	IDENTIFICATION C-CMBS1 LIGO-E950023-03-B			
TITLE COIL MATERIAL BAKE SPECIFICATION	REFERENCE NO. 930212		SHT 1 OF 4	
	OFFICE NOE-C		REVISION 3	
PRODUCT LIGO BEAM TUBE MODULES CALIFORNIA INSTITUTE OF TECHNOLOGY	MADE BY SWP	CHKD BY WJC	MADE BY SWP	CHKD BY MLT
	DATE 3/3/94	DATE 3/3/94	DATE 4/27/95	DATE 5/5/95

0.1 SCOPE

This specification gives the technical requirements for the dry air bake of the SA-240 Type 304L material to reduce the materials hydrogen outgassing rate. The material will be used to manufacture a high vacuum tube with low hydrogen outgassing for laser application.

1.0 APPLICABLE CODES AND SPECIFICATIONS

1.1 ASME Boiler & Pressure Vessel Code, Section II, "Materials", the 1992 Edition with the 1993 Addenda.

1.2 LIGO Specification 1100004, "Beam Tube Module Specification", dated May 11, 1993.

1.3 LIGO Specification 1100007, "Process Specification for Low Hydrogen, Type 304L Stainless Steel Vacuum Products", dated April 5, 1993.

1.4 The latest revision of Specification C-240-0186, "Coil Material Specification for LIGO Beam Tube Modules".

1.5 ASME SA-240, "Specification for Heat-Resisting and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels".

2.0 GENERAL REQUIREMENTS

2.1 The material is intended for use in a high vacuum tube for laser application. Potential sources of hydrocarbon contamination shall be eliminated. Also, the material shall be wrapped and covered at all times that the material is not being processed to minimize possible exposure to contaminants.

2.2 The material shall be positioned on a raised grating with it's surface vertical to promote convection flow over the surface.

2.3 If the furnace is fuel fired the combustion products shall not come into contact with the baked material.

2.4 The material shall be air baked to 440°C ±8°C for a minimum soak time of 36 hours.

2.5 Sufficient time shall be given during the heat up to ensure that the material is heated to a uniform (440°C±8°C) temperature.

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2.6 The first coil of a given geometry and size shall have two thermocouples attached to the coil material at the location(s) of anticipated lowest temperature (center of the coil) to establish the minimum heat up and cooldown times for the baking process. The thirty six hour bake shall not begin until all thermocouples attached to the coil material read 432°C or greater. A 0.075" thick by 1" wide stainless steel shim will be installed across the width of the coil near the center of the coil to provide a gap between the coil layers for installing a 1/16" diameter thermocouple.

2.7 If the furnace air temperatures will exceed 448°C, thermocouples shall also be attached to the coil material at location(s) of anticipated maximum temperatures to assure that the material temperatures do not exceed the 448°C maximum allowable temperature.

2.8 The baked material shall cool to 150°C or lower at all thermocouple locations before the oven door is opened.

2.9 A bake procedure shall be written and submitted for approval prior to use. No bake shall be performed without a written and approved procedure. As a minimum the procedure shall include the following:

- A description of the heating process and equipment. It shall include the furnace configuration, the number of furnaces available, the size of the furnaces, the type and capacity of the heating system, and other equipment that will be used.
- A description of the temperature monitoring and control system that will be used to perform the bake.
- The location and type of thermocouples that will be used.
- An example of the bake out temperature data that will be provided as documentation for the bake.
- The time required for the baking process.

2.10 From the start of the bake to start of cooldown, the oven shall be purged with clean dry air. The purge air shall have a dewpoint less than –20°C and a flow rate of 5 to 10 SCFM.

2.11 From the start of cooldown to oven door opening the oven shall be purged with nitrogen gas. The nitrogen purge gas shall be boiled off a liquid nitrogen source and have a minimum flow rate of 30 SCFM.

3.0 INSPECTION/WITNESS

3.1 The purchaser shall be informed 5 working days before the bake will begin.

3.2 The purchaser has the right to witness any or all of the material bakes.

4.0 RECORDS AND DOCUMENTATION

4.1 A Certificate of Performance certifying that the bake was performed to this specification is required for each bake.

4.2 A thermal chart or graph is required for all bakes. The chart shall record all temperatures monitored during the bake from the start of heating through cooldown to oven door opening.

4.3 A Record of bake the process is required that includes the following:

- Material heat and slab
- Material coil ID
- Furnace ID
- Operator name and/or ID
- Temperature recorder ID and calibration date
- Non-conforming items and/or unusual events that occurred during the bake out.

5.0 PACKAGING, STORING AND SHIPPING

5.1 The material shall be packaged for shipment as described in ASTM A700-94, Section 12.4.9 and 12.4.10 with the additional supplementary requirements as described herein.

- Before the 440°C bake the coil material shall be package as shown in Figure 64 of A700-94. Only unpainted and uncoated plain carbon steel or stainless steel banding materials shall be used to package the material. Only stainless steel or aluminum pads and edge protectors shall be used to package the material.
- After the 440°C bake the coil material shall be package as shown in Figure 67 of ASTM A700-94.

5.2 The material shall be wrapped in waterproof paper and covered with a tarp immediately after all steel processing operations have been completed to minimize contamination. The material shall remain packaged and covered until it is necessary to remove the covering and packaging material for further processing.

6.0 NON-ESCORT PRIVILEGES AND INSPECTION RIGHT

The National Science Foundation (NSF) and Caltech, through their authorized representatives, have the right to inspect and evaluate the work performed or being performed under this specification, including the premises where the work is being performed at all reasonable times. The NSF and Caltech shall have non-escort privileges to all areas of the facilities where the work is being performed under this specification. This shall include access to fabrication, assembly, cleaning, and test areas for the purpose of monitoring activities. The vendor shall furnish all reasonable facilities and assistance for the safe and convenient inspection of the work if requested.