Relativistic Heavy Ion Collider
Magnet Division Specification

Proc. No.: RHIC-MAG-M-4001

Issue Date: 4/20/90

Rev. No.: B

Rev. Date: 7/12/91

Class: Ancillary Specifications
Title: Barrier Grade Niobium Sheet

- Cognizant Engineer: Signature on File
- Approved by: Signature on File
- BNL Q. A. Category: Signature on File
  Major

REVISION RECORD

Rev. No.	Date	Page	Subject	Approved	QA
A	6/27/91	Numerous	Miscellaneous Changes. Production RFQ Release.	On File	On File
B	7/12/91	2,3,4	Grain Size; Ingot Hardness	On File	On File

1. Scope:

This specification establishes the minimum requirements for unalloyed, barrier grade Niobium Sheet. This material will be used in the manufacture of superconducting wire for use in the Relativistic Heavy Ion Collider.

1.1 Definition:

Lot: A lot is defined as all material of a single size, process and casting, heat treated in a single charge in a batch-type furnace.

2. Applicable Documents:

2.1 Applicability:

The following documents of the issue in effect on date of invitation for bids or request for bids or request for proposal, form a part of the specification to the extent specified herein.

2.2.1 Government Documents

MIL-I-45208; Inspection System Requirements

2.1.2 Non-Government Documents

a) ASTM B-393; Standard Specification for Niobium and Niobium Alloy Strip, Sheet, Foil and Plate.

b) ASTM E-112; Standard methods for determining the average grain size.

c) ASTM E-8; Methods of tension testing of metallic materials.

d) ASTM E 10-84 Standard Test Method for Brinell Hardness of Metallic Materials.

2.2 Precedence:

In the event of conflict between the requirements of this specification and the above applicable documents, this specification shall take precedence. Any such conflict shall be brought to the attention of the Buyer.

3. Requirements:

The niobium sheet is to be produced to ASTM B-393 (Reactor Grade I) with additional and overriding requirements as specified herein.

3.1 Chemical Requirements:

3.1.1 The ingot to be converted to sheet shall conform to the requirements given below for chemical composition. Methods for determining composition shall be either Inert Gas Analysis or Plasma Spectrometry.

Niobium (by difference) 99.82% minimum

	% by Weight Maximum
Oxygen	0.015
Nitrogen	0.010
Carbon	0.010
Hydrogen	0.001
Tantalum	0.100
Titanium	0.004
Iron	0.005
Silicon	0.005
Molybdenum	0.005
Tungsten	0.030

3.1.2 In addition, each heat of Niobium sheet (final product) shall conform to the requirements given below for dissolved interstitials. The method for determining composition shall be Inert Gas Analysis.

	% by Weight Maximum
Oxygen	0.020
Nitrogen	0.010
Carbon	0.010
Hydrogen	0.002

3.2 Mechanical Requirements:

Yield Strength (0.2% offset) - 10,000 psi minimum

Elongation (1 in. gauge length) - 25% minimum

3.3 Metallurgical Requirements:

Material shall be at least 90% recrystallized and exhibit an average grain size of ASTM #4 or finer, with no grains larger than ASTM #3. See ASTM E-112.

3.4 Ingot Hardness: (Requirement removed)

4. Quality Assurance:

The seller shall maintain a quality assurance program in general accordance with MIL-I-45208 to insure that each item offered for acceptance or approval conforms to the requirements herein.

4.1 Documentation:

4.1.1 The seller shall maintain records of all inspections and tests. In addition, the following test data shall be submitted to the Buyer:

a. Ingot analysis; specific values by Inert Gas Analysis or Plasma Spectrometry (para. 3.1.1).
b. Product analysis; compliance with the specified values by Inert Gas Analysis (para. 3.1.2).
c. Mechanical properties; specific values (para. 3.2).
d. Grain size; specific values reported in accordance with ASTM E 112, Section 15.5 (para. 3.3).
e. Ingot hardness; compliance with the specification (para. 3.4).

4.2 Tests:

The tests required herein are the minimum required and are not intended to supplant any controls, examination, inspections, or tests normally employed by the seller to assure the quality of the product.

4.2.1 Chemistry

a. Impurity levels on ingot and sheet. By Inert Gas Analysis or Plasma Spectrometry.

4.2.2 Mechanical, in accordance with ASTM E-8

a. Yield strength
b. Elongation

4.2.3 Grain size, in accordance with ASTM E-112, Section 3.1.3. (Alternative proposals to the Intercept Procedure will be considered).

4.2.4 Ingot Hardness

a. Brinell Hardness number.

5. Preparation for Shipment:

5.1 Packaging:

The packaging procedure shall be proposed by the vendor and agreed upon by Buyer.

5.2 Marking for Shipment:

If the purchase is made directly by BNL, each crate shall be legibly and conspicuously marked with the following information:

"Barrier Grade Niobium Sheet"
Specification No. RHIC-MAG-M-4001, Rev. No. B
BNL P.O. Number _____
Name of Material _____
Ingot No. _____
Lot No. _____
Dimensions _____
Date of Manufacture _____
Name of Manufacturer _____