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Magnet Division Procedure

Procedure: SMD-GSI-RD3003

Revision: B



GSI Coil Collaring

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### Revision History

			<i>CE</i>	<i>QA</i>	<i>ES&amp;H</i>
Rev. A	11/18/02	Initial Release	-	-	-
Rev. B	12/30/02	Added 4.5.10 & 4.6.8 (moved from later procedure).	<a href="#">On File</a>	<a href="#">On File</a>	<a href="#">On File</a>

1 Scope

This procedure describes the methods used to prepare a GSI Dipole Collared Coil Assembly.

2 Applicable Documents

RHIC-MAG-R-7226	RHIC Dipole /Quadrupole Coil Length Measurement
RHIC-MAG-R-7228	Inductance and Q Measurement
RHIC-MAG-R-7242	Hypot Testing
RHIC-MAG-R-7243	Low Precision Resistance Insulation Test
RHIC-MAG-R-7318	Impulse Testing
RHIC-MAG-R-7320	Electrical Resistance Measurement for Collared Individual Coils and Connected Coil Sets
RHIC-MAG-Q-1004	Discrepancy Reporting Procedure
RHIC-OPM 8.1.1.5	Operation of Collaring Press

3 Requirements

3.1 Material/Equipment:

None

3.2 Safety Precautions

3.2.1 Operators shall be instructed by their cognizant technical supervisor in the safe operation of the collaring press in accordance with RHIC-OPM 8.1.1.5.

3.2.2 Due to the use of hydraulic fluid under high pressure, all technicians must use safety glasses during the collaring operations. The assembly area near the collaring press must have restricted access while the press is in operation.

3.2.3 The technicians shall be instructed 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 Training Coordinator.

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.
- 3.2.6 All lifting and handling operations requiring overhead crane operations shall be performed by holders of valid Safety Awareness Certificates. They shall also be instructed in the use of the appropriate lifting devices by the Cognizant Engineer or Technical Supervisor, and wear required personal protection.
- 4 Procedure
  - 4.1 Coil Preparation
    - 4.1.1 Record the two coil serial numbers in the traveler.
    - 4.1.2 Remove the upper coil from the transporter box, and position it, midplane up, on the lower roller supports.
    - 4.1.3 Install the upper roller supports and rotate the coil 180 degrees.
    - 4.1.4 Remove the lower coil supports, lift the coil from the rollers and temporarily place it on a table, midplane down.
    - 4.1.5 Remove the lower coil from the transporter box, and position it, midplane up, on the lower roller supports.
    - 4.1.6 Place the inflatable bladder in the I.D. of the lower coil and inflate to 10 PSI.
    - 4.1.7 Move the upper coil into position on top of the lower coil. Align the two coils at the rear face of the lead end polespacer within .03 in.

**NOTE**

**Applying the coil insulation will require rotating the coil and removing the roller supports at various stages of the assembly.**

- 4.1.8 Apply the teflon tape to the O.D. of both coils as shown on the collared coil assembly drawing. Trim the tape at the pole and midplane surfaces.

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SMD-GSI-RD3003B

Page 3 of 8

- 4.1.9 Apply strips of teflon tape at the ends of the coil in the area of the pole to achieve the same radial build up in this area as on the coil O.D.
- 4.1.10 Apply the first layer of creased caps (“J”). Trim the caps so that they end at the first notch on the end polespacers. (.25 inches into the polespacers)
- 4.1.11 Apply .001” x 1/2” wide kapton tape to the circumferential joints at the ends of the kapton caps.
- 4.1.12 Apply the second layer of creased caps (“L”). Trim the caps so that they end at the beginning of the end polespacers.
- 4.1.13 Apply kapton tape .001” x 1/2” wide to the circumferential joints at the ends of the kapton caps.
- 4.1.14 Spiral wrap the NL end of the coils with 2 layers of 50% overlap Kapton tape as shown on the collared coil assembly drawing.
- 4.1.15 Apply Kapton tape to the I.D. of the LE brass spacers as shown on the collared coil assembly drawing.
- 4.1.16 Install the LE brass spacers as shown on the collared coil assembly drawing.
- 4.2 Collar Pack Installation
  - 4.2.1 Perform pre-assembly collar pack inspections per data sheet figure 1. Collars inspected without coils, with production keys installed and collars drawn away from each other to remove any key/keyway clearance.

Figure 1 - Collar Inspection - *Pre-Assembly*

	<b>Vertical OD</b>	<b>Horizontal OD</b>
Straight Section Pack		
Lead End Pack		
Non-Lead Pack		

- 4.2.2 Starting at the lead end, install the collar packs. Temporarily hold all top and bottom collar module assemblies together using velcro straps or suitable clips in the tapered

keyways of the collars.

4.2.3 Install assembly into collaring press and remove all temporary supports.

4.3 Pre-Assembly Electrical Tests

#### **CAUTION**

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

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

#### **NOTE**

**The leakage current must be less than 50  $\mu$ a.**

4.3.2 Electrically connect all the main coil leads together.

4.3.3 Perform a hypot check between the main coils and the collars at 5 KV, attaching the grounded lead of the hypot tester to the collars following RHIC-MAG-R-7242.

#### **NOTE**

**The leakage current must be less than 50  $\mu$ a.**

4.4 Collar Pressing and Keying

4.4.1 Reconnect the coils in series per RHIC-MAG-R-7320 and supply one (1)amp DC. Monitor the DVM's throughout the collaring operation to detect any turn-to-turn electrical shorts.

4.4.2 Apply lubricant to all the keys per the collared coil assembly drawing.

4.4.3 Position the magnet in the collaring press.

4.4.4 Lower the upper platen so that the weight of the platen is on the collared coil assembly.

4.4.5 Install the keys into the key holder cassettes. Apply minimum vertical load and inflate bladder to 60 PSI.

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SMD-GSI-RD3003B

Page 5 of 8

- 4.4.6 Apply a vertical load in steps of 100 psig until the keyway opening = .217 in.
- 4.4.7 Apply side load to the keys in increments of 250 psig and decrease the vertical load in increments of 100 psig after each increase in side load. When the keys are fully seated, remove all side pressure followed by any remaining vertical load.

**NOTE 1**

**10 Cylinders are active**

**NOTE 2**

**Due to the coil ends being softer than the straight section of the coils, the end yokes may close sooner than the center yokes. If so, the end hydraulic cylinders are to be valved off when keys can be inserted in the end collar laminations and the pressure at which the cylinders were valved off is to be noted in the traveler.**

- 4.5 Post-Assembly Electrical Tests:
  - 4.5.1 With coils unconnected, measure coil temperature. Measure voltage drops across coils at 1 amp DC, following RHIC-MAG-R-7320. Complete the measurements of inductance and quality factor (Q) following RHIC-MAG-R-7228.
  - 4.5.2 Perform an ohmmeter check of the resistance between the two coils, following RHIC-MAG-R-7243. Verify that the resistance is at least 20 megohms.

**CAUTION**

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

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

**NOTE**

**The leakage current must be less than 50  $\mu$ a.**

- 4.5.4 Electrically connect the main coil leads together.
- 4.5.5 Perform a hypot check between the main coils and the collars at 5 kV, attaching the grounded lead of the hypot tester to the collars following RHIC-MAG-R-7242.

**NOTE**

**The leakage current must be less than 50  $\mu$ a.**

**CAUTION**

**Be sure the "Impulse Tester", collars, and beam tube are grounded at all times. Failure to observe this caution may result in electrocution.**

- 4.5.6 Disconnect the coils from each other and perform an impulse test of the individual coils at 2 KV, following RHIC-MAG-R-7318.
- 4.5.7 Reconnect the coils in series as per RHIC-MAG-R-7320.
- 4.5.8 Perform an impulse test of the series connected coils at 2 KV, following RHIC-MAG-R-7318.
- 4.5.9 Disconnect the coils from each other and measure coil temperature. Measure voltage drops across each coil at 1 amp DC, following RHIC-MAG-R-7320. Complete the measurements of inductance and quality factor (Q) following RHIC-MAG-R-7228.
- 4.5.10 Measure the resistance of the collared coil assembly from the lead to the non-lead end. Record in traveler.
- 4.5.11 Cognizant electrical engineer to review test data and sign-off traveler "OK to Proceed".
- 4.6 Final Mechanical Assembly
  - 4.6.1 Clearly and boldly mark the face on the last lead end lamination with the cold mass serial number, part number, and revision. Also indicate with an arrow which side is "UP". Use a heavy permanent marker.
  - 4.6.2 Use overhead crane to move the collared coil assembly to roller supports.
  - 4.6.3 Deflate and remove the inflatable bladder.
  - 4.6.4 Measure the length of the upper coils following RHIC-MAG-R-7226 and record the lengths in the traveler.

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SMD-GSI-RD3003B

Page 7 of 8

4.6.5 Check for laminations that protrude radially outward beyond the rest. This is an indication of a defective collar lamination. No lamination shall protrude more than .010 in. above the rest.

4.6.6 Perform post assembly collar inspection per figure 2.

Figure 2 - Collar Inspection - *Post Assembly*

<b>Distance From LE (in.)</b>	<b>Vertical O.D.</b>	<b>Horizontal O.D.</b>
3		
9		
14		
20		
26		
32		
38		
42		
46		

4.6.7 Attach the coil end pressure plates.

4.6.8 Plug the lifting notches on the lead and non-lead end of the collared coil assembly with green putty.

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SMD-GSI-RD3003B

Page 8 of 8

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