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1. Scope:

This procedure describes the method used in the preparation of copper wedges for manufacture of magnet coils. It includes cleaning, chemical milling of wedge ends, and wrapping with insulating film.

2. Applicable Documents:

See applicable copper wedge drawings	12010355	Wedge No. 1	
	12010401	Wedge No. 2	
	12010357	Wedge No. 3	
	12010360	Wedge No. 1	Chem-Milled
	12010361	Wedge No. 2	Chem-Milled
	12010362	Wedge No. 3	Chem-Milled
	12010181	Insulation, Polyimide Film	

RHIC-OPM-8.1.1.26	Operation of Wedge Insulating Machine
RHIC-MAG-Q-1004	Discrepancy Reporting Procedure

3. Requirements:

3.1 Material/Equipment

Flathead micrometer (0 to 1" range) (BNL Stock No. H-12010)
Fine file
3M Scotch Brite scouring pads or equivalent (BNL Stock No. I-82360)
Ethonal Alcohol/alcohol bath (BNL Stock No. E-53912)
Paper towels
Approved non-conductive marking pens (Staedler 317 WP4 or equivalent).
(BNL Stock No. S-23755)
Water (H₂O) 23 ± 5⁰C
Nitric acid (HNO₃) (BNL Stock No. E-52260)
1" Masking tape (BNL Stock No. S-05924)
6" Length scale (BNL Stock No. H-22095)
Beaker (BNL Stock No. C-00460)
Timer (measure seconds and minutes)
Baking soda (BNL Stock No. E-58212)
Single edge safety razor blades (BNL Stock No. H-32985)
Safety Glasses (BNL Stock No. K-63408)
Gloves (BNL Stock No. K-62642(S), K-62644(M), K-62646 (L), or equivalent)
Wedge Wrapping Log Book
Rubber gloves (BNL Stock No. K-62235(S), K-62240(M), K-62280(L),

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K-62282 (XL); or equivalent)
Cotton lab coat (BNL Stock No. K-60956,68,75,78,85,90,95 or K-61000)

3.2 Copper Wedge Cleaning Procedure

Safety Precautions:

An area with adequate ventilation is to be utilized when using alcohol as a cleaning agent. Safety glasses and gloves must be worn during the procedure. **CAUTION: Caution should be taken in the proper disposal of alcohol. Failure to observe these precautions may result in eye, skin and/or respiratory irritation or burn.**

- 3.2.1 Deburr machined ends if necessary as per drawing using a fine file.
- 3.2.2 Lightly wipe wedge with Scotch Brite pad to remove any loose copper flashing on sharp corners of wedge.
- 3.2.3 Inspect each wedge along its length for defects such as nicks, dents, burrs, bends, or sharp edges. If any are found which are considered unacceptable, set aside for further inspection.
- 3.2.4 Soak wedges in alcohol bath for 10 to 15 minutes. Wipe each wedge with paper towel to remove any oils left from machining operation.
- 3.2.5 Proceed with chemical milling of wedge ends if necessary and wedge insulating according to applicable wedge drawing.

3.3 Chemical Milling (Chem-Mil) Procedure

Safety Precautions:

This procedure shall be performed under a hooded work station equipped with an adequate ventilation system to exhaust fumes associated with the procedure. Full face shield, rubber gloves and cotton lab coat shall be worn during the procedure. **CAUTION: Failure to observe these precautions may result in eye, skin and/or respiratory irritation or burn.**

- 3.3.1 Tape wedge with 1 in.-wide masking tape 0.54 ± .020 inches back from the end to be chemically milled.

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3.3.2 Measure 25 ml. water (H₂O) and 15 ml. nitric acid (HNO₃) separately.

CAUTION: Never mix water and nitric acid by pouring water into nitric acid. Failure to observe this caution can result in severe burn injury.

3.3.3 Combine and mix water and nitric acid by adding the nitric acid to the water in glass beaker.

3.3.4 Set timer to time required for specific wedge. (See Table I).

3.3.5 Place taped ends of identical wedges in acid mixture and start timer. (Number of wedges is indicated on Table I.)

3.3.6 Remove and rinse wedge ends in a mixture of 2-1/2 gallons of water to 2 tablespoons of baking soda.

3.3.7 Check thickness of the largest side of the wedge using calibrated flathead micrometer to verify a reduction of 0.008 in. ± 0.003 in. from initial measurement as specified on the wedge drawing.

3.3.8 Immediately remove tape from wedge ends.

Table I. Chemical Milling Times for Coil Wedges.

<u>Wedge No.</u>	<u>BNL Dwg. No.</u>	<u>Number of Wedges</u>	
		<u>Milled</u>	<u>Time (Suggested)*</u>
1	12010355	4	9.5 min.
2	12010401	4	8.5 min.
3	12010357	4	8.5 min.

*The above times listed may vary due to acid strength or temperature. Adjust time as required to achieve proper dimensions.

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All safety precautions shall be used when operating insulating machine including: safety glasses, safety covers (Plexiglas) shall be in place during operation. **CAUTION: Failure to observe these precautions may result in injury and/or equipment or product damage.**

3.4 Insulating Procedure (First Layer)

SAFETY PRECAUTIONS: Operators shall be qualified by their cognizant technical supervisor in the safe operation of the wedge wrapping machine in accordance with RHIC-OPM-8.1.1.26 Operation of Wedge Wrapper.

- 3.4.1 Set control panel controls to initial settings (RHIC-OPM-8.1.1.26, Para. 5.4).
- 3.4.2 Open covers. Install required Kapton spool onto spindle as per applicable drawing.
- 3.4.3 Check that proper guide feed track is installed.
- 3.4.4 Clean track and machine of any dust, dirt or other foreign matter with alcohol.
- 3.4.5 Check that proper wedge guide tube is installed correctly.
- 3.4.6 Insert specified wedge into feed guide track.
- 3.4.7 Open the 4-way adjustable guide to accommodate wedge. Allow wedge to pass through the guide tube and through the 4-way adjustable guide.
- 3.4.8 Adjust top drive roller to desired height with wedge to be wrapped.
- 3.4.9 Set motor speed, motor torque and counter, for wedge to be wrapped (see Table II).

Table II. Wrapping Machine Settings.

Wedge	1	2	3
Motor Speed	32	32	32
Torque	92	92	92
Counter	99422	99422	99422

The settings listed above are approximate, adjust as necessary to achieve required wrap.

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- 3.4.10 Close covers. Push SYSTEM ON button. Verify the red power on light illuminates.
- 3.4.11 Push specified wedge along feed track to depress microswitch.
- 3.4.12 Depress knee kick switch pad.
- 3.4.13 Run wedge through machine without insulation and make any necessary guide adjustments. Repeat until machine operates smoothly.
- 3.4.14 Run wedge through machine, stopping when wedge reaches green drive rollers.
- 3.4.15 Open covers and attach specified Kapton film to wedge with one piece of .0005 inch thick by .375 wide Kapton tape.
- 3.4.16 Close covers and place another wedge of same type into follower track.
- 3.4.17 Push SYSTEM ON button and depress Kick Switch Pad.
- 3.4.18 When insulated wedge is through 4-way adjustable guide, stop machine and set guide to contact wedge.
- 3.4.19 Inspect Kapton for gap size as per drawing. If gap needs to be adjusted, turn counter hand wheel on right side of machine. This increases or decreases gap size. (Higher number increases gap, lower number decreases gap). **CAUTION: Change ratio while machine is running. Failure to do so will result in equipment damage.**
- 3.4.20 If insulation is unacceptable, remove from wedge and re-wrap.
- 3.4.21 Continue to wrap first layer on wedges inspecting continuously for correct gap size, overlaps of Kapton, dirt or debris under Kapton. Stop when wedges no longer fit on follower track.
- 3.4.22 To separate wedges, place one piece of .0005 in. thick x .50 in. wide Kapton tape with adhesive to joint area, butt end to butt end of wedge, covering both sides of joint evenly. Do not overlap tape.

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- 3.4.23 Lift joint area slightly and slide a sharp single edge razor blade between the two wedges and cut all the way through the joint. **CAUTION: Cut hazard exists using sharp single edged razor blade.**
- 3.4.24 Place wrapped wedge on clean surface awaiting second wrap.
- 3.4.25 Continue wrapping wedges until the total required quantity is completed.
- 3.5 Insulating Procedure (Second Layer)
 - 3.5.1 Change Kapton to correct type for second layer as per drawing.
 - 3.5.2 Open 4-way adjustable guide.
 - 3.5.3 Repeat steps 3.4.10 through 3.4.25.
 - 3.5.4 When wedges are insulated with both layers of Kapton, wrap shall be inspected and marked with approved non-conductive marking pen per applicable drawing.

NOTE: Keep all chem-milled wedges separate from straight section wedges.

- 3.5.5 Bundle wedges in amounts needed and wrap in clean brown paper. Identify with appropriate label including BNL drawing number, applicable revision letter and quantity.

4. Quality Assurance:

4.1 The Quality Assurance provisions of this procedure require compliance with the procedural sequence described above.

4.2 Calibration - The following tools must have a current calibration:

Flathead micrometer (0-1" range).

4.3 All discrepancies shall be reported in accordance with RHIC-MAG-Q-1004.

5. Preparation for Delivery

N/A