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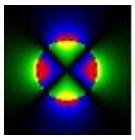
Magnet Division Procedure



Superconducting
Magnet Division

Proc. No.: SMD-AGS-3010

Revision: A

Title: AGS Snake Yoke Warm-Up Heaters

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Revision History

Rev A: Initial Release 7/23/03

1 Scope:

This specification describes the procedure for fabricating, insulating, and testing the warm-up heaters for the AGS Snake magnet.

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:

RHIC-MAG-Q-1004	Discrepancy Reporting Procedure
25-1907.01-4	Warm-Up Heater Assembly Fixture – Ferrule-to-Strip
25-1908.01-3	Foil Clamping Tool

BNL drawings:

22010234 Warm-Up Heater Strip
22010224 Assembly, Warm-Up Heater Strip

3 Requirements:

The warm-up heater shall be assembled in accordance with the drawing and parts list, and the manufacturing sequence described below.

3.1 Material/Equipment

Propane or similar torch for brazing
400 grit “wet-or-dry” sandpaper

3.2 Precautions

3.2.1 Specific steps of this procedure contain Electrical & Mechanical Assembly operations that impact the environment. Prior to performing these steps, personnel shall complete the applicable facility specific environmental training.

3.2.2 Proper Personal Protective Equipment (PPE) shall be worn when handling chemicals or mechanically cleaning equipment. This includes, but is not limited to, safety glasses and disposable latex gloves.

NOTE

Latex gloves only give marginal protection to most solvents used and should only be considered as protection from incidental contact /exposure. If the glove is contaminated, it should be removed and a new glove put on.

3.2.3 Electrical testing described in this procedure poses an electrocution hazard. When testing, a worker 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". At least two people shall be in the test area when testing.

3.2.4 The technicians shall be instructed by their cognizant technical supervisor in the operation of the required test equipment and these electrical testing procedures. In addition, some of these tests require the technician to have special training

4 Procedure

NOTE

Handling - The heater is extremely flexible, and the foil may easily be damaged by improper handling. It must not be allowed to knot, kink, or become creased during all assembly operations.

4.1 SST Strip Preparation

4.1.1 Cut the stainless steel foil to the length specified on drawing 22010225. Inspect the strip on both sides for any visible damage, tears, etc. Notify C.E. before continuing if appropriate.

4.1.2 Lay the foil flat on a table after inspecting. Using a non-conductive permanent marker, place an "X" near each end of the foil strip on the exposed side only. NOTE: The surface opposite each "X" will be cleaned and brazed to the copper pad.

4.1.3 Turn over the strip so that the side with the marked "X" is against the table. Using sandpaper, gently clean the exposed surface of the foil at each end for a length of 4.0 inches to remove any oxides from the surface. Hold the foil to the

table by hand and sand in a single direction so that only tension is applied to the foil, avoiding crinkling.

4.1.4 Clean the surfaces of each of two copper pads (P/N 22010235) along their full length, sanding in a single direction.

4.1.5 Apply brazing flux/filler alloy paste to one cleaned surface of each pad by wiping the flux onto the part; do not dip the part into the flux.

4.1.6 Place the cleaned and fluxed surface of each pad onto the cleaned side of the stainless strip. Locate as shown on Dwg. 22010234.

4.1.7 Clamp the fluxed joints between copper blocks 3.0 long x .38 wide x .25 thick (the blocks will be used to heat the joint indirectly). Center the blocks laterally and longitudinally on each pad; do not allow the brazing paste to come in contact with either block from the sides or ends during heating.

CAUTION

Hot Surfaces. Personnel Injury from Burns. Gloves should be worn if handling fixtures above 140F

4.1.8 Heat the joints to approximately 1200°F using the brazing torch which will melt the pre-applied flux/filler alloy paste. To prevent burn-through DO NOT directly heat the stainless foil; heat only the copper blocks and let the them transfer heat to the foil.

NOTE

Ensure unused solder is recycled or disposed of properly

4.1.9 Once the braze material has melted and flowed, remove the heat and let the joints cool. Remove the copper blocks and set aside.

4.1.10 Thoroughly and carefully clean both sides of each joint using an alkaline cleaner to remove residual flux, which is corrosive.

NOTE

Failure to completely remove flux will cause eventual failure of the joint.

4.1.11 Perform continuity tests on the entire batch of brazed heater strips.

4.1.12 Clean the entire O.D. of each copper ferrule using sandpaper. Install the two ferrules on the assembly fixture, Dwg. 25-1907.01-4. Apply the brazing flux/filler alloy paste to the O.D by wiping the flux onto the part; do not dip the part into the flux.

4.1.13 Wrap the copper ends of the foil strip sub-assembly around the ferrules as indicated on assembly drawing 22010224. Clamp the foil in place using minimum force on clamp tool, Dwg. 25-1908.01-3; take care not to tear the foil.

4.2 Ferrule Brazing Procedure

CAUTION

Hot Surfaces. Personnel Injury from Burns. Gloves should be worn if handling fixtures above 140F

4.2.1 Heat the ferrule to approximately 1200°F using the brazing torch which will melt the pre-applied flux/filler alloy paste. To prevent burn-through DO NOT directly heat the stainless foil; let the ferrule transfer the heat to the foil.

4.2.2 Once the braze material has melted and flowed, remove the heat and allow the joint to cool.

NOTE

Ensure unused solder is recycled or disposed of properly

4.2.3 Clean off any excess paste with a mild alkaline detergent (e.g. Alconox, BNL E-54150). Rinse thoroughly.

4.2.4 Repeat steps in sections 4.1 through 4.2 for all other heater strips and ferrules.

4.2.5 Perform continuity tests on the entire batch of brazed heater assemblies.

4.3 Insulation Procedure

4.3.1 Mark the assembly table with the start and end points of the Kapton insulation and the start and end points of the heater strip to facilitate aligning the two items properly in the lengthwise direction. NOTE: the alignment side-to-side is not critical; needs only to be done by eye.

4.3.2 Cut a strip of insulation to the length specified on the assembly drawing. Lay the strip on the table, adhesive side facing up, aligning it to the marks. Sparingly tape

down the ends and the edges intermittently as required to hold it straight (this tape will be removed later).

4.3.3 Starting at one end, align a brazed heater strip to the table mark. While centering the strip side-to-side over the Kapton, carefully "roll" the heater strip progressively onto the adhesive of the Kapton.

4.3.4 Remove the temporary tape holding the Kapton to the table.

4.3.5 Carefully fold up one side of the Kapton and adhere it to the exposed surface of the heater, starting from the center and working outward. Taking care not to fold the stainless foil, fold and adhere the other side.

4.3.6 Repeat steps in section 4.3 for all other heater strips.

4.4 Hypot Test

4.4.1 Place a series of wooden blocks on a table top, and place a 3.0 inch wide aluminum channel on the blocks, flat side of the web facing upward, so that the channel is insulated from the table. The channel should be about .50 inches shorter than the insulated length of the heater strip.

4.4.2 Place an insulated heater strip on the channel with the gap in the insulation facing upward away from the channel. Center the heater strip lengthwise on the channel (approx. .25 inches will be unsupported at each end).

4.4.3 Place a 3.0 inch wide strip of .005 inch thick Kapton (or similar flexible insulating material) on top of the heater strip. This insulation should be .50 inches longer than the insulated length of the heater strip.

4.4.4 Place a series of lead bricks or other convenient weights on top of the 3.0 inch wide insulator. Each brick should not be longer than 10.0 inches.

CAUTION

The voltage applied during hypot testing can cause serious injury or death. Be certain the hypot equipment is well grounded.

4.4.5 Test the heater assembly for current leakage at 2.5 kV applied voltage between the stainless strip and the external Kapton insulation using the procedure in Appendix A. Record the current obtained; max leakage allowable is 50 μA.

4 Quality Assurance:

The Quality Assurance provisions of this procedure require that all instructions be complied with, and that all discrepancies be reported in accordance with RHIC-MAG-Q-1004.

5 Preparation for Delivery:

N/A

Appendix A - Hypot Procedure

1. Make sure the power ON-OFF switch is in the **OFF** position, that the high voltage ON-OFF switch is in the **OFF** position, and that the voltage control is turned fully counter-clockwise to the zero voltage position.

CAUTION

Ensure "Hypot" is grounded at all times. Failure to observe this caution may result in electrocution.

2. Connect a grounding cable from the safety ground stud of the "Hypot" to a good electrical ground, and make sure the connection is secure at both ends.

3. Connect the return line from the item under test to the Metered Return binding post of the "Hypot" and be sure the grounding switch on the "Hypot" panel is in the **Metered Return** position.

4. Connect the High Voltage lead of the "Hypot" to the item under test.

5. Turn the Microampere Range Switch to the highest range (2000 μa). Put the Kilovolt Range switch to Low.

6. Put the power ON-OFF switch to the **ON** position and put the HIGH VOLTAGE ON-OFF switch to the **ON** position.

7. Rotate the voltage control clockwise until the required voltage is indicated on the Kilovolt meter or until "arcing" takes place, in which case the voltage control should be rotated counter-clockwise until arcing just stops. (Note: Arcing must be kept to a minimum and must not be allowed to occur more than a few times.) The test voltage shall remain for 60 seconds prior to reading leakage current. If a voltage lower than the required voltage is used for the test, as above, it must be recorded on the data sheet under "Comments", along with the reason why.

8. Read and record the leakage current indicated on the Microammeter. If greater sensitivity is desired for the Microammeter, select a lower range with the Microamperes Selector Switch.

9. After the test is completed, rotate the Voltage control fully counter-clockwise, put the HIGH VOLTAGE OFF-ON switch to the **OFF** position and put the power ON-OFF switch in the **OFF** position.

10. With the "Hypot" still connected to the electrical ground, connect a grounding cable from the "Hypot" safety ground stud to the "Hypot" High Voltage Lead (the clip end, still connected to the test item) for 60 seconds.

11. Disconnect all "Hypot" leads from the test item.