SMD Operations Procedures Manual

8.1.1.46 OPERATION OF THE LONG COIL OVEN

Text Pages 1 through 11
Attachment(s) 2

Hand Processed Changes

HPC No.	Date	Page No.	Initials

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1 Purpose and Scope

1.1 To provide instruction in the operation of the Long Coil Oven located in building 902. The oven is a product of L&L Special Furnace Company, Aston PA.

2 Responsibilities

2.1 The operator shall ensure that a calibration of the oven thermocouples has been performed within a one year period.

3 Prerequisites

3.1 Training

3.1.1 Operators shall be instructed by the Technician supervisor before using this procedure.

3.1.2 Operator shall be trained as an "LOTO Authorized Employee" as defined by BNL SBMS Subject Area: “Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance”.

3.1.3 Operators shall have successfully completed the following courses:

- “Compressed Gas Safety” web based course
- “Cryogen Safety

3.2 Equipment

3.2.1 L&L Special Furnace Co., Model: FN2214-FD15-01-G698-480R3K-B06, Serial: B306LL. Max. operating temperature: 1875^0F/1025^0C Process Gas: Argon

3.2.2 DOT 4L200 Container for liquid argon including valves on top of the container.

4 Precautions

4.1 Verify that all guards and shields are in place.

4.2 Ceramic Fiber Cautions: This furnace contains a mineral wool, fiberglass and/or ceramic fiber product.

CAUTION

Ceramic fiber has been classified as a possible carcinogen. Do not disturb ceramic fiber. Breathing fiber can cause lung injury and exposure to fiber

might cause skin or eye irritation. Do not use this product until you have read the MSDS.

4.3 Do not exceed maximum operating temperature listed on nameplate.

4.4 Install barriers to limit transient access.

4.5 Read all cautions listed on nameplate.

CAUTION

The liquid argon containers are equipped with a relief valve and a rupture disc from the factory to prevent over-pressurization

CAUTION 2

Only the "gas use" and "pressure building" valves are to be used. Under no circumstances should any other valves be opened

CAUTION 3

No adjustments to the factory installed regulators shall be made

CAUTION 4

Contact your supervisor if a significant amount of ice forms on the top of the argon container in use

CAUTION 5

Interior of long coil oven is a confined space. Contact ESH Coordinator for entry requirements.

4.6 Containers of liquid argon are used to supply argon gas to the oven. Liquid argon is a cryogenic liquid. Exposure to the extremely cold gas can cause tissue/eye damage. Safety glasses with side shields, a full face shield, long sleeves and appropriate gloves must be worn when handling containers and when installing or removing the gas regulators.

5 Procedure

5.1 Overview

5.1.1 The purpose of the procedure is to provide operating instructions for the L&L Oven used in magnet division.

5.2 Powering Up The Furnace

5.2.1 Make sure the furnace doors and control cabinet doors are closed.

5.2.2 Make sure UPS is "Turned On". Pull Control knob to turn ON control power. Allow control panel to boot up fully before turning on fans.

5.2.3 Turn the Furnace Fans ON by pulling the Fan Control knob on control cabinet.

5.3 Set-Up and Use of Argon Liquid Containers

5.3.1 Argon Container Setup

5.3.1.1 Argon gas is supplied to the oven and the reaction fixture from liquid argon containers using regulators and flex lines. Multiple containers can be used to ensure that flow continues uninterrupted.

5.3.1.2 Fully back off the pressure adjusting knobs on the regulators.

5.3.1.3 Attach the regulators to the "gas use" ports of the argon containers. The "gas use" port is the only one in which the regulator will fit and is the only port to be used on the container.

5.3.1.4 Open the "gas use" valves on the argon containers and adjust regulator pressure to 100 psi on the primary container, 60-80 on the secondary containers.

5.3.1.5 Open the "pressure building" valve on the argon containers. This accelerates the conversion of liquid to gas to ensure that enough gas is available to maintain the required flow.

5.3.1.6 Open the inline valve at the regulators on the container in use.

5.3.2 Argon Container Changeover

5.3.2.1 When the container in use is nearly empty it must be replaced with another container to maintain argon flow. Each container has a level gauge. Monitor container weight for a more precise indication of liquid remaining. Change container when the weight drops to within 25 pounds of the container tare weight.

5.3.2.2 Close the inline valve at the regulator of the empty container.

5.3.2.3 Close the "gas use" and the "pressure building" valves on the empty container.

5.3.2.4 On the empty container, fully back off the pressure adjusting knob on the regulator.

5.3.2.5 Remove the regulator from the empty container and attach regulator to a full Argon container.

5.3.2.6 Open the "gas use" valve on the new argon container and adjust regulator pressure to 100 psi.

5.3.2.7 Open the "pressure building" valve on the new argon container. This accelerates the conversion of liquid to gas to ensure that enough gas is available to maintain the required flow.

5.3.2.8 Open the inline valve at the regulator on the new container.

5.3.3 Argon Container Shutdown

5.3.3.1 When the oven cycle is complete the argon flow can be terminated.

5.3.3.2 Close the "gas use" and the "pressure building" valves on the containers in use.

5.3.3.3 Fully back off the pressure adjusting knob on the regulators.

5.3.3.4 Remove the regulators from the containers.

5.4 Purging The Furnace and Retort With Argon Gas

5.4.1 Open Process Gas Shutoff valve located on the control panel. Set the Process Gas pressure using the regulator on the control panel to 20-25 psi. Adjust the flow rate of Argon to Furnace using knob on left flow meter. See Attachment 1.

5.4.2 For the initial purge of the furnace, open furnace vent ball valve located on the top rear of the oven.

NOTE: Argon process gas returning from retort first enters coarse particle filter then to a fine particle filter. Retort exhaust flow is controlled by flow valve after fine particle filter, it is then directed to O_2 sensor where it is also plumbed with the oven port for gas sampling.

5.4.3 Adjust the flow rate of Argon to retort using the knob on the right flowmeter.

5.4.4 Monitor the % of oxygen in the retort and the furnace using the oxygen sensor. Note: There is one O2 sensor used for measuring the furnace and retort. The technician will have to switch valve orientation depending on source being monitored. See Attachment 1.

5.5 Setup Of Data Logging Computer

5.5.1 Start "Labview" and open the file named 'LARP Coil Reaction'.

5.5.2 Click on the white "Run" arrow.

5.5.3 When prompted, input coil #.

5.5.4 When prompted, input cell phone number(s) and/or e-mail addresses of the operator(s) who will be responding in case of faults. The format is cell#@vtext.com for Verizon and cell#@txt.att.net for AT&T.

5.5.5 Confirm that readings of flow, pressure, and oxygen level and load temperature displayed on the computer monitor are correct.

5.5.6 Click on Faults & Email Notification Tab. Set the Email enable toggle switch to enable. Confirm that alarm set points for various parameters are correct.

5.5.7 Set the data logging interval to the desired value.

5.5.8 Computer will now start logging the temperature and other data.

5.6 Loading The Thermal Cycle

5.6.1 Connect the ether net connection cable of furnace to the network connector of the profile loading computer.

5.6.2 Insert the copy protection *Dongle* to a USB port on the profile loading computer.

5.6.3 Log on to the computer and double click on the icon" Specview".

5.6.4 In the window that opens, click on "Go on Line".

5.6.5 Communication is now established between the computer and furnace controller.

5.6.6 File with the header BNL:Page 1_FN.GDW will open up.

5.6.7 Click on "Program" button, BNL:Page 4_FN.GDW will open up.

5.6.8 Click on "Profile #" button. Type "1" and click "Send" button. Close the pop-up box.

5.6.9 Click on "Recipe" and then select the appropriate recipe. Make changes to the thermal cycle profile (ramp & soak periods) if necessary and then click "SEND". Close the pop-up box.

5.6.10 Click "START" in the controller window. Click "Start" and close the pop-up box. Verify 'Run' mode.

5.6.11 Observe temperature ramp up and segment timing changes as the furnace controller executes the profile. Monitor Argon gas usage.

5.7 Shutdown

5.7.1 Do not open the furnace door until furnace internal temperature has fallen below 100deg Celsius.

5.7.2 When the furnace temperature has dropped to ~100 deg.C, prepare to shut down.

5.7.3 Quit and close the data logging program and close SpecView.

5.7.4 Close Process Gas Shutoff valve on the control panel.

5.7.5 Turn Fans off by pushing closed Fan Control knob.

5.7.6 Turn off Control Power to furnace by pushing Control power knob.

5.7.7 Data Logger computer can now be turned OFF.

5.7.8 Open furnace door and limit access to area. Allow to cool to room temperature.

6 Calibration

NOTE 1

The Calibration Technician is responsible for performing the main actions of the calibration procedure.

The Operator is responsible for those parts of the procedure involving manipulation of the controls of the Long Coil Oven

The Division Quality Assurance Group is responsible for:

- **Notifying responsible persons when calibrations are due**

- **Affixing appropriate labels and stickers indicating calibration status**
- **Maintaining a file for all documents related to calibrations**

NOTE 2

You must be an authorized operator for the Long Coil Oven before performing the sections of the Calibration Procedure designated to be performed by the "Operator". A current list is available from the Cognizant Technical Supervisor for the Long Coil Oven. All applicable steps and precautions in this OPM regarding operation of the Long Coil Oven shall be followed during calibration.

NOTE 3

Required Tools & Equipment:
Safety glasses with side shields, or goggles.
Calibrated Metrology Well (650°C Capable)

NOTE 4

In this section, the tasks designated to be performed by the Authorized Operator, the Calibration Technician, and the Quality Assurance Representative are indicated by the headings "Operator", "Calibration Technician", and "Quality Assurance Representative".

NOTE 5

Calibration frequency is one year. The Thermocouples and the Temperature Indicators are not adjustable

Operator

6.1 Verify that the Temperature Indicators on the Display Panel are energized. The Indicators should display room temperature.

Calibration Technician:

NOTE

The temperature monitoring system consists of 9 oven control thermocouples mounted through the oven wall to monitor the oven interior, and 10 load monitoring thermocouples which are normally mounted to the fixture used in the oven

6.2 Record the ID #'s of the Temperature Reference (Metrology Well) on the Calibration Datasheet (Attachment 2).

6.3 Set up the Metrology Well on a rolling cart & roll the cart to the thermocouple to be tested.

6.4 For thermocouples A thru M, loosen compression fitting nut and remove probe from oven. Thermocouples 1 thru 10 are loose and should have sufficient cabling to bring them out from the open end of the oven.

6.5 Find the correct row on the Calibration Report that matches the thermocouple ID number.

6.6 Insert the thermocouple in the Metrology Well.

6.7 Set the Metrology Well to the test temperature specified on the Calibration Report. Allow the Well to reach the desired temperature.

6.8 Record the temperature reading from oven compute. For oven control TCs - record PV reading from SpecView, for load monitoring TCs – record reading from Labview.

6.9 Repeat steps 6.7 to 6.8 for the remaining test temperatures.

6.10 Place a "*" in the "Fail" column if a reading is outside of the Specified Tolerance.

6.11 For thermocouples A through M, re-install probe thru oven wall and tighten compression fitting.

6.12 Repeat steps 6.4 to 6.11 for each of the remaining thermocouples

6.13 Dismantle the test set-up.

6.14 If all of the readings are within the Specified Tolerance, then the Quality Assurance Representative shall place a calibration sticker on the Display Panel.

6.15 If one or more readings are outside the Specified Tolerance, then the Calibration Technician shall notify the Cognizant Technical Supervisor and the Cognizant Engineer immediately. Also perform the following two steps A & B:

Quality Assurance Representative

A) Place a "DEFECTIVE" Label on the Temperature Indicator or on the Display Panel in a prominent location.

B) Take appropriate steps to resolve the problem and restore the system to working order.

Calibration Technician

6.16 Complete, date, and sign the Calibration Report. Provide a copy to the Quality Assurance Representative.

7 Documentation

None

8 References

8.1 BNL SBMS Subject Area “Lockout /Tagout (LOTO).

8.2 BNL SBMS Subject Area “Electrical Safety”.

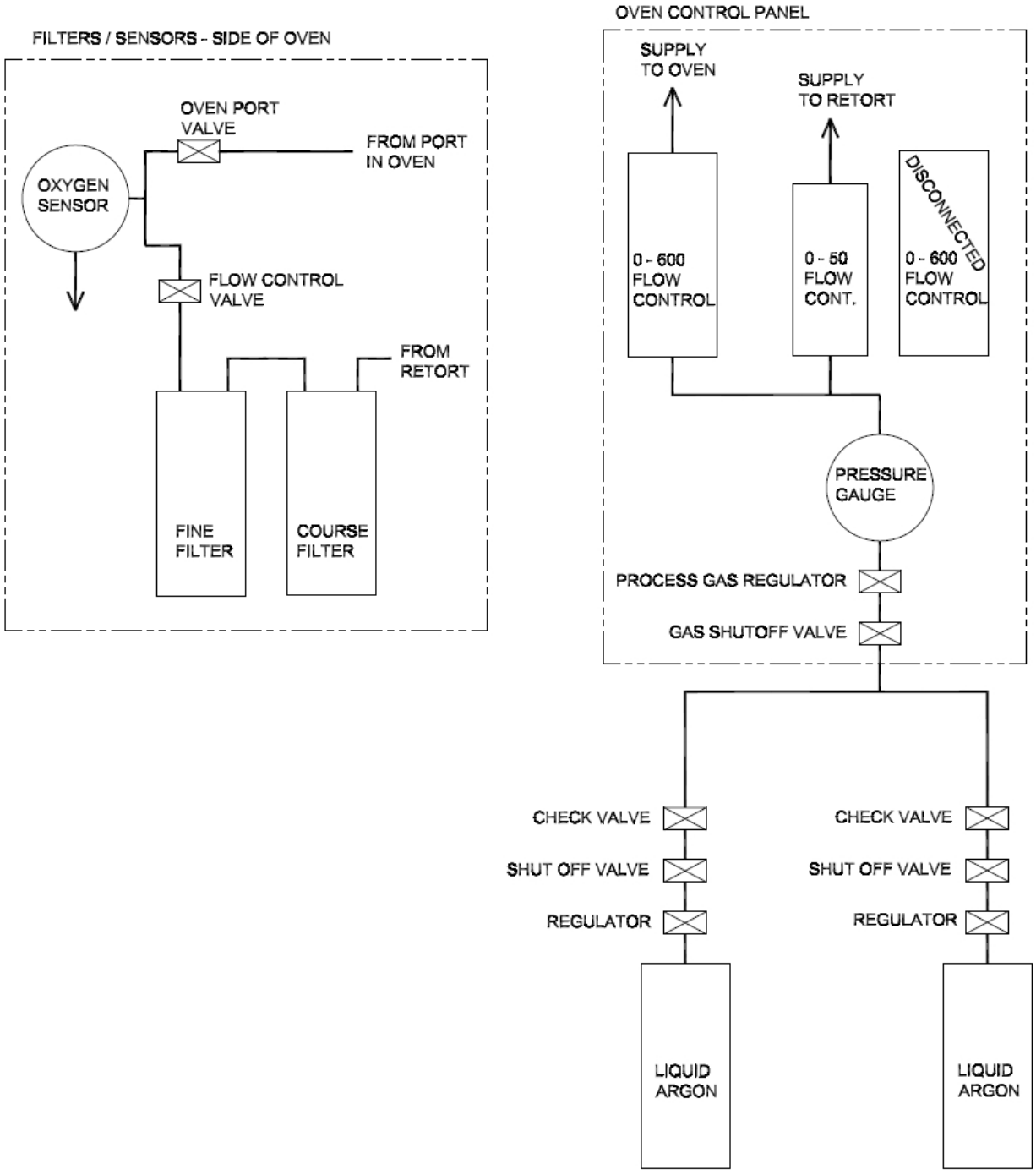
8.3 BNL SBMS Subject Area “Cryogenics Safety”.

8.4 L&L Instruction Manual.

9 Index Of Attachments

1. Argon Schematic
2. Calibration Data Sheet

Attachment 1
Argon Schematic



Attachment 2 – Calibration Datasheet

Service Date: _____By:_____Next Calibration Due: _____

Temperature Reference: _____ ID#_____

		210° C ± 2.2°C	400° C ± 3.0°C	650° C ± 5.0°C	
Type	**T/C#**	**SpecView PV**	**SpecView PV**	**SpecView PV**	**Fail**
Oven Control (Thru Wall)	A				
	B				
	C				
	D				
	E				
	F				
	G				
	H				
	I				
	J				
	K				
	L				
	M				
		Labview Reading	**Labview Reading**	**Labview Reading**	
Load Monitoring	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				

Form Date: 10/6/21