


Collider Accelerator Department / SNS Ring Systems  
**BROOKHAVEN NATIONAL LABORATORY**  
Brookhaven Science Associates  
Upton, New York 11973




SPEC. SNS-010  
Revision A  
Date: December 1, 1999

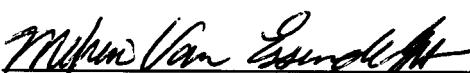
**Specification for Vacuum Chamber Bakeout Oven**

Approvals:

  
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This Specification consists of 8 pages, including this cover sheet.

SNS Ring System  
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SPECIFICATION  
FOR  
VACUUM CHAMBER BAKEOUT OVEN

### **3.0 REQUIREMENTS**

#### **1.0 SCOPE**

This specification defines the fabrication requirements, materials, applicable BNL Quality Assurance clauses, Workmanship and Installation of the SPALLATION NEUTRON SOURCE VACUUM CHAMBER BAKEOUT OVEN (oven hereafter).

#### **2.0 APPLICABLE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issue date or revision level shall be that in effect on the date of the Request for Quote (RFQ). Exceptions shall be approved in writing by BNL.

BNL QA-101 QUALITY ASSURANCE REQUIREMENTS, (March 1999)

#### **2.1 Current Revisions**

It is the responsibility of the seller to determine that the BNL Technical Specifications used in the preparation of quotations by the seller are the most current revisions. This is emphasized here, in the interest of the seller.

### **3.0 REQUIREMENTS**

#### **3.1 Configuration**

The oven must dimensionally conform to the following external and internal requirements when installed and running. The external dimensions are given as a maximum and the internal dimensions as a minimum. The oven shall fit into an area six feet by eighteen feet and not exceed a height of eight feet. The internal working area of the heated chamber can be either 30" x 30" x 180" or 30" ID x 180" DEEP as shown in figure 1.

The oven shall have a minimum of two (2) pumpout ports. The vacuum pumpout ports of the oven shall have a minimum aperture of 7.75 inches and terminate in a 6 inch ANSI flange (MDC P/N: 160014 or equivalent). The pumpout flanges shall extend between four (4) and twelve (12) inches from the oven to allow for easy assembly and disassembly of mating ANSI-type flanges. The maximum temperature at the pumpout flanges shall not exceed  $70^{\circ}\text{C} \pm 10^{\circ}\text{C}$ . The flanges/pumpout pipes may be insulated and/or cooled to prevent excursions above this maximum temperature. All equipment required (i.e., closed loop chiller, hoses, etc.) shall be included with the oven and shall not extend beyond the specified oven dimensions without written agreement between BNL and the seller. The flanges shall extend from either side or the rear of the oven chamber.

The pumpout port pipes shall have a  $\varnothing 1.50$  inch port perpendicular to the pipe centerline. The port shall have a maximum wall thickness of 0.083 inches and terminate in a  $\varnothing 2.75$  inch ConFlat<sup>®</sup>, or equivalent, non-rotatable flange and shall be located on the pipes to allow easy assembly and disassembly of mating flanges. The temperature at the ConFlat<sup>®</sup>-type flange shall not exceed  $70^{\circ}\text{C} \pm 10^{\circ}\text{C}$ .

The oven work zone shall be fitted with one shelf, as specified in Figure 1. The shelf, fabricated from stainless steel, shall be provided with the oven. The shelf shall be capable of supporting a minimum load of forty (40) pounds per ft<sup>2</sup>.

The seller shall provide to the buyer the estimated dimensions and electrical service requirement of the oven with the submission of the bid. The seller shall provide to the buyer a layout drawing showing actual dimensions and general oven component arrangement (e.g., ports, controller and vacuum oven), wiring diagrams for connection to electrical service, and total maximum current and voltage requirements twenty-eight (28) days after receipt of order. A minimum of two (2) instruction manuals shall be shipped with the oven.

The seller is encouraged to make recommendations for changes in the configuration, which might lead to improvement in design or reliability of the oven, or a reduction in cost. However, changes in the oven configuration may be made by the seller only with the written approval of the cognizant engineer.

### 3.2 Materials

The vacuum oven wall shall be fabricated from ASTM 304 stainless steel. The oven's external surface shall not exceed  $70^{\circ}\text{C}$  when the oven is operating at maximum temperature. All exterior surfaces of the oven shall be protected in a manner to prevent corrosion.

Insulating materials shall not contain asbestos or other toxic materials. Non-metallic insulating materials shall not be used within the vacuum envelope.

### 3.3 Operating Temperatures, load and cycles

The normal operating temperature of the oven shall be 500°C. Temperature variance within the oven shall not exceed +/- 20°C or 5% of the soak temperature, whichever is smaller. The oven shall heat, to 500°C, two hundred and fifty pounds (250 lbs) of stainless steel within the time limits set in section 3.4 Performance. This load does not include the interior walls of the oven. The oven will cycle once every other day, from ambient temperature (23°C) to 500°C, remain at 500°C for a minimum of eight (8) hours and return to ambient. (See section 3.4 Performance for specific rate of temperature change instructions).

While operating, the oven shall have a total air leak rate of  $\leq 10^{-6}$  Atm. cc He/sec.

### 3.4 Performance

When switched on the oven shall attain the normal operating temperature (i.e., 500°C) within eight (8) hours. The absolute value of the rate of temperature increase shall not at any time exceed 1½° C/minute.

Once a selected temperature (100°C - 500°C) is attained, the oven should be capable of maintaining temperature from several hours to several days within the temperature tolerance given.

### 3.5 Operating Controls

A controller shall be provided to accept and execute all oven-heating functions. The controller shall be commercially available. The controller shall be capable of being programmed with the sequence of instructions listed below and executing these instructions once the oven is switched on:

- 1) Ramp to soak temperature at a programmable rate of rise.
- 2) Hold at soak temperature for a programmed time period of up to 96 hours.
- 3) Ramp down at a programmable cool down rate.
- 4) Turn off power at programmed duration.

The controller shall allow for programming changes and clearing of existing programs. Provision to store a minimum of five (5) cycle programs in the controller is required.

The oven work zone temperature shall be displayed in °C via the controller or a separate gauge when the oven is operating. A signal for a chart recorder or 0-10 VDC shall be supplied to monitor oven temperature. Two TCs, one for control and one monitoring shall be mounted at 1/3 and 2/3 the oven length. A pre-wired control cabinet shall be provided by the seller within which shall be mounted all electrical components (i.e. temperature and high limit control contactors, vacuum gauge controller, control circuit transformer, pilot lights to indicate when the oven heaters are energized and vacuum interlock input or pump interlock input).

### 3.6 Installation and Initial Operation

The Seller shall provide the oven in a completely assembled form or ship it in a "knock-down" component form and assemble the oven at the Buyer's site. BNL will supply the high-vacuum valve(s) and cryo-pumping system(s). BNL is not a "closed shop" and the Seller shall be responsible for any assembly and shipping costs and any required personnel. Once assembled, installation shall only require the buyer to connect the oven to electrical service, charge the closed loop water cooling system if required and connect the vacuum pumping system. In the event at the time of delivery, electrical services are not available the seller shall return within 90 days for the initial operations (see section 4.3 Performance testing) of the oven.

## 4.0 QUALITY ASSURANCE

### 4.1 General

The quality Assurance requirements applying to the oven defined by this specification are listed in BNL-QA-101 (March 1999); Paragraphs 1.0 thru 2.4, Paragraph 3.1.4 thru 3.8, and paragraph 4.16. Seller failure to meet any of the requirements of this specification shall constitute cause for rejection.

### 4.2 Responsibility for Inspections and Tests

The seller shall be responsible for the performance of all inspections and tests required by this technical specification. All verifying test data submitted to BNL shall be of the form required by section 4.16 of BNL-QA-101. BNL reserves the right, at BNL facilities and BNL expense, to re-perform any of the inspections and/or tests set forth in this specification. BNL reserves the right, on a non-interference basis, to witness the inspections, tests, and analyses conducted by the seller on nonconforming articles returned by BNL.

### 4.3 Performance testing

The seller shall test fire the assembled oven, by programming the following sequence into the controller:

- set soak temperature to 500°C
- set soak duration at eight (8) hours,
- turn controller switch to on.

The oven shall execute the sequence of commands listed in section 3.5 Operating Controls via the oven's controller, using the requirements in Section 3.4 Performance. Final testing shall take

place at the buyer's installation site and shall be witnessed by a buyer's representative. Prior to shipment, at BNL's discretion, BNL may witness, on a non-interference basis, the Performance testing at the seller's facility.

#### 4.3.1 Reliability Requirements

The oven and all of the associated controls and components shall perform continuously in accordance with duty cycles specified in section 3.3 for a period of no less than two (2) year after installation. If during this time any component fails for reasons of faulty design, materials or workmanship the seller shall repair or replace the component(s), without cost to the buyer, within ten (10) working days from the time the seller or their representative has been contacted. This does not excuse the seller from extending to the buyer any other warranties or guarantees the seller usually provides with their ovens.

#### 5.0 PREPARATION FOR DELIVERY

- 5.1 The oven shall arrive at BNL with provisions allowing for easy transport via both an overhead crane and forklift without damage. These provisions may take the form of a pallet on which the oven is shipped and eyelets on the support structure of the oven.
- 5.2 Plastic "peanuts" or other loose packing materials shall not be used by the seller in packaging the oven. Any such packing materials shall be returned to the seller at the seller's expense.

#### 6.0 NOTES

##### 6.1 Performance Objective

6.1.1 The seller is encouraged to bring to the attention of BNL any improvement in performance or reliability, which would result from the use of materials, parts and processes other than those specified. A request for approval of any such improvement shall be submitted to BNL for consideration. Each request shall be accompanied by complete supporting information at least fourteen (14) days prior to bid submittal date. Changes may be made only with the written approval of the cognizant engineer.

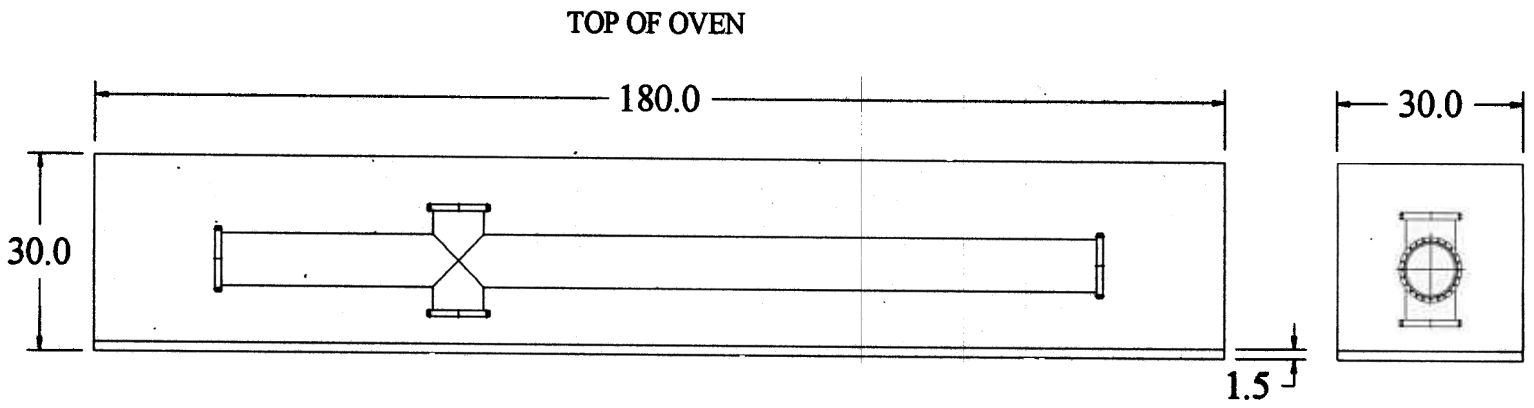
##### 6.1.2 Definitions

6.1.2.1 Failure - A failure shall be defined as any occurrence including one-time non-repeatable anomalies either sudden or gradual in nature, which causes the article performance to deviate from specified limits.

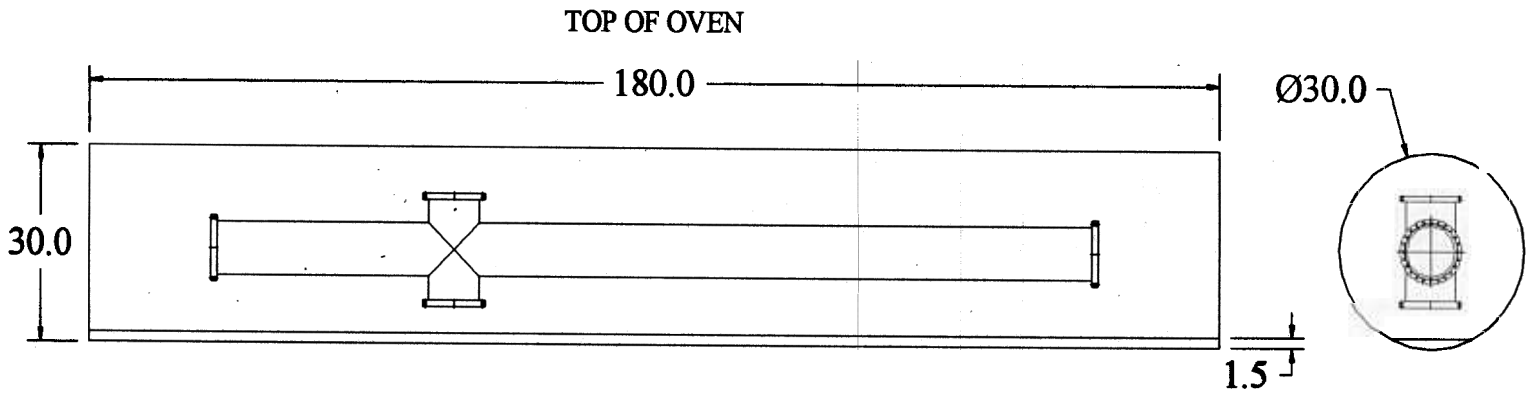
6.1.2.2 Non-conformance - A condition of any article in which one or more characteristics do not conform to the specified requirements.

## **6.2 SELLER SUBCONTRACTING**

The seller may subcontract all or part of the work defined by this specification and the contract. However, the seller is responsible for fulfilling all of the conditions given in this Technical Specification, and the requirements of the Terms and Conditions outlined in the contract.



BOX OVEN SIDE VIEW



CYLINDRICAL OVEN SIDE VIEW

DRAWING NOT TO SCALE. (EXAMPLE PART FOR CLARITY ONLY)

DIMENSIONS INDICATE THE TOP OF THE SHELF LOCATION.

ALL DIMENSIONS ARE INSIDE MINIMUMS (INCHES).

SHELF THICKNESS SHALL NOT EXCEED .0"

TOLERANCE: ALL DIMENSIONS  $\pm .031$ "

FIGURE 1

SPALLATION NEUTRON SOURCE  
VACUUM CHAMBER BAKEOUT OVEN  
October 15, 1999