	Salt Oven Usage Procedures	
Document Number:		Revision Number: 01
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1 Purpose

This document describes the procedure for preparing and operating the Barnstead Thermolyne F21100 for use with a Sodium Chloride (NaCl) loaded quartz tube. The tube furnace heats the salt to a desired temperature of 610C, just below its melting point. A stream of Helium flows through the heated tube, along with the heated NaCl aerosol. The tube has a water cooling section before the gas outlet, preventing damage to the following gas lines and the Umbilical.

Warnings Refer to THA for required precautions needed for tube furnace operations. Always use heat resistance gloves when handling the salt tube. Ensure a proper barricade is in place around the oven work space. Ensure proper signage is in place to warn others of the hazards present beyond the barricade.

2 Preparing Oven

☐ 1: Only use Tube Furnace in designated area

☐ 2: Make sure the furnace is empty before loading the salt tube

☐ 3: Load the salt tube in the oven

☐ 4: Connect Helium gas inlet and outlet to the tube

☐ 5: Connect the output end to the water cooling loop using the attached flex hose

3 Starting Water Cooling Loop

☐ 6: Ensure the needle valve behind the gas board is closed.

☐ 7: Check that the inlet line is attached to the water line after the valve and that the outlet line is running into the drain channel.

☐ 8: Insert the input line into the sleeve on the salt tube closer to the oven. Clamp the line using the hose clamp provided.

☐ 9: Insert the output line into the sleeve on the salt oven nearer to the He gas outlet. Clamp the line using the hose clamp provided.

- [ ] 10: Slowly open the valve. Ensure that all of the bubbles are out of the line before starting the Helium flow.
- [ ] 11: Check the seal on the input and output lines for water leaks. If the water pressure is too high water will leak from the cooling loop connections. If there is a leak close the water valve until the leak is no longer present.

4 Turn on Oven

- [ ] 12: Turn on the furnace, make sure the setpoint is 615C
- [ ] 13: Use the "UP" or "DOWN" button while in the home display to change the setpoint

4.1 Tuning Cycle

- [ ] 14: Press the "PAGE" button until "Atun" is displayed
- [ ] 15: Press the "SCROLL" button, the display will read **tunE**
- [ ] 16: Press either "UP" or "DOWN" to select **ON**
- [ ] 17: Press both "SCROLL" and "PAGE" to return to the main display
- [ ] 18: Wait for the tuning to complete

4.2 Continuous Heating

- [ ] 19: Press the "PAGE" button until **SP** is displayed
- [ ] 20: Press the "SCROLL" button until **tm.OP** is displayed
- [ ] 21: Press either "UP" or "DOWN" to select **Opt.2**. This setting will ramp and maintain setpoint temperature
- [ ] 22: Press the "SCROLL" button until **StAt** is displayed
- [ ] 23: Press either "UP" or "DOWN" to select **run**
- [ ] 24: Press both "SCROLL" and "PAGE" to return to the main display

5 Flow Gas

☐ 25: Ensure that all of the valves on the gas board are closed.

☐ 26: Check that the valves on the He, N_2, and CO_2 bottles are closed.

☐ 27: Verify that the "Solenoid Valve II" switch is in the OFF position.

☐ 28: Enter the DCR using standard entry procedure and verify that

- the gas input line is connected to the "dry" end of the umbilical
- the gas return line is connected to the "dry" end of the umbilical.

☐ 29: Turn on the power onf the main instrument panel and the dual flow controller box.

☐ 30: Flip the switch on the flow controller box to "B" (for N_2 and/or CO_2). The reading takes a few minutes to equilibrate to zero or near zero.

☐ 31: Ensure that the CO_2 and He bottles are hooked up to the input line at VA2. Ensure that the N_2 bottle is connected to VA1.

☐ 32: Check that VA2 and VA2 are closed.

☐ 33: Close the needle valve on the CO_2 bottle.

☐ 34: Open the main valves on the CO_2, He and N_2 bottles.

☐ 35: Set the regulator on the CO_2 and He bottle to 33 psi. Set the N_2 regulator to 20 psi.

☐ 36: Record the bottle pressure:

Transducer	Reading
CO_2 Bottle Pressure	
He Bottle Pressure	
N_2 Bottle Pressure	

*T*he pressure of a full CO_2 bottle is 850 to 900 psi. The CO_2 in the bottle is in liquid or solid form and the pressure will stay relatively high until gas only and will drop rapidly thereafter. The helium bottle is simply gas under pressure and the pressure will drain steadily throughout its use. ...

6 Turn off Oven

☐ 37: Press the "PAGE" button until **SP** is displayed

☐ 38: Press the "SCROLL" button until **StAt** is displayed

☐ 39: Press either “UP” or “DOWN” to select **off**

☐ 40: Press both “SCROLL” and “PAGE” to return to the main display

☐ 41: The oven should start to lose heat, let the salt tube cool to ambient temperature

☐ 42: Turn off tube furnace