

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



SPEC. SNS-0011
Revision A
July 6, 2000

Specification for HEBT
Dipole Chamber Assembly

Approvals:

Handwritten signature of Dan Weiss in black ink.

Dan Weiss, Engineer

Handwritten signature of H.-C. Hseuh in black ink.

H.-C. Hseuh, Vacuum Systems

Handwritten signature of Joseph Tuozzolo in black ink.

Joseph Tuozzolo, Chief M.E.

Handwritten signature of Melvin Van Essendefft in black ink.

Melvin Van Essendefft, Quality Assurance

This Specification consists of 7 pages, including this cover sheet.

SNS Ring Systems
BROOKHAVEN NATIONAL LABORATORY
Brookhaven Science Associates, Inc.
Upton, New York 11973

SPEC. SNS Ring Systems-0011
Rev. A
Date: March 7, 2000

SPECIFICATION
FOR
HEBT DIPOLE CHAMBER ASSEMBLY

1. SCOPE

This specification, in conjunction with the associated Statement of Work (SOW hereafter), drawing(s) and other applicable documents, defines the requirements of design, materials, fabrication, workmanship, cleanliness, quality assurance, and packaging for the High Energy Beam Transport (HEBT hereafter) dipole magnet chamber assemblies (chambers hereafter).

<u>Drawing Number</u>	<u>SNS HEBT Vacuum System Drawing</u>
5103000:	Dipole Chamber, Standard
5103001:	Dipole Chamber, Momentum Scraper
5103002:	Dipole Chamber, LINAC Dump/Beam In Gap
5103003:	Dipole Chamber, Ring Injection

2. 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 Invitation to Quote. Exceptions must be approved in writing by BNL.

<u>Number</u>	<u>Title</u>
BNL-QA-101	BNL Seller Quality Assurance Requirements
ASTM-A240-89B	Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM-A380-88	Standard Practice for Cleaning and Descaling Stainless Steel Parts, Equipment and Systems
ASTM-A480/480M	Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip
ASTM-E498-90	Standard Test Methods for Leaks Using the Mass Spectrometer Leak Detector or Residual Gas Analyzer in the Tracer Probe Mode- Method A

ASTM-A700-81	Standard Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment
ASTM-A249/249M-88B	Standard Specification for Welded Austenitic Steel Boiler, Superheater, Heat Exchanger, and Condenser Tubes

2.1. Order of Precedence

Requirements specifically stated herein, including the SOW and drawings, shall take precedence over requirements in the Applicable Documents in the event of conflicting requirements.

3. REQUIREMENTS

3.1. Design, Material, Fabrication, and Processes

The chambers shall be compatible for use as ultra high vacuum (UHV) hardware. The chambers shall be free of oils, particulate, organic matter and chlorides. All surfaces of each chamber shall be smooth and free of scale, stains and residues of any kind upon receipt by the buyer.

3.1.1. Design

The chambers shall comply with the dimensions, tolerances and notes specified on the drawing(s). Variations in dimensions not specified on the drawing(s) shall be in accordance with the applicable requirements of ASTM A249/A249M-88b.

3.1.2. Material

The chambers shall be produced entirely from cross rolled stainless steel, type AISI 316L or 316LN in accordance with the chemical composition requirements of ASTM A240-89b and ASTM A480/480M. Material shall be in the condition required to produce a smooth, wrinkle-free chamber. Chemical analysis and certification of the material used to produce the chambers are required.

3.1.3. Mechanical Properties

The material mechanical properties of tensile strength, modulus of elasticity and hardness shall be in accordance with requirements specified in ASTM A249/A249M-88b.

3.1.4. Fabrication

A single sheet of the required raw material shall be used to form each half-section of the chamber. Welding is permitted only where specified on the drawing(s). No patches or repairs of the raw material prior to or following forming are permitted.

No abrasive operations are permitted at any stage of the fabrication. Only aqueous based lubricants may be used when performing any forming or machining operation on the chamber. Any proposed lubricant requires BNL approval prior to use.

All formed sections shall be cleaned per the final cleaning requirements specified in the standard practices specified in ASTM A380-88 prior to welding. Acid pickling shall not be performed on final assemblies or welded subassemblies. All parts shall be kept clean subsequent to this cleaning operation. All subsequent operations on the chamber parts

shall be done in a clean environment with clean tools and fixtures and in a manner that insures the chamber cleanliness and performance requirements specified herein are satisfied upon receipt by the buyer.

Formed half-sections of the chamber shall be joined and assembled into subsections by a GTAW or EB weld method per the specifications of the drawing(s) and ASTM A249/A249M-88b, without the addition of filler material, unless otherwise specified in the SOW or drawing(s). Weld seams shall be continuous, and all external welds shall be 100% penetration.

Welded subsections of the chamber shall be joined and assembled together by a GTAW or EB weld method per the specifications of the drawing(s) and ASTM A249/A249M-88b. Weld seams shall be continuous, and all external welds shall be 100% penetration unless specified otherwise.

Completed chambers shall meet all requirements of the respective drawing(s) and performance requirements specified herein.

3.1.5. Final Cleaning

Delivered chambers shall be free of oils, particulate, organic matter, and chlorides. All surfaces of each chamber shall be smooth and free of scale, stains and residues of any kind upon receipt by the buyer. Each chamber shall receive a final cleaning of all surfaces upon completion of assembly. Acid pickling shall not be performed after the first welding operation. The required final cleaning procedure is prescribed herein. Alternative cleaning procedures may only be applied with BNL approval.

Cleaning Procedure

- A. Degrease using only non-chlorinated solvents for a minimum of five (5) minutes. The duration shall be sufficient to remove all lubricants.
- B. Rinse thoroughly in cold running tap water for a minimum of one (1) minute.
- C. Soak in an air agitated non-etch alkaline solution (e.g., Oakite 166, ENBOND Q567, etc.) for a minimum of five (5) minutes, at a temperature of at least 65°C.
- D. Rinse vigorously in cold running tap water for a minimum of two (2) minutes. Continue rinse if water beading appears. The use of 300 series stainless steel brushes, or high pressure water jets to neutralize interior or exterior surfaces of the chamber is permitted.
- E. Immerse and rinse in a deionized water bath for a minimum of two (2) minutes at a minimum temperature of 65°C.
- F. Dry using oil free dry air or dry nitrogen.
- G. Wrap the chamber ends with lint free paper. Over wrap tightly with vacuum grade aluminum foil and secure in place with protective covers. Protective covers shall be

suitable to insure protection during shipping, handling and storage. Protective covers shall not require tools for application and removal, and shall not leave a residue on the chamber.

H. After final cleaning, the ends of each chamber shall remain covered as specified above in all cases, unless the chamber ends or interior are being inspected.

3.2. Performance

The buyer reserves the right to test the performance of any chamber to the requirements specified herein. With the exception of the required seller tests specified in section 4 herein, the seller is not required to qualify the chambers to these performance requirements. However, chambers that do not meet these requirements, shall be in non-conformance.

3.2.1. Leak Rate

The chambers shall be leak tight when checked with a helium mass spectrometer leak detector with a minimum sensitivity of 10^{-11} std cc He/sec or less. Leak tight is hereby defined as an allowable leak of less than 1×10^{-10} std cc He/sec with the chamber internally under vacuum of 1×10^{-6} torr and externally pressurized to 760 torr minimum.

3.2.2. Outgassing

The internal outgassing rate of the chambers shall not exceed 1×10^{-10} torr liter/sec cm^2 after the chamber has been maintained under vacuum for 48 hours. Conventional all-metal ultra high vacuum practices shall be used to make these measurements.

The chambers shall exhibit no traces of oils or other contaminants with atomic masses greater than 40 amu when tested using a residual gas analyzer with a minimum detectable partial pressure of 1×10^{-11} torr N_2 .

3.2.3. Operating Life

The chamber shall remain leaktight after 10 thermal cycles between 10 and 300°C.

3.2.4. Magnetic Permeability

The magnetic permeability of the bulk material shall not exceed a value of 1.05. The magnetic permeability shall not exceed 1.5 at any location on the chamber welds. Welded subsections of the chamber may be annealed to achieve magnetic permeability requirements. However, this does not relieve the vendor from the dimension and tolerance requirements specified on the respective drawing(s). Anneal at a uniform temperature between 950 and 1000°C in vacuum or clean inert atmosphere. Hydrogen annealing is not permitted. The subsections shall then be water quenched or rapid cooled in a uniform manner or by other means as specified in ASTM A249/A249M-88b.

4. QUALITY ASSURANCE PROVISIONS

4.1 General

Articles furnished in compliance with this Specification shall be produced under the controls established herein and as required by the applicable contract. The seller is responsible for

providing chambers that are in complete compliance with this specification. Evidence of noncompliance with any requirement specified herein, shall constitute cause for rejection.

Additional quality assurance requirements shall be in accordance with BNL Quality Assurance clauses provided in BNL QA document BNL-QA-101. The following sections of BNL-QA-101 apply: 1, 2, 3.0, 3.1, 3.1.2, 3.2 thru 3.8, 4.0, 4.2, 4.3, 4.4, 4.4.1 thru 4.4.4, 4.5, 4.6, 4.7, 4.7.1, 4.10, 4.10.1, 4.10.4, 4.10.5, 4.13, 4.15, 4.16, 4.18, 4.18.1, 4.18.4, 4.19, 4.21, 4.23, 4.30, 4.31 and 4.32.

The buyer reserves the right to carry out inspections and to witness seller tests specified herein prior to delivery to the buyer. The seller shall inform BNL at least three (3) weeks prior to conducting the seller tests specified herein, such that arrangements can be made for BNL representatives to witness the seller tests.

4.2 Seller Tests

The seller shall perform all of the seller tests specified herein on all chambers supplied under this contract. All chambers shall pass these tests prior to delivery. The seller shall supply to BNL with each delivered chamber, the associated certificate of conformance and seller test data in accordance with this section.

4.2.1 Visual Inspection

The chambers shall be inspected for any dents or damage, poor workmanship, repairs of welds and internal and external cleanliness.

4.2.2 Magnetic Permeability Measurement

The chambers shall be measured for magnetic permeability at 20 cm intervals along each longitudinal seam weld for the entire length of the chamber.

4.2.3 Dimensional Inspection

Measurements shall be performed with the chambers in a relaxed and unrestrained state. Dimensions of the chambers shall conform, within the allowable tolerances, to the dimensions specified on the drawings.

The cross section of the chamber shall be measured along the entire length of the chamber, using a cross section template. Exact methods of measuring the position and twist of the cross section along the length of the chamber shall be agreed upon between the seller and BNL.

4.2.4 Leak Rate Test

The seller shall verify that each chamber is leak tight to the requirements specified herein. Leak checking shall be performed with a helium mass spectrometer leak detector having a minimum sensitivity of less than or equal to 5×10^{-11} std cc He/sec and in accordance with ASTM-E498-90. Viton O-rings may be used as temporary seals for leak detection. However, the use of lubricants or greases of any kind is prohibited.

4.3 BNL Tests

BNL reserves the right to perform any test on the chambers, at BNL expense and facilities, for verifying full compliance with any requirements of this contract. Evidence of noncompliance with any requirement specified herein, shall constitute cause for rejection.

4.4 Warranty and Certificate of Conformance

All chambers shall be covered by a warranty against material and manufacturing defects. The warranty period shall be valid for a minimum of two (2) years, from the date of receipt at BNL. The seller shall specify in detail the warranty provisions.

5. PREPARATION FOR DELIVERY

5.1 General

The seller is responsible for the safe, secure and clean packaging, transport and delivery of the chambers to the BNL site per the requirements of ASTM-A700-81.

5.2 Packaging

The chamber ends shall be capped and protected in accordance with section 3.1.5 G specified herein. Loose packaging materials such as plastic "peanuts" shall not be used. Any such loose packaging material shall be returned to the seller at seller expense. Provisions shall be made to maintain separation between chambers packaged in the same container.

5.3 Container

Chambers shall be shipped in self-supporting containers such that chambers are not subjected to loads applied externally to the container. Containers shall be reusable. The container shall include access and sealing provisions for removal and replacement of the chamber such that chambers can be repacked in the container. The container shall be strong enough to withstand the load of a single stack of all chamber containers. The container shall include provisions to maintain a space between stacked containers to permit access for a forklift to lift the container. The container shall be clearly marked with PO number and information necessary to insure safe shipping, handling and storage.

6. NOTES

6.1. Performance Objectives

The Seller is encouraged to recommend to the buyer any improvements in design, performance, or reliability that would result from the use of materials, parts, and processes other than those specified. A request for approval of such improvements shall be submitted to BNL for consideration accompanied by complete supporting information no later than fourteen (14) days prior to the quotation due date. Changes may be made only with the written approval of BNL.

6.2. Subcontracting

The seller may subcontract all or part of the work defined by the specification and the contract. However, the seller is responsible for fulfilling all of the requirements of the specification and the requirements of the terms and conditions specified in the contract.