

Linton

SILICON CLEANER

FIT-SLQX14E-001



一. 设备整体概述

I. Equipment Overview

1.1. 设备性能 Equipment Characteristics

1.1.1. 设备描述 Equipment Description

序号 No	项目 Item	描述 Description
1	主要功能 Main functions	对太阳能级硅材料表面清洗处理，去除表面附着的固体颗粒、有机物、金属离子等污染物和自然氧化膜 Cleaning the surface of solar grade silicon material to remove pollutants such as solid particles, organic matter, metal ions and natural oxide film attached to the surface
2	上下料 Loading and unloading	全线自动，匹配现行手动工艺 Automatic in the whole line, matching the current manual process
3	过程控制 Process control	品牌工控机+品牌 PLC 自动控制，设备自动处理 Automatic control of brand IPC+brand PLC, and automatic processing of equipment
4	UPTIME	98% (22h/天，年工作日在 353 天以上) 98% (22h/ day, annual working days more than 353 days)
5	MTBF	>200H
6	MTTR	<2H
7	设备噪音 Noise	≤85dB
8	满足功能 Functions satisfied	全线自动酸洗、水洗及烘干，匹配现行手动工艺 Automatic acid cleaning, rinsing and drying of the whole line, matching the current manual process
9	设备方向 Direction	“左进右出”以人正对设备操作面为参考方向 "Left in and right out", with people facing the equipment operation surface as the reference direction

1.1.2. 生产能力 Production Capacity

序号 No	项目 Item	数据 Data
1	最大提升重量 Max. lifting weight	80~200Kg
2	生产时间 Production time	三班制 (注：一天工作 22h/天) Three-shift system (note: 22h/day)
3	最大生产能力 Max. production capacity	清洗 11 吋和 12 吋单晶边皮、头尾料和单晶方棒，产能要求≥35 吨/天 Required capacity of cleaning 11-inch and 12-inch monocrystal wing materials, head and tail materials and monocrystal bricks ≥35 tons/day
4	生产节拍 Production takt	2.5min~4min/篮 2.5min~4min/cassette

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1.1.3.设备设计尺寸 Equipment Design Size

备注：尺寸仅供参考，请以实际设计为准；

Remarks: The dimensions are for reference only; please refer to the actual design;

序号 No	项目 Item	数据 Data
1	设备外型尺寸 External dimensions of equipment	(L18600×W2800×H2800)

1.1.4.硅料与装载花篮 Silicon Material and Loading Cassette

硅块种类 Silicon Type	装载能力(max)[kg] Loading Capacity (max)[kg]	材质 Material	数量 Qty.
单晶边皮：长 (150-1000) *宽 (50-220) *厚 (25-48) mm Monocrystal wing material: L (150-1000)*W(50-220)*T(25-48)mm	12 吋边皮 14 块/篮,80-200Kg 14 pieces of 12-inch wing material/cassette, 80-200Kg	PPN	外框花篮≥30 件 (边皮内清洗篮上下层≥60 件)
单晶头尾：圆棒φ230φ315* (30-265) mm 单晶方棒边长 210*长 300mm Monocrystal head and tail: ingot φ230φ315*(30-265)mm Monocrystal brick: Side length 210*Length 300mm		PPN	Outer frame cassettes≥ 30 pieces (inner wing material cassettes on the upper and lower layers ≥ 60 pieces)



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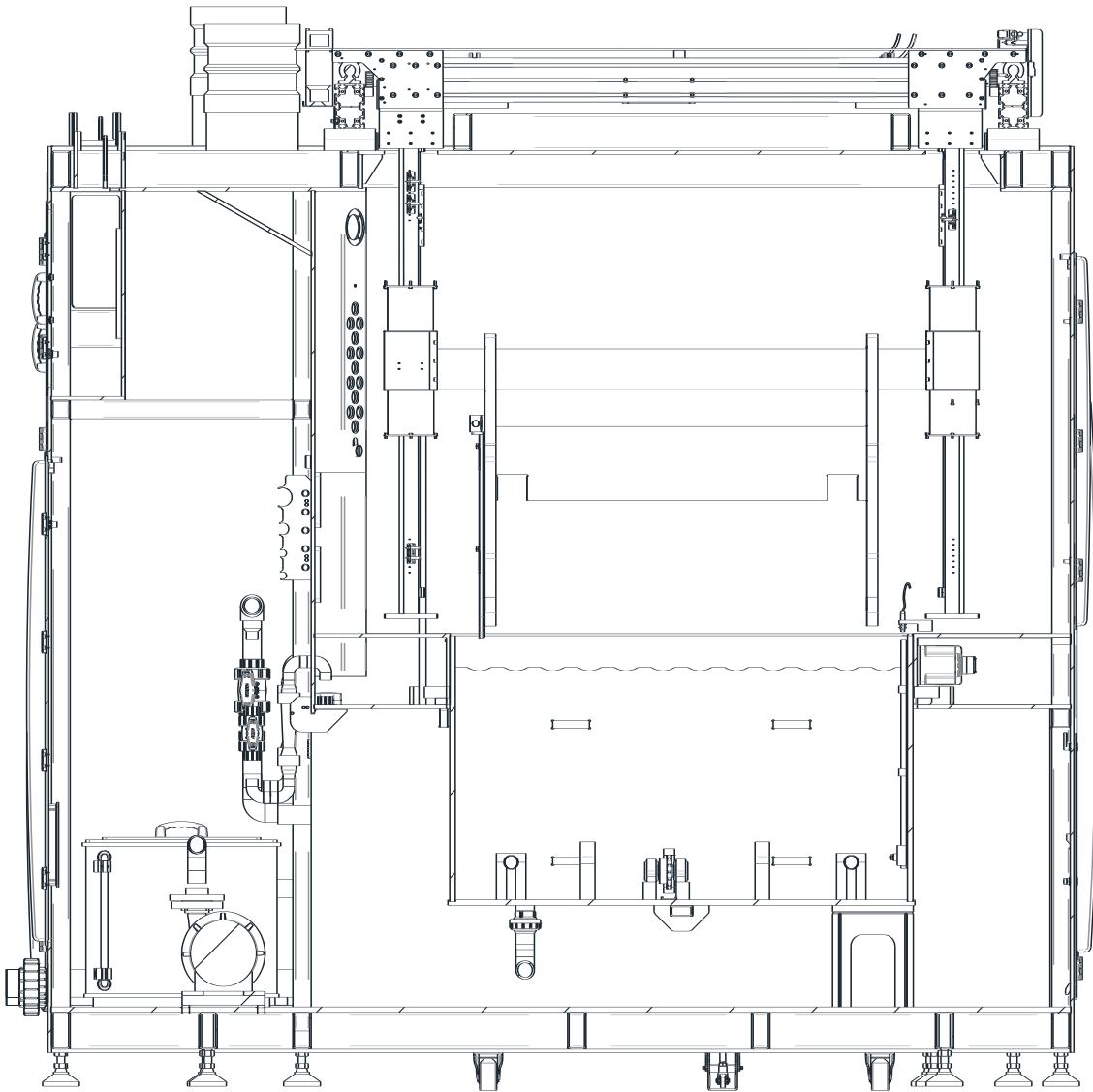
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1.1.5.设备结构 Equipment Structure



1.2. 设备质量标准 Equipment Quality Standards

序号 No	国标号 National Standard No	国标内容 National Standard Content
1	GB50055	通用用电设备配电设计规范 Code for Design of Electric Distribution of General-Purpose Utilization Equipment
2	GB/T2624.2	用安装在圆形截面管道中的差压装置测量满管流体流量 第2部分:孔板 Measurement of Fluid Flow by Means of Pressure Differential Devices Inserted in Circular Cross-Section Conduits Running Full Part 2: Orifice Plate
3	GB/T2624.3	用安装在圆形截面管道中的差压装置测量满管流体流量 第3部分:喷嘴和文丘里喷嘴 Measurement of Fluid Flow by Means of Pressure Differential Devices Inserted in Circular Cross-Section Conduits Running Full Part 3: Nozzles and Venturi Nozzles
4	GB/T2624.4	用安装在圆形截面管道中的差压装置测量满管流体流量 第4部分:文丘里管 Measurement of Fluid Flow by Means of Pressure Differential Devices Inserted in Circular Cross-Section Conduits Running Full Part 4: Venturi Tubes
5	GB50093	自动化仪表工程施工及质量验收规范 Code for Construction and Quality Acceptance of Automation Instrumentation Engineering
6	GB50160	石油化工企业设计防火标准 Fire Prevention Code of Petrochemical Enterprise Design
7	HG/T20507	自动化仪表选型设计规范 Design Code for Instrument Selection
8	HG/T20508	控制室设计规定 Design Code for Control Room
9	HG/T20509	仪表供电设计规定 Design Code for Instrument Power Supply System
10	HG/T20510	仪表供气设计规定 Regulation for Design of Instrument Air Supply System
11	HG/T20511	信号报警及联锁系统设计规范(附条文说明) Design Code for Signal Alarm and Interlock System (Explanatory Notes with Provisions)
12	HG/T20700	可编程序控制器系统工程设计规范 Engineering Design Code for Programmable Logic Controller
13	HG/T20505	过程测量与控制仪表的功能标志及图形符号 Functional Identification and Symbols for Process Measurement and Control Instrumentation
14	HG/T20512	仪表配管配线设计规范 Design Code for Instrument Piping and Wiring
15	HG/T21581	自控安装图册上下册 Instrument Hook-up Drawing (Two Volumes)
16	HG/T20636-20637	化工装置自控工程设计规定 Design Regulations on Chemical Plant Automatic Control Engineering
17	HG20592~20635	钢制管法兰、垫片、紧固件 Steel Pipe Flanges, Gaskets and Bolting
18	GB50052	供配电系统设计规范 Code for Design of Electric Power Supply Systems
19	GB50054	低压配电设计规范 Code for Design of LV Power Distribution System

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1.3.设备技术参数 Technical Parameters of Equipment

1.3.1.设备清单 Equipment List

本自动设备（上、下料为手动）由以下几个部分组成：

The automatic equipment (manual feeding and unloading) consists of the following parts:

序号 No	名称 Name	数量 Qty.
1	设备机架 Equipment frame	1 个 1 pc.
2	输送线 Transfer line	1 个 1 pc.
3	上下料小车 Loading and unloading cart	6 个 6 pc.
4	花篮 Cassette	30 个 30 pc.
5	1.自动配、补液系统（HNO ₃ 、HF）补液系统管路采用 PVDF 材质，其它液体补液系统管路均采用 PP 材质； 2.磁致伸缩液位计方式补液；（寿命 1 年以上） 1. The pipelines of the automatic dispensing and refilling systems (HNO ₃ , HF) are made of PVDF, while the pipelines of other liquid refilling systems are made of PP; 2. Magnetostriction liquidometer is used for refilling; (service life more than 1 year)	以实际设计为准 Subject to the actual design
6	高速移载机械手 High speed transfer manipulator	3 套 3sets
7	电气控制系统 Electrical control system	1 套 1set
8	人机控制台 Man-machine control console	1 套 1set
9	酸性处理工位 Acid treatment station	1 个 1pc.
	中性处理工位（包括隔离段） Neutral treatment station (including isolation section)	8 pcs.
	烘干处理工位 Drying station	5 pcs.
	合计 Total	14 process tanks



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1.3.2.工艺细节:Process details

序号 No	名称 Name	辅助功能 Auxiliary Functions	清洗介质 Cleaning Media	温度 Temperature	材质 Material	槽盖 Tank Cover	循环 Recycling	定排 Periodic Blowdown	抽风 Air Exhaust
LOAD									
1	混合酸腐蚀槽 Mixed acid etching tank	冷却+鼓泡 Cooling+bubbling	氢氟酸+硝酸 HF+HNO ₃	40°C可调 40°C, adjustable	PVDF	有 Yes	有 Yes	有 Yes	有 Yes
2	快排漂洗槽 Quick discharge and rinsing tank	喷淋+溢流+鼓泡+快排 Spraying+overflowing+bubbling+quick discharge	回用水 Recycled water	RT	PPN	/	/	/	有 Yes
3	快排漂洗槽 Quick discharge and rinsing tank	鼓泡+溢流+快排+喷淋 Bubbling+overflowing+quick discharge+spraying	纯水 Pure water	RT	PPN	/	/	/	有 Yes
4	纯水区间潜送隔离槽 Submersible isolation tank in pure water section	溢流+水下横移（链条传输） Overflowing+underwater traverse (chain transmission)	纯水 Pure water	RT	PPN	/	/	/	
5	超声漂洗槽 Ultrasonic rinsing tank	超声+溢流 Ultrasonic + overflowing	纯水 Pure water	40-50°C可调 40-50°C, adjustable	SUS316L	/	/	/	有 Yes
6	超声漂洗槽 Ultrasonic rinsing tank	超声+溢流 Ultrasonic + overflowing	纯水 Pure water	40-50°C可调 40-50°C, adjustable	SUS316L	/	/	/	有 Yes
7	超声漂洗槽 Ultrasonic rinsing tank	超声+溢流 Ultrasonic + overflowing	纯水 Pure water	40-50°C可调 40-50°C, adjustable	SUS316L	/	/	/	有 Yes
8	超声漂洗槽 Ultrasonic rinsing tank	超声+溢流 Ultrasonic + overflowing	纯水 Pure water	70-80°C可调 70-80°C, adjustable	SUS316L	/	/	/	有 Yes
9	自动出料至真空干燥 Automatic discharge to vacuum drying								
10	切水沥水槽 Water shearing and draining tank	切水 Water shearing	洁净压缩空气 Clean compressed air	80°C	SUS316L	/	/	/	有 Yes
11	切水沥水槽 Water shearing and draining tank	切水 Water shearing	洁净压缩空气 Clean compressed air	80°C	SUS316L	/	/	/	有 Yes
12	真空干燥槽 Vacuum drying tank	真空 Vacuum	洁净压缩空气 Clean compressed air	RT	SUS316L	/	/	/	有 Yes
13	真空干燥槽 Vacuum drying tank	真空 Vacuum	洁净压缩空气 Clean compressed air	RT	SUS316L	/	/	/	有 Yes
14	真空干燥槽 Vacuum drying tank	真空 Vacuum	洁净压缩空气 Clean compressed air	RT	SUS316L	/	/	/	有 Yes

1.3.3.设备功能描述 Equipment Function Description

本设备处理功能

作业员将装满工件的清洗篮放置在小车上，上料车进入酸洗机上料平台，该设备通过移载机械手控制花篮进入各工艺槽内，根据设定的程序，机械手依次将清洗篮送到各工位，经过酸洗、水洗、超声、烘干的工艺过程处理后，由设备出料至下料小车上；清洗后硅料表金属≤20ppbw，清洗合格率≥98%，硅料表面无酸液残留；

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设备纯水总入口配置纯水进水流量计，以计量机台总纯水消耗量。各槽进水排水设置由电磁阀自动控制进、排水阀，纯水直接底部或侧面注入；

设备顶部应装有防护栏和相应吊具以方便设备维保,设备下方安装方便抽取托盘以便清洁设备下方

设备要求安装有整机漏电保护装置与接地装置；

Processing Function of Equipment

The operator places the cleaning cassette filled with workpieces on the cart, and the loading cart enters the loading platform of the acid cleaning machine. The equipment controls the cassette to enter each process tank through the transfer manipulator. According to the set procedure, the manipulator sends the cleaning cassette to each station in turn. After the process of acid cleaning, rinsing, ultrasonic and drying, the equipment discharges the material to the unloading cart;

After cleaning, the silicon material surface metal is not greater than 20ppbw, the cleaning pass rate is not less than 98%, and there is no acid residue on the silicon material surface;

The main pure water inlet of the equipment is equipped with a pure water inlet flowmeter to measure the total pure water consumption of the machine. The inlet and outlet valves of each tank are automatically controlled by the magnetic valve, and pure water is directly injected from the bottom or side;

Protective fences and corresponding slings shall be installed on the top of the equipment to facilitate the maintenance of the equipment, and a tray which is easily to be extracted shall be installed under the equipment for cleaning under the equipment.

The equipment is required to be equipped with the leakage protection device and grounding device of the whole machine;

1.3.4. 设备组成 Equipment Composition

(1) 机架；

机架构成设备的基本框架，由方管和扁管焊接而成

方管和扁管表面用 5mm 厚 PP 板包裹，防止腐蚀；

槽底加固处理，无变形，底部下沉、漏液情况；

(1) Rack;

The rack constitutes the basic frame of the equipment, which shall be welded with square tubes and flat tubes.

The square tubes and flat tubes shall be wrapped with 5mm-thick PP plates to prevent corrosion;

The tank bottom shall be reinforced without deformation, sinking and leakage;

(2) 封板

封板构成设备的结构，用 15mm 厚白色（颜色可选）PP 阻燃板焊接而成；

封板组成了抽风道、接水盘、设备前部观察维修门、设备后部维修门；

设备前部观察维修门采用 PP 门板镶嵌 PVC 透明窗设计且配有门保护控制系统，方便观察设备的整体运行状况；

设备后部分为二部分：上部为弱电部件安装区，配透明窗；下部为管道系统安装区，且安装透明板。门、窗有旋转装置控制门的开关；

设备底部配置接漏盘；

酸槽槽体盖板，采用 PVDF 材料，具备耐酸碱，强度高特点；

设备气密性好，正常运行时无气味泄漏；

(2) Sealing Plate

The sealing plate constitutes the structure of the equipment, which is welded with 15mm-thick white (color optional) PP flame retardant boards;

The sealing plate constitutes the exhaust duct, water pond, observation and maintenance door in the front of the equipment, and the maintenance door at the rear of the equipment;

In the front of the equipment, the observation and maintenance door is designed with PP door panels inlaid with a PVC transparent window and equipped with a door protection control system to facilitate the observation of the overall operation of the equipment;

The rear part of the equipment is divided into two parts: the upper part is the installation area of weak current components with a transparent window; the lower part is the piping system installation area with transparent panels. The door and window have a rotating device to control the door opening and closing;

The bottom of the equipment is equipped with a drain pan;

The cover plate of acid tank body is made of PVDF material, which is acid and alkali resistant and has high strength;

The equipment has good air tightness, and there is no odor leakage during normal operation;

(3) 移载机械手

移载机械手实现烘干篮按工艺流程顺序移动；

移载机械手能实现上下左右方向的移动；

机械手的运行能准确定位，速度可调，净载重 200KG；

配置 3 套高速移载机械手；

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酸洗区机械手与设备内部使用风琴罩进行隔离运行；

机械臂采用平稳控制方式，提篮不会晃动；

可以对各个槽处理时间单独设置，实现柔性管理，可以自动和手动转换并继续原程序运行；

机械手定位以接近开关为准，在各槽的减速/停止点设置有方便调整的接近开关。机械臂的定位准确度优于 $\pm 2\text{mm}$ ；

(3) Transfer Manipulator

The transfer manipulator can move the drying cassette according to the process flow sequence;

The transfer manipulator can move up, down, left and right;

The operation of the manipulator can be accurately positioned, the speed is adjustable, and the net load is 200KG;

3 sets of high-speed transfer manipulators shall be provided;

The manipulator in the acid cleaning area and the inside of the equipment are separated by the organ cover;

The mechanical arm adopts a stable control mode and will not shake when lifting the cassette;

The processing time of each tank can be set separately to achieve flexible management, and the original program can be automatically and manually converted and continued to run;

The positioning of the manipulator shall be subject to the proximity switch, and the deceleration/stop point of each tank shall be equipped with a proximity switch for easy adjustment. The positioning accuracy of the manipulator is better than $\pm 2\text{mm}$;

(4) 槽体

所有槽体无泄漏、无明显变形、无明显尺寸偏差、焊接良好符合相应国家标准；

316 材料槽体采用标准板材制作，PP 和 PVDF 材料槽体采用知名品牌标准工业板材制作；

(4) Tank Body

All tanks shall be free of leakage, obvious deformation and obvious size deviation, and shall be well welded in accordance with relevant national standards;

The 316 stainless steel tank is made of standard plates, and the PP and PVDF tanks are made of standard industrial plates of well-known brands;

混合酸洗 (1#槽)

清洗介质 : HF+HNO₃;

处理方式 : 浸泡;

辅助方式 : 快排循环+冷却+鼓泡;

槽材质 : PVDF 材质;

时间管理 : 由人机界面直接管理时间，功能包括显示时间/设定时间/报警，时间控制精度 1s;

配补液 : 具备 CDS 自动配补液系统;

具有漏液检测、报警功能;

补液精度 : 精度 $\pm 1\%$;

清洗温度 : 40°C 可调;

冷却方式 : 配备外置冰机 (需厂务提供冷却水);

排液系统 : 排液口装有可拆式过滤网，用于过滤碎硅渣;

酸槽有加固装置，防止酸泄露;

抽风 : 有抽风，酸排风与外围酸雾塔连接;

副槽 : 配有副槽，副槽内冷凝采用的管壁较厚 PVFA 管，管子寿命 2 年以上;

Mixed Acid Cleaning (1# Tank)

Cleaning medium: HF+HNO₃;

Treatment method: soaking;

Auxiliary mode: quick discharge and circulation+cooling+bubbling;

Tank material: PVDF;

Time management: The time is directly managed by the HMI. The functions include time display/time setting/alarm, and the time control accuracy is 1s;

Liquid dispensing and refilling: With CDS automatic dispensing and refilling system;

With leakage detection and alarm functions;

Refilling accuracy: accuracy $\pm 1\%$;

Cleaning temperature: 40°C, adjustable;

Cooling mode: There is an external ice maker provided (cooling water shall be provided by the Factory Affairs Department);

Liquid discharge system: The liquid outlet is equipped with a removable filter screen for filtering the crushed silicon slag;

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The acid tank is provided with a reinforcement device to prevent acid leakage;

Air exhaust: There is air exhaust, and the acid exhaust is connected with the peripheral acid mist tower;

Auxiliary tank: equipped with an auxiliary tank. The PVFA pipe with thick wall is used for condensation in the auxiliary tank, and the service life of the pipe is more than 2 years;

快排漂洗槽 (2#、3#槽)

清洗介质 : 2#槽采用回用水, 3#采用纯水;

处理方式 : 浸泡;

辅助方式 : 鼓泡+溢流+快排+喷淋;

槽材质 : PPN 材质;

时间管理 : 由人机界面直接管理时间, 功能包括显示时间/设定时间/报警, 时间控制精度 1s;

快排系统 : 配置快排按钮, 打开后自动快排;

给排水系统 : 排水口装有可拆式过滤网, 用于过滤碎硅渣;

清洗温度 : RT;

抽风 : 配备抽风;

Quick Discharge and Rinsing Tanks (2# and 3# Tanks)

Cleaning medium: Reclaimed water is used for 2# tank and pure water is used for 3# tank;

Treatment method: soaking;

Auxiliary mode: bubbling+overflowing+quick discharge+spraying;

Tank material: PPN;

Time management: The time is directly managed by the HMI. The functions include time display/time setting/alarm, and the time control accuracy is 1s;

制造者 Quick discharge system: The tanks are equipped with a quick discharge button; after the system is turned on, it will conduct automatic quick discharge;

Water supply and drainage system: The water outlet is equipped with a removable filter screen for filtering the crushed silicon slag;

Cleaning temperature: RT;

Air exhaust: An air exhaust is provided;

纯水隔离槽 (4#槽)

清洗介质 : 纯水;

处理方式 : 漂洗水下自动横移;

槽材质 : PPN 材质;

溢流系统 : 槽内围沿周测配有溢流口, 水位超高溢流, 设计安装时保持水平结构;

时间管理 : 由人机界面直接管理时间, 功能包括显示时间/设定时间/报警, 时间控制精度 1s;

清洗温度 : RT;

隔离 : 在槽体中间隔离, 隔绝酸洗部分酸雾进入水洗部分;

节水 : 带回收溢流水副槽, 将 4#、5#、6#、7#、8#溢流水水泵打入 2#槽;

隔离方式 : 清洗篮水下自动输送, 将设备清洗区隔离成酸洗区和超声清洗区, 防止酸气对不锈钢槽产生腐蚀, 避免硅料再次污染;

抽风 : 配备抽风;

给排水系统 : 排水口装有可拆式过滤网, 用于过滤碎硅渣;

Pure Water Isolation Tank (4# Tank)

Cleaning medium: pure water;

Treatment method: rinsing and underwater automatic traverse;

Tank material: PPN;

Overflow system: The overflow port is set around the inner perimeter of the tank, and water overflows when the level is too high. The horizontal structure shall be maintained during design and installation;

Time management: The time is directly managed by the HMI. The functions include time display/time setting/alarm, and the time control accuracy is 1s;

Cleaning temperature: RT;

Isolation: Isolation is set in the middle of the tank to isolate the acid mist in the acid cleaning part from entering the rinsing part;

Water saving: There is an auxiliary tank for recycling overflow water to pump the overflow water from 4#, 5#, 6#, 7# and 8# tanks to 2# tank;

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Isolation mode: The cleaning cassette is automatically transported underwater, and the equipment cleaning area is separated into the acid cleaning area and the ultrasonic cleaning area to prevent acid gas from corroding the stainless steel tank and preventing silicon material from being polluted again;

Air exhaust: An air exhaust is provided;

Water supply and drainage system: The water outlet is equipped with a removable filter screen for filtering the crushed silicon slag;

超声漂洗槽 (5#、6#、7#、8#槽)

清洗介质 : 纯水;

处理方式 : 浸泡;

辅助方式 : 溢流+超声;

槽材质 : 2.5mmSUS316L 材质, 表面做镀硬铬处理;

时间管理 : 由人机界面直接管理时间, 功能包括显示时间/设定时间/报警, 时间控制精度 1s;

清洗温度 : 5#、6#、7#槽 40-50°C 可调, 8#槽 70-80°C 可调;

加热方式 : 槽内不锈钢加热器, 加热器有上下液位开关保护, 防止干烧;

抽风 : 配备抽风;

给排水系统 : 排水口装有可拆式过滤网, 用于过滤碎硅渣;

溢流系统 : 槽内围沿周测配有溢流口, 水位超高溢流, 设计安装时保持水平结构;

超声系统 : 配备 1.8KW*2 超声波发生器, 28kHz, 功率密度 >0.35w/cm²。超声波发生器采用 IGBT 大功率驱动电路, 超声电流可调, 有过流、过压、全数字扫频、频率自动水位跟踪、功率可调、短路保护功能;

Ultrasonic Rinsing Tanks (5#, 6#, 7# and 8# Tanks)

Cleaning medium: pure water;

Treatment method: soaking;

Auxiliary mode: overflowing+ultrasound;

Tank material: 2.5mmSUS316L, with hard chrome plating on the surface;

Time management: The time is directly managed by the HMI. The functions include time display/time setting/alarm, and the time control accuracy is 1s;

Cleaning temperature: 40-50°C, adjustable for 5#, 6# and 7# tanks; 70-80°C, adjustable for 8# tank;

Heating mode: There is a stainless steel heater in the tank, which is protected by upper and lower liquid level switches to prevent dry burning;

Air exhaust: An air exhaust is provided;

Water supply and drainage system: The water outlet is equipped with a removable filter screen for filtering the crushed silicon slag;

Overflow system: The overflow port is set around the inner perimeter of the tank, and water overflows when the level is too high. The horizontal structure shall be maintained during design and installation;

Ultrasonic system: There is a 1.8KW*2 ultrasonic generator provided, 28kHz, with power density >0.35w/cm². The ultrasonic generator adopts the IGBT high-power drive circuit, with adjustable ultrasonic current, over-current and over-voltage protection, full digital frequency sweep, frequency automatic water level tracking, adjustable power, and short circuit protection functions;

切水沥水槽 (10#、11#槽)

清洗介质 : 洁净压缩空气;

辅助方式 : 加热+风切;

槽材质 : SUS316 材质;

时间管理 : 由人机界面直接管理时间, 功能包括显示时间/设定时间/报警, 时间控制精度 1s;

风刀 : 配备风刀切水;

温度 : 80°C;

加热方式 : 槽内不锈钢加热器;

抽风 : 配备抽风;

给排水系统 : 排水口装有可拆式过滤网, 用于过滤碎硅渣;

Water Shearing and Draining Tank (10# and 11# Tanks)

Cleaning medium: clean compressed air;

Auxiliary mode: Heating+air shearing;

Tank material: SUS316;

Time management: The time is directly managed by the HMI. The functions include time display/time setting/alarm, and the time control accuracy is 1s;

Air knife: There is an air knife provided to cut water;

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Temperature: 80°C;
 Heating method: stainless steel heater in tank;
 Air exhaust: An air exhaust is provided;
 Water supply and drainage system: The water outlet is equipped with a removable filter screen for filtering the crushed silicon slag;

真空烘干槽 (12#、13#、14#槽)

清洗介质 : 洁净压缩空气;
 辅助方式 : 真空;
 槽材质 : SUS316L 材质;
 温度 : RT;
 时间管理 : 由人机界面直接管理时间, 功能包括显示时间/设定时间/报警, 时间控制精度 1s;
 抽风 : 配备抽风;
 真空系统 : 12#、13#、14#槽采用一套真空系统, 抽气速度 600m³/h, 功率 10.5KW, 真空泵前设有冷凝过滤装置;
 密封性 : 带气动密封槽盖;
 真空槽体底部设计便于清理碎硅料;
 抽真空速度 : 抽真空时间≤40S;

Vacuum Drying Tanks (12#, 13# and 14# Tanks)

Cleaning medium: clean compressed air;
 Auxiliary mode: vacuum;
 Tank material: SUS316L;
 Temperature: RT;
 Time management: The time is directly managed by the HMI. The functions include time display/time setting/alarm, and the time control accuracy is 1s;
 Air exhaust: An air exhaust is provided;
 Vacuum system: 12#, 13# and 14# tanks adopt a set of vacuum system with the pumping speed of 600m³/h and power of 10.5KW, and a condensation filter device is set in front of the vacuum pump;
 Tightness: There is a pneumatic seal groove cover provided;
 The bottom of the vacuum tank is designed to facilitate the cleaning of crushed silicon materials;
 Vacuum pumping speed: vacuum pumping time ≤40S;

(5) 上下料台

上料为上料小车, 下料为下料小车。机械臂抓入(出)的方式进行物料进出设备;
 上料台前台及下料小车厚需配有篮筐暂存功能。物料不满筐时可停滞等待;
 上料台位置可缓冲≥3 篮;
 下料由人工搬运至小车上;
 下料台出口配备风幕冷却, 出料温度要求≤35°C;
 配备上下料花篮小车 6 辆, 采用 PP 板焊接

(5) Loading and Unloading Platforms

Loading carts are used for loading and unloading carts for unloading. Materials are grabbed into or out of the equipment by the mechanical arm;
 The front desk of the loading platform and the unloading cart shall be equipped with the function of temporary storage of cassettes. The cassette can stop and wait when there is no enough material in it;
 No fewer than 3 cassettes can be buffered on the loading platform;
 For unloading, materials shall be carried manually to the unloading cart;
 An air curtain is equipped at the outlet of unloading platform for cooling, and the discharge temperature is required to be ≤ 35°C;
 6 cassette loading and unloading carts shall be provided and welded with PP plates.

(6) 排风

设备顶部配有抽风孔;
 设备设有槽面抽风口;
 设备抽风口酸洗和烘干部分分开, 酸洗和烘干的抽风系统是单独隔开的两个系统;
 所有的抽风口最后都连接到客户提供的抽风装置上;

(6) Air Exhaust

The top of the equipment is equipped with an exhaust hole;
The equipment is equipped with an extraction opening on the tank surface;
The acid cleaning and drying parts of the equipment's extraction opening are separated, and their ventilation systems are two separate systems;
All extraction openings are finally connected to the exhaust device provided by the customer;

(7) 电控系统

主供电电源 380V,3 相 5 线;

操作控制回路 DC24V;

所有元器件都有标牌或者指示牌, 电机、电气元件选用国内一线品牌;

电源进入前接入不小于最大负荷电流的空气开关和漏电开关;

电气控制元件尽可能全部集中在总电气柜内, 整齐有序排列;

控制元件, 执行元件与检测元件之间的连线尽量不经过中间分线器(必要时可采用分线箱);

电气柜照明良好(配手动开关), 以方便维修及更换部件, 在电气柜内需安装 220V 电源插座;

电气柜内高低压电路要明显分界, 不同电位采用不同颜色电线;

接线端两侧接线码(白色整体线码, 字体黑色打印);

连接线长短适当, 不太长或过短, 预留备用接线;

电气柜及各分线箱内各元件之间留有足够维修空间;

电气柜要求通风顺畅(加装两个散热风扇), 通风扇加装隔尘罩, 柜门有可靠密封;

配电电路方面进行功能分块, 强电、弱电分开, 以便维护;

设备各控制元件, 执行元件及检测元件必须在元件安装附近有明确标识;

所有电器、配电箱及控制箱的设计安装, 应符合国家电器技术的安全标准;

电气绝缘性能: E 级, 并有良好的接地, 抵抗 500M Ω 以上。

PLC 控制, 温度、时间控制模块;

触摸屏操作控制面板有抽真空时间、故障提示、声光报警等各项参数检测功能;

触摸屏操作, 可直接查询 PLC 控制程序运行情况;

设备开放端口权限, 在需要时可直接对接 MES 或其他自动化设备, 以配合后续需要 MES 系统的开发;

设备需配备安装支持标准 OPC 协议网络模块, 便于机台数据采集及控制;

设备机台数据存储需保存到 Access, SQL server 等标准数据文件中。(客户可通过 MES, SCADA 等系统自主访问 PLC 提供的数据并做保存操作);

设备具有至少三级的操作权限, 如作业级、工艺级、工程师级等; 采取分级密码控制;

中文&越南语控制界面, 具备自动记录、统计和图表分析等多项功能;

历史记录查看: 能显示温度曲线、流量曲线、补液记录、报警记录, 及各个工位的工作状态;

各项有记录, 至少保存 3 个月数据, 可查询, 可用局域网导出, 可通过 MES 获取, 依据实际发生记录;

报表可分时段查询, 查询内容包含: 批次、化学品使用量、报警次数等;

工艺方案的更改简单易行, 参数更改时超出范围会报错, 能存储 10 个以上工艺方案;

设备具备上、下料自动化配置的软、硬件接口功能;

设备有设定伺服电机原点自动复位清零功能, 以减少伺服电机累计误差, 确保重复定位精度在 ± 0.1 mm 范围内;

报警、设备各项参数检测;

设备管理具有明显开关标识和流向标识;

具备高低水位保护功能;

设备在纯水进水入口配备电导率检测: 具备纯水电导率($\leq 16\mu\text{s}$)检测和报警功能;

具备高液位自动停止加液并在触摸屏上提示的功能(设计溢流清洗的槽仅提示);

自动手动转换开关;

加热器、马达等开关;

清洗时间、温度、传动速度调节器;

紧急停止开关,各侧面及操作台均有急停按钮, 以便有意外发生时可以随时就近急停设备, 保证人员及设备的安全;

设备有明确的指示灯显示设备运转状态;

(一) 绿灯: 设备正常运转中

(二) 黄灯: 设备休止或其它

(三) 红灯: 设备异常或故障

(7) Electronic Control System

Main power supply 380V, 3-phase and 5-wire;

Operation control circuit DC24V;

All components and parts shall be provided with signs or indicators, and the motor and electrical components shall be selected from domestic first-line brands;

The air switch and leakage switch not less than maximum load current shall be connected before power supply enters;

Electrical control elements shall be centralized in the main electrical cabinet as far as possible and arranged neatly and orderly;

The wiring among the control element, the actuating element and the detection element shall not pass through the intermediate deconcentrator as far as possible (if necessary, the patch panel may be used);

The electrical cabinet shall be well illuminated (with manual switch) to facilitate repair and replacement of components. A 220V power socket shall be installed in the electric cabinet;

The high and low voltage circuits in the electrical cabinet need to be clearly separated and different colored wires are used for different potentials;

The wiring code (white whole line code, black print font) is provided on both sides of the terminal;

Connecting wires shall be suitable in length, not too long or too short, and spare wires shall be reserved;

Enough maintenance space is left between the electrical cabinet and the components in each patch panel;

The electric cabinet shall be ventilated smoothly (with two cooling fans), and the fans shall be equipped with a dust shield and the cabinet door shall be reliably sealed;

The distribution circuit is functionally divided into blocks, strong current and weak current, for maintenance;

Each control element, actuating element and detection element of the equipment must be clearly identified near their installation positions;

All electrical appliances, distribution cabinets and control boxes shall be designed and installed in accordance with the safety standards of Chinese electrical technology;

Electrical insulation performance: Class E, with good grounding, resistance above 500MΩ.

PLC control, temperature and time control modules;

The touch screen operation control panel has the functions of detecting parameters such as vacuum time, fault indication, audio-visual alarm, etc.;

The operation of PLC control program can be inquired directly through operation on the touch screen;

The authority of the equipment port is opened, and MES or other automation equipment can be directly docked when needed to match the subsequent development of MES;

The equipment shall be equipped with a network module supporting standard OPC protocol to facilitate data acquisition and control of the machine;

Machine data needs to be saved in standard data files such as Access and SQL server for storage. (Customers can access data provided by PLC independently through MES, SCADA and other systems and operate for saving);

Equipment has at least three levels of operation authority, such as operation level, process level, engineer level, etc.; it shall be controlled with hierarchical passwords;

Chinese-Vietnamese control interface, with automatic recording, statistical and chart analysis functions;

View of historical records: The temperature curve, flow curve, refilling record, alarm record and working status of each station can be displayed;

Each item has records, which can be stored for at least 3 months, and can be queried, exported by local area network, obtained by MES and taken according to actual occurrence;

The report can be queried by time periods, including batches, chemical usage, alarm times, etc.;

It's easy to change the process plan; if the parameters are changed beyond the range, errors will be reported; more than 10 process plans can be stored;

The equipment has software and hardware interface functions for automatic configuration of loading and unloading;

The equipment has the function of setting the origin of the servo motor to reset automatically, so as to reduce the accumulated error of the servo motor and ensure the location accuracy within ± 0.1 mm;

Alarm and parameter detection of equipment;

There are obvious switch and flow identifiers for equipment management;

High and low water level protection function;

The equipment is provided with conductivity detection at the inlet of pure water: pure water conductivity ($\leq 16\mu\text{s}$) detection and alarm functions;

Function of automatically stopping refilling at high level and prompting on the touch screen (only prompting for tanks designed for overflowing and cleaning);

Automatic and hand-operated changeover switches;

Switches of heaters, motors, etc.;

Cleaning time, temperature, and transmission speed regulator;

Emergency stops switches; there are emergency stop buttons on each side and on the console to stop the equipment nearby at any time in case of accidents, so as to ensure the safety of personnel and equipment;

The equipment shall have clear indicator lights to display the operating status of the equipment;

(I) Green lights: equipment in normal operation

(II) Yellow lights: equipment shutdown or others

(III) Red lights: equipment abnormal or faulty

(8) 设备安全

报警可分不同等级，连锁，用户可根据实际情况决定下步动作（如停机、排液等）；

符合中国设备电气安全法规；

设备工作区域设有安全防护措施；

观察门安全检测装置，在设备工作时如果有观察门被打开，设备立刻暂停运行；

设备的主机、附件及所有附属设施应采取安全防护措施，设备具备意外断气、断电维持工作构件正确位置安全保护措施及装置；

设备使用材料、电气件、管路符合安全标准；

设备操作要严格按照操作说明书进行，操作维护人员要进行专门的培训；

可能对人体造成伤害的部分，在设备上贴有明显的警告标示；

专业操作部分在设备上有明确的警告标示；

特殊部分有明确操作步骤；

(8) Equipment Safety

The alarm can be divided into different levels and interlocked. The user can decide the next action (such as stop, discharge, etc.) according to the actual situation;

Comply with China's electrical safety regulations for equipment;

Safety protection measures are provided in the working area of the equipment;

Safety detection device of observation door; if any observation door is opened when the equipment is operating, the equipment shall be stopped immediately;

The hot, accessories and all auxiliary facilities of the equipment shall be provided with safety protection measures. The equipment shall be equipped with safety protection measures and devices which can maintain the correct position of the working components in case of accidental air failure and power failure;

The materials, electrical parts and pipelines of the equipment meet the safety standards;

The equipment shall be operated in strict accordance with the operation manual, and the operators and maintenance personnel shall receive special training;

For parts that may cause harm to human body, clear warning labels shall be affixed to the equipment;

Professional operation parts shall have clear warning labels on the equipment;

Special parts shall have clear operation steps;

二、设备主要元器件清单

II. List of Main Components of Equipment

序号 No	名称 Name	规格 Spec.	供应商 Supplier
1	控制系统 Control system	设计选型 Design and type selection	基恩士 Keyence
2	PLC	设计选型 Design and type selection	基恩士 Keyence
3	电气元器件 Electrical components	设计选型 Design and type selection	施耐德 Schneider
4	主轴轴承 Mainshaft bearing	设计选型 Design and type selection	其它 Other manufacturers
5	气动元器件 Pneumatic components	设计选型 Design and type selection	其它 Other manufacturers
6	导轨丝杠 Guide rail screw	设计选型 Design and type selection	上银(台湾)或其它 HIWIN (Taiwan) or other manufacturers
7	气动隔膜阀	1/2"~1"	科讯 KESION

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	Pneumatically operated diaphragm valve		
8	手动隔膜阀 Manual diaphragm valve	1/2"~1"	科讯 KESION
9	球阀 Globe valve	1/2"~1"	科讯 KESION
10	气缸 Cylinder	设计选型 Design and type selection	亚德客 AirTAC
11	磁性开关 Magnetic switch	D 系列 Series D	亚德客 AirTAC
12	电磁阀 Magnetic valve	设计选型 Design and type selection	亚德客 AirTAC
13	磁力泵 Magnetic pump	设计选型 Design and type selection	协磁或英皇 ASSOMA or EMPEROR GROUP
14	超声波 Ultrasound	设计选型 Design and type selection	FIT

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三、设备随机配件清单
III.List of Accompanying Parts and Components of Equipment

序号 No	备品备件名称 Name of Spare Part	规格型号 Spec./Model	产地 Place of Origin	生产厂家 Manufacturer	品牌 Brand	单位 Unit	单价 Unit Price	维保更换 周期 Maintenance and Replacement Cycle
1	螺纹 L 型气管接头 L-shaped threaded pipe joint	PL601 (PT1/8-φ6)			AirTAC	PCS		
2	螺纹 L 型气管接头 L-shaped threaded pipe joint	PL1202 (PT1/4-φ12)			AirTAC	PCS		
3	软管扩口接头 Flared hose fitting	3/4"PVDF			/	PCS		
4	气动球阀 Pneumatic ball valve	D75DN60, PN6,EPDM 禁油 D75DN60, PN6, EPDM; oil prohibited			科讯 KESION	PCS		
5	气动隔膜阀 Pneumatically operated diaphragm valve	MV300 DN15 对焊 禁油 MV300 DN15, butt welded, oil prohibited			科讯 KESION	PCS		
6	磁制伸缩 Magnetostriction	FC-GLSXJ-01			飞卓 FEEJOY	PCS		
7	水枪套装 (ABS) Water gun set (ABS)	订货型号 18341 Order type 18341			嘉丁拿 GARDENA	PCS		
8	水龙头接头 (ABS) Faucet connector (ABS)	(G1/2",4分)订货型号 18200(G1/2",4 dm) order type 18200			嘉丁拿 GARDENA	PCS		
9	止水接头 (ABS) Water check joint (ABS)	订货型号 18213 Order type 18213			嘉丁拿 GARDENA	PCS		
10	水管 (橡胶) Water pipe (rubber)	订货型号 18039 三星 Order type 18039 SAMSUNG			嘉丁拿 GARDENA	PCS		
11	VMS01-60 系列链条 VMS01-60 series chain	1 列 节距 19.05 内宽 12.7 高 17.2 长 3200mm 1 column, 19.05 in pitch, 12.7 in inner width, 17.2 in height, and 3200mm in length				PCS		
12	管道式流量计 Visual flow	LZT-25 (0.16~1.6m ³ /h) 短管防腐 导杆包氟和浮子接液材质非金属 (PPH)) LZT-25 (0.16~1.6m ³ /h) short pipe anticorrosion, fluorine-containing guide rod, and float connected to non-metallic wetted material (PPH))				PCS		

四、设备易损件清单
IV.List of Vulnerable Parts of Equipment

序号 No	备件名称 Name of Spare Part	品牌 Brand	规格型号 Spec./Model	产地 Place of Origin	备注 Remarks
1	VMS01-60 系列链条 VMS01-60 series chain		1 列 节距 19.05 内宽 12.7 高 17.2 One column, 19.05 in pitch, 12.7 in inner width and 17.2 in height		
2	磁性开关 Magnetic switch	亚德客 AirTAC	设计选型 Design and type selection		
3	气缸 Cylinder	亚德客 AirTAC	设计选型 Design and type selection		
4	电磁阀 Magnetic valve	亚德客 AirTAC	设计选型 Design and type selection		

五、设备随机文件清单
V.List of Accompanying Documents of Equipment

序号 No		项目 Item	数量 Qty.
1	设备操作说明书 Operation manual of equipment	设备使用说明 Equipment instructions	1 份 1 copy
3		控制原理图 Control diagram	1 套 1 set
4		电气接线图、管路图 Electric wiring diagram and piping drawing	1 套 1 set
5		备件清单 List of spare parts	1 份 1 copy
6		易损件清单 List of vulnerable parts	1 份 1 copy
7	主要外购件说明书 Instructions for major purchased parts	/	1 套 1 set

六、设备使用参数

VI. Equipment Operation Parameters

6.1 施工动力条件 Power Conditions for Construction

6.1.1 设备电力供应 Equipment Power Supply

项目 Item	数据 Data
操作控制回路 Operation controlling circuit	DC24V
设备总功率 Total power of equipment	1、~325KW 2、380v, 50Hz, 3相5线制, 冰机单项 380V 3、设备进线开关上侧配备进线铜排(铜排 10cm, 根据载流量选配), 铜排从开关上侧引出 10cm; 4、设备内部各个电源(冰机电源等)最终全部集中在电柜内接线端子; 5、设备技术协议约定电源, 厂家到货设备必须保持一致; 1、~325KW 2. 380v, 50Hz, three-phase five-wire system; 380V for the ice maker 3. The upper side of the incoming line switch is equipped with the incoming line copper bar (10cm copper bar, selected according to the current load), and the copper bar comes out 10cm from the upper side of the incoming line switch; 4. Each power supply (ice maker power supply, etc.) inside the equipment is finally all concentrated in the wiring terminal in the electrical cabinet; 5. The power supply is specified in the technical agreement of equipment, and the equipment delivered by the manufacturer must conform to the specified power supply;

七、设备公用工程条件

VII. Utilities for Equipment

表 1-1 化学品参数

Table 1-1 Chemical Parameters

介质 Medium	温度 [°C]Temperature [°C]	预留端口 Reserved Ports	性质 Nature	压力 [mpa]Pressure (MPa)	消耗量 [m3/h]Consumption [m3/h]
液体 Liquid					
纯水 Pure water	RT	1-1/2"PP 管和 1"PP 管 (2 处) 1-1/2" PP pipe and 1" PP pipe (two points)	电阻率 > 18MΩ·cm (设备进水端具备 DI 水电导监控模块,) Resistivity > 18MΩ·cm (the inlet of the equipment is equipped with a DI water conductivity monitoring module)	0.25±0.05	≤8
HF	RT	3/4" PFA 软管接头 3/4" PFA hose fitting	浓度 49% Concentration 49%	/	由反应决定 Decided by the reaction

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HNO ₃	RT	3/4" PFA 软管接头 3/4" PFA hose fitting	浓度 31% Concentration 31%	/	由反应决定 Decided by the reaction
气体 gas					
压缩空气	RT	SUS 直通接头 (内径 Φ16) SUS straight-through joint (inside diameter Φ16)	露点 < -40°C Dew point < -40°C	0.6±0.05	6
氮气	RT	SUS 直通接头 (内径 Φ16) SUS straight-through joint (inside diameter Φ16)	纯度 ≥ 99.9% Purity ≥ 99.9%	0.25±0.05	11

 表 1-2 排水管连接
 Table 1-2 Drain Pipe Connection

排放类型 Emission Type	温度 [°C] Temperature [°C]	性质 Nature	连接 Connection	材质 Material
混酸排放 Emission of mixed acid	RT	HF+HCl	D63/Dn50	PP
含酸废水排放 Acidiferous wastewater discharge	RT	含酸废水 Acidiferous wastewater	D63/Dn50	PP

八、设备环境

VIII. Equipment Environment

项目 Item		指标 Indicator
设备工作环境 Equipment working environment	温度 Temperature	19~25°C
	相对湿度 Relative humidity	< 70%
	海拔高度 Altitude	3000m 以下 Below 3,000m
设备存放环境	温度 Temperature	5~40°C (在温度低于零度时注意对管道进行防冻保护措施) 5~40°C (Pay attention to anti-freezing measures for pipes when the temperature is below zero)
	24 小时内温差 Temperature difference within 24 hours	< 20°C
	海拔高度 Altitude	15000m 以下 Below 15,000m
	相对湿度 Relative humidity	< 90%

8.1 现场管理 Field Management

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质保期内非操作原因出现设备故障，无锡釜川保证在接到客户通知 24 小时内到达现场（国内），并在 8 小时内解决。人工费、差旅费由无锡釜川承担；

质保期内操作原因出现设备故障，无锡釜川保证在接到客户通知 24 小时内到达现场（国内），并在 8 小时内解决。其间因发生的更换零部件费用由客户承担，人工费由客户承担，差旅费由客户承担；

质保期外出现设备故障，无锡釜川保证在接到客户通知 36 小时内到达现场，并在 8 小时内解决（国内）。其间发生的更换零部件费用由客户承担，人工费由客户承担，差旅费由客户承担；

无锡釜川保证优先优价向客户提供备品备件；

无锡釜川对设备终身提供售后服务；

During the warranty period, if any equipment failure occurs due to non-operational reasons, Fuchuan (Wuxi) Intelligent Technology Co., Ltd. guarantees to arrive at the site (domestic) within 24 hours after receiving the customer's notice, and solve the problem within 8 hours. The labor costs and travel expenses shall be borne by Fuchuan (Wuxi) Intelligent Technology Co., Ltd.;

In case of equipment failure due to operational reasons during the warranty period, Fuchuan (Wuxi) Intelligent Technology Co., Ltd. guarantees to arrive at the site (domestic) within 24 hours after receiving the customer's notice, and solve the problem within 8 hours. The cost of parts replacement shall be borne by the customer, the labor cost shall be borne by the customer, and the travel expenses shall be borne by the customer;

In case of equipment failure after the warranty period, Fuchuan (Wuxi) Intelligent Technology Co., Ltd. guarantees to arrive at the site within 36 hours after receiving the customer's notice, and solve the problem within 8 hours (domestic). The cost of parts replacement, the labor cost and the travel expenses shall be borne by the customer;

Fuchuan (Wuxi) Intelligent Technology Co., Ltd. guarantees to provide customers with spare parts at a preferential price;

Fuchuan (Wuxi) Intelligent Technology Co., Ltd. will provide lifelong after-sales service for equipment;

8.2 质量控制

设计控制：无锡釜川依据本协议的全部要求，并按照行业规范，做出合理的设计，并在与客户的交流过程中，不断优化方案设计。对设备的线体、传动、动力、气动、温控等部分的结构、选型必须留有冗余，保证能够长期安全、可靠、稳定地运行，为客户保证产品质量提供最基本的条件；

无锡釜川分供方的审查认定：为无锡釜川提供原材料、部件、整机的分供方，需要有对其质量保证的认证。无锡釜川提供封样样品，客户按封样验收；

制造过程控制：无锡釜川为客户制作设备的过程中，应严格按照规定进行过程控制，保证按设计要求生产出合格产品；

生产的检验和验收：无锡釜川在设备制作过程中和形成部件成品后，进行严格的检验和试验，不合格品不得进入下一工序；

搬运、存储、包装、防护和交付：无锡釜川应采取保证产品质量的措施，这种保护应延续到交付的目的地，直至安装、调试完毕，交付客户验收；

安装、调试：无锡釜川按行业规定进行设备的安装、调试；

Design control: Fuchuan (Wuxi) Intelligent Technology Co., Ltd. shall make a reasonable design in accordance with all requirements of this Agreement and industry specifications, and continue to optimize the scheme design during the process of communication with customers. Allowance must be reserved for the structure and model selection of the line body, transmission, power, pneumatics, temperature control and other parts of the equipment to ensure long-term safe, reliable and stable operation and provide customers with the most basic conditions to ensure product quality;

Review of the sub-supplier of Fuchuan (Wuxi) Intelligent Technology Co., Ltd.: The sub-supplier that provides raw materials, components and complete machines for Fuchuan (Wuxi) Intelligent Technology Co., Ltd. shall have its quality assurance certification. Fuchuan (Wuxi) Intelligent Technology Co., Ltd. provides sealed samples, and the customer conducts acceptance based on the sealed samples;

Manufacturing process control: In the process of making equipment for customers, Fuchuan (Wuxi) Intelligent Technology Co., Ltd. shall carry out process control in strict accordance with the regulations to ensure that certified products are produced according to the design requirements;

Inspection and acceptance of production: Fuchuan (Wuxi) Intelligent Technology Co., Ltd. shall carry out strict inspection and test during the manufacturing process of equipment and after forming finished parts. Rejected products shall not be allowed to enter the next process;

Handling, storage, packaging, protection and delivery: Fuchuan (Wuxi) Intelligent Technology Co., Ltd. shall take measures to ensure the quality of the products. Such protection shall extend to the destination of delivery until the completion of installation and commissioning, and the products are delivered to the customer for acceptance;

Installation and commissioning: Fuchuan (Wuxi) Intelligent Technology Co., Ltd. shall conduct equipment installation and commissioning according to industry regulations;

8.3 安全保障体系 Safety Assurance System

8.3.1 设备安全 Equipment safety

设备操作要严格按照操作说明书进行，操作维护人员要进行专门的培训；

可能对人体造成伤害的部分，在设备上有明显的警告标示；

专业操作部分在设备上有明确的警告标示；

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特殊部分有明确操作步骤；

The equipment shall be operated in strict accordance with the operation instructions, and the operation and maintenance personnel shall receive special training;

For parts that may cause harm to human body, clear warning labels shall be affixed to the equipment;

Professional operation parts shall have clear warning labels on the equipment;

Special parts shall have clear operation steps;

8.3.2 设备上的安全标志 Safety Marks on Equipment

设备运行状态三色指示灯，绿色：设备正常运行中，黄色：设备休止或其他，红色：设备异常或故障；

设备操作主要控制台，包括有手动/自动转换开关，蜂鸣器停止开关，自动启动、停止开关，紧急停止开关等；

各处紧急停止开关和安全操作标识；

设备主体部分紧急停止开关；

电控柜总电源安全警告标识；

设备高温警告标识；

上料台处安全操作警告标识；

机械手操作维护方法提示；

机械手操作保养方法提示；

机械手手动操作控制开关；

电气盒操作安全警告及手动阀门在设备运行时开关状态指示牌标识；

机械手操作提示；

Three-color indicator of equipment operation status: Green indicates that the equipment is in normal operation; yellow indicates that the equipment is resting or shut down or in other conditions; red indicates the equipment abnormality or faulty;

The main console for equipment operation consists of the manual/automatic switch, buzzer stop switch, automatic start and stop switches, emergency stop switch, etc.;

Emergency stop switches and safety operation signs at various locations;

Emergency stop switch of main body of equipment;

Safety warning label of the main power supply of electric control cabinet;

Warning mark for high temperature of equipment;

Warning mark for safe operation at the loading platform;

Manipulator operation and maintenance method tips;

Manipulator operation and maintenance method tips;

Manual operation control switch of manipulator;

Electric box operation safety warning, and on-off state indicator of manual valve during the operation of equipment;

Manipulator operation tips;

各类安全标识


九、人员培训

IX. Personnel Training

设备试生产运行期间，提供详细的操作、维护、应急处理培训，具体内容如下：

During the trial production and operation of the equipment, the specific content of operation, maintenance and emergency treatment training is provided as follows:

序号 No	内容 Content	参与培训人员 Participants in Training	开始时间 Start Time	时间 Duration	备注 Remarks
1	设备原理 结构培训 Equipment principle Structure	负责设备的电气及机械工 程师 Electrical and mechanical engineer responsible for equipment	在用户通电调试一 周后 After one week of power-on commissioning by users	0.5-2 天 0.5-2 days	提供设备说明书及培训资料及相关录像资 料 Provide equipment instructions, training materials and related video materials
2	应急处理 维修保养 Emergency treatment Maintenance and service	负责设备的电气及机械工 程师 Electrical and mechanical engineer responsible for equipment	在用户通电调试一 周后 After one week of power-on commissioning by users	0.5-3 天 0.5-3 days	提供设备说明书及培训资料及相关录像资 料 Provide equipment instructions, training materials and related video materials
3	设备原理 结构培训 Equipment principle Structure	设备使用人员 Equipment user	在用户通电调试三 周后 After three weeks of power-on commissioning by users	0.5-2 天 0.5-2 days	提供设备说明书及培训资料及相关录像资 料 Provide equipment instructions, training materials and related video materials
4	设备操作 应急处理 Device operation Emergency treatment	设备使用人员 Equipment user	在用户通电调试三 周后 After three weeks of power-on commissioning by users	0.5-3 天 0.5-3 days	提供设备说明书及培训资料及相关录像资 料 Provide equipment instructions, training materials and related video materials

9.1 技术培训 Technical Training

设备试生产运行期间，无锡釜川负责培训客户指定机电维修人员，培训包括设备操作维护，普通故障的分析和处理；

设备投入试生产后，无锡釜川派技术人员一名跟进 7 天；

无锡釜川质保期内每年派出 1-2 名相关技术人员到厂作指导及进行相应维护；

During the trial production of the equipment, Fuchuan (Wuxi) Intelligent Technology Co., Ltd. is responsible for training the mechanical and electrical maintenance personnel designated by the customer, including equipment operation and maintenance, common fault analysis and treatment; After the equipment is put into trial production, Fuchuan (Wuxi) Intelligent Technology Co., Ltd. shall send a technician to follow up for 7 days; During the warranty period, 1-2 technicians shall be sent to the factory every year for guidance and maintenance;

十、技术服务

X. Technical Services

10.1 备品备件 Spare Parts

免费提供从调试之日起一年的技术支持、服务及设备正常使用及维护所需的备品备件；

验收完成，无锡釜川提供以下清单：

保修期外三年强制配备部分（价格不包含在设备报价中，需要客户另行购买/放置在客户工厂备件库）；

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保修期外三年推荐配备部分（价格不包含在设备报价中，需要客户另行购买/放置在无锡釜川工厂内）；

保修期外三年易损件部分（价格不包含在设备报价中，需要客户另行购买/放置在无锡釜川工厂内）；

Free technical support, service and spare parts needed for normal use and maintenance of equipment shall be provided for one year from the date of commissioning;

After the completion of acceptance, Fuchuan (Wuxi) Intelligent Technology Co., Ltd. shall provide the following lists:

Mandatory parts within three years beyond the warranty period (the price is not included in the quote plant price, and the spare parts need to be purchased by the customer or placed in its spare parts warehouse);

Recommended parts within three years beyond the warranty period (the price is not included in the quote plant price, and the spare parts need to be purchased or placed in the factory of Fuchuan (Wuxi) Intelligent Technology Co., Ltd. by the customer);

Vulnerable parts within three years beyond the warranty period (the price is not included in the quote plant price, and the spare parts need to be purchased or placed in the factory of Fuchuan (Wuxi) Intelligent Technology Co., Ltd. by the customer);

10.2 软件服务 Software Services

提供设备相关硬件、软件升级服务；

硬件升级包括：自动化升级和搭接模块升级，速度提升，产量提升等；

软件升级包括：正常设备软件升级，生产管理系统 MES，射频识别 RFID 等；

设备主 PLC 必须带有以太网口，并预留至少一个空余接口（配有小型交换机亦可）及相关通讯模块（作设备间交互使用）。设备 PLC 应支持 S7 TCP/IP Ethernet、Modbus TCP/IP、EtherNet/IP 等主流协议中的一种；

有上位机软件的设备需提供 OPC Server、ODBC、web service 接口的集成方式；

Provide related hardware and software upgrade services of equipment;

Hardware upgrade includes: automation upgrade and lap module upgrade, speed increase, production increase, etc.;

Software upgrade includes: normal equipment software upgrade, MES, RFID, etc.;

The main PLC of the equipment must be equipped with an Ethernet port, and at least one spare interface (or a small exchange may be provided) and relevant communication modules (for the interaction between the equipment) must be reserved. Equipment PLC shall support one of other mainstream protocols including S7 TCP/IP Ethernet, Modbus TCP/IP, and Ethernet /IP;

Equipment with upper computer software shall be provided with the integration mode of OPC Server, ODBC, and web service interfaces;

10.3 设备附件及零备件 Equipment Accessories and Spare Parts

提供设备正常使用及维护所需的备品备件；

提供易损件清单及有关图纸；

Provide spare parts for normal operation and maintenance of equipment;

Provide the list of vulnerable parts and related drawings;

10.4 设备技术资料 Technical Data of Equipment

使用维护说明书：设备安装调试完成后，向客户提供最终使用维护说明书；

安装说明书或现场安装指导，关键外购件说明书；

设备验收单；

Instructions for operation and maintenance: The final instructions for operation and maintenance shall be provided for the customer after the installation and commissioning of the equipment;

Instructions for installation or on-site installation guidance, and instructions for key purchased parts;

Equipment acceptance list;

十一、项目交付和验收

XI. Project Delivery and Acceptance

11.1 设备的安装和调试 Installation and Commissioning of Equipment

设备的安装由无锡釜川负责，并于安装前一到两周提供安装场地要求；

在调试条件具备后，由客户开始设备的调试工作；

在客户提供保证条件的情况下，无锡釜川应按进度日程，保证质量完成安装调试工作；

Fuchuan (Wuxi) Intelligent Technology Co., Ltd. shall be responsible for the installation of the equipment, and provide the installation site requirements 1~2 weeks before the installation;

After the commissioning conditions are met, the customer shall start the commissioning of the equipment;

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In the case that the customer provides guarantee conditions, Fuchuan (Wuxi) Intelligent Technology Co., Ltd. shall complete the installation and commissioning on schedule and ensure the quality;

11.2 出厂测试 Factory Test

验收流程，在无锡釜川完成设备安装以后，双方在无锡釜川工厂进行设备的出厂验收工作。在双方共同监督下进行设备运行状态模拟（无锡釜川提供市水/洁净压缩空气/不含加热的电力负载支持）。如果设备能够完全满足规定的指标，即证明设备出厂验收合格。

验收地点：无锡釜川厂内；

验收条件：满足无锡釜川模拟运行/静态检测条件；

Acceptance process: After the completion of equipment installation in Fuchuan (Wuxi) Intelligent Technology Co., Ltd., both parties shall carry out factory acceptance of equipment in Fuchuan (Wuxi) Intelligent Technology Co., Ltd. Equipment operation state shall be simulated under the joint supervision of both parties (Fuchuan (Wuxi) Intelligent Technology Co., Ltd. provides municipal water/clean compressed air/power load support without heating). If the equipment can fully meet the specified indicators, it is proved that the equipment has passed the factory test.

Acceptance site: Factory of Fuchuan (Wuxi) Intelligent Technology Co., Ltd.;

Acceptance conditions: The simulation operation/static detection conditions specified by Fuchuan (Wuxi) Intelligent Technology Co., Ltd. shall be met;

11.3 最终验收 Final Acceptance

验收流程，在客户指定地点完成设备安装和调试以后，双方进行设备的验收工作。在双方共同监督下进行连续 90 天的生产。如果设备能够完全满足以下规定的指标，即证明设备验收合格，双方可签署验收合格证书。

验收地点：客户厂内；

验收条件：满足无锡釜川提供的 FUM 清单电力项目；

设备未注明细节按照无锡釜川标准生产；

设备连续试生产运行 7 日后，若设备正常运转，客户须进行正式验收；

未验收的设备不可投入生产，若投入生产的设备完全等同于已经验收合格；

验收签署的报告作为验收的依据，验收报告双方各执一份；

备品备件在正式验收后交付；

Acceptance process: After the installation and commissioning of the equipment is completed at the place designated by the customer, both parties shall carry out the acceptance of the equipment. Production shall be conducted continuously for 90 days under the joint supervision of both parties. If the equipment can fully meet the following requirements, it means that the equipment has passed the inspection, and then both parties may sign the acceptance certificate.

Acceptance site: inside the customer's factory;

Acceptance conditions: meet the requirements of the power projects in the FUM list provided by Fuchuan (Wuxi) Intelligent Technology Co., Ltd.;

The equipment without details shall be manufactured according to the standard of Fuchuan (Wuxi) Intelligent Technology Co., Ltd.;

If the equipment runs normally after 7 days of continuous trial production, the customer shall conduct formal acceptance;

Unaccepted equipment cannot be put into production; if such equipment is put into production, it means that it has passed the inspection;

The signed report shall serve as the basis for acceptance. Each party shall hold one copy of the acceptance report;

Spare parts shall be delivered after formal acceptance;

由于技术的不断进步，以上方案允许做以提高设备性能的技术调整。

Due to the continuous progress of technology, the scheme above is allowed to have technical adjustments for the improvement of equipment perform