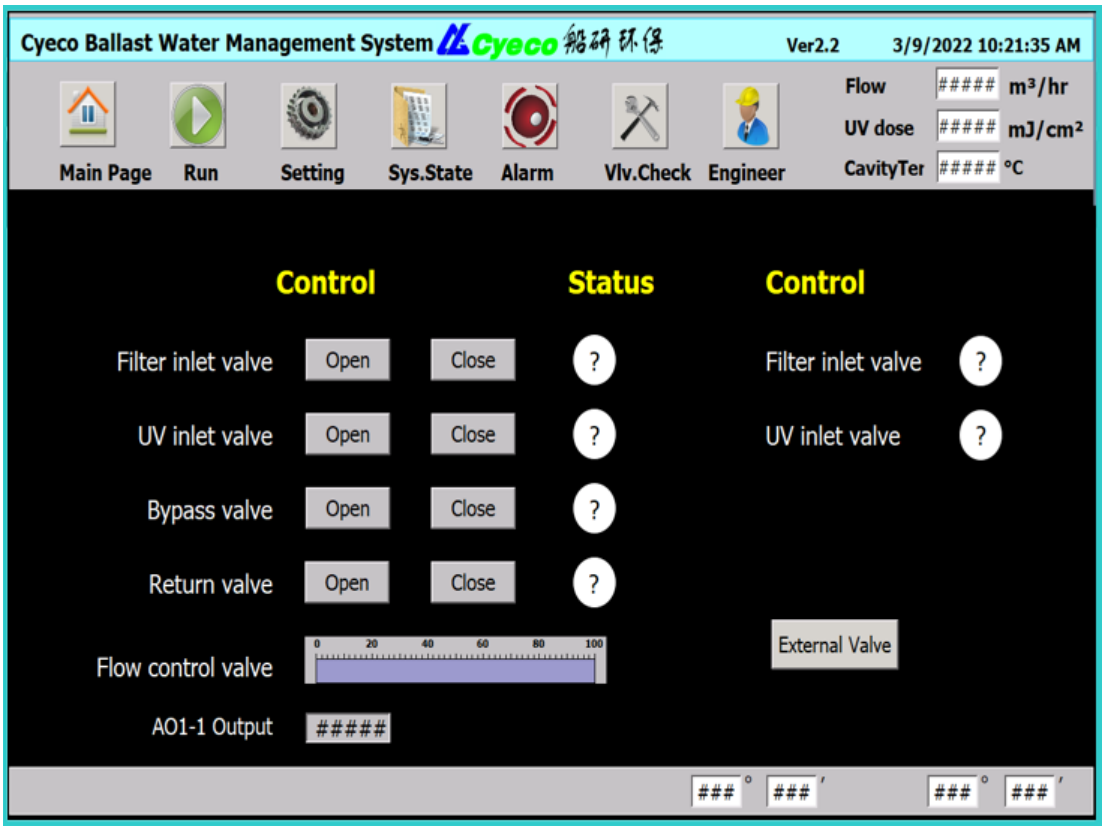


Figure40: Valve inspection screen

3.9.14 Function and operation method of engineer page

"Engineer 1" in the engineer mode page is used to modify and display some special parameters, and non-technicians are not allowed to modify the parameters.

When modifying the parameters, just click the place to be modified, and the input board will pop up. You can modify the relevant parameters as required, as shown in the following figure:

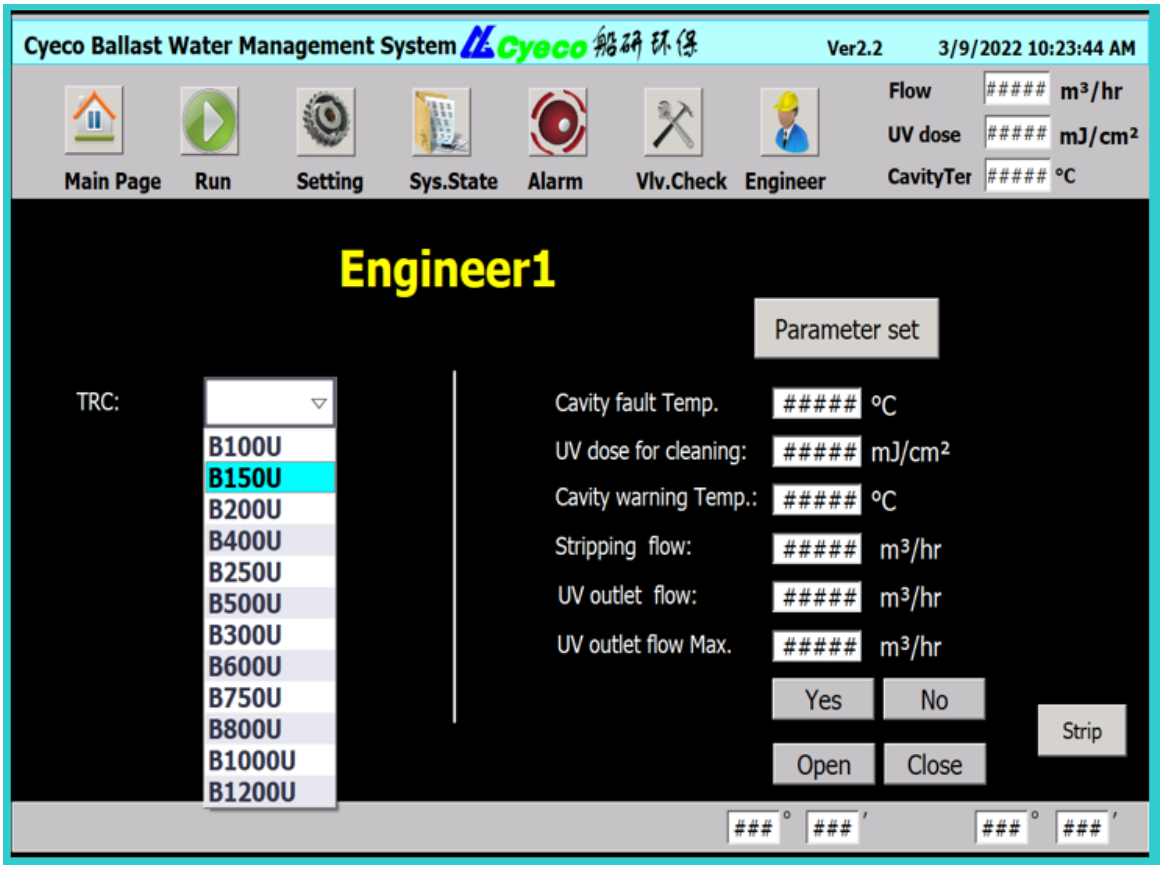


Figure41: Parameter Setting Screen for Engineer 1

3.9.15 Data recording and query

The touch screen is equipped with a memory card, which can save 24 months of "Data query" data records.

Remove the memory card from the touch screen, insert it into the computer, find the folder named "STORAGE Card MMC" ", and open it to view the alarm and operation data.

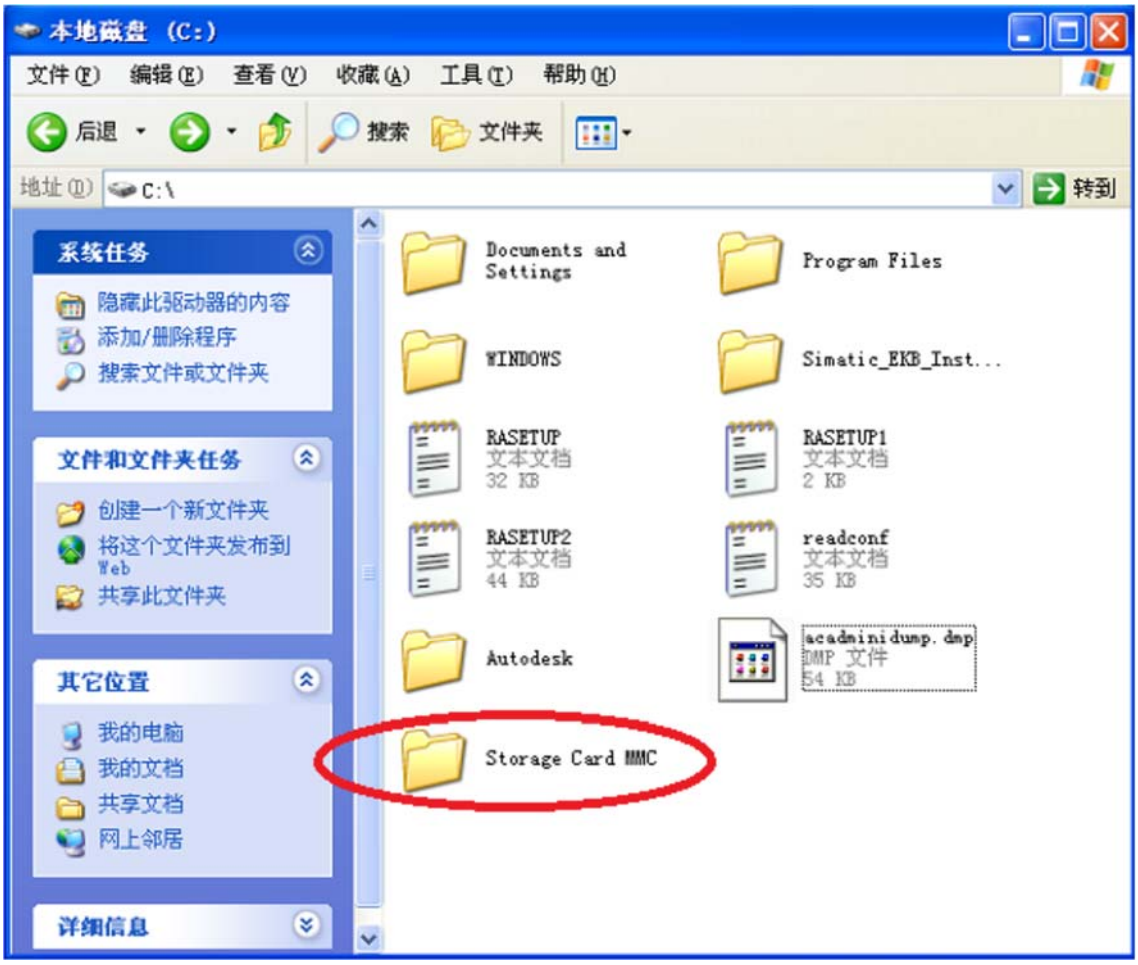


Figure42: Data Storage Operation

Part II: Maintenance Manual

4 Routine maintenance operation of equipment unit

4.1 Operation of self-cleaning filter

4.1.1 Filtration process

- The Cyeco ™ BWMS features a fully automated high-pressure backwash self-cleaning filter.
- The water enters through the water inlet pipe and flows out after being filtered by the filter screen.
- At the same time of filtration, the filter screen is synchronously and reversely flushed by the high-pressure pump, the dirt is sucked by the automatic suction nozzle, and the dirt is discharged by the central shaft.

4.1.2 Self-cleaning process

- The self-cleaning process includes high pressure recoil, negative pressure suction and coordinated action of central shaft blowdown, which are completed synchronously.
- For high-pressure backflushing, the water from the filter is sucked by the high-pressure pump and sprayed out by the high-pressure nozzle through the high-pressure pipeline to carry out reverse flushing on the filter screen and peel off the adhesions on the dirt interception surface of the filter screen.
- The filter interceptor stripped by high-pressure recoil is sucked by the negative pressure suction scanner inside the filter screen and discharged with the sewage flow.
- During the cleaning process, the filter is discharged through the automatic blow-down valve under the action of the pressure difference between the internal pressure of the filter and the external environment.
- The system PLC controls the corresponding relay to control the driving motor to drive the central shaft to run in both directions (forward and reverse rotation), so as to drive the scanner to perform spiral scanning movement around the filter screen.

- The high-pressure cleaning pump is controlled by the relay to start and stop synchronously.

4.1.3 Self-cleaning excitation

The filter cleaning process can be triggered by any of the following conditions:

- Time control mode: the system PLC controls a certain time interval, automatically runs the self-cleaning process, and automatically resets after each backwash cycle.
- Manual cleaning: press the manual backwashing button on the panel to send a signal, and the system will execute a backwashing operation.

4.1.4 Operation of self-cleaning filter

For the operation of the Cyeco ™ BWMS self-cleaning filter, refer to the function and operation method of the filter page 3.9.9.

4.2 Operation of UV Disinfection Reactor

4.2.1 Description of lamp tube self-cleaning device

The UV lamp tube self-cleaning device is used to remove the attachments on the quartz sleeve. The cleaning ring reciprocates along the quartz sleeve in the cleaning process to clean all attachments on the surface of the quartz sleeve.

Limit switches control the start and stop of the motor. The time interval of each cleaning can be set through the touch screen of the control cabinet.

4.2.2 Operation of self-cleaning device for lamp tub

In the non-cleaning state, the lamp tube self-cleaning device stays at the initial position of the non-working section of the lamp tube.

Every time the UV lamp is started, the system first performs a self-cleaning cycle of the lamp tube to ensure the optimal transmission of UV light. In the process of operation, self-cleaning is automatically carried out according to the UV cleaning irradiation dose or time interval cycle set by the system.

PLC controls to start the cleaning program. After the cleaning program is started, the motor drives the cleaning shaft to rotate clockwise to transfer the cleaner from the initial position to the forward rotation limit point until reaching the forward rotation limit switch at the end. As soon as the washer is separated from the initial limit switch

point, the system starts timing and calculates the one-way travel time of the washer to ensure that the washer reaches the other end within the preset time. If the washer fails to reach the other end within the predetermined time, the washer failure signal will be highlighted on the control panel. The washer reaches the other end within a predetermined time, and the timer resets.

When the washer reaches the forward limit switch point (normally closed contact), the PLC will shield the forward limit switch to confirm that the washer has reached the other end of the chamber. The washer will stay at the forward rotation limit point for a predetermined time, and then the PLC controls the motor to rotate in the reverse direction until the washer is transferred to the reverse rotation limit point (initial point).

4.2.3 Operation of UV Disinfection Reactor

The operation of the Cyeco ™ BWMS Ultraviolet (UV) Disinfection Reactor is described on page 3.9.10 UV Functions and Methods of Operation.

5 System protection measures under idle and long-term shutdown conditions

When the installed equipment is required to be idle due to ship shutdown or other reasons, appropriate protective measures shall be taken, including but not limited to the following requirements:

- Cut off the power supply of the system;
- Cut off the passage of the inlet/outlet valve of the pipeline;
- Drain the residual seawater in the system unit;
- When conditions permit, the filter element shall be cleaned protectively;
- Properly protect other parts, instruments, valves, etc. That need to be protected.

If the system is temporarily out of service, flush it with clean water to ensure that no sand, granular salt, or other corrosive media are present. Store the equipment in a dry environment.

Dissolved or undissolved particulate (mineral) media may cause damage to stainless steel materials.

6 Equipment care and maintenance

6.1 Maintenance of self-cleaning filter

6.1.1 Structure of self-cleaning filter

The following figure is the structure diagram of the self-cleaning filter:

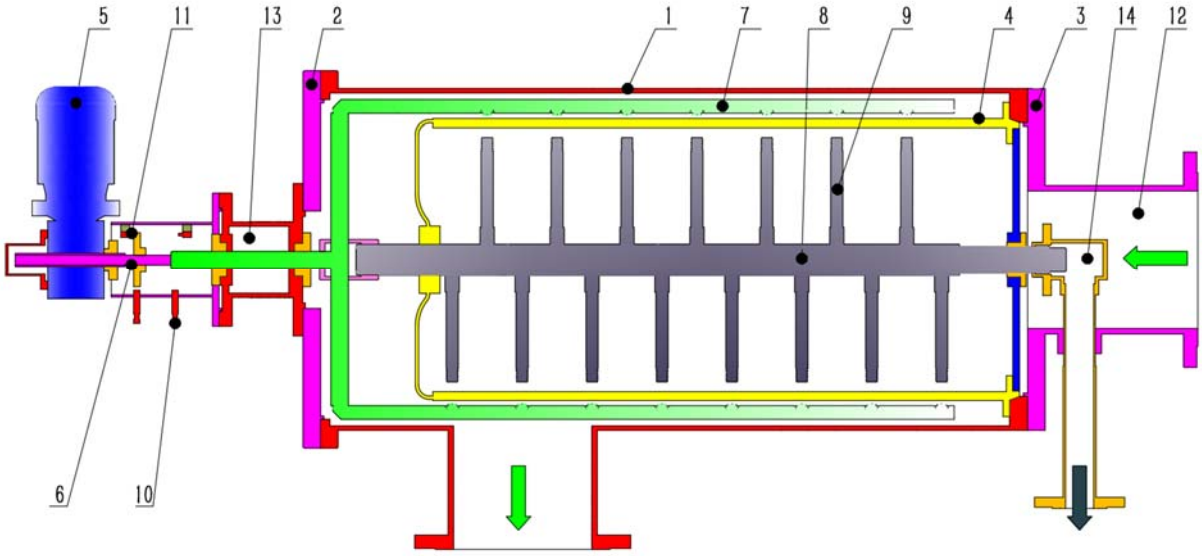


Figure43 Structure diagram of self-cleaning filter

Table4: List of main parts of self-cleaning filter

Serial number	Part name	Quantity	Remark
1	Body assembly	1 set	Including cylinder flange, water inlet and outlet and accessories
2	Drive end cap	1 piece	Precision casting
3	Blowdown end cap	1 piece	Precision casting
4	Strainer	1 piece	Multilayer folding filter screen
5	Gear motor assembly	1 set	
6	Drive assembly	1 set	Assembly
7	High-pressure backwashing nozzle assembly	1 set	Assembly
8	Blowdown shaft assembly	1 set	Wear-resistant treatment
9	Drain Suction Pipe	1 set	Precision casting
10	Proximity switch	2 pieces	
11	Microswitch	2 pieces	

12	Water inlet chamber	1 piece	Precision casting
13	High pressure water inlet chamber	1 piece	Precision casting
14	Blowdown cavity	1 piece	Precision casting

6.1.2 Daily inspection and maintenance of self-cleaning filter

6.1.2.1 Regular maintenance

- According to the general inspection requirements, check that the filter is in normal operation;
- Check whether it is necessary to add lubricating grease to the transmission screw rod and nut, and use No.3 lithium base lubricating grease;
- Check whether there is leakage on the backwash transmission shaft, and replace the seal if there is leakage.

6.1.2.2 Filter inspection before long-term shutdown

If the filter is out of service for more than one month, the following procedures must be completed:

- Rinse (with fresh water if possible)
- Power off the cleaning motor;
- High-pressure pump is powered off;
- Pressure relief inside the filter;
- Add lubricating grease to the drive screw and nut.

6.1.2.3 Check before rebooting

- Connect the control panel to the main control cabinet;
- Check the normal operation of the filter;
- Check the lubricating grease of drive screw and nut.

6.1.2.4 Inspection of transmission system

- Frequently observe whether the operation of the transmission system is stable and whether the motor bolts are loose;
- Check whether there is water leakage in the backwash transmission shaft, and

replace the seal in time in case of any abnormality;

- Frequently check the proximity switch and microswitch of the transmission shaft for looseness and displacement.

6.1.2.5 Inspection of backwashing system

- Before the operation of the high-pressure pump, the vent valve must be opened to exhaust the gas in the pump chamber;
- When the high-pressure pump is running, the reading of the pressure gauge (depending on the pressure of the pipe network) shall be 1.8-2.0 MPa. If the pressure is too high, the high-pressure nozzle may be blocked by dirt and shall be disassembled for cleaning. If the pressure is too low, the seal of the water inlet chamber of the water pump may be worn and should be replaced.
- Frequently check whether the high-pressure cleaning pipeline joint is loose and leaking.

6.1.2.6 Inspection of the sewage system

- Frequently check whether the blowdown pipe is blocked and clean it;
- Check the sealing of the blowdown system frequently, and replace it in time if any damage is found.

6.1.2.7 Inspection of the filtration system

When the pressure difference cannot be restored after the filter screen is automatically cleaned due to stubborn scale, if the cleaning time interval is less than 10 minutes and the pressure difference after cleaning is greater than 0.02 MPa, the filter screen shall be removed and then cleaned offline.

6.1.2.8 Disassembly and cleaning of filter screen

See the attachment for the disassembly, assembly and cleaning of the filter screen: Cyeco/TD04-4003-D008; Instructions for disassembly, assembly and cleaning of self-cleaning filter element.

6.2 Maintenance of UV (Ultraviolet) Disinfection Device

6.2.1 Tructure of UV (ultraviolet) disinfection device

The following figure is the structure diagram of UV (ultraviolet) disinfection device:

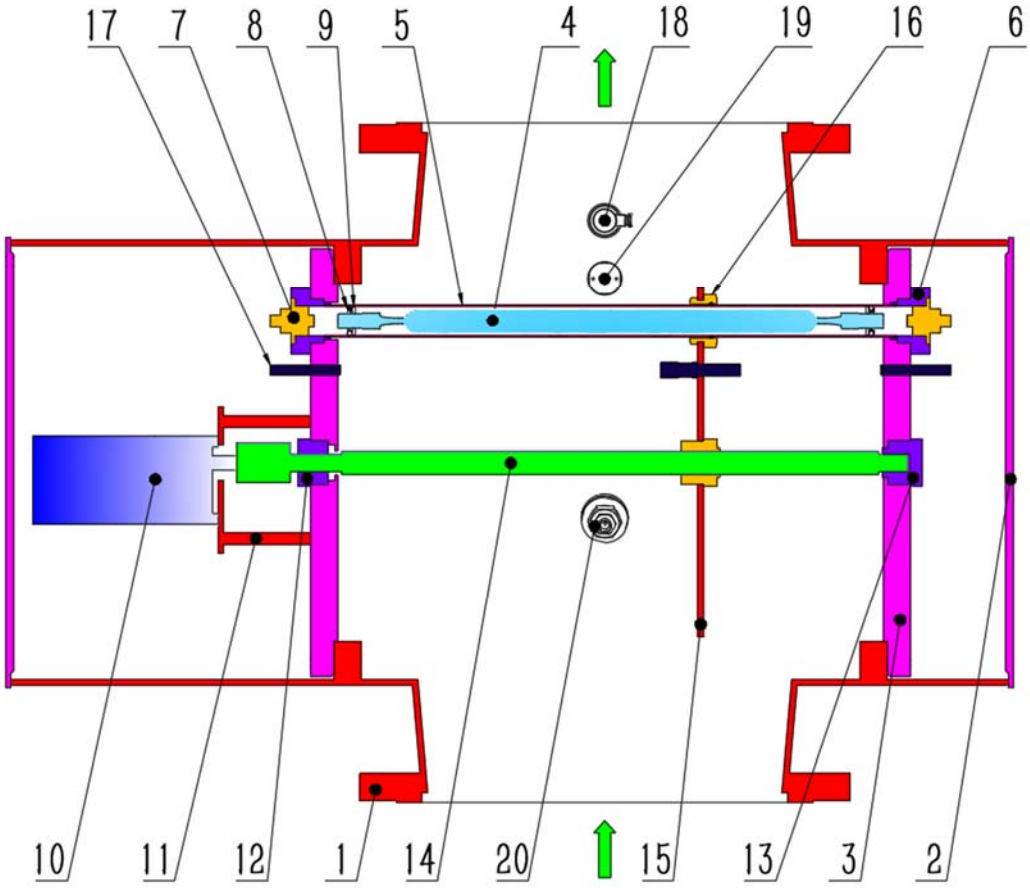


Figure44 Structural Diagram of UV (Ultraviolet) Sterilizer

Table5: List of main parts of UV (ultraviolet) disinfection device

Serial number	Part name	Quantity	Remark
1	Body assembly	1 set	Including cylinder, water inlet and outlet flanges and accessories
2	End Cap	2 pieces	Anodizing
3	Flange	2 pieces	Precision casting
4	UV lamp tube		The number depends on the size of the system, the medium voltage UV lamp
5	Quartz sleeve		The number depends on the system size.
6	Lamp holder		The number depends on the system size.
7	Lamp holder assembly		Quantity depends on system size, assembly,
8	Damping spring		The number depends on the system size.
9	Baffle		The number depends on the system size.
10	Gear motor assembly	1 set	
11	Motor base	1 set	Assembly
12	Front bearing housing	1 set	Assembly, including seals, etc.
13	Rear bearing housing	1 set	Assembly, including seals, etc.
14	Drive assembly	1 set	Assembly
15	Clean the plate	1 set	
16	Clean the ring		The number depends on the system size.
17	Proximity switch	2 pieces	
18	Temperature sensor	1 piece	
19	Temperature switch	1 piece	
20	UV intensity probe	1 piece	

6.2.2 Main Components and Maintenance of UV Disinfection Device

6.2.2.1 UV lamp tube

The ultraviolet lamp tube is arranged in the quartz sleeve and is connected with the cavity, and the water flow is allowed to flow through the stainless steel reaction cavity containing a plurality of ultraviolet lamps from all directions to be treated. The number and type of UV tubes depends on the size of the system.

6.2.2.2 Quartz sleeve

The ultraviolet lamp tube is arranged in the quartz sleeve and is connected with the cavity, and water flow is allowed to flow through the ultraviolet lamp tube containing a plurality of ultraviolet lamps from all directions.

6.2.2.3 UV lamp tube cleaning device

Cyeco ™ Ballast Water Treatment Unit has a built-in automatic cleaning device. When the system detects a low ultraviolet intensity alarm, the automatic cleaning device will automatically start to clean the dirt on the surface of the quartz sleeve, so that the ultraviolet intensity can be restored. When the low ultraviolet intensity alarm occurs continuously for many times in a short time, it indicates that the life of the ultraviolet lamp tube is approaching and needs to be replaced.

- The on-line mechanical automatic cleaning system is used for cleaning substances attached to the wall of the quartz sleeve;
- The cleaned length of the quartz sleeve is the length of the whole ultraviolet lamp tube;
- The normal work of the ultraviolet sterilization system is not affected during cleaning;
- Remote manual or automatic cleaning can be realized through the operation interface and remote control, and the cleaning cycle can be controlled;
- In order to ensure the cleaning performance of the UV lamp cleaning device, the cleaning ring shall be replaced once a year.

6.2.2.4 UV intensity probe

The UV sensor is installed on the cavity to continuously detect the irradiation intensity of the UV lamp tube on the fixed point in the reaction cavity in real time and display the ultraviolet dose data. In the operation process, once the quartz sleeve becomes dirty or the water quality changes to cause the decrease of the ultraviolet intensity of the detection point, which is lower than the set value of "low ultraviolet intensity", the sensor will transmit signals to the control system, and the control system will first start the automatic cleaning device to clean the quartz sleeve, and then adjust the output power of the lamp tube. Make the UV intensity of the detection point reach the set value.

The UV intensity probe should be periodically scrubbed with alcohol.

6.2.2.5 Disassembly and replacement of main components

Disassembly and replacement of UV lamp tube, quartz sleeve, UV cleaning device and UV intensity probe are detailed in the attachment:

Cyeco/TD04-4003-D009; Instructions for Disassembly and Installation of Ultraviolet Disinfection Device

7 Equipment troubleshooting

Please refer to the attachment for details of equipment fault inquiry and troubleshooting:

Cyeco/TD04-4003-D010; BWMS Equipment Troubleshooting Manual.

★ If you have any other questions, please contact Cyeco.

Cyeco™ 船研环保 Marine Equipments & Technology, Water & Wastewater Treatment

上海电气船研环保技术有限公司

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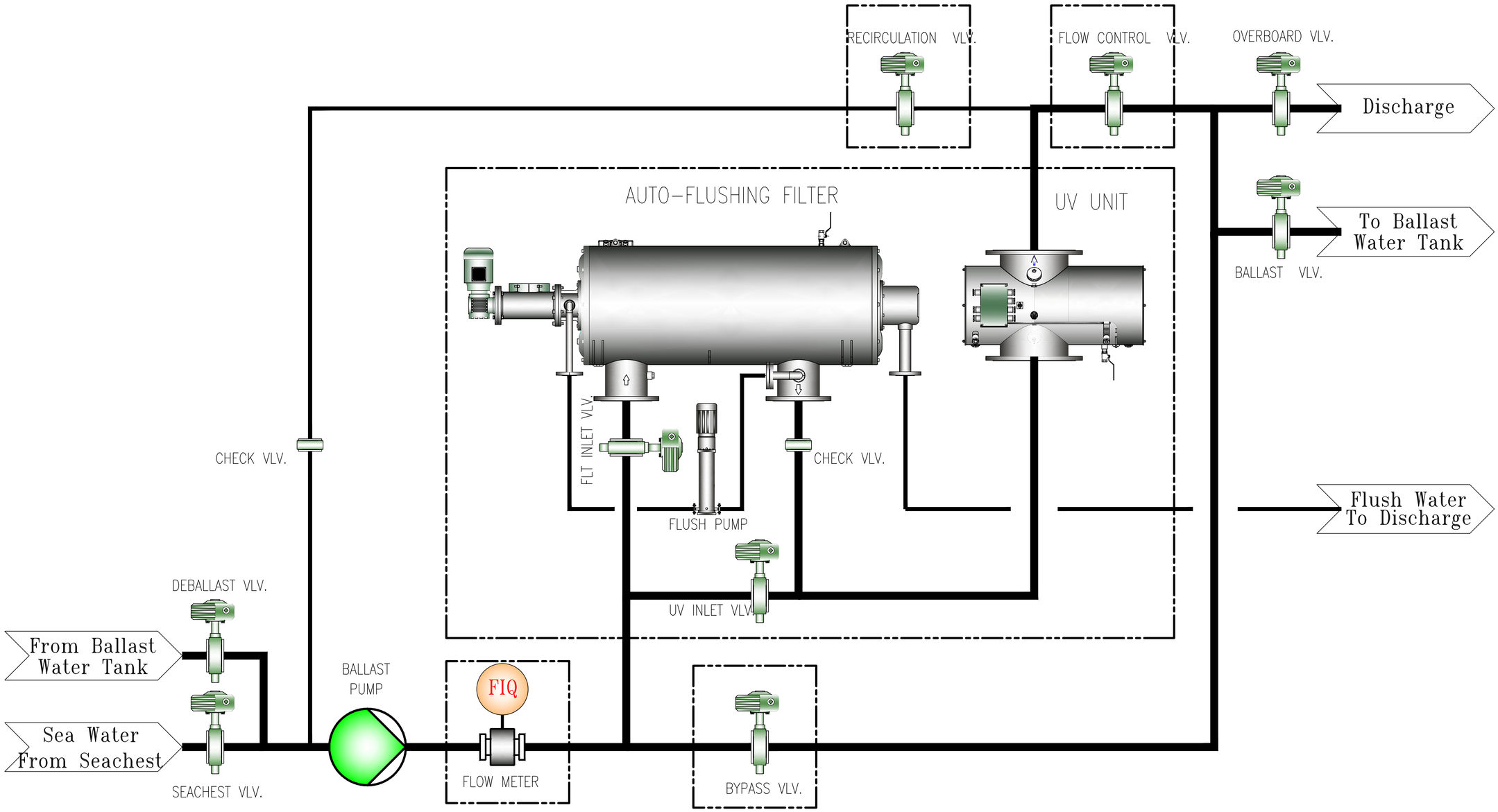
Add： No.2748 Pudong Avenue, Shanghai

BWMS Operation and Maintenance Manual

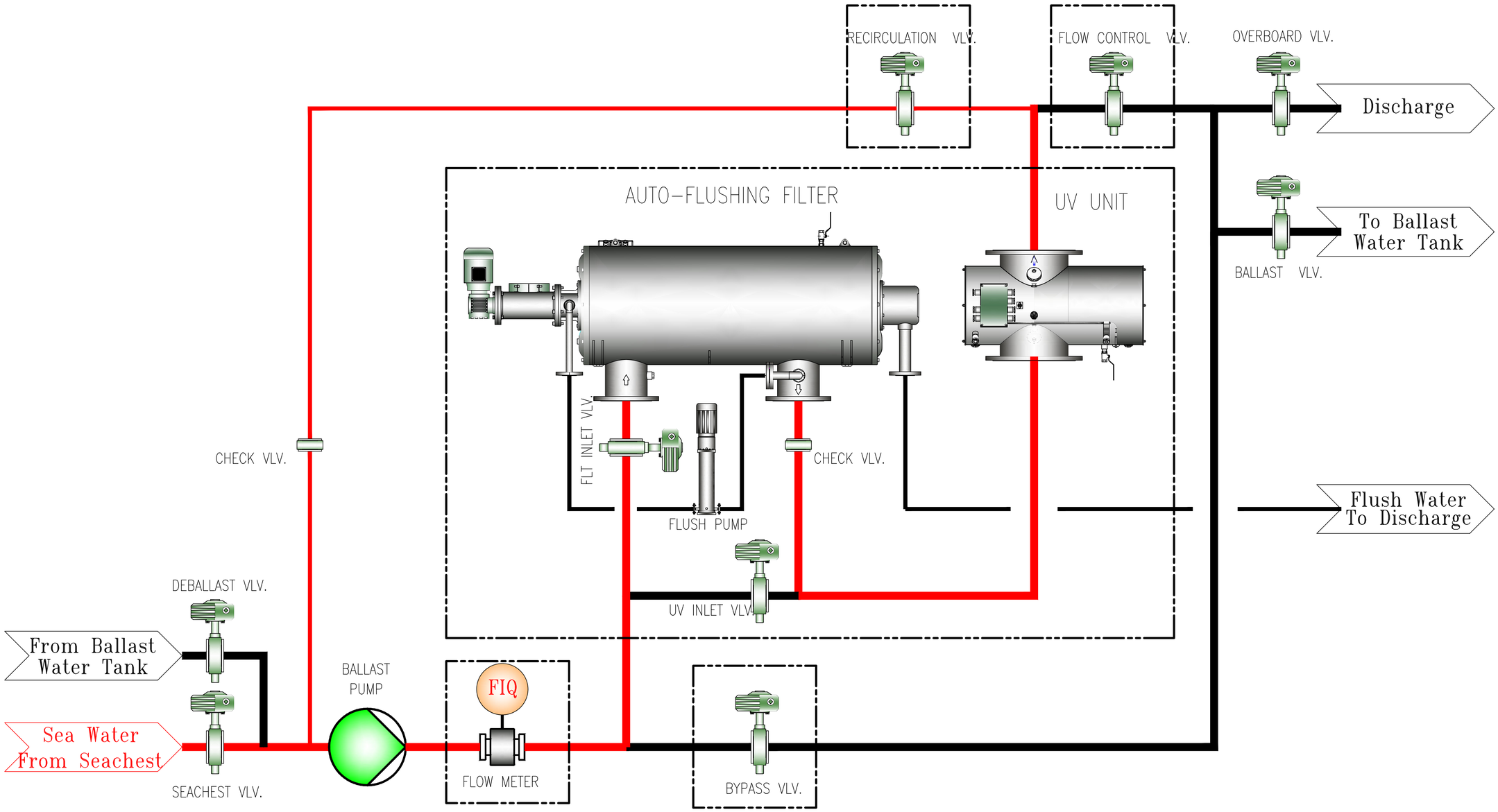
List of attachments

1 List of documents:

Serial number	Document number	File name	Ver.
1	Cyeco/TD04-4003-D003	Cyeco™ BWMS PFD Drawing	V1.0
2	Cyeco/TD04-4003-D004	Cyeco™ BWMS Sample Device	V1.0
3	Cyeco/TD04-4003-D005	BWMS Fault alarm list	V1.0
4	Cyeco/TD04-4003-D006	BWMS FE HMI Operation Manual	V1.0
5	Cyeco/TD04-4003-D008	Instructions for disassembly, assembly and cleaning of filter element of self-cleaning filter	V1.0
6	Cyeco/TD04-4003-D009	Instructions for Disassembly and Installation of Ultraviolet Disinfection Device	V1.0
7	Cyeco/TD04-4003-D010	BWMS Equipment Troubleshooting Manual	V1.0

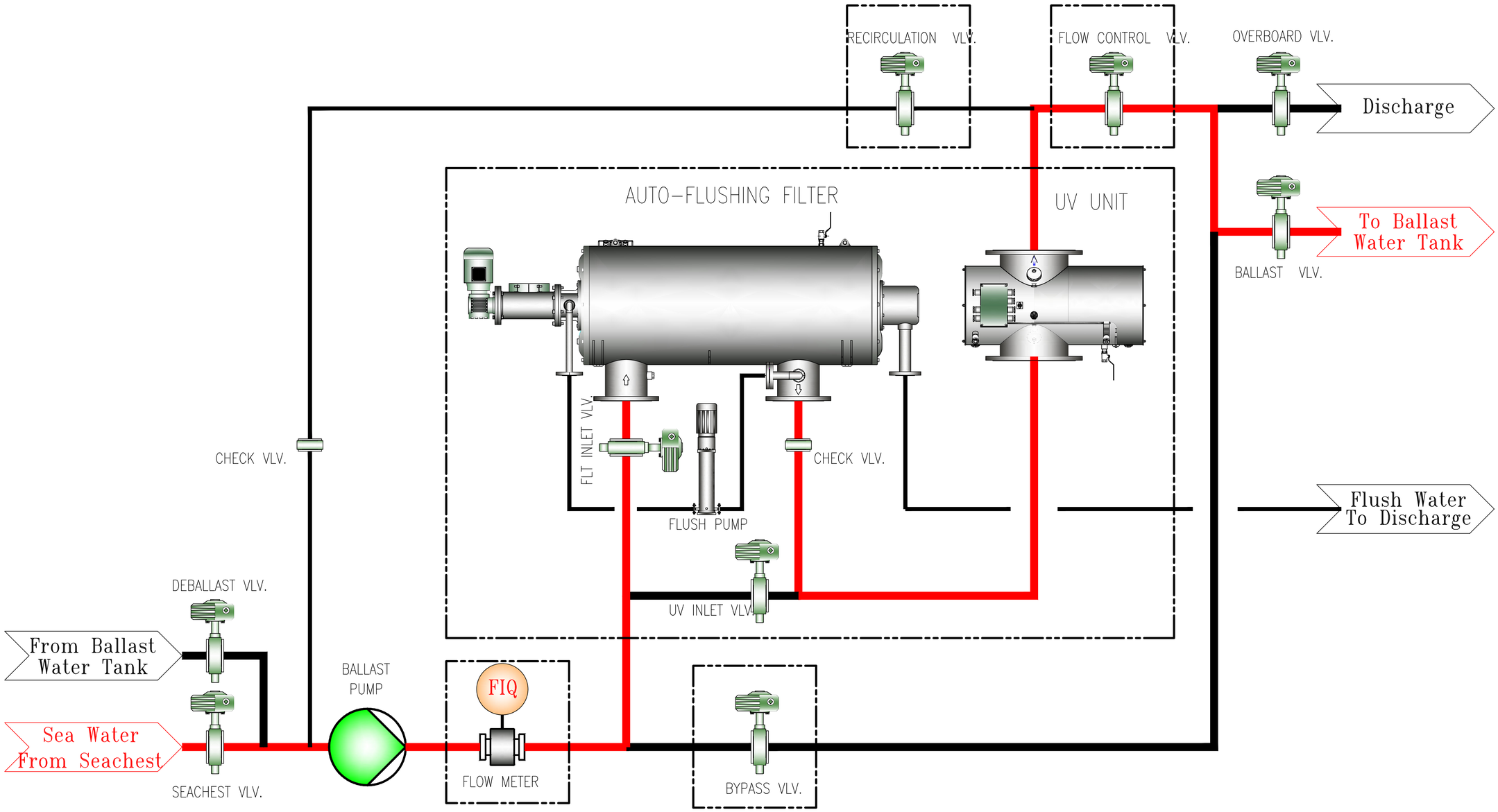


上海电气船研环保技术有限公司 Shanghai Electric Cyeco Environmental Technology Co., Ltd.	
DRAWING TITLE Cyeco™ BWMS PFD Drawing	
DATE DRAWN 2022/06/29	DRAWN BY JIAJIAN YANG
DRAWING NO. Cyeco/TD04-4003-D003	REV. 01
SCALE	
SHEET 1 OF 8	



上海电气船研环保技术有限公司
Shanghai Electric Cyeco Environmental Technology Co., Ltd.

DRAWING TITLE	Cyeco™ BWMS PFD Drawing -Ballast Preheating
DATE DRAWN: 2022/06/29	DRAWN BY: JIAJIAN YANG
DRAWING NO.: Cyeco/TD04-4003-D003	REV.: 01
SCALE	
SHEET 2 OF 8	



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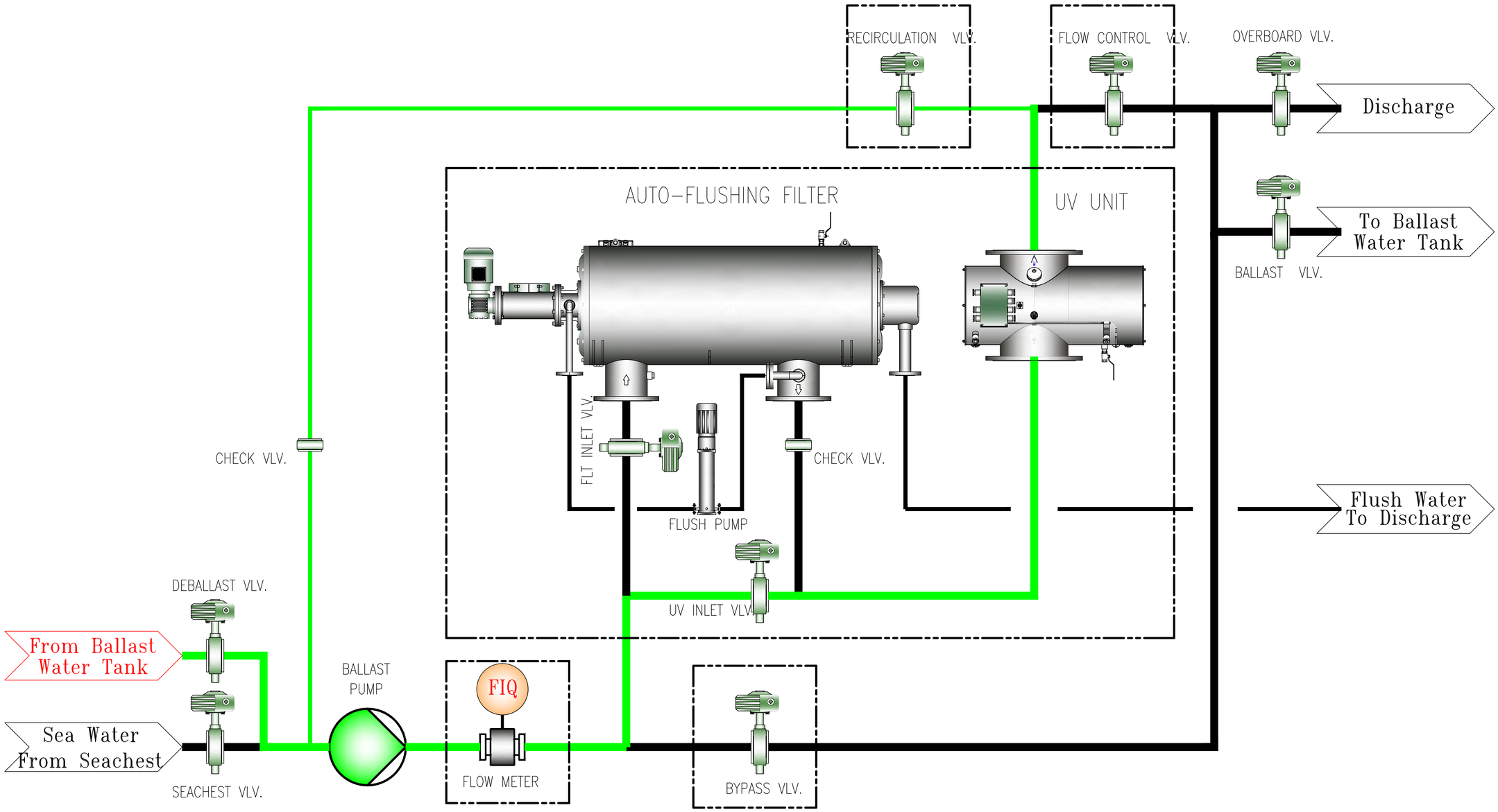
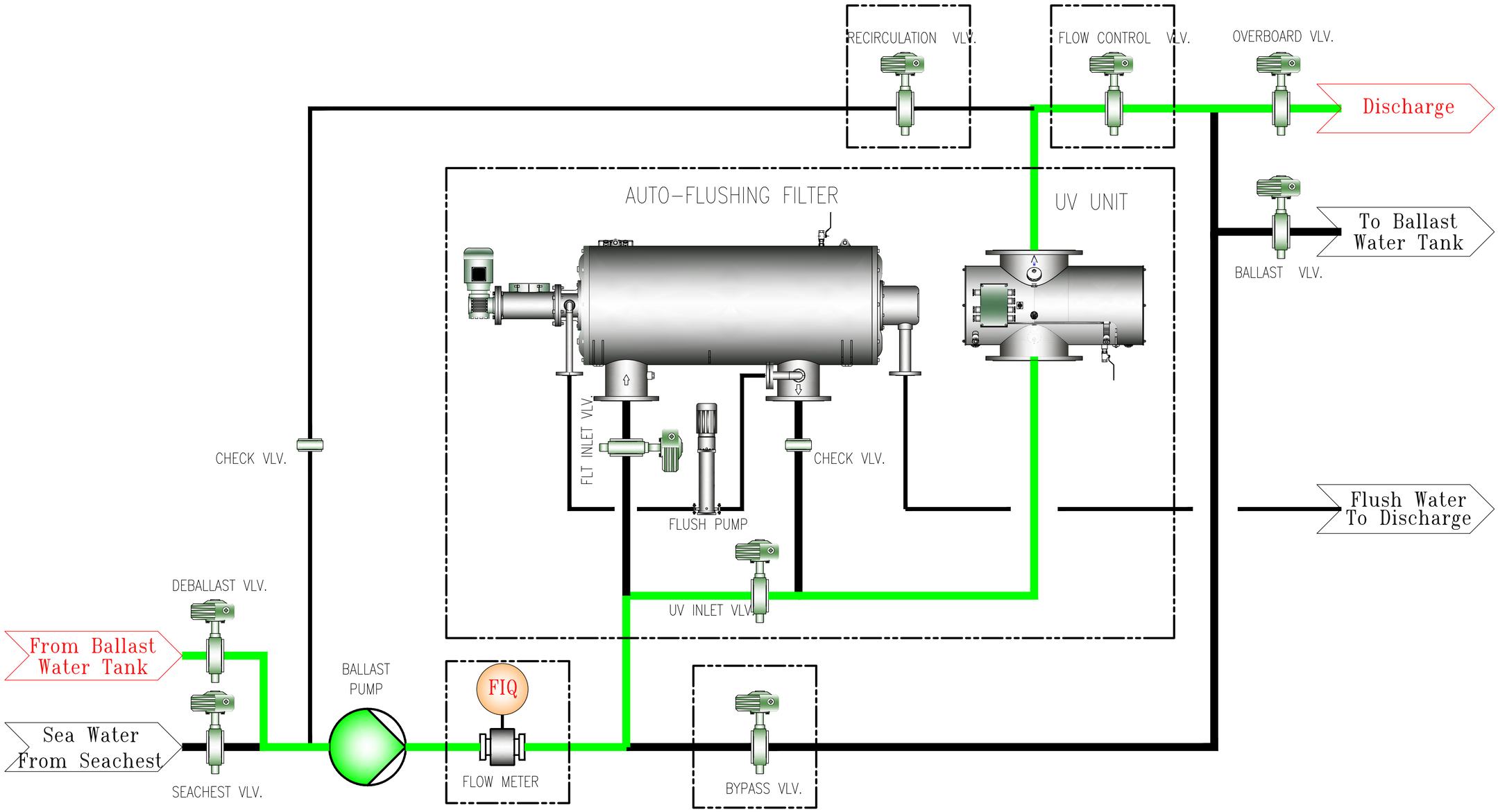
Shanghai Electric Cyeco Environmental Technology Co., Ltd.

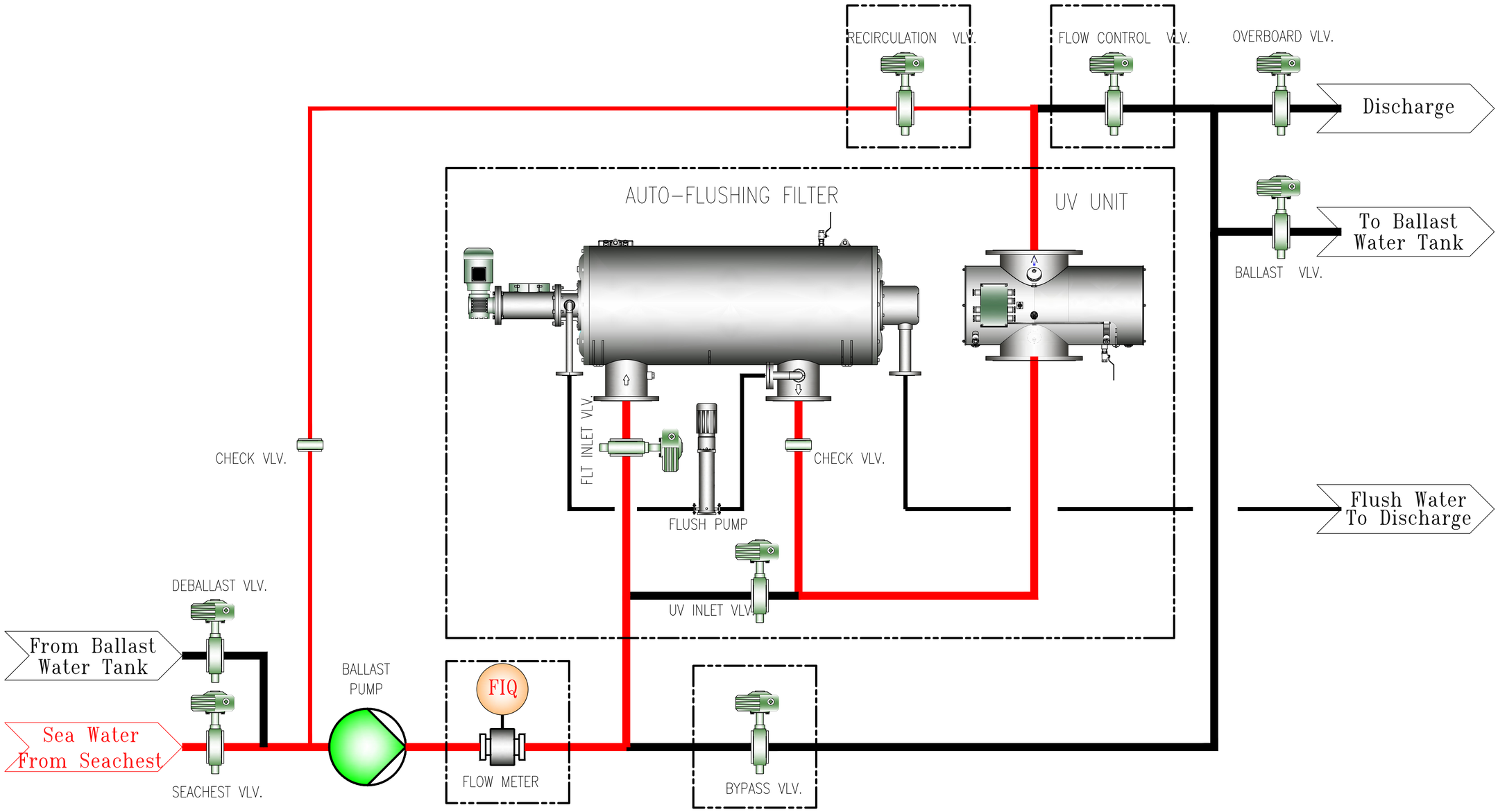
DRAWING TITLE	Cyeco™ BWMS PFD Drawing -Ballasting
DATE DRAWN: 2022/06/29	DRAWN BY: JIAJIAN YANG
DRAWING NO.: Cyeco/TD04-4003-D003	REV.: 01
SCALE	
SHEET 3 OF 8	



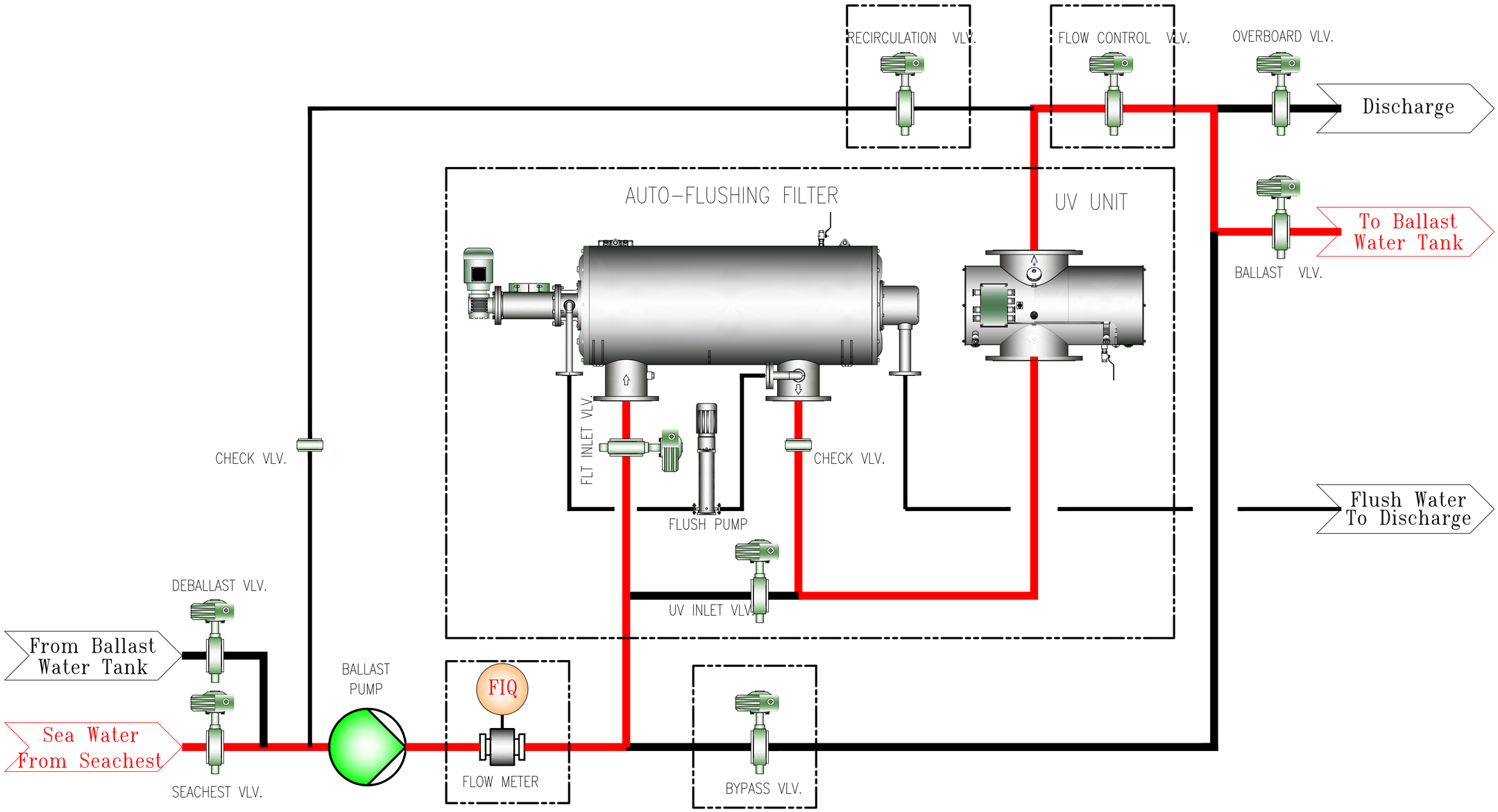
上海电气船研环保技术有限公司 Shanghai Electric Cyeco Environmental Technology Co., Ltd.	
DRAWING TITLE Cyeco™ BWMS PFD Drawing -Discharge Preheating	
DATE DRAWN 2022/06/29	DRAWN BY JIAJIAN YANG
DRAWING NO. Cyeco/TD04-4003-D003	REV. 01
SCALE	
SHEET 4 OF 8	



上海电气船研环保技术有限公司 Shanghai Electric Cyeco Environmental Technology Co., Ltd.	
DRAWING TITLE Cyeco™ BWMS PFD Drawing -Discharge	
DATE DRAWN 2022/06/29	DRAWN BY JIAJIAN YANG
DRAWING NO. Cyeco/TD04-4003-D003	REV. 01
SCALE	
SHEET 5 OF 8	

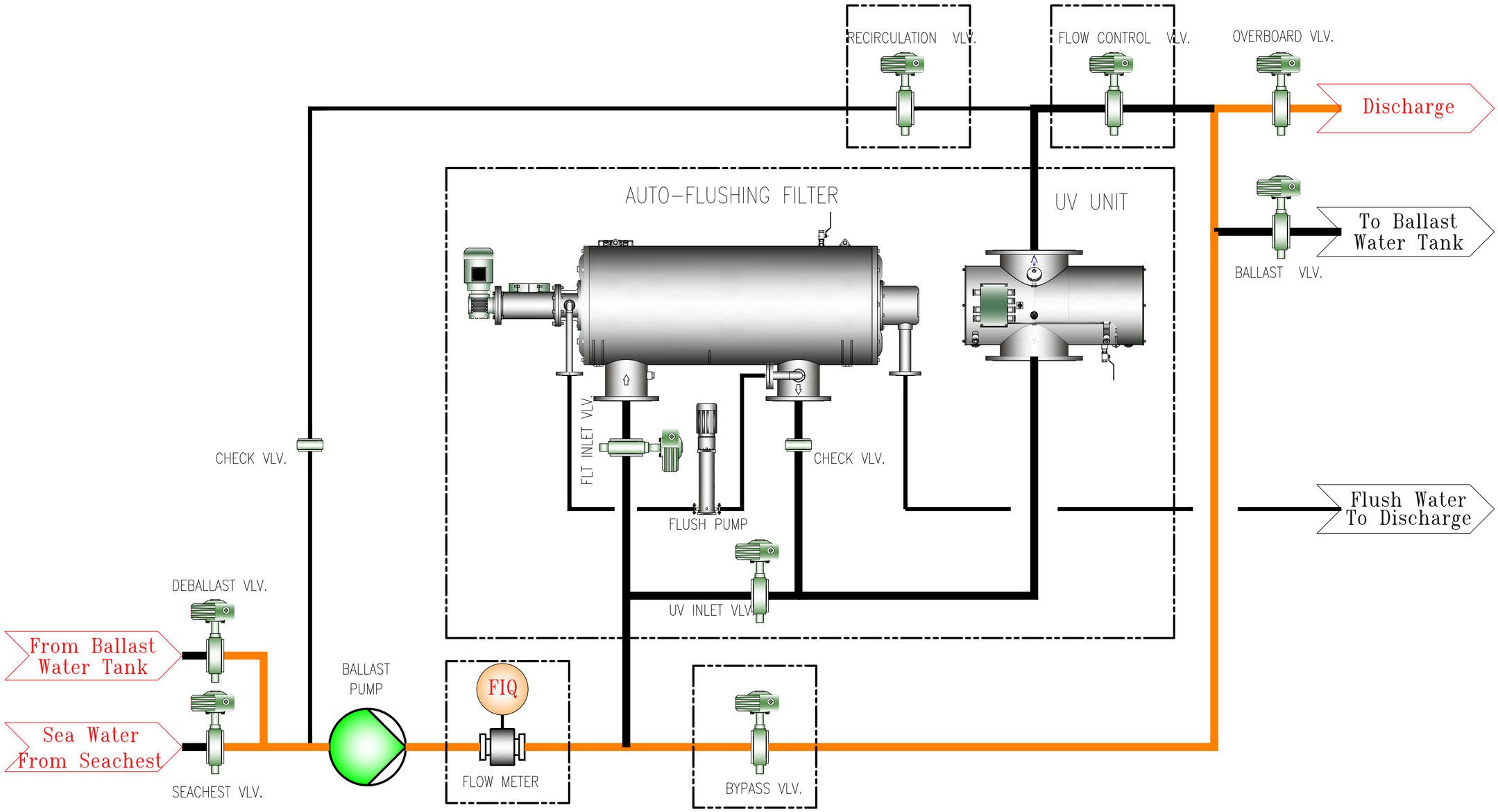


上海电气船研环保技术有限公司 Shanghai Electric Cyeco Environmental Technology Co., Ltd.	
DRAWING TITLE Cyeco™ BWMS PFD Drawing -Strip Preheating	
DATE DRAWN 2022/06/29	DRAWN BY JIAJIAN YANG
DRAWING NO. Cyeco/TD04-4003-D003	REV. 01
SCALE	
SHEET 6 OF 8	



上海电气船研环保技术有限公司
Shanghai Electric Cyeco Environmental Technology Co., Ltd.

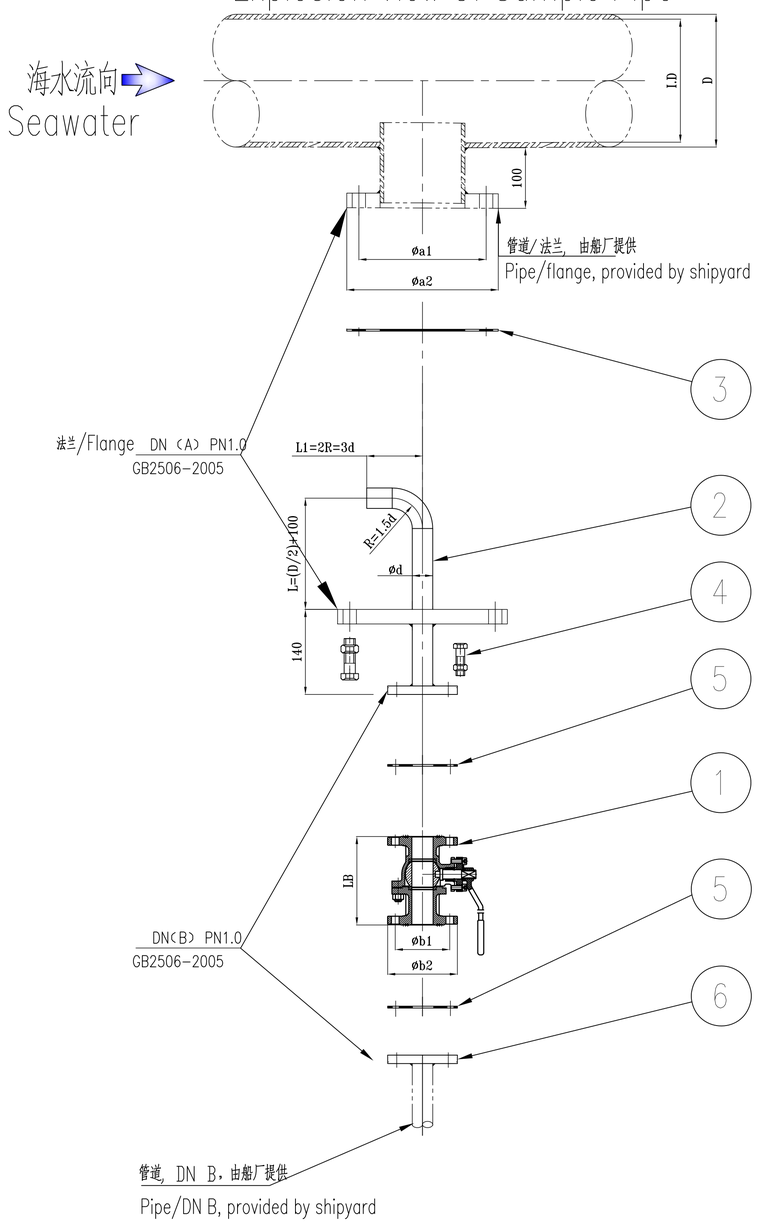
DRAWING TITLE	Cyeco™ BWMS PFD Drawing -Strip
DATE DRAWN: 2022/06/29	DRAWN BY: JIAJIAN YANG
DRAWING NO.: Cyeco/TD04-4003-D003	REV.: 01
SCALE	
SHEET 7 OF 8	

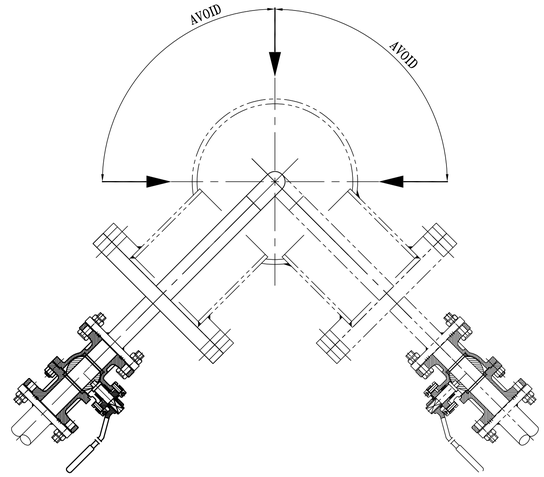


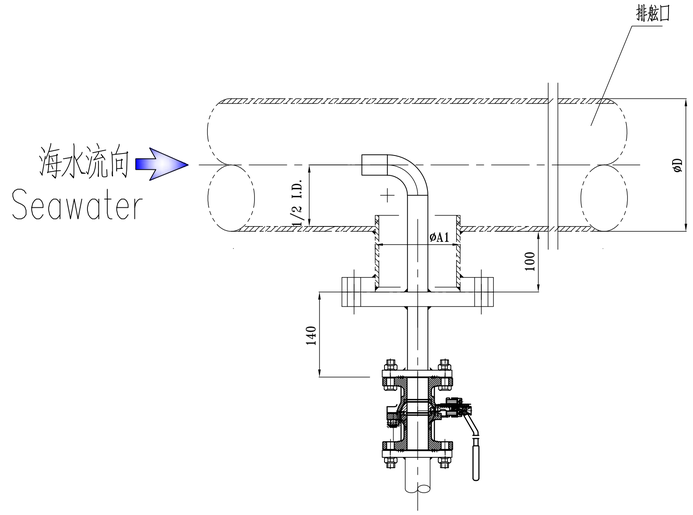
上海电气船研环保技术有限公司 Shanghai Electric Cyeco Environmental Technology Co., Ltd.	
DRAWING TITLE Cyeco™ BWMS PFD Drawing -Bypass	
DATE DRAWN 2022/06/29	DRAWN BY JIAJIAN YANG
DRAWING NO. Cyeco/TD04-4003-D003	REV. 01
SCALE	
SHEET 8 OF 8	

取样管爆炸视图

Explosion View Of Sample Pipe







海水取样主管/Main Sample Pipe		
øD	DN	Select
ø168	DN150	
ø219	DN200	
ø273	DN250	
ø324	DN300	
ø356	DN350	
ø426	DN400	
ø457	DN450	

取样法兰/Sample flange					
DN（A）	a1	a2	øA1	Bolt	Select
DN125	210	250	ø140X8	M16X75	
DN100	180	220	ø114X8	M16X75	
DN80	160	200	ø89X6	M16X70	

取样管/Sample Pipe						
DN（B）	b1	b2	ød	LB	Bolt	Select
DN25	85	115	ø33.7	127	M12X60	
DN32	100	140	ø42.4	165	M16X65	
DN40	110	150	ø48.3	165	M16X65	
DN50	125	165	ø60.3	178	M16X70	
DN65	145	185	ø76.1	190	M16X70	

NO.	DESCRIPTUON	Q'TY	MAT'L	REMARK
6	FLANGE (DNB, PN1.0, RF)	1	SS316L	GB2506-2005
5	GASKET (DNB, PN1.0)	2	EPDM	_
4	BOLT & NUT	4	SUS316L	
3	GASKET(DN A PN1.0)	1	EPDM	_
2	PROBE (DNB)	1	SS316L	–
1	GLOBE VALVE(DNB) PN1.6	1	SS316L	FC.

上海电气船研环保技术有限公司
Shanghai Electric Cyeco Environmental Technology Co., Ltd.

DRAWING TITLE

Cyeco™ BWMS Sample Device/取样装置

DATE DRAWN	DRAWN BY	
2022/06/29	JIAJIAN YANG	
DRAWING NO.	REV.	SCALE
Cyeco/TD04-4003-D004	01	SHEET 1 OF 1

BWMS 故障告警清单

BWMS Fault alarm list

序号	项目	Item
1	电源相序错误	Power phase sequence error
2	急停按钮被按下	Emergency stop
3	系统初始化失败	System initialization failure
4	过滤器电机过载	Filter motor overload
5	动力柜电源故障	Power supply cabinet power fault
6	动力柜温度过高	Power supply cabinet temperature too high
7	动力柜温度高持续时间过长	Power supply cabinet temperature too high
8	UV 电机过载	UV motor overload
9	灯管故障	Lamp fault
10	过滤器进水阀故障	Filter inlet valve fault
11	UV 进水阀故障	UV Inlet valve fault
12	高压泵电机过载	High pressure pump motor overload

BWMS 故障告警清单

BWMS Fault alarm list

序号	项目	Item
1	电源相序错误	Power phase sequence error
2	急停按钮被按下	Emergency stop
3	系统初始化失败	System initialization failure
4	过滤器压差持续时间过长	Differential pressure last for long
5	压差开关报警	Differential pressure switch alarm
6	过滤器电机故障	Filter motor fault
7	过滤器电机过载	Filter motor overload
8	动力柜电源故障	Power supply cabinet power fault
9	动力柜温度过高	Power supply cabinet temperature too high
10	动力柜温度高持续时间过长	Power supply cabinet temperature too high
11	灯管故障	Lamp fault
12	UV 灯管未全开	UV lamp fault
13	UV 剂量低持续时间过长	UV low dose last for long
14	UV 剂量高报警	UV dose high alarm
15	温度高开关报警	Temperature switch alarm
16	腔体温度过高	Temperature is too high
17	UV 腔体温度过高导致系统故障	System failure caused by high temperature
18	UV 电机故障	UV motor fault
19	UV 电机过载	UV motor overload
20	流量未达到要求值导致系统故障	System failure caused by low flow rate
21	过滤器进水阀故障	Filter inlet valve fault
22	过滤器进水阀过载	Filter inlet valve overload
23	UV 进水阀故障	UV Inlet valve fault
24	UV 进水阀过载	UV inlet valve overload
25	旁通阀故障	Bypass valve fault
26	旁通阀过载	Bypass valve overload
27	旁通阀门未到关位	Bypass valve is not in shut position
28	回流阀故障	Return valve fault
29	回流阀过载	Reflux valve overload
30	流量调节阀过载	Flow control valve overload
31	流量调节阀报警	Flow control valve alarm
32	高压泵电机过载	High pressure pump motor overload
33	排污泵电机过载	Sewage pump overload

BWMS FE HMI Operation Manual

Cyeco™ Ballast Water Treatment System

压载水处理系统

Shanghai Electric Cyeco Environmental Technology Co., Ltd

上海电气船研环保技术有限公司

Catalog

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1 Initial system startup condition

- Only the Cyeco™BWMS system that has completed the installation and commissioning of the system shall perform the start-up operation.
- The initial start-up must be carried out under the guidance and supervision of relevant technical personnel.
- Personnel who are not trained and do not have the basic knowledge of system operation shall not operate the system.

2 Operation of control cabinet

In this section, the following type labels such as "Local/Remote" are used as the operation labels of the touch screen.

3 Power supply indication

Power indication: the main power is switched on, and the white power indicator is on.

4 Local remote selector switch

Cyeco™BWMS is divided into local and remote system control functions according to different requirements of users, that is, system operation and control can be completed by local human-machine interface or remote human-machine interface.

- When the "local/remote" touch screen engineer 1 interface selection button is in the "local" position, all control functions can only be realized by the local human-machine interface.
- When the "Local/Remote" touch screen engineer 1 interface selection button is in the "Remote" position, all control functions can only be performed by the remote HMI.

5 Check, Normal, Bypass Select Switch

Cyeco™BWMS has three working modes: check, normal and bypass according to different requirements of users.

- When the touch screen engineer 1 interface selection button is in the "Check" position, it allows the inspection of components and the functional testing of valves, motors, UV, etc.

- When the touch screen engineer 1 interface selection button is in the "normal" position, the system can operate normally and automatically when the startup conditions are met.
- When the touch screen engineer 1 interface selection button is in the "bypass" position, the bypass valve is opened, the filter inlet valve and the UV inlet valve are closed, and the water flow cannot pass through the filter and the UV device.

6 Emergency stop button

The emergency stop button on the panel of the control cabinet is used for immediate shutdown in any emergency. The user only needs to press the emergency stop button, and the system will automatically stop immediately.

7 Operation indication

UV operation indication: the indicator light is on during normal ballasting and unloading.

8 Preheat indication

UV warm-up indicator: the red indicator is on during the warm-up phase of the normal ballast and unloading system.

9 Human Machine Interface (HMI) Operating Manual

9.1 Control system interface and button description

The button functions of each display unit involved in the operation interface of the control system are described in the following table (Table 1 and Table 2).

Table 1: Page Switch Button Symbols and Functions

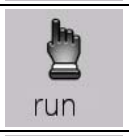
Symbol	Description	Function	Remark
	The main page navigation switches	Page navigation switch	
	Run Mode Page Navigation Toggle	Page navigation switch	
	Parameter setting page navigation switch	Page navigation switch	
	System Status Page Navigation Toggle	Page navigation switch	
	Alarm page navigation switch	Page navigation switch	
	Valve inspection page navigation switch	Page navigation switch	
	Engineer Page Navigation Toggle	Page navigation switch	

Table 2: Function Operation Button Symbols and Functions

Symbol	Description	Function	Remark
LOCAL	Local mode	System state switching	
REMOTE	Remote mode	System state switching	
BYPASS	Bypass mode	System state switching	
NORMAL	Normal mode	System state switching	
MAINT	Check mode	System state switching	
Silence	Alarm silencing	On/off	
Reset	Alarm reset	On/off	
Open	The valve is open	On/off	
Close	Valve is closed	On/off	

Table 3: Parameter Display and Function Description

Parameters	Description	Remarks
Cavity temperature	Indicates the temperature inside the UV chamber	℃
UV dose	Indicating UV irradiation dose	mJ/cm^2
Warm-up time of UV lamp	Display the warm-up time of UV lamp	s
UV lamp cooling time	Displays the UV lamp cooling times	s
Remaining interval of filter self-cleaning	Display the remaining time of filter self-cleaning interval	m
Remaining interval of lamp cleaning	Display the remaining interval time of lamp cleaning	m

9.2 Clock and date settings

Power on the touch screen, and press any point on the screen with your finger until the "Click to operate" interface appears. Click "Set" to enter the SETUP setting interface, as shown in the following figure.

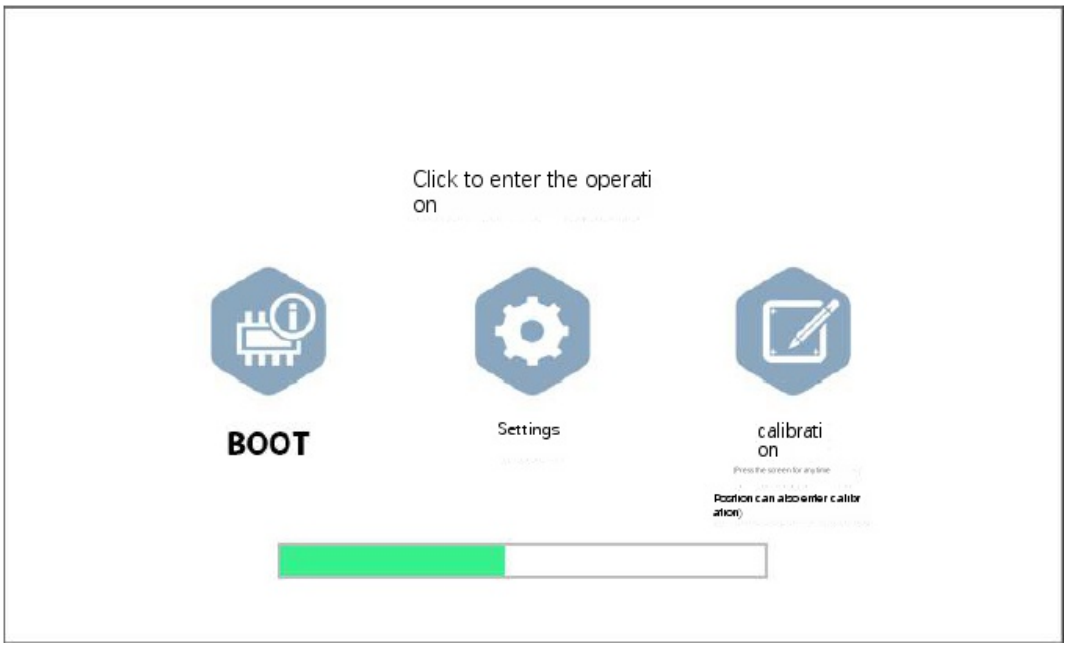


Figure 1: Setup Interface

Enter the SETUP setting interface and select "General Settings" to modify the time, as shown in the following figure.

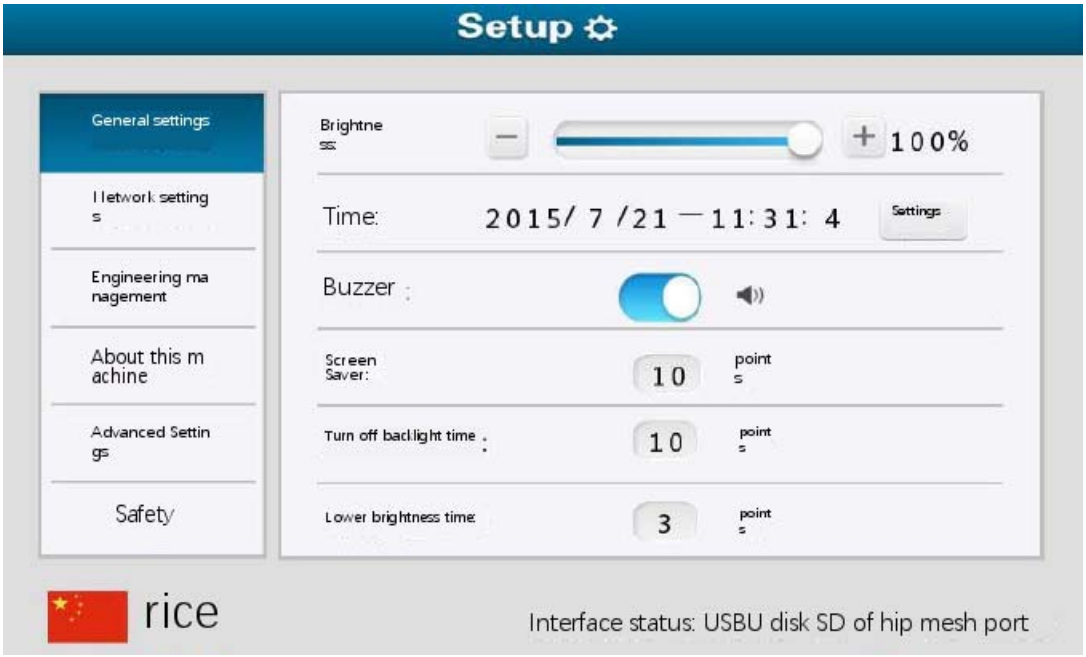


Figure 2: Clock and date setting interface

9.3 Communication settings

Enter the SETUP setting interface, select "Project Management" and enter the password. The default project management password is "888888", as shown in the following figure.

Figure 3: Project Management Password Interface

Enter the SETUP setting interface and select "Network Settings"-IP Settings. Local touch screen IP: 192.168.0.3, remote touch screen IP: 192.168.0.6, subnet mask: 255.255.255.0, as shown in the figure below:

Figure 4: Communication address setting interface

9.4 System password

When the touch screen is powered on, the touch screen startup initial interface will open. As shown in the following figure:

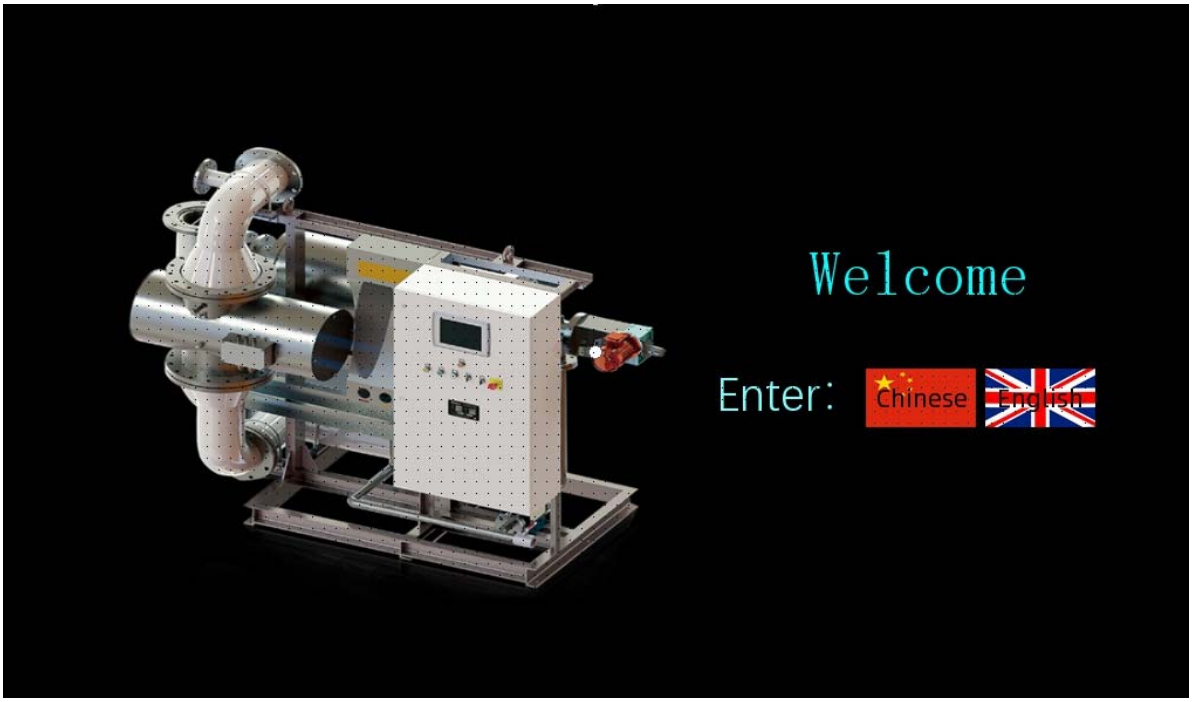


Figure 5: Initial interface

Click Chinese/English to enter the main page of the system, as shown in the following figure.

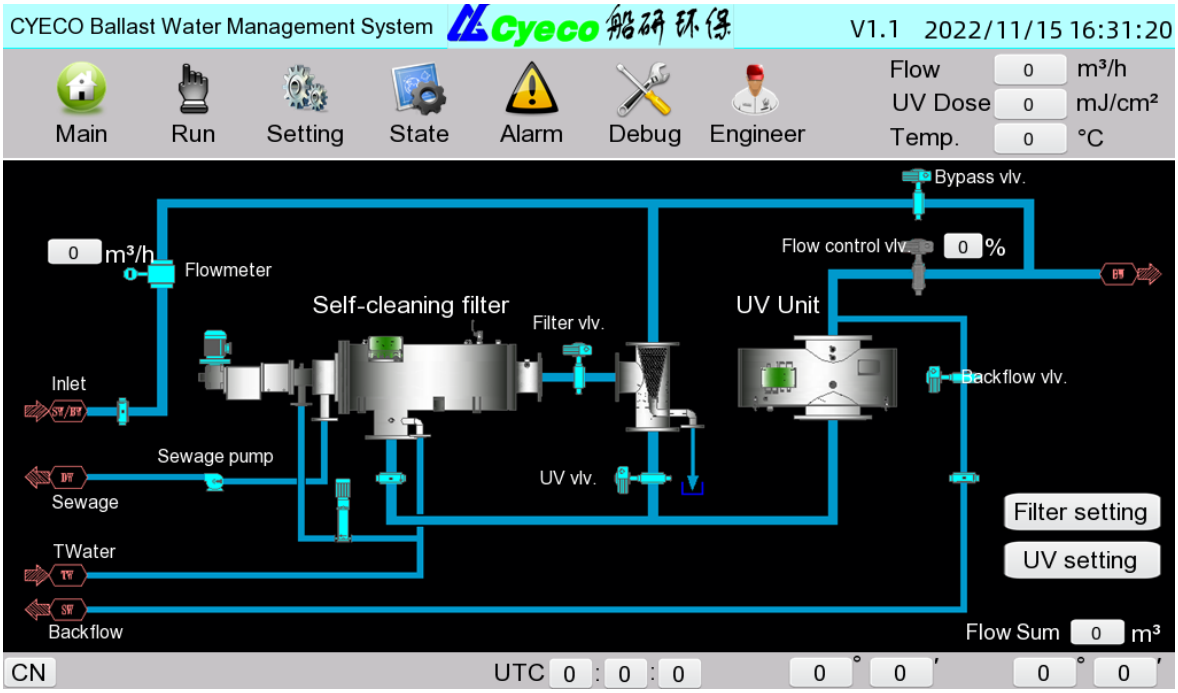


Figure 6: Main interface

9.5 How to start

Before starting the system, select the system working mode as "Normal" as shown in the figure below. At this time, after the system is powered on, it will automatically complete the self-test and initialization.

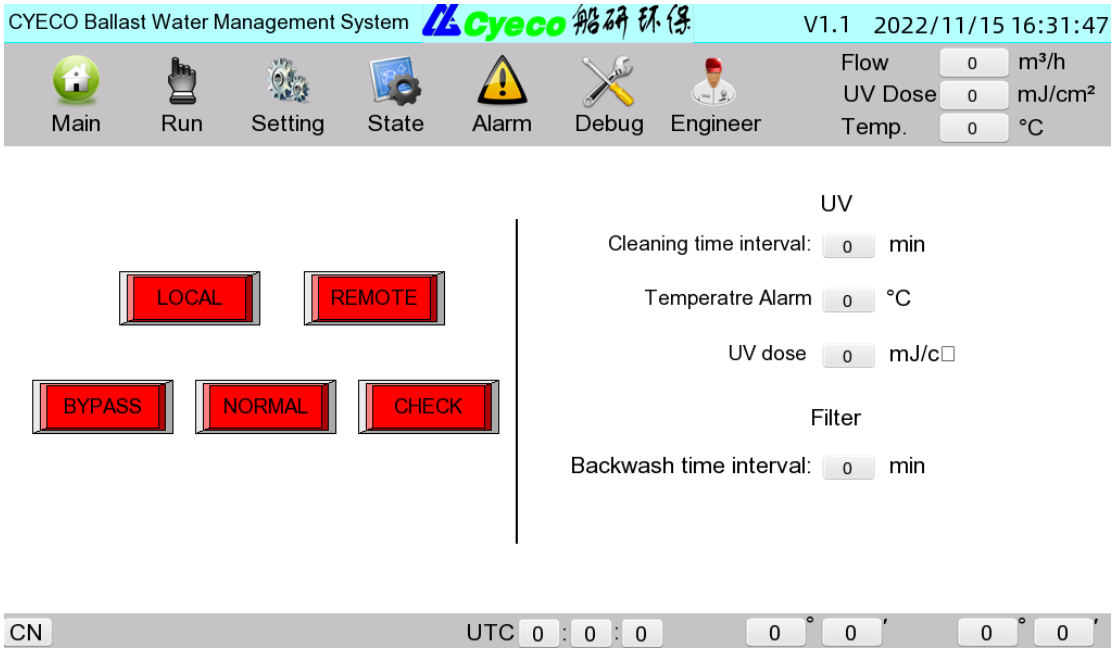


Figure 7: Work mode selection page

At this time, the operation interface is as shown in the figure below, and the "Ballast" and "Unload" buttons are valid.

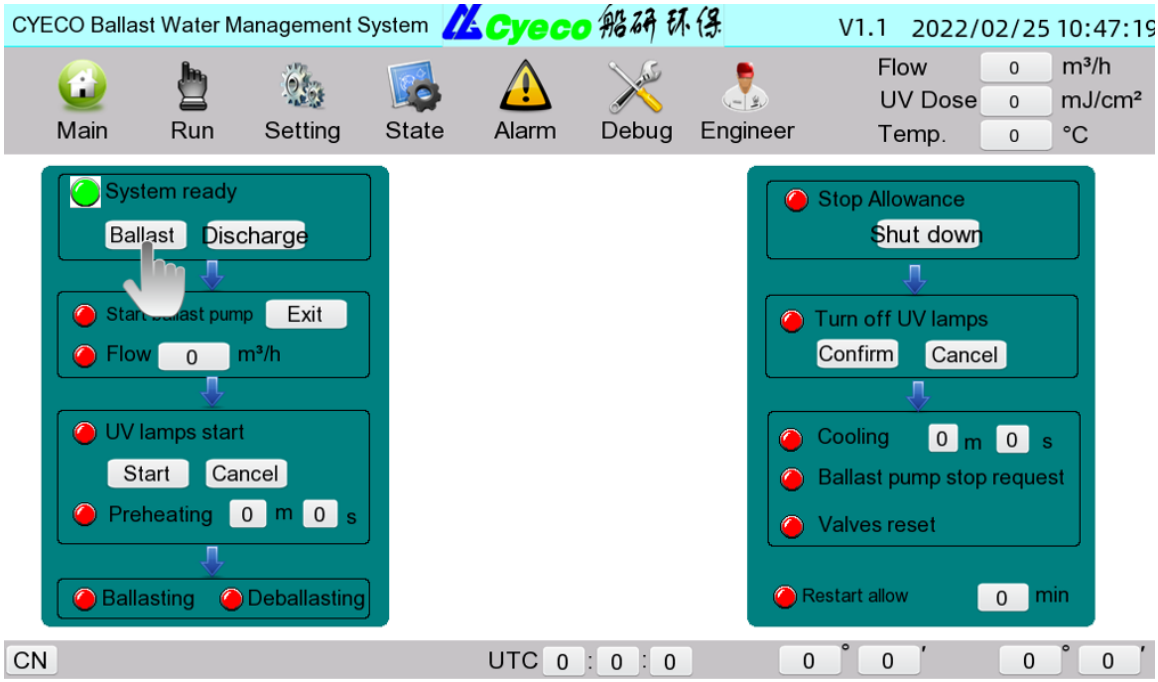


Figure 8: Running the page

Before ballast operation, enter the commissioning interface and confirm that the "Subsea Valve" and "Ballast Valve" have been opened, and before unloading operation, confirm that the "Discharge Valve" and "Sea Discharge Valve" have been opened, as shown in the figure below.

Figure 9: System Valve Status Page

When the working valve is opened in place, the "ballast pump start request" indicator on the operation interface turns green, as shown in the following figure:

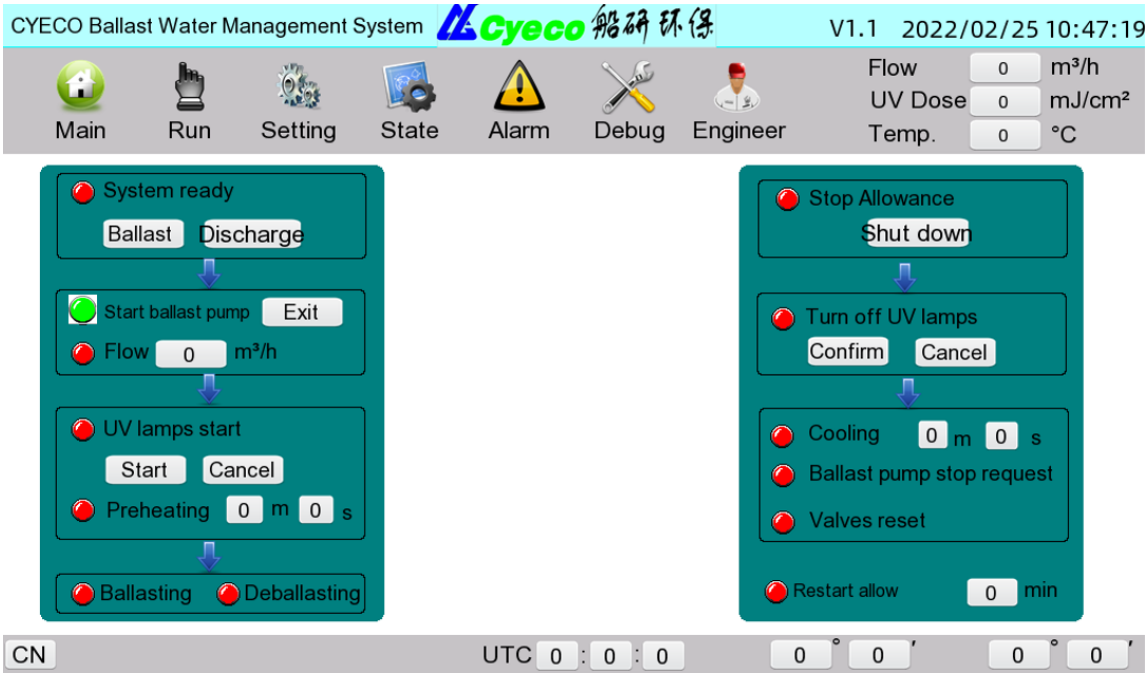


Figure 101: Waiting for ballast pump start page

When the flow reaches the set value of the system, the "UV lamp start request" indicator on the operation interface will turn green. Click the "Start" button, and the operation page is shown in the following figure:

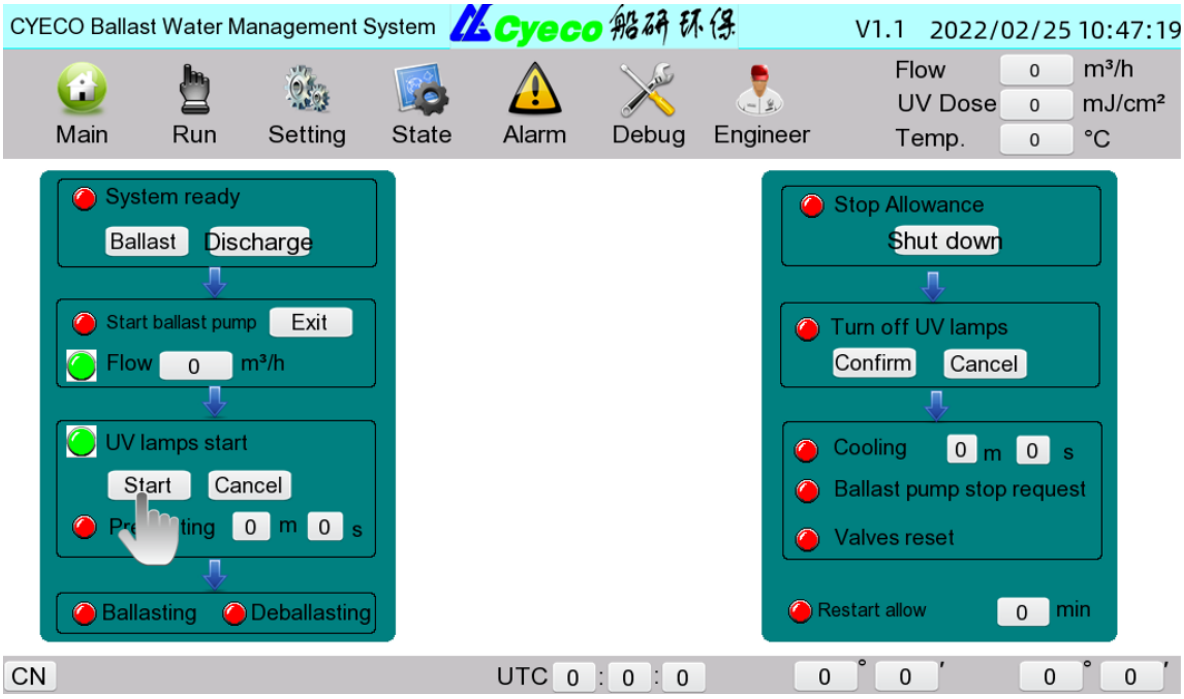


Figure 11: UV lamp startup page

After the equipment starts the UV lamp, the system starts to enter the warm-up state. The running page is shown in the following figure:

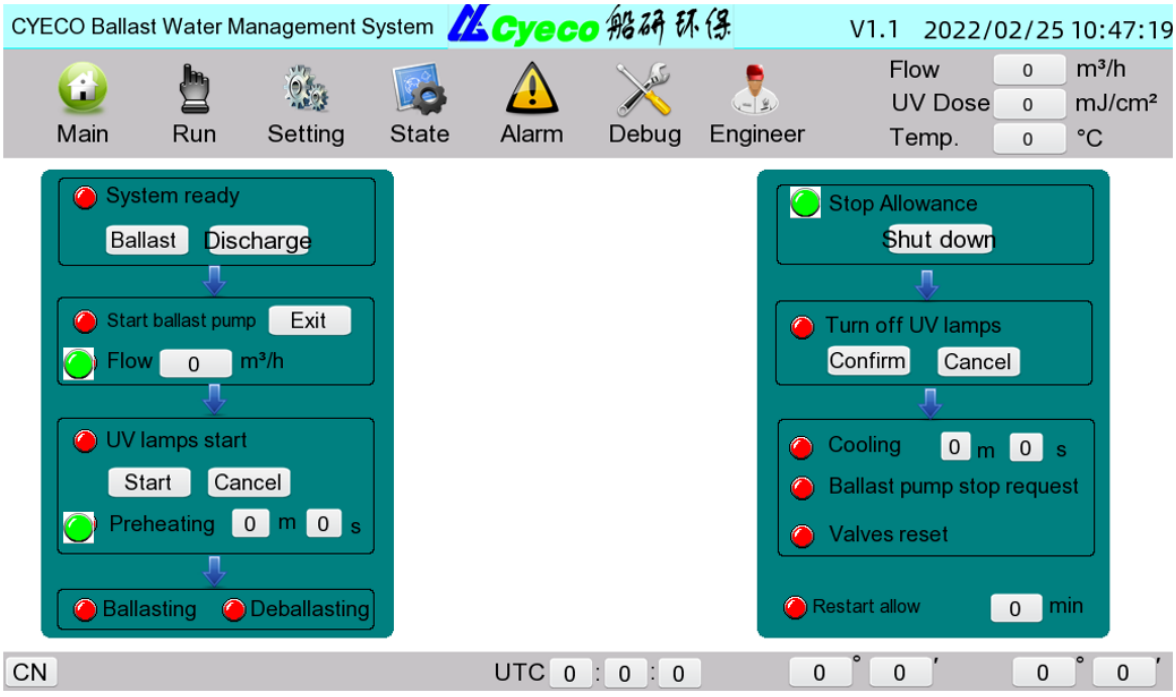


Figure 12: Device warm-up page

The preheating time is 3-6min. After the preheating, the indicator light of "ballast operation" on the operation interface will turn green, as shown in the following figure:

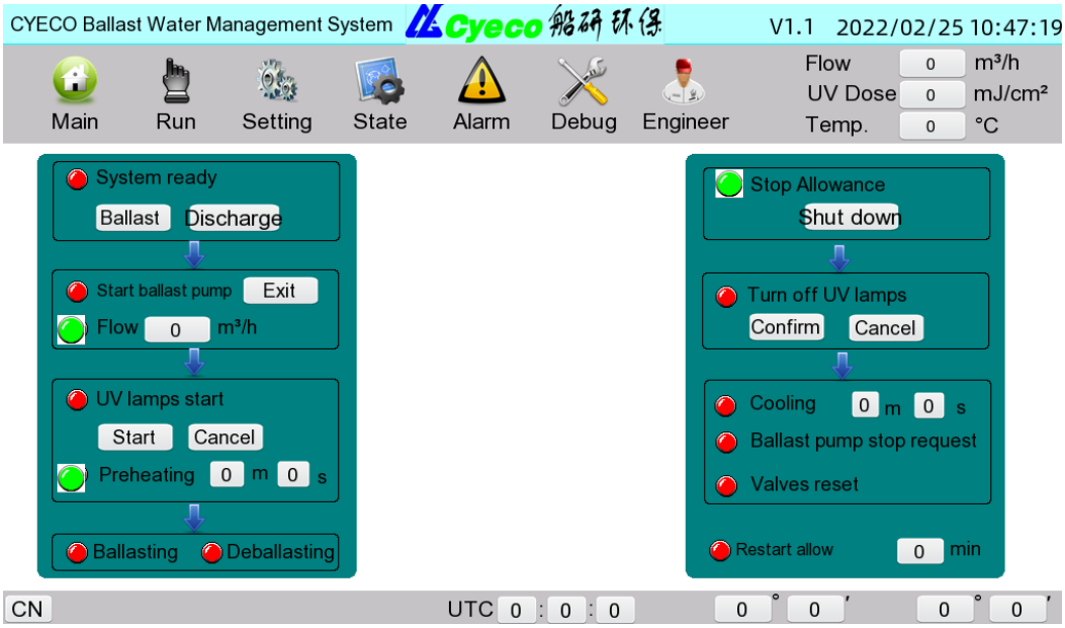


Figure 13: Ballast Running Page

9.6 How to shut down

When shutdown is required, take ballast shutdown as an example, as shown in Figure 13 above, the "shutdown" button is valid. Press the "Shutdown" button, and the "UV Lamp Shutdown Request" indicator will turn green. Click the "Confirm" button, and the system will automatically shut down, as shown in the following figure:

Figure 14: Lamp Off Page

During shutdown, cool the lamp tube for 3-6min. The cooling indicator on the control cabinet panel flashes alternately. After cooling, stop the ballast pump and reset the peripheral valves. The system automatically switches the internal valves. The operation interface is shown in the following figure:

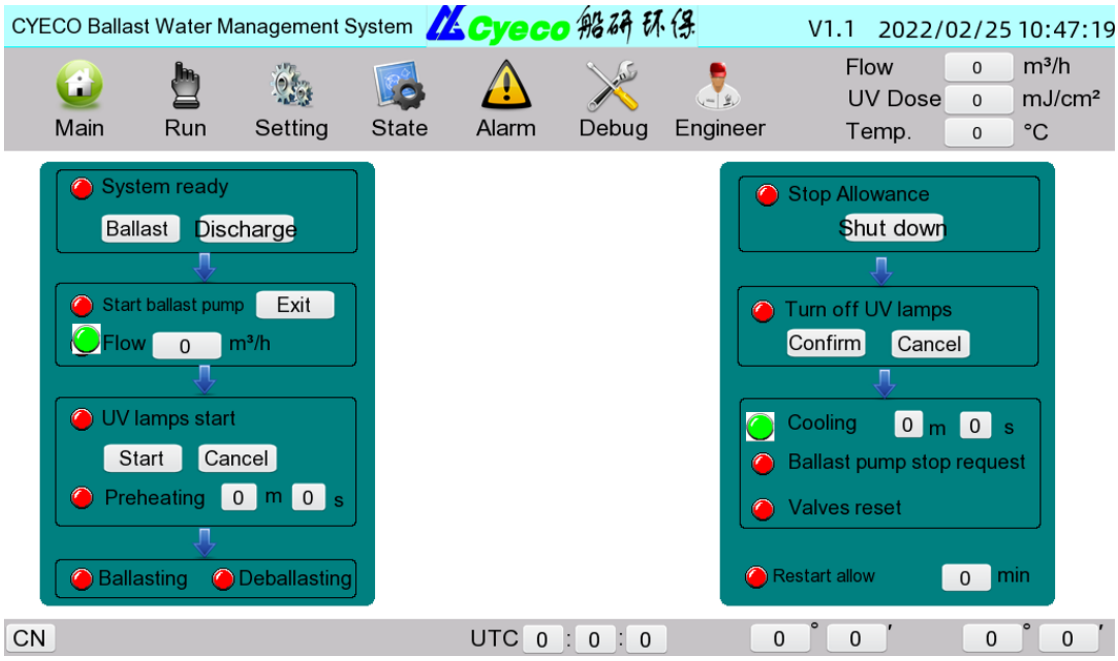


Figure 15: Cooldown Countdown Page

After the operation interface is restored, the "Ballast" and "Unload" operations can be performed again, as shown in the following figure:

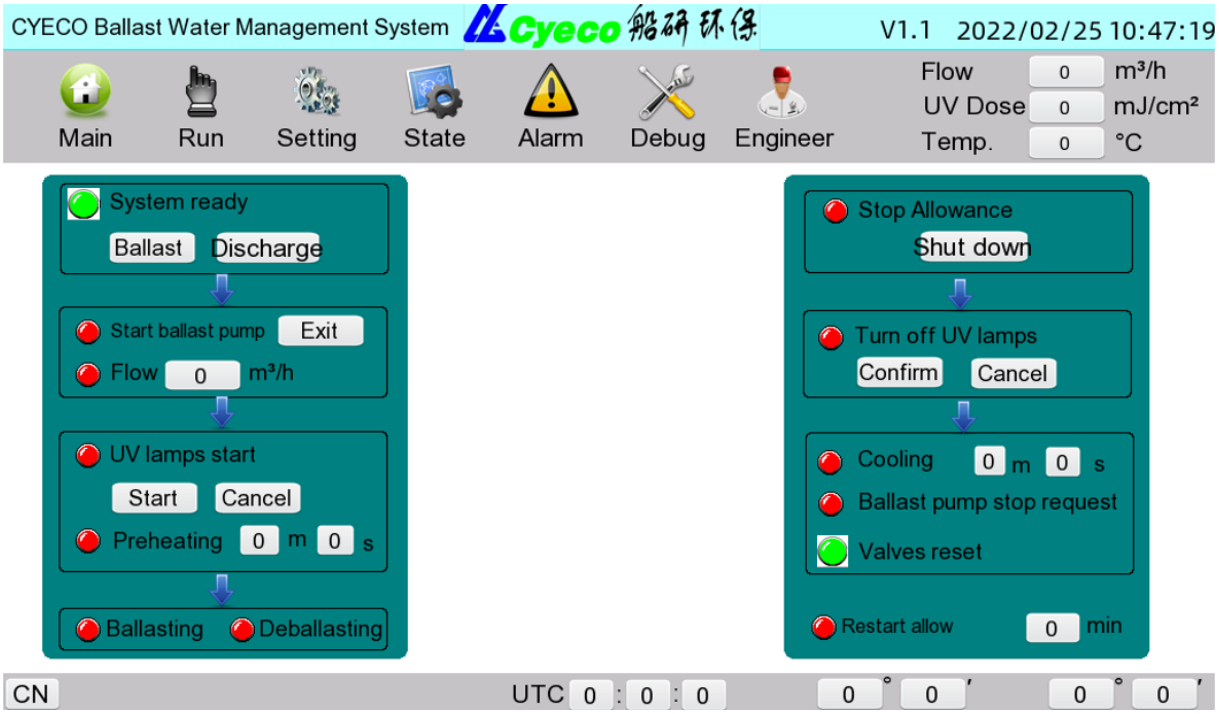


Figure 16: Valve reset, system ready page

9.7 Page function and operation method

- On the main page, you can see the status of each cell.
- Display the instantaneous flow, the total flow for this run, the UV dose, and the cavity temperature.
- The valve is green when it is open and blue when it is closed. The line is green when there is water flow and blue when there is no water flow.
- Click the "Filter operation setting" button to enter the "Filter operation setting" interface, and set some parameters in the filter operation;
- Click the "UV operation setting" button to enter the "UV operation setting" interface to set some parameters in the operation of the UV lamp.

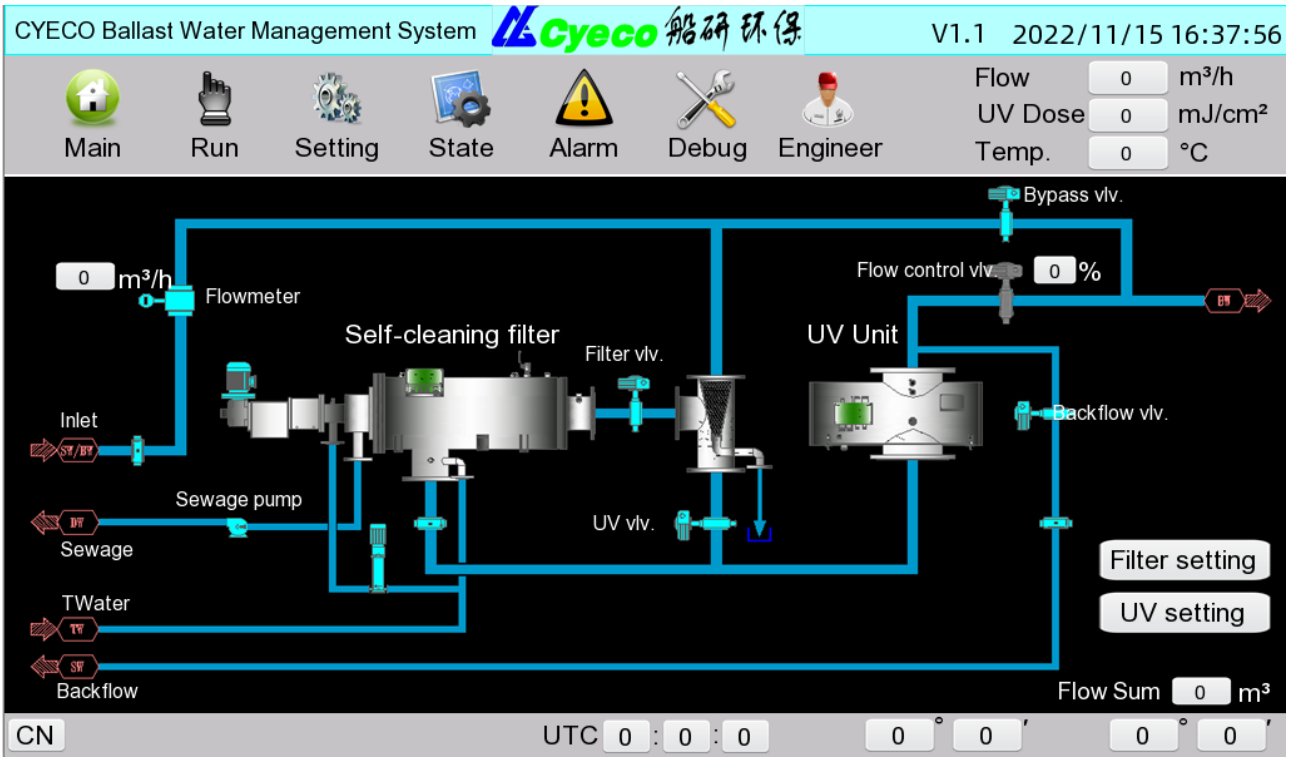


Figure 17: Main page

9.8 Functions and operation methods of the filter page

- Press the Time mode "button and the filter will run in time mode.
- If necessary, if the "Manual mode" "button is pressed, the system will complete a cycle of filter backwashing and return to the original operation mode after the cycle.
- One cycle is that when the user manually presses the control button, the backwashing drive motor only rotates forward or backward once, and after one cleaning is completed, the system will automatically return to the original set operation mode;
- The time mode is to automatically repeat the periodic backwashing according to the time interval set by the user. The default time interval is 10 minutes.

Figure 18: Filter interface

9.9 Function and operation method of UV page

- Press the Dose mode "button and the system will operate in UV intensity mode.
- Press the "Time mode" "button, and the system will operate according to the timing mode.
- If necessary, if the "Manual mode" button is pressed, the system will complete a cycle of lamp cleaning and return to the previous operation mode after the cleaning is completed.
- One cycle is that when the user manually presses the control button, the automatic cleaning device drives the motor to rotate forward and backward only once, and after one cleaning, the system will automatically return to the original set operation mode.
- Intensity mode means that when the actually measured UV irradiation dose value is less than the UV irradiation dose value set by the user, the system will automatically clean the UV lamp tube. The default UV cleaning irradiation dose is 230 mJ/cm2;
- Time mode is to automatically carry out periodic cleaning according to the time interval set by the user. The default time interval is 20 minutes.

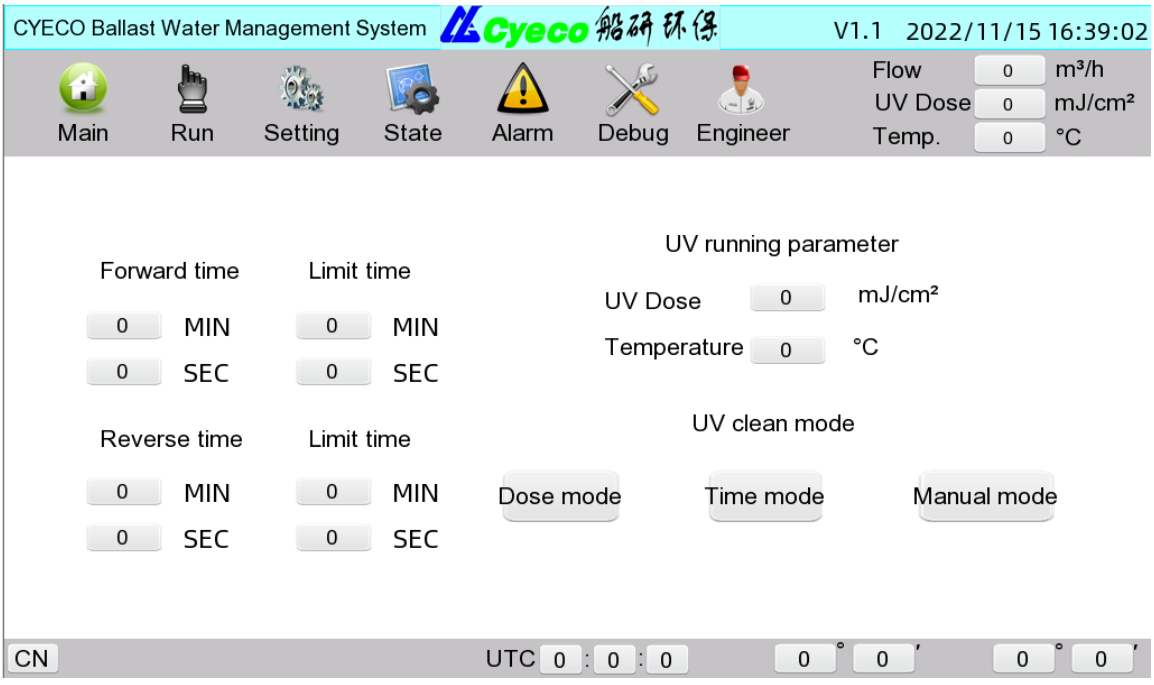


Figure 19: UV interface

9.10 Function and operation method of system status page

- The system status page mainly indicates the operation status of filter unit and UV unit, including the operation mode indication of filter and UV unit, the positive and negative rotation indication of filter freshening motor and UV cleaning motor, and the status indication of UV lamp tube.
- The System Status page also indicates the Backwash Countdown, UV Lamp Warm-up Countdown, and UV Lamp Cooldown Countdown.
- When the indicator light corresponding to each item is green, it indicates that the equipment is in the state of the item. For example, if the indicator light in front of "EB1" in "UV lamps state" is green, it indicates that the "EB1" lamp has been turned on.

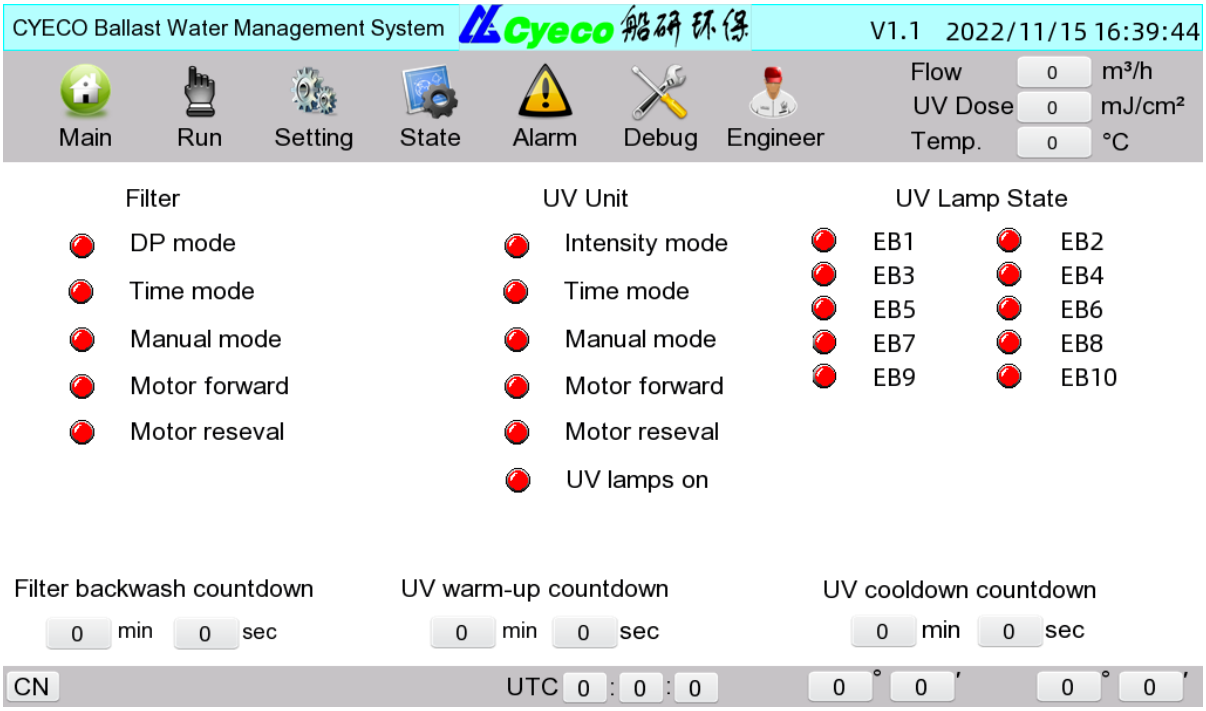


Figure 20: System operation status

The system status page filter unit is detailed as follows:

- DP mode: Automatically control backwashing according to differential pressure
- Time mode: Automatically control the backwashing according to the

accumulated running time

- Manual mode: Manually forced backwashing
- Motor forward: Backwash motor forward rotation
- Motor reversal: Reverse rotation of backwash motor
- The backwash countdown: Filter backwash completion remaining time countdown

The system status page UV units are detailed as follows:

- Intensity mode: Automatic control of backwash according to UV dosage intensity
- Time mode: Automatically control the backwashing according to the accumulated running time
- Manual mode: Manually forced backwashing
- Motor forward: Backwash motor forward rotation
- Motor reveral: Reverse rotation of backwash motor
- UV lamps on: The UV lamp is powered on
- UV lamps preheat countdown: UV lamp preheating is started by 3-minute countdown.
- UV lamps cool countdown: UV lamp cooling is counted down by 3 minutes from the start

The system status page UV lamp status unit is detailed as follows:

- EB1: 1 # lamp tube
- EB2: 2 # lamp tube
- EB3: 3 # lamp tube
- EB4: 4 # lamp tube
- EB5: 5 # lamp tube
- EB6: 6 # lamp tube

- EB7： 7 # lamp tube
- EB8： 8 # lamp tube

And so on.

9.11 Function and operation method of alarm page

- When the "Clear" fault occurs during the operation of the system, the system will give an alarm. Press the "Silence" button to stop the buzzer alarm.
- After the buzzer stops alarming and the fault is eliminated, press the "Reset" button on the alarm page to reset the system.
- If the system is reset without proper troubleshooting for system errors, the system will continue to display non-overridable alarm messages and the system will not function properly. Therefore, proper troubleshooting must be performed when the system fails.
- If "C" appears in the "Status" item in the alarm column, the surface fault is not removed successfully. If the alarm is removed successfully, "CD" is displayed.

Figure 21: Alarm Status Page

9.12 Function and operation method of valve inspection page

- If a single valve is to be opened or closed, the equipment shall be switched to the "inspection mode" (which can be switched in the "parameter setting" interface or in the selector switch of the control cabinet).
- If the "Check Mode" is selected, the user presses the "On" button of the corresponding valve, and the valve will be opened.
- The indicator light behind the ON button is green if the valve is open, the indicator light behind the OFF button is green if the valve is closed, and the no indicator light is green when the valve is not in place.

Figure 22: Valve Inspection Screen

9.13 Function and operation method of engineer page

"Engineer 1" in the engineer mode page is used to modify and display some special parameters, and non-technicians are not allowed to modify the parameters.

When modifying the parameters, just click the place to be modified, and the input board will pop up. You can modify the relevant parameters as required, as shown in the following figure:

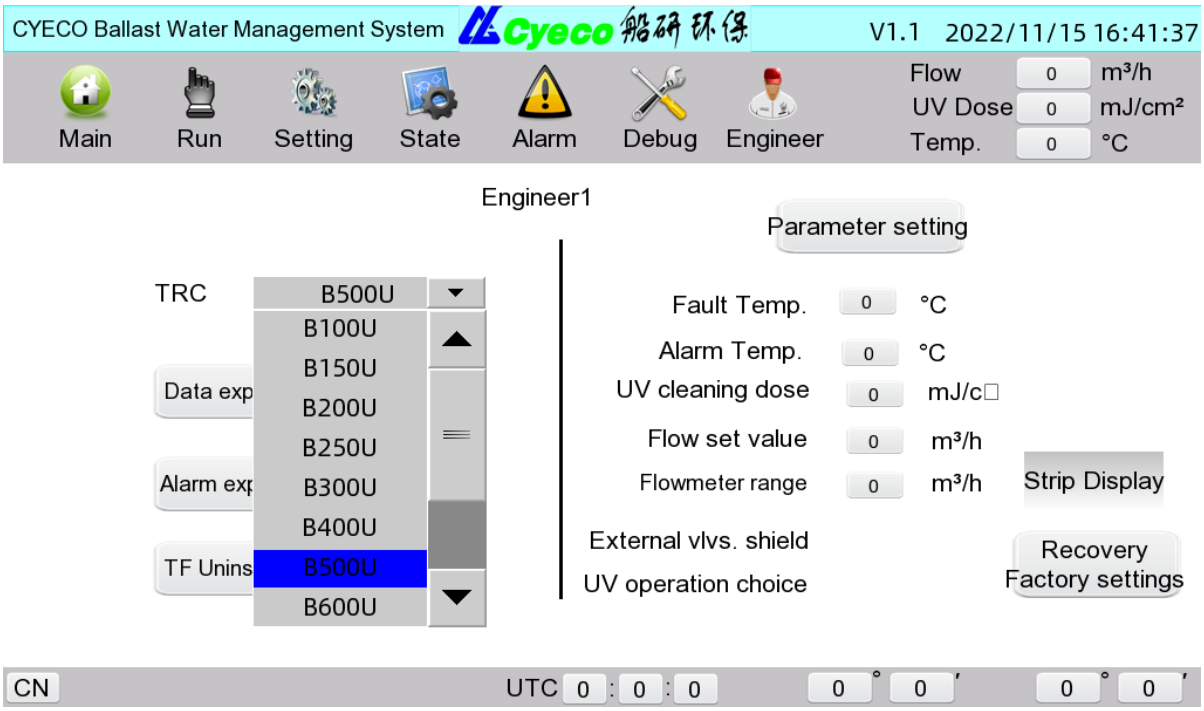


Figure 23: Parameter Setting Screen for Engineer 1

9.14 Data recording and query

The touch screen is equipped with a memory card, which can save 24 months of "Data query" data records.

Remove the memory card from the back of the touch screen, insert it into the computer, find the folder named "database", and open it to view the alarm and operation data.

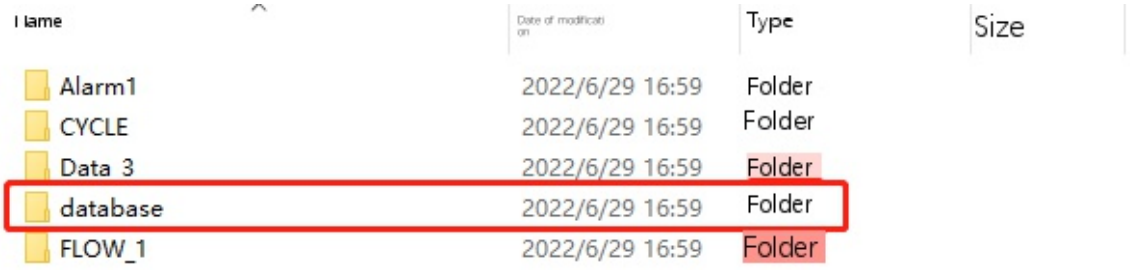


Figure 24: Data storage operation

Instructions for disassembly, assembly and cleaning of filter element of self-cleaning filter

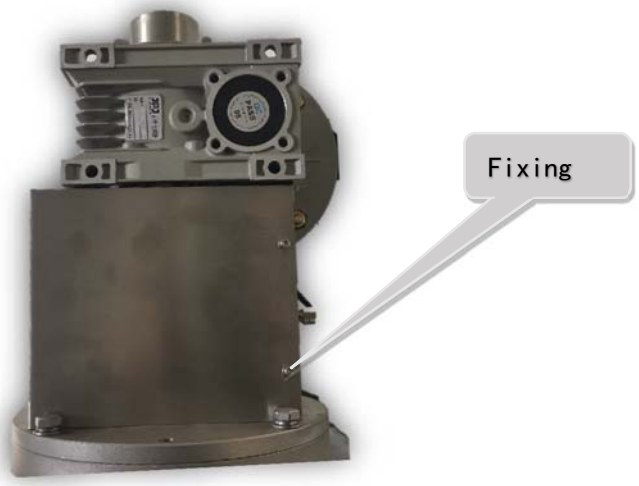
To ensure the operation and maintenance of Cyeco™BWMS system and unit equipment, sufficient operation and maintenance space must be reserved around the equipment and unit. See the relevant drawings provided by the equipment manufacturer for specific requirements. Pay special attention to the maintenance space of the self-cleaning filter screen and the cleaning area, as well as the lifting space on the upper part of the equipment.

Precautions before disassembly!

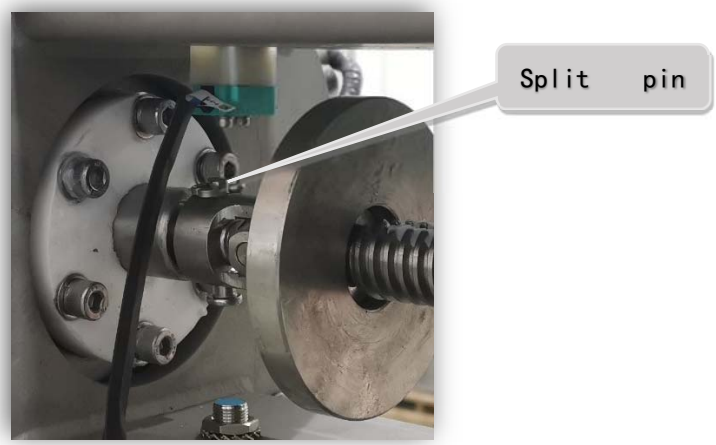
- Before opening the filter, it is recommended to press the "Manual Backwash" button to start backwashing. Disassemble after backwashing!
- Close the inlet and outlet valves of the filter and release the pressure before disassembly!
- Drain the water in the filter cavity!
- Make sure that the equipment is powered off and shut down before disassembly!

Disassembly of strainer:

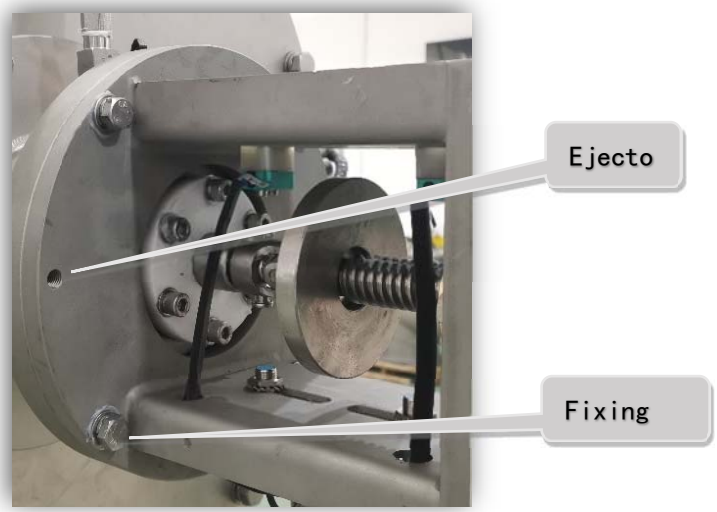
1. Remove the fixing bolts of the housing.



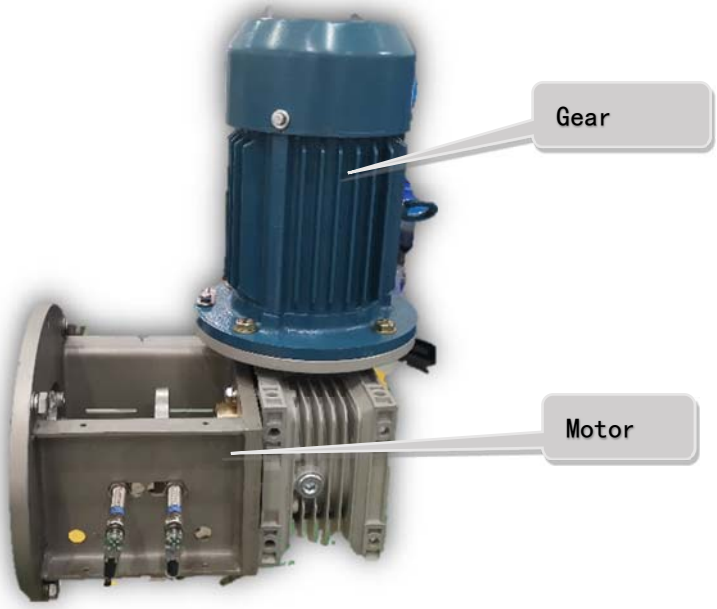
2. Remove the split pin and shaft pin of universal coupling



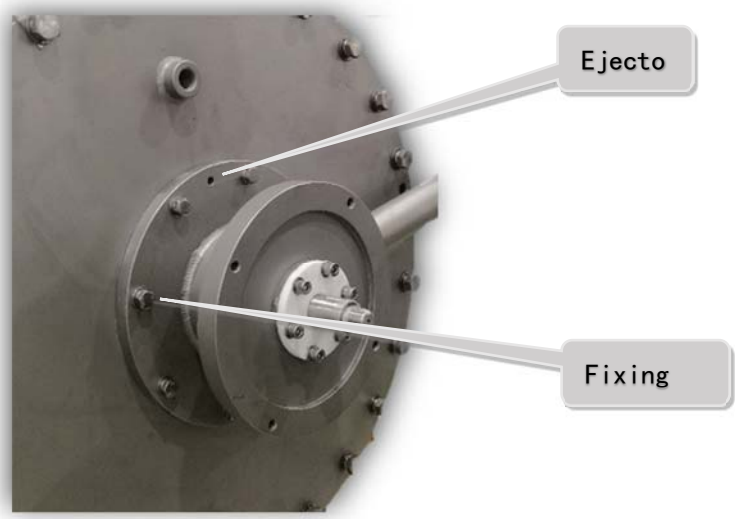
3. Remove the fixing bolts of the motor frame and push out the motor frame with the removed fastening bolts.



4. Remove the motor frame together with the gear motor and drive assembly

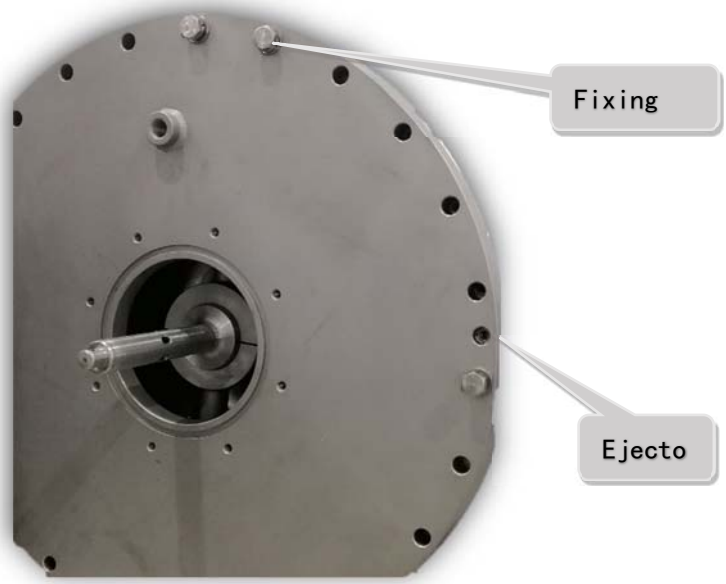


5. Remove the fixing bolts of the high-pressure water inlet chamber, and push out the high-pressure water inlet chamber with the removed fastening bolts.

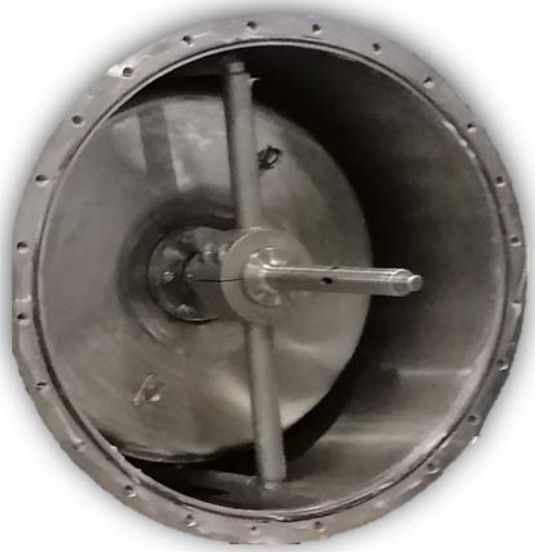


6. Remove the high-pressure water inlet chamber

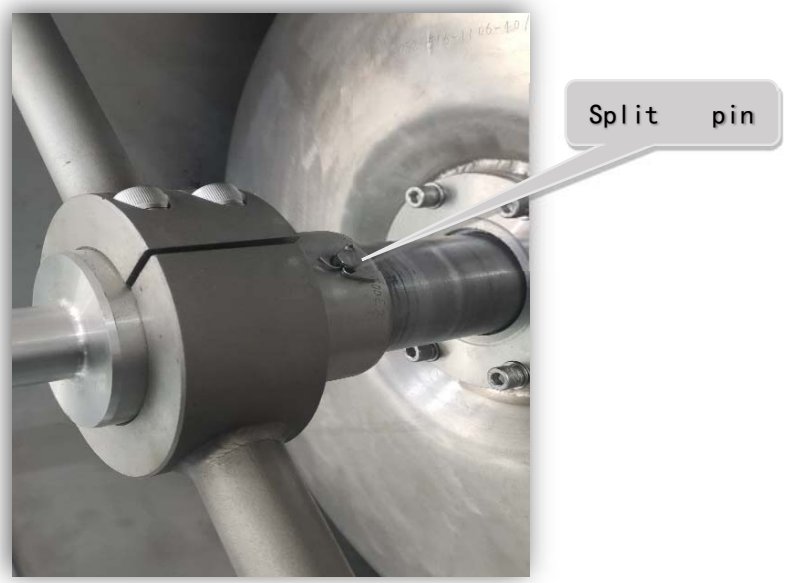
7. Remove the fixing bolts of the drive end cover, and push out the drive end cover with the bolts.



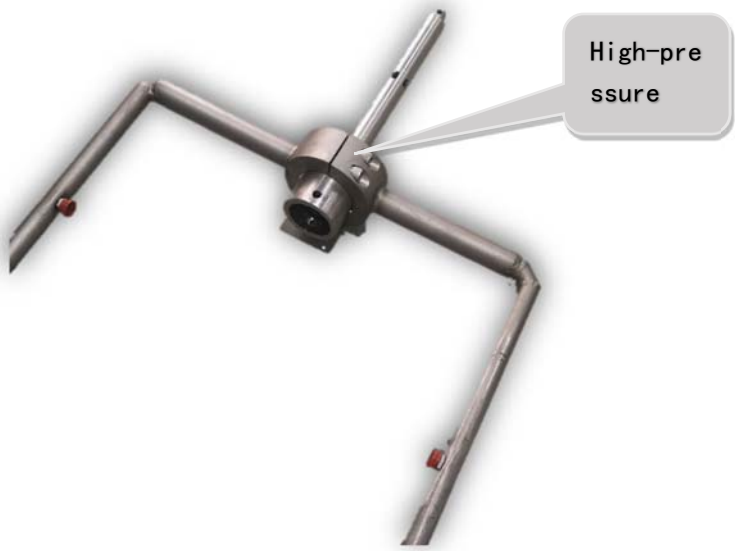
8. Remove the drive end cap



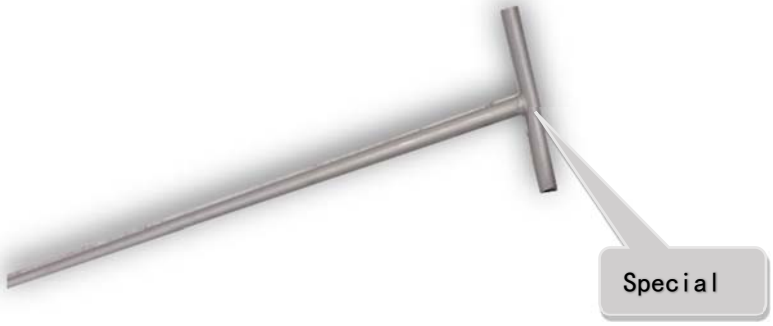
9. Remove the split pin and pin shaft of the high-pressure backwashing nozzle assembly



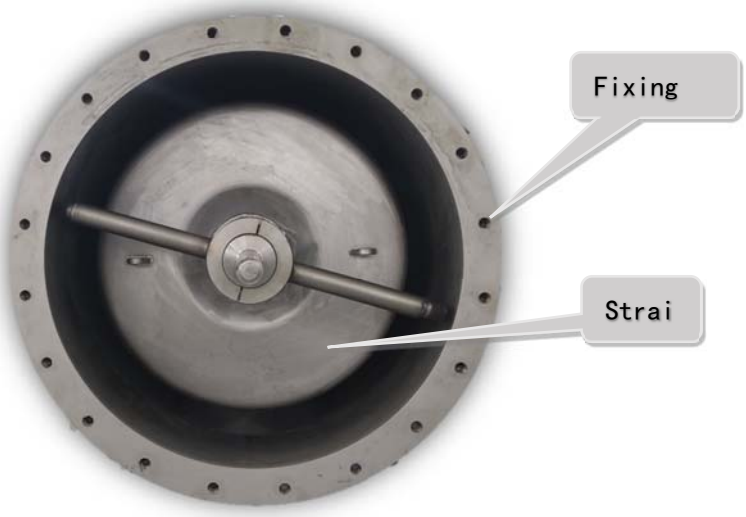
10. Remove the high pressure backwash nozzle assembly
    Note: There are left and right high pressure backwashing nozzles, which should be marked during disassembly to avoid wrong position during reinstallation.
    Installation in the wrong position will result in failure of backwashing.



11. Take out the special wrench for filter screen (provided with the machine)

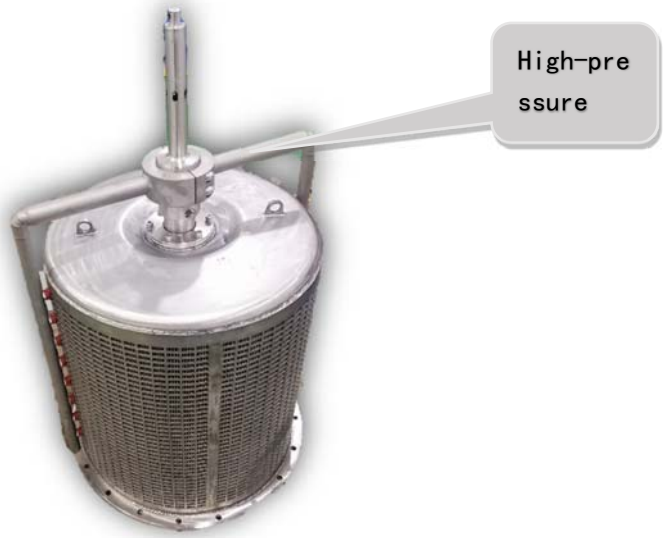


12. Remove the fastening bolts of the filter screen.



13. Carefully remove the screen assembly

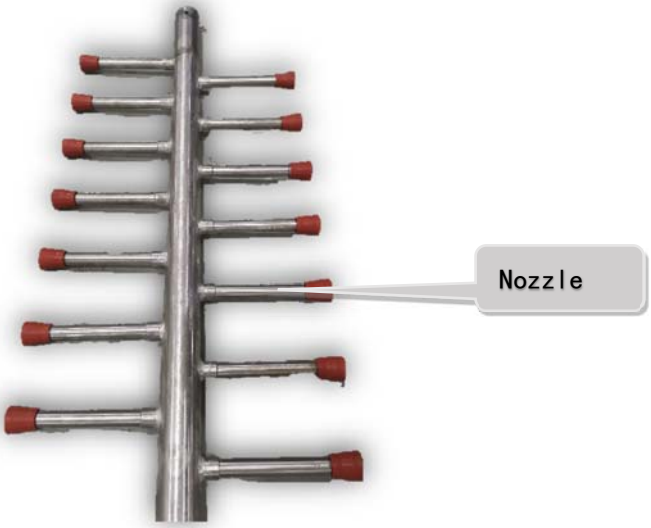
14. If the removal space is sufficient, the high pressure backwash nozzle assembly can be removed integrally with the screen assembly, and the high pressure backwash nozzle assembly can be removed externally



15. Remove the screen flange screw

16. Remove the screen flange

17. Remove the spray bar assembly



18. Remove the strainer

Cleaning of filter screen:

Use hot water (50-60 ℃), add oxalic acid or NaOH to prepare 0.5% -3% cleaning solution, and soak the filter element in the cleaning solution for 60-120 minutes. Then wash the inside and outside of the filter element carefully with clean water (fresh water) for 15 to 20 minutes with a high-pressure water gun.

Assembly of filter screen:

- The process of assembly is just the opposite of disassembly;
- In order to ensure the intact service performance, all the seals involved in the reassembly shall be replaced with new ones.

Instructions for Disassembly and Installation of Ultraviolet Disinfection Device

To ensure the operation and maintenance of Cyeco™BWMS system and unit equipment, sufficient operation and maintenance space must be reserved around the equipment and unit. See the relevant drawings provided by the equipment manufacturer for specific requirements. Pay special attention to the maintenance space of the lamp tube of the ultraviolet disinfection device.

Disassembly and assembly of the ultraviolet disinfection device are divided into four parts:

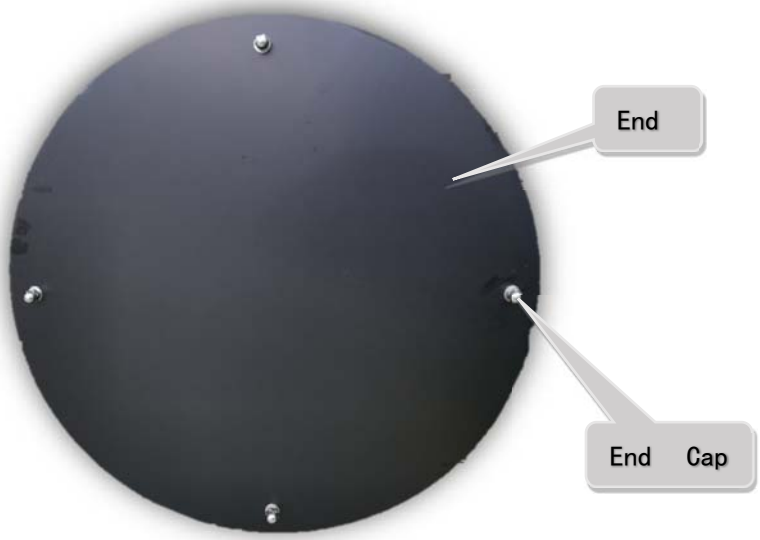
1. Removal and installation of UV lamp tube;
2. Removal and installation of quartz sleeve;
3. Removal and installation of UV cleaning device;
4. Maintenance of UV intensity probe;

Precautions before disassembly!

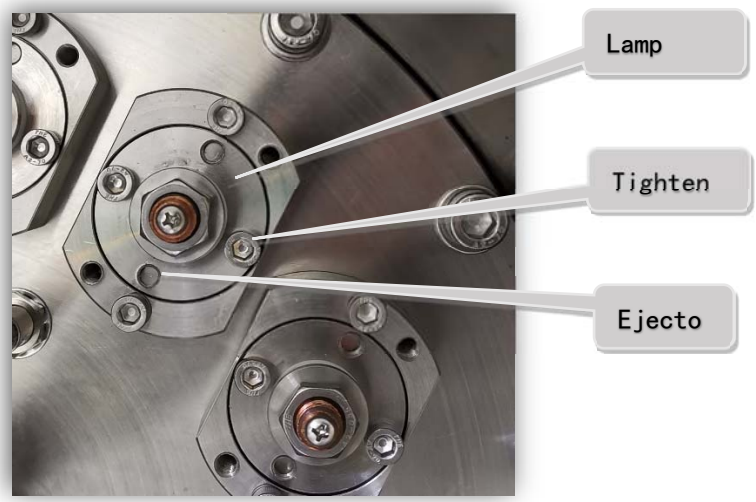
- Before repairing and maintaining the UV chamber, be sure to keep the UV device powered off!
- Before repairing and maintaining the UV chamber, be sure to drain the water in the chamber!
- Always wear cotton gloves when touching the UV tube and quartz sleeve!
- Do not scratch the quartz sleeve, otherwise the surface of the quartz sleeve will be permanently damaged!

Removal and installation of UV lamp tube:

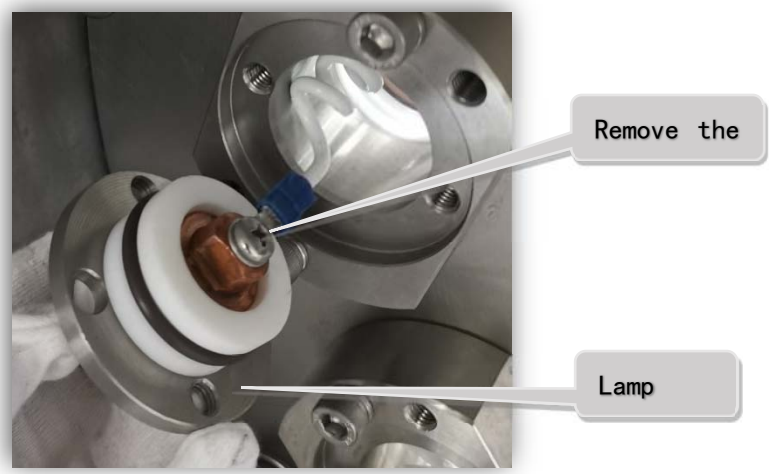
1. Remove the nuts and end covers at both ends.



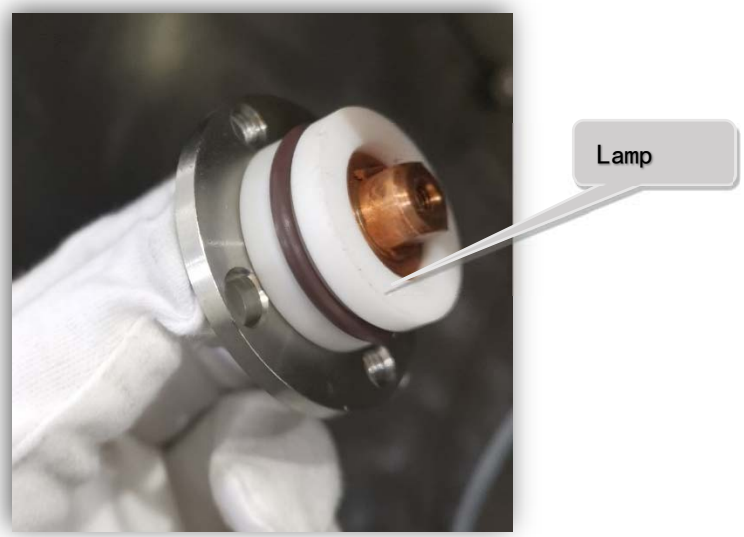
2. Remove the fastening bolt of the lamp holder assembly, and push out the lamp holder assembly with the removed fastening bolt



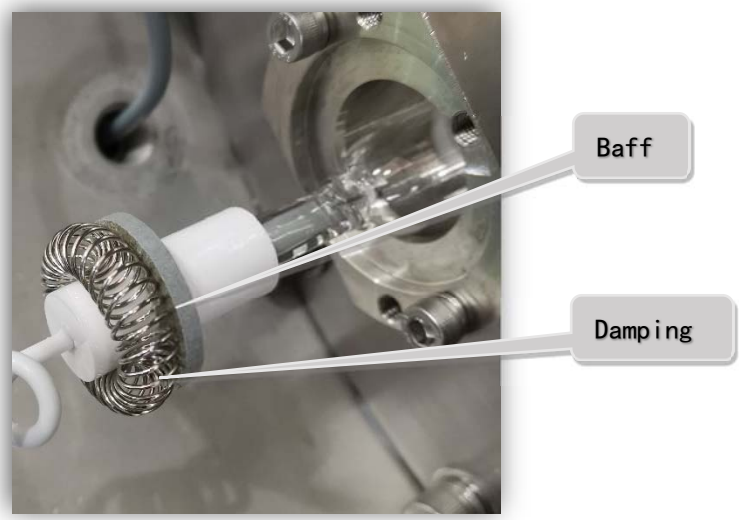
3. Take out the lamp holder assembly at both ends, and remove the cable connecting the lamp tube and the lamp holder assembly



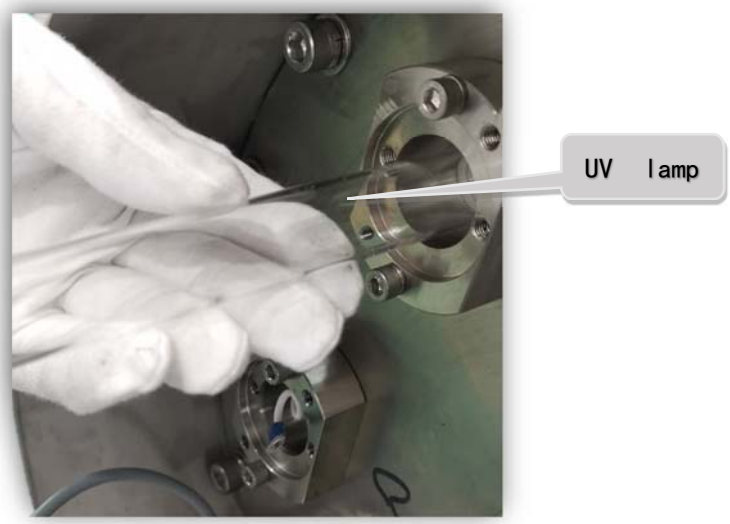
4. Take out the lamp holder assembly



5. Push out the lamp tube, and take out the damping springs and baffles at both ends of the UV lamp tube



6. Take out the UV lamp tube

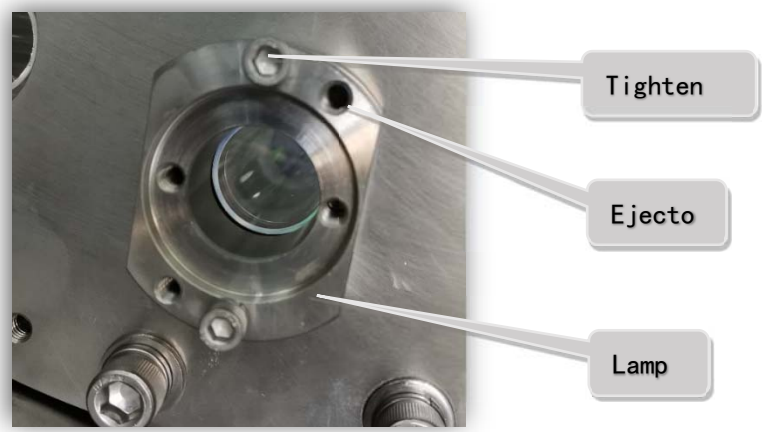


7. Replace the lamp with a new one in the reverse order of taking out the lamp and install it completely.

Removal and installation of quartz sleeve:

1. Remove the UV tube (see Removal and installation of UV tube)

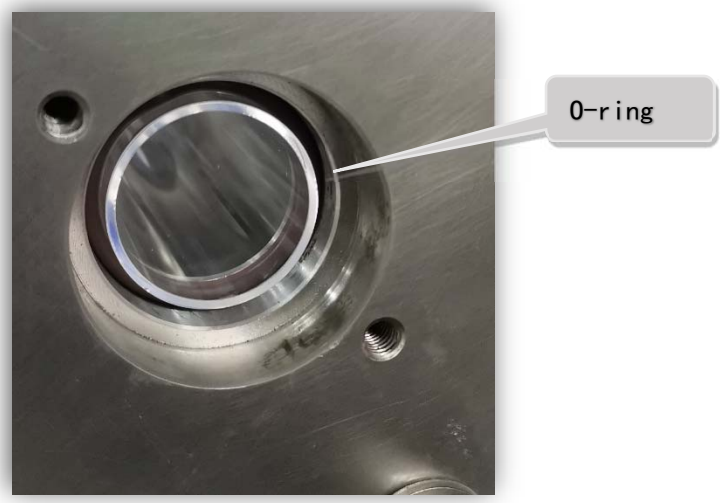
2. Remove the fastening bolt of the lamp holder, and push out the lamp holder with the removed fastening bolt



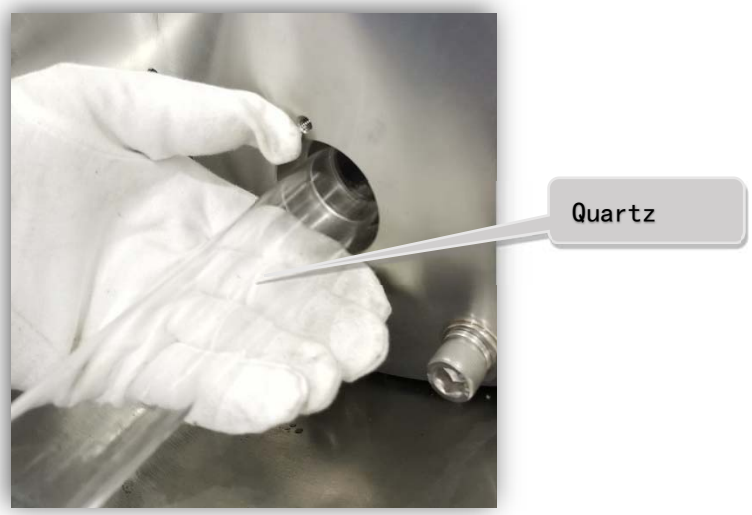
3. Remove the lamp holders at both end

4. Take out the lamp tube collar at both ends.

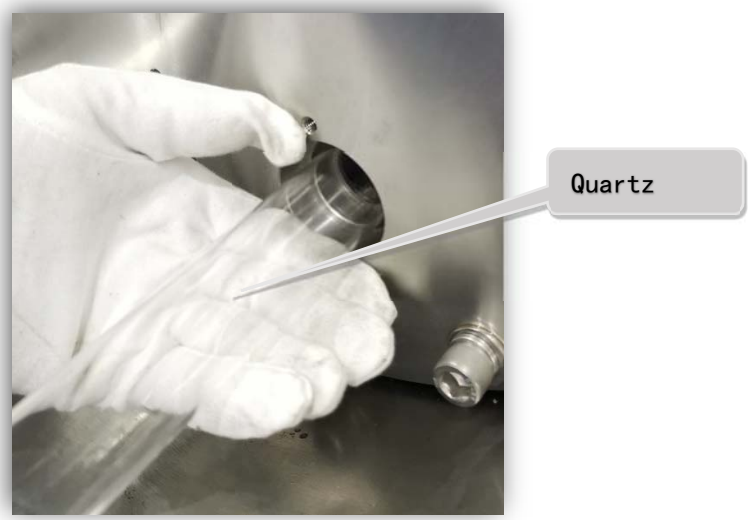
5. Remove the O-rings at both ends and discard the O-rings. If difficult to remove, lubricate with water.



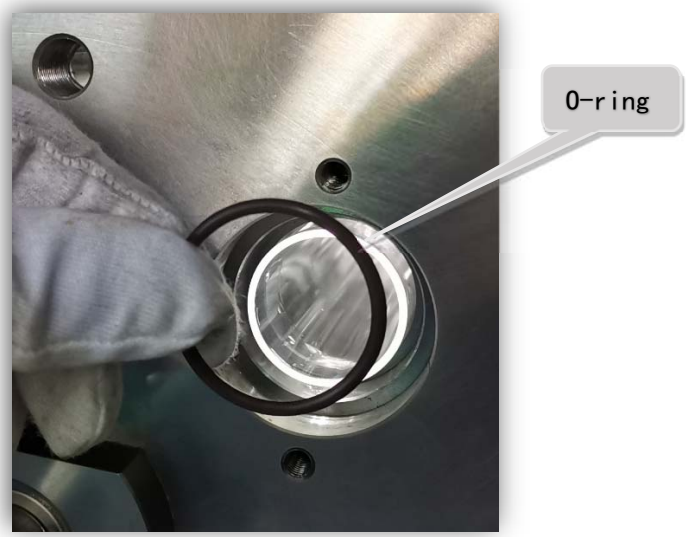
6. Take out the quartz sleeve very carefully. Make sure that the quartz sleeve at the other end is not dropped or damaged in the cavity. It is recommended that two people work together when removing the quartz sleeve.



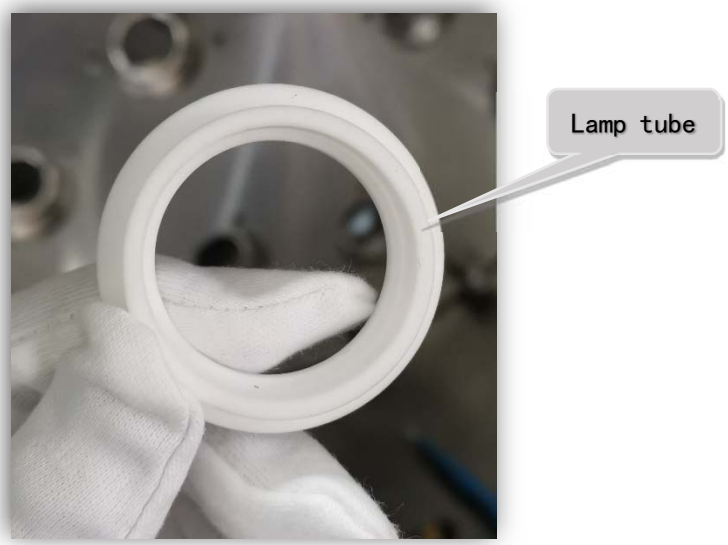
7. Moisten the surface of the new sleeve with water and carefully install the new sleeve into the cavity. When pushing in, make sure that the sleeve is kept horizontal and accurately aligned with the cleaning ring hole of the cleaning plate, so that the wiper blade baffle of the probe is aligned with the position of the probe.



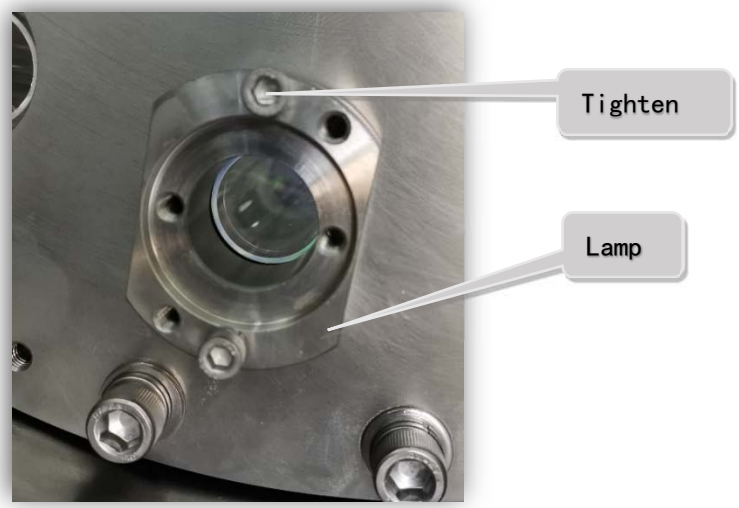
8. Install new O-rings on both ends of the sleeve



9. Reinstall the tube collar at both ends of the sleeve



10. Reinstall the lamp holder at both ends of the sleeve and fasten it.



11. Add water to the reaction chamber for pressure test to check whether there is penetration. In case of leakage, the lamp holder shall be removed and the O-ring and sleeve surface shall be reinspected for damage. Until the pressure test is passed.

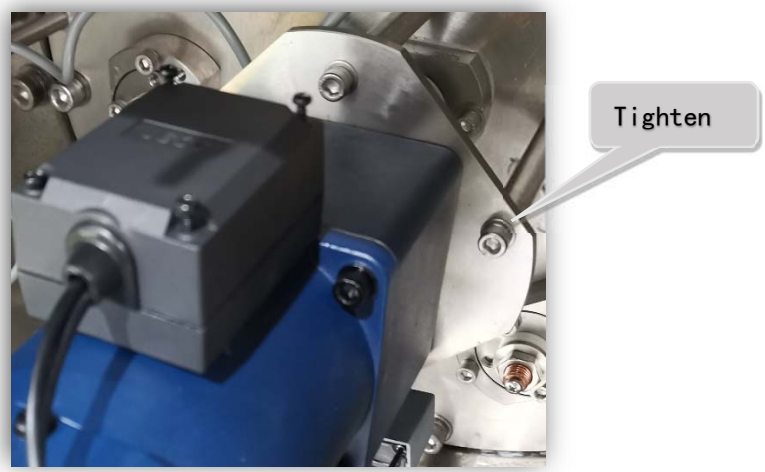
12. Reinstall the UV tube (see UV Tube Removal and Installation)

Removal and installation of UV cleaning device:

1. Remove the wiring in the motor junction box

2. Loosen the coupling screws

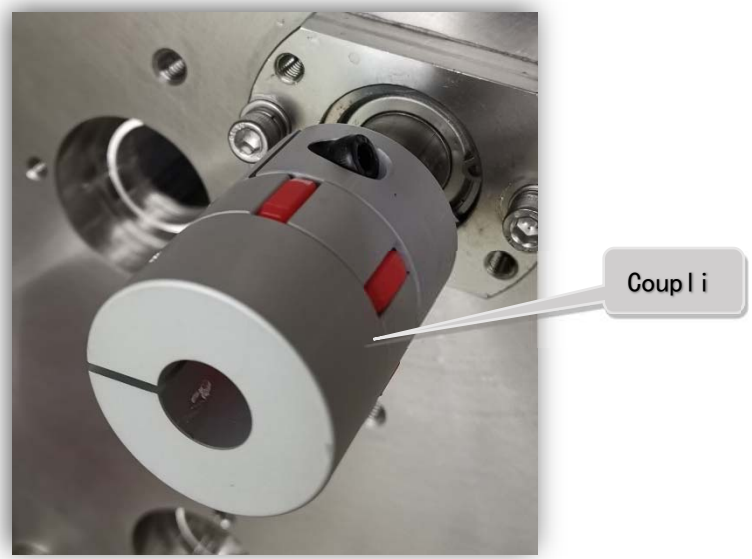
3. Remove the fastening bolts of the motor mounting plate



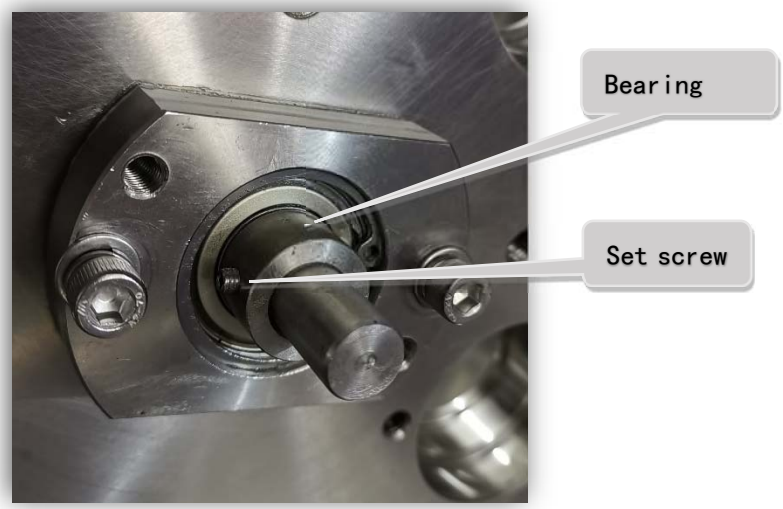
4. Remove the motor

5. Remove all lamps and quartz sleeves (see Removal and Installation of UV Lamps, Removal and Installation of Quartz Sleeves)

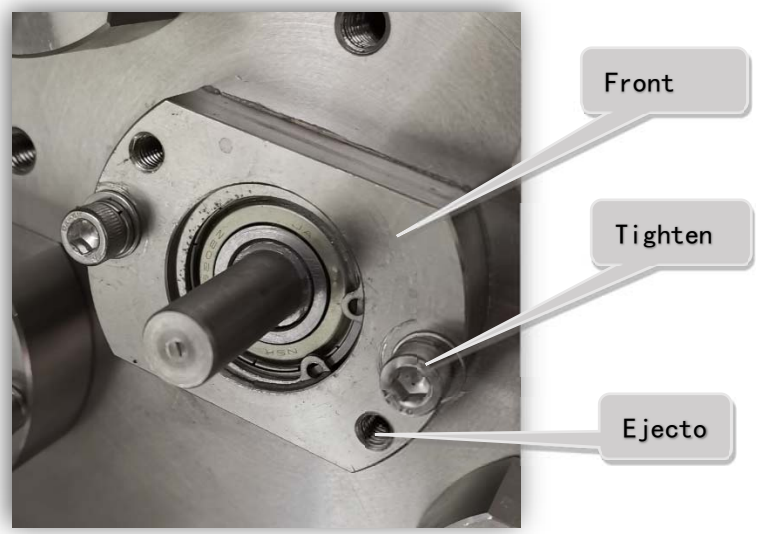
6. Remove the coupling



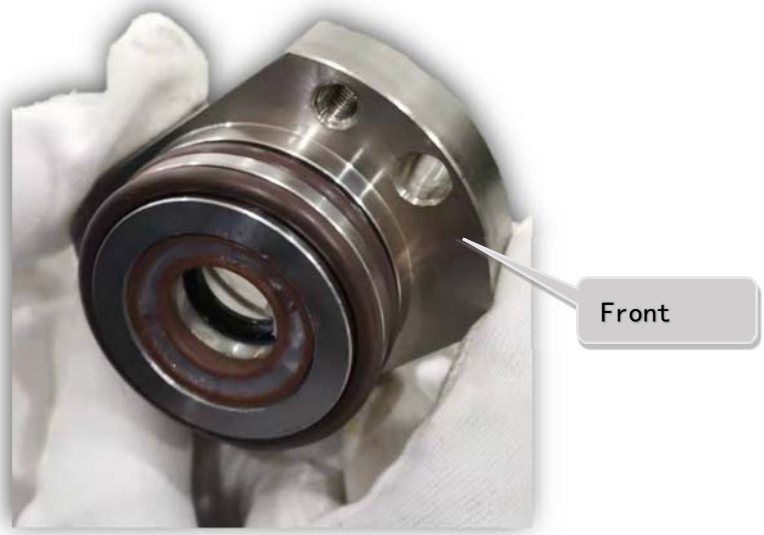
7. Loosen the set screw and remove the bearing locating sleeve



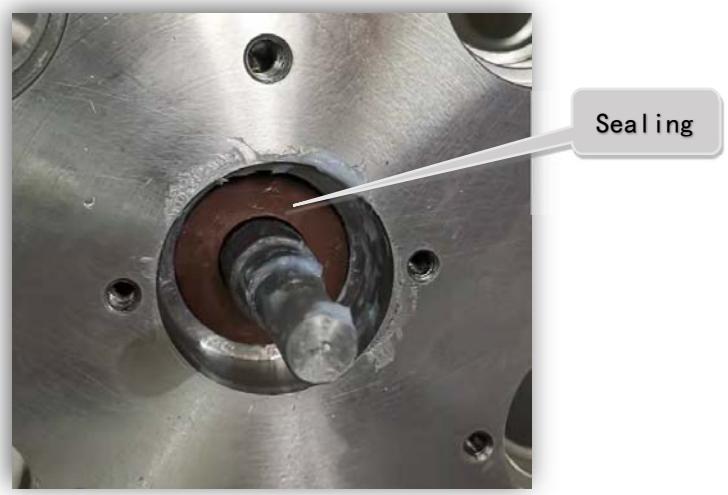
8. Remove the fastening bolts of the front bearing seat, and push out the front bearing seat with the removed fastening bolts.



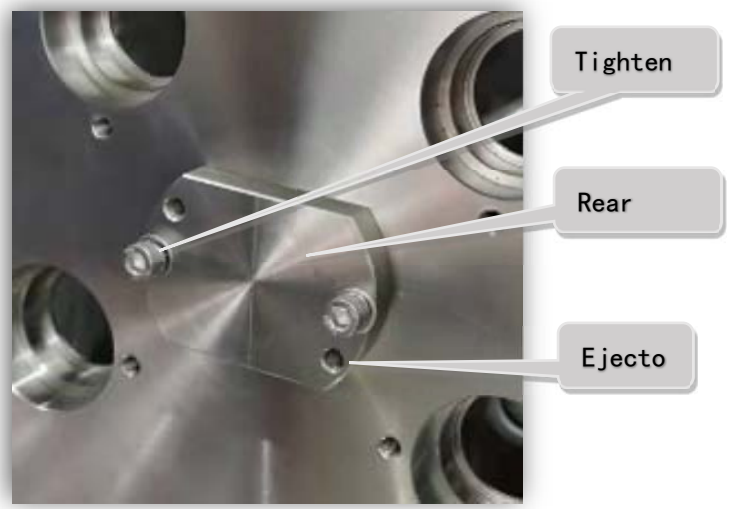
9. Remove the front bearing seat and the bearing and seal ring installed with it.



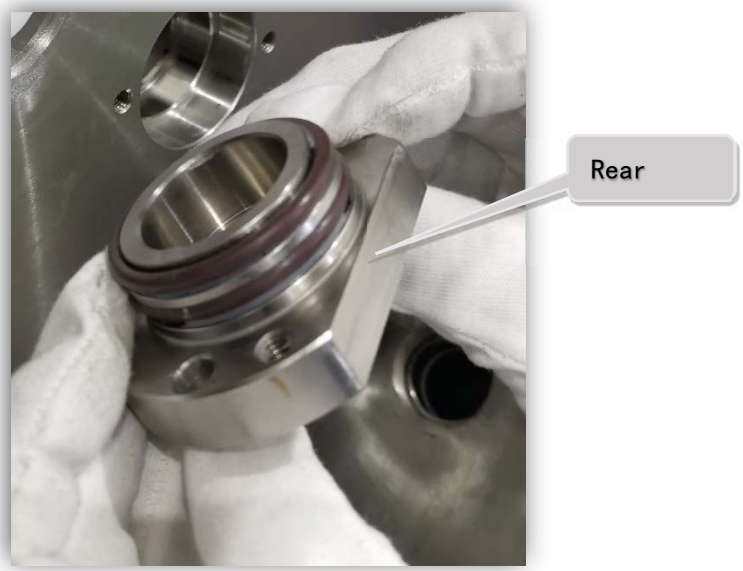
10. Remove the sealing ring



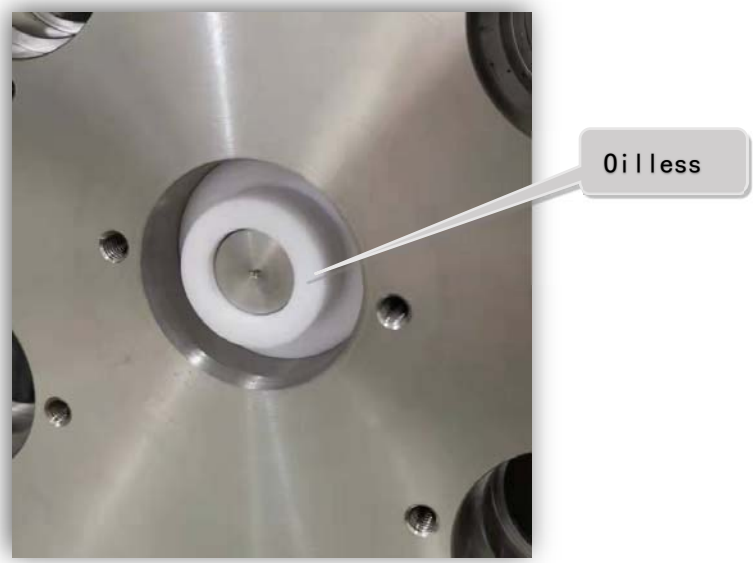
11. Remove the fastening bolt of the rear bearing pedestal, and push out the rear bearing pedestal with the removed fastening bolt



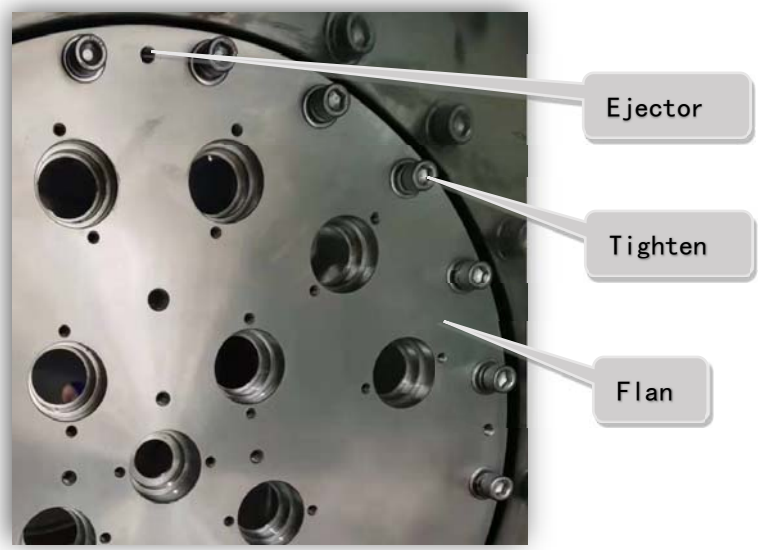
12. Remove the rear bearing housing and the sealing ring fitted to it



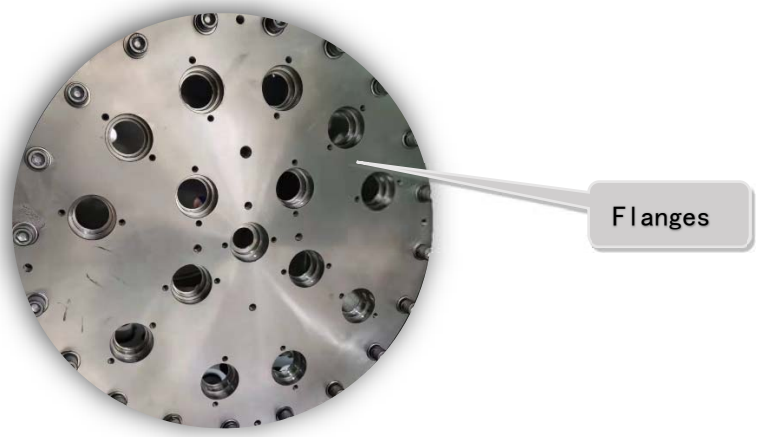
13. Remove the oilless bearing



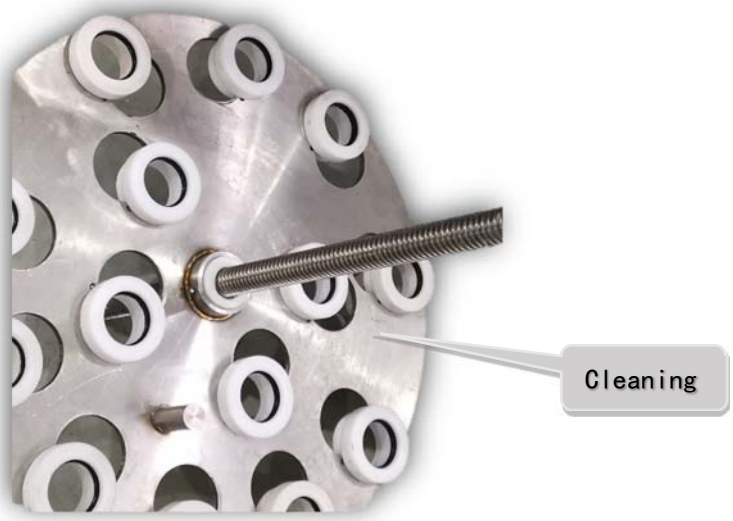
14. Remove the fastening bolts of flanges at both ends, and push out the flanges with the removed fastening bolts.



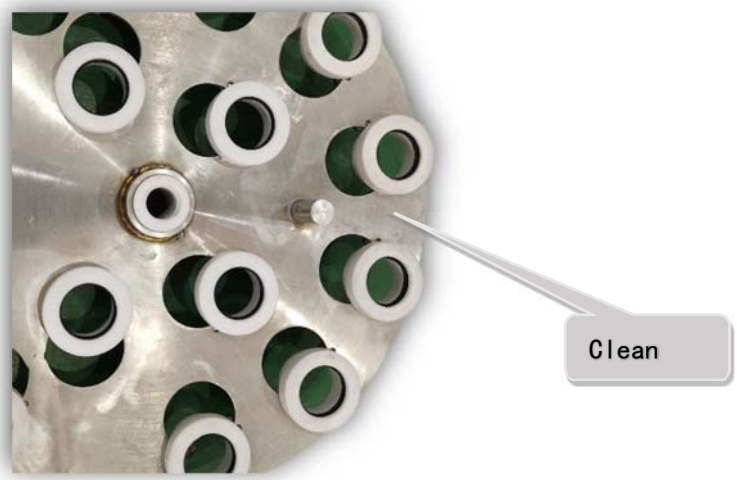
15. Remove both end flanges



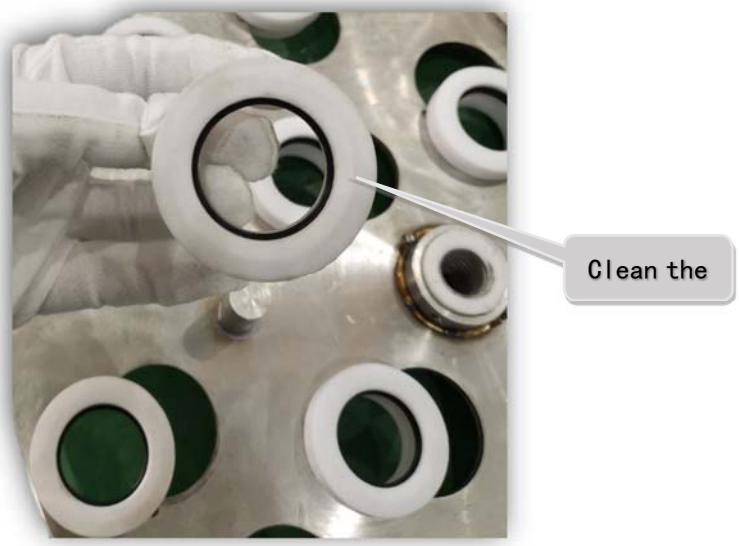
16. Take out the cleaning device from the cavity



17. Remove the wash plate



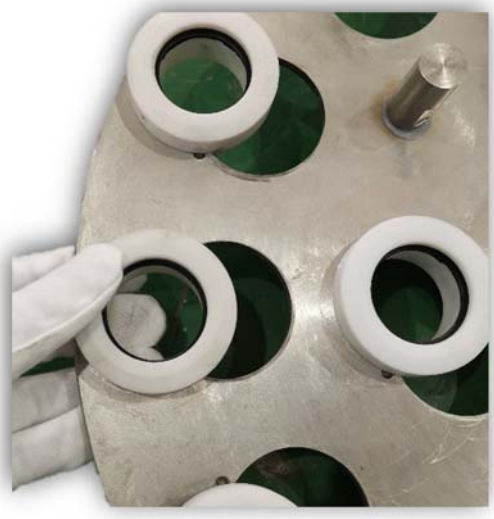
18. Take out and clean the ring seat



19. Remove the purge ring

20. Install a new purge ring

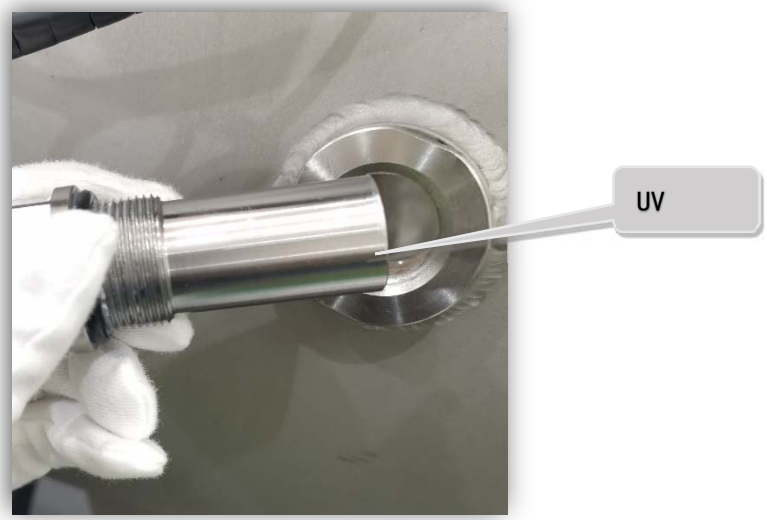
21. Reinstall in the reverse order, and replace the damaged seal during reinstallation.



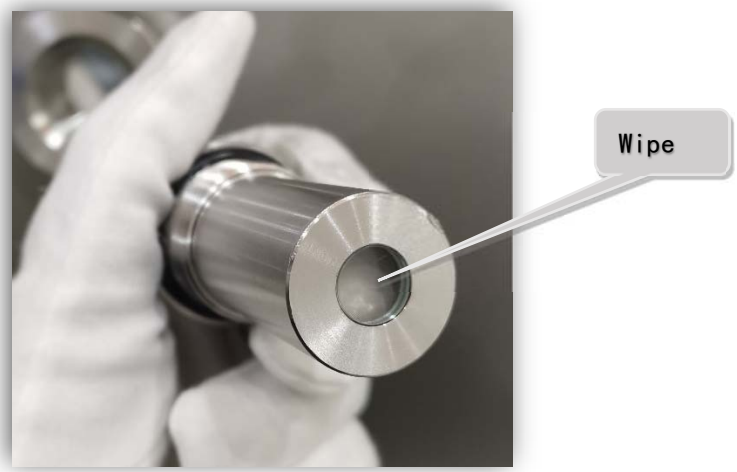
Removal and installation of UV intensity probe:

1. Loosen the probe coupling nut and disconnect the cables

2. Loosen and remove the probe from the probe holder with a suitable wrench



3. Wipe the probe surface with alcohol



4. After wiping, reinstall in reverse order

BWMS Equipment Troubleshooting Manual

1 Warning and Fault Queries

In case of fault alarm, the control cabinet will give an audible and visual alarm.

Press the 

button to see the alarm page. The latest warning message will appear at the top of the screen.

Fault alarm and corresponding fault query and measures are detailed in the following table.

Table1 High pressure backwash filter alarm, A = alarm, T = tripped (closed)

Serial number	Show	Level	Reason	Measures
1	Filter differential pressure for too long	A	The differential pressure between the inlet and outlet exceeded a predetermined value for more than 20 minutes despite the backwash operation	Check and repair the motor and cleaning system
2	Differential pressure switch alarm	A	Inlet and outlet differential pressure exceeds the set value	Check and repair the motor and cleaning system
3	-Filter motor failure -Filter motor overload	T	The forward rotation and reverse rotation of the motor are not stopped in time	Check and repair the motor and cleaning system -Check the limit switches and cables for damage -Manually move the motor to the nearest limit switch and reset the system -Check the cable for damage -Check that the motor cables are connected correctly -Check that the limit switches are correctly wired

Table2 UV sterilization unit alarm, A = alarm, T = trip (closed), A/T = alarm default/possible trip

Serial number	Show	Level	Reason	Measures
1	Power cabinet power failure	T	Faulty electronic ballast or related connection	Check the following and reset manually: -Check electronic ballast equipment -Check the electronic ballast connection
2	-Power cabinet temperature is too high -Power cabinet temperature is too high for too long	T	Temperature in power cabinet exceeds 55 ℃	-Check whether the cooling system of the electronic ballast is allowed to work normally. -Check that the exhaust fan is running -Check whether the exhaust fan filter is blocked.
3	Lamp failure	T	UV lamp does not light up	-Check and replace the UV lamp -Check the UV tube wiring
4	UV lamp tube not fully open	A	The UV tube cannot be fully lit	-Check and replace the UV lamp -Check the UV tube wiring -Check the ballast fault code
5	UV dose is low for too long	A/T	UV irradiation dose is lower than the set lower limit	-Check the cumulative use time of the lamp and replace it if necessary. -Wash the quartz sleeve with alcohol and wipe dry. -Clean the UV intensity sensor with alcohol and wipe dry -Check if the lamp cleaning device is working properly
6	UV irradiation	A	UV irradiation dose	-Check whether the current

Serial number	Show	Level	Reason	Measures
	dose is too high		is higher than the upper limit of the set value	output regulation function of the ballast is normal. -Calibrate UV intensity sensor
7	High temperature switch alarm	T	Medium temperature in UV cavity exceeds preset value	-Check that the input is within 4-20 mA -Check whether the water inflow is normal.
8	Cavity temperature too high	T	Medium temperature in UV cavity exceeds preset value	-Check that the input is within 4-20 mA -Check whether the water inflow is normal.
9	System failure due to too high UV chamber temperature	T	Medium temperature in UV cavity exceeds preset value	-Check that the input is within 4-20 mA -Check whether the water inflow is normal.
10	-UV motor failure -UV motor overload	T	The forward rotation and reverse rotation of the motor are not stopped in time	-Check and repair the motor and cleaning system -Check the limit switches and cables for damage -Manually move the motor to the nearest limit switch and reset the system -Check the motor cable for damage -Check that the motor cables are connected correctly -Check that the limit switches are correctly wired

Table3 Other alarms, A = alarm, T = trip (closed)

Serial number	Show	Level	Reason	Measures
1	Power supply phase sequence error	T	The power supply is wired incorrectly	Check the wiring
2	Emergency stop button pressed	T	Emergency stop button pressed by the user	Manual reset of emergency stop button
3	System initialization failed	T	The feedback signal of each unit of the system does not meet the startup conditions	-Check whether each valve is in place -Is there an alarm?
4	The flow does not reach the required value, resulting in system failure.	A	Inlet water flow is lower than the set value	-Inspection and maintenance of pumps and valves -Check whether the display of flowmeter is normal. -Check that there is no open circuit in the input circuit
5	-Filter inlet valve failure -Filter inlet valve overload	T	Valve failure	-Inspection and maintenance of valves -Check valve wiring
6	-UV inlet valve failure -UV Inlet Valve Overload	T	Valve failure	-Inspection and maintenance of valves -Check valve wiring
7	-Bypass valve failure -The bypass valve is overloaded -Bypass valve is not closed	T	Valve failure	-Inspection and maintenance of valves -Check valve wiring
8	-Failure of the return valve -The return valve is overloaded	T	Valve failure	-Inspection and maintenance of valves -Check valve wiring
9	-Overload of flow	T	Valve failure	-Inspection and maintenance

Serial number	Show	Level	Reason	Measures
	control valve -Flow control valve alarm			of valves -Check valve wiring
10	High pressure pump motor overload	T	High pressure pump failure	Check and repair the high-pressure pump
11	Motor of sewage pump is overloaded	T	Sewage pump failure	Check and maintain the sewage pump
12	Circuit breaker tripped	T	Excessive current in circuit	Check the cause of excessive current, repair and reset manually

2 Equipment troubleshooting

2.1 Troubleshooting of High Pressure Backwash Self-cleaning Filter

- If the filter is not working properly, check the relay contacts that are connected to the external relay.
- Make sure that the time interval between cleaning is more than 2 minutes to prevent motor overload. If the motor is shut down due to overheating, allow it to cool before use.
- Continuous or frequent blowdown of the filter:

Serial number	Possible causes	Exclusion method
1	The set value of differential pressure is too small	Properly increase the set value of backwashing differential pressure
2	Raw water quality is too bad	Shorten the backwash interval
3	The fine screen is clogged	Filter screen off-line cleaning
4	Water seal of drainage chamber is damaged.	Replace the water seal
5	The coarse screen is clogged	Remove and clean the coarse screen
6	The high-pressure nozzle is clogged	Remove and clean the high pressure nozzle
7	Proximity switch failure	Replace the proximity switch
8	Improper setting of proximity switch position	Adjust the proximity switch position
9	Trip of transmission slider	Reset processing

- The filter does not discharge sewage for a long time:

Serial number	Possible causes	Exclusion method
1	The set value of differential pressure is too high	Properly reduce the set value of backwashing differential pressure
2	Control system failure	Check the components of the control system and eliminate them
3	Proximity switch failure	Replace the proximity switch
4	Improper setting of proximity switch position	Adjust the proximity switch position
5	Trip of transmission slider	Reset processing

2.2 Troubleshooting of UV Sterilization Device

Troubleshooting the temperature sensor:

- The temperature of the liquid is constantly measured by the control system to avoid overheating of the UV lamp;
- If it is suspected that the temperature sensor (PT100) is deviated, it can be verified whether it works normally by measuring the control current value on the printed circuit board;
- The medium temperature inside the UV chamber was measured using an external thermometer. Check whether the measured current is consistent with the value in the table. This value may vary by up to 0.15 milliamperes.

The UV tube is not turned on:

- Check whether the lamp is damaged;
- Check whether the corresponding ballast is faulty
- Check for ground leakage or wiring damage
- If the system is set to automatic remote control, check whether the external signal is activated.

BWMS- System Spare Parts Manual

BWMS 备品备件手册

Cyeco™ Ballast Water Treatment System

压载水处理系统

Shanghai Electric Cyeco Environmental Technology Co., Ltd

上海电气船研环保技术有限公司

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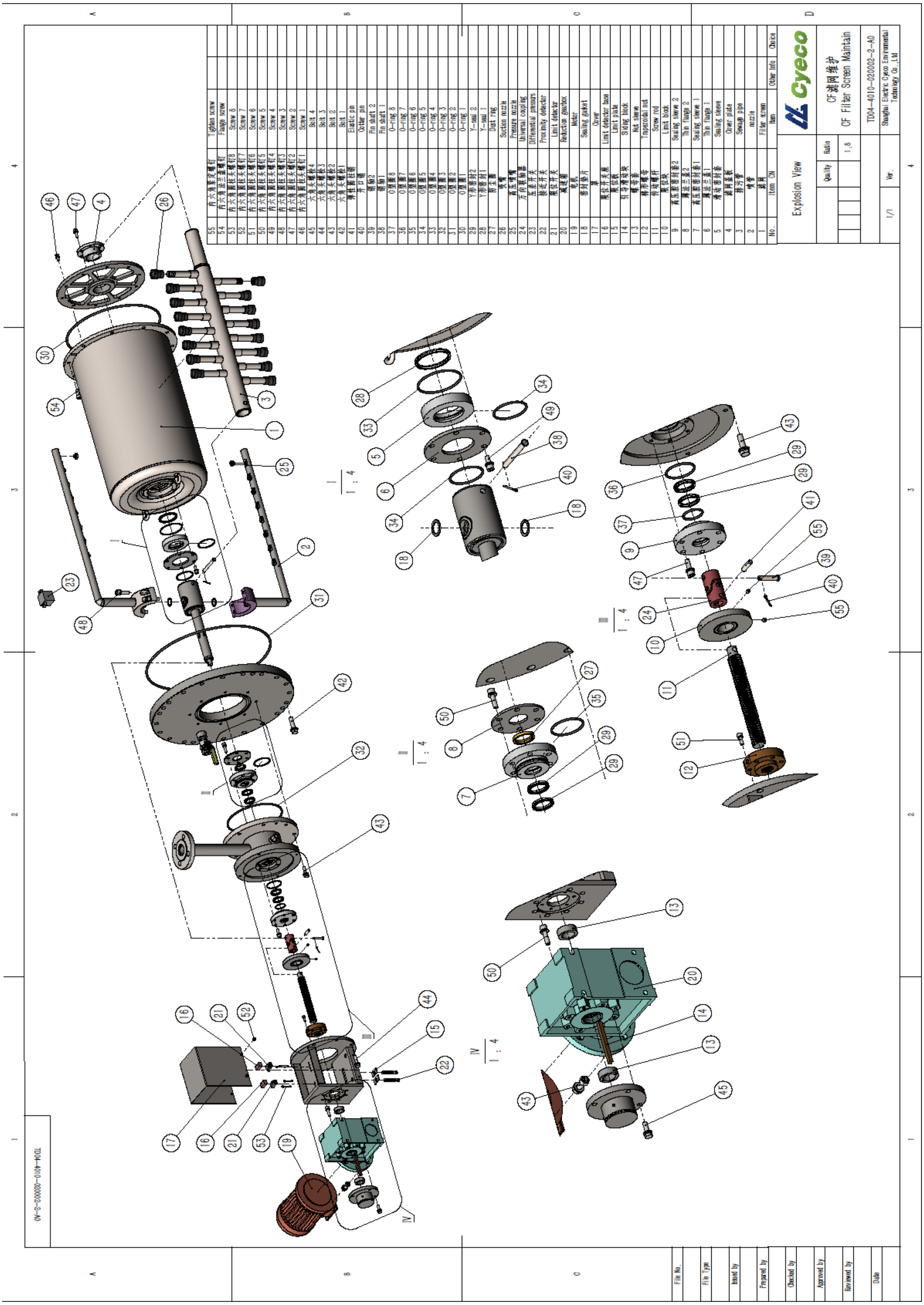
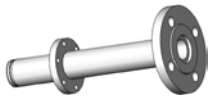
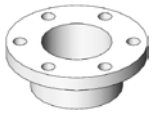
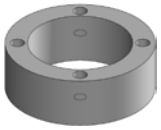
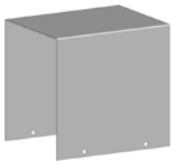
4.2 PLC 柜元器件 BOM / PLC Panal BOM 31



No.	Item CN	Item	Other Info	Choice
55	内六角紧定螺钉	Tighten screw		
54	内六角法兰盘螺钉	Flange screw		
53	内六角圆柱头螺钉8	Screw 8		
52	内六角圆柱头螺钉7	Screw 7		
51	内六角圆柱头螺钉6	Screw 6		
50	内六角圆柱头螺钉5	Screw 5		
49	内六角圆柱头螺钉4	Screw 4		
48	内六角圆柱头螺钉3	Screw 3		
47	内六角圆柱头螺钉2	Screw 2		
46	内六角圆柱头螺钉1	Screw 1		
45	六角头螺栓4	Bolt 4		
44	六角头螺栓3	Bolt 3		
43	六角头螺栓2	Bolt 2		
42	六角头螺栓1	Bolt 1		
41	弹性圆柱销	Elastic pin		
40	开口销	Cotter pin		
39	销轴2	Pin shaft 2		
38	销轴1	Pin shaft 1		
37	O型圈8	O-ring 8		
36	O型圈7	O-ring 7		
35	O型圈6	O-ring 6		
34	O型圈5	O-ring 5		
33	O型圈4	O-ring 4		
32	O型圈3	O-ring 3		
31	O型圈2	O-ring 2		
30	O型圈1	O-ring 1		
29	Y形密封2	Y-seal 2		
28	Y形密封1	Y-seal 1		
27	防尘圈	Dust ring		
26	吸嘴	Suction nozzle		
25	高压喷嘴	Pressure nozzle		
24	万向联轴器	Universal coupling		
23	压差开关	Differential pressurs		
22	接近开关	Proximity detector		
21	限位开关	Limit detector		
20	减速箱	Reduction gearbox		
19	电机	Motor		
18	密封垫片	Sealing gasket		
17	罩	Cover		
16	限位开关座	Limit detector base		
15	限位板	Limit plate		
14	引导滑动块	Sliding block		
13	螺母套	Nut sleeve		
12	梯形螺母	Trapezoidal nut		
11	传动螺杆	Screw rod		
10	限位块	Limit block		
9	高压腔密封套2	Sealing sleeve 2		
8	薄法兰盖2	Thin flange 2		
7	高压腔密封套1	Sealing sleeve 1		
6	薄法兰盖1	Thin flange 1		
5	滑动密封套	Sealing sleeve		
4	滤网盖板	Cover plate		
3	排污管	Sewage pipe		
2	喷管	nozzle		
1	滤网	Filter screen		

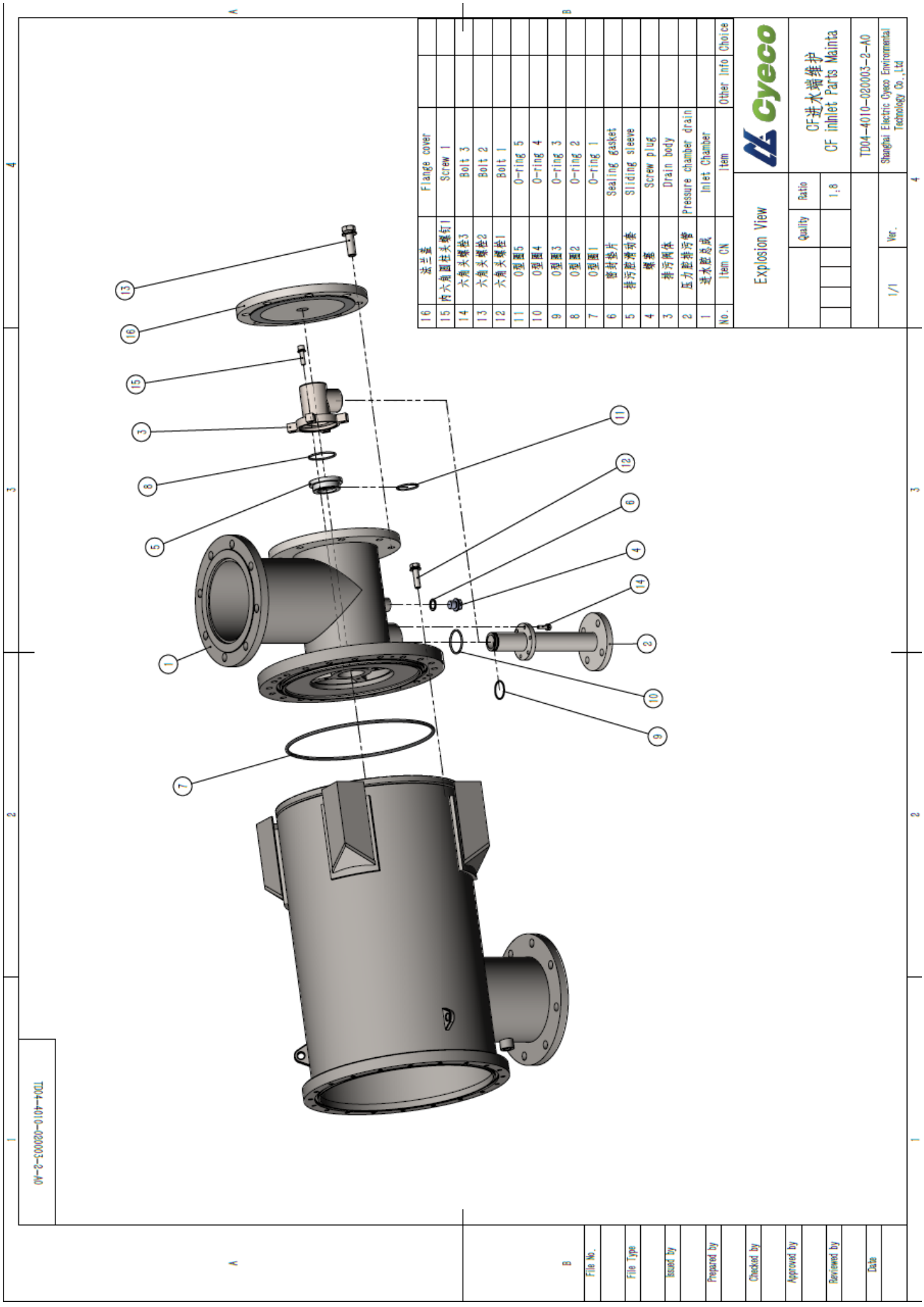
CF 滤网维护（CF Filter Screen Maintain）BOM——TD04-4010-020002-2-A0					
No	Item	Item	Part No	Model	Picture
1	滤网	Filter screen	040200000010	各型号不同 Different Model Parameters	
2	喷管	nozzle	040200000020		
3	排污管	Sewage pipe	040200000030		
4	滤网盖板	Cover plate	0402054100Fg	其余型号 Other Models	
			0402164101Fg	CF1600L-3200L	
5	滑动密封套	Sealing sleeve	0402054200Fg	其余型号 Other Models	
			0402164201Fg	CF1600L-3200L	
6	薄法兰盖 1	Thin flange 1	0402022600FQ	其余型号 Other Models	
			0402162601FQ	CF1600L-3200L	
7	高压腔密封套 1	Sealing sleeve 1	0402054400Fg	各型号相同 All Models	
8	薄法兰盖 2	Thin flange 2	0402022700FQ	各型号相同 All Models	
9	高压腔密封套 2	Sealing sleeve 2	0402054500Fg	各型号相同 All Models	
10	限位块	Limit block	0402021101WR	各型号相同 All Models	
11	传动螺杆	Screw rod	0402022100FR	CF100W-1200W	
				CF200L 1.8m	
			0402022101FR	CF200L-1200L	
			0402162101FR	CF1600L-3200L	
12	梯形螺母	Trapezoidal nut	0402022200FC	各型号相同 All Models	
13	螺母套	Nut sleeve	0402022400FR	各型号相同 All Models	

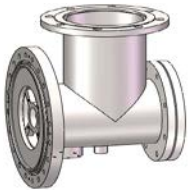
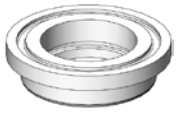
No	Item	Item	Part No	Model	Picture
14	引导滑动块	Sliding block	0402022300FC	各型号相同 All Models	
15	限位板	Limit plate	0402022900FR	各型号相同 All Models	
16	限位开关座	Limit detector base	0402022500Fh	各型号相同 All Models	
17	罩	Cover	0402021300WR	CF100W-1200W	
				CF200L 1.8m	
			0402021301WR	CF200L-1200L	
			0402161301WR	CF1600L-3200L	
18	密封垫片	Sealing gasket	0402024600Fg	各型号相同 All Models	
19	电机	Motor	980100020030	CF100W、200W	
			980100110030	CF300W-800W	
			980100110070	CF1000W、1200W	
			980100110030	CF200L-800L	
				CF200L 1.8m	
			980100110070	CF1200L-3200L	
20	减速箱	Reduction gearbox	980100080040	CF100W、CF200w	
			980100070040	CF300W-1200W	
			980100070050	CF200L-CF3200L	
				CF200L 1.8m	
21	限位开关	Limit detector	980500160010	各型号相同 All Models	
22	接近开关	Proximity detector	980500020010	各型号相同 All Models	
23	压差开关	Differential pressurs	980500100010	各型号相同 All Models	
24	万向联轴器	Universal coupling	98040001004R	各型号相同 All Models	

No	Item	Item	Part No	Model	Picture
25	高压喷嘴	Pressure nozzle	0402030611FQ	各型号相同 All Models	
26	吸嘴	Suction nozzle	0402040105Mc	各型号相同 All Models	
27	防尘圈	Dust ring	98070006002C	各型号相同 All Models	
28	Y 形密封 1	Y-seal 1	98070002008c	其余型号 Other Models	
			98070002014c	CF1600L-3200L	
29	Y 形密封 2	Y-seal 2	98070002007c	各型号相同 All Models	
30	O 型圈 1	O-ring 1	98070001098c	CF100W	
			98070001014c	CF200W-400W	
				CF200 1.8m	
			98070001141c	CF500W-800W	
			98070001145c	CF1000W、1200W	
			98070001193c	CF200L、CF300L	
			98070001196c	CF500L	
			98070001194c	CF800L	
			98070001195c	CF1200L、CF1600L	
			98070001208c	CF2400L	
			98070001205c	CF3200L	
31	O 型圈 2	O-ring 2	98070001167c	CF100W	
			98070001023c	CF200W-400W	
				CF200L 1.8m	
			98070001143c	CF500W-800W	
			98070001146c	CF1000W、1200W	
			98070001149c	CF200L、CF300L	
			98070001192c	CF500L	
			98070001165c	CF800L	
			98070001161c	CF1200L	
			98070001201c	CF1600L	
			98070001210c	CF2400L	
			98070001207c	CF3200L	

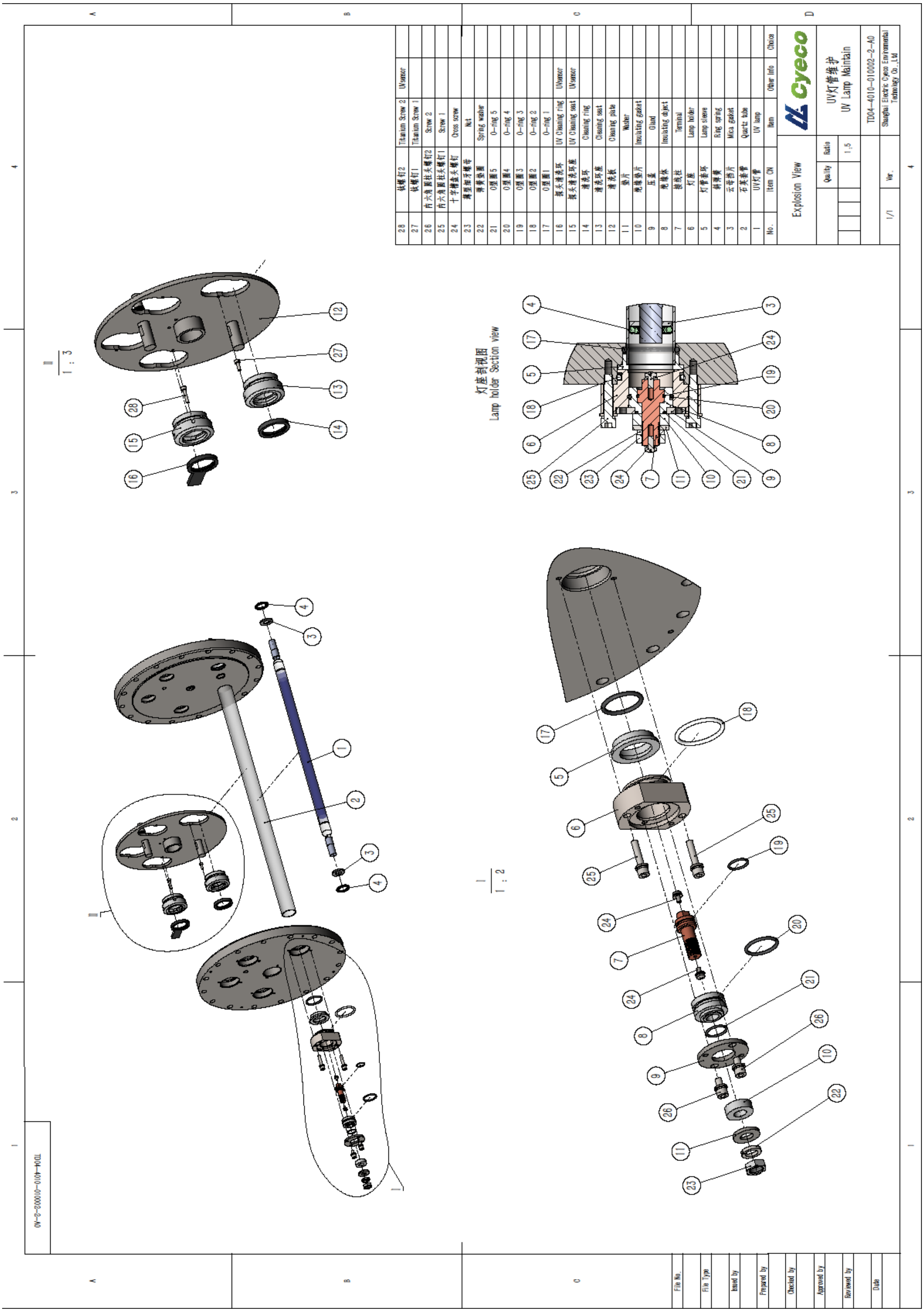
No	Item	Item	Part No	Model	Picture
32	O 型圈 3	O-ring 3	98070001046c	CF100W-400W	
			98070001061c	其余型号 Other Models	
33	O 型圈 4	O-ring 4	98070001028c	其余型号 Other Models	
			98070001202c	CF1600L-3200L	
34	O 型圈 5	O-ring 5	98070001027c	其余型号 Other Models	
			98070001064c	CF1600L-3200L	
35	O 型圈 6	O-ring 6	98070001026c	各型号相同 All Models	
36	O 型圈 7	O-ring 7	98070001025c	各型号相同 All Models	
37	O 型圈 8	O-ring 8	98070001013c	各型号相同 All Models	
38	销轴 1	Pin shaft 1	990734010090	其余型号 Other Models	
			990734010100	CF1600L-3200L	
39	销轴 2	Pin shaft 2	99073402003R	各型号相同 All Models	
40	开口销	Cotter pin	990729010090	各型号相同 All Models	
41	弹性圆柱销	Elastic pin	99073101001R	各型号相同 All Models	
42	六角头螺栓 1	Bolt 1	99070603056R	CF100W	
			99070603104R	CF200W-400W	
			99070603036R	CF500W-1200W	
			99070603104R	CF200L-500L	
				CF200L 1.8m	
			99070603036R	CF800L	
			99070603072R	CF1200L-1600L	
			99070603111R	CF2400L	
			99070603038R	CF3200L	
43	六角头螺栓 2	Bolt 2	99070603052R	各型号相同 All Models	

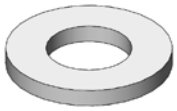
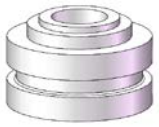
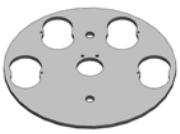
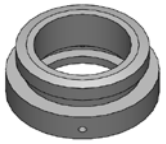
No	Item	Item	Part No	Model	Picture
44	六角头螺栓 3	Bolt 3	99070603004R	各型号相同 All Models	
45	六角头螺栓 4	Bolt 4	99070603032R	各型号相同 All Models	
46	内六角圆柱头螺钉 1	Screw 1	990716030500	CF100W	
			99071603026Q	CF200W-400W	
			99071603027Q	Other Models	
47	内六角圆柱头螺钉 2	Screw 2	99071603026Q	各型号相同 All Models	
48	内六角圆柱头螺钉 3	Screw 3	99071603040Q	各型号相同 All Models	
49	内六角圆柱头螺钉 4	Screw 4	99071603025Q	各型号相同 All Models	
50	内六角圆柱头螺钉 5	Screw 5	99071603027Q	各型号相同 All Models	
51	内六角圆柱头螺钉 6	Screw 6	99071603017Q	各型号相同 All Models	
52	内六角圆柱头螺钉 7	Screw 7	99071603012Q	各型号相同 All Models	
53	内六角圆柱头螺钉 8	Screw 8	99071603002Q	各型号相同 All Models	
54	内六角法兰盘螺钉	Flange screw	990733010010	各型号相同 All Models	
55	内六角紧定螺钉	Tighten screw	99071707002R	各型号相同 All Models	

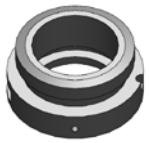

16 法兰盖 Flange cover
15 防水帽固定螺钉1 Screw 1
14 六角头螺栓3 Bolt 3
13 六角头螺栓2 Bolt 2
12 六角头螺栓1 Bolt 1
11 O型圈5 O-ring 5
10 O型圈4 O-ring 4
9 O型圈3 O-ring 3
8 O型圈2 O-ring 2
7 O型圈1 O-ring 1
6 密封垫片 Sealing gasket
5 排污起滑动套 Sliding sleeve
4 螺堵 Screw plug
3 排污阀体 Drain body
2 压力舱排污管 Pressure chamber drain
1 进水舱总成 Inlet Chamber
No. Item CN Item Other Info Choice
Explosion View
Cyeco
CF进水端维护 CF inlet Parts Mainta
Quality
Ratio 1:8
TD04-4010-020003-2-A0
1/1 Ver.
Shanghai Electric Cyeco Environmental Technology Co., Ltd
TD04-4010-020003-2-A0
File No.
File Type
Issued by
Prepared by
Checked by
Approved by
Reviewed by
Date

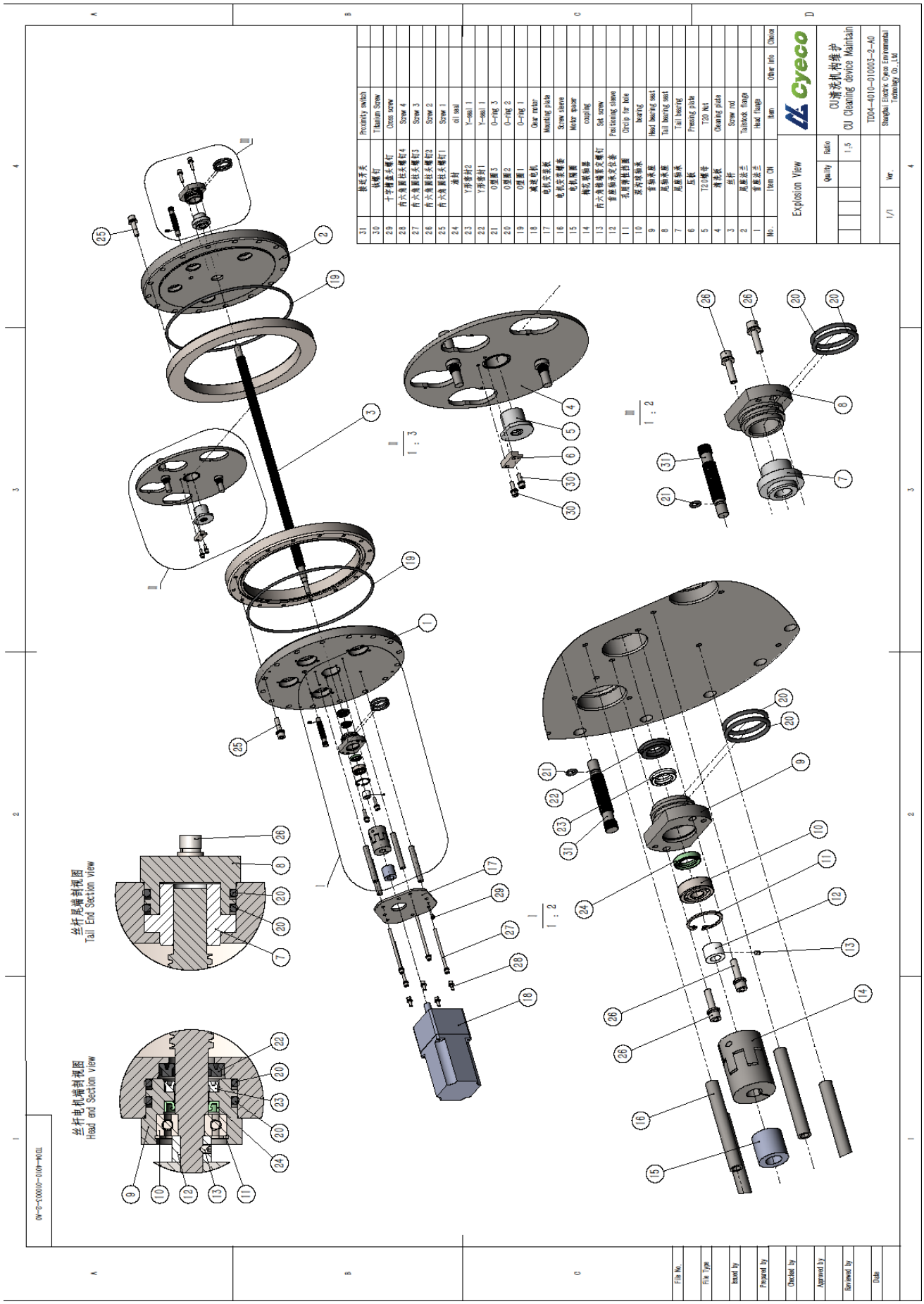
CF 进水端维护（CF Inlet Parts Maintain）BOM——TD04-4010-020003-2-A0					
No	Item	Item	Part No	Model	Picture
1	进水腔总成	Inlet Chamber	040200000040	各型号不同 Different Model Parameters	
2	压力腔排污管	Pressure chamber drain	040200000050		
3	排污阀体	Drain body	040200000060		
4	螺塞	Screw plug	0402022800FQ	各型号相同 All Models	
5	排污腔滑动套	Sliding sleeve	0402054700Fg	各型号相同 All Models	
6	密封垫片	Sealing gasket	0402024600Fg	各型号相同 All Models	
7	O 型圈 1	O-ring 1	98070001168c	卧式 CF100W	
			98070001017c	卧式 CF200W-400W	
			98070001142c	卧式 CF500W-800W	
			98070001147c	卧式 CF1000W、1200W	
			98070001017c	立式 CF200 1.8 米	
				立式 CF200L、CF300L	
			98070001191c	立式 C500L	
			98070001164c	立式 C800L	
			98070001159c	立式 C1200L、CF1600L	
			98070001209c	立式 C2400L	
			98070001206c	立式 C3200L	
8	O 型圈 2	O-ring 2	98070001211c	其余型号	
			98070001203c	立式 CF1600L-3200L	
9	O 型圈 3	O-ring 3	98070001074c	卧式 CF100W-400W	
			98070001212c	卧式 CF500W-1200W	
			98070001074c	立式 CF200 1.8 米	
				立式 CF200L-CF800L	
			98070001212c	立式 CF1200L	
			98070001204c	立式 CF1600L-3200L	

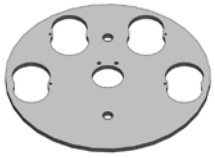
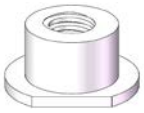
No	Item	Item	Part No	Model	Picture
10	O 型圈 4	O-ring 4	98070001026c	卧式 CF100W-400W	
			98070001078c	卧式 CF500W-1200W	
			98070001026c	立式 CF200 1.8 米	
				立式 CF200L-800L	
			98070001078c	立式 CF1200L	
			98070001203c	立式 CF1600L-3200L	
11	O 型圈 5	O-ring 5	98070001025c	其余型号	
			98070001078c	立式 CF1600L-3200L	
12	六角头螺栓 1	Bolt 1	99070603056R	卧式 CF100W	
			99070603104R	卧式 CF200W-400W	
			99070603036R	卧式 CF500W-1200W	
			99070603104R	立式 CF200 1.8 米	
				立式 CF200L-500L	
			99070603036R	立式 CF800L	
			99070603055R	立式 CF1200L、1600L	
			99070603048R	立式 CF2400L	
			99070603115R	立式 CF3200L	
13	六角头螺栓 2	Bolt 2	99070603100R	立式 CF200 1.8 米	
				立式 CF200L-800L	
			99070603102R	立式 CF1200L	
			99070603105R	立式 CF1600L	
			99070603113R	立式 CF2400L	
			99070603116R	立式 CF3200L	
14	六角头螺栓 3	Bolt 3	99070603033R	各型号相同	
15	内六角圆柱头螺钉 1	Screw 1	99071603037Q	各型号相同	


28 钛螺钉2 Titanium Screw 2 UVsensor
27 钛螺钉1 Titanium Screw 1
26 内六角圆柱头螺钉2 Screw 2
25 内六角圆柱头螺钉1 Screw 1
24 十字槽盘头螺钉 Cross screw
23 薄型细牙螺母 Nut
22 弹簧垫圈 Spring washer
21 O型圈5 O-ring 5
20 O型圈4 O-ring 4
19 O型圈3 O-ring 3
18 O型圈2 O-ring 2
17 O型圈1 O-ring 1
16 探头清洗环 UV Cleaning ring UVsensor
15 探头清洗环座 UV Cleaning seat UVsensor
14 清洗环 Cleaning ring
13 清洗环座 Cleaning seat
12 清洗板 Cleaning plate
11 垫片 Washer
10 绝缘垫片 Insulating gasket
9 压盖 Gland
8 绝缘体 Insulating object
7 接线柱 Terminal
6 灯座 Lamp holder
5 灯管套环 Lamp sleeve
4 斜弹簧 Ring spring
3 云母垫片 Mica gasket
2 石英套管 Quartz tube
1 UV灯管 UV lamp
No. Item CN Item Other Info Choice
Explosion View
UV灯管维护
UV Lamp Maintain
TD04-4010-010002-2-A0
Shanghai Electric Cyeco Environmental Technology Co., Ltd
Quality Ratio 1:5
1/1 Ver.
灯座剖视图
Lamp holder Section view
I 1 : 2
II 1 : 3
File No. File Type Issued by Prepared by Checked by Approved by Reviewed by Date

UV灯管维护（UV Lamp Maintain）BOM——TD04-4010-010002-2-A0					
No	Item	Item	Part No	Model	Picture
1	UV灯管	UV lamp	880100250090	CU200、CU300	
			880100250020	CU100、CU400-CU1200	
			880100250080	CU1200Pro-CU1800	
2	石英套管	Quartz tube	0401080202Am	各型号相同 All Models	
3	云母挡片	Mica gasket	0401022802F0		
4	斜弹簧	Ring spring	0401022701FH		
5	灯管套环	Lamp sleeve	0401024200Fg		
6	灯座	Lamp holder	0401021400FQ		
7	接线柱	Terminal	0401021500FC		
8	绝缘体	Insulating object	0401024400Fg		
9	压盖	Gland	0401021600FR		
10	绝缘垫片	Insulating gasket	0401024300Fg		
11	垫片	Washer	0401021700FR		
12	清洗板	Cleaning plate	040100000030	各型号不同 Different Model Parameters	
13	清洗环座	Cleaning seat	0401024500Fg	各型号相同 All Models	

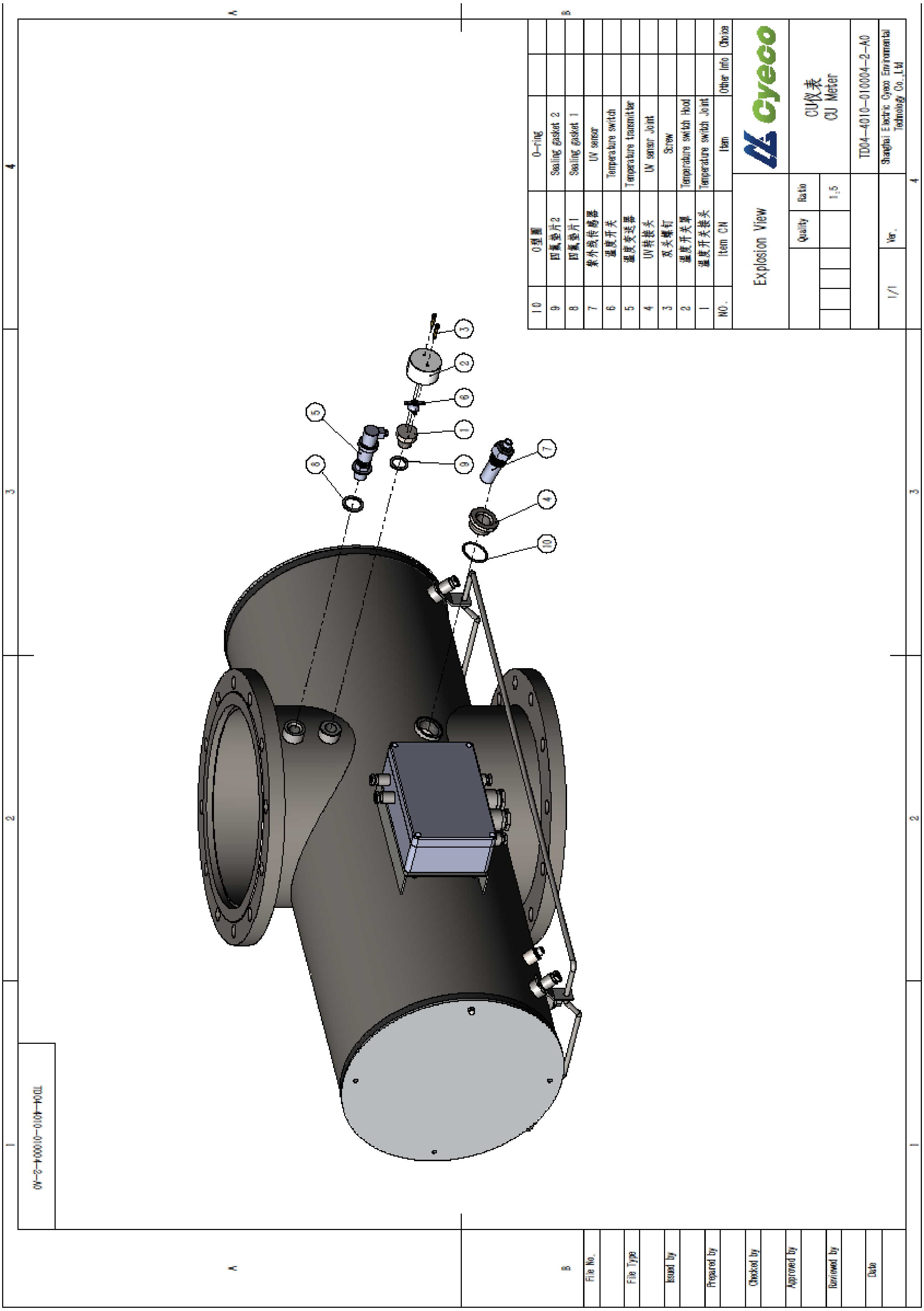
No	Item	Item	Part No	Model	Picture
14	清洗环	Cleaning ring	0401024800Mc	各型号相同 All Models	
15	探头清洗环座	UV Cleaning seat	0401024600Fg		
16	探头清洗环	UV Cleaning ring	0401024900Mc		
17	O 型圈 1	O-ring 1	98070001012c		
18	O 型圈 2	O-ring 2	98070001020b		
19	O 型圈 3	O-ring 3	98070001002c		
20	O 型圈 4	O-ring 4	98070001009c		
21	O 型圈 5	O-ring 5	98070001004c		
22	弹簧垫圈	Spring washer	99072502009R		
23	薄型细牙螺母	Nut	99072302005R		
24	十字槽盘头螺钉	Cross screw	99071504007R		
25	内六角圆柱头螺钉 1	Screw 1	99071604019R		
26	内六角圆柱头螺钉 2	Screw 2	99071604016R		
27	钛螺钉 1	Titanium Screw 1	99074801001T		
28	钛螺钉 2	Titanium Screw 2	99074801002T		


Explosion View
CU清洗机构维护
CU Cleaning device Maintain
TD04-4010-010003-2-A0
Shanghai Electric Cyeco Environmental Technology Co.,Ltd
丝杆尾端剖视图
Tail End Section view
丝杆电机端剖视图
Head end Section view

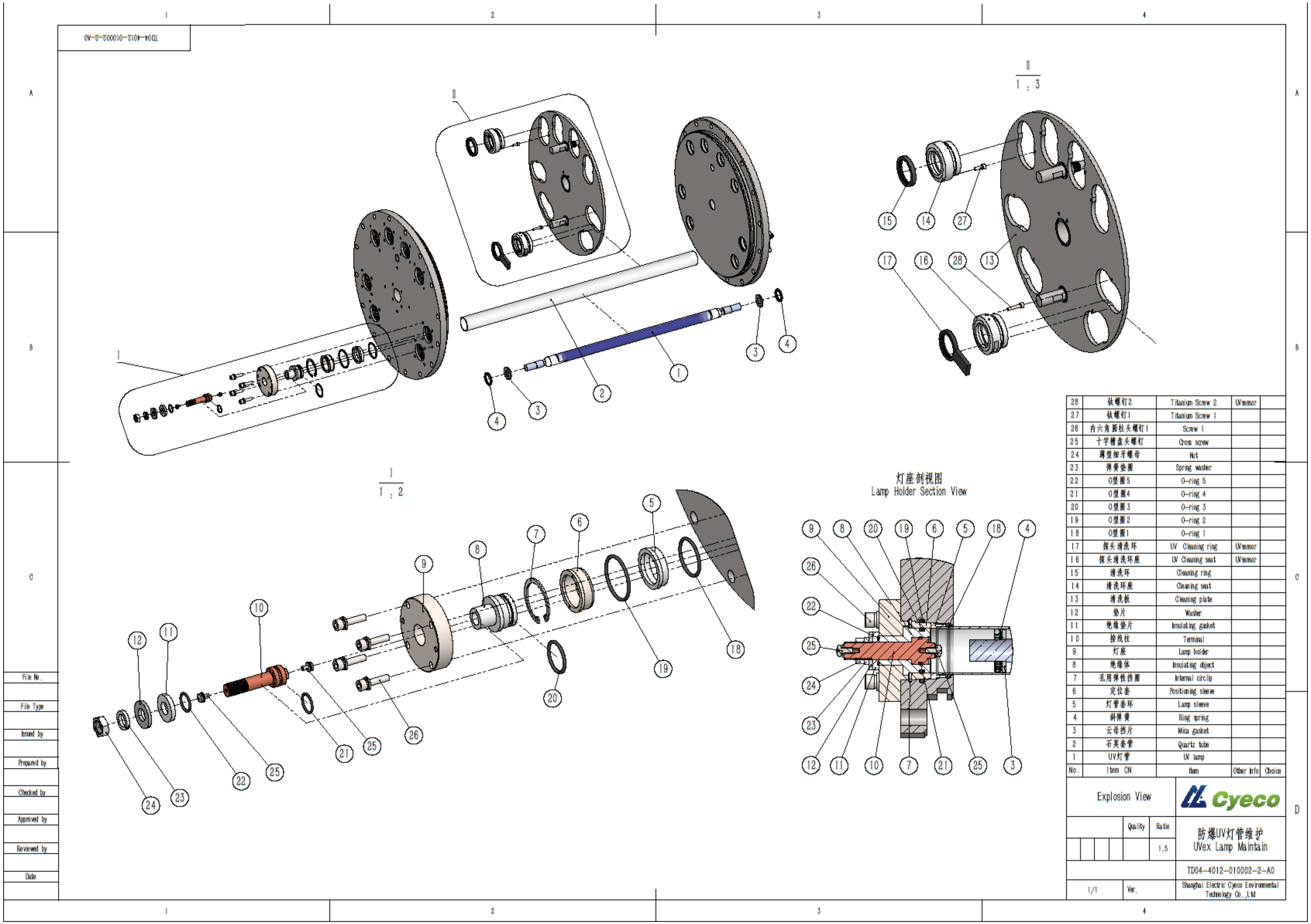
CU 清洗机构维护（CU Cleaning device Maintain）BOM——TD04-4010-010003-2-A0					
No	Item	Item	Part No	Model	Picture
1	首座法兰	Head flange	040100000010	各型号不同 Different Model Parameters	
2	尾座法兰	Tailstock flange	040100000020	各型号不同 Different Model Parameters	
3	丝杆	Screw rod	0401022100FQ	CU100-400	
			0401052100FQ	CU500-1800	
4	清洗板	Cleaning plate	040100000030	各型号不同 Different Model Parameters	
5	T20 螺母	T20 Nut	0401023300Fg	CU100-400	
			0401053300Fg	CU500-1800	
6	压板	Pressing plate	0401023400FQ	CU100-400	
			0401053400FQ	CU500-1800	
7	尾座轴承	Tail bearing	0401024100Fg	CU100-400	
			0401054100Fg	CU500-1800	
8	尾轴承座	Tail bearing seat	0401021900FQ	CU100-400	
			0401051900FQ	CU500-1800	
9	首轴承座	Head bearing seat	0401021800FQ	CU100-400	
			0401051800FQ	CU500-1800	
10	深沟球轴承	bearing	990802020010	CU100-400	
			990802010010	CU500-1800	
11	孔用弹性挡圈	Circlip for hole	99072701001R	CU100-400	
			99072701002D	CU500-1800	
12	首座轴承定位套	Positioning sleeve	0401022000FR	CU100-400	
			0401052000FR	CU500-1800	

No	Item	Item	Part No	Model	Picture
13	内六角锥端紧定螺钉	Set screw	99071707001R	各型号相同 All Models	
14	梅花联轴器	coupling	980400010020	CU100-400	
			98040001003T	CU500-1800	
15	电机隔圈	Motor spacer	0401023000Fh	CU100-400	
			0401053000Fh	CU500-1800	
16	电机安装螺套	Screw sleeve	0401022400FR	各型号相同 All Models	
17	电机安装板	Mounting plate	0401032300FR	CU300	
			0401022300FR	其余型号 Other Models	
18	减速电机	Gear motor	980100050012	CU1200、1600、 1800、1600U	
			980100050010	其余型号 Other Models	
19	O 型圈 1	O-ring 1	98070001098c	CU100	
			98070001014c	CU200-400	
			98070001019c	CU500、CU600	
			98070001022c	CU800、CU1000	
			98070001024c	CU1200-1800	
20	O 型圈 2	O-ring 2	98070001016c	CU100-400	
			98070001018c	CU500-1800	
21	O 型圈 3	O-ring 3	98070001166c	各型号相同 All Models	
22	Y 形密封 1	Y-seal 1	98070002004c	CU100-400	
			98070002006c	CU500-1800	
23	Y 形密封 2	Y-seal 1	98070002013b	CU100-400	
			98070002005c	CU500-1800	
24	油封	oil seal	98070004001c	CU100-400	
			98070005002b	CU500-1800	
25	内六角圆柱头螺钉 1	Screw 1	99071604037R	CU100-600	
			99071604040R	CU800-1800	
26	内六角圆柱头螺钉 2	Screw 2	99071604045R	各型号相同 All Models	

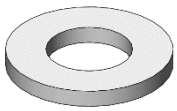
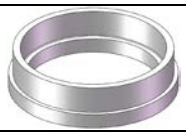
No	Item	Item	Part No	Model	Picture
27	内六角圆柱头螺钉 3	Screw 3	99071604015R	各型号相同 All Models	
28	内六角圆柱头螺钉 4	Screw 4	99071604017R		
29	十字槽盘头螺钉	Cross screw	99071504007R		
30	钛螺钉	Titanium Screw	99074801005T		
31	接近开关	Proximity switch	980500020040		

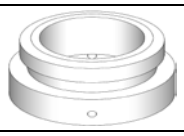

10 O型圈 O-ring
9 四氟垫片2 Sealing gasket 2
8 四氟垫片1 Sealing gasket 1
7 紫外线传感器 UV sensor
6 温度开关 Temperature switch
5 温度变送器 Temperature transmitter
4 UV转接头 UV sensor Joint
3 双头螺钉 Screw
2 温度开关罩 Temperature switch Hood
1 温度开关接头 Temperature switch Joint
NO. Item CN Item Other Info Choice
Explosion View
Cyeco
CU仪表
CU Meter
TD04-4010-010004-2-A0
Shanghai Electric Cyeco Environmental Technology Co., Ltd
Quality
Ratio
1:5
Ver.
1/1
File No.
File Type
Issued by
Prepared by
Checked by
Approved by
Reviewed by
Date
TD04-4010-010004-2-A0

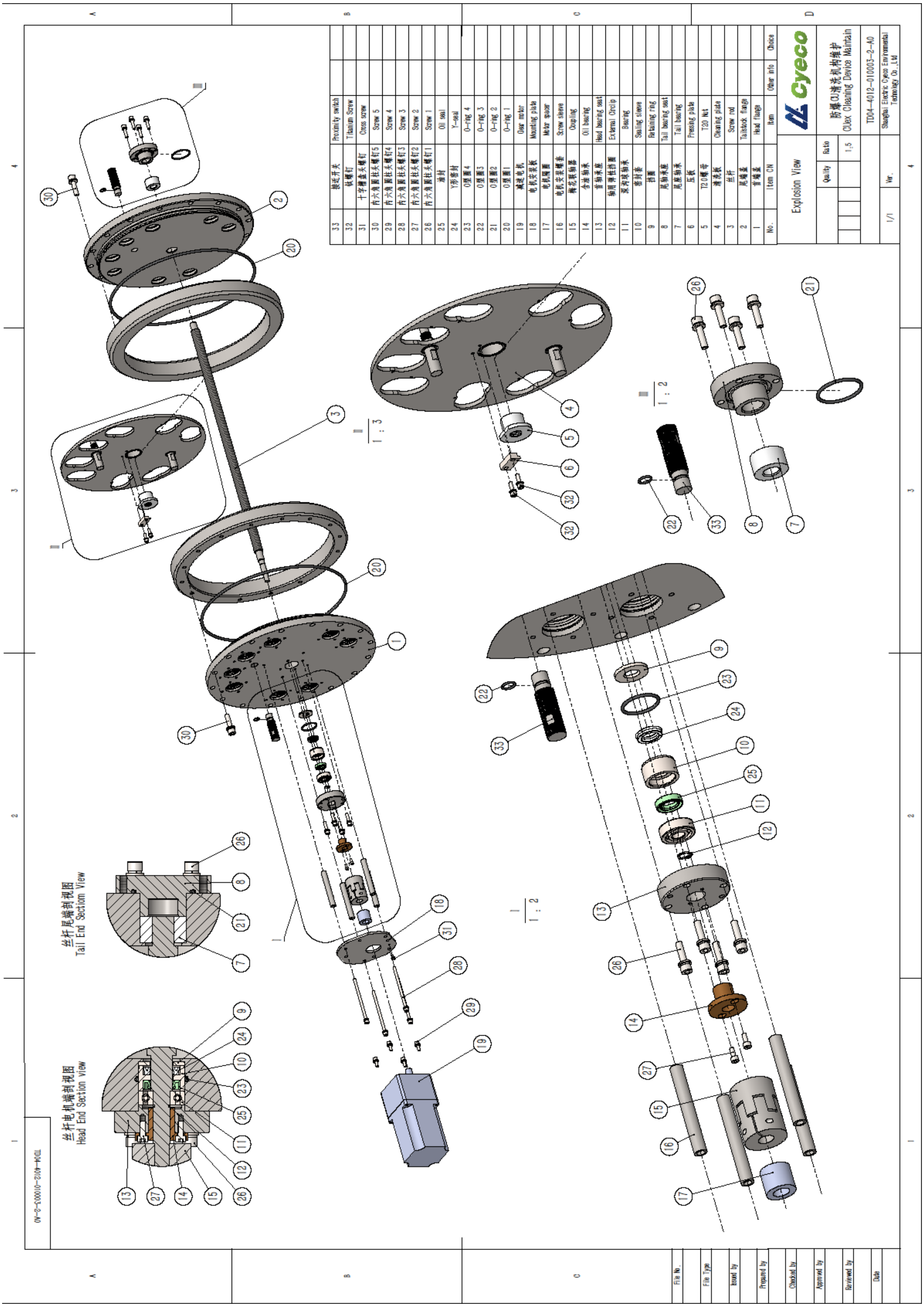
CU 仪表（CU Meter）BOM——TD04-4010-010004-2-A0					
No	Item	Item	Part No	Model	Picture
1	温度开关接头	Temperature switch Joint	0401023200FQ	各型号相同 All Models	
2	温度开关罩	Temperature switch Hood	0401021003Fh		
3	双头螺钉	Screw	0303100002FC		
4	UV 转接头	UV sensor Joint	0401023100FQ		
5	温度变送器	Temperature transmitter	980500030040		
6	温度开关	Temperature switch	980500060010		
7	紫外线传感器	UV sensor	980500070040		
8	四氟垫片 1	Sealing gasket 1	98070009004g		
9	四氟垫片 2	Sealing gasket 2	0401024700Fg		
10	O 型圈	O-ring	98070001038c		



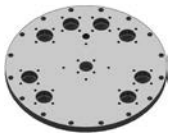
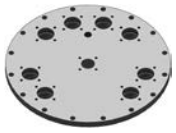
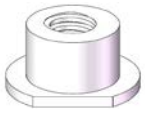
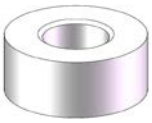
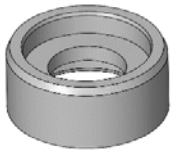
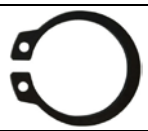
No.	Item CN	Item	Other Info	Choice
28	钛螺钉2	Titanium Screw 2	UVsensor	
27	钛螺钉1	Titanium Screw 1		
26	内六角圆柱头螺钉1	Screw 1		
25	十字槽盘头螺钉	Cross screw		
24	薄型细牙螺母	Nut		
23	弹簧垫圈	Spring washer		
22	O型圈5	O-ring 5		
21	O型圈4	O-ring 4		
20	O型圈3	O-ring 3		
19	O型圈2	O-ring 2		
18	O型圈1	O-ring 1		
17	探头清洗环	UV Cleaning ring	UVsensor	
16	探头清洗环座	UV Cleaning seat	UVsensor	
15	清洗环	Cleaning ring		
14	清洗环座	Cleaning seat		
13	清洗板	Cleaning plate		
12	垫片	Washer		
11	绝缘垫片	Insulating gasket		
10	接线柱	Terminal		
9	灯座	Lamp holder		
8	绝缘体	Insulating object		
7	孔用弹性挡圈	Internal circlip		
6	定位套	Positioning sleeve		
5	灯管套环	Lamp sleeve		
4	斜弹簧	Ring spring		
3	云母挡片	Mica gasket		
2	石英套管	Quartz tube		
1	UV灯管	UV lamp		

防爆 UV 灯管维护（UVex Lamp Maintain）BOM——TD04-4012-010002-2-A0					
No	Item	Item	Part No	Model	Picture
1	UV 灯管	UV lamp	880100250090	CUex200、CUex300	
			880100250020	CUex100、CUex400-CUex1200	
			880100250080	CUex1200Pro-CUex1800	
2	石英套管	Quartz tube	0401080303Am	各型号相同 All Models	
3	云母挡片	Mica gasket	0401022802F0		
4	斜弹簧	Ring spring	0401022701FH		
5	灯管套环	Lamp sleeve	0401024202Fg		
6	定位套	Positioning sleeve	0401021702FQ		
7	孔用弹性挡圈	Internal circlip	99072701005R		
8	绝缘体	Insulating object	0401024402Fg		
9	灯座	Lamp holder	0401021502FQ		
10	接线柱	Terminal	0401021602FC		
11	绝缘垫片	Insulating gasket	0401024302Fg		
12	垫片	Washer	0401021802FR		
13	清洗板	Cleaning plate	040100001030	各型号不同 Different Model Parameters	

No	Item	Item	Part No	Model	Picture
14	清洗环座	Cleaning seat	0401024500Fg	各型号相同 All Models	
15	清洗环	Cleaning ring	0401024800Mc		
16	探头清洗环座	UV Cleaning seat	0401024602Fg		
17	探头清洗环	UV Cleaning ring	0401024900Mc		
18	O 型圈 1	O-ring 1	98070001035c		
19	O 型圈 2	O-ring 2	98070001038c		
20	O 型圈 3	O-ring 3	98070001009c		
21	O 型圈 4	O-ring 4	98070001002c		
22	O 型圈 5	O-ring 5	98070001041c		
23	弹簧垫圈	Spring washer	99072502009R		
24	薄型细牙螺母	Nut	99072302005R		
25	十字槽盘头螺钉	Cross screw	99071504007R		
26	内六角圆柱头螺钉 1	Screw 1	99071604045R		
27	钛螺钉 1	Titanium Screw 1	99074801001T		
28	钛螺钉 2	Titanium Screw 2	99074801002T		

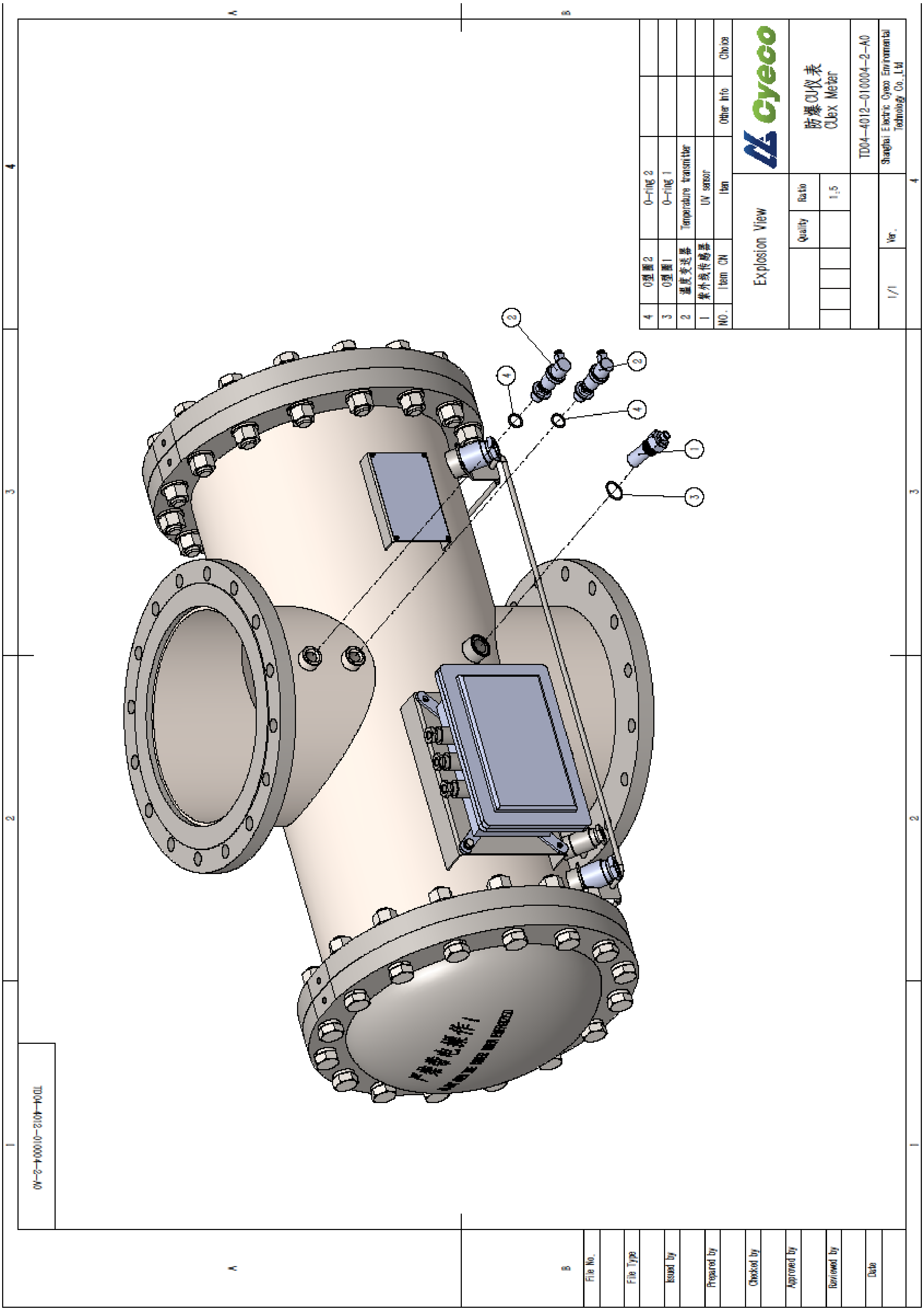


No.	Item CN	Item	Other info	Choice
33	接近开关	Proximity switch		
32	钛螺钉	Titanium Screw		
31	十字槽盘头螺钉	Cross screw		
30	内六角圆柱头螺钉5	Screw 5		
29	内六角圆柱头螺钉4	Screw 4		
28	内六角圆柱头螺钉3	Screw 3		
27	内六角圆柱头螺钉2	Screw 2		
26	内六角圆柱头螺钉1	Screw 1		
25	油封	Oil seal		
24	Y形密封	Y-seal		
23	O型圈4	O-ring 4		
22	O型圈3	O-ring 3		
21	O型圈2	O-ring 2		
20	O型圈1	O-ring 1		
19	减速电机	Gear motor		
18	电机安装板	Mounting plate		
17	电机隔圈	Motor spacer		
16	电机安装螺套	Screw sleeve		
15	梅花联轴器	Coupling		
14	含油轴承	Oil bearing		
13	首轴承座	Head bearing seat		
12	轴用弹性挡圈	External Circlip		
11	深沟球轴承	Bearing		
10	密封套	Sealing sleeve		
9	挡圈	Retaining ring		
8	尾轴承座	Tail bearing seat		
7	尾座轴承	Tail bearing		
6	压板	Pressing plate		
5	T20螺母	T20 Nut		
4	清洗板	Cleaning plate		
3	丝杆	Screw rod		
2	尾端盖	Tailstock flange		
1	首端盖	Head flange		

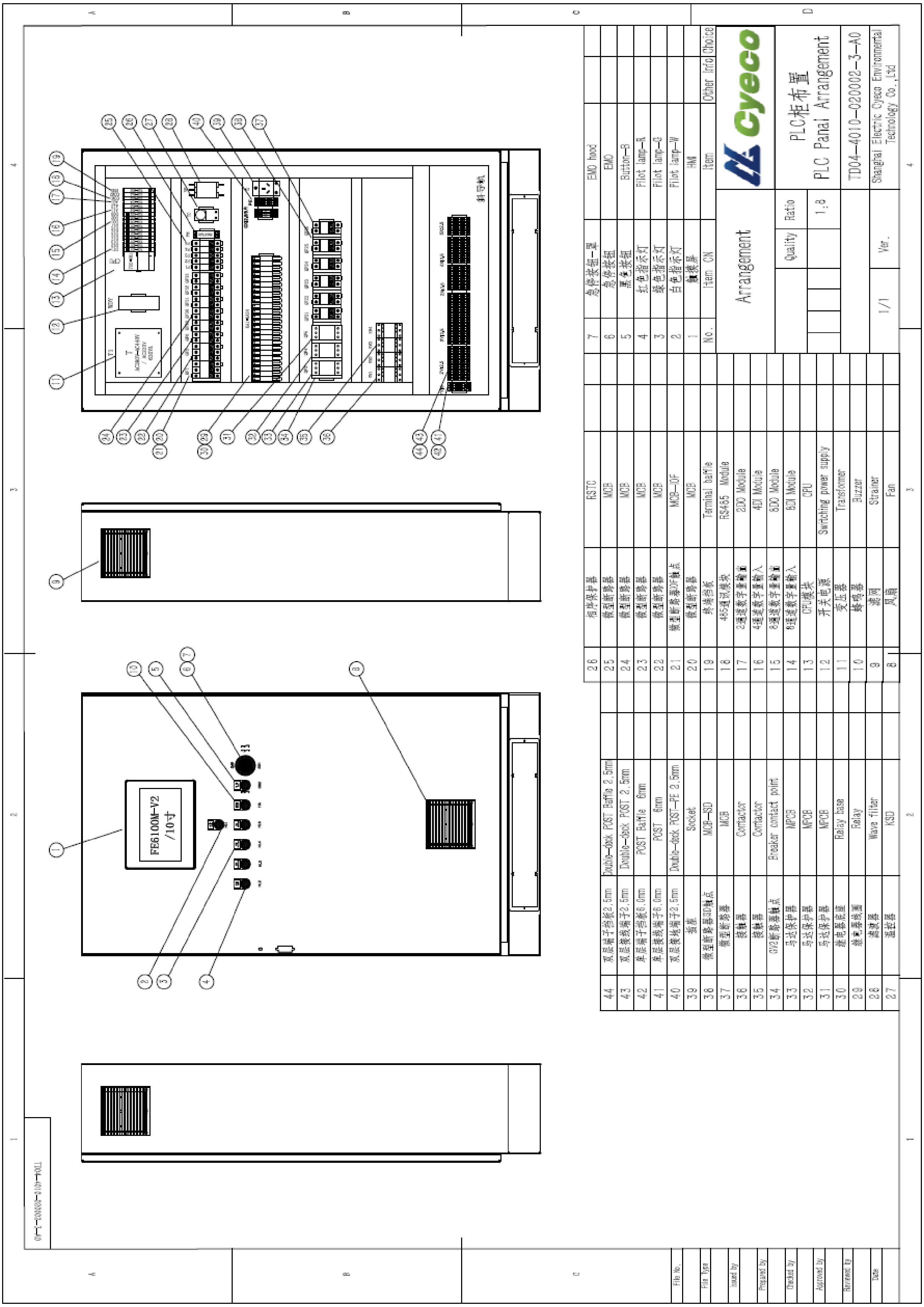
防爆 CU 清洗机构维护（CUex Cleaning Device Maintain）BOM——TD04-4012-010003-2-A0					
No	Item	Item	Part No	Model	Picture
1	首端盖	Head flange	040100001010	各型号不同 Different Model Parameters	
2	尾端盖	Tailstock flange	040100001020	各型号不同 Different Model Parameters	
3	丝杆	Screw rod	0401022802FQ	各型号相同 All Models	
4	清洗板	Cleaning plate	040100001030	各型号不同 Different Model Parameters	
5	T20 螺母	T20 Nut	0401022302Fg	各型号相同 All Models	
6	压板	Pressing plate	0401022602FQ		
7	尾座轴承	Tail bearing	0401024102Fg		
8	尾轴承座	Tail bearing seat	0401022002FQ		
9	挡圈	Retaining ring	0401022102FQ		
10	密封套	Sealing sleeve	0401022202FQ		
11	深沟球轴承	Bearing	990802020010		
12	轴用弹性挡圈	External Circlip	99072701003R		
13	首轴承座	Head bearing seat	0401021902FQ		

No	Item	Item	Part No	Model	Picture
14	含油轴承	Oil bearing	0401080701A0	各型号相同 All Models	
15	梅花联轴器	Coupling	980400010020		
16	电机安装螺套	Screw sleeve	0401022502FR		
17	电机隔圈	Motor spacer	0401022402Fh		
18	电机安装板	Mounting plate	0401022702FR	CUex100-400	
			0401052702FR	其余型号 Other Models	
19	减速电机	Gear motor	980100050012	CUex1200、 CUex1600、CUex1800	
			980100050010	其余型号 Other Models	
20	O 型圈 1	O-ring 1	98070001052c	CUex100	
			98070001057c	CUex200-400	
			98070001019c	CUex500-1000	
			98070001200c	CUex1200-1800	
21	O 型圈 2	O-ring 2	98070001038c	各型号相同 All Models	
22	O 型圈 3	O-ring 3	98070001037c		
23	O 型圈 4	O-ring 4	98070001033c		
24	Y 形密封	Y-seal	98070002002c		
25	油封	Oil seal	98070004007c		
26	内六角圆柱头螺钉 1	Screw 1	99071604045R		
27	内六角圆柱头螺钉 2	Screw 2	99071604003R		

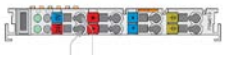
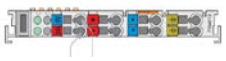
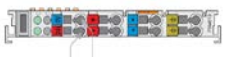
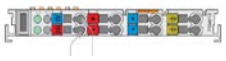
No	Item	Item	Part No	Model	Picture
28	内六角圆柱头螺钉 3	Screw 3	99071604015R	各型号相同 All Models	
29	内六角圆柱头螺钉 4	Screw 4	99071604017R		
30	内六角圆柱头螺钉 5	Screw 5	99071604037R	CUex100-400	
			99071604040R	其余型号 Other Models	
31	十字槽盘头螺钉	Cross screw	99071504007R	各型号相同 All Models	
32	钛螺钉	Titanium Screw	99074801005T		
33	接近开关	Proximity switch	980500020060		


4 O型圈2 O-ring 2
3 O型圈1 O-ring 1
2 温度变送器 Temperature transmitter
1 紫外线传感器 UV sensor
NO. Item CN Item Other Info Choice
Explosion View
防爆CU仪表
CUex Meter
TD04-4012-010004-2-A0
Shanghai Electric Cyeco Environmental Technology Co., Ltd
Quality
Ratio 1:5
Ver.
1/1
File No.
File Type
Issued by
Prepared by
Checked by
Approved by
Reviewed by
Date

防爆 CU 仪表（CUex Meter）BOM——TD04-4012-010004-2-A0					
No	Item	Item	Part No	Model	Picture
1	紫外线传感器	UV sensor	98050007003Q	各型号相同 All Models	
2	温度变送器	Temperature transmitter	98050004001Q		
3	O 型圈 1	O-ring 1	98070001032c		
4	O 型圈 2	O-ring 2	98070001031c		


PLC柜布置
PLC Panal Arrangement
TD04-4010-020002-3-A0
Shanghai Electric Cyeco Environmental Technology Co., Ltd
FE6100M-V2 /10寸

PLC 柜布置（PLC Panal）BOM——TD04-4012-010003-3-A0					
No	Item	Item	Part No	Model	Picture
1	触摸屏	HMI	880200070142	各型号相同 All Models	
2	白色指示灯 DC24V	Pilot lamp-W	880300010052		
3	绿色指示灯 DC24V	Pilot lamp-G	880300010112		
4	红色指示灯 DC24V	Pilot lamp-R	880300010182		
5	黑色按钮	Button-B	041100000010		
6	急停按钮	EMO	880300090032		
7	急停按钮-罩	EMO hood	880300100012		
8	风扇	Fan	880500070111		
9	滤网	Strainer	同上配套 Ditto matching		
10	蜂鸣器	Buzzer	880300020042		
11	变压器	Transformer	880400010230		
12	开关电源	Switching power supply	880400021642		
13	CPU 模块	CPU	880200010047		

No	Item	Item	Part No	Model	Picture
14	8 通道数字量输入	8DI Module	880200040046	各型号相同 All Models	
15	8 通道数字量输出	8DO Module	880200050036		
16	4 通道数字量输入	4DI Module	880200020036		
17	2 通道数字量输出	2DO Module	880200030046		
18	485 通讯模块	RS485 Module	880200060026		
19	终端挡板	Terminal baffle	880200100016		
20	微型断路器	MCB	880100010601	各型号不同 Different Model Parameters	
21	微型断路器 IOF 触点	MCB-IOF	880100020041	各型号相同 All Models	
22	微型断路器	MCB	880100010461	各型号不同 Different Model Parameters	
23	微型断路器	MCB	880100010361	各型号不同 Different Model Parameters	
24	微型断路器	MCB	880100010271	各型号不同 Different Model Parameters	
25	微型断路器	MCB	880100010091	各型号不同 Different Model Parameters	
26	相序保护器	RSTC	880100140011	各型号相同 All Models	
27	温控器	KSD	88010024001g	各型号相同 All Models	

No	Item	Item	Part No	Model	Picture
28	滤波器	Wave filter	88010019001r	各型号相同 All Models	
29	继电器线圈	Relay	880100160120		
30	继电器底座	Relay base	880100170014		
31	马达保护器	MPCB	880100090081	各型号不同 Different Model Parameters	
32	马达保护器	MPCB	880100090041	各型号不同 Different Model Parameters	
33	马达保护器	MPCB	880100090091	各型号不同 Different Model Parameters	
34	GV2 断路器触点	Breaker contact point	880100100011	各型号相同 All Models	
35	接触器	Contactor	880100060021	各型号不同 Different Model Parameters	
36	接触器	Contactor	880100060031	各型号不同 Different Model Parameters	
37	微型断路器	MCB	880100010701	各型号不同 Different Model Parameters	
38	微型断路器 ISD 触点	MCB-ISD	880100020051	各型号相同 All Models	
39	插座	Socket	880100230050		
40	双层接地端子 2.5mm	Double-deck POST-PE 2.5mm	880700050025		

No	Item	Item	Part No	Model	Picture
41	单层接线端子 6.0mm	POST 6mm	880700020045	各型号相同 All Models	
42	单层端子挡板 6.0mm	POST Baffle 6mm	880700030045		
43	双层接线端子 2.5mm	Double-deck POST 2.5mm	880700160060		
44	双层端子挡板 2.5mm	Double-deck POST Baffle 2.5mm	880700060025		

Cyeco™ 船研环保 Marine Equipments & Technology, Water & Wastewater Treatment

上海电气船研环保技术有限公司

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