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Magnet Division Procedure

Procedure: LHC-MAG-R-1055

Revision: A



LHC D4 Beam Tube Insulation and Bumper Installation

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Revision History

Rev. A Initial Release 12/10/02

1 Scope

This specification describes the procedure for insulation of the LHC D4 dipole beam tube and for bumper application following insulation.

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-OPM-8.1.1.27	Operation of Beam Tube Wrapper
RHIC-MAG-R-7261	Beam Tube Assembly Hypot Testing

BNL drawings

14010551	D4 Beam Tube Assembly
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3 Requirements

3.1 Materials

12010008-SPM2	8cm dipole Bumper Application Fixture
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3.2 Safety Precautions

3.2.1 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.

3.2.2 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.

3.2.3 Operators shall be instructed by their cognizant technical supervisor in the details of wrapping of the beam tube.

3.2.4 Operators assigned to wrapping the beam tube shall be instructed by their supervisor in the safe operation of the Beam Tube Wrapper, RHIC-OPM-8.1.1.27.

4 Procedure

4.1 Insulation Procedure

NOTE

Handling - The beam tube may be damaged by improper handling. It must be supported to prevent permanent distortion during all wrapping operations.

NOTE

Wrapping - The beam tube shall be supported by free rolling support rollers while moving through the wrapping station.

4.1.1 Inspect the beam tube for bends, kinks and surface damage such as deep scratches.

4.1.2 Cleaning - Clean the beam tube surface with alcohol and clean wipes, until no contamination is evident on the wipe.

4.1.3 Set the controls to their initial settings (RHIC-OPM-8.1.1.27, Para.5.6).

4.1.4 A copy of the applicable drawing should be available at the wrapping machine. Any discrepancies between the drawing and this MAP must be brought to the attention of the cognizant engineer before work begins.

NOTE

Maintain interior cleanliness in the beam tube during the following operations. Replace end caps promptly.

4.1.5 Remove protective end caps from the beam tube ends. Mount the beam tube on the rollers in the wrapping machine, with the serial numbered end projecting from the wrapping head.

4.1.6 Clean the chain attachment fittings thoroughly, using alcohol and clean paper wipes. Tighten the chain attachment fittings until they do not slide or move under heavy hand pressure. Attach the drive chain to the tube using the fittings, and take up the chain slack in the wrapping machine.

CAUTION

In the setup of this machine, the operator may have to work within the guarded section of the wrapping head. The access doors to the wrapping head are electrically interlocked. When the doors are open the wrapping head is electrically de-activated and cannot rotate. An interlock test procedure is part of the OPM to assure that these door interlocks are operational. As an additional safety measure the operator should check that the door interlocks are operational before setting up the machine.

- 4.1.7 Using a 2 inch piece of adhesive backed tape, secure the end of the Kapton tape (12010181-13) to the beam tube in the location indicated on the applicable drawing.
- 4.1.8 Set speed controls for proper pitch of tape.
- 4.1.9 Wrap one layer at $46\% \pm 3\%$ overlap as shown on the assembly drawing. Secure the end of the tape with a 1 inch piece of adhesive backed tape. Maintain tape tension in the range of 5-10 lbs. during wrapping.
- 4.1.10 Wrap a second layer at $46\% \pm 3\%$ overlap as shown on the assembly drawing. Secure the end of the tape with a 1 inch piece of adhesive backed tape. Maintain tape tension in the range of 5-10 lbs. during wrapping.
- 4.1.11 Energize the oven and pass the wrapped tube back through the machine oven to the starting point to set the tape adhesive. Adjust the speed of the tube to 10 ± 1 inches per minute and allow the tube to cool before proceeding.
- 4.1.12 After the tube cools, examine the tube for uniformity of the wrap, and verify that the Kapton has formed a continuous layer. Trim only the start end of the wrap to dimension shown on the drawing and remove excess.
- 4.1.13 Secure the Kapton wrap with a hose clamp or lacing cord and adhesive as shown on the assembly drawing.
- 4.1.14 Disconnect chain from attachment fittings. Remove fittings from tube and wipe inside of tube ends with alcohol and paper wipes to clean the tube. Replace the tube end caps to maintain cleanliness.

4.2 Bumper Application

NOTE

Some of the bumpers are installed such that the circle formed by the bumpers is offset from the tube. The offset starts near the longitudinal center and the amount of offset increases towards one end of the tube.

4.2.1 Clamp the wrapped beam tube in bumper application fixture with the hose clamp positioned per the assembly drawing.

4.2.2 Shim each side plate to achieve the appropriate offset. See table.

NOTE 1

The first seven sets of bumpers are the standard size and are concentric offset. They do not require special shimming

NOTE 2

On the side where the bumpers are thinner than the standard, the side plates need to be shimmed behind where the bumper contacts the plate.

NOTE 3

On the side where the bumpers are thicker than the standard, the sides plates need to be shimmed where the plates contact the blocks

4.2.3 Clamp the appropriate midplane bumper in each side plate.

4.2.4 Apply epoxy (P/N 12040041) to each bumper, install and clamp each side plate.

4.2.5 Allow epoxy to cure at room temperature for approximately 4 hours.

4.2.6 When the epoxy is fully cured, unclamp and remove the side plates.

4.2.7 Unclamp and remove the top plates and remove the tube from the fixture.

4.2.8 Remove the shims that were installed on the fixture side plates.

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- 4.2.9 Place shims on the rubber on the bottom half of the fixture blocks to achieve the appropriate offset. See table.

NOTE

The shim thickness needs to be twice the desired offset.

- 4.2.10 Rotate the tube 90⁰ and reposition the tube in the application fixture with the thick bumpers facing down.
- 4.2.11 Repeat steps 4.2.3 - 4.2.7 to install the vertical bumpers per the assembly drawing.
- 4.3 Electrical Check

CAUTION

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

- 4.3.1 Place the beam tube assembly on the support stand. Hypot the assembly at 5kV per RHIC-MAG-R-7261.

5 Quality Assurance Provisions

- 5.1 The Quality Assurance provisions of this procedure require that the technician shall be responsible for performing all assembly operations in compliance with the procedural instructions contained herein and the recording of the results on the production traveler.
- 5.2 The technician is responsible for notifying the technical supervisor and/or the cognizant engineer of any discrepancies occurring during the performance of this procedure. All discrepancies shall be identified and reported in accordance with RHIC-MAG-Q-1004.
- 5.3 Measuring and test equipment used for this procedure shall contain a valid calibration label in accordance with RHIC-MAG-Q-1000.

6 Preparation for delivery:

N/A

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D4 Bumper Application			
Midplane Bumpers		Vertical Bumpers	
Position	Fixture Shim	Position	Fixture Shim
1	0.000	1	0.000
2	0.000	2	0.000
3	0.000	3	0.000
4	0.000	4	0.000
5	0.000	5	0.000
6	0.000	6	0.000
7	0.000	7	0.006
8	0.005	8	0.016
9	0.011	9	0.028
10	0.018	10	0.044
11	0.026	11	0.062
12	0.036	12	0.080
13	0.045	13	0.100
14	0.055	14	0.120
15	0.066	15	0.142
16	0.076		