Relativistic Heavy Ion Collider
Magnet Division Procedure

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Class: Ancillary Specifications
Title: RHIC Dipole Magnet Cradle Castings

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- ES&H Review: Signature on File

REVISION RECORD

Rev. No.	Date	Page	Subject	Approval	QA	ES&H
A	1/9/91	Through-	RFP Release.			
		out	General Revisions.			
B	4/14/93		Procedure changes as			
			per ECN #MG00176.			
C	6/8/94		Changes per ECN			
			#MG00606.			
D	7/19/99		Changes per ECN MG00755			

1. Scope:

This specification establishes material and inspection requirements for the fabrication of the RHIC Dipole Magnet Cradle Castings.

2. Applicable Documents:

Unless otherwise specified, the following documents in effect on the date of the invitation to quote form a part of this specification to the extent specified herein.

ASME Boiler Code, Section 8 - Appendix 7	
ASTM A743/A743M-88	Castings, Iron-Chromium, Iron-Chromium-Nickel, etc.
ASTM A488/A488M	Standard Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel
BNL QA-101	Quality Assurance Requirements
Dwg. 12065034	Cradle, Cold Mass - Casting
MIL-STD-410	Nondestructive Testing
MIL-STD-6866	Inspection, Liquid Penetrant
MIL-STD-1949A	Magnetic Particle Inspection
MIL-STD-453C	Radiographic Standards
MIL-STD-2175	Casting, Classification & Inspection Of

3. Requirements:

3.1 Material - Chemical Composition

The casting material shall be carbon steel per ASTM A743/A7 43M-88 Grade CF-8.

3.2 Minimum Mechanical Properties

Tensile Modulus - 24,000,000 psi
Tensile Strength - 70,000 psi
Yield Strength - 30,000 psi
Brinell Hardness - 140

3.3 Service Temperature
4 to 311^0 Kelvin (minus 452.2^0 to 10^0 Fahrenheit).

3.4 Heat Treatment

Water quenched in accordance with ASTM A743/A743M-88 CF-8 grade for notch sensitivity at 4^0K.

4. Quality Assurance Provisions:

4.1 Inspection

Unless otherwise specified in the purchase order, the casting supplier is responsible for the performance of all inspection requirements contained herein. The supplier may utilize his own test facilities or those of a commercial testing laboratory acceptable to the buyer.

4.2 Certificate of Conformance

Unless otherwise specified in the purchase order, the supplier shall furnish the Buyer, with each shipment, a copy of a certified report signed by the duly authorized supplier or testing laboratory official of the facility performing the testing, stating conformance with the requirements of this specification and the applicable drawing(s). The report shall include the specific results of the required tests in addition to the following:

(a) Purchase Order No.
(b) RHIC-MAG-M-7546
(c) Alloy designation
(d) Heat Treat Condition or Grade
(e) Heat or Melt Number
(f) Complete Chemical Composition
(g) Mechanical Property Test Results
(h) Part Number and Revision Status
(i) Quantity of Castings in Shipment

4.2.1 Inspection Records

The supplier's inspection records of inspections and tests shall be maintained in a complete and retrievable manner available to the Buyer upon request.

4.2.2 Personnel Certification

Personnel performing radiographic, penetrant or magnetic particle inspections or tests shall be certified in accordance with the requirements of MIL-STD-410.

4.3 Buyer Surveillance/Source Inspection

The Buyer reserves the right to conduct surveillance inspections and tests at the seller's facility. Requirements for Buyer source inspection shall be specified on the applicable Purchase Order.

4.4 Material Testing

Chemical and mechanical properties including Brinell Hardness shall be conducted on raw material lots for conformance to ASTM A743/A743-M requirements with results recorded. Material failing to meet ASTM A743/A743-M requirements shall not be used for the manufacture of cradle castings. Heat treatment conformance shall be verified as specified by ASTM A743/A743-M. Reheat treatment limitations of ASTM A743/A743-M-88 apply.

4.5 Visual Inspection

Each casting shall be 100% visually inspected for surface defects and irregularities. Cracks shall be cause for rejection. Surface discontinuities in excess of drawing surface finish requirements or the requirements specified herein shall be cause for rejection.

4.6 Non-Destructive Test

4.6.1 Magnetic Particle/Penetrant Inspection

Each rough, heat treated or straightened casting or finished machined casting shall be inspected for surface discontinuities by either the magnetic particle (MIL-STD-1949) or fluorescent penetrant (MIL-I-6868) process as appropriate.

4.6.2 Acceptance Levels

All linear type surface indications shall be removed as outlined in ASME Boiler Code, Section 8 - Appendix 7. Subsurface indications shall be rejectable only when the size and frequency of the indications exceed the acceptable radiographic limits as specified in MIL-STD 2175.

4.6.3 Radiographic inspection shall be performed in accordance with the requirements of MIL-STD-453 with indications meeting the acceptance levels specified in MIL-STD-2175. Each casting requiring radiographic examination shall be radiographed through each of the part's three orthogonal axes.

4.6.3.1 Radiographic Lot Sample Sizes

a. Preproduction/First Article - Castings designated as either preproduction or first article by the Buyer's purchase order shall be radiographically inspected in accordance with the following sampling plan. See Section 4.7 for First Article definition.

Lot Size	Sample Size
Up to 13	13
14-16	14
17-21	15
22-37	16
38-58	18
59 and over	18 + 10% of additional castings above 58 rounded off to the next higher number.

b. Production - Castings designated as production castings by the Buyer's purchase order shall be radiographically inspected in accordance with the following sampling plan per each heat lot.

Heat Lot Size	Sample Size
2-4	All
5-6	4
7-11	5
12-17	6
18-27	7
28-48	8
49 and over	9

4.6.3.2 Casting/Radiograph Identification

Casting radiographics shall be identified by the part number, by axis exposure, casting serial number, and date of exposure. Radiographs of First Article or preproduction castings shall be submitted to the Buyer with shipment of castings. Radiographic for production casting samples shall be retained by the supplier/test laboratory and made available to the buyer upon request.

4.7 First Article Acceptance

Unless otherwise specified in the purchase order the first twenty (20) castings shall be designated the First Article or preproduction sample. These parts shall be subjected to all of the visual and non-destructive examinations and tests defined above. Detail examination and test results shall be submitted to the Buyer in accordance with the requirements of BNL QA-101 Section 4.18, 4.18.3 and 4.18.4. Manufacture of production castings shall not be initiated by the casting supplier until the Buyer has reviewed the First Article Acceptance Report and approved production.

5. Preparation for Delivery:

5.1 Marking

Each casting shall be identified by part number (revision status), heat or melt number using the methods specified in ASTM A743/A743-M-88.

5.2 Packaging for Shipment

Castings shall be suitably protected and packaged for commercial shipment in a manner to prevent shipping or storage damage.