Large Hadron Collider
Magnet Division Specification

Spec. No.: LHC-MAG-R-1003

Issue Date: May 6, 1999

Rev. No.: B

Rev. Date: Sept. 20, 2000

Class: Dipole Coils
Title: LHC DX Dipole Coil Testing and Preparation

- Prepared by: Signature on File
- Cognizant Engineer/Scientist: Signature on File
- Head, Magnet Production Group: Signature on File
- Quality Assurance Representative: Signature on File
- ES&H Review: Signature on File

REVISION RECORD

Rev. No.	Date	Page	Subject	Approval
A	5/6/99		Initial Release.	
B	9/20/00		Changes per ECN #MG2013.	

1. Scope:

This procedure details the steps necessary to inspect, clean, insulate and test coils after winding and curing.

2. Applicable Documents:

The following documents in effect on the date of issue of this specification form a part of this specification.

RHIC-MAG-Q-1004	Discrepancy Reporting Procedure
RHIC-MAG-R-7225	RHIC Dipole/Quadrupole Visual Inspection
RHIC-MAG-R-7227	RHIC Electrical Resistance Measurement for Uncollared Individual Coils
RHIC-MAG-R-7228	RHIC Inductance and Q Measurements
RHIC-MAG-R-7318	RHIC Impulse Testing
LHC-MAG-R-1017	8cm Dipole Coil Azimuthal Size Measurement
LHC-MAG-R-1018	8cm Dipole Coil Length Measurement
BNL Dwg. No. 12010181	Insulation, Polyimide Film
BNL Dwg. No. 14010001	Assembly, 8CM D4B PROTOTYPE
BNL Dwg. No. 14010131	Assembly, 8CM D2/D4 COIL
BNL Dwg. No. 14010232	8CM D1/D3 COIL

3. Requirements:

3.1 Material/Equipment:

8cm Dipole Lead Ramp Solder Fixture Assembly (GAC Dwg. No.)

8cm Dipole Midplane Lead Solder Fixture Assembly (GAC Dwg. No.)

Specification Reference	Technical Reference	Source/Control
Heaters/Thermocouples	Cartridge Heaters Thermocouples	Hilton Sales 119 So. Smith St. Lindenhurst, NY 11757
Acetone	Acetone Solvent	BNL Stock #E-50840
Velcro Straps	Velcro Strap 30 x 5/8	Gleicher Man. 851 Jeraselem Rd. Scoth Plains, NJ
Paper Towels	Kim Wipes Precision Wipes	Kimberly Clark Corp. Scott Towell Corp.
Kapton	Kapton Tape ½ in. wide 0.0005 in. thick 0.0005 in thick Silicone Adhesive	R.H. Carlson P.O. Box 1687 Greenwich, CT Part No. K104
Teflon Tape	Teflon tape 1 in. wide .002 in. thick .0015 in. thick Adhesive	R.H. Carlson P.O. Box 1687 Greenwich, CT P/N HM-430
Tie Wraps		BNL Stock #A-59827

3.2 Safety Precautions:

3.2.1 Proper eye protection (safety glasses, goggles) must be worn during coil measuring, cleaning or soldering operations. Failure to observe this precaution may result in eye injury.

3.2.2 Work areas must be adequately vented when using solvents. No sparks or flames are allowed in the work area. Failure to observe this precaution may result in fire. Dispose of all solvent wetted materials in proper containers. Proper protective gloves are to be used as prescribed, when using solvents.

3.2.3 The technicians shall be qualified by their cognizant technical supervisor in the operation of the required electrical test equipment and the electrical testing procedures. They shall be familiar with the latest revision of the applicable documents referenced in Section 2. In addition, some of these tests require the technician to have special training. A list of qualified personnel shall be maintained with the RHIC Training Coordinator.

3.2.4 Some of these electrical test procedures have specific safety requirements. The technicians performing these specific tests shall rigorously follow all the safety requirements listed as well as those prescribed by the BNL ES&H Standard.

3.3 Procedure:

3.3.1 Visual Inspection and Preparation of Coil Surfaces:

3.3.1.1 Record the serial number of the coil in the traveler.

3.3.1.2 Complete a visual inspection of the coil following RHIC-MAG-R-7225.

3.3.1.3 Use acetone solvent and paper towels to remove any dust, grit or remaining mold release from coil surfaces.

3.3.2 Mechanical Tests:

3.3.2.1 Complete the measurements of the coil azimuthal size following LHC-MAG-R-1017.

3.3.2.2 Measure the coil length following LHC-MAG-R-1018.

3.3.3 Electrical Tests:

3.3.3.1 Complete the electrical resistance measurement of the coil following RHIC-MAG-R-7227.

3.3.3.2 Complete the measurements of inductance and quality factor (Q) on the coil following RHIC-MAG-R-7228.

3.3.3.3 Complete the impulse testing of the coil following RHIC-MAG-R-7318. The test must be completed so the turn-to-turn voltage is $\geq$ 50 volts.

3.3.3.4 Complete the electrical resistance measurement of the coil following RHIC-MAG-R-7227.

3.3.3.5 Complete the measurements of inductance and quality factor (Q) on the coil following RHIC-MAG-R-7228.

3.3.3.6 Attach computer printouts of electrical test data to the traveler.

3.3.4 Solder Copper Stabilizer Cable to Coil Leads:

3.3.4.1 Strip Kapton insulation from the pole lead as shown on the coil assembly drawing.

3.3.4.2 Solder the copper stabilizer cable to the coil pole lead as shown on the coil assembly drawing. All soldering shall be done using silver bearing solder ribbon (P/N 12020421-01) and non-corrosive flux (P/N 12010069).

3.3.4.3 Inspect soldered thickness and height and record on data sheet. Required thickness = .095 ± .001; height = .392 ± .002.

3.3.4.4 Clean the soldered stabilizer connection thoroughly with acetone.

3.3.4.5 Wrap the coil pole lead and attached copper stabilizer with Kapton insulation (P/N 12010181-08) as shown on the coil assembly drawing. The wraps are to be staggered by half the width of the ½ -in. Kapton.

3.3.4.6 Repeat Steps 3.3.4.1 - 3.3.4.2 and 3.3.4.4 - 3.3.4.5 for coil midplane lead.

3.3.5 Apply Kapton Insulation:

3.3.5.1 Reclean the coil with acetone. Reinspect the coil to be sure it is free of metallic chips, abrasions or other abnormalities. Correct defects prior to installation of insulation in steps below.

CAUTION

Care must be taken when using a hot iron. Failure to observe this caution may result in personal injury.

3.3.5.2 Install creased Kapton caps on both mid-plane surfaces of the coil as shown on the coil assembly drawing using a hot iron at a temperature of 150^{o}C.

3.3.5.3 *Perform this step only for D2/D4 Coils (Assembly Part Number 14010131 only).* Install creased Kapton caps on both pole turn surfaces of the coil as shown on the coil assembly drawing using a hot iron at a temperature of 150^{0}C. Install Kapton caps on coil ends as shown on the assembly drawing.

3.3.6 Install pole spacers:

3.3.6.1 Install the non-lead end pole spacer as shown on the coil assembly drawing. Use Kapton tape (.0005 in. thick) to hold the pole spacer in place.

3.3.6.2 Install the lead end pole spacer assembly as shown on the coil assembly drawing.

3.3.7 Final Preparation

.3.7.1 Install the lead ramp assembly as shown on the coil assembly drawing. Secure in place temporarily with velcro strap.

3.3.7.2 Secure midplane and pole leads to coil with velcro straps.

3.3.7.3 Roll up excess coil leads and secure with cable ties.

3.3.7.4 Place coil on storage rack and cover with plastic.

4. Quality Assurance Provisions:

4.1 Insure all inspection and test operations have been verified and signed on the production traveler by the cognizant operator and that any discrepancies have been reported as per RHIC-MAG-Q-1004.

4.2 Product Handling:

4.2.1 Because coils are very delicate, care must be exercised in their handling at all times. Cleanliness is also of importance in handling coils. The work area must be free of any metallic chips or other foreign matter. Coils must not be touched with any markers which will leave conducting residue, e.g., graphite pencils, etc.

5. Preparation for Delivery:

N/A

Data Sheet #1
Pole Lead Solder Joint Inspection

Position	T	W
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		