

Technical Specifications for Single-Tube Horizontal Purification Furnace

I. Equipment Purpose

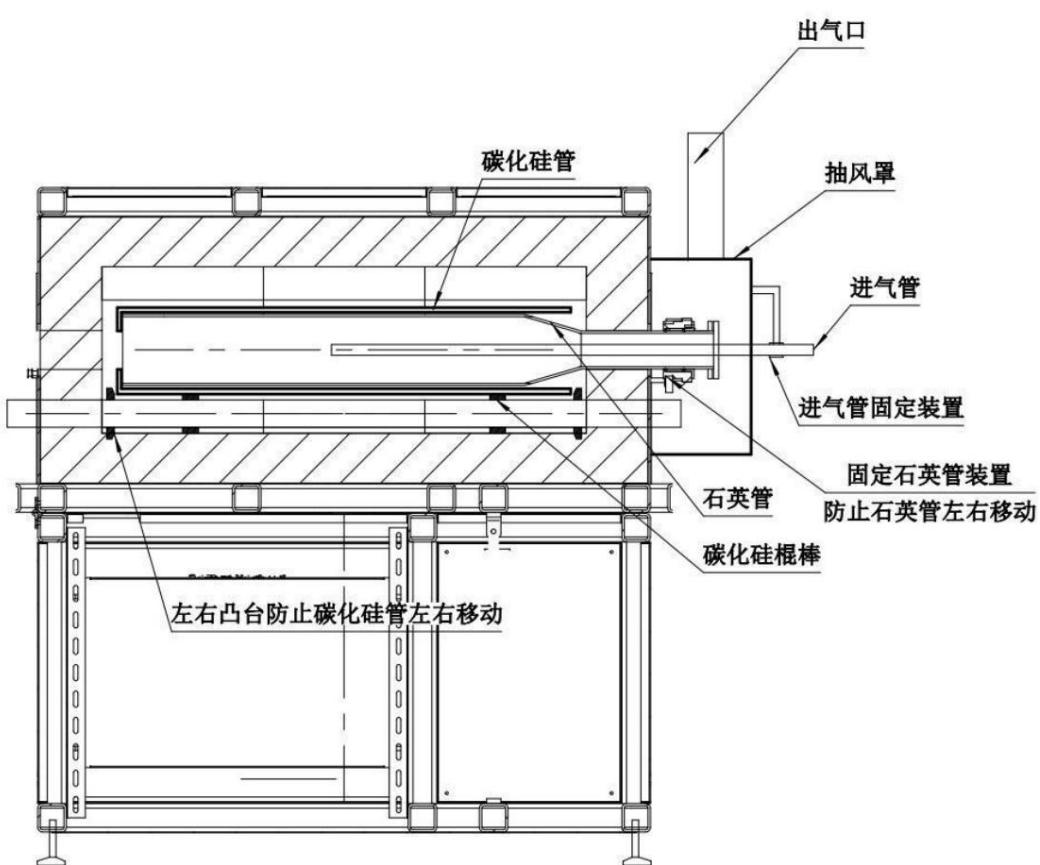
It is mainly used for the periodic purification and sintering of silica powder at high temperatures.

II. Equipment Components and Technical Requirements

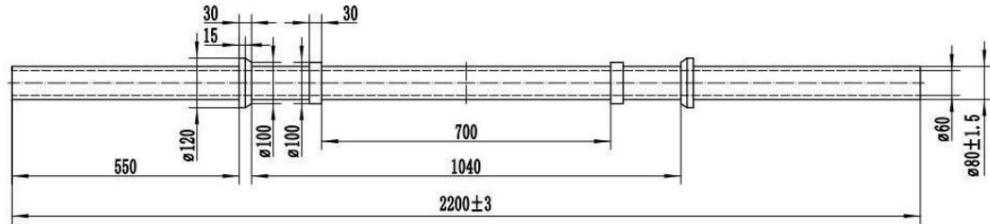
1. Equipment structure diagram (built-in furnace tube drive mechanism, with a quartz tube placed on the drive mechanism, the quartz tube wrapped with silicon carbide/

Silicon nitride composite tube to prevent softening and deformation of the quartz tube due to high temperatures. The transmission mechanism can withstand a weight of at least 80-100 kg. (Quartz tube ruler)

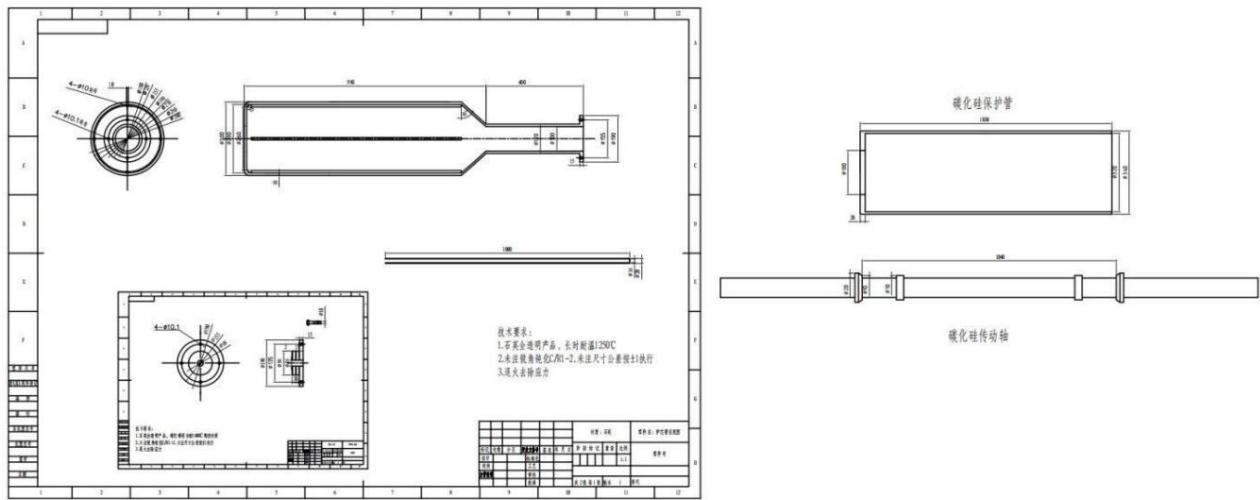
The drawing is provided by our company; the outer diameter is 300mm, the wall thickness is 10mm, and the length is 1500mm.



Structural diagram



Double roller furnace tube drive structure



Drawings of quartz tubes, caps, and silicon carbide tubes

2. Equipment Structure Standards The main

structure of the equipment includes the furnace shell structure, furnace chamber structure, furnace tube structure, silicon carbide roller drive structure, control system, heating and temperature control system structure, and others. Table 1. Equipment Structure Requirements

Equipment Composition	Basic requirements
Furnace body structure	<p>1. The furnace shell has good temperature resistance and will not deform due to high temperatures during long-term use. It is easy to clean and the color is [unclear]. The paint is well-matched and aesthetically pleasing, with no bubbling or paint dripping.</p> <p>2. The transmission components are fully protected to avoid safety risks, and the electrical protection is complete;</p> <p>3. The furnace shell structure is reasonable, avoiding long-term damage to local components (electrical components, hinges, clips, etc.). Overheating will affect the service life;</p> <p>4. The furnace door opening mechanism needs to consider ease of operation; it should be designed as a flip-top furnace body, and the opening angle of the furnace door needs to be... It should be easy to insert and remove the quartz tube; and the sealing performance should be improved as much as possible to prevent uneven temperature field ;</p> <p>5. An observation mirror is installed on the furnace body to observe the rotation of the quartz tube inside;</p>

	<p>6. Within the operating temperature range, the surface temperature of the furnace shell during heating, heat preservation, and cooling processes shall be $\leq 45^\circ\text{C}$;</p>
Gas control system	<p>1. The right end of the furnace core tube is equipped with an air inlet pipe; the furnace tube inlet is equipped with an exhaust hood to prevent gas from entering. Body leakage. 2. No vacuum is required inside the pipe; a flow meter is provided to control the flow rate of each gas; Air flow rate setting range: 1~30L/min; 3. Equipped with pressure protection to prevent blockage of the gas outlet and excessive pressure inside the furnace tube. 4. Equipped with a gas leak alarm system to prevent gas leaks; 5. A metal frame is welded to the outside of the furnace to fix the vent pipe.</p>
Furnace structure	<p>1. The furnace lining is made of vacuum-formed high-purity alumina lightweight material, suitable for loading and unloading materials. Lightweight hollow spherical alumina plates are used in areas prone to material impact (furnace opening, furnace bottom) to prevent damage. High temperature resistance, low heat storage, resistant to rapid heating and cooling, no cracking, no flaking, and good insulation. Good temperature performance; 2. Three layers of insulation are used: aluminum silicate fiberboard, alumina fiberboard, and... Alumina (polycrystalline) fiberboard 3. Two silicon carbide rollers are inserted inside the furnace. 4. The thickness of the insulation material should be carefully considered to avoid heat leakage problems;</p>
Furnace tube and roller structure	<p>1. The furnace tube is a quartz tube with a cap; see the drawings for dimensions. 2. The rollers are made of silicon carbide, with retaining rings welded to both sides or a diameter reducer, used to fix the furnace tubes and prevent... The rotary furnace tube moves left and right; dimensions are detailed in the drawings. Silicon carbide rollers must be supplied by the equipment manufacturer. Suppliers will handle procurement and assembly; 3. The quartz tube is a high-temperature resistant sand-turning tube, which can meet the requirements of powder turning and prevent powder from sticking together. piece; 4. The quartz tube is placed inside a silicon carbide/silicon nitride composite tube to prevent the quartz tube from softening at high temperatures. deformation.</p>
Rotary transmission structure	<p>1. The furnace body is equipped with a rotary transmission structure on one side, which drives two silicon carbide rollers.</p> <p>All rollers are driven; the silicon carbide rollers, under force, drive the internal quartz tube to rotate. Transmission method.</p> <p>It is necessary to ensure that the radial force on the silicon carbide roller is small to avoid cracking caused by radial force, which would affect its performance.</p> <p>Use lifespan;</p> <p>2. The motor is equipped with a variable frequency motor, with an adjustable speed of 1-5 r/min, and can be set to rotate in both forward and reverse directions;</p>
control system	<p>1. The temperature control process can save 5 or more processes, each containing 30 or more temperature settings. It can be edited online; 2. The temperature control system features continuous PID regulation, thermocouple failure alarm, over-temperature alarm, and equipment real-time monitoring.</p>

	<p>Features include power display, temperature compensation setting, real-time temperature monitoring, and temperature curve display.</p> <p>Record and export historical data;</p> <p>3. The control panel can be either touchscreen or keyboard and mouse-based;</p> <p>4. Set automatic power consumption calculation to automatically calculate the power consumption for each furnace cycle;</p>
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Refractory materials	<p>1. The furnace lining is made of vacuum-formed high-purity alumina lightweight material, which is prone to collisions when handling materials.</p> <p>The furnace opening and bottom are made of lightweight hollow spherical alumina plates, which have high operating temperatures and high heat storage capacity.</p> <p>Small, resistant to rapid heating and cooling, does not crack, does not shed slag, and has good thermal insulation properties.</p>
thermal insulation materials	<p>1. Three layers of insulation are used: aluminum silicate fiberboard, alumina fiberboard, and alumina (multi-layer) insulation.</p> <p>Crystal fiberboard has an energy-saving effect of more than 80% compared to old-fashioned electric furnaces.</p>
	<p>1. For long-term use without shutting down the furnace, the outer shell temperature should be less than 45 degrees Celsius.</p>
Protect	<p>1. An integrated modular control unit is adopted, ensuring accurate control precision, and a dual-loop control system is designed.</p> <p>Dual-circuit protection, including overshoot, overadjustment, underadjustment, thermocouple segmentation, phase loss, overvoltage, and overcurrent protection.</p> <p>Over-temperature protection, current feedback protection, soft start protection, etc.</p>
control	<p>1. Utilizes closed-loop technology for thyristor module trigger control, phase-shift trigger control, or zero-crossing trigger control.</p> <p>The output voltage, current, or power is continuously adjustable, and it features constant voltage, constant current, or constant power.</p> <p>The characteristics of the rate; the current loop is the inner loop, and the voltage loop is the outer loop. This is important when a sudden load or load current is applied.</p> <p>When the current limit is exceeded, the voltage regulator's output current is limited to within the rated current range to ensure output current.</p> <p>The voltage regulator and output voltage are operating normally; simultaneously, the voltage loop also participates in the regulation, ensuring the voltage regulator's output voltage is within acceptable limits.</p> <p>The current is limited within the rated current range, maintaining the output with sufficient adjustment margin.</p> <p>Maintaining constant current and voltage; thereby protecting the heating element from excessive current and voltage.</p> <p>Impact, to achieve safe and reliable control effect and control accuracy.</p>
Display parameters	<p>1. Temperature, temperature range number, time period, remaining time, output power percentage, voltage, electrical...</p> <p>Flow, etc.</p>
Button	<p>1. It uses imported buttons with a lifespan of over 100,000 cycles and comes with an LED indicator.</p>
Temperature profile setting	<p>1. Employs an intelligent temperature controller, equipped with standard PID, AI-controlled APID, or MPT, etc.</p> <p>It features multiple adjustment modes, self-tuning and self-learning functions, and excellent performance with no overshoot or undershoot.</p> <p>Its control characteristics include 30-segment programmable control, enabling temperature rise and fall control with arbitrary slopes.</p> <p>It has programmable/operable commands such as jump (loop), run, pause, and stop, and</p> <p>Allows modification of the program at any time during its controlled execution; employs curve fitting functionality.</p> <p>The artificial intelligence adjustment algorithm can achieve a smooth and even curve control effect;</p>

Heating and temperature control system	<p>1. Meets the long-term operating temperature of 1250°C and the maximum operating temperature of 1300°C. The process cycle is intermittent.</p> <p>The process involves heating to room temperature, maintaining that temperature for 2-8 hours, and then cooling back to room temperature.</p> <p>2. The heating rate is freely adjustable, with an adjustment range of: fastest heating rate 10 degrees per minute, slowest...</p> <p>The heating rate is 1 degree per hour (1 degree/h).</p> <p>3. Three or more temperature zones, with each zone requiring a minimum uniform temperature zone length of 1.3m for the furnace tubes.</p> <p>Temperature field uniformity within the temperature uniformity zone is $\pm 5\%$, and temperature control accuracy is $\pm 1\%$.</p> <p>4. The furnace heating elements use silicon carbide rods, arranged in parallel around the perimeter or top and bottom, with wiring on one side for convenience.</p> <p>Installation and replacement;</p> <p>5. The temperature control system uses a silicon controlled rectifier (SCR) voltage regulation method for temperature control;</p> <p>6. The temperature measuring thermocouple uses an S-type thermocouple, with a separate thermocouple line, which can be used for constant temperature control.</p> <p>Intermittently measure the temperature of the homogenization zone inside the quartz tube and calibrate the temperature compensation value;</p>
other	<p>1. Please provide one copy of the equipment installation requirements (including water, electricity, gas, ground, etc.) with the equipment.</p> <p>One certificate of conformity, one equipment instruction manual, one operation manual, and electrical drawings (electrical).</p> <p>One copy each of the schematic diagram (including input/output terminals, with terminal annotations) and the CAD assembly drawing.</p> <p>One copy of the list of consumable parts (including prices), one copy of the maintenance manual, and one copy of the brand and model of standard parts.</p> <p>One packing list and one delivery list are included; a test report will be provided upon delivery of the equipment.</p> <p>2. The electrical cabinet components should be equipped with fans for cooling and heat dissipation. The wiring should be laid out with normal density, and flying wires and sparse, loose wires are prohibited.</p> <p>Cable tray fixing;</p> <p>3. One crucible tong and one pair of high-temperature gloves are provided with the equipment;</p>

III. Brand Requirements for Major Components

Serial Number	Main Components	quantity	Brand/Manufacturer	Remark
1.	Main electrical components Item	1 set	Schneider Electric, Siemens	
2.	touchscreen	1 set	Siemens	10-inch
3.	PLC	1 set	Siemens S7-1200	
4.	thermocouple	1 set	Chongqing Dazheng or equivalent	S-type thermocouple
5.	Temperature control module	1 set	Xiamen Yudian, Japan's Shimadzu Corporation or equivalent	
6.	Refractory and thermal insulation materials	1 set	/	
7.	Furnace outer shell	1 set	/	
8.	Power regulator	1 set	Sichuan Yingjie	

IV. Electrical Control System

1. The system adopts S7-1200 PLC and 10-inch touch screen for joint control.

2. All technical parameters can be set on the touchscreen, and historical curves for at least the past week can be viewed, including at least: voltage, current, and temperature.

Key data such as...

3. The equipment has a communication network port, which can read key data from the equipment. The manufacturer provides corresponding assistance to complete the key data analysis of the equipment.

According to the reading.

4. Configure an emergency stop button.

5. The control cabinet is equipped with ventilation, heat dissipation, and automatic lighting devices.

6. Motor energy consumption: Level 1 energy consumption.

7. Each temperature zone is equipped with a temperature control thermocouple and a monitoring thermocouple, paired in pairs, one for control and one for monitoring.

V. Random Spare Parts

Name:	quantity
Thermocouple	1 of each type
Silicon Carbide Rod	2 of each type

VI. Other Requirements

1. The transmission structure is designed to be stable and reliable, with room for future modification of the idler rollers, ensuring convenient replacement of the rollers later. The heating furnace door can be fully opened.

It meets the requirements.

2. When shipping, a set of spare parts will be sent according to the quantity on the spare parts list (list of vulnerable parts), and the price is included in the equipment price.

3. Equipment color: Main body color is gray (RAL7038), electrical cabinet (RAL7038), rotating body (RAL2003), and anti-counterfeiting features.

Protect (RAL1003).

4. Accuracy Acceptance Criteria: See the table below.

Serial Number	Inspection items	Technical Requirements	Test methods
1.	Long-term operating temperature	Meets 1250°C	Temperature loop or thermocouple test
2.	Temperature control range	Meets 80-1300°C	Temperature loop or thermocouple test
3.	heating rate	Meets the requirement of 0.5-10°C/min	Temperature loop or thermocouple test
4.	cooling rate	Natural cooling at a rate of 0.5°C/min is achieved. speed	Temperature loop or thermocouple test
5.	Number of temperature zones	3 or more	Visual inspection
6.	Length of uniform temperature zone	≥1200mm	Temperature loop or thermocouple test
7.	Temperature control accuracy	Meets ±1°C	Temperature loop or thermocouple test
8. Extreme temperature difference in the uniform temperature zone		Meets ±5°C	Temperature measurement loop or thermocouple test during constant temperature stage
9.	Variable frequency drive	Has inverter certificate of conformity Inverter manual included	Visual inspection
10.	Appearance quality	No bubbling or paint dripping.	Visual inspection

VII. Responsibilities of both supply and demand parties

The manufacturer is responsible for the installation and commissioning of the equipment, as well as training the client's personnel. At least three equipment operators must be trained.

Our company will install and debug all equipment and materials for the system.

1. Responsible for participating in on-site unpacking and inspection of equipment.

2. Responsible for developing a detailed installation and commissioning plan, including project schedule recommendations, identified malfunctions, and potential adverse factors.

Include suggestions on potential delays and remedial measures. Report any emergencies to the supervisor and user unit immediately.

3. We are responsible for strictly adhering to the project schedule and dispatching experienced on-site service engineers to guide the on-site installation.

4. Responsible for conducting self-inspection and mutual inspection, and filling out the equipment installation quality form. For products that can be tested by powering on, conduct a pre-power-on test.

Products that fail inspection or do not meet quality standards must not be installed.

5. We are responsible for assisting user units in implementing the "Excellence Creation Rules".

6. We are responsible for assisting the user and the supervisor in the acceptance of each installation stage.

7. Before the warranty period, including the warranty period, if any quality problems are found with the equipment, our company will provide free repairs.

Repairs will not affect the project schedule; if functional defects are found in the system, our company will be responsible for resolving them.

VIII. Technical Information:

Packing list: 1 copy

Certificate of Conformity: 1 copy

Instruction manual: 1 copy

CAD assembly drawing: 1 copy (including 3D drawing)

List of consumable parts (drawings must be provided if available)

Spare parts list (drawings must be provided if available)

Maintenance and Care Instructions

Operating Safety Procedures

Provide a list of consumables and wear parts, their prices, and replacement cycles.

IX. Acceptance Procedures and Standards

The equipment acceptance process is conducted item by item according to the user requirements document. The acceptance process consists of four steps: factory inspection, unpacking inspection, and inspection upon delivery.

The process involves four steps: acceptance, installation, commissioning, and final acceptance. Upon successful acceptance, both parties sign an acceptance certificate, and the accounting period begins from that date.

Calculate the equipment's shelf life.

• Factory inspection:

Before the equipment is packaged and shipped, Party B shall notify Party A one week in advance to conduct a pre-shipment inspection of the equipment at Party B's location.

The inspection is based on the specifications of the supplied equipment confirmed by both parties. The main inspection items include brand, specifications, and equipment details.

The exterior dimensions, painting requirements, material requirements, and motor power-on testing are prepared. After acceptance, both parties will conduct a factory inspection.

After the receipt is signed and confirmed, the packaging and transportation stage begins.

• Unpacking and inspection:

The equipment's external packaging must be intact. Complete sets of equipment should have a complete wooden or cardboard box. Equipment unsuitable for boxing should be avoided.

For equipment transported over short distances, it can be delivered directly to the factory or delivery location. The type of equipment and the specifications in the technical agreement should be considered.

To verify consistency, check the parts, components, spare parts, tools, accessories, certificates of conformity, instructions, and other drawings against the packing list.

Check if all documents, including paper and technical files, are complete and undamaged. Inspect the equipment for serious damage such as collisions or peeling paint.

Check whether this has affected the accuracy and technical performance of the equipment.

• Installation, commissioning, and acceptance:

a. No-load commissioning: After the equipment installation and commissioning are completed, both parties shall conduct a no-load test run.

The assessment of equipment functionality includes the assessment of individual equipment and the assessment of inter-unit equipment. No-load test run for 6 consecutive days.

Within hours, all performance indicators met the design requirements of the technical agreement, and Party A issued a written acceptance report.

Both parties signed and confirmed the agreement.

b. Load test: Following a successful no-load test, a load test will be conducted, lasting 24 hours.

Within 24 hours, both Party A and Party B will jointly inspect the equipment provided by Party B to check whether Party B's equipment and system are in good working order.

Once the design requirements are met, both parties shall sign and confirm the acceptance results.

Final Acceptance

a. Equipment consistency and integrity: The specifications and type of the equipment shall be consistent with the equipment specifications and parameters confirmed by both parties.

Therefore, the supporting equipment should be compatible with the whole machine and be complete and complete.

b. Control mechanisms: Each control mechanism should be flexible, reliable, provide accurate indications, and be free from jamming during operation and control.

Loosening phenomenon.

c. Operating mechanisms: Each operating mechanism should operate smoothly without any impact, abnormal noise, malfunction, interference, or overheating.

d. Overall machine operating status: Under normal operating conditions, the machine should be able to operate continuously and normally. During operation,

No abnormal noise, interference, or overheating.

e. Production capacity: Under normal production conditions, the production capacity of each piece of equipment should meet the requirements of the user's specifications.

f. Acceptance will be conducted at each stage according to the technical agreement parameters. If specialized instruments are required, the supplier will provide them.

10. Warranty Period and After-Sales Service

1. The quality guarantee period is 12 months from the date of signing the final acceptance report of the equipment.

2. During the warranty period: If the equipment cannot operate normally due to a malfunction, the supplier shall be responsible for free maintenance or replacement.

Parts replacement; if the equipment cannot operate normally due to the buyer's human factors or external objective factors, the supplier will be responsible for maintenance for a fee.

Repairs are available, but only service and material fees will be charged at our discretion.

3. Outside the warranty period: Regardless of whether the equipment malfunctions due to its own defects, customer error, or external factors, the equipment may not be able to function properly.

If production is proceeding normally, the supplier should respond promptly, be responsible for maintenance, and cooperate with the customer to resume production.

4. The scope of quality assurance covers the goods under this technical agreement.