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Scope:

This procedure describes the steps necessary to wind a 8cm dipole coil. The coil is assembled during winding from insulated superconducting cable, copper wedges, wedge tips, end spacers and end saddles.

2. Applicable Documents:

RHIC OPM 8.1.1.19	Operation of Short Coil Winder
RHIC-MAG-Q-1004	Discrepancy Reporting Procedure
RHIC-MAG-R-7337	Kapton Coil Insulation Damage
14010010	8cm Dipole Prototype Coil Winding and Curing Assembly
25-1676.30-5	RHIC DX Coil Winding Machine Set Up
25-1681.01-5	RHIC DX Winding Mandrel Assembly
25-1740.01-4	Coil Scratch Protector
Appendix A -	Coil Recure Procedure

3. Requirements:

The coil shall be wound in accordance with the Coil Drawing and Parts Kit List for the applicable magnet part number and manufacturing procedure described in paragraph 4 below.

- 3.1 Process Materials - The following process materials are referenced for use in this procedure and shall be controlled for procurement, use, storage and handling by the documents or catalog descriptions listed below. Substitutions require prior approval by cognizant engineer.

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<u>Reference Designation</u>	<u>Technical Designation</u>	<u>Source/Control</u>
Degreasers	LPS Contact Cleaner	BNL Stock No. I-78279
Zepspre	BNL Stock No. I-82792	
Towel	Paper towel	BNL Stock No. I-83312
Tack Rag	Gerson Tack Cloth	Gerson Co., Inc. Middleboro, MA
Frekote 700	Frekote 700 Release Interface	Frekote Products Bulletin 700
Kapton	Kapton Tape 1.00 in.-wide 0.001 in.-thick with 0.0015 in. Silicone Adhesive	R.H. Carlson P.O. Box 1687 Greenwich, CT
Kapton	Kapton Tape .75 in.-wide 0.0005 in.-thick with 0.0005 in. Silicone Adhesive	R.H. Carlson P.O. Box 1687 Greenwich, CT
Kapton	Kapton Tape .50 in.-wide 0.0005 in.-thick with 0.0005 in. Silicone Adhesive	R.H. Carlson P.O. Box 1687 Greenwich, CT

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Mylar	Mylar Type S Plastic Film (.005 in.-thick)	BNL Stock No. G-06710
	Mylar Type A Plastic Film (.014 in.-thick)	BNL Stock No. G-06708
Teflon 200 PH	Teflon PFA Film (.002 in.-thick)	E.I. DuPont Co., Inc. Fabricated Products Dept.
Velcro Strap	Velcro Strap 24x5/8	Gleicher Manufacturing 851 Jeraselem Rd. Scoth Plains, NJ
Teflon Coated Fiberglass Tape	Chemfluor TFE Teflon Coated Fiberglass Tape (.003 in.-thick Film with .003 in.- thick adhesive)	Norton Chem Plast Chemfluor Tapes Product Bulletin B-8
Teflon Tape	Teflon Tape HM-350 .002 in.-thick with .0015 in.-thick silicone adhesive	E.I. DuPont Co., Inc. Fabricated Products Dept.
Scouring Pad	Cleaning Pad Fine "Scotch-Brite"	BNL Stock No. I-82360
Cotton Swabs	Wood Applicator, Q-Tip	BNL Stock No. H-27668

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Clamping Ties		BNL Stock No. A-59826
Hose Clamps	Size 104mm x 105 to 178mm	Aero Seal
Neoprene Gloves	Gloves	BNL Stock Nos. K-62460 K-62500, K-62520, K-62540 or equivalent
Solder	Silvabrite Solder 4% Silver (Ag) 96% Tin (Sn)	Engelhard Corp. Route 152 Planville, MA

### 3.2 Tools Required During Coil Winding

Scissors	Delrin tapping tool
Metal shears	Scale (in.)
Degausser	Torque wrench
5/16" + 3/8" nut drivers	0.015" feeler gauge
Razor blades	House vacuum
Rawhide Mallets	Overhead crane
Micrometer	Hex key wrenches
Gaussmeter	
Heat Gun	
Bent tip needle nose pliers	

### 3.3 Safety Precautions

- 3.3.1 All operators/winders shall be qualified by the cognizant technical supervisor in the safe operation of the short coil winder, RHIC OPM-8.1.1.19, Operation of Short Coil Winder.
- 3.3.2 All lifting and handling operations requiring overhead crane operations shall be performed by personnel who are holders of valid Safety Awareness Certificates and who have been trained and certified for the lifting device being used by the Cognizant Engineer or Technical Supervisor.
- 3.3.3 Hard hats are required during crane operations.
- 3.3.4 Safety glasses shall be worn when tension is applied to cable.

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3.3.5 Gloves and safety glasses shall be worn while using degreasers.

3.3.6 Caution must be taken in the proper disposal of degreaser, pads, swabs and towels.

4. Procedures:

4.1 Mandrel, Centerpost and Blade Cleaning

4.1.1 Start up short coil winder following the "Start The Winder" procedure, Section 5.4 of the RHIC-OPM 8.1.1.19, "Operation of Short Winder".

4.1.2 Press "Reset" on the unidex 400 controller.

4.1.3 Press «F5» "Machine " then «F5» "Slew", to enter "Joystick" mode. Position the mandrel drive and carriage to allow the mandrel to be installed onto winding machine.

4.1.4 Remove all tapes from mandrel, centerpost and blade sections remaining from previous coil cure.

4.1.5 Inspect mandrel, centerpost sections, blades assembly, and all tooling hardware for magnetization using gaussmeter. Demagnetize any tooling which reads greater than 10 gauss using the degausser.

**CAUTION: Gloves and safety glasses shall be worn while using degreasers. Failure to observe this caution may result in skin and/or eye irritation.**

4.1.6 Clean mandrel, centerpost and blade sections using scouring pads and degreaser to remove all foreign matter from surfaces to contact coil. Vacuum entire mandrel including thru-hole and threaded hole locations. Use cotton swab and degreaser to clean holes.

4.1.7 Inspect mandrel, centerpost and blade section surfaces to contact coil for burrs or scratches. Deburr if necessary using vacuum to remove chips.

4.1.8 Wipe mandrel, centerpost and blade surfaces clean using degreaser and towel. Follow up with a clean tack rag.

4.1.9 Apply teflon tape HM-350 to the thin edge of pusher blades and to the centerpost straight section on both sides. Trim excess teflon tape. See Fig. 1

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4.1.10 Install centerpost on mandrel. Install straight section locating pins flush or up to .06 in. below centerpost top surface. Torque centerpost mounting bolts to 36 in/lbs.

#### 4.2 Winding Mandrel Preparation and Transfer

4.2.1 Apply two coats of Frekote 700 to the entire winding mandrel, and to the centerpost and blades. Allow 5 minutes drying time between coats. See Fig. 1.

4.2.2 Place coil end scratch protectors on lead and non-lead ends of the winding mandrel. See Fig.1.

4.2.3 Place a Mylar scratch protector (.014 in.-thick) over each mandrel end to cover drive slots. Tape to mandrel using Kapton adhesive tape (1.00 in. wide x .001 in. thick with .0015 in.-thick adhesive).

4.2.4 Apply one coat of FREKOTE 700 to the scratch protectors.

**CAUTION: Gloves and safety glasses shall be worn while using degreasers. Failure to observe this caution may result in skin and/or eye irritation.**

4.2.5 Attach rollover details (12010036-MCA) to the centerpost and blade spacer. Rotate the winding mandrel 180 degrees positioning the side opposite the centerpost facing up.

4.2.6 Vacuum the winding machine top surface, spool carriage and mandrel drive boxes. Wipe these surfaces clean using degreaser and towel.

**CAUTION: Hard hats are required when crane is in use. Failure to observe this caution may result in severe injury.**

4.2.7 Vacuum the mandrel surface opposite the centerpost.

4.2.8 Apply Teflon coated fiberglass tape 1.375 in.-wide x .003 in.-thick with .003 in. adhesive to the mandrel surface opposite the centerpost to cover all holes along the entire length. Attach mandrel rotating supports to the mandrel on the side opposite the centerpost.

4.2.9 Vacuum cable guides, clamps and end retainer tooling. Wipe clean with degreaser and towel. Follow up with a clean tack rag.

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- 4.2.10 Inspect condition of Teflon coated fiberglass tape and Mylar strips attached to the coil end retainers to verify that there are no tears, rips, or damage to the material. If damage exists, replace following paragraph 4.2.15.1, if no damage exists, continue with paragraph 4.2.16.
- 4.2.10.1 To prepare coil end retainers, (1) apply 1 layer of Teflon-coated fiberglass tape (.003 in.-thick with .003 in. adhesive) to the surfaces that face the coil and trim to fit. (2) Cut 2 strips of Mylar (.005 in. thick) to a size of 8 in. long x 1 in. wide.
- 4.2.11 Mount the end coil end retainers and the Mylar strips to the centerpost. Fold overhanging portion of Mylar strip over the top of the coil end retainers and secure with Kapton adhesive tape (1.00 in.-wide x .001 in.-thick with .0015 in. adhesive).

**NOTE: Reposition the Mylar strip when adding coil end retainer extensions during the winding.**

- 4.2.12 Inspect the coil parts kits, verify all parts are present and properly prepared. Check the parts kit drawing numbers and revision levels with the coil assembly drawing and parts list. If discrepancies are found, contact coil parts kitting technical supervisor or cognizant engineer.

#### 4.3 Cable Preparation

- 4.3.1 Record serial number of insulated superconductor cable to be used on traveler. Verify that total footage of cable remaining on spool is at least 660 feet as per the cable history segment card before starting to wind coil. This amount includes 12 feet for holding tension and 5 feet for length counter deviation.
- 4.3.2 Record the serial no. of the coil to be wound and the cable segment number on the traveler.
- 4.3.3 Complete cable history segment card on spool for coil. Subtract 643 foot length of cable for one coil. See Fig. 3 for cable history segment card recording procedure. Attach copy of cable history segment card to coil winding traveler.
- 4.3.4 Record the coil start footage and coil end footage (relative to hub end) on the traveler.
- 4.3.5 Using a micrometer, determine and mark the thick side of the cable; mount the cable spool on the winding carriage with the thick side of the cable facing up.

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- 4.3.6 Position the winder table, carriage and mandrel to begin "HOMING" operation as described in RHIC OPM 8.1.1.19, "Operation of Short Coil Winder", Sect. 5.7, "Starting a Fresh Winding".
- 4.3.7 When ready, press «F4» "abort" to exit "joystick" mode then «F3» "single" to go to "auto" mode, press enter. Press "1" then enter to begin "homing". Press "25" (winding file number), then press "enter".
- 4.3.8 Thread cable through guide rollers, tension sensor, and lump detector as described in Attachment 3 of RHIC OPM 8.1.1.19, "Operation of Short Coil Winder".
- 4.3.9 Apply a bead of solder to the end of the cable. Remove Kapton insulation from the end of the cable, trimming to match the lead slot in the centerpost. Fasten trimmed ends of insulation with Kapton adhesive tape .50 in.-wide x .0005 in.-thick with .0005 in. adhesive.

**NOTE: The cable insulation, made up of 2 layers of Kapton wrap, is removed after the cable end is soldered. This is to prevent the fraying of the cable during handling, which could possibly occur if the insulation were removed first.**

- 4.3.10 Thoroughly clean the cable with degreaser and paper towel.
- 4.3.11 Apply a coat of Frekote 700 to the end of the cable. The coated area will start where the cable will leave the slot, extending around the lead end of the centerpost and  $15 \pm .25$  in. into the straight section of the first turn.
- 4.3.12 Attach cable to centerpost by placing the end of the cable into the centerpost slot. Check that the cable is mounted with the thick edge up.

**CAUTION: Safety glasses are required when tension is applied to cable. Failure to observe this caution may result in eye injury.**

- 4.3.13 Place the tension power ON/OFF switch and tension controller ON/OFF switch to the "ON" position. Switch tension control to "Auto" mode. Press one of the "Continue" pushbuttons. Verify digital read out of tension applied on the manual control console, reads  $20 \pm 3$  lbs.

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4.3.13.1 If the tension alarm sounds during coil winding operation, verify that the tension readout on the manual control console is correct. If so, continue winding. If the tension is not correct or the alarm continues to sound, notify the cognizant technical supervisor.

4.3.14 Turn lump detector on winding carriage to ON position and set with a .015 in. feeler gauge.

4.3.15 Mount cable guide/clamps to the centerpost and clamp cable.

4.4 WINDING OF TURNS #1 THRU #4

**NOTE: Turn numbering designation is for coil winding purposes only. Turn number will be displayed on the upper display panel located on the control console.**

**NOTE: The automatic controls on the coil winder will automatically stop the winding carriage at each coil end. At this point the lower display panel will display part name and number to be installed at this location. After installing specified part the continue switch shall be activated. The winding carriage will proceed to opposite coil end for process to be repeated.**

4.4.1 Start coil winding by pressing any of the "Continue" switches mounted on winder table.

4.4.2 Bring the first turn of the insulated superconducting cable around lead end of the centerpost and lightly tap into place using rawhide mallet and delrin tapping tool so it lies firmly against the centerpost and mandrel.

4.4.3 Complete winding of Turn #1 by bringing the cable around the non-lead end and continuing back to the lead end.

**NOTE: To hold cable and parts in place during winding, adjust clamps and resecure cable at each clamp location.**

4.4.4 Verify  $40 \pm 3$  lb. cable tension is applied.

4.4.5 Wind Turn #2 around the lead end and along the straight section to the non-lead end.

4.4.6 Insert Solid End Spacer #2 at the non-lead end.

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- 4.4.7 Wind Turn #2 around the non-lead end and along the straight section to the lead end.
- 4.4.8 Insert Solid End Spacer #1 at the lead end.
- 4.4.9 Wind Turn #3 around the lead end and along the straight section to the non-lead end.
- 4.4.10 Insert Solid End Spacer #4 at the non-lead end.
- 4.4.11 Wind Turn #3 around the non-lead end and along the straight section to the lead end.
- 4.4.12 Insert Solid End Spacer #3 at the lead end.
- 4.4.13 Wind Turn #4 around the lead end and along the straight section to the non-lead end.
- 4.4.14 Insert Solid End Spacer #5 at the non-lead end.
- 4.4.15 Wind Turn #4 around the non-lead end and along the straight section to the lead end.
- 4.5 INSERT WEDGE #1 AND WIND TURN #5
- 4.5.1 Starting at the lead end of the coil, install Wedge-Wedge Tip Assembly 1A, insulated Wedges No. 1 and Wedge-Wedge Tip Assembly 1B. Install end spacer lamination at the lead end.
  - NOTES: A. The wedges must be placed into the coil so that the markings are placed on the outer radius surface.**
  - B. Wedge-wedge tip interfaces are to be aligned relative to the centerpost straight section as per the coil winding and curing drawing and such that the gap between wedges does not exceed .090.**
  - C. Wedge tips are positioned under Laminated Assembly End Spacers.**
- 4.5.2 Wind Turn #5 around the lead end and along the straight section to the non-lead end.
- 4.5.3 Install Wedge-Wedge Tip Assembly 1C, Insulated Wedges No. 1 and Wedge-Wedge Tip Assembly 1D in proper orientation starting at the non-lead end.
- 4.5.4 Install End Spacer Lamination at the non-lead end, centered on coil axis

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- 4.5.5 Wind Turn #5 around the non-lead end and along the straight section to the lead end.
- 4.5.6 Install End Spacer Lamination at the lead end, centered on coil axis.
- 4.6 WIND TURNS #6 THRU #12
  - 4.6.1 Wind Turn #6 around lead end and along straight section to the non-lead end.
  - 4.6.2 Install Solid End Spacer #7 at the non-lead end.
  - 4.6.3 Wind Turn #6 around the non-lead end and along the straight section to the lead end.
  - 4.6.4 Insert Solid End Spacer #6 at the lead end.
  - 4.6.5 Wind Turn #7 around the lead end and along the straight section to the non-lead end.
  - 4.6.6 Insert Solid End Spacer #9 at the non-lead end.
  - 4.6.7 Wind Turn #7 around non-lead end and along straight section to the lead end.
  - 4.6.8 Insert Solid End Spacer #8 at the lead end.
  - 4.6.9 Wind Turn #8 around the lead end and along the straight section to the non-lead end.
  - 4.6.10 Insert End Spacer Lamination at the non-lead end, centered on coil axis.
  - 4.6.11 Wind Turn #8 around the non-lead end and along the straight section to the lead end.
  - 4.6.12 Wind Turns #9 thru #12, inserting end spacer laminations between individual turns at both ends (4 at LE, 4 at NLE).
- 4.7 INSERT WEDGE #2 AND WIND TURN #13
  - 4.7.1 Starting at the lead end of the coil, install Wedge-Wedge Tip Assembly 2A, insulated Wedges No. 2 and Wedge-Wedge Tip Assembly 2B. Install end spacer lamination at the lead end.

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- NOTE: A. The wedges must be placed into the coil so that the markings are placed on the outer radius surface.**
- B. Wedge-Wedge Tip interfaces are to be aligned relative to the centerpost straight section as per the coil winding and curing drawing and such that the gap between the wedges does not exceed .090.**
- C. Wedge tips are positioned under Laminated Assembly End Spacers.**

- 4.7.2 Wind Turn #13 around lead end and along straight section to the non-lead end.
- 4.7.3 Install Wedge-Wedge Tip Assembly 2C, Insulated Wedge No. 2 and Wedge-Wedge Tip Assembly 2D in proper orientation starting at the non-lead end.
- 4.7.4 Install end spacer lamination at the non-lead end, centered on coil axis.
- 4.7.5 Wind Turn #13 around the non-lead end and along the straight section to the lead end.
- 4.7.6 Install End Spacer Lamination at the lead end, centered on coil axis.
- 4.8 WINDING OF TURNS #14 THRU #23
- 4.8.1 Wind Turn #14 around the lead end and along the straight section to the non-lead end.
- 4.8.2 Install Solid End Spacer #11 at the non-lead end.
- 4.8.3 Wind Turn #14 around the non-lead end and along the straight section to the lead end.
- 4.8.4 Install Solid End Spacer #10 at the lead end.
- 4.8.5 Wind Turns #15 thru #20, inserting End Spacer Laminations between individual turns at both ends (5 at LE, 6 at NLE).
- 4.8.6 Insert Solid End Spacer #12 at the lead end.
- 4.8.7 Wind Turn #21 around the lead end and along the straight section to the non-lead end.

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- 4.8.8 Insert Solid End Spacer #13 at the non-lead end.
- 4.8.9 Wind Turn #21 around the non-lead end and along the straight section to the lead end.
- 4.8.10 Insert Solid End Spacer #14 at the lead end.
- 4.8.11 Wind Turn #22 around the lead end and along the straight section to the non-lead end.
- 4.8.12 Insert Solid End Spacer #15 at the non-lead end.
- 4.8.13 Wind Turn #22 around the non-lead end and along the straight section to the lead end.
- 4.8.14 Insert Solid End Spacer #16 at the lead end.
- 4.8.15 Wind Turn #23 around the lead end and along the straight section to the non-lead end.
- 4.8.16 Insert Solid End Spacer #17 at the non-lead end.
- 4.8.17 Wind Turn #23 around the non-lead end and along the straight section to the lead end.
- 4.9 INSERT WEDGE #3 AND WIND TURN #24
- 4.9.1 Starting at the lead end of the coil, install Wedge-Wedge Tip Assembly 3A, insulated Wedges No. 3 and Wedge-Wedge Tip Assembly 3B. Install end spacer lamination at the lead end.
  - NOTE: A. The wedges must be placed into the coil so that the markings are placed on the outer radius surface.**
  - B. Wedge-Wedge Tip interfaces are to be aligned relative to the centerpost straight section as per the coil winding and curing drawing and such that the gap between the wedges does not exceed .090.**
  - C. Wedge tips are positioned under Laminated Assembly End Spacers.**
- 4.9.2 Wind Turn #24 around the lead end and along the straight section to the non-lead end.

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- 4.9.3 Install Wedge-Wedge Tip Assembly 3C, Insulated Wedges No. 3 and Wedge-Wedge Tip Assembly 3D in proper orientation starting at the non-lead end.
- 4.9.4 Install End Spacer Lamination at the non-lead end, centered on coil axis.
- 4.9.5 Wind Turn #24 around the non-lead end and along the straight section to the lead end.
- 4.9.6 Install End Spacer Lamination at the lead end, centered on coil axis.
- 4.10 WINDING OF TURNS #25 THRU #32
- 4.10.1 Wind Turns #25 thru #32, inserting End Spacer Laminations between individual turns at both ends (7 at LE, 8 at NLE).
- 4.10.2 Wind Turn #32 up to, but not around, lead end. The upper display panel on the control panel will read: "Turn = 32", and the lower display panel will read: "WINDING DONE".
- 4.10.3 Count the number of turns: there should be a total of 32 turns in the coil. Verify that all parts have been installed correctly. Verify #1 and #2 wedge gaps do not exceed "076". Verify #3 wedge gaps do not exceed "030".
- 4.11 CLEAN AND ATTACH BLADES
- 4.11.1 Apply a coat of Frekote 700 to the end of the cable. The coating should cover the cable from the end of the straight section to the end of the mandrel.
- 4.11.2 Clamp cable to the mandrel using a soft piece of rubber around the cable and a hose clamp, be sure not to damage cable.  
  
**NOTE: The hose clamp will be removed prior to placing the coil in the formblock. See Fig.2.**
- 4.11.3 Turn "OFF" the cable spool tensioner by placing the Trac I Tension Controller ON/OFF toggle switches in the "OFF" position. Set the tension control potentiometer to ZERO. Turn off Lump Detector.

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- 4.11.4 Apply Kapton adhesive tape (1.00 in.-wide x .001 in.-thick with .0015 in. Adhesive) where the cable is to be cut. Cut cable, leaving a 21 +2/-0 in. Lead from coil end saddle. Roll up lead and tape to mandrel.

**NOTE: Place strips of .002" tape on both sides of tabs to prevent insulation damage.**

- 4.11.5 Clip off Kapton spacer tabs – use extreme caution not to damage Kapton insulation.
- 4.11.6 Set coil winder to “Joystick” mode by pressing <F4> “ABORT” once. Then <5> “SLEW”.
- 4.11.7 Mount rollover details (12010036-MCA) to centerpost using (2)1/4” T-Pins.
- 4.11.8 Rotate coil so it is in position to accept the pusher blades. Install pusher blades. Release cable clamps as required. Secure pusher blades, tighten screws to contact then back off 1/8 turn.
- 4.11.9 Place velcro straps every 18 inches over the blade assembly and coil. Tighten straps to make a tight coil package. Rotate coil until centerpost is facing up.

4.12 PREPARE ENDS

**NOTE: Perform each step of Section 4.15 for both lead and non-lead ends.**

- 4.12.1 Clamp coil end with 2 tie wraps.
- 4.12.2 Loosen coil end retainer extensions and remove the winding tooling from the coil end.
- 4.12.3 Clamp coil end with at least 1 clamp assembly positioned over last inch of centerpost tip. See Fig. 2.
- 4.12.4 Attach end pusher spacers to each coil end saddle. Be sure correct end pusher spacers are used on each coil end saddle.
- 4.12.5 Install end saddle and position against outside coil turn. Be sure scratch protector does not become pinched between coil and end saddle.
- 4.12.6 Secure saddles to mandrel by applying Kapton adhesive tape (.75 in.-wide x .0005 in.-thick with .0005 in. adhesive) over end pusher spacers.

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4.13           TEFLON WRAP COIL

4.13.1        Set the coil winder to the "Film Wrapping" mode by pressing <F4> "abort" then <F4> "run", toggle <F3> to "auto" type 2 for file #. See RHIC OPM 8.1.1.19, Sect. 5.9, "Film Wrapping". Press the "Continue" green pushbutton to rotate mandrel.

**NOTE: Trim Teflon wrap around the centerpost keys using a razor.**

4.13.2        Using 0.002 in.-thick x 4 or 6 in.-wide Teflon film, wrap the coil by hand holding the roll of Teflon film while rotating the coil/mandrel assembly. Use 44% to 48% (1/8" to 3/8" gap) overlap wrap. Remove clamp assemblies, velcro straps, and cable guides just ahead of wrapping. After Teflon wrap is complete, reinstall Velcro straps and clamp assemblies. At lead and non-lead ends, secure Teflon with Kapton adhesive tape (.75 in.-wide x .0005 in.-thick with .0005 in. adhesive). Use heat gun as necessary to shrink Teflon onto coil.

NOTE: (A)     Be sure to tape on sides of blade assembly when securing Teflon wrap with Kapton adhesive tape.

(B)           Clamp assemblies will remain on the coil ends until coil is transferred to the curing fixture.

4.13.3        Rotate mandrel so coil midplane is facing down.

4.13.4        Loosen centerpost mounting bolts only until torque is removed.

4.13.5        Rotate coil/mandrel assembly with midplane facing up. Remove mandrel rotating supports from blade spacer.

4.13.6        Remove mandrel drive journal shoulder bolts from lead and non-lead ends.

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4.13.7 Set the coil winder to "Initial Control Settings", section 5.3 as described in RHIC OPM 8.1.1.19, "Operation of Short Coil Winder".

- CAUTION:**
- 1. Care shall be used to assure safe transfer of the coil/mandrel assembly to the curing fixture area. Failure to observe this caution can result in product damage.**
  - 2. Hard hats are required when crane is in use. Failure to observe this caution may result in severe injury.**

4.13.8 Using overhead crane and strongback assembly, raise coil/mandrel assembly out of winder. Remove mandrel rotating supports from the centerposts. Transfer coil/mandrel assembly to curing press area.

5. Quality Assurance Provisions:

5.1 The Quality Assurance Provisions of this procedure require compliance with the procedural instructions described above.

5.2 Insure all operations have been verified and signed on the traveler by the Cognizant Operator and that all discrepancies have been reported as per RHIC-MAG-Q-1004.

5.3 Calibration: Verify the calibration for the following equipment is current:

Cable Tensioner - Calibrate at the start of every production run and once a month thereafter.

Lump Detector - Set using a .015 inch feeler gauge before winding each coil.

Gaussmeter

6. Preparation for Delivery:

6.1 Care shall be exercised during lifting, moving, and transporting in- process and wound coils. Wound coils shall be suitably protected or packaged to minimize contamination.



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## APPENDIX A

### Coil Recure Procedure

Scope: This procedure describes the steps necessary to prepare a coil for recuring.

- 1) Clean mandrel and centerpost by following steps in section 4.1.
- 2) Prepare mandrel and transfer to winding machine by following steps 4.2.1 through 4.2.19.
- 3) Apply a bead of solder to the end of the pole lead cable.
- 4) Apply a coat of Frekote 700 to the coil leads following step 4.3.11 and 4.14.1.
- 5) Remove locating pins from each end of the centerpost. Remove the lead and non-lead end centerpost section including the section with the slot for cable anchoring. Leave one straight section centerpost bolted to the mandrel.
- 6) Place coil onto the mandrel. Secure with three clamping ties, one at each end of the coil and one in the center.
- 7) Install lead and non-lead end centerpost sections onto mandrel. Install the lead end locating pin. Install bolts through the slotted holes of the centerpost sections. Hand tighten bolts to secure centerpost to mandrel.
- 8) Fasten cable end into centerpost slot and position centerpost on mandrel. Be sure the cable is flush with the centerpost top surface. Remove centerpost bolts from the centerpost section without slot. Align centerpost joints.
- 9) Position a 6 inch C-clamp with rubber protector on top of centerpost section with the lead slot and a phenolic block on bottom of mandrel (This is to prevent the C-clamp from damaging the top of the centerpost or the bottom of the mandrel).
- 10) Tighten C-clamp enough to allow the centerpost bolts to thread into mandrel. Tighten all centerpost bolts while maintaining force on the centerpost against the mandrel with the C-clamp. Align centerpost joint ends while seating the centerposts.
- 11) Install the non-lead end straight section locating pin.
- 12) Remove C-clamp. Rotate mandrel to accept blade assembly.

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- 13) Clean and mount blade assembly by following steps 4.17.5 through 4.17.15.
- 14) Attach end pusher spacers by following step 4.18.4.
- 15) Teflon wrap and prepare for curing by following steps in section 4.19.