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Large Hadron Collider
Magnet Division Procedure

Proc. No.: LHC-MAG-R-1032

Issue Date: Oct. 6, 2000

Rev. No.: D

Rev. Date: June 25, 2003

Class: Dipole

Title: D1/D3 Dipole Endplate Welding Assembly

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- Q. A. Approval: Signature on File
- ES&H Review: Signature on File

REVISION RECORD

Rev. No.	Date	Page	Subject	Approval
A	10/6/00		Initial Release.	
B	3/25/03		Changes per ECN MG2131	
C	5/23/03		Changes per ECN MG2143	
D	6/25/03		Changes per ECN MG2148	

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1. Scope:

This specification describes the procedure for cold mass endplate installation on the LHC D1 and D3 Dipole Cold Mass Assemblies.

2. Applicable Documents:

The following documents, of the issue in effect at the time of release for manufacture, form a part of this procedure to the extent specified herein:

RHIC-MAG-Q-1004	Discrepancy Reporting Procedure
RHIC-MAG-R-7228	RHIC Inductance & Q Measurement
RHIC-MAG-R-7242	RHIC Hypot Testing
RHIC-MAG-R-7320	RHIC Electrical Resistance Measurement for Collared Individual Coils and Connected Coil Sets

BNL Drawings:

14010119	D1 Containment Assembly
14010487	D3 Containment Assembly

3. Requirements:

The endplates shall be installed in accordance with the drawings and parts lists, and the installation and welding sequence described herein.

All welding shall be performed by welders qualified in accordance with ASME Section IX. The welding parameters shall be set in accordance with those specified during welding process development.

3.1 Material/Equipment

3.2 Safety Precautions

3.2.1 Operators shall be trained by their cognizant technical supervisor and qualified in the operation of the required welding equipment.

3.2.2 No welding shall take place unless all welding screens are in place around the

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welding station, and all personnel not directly involved with the welding process are outside the screens. Any personnel inside the screens shall wear protective gear to prevent eye injury, and shall be clothed to prevent burns caused by intense ultra-violet light.

- 3.2.3 All lifting and handling operations requiring overhead crane operations shall be performed by holders of valid Safety Awareness Certificates. They shall also be trained and certified in the use of the appropriate lifting device by the Cognizant Engineer or Technical Supervisor.
- 3.2.4 Some of the 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.
- 3.2.5 Hypot and impulse testing pose a Class "C" electrocution hazard. At least two properly trained technicians must be present to perform this testing. When testing, a trained technician shall be stationed at any point where the item under test is accessible to unauthorized people, and barriers shall be set up. Signs shall be posted reading "DANGER HIGH VOLTAGE" and warning lights shall be turned on.

3.3 Procedure

3.3.1 Endplate Welding

- 3.3.1.1 Before installing end plates, clean and test set screw threads. Chase threads with a new tap, clean, and retest if necessary. All set screws must thread through by hand without any evidence of binding.
- 3.3.1.2 With the magnet on the shell welding fixture, install the endplates, but do not weld. Feed quench heater and temperature sensor wires through the appropriate holes in the lead end plate per the applicable engineering drawing. Use the endplate alignment bushings to line up endplate holes with matching yoke lamination holes and set the endplate perpendicular to the magnet axis using a precision square. Set weld root gaps equally at each end to achieve proper overall assembly length as shown on end plate welding assembly.

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Endplate to endplate distance should be set to approximately .25 greater than final dimension shown prior to welding to allow for weld shrinkage.

- 3.3.1.3 Tack weld each endplate to the shell using eight equally spaced welds approximately 1/2" long with filler wire (P/N 12010441-03). Use a welding sequence where four welds are made, equally spaced around the endplate then a second pass of four welds are made to complete the operation. Re-verify proper overall assembly length.
- 3.3.1.4 Place the magnet on the power roller supports.
- 3.3.1.5 Complete the welding of the lead endplate by manually TIG welding or rotary MIG welding using the appropriate ER385 filler wire per P/N 12010441.
- 3.3.1.6 Repeat steps 3.3.1.4-3.3.1.5 for the non-lead endplate.
- 3.3.1.7 Complete the longitudinal seam welds on the shells at both ends by manually TIG welding using filler wire (P/N 12010441-03).
- 3.3.1.8 Allow sufficient time for endplate welds to be cool to the touch. Apply Loctite to the pressure plate set screws and install into the endplates. Torque each set screw to the value given on the endplate welding assembly. Use a crisscross pattern and proceed in 10 in.-lb. increments up to the final value and then go around twice more to set final torque.
- 3.3.1.9 Measure and record overall endplate-to-endplate magnet length at the top and the bottom of the magnet.
- 3.3.2 Electrical Testing

CAUTION

Be sure the "Hypot", yoke, and beam tube is grounded at all times. Failure to observe this caution may result in electrocution.

- 3.3.2.1 Perform a coil-to-coil hypot check at 3 kV, following RHIC-MAG-R-7242.

NOTE

The leakage current must be less than 50 μ a.

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- 3.3.2.2 Electrically connect the main coil leads together.
- 3.3.2.3 Ground beam tube and strip heaters to yoke. Perform a hypot check between the main coils and the yoke at 5 kV, attaching the grounded lead of the hypot tester to the shell/ endplate following RHIC-MAG-R-7242.

NOTE

The leakage current must be less than 50 μ a.

- 3.3.2.4 Measure coil temperature. Measure voltage drops across coil at 1 amp DC, following RHIC-MAG-R-7320. Complete the measurements of inductance and quality factor (Q) following RHIC-MAG-R-7228.
- 3.3.2.5 Perform a hypot check between the collars and each of the quench protection resistors at 2.5 kV attaching the grounded lead of the hypot tester to the shell/endplate following RHIC-MAG-R-7242.

NOTE

The leakage current must be less than 50 μ a.

- 3.3.2.6 Perform a hypot check between the collars and each of the quench protection resistors at 5.0 kV attaching the grounded lead of the hypot tester to the shell/endplate following RHIC-MAG-R-7242. Record the leakage.
- 3.3.2.7 Perform resistance check of each yoke temperature sensor as noted in LHC-MAG-R-1051. Record results in traveler.
- 3.3.2.8 Perform resistance test on each of two quench protection resistor circuits.
- 3.3.2.9 Electrical engineer to review electrical test data and sign off “OK to Proceed”.

4. Quality Assurance Provisions:

- 4.1 The Quality Assurance provisions of this procedure require that all assembly and test operations be performed in accordance with the procedural instructions contained herein.

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4.2 Measuring and test equipment used for this procedure shall contain a valid calibration label in accordance with RHIC-MAG-Q-1000.

4.3 All discrepancies shall be identified and reported in accordance with RHIC-MAG-Q-1004.

5. Preparation for Delivery:

N/A