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Magnet Division Procedure

Procedure: SMD-GSI-RD3004

Revision: B

GSI Yoke, Shell & Endplate Assembly

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- Q. A. Approval: Signature on File
- ES&H Review: Signature on File

Revision History

			CE	*QA*	*ES&H*
Rev. A	12/17/02	Initial Release	-	-	-
Rev. B	12/30/02	Moved 4.1.10 from after shell welding.	On File	On File	On File

1 Scope

This specification describes the procedure for yoke stacking, longitudinal seam welding & endplate welding of GSI Dipole Cold Mass Assemblies.

2 Applicable Documents

RHIC-MAG-Q-1004 Discrepancy Reporting Procedure
RHIC-MAG-Q-1000 Procedure For Control of Measurement Test Equip.
SMD OPM 8.1.1.39 Operation of the LHC Shell Welding Fixture

BNL Drawings:

RD19010200 GSI Yoke Containment

3 Requirements:

The Dipole Cold Mass Assembly shall be welded in accordance with this specification and associated drawings.

All welding must be performed by welders qualified in accordance with ASME Section IX.

3.1 Material/Equipment

25-1776.01-5 Shell Weld Fixture Stand Assembly

3.2 Safety Precautions

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

3.2.2 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.

3.2.3 All lifting and handling operations requiring overhead crane operations shall be performed by holders of valid Safety Awareness Certificates and instructed in the use of the lifting device by the Cognizant Engineer or Technical Supervisor.

3.2.4 Some of the 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.

3.2.5 Hypot and impulse testing pose 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.

3.2.6 The LHC Shell Welding Fixture should be identified with a "Caution" Tag when it is in the modified condition required for this procedure. See Appendix A.

4 Procedure

4.1 Yoke & Shell Assembly

NOTE

See Appendix A for changes required in configuration and operation of Shell Welding Fixture

4.1.1 Position 3 pairs of yoke support feet on the fixture support rails.

4.1.2 Place the upper shell on the rails with the support feet extending thru the shell holes just enough to engage the yoke notches. Block under the shell to hold it in position.

NOTE

The cold mass will be assembled upside down since only the upper shell has holes

4.1.3 Plug the survey notch, lifting notch, and stamping orientation notches at the lead and non-lead end of the yoke with green putty. Plug the loose keyway at the lead and non-lead end of the yoke with green putty.

4.1.4 Place the upper yoke blocks in the shell with the end and center blocks supported by the fixture feet to maintain alignment. Record the weight of each block.

4.1.5 Install the non-lead end filler lamination packs.

4.1.6 Place the collared coil upside down in the yoke.

4.1.7 Install the yoke alignment key in the tight keyway.

4.1.8 Install the non-lead end filler lamination packs.

4.1.9 Place the lower blocks on the collared coil, record the weight of each block.

4.1.10 Install the connecting rods in the yoke with the G10 tubes and washers as shown on the assembly drawing. Torque each bolt to 20 ft-lbs.

4.1.11 Install the lower half shell.

4.1.12 Install band clamps around the shells.

4.1.13 Install the backing strips.

4.1.14 Clamp the assembly by applying 212 psi maximum to the air cylinders. See Appendix A. Again check the gap between the half-shells and their longitudinally alignment. The clamping must not make the half-shell gap uneven.

4.1.15 Check the yoke assembly with .002 feeler stock for full contact with the fixture in all support locations. Use the c-clamps, located between the cylinders to draw in the edges of the shell.

4.1.16 Tack weld the shell halves together using filler wire (P/N 12010441-03). Use two certified welders, with one welder on each side of the magnet, remaining in-step along the length, within approximately 6 inches. Leave the last three inches at each end unwelded in order to slide in the end plate later.

4.1.17 Make TIG root passes on each longitudinal seam using filler wire (P/N 12010441-03). Use two certified welders, with one welder on each side of the magnet, remaining in-step along the length, within approximately 6 inches. Leave the last three inches at each end unwelded in order to slide-in the end plate later.

4.1.18 Complete the weld on each longitudinal seam by TIG welding using filler wire (P/N 12010441-03). Use two certified welders, with one welder on each side of the magnet, remaining in-step along the length, within approximately 6 inches. Leave the last three inches at each end unwelded in order to slide-in the end plate later.

4.1.19 Unclamp the assembly and remove the air cylinder support assembly.

NOTE

The Shell Welding Fixture must be returned to its drawing configuration prior to removal of the "Caution" Tag

4.1.20 Install the helium blocking reed valves over the helium bypass notches on both ends of the yoke as shown on the assembly drawing.

4.2 Electrical Testing

4.2.1 Measure the resistance of the collared coil assembly from the lead to the non-lead end. Record in traveler.

DANGER

Be sure the "Hypot", yoke, and beam tube is grounded at all times. Failure to observe this caution may result in electrocution.

4.2.2 Perform a coil-to-coil hypot check at 3 kV, following RHIC-MAG-R-7242.

NOTE

The leakage current must be less than 50 μa.

4.2.3 Electrically connect the main coil leads together.

4.2.4 Perform a hypot check between the main coils and the yoke at 5 kV, attaching the grounded lead of the hypot tester to the yoke/shell following RHIC-MAG-R-7242.

NOTE

The leakage current must be less than 50 μa.

4.2.5 With the coils disconnected, measure coil temperature. Measure voltage drops across coils at 1 amp DC, following RHIC-MAG-R-7320. Complete the measurements of inductance and quality factor (Q) following RHIC-MAG-R-7228.

4.3 Endplate Welding

4.3.1 With the magnet on the weld station rollers, install the endplates, but do not weld. Set the endplate perpendicular to the magnet axis using a precision square. Set weld root gaps equally at each end to achieve proper overall assembly length as shown on end plate welding assembly drawing.

NOTE

Endplate to endplate distance should be set to approximately .25 greater than final dimension shown prior to welding to allow for weld shrinkage.

4.3.2 Tack weld each endplate to the shell using eight equally spaced welds approximately 2" long with filler wire (P/N 12010441-03). Use a welding sequence where four welds are made, equally spaced around the endplate then a second pass of four welds are made to complete the operation. Re-verify proper overall assembly length.

4.3.3 Complete the welding of the lead endplate by manually TIG welding or rotary MIG welding using filler wire (P/N 12010441-01).

4.3.4 Repeat for the non-lead endplate.

4.3.5 Complete the longitudinal seam welds on the shells at both ends by manually TIG welding using filler wire (P/N 12010441-03).

4.3.6 Have an authorized weld inspector inspect the completed seam weld and the endplate welds. Weld inspector must sign the traveler.

4.3.7 Allow sufficient time for endplate welds to be cool to the touch. Apply Loctite to the pressure plate set screws and install into the endplates. Torque each set screw to the value given on the endplate welding assembly. Use a crisscross pattern and proceed in 10 in.-lb. increments up to the final value and then go around twice more to set final torque.

4.3.8 Measure and record overall endplate-to-endplate magnet length at the top and the bottom of the magnet.

4.4 Electrical Testing

CAUTION

Be sure the "Hypot", yoke, and beam tube is grounded at all times. Failure to observe this caution may result in electrocution.

4.4.1 Perform a coil-to-coil hypot check at 3 kV, following RHIC-MAG-R-7242.

NOTE

The leakage current must be less than 50 µa.

4.4.2 Electrically connect the main coil leads together.

4.4.3 Perform a hypot check between the main coils and the yoke at 5 kV, attaching the grounded lead of the hypot tester to the shell/ endplate following RHIC-MAG-R-7242.

NOTE

The leakage current must be less than 50 µa.

4.4.4 With the coils disconnected, measure coil temperature. Measure voltage drops across coils at 1 amp DC, following RHIC-MAG-R-7320. Complete the measurements of inductance and quality factor (Q) following RHIC-MAG-R-7228.

4.4.5 Cognizant Electrical Engineer to review test data and sign off traveler "OK to Proceed".

5 Quality Assurance Provisions:

5.1 The Quality Assurance provisions of this procedure require that all assembly and test operations be performed in accordance with the procedural instructions contained herein.

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

5.3 All discrepancies shall be identified and reported in accordance with RHIC-MAG-Q-1004.

6 Preparation for Delivery:

N/A

Yoke Block Weight

Block	Lower	Upper
LE		
LE /Center		
Center		
Center 2		
Center / NLE		
Total /Half Yoke		
Total /Full Yoke		

Appendix A - Use of LHC Shell Welding Fixture for GSI Shell Welding

NOTE

Shell welding of GSI Cold Masses uses the LHC Shell Welding Fixture. Due to the shorter length of GSI magnets, some of the bridge assembly air cylinders are not used. In addition the deflection compensation system (including the control cart and the lower hydraulic cylinder) is not used. This appendix lists modifications required. All other parts of the OPM still apply.

- Modifications to Fixture

  Table Rails Position: *Inboard (Only 2 rails on each side are required).*

  Air Cylinder Bridge Height: *Low*

  Beam Support Spacers: *Not Used*

- Modifications to Pneumatics

  On the Air Cylinder Beam Assembly, disconnect the Pressure Side airline at the connection between the 3rd and 4th cylinder. Cap the stub from the 3rd cylinder using a Swagelock cap. This leaves only 3 cylinders connected to the Pressure Side Disconnect. Repeat for the Vent Side airline.

  Connect the line from the regulated nitrogen tank directly to the Air Cylinder Beam Assembly disconnects instead of to the Control Cart. All cautions and sequencing notes regarding the nitrogen supply and the operation of the beam air cylinder disconnects and valves shall be followed.

- Tagging

  Apply a "Caution" tag to the fixture to indicate it has been modified. Tag is to remain until work is complete, and fixture has been returned to its original state.