



Automatic UV spraying curing Line

Using Instruction

Machine model: _____

Production date: _____

Catalogue

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Chapter 1 Introduction and Safety Instructions

1.1 Introduction

Dear User :

Thank you for choosing the UV coating line equipment manufactured by Jiangsu Cicel Vacuum Technology Co.,Ltd. This instruction manual applies to the UV coating line produced by our company, used for the automatic spraying of pretreatment and post-vacuum coating (UV) protective coatings.

This manual focuses on the dust-free UV spraying process before and after vacuum coating, systematically introducing the structure, function, usage methods, precautions, maintenance, and troubleshooting methods for each functional section of the production line. Operators, maintenance personnel, and repair personnel must carefully read this manual before installing, using, and maintaining this equipment, and keep it safe for future reference. The technical parameters, structural forms, and configurations listed in this manual are subject to the accompanying technical documents and the actual delivered configuration. Due to continuous product improvement, the company reserves the right to adjust the equipment structure, parameters, and accessories without prior notice.

1.2 Operator Requirements

This equipment must be operated by personnel who have received professional training and are familiar with the equipment structure and coating process. Untrained personnel are not allowed to start the machine.

Operators should be familiar with the location of the emergency stop button, power switch, and switches for each function section, and master the emergency shutdown procedures in abnormal situations.

- During equipment operation, operators must not leave their posts without authorization; if it is necessary to leave, the production line should be stopped.
- The equipment should be maintained by professional personnel; electrical repairs must be performed by a certified electrician.

1.3 Safety Precautions

【Safety Warning】 This equipment is a moving machine. As long as the equipment is powered on, no personnel may enter its operating area. Due to industrial site interference, equipment malfunction, or accidental operation, the equipment may suddenly activate even when the system is on. Operators and maintenance personnel must maintain a safe distance.

(1) Electrical safety:

The main power supply of this equipment is a three-phase four-wire 380VAC/50-60 Hz . (Some configurations are three-phase 415VAC/50-60 Hz), and an additional 220VAC single-phase control power supply is required. Wiring and maintenance work must be carried out only after the power has been turned off for ten minutes and confirmed with a multimeter that there is no power. The equipment must be reliably grounded (PE) to prevent electric shock.

(2) UV protection:

UV lamps emit strong ultraviolet rays, which are harmful to human skin and eyes. It is strictly forbidden to open the observation door of the UV curing chamber when the equipment is running; operators and maintenance personnel must wear protective clothing and UV-protective glasses, and must not look directly at the UV light source for a long time.

(3) High voltage protection:

The working voltage of the UV power supply can reach hundreds to thousands of volts. The starting capacitor of the UV lamp may still retain a high voltage of about 900V after the power is cut off. Do not touch the two poles of the capacitor with your hands after the machine is stopped; the UV power supply box must be fully discharged before opening.

(4) High temperature protection:

The surface temperature of the furnace body and lamps is high when the IR infrared leveling oven and UV curing chamber are working. Do not touch them during operation and for a short time after shutdown to avoid burns.

(5) Fire and explosion prevention:

The solvents and paints used in the coating operation are flammable and explosive materials. The equipment uses non-explosion-proof motors. The production site must be kept clean and well-ventilated. Smoking and open flames are strictly prohibited. Sufficient fire extinguishers must be provided. If any products fall to the bottom of the UV curing chamber, they must be cleaned up in time to prevent fire caused by prolonged exposure to sunlight.

(6) Chemical protection:

When in contact with chemicals such as paint, solvent, thinner, etc., protective gloves, masks and goggles should be worn, and the workplace should be well ventilated.

(7) After shutdown :

After the work is completed each day, the UV lamp must be turned off, the power switch and circuit breaker must be turned off, and the spray gun, paint pipe and pump must be cleaned.

Chapter 2 General Description and Process Flow of the UV Coating Line

2.1 Equipment Purpose and System Overview

- This UV coating line is used for dust-free automated coating operations before and after vacuum coating. The system employs automated control, replacing manual spraying with automatic spraying to improve efficiency. The automated dust removal production line is placed inside the cleanroom and connected to the outside environment via a conveyor line. Personnel enter and exit through an air shower, and goods enter and exit through a cargo shower to maintain the cleanliness of the workshop. The automated line includes a UV curing system, suitable for paints requiring UV curing.
- The automatic spraying line adopts the following layout: one spray, one bake, one UV curing / two sprays, two bakes, one UV curing / three sprays, three bakes, two UV curings. (According to actual configuration) The primer line and topcoat line are each equipped with independent conveyor chains, and functional sections such as

electrostatic dust removal, flame spraying, spraying, leveling (baking), UV curing and cooling, which can meet the requirements of dust-free spraying operations before and after vacuum coating.

2.2 Production Line Process Flow and Main Technical Parameters

The automatic spray coating line - **primer process flow** is as follows:

Loading → Electrostatic dust removal 1 → Flame treatment → Electrostatic dust removal 2 → Solvent treatment → IR infrared leveling 1 → Automatic primer spraying → IR infrared leveling 2 → UV curing → Cooling → Unloading (vacuum coating)

The automatic spraying line -**topcoat process** is as follows:

Loading → Electrostatic dust removal 1 → Electrostatic dust removal 2 → IR infrared leveling 1 → Automatic topcoat spraying → IR infrared leveling 2 → UV curing → Cooling → Unloading (finished product packaging)

2.2.1 Main Technical Parameters

project	parameter
Use power supply	Three-phase 380V/415V AC 50-60Hz; (Voltage and frequency can be customized)
	A 220VAC single-phase control power supply is also required;
	Power supply capacity $\geq 300\text{kW}$, voltage fluctuation $\pm 10\text{V}$ (can be adjusted according to actual parameters)
Linear speed	The automatic production line speed is 5 to 20 meters per minute, and the process speed is 12 meters per minute (adjustable).
Linear Dynamics	2.2 K W $\times$ 2 sets -- one set each of primer line and topcoat line (customization optional)
chain length	The line length is approximately 50-300 meters (customized according to actual configuration) .
Rotating mechanism	Adjustable rotation speed from 50 to 150 rpm, self-rotation power 0.4 KW

Oven baking	Temperature adjustable from 65-100 °C ; straight far-infrared quartz heating tube , 800mm long, 1000W power; (stainless steel heating tube optional)
	Furnace internal heat circulation fan 0.75kW (optional)
Water tank (Wet spray booth)	W3000 × D2500 × H2200mm, water pump power 0.75kW, exhaust fan power 7.5kW (Size can be customized)
PP cabinet (Wet spray painting booth)	W2500 × D2500 × H2200mm, water pump power 0.75kW, exhaust fan power 4kW (Size can be customized)
Dust removal cabinet	W1500 × D2200 × H2200mm, water pump power 0.75kW, exhaust fan power 1.5kW (Size can be customized)
Flame Cabin	W1300×D2200×H2200mm, exhaust fan power 1.5kW
UV curing machine	L3000/L4000 (optional) × W2000×H2200mm
	UV lamp power supply 5.6kW × 6-9 units (optional) 3.0kW UV exhaust fan
	4kW UV air supply fan
UV air purification system	L3000×W1520×H2010mm, fan power 4kW
UV spray booth/dust removal cabinet air supply and purification system	L3000 × W3040 × H2010mm, air supply fan power 15kW, air supply sprinkler pump power 0.200kW
PP spray booth/flame cabinet air supply and purification system	Dimensions: L 3000×W 3040 × H 2000mm ; Power supply fan: 15kW; Power supply sprinkler pump: 0.2kW .
Exhaust gas treatment system	L4300 × W1220 × H3600mm, exhaust gas treatment water pump power 2.2kW, water impeller motor power 4kW
Air shower	Air shower room W1 40 0×D1000×H2 10 0mm (size can be customized)

	Cargo shower chamber W2000×D2000×H2100mm (size can be customized)
Human-computer interface	Weintek CMT2129X 12 - inch touchscreen (Touchscreen brand and size are optional)
Programmable Logic Controller (PLC)	Mitsubishi FX 3U - 80MR (Electrical appliance brands can be customized)

2.2.2 Precautions before use

(1) Fixing of equipment

All equipment has mounting holes and supports. The equipment must be leveled before fixing it; otherwise, its performance and lifespan will be affected.

(2) Inspection of equipment components

The fan is connected to the base via shock-absorbing pads and screws; the sprocket and output shaft are connected by a tight fit, with a key embedded in the middle, and secured with screws (sealing glue was applied during tightening). Each component should be checked and confirmed before starting the machine.

(3) Equipment lubrication

Because the equipment is in motion, lubrication is necessary to extend its service life and reduce noise. Please select a suitable oil; high-temperature resistant solid lubricating oil is recommended. If the equipment has been in operation for more than three days, lubrication must be repeated on areas requiring lubrication. A suitable grease gun or brush should be used for lubrication.

2.3 Main Drive System

2.3.1 System Description

Direct-drive worm gear reducer : This is the main drive reducer used to control the operation and stopping of the conveyor chain. It features low load vibration and noise

during startup, resulting in energy savings and higher efficiency. It should be kept clean to prevent contamination, and the oil should be changed regularly.

Main shaft : The power shaft for chain operation.

Coupling: The worm gear reducer and the main shaft adopt a double-row chain coupling, which is convenient and quick to disassemble.

2.3.2 Maintenance Items

The bearing housing every two weeks using a grease gun or by brushing it onto the spindle sprocket .

In the gearbox should be changed every 800 hours initially , and then every 3000 hours thereafter.

2.4 Conveyor Chain System

2.4.1 Precautions

- The chain conveyor wheel should be kept free of oil to prevent slippage during material transfer.
assembling or disassembling it. When assembling, make sure the buckle is properly fastened into the groove.
- When the chain elongation exceeds the range that the tensioning slide can absorb, two or four chain links can be removed at once, with the removal amount always being an even number.

2.4.2 Maintenance Items

Chain: Apply grease or chain oil to the bushing regularly to keep the chain and track adequately lubricated.

Sprockets: Regularly clean the oil stains on the conveyor belt sprockets and apply grease.

2.4.3 Chain tensioning slide

- Function Description: After a period of use, the chain may stretch slightly. Adjusting the slide will help maintain proper tension on the chain.

- Adjustment method (manual adjustment) : Loosen the positioning nut, use a wrench to adjust the screw clockwise to the appropriate tightness (torque of about 120-130 kgf/cm²), and then fix the adjusting screw.
- Air pressure adjustment: Rotate the pressure regulating valve to set the air pressure to 2-3 kg/cm². The higher the pressure, the greater the chain tension. Before starting the machine, air must be input to the pressure regulating switch and the pressure valve adjusted to above 3 kg/cm². At this time, the cylinder will activate to tighten the chain, and the machine can operate normally (after tightening, adjust the adjusting screw on the tensioning slide).

2.5 Workpiece Rotation System

2.5.1 Precautions

Make sure the paint baffle on the self-rotating plate is installed to prevent paint from seeping into the bearing and causing damage to the machine parts.

Regularly inspect the self-rotating belt and replace it immediately if it is severely worn.

2.5.2 Maintenance Items

With an air gun or a clean, pure white cotton cloth once a week.

2.5.3 Institutional Adjustment

Adjusting the tension of the self-rotating belt: Loosen the fixing screw of the self-rotating belt pulley, and then tighten the tension adjustment screw clockwise with a wrench.

Self-rotating belt pulley assembly adjustment: Loosen or tighten the middle screw of the material transfer pressure roller assembly to obtain the best transmission efficiency.

Drive chain tension adjustment: Loosen the motor plate fixing screws and adjust the motor plate fixing screws forward or backward.

The belt specifications are indicated by the stamped markings on the self-rotating mechanism .

2.6 Control System (PLC and Human-Machine Interface)

2.6.1 System Description

This machine uses a PLC programmable controller (Mitsubishi FX 3U - 80 MR), which has a low failure rate and is easy to maintain; all controls are uniformly controlled by the human-machine interface on the main control box, making operation convenient and user-friendly.

The main components of the control panel are as follows:

Buzzer	The three alarms before the main drive starts serve as a reminder that the chain is ready to start, and also as a normal status alarm.
Power indicator	Used to indicate whether the 220VAC control power supply is supplied normally.
Power switch	Turn on the 220VAC control power supply
Light switch	Turn on the switch to turn on the spray booth lights
Frequency converter	The system independently controls the main drive motor, the static eliminator rotation, the flame chamber rotation, the paint spraying chamber rotation, the UV curing rotation, and the air supply speed for each section. There is a correlation between the chain speed and the paint spraying chamber rotation speed; users can adjust these based on the workpiece's outer diameter and the required coating quality. The air supply section controls the air intake of the paint spraying chamber, maintaining a slight negative pressure to prevent air from flowing into the machine. Adjustment method: Simply input the desired speed through the human-machine interface; the displayed value is the operating frequency.
Thermostat	Adjust the heating temperature by using a temperature sensor to detect the actual temperature and compare it with the set temperature. If the set temperature is not reached, heating continues. When the

	temperature is reached, the solid-state relay will automatically turn off. When the temperature drops, heating will automatically resume.
Human-computer interface	The plan includes eight screens (5 in English and 5 in Chinese) : homepage, user interface , runtime, frequency settings, and alarm monitoring .

2.6.2 Operation Button Screen Functions

Area	Function Description
1/2 dust removal chamber	Air supply: Controls the start and stop of the air supply motor in the dust removal chamber; the speed is controlled by a frequency converter; Exhaust ventilation: Controls the start and stop of the exhaust motor in the dust removal chamber; Electrostatic gun 1/2; Controls the start and stop of the electrostatic gun in the dust removal chamber (automatic selection is available inside the dust removal chamber); Rotation: Controls the start and stop of the self-rotating motor in the dust removal chamber; the speed is controlled by a frequency converter ; LED lighting switch.
Flame Chamber	Exhaust: Controls the start and stop of the exhaust motor in the flame chamber; Rotation: Controls the start and stop of the flame chamber's self-rotating motor; the speed is controlled by a frequency converter , LED lighting switch.
1/2 spray booth	Water curtain: Controls the start and stop of the water pump motor in the spray booth, Air supply: The air supply motor for the spray booth starts and stops, and its speed is controlled by a frequency converter; the exhaust motor for the spray booth starts and stops; Rotation 1 / Rotation 2: Turn on the paint spraying motor, start and stop, speed controlled by frequency converter ; LED lighting switch.
IR infrared heating	Heating: Controls pretreatment heating and leveling heating in the spray booth, including start-up and stop, temperature is controlled by a temperature controller.
Circulating air 1/2 (Optional)	Control the start and stop of the circulating fan motor for heating 1/heating 2.

Main drive	The chain motor is started and stopped, and its speed is controlled by a frequency converter.
UV Chamber	Air supply: Controls the start and stop of the UV chamber air supply motor; the speed is controlled by a frequency converter. Exhaust: Controls the start and stop of the UV chamber exhaust motor (exhaust for 1-6 UV lamps); Rotation 1 / Rotation 2: Controls the start and stop of the UV chamber's rotation motor; the speed is controlled by a frequency converter.
UV lamp	UV lamp master off: Controls the power on/off of UV lamps 1 to 6; UV lamps 1 through 6: Control the start and stop of each UV lamp respectively.
Cooling chamber	Air supply: Controls the start and stop of the cooling chamber air supply motor; Exhaust: Controls the start and stop of the cooling chamber exhaust fan motor ;

2.6.3 External Wiring

The required three-phase power supply for this machine is a three-phase four-wire 380VAC (or the type specified in the package); an additional 220VAC single-phase control power supply is also required. Please refer to the PLC control circuit diagram.

2.6.4 Precautions

Control Panel: The inverter panel is set to inactive; the operating frequency is set via the HMI. The inverter's internal functions are set to optimal values; please do not modify them arbitrarily.

Control box: Maintenance personnel should carefully read the instruction manual and master circuit diagram before performing maintenance. If there are any problems, please contact our company by phone.

External wiring: Do not remove wires, and ensure that the wiring is completely correct before powering on.

Before starting, please confirm that the mode displayed on the HMI screen is the same as the current mode of the machine. If they are not the same, please do not start, otherwise the machine will not be able to operate normally and will cause problems.

2.7 Paint Supply System

2.7.1 Composition and Principle

The paint supply system consists of paint storage tanks, agitators, paint pumps (pressure pumps), paint pipelines, paint pressure regulating valves, paint return valves, back pressure valves, and control systems.

The principle is to install a pressure pump on the paint tank to deliver the paint to the spray gun; the advantages are that the paint tank does not need to be sealed and pressurized, it is convenient to observe the paint consumption and replenish it, the pressure is stable and easy to adjust.

2.7.2 Operating Procedures

1. Insert the pump nozzle into the paint (solvent) container and connect the paint outlet and return lines.
2. Connect the air inlet connector to the pump actuator, turn on the actuator pressure switch, adjust the pump actuator pressure valve, and adjust the actuator pressure gauge pointer to [value missing]. $2.5 \sim 4 \text{ kg/cm}^2$.
3. Open all return paint valve switches and adjust the paint outlet pressure regulating valve to set the paint outlet pressure to $1.0\text{-}2 \text{ kg/cm}^2$.
4. Set the back pressure valve pressure to $0.5 - 1 \text{ kg/cm}^2$. The pressure displayed on the back pressure valve pressure gauge is the paint pressure inside the spray gun and paint delivery pipe, which keeps the paint pressure inside the pipe constant and unaffected by the spray flow rate.
5. After the paint is delivered normally, please check whether there is any residual air in the pipe. Once you are sure that all the air in the pipe has been expelled, you can proceed with the painting operation.

2.7.3 Cleaning Procedure

To ensure coating quality and extend the service life of the paint pump, operators should perform the following cleaning steps with solvent after each coating application:

1. Remove paint from the pump: Raise the paint filter head above the liquid level, open the paint return valve, and start the pump to drain any remaining paint from the pump.

2. Cleaning the pump: Place the pump nozzle into the solvent and turn on the pump return switch to clean the pump.

3. Cleaning the pipeline and spray gun: Turn on the pump return switch to start the pump and pump the solvent into the paint pipeline. Use the solvent to clean the paint residue in the paint pipeline. At the same time, turn on the manual spray switch to clean the spray gun.

4. Repeat cleaning: Take clean solvent and repeat the above steps to clean the pipeline and spray gun again, and let the solvent circulate in the pipeline until the next use, then remove the solvent.

2.7.4 Precautions

After each workday, the paint in the paint pipes should be drained and thoroughly cleaned with solvent.

Paint pipes and pumps should be checked regularly for leaks and blockages.

Paints and solvents are flammable materials. Smoking and open flames are strictly prohibited in the work area. Cover the containers immediately after use.

Chapter 3 Explanation of Functional Segments of the Linear Body

This chapter explains the structure, function, usage, and precautions of each functional section in the order of the process flow. The operation of fans, water pumps, heating, lighting, etc. in each section is centrally controlled by the electrical control cabinet/human-machine interface (HMI). For specific button and screen functions, please refer to the accompanying electrical schematic diagram.

3.1 Electrostatic dust removal (ion electrostatic dust removal)

3.1.1 Structure

- Electrostatic dust removal consists of : dust removal cabinet, ion air gun (static eliminator), dust blowing nozzle, air supply chamber and filter box, exhaust fan, etc.

- The supply air chamber filter box consists of : coarse-efficiency aluminum alloy louvers (e.g., 1830×1200), a primary paper frame filter (e.g., $595 \times 595 \times 25$), an F7 galvanized frame intermediate bag filter (e.g., $595 \times 595 \times 600 \times 6B$), and a supply fan; the outlet/inlet cut-off air box is equipped with... H13 galvanized frame aluminum partition high-efficiency filter. The filtered clean air is evenly delivered into the dust removal air supply chamber through the air supply chamber, and the air supply volume can be adjusted by a frequency converter.

3.1.2 Functions

Plastic products and vacuum-coated workpieces are prone to static electricity, making them highly susceptible to dust accumulation. This section utilizes a static eliminator to blow ionized air onto the workpiece surface, neutralizing static electricity and removing dust, thus ensuring coating quality. The equipment employs a long-headed, multi-hole static eliminator and dust removal system, combined with high-pressure airflow to remove dust.

3.1.3 Usage Method

- Confirm that the air source has been filtered to remove moisture and dust, and turn on the static electricity removal system to ventilate and exhaust, so that a stable airflow is formed in the dust removal chamber.
- It is recommended to use an air source pressure of 4 kg/cm^2 , with the nozzle distance from the workpiece. To achieve the best electrostatic and dust removal effect, the distance should be within 200mm .

After the air source strength is turned on, the efficiency of electrostatic removal and dust removal should be adjusted according to the site conditions, environment and actual situation.

- After the workpiece enters the dust removal section, it is manually cleaned by holding an ion gun and blowing it in sequence according to the shape of the workpiece, with a focus on cleaning grooves, corners and other areas that are prone to dust accumulation.
- After the operation is completed, the photoelectric switch will automatically turn off the ion gun, and then you can manually turn off the air supply and exhaust.

3.1.4 Precautions

When the static eliminator is in operation, the discharge needle will release high voltage and low current. Although it will not cause harm to people, please do not touch the discharge needle directly unless necessary.

It is essential to use a clean air source. Moisture and dust in the air source must be filtered out; otherwise, it will not only affect the cleanliness of the electrostatic discharge and dust removal, but also shorten the service life of the equipment.

When blowing, avoid blowing the same area directly with the air gun for a long time to prevent damage to the workpiece surface or the regeneration of static electricity.

The cleanliness of the dust removal room directly affects the coating quality, and the dust in the room must be cleaned after each shift.

3.1.5 Maintenance Items

Cleaning the discharge needle (once a week):

With prolonged use, organic crystals and dust may accumulate on the tip of the discharge needle. Please clean it with a cotton swab dipped in alcohol. Note: The power must be turned off during cleaning.

Filter box inspection:

Regularly inspect the pre-filter and medium-efficiency filter. If there is excessive dust accumulation or damage, replace them immediately. The air cut-out filter is semi-permanent. Since the air has already undergone the first stage of cleaning in the filter box, the loss rate is low. The replacement cycle can be ordered by contacting CICEL sales staff according to actual needs .

Regularly clean the dust accumulated in the ventilation room and exhaust ducts to maintain a stable airflow.

3.2 Flame Treatment

3.2.1 Structure

The flame treatment unit mainly consists of a water tank, a fan and exhaust system, and working positions; the flame treatment section comprises a flame gun (including gas/auxiliary gas pipelines, pressure regulating valve, and ignition device), a

workpiece support or rotation mechanism, and an exhaust system. The typical dimensions of the flame treatment cabinet (typical configuration) are approximately $W1300 \times D2000 \times H2500$ mm , and the exhaust fan power is approximately 1.5 kW .

3.2.2 Functions

Flame treatment utilizes a gas flame to instantly oxidize the surface of a workpiece, thereby improving the adhesion of UV coatings to the substrate. It is especially suitable for plastic parts that are difficult to adhere to, such as PP and PE . When the workpiece passes through the flame chamber, the support/rotation mechanism drives the workpiece to rotate, and the surface of the workpiece is treated by the flame gun. Subsequently, a fan creates negative pressure inside the chamber to remove the smoke and dust.

3.2.3 Usage Method

Before starting the machine, check whether the gas pipeline, pressure regulating valve, and ignition device are normal and confirm that there is no gas leak; check whether the water level in the water tank is in place.

Turn on the exhaust fan in the flame chamber and confirm that a negative pressure has been created inside the chamber before igniting the flame gun.

Adjust the angle, distance, and flame intensity of the flame gun to ensure the flame sweeps evenly across the workpiece surface. Control the processing time according to the process requirements to avoid overheating or under-processing.

After the operation is completed, first turn off the flame gun and cut off the gas supply. Then, wait for the smoke and dust inside the cabinet to be completely removed before turning off the exhaust fan.

3.2.4 Precautions

[Fire Prevention Warning] Flame handling involves open flames and gas, and fire prevention regulations must be strictly followed: Flammable materials must not be piled up in the work area, gas pipelines must not be near heat sources, and gas leaks must be checked before and after the work; no one may leave their post until the fire is completely extinguished.

Flame treatment involves high temperatures, resulting in high surface temperatures for the treated workpieces and cabinets. Do not touch them immediately.

It is essential to ensure proper ventilation to prevent unburned gases and smoke from accumulating inside the cabinet.

The water tank should be kept at the specified water level to prevent smoke and dust from escaping.

Gas pipelines should be installed and maintained by professionals, and leaks should be checked regularly.

3.2.5 Maintenance Items

Regularly check whether the motor buttons are working properly and whether the wiring is loose; if the fan or motor makes abnormal noises while running, stop the machine immediately for inspection and repair.

Regularly check and clean the carbon buildup on the flame gun nozzle, and check the gap between the ignition electrodes.

3.3 Solvent Processing Chamber

3.3.1 Structure

The solvent handling chamber consists of a chamber body (with a stainless steel or PP anti-corrosion lining), solvent spraying system, exhaust system, explosion-proof lighting, and electrostatic grounding device. The chamber includes workpiece support stations, and the water tank is equipped with an anti-liquid-accumulation slope and a collection trough.

3.3.2 Functions

It is used to wipe and spray the workpiece surface with solvent before spraying, to remove oil, release agent, fingerprints and residues from previous processes, and further reduce surface tension, providing a clean and activated adhesion surface for UV coating , thereby reducing solvent consumption and exhaust emissions.

3.3.3 Usage Method

Before starting the machine, confirm that the liquid level in the collection tank is normal and that the static grounding is in good condition.

Turn on the exhaust system to maintain a slight negative pressure in the room before starting the solvent treatment process . Only after the solvent has completely evaporated can the spraying process begin.

After the operation is completed, turn off the spray device and continue to exhaust for 5 to 10 minutes until the solvent vapor in the room is completely discharged, then turn off the exhaust.

3.3.4 Precautions

【 Explosion-proof Warning 】 The solvent vapor is flammable and explosive. Smoking and open flames are strictly prohibited in the work area. The use of non-explosion-proof electrical equipment is also strictly prohibited. Sparks and static discharge must not be generated during operation. The solvent should be stored in a sealed container and sealed immediately after use.

Solvent handling rooms must be well-ventilated, and the concentration of solvents in the room must not exceed the safety limits.

Operators must wear solvent-resistant gloves, goggles, and protective masks.

Waste solvents should be collected centrally and handed over to qualified units for recycling and disposal; indiscriminate dumping is strictly prohibited.

Solvents must not remain on the surface of the workpiece for an extended period of time to prevent corrosion of the substrate or the formation of watermarks or atomization.

3.3.5 Maintenance Items

After each shift, clean the accumulated liquid and paint residue in the collection tank to keep the pipeline unobstructed.

Regularly check valves for leaks or blockages, and clean or replace them promptly.

Regularly inspect indoor explosion-proof lighting and static grounding resistance to ensure they meet safety requirements.

Replace the solvent filter cotton/filter cartridge regularly.

3.4 Spray booth (dry type)

3.4.1 Structure

The dry spray booth consists of the booth body, workpiece support station, spray gun and paint supply pipeline, dry paint mist filtration system (dry filter box/filter cotton/labyrinth filter plate), ventilation filter box and exhaust system, lighting system, fire protection facilities, etc.

3.4.2 Functions

Dry spray booths rely on dry filter media to directly capture overspray paint mist, eliminating the need for a circulating water system. Filtered clean air is evenly supplied into the booth through an air supply chamber, replenishing the air exhausted from the spray booth and effectively suppressing paint splatter, directing the airflow towards the suction filter surface. Its advantages include no water treatment, no wastewater discharge, convenient color changes, and simple maintenance, making it suitable for small-batch, multi-variety production, frequent color changes, and applications where wastewater generation is unacceptable. Disadvantages include the need for regular filter media replacement, relatively high operating consumable costs, and unsuitability for large-scale continuous spraying.

3.4.3 Usage Method

- Check whether the dry filter material is installed flat and sealed tightly, and check whether the air supply and exhaust fans are rotating in the correct direction (clockwise is the correct direction for fan rotation).
- Turn on the exhaust fan and then the supply fan to create a stable unidirectional airflow in the room (maintain a slight negative pressure) before starting the spraying operation.
- Adjust the spray gun direction and position to the appropriate position; manually test spray to adjust the paint volume, atomized air, spray direction and spray width.
- When performing a test spray, the manual spray gun operator should spray the workpiece shape sequentially, controlling the gun distance, gun speed, and overlap to avoid drips and missed areas. If the workpiece needs to be rotated, safety precautions should be taken.
- After the spraying operation is completed, first turn off the spray gun and paint supply, then turn off the air supply and exhaust; clean the spray gun and paint pipe.

3.4.4 Precautions

- The cleanliness of the spray booth directly affects the coating quality, and the booth must be thoroughly cleaned after each workday.
- Dry filter media must be replaced promptly once it becomes saturated; otherwise, airflow will decrease, paint mist will escape, and there will be a fire hazard.
- Good directional airflow must be maintained indoors to ensure that paint mist does not diffuse to the work area and adjacent functional sections.
- When operating a spray gun, avoid spraying the same area continuously for a long time to prevent the paint film from becoming too thick and sagging.
- Smoking and open flames are strictly prohibited indoors; fire extinguishers must be provided. Waste filter materials (including paint residue) should be properly collected and disposed of as hazardous waste.

3.4.5 Maintenance Items

Daily tasks: After each shift, clean the indoor floor, walls, and workstations to remove accumulated paint; clean and maintain the spray gun nozzles and air caps.

Filter media: Regularly check the dry filter/filter cotton. Replace it immediately if it is too dirty or damaged. When replacing, the filter cotton should be laid flat and pressed tightly to prevent leakage.

Fan: Regularly check the fan motor temperature (if the fan motor temperature is $> 60^{\circ}\text{C}$ during daily inspection, the machine should be stopped for inspection), belt tension, and whether there is any leakage of lubricating oil in the bearing position.

Regularly inspect vulnerable parts such as the spray gun's firing pin and sealing ring, and replace them promptly.

3.5 Spray booth (wet water curtain)

3.5.1 Structure

A wet spray booth (water curtain spray booth) mainly consists of a water tank, water curtain chamber, water pump, fan and exhaust system, and workstations. The rinsing chamber includes spray pipes, baffles, overflow troughs, and water curtain panels. Typical cabinet dimensions are approximately $\text{W}3000 \times \text{D} 2500 \times \text{H} 2500\text{mm}$ (spray booth) or $\text{W} 2500 \times \text{D} 2500 \times \text{H} 2500\text{mm}$ (PP cabinet). The water pump power is $0.75 \sim 1.5 \text{ kW}$, and the exhaust fan power is $4 \sim 7.5\text{kW}$. The air supply and

filtration box consists of coarse louvers, a 35% primary paper frame pleated filter, an F7 medium-efficiency bag filter, and a blower. The spray booth air supply chamber is equipped with H1 3... Sub-HEPA filter.

3.5.2 Functions

The wet spray booth utilizes a water pump to circulate water, creating a mist within the rinsing chamber and a large water curtain outside. This absorbs and washes away excess paint mist, mixing it with water and allowing it to settle in the pool. The improved roll-up water washing station boasts a replenishment efficiency of over 95% . The water curtain panel is less prone to paint adhesion, facilitating cleaning and maintenance, and meeting environmental protection requirements. Simultaneously, exhaust fans and ductwork ensure unidirectional airflow within the work area, preventing paint mist from escaping and causing pollution or harm to operators' health.

3.5.3 Functions of Each Part

Water tank: Stores liquid used to clean paint mist during the production process (mainly water, detergents such as dish soap or AB agent can be added if necessary).

Rinse chamber: Includes water spray pipes, baffles, overflow troughs and water curtain plates, etc. It relies on the circulation action of the plugless liquid pump to make the water in the water tank circulate, overflow from the overflow trough and flow through the water curtain plate to form a smooth water curtain.

Water pump: circulates water to form a water curtain and generate a spray.

Fans and exhaust system: Excess paint mist generated during production is drawn into the water curtain chamber for secondary filtration, and the air in the work area flows in one direction.

Workstation: A workstation for spray painting, which is a four-sided enclosed space that allows only one-way airflow.

3.5.4 Usage Method

- Check for leaks in the pipes and check if the power supply voltage is normal.
- When using this machine for the first time, fill the water tank with clean water to a depth of about 350mm (as marked by the arrow), and check that the filter box at the water pump inlet is properly placed to prevent paint residue from entering and clogging the water pump.

- Turn on the water pump motor switch and check the direction of rotation, water flow, spray angle and pressure of the water pipe, and the effect of water curtain formation. You can also adjust the corresponding valves to set the spray pressure and the flow rate of the water curtain.
- Check the fan rotation direction (clockwise is positive): Press the start button lightly and stop immediately to check the rotation direction, or check whether the side door is sucked in after the fan starts. If it is not sucked in, the rotation is incorrect.
- Turn on the water curtain in the order of “ water curtain → exhaust → air supply ” , and start the spraying operation after confirming that the water curtain is formed and the airflow is stable.
- After the operation is completed, remove paint residue from the water, drain or replace the circulating water, and clean the spray gun and paint hose.

3.5.5 Precautions

- The water level in the pool must be kept within the specified range. Insufficient water level will cause the water curtain to fail and paint mist to escape.
- No workpieces, adhesive tape, or other debris should fall into the water tank, otherwise foreign objects may enter the exhaust fan and cause damage to the fan. Paint residue must be cleaned daily to prevent clogging of pipes and damage to the water pump.
- The water source for the water curtain of the water washing station is the water inside the spray booth. Long-term use can easily clog the water pipes, reduce the water flow of the water curtain, and make it easier for paint to adhere to the water curtain panel. The water pipes should be cleared regularly (once a week).

3.5.6 Maintenance Items

- Before leaving get off work each day, open the side door of the water mist chamber and clean the oil residue inside the baffle plate.
- Regularly drain the wastewater from the water tank and refill it with clean water; adding an appropriate amount of laundry detergent or dish soap to the pool helps the paint settle and improves the cleaning effect.
- Clean the paint residue from the water tank once a day; do not open the filter tank until the paint residue has been cleaned.
- Regularly inspect the air filter and replace it immediately if it is too dirty or damaged; the air filter at the entrance and exit of the paint booth is a semi-permanent

type, and the replacement cycle can be ordered by contacting CICEL salesperson as needed .

- Regularly check whether the motor buttons are working properly and whether the wiring is loose; if the water pump, fan, or motor makes abnormal noises while running, stop the machine immediately for inspection and repair.

3.6 IR Infrared Leveling Section (Infrared Leveling Furnace)

3.6.1 Structure

The IR leveling furnace mainly consists of a furnace body, an infrared heating system (IR-C far-infrared heating tube), a hot air circulation fan (optional) , a temperature control system (temperature controller + temperature probe), and a conveying mechanism. A typical configuration uses a straight far-infrared quartz heating tube, with specifications including length... The oven has an 800mm diameter , 1000W power rating, and a 0.75kW internal heat circulation fan (optional) . The oven baking temperature is adjustable from 60 to 100 °C . The IR curing oven mainly consists of the oven body and a heating control system.

3.6.2 Functions

The IR leveling section uses fixtures on the conveyor line to transport the workpiece to a baking oven equipped with an infrared heating system for drying and leveling. With a built-in IR-C far-infrared heating tube, the workpiece absorbs infrared radiation energy in the baking oven, causing the solvent in the wet film to pre-evaporate evenly, resulting in a dense and leveled coating. This eliminates defects such as orange peel and pinholes caused by spraying, providing a smooth coating surface for subsequent UV curing.

3.6.3 Usage Method

- Check whether the heating element is damaged and whether the wiring terminals are loose.
- Restart heating; set the desired temperature (adjustable from 60 to 100 °C) via the thermostat. The thermostat detects the actual temperature using the temperature probe and compares it with the set temperature. If the set temperature is not reached, heating continues. Once the set temperature is reached, the solid-state relay automatically shuts off. It automatically reheats when the temperature drops.

- Adjust the furnace temperature and dwell (leveling) time according to the workpiece shape, coating thickness and solvent evaporation characteristics.

3.6.4 Precautions

The furnace temperature should not be set too high to avoid premature film formation on the coating surface, which would prevent the internal solvent from escaping and cause pinholes and blistering; it should also not be set below the lower limit of the process to prevent insufficient leveling.

The furnace body and heating element surfaces are hot, so they should not be touched during operation or for a short period after shutdown.

To prevent localized overheating and solvent vapor buildup inside the furnace.

If any workpieces are found to have fallen inside the furnace, they should be cleaned up promptly to prevent fires caused by prolonged baking.

3.6.5 Maintenance Items

Regularly clean the paint residue and dust from the furnace walls, air ducts, and heating tube surfaces to maintain heat transfer efficiency.

Regularly check whether the heating element, thermocouple (temperature sensing rod) and temperature controller are working properly, and calibrate the temperature if necessary.

Regularly check bearing lubrication and replenish or replace lubricating grease as needed.

Regularly check the furnace insulation layer to ensure it is intact and reduce heat loss.

3.7 UV Curing Chamber

3.7.1 Structure

The UV curing chamber consists of the oven body, UV lamps, a UV power supply (intelligent UV inverter power supply), an exhaust system, an air supply system, and a control system. Typical configuration dimensions are approximately L 3000 - L4000 × W 2000 × H 2200mm ; the UV lamp configuration can be 5.6kW × 6-9 units (6 lamps total, 2 on the top, 2 on the sides , and 2 on the bottom , with omnidirectional adjustment rods to achieve irradiation without blind spots), the UV exhaust fan power is 3.0kW , and the UV air supply fan power is... 4 kW . UV curing chamber air supply

chamber equipped with H13 High-temperature resistant high-efficiency filter with galvanized frame and aluminum partition ($595 \times 595 \times 292$, 2 sets).

The UV power supply adopts an intelligent digital frequency converter, with key technical features including: using the HV3000 series - G5200 intelligent power supply ; equipped with an LCD screen HMI control box ; constant and steplessly adjustable output power; power setting resolution of 0.1kW ; output frequency of 16kHz ; efficiency up to 97 % ; comprehensive protection functions including phase loss, overcurrent, overload, overtemperature, undervoltage, and overvoltage; standard RS485 (MODBUS-RTU) communication interface, enabling multi-unit parallel networking or external PLC control; and lamp running time recording function.

3.7.2 Functions

UV inks/coatings dry using ultraviolet light, without the need for heat curing. UV lamps emit high-energy ultraviolet light of a specific wavelength (365nm), causing the photoinitiator within the UV coating to rapidly decompose and generate free radicals. This triggers cross-linking and polymerization of monomers and oligomers, achieving instant drying and curing, resulting in a coating surface with high gloss, abrasion resistance, and solvent resistance. The exhaust system removes heat from the UV lamps from the oven to prevent workpiece deformation due to excessive heat; the air supply system provides clean cooling air to the lamps and the oven, ensuring lamp life and a clean curing environment.

3.7.3 Usage Method

- Before starting the machine, ensure that the UV lamps and reflectors are clean and that the air supply and exhaust systems are functioning properly; also, ensure that the UV power supply is reliably grounded.
- Turn on the following functions in the order of " air supply → exhaust → rotation (if applicable) → UV lamp main switch → select UV lamp as needed " ; the air supply, exhaust, and static elimination motors should be running normally for about 10 to 15 seconds before starting the next function switch.
- UV lamps to use based on the performance of the product and UV paint , and accurately set the output power through the UV power supply (or HMI , PLC).

- The UV lamp has an ultraviolet wavelength of 365nm and an effective radiation diameter of approximately 200mm . When using it, the distance between the workpiece plane and the lamp tube should be within 150mm , and the position of the lamp holder should be adjusted according to the different heights of the workpiece.
- When the UV lamp is working normally, it needs to wait about 2 minutes after the power is cut off before it can be restarted (the time controller is usually set within 5 minutes). It can only be restarted after the lamp has cooled down.
- After the operation is completed, shut down the machine in the following order: “UV lamps off → exhaust → air supply ” . Check if any products have fallen into the UV chamber.

3.7.4 Precautions

【UV and High Voltage Warning】 The UV lamp light is strong and harmful to human skin and eyes. Do not look directly at the light source for a long time during operation. Personnel must wear protective clothing and protective glasses. After the UV lamp is turned off, the capacitor still retains a high voltage of about 900V. It is strictly forbidden to touch the two poles of the capacitor with your hands. The capacitor must be fully discharged before maintenance.

[Fire Warning] At the end of each workday, the UV lamps must be turned off, and the UV chamber must be checked for any fallen products. If any are found, they must be cleaned up immediately to prevent fire. (The bottom lamp illuminates the products underneath; if any products fall onto the bottom lamp, prolonged operation may cause a fire.)

- UV lamps have a certain lifespan, with domestically produced lamps typically lasting 800 to 1000 hours. The usage time can be accumulated using a timer, and the lamp must be replaced when the timer reaches the end of its lifespan (the device screen records the usage time of each lamp, which can be cleared by pressing CLR after replacement).
- The thermal relay of the control system must be set according to the rated current of the motor power supply ;

- The UV power supply must be installed vertically to ensure heat dissipation; the installation environment temperature should not exceed 60 °C , the humidity should not exceed 80% , there should be no corrosive gases, and the ventilation should be good.
- Do not install power factor correctors and surge absorbers at the power output terminal; the parameters in the control box are already set to optimal values and should not be modified arbitrarily.

3.7.5 Maintenance Items

UV lamp tubes and reflector surfaces with anhydrous ethanol to remove dust and paint mist and maintain light transmission and reflection efficiency (power must be turned off and the lamp tubes must be cooled before cleaning).

UV lamp tube using the timer ; gloves must be worn during replacement to avoid contaminating the quartz tube wall with finger oils.

Regularly check the UV power supply cooling fan and vents for blockages, and clean the accumulated dust to ensure heat dissipation.

H13 high-temperature resistant high-efficiency filter in the air supply chamber ; replace it immediately if there is excessive dust accumulation or damage.

Regularly check the UV power supply fault records and operating status to confirm that there are no alarms such as over-temperature or over-current.

3.8 AHU Fresh Air System (Air Supply and Purification Unit)

3.8.1 Structure

AHU fresh air system (air supply unit) consists of a coarse louver filter section, a primary paper frame filter section, a medium-efficiency bag filter section, a fan section, air ducts, air valves, and a high-efficiency (sub-high-efficiency) filter section. A typical configuration includes: a UV air supply purification system (L3000 × W 1520 × H 2010mm , one air supply box fan power 5.5kW); and a UV spray booth and dust collection cabinet air supply purification system (L 3000 × W 3040 × H 2010mm , two air supply boxes fan power 15kW , air supply spray water pump power 0.25kW) . PP Air supply and purification system for spray booths and flame booths

(L3000 × W3040 × H2010mm , two air supply boxes with 15kW fan power) . The power of the air supply sprinkler pump is 0.25 kW .

3.8.2 Functions

The AHU fresh air system is responsible for supplying multi-stage filtered clean air to each functional section and maintaining the pressure difference between the workshop and each functional section (the spray booth maintains a slight negative pressure to prevent paint mist from flowing into the machinery and adjacent clean areas). Its working principle is as follows: changes in the cross-sectional area of the ventilation ducts in the delivery system convert the dynamic pressure of the flowing gas into static pressure, and the air supply needs of each piece of equipment are met through adjustments to the valves of the various air-consuming devices. The air supply volume is adjusted by a frequency converter, and the operating frequency can be set according to the site conditions.

3.8.3 Usage Method

Before starting the machine, check that all air supply dampers are tightly closed; do not start the fan if any dampers are not closed.

Start the fan in the order of " supply air → exhaust air " ; if you hear abnormal noise after starting the fan, stop it immediately and check the fan (remember to press the emergency stop switch when checking).

According to the needs of each functional section, the operating frequency of air supply volume 1 , 2 and dust removal air supply volume is set by frequency converter to keep the spray booth under slight negative pressure.

Routine checks: fan motor temperature ($> 60^{\circ}\text{C}$ requires shutdown for inspection), belt tension, and whether there is any leakage of lubricating oil in the bearing positions.

When shutting down, close the exhaust air in the order of “ exhaust air → supply air ” . For long-term shutdown, the fresh air valve should be closed.

3.8.4 Precautions

When replacing filter cotton, please note the following: When pressing the filter cotton frame, make sure the cotton is laid flat and pressed tightly without any leaks;

when replacing filter bags, make sure the filter bags are properly installed and the bag frames are flat to avoid affecting air cleanliness.

Do not start the fan when the door is not closed to avoid loss of airflow and the entry of foreign objects.

If abnormal noise or vibration occurs during the operation of the fan, it should be stopped immediately for inspection. It must not be operated while malfunctioning.

The fresh air inlet should be kept away from the exhaust outlet and pollution sources, and the air inlet filter should be cleaned regularly.

3.8.5 Maintenance Items

Regularly inspect and replace coarse, medium, and high-efficiency (or sub-high-efficiency) filters, and record the replacement dates.

Regularly check the tension of the fan belt and adjust it in time; check the bearing lubrication and replenish the grease.

Regularly clean dust from air ducts, valves, and air outlets to maintain stable airflow.

Regularly check the working status of the damper actuator and frequency converter to confirm that the air volume regulation is normal.

Chapter 4 Equipment Maintenance

4.1 General Maintenance Requirements

This equipment should be operated and maintained by qualified personnel; electrical repairs must be performed by a certified electrician.

Before performing maintenance work, the power must be disconnected and a warning sign must be posted; work involving UV lamps, capacitors, and heating elements must be carried out after they have cooled down and been fully discharged.

Establish equipment maintenance records, and register each item such as filter replacement, lamp replacement, lubricant addition, and troubleshooting to facilitate traceability.

If any abnormalities are found during maintenance (abnormal noise, odor, leakage, abnormal temperature rise, etc.), the machine should be stopped immediately for repair. It must not be operated while malfunctioning.

4.2 Routine Maintenance

Part	Maintenance content	Key Points
Spray booth (dry/wet)	Clean the indoor floors, walls, and work areas of accumulated paint; remove paint residue from the water tank.	Whether the paint booth is clean or not directly affects the coating quality.
Water curtain cabinet	Open the side door of the water mist chamber to clean the oil residue inside the baffle plate.	To prevent oil residue from clogging pipes and burning out the water pump
spray gun and paint hose	Clean all painting tools, spray guns, diaphragm pumps, and paint hoses, keeping organic solvents in place. Immerse the spray gun atomizing caps in the organic solvents.	Prevent paint from hardening and clogging
UV curing chamber	After turning off the UV lamps, check the room for any fallen products and clean it up.	To prevent fires caused by products falling from the bottom light after prolonged exposure.
UV power supply	Check the operating status and fault records to confirm there are no alarms.	Pay attention to over-temperature and over-current protection actions.
Combustion/Flame Section	Turn off the flamethrower, cut off the gas supply, and check for leaks.	Please be careful with fire !

4.3 Weekly Maintenance

Cleaning the discharge needles of the electrostatic dust removal section: Wipe with a cotton swab dipped in alcohol (the power must be turned off first), once a week.

Self-rotating belt wear dust removal: Use an air gun or vacuum cleaner to remove belt wear dust once a week.

Control cabinet cleaning: about once a week, open the control cabinet and use an air gun to clean the inside of the cabinet and the surface of the switches from a distance; before blowing, make sure that the air being sprayed does not contain moisture.

Control cabinet filters: There are twelve filters on the top and bottom of both sides of the cabinet. They should be removed and cleaned approximately once a week to maintain smooth airflow inside the cabinet and reduce the temperature inside the cabinet.

Water curtain pipe unclogging: every 2 weeks, to prevent pipe blockage from reducing water flow and paint buildup on the water curtain panels.

4.4 Monthly Maintenance

Grease the bearing housing every two weeks using a grease gun.

Conveyor chain: Regularly apply grease or chain oil to the bushing to keep the chain and track adequately lubricated; regularly clean the oil stains on the conveyor belt sprockets and inject grease.

Self-rotating belt inspection: Check for severe wear, and replace it immediately if necessary; check the tension of the self-rotating belt and the pulley assembly.

Fan: Check the fan motor temperature, belt tension, and whether there is any leakage of lubricating oil in the bearing housing.

Filter media: Check the dust accumulation in the pre-filter and medium-efficiency filter, and replace them if necessary.

4.5 Annual maintenance

Gearbox oil change: Initial use Replace the oil after 300 hours, and then every 2500 hours thereafter .

High-efficiency/sub-high-efficiency filters should be replaced according to their service life.

Comprehensive inspection of the electrical system: tightness of circuit breakers, contactors, relay contacts, and wiring terminals; grounding resistance test.

UV lamps and IR heating tubes should be replaced based on their cumulative usage time.

Temperature controller and thermocouple calibration; UV power supply insulation and protection function testing.

4.6 Reference for Key Consumables and Replacement Cycles

Consumable Name	Recommended replacement cycle	Illustrate
Coarse filter screen (aluminum alloy louvered plastic mesh)	Clean regularly according to the amount of dust accumulation.	Washable and reusable
35% Primary Paper Frame Pleated Filter	1 to 3 months	Judge based on pressure difference and dust accumulation.
F7 (85%) medium-efficiency bag filter	3 to 6 months	Judging by pressure difference
H1 3 High-efficiency filter	8 to 12 months	According to pressure difference and cleanliness requirements
H13 High Temperature Resistant High Efficiency Filter (UV Segment)	According to dust accumulation and damage	Note: High temperature resistant type required.
UV lamp tube 778mm-5.6kw	800-1000 hours	According to the timer's record, press CLR to reset after replacement.
IR far-infrared heating tube	According to performance degradation	Pay attention to the decrease in heating efficiency
Gearbox oil	The first 300 hours, then every 2500 hours.	It is recommended to use the specified brand.
spray gun firing pin,	According to wear	Affects atomization and

sealing ring	condition	paint volume stability
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Chapter 5 Troubleshooting Tips for UV Coating Lines

The following are suggested troubleshooting methods compiled by our company based on common operating conditions of the equipment and the accompanying technical documentation, for reference by operators and maintenance personnel. In addition to the fault causes displayed on the HMI, there may be other possible abnormal conditions; for abnormalities not listed in the table, please refer to the HMI prompts or contact our company by phone. Before performing any maintenance, please be sure to disconnect the power supply and ensure safety.

5.1 Conveying/Rotation/Main Drive System

Abnormal situation	Possible reasons	Elimination methods
The spray nozzle and its rotation cannot move.	1. Inverter malfunction 2. Inverter operation signal malfunction	1. Check the inverter display panel; if there is no display, it needs to be replaced. 2. Check the controller using the I/O table to verify if the signals are normal.
The self-rotating belt cannot move.	Belt wear and breakage, bearing damage	Replace with new products
The main drive cannot move.	Foreign objects are stuck on the conveyor belt	Stop the machine, inspect and remove foreign objects.
Chain slippage and unstable operation	1. The chain is too loose or too long. 2. The chain's feed pulley is contaminated with oil.	1. Adjust the chain tensioning slide (air pressure adjustment setting: 2-3 kg/cm ² ; manual adjustment torque: approximately 120-130 kgf/cm ²); confirm that the chain tensioning cylinder pressure is ≥ 3 kg/cm ² . 2. Clean the oil stains from the material transfer shaft wheel.
Chain elongation	Chains naturally elongate	Two or four chain links can be

exceeds adjustment range	over long-term operation	removed at a time, preferably in even numbers. Do not strike the chain during disassembly or assembly. When assembling, make sure the clasp is properly engaged in the groove.
Uneven rotation or stoppage of the workpiece	1. Insufficient tension in the self-rotating belt. 2. Loose pressure roller in the pulley assembly. 3. Too loose drive chain.	1. Adjust the tension adjusting screw of the self-rotating belt 2. Tighten the middle screw of the material handling roller assembly. 3. Adjust the motor mounting plate screws to ensure proper tension in the transmission chain.

5.2 Spraying and Paint System

Abnormal situation	Possible reasons	Elimination methods
Spray gun not producing paint	1. Spray gun malfunction 2. Spray gun switch failure 3. Solenoid valve malfunction	1. Check the spray gun's firing pin or other parts for damage. Replace any damaged parts; if severely damaged, replace the entire gun. 2. Check the switch wiring connections for poor contact or damage. Replace any damaged connections. 3. Check if the solenoid valve has 220V voltage. If it has voltage, check if air is coming out. You can disassemble it to check for foreign objects obstructing the flow. Replace any damaged parts.
Poor spray atomization and uneven paint film	1. Improper atomizing air pressure; 2. Improper paint level control valve setting; 3. Paint buildup or wear on the nozzle/air cap.	1. Adjust the atomizing air pressure (approximately 3 kg/cm²). 2. Reset the paint outlet pressure regulating valve (1.5 – 2 kg/cm²). 3. Clean or replace the nozzle and air cap.
Paint drips, orange peel	1. Single coat too thick 2. Solvent evaporation too fast or too slow	1. Adjust the production line speed and spray gun flow rate to control the single-layer film

	3. Insufficient leveling temperature/time	thickness . 2. Adjust the solvent ratio according to the process. 3. Adjust the IR leveling temperature and residence time.
Poor coating adhesion and peeling	1. Incomplete static electricity removal and dust removal. 2. Insufficient or excessive flame treatment . 3. Inadequate solvent treatment or oil stains on the surface.	1. Check the cleanliness of the gas source and the distance to the nozzle; redo the dust removal process. 2. Adjust the flame intensity and processing time . 3. Replace with a clean solvent and standardize the processing procedure.
Unstable output pressure of paint pump	1. Improper actuation pressure setting; 2. Improper back pressure valve setting; 3. Residual air in the circuit or blockage of the filter head.	1. Adjust the actuation pressure to 3.5-4 kg/cm ² 2. Set the back pressure valve to 0.5 ~ 1 kg/cm ² . 3. Purge air from the pipe, and clean or replace the filter head.
Paint supply pressure fluctuations and paint outlet pulsations	1. Insufficient pressure in the oil-water separator. 2. Return valve opened too wide.	1. Turn on the oil-water separator and adjust the pressure to approximately 8 kg/cm ² . 2. Close the return oil valve of the spray gun and paint pressure regulating valve to 95% , allowing a small amount of return oil.

5.3 Water curtain booth/wet spray booth

Abnormal situation	Possible reasons	Elimination methods
Insufficient wind	1. Power phase disorder after repair and restoration of power supply due to external line fault. 2. Blockage at the fan's air intake or exhaust vent.	1. Adjust the power connection. 2. Clear any obstructions.
Fan vibration	1. Prolonged water shortage or incomplete paint filtration leading to paint adhering to	1. Remove any adhering debris and add water as required. 2. Remove any foreign objects

	the fan blades causes imbalance. 2. Foreign objects on the impeller.	and readjust the fan blades to maintain balance.
The cleaning was incomplete, resulting in a large amount of paint being discharged outdoors.	1. Insufficient water in the paint sprayer. 2. The paint used is not prone to settling.	1. Add enough water to the required level; adding laundry detergent or dish soap to the tank can help with sedimentation. 2. Adjust the paint/solvent formula or replace the paint that is prone to sedimentation.
The water curtain is not properly formed, and paint is adhered to the water curtain panel.	1. Insufficient water level; 2. Clogged water hose or improper spray angle; 3. Blocked pipes due to prolonged use.	1. Add water to the specified level (approximately 350mm deep initially). 2. Clean the spray hose and adjust the spray angle and pressure. 3. Regularly unclog the water hose (every two weeks).
The motor makes a dull humming sound when it runs.	1. Phase loss in motor power supply. 2. Phase loss caused by poor contact of the power switch contacts.	1. Check if the power supply is normal. 2. Check the power switch contacts; replace the switch if necessary.

5.4 Flame Treatment Section

Abnormal situation	Possible reasons	Elimination methods
The flame is difficult to ignite or easily goes out.	1. Insufficient gas pressure; 2. Improper ignition electrode gap or carbon buildup; 3. Clogged nozzle.	1. Check gas pressure and pipeline valves. 2. Adjust ignition electrode gap and clean carbon deposits. 3. Clean or replace the nozzle.
Uneven flame treatment effect	1. Inappropriate workpiece rotation speed; 2. Inconsistent flame gun distance/angle; 3. Excessive exhaust from the flame chamber carrying	1. Adjust the flame chamber rotation speed using a frequency converter . 2. Adjust the position, angle, and distance of the flame gun uniformly .

	away the flame.	3. Reduce the exhaust fan slightly to maintain a slight negative pressure inside the cabinet.
Smoke and dust escaped from inside the cabinet	Insufficient exhaust volume or blocked exhaust duct	Inspect and clean the exhaust ductwork to increase the exhaust volume.

5.5 IR Leveling/UV Curing System

Abnormal situation	Possible reasons	Elimination methods
The furnace temperature cannot be raised	1. Heating element damaged; 2. Solid state relay malfunction; 3. Temperature controller or temperature sensor malfunction.	1. Measure the resistance of the heating element; replace if damaged. 2. Check the continuity of the solid-state relay; replace if necessary. 3. Replace the thermostat or temperature sensor and recalibrate.
Incomplete curing of coating, sticky surface	1. UV lamp power setting too low; 2. Lamp tube aging, light intensity attenuation; 3. Lamp spacing too large (exceeding 150mm); 4. Production line speed too high, resulting in insufficient irradiation time.	1. Increase output power via UV power supply (HMI/PLC) 2. Replace lamps after 800-1000 hours of lifespan 3. Adjust the distance between the workpiece surface and the lamp to within 150mm. 4. Adjust the production line speed or increase the number of UV lamps used.
UV lamp not working/frequently turning off	1. UV power supply protection trips (over-temperature, over-current, phase loss) 2. Lamp life expires 3. Insufficient restart interval	1. Check the UV power supply status and fault codes (refer to Section 5.6), troubleshoot and then reset. 2. Replace the lamp. 3. After powering off, wait approximately 2 minutes (or 5 minutes if the timer is set) for the lamp to cool down before restarting.

UV curing chamber temperature too high	1. Insufficient airflow. 2. Exhaust fan malfunction or blocked exhaust duct. 3. Temperature controller setting too high.	1. Check and increase the exhaust volume (exhaust control is based on UV lamp grouping). 2. Inspect the exhaust fan and exhaust ductwork 3. The temperature controller is generally adjusted to around 65 °C.
The curing chamber has an odor and smoke.	The product fell and was exposed to the bottom light for a long time.	Immediately stop the machine, turn off the UV lamps, and remove any fallen products. Before restarting the machine, always check the UV chamber for any fallen products.

5.6 UV Power Supply Alarm and Fault Definition

This equipment uses an intelligent digital frequency converter power supply for its UV power supply, and comes standard with an eight-segment LED display (an LCD screen is optional). It supports RS485 (MODBUS-RTU) communication and can read operating status and fault information. When an alarm occurs, the fault information can be read through the handheld control box/ HMI . Common fault status definitions can be found in the UV power supply manual .

5.7 AHU Air Supply/Exhaust Gas Treatment System

Abnormal situation	Possible reasons	Elimination methods
Abnormal pressure differential in the workshop (paint mist escaping)	1. Incorrect air supply or exhaust volume setting; 2. Clogged filter causing reduced airflow; 3. Door not closed.	1. Adjust the air supply and exhaust volume using a frequency converter to maintain a slight negative pressure in the spray booth. 2. Inspect and replace the filter. 3. Close all doors before starting the fan.
abnormal noise/vibration of the fan	1. Improper belt tension. 2. Insufficient lubrication or worn bearings. 3. Impeller imbalance	1. Adjust the fan belt tension. 2. Check bearing lubrication; add grease or replace the bearings.

		3. Clean dust from the impeller and perform dynamic balancing.
Cleanliness not up to standard	1. Medium/high efficiency filter failure. 2. Filter cotton/filter bag uneven installation or leakage.	1. Replace the filter according to the cycle or differential pressure. 2. When replacing, ensure the filter cotton is laid flat, pressed tightly to prevent leaks, and the filter bag is properly installed and the bag frame is flattened.
Poor exhaust gas treatment effect and strong odor	1. Failure of the exhaust gas treatment water pump or water pump impeller motor. 2. Circulating water has not been changed for a long time.	1. Overhaul the exhaust gas treatment water pump (2.2kW) and water pump impeller motor (4kW). 2. Regularly change the circulating water and clean away paint residue.

5.8 Electrical Control System

Abnormal situation	Possible reasons	Elimination methods
The device cannot start.	1. Circuit breaker not closed or key switch not turned on. 2. Incorrect password entered for HMI. 3. Mode inconsistent with actual machine.	1. Turn on the circuit breaker switch inside the control box and turn on the key switch on the control box panel. 2. Re-enter the correct password. 3. Before starting, confirm that the mode displayed on the HMI screen is the same as the machine's current mode; if they are different, do not start.
The buzzer is not working.	Buzzer malfunction or circuit fault	Inspect the buzzer and its wiring; replace if damaged.
Inverter has no display	Inverter failure	Check the inverter display panel; if there is no display, it must be replaced. Note that the inverter panel is set to inactive; the operating frequency is set via the HMI, and the internal functions are already set to optimal values. Do not modify them arbitrarily.

Temperature control failure	Thermostat or temperature sensor malfunction	Replace and recalibrate; the thermostat compares the actual temperature detected by the temperature sensor with the set temperature. If the set temperature is not reached, heating continues; if it is reached, the solid-state relay automatically shuts off.
PLC input/output malfunction	Poor contact at contacts, I/O module failure	View the PLC input and output status through the HMI [Status Screen], and check each I/O item one by one.

Note: Repair personnel must carefully read the instruction manual and master circuit diagram before performing any repairs. If any problems arise, please contact our company by phone. Do not allow external wiring wires to come loose, and ensure all wiring is completely correct before supplying power.

Chapter 6 Appendix

6.1 Technical Data

Document Name	quantity	Remark
Instruction Manual	1 copy	This document
Electrical schematic diagram	1 copy	Random delivery
UV Power Supply Instruction Manual	1 copy	Random delivery

6.2 Operating Procedure Summary

1. Power on

1. Turn on the circuit breaker switch inside the control box; turn on the key switch on the control box panel.
2. The human-machine interface requires a password (username 1 - password 1879) . Only after the password is correct can you enter each screen. Turn on the

operation switches and related values of each screen in sequence as needed and enter appropriate values (to modify the values, you need to enter the password again: username 2 - password 188).

3. Select the appropriate spray booth according to actual needs and turn it on in the following order: " water curtain → exhaust → air supply → rotation 1 → rotation 2 " ; turn on the dust removal systems of IR heating drying room 1 , drying room 2 , and drying room 3 as needed .
4. Turn on the exhaust, air supply, and static electricity eliminator; the motor must be running normally for approximately [time period missing]. 5 ~ 10 The next function switch will be activated in seconds.
5. Air conditioning (AHU) system adjustment: Adjust the supply air volume 1 , 2 , and electrostatic dust removal air volume to appropriate levels before restarting.
6. UV chamber is turned on in the following order: " Air supply → Air exhaust → Rotation 1 → Rotation 2 → UV lamp main switch → Select UV lamp as needed " ; the cooling chamber is turned on in the following order: air supply and air exhaust.
7. Adjust the spray gun direction and position to the appropriate level; manually adjust the paint volume, atomized air, spray direction, and spray width.
8. Chain tension cylinder adjustment: Input air to the pressure regulating switch and adjust the pressure gauge to above 3 kg/cm² . At this time, the cylinder will activate and tighten the chain, allowing the machine to operate normally (after tightening, adjust the adjusting screw on the slide).

2. Power off

1. Clean all painting tools, spray guns, and diaphragm pumps , and keep the spray gun nozzles filled with organic solvents, while immersing the spray gun atomizing caps in organic solvents.
2. Turn off the power switch and circuit breaker.

If there are any details that you are interested in that are not clearly explained in this manual, please feel free to contact us.

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