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1. Scope:

This MAP describes the procedure used to produce DESY GO & GG Lead Tower Assemblies.

2. Applicable Documents:

RHIC-MAG-Q-1000	Control of Measurement Test Equipment
RHIC-MAG-Q-1004	Discrepancy Reporting Procedure
CR-E-4703-0041	Leak Check Specification
RHIC-MAG-R-7242	Hypot Procedure
15010010	GO Zeus Lead Tower Assembly
15010159	GO H1 Lead Tower Assembly
15020010	GG Zeus Lead Tower Assembly
15020159	GG H1 Lead Tower Assembly
RD 12159073	GO Wiring Diagram
RD 12159074	GG Wiring Diagram

3. Requirements:

All welding must be performed by welders qualified I.A.W. ASME Section IX.

3.1 Material/Equipment

DESY Pressure Test Fixture
DESY Shipping Fixture

3.2 Safety Precautions

3.2.1 Operators shall wear safety glasses with side shields, or goggles.

3.2.2 Operators shall be trained by their cognizant technical supervisor and qualified in the operation of the required welding equipment.

3.2.3 No welding shall take place unless all welding screens are in place around the welding station, and all personnel not directly involved with the welding process are outside the screens. Any personnel inside the screens shall wear protective gear to prevent eye injury, and shall be clothed to prevent burns caused by intense ultra-violet light.

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- 3.2.4 All lifting and handling operation requiring overhead crane operations shall be performed by holders of valid Safety Awareness Certificates and trained in the use of the lifting device by the Cognizant Engineer or Technical Supervisor.
- 3.2.5 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.
- 3.2.6 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.
- 3.2.7 This testing poses a Class "C" electrocution hazard. At least two properly trained technicians must be present to perform this testing. When testing, a trained technician 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" and warning lights shall be turned on.
- 3.2.8 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.
- 3.3 Procedure
 - 3.3.1 Insulate gas cooled leads with 2 layers of 3 mil adhesive-backed Kapton using a 50% overlap.
 - 3.3.2 At 6 equally spaced positions along the insulated length of the gas cooled leads, build up a "bushing" of Kapton that will fit snugly (less than .002" clearance) into its respective tube in the manifold assembly.
 - 3.3.3 Grease and install O-rings onto the gas-cooled leads. Insert leads into their respective tubes.
 - 3.3.4 Install the voltage tap harness through the center tube of the manifold assembly using the procedure of 3.3.2.
 - 3.3.5 Solder main superconductor leads to the end of the gas cooled leads (refer to wiring diagram for color designations) using silverbright solder and copper backing strip. See drawings 15010298 & 15010299 for copper backing strips.

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NOTE

Ensure unused solder is recycled or disposed of properly

NOTE

Be sure that copper backing strip is positioned so it can be drawn back into its manifold tube. Also check that there is enough slack in harness to accomplish this.

3.3.6 Strain relief each lead with Kevlar cord and epoxy knot.

3.3.7 Insulate solder joint with same material and scheme as in 3.3.1

WARNING

Failure to meet the safety requirements included in the individual electrical test procedures can cause severe personal injury and/or equipment damage

3.3.8 Route leads through lead tower to interconnect region. Hypot all power leads to each other and to ground @ 2kV. Maximum leakage is 10 μ A. Record results.

3.3.9 Perform continuity check on all wiring.

3.3.10 Insulate top half of manifold assembly with minimum 10 layers of superinsulation.

3.3.11 Install Upper Tower weldment with O-ring.

3.3.12 Weld the respective extension tube flex hose assembly to the helium cup. Make note of proper orientation.

3.3.13 Slide this assembly over the main and voltage tap harness and into position. Fiberglass wrap harnesses where they pass through the weld.

3.3.14 Install .010" NOMEX insulator & .005" Kapton sleeve around leads inside the cup assembly.

3.3.15 Retract all of the gas-cooled leads into their manifold tubes to protect them from welding.

3.3.16 Temporarily wrap .010 NOMEX around wires to prevent contact with manifold tubes.

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CAUTION

Be sure lead wires are not touching outside point of manifold tubes

3.3.17 Weld cup & 4K transfer to manifold assembly.

CAUTION

Do not generate excessive heat in assembly

3.3.18 Return gas cooled leads into their final position and bolt in place.

3.3.19 Position and weld bottom plate assembly onto cup assembly. Make note of proper orientation.

WARNING

Failure to meet the safety requirements included in the individual electrical test procedures can cause severe personal injury and/or equipment damage

3.3.20 Hypot all power leads to each other and to ground @ 2kV. Maximum leakage is 10 μ A. Record results.

3.3.21 Perform continuity check on all wiring.

3.3.22 Leak check welds. Max Leak Rate is 2×10^{-10} Std cc He /Sec.

3.3.23 Pull vacuum on 4K He circuit.

3.3.24 Install Large & Small Sealing Rings (15010294 & 15010293 Resp.).

3.3.24.1 Coat bottom surface with Stycast 2850FT epoxy.

3.3.24.2 Bolt rings down into position on top of gas cooled lead flanges.

3.3.24.3 Inject Stycast 2850 epoxy into annulus around lead stem.

3.3.24.4 Allow to cure at room temperature for 16 hours minimum.

3.3.25 Pressure Check 4K & 40K Circuits

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CAUTION

When testing above 295 psig, the area shall be restricted to authorized personnel only

NOTE

These steps should be witnessed by Safety Engineering (or other designated personnel)

- 3.3.25.1 Gradually increase pressure of 4K system to 185 PSIG.
- 3.3.25.2 After 185 PSIG is reached, increase pressure in 20 PSI increments until max pressure of 368 PSIG is reached. Hold at this pressure for 10 minutes.
- 3.3.25.3 If no abnormalities are observed, lower pressure to 295 PSIG.
- 3.3.25.4 Spray Leak Teck around all welds & joints. No evidence of leaking is permitted.
- 3.3.25.5 Repeat 3.3.25.1-3.3.25.4 for 40K circuit.
- 3.3.26 Leak check 40K & 4K Helium circuits. Max Leak Rate is 2×10^{-10} Std cc He /Sec.
- 3.3.27 Superinsulate helium containment pot and 4K extension line.
- 3.3.28 Weld front split cover to extension arm stub.
- 3.3.29 Position 40K extension line in position and superinsulate.
- 3.3.30 Slide assembly of 3.3.29 over both 4K & 40K extension lines and into position.
- 3.3.31 Position rear split cover and lower tube weldment into position and weld into place.
- 3.3.32 Mount lead tower to its support in proper position on Shipping /Assembly fixture.
- 3.3.33 Assemble the remaining parts of the extension arm outer jackets. Be sure to install 15010269 & 15010270 Spider assemblies as shown on respective assembly drawings.

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- 3.3.34 Route wires into lead box and connect flanges that attach extension arm to magnet. Connect power leads and voltage taps to upper and lower terminal boards in interconnect region. Reference the appropriate wiring diagram.
- 3.3.35 Wire temperature sensors. Record serial #'s of both sensors.

WARNING

Failure to meet the safety requirements included in the individual electrical test procedures can cause severe personal injury and/or equipment damage

- 3.3.36 Perform Hypot @ 1kV. Maximum leakage is 10 μ A. Record results.
- 3.3.37 Perform continuity check on all wiring.
- 3.3.38 Attach O-rings and install sliding cover to lower tube weldment.
- 3.3.39 Route voltage tap wires through and mount instrumentation port.
- 3.3.40 Slide copper gaskets over instrumentation wires. Wire to Feedthroughs using wiring diagram as a guide.
- 3.3.41 Mount Feedthroughs to instrumentation port.
- 3.3.42 Install 1000amp & 500amp powerlead clamps onto the ends of the gas cooled leads.
- 3.3.43 Solder and insulate feed-throughs #9, #10, #11 on lead tower. Reference wiring diagram.

NOTE

Ensure unused solder is recycled or disposed of properly

WARNING

Failure to meet the safety requirements included in the individual electrical test procedures can cause severe personal injury and/or equipment damage

- 3.3.44 Perform electrical tests per attachment 1 and record results.
- 3.3.45 Tighten all Varian seals.

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CAUTION

Hold a wrench on the head and nut of the clamp bolts. Do not apply any torque to the gas cooled lead insulator.

- 3.3.46 Install swagelock fittings onto the ends of the gas cooled leads.
- 3.3.47 Install line insulators onto the swagelock fittings of 3.3.46.
- 3.3.48 Install .005" KAPTON insulator sleeve around 1000 Amp Insulators. Tie off with Kevlar cord and epoxy knot.
- 3.3.49 Install insulator clamps onto the instrumentation port and over insulator exit tubes.
- 3.3.50 Perform Pressure check on 4K system as noted in 3.3.25.1-3.3.25.4.
- 3.3.51 Purge magnet with nitrogen and perform electrical tests per attachment 1 and record results.
- 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 Delivery:

Assembly to be prepared for delivery to customer under direction of Technical Supervisor and Cognizant Engineer.

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Attachment 1 - Electrical Checks

1. Hypot all coils to ground and each other @ 1Kv. Max leakage 10 μ A.
2. Perform resistance check (+) to (-) mains for each coil and record results.
3. Perform resistance checks as follows:

Coil	Feed Through	From	To
Dipole	FT#10	Pin 1	Pin 2
Dipole	FT#10	Pin 1	(+) Lead
Quad	FT#10	Pin 3	Pin 6
Quad	FT#10	Pin 3	Pin 4
Quad	FT#10	Pin 4	Pin 5
Quad	FT#10	Pin 5	Pin 6
Skew Dipole	FT#10	Pin 7	Pin 8
Skew Dipole	FT#10	Pin 7	(+) Lead
Skew Quad	FT#10	Pin 9	Pin 10
Skew Quad	FT#10	Pin 9	(+) Lead
Sextupole	FT#11	Pin 1	Pin 2
Sextupole	FT#11	Pin 1	(+) Lead
Temperature Sensor #1	FT#11	Pin 3	Pin 6
Temperature Sensor #1	FT#11	Pin 4	Pin 5
Temperature Sensor #2	FT#11	Pin 7	Pin 10
Temperature Sensor #2	FT#11	Pin 8	Pin 9