

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.

Relativistic Heavy Ion Collider
Magnet Division Procedure

Proc. No.: RHIC-MAG-R-7155

Issue Date: May 11, 1992

Rev. No.: C

Rev. Date: Aug. 29, 2000

Class: Dipole/Quadrupole Conductor

Title: RHIC Dipole/Quadrupole Cable Insulating Procedure – All Kapton

- Prepared by: Signature on File
- Cognizant Engineer/Scientist: Signature on File
- Cognizant Electrical Engineer: Signature on File
- Project Engineer: Signature on File
- Q. A. Approval: Signature on File
- ES&H Review: Signature on File

REVISION RECORD

Rev. No.	Date	Page	Subject	Approval
A	5/11/92		Initial Release.	AM/ERK
B	3/15/93		Specification Changes Throughout as per SCR #456.	AM/ERK/ CSP
C	8/29/00		Changes per ECR #MG2011	HH

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.

RHIC-MAG-R-7155C
Page 1 of 9

1 Scope:

This procedure prescribes the method to insulate superconducting cable using the BNL Cable Wrapping Line

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:

SMD OPM-8.1.1.8	Operation of Superconducting Cable Insulating Line
RHIC-MAG-R-7152	Splicing Electrical Insulating Tape
RHIC-MAG-Q-1000	Procedure for Control of Measurement Test Equipment
RHIC-MAG-Q-1004	Discrepancy Reporting Procedure
12000011	Assembly, Keystoned Cable & Insulation
12000013	Assembly, Keystoned Cable & Insulation
12000024	Assembly, Keystoned Cable & Insulation
14010104	Assembly, Keystoned Cable & Insulation

3 Requirements:

3.1 Required Equipment

Double braided cotton cord (Part No. NWT - cotton cord)
Digital Volt & Ohmmeter
Feeler gauge

3.2 Safety Precautions:

3.2.1 Operators shall be qualified by their cognizant technical supervisor in the safe operation of the superconducting cable insulating machine in accordance with the Operation Procedures Manual SMD-OPM-8.1.1.8 Operation Of the Superconducting Cable Insulating Line.

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.

RHIC-MAG-R-7155C

Page 2 of 9

3.3 Procedure

3.3.1 Insulating Procedure

3.3.1.1 Verify both short checkers are off.

WARNING

Failure to check ground may result in electrocution

- 3.3.1.2 Using an Ohmmeter, verify that the guide wheels before and at the taping head are grounded to the machine.
- 3.3.1.3 Using the grounding cable, ground short checker # 1 & #2. Verify that there is zero volts at the short checker with a digital volt meter. Open short checker covers.
- 3.3.1.4 Load the specified spool of bare cable onto the supply spooler (Item 1, Fig. 1). Check that major edge (thick side) of cable is facing operator (Fig. 2).
- 3.3.1.5 Attach 20 feet minimum long leader cable to the end of superconducting cable using clamp and clamping device or solder together using a solder fixture.
- 3.3.1.6 Open covers and load wrapping head number 1 (Item 4, Fig. 1) with specified spools of Insulation. Load enough material for the amount of cable to be insulated. Amount loaded should include 10% additional for safety factor. Record the mill roll numbers of insulation on Data Sheet of traveler.
- 3.3.1.7 Open covers and load wrapping head number 2 (Item 7, Fig.1) with specified spools of Insulation. Load enough material for the amount of cable to be insulated. Amount loaded should include 10% additional for safety factor. Record the mill roll numbers of insulation on Data Sheet of traveler.
- 3.3.1.8 Open both sets of guide rollers on each taping head by loosening the top and one side roller. Clean all roller assemblies with acetone and a lint free towel. Clean and inspect tape guide arm and rollers for burrs and debris.
- 3.3.1.9 Unclamp cable leader and thread through tension sensing head rollers (Item 3, Fig. 1), wrapping head number 1 (Item 4, Fig. 1), , first short checker (Item 5, Fig. 1), wrapping head number 2 (Item 7, Fig. 1), and second short checker (Item 8, Fig. 1). Pull cable leader through until cable lead splice joint is past both sets of guide rollers on wrapping head number 1. Clamp cable leader at the cable puller (Item

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.

RHIC-MAG-R-7155C

Page 3 of 9

10, Fig. 1) between rollers.

- 3.3.1.10 Adjust first set of guide rollers at wrapping head number 1 snugly against bare cable.
- 3.3.1.11 Attach cable insulation at wrapping head number 1 to cable with .0005 in. thick Kapton tape 12010181-02. Rotate wrapping head number 1 by hand until lead end of insulated cable passes second set of rollers. Adjust second set of rollers to contact insulated cable.
- 3.3.1.12 Adjust both sets of side rollers to .003 to .005 inches total clearance using a feeler gage. Check alignment of first set of roller to second set of rollers. Correct if necessary.
- 3.3.1.13 Close covers at both wrapping heads. Start machine per OPM 8.1.1.8 section 5.7. Adjust RUN TENSION for No. 1 Tape Tension Adjust until acceptable wrap (no obvious wrinkles) is achieved. Continue operating until cable lead splice joint moves through both sets of guide rollers on wrapping head number 2.

NOTE

Machine will not run with covers open.

- 3.3.1.14 Stop cable insulating machine. Open covers for wrapping head number 2 and adjust first set of guide rollers at wrapping head number 2 snugly against cable.
- 3.3.1.15 Attach cable insulation at wrapping head number 2 to cable with .0005 inch thick Kapton tape 12010181-02. Rotate wrapping head number 2 by hand until lead end of double insulated cable passes second set of rollers. Adjust second set of rollers to contact insulated cable.
- 3.3.1.16 Adjust both sets of side rollers to .003 to .005 inches total clearance using a feeler gauge. Check alignment of first set of rollers to the second set. Correct if necessary.
- 3.3.1.17 Close covers and start cable insulating machine per OPM 8.1.1.8 section 5.7. Adjust RUN TENSION for No. 2 Tape Tension Adjust to achieve acceptable wrap (no obvious wrinkles). Continue operating until cable lead splice joint moves through lump detector. The cable lead splice joint must be hand guided through lump detector rollers to avoid damage.
- 3.3.1.18 Run splice joint through cable puller (Item 10, Fig. 1) and zero cable footage counter on top of cable puller.

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.

RHIC-MAG-R-7155C

Page 4 of 9

- 3.3.1.19 Stop the cable insulating machine. Verify superconducting cable is grounded to machine before wrapping head using an ohmmeter.

WARNING

Failure to check ground may result in electrocution.

- 3.3.1.20 Activate and calibrate both short checkers (Items 5 and 8, Fig. 1) to 1000 volts RMS and lump detector (Item 9, Fig. 1) for .005 inch setting. Refer to SMD-OPM-8.1.1.8, paragraphs 5.15 and 5.19 for calibration procedures.
- 3.3.1.21 Start machine per OPM 8.1.1.8 section 5.7 and run until cable lead splice joint reaches take-up spooler (Item 12, Fig. 1). Switch tension control from torque motor to automatic tension control. (Digitrac) Remove cable lead splice joint and cable leader. Press STOP button. Secure cable to hub of spool on take-up spooler using aluminum clamping block.
- 3.3.1.22 Start machine per OPM 8.1.1.8 section 5.7 and resume cable insulating.
- 3.3.1.23 During spool insulating, double braided cotton cord is installed along the flanges as the cable changes direction (each side of spool) to fill gaps and protect cable (Fig. 2).
- 3.3.1.24 Insulate specified cable length. If any of the audible (and visual) alarms for the two short checkers sound during the insulating process proceed to section 3.3.2 or 3.3.3 covering insulation breaks, splices and pinhole repairs. If the audible (and visual) alarm for the lump detector sounds, mark affected area and continue cable insulating until marked area reaches the work station (Item 11, Fig. 1). Inspect marked area. If cable is damaged, contact cognizant engineer immediately. If insulation is damaged, repair as required, referring to either section 3.3.2 or 3.3.3.
- 3.3.1.25 Insulated cable spools shall be loaded with no more than 4500 linear feet of cable. Actual cable length spooled on individual spools shall be multiples of unit lengths as specified on traveler.
- 3.3.1.26 When a new spool is placed onto the cable take up spooler the cable wound onto the new spool shall be identified as a cable segment of the original master spool. This data is to be recorded onto the Cable History Segment Card which stays with the insulated cable spool. (See Fig. 3, Exam 2, for example segment card filled out.). The following information must be filled out:

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.

RHIC-MAG-R-7155C

Page 5 of 9

- 1) Cable number (includes Segment ID).
- 2) Segment start position relative to master spools orientation (2 places).
- 3) Whether direction is increasing or decreasing.
- 4) Hub position of segment spool in feet.

NOTE

The difference between Items 2 and 4 above equals the total cable length on the segment spool.

3.3.1.27 For labeling, packaging, storage and delivery requirements, see section 5.

3.3.2 Insulation Breaks and Splices:

3.3.2.1 The insulating machine will automatically shut down if either of the two wrapping heads experience an insulation break during the insulation process. Inspect both wrapping heads.

3.3.2.2 If the break occurs at either wrapping head, reattach the insulation to the cable at the exact location of break using .0005 inch thick Kapton tape 12010181-02.

3.3.2.3 Rotate wrapping head by hand two full rotations.

3.3.2.4 Restart cable insulating machine slowly until the reattached section reaches one of the work stations (Item 6 or 11, Fig. 1).

3.3.2.5 At the work station, insulate area between the original break and the reattached area as per RHIC-MAG-R-7152 "Splicing Electrical Insulating Film".

3.3.2.6 Record splice repair on Data Sheet of traveler. Continue cable insulating.

3.3.3 Pinhole Repairs:

3.3.3.1 Stop the machine if either of the two short checkers audible and visual alarms are activated during the insulating process. Locate the pinhole using the hand held short checker. If the area requires a splicing repair, refer to RHIC-MAG-R-7152, "Splicing Electrical Insulating Film".

3.3.3.2 After locating the exact position of the pinhole, repair the area by applying a 0.25 inch diameter by .0005 inch thick with .0005 inch thick silicone adhesive Kapton repair patch to the pinhole.

3.3.3.3 Retest the repaired area using the hand held short checker. If the repair is

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the website.

RHIC-MAG-R-7155C

Page 6 of 9

satisfactory, record the location of the repair on Data Sheet of traveler. Resume cable insulating.

4 Quality Assurance Provisions:

4.1 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.

4.2 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.

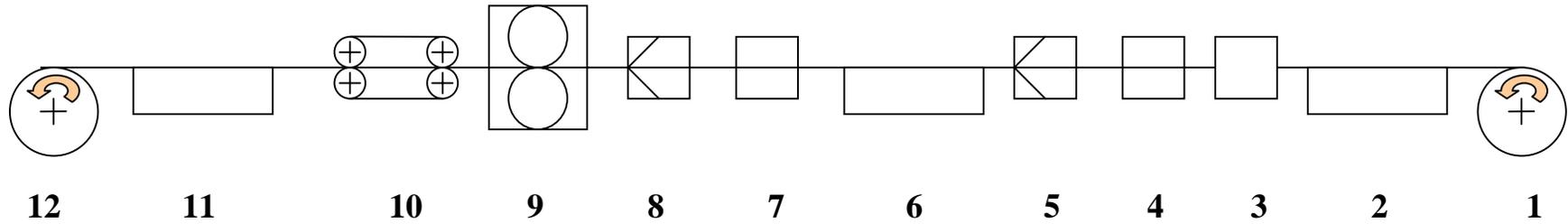
4.3 Measuring and test equipment used for this procedure shall contain a valid calibration label in accordance with RHIC-MAG-Q-1000.

5 Preparation for Storage

5.1 Packaging/Packing: Each spool of insulated cable shall be identified with the Cable Manufacturer's Cable Number, the Insulated Cable Drawing part number, the number of unit lengths if known, and the total length in feet. Each spool shall be individually wrapped with plastic stretch wrap film to protect from contamination. During storage, cable spools must be stacked with spool flanges maintained in a vertical orientation (axis horizontal) in order to prevent the cable from settling on the spool.

5.2 Spools/Reels: The insulated cable shall be spooled on BNL-approved reels with a minimum diameter of 14 inches.

Figure 1 - Cable Insulating Machine - Arrangement of Units



ITEM	UNIT DESCRIPTION
1	SUPPLY SPOOLER
2	WORK STATION #1
3	TENSION SENSING HEAD
4	KAPTON WRAPPER #1
5	SHORT CHECKER #1
6	WORK STATION #2
7	KAPTON WRAPPER #2
8	SHORT CHECKER #2
9	LUMP DETECTOR
10	PULLER
11	WORK STATION #3
12	TAKE-UP SPOOLER

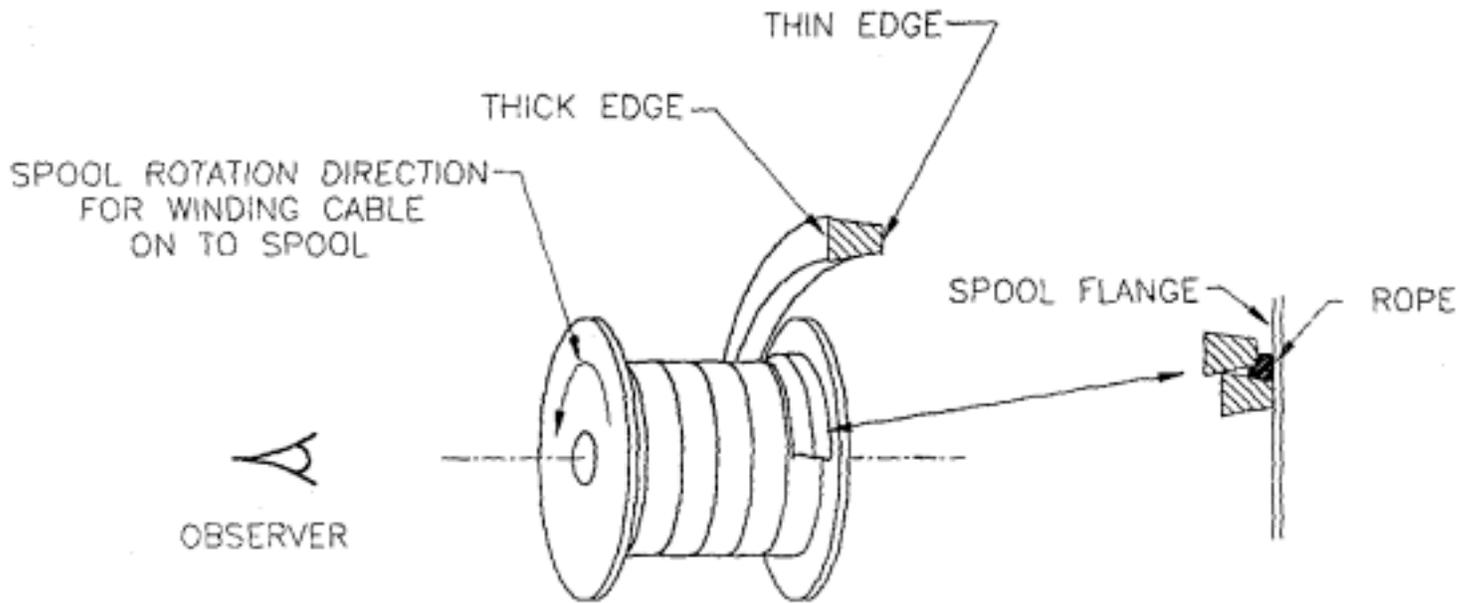


Figure 2 - Cable Spooling Directions

