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Relativistic Heavy Ion Collider
Magnet Division Procedure

Proc. No.: RHIC-MAG-R-7228

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Class: Electrical Testing
Title: RHIC Magnet Coil Inductance and Q Measurements

- Prepared by: _____ [Signature on File](#)
- Cognizant Engineer/Scientist: _____ [Signature on File](#)
- Electrical Systems: _____ [Signature on File](#)
- Q. A. Approval: _____ [Signature on File](#)
- ES&H Review: _____ [Signature on File](#)

REVISION RECORD

Rev. No.	Date	Page	Subject	Approval	QA	ES&H
A	5/18/90	Title	Change title to include Quadrupole.			
		2,3	Section 4.2.3.1 - added data for Quad.			
			Data Sheet title - added Quadrupole.	On File		
B	5/15/92	1,3	Revised values of L&Q for Quadrupole			
			to agree with Specification 7401	On File		
C	3/16/93		Revised specification as per SCR #466	On File	On File	On File

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1. Scope:

This procedure describes a method for measuring electrical inductance (L) and Quality Factor (Q) of a coil. This test is used on individual coils or a full series connected magnet to determine if any turn-to-turn shorts exist.

2. Applicable Documents:

Data Sheet - RHIC Magnet Coil Inductance and Q Measurements

RHIC-MAG-Q-1000 - Magnet Division Procedure for Control of
Measurement and Test Equipment

RHIC-MAG-Q-1004 - Discrepancy Reporting Procedure

3. Requirements:

3.1 Equipment Required:

3.1.1 General Radio # 1657, Hewlett Packard # 4263A RLC Meter or project approved equivalent digital impedance bridge.

3.1.2 Thermometer capable of reading to $\pm 0.1^{\circ}\text{C}$ @ room temperature.

3.1.3 Work bench/coil stand a minimum of 1 ft. from all metallic materials.

3.2 Safety Precautions:

3.2.1 The technicians shall be qualified by their cognizant technical supervisor in the operation of the required test equipment and these 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 ES & H Coordinator and the RHIC Training Coordinator.

3.2.2 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 During the following measurements the uncollared coil (in air) should be a minimum of 1 ft. distant from all metallic materials in order to insure accuracy of the readings.

3.3.2 Measure and record coil temperature.

3.3.3 Using a digital impedance bridge (series mode) connected across the two coil leads, measure and record inductance, L and Quality Factor, Q, of coil at 1.0 KHz test frequency; for a coil in iron use 120 Hz test frequency. Fill out the attached data sheet. Typical values for RHIC magnet coil(s) are shown below.

3.3.3.1 Arc Dipole Magnet, 8 cm, 9.45 Meter.
L=6.1 mH, Q=16, @ 1 KHz, single coil in air.
L=9.24 mH, Q=3.3 @ 120 Hz, single coil in iron.
L=28.4 mH, Q=3.8 @ 120 Hz, full series magnet.

3.3.3.2 Arc Quadrupole Magnet, 8 cm, 1.13 Meter.
L=0.205 mH, Q=11.1, @ 1 kHz, single coil in air.
L=0.277 mH, Q=1.95, @ 120 Hz, single coil in iron.
L=1.53 mH, Q=2.76, @ 120 Hz, full series magnet.

3.3.3.3 Insertion Quadrupole Magnet, 13 cm, 1.44 Meter.
L=0.719 mH, Q=17.7, @ 1 kHz, single coil in air.
L=0.981 mH, Q=3.51, @ 120 Hz, single coil in iron.
L=5.31 mH, Q=3.55, @ 120 Hz, full series magnet.

3.3.3.4 Corrector Magnet, 8 cm, 0.5 Meter.
a) dipole winding, B0, coil
L=TBD mH, Q=TBD, @ 1 kHz, single coil in air.
L=570. mH, Q=0.68, @ 120 Hz, single coil in iron.
b) quadrupole winding, B1, coil
L=TBD mH, Q=TBD, @ 1 kHz, single coil in air.
L=25. mH, Q=0.14, @ 120 Hz, single coil in iron.
c) octupole winding, B3, coil
L=TBD mH, Q=TBD, @ 1 kHz, single coil in air.
L=7.55 mH, Q=0.05, @ 120 Hz, single coil in iron.
d) decapole winding, B4, coil
L=TBD mH, Q=TBD, @ 1 kHz, single coil in air.
L=4.85 mH, Q=0.03, @ 120 Hz, single coil in iron.

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3.3.3.5 Sextupole Magnet, 8 cm, 0.75 Meter.

L=27.3 mH, Q=4.65, @ 1 kHz, single coil in air.

L=85.0 mH, Q=1.34, @ 120 Hz, single coil in iron.

L=735. mH, Q=1.62, @ 120 Hz, full series magnet.

4. Quality Assurance Provisions:

- 4.1 The quality assurance provisions of this procedure requires that the technician shall be responsible for performing all inspections and tests in compliance with the procedural instructions contained herein and the recording of test results on the data sheet(s) and/or on the production traveler.
- 4.2 The technician is responsible for verifying that the test and measurement equipment used in this procedure has been calibrated and that the calibration sticker (date) has not expired as per RHIC-MAG-Q-1000.
- 4.3 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 as per RHIC-MAG-Q-1004.

5. Preparation for Delivery:

N/A

