

**STT-1200C-3.5-12-QZ High Temperature Tube  
Furnace Installation and Operation Manual**

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# **STT-1200C-3.5-12 High Temperature Tube Furnace Installation and Operation Manual**

## **1. INTRODUCTION**

This Manual and related drawings provide the necessary instructions to install, operate and maintain the Sentro Tech's STT-1200C-3.5-12 Tube Furnace. We recommend careful reading of these instructions BEFORE installing and operating the Furnace and its related equipment.

### **WARNING !**

**Do not service equipment with voltage applied. Controller can be a source of fatal electrical shock. To avoid shock hazard, remove all sources of power before maintaining the Controller and Furnace.**

Refer to the Instruction Manual and supplied drawings BEFORE operating or maintaining this equipment. Installation, operation and maintenance must be entrusted only to technically competent and authorized personnel.

**Furnace and Controller box have to be 100% grounded at all times. Use a properly sized ground wire at Controller box with mark: "Ground", to an appropriate ground in the customer's facility. (Be sure to follow local electrical codes.)**

**Turning off the Furnace at the Control Panel DOES NOT mean that the Power Supply is disconnected from the Control Console. Main Power Disconnect has to be turned off in order to perform maintenance.**

### **Warning:**

**Good ventilation system is required near the furnace and the room when injecting Argon gas into the Furnace Tube!**

**No explosive, combustible or corrosive gases/materials should be introduced into the Furnace!**

**Good ventilation is absolutely required in the room ! Must use oxygen sensor to ensure that oxygen concentration in the furnace room remains above 19.5% when Argon gas is injected into the furnace. Local exhaust at furnace point is preferred.**

STT-1200C-3.5-12 High Temperature Tube Furnace is easy to operate. Furnace uses High Temperature Metallic Heating Elements, K-type Thermocouple, and 30 segments Programmable Temperature Controller.




### System Information:

Furnace max power	3KW
Voltage (single phase)	208V
Max Temperature in air or inert gases	1200 °C
Max temperature under vacuum for Quarts Tube	800°C
Max temperature under vacuum for Alumina Tube	1200°C
Max Heating Rate for alumina tube	5°C/min
Recommended Heating Rate for alumina tube	4°C/min
Max Heating Rate for quartz tube	10°C/min
Recommended Heating Rate for quartz tube	8°C/min
Type of Heating Elements	High Temperature Metallic Heating Elements
Heating Zone Length:	12"

## 2. Furnace Controller Console

### Temperature Controller:

The Temperature Controller is housed beneath the Furnace on Control Console. The basic features of Temperature Controller are briefly described below:

1. Output indicator ( out )
2. Temperature alarm 1 ( AL1 )
3. Temperature alarm 2 (AL2 )
4. Aux. Data indicator from outside source (AUX )
5. Thermocouple measured temperature ( PV )
6. Program set temperature ( SV )
7. Scroll Button ( also for controller parameter selection) (  )
8. Down Button ( press to decrease value and to start or hold program) (  ) ( run/hold)
9. Program Input (  ) ( A/M)



10. Up Button (press to increase a value

or to stop program)



### 3. Furnace construction

#### Heating elements:

Heating chamber is insulated by heat conductive ceramic tube which will prevent process tube to touch the heating elements.

#### Furnace structure:

The Furnace contains a removable top and back plate cabinet, which provides access to the Power Connection, the Heating Element terminals and thermocouple.

Unscrew front controller panel, controller box can easily pulled out for future maintenances.

The Furnace uses 1400°C grade high temperature Ceramic Fiber Board materials in Heating Chamber.

During normal use it will not generate any significant level of dust from these materials, but much higher level of dust may be generated during the service. Always wear a Respirator for protection against Dust particles.

When servicing this Furnace wear proper safety glasses and long sleeve dress. Make sure to use proper mechanical ventilation during the service of this Furnace.

**Warning: This Furnace uses vacuum formed high temperature ceramic fiber board materials in heating chamber. Under normal use, it will not generate any significant level of dust from these materials, but much higher level of dust may be generated during service. Always wear a respirator for dust particles, wear safety glasses when serving the Furnace.**

K type of thermocouple is inserted from the bottom of the Furnace. This type of thermocouple will provide long service life under normal working condition.

### 4. Installation

#### Handling and unpacking

Upon receipt of this Furnace you should immediately do the following:



Inspect the packaging before the Furnace is unpacked. A visual inspection of all packaging should be made. If damaged during transit, you should notify the Freight Carrier and file a claim so that an inspector can be present to verify any damage before the Furnace and its components are unpacked.

If no damage is apparent,

1. Move the shipping container to the Furnace's designated location.
2. Open container and remove the Furnace and all packaging material.
3. **Do not throw away** any packaging materials until Furnace assembly is complete and all components are working.

### Furnace installation

Furnace should be installed on a strong and stable /level table without vibration source near by. Make sure there is no flammable material or explosive/ corrosive gas around the Furnace area.

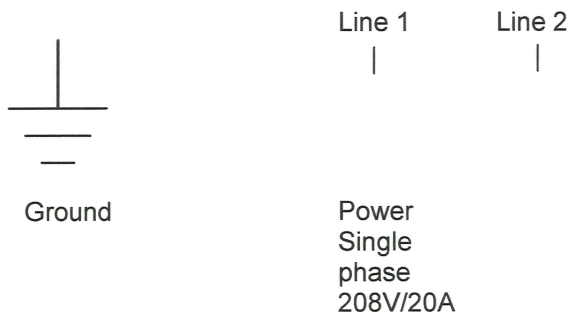
The Furnace is shipped with Thermocouple installed.

- A. Unscrew and remove the Access Panel located on the back of the Furnace Cabinet. Removal of this Panel will enable access to the Electric Power connection. Make sure all connections are tight.

#### B. Power wiring

The Furnace is designed to operate on a power source of 208/220 volts x 20A, single phase, at 50 or 60 Hertz.

The customer must provide power connection wires between the Main Power Junction, Circuit Breaker Box or Disconnect Switch and the Furnace. Remove the Rear Panel of Controller Box. A hole on the Cover provides an access for the Power Connection wires.



The customer must also provide a main-line Disconnect Switch or Main-line Circuit Breaker at the Power Supply. This must comply with local electrical codes. These codes must also be observed in grounding the Furnace and in sizing of the Power Line from the customer's Disconnect Switch to the Furnace.

**Furnace must be grounded 100%. DO NOT ground the Furnace to a painted surface. The Ground connection must be to a clean, bare metal surface to assure proper Furnace operation. A Ground connection is available on Rear side Controller Box near the Main Power Terminal Block.**

Connect power to the Furnace according to the following procedure:

1. Remove the Rear panel of the Furnace

Connect two leads 208 volt, single phase, 50/60 Hz. Power supply, using labels Line 1 and Line 2 in terminal block, from the customer Main Power Disconnect Switch to the terminal block in the control console. See the Furnace diagram.




### **WARNING !**


**BE SURE THAT THE POWER IS TURNED OFF WHILE MAKING WIRE CONNECTIONS.**

Replace and secure the rear Access Panel of the Control Console, using the necessary screws. Secure the power wire to the Furnace Panel.

## **5. OPERATION**

### **INITIAL START UP PROCEDURE**


- a. Tube set up, as shown in tube setup page
- b. Install vacuum sealing plate, as shown on the attached pictures.
- c. Turn on the Main Power at the customer-provided Disconnect Switch.
- d. Turn the power switch on ( Depress the red power switch). Temperature Controller shows power on, Power contactor relay kicks in.
- e. Temperature Controller should be on measuring only mode: PV showing double digital number ( for example: 30 ) and SV flashing "Stop". If Controller is not in this mode, press  and make Controller be on measuring only mode ( SV flashing "Stop".)
- f. Set up the program in Temperature Controller, as shown in the page of program setup sheet. ( Note: temperature is in Degree °C and time is in minutes)
- g. Press  key for two seconds, PV shows Run. Now the Temperature Controller is in Control Mode, Furnace starts to heat up. Press  for two seconds while

program is running, Controller shows Hold, Controller will hold current temperature. Press  for other two seconds, controller will show run again and resume program.

**Note: If temperature controller is in Aux. mode ( aux light on), Press  to return normal program setup mode (aux light off).**

**Note: It is recommended for the first use or the use after extensive outage to run the furnace at 200C for two hours and let moisture in the refractory evaporate.**

Shut down procedures

1. Press  , SV flashing “Stop”, this will put Controller in Measuring Mode (not controlling).
2. Turn Red Power Switch off , Power Contactor Relay kicks off.
3. Shut off the Main Circuit Breaker.

### **WARNING !**

**Always wear safety glasses when you are operating the Furnace and handling the samples in the Furnace. The fiber layer may be spalling off when Furnace is cooling down.**

**Never use bare hand to touch hot furnace case, Furnace Refractory Lining or Samples.**

**Never load, remove sample when furnace power is on. Always shut off the Main Circuit Breaker before opening the furnace sealing plated or when loading or removing sample.**

**If Stainless steel tube is used, the stainless steel tube has to be 100% grounded at all time.**

Furnace insulation materials:

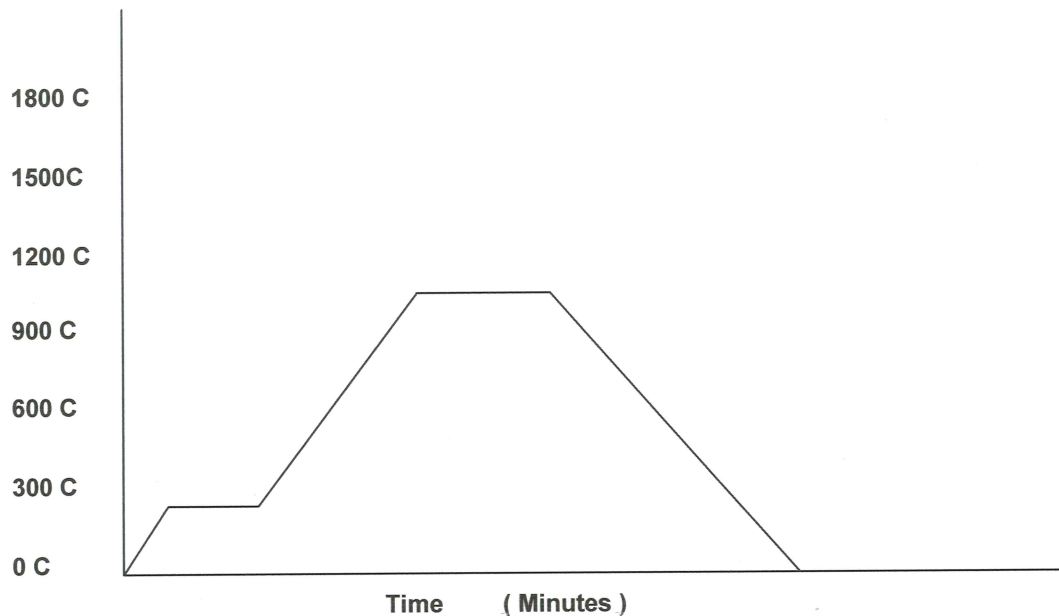
The max furnace operating temperature is 1200°C. It is recommended, however, that the Furnace be operated at 1100°C or less, for continuous duty in order to prolong the life of the Furnace components, Heating Elements, Thermocouple and insulation.

## **6. Maintenance**








1. First use or use after extended outage, refractory will absorb significant amount of moisture. It is advisable to slowly heat to 200°C and keep at 200°C for 2hrs. and let moisture evaporate
2. Never operate Furnace above 1200°C in air. It will damage Heating Elements and Refractory
3. This Furnace is designed for use of Vacuum or inert atmosphere. No explosive or corrosive gas should be introduced to the Furnace tube.
5. Make sure Heating Element terminal connection is tight. Power should be shut down and absolutely disconnected before checking the Heating Elements.
6. This Furnace is designed for indoor, ambient temperature between: 10°C - 60 °C, RH less than 85%. No electrically conductive powder dust or explosive/ corrosive gas around Furnace area is allowed.

## Temperature controller program set up procedure(Standard Sentro Trch Default Program)



- |         |       |  |  |
|---------|-------|--|--|
| Step 1  | Press |  | PV showing small digital such as 25, 30, SV flash stop   |
| Step 2  | Press |  | for just one second, controller shows C 01, 0 C is your starting point<br>C01 should always set as 0 |
|         |       |  | use   to change the number   |
| Step 3  | Press |  | Controller shows t 01, 40min which is the time the furnace will take to next temperature             |
| Step 4  | Press |  | Controller shows C 02, 200C  |
| Step 5  | Press |  | Controller shows t 02, 120min which is the time the furnace will soak at 200C                        |
| Step 6  | Press |  | Controller shows C 03, 200C  |
| Step 7  | Press |  | Controller shows t 03, 120min which is the time the furnace will take to next temperature            |
| Step 8  | Press |  | Controller shows C 04, 1000C   |
| Step 9  | Press |  | Controller shows t 04, 60min which is the time the furnace will soak at 1000C                        |
| Step 10 | Press |  | Controller shows C 05, 1000 C  |
| Step 11 | Press |  | Controller shows t 05, 120min which is the time the furnace will take to next temperature            |

- Step 12 Press  Controller shows C 06, 0 C ( furnace to room temperature)
- Step 13 Press  Controller shows t 06, -121 , program end automatically.  
note: make sure last t set as -121. -121 is the order for controller to end the program.

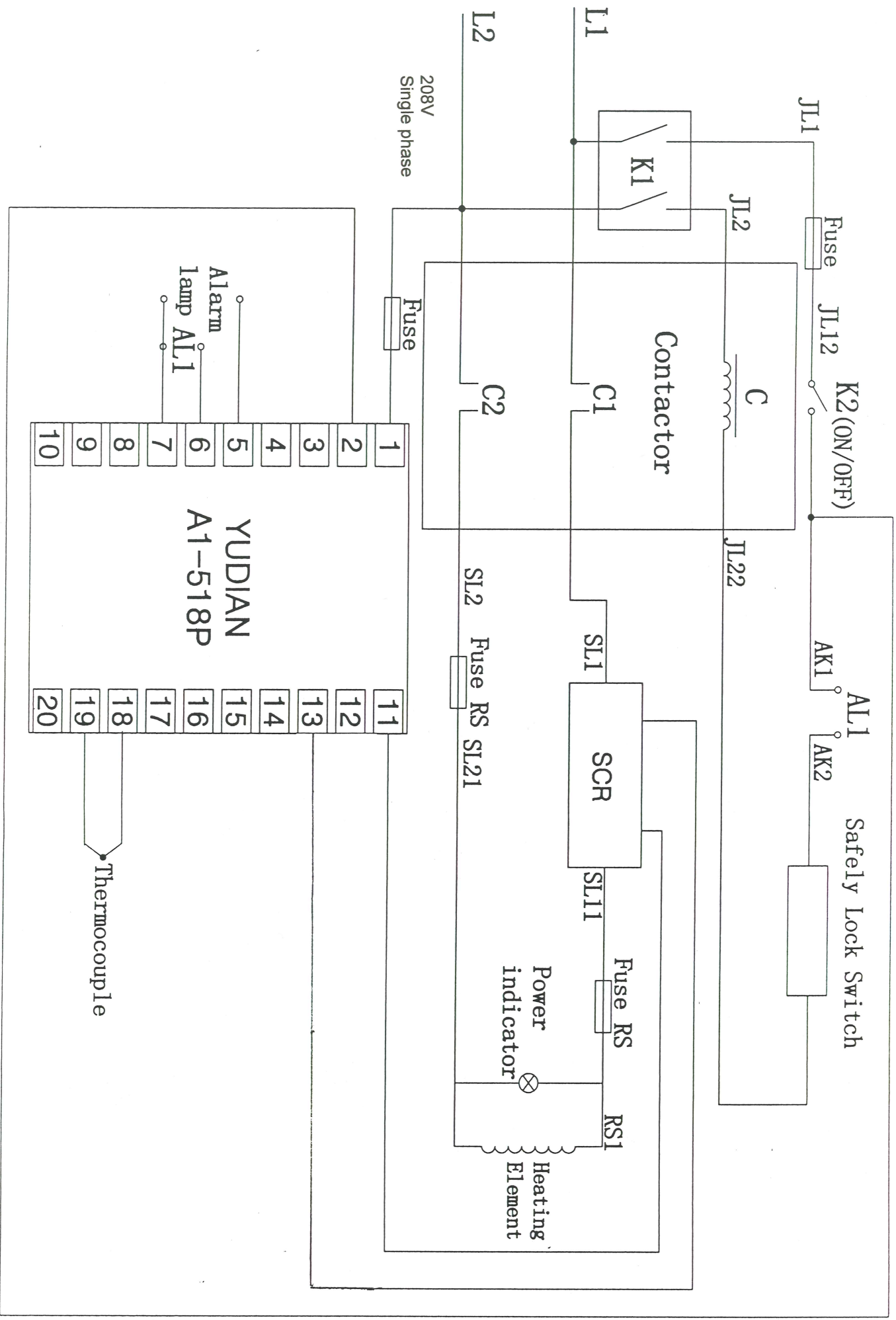
After setting up temperature profile program, wait 30 second, or press  and  at same time, controller will return to measuring mode automatically, then press  to run the program

Note 1: step 1: if controller SV is already flash stop, you may not need press , directly to step 2

step 2:  press for 1 second only

Note 2: use   to change the setting temperature and time





ST-1200C small furnace electric diagram

### Tube set up procedure:

A high purity alumina tube is supplied with the tube furnace. Tube setup procedure is summarized in the following steps:

**Step 1: Insert the tube through the furnace tube holes.**

Make sure this is done without touching the Heating Elements. The Elements are brittle and may be broken by careless handling of the Tube during insertion. The gap between the Tube O.D. and the opening in the refractory should be 1-2 mm in order to ensure the free movement of the tube and to avoid the cracking of the Tube. If the customer decides to use smaller diameter tube, tube conversion ring and support block should be used, please contact Sentro Tech for tube conversion ring and support block.

**Step 2:** For temperature uniformity and protection of high temperature rubber seals and stainless steel plate, Use of insulating refractory plugs is strongly recommended. Fiber blanker wrapping should be placed in the tube's ends ( just outside of furnace heated area) as shown in the attached picture. Ceramic fiber wrapping will improve tube life and reduce thermal shock cracking.

**Step 3:** Insulating refractory plugs should always be installed after loading the sample in the tube as shown in the attached drawing. Rubber seals and stainless steel plate are also supplied. The stainless steel sealing plate is affixed to the tube by the ring clips and wing nuts, as shown on the attached picture.

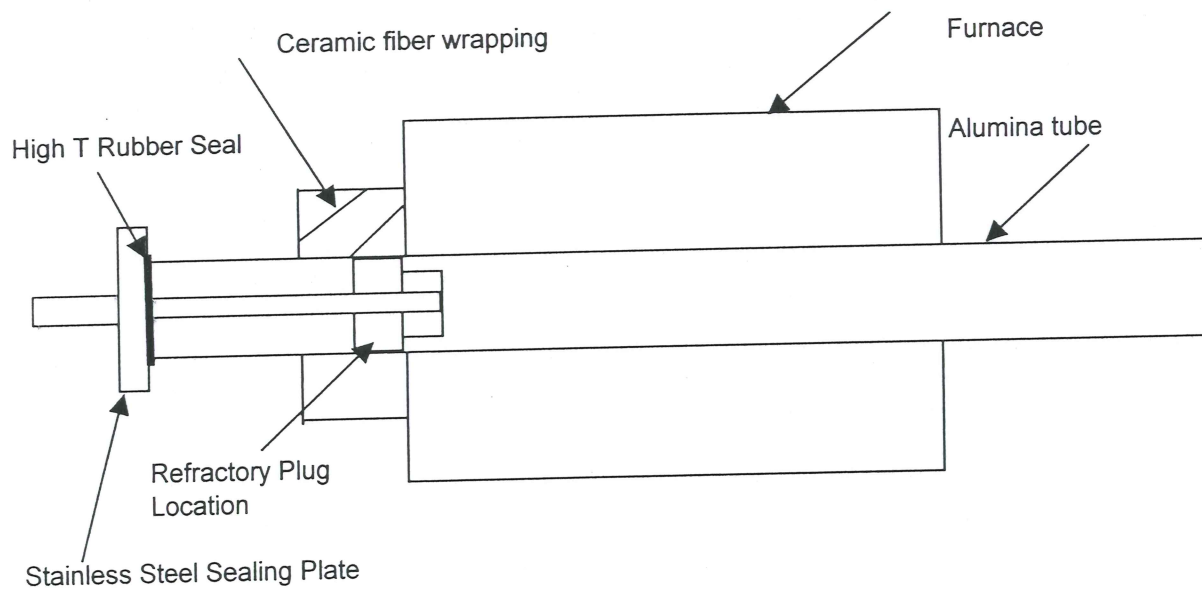
**Step 4:** Install tube support hanger system (optional) as shown in the attached picture. We strongly recommend tube hanger system for large tube furnace.

### Additional Notes:

- 1: The life of the heating elements and the ceramic tube is shortened by operating at temperatures close to maximum. Do not leave the furnace at high temperature when not required.
- 2: Under high temperature alumina tube may become electrically conductive. **DO NOT use any conductive tools within the work Tube without isolating it!**
3. No flammable objects should be placed in such a way as to be ignited if the work tube should break and fall on them.
4. **Do not use explosive or flammable gasses in the Tube.**
5. Turn the furnace power off when loading or unloading samples.
6. High purity alumina tube may crack if work pieces are inserted too quickly or at a temperature below 900C (the tube is more brittle.) Larger pieces should be heated

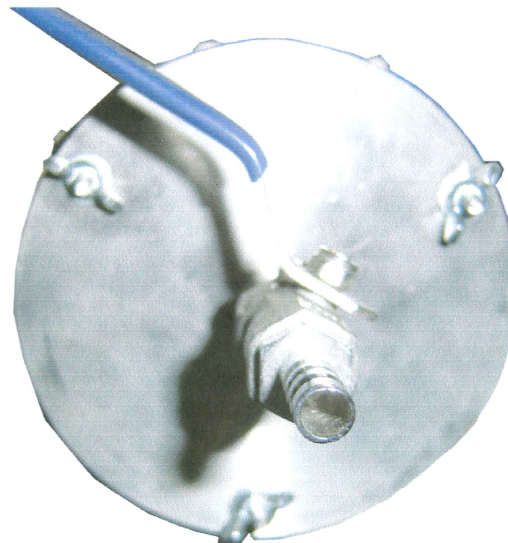
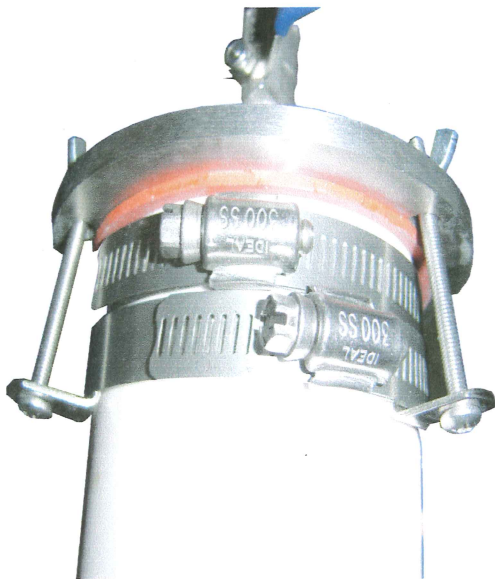
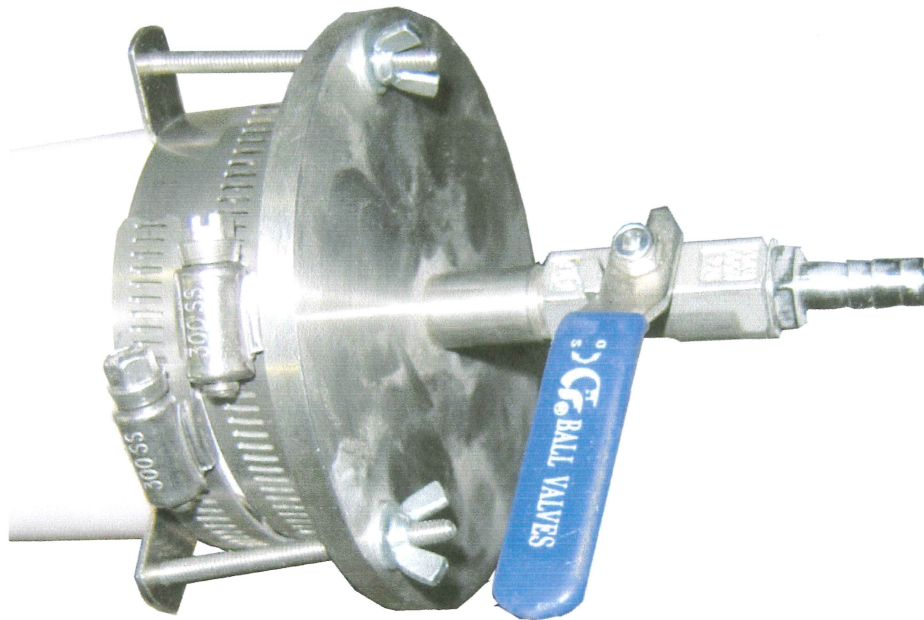
slowly in order to avoid large temperature differences.

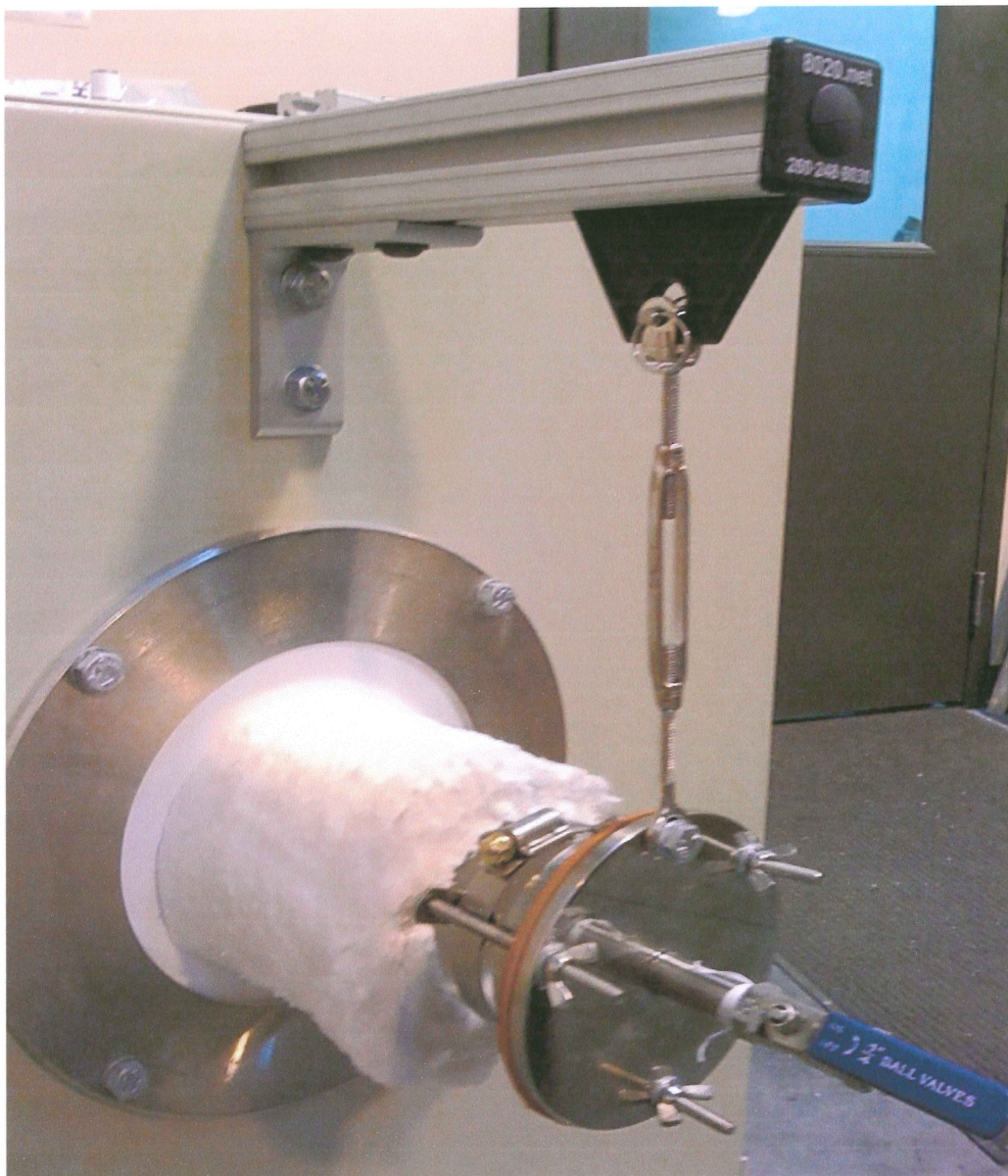
7. Always use poor thermal contact between the sample and the tube. The crucibles or boats should have low thermal mass and have feet which will reduce the contact with the Tube.
8. Use a low heating rate. Large diameter tubes are very susceptible to thermal shock, more so than the smaller. A general rule for maximum heating rate is:  
 $400/\text{I.D. (mm)} = (\text{Degrees C/ Minute})$ . For 3" I.D Tube, (76.2 mm) the result is 5.2.  
We recommend heating rate of 4 C/Minute for longer life of the tube. The heating rate is set by the temperature controller.
9. Positive pressure at the process tube: due to the nature of the high purity Alumina, the tube should not work under high internal pressure. The normal positive operating pressure should be 1 PSI or less.





## Tube furnace sealing flange assembly









**Picture: tube support hanger system**

## Factory Preset Temperature Controller Critical Parameters

For STT-1200 tube furnace:

(2010 model with Yudain-518P)

Wrong Parameter setting may result in Controller malfunction. Critical data has been locked ( Loc: 0 ) under current condition. To unlock critical data, change Loc to 808 ( we don't recommend to unlock these critical data).

To change Critical Parameters, press  for two seconds. Use  and  to change the Parameter number. Press  again for one second to change to the next one. After Parameter setting, wait for 30 seconds. Controller will return to measuring mode (SV shows Stop ). If you press wrong keys, just simply wait 30 seconds. Controller will return to measuring mode.

HIAL	1203 ( Alarm Setting Temperature. Controller SV will flash HIAL ( alarm) when Furnace Temperature is higher than 1203°C, furnace will be shut down when temperature is higher than 1203°C).
LoAL	-1999
dHal	999.9
dLAL	999.9
dF	2
Ctrl	3
M5	100
P	80
T	70
Ctl	1
Sn	0 ( K type of Thermocouple. This number should never change)
dIP	0
diL	0
DIH	1200
SC	0 ( Thermocouple Temperature adjustment, typical from 0-25)
oPt	0 ( Output mode of Temperature Controller. This number should never change )
oPL	0
oPH	90 ( max power output, it can be adjusted from 50% to 110%)
ALP	3333
CF	0
Addr	1
bAud	9600
dL	2
run	10
Loc	0 ( critical data is locked), 808 ( critical data is unlocked, you can change critical parameter when Loc is 808)
EP1	HIAL
EP2	dF
EP3	Ctrl
EP4	none
EP5	nonE
EP6	nonE
EP7	nonE
EEP8	nonE